



Alcatel-Lucent 1850

Transport Service Switch (TSS-5) | Release 7.0

Product Information and Planning Guide

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Limited warranty

Alcatel-Lucent provides a limited warranty for this product. For more information, consult your local Alcatel-Lucent customer support team.

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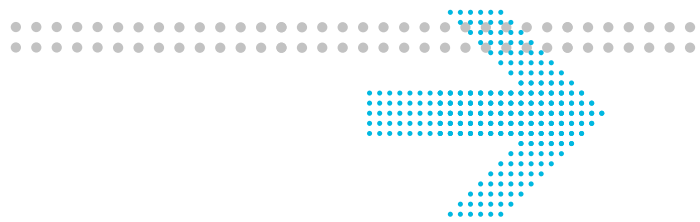
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About this document



Purpose

This Product Information and Planning Guide provides the following information for Alcatel-Lucent 1850 Transport Service Switch 5 (Alcatel-Lucent 1850 TSS-5):

- Features
- Applications
- Operation
- Engineering
- Support
- Specifications
- Ordering

Reason for revision

This document, *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Product Information and Planning Guide*, Issue 1, is issued to provide information about the following significant Release 7.0 features.

- T-MPLS support on the VLNC42B circuit pack.
- VLNC62 Circuit Emulator Card supports 8 DS1/E1 encapsulated into Ethernet 2 PTMs for FE/GigE 100/1000-T/ F. Circuit pack supports IEEE 1588v2 Transparent Clock, CES, Synchronous Ethernet, Time of Day/1PPS.
- VLIU3 interface unit supports the Time of Day features of the VLNC62 circuit pack.
- 75 ohm interface on E1 timing input/output is supported on the VLNC62 circuit pack.
- RADIUS Client support is for CLI user logins on the VLNC62 circuit pack.
- Synchronous Ethernet is supported on the VLNC62 circuit pack.
- Fast bidirectional forwarding detection (BFD) is supported on the VLNC62 circuit pack.

Intended audience

This guide is intended for network planners and engineers. However, anyone who needs specific information regarding the features, applications, operation, engineering, and ordering of Alcatel-Lucent 1850 TSS-5 would benefit from this document.

Important! This document is not a cabinet-level end-product requirements document. Cabinet-level end-product requirements, like limits for cabinet electrical emissions, requirements for backup batteries, and similar cabinet-level site requirements must be determined and agreed to by the system supplier and customer.

How to use this information product

This guide is divided into ten chapters and an appendix. Refer to the Contents section to locate specific information by chapter.

Conventions used

Bold typeface signifies emphasis.

Italic typeface denotes a particular product line or information product.

Bold courier typeface signifies a TL1 command.

Bold typeface signifies a GUI command.

Related information

The following table lists the documents included in the Alcatel-Lucent 1850 TSS-5 documentation set.

Table 1 Alcatel-Lucent 1850 TSS-5 documentation set

Comcode	Document Number	Title
NA	365-372-330	<i>WaveStar® CIT</i>
109 746 933	365-372-400R7.0	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Product Information and Planning Guide</i>
109 746 941	365-372-401R7.0	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) User Provisioning Guide</i>
109 746 958	365-372-402R7.0	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Maintenance and Trouble-Clearing Guide</i>
109 746 966	365-372-403R7.0	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Installation and System Turn-Up Guide</i>
109 746 974	365-372-404R7.0	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) TL1 Command Guide for MSPP</i>
109 746 982	365-372-405R7.0	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide</i>
109 746 990	365-372-406R7.0	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) CLI User Provisioning Guide</i>
109 748 723	365-372-407R7.0	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) TL1 Command Guide for T-MPLS</i>
NA	ED8C956-10	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Release 7.0.0 Engineering and Ordering Information</i>
NA	ED8C956-20	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Release 7.0.0 Interconnect Information</i>
109 747 766 Paper	NA	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) 7.0.X Software Release Description</i>
109 747 774 CD-ROM		
109 747 782	NA	<i>Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Release 7.0.X Customer Documentation (CD-ROM)</i>

Technical support

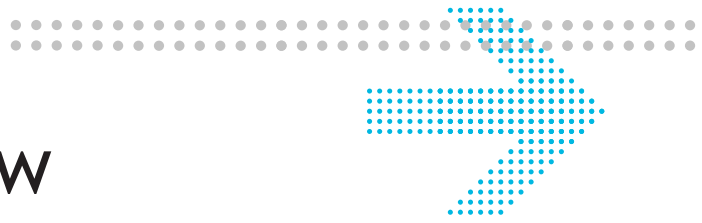
For technical support, contact your local Alcatel-Lucent customer support team. See the [Alcatel-Lucent Support web site](http://alcatel-lucent.com/support/) (<http://alcatel-lucent.com/support/>) for contact information. For more information, refer to [Chapter 8, “Product support”](#).

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1 System overview

Overview

Purpose

Alcatel-Lucent 1850 Transport Service Switch 5 (Alcatel-Lucent 1850 TSS-5) is a member of the Alcatel-Lucent 1850 Transport Service Switch product portfolio. This chapter introduces Alcatel-Lucent 1850 TSS-5, provides a brief description of how the Alcatel-Lucent 1850 TSS-5 fits into this portfolio, and an overview of the features that Alcatel-Lucent 1850 TSS-5 supports.

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Overview of the Alcatel-Lucent 1850 Transport Service Switch portfolio

Purpose

New bandwidth-hungry services, such as triple play and Ethernet virtual private networks (VPNs), are redefining the capacity and functionality requirements of the existing transport infrastructure. These changes are driving the move from circuit-based transport using time division multiplexing (TDM) to packet-based transport using Ethernet in metro and wide-area networks.

Different network approaches and topologies can be implemented, depending on the service provider's business model, service offerings and history. Service providers focusing on broadband access, triple play, and business Ethernet services, tend to build Ethernet-based networks with wavelength division multiplexing (WDM) support for

scalable service delivery. On the other hand, service providers offering multiple services, including business and mobile, can leverage their installed base to transport existing and new services, taking advantage of the full-featured, transport-oriented operations, administration, maintenance and provisioning (OAM&P) capabilities of their SDH/SONET networks.

The major challenge for service providers today is that the increasing demand for bandwidth for new services is not reflected in comparable increases in revenue. The Alcatel-Lucent 1850 Transport Service Switch helps service providers to maximize their profitability by transporting any service mix and keeping strict control of the costs.

Solution

The Alcatel-Lucent 1850 Transport Service Switch is the next step towards a converged transport network: it is a single transport aggregation platform that switches packets and circuits, and transports any kind of service in any possible mix, enabling service providers to build future-proof transport networks that can support any future traffic requirement. The industry's first transport service switch, the Alcatel-Lucent 1850 Transport Service Switch builds on the success of today's Optical Multi-Service Node (OMSN), the Alcatel-Lucent solution for multiservice SONET/SDH.

Portfolio

The Alcatel-Lucent 1850 Transport Service Switch portfolio includes several next-generation products with different capacities, based on the most common requirements of metro networks:

- Alcatel-Lucent 1850 Transport Service Switch (TSS-3) — Supports 2 Gb/s data switching capacity Transport over Ethernet or PDH.
- Alcatel-Lucent 1850 Transport Service Switch (TSS-5) — When equipped with the VLNC40/42/42B Ethernet Aggregator and VLNC50/52 SONET/SDH Transport circuit packs, Alcatel-Lucent 1850 TSS-5 supports up to 20 Fast Ethernet ports, 4 GbE/FE up-link ports, 8DS1/E1 ports (VLNC50)/28 DS1/21 E1 ports(VLNC52), and 3 DS3/3 E3 ports with switching capacity for transport over Ethernet/SONET/SDH, or DS1/E1 and data backhaul over Ethernet.

The VLNC35 Fast Ethernet Private Line circuit pack supports up to 4 electrical Fast Ethernet (10/100BASE-T) ports and 2 optical Fast Ethernet (100BASE-X) ports.

The VLNC60 Circuit Emulator circuit pack supports up to 8 DS1/E1 ports and 2 FE/GbE ports. The VLNC61 Circuit Emulator circuit pack supports up to 16 DS1/E1 ports and 2 FE/GbE ports. The VLNC62 Circuit Emulator circuit pack supports up to 8 DS1/E1 ports and 2 FE/GbE ports.

The VLNC64 Circuit Emulation Mini-Hub circuit pack supports up to 2 GbE/FE

PTM interfaces and one channelized OC-3/STM-1 PTM. The VLNC64 circuit pack recovers DS1/E1 signals from the Ethernet LAN inputs, maps them (based on pseudowire provisioning) into VT1.5/VC-12s, which are then transported over the channelized OC-3/STM-1 interface. The VLNC64 circuit pack supports up to 84 DS1 signals or up to 63 E1 signals.

- Alcatel-Lucent 1850 Transport Service Switch (TSS-40) — Supports 40 Gb/s of switching capacity in mixed packet/SDH configurations. (ETSI only)
- Alcatel-Lucent 1850 Transport Service Switch (TSS-100) — Supports 60 Gb/s data switching capacity or up to 100 Gb/s in mixed packet/TDM/WDM configurations.
- Alcatel-Lucent 1850 Transport Service Switch (TSS-320) — Supports 160 Gb/s data switching capacity or up to 320 Gb/s in mixed packet/TDM/WDM configurations.

Introduction to Alcatel-Lucent 1850 Transport Service Switch 5

Overview

Alcatel-Lucent 1850 TSS-5 has an extremely small footprint that enables its *seamless* integration as a piece of customer premise equipment (CPE). As CPE, it is ideal for Fiber to the Business (FTTB) and end-user access applications.

Alcatel-Lucent 1850 TSS-5 has a modular architecture that supports the following:

- DS1/E1, DS3/E3, and Gigabit Ethernet private line transport over SONET or SDH with the VLNC50/52 SONET/SDH Transport circuit pack.
- 10/100 Ethernet aggregation with the VLNC40/42/42B Ethernet Aggregator circuit pack.
- 10/100 Mb/s Fast Ethernet Private Line transport over OC-3/STM-1 or OC-12/STM-4 interfaces with the VLNC35 Fast Ethernet Private Line circuit pack.
- DS1/E1 circuit emulation service over packet (CESoP) and ML-PPP termination for IP backhaul with the VLNC60/61/62 Circuit Emulator circuit packs.
- DS1/E1 circuit emulation service over packet (CESoP) and book-ended connection with the VLNC64 Circuit Emulation Mini-Hub circuit pack.

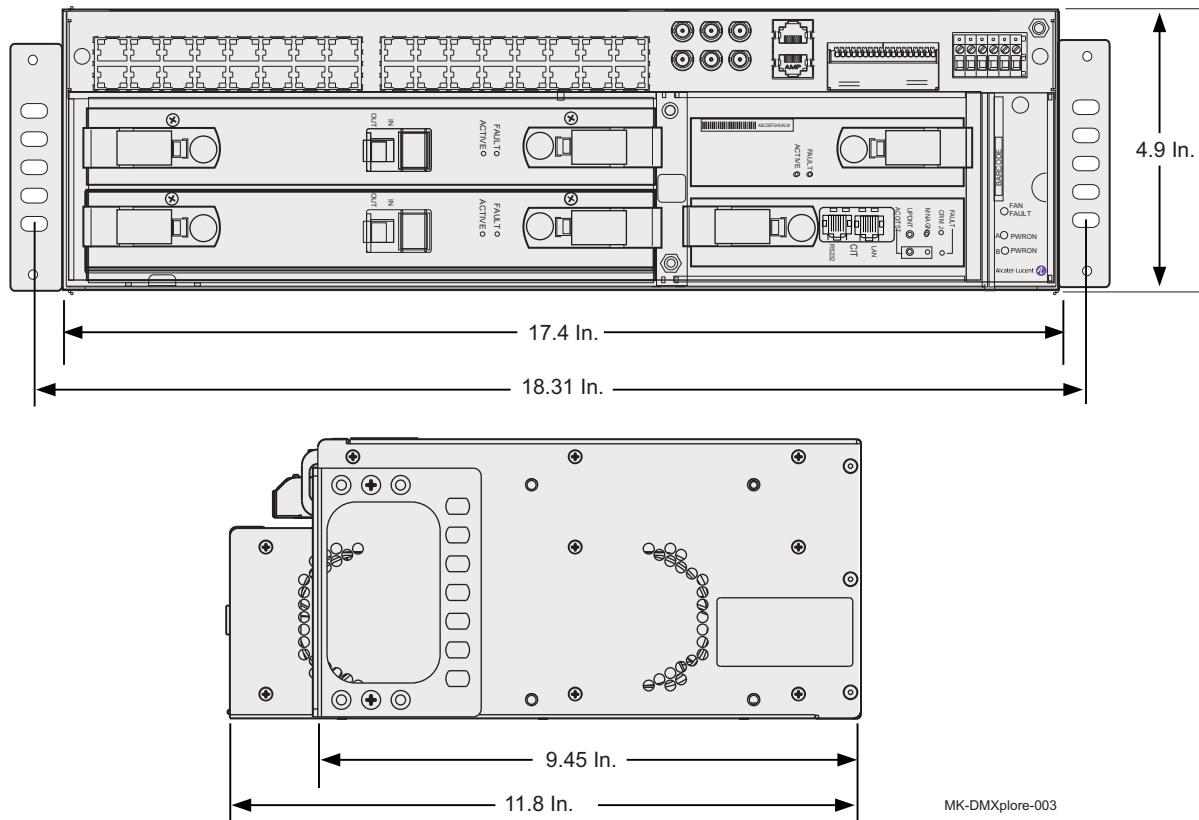
Alcatel-Lucent 1850 TSS-5 utilizes a High Capacity rack-mount shelf that provides access to all shelf interfaces, power connections, and LEDs on a removable board in the front of the shelf.

Alcatel-Lucent 1850 TSS-5 High Capacity rack-mount shelf

The following illustration is a front and side view of an Alcatel-Lucent 1850 TSS-5 High Capacity rack-mount shelf. It shows the dimensions of the shelf, the position of the mounting bracket installed for front mounting in a 19-inch rack, and the location of physical interfaces accessible from the front. The mounting brackets shipped with the shelf can also be rotated for installation in 23-inch racks. Optional brackets for ETSI

racks are also available. For additional information about the shelf and its physical interfaces, see [“Shelf description”](#) (p. 4-2), and [“Electrical interfaces”](#) (p. 10-5). Physical interfaces on the faceplates of circuit packs vary depending upon the circuit pack. For more information about interfaces on the circuit packs, and the circuit packs supported on this shelf, see [“Circuit pack codes”](#) (p. 4-9).

Figure 1-1 Alcatel-Lucent 1850 TSS-5 High Capacity rack-mount front/side view with mounting bracket



Functionality

There are 5 slots in the shelf:

- 1 VLIU slot for the VLIU1, VLIU2, VLIU3, or VLIU10 interface unit. The VLIU(1,2,3,10) interface unit provides access to the electrical transmission, control, timing, and power interfaces. The VLIU(1,2,3,10) interface unit is a removable access panel that contains the physical interfaces associated with the shelf. Refer to [Table 6-1, “VLIU compatibility”](#) (p. 6-4) and [“VLIU\(1,2,3,10\) interface unit description”](#) (p. 4-8) for additional details.
- 1 Control slot for the VLNC2 SYSCTL circuit pack. The SYSCTL circuit pack provides control functions for the shelf and is required when the shelf is equipped with the VLNC50/52 SONET/SDH Transport circuit pack.

- 2 MAIN slots for VLNC40/42/42B Ethernet Aggregator, VLNC50/52 SONET/SDH Transport, VLNC60/61/62 Circuit Emulator, and VLNC64 Circuit Emulation Mini-Hub circuit packs.
- 1 Function Group C slot for the VLNC35 10/100 Mb/s Ethernet circuit pack that supports electrical and optical interfaces.

The Alcatel-Lucent 1850 TSS-5 front panel contains the physical interfaces associated with the shelf. The following interfaces are supported:

- 4 miscellaneous discrete inputs (MDI) and 4 miscellaneous discrete outputs (MDO) (The VLIU10 in the High Capacity Rack-mount shelf supports 2 additional, unused MDOs.)
- 28 DS1/21 E1 interfaces
- 3 DS3/E3 interfaces
- 4 10/100BASE-T Fast Ethernet interfaces supported by Function Group C circuit pack (VLNC35)
- 2 –48 VDC or +24 VDC A & B power feeds.
- Optional AC power converter available
- 1 office alarm interface (CR/MJ, MN/Audible, Visual).

Capacity

The capacity of Alcatel-Lucent 1850 TSS-5 shelf depends on the installed circuit packs/pluggable transmission modules. Alcatel-Lucent 1850 TSS-5 supports the following signals:

- Up to 2 OC-3/STM-1 or OC-12/STM-4, 1 GbE, 8 DS1/E1, and 3 DS3/E3 signals with a VLNC50 SONET/SDH Transport circuit pack. If two VLNC50s are installed in the shelf, the OC-n/STM-n capacity and GbE capacities are doubled but the DS1/E1 and DS3/E3 capacities are not doubled.
- Up to 2 OC-3/STM-1 or OC-12/STM-4, 1 GbE, 28 DS1/21 E1, and 3 DS3/E3 signals with a VLNC52 SONET/SDH Transport circuit pack. If two VLNC52s are installed in the shelf, the OC-n/STM-n capacity and GbE capacities are doubled but the DS1/E1 and DS3/E3 capacities are not doubled.
- Up to 20 electrical 10/100BASE-T Ethernet and 4 GbE/FE signals with a VLNC40/42/42B Ethernet Aggregator circuit pack.
- Up to 8 DS1/E1 and 2 GbE/FE signals with a VLNC60 Circuit Emulator circuit pack.
- Up to 16 DS1/E1 and 2 GbE/FE signals with a VLNC61 Circuit Emulator circuit pack.
- Up to 8 DS1/E1 and 2 GbE/FE signals with a VLNC62 Circuit Emulator circuit pack.

- Up to 2 GbE/FE and 1 OC-3/STM-1 signal with a VLNC64 Circuit Emulation Mini-Hub circuit pack. If two VLNC64s are installed in the shelf, the OC-n/STM-n and GbE capacities are doubled. The packs act independently; they do not form a protected pair.
- Up to 4 10/100BASE-T Ethernet Private Line signals and up to 2 100BASE-LX Optical Ethernet Private Line signals with a VLNC35 circuit pack.

The signals supported at any one time depend upon the circuit packs/pluggable transmission modules that are installed in the shelf. For more information about the interfaces supported by each circuit pack, refer to [Table 4-1, “Circuit packs in Alcatel-Lucent 1850 TSS-5 shelf” \(p. 4-9\)](#).

Shelf size

The Alcatel-Lucent 1850 TSS-5 High Capacity shelf has the following dimensions:

- Width: 17.4 inches (441 mm) (includes integral fan unit)
- Height: 4.9 inches (125 mm)
- Depth: 11.8 inches (300 mm)

Shelf mounting options

The Alcatel-Lucent 1850 TSS-5 High Capacity shelf has three different mounting options:

- Wall-mount
- ANSI rack-mount
- ETSI rack-mount

You must order the appropriate mounting bracket kit that supports your desired application. Refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Release 7.0.0 Engineering and Ordering Information* for more information about the bracket options.

Operations

Alcatel-Lucent 1850 TSS-5 is representative of ten years of Alcatel-Lucent's innovation and experience in network operations, control, and maintenance. Level 1 and Level 2 Target Identifier (TID) Address Resolution Protocol (TARP), a consistent and standard form of address resolution, allows the Alcatel-Lucent 1850 TSS-5 to be easily monitored and maintained.

Alcatel-Lucent 1850 TSS-5 also supports the Open Systems Interconnection (OSI) Connectionless Network Protocol (CLNP) over the Data Communications Channel (DCC) of the SONET/SDH link. Networks of up to 1000 network elements are supported via IS-IS Level 1 and Level 2 routing.

Centralized operation is supported by a full set of single-ended operations (SEO), control, and maintenance features. Integrated test capabilities and default provisioning simplify installation.

Basic maintenance tasks can be performed using faceplate LED displays and controls. A craft interface terminal (CIT) or a remote OS provides access to more sophisticated maintenance, provisioning, and reporting features.

Built-in maintenance capabilities support both installation and system operation. An Alcatel-Lucent 1850 TSS-5 can be tested and installed without external test equipment.

Feature release plan

Overview

This section outlines the major features for Alcatel-Lucent 1850 TSS-5 Release 7.0. The feature release plan in this document will be updated for each future release of the system.

Release 6.0 features

The following significant features are included in Release 6.0. This list is subject to change without notice.

- VLNC42B Ethernet Aggregator circuit pack: provides up to 20 electrical Fast Ethernet (10/100BASE-T) ports and 4 Fast Ethernet/Gigabit Ethernet (100/1000BASE-X or 1000BASE-T) PTM-based ports.
The VLNC42B is hardware-enabled to support:
 - Synchronous Ethernet
 - High-performance Ethernet OAM ITU-T Y.1731
 - Time of Day(ToD)/1PPS feature
 - T-MPLS starting in Release 7.0
- Wall-mount brackets to mount the Alcatel-Lucent 1850 TSS-5 shelf on a wall. New brackets have been designed that allow the existing rack-mount shelf to be mounted on a wall. The mounting orientation is determined by the customer.
- ETSI Brackets to mount the Alcatel-Lucent 1850 TSS-5 shelf in an ETSI bay.
- High-performance Ethernet OAM, Y.1731 on VLNC42/42B Ethernet Aggregator circuit packs.
- Layer 2 Control Protocol interworking with 802.3ah features (except loopback) on the VLNC40/42/42B circuit packs
- Fast bidirectional forwarding detection (BFD) on the VLNC60/61/64 circuit packs
- Increased VCGs on the VLNC50/52 circuit packs
- DS1 locked bandwidth on the VLNC50/52 circuit packs
- Synchronous Ethernet on the VLNC42, VLNC50/52, VLNC60, VLNC61, and VLNC64 circuit packs.
- 75 ohm interface on E1 timing input/output on the VLNC50/52, VLNC60, VLNC61, and VLNC64 circuit packs

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- Cross-connect loopbacks are supported on the tributaries of the optical SONET/SDH ports of the VLNC50/52 circuit packs.
 - Terminal loopbacks are supported on the VLNC35 circuit pack.
 - Web-based GUI supported for VLNC4x and VLNC6x CLI-based circuit packs.
 - BASE-T-C1 PTM is supported on the VLNC40/42/42B and VLNC60, VLNC61, and VLNC64 circuit packs.
 - 1000BASE-ZX-I1 PTM is supported on the VLNC40/42/42B circuit packs. In the previous release, the 1000BASE-ZX-I1 PTM was only supported on the VLNC50/52 circuit packs.
 - Four new bidirectional PTMs are supported on VLNC40/42/42B, VLNC50/52, VLNC60, VLNC61, and VLNC64 circuit packs. These bidirectional PTMs support both directions of transmission over a single fiber; one direction operates at ~1550 nm while the other direction operates at ~1310 nm.
 - RADIUS Client Support is supported for TL1 user logins on the VLNC2 circuit pack and for CLI user logins on the VLNC40/42/42B, VLNC60, VLNC61, and VLNC64 circuit packs.

Release 5.1 features

The following significant features are included in Release 5.1. This list is subject to change without notice.

- VLNC35 Fast Ethernet Private Line circuit pack that supports up to 4 electrical Fast Ethernet (10/100BASE-T) ports and 2 optical Fast Ethernet (100BASE-X) ports and works with the VLNC50/52 SONET/SDH Transport circuit packs in Ethernet over SONET/SDH applications.
- VLNC42 Ethernet Aggregator circuit pack that provides up to 20 electrical Fast Ethernet (10/100BASE-T) ports and 4 Fast Ethernet/Gigabit Ethernet (100/1000BASE-X or 1000BASE-T) PTM-based ports. The VLNC42 is hardware-enabled to support synchronous Ethernet and high-performance Ethernet OAM ITU-T Y.1731.
- VLNC50/52 SONET/SDH Transport circuit packs support 1+1 SONET/SDH line protection, 2-way hairpin cross-connections, and linear/unprotected UPSR/SNCP cross-connections. In addition to the SONET and Ethernet SNMP gets and traps that were supported in previous releases, SDH SNMP gets and traps are now supported on VLNC50/52 circuit packs.
- Metro Ethernet Forum (MEF) Ethernet Virtual Connection (EVC) service multiplexing on VLNC40/42 Ethernet Aggregator circuit packs.
- MEF 8 encapsulation on VLNC60/61/62 Circuit Emulator and VLNC64 Circuit Emulation - Mini Hub circuit packs.
- ITU-T G.8032-based Ethernet ring protection switching on VLNC40/42 Ethernet Aggregator circuit packs. Circuit Emulation traffic can be protected by ERP switching by having a VLNC60/61/62/64 interwork with a VLNC40/42 on an ERP ring.

-
- Ethernet Link OAM, IEEE 802.3 Clause 57 (802.3ah), on VLNC40/42 Ethernet Aggregator circuit packs.
 - Ethernet Service OAM, IEEE 802.1ag, on VLNC40/42 Ethernet Aggregator circuit packs.

Release 5.0 features

The following significant features are included in Release 5.0. This list is subject to change without notice.

- VLNC52 SONET/SDH Transport circuit pack supports up to 28 DS1/21 E1 ports, 3 DS3/E3 ports, 2 OC-3/OC-12/STM-1/STM-4 ports, and 1 Gigabit Ethernet port.
- VLNC61 Circuit Emulator circuit pack that supports up to 16 DS1/E1 ports and 2 Gigabit Ethernet/Fast Ethernet ports.
- VLIU2 interface unit supports an additional 20 DS1 ports or 13 E1 ports that are required to support the higher density VLNC52 (unprotected) and VLNC61. The VLIU2 also supports 20 Fast Ethernet ports from a VLNC40 installed in the Main 2 slot.
- VLIU10 interface unit supports equipment protection for the 28 DS1/21 E1 ports required to support VLNC50 and VLNC52 equipment protection. However, the VLIU10 does not support the VLNC40.
- Layer 2 control protocol tunneling on VLNC40 circuit packs. Layer 2 control protocols are used for several purposes in IEEE 802 standard networks including link maintenance, aggregation, flow control, authentication, identity/capability discovery and management.
- Ethernet OAM 802.3 Clause 57 (formerly 803.3ah) link loopback on the VLNC40.
- Channelized DS3 (TMUX - DS1/VT1.5/STS-1 to OC-3/12) interface supported on DS3 port b-3 on the VLNC50 and VLNC52 circuit packs. The channelized DS3 can be mapped into 28 DS1s, which can then be mapped into an STS-1.
- 1x1 equipment protection for VLNC50/52 SONET/SDH EoS circuit packs.
- Far-end alarm and control (FEAC) for channelized DS3 interfaces (loopbacks and alarms).
- SONET and Ethernet SNMP gets and traps supported on SYSCTL and VLNC50 and VLNC52 circuit packs.

Release 4.1 features

The following significant features were included in Release 4.1.

- The VLNC64 Circuit Emulation Mini-Hub circuit pack is introduced and supports
 - 1 channelized OC-3/STM-1 interface
 - 2 GbE/FE interfaces
 - DS1/E1 circuit emulation over Ethernet
 - BITS input

-
- IEEE 1588 precision timing protocol (PTP)
 - Bidirectional Forwarding Detection
 - Interworking with the VLNC60 Circuit Emulator circuit pack.
 - E1 interfaces for the VLNC60 Circuit Emulator circuit pack that support E1 circuit emulation.
 - E3 interfaces and low-order VT1.5/VC-12 virtual concatenation (VCAT)/link capacity adjustment scheme (LCAS) for the VLNC50 SONET/SDH Transport circuit pack.
 - Coarse wavelength division multiplexing (CWDM) pluggable transmission modules for Gigabit Ethernet interfaces on the VLNC40, VLNC50, VLNC60, and VLNC64 circuit packs.
 - Inband-requested DS1/E1 loopbacks for VLNC50 SONET Transport and VLNC60 Circuit Emulator circuit packs.
 - IP tunneling interworking between the Alcatel-Lucent 1850 TSS-5 and the Alcatel-Lucent 1850 TSS-100/Alcatel-Lucent 1850 TSS-320.
 - Link Access Protocol on the D-channel (LAPD)/Unacknowledged Information Transfer Service (UITS) mode to support DCC interworking with SDH products.
 - Default IP address on VLNC2 front LAN port.

Release 4.0 features

The following significant features were included in Release 4.0.

- SONET transport for DS3 is supported with the SONET/SDH Transport circuit pack (VLNC50) installed. This includes support for the following:
 - 3 DS3 interfaces on the Alcatel-Lucent 1850 TSS-5 VLIU1
 - DS3 PDH loopbacks
 - DS3 performance monitoring
- The SONET/SDH Transport circuit pack (VLNC50) supports SDH transport including:
 - Two ports for STM1 or STM4 transport
 - SDH regenerator section DCC (1 per port, interoperable with SONET DCC)
 - Transport of Ethernet over SDH (EoSDH) for the 1GbE optical
 - SDH timing inputs and outputs
 - Up to 8 E1 ports on the Alcatel-Lucent 1850 TSS-5 VLIU1
 - E1 PDH loopbacks
 - E1 performance monitoring

- The TDM Interface Unit (TIU) circuit pack (VLNC60) is introduced and supports
 - Origination or termination of TDM pseudowires for encapsulation and transport of DS1 over Ethernet (CESoP)
 - Termination of DS1 ML-PPP sessions and transmission of the IP traffic directly over the packet network using Ethernet 802.1Q encapsulation
 - Up to 8 DS1 ports
 - DS1 PDH loopbacks
 - DS1 performance monitoring
 - 2 GbE/FE interfaces
 - BITS input
 - IEEE 1588 precision timing protocol (PTP)
- VLNC40 supports a GbE backplane connection to VLNC50 or VLNC60 circuit packs, eliminating the need for PTMs and cables for connections between these cards in the same shelf with the VLNC40.

Release 3.0 features

The following significant features were included in Release 3.0.

- The Alcatel-Lucent 1850 TSS-5 High Capacity rack-mount shelf is an ETSI compliant shelf that has all electrical interfaces brought to the front of the shelf on the removable interface board (VLIU1).
The Alcatel-Lucent 1850 TSS-5 High Capacity rack-mount shelf is designed to serve the worldwide needs of wireline service providers at the edge of their networks. Applications include the traditional TDM Private Line services, and are expanded to include the flexibility and capacity for data services.
- The SYSCTL (VLNC2) supports Release 3.0 software and hardware, and future software and hardware. The VLNC2 operates at both -48 VDC and +24 VDC.
- The SONET Transport circuit pack (VLNC50) supports two ports for OC-3 or OC-12 PTMs and one port for either a 1000BASE-SX, 1000BASE-LX, or 1000BASE-ZX PTM.
For Alcatel-Lucent 1850 TSS-5 the lines may be used as 0x1 or UPSR/SNCP. The VLNC50 also supports 8 DS1 (T1) shelf electrical ports.
The VLNC50 provides SONET Minimum Clock (SMC) ± 20 PPM timing and provides DS1 sync output. It does not support external timing input. Line timing and

BITS generation is allowed from either line. Auto-reconfiguration allows automatic switching between the two lines on the same pack during unprotected operation. The 1000BASE-SX, 1000BASE-LX, or 1000BASE-ZX PTM port can be used to provide a connection to the LAN port of an Ethernet Aggregator Card (VLNC40) with an optical pluggable transmission module (PTM) installed.

- The Ethernet Aggregator Circuit Pack (VLNC40), also referred to as an Ethernet Interface Unit (EIU), aggregates traffic from a group of 10/100 Mb/s host Ethernet ports on the shelf into one or more Gigabit/Fast Ethernet ports on the faceplate supports up to 20 10/100 Mb/s Ethernet ports and 4 network GbE/FE Ethernet ports. Pluggable transmission modules (PTMs) are required on the 4 faceplate ports. The PTMs can be GbE or FE optical. The 20 shelf Ethernet ports are Fast Ethernet electrical ports.

2 Features



Overview

Purpose

This chapter briefly highlights the features supported by Alcatel-Lucent 1850 Transport Service Switch 5 (Alcatel-Lucent 1850 TSS-5), Release 7.0 and earlier. Features are described in more detail in [Chapter 3, “Topologies”](#), [Chapter 4, “Product description”](#), and [Chapter 5, “Operations, administration, maintenance, and provisioning”](#), as applicable.

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Hardware features

Overview

This section briefly describes the major hardware features supported in Release 7.0 of Alcatel-Lucent 1850 TSS-5.

The following is included in this section.

- Multi-function network interface circuit packs, housed in the MAIN slots
- Function Group C circuit packs, housed in the C slot
- Pluggable transmission modules installed in the circuit pack faceplates as needed
- High-density version of the Alcatel-Lucent 1850 TSS-5 rack-mount shelf

Important! For more detailed information about circuit pack capabilities, refer to [Chapter 4, “Product description”](#). For detailed technical specifications, refer to [Chapter 10, “Technical specifications”](#).

Main circuit packs

This section briefly describes the circuit packs supported in the MAIN1 and MAIN2 slots.

VLNC40 Ethernet Aggregator circuit pack

The VLNC40 Ethernet Aggregator circuit pack aggregates traffic from up to 20 electrical Fast Ethernet (10/100BASE-T) ports into one or more of the Fast Ethernet/Gigabit Ethernet (100/1000BASE-X or 1000BASE-T) PTM-based ports. The 4 network GbE/FE Ethernet ports on the faceplate require pluggable transmission modules. The VLNC40 supports Ethernet Link OAM IEEE 802.3 Clause 57 (formerly referred to as 802.3ah) and Ethernet Service OAM IEEE 802.1ag.

The faceplate ports may be connected using an external cable to any Ethernet port on the VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, or VLNC64 circuit pack. One faceplate Ethernet port may instead be provisioned to use a backplane connection at the Gigabit Ethernet rate to a VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, or VLNC64 in the shelf.

The VLNC40 circuit pack is only supported in the MAIN2 slot. The VLIU1 or VLIU2 interface unit is required to support the VLNC40 circuit pack. The VLIU1, VLIU2, or VLIU3 interface unit is required to support the VLNC40 circuit pack.

VLNC42 Ethernet Aggregator circuit pack

The VLNC42 Ethernet Aggregator circuit pack aggregates traffic from up to 20 electrical Fast Ethernet (10/100BASE-T) ports into one or more of the Fast Ethernet/Gigabit Ethernet (100/1000BASE-X or 1000BASE-T) PTM-based ports. The four network GbE/FE Ethernet ports on the faceplate require pluggable transmission modules. The VLNC42 supports Link OAM IEEE 802.3 Clause 57 (formerly referred to as 802.3ah) and Ethernet Service OAM IEEE 802.1ag. In addition, the VLNC42 is hardware-enabled to support synchronous Ethernet and high-performance Ethernet OAM ITU-T Y.1731. The VLNC42 is hardware-enabled to support the Time of Day (ToD)/1PPS feature for GPS replacement applications in a future release.

The faceplate ports may be connected using an external cable to any Ethernet port on the VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, or VLNC64 circuit pack. One faceplate Ethernet port may instead be provisioned to use a backplane connection at the Gigabit Ethernet rate to a VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, or VLNC64 in the shelf.

The VLNC42 circuit pack is only supported in the MAIN2 slot. The VLIU1, VLIU2, or VLIU3 interface unit is required to support the VLNC42 circuit pack.

VLNC42B Ethernet Aggregator circuit pack

The VLNC42B Ethernet Aggregator circuit pack aggregates traffic from up to 20 electrical Fast Ethernet (10/100BASE-T) ports into one or more of the Fast Ethernet/Gigabit Ethernet (100/1000BASE-X or 1000BASE-T) PTM-based ports. The four network GbE/FE Ethernet ports on the faceplate require pluggable transmission modules. The VLNC42B supports Link OAM IEEE 802.3 Clause 57 (formerly referred to as 802.3ah) and Ethernet Service OAM IEEE 802.1ag. In addition, the VLNC42B is hardware-enabled to support synchronous Ethernet and high-performance Ethernet OAM ITU-T Y.1731. In addition, the VLNC42B supports T-MPLS starting in Release 7.0.

The faceplate ports may be connected using an external cable to any Ethernet port on the VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, or VLNC64 circuit pack. One faceplate Ethernet port may instead be provisioned to use a backplane connection at the Gigabit Ethernet rate to a VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, or VLNC64 in the shelf.

The VLNC42B circuit pack is only supported in the MAIN2 slot. The VLIU1, VLIU2, or VLIU3 interface unit is required to support the VLNC42B circuit pack.

VLNC50 SONET/SDH Transport circuit pack

The VLNC50 SONET/SDH Transport circuit pack supports up to two OC-3/STM-1 or OC-12/STM-4 ports, and one GbE port using pluggable transmission modules. The GbE port may be connected manually using a fiber jumper to the VLNC40/42/42B Ethernet Aggregator circuit pack. The GbE port may also be provisioned to use a backplane connection. The VLNC50 also supports up to 8 DS1/E1 ports and up to 3 DS3/E3 ports.

The VLNC50 circuit pack can be installed in MAIN1 (VLIU[1,2,10]) and optionally in the MAIN2 slot. The VLIU1 or VLIU10 interface unit is required to support the VLNC50 in MAIN2 and equipment protection (UNPROT/PROT).

When UNPROT (protection-not-allowed), the two lines on the same board (OC-3/STM-1 or OC-12/STM-4) must be the same rate and may be either 0x1 (default) or UPSR/SNCP.

When PROT (equipment-protection-allowed), each pair of lines across the boards may be a different rate and may be either 1+1 or UPSR/SNCP. The two pairs of lines can have different applications.

VLNC52 SONET/SDH Transport circuit pack

The VLNC52 SONET/SDH Transport circuit pack supports up to two OC-3/STM-1 or OC-12/STM-4 ports, and one GbE port using pluggable transmission modules. The GbE port may be connected manually using a fiber jumper to the VLNC40/42/42B Ethernet Aggregator circuit pack. The GbE port may also be provisioned to use a backplane connection. The VLNC52 also supports up to 28 DS1/21 E1 ports and up to 3 DS3/E3 ports.

The VLNC52 circuit pack must be installed in MAIN1 (and optionally MAIN2) slot. The VLIU2 or VLIU10 interface unit is required to support the additional DS1/E1 interfaces on the VLNC52 circuit pack. The VLIU10 interface unit is required to support the VLNC52 in MAIN2 and equipment protection (UNPROT/PROT).

When UNPROT (protection-not-allowed), the two lines on the same board (OC-3/STM-1 or OC-12/STM-4) must be the same rate and may be either 0x1 (default) or UPSR/SNCP.

When PROT (equipment-protection-allowed), each pair of lines across the boards may be a different rate and may be either 1+1 or UPSR/SNCP. The two pairs of lines can have different applications.

VLNC60 Circuit Emulator circuit pack

The VLNC60 Circuit Emulator circuit pack creates pseudowire connections for up to 8 DS1/E1 ports. The TDM signals are encapsulated into Ethernet packets and extracted at the far end as per specification in IETF RFC 4553, Structure Agnostic Transport over Packet (SAToP).

The VLNC60 circuit pack can also terminate ML-PPP sessions on DS1/E1 interfaces and transmit the IP traffic directly over the packet network using Ethernet 802.1Q encapsulation.

The VLNC60 circuit pack faceplate can be equipped with up to 2 pluggable transmission modules for packet transport. They can be used for interworking with a VLNC40/42/42B Ethernet aggregator (on same shelf, or on another shelf), or for transport directly into the Ethernet Access Transport Network (EATN). The circuit pack faceplate ports may be manually connected using external cabling to any VLNC40/42/42B port. One faceplate Ethernet port may instead be provisioned to use a backplane connection at the Gigabit Ethernet rate to a VLNC40, VLNC42, or VLNC42B in the shelf.

The VLNC60 Circuit Emulator circuit pack may be installed in the MAIN1 or MAIN2 slot.

VLNC61 Circuit Emulator circuit pack

The VLNC61 Circuit Emulator circuit pack creates pseudowire connections for up to 16 DS1/E1 ports. The TDM signals are encapsulated into Ethernet packets and extracted at the far end as per specification in IETF RFC 4553, Structure Agnostic Transport over Packet (SAToP).

The VLNC61 circuit pack can also terminate ML-PPP sessions on DS1/E1 interfaces and transmit the IP traffic directly over the packet network using Ethernet 802.1Q encapsulation.

The VLNC61 circuit pack faceplate can be equipped with up to 2 pluggable transmission modules for packet transport. They can be used for interworking with a VLNC40/42/42B Ethernet aggregator (on same shelf, or on another shelf), or for transport directly into the Ethernet Access Transport Network (EATN). The circuit pack faceplate ports may be

manually connected using external cabling to any VLNC40/42/42B port. One faceplate Ethernet port may instead be provisioned to use a backplane connection at the Gigabit Ethernet rate to a VLNC40, VLNC42, or VLNC42B in the shelf.

The VLNC61 Circuit Emulator circuit pack may be installed in the MAIN1 or MAIN2 slot. The VLIU2 or VLIU10 interface unit is required to support the additional DS1/E1 interfaces on the VLNC61 circuit pack.

VLNC62 Circuit Emulator circuit pack

The VLNC62 circuit pack provides TDM interface termination for up to 8 DS1/E1 interfaces. It supports CESoP and ML-PPP termination on a port-by-port basis. These services can be mixed as needed among the ports. The VLNC62 circuit pack is installed in the MAIN 1 or MAIN 2 slot of the High Capacity rack-mount shelf. The VLNC62 circuit pack has a MGMT LAN port on the faceplate and two Ethernet LAN ports with PTM sockets for Fast Ethernet or Gigabit Ethernet connections. Both Ethernet interfaces must be the same rate.

In order to support a Metro Ethernet Forum 8 (MEF-8) based circuit emulation service, the user can specify an option for the mode of Circuit Emulation Service on the pack, either MPLS (RFC 4553) or Ethernet (MEF-8).

The VLNC62 circuit pack faceplate can be equipped with up to 2 pluggable transmission modules for packet transport. They can be used for interworking with a VLNC40/42/42B Ethernet aggregator (on same shelf, or on another shelf), or for transport directly into the Ethernet Access Transport Network (EATN). The circuit pack faceplate ports may be manually connected using external cabling to any VLNC40/42/42B port. One faceplate Ethernet port may instead be provisioned to use a backplane connection at the Gigabit Ethernet rate to a VLNC40, VLNC42, or VLNC42B in the shelf.

The VLNC62 Circuit Emulator circuit pack may be installed in the MAIN1 or MAIN2 slot. The VLIU1, VLIU2, or VLIU3 interface unit is required to support the VLNC62 circuit pack. The VLIU3 interface unit is required if Time of Day is desired.

VLNC64 Circuit Emulation Mini-Hub circuit pack

The VLNC64 Circuit Emulation Mini-Hub circuit pack is a variation of the VLNC60 Circuit Emulator circuit pack that performs Circuit Emulation functions. Instead of supporting electrical DS1/E1 interfaces, the VLNC64 circuit pack provides a single optical channelized OC-3/STM-1 interface on the TDM side, and two optical FE/GbE interfaces on the Ethernet side. All interfaces support pluggable transmission modules.

The OC-3/STM-1 interface is unprotected (0x1). In one direction, the VLNC64 recovers DS1 or E1 signals from the Ethernet LAN inputs, maps them (based on pseudowire provisioning) into VT1.5/VC-12s, which are transported over the OC-3/STM-1. The opposite occurs in the other direction. The board supports up to 84 circuit-emulated DS1s or up to 63 E1 channels. The pseudowires corresponding to the DS1 or E1 signals are protected using Bidirectional Forwarding Detection (BFD) protocol.

The VLNC64 circuit pack may work with a VLNC40/42/42B circuit pack in the adjacent MAIN 2 slot. The VLNC64 circuit pack also interworks at the far end of the Ethernet links with multiple, aggregated VLNC60/61/62 circuit packs. The optical OC-3/STM-1 interface is intended for connecting to an external DACS or ADM.

The VLNC64 Circuit Emulation Mini-Hub may be installed in the MAIN1 or MAIN2 slot. It is compatible with all interface units (VLIU[1,2,3,10]).

Function Group C circuit packs

Circuit packs installed in the Function Group C slot are associated with the shelf Group C electrical interfaces. The VLNC35 is the only circuit pack currently supported in this slot.

VLNC35 Fast Ethernet Private Line circuit pack that supports up to 4 electrical Fast Ethernet (10/100BASE-T) ports and 2 optical Fast Ethernet (100BASE-X) ports and works with the VLNC50/52 SONET/SDH Transport circuit packs in Ethernet over SONET/SDH applications.

Pluggable transmission modules (PTMs)

The VLNC35, VLNC40, VLNC42/42B, VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs support pluggable transmission modules (PTMs). They are purchased separately from the circuit pack and equipped (or plugged in) only as additional interfaces become necessary. PTMs make Alcatel-Lucent 1850 TSS-5 interface density scalable and can lower initial costs.

CWDM pluggable transmission modules are available for VLNC40, VLNC42/42B, VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs.

Networking capabilities

Overview

This section briefly describes the major networking capabilities supported for Release 7.0 of Alcatel-Lucent 1850 TSS-5.

Main SONET interfaces

Alcatel-Lucent 1850 TSS-5 supports unprotected and protected OC-3 and OC-12 linear optical extensions. Single-homed and dual-homed ring extensions are supported. UPSR switching can be used at the STS-1, STS-3c and VT1.5 level with the VLNC50/52 circuit pack. For additional information see [“Optical topologies” \(p. 3-2\)](#).

Alcatel-Lucent 1850 TSS-5 interfaces can be equipment protected, network (SONET) protected, or unprotected. In order to have network protection the MAIN packs must be equipment protected. Equipment protection is accomplished by virtue of circuit pack

redundancy in MAIN1 and MAIN2 slots. This redundancy allows for traffic restoration and circuit pack replacement without loss of TDM/FE service. SONET protection is accomplished via UPSR and 1+1 capabilities.

When UNPROT (protection-not-allowed), the two lines on the same board (OC-3 or OC-12) must be the same rate and may be either 0x1 (default) or UPSR.

When PROT (equipment-protection-allowed), each pair of lines across the boards may be a different rate and may be either 1+1 or UPSR. The two pairs of lines can have different applications.

The VLNC50/52 circuit pack supports OC-3 and OC-12 interfaces.

The VLNC64 circuit pack supports OC-3 interfaces.

Main PDH interfaces

Alcatel-Lucent 1850 TSS-5 supports DS1/E1 and DS3/E3 interfaces.

The VLNC50 circuit pack supports 8 DS1/E1 ports and 3 DS3/E3 interfaces.

The VLNC52 circuit pack supports 28 DS1/21 E1 ports and 3 DS3/E3 interfaces.

The VLNC60 circuit pack supports 8 DS1/E1 interfaces.

The VLNC61 circuit pack supports 16 DS1/E1 interfaces.

The VLNC62 circuit pack supports 8 DS1/E1 interfaces.

Note: On the VLNC50/52, one of the DS3 interfaces (port b-3) may be used for TMUX (channelized with DS1s).

Main SDH interfaces

Alcatel-Lucent 1850 TSS-5 supports unprotected STM-1 and STM-4 linear optical extensions. SNCP switching can be used at the VC-3 (low-order), VC-4, and VC-12 level with the VLNC50/52 circuit pack.

Alcatel-Lucent 1850 TSS-5 interfaces can be equipment protected, network (SDH) protected, or unprotected. In order to have network protection the MAIN packs must be equipment protected. Equipment protection is accomplished by virtue of circuit pack redundancy in MAIN1 and MAIN2 slots. This redundancy allows for traffic restoration and circuit pack replacement without loss of SDH/FE service. SONET protection is accomplished via SNCP and 1+1 capabilities.

When UNPROT (protection-not-allowed), the two lines on the same board (STM-1 or STM-4) must be the same rate and may be either 0x1 (default) or SNCP.

When PROT (equipment-protection-allowed), each pair of lines across the boards may be a different rate and may be either 1+1 or SNCP. The two pairs of lines can have different applications.

The VLNC50/52 circuit pack supports STM-1 and STM-4 interfaces.

The VLNC64 circuit pack supports STM-1 interfaces.

The Link Access Protocol on the D-channel (LAPD)/Unacknowledged Information Transfer Service (UITs) mode is supported on the VLNC50/52 to allow DCC interworking with SDH products.

VT1.5/VC-12 granularity

The VLNC50/52 circuit pack supports full VT1.5 granularity on OC-3/OC-12 interfaces and full VC-12 granularity on STM-1/STM-4 interfaces. The VLNC50/52 circuit pack supports 63 VT1.5/VC-12 cross-connections to the GbE Ethernet port. The VLNC50 supports VT1.5 cross-connections to 8 DS1 ports or VC-12 cross-connections to 8 E1 ports. The VLNC52 supports VT1.5 cross-connections to 28 DS1 ports or VC-12 cross-connections to 21 E1 ports.

The VLNC64 circuit pack recovers DS1/E1 signals from the Ethernet LAN inputs, maps them (based on pseudowire provisioning) into VT1.5/VC-12s, which are then transported over the channelized OC-3/STM-1 interface. The VLNC64 circuit pack supports up to 84 DS1 signals or up to 63 E1 signals.

Channelized DS3

The VLNC50/52 circuit pack can be provisioned to support a channelized DS3 signal on port b-3. The channelized DS3 signal can be mapped into 28 DS1 signals. Each of the 28 DS1 signals can be cross-connected to an VT1.5 tributary or a DS1 port. Because these packs support a maximum of 28 DS1s split between the A group and the B-3 group, if a port is used as an electrical DS1 port, the corresponding DS1 port number within the TMUXed DS3 cannot be used. For example, if DS1 port a-1-3 is being used, TMUXed DS1 port b-3-1-3 cannot be used.

Private Line Ethernet

The VLNC50/52 circuit pack supports dedicated Private Line links between two Ethernet end-points. Private Line service requires minimal provisioning, typically just SONET/SDH cross-connections. The VLNC50/52 circuit pack supports only fractional Private Line, not full rate Private Line. For additional information see [“Ethernet services” \(p. 3-19\)](#) and [Appendix A, “Ethernet”](#). Fractional Private Line uses a fractional portion of SONET/SDH bandwidth to provide an Ethernet link with limited bandwidth. It is a form of rate control that also improves efficiency by only consuming the required SONET/SDH bandwidth in increments. For information about how STS-1/VC-3 (low-order), STS-3c/VC-4, or VT1.5/VC-12 tributaries can be virtually concatenated to provide Private Line service, refer to [“Virtual concatenation” \(p. A-6\)](#).

The intermediate link of an Ethernet Private Line connection prohibits Layer 2 functionality between the two end-points. The performance of a Fractional Private Line with limited bandwidth may be improved using flow control. Because flow control is a layer 2 mechanism, it must be managed across the Private Line by the devices terminating the physical Ethernet links on either end. For information about flow control functionality, refer to [“Flow control” \(p. A-8\)](#).

The VLNC35 circuit pack supports Gbe/FE Private Line links to the VLNC50/52 circuit packs. For more information, refer to [“Fast Ethernet Private Line over SONET/SDH” \(p. 3-19\)](#).

Ethernet aggregation

The VLNC40/42/42B Ethernet aggregator circuit pack supports the aggregation of traffic from up to 20 10/100BASE-T ports onto one or more of 4 100/1000BASE-X or 1000BASE-T PTM-based ports. For additional information, see [“Ethernet aggregation” \(p. 3-20\)](#), and [“10/100/1G-T/F \(VLNC40\)” \(p. 4-14\)](#)/[“10/100/1G-T/F \(VLNC42/42B\)” \(p. 4-16\)](#).

Circuit emulation

The VLNC60/61/62 Circuit Emulator and VLNC64 Circuit Emulation Mini-Hub circuit packs support circuit emulation to preserve the context and nature of TDM services, using the pseudowire technology, over an Ethernet network. The VLNC60 circuit pack supports 8 DS1/E1 access ports, and 2 PTM-based Ethernet LAN ports as uplinks to the EATN or connections to a VLNC40/42/42B. The VLNC61 circuit pack supports 16 DS1/E1 access ports, and 2 PTM-based Ethernet LAN ports as uplinks to the EATN or connections to a VLNC40/42/42B. The VLNC62 circuit pack supports 8 DS1/E1 access ports, and 2 PTM-based Ethernet LAN ports as uplinks to the EATN or connections to a VLNC40/42/42B. The VLNC64 supports 1 channelized OC-3/STM-1 port, and 2 PTM-based Ethernet LAN ports as uplinks to the EATN or connections to a VLNC40/42/42B.

For additional information, see [“Circuit emulation service over packet \(CESoP\)” \(p. A-23\)](#), and [“ML-PPP termination” \(p. A-27\)](#).

ML-PPP termination

The VLNC60/61/62 Circuit Emulator circuit pack terminates ML-PPP sessions at base transceiver stations and transmits the IP traffic directly over the packet network using Ethernet 802.1Q encapsulation. This reduces frame overhead associated with data backhaul over DS1/E1, and reduces the number of ML-PPP sessions that must be terminated by the MLS router at the mobile switching center.

Layer 2 control protocol tunneling

Layer 2 Control Protocols (L2CPs) are used for several purposes in IEEE 802 standard networks, including link maintenance, aggregation, flow control, authentication, identity/capability discovery and management. L2CPs are also used for managing the behavior of LAN bridges, including STP/RSTP/MSTP and GARP/MRP. The VLNC40/42/42B circuit packs support L2CP tunneling. A L2CP frame is identified by the destination MAC address.

On the VLNC40/42/42B, L2CP Tunneling (l2cp-tunnel) can be enabled or disabled on a port-by-port basis. When the mode is disabled, all the rules and characteristics described for the peering of supported protocols apply. When the l2cp-tunnel mode is enabled on a port, all customer L2CP frames/messages for supported and unsupported protocols that are received at that port are forwarded. Because the tunneled protocol is either disabled or unsupported, VLNC40/42/42B does not interpret any of the frames associated with a tunneled protocol.

L2CP Tunneling and Link OAM are allowed simultaneously. However, the loopback cannot be operated and remote loopback capability cannot be enabled when L2CP Tunneling and Link OAM are both enabled on a port.

Note: Refer to [“Layer 2 control protocol tunneling” \(p. A-30\)](#) for more information.

T-MPLS

Transport Multi-protocol Label Switching (T-MPLS) is a network layer technology that uses a subset of the existing MPLS standards and is designed specifically for application in packet networks. It is a connection-oriented packet-switched (CO-PS) technology, well-suited to support Ethernet services. It offers a simpler implementation than MPLS by removing features that are not relevant to CO-PS applications and adding mechanisms that provide support of critical transport functionality (T-MPLS = MPLS - IP + OAM).

T-MPLS uses the same architectural principles of layered networking that are used in other technologies like SDH and OTN and provides a reliable packet-based technology that is familiar and aligned with circuit-based transport networking. It can run on any physical layer.

VLNC42B circuit pack

The VLNC42B circuit pack supports T-MPLS.

- 2 GbE Label Edge Router (LER) or Label Switch Router (LSR) Network to Network Interface (NNI) ports without egress rate shaping on Ethernet NNI ports.
- 2 GbE Ethernet User to Network Interface (UNI) ports with ingress single rate metering only per port on Ethernet UNI ports.
- 20 100BASE-TX Ethernet User to Network Interface (UNI) ports.

T-MPLS label space management

According to G.8112, the Alcatel-Lucent 1850 TSS-5 supports reserved label space [Label Range: 0..15] with label 14 for T-MPLS OAM and label space [16...1048575] as T-MPLS Label Range. Both label static allocation.

Highlights of the T-MPLS feature

Highlights of the T-MPLS feature

- Ethernet over T-MPLS encapsulation (LER functionality). Circuit Emulation traffic from VLNC6x is carried as Circuit Emulation over Ethernet over T-MPLS
- 1588 ToD and 1PPS capabilities supported on the VLNC62 circuit pack. With 1588 transparent clock for 1588/VLAN/Eth PW/T-MPLS/EthPHY. 1588 packets will be carried in a tunnel provisioned with a special, reserved label number range.
- Point-to-point (E-LINE) connections
- Support for 500 bidirectional tunnels in total.
 - Maximum of 250 bidirectional LSR tunnels per shelf
 - Maximum of 250 bidirectional LER tunnels per shelf (protected + unprotected)
- 64 protection groups (exactly 2 tunnels per group)
- 250 bidirectional pseudowires per shelf
- Limited T-MPLS OAM
 - Connectivity Verification (CV) capability to be used as a trigger for tunnel protection switching
 - Automatic Protection Switching (APS) capability needed to support protection switching
- T-MPLS Quality Of Service: single rate metering only (CIR+CBS or PIR+PBS, per service)
- ETS Component management (the connection between the Ethernet UNI and the T-MPLS Pseudowire), including Ethernet Port provisioning. This functionality to be supported by OpticsIM MIB SNMP and includes provisioning and alarming. NML T-MPLS service provisioning is included.
- OpticsIM MIB SNMP support for ETS provisioning and Ethernet port provisioning. SNMP Get/Trap support for Circuit Emulation functionality.
- TL1 commands support T-MPLS provisioning and TL1 autonomous message support for T-MPLS alarms.

Refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) TL1 Command Guide for T-MPLS* for details.

Cross-connections

Overview

Alcatel-Lucent 1850 TSS-5 has two-way cross-connection capabilities that offer you flexibility in directing traffic flow through systems to support a wide variety of customer applications.

Creating cross-connections

Cross-connections are created by specifying the SONET (VT1.5 or STS-n) or SDH (VC-3 [low-order], VC-4, or VC-12) rate, the end point addresses (AIDs), and the cross-connection type (for example, two-way). Each single cross-connection command establishes a two-way cross-connection.

Cross-connection rates

Alcatel-Lucent 1850 TSS-5 supports the following SONET VT1.5/STS-n or SDH VC-n rate cross-connections.

- SONET: VT1.5, STS-1, and STS-3C
- SDH: VC-12, VC-3 (low-order), and VC-4

Cross-connection types

Alcatel-Lucent 1850 TSS-5 supports the following cross-connection types:

- *1+1 Add/Drop* Alcatel-Lucent 1850 TSS-5 complies with SONET/SDH 1+1 unidirectional nonrevertive protection switching requirements. Automatic line switches are initiated by signal fail and signal degrade conditions on the received high-speed (OC-3/STM-1 or OC-12/STM-4) optical signal and are completed within 50 milliseconds of a signal failure. Manual switch commands are available through the local and remote operations interfaces.
- *UPSR Add/Drop* (SONET only): A two-way cross-connection that add/drops traffic to/from a tributary on a UPSR protected interface. In the add direction, traffic is bridged to the same tributary in both rotations of the UPSR. In the drop direction, the path (tributary) selector monitors both tributaries independently, and selects traffic from one tributary based on performance criteria and technician/OS control.
- *SNCP Ring Add/Drop* (SDH only): A two-way cross-connection that add/drops traffic to/from a tributary on a SNCP protected interface. In the add direction, traffic is bridged to the same tributary in both rotations of the SNCP. In the drop direction, the path (tributary) selector monitors both tributaries independently, and selects traffic from one tributary based on performance criteria and technician/OS control.

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- *2-Way point-to-point, through*: A two-way cross-connection between the two sides of a UPSR/SNCP node. Traffic received on a timeslot on one side of the UPSR/SNCP node is passed through to the same timeslot on the opposite side of the UPSR/SNCP node.
 - *2-Way Hairpin*: A two-way cross-connection between a DS1 port in virtual function group A (VLNC50/52) and a DS1 port within a channelized DS3 in virtual function group B-3 (VLNC50/52).
 - *Linear/Unprotected UPSR* (SONET only): A two-way cross-connection between a tributary on one side of an UPSR interface and a tributary on a VCG port in function group C or D.
 - *Linear/Unprotected SNCP* (SDH only): A two-way cross-connection between a tributary on one side of an SNCP interface and a tributary on a VCG port in function group C or D.

Refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) TL1 Command Guide for MSPP* for detailed information about cross-connection types and restrictions.

Management and operations features

Overview

This section briefly describes the major features related to management and operation of Alcatel-Lucent 1850 TSS-5, supported for Release 7.0. It also includes descriptions of features that will be supported in future releases of Alcatel-Lucent 1850 TSS-5.

Loopbacks

Alcatel-Lucent 1850 TSS-5 supports terminal and facility loopbacks for DS1/E1 and DS3/E3 interfaces supported by the VLNC50/52 circuit pack and DS1/E1 interfaces supported by the VLNC60/61/62 circuit pack. The VLNC35 supports terminal loopbacks on Ethernet interfaces.

A terminal loopback connects the signal that is about to be passed through the tributary interface to the DSX back toward the cross-connect fabric to the optical line (or pseudowire in the case of the VLNC60/61/62). During a terminal loopback, the tributary DSX interface outputs an Alarm Indication Signal (AIS). Terminal loopbacks are used during installation and maintenance procedures to test the integrity of near and far-end interfaces as well as fibers and system circuitry.

A facility loopback loops the signal at the tributary interface so that the signal received from the DS1/E1 facility is transmitted back toward the facility. Facility loopbacks are used for installation and maintenance procedures to test the integrity of the tributary facilities and the DS1/E1 terminal equipment.

Alcatel-Lucent 1850 TSS-5 supports external optical loopbacks on the optical interfaces for the OC-n/STM-n lines.

Alcatel-Lucent 1850 TSS-5 supports Loopback-Opt and Loopback-Eth on the DS1/E1 interfaces of VLNC64. Loopback-Opt is used in maintenance procedures to test the DS1/E1 signal from OC-3/STM-1 interface. Loopback-Eth is used in maintenance procedures to test the DS1/E1 signal received via the Circuit Emulation Pseudowire.

Inband-requested DS1 loopbacks for VLNC50/52 SONET Transport and VLNC60/61/62 Circuit Emulator circuit packs are also supported. Inband-requested DS1 loopbacks can be provisioned using either inband signal control (ISC) patterns or a bit-oriented codes (BOC) within the DS1 signal received from the DSX (VLNC50/52 and VLNC60/61/62) or optical fiber (VLNC50/52).

The VLNC50/52 circuit packs also support Far End Alarm Channel (FEAC) requested DS1 and DS3 facility loopbacks on the channelized, cbit-framed, b-3 DS3 port. The FEAC-requested loopbacks are provisioned using FEAC codes within the b-3 DS3 signal received from the DSX. The ability to respond to FEAC loopback requests is provisionable on the b-3 DS3 port only.

Cross-connect loopbacks are supported on the tributaries of the optical SONET/SDH ports of the VLNC50/52 circuit pack. A tributary received on an optical interface is looped back, through the cross-connect fabric, to the same-numbered tributary in the transmit optical interface, and AIS is inserted downstream if the tributary is cross connected.

The VLNC40/42/42B supports IEEE 802.3 Clause 57 (802.3ah) active and passive mode Link OAM on the 20 10/100 backplane FE ports and the 4 PTM-based faceplate ports. The remote loopback option is supported, allowing an interface to initiate or respond to loopback requests with compatible link partners. In Active mode, a port can send a loopback command or respond to a loopback request from the remote end. In the Passive mode, a port can only respond to a loopback request from the remote end. The loopback routes frames received from the line back to the transmit direction. This facility loopback can only be operated remotely, with a CLI command at the originating node causing activate/deactivate inband OAMPDU frames to be sent to the remote node. Monitoring associated with the loopback can be done at the originating end of the link allowing tests to be run from one location.

L2CP Tunneling and Link OAM are allowed simultaneously. However, the loopback cannot be operated and remote loopback capability cannot be enabled when L2CP Tunneling and Link OAM are both enabled on a port.

WaveStar® CIT for SONET/SDH operations

When equipped with VLNC2 and VLNC50/52 circuit packs, the *WaveStar®* CIT manages SONET/SDH operations for the Alcatel-Lucent 1850 TSS-5 through the serial RS-232 or IAO/LAN port. It provides TL1 messaging, software download for the VLNC2 and

VLNC50/52, and full operations and provisioning capability via a Graphical User Interface (GUI) or TL1 command builder. The *WaveStar*® CIT can run a full-featured GUI or TL1 scripts. Using the GUI, a crafts person can access all Alcatel-Lucent 1850 TSS-5 software functions and context-sensitive help. The TL1 command builder is a flexible TL1 command builder that supports full TL1 management through LAN or RS-232 interfaces. It provides a simple list of TL1 commands and prompts to help complete them more quickly.

TFTP

Software and software upgrades may be downloaded to the CLI-managed circuit packs (VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64) using a Trivial File Transfer Protocol (TFTP) server. The requirements of a TFTP server depend upon the characteristics (for example, speed and delay) of the customer's management network, and the possible load placed on the server by multiple NEs.

If the TFTP server is on a heavily loaded (or limited bandwidth) network, the server should provide a configurable per-packet timeout of up to approximately 15 seconds. If many NEs will be hosted by a single TFTP server, then the server should support multiple, simultaneous transfers (multi-threaded).

Free TFTP servers that support the features described are available from multiple sources. 3Com provides a free TFTP server, 3CDaemon, that supports the features described. The software package is available for download from the 3Com Support web site, [Utilities for Windows 32 Bit](http://support.3com.com/software/utilities_for_windows_32_bit.htm) (http://support.3com.com/software/utilities_for_windows_32_bit.htm) .

Performance monitoring

Performance monitoring (PM) data is reported on the VT1.5, STS-1, STS-3c, VCN, DS1, DS3, OC-3, OC-12, E1, STM-1, STM-4, Fast Ethernet, and Gigabit Ethernet levels.

CLI management

Operations supported by the VLNC40, VLNC42/42B, VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs are managed by a separate Command Line Interface (CLI) that is accessed by a serial or network connection to the circuit pack.

You have two options to communicate with the CLI-based packs:

- PC and the Web GUI interface
- Command Line Interface (CLI) messages

The Web GUI and CLI messages permit VLNC4x/VLNC6x circuit pack operations to be performed (for example, administration and provisioning). The Web GUI and navigation windows are designed to be straightforward and to contain all information relating to a particular operation.

For a detailed description of the Command Line Interface (CLI) messages and general information about using the Command Line Interface (CLI), refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide*.

Using the Web GUI

To use the Web GUI, each VLNC4x or VLNC6x pack must be connected to the network and have its IP address configured. The user then accesses the pack via the Web GUI by entering the IP address of the pack as the URL in the HTTP-enabled Web browser. The Login screen is displayed next. Once the user enters the valid username and password and connecting to the VLNC4x or VLNC6x pack is successful, then the Web GUI main page is displayed.

Refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) CLI User Provisioning Guide* for more information about using the Web GUI.

Browsers

The Web GUI has been tested with the following browsers:

- Mozilla FireFox® 3
- Mozilla FireFox® 3.5
- Microsoft® Internet Explorer 7.0
- Microsoft® Internet Explorer 8.0

TL1 management

When equipped with a VLNC2 and VLNC50/52, TL1 management for SONET/SDH operations is supported via the RS-232 and LAN interface using a PC and a windows-based graphical user interface (GUI). The GUI is called the *WaveStar®* Craft Interface Terminal (*WaveStar®* CIT) and permits system-level and VLNC50/52 circuit pack/port operations to be performed (for example, administration, provisioning, and fault management).

Default IP access on the front LAN ports

Default IP access and addresses on the faceplate LAN ports of the SYSCTL and the self-managed VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs allows a plug-and-play capability for IP communications between the *WaveStar®* CIT or other PC and the network element initially. You can log in and perform an initial software download to the network element via IP from the *WaveStar®* CIT or other PC without manually reconfiguring the *WaveStar®* CIT/PC.

Remote software download

Software and software upgrades can be downloaded to remote NEs via the File Transfer Protocol (FTP) from a *WaveStar*® CIT over the IAO LAN connected to the LAN port on the SYSCTL. This requires that FTP is enabled on the NE, and that IP is enabled and properly configured on the SYSCTL LAN port.

Software and software upgrades can also be downloaded to a VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack using a Trivial File Transfer Protocol (TFTP) server.

Software downloads and control of the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs are independent of the SYSCTL circuit pack. They require IP network connectivity to the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack as described in [“Remote software download for non-SYSCTL controlled circuit packs”](#) (p. 5-24).

Proxy ARP

The address resolution protocol (ARP) is a method for associating the physical media access code (MAC) of a hardware device on a local physical network with a network address that can be routed for use over the larger overall network. Using this protocol, one network device tries to locate another device associated with a specific network address by broadcasting an ARP request on the on the local physical network. The ARP request contains the IP address of the device being sought. If a device on the local network has been configured with this network address, it responds with to the ARP request its physical MAC address. Once the association between local MAC hardware address and the network address of the device is established it can communicate with other devices on remote networks, using its network address.

ARP requests are not broadcast or routed beyond the local physical network media. Standard ARP cannot resolve addresses for network devices on the single logical network if that logical network consists of multiple physical networks linked by different physical media. Devices on one physical network cannot receive ARP requests from devices on another physical network. Proxy ARP uses a system, called ARP sub-net gateway, to answer ARP requests received from a device on one of its physical (LAN) networks for a target that is located on a different physical network.

Alcatel-Lucent 1850 TSS-5 supports IP tunneling to encapsulate and route IP packets over OSI-based embedded DCN. This allows NTP server and other services located in the IP-based access Data Communication Network (DCN) to communicate with NEs located in the OSI-based DCN. The tunnels also physically separate the devices on the IP network. Proxy ARP support on the Gateway Network Element (GNE) eliminates the need to create static routes to route the IP packets from the access DCN to the embedded DCN.

ARP subnet gateway (RFC 1027)

The ARP Subnet Gateway implementation adheres to RFC1027 which states that, if the IP networks of the source and target hosts of an ARP request are different, an ARP subnet gateway implementation should not reply to the request. This is to prevent the ARP subnet gateway from being used to reach foreign IP networks and possibly bypass security checks provided by IP gateways.

Because of this RFC requirement, the IP addresses of both the GNE and RNE must be in the same network with respect to network class (A, B and C). For example, if the GNE has a class C IP address 192.168.170.1, the RNE must have an IP address in the same Class C network, in the form 192.168.170.x. For proxy ARP to function properly, the Remote NE IP address must be in the same subnet as the IP address of the router, as specified by the network mask on the router. Otherwise, the router will not send the ARP request to the appropriate LAN port, and will instead route the packet through its default IP gateway into the IP cloud.

However, the IP address of the remote NE should not be in the same subnet as the IP address of the GNE, from either the GNE's network mask perspective or the RNE's network mask perspective. An easy way to achieve this on the RNE is to assign a 32-bit network mask to all RNEs.

OSI seven-layer protocol stack

This feature provides interworking using the Open Systems Interconnection (OSI) seven-layer protocol stack over the data communications channel (DCC). The OSI seven-layer protocol stack refers to the OSI reference model, a logical structure for network operations standardized by the International Standards Organization (ISO).

Support of Simple Network Management Protocol

The independently-managed VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs and the SYSCTL-controlled VLNC50/VLNC52 circuit packs use Simple Network Management Protocol (SNMP). SNMP is the most common protocol used by data network management applications to query a management agent using a supported Management Information Base (MIB). SNMP operates at the OSI Application layer. The IP-based SNMP is the basis of most network management software, to the extent that today the phrase *managed device* implies SNMP compliance. Alcatel-Lucent 1850 TSS-5 supports SONET, SDH, and Ethernet gets and traps.

For more information, refer to [“SNMP interface” \(p. 5-84\)](#) in [Chapter 5, “Operations, administration, maintenance, and provisioning”](#) of this document.

Remote NE status

This feature partitions a subnetwork into maintenance domains (alarm groups). An Alarm Group is a set of NEs that share status information. Alarm groups can be nodes in a ring or any other logical grouping such as a maintenance or geographical group. Each Level 1 area can be identified as a separate Alarm Group, as long as it does not exceed 250 nodes. You must provision one NE in an Alarm Group as an alarm gateway NE (AGNE) to support office alarms and a summary alarm information of remote NEs in the local alarm report. More than one AGNE can be provisioned per alarm group, but this is not recommended.

Security

Security features include 1–999 day password aging, customized login proprietary messages, and up to 150 users.

Remote Authentication Dial In User Service (RADIUS) authentication for user logins

When the network element is provisioned to use RADIUS authentication, any user TL1/CLI/Web GUI login attempt triggers the network element, if the maximum number of logins is not reached, to query the designated RADIUS server(s) and act on the response.

TARP

Alcatel-Lucent 1850 TSS-5 is compatible with any other-vendor NEs that support Target ID Address Resolution Protocol (TARP), OSI, IAO LAN, and TL1 as specified in *Telcordia*® GR-253.

SONET/SDH

Many of the traditional SONET/SDH maintenance, provisioning, operations, control, and synchronization features are included in the Alcatel-Lucent 1850 TSS-5. The flexible SONET and SDH standards provide a formidable foundation for the Alcatel-Lucent 1850 TSS-5 to build upon.

Multivendor operations Interworking

Alcatel-Lucent 1850 TSS-5 supports interoperability with many vendors' equipment; particularly those that support GR-253 standards-based SONET and ITU-T standards-based SDH.

Product Family 2000/*WaveStar*® Product Family interworking

Alcatel-Lucent 1850 TSS-5 supports TARP interoperability with Product Family 2000 nodes such as the FT-2000 OC-48 Lightwave System, the DDM-2000 OC-3/OC-12 Multiplexer, and the DDM-2000 FiberReach Multiplexer.

Alcatel-Lucent 1850 TSS-5 also provides interoperability with all *WaveStar*® Product Family nodes supporting TARP.

IP tunneling interworking

In a typical network, the Alcatel-Lucent 1850 TSS-5 is a remote NE (RNE) interworking with an Alcatel-Lucent 1850 TSS-100 or Alcatel-Lucent 1850 TSS-320 functioning as the gateway NE (GNE). The Alcatel-Lucent 1850 TSS-100/Alcatel-Lucent 1850 TSS-320 GNE supports T-TD (TL1 Translation Device) to translate TL1 over TCP/IP to TL1 over OSI. This allows TL1 management of a remote Alcatel-Lucent 1850 TSS-5. However, to fully support IP tunneling interworking between a remote Alcatel-Lucent 1850 TSS-5 and the Alcatel-Lucent 1850 TSS-100/Alcatel-Lucent 1850 TSS-320 GNE, the Alcatel-Lucent 1850 TSS-5 supports a provisionable NSAP selector parameter that allows software operations (download/backup/restore) to a remote Alcatel-Lucent 1850 TSS-5 using FT-TD (File Transfer Translation Device) to translate FTP over TCP/IP to FTAM over OSI.

Far End Alarm Channel (FEAC) for channelized DS3 interface

When the channelized DS3 (port b-3) of the VLNC50/52 circuit pack is provisioned for cbit formatting a limited set of FEAC codes (defined in ANSI T1.107) is transmitted toward the DSX when certain alarm conditions are detected (for example, DS3 loss of signal or equipment failure).

The FEAC requested DS1 and DS3 loopback capability can also be enabled/disabled on the cbit-formatted, channelized b-3 DS3 port of the VLNC50/52 circuit pack. The FEAC loopback codes are received on the incoming DS3 from the DSX.

Synchronization features

Overview

Synchronization is an important part of all SONET/SDH products. Alcatel-Lucent 1850 TSS-5, equipped with a VLNC2 and VLNC50/52, VLNC42, and VLNC6x circuit packs is designed for high performance and reliable synchronization and can be used in a number of synchronization environments.

VLNC50/52 circuit pack timing is provided by an internal SONET Minimum Clock (SMC) Timing Generator (no synchronization inputs), or SDH Equipment Clock, Option 2 (SEC). Internal timing functions such as reference interfaces, the on-board clock elements, and timing distribution, are provided by the SMC/SEC Timing Generator. The timing generator distributes clock and frame signals, derived from the ± 20 ppm generator, to any companion VLNC50/52, VLNC35, or VLNC42 circuit pack.

The VLNC52 circuit pack supports synchronous Ethernet by transmitting timing and Ethernet synchronization status messages on the Gigabit Ethernet interface. The VLNC52 circuit pack also provides a 25 MHz backplane reference signal for VLNC42 circuit packs. The VLNC52 circuit pack can not recover timing reference signals or Ethernet synchronization status messages from the Gigabit Ethernet interface.

VLNC42/42B circuit pack timing is provided by an internal SONET Minimum Clock (SMC) Timing Generator and clock extraction from any Gigabit Ethernet interface. Internal timing functions such as reference interfaces, the on-board clock elements, and timing distribution, are provided by the SMC/SEC Timing Generator. The timing generator transmits timing, derived from the ± 20 ppm generator, and Ethernet synchronization status messages to any synchronous Ethernet port. The VLNC42/42B circuit pack can also recover Ethernet synchronization status messages from any synchronous Ethernet port.

VLNC6x circuit pack timing is provided by an internal Stratum 3 Timing Generator and clock extraction from any Gigabit Ethernet interface, optical line, or BITS clock. Internal timing functions such as reference interfaces, the on-board clock elements, and timing distribution, are provided by the Stratum 3 Timing Generator. The timing generator transmits timing, derived from the ± 4.6 ppm generator, and Ethernet synchronization status messages to any synchronous Ethernet port. The VLNC6x circuit pack can also recover Ethernet synchronization status messages from any synchronous Ethernet port.

Synchronization features on the VLNC6x circuit packs

Alcatel-Lucent 1850 TSS-5 VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs support the following synchronization modes:

- System timing
- Interface timing

System timing

System Timing provides the timing information for all devices on the VLNC60, VLNC61, VLNC62, or VLNC64 pack. The sources for this timing are:

- **Building Integrated Timing Supply, BITS**
BITS is a timing source traceable to a common Primary Reference Clock in the network. The shelf has a special DS1/E1 input interface associated with each main slot for receiving this timing.
- **Line** (applicable only to the VLNC64)
In this mode, the System Timing is derived from an OC-3/STM-1 line on the VLNC64 pack.

- **Precision Timing Protocol, 1588v2**

The VLNC60/VLNC61/VLNC62/VLNC64 packs can be deployed in remote locations where there is no access to physical external clocking source, such as BITS. In such cases, timing information is distributed across the network using a Precision Timing Protocol known as 1588. VLNC60/VLNC61/VLNC62/VLNC64 implement version 2 of the protocol (1588v2). This protocol may be run in Master mode or Slave mode. The pack which has access to external timing source is run in Master mode. The pack running in 1588 Master mode distributes the clocking information across a network over Ethernet. At remote locations, 1588 must run in Slave mode. In Slave mode, the pack derives System Timing from 1588 protocol messages being received from the Master system in the network.

- **Free running**

The VLNC60/VLNC61/VLNC62/VLNC64 circuit pack contains a Stratum 3 (ST3/SEC) oscillator (± 4.6 ppm). In Free Running mode, this oscillator serves as the timing source for the pack. Free running is the default System Timing mode. When all the interfaces on the pack provide ML-PPP service, free running is the recommended mode. In all other situations, one of the other system timing modes should be provisioned.

- **Holdover**

When the pack loses a valid timing input, the timing generator switches to holdover mode and continues to provide system timing, using the internal oscillator to maintain the last known good reference frequency.

Interface timing

Interface timing refers to the timing source of the DS1/E1, OC-3/STM-1 interfaces on the VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs.

- **System**

In this mode, the interface derives its timing from the same source as the System Timing. System is the default timing mode for the individual interfaces.

- **Loop**

In this mode, the interface derives its timing from the incoming signal of the interface.

- **Differential**

In this mode, the interface derives its timing by taking into account the System Timing and information it retrieves from the Real Time Protocol (RTP) timestamps of the Pseudowire. These RTP timestamps are sent by the VLNC60/VLNC61/VLNC62/VLNC64 packs on the pseudowire as part of the RFC 4553 header.

Differential timing is required on DS1/E1 interfaces carrying Circuit Emulation traffic.

Differential Timing Domain

The VLNC64 pack has internal resources to generate and recover RTP differential timestamps. These timestamps are carried in the SAToP (RFC 4553) encapsulated data traffic. The information contained in this timestamp is used to recover timing information from the embedded TDM signal in the data frame, when it reaches the

other end of the packet network.

On the VLNC64 there are up to 28 internal resources which can generate/recover the RTP differential timestamps. This means that up to 28 TDM timing domains can be generated/recovered from these data frames. The VLNC64 supports up to 84 DS1 or 63 E1 signals. Since there can be only 28 distinct TDM timing domains, these DS1/E1 signals must be grouped into 28 timing domains. In each group, one of the DS1/E1 signals serve as the source of timing for all other DS1/E1 signals in the group. The DS1/E1 signals on VLNC64 that are used to carry the TDM traffic must be grouped into one of these domains.

Although differential timestamps are applicable to the VLNC60/61/62 pack, the number of timing domains is greater than the number of DS1/E1 interfaces on it. The system internally manages the domain value allocation. Therefore, you cannot explicitly configure this parameter on VLNC60/61/62.

Synchronization features on the VLNC50/52 circuit packs

Alcatel-Lucent 1850 TSS-5 supports three synchronization modes. These timing modes are supported by the embedded internal SONET Minimum Clock (SMC) Timing Generator (no synchronization inputs) or SDH Equipment Clock, Option 2 (SEC) in the VLNC50/52 circuit packs. The basic timing modes can be combined into various network configurations.

- **Line timing**

Line timing is derived from incoming OC-3/OC-12 or STM-1/STM-4 signal (for small COs or remote sites). In line timing mode, the timing generator derives local shelf timing from the incoming OC-n/STM-n signal to the VLNC50/52. If the incoming reference is corrupted, unavailable, or lost (for example, due to a cable cut), the timing generator will switch to holdover mode. The timing generator will normally switch back to the line timing mode when a good reference is available, but it can be provisioned to require a manual switch.

In line timing mode the VLNC50/52 can also provide DS1/E1 sync output, derived from the incoming line.

- **Free running**

In free running from the internal SMC or SEC, mode switching is not performed. The timing generator derives timing from the internal timing generator in the VLNC50/52. The SMC/SEC oscillator provides ± 20 ppm accuracy. At most, one NE in a network should be provisioned in the free running mode. All other NEs in the subnetwork should be line timed to this free running system to avoid performance degradation.

- **Holdover**

When there is a synchronization reference failure on a system that is line timed and unprotected, a timing generator switches to holdover mode and continues to provide system timing, using the internal oscillator to maintain the last known good reference frequency.

DS1/E1 timing output

Alcatel-Lucent 1850 TSS-5 also supports a DS1 (OC-n) or an E1 (STM-n) timing output feature that facilitates network timing distribution. DS1 (OC-n) and E1 (STM-n) timing outputs are available with the VLNC50/52. The DS1/E1 timing output is derived from the OC-n/STM-n line rate, so it is not subjected to multiplexing or pointer processing effects. The result is a DS1/E1 traceable to the far-end source with extremely low jitter and wander. The timing output can be locked to an OC-n/STM-n line or the OC-n/STM-n source can be automatically selected using synchronization messages. In either case Threshold AIS may be enabled to insert AIS if the synchronization message of the OC-n/STM-n source matches a provisioned threshold.

The frame format on the DS1 output is provisionable as superframe format (SF) or extended SF (ESF). The E1 frame format can be provisioned as FAS or CRC4. The DS1/E1 is a framed all-ones signal under normal conditions or an AIS signal under failure conditions.

75 ohm interface for E1 timing input/output

The Alcatel-Lucent 1850 TSS-5 shelf provides physical connections for timing inputs and outputs. Currently, the physical timing connections are multi-wire connections. Beginning in Release 6.0, Alcatel-Lucent 1850 TSS-5 supports a 75 ohm BNC interface for E1 timing. The interface converter provides the physical and impedance transformation to accommodate a 75 ohm E1 interface for both input and output timing signals. In most cases, a single shelf would contain either an input timing converter or an output timing converter, not both.

Input timing

Alcatel-Lucent 1850 TSS-5 accepts two twisted pair timing inputs: one for each main slot - Main1 [M1] and Main 2 [M2]. The twisted pair interface is three-wire 100 ohm or 120 ohm with tip, ring, and ground. The physical receptacle is a spring-loaded terminal block on the VLIU. The interface converter allows a 75 ohm BNC cable to connect E1 timing signals to the shelf. The VLNC50/52 and VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs support the E1 timing input converter.

Output timing

Alcatel-Lucent 1850 TSS-5 shelf supports a synchronization output signal. The Sync Out interface is a three-wire 100 or 120 ohm with tip, ring, and ground. The physical connection for VLNC6x packs is an RJ-45 connector on the VLIU. The physical connection for VLNC5x packs is a three-wire tip/ring/ground on the terminal block on the VLIU. The E1 interface converter provides a 75 ohm BNC connection for the output synchronization signal from an RJ-45 connector on the VLIU. The E1 timing output interface from the RJ45 connection is only supported by the VLNC62 circuit pack.

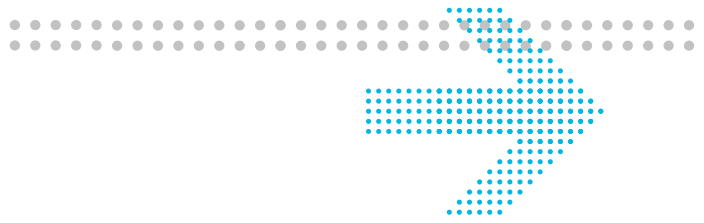
Synchronous Ethernet

The Alcatel-Lucent 1850 TSS-5 supports synchronous Ethernet on Fast Ethernet and Gigabit Ethernet interfaces. A synchronous Ethernet architecture requires a primary reference clock feeding a network element in an Ethernet network. The primary reference clock for Synchronous Ethernet could be located in different parts of the network.

When the physical layer transmitter clock is derived from a high quality reference clock, the receivers lock on the physical layer clock of the received signal and gain access to a stable and accurate frequency reference. The port transmitter clock is also locked to the accurate reference frequency. Synchronous Ethernet standardization as a network-wide solution is described in ITU-T Recommendation G.8261.

Synchronization status messaging provides a mechanism for downstream Ethernet switches to determine the traceability of the synchronization distribution scheme back to the primary reference clock or highest quality clock that is available. The synchronization function processes the synchronization status messages. Under upstream network failure conditions, the synchronization function takes appropriate action based on the synchronization status messages and pre-set priorities and selects an alternate synchronization feed.

Refer to [“Synchronous Ethernet network configurations” \(p. 6-25\)](#) for details about the packs and configurations that support Synchronous Ethernet.



3 Topologies

Overview

Purpose

Alcatel-Lucent 1850 Transport Service Switch 5 (Alcatel-Lucent 1850 TSS-5) supports a wide range of service applications and a variety of network topologies economically and efficiently.

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Optical topologies

Overview

Alcatel-Lucent 1850 TSS-5 supports OC-3, OC-12, STM-1, and STM-4 optical connections for the transport of TDM or Packet over SONET/SDH (POS) data. This section briefly describes the major optical and packet network topologies.

Network interface linear optical extensions

By default, Alcatel-Lucent 1850 TSS-5 supports protected and unprotected linear optical extensions. The linear optical extension may connect the Alcatel-Lucent 1850 TSS-5 shelf, by way of network interfaces in the VLNC50/52 (OC-3/STM1 or OC-12/STM-4), to an OC-12/STM-4, OC-48/STM-16 or OC-192/STM-64 node with OC-3/STM1 or OC-12/STM-4 tributary interfaces or to an OC-3/STM1 or OC-12/STM-4 node through the network interface.

When UNPROT (protection-not-allowed), the two lines on the same board (OC-3/STM-1 or OC-12/STM-4) must be the same rate and may be either 0x1 (default) or UPSR/SNCP.

When PROT (equipment-protection-allowed), each pair of lines across the boards may be a different rate and may be either 1+1 or UPSR/SNCP. The two pairs of lines can have different applications.

Network interface path switching

Alcatel-Lucent 1850 TSS-5 supports VT1.5, STS-1, and STS-3c path-level UPSRs, and VC-12, VC-4, and VC-3 (low-order) path level SNCPs. A switch fabric in the VLNC50/52 circuit pack supports the tributary interfaces. This circuit pack establishes both an east-to-west and a west-to-east rotation on the ring. A UPSR/SNCP ring provides a very valuable and reliable foundation for services protecting against fiber cuts and node failures.

For SDH, Alcatel-Lucent 1850 TSS-5 supports SNC/Ne non-revertive 1+1 unidirectional switching. SNC/N (non-intrusive subnetwork connection) switching rules for Alcatel-Lucent 1850 TSS-5 are similar to those for UPSR. Switching is based on LOP, AIS, UNEQ, EXC (SF-BER), and DEG (SD-BER). However with SNCP, EXC (hard BER signal failure) has the same switch priority as other hard failures.

Pairing and pass-throughs are limited to a path and its companion (same timeslot on the other line). When UNPROT (protection-not-allowed), the two lines on the same board (OC-3/STM-1 or OC-12/STM-4) must be the same rate and the paths are paired across the two lines on the same pack. When PROT (equipment-protection-allowed), each pair of lines across the boards may be a different rate and the paths are paired across the packs.

Single- and dual-homed ring extensions

The Alcatel-Lucent 1850 TSS-5 supports OC-3/STM-1 and OC-12/STM-4 optical extensions, including single- and dual- homed ring extensions. A DDM-2000 OC-3/STM-1, OC-12/STM-4, Alcatel-Lucent 1850 TSS-5, Alcatel-Lucent 1665 DMXplore, or Alcatel-Lucent 1665 DMXtend may be the add/drop multiplexer on the ring.

TMUX service

The VLNC50/52 SONET/SDH Transport circuit pack supports TMUX services on the DS3 port b-3 provisioned as channelized. The channelized DS3 signal can be mapped into 28 DS1 signals. A DS1 signal can be cross-connected to a VT1.5 tributary or a DS1 port.

Service applications

The following sections describe some typical service applications supported by the Alcatel-Lucent 1850 TSS-5 shelf. This set of applications does not describe all possible applications of the Alcatel-Lucent 1850 TSS-5, but merely shows some common network scenarios.

Small or medium-sized business access

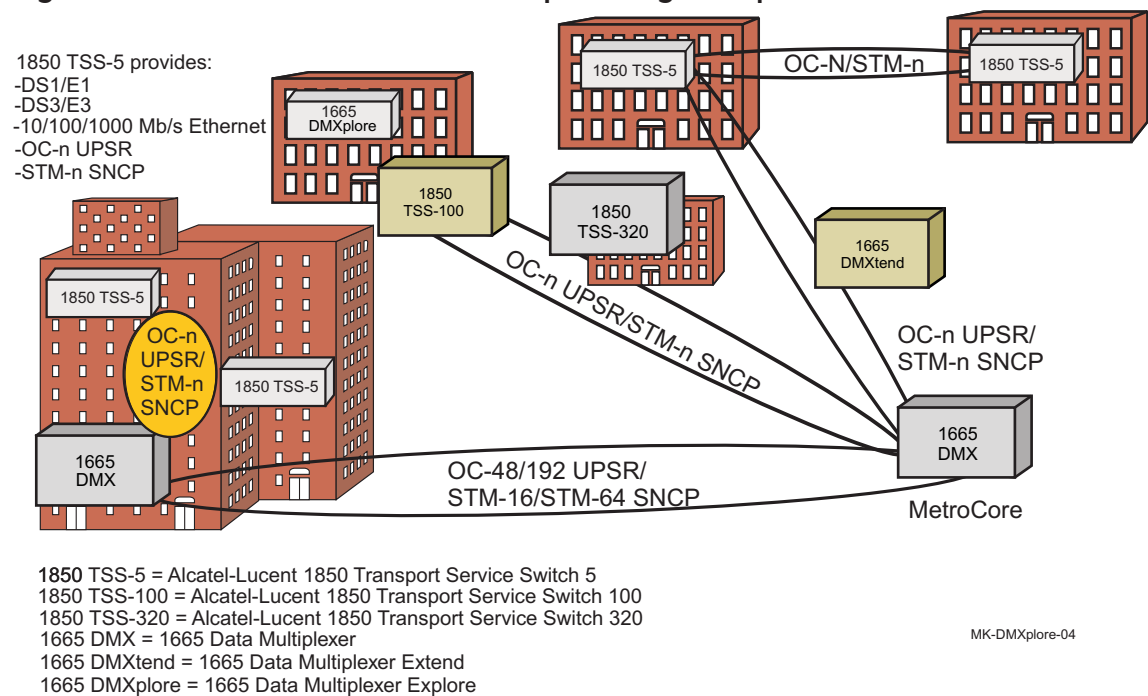
Overview

Alcatel-Lucent 1850 TSS-5 provides a low-cost solution for offering access to small to medium-sized enterprise end customers. Alcatel-Lucent 1850 TSS-5 can provide businesses with reliable transport for both voice and data service using DS1/E1, DS3/E3, and 10/100 Mb/s Ethernet over SONET/SDH protected OC-3/STM-1 or OC-12/STM-4 lines.

Enterprise access

Alcatel-Lucent 1850 TSS-5 is optimized for low-cost, small footprint entry into end-user environments. Alcatel-Lucent 1850 TSS-5 can be placed in an office building, medical facility, hotel, college dormitory, or any building housing a moderate amount of distinct end users. In its ability to provide a flexible mix of DS1/E1, DS3/E3, OC-n/STM-n, and 10/100/1000 Mb/s Ethernet interfaces, Alcatel-Lucent 1850 TSS-5 is ideal as a collection point for multiple lines within a diverse MTU (Multi-Tenant Unit), providing a variety of both voice and data services. Up to 8 Ethernet private line services can be transported using Ethernet over SONET/SDH, and Ethernet traffic from up to 23 ports can be aggregated at the packet layer and then transported using Ethernet over SONET/SDH.

Figure 3-1 Alcatel-Lucent 1850 TSS-5 providing enterprise access



Application advantage

Using Alcatel-Lucent 1850 TSS-5 in this application results in the following advantages:

- Alcatel-Lucent 1850 TSS-5 is designed as an ultra-compact, full-service TDM/Ethernet CPE, eliminating the need for larger NEs or data-specific switches and routers within the building. This is extremely advantageous as the cost of renting space in high-rise basements for telecommunications equipment is high.
- Low-cost fiber terminations directly to the business.
- Flexible service offerings.
- Service flexibility with DS1/E1, DS3/E3, FE/GbE interfaces; all of which are meant to facilitate cost-effective and steady growth.

-
- Easily managed solution: if the Alcatel-Lucent 1850 TSS-5 is equipped with a VLNC2 and VLNC50/52, and connected to the Alcatel-Lucent 1665 DMX/Alcatel-Lucent 1665 DMXtend, Alcatel-Lucent 1675 LambdaUnite MSS, or *WaveStar*® 2.5G/10G the SONET/SDH operations of the remotely located Alcatel-Lucent 1850 TSS-5 can be managed from the central office using the *WaveStar*® CIT.
 - Reliable SONET or SDH protection of both voice and data services.
 - Integrated Ethernet switching and Ethernet compatibility with BLEC/enterprise switches.

Wireless optical build-out

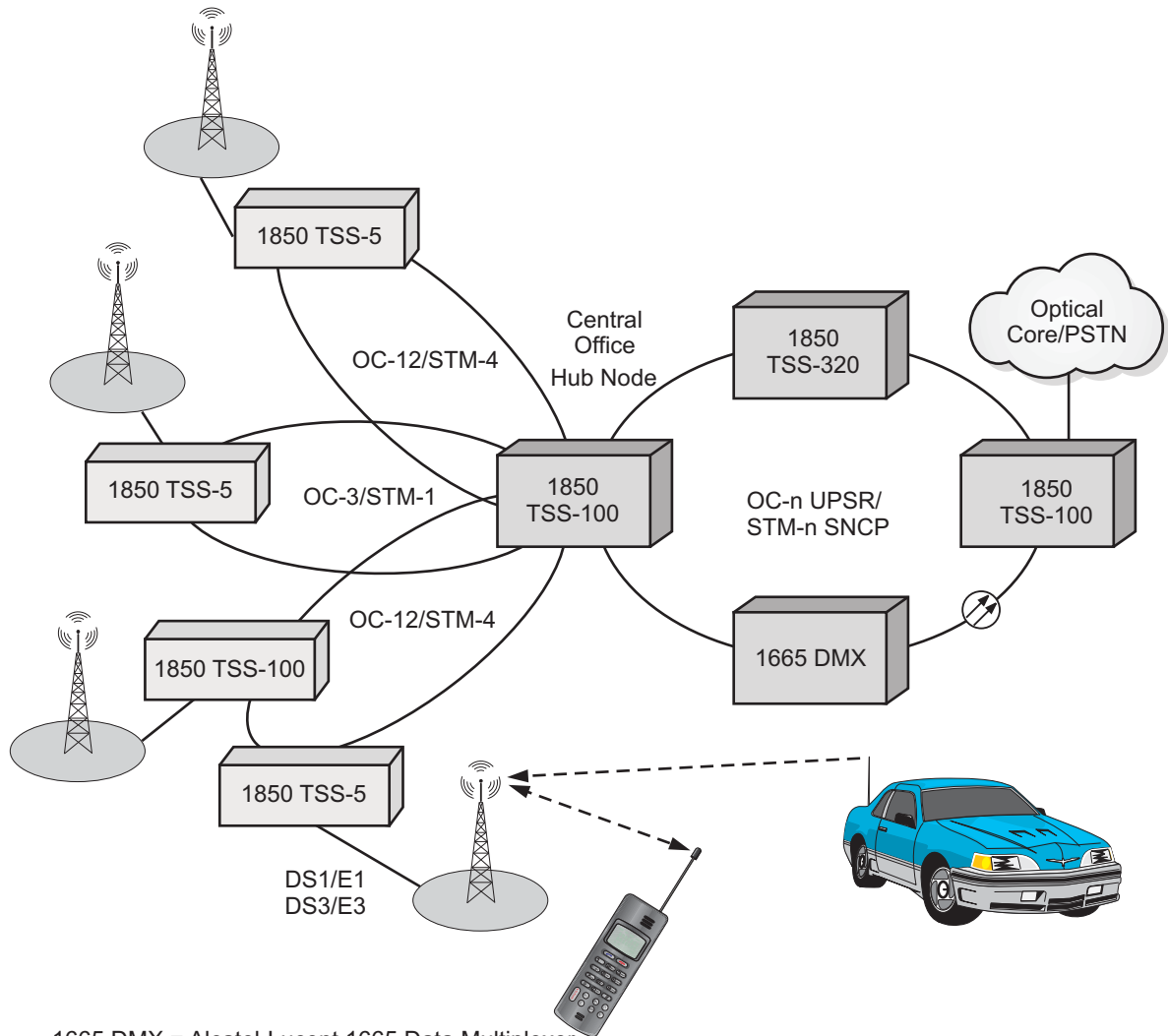
Overview

Alcatel-Lucent 1850 TSS-5 is environmentally hardened for outside and wireless cabinet deployment using OC-3/STM-1 and OC-12/STM-4 optical interfaces.

Description

Alcatel-Lucent 1850 TSS-5 can be deployed in outside cabinets at such places as wireless/cellular sites, allowing for cost-effective aggregation of DS1/E1, DS3/E3, 10/100 Mb/s Ethernet, OC-3/STM-1, and OC-12/STM-4 signals and reliable, SONET or SDH protected transport of these services to Hub nodes at the CO in a scalable, compact, and easily managed NE. In this application, Alcatel-Lucent 1850 TSS-5 is line-timed from an NE that is timed from an external timing reference. For example, Alcatel-Lucent 1665 DMX is a Stratum 3 timed device from which the Alcatel-Lucent 1850 TSS-5 is line-timed.

Figure 3-2 Wireless optical build-out



1665 DMX = Alcatel-Lucent 1665 Data Multiplexer
 1850 TSS-5 = Alcatel-Lucent 1850 Transport Service Switch 5
 1850 TSS-100 = Alcatel-Lucent 1850 Transport Service Switch 100
 1850 TSS-320 = Alcatel-Lucent 1850 Transport Service Switch 320

MA-DMXplore-021a

Application advantage

Using Alcatel-Lucent 1850 TSS-5 in this application results in the following advantages:

- Cost-effective transport of wireless service in an environmentally hardened unit designed for outside deployment.
- Compact size of Alcatel-Lucent 1850 TSS-5 provides for reduced cost, space, and heat generation at antenna sites.
- Easily managed monitoring of equipment at antenna site (such as doors, fire alarms, heating or cooling systems, etc.) through the miscellaneous discrete interfaces on Alcatel-Lucent 1850 TSS-5: 4 miscellaneous discrete inputs (MDI) and 6 miscellaneous discrete outputs (MDO). Four MDOs are controlled by the VLNC2, and one is assigned to each Main slot. The MDIs are only processed on the VLNC2. Currently, only the VLNC40/42/42B in the MAIN2 slot is capable of using the slot MDO.

Wireless backhaul

Overview

Alcatel-Lucent 1850 TSS-5 supports circuit emulation to provide backhaul for wireless voice and data, from next-generation Ethernet-based mobility equipment (BTS, NodeB) or T1-based legacy equipment, over a packet-based Ethernet network.

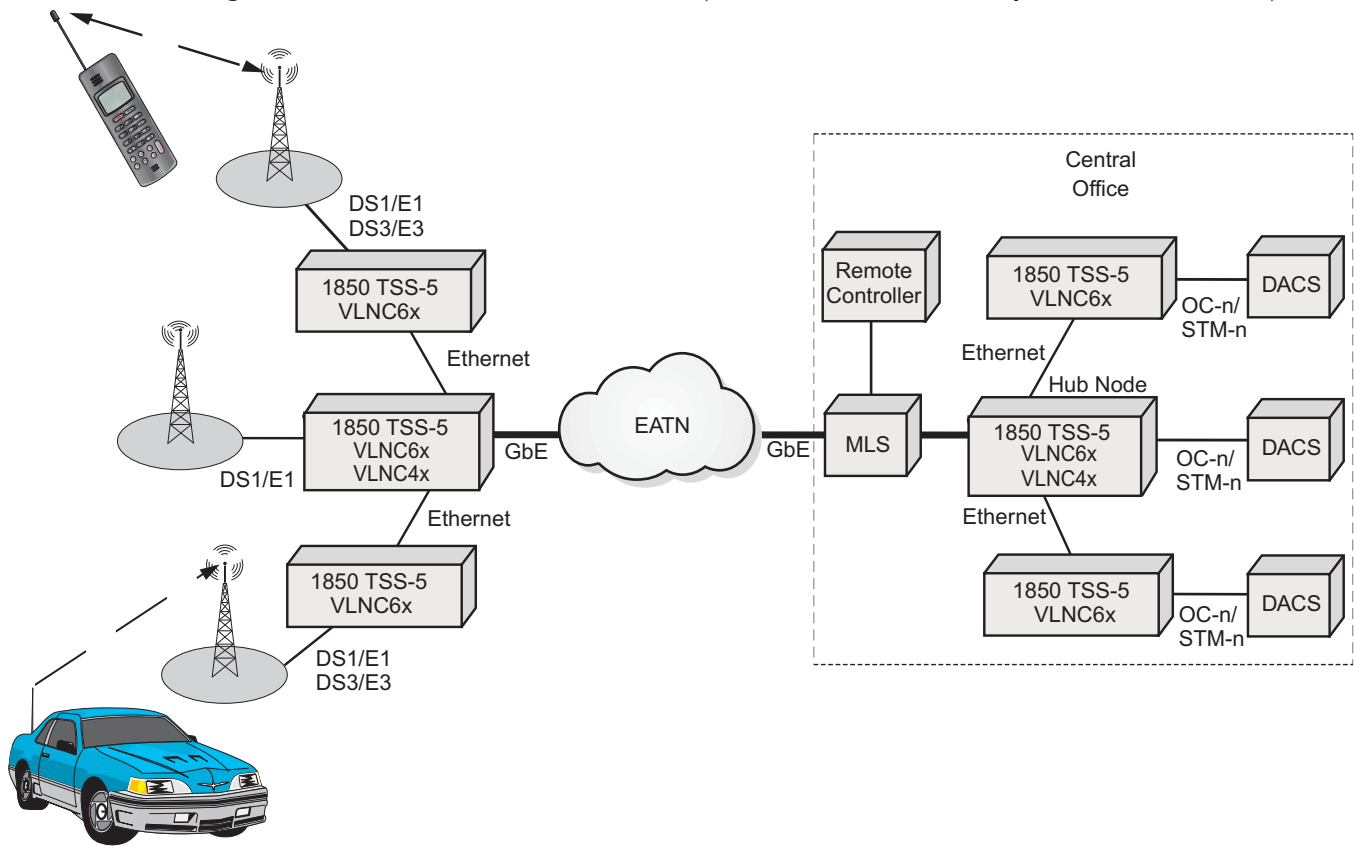
Wireless voice backhaul

Circuit Emulation is required to preserve the context and nature of a circuit over a packet network. Circuit emulation on Alcatel-Lucent 1850 TSS-5 uses static pseudowires (no signalling or routing plane) within a configured pair of unidirectional tunnels to backhaul mobility TDM/ATM services over an Ethernet network.

[Figure 3-3, “Wireless voice backhaul \(VLNC60/61/62 circuit packs at both ends\)”](#) (p. 3-8) shows an application using Alcatel-Lucent 1850 TSS-5 shelves equipped with VLNC60/61/62 Circuit Emulator circuit packs at both ends of the virtual circuit connection. The VLNC40/42/42B Ethernet Aggregator circuit pack can be used in the shelf to aggregate the Ethernet connections.

[Figure 3-4, “Wireless voice backhaul \(VLNC60/61/62 and VLNC64 circuit packs\)”](#) (p. 3-9) shows an application using Alcatel-Lucent 1850 TSS-5 shelves equipped with VLNC60/61/62 Circuit Emulator circuit packs at the remote sites and the VLNC64 Circuit Emulation Mini-hub circuit pack used as a hub at the opposite end of the virtual circuit connection.

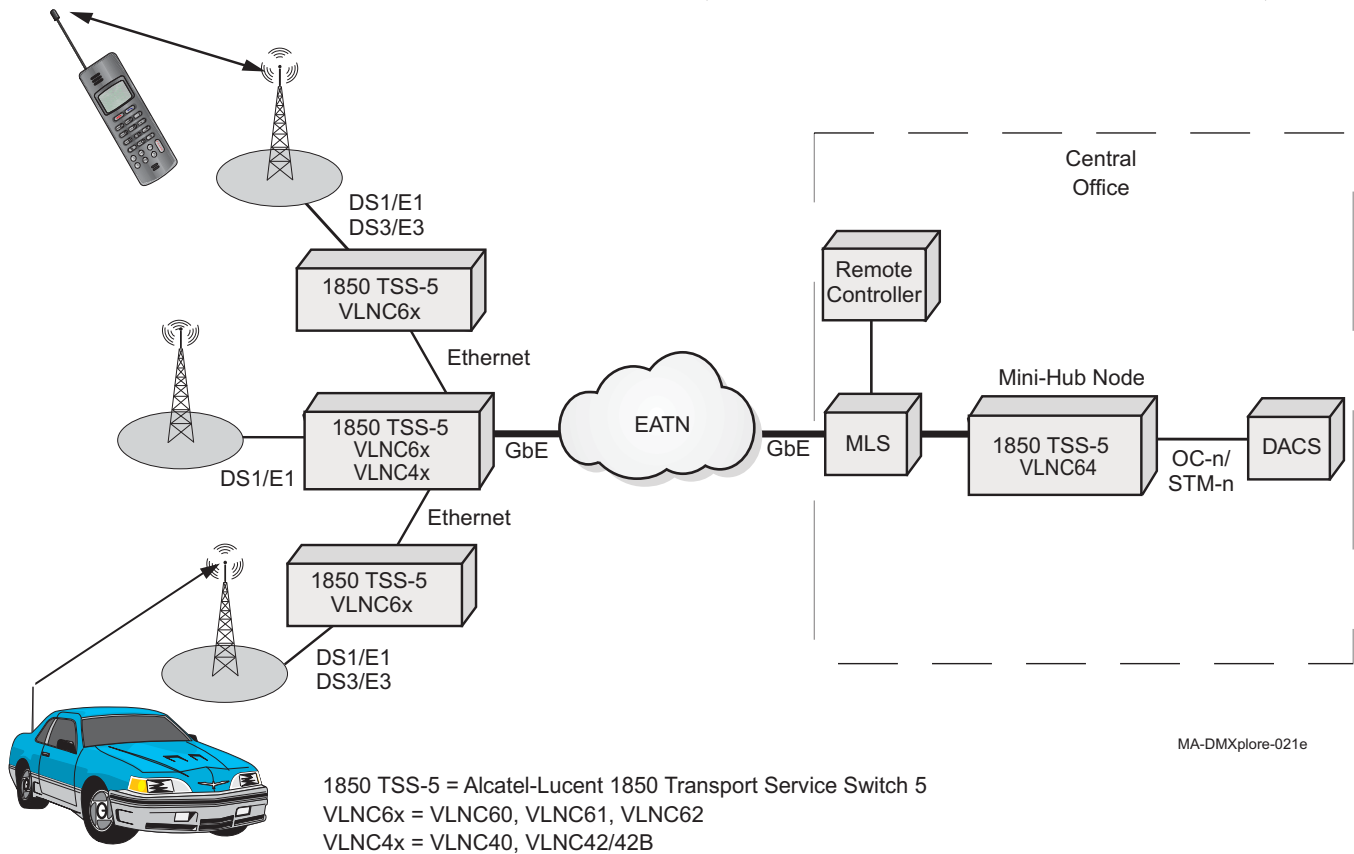
Figure 3-3 Wireless voice backhaul (VLNC60/61/62 circuit packs at both ends)



1850 TSS-5 = Alcatel-Lucent 1850 Transport Service Switch 5
 VLNC6x = VLNC60, VLNC61, VLNC62
 VLNC4x = VLNC40, VLNC42/42B

MA-DMXplore-021c

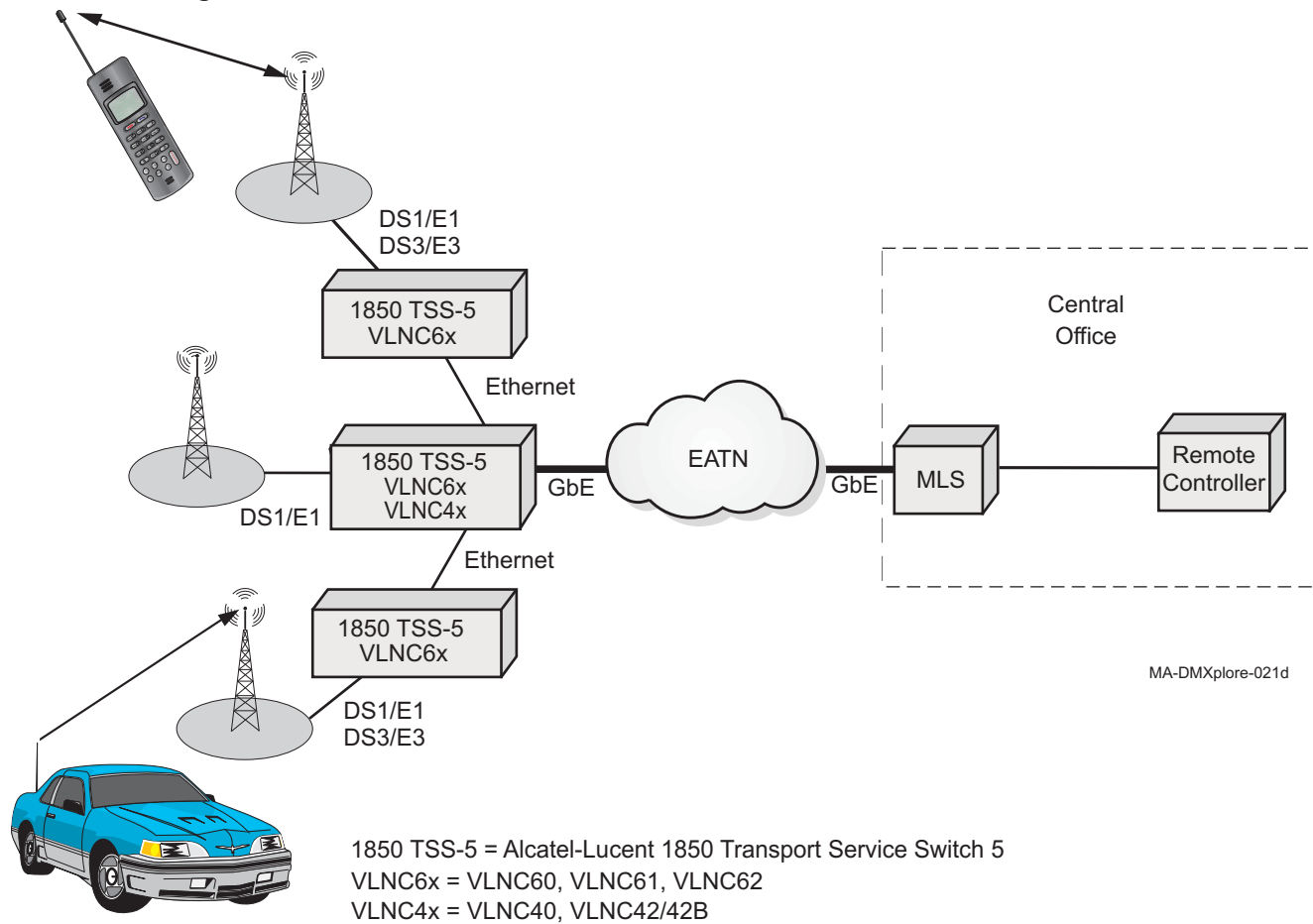
Figure 3-4 Wireless voice backhaul (VLNC60/61/62 and VLNC64 circuit packs)



Wireless data backhaul

The VLNC60/61/62 Circuit Emulator circuit pack can also provide ML-PPP Layer 2 termination service to reduce bandwidth requirements for wireless data backhaul. In this application, the incoming DS1/E1 signals contain Ethernet data in ML-PPP links, which are terminated by the VLNC60/61/62 circuit pack. The VLNC60/61/62 circuit pack uses 802.1Q encapsulation to transmit the IP traffic directly over the packet network. It interworks between the DS1/E1 ML-PPP links from the BTS Universal Radio Controller (URC) and Ethernet links running 802.1Q encapsulation towards the MSCs.

Figure 3-5 Wireless data backhaul



Application advantage

Mobility backhaul networks are moving from circuit switched to packet-based (Ethernet, IP/MPLS) technologies. Alcatel-Lucent 1850 TSS-5 uses circuit emulation to provide backhaul for wireless voice and data, from next-generation Ethernet-based mobility equipment (BTS, NodeB) or DS1/E1-based legacy equipment, over a packet-based Ethernet network. It preserves the context and nature of a circuit over a packet network, and allows wireless providers to preserve their investment in the remote and hub equipment (BTS/NodeB and edge router or RNC/MSR).

Ethernet extension and aggregation

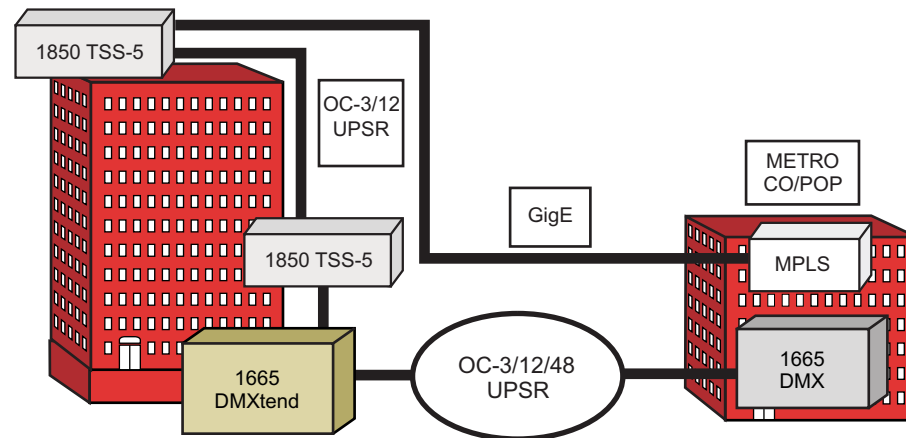
Overview

Alcatel-Lucent 1850 TSS-5 provides a low-cost solution for offering access to small to medium-sized enterprise end customers. Alcatel-Lucent 1850 TSS-5 can provide businesses with reliable transport for both voice and data service using DS1/E1, DS3/E3, and Gigabit Ethernet over SONET/SDH protected OC-3/STM-1 or OC-12/STM-4 lines, and aggregation of 10/100BASE-T Ethernet connections for transport over Ethernet.

Description

The following figure shows Alcatel-Lucent 1850 TSS-5s in a few different offices within the same high-rise building. With the ports for OC-3/STM-1 and OC-12/STM-4 lines on the VLNC50/52 SONET/SDH Transport circuit pack and Gigabit Ethernet ports on the VLNC40/42/42B Ethernet Aggregator circuit pack, the Alcatel-Lucent 1850 TSS-5 is perfect for the application pictured below because it can serve as a collection point for various individual business groups collocated in the same office, business unit, floor, or building. It can then transmit SONET, SDH, or Ethernet traffic to an Alcatel-Lucent 1665 DMX, Alcatel-Lucent 1665 DMXtend, or Alcatel-Lucent 1850 TSS-5 located in the basement or in a wiring closet, or directly to a service provider's site outside of the building. Applications include DS1/E1, DS3/E3, Private Line Ethernet, and Ethernet Aggregation.

With its Ethernet capabilities, Alcatel-Lucent 1850 TSS-5 can provide secure lines for vital business data within a private LAN. Transparent Ethernet switching through SONET/SDH networks preserves on-site integrity and security of the private LAN through the larger network. Thus, multiple offices using Alcatel-Lucent 1850 TSS-5 at different sites can be connected by the same, secure Ethernet Private Line. In locations where the number of Ethernet connections and bandwidth requirements exceed the SONET/SDH bandwidth of Alcatel-Lucent 1850 TSS-5, Ethernet connections can be aggregated by the VLNC40/42/42B circuit pack onto Gigabit Ethernet connections.

Figure 3-6 Ethernet extension

1850 TSS-5 = 1850 Transport Service Switch 5

1665 DMXtend = 1665 Data Multiplexer Extend

1665 DMX = 1665 Data Multiplexer

MK-DMXplere-05

Note: In an SDH environment, equivalent bandwidths are supported, and SNCP protection is used.

Application advantage

Using the Alcatel-Lucent 1850 TSS-5 in this application results in the following advantages:

Alcatel-Lucent 1850 TSS-5 is designed as an ultra-compact, full-service TDM/Ethernet CPE, eliminating the need for larger NEs or data-specific switches and routers within the building. This is extremely advantageous as the cost of renting space in high-rise basements for telecommunications equipment is high.

- Enhances fiber up the riser distribution within the building
- Offers low-cost Ethernet and TDM Private Line transport
- Enables next generation Ethernet over SONET/SDH services such as VLANs, Transparent LANs, and Ethernet Private Lines
- Supports both electrical and optical Ethernet interfaces
- Low-cost multi-service optical BLEC/Enterprise network
- Strong transmission capability of OC-3/STM-1, OC-12/STM-4, Gigabit Ethernet interfaces compensates for poor quality fiber within the building
- Reliable, SONET/SDH protection of both voice and packet services
- Aggregation of VLAN and individual Ethernet connections onto Gigabit Ethernet for transport
- Integrated Ethernet switching and Ethernet compatibility with BLEC/enterprise switches

Hitless bandwidth provisioning with LCAS

Overview

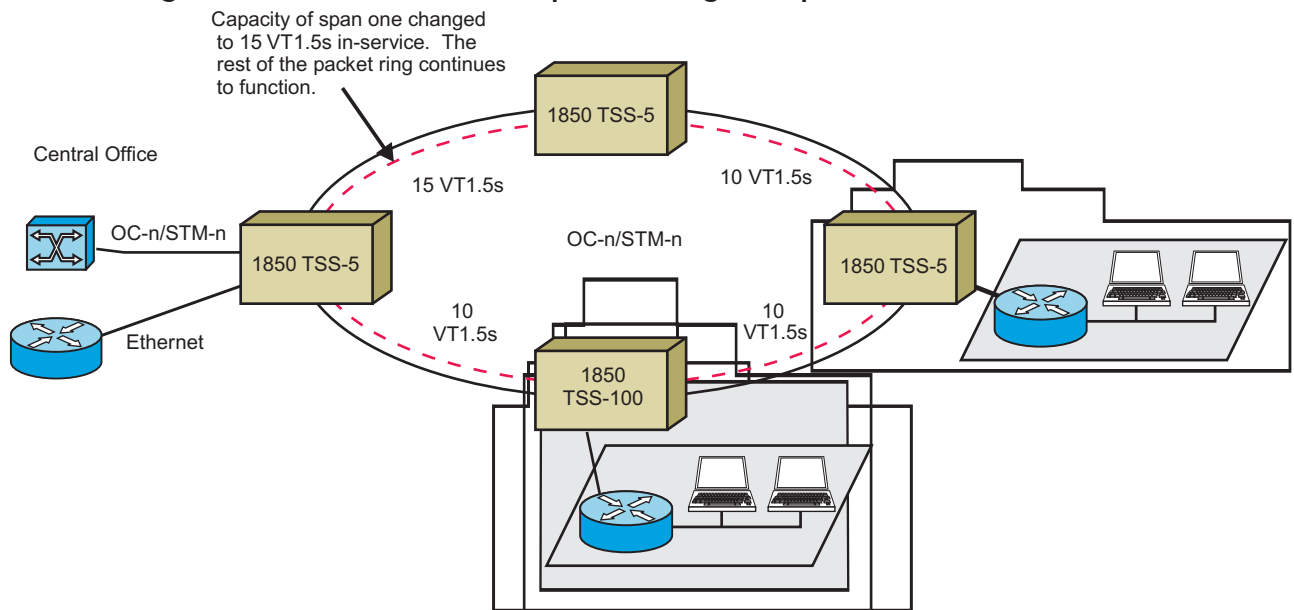
Link Capacity Adjustment Scheme (LCAS) enables in-service (or non-service affecting) bandwidth increases/decreases for Ethernet links.

Description

Alcatel-Lucent 1850 TSS-5 VLNC50/52 SONET/SDH Transport circuit pack supports standard LCAS per ITU G.7041. Bandwidth changes to Ethernet links are done one span at a time. Without LCAS, provisioning a bandwidth change on the first span of a packet ring takes down Ethernet service around the rest of the ring until the entire ring is set to operate at the same capacity.

With LCAS, planned increases or decreases of bandwidth are hitless (that is, they do not affect service). As the following figure illustrates, when capacity changes to each span around the packet ring are provisioned, service is not interrupted. While the span between nodes A and B is set to 15 VT1.5 signals, the remaining spans continue to function using 10 VT1.5 signals.

Figure 3-7 Hitless bandwidth provisioning: 1st span



1850 TSS-5 = Alcatel-Lucent 1850 Transport Service Switch 5

1850 TSS-100 = Alcatel-Lucent 1850 Transport Service Switch 100

JK-E-10_1850.esp

Application advantages

As the global market for communication services is in continuous flux, both advances in technology and changes in state, regional, and national economies exert various pressures on your network. Accordingly, capacity changes to your network are necessary on a regular basis.

LCAS enables you to meet the challenges of today's market without affecting service. With LCAS, you are not in danger of violating stringent Enterprise customer SLAs. You can also deploy your SONET/SDH network according to long-term growth forecasts, and get the most out of the ability to adjust Private Line and packet ring capacity within your SONET/SDH lines.

Packet topologies

Overview

Packet networks can be created over a variety of SONET and SDH topologies. Because the packet network connections use VLAN or Private Line connections over SONET/SDH, the topology of the resulting packet network can be different from the topology of the SONET/SDH transport network. For example, a Private Line service uses a point-to-point packet topology, but may be carried over a SONET/SDH ring, which may be configured with SONET UPSR or SDH SNCP protection.

The following packet topologies are supported:

- Point-to-point
- Ethernet Ring Protection
- Multipoint
- Hub-and-spoke

Point-to-point

The point-to-point topology is a simple end-to-end connection, used to join two network nodes that are not located on the same physical network. For example, a business at one location may connect to an ISP at a distant location, via a point-to-point connection. This point-to-point connectivity can be established over different media, using dedicated cross-connections or tunneling protocols. Point-to-point connectivity over SONET or SDH benefits from the redundancy provided by SONET or SDH protection mechanisms. Point-to-point connectivity can also use data-layer protection mechanisms, such as Link Aggregation.

Ethernet Ring Protection

An ERP ring topology is used when 50 ms switching is required for nodes configured in a ring. ITU-T G.8032 defines the ERP protocol. Alcatel-Lucent 1850 TSS-5 currently supports ERP for physically-connected optical PTM ports, with switching based on Ethernet link failures. Each node can support two ERP instances.

Multipoint

In a multipoint network all points converse with each other. Note that connecting three locations by two point-to-point connections is not the same as if done by a multipoint connection. The location in the middle of the point-to-point connections would have to provide external switching to enable the outer locations to converse with each other.

One useful case of multipoint configurations is a packet ring. In a closed-ring configuration all nodes converse. An internal spanning tree may be configured for protection and loop prevention. The spanning tree blocks one link to avoid a loop. In the case of a link failure, the spanning tree algorithm restores connectivity by removing the block.

A special case of multipoint configuration is where one node acts as a hub and all other nodes converse only with it. This hub configuration differs from a hub-and-spoke network only in that the spokes share bandwidth to reach the hub. It is more efficient and may be more practical because it conserves hub ports; only two VCG (WAN) ports are needed, regardless of the number of spokes. (In a packet ring configuration the blocked link is placed between the two nodes most remote from the hub; because those nodes don't converse, there is no loss of useful bandwidth.) Both this topology and the hub-and-spoke described next are sometimes called point-to-multipoint.

Hub-and-spoke

The hub-and-spoke network is a hybrid between point-to-point and multipoint. Each node connects to the hub location via a dedicated link; but, the links terminate on an embedded switch at the hub location. In a typical back-haul application, the switch aggregates the traffic into a single Ethernet link for hand off. As in the multipoint hub network, tags are used to identify and direct traffic to and from the hub location.

T-MPLS network scenarios

T-MPLS label processing

The NE performs the following operations on the label:

- Push: T-MPLS supports the capability to push two labels (the pseudowire (PW) and PSN Tunnel labels) to a service packet entering the T-MPLS domain (ingress UNI), where both PW and PSN Tunnels are generated.
- Pop: T-MPLS supports the capability to pop two labels (the pseudowire (PW) and PSN Tunnel labels) from a T-MPLS packet exiting the T-MPLS domain (egress UNI), where the PW-LSP and PSN Tunnel are terminated.
- Swap: T-MPLS supports the capability to swap the T-MPLS label at the Tunnel layer between T-MPLS NNI interfaces at a provider node (LSR).

Notes to [Figure 3-8, “Label processing: push, swap, pop”](#) (p. 3-17):

- The change of the LSP label number in adjacent hops (Tunnel1, Tunnel2) means that they are different LSPs (different Tunnels)
- The change of the LSP label color in adjacent hops, with the same label number, means that it is the same LSP with swapped label value.

Figure 3-8 Label processing: push, swap, pop (1 of 2)

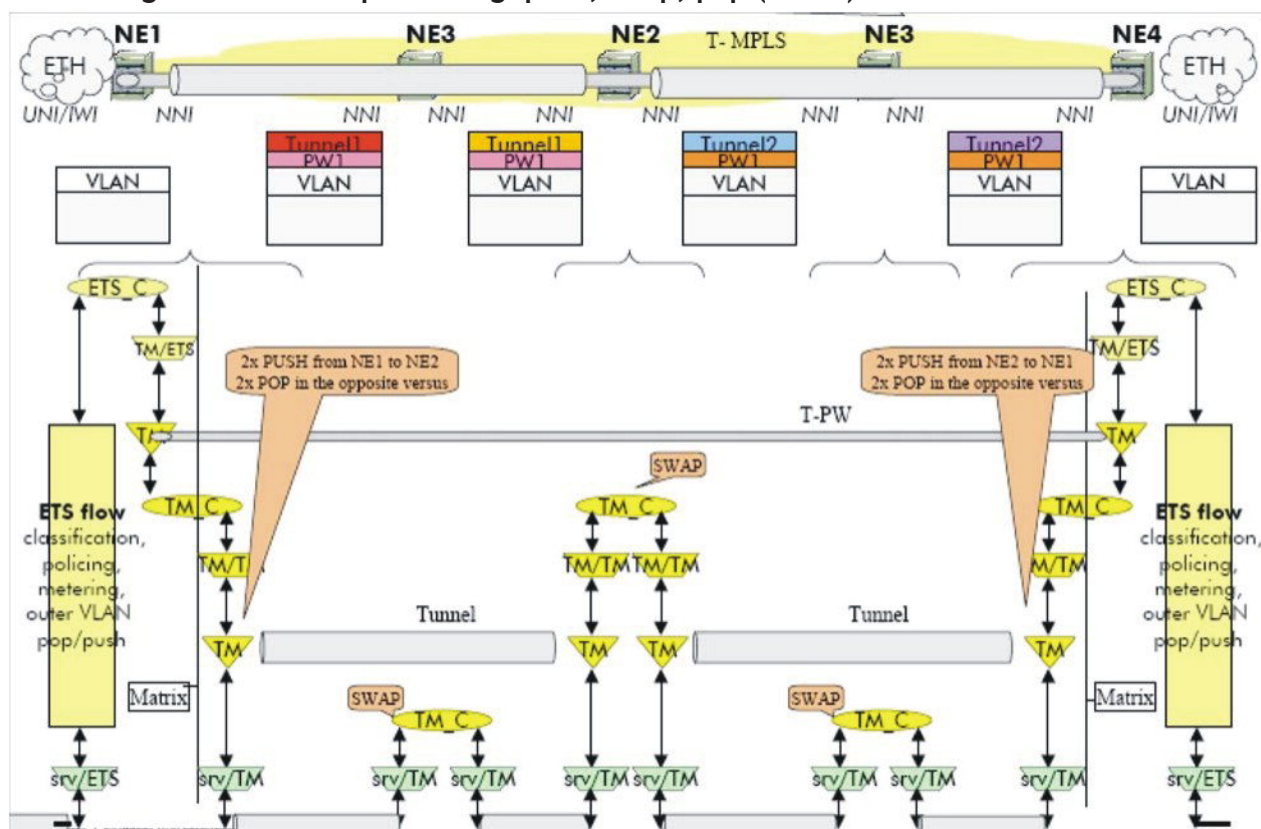
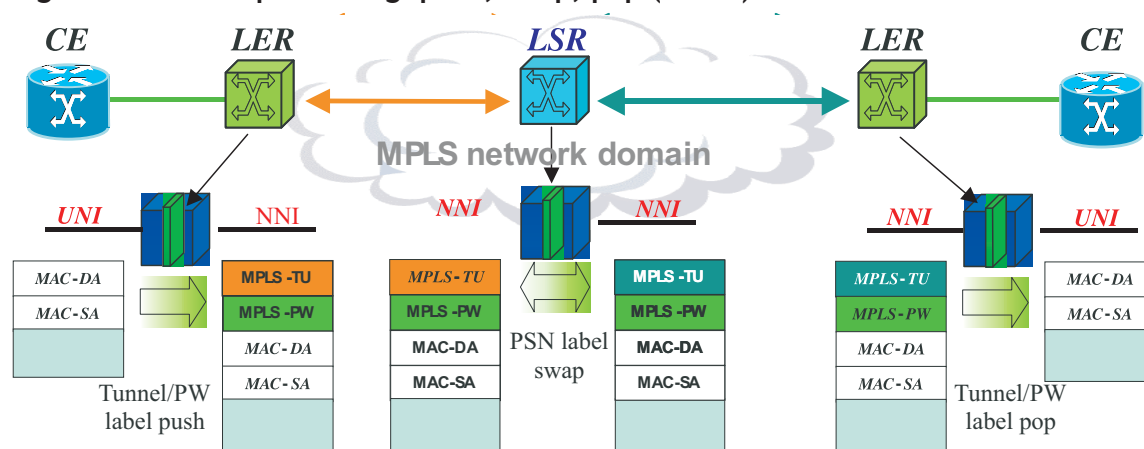
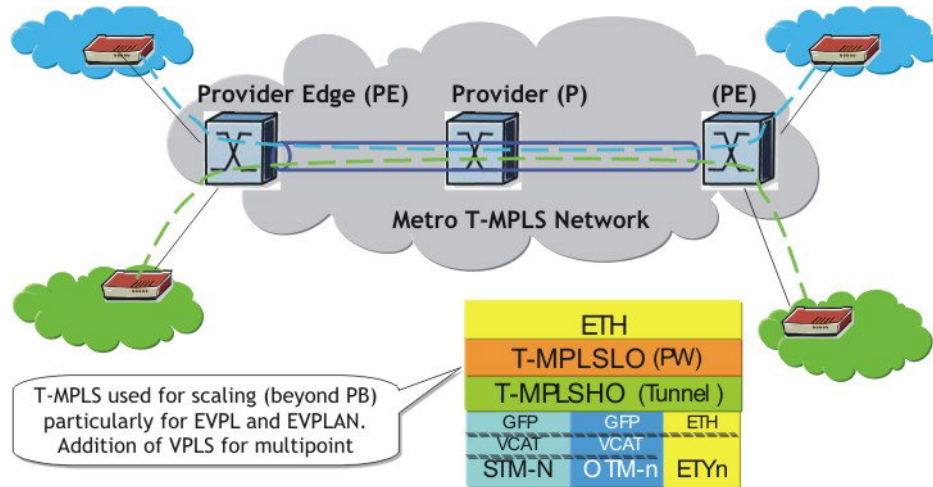


Figure 3-8 Label processing: push, swap, pop (2 of 2)



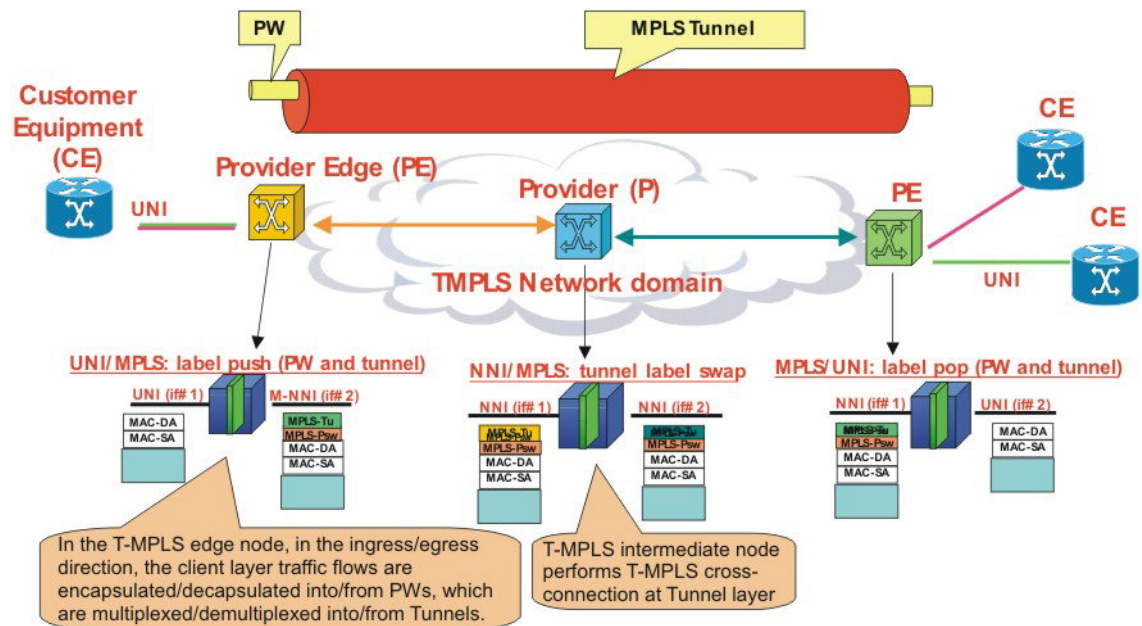
Scaling Ethernet services with T-MPLS

Figure 3-9 Scaling Ethernet services with T-MPLS



T-MPLS single domain scenario

Figure 3-10 T-MPLS single domain scenario



Ethernet services

Overview

Most end-users and many edge-access networks use Ethernet to connect to their next-higher tier network. Alcatel-Lucent 1850 TSS-5 supports Private Line Ethernet connections.

The Private Line services are transported over their own dedicated SONET or SDH timeslots. If present, Ethernet switching functions may or may not be shared.

Private Line services are point-to-point in nature while Private LAN services are multipoint. Private LAN services always involve internal Ethernet switching while Private Line services do not.

Ethernet aggregation supports connections for up to 20 Fast Ethernet ports on Alcatel-Lucent 1850 TSS-5 with 802.1Q VLAN tagging.

Fast Ethernet Private Line over SONET/SDH

Alcatel-Lucent 1850 TSS-5 Fast Ethernet (10/100 Mb/s) Private Lines enable premium data transport services offering 10/100 Mb/s transport with optional bandwidth provisioning up to 100 Mb/s (variable bandwidth provisioning of 1, 2, or 3 STS-1/VC-3s). Fast Ethernet Private Lines provide the user the ability to transport frames completely transparently between two Alcatel-Lucent 1850 TSS-5 NEs. No VLAN knowledge or packet-layer provisioning is required by the user in this application. Simple, SONET/SDH cross-connect provisioning is all that is required. These Fast Ethernet capabilities allow the Alcatel-Lucent 1850 TSS-5 to provide dedicated bandwidth for individual customers and fast SONET/SDH-layer restoration.

Gigabit Ethernet Private Line over SONET/SDH

Alcatel-Lucent 1850 TSS-5 supports Gigabit Ethernet Private Lines. Bandwidth provisioning is available using variable bandwidth provisioning for SONET/SDH of up to 12 STS-1/VC-3s (low-order), 4 STS3c/VC-4s, or 63 VT1.5s/VC-12s. Ethernet Private Lines provide the user the ability to transport frames completely transparently between two Alcatel-Lucent 1850 TSS-5 NEs. No VLAN knowledge or packet-layer provisioning is required by the user in this application. Simple SONET/SDH cross-connect provisioning is all that is required. These Ethernet capabilities allow an Alcatel-Lucent 1850 TSS-5, equipped with a VLNC50/52 circuit pack, to provide dedicated bandwidth for individual customers and fast SONET/SDH-layer restoration. Alcatel-Lucent 1850 TSS-5, equipped with a VLNC40/42/42B circuit pack, supports aggregating traffic from up to 20 10/100 Mb/s Fast Ethernet ports into a Gigabit Ethernet port, which may then be connected (using faceplate pluggable transmission modules, or a backplane connection) to the VLNC50/52 circuit pack for transport over SONET or SDH.

Ethernet aggregation

Up to 20 Fast Ethernet ports can be aggregated by Alcatel-Lucent 1850 TSS-5 into Gigabit Ethernet or Fast Ethernet links using 802.1Q VLAN tagging and 802.1D bridging. It also supports VLAN transparency with 802.1ad double VLAN tagging, but does not support other 802.1ad features.

Up to four Gigabit Ethernet or Fast Ethernet PTM ports are supported on each VLNC40/42/42B Ethernet Aggregator circuit pack. Although the VLNC40/42/42B circuit pack is not hardware protected, traffic toward the Ethernet access transport network (EATN) can be protected by multiple paths controlled by 802.1D Rapid Spanning Tree Protocol (RSTP) or ERP.

Ethernet aggregation on the VLNC40/42/42B circuit pack provides Layer 2 protection against denial of service attacks with ACL filtering and rate limiting. Security for connections to the VLNC40/42/42B circuit pack is provided by limiting connections from hardware with specific MAC addresses (MAC locking).

Circuit emulation service over packet (CESoP)

TDM streams from DS1/E1 ports can be transported over Ethernet by Alcatel-Lucent 1850 TSS-5 equipped with a VLNC60/61/62 Circuit Emulator circuit pack. Two Gigabit Ethernet or Fast Ethernet PTM ports are supported on each VLNC60/61/62 circuit pack. These ports can be connected directly to the EATN, or they can be connected to the VLNC40/42/42B Ethernet Aggregator circuit pack for aggregation with other Ethernet traffic. The VLNC64 Circuit Emulation Mini-hub circuit pack supports up to 2 Gigabit Ethernet or Fast Ethernet PTM ports and one OC-3/STM-1 port channelized into VT1.5s (carrying DS1) or VC-12s (carrying E1).

One or more pairs of unidirectional tunnels are configured to create point-to-point connections in both directions over the packet switched network (PSN) between the Alcatel-Lucent 1850 TSS-5 shelves at edges of the network. Matching bi-directional pseudowire configurations are created on Alcatel-Lucent 1850 TSS-5 shelves connected by a pair of unidirectional tunnels and are associated with the tunnel connections. Then a DS1/E1 interface is associated with the pseudowire on each shelf. DS1/E1 voice data is carried over the pseudowire within the tunnel connections between the shelves. Timing is handled via BITS input, IEEE 1588 PTP, or Synchronous Ethernet. This creates a virtual DS1/E1 TDM circuit over Ethernet between the shelves.

MEF-8

In order to support a Metro Ethernet Forum 8 (MEF-8) based circuit emulation service, the user can specify an option for the mode of Circuit Emulation Service on the pack, either MPLS or Ethernet. If MPLS is selected, then the circuit emulation service is based on RFC 4553. If Ethernet is selected, then the circuit emulation service is based on MEF-8. The VLNC60/VLNC61/VLNC62/VLNC64 circuit pack cannot support mixed transport modes (RFC 4553 and MEF-8) simultaneously. In order to support a Metro Ethernet Forum 8 (MEF-8) based circuit emulation service, the user can specify an option for the mode of Circuit Emulation Service on the pack, either MPLS or Ethernet. If the mode of circuit emulation service is changed (from MPLS to Ethernet, or Ethernet to MPLS), all existing configurations are cleared and the pack is reset. Alcatel-Lucent 1850 TSS-5 can connect to either an MPLS network or a Metro Ethernet network; Alcatel-Lucent 1850 TSS-5 cannot connect to both simultaneously.

If MPLS is selected, then the circuit emulation service is based on RFC 4553. If Ethernet is selected, then the circuit emulation service is based on MEF-8. In the Ethernet mode, PSN Tunnel requires an endpoint which is based on Ethernet MAC address. The PWEs transported in Ethernet mode will have Ethertype of 0x88d8. In the Ethernet mode, there is no UPSR-like protection solution for the PWEs and end-to-end protection via BFD is not supported. If there is physical failure on Ethernet port that supports the PSN Tunnel, the PWE switches to the backup PSN Tunnel.

Ethernet mode specifies a differential timestamp frequency of 25 MHz. By default, the frequency for differential timestamp on the VLNC60/61/62/64 packs is 77.76 MHz. Beginning in Release 5.1, the VLNC60/61 packs also support the 25 MHz frequency. Beginning in Release 6.0, the VLNC64 packs support 25 MHz frequency.

Note: The VLNC64 must be Series 1:2 (S1:2) or later, to support the 25 MHz frequency.

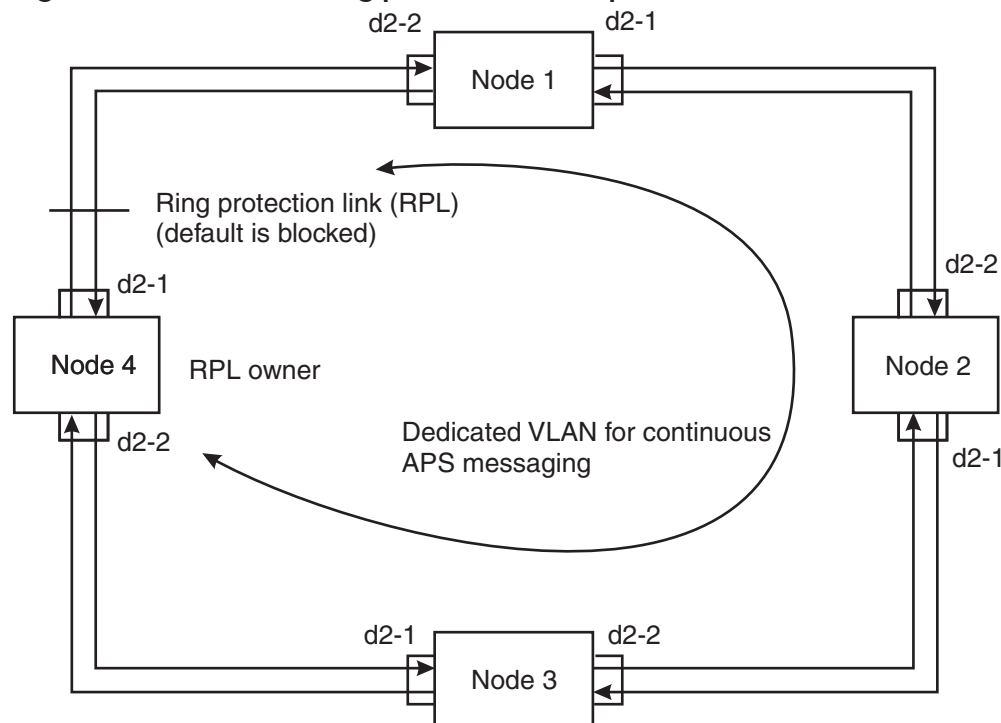
Ethernet ring protection

Ethernet ring protection (ERP) is based on ITU-T G.8032 and provides rapid switching (50 ms) for physically directly-connected Ethernet links in a ring configuration. The links in the ring can be a mix of FE and GbE ports. ERP is supported on optical PTM ports 1–4 on VLNC40/42/42B circuit packs. Each circuit pack can support a maximum of two rings.

[Figure 3-11, “Ethernet ring protection example” \(p. 3-22\)](#) illustrates a four-node ring. One of the links on Node 4 has been provisioned to be the Ring Protection Link (RPL). This is the link that by default is blocked for normal traffic. Node 4 is therefore the RPL Owner and blocks traffic bidirectionally. Switching is revertive – when a failure clears in the ring, the RPL is blocked (after a wait-to-restore delay).

The ring has a VLAN dedicated to APS signaling, called the R-APS channel. Messages are R-APS protocol data units (PDUs). When a change occurs in the ring, 3 R-APS PDUs are sent quickly; otherwise R-APS PDUs are sent every 5 seconds. Under most conditions, only a single node in the ring is sending R-APS messages. The link that is blocked in the ring is blocked bidirectionally by the RPL Owner, or by the node(s) detecting a failure. The R-APS channel within a blocked link is also partially blocked: it does not forward any messages it receives, but the node can initiate or receive messages. The VLAN used for the R-APS channel must be the same at every node in the ring, and should not be used for any other purpose. All traffic within the physical ports is protected. Switching is based on line failures. ERP switching is supported on Q-in-Q node service providers ports or customer ports; within a node both ports must be of the same Q-in-Q type.

Figure 3-11 Ethernet ring protection example



Ethernet service multiplexing and bundling

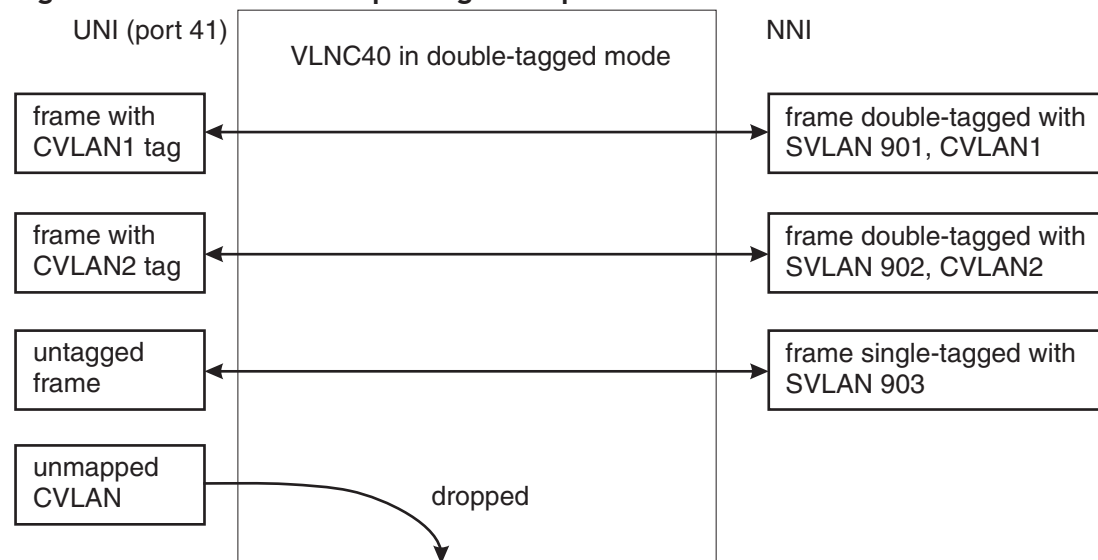
In addition to the All-to-one Bundling capability supported in previous releases, in Release 5.1 Alcatel-Lucent 1850 TSS-5 supports Ethernet service multiplexing and bundling capabilities of MEFh Ethernet Virtual Connections (EVCs) on the VLNC40/42/42B circuit packs. In Q-in-Q nodes, Ethernet service multiplexing allows packets incoming from a customer port to have different outer (SVLAN) tags added, based on the incoming tag (CVLAN), preserving all the customer VLAN information. Untagged packets may also be mapped to an SVLAN using 0 (zero) as a special CVLAN

for mapping untagged or priority-tagged packets. Every incoming packet receives a per-port provisionable default VLAN (DVLAN, provisioned using the **vlan pvid <vlanid>** command), unless it already had a tag with the DVLAN. This DVLAN must then be mapped to the proper SVLAN. After Level 2 switching (based on the DVLAN), the DVLAN tag is overwritten by the configured SVLAN.

Important! Each NNI may communicate with service-multiplexed ports, or with non-service-multiplexed ports, but not both.

All Network-Network Interfaces (NNIs), also called service provider ports, must be PTM-based ports in order to turn on service-multiplexing on a User-Network Interface (UNI), (also called a customer port). Service multiplexed ports cannot be turned into NNI ports. When a port has service-multiplexing turned on, Level 2 switching occurs based on the port's pvid, so a packet will only egress the destination port if that port's VLAN participation include list contains: both the ingress port's DVLAN and a mapped SVLAN if the destination is an NNI, and both the ingress port's DVLAN and a mapped CVLAN if the destination is a UNI. Untagged and priority tagged packets are mapped using the special value of "0" (which is otherwise not a valid VLAN value). Packets with CVLAN values that do not have a mapping are dropped.

Figure 3-12 Service multiplexing concept



UNI port 41 provisioned mapping table using "map cvlan svlan"
 cvlan1 svlan 901
 cvlan2 svlan 902
 cvlan 0 svlan 903 (cvlan 0 is used for mapping untagged/priority-tagged packets)

Service protection based on UPSR/SNCP path switching

TDM service protection can be provided using UPSR/SNCP path switching. A DACS or similar device that provides a grooming function is required at one end to support UPSR/SNCP path switching.

At one end of a typical network, a single VLNC60/61/62 Circuit Emulator circuit pack is configured with two bidirectional tunnels. Each tunnel terminates on a different VLNC64 Circuit Emulation Mini-hub circuit pack at the opposite end. Each tunnel has bidirectional forwarding detection (BFD) enabled. BFD is a network protocol that provides low-overhead method of detecting faults across media that does not support failure detection, like asynchronous messaging across Ethernet. BFD switch times are on the order of several seconds, rather than msec.

Each VLNC64 Circuit Emulation Mini-hub circuit pack is connected to the DACS. The DACS must be configured for UPSR/SNCP path switching. In the transmit direction, the DACS sends data in both directions of the UPSR/SNCP ring to both VLNC64 Circuit Emulation Mini-hub circuit packs. In the receive direction, the DACS receives traffic from only one VLNC64 Circuit Emulation Mini-hub circuit pack based on which VLNC64 Circuit Emulation Mini-hub circuit pack receives traffic on the tunnel. The other VLNC64 Circuit Emulation Mini-hub circuit pack sends VT/VC level AIS to the DACS.

ML-PPP termination

The Alcatel-Lucent 1850 TSS-5 VLNC60/61/62 Circuit Emulator circuit pack can terminate ML-PPP links on up to 8 DS1/E1 interfaces (VLNC60/62) or 16 DS1/E1 interfaces (VLNC61). The pack terminates the DS1/E1 ML-PPP links and transmits the data over Ethernet links running 802.1Q encapsulation. This reduces frame overhead associated with data backhaul over DS1/E1, and reduces the number of ML-PPP sessions that must be terminated by the MLS router.

Layer 2 control protocol tunneling

Layer 2 Control Protocols (L2CPs) are used for several purposes in IEEE 802 standard networks, including link maintenance, aggregation, flow control, authentication, identity/capability discovery and management. L2CPs are also used for managing the behavior of LAN bridges, including STP/RSTP/MSTP and GARP/MRP. The VLNC40/42/42B circuit packs support L2CP tunneling. A L2CP frame is identified by the destination MAC address.

On the VLNC40/42/42B, L2CP Tunneling (l2cp-tunnel) can be enabled or disabled on a port-by-port basis. When the mode is disabled, all the rules and characteristics described for the peering of supported protocols apply. When the l2cp-tunnel mode is enabled on a port, all customer L2CP frames/messages for supported and unsupported protocols that

are received at that port are forwarded. Because the tunneled protocol is either disabled or unsupported, VLNC40/42/42B does not interpret any of the frames associated with a tunneled protocol.

L2CP Tunneling must be enabled on the terminating customer LAN/host port, as well as all Ethernet ports carrying the tunneled frames at all nodes through the network. Layer 2 control protocol tunneling may not be enabled on ports that are part of a protected Ethernet ring.

Note: Refer to [“Layer 2 control protocol tunneling” \(p. A-30\)](#) for more information.

Applications

Ethernet applications are examples of what users can do with the services and topologies described in previous sections. The user can be the owner of the equipment or a client of the owner. For example, an ISP can have a private network or buy the services from an LEC to construct the application. Applications include:

- LAN interconnect
- LAN extension
- ISP access
- Internet access
- Wireless backhaul
- Video distribution

LAN interconnect

Two or more enterprise LANs are interconnected. The LANs may be point-to-point Private Line connections, in which case Ethernet switching services are not provided. If Virtual Private Lines are desired, Ethernet switching is required. Even so, in a three-node LAN Interconnect application composed of Virtual Private Lines the middle node has two termination ports, one for each neighbor. This is different from a three-node LAN Extension (next application) using Virtual Private LAN in which the middle node may have only one (effectively a hub) port.

LAN extension

Sometimes called intranet or Layer 2 VPN, this extends an enterprise LAN to multiple locations via embedded Ethernet switching. Either Private LAN or Virtual Private LAN may be used.

Transparent LAN is a common form of LAN Extension in which the subscriber's traffic is transported without regard to the presence of subscriber VLAN tags. Transparency is achieved by the use of Port Tags, avoiding the need for the provider to administer VLANs with subscribers. The Port Tag is effectively a customer ID; only ports in the network assigned a particular customer ID will exchange traffic.

In *Non-Transparent LANs*, greater flexibility is available when the subscriber's 802.1Q tags are used for traffic management (802.1Q mode). For example, the priority bits within the tag can be used to give a portion of the subscriber's traffic, for example VoIP, preferential treatment through the network versus its file transfer or Internet traffic. Although in a Virtual Private LAN service a Non-transparent LAN application requires the administration of VLAN IDs among customers, in a Private LAN where no other customers share the embedded Ethernet switch this is not necessary.

ISP access

In this application an ISP uses a provider's network to collect Internet traffic. It is also an example of a trunking application, where traffic from multiple customers is handed off to the ISP router on a single trunk link for efficiency. The Virtual Private LAN service may be used to efficiently transport the best-effort Internet traffic. It is typically done using the 802.1Q mode for separating the ISP's clients' traffic. If the ISP's router supports stacked VLANs then it can be done in Transparent Mode. The trunk link may be GbE while the access links may be 10/100 Mb/s Ethernet.

Internet access

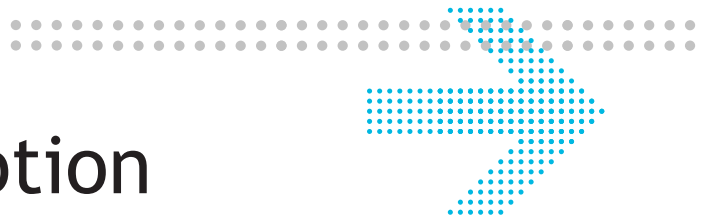
In this application the ISP owns the network. In this case the clients' traffic is untagged. The ISP adds tags for customer separation using the 802.1Q mode. The ISP administers the tags directly; there is no third party involved.

Wireless backhaul

In this application a wireless service provider uses Ethernet links between remote base transceiver stations (BTS) and the central office to transport TDM/voice or data. TDM information for DS1/E1 signals is carried over pseudowires within Ethernet tunnel connections. The DS1/E1 signals at the base transceiver stations (BTS) are connected to the DSX in the central office over the Ethernet pseudowire connections. Timing for the DS1/E1 signals is handled via BITS input, IEEE 1588 PTP, or Synchronous Ethernet. Data backhaul is handled by terminating ML-PPP links containing data at the remote location and transmitting the data via Ethernet over the EATN.

Video distribution

Video distribution can be accomplished using Ethernet Multicasting. A Private LAN service is used to guarantee the bandwidth. Video traffic, generated at the head end, is sent using a multicast address. Transparent mode or 802.1Q mode may be used. At each node the traffic is dropped to its user and also duplicated and sent to the rest of the Private LAN. Because of the duplication process, the maximum throughput is only half the line rate, for example 500 Mb/s on GbE links.



4 Product description

Overview

Purpose

This chapter provides a detailed view of the Alcatel-Lucent 1850 Transport Service Switch 5 (Alcatel-Lucent 1850 TSS-5) architecture. After introducing the Alcatel-Lucent 1850 TSS-5 shelf, this chapter describes the system circuit packs, control, power, and cabling.

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Shelf description

Overview

Alcatel-Lucent 1850 TSS-5 is a single-shelf multiplexer that offers the following capabilities:

- The VLNC50/52 SONET/SDH Transport circuit pack and the and VLNC35 Fast Ethernet Private Line circuit pack are controlled by, and require, a VLNC2 System Controller in the SYSCTL slot.
- DS1 and DS3 signals can be multiplexed over OC-3 or OC-12 lines, and E1 and E3 signals over STM-1 or STM-4 lines. The VLNC50/52 circuit pack must be installed in the MAIN1 (and optionally MAIN2 slot), equipped with the required pluggable transmission modules, and be provisioned for the desired signal rate.
When UNPROT (protection-not-allowed), the two lines on the same board (OC-3/STM-1 or OC-12/STM-4) must be the same rate and may be either 0x1 (default) or UPSR/SNCP.
When PROT (equipment-protection-allowed), each pair of lines across the boards may be a different rate and may be either 1+1 or UPSR/SNCP. The two pairs of lines can have different applications.
- Fast Ethernet or Gigabit Ethernet optical connections, depending upon the type of pluggable transmission modules in the VLNC40/42/42B circuit pack installed in the MAIN 2 slot.
- Ethernet aggregation of up to 20 10/100BASE-T Electrical Ethernet ports onto Gigabit or Fast Ethernet links using the VLNC40/42/42B circuit pack in the MAIN 2 slot.
- Circuit emulation of DS1/E1 signals over Ethernet and off-load of DS1/E1 ML-PPP data traffic for transport over Ethernet, using the VLNC60/61/62 circuit pack.
- Circuit emulation of DS1/E1 signals over Ethernet and a channelized OC-3/STM-1 line, using the VLNC64 Circuit Emulation Mini-hub circuit pack in the MAIN 1 or MAIN 2 slot.
- Data off-load for Ethernet back-haul from remote wireless locations, using the VLNC60/61/62 circuit pack.
- The VLNC40/42/42B Ethernet Aggregator, VLNC60/61/62 Circuit Emulator, and VLNC64 Circuit Emulation Mini-hub circuit packs operate independent of the SYSCTL circuit pack and are self-managed.

The VLNC2, VLNC40, VLNC42/42B, VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs are compatible with the Alcatel-Lucent 1850 TSS-5 High Capacity shelf.

Shelf size

The Alcatel-Lucent 1850 TSS-5 High Capacity shelf has the following physical characteristics.

- Dimensions
 - Height: 4.9 in. (125 mm)
 - Width: 17.4 in. (441 mm)
 - Depth: 11.8 in. (300 mm)
- Weight
 - Empty: 10 lbs. (4.536 kg.)
 - Full: 15 lbs. (6.804 kg.)

Capacity

The capacity of Alcatel-Lucent 1850 TSS-5 shelf depends on the installed circuit packs/pluggable transmission modules.

- VLNC35 Fast Ethernet Private Line circuit pack (10/100 T/F): Provides up to 4 electrical Fast Ethernet (10/100BASE-T) ports and up to 2 100BASE-X pluggable transmission modules.
- VLNC40 Ethernet Aggregator (10/100/1G-T/F): Provides up to 4 100/1000BASE-X or 1000BASE-T pluggable transmission modules and up to 20 10/100BASE-T ports. The VLNC40 supports Ethernet Link OAM IEEE 802.3 Clause 57 (formerly referred to as 802.3ah) and Ethernet Service OAM IEEE 802.1ag.
- VLNC42 Ethernet Aggregator (10/100/1G-T/F): Provides the same interfaces and feature support as the VLNC40. In addition, the VLNC42 is hardware-enabled to support synchronous Ethernet and high-performance Ethernet OAM ITU-T Y.1731. The VLNC42 is hardware-enabled to support the Time of Day (ToD)/1PPS feature for GPS replacement applications in a future release.
- VLNC42B Ethernet Aggregator (10/100/1G-T/F): Provides the same interfaces and feature support as the VLNC42. In addition, the VLNC42B supports T-MPLS starting in Release 7.0.
- VLNC50 SONET/SDH Transport (OC-3/OC-12/STM-1/STM-4/8DS1E1/3DS3E3/1G): Provides 1 GbE pluggable transmission module interface, up to 2 OC-3/STM-1 or OC-12/STM-4 pluggable transmission module interfaces, and support for up to 8 DS1/E1 and 3 DS3/E3 interfaces. The VLNC50 circuit pack provides the main SONET or SDH switch fabric for the shelf.
- VLNC52 SONET/SDH Transport (OC-3/OC-12/STM-1/STM-4/28DS1/21E1/3DS3E3/1G): Provides 1 GbE pluggable transmission module interface, up to 2 OC-3/STM-1 or OC-12/STM-4 pluggable transmission module interfaces, and support for up to 28 DS1/21 E1 and 3 DS3/3 E3 interfaces. The VLNC52 circuit pack provides the main SONET or SDH switch fabric for the shelf.

-
- VLNC60 Circuit Emulator (8DS1/E1-100/1G-T/F): Provides up to 2 100/1000BASE-X pluggable transmission module interfaces and supports circuit emulation or Multilink Point-to-Point Protocol (ML-PPP) termination for up to 8 DS1/E1 interfaces. Both Ethernet ports must be the same rate.
 - VLNC61 Circuit Emulator (16DS1/E1-100/1G-T/F): Provides up to 2 100/1000BASE-X pluggable transmission module interfaces and supports circuit emulation or Multilink Point-to-Point Protocol (ML-PPP) termination for up to 16 DS1/E1 interfaces. Both Ethernet ports must be the same rate.
 - VLNC62 Circuit Emulator (8DS1/E1-100/1G-T/F): Provides up to 2 100/1000BASE-X pluggable transmission module interfaces and supports circuit emulation or Multilink Point-to-Point Protocol (ML-PPP) termination for up to 8 DS1/E1 interfaces. Both Ethernet ports must be the same rate.
 - VLNC64 Circuit Emulation Mini-Hub (OC3/OC12-STM1/STM4-100/1G-T/F): Provides 1 channelized OC-3/STM-1 pluggable transmission module interface, up to 2 GbE/FE pluggable transmission module interfaces, and supports DS1/E1 circuit emulation. Both Ethernet ports must be the same rate. The VLNC64 does not currently support OC-12/STM-4 interfaces.

The signals supported at any one time depend upon the circuit packs/pluggable transmission modules that are installed in the shelf. For more information about the interfaces supported by each circuit pack, refer to [Table 4-1, “Circuit packs in Alcatel-Lucent 1850 TSS-5 shelf” \(p. 4-9\)](#).

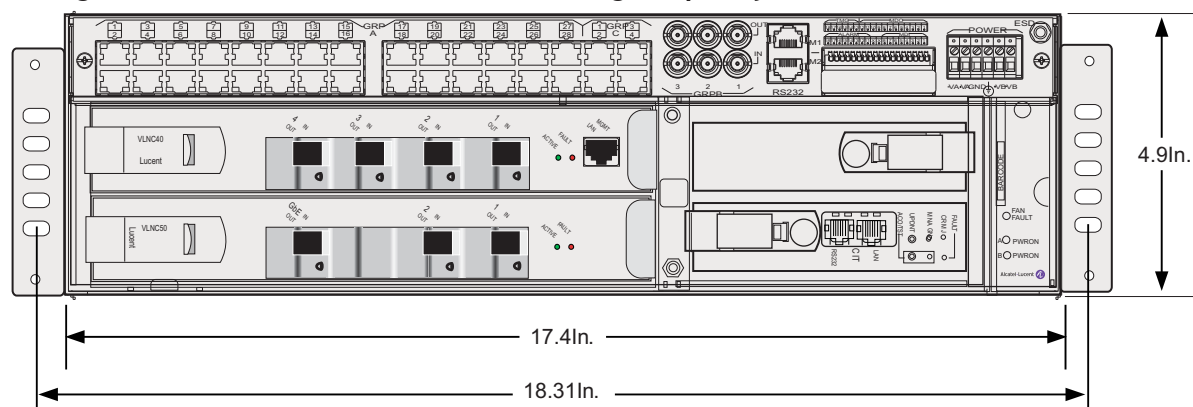
Shelf view

The following figure shows the front of the Alcatel-Lucent 1850 TSS-5 Rack Mount High-capacity shelf, equipped with the following:

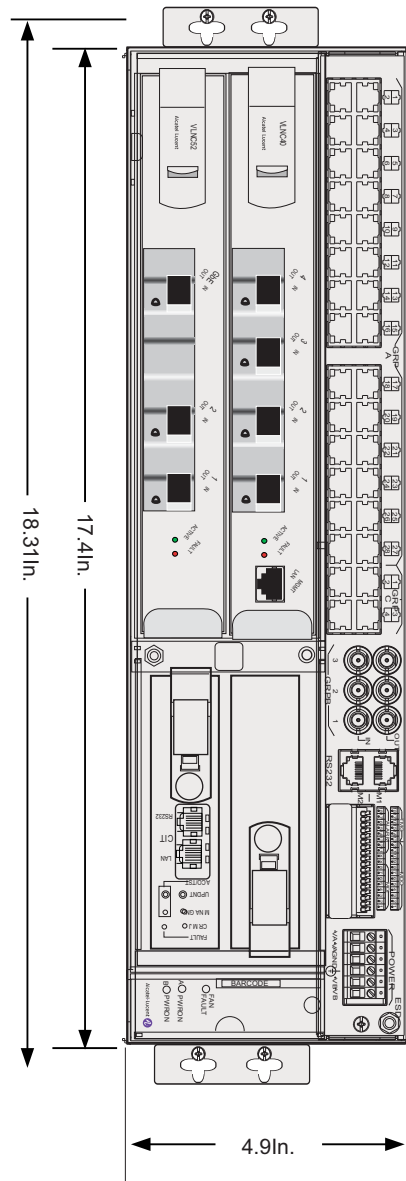
- VLNC50 SONET/SDH Transport circuit pack in the MAIN 1 slot
- VLNC40 Ethernet Aggregator circuit pack in the MAIN 2 slot
- VLNC2 SYSCTL circuit pack in the CTL slot
- A blank slot cover over the Group C slot

The Alcatel-Lucent 1850 TSS-5 High-capacity rack-mount shelf occupies less than 3RU of vertical space in a 19-inch equipment rack. Access to removable circuit packs and all interfaces is provided from the front of the shelf. Electrical interfaces not located on circuit packs are accessible on a removable assembly that is installed on the front of the shelf, above the circuit packs. This assembly is known as the VLIU(1,2,3,10) interface unit.

Figure 4-1 Alcatel-Lucent 1850 TSS-5 High Capacity rack-mount front view



MK-DMXplore-010

Figure 4-2 Alcatel-Lucent 1850 TSS-5 High Capacity wall-mount front view

MK-DMXplore-010W

Shelf description

Alcatel-Lucent 1850 TSS-5 contains 1 Function Group C slot, 2 Main slots, and one CTL slot. Refer to [Figure 4-1, “Alcatel-Lucent 1850 TSS-5 High Capacity rack-mount front view”](#) (p. 4-5).

Function Group C slot

The Function Group C slot is designed to house a VLNC35 Fast Ethernet Private Line circuit pack. It is mapped directly to four RJ-45 connectors, labeled for GRP C, on the VLIU(1,2,10) interface unit. A 199SC Apparatus Blank must be installed if the slot is unequipped.

Main slots (MAIN 1 and MAIN 2)

The MAIN 1 and MAIN 2 slots are reserved for the VLNC40, VLNC42/42B, VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs. They provide the optical links from which bandwidth can be mapped to support the lower bandwidth TDM and packet interfaces on the shelf. The SMC/SEC (± 20 ppm) timing generator and main TDM switch fabric is embedded in the VLNC50/52. The Stratum 3 (± 4.6 ppm) clock and main TDM switch fabric is embedded in the VLNC60/61/62 and VLNC64 circuit packs.

The VLNC40/42/42B circuit pack is supported in the MAIN 2 slot.

The VLNC50/52 circuit pack is supported in the MAIN 1 slot and MAIN 2 slots.

The VLNC60/61/62/64 circuit pack is supported in the MAIN 1 and MAIN 2 slots.

A 199MN Apparatus Blank must be installed in any unused Main slot.

Control slot

The CTL slot is reserved for the non-redundant VLNC2 System Controller (SYSCTL) circuit pack. The System Controller provides control and communications functions with the VLNC50/52 SONET/SDH Transport circuit pack and the VLNC35 Fast Ethernet Private Line circuit pack. The VLNC50/52 and VLNC35 require a VLNC2. The SYSCTL circuit pack also provides a serial RS-232 port and an 100-bps Ethernet LAN port that support *WaveStar*® CIT operations. A 199SC Apparatus Blank must be installed in an unequipped CTL slot.

Fan unit

The Alcatel-Lucent 1850 TSS-5 High Capacity rack-mount shelf contains a plug-in fan unit.

Circuit pack blanks

Any unused slot in the Alcatel-Lucent 1850 TSS-5 must be equipped with an appropriate circuit pack blank in order to meet radiated emission requirement per GR-1089.

A 199MN Apparatus Blank must be installed in an unused Main slot.

A 199SC Apparatus Blank must be installed in an unequipped Function Group C slot and an unequipped CTL slot.

VLIU(1,2,3,10) interface unit description

The Alcatel-Lucent 1850 TSS-5 shelf provides the following connections on the VLIU(1,2,3,10) interface unit. (Refer to [Figure 4-1, “Alcatel-Lucent 1850 TSS-5 High Capacity rack-mount front view”](#) (p. 4-5).)

- 2 pairs of positive and negative connections (VA and VB) for –48 VDC or +24 VDC power.
- 2 power-on LEDs (PWR-A and PWR-B), located on the front of the fan unit in the High Capacity rack-mount shelf.
- DS3/E3 coaxial ports: two sets of backplane DS3/E3 ports that are routed to the 3 pairs of DS3/E3 connectors on the faceplate (does not apply to the VLIU3)
- RJ-45 connectors (GRP A)
 - VLIU1: 8 ports (1–8), mapped to the MAIN slots and supported as DS1/E1 ports by a VLNC50, or as DS1/E1 ports by a VLNC60. The VLIU1 supports an unprotected or protected VLNC50 or VLNC60, and can also support a VLNC40/42/42B.
 - VLIU2: 28 DS1 ports (1–28) or 21 E1 ports (1–21), mapped to the MAIN slots and supported as DS1/E1 ports by a VLNC52 or VLNC61 circuit pack. The VLIU2 supports an unprotected VLNC50/52, VLNC60, VLIU61, VLIU62, or VLNC64 and can also support a VLNC40/42/42B and/or a VLNC64.
 - VLIU3: 16 DS1 ports (1–16) or 16 E1 ports (1–16), mapped to the MAIN1 slot and supported as DS1/E1 ports by VLNC62 circuit pack. The VLIU3 supports an unprotected VLNC60, VLIU61, VLIU62, or VLNC64 and can also support a VLNC40/42/42B and/or a VLNC64.
 - VLIU10: equipment-protected 28 DS1 ports (1–28) or 21 E1 ports (1–21) mapped to the MAIN slots and supported as DS1/E1 ports by VLNC50/52 circuit packs, in MAIN 1 and 2 slots. The VLIU2 supports VLNC50/52 equipment protection. The VLIU10 can also support VLNC60, VLNC61, and/or a VLNC64. The VLIU10 does not support the VLNC40/42/42B.
- 20 10/100 Mb/s Ethernet ports are mapped to MAIN 2 and supported by the VLNC40/42/42B.
 - On the VLIU1, these ports appear on RJ-45 jacks numbered 9–28
 - On the VLIU2 and VLIU3, these ports appear on RJ-45 jacks numbered 41–60. On the VLIU3, the 20 FE ports are consolidated into 10 RJ-45 faceplate jacks (down from 12 jacks in VLIU2). Ports 49/51 and ports 50/52 are combined. 2:1 breakout cables (same as those used for VLIU2 FE ports) are needed to obtain access to the second group of ten FE ports.
- On the VLIU3, the two recovered RJ-45 jacks (from previous item) are combined with the four recovered C-Group RJ-45 jacks (following item), to form a new group of six Time of Day ports for use with the VLNC62 circuit pack. These occupy the right-most six positions of the right-most 16-jack block. The three upper jacks are connected to M1. The lower three jacks are connected to M2.

- On the VLIU1, VLIU2, and VLIU10: 4 Ethernet ports, mapped directly to the Function Group C slot.
 - 2 RJ-45 connectors for RS-232 management connections to any packs in the MAIN 1 or MAIN 2 slots that are not managed by the SYSCTL circuit pack.
 - Connectors for 4 miscellaneous discrete input (MDI) and 6 miscellaneous discrete output (MDO) conditions. Four MDOs are controlled by the VLNC2, and one is assigned to each Main slot. The MDIs are only processed on the VLNC2. Currently, only the VLNC40/42/42B in the MAIN2 slot is capable of using the slot MDO.
 - 2 audible and visual **Critical/Major** and **Minor** office alarm closures. These office alarm closures are only used by the VLNC2 and the VLNC50/52.
 - BITS I/O
A derived DS1/E1 output is available when a VLNC50/52 circuit pack is in the MAIN 1 slot or MAIN 2 slot. When a VLNC60/VLNC61/VLNC62/VLNC64 is installed in either the MAIN 1 slot or MAIN 2 slot, DS1/E1 BITS input is supported.
- Note:** Refer to [Table 6-1, “VLIU compatibility” \(p. 6-4\)](#) for more information about supported configurations.

Circuit pack codes

Overview

The following information identifies the supported circuit packs, the initial compatible software release, and the compatible shelf slot.

Available circuit packs

[Table 4-1, “Circuit packs in Alcatel-Lucent 1850 TSS-5 shelf” \(p. 4-9\)](#) contains a list of each circuit pack supported by Alcatel-Lucent 1850 TSS-5, indicates the slots into which they can be installed, and the release supported by each circuit pack.

Table 4-1 Circuit packs in Alcatel-Lucent 1850 TSS-5 shelf

Circuit Pack	Apparatus Code	Slot(s)	Release	Comments
Apparatus Blank	199SC	Function Group C and CTL	3.0	Filler plate to be used in • Function Group C slot when a VLNC35 is not installed • CTL slot when the SYSCTL is not installed

Table 4-1 Circuit packs in Alcatel-Lucent 1850 TSS-5 shelf (continued)

Circuit Pack	Apparatus Code	Slot(s)	Release	Comments
Interface unit	VLIU1	VLIU	3.0	Required for shelf operation. Supports up to 8 electrical DS1/E1 ports. Supports equipment protection for VLNC50 circuit packs.
Interface unit	VLIU2	VLIU	5.0	Required for shelf operation. Supports up to 28 electrical DS1/E1 ports. Does not support equipment protection.
Interface unit	VLIU3	VLIU	7.0	Required for shelf operation. Supports up to 16 electrical DS1/E1 ports and Time of Day. Does not support equipment protection.
Interface unit	VLIU10	VLIU	5.0	Required for shelf operation. Supports up to 28 electrical DS1/E1 ports. Supports equipment protection for VLNC50 and VLNC52 circuit packs. Does not support the VLNC40/42/42B.
System Controller (SYSCTL)	VLNC2	CTL	3.0	Extended temperature certification for outside cabinet deployment (OSP Hardened)
10/100 Private Line (2 optical ports and 4 electrical ports)	VLNC35	Function Group C	5.1	Support for the 4 10/100BASE-T ports on the access panel and 2 100BASE-LX ports on the faceplate (via PTM optics). Supports Ethernet Private Lines, OSP hardened. SYSCTL circuit pack and at least one VLNC50/52 are required.
10/100/1G-T/F Ethernet Aggregator	VLNC40	MAIN 2	3.0	Supports 20 10/100 Mb/s Fast Ethernet ports in Group A ¹ and 4 PTM (100/1000BASE-X) ports. SYSCTL circuit pack not required.
10/100/1G-T/F Ethernet Aggregator	VLNC42/ VLNC42B	MAIN 2	5.1	Supports 20 10/100 Mb/s Fast Ethernet ports in Group A ¹ and 4 PTM (100/1000T/F) ports. SYSCTL circuit pack not required.

Table 4-1 Circuit packs in Alcatel-Lucent 1850 TSS-5 shelf (continued)

Circuit Pack	Apparatus Code	Slot(s)	Release	Comments
OC-3/OC-12/STM-1/STM-4/ 8DS1E1/3DS3E3/1G SONET/ SDH Transport	VLNC50	MAIN 1, MAIN 2 ⁴	3.0	Supports up to 2 OC-3/STM-1 or OC-12/STM-4 PTMs, one GbE Ethernet PTM, 8 DS1/E1 ports, and 3 DS3/E3 ports. SYSCTL circuit pack is required.
OC-3/OC-12/STM-1/STM-4/ 28DS1E1/3DS3E3/1G SONET/ SDH Transport	VLNC52	MAIN 1 ² , MAIN 2 ⁵	5.0	Supports up to 2 OC-3/STM-1 or OC-12/STM-4 PTMs, one GbE Ethernet PTM, 28 DS1/21 E1 ports, and 3 DS3/E3 ports. SYSCTL circuit pack is required.
8DS1/E1-100/1G-T/F Circuit Emulator	VLNC60	MAIN 1, MAIN 2	4.0	Supports up to 2 FE/GbE PTMs and 8 DS1/E1 ports. SYSCTL circuit pack is not required.
16DS1/E1-100/1G-T/F Circuit Emulator	VLNC61	MAIN 1 ² , MAIN 2	5.0	Supports up to 2 FE/GbE PTMs and 16 DS1/E1 ports. SYSCTL circuit pack is not required.
8DS1/E1-100/1G-T/F Circuit Emulator	VLNC62	MAIN 1 ³ , MAIN 2	7.0	Supports up to 2 FE/GbE PTMs and 8 DS1/E1 ports. SYSCTL circuit pack is not required.
OC3/OC12- STM1/STM4- 100/1G-T/F Circuit Emulation Mini-hub	VLNC64	MAIN 1, MAIN 2	4.1	Supports up to 2 FE/GbE PTMs and 1 OC-3/STM-1 PTM. SYSCTL circuit pack is not required.

Notes:

1. On the VLIU1, these ports appear on RJ-45 jacks numbered 9–28. On the VLIU2, these ports appear on RJ-45 jacks numbered 41–60.
2. A VLNC52 or VLNC61 installed in MAIN1 requires either the VLIU2 or VLIU10 interface unit.
3. The VLIU1, VLIU2, or VLIU3 interface unit is required to support the VLNC62 circuit pack. The VLIU3 interface unit is required if Time of Day feature is desired.
4. A VLNC50 installed in MAIN1 and MAIN2 requires either the VLIU1 or VLIU10 interface unit.
5. A VLNC52 installed in MAIN1 and MAIN2 requires the VLIU10 interface unit.

Important! Changes may be made to offerings at any time and without notice.

Group C circuit packs

Overview

The information describes the details of each of the Ethernet circuit packs that are installed in the Group C slot of Alcatel-Lucent 1850 TSS-5. These circuit packs support the 4 RJ-45 10/100 Mb/s Ethernet interfaces, identified as the C Group, on the shelf access panel. Some circuit packs provide additional optical Ethernet interfaces on the circuit pack.

Optical/Electric 10/100 (VLNC35) Ethernet interface

The VLNC35 circuit pack is available beginning in Release 5.1. It is installed in the Function Group C slot of the Alcatel-Lucent 1850 TSS-5 shelf. The Function Group C slot does not support an additional protection circuit pack. The VLNC35 is designed to support Fast Ethernet Private Line applications. Each VLNC35 circuit pack can support 6 Private Lines. The VLNC35 supports VT1.5/VC-12, STS-1/VC-3 (low-order), and STS-3c/VC-4 cross-connections. Cross-connections are supported on up to 8 STS-1/VC-3s on the VLNC35 packs.

The VLNC35 supports the following capabilities:

- Standard Ethernet switching per IEEE 802.1
- Standard encapsulation according to ITU G.7041 for Generic framing procedure (GFP)
- Virtual Concatenation (VCAT) per ITU G.707
- Support for up to 6 VCG ports
- Support for LCAS
- Support for STS-1/VC-3, STS-3c/VC-4, and VT1.5/VC-12 mode (up to 224 VT1.5s or 168 VC12s may be used between 1 and 63 assigned to any VCG.)

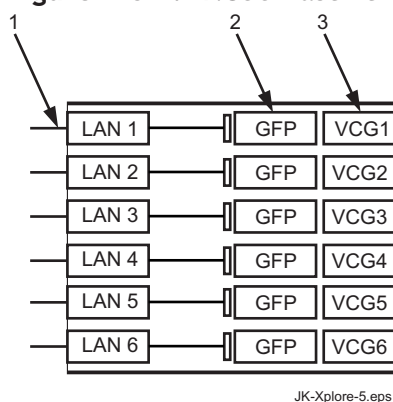
The VLNC35 supports 2 optical 100BASE-LX ports and four 10/100BASE-T electrical ports, that provide 10/100 Mb/s links using standard Ethernet switching (IEEE 802.1), standard encapsulation according to ITU G.7041 for Generic Framing Procedure (GFP), and ITU G.707 for Virtual Concatenation (VCAT). The electrical interfaces supported by the VLNC35 can transmit signals up to 100 meters. The optical interfaces can transmit signals up to 10,000 meters.

The VLNC35 optical ports use pluggable transmission modules (PTMs). They can be plugged into a circuit pack as they become necessary. This allows customers to grow their network incrementally, only realizing the cost of optics when they are needed to provision service. PTMs are not included when VLNC35 packs are purchased and shipped. PTMs are purchased and installed separately by the customer as needed.

When VT mapping is selected, up to 8 STS1s/TUG3s are available for cross-connection at any rate (STS1, STS-3c, VT1.5, VC3 (low-order), VC4, VC12). Each VCG supports up to 1 STS3c/VC4 (with virtual concatenation not allowed), up to 3 STS1/VC3, or up to 63 VT1.5/VC12. A report provides backplane usage information, and on-demand backplane optimization is provided; this optimization is service affecting.

Electrical connections to the 10/100BASE-T interface are via multi-service connectors on the Alcatel-Lucent 1850 TSS-5 VLIU while optical ports are located on the faceplate of the VLNC35.

Figure 4-3 VLNC35 Fast Ethernet (Private Line) circuit pack



Legend:

1. External Ethernet Port
2. Generic Framing Procedure
3. Virtual Concatenation Group

The electrical ports auto-negotiate speed (10/100 Mb/s) and flow control when interfacing with other 802.3 compliant devices over twisted pair media. The ports supports the full duplex mode only.

Main circuit pack descriptions

Overview

This section briefly describes Alcatel-Lucent 1850 TSS-5 main circuit packs, installed in the MAIN 1 and MAIN 2 shelf slots.

10/100/1G-T/F (VLNC40)

The VLNC40 circuit pack is an Ethernet interface unit (EIU) that supports aggregation of Ethernet service. The VLNC40 circuit pack operates unprotected and can only be installed in the MAIN 2 slot of a High Capacity rack-mount shelf.

The VLNC40 circuit pack is compatible with, and its presence is reported by, the VLNC2 SYSCtl circuit pack, if one is present in the shelf. However, the VLNC40 circuit pack is not controlled by a SYSCtl circuit pack, and is not managed by TL1, or through the *WaveStar*® CIT.

Management and configuration of VLNC40 circuit pack is accomplished using a separate Command Line Interface (CLI). The CLI can be accessed from a serial connection to the VLNC40 through the RS232 port on the VLIU(1,2) associated with the MAIN slot in which the VLNC40 is installed or from the web-based graphical user interface (GUI). The web-based GUI and CLI messages permit VLNC40/42/42B and VLNC60/61/62/64 circuit pack operations to be performed (for example, administration and provisioning).

The VLNC40 is shipped with a default IP address, 169.254.1.1, assigned to the MGMT LAN port on the faceplate of the circuit pack. This address can be set or changed through the RS-232 port on the shelf. The CLI can also be accessed through an IP connection to the MGMT LAN port on the face of the VLNC40 circuit pack, either by direct connection with an Ethernet cross-over cable, or through a network connected to this port. For a detailed description of the Command Line Interface (CLI) messages used to interface with the VLNC40/VLNC42/VLNC42B and VLNC60/VLNC61/VLNC62/VLNC64 circuit packs and general information about using the Command Line Interface (CLI), refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide* and the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) CLI User Provisioning Guide*.

The VLNC40 circuit pack also has an internal network port. An IP address can be assigned to this internal port, and used for inband access to the CLI from any configured Ethernet port supported by the VLNC40 circuit pack.

Ethernet ports

The VLNC40 circuit pack has 4 100/1000 Mb/s Ethernet ports on the faceplate of the circuit pack. The ports support connections to the Ethernet Access Transport Network (EATN). These ports can be used to externally connect a Gigabit Ethernet link to a VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, or VLNC64 circuit pack. The VLNC40 circuit pack also support a Gigabit Ethernet backplane connection to a VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, or VLNC64 in the same shelf.

If the backplane connection is utilized, the following port is unavailable:

- VLNC40/42/42B: the bottom, left-hand port is unavailable.
- VLNC50/52: the single Gigabit port is unavailable.
- VLNC60/61/62: the top, right-hand port is unavailable.
- VLNC64: the top, right-hand port is unavailable.

When not using the backplane connection, the ports use pluggable transmission modules (PTMs). They can be plugged into the circuit pack as they become necessary. This allows customers to grow their network incrementally, only realizing the cost of optics when they are needed to provision service. PTM optics are not included when VLNC40 packs are purchased and shipped.

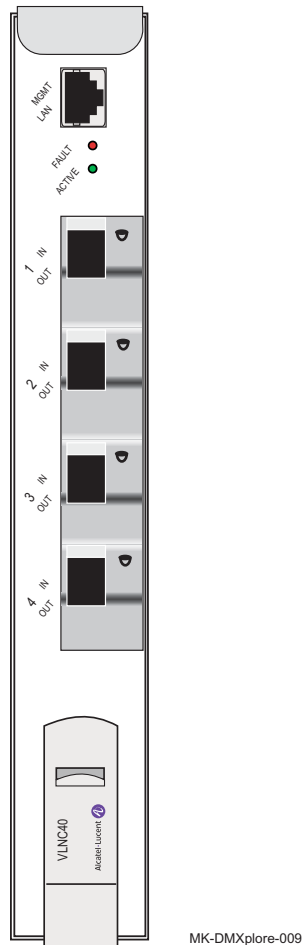
Tributary ports

The VLNC40 circuit pack also supports up to 20 10/100 Mb/s Ethernet ports through RJ45 connectors on the VLIU(1,2) interface unit. The shelf ports provide 10/100 Mb/s links using standard Ethernet switching (IEEE 802.1).

VLNC40 circuit pack faceplate

The following figure shows the VLNC40 faceplate including the following details:

- MGMT LAN RJ45 Ethernet port
- Fault indicator LED
- Active indicator LED
- 4 sockets for the FE/GbE PTMs

Figure 4-4 VLNC40 circuit pack**10/100/1G-T/F (VLNC42/42B)**

The VLNC42/42B circuit pack is an Ethernet interface unit (EIU) that supports aggregation of Ethernet service. The VLNC42/42B circuit pack operates unprotected and can only be installed in the MAIN 2 slot of a High Capacity rack-mount shelf.

The VLNC42/42B circuit pack is compatible with, and its presence is reported by, the VLNC2 SYSCTL circuit pack, if one is present in the shelf. However, the VLNC42/42B circuit pack is not controlled by a SYSCTL circuit pack, and is not managed by TL1, or through the *WaveStar*® CIT.

Management and configuration of VLNC42/42B circuit pack is accomplished using a separate Command Line Interface (CLI). The CLI can be accessed from a serial connection to the VLNC42/42B through the RS-232 port on the VLIU(1,2) associated with the MAIN slot in which the VLNC42/42B is installed or from the web-based

graphical user interface (GUI). The web-based GUI and CLI messages permit VLNC40/42/42B and VLNC60/61/62/64 circuit pack operations to be performed (for example, administration and provisioning).

The VLNC42/42B is shipped with a default IP address, 169.254.1.1, assigned to the MGMT LAN port on the faceplate of the circuit pack. This address can be set or changed through the RS-232 port on the shelf. The CLI can also be accessed through an IP connection to the MGMT LAN port on the face of the VLNC42/42B circuit pack, either by direct connection with an Ethernet cross-over cable, or through a network connected to this port. For a detailed description of the Command Line Interface (CLI) messages used to interface with the VLNC40/VLNC42/VLNC42B and VLNC60/VLNC61/VLNC62/VLNC64 circuit packs and general information about using the Command Line Interface (CLI), refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide* and the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) CLI User Provisioning Guide*.

The VLNC42/42B circuit pack also has an internal network port. An IP address can be assigned to this internal port, and used for in-band access to the CLI from any configured Ethernet port supported by the VLNC42/42B circuit pack.

Ethernet ports

The VLNC42/42B circuit pack has 4 100/1000 Mb/s Ethernet ports on the faceplate of the circuit pack. The ports support connections to the Ethernet Access Transport Network (EATN). These ports can be used to externally connect a Gigabit Ethernet link to a VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, or VLNC64 circuit pack. The VLNC42/42B circuit pack also support a Gigabit Ethernet backplane connection to a VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, or VLNC64 in the same shelf.

If the backplane connection is utilized, the following port is unavailable:

- VLNC40/42/42B: the bottom, left-hand port is unavailable.
- VLNC50/52: the single Gigabit port is unavailable.
- VLNC60/61/62: the top, right-hand port is unavailable.
- VLNC64: the top, right-hand port is unavailable.

When not using the backplane connection, the ports use pluggable transmission modules (PTMs). They can be plugged into the circuit pack as they become necessary. This allows customers to grow their network incrementally, only realizing the cost of optics when they are needed to provision service. PTM optics are not included when VLNC42/42B packs are purchased and shipped.

Tributary ports

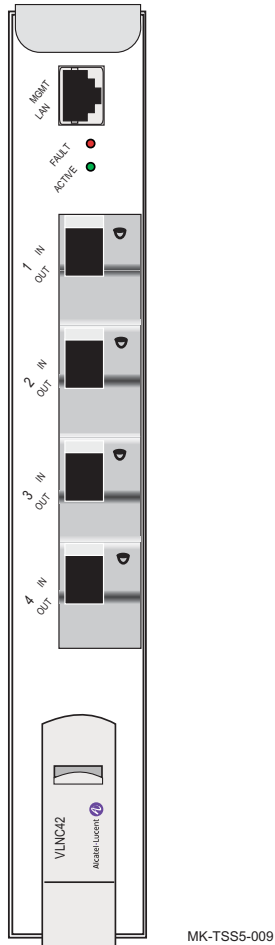
The VLNC42/42B circuit pack also supports up to 20 10/100 Mb/s Ethernet ports through RJ45 connectors on the VLIU(1,2) interface unit. The shelf ports provide 10/100 Mb/s links using standard Ethernet switching (IEEE 802.1).

VLNC42/42B circuit pack faceplate

The following figure shows the VLNC42/42B faceplate including the following details:

- MGMT LAN RJ45 Ethernet port
- Fault indicator LED
- Active indicator LED
- 4 sockets for the FE/GbE PTMs

Figure 4-5 VLNC42/42B circuit pack



OC-3/OC-12/STM-1/STM-4/8DS1E1/3DS3E3/1G (VLNC50)

The VLNC50 circuit pack is a multi-function SONET/SDH transport circuit pack installed in the MAIN 1 and MAIN 2 slot of the High Capacity rack-mount shelf. The VLNC50 circuit pack has two PTM sockets that support OC-3/STM-1 or OC-12/STM-4 optics and one PTM socket that supports Gigabit Ethernet.

Protection

The OC-3/STM-1 or OC-12/STM-4 ports can be used unprotected as 0x1 or provisioned as 1+1 or UPSR/SNCP. The VLIU1 or VLIU10 interface unit is required to support the VLNC50 circuit pack in MAIN2 with equipment protection (UNPROT/PROT).

When UNPROT (protection-not-allowed), protection is between the 2 optical lines on the VLNC50 circuit pack in Main slot 1. The parameter values of Application (0x1 or UPSR/SNCP) and Signal Type (OC-3/STM-1 or OC-12/STM-4) for both optical lines on the circuit pack must be the same value. Unprotected operation is supported in the Main 1 slot only. If a VLNC50 circuit pack is inserted in the unprotected Main 2 slot, the system reports an unexpected CP type alarm.

When PROT (equipment-protection-allowed), each pair of lines across the boards may be a different rate and may be either 1+1 or UPSR/SNCP. The two pairs of lines can have different applications.

DS1 and DS3 support

The VLNC50 circuit pack supports up to 8 DS1 ports and 3 DS3 ports via the VLIU(1,2,10) interface unit. The 8 DS1 ports can be cross-connected to VT1.5 timeslots, and 3 DS3 ports can be cross-connected to STS-1 timeslots when the system is operating with a UPSR, 1+1, or 0x1 OC-3 or OC-12 interface. Line build-outs and DS1/DS3 signal encoding are software provisionable. VLNC50 circuit pack supports the transport of DS1 signals coded in either alternate mark inversion (AMI) or bipolar 8-zero substitution (B8ZS) modes. DS3 signals are coded using B3ZS.

The VLNC50 circuit pack can be provisioned to support a channelized DS3 signal on port b-3. The channelized DS3 signal can be mapped into 28 DS1 signals. Each of the 28 DS1 signals can be cross-connected to an VT1.5 tributary or a DS1 port. Because these packs support a maximum of 28 DS1s split between the A group and the B-3 group, if a port is used as an electrical DS1 port, the corresponding DS1 port number within the TMUXed DS3 cannot be used. For example, if DS1 port a-1-3 is being used, TMUXed DS1 port b-3-1-3 cannot be used.

E1/E3 support

The VLNC50 circuit pack supports up to 8 E1 ports and up to 3 E3 ports via the VLIU(1,2,10) interface unit.

The 8 E1 ports can be cross-connected to VC-12 timeslots when the system is operating with an SNCP, 1+1, or 0x1 STM-1 or STM-4 interface. The E1 ports have 120 Ohm terminations, and are HDB3-encoded. The mapping is E1 <-> VC-12 <-> TU-12 <-> TUG2

<-> TUG3 <-> VC-4 <-> AU4. The signals received from the E1 ports are mapped into SDH signals within the VLNC50 circuit pack and then routed to the STM-1 or STM-4 ports.

The 3 E3 ports can be cross-connected to low-order VC-3 timeslots when the system is operating with an SNCP, 1+1, or 0x1 STM-1 or STM-4 interface. The mapping is VC-3 <-> TU3 <-> TUG3 (times 3) <-> VC-4 <-> AU4. The signals received from the E3 ports are mapped into SDH signals within the VLNC50 circuit pack and then routed to the STM-1 or STM-4 ports.

Ethernet

The VLNC50 circuit pack also has a single PTM socket for a Private Line Gigabit Ethernet connection. This port can be used to connect to the LAN port on an Ethernet Aggregator circuit pack (VLNC40/42/42B). If the VLNC50 and VLNC40/42/42B circuit packs are in the same shelf (requires the VLIU1 or VLIU2 interface unit), a Gigabit Ethernet backplane connection between the circuit packs can be provisioned instead of the manual fiber connections on the faceplates. Support for ITU G.7041 for Generic Framing Procedure (GFP), and ITU G.707 for Virtual Concatenation (VCAT) is provided on the VLNC50 for Ethernet over SONET/SDH. The VLNC50 also supports cross-connections from the OC-n/STM-n lines to Fast Ethernet ports on a VLNC35 circuit pack.

OC-3/OC-12/STM-1/STM-4/28DS1E1/3DS3E3/1G (VLNC52)

The VLNC52 circuit pack is a multi-function SONET/SDH transport circuit pack installed in the MAIN 1 and MAIN 2 slot of the High Capacity rack-mount shelf. The VLNC52 circuit pack has two PTM sockets that support OC-3/STM-1 or OC-12/STM-4 optics and one PTM socket that supports Gigabit Ethernet.

Protection

The OC-3/STM-1 or OC-12/STM-4 ports can be used unprotected as 0x1 or provisioned as 1+1 or UPSR/SNCP. The VLIU10 interface unit is required to support the VLNC52 circuit pack in MAIN2 with equipment protection (UNPROT/PROT).

When UNPROT (protection-not-allowed), protection is between the 2 optical lines on the VLNC52 circuit pack in Main slot 1. The parameter values of Application (0x1 or UPSR/SNCP) and Signal Type (OC-3/STM-1 or OC-12/STM-4) for both optical lines on the circuit pack must be the same value. Unprotected operation is supported in the Main 1 slot only. If a VLNC52 circuit pack is inserted in the unprotected Main 2 slot, the system reports an `unexpected CP` type alarm.

When PROT (equipment-protection-allowed), each pair of lines across the boards may be a different rate and may be either 1+1 or UPSR/SNCP. The two pairs of lines can have different applications.

DS1 and DS3 support

The VLNC52 circuit pack supports up to 28 DS1 ports and 3 DS3 ports via the VLIU2 (required if equipping a VLNC40/42/42B in the same shelf) or VLIU10 (required for protection) interface unit. The 28 DS1 ports can be cross-connected to VT1.5 timeslots, and 3 DS3 ports can be cross-connected to STS-1 timeslots when the system is operating with a UPSR, 1+1, or 0x1 OC-3 or OC-12 interface. Line build-outs and DS1/DS3 signal encoding are software provisionable. VLNC52 circuit pack supports the transport of DS1 signals coded in either alternate mark inversion (AMI) or bipolar 8-zero substitution (B8ZS) modes. DS3 signals are coded using B3ZS.

The 52 circuit pack can be provisioned to support a channelized DS3 signal on port b-3. The channelized DS3 signal can be mapped into 28 DS1 signals. Each of the 28 DS1 signals can be cross-connected to an VT1.5 tributary or a DS1 port. Because these packs support a maximum of 28 DS1s split between the A group and the B-3 group, if a port is used as an electrical DS1 port, the corresponding DS1 port number within the TMUXed DS3 cannot be used. For example, if DS1 port a-1-3 is being used, TMUXed DS1 port b-3-1-3 cannot be used.

E1/E3 support

The VLNC52 circuit pack supports up to 21 E1 ports and up to 3 E3 ports located via the VLIU2 (required for the VLNC52) or VLIU10 (required for protection) interface unit.

The 21 E1 ports can be cross-connected to VC-12 timeslots when the system is operating with an SNCP 1+1, or 0x1 STM-1 or STM-4 interface. The E1 ports have 120 Ohm terminations, and are HDB3-encoded. The mapping is E1 <-> VC-12 <-> TU-12 <-> TUG2 <-> TUG3 <-> VC-4 <-> AU4. The signals received from the E1 ports are mapped into SDH signals within the VLNC52 circuit pack and then routed to the STM-1 or STM-4 ports.

The 3 E3 ports can be cross-connected to low-order VC-3 timeslots when the system is operating with an SNCP, 1+1, or 0x1 STM-1 or STM-4 interface. The mapping is VC-3 <-> TU3 <-> TUG3 (times 3) <-> VC-4 <-> AU4. The signals received from the E3 ports are mapped into SDH signals within the VLNC52 circuit pack and then routed to the STM-1 or STM-4 ports.

Ethernet

The VLNC52 circuit pack also has a single PTM socket for a Private Line Gigabit Ethernet connection. This port can be used to connect to the LAN port on an Ethernet Aggregator circuit pack (VLNC40/42/42B). If the VLNC52 and VLNC40/42/42B circuit packs are in the same shelf, a Gigabit Ethernet backplane connection between the circuit packs can be provisioned instead of the manual fiber connections on the faceplates. Support for ITU G.7041 for Generic Framing Procedure (GFP), and ITU G.707 for Virtual Concatenation (VCAT) is provided on the VLNC52 for Ethernet over SONET/SDH. The VLNC52 also supports cross-connections from the OC-n/STM-n lines to Fast Ethernet ports on a VLNC35 circuit pack.

8DS1/E1-100/1G-T/F (VLNC60)

The VLNC60 circuit pack provides TDM interface termination for up to 8 DS1/E1 interfaces. It supports CESoP and ML-PPP termination on a port-by-port basis. These services can be mixed as needed among the ports. The VLNC60 circuit pack is installed in the MAIN 1 or MAIN 2 slot of the High Capacity rack-mount shelf. The VLNC60 circuit pack has a MGMT LAN port on the faceplate and two Ethernet LAN ports with PTM sockets for Fast Ethernet or Gigabit Ethernet connections. Both Ethernet interfaces must be the same rate. The Ethernet port #1 (the right-most port) can be routed as an electrical GbE across the backplane to a companion VLNC40/42/42B circuit pack.

In order to support a Metro Ethernet Forum 8 (MEF-8) based circuit emulation service, the user can specify an option for the mode of Circuit Emulation Service on the pack, either MPLS (RFC 4553) or Ethernet (MEF-8).

By default, the frequency for differential timestamp on the VLNC60 packs is 77.76 MHz. Beginning in Release 5.1, the 25 MHz frequency is supported as well. The frequency must be the same on both ends.

VLNC60 management

The VLNC60 circuit pack is compatible with, and its presence is reported by, the VLNC2 SYSCTL circuit pack, if one is present in the shelf. However, the VLNC60 circuit pack is not controlled by a SYSCTL circuit pack, and is not managed by TL1, or through the *WaveStar*® CIT. Management and configuration of VLNC60 circuit pack is accomplished using a separate Command Line Interface (CLI). The CLI can be accessed from a serial connection to the VLNC60 circuit pack through the RS-232 port on the VLIU(1,2,10) interface unit associated with the MAIN slot in which the VLNC60 is installed or from the web-based graphical user interface (GUI). The web-based GUI and CLI messages permit VLNC40/42/42B and VLNC60/61/62/64 circuit pack operations to be performed (for example, administration and provisioning). For a detailed description of the Command Line Interface (CLI) messages used to interface with the VLNC40/VLNC42/VLNC42B and VLNC60/VLNC61/VLNC62/VLNC64 circuit packs and general information about using the Command Line Interface (CLI), refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide* and the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) CLI User Provisioning Guide*.

The VLNC60 is shipped with a default IP address, 169.254.1.1, assigned to the MGMT LAN port on the faceplate of the circuit pack. This address can be set or changed through the RS-232 port on the shelf. The CLI can also be accessed through an IP connection to the MGMT LAN port on the face of the VLNC60, either by direct connection with an Ethernet cross-over cable, or through a network connected to this port.

The VLNC60 also has an internal network port. An IP address can be assigned to this internal port, and used for inband access to the CLI from any configured Ethernet port supported by the VLNC60.

DS1/E1 pseudowire support

The VLNC60 can handle TDM signals for up to 8 DS1/E1 ports. It can encapsulate them into, or extract them from, Ethernet pseudowires. The circuit pack has 2 PTM sockets for pseudowire packet transport. They can be used for interworking with a VLNC40/42/42B Ethernet aggregator (on same shelf, or on another shelf), or for transport directly into the Ethernet Access Transport Network (EATN). The pseudowires corresponding to the DS1 or E1 signals are protected using Bidirectional Forwarding Detection (BFD) protocol.

ML-PPP termination support

DS1/E1 continues to be the predominant Layer-1 technology for IP Backhaul applications, transporting wireless voice and data to and from servers at Mobile Switching Centers (MSCs). The layer 2 protocol used for IP backhaul by the base transceiver station (BTS) universal radio controllers (URCs) is Multi-Link PPP over DS1/E1. The VLNC60 circuit pack can terminate the ML-PPP sessions at the BTS and transmit this IP traffic directly over a packet network using Ethernet 802.1Q encapsulation. The VLNC60 circuit pack interworks between the T1/E1 ML-PPP links from the URC and Ethernet links running 802.1Q encapsulation towards the MSC. This reduces frame overhead associated with data backhaul over DS1/E1, and reduces the number of ML-PPP sessions that must be terminated by the MLS router at the MSC.

16DS1/E1-100/1G-T/F (VLNC61)

The VLNC61 circuit pack provides TDM interface termination for up to 16 DS1/E1 interfaces. It supports CESoP and ML-PPP termination on a port-by-port basis. These services can be mixed as needed among the ports. The VLNC61 circuit pack is installed in the MAIN 1 or MAIN 2 slot of the High Capacity rack-mount shelf. The VLNC61 circuit pack has a MGMT LAN port on the faceplate and two Ethernet LAN ports with PTM sockets for Fast Ethernet or Gigabit Ethernet connections. Both Ethernet interfaces must be the same rate. The Ethernet port #1 (the right-most port) can be routed as an electrical GbE across the backplane to a companion VLNC40/42/42B circuit pack.

In order to support a Metro Ethernet Forum 8 (MEF-8) based circuit emulation service, the user can specify an option for the mode of Circuit Emulation Service on the pack, either MPLS (RFC 4553) or Ethernet (MEF-8).

By default, the frequency for differential timestamp on the VLNC61 packs is 77.76 MHz. Beginning in Release 5.1, the 25 MHz frequency is supported as well. The frequency must be the same on both ends.

VLNC61 management

The VLNC61 circuit pack is compatible with, and its presence is reported by, the VLNC2 SYSCTL circuit pack, if one is present in the shelf. However, the VLNC61 circuit pack is not controlled by a SYSCTL circuit pack, and is not managed by TL1, or through the *WaveStar*® CIT. Management and configuration of VLNC61 circuit pack is accomplished using a separate Command Line Interface (CLI). The CLI can be accessed from a serial

connection to the VLNC61 circuit pack through the RS-232 port on the VLIU2 or VLIU10 interface unit associated with the MAIN slot in which the VLNC61 is installed or from the web-based graphical user interface (GUI). The web-based GUI and CLI messages permit VLNC40/42/42B and VLNC60/61/62/64 circuit pack operations to be performed (for example, administration and provisioning). For a detailed description of the Command Line Interface (CLI) messages used to interface with the VLNC40/VLNC42/VLNC42B and VLNC60/VLNC61/VLNC62/VLNC64 circuit packs and general information about using the Command Line Interface (CLI), refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide* and the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) CLI User Provisioning Guide*.

The VLNC61 is shipped with a default IP address, 169.254.1.1, assigned to the MGMT LAN port on the faceplate of the circuit pack. This address can be set or changed through the RS-232 port on the shelf. The CLI can also be accessed through an IP connection to the MGMT LAN port on the face of the VLNC61, either by direct connection with an Ethernet cross-over cable, or through a network connected to this port.

The VLNC61 also has an internal network port. An IP address can be assigned to this internal port, and used for inband access to the CLI from any configured Ethernet port supported by the VLNC61.

DS1/E1 pseudowire support

The VLNC61 can handle TDM signals for up to 16 DS1/E1 ports. It can encapsulate them into, or extract them from, Ethernet pseudowires. The circuit pack has 2 PTM sockets for pseudowire packet transport. They can be used for interworking with a VLNC40/42/42B Ethernet aggregator (on same shelf, or on another shelf), or for transport directly into the Ethernet Access Transport Network (EATN). The pseudowires corresponding to the DS1 or E1 signals are protected using Bidirectional Forwarding Detection (BFD) protocol.

ML-PPP termination support

DS1/E1 continues to be the predominant Layer-1 technology for IP Backhaul applications, transporting wireless voice and data to and from servers at Mobile Switching Centers (MSCs). The layer 2 protocol used for IP backhaul by the base transceiver station (BTS) universal radio controllers (URCs) is Multi-Link PPP over DS1/E1. The VLNC61 circuit pack can terminate the ML-PPP sessions at the BTS and transmit this IP traffic directly over a packet network using Ethernet 802.1Q encapsulation. The VLNC61 circuit pack interworks between the T1/E1 ML-PPP links from the URC and Ethernet links running 802.1Q encapsulation towards the MSC. This reduces frame overhead associated with data backhaul over DS1/E1, and reduces the number of ML-PPP sessions that must be terminated by the MLS router at the MSC.

8DS1/E1-100/1G-T/F (VLNC62)

The VLNC62 circuit pack provides TDM interface termination for up to 8 DS1/E1 interfaces. It supports CESoP and ML-PPP termination on a port-by-port basis. These services can be mixed as needed among the ports. The VLNC62 circuit pack is installed in the MAIN 1 or MAIN 2 slot of the High Capacity rack-mount shelf. The VLNC62 circuit pack has a MGMT LAN port on the faceplate and two Ethernet LAN ports with PTM sockets for Fast Ethernet or Gigabit Ethernet connections. Both Ethernet interfaces must be the same rate. The Ethernet port #1 (the right-most port) can be routed as an electrical GbE across the backplane to a companion VLNC40/42/42B circuit pack.

In order to support a Metro Ethernet Forum 8 (MEF-8) based circuit emulation service, the user can specify an option for the mode of Circuit Emulation Service on the pack, either MPLS (RFC 4553) or Ethernet (MEF-8).

By default, the frequency for differential timestamp on the VLNC62 packs is 77.76 MHz. The 25 MHz frequency is supported as well. The frequency must be the same on both ends.

VLNC62 management

The VLNC62 circuit pack is compatible with, and its presence is reported by, the VLNC2 SYSCTL circuit pack, if one is present in the shelf. However, the VLNC62 circuit pack is not controlled by a SYSCTL circuit pack, and is not managed by TL1, or through the *WaveStar*® CIT. Management and configuration of VLNC62 circuit pack is accomplished using a separate Command Line Interface (CLI). The CLI can be accessed from a serial connection to the VLNC62 circuit pack through the RS-232 port on the VLIU3 interface unit associated with the MAIN slot in which the VLNC62 is installed or from the web-based graphical user interface (GUI). The web-based GUI and CLI messages permit VLNC40/42/42B and VLNC60/61/62/64 circuit pack operations to be performed (for example, administration and provisioning). For a detailed description of the Command Line Interface (CLI) messages used to interface with the VLNC40/VLNC42/VLNC42B and VLNC60/VLNC61/VLNC62/VLNC64 circuit packs and general information about using the Command Line Interface (CLI), refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide* and the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) CLI User Provisioning Guide*.

The VLNC62 is shipped with a default IP address, 169.254.1.1, assigned to the MGMT LAN port on the faceplate of the circuit pack. This address can be set or changed through the RS-232 port on the shelf. The CLI can also be accessed through an IP connection to the MGMT LAN port on the face of the VLNC62, either by direct connection with an Ethernet cross-over cable, or through a network connected to this port.

The VLNC62 also has an internal network port. An IP address can be assigned to this internal port, and used for inband access to the CLI from any configured Ethernet port supported by the VLNC62.

DS1/E1 pseudowire support

The VLNC62 can handle TDM signals for up to 8 DS1/E1 ports. It can encapsulate them into, or extract them from, Ethernet pseudowires. The circuit pack has 2 PTM sockets for pseudowire packet transport. They can be used for interworking with a VLNC40/42/42B Ethernet aggregator (on same shelf, or on another shelf), or for transport directly into the Ethernet Access Transport Network (EATN). The pseudowires corresponding to the DS1 or E1 signals are protected using Bidirectional Forwarding Detection (BFD) protocol.

ML-PPP termination support

DS1/E1 continues to be the predominant Layer-1 technology for IP Backhaul applications, transporting wireless voice and data to and from servers at Mobile Switching Centers (MSCs). The layer 2 protocol used for IP backhaul by the base transceiver station (BTS) universal radio controllers (URCs) is Multi-Link PPP over DS1/E1. The VLNC62 circuit pack can terminate the ML-PPP sessions at the BTS and transmit this IP traffic directly over a packet network using Ethernet 802.1Q encapsulation. The VLNC62 circuit pack interworks between the T1/E1 ML-PPP links from the URC and Ethernet links running 802.1Q encapsulation towards the MSC. This reduces frame overhead associated with data backhaul over DS1/E1, and reduces the number of ML-PPP sessions that must be terminated by the MLS router at the MSC.

OC3/OC12-STM1/STM4-100/1G-T/F (VLNC64)

The VLNC64 Circuit Emulation Mini-Hub circuit pack is a variation of the VLNC60 Circuit Emulator circuit pack that performs CESoP hub and pseudowire functions. Instead of supporting electrical DS1/E1 interfaces, the VLNC64 circuit pack provides a single optical channelized OC-3/STM-1 interface on the TDM side, and two optical FE/GbE interfaces on the Ethernet side. Ethernet interfaces must be the same rate.

The VLNC64 circuit pack performs mapping between DS1/E1 signals recovered from the FE/GbE interfaces and VT1.5/VC-12 tributaries on the channelized OC-3/STM-1 interface. The VLNC64 does not currently support OC-12/STM-4 interfaces. All interfaces support pluggable transmission modules.

The OC-3/STM-1 interface is unprotected (0x1). The OC-3/STM-1 interface does not support DCC. In one direction, the VLNC64 recovers DS1 or E1 signals from the Ethernet LAN inputs, maps them (based on pseudowire provisioning) into VT1.5/VC-12s, which are transported over the OC-3 /STM-1. The opposite occurs in the other direction. The board supports up to 84 circuit-emulated DS1s or up to 63 E1 channels. The pseudowires corresponding to the DS1 or E1 signals are protected using Bidirectional Forwarding Detection (BFD) protocol. BFD is switched based on incoming RDI-L on the OC-3/STM-1, which allows interworking with UPSR/SNCP.

In order to support a Metro Ethernet Forum 8 (MEF-8) based circuit emulation service, the user can specify an option for the mode of Circuit Emulation Service on the pack, either MPLS (RFC 4553) or Ethernet (MEF-8).

By default, the frequency for differential timestamp on the VLNC64 packs is 77.76 MHz. Beginning in Release 5.1, the 25 MHz frequency is supported as well.

Note: The VLNC64 must be Series 1:2 (S1:2) or later, to support the 25 MHz frequency.

VLNC64 management

The VLNC64 circuit pack is compatible with, and its presence is reported by, the VLNC2 SYSCTL circuit pack, if one is present in the shelf. However, the VLNC64 circuit pack is not controlled by a SYSCTL circuit pack, and is not managed by TL1, or through the *WaveStar*® CIT. Management and configuration of VLNC64 circuit pack is accomplished using a separate Command Line Interface (CLI). The CLI can be accessed from a serial connection to the VLNC64 circuit pack through the RS232 port on the VLIU(1,2,10) interface unit associated with the MAIN slot in which the VLNC64 is installed. For a detailed description of the Command Line Interface (CLI) messages used to interface with the VLNC40/VLNC42/VLNC42B and VLNC60/VLNC61/VLNC62/VLNC64 circuit packs and general information about using the CLI, refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide*.

The VLNC64 circuit pack is shipped with a default IP address, 169.254.1.1, assigned to the MGMT LAN port on the faceplate of the circuit pack. This address can be set or changed through the RS-232 port on the shelf. The CLI can also be accessed through an IP connection to the MGMT LAN port on the circuit pack faceplate, either by direct connection with an Ethernet cross-over cable, or through a network connected to this port.

The VLNC64 circuit pack also has an internal network port. An IP address can be assigned to this internal port, and used for inband access to the CLI from any configured Ethernet port supported by the VLNC64 circuit pack.

Control circuit packs

Overview

Alcatel-Lucent 1850 TSS-5 provides extensive control features, accessible through a number of technician and operations system (OS) interfaces. In addition to accessing local Alcatel-Lucent 1850 TSS-5 NEs through direct interfaces, technicians and OSs can use the operations features supported via the data communications channel (DCC) in the optical signals to access remote NEs. Control functions are supported by the SYSCTL circuit pack.

System Controller (VLNC2)

The VLNC2 SYSCTL circuit pack is required in any shelf that is equipped with the VLNC50 or VLNC52 and VLNC35 circuit packs. It provides communication with the VLNC50/52 and VLNC35 circuit packs in the Alcatel-Lucent 1850 TSS-5. The SYSCTL circuit pack supports Alcatel-Lucent 1850 TSS-5 operations interfaces associated with SONET/SDH operation, including IAO LAN (OSI or TCP/IP), TL1, CIT, office alarms, and miscellaneous discrete interfaces. The SYSCTL does not control the functions of the VLNC40/VLNC42/VLNC42B and VLNC60/VLNC61/VLNC62/VLNC64 circuit packs or the associated Ethernet interfaces. In a shelf that only contains VLNC40/VLNC42/VLNC42B or VLNC60/VLNC61/VLNC62/VLNC64 circuit packs, a SYSCTL is not required. An unequipped SYSCTL slot must be equipped with a 199SC apparatus blank.

The SYSCTL circuit pack faceplate has 2 push-button switches (ACO and UPDATE), alarm/status LEDs and a dual RJ45 CIT connector. Transmission is not affected if the SYSCTL circuit pack fails or is removed while the shelf is in service.

The VLNC2 SYSCTL circuit pack provides a microprocessor, nonvolatile memory to store the program software and provisioning database, and additional memory for system SONET/SDH operations. The SYSCTL circuit pack is capable of operating with either -48 VDC or +24 VDC applied to the shelf.

The SYSCTL circuit pack faceplate supports *WaveStar*[®] CIT access to Alcatel-Lucent 1850 TSS-5 via the IAO LAN and a serial RS-232 port.

Multi-level operations interface

Alcatel-Lucent 1850 TSS-5 maintenance procedures are built on multiple levels of system information and control. The first level consists of physical on-site indications, the information provided by the LEDs, displays, and activities supported by the push-button switches located on the faceplate of the SYSCTL circuit pack. The second level uses the graphic interface and menu tools provided by the *WaveStar*[®] CIT. to remotely provision and retrieve detailed performance reports, alarm and status information, and system configurations. The *WaveStar*[®] CIT provides an operations interface for a remote NE at the other end of a network connection, and other NEs to which the remote NE has network access. The third interface level uses direct access to the OS interfaces such as TL1 or the VLNC40/VLNC42/VLNC42B and VLNC60/VLNC61/VLNC62/VLNC64 CLI. Access to the NE OS can be over IAO LAN (TCP/IP or OSI). The VLNC40/VLNC42/VLNC42B and VLNC60/VLNC61/VLNC62/VLNC64 CLI can be accessed via Telnet or SSH connection over an IP network.

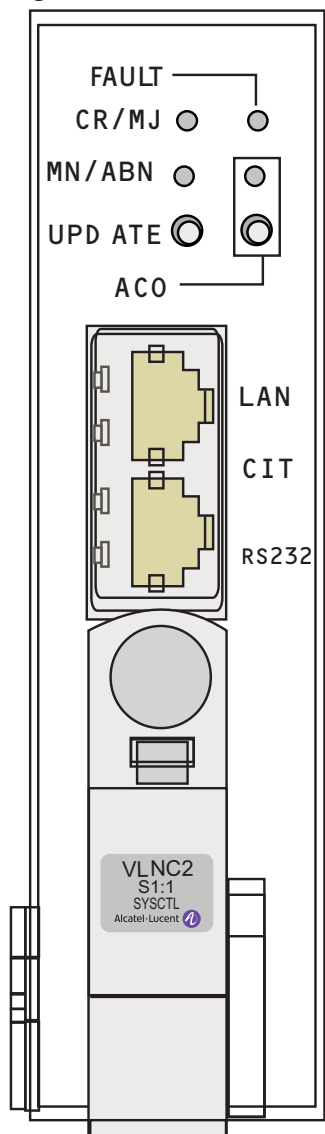
SYSCTL faceplate

The SYSCTL circuit pack faceplate has indicators and switches that provide system-level information and control functions. The condition of the individual transmission circuit packs can be determined by observing the LEDs on their faceplates.

The following figure shows the SYSCTL circuit pack faceplate. There are two push-button switches, Update and ACO, and the two alarm/status LEDs listed below.

- Critical (CR)/Major (MJ)
- Minor (MN)/Abnormal (ABN)

Figure 4-6 SYSCTL circuit pack



MK-DMXplore-011

Embedded operations channel

Access and control extends beyond the local Alcatel-Lucent 1850 TSS-5 to remote Alcatel-Lucent 1850 TSS-5 units via the SONET section or SDH regenerator section DCC. Alcatel-Lucent 1850 TSS-5 supports four DCC channels.

Alcatel-Lucent 1850 TSS-5 also supports Link Access Protocol on the D-channel (LAPD)/Unacknowledged Information Transfer Service (UITS) mode to support DCC interworking with SDH products.

Power specifications

Power supply

Table 4-2, “Alcatel-Lucent 1850 TSS-5 power supply requirements” (p. 4-30) lists Alcatel-Lucent 1850 TSS-5 power requirements.

Table 4-2 Alcatel-Lucent 1850 TSS-5 power supply requirements

Item	Description
Power Feeders	A and B (–48 VDC or +24 VDC)
Voltage range	–40 to –57 VDC +20 to +28 VDC
External fuses required (1 per feed)	Two, 8A fuses

Alcatel-Lucent 1850 TSS-5 uses on-board power conversion eliminating the need for slots for bulk power converters. Two independent –48 VDC or +24 VDC office power feeders (A and B) enter the shelf through a terminal block and are filtered and distributed to the circuit packs. Power conversion is performed via modular power converters located on the circuit packs. Within each circuit pack, the two power feeds are fused, filtered, and connected to the board-mounted power modules through diodes that provide an electrical “OR” connection. This provides the required redundancy in case of the loss of one feeder. The two green power LEDs are located to the left of the input power terminal block.

Current drains

Alcatel-Lucent 1850 TSS-5 has the following current drain requirements.

- 1850 TSS-5: 2.5 Amps (maximum at –48 VDC)
- 1850 TSS-5: 5 Amps (maximum at +24 VDC)

Heat dissipation

The maximum heat dissipation of Alcatel-Lucent 1850 TSS-5 is 100 watts.

Cabling

Overview

This section briefly describes cabling information. For more information about available cable lengths and ordering, refer to [Chapter 7, “Ordering”](#).

Cable types

The following table lists the cable types and requirements.

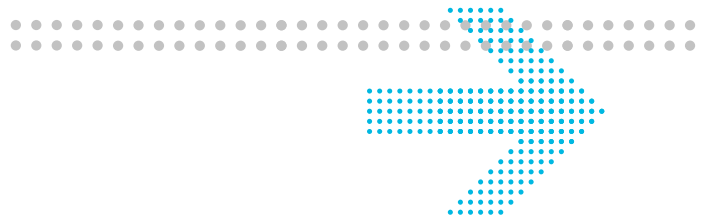
Table 4-3 Cables

Cable Assembly Description	Quantity per Shelf
Power	2 twisted pair cables per shelf ¹
DS1/E1 (RJ-45 Transmit and Receive)	Up to 28 as required ³
Dual DS1/E1 (RJ-45 Transmit and Receive)	Up to 28 as required ²
DS3/E3 (receive and transmit are not bundled)	Up to 6 per MAIN pair housing a VLNC50/52 circuit pack (as required) ⁴
Office Alarm	1 Kit (26 AWG, 30', 8 conductors) ⁵
Miscellaneous Discrete	1 Kit (26 AWG, 30', 8 conductors) ⁵
LAN 100 BaseT (Crossover)	1 per shelf (as required) ^{6, 7}
LAN 100BASE-T (Straight Through)	1 per shelf (as required) ^{6, 7}
LAN 10/100BASE-T	Up to 20 per shelf (as required) ⁷
Timing	1 pair for TMG(1,2): 22 GA shielded, non-connectorized
WaveStar® CIT	1 per shelf (as required) ⁷

Notes:

1. One cable assembly supports both the –48 VDC and +24 VDC (A and B) main power feeders on the Alcatel-Lucent 1850 TSS-5 shelf. A cable assembly kit is available (12 AWG, 30'). Wires are stripped and connected directly to the field wiring terminal block on the shelf.
2. One DS1/E1 Cable Assembly is required for each DS1/E1 channel in service. 1 cable is needed for receive and the other for transmit interfaces. The cables can be RJ-45 to RJ-45 or RJ-45 to blunt cut cable for connection to DSX panel. Lengths up to 550'.
3. One RJ-45 plug provides two DS1/E1 signals on 24GA solid-shielded halogen-free cable. Lengths up to 550'.
4. One DS3/E3 cable is required for each DS3/E3 circuit in service. 1 cable is needed for receive and the other for transmit interfaces. Populate in pairs (1 receive and 1 transmit), as required up to a total of 6. Lengths up to 250'.
5. Same cable is used for MDI/MDO and Alarm (26 AWG, 30', 8 conductors). 3 cable kits are required per shelf (MDI/MDO/Alarms).

-
6. The Crossover cable is used when connecting to a PC. The Straight Through cable is used when connecting with a hub.
 7. The same cable is used for LAN operations and CIT interface as for 100 BASE-T transmission.



5 Operations, administration, maintenance, and provisioning

Overview

Purpose

This chapter describes the operations, administration, maintenance, and provisioning (OAM&P) functions for the Alcatel-Lucent 1850 Transport Service Switch 5 (Alcatel-Lucent 1850 TSS-5).

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Maintenance

Overview

Purpose

This section describes the maintenance philosophy of Alcatel-Lucent 1850 TSS-5.

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Multi-level operations

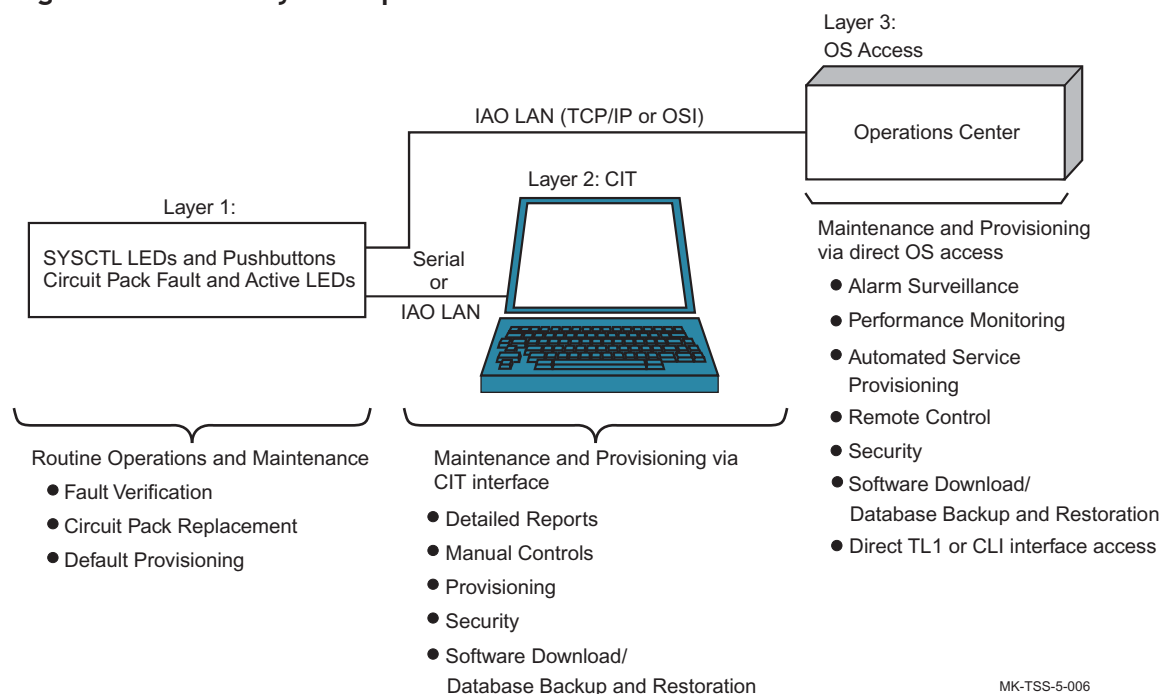
Overview

The following figure shows the multiple levels of operations procedures for Alcatel-Lucent 1850 TSS-5. The Alcatel-Lucent 1850 TSS-5 operations procedures are built on three levels of system information and control, spanning operations needs from summary-level status to detailed reporting. Different software is used and different features are available, depending on whether SONET/SDH (VLNC2, VLNC50, VLNC52, VLNC64), PDH (VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, VLNC64) or Ethernet (VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64) operations are involved.

Example

The following figure, shows the multi-level operations procedures for Alcatel-Lucent 1850 TSS-5. The Alcatel-Lucent 1850 TSS-5 operations procedures are built on three levels of system information and control, from on-site indicators and switches, to remote methods for status reporting and control.

Figure 5-1 Multi-layered operations



SYSCTL, VLNC50/VLNC52, and VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 faceplate (operations level 1)

When a SYSCTL circuit pack is installed, office alarms are provided by a set of discrete relays that control office visual alarms. Separate relays handle critical/major alarms (CR/MJ) and minor (MN) alarms. These relays are located on the access panel at the right of the wall-mount shelf, or at the rear of the rack-mount shelf. When a SYSCTL circuit pack is not installed, and the shelf is operating with VLNC40/42/42B circuit packs, a physical alarm output is available on the Miscellaneous Discrete Output connection MDO for that slot.

The first operations tier consists of light-emitting diodes (LEDs) and push buttons on the SYSCTL circuit pack faceplate, and LEDs on the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack faceplate. These allow routine tasks and diagnostics to be performed without a craft interface terminal (CIT) or any test equipment. The SYSCTL circuit pack faceplate provides system-level alarm and status information for the local and remote terminals. The circuit pack faceplate FAULT LEDs allow fast and easy fault isolation to a particular circuit pack.

SYSCTL

The SYSCTL faceplate LEDs show local system information. The highest active alarm level is shown by the red LEDs for CR and MJ alarms. Yellow LEDs are shown for MN and ABN alarms. A green PWR ON LED shows that the power is on and the terminal is receiving a -48 VDC or +24 VDC source.

The Update/Initialize (UPD/INIT) button addresses the local system. The recessed UPD/INIT button serves several functions during installation and circuit pack replacement. During the first 10 seconds after powering up the SYSCTL circuit pack, depressing this button initializes the nonvolatile memory with provisioning and state information. Secondly, after removing a circuit pack or PTM, depressing this button updates the system equipment list to show the slot or signal is now unequipped.

The SYSCTL circuit pack faceplate's remote display functions serve the single-ended maintenance needs of access transport applications. When any alarm or status condition exists at a remote Alcatel-Lucent 1850 TSS-5 shelf, that alarm can be viewed in the Alarm List on the *WaveStar*® CIT.

[Table 5-1, “SYSCTL circuit pack faceplate LEDs” \(p. 5-6\)](#) details the various LEDs and push-button switches and describes their functions.

Table 5-1 SYSCTL circuit pack faceplate LEDs

LED/Push-button	Indicator name	Function
FAULT	Fault	Indicates isolated circuit pack failure
CR/MJ	Critical/major	Indicates critical/major alarm for local system.

Table 5-1 SYCTL circuit pack faceplate LEDs (continued)

LED/Push-button	Indicator name	Function
MN/ABN	Minor/Abnormal	Indicates minor or abnormal conditions
UPD/INIT	Update/Initialize	Updates the local system.
ACO	Alarm Cut-off	Indicates an active alarm, but the alarm indication has been cut off.

VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64

When Alcatel-Lucent 1850 TSS-5 is equipped with only a VLNC40/42/42B circuit pack, it operates as an Ethernet aggregator. When the shelf is equipped only with a VLNC60, VLNC61, VLNC62, or VLNC64 circuit pack, it operates as an Ethernet backhaul device for T1/E1 pseudowires (VLNC60/VLNC61/VLNC62/VLNC64), or data from ML-PPP sessions (VLNC60/61/62). If the shelf is equipped with two circuit packs, it can perform two functions. In these applications, it is not functioning as a SONET or SDH network element. The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 faceplate LEDs show the state of the circuit packs.

[Table 5-2, “VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 faceplate LEDs” \(p. 5-7\)](#) details the various LEDs and describes their functions.

Table 5-2 VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 faceplate LEDs

LED	Behavior	Indication
FAULT	Lit solid	Circuit pack failure
	Blinking	Incoming signal failure on any port that is in service, or PTM failure on any installed PTM. On the VLNC60/61/62, signal failure on the T1/E1 ports is indicated only when an encapsulation (satop or ppp) is configured on it.
ACTIVE	Lit solid	Circuit pack is powered up and active (latch closed)
PTM ports (VLNC40/42/42B 1–4) (VLNC60/61/62 1–2) (VLNC64 1–3)	Off	No errors or problems on the port
	On	Equipment failure (PTM removed, TX fault, or other problem)
	Blinking	Signal failure (Auto-negotiation failure or other problem)

VLNC35 and VLNC50/52

Table 5-3, “VLNC35 and VLNC50/52 faceplate LEDs” (p. 5-8) details the various VLNC35 and VLNC50/52 LEDs and describes their functions.

Table 5-3 VLNC35 and VLNC50/52 faceplate LEDs

LED	Behavior	Indication
FAULT	Lit solid	Circuit pack failure
	Blinking	Incoming signal failure on any port that is in service, or PTM failure on any installed PTM
ACTIVE	Lit solid	Indicates the circuit pack is powered up and active (latch closed)
PTM ports	Off	No errors or problems on the port
	On	Equipment failure (PTM removed, TX fault, or other problem)
	Blinking	Signal failure (Auto-negotiation failure or other problem)

Local craft interfaces (operations level 2)

An on-site craft person can connect a local terminal or PC to the Alcatel-Lucent 1850 TSS-5 for administrative access. This administrative access can be to the CIT/TL1 interface of the VLNC2 SYSCCTL circuit pack for administration of TDM operations for the VLNC50/52, VLNC35, and SYSCCTL, or to the CLI interface of the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 for administration of the functions of each circuit pack.

SYSCCTL craft interfaces

Local craft interfaces available from the SYSCCTL circuit pack are generally accessed on-site through a serial connection to the RS-232 port on the circuit pack faceplate. The serial port on the SYSCCTL circuit pack can be used for an on-site CIT and TL1 administrative connection, and for software downloads.

Alcatel-Lucent 1850 TSS-5 also has a LAN port on the SYSCCTL circuit pack faceplate. The LAN port, normally used for remote access, can also be used for on-site access. A network connection to the LAN port supports TL1 over OSI and IP network connections. Software download via FTAM or FTP is also supported.

VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 craft interfaces

The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs operate independent of the SYSCCTL circuit pack, and are configured using their own internal command line interface (CLI). Two RJ45 connectors on the VLIU interface unit provide RS-232 connections to the MAIN slots. One of RJ45 connector can be used to establish a serial connection to a

VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack in the MAIN 2 slot, and the other can be used to establish a connection to a VLNC60/VLNC61/VLNC62/VLNC64 in the MAIN 1 slot.

The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs also have a LAN port on their faceplates, that can be used to access the CLI via a TELNET or SSH connection from a properly configured PC, connected with a crossover cable. The LAN port has a default IP address that can be changed, using a CLI serial connection through the serial port on the VLIU interface unit associated with the MAIN slot in which the circuit pack is located. If an appropriate IP address is assigned to the LAN port, it can be connected and accessed through the office IP network.

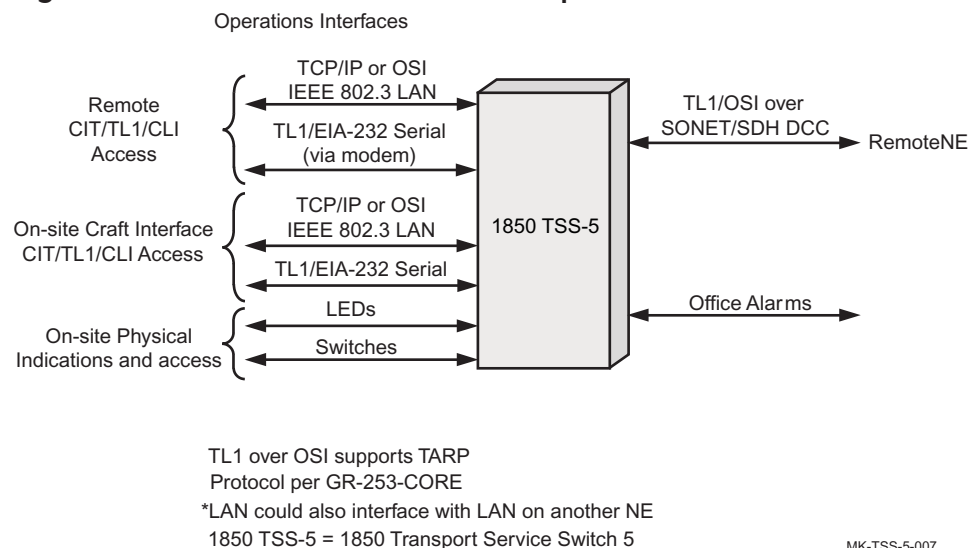
Note: Refer to [Table 6-1, “VLIU compatibility” \(p. 6-4\)](#) for more information about supported configurations.

Remote Operations System (OS) TL1/CLI/LAN interfaces (operations level 3)

The third operations level consists of the remote access to OS interfaces. Access for TL1 and related SONET/SDH network monitoring is provided via the CIT LAN and serial connection to the SYSCTL. Access for the Command Line Interface of Ethernet circuit packs that operate independent of the SYSCTL circuit pack is provided via IP network and serial connection to the circuit pack.

The following figure shows how the Alcatel-Lucent 1850 TSS-5 works with the various operations interfaces.

Figure 5-2 Alcatel-Lucent 1850 TSS-5 operations interfaces



For SONET/SDH operations using the SYSCTL, the OS can use more than one NE as a GNE to provide redundancy and distribute the TL1 message volume across multiple links to the OS. The TL1 GNE serves as a single interface to the OS for NEs in the same

subnetwork. The TL1 GNE receives operations information from NEs through the DCC. It reports this information, and its own information, to the OS using TL1 messages. The OS can send TL1 commands through the GNE to any NE in the subnetwork. Alcatel-Lucent 1850 TSS-5, as well as other-vendor NEs that adhere to GR-253-CORE, can serve as the TL1 GNE for Alcatel-Lucent 1850 TSS-5.

CIT LAN (IAO LAN) and RS-232 CIT (Serial)

The LAN interface on the SYSCTL circuit pack can be used for a CIT network connection to the unit. OSI or IP based network connections are supported. OAM&P activities such as loopbacks and testing, protection switching, provisioning, PM, retrieving reports, and security on other Alcatel-Lucent 1850 TSS-5 NEs in a subnetwork are supported through the *WaveStar*® CIT.

A remote *WaveStar*® CIT connection through the serial port on the SYSCTL circuit pack is also possible if the port is equipped with a modem for remote dial-in access. However this port is usually used for on-site serial access to the unit.

CLI LAN and RS-232

The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs are configured using their own internal command line interface (CLI) accessed via a serial or an IP network connection or from the web-based graphical user interface (GUI). A local CLI connection can be established through one of the RJ45 serial ports on the VLIU interface unit. A remote connection to this port is also possible if the port is equipped with a modem for remote dial-in access.

The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs have a network connector on their faceplates. When the port is properly configured, the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack can be connected to an administrative IP network through this connector, and can be accessed remotely by a TELNET or SSH connection.

Note: Refer to [Table 6-1, “VLIU compatibility” \(p. 6-4\)](#) for more information about supported configurations.

Refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) CLI User Provisioning Guide* for more information on the Web GUI.

IAO LAN ports (detail)

Overview

Alcatel-Lucent 1850 TSS-5 supports administrative LAN ports on the front of the VLNC2 SYSCTL, VLNC40, VLNC42/42B, VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs. The LAN port on the SYSCTL circuit pack can be connected to the intraoffice LAN, and is also referred to as the IAO LAN port. This port is recommended for convenient, local *WaveStar*® CIT access. The LAN ports on the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs can be connected to the intraoffice LAN if it is functioning as a TCP/IP network. When a direct terminal or PC connection is made to either LAN port, a LAN crossover cable is required (to connect the transmit wire-pair at one end to the receive wire-pair at the other end, and vice versa).

The administrative LAN ports support 10/100BASE-T Ethernet (per *Telcordia*® GR-253, ANSI/IEEE 802.2 and 802.3, and ISO 8802.2 and 8802.3) over four-wire twisted pair using an RJ-45 connector.

OSI on the IAO LAN

When the OSI protocol stack is used on an IAO LAN port of the SYSCTL circuit pack, the term OSI LAN is sometimes used. The OSI LAN is effectively an extension of the DCC. All remote operations supported over the DCC are also supported over the OSI LAN. The term DCC connectivity, used throughout this document means, DCC and/or OSI LAN connectivity.

TCP/IP on the IAO LAN

The IAO LAN port on the SYSCTL circuit pack also supports the TCP/IP protocol stack. TCP/IP communications on the IAO LAN port can be enabled or disabled. By default, TCP/IP is disabled on the IAO LAN port. When the TCP/IP protocol stack is used on an IAO LAN port, the intraoffice LAN may be referred to as a TCP/IP LAN. An IAO LAN that uses TCP/IP can be connected to a VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 LAN port and used to access the CLI.

Alcatel-Lucent 1850 TSS-5 supports TL1 over TCP/IP for the IAO LAN. As a TL1 responder, Alcatel-Lucent 1850 TSS-5 TCP/IP GNE accepts incoming TL1 connections, encoded as described, to SYSCTL circuit pack TCP port 3081 with length-value encoding.

Each TL1 message is encapsulated into the TCP data stream as follows:

- Version number (1 byte, value set to 3)
- Reserved (1 byte, value set to 0)

- Length (2 bytes, value set to length in bytes of TL1 message +4)
- TL1 Message (variable length)

The length-value encoding is the preferred encoding for machine/machine interactions.

Port 3082: Raw Encoding. Each raw encoded TL1 message is encapsulated into the TCP data stream of length 1 - 4096 bytes. The TL1 message must be parsed to find the boundary between successive TL1 messages (see *Telcordia*® GR-831-CORE for the syntax of TL1 messages).

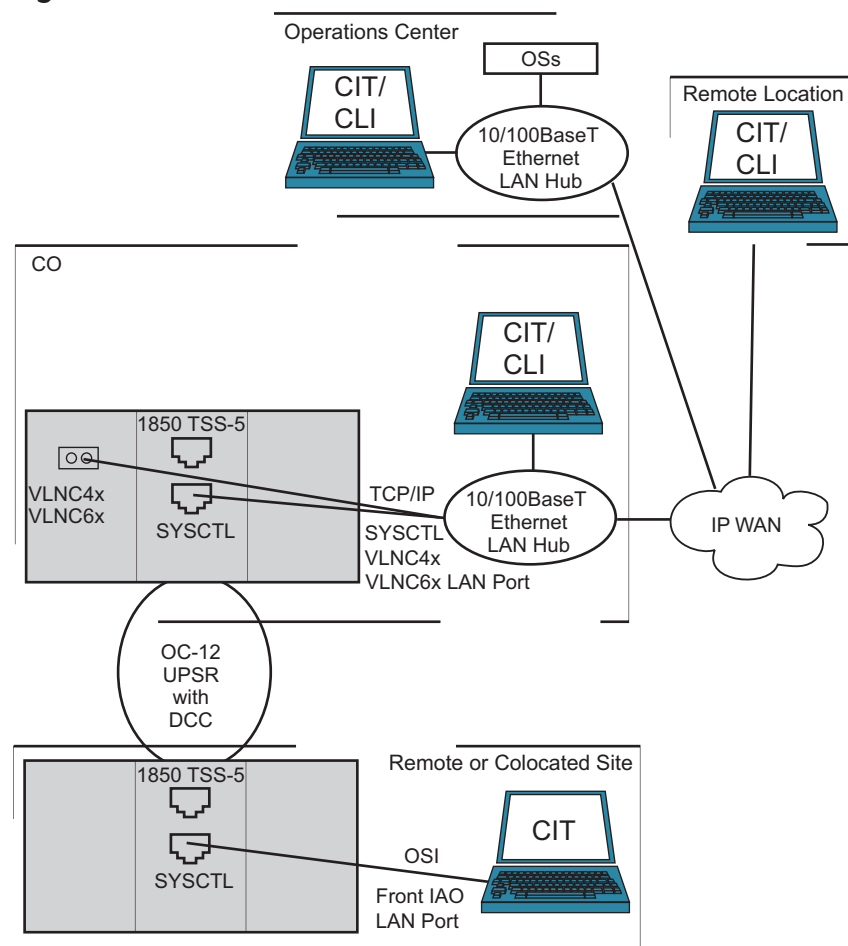
Port 3083: Telnet Encoding. The Telnet encoding is a variation on the raw encoding. It encapsulates TL1 messages in a TCP stream and uses Telnet for transmitting text over TCP/IP.

OSI or TCP/IP on the same IAO LAN

It is generally recommended that the IAO LAN port be used for OSI or TCP/IP, but not both protocols simultaneously on the same IAO LAN port.

The following figure provides examples of common connections to the Alcatel-Lucent 1850 TSS-5 from the IAO LAN.

Figure 5-3 IAO LAN connections



MK-DMXplore-008

IAO LAN compatibility

Table 5-4, “IAO LAN compatibility” (p. 5-14) lists Alcatel-Lucent 1850 TSS-5 IAO LAN communications compatibility with other products and the applicable OSI and/or TCP/IP protocol stacks. (*WaveStar*® CIT and OS access applications compatibility via the IAO LAN is covered separately later.)

Table 5-4 IAO LAN compatibility

Product	Alcatel-Lucent 1850 TSS-5	
	OSI	TCP/IP
Alcatel-Lucent 1850 TSS-5	yes	yes
Alcatel-Lucent 1665 DMX	yes	yes
Alcatel-Lucent 1665 DMXtend	yes	yes
Alcatel-Lucent 1665 DMXplore	yes	yes
DDM-2000 OC-3	yes	yes
DDM-2000 OC-12	yes	yes
FiberReach	-	-
FT-2000 ADR	-	-
<i>WaveStar</i> ® TDM 2.5G/10G (2-Fiber)	yes	yes
<i>WaveStar</i> ® BandWidth Manager	yes	yes
Alcatel-Lucent 1675 LambdaUnite MSS	yes	yes
<i>WaveStar</i> ® CIT	yes	yes
1350OMS	yes	yes
Ethernet Management System	yes	yes

Operations philosophy

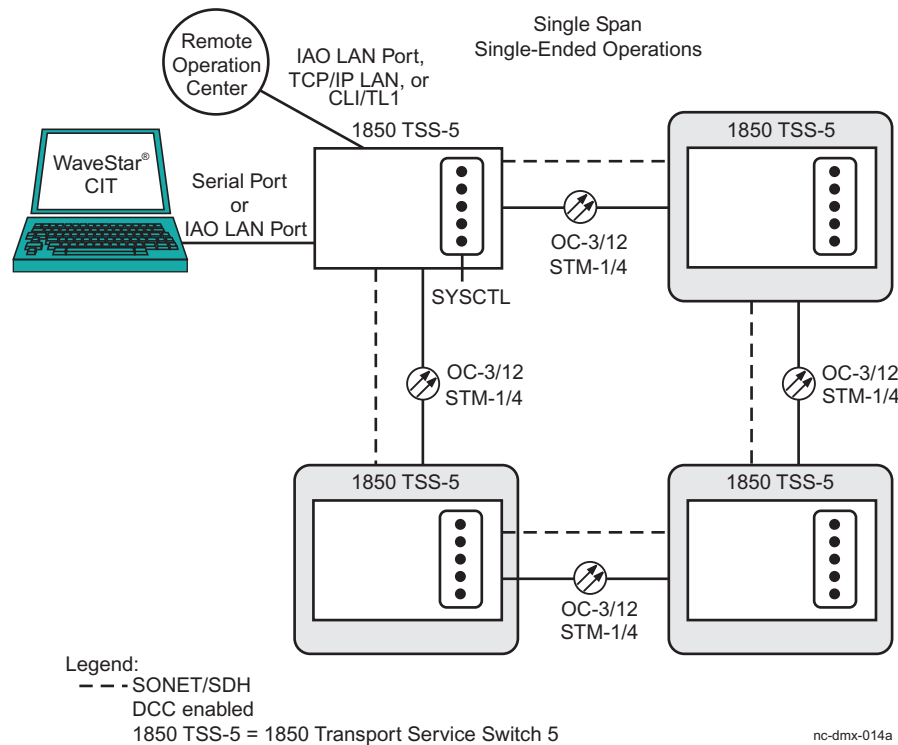
Overview

Alcatel-Lucent 1850 TSS-5 has incorporated an operations philosophy that is optimized for operations in the access transport environment. This allows operation and maintenance of remote NEs from a single centralized operations center. It also allows technicians working at remote sites to gain access to NEs at other locations.

Alcatel-Lucent 1850 TSS-5 equipped with the VLNC2 SYSCTL and VLNC50/52 SONET/SDH Transport circuit packs uses the SONET or SDH data communications channel (DCC) to provide remote CIT access, remote CO alarms, remote alarm reports, and remote OS access. The terms remote operations, single-ended operations (SEO), and Operations Interworking (OI) are synonymous. Alcatel-Lucent 1850 TSS-5 equipped with circuit packs that are not controlled by the SYSCTL uses a TCP/IP network for remote access to those packs.

SEO capability

The following figure shows the SEO capability that provides remote access via DCC to all Alcatel-Lucent 1850 TSS-5 systems in a subnetwork from a single Alcatel-Lucent 1850 TSS-5 location. This minimizes the need for technician travel because most maintenance, provisioning, and administration can be performed on all NEs with DCC connectivity by accessing any one NE. The SEO capability can be disabled between NEs to create maintenance boundaries (for example, interoffice applications) or for security reasons.

Figure 5-4 Remote operations philosophy

Operations interworking

Overview

For VLNC50/52 SONET/SDH network elements, operations interworking (OI) provides the capability to access, operate, administer, maintain, and provision remote Alcatel-Lucent NEs from any Alcatel-Lucent NE in a subnetwork or from a centralized OS. OI among the Alcatel-Lucent 2000, *WaveStar*®, Alcatel-Lucent 1850 TSS-5, and 1665 Data Multiplexer Product Families uses Target ID Address Resolution Protocol (TARP).

OI support

The following Alcatel-Lucent products support OI:

- DDM-2000 OC-12 Multiplexer, R7.0 and later
- DDM-2000 FiberReach Multiplexer, R3.0 and later
- DDM-2000 OC-3 Multiplexer, R13.0 and later
- FT-2000 OC-48 Add/Drop-Rings Terminal, R9.1 and later
- All *WaveStar*® Product Family systems

- All Alcatel-Lucent 1850 Transport Service Switch Product Family systems
- All Alcatel-Lucent 1665 Data Multiplexer Product Family systems

The Alcatel-Lucent OI is available among NEs that are connected through the SONET/SDH DCC or IAO LAN. With this feature, users can perform OAM&P activities on a centralized basis, saving travel time and money.

OI features including the following:

- Remote OS access via TL1 over TCP/IP
- Remote login
- Remote office alarms
- Remote software download and copy

Alarm groups

An alarm group is a set of SONET/SDH NEs that share status information between themselves, such as alarms, LEDs, and ACO status. The set of remote NEs that an NE can exchange status information with is determined by the value of the local alarm group parameter. This parameter is provisioned at each local NE and specifies whether that local NE does or does not exchange remote NE status with other Alcatel-Lucent NEs in the same SONET/SDH subnetwork. In Alcatel-Lucent 1850 TSS-5, all NEs are defaulted into the same alarm group (number 255).

Alarm groups can be nodes in a ring, nodes of a linear extension, or any other logical grouping such as a maintenance group or geographical group.

All members of the same alarm group share NE status information but do not share information with other alarm groups.

Important! Only alarm information about operations managed by the VLNC2 SYSCTL, VLNC35, and VLNC50/52 circuit packs is shared between NEs.

Information about operations managed by the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs is monitored separately.

Alarm group functions

Depending on provisioning, a member of an alarm group can:

- Know the alarm/status of all members of the same alarm group.
- List a report of the summary alarm or status condition of other NEs in the group.

Multi-vendor operations interworking

TARP

To support multi-vendor OI, the Alcatel-Lucent 1850 TSS-5 supports Target ID Address Resolution Protocol (TARP).

TARP provides NSAP-TID translations and is the established multi-vendor standard for SONET/SDH NEs that support TL1 OS interfaces. Alcatel-Lucent 1850 TSS-5 supports the TARP Data Cache (TDC) function to reduce the frequency of TARP propagation throughout the subnetwork and to improve performance.

Compatibility

The Alcatel-Lucent 1850 TSS-5 is developed to be compatible with any other-vendor NEs that support TARP, OSI, IAO LAN, and TL1 as specified in *Telcordia*® GR-253. In addition, Alcatel-Lucent 1850 TSS-5's TARP Manual Adjacency feature enables it to operate in networks that include CMISE-based NEs which may not support TARP propagation. Alcatel-Lucent 1850 TSS-5 supports user provisioning of several OSI parameters to allow users to adjust their operations subnetwork, if necessary. For example, to support subnetwork partitioning of large subnetworks, Alcatel-Lucent 1850 TSS-5 supports user provisioning of NSAP area addresses and Level 2 Intermediate System (IS) functionality.

The Alcatel-Lucent 1850 TSS-5's compatibility with other-vendor NEs will be tested by independent third parties such as *Telcordia*® on behalf of the SONET Interoperability Forum (SIF).

OI applications supported

Alcatel-Lucent 1850 TSS-5 supports the following Alcatel-Lucent proprietary OI applications between Alcatel-Lucent NEs in multi-vendor subnetworks:

- Remote CIT login
- Remote software download and copy
- Remote NE-to-NE automatic time/date synchronization and start-up.

Data communications channel

Provisioning the DCC

To support remote operations over the data communications channel (DCC) embedded in the SONET section or SDH regenerator section overhead of the optical signal, the DCC itself must be provisioned as indicated in the following paragraphs.

DCC enable/disable

By default, the DCC is enabled on VLNC50/52 SONET/SDH ports. DCC communications can be enabled or disabled on each port independently. DCC is not supported on VLNC64 SONET/SDH ports.

DCC protection mode

The DCC protection mode and user side/network side UPSR/SNCP or 1+1 is determined by the transmission protection mode assigned to the (main OLIUs) optical port (per the *application* parameter). The ports can be 0x1, 1+1, or UPSR/SNCP.

Link Access Protocol on the D-channel (LAPD) mode

For OSI over DCC, the Data Link layer protocol is Link Access Protocol on the D-channel (LAPD). The LAPD protocol supports the following two modes of local operation:

- AITS (Acknowledged Information Transfer Service): AITS provides connection-oriented service. It establishes and maintains a logical connection between two NEs over a DCC point-to-point link, providing the means to reliably send and receive data. AITS, which is commonly used in SONET NEs (defined as a default mode in GR-253-CORE), is currently supported.
- UITS (Unacknowledged Information Transfer Service): UITS provides connection-less service. It transfers data without establishing a logical connection. With the connection-less mode service, there is no guarantee of data delivery or any indication of communication failure. The UITS mode supports DCC interworking with SDH products.

UITS is simpler and has better performance than AITS, but lacks error detection and retransmission (error recovery) functions.

User side and network side

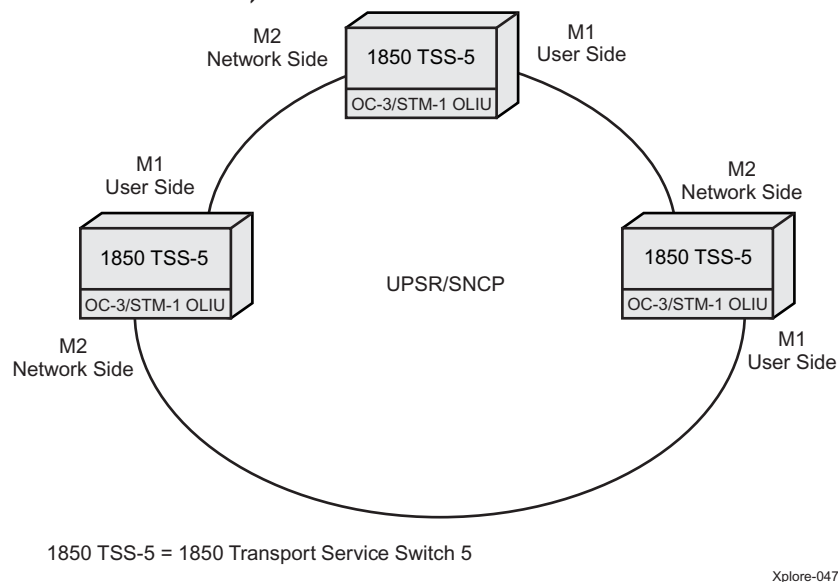
When the LAPD/AITS mode is provisioned, the operation of each DCC span also depends on one end of the span being designated the User side and the other end being designated the Network side. The DCC User/Network side assignments are provisionable.

For UPSR/SNCP, the port dcc-m1-1 is designated the Network side and dcc-m1-2 is designated the User Side. For 0x1 both ports are designated as the Network side.

When the LAPD/UITs mode is provisioned, the User Side/Network Side designations may be the same at both ends of a span. No alarms are reported if both end of the span are designated the same.

The following figure shows the User and Network side designations for Alcatel-Lucent 1850 TSS-5s on a UPSR/SNCP in the LAPD/AITS mode.

Figure 5-5 Default user/network side designation on a UPSR/SNCP (LAPD/AITS mode)



DCC compatibility

Table 5-5, “DCC compatibility” (p. 5-21) lists supported DCC communications compatibility for Alcatel-Lucent 1850 TSS-5. Alcatel-Lucent 1850 TSS-5 supports SONET Section or SDH Regenerator Section DCC running the OSI protocol stack.

Table 5-5 DCC compatibility

Product	Optical Interfaces Supported	VLNC50/52
Alcatel-Lucent 1850 TSS-5	OC-3	UPSR, 1+1, 0x1
	OC-12	UPSR, 1+1, 0x1
	STM-1	SNCP, 1+1, 0x1
	STM-4	SNCP, 1+1, 0x1
Alcatel-Lucent 1665 DMXplore	OC-3	UPSR, 1+1, 0x1
	OC-12	UPSR, 1+1, 0x1
Alcatel-Lucent 1665 DMX	OC-12	UPSR, 1+1, 0x1
	OC-3	UPSR, 1+1, 0x1
Alcatel-Lucent 1665 DMXtend	OC-12	UPSR, 1+1, 0x1
	OC-3	UPSR, 1+1, 0x1
Alcatel-Lucent 1675 LambdaUnite MSS	OC-12	UPSR, 1+1, 0x1
	OC-3	UPSR, 1+1, 0x1
	STM-4	SNCP, 1+1, 0x1
	STM-1	SNCP, 1+1, 0x1
Alcatel-Lucent 1850 TSS-100	OC-12	UPSR, 0x1
	OC-3	UPSR, 0x1
Alcatel-Lucent 1850 TSS-320	OC-12	UPSR, 0x1
	OC-3	UPSR, 0x1
DDM-2000 OC-3	OC-12	UPSR, 1+1, 0x1
	OC-3	UPSR, 1+1, 0x1
DDM-2000 OC-12	OC-12	UPSR, 1+1, 0x1
	OC-3	UPSR, 1+1, 0x1
FiberReach	OC-12	UPSR, 1+1, 0x1
	OC-3	UPSR, 1+1, 0x1
FT-2000 ADR	OC-12	UPSR, 1+1, 0x1
	OC-3	UPSR, 1+1, 0x1

Table 5-5 DCC compatibility (continued)

Product	Optical Interfaces Supported	VLNC50/52
<i>WaveStar</i> [®] TDM 2.5G/10G (2-Fiber)	OC-12	UPSR, 1+1, 0x1
	OC-3	UPSR, 1+1, 0x1
<i>WaveStar</i> [®] BandWidth Manager, Release 4.0	OC-12	UPSR, 1+1, 0x1
	OC-3	UPSR, 1+1, 0x1

Software download (generic)

Overview

Alcatel-Lucent 1850 TSS-5 supports local and remote software downloads for the SYSCTL circuit pack, VLNC50/52 circuit packs, and for packs that operate independent of the SYSCTL circuit pack (VLNC40, VLNC42/42B, VLNC60, VLNC61, VLNC62, VLNC64).

When new software is downloaded to the SYSCTL circuit pack, a compressed software image is download to FLASH memory. The new software is uncompressed and moved to the active boot memory space. During this process, the older software release continues to run in random access memory (RAM). Installation is not service-affecting, so down time is limited to the time it takes to reboot.

Local software download for the SYSCTL and controlled circuit packs

Alcatel-Lucent 1850 TSS-5 supports the following local software downloads.

- Local software download from a *WaveStar*[®] CIT connected to the CIT RS-232 (RS-232 serial) port on the SYSCTL circuit pack faceplate
- Local software installation via File Transfer Protocol (FTP) from a *WaveStar*[®] CIT connected to the **CIT LAN** (IAO LAN) port on the SYSCTL circuit pack faceplate. Software installation via FTP requires the following:
 - FTP Client software is enabled on the NE
 - IP parameters are provisioned on the NE.

Important! Serial Download (TERM) is not supported in the Microsoft *Windows*[®] XP Operating System. Therefore, FTP must be used to install software when using the Microsoft *Windows*[®] XP Operating System.

Local software download for non-SYSCTL controlled circuit packs

For circuit packs that are not controlled by the SYSCTL circuit pack, Alcatel-Lucent 1850 TSS-5 supports local software installation via Trivial File Transfer Protocol (TFTP). To perform a Remote software download the non-SYSCTL controlled circuit pack must be functioning properly using the software version that is being replaced.

For more information, refer to [“TFTP” \(p. 2-15\)](#).

Important! If the circuit pack cannot be successfully booted because the flash file system has been corrupted, it must be replaced and returned.

A local PC can be connected to the non-SYSCTL controlled circuit pack in one of the following ways:

- A direct connection to the LAN port on the faceplate of the circuit pack, using an Ethernet cross-over cable.
- A connection to the local IP administrative network supporting the non-SYSCTL circuit pack
- A connection to any configured Ethernet port supported by the non-SYSCTL circuit pack

A direct connection to the circuit pack or to the local network, allows you to establish an IP connection to the default LAN port address or internal Service Port address which may not be capable of being routed beyond the local network. The IP configuration of the PC must be set to allow it to connect to the IP address of the circuit pack.

Using Telnet or SSH client software, you access the CLI for the non-SYSCTL circuit pack from the PC. With the CLI, you verify the current software version on the pack, specify the address of the TFTP server and name of the file containing the new software, and initiate the copy process. The circuit pack then connects to the TFTP server and downloads the software.

For a detailed description of the Command Line Interface (CLI) messages used to interface with the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs and general information about using the Command Line Interface (CLI), refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide*.

Remote software download for the SYSCTL and controlled circuit packs

Remote software download reduces the need to travel to remote sites when the software version of multiple Alcatel-Lucent 1850 TSS-5 systems is being upgraded throughout a network.

- Remote software download from a local PC connected to the CIT RS-232 (RS-232 serial) port on the SYSCTL circuit pack faceplate to a remote:
 - Alcatel-Lucent 1850 TSS-5
 - Alcatel-Lucent 1665 DMX
 - Alcatel-Lucent 1665 DMXtend
 - Alcatel-Lucent 1665 DMXplore
 - DDM-2000 OC-3
 - DDM-2000 OC-12
 - FiberReach

Both the local and remote NEs must have an active software generic.

- Software copy from the local Alcatel-Lucent 1850 TSS-5 to a remote:
 - Alcatel-Lucent 1850 TSS-5
- Remote software download via FTP to Alcatel-Lucent 1850 TSS-5. Both the FTP gateway network element (GNE) and remote NE must have an active software generic.
- Remote software download via an FTAM-FTP gateway to Alcatel-Lucent 1850 TSS-5. The FTAM-FTP gateway is also referred to as the file transfer translation device (FTTD).

Remote software download for non-SYSCTL controlled circuit packs

Circuit packs that operate independent of a SYSCTL circuit pack can be connected directly to an IP administrative network. Software can be downloaded over the network to the circuit pack via TFTP. To perform a Remote software download the non-SYSCTL controlled circuit pack must be functioning properly using the software version that is being replaced.

Important! If the circuit pack cannot be successfully booted, because the flash file system has been corrupted, it must be replaced and returned.

To perform a TFTP download, the TFTP server with the new operating software must be accessible to the circuit pack being upgraded. This means that the circuit pack must be configured with an IP address that can be routed and accessed from the remote network location, where the remote TFTP server is connected.

Using Telnet or SSH client software, you access the CLI for the non-SYSCTL circuit pack from a remote location. With the CLI, you verify the current software version for the pack, specify the address of the TFTP server and name of the file containing the new software, and initiate the copy process. The circuit pack then connects to the TFTP server and downloads the software.

For a detailed description of the Command Line Interface (CLI) messages used to interface with the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs and general information about using the Command Line Interface (CLI), refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide*.

Impact of software download and activation

Local software downloads to the SYSCTL circuit pack temporarily disrupt operations communications because a system controller reset is involved, and the dormant software is not activated immediately.

Remote software download or copy of compressed dormant software is accomplished without any disruption of operation, because the dormant software is not activated immediately.

The dormant SYSCTL circuit pack software may be applied at any time the user specifies, for example, the same time for all NEs to be upgraded. Activation of the dormant NE software generic requires the Alcatel-Lucent 1850 TSS-5 system controller to reset, thus temporarily disrupting operations communications.

Remote software download compatibility

You can download software remotely from a *WaveStar*® CIT connected to an Alcatel-Lucent 1850 TSS-5 via the Front Serial or LAN Port to the following products:

- Alcatel-Lucent 1850 TSS-5
- Alcatel-Lucent 1665 DMX
- Alcatel-Lucent 1665 DMXtend
- Alcatel-Lucent 1665 DMXplore
- DDM-2000 OC-3
- FiberReach

Digital signature capability

Alcatel-Lucent 1850 TSS-5 verifies software downloads using a digital signature. When FTP over TCP/IP is used for a software download, a digital signature is transmitted with the software download and verified by the network element. If the verification fails, Alcatel-Lucent 1850 TSS-5 reports an autonomous message and the software download fails. The digital signature is discarded after verification.

Database backup and restore

Overview

This section describes the database backup and restore feature in Alcatel-Lucent 1850 TSS-5 for SYSCTL pack information and information about SYSCTL controlled circuit packs.

The Alcatel-Lucent 1850 TSS-5 uses the following connections to perform database backup and restore:

- A direct IP connection
- OSI connectivity to an FTP GNE.
- FTAM Backup and Restore

Database backup

Alcatel-Lucent 1850 TSS-5 can back up all provisionable data via a local or remote FTP file transfer. Data can be backed up to a remote operations system via an FTAM-FTP gateway. The FTAM-FTP gateway is also referred to as the file transfer translation device (FTTD).

The backup database is stored on a *WaveStar*® CIT or another FTP server.

Database restore

In the event of a catastrophic failure, Alcatel-Lucent 1850 TSS-5 can restore all provisionable data (from the backup file) via local or remote FTP. Data can be restored from a remote operations system via an FTAM-FTP gateway. The FTAM-FTP gateway is also referred to as the file transfer translation device (FTTD).

If there are Ethernet cross-connections and the database is restored, then the VLNC2, VLNC50/52, and VLNC35 circuit packs are hard-reset. The circuit pack resets can cause an outage of up to two minutes. In Release 5.1, Alcatel-Lucent 1850 TSS-5 supports a restoration of circuit IDs only, which is hitless. The circuit ID restoration can be used when replacing a VLNC2 SYSCTL.

The backup database maybe stored on a *WaveStar*® CIT or another FTP server.

Automatic database backup

Alcatel-Lucent 1850 TSS-5 supports automatic database backups. This allows users to establish a backup interval, date, and time. The database backups may be saved on the *WaveStar*® CIT or another FTP server.

The user can also specify the number of backups to destination files before overwriting those same files with subsequent backups. To eliminate the scenario of multiple Alcatel-Lucent 1850 TSS-5 systems initiating automatic backups simultaneously,

Alcatel-Lucent 1850 TSS-5 does not support a default scheduled backup date/time; the user must provision their own date/time. For information about the **Configuration → Software → Configure Auto Backup Interval** command, refer to the *WaveStar®* CIT help.

Maintenance signaling

Compliance

Maintenance signaling is compliant with SONET (*Telcordia*® GR-253), SDH (ITU-T G.806 and G.783), and asynchronous (*Telcordia*® TR-TSY-000191) network requirements. Alarm indication signals comply with GR-253 section 6.2.1.2 and ITU-T G.784.

Fault detection, isolation, and reporting

Overview

Alcatel-Lucent 1850 TSS-5 continuously monitors incoming signals and internal system conditions. Incoming SONET/SDH signals are monitored for loss of signal (LOS), loss of frame (LOF), loss of pointer (LOP), line AIS, path AIS (only rings will be switched due to path AIS), bit error ratio (BER) thresholds and unequipped signals. The BER threshold crossings are detected for DS1, DS3, E1, E3, VT1.5, VC-12, VC-3 (low-order), VC-4, OC-3, STM-1, OC-12, STM-4, STS-1, and STS-3c signals.

Ethernet faults/errors, dropped frames, CRC errors, alignment errors, and collisions associated with the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs are monitored using SNMP MIBs. See [“SNMP interface” \(p. 5-84\)](#) for complete details.

Fault detection

In addition to detecting line and path faults, the system also detects internal circuit pack faults. When an internal fault is detected, automatic diagnostics isolate the faulty circuit pack. Faults are reported to local technician and OSs so that technician dispatch and repair decisions can be made. If desired, OS personnel and local technicians can use the CIT to gain more detailed information on the fault condition.

Service OAM provides carrier-grade fault detection.

Fault isolation

All detected fault conditions are stored and are available to be reported on demand. In addition, a history of past alarm and status conditions and events is maintained and available for on-demand reporting. Each event is real-time and date stamped.

Service OAM provides carrier-grade fault isolation.

Fault reporting

Alcatel-Lucent 1850 TSS-5 reports all detected alarm and status conditions through the appropriate office alarm relays, SYSCTL faceplate LEDs, transmission circuit pack LEDs, and TL1 interfaces.

The b-3 DS3 port of the VLNC50/52 SONET/SDH Transport circuit pack also transmits a limited set of Far End Alarm Channel (FEAC) codes (defined in ANSI T1.107) toward the DSX panel during certain alarm conditions (for example, DS3 loss of signal or equipment failure). The b-3 DS3 port must be channelized with cbit formatting.

Alarm masking

In order to minimize the number of alarm conditions reported by the NE, Alcatel-Lucent 1850 TSS-5 automatically masks (suppresses the reporting of) alarms of the same root cause. Alarms/status conditions of the same root cause are arranged in a hierarchical order. When more than one alarm or status condition in a hierarchical group exists in a single NE, only the top level condition in that hierarchy is reported.

Loopbacks and tests

Overview

Alcatel-Lucent 1850 TSS-5 allows technicians to perform loopback tests on all SONET/SDH interfaces. loopbacks are individually controllable from the CIT or the OS interface. The VLNC50/52 circuit pack supports terminal and facility loopbacks on DS1/E1 and DS3/E3 ports. The VLNC60/61/62 circuit pack supports terminal and facility loopbacks for DS1/E1 signals. The VLNC35 supports terminal loopbacks. Active electronic loopbacks are shown by the **MN/ABN** LED on the SYSCTL faceplate and in the alarm and status report.

Loopbacks

There are two software-controlled electrical loopbacks.

Facility loopbacks

The Facility loopback connects the DS1, DS3, E1, or E3 transmit side input to the corresponding receiver side output.

Cross-connect facility loopbacks are supported on the tributaries of the optical SONET/SDH ports of the VLNC50/52 circuit pack. A tributary received on an optical interface is looped back, through the cross-connect fabric, to the same-numbered tributary in the transmit optical interface, and AIS is inserted downstream if the tributary is cross connected.

Terminal loopbacks

Low-speed DS1, DS3, E1, and EC-1 electronic loopbacks, directed toward the high-speed line (terminal loopbacks) connect the entire signal that is about to be passed-through the tributary interface to the DSX (in the case of DS1/E1/DS3/E3 signals) back toward the cross-connect fabric to the optical line. AIS is the output to the DSX. Alcatel-Lucent 1850 TSS-5 also supports terminal loopbacks on VLNC35 Ethernet interfaces.

Terminal loopbacks are used for installation and maintenance procedures to test the integrity of near and far-end interfaces as well as fibers and system circuitry.

Manual optical loopbacks

Front access to the optical connectors on the optical line interface unit (OLIU) circuit pack allows easy manual optical loopback. This loopback is performed by connecting a fiber jumper from the MAIN circuit pack output to its input. In some cases a lightguide buildout assembly is required to prevent receiver overload when performing loopbacks.

Inband requested DS1 loopbacks

The VLNC50/52 and VLNC60/61/62 circuit packs support inband-requested DS1 loopbacks. Inband-requested DS1 loopbacks can be provisioned using either inband signal control (ISC) patterns or a bit-oriented codes (BOC) within the DS1 signal received from the DSX (VLNC50/52 and VLNC60/61/62) or optical fiber (VLNC50/52). The ability to respond to inband loopback requests is provisionable on a per-port, per-direction basis, and is by default disabled. If inband loopbacks are enabled in either direction, then command-based loopbacks are denied. If inband loopbacks are disabled while inband-requested loopbacks are active, the loopbacks are released.

Far End Alarm Channel (FEAC) requested DS1 and DS3 loopbacks

The VLNC50/52 circuit packs support Far End Alarm Channel (FEAC) requested DS1 and DS3 facility loopbacks on the channelized, C-bit framed, b-3 DS3 port. The FEAC-requested loopbacks are provisioned using FEAC codes within the b-3 DS3 signal received from the DSX. The ability to respond to FEAC loopback requests is provisionable on the b-3 DS3 port only, and is by default disabled. If FEAC-requested loopbacks are enabled, then *WaveStar*[®] CIT-based facility loopbacks (VLNC50/52) are denied. Terminal loopbacks are not denied. If FEAC-requested loopbacks are disabled while a FEAC-requested loopback is active, the loopback is released.

Ethernet Link OAM IEEE 802.3 Clause 57

Overview

Link OAM provides a way to monitor the health of a physical Ethernet link through:

- Continuous, bidirectional discovery protocol
- Loopback
- Communication of
 - Link events
 - Failures
 - Threshold monitoring events

The VLNC40 and VLNC42/42B support IEEE 802.3 Clause 57, formerly referred to as 802.3ah.

Note: L2CP Tunneling and Link OAM are allowed simultaneously. However, the loopback cannot be operated and remote loopback capability cannot be enabled when L2CP Tunneling and Link OAM are both enabled on a port.

OAMPDUs

Link OAM uses Operations, Administration, and Maintenance Protocol Data Units (OAMPDUs) for:

- Discovery
- Loopback control/response
- Event notification

During normal operation, one PDU is sent per second. Up to 10 PDUs can be sent per second, unless there is a new critical event. The absence of PDUs indicates that a failure or fault has occurred. PDUs can contain multiple Type/Length/Value (TLV).

Discovery

Each port can be configured in active or passive mode. The discovery function is mandatory and is used to determine if the link partner is 802.3 OAM-capable and which features of the protocol it supports

Active mode

Only active ports can initiate discovery or loopback. Discovery is initiated when link OAM is enabled on a port and the port is configured in the active mode. The port sends information PDUs. In active mode, a port can initiate discovery, respond to discovery initiated from the remote end and initiate or respond to a loopback command.

Passive mode

Only active ports can initiate discovery or loopback. If a port is in the passive mode, it can respond to discovery and can respond to a loopback command, but cannot initiate discovery or loopback.

Loopback

A loopback is initiated at one end using the CLI. OAMPDUs are then sent to the far end, requesting that it put up a physical loopback. Once the loopback is up, a response is sent to the originating node. During the loopback, the remote node loops all traffic except for link OAMPDUs, and optionally L2CP PDUs (so that protocols such as RSTP and LACP may continue to be peered during the loopback). The local end drops all traffic coming from the remote, except for link OAMPDUs, and optionally L2CP PDUs. The loopback may be disabled at the local end using the CLI, or at the remote end by disabling the remote loopback capability, or disabling the link OAM feature.

Link OAM events

Beginning in Release 5.1, Alcatel-Lucent 1850 TSS-5 supports generation and processing of link OAM events. Non-thresholded events include Link Fault, which can be used to generate a Remote Failure Indication for ports which support Unidirectional Transmission (1000BASE-X PTM-based optical ports).

Thresholded events are:

- Errored Symbol Period
- Errored Frame
- Errored Frame Period
- Errored Frame Second

These events may be individually enabled or disabled, and have configurable intervals and thresholds. Non-zero events are logged at both ends.

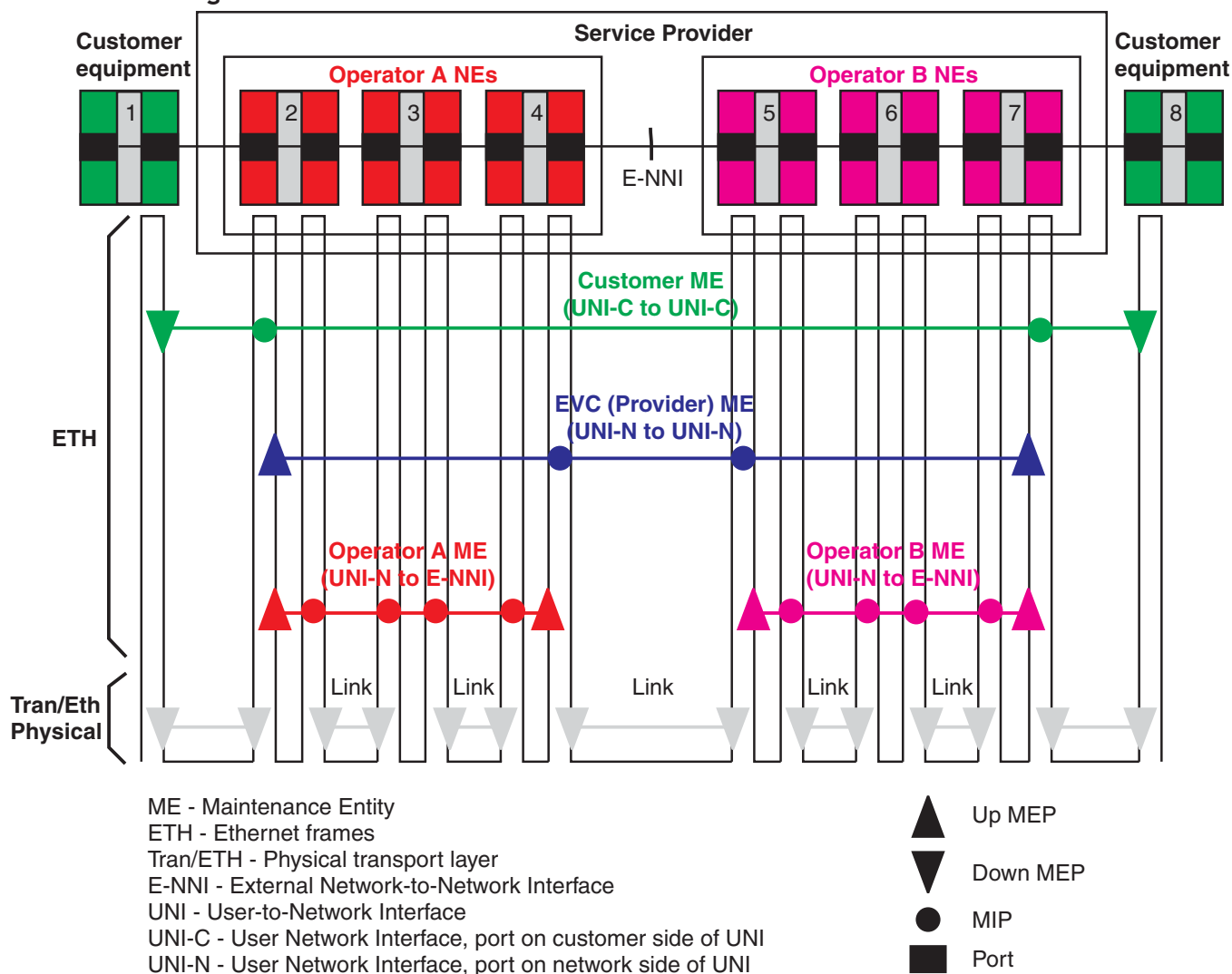
Ethernet Service OAM IEEE 802.1ag

Overview

Ethernet service OAM (Operations, Administration, and Maintenance) provides maintenance features for detecting, isolating, and reporting connectivity faults for Ethernet services. This release implements IEEE Std 802.1ag™ -2007 Connectivity Fault Management for the VLNC40/42/42B circuit packs. Three basic features are currently specified: Continuity Check, Link Trace, and Loopback.

For each service, generally three types of players are involved: the customer, the service provider, and operators. For this reason Service OAM is defined at multiple levels, as shown in Figure 5-6, “Service OAM reference model” (p. 5-32).

Figure 5-6 Service OAM reference model



OAMservice

Note: Service OAM also applies to more complex networks than are represented in [Figure 5-6, “Service OAM reference model” \(p. 5-32\)](#), including multipoint and ring networks.

Each player can establish their own Maintenance Associations (MA), consisting of Maintenance Endpoints (MEP's, shown as triangles), which allows them to exchange OAM messages over their domain of the service. MEPs can perform fault detection using keep-alive messages called Continuity Check Messages (CCM). Maintenance Intermediate Points (MIPs, shown as circles) may be created to facilitate fault isolation. They can respond to, but do not initiate, certain OAM functions. For example, loopbacks may be initiated from a MEP which has detected a CC fault and targeted successively to each MIP at its level. A provider can isolate a fault to one operator, and an operator can isolate to a single NE.

Connectivity fault management

Connectivity fault management (CFM) supports concepts to support multiple independent operators, services, and customers.

Maintenance domains

A Maintenance domain (MD) is a part of the network controlled by a single player (owner) to support connectivity between maintenance end points (MEPs) that bound the maintenance domain.

Maintenance domain levels

Maintenance domain levels allow customers, service providers, and operators to run independent OAMs on their own level. Up to eight OAM levels are defined (0–7), with seven (7) being the highest. Customers are allocated up to three levels (5, 6, 7), service providers two levels (3, 4), and operators three levels (0, 1, 2).

Maintenance associations

Maintenance associations (MA) are associated with a single service instance (identified by the service VLAN identifier) within a maintenance domain (identified by the maintenance domain name). The combination of the maintenance domain name (if MD name format is not null) and the maintenance association name is called maintenance Association Identifier (MAID).

Maintenance end points

Maintenance End Points (MEP) are established on interfaces at each end of a maintenance domain. MEPs are configured for a specific MA within a maintenance domain to generate and receive Connectivity Fault Management (CFM) PDUs. Each individual MEP is configured with a MEPID that is unique within its MA. MEPs may be configured as Up MEPs or Down MEPs. MEPs may be addressed by the MEPID or by their port's MAC address for Down-MEPs or by the shared bridge CPU MAC address for Up-MEPs.

Each individual MEP is configured with a MEPID that is unique within a given MA. MEPs may be configured as Up MEPs or Down MEPs. MEPs may be addressed by the MEPID or by their port's MAC address for Down-MEPs or by the shared bridge CPU MAC address for Up-MEPs.

Maintenance intermediate points

Maintenance Intermediate Points (MIPs) may be not individually created by the user like MEPs are. When allowed, MIPs are automatically created on a port at the MD level above the highest level MEP (or in the lowest configured MD level if there is no MEP on the port). When an MA is created, it is provisioned to either enable or disable automatic creation of MIPs on that MA based on lower level MEPs. A MIP consists of two MIP Half Functions (MHFs) on a single bridge port; an Up MHF and a Down MHF. MIPs facilitate fault isolation. They can respond to, but do not initiate, certain OAM functions. For example, loopbacks may be initiated from a MEP which has detected a CC fault and targeted successively to each MIP at its level. MIPs may be addressed by their port's MAC address for Down-MHFs or by the shared bridge CPU MAC address for Up-MHFs.

Service OAM configurations

An example application is a VLNC40/42/42B provider-owned demarcation point between customers and the provider's network. This is Node 2 or Node 7 in [Figure 5-6, "Service OAM reference model"](#) (p. 5-32). Each customer port may be provisioned to support a customer MIP and at least a provider Up-MEP, and if applicable an operator Up-MEP, for each Ethernet Virtual Connection (EVC). A link-level Down-MEP may be configured on both customer and network ports, with no VID, to protect the entire link.

Provider bridging (double tagging) is typically used. In that case, a customer MIP can only function if the customer supplies untagged Ethernet OAM frames, see ["MIP support"](#) (p. 5-35), which get tagged with S-VLAN, otherwise the customer's OAM traffic is tunneled. Refer to [Table 5-7, "Double tagging – All to one bundling"](#) (p. 5-36) and [Table 5-8, "Double tagging – Service multiplexed"](#) (p. 5-36) for more information. In Release 5.1, no VLAN translation of a customer's tagged OAM traffic is supported, which would allow a customer's OAM VLAN to be translated to the SVLAN. OAM for multiple EVCs (service multiplexing) is supported. Similarly, in that case only one of the EVCs on a port can support a customer MIP, the one which includes untagged traffic, see [Table 5-8, "Double tagging – Service multiplexed"](#) (p. 5-36).

If double tagging is not used then a customer MIP may be supported in the default VLAN if the customer supplies untagged Ethernet OAM frames, or by agreement with the customer on a specific VLAN for OAM. See [Table 5-6, "No double tagging"](#) (p. 5-36). The provider's OAM also uses that same VLAN, representing the "service."

MIP support

Whether and how a customer MIP can be supported depends on the tagging mode, and whether the customer OAM frames (only levels 5, 6 and 7 are designated for customer use) are tagged. [Table 5-6, “No double tagging” \(p. 5-36\)](#) through [Table 5-8, “Double tagging – Service multiplexed” \(p. 5-36\)](#) show, for the provider edge, the relation between customer OAM tagging and the Service VLAN to be used for configuring the MA. For example, Node 2 in [Figure 5-6, “Service OAM reference model” \(p. 5-32\)](#). A customer MIP can only be supported (be accessible) in the provider’s equipment when the customer’s OAM frames have a single tag when forwarded to the CPU. When double-tagged, they are tunneled.

In the no double tagging (single tag) case [Table 5-6, “No double tagging” \(p. 5-36\)](#), untagged customer traffic, including OAM, may be configured to be dropped or not. If not dropped, then certain untagged customer OAM traffic is tagged with the Port VID (which is the Service VLAN ID). This enables customer MIP support. The OAM traffic tagged this way includes traffic with a unicast DA, and with the OAM multicast DA at the customer levels.

Untagged customer OAM traffic at lower levels (0–4) may be destined to a no-VLAN Down-MEP there. Only OAM frames that encode the level in the DA are available to such a Down-MEP. This includes CCM, which is the only function needed by a Down-MEP on a customer port. This same consideration applies in the case of a LAG. Untagged customer-level OAM may address a customer MIP on the LAG port while at lower levels it can only belong to a no-VLAN Down-MEP on a member port.

Tagged customer OAM traffic in a particular VLAN can address a MIP on the port, and that VLAN is used by agreement for the provider’s Service VLAN ID. When there is no customer OAM, the Service VLAN ID for provider OAM can be any value to represent the customer’s service.

In the double tagging cases, the situation for untagged customer OAM traffic is the same as for the single tagging case when untagged traffic is not dropped. When Service Multiplexing is enabled, the Service VLAN ID is according to the Customer VLAN to Service VLAN mapping.

Tagging

Table 5-6 No double tagging

Customer OAM VLAN	Customer MIP supported?	Service VLAN ID
Untagged (untagged not accepted)	No	N/A
Untagged (untagged accepted)	Yes, in pvid	pvid
VLAN=X	Yes	X
No OAM	No	Any

Table 5-7 Double tagging - All to one bundling

Customer OAM VLAN	Customer MIP supported?	Service VLAN ID
Untagged	Yes, in default VLAN (pvid)	pvid
VID=X	No, tunneled	pvid

Table 5-8 Double tagging - Service multiplexed

Customer OAM VLAN	Customer MIP supported?	Service VLAN ID
Untagged	Yes, in only one EVC	As mapped with SVLAN
VID=X	No, tunneled	As mapped with SVLAN

T-MPLS operation and maintenance (OAM)

Overview

OAM functions are supported only at Tunnel termination points (no intermediate checks).

Connectivity verification

Connectivity verification (CV) is based on the periodic transmission of CV packets from ingress to egress of a T-MPLS connection. The period is provisionable.

The egress of the T-MPLS connection extracts T-MPLS CV from the T-MPLS signal checking for the defects. The main defects concern:

- The presence of continuity in T-MPLS trail
- The connectivity to the specified source in T-MPLS trails

T-MPLS conditions/alarms

The following VLNC62 T-MPLS tunnel segment conditions/alarms are detected and reported:

- LOC Loss of Connectivity: Loss of CV packets for a period greater than 3.5 the CV provisioned period.
- MMG Unexpected MEG: A CV packet with MEL=0 and an invalid MEG value (that is with a MEG_ID different from the configured MG_ID at the received MEP) has been received.
- SSF Server Signal Failure: cSSF = FDI or CI-SSF.
- UNM Unexpected MEP: A CV packet with MEL=0 and a valid MEG_ID, but with an invalid MEP (that is with a MEP_ID different from the configured PeerMEP_ID at the receiving MEP) has been received.
- UNP Unexpected Period: A CV packet with MEL=0, valid MEG_ID, valid MEP_ID, but with an invalid CV_PHB (that is with a received PHB value different from the configured PHB at the receiving MEP) has been received.
- UNPHB Unexpected PHB: A CV packet with MEL=0, valid MEG_ID, valid MEP_ID, but with an invalid CV_Period (that is with a received Period value different from the configured Period at the receiving MEP) has been received.

Refer to

High-performance Ethernet OAM ITU-T Y.1731 for VLNC42/42B circuit packs

Overview

The VLNC42/42B circuit pack supports high-performance Ethernet OAM ITU-T Y.1731 to provide fault and performance management for service providers in large Ethernet networks.

ITU-T service OAM standard Y.1731 is similar to IEEE standard 802.1ag in that it divides a network into maintenance domains in the form of hierarchy levels. Both of these are then allocated to users, service providers, and operators. Connectivity Fault Management (CFM) assigns maintenance end points (MEPs) to the edges of each domain and maintenance intermediate points (MIPs) to ports within domains. This defines the relationships between all entities from a maintenance perspective to allow each entity to monitor the layers under its responsibility and easily localize problems.

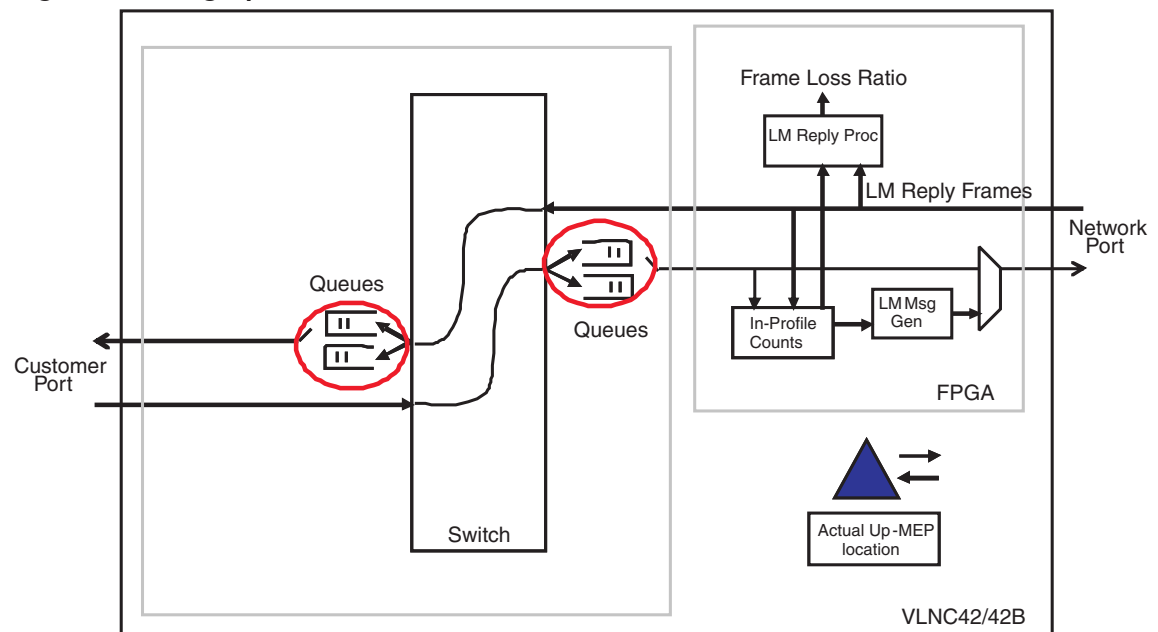
The VLNC42/42B circuit packs support the following High-performance Ethernet OAM ITU-T Y.1731 features:

- Service OAM
 - Loss measurement
 - Delay measurement
- Ethernet AIS
- Y.1731/G.8021 CCM alarms

Architecture

All Customer Port OAM is implemented in the FPGA device at the Network port as shown in the following figure.

Figure 5-7 High-performance Ethernet OAM ITU-T Y.1731 architecture



1731-arch

The FPGA device provides Y.1731 functionality for customer port Up-MEPs and network port Down-MEPs. The received OAM frames that are processed by the FPGA are terminated in the MEP and do not propagate towards the switch. In the (network port) transmit direction, OAM frames are merged with data frames in the FPGA. This introduces a store-and-forward buffer in that direction, which adds some latency and jitter, which is not measured by the delay measurement.

Loss measurement (LM)

Loss Measurement provides an accurate accounting of frames received versus frames sent for a service. A typical use is by a Service Provider who conducts the measurement proactively (continuously) end-to-end for Service Level Agreement (SLA) verification. Up-MEPs at the service endpoints exchange frame count information to make the calculation. The customer can do the same in their equipment for the same reason, using Down-MEPs on their UNI ports. If the service crosses administrative boundaries, then the responsible entities may measure performance on each leg, bounded by their MEPs.

Alcatel-Lucent 1850 TSS-5 supports the following types of loss measurements.

- *Proactive* loss measurement is used to monitor Severely Errored Seconds (SES) and Unavailable Seconds (UAS), also for SLA verification. A Frame Loss Ratio (FLR) is calculated each second, and if it exceeds 75%, (or if the MEP detects a local fault) then the SES counter is incremented. UAS is calculated in the same manner as in TDM. Both are implemented according to ITU-T G.7710.
- *On-Demand* loss measurements provide a troubleshooting tool. It consists of the Frame Loss Ratio (FLR) measured over a specified interval at a specified time.

Delay measurement (DM)

Proactive Delay and Delay Variation measurements are also typically done for SLA verification, and so may be used simultaneously with Loss Measurement for the same services.

Delay is measured by synthetic frames using probe messages rather than measured directly on data frames. This allows for measuring two-way or round-trip (RT) delay using initiator and responder frames, which can be done without synchronizing clocks between endpoints. The responder reflects the initiator's probe frame: the initiator timestamps the frame when sent, and again when the reflection is received. The closer timestamps are to the actual sending and receiving of the frames, the more accurate the measurement. The difference between the timestamps is the RT delay, including the time it takes the responder to reflect the message.

This can be improved by having the responder also timestamp the message when received and again when reflected. Then the initiator can use the responder's timestamps to obtain its processing interval, and subtract that from the RT delay to get a better measure of the delay experienced by data traffic.

Ethernet AIS

Ethernet AIS is similar to SONET/SDH AIS. It is used to convey fault information forward so that downstream MEPs can avoid declaring actionable alarms for the same fault.

AIS insertion may be enabled on any MEP except on a port which has spanning tree or ERP enabled. Ethernet AIS is inserted into a configured client MD level, in the direction opposite of other MEP OAM transmission. Because AIS processing is done in software, frames are only sent at 1-minute periods (with a three-frame burst on initiation).

AIS detection on a MEP is used to suppress Loss of Continuity (LOC) alarms. It also may trigger AIS if the detecting MEP is enabled to do so. In this way the cascade behavior is obtained even if the detecting MEP does not run Continuity Check Messages (CCM). AIS detection is alarmed. AIS detection is not configurable and all MEPs can detect AIS.

If AIS is to be used in the network, all MEPs should be enabled for AIS generation. The client MD level of the next configured MD can also be provisioned so that AIS cascades to suppress all secondary alarms. An exception is a Down-MEP on a UNI-N port. In this case the client level may be that of a Customer ME (because Up-MEPs at Provider or Operator levels do not experience secondary alarms due to an LOS at the UNI-N.)

Y.1731/G.8021 Continuity Check Message (CCM) alarms

G.8021 splits two of the 802.1ag Continuity Check Message (CCM) defects into four components. Some of the components are used to trigger AIS. It splits the 802.1ag loss of continuity defect into individual LOC indications for each remote MEP. It also adds a defect for receiving a CCM with a different priority than configured.

A list of the G.8021 CCM defects include the following:

- dLOC (Loss of Continuity): This is the same as someRMEPCCMdefect, but detected individually per remote MEP.
- dMMG (Mismerge): This is the different-MAID component of xconCCMdefect.
- dUNM (Unexpected MEP): This is the unexpected-MEP component of errorCCMdefect.
- dUNP (Unexpected Period): This is the unexpected-period component of errorCCMdefect.
- dUNL (Unexpected Level): This is the unexpected-level component of xconCCMdefect.
- dUNPr (Unexpected Priority): This defect detects CCM frames whose priority does not match the configured priority.
- dRDI (Remote Defect Indicator): The RDI flag in CCM is generated only according to the G.8021 definition, because dRDI, detected from receiving the set RDI flag, is used in the determination of SES and UAS PM.

User interface

Overview

Purpose

This section describes the *WaveStar*® CIT (TL1-based packs) and the Web GUI (CLI-based packs)

Contents

WaveStar® CIT	5-41
Web GUI	5-45

WaveStar® CIT

Purpose

The *WaveStar*® CIT is the primary tool used to interface with the SYSCTL circuit pack and manage VLNC50/52 circuit pack SONET/SDH operations on Alcatel-Lucent 1850 TSS-5.

The *WaveStar*® CIT user-interface software is installed and operates on your PC.

The *WaveStar*® CIT supports the following user interface options:

- Graphical user interface (GUI)
- TL1 cut-through

The *WaveStar*® CIT is referred to as the *WaveStar*® CIT because the Alcatel-Lucent 1850 TSS-5 user-interface software is integrated with the *WaveStar*® CIT software for the *WaveStar*® products.

WaveStar® CIT functionality

The *WaveStar*® CIT provides an easy-to-use interface and security features to prevent unauthorized access. The *WaveStar*® CIT supports the following:

- Local access control based on login and password
- OSI neighbor discovery for easy access to the local NE(s)
- User provisioning of cross-connections, equipment, Ethernet services, software management, protection provisioning, and fault management
- Reports on NE equipment, cross-connections, alarms, and states

TL1 interface

The interface between the *WaveStar*® CIT and the Alcatel-Lucent 1850 TSS-5 supports TL1 messages. This interface allows the *WaveStar*® CIT to issue TL1 commands and receive responses, as well as receive TL1 alarm reports from autonomous events that are detected by the Alcatel-Lucent 1850 TSS-5.

WaveStar® CIT access methods

The *WaveStar*® CIT can access a network element using the following:

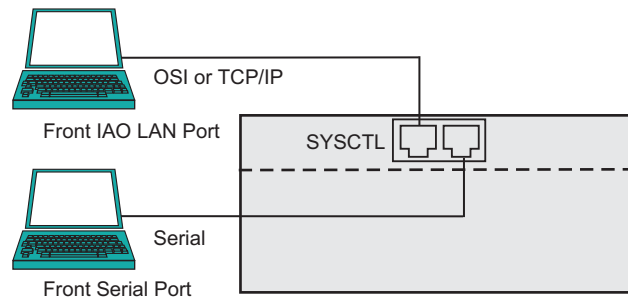
- Front IAO LAN port supporting OSI or TCP/IP communications
- Front serial port

WaveStar® CIT direct local access

The recommended method for temporary local access is to connect the *WaveStar*® CIT to Alcatel-Lucent 1850 TSS-5 via the CIT **LAN** port on the system controller (**SYSCCTL**) circuit pack faceplate. IP access is enabled by default on the **LAN** port and default IP addresses are assigned.

The *WaveStar*® CIT can also be connected to the serial **CIT RS-232** port on the **SYSCCTL** circuit pack faceplate.

Figure 5-8 *WaveStar*® CIT direct local access



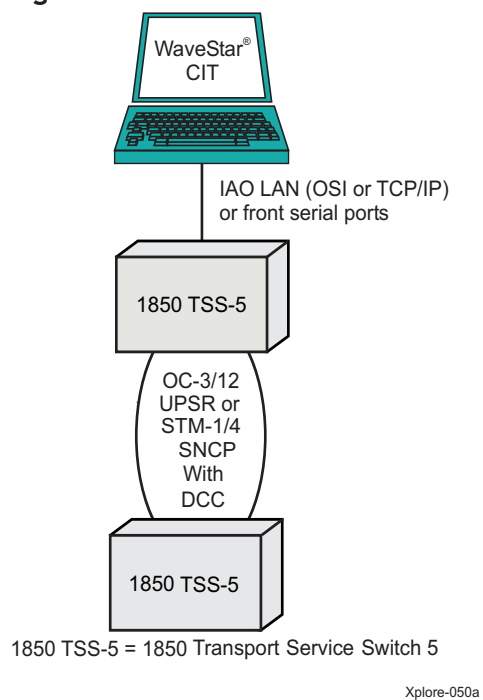
Xplore-048

Important! When the *WaveStar*® CIT is directly connected to the CIT LAN port (not to an Ethernet LAN hub), a LAN crossover cable is required.

WaveStar® CIT remote access using DCC

A *WaveStar*® CIT with direct physical access to a local Alcatel-Lucent 1850 TSS-5 can also be used to access remote NEs with DCC connectivity to the local Alcatel-Lucent 1850 TSS-5. *WaveStar*® CIT remote access over DCC is functionally equivalent to *WaveStar*® CIT direct access.

Figure 5-9 WaveStar® CIT access via DCC

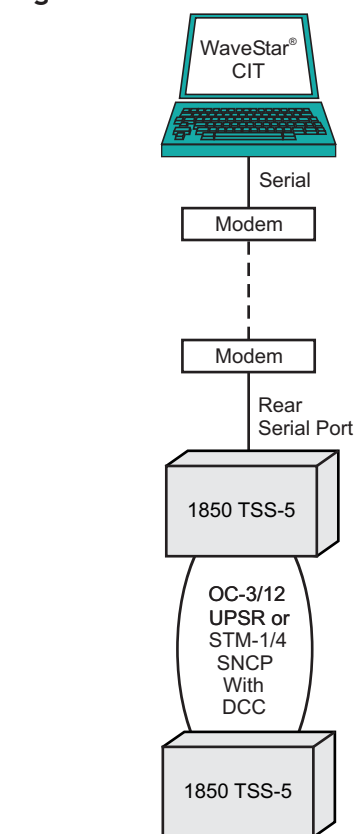


Remote access to the front serial port

Alcatel-Lucent 1850 TSS-5 can also be accessed remotely via dialup modems, but not by the WaveStar® CIT software. The serial port when equipped with the recommended cable is configured as DTE to allow a permanent modem connection.

A PC with a terminal emulation software package, such as HyperTerminal, can be used for access to Alcatel-Lucent 1850 TSS-5's serial port via dialup modems. The PC can use its internal modem or an external modem (shown). This form of access supports TL1 messages only, and can be used to access remote NEs with DCC connectivity to the Alcatel-Lucent 1850 TSS-5 with the modem connection.

Figure 5-10 Remote WaveStar® CIT access via modem



1850 TSS-5 = 1850 Transport Service Switch 5

Xplore-052a

Web GUI

Overview

The Alcatel-Lucent 1850 TSS-5 CLI-based circuit packs can be managed using the CLI command interface or the Web GUI interface. This section provides a brief introduction to the Web GUI interface. It explains how to access the interface and use the menu structure for system management and provisioning.

Each VLNC4x or VLNC6x pack should be connected to the network and have its IP address configured first. The user then accesses the pack via the Web GUI by entering the IP address of the pack as the URL in the HTTP-enabled Web browser. The Login screen is displayed next. Once the user enters the valid username and password and connecting to the VLNC4x or VLNC6x pack is successful, then the Web GUI main page is displayed.

Access ports

Initial configuration for connectivity requires you to use either the RS-232 console port or the MGMT LAN service port.

Out-of-band connectivity refers to using the RS-232 console port on the VLIU or the MGMT LAN service port on the VLNC4x/VLNC6x faceplate to access the VLNC4x/VLNC6x.

In-band connectivity allows you to access the VLNC4x/VLNC6x from a local or remote PC using the Ethernet network and the IP address information assigned to the VLNC4x/VLNC6x. You must configure the VLNC4x/VLNC6x network parameters with IP address information (IP address, subnet mask, and default gateway) to access the VLNC4x/VLNC6x in-band. All the network LA ports will share one IP address.

Protection switching

Overview

Purpose

This section describes the types and functions of protection switching in Alcatel-Lucent 1850 TSS-5.

Contents

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Path protection switching (path switched rings)	5-47
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Line protection switching

Overview

Line protection switching (1+1) occurs automatically in response to detected faults, as well as in response to external commands from technicians at a local or remote CIT or OS. Alcatel-Lucent 1850 TSS-5 provides SONET/SDH standard line protection switching on optical interfaces as a user-provisionable option.

1+1 facility protection

Alcatel-Lucent 1850 TSS-5 supports non-revertive, unidirectional 1+1 line switching protection on the VLNC50/52 OC-3/STM-1 and OC-12/STM-4 interfaces.

When PROT (equipment-protection-allowed) is enabled on the shelf, 1+1 is a supported application and each pair of lines across the boards may be a different rate. The two pairs of lines can have different applications (either 1+1 or UPSR/SNCP).

Protection switching priorities

Alcatel-Lucent 1850 TSS-5 uses standard protection switching priorities as follows:

- Lockout of protection
- Forced switch (FS)
- Automatic switch: signal fail (SF)

- Automatic switch: signal degrade (SD)
- Manual switch (MS)

Alcatel-Lucent 1850 TSS-5 uses unidirectional, non-revertive 1+1 line switching.

Automatic protection switch procedures as specified by the SONET/SDH standards are used.

Automatic line switching

Automatic line switches are initiated by signal fail and signal degrade conditions on the received OC-n/STM-n signal. This signal's BER is calculated from violations in the SONET/SDH line overhead B2 parity byte. Signal fail is declared for incoming loss of signal, loss of frame, line AIS, or a BER exceeding a provisionable 10^{-3} to 10^{-5} threshold, while a BER exceeding a provisionable 10^{-5} to 10^{-9} threshold causes the signal degrade condition. A line protection switch is completed within 50 milliseconds of the onset of a hard failure such as a fiber cut.

Path protection switching (path switched rings)

Overview

Alcatel-Lucent 1850 TSS-5 supports path switched ring applications using the SONET path protection switching schemes described in *Telcordia*® GR-1400. This scheme offers 60-millisecond restoration times and simple network administration for access applications. The ring facility consists of two fibers, with service and protection traffic travelling in opposite rotations around the ring. Each input is bridged and transmitted in both directions around the ring. The receiving end terminal monitors the quality of both signals and selects the best signal to drop.

Subnetwork connection protection (SNCP) is supported for SDH rings. Alcatel-Lucent 1850 TSS-5 supports SNC/n non-revertive 1+1 unidirectional path switching as described in ITU-T G.808.1.

UPSR configurations

Alcatel-Lucent 1850 TSS-5 supports the following OC-3/12 ring configurations:

- VT1.5
- STS-1
- STS-3c

Path protection switching is non-revertive. STS-n path switching is triggered by incoming line LOP, AIS, and unequipped or STS-n path BER exceeding a provisionable 10^{-3} to 10^{-5} threshold or signal degrade threshold. The system also supports VT path protection switching based on VT AIS, LOP, unequipped, and signal degrade.

SNCP configurations

Alcatel-Lucent 1850 TSS-5 supports the following STM-1/STM-4 subnetwork connection protection ring configuration:

- VC-12
- VC-4
- VC-3 (low-order)

Path protection switching is non-revertive. SDH failures/degrade conditions for switching are defined in G.783 (Section 12.1.1.1). The Alcatel-Lucent 1850 TSS-5 supports SNC/Ne non-revertive 1+1 unidirectional path switching version of SNCP described in ITU-T G.808.1. SNCP switching is based on LOP, AIS, UNEQ, EXC (SF-BER), and DEG (SD-BER). SNCP EXC (hard BER signal failure) has the same switch priority as other hard failures.

Link aggregation

Overview

Alcatel-Lucent 1850 TSS-5 supports link aggregation on the VLNC40/42/42B circuit pack. The ports comprising a link aggregation group (LAG) must be located on the same pack. Link aggregation can also provide facility protection on VLNC40/42/42B LAN ports.

Note: LAG is not allowed on ports associated with an ERP instance.

Hitless bandwidth increase/decrease

Ordinarily, multiple Ethernet links between two bridges form loops (unless a spanning tree blocks all but one) so they cannot be used to increase bandwidth. Link aggregation causes defined groups of links to be treated as a single logical link, making multiple LAN ports appear as one. In this manner, bandwidth can be increased without requiring an upgrade to a higher rate link.

Facility protection

Link aggregation can provide facility protection by removing failed links automatically. When a link fails, traffic is shifted to the remaining links in that LAG. More links than are needed can be added to the group and each is active until it fails (similar to utilizing LCAS protection for SONET tributaries).

Link aggregation control protocol

Link aggregation is specified in IEEE 802.3 clause 43, formerly specified in 802.3ad. A VLNC40/42/42B can be configured to either use this standard protocol to control link aggregation (which negotiates with the equipment at the other end of the link) or to simply force aggregation without a control protocol.

General link aggregation rules

Link aggregation follows these basic guidelines:

- Available for LAN ports on the VLNC40/42/42B circuit pack
- Maximum of 12 LAGs per pack and 8 ports per LAG.
- The ports in a LAG must be on the same pack, and be functioning at the same rate (for example, 10 or 100 Mbps).
- All links in a LAG are in-service until they fail.
- A LAG behaves like a logical port; features like VLAN assignments should be provisioned on the LAG. VLAN assignments and other features provisioned on LAG member ports are not operational while a port is a member of the LAG.

Link aggregation example

The figure below depicts link aggregation on two VLNC40/42/42B LAN ports functioning at 100 Mbps. The top portion of the figure shows two ports receiving separate 100 Mbps inbound flows. The bottom portion depicts the same two flows being equally split across the two outbound ports in the LAG. In this example, no failure has occurred and both ports comprising the LAG are in-service. However, link OAM operates on a port, even when it is a member of a LAG.

Traffic entering incoming ports is aggregated into a LAG. While both ports are in-service, outgoing traffic is split between working ports.

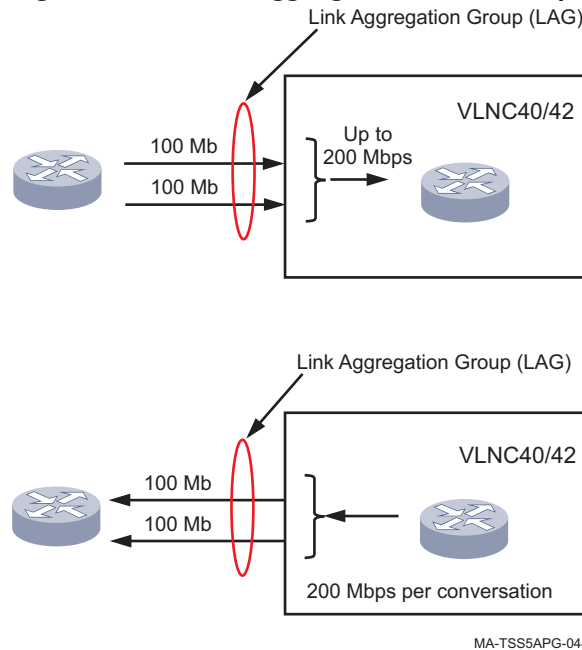
Figure 5-11 Link aggregation at 100 Mbps (all ports in-service)

Figure 5-11, “Link aggregation at 100 Mbps (all ports in-service)” (p. 5-50) represents the ideal case, in which there are at least 2 flows, each a maximum of 100 Mbps. In this case, they can be equally split over the two ports comprising the LAG. The ability to split the two flows across multiple ports also depends on the distribution of MAC/IP addresses.

Link aggregation employs an algorithm that assigns traffic to member ports to prevent misreading. A given flow can be assigned to only one port and cannot be split across multiple ports in the same LAG. A flow is defined by an IP source and destination pair (for IP packets) and by a MAC source and destination pair (for non-IP packets). The algorithm uses the XOR of the three least significant bits of the address pairs to assign a port/link. Therefore, the actual load balancing achieved depends on the distribution of MAC/IP addresses.

T-MPLS 1:1 Linear tunnel protection

Automatic protection switching

Automatic protection switching (APS) is used to control protection switching operations. APS carries information about the protection architecture, the remote node condition, the signal that the near end requests to be carried over the protection path and the signal that is bridged onto the protection path.

Switch initiation criteria

The APS switch initiation criteria are:

- Externally initiated commands, by operator:
 - Clear
 - Lockout of Protection (LO)
 - Forced Switch (FS)
 - Manual Switch (MS)
- Automatically initiated command associated with a protection domain: Signal Fail (SF)
- States of the protection switching function:
 - Wait to Restore (WTR)
 - No Request (NR)

Switching priority

The priority order is according to the Request/State field of the APS payload structure, that is, considering a decreasing priority from top to the bottom in the following list:

- Lockout of Protection (LO)
- Signal Fail for Protection (SF-P)
- Forced Switch for Working (FS)
- Signal Fail for Working (SF)
- Manual Switch for Working / Manual Switch for Protection (MS)
- Wait to Restore (WTR)
- No Request (NR)

Performance monitoring

Overview

Purpose

This section lists and describes performance monitoring parameters, SNMP traps and parameters, data storage, thresholds, and TCA transmission. This section is meant to serve as a high-level overview to the performance monitoring capabilities of the Alcatel-Lucent 1850 TSS-5. Performance monitoring for the VLNC50/52 and VLNC35 is covered in detail in this section.

The VLNC40, VLNC42/42B, VLNC60, VLNC61, VLNC62, and VLNC64 support performance monitoring parameters that are accessible via CLI commands and SNMP MIBs. The PM parameters are based on RFC 2495(4805), RFC 2558(3592). For details on the supported PM parameters, refer to the “Performance monitoring” section in the “PDH/TDM configuration and maintenance commands” chapter in *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide*. The SNMP MIBs that are used to retrieve the PM parameters are listed in [“SNMP interface”](#) (p. 5-84).

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Performance monitoring terms

Overview

This section lists and describes terms related to performance monitoring and performance monitoring reports for Alcatel-Lucent 1850 TSS-5.

Proactive maintenance

Proactive maintenance is corrective action, taken to correct degrading conditions before they result in complete failure that interrupts service. The conditions associated with SONET/SDH sections, lines and paths within the SONET/SDH network can be monitored for this purpose using the performance monitoring parameters that are available with Alcatel-Lucent 1850 TSS-5.

Reactive maintenance

Reactive maintenance is the response to the failure of a transmission line or path that completely interrupts service. Alcatel-Lucent 1850 TSS-5 provides alarm indications that can indicate this type of failure.

Performance monitoring

Performance is monitored for SONET/SDH/PDH operations by observing the number of errors or violations that occur for line or path parameters. This information is accumulated and stored the current 15-minute and 24-hour registers. A second 24-hour register maintains the number of errors recorded during the previous 24 hours. For the VLNC50/52, VLNC35, and VLNC2, the number of errors accumulated during the previous 8 hours are maintained in 31 additional 15-minute registers. For the VLNC40, VLNC42/42B, VLNC60, VLNC61, VLNC62, and VLNC64, the number of errors accumulated during the previous 24 hours are maintained in 95 additional 15-minute registers.

DS1 performance monitoring

Tariffed service verification consists of monitoring performance parameters that can be associated with the customer's end-to-end service. Alcatel-Lucent 1850 TSS-5 provides this capability for DS1 services with the DS1 performance monitoring feature. Based on *ANSI T1.403*, Alcatel-Lucent 1850 TSS-5 provides both Superframe Format (SF) and extended superframe format (ESF). With the SF format the F-bits are used for framing only and near-end PM is provided. With ESF format, the F-bits and the extended superframe format are used. The ESF format retrieves performance messages written into the ESF data link by the customer's terminal equipment. From these ESF messages, the Alcatel-Lucent 1850 TSS-5 can determine and report near-end and far-end error performance of the entire DS1 link. Thresholds are set for DS1 PM parameters. Reports

of thresholds being exceeded can be used to indicate degraded performance. The number of threshold crossing occurrences are retrieved by the message-based operations system to determine if the service is operating within tariffed limits.

DS3 performance monitoring

Alcatel-Lucent 1850 TSS-5 provides DS3 performance monitoring with three DS3 path PM options: P-bit (parity bit), adjusted F&M bit (frame and multi-frame bit), and C-bit.

P-Bit

When FMT is set to P-bit, P-bit errors are used as the basis for determining code violation counts. When provisioned for P-bit, the system calculates and provides counts of DS3 P-bit coding violations (CV), errored seconds (ES), and unavailable seconds (UAS) incoming from the fiber. Quarter-hour and day registers are provided with provisionable threshold crossing alerts (TCAs) on a per-shelf basis. Severely errored frame seconds (SEFS) are also monitored.

Because P-bits can be corrected at nodes provisioned for VMR along a DS3 path, the DS3 P-bit PM data may not provide a complete report of the end-to-end DS3 path errors.

Adjusted F&M bit

When FMT is set to FM-bit, F & M bits are used as the basis for determining code violation counts. Adjusted F&M bit performance monitoring provides an alternative method for determining and accumulating DS3 path performance data based on an error estimation technique using errors on the F&M framing bits to approximate the actual error counts in the DS3 path payload. F&M bits are not corrected at nodes provisioned for VMR along a DS3 path. When provisioned for adjusted F&M bit, the system calculates and provides estimated counts of DS3 adjusted F&M bit coding violations (CV), errored seconds (ES), severely errored seconds (SES), and unavailable seconds (UAS) incoming from the fiber.

Quarter-hour and current day registers are provided with provisionable threshold crossing alerts (TCAs) on a per-shelf basis. Severely errored frame/AIS seconds (SAS-P) are also monitored.

C-Bit

When FMT is set to cbit, C-bit errors are used as the basis for determining code violation counts.

The system provides counts of DS3 C-Bit parity coding violations (CV-P), errored seconds (ES-P), severely errored seconds (SES-P), and unavailable seconds (UAS-P) incoming from the DSX-3 and the fiber. The type of performance monitoring is provisioned per DS3 service by a CIT command.

For C-bit PM, the DS3 service can be provisioned in violation monitor (VM) or violation monitor and removal (VMR) modes. In VM mode, the C-bit errors are not corrected as in the P-bit option.

Quarter-hour and day registers are provided with provisionable threshold crossing alerts (TCAs). The TCAs are provisionable on a per-shelf basis. Severely errored frame seconds (SEFS) counts are also provided.

Section parameter

No Far-End PM parameters are defined for the Section layer. The system, as it receives SONET/PDH signals, terminates the SONET/PDH Section and Line layers and therefore is involved with Section layer PM. Section layer PM applies to optical and electrical SONET/PDH interfaces. It also applies to service and protection sections of optical sections.

Line parameter

A SONET/PDH line is a physical transport vehicle that provides the means of moving digital information between two points in a network. The line is characterized by a transmission medium and its specific coding type. A line is bounded by its two end points, known as line terminations. A line termination is the point where the bipolar line signal is generated and transmitted, or received and decoded.

Multiplex section parameter

A multiplex section is a physical transport link that moves digital information between two cross-connect points in an SDH network. A multiplex section is bounded by two end points, where the electrical or optical signal is cross-connected and transmitted, or received. A multiplex section supporting SDH operation, can be an STM-1 or STM-4 facility. The multiplex section (MS) parameters of Alcatel-Lucent 1850 TSS-5 are used to monitor the performance of lines that support SDH operation, to determine their health.

Regenerator section parameter

A regenerator section is a physical transport link that moves digital information between two successive SDH network elements that perform signal regenerator. A regenerator section can be between two regenerators, a multiplexer and a regenerator, or between two multiplexers, when no intermediate regenerators are required. The regenerator layer is managed using the RSOH (regenerator Section Overhead) bytes of the STM-n frame to give warnings of errors and alarms. A regenerator section supporting SDH operation, can be an STM-1 or STM-4 facility. The regenerator section (RS) parameters of Alcatel-Lucent 1850 TSS-5 are used to monitor the performance of lines that support SDH operation, to determine their health.

Path parameter

A path is a framed stream between two points in a SONET or SDH network at a specified rate, independent of the equipment and media providing the physical transport. A path is defined by its two end points, called path terminations, where its frame structure is generated and decoded. A path may be switched and carried over multiple lines segments of different bandwidths, as long as the line segments can accommodate the bandwidth specified for the path. For Alcatel-Lucent 1850 TSS-5 that are equipped with VLNC2 and VLNC50/52 circuit packs, the path parameters are used to monitor the performance of a path to determine its health.

Ethernet performance monitoring

Alcatel-Lucent 1850 TSS-5 provides PM capabilities Ethernet interfaces. For the Gigabit Ethernet interface on the VLNC50/52 circuit pack and the Fast Ethernet interfaces on the VLNC35 circuit pack, PM data is collected at the interface for both incoming and outgoing directions. The interface provides a connection to a SONET/SDH Virtual Concatenation Group (VCG). The performance of the Ethernet interfaces supported by the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs is monitored using SNMP traps.

Threshold Crossing Alert reports

Thresholds can be set for the number of errors or violations that occur for SONET section and line, SDH regenerator section and multiplex section, Ethernet, and PDH (DS1, E1, DS3) line or path parameters in a 15 minute or 24 hour period. When a 15 minute or 24 hour threshold is exceeded, or crossed, a Threshold Crossing Alert (TCA) occurs.

Threshold crossing alerts are clearly identified and the time the performance registers were last initialized is also shown. Any registers that may have been affected by this initialization are marked. There are separate reports for section, line, and path parameters, as well as Ethernet parameters.

For the VLNC50/52 and VLNC35 circuit packs, line and path TCA reporting may be enabled or disabled using the TL1 TCAMD parameter, or through the GUI interface provided by *WaveStar*® CIT software. For the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs, retrievable PM data is accumulated and reported according to SNMP PM objects, that are returned in SNMP tables and MIBs. Threshold reporting is provisionable, individually, at the port, line, or path level, and for Ethernet interfaces.

DS1 performance monitoring parameters

Overview

This section describes the performance monitored parameters relevant to DS1 signals incoming from the fiber or DSX-1. DS1 signals and the monitored parameters for these signals are supported when Alcatel-Lucent 1850 TSS-5 is equipped with a VLNC2 and VLNC50/52 circuit packs.

Performance monitoring

Performance is monitored by observing the number of errors or violations that occur for line or path parameters. This information is accumulated and stored in the current 15-minute and 24-hour registers. A second 24-hour register maintains the number of errors recorded during the previous 24 hours. The number of errors accumulated during the previous 8 hours are maintained in 31 additional 15-minute registers.

Threshold Crossing Alert reports

Thresholds can be set for the number of errors or violations that occur for line or path parameters in a 15 minute or 24 hour period. When a 15 minute or 24 hour threshold is exceeded, or crossed, a Threshold Crossing Alert (TCA) occurs.

Threshold crossing alerts are clearly identified and the time the performance registers were last initialized is also shown. Any registers that may have been affected by this initialization are marked. There are separate reports for section, line, and path parameters, as well as Ethernet parameters.

Line and path TCA reporting may be enabled or disabled using the TL1 TCAMD parameter, or through the GUI interface provided by CIT software. Threshold reporting is provisionable, individually, at the port, line, or path level, and for Ethernet interfaces.

DS1 ESF format

Tariffed service verification consists of monitoring performance parameters that can be associated with the customer's end-to-end service. Based on *ANSI T1.403* extended superframe format (ESF), this capability retrieves performance messages written into the ESF data link by the customer's terminal equipment. From these messages, Alcatel-Lucent 1850 TSS-5 can determine and report the end-to-end error performance of the entire DS1 link *as seen by the customer*. The counts are retrieved by the message-based operations system to determine if the service is operating within tariffed limits.

DS1 SF format

Each DS1 circuit pack measures the near-end performance of the incoming DS1 signals, allowing the service provider to determine if a good DS1 signal was received from the customer before transporting it through the network. This information can then aid in localizing any reported performance problems. The DS1 circuit packs can also provide this same near-end information for super frame (SF) formatted (sometimes known as D4 framing) DS1 services, but complete end-to-end performance verification is limited due to the lack of the PRM in the SF format.

Monitored parameters

The following table lists the DS1 line and path performance parameters that Alcatel-Lucent 1850 TSS-5 monitors, including the default and ranges for the 15-minute and 1-day (24-hour) registers.

Table 5-9 DS1 performance parameters

Facility	Measured Provisionable Parameter	15-Min		1-Day	
		Default	Range ¹	Default	Range ¹
DS1 Line	Errored Seconds (ES-L)	65	0–900	648	0–65535
DS1 Path	Coding Violations (fmt=SF) (CV-P)	72	0–16383	691	0–1048575
	Coding Violations (fmt=ESF) (CV-P)	13296	0–16383	132960	0–1048575
	Coding Violations Far End (CV-PFE)				
	Errored Seconds (ES-P)	65	0–900	648	0–65535
	Errored Seconds Far End (ES-PFE)				
DS1 Path	Severely Errored Seconds (SES-P)	10	0–900	100	0–65535
	Severely Errored Seconds Far End (SES-PFE)				
	Unavailable Seconds (UAS-P)	10	0–900	10	0–65535
	Unavailable Seconds Far End (UAS-PFE)				
	SE Frame/Alarm Indication Signal Seconds (SAS-P) SE Frame Seconds Far End (SEFS-PFE)	2	0–900	17	0–65535

Notes:

1. When an individual performance monitoring parameter threshold is provisioned as zero (0), TCA reporting for the affected parameter is disabled.

DS1 line parameters

Alcatel-Lucent 1850 TSS-5 monitors the following near end DS1 line parameter on incoming (from the DSX-1 cross-connect) DS1 signals. The parameter is measured at the input of the DS1 circuit pack on the DS1 line side (also referred to as facility, customer terminal, or DSX side).

Errored seconds (ES-L)

The near end ES-L parameter increments once for each second during which Alcatel-Lucent 1850 TSS-5 detects either one or more bipolar violations (BPVs) or excessive zeros (EXZ), or one or more LOS defects.

DS1 line PM report

Use the **Performance → View PM Reports → DS1 Line** command to obtain the DS1 Line PM Report. Near end DS1 line PM is reported with an AID of the DS1 interface and a modifier of T1. For more information about the DS1 line parameter and the **Performance → View PM Reports → DS1 Line** command, refer to the *WaveStar*® CIT online help.

Near end DS1 path parameters

Alcatel-Lucent 1850 TSS-5 monitors the following near end DS1 path parameters at the local network element. The parameters are measured at the input of the local DS1 circuit pack on the DS1 line side (also referred to as facility, customer terminal, or DSX side).

Coding violations (CV-P)

For the SF format, the CV-P parameter increments once for each frame synchronization bit error (FE) detected at the path level. For the ESF format, the CV-P parameter increments once for each cyclic redundancy check error (CRC) detected at the path level.

Errored seconds (ES-P)

For the SF format, the ES-P parameter increments once for each second during which Alcatel-Lucent 1850 TSS-5 detects FE errors, CS events, SEF defects, or AIS defects. For the ESF format, the ES-P parameter increments once for each second during which Alcatel-Lucent 1850 TSS-5 detects CRC errors, CS events, SEF defects, or AIS defects.

Severely errored seconds (SES-P)

For the SF format, the SES-P parameter increments once for each second during which Alcatel-Lucent 1850 TSS-5 detects 8 or more FE events (if Ft and Fs bits are measured) or 4 or more FE events (if only Ft bits are monitored), or SEF defects, or AIS defects.

Unavailable seconds (UAS-P)

A UAS-P is a second during which the path is unavailable. A path is considered unavailable from the beginning of 10 consecutive severely errored seconds until the beginning of 10 consecutive seconds, none of which are severely errored.

Severely errored frame/alarm indication signal seconds (SAS-P)

The SAS-P parameter increments once for each second during which Alcatel-Lucent 1850 TSS-5 detects either one or more severely errored frame defects, or one or more AIS defects. The SAS-P parameter applies to SF and ESF frame formats.

Near end DS1 path PM report

Use the **Performance → View PM Reports → DS1 Line** command to obtain the DS1 Path PM Report. Near end DS1 path PM is reported with an AID of the DS1 interface and a modifier of T1. For more information about the DS1 path parameters and the **Performance → View PM Reports → DS1 Line** command, refer to the *WaveStar®* CITonline help.

Far end DS1 path parameters

Alcatel-Lucent 1850 TSS-5 monitors the following far end DS1 path parameters at the local network element. If the far end network element detects an incoming error, the far end network element communicates the error back to the local near end network element using Performance Report Message (PRM) frames or a Remote Alarm Indication (RAI) signal.

The far end parameters are measured at the input of the local DS1 circuit pack on the DS1 line side (also referred to as facility, customer terminal, or DSX side).

Important! The format must be set to ESF to monitor the far end parameters (CV-PFE, ES-PFE, SES-PFE, and UAS-PFE).

Coding violations far end (CV-PFE)

The CV-PFE parameter increments based on the PRM G bits defined in the following table.

Table 5-10 CV-PFE parameter increments

PRM Bit = 1	CV Count Accumulated
G1	1
G2	5
G3	10
G4	100
G5	319
G6	333

Errored seconds far end (ES-PFE)

The ES-PFE parameter is a count of one second PRM intervals containing an RAI or RAI-CI signal, or a 1 in any of the following bits: G1, G2, G3, G4, G5, G6, SE, or SL.

Severely errored seconds far end (SES-PFE)

The SES-PFE parameter is a count of one second PRM intervals containing an RAI or RAI-CI signal or a 1 in any of the following bits: G6 or SE.

Unavailable seconds far end (UAS-PFE)

A UAS-PFE is a second during which the path is unavailable. A path is considered unavailable from the beginning of 10 consecutive severely errored seconds until the beginning of 10 consecutive seconds, none of which are severely errored.

Severely errored frame seconds (SEFS-PFE)

The SEFS-PFE parameter is a count of 1 second PRM intervals that SE bit is equal to 1.

Far end DS1 path PM report

Use the **Performance → View PM Reports → DS1 Line** command to obtain the DS1 Path PM Report. Far end DS1 path PM is reported with an AID of the DS1 interface and a modifier of T1. For more information about the DS1 path parameters and the **Performance → View PM Reports → DS1 Line** command, refer to the *WaveStar®* CIT online help.

DS3 performance monitoring parameters

Overview

This section describes the performance monitoring parameters that are monitored on DS3 signals incoming from the high speed fiber and from the local DSX-3 cross-connect.

In order to generate DS3 PM reports, the port Primary State must be IS (in service). (When the PST parameter is provisioned as AUTO and a valid DS3 signal is detected, the PST parameter automatically transitions to the IS state.) The VM mode should be off because the P-bits can be corrected at nodes where the VM Mode is provisioned on, and the DS3 P-bit PM data may not provide a complete report of the end-to-end DS3 path errors.

Monitored parameters

The following table lists the DS3 line and path performance parameters that Alcatel-Lucent 1850 TSS-5 monitors, including the default and ranges for the 15-minute and 1-day (24-hour) registers.

Table 5-11 DS3 performance parameters

Facility	Measured Provisionable Parameter	15-Min		1-Day	
		Default	Range ¹	Default	Range ¹
DS3 Line	Coding Violations (CV-L)	387	0–16383	3865	0–1048575
	Errored Seconds (ES-L), ES-L FE	25	0–900	250	0–65535
	Severely Errored Seconds (SES-L)	4	0–900	40	0–65535
DS3 Path	Coding Violations (CV-P) Coding Violations Far End (CV-PFE)	382	0–16383	3820	0–1048575
	Errored Seconds (ES-P) Errored Seconds Far End (ES-PFE)	25	0–900	250	0–65535
	Severely Errored Seconds (SES-P) Severely Errored Seconds Far End (SES-PFE)	4	0–900	40	0–65535
	Unavailable Seconds (UAS-P) Unavailable Seconds Far End (UAS-PFE)	10	0–900	10	0–65535
	SE Frame/Alarm Indication Signal Seconds (SAS-P) SE Frame/Alarm Indication Signal Seconds Far End (SAS-PFE)	2	0–900	8	0–65535

Notes:

1. When an individual performance monitoring parameter threshold is provisioned as zero (0), TCA reporting for the affected parameter is disabled.

DS3 line parameters

Alcatel-Lucent 1850 TSS-5 monitors the following ingress near end DS3 line parameters on incoming (from the DSX-3 cross-connect) DS3 signals. Ingress refers to performance monitoring parameters that are measured at the input of the DS3 circuit pack on the DS3 line side (also referred to as facility, customer terminal, or DSX side).

Supported performance monitoring signal formats

Alcatel-Lucent 1850 TSS-5 supports DS3 line performance monitoring on DS3 signals with P-bit parity, FM-bit parity, or CP-bit parity performance monitoring signal formats.

Coding violations (CV-L)

The near end CV-L parameter increments once for each bipolar violation (BPV) and excessive zeros (EXZ) detected at the DS3 line layer.

Errored seconds (ES-L)

The near end ES-L parameter increments once for each second during which Alcatel-Lucent 1850 TSS-5 detects either one or more bipolar violations (BPVs) or excessive zeros (EXZ), or one or more LOS defects.

Severely errored seconds (SES-L)

The near end SES-L parameter increments once for each second during which Alcatel-Lucent 1850 TSS-5 detects either one or more LOS defects, 2444 or more BPVs at a minimum BER of 7.5×10^{-5} , or 45 or more BPVs at a minimum BER of 1×10^{-6} .

DS3 line PM report

Use the **Performance → View PM Reports → DS3 Line** command to obtain the DS3 Line PM Report. Ingress near end DS3 line PM is reported with an AID of the DS3 interface and a modifier of T3. For more information about the DS3 line parameters and the **Performance → View PM Reports → DS3 Line** command, refer to the *WaveStar*® CIT online help.

DS3 path performance monitoring signal format

Alcatel-Lucent 1850 TSS-5 supports the following DS3 path performance monitoring signal formats:

- P-bit parity: The P bits are monitored for detecting code violations at the near end.
- FM-bit parity: The F and M bits are monitored for detecting code violations at the near end.
- CP-bit parity: CP-bit parity is used for end-to-end DS3 path PM (near end and far end). The C bits are monitored for code violations. CP-bit parity is only allowed on DS3 signals with the C-bit signal format.

P-bit parity

When provisioned for P-bit parity, Alcatel-Lucent 1850 TSS-5 calculates and provides counts of the following near end DS3 path parameters incoming from the fiber or DSX-3:

- Coding violations (CV-P)
- Errored seconds (ES-P)
- Severely errored seconds (SES-P)
- Unavailable seconds (UAS-P)
- Severely errored frame/alarm indication signal seconds (SAS-P)

FM-bit parity

FM-bit parity provides an alternative method for determining and accumulating DS3 path performance data based on an error estimation technique using errors on the F&M framing bits to approximate the actual error counts in the DS3 path payload.

Adjusted F&M bit performance monitoring estimates the following near end DS3 path parameters incoming from the fiber or DSX-3:

- Coding violations (CV-P)
- Errored seconds (ES-P)
- Severely errored seconds (SES-P)
- Unavailable seconds (UAS-P)
- Severely errored frame/alarm indication signal seconds (SAS-P)

CP-bit parity

When provisioned for CP-bit parity, Alcatel-Lucent 1850 TSS-5 calculates and provides counts of the following DS3 near end and far end path parameters incoming from the fiber or DSX-3:

- Coding violations (CV-P)
- Errored seconds (ES-P)
- Severely errored seconds (SES-P)
- Unavailable seconds (UAS-P)
- Severely errored frame/alarm indication signal seconds (SAS-P)

Violation monitoring and removal

The DS3 path performance monitoring signal formats support provisionable P-bit monitoring and correction (violation monitoring mode) on the outgoing DS3 signal toward the DS3 facility.

The following table shows the provisionable DS3 signal formats, performance monitoring signal formats, and VM modes.

Table 5-12 DS3 signal formats, PM signal formats, and VM modes

DS3 Signal Format	Performance Monitoring Signal Format	VM Mode	Monitor P-Bits	Correct P-Bits
C-Bit	P-bit parity	On	X	X
		Off	X	
	FM-bit parity	On		X
		Off		
	CP-bit parity	On		X
		Off		

Near end DS3 path parameters

Alcatel-Lucent 1850 TSS-5 monitors the following ingress and egress near end DS3 path parameters at the local network element. Ingress refers to parameters that are measured on incoming DS3 signals at the input of the local DS3 circuit pack on the DS3 line side (also referred to as facility, customer terminal, or DSX side). Egress refers to parameters that are measured on incoming DS3 signals at the input of the local DS3 port unit on the SONET side (also referred to as fiber side).

Coding violations (CV-P)

The near end CV-P parameter increments once for each parity error detected at the path level. The CV-P parameter applies to all performance monitoring signal formats.

In the P-bit parity signal format, non-identical P-bits corresponding to the same DS3 M-frame also increment the CV-P parameter.

For CP-bit parity signal format, the three C-bits in subframe 3 of a C-bit formatted DS3 frame carry the DS3 path-parity information. At the DS3 transmitter, the CP bits in the DS3 C-bit frame are set equal to the two P-bits in frame "n". These CP bits are then inserted into frame "n+1". Since the CP bits are not modified in any way while passing through the network, the DS3 receiver can determine if errors occurred in the DS3 path. The DS3 receiver computes the parity of frame "n" and compares that parity with the value received in the CP bits in frame "n+1". If the values do not match, DS3 path parity violations are counted.

Errored seconds (ES-P)

The near end ES-P parameter increments once for each second during which Alcatel-Lucent 1850 TSS-5 detects either one or more parity errors, one or more SEF defects, or one or more AIS defects. The ES-P parameter applies to all performance monitoring signal formats.

Severely errored seconds (SES-P)

The near end SES-P parameter increments once for each second during which Alcatel-Lucent 1850 TSS-5 detects either one or more AIS or SEF defects, 2444 or more BPVs at a minimum BER of 7.5×10^{-5} , or 45 or more BPVs at a minimum BER of 1×10^{-6} . The SES-P parameter applies to all performance monitoring signal formats.

Unavailable seconds (UAS-P)

A near end UAS-P is a second during which the path is unavailable. A path is considered unavailable from the beginning of 10 consecutive severely errored seconds until the beginning of 10 consecutive seconds, none of which are severely errored. The UAS-P parameter applies to the P-bit parity and FM-bit parity performance monitoring signal formats.

Severely errored frame/alarm indication signal seconds (SAS-P)

The SAS-P parameter increments once for each second during which Alcatel-Lucent 1850 TSS-5 detects either one or more severely errored frame defects, or one or more AIS defects. The SAS-P parameter applies to all performance monitoring signal formats.

Near end DS3 path PM report

Use the **Performance → View PM Reports → DS3 Path** command to obtain the DS3 Path PM Report. Ingress near end DS3 path PM is reported with an AID of the DS3 interface and a modifier of T3. Egress near end DS3 path PM is reported with an AID of the SONET interface and a modifier of T3. For more information about the DS3 path parameters and the **Performance → View PM Reports → DS3 Path** command, refer to the *WaveStar*® CIT online help.

E1 performance parameters

Overview

This section describes the performance monitoring parameters that are applicable to E1 signals.

Monitored parameters

The following table lists the E1 line performance parameters that Alcatel-Lucent 1850 TSS-5 monitors, including the default and ranges for the 15-minute and 1-day (24-hour) registers.

Table 5-13 E1 performance parameters

Facility	Measured Provisionable Parameter	15-Min		1-Day	
		Default ¹	Range (Note)	Default	Range ¹
E1 Line	Errored Seconds (ES-L)	65	0–900	648	0–65535
	Severely Errored Seconds (SES-L)	10	0–900	100	0–65535
E1 Path	Background Block Errors - Path, Path Far End (BBE-P, BBE-PFE)	13296	0–16383	132960	0–1048575
	Errored Seconds - Path, Path Far End (ES-P, ES-PFE)	65	0–900	648	0–65535
	Severely Errored Seconds - Path, Path Far End (SES-P, SES-PFE)	10	0–900	100	0–65535
	Unavailable Seconds - Path, Path Far End (UAS-P, UAS-PFE)	10	0–900	10	0–65535

Notes:

1. When an individual performance monitoring parameter threshold is provisioned as zero (0), TCA reporting for the affected parameter is disabled.

E1 line parameters

Alcatel-Lucent 1850 TSS-5 monitors the following near end line parameters on incoming (from the local cross-connect) E1 signals. The parameters are measured at the input of the circuit pack on the E1 line side (also referred to as facility, customer terminal, or STSX-1 side).

Errored seconds (ES-L)

The Near-End Line Errored Seconds (ESL) parameter for each Line is monitored. The Near-End CVL parameter increments once for every second that contains at least one BIP error detected at the Line layer (at any point during the second), or an AIS-L defect was present. The Far-End Line Errored Seconds parameter for each line is monitored. The

Far-End ESL parameter increments once for each second where one or more Far-End Line layer BIP errors are detected as reported by the REI-L indication of the line overhead or an RDI-L defect is detected.

Severely errored seconds (SES-L)

The Near-End Line Severely Errored Seconds (SESL) parameter for each Line is monitored. The Near-End SESL parameter increments once for every second that contains more than a specified number of BIP errors detected at the Line layer (at any point during the second), or an AIS-L defect was present. The specified number of tolerated BIP errors is hard-coded, see [Table 5-13, “E1 performance parameters” \(p. 5-67\)](#) for a list of the values.

The Far-End Line Severely Errored Seconds parameter for each line is monitored. The Far-End SESL parameter increments once for each second where more than a specified number of Line layer BIP errors are detected as reported by the REI-L indication of the line overhead or an RDI-L defect is detected. The integer value for the number of tolerated errors is set by standards and is selectable.

E1 line PM report

Use the **Performance** → **Reports** → **E1 Line** command to obtain the E1 Line PM Report. For more information about the E1 line parameters and the **Performance** → **Reports** → **E1 Line** command, refer to the *WaveStar*® CIT online help.

E1 path parameters

Alcatel-Lucent 1850 TSS-5 monitors the following near end path parameters on incoming (from the local cross-connect) E1 signals. The parameters are measured at the input of the circuit pack on the E1 line side (also referred to as facility, customer terminal, or STSX-1 side).

Background block errors (BBE-P)

The Near-End E1 Background Block Errors (BBE-P) parameter for each E1 Path is monitored. The number of Near-End BBE-Ps in a one second period is equal to the Near-End EBC if the second is not a Near-End SES. Otherwise, the BBE-P is set to zero for that second.

The Far-End E1 Background Block Errors (BBE-P) parameter for each E1 Path is monitored. The number of Far-End E1 BBE-Ps in a one second period is equal to the Far-End EBC if the second is not a Far-End SESP and there is not a Near-End Defect. Otherwise, the BBE-P is set to zero for that second.

The BBE-P parameter applies only to the CRC-4 MultiFrame format.

Errored seconds (ES-P)

The Near-End E1 Path Errored Seconds (ESP) parameter for each E1 signal is monitored. The ESP parameter applies to both FAS format and CRC-4 MultiFrame format.

For the FAS format, the ESP parameter increments once for each one second interval containing one or more errored FAS anomalies, or one or more defects.

For the CRC-4 MultiFrame format, the ESP parameter increments once for each one second interval containing CRC-4 block errors, or one or more defects.

The Far-End E1 Path Errored Seconds (ESP) parameter for each E1 path is monitored. The Far-End ESP parameter applies to both FAS format and CRC-4 MultiFrame format.

For the FAS format, the Far-End ESP parameter increments once for each one second interval containing one or more RDI defects and there is not a Near-End Defect.

For the CRC-4 MultiFrame format, the Far-End ES parameter increments once for each one second interval containing one or more RDI defects, or a Far-End Block Error (FEBE), and there is not a Near-End Defect.

If the A-Bit equals 1 in four or more double frames, then there is an RDI defect.

Severely errored seconds (SES-P)

The Near-End E1 Path Severely Errored Seconds (SESP) parameter for each E1 path is monitored. The SES parameter applies to both FAS frame and CRC-4 MultiFrame formats.

For the FAS format, the SES parameter increments once for each one second interval containing 28 or more frame bit errors, or one or more defects.

For the CRC-4 MultiFrame format, the SES parameter increments once for each one second interval containing 300 or more CRC-4 block errors, or one or more defects.

The Far-End E1 Path Severely Errored Seconds (SESP) parameter for each E1 path is monitored. The Far-End SESP parameter applies to both FAS format and CRC-4 MultiFrame format.

For the FAS format, the Far-End SESP parameter increments once for each one second interval containing one or more RDI defects and there is not a Near-End Defect.

For the CRC-4 MultiFrame format, the Far-End ESP parameter increments once for each one second interval containing one or more RDI defects, or 300 or more FEBEs and there is not a Near-End Defect.

If the A-Bit equals 1 in four or more double frames, then there is an RDI defect.

FEBE is based on the E-bit (ITU-T G.704).

Unavailable seconds (UAS-P)

The Near-End E1 Path UAS Seconds (UASP) parameter for each E1 path is monitored. The UAS parameter is a count of 1 second intervals for which the E1 path is unavailable at the onset of 10 contiguous SESSs. The 10 SESSs are included in the unavailable time. Once unavailable, the UAS continues to increment once for each second until ten

consecutive seconds without SES are detected. The 10 seconds without SESs are excluded from the unavailable time. The UAS parameter applies to both FAS frame and CRC-4 MultiFrame formats.

The Far-End E1 Path UAS Seconds (UASP) parameter for each E1 path is monitored. The Far-End UASP parameter is a count of 1 second intervals for which the E1 path is unavailable at the onset of 10 contiguous SESs. The 10 SESs are included in the unavailable time. Once unavailable, the Far-End UASP continues to increment once for each second until ten consecutive seconds without SES are detected. The 10 seconds without SESs are excluded from the unavailable time. The Far-End UASP parameter applies to both FAS frame and CRC-4 MultiFrame formats.

E3 performance parameters

Overview

E3 performance monitoring is not supported in this release.

VT1.5 performance parameters

Overview

This section describes the terminated SONET VT1.5 performance monitoring parameters. Terminated SONET VT1.5 path performance monitoring applies to VT1.5 paths cross-connected to a non-SONET interface (for example, DS1).

Monitored parameters

The following table lists the SONET VT1.5 path performance parameters that Alcatel-Lucent 1850 TSS-5 monitors, including the default and ranges for the 15-minute and 1-day (24-hour) registers.

Table 5-14 SONET VT1.5 performance parameters

Facility	Measured Provisionable Parameter	15-Min		1-Day	
		Default	Range ¹	Default	Range ¹
VT1.5 Path	V5 Errored Seconds (ES-P)	40	0–900	900	0–65535
	V5 Severely Errored Seconds (SES-P)	40	0–900	900	0–65535
	V5 Unavailable Seconds (UAS-P)	40	0–900	900	0–65535

Notes:

1. When an individual performance monitoring parameter threshold is provisioned as zero (0), TCA reporting for the affected parameter is disabled.

VT1.5 path parameters

Alcatel-Lucent 1850 TSS-5 monitors the following near end SONET VT1.5 path parameters on incoming (from the SONET interface) VT1.5 signals.

Errored seconds (ES-P)

The Near-End STS Path Errored Seconds (ESP) parameter for each SONET path is monitored. The ESP parameter increments once for each second where one or more STS Path layer BIP errors are detected or an AIS-P, LOP-P, or UNEQ-P defect is detected. BIP errors are not monitored for VTs.

Severely errored seconds (SES-P)

The Near-End STS Path Severely Errored Seconds (SESP) parameter for each SONET path is monitored. The SESP parameter increments once for each second where 15 or more STS Path layer BIP errors are detected or an AIS-P, LOP-P, or UNEQ-P defect is detected. Alcatel-Lucent 1850 TSS-5 detects 1-bit RDI, but treats it as though it is the high order bit of a 3-bit ERDI in that it includes UNEQ.

Unavailable seconds (UAS-P)

The Near-End STS Path Unavailable Seconds (UASP) parameter for each SONET path is monitored. The UASP parameter increments once for each second where SESP is detected after ten consecutive seconds with SESP detected. UASP continues to increment once for each second until ten consecutive seconds without SESP are detected.

VC-n performance parameters

Overview

This section describes the terminated SDH VC performance monitoring parameters. Terminated SDH VC path performance monitoring applies to all supported VC paths.

Monitored parameters

The following table lists the SDH VC path performance parameters that Alcatel-Lucent 1850 TSS-5 monitors, including the default and ranges for the 15-minute and 1-day (24-hour) registers.

Table 5-15 SDH VC performance parameters

Facility	Measured Provisionable Parameter	15-Min		1-Day	
		Default	Range ¹	Default	Range ¹
VC-12 Path	Background Block Errors - Path (BBE-P)	75	0–16383	750	0–1048575
	Errored Seconds - Path (ES-P)	40	0–900	900	0–65535
	Severely Errored Seconds - Path (SES-P)	40	0–900	900	0–65535
	Unavailable Seconds - Path (UAS-P)	40	0–900	900	0–65535
VC-4	Positive Pointer Justification Counts (PPJC-PDET)	30	0–1800000	2800	0–172800000
	Negative Pointer Justification Counts (NPJC-PDET)	30	0–1800000	2800	0–172800000
	Background Block Errors - Path (BBE-P)	25	0–16383	250	0–1048575
	Errored Seconds - Path (ES-P)	20	0–900	200	0–65535
	Severely Errored Seconds - Path (SES-P)	3	0–900	7	0–65535
	Unavailable Seconds - Path (UAS-P)	10	0–900	10	0–65535
VC-3	Background Block Errors - Path (BBE-P)	15	0–16383	125	0–1048575
	Errored Seconds - Path (ES-P)	12	0–900	100	0–65535
	Severely Errored Seconds - Path (SES-P)	3	0–900	7	0–65535
	Unavailable Seconds - Path (UAS-P)	10	0–900	10	0–65535

Notes:

1. When an individual performance monitoring parameter threshold is provisioned as zero (0), TCA reporting for the affected parameter is disabled.

VC-n path parameters

Positive pointer justifications counts detected (PPJC-PDET)

This parameter summarizes all Positive Pointer Justifications detected by the system. Alcatel-Lucent 1850 TSS-5 monitors positive line Pointer Justifications on a VC-4 in 1 second intervals. (Users may select which VC-4 to monitor by provisioning the PJC Monitoring point parameter using the **Performance** → **Provision PM** command.) The count increments for each incoming positive pointer justification.

Negative pointer justifications counts detected (NPJC-PDET)

This parameter summarizes all Negative Pointer Justifications detected by the system. Alcatel-Lucent 1850 TSS-5 monitors negative line Pointer Justifications on a VC-4 in 1 second intervals. (Users may select which VC-4 to monitor by provisioning the PJC Monitoring point parameter using the **Performance** → **Provision PM** command.) The count increments for each incoming negative pointer justification.

Background block errors (BBE-P)

The Near-End VC-n Background Block Errors (BBE-P) parameter for each VC-3 (low-order), VC-4, and VC-12 Path is monitored. The number of Near-End BBE-Ps in a one second period is equal to the Near-End EBC if the second is not a Near-End SES. Otherwise, the BBE-P is set to zero for that second.

Errored seconds (ES-P)

The Near-End VC-n Errored Seconds (ESP) parameter for each for each VC-3 (low-order), VC-4, and VC-12 Path is monitored. A Near-End VC-n ES parameter increments for each second in which there is one or more N_Bs (detected at the Low Order Path Layer) or a N_DS defect is present.

ITU-T standards refers to this parameter as N_ES, but for consistency within the Alcatel-Lucent 1850 TSS-5 product, this parameter is referred to as ES with a locn value of NEND to indicate that it is the Near-End Errored Seconds.

Severely errored seconds (SES-P)

The Near-End VC-n Severely Errored Seconds (SESP) parameter for each for each VC-3 (low-order), VC-4, and VC-12 Path is monitored. An Near-End VC-n SES parameter increments for each second in which the N_EBC is equal to or greater than a hard-coded value, or an N_DS defect is present. The integer hard-coded threshold is shown in [Table 5-15, “SDH VC performance parameters” \(p. 5-72\)](#). ITU-T standards refers to this parameter as N_SES, but for consistency within the Alcatel-Lucent 1850 TSS-5 product, this parameter is referred to as SES with a locn value of NEND to indicate that it is the Near-End Severely Errored Seconds parameter.

Unavailable seconds (UAS-P)

The Near-End VC-n Unavailable Seconds (UASP) parameter for each VC-3 (low-order), VC-4, and VC-12 Path is monitored. The Near-End VC-n UAS parameter increments once for every second that the Low Order Path was considered unavailable (at any point during the second). A Low Order Path becomes unavailable at the onset of 10 consecutive seconds that qualify as Near-End VC-n SESP, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as Near-End VC-n SES.

The (un)available time can not be determined if it is unknown whether the previous 10 seconds are Severely Errored on non-Severely Errored. Thus the SES must be processed to determine whether the SES are consecutively present or absent. ITU-T standards refers to this parameter as N_UAS, but for consistency within the Alcatel-Lucent 1850 TSS-5 product, this parameter is referred to as UAS with a locn value of NEND to indicate that it is the Near-End Unavailable Seconds.

STM-n performance parameters

Overview

This section describes the performance monitoring parameters on STM-1 and STM-4 regenerator sections and multiplex sections that are terminated on the system.

Monitored parameters

The following table lists the SDH STM-1 and STM-4 path performance parameters that Alcatel-Lucent 1850 TSS-5 monitors, including the default and ranges for the 15-minute and 1-day (24-hour) registers.

Table 5-16 SDH STM-1/STM-4 performance parameters

Section type	Measured Provisionable Parameter	15-Min		1-Day	
		Default	Range ¹	Default	Range ¹
Regenerator section	Near-end Errored Seconds (RS-N-ES)	180	0–900	1500	0–86400
	Near-end Severely Errored Seconds (RS-N-SES)	15	0–810	20	0–77760
	Near-end Background Block Errors (RS-N-BBE)	9000	0–7199100	48000	0–691113600
	Near-end Unavailable Seconds (RS-N-UAS)	15	0–900	20	0–86400

Table 5-16 SDH STM-1/STM-4 performance parameters (continued)

Section type	Measured Provisionable Parameter	15-Min		1-Day	
		Default	Range ¹	Default	Range ¹
Multiplex section	Near-end Errored Seconds (MS-N-ES)	50	0–900	150	0–86400
	Near-end Severely Errored Seconds (MS-N-SES)	10	0–810	15	0–77760
	Near-end Background Block Error (MS-N-BBE)	STM-1: 228000 STM-4: 912000	STM-1: 0–1727999100 STM-4: 0–691113600	STM-1: 432000 STM-4: 1728000	STM-1: 0–4294967295 STM-4: 0–4294967295
	Near-end Unavailable Seconds (MS-N-UAS)	15	0–911	20	86400
	Far-end Errored Seconds (MS-F-ES)	50	0–900	50	86400
	Far-end Severely Errored Seconds (MS-F-SES)	10	0–810	10	0–77760
	Far-end Background Block Error (MS-F-BBE)	STM-1: 228000 STM-4: 912000	STM-1: 0–1727999100 STM-4: 0–691113600	STM-1: 432000 STM-4: 1728000	STM-1: 0–4294967295 STM-4: 0–4294967295
	Far-end Unavailable Seconds (MS-F-UAS)	15	0–911	15	0–86400

Notes:

- When an individual performance monitoring parameter threshold is provisioned as zero (0), TCA reporting for the affected parameter is disabled.

STM-n section parameters

Alcatel-Lucent 1850 TSS-5 monitors the following near end SDH STM-n multiples and regenerator section parameters on incoming (from the SDH interface) STM-n signals.

Near-end errored seconds (RS-N-ES/MS-N-ES)

The Regenerator Section Near-end Errored Seconds (RS-N-ES) and Multiplex Section Near-end Errored Seconds (MS-N-ES) parameters for each SDH section are monitored. These parameters increment once for each second where one or more SDH errored blocks are detected at the associated regenerator or multiplex section layer.

Severely errored seconds (RS-N-SES/MS-N-SES)

The Regenerator Section Near-end Severely Errored Seconds (RS-N-SES) and Multiplex Section Near-end Severely Errored Seconds (MS-N-SES) parameters for each SDH section are monitored. The parameters increment once for each one-second interval in which the amount of block errors have exceeded the near-end SES threshold for the associated regenerator or multiplex section layer.

Background block errors (RS-N-BBE/MS-N-BBE)

The Regenerator Section Near-end Background Block Errors (RS-N-BBE) and Multiplex Section Near-end Background Block Errors (MS-N-BBE) parameter for each SDH section are monitored. The parameters increment once for each block error not occurring as part of a severely errored second on the associated regenerator or multiplex section layer.

Unavailable seconds (RS-N-UAS/MS-N-UAS)

The Regenerator Section Near-end Unavailable Seconds (RS-N-UAS) and Multiplex Section Near-end Unavailable Seconds (MS-N-UAS) parameters for each SDH section are monitored. The parameters determine the period of time during which the transmission route in the receive direction is not in an available state at the associated regenerator or multiplex layer. A period of unavailability begins at the onset of ten consecutive near-end severely errored seconds. These ten seconds are considered to be part of the unavailability period (UAP). A new period of availability begins at the onset of ten consecutive non-severely-errored seconds. These ten seconds are considered to be part of the availability period.

Far-end errored seconds (MS-F-ES)

The Multiplex Section Far-end Errored Seconds (MS-F-ES) parameter for each SDH section is monitored. The MS-F-ES parameter increments once for each second where one or more SDH errored blocks are detected at the far end of the multiplex section.

Severely errored seconds (MS-F-SES)

The Multiplex Section Far-end Severely Errored Seconds (MS-F-SES) parameter for each SDH section is monitored. The parameter increments once for each one-second interval in which the amount of block errors have exceeded the far-end SES threshold for the associated multiplex section.

Background block errors (MS-F-BBE)

The Multiplex Section Far-end Background Block Errors (MS-F-BBE) parameter for each SDH section is monitored. The parameter increments once for each block error detected at the far end, not occurring as part of a severely errored second on the associated multiplex section.

Unavailable seconds (MS-F-UAS)

The Multiplex Section Far-end Unavailable Seconds (MS-F-UAS) parameter for each SDH section is monitored. The parameter determines the period of time during which the transmission route in the transmit direction is not in an available state. A period of unavailability begins at the onset of ten consecutive severely errored seconds at the far end. These ten seconds are considered to be part of the unavailability period (UAP). A new period of availability begins at the onset of ten consecutive non-severely-errored seconds. These ten seconds are considered to be part of the availability period.

STS-n performance parameters

Overview

This section describes the performance monitoring parameters on terminated (STS-1 and STS-3c) and intermediate STS-n (STS-1 and STS-3c) paths that are cross-connected through the system. Intermediate SONET STS-n path performance monitoring applies to STS-n paths cross-connected to another SONET interface. Terminated SONET STS-n path performance monitoring applies to STS-n paths cross-connected to a non-SONET interface (for example, DS3).

Monitored parameters

The following table lists the SONET STS-n path performance parameters that Alcatel-Lucent 1850 TSS-5 monitors, including the default and ranges for the 15-minute and 1-day (24-hour) registers.

Table 5-17 SONET STS-n performance parameters

Facility	Measured Provisionable Parameter	15-Min		1-Day	
		Default	Range ¹	Default	Range ¹
STS-3c Path	Coding Violations (CV-P)	25	0–16383	250	0–1048575
STS-1 Path	Coding Violations (CV-P)	125	0–16383	150	0–1048575
STS-3c Path	Errored Seconds (ES-P)	20	0–900	200	0–65535
STS-1 Path	Errored Seconds (ES-P)	12	0–900	100	0–65535
STS-n Path	Unavailable Seconds (UAS-P)	10	0–900	10	0–65535

Notes:

1. When an individual performance monitoring parameter threshold is provisioned as zero (0), TCA reporting for the affected parameter is disabled.

STS-n path parameters

Alcatel-Lucent 1850 TSS-5 monitors the following near end SONET STS path parameters on incoming (from the SONET interface) STS-n signals.

Coding violations (CV-P)

The Near-End STS Path Coding Violations (CVP) parameter for each SONET path is monitored. The CVP parameter increments once for each BIP error detected at the STS path layer (the B3 byte of the incoming SONET STS Path overhead). Up to 8 BIP errors can be detected per frame.

Errored seconds (ES-P)

The Near-End STS Path Errored Seconds (ESP) parameter for each SONET path is monitored. The ESP parameter increments once for each second where one or more STS Path layer BIP errors are detected or an AIS-P, LOP-P, or UNEQ-P defect is detected.

Currently this product detects 1-bit RDI, but treats it as though it is the high order bit of a 3-bit ERDI in that it includes UNEQ.

Severely errored seconds (SESP-P)

The Near-End STS Path Severely Errored Seconds (SESP) parameter for each SONET path is monitored. The SESP parameter increments once for each second where 2400 or more STS Path layer BIP errors are detected or an AIS-P, LOP-P, or UNEQ-P defect is detected. Currently Alcatel-Lucent 1850 TSS-5 detects 1-bit RDI, but treats it as though it is the high order bit of a 3-bit ERDI in that it includes UNEQ.

Currently this product detects 1-bit RDI, but treats it as though it is the high order bit of a 3-bit ERDI in that it includes UNEQ.

Unavailable seconds (UASP-P)

The Near-End STS Path Unavailable Seconds (UASP) parameter for each SONET path is monitored. The UASP parameter increments once for each second where SESP is detected after ten consecutive seconds with SESP detected. UASP continues to increment once for each second until ten consecutive seconds without SESP are detected.

STS-n path PM report

Use the **Performance → View PM Reports → STSn Path** command to obtain the STS-n Path PM Report. For more information about the STS-n path parameters and the **Performance → View PM Reports → STSn Path** command, refer to the *WaveStar*® CIT online help.

OC-n performance parameters

Overview

This section describes the performance monitoring parameters that are applicable to SONET OC-n (OC-3, OC-12) signals.

Monitored parameters

The following table lists the SONET OC-n section and line performance parameters that Alcatel-Lucent 1850 TSS-5 monitors, including the default and ranges for the 15-minute and 1-day (24-hour) registers.

Table 5-18 SONET OC-n performance parameters

Facility	Measured Provisionable Parameter	15-Min		1-Day	
		Default	Range ¹	Default	Range ¹
OC-n Section	SE Frame Seconds (SEFS)	10	0–900	30	0–65535
OC-3 Line	Coding Violations (CV-L), CV-L FE	140	0–16383	1344	0–1048575
OC-12 Line	Coding Violations (CV-L), CV-L FE	560	0–16383	5376	0–1048575
OC-n Line	Errored Seconds (ES-L)	40	0–900	900	0–65535
	Severely Errored Seconds (SES-L)	30	0–900	90	0–65535
	Unavailable Seconds (UAS-L)	30	0–900	89	0–65535
	Protection Switch Count Line (PSC-L)	2	0–63	4	0–255
	Pointer Justification Count Difference (PJCDIFF-P)	60	0–1048575	5760	0–16777215

Notes:

1. When an individual performance monitoring parameter threshold is provisioned as zero (0), TCA reporting for the affected parameter is disabled.

OC-n line parameters

Alcatel-Lucent 1850 TSS-5 monitors the following near end SONET line parameters for incoming (from the lightguide cross-connect) OC-n signals. The parameters are measured at the input of the OC-n OLIU circuit pack on the OC-n line side (also referred to as LGX side).

Coding violations (CV-L)

The Near-End Line Coding Violation (CVL) parameter for each SONET Line is monitored. The Near-End CVL parameter increments once for every occurrence of a BIP error detected at the Line layer (i.e. using the B2 byte in the incoming SONET signal). Up to $8 \times N$ BIP errors can be detected per STS-n frame.

Errored seconds (ES-L)

The Near-End Line Errored Seconds (ESL) parameter for each SONET Line is monitored. The Near-End ESL parameter increments once for every second that contains at least one BIP error detected at the Line layer (at any point during the second), or an AIS-L defect was present.

Severely errored seconds (SES-L)

The Near-End Line Severely Errored Seconds (SESL) parameter for each SONET Line is monitored. The Near-End SESL parameter increments once for every second that contains an AIS-L defect.

Unavailable seconds (UAS-L)

The Near-End Line Unavailable Seconds (UASL) parameter for each SONET Line is monitored. The Near-End UASL parameter increments once for every second that the Line was considered unavailable (at any point during the second). A Line becomes unavailable at the onset of 10 consecutive seconds that qualify as Near-End SESLs, and continues to be unavailable until the onset of 10 consecutive seconds that do not qualify as Near-End SESLs.

Pointer justifications counts difference (PJCDIFF-P)

This is a calculation of the absolute value of the PJC parameters listed under the headings below. PJCDIFF-P is used to calculate the difference between calculate the difference between the PPJC-PGEN, NPJC-PGEN and between PPJC-PDET and NPJC-PDET. Alcatel-Lucent 1850 TSS-5 monitors the first good cross-connected STS or the provisioned STS. From this STS, the calculation is to (A) calculate the difference between the PPJC-PGEN, NPJC-PGEN. (B) Calculate the difference of the PPJC-PDET, NPJC-PDET. The resulting PJC is the absolute value of the difference between A and B.

OC-n line PM report

Use the **Performance → View PM Reports → OCn Line** command to obtain the OC-n Line PM Report. For more information about the OC-n line parameters and the **Performance → View PM Reports → OCn Line** command, refer to the *WaveStar*® CIT online help.

Ethernet performance monitoring parameters

Overview

Alcatel-Lucent 1850 TSS-5 SYSCTL circuit pack provides PM capabilities for the Gigabit Ethernet interface on the VLNC50/52 circuit pack and Fast Ethernet interfaces on the VLNC35 circuit pack. PM data is collected at the interface for both incoming and outgoing directions and is stored in quarter-hour and day bins. The interface provides a connection to a SONET Virtual Concatenation Group (VCG).

Ethernet interfaces supported by the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs are monitored separately, using the CLI.

TCAs

Provisionable threshold crossing alerts (TCAs) are supported on the Ethernet interfaces.

Monitored parameters

The following table lists the performance parameters that Alcatel-Lucent 1850 TSS-5 monitors for the Ethernet interfaces on the VLNC50/52 and VLNC35 circuit packs, including the ranges for the 15-minute and 1-day (24-hour) registers.

Table 5-19 Ethernet performance parameters

Facility	Monitored Parameter	15-Min		1-Day	
		Default	Range ¹	Default	Range ¹
Ethernet	Ethernet dropped frames (errors) (EDFE) ¹	70,000	0–7,000,000	900,000	0–90,000,000
	Incoming number of bytes (EINB)	70,000	0–7,000,000	900,000	0–90,000,000
	Incoming number of frames (EINF)	70,000	0–7,000,000	900,000	0–90,000,000
	Outgoing number of bytes (EONB)	70,000	0–7,000,000	900,000	0–90,000,000
	Outgoing number of frames (EONF)	70,000	0–7,000,000	900,000	0–90,000,000

Notes:

1. Counter can overflow.

Enabling/disabling

Performance monitoring is enabled/disabled via the *WaveStar*® CIT. From the System View menu, select **Provision > Prov PM Ports**, then navigate to the port.

VLNC50/52 and VLNC35 Ethernet parameters

Alcatel-Lucent 1850 TSS-5 monitors several Ethernet parameters.

Ethernet dropped frames (errors) (EDFE)

The EDFE parameter counts the number of incoming Ethernet frames dropped at a LAN/WAN port due to a frame check sequence (FCS) error or another defect in the frame.

Ethernet dropped frames (congestion) (EDFC)

The EDFC parameter counts the number of incoming Ethernet frames dropped at a LAN/WAN port due to congestion on the interface.

VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 Ethernet parameters

The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs are not controlled by the SYSCTL circuit pack and not monitored or managed through the *WaveStar*® CIT. The

VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs run independently and are managed via a separate CLI. For a detailed description of the Command Line Interface (CLI) messages used to interface with the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs and general information about using the Command Line Interface (CLI), refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide*.

In addition to the total number of packets received and transmitted from an interface, the following parameters can be displayed.

- Packets received without error
- Packets received with error
- Packets transmitted without error
- Transmit packet errors
- Collision frames
- Receive packets discarded
- Transmit packets discarded

Performance monitoring data storage

Quarter-hour and current day registers

Alcatel-Lucent 1850 TSS-5 provides current quarter-hour and current day registers for all accumulated performance parameters supported by the SYSCTL and VLNC50/52 circuit packs with TL1/*WaveStar*[®] CIT. For the VLNC50/52, VLNC35, and VLNC2, the number of errors accumulated during the previous 8 hours are maintained in 31 additional 15-minute registers. For the VLNC60, VLNC61, VLNC62, and VLNC64, the number of errors accumulated during the previous 24 hours are maintained in 95 additional 15-minute registers. The VLNC60/VLNC61/VLNC62/VLNC64 circuit packs support these registers through their CLI and SNMP.

Access

Alcatel-Lucent 1850 TSS-5 can initialize these registers through the *WaveStar*[®] CIT or OS, locally or remotely at any time, as well as retrieve and report their contents.

Performance parameter thresholds

Provisioning

The current quarter-hour and current day thresholds for each parameter type are provisionable, using the *WaveStar*[®] CIT, on a per-shelf basis. If values other than the defaults are used, only one value for each parameter type needs to be set.

Threshold-Crossing Alerts (TCAs)

Whenever the current quarter-hour or the current day threshold for a given parameter is exceeded, Alcatel-Lucent 1850 TSS-5 generates a threshold-crossing alert (TCA) that is entered into the performance monitoring exception report and reported to the OS through the TL1 interface and *WaveStar*[®] CIT for the VLNC50/52 and VLNC35 circuit packs, or through the CLI and SNMP for the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs.

TCA transmission to OS

Overview

The TCA information may be reported to the OS using the TL1 message-based OS interfaces. TCAs can be used to trigger proactive maintenance activity at the OS.

TL1 over TCP/IP access

The TL1 interfaces should be used to derive full benefit from Alcatel-Lucent 1850 TSS-5's performance monitoring capabilities. The full set of PM data stored by Alcatel-Lucent 1850 TSS-5 VLNC50/52 and VLNC35 circuit packs (TCAs and the contents of PM registers) is provided through the TL1 interface.

SNMP interface

Overview

Alcatel-Lucent 1850 TSS-5 supports Simple Network Management Protocol (SNMP) to retrieve system information and monitor system operation. SNMP is the most common protocol used by network management applications, and is the basis of most network management software. Alcatel-Lucent 1850 TSS-5 uses SNMPv2c protocol gets and traps to monitor system operation. The self-managed VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs independently support SNMPv3 protocol to monitor individual circuit pack operation.

SNMP applications use public and private Management Information Bases (MIBs) that define the equipment and Ethernet/SONET/SDH/PDH performance monitoring parameters (objects) and alarm/event messages (traps) that can be communicated. Public MIBs are specified in standards. Private MIBs are unique to Alcatel-Lucent 1850 TSS-5. The public and private MIBs are stored on the PC that is running the SNMP application. SNMP implementation on Alcatel-Lucent 1850 TSS-5 conforms with the MIBs listed in this section.

Alcatel-Lucent 1850 TSS-5 supports the following public (standard) and private MIBs:

- RFC 1907 Systems Group MIB
- RFC 2863 Interfaces Group MIB
- RFC 2358/RFC 2665 Ethernet PM MIB
- RFC 2558 SONET/SDH PM MIB
- RFC 2495 DS1/E1 PM MIB
- RFC 2496 DS3/E3 PM MIB
- Private Alarm MIB

- Private Equipment MIB
- Private Ethernet MIB
- Private SONET/SDH Day PM MIB
- Private DS1/E1 Day PM MIB
- Private DS3/E3 PM MIB Module
- Private DS3/E3 Day PM MIB Module
- Public (standard) and Private MIBs for the self-managed VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs.
- RFC 4878 IEEE 802.3 Clause 57 Link OAM MIB
- IEEE 802.1 Service OAM MIB

RFC 1907 Systems Group MIB

Alcatel-Lucent 1850 TSS-5 supports the following system-level RFC 1907 MIB parameters and traps.

Object	Definition
sysDescr	Name and version identification of the system's hardware and software
sysObjectID	Identification of the network management subsystem contained in the node
sysUpTime	Time since the network management portion of the system was last re-initialized
sysContact	Contact person and contact information for the node
sysName	Name of the node
sysLocation	Physical location of the node
sysServices	Services that this entity may potentially offer.
coldStart trap	NE is re-initializing itself and that its configuration may have been altered
authenticationFailure trap	NE has received a protocol message that is not properly authenticated.

RFC 2863 Interfaces Group MIB for Ethernet Interfaces

Alcatel-Lucent 1850 TSS-5 VLNC50/VLNC52 circuit packs support the following RFC 2863 Ethernet port parameters.

Object	Definition
ifIndex	Interface Index
ifDescr	Interface description (mfg, product, version)
ifType	Type of interface

Object	Definition
ifMtu	Maximum packet size
ifSpeed	Interface maximum rate (bps) - for GbE circuit pack, this is 1,000,000,000, for FE circuit pack, value is based on value of the line rate parameter. If the line rate is 10M, <i>ifSpeed</i> value is 10,000,000. If the line rate parameter is 100M, <i>ifSpeed</i> value is 100,000,000.
ifPhysAddress	MAC Address
ifAdminStatus	Administration status (up, down or testing) (read only). Value is always up.
ifOperStatus	Operational status (up, down, testing, unknown, dormant, notPresent or lowerLayerDown). If board/port is removed, value is notPresent. If there is an existing alarm on the port, i.e., Loss of signal (LOS) or Auto-Negotiation Mismatch (ANM) on the port, then the value is down, else the value is up.
ifLastChange	TimeTicks since last re-initialization
ifInOctets	Total Bytes Received
IfInUcastPkts	Frames Received: Broadcast Frames Received - Multicast Frames Received
ifInMulticastPkts	Multicast Frames Received
ifInBroadcastPkts	Broadcast Frames Received
ifInDiscards	Dropped Frames
ifInErrors	CRC Error + Oversize Frames + Fragments + Jabber + MAC Rx Error
ifInUnknownProtos	(always 0)
ifOutOctets	Bytes Sent
IfOutUcastPkts	Frames Sent - Out Multicast Frames - Out Broadcast Frames
ifOutMulticastPkts	Out Multicast Frames
ifOutBroadcastPkts	Out Broadcast Frames
IfOutDiscards	(always 0) (not supported in this release)
ifOutErrors	(always 0) (not supported in this release)
ifName	Interface name - (always set to NULL)
ifHCInOctets	Total Bytes Received
ifHCInUcastPkts	Frames Received: Broadcast Frames Received - Multicast Frames Received
ifHCInMulticastPkts	Multicast Frames Received
ifHCInBroadcastPkts	Broadcast Frames Received
ifHCOctets	Bytes Sent
ifHCOctetsUcastPkts	Frames Sent - Out Multicast Frames - Out Broadcast Frames
ifHCOctetsMulticastPkts	Out Multicast Frames

Object	Definition
ifHCOutBroadcastPkts	Out Broadcast Frames
ifLinkUpDownTrapEnable	Traps enabled or disabled - Alcatel-Lucent 1850 TSS-5
ifHighSpeed	Interface speed (Mb/s) - for GbE circuit pack, this is 1,000, for FE circuit pack, value is based on line rate parameter. If the line rate is 10M, <i>ifSpeed</i> value is 10. If the line rate is 100M, <i>ifSpeed</i> value is 100.
ifPromiscuousMode	Promiscuous mode (true or false) - support READ-ONLY
ifConnectorPresent	Physical connector present (true or false)
ifAlias	Interface alias name - READ-ONLY - (always set to NULL)
ifCounterDiscontinuityTime- TimeStamp	Time of last counter discontinuity

RFC 2863 Interfaces Group MIB for SONET/SDH, DS1/E1, and DS3/E3

Alcatel-Lucent 1850 TSS-5 VLNC50/VLNC52 circuit packs support the following RFC 2863 SONET/SDH, DS1/E1, and DS3/E3 port parameters.

Parameter	Definition
ifIndex	Interface Index
ifDescr	Interface Description
ifType	Interface Type
ifSpeed	Interface Speed
ifPhysAddress	Wavelength
ifAdminStatus	Administration Status
ifOperStatus	Operational Status
ifLastChange	TimeTicks since last re-initialization
ifName	Interface Name
ifLinkUpDownTrap	Traps enabled or disabled
ifHighSpeed	Interface speed
ifConnectorPresent	Physical connector present
ifAlias	Interface alias name

RFC 2358/RFC 2665 Ethernet PM MIB

Alcatel-Lucent 1850 TSS-5 VLNC50/VLNC52 and VLNC35 circuit packs support the following RFC 2358/RFC 2665 Ethernet PM parameters.

Object	Definition
ifIndex	Interface Index
dot3StatsAlignmentErrors	Fragments
dot3StatsFCSErrors	CRC Error
dot3StatsSingleCollisionFrames	Collision
dot3StatsMultipleCollisionFrames	(always 0) (not supported in this release)
dot3StatsSQETestErrors	(always 0) (not supported in this release)
dot3StatsDeferredTransmissions	(always 0) (not supported in this release)
dot3StatsLateCollisions	Late Collision
dot3StatsExcessiveCollisions	(always 0) (not supported in this release)
dot3StatsInternalMacTransmitErrors	(always 0) (not supported in this release)
dot3StatsCarrierSenseErrors	(always 0) (not supported in this release)
dot3StatsFrameTooLongs	Oversize Frames
dot3StatsInternalMacReceiveErrors	MAC Rx Error
dot3StatsSymbolErrors	(always 0) (not supported in this release)
dot3StatsDuplex Status	Duplex Status (half duplex (2), full duplex (3) - added by RFC2665
dot3ControlFunctionsSupported	pause (0) - 802.3 flow control - added by RFC2665
dot3ControlInUnknownOpcodes	(always 0) - added by RFC2665 (not supported in this release)
dot3PauseAdminMode	Flow control default mode (read only) - added by RFC2665
dot3PauseOperMode	Flow control operational mode (disabled (1), enabled transmit & receive (4)) - added by RFC2665
dot3InPauseFrames	(always 0) - added by RFC2665 (not supported in this release)
dot3OutPauseFrames	(always 0) - added by RFC2665 (not supported in this release)

RFC 2558 SONET/SDH PM MIB

Alcatel-Lucent 1850 TSS-5 VLNC50/VLNC52 circuit packs support the following RFC 2558 SONET/SDH PM parameters.

Table	Parameter
sonetMedium Group	sonetMediumType (READ-ONLY)
	sonetMediumTimeElapsed
	sonetMediumValidIntervals
	sonetMediumLineCoding (READ-ONLY)
	sonetMediumInvalidIntervals
	sonetMediumLoopbackConfig (READ-ONLY)
sonetSectionCurrent Table	sonetSectionCurrentStatus
	sonetSectionCurrentSEFSs
sonetSectionInterval Table	sonetSectionIntervalNumber
	sonetSectionIntervalSEFSs
	sonetSectionIntervalValidData
sonetLineCurrent Table	sonetLineCurrentStatus
	sonetLineCurrentESs
	sonetLineCurrentSESs
	sonetLineCurrentCVs
	sonetLineCurrentUASs
sonetLineInterval Table	sonetLineIntervalNumber
	sonetLineIntervalESs
	sonetLineIntervalSESs
	sonetLineIntervalCVs
	sonetLineIntervalUASs
	sonetLineIntervalValidData
sonetPathCurrent Table	sonetPathCurrentWidth
	sonetPathCurrentStatus
	sonetPathCurrentESs
	sonetPathCurrentSESs
	sonetPathCurrentCVs
	sonetPathCurrentUASs

Table	Parameter
sonetPathInterval Table	sonetPathIntervalNumber
	sonetPathIntervalESs
	sonetPathIntervalSESs
	sonetPathIntervalCVs
	sonetPathIntervalUASs
	sonetPathIntervalValidData
sonetVTCurrent Table	sonetVTCurrentWidth
	sonetVTCurrentStatus
	sonetVTCurrentESs
	sonetVTCurrentSESs
	sonetVTCurrentCVs
	sonetVTCurrentUASs
sonetVTInterval Table	sonetVTIntervalNumber
	sonetVTIntervalESs
	sonetVTIntervalSESs
	sonetVTIntervalCVs
	sonetVTIntervalUASs
	sonetVTIntervalValidData

RFC 2495 DS1/E1 PM MIB

Alcatel-Lucent 1850 TSS-5 VLNC50/VLNC52 circuit packs support the following RFC 2495 DS1/E1 PM parameters.

Table	Parameter
dsx1ConfigEntry Table	dsx1LineIndex
	dsx1TimeElapsed
	dsx1ValidIntervals
	dsx1LineType
	dsx1LineCoding
	dsx1SendCode
	dsx1CircuitIdentifier
	dsx1LoopbackConfig
	dsx1LineStatus
	dsx1SignalMode
	dsx1TransmitClockSource
	dsx1Fdl
	dsx1InvalidIntervals
	dsx1LineLength
	dsx1LineStatusLastChange
	dsx1LineStatusChangeTrapEnable
	dsx1LoopbackStatus
	dsx1Ds1ChannelNumber
	dsx1Channelization
dsx1CurrentEntry Table	dsx1CurrentIndex
	dsx1CurrentESs
	dsx1CurrentSESs
	dsx1CurrentSEFSs
	dsx1CurrentUASs
	dsx1CurrentPCVs
	dsx1CurrentLESs

Table	Parameter
dsx1IntervalEntry Table	dsx1IntervalIndex
	dsx1IntervalNumber
	dsx1IntervalESs
	dsx1IntervalSESs
	dsx1IntervalSEFSs
	dsx1IntervalUASs
	dsx1IntervalPCVs
	dsx1IntervalLESs
	dsx1IntervalValidData
dsx1TotalEntry Table	dsx1TotalIndex
	dsx1TotalESs
	dsx1TotalSESs
	dsx1TotalSEFSs
	dsx1TotalUASs
	dsx1TotalCSSs
	dsx1TotalPCVs
	dsx1TotalLESs
	dsx1TotalBESs
	dsx1TotalDMs
dsx1ChanMappingEntry Table	dsx1ChanMappedIfIndex
dsx1FarEndCurrentEntry Table	dsx1FarEndCurrentIndex
	dsx1FarEndTimeElapsed
	dsx1FarEndValidIntervals
	dsx1FarEndCurrentESs
	dsx1FarEndCurrentSESs
	dsx1FarEndCurrentSEFSs
	dsx1FarEndCurrentUASs
	dsx1FarEndCurrentPCVs
	dsx1FarEndInvalidIntervals

Table	Parameter
dsx1FarEndIntervalEntry Table	dsx1FarEndIntervalIndex
	dsx1FarEndIntervalNumber
	dsx1FarEndIntervalESs
	dsx1FarEndIntervalSESs
	dsx1FarEndIntervalSEFSs
	dsx1FarEndIntervalUASs
	dsx1FarEndIntervalPCVs
	dsx1FarEndIntervalValidData
dsx1FarEndTotalEntry Table	dsx1FarEndTotalIndex
	dsx1FarEndTotalESs
	dsx1FarEndTotalSESs
	dsx1FarEndTotalSEFSs
	dsx1FarEndTotalUASs
	dsx1FarEndTotalCSSs
	dsx1FarEndTotalPCVs
	dsx1FarEndTotalBESs
	dsx1FarEndTotalDMs
ds1Traps	dsx1LineStatusChange

RFC 2496 DS3/E3 PM MIB

Alcatel-Lucent 1850 TSS-5 VLNC50/VLNC52 circuit packs support the following RFC 2496 DS3 PM parameters.

Note: RFC 2496 E3 PM parameters are not supported in this release.

Table	Parameter
dsx3ConfigEntry Table	dsx3LineIndex
	dsx3TimeElapsed
	dsx3ValidIntervals
	dsx3LineType
	dsx3LineCoding
	dsx3SendCode
	dsx3CircuitIdentifier
	dsx3LoopbackConfig
	dsx3LineStatus
	dsx3TransmitClockSource
	dsx3InvalidIntervals
	dsx3LineLength
	dsx3LineStatusLastChange
	dsx3LineStatusChangeTrapEnable
	dsx3LoopbackStatus
dsx3CurrentEntry Table	dsx3Channelization
	dsx3CurrentIndex
	dsx3CurrentPESs
	dsx3CurrentPSESs
	dsx3CurrentSEFSs
	dsx3CurrentUASs
	dsx3CurrentLCVs
	dsx3CurrentPCVs
	dsx3CurrentLESs
	dsx3CurrentCCVs
	dsx3CurrentCESs
	dsx3CurrentCSESs

Table	Parameter
dsx3IntervalEntry Table	dsx3IntervalIndex
	dsx3IntervalNumber
	dsx3IntervalPESs
	dsx3IntervalPSESs
	dsx3IntervalSEFSs
	dsx3IntervalUASs
	dsx3IntervalLCVs
	dsx3IntervalPCVs
	dsx3IntervalLESs
	dsx3IntervalCCVs
	dsx3IntervalCESs
	dsx3IntervalCSESs
	ds3IntervalValidData
dsx3TotalEntry Table	dsx3TotalIndex
	dsx3TotalPESs
	dsx3TotalPSESs
	dsx3TotalSEFSs
	dsx3TotalUASs
	dsx3TotalLCVs
	dsx3TotalPCVs
	dsx3TotalLESs
	dsx3TotalCCVs
	dsx3TotalCESs
	dsx3TotalCSESs
DS3 Traps	dsx3LineStatusChange

Private Alarm MIB

Alcatel-Lucent 1850 TSS-5 supports the following private alarm notifications.

Notification	Definition
tss5Alarm	Alarm Trap
tss5AlarmCL	Alarm Cleared Trap
tss5StandingCond	Standing Condition Trap
tss5StandingCondCL	Standing Condition Cleared Trap
tss5TransientCond	Transient Condition Trap (TC)

Private Equipment MIB

Alcatel-Lucent 1850 TSS-5 supports the following private equipment parameters.

Object	Definition
tss5CardType	Circuit pack type.
tss5CardAPP	Circuit pack apparatus code.
tss5CardSSN	Circuit pack series number.
tss5CardCLEI	Common Language Equipment code.
tss5CardECI	Equipment Catalog Item code.
tss5CardSLN	Circuit pack serial number.
tss5CardVersion	Version of the software currently stored in the circuit pack.
tss5CardProtState	Protection State. Slot protection state. This parameter specifies if there are any provisioned protection groups for the slot. Values are PROT and UNPROT.

Private Ethernet MIB

Alcatel-Lucent 1850 TSS-5 VLNC50/VLNC52 and VLNC35 circuit packs support the following private Ethernet port parameters.

Object	Definition
tss5EthPmonTypeCurrent	port type
tss5EthPmonCurrentEinb	Incoming number of bytes (EINB)
tss5EthPmonCurrentEinf	Incoming number of frames (EINF)
tss5EthPmonCurrentEdfc	Dropped frames: congestion (EDFC)
tss5EthPmonCurrentEonb	Dropped frames: errors (EDFE)
tss5EthPmonCurrentEonb	Outgoing number of bytes (EONB)
tss5EthPmonCurrentEonf	Outgoing number of frames (EONF)
tss5EthPmonIntervalIndex	15 minute bucket index
tss5EthPmonTypeInterval	port type
tss5EthPmonIntervalEinb	Incoming number of bytes (EINB)
tss5EthPmonIntervalEinf	Incoming number of frames (EINF)
tss5EthPmonIntervalEdfc	Dropped frames: congestion (EDFC)
tss5EthPmonIntervalEdfe	Dropped frames: errors (EDFE)
tss5EthPmonIntervalEonb	Outgoing number of bytes (EONB)
tss5EthPmonIntervalEonf	Outgoing number of frames (EONF)
tss5EthPmonDayIndex	day index
tss5EthPmonDayType	port type
tss5EthPmonDayEinb	Incoming number of bytes (EINB)
tss5EthPmonDayEinf	Incoming number of frames (EINF)
tss5xEthPmonDayEdfc	Dropped frames: congestion (EDFC)
tss5EthPmonDayEdfe	Dropped frames: errors (EDFE)
tss5EthPmonDayEonb	Outgoing number of bytes (EONB)
tss5EthPmonDayEonf	Outgoing number of frames (EONF)

Private SONET/SDH Day PM MIB

Alcatel-Lucent 1850 TSS-5 VLNC50/VLNC52 circuit packs support the following private SONET/SDH Day PM MIB parameters.

Table	Parameter
tss5SonetSectionDay Table	tss5SonetSectionDayNumber
	tss5SonetSectionDayESs (SDH only)
	tss5SonetSectionDaySESs (SDH only)
	tss5SonetSectionDaySEFSs
	tss5SonetSectionDayCVs (SDH only)
	tss5SonetSectionDayValidData
tss5SonetLineDay Table	tss5SonetLineDayNumber
	tss5SonetLineDayESs
	tss5SonetLineDaySESs
	tss5SonetLineDayCVs
	tss5SonetLineDayUASs
	tss5SonetLineDayValidData
tss5SonetFarEndLineDay Table (SDH only)	tss5SonetFarEndLineDayNumber (SDH only)
	tss5SonetFarEndLineDayESs (SDH only)
	tss5SonetFarEndLineDaySESs (SDH only)
	tss5SonetFarEndLineDayCVs (SDH only)
	tss5SonetFarEndLineDayUASs (SDH only)
	tss5SonetFarEndLineDayValidData (SDH only)
tss5SonetPathDay Table	tss5SonetPathDayNumber
	tss5SonetPathDayESs
	tss5SonetPathDaySESs
	tss5SonetPathDayCVs
	tss5SonetPathDayUASs
	tss5SonetPathDayValidData

Table	Parameter
tss5SonetVTDay Table	tss5SonetVTDayNumber
	tss5SonetVTDayESs
	tss5SonetVTDaySESs
	tss5SonetVTDayCVs (SDH only)
	tss5SonetVTDayUASs
	tss5SonetVTDayValidData

Private DS1/E1 Day PM MIB

Alcatel-Lucent 1850 TSS-5 VLNC50/VLNC52 circuit packs support the following private DS1 Day PM MIB parameters.

Note: Private E1 Day PM parameters are not supported in this release.

Table	Parameter
tss5Dsx1Day Table	tss5Dsx1DayNumber
	tss5Dsx1DayESs
	tss5Dsx1DaySESs
	tss5Dsx1DaySEFSs
	tss5Dsx1DayUASs
	tss5Dsx1DayPCVs
	tss5Dsx1DayLESSs
	tss5Dsx1DayLCVs
	tss5Dsx1DayValidData
tss5Dsx1FarEndDay Table	tss5Dsx1FarEndDayNumber
	tss5Dsx1FarEndDayESs
	tss5Dsx1FarEndDaySESs
	tss5Dsx1FarEndDaySEFSs
	tss5Dsx1FarEndDayUASs
	tss5Dsx1FarEndDayLESSs
	tss5Dsx1FarEndDayPCVs
	tss5Dsx1FarEndDayValidData

Private DS3/E3 PM MIB Module

Alcatel-Lucent 1850 TSS-5 VLNC50/VLNC52 circuit packs support the following private DS3 PM MIB parameters.

Note: Private E3 PM MIB parameters are not supported in this release.

Table	Parameter
tss5Dsx3Current Table	tss5Dsx3CurrentIndex
	tss5Dsx3CurrentFMESs
	tss5Dsx3CurrentFMSEsSs
	tss5Dsx3CurrentFMCVs
tss5Dsx3Interval Table	tss5Dsx3IntervalIndex
	tss5Dsx3IntervalNumber
	tss5Dsx3IntervalFMESs
	tss5Dsx3IntervalFMSEsSs
	tss5Dsx3IntervalFMCVs
	dsx3DMXIntervalValidData
tss5Dsx3FarEndCurrent Table	tss5Dsx3FarEndCurrentIndex
	tss5Dsx3FarEndTimeElapsed
	tss5Dsx3FarEndValidIntervals
	tss5Dsx3FarEndCurrentCFMESs
	tss5Dsx3FarEndCurrentCFMSEsSs
	tss5Dsx3FarEndCurrentCFMCMVs
	tss5Dsx3FarEndCurrentUASs
	tss5Dsx3FarEndInvalidIntervals
tss5Dsx3FarEndInterval Table	tss5Dsx3FarEndIntervalIndex
	tss5Dsx3FarEndIntervalNumber
	tss5Dsx3FarEndIntervalCFMESs
	tss5Dsx3FarEndIntervalCFMSEsSs
	tss5Dsx3FarEndIntervalCFMCMVs
	tss5Dsx3FarEndIntervalUASs
	tss5Dsx3FarEndIntervalValidData

Private DS3/E3 Day PM MIB Module

Alcatel-Lucent 1850 TSS-5 VLNC50/VLNC52 circuit packs support the following private DS3 Day PM MIB parameters.

Note: Private E3 Day PM MIB parameters are not supported in this release.

Table	Parameter
tss5Dsx3Day Table	tss5Dsx3DayNumber
	tss5Dsx3DayPESs
	tss5Dsx3DayPSESs
	tss5Dsx3DaySEFSs
	tss5Dsx3DayUASs
	tss5Dsx3DayLCVs
	tss5Dsx3DayPCVs
	tss5Dsx3DayLESs
	tss5Dsx3DayCCVs
	tss5Dsx3DayCESs
	tss5Dsx3DayCSESs
	tss5Dsx3DayFMESs
	tss5Dsx3DayFMSESs
	tss5Dsx3DayFMCVs
	tss5Dsx3DayValidData
tss5Dsx3FarEndDay Table	tss5Dsx3FarEndDayNumber
	tss5Dsx3FarEndDayCFMESs
	tss5Dsx3FarEndDayCFMSESs
	tss5Dsx3FarEndDayCFMCVs
	tss5Dsx3FarEndDayUASs
	tss5Dsx3FarEndDayValidData

Standard MIBs (self-managed circuit packs)

The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs support the following standard MIBs, depending upon the circuit packs installed.

VLNC40/42/42B standard MIBs

The VLNC40/42/42B circuit pack supports the following standard MIBs.

MIB module	Supported traps
Bridging MIB - RFC 1493	newRoot
	topologyChange
SNMPv2 MIB - RFC 3418	coldStart
	warmStart
	authenticationFailure
Entity MIB - RFC 3812	entConfigChange
Interface Group MIB - RFC 2233 (for Ethernet Interfaces)	linkUp
	linkDown

The VLNC4x circuit packs also support the TSD-IM SNMP MIB.

VLNC60/61/62 standard MIBs

The VLNC60/61/62 circuit pack supports the following standard MIBs.

MIB module	Supported objects
Interface Group MIB for Ethernet Interfaces - RFC 2233	ifTable
Managed Objects MIB - RFC 4805 (RFC 2495) (for T1/E1 interfaces)	ifTable
	dsxConfigTable
Entity MIB - RFC 2737	entPhysicalTable
Definitions of Managed Objects for the IP Network Control Protocol of the Point-to-Point Protocol - RFC 1473	pppipTable
	pppipConfigTable
Definitions of Managed Objects for the Link Control Protocol of the Point-to-Point Protocol - RFC 1471	pppLinkstatusTable
	pppLinkConfigTable
VLAN MIB - RFC 2674	dot1qGroup
	dot1qVlanStaticTable
Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) - RFC 3812	mplsTunnelTable
IETF Draft Pseudowire (PW) MIB	pwTable

MIB module	Supported objects
IETF Draft Managed Objects for TDM over Packet Switched Network	pwTDMTable

The VLNC60/61/62 circuit packs also support the TSD-IM SNMP MIB.

VLNC64 standard MIBs

The VLNC64 circuit pack supports the following standard MIBs.

MIB module	Supported objects
Interface Group MIB for Ethernet Interfaces - RFC 2233	ifTable
Managed Objects MIB - RFC 4805 (RFC 2495) (for T1/E1 interfaces)	ifTable
	dsxConfigTable
Entity MIB - RFC 2737	entPhysicalTable
VLAN MIB - RFC 2674	dot1qGroup
	dot1qVlanStaticTable
Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) - RFC 3812	mplsTunnelTable
IETF Draft Pseudowire (PW) MIB	pwTable
IETF Draft Managed Objects for TDM over Packet Switched Network	pwTDMTable
Definitions of managed objects for the SONET/SDH interface type (for SONET/SDH interfaces) RFC 3592 (RFC 2558)	ifTable
	sonetSectionCurrentTable
	sonetSectionIntervalTable
	sonetLineCurrentTable
	sonetLineIntervalTable
	sonetPathCurrentTable
	sonetPathIntervalTable
	sonetVTCurrentTable
	sonetVTIntervalTable
	sonetFarEndLineCurrentTable
	sonetFarEndLineIntervalTable
	sonetFarEndPathCurrentTable
	sonetFarEndPathIntervalTable
	sonetFarEndVTCurrentTable
	sonetFarEndVTIntervalTable

The VLNC64 circuit pack also supports the TSD-IM SNMP MIB.

RFC 2863 Interfaces Group MIB for Ethernet Interfaces (self-managed circuit packs)

Alcatel-Lucent 1850 TSS-5

VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs
support the following RFC 2863 Ethernet port parameters.

Object	Definition
ifIndex	Interface Index
ifDescr	Interface description (mfg, product, version)
ifType	Type of interface
ifMtu	Maximum packet size
ifSpeed	Interface maximum rate (bps) - for GbE circuit pack, this is 1,000,000,000, for FE circuit pack, value is based on value of the line rate parameter. If the line rate is 10M, <i>ifSpeed</i> value is 10,000,000. If the line rate parameter is 100M, <i>ifSpeed</i> value is 100,000,000.
ifPhysAddress	MAC Address
ifAdminStatus	Administration status (up, down or testing) (read only). Value is always up.
ifOperStatus	Operational status (up, down, testing, unknown, dormant, notPresent or lowerLayerDown). If board/port is removed, value is notPresent. If there is an existing alarm on the port, i.e., Loss of signal (LOS) or Auto-Negotiation Mismatch (ANM) on the port, then the value is down, else the value is up.
ifLastChange	TimeTicks since last re-initialization
ifInOctets	Total Bytes Received
IfInUcastPkts	Frames Received: Broadcast Frames Received - Multicast Frames Received
ifInMulticastPkts	Multicast Frames Received
ifInBroadcastPkts	Broadcast Frames Received
ifInDiscards	Dropped Frames
ifInErrors	CRC Error + Oversize Frames + Fragments + Jabber + MAC Rx Error
ifInUnknownProtos	(always 0)
ifOutOctets	Bytes Sent
IfOutUcastPkts	Frames Sent - Out Multicast Frames - Out Broadcast Frames
ifOutMulticastPkts	Out Multicast Frames
ifOutBroadcastPkts	Out Broadcast Frames
IfOutDiscards	(always 0) (not supported in this release)
ifOutErrors	(always 0) (not supported in this release)

Object	Definition
ifName	Interface name - (always set to NULL)
ifHCInOctets	Total Bytes Received
ifHCInUcastPkts	Frames Received: Broadcast Frames Received - Multicast Frames Received
ifHCInMulticastPkts	Multicast Frames Received
ifHCInBroadcastPkts	Broadcast Frames Received
ifHCOctets	Bytes Sent
ifHCOOutUcastPkts	Frames Sent - Out Multicast Frames - Out Broadcast Frames
ifHCOOutMulticastPkts	Out Multicast Frames
ifHCOOutBroadcastPkts	Out Broadcast Frames
ifLinkUpDownTrapEnable	Traps enabled or disabled - Alcatel-Lucent 1850 TSS-5
ifHighSpeed	Interface speed (Mb/s) - for GbE circuit pack, this is 1,000, for FE circuit pack, value is based on line rate parameter. If the line rate is 10M, <i>ifSpeed</i> value is 10. If the line rate is 100M, <i>ifSpeed</i> value is 100.
ifPromiscuousMode	Promiscuous mode (true or false) - support READ-ONLY
ifConnectorPresent	Physical connector present (true or false)
ifAlias	Interface alias name - READ-ONLY - (always set to NULL)
ifCounterDiscontinuityTime- TimeStamp	Time of last counter discontinuity
linkUp trap	Port state transitioned to down due to administrative action, line or SFP condition
linkDown trap	Port state transitioned to up due to administrative action, good line and/or SFP condition

RFC 2358/RFC 2665 Ethernet PM MIB (self-managed circuit packs)

Alcatel-Lucent 1850 TSS-5

VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs
support the following RFC 2358/RFC 2665 Ethernet PM parameters.

Object	Definition
ifIndex	Interface Index
dot3StatsAlignmentErrors	Fragments
dot3StatsFCSErrors	CRC Error
dot3StatsSingleCollisionFrames	Collision
dot3StatsMultipleCollisionFrames	(always 0) (not supported in this release)
dot3StatsSQETestErrors	(always 0) (not supported in this release)
dot3StatsDeferredTransmissions	(always 0) (not supported in this release)
dot3StatsLateCollisions	Late Collision
dot3StatsExcessiveCollisions	(always 0) (not supported in this release)
dot3StatsInternalMacTransmitErrors	(always 0) (not supported in this release)
dot3StatsCarrierSenseErrors	(always 0) (not supported in this release)
dot3StatsFrameTooLongs	Oversize Frames
dot3StatsInternalMacReceiveErrors	MAC Rx Error
dot3StatsSymbolErrors	(always 0) (not supported in this release)
dot3StatsDuplex Status	Duplex Status (half duplex (2), full duplex (3) - added by RFC2665
dot3ControlFunctionsSupported	pause (0) - 802.3 flow control - added by RFC2665
dot3ControlInUnknownOpCodes	(always 0) - added by RFC2665 (not supported in this release)
dot3PauseAdminMode	Flow control default mode (read only) - added by RFC2665
dot3PauseOperMode	Flow control operational mode (disabled (1), enabled transmit & receive (4)) - added by RFC2665
dot3InPauseFrames	(always 0) - added by RFC2665 (not supported in this release)
dot3OutPauseFrames	(always 0) - added by RFC2665 (not supported in this release)

Standard VLAN MIB module (self-managed circuit packs)

Alcatel-Lucent 1850 TSS-5

VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs support the VLAN MIB components, specified in the dot1qVlan group of RFC 2674. The dot1qVlanStatic, dot1qPortVlan, dot1qPortVlanStatistics, and dot1qPortVlanHCStatistics tables are supported.

Table 5-20 dot1qVlanStatic values

Object	Definition
dot1qVlanStaticName	PortList - Not supported
dot1qVlanStaticEgressPorts	PortList
dot1qVlanForbiddenEgressPorts	PortList - Not supported
dot1qVlanStaticUntaggedPorts	PortList - Ports for transmitting untagged egress packets
dot1qVlanStaticRowStatus	
dot1qNextFreeLocalVlanIndex	Not Supported

Table 5-21 dot1qPortVlan values

Object	Definition
dot1qPvid	Vlan Index
dot1qPortAcceptableFrameTypes	Admin all Admit only Vlan Tagged
dot1qPortIngressFiltering	Truth Value
dot1qPortGvrpStatus	Enabled Status - Not supported
dot1qPortGvrpFailedRegistrations	Not supported
dot1qPortGvrpLastPduOrigin	Mac Address - Not supported

Table 5-22 dot1qPortVlanStatistics values

Object	Definition
dot1qTpVlanPortInFrames	
dot1qTpVlanPortOutFrames	Not supported - always 0
dot1qTpVlanPortInDiscards	
dot1qTpVlanPortInOverflowFrames	
dot1qTpVlanPortOutOverflowFrames	
dot1qTpVlanPortInOverflowDiscards	

Table 5-23 dot1qPortVlanHCStatistics values

Object	Definition
dot1qTpVlanPortHCInFrames	
dot1qTpVlanPortHCOutFrames	Not supported - always 0
dot1qTpVlanPortHCInDiscards	

Private MIBs (self-managed circuit packs)

The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs support the following private MIBs.

VLNC40/42/42B private MIBs

The VLNC40/42/42B circuit pack supports the following private MIBs.

MIB module	Supported traps and objects
FASTPATH Port Security Private MIB	agentPortSecurityViolation
FASTPATH Switching MIB	multipleUsersTrap
	fanFailureTrap
	fanFailureClearTrap
	stpInstanceNewRootTrap
	stpInstanceTopologyChangeTrap
	failedUserLoginTrap
FASTPATH Security MIB	agentSSHConfigGroup

VLNC60/61/62 private MIBs

The VLNC60/61/62 circuit pack supports the following private MIBs.

MIB module	Supported objects
FASTPATH Routing MIB	agentSwitchArpGroup
	agentSwitchIPInterfaceTable
FASTPATH Security MIB	agentSSHConfigGroup
FASTPATH Switching MIB	agentSerialGroup
	agentNetworkConfigGroup
TSS-5 Timing MIB for system, interface, 1588 timing, and Time of Day (VLNC62 only)	sysTimingMib

MIB module	Supported objects
TSS-5 PPP MP MIB	mpConfigTable
	mpStatusTable
	mpClassStatusTable
	mpLinkStatusTable
	priDNXIpAddr
	priDNSIpAddr
	fragConfigTable
TSS-5 DS1 MIB (Extensions for T1/E1)	dsx1extTable
	dsx1TCAConfigTable
TSS-5 PWE MIB (Extensions)	PwExtTable
	PwTDMPerfSnapshotTable
TSS-5 PSN MIB (Extension)	psnTunnelProtectionTable
TSS-5 IPCP MIB (Extension)	pppExtIpTable
TSS-5 LCP MIB	pppExtLinkConfigTable
	pppExtLinkStatusTable

VLNC64 private MIBs

The VLNC64 circuit pack supports the following private MIBs.

MIB module	Supported objects
FASTPATH Routing MIB	agentSwitchArpGroup
	agentSwitchIPInterfaceTable
FASTPATH Security MIB	agentSSHConfigGroup
FASTPATH Switching MIB	agentSerialGroup
	agentNetworkConfigGroup
TSS-5 Timing MIB for system, interface, and 1588 timing	sysTimingMib
TSS-5 DS1 MIB (Extensions for T1/E1)	dsx1extTable
	dsx1TCAConfigTable
TSS-5 PWE MIB (Extensions)	PwExtTable
	PwTDMPerfSnapshotTable
TSS-5 PSN MIB (Extension)	psnTunnelProtectionTable
sonetMedium Table for SONET/SDH (extensions)	sonetMediumextTable

MIB module	Supported objects
Total Entry tables for SONET/SDH	sonetSectionTotalTable
	sonetLineTotalTable
	sonetPathTotalTable
	sonetVTTotalTable
	sonetFarEndLineTotalTable
	sonetFarEndPathTotalTable
	sonetFarEndVTTotalTable
	sonetSectionTCAConfigTable
	sonetLineTCAConfigTable
	sonetPathTCAConfigTable
	sonetVTTCACConfigTable

RFC 4878 Link OAM MIB module (self-managed circuit packs)

Alcatel-Lucent 1850 TSS-5 VLNC40/VLNC42/VLNC42B circuit packs support the Link OAM MIB components, specified in RFC 4878. The dot3Oam, dot3Peer, dot3OamLoopback, dot3OamStats, dot3OamEventConfig, dot3OamEventLog, dot3OamNotifications, and linkOamConfigTable, linkOamNotification tables are supported.

Table 5-24 dot3OamTable values

Table	Parameter
dot3OamEntry	dot3OamAdminState
	dot3OamOperStatus
	dot3OamMode
	dot3OamMaxOamPduSize
	dot3OamConfigRevision
	dot3OamFunctionsSupported

Table 5-25 dot3OamPeerTable values

Table	Parameter
dot3OamPeerEntry	dot3OamPeerMacAddress
	dot3OamPeerVendorOui
	dot3OamPeerVendorInfo
	dot3OamPeerMode
	dot3OamPeerMaxOamPduSize
	dot3OamConfigRevision
	dot3OamFunctionsSupported

Table 5-26 dot3OamLoopbackTable values

Parameter	Table
dot3OamLoopbackEntry	dot3OamLoopbackStatus
	dot3OamLoopbackIgnoreRx

Table 5-27 dot3OamStatsTable values

Table	Parameter
dot3OamStatsEntry	dot3OamInformationTx
	dot3OamInformationRx
	dot3OamUniqueEventNotificationTx
	dot3OamUniqueEventNotificationRx
	dot3OamDuplicateEventNotificationTx
	dot3OamDuplicateEventNotificationRx
	dot3OamLoopbackControlTx
	dot3OamLoopbackControlRx
	dot3OamVariableRequestTx
	always 0; not supported
	dot3OamVariableRequestRx
	dot3OamVariableResponseTx
	dot3OamVariableResponseRx
	always 0; not supported
	dot3OamOrgSpecificTx
	always 0; not supported
	dot3OamOrgSpecificRx
	dot3OamUnsupportedCodesTx
	always 0; not supported
	dot3OamUnsupportedCodesRx
	dot3OamFramesLostDueToOam

Table 5-28 dot3OamEventConfigTable values

Table	Parameter
dot3OamEventConfigEntry	dot3OamErrSymPeriodWindowHi
	dot3OamErrSymPeriod WindowLo
	dot3OamErrSymPeriodThresholdHi
	dot3OamErrSymPeriodThresholdLo
	dot3OamErrSymPeriodEvNotifEnable
	dot3OamErrFramePeriodWindow
	dot3OamErrFramePeriodThreshold
	dot3OamErrFramePeriodEvNotifEnable
	dot3OamErrFrameWindow
	dot3OamErrFrameThreshold
	dot3OamErrFrameEvNotifEnable
	dot3OamErrFrameSecsSummaryWindow
	dot3OamErrFrameSecsSummaryThreshold
	dot3OamErrFrameSecsEvNotifEnable
	dot3OamDyingGaspEnable
	dot3OamCriticalEventEnable

Table 5-29 dot3OamEventLogTable values

Table	Parameter
dot3OamEventLogEntry	dot3OamEventLogIndex
	dot3OamEventLogTimestamp
	dot3OamEventLogOui
	dot3OamEventLogType
	dot3OamEventLogLocation
	dot3OamEventLogWindowHi
	dot3OamEventLogWindowLo
	dot3OamEventLogThresholdHi
	dot3OamEventLogThresholdLo
	dot3OamEventLogValue
	dot3OamEventLogRunningTotal
	dot3OamEventLogEventTotal

Table 5-30 dot3OamNotifications values

Table	Parameter
dot3OamThresholdEvent	dot3OamNonThresholdEvent

Table 5-31 linkOamConfigTable values

Table	Parameter
linkOamConfigEntry	linkOamConfigL2cpAware

Table 5-32 linkOamNotification table

Object	Definition
LOULB	LinkOAM Unrequested Loopback: the remote end is reporting a loopback that this end hasn't requested
LOLBR	LinkOAM Loopback Refused: A loopback request was sent to the far end, but the remote does not report an active loopback after 5 seconds
LODNC	LinkOAM Discovery Not Complete: linkOAM is enabled, the link is up, but the Discovery State is not SEND-ANY for more than 3 seconds
LODC	LinkOAM Discovery Complete: linkOAM Discovery State changed to SEND-ANY

Service OAM MIB module (self-managed circuit packs)

Alcatel-Lucent 1850 TSS-5 VLNC40/VLNC42/VLNC42B circuit packs support the Service OAM MIB components. The standard dot1agCfmStack, dot1agCfmMaNet, dot1agCfmMaComp, dot1agCfmMaMepList, dot1agCfmMep, dot1agCfmLtr, dot1agCfmMepDb, and dot1agCfmFaultAlarm tables are supported. In addition, the private CfmStatus table is supported.

Table 5-33 dot1agCfmStackTable values

Table	Parameter
dot1agCfmStackEntry	dot1agCfmStackIfIndex
	dot1agCfmStackVlanIdOrNone
	dot1agCfmStackMdLevel
	dot1agCfmStackDirection
	dot1agCfmStackMdIndex
	dot1agCfmStackMaIndex
	dot1agCfmStackMepId
	dot1agCfmStackMac

Table 5-34 dot1agCfmMdTable values

Table	Parameter
dot1agCfmMdEntry	dot1agCfmMdIndex
	dot1agCfmMdFormat
	dot1agCfmMdName
	dot1agCfmMdLevel
	dot1agCfmMdMhfCreation
	dot1agCfmMdIdPermission
	dot1agCfmMdMaNextIndex
	dot1agCfmMdRowSatus

Table 5-35 dot1agCfmMaNetTable values

Parameter	Table
dot1agCfmMaNetEntry	dot1agCfmMaIndex
	dot1agCfmMaNetFormat
	dot1agCfmMaNetName
	dot1agCfmMaNetCcmInterval
	dot1agCfmMaNetRowStatus

Table 5-36 dot1agCfmMaCompTable values

Table	Parameter
dot1agCfmMaCompEntry	dot1agCfmMaComponentId always 0; not supported
	dot1agCfmMaCompPrimaryVlanId
	dot1agCfmMaCompMhfCreation
	dot1agCfmMaCompIdPermission
	dot1agCfmMaCompNumberOfVids always 0; not supported
	dot1agCfmMaCompRowStatus

Table 5-37 dot1agCfmMaMepListTable values

Table	Parameter
dot1agCfmMaMepListEntry	dot1agCfmMaMepListIdentifier
	dot1agCfmMaMepListRowStatus

Table 5-38 dot1agCfmMepTable values

Table	Parameter
dot1agCfmMepEntry	dot1agCfmMepIdentifier
	dot1agCfmMepIfIndex
	dot1agCfmMepDirection
	dot1agCfmMepPrimaryVid
	dot1agCfmMepActive
	dot1agCfmMepFngState
	dot1agCfmMepCciEnabled
	dot1agCfmMepCcmLtmPriority
	dot1agCfmMepMacAddress
	dot1agCfmMepLowPrDef
	dot1agCfmMepFngAlarmTime
	dot1agCfmMepFngResetTime
	dot1agCfmMepHighestPrDefect
	dot1agCfmMepDefects
	dot1agCfmMepErrorCcmLastFailure
	dot1agCfmMepXconCcmLastFailure
	dot1agCfmMepCcmSequenceErrors
	dot1agCfmMepCciSentCcms
	dot1agCfmMepNextLbmTransId
	dot1agCfmMepLbrIn
	dot1agCfmMepLbrInOutOfOrder
	dot1agCfmMepLbrBadMsdu
	dot1agCfmMepLtmNextSeqNumber
	dot1agCfmMepUnexpLtrIn
	dot1agCfmMepLbrOut
	dot1agCfmMepRowStatus

Table 5-39 dot1agCfmLtrTable values

Table	Parameter
dot1agCfmLtrEntry	dot1agCfmLtrSeqNumber
	dot1agCfmLtrReceiveOrder
	dot1agCfmLtrTtl
	dot1agCfmLtrForwarded
	dot1agCfmLtrTerminalMep
	dot1agCfmLtrLastEgressIdentifier
	dot1agCfmLtrNextEgressIdentifier
	dot1agCfmLtrRelay
	dot1agCfmLtrChassisIdSubtype
	Not required
	dot1agCfmLtrChassisId
	Not required
	dot1agCfmLtrManAddressDomain
	Not required
	dot1agCfmLtrManAddress
	Not required
	dot1agCfmLtrIngress
	dot1agCfmLtrIngressMac
	dot1agCfmLtrIngressPortIdSubtype
	dot1agCfmLtrIngressPortId
	dot1agCfmLtrEgress
	dot1agCfmLtrEgressMac
	dot1agCfmLtrEgressPortIdSubtype
	dot1agCfmLtrEgressPortId
	dot1agCfmLtrOrganizationSpecificTlv
	Not required

Table 5-40 dot1agCfmMepDbTable values

Table	Parameter
dot1agCfmMepDbEntry	dot1agCfmMepDbRMepIdentifier
	dot1agCfmMepDbRMepState
	dot1agCfmMepDbRMepFailedOkTime
	dot1agCfmMepDbMacAddress
	dot1agCfmMepDbRdi
	dot1agCfmMepDbPortStatusTlv
	dot1agCfmMepDbInterfaceStatusTlv
	dot1agCfmMepDbChassisIdSubtype
	Not required
	dot1agCfmMepDbChassisId
	Not required
	dot1agCfmMepDbManAddressDomain
	Not required
	dot1agCfmMepDbManAddress
	Not required

Table 5-41 dot1agCfmFaultAlarm table

Object	Definition
dot1agCfmMepHighestPrDefect	DefXconCCM (highestDefectPri = 5) DefErrorCCM (highestDefectPri = 4) DefRemoteCCM (highestDefectPri = 3) DefMACstatus (highestDefectPri = 2)

Table 5-42 CfmStatusTable values

Object	Definition
CfmStatusEntry	CfmStatus (enabled/disabled)

Ethernet Ring Protection (ERP) module (self-managed circuit packs)

Alcatel-Lucent 1850 TSS-5 VLNC40/VLNC42/VLNC42B circuit packs support the ERP MIB components.

Table 5-43 EthernetRingProtectionTable values

Table	Parameter
erpEntry	erpIndex
	erpName
	erpPort1
	erpPort1Status
	erpPort2
	erpPort2Status
	erpGuardTimer
	erpMDLevel
	erpVLAN
	erpStatus
	erpRPLOwner only exists if erpRPLOwner is true
	erpRPLWTR only returned if the node is the RPL Owner
Statistics	rplBlockChangedCounter
	port1BlockChangedCounter
	port2BlockChangedCounter
	txRAPSPDUs
	rxRAPSPDUs
Notifications all notifications contain the erpIndex	erpPort1Blocked
	erpPort1Unblocked
	erpPort2Blocked
	erpPort2Unblocked
	erpMultipleRPLs
	erpMultipleRPLsCleared
	erpWatchdogTimeout
	erpWatchdogTimeoutClear

Service Multiplexing MIB (self-managed circuit packs)

Alcatel-Lucent 1850 TSS-5 VLNC40/VLNC42/VLNC42B circuit packs support the ERP MIB components.

Table 5-44 ServiceMultiplexingTable values

Table	Parameter
serviceMultiplexingEntry	cvlanIndex
	svlan

Provisioning

Overview

Purpose

This section describes the many types of provisionable parameters for SONET/SDH and Ethernet operations that are available in Alcatel-Lucent 1850 TSS-5 when equipped with VLNC2, VLNC35, and VLNC50/52 circuit packs. This section does not include commands for provisioning VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs. For a detailed description of the Command Line Interface (CLI) messages used to interface with the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs and general information about using the Command Line Interface (CLI), refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide*.

Definition

Provisioning is the modification of certain programmable parameters that define how the node functions with various installed entities. Provisioning requests may alter auto provisioned values of an entity that already exists. Parameter modifications for SONET/SDH operations may be initiated locally or remotely with a *WaveStar*® CIT or an OS. Parameter modifications may be applied to the node via the intra-office local area network (IAO LAN), serial port, or any data communications channel (DCC). The provisioned data is maintained in NVM and/or hardware registers. The provisionable parameters and values (current and original) are maintained in the nonvolatile memory.

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Default provisioning

Overview

This section describes the many types of provisionable parameters available in Alcatel-Lucent 1850 TSS-5 for managing VLNC50/52 SONET/SDH Transport and VLNC35 Fast Ethernet circuit packs operations through the VLNC2 SYSCTL circuit pack.

Alcatel-Lucent 1850 TSS-5 allows the user to customize many system characteristics through provisioning features. Provisioning parameters are set by software controls.

Default values

Installation provisioning for the VLNC2, VLNC35, and VLNC50/52 circuit packs is minimized with thoughtfully-chosen default values set in the factory. Every parameter has a factory default value. These factory defaults for software parameters are maintained in the SYSCTL circuit pack, and a single command is provided to restore all default values. All provisioning data is stored in nonvolatile memory to prevent data loss during power failures and maintenance operations.

Remote provisioning

Remote provisioning

Software control allows remote provisioning of Alcatel-Lucent 1850 TSS-5 network elements. This feature is provided especially for provisioning parameters likely to change in service, in support of centralized operations practices.

Cross-connect provisioning

Cross-connect provisioning

Alcatel-Lucent 1850 TSS-5 VLNC50/52 circuit pack can be provisioned for signal routing. Depending on the application, SONET/SDH, VT1.5/VC-12/VC-3, and STS-n/VC-n signal cross-connections may be established to route traffic in a specific manner. All cross-connections are bidirectional. Thus, each connection goes from HS to LS within the MAIN pack or from HS to HS in the case of pass-through cross-connections.

SONET VT1.5 and STS-n, and SDH VC-n signals may be cross-connected in several ways. For bidirectional drop services, the cross-connection is used to connect a like signal in the MAIN slot to any available timeslot in Gigabit Ethernet (1000 Mb/s), Fast Ethernet (100 Mb/s), DS1/E1, or DS3/E3 interfaces.

In UPSR/SNCP applications, bidirectional pass-through cross-connections are used to pass VT1.5, VC-n, or STS-n signals through the NE on the same timeslot. In 0x1 applications, bidirectional cross-connections can go between any available timeslot to any other available timeslot. In equipment-protected applications (PROT), signals may be connected between any available timeslots in the two line pairs (UPSR/SNCP or 1+1).

Beginning in Release 5.1, linear/unprotected UPSR/SNCP cross-connections and 2-way hairpin cross-connections are also supported.

Reference:

For more information on cross-connections, refer to [Chapter 6, “System planning and engineering”](#).

Automatic provisioning on circuit pack replacement

Overview

Replacing a failed VLNC35/VLNC50/52 circuit pack is simplified by automatic provisioning of the set circuit pack values. The SYSCTL circuit pack maintains a provisioning map for the VLNC35/VLNC50/52 circuit pack, so when the transmission pack is replaced, the SYSCTL circuit pack automatically downloads the correct values (those that were previously provisioned) to the new circuit pack. Likewise, if the SYSCTL circuit pack is ever replaced, the correct provisioning data from the VLNC35/VLNC50/52 circuit pack is automatically uploaded to the new SYSCTL circuit pack's nonvolatile memory.

Auto provisioning

Auto provisioning is the ability of an NE to detect the presence of equipment, validate it, and then assign default original values. Nonvolatile memory (NVM) and/or hardware registers maintain the parameter values. Auto-provisioning allows an NE to be set up initially with minimal user intervention. Auto-provisioning also supports a self inventory function which allows operations center personnel to learn about and track activities at a remotely located NE.

Automatic provisioning on circuit pack replacement

Replacing a failed circuit pack is simplified by automatic provisioning of the original circuit pack values. The SYSCTL circuit pack maintains a provisioning map for the VLNC35/VLNC50/52 circuit pack, so when it is replaced, the SYSCTL circuit pack

automatically downloads the correct values to the new circuit pack. Likewise, if the SYSCTL circuit pack is ever replaced, the correct provisioning data from every other circuit pack in the shelf is automatically uploaded to the new SYSCTL circuit pack's nonvolatile memory. However, if a SYSCTL circuit pack is replaced, some provisioned data is lost, unless the data is backed up before replacement.

If there are Ethernet cross-connections and the database is restored, then the VLNC2, VLNC50/52 and VLNC35 circuit packs are hard-reset. The circuit pack resets can cause an outage of up to two minutes. In Release 5.1, Alcatel-Lucent 1850 TSS-5 supports a restoration of circuit IDs only, which is hitless. The circuit ID restoration can be used when replacing a VLNC2 SYSCTL.

Items auto provisioned

Some items that are auto-provisioned include the following:

- System target identifier (TID) (which can be changed at initial start-up)
- Default threshold-crossing alert (TCA) profiles
- Circuit packs
- Synchronization default mode

Equipment removal

The NE detects and reports the removal of equipment. The removal of equipment does not cause the NE to delete any entities. Removal of a piece of equipment may result in equipment alarms and insertion of maintenance signals when the state-related data is updated. However, removal of equipment does not necessarily mean that the provisioning of the shelf slot has changed. The user must execute specific commands to remove an entity from the system database.

Line/port state provisioning

Overview

When equipped with VLNC2, VLNC35, and VLNC50/52 circuit packs, the line/port state provisioning feature is provided on Alcatel-Lucent 1850 TSS-5 NEs. This feature can help suppress alarm reporting and performance monitoring by supporting multiple states for high-speed OCn/STMn lines and electrical ports.

The following states are supported:

- Automatic (AUTO)
- In-service (IS)
- Not monitored (NMON)

Line/port states

In the AUTO state, the line/port waits for the presence of a good signal (not LOS), and the line/port is not monitored/alarmed.

When a good signal (not LOS) is detected, the line/port automatically transitions from the AUTO state to the IS state, and the line/port is monitored/alarmed.

In the NMON state, the line/port is not monitored/alarmed and the line/port will not automatically transition to the IS state when a good signal (not LOS) is detected.

The user can submit commands to manually change a line/port from IS or AUTO to NMON, and from NMON to AUTO. A user cannot manually change from AUTO or NMON to IS.

Channel state provisioning

Overview

Automatic channel state provisioning is a capability provided on Alcatel-Lucent 1850 TSS-5 NEs that are equipped with SYSCTL, VLNC35, and VLNC50/52 circuit packs. It suppresses reporting transient alarms and events during provisioning by supporting multiple states (AUTO, IS, NMON) for SONET VT1.5 and STS-n, and SDH VC-n channels.

Automatic channel state provisioning

While an end-to-end circuit is being set up, particularly during SONET VT1.5 and STS-n, and SDH VC-n cross-connect provisioning, several transient maintenance signals result. Without automatic channel state provisioning, these are reported as alarms and events. You can generally ignore these transient alarms, and initiate corrective action only if the alarms persist after the provisioning is completed. To avoid the confusion created by this, Alcatel-Lucent 1850 TSS-5 provides automatic channel state provisioning.

Channel states

A VC-n, VT1.5, STS-1, or STS-3c channel is kept in the default automatic (AUTO) state or, for pass-through connections, the default not-monitored (NMON) state until the reception of a valid signal (a framed non-AIS, non-LOP, or non-UNEQ). A channel state transition from the AUTO state is based on the absence of all monitored path level defects in that channel. While in the AUTO state, no alarms or events are reported on the channel. On receiving a valid signal, the channel automatically changes to the in-service (IS) state, where it resumes normal alarm and event reporting. An additional state, not-monitored (NMON), is also supported in which alarm and event reporting is suppressed regardless of the validity of the signal being received on the channel. The user can submit

commands to manually change a channel from IS or AUTO to NMON, and from NMON to AUTO. A user cannot manually change from AUTO or NMON to IS. In a UPSR/SNCP ring, the state will go from AUTO to IS as soon as a good signal is received on either side of the ring.

Flow control

Provisioning

The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs provide both local and end-to-end flow control if flow control is enabled. Similarly, disabling flow control disables both forms of flow control. The configuration of flow control is supported in the Command Line Interface (CLI), using the **storm control** command. The command enables 802.3x flow control for the switch, or on a per-port basis. Flow control only applies to full-duplex mode ports. The port-specific setting overrides the global setting of the switch. See, the Alcatel-Lucent 1850 TSS-5 Command Line Interface Guide for details.

Important! 802.3x flow control works by pausing traffic on a port when the port becomes oversubscribed. This results in dropping all traffic for short bursts of time during the congested condition. It can lead to the loss of high-priority and network control traffic.

VLNC40/42/42B resource guidelines

Overview

The VLNC40/42/42B circuit pack uses programmable masks and rules in order to recognize and manipulate packets. However, there are a limited number of masks and rules in the hardware.

Rules and masks

Each rule is associated with one mask. Each mask can be associated with one or more rules. Deinstalling and reinstalling masks and rules can cause features to be temporarily disabled/broken, and this can include all features which use masks and rules, not just the one for which the hardware is being changed.

Shared blocks

For shared blocks, it is possible for ports which are configured for the same functionality to share masks and rules. However, slight changes in the provisioning can make sharing impossible. Masks are generally sharable; rules may or may not be.

The shared blocks are shared across the following ports:

- block 1:
 - VLIU1: ports 9–16
 - VLIU2: ports 41–48
- block 2:
 - VLIU1: ports 17–24
 - VLIU2: ports 49–56
- block 3:
 - VLIU1: ports 25–28
 - VLIU2: ports 57–60

Table 5-45 Resource usage

Feature	Masks ¹		Rules ²	
	Backplane (shared blocks)	Faceplate	Backplane (shared blocks)	Faceplate
basic system functions	6	6	6	6
DiffServ ³	1 per class	1 per class	1 per class	1 per class
Access Control List (ACLs) ⁴	1 per rule	1 per rule	1 per rule	1 per rule
Link OAM Loopback local ⁵	1	1	1	1
Link OAM Loopback remote ⁶	1	1	1	1
Ethernet Ring Protection (ERP)	NA	1 per ERP port	NA	1 per ERP port
Service Multiplexing ⁷	max 3	max 4	6 plus 1 per mapping ⁸ plus 1 per shared block for serv-mult UNI to non-serv-mult UNI (VLAN participation include same VLAN) on different shared blocks	6 plus 1 per mapping on each NNI participating in pvid and svlan

Table 5-45 Resource usage (continued)

Feature	Masks ¹		Rules ²	
	Backplane (shared blocks)	Faceplate	Backplane (shared blocks)	Faceplate
Service OAM initial ⁹	1	1	25 single-tagging mode 41 double-tagging mode ¹⁰	18 single-tagging mode 34 double-tagging mode ¹⁰
Service OAM MEPs	0	0	1 per port per down MEP 1 max, if there are any up MEPs	1 per down MEP 1 per up MEP

Notes:

1. The total number of available masks per backplane shared block is 16. The total number of available masks on each faceplate port is 16.
2. The total number of available masks per backplane shared block is 256. The total number of available masks on each faceplate port is 128.
3. Limits are: 25 classes system-wide; 10 classes per policy; 1 policy per port. Masks/rules may be reused across policies, but not within policies. The pack supports a maximum of 10 rules per faceplate port and 80 rules per shared block.
4. Limits are: 100 ACLs system-wide; 8 rules per list; 1 list per port. Masks/rules may be reused across ACLs, but not within ACLs. The pack supports a maximum of 8 rules per faceplate port and 64 rules per shared block.
5. Allocated when **linkoam enable** is issued for a port. Mask and rule are shared across all shared block ports with linkoam enabled.
6. Allocated when **linkoam loopback-capability enable** is issued for a port. Mask and rule are shared across all shared block ports with linkoam enabled.
7. The maximum number of masks, plus the initial rules are added as soon as any UNI port is set to enable service multiplexing, and at least one mapping and associated VLAN participation has been added. Additional rules are then added/removed whenever a mapping is added/removed, or when VLAN participation changes. Note that the special case of CVLAN "0" uses 2 rules. Masks are always shared across all of each of the shared blocks. Wherever possible, rules are reused within a shared group. For example, if two service-multiplexed ports within a group have the same mapping, then they share a rule.
8. A single mapping is created each time the **map <cvlan><svlan>** command is used. A mapping applies to a single service-multiplexed UNI port.
9. Allocated when **ethoam cfm** is enabled. The mask is also used for up and down MEPs.
10. The shelf is double-tagging if any port is set to **mode dvlan-tunnel** enabled.

Reports

Overview

Purpose

This section describes the reports generated by Alcatel-Lucent 1850 TSS-5. It primarily contains information about SYSCTL-controlled circuit packs

Contents

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State reports	5-132
Provisioning reports	5-132
Maintenance history reports	5-133
Version/equipment list	5-133

Alarm report

Purpose

The system provides an alarm report that lists all the active alarms and standing conditions, including a remote alarm status feature that summarizes alarms in other NEs in an alarm group.

Report details

A description of the condition (for example, controller failure, incoming signal failure, synchronization hardware, etc.) is included in the report along with a time stamp indicating when the condition was detected, its severity, and whether it is service affecting or not. The option to display specified subsets of alarm conditions is provided (for example, critical alarms only).

Status conditions include:

- Manually initiated abnormal conditions (for example, forced switch, loopbacks, system testing)
- Incoming AIS detected

A description of the status condition (for example, DS1 loopback active, DS3 facility loopback active, and so on) is included in the report along with a time stamp indicating when the condition began.

Performance monitoring reports

TCA summary report

Alcatel-Lucent 1850 TSS-5 provides a report that lists the number of performance-monitoring parameters, related to SONET/SDH, Ethernet, DS1/E1, and DS3 operations, that have crossed their thresholds. This report provides a snapshot of the system performance level. If there is signal degradation, it is quickly pinpointed so that corrective action may be taken before customers are affected, thus supporting proactive maintenance.

This report provides separate parameter summaries for each signal level in the system for the following:

- SONET section, line, and path
- SDH multiplex and regenerator sections and path
- DS3 line and path
- DS1 line and path
- E1 line and path
- Dropped incoming or outgoing Ethernet bytes and frames

The parameter summaries show the user which performance status to request if they want further information.

Performance status reports

These reports provide detailed information on the current and previous 8 hours in quarter-hour (15-minute) increments, as well as the current and previous day's performance. Threshold crossing alerts are clearly identified and the time the performance registers were last initialized is also shown. Any registers that may have been affected by this initialization are marked. There are separate reports for section, line, and path parameters, as well as Ethernet parameters.

State reports

Overview

The state report shows the protection state of all SYSCTL-controlled circuit packs installed in the system and the state of the individual tributary and network channels.

Circuit pack states

The circuit pack state is reported as no state or IS (in-service).

Socket states

The socket state is reported as automatic (AUTO) or Equipped.

Channel states

The state of the individual VT1.5/STS-n, VC-3 (low-order), VC-4, and VC-12 channels and paths may be one of the following:

- not monitored (NMON)
- in service (IS)
- auto (AUTO).

Line/port states

The state of individual lines/ports may be automatic (AUTO), IS (in-service), or not monitored (NMON).

Provisioning reports

Overview

Alcatel-Lucent 1850 TSS-5 provides a variety of provisioning reports that contain the current values of all electronically-provisionable parameters and hardware-selectable parameters. For more information on the provisioning reports generated, refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) User Provisioning Guide*.

Maintenance history reports

Overview

A maintenance history report contains the following past conditions:

- Alarms
- Status
- Protection switching
- User interface commands (for example, provisioning, loopback request, manual protection, and so on.)

Summary

The maintenance history report contains time stamps indicating when each condition was detected and when it cleared, as well as when the command was entered. Any system controller reset clears all records in the log.

Reference:

Refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) User Provisioning Guide*, for details on the history log.

Version/equipment list

Overview

Alcatel-Lucent 1850 TSS-5 provides a full inventory report on all hardware and software currently installed in the system.

Important! The VLNC2 SYSCTL and the *WaveStar*® CIT reports the presence and name of a non-SYSCTL controlled pack (VLNC40, VLNC42/42B, VLNC60, VLNC61, VLNC62, VLNC64), but reports no other information about the non-SYSCTL controlled packs.

Information provided

The version/equipment list provides the following information:

- Circuit pack name
- Slot/Socket ID
- 10-character *CLEI* code
- 6-digit equipment catalog item (ECI)
- 10-character apparatus code
- 6-character series number

- 12-character serial number (includes date and location of manufacture)
- 6-digit program version (software generic) code

The version/equipment list provides the following information relative to pluggable transmission modules (PTMs):

- Comcode
- *CLEI* code
- Date of manufacture
- 10-character apparatus code
- 6-character series number
- 12-character serial number (includes date and location of manufacture)
- Manufacturer identifier
- Module name
- Module product ID
- Reach (i.e. short, intermediate, long)
- PTM wavelength

Administration

Overview

Purpose

This section provides information on system administration.

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Software upgrades

Overview

Alcatel-Lucent 1850 TSS-5 provides an in-service software installation capability to update the generic program in local and remote systems. Upgrades are distributed on CD-ROMs containing the new software and an installation program. These software upgrades are the primary mechanism to add new feature enhancements to the in-service Alcatel-Lucent 1850 TSS-5 network. All software upgrades are in-service and do not affect any provisionable parameters. For example, cross-connections are left unchanged by the software upgrade.

For the Alcatel-Lucent 1850 TSS-5 SYSCTL, software downloads take place in two stages. In the first stage, the new generic software is downloaded into a dormant flash area as a compressed file. In the second stage, the new generic is decompressed and moved into an active flash space. During this process, the old release continues to run from random access memory (RAM).

The process for downloading software to the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs is similar to the process for the SYSCTL circuit pack. The new version of the software is downloaded to a backup memory area in the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs, without affecting the operation of the circuit pack. The backup memory area is then designated as the boot memory location, and the circuit pack is rebooted using the restart command from the CLI. The download process for the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs uses TFTP over an IP network connection.

With both procedures, installation is not service-affecting. Down time is limited to the time required to reboot.

Local installation procedure

Software controlling SONET/SDH operations is downloaded locally to the SYSCTL circuit pack over a serial connection. Software controlling Ethernet operations is downloaded locally to the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack over a network connection.

SYSCTL

The procedure is straightforward. You connect a personal computer (PC) to the LAN or RS-232 CIT port on the local SYSCTL circuit pack faceplate, start the installation program, and are prompted with a few warnings before the upgrade installation actually begins. After you confirm that it is alright to proceed, the PC takes over the process and completes the installation.

VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64

The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs each operate independently and use self-contained operating software that is separate from the software used by the SYSCTL. Software downloads to the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack require a network connection to the CLI of the circuit pack, and network access between the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack and the TFTP server with the new software. You can establish a network connection to the CLI of the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack through the local administrative network, through a direct connection to LAN port on the faceplate, or through a connection to any operational Ethernet port supported by the pack.

You use the CLI commands to verify the current operating software, specify the address of the TFTP server, specify the name of the new software image, and initiate the process copying the software. The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack then connects and downloads the new software.

IP Access for network management

Overview

For network management purposes, the Alcatel-Lucent 1850 TSS-5 supports the following types of IP Access:

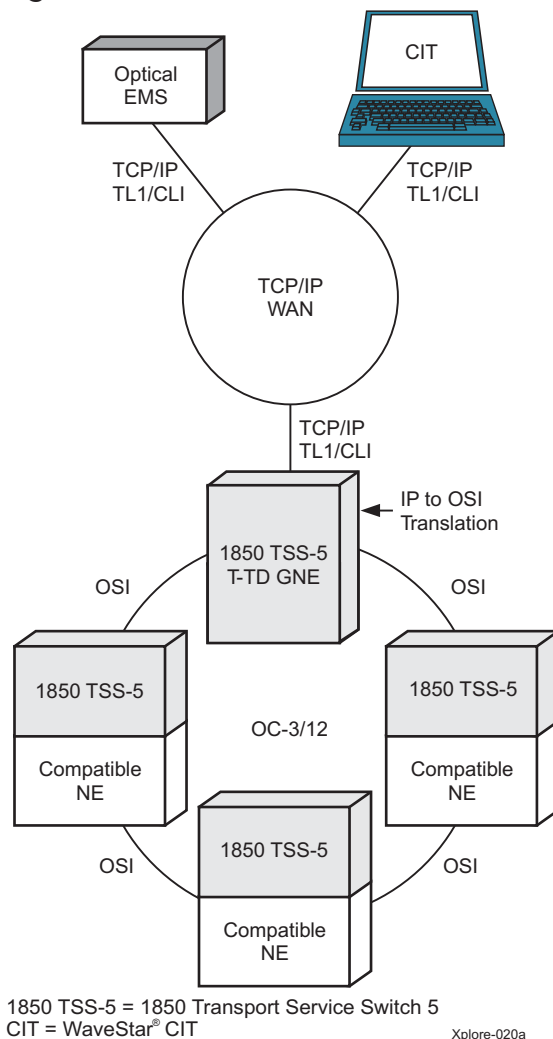
- When operating as a SONET/SDH network element with a SYSCTL and VLNC50/52 installed, Alcatel-Lucent 1850 TSS-5 can serve as a TL1 Translation Device (T-TD) by acting as a gateway network element that allows *WaveStar*® CIT to communicate to other network elements (NEs) through an IP access network. This capability allows you to send TL1 commands from *WaveStar*® CIT located on a TCP/IP based network to various NEs connected on an OSI network.
- As a SONET/SDH VLNC50/52 network element, Alcatel-Lucent 1850 TSS-5 can functionally encapsulate IP packets within OSI packets to be transmitted through the OSI network to the proper NE. Thus Alcatel-Lucent 1850 TSS-5 supports IP based protocols such as FTP by providing end-to-end IP connectivity between OS and NE. This capability is called IP tunneling. IP tunneling is required to support remote database backup/restore in between Alcatel-Lucent 1850 TSS-5 systems.
- With SYSCTL and VLNC50/52 circuit packs installed, Alcatel-Lucent 1850 TSS-5 can also serve as a File Transfer Translation Device (FTTD) by acting as an FTAM-FTP gateway network element. The FTAM-FTP gateway network element translates FTAM over OSI presentation to FTP over TCP/IP. The FTAM-FTP gateway supports software downloads, database backups, and database restores.
- Alcatel-Lucent 1850 TSS-5 supports Simple Network Management Protocol (SNMP) for data network applications supported by the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack. Alcatel-Lucent 1850 TSS-5 provides limited support for certain reports and traps (alarms and events autonomous messages).
- Alcatel-Lucent 1850 TSS-5 also supports Network Time Protocol (NTP) using IP tunneling to synchronize the time and date to a standard time reference.

TL1 GNE (T-TD)

When operating as a SONET/SDH VLNC50/52 network element, Alcatel-Lucent 1850 TSS-5 can copy the application information within an IP packet into an OSI packet. This translation is performed at the application layer. When acting as a TL1 translation device, Alcatel-Lucent 1850 TSS-5 system must be provisioned with a list of possible OSs. If an

OS is not on the list residing within the system, a connection from that OS will not be accepted. When Alcatel-Lucent 1850 TSS-5 is used as a TL1 translation device it is referred to as the T-TD GNE (Gateway Network Element).

Figure 5-12 TL1 translation device



OSI associations and TCP/IP connections

When used as a GNE, Alcatel-Lucent 1850 TSS-5 supports a total of 105 OSI associations (logins). Each TCP/IP (or Telnet) connection can support 64 associations. If the user attempts to establish a sixty-fifth association from a TCP/IP connection, the connection is denied. The user must establish an additional TCP/IP (or Telnet) session. The Alcatel-Lucent 1850 TSS-5 GNE supports up to 20 TCP/IP connections. The combined number of OSI associations on all TCP/IP sessions cannot exceed 105.

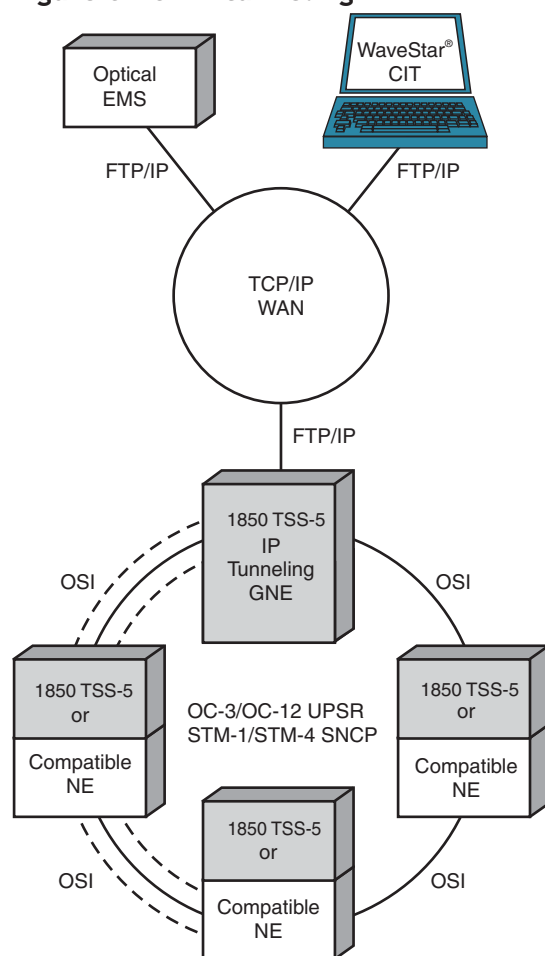
IP tunneling

The Alcatel-Lucent IP tunneling solution consists in encapsulating IP packets inside CLNP (ISO 8473 ConnectionLess Network Protocol) PDU, in order to be able to use an existing OSI-based embedded Data Communications Network (DCN) for IP traffic.

With the IP tunneling over CLNP solution, Alcatel-Lucent 1850 TSS-5 NE can support the following two customer applications: IP access and IP fringe.

An IP access application is shown in [Figure 5-13, “IP tunneling” \(p. 5-139\)](#), where an IP based OS (for example, SNMP manager) located in the IP access DCN manages a remote Alcatel-Lucent 1850 TSS-5 NE located in the OSI-based embedded DCN. The IP application initiated at the OS terminates at the remote NE.

Figure 5-13 IP tunneling



MA-TSS5APG-003

== = FTP through IP Tunnel
GNE = Gateway Network Element

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An IP fringe application, where an IP based OS located in the IP access DCN manages an IP managed NE (non Alcatel-Lucent 1850 TSS-5) on the fringe of Alcatel-Lucent 1850 TSS-5 OSI-based embedded DCN. The IP application initiated at the OS terminates at the IP managed NE. Note that if the IP managed NE is not directly connected to Alcatel-Lucent 1850 TSS-5 remote NE via the LAN, but can be reached via additional routers, some static routes have to be provisioned manually on the routers.

Alcatel-Lucent 1850 TSS-5 and Alcatel-Lucent 1850 TSS-100/Alcatel-Lucent 1850 TSS-320 IP tunneling interworking

In a typical network, the Alcatel-Lucent 1850 TSS-5 is a remote NE (RNE) interworking with an Alcatel-Lucent 1850 TSS-100 or Alcatel-Lucent 1850 TSS-320 functioning as the gateway NE (GNE). The Alcatel-Lucent 1850 TSS-100/Alcatel-Lucent 1850 TSS-320 GNE supports T-TD (TL1 Translation Device) to translate TL1 over TCP/IP to TL1 over OSI. This allows TL1 management of a remote Alcatel-Lucent 1850 TSS-5.

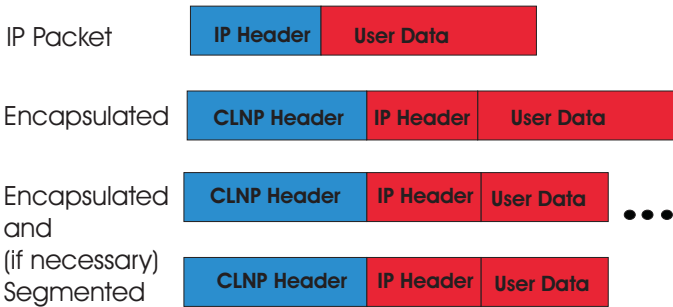
However, to fully support IP tunneling interworking between a remote Alcatel-Lucent 1850 TSS-5 and the Alcatel-Lucent 1850 TSS-100/Alcatel-Lucent 1850 TSS-320 GNE, Alcatel-Lucent 1850 TSS-5 supports a provisionable NSAP selector and a reduced Maximum Transmission Unit (MTU) size.

To support interworking with the Alcatel-Lucent 1850 TSS-100/Alcatel-Lucent 1850 TSS-320, the NSAP selector parameter must be provisioned to f0 (04 default value) at the remote Alcatel-Lucent 1850 TSS-5. This allows software operations (download/backup/restore) to a remote Alcatel-Lucent 1850 TSS-5 using FT-TD (File Transfer Translation Device) to translate FTP over TCP/IP to FTAM over OSI.

Encapsulating IP packets

When functioning as a GNE, Alcatel-Lucent 1850 TSS-5 acts as the tunnel entrance, i.e., the interface between IP and CLNP. When an IP packet is received from the LAN interface of the GNE, if it is not destined for the GNE, the received IP packet is encapsulated into CLNP PDU(s) as simple CLNP user data, losing any IP protocol meanings (such as IP addressing and life time), as shown in the following figure.

Figure 5-14 Encapsulated IP packets



For the CLNP PDU that contains the encapsulated IP packet, the CLNP source address is the NSAP of the NE where the IP packet is encapsulated (tunnel entrance), and the CLNP destination address is the NSAP of the NE where the IP packet will be de-capsulated (tunnel exit). The CLNP PDU then is routed via the ISO-10589 "IS to IS intra-domain information exchange protocol (IS-IS)" within the embedded OSI DCN. Therefore, the IP tunneling over CLNP is transparent for the IP world. The CLNP world is only used to carry the IP traffic and there is no possible connections between the OSI applications and the IP applications. The IP tunnel serves as a normal point-to-point link for the IP traffic between two NSAP entities (the tunnel entrance and tunnel exit). Note that because the IP traffic flows in both directions between two NSAP entities, the tunnel entrance entity also serves as the tunnel exit entity, and vice versa.

In the tunnel entrance, the way to associate an IP destination address in the IP packet with an OSI NSAP address (the NSAP of tunnel exit entity) can be derived by the static user provisioned information or by the automatic distributed tunnel routing information, called Tunnel Auto Provisioning (TAP).

Tunnel auto provisioning (TAP)

In the OSI networks, the network elements use the ISO-10589 "IS to IS intra-domain information exchange protocol (IS-IS)" to exchange the topology information. The knowledge by every network element of the whole network topology at a given time allows the computation of the optimal route to any possible destination on the network. The IS-IS protocol provides for the inclusion of optional variable length fields in all IS-IS packets. This allows additional IP specific information to be added to the OSI IS-IS routing packets.

The topological information between network elements (or called intermediate systems) is communicated by sending a specific IS-IS PDU called LSP (Link-State PDU). In the LSP optional fields, the NEs send (advertise) information about the IP sub-nets that can be reached via that NE. By default, this will be locally attached subnet, but other sub-nets can also be provisioned for the advertisement.

The advertising of IP information using the LSP options can be enabled or disabled via the user interfaces. Based on the specification of the IS-IS protocol, any intermediate systems that could not recognize the encoded optional fields shall just ignore and pass through these fields unchanged. This makes it possible for NEs that advertise both OSI and IP routing information work with NEs that advertise OSI routing information only.

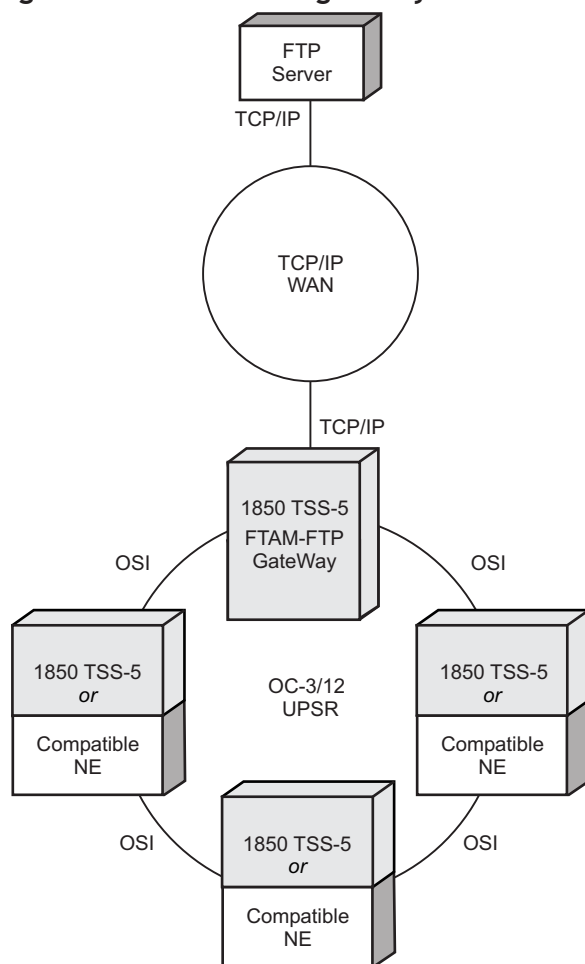
With automatic distribution of IP routing information via IS-IS LSP, a NE, which learned such information, then can associate an IP destination address of an IP packet with an OSI NSAP address, and uses this NSAP address as the destination address of CLNP PDU(s) which encapsulates the IP packet.

FTAM-FTP gateway network element

Alcatel-Lucent 1850 TSS-5 can serve as a File Transfer Translation Device (FTTD) by acting as an FTAM-FTP gateway network element. The FTAM-FTP gateway network element translates FTAM over OSI presentation to FTP over TCP/IP. The FTAM-FTP gateway supports software downloads, database backups, and database restores.

The following figure shows an Alcatel-Lucent 1850 TSS-5 provisioned as an FTAM-FTP gateway network element. The FTAM-FTP gateway network element allows remote Alcatel-Lucent 1850 TSS-5 network elements to request software downloads and database restores from an FTP server. The FTAM-FTP gateway network element also allows remote Alcatel-Lucent 1850 TSS-5 network elements to backup databases to an FTP server.

Figure 5-15 FTAM-FTP gateway



1850 TSS-5 = 1850 Transport Service Switch 5

Xplore-046a

Time and date synchronization

Overview

When equipped with SYSCTL and VLNC50/52 circuit packs, and functioning as a network element, Alcatel-Lucent 1850 TSS-5 can synchronize the time and date among all NEs in a network to help correlate events reported by different NEs.

The time and date is synchronized:

- Manually using the *WaveStar*® CIT **Administration** → **Set Date and Time** command.
- Automatically from another NE via the DCC.
- Automatically by the OS

Provisioning

In a new installation, it is recommended that the time and date be manually provisioned in at least the first Alcatel-Lucent 1850 TSS-5 in each ring. Each subsequent Alcatel-Lucent 1850 TSS-5 that is added to the network tries to learn the current time and date from one of the existing NEs automatically.

After start-up (or any subsequent controller resets), the Alcatel-Lucent 1850 TSS-5's time and date revert back to the last time and date before the reset. Alcatel-Lucent 1850 TSS-5 waits 5 minutes, in case other NEs are also resetting (for example, as part of a software upgrade of the network), before starting to check with other NEs for the current time and date. If necessary, the Alcatel-Lucent 1850 TSS-5 checks with all remote NEs for the current time and date.

The Alcatel-Lucent 1850 TSS-5s allow up to 2 minutes for each remote NE to respond before checking with the next remote NE for the current time and date, and keep checking until a valid current time and date is found.

Alcatel-Lucent 1850 TSS-5 accepts a provisioned time and date value or any remote NE date later than 00-01-01 as a valid current time and date.

Network Time Protocol (NTP)

Network Time Protocol (NTP) assures accurate synchronization of the Alcatel-Lucent 1850 TSS-5 with reference to radio and/or atomic clocks located on the Internet.

Considerations

The automatic time and date synchronization is intended to achieve time and date synchronization among compatible NEs with DCC connectivity in a network, but such synchronization can not be guaranteed at start-up for all network configurations or over the course of time.

TL1 command responses and autonomous messages include Alcatel-Lucent 1850 TSS-5's current time and date.

Time and date synchronization compatibility

Alcatel-Lucent 1850 TSS-5 supports time and date synchronization with the following products:

- Alcatel-Lucent 1850 TSS-5
- Alcatel-Lucent 1665 DMX
- Alcatel-Lucent 1665 DMXtend
- Alcatel-Lucent 1665 DMXplore
- Alcatel-Lucent DDM-2000 OC-3
- Alcatel-Lucent DDM-2000 OC-12
- Alcatel-Lucent FiberReach
- Alcatel-Lucent FT-2000 ADR

Office alarms interface

Description

The office alarms interface is a set of discrete relays controlling audible and visible office alarms. CR (critical) and MJ (major) alarm conditions are reported through one pair of relays. MN (minor) alarm conditions are reported through another pair of relays.

These alarm relays are controlled by the SYSCTL and are functional in a shelf that is equipped with a SYSCTL.

Steady state current

The steady state current for office alarm connections must not exceed 1.0 Amp at 60 Volts or 1.8 Amps at 30 Volts. The maximum transient currents (20 msec duration) during initial contact closure must not exceed 9 Amps at 60 Volts or 18 Amps at 30 Volts.

Provisionable alarm delay and alarm clear delay

Alcatel-Lucent 1850 TSS-5 provides provisionable incoming signal alarm delay and alarm clear delay. The alarm clear delay only applies to equipment alarms. It does not apply to signal failures. The office alarms are not activated unless an incoming signal condition of greater duration than the alarm delay occurs. When a failure clears, a provisionable alarm clear delay prevents premature clearing of the alarm.

Multiple alarms

When multiple alarm conditions occur, the highest-level office alarm (audible and visible) is activated. When the highest-level alarm condition clears, the office alarm bumps down to the next highest level alarm condition.

If enabled, the Remote NE Status feature includes alarms at other NEs in the same alarm group as the local NE to determine when to activate the local office alarm and the appropriate alarm level.

Alarm cut-off

The audible office alarms are silenced through activation of the alarm cut-off (ACO) function. Visible alarms are not extinguished by the ACO function.

If the ACO function has been activated to silence the active audible alarm and a bump down occurs, the audible alarm remains silent (that is, the lower level visible alarm is activated, but the corresponding audible alarm is not reactivated). If another alarming condition occurs while the ACO is active, the audible alarm is activated even if the new condition is a lower level. For example, if a major (MJ) alarm was active and silenced using the ACO function and a minor (MN) alarming condition occurs, the audible alarm will sound.

Remote NE status

Overview

If the shelf is equipped with SYSCTL and VLNC50/52 circuit packs, the Remote NE Status feature can be enabled. It reflects the summary alarm/status level for both the local and remote NEs in the same alarm group as the local NE. Information in this section describes local indications for Alcatel-Lucent 1850 TSS-5 that are equipped to support this feature.

Office alarms

The local office visual alarm always shows the highest alarm level. The local office audible alarm is activated in response to each new alarm occurrence among the local and remote NEs. This alerts on-site craft of problems in the network with and gives them an indication of the severity.

SYSCTL faceplate LEDs

The CR, MJ, or MN LED on the local SYSCTL circuit pack faceplate shows the highest alarm level among the local and remote NEs. The FE LED on the local SYSCTL circuit pack faceplate is illuminated if any remote NE has an active alarm, abnormal status (indicated by the ABN LED), or activity status condition, thus identifying the local NE to query further. (Although not dependent on the Remote NE Status feature, the Near-End LED on the local SYSCTL circuit pack faceplate is only illuminated if the local NE itself has an active alarm, abnormal status, or activity status condition.)

Remote NE status and alarm/status retrieval

The local NE can retrieve the highest alarm/status level of each NE in a network with an active alarm, abnormal status, or activity status condition, thus identifying the remote NE to further query.

Determination of the highest alarm/status level of each NE includes the alarm/status level of active miscellaneous discrete alarm/status inputs.

The Remote NE Status feature can be used to expedite maintenance activities for NEs that report TL1 autonomous alarm/status messages to a maintenance OS at an operations center.

The Remote NE Status feature may be enabled or disabled. By default, the Remote NE Status feature is disabled.

Alarm group

By default, all Alcatel-Lucent 1850 TSS-5 systems are assigned to alarm group 255. This is typically sufficient for small networks of up to 50 nodes. All NEs with DCC connectivity that have the same alarm group number are members of the same alarm group. All alarm group members share summary alarm/status information with each other but not with NEs in different alarm groups. To take advantage of the remote activation of local office alarms, in particular, at least one member of the alarm group should be located in a central office.

In large networks, with IS-IS Level 2 Routing and multiple Level 1 areas, each alarm group *must* be confined to within a single Level 1 area only. For example, a network with three different Level 1 areas would require a minimum of three alarm groups, that is, one

alarm group for each Level 1 area. If desired, multiple alarm groups can be defined within a Level 1 area, also. The maximum number of NEs in an alarm group is limited by the maximum number of nodes in a Level 1 area.

Alarm Gateway NE (AGNE)

By default, no NE is enabled as an AGNE. Even if the default alarm group number for all NEs is used, at least one NE in each alarm group must be enabled as an AGNE. Any NE in an alarm group can be enabled as an AGNE, for example, an AGNE does not need to be located in a central office, in fact, it is recommended that an AGNE should not also be a TL1 TCP/IP GNE, TL1 GNE, or IS-IS Level 2 Router.

A second NE in each alarm group may be enabled as a backup AGNE, if required. It is recommended that the maximum number of AGNEs per alarm group be limited to at most two to assure good performance.

Instead of having every NE exchange alarm/status information with every other NE in the same alarm group directly, only the AGNE receives alarm/status information from every NE directly, and the AGNE distributes the accumulated alarm/status information for all the NEs to every NE in the alarm group.

Provisioning sequence

If there is no AGNE, each NE in an alarm group reports an `AGNE Communications Failure` alarm; therefore, the following provisioning sequence is recommended:

1. Provision one or two (at most) NEs as the AGNE
 - Enable the Remote NE Status parameter
 - Enable the network element as an Alarm Gateway
 - Provision the alarm group number, if different than the default.
2. Provision the other NEs in the same alarm group
 - Enable the Remote NE Status parameter
 - Provision the alarm group number, if different than the default.

For more information about the **Administration** → **Set NE** command, refer to the *WaveStar*® CIT help.

Remote NE status compatibility

Alcatel-Lucent 1850 TSS-5 supports remote NE status compatibility with the following products

- Alcatel-Lucent 1850 TSS-5
- Alcatel-Lucent 1665 DMX
- Alcatel-Lucent 1665 DMXtend

- Alcatel-Lucent 1665 DMXplore
- Alcatel-Lucent DDM-2000 OC-3
- Alcatel-Lucent DDM-2000 OC-12
- Alcatel-Lucent FiberReach

SONET/SDH network size

Overview

When Alcatel-Lucent 1850 TSS-5 is equipped with SYSCTL and VLNC50/52 circuit packs to function as a network element, there is no inherent limit to the total number of NEs in a SONET/SDH transmission network with it. However, there is a limit to the number of nodes that can be in the same OSI domain, with OSI LAN and/or DCC connectivity for operations communications among the NEs.

Maximum number of OSI nodes

A maximum of 250 OSI nodes is supported, unless IS-IS Level 2 Routing is used. With Level 2 Routing enabled, a maximum of 1000 OSI nodes are supported in a domain of up to 50 Level 1 areas. Each Alcatel-Lucent 1850 TSS-5 counts as one OSI node.

To simplify administration and minimize provisioning, the number of nodes included in the same OSI domain should be limited to no more than 1000, whenever practical, by disabling all OSI LAN and DCC between some logical groupings of NEs.

IS-IS level 2 routing

IS-IS Level 2 Routing involves the assignment of NEs to multiple areas of less than 250 nodes each. Level 2 routers support OSI communications between the NEs in different areas. Both the assignment of NEs to areas and the enabling of NEs as Level 2 routers is accomplished by provisioning.

Directory services

Definition of directory services

OS and *WaveStar*® CIT users access remote Alcatel-Lucent 1850 TSS-5s equipped to operate as SONET/SDH network elements, using the remote Alcatel-Lucent 1850 TSS-5 Target Identifier (TID, name). However, remote Alcatel-Lucent 1850 TSS-5s are addressed on the DCC using Network Service Access Point Address (NSAP). Therefore, a method to provide TID-to-NSAP (name-to-address) and NSAP-to-TID (address-to-name) translations is necessary. Target Identifier Address Resolution Protocol (TARP) provides this capability.

For SONET NEs that support TCP/IP and TL1 OS interfaces, TARP is the de facto directory services standard to support multi-vendor OI compatibility. TARP is specified in *Telcordia*® GR-253-CORE, SONET Transport Systems: Common Criteria.

TID provisioning

Each NE in a network must be provisioned with a unique TID. The Alcatel-Lucent 1850 TSS-5's default TID is "ALU-1850TSS-5". The terms TID and source identifier (SID) are generally used interchangeably.

Important! Some vendor NEs require that all TIDs start with an alphabetic character, or that each TID consist of specified minimum number of characters.

To be compatible with *WaveStar*® products, Alcatel-Lucent 1850 TSS-5 TIDs should *not* include special characters "%" and "#". Alcatel-Lucent 1850 TSS-5 TID provisioning allows special characters, but T1.245 SONET Directory Services (SDS) does not support special characters.

NSAP provisioning

By default, each Alcatel-Lucent 1850 TSS-5 has a unique Network Service Access Point (NSAP) address, thus no NSAP provisioning is necessary in small networks. If the network size exceeds 50 OSI nodes, NSAP provisioning is required.

TARP provisioning

Although TARP functions automatically without any user provisioning, using standard default values, Alcatel-Lucent 1850 TSS-5 allows provisioning of the following TARP parameters. All TARP parameters are provisionable:

- Lifetime
- Manual Adjacency
- Timers
- Loop Detection Buffer (LDB) Flush Timer

- TARP Data Cache (TDC) Enable/Disable
- TDC TID-NSAP Entries.

It is recommended that the TARP default values always be used.

TARP TID-to-NSAP translations

The three operations that depend on TARP TID-to-NSAP translations are:

1. TL1 OS access
2. *WaveStar*® CIT access
3. Remote (Software) Install Program/Copy Program.

When a TL1 TCP/IP or TL1 Gateway Network Element (GNE) receives a TL1 login request for a TL1-RNE, the TL1 login request includes the TL1-RNE's TID. The TL1-GNE relies on TARP to determine the TL1-RNE's NSAP. The TL1-GNE needs the NSAP to establish an OSI association with the TL1-RNE. The TL1 login request is forwarded to the TL1-RNE over that OSI association.

The local Alcatel-Lucent 1850 TSS-5 serves as a TL1-GNE and uses TARP as described above for *WaveStar*® CIT access via Alcatel-Lucent 1850 TSS-5's serial ports or TCP/IP. When accessing Alcatel-Lucent 1850 TSS-5 via OSI LAN, the *WaveStar*® CIT (or OS) performs the TL1-GNE function and uses TARP in a similar manner, also. The local Alcatel-Lucent 1850 TSS-5 uses TARP as described above to support remote Install Program/Copy Program.

TARP propagation

The first time a TL1-GNE (or local Alcatel-Lucent 1850 TSS-5) requires a TARP TID-to-NSAP translation for each remote NE, the TL1-GNE originates a TARP query. The TARP query is propagated to all NEs in the same OSI routing area, and if no response is received from within the area, up to two additional TARP queries are propagated throughout the OSI domain. Each NE forwards the TARP queries to each of its neighboring OSI nodes (that is, adjacencies), except the neighbor from which the TARP query was received.

When the TARP query reaches the remote NE with the requested TID, that remote NE responds to the originating NE with the remote NE's NSAP address. If there is no response to any of the TARP queries for a TID, after the third query times out, an error response (for example, TL1- GNE unknown TID or TID not found) is returned to the originating NE.

TARP NSAP-to-TID translations

When an Alcatel-Lucent 1850 TSS-5 is commanded to perform this translation, it knows the NSAPs of the remote NEs to be included in the responses but relies on TARP to determine the corresponding TIDs.

To ensure that the responses to these commands always include the most up-to-date network information, real-time TARP queries are originated instead of relying on the TARP Data Cache or TDC (although the TDC is updated, as appropriate, based on the responses to these NSAP-to-TID queries).

Because the NSAPs are known, these TARP queries are addressed directly to each remote NE (TARP propagation is not necessary). Each remote NE responds to the originating NE with the remote NE's TID.

TARP data cache

In order to reduce the frequency of TARP propagation, and to improve the performance of the affected operations, Alcatel-Lucent 1850 TSS-5 supports a TDC option. By default, the TDC is enabled.

Each Alcatel-Lucent 1850 TSS-5 maintains its own TDC, independently. The TDC consists of TID-NSAP translations. Each Alcatel-Lucent 1850 TSS-5 automatically updates its own TDC based on the responses to previous TARP queries. The TDC may also be updated upon receipt of an unsolicited, automatic notification from another NE in the same OSI domain of a TID or NSAP change.

Alcatel-Lucent 1850 TSS-5 checks its TDC to see if it already has a required TID-to-NSAP translation before originating a TARP query. If a translation is not found in the TDC, the response to that TARP query is used to update the originating TDC. Alcatel-Lucent 1850 TSS-5 assures that its TDC maintains only one TID-NSAP translation for each unique TID. Alcatel-Lucent 1850 TSS-5 supports TDC sizes of up to 110 TID-NSAP translations. If the TDC is disabled or Alcatel-Lucent 1850 TSS-5's system controller is reset, the contents of the TDC are deleted.

TDC accuracy

In the unlikely event that a TDC includes an inaccurate TID-to-NSAP translation, Alcatel-Lucent 1850 TSS-5 confirms that both the NSAP and TID of the remote Alcatel-Lucent 1850 TSS-5 are correct before a remote operation proceeds. If there is a mismatch, an error response (for example, `TL1-RNE unknown TID`, `Inconsistent TID`, or `Association Setup Failure`) is returned to the originating NE.

To correct such a situation, delete the subject TID (L4tdctid) from the TDC, then re-request the remote operation for the subject TID. The subsequent TARP query results in an accurate TID-to-NSAP translation, and the TDC is updated accordingly. A broader solution is to disable and re-enable the TDC in which case *all* TDC entries are deleted.

Security

Capabilities

Alcatel-Lucent 1850 TSS-5 provides security capabilities to protect against unauthorized access to the system.

Two sets of capabilities are supported. One set of security capabilities is tied to the generic operating software on the SYSCTL circuit pack. A second set of security capabilities is tied to the software that supports the CLI on the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs.

User types

The operating software on the SYSCTL circuit pack allows access for four types of users (with tiered restriction levels) with a valid user ID and password:

- Privileged users can execute all commands
A privileged user has access to all the system functional capabilities. Only the privileged users have access to the security and access functions. These functions include assigning/changing user ID/passwords for other users, setting target identifier (TID) names, resetting the system, and system initialization functions.
A privileged user can terminate the login session of other individual users (including other privileged users) or terminate all login sessions of non-privileged users.
- General users have access to all the system functional capabilities except security, access, system initialization and software installation functions.
- Maintenance users can only execute commands that access the system, extract reports and execute maintenance functions through a specific set of commands. No privileged commands may be executed by maintenance users.
- Reports-only users can only execute commands that retrieve reports from the system.

Security can be set to a lockout state, which blocks non-privileged users from logging in to the system.

System initialization

When the system is first initialized, three privileged default user IDs and passwords are provided. Up to 147 user IDs and passwords can be added, deleted, and/or changed by any of the privileged users. Timeouts are provisionable on a per-user basis.

User IDs and passwords

The *WaveStar*® CIT always asks the user for the NE user ID and password with the first NE connection. The user ID and password can be saved for subsequent connections, but the user ID and password can not be saved past the current *WaveStar*® CIT session. User ID and password parameters must be administered on a per-NE basis. You may have a different user ID and/or password on one NE than you have on other NEs.

Each time the number of invalid sequential login attempts reach or exceed the provisionable user ID lockout threshold, the network element reports a Security Alert alarm.

Inactivity timeout period

The inactivity timeout period is the number of minutes after which a user with an inactive session is logged out. A provisionable inactivity timeout period is supported on a per-user basis.

Password aging

The password aging interval is the number of days allowed before a user's password expires. When a user's password expires, the user is prompted to select a new password prior to login. The values for the password aging interval are zero (0) or a range from 7 to 999 days. A value of zero (0) disables password aging. The default value is 0. Password aging does not apply to privileged users' passwords.

WaveStar® CIT default user IDs and passwords

The two default Privileged user IDs and passwords initially installed in the *WaveStar*® CIT are LUC01 and LUC02 (LUC-zero-one, and LUC-zero-two). Their associated passwords are LUC+01, LUC+02, (LUC-plus sign-zero-one, LUC-plus sign-zero-two), respectively.

NE default user IDs and passwords

The three default Privileged user IDs and passwords initially installed in the NE are ALU01, ALU02, or ALU03 (ALU-zero-one, ALU-zero-two, and ALU-zero-three). The default password is 1850TSS-5.

RADIUS authentication for user logins

When the network element is provisioned to use Remote Authentication Dial In User Service (RADIUS) authentication for user logins, any user login triggers the network element, if the maximum number of logins is not reached, to query the designated RADIUS server(s) and act on the response.

The network element (RADIUS client) sends a RADIUS Access-Request packet to the RADIUS server via the IP network. The Access-Request packet contains the User-Name, User-Password, and the network element IP address. The User-Password is hidden (encrypted).

When the RADIUS server receives the Access-Request packet, it validates the sending RADIUS client. A RADIUS client and server must have a provisioned shared secret (the password shared between the RADIUS client and server). If the shared secret is not valid, the Access-Request packet is silently discarded without sending a response. If the shared secret is valid, the RADIUS server searches the user database. If the username is found and the password is correct, the RADIUS server returns an Access-Accept packet to the RADIUS client.

The Access-Accept packet informs the RADIUS client that the user's login attempt is authenticated and authorized. No further local validation is required.

The Access-Reject packet informs the RADIUS client that the user's login attempt is rejected due to invalid username and/or password.

If no response is returned within approximately 5 seconds to the RADIUS client, the Access-Request packet is re-sent one time. If the retry to the primary RADIUS server fails, the RADIUS client sends the Access-Request packet to the secondary RADIUS server (if provisioned).

If no response is received after retries to the primary and secondary RADIUS servers, the network element validates the user login using the local database.

Password administration (CIT and system)

Overview

System administration includes performing the following:

- Changing passwords
- Changing notifications
- Performing security administration
- Viewing NE administration
- Setting TIDs
- Setting NE defaults
- Performing a LAN reset
- Provisioning data communications
- Viewing OSI routing map

WaveStar® CIT user ID/password administration

The **Administration → Security → User Provisioning** command on the *WaveStar®* CIT View menu allows a privileged user to create, change, or delete another user ID or password.

Important! Any changes made to a user's provisioning takes place the next time the user logs in. If the user is currently logged in, no changes take place until that user logs off and logs back in.

Valid WaveStar® CIT user IDs

A valid *WaveStar®* CIT user ID must be a minimum of one character to a maximum of ten characters (no character restrictions).

Valid WaveStar® CIT passwords

A valid *WaveStar®* CIT password must comply with the following:

- Length must be a minimum of six characters to a maximum of ten characters
- Must begin with a letter
- Must contain at least three non-alphabetic characters (symbol or number)
- At least one of the non-alphabetic characters must be a symbol
- When changing a password, the new password must be different than the previous password by at least one character.

Important! User passwords are case-sensitive.

Characters NOT allowed in a *WaveStar*® CIT password

Table 5-46, “Characters NOT allowed in a *WaveStar*® CIT password” (p. 5-156) lists the characters that are not allowed in a *WaveStar*® CIT password.

Table 5-46 Characters NOT allowed in a *WaveStar*® CIT password

Character	Description	Character	Description
	Space	"	Quotation mark
@	Commercial at	&	Ampersand
,	Comma	;	Semicolon
:	Colon	—	horizontal bar (underscore)
=	Equals sign	?	Question mark

Characters allowed in a *WaveStar*® CIT password

Table 5-47, “Characters allowed in a *WaveStar*® CIT password” (p. 5-156) lists the characters that are allowed in a *WaveStar*® CIT password.

Table 5-47 Characters allowed in a *WaveStar*® CIT password

Character	Description	Character	Description
A... Z	Uppercase letters	*	Asterisk
a... z	Lowercase letters	[	Left square bracket
0... 9	Digits	]	Right square bracket
'	Apostrophe	^	Caret
-	Hyphen	`	Grave accent
(	Left parenthesis	{	Left curly brace
)	Right parenthesis	}	Right curly brace
.	Period (full stop)		Vertical bar
/	Slash (Solidus)	<	Less than
+	Plus sign	>	Greater than
!	Exclamation mark	~	Tilde
%	Percent sign	#	Number sign

Changing your own WaveStar® CIT password

The *WaveStar*® CIT **Administration** → **Change Password** command allows any user to change his or her own *WaveStar*® CIT password. Only privileged users can change another user's ID or password.

The Change Password screen is also automatically invoked immediately after the login screen if a user's password has expired. The user is prevented from performing any other function until the password is successfully changed. This screen is also invoked the first time a login is attempted for a new user ID.

Alcatel-Lucent 1850 TSS-5 user ID/password administration

The **Administration** → **Security** → **User Provisioning** command on the network element System View menu allows a privileged user to create, change, or delete another network element user ID or password.

Important! Any changes made to a user's provisioning takes place the next time the user logs in. If the user is currently logged in, no changes take place until that user logs off and logs back in.

Valid Alcatel-Lucent 1850 TSS-5 user IDs

A valid user ID must be a minimum of five allowed characters to a maximum of ten allowed characters.

Valid Alcatel-Lucent 1850 TSS-5 passwords

A valid password must comply with the following conditions:

- Length must be a minimum of six characters to a maximum of ten characters
- Must contain at least one alphabetic character and at least three non-alphabetic characters (symbol or number)
- At least one of the non-alphabetic characters must be number and at least one must be a symbol
- When changing a password, the new password must be different than the previous password by at least one character.

Important! User passwords are case-sensitive.

Characters NOT allowed in an Alcatel-Lucent 1850 TSS-5 password and user ID

Table 5-48, “Characters NOT allowed in an Alcatel-Lucent 1850 TSS-5 password and User ID” (p. 5-158) lists the characters that are not allowed in a password and user ID.

Table 5-48 Characters NOT allowed in an Alcatel-Lucent 1850 TSS-5 password and User ID

Character	Description	Character	Description
	Space	"	Quotation mark
@	Commercial at	;	Semicolon
,	Comma	*	Asterisk
:	Colon	!	Exclamation Mark
=	Equals sign	?	Question mark
\	Back slash		

Characters allowed in an Alcatel-Lucent 1850 TSS-5 password and user ID

Table 5-49, “Characters allowed in an Alcatel-Lucent 1850 TSS-5 password and User ID” (p. 5-158) lists the characters that are allowed in a password and user ID.

Table 5-49 Characters allowed in an Alcatel-Lucent 1850 TSS-5 password and User ID

Character	Description	Character	Description
A... Z	Uppercase letters	^	Caret
a... z	Lowercase letters	`	Grave accent
0... 9	Digits	{	Left curly brace
'	Apostrophe	}	Right curly brace
-	Hyphen		Vertical bar
(	Left parenthesis	<	Less than
)	Right parenthesis	>	Greater than
.	Period (full stop)	~	Tilde
/	Slash (Solidus)	%	Percent sign
+	Plus sign	#	Number sign
[	Left square bracket	&	Ampersand
]	Right square bracket	_	Horizontal bar (underscore)

Changing your own password

From the network element System View, the **Administration → Change Password** command allows any user to change his or her own password. Only privileged users can change another user's ID or password.

When a user changes their own password, the new password must be different in at least three character positions from the current password.

The original password, or a significant substring of it, must not be part of the new password.

- If the current and new passwords are the same length, then the characters in at least 3 character positions must be different.
- If the current and new passwords are different lengths, then for every possible contiguous substring of the length of the shorter password within the longer password, the characters in at least three character positions must be different between the shorter password and the character substring within the longer password.

User-defined miscellaneous discrete interface

Overview

This section describes the miscellaneous discrete environmental alarm/status input points and (external) control output points.

Description

The user-defined miscellaneous discrete interface allows users to monitor and control equipment collocated with Alcatel-Lucent 1850 TSS-5 through a set of discrete input and output points. There are 4 miscellaneous discrete inputs (MDIs) to monitor environmental conditions such as open doors or high temperature, and 6 miscellaneous discrete outputs (MDOs) to control equipment such as fans and generators. The MDIs are only processed on the VLNC2. Four MDOs are controlled by the VLNC2, and one is assigned to each Main slot. Currently, only the VLNC40/42/42B in the MAIN2 slot is capable of using the slot MDO.

Local miscellaneous discrete input points are included in the determination of the summary alarm/status level for each NE. But even if the Remote NE Status feature is enabled, the alarm/status of *individual* miscellaneous discrete inputs/outputs is not exchanged among NEs.

Miscellaneous discrete input alarm level

The alarm level to be associated with each miscellaneous discrete input point is provisionable. By default, each miscellaneous discrete input is a minor alarm.

If a miscellaneous discrete input point is provisioned as an alarm (minor, major, or critical), TL1 autonomous message **REPT ALM ENV** is used to report the alarm occurrence. This identifies the remote NE to further query.

If a miscellaneous discrete input point is provisioned as not alarmed (that is, status), TL1 autonomous message **REPT EVT COM** is used to report the condition. This identifies the need to retrieve any active miscellaneous discrete status conditions.

Miscellaneous discrete input description

The description to be associated with each miscellaneous discrete input alarm or status point may be provisioned. The provisioned description appears as the `almmsg` or `conddescr` parameter value in applicable TL1 messages. The default description for each miscellaneous discrete input point is `environment1`, `environment2`, and so forth.

Miscellaneous discrete output description

The description to be associated with miscellaneous discrete output control points 1–4 may be provisioned. The default description for each miscellaneous discrete output point is `control1`, `control2`, `control3`, and `control4`. Control points for miscellaneous discrete outputs may be operated and then released. Four MDOs are controlled by the VLNC2, and one is assigned to each Main slot; MDOs 5 and 6 are associated with the two MAIN slots. The MDIs are only processed on the VLNC2. Currently, only the VLNC40/42/42B in the MAIN2 slot is capable of using the slot MDO. If there is a service-affecting failure on the VLNC40/42/42B, the VLNC40/42/42B pack operates its MDO.

Reference:

For information about the **Configuration → Misc. Discretes** command, refer to the *WaveStar®* CIT help. For detailed wiring information, refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Installation and System Turn-Up Guide*.

6 System planning and engineering



Overview

Purpose

This section summarizes basic system planning and engineering information to plan procurement and deployment of Alcatel-Lucent 1850 TSS-5. There are a number of considerations that should be kept in mind when planning the Alcatel-Lucent 1850 TSS-5's role in the network. Projected customer requirements will determine initial capacity needed, as well as evolution to higher capacities. The advanced networking capabilities of the Alcatel-Lucent 1850 TSS-5 offer many economic and planning benefits, and certain guidelines should be followed to maximize these benefits. Physical installation considerations will be guided by the installation location (central office, uncontrolled, or customer locations). Initial network configuration will determine synchronization requirements. Synchronization should be planned on a network basis considering items like topology, reliability, network connectivity, and service evolution.

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Physical arrangements

Overview

Purpose

This section describes the possible physical arrangements of Alcatel-Lucent 1850 TSS-5.

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Shelf configurations

Overview

Alcatel-Lucent 1850 TSS-5 is designed to provide a variety of wide-band and broadband voice and data services. The following paragraphs outline the specific packs that may be used for certain applications.

Slots

The MAIN 1 and MAIN 2 slots accept high-speed line interface and network interface units. In some configurations, only one MAIN slot may be populated with a circuit pack. The VLNC2 SYSCTL circuit pack is not required for all configurations; it is only required when the shelf is equipped with VLNC50/52 circuit packs. When the SYSCTL VLNC2 circuit pack is installed, it is always located in the CTL slot.

Main slots

The following combinations of circuit packs in the Main slots and compatible VLIU interface units are supported.

Table 6-1 VLIU compatibility

Supported circuit pack configurations		Compatible VLIU Interface Units			
Main 1	Main 2	VLIU1	VLIU2	VLIU3	VLIU10
VLNC50	Not Equipped	✓	✓	Not Compatible	✓
Not Equipped	VLNC50 ¹	✓	Not Compatible	Not Compatible	✓
VLNC50	VLNC50 ¹	✓	Not Compatible	Not Compatible	✓
VLNC52	Not Equipped	Not Compatible	✓	Not Compatible	✓
Not Equipped	VLNC52 ¹	Not Compatible	Not Compatible	Not Compatible	✓
VLNC52	VLNC52 ¹	Not Compatible	Not Compatible	Not Compatible	✓
VLNC60/62	Not Equipped	✓	✓	✓	✓
Not Equipped	VLNC60/62	✓	Not Compatible	Not Compatible	✓
VLNC60/62	VLNC60/62	Not Compatible	Not Compatible	Not Compatible	Not Compatible
VLNC61	Not Equipped	Not Compatible	✓	✓	✓
Not Equipped	VLNC61	Not Compatible	Not Compatible	Not Compatible	✓
VLNC61	VLNC61	Not Compatible	Not Compatible	Not Compatible	Not Compatible
Not Equipped	VLNC40/42/42B	✓	✓	✓	Not Compatible
VLNC40/42/42B	Not Equipped	Not Compatible	Not Compatible	Not Compatible	Not Compatible
VLNC50	VLNC40/42/42B	✓	✓	Not Compatible	Not Compatible
VLNC52	VLNC40/42/42B	Not Compatible	✓	Not Compatible	Not Compatible
VLNC60/62	VLNC40/42/42B	✓	✓	✓	Not Compatible
VLNC61	VLNC40/42/42B	Not Compatible	✓	✓	Not Compatible
VLNC64	VLNC40/42/42B	✓	✓	✓	Not Compatible
VLNC64	Not Equipped	✓	✓	✓	✓
Not Equipped	VLNC64	✓	✓	✓	✓
VLNC64	Any Circuit Pack ²	✓	✓	✓	✓
Any Circuit Pack ²	VLNC64	✓	✓	✓	✓
VLNC64 ³	VLNC64 ³	✓	✓	✓	✓

Notes:

1. The circuit pack Slot Protection State parameter must be provisioned Protected. If a VLNC50/52 circuit pack is inserted in Main 2 and the circuit pack Slot Protection State parameter is Unprotected, the system reports an unexpected CP type alarm. To change the circuit pack Slot Protection State parameter refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) User Provisioning Guide*.
2. Any circuit pack that is otherwise allowed in this slot is allowed next to the VLNC64 circuit pack.
3. The VLNC64s in Main 1 and Main 2 operate separately and do not form an equipment-protected pair.

Control slot

The control slot is reserved for the VLNC2 System Controller (SYSCTL) circuit pack. The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC64 circuit packs do not require a SYSCTL circuit pack in the shelf. However, if a VLNC50 or VLNC52 circuit pack is installed, the control slot must be equipped with a SYSCTL VLNC2 circuit pack.

Function Group C slot

The C slot is designed to house an Ethernet circuit pack (VLNC35) and is mapped directly to the four FN GRP C connectors. When not being used, this slot equipped with a 199SC apparatus blank.

Fan unit

The Alcatel-Lucent 1850 TSS-5 shelf contains an integral fan unit. Due to their horizontal orientation, a fan unit is required to dissipate heat across the circuit packs.

Blank circuit pack

In order to meet radiated emission requirements per GR-1089, any unused slot in the Alcatel-Lucent 1850 TSS-5 shelf must be equipped with an appropriate apparatus blank.

Available circuit packs

The supported circuit packs, the compatible slots, and the initial product release that each circuit pack is available can be found in [Table 4-1, “Circuit packs in Alcatel-Lucent 1850 TSS-5 shelf” \(p. 4-9\)](#).

Physical shelf specifications

Overview

The following information about Alcatel-Lucent 1850 TSS-5 shelves must be considered during installation.

Mounting brackets

The Alcatel-Lucent 1850 TSS-5 High Capacity shelf has three different mounting options:

- **ANSI rack-mount**
Brackets can be ordered that can be rotated to mount the unit in a 19-inch or 23-inch ANSI equipment rack. Refer to [Figure 4-1, “Alcatel-Lucent 1850 TSS-5 High Capacity rack-mount front view”](#) (p. 4-5).
- **ETSI rack-mount**
Brackets can be ordered to mount the shelf in an ETSI equipment rack.
- **Wall-mount**
Brackets can be ordered that allow the existing rack-mount shelf to be mounted on a wall. The mounting orientation is determined by the customer. Refer to [Figure 4-2, “Alcatel-Lucent 1850 TSS-5 High Capacity wall-mount front view”](#) (p. 4-6).

You must order the appropriate mounting bracket kit that supports your desired application. Refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Release 7.0.0 Engineering and Ordering Information* for more information about the bracket options.

Shelf size and weight information are described in [“Shelf size”](#) (p. 4-3).

Rack bracket positions

The ANSI and ETSI rack brackets can be positioned at multiple locations along the side of the shelf to adjust its position in the equipment rack.

Table 6-2 Rack mounting specifications

Mounting specifications	ANSI		ETSI
Rack width	19”	23”	600 mm
Hole horizontal spacing	18.312”	22.312”	515 mm
Hole vertical spacing	Based on 0.5” vertical centers		Based on 2 5 mm vertical centers
Mounting screw	12-24 thread		M5 thread form

Cabinet installation

Overview

Alcatel-Lucent 1850 TSS-5 and its circuit packs are hardened for use in outside plant (OSP) applications.

Cabinet requirements

Outside plant cabinets for use with Alcatel-Lucent 1850 TSS-5 equipment in NAR applications are compliant with GR-4874.

Refer to *Telcordia*® Generic Requirements for Electronic Equipment Cabinets, GR-487, Issue 2, March 2000. Typical requirements covered in this specification include Water and Dust Intrusion, Wind-Driven Rain, Thermal Shock, Impact Resistance and Shock and Vibration.

Equipment compartment

All covers and faceplates that are part of the Alcatel-Lucent 1850 TSS-5 must be in place when installed in the cabinet to minimize losses in cooling and maximize resistance to electromagnetic interference. Apparatus Blanks (see engineering drawings) are ordered separately and must be used where no circuit packs are installed.

Refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Release 7.0.0 Engineering and Ordering Information*.

Splicing compartment

Cable access ports must be provided in the base of the splicing compartment to permit the entrance of metallic and fiber cables into the equipment. Ports must be sized to allow cables to be placed in accordance with minimum bend radii guidelines, as specified by the cable supplier.

Battery compartment

If a battery compartment is provided, it must be segregated from the electronics compartment. A seal must be provided to prevent gases from seeping into the electronics and splicing compartments. The compartment must be vented to the outside.

Air flow

The heat from the Alcatel-Lucent 1850 TSS-5 rack-mount shelf is dissipated by horizontal air flow provided by fans inside the shelf. Air flow caused by equipment cabinet fans must not impede the function of the Alcatel-Lucent 1850 TSS-5 shelf fans. The Alcatel-Lucent 1850 TSS-5 requires a minimum airflow of 100 LFM.

Alarms for a cabinet environment

The cooling systems and temperatures within a cabinet enclosure must be monitored to avoid conditions that can cause heat-related failures.

Alarm for cooling system failure

A system failure alarm must be provided for cabinet cooling systems with forced air ventilation and active heat exchange systems

High-temperature alarm

A temperature sensor must be located in the electrical equipment compartment to provide a high-temperature alarm when an internal cabinet temperature of 65°C is reached. The air temperature must be measured at the inlet of the top Alcatel-Lucent 1850 TSS-5 shelf.

Cabinet strength

The cabinet must be resistant to continuous low-level vibrations from sources including train and vehicular traffic, rotating machinery, construction activities, etc. Physical tests must be performed to assure the cabinet does not amplify vibrations from these sources such that the vibration levels transmitted to the equipment do not exceed design limits. Tests must be performed in accordance with GR-487 and GR-63 to verify the performance of the cabinet and equipment during vibratory test conditions.

Operating temperature range

Inlet air to the Alcatel-Lucent 1850 TSS-5 equipment must be controlled within the range of -40°C to +65°C. Ambient air from outside the cabinet cannot be introduced into the electronics compartment or used in any way to directly cool the Alcatel-Lucent 1850 TSS-5 equipment within the cabinet.

Heat exchange systems for the cabinet must be sized so that maximum inlet temperature will not exceed 65°C even when the shelf is equipped in such a way that it approaches the maximum current drains detailed in [“Alcatel-Lucent 1850 TSS-5 current drain”](#) (p. 6-11). Also, the cabinet must be sized to ensure that inlet temperature will not exceed 65°C given both severe outside ambient temperature and solar heating relative to the conditions of the region where the shelf is deployed.

The supplier must supply performance data upon request for cabinets cooled by compact heat exchangers or any other method. This information may include the appropriate factor of safety, or excess capacity, accounting for normal fouling of the heat exchanger core. During operation, the time rate of change of the internal air temperature must not exceed 30°C/hr as the result of solar heating and radiation cooling of the enclosure, and power cycling the equipment.

Cabinet condensation

The relative humidity of the internal air of an outside cabinet must be maintained in accordance with GR-63. This applies even when the equipment within the cabinet does not have power applied, e.g., during installation of equipment. During such times a source of heat, or desiccant packs, must be provided for maintaining the necessary relative humidity level.

System thermal performance verification

For the fully equipped cabinet configuration, a functional test of the Alcatel-Lucent 1850 TSS-5 shelf must be performed with all systems powered at their appropriate levels for typical service applications that approach the maximum current drains detailed in [“Alcatel-Lucent 1850 TSS-5 current drain” \(p. 6-11\)](#). The cabinet surfaces must be respectively heated at the appropriate maximum solar radiation levels. Absorbed solar heating must be estimated using the formulations and methods in accordance with GR-487 and the ASHRAE handbook.

Refer to 2001 ASHRAE Handbook Fundamentals — American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., Atlanta GA.

During this testing measure, record the following:

- Power level into the cabinet in amperes
- Air Velocities in the airflow channels formed by the Alcatel-Lucent 1850 TSS-5 circuit packs are in linear ft./min.
- Air temperature entering and exhausted from the Alcatel-Lucent 1850 TSS-5 shelf (measured in °C)
Three K or T type thermocouples must be added at the inlet and exhaust of all circuit pack slots. Take the average of the three thermocouples for each circuit pack slot for both inlet and exhaust and record (Tinlet_avg, Texhaust_avg, TC type, and slot number).
- Ambient temperature (temperature outside the cabinet and measured in °C).
- Solar heating loads on respective cabinet surfaces (°C).

Installation cabling

Overview

Alcatel-Lucent offers a full complement of transmission cables and optical jumpers. All interfaces to the Alcatel-Lucent 1850 TSS-5 are front-access, and all service interfaces have physical connectors. For additional cabling details, see [“Cabling” \(p. 4-31\)](#).

Cable placement and routing

Refer to *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Installation and System Turn-Up Guide* for cable placement and routing information. Cables must be routed in accordance with the guidelines provided in the Installation Manuals. Circuit pack cables must be routed with half of the total number of cables from each side of the shelf.

Cable rating

Cables must be rated for a minimum temperature of 80°C.

Cable contacts

All connector contacts that mate to Alcatel-Lucent 1850 TSS-5 equipment must be of similar contact finishes. Alcatel-Lucent recommends the use of gold with a minimum of 30 micro-inches.

Environmental considerations

Overview

Alcatel-Lucent 1850 TSS-5 meets NEBS Level 3 standards for use in central office environments as specified in GR-63-CORE and GR-1089-CORE. Alcatel-Lucent 1850 TSS-5 also meets standards for uncontrolled environments as specified in GR-63-CORE and GR-499-CORE. For detailed specifications, refer to [Chapter 10, “Technical specifications”](#).

Power and electrical requirements

Overview of power requirements

The power consumption of the Alcatel-Lucent 1850 TSS-5 products is dependent on the circuit packs installed and their operating state. These variables must be taken into account when sizing the power system.

Alcatel-Lucent 1850 TSS-5 power supply

The following table lists Alcatel-Lucent 1850 TSS-5 power requirements.

Table 6-3 Alcatel-Lucent 1850 TSS-5 Power supply requirements

Item	Description
Voltage range	–40 to –57 VDC +20 to +28 VDC
Power Feeders	A and B (–48 VDC or +24 VDC)
Circuit Breakers	Two, 8A fuses

Alcatel-Lucent 1850 TSS-5 current drain

Alcatel-Lucent 1850 TSS-5 has the following maximum current drain requirements.

- +24 VDC maximum: 5 Amps
- –48 VDC maximum: 2.5 Amps

Power quality

Alcatel-Lucent 1850 TSS-5 products require a reliable low-noise power source in accordance with GR-947.

Refer to *Telcordia*® Generic Requirements for a -48 VDC and +24 VDC Telecommunications Switchmode Rectifier/ Power Supply, GR-947, Issue 1, December 1996.

This is usually accomplished by float charging batteries at the input to the Alcatel-Lucent 1850 TSS-5 shelves. Batteries are installed to provide backup power in the event of AC power outages. When deployed in a float charge configuration they also provide filtering of AC power line drop outs and noise generated by equipment in the cabinet. In all cases power must be configured to avoid dropping below or exceeding the voltage limits listed in [Table 6-3, "Alcatel-Lucent 1850 TSS-5 Power supply requirements" \(p. 6-11\)](#).

Electrical noise

Care must be taken to insure that electrical noise generated by the power system, fans, or other equipment does not interfere with the operation of the Alcatel-Lucent 1850 TSS-5 products. Electrical noise on the -48 VDC or +24 VDC power lines at the shelf must not exceed the voice frequency and wide-band noise limits in accordance with GR-947.

Interruptions

Momentary AC power line interruptions are accommodated by the batteries on float charge.

Inrush current

While there is no requirement to limit the rate of power application to the Alcatel-Lucent 1850 TSS-5 shelves, the voltage at the shelf must remain within the specified limits at all times.

Battery backup

In all cases battery backup power must be configured to avoid dropping below the voltage limits listed in [Table 6-3, "Alcatel-Lucent 1850 TSS-5 Power supply requirements" \(p. 6-11\)](#). The preferred method of battery backup is a float charge configuration. Alternatively, a separate battery and charger system can be used utilizing a diode "OR" configuration. Systems employing transfer switches are not recommended unless sufficient capacitance is installed to carry the system over through the transfer period.

Grounding and bonding

Grounding must meet the following appropriate requirements for outside plant and customer premises applications

- *Telcordia*® Network Equipment - Building System (NEBS) Requirements: Physical Protection, GR-1089-CORE, Issue 5 August 2009.
- UL: UL 60950/ CAN/CSA- 22.2 NO. 60950-00 “Safety of Information Technology Equipment,” December 2000
- NEC: National Fire Protection Agency (NFPA-70), National Electrical Code (NEC), 2002 Edition

The Alcatel-Lucent 1850 TSS-5 shelves require a single common ground reference. The Alcatel-Lucent 1850 TSS-5 shelf frame must be bonded to an earth ground within the cabinet. Alcatel-Lucent 1850 TSS-5 shelf mounting screws should be used to provide a low impedance multipoint electrical connection through the mounting structure to earth ground. A frame ground wire located on the shelf must be connected to the cabinet ground.

I/O protection

The DS1/E1 and DS3/E3 interfaces (traffic ports) or other metallic telecommunications interfaces must not leave the cabinet unless connected to telecommunications devices providing primary and secondary protection, as per GR-1089 and UL-60950 (UL 60950/ CAN/CSA- 22.2 NO. 60950-00 *Safety of Information Technology Equipment*, December, 2000).

TELCORDIA WORDING FROM 4.6.9.2 GR-1089

WARNING: The intra-building port(s) of the equipment or subassembly is suitable for connection to intrabuilding or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly MUST NOT be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 5) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring. The equipment documentation shall contain a statement indicating that the intrabuilding port(s) of the equipment or subassembly is suitable for connection only to shielded intra-building cabling grounded at both ends.

dmx PARA

The DS1/E1 and DS3/EC-1 interfaces (traffic ports) or other metallic telecom interfaces must not leave the cabinet unless connected to telecom devices providing primary and secondary protection, as per GR-1089 and UL-609503 (not applicable for Ethernet packs).

Cross-connections

Overview

Purpose

This section provides cross-connection information for Alcatel-Lucent 1850 TSS-5. For more information about cross-connection provisioning, refer to [Chapter 5, “Operations, administration, maintenance, and provisioning”](#).

Contents

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Allowable cross-connections	6-15

Cross-connection types

Overview

Alcatel-Lucent 1850 TSS-5 has cross-connection capabilities offering users flexibility in directing traffic flow through systems to support a wide variety of customer applications using two-way cross-connections.

Types

Cross-connections are made by specifying the SONET or SDH rate, the end point addresses (AIDs), and the cross-connection type (add/drop, 0x1, or through). Each single cross-connection command establishes a two-way cross-connection.

Cross-connection rates

Alcatel-Lucent 1850 TSS-5 supports the following cross-connection rates:

- SONET VT1.5, STS-1, and STS-3c
- SDH VC-12, VC-3 (low-order), and VC-4

Allowable cross-connections

Overview

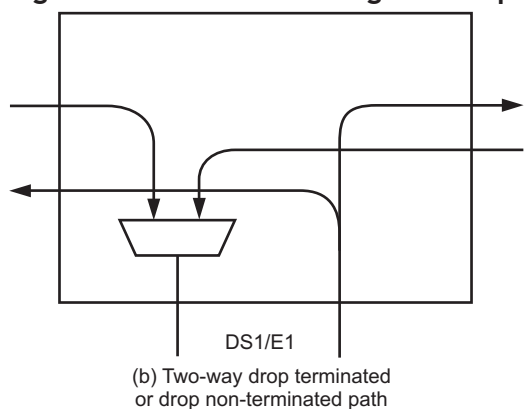
This section describes the Alcatel-Lucent 1850 TSS-5 two-way add/drop and pass-through cross-connections.

UPSR/SNCP ring add/drop

A UPSR/SNCP ring add/drop cross-connection is a two-way cross-connection that add/drops traffic to/from a tributary on a UPSR/SNCP protected interface. In the add direction, traffic is bridged to the same tributary in both rotations of the UPSR/SNCP. In the drop direction, the path (tributary) selector monitors both tributaries independently, and selects traffic from one tributary based on performance criteria and technician/OS control.

The following figure shows a high-level schematic of a two-way UPSR/SNCP ring add/drop cross-connection.

Figure 6-1 UPSR/SNCP ring add/drop cross-connection



Unidirectional Path Switched Ring

A Unidirectional Path Switched Ring (UPSR) is a self-healing ring configuration in which traffic is bridged onto both rotations (both fibers) of the ring in opposite directions.

Path-switched means that if the working signal fails, the path switches to the protection signal. Protection switching is done independently for each SONET path. UPSRs operate in an integrated, single-ended fashion, negating the need for complex network-level coordination in the effort to restore traffic.

The VLNC50/52 circuit packs may be configured for equipment protection (PROT). This protected configuration supports either two UPSRs, two 1+1 protected lines, or one UPSR and one 1+1 protected line. Cross-connections between the two rings (hairpin), between the two 1+1 lines, or between a SNCP and a 1+1 line are supported.

Subnetwork Connection Protection

Subnetwork connection protection (SNCP) can be used in an SDH protection ring configuration, similar to UPSR for SONET. SNCP rings have duplicate fiber paths. Traffic flows in one direction around the ring and protection traffic flows in the opposite direction. If there is a problem that interrupts or creates errors in the working traffic path, the node receiving the errors or sensing the interruption switches to the path in the opposite direction. SNCP on Alcatel-Lucent 1850 TSS-5 only allows pairing of the same timeslot on the two network lines of the VLNC50/52 circuit pack.

The VLNC50/52 circuit packs may be configured for equipment protection (PROT). This protected configuration supports either two SNCPs, two 1+1 protected lines, or one SNCP and one 1+1 protected line. Cross-connections between the two rings (hairpin), between the two 1+1 lines, or between a SNCP and a 1+1 line are supported.

0x1 add/drop

A 0x1 add/drop cross-connection is a terminated cross-connection between a ring channel on an OC-3/STM-1 or OC-12/STM-4 main port that has an application value of 0x1 to a PDH (DS1/E1 or DS3/E3) port or to an Ethernet port.

Hairpin

A hairpin is a 0x1 to 0x1 two-way cross-connection between a ring channel on an OC-3/STM-1 or OC-12/STM-4 main port that has an application value of 0x1 to another main port, that has the application value 0x1.

2-Way hairpin

2-Way hairpin is a two-way cross-connection between a DS1 port in virtual function group A (VLNC50/52) and a DS1 port within a channelized DS3 in virtual function group B-3 (VLNC50/52).

Linear 1+1

The linear application mode is a standards compliant 1+1 protected configuration, providing unidirectional, non-revertive line switching. Protected cross-connections between the two 1+1 lines, or between a UPSR/SNCP and a 1+1 line are supported.

Linear/Unprotected UPSR/SNCP

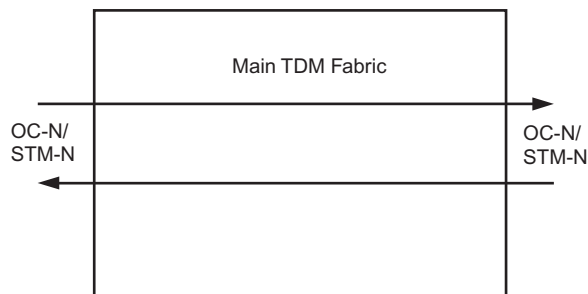
Linear/Unprotected UPSR/SNCP is a two-way cross-connection between a tributary on one side of an UPSR/SNCP interface and a tributary on a VCG port in function group C.

Point-to-point, through

A point-to-point, through cross-connection is a two-way cross-connection between the two sides of a UPSR/SNCP node. Traffic received on a timeslot on one side of the UPSR/SNCP node is passed through to the same timeslot on the opposite side of the UPSR/SNCP node.

The following figure shows a pass-through cross-connection on the network interface (OC-3/STM-1 or OC12/STM-4).

Figure 6-2 Point-to-point, through cross-connection



Two-way pass-through path

Nc-dmx-160a

Allowable 1+1 add/drop cross-connections

Table 6-4, “Allowable 1+1 add/drop cross-connections” (p. 6-17) lists add/drop cross-connections supported by Alcatel-Lucent 1850 TSS-5. The cross-connections in the following table are all add/drop cross-connections.

Table 6-4 Allowable 1+1 add/drop cross-connections

Source		Destination
OC-3/OC-12 (1+1)		
2waypr STS-3c	to	VCG Tributary
2waypr STS-1	to	VCG Tributary
2waypr VT1.5	to	VCG Tributary
2waypr STS-1	to	DS3
2waypr VT1.5	to	DS1
STM-1/STM-4 (1+1)		
2waypr VC-3 (low-order)	to	VCG Tributary
2waypr VC-4	to	VCG Tributary
2waypr VC-12	to	VCG Tributary

Table 6-4 Allowable 1+1 add/drop cross-connections (continued)

Source		Destination
2waypr VC-3 (low-order)	to	E3
2waypr VC-12	to	E1

Allowable UPSR/SNCP ring add/drop cross-connections

The following table lists the supported UPSR/SNCP ring add/drop cross-connections.

Table 6-5 Allowable UPSR/SNCP ring add/drop cross-connections

Source		Destination
OC-3/OC-12 VLNC50/52 (UPSR)		
2waypr STS-3c	to	VCG Tributary
2way STS-3c	to	VCG Tributary
2waypr STS-1	to	VCG Tributary
2way STS-1	to	VCG Tributary
2waypr VT1.5	to	VCG Tributary
2way VT1.5	to	VCG Tributary
2waypr STS-1	to	DS3
2way VT1.5	to	DS1
2waypr VT1.5	to	DS1/TMUX
STM-1/STM-4 VLNC50/52 (SNCP)		
2waypr VC-3 (low-order)	to	VCG Tributary
2way VC-3 (low-order)	to	VCG Tributary
2waypr VC-4	to	VCG Tributary
2way VC-4	to	VCG Tributary
2waypr VC-12	to	VCG Tributary
2way VC-12	to	VCG Tributary
2waypr VC-3 (low-order)	to	E3
2way VC-12	to	E1
2waypr VC-12	to	E1

Allowable hairpin cross-connections

The following table lists the supported hairpin cross-connections.

Table 6-6 Allowable hairpin cross-connections

Source		Destination
OC-3/OC-12 VLNC50/52 (UPSR/1+1)		
2waypr STS-3c	to	OC-3/OC-12 (UPSR or 1+1)
2waypr STS-1	to	OC-3/OC-12 (UPSR or 1+1)
2waypr VT1.5	to	OC-3/OC-12 (UPSR or 1+1)
OC-3/OC-12 VLNC50/52 (0x1)		
2way STS-3c	to	OC-3/OC-12
2way STS-1	to	OC-3/OC-12
2way VT1.5	to	OC-3/OC-12
STM-1/STM-4 VLNC50/52 (SNCP/1+1)		
2waypr VC-4	to	STM-1/STM-4 (SNCP or 1+1)
2waypr VC-3 (low-order)	to	STM-1/STM-4 (SNCP or 1+1)
2way VC-12	to	STM-1/STM-4 (SNCP or 1+1)
STM-1/STM-4 VLNC50/52 (0x1)		
2way VC-4	to	STM-1/STM-4
2way VC-3 (low-order)	to	STM-1/STM-4
2way VC-12	to	STM-1/STM-4
DS1 VLNC50/52		
DS1 (2way VT1.5)	to	TMUX DS1

Allowable 0x1 cross-connections

The following table lists the supported 0x1 cross-connections.

Table 6-7 Allowable 0x1 cross-connections

Source		Destination
OC-3/OC-12 VLNC50/52 (add/drop)		
2way STS-3c	to	VCG Tributary
2way STS-1	to	VCG Tributary
2way STS-1	to	DS3
2way VT1.5	to	VCG Tributary

Table 6-7 Allowable 0x1 cross-connections (continued)

Source		Destination
2way VT1.5	to	DS1/TMUX
STM-1/STM-4 VLNC50/52 (add/drop)		
2way VC-4	to	VCG Tributary
2way VC-3 (low-order)	to	E3
2way VC-3 (low-order)	to	VCG Tributary
2way VC-12	to	E1
2way VC-12	to	VCG Tributary

Allowable point-to-point, through cross-connections

The following table lists the supported pass-through cross-connections.

Table 6-8 Allowable point-to-point through cross-connections

Source		Destination
OC-3/OC-12 VLNC50/52 (UPSR)		
2waypr STS-1	to	OC-3/OC-12 UPSR ¹
2waypr STS-3c	to	OC-3/OC-12 UPSR ¹
2waypr VT1.5	to	OC-3/OC-12 UPSR ¹
STM-1/STM-4 VLNC50/52 (SNCP)		
2waypr VC-12	to	STM-1/STM-4 SNCP ¹
2waypr VC-3 (low-order)	to	STM-1/STM-4 SNCP ¹
2waypr VC-4	to	STM-1/STM-4 SNCP ¹

Notes:

1. This is a direct pass-through connection: from a particular timeslot on one side of the ring to the same timeslot on the other side of the same ring.

Synchronization

Overview

Purpose

This section describes synchronization features and functions for the Alcatel-Lucent 1850 TSS-5.

Contents

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Network synchronization environment

Overview

When equipped with a VLNC2 SYSCTL, a VLNC50/52 and/or VLNC64 SONET/SDH Transport circuit pack the Alcatel-Lucent 1850 TSS-5 can operate as an integrated network element within a synchronous SONET/SDH network.

When equipped with a VLNC42//42B, VLNC52, and/or VLNC6x circuit packs the Alcatel-Lucent 1850 TSS-5 can operate as an integrated network element within a synchronous Ethernet network.

The information in this section describes synchronization within synchronous SONET/SDH and synchronous Ethernet networks.

For additional information about synchronization, refer to [“Synchronization features” \(p. 2-20\)](#).

With a synchronous network, careful consideration should be given to proper design of the network's synchronization environment. Proper synchronization engineering minimizes timing instabilities, maintains quality transmission network performance, and limits network degradation due to unwanted propagation of synchronization network faults. The synchronization features of the Alcatel-Lucent 1850 TSS-5 are designed to

complement the existing and future synchronization network and allow it not only to make use of network timing but also to take on an active role in facilitating network synchronization.

A number of published sources give generic recommendations on setting up a synchronization network. The Alcatel-Lucent 1850 TSS-5 is designed to operate in a network that complies with SONET/SDH recommendations stated in GR-253-CORE and GR-436-CORE.

Synchronous Ethernet network standards are described in ITU-T Recommendation G.8261/Y.1361.

Recommendations

The following are some key recommendations from the documents listed above. For further detailed explanation, the sources should be consulted directly.

1. A node can only receive the synchronization reference signal from another node that contains a clock of equivalent or better quality (± 20 ppm for the VLNC42/42B and VLNC50/52 circuit packs, ± 4.6 ppm for the VLNC6x circuit packs).
2. The facilities with the greatest availability (absence of outages) should be selected for synchronization facilities.
3. Where possible, all primary and secondary synchronization facilities should be diverse, and synchronization facilities with the same cable should be minimized.
4. The total number of nodes in series from the Stratum 1 source should be minimized. For example, the primary synchronization network would ideally look like a star configuration with the Stratum 1 source at the center. The nodes connected to the star would branch out in decreasing Stratum level from the center.
5. No timing loops may be formed in any combination of primary and secondary facilities.

Timing modes

Refer to [“Synchronization features” \(p. 2-20\)](#) for detailed information about the timing modes.

SONET/SDH network configurations

Overview

The following pages detail the two different network configuration types: free running and line timing for Alcatel-Lucent 1850 TSS-5 shelves equipped with VLNC2 and VLNC50/52 circuit packs.

Free running configuration

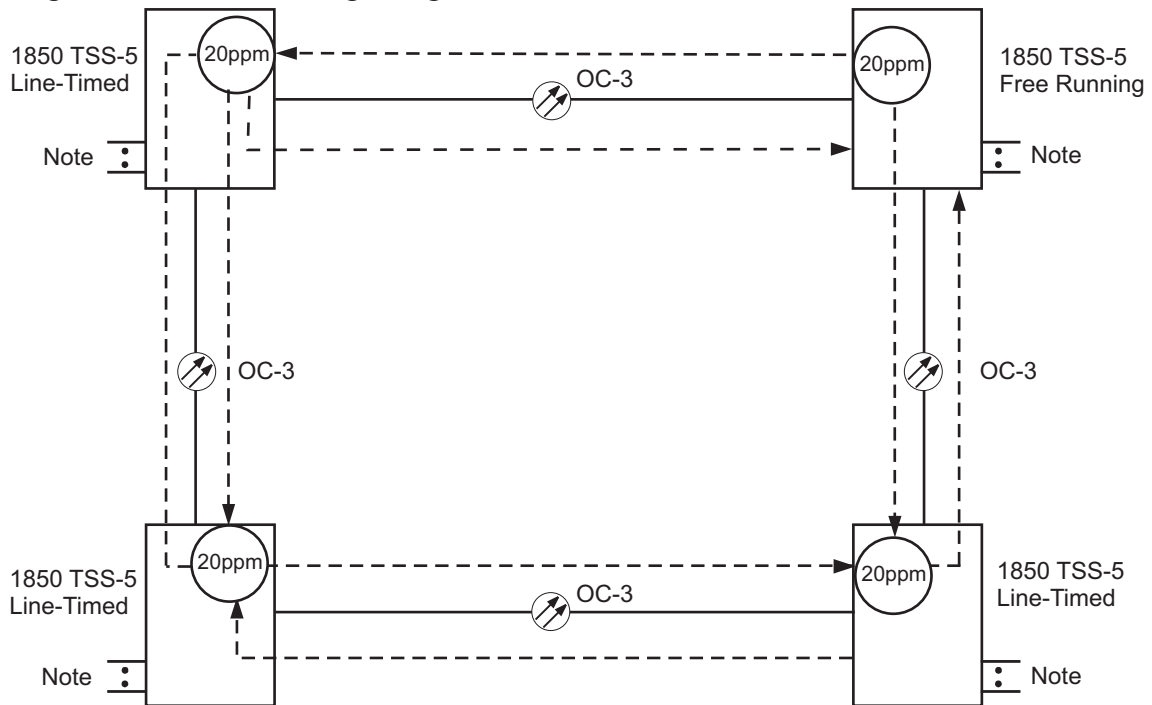
The free running/line timing network can operate without an external clock source. This configuration may be useful for initial access transport and customer location applications, and also meets the needs of an end-office trunk facility. This configuration cannot be used to provide OC-n/STM-n timing distribution or where SONET/SDH interconnections to other SONET/SDH networks are needed.

One Alcatel-Lucent 1850 TSS-5 synchronizes its transmitted OC-n/STM-n signals from the internal ± 20 ppm timing generator. The other Alcatel-Lucent 1850 TSS-5 systems recover timing from the incoming OC-n/STM-n signal and use this timing for their transmitted signals.

Because the free running/line timed Alcatel-Lucent 1850 TSS-5 network is asynchronous, additional jitter may be experienced on de-multiplexed DS1/E1 or DS3/E3 signals. Certain interconnected equipment may be sensitive to such jitter and this configuration should not be used in cases where it would cause a problem for that equipment.

Important! If the network is self-contained and the DS1/E1 or DS3/E3 synchronizer/desynchronizers are using the same reference (derived from the free running SMC/SEC ± 20 ppm timing generator) then there is no additional jitter due to pointer adjustments because there will be no timing adjustments.

The following figure shows a free running configuration in a ring network.

Figure 6-3 Free running - ring network

Note: DS1
1850 TSS-5 = 1850 Transport Service Switch 5

MA-DMXplore-020a

Line timing configuration

The external/line timing configuration integrates access transport and customer location networks into the digital synchronization network. This application is ideal for networks where only one location has a building integrated timing supply (BITS) clock. The network is synchronized to a local central office clock via DS1/E1 references.

Important! It is either the Alcatel-Lucent 1665 DMX or Alcatel-Lucent 1665 DMXtend system that is externally timed in the following description, NOT the Alcatel-Lucent 1850 TSS-5.

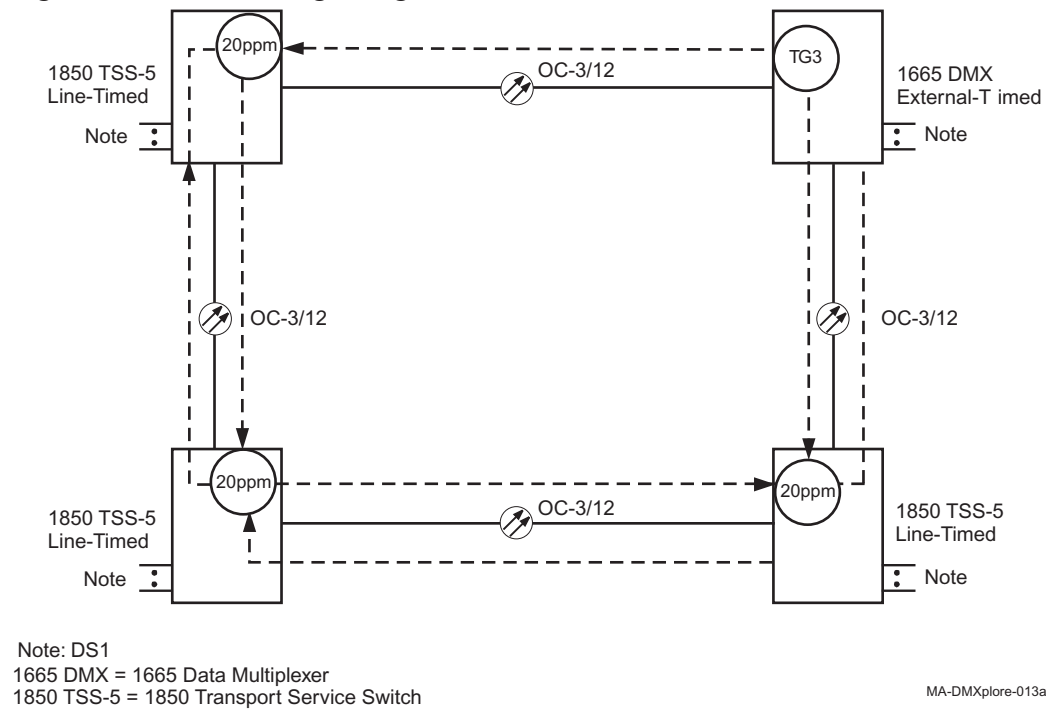
The Alcatel-Lucent 1850 TSS-5 can be line timed from a SONET NE, such as the Alcatel-Lucent 1665 DMX or Alcatel-Lucent 1665 DMXtend system. The local office clock from which the Alcatel-Lucent 1665 DMX or Alcatel-Lucent 1665 DMXtend is timed should be Stratum 3 or better, with timing traceable to a primary reference source. The Alcatel-Lucent 1665 DMX/Alcatel-Lucent 1665 DMXtend times its transmitted OC-n signals from the internal oscillator that is locked on the external reference. The remote Alcatel-Lucent 1850 TSS-5 recovers timing from the incoming OC-n signal and uses this timing for its transmitted signals.

A remote Alcatel-Lucent 1850 TSS-5 can also recover timing from an STM-n signal received from an NE that supports external timing from an SDH Equipment Clock (SEC). The Alcatel-Lucent 1850 TSS-5 is not externally timed.

In a ring topology, synchronization messaging allows automatic synchronization reconfiguration in the event of a fiber or equipment failure.

The following figure shows line timing in a ring configuration.

Figure 6-4 Line timing - ring network



Synchronous Ethernet network configurations

Overview

Synchronous Ethernet provides the Alcatel-Lucent 1850 TSS-5 the capability to derive timing based on incoming data from the packet network.

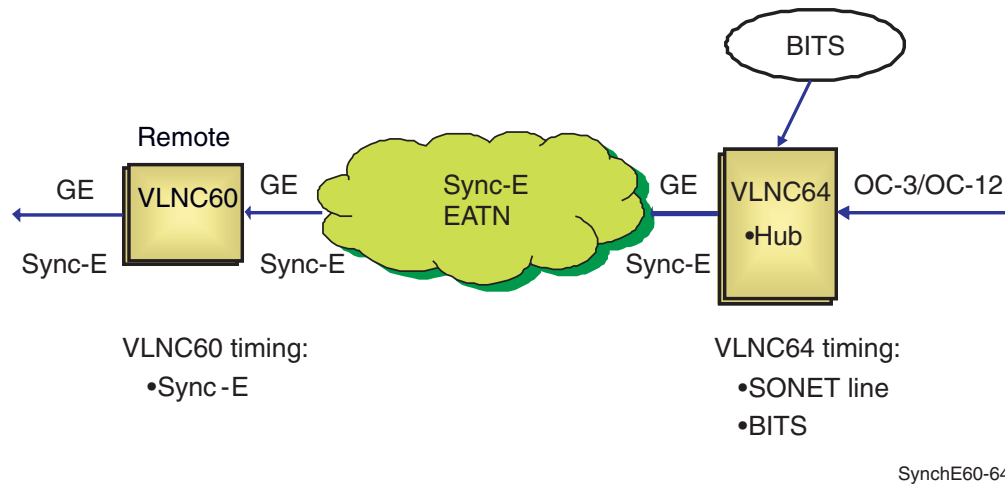
This section describes the following examples of synchronous Ethernet network configurations:

- VLNC60/64 synchronous Ethernet network configuration
- VLNC42/42B/60/64 synchronous Ethernet network configuration
- VLNC42/42B/52 synchronous Ethernet network configuration

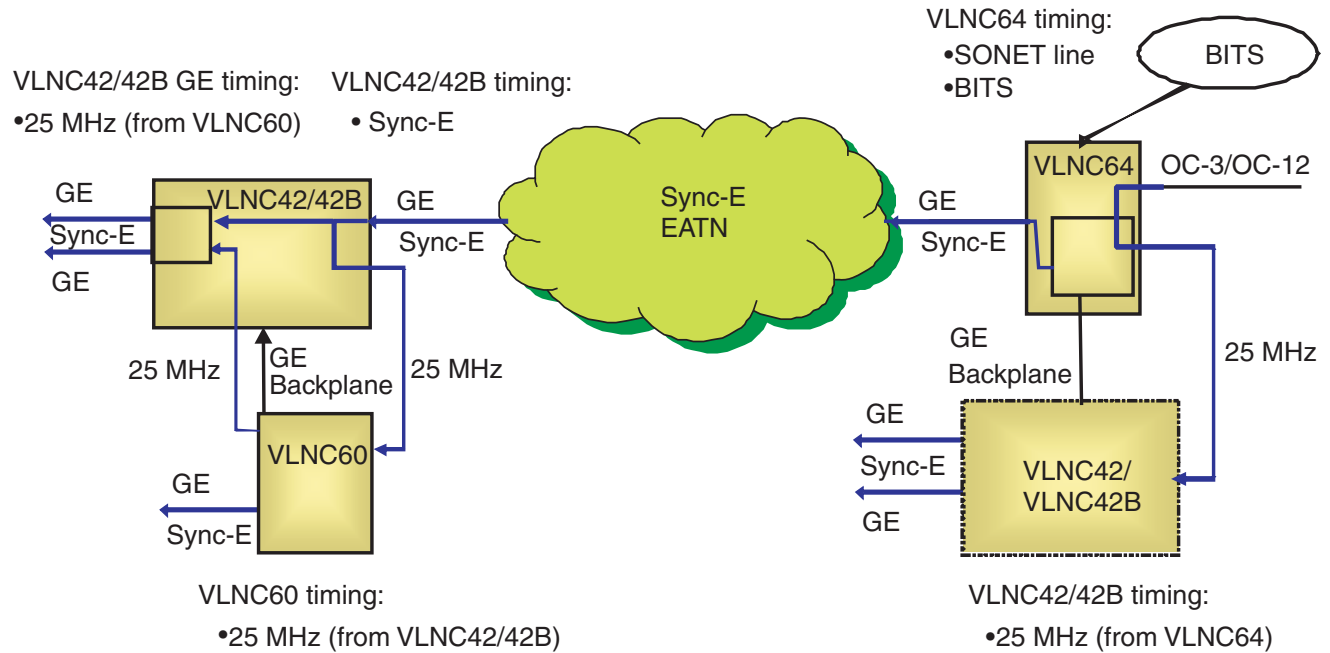
VLNC60/64 synchronous Ethernet network configuration

In this configuration the hub VLNC64 circuit pack recovers timing from the SONET/SDH line (OC-3/OC-12) or from a BITS source. The remote VLNC60 circuit pack recovers timing from the incoming GE port.

The VLNC60 circuit pack may also be used with the VLNCN40/42/42B circuit pack in a wireless base station to backhaul Ethernet and circuit emulation traffic.

**VLNC42/42B/60/64 synchronous Ethernet network configuration**

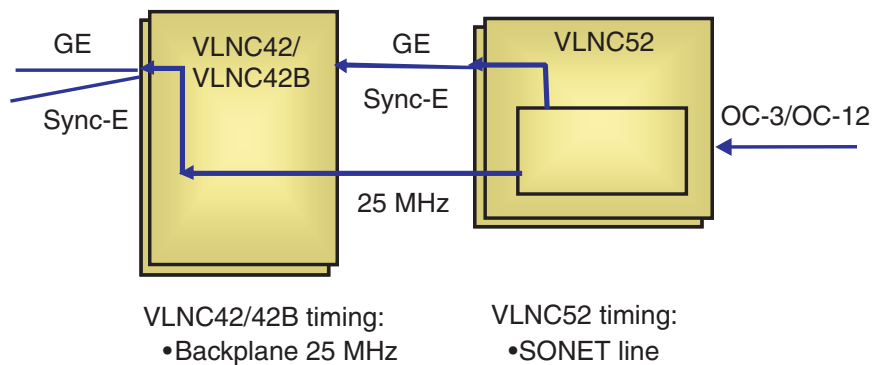
In this configuration, the VLNC64 circuit pack recovers timing from the SONET/SDH line (OC-3/OC-12) or from a BITS source. The remote VLNC42/42B circuit pack recovers timing from an incoming GE port and provides timing to a collocated VLNC60 circuit pack using the backplane 25 MHz signal. The VLNC6x and VLNC42/42B circuit packs may provide timing to collocated circuit packs using the backplane 25 MHz signal.



SynchE42-60-64h

VLNC42/42B/52 synchronous Ethernet network configuration

In this configuration the VLNC52 circuit pack recovers timing from the SONET/SDH line (OC-3/OC-12). The collocated VLNC42/42B circuit pack recovers timing from the incoming GE port or the backplane 25 MHz signal.



SynchE42-52

Synchronization status messaging

Overview

Alcatel-Lucent 1850 TSS-5 provides a synchronization status messaging feature to ensure the integrity of network synchronization during both normal and abnormal conditions. Through the use of synchronization status messaging, the current quality of the timing source can be conveyed from one Alcatel-Lucent 1850 TSS-5 to the next. This capability allows the Alcatel-Lucent 1850 TSS-5 to automatically change its timing reference in order to always maintain the highest quality timing available.

Applications

The applications that are currently supported with the synchronization messaging feature can be divided into two categories:

- Automatic synchronization reconfiguration
- Synchronization provisioning integrity

Automatic synchronization reconfiguration

Alcatel-Lucent 1850 TSS-5, supports automatic synchronization reconfiguration.

SONET and SDH were designed to operate optimally in synchronous environments. Although plesiochronous and asynchronous operation can be supported through the use of pointer adjustments, transmission quality may be affected by the generation of additional jitter and wander due to pointer adjustments in some applications. Because of this, it is desirable to maintain synchronous operation whenever possible over SONET/SDH/Ethernet networks. Through the use of synchronization status messages over SONET/SDH/Ethernet, the quality of the different timing references can be made available at each Alcatel-Lucent 1850 TSS-5 NE. The Alcatel-Lucent 1850 TSS-5 system can be optioned to determine the best timing reference available and switch to that reference. Through this mechanism, the synchronous operation of the subnetwork can be maintained. The switching of timing references is hitless, and the synchronization status messages also allow it to be done without creating timing loops in the process.

Synchronization provisioning integrity

A welcome side benefit of synchronization messaging is that it helps prevent provisioning errors. Provisioned timing loops on Alcatel-Lucent 1850 TSS-5 systems will be quickly detected through the synchronization messaging algorithm and prevented by forcing the system into holdover. The system can then be provisioned correctly.

Sync messaging feature details and options

Overview

As mentioned previously, synchronization status messaging is used to communicate the quality of the subnetwork timing throughout the subnetwork.

In SONET/SDH networks, synchronization status messages use bits 5-8 of the S1 byte in the SONET/SDH overhead.

In Synchronous Ethernet networks, synchronization status messages use OAM Protocol Data Units (OAMPDUs) which are identified by specific header fields in the Ethernet frame. OAMPDUs are standard Ethernet MAC frames but are then identified through both the Length/Type as Slow Protocol frames (value 8809) and then specifically by a Subtype (value 0x0A) as OAMPDUs.

If an Alcatel-Lucent 1850 TSS-5 shelf/circuit pack is deriving timing from a given SONET/SDH or Ethernet interface, and synchronization status messaging is enabled on that interface, the system interprets the received message to determine the timing status. Alcatel-Lucent 1850 TSS-5 shelf/circuit packs also transmits over the particular SONET/SDH or Ethernet interface, and all other SONET/SDH or Ethernet interfaces that are enabled for synchronization status messaging, the appropriate message indicating the quality of its timing and its usability.

SONET/SDH synchronization status messages

[Table 6-9, “SONET/SDH synchronization status messages” \(p. 6-29\)](#) lists the associated internal timing status and DS1/E1 output states that are associated with synchronization status messages received from the OC-n/STM-n interface when synchronization status messaging is enabled.

Table 6-9 SONET/SDH synchronization status messages

SONET				SDH			
Received Message	Active Timing Mode ¹	DS1 Output State ²	Quality Level	Received Message	Active Timing Mode ¹	E1 Output State ²	Quality Level
Don't Use (DUS)	Holdover	AIS	9	Don't Use (DUS)	Holdover	AIS	5
Traceable Stratum 4 (ST4) ⁴	Holdover	AIS	8	NA	NA	NA	NA

Table 6-9 SONET/SDH synchronization status messages (continued)

SONET				SDH			
Received Message	Active Timing Mode ¹	DS1 Output State ²	Quality Level	Received Message	Active Timing Mode ¹	E1 Output State ²	Quality Level
Traceable SONET Clock w/S3-TG (SMC)	OK to use	Good	7	SDH Equipment Clock	OK to use	Good	4
Traceable Stratum 3 (ST3)	OK to use	Good	6	Synchro-nization Supply Unit - Type B	OK to use	Good	3
Traceable Stratum 3E (ST3E)	OK to use	Good	5	NA	NA	NA	NA
Traceable Transit Node Clock (TNC)	Ok to use	Good	4	Synchro-nization Supply Unit - Type A	OK to use	Good	2
Traceable Stratum 2	OK to use	Good	3	NA	NA	NA	NA
Sync Trace Unknown (STU)	OK to use	Good	2	NA	NA	NA	NA
PRS Traceable ³	OK to use	Good	1	Primary Reference Clock	OK to use	Good	1

Notes:

1. This column applies only when provisioned for line timing mode.
2. This column represents DS1/E1 output AIS threshold equal to level 7 (SONET) and level 4 (SDH).
3. The oscillator in the VLNC50/52 provides an embedded SMC/SEC ± 20 ppm.
4. *Telcordia*® has not assigned a value to the S1 byte for ST4.

Synchronous Ethernet synchronization status messages

Alcatel-Lucent 1850 TSS-5 supports the following synchronous Ethernet synchronization status messages as specified in ITU-T G.8264.

- EEC-Option 1 clock: SSM code 1011
- EEC-Option 2 clock: SSM code 1010

When synchronous Ethernet ports are provisioned as the timing sources, the incoming synchronization status messages are used to select the highest quality synchronous Ethernet timing source. When an Ethernet port is provisioned as a synchronous Ethernet port and is not one of the timing sources, the outgoing synchronization status message represent the quality of the timing source for the network element.

Disabling synchronization status messaging

Synchronization status messaging can be disabled on a per OC-n/STM-n/Ethernet interface basis.

A `DON'T USE` message is sent to indicate that its timing is not suitable for synchronization (for example, back towards the line timing source).

Line timing

When Alcatel-Lucent 1850 TSS-5 is configured for line timing, the `DON'T USE` message is sent on the OC-n/STM-n interfaces towards the NE from which the timing is being derived. The message received on the OC-n/STM-n interface is sent on all other OC-n/STM-n interfaces where synchronization status messaging is enabled.

Automatic synchronization reconfiguration

With automatic synchronization reconfiguration, the Alcatel-Lucent 1850 TSS-5 shelves receive and compare the incoming synchronization status messages on the OC-n/STM-n/Ethernet interfaces available for line timing to select the highest quality synchronization reference available. If the received quality levels are the same on the references available for timing, the active line timing reference takes precedence. This feature guarantees the non-revertive operation of reconfiguration.

Sync messaging examples

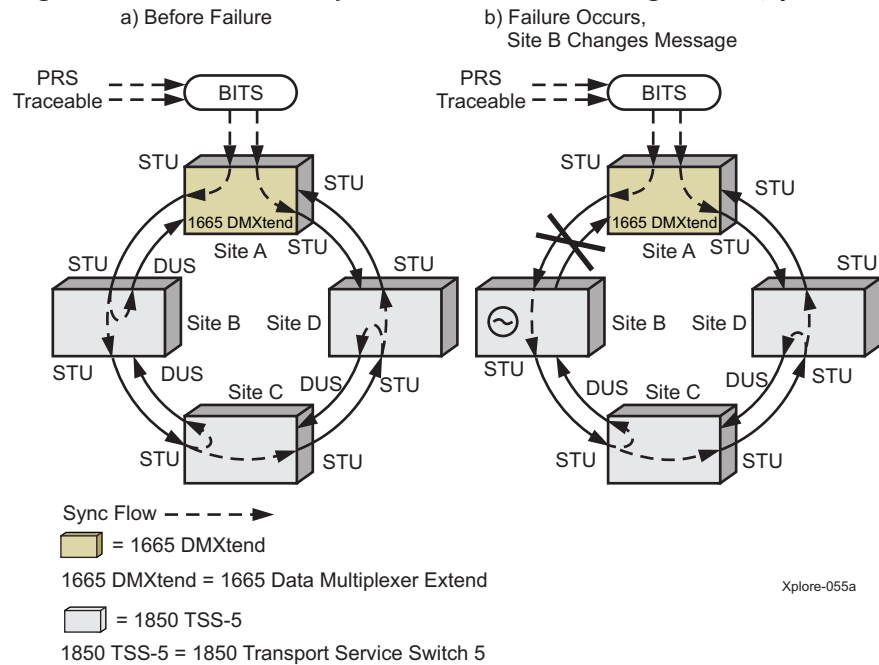
Overview

In this section, some detailed examples are given to show specifically how the sync messages propagate through network and assist in the recovery from a fiber failure. Through these examples, one can extend the same concept to any other network that may include different topologies, number of sites, failure locations, and number of BITS clocks.

Synchronization reconfiguration in an access ring

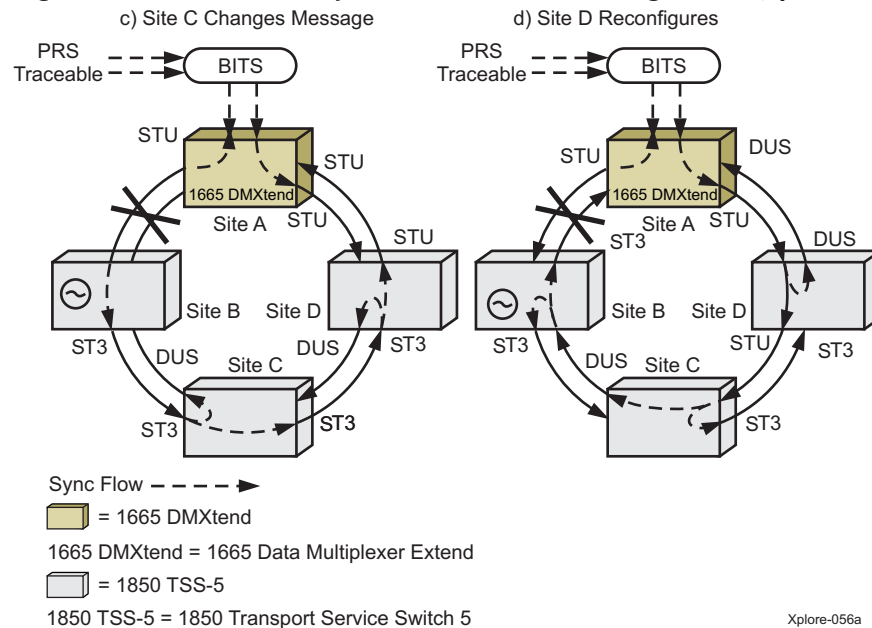
The following figure, Part A, illustrates an access ring operating in its normal configuration. The Alcatel-Lucent 1665 DMXtend shelf at the CO is externally timed, and each of the other Alcatel-Lucent 1850 TSS-5 shelves are line timed in a counterclockwise direction. The STU message is sent to indicate where timing is traceable to an external BITS and where it is valid to be used. The DON'T USE message is sent on the interface that is being used as the line timing reference and, thus, where using that timing would create a timing loop. Sync messaging and automatic synchronization have both been enabled for this network.

In the following figure, Part B, a fiber has been cut between sites A and B. Immediately, the Alcatel-Lucent 1850 TSS-5 shelf at site B enters holdover and sends out the STU message to site C. The Alcatel-Lucent 1850 TSS-5 shelf at site B cannot switch to line time from site C because it is receiving the DON'T USE message on that interface.

Figure 6-5 Automatic synchronization reconfiguration, part A and B

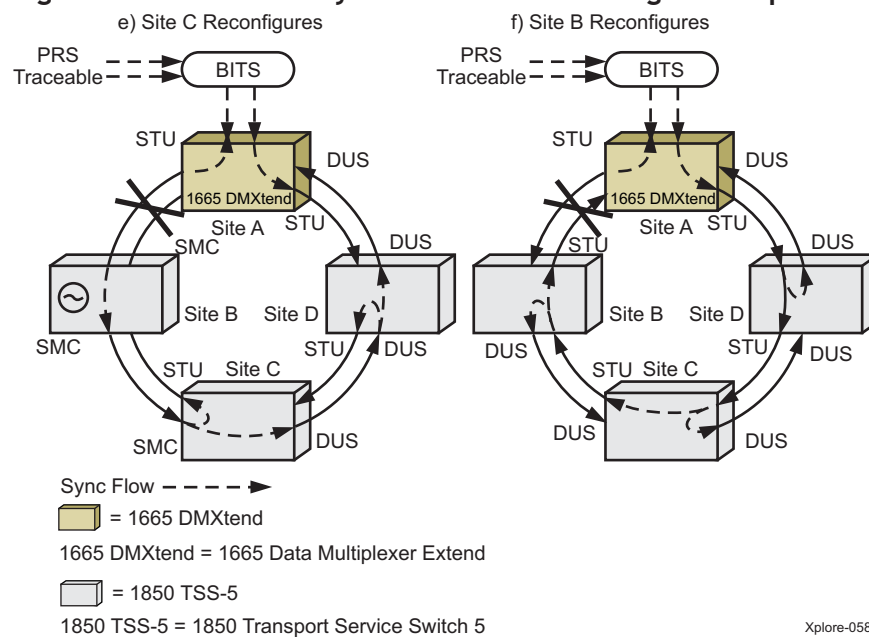
In the following figure, Part C, the Alcatel-Lucent 1850 TSS-5 shelf at site C detects the incoming Traceable Stratum 3 message and sends the message to site D. The Alcatel-Lucent 1850 TSS-5 shelf at site C cannot switch to line timing from the other rotation because it is receiving the `DON'T USE` message on that interface.

In the following figure, Part D, the Alcatel-Lucent 1850 TSS-5 at site D detects the incoming Traceable Stratum 3 message. The STU message is a better quality message than the SONET Minimum Clock message, so the Alcatel-Lucent 1850 TSS-5 shelf at site D switches to line timing from site A. After the switch occurs, the `DON'T USE` message is sent back to site A, and the STU message is retransmitted to site C.

Figure 6-6 Automatic synchronization reconfiguration, part C and D

In the following figure, Part E, the Alcatel-Lucent 1850 TSS-5 shelf at site C detects the incoming STU message from site D. The STU message is a better quality message than the SONET Minimum Clock message being received from site B, so the Alcatel-Lucent 1850 TSS-5 shelf at site C switches to line time from site D. After the switch occurs, the **DON'T USE** message is sent back to site D, and the STU message is retransmitted to site B.

In the following figure, Part F, the Alcatel-Lucent 1850 TSS-5 shelf at site B detects the incoming STU message from site C. The STU message is a better quality message than the internal holdover capability, so the Alcatel-Lucent 1850 TSS-5 shelf at site B switches to line time from site C. After the switch occurs, the **DON'T USE** message is sent back to site C, and the STU message is forwarded to site A. When the failure clears, the synchronization remains in the new configuration unless it is manually switched back.

Figure 6-7 Automatic synchronization reconfiguration part E and F

IS-IS Level 2 routing guidelines

Overview

Purpose

This section details the guidelines for IS-IS Level 2 Routing in OSI CLNP networks with more than 250 total nodes.

Contents

Introduction	6-36
Network services access point	6-38
Level 2 routing	6-39
IS-IS Level 2 routing remote provisioning sequence	6-40
IS-IS Level 2 routing provisioning confirmation	6-41
Maximum number of OSI nodes	6-43
Engineering rules and guidelines	6-43

Introduction

Overview

The IS-IS routing protocol an interior gateway protocol (IGP) that is used for routing within a single domain. If the domain contains a large number of nodes, nodes must be split into a number of logical areas. IS-IS Level 1 Routing provides routing between nodes and other Layer 1 routers within a single area. IS-IS Level 2 Routing provides routing between the other Layer 2 routers in the network areas that compose the domain.

Support of Level 2 routing by Alcatel-Lucent 1850 TSS-5 means that it can be used to support routing between areas within large domains.

Both the assignment of NEs to areas and the enabling of NEs as Level 2 routers is accomplished by provisioning (refer to [“Network services access point”](#) (p. 6-38) and [“Level 2 routing”](#) (p. 6-39), respectively).

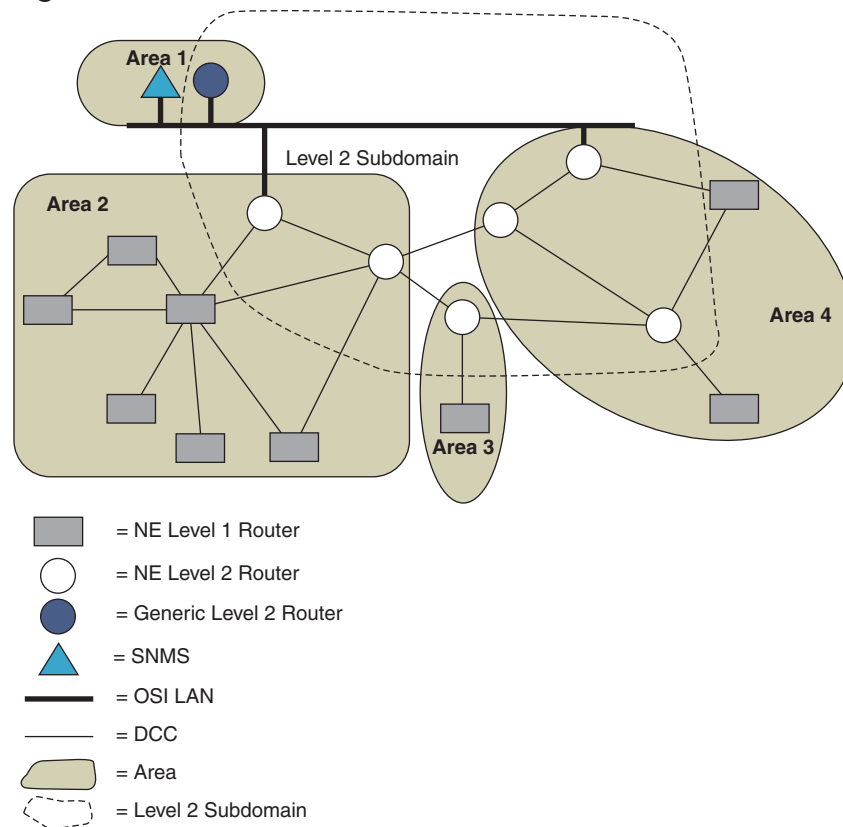
OSI node vs. Network Element terminology

Each Alcatel-Lucent 1850 TSS-5 is an NE that functions as a single OSI node. Some NEs support multiple OSI nodes in a single device. So, the term OSI node, when used to describe network size, may not correspond with the number of NEs in that network.

Symbols

The graphical examples in this appendix use the symbols that are defined in the following figure. The following figure illustrates an example network with nodes assigned to four different areas connected by Level 2 routers.

Figure 6-8 Network with Level 2 routers



NC-DMX-042

Network services access point

Overview

Each network node is assigned a Network Services Access Point (NSAP) address that is stored in the SYSCTL. This address is used by the IS-IS routing protocol. This address can be configured to group nodes into different logical areas within a network domain.

NSAP address format

The Network Services Access Point (NSAP) address is composed of 20 octets. These 20 octets can be represented by 40 hexadecimal characters. The 20 octet-space of the NSAP address is used store values for the 9 fields that compose the NSAP.

The following table displays the 9 fields of the NSAP, and the number of octets used by each field.

Table 6-10 NSAP addresses

NSAP Field:	AFI	IDI	DFI	Organization ID	RES	RD	Area	System Identifier	SEL
Octets:	1	2	1	3	2	2	2	6	1
Default Value: (hex)	39	840F	80	000000	0000	0000	0000	none	00
	not provisionable			user provisionable				not provisionable	

The first 4 octets of the Alcatel-Lucent 1850 TSS-5 NSAP address are always the same and cannot be changed. The next 9 octets of the NSAP address are provisionable. The last 7 octets contain the System Identifier field, which is unique to each node, and the Selector (SEL) field.

Area field

The Area field consists of two octets, that can be represented by four hexadecimal characters. It has a default value of 0000 (hex). The Area field can be provisioned to assign a node to a specific area. TL1 command **ENT-ULSDCC-L3** can be used to change the Area field.

Multiple area addresses

Multiple area addressing is the capability of assigning more than one area address to a node. Multiple area addresses are not supported for Alcatel-Lucent 1850 TSS-5. However, if multiple area addresses are provisioned in another node, Alcatel-Lucent 1850 TSS-5 will recognize its own primary area address plus up to two other area addresses. The use of multiple area addresses is not recommended.

Level 2 routing

Overview

A Level 1 router directly supports one or more individual network nodes. Level 1 routing is the routing that takes place within a single area, between Level 1 routers and their associated nodes.

Each area in a Domain must have at least one Level 2 router. Level 2 routing is the routing that occurs between Level 2 routers, and generally between the areas within a network domain. An area without a Level 2 router is isolated from the rest of the network.

An Alcatel-Lucent 1850 TSS-5 that has IS-IS Level 2 routing enabled, functions as a Level 1-2 router. It continues to provide Level 1 routing within its area, and also provides Level 2 routing to adjacent Level 2 routers. It can be connected to individual network nodes, one or more Level 1 routers, and one or more Level 2 routers.

Level 2 sub-domain

An adjacent set of Level 2 routers forms a Level 2 sub-domain. For proper OSI routing, every Level 2 router should have at least one neighbor (via OSI LAN or DCC) that is also a Level 2 router. At least one Level 2 router in an area must be adjacent to a Level 2 router in another area, otherwise, the former area is isolated from the rest of the network.

Enabling Level 2 routing capability

Each Alcatel-Lucent 1850 TSS-5 functions as a Level 1 router by default. You can use the TL1 command **ENT-ULSDCC-L3** to also enable Level 2 routing on an Alcatel-Lucent 1850 TSS-5.

IS-IS Level 2 routing remote provisioning sequence

Avoid isolating nodes

Avoid isolating any nodes when provisioning area addresses and Level 2 routers remotely. It may be necessary to dispatch a craft technician to recover an isolated node.

To avoid isolating nodes, a sequence for remote provisioning is established with respect to the local node to which the *WaveStar*® CIT is connected. Typically, the local node is provisioned to be a Level 2 router first, but its area address is not changed initially. This general sequence can be modified in networks with redundant OSI LAN or DCC connectivity between and within areas.

1. The nodes and sub-tending rings that are furthest away from this local node are provisioned first.
2. Work back toward the local node's sub-tending ring.
3. Provision the local node's sub-tending ring.
4. Provision the local node last.

Important! Before assigning area addresses and Level 2 routers in a network, be sure no alarms (especially DCC failure alarms) exist; otherwise, even the recommended remote provisioning sequence might result in isolated nodes. To confirm the network alarm status, it is recommended that a centralized maintenance center with TL1 OS support be consulted.

Provisioning sub-tending rings

Always provision new area addresses for a sub-tending ring by starting with a node that is adjacent to the node that connects this sub-tending ring to the rest of the network, and then provision the area address for each sequential adjacent node going around the sub-tending ring. Provision the area address of the connecting node last, especially if the connecting node supports multiple sub-tending rings.

For single-homed sub-tending rings, provision the node that will be the Level 2 router node last; otherwise, nodes in its area could be isolated. For dual-homed rings, provision one of the nodes that will be Level 2 router first, so that OSI connectivity is established with provisioned nodes as soon as they complete their controller resets.

Minimizing OSI communications disruption

Another important goal is to provision the network in such a way that OSI communications disruption is minimized. Changing a node's area address or enabling a node as a Level 2 router causes the node to reset its controller. The reset is immediate upon completion of the command. In addition to temporarily disrupting OSI communications, controller resets temporarily disable automatic transmission protection switching.

If a node's area address and Level 2 routing status are both being changed, both changes should be made with a single command.

As one node is undergoing a controller reset in an area, the next adjacent node should be provisioned to minimize the overall time required to provision the nodes in an area and minimize the time that OSI communications with the nodes in the area are lost.

IS-IS Level 2 routing provisioning confirmation

Overview

You can use TL1 **RTRV-MAP-NETWORK** commands to confirm the area address and Level 2 router assignments of all nodes with OS LAN or DCC connectivity in a network.

Small networks

In a small network without IS-IS Level 2 Routing, the **RTRV-MAP-NETWORK** response includes the NSAPs of the local node and all remote nodes. This command may be useful to confirm the uniqueness of the area addresses before combining two existing networks into one large network requiring IS-IS Level 2 Routing.

Large networks

In large networks with IS-IS Level 2 Routing, the **RTRV-MAP-NETWORK** response can vary based on whether or not the local node is a Level 2 router.

1. If the local node is not a Level 2 router, the response includes only remote nodes in the same OSI area as the local node and indicates which remote node is the default Level 2 router for the local node.
The default Level 2 router is the node that the local node would rely on to route an OSI message outside the local NE's own area. When there are multiple Level 2 routers in the same area, not all nodes in the area would identify the same default Level 2 router typically.
2. If the local node is a Level 2 router, user input dictates whether the response includes:
 - only remote nodes in the same OSI area as the local node (as in #1 above) but indicating which of those remote nodes are Level 2 routers
 - all remote nodes that are Level 2 routers across all OSI areas.

Thus, a **RTRV-MAP-NETWORK** command to one Level 2 router in each area, will identify all nodes in a large network with IS-IS Level 2 Routing. One **RTRV-MAP-NETWORK** command at time per area is recommended to avoid unnecessarily burdening the network with many simultaneous or redundant TARP queries.

Problem isolation

You can use TL1 command **RTRV-MAP-NEIGHBOR** to help locate and resolve IS-IS Level 2 Routing provisioning mistakes. This command highlights any neighbors that have DCC enabled but do not have fully functional OSI communications. When this command addressed to a reachable node with an unreachable neighbor, it identifies the NSAP area address and the Level 2 router status, if known, of the unreachable neighbor. The unreachable neighbor may simply have the wrong area address or both nodes may need to be enabled as Level 2 routers.

The administrator must confirm that all IS-IS Level 2 Routing rules have been followed to ensure successful OSI communications among the nodes in a network. There are no alarm or status conditions that will identify address inconsistency or a lack of Level 2 routing capability, if these have not been configured properly.

Maximum number of OSI nodes

Rules

The total number of nodes within a Level 1 area cannot exceed 250. When Level 2 routing is enabled, Alcatel-Lucent 1850 TSS-5 performs Level 1-2 routing as a single node within the Level 1 area total of 250.

Maximum number of nodes per area and OSI domain

The maximum number of nodes in a domain is determined by multiplying the number of Level 2 routers by the maximum number of nodes per area, up to a maximum of 50 areas, and a maximum total of 1000 nodes.

Engineering rules and guidelines

Overview

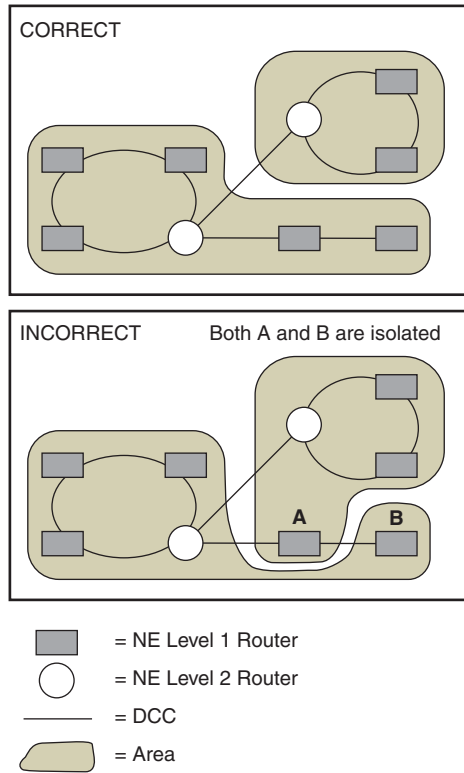
To use IS-IS Level 2 Routing, the user must plan and engineer the provisioning of Level 2 routers and area addresses in the network.

The goal is to create a network with all nodes having OSI LAN or DCC connectivity with each other so that access to all the nodes can be gained from any node in the network.

Rules must be followed to assure OSI LAN and DCC message routing. Guidelines are recommendations that add survivability in the event of a node, OSI LAN or DCC failure. Rules *must* be followed. Guidelines *should* be followed. There may be customer applications that cannot adhere to some or all of the guidelines. In most cases, the potential consequence is that a single failure would at least partially disrupt operations communications.

Rule: OSI LAN or DCC connectivity within an area

All nodes in an area must have OSI LAN or DCC connectivity within the area to all other nodes in the same area. Otherwise, the area would be segmented and message routing could not be expected to function properly. The following figure illustrates a correct and an incorrect example of assigning nodes to areas.

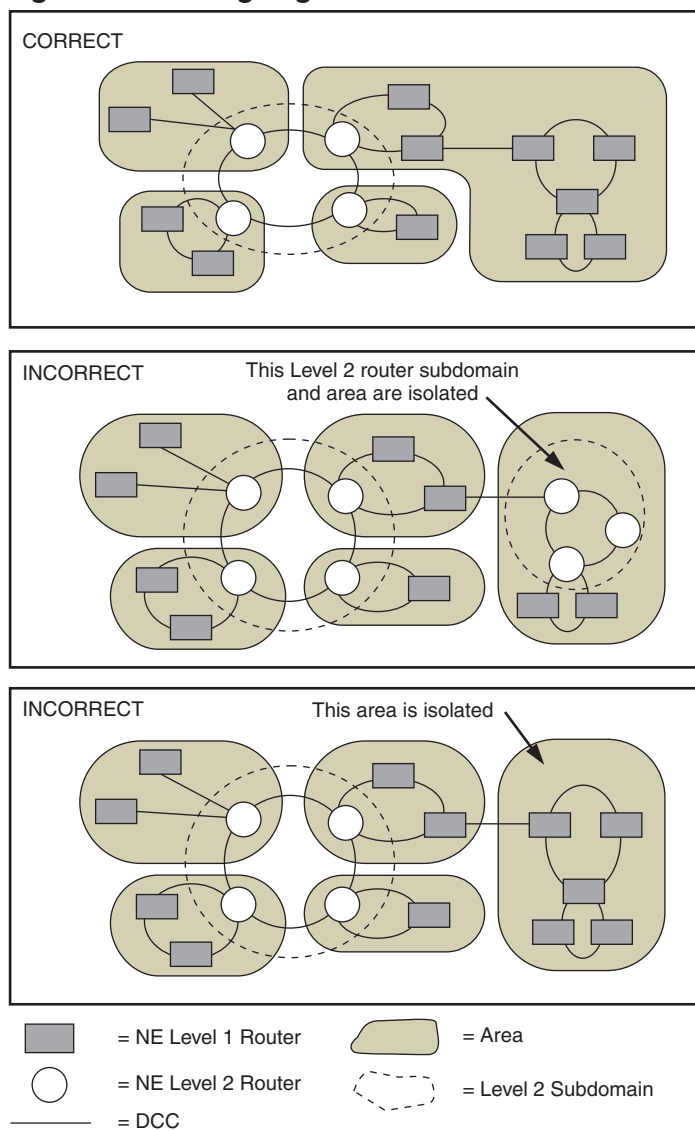
Figure 6-9 Assigning areas

nc-dmx-043

Rule: single Level 2 router sub-domain

All Level 2 routers must have OSI LAN or DCC connectivity, either directly or indirectly via other Level 2 routers, to all other Level 2 routers in the network to form a single Level 2 router sub-domain that provides connectivity to all areas. If more than one Level 2 router sub-domain exists, the network becomes segmented and routing will not function properly.

The following figure illustrates a correct and two incorrect examples of assigning a Level 2 router sub-domains.

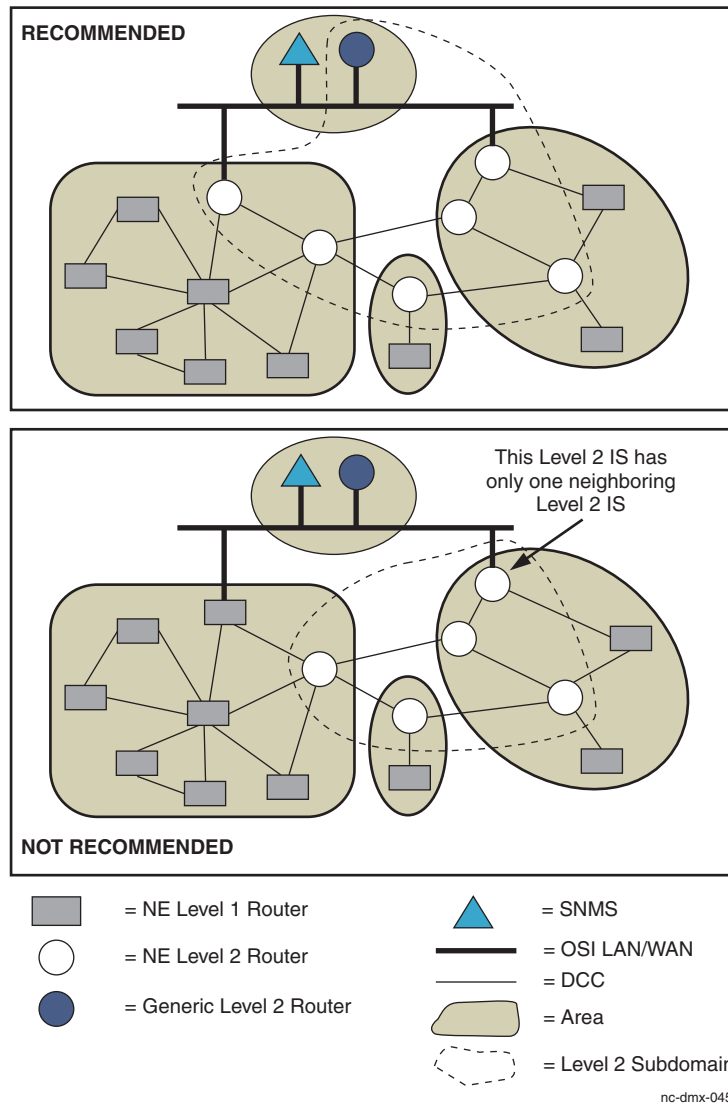
Figure 6-10 Assigning sub-domains

Guideline: redundant routes within the Level 2 sub-domain

When practical, redundant routes in the Level 2 subdomain should be available between all Level 2 routers to ensure that proper routing will occur in the event of a single failure. To satisfy this guideline, every Level 2 router has at least two other Level 2 routers as direct neighbors.

The following figure illustrates a recommended example and an example that is not recommended for redundant routes within the Level 2 subdomain:

Figure 6-11 Redundant routes with the Level 2 sub-domain



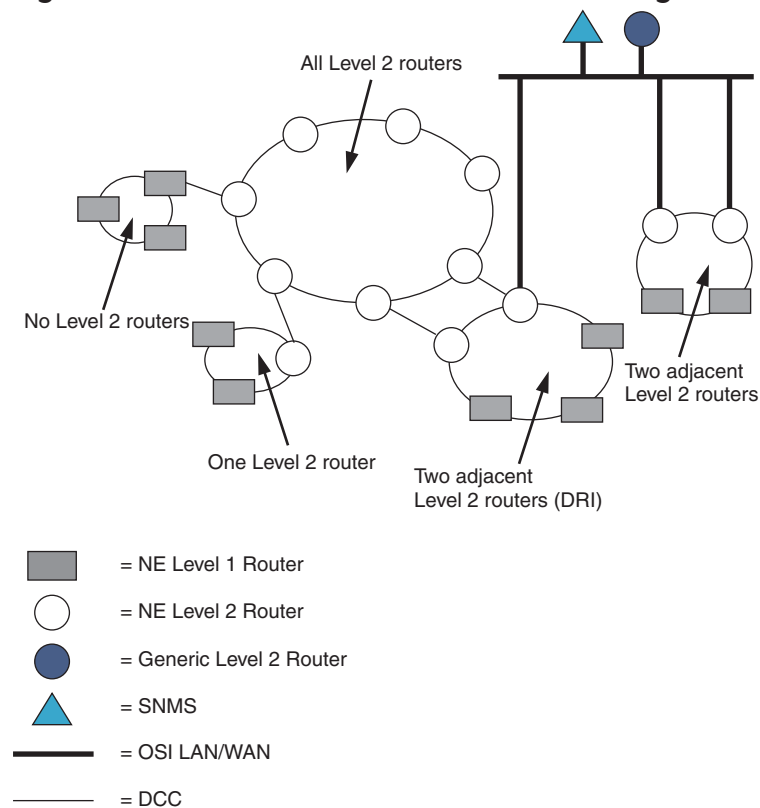
Guideline: Level 2 router assignment in a ring

The recommended number of Level 2 routers in a ring may be one of the following:

- None
- One
- All nodes in the ring
- Two; for example, when dual-homing or dual ring interworking (DRI) is used.

The following figure illustrates examples of recommended Level 2 router assignments in various ring configurations.

Figure 6-12 Recommended Level 2 router assignments



nc-dmx-046

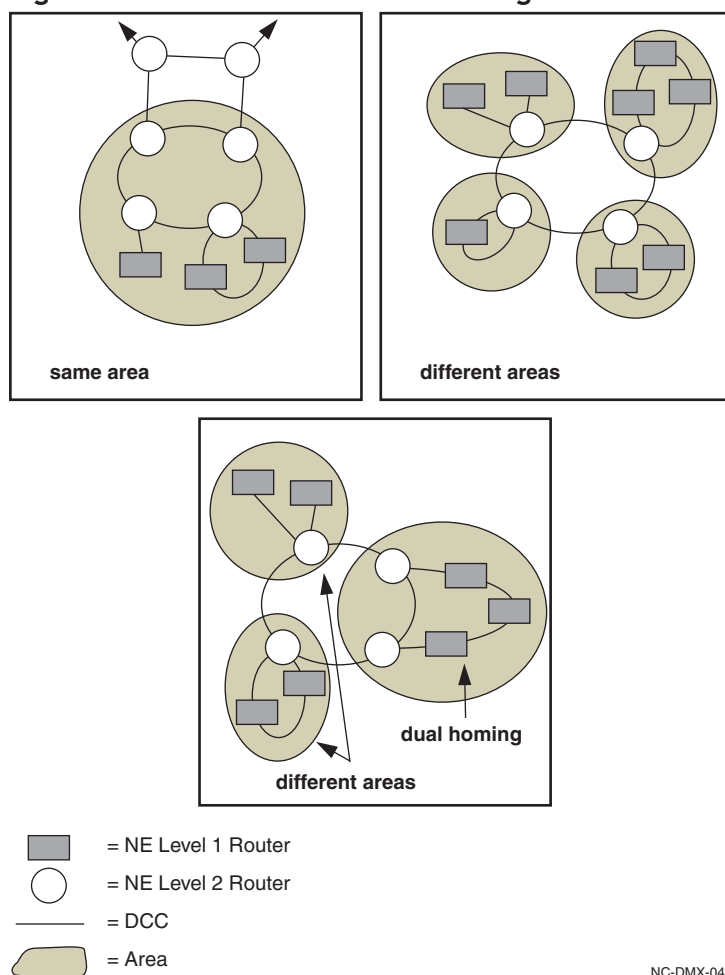
Guideline: Level 2 router area assignments in a ring

For a ring of Level 2 routers, the recommended area assignments may be one of the following:

- All Level 2 routers are part of the same area.
- Each Level 2 router is part of a different area.
- A pair of adjacent Level 2 routers are in the same area (for example, with dual-homing or DRI), with either the other Level 2 routers similarly paired off or individually in different areas.

The following figure illustrates examples of recommended Level 2 router area assignments in a ring.

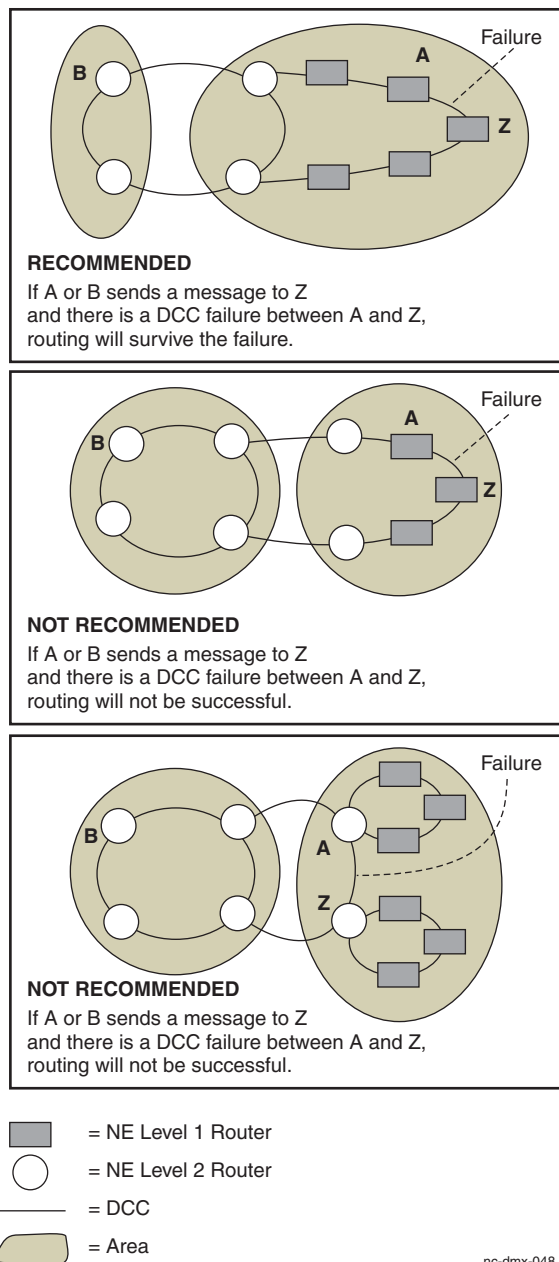
Figure 6-13 Recommended area assignments



Guideline: adjacent Level 2 routers within an area

It is recommended that dual Level 2 routers in an area be adjacent to each other and have a redundant route within the area. Failure to meet this guideline would result in some messages not being routed properly in the event of a single failure that divides an area into two separate islands.

The following figure illustrates a recommended example and two examples that are not recommended of dual Level 2 routers in an area:

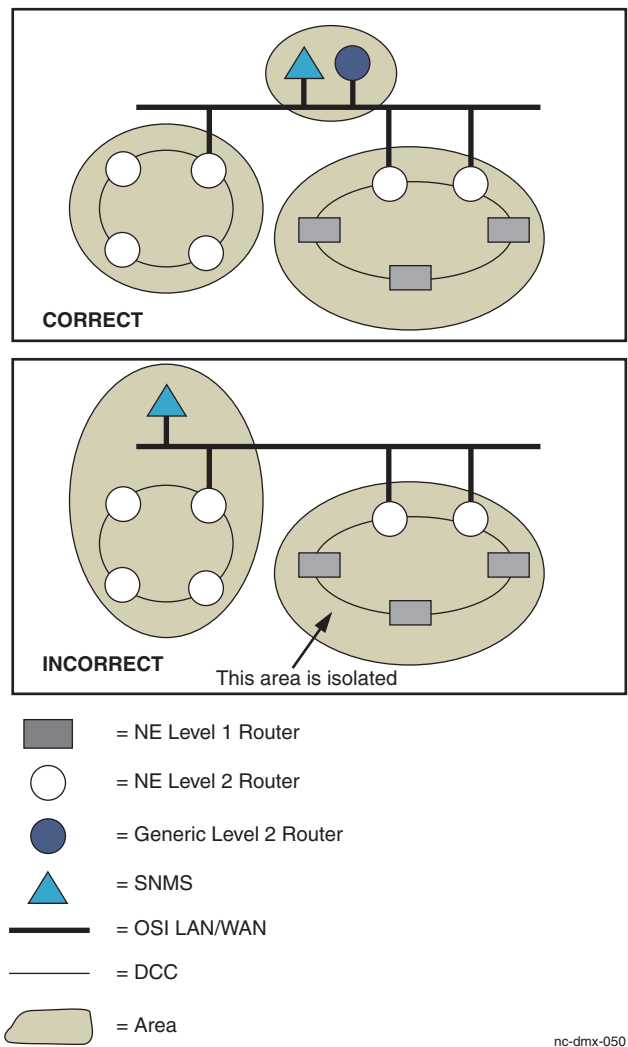
Figure 6-14 Recommended placement of Level 2 routers

Rule: Level 2 routers on an OSI LAN

If an OSI LAN (or WAN) is used to connect between areas, then at least one node in each area on the OSI LAN must be provisioned to be a Level 2 router. Otherwise, the areas won't route to each other via the OSI LAN.

The following figure illustrates a correct and an incorrect example of Level 2 router assignments on an OSI LAN:

Figure 6-15 Level 2 router assignments on an OSI LAN

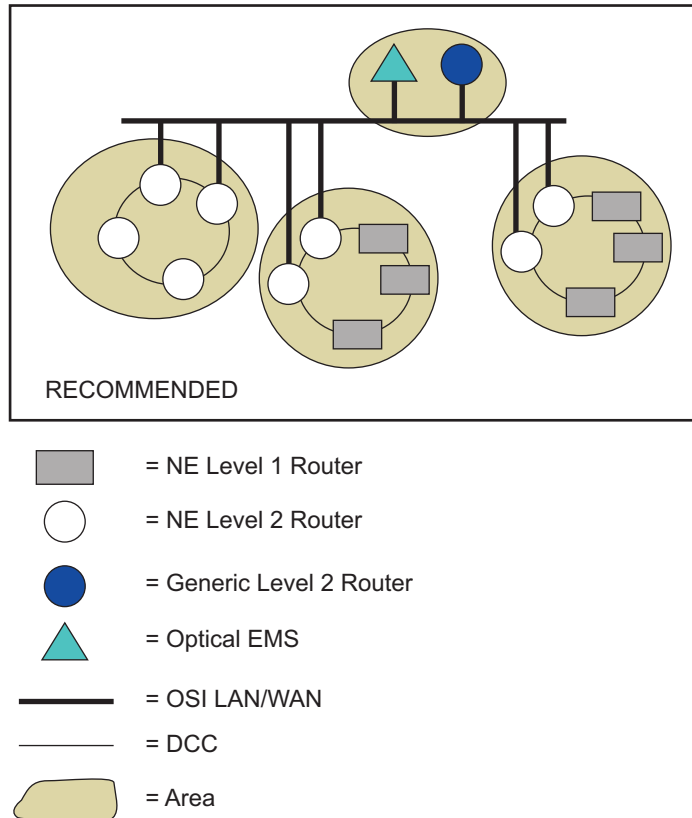


Guideline: OSI LAN redundancy

If an OSI LAN (or WAN) is the only method of connecting between areas, then at least two Level 2 routers directly connected to the OSI LAN for each area are recommended for redundancy purposes. A second, separate OSI LAN hub would provide additional redundancy.

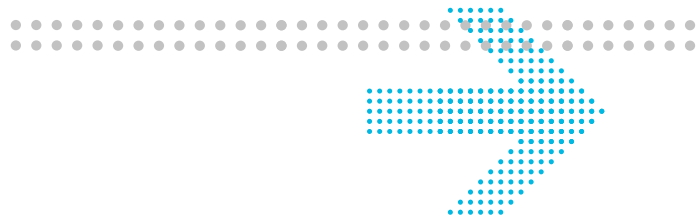
The following figure illustrates a recommended example for providing redundancy between areas connected solely by OSI LANs:

Figure 6-16 OSI LAN redundancy



nc-dmx-051

7 Ordering



Overview

Purpose

This chapter contains information on ordering Alcatel-Lucent 1850 Transport Service Switch 5 (Alcatel-Lucent 1850 TSS-5) equipment and software. The information in this chapter tells you where to go for ordering information, and provides important sparing information and FIT rates relative to both circuit packs and other equipment.

Contents

Introduction	7-2
Sparing information	7-2
Sparing graph	7-3
Engineering drawings	7-5
Software and documentation	7-5
Miscellaneous equipment and tools	7-7

Introduction

Overview

Alcatel-Lucent has created a set of engineering drawings to facilitate the ordering of all products in the future. These drawings are updated for each planned Release, and contain all of the information needed to order Alcatel-Lucent 1850 TSS-5 equipment. The information contained in the engineering drawings will not be duplicated here in the interest of keeping all information current and consistent at all times. This chapter will explain how to make sure you are using the most current version of the engineering drawings and where to order the documents.

Any information about particular pieces of equipment (i.e. the uses of various cables versus other) is meant to convey useful information that may also be contained in the engineering drawings. This information is meant to be used in conjunction with engineering drawings, but not to replace them.

How to order

Equipment and software orders may be placed via Alcatel-Lucent's online ordering process. For more information, contact your Account Executive.

Sparing information

Overview

This section provides guidelines and a procedure to determine the number of spares needed at each location. The number of spares for each field replaceable unit (FRU) must be determined and maintained separately, based on that FRU's in-service population at each given location.

Lead time

Lead time, or turnaround time is the elapsed time between a known FRU failure at a given service location and the arrival of a repaired (or new) FRU at the location where spare circuit packs are stocked to maintain a spare FRU level consistent with the population in service.

Important! The number of spares for each code must be determined and maintained separately, based on the in-service population of the code at each location.

Lead time should not be confused with mean time to repair, which is the elapsed time between discovery of the failure of an in-service FRU and when a replacement is put into service.

Sparing graph

Overview

This section provides guidelines and a procedure to determine the number of spares needed at each location. The number of spares for each circuit pack must be determined and maintained separately, based on that code's in-service population at each given location.

FIT rates

Refer to [“Failure rates” \(p. 9-3\)](#) to determine the FIT for each piece of equipment.

Using the sparing graph

Use the following procedure to determine how many spare circuit packs, port units, or other pieces of equipment are required for each code at each location to maintain 99.9% service continuity, given a ten day lead time.

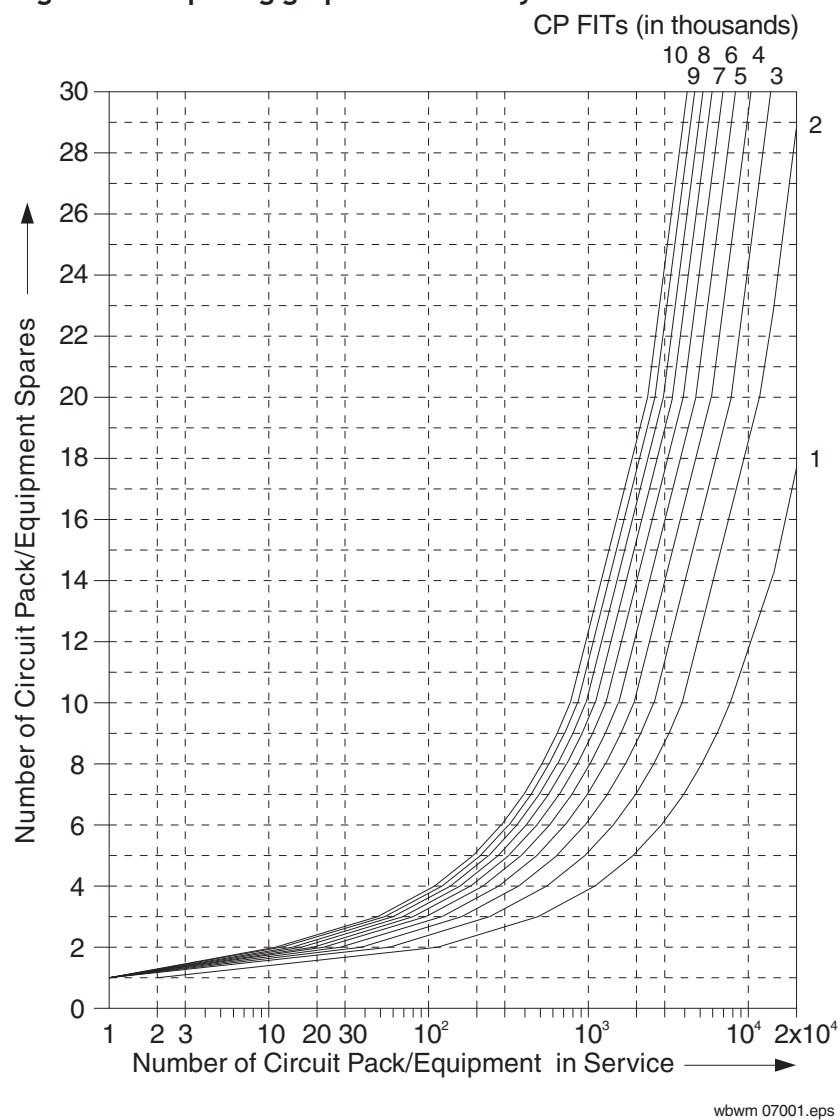
-
- 1 Locate the failure rate for the unit under consideration using the tables above.
 - 2 Refer [Figure 7-1, “Sparing graph for a 10-day lead time” \(p. 7-4\)](#) and select the curve that represents the nearest failure rate. Interpolation may be necessary.
 - 3 Follow the curve until it intersects the vertical line that represents the number of units in service at the given location. Interpolation may be necessary.
 - 4 Refer to the horizontal line immediately above the intersection. The number associated with this line is the minimum number of spares recommended for that location.
 - 5 Repeat steps 1–4 for each circuit pack, port unit, and type of equipment listed in the tables above.

Example of using the graph If there are 100 VLNC50 OC-3 OLIUs (failure rate of 3619) in service at a given location and your lead time is 10 days, then you should order and stock 3 spare OC-3 OLIUs port units for that location.

Sparing graph for a 10-day lead time

Use the graph below to plan the number of spares necessary for the circuit packs and equipment used in Alcatel-Lucent 1850 TSS-5.

Figure 7-1 Sparing graph for a 10-day lead time



END OF STEPS

Engineering drawings

Overview

To ensure that ordering information is always consistent and up-to-date, Alcatel-Lucent provides engineering drawings that contain all the information required to order Alcatel-Lucent 1850 TSS-5.

Where to obtain engineering drawings

The engineering drawing is likely to be updated more frequently than the Product Information and Planning Guide. Order the most current version of the engineering drawing from the [Online Customer Support \(OLCS\)](https://support.lucent.com/portal/olcsHome.do) (<https://support.lucent.com/portal/olcsHome.do>) web site.

Important! When ordering equipment, obtain the current version of the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Release 7.0.0 Engineering and Ordering Information*.

How to order engineering drawings

The most up-to-date version of the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Release 7.0.0 Engineering and Ordering Information* may be obtained through the [Online Customer Support \(OLCS\) web site](https://support.lucent.com) (<https://support.lucent.com>) .

Software and documentation

Overview

This section provides software ordering information.

Software ordering information

Listed below are some need-to-know items before ordering Alcatel-Lucent 1850 TSS-5 software:

- Order one set of software for each shelf ordered. Software orders must be placed in addition to the hardware order to receive software.
- It may be desirable to have backup CD-ROMs for all releases on hand for backup or initial downloading.
- The software ordering table includes cross-references to comcodes where available.
- The Alcatel-Lucent 1850 TSS-5 software CD includes *WaveStar*® CIT software.

Available software

The following table lists the most recent Alcatel-Lucent 1850 TSS-5 software that may be ordered.

Table 7-1 Available software

Comcode	Product Release	Description
109 747 790	R7.0.0	Alcatel-Lucent 1850 TSS-5 R7.0.0 Software Initial Application (NE software CD-ROM, Right to Use License Fee, SRD on CD-ROM, and customer documentation CD-ROM)

Available documentation

For a table of the available documentation, refer to [Table 1, “Alcatel-Lucent 1850 TSS-5 documentation set” \(p. xxv\)](#).

Miscellaneous equipment and tools

Lightguide build-outs

Alcatel-Lucent 1850 TSS-5 utilizes Alcatel-Lucent's state-of-the-art *AllWave ADVANTAGE*TM Fiber Optic Attenuators. These attenuators reduce optical power from the transmitter that can otherwise result in over-saturation of the receiver, have low reflection to meet stringent system requirements, and are backward compatible with existing transmission systems. Unique to the AllWave ADVANTAGE optical connectivity solution (OCS), the *LC*TM optical attenuators are designed to provide flat spectral loss across the full spectrum. LC optical attenuators are ideal for networks deploying AllWave fiber, metropolitan networks, applications supported by conventional single-mode optical fiber, multiservice network protocols, and DWDM networks.

[Table 7-2, “Lightguide build-outs” \(p. 7-7\)](#) lists the available LC-type lightguide buildout attenuators for the Alcatel-Lucent 1850 TSS-5.

Table 7-2 Lightguide build-outs

Description	Comcode
LC Build-Out Attenuators ¹	
5 dB	108279381
10 dB	108279431
15 dB	108279480
20 dB	108279530
AllWave ADVANTAGE TM Fiber Optic Identification Kit ²	108622929

Notes:

1. The LC buildout attenuators listed are polished connector (PC) style connectors at the fiber end. These attenuators must be used on the receive side in all cases.
2. The AllWave ADVANTAGE Fiber Optic Identification Kit includes labels for fiber optic apparatus products to identify Alcatel-Lucent AllWave Fiber paths. An instruction sheet is included with recommendations on how to install and use the labels.

Accessories

Table 7-3, “Miscellaneous accessories” (p. 7-8) lists the miscellaneous accessories available for Alcatel-Lucent 1850 TSS-5. This equipment may not be necessary at all locations. It is to be used when the ports need to be verified for cleanliness. If care is exercised when cleaning fibers, the video scope may not be needed.

Table 7-3 Miscellaneous accessories

Product	Model/ Description	Comcode	ITE#	Installation Order #
Optical Fiber Scope	Noyes OFS 300-200X	408197028	ITE-7129	33712900
2.5mm Universal Adapter Cap	For use with the Noyes OFS 300-200X	408197044	ITE-7129D1	33712901
1.25mm Universal Adapter Cap	For use with the Noyes OFS 300-200X	408197069	ITE-7129D2	33712902
Video Fiber Scope1	Noyes VFS-1	TBD	TBD	TBD
Individual, presaturated alcohol wipes	99% pure isopropyl alcohol	901375147	ITE-7136	33713600
CLETOP Cleaning Cassette	Type A Reel	901375154	ITE-7137	33713700
CLETOP Cleaning Cassette Replacement Reel	Type A Reel	901375014	ITE-7137 D1	33713701
Luminex Stick port cleaners	1.25 mm	901375030	ITE-7134	33713400
Luminex Stick port cleaners	2.5 mm	901375022	ITE-7135	33713500
Luminex Stick port cleaners	5.5" x 5.5"	408201226	R6033	23603300

Important! The equipment and material listed in Table 7-3, “Miscellaneous accessories” (p. 7-8) has been tested and is proven effective. Substitution of equipment or materials is at the discretion of the user and is not recommended.

PTM optics

Alcatel-Lucent 1850 TSS-5 utilizes pluggable transmission modules (PTMs). To ensure proper optical performance, mechanical fit, compliance with EMC, and compliance with laser safety standards, the Alcatel-Lucent approved PTM transceivers listed in the following table must be used.

Table 7-4 PTM optics

Name/Qualifier	Pluggable Transmission Module Code/Comcode	Description	Compatible Circuit Packs
OMFE/100BASE-LX-SM	100BASE-LX-I1 109527812	100 Mb/s optical Fast Ethernet SFP TRCVR	VLNC35 VLNC40 VLNC42 VLNC42B VLNC60 VLNC61 VLNC62 VLNC64
OM1G/1000BASE-ZX	1000BASE-ZX-I1 109541862	GbE SM 1550 nm 1000BASE-ZX SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52
EM1G//EMFE 1000BASE-T//100BASE-T	BASE-T-C1 109565549	10 Mb/s, 100 Mb/s and 1000 Mb/s, Copper, SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64

Table 7-4 PTM optics (continued)

Name/Qualifier	Pluggable Transmission Module Code/Comcode	Description	Compatible Circuit Packs
OM1G//OMFC 1000BASE-LX// 100/200-SM-LL-L-I	GE-1X2XFC-LX-I1 109568782	GbE SM 1310 nm 1XFC/2XFC 1000BASE-LX SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
OM1G//OMFC 1000BASE-SX// 100/200-M5/M6-SN-S	GE-1X2XFC-SX-I1 109570606	GbE MM 850 nm 1XFC/2XFC 1000BASE-SX SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
OM155/IR1(S-1.1)	OC3IR1-I1 109453894	OC3 IR1, SM, 1310 nm, 15 km, SFP TRCVR	VLNC50 VLNC52 VLNC64
OM155/LR1(L-1.1)	OC3LR1-I1 109453886	OC3 LR1, SM, 1310 nm, 40 km, SFP TRCVR	VLNC50 VLNC52 VLNC64
OM622/IR1(S-4.1)	OC12IR1-I1 109453902	OC12 IR1, SM, 1310 nm, 15 km, SFP TRCVR	VLNC50 VLNC52
OM622/LR1(L-4.1)	OC12LR1-I1 109467522	OC12 LR1, SM, 1310 nm, 40 km, SFP TRCVR	VLNC50 VLNC52
OM622/LR2(L-4.2)	OC12LR2-I1 109604447	OC12 LR2, SM, 1550 nm, 80 km, SFP TRCVR	VLNC50 VLNC52

Table 7-4 PTM optics (continued)

Name/Qualifier	Pluggable Transmission Module Code/Comcode	Description	Compatible Circuit Packs
OM155/SR1(I-1)	S155I2 109602599	OC-3 SR-1/STM-1, SM, 1310 nm, 2 km, SFP TRCVR	VLNC50 VLNC52 VLNC64
OM622// OM1G 40KMBIDI// 1000BASE- BX40	GE-131T149R-I1 109703215	Bidirectional SFP, 1000BASE-BX40, OC-12/STM-4, 40 km, SM, 1310 nm Tx, 1490 nm Rx	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
OM622// OM1G 40KMBIDI// 1000BASE- BX40	GE-149T131R-I1 109703207	Bidirectional SFP, 1000BASE-BX40, OC-12/STM-4, 40km, SM, 1490 nm Tx, 1310 nm Rx	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
OM155// OM622/ 40KMBIDI// 40KMBIDI	622-131T155R-I1 109703165	Bidirectional SFP, OC-3/ STM-1/OC-12/STM-4, 40 km, SM, 1310 nm Tx, 1550 nm Rx	VLNC50 VLNC52
OM155// OM622/ 40KMBIDI// 40KMBIDI	622-155T131R-I1 109703181	Bidirectional SFP, OC-3/ STM-1/OC-12/STM-4, 40 km, SM, 1550 nm Tx, 1310 nm Rx	VLNC50 VLNC52
OM155//OM622/ CWDM-LR	S622C47EL 109664086	OC-3/STM-1 or OC-12/STM-4 CWDM, 1471 nm, SFP TRCVR	VLNC50 VLNC52 VLNC64

Table 7-4 PTM optics (continued)

Name/Qualifier	Pluggable Transmission Module Code/Comcode	Description	Compatible Circuit Packs
OM155//OM622/ CWDM-LR	S622C49EL 109664094	OC-3/STM-1 or OC-12/STM-4 CWDM, 1491 nm, SFP TRCVR	VLNC50 VLNC52 VLNC64
OM155//OM622/ CWDM-LR	S622C51EL 109664102	OC-3/STM-1 or OC-12/STM-4 CWDM, 1511 nm, SFP TRCVR	VLNC50 VLNC52 VLNC64
OM155//OM622/ CWDM-LR	S622C53EL 109664110	OC-3/STM-1 or OC-12/STM-4 CWDM, 1531 nm, SFP TRCVR	VLNC50 VLNC52 VLNC64
OM155//OM622/ CWDM-LR	S622C55EL 109664128	OC-3/STM-1 or OC-12/STM-4 CWDM, 1551 nm, SFP TRCVR	VLNC50 VLNC52 VLNC64
OM155//OM622/ CWDM-LR	S622C57EL 109664136	OC-3/STM-1 or OC-12/STM-4 CWDM, 1571 nm, SFP TRCVR	VLNC50 VLNC52 VLNC64
OM155//OM622/ CWDM-LR	S622C59EL 109664144	OC-3/STM-1 or OC-12/STM-4 CWDM, 1591 nm, SFP TRCVR	VLNC50 VLNC52 VLNC64
OM155//OM622/ CWDM-LR	S622C61EL 109664151	OC-3/STM-1 or OC-12/STM-4 CWDM, 1611 nm, SFP TRCVR	VLNC50 VLNC52 VLNC64
OM1G/ 1000BASE-LCWDM	SGEC47EL 109669622	GbE CWDM, 1471 nm, SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64

Table 7-4 PTM optics (continued)

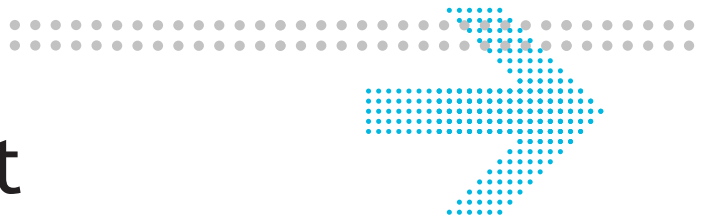
Name/Qualifier	Pluggable Transmission Module Code/Comcode	Description	Compatible Circuit Packs
OM1G/1000BASE-LCWDM	SGEC49EL 109669630	GbE CWDM, 1491 nm, SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
OM1G/1000BASE-LCWDM	SGEC51EL 109669648	GbE CWDM, 1511 nm, SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
OM1G/1000BASE-LCWDM	SGEC53EL 109669655	GbE CWDM, 1531 nm, SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64

Table 7-4 PTM optics (continued)

Name/Qualifier	Pluggable Transmission Module Code/Comcode	Description	Compatible Circuit Packs
OM1G/1000BASE-LCWDM	SGEC55EL 109669663	GbE CWDM, 1551 nm, SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
OM1G/1000BASE-LCWDM	SGEC57EL 109669671	GbE CWDM, 1571 nm, SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
OM1G/1000BASE-LCWDM	SGEC59EL 109669689	GbE CWDM, 1591 nm, SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64

Table 7-4 PTM optics (continued)

Name/Qualifier	Pluggable Transmission Module Code/Comcode	Description	Compatible Circuit Packs
OM1G/1000BASE-LCWDM	SGEC61EL 109669697	GbE CWDM, 1611 nm, SFP TRCVR	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64



8 Product support

Overview

Purpose

This chapter describes the support services available to Alcatel-Lucent customers.

Alcatel-Lucent offers a number of services to assist customers with Engineering, Installation and Technical Support of their networks. Additionally, Alcatel-Lucent offers product-specific training courses.

Contents

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Worldwide Services

Overview

Alcatel-Lucent Worldwide Services provides a full life-cycle of services and solutions to help you plan, design, implement, and operate your network in today's rapidly changing and complex environment.

Engineering Services

Engineering Services provide information and technical support to customers during the planning, implementation, and placement of equipment into new or existing networks. We determine the best, most economical equipment solution for a customer and help ensure equipment is configured correctly for the customer's network needs, works as specified, and is ready for installation on delivery. These services consist of the following:

- Equipment engineering
- Software engineering
- Site records
- Engineering consulting
- Additional engineering services (Network Realignment, System Capacity Planning, System Health Assessment)

Installation Services

Alcatel-Lucent offers Installation Services focused on providing the technical support and resources customers need to efficiently and cost-effectively install their network equipment. We offer a variety of options that provide extensive support and deliver superior execution to help ensure the system hardware is installed, tested, and functioning as engineered and specified. Installation Services provides a complete flexible solution tailored to meet customers' specific needs. These services consist of the following:

- Equipment installation
- Specialized equipment installation
- Network connectivity services
- Installation support services

Technical support

For technical support, contact your local customer support team. Refer to the [Alcatel-Lucent Customer Support web site \(http://alcatel-lucent.com\)](http://alcatel-lucent.com) and select the Support tab, or select the Contact Us tab and navigate to the Customer Technical Support section.

Web site

For additional information regarding support services, refer to the [Alcatel-Lucent Products & Services web site](http://www.alcatel-lucent.com/products) (<http://www.alcatel-lucent.com/products>)

1. Click **Services**
2. Select the desired service to display:
 - Consult & Design
 - Integrate & Deploy
 - Maintain & Operate

Training

Overview

Alcatel-Lucent offers a formal training curriculum to complement your product needs.

Registering for a course

To explore the available courses, enroll in a training course at one of Alcatel-Lucent's corporate training centers, or to arrange for a suitcase session at your facility, choose one of the following contact methods:

- Refer to [Product Training web site](https://training.lucent.com/) (<https://training.lucent.com/>) for access to the training catalog
- Within the United States, call 888-582-3688 and select *Prompt 2*.
- Outside the United States:
 - Telephone: +1 407 767 2667
 - Fax: +1 407 767 2677
 - Refer to [Product Training web site](https://training.lucent.com/) (<https://training.lucent.com/>) and click Contact Us for a detailed list of international contact numbers.
 - Contact your in-country training representative

9 Quality and reliability



Overview

Purpose

This chapter details quality and reliability information for Alcatel-Lucent 1850 Transport Service Switch 5 (Alcatel-Lucent 1850 TSS-5).

Contents

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Quality certifications	9-7
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Eco-environmental statements	9-9

Alcatel-Lucent Quality Policy

Quality Policy

We ensure that everything we do must be focused on becoming the trusted partner of our customers by:

- Delivering high quality, secure and reliable products, services, software and solutions the first time, every time, and on time - as promised.
- Continuously making improvements and looking for innovative ways to anticipate and fully meet the highest expectations of our customers.
- Counting on all employees to be personally accountable for putting the customer first and honoring the commitments we make.

Reliability program and specifications

Overview

The reliability program provides enhanced reliability and is implemented as an integral part of the Alcatel-Lucent Product Life Cycle (PLC) process. The reliability program is comprehensive, and includes activities such as setting and ensuring compliance with customer-focused system-reliability requirements, ensuring component qualification is consistent with use environment and system design, assuring satisfactory component-attachment reliability, predicting failure rates of Field Replaceable Units (FRUs), making sparing recommendations, assessing reliability architecture, modeling system reliability, assuring satisfactory system-downtime performance, reducing hardware failure rates through Environmental Stress Testing (EST), and tracking field returns.

Design and development

During the design and development stage, reliability predictions, qualification and selection of components, definition of quality assurance audit standards, and prototyping of critical areas of the system ensure built-in reliability.

Manufacturing and field deployment

During manufacturing and field deployment, techniques such as environmental stress testing, production quality audits, field-return tracking, failure-mode analysis, and feedback and corrective-action further enhance the ongoing reliability improvement efforts on the Alcatel-Lucent 1850 TSS-5.

Environmental Stress Testing

Alcatel-Lucent 1850 TSS-5 circuit packs are subjected to an Environmental Stress Testing (EST) program. The purpose of the program is to improve reliability by reducing early life failures and implementing root-cause analysis and corrective action on circuit packs that fail EST.

Transmission downtime

Alcatel-Lucent 1850 TSS-5 satisfies a stringent set of reliability specifications. Some of the critical specifications include *Telcordia*® downtime requirements for multiplexers. *Telcordia*® requirements state that the downtime of a two-way channel within a SONET multiplexer, due to hardware failure, must be less than 1.75 minutes per year in a Central Office (CO) environment and 5.25 minutes per year in an Outside Plant (OSP) environment. These requirements appear in *Telcordia*® GR-418-CORE.

These requirements apply to all system elements needed to process a two-way channel, including the core system as well as the network and tributary interfaces. System-reliability analysis employing Markov modeling is used to determine the system downtimes. As specified in *Telcordia*® GR-418-CORE, this analysis assumes a mean time to repair of 2 hours for the CO environment and 4 hours for the OSP environment. Individual Field Replaceable Unit (FRU) failure rates used in the model were determined using the method described in *Telcordia*® SR-332, *Reliability Prediction Procedure for Electronic Equipment (RPP)*. FRUs are system elements that can be replaced in the field, including items such as circuit packs, removable optical interfaces, housings, cooling units, and removable LEDs. In addition, failure-rate-prediction and availability-analysis methods used for Alcatel-Lucent 1850 TSS-5 comply to ITU-T G.911

Failure rates

Overview

This section provides circuit pack, PTM, and equipment failure rates for Alcatel-Lucent 1850 TSS-5.

Circuit pack failure rates

[Table 9-1, “Circuit pack failure rates” \(p. 9-3\)](#) lists failure-rate predictions for all circuit packs. These failure rates were determined per *Telcordia*® SR-332.

Important! Failure-rate predictions are estimates; actual values may vary.

Table 9-1 Circuit pack failure rates

Circuit Pack	Apparatus Code	Failure Rate (FIT)	
		Central Office	Outside Plant
SYSCTL	VLNC2	1898	3796
100BASE-LX/ 10/100BASE-T Private Line	VLNC35	938	1877
10/100/1G T/F	VLNC40	2991	5982
10/100/1G T/F	VLNC42	2367	4734
10/100/1G T/F	VLNC42B	3336	6672
OC-3/OC-12/STM-1/STM-4/8DS1E1/3DS3E3	VLNC50	3619	7238
OC-3/OC-12/STM-1/STM-4/28DS1E1/3DS3E3	VLNC52	2679	5358
8DS1/E1-100/1G-T/F	VLNC60	2807	5614
16DS1/E1-100/1G-T/F	VLNC61	3395	6791

Table 9-1 Circuit pack failure rates (continued)

Circuit Pack	Apparatus Code	Failure Rate (FIT)	
		Central Office	Outside Plant
8DS1/E1-100/1G-T/F	VLNC62	2657	5313
OC3/OC12-STM1/STM4-100/1G-T/F ¹	VLNC64	2675	5350

Notes:

1. The VLNC64 does not currently support OC-12/STM-4 interfaces.

PTM failure rates

The following table provides failure-rate predictions for all Pluggable Transmission Modules (PTMs) used in Alcatel-Lucent 1850 TSS-5.

These failure rates were determined per *Telcordia*® SR-332.

Important! Failure-rate predictions are estimates; actual values may vary.

Table 9-2 Pluggable Transmission Module failure rates

Apparatus Code	Type	Failure Rate (FIT)	
		Central Office ¹	Outside Plant
100BASE-LX-I1	100 Mb/s optical Fast Ethernet SFP TRCVR	261	522
1000BASE-ZX-I1	GbE SM 1550 nm 1000BASE-ZX SFP TRCVR	261	522
BASE-T-C1	10 Mb/s, 100 Mb/s and 1000 Mb/s, Copper, SFP TRCVR	308	NA ²
GE-1X2XFC-LX-I1	GbE SM 1310 nm 1XFC/2XFC 1000BASE-LX SFP TRCVR	261	522
GE-1X2XFC-SX-I1	GbE MM 850 nm 1XFC/2XFC 1000BASE-SX SFP TRCVR	261	522
OC3IR1-I1	OC3 IR1, SM, 1310 nm, 15 km, SFP TRCVR	261	522
OC3LR1-I1	OC3 LR1, SM, 1310 nm, 40 km, SFP TRCVR	261	522
OC12IR1-I1	OC12 IR1, SM, 1310 nm, 15 km, SFP TRCVR	261	522
OC12LR1-I1	OC12 LR1, SM, 1310 nm, 40 km, SFP TRCVR	261	522
OC12LR2-I1	OC12 LR2, SM, 1550 nm, 80 km, SFP TRCVR	261	522
GE-131T149R-I1	Bidirectional SFP, 1000BASE-BX40, OC-12/STM-4, 40 km, SM, 1310 nm Tx, 1490 nm Rx	261	522

Table 9-2 Pluggable Transmission Module failure rates (continued)

Apparatus Code	Type	Failure Rate (FIT)	
		Central Office ¹	Outside Plant
GE-149T131R-I1	Bidirectional SFP, 1000BASE-BX40, OC-12/STM-4, 40km, SM, 1490 nm Tx, 1310 nm Rx	261	522
622-131T155R-I1	Bidirectional SFP, OC-3/ STM-1/OC-12/STM-4, 40 km, SM, 1310 nm Tx, 1550 nm Rx	261	522
622-155T131R-I1	Bidirectional SFP, OC-3/ STM-1/OC-12/STM-4, 40 km, SM, 1550 nm Tx, 1310 nm Rx	261	522
S155I2	OC-3/STM-1 SR-1, SM, 1310 nm, 2 km, SFP TRCVR	261	522
S622C47EL	OC-3/STM-1 or OC-12/STM-4 CWDM, 1471 nm, SFP TRCVR	261	³
S622C49EL	OC-3/STM-1 or OC-12/STM-4 CWDM, 1491 nm, SFP TRCVR	261	³
S622C51EL	OC-3/STM-1 or OC-12/STM-4 CWDM, 1511 nm, SFP TRCVR	261	³
S622C53EL	OC-3/STM-1 or OC-12/STM-4 CWDM, 1531 nm, SFP TRCVR	261	³
S622C55EL	OC-3/STM-1 or OC-12/STM-4 CWDM, 1551 nm, SFP TRCVR	261	³
S622C57EL	OC-3/STM-1 or OC-12/STM-4 CWDM, 1571 nm, SFP TRCVR	261	³
S622C59EL	OC-3/STM-1 or OC-12/STM-4 CWDM, 1591 nm, SFP TRCVR	261	³
S622C61EL	OC-3/STM-1 or OC-12/STM-4 CWDM, 1611 nm, SFP TRCVR	261	³
SGEC47EL	GbE CWDM, 1471 nm, SFP TRCVR	261	³
SGEC49EL	GbE CWDM, 1491 nm, SFP TRCVR	261	³
SGEC51EL	GbE CWDM, 1511 nm, SFP TRCVR	261	³
SGEC53EL	GbE CWDM, 1531 nm, SFP TRCVR	261	³
SGEC55EL	GbE CWDM, 1551 nm, SFP TRCVR	261	³
SGEC57EL	GbE CWDM, 1571 nm, SFP TRCVR	261	³
SGEC59EL	GbE CWDM, 1591 nm, SFP TRCVR	261	³
SGEC61EL	GbE CWDM, 1611 nm, SFP TRCVR	261	³

Notes:

1. The predictions for the central office environment assume a system-inlet air temperature of 25°C.
2. NA in the Outside Plant (OSP) column indicates that the PTM is not used in OSP environments.
3. The S622CxxEL and SGECxxEL PTMs (xx = 47–61) are approved to operate at –5°C to +85°C. When operating within this temperature range, the S622CxxEL and SGECxxEL PTMs have a predicted failure rate of 522 FIT.
4. LR: Long Reach
5. IR: Intermediate Reach
6. SR: Short Reach

Equipment failure rates

Table 9-3, “Equipment failure rates” (p. 9-6) provides the steady-state equipment failure rates for Alcatel-Lucent 1850 TSS-5.

Table 9-3 Equipment failure rates

Equipment	Failure Rate Central Office	Failure Rate Outside Plant
Fan unit	1157	2313
Rack mount shelf assembly	130	259
–48 VDC Power Supply (Mascot AS Type 2025)	9460	NA
VLIU1	321	642
VLIU2	221	442
VLIU3	193	386
VLIU10	179	358
timing output assembly (849114988)	15	30 ¹
timing input assembly (849108733)	14	28 ¹

Notes:

1. The signal could be slightly degraded if exposed to extreme low-end operating temperatures that approach –40°C.

Quality certifications

Overview

Alcatel-Lucent 1850 TSS-5 achieved TL 9000 certification in 2004, as part of the Lucent-wide registration under the Lucent Management System (LMS). This certification includes ISO certification and remains valid.

Alcatel-Lucent is in the process of moving all current registrations to one quality management system for the entire company, with an estimated completion date of December 2008.

Quality Management System

The Alcatel-Lucent 1850 TSS-5 product family adheres to the Alcatel-Lucent Quality Management System (ALU QMS) as described in the *OMSN North America (NA) Product Realization (PR) Quality Manual*.

The ALU QMS enables Alcatel-Lucent to demonstrate a global approach for quality management, deploy common processes, share lessons learned for improving efficiency and customer satisfaction, and achieve consolidated registration to international standards.

TL 9000

TL 9000 is a telecommunications industry-specific set of requirements and measurements for software, hardware and services. TL 9000 is built on existing industry standards, including ISO 9001. Conformance to TL 9000 constitutes conformance to corresponding ISO 9001 requirements. TL 9000 consolidates various industry requirements and customer requests for measurements; it reduces problems caused by multiple requirements and audits; and it standardizes reporting and use of supplier performance data via defined measurements. TL 9000 requires well-documented, implemented controls for design development, production, delivery, installation, and service. The primary purpose of TL 9000 is to ensure that manufacturers produce products with consistently high levels of quality and service.

Warranty

Hardware warranty

Alcatel-Lucent provides a one year hardware warranty on Alcatel-Lucent 1850 TSS-5, effective from the date the unit is shipped.

Hardware failure emergencies

In the event of a service outage or failure during the initial installation and turn-up of Alcatel-Lucent 1850 TSS-5, go to [Global Reverse Supply Chain web site](http://esupply.web.lucent.com/grsc/) (<http://esupply.web.lucent.com/grsc/>) . The instructions and contacts for various global locations are listed under, “Returns Information” in the upper right part of the page.

OLCS

Alcatel-Lucent provides one year of access to the [Online Customer Support \(OLCS\) web site](https://support.lucent.com/portal/olcsHome.do) (<https://support.lucent.com/portal/olcsHome.do>) . Any 3rd-party vendor warranty terms will be pass-through from original vendor.

Software warranty

Alcatel-Lucent offers a 90-day warranty for defect resolution. All warranties pertain to the deployment of a release and do not apply to individual software licenses.

Alcatel-Lucent's warranty on any software release will not exceed 90 days for defect resolution. All warranties pertain to the deployment of a release and do not apply to individual software licenses.

For more warranty information, contact your local Alcatel-Lucent account executive.

Eco-environmental statements

Overview

The statements that follow are the eco-environmental statements that apply to Alcatel-Lucent 1850 TSS-5 when deployed in the European Union, China, Canada, and the United States.

Packaging collection and recovery requirements

Countries, states, localities, or other jurisdictions may require that systems be established for the return and/or collection of packaging waste from the consumer, or other end user, or from the waste stream. Additionally, reuse, recovery, and/or recycling targets for the return and/or collection of the packaging waste may be established.

For more information regarding collection and recovery of packaging and packaging waste within specific jurisdictions, please contact the Alcatel-Lucent Services - Environmental Health and Safety organization.

Material content compliance

European Union RoHS

European Union (EU) Directive 2002/95/EC, "Restriction of the use of certain Hazardous Substances" (RoHS), restricts the use of lead, mercury, cadmium, hexavalent chromium, and certain flame retardants in electrical and electronic equipment. This Directive applies to electrical and electronic products placed on the EU market after 1 July 2006, with various exemptions, including an exemption for lead solder in network infrastructure equipment. Alcatel-Lucent products shipped to the EU after 1 July 2006 comply with the EU RoHS Directive.

China RoHS

The Peoples Republic of China Ministry of Information Industry has published a regulation (Order #39) and associated standards regarding restrictions on hazardous substances (China RoHS). Currently, the legislation requires all Electronic and Information Products (EIP) to comply with certain labeling and documentation requirements. Alcatel-Lucent products manufactured on or after 1 March 2007, that are intended for sale to customers in the China market, comply with these requirements.

In accordance with the People's Republic of China Electronic Industry Standard "Marking for the Control of Pollution Caused by Electronic Information Product" (SJ/T11364- 2006), customers may access Alcatel-Lucent's Hazardous Substances Table information at either of the following two URLs (for the convenience of our diverse customer base):

- Access via the Alcatel-Lucent Corporate website at:
<http://www.alcatel-sbell.com.cn/live/home/index.jsp> (<http://www.alcatel-sbell.com.cn/live/home/index.jsp>)
- Access via the Alcatel Shanghai Bell website at:
<http://www.alcatel-sbell.com.cn/wwwroot/images/upload/private/1/media/China-RoHS-HST-3.1.pdf> (<http://www.alcatel-sbell.com.cn/wwwroot/images/upload/private/1/media/China-RoHS-HST-3.1.pdf>)

Recycling / take-back / disposal of products

Electronic products bearing or referencing the symbols shown below shall be collected and treated at the end of their useful life, in compliance with applicable European Union and other local legislation. They shall not be disposed of as part of unsorted municipal waste. Due to materials that may be contained in the product and batteries, such as heavy metals, the environment and human health may be negatively impacted as a result of inappropriate disposal.

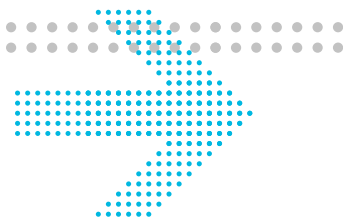
Note: For electronic products put on the market in the European Union, a solid bar under the crossed-out wheeled bin indicates that the product was put on the market after 13 August 2005.



Moreover, in compliance with legal requirements and contractual agreements, where applicable, Alcatel-Lucent will offer to provide for the collection and treatment of Alcatel-Lucent products bearing the logo at the end of their useful life, or products displaced by Alcatel-Lucent equipment offers.

For information regarding take-back, recycling, or disposal of equipment by Alcatel-Lucent or for equipment take-back requests, visit the [Alcatel-Lucent Take-Back web page](http://www.alcatel-lucent.com/product_takeback) (http://www.alcatel-lucent.com/product_takeback) or contact [Alcatel-Lucent Takeback Support](mailto:takeback@alcatel-lucent.com) (takeback@alcatel-lucent.com) . For technical information on product treatment, consult the [Alcatel-Lucent Recycling Information web page](http://www.alcatel-lucent.com/product_recycling) (http://www.alcatel-lucent.com/product_recycling) .

10 Technical specifications



Overview

Purpose

This section contains the technical specifications for the Alcatel-Lucent 1850 Transport Service Switch 5 (Alcatel-Lucent 1850 TSS-5).

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Established standards

Interface standards

Transmission interface standards

Table 10-1, “Transmission interface standards” (p. 10-3) lists the transmission interface standards for electrical, optical, and Ethernet interfaces.

Table 10-1 Transmission interface standards

Interface	Standard	Comments
DS1	ANSI T1.231-1997	B8ZS/AMI option SF (Super Frame), ESF (Extended Super Frame), UF (Unframed)
E1	ITU G.703, G.704, G.706, G.736, G.775, M.2100	FAS/CRC-4 (120-Ohm termination)
DS3	GR-499-CORE, Issue 2, 1998	VMR, VM Framed (M13-formatted), C-Bit, or Clear Channel
E3	ITU G.703, G.823	Unframed only
OC-3/OC-12	GR-253-CORE, Issue 3, 2000	NA
	GR-496-CORE, Issue 1, 1998	
	ANSI T1.231-1997	
STM-1/STM-4	ITU-T G.957	
10/100BASE-T, 100BASE-LX, 1000BASE-T 1000BASE-SX 1000BASE-LX 1000BASE-ZX	IEEE 802.3, 802.3as, and 802.3x	NA

Power and EMI substation standards

Purpose

Alcatel-Lucent 1850 TSS-5 complies fully and partially with the substation standards that follow. All five standards are harmonized with each other.

Full compliance

Alcatel-Lucent 1850 TSS-5 complies with the following standards:

- IEEE STD C37.90.1-2002: IEEE Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus (SWC)
- IEEE STD C37.90.2-2004: IEEE Standard for Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers (RFI)
- IEEE STD C37.90.3-2001: IEEE standard electrostatic discharge tests for protective relays (ESD)

Partial compliance

Alcatel-Lucent 1850 TSS-5 complies with the following standards:

- IEEE STD C37.90-2005: IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus (Revision of C37.90-1989)
- IEEE STD 1613 -2003: IEEE Standard for Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations

Note: Alcatel-Lucent 1850 TSS-5 does not conform to all the requirements listed in these referenced documents.

Electrical interfaces

Overview

Purpose

This section contains the technical specifications for the tributary electrical interfaces.

Contents

DS1/E1 (VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64)	10-5
DS3/E3 (VLNC50 and VLNC52)	10-7
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DS1/E1 (VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64)

Purpose

The DS1/E1 tributary interfaces transmit and receive a standard electrical DS1/E1 signal. DS1 signals are as specified in GR-499-CORE (1.544 Mb/s nominal rate, DSX-1 interconnect specification). E1 signals are as specified in ITU G.703, G.704, G.706, G.736, G.775, M.2100 (120-Ohm termination, 2.048 Mb/s nominal rate, DSX-1 interconnect specification).

DS1 format specification

The VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64 framing format can be set to SF, ESF, and UF (unframed) for the DS1 ports. Interfaces used in ML-PPP mode cannot be unframed. DS1 line coding (VLNC50/52 and VLNC60/61/62) is provisioned per DS1 port to alternate mark inversion (AMI) or AMI with bipolar 8-zero substitution (B8ZS).

E1 format specification

The VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64 framing format can be set to FAS or CRC-4, and a line code of HDB3.

Alarms

The following parameters are monitored on the VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64 DS1/E1 interfaces:

- Loss of signal (LOS): VLNC50, VLNC52, VLNC60, VLNC61, VLNC62
- Loss of frame (LOF): VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, VLNC64
- Alarm Indication Signal (AIS): VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, VLNC64
- Bit error rate threshold (BER) based on line coding violations (CV-L): VLNC50, VLNC52, VLNC60, VLNC61, VLNC62.

The alarm level for the monitored parameters can be provisioned to critical (CR), major (MJ), minor (MN), or status.

Coding violation failure thresholds are provisionable.

- The valid values for the VLNC50 and VLNC52 are 10^{-3} , 10^{-6} , 10^{-7} , 10^{-8}
- The valid values for the VLNC60/61/62 are 10^{-4} , 5×10^{-4} , 5×10^{-5} , 10^{-6} , 5×10^{-6} , 10^{-7} , 10^{-8}

DS1/E1 transmission length

When transmitting the DS1/E1 signals to a DSX panel, the Approximate Span Length is 655 feet.

Loopbacks

The following loopbacks are supported on the VLNC50, VLNC52, VLNC60, VLNC61, VLNC62 circuit packs:

- Per-port DS1/E1 facility loopback
- Per-port DS1/E1 terminal loopback

The following loopbacks are supported on the VLNC64 circuit pack:

- loopback-eth (loopback toward the Ethernet packet network)
- loopback-opt (loopback toward the optical OC-3/STM-1)

Line build-outs (LBOs)

Line build-outs are software-provisionable for VLNC50, VLNC52, VLNC60, VLNC61, VLNC62; LBOs do not apply to the portless VLNC64 packs. The maximum distance depends on the cable type. The maximum cable length for DS1/E1 lines is 655 feet.

Performance monitoring

For a detailed list of PM parameters and thresholds, refer to [“DS1 performance monitoring parameters”](#) (p. 5-57) and [“E1 performance parameters”](#) (p. 5-66) in Chapter 5, “Operations, administration, maintenance, and provisioning”.

DS3/E3 (VLNC50 and VLNC52)

Electrical specifications

The DS3 interfaces transmit/receive a standard electrical DS3 signal as specified in GR-499-CORE, Section 9 (44.736 Mb/s rate, DSX-3 interconnect specification, bipolar 3-zero substitution (B3ZS) encoding). However, the signal does not have to contain a standard DS3 frame.

The E3 interfaces transmit/receive a standard electrical E3 signal as specified in ITU G.703 and G.823.

DS3 transmission length

When transmitting DS3 signals to a DSX panel, the approximate span length is 450 feet.

Table 10-2 DS3 cable lengths

Cable type	LBO in	LBO out
728A/B	0–225 ft.	225–450 ft.
735A	0–112 ft.	112–225 ft.

Performance monitoring

For a detailed list of DS3 PM parameters and thresholds, refer to [“DS3 performance monitoring parameters”](#) (p. 5-61) in Chapter 5, “Operations, administration, maintenance, and provisioning”.

E3 performance monitoring is not supported in this release.

10/100T (10/100 Mb/s) Ethernet (VLNC35)

VLNC35

The VLNC35 circuit packs provide four 100BASE-T, IEEE 802.3 compliant electrical interfaces that are capable of spanning distances of 100 meters. The VLNC35 also provides two optical 100BASE-LX IEEE 802.3 compliant (100 Mb/s) fast Ethernet interfaces that are capable of spanning distances of 10,000 meters. The 10/100T port performs protocol transparent filtering and bridging of incoming media access control (MAC) frames. MAC frames with a destination address on the local bus are filtered by the 10/100T circuit packs to prevent unnecessary transmission of frames over the wide area network (WAN). The 10/100T interface auto-negotiates mode (full/half duplex) and speed (10/100 Mb/s) when interfacing with other 802.3 compliant devices over twisted pair media. The VLNC35 circuit pack must be housed in slot 1 of Function Unit C and is

not equipment protected. However, facility protection can be provided through the WAN via SONET (UPSR/SNCP, or 1+1) and/or through the IEEE 802.1W spanning tree algorithm.

Optical specification

The VLNC35 utilizes 100BASE-LX PTM optics. These PTM optics can be ordered and plugged into the VLNC35 as their capacity becomes needed. Refer the sections entitled [“100BASE-LX optical Ethernet specification”](#) (p. 10-33) and [“Allowed optics”](#) (p. 10-27) for the detailed specifications of these optics.

Performance monitoring

For a detailed list of PM parameters and thresholds, refer to [“Ethernet performance monitoring parameters”](#) (p. 5-81) in [Chapter 5, “Operations, administration, maintenance, and provisioning”](#).

10/100/1G T/F Ethernet (VLNC40, VLNC42/42B, VLNC60, VLNC61, VLNC62, VLNC64)

VLNC40/42/42B

The VLNC40/42/42B circuit pack supports up to 20 10/100BASE-T, IEEE 802.3-compliant electrical interfaces that are capable of spanning distances of 100 meters. When the auto-negotiate mode is enabled on a 10/100BASE-T interface, the interface automatically negotiates the duplex mode (full/half duplex) and speed (10/100 Mb/s) when interfacing with another 802.3-compliant device over twisted-pair media. The VLNC40/42/42B circuit pack is housed in the MAIN2 slot and is not equipment protected.

VLNC60

The VLNC60 circuit pack has a MGMT LAN port on the faceplate and two Ethernet LAN ports with PTM sockets for Fast Ethernet or Gigabit Ethernet connections. Both Ethernet interfaces must be the same rate. The Ethernet port #1 (the right-most port) can be routed as an electrical GbE across the backplane to a companion VLNC40/42/42B circuit pack. The VLNC60 circuit pack is installed in the MAIN1 or MAIN2 slot.

The VLNC60 also provides TDM interface termination for up to 8 DS1/E1 interfaces. The VLNC60 circuit pack supports CESoP and ML-PPP termination on a port-by-port basis. These services can be mixed as needed among the ports.

VLNC61

The VLNC61 circuit pack has a MGMT LAN port on the faceplate and two Ethernet LAN ports with PTM sockets for Fast Ethernet or Gigabit Ethernet connections. Both Ethernet interfaces must be the same rate. The Ethernet port #1 (the right-most port) can be routed as an electrical GbE across the backplane to a companion VLNC40/42/42B circuit pack. The VLNC61 circuit pack is installed in the MAIN1 or MAIN2 slot.

The VLNC61 also provides TDM interface termination for up to 16 DS1/E1 interfaces. The VLNC61 circuit pack supports CESoP and ML-PPP termination on a port-by-port basis. These services can be mixed as needed among the ports.

VLNC62

The VLNC62 circuit pack has a MGMT LAN port on the faceplate and two Ethernet LAN ports with PTM sockets for Fast Ethernet or Gigabit Ethernet connections. Both Ethernet interfaces must be the same rate. The Ethernet port #1 (the right-most port) can be routed as an electrical GbE across the backplane to a companion VLNC40/42/42B circuit pack. The VLNC62 circuit pack is installed in the MAIN1 or MAIN2 slot.

The VLNC62 provides TDM interface termination for up to 8 DS1/E1 interfaces. The VLNC62 circuit pack supports CESoP and ML-PPP termination on a port-by-port basis. These services can be mixed as needed among the ports. The VLNC62 supports Time of Day (ToD) and 1 pulse per second (PPS) reception and transmission. It also provides sync out capability.

VLNC64

The VLNC64 Circuit Emulation Mini-Hub circuit pack is a variation of the VLNC60 Circuit Emulator circuit pack that performs CESoP hub and pseudowire functions. Instead of supporting electrical DS1/E1 interfaces, the VLNC64 circuit pack provides a single optical channelized OC-3/STM-1 interface on the TDM side, and two optical FE/GbE interfaces on the Ethernet side. Ethernet interfaces must be the same rate. The VLNC64 circuit pack is installed in the MAIN1 or MAIN2 slot.

Format specification

10/100/1G T/F circuit packs comply with the following formatting standards:

- Packet size, including one or more VLAN tag headers as defined in IEEE 802.3as, is up to 9216 bytes on the VLNC40/42/42B circuit packs.
- Maximum packet sizes on the Ethernet interfaces of VLNC60/61/62 circuit packs are:
 - CES T1 = 526 bytes, for 2 levels of MPLS Header (mpls-php-disable), 20 T1 frames/Ethernet
 - CES E1 = 686 bytes, for 2 levels of MPLS Header (mpls-php-disable), 20 E1 frames/Ethernet
 - MLPPP = 1522 bytes, assuming maximum possible MLPPP payload of 1500
- Maximum packet sizes on the Ethernet interfaces of VLNC64 circuit packs are:
 - CES T1 = 526 bytes, for 2 levels of MPLS Header (mpls-php-disable), 20 T1 frames/Ethernet
 - CES E1 = 686 bytes, for 2 levels of MPLS Header (mpls-php-disable), 20 E1 frames/Ethernet
 - MLPPP is not applicable.
- Protection (802.1W) and Ethernet Bridging (802.1D) on VLNC40/42/42B
- Standard IEEE 802.1Q bridging of up to
 - 3965 VLANs (VLNC40/42/42B)
 - 18 VLANs (VLNC60) in T1/E1 mode
 - 34 VLANs (VLNC61) in T1/E1 mode
 - 17 VLANs (VLNC62) in T1/E1 mode
 - 170/128 VLANs (VLNC64) in SONET/SDH mode respectively

Note: For VLNC60/61/62/64, the VLAN numbers are derived based on the following assumptions:

- 1 VLAN for each PWE on its own set of active outgoing/incoming PSN Tunnels
- 1 VLAN for each PWE on its own set of backup outgoing/incoming PSN Tunnels
- 1 VLAN for Management traffic
- 1 VLAN for 1588 protocol

Optical interfaces

Overview

Purpose

This section contains technical specifications for the Alcatel-Lucent 1850 TSS-5 optical interfaces.

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OC-3/STM-1 and OC-12/STM-4 PTMs

Overview

The following tables describe the SONET PTMs that are supported by Alcatel-Lucent 1850 TSS-5 and identifies the circuit packs in which they are used.

OC-3/STM-1 PTMs

The following table lists the allowable OC-3/STM-1 PTMs and identifies the circuit packs in which they can be installed.

Table 10-3 OC-3/STM-1 PTMs

Apparatus code	Description	Name	Qualifier	Circuit pack
OC3IR1-I1	SFP, OC-3 IR-1/STM-1 S-1.1, SM, 1310 nm, 15 km, industrial temperature range	OM155	IR1(S-1.1)	VLNC50 VLNC52 VLNC64
OC3LR1-I1	SFP, OC-3 LR-1/STM-1 L-1.1, SM, 1310 nm, 40 km, industrial temperature range	OM155	LR1(L-1.1)	VLNC50 VLNC52 VLNC64
S155I2	SFP, OC-3 SR-1/STM-1 I-1, SM, 1310 nm, 2 km, industrial temperature range	OM155	SR1(I-1)	VLNC50 VLNC52 VLNC64
S622C47EL	SFP, OC-3/STM-1 or OC-12/STM-4 SFP CWDM, 1471 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52 VLNC64
S622C49EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1491 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52 VLNC64
S622C51EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1511 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52 VLNC64
S622C53EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1531 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52 VLNC64

Table 10-3 OC-3/STM-1 PTMs (continued)

Apparatus code	Description	Name	Qualifier	Circuit pack
S622C55EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1551 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52 VLNC64
S622C57EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1571 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52 VLNC64
S622C59EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1591 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52 VLNC64
S622C61EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1611 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52 VLNC64
622-131T155R-I1	Bidirectional SFP, OC-3/STM-1/OC-12/STM-4, 40 km, SM, 1310 nm Tx, 1550 nm Rx, industrial temperature range	OM155// OM622	40KMBIDI// 40KMBIDI	VLNC50 VLNC52
622-155T131R-I1	Bidirectional SFP, OC-3/STM-1/OC-12/STM-4, 40 km, SM, 1550 nm Tx, 1310 nm Rx, industrial temperature range	OM155// OM622	40KMBIDI// 40KMBIDI	VLNC50 VLNC52

OC-12/STM-4 PTMs

The following table lists the allowable OC-12/STM-4 PTMs and identifies the circuit packs in which they can be installed.

Table 10-4 OC-12/STM-4 PTMs

Apparatus code	Description	Name	Qualifier	Circuit pack
OC12IR1-I1	SFP, OC-12 IR1/STM-4 S-4.1, 1310 nm, SM, 15 km, industrial temperature range	OM622	IR1(S-4.1)	VLNC50 VLNC52

Table 10-4 OC-12/STM-4 PTMs (continued)

Apparatus code	Description	Name	Qualifier	Circuit pack
OC12LR1-I1	SFP, OC-12 LR1/STM-4 L-4.1, 1310 nm, SM, 40 km, industrial temperature range	OM622	LR1(L-4.1)	VLNC50 VLNC52
OC12LR2-I1	SFP, OC-12 LR2/STM-4 L-4.1, SM, 1550 nm, 80 km, industrial temperature range	OM622	LR2(L-4.2)	VLNC50 VLNC52
S622C47EL	SFP, OC-3/STM-1 or OC-12/STM-4 SFP CWDM, 1471 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52
S622C49EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1491 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52
S622C51EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1511 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52
S622C53EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1531 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52
S622C55EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1551 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52
S622C57EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1571 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52
S622C59EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1591 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52

Table 10-4 OC-12/STM-4 PTMs (continued)

Apparatus code	Description	Name	Qualifier	Circuit pack
S622C61EL	SFP, OC-3/STM-1 or OC-12/STM-4 CWDM, 1611 nm, extended temperature range (–5°C to 85°C)	OM155// OM622	CWDM-LR	VLNC50 VLNC52
622-131T155R-I1	Bidirectional SFP, OC-3/STM-1/OC-12/STM-4, 40 km, SM, 1310 nm Tx, 1550 nm Rx, industrial temperature range	OM155// OM622	40KMBIDI// 40KMBIDI	VLNC50 VLNC52
622-155T131R-I1	Bidirectional SFP, OC-3/STM-1/OC-12/STM-4, 40 km, SM, 1550 nm Tx, 1310 nm Rx, industrial temperature range	OM155// OM622	40KMBIDI// 40KMBIDI	VLNC50 VLNC52

OC-3/STM-1 PTM optical specification

Overview

The VLNC50/52 supports up to two OC-3/STM-1 or OC-12/STM-4 connections. Either the VLIU1 or VLIU10 interface unit is required to support VLNC50 equipment protection (UNPROT/PROT). The VLIU10 interface unit is required to support VLNC52 equipment protection (UNPROT/PROT).

When UNPROT (protection-not-allowed), protection is between the two optical lines on the VLNC50/52 circuit pack in Main slot 1. The values of the port Application and Signal Type parameters for both optical lines on the circuit pack must be the same value.

The VLNC64 circuit pack supports a single OC-3/STM-1.

System specifications

The following table lists the system specifications for OC-3/STM-1 PTM interfaces.

Table 10-5 OC-3/STM-1 PTM optical system specifications

System information	OC-3 SR-1/STM-1 I-1	OC-3 IR-1/STM-1 S-1.1	OC-3 LR-1/STM-1 L-1.1	OC-3/STM-1 CWDM-LR
Optical Line Rate	155.52 Mb/s			
Optical Line Coding	Scrambled NRZ			
Optical Wavelength	1310 nm			Refer to Table 10-6 , “OC-3/STM-1 or OC-12/STM-4 CWDM-LR PTM wavelengths” (p. 10-17).
Performance	Short Reach, SR-1/I-1	Intermediate Reach, IR-1/ S-1.1	Long Reach, LR-1/L-1.1	Coarse Wavelength Division Multiplexing (CWDM), Long Reach
Temperature Range	OSP Hardened/Industrial (−40°C to 85°C)			Extended temperature range (−5°C to 85°C)

Table 10-6 OC-3/STM-1 or OC-12/STM-4 CWDM-LR PTM wavelengths

Apparatus Code	Channel #	Wavelength
S622C47EL	47	1471 nm
S622C49EL	49	1491 nm
S622C51EL	51	1511 nm
S622C53EL	53	1531 nm
S622C55EL	55	1551 nm
S622C57EL	57	1571 nm
S622C59EL	59	1591 nm
S622C61EL	61	1611 nm

Transmitter specifications

The table below lists the OC-3/STM-1 PTM transmitter information.

Table 10-7 OC-3/STM-1 PTM optical transmitter information

Transmitter information	OC-3 SR-1/STM-1 I-1	OC-3 IR-1/STM-1 S-1.1	OC-3 LR-1/STM-1 L-1.1	OC-3/STM-1 CWDM-LR
Optical Device Temperature Controller	None			
IEC 60825 Laser Classification	Class 1			
FDA Laser Classification	Class I			
Optical Source	Fabry Perot (FP)/Light Emitting Diode (LED) Laser	Fabry Perot (FP) Laser	Fabry Perot (FP)/Distributed Feed-Back (DFB) Laser	Distributed Feed-Back (DFB) Laser

Receiver specifications

The table below lists the OC-3 PTM receiver information.

Table 10-8 OC-3/STM-1 PTM optical receiver information

Receiver information	OC-3 SR-1/STM-1 I-1 OC-3 IR-1/STM-1 S-1.1 OC-3 LR-1/STM-1 L-1.1	OC-3/STM-1 CWDM-LR
Optical Detector	InGaAsP PIN	Avalanche Photo Diode (APD)
Faceplate Optical Connector	LC connector	

Link budgets

The table below lists the OC-3/STM-1 PTM link budgets.

Table 10-9 OC-3/STM-1 PTM optical specifications and link budgets

Parameter	OC-3 SR-1/I-1 ¹	OC-3 IR-1/S-1.1 ¹	OC-3 LR-1/L-1.1 ¹	OC-3/STM-1 CWDM-LR ²
Minimum Wavelength	1260 nm	1261 nm	1263 nm	$\lambda_c - 7$ nm
Maximum Wavelength	1360 nm	1360 nm	1360 nm	$\lambda_c + 7$ nm
Maximum Spectral Width ($\Delta\lambda_{20}$)	NA	NA	NA /1.0 nm ³	1.0 nm
Maximum RMS Spectral Width (σ)	40/80 nm	7.7 nm	3.0 nm /NA ³	NA
Minimum Side-Mode Suppression Ratio (SSMR)	NA	NA	NA /30 dB ³	30 dB
Maximum Transmitter Power	-8.0 dBm	-8.0 dBm	0.0 dBm	+5.0 dBm
Minimum Transmitter Power	-15.0 dBm	-15.0 dBm	-5.0 dBm	-1.0 dBm
Maximum Received Power	-8.0 dBm	-8.0 dBm	-10.0 dBm	-9.0 dBm

Table 10-9 OC-3/STM-1 PTM optical specifications and link budgets (continued)

Parameter	OC-3 SR-1/I-1 ¹	OC-3 IR-1/S-1.1 ¹	OC-3 LR-1/L-1.1 ¹	OC-3/STM-1 CWDM-LR ²
Minimum Received Power (1x10 ⁻¹⁰ BER)	-23.0 dBm	-28.0 dBm	-34.0 dBm	-28.0 dBm
System Gain ⁴	8.0 dB	13.0 dB	29.0 dB	27.0 dB
Maximum Dispersion	NA	NA	NA	1600 ps/nm
Optical Path Penalty ⁵	1.0 dB	1.0 dB	1.0 dB	1.0 dB
Minimum Optical Return Loss ⁶	NA	20.0 dB	24.0 dB	24.0 dB
Maximum Receiver Reflectance ⁶	NA	-14.0 dB	-27.0 dB	-27.0 dB
Minimum Loss Budget ⁷	0 dB	0 dB	10.0 dB	14.0 dB
Maximum Loss Budget ⁸	7.0 dB	12.0 dB	28.0 dB	26.0 dB
Target Distance ⁹	2 km	15 km	40 km	96 km

Notes:

1. All terminology is consistent with GR-253-CORE, Issue 3 and ITU-T G.957. All values are worst-case end of life. Optical specifications meet or exceed equivalent GR-253-CORE and ITU-T G.957 requirements.
2. The OC-3/STM-1 CWDM PTMs can also operate as OC-12/STM-4 PTMs.
3. x/y: x is using Fabry Perot (FP) and y is using Distributed Feed-Back (DFB) laser.
4. The System Gain is Minimum Transmitter Power minus Minimum Received Power.
5. Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path. The optical path penalty for 1310 nm optics is normally 1.0 dB.
6. Refer to GR-253-CORE for more information about these parameters.
7. For all packs where the Minimum Loss Budget (MLB) is 0, no attenuator is required for loopbacks. For all packs where the MLB is greater than 0, an attenuator is required. The value of the LBO must be equal to or greater than the MLB.
8. The stated maximum loss budgets are assumed to be worst-case values including losses due to splices, connectors, optical attenuators or other passive optical devices, and any additional cable margin.

9. The target distance assumes that passive optical units are not being used.

OC-12/STM-4 PTM optical specification

Overview

The VLNC50/52 supports up to two OC-3/STM-1 or OC-12/STM-4 connections, depending upon the type of PTM that is installed.

System specifications

The following table lists the system specifications for OC-12/STM-4 PTM interfaces.

Table 10-10 OC-12/STM-4 PTM optical system specifications

System information	OC-12 IR-1/ STM-4 S-4.1	OC-12 LR-1/ STM-4 L-4.1	OC-12 LR-2/ STM-4 L-4.2	OC-12/STM-4 CWDM-LR
Optical Line Rate	622.08 Mb/s			
Optical Line Coding	Scrambled NRZ			
Optical Wavelength	1310 nm		1550 nm	Refer to Table 10-11 , “OC-3/STM-1 or OC-12/STM-4 CWDM-LR PTM wavelengths” (p. 10-21).
Performance	Intermediate Reach, IR-1/S-4.1	Long Reach, LR-1/L-4.1	Very Long Reach, LR-2/L-4.2	Coarse Wavelength Division Multiplexing (CWDM), Long Reach
Temperature Range	OSP Hardened/Industrial (−40°C to 85°C)			Extended temperature range (−5°C to 85°C)

Table 10-11 OC-3/STM-1 or OC-12/STM-4 CWDM-LR PTM wavelengths

Apparatus Code	Channel #	Wavelength
S622C47EL	47	1471 nm
S622C49EL	49	1491 nm
S622C51EL	51	1511 nm
S622C53EL	53	1531 nm
S622C55EL	55	1551 nm
S622C57EL	57	1571 nm
S622C59EL	59	1591 nm
S622C61EL	61	1611 nm

Transmitter specifications

The table below lists the OC-12/STM-4 PTM transmitter information.

Table 10-12 OC-12/STM-4 PTM optical transmitter information

Transmitter information	OC-12 IR-1/ STM-4 S-4.1	OC-12 LR-1/ STM-4 L-4.1	OC-12 LR-2/ STM-4 L-4.2	OC-12/STM-4 CWDM-LR
Optical Device Temperature Controller	None			
IEC 60825 Laser Classification	Class 1			
FDA Laser Classification	Class I			
Optical Source	Fabry Perot (FP) Laser	Distributed Feed-Back (DFB) Laser		

Receiver specifications

The table below lists the OC-12/STM-4 optical receiver information.

Table 10-13 OC-12/STM-4 PTM optical receiver information

Receiver information	OC-12 IR-1/STM-4 S-4.1 OC-12 LR-1/STM-4 L-4.1 OC-12 LR-2/STM-4 L-4.2	OC-12/STM-4 CWDM-LR
Optical Detector	InGaAsP PIN	Avalanche Photo Diode (APD)
Faceplate Optical Connector	LC connector	

Link budgets

The table below lists the OC-12/STM-4 PTM link budgets.

Table 10-14 OC-12/STM-4 PTM optical specifications and link budgets

Parameter	OC-12 IR-1 ¹	OC-12 LR-1 ¹	OC-12 LR-2 ¹	OC-12/STM-4 CWDM-LR ²
Minimum Wavelength	1274 nm	1280 nm	1480 nm	$\lambda_c - 7$ nm
Maximum Wavelength	1356 nm	1335 nm	1580 nm	$\lambda_c + 7$ nm
Maximum Spectral Width ($\Delta\lambda_{20}$)	NA	1.0 nm	1.0 nm	1.0 nm
Maximum RMS Spectral Width (σ)	2.5 nm	NA	NA	NA
Minimum Side-Mode Suppression Ratio (SSMR)	NA	30 dB	30 dB	30 dB
Maximum Transmitter Power	-8.0 dBm	+2.0 dBm	+2.0 dBm	+5.0 dBm
Minimum Transmitter Power	-15.0 dBm	-3.0 dBm	-3.0 dBm	-1.0 dBm
Maximum Received Power	-8.0 dBm	-8.0 dBm	-8.0 dBm	-9.0 dBm
Minimum Received Power (1×10^{-10} BER)	-28.0 dBm	-28.0 dBm	-28.0 dBm	-28.0 dBm
System Gain ³	13.0 dB	25.0 dB	25.0 dB	27.0 dB
Maximum Dispersion	NA	NA	1600 ps/nm	1600 ps/nm
Optical Path Penalty ⁴	1.0 dB	1.0 dB	1.0 dB	1.0 dB

**Table 10-14 OC-12/STM-4 PTM optical specifications and link budgets
(continued)**

Parameter	OC-12 IR-1 ¹	OC-12 LR-1 ¹	OC-12 LR-2 ¹	OC-12/STM-4 CWDM-LR ²
Minimum Optical Return Loss ⁵	NA	20.0 dB	24.0 dB	24.0 dB
Maximum Receiver Reflectance ⁵	NA	−14.0 dB	−27.0 dB	−27.0 dB
Minimum Loss Budget ⁶	0 dB	10 dB	10.0 dB	14.0 dB
Maximum Loss Budget ⁷	12.0 dB	24.0 dB	24.0 dB	26.0 dB
Target Distance ⁸	15 km	40 km	80 km	96 km

Notes:

1. All terminology is consistent with GR-253-CORE, Issue 3 and ITU-T G.957. All values are worst-case end of life. Optical specifications meet or exceed equivalent GR-253-CORE and ITU-T G.957 requirements.
2. The OC-12/STM-4 CWDM PTMs can also operate as OC-3/STM-1 PTMs.
3. The System Gain is Minimum Transmitter Power minus Minimum Received Power.
4. Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path. The optical path penalty for 1310 nm optics is normally 1.0 dB.
5. Refer to GR-253-CORE for more information about these parameters.
6. For all packs where the Minimum Loss Budget (MLB) is 0, no attenuator is required for loopbacks. For all packs where the MLB is greater than 0, an attenuator is required. The value of the LBO must be equal to or greater than the MLB.
7. The stated maximum loss budgets are assumed to be worst-case values including losses due to splices, connectors, optical attenuators or other passive optical devices, and any additional cable margin.
8. The target distance assumes that passive optical units are not being used.

OC-3/STM-1/OC-12/STM-4 bidirectional PTM optical specification

Overview

The VLNC50/52 supports up to two OC-3/STM-1 or OC-12/STM-4 connections, depending upon the type of PTM that is installed.

System specifications

The following table lists the system specifications for OC-3/STM-1/OC-12/STM-4 bidirectional PTM interfaces.

Table 10-15 OC-3/STM-1/OC-12/STM-4 bidirectional PTM optical system specifications

System information	OM155/OM622 40km BiDi 1550Tx/1310Rx downstream	OM155/OM622 40km BiDi 1310Tx/1550Rx upstream
Optical Line Rate	622.08 Mb/s, 155.52 Mb/s	
Optical Line Coding	Scrambled NRZ	
Optical Wavelength	1550Tx/1310Rx	1310Tx/1550Rx
Performance	40 km	
Temperature Range	OSP Hardened/Industrial (−40°C to 85°C)	

Transmitter specifications

The table below lists the OC-3/STM-1/OC-12/STM-4 bidirectional PTM transmitter information.

Table 10-16 OC-3/STM-1/OC-12/STM-4 bidirectional PTM optical transmitter information

Transmitter information	OM155/OM622 40km BiDi 1550Tx/1310Rx downstream	OM155/OM622 40km BiDi 1310Tx/1550Rx upstream
Optical Device Temperature Controller	None	
IEC 60825 Laser Classification	Class 1	
FDA Laser Classification	Class I	
Optical Source	Distributed Feed-Back (DFB) Laser	

Receiver specifications

The table below lists the OC-3/STM-1/OC-12/STM-4 bidirectional PTM optical receiver information.

Table 10-17 OC-3/STM-1/OC-12/STM-4 bidirectional PTM optical receiver information

Receiver information	OM155/OM622 40km BiDi 1550Tx/1310Rx downstream	OM155/OM622 40km BiDi 1310Tx/1550Rx upstream
Optical Detector	InGaAsP PIN	
Faceplate Optical Connector	LC connector	

Link budgets

The table below lists the OC-3/STM-1/OC-12/STM-4 bidirectional PTM link budgets.

Table 10-18 OC-3/STM-1/OC-12/STM-4 bidirectional PTM optical specifications and link budgets

Parameter	OM155/OM622 40km BiDi 1550Tx/1310Rx downstream ¹	OM155/OM622 40km BiDi 1310Tx/1550Rx upstream ¹
Minimum Wavelength	1480 nm	1260 nm
Maximum Wavelength	1580 nm	1360 nm
Maximum Spectral Width ($\Delta\lambda_{20}$)	1.0 nm	1.0 nm
Minimum Side-Mode Suppression Ratio (SSMR)	NA	NA
Maximum Transmitter Power	+2.0 dBm	+2.0 dBm
Minimum Transmitter Power	−3.0 dBm	−3.0 dBm
Maximum Received Power	−3.0 dBm	−3.0 dBm
Minimum Received Power (1×10^{-10} BER)	−28.0 dBm	−28.0 dBm
System Gain ²	25.0 dB	25.0 dB
Maximum Dispersion	800 ps/nm	256 ps/nm
Optical Path Penalty ³	1.0 dB	1.0 dB
Minimum Optical Return Loss ⁴	25.0 dB	25.0 dB
Maximum Receiver Reflectance ⁴	−14.0 dB	−14.0 dB
Minimum Loss Budget ⁵	5.0 dB	5.0 dB

Table 10-18 OC-3/STM-1/OC-12/STM-4 bidirectional PTM optical specifications and link budgets (continued)

Parameter	OM155/OM622 40km BiDi 1550Tx/1310Rx downstream ¹	OM155/OM622 40km BiDi 1310Tx/1550Rx upstream ¹
Maximum Loss Budget ⁶	24.0 dB	24.0 dB
Target Distance ⁷	40 km	40 km

Notes:

1. All terminology is consistent with GR-253-CORE, Issue 3 and ITU-T G.957. All values are worst-case end of life. Optical specifications meet or exceed equivalent GR-253-CORE and ITU-T G.957 requirements.
2. The System Gain is Minimum Transmitter Power minus Minimum Received Power.
3. Optical path penalty includes effects of dispersion, reflection, and jitter that occur on the optical path. The optical path penalty for 1310 nm optics is normally 1.0 dB.
4. Refer to GR-253-CORE for more information about these parameters.
5. For all packs where the Minimum Loss Budget (MLB) is 0, no attenuator is required for loopbacks. For all packs where the MLB is greater than 0, an attenuator is required. The value of the LBO must be equal to or greater than the MLB.
6. The stated maximum loss budgets are assumed to be worst-case values including losses due to splices, connectors, optical attenuators or other passive optical devices, and any additional cable margin.
7. The target distance assumes that passive optical units are not being used.

10/100T (100BASE-T)/Fast Ethernet (100BASE-LX) Optical Ethernet Private Line (VLNC35)

Purpose

The VLNC35 provides two optical 100BASE-LX IEEE 802.3-compliant (100 Mb/s) fast Ethernet interfaces. The 10/100T port performs protocol transparent filtering and bridging of incoming media access control (MAC) frames. MAC frames with a destination address on the local bus are filtered by the 10/100T circuit packs to prevent unnecessary transmission of frames over the wide area network (WAN). The 10/100T interface auto-negotiates mode (full/half duplex) and speed (10/100 Mb/s) when interfacing with other 802.3-compliant devices over twisted pair media. The VLNC35 circuit pack must be housed in slot 1 of Function Unit C and is not equipment protected. However, facility protection can be provided through the WAN via UPSR/SNCP or 1+1). The VLNC35 circuit packs also provide four 10/100BASE-T, IEEE 802.3-compliant electrical

interfaces that are capable of spanning distances of 100 meters. See, [“10/100T \(10/100 Mb/s\) Ethernet \(VLNC35\)” \(p. 10-7\)](#) for additional information about these electrical interfaces.

Allowed optics

The following table lists the 10/100T PTM optics that may be used in VLNC35 circuit packs.

Table 10-19 10/100T PTM optics for VLNC35

Apparatus Code	Comcode	Description
100BASE-LX-I1	109527812	Optical Fast Ethernet PTM, LC-type connectors (FE-1310SM)

Performance monitoring

Each Ethernet port has associated performance monitoring parameters and counters. The counters are provided for incoming and outgoing frames. For more information, refer to [“Ethernet performance monitoring parameters” \(p. 5-81\)](#) in [Chapter 5, “Operations, administration, maintenance, and provisioning”](#).

Allowed Ethernet PTM transceivers

Overview

All of the MAIN circuit packs for the Alcatel-Lucent 1850 TSS-5 support one or more Ethernet PTMs. The VLNC40/42/42B can accept up to four PTMs supporting FE/GbE Ethernet connections, depending upon the PTM installed. The VLNC50/52 circuit pack can accept one GbE PTM. The VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs can accept two FE/GbE PTMs. When authorized Alcatel-Lucent PTMs are installed, they are automatically detected.

Allowed Ethernet optics

The following information details the PTMs that support Ethernet connections on the VLNC35, VLNC40, VLNC42/42B, VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs.

Table 10-20 Ethernet PTMs

Apparatus Code	Description	Circuit Pack
100BASE-LX-I1	Optical Fast Ethernet PTM, LC-type connectors (FE-1310SM), OSP Hardened/Industrial (−40°C to 85°C). Specification: “100BASE-LX optical Ethernet specification” (p. 10-33)	VLNC35 VLNC40 VLNC42 VLNC42B VLNC60 VLNC61 VLNC62 VLNC64
1000BASE-ZX-I1 (1000BASE-ZX, 1Gbps)	GbE long-reach, Single-Mode PTM, supports Ethernet, LC-type connectors, and is OSP Hardened/Industrial, (−40°C to 85°C), (GbE-1550). Specification: “1000BASE-ZX optical Ethernet specification” (p. 10-40)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52
BASE-T-C1 electrical (NOT OSP)	Electrical PTM, provisionable to 100 or 1000 Mbps, Alcatel-Lucent Approved RJ-45 Cat 5-E cable, maximum span length of 100 meters	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64

Table 10-20 Ethernet PTMs (continued)

Apparatus Code	Description	Circuit Pack
GE-1X2XFC-LX-I1 (1000BASE-LX, 1Gbps)	GbE long-reach, Single-Mode PTM, supports Ethernet traffic, LC-type connectors, OSP Hardened/Industrial (–40°C to 85°C), (GbE/FC/2FC-1310) Specification: “1000BASE-LX optical Ethernet specification” (p. 10-38)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
GE-1X2XFC-SX-I1 (1000BASE-SX, 1Gbps)	GbE short-reach, Multi-Mode PTM, supports Ethernet and Fibre-Channel traffic, LC-type connectors, OSP Hardened/Industrial (–40°C to 85°C), (GbE/FC/2FC-850). Specification: “1000BASE-SX optical Ethernet specification” (p. 10-35)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
GE-131T149R-I1	Bidirectional SFP, 1000BASE-BX40, OC-12/STM-4, 40 km, SM, 1310 nm Tx, 1490 nm Rx, industrial temperature range Specification: “1000BASE-BX40 optical Ethernet specifications” (p. 10-43)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64

Table 10-20 Ethernet PTMs (continued)

Apparatus Code	Description	Circuit Pack
GE-149T131R-I1	Bidirectional SFP, 1000BASE-BX40, OC-12/STM-4, 40 km, SM, 1490 nm Tx, 1310 nm Rx, industrial temperature range Specification: “1000BASE-BX40 optical Ethernet specifications” (p. 10-43)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64

Allowed CWDM Ethernet optics

The following information details the PTMs that support CWDM Ethernet connections on the VLNC40, VLNC42/42B, VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs. Refer to [“1000BASE-LCWDM optical Ethernet”](#) (p. 10-41) for specifications.

Table 10-21 CWDM Ethernet PTMs

Apparatus Code	Description	Circuit Pack
SGEC47EL	GbE CWDM, 1471 nm, SFP TRCVR, extended temperature range (–5°C to 85°C)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64

Table 10-21 CWDM Ethernet PTMs (continued)

Apparatus Code	Description	Circuit Pack
SGEC49EL	GbE CWDM, 1491 nm, SFP TRCVR, extended temperature range (–5°C to 85°C)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
SGEC51EL	GbE CWDM, 1511 nm, SFP TRCVR, extended temperature range (–5°C to 85°C)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
SGEC53EL	GbE CWDM, 1531 nm, SFP TRCVR, extended temperature range (–5°C to 85°C)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64

Table 10-21 CWDW Ethernet PTMs (continued)

Apparatus Code	Description	Circuit Pack
SGEC55EL	GbE CWDW, 1551 nm, SFP TRCVR, extended temperature range (–5°C to 85°C)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
SGEC57EL	GbE CWDW, 1571 nm, SFP TRCVR, extended temperature range (–5°C to 85°C)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64
SGEC59EL	GbE CWDW, 1591 nm, SFP TRCVR, extended temperature range (–5°C to 85°C)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64

Table 10-21 CWDW Ethernet PTMs (continued)

Apparatus Code	Description	Circuit Pack
SGEC61EL	GbE CWDW, 1611 nm, SFP TRCVR, extended temperature range (−5°C to 85°C)	VLNC40 VLNC42 VLNC42B VLNC50 VLNC52 VLNC60 VLNC61 VLNC62 VLNC64

100BASE-LX optical Ethernet specification

Overview

The 100BASE-LX PTMs can be used on the VLNC35, VLNC40, VLNC42/42B, VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs.

System specifications

The following are the 100BASE-LX system specifications:

- Optical Line Rate: 125 MBd (±50 ppm)
- Optical Line Coding: 4B/5B
- Fiber Type: 10 µm SMF
- Minimum Range: 2 to 10,000 meters
- Performance: Long-reach

Transmitter specifications

The 100BASE-LX transmitter meets these specifications defined in IEEE 802.3. The table below describes some of the transmit specifications for 100BASE-LX.

Table 10-22 100BASE-LX transmit specifications

Description	100BASE-LX
Transmitter type	Longwave Laser
Signaling speed (range)	125 MBd (±50 ppm)
Wavelength (range)	1260 to 1360 nm

Table 10-22 100BASE-LX transmit specifications (continued)

Description	100BASE-LX
Maximum RMS Spectral Width (σ)	7.7 nm
Average launch power (max)	−8 dBm
Average launch power (min)	−15 dBm

Receiver specifications

The 100BASE-LX receiver meets these specifications defined in IEEE 802.3. The table below describes some of the receiver specifications for 100BASE-LX.

Table 10-23 100BASE-LX receive specifications

Description	100BASE-LX
Signaling speed (range)	125 MBd (± 50 ppm)
Wavelength (range)	1260 to 1360 nm
Average receive power (max)	−8.0
Receive sensitivity	−25.0 dBm
Return loss (min) ¹	12.0 dB

Notes:

1. Refer to the IEEE802.3 standards for more information about return loss (min).

Link budgets

The worst-case power budget and link penalties for a 100BASE-LX channel are shown in the table below.

Table 10-24 100BASE-LX link budgets and penalties

Parameter	100BASE-LX
Link power budget	10 dB
Operating distance	10,000 m
Allocation for link penalties ¹	4.0 dB

Notes:

1. A wavelength of 1270 nm is used to calculate the link penalty allocation.

1000BASE-SX optical Ethernet specification

Overview

The 1000BASE-SX PTMs can be used for Gigabit Ethernet service over Multi-Mode Fiber (MMF).

System specifications

The following are the 1000BASE-SX system specifications:

- Optical Line Rate: 1.25 Gb/s (± 100 ppm)
- Optical Line Coding: 8B/10B
- Performance: Short-reach

GbE compliance

The PTM optics are compliant with GbE specifications.

Operating range

The table below shows the operating range for the 1000BASE-SX optical Ethernet interface. A 1000BASE-SX compliant transceiver supports both 50 μm and 62.5 μm fiber media types. A transceiver that exceeds the operational range requirement while meeting all other optical specifications is considered compliant (for example, a 50 μm solution operating at 600 m meets the minimum range requirement of 2 to 550 m).

Table 10-25 1000BASE-SX operating range over each optical fiber type

Fiber Type	Modal Bandwidth @ 850 nm (minimum overfilled launch)	Minimum Range
62.5 μm MMF	160 MHz-km	2 to 220 m
	200 MHz-km	2 to 275 m
50 μm MMF	400 MHz-km	2 to 500 m
	500 MHz-km	2 to 550 m
10 μm SMF	Not supported	Not supported

Transmitter specifications

The 1000BASE-SX optical transmitter meets the specifications defined in IEEE 802.3. The table below shows some of the 1000BASE-SX optical transmitter specifications. Measurement techniques are defined in IEEE 802.3, Section 38, Clause 6.

Table 10-26 1000BASE-SX transmit specifications

Description	1000BASE-SX
Transmitter type	Shortwave Laser
Signaling speed (range)	1.25 GBd (± 100 ppm)
Wavelength (λ , range)	770 to 860 nm
$T_{\text{rise}}/T_{\text{fall}}$ (max; 20%–80%; $\lambda > 830$ nm)	0.26 ns
$T_{\text{rise}}/T_{\text{fall}}$ (max; 20%–80%; $\lambda \leq 830$ nm)	0.21 ns
Maximum RMS Spectral Width (σ)	0.85 nm
Average launch power (max) ¹	0 dBm
Average launch power (min)	–9.5 dBm
Average launch power of OFF transmitter (max) ²	–30 dBm
Extinction ratio (min)	9 dB
RIN (max)	–117 dB/Hz
Coupled Power Ratio (CPR) (min) ³	9 dB < CPR

Notes:

1. The 1000BASE-SX launch power must be the lesser of the class 1 safety limit as defined by IEEE 802.3, Section 38, Clause 7.2 or the average receiver power (maximum) defined by [Table 10-27, “1000BASE-SX receive specifications” \(p. 10-37\)](#).
2. Examples of an OFF transmitter are as follows: no power supplied to the optical module, laser shutdown for safety conditions, and activation of a "transmit disable" or other optional module laser shut-down conditions.
3. Radial overfilled launches (described in IEEE 802.3, Section 38A, Clause 2) should be avoided even if they meet CPR ranges.

Receiver specifications

The 1000BASE-SX optical receiver meets the specifications defined in IEEE802.3, Section 38.3.2. The table below shows some of the 1000BASE-SX optical receiver specifications. Measurement techniques are defined in IEEE802.3, Section 38, Clause 6.

Table 10-27 1000BASE-SX receive specifications

Description	1000BASE-SX	
	62.5 μ m MMF	50 μ m MMF
Signaling speed (range)	1.25 GBd (± 100 ppm)	1.25 GBd (± 100 ppm)
Wavelength (range)	770 to 860 nm	770 to 860 nm
Average receive power (max)	0 dBm	0 dBm
Receive sensitivity	−17.0 dBm	−17.0 dBm
Return loss (min) ¹	12.0 dB	12.0 dB
Receive electrical 3 dB upper cutoff frequency (max)	1500 MHz	1500 MHz

Notes:

1. Refer to the IEEE802.3 standards for more information about return loss (min).

Link budgets

The worst-case power budget and link penalties for a 1000BASE-SX channel are shown in the table below.

Table 10-28 1000BASE-SX link budgets and penalties

Parameter	1000BASE-SX			
	62.5 μ m MMF		50 μ m MMF	
Modal bandwidth as measured at 850 nm (minimum, overfilled launch)	160 MHz-km	200 MHz-km	400MHz-km	500 MHz-km
Link power budget	7.5 dB	7.5 dB	7.5 dB	7.5 dB
Operating distance	220 m	275 m	500 m	550 m
Channel insertion loss ¹	2.38 dB	2.60 dB	3.37 dB	3.56 dB
Link power penalties ¹	4.27 dB	4.29 dB	4.07 dB	3.57 dB
Unallocated margin in link power budget	0.84 dB	0.60 dB	0.05 dB	0.37 dB

Notes:

1. A wavelength of 830 nm is used to calculate the channel insertion loss, link power penalties, and unallocated margin.

1000BASE-LX optical Ethernet specification

Overview

The 1000BASE-LX PTMs can be used for GbE, 1Gbps and 2 Gbps service over Single-Mode Fiber (SMF).

System specifications

The following are the 1000BASE-LX system specifications:

- Optical Line Rate: 1.25 Gb/s (± 100 ppm)
- Optical Line Coding: 8B/10B
- Fiber Type: 10 μ m SMF
- Minimum Range: 2 to 10,000 meters
- Performance: Long-reach

GbE compliance

The PTM optics are compliant with GbE specifications.

Transmitter specifications

The optical 1000BASE-LX optical transmitter meets the specifications defined in IEEE802.3. The table below shows some of the 1000BASE-LX optical transmitter specifications.

Table 10-29 1000BASE-LX transmit specifications

Description	1000BASE-LX
Transmitter type	Longwave Laser
Signaling speed (range)	1.25 GBd (± 100 ppm)
Wavelength (λ , range)	1270 to 1355 nm
$T_{\text{rise}}/T_{\text{fall}}$ (max; 20%–80% response time)	0.26 ns
Maximum RMS Spectral Width (σ)	4 nm
Average launch power (max)	−3.0 dBm
Average launch power (min)	−11.0 dBm
Average launch power of OFF transmitter (max)	−30.0 dBm

Table 10-29 1000BASE-LX transmit specifications (continued)

Description	1000BASE-LX
RIN (max)	−120 dB/Hz

Receiver specifications

The 1000BASE-LX receiver meets the specifications defined in IEEE 802.3. The table below shows some of the 1000BASE-LX optical receiver specifications.

Table 10-30 1000BASE-LX receive specifications

Description	1000BASE-LX
Signaling speed (range)	1.25 GBd (±100 ppm)
Wavelength (range)	1270 to 1355 nm
Average receive power (max)	−3.0 dBm
Receive sensitivity	−19.0 dBm
Return loss (min) ¹	12.0 dB
Receive electrical 3 dB upper cutoff frequency (max)	1500 MHz

Notes:

1. Refer to the IEEE802.3 standards for more information about return loss (min).

Link budgets

The worst-case power budget and link penalties for a 1000BASE-LX channel are shown in the table below.

Table 10-31 1000BASE-LX link budgets and penalties

Parameter	1000BASE-LX
Link power budget	+8.0 dB
Operating distance	10,000 m
Allocation for link penalties ¹	+2.0 dB

Notes:

1. A wavelength of 1270 nm is used to calculate the link penalty.

1000BASE-ZX optical Ethernet specification

Overview

The 1000BASE-ZX PTMs can be used for GbE service over Single-Mode Fiber (SMF). The 1000BASE-ZX PTMs are OSP hardened for outside plant applications.

System specifications

The following are the 1000BASE-ZX system specifications:

- Optical Line Rate: 1.25 Gb/s (± 100 ppm)
- Optical Line Coding: 8B/10B
- Fiber Type: 10 μ m SMF
- Minimum Range: 2 to 80,000 meters
- Performance: Long-reach (80 km)

Transmitter specifications

The 1000BASE-ZX optical transmitter meets the specifications defined in IEEE802.3. The table below shows some of the 1000BASE-ZX optical transmitter specifications.

Table 10-32 1000BASE-ZX transmit specifications

Description	1000BASE-ZX
Transmitter type	Longwave Laser
Signaling speed (range)	1.25 GBd (± 100 ppm)
Wavelength (λ , range)	1500 to 1580 nm
$T_{\text{rise}}/T_{\text{fall}}$ (max; 20%–80% response time)	0.26 ns
Maximum Spectral Width ($\Delta\lambda_{20}$)	+1.0 nm
Average launch power (max)	+5.0 dBm
Average launch power (min)	0 dBm
Average launch power of OFF transmitter (max)	−40.0 dBm
RIN (max)	−120.0 dB/Hz

Receiver specifications

The 1000BASE-ZX receiver meets the specifications defined in the table below.

Table 10-33 1000BASE-ZX receive specifications

Description	1000BASE-ZX
Signaling speed (range)	1.25 GBd (± 100 ppm)
Wavelength (range)	1500 to 1580 nm
Average receive power (max)	0 dBm
Receive sensitivity	-22.5 dBm
Return loss (min) ¹	12 dB

Notes:

1. Refer to the IEEE802.3 standards for more information about return loss (min).

Link budgets

The worst-case power budget and link penalties for a 1000BASE-ZX channel are shown in the table below.

Table 10-34 1000BASE-ZX link budgets and penalties

Parameter	1000BASE-ZX
Maximum Channel Insertion Loss	+21.0 dB
Minimum Channel Insertion Loss	+5.0 dB
Maximum Dispersion	1600 ps/nm
Optical Path Penalty	1.5 dB

1000BASE-LCWDM optical Ethernet

Overview

The 1000BASE-LCWDM PTMs can be used for Coarse Wavelength Division Multiplexing (CWDM) GbE service over Single-Mode Fiber (SMF). The 1000BASE-LCWDM PTMs are hardened for extended temperature applications.

System specifications

The following are the 1000BASE-LCWDM system specifications:

- Optical Line Rate: 1.25 Gb/s (± 100 ppm)
- Optical Line Coding: 8B/10B

- Fiber Type: 10 μ m SMF
- Minimum Range: 2 to 96,000 meters
- Temperature range: Extended temperature (-5°C to $+85^{\circ}\text{C}$)

Transmitter specifications

The 1000BASE-LCWDM optical transmitter meets the specifications listed in the following table.

Table 10-35 1000BASE-LCWDM transmit specifications

Description	1000BASE-LCWDM
Transmitter type	Distributed Feed-Back (DFB) Laser
Signaling speed (range)	1.25 GBd (± 100 ppm)
Wavelength (λ)	Refer to Table 10-36, “1000BASE-CWDM PTM wavelengths” (p. 10-42).
Minimum Wavelength	$\lambda_c - 7$ nm
Maximum Wavelength	$\lambda_c + 7$ nm
$T_{\text{rise}}/T_{\text{fall}}$ (max; 20%–80% response time)	0.26 ns
Maximum Spectral Width ($\Delta\lambda_{20}$)	1 nm
Average launch power (max)	+5 dBm
Average launch power (min)	−1.0 dBm
Average launch power of OFF transmitter (max)	−40 dBm
RIN (max)	−120 dB/Hz

Table 10-36 1000BASE-CWDM PTM wavelengths

Apparatus Code	Channel #	Wavelength
SGEC47EL	47	1471 nm
SGEC49EL	49	1491 nm
SGEC51EL	51	1511 nm
SGEC53EL	53	1531 nm
SGEC55EL	55	1551 nm
SGEC57EL	57	1571 nm
SGEC59EL	59	1591 nm
SGEC61EL	61	1611 nm

Receiver specifications

The 1000BASE-LCWDM receiver meets the specifications defined in the table below.

Table 10-37 1000BASE-LCWDM receive specifications

Description	1000BASE-LCWDM
Signaling speed (range)	1.25 GBd (± 100 ppm)
Average receive power (max)	−9.0 dBm
Receive sensitivity	−29.0 dBm
Return loss (min)	24.0 dB

Link budgets

The worst-case power budget and link penalties for a 1000BASE-LCWDM channel are shown in the table below.

Table 10-38 1000BASE-LCWDM link budgets and penalties

Parameter	1000BASE-LCWDM
Maximum Channel Insertion Loss	28.0 dB
Minimum Channel Insertion Loss	14.0 dB
Maximum Dispersion	1600 ps/nm
Optical Path Penalty	2.0 dB
Target Distance ¹	96 km

Notes:

1. The target distance assumes that passive optical units are not being used.

1000BASE-BX40 optical Ethernet specifications

Overview

The 1000BASE-BX40 PTMs can be used for GbE service over Single-Mode Fiber (SMF).

System specifications

The following are the 1000BASE-BX40 system specifications:

- Optical Line Rate: 1.25 Gb/s (± 100 ppm)
- Optical Line Coding: 8B/10B
- Fiber Type: 10 μ m SMF

- Minimum Range: 2 to 40,000 meters
- Performance: Long-reach (40 km)
- Temperature range: Industrial temperature (−40°C to +85°C)

Transmitter specifications

The 1000BASE-BX40 optical transmitter meets the specifications listed in the following table.

Table 10-39 1000BASE-BX40 transmit specifications

Description	1000BASE-BX40 Downstream	1000BASE-BX40 Upstream
Transmitter type	Longwave Laser	
Signaling speed (range)	1.25 GBd (± 100 ppm)	
Wavelength (λ)	1480 to 1500 nm	1260 to 1360 nm
Maximum Spectral Width ($\Delta\lambda_{20}$)	1.0 nm	1.0 nm
Average launch power (max)	+2.0 dBm	+2.0 dBm
Average launch power (min)	−3.0 dBm	−3.0 dBm
Average launch power of OFF transmitter (max)	−45.0 dBm	−45.0 dBm

Receiver specifications

The 1000BASE-BX40 receiver meets the specifications defined in the table below.

Table 10-40 1000BASE-BX40 receive specifications

Description	1000BASE-BX40 Downstream	1000BASE-BX40 Upstream
Signaling speed (range)	1.25 GBd (± 100 ppm)	
Wavelength (λ)	1260 to 1360 nm	1480 to 1500 nm
Average receive power (max)	−3.0 dBm	−3.0 dBm
Receive sensitivity	−25.0 dBm	−25.0 dBm
Return loss (min) ¹	12.0 dB	12.0 dB

Notes:

1. Refer to the IEEE 802.3 standards for more information about return loss (min).

Link budgets

The worst-case power budget and link penalties for a 1000BASE-BX40 channel are shown in the table below.

Table 10-41 1000BASE-BX40 link budgets and penalties

Parameter	1000BASE-BX40 Downstream	1000BASE-BX40 Upstream
Maximum Channel Insertion Loss	21.0 dB	21.0 dB
Minimum Channel Insertion Loss	5.0 dB	5.0 dB
Maximum Dispersion	700 ps/nm	256 ps/nm
Optical Path Penalty	1.0 dB	1.0 dB
Target Distance ¹	40 km	40 km

Notes:

1. The target distance assumes that passive optical units are not being used.

Lightguide jumpers and build-outs

Overview

Alcatel-Lucent 1850 TSS-5 provides standard LC-type connectors on all optical interfaces. 5 dB, 10 dB, 15 dB, and 20 dB attenuating build-outs are supported.

Single-mode jumpers

All the interfaces in Alcatel-Lucent 1850 TSS-5, except BASE-T-C1 and GE-1X2XFC-SX-I1, use single-mode jumpers for connecting to and from the outside plant *LGX* panel and the Alcatel-Lucent 1850 TSS-5.

Reference:

For more information, including a complete list of available jumpers and build-outs, refer to [“Miscellaneous equipment and tools” \(p. 7-7\)](#) in [Chapter 7, “Ordering”](#).

System performance

Overview

Purpose

This section provides performance specifications for the Alcatel-Lucent 1850 TSS-5.

Contents

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Wander/Jitter

Maximum time interval error (MTIE)

For SONET/SDH optical interfaces, the maximum time interval error (MTIE) does not exceed 60 nanoseconds phase variation when timed with a wander-free reference.

Wander requirements

Wander transfer, tolerance, and generation requirements are met as specified in the following documents:

- SONET: *Telcordia*® GR-253-CORE, “Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria”, Issue 4, December 2005
- SDH: ITU-T Recommendation G.813, “Timing characteristics of SDH equipment slave clocks (SEC)”, March 2003.

Jitter requirements

Jitter transfer, tolerance, and generation requirements are met as specified in the following documents:

- SONET:
 - *Telcordia*® GR-253-CORE, “Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria”, Issue 4, December 2005

Telcordia® GR-499-CORE “Transport Systems Generic Requirements (TSGR): Common Requirements”, Issue 3, September 2004

- SDH: ITU-T Recommendation G.813, “Timing characteristics of SDH equipment slave clocks (SEC)”, March 2003.

Short-term stability

The interfaces meet the OC-n/STM-n output short-term stability mask as specified in the following documents:

- SONET: *Telcordia*® GR-253-CORE, “Synchronous Optical Network (SONET) Transport Systems: Common Generic Criteria”, Issue 4, December 2005
- SDH: ITU-T Recommendation G.813, “Timing characteristics of SDH equipment slave clocks (SEC)”, March 2003.

Signal performance

Overview

The following specifications apply to the standard networks defined in the following documents:

- *Telcordia*® GR-499-CORE, Issue 3 (DS1/DS3)
- ITU G.703, G.704, G.706, G.736, G.775, M.2100 (E1)
- ITU G.703, G.823 (E3)

DS1/E1 rate

For systems interfacing at the DS1/E1 rate, the number of errored seconds during a 7-hour, one-way loopback test, is less than 10.

DS3/E3 rate

For systems interfacing at the DS3/E3 rate, the number of errored seconds during a 2-hour, one-way loopback test, is less than 29.

BER

The BER is less than 2×10^{-10} for both the DS1/E1 and DS3/E3 rates. Burst-errored seconds are excluded.

Burst-errored seconds

The frequency of burst-errored seconds, other than those caused by protection switching induced by hard equipment failures, averages less than 4 per day.

Synchronization

Overview

The VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs have similar mechanisms for synchronization. However, the VLNC50/52 has a ± 20 ppm SMC/SEC clock whereas the VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs have a ± 4.6 ppm Stratum 3 clock. The VLNC50/52 supports deriving a T1/E1 sync output from the incoming line(s). The VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs also have the ability to derive a clock, based on incoming data from a packet network. VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs support external timing from an incoming T1/E1 BITS input.

Timing modes

Refer to [“Synchronization features” \(p. 2-20\)](#) for detailed information about the timing modes.

Protection switching

1+1 networks

Alcatel-Lucent 1850 TSS-5 complies with SONET/SDH 1+1 unidirectional non-revertive protection switching requirements as specified in GR-253-CORE and ITU-T G.957. Automatic line switches are initiated by signal fail and signal degrade conditions on the received OC-3STM-1 or OC-12/STM-4 optical signal and are completed within 50 milliseconds of a signal failure. The signal's BER is calculated from violations of the line overhead B2 parity bytes. Signal fail is declared for incoming LOS, LOF, line AIS, or a BER exceeding 10^{-3} , while a BER exceeding a provisioned threshold between 10^{-3} and 10^{-5} causes a signal degrade to be declared. The user can control switching through protection switching commands.

UPSR networks

Path protection rings feed a SONET payload (STS or virtual tributary [VT]) from the ring entry point, simultaneously in both rotations of the ring, to the signal's ring exit point. The node that terminates the signal from the ring monitors both ring rotations and is responsible for selecting the signal that has the highest quality based on loss of pointer (LOP), path AIS (AIS-P), unequipped signal (UNEQ), signal fail BER (SF) (STS paths only) and signal degrade BER (SD). Line level faults such as LOS and LOF result in downstream AIS-P faults which in turn may result in path switching. On pass-through paths, all detected hard failures (LOS, LOF, LOP, line AIS, or STS-1 path AIS) result in

AIS insertion in the outgoing VT and STS signals. This allows the terminating node to be aware of the failure and to switch to protection. Protection switching is completed within 50 milliseconds of failure detection.

Under normal conditions, both incoming SONET path signals to the switch selection point are of high quality, and the signal can be selected from either ring. A failure or transmission degradation on one of the rings requires that the other ring path be selected. Alcatel-Lucent 1850 TSS-5 provides non-revertive switching to minimize the impact on critical customer services by giving the service provider control, when and if the critical service should revert to a particular ring. A manual path protection switching command allows switching back to the original path for ease of ring maintenance.

SNCP rings

A Sub-Network Connection Protection (SNCP) ring provides path-level protection for VC-n circuits that are routed along two diverse paths in a network. First, each direction of the circuit is bridged onto two paths at the add-node (head-end), then carried through multiple facilities of any type, and finally selected from the two paths at the drop-node (tail-end). The path selection at the tail-end may be between any two tributaries from any SDH port. (Because of the different switching criteria used in the two standards, the two ports cannot be a mix of SONET and SDH.) Alcatel-Lucent 1850 TSS-5 supports STM-1 and STM-4 SNCP rings.

Alcatel-Lucent 1850 TSS-5 supports SNC/Ne non-revertive 1+1 unidirectional switching. This minimizes the impact on critical customer services by giving the service provider control, when and if the critical service should revert to a particular ring. A manual path protection switching command allows switching back to the original path for ease of ring maintenance.

Protection for pseudowires

Bi-directional forwarding detection (BFD) is a network protocol that provides a low-overhead method of detecting faults across media that does not support failure detection, like asynchronous messaging across Ethernet. Alcatel-Lucent 1850 TSS-5 uses BFD to monitor the integrity of MPLS tunnels between shelves. Duplicate pairs of unidirectional MPLS tunnels with associated pseudowires can be configured to provide two bi-directional links using different paths between Alcatel-Lucent 1850 TSS-5 shelves. One pair of tunnels can carry the active pseudowire and its traffic, while the other pair of tunnels serve as a backup. BFD is configured on each tunnel. If the BFD detects a failure, the VLNC60/VLNC61/VLNC62/VLNC64 circuit pack directs all pseudowire traffic onto the backup tunnel.

Transient performance

Power loss restart

After system shutdown due to power loss, the system will exhibit a 2-second error free transmission interval which begins about 1 minute after restoration of power.

Transmission start-up on signal application

The system, after having no signal applied for greater than 1 minute at the DSX-n interface, will exhibit a 2-second error free transmission interval which begins within 5 seconds of the reapplication of a signal.

Transmission delay

One-way transmission delay

The following tables list the worst-case maximum one-way transmission delay (microseconds) between Alcatel-Lucent 1850 TSS-5 interfaces. Alcatel-Lucent 1850 TSS-5 is a hybrid box combining features of an add/drop mux (ADM) and a digital cross-connection system (DCS). Consequently the specified maximum delay is a summation of the requirements for these two functions. Actual transmission delays are likely to be less than specified.

Table 10-42 SONET transmission delay in microseconds

Interface	OC-n		DS1		DS3
Cross-Connect	VT	STS-n	VT	STS-1	STS-1
OC-n	130	80	180	180	155
DS1	180	180	NA	NA	NA
DS3	N/A	155	NA	NA	NA

Table 10-43 SDH transmission delay in microseconds

Interface	STM-n		E1		E3
Cross-Connect	VC-12	VC-n	VC-12	VC-n	VC-n
STM-n	130	80	180	155	155
E1	180	NA	NA	NA	NA
E3	NA	155	NA	NA	NA

SYSCTL and SONET/SDH Operations Interfaces

Overview

Purpose

This section presents information about the operation interfaces that are required to support technician access to the system and allow alarms and status information generated by the system for synchronous operations and SONET/SDH interfaces to be reported. It includes the *WaveStar*® CIT interface, IAO LAN (via OSI or TCP/IP), SYSCTL faceplate LEDs, and equipment indicators. A second set of interfaces manages the interfaces supported by the VLNC40, VLNC42/42B, VLNC60, VLNC61, VLNC62, and VLNC64. These are described in, [“VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 operations interfaces” \(p. 10-56\)](#). Alcatel-Lucent 1850 TSS-5 equipped with a SYSCTL also supports office alarms, user-definable miscellaneous discrete inputs, and TL1.

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Craft Interface Terminal (CIT)

Overview

The *WaveStar*® CIT is the primary tool used to interface with the Alcatel-Lucent 1850 TSS-5 for managing synchronous interfaces and SONET/SDH operations. The *WaveStar*® CIT client software is installed on a personal computer (PC), and provides the Alcatel-Lucent 1850 TSS-5 user-interface for SONET operations.

Requirements

It is anticipated that most customers will dedicate a laptop or personal computer (PC) to run the *WaveStar*® CIT software. However, any properly configured computer will suffice.

The following table lists the customer-provided PC minimum and recommended requirements for using the *WaveStar*® CIT.

Table 10-44 *WaveStar*® CIT PC requirements

Component	Minimum ¹	Recommended
Processor	Pentium II 266 MHz	Pentium IV 1GHz or higher
RAM (one System View)	256 MB	512 MB
RAM (up to 5 System Views)	512 MB	1 GB
Virtual memory	139 MB	267 MB
Available disk space	750 MB	850 MB ²
Video	800x600 256 colors (8 bit)	1024x768 16 million colors (24 bit)
Network Interface card	10/100BASE-T Network Interface Card 10/100 BASE-T LAN interface Pin Designations/signals are: • 1 TD+ • 2 TD– • 3 RD+ • 6 RD–	
CD-ROM drive	Required	
Operating System	Supported Operating Systems are: • Microsoft <i>Windows</i>® 2000 • Microsoft <i>Windows</i>® XP The customer is responsible for ensuring that the PC remains virus-free.	
Internet Browser	<i>Microsoft</i> ® Internet Explorer 5.0, 5.5, 6.0, or 7.0	

Notes:

1. Minimum requirements are sufficient to run two or three graphical System Views, unless otherwise noted. Recommended requirements are intended to be used as a general guideline to optimize *WaveStar*® CIT performance. Since the *WaveStar*® CIT is used with multiple NE connections and multiple NE types, the processor type and speed and the memory size all factor into the performance.
2. Available hard disk space required to install and store the *WaveStar*® CIT and on-line help files is approximately 750 MB. During installation, an additional 100 MB is required. To store a copy of an NE generic, another 125 MB is needed for each generic

Table 10-45 CIT and Microsoft *Windows*® requirements

Alcatel-Lucent 1850 TSS-5 port/Microsoft <i>Windows</i> ® Guidelines	Serial Port	OSI/TCP-IP LAN Port
Microsoft <i>Windows</i> ® 2000	X	NA
Microsoft <i>Windows</i> ® XP	NA	X

TL1/LAN

Overview

Alcatel-Lucent 1850 TSS-5 supports a TL1 over TCP/IP interface or TL1 over OSI LAN interface for communication between a Alcatel-Lucent 1850 TSS-5 NE and an Element Management System (EMS) of a Network Management System (NMS). TL1 over TCP/IP LAN complies with requirements specified in IEEE 802.3 and NSIF-AR-9806-088R11.

TL1 translation device (T-TD Gateway)

The T-TD is a device that translates TL1 messages over a TCP/IP connection to a TL1 over OSI association, providing a TL1 TCP-OSI gateway. The T-TD, when used in conjunction with the CIT, is an open system interconnection (OSI) proxy that accepts TCP/IP connections and sets up matching OSI connections. This requires the support of the TCP/IP stack and the seven-layer OSI stack.

Front IAO LAN interface

Alcatel-Lucent 1850 TSS-5 provides an RJ45-compatible front IAO LAN interface that is intended for use with a local PC.

SONET/SDH DCC

The SONET/SDH DCC provides TL1 over OSI connections with remote NEs in a subnetwork.

Personal computer specifications for software download

Specifications

The PC used for software download should have:

- Microsoft *Windows*® XP or 2000
- CD-ROM drive for CD-ROM download.

Compatible modems

A compatible modem must meet the following minimum requirements:

- 300, 1200, 2400, 4800, 9600, 19,200 or 115,000 baud
- Full duplex
- 8 data bits
- No parity bits
- 1 start bit
- 1 stop bit
- No flow control.

LEDs, indicators, and office alarms

SYSCTL faceplate

In addition to the FAULT LED, which is lit if the SYSCTL detects its own failure, there are also three alarm/status LEDs on the SYSCTL faceplate, listed below:

- Critical (CR)/Major (MJ)
- Minor (MN)/Abnormal (ABN)

There are LEDs and two push-button switches for Update (UPDATE) and ACO (ACO).

Equipment indicators

A red LED FAULT indicator is provided on all circuit packs. A green LED ACTIVE indicator is provided on all circuit packs to indicate which circuit packs are actively carrying traffic.

Office alarms

The office alarms interface is a set of discrete relays that control office audible and visual alarms. Separate relays handle CR/MJ (both critical and major alarms are reported through one pair of relays) and MN alarms. Each contact closure is rated at 1 A, 60 V maximum. The CR alarm relays are fail safe against unprotected power failures.

User-defined miscellaneous discrete interface

Overview

The user-defined miscellaneous discrete interface allows an operations system (OS) to control and monitor equipment collocated with the Alcatel-Lucent 1850 TSS-5 through a set of input and output contact closures. Miscellaneous discrete environmental inputs can monitor conditions like open doors or high temperature; miscellaneous discrete outputs control equipment such as fans and generators. The status of the miscellaneous discrete environmental inputs can be queried on demand via the *WaveStar*® CIT. Alcatel-Lucent 1850 TSS-5 collects miscellaneous discrete alarms and automatically sends them to the operations system (OS).

External customer equipment

Any external customer equipment to be monitored by Alcatel-Lucent 1850 TSS-5 must provide the electrical equivalent of a contact closure across the corresponding environmental input wiring pairs. The contact closure must be capable of passing at least 10 mA of drive current.

Power source

The power source to enable the control of external customer equipment may have a voltage range from a minimum of 3V to a maximum of 72V. Alcatel-Lucent 1850 TSS-5 provides a unidirectional opto-isolator connection across each corresponding control output wiring pair. The load current across each control output wiring pair must be limited by the external customer equipment and must not exceed 35 mA.

Reference:

For detailed wiring information, refer to the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Installation and System Turn-Up Guide*.

VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 operations interfaces

Overview

Purpose

This section presents information about the operation interfaces that are required to support technician access to the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs. It includes the serial RS-232 interface, administrative IP LAN (via faceplate connector, or remotely), circuit pack faceplate LEDs, and shelf equipment indicators. The command line interface (CLI) is used for most administrative and configuration tasks. SNMP traps provide surveillance information for VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack operations.

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Craft serial interface

Overview

There are two RJ45 serial ports on the VLIU(1,2,10) interface panel, labeled M1 and M2. The M1 port provides a serial link to the MAIN 1 slot, which can contain a VLNC60/VLNC61/VLNC62/VLNC64 circuit pack. The M2 port provides a serial link to the MAIN 2 slot, which can contain a VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack. A PC connected to either port can access the CLI for the associated circuit pack, to set or change initial configuration settings during installation. Once properly configured and integrated with the local administrative IP network, the VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit pack can be administered remotely via a network connection.

Note: The VLNC50/VLNC52 can also be installed MAIN 1 and MAIN 2 with the appropriate VLIU, but it does not use the serial link.

Refer to [Table 6-1, “VLIU compatibility” \(p. 6-4\)](#) for more information about supported configurations.

Requirements

The following list shows the requirements for the customer-provided PC with recommended Microsoft *Windows*® operating system.

- A standard personal computer or laptop with at least one serial port, or serial port adapter
Microsoft *Windows*® 2000 or XP Operating System with service pack 4. The customer is responsible for ensuring that the PC remains virus-free.
- Terminal software (HyperTerminal, or similar software) capable of accessing a serial port on the PC.
- SVGA monitor 800x 600 resolution (1024 x 768 recommended)
- A serial connector cable appropriate for the port on the PC, and terminating in an RJ45 connector for the M1/2 port on the VLIU interface unit. The RJ45 connector has the following pinouts:
 - 1 N
 - 3 DTR
 - 5 TXD
 - 6 RXD

Front MGMT LAN interface

Overview

The VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs provide an RJ45 Ethernet port on the faceplate for a management LAN connection. A PC or laptop can be connected directly to this Ethernet port during installation using an Ethernet cross-over cable, and the default IP address assigned to this port. Once this port has been properly configured to operate within the local management LAN environment, the circuit pack can be accessed remotely over the network. DHCP can also be enabled on this interface, to allow it to obtain an IP address from a DHCP server. Secure remote connections over the network to the

VLNC40/VLNC42/VLNC42B/VLNC60/VLNC61/VLNC62/VLNC64 circuit packs require the use of Secure Shell (SSH) client software.

Requirements

The following list shows the requirements for the customer-provided PC with recommended Microsoft *Windows*® operating system.

- A standard personal computer or laptop with at least one 10/100BASE-T Ethernet port adapter
Microsoft *Windows*® 2000 or XP Operating System with service pack 4. The customer is responsible for ensuring that the PC remains virus-free.
- Terminal software (HyperTerminal, or similar software) capable of configuring and accessing a 10/100BASE-T Ethernet port on the PC.
- SVGA monitor 800x 600 resolution (1024 x 768 recommended)
- An Ethernet cross-over cable with the connectors wired as described in the following table

Connector A Pin number	Wire color	Connector B Pin number
1	Wh/Or	3
2	Orange	6
3	Wh/Grn	1
4	Blue	7
5	Wh/Blu	8
6	Green	2
7	Wh/Brn	4
8	Brown	5

Remote LAN interface

The VLNC40/42/42B circuit pack supports up to 20 10/100BASE-T Ethernet ports on the Alcatel-Lucent 1850 TSS-5 shelf. Any of these ports can be used to remotely access the CLI, via an internal network address on the VLNC40/42/42B circuit pack.

Physical specifications

Overview

Purpose

This section provides Alcatel-Lucent 1850 TSS-5 physical characteristics, including environmental and power specifications.

Contents

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Physical specifications

High Capacity rack-mount shelf

The Alcatel-Lucent 1850 TSS-5 High Capacity rack-mount shelf has the following characteristics:

- Width: 17.4 inches (441mm), including integral fan unit
- Height: 4.9 inches (125mm)
- Depth (front to back): 11.8 inches (300mm)

Environmental specifications

Temperature and humidity

Alcatel-Lucent 1850 TSS-5 is environmentally (OSP, Outside Plant) hardened and will function at temperatures of -40°C to $+65^{\circ}\text{C}$ and humidity of 5 to 95 percent (non-condensing) in all TDM and Ethernet applications when equipped with the VLNC2, VLNC35, VLNC40, VLNC42/42B, VLNC50, VLNC52, VLNC60, VLNC61, VLNC62, and VLNC64 circuit packs.

Therefore, the Alcatel-Lucent 1850 TSS-5 shelf meets *Telcordia*® Network Equipment Building System (*NEBS Generic Equipment Requirements*, GR-63-CORE) requirements for use in CO environments.

EMI compliance

Alcatel-Lucent 1850 TSS-5 complies with the limits for a Class A device, in accordance with Part 15 of the FCC rules and *Telcordia*® GR-1089-CORE. These limits provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy. This equipment must be installed and operated in accordance with the instruction manual, to avoid interference to radio communications. This equipment is not designed for installation in a residence location. The user assumes responsibility for EMI interference, resulting from improper installation.

Earthquake requirements

Alcatel-Lucent 1850 TSS-5 meets the earthquake requirements defined in *Telcordia*® GR-63-CORE and Pacific Bell Standard PBS-000-102PT.

Fire resistance

Alcatel-Lucent 1850 TSS-5 meets flammability requirements specified in *ANSI* T1.307-1997. In addition, the Alcatel-Lucent 1850 TSS-5 meets the fire resistance requirements of *UL* 60950, 3rd Edition and *Telcordia*® GR-63, Issue 2, April 2002.

Safety

Alcatel-Lucent 1850 TSS-5 complies with CSA-C22.2 No. 60950-00, and UL60950-00 Safety of information technology equipment.

Alcatel-Lucent 1850 TSS-5 is *UL* recognized for restricted access installations in business and customer premises applications installed in accordance with Articles 110-16 and 110-17 of the *National Electric Code*, *ANSI/NFPA* Number 70-87. Other installations, exempt from the requirements of the National Electric Code, may be engineered according to the accepted practices of the local telecommunications utility.

Canadian Standards Association

Alcatel-Lucent 1850 TSS-5 has been certified by the Canadian Standards Association per standard CAN/CSA-C22.2 Number 60950-00.

Power specifications

Power supply

[Table 6-3, “Alcatel-Lucent 1850 TSS-5 Power supply requirements” \(p. 6-11\)](#) lists Alcatel-Lucent 1850 TSS-5 power requirements.

Alcatel-Lucent 1850 TSS-5 uses on-board power conversion eliminating the need for slots for bulk power converters. Two independent –48 VDC or +24 VDC office power feeders (A and B) enter the shelf through a terminal block and are filtered and distributed to the circuit packs. Power conversion is performed via modular power converters located on the circuit packs. Within each circuit pack, the two power feeds are fused, filtered, and connected to the board-mounted power modules through diodes that provide an electrical “OR” connection. This provides the required redundancy in case of the loss of one feeder. The power LEDs, labeled A and B PWRON, are located on the fan unit.

Current drains

Alcatel-Lucent 1850 TSS-5 has the following current drain requirements.

- 1850 TSS-5: 2.5 Amps (maximum at –48 VDC)
- 1850 TSS-5: 5 Amps (maximum at +24 VDC)

Heat dissipation

The maximum heat dissipation of Alcatel-Lucent 1850 TSS-5 is 100 watts.

Appendix A: Ethernet



Overview

Purpose

This section describes the Ethernet implementation for Alcatel-Lucent 1850 Transport Service Switch 5 (Alcatel-Lucent 1850 TSS-5).

Contents

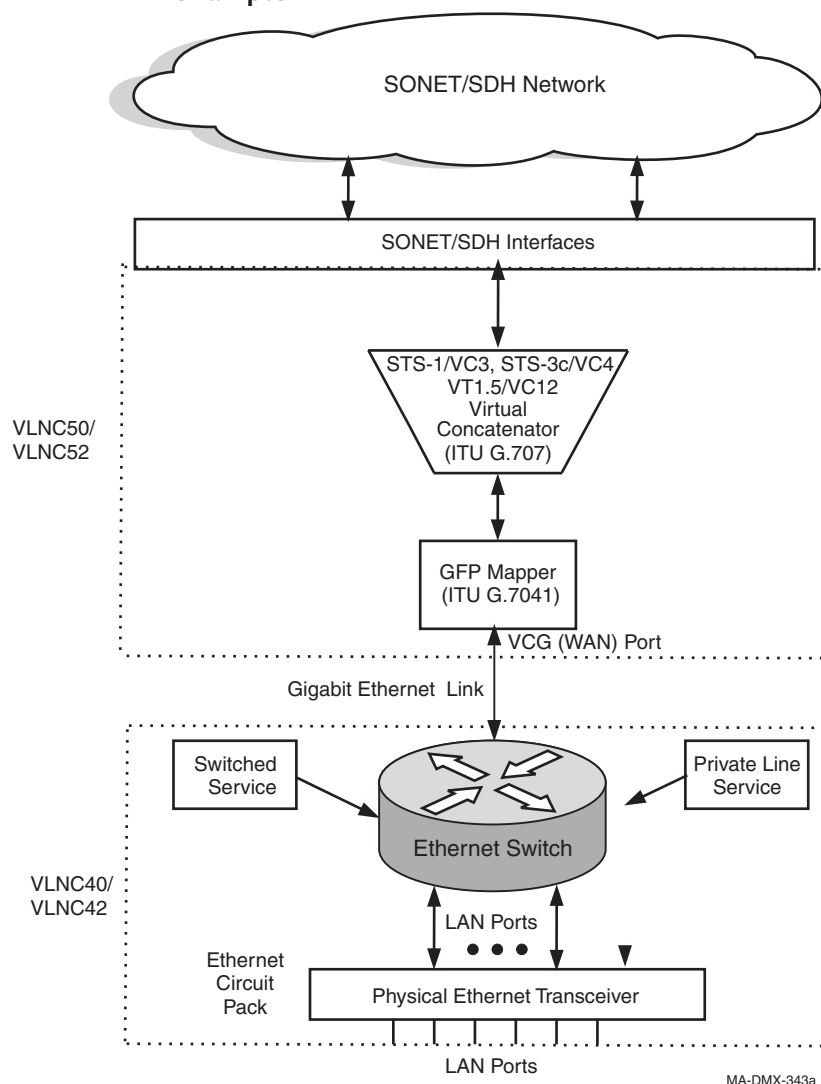
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Ethernet transport over SONET/SDH

Overview

Alcatel-Lucent 1850 TSS-5 accepts Ethernet frames at an ingress port and transmits them out of one or more egress ports. The egress port(s) can be on the same network element or on a different network element. If it is on a different network element, Ethernet frames are transmitted over a SONET/SDH network. For Ethernet over SONET/SDH, the VLNC40/42/42B circuit pack transmits frames to the VLNC50/52 circuit pack over a Gigabit Ethernet link between the circuit packs, or over a Gigabit Ethernet link on the backplane. The VLNC50/52 circuit pack transmits them out of one or more of the egress ports to OC-n/STM-n SONET/SDH lines or a Gigabit Ethernet link. To transport an Ethernet frame across the SONET/SDH network, the Ethernet Frame is moved between a LAN port (VLNC35) and the SONET/SDH network.

Figure A-1 Ethernet over SONET/SDH transport through Alcatel-Lucent 1850 TSS-5 example



The following occurs to transport an Ethernet frame over a SONET/SDH network:

- Alcatel-Lucent 1850 TSS-5 accepts an Ethernet Frame at an ingress LAN Port.
- For Ethernet over SONET/SDH, the Ethernet frame is sent directly to the GFP mapper via a VCG port
- The generic framing procedure (GFP) mapper encapsulates the Ethernet frame into a GFP Frame.

-
- Virtual Concatenation maps the Ethernet stream into one or more SONET tributaries or SDH virtual containers (timeslots). This allows the network to carry traffic (Ethernet stream) at higher speeds than allowed by single tributaries or channels in either SONET or SDH. The group of virtually concatenated tributaries/VCs is referred to as a Virtual Concatenation Group (VCG).
 - The VCG is then placed on SONET/SDH tributaries/VCs and transmitted over the network.

Enhanced Ethernet features

The VLNC35 and VLNC50/52 circuit packs also provides the following enhanced Ethernet features.

- TCAs on Ethernet PM error counts
- Link Capacity Adjustment Scheme (LCAS) per ITU G.7042
 - VT1.5/VC-12 and STS-1/VC-3 VCAT with LCAS (VLNC35)
 - VT1.5/VC-12, STS-1/VC-3, STS-3c/VC-4 VCAT with LCAS (VLNC50/52)
- Client Signal Failure per ITU-T G.7041/Y.1303

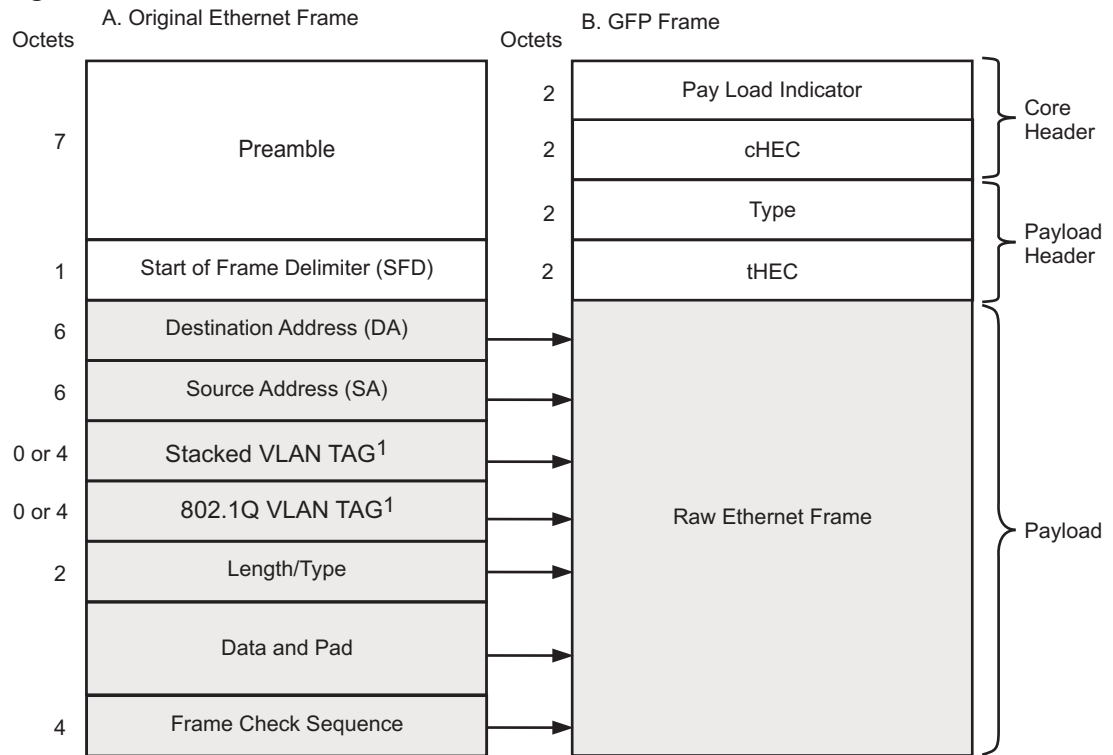
Ethernet loopbacks

Alcatel-Lucent 1850 TSS-5 supports terminal loopbacks on VLNC35 Ethernet interfaces. Loopbacks may be used during installation and maintenance procedures to test the integrity of near and far-end interfaces as well as fibers and system circuitry.

Generic framing procedure (GFP)

Generic Framing Procedure (GFP) is used to encapsulate Ethernet frames for transport over a SONET/SDH network. Alcatel-Lucent 1850 TSS-5 uses frame-based GFP with the core header and no optional extension headers or Frame Check Sequence (FCS).

To encapsulate an Ethernet frame, the Ethernet preamble and Start of Frame Delimiter (SFD) fields are removed from the frame. A Type header and check (tHEC) is added to the Ethernet frame creating a GFP payload. The GFP payload is then scrambled and a Core header is added. The GFP frame is then sent to the Virtual Concatenator. The following figure shows the format of a GFP frame.

Figure A-2 GFP frame format

Note: 1 - May not be present

MA-DMX-344

Table A-1 GFP frame format details

Section	Field	Description
Core Header	Payload Indicator (PLI)	Binary number representing the number of octets in the GFP payload.
	Core Header Error Control (cHEC)	CRC-16 checksum that protects the integrity of the contents of the Core Header.
Payload Header	Type	The type of information contained in the Payload field. The value is 01hex.
	Type Header Error Control (tHEC)	CRC-16 checksum that protects the integrity of the contents of the Type Field.
Payload		The raw Ethernet Frame (that is, the original Ethernet Frame without the Preamble and SFD).

In the opposite direction when the GFP Mapper receives a GFP frame from the Virtual Concatenator, it removes the Core Header and, using the cHEC field, performs a Header Error Check. If the header is correct, the payload area of the GFP is then de-scrambled and the Type field and tHEC in the GFP header are checked for correctness. The Ethernet frame is extracted and the Preamble and SFD are added.

The GFP mapper at the far end of the network inserts idle GFP frames when there are no Ethernet frames to send. The near end GFP Mapper discards any idle GFP frames it receives over the SONET network. The idle GFP frames are not forwarded to the Ethernet Switch.

The GFP Mapper contains GFP queues that are used to store Ethernet frames while they are being processed.

The Generic Framing Procedure is defined in ITU-T G.7041/Y.1303 and ANSI T1X1.105 Sections 7.3.2 and 7.3.3.

Virtual concatenation

Virtual Concatenation is a standard *inverse multiplex* scheme for transporting a payload using multiple channels each of which has a lower capacity than the payload to be transported. It allows finer granularity in allocating the transport bandwidth than is available in standard contiguous concatenation (STS-3c/VC-4).

The grouped SONET/SDH tributaries or channels form a Virtual Concatenation Group (VCG). A VCG is treated as a single logical serial byte stream whose payload capacity equals that of the sum of the payload capacities of the constituent SONET/SDH tributaries or channels. The following figure shows a virtual concatenation group.

Figure A-3 Virtual concatenation group for VLNC50/52

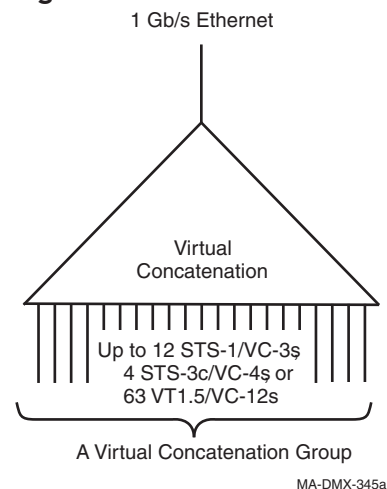
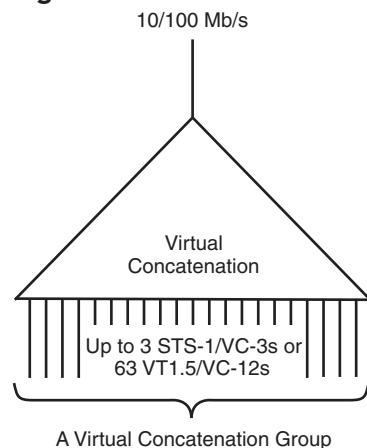


Figure A-4 Virtual concatenation group for VLNC35

MA-DMX-345

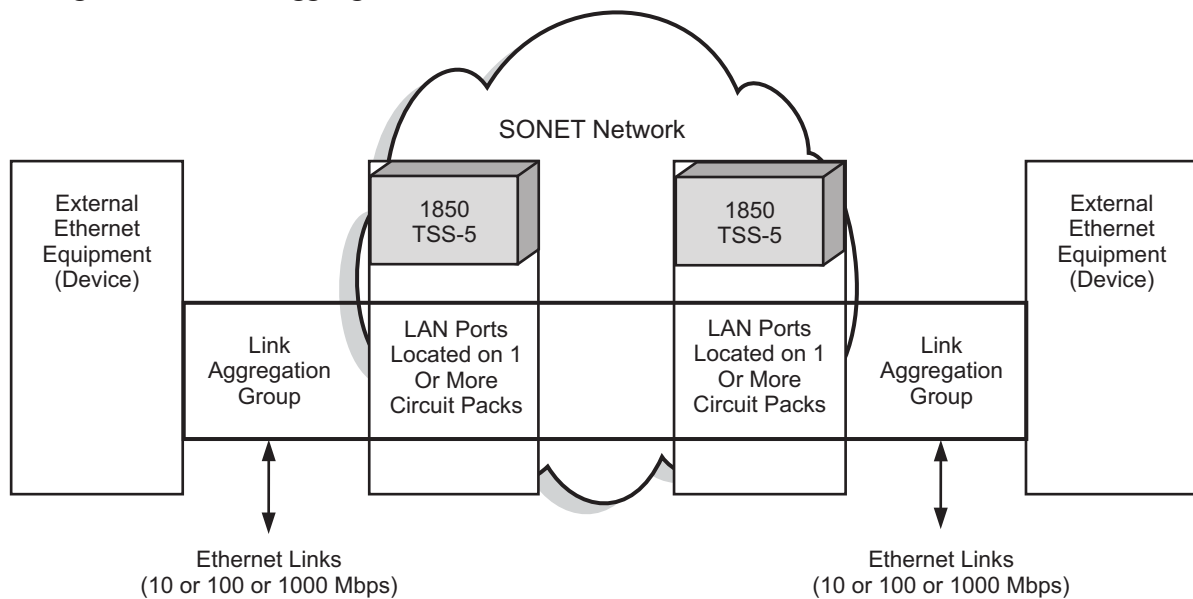
Individual tributaries/VCs in the VCG are independently transported through the SONET/SDH network. Only the initial and final network nodes perform the Virtual Concatenation. Since the VCGs are invisible to the intermediate nodes, the intermediate nodes only need to transport normal SONET/SDH traffic and do not need to understand VCGs. This allows the tributaries/VCs to be transported through equipment which does not handle VCGs.

Differential delay buffers

Because the individual tributaries/VCs of a virtual concatenation group (VCAT) can take different paths through the network, they may experience different delays. VCG ports use differential delay buffers to accommodate differential delay. All VCAT and VCG functions for Ethernet over SONET/SDH are handled on the VLNC50/52 and VLNC35 circuit packs.

Link aggregation

Link aggregation allows multiple physical links between Ethernet switches to be treated as a single link. This provides for more bandwidth between the switches than can be transmitted over a single Ethernet port and it can provide protection from a cable, Ethernet port, or Ethernet circuit pack failure. Alcatel-Lucent 1850 TSS-5 supports Link Aggregation on the VLNC40/42/42B circuit pack. Alcatel-Lucent 1850 TSS-5 also supports transparency through the VLNC50/52, as well as the VLNC40/42/42B circuit pack. Transparency is supported on ports that have L2CP tunneling enabled but do not have Link Aggregation enabled.

Figure A-5 Link aggregation

==== Link Aggregation Group (e.g. Links that are aggregated together)

1850 TSS-5 = 1850 - Transport Service Switch 5

MA-DMXplore-357a

The figure shows two Ethernet devices running link aggregation interconnected via Ethernet circuit packs and a SONET Network. The Alcatel-Lucent 1850 TSS-5 shelves and the SONET network are invisible to the two Ethernet devices. The Ethernet traffic is transparently transferred between the external devices. Link aggregation is typically implemented using two dedicated unprotected point-to-point links (Ethernet Private Line Service) for each pair of external ports.

Link Aggregation is specified in IEEE 802.3 clause 43, formerly specified in 802.3ad. Link aggregation transparency does not require default VLAN ID.

Flow control

This section describes how Alcatel-Lucent 1850 TSS-5 controls the flow of Ethernet traffic. Alcatel-Lucent 1850 TSS-5 supports the following types of flow control:

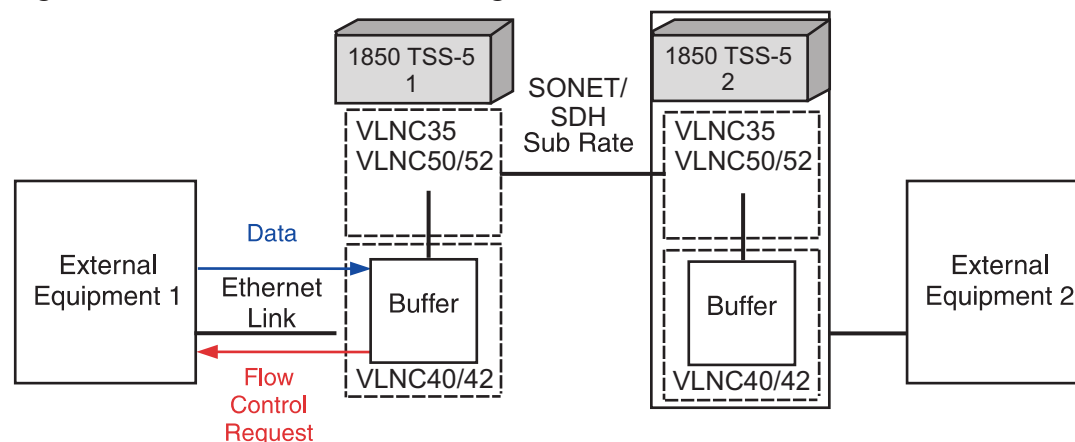
- Local flow control
- End-to-end flow control

Note: In the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide*, flow control is referred to as storm control.

Local flow control (ingress traffic direction)

If the external equipment delivers Ethernet frames to the Ethernet circuit pack faster than they can be delivered across the network, the data buffers in the circuit pack (VLNC35, VLNC40/42/42B, VLNC50/52) fill up. When the data buffers reach the flow control threshold, the circuit pack initiates flow control. On full duplex links, the circuit pack issues a flow control request to the external equipment, requesting that the flow of frames be suspended.

Figure A-6 Local flow control of ingress traffic



When data rate from External Equipment 1 exceeds SONET bandwidth, 1850 TSS-5 1 will invoke flow control toward External Equipment 1

1850 TSS-5 = Alcatel-Lucent 1850 Transport Service Switch 5

MK-DMXplore-013

Note that this local flow control mechanism is concerned only with congestion (full packet buffers) at the local Alcatel-Lucent 1850 TSS-5. If Alcatel-Lucent 1850 TSS-5 at the other end of the SONET/SDH network is unable to deliver the Ethernet frames to the attached external equipment due to flow control conditions there, that does *not* directly affect the local flow control operation at the ingress Alcatel-Lucent 1850 TSS-5.

Local flow control (egress traffic direction)

If the local Ethernet circuit pack attempts to deliver Ethernet frames to the attached external equipment faster than the external equipment can accept them, the external equipment may initiate flow control. On full duplex links, the external equipment issues a flow control request to the Ethernet circuit pack requesting that the flow of frames be suspended.

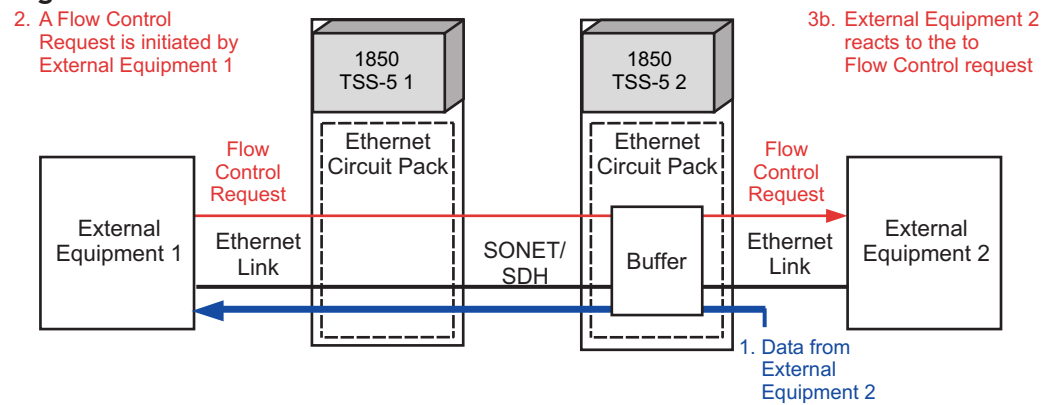
End-to-end flow control

If the external equipment at the destination of an Ethernet connection cannot handle the rate of traffic being sent to it, it may be desirable to apply back pressure across the network to slow down the external source of the Ethernet traffic. This cross-network back

pressure can only work well, however, when the source of the traffic can be identified unambiguously. Only the Ethernet Private Line Service offers this opportunity; thus, it is the only service that supports End-to-End Flow Control.

When end-to-end flow control is enabled, the circuit pack sends a flow control request across the SONET/SDH network immediately upon receiving a flow control request from external equipment.

Figure A-7 End-to-end flow control



Flow Control Request is generated by External Equipment 1

Flow Control Request is sent immediately to External Equipment 2

External Equipment 2 stops sending data in time for a loss-less transmission

1850 TSS-5 = Alcatel-Lucent 1850 Transport Service Switch 5

TSS5-E-7

Flow control provisioning

The Ethernet circuit packs automatically provide both local and end-to-end flow control if flow control is enabled for a LAN port. Similarly, disabling flow control for an LAN port disables both forms of flow control.

Table A-2 Flow control

LAN Port Flow Control State	Flow Control Status	Use/Comments
Disabled	Disabled	Alcatel-Lucent 1850 TSS-5 does not participate in flow control. The LAN port does not respond to flow control requests. The LAN port does not generate flow control requests due to congestion. Flow control requests are transported when received.
Enabled	Enabled	Flow control requirements are sent to the far-end Alcatel-Lucent 1850 TSS-5. LAN ports generate flow control requirements for fractional service.
Drop	Drop	Disables Network-element controlled flow control and drops end-to-end flow control messages.

Physical interface

Each Ethernet circuit pack contains a transceiver that implements the physical interface for that circuit pack's line type. For the 10/100 Mb/s circuit packs, this physical interface must be provisioned to or auto-negotiate to the proper line rate and duplex mode in order to communicate successfully with the connected equipment.

At the physical layer, many types of LANs can be used for multiple line rates and duplex modes. For example the LAN port on most PCs can be connected to a 10BASE-T (10 Mb/s) or a 100BASE-T (100 Mb/s) LAN. Before data traffic can be transmitted onto a

LAN, all ports connected to the LAN must operate with the same line rate and duplex mode. LAN ports can either be provisioned with these values or provisioned to automatically negotiate (auto-negotiate) the values.

The VLNC40/42/42B supports 20 electrical 10/100BASE-T Ethernet ports on the shelf that can be used for multiple line rates and duplex modes. For example the LAN port on most PCs can be connected to a 10BASE-T (10 Mb/s) or a 100BASE-T (100 Mb/s) LAN. Before data traffic can be transmitted onto a LAN, all ports connected to the LAN must operate with the same line rate and duplex mode. LAN ports can either be provisioned with these values or provisioned to automatically negotiate (auto-negotiate) the values.

Auto-negotiation

In the auto-negotiation process, a LAN port advertises its acceptable parameters, compares these with the advertised parameters of its link partner, and then agrees upon a set of parameters with the link partner. IEEE 802.3 allows the line rate, duplex mode, and flow control mode to be auto-negotiated. A LAN port not configured to support auto-negotiation will use provisioned values for these parameters. A LAN port configured for auto-negotiation that is connected to a LAN port not configured for auto-negotiation will follow prescribed rules for parameter settings.

In Alcatel-Lucent 1850 TSS-5, auto-negotiation is available on all Ethernet ports.

Table A-3 Line rate operation for shelf-based electrical ports

Alcatel-Lucent 1850 TSS-5 LAN Port Rate Provisioning	Connected Equipment Provisioning		Ethernet Link Rate ¹
	Auto-Negotiation	Advertised/Set at	
10	Disabled	10	10
	Disabled	100	No Link
	Enabled	10	10
	Enabled	100	No Link
	Enabled	10/100	10
100	Disabled	10	No Link
	Disabled	100	100
	Enabled	10	No Link
	Enabled	100	100
	Enabled	10/100	100

Table A-3 Line rate operation for shelf-based electrical ports (continued)

Alcatel-Lucent 1850 TSS-5 LAN Port Rate Provisioning	Connected Equipment Provisioning		Ethernet Link Rate ¹
	Auto-Negotiation	Advertised/Set at	
Auto	Disabled	10	10
	Disabled	100	100
	Enabled	10	10
	Enabled	100	100
	Enabled	10/100	100

Notes:

- Both the Alcatel-Lucent 1850 TSS-5 and the connected equipment will try to determine a common line rate. The link will not come up if both ends have auto-negotiation enabled and advertise incompatible duplex modes.

Table A-4 PTM rate and flow control operation

	GE optical	FE optical	GE electrical
Auto-negotiation	Yes	No	Yes
Duplex mode	Full	Full	Full
Flow control	yes/no/auto	yes/no	yes/no/auto
Master/slave operational value	NA	NA	multiport device
Crossover mode	NA	NA	Auto-detection

Table A-5 Flow control operation

LAN Port Provisioning		Connected Equipment Provisioning		Duplex Mode State		Comments
Flow Control	Auto-Negotiation State	Auto-Negotiation	Advertised/ Set at ¹	Alcatel-Lucent 1850 TSS-5 ²	Connected Equipment	
Auto	Enabled	Disabled	Disabled	Enabled	Disabled	Inconsistent Provisioning
			Enabled	Enabled	Enabled	Inconsistent Provisioning
		Enabled	Disabled	Enabled	Disabled	
			Enabled		Enabled	
Enabled	Enabled	Disabled	Disabled	Enabled	Disabled	Inconsistent Provisioning
			Enabled	Enabled	Enabled	Inconsistent Provisioning
		Enabled	Disabled	Enabled	Disabled	
			Enabled	Enabled	Enabled	
	Disabled	Disabled	Disabled	Enabled	Disabled	Inconsistent Provisioning
			Enabled	Enabled	Enabled	
		Enabled	Disabled	Enabled	Unknown	Inconsistent Provisioning
			Enabled	Enabled	Unknown	Inconsistent Provisioning

Table A-5 Flow control operation (continued)

LAN Port Provisioning		Connected Equipment Provisioning		Duplex Mode State		Comments
Flow Control	Auto-Negotiation State	Auto-Negotiation	Advertised/Set at ¹	Alcatel-Lucent 1850 TSS-5 ²	Connected Equipment	
Disabled	Enabled	Disabled	Disabled	Disabled	Disabled	Inconsistent Provisioning
			Enabled	Disabled	Enabled	Inconsistent Provisioning
		Enabled	Disabled	Disabled	Disabled	
			Enabled	Disabled	Disabled	
	Disabled	Disabled	Disabled	Disabled	Disabled	
			Enabled	Disabled	Enabled	Inconsistent Provisioning
		Enabled	Disabled	Disabled	Unknown	Inconsistent Provisioning
			Enabled	Disabled	Unknown	Inconsistent Provisioning

Notes:

1. Flow control will only be enabled if the connected equipment is capable of Symmetric Flow Control.
2. IEEE 802.3 does not define flow control states for half duplex links or when only one side of a link is provisioned for auto-negotiation. This is the expected behavior of the connected equipment.
3. IEEE 802.3 recommends that equipment be configured for auto-negotiation to avoid inconsistent provisioning.

Queues and buffers

Ethernet circuit packs contain small buffer pools that provide storage of Ethernet frames for brief periods of congestion or until flow control requests can be honored. These small buffer pools are associated with the Ethernet switch and the Generic Framing Procedure (GFP) mechanism. The GFP mechanism is described further in [“Generic framing procedure \(GFP\)” \(p. A-4\)](#). A larger buffer pool designed to handle different path lengths for individual STS-1/VC-3s, STS3c/VC-4s, or VT1.5/VC-12s is associated with the virtual concatenation process. Its function is described in more detail in [“Virtual concatenation” \(p. A-6\)](#). Two priority-based queues are provided to allow high priority traffic to be forwarded ahead of low priority traffic.

Tagging modes

Overview

Alcatel-Lucent 1850 TSS-5 supports the following tagging modes.

- Private Line mode
- VLAN tagging

Private Line mode

The Private Line mode is used to establish simple point-to-point connections between two ports with no Ethernet switching functions applied. No additional Ethernet provisioning is required after the cross-connection is established. Private Line mode can be used to provide either a full rate or sub-rate (fractional rate) dedicated Ethernet link across SONET/SDH networks. No preferential treatment for high priority packets is provided. In a sub-rate service, frames may be dropped due to congestion. Any correctly formatted Ethernet frame received at a source port is transmitted out of the destination port. Private Line mode is supported on VLNC50/52 and VLNC35 circuit packs.

The Private Line mode supports the following features:

- Point-to-point topology with only two LAN ports
- Protection is provided at the SONET/SDH network layer by UPSR/SNCP and 1+1 switching
- No spanning tree protocol (supports transparency of customer spanning tree protocol)
- No VLAN ingress filtering or classification (VLAN tags are not verified or added)
- Ethernet PM per port

Table A-6 Private Line mode packet handling

VLAN Tag	VLAN Filtering	Spanning Tree	Priority	Max. Frame Size (Bytes)	Applicable Circuit Packs
N/A	No	No	No (802.1p)	9614	VLNC50/52 VLNC35

802.1Q VLAN mode

In 802.1Q Mode, a VLNC40/42/42B circuit pack can be provisioned to use an incoming frame's VLAN tag, to add a VLAN tag associated with the port for untagged frames, or to drop an incoming frame if its VLAN tagging does not meet provisioned specifications. The priority bits in an incoming frame's VLAN tag can also be used to affect the handling of the frame.

Table A-7 802.1Q VLAN mode packet handling

VLAN Tag	VLAN Filtering	Spanning Tree	Priority	Max. Frame Size (Bytes)	Applicable Circuit Packs
Yes	Yes	Yes (RST 802.1D) (MST 802.1S up to 4 instances)	Yes (802.1p)	9216	VLNC40 VLNC42 VLNC42B

Quality of Service

Overview

Alcatel-Lucent 1850 TSS-5 supports the following Quality of Service (QoS) capabilities:

- Private Line service provides dedicated bandwidth between two end points (best QoS).
- Fractional rate services provide basic rate shaping with approximately 50 Mb/s or 1.5 Mb/s granularity.
- Class of Service scheduling and queuing

QoS services

The VLNC35 circuit packs provide 10 Mb/s and 100 Mb/s Private Line services. They do not contain an Ethernet Switch. Each LAN port is connected to its own VCG. 100 Mb/s traffic can be rate-limited by provisioning less SONET/SDH bandwidth than required to carry the full line rate. Traffic is buffered and flow control is invoked when ingress traffic on a LAN port exceeds the VCG's SONET/SDH bandwidth. If flow control is disabled or ignored by the external equipment, Ethernet frames are dropped when the ingress buffer overflows.

The VLNC40/42/42B contains an Ethernet Switch that can switch traffic over Gigabit Ethernet links into the EATN. 100 Mb/s traffic can be rate-limited by provisioning. Up to 8 classes of service are supported, using class-based queuing with Weighted Random Early Detection (WRED) with tail-drop, and scheduling using Static Priority, Weighted Round Robin (WRR), and Weighted Fair Queuing (WFQ).

The VLNC50/52 circuit pack provides partial-rate GbE Private Line services over SONET/SDH. Each VLNC50/52 LAN port is connected to its own VCG. Traffic is buffered and flow control is invoked when ingress traffic on a LAN port exceeds the VCGs bandwidth. If flow control is disabled or ignored by the external equipment, Ethernet frames are dropped when the ingress buffer overflows.

Ethernet service management

Overview

The Ethernet services are managed by provisioning the following:

- Cross-connections
- LAN ports
- VCG (WAN) ports
- Performance monitoring.
- Class of service

For detailed information about available parameters and their values, refer to [“Ethernet performance monitoring parameters”](#) (p. 5-81) in Chapter 5, “Operations, administration, maintenance, and provisioning”.

Cross-connections

The following types of cross-connections are support on Ethernet ports on the VLNC35 and VLNC50/52 circuit packs.

- 2wayPR
- 2way

For detailed information about supported cross-connections refer to [Chapter 6, “System planning and engineering”](#) in this document and the *WaveStar*® CIT online help.

Cross-connection types and supported configurations

The following table shows the cross-connection types and supported services.

Table A-8 Supported configurations and cross-connection types

SONET/SDH rate	Cross Connection Type	Number of Connections (VCG tribs per VCG)	
		VLNC50/52	VLNC35
SONET 0x1	STS-1 2way	1–12	1–3
	STS-3c 2way	1–4	1
	VT1.5 2way	1–63	1–63
SONET 1+1	STS-1 2waypr	1–12	1–3
	STS-3c 2waypr	1–4	1
	VT1.5 2waypr	1–63	1–63
UPSR	STS-1 2way	1–12	1–3
	STS-3c 2way	1–4	1
	VT1.5 2way	1–63	1–63
	STS-1 2waypr	1–12	1–3
	STS-3c 2waypr	1–4	1
	VT1.5 2waypr	1–63	1–63
SDH 0x1	VC-3 (low-order) 2way	1–12	1–3
	VC-4 2way	1–4	1
	VC-12 2way	1–63	1–63
SDH 1+1	VC-3 (low-order) 2waypr	1–12	1–3
	VC-4 2waypr	1–4	1
	VC-12 2waypr	1–63	1–63
SNCP	VC-3 (low-order) 2way	1–12	1–3
	VC-4 2way	1–4	1
	VC-12 2way	1–63	1–63
	VC-3 (low-order) 2waypr	1–12	1–3
	VC-4 2waypr	1–4	1
	VC-12 2waypr	1–63	1–63

Notes:

1. The VLNC35 circuit packs supports a total bandwidth of 8 STS1/TUG3 when used with VLNC50/52 circuit pack.
2. The *WaveStar*® CIT provides a backplane utilization report and on-demand backplane utilization optimization.

LAN ports

All LAN ports have characteristics that must be the same on all sides of a link. Some characteristics are strictly physical in nature. They can only be changed by using different equipment. Some examples of these characteristics are cable type (for example, twisted pair, fiber) and optical type (short reach, long reach). For more information about the Ethernet circuit packs, refer to [Chapter 4, “Product description”](#).

The **Configuration → Equipment** *WaveStar*® CIT command is used to provision LAN ports. For more information about the **Configuration → Equipment** command and LAN port provisioning, refer to the *WaveStar*® CIT online help.

VCG (WAN) ports

The **Configuration → Equipment** *WaveStar*® CIT command is used to provision VCG (WAN) ports. For more information about the **Configuration → Equipment** command and VCG (WAN) port provisioning, refer to the *WaveStar*® CIT online help.

The VLNC50/52 circuit pack has a single private-line LAN port with a single associated VCG. The VLNC35 circuit pack has a 6 private-line LAN ports, each with a single associated VCG. Once the first cross-connection is established to a VCG, all subsequent cross-connections must be of the same rate.

Performance monitoring

Each Ethernet port has associated performance monitoring parameters and counters. The counters are provided for incoming and outgoing frames. For more information, refer to [“Ethernet performance monitoring parameters” \(p. 5-81\)](#) in [Chapter 5, “Operations, administration, maintenance, and provisioning”](#).

Ethernet services configurations

Ethernet services configurations

Alcatel-Lucent 1850 TSS-5 supports the Ethernet over SONET/SDH services on the VLNC50/52 and VLNC35 circuit packs, as shown in the following table.

Table A-9 Supported Ethernet services

Service	VCGs (per Circuit Pack)	Ethernet Ports	SONET/SDH Capacity	Tagging Mode	Ethernet Forwarding (Switching) based on
Private Line	1 Private Line per VCG VCAT, with or without LCAS	Dedicated	Dedicated	Private Line (No tag)	No Ethernet switching. Point-to-Point connection is pre-configured.

The following table shows the typical Ethernet service configurations.

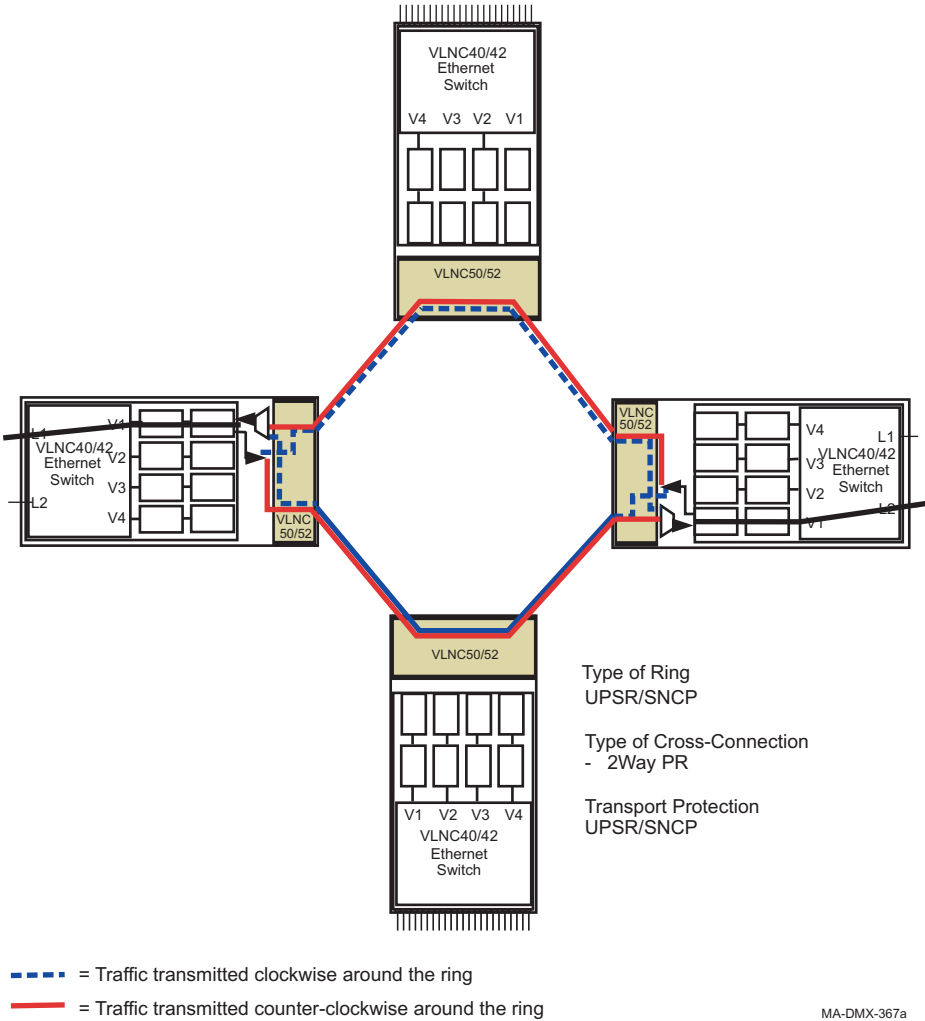
Table A-10 Typical Ethernet service configurations

Service	Protection		Cross-Connection Type
	SONET/SDH	Spanning Tree	
Private Line	UPSR/SNCP	Not Allowed	2wayPR
Private Line	UPSR/SNCP	Not Allowed	2way
Private Line	1+1	Not Allowed	2wayPR
Private Line	0x1	Not Allowed	2way

Private Line service

Private Line service is a point-to-point service with two dedicated LAN ports and dedicated SONET/SDH capacity. Because it is a point-to-point service, spanning tree protection is not used. Protection is provided at the SONET/SDH layer by UPSR/SNCP and 1+1.

Figure A-8 Ethernet Private Line service over protected UPSR/SNCP



Circuit emulation service over packet (CESoP)

Overview

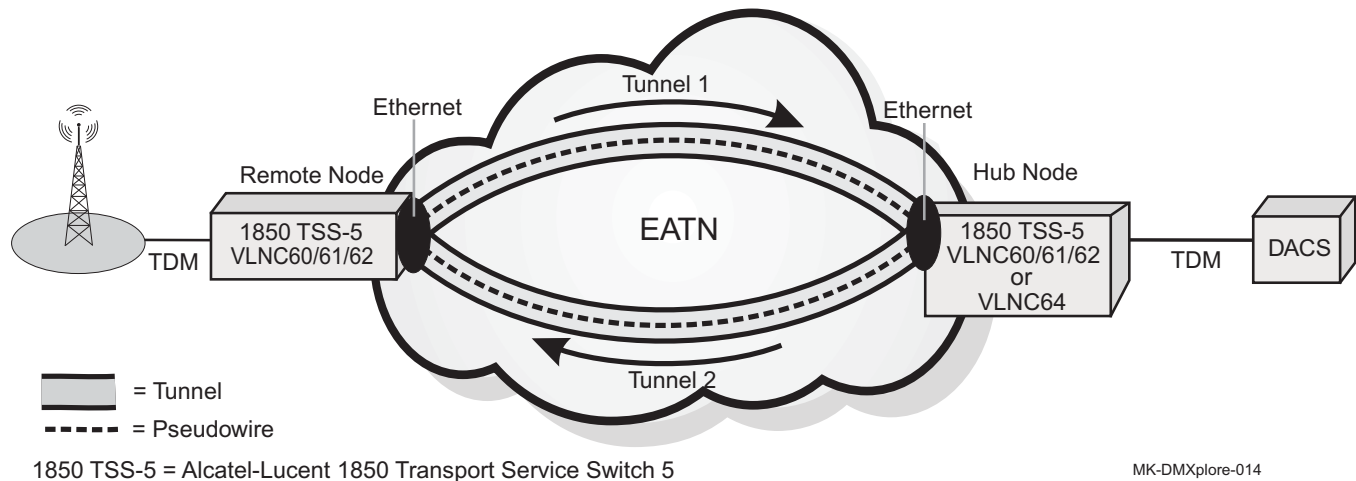
Circuit Emulation is required to preserve the context and nature of a circuit over a packet network. Backhaul networks are moving from circuit switched to packet-based (Ethernet, IP/MPLS) network transport. However, service providers have to preserve investments in the network equipment. The Alcatel-Lucent 1850 TSS-5 with a VLNC60/VLNC61/VLNC62/VLNC64 circuit pack provides the ability to handle TDM services using the pseudowire technology over an Ethernet network. The Alcatel-Lucent 1850 TSS-5 provides interfaces to connect to the existing network equipment to backhaul the traffic over a packet network.

For specific configuration information and CLI command information see the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide*.

Pseudowire architecture

The VLNC60/61/62 circuit pack supports DS1/E1 access interfaces and Ethernet trunk interfaces. The VLNC64 circuit pack supports a channelized OC-3/STM-1 interface and Ethernet trunk interfaces. The VLNC60/VLNC61/VLNC62/VLNC64 circuit pack can connect directly to the EATN, or can connect through a VLNC40/42/42B Ethernet Aggregator circuit pack. When the VLNC60/VLNC61/VLNC62/VLNC64 circuit pack is connected to a VLNC40/42/42B the trunk interfaces interact as if the VLNC60/VLNC61/VLNC62/VLNC64 circuit pack is connected to a standard Ethernet switch or an IP router. No proprietary protocols/messaging is used on the data path. If the VLNC60/VLNC61/VLNC62/VLNC64 circuit pack and VLNC40/42/42B are in the same shelf, backplane GbE interfaces can be used between the two circuit packs.

The VLNC60/VLNC61/VLNC62/VLNC64 circuit pack supports Structure Agnostic Transport over Packet (SAToP) pseudowire (RFC 4553). Each physical DS1/E1 interface is associated with a single pseudowire. The pseudowire is associated with a pair of unidirectional tunnels, configured between shelves, as a link between the DS1/E1 interfaces on those shelves. In Unstructured Emulation Mode, the VLNC60/VLNC61/VLNC62/VLNC64 circuit pack treats the data on the incoming pseudowire interface as if it were unstructured. All signalling CAS, CCS is carried in-band without knowledge of the signalling protocol itself.



Pseudowire operation

TDM frames are sent over the packet network encapsulated in RFC 4553 format. The Real-time Transport Protocol (RTP) header is always included in the encapsulated packet. Because the packet network is asynchronous, RTP packets with TDM payloads may not arrive in sequence, or in synchronization with SONET timing. Packets are resequenced, if needed, using a control word in the RTP header, and placed in a de-jitter buffer so that their TDM payloads can be synchronized, and delivered to the DACS. Alcatel-Lucent 1850 TSS-5 shelves at either end of an EATN are synchronized using differential clock recovery.

Differential clock recovery is based on SRTS (Synchronous Residual Time Stamp) requires a common clock between the 2 devices doing Circuit Emulation Function. IEEE 1588v2 (pending ratification) is a protocol used to supply clocks across an Ethernet network. It ensures that the clock on the 2 IWFs are in sync. RTP used to carry time stamps through the network. Clock recovery is done on a per pseudowire basis. Each DS1/E1 can be asynchronous to other DS1/E1 signals on the same shelf. On the VLNC64, the DS1/E1 signals can be grouped in up to 28 different differential timing domains.

Refer to [“Synchronization features” \(p. 2-20\)](#) for more information about Differential Timing Domain.

The following illustration shows how timing is accomplished across the packet network using IEEE 1588 protocol.

The activities that take place, from right to left are:

- The DACS BITS input is used as the main clock source, and this clock is supplied to the VLNC60/VLNC61/VLNC62/VLNC64 circuit pack at the DACS end.
- The 1588 protocol is used to transfer synchronization messages to the remote VLNC60/VLNC61/VLNC62/VLNC64 circuit pack via the EATN.
- The VLNC60/VLNC61/VLNC62/VLNC64 circuit pack uses differential clock recovery to generate T1/E1 towards the base transceiver stations (BTS), using 1588 protocol and RTP.
- The BITS derives clock from one of the incoming TDM signals (Loop timed)

Figure A-9 Example of pseudowire timing



----- = 1588 protocol

1850 TSS-5 = 1850 Transport Service Switch 5

MK-DMXplore-015

QoS

Depending on the header (P bits for VLAN, EXP for MPLS), the VLNC60/VLNC61/VLNC62/VLNC64 circuit pack supports QoS marking on a per-pseudowire basis. Intermediate devices in the EATN must honor this marking in order to ensure end to end QoS. The QoS mapping is can be configured. Each DS1/E1 port can be provisioned to map to a p bit or EXP.

Jitter management

The VLNC60/VLNC61/VLNC62/VLNC64 circuit pack provides de-jitter buffers that can be configured for each pseudowire. The de-jitter buffers absorb the jitter introduced in the packet network and stabilize data towards the TDM interface. The jitter buffer value can be configured.

Protection for pseudowires

Bi-directional forwarding detection (BFD) is a network protocol that provides low-overhead method of detecting faults across media that does not support failure detection, like asynchronous messaging across Ethernet. Alcatel-Lucent 1850 TSS-5 uses BFD to monitor the integrity of MPLS tunnels between shelves. Duplicate pairs of unidirectional MPLS tunnels with associated pseudowires can be configured to provide two bi-directional links using different paths between Alcatel-Lucent 1850 TSS-5 shelves. One pair of tunnels can carry the active pseudowire and its traffic, while the other pair of tunnels serve as a backup. BFD is configured on each tunnel. If the BFD detects a failure or and RFI, the VLNC60/VLNC61/VLNC62/VLNC64 circuit pack directs all pseudowire traffic onto the backup tunnel.

Note: Prior to Release 6.0, the protection switching time of Circuit Emulation pseudowires was in the range of 600 msec to 5 sec. Beginning in Release 6.0, tunnel failure detection is now in tens of milliseconds.

MEF-8

In order to support a Metro Ethernet Forum 8 (MEF-8) based circuit emulation service, the user can specify an option for the mode of Circuit Emulation Service on the pack, either MPLS or Ethernet. If MPLS is selected, then the circuit emulation service is based on RFC 4553. If Ethernet is selected, then the circuit emulation service is based on MEF-8. The VLNC60/VLNC61/VLNC62/VLNC64 circuit pack cannot support mixed transport modes (RFC 4553 and MEF-8) simultaneously. If the mode of circuit emulation service is changed (from MPLS to Ethernet, or Ethernet to MPLS, all existing configurations are cleared and the pack is reset. Alcatel-Lucent 1850 TSS-5 can connect to either an MPLS network or a Metro Ethernet network; Alcatel-Lucent 1850 TSS-5 cannot connect to both simultaneously.

Ethernet mode (MEF-8)

In the Ethernet mode, PSN Tunnel requires an endpoint which is based on an Ethernet MAC address. The PWEs transported in Ethernet mode will have an Ethertype of 0x88d8. In the Ethernet mode, there is no UPSR/SNCP-like protection solution for the PWEs and end-to-end protection via BFD is not supported. If there is physical failure on Ethernet port that supports the PSN Tunnel, the PWE switches to the backup PSN Tunnel.

Ethernet mode specifies a differential timestamp frequency of 25 MHz. By default, the frequency for differential timestamp on the VLNC60/61/62/64 packs is 77.76 MHz. Beginning in Release 5.1, the packs support 25 MHz frequency as well.

Note: The VLNC64 must be Series 1:2 (S1:2) or later, to support the 25 MHz frequency.

ML-PPP termination

Overview

At many base transceiver stations (BTS), T1/E1 Layer-1 technology is used to transport wireless voice and data between the BTS and the servers at the Mobile Switching Center (MSC). User traffic and signaling are multiplexed onto common DS1/E1 signals and the IP layer is used to route packets for the desired MSC server.

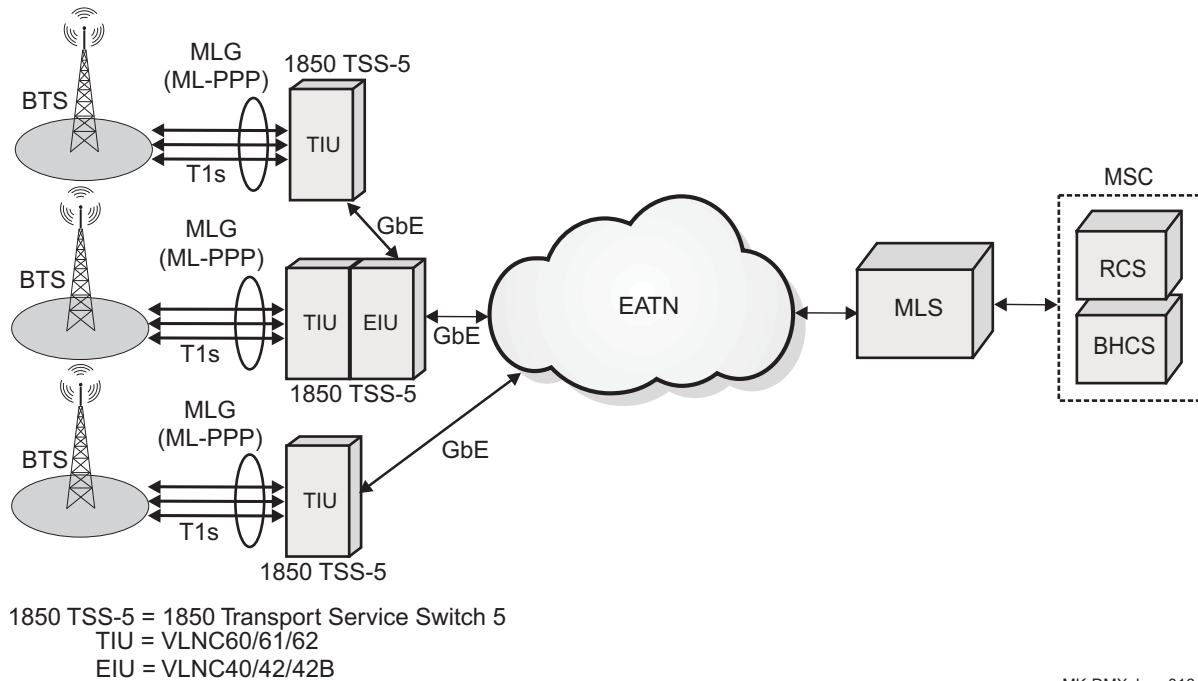
The layer 2 protocol used for IP backhaul by the BTS URCs is Multi-Link PPP over one or more DS1/E1 signals. Each URC at the BTS uses a group of T1/E1s (typically 1–4) that is treated as a single bandwidth pipe called a Multilink Group (MLG). Traffic is bundled, fragmented, and prioritized to maximize the throughput while minimizing voice delay and jitter. Since each link requires a unique IP address, bundling of DS1/E1 signals into MLGs minimizes the number of IP addresses required by a BTS and also provides the ability to aggregate bandwidth.

The Alcatel-Lucent 1850 TSS-5 VLNC60/61/62 ML-PPP termination feature supports the IP backhaul application by reducing the frame overhead and off-loading the MLSSs. The VLNC60/61/62 terminates the ML-PPP session and transmits the IP traffic directly over the packet network using Ethernet 802.1Q encapsulation. It interworks between the DS1/E1 ML-PPP links from the BTS Universal Radio Controller (URC) and Ethernet links running 802.1Q encapsulation towards the MSCs.

For specific configuration information and CLI command information see the *Alcatel-Lucent 1850 Transport Service Switch (TSS-5) Command Line Interface Guide*.

ML-PPP termination architecture

Alcatel-Lucent 1850 TSS-5 supports up to 8 MLGs per VLNC60/62 and up to 16 MLGs per VLNC61. On the VLNC60/62, up to 8 T1/E1 ports can be aggregated onto a single MLG. On the VLNC61, up to 16 T1/E1 ports can be aggregated onto a single MLG. ML-PPP links within the MLGs are terminated on the VLNC60/61/62 installed in the Alcatel-Lucent 1850 TSS-5. The VLNC60/61/62 can connect directly to the EATN, or traffic from multiple shelves with VLNC60/61/62s can be aggregated through a shelf with a VLNC40/42/42B installed.



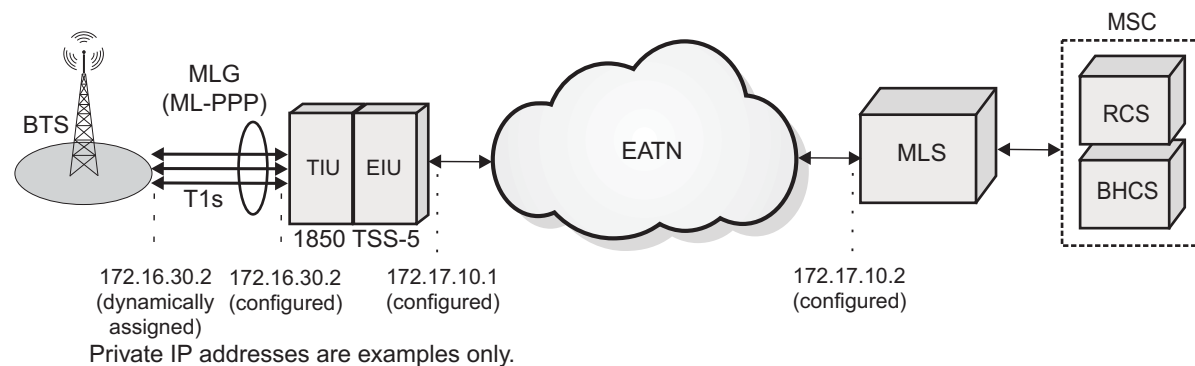
Address assignment

Each MLG can be configured with a single local IP address on the VLNC60/61/62. The VLNC60/61/62 will assign a remote IP address to the MLG at the BTS, based on the locally configured IP address and a user configured offset value. Remote IP address assignment is dynamically communicated using the IPCP IP Address Option during ML-PPP link initialization. VLNC60/61/62 also assigns the addresses of a pair of OA servers, known as Backhaul Connection Servers (BHCS) at the MSC to each BTS URC, via IPCP extensions RFC 1877. This is done so that BTS URC can communicate with MSC RCS, because neither has knowledge of the others address.

This takes place in the following way:

1. The BTS URC sends an address query to the RCS containing its own address.
2. The BHCS replies with the RCS address
3. The BTS can then initiate connection with RCS

Important! There is one set of primary/backup BHCS addresses per VLNC60/61/62 for all MLGs.



1850 TSS-5 = 1850 Transport Service Switch 5
 TIU = VLNC60/61/62
 EIU = VLNC40/42/42B

MK-DMXplore-017

Capacities

The following table describes the capacities of the VLNC60/61/62 for IP backhaul.

Table A-11 IP backhaul capacities

VLNC60/61/62 item	Maximum size
MLGs	8 (VLNC60/62)
	16 (VLNC61)
DS1/E1 signals per MLG	8 (VLNC60/62)
	12 (VLNC61)
Classes per MLG	4
IP routes	128
ARP entries	32
L3 ACLs	64
	128
L2 ACLs	64
VLANs	32
Fragment Map Profiles	8 (VLNC60/62)
	16 (VLNC61)

Layer 2 control protocol tunneling

Overview

Layer 2 Control Protocols (L2CPs) are used for several purposes in IEEE 802 standard networks, including link maintenance, aggregation, flow control, authentication, identity/capability discovery and management. L2CPs are also used for managing the behavior of LAN bridges, including STP/RSTP/MSTP and GARP/MRP. The VLNC40/42/42B circuit packs support L2CP tunneling. A L2CP frame is identified by the destination MAC address.

Supported protocols

Ethernet service provider LAN bridging equipment is normally prohibited (by standards) from forwarding L2CP messages/frames across the network, to other LAN segments. An Ethernet service provider's equipment is required to either participate in L2CPs with customer equipment, or discard all such L2CP frames. When a supported VLNC40/42/42B protocol is enabled on a port, software interprets customer L2CP frames of the relevant type on that port, and sends response(s) to peer NEs, as appropriate. This capability is called "peering."

Each supported protocol may be selectively disabled on an individual port. In this case, the VLNC40/42/42B simply discards (does not forward them to any other NE) received L2CP frames of the relevant type.

The VLNC40/42/42B discards any received L2CP frames associated with all unsupported protocols.

Supported protocols	Enable/Disable command
Flow Control: 802.3x ¹	storm-control flowcontrol
Spanning Tree: xSTP ¹	spanning-tree port mode
Link aggregation control: LACP ¹	port lacpmode
Link OA&M: 802.3 Clause 57	linkoam enable

Notes:

1. If this protocol is enabled on a port, you cannot enable the l2cp-tunnel command on that port.

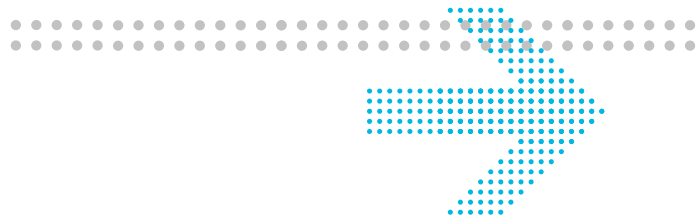
Tunneling

If a network operator wants to provide its customer a LAN segment interconnect hub service, or a direct host-to-host Ethernet interconnect service, it needs to be able to tunnel L2CP frames between customer endpoints. The Alcatel-Lucent 1850 TSS-5 VLNC40/42/42B can be configured to support this capability.

On the VLNC40, L2CP Tunneling (l2cp-tunnel) can be enabled or disabled on a port-by-port basis. When the mode is disabled, all the rules and characteristics described for the peering of supported protocols apply. When the l2cp-tunnel mode is enabled on a port, all customer L2CP frames/messages for supported and unsupported protocols that are received at that port are forwarded. Because the tunneled protocol is either disabled or unsupported, VLNC40/42/42B does not interpret any of the frames associated with a tunneled protocol.

L2CP Tunneling must be enabled on the terminating customer LAN/host port, as well as all Ethernet ports carrying the tunneled frames at all nodes through the network. Layer 2 control protocol tunneling may not be enabled on ports that are part of a protected Ethernet ring. Beginning in R6.0, PAUSE frames (Ethernet Flow Control) and SSM frames (Synchronous Ethernet source Management) are not tunneled.

Glossary



Symbols

μ	Microns
μm	Micrometer

Numerics

1+1 (unidirectional)

The 1+1 optical line protection switching architecture protects against failures of the optical transmit/receive equipment and their connecting fiber facility. One optical line (two fibers plus associated OLIUs on each end) is designated "service," and the other optical line is designated "protection." In the transmit direction at each end, identical signals are bridged on the service and protection lines ("dual-fed"). At each end, the receiving equipment monitors the incoming service and protection lines independently, and selects traffic from one line (the "active" line) based on performance criteria and technician/OS control. In unidirectional 1+1 both service and protection lines could be active at the same time (service in one direction, protection in the other).

1xN, 1x1

1xN protection switching pertains to circuit pack protection that provides a redundant signal path through the system (it does not cover protection switching of an optical facility; see "1+1"). In 1xN switching, a group of N service circuit packs share a single spare protection circuit pack. 1x1 is a special case of 1xN, with N=1. In 1x1 only one is active at a time.

802.1Q Mode

In 802.1Q Mode, a circuit pack can be provisioned to use an incoming frame's VLAN tag, to add a VLAN tag associated with the port for untagged frames, or to drop an incoming frame if its VLAN tagging does not meet provisioned specifications. The priority bits in an incoming frame's VLAN tag can also be used to affect the handling of the frame.

A	ABN
	Abnormal (status condition)

AC	Alternating Current
-----------	---------------------

Active

Active identifies any protected entity which is currently selected by the receiver at either end as the payload carrying signal that is currently carrying service. (See Standby).

Add/Drop Multiplexer (ADM)

The term for a synchronous network element capable of combining signals of different rates and having those signals added to or dropped from the stream.

ADM

Add/Drop Multiplexer

Administrative Unit (AU)

An information structure which provides adaptation between the higher-order path layer and the multiplexer section layer.

AGNE

Alarm Gateway Network Element

AIS

Alarm Indication Signal

Alarm

Visible or audible signal indicating that an equipment failure or significant event/condition has occurred.

Alarm Cut-Off (ACO/TST)

A button on the SYSCCTL used to silence audible alarms. Alarms can also be silenced using the **Fault** → **Alarm Cutoff** command.

Alarm Gateway Network Element (AGNE)

A defined NE in an alarm group through which members of the alarm group exchange information.

Alarm Indication Signal (AIS)

A code transmitted downstream in a digital network that shows that an upstream failure has been detected and alarmed.

Alternate Mark Inversion (AMI)

A line code that employs a ternary signal to convey binary digits, in which successive binary ones are represented by signal elements that are normally of alternating, positive and negative polarity but equal in amplitude, and in which binary zeros are represented by signal elements that have zero amplitude.

American Standard Code for Information Interchange (ASCII)

A standard 7-bit code that represents letters, numbers, punctuation marks, and special characters in the interchange of data among computing and communications equipment.

AMI

Alternate Mark Inversion

ANSI

American National Standards Institute

APS

Automatic Protection Switch

APS Channel

The signalling channel carried in the K1 and K2 bytes of the overhead on the protection line. It is used to exchange requests and acknowledgments for protection switch actions.

ASCII

American Standard Code for Information Interchange

Asynchronous Transfer Mode (ATM)

A transmission technology characterized by high bandwidth and low delay. It utilizes a packet switching and multiplexing technique which allocates bandwidth on demand.

ATM

Asynchronous Transfer Mode

AU

Administrative Unit

Auto

Automatic

Auto

One possible state of ports, lines, and channels. In this state, the port, line, or channel will automatically be put in service if a good signal is detected coming from the DSX panel.

Automatic Protection Switch

A feature that allows another source to be automatically selected and reconfigured in the event of a source failure or network change; for example, a fiber cut.

Autonomous Message

A message transmitted from the controlled Network Element to the ITM-SC which was not a response to an ITM-SC originated command.

B

B3ZS

Bipolar 3-Zero Substitution

B8ZS

Bipolar 8-Zero Substitution

Backbone Ring

A host ring.

Backout

Refers to backing out of an upgrade in progress. A backout returns a node(s) to the pre-upgrade state.

Backup

The backup and restoration features provide the capability to recover from loss of network element data because of such factors as human error, power failure, and network element design flaws.

Bandwidth

The difference in Hz between the highest and lowest frequencies in a transmission channel. The data rate that can be carried by a given communications circuit.

Baud Rate

Transmission rate of data (bits per second) on a network link.

BDFB

Battery Distribution and Fuse Bay

BER

Bit Error Rate

BFD

Bidirectional Forwarding Detection

Bidirectional Forwarding Detection (BFD)

A protocol used to improve failure detection times on Ethernet links.

Bidirectional Line

A transmission path consisting of two fibers that handle traffic in both the transmit and receive directions.

BIP

Bit Interleaved Parity

Bipolar 8-Zero Substitution (B8ZS)

A line coding technique that replaces eight consecutive zeros with a bit sequence having special characteristics accomplishing two objectives: First, this bit sequence accommodates the density requirements of the ones for digital T1 carrier; Second, the sequence is recognizable at the destination (due to deliberate bipolar violations) and is removed to produce the original signal.

Bit

The smallest unit of information in a computer, with a value of either 0 or 1.

Bit Error Rate (BER)

The ratio of error bits received to the total number of bits transmitted.

Bit Error Rate Threshold

The point at which an alarm is issued for bit errors.

Bit Interleaved Parity-N(BIP-N)

A method of error monitoring over a specified number of bits (BIP-3 or BIP-8).

BITS

Building Integrated Timing Supply

BITS clock

A BITS (Building Integrated Timing Source) clock is a clock within a central office that distributes timing to all the equipment in that central office. The BITS clock is tied to an external, stable timing source, such as a GPS (global positioning satellite).

Blocking

The state in which an Ethernet port does not participate in frame relay. The forwarding process discards received frames.

BPDU

Bridge protocol data unit

Bridge Cross-Connection

Setting up a cross-connection leg with the same input tributary as that of an existing cross-connection leg, forming a 1:2 bridge from an input tributary to two output tributaries.

Broadband

Any communications channel with greater bandwidth than a voice channel; sometimes used synonymously with wideband.

BTS

Base Transceiver Station

Byte

Refers to a group of eight consecutive binary digits.

C

C-Bit

A framing format used for DS3 signals produced by multiplexing 28 DS1s into a DS3. This format provides for enhanced performance monitoring of both near-end and far-end entities.

CC

Clear Channel

CCITT

Comité Consultatif International Télégraphique & Téléphonique
(International Telephone and Telegraph Consultative Committee)

CCITT - International Telephone and Telegraph Consultative Committee

An international advisory committee under United Nations' sponsorship that has composed and recommended for adoption worldwide standards for international communications. Recently changed to the International Telecommunications Union Telecommunications Standards Sector (ITU-TSS).

CD-ROM

Compact Disk, Read-Only Memory

CESoP

Circuit Emulation Service over Packet

Channel

A logical signal within a port. For example, for an OC-3 port, there are three STS-1 channels. See Port.

Channel State

The channel state is also referred to as the primary state of an STS-n, VT1.5, or VCN tributary. The values may be AUTO, NMON, or IS. The primary state parameter affects alarm reporting and performance monitoring.

Channel State Provisioning

A feature that allows a user to suppress reporting of alarms and events during provisioning by supporting multiple states (automatic, in-service and not monitored) for VT1.5, STS-n, VCN channels. See Port State Provisioning.

Circuit

A set of transmission channels through one or more network elements that provides transmission of signals between two points, to support a single communications path.

Circuit Emulation Service over Packet (CESoP)

Trunking TDM data between two points. This provides a method to transport T1/E1 or T3/E3 streams over an IP network.

CIT

Craft Interface Terminal

Clear Channel (CC)

A provisionable mode for the DS3 output that causes parity violations not to be monitored or corrected before the DS3 signal is encoded.

CLEI

Common Language Equipment Identifier

CLI

Command Line Interface

Client Signal Fail (CSF)

When a defect is detected in the incoming client signal, the Generic Framing Procedure uses the Client Management Frame to report Client Signal Fail to the far-end customer equipment.

CO

Central Office

Coarse Wavelength Division Multiplexing (CWDM)

Coarse wavelength division multiplexing (CWDM) is a method of combining multiple signals on laser beams at various wavelengths for transmission along fiber optic cables, such that the number of channels is fewer than in dense wavelength division multiplexing (DWDM) but more than in standard wavelength division multiplexing (WDM).

Coding Violation (CV)

A performance monitoring parameter indicating that bipolar violations of the signal have occurred.

Collocated

System elements that are located in the same location.

Command Line Interface (CLI)

The Command Line Interface (CLI) commands use either telnet-sessions (not secure) or secure shell (ssh) sessions to communicate with the VLNC40/42/42B Ethernet Aggregator, VLNC60/61/62 Circuit Emulator, and VLNC64 Circuit Emulation Mini-Hub circuit packs.

CPE

Customer Premises Equipment

CR

Critical (alarm status)

Craft Interface Terminal (CIT)

The user interface terminal used by craft personnel to communicate with a network element.

Credit Interval

The provisioned interval for adding tokens to the token bucket used by the peak information rate policer. This affects policing for all VLANs (in 802.1Q mode), all port tags (in transparent mode), and all Private line services (in Private Line or No Tag mode).

Critical (CR)

Alarm that indicates a severe, service-affecting condition.

Cross-Connect Capacity

The total bandwidth of cross-connections as measured by the bandwidth of input and output tributaries. A system with N STS-1 equivalent input tributaries and N STS-1 equivalent output

tributaries (referred to as "NxN") provides a cross-connection capacity of N STS-1 equivalents. This system could provide N one-way point-to-point cross-connections or N^2 two-way point-to-point cross-connections at the equivalent rate of STS-1.

Cross-Connection Rate

The attribute of a cross-connection that defines the constituent signal rates it can carry.

CSF

Client Signal Fail

CTS

Customer Technical Support; now known as Technical Support Services (TSS)

Cut-Through

Refers to a simple ASCII interface to an NE. It enables the user to send TL1 messages directly to the NE with no interpretation or assistance provided by the *WaveStar*® CIT.

CV

Coding Violation

CVFE

Coding Violation Far End

CWDM

Coarse Wavelength Division Multiplexing

D Data Communications Channel (DCC)

The embedded overhead communications channel in the synchronous line, used for end-to-end communications and maintenance. The DCC carries alarm, control, and status information between network elements in a synchronous network.

Data Communications Equipment (DCE)

The equipment that provides signal conversion and coding between the data terminating equipment (DTE) and the line. The DCE may be separate equipment or an integral part of the DTE or of intermediate equipment. A DCE may perform other functions usually performed at the network end of the line.

Data Terminating Equipment (DTE)

The equipment that originates data for transmission and accepts transmitted data.

dB

Decibels

DC

Direct Current

DCC

Data Communications Channel

DCE

Data Communications Equipment

Default Provisioning

The parameter values that are preprogrammed as shipped from the factory.

Demultiplexing

A process applied to a multiplexed signal for recovering signals combined within it and for restoring the distinct individual channels of these signals.

DEMUX

Demultiplexer

DEMUX - Demultiplexer

The DEMUX direction is from the fiber toward the DSX.

DHCP

Dynamic Host Configuration Protocol

Digital Cross-Connect Panel (DSX)

A panel designed to interconnect to equipment that operates at a designated rate. For example, a DSX-3 interconnects equipment operating at the DS3 rate.

Digital Multiplexer

Equipment that combines time-division multiplexing several digital signals into a single composite digital signal.

Digital Signal Levels 0, 1, 3 (DS0, DS1, DS3)

An ANSI-defined signal or service level corresponding to the following: DS0 is 64 Kb/s, DS1 is 1.544 Mb/s (equivalent to T1), and DS3 is 44.736 Mb/s (equivalent to 28 T1 channels or T3).

Directory Services Network Element (DSNE)

A designated network element that is responsible for administering a database that maps network element names (TIDs) to addresses (NSAPs - network service access points) in an OSI subnetwork. There can be one DSNE per ring. Can also be a GNE.

Disable admin

An Ethernet port that does not participate in the spanning tree. The port is disabled by management.

Disable failure

A port in this state does not participate in the spanning tree. The port is disabled due to a hardware or software failure.

DLC

Digital Loop Carrier

DS1

Digital Signal Level 1

DS3

Digital Signal Level 3

DS3 Format

Specifies the line format of a DS3 interface port, such as M23 or C-bit parity.

DSLAM

Digital Subscriber Line Access Multiplexer

DSNE

Directory Services Network Element

DSX

Digital Cross-Connect Panel

DTE

Data Terminating Equipment

E E1

E1 is an SDH/PDH (Synchronous Digital Hierarchy/Pleiosynchronous Digital Hierarchy, the European equivalent of SONET/DSx) electrical signal comparable to (but slightly faster than) a DS1. E1 is also sometimes called CEPT-1 (Conference of European Posts and Telecommunications) and is at 2.048 Mbps.

EATN

Ethernet Access Transport Network

ECI

Equipment Catalog Item

EEPROM

Electrically-Erasable Programmable Read-Only Memory

EIA

Electronic Industries Association

EIU

Ethernet Interface Unit

Electromagnetic Compatibility (EMC)

A measure of equipment tolerance to external electromagnetic fields.

Electromagnetic Interference (EMI)

High-energy, electrically induced magnetic fields that cause data corruption in cables passing through the fields.

Electronic Industries Association (EIA)

A trade association of the electronic industry that establishes electrical and functional standards.

Electrostatic Discharge (ESD)

Static electrical energy potentially harmful to circuit packs and humans.

EMC

Electromagnetic Compatibility

EMI

Electromagnetic Interference

EOOF

Excessive Out of Frame

EPORT

Ethernet port

EPROM

Erasable Programmable Read-Only Memory

EQ

Equipped (memory administrative state)

EQPT

Equipment

Equipment Catalog Item (ECI)

The bar code number on the faceplate of each circuit pack used by some inventory systems.

ERP

Ethernet Ring Protection

Errored Seconds (ES)

A performance monitoring parameter.

ES

Errored Seconds

ESD

Electrostatic Discharge

ESF

Extended Super Frame

EVC

Ethernet Virtual Connection

Event

A significant change. Events in controlled Network Elements include signal failures, equipment failures, signals exceeding thresholds, and protection switch activity. When an event occurs in a controlled Network Element, the controlled Network Element will generate an alarm or status message and send it to the management system.

Extended Superframe Format (ESF)

A T1 format that uses the framing bit for non-intrusive signaling and control. A T1 frame is sent 8,000 times a second, with each frame consisting of a payload of 192 bits, and with each frame preceded by a framing bit. Because ESF only requires 2,000 framing bits for synchronization, the remaining 6,000 framing bits can be used for error detection.

F Facility

A one- or two-way circuit that carries a transmission signal.

Facility Loopback

A facility loopback is where an entire line is looped back.

Facility Roll

The disconnection of the circuit cross-connecting input tributary to an output tributary followed, within the required completion time, by a cross-connection of an input tributary to an output tributary.

Failures in Time (FIT)

Circuit pack failure rates per 10^9 hours as calculated using the method described in Reliability Prediction Procedure for Electronic Equipment, *Telcordia*® Method I, Issue 5, September 1995.

Far End (FE)

Any other network element in a maintenance subnetwork other than the one the user is at or working on. Also called remote.

Far End (FE)

Any other network element in a maintenance subnetwork other than the one the user is at or working on. Also called remote.

Far End Alarm and Control (FEAC)

The FEAC data link is used by the channelized, cbit framed, b-3 DS3 port of the VLNC50/52 circuit pack to transmit a subset of FEAC codewords defined in ANSI T1.107. FEAC requested DS1 and DS3 loopbacks requests may also be accepted for the DS3 line, individual constituent DS1 signals, or all constituent DS1 signals simultaneously.

Fault

Term used when a circuit pack has a hard (not temporary) fault and cannot perform its normal function.

Fault Management

Collecting, processing, and forwarding of autonomous messages from network elements.

FCC

Federal Communications Commission

FE

Fast Ethernet

FE ACTY

Far End Activity

FEAC

Far End Alarm and Control

FEBE

Far End Block Error

FEPROM

Flash EPROM

File Transfer and Access Management (FTAM)

FTAM is the Open Systems Interconnection (OSI) standard for file transfer, file access, and file management.

FIT

Failures in 10^9 hours of operation.

Flash EPROM

A technology that combines the nonvolatility of EPROM with the in-circuit reprogrammability of EEPROM (electrically-erasable PROM).

Forced

Term used when a protected entity (either working or protection) has been locked into a service-providing state by user command.

Forced Switch to Protection

The *WaveStar*® CIT command that forces the protection group to be the "Active Unit." The clear command is required to remove the Forced Switch state. While in the Forced Switch state the system may not switch the active unit either automatically, by means of the *WaveStar*® CIT Forced Switch, or Manual Switch command.

Forwarding

The state in which an Ethernet port participates in frame relay.

Free Running

An operating condition of a clock in which its local oscillator is not locked to an external synchronization reference and is using no storage techniques to sustain its accuracy.

FTAM

File Transfer and Access Management

FTAM-FTP Gateway

This is also referred to as file transfer translation device (FTTD). The FTTD translates FTAM over OSI presentation to FTP over TCP/IP.

G GARP

Generic Attribute Resolution Protocol

Gateway Network Element (GNE)

A network element that passes information between other network elements and management systems through a data communication network.

GB

Gigabytes

Gb/s

Gigabits per second

GbE

Gigabit Ethernet

Generic Framing Procedure (GFP)

The Generic Framing Procedure, described in ITU-T G.7041/Y1303, provides a generic mechanism to adapt traffic from higher-layer client signals over a SONET/SDH network.

GFP

Generic Framing Procedure

GHz

Gigahertz

GMRP

GARP Multicast Registration Protocol (based on GARP)

GNE

Gateway Network Element

GR-XXX

Telcordia® General Requirement-XXX

GUI

Graphical User Interface

H Hashed FTP

The hashed FTP (digital signature) capability prevents tampering with a downloadable software image.

Holdover

An operating condition of a network element in which its local oscillator is not locked to any synchronization reference but is using storage techniques to maintain its accuracy with respect to the last known frequency comparison with a synchronization reference.

Hz

Hertz

I I/O

Input/Output

IAO LAN

Intraoffice Local Area Network

ID

Identifier

IEC

International Electrotechnical Commission

IEEE

Institute of Electrical and Electronics Engineers

In-Service (IS)

A memory administrative state for ports. IS refers to a port that is fully monitored and alarmed.

INC

Integrated Network Controller

Intermediate Reach (IR)

A term used to describe distances of 15 to 40 km between optical transmitter and receiver without regeneration. See long reach.

IP

Internet Protocol

IP-BH

IP Backhaul

IR

Intermediate Reach

IS

In Service

ISDN

Integrated Services Digital Network

ISO

International Standards Organization

ISP

Internet Service Provider

J Jitter

Timing jitter is defined as short-term variations of the significant instants of a digital signal from their ideal positions in time.

Jumbo frame

Jumbo frames increase network efficiency by reducing the number of frames to be processed.

K Kb/s

Kilobits per second

L L2CP

Ethernet Layer 2 Control Protocol

LAN

Local Area Network

LAPD

Link Access Procedure "D"

LBC

Laser Bias Current

LBO

Lightguide Build Out

LCAS

Link Capacity Adjustment Scheme

LCN

Local Communications Network

LCP

Link Control Protocol

LEC

Local Exchange Carrier

LED

Light-Emitting Diode

LFD

Loss of Frame Delineation

LGX

Lightguide Cross-Connect

Light Emitting Diode (LED)

Used on a circuit pack faceplate to show failure (red) or service state. It is also used to show the alarm and status condition of the system.

Lightguide Build-Out (LBO)

An attenuating (signal-reducing) element used to keep an optical output signal strength within desired limits.

Lightguide Cross-Connect (LGX)

A device that contains ports for optical fiber connections to an optical network element (NE). An LGX is used to make and change connections to an NE without changing the cabling on the NE itself.

Line

A transmission medium, together with the associated equipment, required to provide the means of transporting information between two consecutive network elements. One network element originates the line signal; the other terminates it.

Line Timing

The capability to directly derive clock timing from an incoming OC-N signal while providing the user the capability to provision whether switching to an alternate OC-N from a different source (as opposed to entering holdover) will occur if the OC-N currently used as the timing reference for that NE becomes unsuitable as a reference.

Link Capacity Adjustment Scheme (LCAS)

LCAS is an enhancement to SONET/SDH Virtual Concatenation that allows adding or removing Virtual Concatenation Group (VCG) members, to vary its bandwidth, by management command. It also automatically removes and restores failed members.

Listening

The state in which an Ethernet port is preparing to participate in frame relay. In the listening state, frame relay is disabled. This is an interim state between blocking and learning.

LOA

Loss of Alignment

Local

See Near-End.

Local Area Network (LAN)

A communications network that covers a limited geographic area, is privately owned and user administered, is mostly used for internal transfer of information within a business, is normally contained within a single building or adjacent group of buildings, and transmits data at a very rapid speed.

LOF

Loss of Frame

Long Reach (LR)

A term used to describe distances of 40 km or more between optical transmitter and receiver without regeneration. See Intermediate Reach.

Loopback

Type of diagnostic test used to compare an original transmitted signal with the resulting received signal. A loopback is established when the received optical or electrical external transmission signal is sent from a port or tributary input directly back toward the output.

LOP

Loss of Pointer

LOS

Loss of Signal

Loss of Alignment (LOA)

One or more STS-1s that compose a VCG are out of multiframe alignment because of excess delay difference.

Loss of Frame (LOF)

A failure to synchronize to an incoming signal.

Loss of Frame Delineation (LFD)

Lack of sufficient bandwidth that is reported when there is a mismatch in the number of STS tributaries.

Loss of Pointer (LOP)

A failure to extract good data from an STS-n/VCN payload.

Loss of Signal (LOS)

The complete absence of an incoming signal.

LPBK

Loopback

LR

Long Reach

M Major

Indicates a service-affecting failure, main or unit controller failure, or power supply failure.

MB

Megabytes

Mb/s

Megabits per second

MEF

Metro Ethernet Forum (a standards body)

Minor (MN)

Indicates a non-service-affecting failure of equipment or facility.

Miscellaneous Discrete Interface

Allows an operations system to control and monitor equipment collocated within a set of input and output contact closures.

MLG

Multilink Group

MLPPP

Multilink Point-to-Point Protocol

MM

Multimode

MN

Minor Alarm

MS

Multiplex Section

Mult

Multipling

Multi-link Point-to-Point Protocol (ML-PPP)

Multi-link Point-to-Point Protocol (ML-PPP) with Multi-class extension is a standards based layer 2 protocol used to transmit data over a group of serial point-to-point links which are treated as a single aggregated pipe.

Multilink Group (MLG)

Multilink Group (MLG) interface is used to aggregate T1 bandwidth and provide a single routing entity for the bundle in Multi-link Point-to-Point Protocol applications.

Multiplexer

A device (circuit pack) that combines two or more transmission signals into a combined signal on a shared medium.

Multiplexing

The process of combining multiple signals into a larger signal at the transmitter by a multiplexer. The large signal is then split into the original smaller signals at the receiver by a demultiplexer.

MUX

Multiplex

N NA

Not Applicable

NE

Near End

NE

Network Element

NE ACTY

Near-End Activity

Near End

The network element the user is at or working on. Also called local.

NEBS

Network Equipment-Building System

Network Element (NE)

A node in a telecommunication network that supports network transport services and is directly manageable by a management system.

Network Element (NE)

The basic building block of a telecommunications equipment within a telecommunication network that meets SONET/SDH standards. Typical internal attributes of a network element include: one or more transmission ports, built-in intelligence, synchronization and timing capability, and access interfaces for use by technicians and/or operation systems. In addition, a

network element may also include a timeslot interchanger.

Network Service Access Point (NSAP) Address

Network Service Access Point Address (used in the OSI network layer 3). An automatically assigned number that uniquely identifies a Network Element for the purposes of routing DCC messages.

Network Time Protocol

Network time protocol is an easy, accurate, and automatic method to get and synchronize date/time.

nm

Nanometer (10^{-9} meters)

NMA

Network Monitoring and Analysis

NMON

Not Monitored (provisioning state)

NNI

Network-Network Interface

No Request State

This is the routine-operation quiet state in which no external command activities are occurring.

Node

A network element in a ring or, more generally, in any type of network. In a network element supporting interfaces to more than one ring, node refers to an interface that is in a particular ring. Node is also defined as all equipment that is controlled by one system controller. A node is not always directly manageable by a management system.

Non-Revertive Switching

In non-revertive switching, an active and standby line exist on the network. When a protection switch occurs, the standby line is selected to support traffic, thereby becoming the active line. The original active line then becomes the standby line. This status remains in effect even when the fault clears. That is, there is no automatic switch back to the original status.

Non-Volatile Memory (NVM)

Memory that retains its stored data after power has been removed. An example of NVM would be a hard disk.

Not Monitored (NMON)

A provisioning state for equipment that is not monitored or alarmed.

NR

Not Reported

NRZ

Nonreturn to Zero

NSA

Not Service Affecting

NSAP Address

Network Service Access Point Address (used in the OSI network layer 3)

NTF

No Trouble Found

NTP

Network time protocol

NVM

Non-Volatile Memory

O

OAM&P

Operations, Administration, Maintenance, and Provisioning

OAMPDU

Operations, Administration and Maintenance Protocol Data Unit

OC, OC-n - Optical Carrier

The optical signal that results from an optical inversion of an STS signal; that is, OC-1 from STS-1 and OC-n from STS-n.

OC-12

Optical Carrier, Level 12 Signal (622.08 Mb/s)

OC-3

Optical Carrier, Level 3 Signal (155.52 Mb/s)

OC-48

Optical Carrier, Level 48 Signal (2488.32 Mb/s) (2.5 Gb/s)

OI

Operations Interworking

OLIU

Optical Line Interface Unit

OMS

Optical Management System

OOF

Out of Frame

OOL

Out of Lock

OOS

Out-of-Service

Open Systems Interconnection (OSI)

Referring to the OSI reference model, a logical structure for network operations standardized by the International Standards Organization (ISO).

Operations Interface

Any interface providing you with information on the system behavior or control. These include the equipment LEDs, SYSCTL faceplate, *WaveStar*® CIT, office alarms, and all telemetry interfaces.

Operations Interworking (OI)

The capability to access, operate, provision, and administer remote systems through craft interface access from any site in a SONET/SDH network or from a centralized operations system.

Operations System (OS)

A central computer-based system used to provide operations, administration, and maintenance functions.

OPS/INE

Operations System/Intelligent Network Element

OS

Operations System

OSI

Open Systems Interconnection

OSMINE

Operations Systems Modifications for the Integration of Network Elements

OSP

Outside Plant

P

P-bit

Performance Bit

Pass Through

Paths that are cross-connected directly across an intermediate node in a ring network.

Path

A logical connection between the point at which a standard frame format for the signal at the given rate is assembled, and the point at which the standard frame format for the signal is disassembled.

Path Protection Group

The part of a cross-connection topology that is provisioned to provide path-level protection switching for all the constituent signals carried by the cross-connection. A path protection group can be identified as an entity by its logical output tributary and its cross-connection rate. A path protection group consists of one or more constituent path selectors.

PC

Personal Computer

PCMCIA

Personal Computer Memory Card International Association

PDU

Protocol Data Unit

Peak Information Rate Policer

The peak information rate policer meters packet traffic leaving the internal packet switch and going toward the SONET/SDH network. If the packets exceed the provisioned peak information rate, the packets are dropped.

Performance Monitoring (PM)

Measures the quality of service and identifies degrading or marginally operating systems (before an alarm would be generated).

PID

Program Identification

PJC

Pointer Justification Count

Plesiochronous Network

A network that contains multiple maintenance subnetworks, each internally synchronous and all operating at the same nominal frequency, but whose timing may be slightly different at any particular instant. For example, in SONET/SDH networks, each timing traceable to their own Stratum 1 clock are considered plesiochronous with respect to each other

PLL

Phase-Locked Loop

PM

Performance Monitoring

POP

Points of Presence

Port (also called Line)

The physical interface, consisting of both an input and output, where an electrical or optical transmission interface is connected to the system and may be used to carry traffic between network elements. The words "port" and "line" may often be used synonymously. "Port" emphasizes the physical interface, and "line" emphasizes the interconnection. Either may be used to identify the signal being carried.

Port Protection Group

A user provisioned association of protected optical interface ports. This association is used for line protection. The group of ports represent both a protection switching entity and also a set of lines that carry services to/from another network element. The port protection groups also determine the set of logical tributaries from and to which cross-connections can be provisioned.

Port State Provisioning

A feature that allows a user to suppress alarm reporting and performance monitoring during provisioning by supporting multiple states (automatic, in-service, and not monitored) for transmission ports.

Proactive Maintenance

Refers to the process of detecting degrading conditions not severe enough to initiate protection switching or alarming, but indicative of an impending signal fail or signal degrade defect (for example, performance monitoring).

Protection

Extra capacity (channels, circuit packs) in transmission equipment that is not intended to be used for service, but rather to serve as backup against failures.

Protection Group

A logical grouping of ports or circuit packs that share a common protection scheme, for example, UPSR/SNCP switching or 1+1 line.

PROTN

Protection

Provisioning

The modification of certain programmable parameters that define how the node functions with various installed entities. These modifications are initiated locally or remotely by either a CIT or an OS. They may arrive at the node via the IAO LAN, CIT port, or any DCC channel. The provisioned data is maintained in NVM and/or hardware registers.

PSN

Packet Switched Network

PTM

Pluggable Transmission Module

PW

Pseudowire

PWR

Power

R

RAI

Remote Alarm Indication

RAM

Random Access Memory

RDI

Remote Defect Indication

Reactive Maintenance

Refers to detecting defects/failures and clearing them.

Remote

See Far-End (FE).

Remote Defect Indication (RDI)

An indication returned to a transmitting terminal that the receiving terminal has detected an incoming section failure. [Previously called far-end-receive failure (FERF).]

Remote Network Element

Any Network Element that is connected to the referenced Network Element through either an electrical or optical link. It may be the adjacent node on a ring, or N nodes away from the reference. It also may be at the same physical location but is usually at another (remote) site.

Revertive

A protection switching mode in which, after a protection switch occurs, the equipment returns to the nominal configuration (that is, the service equipment is active, and the protection equipment is standby) after the clearing of any failure conditions that caused a protection switch to occur or after any external switch commands are reset. See Non-Revertive.

RFI

Remote Failure Indication

Ring

A configuration of nodes comprised of network elements connected in a circular fashion. Under normal conditions, each node is interconnected with its neighbor and includes capacity for transmission in either direction between adjacent nodes. Path switched rings use a head-end bridge and tail-end switch. Line switched rings actively reroute traffic over a protection line.

RPL

Ring Protection Link

RS	Regenerator Section
RSTP	Rapid Spanning Tree Protocol
RTP	Real-time Transport Protocol
RTRV	Retrieve
RU	Rack Unit
RZ	Return to Zero

S	SA	Service Affecting
	SAToP	Structure Agnostic Transport over Packet
	SD	Signal Degrade
	SDH	Synchronous Digital Hierarchy
	SEC	SDH Equipment Clock, Option 2
	SEFS	Severely Errored Frame Seconds
	Self-Healing	Ring architecture in which two or more fibers are used to provide route diversity. Node failures only affect traffic dropped at the failed node.
	Service	The operational mode of a physical entity that indicates that the entity is providing service. This designation will change with each switch action.
	SES	Severely Errored Seconds

Severely Errored Seconds (SES)

This performance monitoring parameter is a second in which a signal failure occurs, or more than a preset amount of coding violations (dependent on the type of signal) occur.

SF

Super Frame (format for DS1 signal)

SFP

Small Form-factor Pluggable

Shelf View

A graphical depiction of one shelf. Selectable objects in this view are the shelf, the slots/circuit packs, and the ports.

SID

System Identification

Slot

A physical position in a shelf for holding a circuit pack and connecting it to the backplane. This term is also used loosely to refer to the collection of ports or tributaries connected to a physical circuit pack placed in a slot.

SM

Single Mode

SMC

SONET Minimum Clock

SNCP

Subnetwork Connection Protection

SNMP

Simple Network Management Protocol

Software Backup

The process of saving an image of the current network element's databases, which are contained in its NVM, to a remote location. The remote location could be the *WaveStar*® CIT or an OS.

Software Download

The process of transferring a software generic from a remote entity to the target network element's memory. The remote entity may be the *WaveStar*® CIT or an OS. The download procedure uses bulk transfer to move an uninterpreted binary file into the network element.

SONET

Synchronous Optical NETwork

Spanning Tree Group

Nodes can be provisioned to belong to a spanning tree group. Only the nodes within that group participate in the spanning tree for the group.

SPE

Synchronous Payload Envelope

SRD

Software Release Description

Standby

Standby identifies a protected entity which is not currently selected by the receiver at either end as the payload carrying signal that is not currently carrying service. See Active.

Standing Condition

A standing condition (SC) is either an event (usually user initiated such as a switch request) or an alarm that is provisioned NA (Not Alarmed).

Status

The indication of a short-term change in the system.

STM

Synchronous Transport Module (SDH)

STM-1

Synchronous Transport Module Level 1 Signal (155 Mb/s).

STM-4

Synchronous Transport Module Level 4 Signal (622 Mb/s).

STM-n - Synchronous Transport Module Level n

The basic optical signal building block information structure that supports the SDH section layer connections.

Stratum 3 Timing Generator

The timing generator circuit pack, located in an OLIU circuit pack, that generates clock signals for distribution to the transmit circuits. It operates in the free-running, line-timing, externally times, and holdover modes.

STS, STS-n

Synchronous Transport Signal

STS-1 SPE

STS-1 Synchronous Payload Envelope

STS-1 SPE - STS-1 Synchronous Payload Envelope

A 125-microsecond frame structure composed of STS path overhead and the STS-1 payload.

STS-12c

Synchronous Transport Level 12 Concatenated Signal

STS-3c

Synchronous Transport Level 3 Concatenated Signal

STS-n - Synchronous Transport Signal

The basic building block signal with a rate of 51.840 Mb/s for an STS-1 signal and a rate of n times 51.840 Mb/s for an STS-n signal.

STU

Synchronized - Traceability Unknown

Subnetwork

A group of interconnected/interrelated Network Elements. The most common connotation is a synchronous network in which the Network Elements have data communications channel (DCC) connectivity.

Superframe Format (SF)

A DS1 framing format in which 24 DS0 timeslots plus a coded framing bit are organized into a frame which is repeated 12 times to form the superframe.

Suspend

Suspend refers to temporarily stopping an upgrade in progress.

Synchronization Messaging

SONET/SDH synchronization messaging is used to communicate the quality of network timing, internal timing status, and timing states throughout a subnetwork.

Synchronous Digital Hierarchy (SDH)

The European standard for the rates and formats that defines optical signals and their constituents.

Synchronous Network

The synchronization of transmission systems with synchronous payloads to a master (network) clock that can be traced to a reference clock.

Synchronous Optical Network (SONET)

The North American standard for the rates and formats that defines optical signals and their constituents.

Synchronous Payload

Payloads that can be derived from a network transmission signal by removing integral numbers of bits from every frame. Therefore, no variable bit-stuffing rate adjustments are required to fit the payload in the transmission signal.

Synchronous Payload Envelope (SPE)

The combined payload and path overhead of an STS-1, STS-3c, or VCN signal.

SYSCTL

System Controller (circuit pack)

SYSCTL - System Controller

The system controller circuit pack that provides overall administrative control of the terminal.

System View

A graphical depiction of the entire Network Element. Selectable objects in this view are the bays and shelves.

T T1

A carrier system that transmits at the rate of 1.544 Mbps (a DS1 signal).

T1X1 and T1M1

The ANSI committees responsible for telecommunications standards

T2

A carrier system that transmits at the rate of 6.312 Mbps (a DS2 signal).

T3

A carrier system that transmits at the rate of 44.736 Mbps (a DS3 signal).

TA

Telcordia® Technical Advisory

Target Identifier (TID)

A provisionable parameter that is used to identify a particular Network Element within a network. It is a character string of up to 20 characters where the characters are letters, digits, or hyphens (-).

TARP

Target Identifiers Address Resolution Protocol

TBD

To Be Determined

TCA

Threshold-Crossing Alert

TCP/IP

Transmission Control Protocol/Internet Protocol

TDC

TARP Data Cache

TDM

Time Division Multiplexing

Telcordia ®

Telcordia ® (formerly Bellcore) is a well-recognized telecommunications standards organization.

TFTP

Trivial File Transport Protocol

Threshold-Crossing Alert (TCA)

A message type sent from a Network Element that indicates that a certain performance monitoring parameter has exceeded a specified threshold.

Through (or Continue) Cross-Connection

A cross-connection within a ring, where the input and output tributaries have the same tributary number but are in lines opposite each other.

THz

Terahertz (10^{12} Hz)

TID

Target Identifier

Time Division Multiplexing (TDM)

A technique for transmitting a number of separate data, voice, and/or video signals simultaneously over one communications medium by interleaving a portion of each signal one after another.

Time Slot Assignment (TSA)

A capability that allows any tributary in a ring to be cross-connected to any tributary in any lower-rate, non-ring interface or to the same-numbered tributary in the opposite side of the ring.

Time Slot Interchange (TSI)

A set of nodes configured as a ring with paths established in both directions of the ring. Switching occurs per-path at the drop nodes.

TIRKS

Trunks Integrated Records Keeping System

TIU

TDM Interface Unit

TL1

Transaction Language 1

TMUX

TransMultiplexer service

TR

Telcordia ® Technical Requirement

Transaction Language One (TL1)

The permission level associated with each user login that defines which commands the user can execute.

Transparent Mode

In Transparent Mode, port tags (which are actually VLAN tags with a TPID value other than 8100hex) are used to separate traffic for different customers. A port tag is added to each incoming frame at the ingress LAN port. The port tag contains a provisionable customer ID and priority level.

Tributary

A path-level unit of bandwidth within a port, or the constituent signal(s) being carried in this unit of bandwidth, for example, an STS-1 tributary within an OC-N port.

Trivial File Transport Protocol (TFTP)

SolarWinds Trivial File Transport Protocol (TFTP) server software.

TSA

Time Slot Assignment

TSI

Time Slot Interchange

TSO

Technical Support Organization

TU (Tributary Unit)

An information structure which provides adaptation between the lower order path layer and the higher order path layer.

TUG

Tributary Unit Group

U

UAS

Unavailable Seconds

Unavailable Seconds (UAS)

In performance monitoring, the count of seconds in which a signal is declared failed or in which 10 consecutively severely errored seconds (SES) occurred, until the time when 10 consecutive non-SES occur.

UNI

User-Network Interface

Unidirectional Path-Switched Ring (UPSR)

Path-Switched rings employ redundant fiber optic transmission facilities in a pair configuration, with one fiber transmitting in one direction (for example, East) and the backup fiber transmitting

in the other direction (for example, West). If the primary ring fails, then the protection ring takes over.

UPD/INIT

Update/Intialize

UPD/INIT

A push-button on the SYSCTL faceplate.

UPSR

Unidirectional Path Switched Rings

User Privilege

Permits a user must perform on the computer system on which the system software runs.

V VAC

Volts Alternating Current

VC

Virtual Container

VCG

Virtual Concatenation Group

VDC

Volts Direct Current

Virtual LAN (VLAN)

A virtual LAN (VLAN) is a subset of a LAN. A VLAN is created by putting VLAN IDs in packets that indicate membership to a VLAN of that ID. A Local Area Network (LAN) can have multiple VLANs within it, up to the number of IDs available. Members (ports) of different VLANs do not see the traffic of VLANs of which they are not members. A port may be a member of many VLANs (LAN ports in 802.1Q mode, WAN ports). In the Transparent mode, a LAN port is typically assigned membership to a single VLAN.

In Transparent mode, VLANs are assigned to ports using Port Tag (ed-eport and ed-vcg. In 802.1Q mode, VLANs are assigned to ports using VLAN IDs (ent-vlan/ed-vlan).

A VLAN tag is the specific field of information in a packet that carries the VLAN ID number.

Virtual Switch

A virtual switch is a grouping of ports on an Ethernet switch that results in partitioning of the switch into multiple "logical" switches. A port may only be a member of one virtual switch.

Virtual Tributary (VT)

A structure designed for transport and switching of sub-STs-1 payloads. There are currently four sizes: VT1.5 (1.728 Mb/s), VT2 (2.304 Mb/s), VT3 (3.456 Mb/s), and VT6 (6.912 Mb/s).

VLAN

Virtual Local Area Network

VM

Violation Monitor

VMR

Violation Monitor and Removal

VoIP

Voice over Internet Protocol

VT

Virtual Tributary

VT-G - Virtual Tributary Group

A 9-row by 12-column SONET structure (108 bytes) that carries one or more VTs of the same size. Seven VT groups (756 bytes) are byte-interleaved within the VT-organized STS-1 synchronous payload envelope

VT1.5

Virtual Tributary 1.5 (1.728 Mb/s)

VT1.5 Tributary

A SONET logical signal with a data rate of 1.728 Mbps. In the 9-row structure of the STS-1 SPE, a VT1.5 occupies three columns. VT-structured STS-1 SPEs are divided into seven VT groups. Each VT group occupies twelve columns of the 9-row structure and, for VT1.5s, contains four VTs per group.

W

WAN

Wide Area Network

Wavelength Division Multiplexing (WDM)

A means of increasing the information-carrying capacity of an optical fiber by simultaneously transmitting signals at different wavelengths.

WDCS

Wideband Digital Cross-Connect System

WDM

Wavelength Division Multiplexing

Wide Area Network (WAN)

A communication network that uses common-carrier provided lines and covers an extended geographical area.

Wizard

A form of user assistance that automates a procedure through a dialog with the user.

Z Zero Code Suppression

A technique used to reduce the number of consecutive zeros in a line-codes signal (B3ZS for DS3 signals and B8ZS for DS1 signals).

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