Lucent Technologies
Bell Labs Innovations

WaveStar® Integrated Transport Management Subnetwork Controller (ITM-SC) Rel.10.x

Application and Planning Guide

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Notice

Every effort was made to ensure that the information in this Information Product (IP) was complete and accurate at the time of printing. However, information is subject to change. This IP describes certain hardware, software, features, and capabilities of Lucent Technologies products that may not be the same as the equipment that you have. The IP is for information purposes, and you are cautioned that it may not describe your specific equipment

Mandatory customer information

Overview EMC/ESD Safety

The EMC/ESD boundary has been defined at Rack/Subrack level. The principle is based on the “Faraday Cage” theory. If there are doors, then the doors must be closed. With every rack/subrack an ESD (electrostatic discharge) earth socket and an ESD sticker are supplied. On the Rack frame ETSI an ESD bonding point for an ESD wrist strap is present. It is mounted in a way that it’s always accessible for installation, normal operation and maintenance activity.

Wrist Strap

The wrist strap must be worn when opening the Subrack doors.

Electrostatic Sensitive Devices

The equipment described in this guide contains static sensitive devices. Electrostatic Discharge Precautions should be taken when operating or working on this equipment.

Special handling precautions apply whenever installing or removing parts of the equipment include:

- Leaving components or equipment in original packaging until required for use.
- Removing plug-in units with previously discharged hands (e.g. using grounded wrist straps connected to the ESD Bonding Point on the Cabinet).
- Returning items for repair in suitable antistatic packaging.

Trademarks

Ordering information

The order number of this document can be found on the frontpage.

Support

Technical support

Please contact your Lucent Technologies Local Customer Support Team (LCS) for technical questions about the information in this document.

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About this information product

Purpose

The Application and Planning Guide (APG) provides information about the features, the system functions, engineering rules and technical specifications of the WaveStar® Integrated Transport Management Subnetwork Controller (ITM-SC).

Reason for reissue

WaveStar® ITM-SC release 10.0, July 2002.

Safety labels

Safety guidelines are not applicable for the WaveStar® ITM-SC.

Intended audience

This Application and Planning Guide is primarily for network planners and engineers. However, it is also useful for anyone who needs specific information about the features and applications of the WaveStar® ITM-SC.

How to use this information product

The Application and Planning Guide (APG) is divided into a number of chapters. This enables readers to quickly locate the various subjects.

This guide is divided into the following chapters:

- About this information product Brief description over how to use this guide.
- Introduction A brief introduction to the WaveStar® ITM-SC by explaining its functions and its place in the network.

- Features This chapter describes the features of the WaveStar® ITM-SC, either core features or licensable features.
- Network Topologies This chapter gives examples of different network topologies, including topologies for geographic redundancy The chapter also gives information about loading network elements.
- Product Description This chapter comprises a functional description of the WaveStar® ITM-SC in terms of architecture and user interface.
- System Planning and Engineering This chapter provides rules for system planning and engineering that must be taken into account. This means the use of bridges, routers and modems.
- Ordering In this chapter brief information is given on how to order software and license keys.
- Product Support In this chapter information is provided on product training, documentation and other customer support services .
- Technical Specifications Summarizes the technical data of the product as regards interfaces and hardware requirements.
- Appendix The appendix contains examples of WaveStar® ITM-SC windows and standard compliances.
- Abbreviations and Acronyms A list of all the abbreviations and acronyms that are used in this guide.
- A glossary of all the special terms that are used in this guide.

Conventions used This guide uses the following notations

DANGER

Suggests the possibility of a personal injury

CAUTION

Suggests the possibility of service interruption

WARNING

Suggests the possibility of equipment damage or software corruption

Important! Gives supplementary information

Related documents The following documents relate to the WaveStar® ITM-SC:

- For more detailed information on the technical characteristics, features, applications, system planning and engineering of the WaveStar® ITM-SC, refer to the: APPLICATION AND PLANNING GUIDE
- For information on installation of the WaveStar® ITM-SC, refer to the: INSTALLATION GUIDE
- For information on how to give users access to the WaveStar® ITM-SC and on how to backup and restore databases, refer to the: ADMINISTRATION GUIDE
- For information on maintenance of the Network Elements when using the WaveStar® ITM-SC, refer to the: MAINTENANCE GUIDE
- For information on provisioning of the Network Elements when using the WaveStar® ITM-SC, refer to the: PROVISIONING GUIDE FOR THE NETWORK ELEMENT

- For information on corrective procedures and action tables of the WaveStar® ITM-SC, refer to: ALARM MESSAGES AND TROUBLE CLEARING GUIDE
- For information on the Data Communications Network (DCN), which is used for the management of an SDH transmission network and consists of Lucent Technologies' SDH equipment and management systems, refer to: PROVISIONING GUIDE FOR THE NETWORK ELEMENT chapter Concepts.

How to comment

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How to order

Copies of this document can be obtained from the Lucent Learning organization within Lucent Technologies, which can be found at URL http://www.lucent-info.com/

1 Introduction

Overview

Purpose This chapter provides an introduction to the WaveStar® Integrated Transport Management Subnetwork Controller ITM-SC.

Topics The main topics covered in this introduction are the position of the WaveStar® ITM-SC in the network.

□

Section: Introduction to the WaveStar® ITM-SC

Overview

Purpose The efficiency, reliability and security of communications networks have a direct impact on enterprises. The speed and efficiency of intervention in the course of events in individual parts of the network and the efficient control of individual network elements (NEs) are of crucial importance. In order to take these requirements into account Lucent Technologies has developed the WaveStar® ITM-SC. This introduction first provides an explanation of the management product range and then goes on to explain the position and capabilities of the WaveStar® ITM-SC.

□

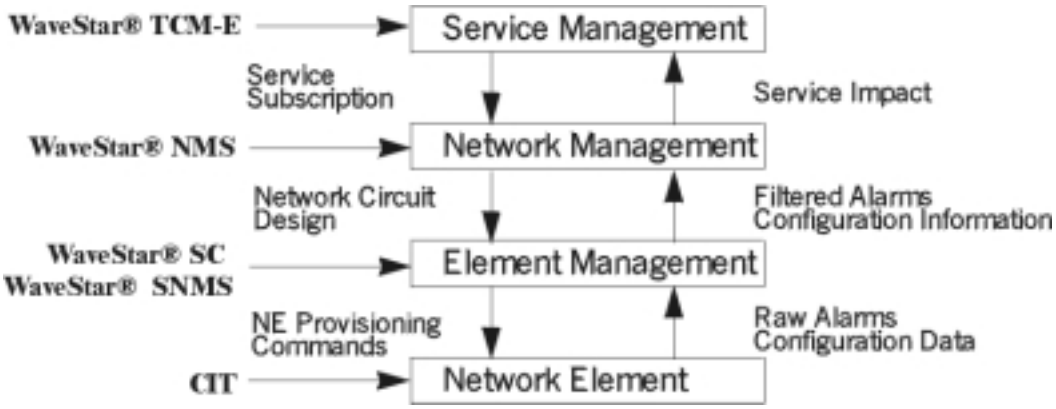
Implementation of the ITM Framework

Introduction

The Lucent Management product range complies with the telecommunications management network (TMN) building blocks. Each management module can be assigned to one of the TMN building blocks (e.g. operations system, mediation device) according to the mandatory functions performed by that module. In addition, the products of the management family can also be situated in the layering concept of the TMN framework.

Overview

Figure 1-1 The management layers in which the ITM products can be situated.



WaveStar® TCM-E

For more information on a possible architecture for WaveStar® TCM emulation, see chapter “Product Description” paragraph “TCM emulation.. The facilities which could be provided by such a system are described and the ways in which it could (in future) be further integrated within Lucent’s family of management systems are also described.

Navis™ Optical Network Management System (formerly named the WaveStar® NMS)

The Navis™ Optical Network Management System (formerly named the WaveStar® NMS) is placed in the network management layer. The Navis™ Optical Network Management System performs operations system functions: it manages an SDH network through several element management systems, each of which manage a subnetwork. An operations system can manage traffic services through the whole network and is therefore situated in the network management layer. The Navis™ Optical Network Management System has a Q-interface to the systems that manage the subnetworks. It also provides an F-interface for workstation functions.

WaveStar® ITM-SC

The WaveStar® ITM-SC is an element management system (EMS) for Lucents SDH product family as well as for WaveStar® OLS 80G and WaveStar® DACS 4/4/1. An EMS allows monitoring, (re-)configuring and provisioning of network elements within a subnetwork. It also allows to measure the performance of the subnetwork from a central point of view. An EMS also acts as a mediation device for communication between WaveStar® NMS and the managed network elements. Since an EMS manages the network elements directly and individually it is functionally located in the element management layer. The EMS has a northbound Q-interface for communication with the Navis™ Optical Network Management System. Another interface, the southbound Q-interface is provides for management of the network elements in the subnetwork. Workstation functions are supported by using the F-interface of the Navis™ Optical Element Management System.

Navis™ Optical Element Management System (formerly named the WaveStar® SNMS)

The Navis™ Optical Element Management System (formerly named the WaveStar® SNMS) is a management system for the WaveStar® product family, providing Element Management Layer (EML) management functions for the WaveStar® products. Navis™ Optical Element Management System management functions include configuration management, fault management, performance management, and security management functions. Currently the Navis™ Optical Element Management System supports the WaveStar® BandWidth Manager, the WaveStar® TDM 10G (OC-192 four fiber), the WaveStar® TDM 2.5/10G (SONET), the WaveStar® 10G (SDH), the WaveStar® LambdaRouter, theWaveStar® OLS400/800G, and the WaveStar® NCC. As additional products are introduced as part of the WaveStar® product family, it will concurrently add support for most of those products.

CIT

The Craft Interface Terminal (CIT) does not act as a mediation device or operations system. A CIT manages a network element locally by using the F-interface. Functions like alarm monitoring and configuration are performed for single network element. The CIT is a powerful tool for local activities that are associated with installing, testing and local provisioning. Workstation and operations functions are integrated in one physical system.

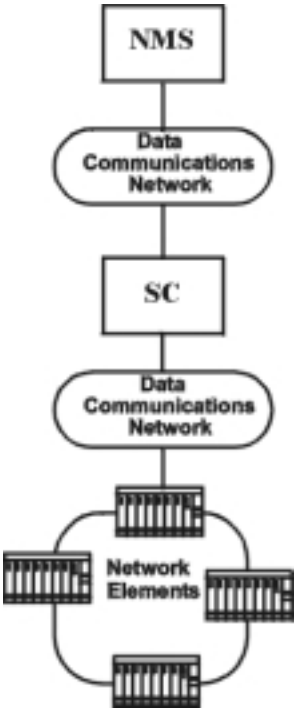
□

Capabilities of WaveStar® ITM-SC

Introduction

The WaveStar® ITM-SC is part of a telecommunications management network. It operates as an element management system for the Lucent SDH network elements. The WaveStar® ITM-SC also acts as a mediation device for smooth communication between an Navis™ Optical Network Management System and the managed network elements (NEs). The WaveStar® ITM-SC is functionally located in the element management layer.

Figure 1-2 A schematic view of the position of the WaveStar® ITM-SC within the SDH network



Capabilities provided

The WaveStar® ITM-SC can provision, configure, and monitor network elements as single entities. From one single point, the WaveStar® ITM-SC can manage the following elements:

- ISM
- SLM
- Radio Relay (RR)
- ADM 155
- PHASE (including WaveStar® LXC 16/1)
- WaveStar® ADM 4/1
- WaveStar® ADM 16/1
- WaveStar® ADM 16/1 Compact

- WaveStar® TM 1
- WaveStar® AM 1
- WaveStar® AM 1 Plus
- WaveStar® DACS 4/4/1
- WaveStar® OLS 80G

The WaveStar® ITM-SC has the flexibility of system design to manage additional types of network elements. It is also designed to manage different numbers of network elements and features on a cost effective combination of hardware platforms.

Conforms to ITU, ETSI, and ISO standards

The management capabilities of the WaveStar® ITM-SC cover the functional areas that are described by the associated ITU and ETSI standards and recommendations for SDH management systems. The system manages in accordance with the 7-layer OSI communication stack. Development of the WaveStar® ITM-SC is in accordance with ISO standard 9001.

□

2 Features

Overview

Purpose

This chapter describes the features per functional area and the features of previous and of last releases.

Functions of the WaveStar® ITM-SC

The WaveStar® ITM-SC is a centralized subnetwork management system that can provision, monitor and control network elements carrying Synchronous Digital Hierarchy (SDH) signals. The WaveStar® ITM-SC provides element-level management for high capacity telecommunications networks that employ Add-Drop Multiplexers (ADMs), Terminal-, Cross Connect-, and Line systems. More information about the functions and capabilities of the WaveStar® ITM-SC can be found in the chapters “Introduction” and “Network Topologies”. The WaveStar® ITM-SC can manage small and medium sized networks at network level. The WaveStar® ITM-SC offers a user-friendly, color graphics interface supported by point-and-click menus and forms to enable the users to easily access the management features for centralized control of SDH and optical networks.

□

Section: Features per Functional Area and Features of Previous Releases

Overview

Purpose

The features of the ITM-SC are classified in several functional areas. This chapter describes these features within each functional area.

Functional areas and previous releases

The functional areas in the Element Management Layer are:

- User support facilities
- Security issues
- Network element provisioning
- Traffic setup (configuration)
- Alarm and event handling (corrective maintenance)
- Performance monitoring (preventive maintenance)
- Diagnostic facilities
- WaveStar® ITM-SC administrator facilities
- Geographic redundancy
- WaveStar® ITM-SC services to the Network Management Layer
- Previous releases (Emerald and Topaz).

Apart from these functional areas the WaveStar® ITM-SC also provides services to the Network Management Level (NML). The main task of the Network Management Level is to allow centralized network management to provision, monitor, control and restore digital paths and circuits across a range of network elements and topologies so as to provide end-to-end interworking solutions. Specifically, the NML supports the creation, maintenance, monitoring and removal of both plesiochronous paths and SDH VC paths that are supported by the network elements. Network elements may be added and removed from the network view. Lucent Technologies Navis™ Optical Network Management System (formerly named the WaveStar® NMS) provides a complete solution for management at NML for a large range of SDH networks.

□

WaveStar® ITM-SC User Support Facilities

Introduction

A large number of capabilities facilitate the task of managing network elements via the WaveStar® ITM-SC. Apart from procedural software support facilities, the WaveStar® ITM-SC also supports the user in daily operations by means of an easy to use Graphical User Interface. This GUI provides a shelf-display of the managed NE. The (alarm) status of each piece of equipment (cards/shelves/ports) is displayed. Pieces of equipment may be addressed by point-and-click procedures. In addition, the WaveStar® ITM-SC can display a graphical picture of the cross-connect matrix, so the cross-connect connectivity can be determinated. The WaveStar® ITM-SC also provides a map on which all the NEs within the domain of the WaveStar® ITM-SC are displayed as icons. Icons are colored according to the degree of severity of the most severe alarm that has occurred. NEs may be addressed by pointing and clicking the corresponding icon.

User support facilities

The following user support facilities are available:

- 10 concurrent users are supported on a server that is running the WaveStar® ITM-SC solely
- A single user may perform operations on up to five NEs concurrently
- The WaveStar® ITM-SC user documentation is available on-line
- English is supported on GUI and keyboard.
- Special characters are also supported.
- Help facilities (context sensitive) are supported and can be loaded easily into the WaveStar® ITM-SC. Help texts contain context sensitive hyperlinks
- The operations performed are stored in the user log and can be viewed by that user and by the administrator.

□

Security Issues

Introduction

Security provides protection against unauthorized use and offers the possibility of separating tasks of individual users. Only authorized users with the correct login-id and password combination will be able to access the WaveStar® ITM-SC and the workstations. The System Administrator will be able to setup the respective privileges.

Security features

The WaveStar® ITM-SC supports the following security features:

- Every user is assigned a user class:
  - ***The Administrator*** can perform all WaveStar® ITM-SC control activities that are not related to transmission. An WaveStar® ITM-SC administrator does not have authority to retrieve or alter any transmission related data or to see the current status of the transmission network or network elements. The administrator cannot suppress transmission alarms at the WaveStar® ITM-SC. He can decide the network elements that the server is able to access. He can also configure a workstation to monitor alarms from various servers.
  - ***The Supervisor*** can perform all transmission-related tasks and retrieve and edit all data related to network elements.
  - ***The Operator*** can retrieve all data from the network elements by using the WaveStar® ITM-SC to see the current status. The operator can only view and not change the network element configuration.
  - ***The Unix user*** (referred to as not defined) is restricted in WaveStar® ITM-SC access on a network where WaveStar® ITM-SCs are configured.
- The users gain access by entering login-IDs and passwords
- The combination of ID and password determines what the user can do
- A user cannot see any features that are unavailable to him
- ID and password are checked before access to any EMS functionality is granted
- The administrator can define 5 user roles to which specific management functions and NE groups can be assigned. These management functions relate to such as alarms, equipment, traffic, or performance monitoring

- When a user is not assigned to a user role, his user class determines his privileges
- An inactive terminal is detected and locked. The users current password must be entered to unlock the terminal again.

□

Network Element Provisioning

Introduction

Network element provisioning provides an NE with all data required for proper operation. These data are stored in the database of the WaveStar® ITM-SC. The user is allowed to modify these data, after which the NE will be re-configured using the modified data. Provisioning data provide an inventory of controlled NE resource records for shelf, slot and port. Great care is taken to ensure that the data in the NE and the mirror data in the WaveStar® ITM-SC are exactly the same under all circumstances (database integrity).

NE provisioning features

The WaveStar® ITM-SC Element Manager provides the following basic network element provisioning features:

- An NE can be provided with provisioning data (name, location, type of cards, etc.). For some NE types this information may be pre-provisioned before the node actually exists, after which it can be used at node creation
- The EMS allows software images to be held for downloading into the NE for upgrade or repair. A new software image is downloaded to the non-active software image storages within the NE. Multiple NEs can be provided with software from the WaveStar® ITM-SC simultaneously. For information on support of software downloads on the different NE types the reader is referred to the product description of the NE types
- The WaveStar® ITM-SC allows a user to configure, view and modify the cards as supported by the NE. It is possible to configure more cards than can be used for traffic according to the NE transmission capabilities. With WaveStar® OLS 80G the card states can be viewed, but not configured
- The transmitted and expected path traces and signal labels can be provisioned. For PHASE and WaveStar® LXC 16/1 TU2, HPOM and LPOM functionality can be provisioned as well.
- On PHASE and WaveStar® ADM4/1 optical parameters can be reported and ALS provisioned. On WaveStar® OLS 80G the optical output power can be viewed and controlled
- The timing source can be selected as external or internal as supported by the NE type. External timing may be chosen from Line, Tributary or WaveStar® ITM-SC I (Station Clock Interface) timing blocks. Internal timing may be chosen from STM-N Line, Tributary or WaveStar® ITM-SC I timing blocks. A ″fallback″ timing source protection can be specified. The 2 MHz clock output may be enabled/disabled and its source can be specified. The timing marker can be managed as supported by the NE type.

The synchronization reference signal and the SSM (Synchronization Status Message) will be extracted from the input signal received. Defects will be processed to a “Reference Failure” condition. A subset of all possible reference sources will be connected with the timing sources (assignment). There is automatic switching between timing references that have been configured as pairs according to priority criteria. The quality levels (QL) will be determined for all timing links to be forwarded to the system timing and station clock output timing blocks. The QL of a timing link can be determined from the incoming reference SSM. The signal status will be determined for all timing links forwarded to the system timing and station clock output timing blocks. Timing events are stored in a separate file. No timing mode can be changed with WaveStar® OLS 80G.

- The Management System user can use one of two ways to provision the timing configuration in an ISM, SLM, ADM16/1, ADM16/1 Compact, TM 1, AM 1 or AM 1 Plus network element: “manually” by changing individual parameters in one of the 3 main forms (Timing Sources, System Timing, Station Clock Output Timing) or via “Timing Templates”. The Management System user can only “manually” provision the timing configuration for a PHASE or an ADM155 network element. Note that the timing templates should not be confused with the existing network element templates, which are used to provision nodes. A user can only provision the timing configuration (manually or via timing templates) for the nodes that are already provisioned. The network element templates and the pre-provisioned data inside the Management System do not contain any timing data. The result of an operation to “Provision NE from template or from Pre-Provisioned data” is to put the timing in the NE in the free running mode.
  The Timing Templates allow the user to configure the timing in a network element with a single operation. The Timing Templates are re-usable and allow the user to configure the timing in many network elements in the same way. The management system provides the user with a set of default timing templates. In addition, the user of the management system can create new timing templates and edit or delete user-created ones. Each network element type has a set of Timing Templates if it is capable of supporting them. If a user configures the timing in an NE from a Timing Template the management system will first check that the Timing Template data are all compatible with the selected NE. For example, it is not possible to assign a reference to a timing source that does not exist in the NE. This set of checks simply allows the management system to send valid

CMISE requests to valid objects/attributes. The timing template operation might still fail halfway through because of CMISE that are requests rejected by the network element. In this case, the management system does NOT proceed but displays the reason why it failed so that the user can edit the timing template or create a new one and start the operation again. Note that after a successful timing template operation in an NE, all switches are at “No Request” status, and all timing-source lockout are at “Lockout No”.
The management system provides default timing templates for the following situations:

- ISM hub node
- ISM access node
- ISM terminal
- ISM/SDH terminal
- SLM hub node in locked mode
- SLM access node in locked mode
- SLM terminal in locked mode
- SLM access node in through-timed mode
- WaveStar® ADM 16/1 protected hub
- WaveStar® ADM 16/1 access/hub
- WaveStar® ADM 16/1 timing hub
- WaveStar® ADM 16/1 access node
- WaveStar® ADM 16/1 single terminal
- WaveStar® ADM 16/1 dual terminal
- WaveStar® TM 1 terminal
- AM 1 and AM 1 Plus access node
- AM 1 and AM 1 Plus MSP terminal.

- Upon association, the WaveStar® ITM-SC checks its own Management Information Base (MIB) and the MIB in the NE. If the NEs MIB is empty the WaveStar® ITM-SC provides the NE with its MIB image automatically or on user initiation. If its own MIB is empty the WaveStar® ITM-SC automatically extracts the MIB from the NE. Discrepancies between provisioning data in the NE and its copy maintained by theWaveStar® ITM-SC are identified and automatically corrected. Following recovery after a communications breakdown the WaveStar® ITM-SC

automatically re-synchronizes with the NE. With the WaveStar® ADM 4/1, Radio Relay NEs and WaveStar® OLS 80G images of the MIB can be loaded into a local management system; these backups can be downloaded again using the same local management system.

- The WaveStar® ITM-SC allows a user to view and set equipment protection and timing protection as supported by the NE
- DCN parameters can be configured (defining NEs as gateways, IS-IS L1/L2, switching DCC channels on/off). Different levels can be used in the routing protocol of the OSI stack to obtain an hierarchical routing WaveStar® ITM-SC scheme (IS-IS-level2). This scheme enlarges the total size of the management network by dividing the OSI management network into several areas and using the extra interworking level between these areas. Moreover, an integrated management network via level 2 areas will provide a more flexible, cost effective and robust environment for accessing each network element from the WaveStar® ITM-SC.

□

Traffic Setup (Configuration)

Introduction

Traffic is setup by configuring the cross-connection fabric inside to the controlled SDH network elements. The WaveStar® ITM-SC holds records of all the cross-connect maps of the controlled NEs. The WaveStar® ITM-SC can also be used to setup transport protection WaveStar® ITM-SC schemes, which are inherent to SDH transport networks. These protection schemes ensure service availability by autonomously switching traffic to redundant bandwidth capacity in case of failure. The status of the protection schemes can be monitored this protection schemes can also be manually activated.

Configuration features

The following configuration features are supported:

- The WaveStar® ITM-SC enables the user to view and set the VC cross-connection for an NE within the range of cross-connections that the particular NE can support. By informing the NE of a specific cross-connection, paths through the NE are actually setup. Uni- and bi-directional cross connects can be configured depending on the type of NE. The user is informed of the occupied and spare (cross-connection) capacity via the graphical user interface of the WaveStar® ITM-SC.
- All user requests that are service affecting have to be confirmed
- The WaveStar® ITM-SC allows a user to view and set protection WaveStar® ITM-SC schemes as supported by the NEs.
- Where the NE supports MSP the WaveStar® ITM-SC allows a user to modify and view the MSP mode set STM lines. MSP switching may be manually activated
- With PHASE, WaveStar® ADM16/1 and, WaveStar® ADM16/1 Compact AU4 concatenation is provided by individually setting up four STM-1 connections and defining them afterwards as concatenated.

□

Alarm and Event Handling

Introduction

The status of the network element together with the status of all its components must be closely monitored to anticipate any possible degradation of the services and to enable reaction as quickly and adequately as possible to failures.

Alarm and event handling features

The Event and Alarm Surveillance features of the WaveStar® ITM-SC are as follows:

- The WaveStar® ITM-SC collects alarm/faults from each NE in its domain. For each alarm a number of attributes (type, state, date and time, location, severity, NE) are stored in a ″current active″ alarms logfile. Alarms are moved to history logfiles when they disappear. The user may choose to have current active alarms acknowledged before they can be moved to history files (so-called ″latching″)
- The user is notified of the arrival of an alarm (audio/visual notification). The alarm status of cards/shelves/ports is represented on the equipment view by color-coding the appropriate piece of equipment according to the severity of the most severe alarm that has occurred.

The color WaveStar® ITM-SC scheme used for the ITM-SC alarms is as follows:

Color	Alarm Type	Indicates that ...
Red	Prompt	There is at least one urgent alarm.
Yellow	Deferred	There is at least one non-urgent alarm and there are no urgent alarms.
Orange	Information	There are information alarms only.
Green	No alarm	There are no alarms.
Gray		No association.
Gray hollow		Geographic Redundancy protected, no association.

- The user can access alarm logs and filter and sort alarms by selecting a combination of e.g. NE, severity and state (raised, acknowledged and cleared)
- The user is can put an SDH NE in the ″lining-up″ mode. When an SDH NE is in ″lining-up″ mode no alarms are reported for that NE. This feature is especially useful when an NE is in initializing state, or otherwise generates lots of alarms due to known causes

- The user is notified when an adjustable high watermark that is pointing into the alarm log file is exceeded
- A number of alarms are forwarded to the Network Layer
- Alarm reporting can be enabled/disabled per event type for a particular NE. For PHASE and WaveStar® LXC 16/1 the alarm reporting can also be enabled/disabled per individual alarm source
- The user can view and modify the severity of each alarm type per NE type
- Configurable alarm profiles can be applied for a set of network elements
- The WaveStar® ITM-SC user can define Miscellaneous Discrete Inputs (MDIs) as supported by the NE. MDIs are typically used to detect (unusual) environmental circumstances. The severity of each MDI can be defined and a name can be allocated. MDI notifications appear as alarms. The MDI name and severity is part of the MDI (alarm) notification
- The WaveStar® ITM-SC provides control of Miscellaneous Discrete Outputs (MDOs). MDOs can be used to start-up standby equipment. The ITM-SC user may assign a descriptive string to an MDO. For PHASE and WaveStar® LXC 16/1 MDOs are not supported
- The ITM-SC has an external alarm interface called “External Alarm Presentation” through which external devices, such as a pager or an E-mail/text, can be activated by the alarms raised or acknowledged on the WaveStar® ITM-SC. The user can select alarm severity that triggers the event. This enables out-of-hours call up support (the engineer can login from home to get the ITM-SC display and read the alarms
- The ITM-SC can work closely together with the Navis™ Optical Network Management System. The information exchange between these two management systems includes node names, available ports, setting of cross-connects, PM information and alarm information
- A periodic check on unacknowledged alarms and an accompanying audible beep can be configured. This beep is different from the beep when a new alarm arrives
- The user ID and time and date are added to the alarm record when an alarm is acknowledged
- The alarm history is stored in the WaveStar® ITM-SC up to a configurable limit

- The alarm history can be written to tape, or exported as an ASCII file. This makes it possible to store/process the alarm information off-line. These alarm history archives can not be re-entered into the WaveStar® ITM-SC.
- For selected workstations the alarm summary will always be displayed, even before a user logs in at that workstation
- Double acknowledgment and forms of latching can be configured.

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Performance Monitoring (PM)

Introduction

Performance Monitoring specifies continuous monitoring of termination points within SDH equipment. This enables the administration to spot performance degradation and initiate pro-active maintenance and to monitor precisely the quality of the end-to-end paths. Performance Monitoring is implemented according to the relevant ITU-T recommendations (G.826, G.774-01).

Performing monitoring features

Performance monitoring comprises the following basic features:

- Via the graphical user interface the user can specify which counts (15 min., 24 hr bins) are to be taken from which transport facilities (VC12, MS, etc.) for which NE
- If association between the WaveStar® ITM-SC and the NE fails, the ITM-SC regains information about the lost time by reading the network element bins for the relevant interval
- The ITM-SC supports Performance Monitoring as provided by the particular SDH network elements. This includes Errored Seconds (ES), Severely Errored Seconds (SES), Unavailable Seconds (UAS) and Background Block Errors (BBE) parameters for VC12, VC3, VC4, MS and RS termination points
- The WaveStar® ITM-SC performance data log can held up to 31 days of data from the 24 hour bins and 24 hours of data from the 15 minute bins
- The user can enable/disable performance data collection
- Snapshots of counts can be inspected via current registers
- The user can print completed performance monitoring reports in tabular and graphical format. This makes it easy for the user to spot trends in performance behavior
- The user may select 1 or 2 termination points for viewing or printing. Depending on the termination point type, the user may select up to a maximum of 4 counters. The information can be displayed in tabular or graphical form. The display/printout covers 31 days from the 24 hour bins and 24 hours from the 15 minute bins
- Performance monitoring data can be written to tape in ASCII form.

PM Termination Points

Termination Points that can be selected for PM measurements:

Node type	Termination Point type	Equipment
ISM	VC-12	TPU (2 Mbit/s)
	VC-3	TPU (34 Mbit/s) [a.]
	VC-4	TPU (155 Mbit/s) [a.]
	MS-1	TPU (155Mbit/s) [a]
		LPU (155 Mbit/s)
	MS-4	LPU (620 Mbit/s) [a.]
SLM	VC-4	TPU 140
		TPU140/155 in TPU140 mode
	MS-16	LRX2.5 (Gbit/s)
	MS-4	LRX620 (620 Mbit/s)
	MS-1	TPU-155
		TPU140/155 in TPU155 mode
	RS-4	LRX620 (620 Mbit/s)
	RS-16	LRX2.5 (2.5 Gbit/s)
RR	RS-1	DEMOD
ADM155	VC-12	TPU (2 Mbit/s)
	VC-3	TPU (34 Mbit/s)
	VC-4	TPU (155 Mbit/s)
	MS-1	TPU (155 Mbit/s)
		LPU (155 Mbit/s)
ADM 4/1	VC-12	TPU (2 Mbit/s)
	VC-3	TPU (34 Mbit/s)
	VC-4	TPU (155 Mbit/s)
	MS-1	TPU (155 Mbit/s)
		LPU (155 Mbit/s)
	MS-4	LPU (620 Mbit/s)

Node type	Termination Point type	Equipment
PHASE	VC-12	TIU-1 (2 Mbit/s)
	VC-3	TIU-3 (34 or 45 Mbit/s)
	VC-4	TIU-4 (STM-1 or 140 Mbit/s, SIU-1, SIU-4, SIU-16
	MS-1	SIU-1
		SIU-1EL (electrical)
	MS-4	SIU-4
	MS-16	SIU-16
	RS-1	SIU-1
		SIU-1EL (electrical)
	RS-4	SIU-4
	RS-16	SIU-16
	TU-12	PPU1, PPU4, PPU8, PPU16
	TU-2	PPU1, PPU4, PPU8, PPU16
	TU-3	PPU1, PPU4, PPU8, PPU16
	AU-4	SIU-1, SIU-4, SIU-16, TIU-4
	AU-4/PJE	SIU-1, SIU-4, SIU-16, TIU-4
	TCM sink	CMU-1T, CMU-1(64)T
	TCM NIM	CMU-1T, CMU-1(64)T
OLS 80G	OPL	OA (1 or 2)
	OCH	OA
	OPT-IN, OPT-OUT	OTU/OTPM or OMU, ODU
	RS-1	OTU/OTPM
	RS-4	OTU/OTPM
	RS-16	OTU
	SU	TLM
TM 1	VC-12	CMB-STM1
	VC-4	CMB-STM1
	MS-1	CMB-STM-1

Node type	Termination Point type	Equipment
DACS	MS-1	PU-STM-1
	MS-4	PU-STM-4
	MS-16	PU-STM-16
	RS-1	PU-STM-1
	RS-4	PU-STM-4
	RS-16	PU-STM-16
	VC-4	PU-STM-1, PU-STM-4, PU-STM-16
	AU4-4c	PU-STM-4, PU-STM-16
	AU-4	PU-STM-1, STM-4, PU-STM-16
	VC-3	PU-STM-1, STM-4, PU-STM-16
	VC-12	PU-STM-1, STM-4, PU-STM-16

[a.] Not applicable for ISM/SDH-T

Termination Points that can be selected for PM measurements:

Node type	Termination Point type	Equipment	
		Senior	**Compact**
ADM 16/1 and ADM 16/1 Compact	VC-11	PI-DS1/63	
	VC-12	PI-E1/63	PI-E1/63
		PI-IP-LAN/8	PI-IP-LAN/8
	VC-3	PI-DS3/12, PI-E3DS3/6+6, PI-3/6, PI-DS3/6, PI-IP-LAN8	PI-IP-LAN/8
			PI-E3DS3/12
		PI-IP-LAN/2	PI-IP-LAN/2
	VC-4	SI-L4/1 (AU-3 mode)	SI-S4/1 (AU3 mode)
		SI-S4/1 (AU3 mode)	
		SI-1/4	SI-1/4
		PI-E4/4	PI-E3DS3/12
		PI-DS3/12	PI-E1/63
		PI-E3DS3/6+6	SI-L1/4
		PI-E3/6	SI-S1/4
		PI-DS3/6	SI-L4/1
		PI-E1/63	
		SA-1/4 (AU3 mode)	
		SA-1/4B (AU3 mode)	
		SA-0/12	
		CC-64/16, CC-64/16B, CC-64/32, CC-64/32B	
		SPIA-1E4/4	
		PI-IP-LAN/2	PI-IP-LAN/2
	TU-12	CC-64/32B	-
	TU-3	CC-64/32B	-
	AU4-4c	SI-L16/1	SI-S4/1
		SI-S4/1, SI-L4/1	SI-L4/1
	AU-4	SI-L16/1	SI-S4/1
		SI-S4/1, SI-L4/1	SI-L4/1
		SI-1/4	SI-S1/4
			SI-L1/4
			SI-L4/1
	MS-16	SI-16/1	SI-16/1/CC64/32
	MS-4	SI-S4/1, SI-L4/1	SI-S4/1, SI-L4/1
	MS-1	SI-1/4	SI-1/4
		SA-1/4B	SI-S11/4
		SPIA-1E4/4	SI-L1/4
	MS-0	SA-0/12	

Node type	Termination Point type	Equipment	
		Senior	Compact
	RS-16	SI-16/1	
	LAN	LAN interconnect unit	LAN interconnect unit
	WAN	LAN interconnect unit	LAN interconnect unit

Termination Points that can be selected for PM measurements:

Node type	Termination Point type	Equipment		
		AM 1	AM 1 Plus (STM-1)	AM 1 Plus (STM-4)
AM 1 family	E1		CMC-E1/16	CMC-E1/16
			CMB-STM1, CMB-STM4	CMB-STM1, CMB-STM4
			CMC-SDSL/12	
	VC-11	-	CMC-DS1/16	CMC-DS1/16
	VC-12	CMC-E1/16	CMC-E1/16	CMC-E1/16
		CMB-STM1	CMB-STM1, CMB-STM4	CMB-STM1, CMB-STM4
		CMC-10/100X21	CMC-X21/4	CMCX21/4
		CMC-10/100 (LAN interconnect)	CMC-10/100 (LAN interconnect)	CMC-10/100 (LAN interconnect)
			CMC-SDSL/12	
	VC-3	CMC-E3/2, CMC-DS3/2	CMC-E3/2, CMC-DS3/2	CMC-E3/2, CMC-DS3/2
		CMC-10/100 (LAN interconnect)	CMC-10/100 (LAN interconnect)	CMC-10/100 (LAN interconnect)
	VC-4	CMB-STM1	CMB-STM1	CMB-STM1, CMB-STM4
	MS-1	CMB-STM1	CMB-STM1	CMB-STM1, CMB-STM4, CMC-STM1
	MS-4	-	-	CMB-STM4
	LAN	CMC-10/100 (LAN interconnect)	CMC-10/100 (LAN interconnect)	CMC-10/100 (LAN interconnect)
	WAN	CMC-10/100 (LAN interconnect)	CMC-10/100 (LAN interconnect)	CMC-10/100 (LAN interconnect)

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Diagnostic Facilities

Introduction

Test Management ensures correct functioning of both the SDH NEs within the domain of the ITM-SC and of the management system itself.

Test and diagnostic features

The combination of WaveStar® ITM-SC <-> managed SDH NEs supports the following test and diagnostic functionalities:

- WaveStar® ITM-SC <-> NE communication is continually checked by the ITM-SC. The user may initiate a WaveStar® ITM-SC <->NE communication test. Any failure in communication is notified to the user. If communication is management communication is disabled, the ITM-SC tries to re-establish it in a 2 minute time interval
- Network element software contains multiple test routines which continually monitor correct behavior. If an anomaly is found an alarm is generated. If no alarm is generated, the NE is functioning correctly
- The ITM-SC monitors its own functionality in order to aid in the location of faults and to identify potential trouble spots. Any anomalies are reported to the user. The WaveStar® ITM-SC autonomously tries to re-start malfunctioning processes. The ITM-SC user may disable the autonomous monitoring process
- Where the network element supports this it is possible to enable/disable in-loops and out-loops and to insert/monitor test-patterns (VC12, 2 Mbit/s)
- Loopbacks, if supported by the network element are supported.

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WaveStar® ITM-SC Administrator Facilities

Introduction Tools are available to facilitate the task of a computer administrator.

Administrator facilities The WaveStar® ITM-SC has the following administrator facilities:

- The WaveStar® ITM-SC is equipped with software license keys that can be loaded at run time to define or amend the types and number of NEs managed by one ITM-SC. For the list of license key see, Chapter 6 section “Ordering ITM-SC software”.
- The WaveStar® ITM-SC is supplied with software tools to guide the user and simplify software loading, equipment configuration and software upgrade for the ITM-SC itself. Software upgrade procedures are not NE service affecting. Software upgrade procedures maintain database integrity over several releases. This software upgrade procedure is completed within approx. 3 minutes.
- Software tools are available to easily backup and restore the full network database (MIB images, network information, user entered information etc.). These backups can be made while the ITM-SC is running. For restores the ITM-SC has to be shut down first.
- Non-functioning of internal processes will be detected within 1 minute, shutdown and restart will then be initiated (procedure completed within 3 minutes).
- The WaveStar® ITM-SC has the means of reporting internal system errors in tracing program execution that are invisible to the normal user
- The administrator can view the system (UNIX) error log
- The administrator can adjust and set the system date and time
- Single seat database backup and restore. Database backup and restore can be run from any terminal position using a designated tape drive or disk.
- Sharing Consoles across a stack of WaveStar® ITM-SC servers. A web console connects to a server console port and a LAN. By using a web browser, a user can enter a special IP address and access the information presented on the servers console.
- Combined application and terminal server. Specially for Integrated Product Offering (IPO) deployments using PC desktops. The L-class server can host the GUI software and export the display to desk stations. Removes the need for the addition of HPUX machines as terminal servers.

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Geographic Redundancy (GR)

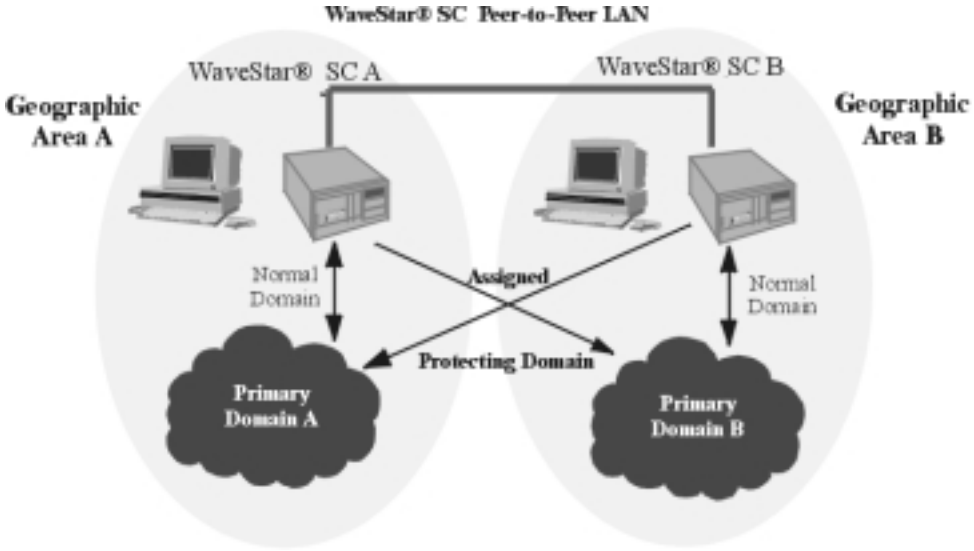
Introduction

The WaveStar® ITM-SC can be configured with the option of geographic redundancy. This feature provides increased reliability through a mechanism where network elements have a backup WaveStar® ITM-SC system that will resume responsibility for the network elements if the primary WaveStar® ITM-SC fails or is unavailable due to maintenance. This feature is extremely effective in a situation in which active network element management of an SDH transmission network is distributed over several WaveStar® ITM-SC systems.

Geographic redundancy

To enable geographic redundancy, there must be a primary and a protecting domain assigned to each network element. In the first instance each WaveStar® ITM-SC manages the network elements in its primary domain. If the WaveStar® ITM-SC in a primary domain fails, other WaveStar® ITM-SC s will take over the management of those elements that are part of their protecting domain. Performance Monitoring is also supported on a secondary GR manager (for the nodes) that are protected by that GR manager.

Figure 2-1 Geographic redundancy



Peer geographic redundancy

Since the primary WaveStar® ITM-SC can manage only a limited number of network elements, the total amount of network element equivalents in the primary and the protecting domain is also limited. If for example, in a client/server configuration an WaveStar® ITM-SC can manage up to 50 network elements at any time. It is therefore possible to distribute this 50 NEs over the primary and protecting domain. Any WaveStar® ITM-SC that is communicating with another WaveStar® ITM-SC as part of the geographic redundancy ITM-SC scheme considers the other ITM-SC as a peer system. Notifications between a primary and a secondary WaveStar® ITM-SC of WaveStar® ITM-SC failure are transported by the TCP/IP network. Under geographic redundancy each WaveStar® ITM-SC can protect (part of) the domains of up to four different WaveStar® ITM-SCs. Different ITM-SCs can have different peer groups.

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WaveStar® ITM-SC services to the Network Management Layer (NML)

Introduction

The WaveStar® ITM-SC) may work stand-alone, but it may also act as a mediation device between the SDH NEs and a network management system like Navis™ Optical Network Management System (formerly named the WaveStar® NMS). The EML of the WaveStar® ITM-SC provides services to the network management system to enable it to set up end-to-end paths and to monitor overall network behavior in terms of events and alarms.

Services to the NML

The following services are provided to the Network Management Layer:

- The WaveStar® ITM-SC allows the NML to provision a physical port in a given NE
- Depending on the capabilities of the NE, the WaveStar® ITM-SC allows the NML to set-up a VC4, VC12 or VC3 end point including the trail trace information and the signal label. Trail trace information is not supported for the WaveStar® ADM 4/1. The ITM-SC allows the NML to set-up the cross-connect in a given NE. Cross-connect capabilities are as supported by the given NE
- The WaveStar® ITM-SC allows the NML to perform protection switch actions on protected connections and multiplex sections. This includes setting up protections and performing a forced switch to a protection termination. The WaveStar® ITM-SC allows the NML to initiate a re-synchronization between the NML and the WaveStar® ITM-SC . The WaveStar® ITM-SC then sends all the required data to the NML. This includes alarm & event information, port information, cross-connect information, etc.
- The Performance Monitoring data is only stored in the WaveStar® ITM-SC and retrieved by the Navis™ Optical Network Management System when necessary
- The ITM-SC informs the NML about all changes in the status of an NE. This includes NE creation events, port creation events, cross-connection events, protection switching events, etc. When a new NE is created on the WaveStar® ITM-SC level, the Navis™ Optical Network Management System will receive a notification. Upon receipt of the notification, the Navis™ Optical Network Management System displays the new NE on the left side of the map

- When an alarm disappears from the list of current alarms this is reported as well. The WaveStar® ITM-SC informs the NML about alarms that appear in the current list of alarms
- The WaveStar® ITM-SC informs the Navis™ Optical Network Management System of geographic redundancy events.

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Features added in the Emerald release

WaveStar® ADM 16 Compact

The WaveStar® ITM-SC supports the following functions on the ADM 16/1 Compact:

- The ADM 16/1 Compact supports bytes D1–D3 on all optical interfaces.
- The ADM 16/1 Compact interworks with the SLM regenerator. The fault-locate protocol for the ADM 16/1 Compact is provided via the DCN.
- The ADM 16/1 Compact supports DNI with drop/continue between two MS-SPRING rings and also between an MS-SPRING ring and a LO-SNCP subnetwork.
- The ADM 16/1 Compact supports protection access on the MS-SPRING, cascading of identical SNCP sections and cascading of MS-SPRING/MSP and HO-SNCP sections.
- The ADM 16/1 Compact supports monitoring of any incoming VC-12, VC-3 or VC-4 that terminates in the network element (NE). It is also possible to non-intrusively monitor any VC-4, even if this VC-4 does not terminate in that NE. It is possible to monitor VC-12s or VC-3s that go through the LO cross-connect and do not terminate in that NE.
- Element Management is supported for VC-4–4c. Provisioning is supported for R2.0 > STM-1 data rates.
- There are LAN interfaces on the AM 1 Plus and on the ADM 16/1 Compact for multiplexing multiple LANs onto one VC-12 or onto one VC-3 (MultiLAN). An AM 1 LAN card maps of 100 Mbit/s Ethernet LAN onto VC-3s.
- IP tunneling is supported on the new ADM 16/1 controller hardware.
- There is support for 32 VC-4 equivalent Lower-Order Cross-Connects which are configurable via the graphical user interface (GUI).
- There is support for 1+1 equipment protection on the E1 tributary level of the SI-16 C unit.
- The maximum number of PM points for the 24 hour bin is now 600.
- The maximum number of unprotected LAN interfaces on a single subbay is now 32.

WaveStar® AM 1 Plus

The WaveStar® ITM-SC database has been enhanced so that it to recognizes a new AM 1 Plus mainboard for adaptation from 120 ohms to 75 ohms.

WaveStar® OLS 80G

The WaveStar® ITM-SC supports the following functions on the OLS 80G:

- Two alarms indicate that an attempt has been made to duplicate a wavelength within one OLS 80G terminal. These two alarms can also be forwarded to the northbound interface (to the higher management layers).
- Association of the OLS 80G node to either GNE*, AGNE, DSNE, or Not Applicable. Node type *GNE is not used but may be used in future releases.
- Two software versions can be displayed, namely the active and the backup version of the software.
- The Node Name field accepts the special characters (% and _).
- The Data Communication Network (DCN) has been extended to support 50 OLS 80G network elements within a string.
- The card inventory WaveStar® ITM-SC screens now have additional entries for the OLS 80G. The ITM-SC screen display gives the serial number/CLEI code/ECI version/SW version.
- The information model for the OLS 80G has been extended so that 15 minute and 24 hour Threshold Crossing Alarms (TCAs) are reported for OPT-OUT, OPT-T, and LBC parameters.

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Features added in the Topaz Release

Network element support

Supported are new releases of the following network elements:

- WaveStar® AM 1 Plus release 2.0
- WaveStar® DACS 4/4/1 release 3.0
- WaveStar® ADM 16/1 release 4.0.1

WaveStar® AM 1 Plus

The WaveStar® ITM-SC supports the following functions on the AM 1 Plus:

- Enhancements in Performance Monitoring for the AM 1 Plus (STM-1 and STM-4)

Performance Monitoring measurements on the AM 1 Plus:

Measurement
The EMS is capable of handling SES, ES, BBE and UAS counts and UAP data of TTPs
The EMS is capable of handling SES, ES, BBE and UAS counts of TTPs
View UAS registers, maintain last month's log, use NE data to synchronize EMS data
View/reset UAP count registers
Bi-directional Performance Monitoring
VC-12 trail monitoring — full flexibility
VC-11 trail monitoring — full flexibility
VC-3 trail monitoring — full flexibility
VC-4 trail monitoring — full flexibility

- Specific alarm-severity settings for the AM 1 Plus (STM-1 and STM-4):
    1. Programmable alarm severity per fault type per location instance
    2. Provisionable alarm reporting mode per fault type per instance.

Reset to default factory is a facility that allows the user to reset the parameters of all persistent alarm types in the NE to the parameters that are originally defined for that NE type (i.e. the parameters default list).

NE type	Severity		Reporting flag		Hold off timer		Related MDO ID
	Global	Per instance	Global	Per instance	Raise	Clear	
ADM 16/1	reset	not reset	reset	not reset	—	—	reset
AM 1/TM 1	reset	—	reset	—	—	—	—
ISM/SLM/RR	reset	—	reset	—	—	—	—
Phase	reset	—	reset	not reset	reset	reset	—
ADM 155	reset	not reset	reset	not reset	reset	reset	—
OLS 80G	reset to defaults is not supported						
DACS	reset	—	—	—	—	—	—
AM 1 Plus	reset	not reset	reset	not reset	—	—	reset
— not supported or managed							

- A new option card for the AM 1 Plus supports two STM-1 optical tributary interfaces. This option card can only be used with the STM-4 version of the AM 1 Plus.

The WaveStar® ITM-SC supports/manages the following functions on the network element:

Supported functions
Degraded signal threshold (MS level)
VC-4 overhead access, J1 source
VC-4 overhead access, J1 sink
VC-4 overhead access, C2 sink
Degraded signal threshold (VC-4 level)
Higher order VC-4 connection function for clear-channel AU-4s
Locked mode
Independent reference for external synchronized output
Reference-signal switching
Timing-link switching for internal clock
Timing-link switching for external synchronized output
Force outgoing SSMs to “DNU”
General HO-VC4 SNC/N protection (non-revertive)
Programmable hold-off times for VC-4 SNC/N
VC-4 SNC/N switch criteria
G.783/annex A compliant 1+1 MSP on STM-1 optical tributary interfaces

Supported functions
Wait-to-restore timer for MSP
Physical-port modes
VC path termination-point modes
DCC support on STM-1 optical tributary interfaces via D4-12
Optical STM-1 MS monitoring: full flexibility

- There is TransLAN support for mixed VC-12gX and VC-3gX connections. This enhancement allows the LAN unit to choose both VC-3-Xv and VC-12-Xv simultaneously as WAN-port transport signals. In other words the mapping becomes more flexible, but only up to a limit of one VC-4 (equivalent bandwidth between the option board and the mother board).
- The Auto-Negotiation function is always enabled. In order to allow interworking in all cases with equipment that does not support auto-negotiation an option has been added that allows the user to override the auto-negotiation. When auto-negotiation has been disabled the user can manually set the port speed and duplex mode of the Ethernet port. When the Ethernet port is set to full duplex it is also possible to enable pause mode.
- Frozen versions of NEs can now be managed by the WaveStar® ITM-SC. When features are added to an NE a corresponding change is needed to the information model that defines the interface between the NE and the ITM-SC so that the WaveStar® ITM-SC can manage the new features. The Compact mux (CMUX) information model is the same for the TM 1, AM 1 and AM 1 Plus network elements. Currently the TM 1, AM 1 and AM 1 Plus all have to be upgraded when new features are added to any network element and this addition changes the CMUX information model. This upgrade is necessary so that all 3 network element types can still be managed by the WaveStar® ITM-SC. This feature allows the TM 1/AM 1 software to be frozen while the AM 1 Plus can continue in development and it will not be necessary to upgrade the TM 1/AM 1 NEs for new releases.
- There is an extension to the ISDN Primary Rate Interface (PRI) feature on the AM 1 Plus. Note: Only one mode can be activated at a time.
  This feature adds functionality to the AM 1 Plus by allowing the user to choose from two distinct operational modes:
  1. ISDN Primary Mode
  2. ISDN Leased-Line Mode.

The 'Leased-Line' mode can be used to access the network in two different ways:

1. Back-to-back digital sections that give modified access. These sections are separated by an SDH transport network
2. A modified-access digital section and the existing transparent SDH multiplexer, which are separated by an SDH transport network.

WaveStar® DACS

The WaveStar® ITM-SC supports the following functions on the WaveStar® DACS:

- The system provides SNCP for VC-4 and VC-4c on STM-N interfaces. There is SNCP/N and SNCP/I (both revertive or non-revertive) and an SNCP selector with or without a head-end bridge.
- The system provides high-order VC-3 protection according to section 8 of ITU-T G.841 for VC-3 subnetwork connections (as for AU-3 subnetwork connections) on the STM-4 and STM-16 interfaces.
- The existing WaveStar® DACS performance monitoring has been extended to cover low order-trail terminations, specifically VC3 and VC12 trail termination points. The same eight performance monitoring counts are supported as for other trail termination types, i.e. background error block, errored seconds, severely errored seconds and unavailable seconds, for the near and far end of a trail.

Termination points that can be selected for PM measurements:

Termination Point Type	Equipment
MS-1	PU-STM-1
MS-4	PU-STM-4
MS-16	PU-STM-16
RS-1	PU-STM-1
RS-4	PU-STM-4
RS-16	PU-STM-16
VC-4	PU-STM-1, STM-4, PU-STM-16
AU-4c	STM-4, PU-STM-16
AU-4	PU-STM-1, STM-4, PU-STM-16
VC-3	PU-STM-1, STM-4, PU-STM-16
VC-12	PU-STM-1, STM-4, PU-STM-16

- The system provides non intrusive monitoring for non-terminated high order VC-3 or AU-3 paths (this monitoring is needed for SNCP/N and stand-alone paths). Block errors are monitored according to ITU-T G.826 by using the B3 and G1 bytes for the nearend and farend. In all cases where non intrusive monitoring is performed the computer parameters, the logging and the threshold facilities are the same as “supervisory unequipped” VC-3 performance monitoring.
- In order to minimize the impact on the WaveStar® ITM-SC northbound interface we shall attempt to support as much of the current functionality as possible. The wdacs_config_man process will apply a set of rules to each cross-connection report that is received from the WaveStar® DACS. This will have the effect of imposing the WaveStar® ITM-SC view of cross-connections onto the set of connections that are still on the DACS and are held in the WaveStar® ITM-SC MIB copy. The effect of the R3.0 changes to NEs is to make the WaveStar® DACS cross-connection engine more flexible. Consequently a CIT user can provision a cross-connection set that falls outside the current WaveStar® ITM-SC view. The wdacs_config_man process will attempt to make sense of such cross-connections by applying its rules. This may result in groupings that does not mean to achieve that. The aim is to ensure that no information is lost. Any cross-connection on the DACS will be shown on the WaveStar® ITM-SC.

WaveStar® ITM-SC

The following WaveStar® ITM-SC features are not related to a network element:

- The new features of the path-discovery tools for this release are:

  1. STM—1 tributaries for AM 1 Plus

  2. SNC protected cross-connections for the WaveStar® DACS. The Path Discovery tool was created to support the Navis™ Optical Network Management System auto-discovery. A set of tools is provided with the ITM-SC to aid in the addition of a WaveStar® Navis™ Optical Network Management System to networks that are not managed by WaveStar® ITM-SCs. These tools extract cross-connection and port-provisioning data from the WaveStar® ITM-SC Management Information Base and produce data files that are ready for the Navis™ Optical Network Management System to import. These interface tools can be used with the following NEs which are managed by the WaveStar® ITM-SC: ISM SLM, Radio Relay, ADM155e, ADM4/1 PHASE (LXC4/1, LXC16/1, TM4/4, TM16/4, ADM4/4, ADM16/4) and ADM16/1 (Senior and Compact), AM 1, AM 1 Plus, TM-1 and

WaveStar® DACS. Two WaveStar® ITM-SC tools are provided to generate a port report file and a cross-connection report file for use by the Navis™ Optical Network Management System. For the port file the interface can be used for the following rates: E1 (2 Mbit/s), E3 (34 Mbit/s), DS3 (45 Mbit/s), DS1 (1.5 Mbit/s) and VC–4 (155/140 Mbit/s). For the "cross-connect file" the interface can be used for the following rates: VC–12, VC–2, VC–3, AU–3, VC–4 and VC–4-4c.
When data is extracted the tool can support the following extraction criteria:

1. Criteria that are based on a list of NE models
2. Criteria that are based on a list of given rates.

- The following new features support the Navis™ Optical Network Management System in the insertion of a node in the physical layer or the removal of a node from the physical layer:

  1. STM–1 tributaries for AM 1 Plus
  2. SNC protected cross-connections for the WaveStar® DACS.

  This release supports the following NE types:

  - ISM (ADM–1 and ADM–4)
  - SLM (ADM–16)
  - ADM 155, ADM 4/1 (STM–1 and STM–4)
  - PHASE (ADM 4/4, ADM 16/4, LXC 4/1 and LXC 16/1)
  - WaveStar® ADM 16/1 (Senior and Compact)
  - WaveStar® AM 1, AM 1 Plus
  - WaveStar® DACS 2.1

- WaveStar® OLS 80G R6.0.1 also called Metropolis® metro EON
- Radio Relay as a legacy supported network element.

- The aliasing feature. There is a growing market for configurable naming schemes. Customers require their own naming conventions to be shown on the Lucent Graphical User Interfaces. The first release of the aliasing feature will only support aliasing for the ADM 16/1 network element. Some custromers currently use an access-database lookup tool that allows them to convert Lucent naming schemes to the equivalent customer port name. For the long term and we have agreed the following solution:-
  The Management Systems will support the import of a flat file that contains the LT port name (for Navis™ Optical Network Management System and either WaveStar® ITM-SC or Navis™ Optical Network Management System) and the corresponding customer port name for each network element that is managed. The port names need to be provided for both physical and logical ports in both formats *. The flat file will be produced in the same way as the existing data is produced for the access database tool and will be produced by the customer team. It will also be possible to create a flat file from the access database tool; this will allow an easy update of deployed network elements.
  * This lookup tool only provides physical port conversion. In order to enhance this to allow cross-connections to be provisioned the customer team must provide additional mapping information for all possible Termination Points. This will also allow the associated logical alarm information to be shown in a customer format where this possibility is supported. Where customer names are not provided in the mapping table the existing Lucent name will be displayed.

□

Features added in the Diamond Release 9.0

WaveStar® AM 1 Plus

The WaveStar® ITM-SC supports the following new functions on the AM 1 Plus:

- A new option card for the AM 1 Plus supports two STM-1 electrical tributary interfaces. This option card can only be used with the STM-4 version of the AM 1 Plus
- Single frame slip buffer and counter. The feature is to provide an extension to the ISDN leased line feature on the AM 1 Plus multiplexer. This feature adds functionality to the AM 1 Plus by adding a new frame slip mechanism and slip/skip counter. To enable the mechanism, and counter, the Port Type must be set to 2 Mbits/s ISDN leased line, and in re-timing mode. If the timing mode is changed to self-timed the frame slip mechanism is disabled. The performance monitoring counter logs frame slips/skips by quantities of a whole frame. The counter will roll over when the maximum count is reached (maximum is 1 slip/skip event per second). It is read at a frequency that ensures the slips/skips cannot have rolled over more than once between two pollings. Standard PM binning and thresholding processes are applicable to this counter
- Aggregation of LAN traffic via VLAN Trunking on TransLAN cards.
  A brief history TransLAN
  1. The original TransLAN feature for AM 1 was a very basic point to point implementation enabling network providers a method of transporting ethernet packets over the SDH network using up to 8 Mbit/s bandwidth (configurable in 2 Mbit/s steps via cross connection of the SDH VC-12's associated with the physical LAN ports. This option card consisted of two LAN ports and four X21 serial ports (transported as single VC-12's). No special Ethernet provisioning was required for this feature, however Performance Monitoring was possible on the associated VC-12's.
  2. A later release of the WaveStar® ITM-SC saw the introduction of the enhanced TransLAN feature known as TransLAN + and the Multi LAN feature (MLAN, a further development of TransLAN +) TransLAN + permitted customers to be allocated more than one physical LAN port

and then associate this ‘LAN group’ SDH bandwidth in a flexible manner using either virtually concatenated VC-12 or VC-3 SDH capacity. This allowed significant flexibility for the feature but required specific provisioning of the physical ports to the SDH bandwidth (SDH Channels).

3. Multi LAN or MLAN was a further enhancement on the TransLAN + feature permitting different customers on different physical ports to share SDH capacity. To avoid conflicts it was done by provisioning each customer a ‘tag’ known as a Customer ID tag (CID). This was primarily due to the fact that customers were controlling the IEEE 802.1 tag. Customers could have the same tag. Upon receipt of an Ethernet packet on a physical port, the network provider woul add a CID to permit the shareing of SDH bandwidth. When the packet reached it’s destination, this CID was removed. This method is known as ‘Double Tagging’.
4. VLAN Trunking or 802.1 tagging. The MLAN feature was futher enhanced due to possible problems where a customer would wish to have access to something like the internet via an aggregation function to an edge router. When the NE recieves a packet (In MLAN mode) a CID tag is added, all is well until the packet exits the network providers domain (or Virtual Private Network as far as the customer sees it. At this point the CID tag is removed, the packet then follows on it’s course to the aggregation function and so on. Problems arise when packets return, with no CID tag, the tag cannot successfully routed back. To overcome this problem, the 802.1 tag needs to be ‘assigned’ by the network provider. As different 802.1 tagged Ethernet frames could enter the same physical LAN port on the Network Element, further provisioning is needed.
   The advantages of VLAN trunking are: It does not require the assignment of Customer ID (CID) tags, it permits different 802.1 taged frames to share the same physical LAN port, it gives additional flexibility for egress logical WAN port asignment and it successfully permits routing via an aggregation function.
   For more information on VLAN trunking, refer to the: PROVISIONING GUIDE FOR THE NETWORK ELEMENT, chapter Concepts

- The WaveStar® ITM-SC can manage network element WaveStar® AM 1 Plus release 2.2.

WaveStar® ADM 16/1 Senior and Compact

The WaveStar® ITM-SC supports the following new functions on the ADM 16/1.

- A new line interface L-16.2/3 on the Core Unit of the ADM 16/1 Compact. The Core Unit can be ordered with an STM-16 line interface with 1550 nm wavelength.
- TMF/CORBA interface 2.0 on MS-SPring. Network element ADM 16/1 has an identifier which gives the position of the NE in a MS-SPring. A maximum of 16 NEs can be configured in an MS-SPring, and the identifier contains the 4 bits in the K byte used to define the numerical value. This value is between 0 and 15, as defined in ITU-T recommendation G.841. The ADM 16/1 MS-SPring Node ID needs to be sent on the TMF/G7 2.0 interface for reporting MS-SPring protection resources and establishing cross connections when bridging different rings. The MS-SPring Node ID is only passed on to the TMF/G7 interface and is otherwise not used by WaveStar® ITM-SC. The NE may not initially be able to determine a valid value for the MS-SPring Node ID, e.g. when MS-SPring is set up but the NE is disconnected from the rest of the ring. In this case the MS-SPring Node ID reported by the NE will have a value of '-1'.
- There is TransLAN support for mixed VC-12gX and VC-3gX connections. This enhancement allows the LAN unit to choose both VC-3-Xv and VC-12-Xv simultaneously as WAN-port transport signals. In other words the mapping becomes more flexible, but only up to a limit of one VC-4 (equivalent bandwidth between the option board and the mother board).
- The Auto-Negotiation function is always enabled. In order to allow interworking in all cases with equipment that does not support auto-negotiation an option has been added that allows the user to override the auto-negotiation. When auto-negotiation has been disabled the user can manually set the port speed and duplex mode of the Ethernet port. When the Ethernet port is set to full duplex it is also possible to enable pause mode.
- A new tributary card for the ADM 16/1 Compact supports 12 individually switchable ports. The unit is fully flexible and therefore will support any combination of 34/45Mbit/s ports.
- Pointer Justification Events (PJE) events counters for ADM16/1 Senior and ADM16/1 Compact.

The maximum number of Termination Points (TP) which may be monitored simultaneously by NE type are as follows:

- ISM: Maximum of 138 TPs (VC12 - 126; VC4 - 10; MS - 2)
- SLM: Maximum of 38 TPs (RS4/16 - 2; MS4/16 - 2 (NE); MS4/16 - 2 (FE); VC4 -16 (NE); VC4 -16 (FE)
- RR: Maximum of 16 TPs (RS -16; 2 terminals, 14 regenerators)
- ADM155C/E, ADM4/1: Maximum of 170 (MS - 4, RS -4, VC12 - 128, VC12-TP - 32, VC4 - 2)
- PHASE: Maximum Total of 150 TPs. VC12 - 315, VC3 90, VC4 100, 62 MS, 62 RS, 1 AU4-PJE, 1 - PSC, 6300 TU12-CTP, 2100 TU2-CTP, 300 TU3-CTP. 1 TCM Sink Point and 1 TCM NIM Point associated with every valid TTP or CTP (VC12, VC3, VC4, TU12, TU2, TU3 & AU4)
- ADM16/1 family: Maximum of 250 TPs. VC11 - 504, VC12 - 504, VC3 - 96, VC4 - 64, MS - 34, RS -34, AU4-PJE -1, AU4 - 64, AU4-4C - 16, 2016 TU12-CTP, 96 TU3-CTP
- TM 1: Maximum of 18 TPs. (MS - 1, VC12 - 16, VC3 - 0, VC4 - 1)
- AM 1 family: Maximum of 36 TPs. (MS - 2, VC11 - 16, VC12 - 32, VC3 - 2, VC4 - 2)
- WDACS: Theoretical Maximum of 3072 TPs, any combination of supported TP types. The actual maximum will depend on WaveStar® ITM-SC loading and hardware configuration.
- OLS 80G: Maximum of 36 TPs for a Regenerator. Maximum Total of 196 TPs for a 2 Lines System as shown in table table “Termination Points (196) for a 2–Line OLS 80G System”.

- DCC support on STM-1e interfaces. The WaveStar® ADM 16/1 Compact supports the bytes D1–D3 and D4–D12 on STM-1e interfaces.
- New hardware for the ADM 16/1 Senior TransLAN plus card (IP-LAN 8 Tlan+). With this new hardware it supports the same features as the ADM 16/1 Compact.
- New paddle board, 32 channels 2 Mbit/s, for the ADM 16/1 Compact (PB-E1/P75/32).

- Size (SS) bits monitoring. The ADM16/1 Senior and ADM16/1 Compact monitors the size bits in the AU-n pointer (called SS bits) in a received signal. These are used to identify the type of signal being received (SDH or SONET). Normally, only the SDH setting is accepted - however it is possible to disable the monitoring and accept any setting for the size bits. The SS bits are slaved to MSP - i.e. the SS bits are processed after the MSP selection has occurred. When MSP is configured for a pair of ports (MS TTPs), the user can provision only one value for SS monitoring. The received ss-bits are ignored by ADM 16/1 Senior and ADM 16/1 Compact. It is also possible to set the value to be sent in the size bits being transmitted. The transmitted ss-bits for STM-16 line interfaces for both ADM 16/1 Senior and ADM 16/1 Compact are set to “SDH” mode and cannot be changed to “SONET” mode.
- Aggregation of LAN traffic via VLAN Trunking on TransLAN cards. For more information on VLAN trunking, refer to the: PROVISIONING GUIDE FOR THE NETWORK ELEMENT, chapter Concepts.
- A new tributary card for the ADM 16/1 Compact supports four STM-1 electrical tributary interfaces.
- A new tributary card for the ADM 16/1 Compact supports one STM-4 optical (short or long haul) tributary interface.
- 1+1 MSP protection on STM-n Lines for WaveStar® ADM 16/1 Compact.
- The WaveStar® ITM-SC can manage network element WaveStar® ADM 16/1 Compact release 2.0.

Table 2-1 Termination Points (196) for a 2–Line OLS 80G System

Direction	OTU	OMU	OA	SU	LINE
Tx	16	16	16	1	1
Rx	16	16	16	1	1
Total of 98 per Line	32	32	32	2	2

a) LAN ports are mapped to 1 to 4 VC 12s.

WaveStar® ITM-SC

Important! For this Diamond release the northbound TMAG interface, meaning the interface towards the NMS is not supported.

WaveStar® ITM-SC features which are not related to a network element

- Aliasing is extended to WaveStar® DACS. Also see the description of this feature as described in the previous section “Features added in the Topaz Release”, paragraph “WaveStar® ITM-SC”.

The following table presents the list with supported NEs and their configuration.

Supported network elements
WaveStar® AM1
WaveStar® AM1 Plus
WaveStar® TM 1
ISM T-1
ISM T-4
ISM ADM-1
ISM ADM-4
ISM SDH-T
ISM R-1
ISM R-4
SLM 2FAD-16
SLM LTA-16
WaveStar® ADM 4/1
ADM155
PHASE TM-4-4
PHASE TM-16–4
PHASE LR-4
PHASE LR-16
PHASE ADM-4-4
PHASE ADM-16–4
PHASE LXC-4-1
WaveStar® M80G T SE
WaveStar® M80G T DF
WaveStar® M80G T REGEN
WaveStar® ADM 16/1
WaveStar® ADM 16/1 Compact

Supported network elements
Radio Relay T
Radio Relay REGEN
WaveStar® DACS

Port types and protection schemes

The SDH and PDH port types are supported:

Port type	Signal type	Medium	ADM 16/1 Senior	ADM 16/1 Compact
SDH	STM-16	Optical	Yes	Yes
SDH	STM-4	Optical	Yes	No
SDH	STM-1	Optical	Yes	No
SDH	STM-1	Electrical	Yes	Yes
SDH	STM-0	Optical	Yes	No
PDH	140 Mbit/s	Electrical	Yes	No
PDH	45 Mbit/s	Electrical	Yes	Yes
PDH	34 Mbit/s	Electrical	Yes	Yes
PDH	2 Mbit/s	Electrical	Yes	Yes
PDH	1.5 Mbit/s	Electrical	Yes	No
LAN	10/100 BaseT Ethernet[a)]	Electrical	Yes	Yes

The following equipment protection schemes are supported:

Protection type	Protection level	Revertive	ADM 16/1 Senior	ADM 16/1 Compact
1+1	CCU	Non-revertive	Yes	Unit is not present in Compact
1+1	PSF/TU	Non-revertive	Yes	Unit is not present in Compact
1+1	E3/DS3 TPU	Non-revertive	Yes	Yes

Protection type	Protection level	Revertive	ADM 16/1 Senior	ADM 16/1 Compact
1+1	Core unit	Non-revertive	Unit is not present in Senior	Yes
1+1	LAN TPU	Non-revertive	Yes	No
1+1	SI-1/4 TPU	Revertive	No	Yes
1:N	2 Mbit/s TPU	Revertive	Yes	Yes
1:N	1.5 Mbit/s TPU	Revertive	Yes	No
1:N	E4/STM–1E	Revertive	Yes	No
1:N	SI-1/4 TPU	Revertive	Yes	Yes
1:N	SPIA-1E4/4	Revertive	Yes	No

The following transport protection schemes are supported:

Protection Type	Protection Level	Revertive	ADM 16/1 Senior	ADM 16/1 Compact
SNC/N	VC-12	Non-revertive	Yes	Yes
SNC/N	VC-3	Non-revertive	Yes	Yes
SNC/N	VC-4	Non-revertive	Yes	Yes
SNC/N	VC-4c	Non-revertive	Yes	Yes
MS-Spring including NUT	STM-16	Revertive	Yes	Yes
1+1 MSP	STM-16	Either	Yes	No
1+1 MSP	STM-4	Either	Yes	Yes
1+1 MSP	STM-1	Either	Yes	Yes
DNI		Non-revertive	Yes	No
CASCAD-ING		Non-revertive	Yes	No

□

Features added in Pearl Release 9.1

WaveStar® ITM-SC

WaveStar® ITM-SC features that are not related to a specific network element:

- Support of the B-2600 management system. The B-2000 was been used as a workstation. but since October 2001 it has not been available and has been replaced by the B-2600. HP Unix, version 11.x must be pre-installed in the hardware (servers and workstations). If this is not the case the customer should either contact Lucent or Hewlett Packard to enquire about obtaining a license for the HP Unix, version 11.x.
  The capacity of the B-2600 management system which is expressed in Network-Element Equivalents (NEEs), is regarded in the same way as for the B–2000 management system.
- A set of interface tools is provided with the ITM-SC to aid the addition of a Navis™ Optical NMS to networks that are only managed by the ITM-SC. These tools extract cross-connection and port-provisioning data from the WaveStar® ITM-SC MIB and produce data files that are ready for the Navis™ Optical NMS to import.
  These interface tools are applicable to the following NEs:
  - ISM
  - SLM
  - Radio Relay
  - ADM155E
  - WaveStar® ADM4/1
  - PHASE (LXC4/1, LXC16/1,TM4/4, TM16/4, ADM4/4, ADM16/4)
  - WaveStar® ADM16/1 (Senior and Compact)
  - WaveStar® AM 1
  - WaveStar® AM 1 Plus
  - WaveStar® TM-1
  - WaveStar® DACS (managed by the ITM-SC).

  Two ITM-SC tools are provided to generate a port report file and a cross-connection report file for use by the Navis™ Optical NMS.
- The following NEs are supported in Pearl Release 9.1 of the WaveStar® ITM-SC:

Network Element	Release supported
ISM	R1.10, R2.5, R3.5
SLM	R5.0
Radio Relay	R3B
ADM 155E and WaveStar® ADM 4/1	V5 ***maintenance release***
WaveStar® ADM 16/1	R5.0, R5.1
WaveStar® ADM 16/1 Compact	R2.0, R2.1
Phase	R5.0
WaveStar® AM 1 Plus	R2.1, R2.2
WaveStar® AM 1	R3.1
WaveStar® TM 1	R2.2
WaveStar® OLS 80G	R6.0
WaveStar® DACS	R3.0

- Other than the ITM-SC management system the following management systems are also supported in Pearl Release 9.1 of the WaveStar® ITM-SC:

Management system/Interface name	Release supported	Previous ITM-SC release that supports this interface	Supported in Pearl
TMAG	Navis™ ONMS	R8.0.x	Yes
TMF	R2.0	R9.0	Yes
PAMS	—	R9.0	Yes
Navis™ OCA	R4.0.1	R9.0	Yes
TCM-E	R1.0	R9.0	Yes
ITM-CIT	R9.1	R9.0	Yes

Important! In this release the TMAG interface to the Navis™ Optical Network-Management System is supported. Moreover network-element features that were added in the Diamond release are now supported on the northbound TMAG interface. ***This is except for features that have no impact on the TMAG interface like:***

- ***Remote alarming via MDO/MDI***
- ***DCC support on STM-1e interfaces on the ADM 16/1 Compact***
- ***TransLAN support of mixed VC-12gX and VC-3gX connections***
- ***1200 monitoring points on the ADM 16/1 Senior and Compact***
- ***ss-bit provisioning on the ADM 16/1 Senior and Compact.***

WaveStar® ADM 16/1

A successor for the WaveStar® ADM 16/1 boosters' pre-amp interworking pack has been created from OLS400G interworking pack LJB525. The item code for the new pack will be LJB500.

WaveStar® DACS

The WaveStar® ITM-SC supports the following new functions on the WaveStar® DACS 4/4/1:

- The existing WaveStar® ITM-SC Graphical User Interface behaviour for MDI handling has been extended to the WaveStar® DACS. Unlike other NEs, for the WaveStar® DACS no interaction with the NE is involved. The MDI strings are held in the ITM-SC and not in the NE database.
- Remote downloading of WaveStar® DACS 4/4/1 software is required due to the large increase in the number of WaveStar® DACS NEs that are being introduced in Lucent customers' networks. Currently the only way to upgrade the software in the WaveStar® DACS network element is for an engineer to visit the NE location and perform the upgrade using the Craft Terminal. This procedure is followed for ANY change in the network-element software (even maintenance or 'point' releases).
  The solution to the above is to provide an 'off-line' tool that will make the change using scripts and which has its own graphical front-end to execute those scripts.
  The software currently used for WaveStar® DACS NE upgrades can be over 200 Mb in size which would take a significant amount of time to transfer over a limited-bandwidth communications link. For a link speed of 64 kbit/s with an occupancy of around 60% the transfer could take many hours. Of course the faster the link speed, the shorter the transfer time. Given that a customer is unlikely to set up a dedicated high-speed TCP/IP link just for software download a mechanism is chosen such that the time taken to perform this task is significantly reduced. Given that most of the network-element software will not be different, some files may have changed but should not be completely different. An ideal method would be to transfer only the differences to the network element, not the whole of a changed file but just the differences. New files are transferred completely.
  The operator view of the remote software-download is in a graphical format, which is similar to the style currently used in the WaveStar® ITM-SC. Drop-down menu commands and buttons are provided to "drive" the download (with a series of scripts that execute behind the action); the operator is presented with a form of progress indication. To initiate remote software-download, the operator must select the WaveStar® DACS NE details including the NE name and the IP address

along with the source directory and the list of NE software versions. When the operator attempts to perform the upgrade, he is prompted with a warning screen that states that the association with the “target” NE will be lost. After the download, the ITM-SC’s remote software-download tool will wait for a specified time for the NE to boot to the new software image (the NE will take around 20 minutes to perform a reboot) The tool will then “ping” the NE to check for a live network-element operating system. If the NE is “alive” the operator is informed that the softwware download has been successful. After a successful software upgrade, the NE database may need to be uploaded to the ITM-SC.

- It is possible to execute a backup of a WaveStar® DACS database from the WaveStar® ITM-SC that manages this DACS and, if need be, to restore the database to that DACS. When the user requests a backup, the system will request the WaveStar® DACS to make a snapshot of its own database. This snapshot will be copied to the WaveStar® ITM-SC platform. If it is unable to make a backup when requested the DACS will send a message and the tool will report the reason to the user.
  For most network elements that are supported by the ITM-SC the information required to restore the NE in a disaster recovery-scenario is stored in the MIB. A synchronised version of the MIB is stored in the ITM-SC. For the WaveStar® DACS things are different. The DACS has no MIB as such (not like CMISE NEs); the ITM-SC does store a synchronised partial version of its database. For the DACS a remote databasebackup-and-restore feature makes a “snapshot” of the DACS database, stores it on the WaveStar® ITM-SC and restores it when required.
  The live version of the DACS database is stored in the DACS memory. For the database backup this database is saved to the hard disk, from where it is copied to the remote ITM-SC. The mechanism for copying the database is “rsync”. ”Rsync” compares the two files and copies only the differences where there are differences between the two files. This is particularly useful as the DACS database can be up to 50 Mb in size and typical day-to-day changes are of the order of 1%. The volume of traffic is greatly reduced and therefore the backup duration is greatly reduced as well. In most cases these transfers are actually updates or incremental backups, where an older version of the file already exists at the ITM-SC end of the link. Therefore the ITM-SC makes a copy of a previous backup to use for synchronisation at the same time as it requests the DACS to take

a database snapshot. Once the DACS indicates that the snapshot is complete the ITM-SC initiates “rsync”. Once this synchronisation is complete the resultant file is renamed and the previous version is now deleted. The backup file can then be archived to DAT tape.
The ITM-SC will store one backup per DACS network element that it manages.

□

New Features in the WaveStar® ITM-SC in the Garnet Release 10.0

Overview

Purpose

This section presents the new features that were added to the WaveStar® ITM-SC in Garnet Release 10.0. The features are grouped per network-element type. These new features enable the WaveStar® ITM-SC to provision and/or manage new functions on the different NEs.

Supplemental information, which includes a list of problems that were known when this document was written, can be found in the separate document that is called “Release Notes: WaveStar® ITM-SC, Release 10.0”.

Prerequisites

To operate the new WaveStar® ITM-SC (release 10.0), the HP Unix (version 11.x) must be pre-installed in the hardware (servers and workstations) and must be up and running before the upgrade can be performed. If this is not the case the customer should either contact Lucent or Hewlett Packard to enquire about obtaining a license for the HP Unix, version 11.x. Due to the renegotiated situation the database customers may need to repurchase the database or have a maintenance contract signed. The legal situation is currently being worked out.

□

New features for the WaveStar® AM 1 Plus

SDSL option card

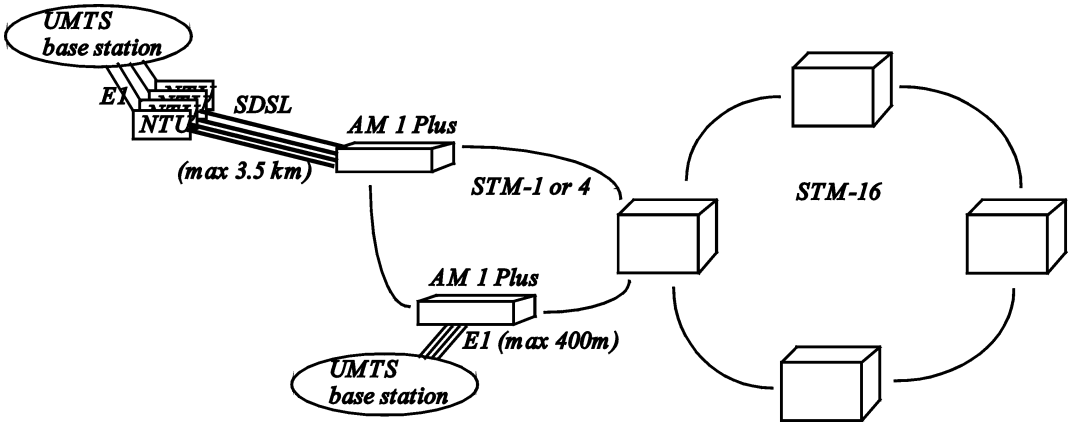
The SDSL feature is used to transport 2 Mbit/s signals over copper lines in cases where no fiber is available for transportation.

This option card can be used for the following applications:

- to connect UMTS base stations to the SDH network when only copper lines are available
- to deliver ISDN PRI to customers over copper lines.

In the first application an n* 2 M bit/s connection to a UMTS base station is provided over copper pairs (max. 3.5 km). In the base station, the termination of the SDSL signal (the NTU function) can be done by off-the-shelf modems or by an NTU device. It is expected that each UMTS service provider is will need four 2 Mbit/s links; a base station will be used by at most three providers. There can be 12 customers per NTU (i.e. one for each port). Another application consists of the delivery of an ISDN 2 Mbit service over SDSL.

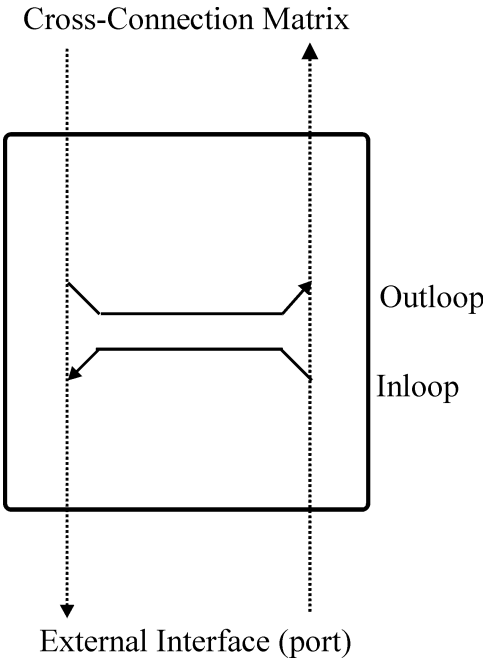
Figure 2-2 Application with UMTS base station and NTU modems



The WaveStar® ITM-SC supports this new option board on the AM 1 Plus.

The SDSL option board can be added to the AM 1 Plus to provide capabilities in addition to those that are provided by the main board: the option board provides 12 Symmetrical single-pair high-bitrate Digital-Subscriber Line (SDSL) interfaces.

The SDSL option card supports inloop and outloop loopbacks on all ports.



STM-1 interface

The WaveStar® ITM-SC can manage an AM 1 Plus unit that has an STM-1 Long-haul L-1.2 interface.

Interfaces on the WaveStar® AM 1 Plus

The following tables provide information about the existing and the new AM 1 Plus interfaces and the signal and port types.

With this option card the AM 1 Plus now provides the following interfaces:

Option Card[a]
16 DS-1 (1.5 Mbit/s) interfaces
16 E-1 (2 Mbit/s) interfaces
2 E-3 (34 Mbit/s) interfaces
2 DS-3 (45 Mbit/s) interfaces
4 TransLAN Plus interfaces
4 X.21 interfaces
12 SDSL interfaces

a) The mother board provides 16 E-1 (2 Mbit/s) interfaces.

With this option card the AM 1 Plus now supports the following signal types:

Signal Type	Port Type	Medium
STM-4	SDH	Optical
STM-1	SDH	Optical
34 Mbit/s	PDH	Electrical
45 Mbit/s	PDH	Electrical
10/100 BaseT Ethernet[a]	LAN	Electrical
2 M bit/s	X.21	Electrical
2 M bit/s	PDH	Electrical
2 M bit/s	SDSL	Electrical
1.5M bit/s	PDH	Electrical

a) LAN ports are mapped 1 to 4 VC 12s.

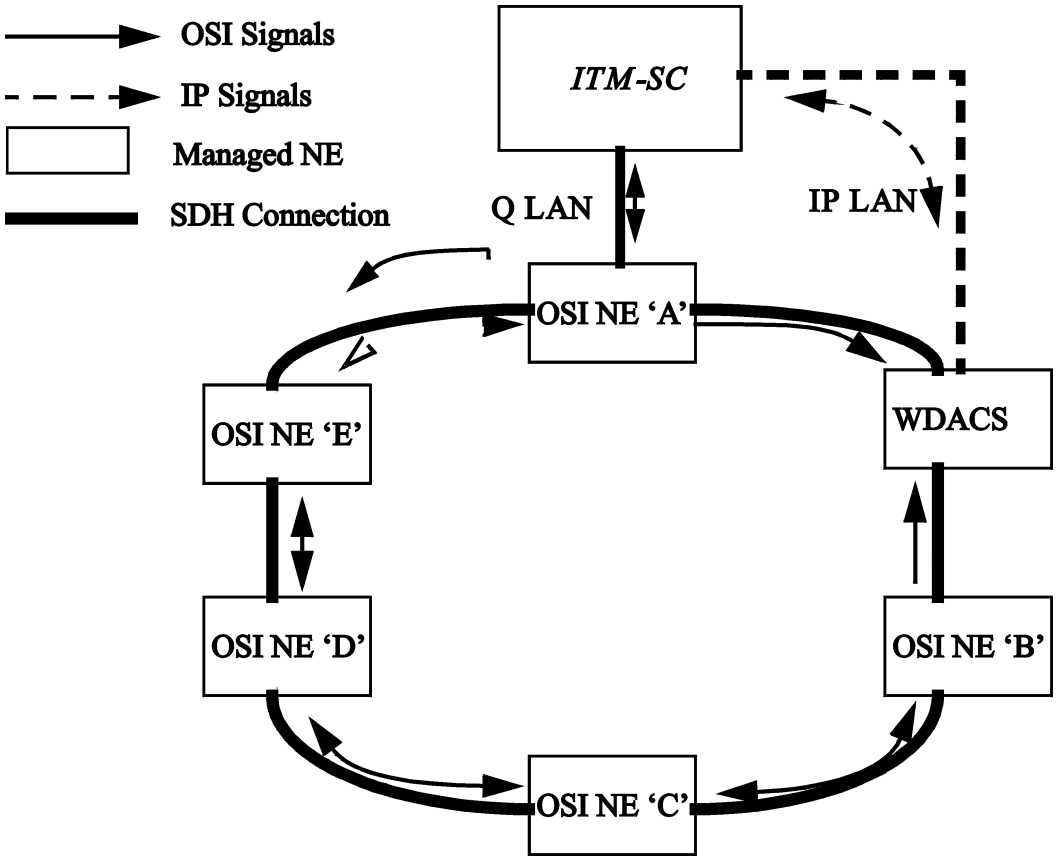
□

New features for the WaveStar® DACS

DCC support

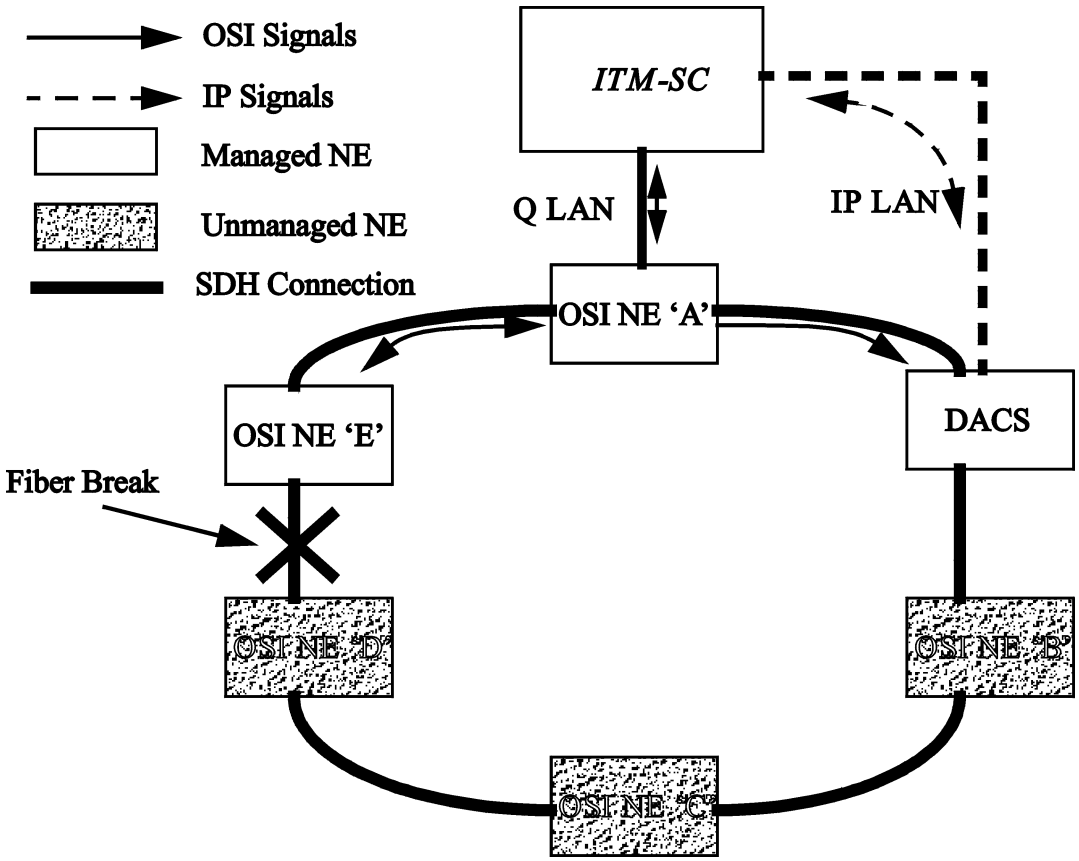
The DCC support on the STM-1, the STM-4 and the STM-16 on the DACS allows the WaveStar® DACS 4/4/1 network element to route and transport DCN information that is received from OSI network elements to other OSI network elements. DCC support also allows the WaveStar® DACS NE to be provisioned as a gateway NE. Currently the DACS NE does not include OSI functionality, so when the DACS NE is provisioned within an SDH ring that is connected to other OSI NEs, there is a possibility of a single point of failure. Also, if the DACS NE is provisioned to be the gateway NE, it will only be possible to manage other NEs that are managed via TCP/IP; any OSI NEs would not be visible to the element-management system. DCC overhead byte-provisioning is also required on either the MS or the RS overhead. New hardware is required such that a Q-LAN interface is available per PSA and per PSC subrack (in the form of a new subrack controller). This new hardware must be provisioned per subrack controller by the ITM-SC. DCC provisioning on MS or RS overheads is a new application.

Figure 2-3 WaveStar® DACS in an OSI ring



The above diagram shows the WaveStar® DACS NE in an SDH ring that is managed by the IP LAN of the ITM-SC as well as an OSI NE (for instance an ADM16/1) that is used as a gateway NE for the other network elements that are managed by the OSI. If a fiber break occurred between OSI NEs ‘E’ and ‘D’, all ITM-SC management of OSI NEs ‘D’, ‘C’ and ‘B’ would be lost as the OSI signals are not propagated through the DACS NE.

Figure 2-4 WaveStar® DACS in an OSI ring, fiber break



The single point of failure that is as illusratated above is removed because the DACS NE is able to pass OSI information through. This is accomplished by adding a new Subrack Controller to each PSA and PSC subrack that includes an OSI stack and a Q-LAN. By connecting these Subrack Controllers together the OSI signals can be passed through the NE. This also allows the WaveStar® DACS NE to be the gateway NE for other OSI network elements. Provisionable DCN Parameters

For this new hardware the following will be provisioned per subrack controller:

- DCC for the full NSAP Area Address
  - DCC Fixed 20 octets
  - DCC Fixed 10 octets
  - DCC Flexible
- Manual Area Address
- Second Manual Area Address
- Third Manual Area Address
- NE IS-IS Level
  - DCC Level 1
  - DCC Level 1 plus 2
  - DCC Level 1 plus 2 Area Repair
- IS-IS Level on LAN (See the next table for relationship to NE IS-IS Level)
  - Normal IS-IS
  - Level 2 Only
  - No IS-IS

Relationship to NE IS-IS Level

NE IS-IS Level	IS-IS Level on LAN
DCC Level 1	No IS-IS
	Normal IS-IS
DCC Level 1 plus 2	No IS-IS
	Normal IS-IS
	Level 2 Only
DCC Level 1 plus 2 Area Repair	Noninal IS-IS

- Router Priority

In addition to the provisionable DCN parameters, the following are reported from the DACS NE (additional information is contained in the standard ISO 10589):

- OSI Stack status
  - Configured
  - Not Configured
- Computed Area Address. A computed Area Address is applicable per Area Address including manual addresses).

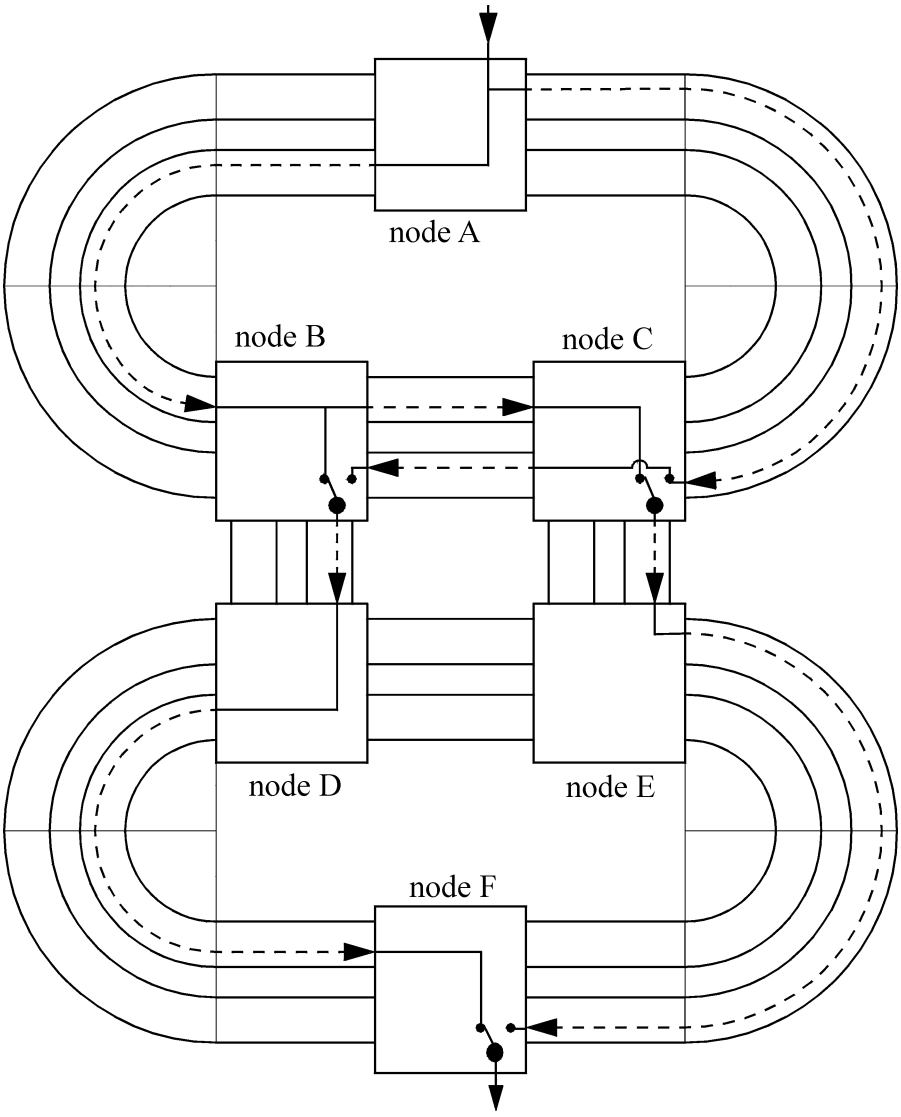
- Neighbor Nodes' NSAP. Neighbour Nodes NSAP is applicable per Adjacent connected area address within the same managed area.
- QLAN State
  - QLAN Active
  - QLAN Inactive

For the WaveStar® DACS the management of the EOW and USER channels is as follows. Order-wire voice applications through the E1 (2,4,1) byte are available on the PSC subrack on STM–16 and STM–4 units between regenerators or between a regenerator and a terminal (i.e. regenerator sections). Usage conforms to ITU-T Rec. G.707 and ETSI ETS 300417. Order-wire voice applications through the E2 (9,7,1) byte are available on the PSC subrack on STM–16 and STM–4 units between terminals (i.e. multiplex sections). Usage conforms to ITU-T Rec. G.707 and ETSI ETS 300417. User-channel data applications through the F1 (2,7,1) byte are available on the PSC subrack on STM–16 and STM–4 units between regenerators or between a regenerator and a terminal (i.e. regenerator sections). Usage conforms to ITU-T Rec. G.707 and ETSI ETS 300417.

DNI support

Dual Node Interworking (DNI) is a network-protection scheme that is used to improve the reliability of the connection between two rings. DNI architectures provide network connections by using node diversity. This means that the protected and protecting paths or the subnetwork connections may be routed across different nodes when these paths and connections go from one network to another.

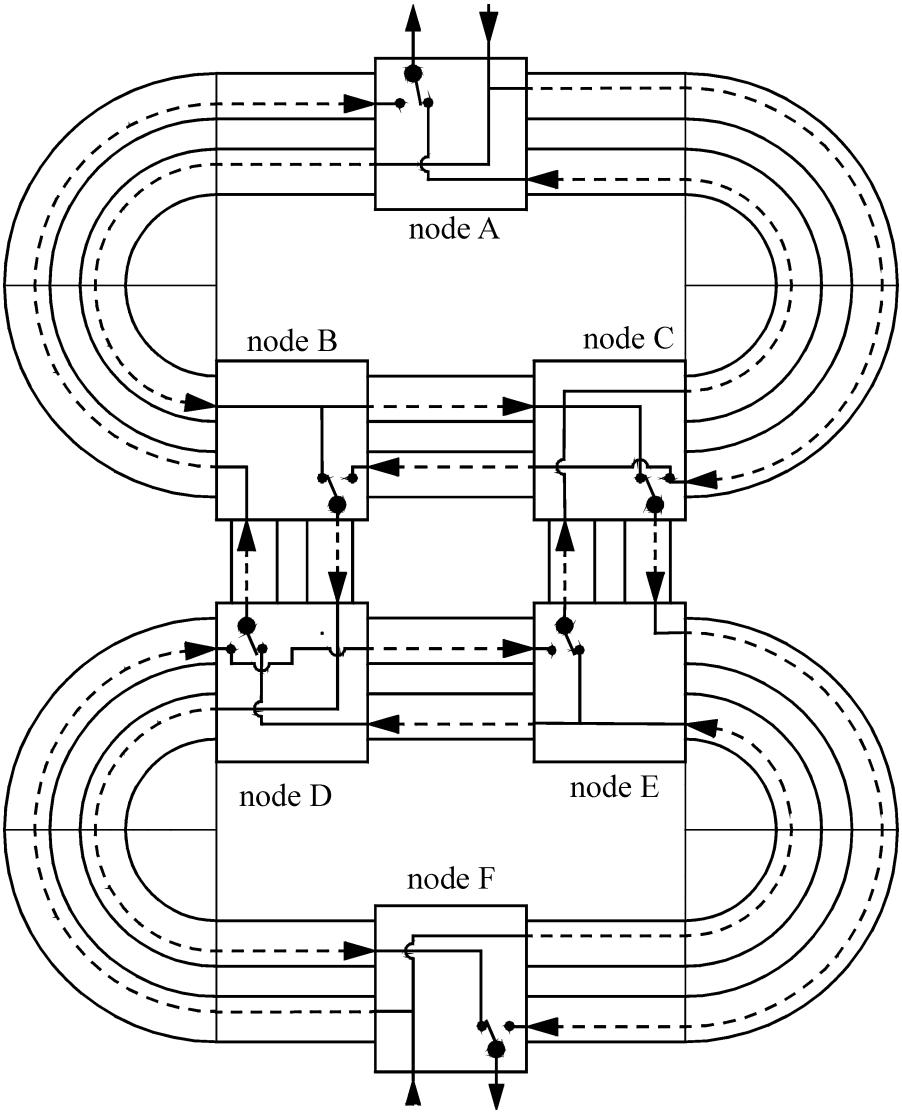
Figure 2-5 Unidirectional Dual Node Ring Interworking with SNCP Low Order (LO) and High Order (HO) rings



In the figure above, Node A has a head and a bridge. Node B has an SNCP group with a drop-and-continu working configuration and is the primary node for DNI. Node C an SNCP group with a drop-and-continu protect configuration and is the secondary node for DNI. Nodes D and E have a unidirectional cross-connect. Node F has a unidirectional SNCP group (selector switch and no bridge). Nodes B

and D can be the same node and nodes C and E can be the same node.

Figure 2-6 Bidirectional Dual Node Ring Interworking with SNCP Low Order (LO) and High Order (HO) rings



In the figure above Node A has a bidirectional SNCP group (bridge and switch). Node B has an SNCP group a with drop-and-continu working configuration and is a primary node for DNI. Node B has a unidirectional cross-connect. Node C has an SNCP group with a drop-and-continu protect configuration and is a secondary node for DNI. Node C has an unidirectional cross-connect. Node D has an SNCP group with a drop-and-continu protect configuration and is a secondary node for DNI. Node D also has a unidirectional cross-connect. Node E has an SNCP group with a drop-and-continu working configuration and is a primary node for DNI. Node E also

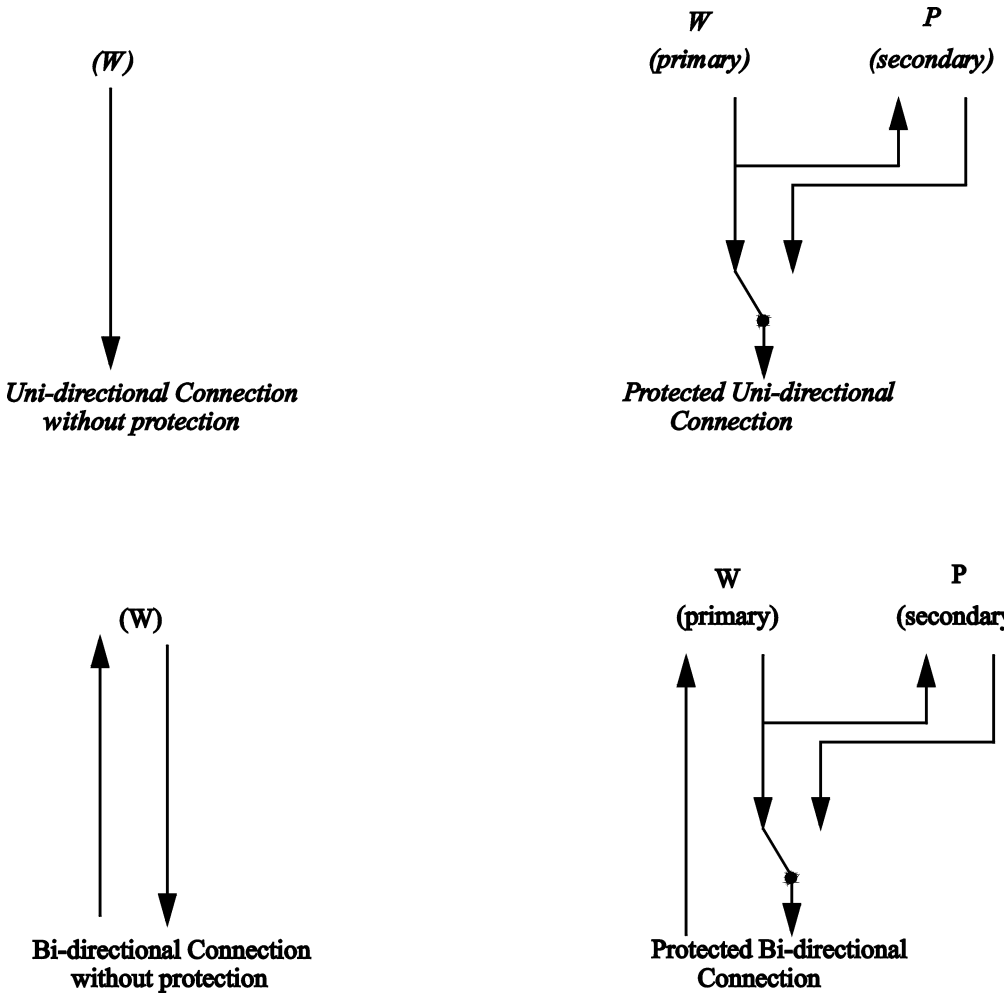
has a unidirectional cross-connect. Node F has a bidirectional SNCP group (bridge and switch).

The implementation is achieved by using a special configuration of SNCP (Unidirectional SNCP with Drop and Continue). In the incoming direction, there is a selector between the working and the protection copy of the path. The outgoing path is sent in only one direction, while the opposite direction is a bridged copy of either the working or the protection path. A restriction on this feature is that it is not possible to support drop and continue of a high-order path that is multiplexed on the DACS to carry lower-order paths. The configurations that are described below are used for dual node ring interworking from an SNCP ring. These types of protection can be applied to unidirectional and bidirectional connections. See ITU-T Recommendation G.842 for the network context in which these bridge-and-selector configurations are used in dual node ring interworking.

Drop-and-continue working configuration.

This configuration is used at the primary node in a DNI configuration. The outgoing traffic on the working port is unrelated to this bridge-and-selector configuration. In terms of applicability to point-to-multipoint connections, any bridges or broadcasts of the incoming signal to the working port will be “inside” the selector, while the bridge to the outgoing signal of the protection port is “outside” the selector. For the drop-and-continue working

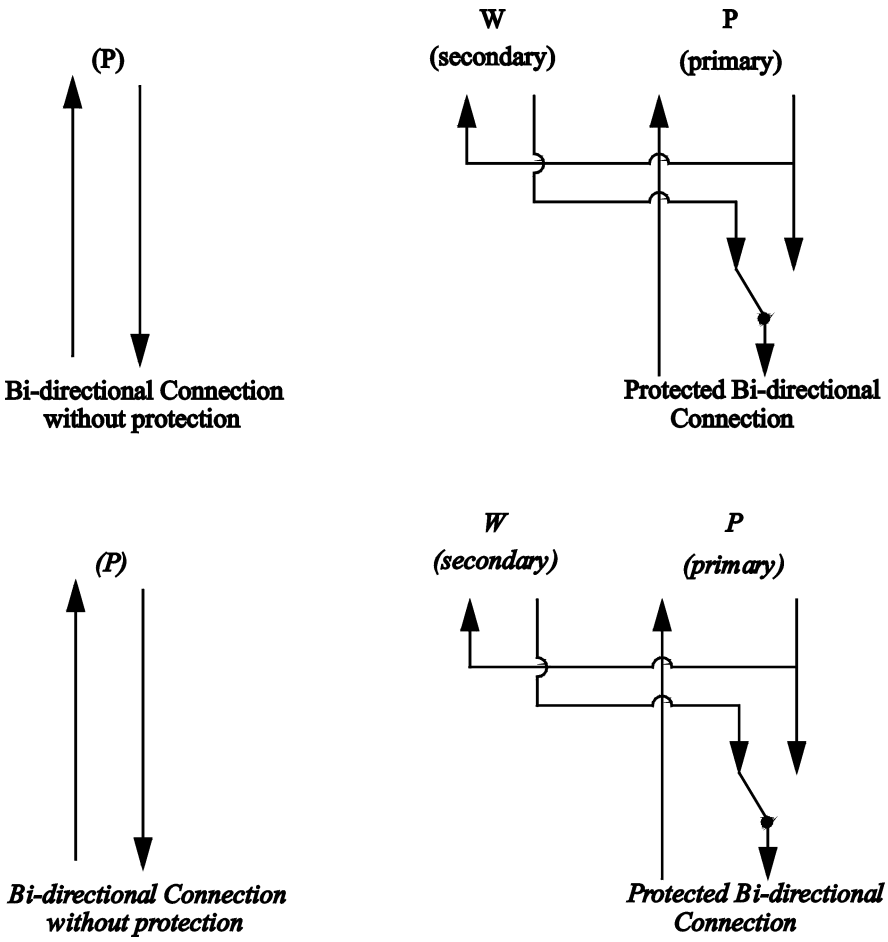
configuration, the primary path is considered to be the working path while the secondary path is considered to be the protection path.



Drop-and-continue protect configuration.

This configuration is used at the secondary node in dual node ring interworking.The outgoing traffic on the protection port is unrelated to this bridge-and-selector configuration. For the drop-and-continue protect configuration, the primary path is the protection path and the working path is the secondary path. This type of protection group will be identified by the name of the protection path. In terms of applicability to point-to-multipoint connections, any bridges or broadcasts of the incoming signal to the protection port will be

"inside" the selector, while the bridge to the outgoing signal of the working port is "outside" the selector.



WaveStar® DACS switch matrix.

The bridge-and-selector functions are provided in the DACS switch matrix. This allows common implementation of SNCP for all types of paths. The monitoring is provided on the port units where the working and protection paths are received at the tail end of the subnetwork connection.

Synchronization management

In order to understand the timing configuration in the management system, it is important to have a basic knowledge of the way network synchronization is implemented in the SDH network elements. Therefore it is recommended that you first read the sections "Timing Concepts" and "Timing Provisioning" in the Provisioning Guide of the WaveStar® DACS. The following text blocks indicate only aspects of network synchronization that are ***specific*** to the WaveStar® DACS.

Timing sources

'Timing sources' covers the station-clock input processes, the input-port timing processes, the timing-source assignment and the

timing-source function. The SSM words are extracted only from the 2 Mbit/s framed input signal. The user can enable or disable the extraction of the SSM words on station-clock input. The WaveStar® DACS supports 2 Mbit/s or 64 kbit/s station-clock inputs but all the station-clock inputs must be of the same type. The user can specify the location of the Sa bit that carries the SSM words for the 2 Mbit/s framed station-clock input signal.

The WaveStar® DACS may have a maximum of five timing sources, which are selected from STCLK_1, STCLK_2, LINE_1, LINE_2, LINE_3, LINE_4 and LINE_5. For each timing source the management system populates a list of valid working references. This list is provided by the network element. For each timing source the ITM-SC user can assign 0 or 1 working references.

System timing

The ITM-SC manages the following system-timing parameters:

- Priority, which is readable and adjustable for each timing source (disable, 1, 2, 3, 4)
- Lockout state, which is readable for each timing source
- Lockout request, which is adjustable for each timing source
- Switch status, which is readable
- Switch requests, which are adjustable
- Active timing source, which is readable
- System-timing and output-timing QL, which is readable and adjustable (enabled, disabled)
- Timing mode, which is readable and adjustable
- Timing state, which is readable (normal, loopback on line A, loopback on line B, FR, HO)
- System QL, which is readable.

In addition, the ITM-SC manages a number of “transmission output-port” parameters that are related to timing:

1. SDH output ports:
    - outgoing SSM, which is readable
    - force DNU, which is readable and adjustable
2. 2 Mbit/s output ports:
    - Port timing-mode which is readable and adjustable to (Self-Timed, Re-Timed)
    - Port timing-state, which is readable (Normal, Fallback)
    - Fallback mode, which is readable and adjustable to (None, Re-Timed AIS, Self-Timed)

- Acceptance QL, which is readable and adjustable to (PRC, SSU-T, SSU-L, SEC)
- Outgoing QL, which is readable (PRC, SSU-T, SSU-L, SEC)
- Timing-alarm reporting,, which is readable and adjustable to (enable, disable).

The system timing modes for the WaveStar® DACS are:

- Locked Mode; in this mode the system time-base is locked to one of the input reference signals as the time base determined by the timing link switch
- Hold-over Mode; in this mode the time-base takes its reference from the hold-over memory.

Station-clock output timing

For the NE the timing sources are dedicated to the type of timing references (station-clock input, or line). A maximum of four timing sources of both types can be selected as inputs to the system timing-link switch. Only one line timing-source can be selected as input to the Station-Clock Output Timing-Link Switch.

The network element has a maximum of two station-clock output ports because there is a duplicate System-Timing Unit that provides equipment protection. The NE supports 2 MHz station clock-outputs.

Timing-event log

Timing events that are sent by WaveStar® DACS NEs are not stored in the timing event log store of the ITM-SC.

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New features for the WaveStar® ADM 16/1 Senior and the WaveStar® ADM 16/1 Compact

Gigabit Ethernet card

The Gigabit Ethernet card (or GbE card) allows a much larger Ethernet pipe to be used. The GbE card will support an SDH Channel/VCG of up to VC4-4v.

The main differences between the existing Ethernet cards and the GbE card is that the GbE card has VC4-Xv and VC3-Xv rather than VC3-Xv and VC12-Xv capacity to cope with the larger payloads.

The difference between provisioning the GbE card and the TransLan+ /M-LAN cards is the increased flexibility of VC to VCG mapping which means that the operator can no longer simply select the capacity. An operator will now be able to select which VCs will be used.

Dynamic bandwidth adjustment

One of the major problems with using Virtual Concatenation is that if one of the VCs has a fault and fails the whole signal fails. This means that if a single VC fails the entire SDH Channel/VCG is lost. The GbE card for the ADM16/1 family of Network Elements supports LCAS. LCAS (or Link Capacity Adjustment Scheme) allows dynamic bandwidth increase or decrease without loss of signal. Furthermore, if the signal of one or more of the components becomes degraded then LCAS will autonomously remove those VCs from the group. When the failure is repaired LCAS will automatically return those component VCs to the SDH Channel/VCG.

The following table indicates the effect of the LCAS has on the transmission capacity:

LCAS enabled/disabled	Capacity with no VC-n failures	One or more (but not all) VC-ns failures	All VC-ns fail.
No LCAS	Working Capacity = Provisioned Capacity	Working Capacity = 0	Working Capacity = 0
LCAS enabled	Working Capacity = Provisioned Capacity	Working Capacity is reduced by amount of failed VC-ns service is degraded.	Working Capacity = 0

Figure 2-7 Non-degraded service

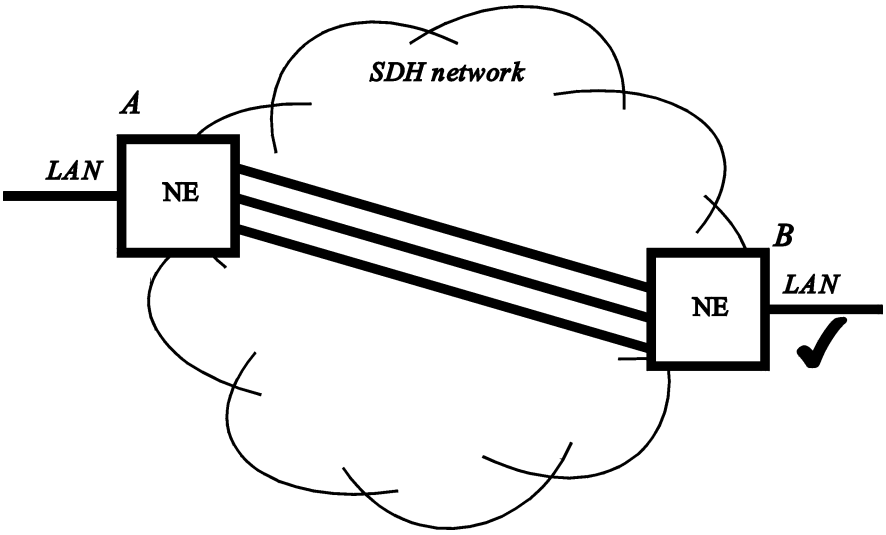
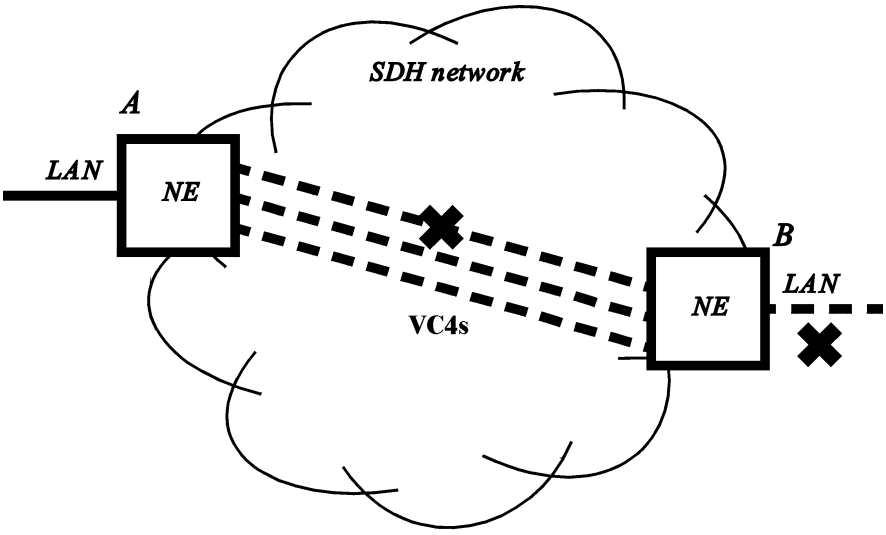
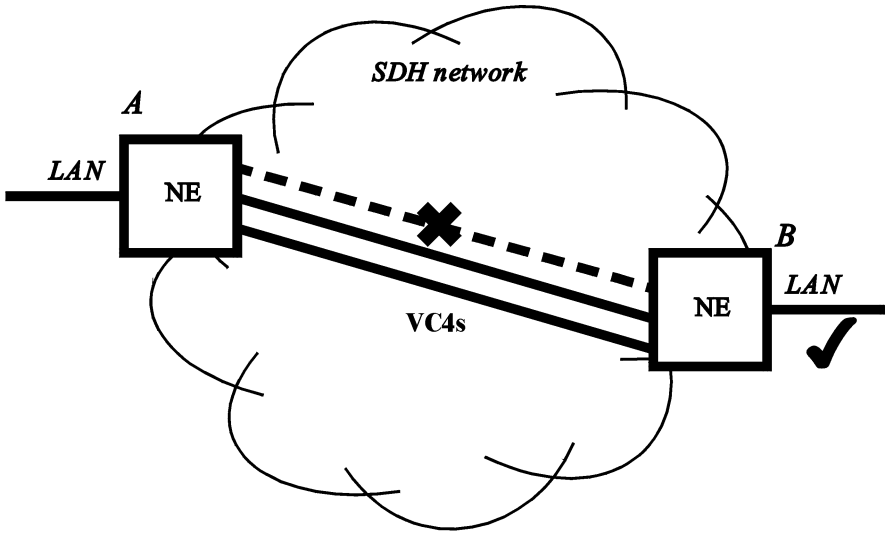


Figure 2-8 Non-LCAS mode where a degraded service is the result



Single failure causes total signal loss.

Figure 2-9 With LCAS enabled the only result is degradation of the signal



Single failure only causes signal degradation.

VC allocation

There are 4 x VC-4 TTPs on the GbE card. Each of these can be substructured to VC-3 TTPs or used as VC-4 TTPs. When the operator requests an SDH Channel/VCG he has a choice of various capacities from a single VC-3 (50 mbit/s) up to VC-4-4v (600 mbit/s). If the operator requires a bandwidth of say 100 mbit/s, one of the VC-4 TTPs must be adapted into VC-3 TTPs, and two of these will be virtually concatenated as a VC-3-2v.

LCAS and the Ethernet encapsulation mode

There are two new provisionable items for the GbE card, LCAS (Link Capacity Adjustment Scheme) and Ethernet Encapsulation Mode. Ethernet Encapsulation Mode indicates the method of encapsulation for adapting asynchronous Ethernet traffic over synchronous TDM transport.

For VC3 there are two modes of operation, ‘Ethernet Over SDH’ (EoS) for VC3-Xv, which is a Lucent proprietary system, will allow interworking with the current ITM-SC supported hardware (eg AM 1 Plus) and ‘Generic Framing Procedure’ (GFP). For VC4-Xv there is only one available encapsulation mode ‘GFP’. GFP will allow interworking with other equipment.

E3 and DS3 tributary units

Two new tributary units have been developed for the WaveStar® ADM 16/1 Senior. One unit has six E3 (34 Mbit/s) interfaces and the other unit has six DS3 (45 Mbit/s) interfaces.

Together with these new units the following equipment protection schemes are supported:

Protection type	Protection level	Revertive	ADM 16/1 Senior	ADM 16/1 Compact
1+1	CCU	Non-revertive	Yes	No
1+1	PSF/TU	Non-revertive	Yes	No
1+1	E3/DS3 TPU	Non-revertive	Yes	Yes
1+1	E3 TPU	Non-revertive	Yes	No
1+1	DS3 TPU	Non-revertive	Yes	No
1+1	SI-1/4 TPU	Non-revertive	No	Yes
1+1	Core unit	Non-revertive	No	Yes
1+1	LAN TPU	Non-revertive	Yes	No
1+1	SI-4/1 TPU	Non-revertive	No	Yes
1:N	2 Mbit/s TPU	Revertive	Yes	Yes
1:N	1.5 Mbit/s TPU	Revertive	Yes	No
1:N	E4/STM–1E	Revertive	Yes	No
1:N	SI-1/4 TPU	Revertive	Yes	Yes
1:N	SPIA-1E4/4	Revertive	Yes	No

The 34 Mbit/s unit has six 34 Mbit/s ports, which have fixed mappings into two VC-4s. The mapping can not be changed, but the two VC-4s can be cross-connected independently.

The mappings are shown in the following table:

34 Mbit/s port	Mapping	VC-4 number
1 to 3	<–>	1
4 to 6	<–>	2

The 45 Mbit/s unit has six 45 Mbit/s ports, which have fixed mappings into two VC-4s. The mapping can not be changed, but the two VC-4s can be cross-connected independently.

The mappings are shown in the following table:

45 Mbit/s port	Mapping	VC-4 number
1 to 3	<–>	1
4 to 6	<–>	2

Partition repair for the ADM 16/1 Compact

The partition repair is needed to allow management DCNs for large multi-ring networks to be designed such that single points of failure are avoided. The use of partition repair is restricted to those cases where the current mechanisms cannot avoid a single point of failure, even though a physical backup route is available.

Partition repair provides a way to enhance the robustness of the DCN by providing the capability to repair intra-area routing using connections via nodes outside the area. This is done by creating a path outside the area, between two level 2 nodes (which are provisioned to be partition capable level 2 nodes) that belong to distinct partitions of the same IS-IS area.

Note that network element types that do not support partition repair, like ISM, LR16, SLM and LXC, can exist in the “repaired” areas; however, these network elements cannot be part of the level 2 repair path (they cannot be part of the level 1 tunnel through the level 2 domain).

□

New features for the WaveStar® ITM-SC

Monitored termination points

The maximum number of Termination Points (TP) that may be monitored simultaneously by an NE type is as follows:

- ISM: Maximum of 138 TPs (VC12 - 126; VC4 - 10; MS - 2).
- SLM: Maximum of 38 TPs (RS4/16 - 2; MS4/16 - 2 (NE); MS4/16 - 2 (FE); VC4 -16 (NE); VC4 -16 (FE).
- RR: Maximum of 16 TPs (RS -16; 2 terminals, 14 regenerators).
- ADM155C/E, ADM4/1: Maximum of 170 (MS - 4, RS -4, VC12 - 128, VC12-TP - 32, VC4 - 2).
- PHASE: Maximum of 150 TPs. VC12 - 315, VC3 90, VC4 100, 62 MS, 62 RS, 1 AU4-PJE, 1 - PSC, 6300 TU12-CTP, 2100 TU2-CTP, 300 TU3-CTP. 1 TCM Sink Point and 1 TCM NIM Point are associated with every valid TTP or CTP (VC12, VC3, VC4, TU12, TU2, TU3 & AU4).
- ADM16/1 Senior: Maximum of 1200 TPs. VC11 - 504, VC12 - 504, VC3 - 96, VC4 - 64, MS - 34, RS -34, AU4-PJE -1, AU4 - 64, AU4-4C - 16, 2016 TU12-CTP, 96 TU3-CTP.
- ADM16/1 Compact: Maximum of 1200 TPs. VC4 - 16, MS - 34, RS -34, AU4-16, AU4-4C - 4, LAN – 32, WAN – 32.
- TM 1: Maximum of 18 TPs (MS - 1, VC12 - 16, VC3 - 0, VC4 - 1)
- AM 1 family: Maximum of 36 TPs (MS - 2, VC11 - 16, VC12 (including remote ports) - 32, VC3 - 2, VC4 - 2, E1 (PDH-SDH and SDH-PDH) LAN, WAN).
- WDACS: Any combination of supported TP types. The actual maximum depends on the load on the ITM-SC and on the hardware configuration but can be calculated as follows: Max_tps = number_of _port_racks x number_of_port_unit_shelves x number_of_port_units x number_of_ports. for example, for an all PSA WDACS you can have 8 x 4 x 9 x 4 = 1152 TPs.
- OLS 80G: Maximum of 36 TPs for a Regenerator. Maximum of 196 TPs for a 2–Line System as shown in the next table.

Table 2-2 Termination Points (196) for a 2–Line OLS 80G System

Direction	OTU	OMU	OA	SUP	LINE
Tx	16	16	16	1	1
Rx	16	16	16	1	1
Total of 98 per Line	32	32	32	2	2

Supported NEs The following table provides information about the existing and the new network element releases that are supported by the ITM-SC.

Network Element	Release supported
ISM	Unchanged since the Gold release
SLM	Unchanged since the Gold release
Radio Relay	Unchanged since the Gold release
ADM 155E and WaveStar® ADM 4/1	Unchanged since the Sapphire 3 release
WaveStar® ADM 16/1 Senior	R6.0
WaveStar® ADM 16/1 Compact	R2.0
Phase	Unchanged since the Sapphire 3 release
WaveStar® AM 1 Plus	R3.0
WaveStar® AM 1	Unchanged since the Diamond release
WaveStar® TM 1	Unchanged since the Diamond release
WaveStar® OLS 80G	Unchanged since the Emerald release
WaveStar® DACS	R3.1

Compatibility The WaveStar® ITM-SC supports management of the following ***previous*** network element releases:

- WaveStar® AM 1 Plus release 2.2
- WaveStar® DACS release 3.0.

□

3 Network Topologies

Overview

Purpose This chapter explains a number of possible management network configurations with the WaveStar® ITM-SC and Navis™ Optical Network Management System (formerly named the WaveStar® NMS), including the specific configuration functionalities. The Navis™ Optical Network Management System is used for Network level Management.

□

Section: Network Loading and Network Configurations

Overview

Purpose

Depending on the network structure, there are several possible deployment configurations of the element and the network management system. This section discusses combinations of element- and network management systems and workstations that are present within one management domain. The configurations that are shown focus on the management of transmission networks. The configurations of network elements in the figures are arbitrary.

Network element equivalents

The total number of network elements that can be managed depends on the hardware configuration and the number of licensed features. For instance, performance monitoring takes processing resource and communications bandwidth. The functionality, database size and processing power required from the WaveStar® ITM-SC are also different for each supported type network element. Therefore each type of network element represents an amount of Network Element Equivalents (NEEs). The maximum numbers of NEEs for the WaveStar® ITM-SC deployments are given in this document.

Configurations

The types of configurations that are described in this section are:

- Stand-alone WaveStar® ITM-SC
- Stand-alone WaveStar® ITM-SC with management of a WaveStar® DACS
- Stand-alone WaveStar® ITM-SC with an network management system on a separate server
- Client-server, of which the following configurations are described:
  - Client-server
  - Client-server with management of a WaveStar® DACS
  - Client-server with separate Navis™ Optical Network Management System.
- X-terminal configurations.

Servers and workstations can be local or remote with respect to each other. No distinction is made between local and remote systems.

□

Network Element Equivalent Loading

Introduction

This chapter presents a number of possible network element configurations and the effect of these configurations on the network element equivalent. One NEE corresponds to a fully provisioned ISM network element with disabled performance monitoring. We could not include the NEEs for all possible network configurations in the table below, so please contact Lucent Technologies regarding other configurations.

Subrack development

The next table shows the cost per network element type and for different configurations. The following configurations are used:

1. association only
2. 100% termination point capability, 0% cross-connections and 0% performance monitoring
3. 0% termination point capability, 100% cross-connections and 0% performance monitoring
4. 0% termination point capability, 0% cross-connections and 100% performance monitoring
5. 50% termination point capability, 50% cross-connections and 20% performance monitoring (this configuration may be used as the ″average″ network element
6. 100% termination point capability, 100% cross-connections and 0% performance monitoring
7. 100% termination point capability, 100% cross-connections and 100% performance monitoring.

Network Element Type	Configuration						
	1	2	3	4	5	6	7
ISM	0.5	0.75	0.75	1.80	1.01	1	2.29
SLM	0.5	0.53	0.54	0.95	0.61	0.57	1.01
NERA RR	0.5	0.53	0.51	0.69	0.56	0.54	0.73
WaveStar® ADM 4/1	0.5	0.75	0.79	2.09	1.09	1.04	2.64
WaveStar® ADM 16/1 (16x16 cross- connect)	0.5	1.48	1.3	11.75	3.61	2.28	13.53
WaveStar® ADM 16/1 (32x32 cross-connect)	0.5	1.48	2.1	11.75	4.04	3.08	14.33
WaveStar® ADM 16/1 Compact (32x32 cross-connect)	0.5	0.99	2.1	11.75	3.80	2.59	13.84

Network Element Type	Configuration						
	1	**2**	**3**	**4**	**5**	**6**	**7**
PHASE TM X/4	0.5	1.12	0.51	1.91	1.09	1.13	2.53
PHASE LR/X	0.5	0.51	0.50	0.54	0.51	0.51	0.55
PHASE ADM X/4	0.5	1.04	0.51	1.91	1.06	1.05	2.46
PHASE LXC 4/1	0.5	1.04	1.47	1.91	1.53	2.00	3.41
WaveStar® LXC 16/1	0.5	0.89	3.85	1.91	2.65	4.24	5.65
WaveStar® OLS-80G (End Terminal)	0.5	0.75	0.5	3.01	2.34	0.75	2.59
WaveStar® OLS-80G (Repeater)	0.5	0.5	0.5	0.84	0.57	0.5	0.84
WaveStar® TM 1	0.5	0.53	0.51	0.67	0.56	0.54	0.71
WaveStar® AM 1	0.5	0.57	0.53	0.97	0.64	0.60	1.07
WaveStar® AM 1 Plus	0.5	0.57	0.52	1.03	0.65	0.60	1.13
WaveStar® DACS (256x256)	0.5	0.5	6.9	29.3	9.46	6.9	35.7
WaveStar® DACS (512x512)	0.5	0.5	13.3	29.3	12.66	13.3	42.1

Stand-alone WaveStar® ITM-SC

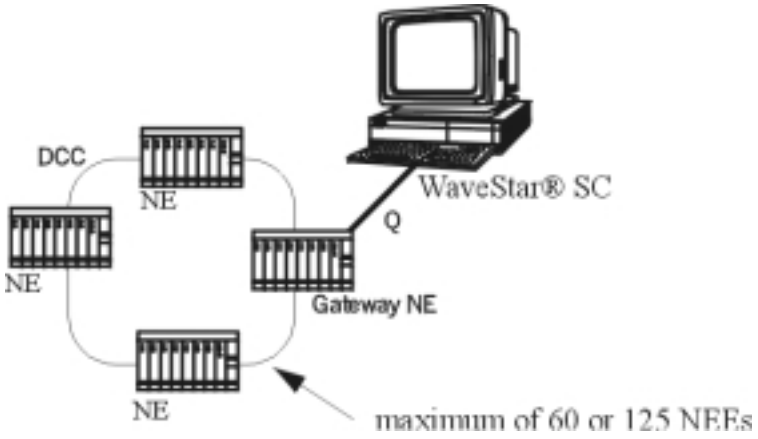
Introduction

In this configuration there is no Navis™ Optical Network Management System and there are no client workstations present. The element management system is located in one place. It can be managed by a maximum of two users, provided that each user has a separate workstation.

In SDH transmission networks a maximum of 60 network element equivalents (NEEs) can be managed with a single stand-alone B180L SC workstation. A B2000 workstation can manage up to 125 NEEs.

Example

Figure 3-1 A configuration with a stand-alone WaveStar® ITM-SC



Equipment

The following equipment is needed:

Management Equipment	Maximum number
Stand-alone WaveStar® ITM-SC	1
Network Element Equivalent	60 or 125

Stand-alone WaveStar® ITM-SC with management of a WaveStar® DACS

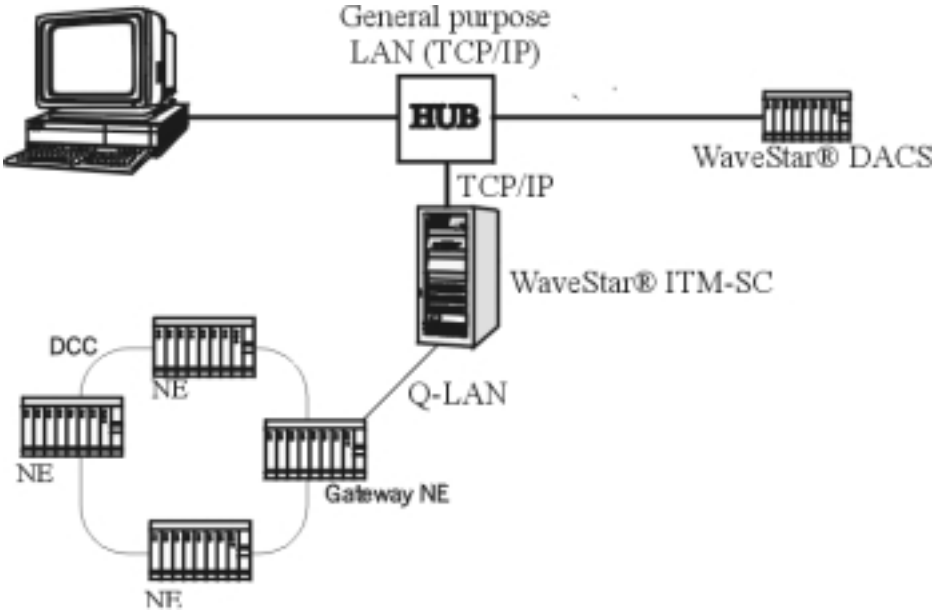
Management of a WaveStar® DACS

As regards the connections between the WaveStar® ITM-SC and the WaveStar® DACS:

- The WaveStar® DACS is connected to the general purpose LAN (the TCP/IP LAN).
- Under no circumstances should the WaveStar® DACS be connected to the Q-LAN
- To limit the performance implications of connecting the WaveStar® DACS to the general purpose LAN there are some additional restrictions as to what the stand-alone system's general purpose LAN can be connected to:
  1. WaveStar® ITM-SC client workstations can be connected to this LAN to run client interfaces.
  2. A network manager cannot be connected to the stand-alone workstation via the general purpose LAN (if network management is required, a server must be used to manage the WaveStar® DACS).
  3. Under no circumstances should the stand-alone system's TCP/IP LAN connection be connected to an intranet if the system is managing a WaveStar® DACS.

Example

Figure 3-2 A configuration with a stand-alone WaveStar® ITM-SC and management of a WaveStar® DACS



Stand-alone WaveStar® ITM-SC with management of a WaveStar® DACS

Equipment The following equipment is needed:

Management Equipment	Maximum number
Stand-alone WaveStar® ITM-SC	1
Network Element Equivalent	60 or 125

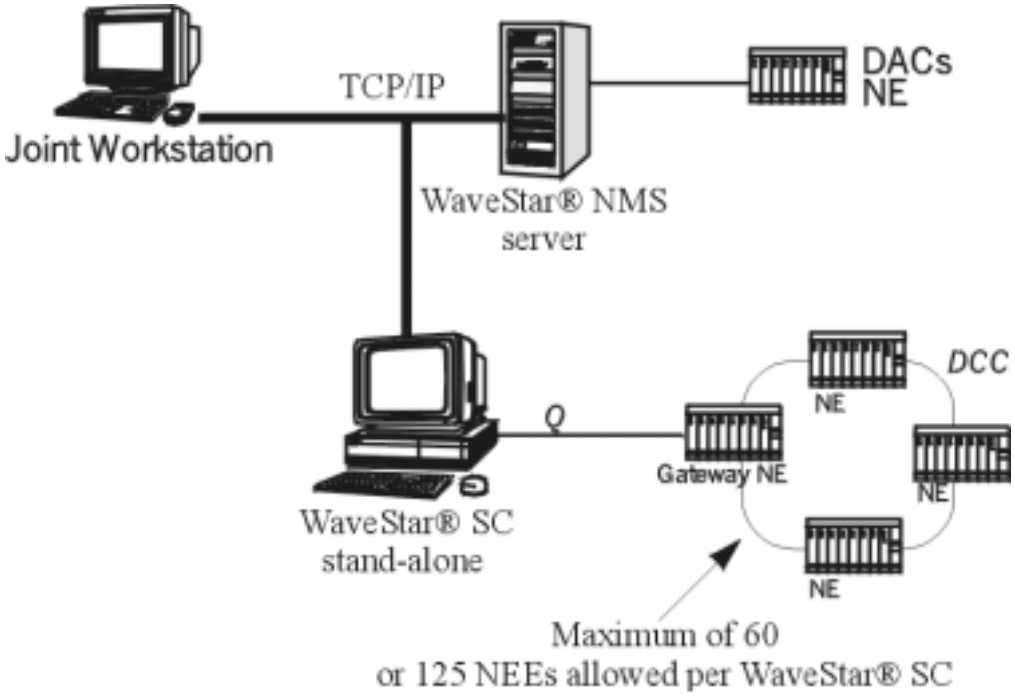
Stand-alone WaveStar® ITM-SC with an Navis™ Optical NMS on a separate server

Introduction

In this configuration there is one Navis™ Optical Network Management System and a maximum of one joint workstation with the Navis™ Optical Network Management System on a separate server. A joint workstation can provide a graphical user interface to both an Navis™ Optical Network Management System server and a stand-alone WaveStar® ITM-SC. In this configuration the WaveStar® ITM-SC can manage up to 60 network element equivalents (NEEs) if B180L workstation is used. If workstation B2000 is used up to 125 NEEs can be managed.

Example

Figure 3-3 A configuration with a stand-alone WaveStar® ITM-SC with a Navis™ Optical NMS (Navis™ Optical NMS was formerly called the WaveStar© NMS).



Equipment

The following equipment is needed:

Management Equipment	Maximum number
Stand-alone WaveStar® ITM-SC stand-alone	1
Navis™ Optical Network Management System server	1

Management Equipment	Maximum number
Joint Client Workstations	1
Network Element Equivalent	60 or 125

Client-Server

Introduction

For larger networks the WaveStar® ITM-SC can be run using a client server system architecture. The client provides a user interface to the server. The main application tasks are performed on the server.

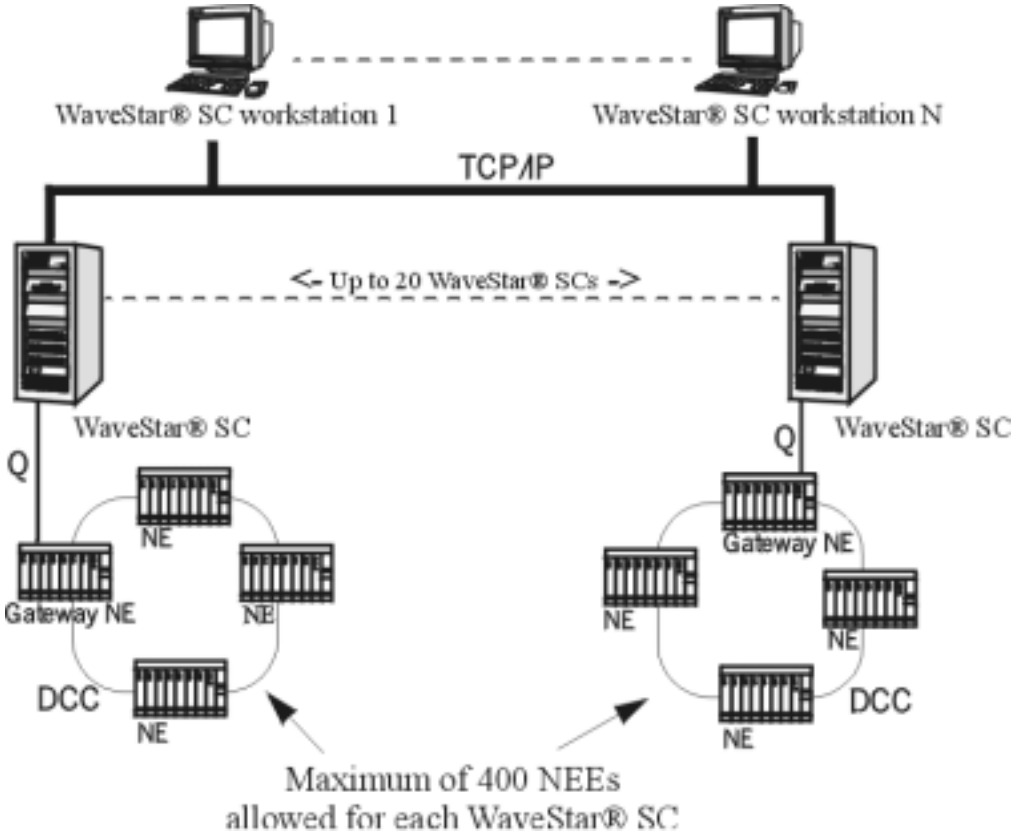
For each of the following configurations all the workstations can access the WaveStar® ITM-SC server concurrently and each workstation may have access to all the WaveStar® ITM-SCs in the network. Up to 10 users can work concurrently on an WaveStar® ITM-SC. The possible client-server WaveStar® ITM-SC configurations are described in the following blocks.

Client server

In this configuration the network is managed by a maximum of 20 WaveStar® ITM-SCs. The number of WaveStar® ITM-SC workstations that may be connected is limited by the capacity of the LAN/WAN. There is no Navis™ Optical Network Management System, so there are no joint workstations. Each WaveStar® ITM-SC, without a backup element management system or an appropriate license setup, is allowed to manage up to 400 network element equivalents.

Example

Figure 3-4 A client-server configuration.



Equipment The following equipment is needed:

Management Equipment	Maximum number
WaveStar® ITM-SC server	20
WaveStar® ITM-SC Client Workstation	Depends on the LAN/WAN capacity
Network Element Equivalent per WaveStar® ITM-SC	400

□

Client-Server with management of a WaveStar® DACS

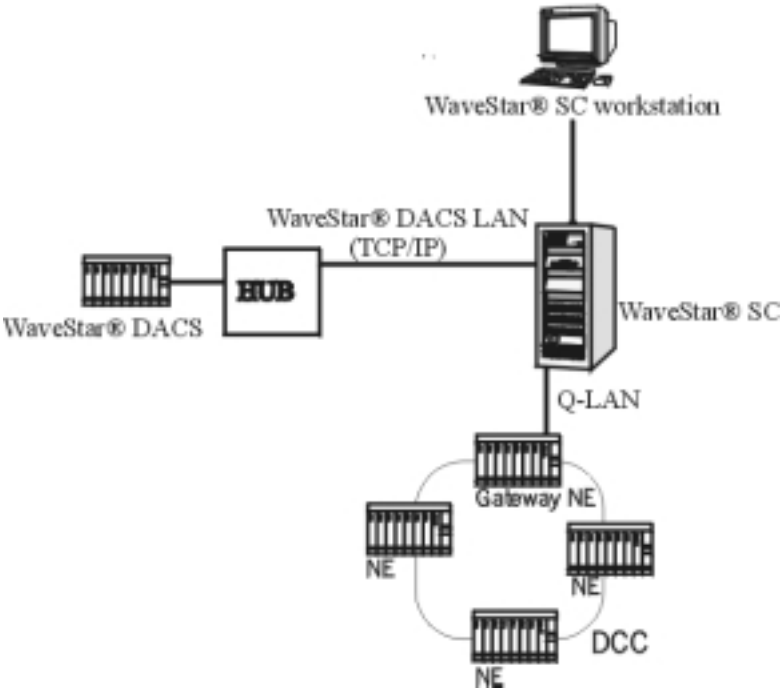
Management of a WaveStar® DACS

As regards the connections between the WaveStar® ITM-SC and the WaveStar® DACS:

- The WaveStar® ITM-SC server will have a third LAN card added for management of a DACS. This means that WaveStar® ITM-SC servers will have LANs for the following purposes:
  1. The Q-LAN will manage network elements other than the WaveStar® DACS.
  2. The general purpose LAN will be used for TCP/IP connectivity workstations, Navis™ Optical Network Management System, etc.
  3. The WaveStar® DACS LAN will be used for the TCP/IP connectivity of any DACS systems in the network.
- Under no circumstances should the WaveStar® DACS be connected to the Q-LAN.
- The WaveStar® DACS is connected (where possible) to a separate physical LAN. This separate LAN is chosen to a avoid performance-feedback loop. This is important when this network is actually a wide area network.

Example

Figure 3-5 A client server configuration of a WaveStar® ITM-SC with management of a WaveStar® DACS



Equipment The following equipment is needed:

Management Equipment	Maximum number
WaveStar® ITM-SC server	20
WaveStar® ITM-SC Client Workstation	Depends on the LAN/WAN capacity
Network Element Equivalent per WaveStar® ITM-SC	400

□

Client-Server with separate Navis™ Optical NMS

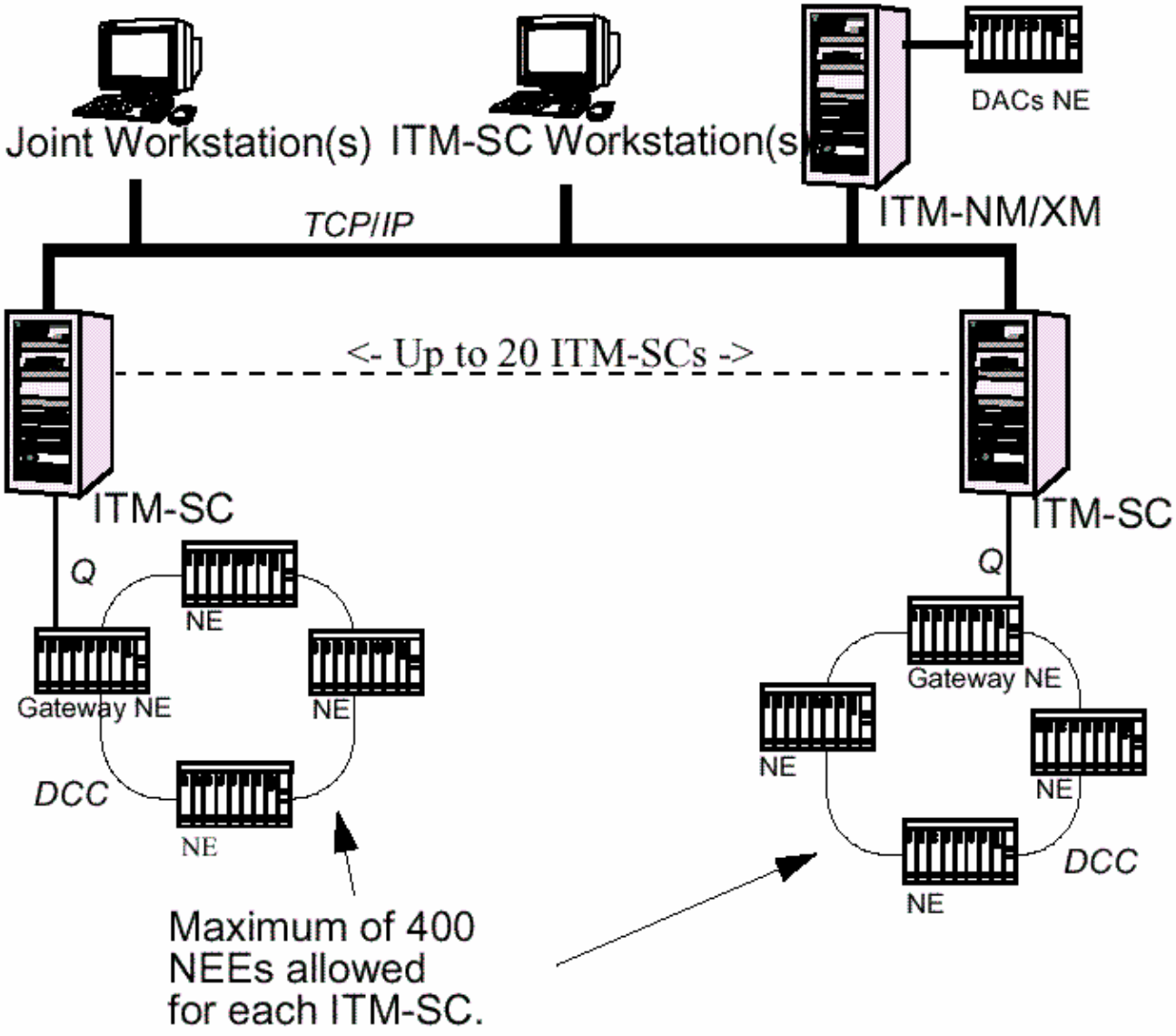
Introduction

The figure below shows a possible client-server configuration with a maximum of one Navis™ Optical Network Management System and 20 WaveStar® ITM-SCs. The WaveStar® ITM-SC workstations and joint workstations are connected by TCP/IP. The maximum number of connected and WaveStar® ITM-SC workstations depends on the LAN/WAN capacity but is limited to 50.

The number of different users that can be logged on to the Navis™ Optical Network Management System depends on the purchased license option . Each WaveStar® ITM-SC, without a backup element management system or an appropriate license setup, is allowed to manage up to 400 network element equivalents.

Example

Figure 3-6 A client-server configuration with separate Navis™ Optical NMS (Navis™ NMS was formerly called the WaveStar© NMS)



Equipment The following equipment is needed:

Management Equipment	Maximum number
WaveStar® ITM-SC server	20
WaveStar® ITM-SC Client Workstation	Depends on the LAN/WAN capacity
Network Element Equivalent per WaveStar® ITM-SC	400

□

X-Terminal Configurations

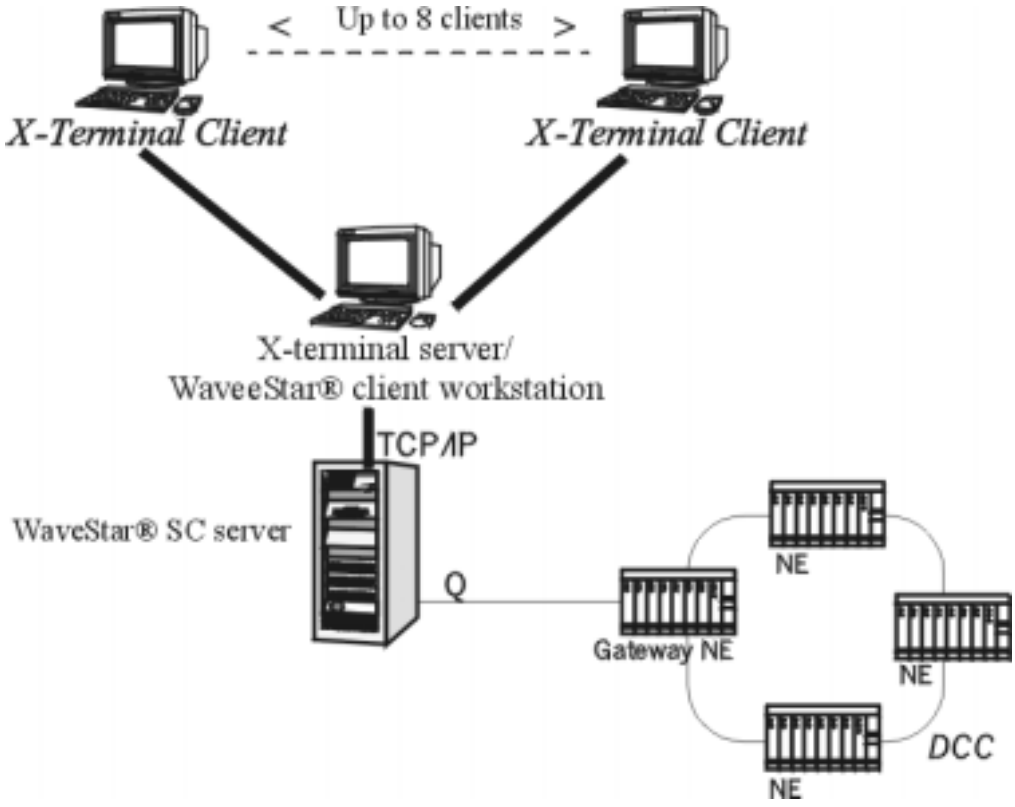
Introduction

In order to expand the graphical user interface (GUI), workstations can be given additional access by means of X-terminals. The workstation, which is already providing a client with a GUI to the WaveStar® ITM-SC server, can also act as an X-terminal server for X-terminal clients. The X-terminal server (workstation) sends graphics commands to the relevant X-terminal client in order to provide a GUI for the X-terminal client. The X-terminal server can support up to 8 X-terminal clients (depending on the server type).

The figure below shows a possible deployment. The connection between X-terminal client and server depends on the customer's network, so the X-terminal clients may be local or remote relative to the X-terminal server. The X-terminals cannot be directly connected to a server.

Example

Figure 3-7 An X-terminal configuration



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Section: High Availability Configurations

Overview

Purpose Several features have been developed to secure the availability of management in case of system failure. These features are described in this section.

These are the features concerned:

- Geographic redundancy
- Uninterruptible power supply
- Mirrored disks
- Cold standby.

□

Geographic Redundancy

Overview

Geographic redundancy for WaveStar® ITM-SC provides increased reliability through a backup WaveStar® ITM-SC system that will take over the management of the network elements if the primary WaveStar® ITM-SC fails or is unavailable due to maintenance.

Geographic redundancy is only possible if a primary and a protecting domain are assigned to each network element. In the first instance the WaveStar® ITM-SC manages the network elements in its primary domain. If the WaveStar® ITM-SC in a primary domain fails, other WaveStar® ITM-SCs will take over the management of those elements that are part of their protecting domain.

Since the primary WaveStar® ITM-SC can manage only a limited number of network elements, the total amount of network element equivalents in the primary and the protecting domain is also limited. Any WaveStar® ITM-SC that is communicating with another WaveStar® ITM-SC as part of the geographic redundancy scheme considers the other WaveStar® ITM-SC to be a peer system. The TCP/IP network transports notifications of WaveStar® ITM-SC failure, from a primary to a secondary WaveStar® ITM-SC.

In a geographic redundancy deployment each WaveStar® ITM-SC can protect (part of) the domains of up to four different WaveStar® ITM-SCs. Different ITM-SCs can have different peer groups.

Failures covered by geographic redundancy

Geographic redundancy takes advantage of spare capacity in adjacent WaveStar® ITM-SC systems to cover a number of possible failures. These failures include:

- Complete failure of a WaveStar® ITM-SC (e.g. a disk crash or processor failure)
- Failure of the Q-LAN between an WaveStar® ITM-SC and its gateway network elements
- A fiber break that would otherwise lead to loss of management of a network element.

Switching triggers

Management can be switched to the protecting system as a result of a manual or an automatic request and this swich-over can affect one or more network elements. Manual switch-over might be made so that the primary WaveStar® ITM-SC can be maintained. An automatic switch-over might be the result of an WaveStar® ITM-SC failure.

Interworking with the Navis™ Optical NMS

In case of a switch-over, the WaveStar® ITM-SC will automatically inform the Navis™ Optical NMS (Navis™ Optical NMS was formerly named the WaveStar NMS). Network layer management is completely available after the switch-over.

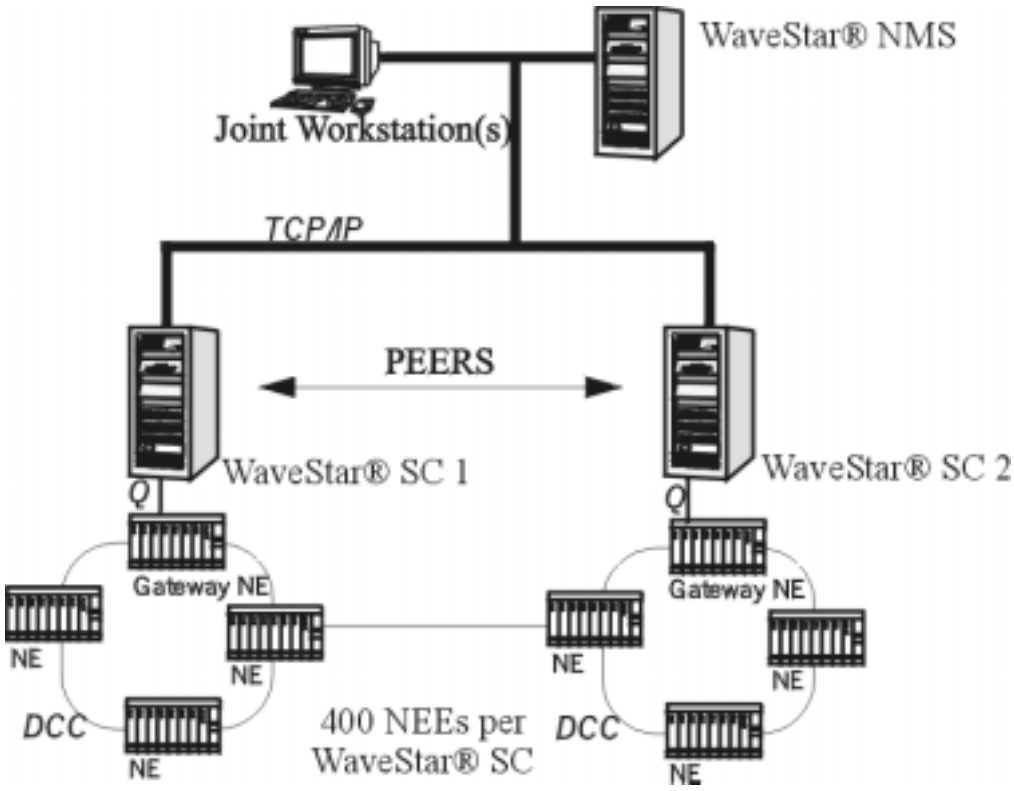
Configurations

Geographic redundancy can be configured as follows:

- Stand-alone without a Navis™ Optical Network Management System
- Stand-alone with a separate Navis™ Optical Network Management System
- Client/server without a Navis™ Optical Network Management System
- Client/server with a separate Navis™ Optical Network Management System.

Example

Figure 3-8 An example of geographic redundancy



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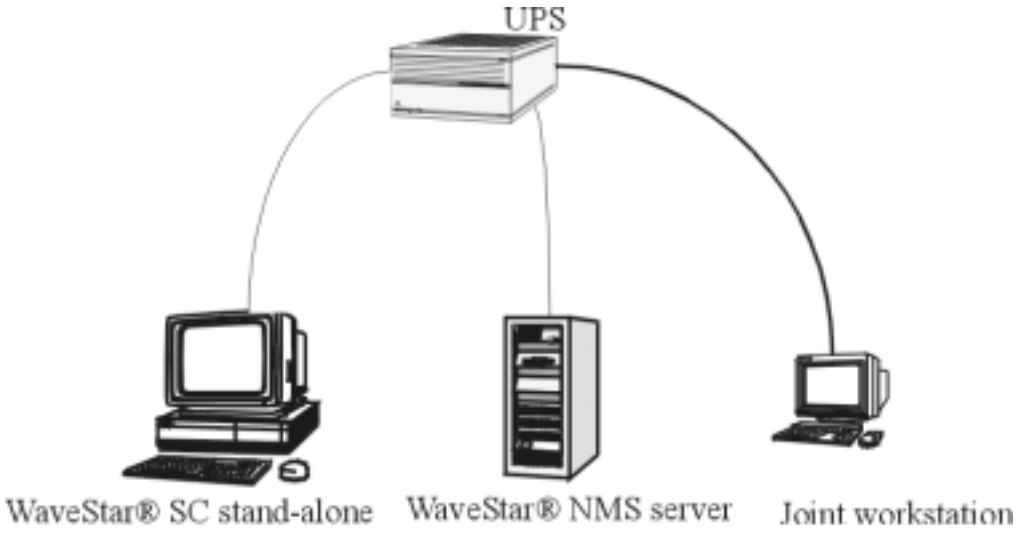
Uninterruptible Power Supply

Overview

An uninterruptible power supply (UPS) can be provided to increase system availability by powering the WaveStar® ITM-SC during short-term drops in or total loss of mains power. The length of time that UPS is provided is configurable. If mains power does not return within this time the system will perform an orderly shutdown. The UPS system sends messages to the WaveStar® ITM-SC via a serial link to inform the user of problems with the mains power supply.

Example

Figure 3-9 An example of uninterruptible power supply.



□

Other High Availability Features

Mirrored disks A second disk or a second pair of disks can be installed to increase the reliability of the WaveStar® ITM-SC server. The second disk or pair of disks will maintain an exact copy of the primary disk. When the primary disk fails the second disk will take over all processes that are active on the WaveStar® ITM-SC Server.

Cold standby It is also possible to enhance the availability of WaveStar® ITM-SC management by replacing a failed WaveStar® ITM-SC server with a cold standby server. This standby server needs to be available in a ″prepared″ state in other words the WaveStar® ITM-SC software must already be loaded. In the event the cold standby server must be used the network management database is created on it from the backup tape(s).

□

4 Product Description

Overview

Purpose This chapter gives an overview of the WaveStar® ITM-SC. There is a description the software architecture, the software modules, the communication interfaces to other parts of the network, the hardware platform on which the application can be installed, security access items and the graphical user interface.

□

Section: Description of the WaveStar® ITM-SC

Overview

Purpose The software modules of the WaveStar® ITM-SC are flexible, easy to modify and can easily be maintained. These modules reliably and efficiently manage SDH network elements. The high level software architecture of the WaveStar® ITM-SC comprises two distinctive parts at the ″element level″.

□

Management Levels

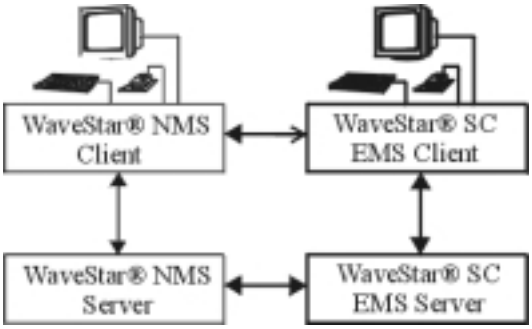
Element level

The two ″element level″ parts comprise an Element Management System (EMS), which is also known as the WaveStar® ITM-SC EMS. These two “element level” parts are:

- the ″element level″ operations system, which is packaged as the WaveStar® ITM-SC server
- the ″element level″ user interface (GUI), which is packaged as the WaveStar® ITM-SC client.

See the following block diagram.

Figure 4-1 Block diagram of the WaveStar® ITM-SC software components (the Navis™ Optical NMS was formerly called WaveStar© NMS)



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Element Management Level

Introduction

The Element Management Level (EML) interfaces to each network element within its domain. The EML allows the user to manage each element individually.

Element Management Level

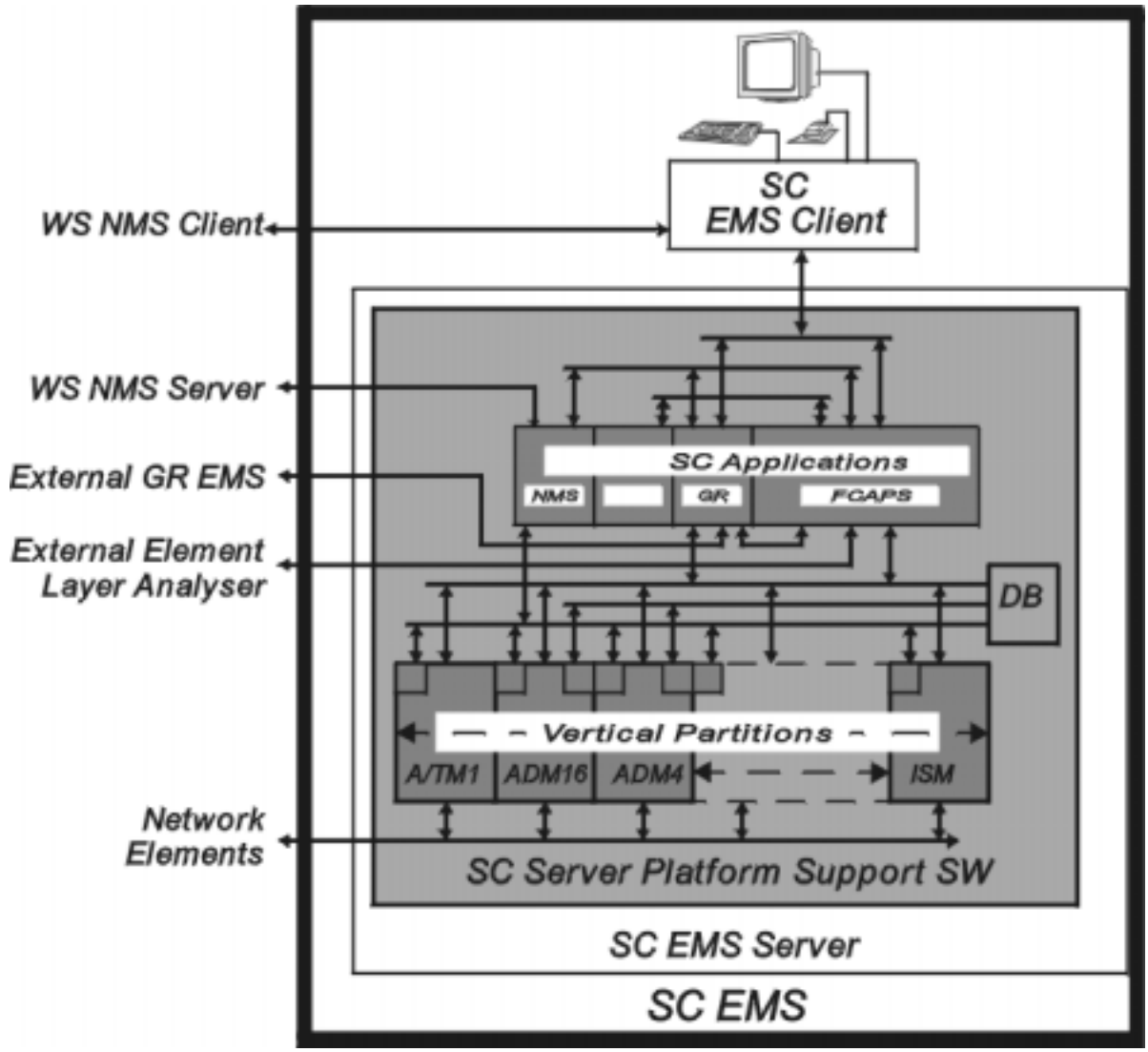
The EML has the following properties:

- The EML communicates with each of the network elements within its domain. It monitors and maintains the associations between the network elements and the WaveStar® ITM-SC.
- The EML maintains a full copy of the network database of all network elements in its domain and supports a range of data recovery scenarios between the WaveStar® ITM-SC and the network elements.
- The EML provides the full range of equipment management for the network elements, including graphic shelf displays, configuration, provisioning and protection control of the hardware and software resources as applicable for the particular network elements.
- The EML provides the first level of alarm and event handling for the network by giving the user access to all alarm information on the network. The EML provides the first level of network performance management in collection of network data and configuration of the measurements and the reporting.
- The EML provides the full range of transmission management for each element type within the various families of SDH network elements, including port control and monitoring, cross connection control and monitoring, and ring protection switch control and monitoring. The EML uses the ITU standard PDH/SDH termination point model of the transmission capabilities of each network element.
- The implementation philosophy of the (Qx) interface between the WaveStar® ITM-SC and the network elements is fully compliant with the standardized manager <-> agent object oriented paradigm.

The EML provides a number of interfaces to other systems, both internal WaveStar® ITM-SC and external systems. In particular, the EML provides an interface to the Network Management Layer (NML). The software architecture consists of application software subsystems, which use services provided by common software platform modules. These platform modules build up from the underlying HP-UX operating system. Furthermore a number of platform-based software components are available that support the

administration, maintenance and use of the WaveStar® ITM-SC system. In addition, there are so-called separate vertical partitions in the architecture. These partitions use the common platform and application modules and are associated with the different network element types.

Figure 4-2 Block diagram of the WaveStar® ITM-SC EMS components (the WS NMS is now called the Navis™ Optical NMS)



The platform components are:

- BaseWorX Provides mechanisms for the Unix process to communicate and a common mechanism for logging errors and managing Unix processes
- External Communications Represents the Qx interface to the SDH NEs

- The Internal Communication process allows and exchange of messages between Unix processes. that are running in parallel to each other.
- System Manager functions takes care of system operation, administration and maintenance

The WaveStar® ITM-SC application software subsystems include:

- Alarm Manager Handles alarm messages from the different NEs
- OS interface Controls communication with the NML
- Performance Monitoring Sets up measurements and collects and stores performance data
- Resource Monitor Checks the availability of disk a and memory without performance degradation
- Archive Broker Controls database archive activities
- Geographic Redundancy Takes care of internal and external communication for the Geographic Redundancy feature.
- Subsystem for TMF/CORBA/G7 interface, information can be provided on request
- Subsystem for PAMS interface, information can be provided on request
- Subsystem for TCM-E interface, information can be provided on request
- Optional subsystem for TMAG interface, information can be provided on request.

□

Management Information Base

Introduction

For every registered network element the WaveStar® ITM-SC creates a so-called Management Information Base (MIB) image in its database. This MIB image contains all the provisioning data of the network element.

MIB database

The network elements implement the network element function (NEF) as described by ITU-T M.3100. The system resources are modeled using managed object classes and a particular configuration is represented by a collection of managed object instances (MOIs). The information model, which describes the managed object classes, is based on the ITU-T standards for configuration management, event management and performance monitoring for SDH networks. These managed objects are easily recognizable SDH entities, such as optical SPI (optical SDH physical interface), rsTTP (regenerator section trail termination point), au4CTP (au4 connection termination point), etc. The network elements store the collection of managed object instances in a database that is referred to as the Management Information Base, or MIB. The configuration data may change as a result of a change in system state or as a result of a request from the management system (ITM). Whenever the data changes, a notification is sent to the management system. The MIB is stored permanently in the NEs, so that the configuration is recovered after incidents such as power failure or system controller restart. Any items of configuration data that are dependent on the system state, such as protection switch states, are always re-evaluated when the system controller starts up and the values in the MIB are updated accordingly.

Event management data

In addition, the network elements store event management information and performance monitoring data. The event management information is derived directly from the appropriate termination, adaptation and handler functions within the network elements. This information is stored in the system controller (SC). Each event must always be associated with a managed object instance in the MIB, i.e. an event cannot be reported to the ITM unless it is associated with a managed object instance. Event management information data is stored in the system controller memory and is lost after incidents such as power failure or system controller restart. This data is always re-evaluated when the system controller starts up.

Performance monitoring data

In a similar manner, the performance monitoring data is retrieved from the appropriate termination point and stored by the system controller. This data must always be associated with a managed object instance in the MIB. The network elements store 1 current and 16 historical counts for each 15 minute counter and 1 current and 1 historical count for each 24 hour counter. Performance monitoring data is stored in the system controller memory and is lost after incidents such as power failure or system controller restart. This data is always re-evaluated when the system controller starts up.

Summary

The data stored by the network elements is structured according to the ITU-T standards. All configuration data is stored permanently in the MIB which is failure-tolerant.. Event management and performance monitoring data is stored in non-persistent memory. Any data that depends on the state of the network element system is re-evaluated on startup and is then updated whenever the system state changes or on a periodic basis (e.g. performance monitoring data). The WaveStar® ITM-SC implements the element management function (EMF) as described in ITU-T M.3100. It uses a relational database management system (Informix On-line) to provide non-volatile data storage.

Although a single Informix database is used for all data, the data within is logically partitioned into a number of areas:

- MIB Data:
  An image of the MIB in each network element
- Fault Data:
  Current and History Alarms
- Performance Monitoring Data:
  Historical PM counter values (24 hr and 15 min)
- Network Data
  Data: associated with the WaveStar® Navis™ Optical Network Management System network manager
- Management Data:
  Other data required by the WaveStar® ITM-SC.

In addition, the MIB data is divided further based on the underlying information model that is used to represent network elements.

□

Communications Interfaces

Interface towards the network elements

Support is provided for the full ITU standards for Q-interfaces using the 7–layer OSI stack of Common Management Information Service Elements (CMISE). The WaveStar® ITM-SC communicates with the managed network via a Q-LAN. Communications with the network elements that cannot be reached directly via the LAN pass through a gateway network element on the LAN. The communication path between the gateway network element and the destination network element is generally a Data Communication Channel (DCC). The IS/IS protocol in the transport layer of the OSI stack is used for routing within the network. The implementation of the Q3 interface fully complies with the relevant ITU and ETSI standards regarding the object oriented manager<->agent paradigm. However choice of the managed objects is proprietary. The functionality generally adheres to and in several aspects exceeds the functionality prescribed by the standards (for example database synchronization procedures, software download etc.). However, the functionality is divided over the managed objects in a proprietary way.

Interface to the Network Management Level

The WaveStar® ITM-SC has currently a proprietary interface to the Network Management Level (NML) and this can be interfaced to the network module of the ITM family, the WaveStar® Navis™ Optical Network Management System. The WaveStar® Navis™ Optical Network Management System provides the user with a view of the entire network, including the SDH NEs that are managed by the WaveStar® ITM-SC. The WaveStar® ITM-SC provides services to the Navis™ Optical Network Management System to allow the WaveStar® Navis™ Optical Network Management System to perform its network management tasks. The interface between the WaveStar® ITM-SC and the WaveStar® Navis™ Optical Network Management System is based on a TCP/IP protocol over an ethernet link that supports a minimum of one 64 kbit/s transmission channel per WaveStar® ITM-SC. In the near future a Corba northbound interface will be provided as well

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Database Synchronization and Loading of Software

Association link

Each NE can be actively managed by only one WaveStar® ITM-SC an association link has to be established for this purpose. Upon association, the WaveStar® ITM-SC compares its own Management Information Base (MIB) with the MIB in the network element.

If differences are found this means one of the following:

- The MIB image in the WaveStar® ITM-SC differs from the MIB in the network element and the MIB in the NE is not empty: the WaveStar® ITM-SC will upload the MIB from the NE (depending on the mode that was preset by the user this will be done automatically or only after confirmation by the user).
- The MIB in the network element is empty: the WaveStar® ITM-SC will download its MIB image to the NE (if a download is supported by the NE).

During association, any discrepancies between provisioning data in the network element and its copy which is maintained by the WaveStar® ITM-SC are identified and automatically corrected. Following recovery after a communications breakdown the WaveStar® ITM-SC automatically re-synchronizes with the network element. See the Application and Planning Guide (APG) NE concerned for information on support of software download.

Loading of software

The WaveStar® ITM-SC can load and store software for the system controller of a network element. This software can be downloaded into the NE for upgrades or repairs. Multiple NEs can be provided with software from the WaveStar® ITM-SC simultaneously. See the APG of the network element in question for information on support of software downloads on the different network element types.

□

Alarm Philosophy

Current alarms

The WaveStar® ITM-SC stores current alarms and history alarms. The information in the current alarm list is taken from the event management information from the network elements. The current alarm list always reflects the current alarm state of the network elements in the subnetwork. Whenever an event occurs in the NEs, it is recorded by the system controller and a message is sent to the WaveStar® ITM-SC. If the message indicates that an event is raised, then an entry is added to the current alarm list. The WaveStar® ITM-SC adds further location information in addition to the information sent by the NE. For example, if the event is reported by a physical interface or termination point, the WaveStar® ITM-SC will work out which card supports that function. This assists the ITM when presenting the alarm to the user. In “Appendix A” paragraph “Alarm Reporting” an example of an alarm list is shown.

History alarms

If the message indicates that an event is cleared, then the entry in the current alarm list is marked as cleared and immediately moved to the history list. Whenever an alarm is moved to the history list the entry in the current list is deleted. If ″latching″ is enabled, the user must acknowledge the cleared alarm before it is moved to the history list. The system can limit the capacity of the history list to a maximum size of only the last 10,000 history alarms or to a maximum age of for example only the alarms for the last 30 days. A combination of both the two criteria is also possible. The history alarm store is continually checked to ensure that the capacity limits are not exceeded.

Severity of alarms

Alarms can be given three different degrees. On the GUI the icons are the color of the alarm with the highest degree of severity (red, orange, yellow or green).

The color scheme used for the WaveStar® ITM-SC alarms is described below:

Color	Alarm Type	Indicates that ...
Red	Prompt	There is at least one urgent alarm.
Yellow	Deferred	There is at least one non-urgent alarm and there are no urgent alarms.
Orange	Informa-tion	There are information alarms only.

Color	Alarm Type	Indicates that ...
Green	No alarm	Associated with no alarm.
Gray		No association.
Gray hollow		Geographic Redundancy protected, no association.

□

Performance Monitoring (PM)

Introduction

Performance Monitoring provides continuous monitoring of termination points within SDH equipment. Performance Monitoring can also be performed on 2 Mbit/s PDH signals and on Ethernet connections. This means that performance degradation is located and the administration can then initiate pro-active maintenance. Performance Monitoring is implemented according to the relevant ITU-T recommendations (G.826, G.784, M.2101). In ″Appendix A″ paragraph “Performance Monitoring” an example of the results of performance monitoring is shown.

Processing PM data

The operator can process the Performance Monitoring data for configured termination points as follows:

- Via the graphical user interface the user can specify which counts (15 min., 24 hr bins) are to be taken from certain transport facilities for a certain NE.
- Each network element counts the different PM parameters and saves the result in its (non-volatile) memory.
- The WaveStar® ITM-SC can retrieve this data via the DCC/DCN Network.
- If the association between the WaveStar® ITM-SC and the NE is lost, the WaveStar® ITM-SC obtains information about the lost time by reading the network element bins for the relevant interval.

The WaveStar® ITM-SC stores historical PM data only, although it can retrieve and present current bin PM data in user reports. The historical PM data is retrieved periodically from the network elements.

PM measurements

Performance monitoring is based on measurements taken on blocks that are being transported through the network (a block is a number of consecutive bits). An error event inside a block can be discovered by applying inherent Error Detection Code (e.g. Bit Interleaved Parity (BIP)). If an error event occurs in a block the block will be counted as “errored”.

The following error events can occur:

Event	Indicates
Errored Second (ES)	A one-second period with one or more errored blocks
Severely errored second (SES)	A one-second period in which more than 30% of the blocks are errored

Event	Indicates
Unavailability seconds (UAS)	Seconds of unavailable time (10 or more consecutive SES produces a UAS event)
Background Block Errors (BBE)	An errored block that is not in an SES

□

Performance Monitoring (PM) Archive

Introduction

The PM archive allows the output of raw PM data to an ASCII file for later analysis by external tools.

PM archive

The feature can be run either from the WaveStar® ITM-SC Graphical User Interface or as a command from the Command Line Interface (CLI). On the CLI the command is typed in the UNIX window. This CLI access to the PM archive is used by the Navis™ Optical Capacity Analyzer (formerly named Dynamic Network Analyzers DNAs) and is also available for use by other external management systems or by the user directly. The PM archive is enabled by enabling its PM archive license key as well as the PM license key for any monitored network element types.

When opting for the PM feature the user should be aware of the impact that running the tool will have on the WaveStar® ITM-SC itself. There is the potential to produce large amounts of data. The systems should have at least 4 GByte storage capacity. A file dump should not take more than 30 minutes under normal WaveStar® ITM-SC loading conditions. However, a file dump can be delayed if the archive broker is already running at full capacity. It is also not permitted to create more than one archive a time, i.e. one archive must finish before the next one can start. PM data extraction is available for features like Service Level Agreement (SLA) where limited PM data is required (24 hour PM counts only). PM data extraction is not in general intended for applications like debugging or pre-service testing where 15 minute counters are needed.

For more information about graphical user interface access see the WaveStar® ITM Administration Guide.

Available interfaces for PM data extraction

The following interfaces are available for PM data from the management systems:

- CORBA/TMF G7: WaveStar® Navis™ Optical Network Management System and WaveStar® ITM-SC
- DNA: WaveStar® Navis™ Optical Network Management System and WaveStar® ITM-SC
- PM Export: WaveStar® Navis™ Optical Network Management System and WaveStar® ITM-SC
- Data Extraction/PM Archive: WaveStar® ITM-SC.

CORBA/TMF G7 interface

The capabilities (starting from the emerald release) and availability of this interface are as follows:

- Available for all network elements other than ISM, SLM and RR in the emerald release
- PM data is obtained directly from the Element Management Systems; circuit information is obtained from the WaveStar® Navis™ Optical Network Management System
- The client requests a dump of all PM data and indicates the destination of the data
- The server i.e. the EMSs produce a file that contains the data
- The server transfers the file to the given destination by using an FTP
- The server responds to the client by informing the client that the operation is complete
- The file is in ASCII format.

Navis™ Optical Capacity Analyzer

The capabilities and availability of this interface are as follows:

- Available for all network elements in the sapphire 3 release
- The DNA gets PM data from the WaveStar® ITM-SC and circuit data from the WaveStar® Navis™ Optical Network Management System.

PM export

The capabilities and availability of this interface are as follows:

- Available for all network elements that are managed by WaveStar® ITM-SC from the sapphire 3 release onwards.
- Data is sent to vendors' own system files from the EMSs via FTPs
- Only PM data is available; this data includes path ID (so a TP list for a path can be determined)
- The interface is initiated from the WaveStar® Navis™ Optical Network Management System, which identifies the TPs for which measurements are required. The WaveStar® Navis™ Optical Network Management System sends the request to the WaveStar® ITM-SC.

Data extraction/PM archive

The capabilities and availability of this interface are as follows:

- Available for all network elements that are managed by the WaveStar® ITM-SC
- The interface is initiated either from the graphical user interface or from the command line interface

- This interface is also used to obtain data for the DNA
- The output is in a form that can be read by human beings (tab-sepaced columns) with or without header lines
- The intention is that this interface will be available for the WaveStar® WaveStar® ITM-SC that is currently at the planning stage.

□

Management Data

MIB data

The MIB of the WaveStar® ITM-SC also contains data about the WaveStar® ITM-SC itself and the subnetwork that it manages. These data include the domain partitioning data, the supported users and the user profiles. The WaveStar® ITM-SC also stores the hostname of the Navis™ Optical Network Management System machine and the hostnames of any peer WaveStar® ITM-SCs that are involved in the geographic redundancy scheme. The following management data concerning network elements are not stored in the MIB of the network elements: the full NSAP address that is used to communicate with the network element; the current status of the NE from the WaveStar® ITM-SC view-point; and the status of the NE in the geographic redundancy scheme.

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Hardware Platform

Hardware platform

The WaveStar® ITM-SC software components are installed on standard Hewlett-Packard machines. Different deployment schemes are possible depending on the size of network. These schemes vary from a stand-alone workstation to a server machine, that with supports several remote workstations. The hardware platforms are supplied with the associated Operating System. In order to guarantee that the same patches of HP-UX are used, the HP-UX version is delivered with the WaveStar® ITM-SC load. HP-UX offers a robust, standards-based open computing environment and provides a solid foundation for key applications that need high availability, distributed computing, and systems and network management. HP-UX is Hewlett-Packard implementation of the UNIX Operating System.

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TCM Emulation in Multi Vendor SDH Environments

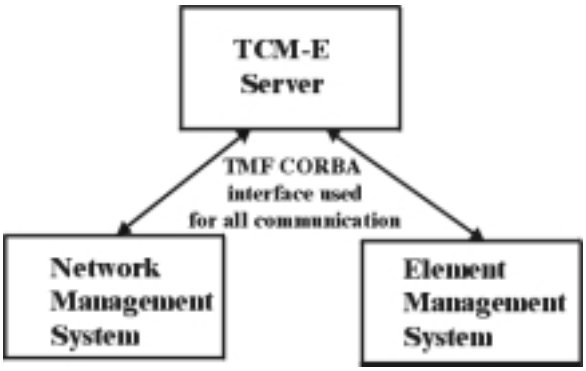
System architecture

The TCM-emulation will consist of two parts (a client and a server part) although in practice, all software will execute on a single appropriately specified Hewlett Packard box. The display part will be pushed on to the existing workstations within the network using the X-protocol; this maximizes the deployments which such a system can be added to. The system will interwork correctly with any systems supporting the TMF 2.0 interface.

The TCM-E server will upload network configuration information from one or more network(s) or subnetwork management systems within the network using the TMF CORBA interface. It will also be able to upload information about network elements managed by individual EMS systems. It will again use the TMF CORBA interface to obtain Performance Monitoring data (15 minute and 24 hour information for high order paths, and 24 hour data for low order paths) as required from these systems. See the block diagram.

In a future release, the TCM-E server could be extended to provide a standard CORBA interface to enable both alarm information and its report information to be extracted by a higher order system. This could be used by some other system to integrate the TCM-emulated information with the other network level information contained within these systems.

Figure 4-3 System architecture



System functionality

The system will provide the user with the following provisioning options:

- Join paths — connect together connection from multiple subnetwork systems (only required if there is no system with an end to end view).
- Provision “tandem connection” to be monitored (at all levels). Note: NIM must be implemented for a node if it is to be possible to provide full monitoring of that function.
- Provision levels at which “threshold crossing alerts” for path segment will be raised (15 minute monitoring and 24 hour supported for high order paths; 24 hour only for low order paths).

The system will provide a reporting interface with the following information:

- Alarms indicating poor segment performance (as outlined in provisioning options)
- Alarms indicating system problems (loss of connection to the system, system errors, etc.,).

The system will provide a reporting interface with the following information: report about quality of service on a particular connection (or on all connections).

The system will execute on a single (appropriately dimensioned) Hewlett Packard server, and will inherit the common Optical Network Group management systems hardware and OA&M requirements. In a future release of the system, it will support a CORBA interface to facilitate passing alarm information to other systems.

□

Overview of data extraction

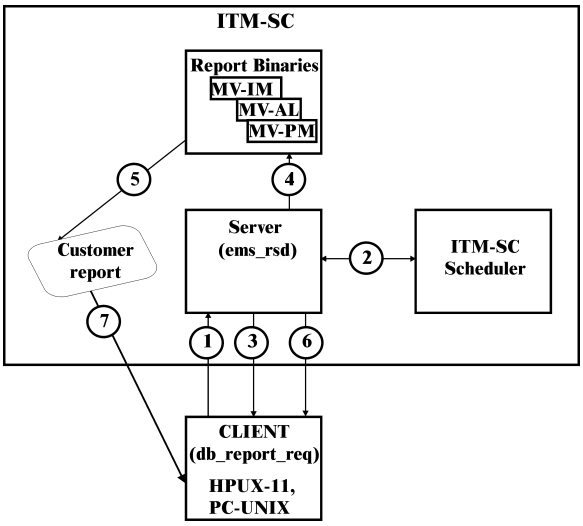
Introduction

The WaveStar® ITM-SC has a number of associated tools that can be purchased as separate items. These tools are used to a produce reports from data that is extracted from the database. To manage access to these reports and their impact on the ITM-SC, the reports are packaged into the data-extraction toolset. The data-extraction toolset allows access to the tools from an external system.

A license and reports are available on a per-customer basis. The data-extraction toolset can be configured when the ITM-SC is installed.

Data-extraction mechanism

Figure 4-4 Data extraction



The steps to retrieve data from the ITM-SC's database are explained with the help of the next figure

1. The client requests a report and gives selection criteria for data where appropriate (e.g. reduce the number of records read).
2. The server checks with the Total Integrated Management-SC that the report is available and with the ITM-SC as regards the license and permission to run the report (permission is based on the ITM-SC's processing load).
3. The server notifies the client that the request will be processed (and names the output file).
4. The correct report is run using the client's selection criteria.
5. The report is produced in the form of an ASCII file.

6. A response with a return value is sent to the client. This response indicates that the report is available (or indicates an error possibly with further error information in a named error file on the server).
7. The client ftp's the output file to the client's own system, or the client ftp's the error file to determine the failure.

Database-report request (db_report_req)

The client is provided with this package. The package interworks with the report server using the defined interface (in this case the Datagram Request Format). The package is built to run on an HP-UX 11 platform, but the defined interface allows for the development of clients on other platforms.

Two sets of switches are passed/used:

- Switches to db_report_req that are general in nature or deal with the behavior a of db_report
- Switches to the report binary that usually limit the data that is produced (e.g. time period for data to be reported).

Both these sets of switches have to be passed at step one above, but the switches to the report binary are passed as "Arguments", i.e. in the A switch.

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Section: Security Access

Overview

Purpose

The WaveStar® ITM-SC security management allows authorized users to have different levels of access. Each user has specific privileges according to the user role assigned to them. To restrict the number of NEs that can be managed by one user the system administrator also assigns access domains

The WaveStar® ITM-SC stores login names, passwords, access domains, and assigned user roles. To access the WaveStar® ITM-SC application a user needs to log in before any tasks can be performed with a specific login identification. More information about administration and CIT access control on the WaveStar® ITM-SC can be found in the WaveStar® ITM-SC Administration Guide in chapter “Security Management” and in chapter “Concepts”.

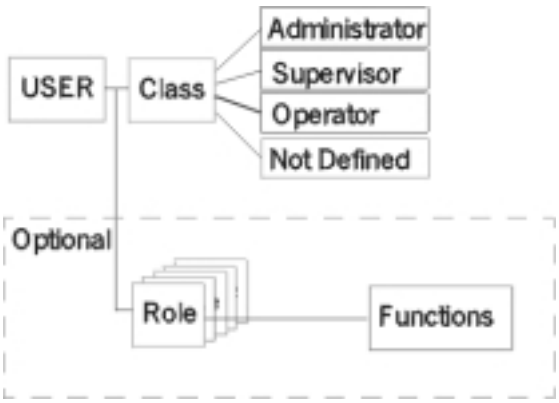
Concept

The system administrator assigns each user to one of the user classes:

- Administrator
- Supervisor
- Operator
- Not Defined

These user classes all have fixed user roles. In addition to these classes, a user can be assigned to a user role. If a user is not assigned to a user role, his user class will determine the privileges.

Figure 4-5 The hierarchy of the different user roles and - classes



□

WaveStar® ITM-SC User Classes

Introduction

Every WaveStar® ITM-SC user must be assigned to a user class. The user classes are based on fixed user roles. The fixed user role is described below per user class. The following user classes are applied:

- Administrator
- Supervisor
- Operator
- Not Defined, which means that the user has access to one WaveStar® ITM-SC server only. This access privilege is allowed via the extended user roles.

Administrator

An administrator can perform all WaveStar® ITM-SC system control activities that are not related to transmission. An WaveStar® ITM-SC administrator does not have authority to retrieve or alter any transmission-related data or to see the current status of the transmission network or network elements. The administrator cannot suppress transmission alarms at the WaveStar® ITM-SC. He can decide the network elements that the server is able to access. He can also configure a workstation to monitor alarms from various servers.

Supervisor

A supervisor can view and modify all network element provisioned information and view administration information.

Operator

An operator can retrieve all data from the network elements using the WaveStar® ITM-SC to see the current status. The operator can only view and not make changes to network element configuration.

Not Defined

The Unix user is restricted in WaveStar® ITM-SC access on a network where WaveStar® ITM-SCs are configured. The user only has Unix access, and any access privilege allowed via the extended user roles.

Example: when there are two WaveStar® ITM-SC servers and a user is allowed access to only one of the servers, the user is made into a Unix user. The user is then added to one server using the user roles feature. If he tries to use the user roles to login on a server where he is not configured his login attempt will be rejected.

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WaveStar® ITM-SC User Roles

Introduction

In addition to the 4 user classes, the WaveStar® ITM-SC Administrator can create 5 user roles. The extended user class license key must be enabled to enable the user roles. A user role consists of a collection of user functions. Once a user is assigned to a specific user role, his privileges are determined by that role.

User roles optional

When a user is not assigned to a user role his user class (Administrator, Supervisor, Operator or Not Defined) determines his privileges.

User functions

The Administrator creates a list of user functions and their privileges (read, edit or disabled) from an extensive list of all user functions.

Functions that can be selected for user roles are:

Report management	Traffic management	Performance monitoring
Report timing	Operator logs	Performance set up monitoring
Report definition	Operator log archive	Performance archiving
Template management	Equipment management	Confirmation required
Templates timing	Alarms	Licensing
Templates protection	Alarm archive	Alarm summary
Card management	EMS alarm control	Map
User roles	Geographic redundancy	CIT access feature
Pre-provisioning	Protection	Access groups feature
EMS administration	Performance	

Number of user roles

The Administrator can assign up to five different user roles.

□

CIT Access

Introduction To restrict the NE access via a CIT the ITM-SC supervisor and the ITM-SC administrator are able to control NE access for CIT users. This access control is done by the WaveStar® ITM-SC.

Definition CIT access means management of an NE by means of a CIT.

CIT user roles The CIT users are divided into three CIT (User) Roles: Admin, Config, and View.

Each CIT role has its own set of privileges:

CIT user role	Privilege
View	The CIT user is allowed to monitor the NE
Config	The CIT user is allowed to provision the NE
Admin	The CIT user has Config capability and is allowed to administer the password, the lock flag and the inactivity time-out.

ITM-SC control The WaveStar® ITM-SC Administrator and Supervisor are able to change the privileges of CIT users by changing the CIT roles. They are also able to disconnect the access of any CIT to an NE at once.

Association loss When the association is lost between the ITM-SC and an NE the privileges set for the CIT roles will be ignored. Each CIT role will have access to the NE without any restriction.

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Section: Graphical User Interface (GUI)

Overview

Purpose One of the most important characteristics of the WaveStar® ITM-SC is its ease of operation via the ergonomically designed and convenient graphical user interface. This interface is mouse-controlled, window-orientated and based on the rules of the OSF/Motif Style Guide. This section describes the structure of the graphical user interface and includes an explanation of the dialogue boxes, the online help system and the online documentation system.

□

Structure of the Graphical User Interface

Introduction

The common Graphical User Interface (GUI) of the WaveStar® ITM-SC provides a user-friendly interface to simplify and speed up the managers daily operations. The WaveStar® ITM-SC user interface employs cascading menus, which can be selected using a mouse or the keyboard, and overlapping windows that display multiple forms simultaneously. The users can easily access and manage information and execute commands via these forms.

Graphical User Interface features

The Graphical User Interface provides the following features:

- A help facility is provided. Pointing and clicking on a specific item brings up information on that item.
- The GUI supports the configuration of an audible warning.
- The GUI changes the color of a specific entity (such as a particular circuit board in the Element management view or NEs in the Network management view). The new color is defined by the alarm event that has occurred in the node. Additional detail about particular alarms can be found by consulting the appropriate forms and menus.
- Text can be ordered in other than English languages.
- Information displayed to the user is automatically updated so that it always represents the current NE state.
- All user requests that are traffic-affecting have to be confirmed.
- User access to the WaveStar® ITM-SC can be obtained via several user terminals.
- A single user may work on several network elements simultaneously.
- The user terminal is a workstation or X terminal.
- The GUI employs OSF/MOTIF standards.

The user may call up the view of a particular network element. This graphic illustration provides the user with the subbay layout, the slot occupancy and card characteristics. Management tasks can be performed by pointing and clicking specific items on the graphic illustration. Alarms and events are made visible by coloring the affected items.

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Windows of the Graphical User Interface

Introduction

This paragraph briefly explains elements of the windows in the graphical user interface. The windows themselves are shown in ″Appendix A″.

Top menu window

The top level windows are shown in ″Appendix A″ paragraph “Accessing the WaveStar® ITM-SC”. The major tasks of the WaveStar® ITM-SC top-level window are to provide:

- Access to all WaveStar® ITM-SC functions and features
- An overview of all current alarms by means of the alarm counters
- A graphical display of all provisioned network elements and their alarm status on the alarm map; the color of the network element indicates the most severe of all current alarms.

Windows with dialogue boxes

In paragraph “Dialog Boxes” in ″Appendix A″ an example is shown of a window with dialogue boxes and the elements of that window. Dialogue boxes are used to handle all interconnections between the users and the network management system. This applies for example to the provisioning of network elements or the retrieval of parameters of specific network elements.

Window elements

The paragraph briefly explains the elements of the windows:

- Window Title: The title bar contains the window name, which specifies the function of the window or the information provided in the window.
- Push Button: The text on each push button explains which function will be initiated by clicking on that button. The help button, for example, is used to load the help system.
- Check Box: A check box functions as an on/off switch. If the check box is on, the option next to it is selected. If the check box is off, the option next to it is not selected.
- Radio Button: The radio button has the same function as the check button, except that only one of the several radio buttons for one generic term can be on at any time.
- Options Button: Clicking the options button opens a menu from which further options can be selected.
- Text Field: User entries via the keyboard are displayed in text fields. An active field is indicated by a frame or by its darker shading.

- Text List: This is a list of individual lines of information. Each line can be selected by clicking on it.
- Text Selection Box: The text selection boxes are opened by clicking on the text selection button. They offer alternative entries, which can be selected so that they appear in the respective text field.
- Graphical Display of Information: In addition to the other dialogue boxes that are also dialogue boxes that provide the information in a graphical way.
  These dialogue boxes display:
  - the installed cross-connections
  - the evaluated performance data
  - the shelves of the individual network elements and their equipment (including a display of alarm statuses and any deviation from the provisioned equipment).
- In paragraph “Dialog Boxes” in ″Appendix A″ an example is shown of a dialogue box with graphical elements.

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Online Help System

Introduction The WaveStar® ITM-SC provides a context-sensitive online help system.

Online help contents The text displayed in the window helps to solve the conceptual or technical problems that occur when working with the WaveStar® ITM-SC. The help is always context-sensitive.

Activation The online help is activated by clicking the Help button. A help text is prompted with all the relevant problem information about this window and output the possible problems.

Online Glossary Besides the Help text for each window, an online ″Glossary″ is also available. All special terms in the Help text that are contained in the ″Glossary″ are highlighted in color. Clicking on a highlighted term displays the ″Glossary″ entry for that term.

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Online Documentation System

Introduction

The online help system is supplemented by the online documentation system. This online documentation system can be used to display the contents of the manuals in the window. In addition to the text of the manuals it is also possible to display the text in the online help system without first having to open the relevant WaveStar® ITM-SC window.

Activation

The online documentation system is activated by clicking the Help button in the top menu window and then selecting the ″Online Documentation Function″.

Information in the Online documentation

There are three options for finding the information:

- Select an entry in the table of contents: The table of contents is arranged by manual and contains the heading from the manuals. If the user already knows where to find a particular subject, the corresponding passage in the manual can be displayed directly.
- Index with key words: The user can search for a keyword in an index. The index for the online documentation system is the complete index of all the WaveStar® ITM-SC manuals.
- Search function: A full text search can be carried out of all the text in the manuals. Any matches can be selected and displayed individually.

The online documentation also offers the following:

- List of abbreviations and acronyms
- Glossary from the manuals
- Glossary of the online help system.

These glossaries provide definitions of a variety of terms that are used in the documentation.

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Section: Interfaces of the WaveStar® ITM-SC

Overview

Purpose This section provides a brief survey of the interfaces on the WaveStar® ITM-SC. For further reference see the section entitled “PM Archiving”.

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Interfaces to other systems

Interface between the WaveStar® ITM-SC and the NEs

This TMN Q-interface is characterized by:

- The portion of Lucent's Management Information Model that is known to the WaveStar® ITM-SC. For this software, that portion is considered to comprise the information models of the ADM16/1, the AM 1, the TM 1 and the OLS 80G
- The CMIP operations that are supported by the third party software.

The communication between the WaveStar® ITM-SC and the network elements is via CMISE/ACSE messages over an OSI-IP.

Interface between the WaveStar® ITM-SC and the Navis™ ONMS server

Important! In this Pearl release the TMAG interface to the Navis™ Optical Network Management System is supported. In the Diamond release however, the TMAG interface, meaning the interface towards the NMS is not supported.

This TMN Q-interface is characterized by Lucent's proprietary TMAG information/operations messaging protocol. The communication between the WaveStar® ITM-SC and the Navis™ Optical Network Management System is by G2 encoded CCP based messages over a TCP/IP

Interface between the WaveStar® ITM-SC server and the WaveStar® ITM-SC client workstation

This TMN F-interface is characterized by a proprietary information/operations messaging protocol. The communication between the WaveStar® ITM-SC server and the WaveStar® ITM-SC client processes is in the form of socket-based messages over a TCP/IP.

Interface between the WaveStar® ITM-SC and the Navis™ ONMS client workstations

This TMN F-interface is characterized by a proprietary information/operations messaging protocol. The communication between the WaveStar® ITM-SC client and the Navis™ Optical Network Management System client processes is in the form of socket-based messages over a TCP/IP.

Network elements with interface TMF G7 2.0

Network element	Releases			
	Emerald R7.0.x	Topaz R8.0.x	Diamond R9.0.x	Pearl R9.1
WaveStar® ADM 16/1	x	x	x	x

Network element	Releases			
	Emerald R7.0.x	Topaz R8.0.x	Diamond R9.0.x	Pearl R9.1
WaveStar® ADM 16/1 Compact	x	x	x	x
WaveStar® OLS 80G	x (only for FM)	x	x	x
WaveStar® AM1		x	x	x
WaveStar® AM 1 Plus		x	x	x
WaveStar® ADM 4/1	x	x	x	x

Supported functions of the TMF G7 2.0 interface

Supported on Fault Monitoring (FM):

- Get all active alarms (managed element manager)
- Get all EMS active alarms (network R1)
- Attach (observer / observable)
- Detach (observer / observable)
  Attach or detach can be set for the following fault monitoring reports:
  - Alarms
  - Threshold Crossing Alarm (TCA)
  - Notification.

  Supported on Performance Monitoring (PM):
- Get Performance Monitoring manager
- Disable Performance Monitoring data
- Enable Performance Monitoring data
- Get all current Performance Monitoring data
- Get Threshold Crossing Alarm tributary port parameter
- Set Threshold Crossing Alert tributary parameter
- Get history Performance Monitoring data.

Supported on Customer Monitoring (CM):

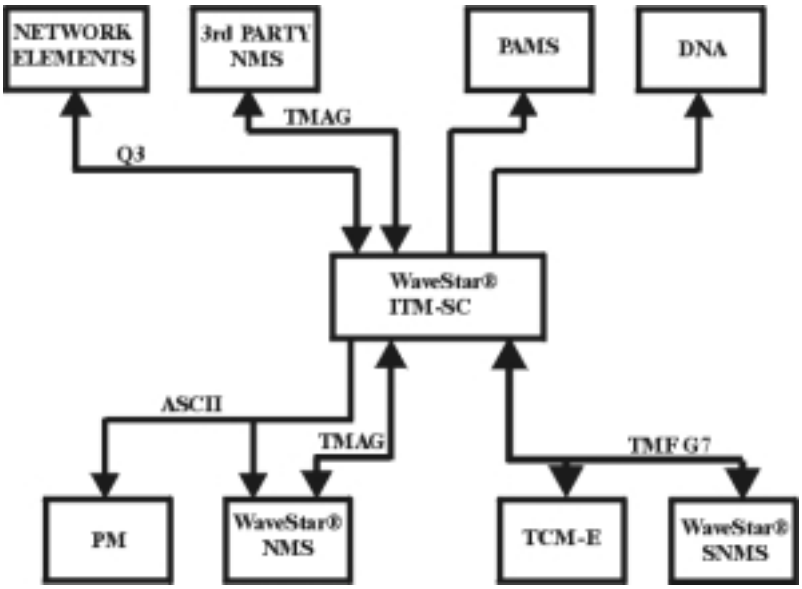
- On the Subnetwork Connection (SNC) level:
  - Get multi-layer subnetwork manager
  - Get all top level subnetworks
  - Get all subnetwork connections

- Create and activate the SNC
- De-activate and delete the SNC
- Set user label.

- On protection level:
  - Get protection manager
  - Get all protection groups
  - Retrieve switch data.
- On tributary port level:
  - Get all protected tributary ports
  - Set tributary port data
  - Get contained tributary ports
  - Get tributary ports.
- On managed elements level:
  - Get managed element manager
  - Get all managed elements
  - Set the user label.

Interfaces of the WaveStar® ITM-SC

The management systems WaveStar® NMS and the WaveStar© SNMS are now called the Navis™ Optical NMS and the Navis™ Optical EMS.



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Section:Accessing Management Systems Data

Overview

Purpose The ITM-SC provides interfaces for integration into 3rd party management systems for the following reasons:

- Fault management
- Configuration management
- Performance management
- Inventory and resource management.

A number of interfaces exist to meet the operational, commercial, and future needs of the operator. These can be discussed with your Customer Team representative and Lucent's Optical Networking Group's Solutions Integration' Team.

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Customer management

Data to the customer management system

Customer's higher level management system requires data from an optical network management system to fulfil its function. The exact nature of the data required will depend on the higher level management system but examples include inventory data, performance monitoring data, fault information etc.

It is critical that the optical network management system has a mechanism to facilitate integration with customer management systems, but also critical that the optical network management system continues to function in an efficient manner.

The communication between the WaveStar® ITM-SC and the network elements is via CMISE/ACSE messages over an OSI-IP.

Possible solutions

- Allow customer direct access to database (e.g. using networking version of RDBMS, or ODBC/JDBC).
- Replicate database to off-line system for later processing.
- Use CORBA interface to provide access to any data required by higher level management systems.
- Use Application Programming Interface (API) to provide access to any data required by higher level management systems.

Important! Direct database acess will not be supported on the ITM-SC.

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Data replication

Characteristics

- Data periodically archived from ONM management system to separate disk.
- Can archive all or selected data.
- Some additional load placed on Optical Network Management system but this is quantifiable and controllable.
- Optical Network Management system platform is sizable.

Advantages

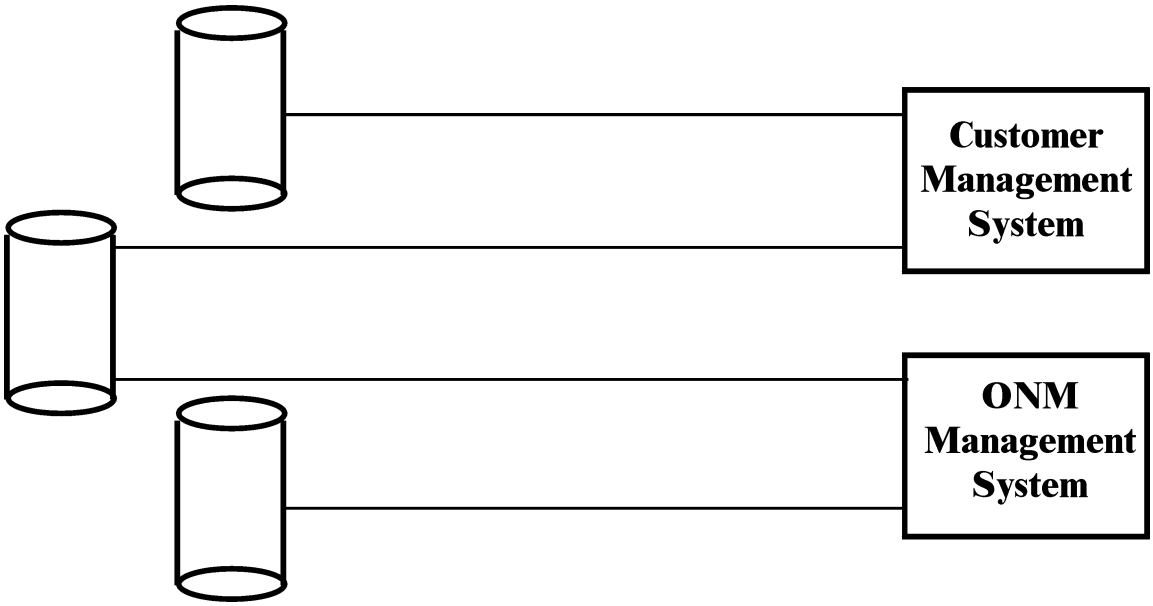
- Limited simple code to write on Optical Network Management system.
- All Optical Network Management data readily available to customer system (full database archive).
- Customer may use familiar technology in their management system (e.g. SQL) to access Optical Network Management data once data loaded into offline database.
- Very suitable for “off-line” applications where it is acceptable for data to be several hours old e.g. Service Level Agreements (SLA) manager.

Disadvantages

- Customer application may be tightly coupled to Optical Network Management system database schema (full database archive).
- Schema will change between releases.

- Not suitable for customer management systems requiring access to up-to-date Optical Network Management data.

Figure 4-6 Date replication



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CORBA interface

Characteristics

- Data passed from Optical Network Management management system using CORBA interface.
- Services must be provided for all required data.
- Some additional load placed on Optical Network Management system but this is quantifiable and controllable.
- Optical Network Management system platform is sizable.

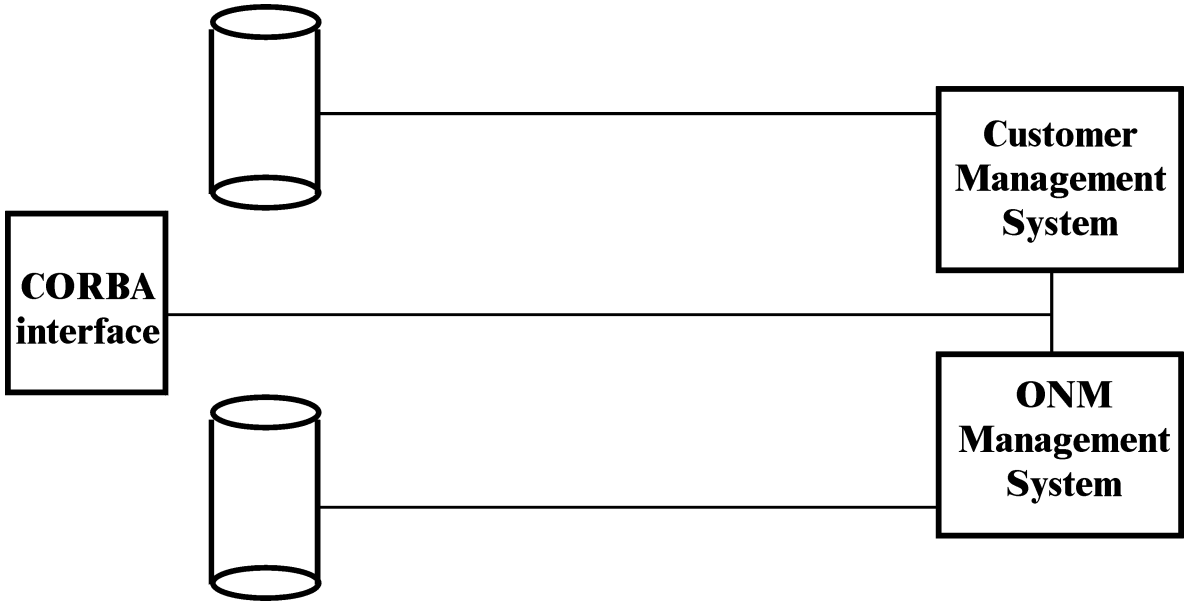
Advantages

- Up-to-date data available for all supported services.
- Much data already supported by TMF CORBA interface already supported in management systems.
- Single interface may generate requests and also support data retrieval.
- Interface to Optical Network Management system decoupled from underlying database schema.

Disadvantages

- Concern about complexity of CORBA as implementation technology. Can become to complex.
- Additional development for each additional service is required.

Figure 4-7 CORBA Interface



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Application Programming Interface (API)

Characteristics

- C++ or JAVA API provided to access data from ONM management system.
- Services must be provided for all required data.
- Some additional load placed on Optical Network Management system but this is quantifiable and controllable.
- Optical Network Management system platform is sizable.

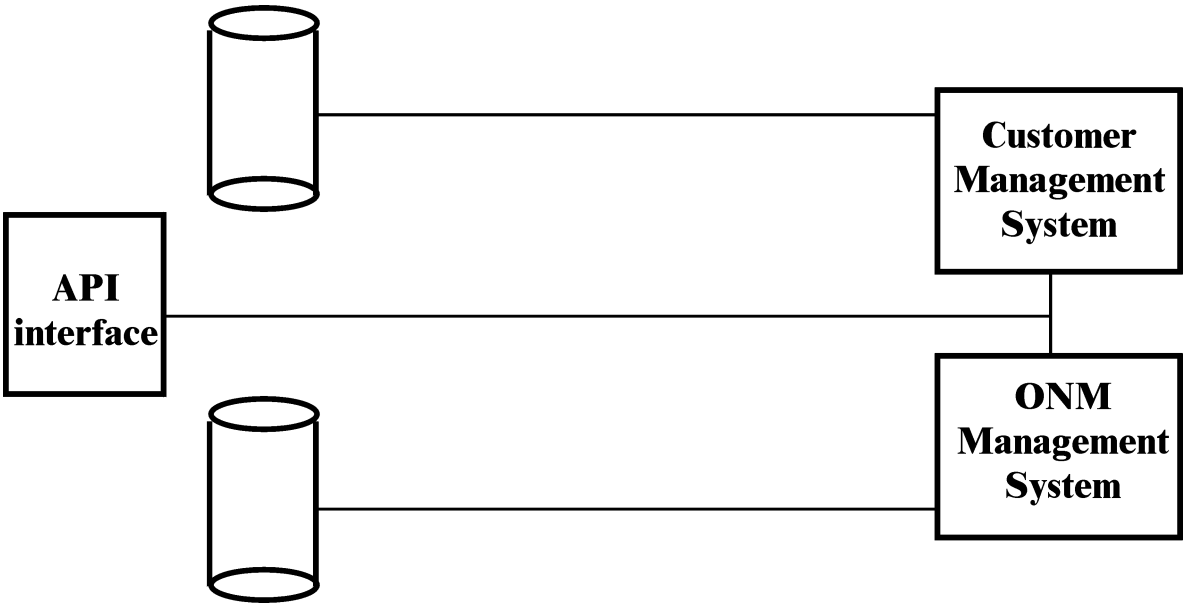
Advantages

- Up-to-date data available for all supported services.
- Interface supported using industry standard programming language.
- Single interface may generate requests and also support data retrieval.
- Interface to Optical Network Management system decoupled from underlying database schema.

Disadvantages

- Additional development for each additional service is required.

Figure 4-8 API Interface



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Summary

Management systems strategy

Optical Network Management systems strategy is to support customer system access data through combination of:

- Data replication (this feature is supported on the current ITM-SC)
- CORBA interface (this feature is supported on the current ITM-SC)
- API interface (this feature is planned for new releases of the ITM-SC).

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5 System Planning and Engineering

Overview

Purpose Design rules have to be taken into account when designing the hardware and software assets that are necessary to perform network element management for SDH transport networks. This is basically because of limits in processing capacity and core memory in both the SDH NEs and the WaveStar® ITM-SC management system. The capacity of the data communication network that connects a (remote) WaveStar® ITM-SC to the SDH network may also limit the number of SDH NEs that can be managed.

Topics The main topics covered in this chapter are:

- The use of LANs
- Principles of management in SDH transport networks
- Constraints on managed SDH transport networks
- Dividing a network into management areas
- The use of the management network for WaveStar® ITM-SC management purposes and other purposes
- Management areas
- Redundancy in the management network
- When introducing redundancy
- Data communication networks
- WaveStar® ITM-SC connected to the SDH network
- WaveStar® ITM-SC connected to the ITM network manager
- WaveStar® ITM-SC server and workstation.

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Section: Design Rules

Overview

Purpose This section provides information on design rules for SDH transport networks. However, it should be noted that the rules presented here are just guidelines and should not be used for detailed planning of either the transmission network or the data communications network. For more details on engineering the reader is referred to documentation that is dedicated to transmission networks or data communication networks. Moreover, to ensure the quality of working of either transmission or data-communications networks detailed planning and design should always be discussed and executed in close collaboration with the technical specialists of Lucent Technologies. More information about routing of management information can be found in the separate document ″SDH DATACOMMUNICATIONS NETWORK DESIGN″.

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The use of LANs

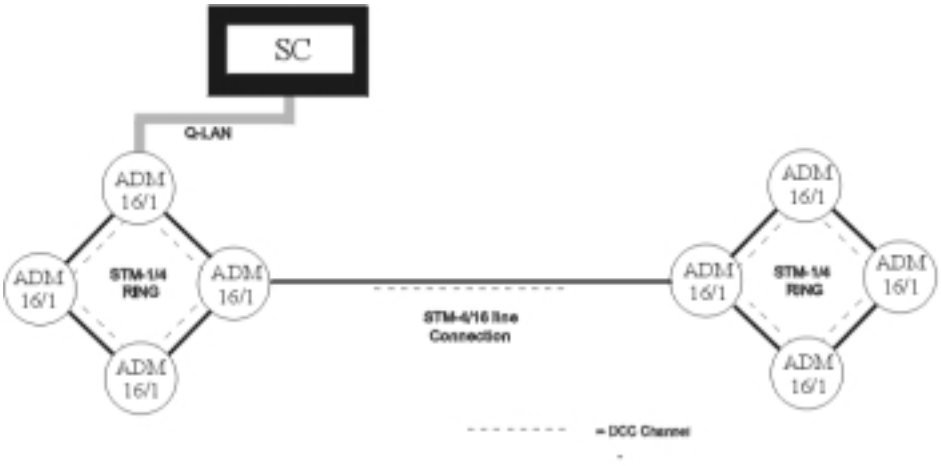
Transport of management information

LUCENT TECHNOLOGIES used an OSI Network Layer to route protocols as prescribed by the standards. The OSI Network Layer allows management information to be routed across the DCC bytes that are embedded in the STM-n signal, and/or via LANs. Network elements are equipped with LAN interfaces. So if there is no STM-n connection between two NEs, or when the DCC bytes in an existing STM-n connection are not processed, management information exchange may be realized via a dedicated LAN connection. The figure below shows an example of such dedicated LAN connections which are referred to in this chapter as Q-LAN extensions.

Example

The WaveStar® ITM-SC can manage both the ″nearby″ ADM 16/1 ring and the ″far-end″ ADM 16/1 ring. An LAN that is dedicated to the exchange of Q-compliant management information is called a Q-LAN.

Figure 5-1 Example of how to use the Q-LAN to transport management information



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Principles of Management in SDH Transport Networks

Introduction

Network elements within the SDH network may be managed by the WaveStar® ITM-SC directly (via a Q-LAN), via the WaveStar® ITM-SC Q-LAN and the embedded Data Communication Channel (DCC), or via the WaveStar® ITM-SC Q-LAN, the DCC and one or more Q-LAN extensions. Which of these management options is used depends on the position of the SDH-NE within the SDH Transport Network and the type of NE. The previous figure showed the WaveStar® ITM-SC Q-LAN, and the DCC. By virtue of the (IS-IS/ES-IS) OSI Network Layer protocol one WaveStar® ITM-SC can manage all NEs that are interconnected via the Q-LANs and/or the DCC. All systems that can be reached by the WaveStar® ITM-SC, i.e. all systems that can exchange management information with the WaveStar® ITM-SC, are said to form part of the management domain of that WaveStar® ITM-SC.

Routing of management information

No routing tables are necessary to ensure communication between the WaveStar® ITM-SC and NEs within the management domain of that WaveStar® ITM-SC. Routing on the IS-IS/ES-IS OSI network layer is completely dynamic. Static routing is also supported. The shortest route between the WaveStar® ITM-SC and a particular NE is automatically selected (the shortest route has the least number of hops between the WaveStar® ITM-SC and the given NE). It should be noted that when determining this shortest route no account is taken of passive devices (e.g. bridges) or bandwidth. From the perspective of the OSI protocol the management domain can formally be seen as a collection of IS (Intermediate System) or ES (End System) nodes. A node is of the ES type when the corresponding NE can be managed by a network or network element management system. ES nodes can be supported by a Q-LAN. IS nodes can forward the management information to an adjacent node. NEs that belong to both categories can forward information and also be managed by using the DCC of the SDH signal. Some nodes are of neither type; these nodes have to be managed by their end systems through proprietary channels in the transmission signal.

The following table gives the node type of each transmission network element:

NE	Node type
ISM	IS+ES
SLM	IS+ES
SLM Regenerator	-

NE	Node type
SDH RR	ES
SDH RR Regenerator	-
WaveStar® ADM 4/1	IS+ES
PHASE	IS+ES
WaveStar® LXC 16/1	IS+ES
WaveStar® ADM 16/1	IS+ES
WaveStar® ADM 16/1 Compact	IS+ES
WaveStar® OLS 80G	IS+ES
WaveStar® TM 1	ES
WaveStar® AM 1	IS+ES
WaveStar® AM 1 Plus	IS+ES

Management communication between nodes

Communication between ES nodes via IS nodes is prescribed by the IS-IS/IS-ES protocol in layer 3 of the OSI stack. This protocol automatically builds routing tables for routing to ES nodes through IS nodes. To this end each node within a management domain is assigned an NSAP address which contains a unique label for the node within its domain. In order for an NE to receive and/or forward management information within the domain it has to be provided with the proper hardware and software to identify node labels and route information. The routing scheme followed is known as IS-IS level 1-routing. The maximum number of nodes within a management domain is 50. When larger networks are required the IS-IS level 1 routing scheme is insufficient. In such cases areas of management domains can be formed and information is sent from one area to another. The NSAP address of each NE not only contains a label that identifies the NE within its own area, but also a label that describes the domain. This provides a unique identification of an NE within the transmission network and this identification is used for routing management information. The connectivity between different areas is provided by level 2 of the IS-IS protocol. In order that information can be exchanged between two areas from one area two adjacent nodes in each of these domains must be able to deal with the IS-IS level 2 protocol. In addition, in order to allow the nodes to communicate with the other nodes within their own domain, IS-IS level 1 capability for these nodes is required as well. Dividing the transmission network into areas and using the IS-IS level 1+2 protocol greatly reduces the constraint on the size of the network in terms of the number of NEs and means that and means that the size of the network will be effectively determined by the capacity of the element manager. The NE must be provided with the proper hardware and software before the IS-IS level 1+2 routing scheme can be applied.

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Constraints on Managed SDH Transport Networks

Introduction

In addition to the requirement for the network elements to have the proper hardware and software, there are three basic constrains on the managements of SDH transport networks.

Constraints on SDH management

The three basic constrains on management of SDH Transport Networks are:

1. The number of SDH NEs that can be managed by the WaveStar® ITM-SC is limited to a certain maximum depending on the choice of hardware platform. An SDH NE that is not managed by the WaveStar® ITM-SC does not need to be taken into account.
2. The maximum number of NEs in a management domain is determined by the OSI routing protocol. The IS-IS level 1+2 routing scheme can be implemented.
3. The capacity of the network to carry management traffic.

The first constraint which from processing capacity limits and memory limits in the WaveStar® ITM-SC. The second constraint follows from processing capacity limits and memory in the SDH NEs. See also the chapter “Network Topologies” section “Network Loading and Network Configurations”.

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Management Areas

Performance

It is should be noted that the performance drops when limits are reached or exceeded. When limits are greatly exceeded it is no longer possible to operate the network.

Number of WaveStar® ITM-SCs in a management domain

Dividing an SDH network into management areas means that the SDH network can be managed by one WaveStar® ITM-SC (if the total number of NEs is less than 200) or by several WaveStar® ITM-SC systems (if the total number of NEs is greater than 200). Usually one WaveStar® ITM-SC system will manage one or more management areas, together forming one management domain i.e. a management domain may consist of one or more management areas. However, nothing prevents an operator from attaching more than one WaveStar® ITM-SC system to the same management domain or management area. The only thing to keep in mind is that an SDH NE can be managed by only one WaveStar® ITM-SC at a time in other words, an SDH NE can have an association with only one manager. This means that when multiple WaveStar® ITM-SC systems are attached to the same management domain, the SDH NEs within the management domain must be divided over the WaveStar® ITM-SC systems. It should be noted that having more than one WaveStar® ITM-SC manager attached to the same management domain or management area does not increase the maximum number of NEs that may be in that domain or area.

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Redundancy in the Management Network

Introduction

The WaveStar® ITM-SC and a specific SDH NE can exchange management information either directly via the Q-LANs or via the Q-LAN and the DCC. In many cases multiple paths are available from the WaveStar® ITM-SC to a particular NE. Multiple paths provide redundancy in the management network.

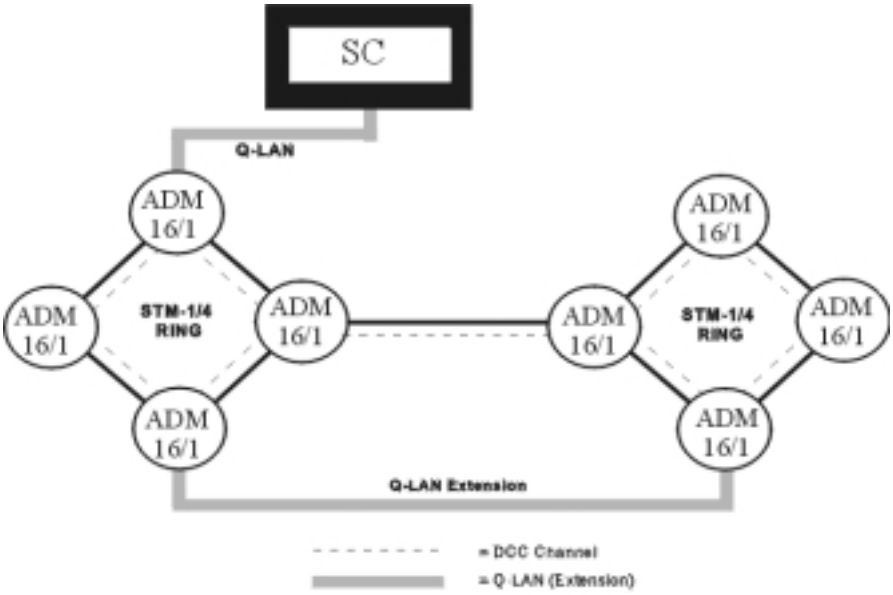
Multiple paths

When one route from the WaveStar® ITM-SC to a specific NE is disabled, for instance because the cable cut an alternative route is chosen were available. The IS-IS/ES-IS routing protocol in the OSI Network Layer dynamically picks the shortest available route to transfer messages between the WaveStar® ITM-SC and a particular NE. When the shortest route is no longer available the next shortest route is automatically selected. When a route ceases to be available it is possible that re-routing may not take place immediately. Due to the relationship between the various stack timers, and the size of the routing tables in the stacks, transient association losses may occur before associations are recovered by a different route. Creating a meshed DCN network can lead to instabilities. Such redundancy can be introduced deliberately to ensure communication between the WaveStar® ITM-SC and NEs.

Introducing redundancy

The following figure shows a typical example of the use of a Q-LAN extension to introduce redundancy in the management network. The Q-LAN extension means that the WaveStar® ITM-SC can reach via at least two different paths the majority of NEs. For many NEs more than two different paths are available. Only the node that is directly attached to the WaveStar® ITM-SC can be reached in only one way (via the Q-LAN). As far as the managed network is concerned this NE represents a single point of failure. This single point of failure can be lifted by connecting the WaveStar® ITM-SC to two NEs in the network as shown in figure ″Redundancy without a single point of failure.

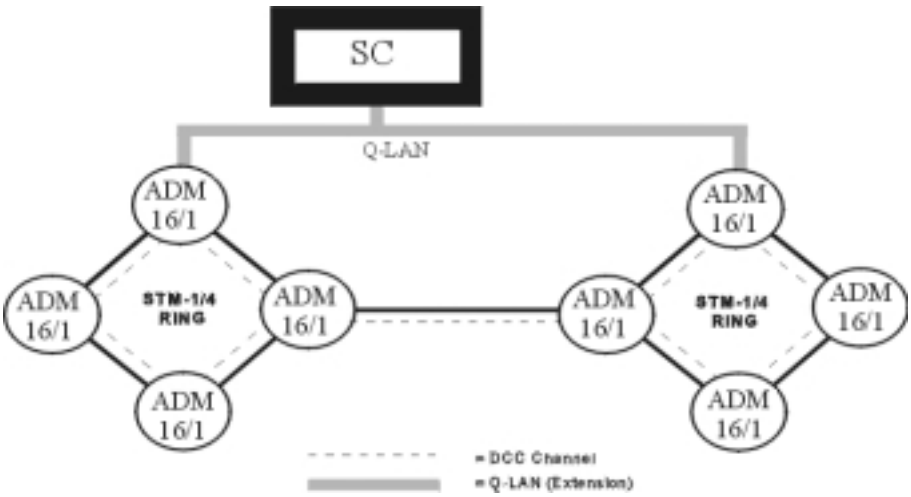
Figure 5-2 Redundancy is introduced to make the management network more reliable



Redundancy without a single point of failure

The redundancy solutions shown in both figures are of course only possible within a management area as management communication is deliberately disabled between management areas. The solution presented in the previous figure is actually only possible when the total number of NEs in the network is less than 50. Otherwise gateway NEs would have to be introduced. The special purpose software that comes with gateway NEs effectively takes away the redundancy shown in figure ″Redundancy without a single point of failure″. With IS-IS routing you can use this redundancy solution as long as you configure your parameters correctly.

Figure 5-3 Redundancy without a single point of failure



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When Introducing Redundancy

Introduction

Introducing redundancy makes the management network more complex. If the network becomes very complex in other words there are many alternative routes, the network can become unstable due to the dynamic nature of the ES-IS/IS-IS routing protocols. Therefore redundancy in the management network should be introduced where necessary, as long as it really adds to the reliability of the management network. The Lucent Technologies specialists can give advice on optimizing your network management topology.

Complexity of the network

The following rules of thumb apply to the complexity of the network topology:

- The maximum number of nodes (SDH NEs) on a Q-LAN segment is 25. As the WaveStar® ITM-SC has to be counted as a node as well, there cannot be more than 24 SDH NEs on the Q-LAN segment to which the WaveStar® ITM-SC is attached. Since this restriction applies to a single Q-LAN the number of nodes can be increased by using of hubs and/or bridges.
- There should be no more than 8 different Q-LANs that have to be crossed to find the (shortest) route between the WaveStar® ITM-SC and a particular NE. There may be more Q-LANs in the network, but there should not be more than 8 Q-LANs in a route between an WaveStar® ITM-SC and an SDN NE.

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Data Communication Networks

Introduction

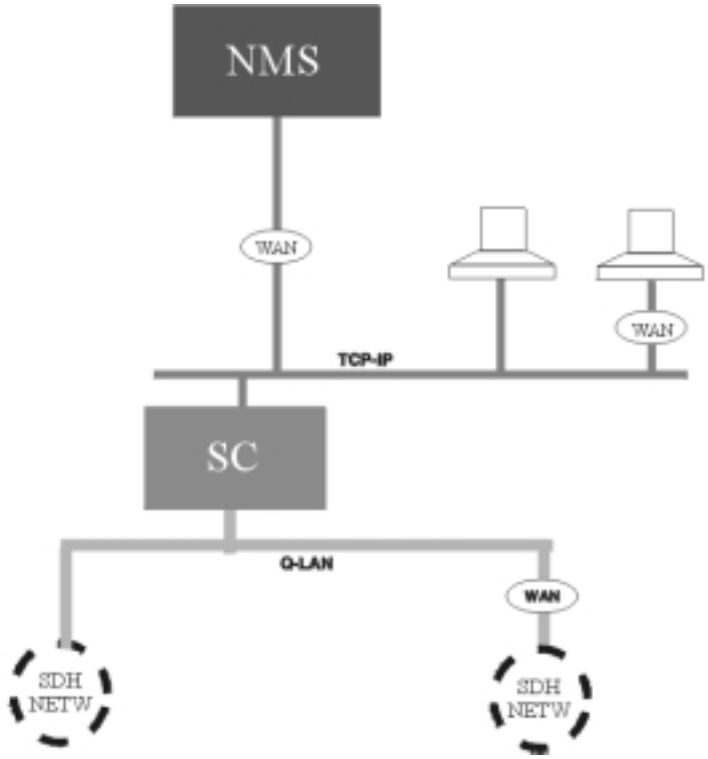
An WaveStar® ITM-SC system may be connected to the following systems:

- SDH Network Elements
- Workstations
- Peer WaveStar® ITM-SCs
- Other management systems like the Navis™ Optical Network Management System.

Connections to the WaveStar® ITM-SC

The figure below shows the WaveStar® ITM-SC and the devices to which it may be connected. As shown in the figure, the links between the WaveStar® ITM-SC and the devices may be local or remote (via a Wide Area Network (WAN)). Bridges may be used when the links are remote. This section presents some examples of the use of bridges.

Figure 5-4 WaveStar® ITM-SC within its data communication environment



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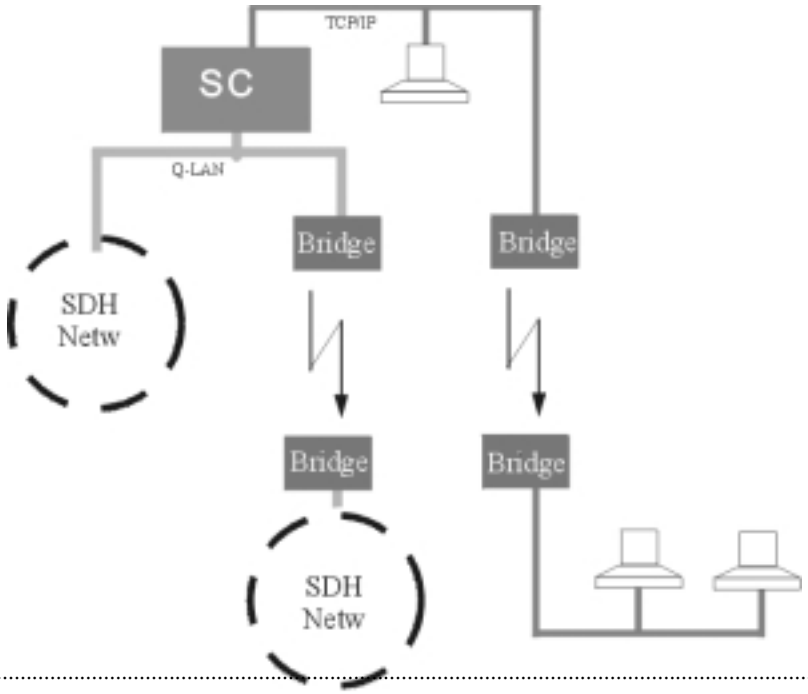
WaveStar® ITM-SC Connected to the SDH network

Ethernet The managed SDH Network is accessed via a 10Base2 (Thin) Ethernet or any other type of media via an appropriate adapter to the Thin Ethernet standard. 10BaseT is supported on PHASE and Wavestar® ADM 16/1. Ethernet is defined in the series of specifications IEEE 802.1, 802.2 and 802.3. Thin wire Ethernet is referred to in the standard as 10 base 2Baseband Medium Specification. The thin wire Ethernet medium is a coaxial cable that has a characteristic impedance of 50 ohms. The data rate is 10 Mbit/s (this is not the data throughput since the CSMA/CD protocol adds data as well). The maximum length of a 50 ohms coaxial segment is 180 m.

Bridges

Connections to (parts of) the managed network can be via LAN bridges. These components allow two geographically separate Ethernet LAN segments to be connected via a lower speed communication channel (typically 2 Mbit/s). A LAN bridge works on the Data Link LAN data. It effectively provides a transparent point-to-point link between LAN segments. As long as the LAN bridges work at the level 2 layer, all existing protocols between WaveStar® ITM-SC and SDH NEs (ES-IS/IS-IS) will work satisfactorily. A LAN bridge pair is required for each remote segment one bridge on the WaveStar® ITM-SC LAN segment and the other on the remote LAN segment. Bridges typically provide LAN access across digital (leased) lines. It is especially important to use the right equipment for the type of medium (digital/analog) that is used to connect the LANs. Bridges may be of the ″learning″ type, i.e. address filtering is used to eliminate unnecessary traffic on the link and on the LANs. The recommended maximum number of SDH NEs over a single LAN bridge depends on the topology and the available bandwidth; the user is requested to contact the Lucent Technologies specialists for advice. Temporary performance drops may occur when DCN intensive operations are executed (e.g. software downloads). A LAN bridge can also be used to connect a remote workstation to the WaveStar® ITM-SC. the following figure shows a typical configuration. The figure shows that the communication between the WaveStar® ITM-SC and the SDH networks is via a Q-LAN, whereas the communication between the WaveStar® ITM-SC and workstations is via TCP-IP. The Q-LAN extensions that were presented earlier in this chapter may be realized by using hardware bridges as described in this paragraph.

Figure 5-5 The use of bridges in the data communication network



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WaveStar® ITM-SC Connected to the Navis™ ONMS

Ethernet The communication between the WaveStar® ITM-SC and the Navis™ Optical Network Management System is via an Ethernet/IEEE 802.3 connection. See the previous figure. This Ethernet connection is different from the one that is used for WaveStar® ITM-SC to SDH NE communication. The communication/routing protocol for WaveStar® ITM-SC to Navis™ Optical Network Management System communication is the TCP/IP protocol. As far as the physical medium is concerned, the remarks apply that were made for WaveStar® ITM-SC to SDH transport network communication.

Bridges The remarks that were made for WaveStar® ITM-SC to SDH NE communication essentially apply to this bridge connection as well. The capacity of the bridge connection depends on the number of NEs that are managed by the WaveStar® ITM-SC that is controlled by the Navis™ Optical Network Management System. However, less traffic per SDH NE is expected on the Navis™ Optical Network Management System to WaveStar® ITM-SC connection than the between the WaveStar® ITM-SC and specific SDH NEs.

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WaveStar® ITM-SC Server and Workstations

Ethernet The type of hardware that can run the WaveStar® ITM-SC application depends on the number of SDH NEs that must be managed by the WaveStar® ITM-SC. Details about the HP platforms are provided in the chapter ″Technical Specifications″. HP workstations can be used for local and remote access to the WaveStar® ITM-SC application. Workstations communicate with the WaveStar® ITM-SC platform via an Ethernet/IEEE 802.3 connection. This Ethernet connection is the same as the one that is used for communication between the WaveStar® ITM-SC and the Navis™ Optical Network Management System.

Bridges Bridges may be used to connect remote workstations to the WaveStar® ITM-SC. The bridges can be the same as those used for the other communication applications. A typical server to workstations configuration was shown in the previous figure. As the figure suggests more than one workstation at a time is allowed to communicate with the WaveStar® ITM-SC. Ten concurrent users are allowed to operate the WaveStar® ITM-SC. It is also possible to operate multiple WaveStar® ITM-SC systems from a single workstation. A workstation may also run the Navis™ Optical Network Management System and the WaveStar® ITM-SC.

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Dual stack with tunneling (DSwT)

Introduction

The Dual Stack with Tunneling (DSwT) feature provides a way to manage IP devices through the DCN network. More information on Dual Stack with Tunneling can be found in chapter Concepts of the different Provisioning Guides.

An IP EMS (Element Management System) is used to manage NEs which use IP based management protocols (IP NEs).

Dual stack

Dual Stack means adding an IP Router stack to an existing OSI stack.

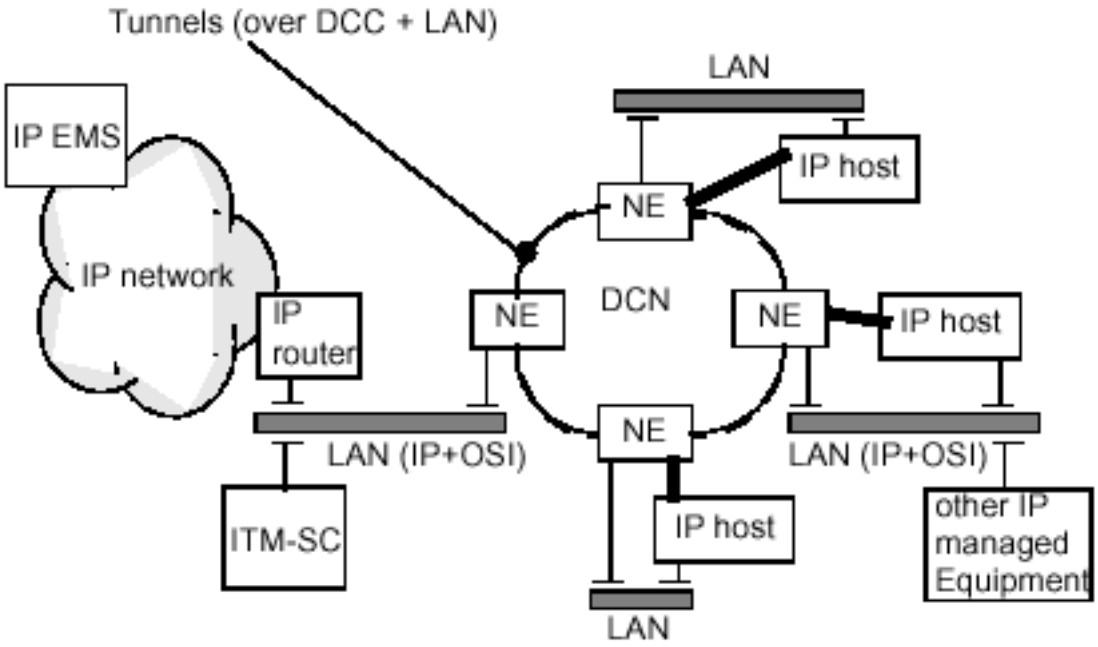
Tunnel

A tunnel is a unidirectional path through the OSI domain capable of transporting IP packets. The tunnel consists of an endpoint in the OSI domain (NSAP) and the encapsulation/decapsulation mechanism to transport an IP packet in an OSI network. The actual path taken by the encapsulated IP packet is completely determined by the normal OSI routing mechanisms.

Network architecture

The network architecture in the figure is used in this example.

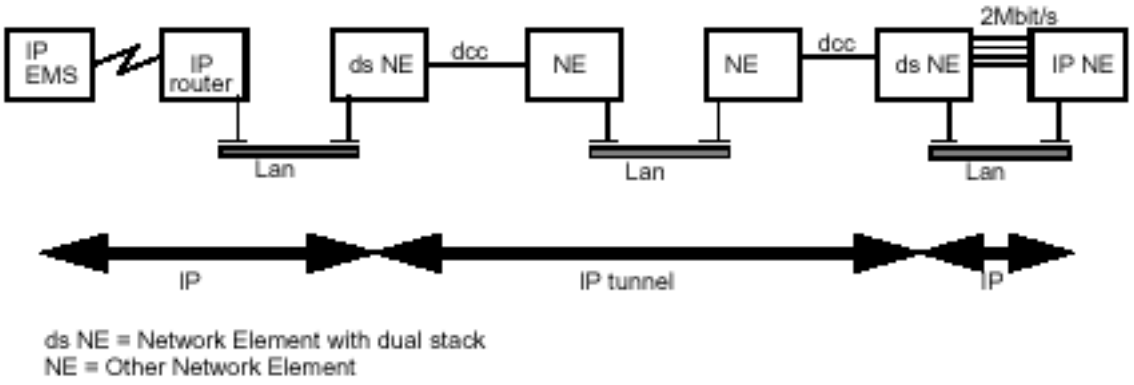
Figure 5-6 Network Architecture example



IP tunnel architecture

The IP Tunnel architecture in the figure is used in this example.

Figure 5-7 IP Tunnel example



Tunnel configuration

A tunnel can be seen as a set of two static routing entries in nodes on the edge of the OSI network and the corresponding static entries in the routing table. The term tunnel may be misleading because it is often associated with connections which must be set up in advance. In this case, only some routing and mapping information needs to be provisioned and no communication between two systems is needed to set up the “tunnel” between them. To avoid confusion, it is better to speak of encapsulation and to think of the OSI network as a NBMA (non broadcast multiple access) subnetwork within the IP network.

The NEs need to be configured with one IP address on the LAN side, connected to the IP subnet with the IP NEs.The LAN can be used for both OSI and IP traffic. The same ethernet address will be used for both protocols.

IP encapsulation

The IP packets are encapsulated in CLNP (Connectionless Network Protocol) packets which are routed through the OSI-only node which routes the CLNP packets as normal, totally oblivious of the CLNP packets contents.

IP and DCC

A benefit of the tunneling approach, is that IP need not to be carried on the DCC. Only the CLNP packets (possibly carrying IP) go on to the DCC.

IP routing

In the Dual Stack with Tunnelling configuration, a second network layer entity (the IP router) is added alongside the existing OSI network layer entity (CLNP). The CLNP entity has the routing tables and the mechanisms to automatically populate them - namely the IS-IS and ES-IS dynamic routing protocols.

This is not the case for the IP routing tables since there is no IP dynamic routing protocol to populate the IP routing tables. IP routing tables have to be manually provisioned by the operator.

DSwT routing table

A Routing Table, IP or OSI, is divided into 2 columns:

- "Final Destinations" of each Network Node,
- for each Final Destination, the identity of the "Next Hop" which is the next network node in the path towards the Final Destination.

The table below shows a simplified IP routing table for IP router in a DSwT stack. It is divided into 2 main columns. These two parts of the routing table will be discussed separately.

FinalDestination	**Next Hop**	
	Subnetwork	**Node**
130.44.5.0/24	LAN 0	<local>
120.23.4.0 / 24	LAN 0	130.44.5.8
150.35.10.0 / 24	DCC 1	-
150.35.20.0 / 24	DCC 2	-
160.22.0.0 / 16	CLNP-Tunnel	NSAP (node X)

Final destination

This column of the Routing Table is a list of all the final destination nodes. When a packet is received at this node, then the destination address in that packet is checked against the list of destinations in the destination column of the routing table. If there is no entry in the table for the packet destination, then the node won't know how to route the packet and will execute the error procedure (which involves discarding the packet and trying to send an error message packet back to the source). If a match is found, the next hop towards the destination can be looked up in he "Next Hop" column.

IP prefixes

An IP Prefix is a mechanism of identifying a collection of IP addresses with some common root. The general principle is to choose a mask which identifies a suitable first part of the IP address which summarizes a number of addresses. For example, the addresses 120.10.2.1, 120.10.2.5 and 120.10.2.13 can be summarized by the IP Prefix: 120.10.2.0 / 24. The 24 identifies the first 24 bits of the address. Summarizing IP addresses is a very powerful way to reduce the number of entries in a Routing Table.

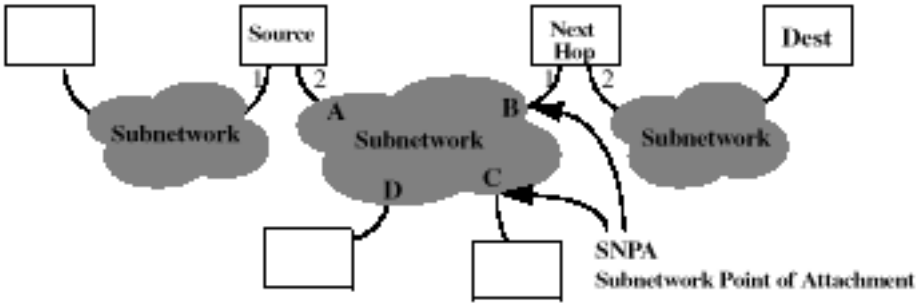
Next hop

Two pieces of information are needed in order to identify the next hop node:

- on which subnetwork (for example on which exit port) is the next hop node,
- which node on that subnetwork is the next hop.

This is shown in the figure below.

Figure 5-8 Next Hop Identification



To send a packet to the destination Dest, the Source must identify the node Next Hop. This is identified by the subnetwork (on Port 2 of Source) and then the node on that subnetwork (identified by B). In OSI terminology the address B is known as a Subnetwork Point of Attachment (SNPA), which is the point that the node is attached to the subnetwork.

The second column in the Routing Table is the next hop and is divided into 2 parts:

- the Next Hop Subnetwork
- the Next Hop Node.

Next hop subnetwork

A router, by its nature, must be connected to multiple subnetworks. Each subnetwork is connected to a separate port on that router. The Next Hop Port identifies the subnetwork to exit this node for the next hop towards the destination.

For the DSwT IP router entity, there are 2 types of port/subnetwork:

1. LAN. This is the ethernet (common subnetwork type for IP routers).
2. CLNP-Tunnel. This is a logical subnetwork created by the OSI CLNP network itself. From the IP router perspective, this subnetwork is seen as a “Non-Broadcast Multiple Access” (NBMA) subnetwork. The IP router simply sees all the neighbour IP router entities connected together to this NBMA. It does not see any of the OSI CLNP nodes inside this network.

Next hop node

Once the correct exit port (subnetwork) has been identified, the correct node on that subnetwork must be identified by its SNPA. This could be an Ethernet address (for a LAN), or a X.121 address for a X.25 subnetwork. When the subnetwork is a point-to point link then there is no need to identify the Next Hop.There are various ways to identify the Next Hop Node, and they depend on the type of subnetwork that node is attached to. The following table provides an overview:

Subnetwork Type	Next Hop Node (Identity Type)
LAN	IP address or none if the destination is actually on this LAN (there is no Next Hop Node).
CLPN-Tunnel	NSAP

6 Ordering and Upgrading

Overview

Purpose This chapter explains how to order software for the WaveStar® ITM-SC and how to upgrade the WaveStar® ITM-SC from a previous release.

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Section: Ordering WaveStar® ITM-SC software

Overview

Purpose This section explains how to order software and license keys for the WaveStar® ITM-SC from the Software Realization Center (SRC) at Merrimack Valley (MV).

□

Ordering and Deliveries of SDH Software

Ordering software

Use the TIPSYS system to build a complete list of requested items with comcodes and prices for the purchase order.

- A list of all deliverable SDH items with their comcodes (***no prices***) can be found at: ***http://www2.nl.lucent.com/icbm-sdh/gpm/ident/sdh/main.html***
- Send this purchase order with the specified list of comcodes to the country desk in Warren, New Jersey
- From Warren the purchase order is routed to the responsible GPC for delivery
- If necessary Warren will split the original order into different suborders and distribute these over different GPCs.

Record the purchase order number and the delivery date as assigned by Warren for tracking purposes.

Software deliveries by MVW

The following should be noted:

- Merrimack Valley, Warren is the sole GPC of software for ISM, SLM, WaveStar® ADM 16/1, WaveStar® CIT, WaveStar® ITM-SC, Navis™ Optical Network Management System, and WaveStar® DACS 4/4/1
- Requests for software deliveries should be addressed to Warren
- Only after receipt of the purchase order will Warren process the request
- Information on delivery status can only be given if the purchase order number received from Warren is provided.

Ordering WaveStar® ITM-SC software

Merrimack Valley, Warren is the sole GPC for the WaveStar® ITM-SC.

The purchase order for WaveStar® ITM-SC software consists of:

- Tapes with core software
- License keys.

Only after receipt of the purchase order from Warren will MVW process the request.

On the basis of the purchase order MVW will ship:

- Tapes with core software
- Information forms for license keys.

Available license keys The following table contains the license keys which can be ordered in the Garnet release:

ComCode	Description	App. code	Remark
109192088	WaveStar® ITM-SC core module garnet R10.x	SAA512	1 per server
109191759	DACS license key garnet R10.x	SBA352	per NE
109191775	DACS GR license key garnet R10.x	SBA353	per NE
109191783	ADM 155 license key garnet R10.x	SBA354	per NE
109191791	ADM 155 GR license key garnet R10.x	SBA355	per NE
109191809	Phase license key garnet R10.x	SBA356	per NE
109191817	Phase GR license key garnet R10.x	SBA357	per NE
109191825	Radio Relay license key garnet R10.x	SBA358	per NE
109191833	Radio Relay GR license key garnet R10.x	SBA359	per NE
109191841	SLM license key garnet R10.x	SBA360	per NE
109191858	SLM GR license key garnet R10.x	SBA361	per NE
109191866	ISM license key garnet R10.x	SBA362	per NE
109191874	ISM GR license key garnet R10.x	SBA363	per NE
109191882	ADM 4/1 license key garnet R10.x	SBA364	per NE
109191890	ADM 4/1 GR license key garnet R10.x	SBA365	per NE
109191908	ADM 16/1 license key garnet R10.x	SBA366	per NE
109191916	ADM 16/1 GR license key garnet R10.x	SBA367	per NE
109191924	ADM 16/1 Compact license key garnet R10.x	SBA368	per NE
109191932	ADM 16/1 Compact GR license key garnet R10.x	SBA369	per NE
109191940	AM1/AM1 Plus/TM1 license key garnet R10.x	SBA370	per NE
109191957	AM1/AM1 Plus/TM 1 GR license key garnet R10.x	SBA371	per NE
109191965	OLS 80G license key garnet R10.x	SBA372	per NE
109191973	OLS 80G GR license key garnet R10.x	SBA373	per NE
109192013	Geographic Redundancy (GR) license key garnet R10.x	SBA377	
109196717	CORBA northbound interface TMF G7 garnet R10.x–single function (e.g. FM only)	SBA423	
109196725	CORBA northbound interface TMF G7 garnet R10.x–all functions	SBA424	
109279026	Informix 5.10/16 users	SBA 453	1 per server
109192039	LXC 16 license key garnet R10.x	SBA379	
109192047	LXC 16 GR license key garnet R10.x	SBA380	

ComCode	Description	App. code	Remark
109192559	Cust. documentation English for WaveStar® ITM-SC garnet R10.x (Installation Guide IG)	DSCSIGGE	
109192575	Cust. documentation English for WaveStar® ITM-SC garnet R10.x (Administration Guide AG)	DSCSAGGE	
109192591	Cust. documentation English for WaveStar® ITM-SC garnet R10.x (Alarm Messages and Trouble Clearing Guide AMTCG)	DSCAMTGE	
109192641	Cust. documentation English for WaveStar® ITM-SC garnet R10.x (Application and Planning Guide APG)	DSCAPOGGE	
109192609	Cust. documentation English for WaveStar® ITM-SC garnet R10.x (Maintenance Guide SMG)	DSCSMGGE	
109196758	TMAG interface R10.x garnet	SBA427	
109196964	Network data report FM R10.x garnet	SBA448	
109196980	Network data report PM R10.x garnet	SBA449	
109196998	Network data report PORT R10.x garnet	SBA450	
109197004	Network data report NODE R10.x garnet	SBA451	
109098566	HP Process Recource Manager	SBA314	
109102731	HP mirror UX	SBA316	
109098558	RoqueWave Runtime licenses	SBA315	
109084905	RTU IONA orbix MT3	RTU IONA ORBIX	

How to get WaveStar® ITM-SC license keys

The following process must be followed:

- The customer places the order for the required license keys through the regular Lucent order management process.
- The Lucent order management process then routes the order to Merrimack Valley. The software realization center will process and ship the order. For license keys the shipment is in fact a paper form entitled ″Activation Code Request″.
- When customers receive the Activation Code Request form they complete it and fax it to the SRC
- When the Activation Code Request form arrives at Merrimack Valley the SRC uses the information on the form to generate the activation codes. The activation codes are faxed to the customer.
- The customer inputs the activation codes into the HP machine. This enables the features of the WaveStar® ITM-SC.

The next paragraph summarizes the information that must be provided to the SRC in different situations.

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Information on the Activation Code Request forms

New installations

With new installations, customers need to provide the following information:

- Name and location of the person or group to receive the activation codes from the SRC
- Phone number and fax number of the person or group to receive the activation codes
- Host ID of the HP machine.

Upgrades from one release to another release

When upgrading from one release to another release, customers order all the required license keys, not just the additional ones that are now needed. Customers need to provide the following information:

- Name and location of the person or group to receive the activation codes from the SRC
- Phone number and fax number of the person or group to receive the activation codes
- Host ID of the HP machine.

Upgrades of the core software within the same release

To accurately provide license keys in this situation, the SRC must know what license keys are already installed on the WaveStar® ITM-SC system. Therefore the customer must provide the following information:

- Name and location of the person or group to receive the activation codes from the SRC
- Phone number and fax number of the person or group to receive the activation codes
- Host ID of the HP machine
- Serial number of the media that provided the core software that is currently on the WaveStar® ITM-SC
- List of the features that are currently installed on the WaveStar® ITM-SC.

Expansions of a network that use the same core but add license keys

This situation is like upgrading within the same release. The customer must provide the following information:

- Name and location of the person or group to receive the activation codes from the SRC
- Phone number and fax number of the person or group to receive the activation codes
- Host ID of the HP machine

- Serial number of the media that provided the core software that is currently on the WaveStar® ITM-SC
- List of the features that are currently installed on the WaveStar® ITM-SC.

Repair procedure that results in a new host ID

In this situation the customer must provide the following information:

- Name and location of the person or group to receive the activation codes from the SRC
- Phone number and fax number of the person or group to receive the activation codes
- Original host ID of the HP machine
- New host ID of the HP machine
- Serial number of the media that provided the core software that is currently on the WaveStar® ITM-SC
- List of the features that are currently installed on the WaveStar® ITM-SC.

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Upgrading the WaveStar® ITM-SC

License agreement

The customer must have a license agreement with HP or with Lucent to operate the new HP Unix Operating System 11.xx. version. Orders for the new software release must be placed through the Lucent order channels.

The customer must provide the following information in order to receive the correct license keys:

- Host ID of the HP machine
- The network element type(s) and the quantity of this network elements
- The optional features activated on this WaveStar® ITM-SC
- The license keys are unique for a host-id of a server, therefore if the customer wants to use a new server he needs to request a new set of license keys.

Upgrading

To upgrade the WaveStar® ITM-SC from a previous release the carry out the following steps:

1. Upgrade the HP Unix Operating System 10.xx to HP Unix Operating System 11.xx with additional core enhancements delivered in HP-UX 11.xx after November 1999
2. Upgrade the old application software to the new application software ITM-SC WaveStar® release Garnet 10.

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Ordering Example

Standalone configuration

Ordering one new system with 10 ADM 16/1 compact and 5 AM 1 Plus network elements without Navis™ Optical NMS:

- 1 x Core Module ITM-SC garnet
- 1 x database informix 5.10x
- 10 x ADM 16/1 compact license key for garnet
- 5 x AM 1 Plus license key for garnet.

Optional features for example Network Data Reporting and/or Geographic Redundancy.

Northbound interface

For having the Navis™ Optical NMS involved as a network manager license keys the following license key must be added:1 x TMAG interface R.10.x garnet.

For using a 3rd party CORBA based manager instead of the Navis™ Optical NMS the following software needs to be ordered:

- 1 x TMF G7 CORBA interface R10.x (single function) ***or***
- 1 x TMF G7 CORBA interface R10.x (all functions).

For using the northbound CORBA functionality additional 3rd party software must be ordered - please contact our marketing team or product management for further information.

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7 Product Support

Overview

Purpose This chapter describes how Lucent Technologies supports the WaveStar® ITM-SC. This support includes engineering and installation services, training, and documentation services.

Objective Lucent Technologies is convinced that product support is an important part of the total product. Lucent Technologies offers various services for the planning, implementation and operations of networks with the WaveStar® product family and its management systems. Services for network planning include economical and technical support and network planning and design. Project implementation services include site surveys, engineering, installation and testing, acceptance support, database preparation and project management. Operations services include field support, repair and exchange services, product introduction and emergency recovery. The introduction of the WaveStar® ITM-SC Element Management System in networks and the corresponding organizational system is supported by a comprehensive range of training courses and documentation.

Intended use This chapter is intended for the technical staff who plan and work with the WaveStar® ITM-SC Element Management System.

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Section: Engineering and Installation, Training and Documentation

Overview

Purpose This section provides information about engineering and installation services, training, and documentation services.

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Engineering and Installation Services

Customer Support

Lucent Technologies Customer Support is committed to providing customers with high quality product support services. Whether there is a need for assistance in engineering, installation, normal maintenance, or disaster recovery, the support staff will provide you with the high quality technical support you need to get the job done. Each segment of Customer Support regards the customer as highest priority and understands your obligation to maintain the highest standards for your customer as well.

Engineering and Installation Group

Within Customer Support, the Engineering and Installation Services Group provides a highly skilled force of support personnel to provide customers with high quality engineering and installation services. These engineering and installation specialists use state-of-the-art technology, equipment and procedures to provide customers with highly competent, rapid response services. These services include analyzing an equipment request, preparing a detailed specification for manufacturing and installation, creating and maintaining job records, installing the equipment, and testing and turning over a working system.

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Training Services

Courses

The following courses are available for technical staff who work with the WaveStar® ITM-SC Element Manager:

- SDH Introduction This course is designed for technical personnel who need to know the functional and physical features and the applications of the SDH NEs and their management system. The course″s high-level approach makes it equally accessible to personnel from service, purchasing and planning departments. This course is also available on CD-Rom.
- WaveStar® ITM-SC Operations This course provides an introduction to the features, network applications, and configurations of the WaveStar® ITM-SC. In addition, the course covers provisioning, monitoring of events, and maintenance activities by means of hands-on exercises using the WaveStar® ITM-SC.

Apart from these general courses, training with the management system is also given in courses that are dedicated to a specific network element type and in which the focus is more on the specific functional and physical features of that network element type. More information about these courses can be found in the ″Application and Planning Guide″ for each network element type.

□

Documentation

Manual structure

The SDH customer documentation has a ″TASK-ORIENTED-APPROACH″ that is based on the task analysis as performed for other transmission systems. this means that there are different manuals for each specific task. The contents of the manuals are closely related to the deployment phases of a telecommunications network, i.e. planning, installing, and maintaining the network and its elements.

Manual set

The following documents relate to the WaveStar® ITM-SC:

- For more detailed information on the technical characteristics, features, applications, system planning and engineering of the WaveStar® ITM-SC, refer to the: APPLICATION AND PLANNING GUIDE
- For information on installation of the WaveStar® ITM-SC, refer to the: INSTALLATION GUIDE
- For information on how to give users access to the WaveStar® ITM-SC and on how to backup and restore databases, refer to the: ADMINISTRATION GUIDE
- For information on maintenance of the Network Elements when using the WaveStar® ITM-SC, refer to the: MAINTENANCE GUIDE
- For information on provisioning of the Network Elements when using the WaveStar® ITM-SC, refer to the: PROVISIONING GUIDE FOR THE NETWORK ELEMENT
- For information on corrective procedures and action tables of the WaveStar® ITM-SC, refer to: ALARM MESSAGES AND TROUBLE CLEARING GUIDE
- For information on the Data Communications Network (DCN), which is used for the management of an SDH transmission network and consists of Lucent Technologies' SDH equipment and management systems, refer to: SDH DATA COMMUNICATIONS NETWORK DESGN

Apart from these documents there are also Provisioning guides and Alarm Messages & Maintenance guides that are specific to particular network elements. More information about these documents can be found in the ″Application and Planning Guide″ of the relevant network element type.

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8 Technical Specifications

Overview

Purpose This chapter provides the technical specifications and hardware requirements of the WaveStar® ITM-SC. Hardware requirements are provided for recent orderable workstations, servers, and X-terminals. The hardware configurations mentioned in this paragraph are delivered for current orders. It is still possible to use hardware from previous WaveStar® ITM-SC releases that are already in operation.

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Section: Hardware requirements for the WaveStar® ITM-SC

Overview

Purpose

The hardware architecture that is required to support the WaveStar® ITM-SC system depends on the size of the network to be managed. In this context size means the weighted number of network elements that are managed. This weighting is applied because some network element types will require more management resources than others. Thus the hardware specification is designed to meet the hardware requirements of a particular customer. The hardware architecture is designed to support the WaveStar® ITM-SC software and supporting components. The hardware must provide sufficient processing power and memory to allow the software to function efficiently, but at an acceptable cost. As the WaveStar® ITM-SC has its own installed customer base (both in previous releases of the WaveStar® ITM-SC and in the PHAMOS system), the hardware platforms of the existing customer base are still supported. However, certain functionalities will not be supported on these hardware platforms due to insufficient resources. Note that in addition to restrictions imposed by the hardware platform, there are some features that are not supported across low band-width communication links in the management network. Up-to-date information about available hardware can be found at:

http://www2.nl.lucent.com/icbm-sdh/ITM_SC_Conf/index.html

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Client workstation

Introduction

This workstation has an identical configuration whether it is deployed as a WaveStar® ITM-SC only workstation or a joint WaveStar® ITM-SC/Network Management System workstation. The Navis™ Network/Element client workstation supports one user at the console. The hardware configurations for this solution are outlined in “Chapter 3 Network Topologies”.

One client workstation is required for each concurrent user of the WaveStar® ITM-SC. Additionally at least one WaveStar® ITM-SC server or stand-alone SC is always needed. The workstation proposed for this configuration is the workstation HP B2600. This B2600 machine requires the additional core enhancements delivered in HP/UX 11.00 after November 1999. The HP workstation third party software in also required to support the WaveStar® ITM-SC software.

Workstation type

Hardware requirements, client workstation-B2600:

- Workstation HP B2600 500 MHz PA-RISC 8600 CPU workstation. IEE 802.3 Ethernet LAN configured with RJ45 UTP connector.
  Comes with the folowing features:
  - HP-UX run time, 2 user license
  - 1 LVD SCSI interface, internal
  - CD-ROM
- Desktop orientation
- CD-ROM drive, factory integrated
- 512 Mb SDRAM. Total memory 1024 Mb, factory integrated
- 18 Gb LVDdisk, factory integrated
- VISUALISE fxe REV B graphics
- 21 inch monitor
- PCI ultra SCSI single ended adapter, factory integrated
- Keyboard plus localisation option. The localization kit provides mouse cable and HP documentation
- Power cord kit
- HP-UX 11.0.

Optional items

Optional items, client workstations B2600:

- DDS-3 smart desktop DAT[a]
- 1 m 50 pin HP-68 pin SE SCSI cable
- SE SCSI-2 terminator.

[a.] An internal DDS DAT cannot be added to the workstation. The external SE SCSI-2 DDS smart desktop DAT drive must be attached to the external SE SCSI-2 interface. Only 1 DAT drive is required per customer location as the DAT drive can be shared between machines.

Optional items, monitor:

- 18 quarts grey flat panel with maximum reselution 1280x1024
- Localisation option.

[b.] If a flat panel is ordered then the standard screen is not required.

Client workstation SCSI IDs

The B2600 client workstation has a SE SCSI bus for external devices. The devices must be setup as defined in the following table.

Client workstation SCSI IDs:

Device name	Device location	SCSI device instance[a.]	SCSI ID
Root disk	internal	LVD-1	6
Tape drive[b.]	external	SE-1	3
CD ROM drive	internal	IDE	not applicable

[a.] Instance SE-1 is for devices connected to the single ended SCSI connection, instance LDV-1 is for devices connected to the Ultra2 Wide LVD SCSI card.

[b.] This is an optional item which may be shared between machines.

□

Client workstation

Introduction

This workstation has an identical configuration whether it is deployed as a WaveStar® ITM-SC only workstation or a joint WaveStar® ITM-SC/Network Management System workstation. The Navis™ Network/Element client workstation supports one user at the console. The hardware configurations for this solution are outlined in “Chapter 3 Network Topologies”.

One client workstation is required for each concurrent user of the WaveStar® ITM-SC. Additionally at least one WaveStar® ITM-SC server or stand-alone SC is always needed. The workstation proposed for this configuration is the workstation HP B2000. This B2000 machine requires the additional core enhancements delivered in HP/UX 11.00. The HP workstation third party software in also required to support the WaveStar® ITM-SC software.

Workstation type

Hardware requirements, client workstation — B2000:

- Workstation HP B2000 400 MHz PA-RISC 8500 CPU mini tower workstation.
  Comes with the folowing features:
  - HP-UX 11.00 Run-Time, 2 user license
  - 256 Mb SDRAM
  - Ultra 2 SCSI LVD
  - integrated VISUALIZE fxe graphics
  - 9 Gb disk
  - CD-ROM
  - 10/100 BaseTx Ethernet
  - 1.5 Mb primary cache
- 21 inch colour monitor
- 512 Mb SDRAM provides a total of 768 Mb
- PCI ultra SCSI single ended adapter. Factory integrated.
- HP-UX USB keyboad kit. Localisation kit provides mouse cable and HP documentation.
- Keyboard power cord kit
- HP-UX media on CD-ROM

Optional items

Optional items, client workstations B2000:

- DDS-2 DAT drive 1 m 50 pin HD-HD SCSI cable SE SCSI-2 terminator[a]
- 18 inch quartz grey flat panel with maximum resolution 1280x1024[b].

[a.] An internal DDS DAT cannot be added to the workstation. The external DDS-2 DAT drive must be attached to the external SE SCSI-2 interface. Only 1 DAT drive is requiured per customer location as the DAT drive can be shared between machines.

[b.] If a flat panel is ordered then the standard screen is not required.

Client workstation SCSI IDs

The B2000 client workstation has a SE SCSI bus for external devices. The devices must be setup as defined in the following table.

Client workstation SCSI IDs:

Device name	Device location	SCSI device instance[a.]	SCSI ID
Root disk	internal	LVD-1	6
Tape drive[b.]	external	SE-1	3
CD ROM drive	internal	IDE	not applicable

[a.] Instance SE-1 is for devices connected to the single ended SCSI connection, instance LDV-1 is for devices connected to the Ultra2 Wide LVD SCSI card.

[b.] This is an optional item which may be shared between machines.

□

Stand-alone manager

Introduction

The proposed workstation for this configuration is the workstation B2600. The stand-alone manager can support up to 2 users, the second user being on another workstation. The hardware configurations for this solution are outlined in “Chapter 3 Network Topologies”. This B2600 machine requires the additional core enhancements delivered in HP/UX 11.00 after November 1999. The HP workstation third party software in also required to support the WaveStar® ITM-SC software.

Stand-alone element manager

Hardware requirements, stand-alone element manager-B2600:

- Workstation HP B2600 500 MHz PA-RISC 8600 CPU workstation. IEE 802.3 Ethernet LAN configured with RJ45 UTP connector.
  Comes with the folowing features:
  - HP-UX 11.00 Run-Time, 2 user license
  - 1 LVD SCSI interface, internal
  - CD-ROM
- Desktop orientation
- CD-ROM drive, factory integrated
- 512 Mb SDRAM. Total memory 1024 Mb, factory integrated
- 18 Gb LVDdisk, factory integrated
- VISUALISE fxe REV B graphics
- 21 inch monitor
- PCI ultra SCSI single ended adapter, factory integrated
- 100 BaseT adapter and license. Autosensing to 10 base T.
- Keyboard plus localisation option. The localization kit provides mouse cable and HP documentation
- Power cord kit
- DDS-3 smart desktop DAT[a]
- 1 m 50 pin HP-68 pin SE SCSI cable
- SE SCSI-2 terminator.
- HP-UX 11.0[b].

[a.] An internal DDS DAT cannot be added to the workstation. The external SE SCSI-2 DDS smart desktop DAT drive must be attached to the external SE SCSI-2 interface.

[b] Only one copy is required per site

[a.] The DAT drive must be attached to the external SE SCSI-2 interface.

Optional items

Optional items, stand-alone manager B2600 an 18 inch quartz grey flat panel with maximum resolution 1280x1024[a].

[a.] If a flat panel is ordered then the standard screen D8915W is not required.

Stand-alone SCSI IDs

The B2600 stand-alone workstation has a SE SCSI bus for external devices. The devices must be setup as defined in the following table.

Stand-alone SCSI IDs:

Device name	Device location	SCSI device instance[a.]	SCSI ID
Root disk	internal	LVD-1	6
2nd disk	internal	LVD-1	5
Tape drive	external	SE-1	3
CD ROM drive	internal	IDE	not applicable

[a.] Instance SE-1 is for devices connected to the single ended SCSI connection, instance LDV-1 is for devices connected to the Ultra2 Wide LVD SCSI card.

□

Stand-alone manager

Introduction

The proposed workstation for this configuration is the workstation B2000. The stand-alone manager can support up to 2 users, the second user being on another workstation. The hardware configurations for this solution are outlined in “Chapter 3 Network Topologies”. This B2000 machine requires the additional core enhancements delivered in HP/UX 11.00. The HP workstation third party software in also required to support the WaveStar® ITM-SC software.

Stand-alone element manager

Hardware requirements, stand-alone element manager — B2000

- Workstation HP B2000 400 MHz PA-RISC 8500 CPU mini tower workstation
  Comes with the folowing features:
  - HP-UX 11.00 Run-Time, 2 user license
  - 256 Mb SDRAM
  - Ultra 2 SCSI LVD
  - integrated VISUALIZE fxe graphics
  - 9 Gb disk
  - CD-ROM
  - 10/100 BaseTx Ethernet
  - 1.5 Mb primary cache
- 21 inch colour monitor
- 256 Mb SDRAM provides a total of 512 Mb
- PCI ultra SCSI single ended adapter. Factory integrated
- 9 Gb LVD SCSI disc drive 7200 RPM. Provides a total of 18 Gb
- 4 Gb external SE SCSI-2 DDS smart desktop DAT drive 1 m 50 pin HP — 68 pin SE SCSI cable SE SCSI-2 terminator[a]
- 100 BaseT adapter and license. Autosensing to 10 BaseT
- HP-UX USB keyboad kit. Localisation kit provides mouse cable and HP documentation
- Keyboard power cord kit
- HP-UX media on CD-ROM. Version 11.00

[a.] The DAT drive must be attached to the external SE SCSI-2 interface.

Optional item

The optional item, for stand-alone manager is the B200018 inch quartz grey flat panel with maximum resolution 1280x1024[a].

[a.] If a flat panel is ordered then the standard screen D8915W is not required.

Stand-alone SCSI IDs

The B2000 stand-alone workstation has a SE SCSI bus for external devices. The devices must be setup as defined in the following table.

Stand-alone SCSI IDs:

Device name	Device location	SCSI device instance[a.]	SCSI ID
Root disk	internal	LVD-1	6
2nd disk	internal	LVD-1	5
Tape drive	external	SE-1	3
CD ROM drive	internal	IDE	not applicable

[a.] Instance SE-1 is for devices connected to the single ended SCSI connection, instance LDV-1 is for devices connected to the Ultra2 Wide LVD SCSI card.

□

X-terminal server

Introduction

The proposed workstation for this configuration is the B2000. This platform may be configured with up to 8 X-terminals connected to give a maximum of 8 users, one at the console and one on each X-terminal. The hardware configurations for this solution are outlined in “Chapter 3 Network Topologies”. Additionally at least one SC server is always needed. This B2000 machine requires the additional core enhancements delivered in HP/UX 11.00. The HP workstation third party software in also required to support the WaveStar® ITM-SC software.

X-terminal server

Hardware requirements, X–terminal server B2000:

- Workstation HP B2000 400 MHz PA-RISC 8500 CPU mini tower workstation.
  Comes with the folowing features:
  - HP-UX 11.00 Run-Time, 2 user license
  - 256 Mb SDRAM
  - Ultra 2 SCSI LVD
  - integrated VISUALIZE fxe graphics
  - 9 Gb disk
  - CD-ROM
  - 10/100 Base Tx Ethernet
  - 1.5 Mb primary cache
- 21 inch colour monitor
- PCI ultra SCSI single ended adapter. Factory integrated
- 100 BaseT adapter and license. Autosensing to 10 BaseT.
- HP-UX USB keyboad kit. Localisation kit provides mouse cable and HP documentation.
- Keyboard power cord kit
- HP-UX media on CD-ROM. Version 11.00

Optional items

Optional items, X-terminal server B2000:

- DDS-2 DAT drive 1 m 50 pin HD-HD SCSI cable SE SCSI-2 terminator[a]
- 18 inch quartz grey flat panel with maximum resolution 1280x1024[b]

[a.] An internal DDS DAT cannot be added to the X-terminal server. The external DDS-2 DAT drive must be attached to external SE SCSI-2

interface. Only 1 DAT drive is required per customer location as the DAT drive can be sharedbetween machines.

[b.] If a flat panel is ordered then the standard screen is not required.

X-terminal SCSI IDs

The B2000 X-terminal server has an SE SCSI bus for external devices. These devices must be set up as defined in the following table.

Stand-alone/X—terminal server SCSI IDsSCSI IDs:

Device name	Device location	SCSI device instance[a]	SCSI ID
Root disk	internal	LVD-1	6
Tape drive[b]	external	SE-1	3
CD ROM drive	internal	IDE	not applicable

[a.] Instance SE-1 is for devices connected to the single ended SCSI connection, instance LDV-1 is for devices connected to the Ultra2 Wide LVD SCSI card.

[b.] This is an optional item which may be shared between machines.

□

Large network management server

Introduction

The server required is a HP9000 L-Class Enterprise server, which also requires a number of factory integrated features as specified in the following table. The hardware configurations for this solution are outlined in “Chapter 3 Network Topologies”.

Large network management server

Hardware requirements, large network management server:

- HP9000 L-Class Enterprise server L2000
- 440 MHz PA-RISC PA-8500 processor with the following feature 1.5 MB integrated cache.
- Processor support module
- DVD CD-ROM drive
- 256 Mb high density SDRAM memory module. 512 Mb high density SDRAM memory module. Provides a total of 768 Mb.
- 9 Gb hotplug Ultra2 SCSI low profile disk. Provides a total of 27 Gb.
- Single port 100 Base-TX Ethernet LAN adapter
- Smart storage enclosure with DDS-3 DAT drive. 1.0M SCSI cable for m-drive (68–pin VHDIC to 68–pin HD). Ultra2 SCSI terminator HDTS68
- HP Unix operating environment license to use HP-UX Operating license to use * Basic environment (does not include additional products).
- HP/UX media on CD-ROM version 11.00
- Factory racked using high availability slider rails[a].

[a.] The rack must be ordered at the same time.

Optional items

Since secure web console is provided with the L2000 as standard the system console can be an optional item for servers.

An optional item, for the large network management server is the HP 700/96 system console (white 14 inch)

Large network manager SCSI IDs

The large network manager is an Ultra2 SCSI device with up to 10 devices supported by HP per SCSI adapter. The devices must be setup as defined in the following table.

Large Network Manager SCSI IDs

Device name	Device location	SCSI device instance[a]	SCSI ID
Root disk	internal	Ultra2–1	5
Archive disk	internal	Ultra2–1	8
Databasedisk	internal	Ultra2–1	11
Tape drive	external	SE-1	3
CD ROM drive	internal	SE-1	2

[a.] Instance SE-1 is for devices connected to the single ended SCSI connection.

□

Combined terminal server

Introduction

The hardware configurations for this solution are outlined in “Chapter 3 Network Topologies”. The server required for this solution is a HP9000 L2000 Enterprise Server, which also requires a number of factory integrated features as specified in the following table. Two CPUs must be used in this deployment.

The most significant differences from the large network management server are as follows:

- Memory increased to 1024 Mbyte
- One additional 440 MHz PA-RISC PA-8500 processor.

Combined terminal server

Hardware requirements, combined terminal server:

- HP9000 L-Class Enterprise server L2000
- 440 MHz PA-RISC PA-8500 processor with feature 1.5 Mb integrated cache.
- Processor support module
- DVD CD-ROM drive
- 1024 Mb high density SDRAM memory module. Provides a total of 1024 Mb.
- 9 GB hotplug Ultra2 SCSI low profile disk. Provides a total of 27 Gb.
- Smart storage enclosure with DDS-3 DAT drive. SCSI cable for m-drive (68–pin VHDIC to 68–pin HD). Ultra2 SCSI terminator HDTS68.
- Single port 100Base-T Ethernet LAN adapter card
- HP Unix operating environment license to use HP-UX Operating license to use * Basic environment (does not include additional products)
- HP/UX media on CD-ROM version 11.00
- Factory racked using high availability slider rails[a].

[a.] The rack must be ordered at the same time.

Optional items

Since secure web console is provided with the L2000 as standard the system console can be an optional item for servers.

Optional item, for combined terminal servers is the HP 700/96 system console (white 14 inch)

Combined terminal server SCSI IDs

The combined terminal server is an Ultra2 SCSI device with up to 10 devices supported by HP per SCSI adapter. The devices must be setup as defined in the following table.

Combined terminal server SCSI IDs

Device name	Device location	SCSI device instance[a]	SCSI ID
Root disk	internal	Ultra2–1	5
Archive disk	internal	Ultra2–1	8
Database disk	internal	Ultra2–1	11
Tape drive	external	SE-1	3
CD ROM drive	internal	SE-1	2

[a.] Instance SE-1 is for devices connected to the single ended SCSI connection.

□

X-terminal

Introduction

The hardware configurations for this solution are outlined in “Chapter 3 Network Topologies”. Two specifications are given one for a dedicated X-terminal and one for a PC solution.

Dedicated X-terminal

Hardware requirements, X-terminal:

- NCD NC200 base unit with 16 MB system memory and 8 MB flash ROM
- 32 Mb DIMM memory module provides a total of 48 Mb
- Power cords[a].
- Keyboard
- Display stand
- Sony trinitron 19 inch colour monitor

[a.] Only required if ordered for use within Europe, elswhere the power cables are supplied with the base unit

PC with operating system NT

Localisation codes are required for HP workstations and servers. The localisation codes for a particular country is dependant on the product and country.

Hardware requirements, PC:

- HP Kayak XM600
  Comprising the following features:
  - Intel Pentium III 733 MHz
  - 128 Mb SDRAM
  - 256 k cache
  - 9.1 Gb IDE hard disk
  - 48 x CDROM drive
  - Matrox MILL-G400 dual graphics card
  - 10/100 BaseT LAN
  - NT 4.0 operating system
- 21 inch monitor with its localisation option (this code is dependant on the country where the X-terminal shall be used)

□

High Availability Configurations and Geographic Redundancy

High availability options

The WaveStar® ITM-SC has high availability options:

- Uninterruptible Power Supply (UPS)
- Mirrored Disks
- Cold Standby.

These options are only supported on the following server platforms:

Hardware platform	UPS supported	Mirrored disks supported	Cold standby supported
B-132L+ (headless)	No [a.]	No	Yes
B-180L (headless)	No [a.]	No	Yes
B-1000	No [a.]	No	Yes
B-200	No [a.]	No	Yes
E-35	No [a.]	No	Yes
G-50	No [a.]	No	Yes
D230	Yes	Yes	Yes
D-380	Yes	Yes	Yes
D-390	Yes	Yes	Yes
L-2000	Yes	Yes	Yes

[a.] It is possible to connect a UPS to these platforms. However, this UPS will not be fully monitored from the WaveStar® ITM-SC software.

Geographic redundancy

The WaveStar® ITM-SC provides for the use of geographic redundancy features. These features enable a second WaveStar® ITM-SC to manage the NEs of a failed WaveStar® ITM-SC, for example during local power difficulties. The Geographic Redundancy feature is supported on all stand-alone and client-server WaveStar® ITM-SC platforms and may be used in conjunction with Navis™ Optical Network Management System.

□

Peripherals

Supporting the systems application

The WaveStar® ITM-SC is supported by a number of peripherals that support the systems applications.

Tape Drive: This is used for installing the system software and archiving the INFOMIX database on user request. The tape drive is also used for loading network element software images and may be used for other archive activities. There is a single tape drive in the system. This tape drive is mounted on the machine that supports the WaveStar® ITM-SC server.

Printer: The printer is used to obtain hard copies of WaveStar® ITM-SC configuration/alarm reports and of performance monitoring measurements. Printers may be connected to the general purpose LAN but must not be connected to the Q-LAN. The printer must be able to support both ASCII and postscript printing.

The recommended printer is the HP LaserJet 4050N Printer, 16 Mbyte RAM, 17 ppm, 600 dpi laser printer[a].

[a.] This printer requires the HP JetAdmin Software J2559C of at least version D.0621, which should be provided on the installation tape.

Bridges: Bridges are only for use on the general purpose LAN and should not be used on the Q-LAN. The bridge must be attached to a 64 kbit/s link. It can autosense voltages from 100 to 230 V, and has a VA rating of 10 when connecting to a UPS. As there are a wide range of voltages automatically configured by the bridge, then this bridge should be purchased with the appropriate power lead for the country where it will be deployed.

The recommended bridge is theRAD Ethernet bridge[a].

[a.] A suffix specifies a 10Base-T connection. The BNC option has been specified for previous deployments.

Modems: The modem is required for remote diagnostics and can either be directly connected to the WaveStar® ITM-SC, or connected to a 64 kbit/s line leading to the SC via a bridge. The recommended modem is the Paradyne Comsphere 3920 Plus. When ordering Paradyne 3920 modems a platform must be specified with a model number where the country requires approval before the modem may be attached to their phone system.

Routers: Routers are required to use remote workstations with the WaveStar® ITM-SC. The specified router is a dual LAN, dual serial router. The software loaded on the router must be at least IOS version 11.3 Enterprise.

Recommended router:

- 2 LAN, 2 serial port Cisco router
- 8 Mb to 16 Mb DRAM factory upgrade

Hubs: The use of hubs is permitted on the general purpose LAN and on the Q-LAN. Hewlett Packard offers a cheap and simple unmanaged 10Base-T hub with 8 RJ45 connectors and a 10Base2 BNC with the following order code. This hubs can be cascaded to three levels.

If a larger of number of ports are required, a 16 port hub is also available.

If connection to a 10/100 Mbit/s general purpose LAN is required then the 12 port hub should be ordered.

Recommended hubs:

- HP Advance stack 10Base-T hub-8E
- 16 port HP advance stack 10Base-T hub-16U
- 12 port HP procurve 10/100 hub

Recommended transceivers:

- ThinLAN transceiver module[a].
- EtherTwist transceiver (AUI to 10BaseT) (for PHASE)

[a.] This transceiver is only required if a BNC connection is required when purchasing the 16 port hub in preference to the 8 port hub.

Note that transceivers are used on some NEs for connection to the Q-LAN. The first transceiver mentioned in the table is an AUI to 10Base2 transceiver which can be used on a number of NE types. On PHASE NEs 10BaseT is also supported hence an AUI to 10BaseT transceiver can be used.

□

Platform Capabilities

Capabilities

The following table summarizes the maximum number of supported vertical partitions (VP) and network element equivalents (NE) per hardware platform. The number of vertical partitions indicates how many NE families a WaveStar® ITM-SC can handle. For more information about the NE equivalent, see Chapter 3 “Section Network Loading and Network Configuration”.

Hardware platform	Max. VPs supported	Max. NEs supported	NE equiv. (with client)	NE equiv. (without client)
715/80	3	30	30	
715/100	3	35	35	
B132L	3	50	50	
B132L+	3	50	50	
B180L	3	60	60	
B1000	3	100	100	
B2000	3	125	125	
E35	3	100		100
G50	3	100		100
D230	5	250		200
D380	5	400		300
D390	5	400		350
L2000–44	7	400		400
L[a]	7	400		400
Generic 700[b]	3	30	30	60
Generic 800[c]	5	250		200

[a)] Generic L series. [b)] Generic 700 series not mentioned in the list before. [c)] Generic 800 series not mentioned in the list before.

The WaveStar® ITM-SC distinguishes between the following network element families:

- ISM
- SLM
- Nera Radio Relay
- WaveStar® ADM 4/1

- PHASE
- WaveStar® ADM 16/1
- WaveStar® OLS80G
- WaveStar® DACS 4/4/1
- WaveStar® AM 1

WaveStar® AM 1, WaveStar® AM 1 plus and WaveStar® TM 1 count as one family, WaveStar® ADM 16/1 senior and WaveStar® ADM 16/1 compact count as one family, the PHASE products also count as one family.

□

Appendix A: Standard WaveStar® ITM-SC Compliances and Examples of Windows

Overview

Purpose The purpose of this appendix is to provide information about the standard compliances of the WaveStar® ITM-SC. The appendix also contains examples from the WaveStar® ITM-SC's graphical user interface.

□

WaveStar® ITM-SC Standard Compliances

General

The WaveStar® ITM-SC achieves the basic objectives of the Transmission Management Network principles of ITU recommendation M.3010.

The WaveStar® ITM-SC supports the following functional areas that are identified in recommendation M.3010:

- Performance Monitoring: the WaveStar® ITM-SC supports the configuring of measurement and gathering of measurement data.
- Fault Management
- Configuration Management
- Security Management: this release only provides security to restrict user access to the WaveStar® ITM-SC system.

General standards

The following other general ITU-T recommendations apply to the WaveStar® ITM-SC: M.3000, M.3010, M.3020, M.3100, M.3300 and M.3400.

□

Management Interface

General

The WaveStar® ITM-SC management interface is described as Q3 in the sense that the methods and paradigm that are used to specify the management interface are compliant with the following ITU-T recommendations: X.209, X.700, X.710, X.720, X.721, X.722, X.723, X.724, X.725, X.730, X.731, X.732, X.733, X.734 and X.735.

SDH management interface

The SDH management interface is based on the following recommendations:

- general SDH management G.774, G.780, G.784, G.781, G.782, G.783, G.784 and G.773 (The ITM-SC is compliant with the standard for the A2 protocol suite IEEE802.3)
- performance monitoring G.774.01, G.826
- structure of transport networks G.805
- transport management G.852.02, G.853.1.

□

7-Layer OSI Stack

7-Layer OSI stack

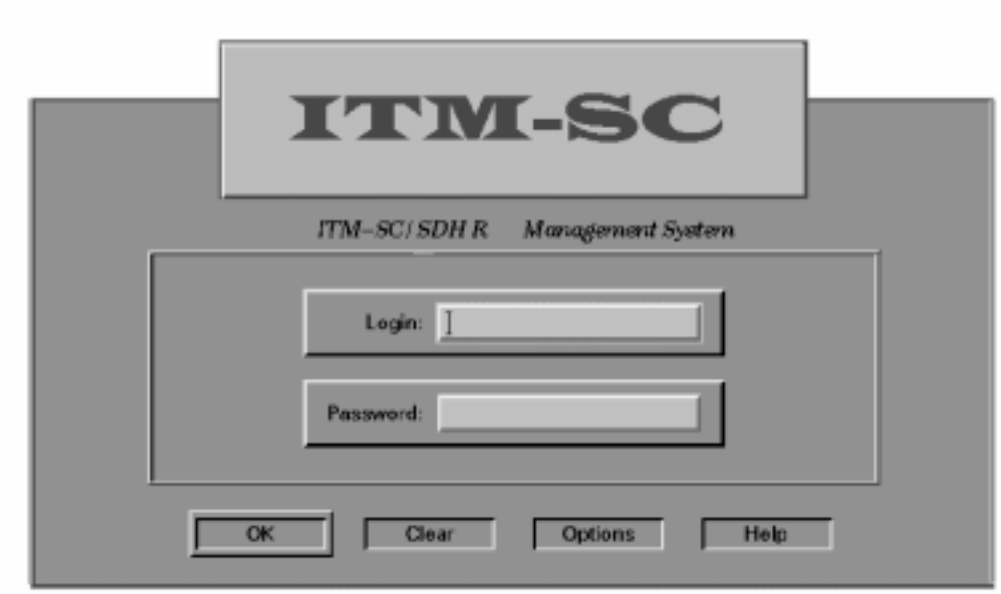
The 7-layer OSI communication stack complies with the following recommendations:

- open systems interconnection - general - model and notation X.200, X.208 and X.209
- service definitions X.214, X.215, X.216, X.217 and X.219
- connection mode protocol specifications X.224, X.225, X.226 and X.227
- OSI management X.700, X.701, X.710, X.711 and X.712
- routing ISO 9542, ISO 10172 and ISO 10589.

□

Accessing the WaveStar® ITM-SC

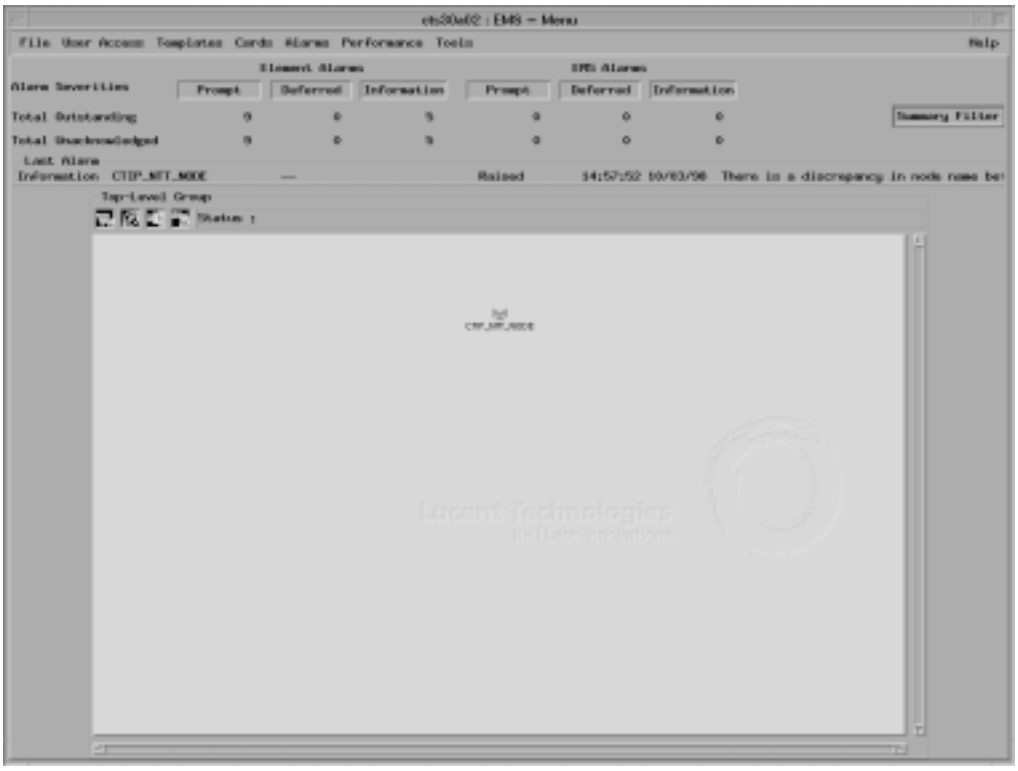
Login Before the WaveStar® ITM-SC application can be started the user needs to login.



Important! The windows presented must be regarded as examples. Windows may slightly differ per WaveStar® ITM-SC release.

EMS menu

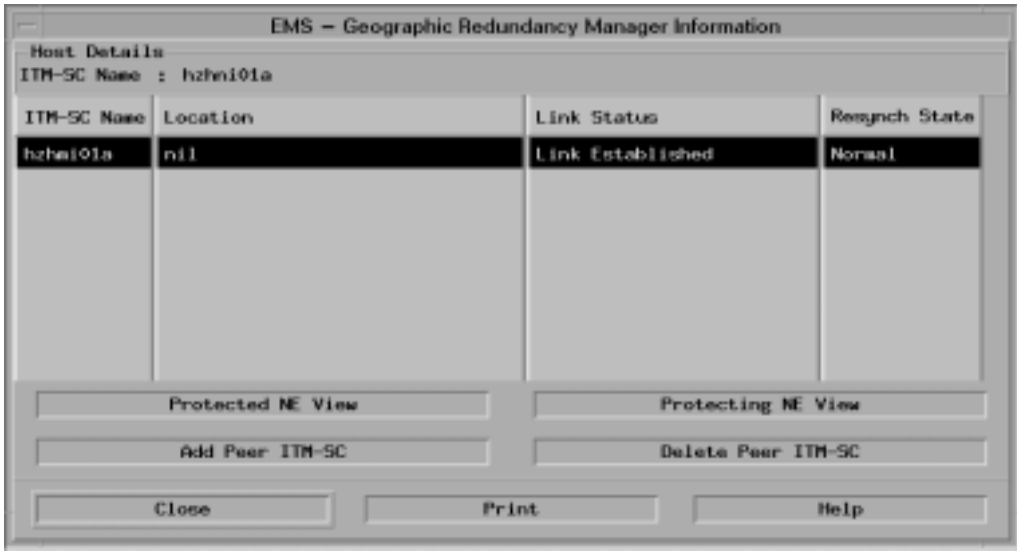
The EMS - menu is the main menu of the WaveStar® ITM-SC application. The EMS - menu contains several fields that either provide information about the current status of the network element, or that can be used to manage the network element.



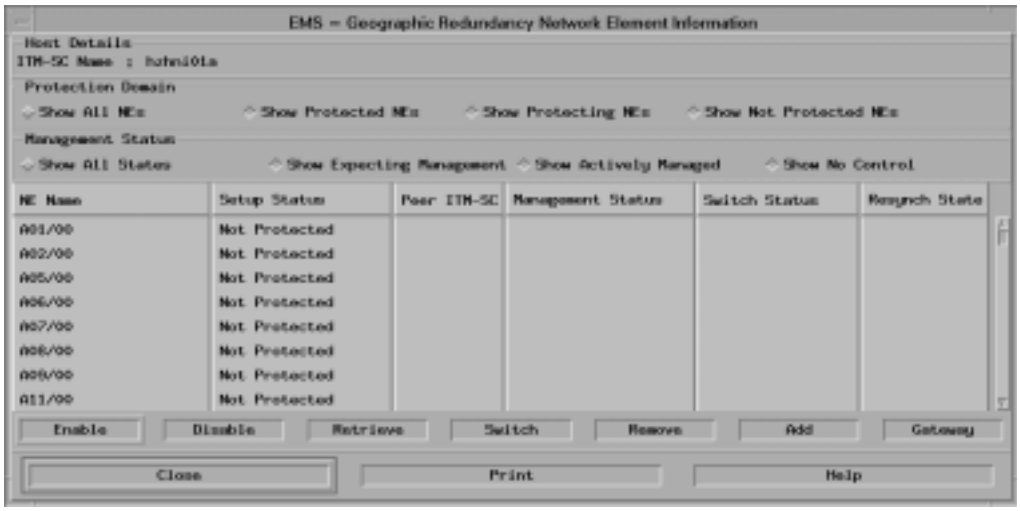
□

Geographic Redundancy (GR)

GR manager information This window is used to add or delete a peer WaveStar® ITM-SC.



GR NE information This window is used to add or delete network elements in the geographic redundancy scheme.

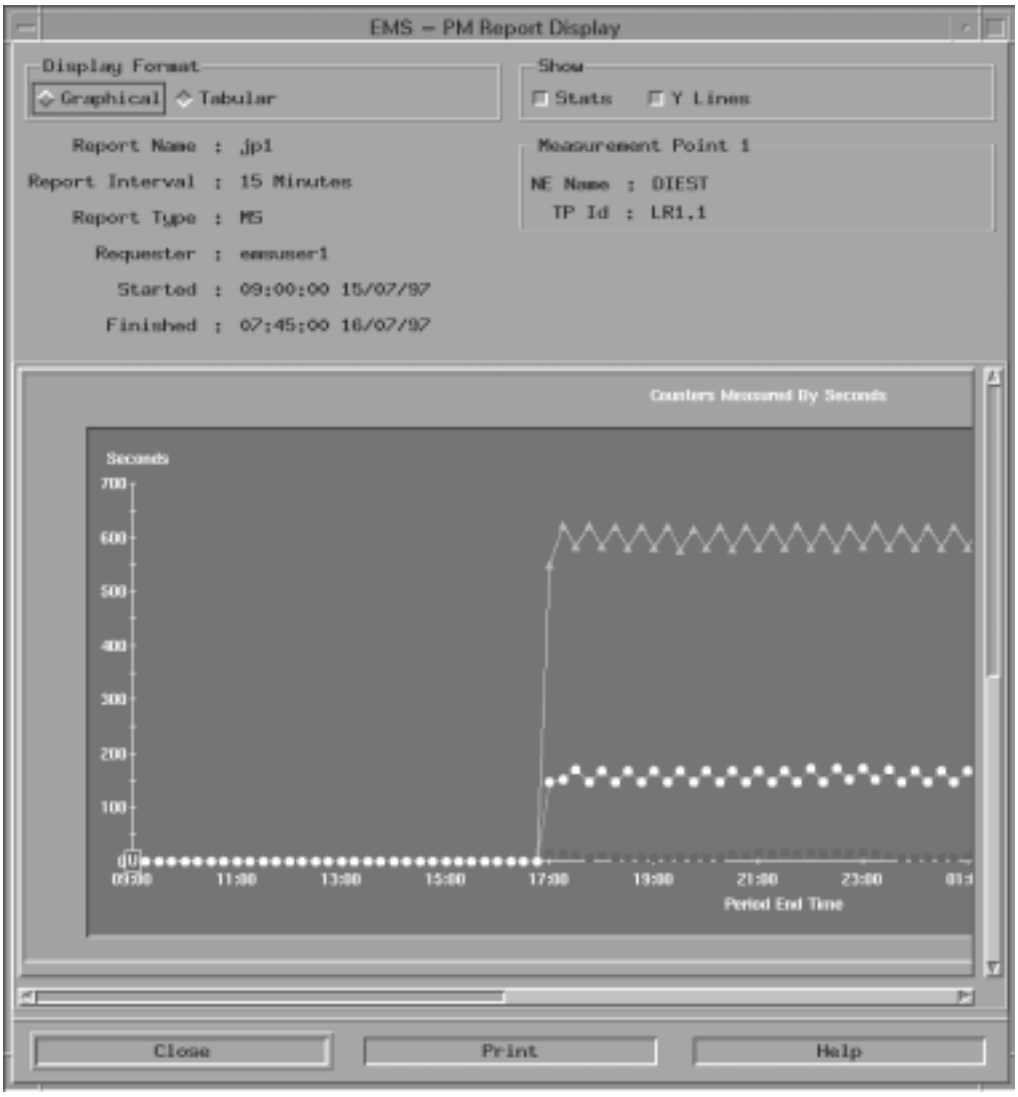


□

Performance Monitoring (PM)

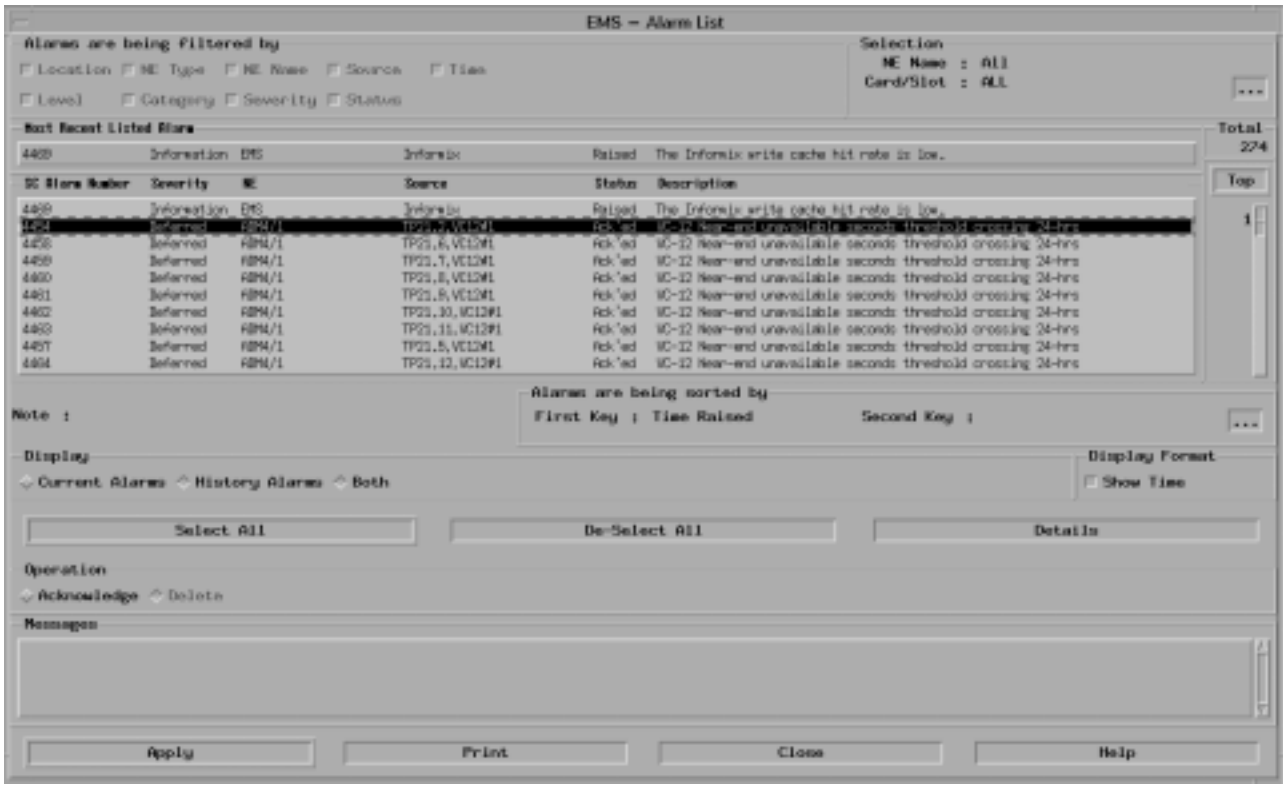
Performance Monitoring report

This window is used to display the data in a Performance Monitoring report.



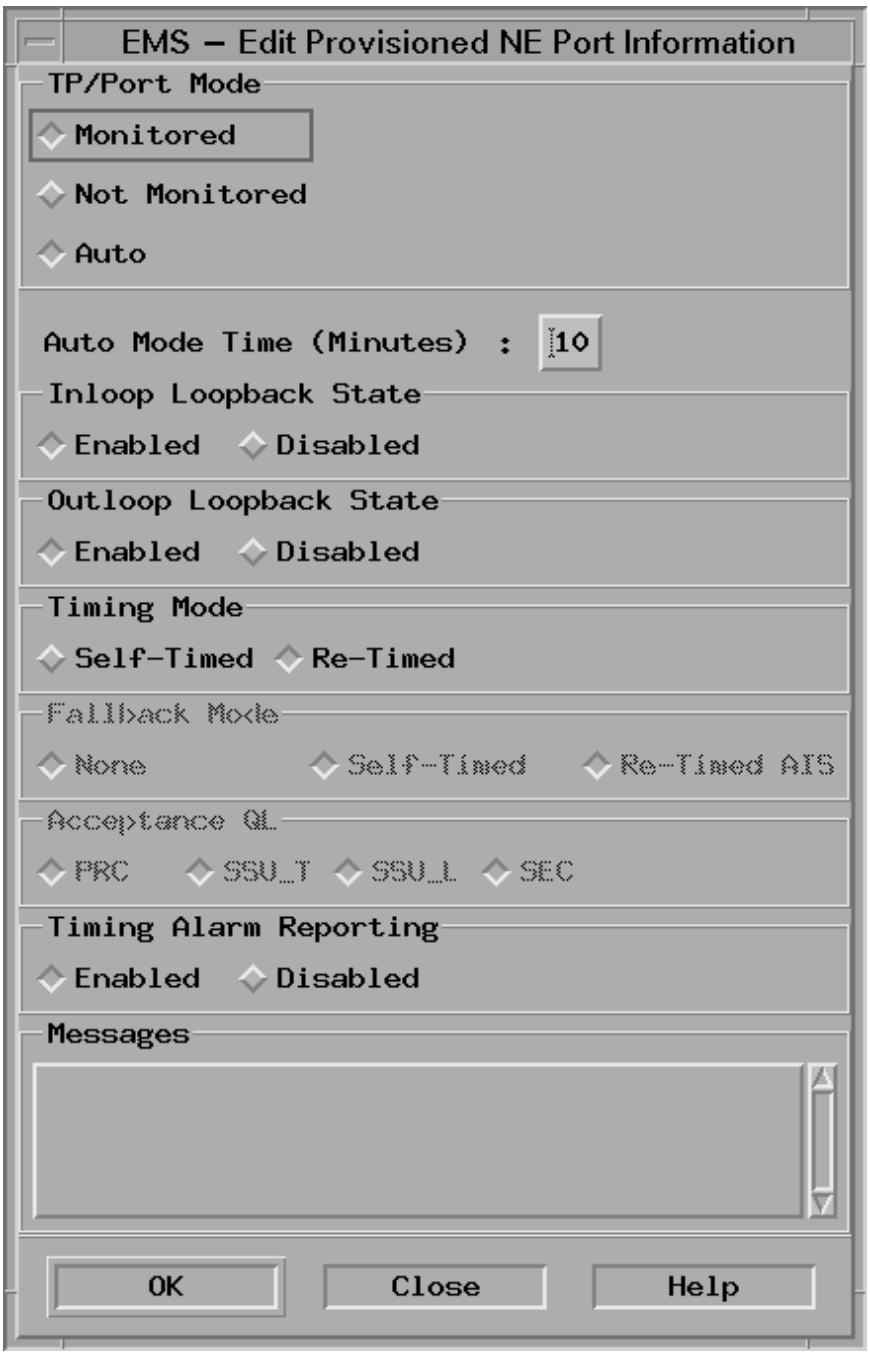
Alarm Reporting

Alarm report This window is used to display all current or history alarms.

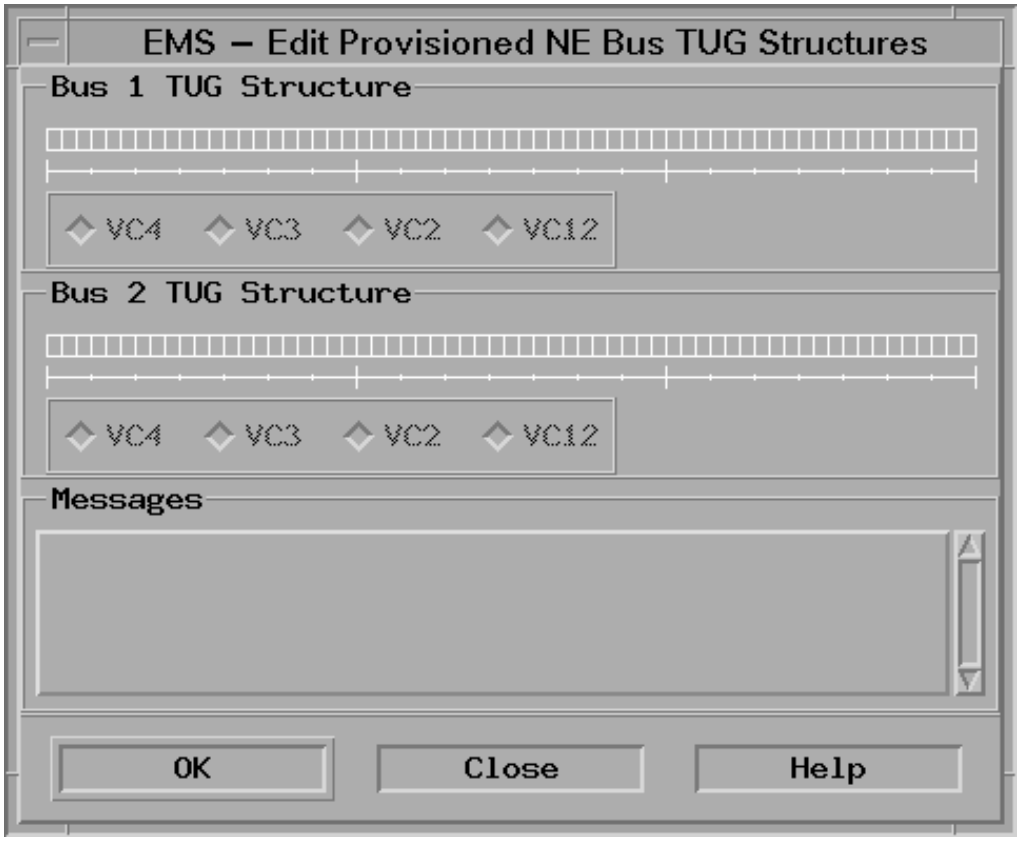


Dialog Boxes

Dialog box



Dialog box with a graphical element



□

Glossary

NUMERICS

5ESS
Number 5 Electronic Switching System

5TAD
Five Tributary Add Drop subrack (WaveStar® ADM 16/1)

9TAD
Nine Tributary Add Drop subrack (WaveStar® ADM 16/1)

12 digit numerical code (12NC)
Used to uniquely identify an item or product. The first ten digits uniquely identify an item. The eleventh digit is used to specify the particular variant of an item. The twelfth digit is used for the revision issue. Items with the first eleven digits the same, are functionally equal and may be exchanged.

A

AAU
Alarm Adapter Unit (RR)

AC
Alternating Current

ACU
Alarm Collection Unit (RR)

Add-drop multiplexer 155 Mbit/s compact subrack (ADM-155C)
A network multiplexer that is designed to flexibly multiplex plesiochronous and STM-1 tributary port signals into STM-1 line port signals.

ADM
Add-Drop Multiplexer

Administrative unit (AU)
Carrier for TUs.

Administrative unit pointer (AU PTR)
Indicates the phase alignment of the VC-n with respect to the STM-N frame. The pointer position is fixed with respect to the STM-N frame.

Administrator
See ITM-SC System Administrator.

Agent
Performs operations on managed objects and issues events on behalf of these managed objects. All SDH managed objects will support at least an agent. Control of distant agents is possible via local ″Managers″.

Alarm
The notification (audible or visual) of a significant event. See also Event.

Alarm adapter unit (AAU)
Radio Relay circuit pack that is used for collection of external alarms and remote control of external equipment.

Alarm collection unit (ACU)
Radio Relay circuit pack that performs collection of equipment alarms, analogue measurement from internal monitoring points and calculating data.

Alarm indication signal (AIS)
Code transmitted downstream in a digital Network that shows that an upstream failure has been detected and alarmed if the upstream alarm has not been suppressed. Also referred to as All OneS.

Alarm severity
An attribute defining the priority of the alarm message. The way alarms are processed depends on the severity.

Aligning
Indicating the head of a virtual container by means of a pointer, i.e. creating an Administrative Unit (AU) or a Tributary Unit (TU).

ALS
Automatic Laser Shutdown

Alternate mark inversion (AMI)
A line code that employs a ternary signal to convert binary digits, in which successive binary ones are represented by signal elements that are normally of alternative 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 8-bit code used for exchanging information among data processing systems and associated equipment.

Anomaly
A difference between the actual and desired operation of a function.

ANSI
American National Standards Institute

APS
Automatic Protection Switching

AS
Alarm Suppression assembly

Assembly
Gathering together of payload data with overhead and pointer information (an indication of the direction of the signal).

Association
A logical connection between manager and agent through which management information can be exchanged.

Asynchronous
See Non-synchronous.

ATC
Auxiliary Transmission Channel

ATM
Asynchronous Transfer Mode

ATPC
Automatic Transmit Power Control

AU
Administrative Unit

AU4AD
Administrative Unit 4 Assembler/Disassembler

AUG
Administrative Unit Group

AUTO
Automatic

Automatic transmit power control (ATPC)
Reduces the transmitter power output level during normal propagation conditions, and increase the power output to maximum level during fading periods trying to maintain nominal receiver input level.

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

BBTR
Backplane Bus TRansceiver

BC
Board Controller

BCC
Board Controller Complex

BIN
BINary

BIP
Bit Interleaved Parity

BISDN
Broadband Integrated Services Digital Network

Bit error ratio (BER)
The ratio of bits received in error to bits sent.

Bit interleaved parity (BIP)
A method of error monitoring using a specified number of bits (BIP-8)

BLD OUT LG
Build-Out Lightguide

Board controller local area network (BC-LAN)
The internal local area network that provides communications between the Line Controller circuit pack and board controllers on the circuit packs associated with a high speed line.

Branching
Interconnection of independent line systems.

Broadband communication
Voice, data, and/or video communication at greater than 2 Mbit/s rates.

Broadband service transport
STM-1 concatenation transport over the SLM for ATM applications.

BUSTR
BUS Transmitter and Receiver

C

CAS
Channel Associated Signalling

CAT
CATastrophic

CC
Cross-Connection Cross-Connect (WaveStar® ADM 16/1)

CCIR
See ITU-R.

CCITT
See ITU-T.

CCS
Common Channel Signaling

CEPT
Conférence Européenne des Administrations des Postes et des Télécommunications

Channel
A sub-unit of transmission capacity within a defined higher level of transmission capacity, e.g. a CEPT-4 (140 Mbit/s) within a 565 Mbit fiber system.

Circuit
A combination of two transmission channels permitting bi-directional transmission of signals between two points, to support a single communication.

CIT
Craft Interface Terminal

Clear channel (Cl. Ch.)
A provisionable mode for the 34 and 140 Mbit/s tributary outputs that causes parity violations to not be monitored or corrected before the 34 and 140 Mbit/s are encoded.

Client
Computer in a computer network that generally offers a user interface to a server. See also Server.

CMI
Coded Mark Inversion

CMISE
Common Management Information Service Element (all network elements are CMISE manged exept the WaveStar® DACS)

CO
Central Office

Co-resident
A hardware configuration where the ITM-SC and ITM-NM applications can be active at the same time independently on the same hardware and software platform without interfering each others functioning.

Common object request broker architecture (CORBA)
CORBA allows applications to communicate with one another no matter where they are located or who has designed them.

Concatenation
A procedure whereby a multiplicity of Virtual Containers is associated one with another with the result that their combined capacity can be used as a single container across which bit sequence integrity is maintained.

Configuration management (CM)
Subsystem of the ITM-SC that, among other things, configures the network and processes messages from the network.

CONN PCB
Connector Printed Circuit Board

Container (C)
Carries plesiochronous signal, the ″payload″.

CP
Circuit Pack

Craft interface terminal (CIT)
Local manager for SDH Network Elements.

CRC
Cyclic Redundancy Check

Cross polarization interference cancellation
This feature permits both orthogonal polarizations of one Radio Frequency carrier to be used simultaneously, thus achieving greater spectral efficiency.

Cross-connect map
Connection map for an SDH Network Element; contains information about how signals are connected between high speed timeslots and low speed tributaries. See also Squelch Map.

CV
Code Violation

D

DACS
Digital Access & Cross-connect System

DACScan-T
See Integrated Transport Management Network Manager.

Data communication channel (DCC)
The embedded overhead communication channel in the SDH line. This is used for end-to-end communication and maintenance. It carries alarm, control, and status information between Network Elements in an SDH network.

Data communication equipment (DCE)
Provides the signal conversion and coding between the data terminating equipment and the line. The DCE may be separate equipment or a part of the data terminating equipment.

Data terminating equipment (DTE)
Originates data for transmission and accepts transmitted data.

Database administrator
A user who administers the database of the ITM-SC application. See also User Privilege.

DC
Direct Current

DCF
Data Communications Function

DCN
Data Communications Network

DCS
Digital Cross-connect System

DDF
Digital Distribution Frame

Dedicated protection ring (DP-Ring)
A protection method used in ISM Network Elements.

Defect
A limited interruption of the ability of an item to perform a required function. It may or may not lead to maintenance action depending on the results of additional analysis.

Demultiplexing
A process applied to a multiplexed signal for recovering signals combined within it and for restoring the distinct individual channels of these signals.

Digital link
A transmission span such as a point-to-point 2 Mbit/s, 34 Mbit/s, 140 Mbit/s, VC12, VC3 or VC4 link between controlled Network Elements. The channels within a digital link are insignificant.

Digital section
A transmission span such as an STM-N or 565 Mbit/s signal. A digital section may contain multiple digital channels.

DIL
Dual In Line

Directory service network element (DSNE)
A designated Network Element that is responsible for administering a database that maps Network Elements names (node names) to addresses (node Id). There can be one DSNE per (sub)network.

Disassembly
Splitting up a signal into its constituents as payload data and overhead (an indication of the direction of a signal).

Domain
The domain of an ITM-SC is the set of all SDH Network Elements that are controlled by that particular ITM-SC.

Downstream
At or towards the destination of the considered transmission stream, i.e. looking in the same direction of transmission.

DPLL
Digital Phase Locked Loop

DPS
Data communication Packet Switch (ISM)

DR
Digital Radio

DRI
Dual Ring Interworking

DS-n
Digital Signal, Level n

DTMF
Dual Tone Multi-Frequency

DUS
Do not Use for Synchronization

DWDM
Dense Wavelength Division Multiplexing

E

E1 Remote Port
An E1 electrical physical port on an NTU Device.

EC-n
Electrical Carrier, Level n

ECC
Embedded Control Channel

Electronic industries association (EIA)
A trade association of the electronic industry that establishes electrical and functional standards.

Element management system (EMS)
See Integrated Transport Management Subnetwork Controller.

EMC
ElectroMagnetic Compatibility

EMI
ElectroMagnetic Interference

EOW
See Orderwire.

Equivalent bit error ratio (EBER)
The calculated average bit error rate over a data stream.

Errored second (ES)
A performance monitoring parameter.

ES
End System

ESD
ElectroStatic Discharge

ESPG
Elastic Store & Pointer Generator

ETSI
European Telecommunication Standardisation Institute

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 ITM-SC.

Event management (EM)
Subsystem of ITM-SC that processes and logs event reports of the network.

Externally timed
An operating condition of a clock in which it is locked to an external reference and is using time constants that are altered to quickly bring the local oscillator's frequency into the approximate agreement with the synchronization reference frequency.

Extra traffic
Unprotected traffic that is carried over the protection channels when that capacity is not used for the protection of service traffic.

F

Far end block error (FEBE)
An indication returned to the transmitting node that an errored block has been detected at the receiving node. A block is a specified grouping of bits.

Far end receive failure (FERF)
An indication returned to a transmitting Network Element that the receiving Network Element has detected an incoming section failure.

FAS
Frame Alignment Signal

FAW
Frame Alignment Word

FC
Full contact Connector

FCC
Federal Communications Commission

FDDI
Fiber Distributed Data Interface

FEP
Front End Processor

Free running
An operating condition of a Network Element in which its local oscillator is not locked to any synchronization reference and is using no storage techniques to sustain its accuracy.

G

Gateway network element (GNE)
Passes information between other Network Elements and management systems via a Data Communications Network.

Geographic location
Location of the ITM-SC server. This is entered as part of the installation procedure of an ITM-SC.

Geographic redundancy (GR)
Allows protection of management for a Network Element by assigning it to two ITM-SCs. The first primary ITM-SC, usually manages the Network Element and is now in the protected domain. If the primary ITM-SC or the link between the Network Element and the primary fails, the secondary ITM-SC will automatically take over management of the Network Element and is now in the protecting domain. The two ITM-SCs are connected by a peer to peer link, which they use to pass Geographic Redundancy management information over. This link must be established before any Network Element can be protected by Geographic Redundancy.

Global wait to restore time
Corresponds to the time to wait before switching back to the timing reference occurs after a timing link failure has cleared. This time applies for all timing sources in a system hence the name global. This can be between 0 and 60 minutes, in increments of one minute.

GUI
Graphical User Interface

H

HE
Host Exchange

High density bipolar 3 code (HDB3)
Line code for e.g. 2 Mbit/s transmission systems.

High level data link control (HDLC)
OSI reference model datalink layer protocol.

Higher order path adaptation (HPA)
Function that adapts a lower order Virtual Container to a higher order Virtual Container by processing the Tributary Unit pointer which indicates the phase of the lower order Virtual Container Path Overhead relative to the higher order Virtual Container Path Overhead and assembling/disassembling the complete higher order Virtual Container.

Higher order path connection (HPC)
Function that provides for flexible assignment of higher order Virtual Containers within an STM-N signal.

Higher order path termination (HPT)
Function that terminates a higher order path by generating and adding the appropriate Virtual Container Path Overhead to the relevant container at the path source and removing the Virtual Container Path Overhead and reading it at the path sink.

HMI
Human Machine Interface

HO
High Order

Holdover
An operating condition of a clock in which its local oscillator is not locked to an external reference but is using storage techniques to maintain its accuracy with respect to the last known frequency comparison with a synchronized reference.

Host name
Name of the server on which the ITM-SC is running.

HP-UX
Unix Operating System for Hewlett Packard platform.

HS
High Speed

I

ICB
Interconnection Box

ICP
InterConnection Panel

IEC
International Electrotechnical Committee

IEEE
Institute of Electrical and Electronic Engineers

IF
Intermediate Frequency

IFT
InterFace Terminal

Intelligent synchronous multiplexer (ISM)
A network multiplexer that is designed to flexibly multiplex plesiochronous and STM-1 tributary port signals into STM-1 or STM-4 line port signals.

Intergrated transport management craft interface terminal (ITM-CIT)
Local manager for SDH Network Elements in a subnetwork. Also referred to as Craft Interface Terminal.

Intermediate system (IS)
A system which routes/relays management information. An SDH Network Element may be a combined Intermediate and end system.

IPS
Inter Processor Status

IS
In-Service

IS-IS routing
The Network Elements in a management network, route packets (data) between each other using a IS-IS level protocol. The size of a network running IS-IS Level 1 is limited, and therefore certain mechanisms are employed to facilitate the management of larger networks. For STATIC ROUTING, the capability exists for disabling the protocol over the LAN connections, effectively causing the management network to be partitioned into separate IS-IS Level 1 areas. In order for the ITM-SC to communicate with a specific Network Element in one of these areas, the ITM-SC must identify through which socalled Gateway Network Element this specific Network Element is connected to the LAN. All packets to this specific Network Element are routed directly to the Gateway Network Element by ITM-SC, before being re-routed (if necessary) within the Level 1 area. For DYNAMIC ROUTING an IS-IS Level 2 routing protocol is used allowing a number of Level 1 areas to interwork. The Network Elements which connect an IS-IS area to another area are set to run the IS-IS Level 2 protocol within the Network Element and on the connection between other Network Elements. Packets can now be routed between IS-IS areas and the ITM-SC does not have to identify the Gateway Network Elements.

ISDN
Integrated Services Digital Network

ISO
International Standards Organisation

ITM-SC administrator
See ITM-SC System Administrator.

ITM-SC system administrator
A user of the ITM-SC application with System Administrator privileges. See also User Privilege.

ITU
International Telecommunications Union

ITU-R
International Telecommunications Union - Radio standardization sector. Formerly known as CCIR: Comité Consultatif International Radio; International Radio Consultative Committee.

ITU-T
International Telecommunications Union - Telecommunication standardization sector. Formerly known as CCITT: Comité Consultatif International Télégrafique & Téléphonique; International Telegraph and Telephone Consultative Committee.

J

Jitter
Short term variations of amplitude and frequency components of a digital signal from their ideal position in time.

L

LAN
Local Area Network

LBA
Lightwave Booster Amplifier.

LCAS
Link Capacity Adjustment Scheme

LCN
Local Communications Network

LDI
Linear Drop/Insert (Add-Drop)

LED
Light Emitting Diode

LEN
Local Exchange Node

LF
Low Frequency

LH
Long Haul

License key
An encrypted code that is required to enable the use of specific modules in the ITM-SC. Valid license keys can be obtained from your provider.

Line
Transmission line; refers to a transmission medium, together with the associated high speed equipment, required to provide the means of transporting information between two consecutive

Network Elements, one of which originates the line signal and the other terminates the line signal.

Line build out (LBO)
An optical attenuator that guarantees the proper signal level and shape at the receiver input.

Line overhead controller (LOC)
SLM circuit pack that accesses the overhead bytes from the high speed line.

LNC
LiNe Controller (SLM)

LO
Low Order

LOF
Loss Of Frame

LOM
Loss Of Multiframe

LOP
Loss Of Pointer

LOS
Loss Of Signal

Lower order path adaptation (LPA)
Function that adapts a PDH signal to a synchronous network by mapping the signal into or de-mapping the signal out of a synchronous container.

Lower order path connection (LPC)
Function that provides for flexible assignment of lower order VCs in a higher order VC.

Lower order path termination (LPT)
Function that terminates a lower order path by generating and adding the appropriate VC POH to the relevant container at the path source and removing the VC POH and reading it at the path sink.

LPU
Line Port Unit (ISM)

LPU155
Line Port Unit 155 Mbit/s (WaveStar® ADM 4/1)

LRX
Line Receiver (SLM)

LS
Low Speed

LTA
Line Terminal Application (SLM)

LTU
A network element which is part of an SDH Transport system, is managed directly and contains an SDSL Option card

LTX
Line Transmitter (SLM)

LTX/EML
Line Transmitter with Electro-absorption Modulated Laser (SLM)

M

MAF
Management Application Function

Management connection
Identifies the type of routing used (STATIC or DYNAMIC), and if STATIC is selected allows the Gateway Network Element to be identified. See also IS-IS Routing.

Management information base (MIB)
The database in the Network Element and contains the configuration data of the Network Element. A copy of each MIB is available in the ITM-SC and is called the MIB image. Under normal circumstances the MIB and MIB image of one Network Eelement are synchronized.

Manager
Capable of issuing network management operations and receiving events. The manager communicates with the Agent in the controlled Network Element.

Manufacturer executable code (MEC)
Network Element system software in binary format that after being downloaded to one of the stores can be executed by the system controller of the Network Element.

Mapping
Gathering together of payload data with overhead, i.e. packing the PDH signal into a Virtual Container.

MDI
Miscellaneous Discrete Input

MDO
Miscellaneous Discrete Output

Mediation device (MD)
Allows for exchange of management information between Operations System and Network Elements.

MEF
Maintenance Entity Function (in NE)

MEM
System MEMory unit (for SLM ADM NEs)

Message communications function (MCF)
Function that provides facilities for the transport and routing of Telecommunications Management Network messages to and from the Network Manager.

MF
Mediation Function

MFS
Multi Frame Synchronization signal

MIB image
See Management Information Base.

Midspan meet
The capability to interface between two lightwave Network Elements of different vendors. This applies to high speed optical interfaces.

MMI
Man-Machine Interface Also referred to as Human Machine Interface (HMI)

MO
Managed Object

Modem
A modem connected to an LTU via an SDSL line

Motif
X-Windows System supplied by Open Software Foundation.

MS
Multiplexer Section

MTBF
Mean Time Between Failures

MTBMA
Mean Time Between Maintenance Activities

MTIE
Maximum Time Interval Error

MTPI
Multiplexer Timing Physical Interface

MTTR
Mean Time To Repair

Multiplexer section overHead (MSOH)
Part of the Section Overhead. Is accessible only at line terminals and multiplexers.

Multiplexer section protection (MSP)
Provides capability for switching a signal from a working to a protection section.

Multiplexer section shared protection ring (MS-SPRING)
A protection method used in SLM Add-Drop Multiplexer Network Elements.

Multiplexer section termination (MST)
Function that generates the Multiplexer Section OverHead in the transmit direction and terminates the Multiplexer Section OverHead in the receive direction.

Multiplexer timing source (MTS)
Function that provides timing reference to the relevant component parts of the multiplex equipment and represents the SDH Network Element clock.

Multiplexing
A procedure by which multiple lower order path layer signals are adapted into a higher order path, or the multiple higher order path layer signals are adapted into a multiplex section.

N

Navis™ OCA
Navis™ Optical Capacity Analyzer (formerly named the OneVision® DNA CA)

Navis™ ONMS
Navis™ Optical Network Management System (formerly named the WaveStar® NMS)

NEF
Network Element Function

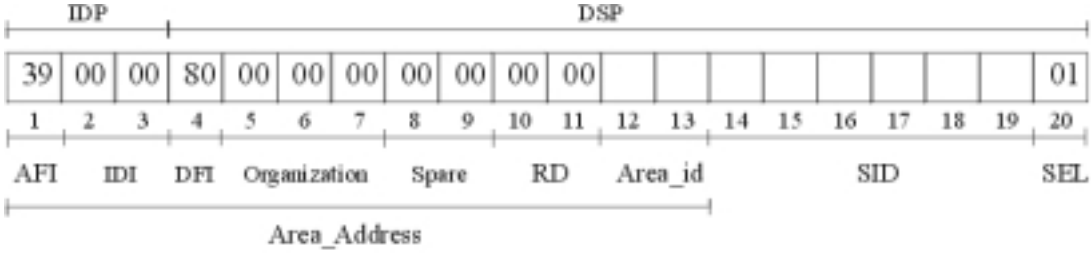
NEM
Network Element Manager

Network element (NE)
A Network Element is comprised of telecommunication equipment (or groups/parts of telecommunication equipment) and support equipment that performs network element functions and has one or more standard Q-type interfaces. A Network Element is direct manageable by a management system. See also Node.

Network element equivalent (NEE)
The functionality, database size and processing power required from the ITM-SC is different for each Network Element type supported. Therefore each type represents an amount of Network Element Equivalent.

Network mediation unit (NMU)
Used to collect fault and alarm events from transmission equipment. The ITM-SC can forward alarms to the NMU. The NMU can forward alarms to an Operations System.

Network service access point (NSAP)
An end system address of the System Controller according to ISO 8348 AD2. The format used is ISO_DCC_LUCENT, which has the following structure:



Where

Field	Description	Length	Fixed Values
IDP	Initial Domain Part	3 octets	-
DSP	Domain Specific Part	17 octets	-
AFI	Authority and Format Identifier	1 octet	39
IDI	Initial Domain Identifier	2 octets	00 00
DFI	DSP Format Identifier	1 octet	80
Organization		3 octets	00 00 00
Spare		2 octets	00 00
RD	Routing Domain	2 octets	00 00
Area_id		2 octets	Provisionable
SID	System Identification	6 octets	-
SEL	NSAP Selector	1 octet	01
Area_Address	All Octects from AFI to Area_id	13 or 3 octets	-

NMC
Network Maintenance Center

NMS
Network Management System

NNE
Non-SDH Network Element

NNI
Network Node Interface

Node
Defined as all equipment that is controlled by one system controller. A node is not always direct manageable by a management system. See also Network Element.

NOMC
Network Operation Maintenance Channel

Non-revertive switching
In non-revertive switching there is an active and standby high speed line, circuit pack, etc. When a protection switch occurs, the standby line, circuit pack, etc., is selected causing the old standby line, circuit pack, etc., to be used for the new active line, circuit pack, etc. The original active line, circuit pack, etc., becomes the standby line, circuit pack, etc. This status remains in effect when the faults clears. Therefore, this protection scheme is non-revertive in that there is no switch back to the original status in effect before the fault occurred.

Non-synchronous
The essential characteristic of time-scales or signals such that their corresponding significant instants do not necessarily occur at the same average rate.

Not protected domain
The not protected domain for the ITM-SC contains all the Network Elements which are managed by one ITM-SC and are not currently protected by another ITM-SC. If the ITM-SC fails, the Network Elements in this domain are not managed by any ITM-SC. See also Geographic Redundancy.

NPI
Null Pointer Indication

NRZ
Non-Return to Zero

NSA
Non-Service Affecting

NTU Device
A device which is managed indirectly via a dedicated LTU using SDSL lines. The MIB Image of these appears as an extension of the MIB image of the parent LTU.

NUT
Non pre-emptible Unprotected Traffic

NVM
Non-Volatile Memory

O

OA
Optical Amplifier (OLS)

OAA case tools
A software package/tool to aid the process of requirements, analysis, design and implementation of object orientated systems.

OAM&P
Operations, Administration, Maintenance and Provisioning

OC-n
Optical Carrier, Level n

ODF
Optical Distribution Frame

ODU
Optical Demultiplexer Unit (OLS)

OFS
Out of Frame Second

OI
Optical Interface (WaveStar® ADM 16/1)

OMU
Optical Multiplexer Unit (OLS)

OOF
Out Of Frame

OOS
Out Of Service

Operations system (OS)
Operations System is the system which provides operations, administration and maintenance functions.

Operator
A user of the ITM-SC application with Operator privileges. See also User Privilege.

Optical line system (OLS)
A high-capacity lightwave system that is designed to multiplex eight optical signals with different wavelengths into one combined signal through an optical fiber. There is a difference of 1.5 micrometer in wavelength between two multiplexed signals.

OSB
Optical Splice Box

OSF
Open Software Foundation Operations System Function

OSF/Motif
The WaveStar® ITM-SC application has an X-windows graphical representation and the components used in the “Graphical User Interface” are OSF/Motif compliant, these components comprise of items such as: scrollbars, menus, radio buttons, etc.

OSI
Open Systems Interconnection

OW
(Engineering) Order Wire

P

PABX
Private Automatic Branch eXchange

Paddle board - peripheral control and timing link (PB-PCT)
Is a small circuit board used in a 5ESS exchange for protection switching and optical to electrical conversion of the PCT-link.

Path
A logical connection between a termination point at which a standard format for a signal at the given rate is assembled, and transmitted and another termination point at which the received standard frame format for the signal is disassembled.

Path overhead (POH)
Virtual Container Path Overhead provides for integrity of communication between the point of assembly of a Virtual Container and its point of disassembly.

PC
Personal Computer

PCB
Printed Circuit Board

PCM
Pulse Code Modulation

PCT-link
Peripheral Control and Timing-link

PDH
Plesiochronous Digital Hierarchy

Peer ITM-SC
ITM-SC at the other end of the Peer to Peer link.

Peer to peer link
Connection between two ITM-SCs with Geographic Redundancy. The link is used to co-ordinate the management of a Network Element. See also Geographic Redundancy.

Performance monitoring (PM)
Measures the quality of service and identifies degrading or marginally operating systems (before an alarm is generated).

Peripheral control and timing facility interface (PCTFI)
A proprietary physical link interface supporting the transport of 21 * 2 Mbit/s signals.

PI
Physical Interface Plesiochronous Interface (WaveStar® ADM 16/1)

PJE
Pointer Justification Event

Platform
Family of equipment and software configurations designed to support a particular Application.

Plesiochronous network
A network that contains multiple subnetworks, each internally synchronous and all operating at the same nominal frequency, but whose timing may be slightly different at any particular instant.

PMA
Performance Monitoring Application

Pointer
An indicator whose value defines the frame offset of a virtual container with respect to the frame reference of the transport entity on which it is supported.

POTS
Plain Old Telephone Service

PP
Pointer Processing

PPC
Pointer Processor and Cross-connect (ISM)

Primary ITM-SC
ITM-SC that is usually managing a Network Element. If the primary ITM-SC fails, management of the Network Element is passed over to the secondary ITM-SC. A Network Element should be provisioned normally on the primary ITM-SC and then be configured for use on the secondary. See also Geographic Redundancy.

Primary reference clock (PRC)
The main timing clock reference in SDH equipment.

Protected domain
The protected domain for an ITM-SC contains all the Network Elements this manager is the primary ITM-SC for and are protected by another secondary ITM-SC. See also Geographic Redundancy.

Protecting domain
The protecting domain for an ITM-SC contains all the Network Elements this manager is the secondary ITM-SC for. See also Geographic Redundancy.

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 equipment failures.

PSA
Partially Service Affecting

PSDN
Public Switched Data Network

PSF
Power Supply Filter

PSF-SIP
Power Supply Filter; originally designed for Italian customer.

PSN
Packet-Switched Network

PSTN
Public Switched Telephone Network

PT
Protected Terminal Power supply filter and Timing circuit pack (WaveStar® ADM 16/1)

Q

Q-LAN
Thin Ethernet LAN which connects the manager to Gateway Network Elements so that management information between Network Elements and management systems can be exchanged.

QAF
Q Adapter Function (in NE)

QOS
Quality Of Service

Quality level (QL)
The quality of the timing signal(s) provided to clock a Network Element. The level is provided by the Synchronization Status Marker which can accompany the timing signal. If the System and Output Timing Quality Level mode is “Enabled”, and if the signal selected for the Station Clock Output has a quality level below the Acceptance Quality Level, the Network Element “squelches” the Station Clock Output Signal, which means that no signal is forwarded at all. Possible levels are: - PRC (Primary Reference Clock) - SSU_T (Synchronization Supply Unit - Transit) - SSU_L (Synchronization Supply Unit - Local) - SEC (SDH Equipment Clock) - DUS

(Do not Use for Synchronization)

R

RA
Regenerator Application (SLM)

Radio protection switching system (RPS)
Its main function is to handle the automatic and manual switching from a main channel to a common protection channel in an N+1 system.

Radio relay (RR)
A point-to-point Digital Radio system to transport STM-1 signals via microwaves.

RCU
Rigid Connect Unit (SLM)

RCVR data distribution unit (RCVR)
Radio Relay circuit pack that performs distribution of the protection channel and the low priority traffic in the receiver side.

RDDU
RCVR Data Distribution Unit (RR)

RDI
Remote Defect Indicator. Previously known as Far End Receive Failure (FERF).

RDI
Ring Drop/Insert (Add-Drop)

RDSV
Running Digital Sum Violations

Receive-direction
The direction towards the cross-connect.

REGEN
Regenerator (SLM)

Regenerator loop
Loop in a Network Element between the Station Clock Output(s) and one or both Station Clock Inputs, which can be used to dejitterize the selected timing reference in network applications.

Regenerator overhead controller (ROC)
SLM circuit pack that provides user access to the SDH overhead channels at repeater sites.

Regenerator section termination (RST)
Function that generates the Regenerator Section Overhead (RSOH) in the transmit direction and terminates the RSOH in the receive direction.

REI
Remote Error Indication. Previously known as Far End Block Error (FEBE).

Relay unit (RU)
Radio Relay circuit pack whose main function is to perform protection switching when the Alignment Switch in the demodulator unit is unable to perform protection switching.

Remote Port
Any port not on an LTU.

Restore timer
Counts down the time (in minutes) during which the switch waits to let the worker line recover before switching back to it. This option can be set to prevent the protection switch continually switching if a line has a continual transient fault. This field is greyed out if the mode is non-revertive.

Revertive switching
In revertive switching, there is a working and protection high speed line, circuit pack, etc. When a protection switch occurs, the protection line, circuit pack, etc., is selected. When the fault clears, service reverts back to the original working line.

RF
Radio Frequency

RFI
Remote Failure Indicator

RGU
ReGenerator Unit (SLM)

Route
A series of contiguous digital sections.

RPS
Ring Protection Switching

RSM
Remote Switching Module

RSOH
Regenerator Section OverHead; part of SOH.

RZ
Return to Zero

S

SA
Service Affecting Synchronous Adapter (WaveStar® ADM 16/1)

SAI
Station Alarm Interface

SC
Square coupled Connector

SD
Signal Degrade

SDH-TE
SDH - Terminal Equipment

SDSL
Symmetrical single pair high bitrate Digital Subscriber Line

SDSL Local Port
A physical port on an SDSL Option Card assigned to an LTU

SDSL Remote Port
A physical SDSL port on an NTU Device.

SDSL Transport Mode
The type of PDH or SDH signal carried inside the SDSL protocol. The supported modes are E1 Mode and TU12 Mode.

SEC
SDH Equipment Clock

Secondary ITM-SC
Backup ITM-SC for a Network Element should the primary ITM-SC fail. A Network Element should be provisioned normally on the primary ITM-SC and then be configured for use on the secondary. See also Geographic Redundancy.

Section
A transport entity in the transmission media layer network which provides integrity of information transfer across a section layer network connection by means of a termination function at the section layer.

Section adaptation (SA)
Function that processes the AU-pointer to indicate the phase of the VC-3/4 POH relative to the STM-N SOH and assembles/disassembles the complete STM-N frame.

Section overhead (SOH)
Capacity added to either an AU-4 or assembly of AU-3s to create an STM-1. Contains always STM-1 framing and optionally maintenance and operational functions. SOH can be subdivided in MSOH (multiplex section overhead) and RSOH (regenerator section overhead).

SEF
Support Entity Function (in NE)

Self-healing
A network's ability to automatically recover from the failure of one or more of its components.

Server
Computer in a computer network that performs dedicated main tasks which require generally sufficient performance. See also Client.

Service
The operational mode of a physical entity that indicates that the entity is providing service. This designation will change with each switch action.

Severely errored frame seconds (SEFS)
A performance monitoring parameter.

Severely errored second (SES)
A second with a binary error ratio and used as a performance monitoring parameter.

Severity
See Alarm Severity

SH
Short Haul

SI
Synchronous Interface (WaveStar® ADM 16/1)

SIB
Subrack Interface Box

SLC
Subscriber Loop Carrier

SLM
Signal Label Mismatch

Smart communication channel (SCC)
A HDLC messaging channel between the SDH-TE and the 5ESS host node. Similar to the DCC messaging channels located in the STM-N section overhead.

SML
Service Management Level

SMN
SDH Management Network

SMS
SDH Management Subnetwork

SNC/I
SubNetwork Connection (protection) / Inherent monitoring

SNC/NI
SubNetwork Connection / Non Intrusive monitoring

SNR
Signal to Noise Ratio

Soft windows
PC emulator package for HP platforms.

SONET
Synchronous Optical Network

Space diversity (SD)
Reception of the Radio signal via mirror effects on earth.

SPB2M
Subrack Protection for 2 Mbit/s Board (WaveStar® ADM 4/1)

Specification and design language (SDL)
This is a standard formal language for specifying (essentially) finite state machines.

SPI
SDH Physical Interface Synchronous-Plesiochronous Interface (WaveStar® ADM 16/1)

Squelch map
Traffic map for SLM Add-Drop Multiplexer Network Elements that contains information for each cross-connection in the ring and indicates the source and destination Network Elements for the low speed circuit that the cross-connection is part of. This information is used to prevent traffic misconnection in rings with isolated Network Elements or segments. See also Cross Connection Map.

SSM
Synchronization Status Marker

Standby
The operational mode of a physical entity that indicates that the entity is not providing service, but standby. This designation will change with each switch action.

Station clock input (SCI)
An external clock may be connected to a Station Clock Input.

Station clock output (SCO)
A clock signal that can be used for other systems.

Streched ring (STRING)
An open ring in which each node is an Add-Drop Multiplexer. The end nodes operate with one high speed line equipped.

STS
Synchronous Transport Signal; used in SONET.

Subnetwork
A group of interconnected/interrelated Network Elements. The most common connotation is an SDH network in which the Network Elements have data communications channels (DCC) connectivity.

Supervisor
A user of the ITM-SC application with Supervisor privileges. See also User Privilege.

Supervisory unit (SU)
Radio Relay circuit pack that gives comprehensive supervision and control facilities to the user by collecting information from the Alarm Collection Units and Alarm Adapter Units.

SUPV
Supervision unit (WaveStar® ADM 4/1)

SUPV_SVC
Supervision with Service Channel unit (WaveStar® ADM 4/1)

SVCE
Service

Switch receive unit (SWR)
SLM circuit pack that provides the cross-connect in the receive direction between high speed line timeslots and low speed tributaries.

Switch transmit unit (SWT)
SLM circuit pack that provides the cross-connect in the transmit direction between high speed line timeslots and low speed tributaries.

Switching module (SM)
An access module from the 5ESS switch.

Synchronization supply unit (SSU)
A circuit pack that recovers and reshapes the clock signal in order to filter out jitter. The Local (SSU_L) and Transit (SSU_T) types are available.

Synchronous
The essential characteristic of time-scales or signals such that their corresponding significant instants occur at precisely the same average rate.

Synchronous digital hierarchy (SDH)
A hierarchical set of digital transport structures, standardized for the transport of suitable adapted payloads over transmission networks.

Synchronous equipment management function (SEMF)
Function that converts performance data and implementation specific hardware alarms into object-oriented messages for transmission over the DCC and/or Q-interface. It also converts object-oriented messages related to other management functions for passing across the S reference points.

Synchronous line multiplexer (SLM)
A line multiplexer that is designed to multiplex VC-4 and STM-1 tributary port signals into STM-16 line port signals.

Synchronous Network
The synchronization of synchronous transmission systems with synchronous payloads to a master Network clock that can be traced to a single reference clock.

Synchronous transport module (STM)
The information structure used to support (section layer) connections in SDH.

System administrator
A user of the computer system on which the ITM-SC application can be installed. See also User Privilege.

System controller (CTL)
ISM circuit pack that controls the configuration of an Intelligent Synchronous Multiplexer system.

System controller (SC)
WaveStar® ADM 16/1 circuit pack that controls and provisions all units. It also contains the data communication packet switch functionallity which is necessary for routing of management information between Network Elements and their management system.

System controller (SCT)
SLM Line Terminal and Regenerator Network Element circuit pack that provides the highest level of system control for the Synchronous Line Multiplexer system. The SCT circuit pack provides overall administrative control of the system. Its memory is included in the same one circuit pack.

System controller (STC)
SLM Add-Drop Multiplexer Network Element circuit pack that provides the highest level of system control for the Synchronous Line Multiplexer system. The STC circuit pack provides overall administrative control of the system. Its memory is provided by the MEM circuit pack.

System controller (SYSCTL)
OLS circuit pack that provides the highest level of system control for the Optical Line System. The SYSCTL circuit pack provides overall administrative control of the system. Its memory is provided by the SYSMEM circuit pack.

System memory unit (MEM)
SLM Add-Drop Multiplexer Network Element circuit pack that provides the highest level of system control for the Synchronous Line Multiplexer system. The MEM circuit pack provides memory support for the System Controller (STC) circuit pack.

System memory unit (SYSMEM)
OLS circuit pack that provides the highest level of system control for the Optical Line System. The SYSMEM circuit pack provides memory support for the SYSCTL circuit pack.

T

TCA
Threshold Crossing Alarm

TCP/IP
Transmission Control Protocol/Internet Protocol

TDEV
Timing DEViation

TDM
Timing Division Multiplexing

Template
A collection of parameters that define a specific Network Element configuration. A Template gives the user the opportunity to configure parameters in a Network Element with a single operation. They are re-usable, and allow the user to configure the parameters in many Networks Elements in the same way. A set of Default templates is provided, and the user can create new templates and edit or delete user-created ones. Note that a template is always associated with one specific Network Element type and can not be used for other Network Element types.

TERM
Terminal Multiplexer

TGU
Timing Generator Unit

TI
Timing Interface (WaveStar® ADM 16/1)

TLM
TeLeMetry Unit (OLS)

TLP
Terminal with Line Protection

TMN
Telecommunications Management Network

TPU
Tributary Port Unit

TPU-PCT
Tributary Port Unit - Peripheral Control and Timing link

TPU155
Tributary port Unit 155 Mbit/s (WaveStar® ADM 4/1)

TPU2
Tributary port Unit 2 Mbit/s (WaveStar® ADM 4/1)

TPU34/45
Tributary port Unit 34 / 45 Mbit/s (WaveStar® ADM 4/1)

Transmit-direction
The direction outwards from the cross-connect.

Trellis code modulation
A combined coding and modulation scheme for improving the reliability of a digital transmission system without increasing the transmitted power or the required bandwidth.

TRF
TRansFer unit (WaveStar® ADM 4/1)

Tributary
A signal of a specific rate (2 Mbit/s, 34 Mbit/s, 140 Mbit/s, VC12, VC3, VC4, STM-1 or STM-4) that may be added to or dropped from a line signal.

Tributary overhead controller (TOC)
SLM circuit pack that allows access to the overhead bytes of the incoming tributary signal.

Tributary overhead controller (TOHCTL)
OLS circuit pack that allows access to the overhead bytes of the Supervisory channel.

Tributary unit (TU)
An information structure which provides adaptation between the lower order path layer and the higher path layer. Consists of a VC-n plus a tributary unit pointer TU PTR.

Tributary unit pointer (TU PTR)
Indicates the phase alignment of the VC with respect to the TU in which it resides. The pointer position is fixed with respect to the TU frame.

TSA
Time Slot Assignment

TSI
Time Slot Interchange

TTP
Trail Termination Point

TUG
Tributary Unit Group

U

UAS
UnAvailable Seconds

UIM/X
A package used for developing the WaveStar® ITM-SC GUI for X-windows.

ULDT
Ultra Long Distance Transmission

Unavailable seconds
A performance monitoring parameter.

Uninterruptable power supply (UPS)
Allows connected computer equipment to gracefully shutdown, therefore preventing damage in case of a power fail and absorb dips in the supplied power.

Universal co-ordinated time (UTC)
A time-zone independent indication of an event. The local time can be calculated from the Universal Co-ordinated Time.

UPL
User PaneL

Upstream
At or towards the source of the considered transmission stream, i.e. looking in the opposite direction of transmission.

User privilege
Permissions a user has to perform actions on the computer system on which the ITM-SC application runs. The following users can be distinguished:

User Type	User name	Permissions
System Administrator this is NOT an ITM-SC user	root (fixed)	maintain platform.
Database Administrator this is NOT an ITM-SC user	informix (fixed)	maintain database.
ITM-SC System Administrator	i2kadmin (fixed)	maintain ITM-SC application, maintain Network Element templates, maintain MEC files on the ITM-SC, set default ITM-SC parameters.
Supervisor	free choice	perform all data retrieval functions, perform all alarm suppression functions, perform configuration changes.
Operator	free choice	perform all data retrieval functions, perform all alarm suppression functions.

V **Vertical partition**
Family of UNIX processes and libraries associated with management of a particular network element family

VF
Voice Frequency

Virtual container (VC)
Container with path overhead.

W **Wait to restore time (WRT)**
Corresponds to the time to wait before switching back after a failure has cleared, in a revertive protection scheme. This can be between 0 and 15 minutes, in increments of one minute.

WAN
Wide Area Network

Wander
Long term variations of amplitude frequency components (below 10 Hz) of a digital signal from their ideal position in time possibly resulting in buffer problems at a receiver.

WaveStar® ADM 16/1
A network multiplexer that is designed to flexibly multiplex plesiochronous and STM-1 tributary port signals into STM-4 or STM-16 line port signals.

WaveStar® Integrated Transport Management Subnetwork Controller (ITM-SC)
Manager for SDH Network Elements in a subnetwork. Also referred to as Element Management System.

WaveStar® Network Management System (NMS)
Manager for SDH Network Elements in a network. Formerly known as DACScan-T.

WDM
Wavelength Division Multiplexing

What you see is what you get (WYSIWYG)
Information as displayed on the screen will appear in the same way on printed output.

Wideband communications
Voice, data, and/or video communication at digital rates from 64 kbit/s to 2 Mbit/s.

Windows
Graphical User Interface on PC systems.

Working
Label attached to a physical entity. In case of revertive switching the working line or unit is the entity that is carrying service under normal operation. In case of non-revertive switching the

label has no particular meaning.

WS
Work Station

WSF
Work Station Facility

X **X-Terminal**
Workstation that can support an X-Windows interface

X-Windows
Graphical User Interface on Unix Systems.

XMTR
Transmitter (RR)

XMTR switch unit
Radio Relay circuit pack that performs connections for protection switching and transmission of low priority traffic on the protection channel.

XPIC
Cross Polarization Interference Cancellation

XSU
XMTR Switch Unit (RR)

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