NOKIA

NSP
Network Services Platform

Release 22.6

Simplified RAN Transport Solution

3HE-18165-AAAB-TQZZA

Issue 1

June 2022

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Contents

About this document

Purpose

The *Simplified RAN Transport Solution* introduces the RAN transport functions of the Network Health application GUI and other NSP applications to operators and administrators.

Scope

This document covers the RAN transport features and functions of the Network Health application. Other NSP applications provide additional functionality that is required to manage RAN transport and is described in detail where applicable. See 1.1.4 "What other NSP applications are involved in managing RAN transport?" (p. 11) for a list of relevant NSP applications and where you can find more information about their functionality in the context of managing RAN transport.

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1 Simplified RAN Transport

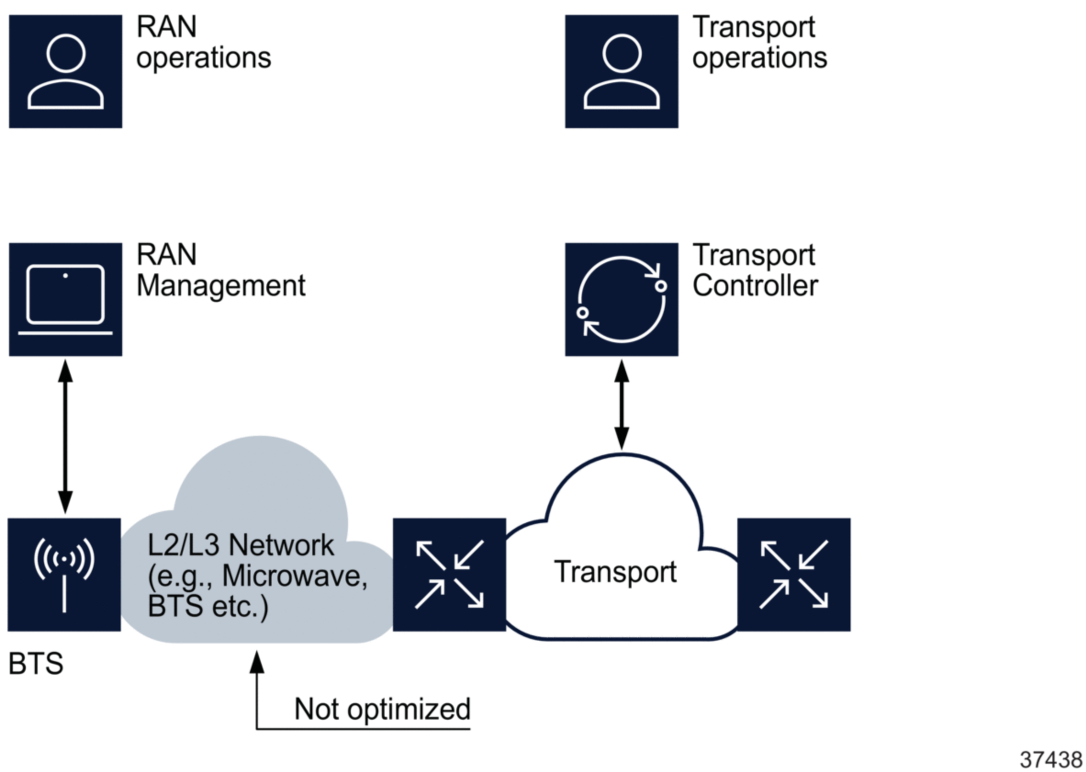
1.1 What is Simplified RAN Transport?

Consider the following issues in the traditional RAN management process:

- **Operations teams are split into separate departments to manage the RAN and transport domains**. Each team is responsible for provisioning, monitoring, and maintenance for their respective domain. See Figure 1-1, "Present mode of operation for managing RAN and transport domains" (p. 8).
- **Transport provisioning across the RAN/transport boundary requires provisioning alignment, but is typically managed via offline processes and tools** leading to double effort, error prone procedures, and longer lead time. Impact and fault analysis require additional time to identify root causes since troubleshooting procedures and data coordination must be implemented across more than one team.
- **Transport parameters (VLAN/IP, QoS) must be configured twice** via RAN and transport controllers. This presents double the effort and manual alignment of offline tools, along with an increases risk of errors.

Evolution to 5G with a RAN enabled for network slicing presents additional complexity that requires automation between the RAN and transport domains. The dynamic nature of network slicing leads to an exponential increase in OPEX.

Figure 1-1 Present mode of operation for managing RAN and transport domains



1.1.1 NSP Simplified RAN Transport Solution

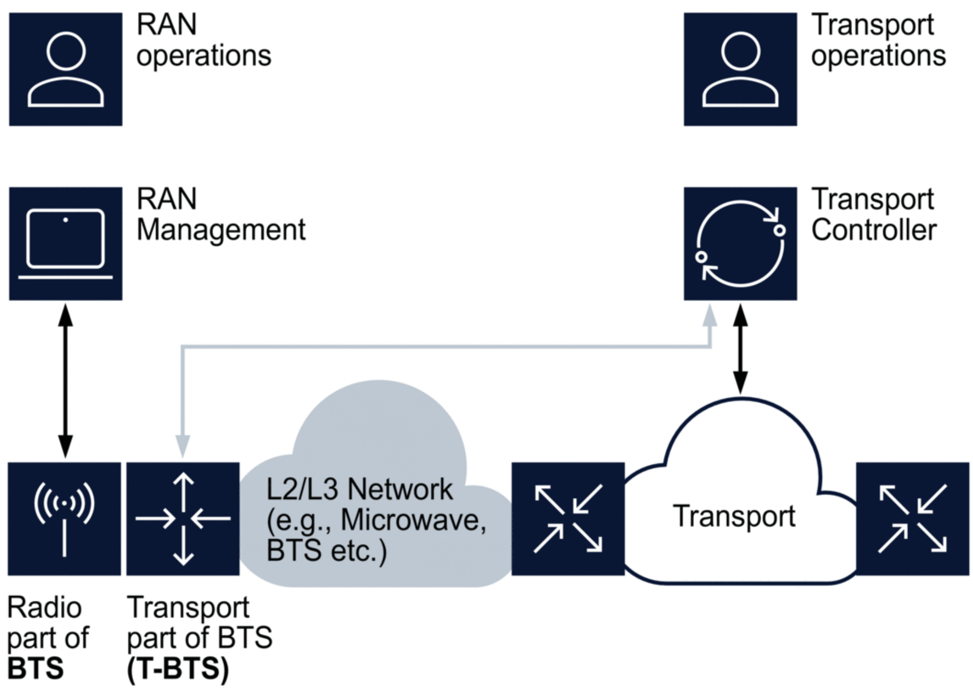
The NSP Simplified RAN Transport (SRT) solution streamlines the configuration of transport parameters by extending the transport domain to the RAN through management of the Transport BTS (T-BTS). SRT uses the existing RAN management functions of NetAct as a mediation layer to provide discovery, provisioning, fault management, and performance management for the T-BTS. Specifically, SRT provides a means to manage T-BTS transport features and Radio Plane (VLAN-based independent network layer) bindings to IP transport services in 4G and 5G networks, in addition to easy access to T-BTS transport parameter configurations. See Figure 1-2, “Enhance transport automation capabilities across the entire mobile network using SRT” (p. 9).

SRT provides the following benefits:

- logically disaggregates the transport portion of the T-BTS and manages the T-BTS as SDN controller via NetAct mediation
- extends the transport domain to the RAN
- uses the existing RAN management functions of NetAct as mediation to NSP and manages T-BTS logical nodes via NetAct

- extends the transport domain to the T-BTS, which simplifies mobile transport provisioning and enhances service and network assurance (FM and PM)
- using SRT, the operations team can access T-BTS transport parameters for configuration checks and troubleshooting
- transport capabilities previously used by the transport operations team can be brought to the RAN transport domain

Figure 1-2 Enhance transport automation capabilities across the entire mobile network using SRT



Via the NSP, SRT is aware of the L2 links between BTS and PE routers through the shared VLAN connection. Direct connections and microwave (Wavence) between the BTS and the transport network are supported. These topology elements are automatically updated on discovery, configuration change, and deletion via LLDP. In cases where LLDP is not supported by the node, the link can be manually created.

1.1.2 What are the use-cases for SRT?

The following are example use-cases for SRT.

Discovery of the transport portion of 4G/5G nodes (T-BTS) in NSP

SRT provides the functionality to discover T-BTS as transport nodes in NSP and display them on the topology map. The links between T-BTS and the transport network are also displayed on the map, and are either dynamically discovered via LLDP or manually configured. The following functionality is also provided:

- retrieval of T-BTS equipment inventory
- retrieval of T-BTS equipment alarms, which are viewable in the Fault Management application
- for T-BTS that are capable of RAN slicing, display equipment information specific to 4G/5G RAN slicing

Links can be manually created using the Original Service Fulfillment application. See “How do I create a physical link between ports?” in *NSP Original Service Fulfillment Application Help*. Links can also be manually created using the Network Supervision application. See “How do I create physical links?” in *NSP Network Supervision Application Help*.

Retrieval of T-BTS Radio Planes and correlation to transport services

In this context, the SRT is capable of:

- retrieving and displaying all 4G/5G Radio Planes, including relevant attributes and alarms
- auditing all Radio Planes for active connections to transport services
- correlating 4G/5G Radio Planes to transport services

In addition to displaying the bindings between Radio Planes and transport services, SRT provides functionality to create these bindings (see 3.2 “How do I bind a Radio Plane?” (p. 29)). RAN services that exist in the context of a 4G/5G RAN slice are also available in the 5G Transport Slice Controller application.

Leveraging 4G/5G network slicing full life cycle management

SRT provides the following end-to-end features:

- extension of automation to 5G transport slices and transport RAN with full flexibility for any combination of resource (IP address, VLAN, QoS, and traffic identifiers) between RAN and transport
- end-to-end monitoring, reporting, and alarm correlation for the T-BTS
- extension of closed-loop automation of transport slices to T-BTS

Zero footprint microwave with BTS networking boost

SRT simplifies Wavence deployment by integrating L2 transport features at cell sites inside the BTS. The SRT is capable of managing the binding status of Radio Planes for RAN and transport networks connected via Wavence nodes.

1.1.3 What are Radio Plane bindings?

Radio Planes are sources of network packets coming from the radio components of the T-BTS. One of the primary functions of SRT is to compute the "Binding State" for all Radio Planes on the T-BTS; a Radio Plane is considered "bound" to a given L3 VPN SAP on a mobile core router when the configuration (VLAN/IP/routes) on the T-BTS allows network traffic generated by the Radio Plane to reach the L3 VPN SAP by traversing the L2 backhaul network. Other possible Binding States are "Misconfigured" and "Not Bound", depending on the missing elements that are preventing a connection with the L3 VPN.

On NSP systems with SRT installed, Radio Plane binding information is displayed in a dedicated panel in the Network Health Dashboard named Radio Plane Bindings. SRT allows operators to bind a given Radio Plane on the T-BTS to connect the Radio Plane to a selected L3 VPN on the mobile core network. This is performed using a Workflow Manager template that can be launched in-context for a given Radio Plane.

1.1.4 What other NSP applications are involved in managing RAN transport?

The following NSP applications are used for managing RAN transport:

- Network Health: viewing RAN transport equipment and bindings, creating Radio Plane bindings. See 3.1 “RAN transport equipment and bindings summary in Network Health dashboard” (p. 21) for more information.
- Network Supervision: viewing T-BTS nodes and their links (with highest alarm severity) on the topology map. Network Supervision also provides the ability to view MRBTS equipment inventory, and the ability to create links between MRBTS that do not support LLDP protocol and their neighboring equipment. See 3.3 “Link management using Network Supervision” (p. 30) for more information.
- Fault Management: viewing and managing T-BTS alarms. See *NSP Fault Management Application Help* for more information.
- Workflow Manager: executing RAN transport bindings. See *NSP Workflow Manager Application Help* for more information.
- Device Administrator: managing NetAct and T-BTS supervision. See *NSP Device Administrator Application Help* for more information.
- Group Manager: creating views and supervision groups Service Supervision. See *NSP Group Manager Application Help* for more information.
- Service Supervision. See *NSP Service Supervision Application Help* for more information.

The Original Service Fulfilment application provides the following capabilities:

- viewing and creating links between T-BTS and transport nodes in the INVENTORY tab
- viewing T-BTS L2 backhaul services in SERVICES tab
- The description for each L2 backhaul service displays the names of the T-BTS associated with the service. See 3.4 “L2 backhaul service management using Original Service Fulfillment” (p. 31) for more information.

1.1.5 SRT support in Release 22.6

SRT is aligned with the following BTS releases:

- 5G Classical: 5G21A, 5G21B, SRAN 22R1-5G, SRAN 22R2-SR
- SRAN 21A, SRAN 21B, SRAN 22R1-4G, SRAN 22R2-SR

SRT in NSP Release 22.6 is based on NetAct 20 22 FP2205 and Wavence Release W21ASP1.

1.1.6 Integration with NetAct

T-BTS are managed in NSP via NSP management of NetAct, which is managed through MDM adaptors. Through this, the NSP can retrieve T-BTS nodes, RAN services, and associate the RAN services with transport services. T-BTS alarms are also retrieved from NetAct and displayed in the Fault Management application.

Note: Fault management for NetAct servers is not provided through the NSP.

2 SRT installation and setup

2.1 NSP installation tasks

2.1.1 Deploying the ran-services-app backend in NSP

The SRT backend ran-services-app is installed by adding the *networkInfrastructureManagement-simplifiedRanTransport* feature package to the *installationOptions* section of the NSP configuration file. For more information, see the following:

- See the *NSP System Architecture Guide* for more information about feature packages and installation options.
- See the *NSP Installation and Upgrade Guide* for more information about enabling installation options in a containerized NSP deployment.

2.1.2 Importing the SRT workflows

The SRT workflows must be downloaded and imported using the Workflow Manager application.

1

Download the zip and action files from the following URL:

`https://gitlabe2.ext.net.nokia.com/automation/community/-/tree/master/Simplified-RAN-Transport/22.6`

2

Launch the Workflow Manager application.

3

Go to Dashboard / Actions.

4

Click “Import”. Drag and drop the following files to the “Files to Import” form.

simplifiedRanTransport.mrbtsList.action

simplifiedRanTransport.radioPlaneByMrbtsId.action

simplifiedRanTransport.RefreshServices.action

simplifiedRanTransport.RefreshServicesResult.action

simplifiedRanTransport.transportServiceByMrbtsId.action

simplifiedRanTransport.transportServiceByServiceName.action

5

Go to Dashboard / Workflow.

6

Click Import / File System.

7

Drag and drop the following files:

SRT_bindRadioPlane.zip

SRT_RefreshServices.zip

8

After all files are imported, modify their status to publish them.

END OF STEPS

2.1.3 Adaptor installation, integration, and T-BTS discovery

See the *NSP Nokia TBTS Adaptor Guide* for information about:

- Installing and upgrading the T-BTS adaptor
- Configuring the SNMP interface and integrating NSP and NetAct
- Discovering NetAct and the T-BTS

2.1.4 Supported router product types

The ran-services-app backend supports the following router product types:

- 7250 IXR
- 7705 SAR
- 7705 SAR H
- 7705 SAR Hm
- 7750 SR
- 7710 SR

The list of supported routers is described in the *srt-ran-services-app-configmap* file. Nokia support can modify this file to expand the list of products, if required.

2.2 T-BTS management and troubleshooting

This section:

- describes SRT backend logging
- provides example failure cases and provides sample server log outputs to help identify the type of issue encountered

2.2.1 SRT backend logging

SRT backend logs are viewable using the NSP Log Viewer application. Logging levels can be configured by Nokia support using the **kubectl edit cm srt-ran-services-app-logback** command.

2.2.2 Parsing error case 1: missing T-BTS parameter

In this error case, the T-BTS is missing a mandatory parameter. The following occurs:

- the NSP logs the error during the resynchronization process with the name of the missing parameter
- the T-BTS resync state is failed

Note that the MO id parameter is mandatory only in T-BTS Yang model v1.

The logs for a resync failure can be viewed in MdmServer.log. The following is an example:

```
<2021.06.30 12:43:13 811 +0000><mdm><E><mdm-server-0>
<ResyncPollerTaskExecutor[3]><com.nokia.nsp.mdm.core.sbi.resync.imp.
ResyncConsumer.failed> Full resync failed for node=10.0.3.238,
detailStatus=null

java.lang.RuntimeException: com.fasterxml.jackson.databind.
JsonMappingException: N/A

at [Source: (ByteArrayInputStream); line: 1, column: 6618] (through
reference chain: com.nokia.nsp.mdm.device.mrbts.model.impl.rest.
adaptation.read.DescendantMoLitesResponse["moLites"]->java.util.HashMap
["PLMN-PLMN/MRBTS-1000"]->java.util.ArrayList[46]->com.nokia.nsp.mdm.
device.mrbts.model.impl.rest.adaptation.common.MoLite["moId"])

        at io.reactivex.internal.util.ExceptionHelper.wrapOrThrow
(ExceptionHelper.java:45)

<2021.06.30 12:43:13 778 +0000><mdm><I><mdm-server-0>
<ResyncPollerTaskExecutor[13]><com.nokia.nsp.mdm.device.mrbts.model.impl.
rest.adaptation.read.ReadHelper.queryAllObjectsFDNAsString> queryAll:
Perform Rest Request POST /persistency/v1/descendantMOLites

<2021.06.30 12:43:13 768 +0000><mdm><E><mdm-server-0><pool-15-thread-2>
<com.nokia.nsp.mdm.device.mrbts.model.impl.rest.adaptation.read.
ReadHelper.getObjectsFDN> Could not read descendantMoLites
```

2.2.3 Parsing error case 2: T-BTS parameter type not compliant with NSP Yang model

In this case, a parameter has been set as a string when an integer is required. The following occurs:

- the NSP logs the error
- the T-BTS resync state is failed

The logs for a resync failure can be viewed in MdmServer.log. The following is an example:

```
2021.06.29 07:29:59 041 +0000><mdm><E><mdm-server-0>
<ResyncPollerTaskExecutor[13]><com.nokia.nsp.mdm.core.sbi.resync.imp.
ResyncConsumer.failed> Full resync failed for node=10.0.3.243,
detailStatus=null

java.lang.NumberFormatException: For input string: "Test"

at java.lang.NumberFormatException.forInputString(NumberFormatException.
java:65
```

2.2.4 REST error case 1: Netact is unreachable on T-BTS configuration resynchronization

NetAct is unreachable and the error is logged in MdmServer.log. The following is an example:

```
<mdm><E><mdm-server-0><ResyncPollerTaskExecutor[37]><com.nokia.nsp.mdm.
core.sbi.resync.imp.ResyncConsumer.failed> Partial resync failed for
node=10.0.3.243, detailStatus=null, class="nokia-tbts-v1-model":
/MRBTS/TNLSVC/TNL/ETHAPP/LLDP

java.lang.RuntimeException: org.apache.http.conn.
HttpHostConnectException: Connect to 10.11.210.158:8001 [/10.11.210.158]
failed: Connection refused (Connection refused)

    at io.reactivex.internal.util.ExceptionHelper.wrapOrThrow
(ExceptionHelper.java:45)

    at io.reactivex.internal.observers.BlockingMultiObserver.blockingGet
(BlockingMultiObserver.java:91)

    at io.reactivex.Single.blockingGet(Single.java:2157)
```

2.2.5 REST error case 2: Body is not compliant with REST format

There is a syntax error in the REST body. For example, there is a missing “}” and the structure is invalid. The error is logged in MdmServer.log. The following is an example:

```
<mdm><E><mdm-server-0><ResyncPollerTaskExecutor[38]><com.nokia.nsp.mdm.
core.sbi.imp.AsynResync.doResync> Partial aInCurrent=com.nokia.nsp.mdm.
device.mrbts.model.impl.rest.adaptation.read.ReadAdaptation@535e9f6e,
aInMetaDevicePojo=MetaDevicePojo{classId='nokia-tbts-v1-model:
/MRBTS/TNLSVC/TNL/ETHAPP/LLDP', sbiProtocol=rest, priority=21,
alwaysReadFromNetwork=false, resyncType=getQuery, isGenericPojo=true,
iDevicePojoBuilder=null, FilterNode=null}

java.lang.RuntimeException: com.fasterxml.jackson.core.
JsonParseException: Unexpected close marker '}': expected ']' (for root
starting at [Source: (ByteArrayInputStream); line: 1, column: 0])
```

```
at [Source: (ByteArrayInputStream); line: 1, column: 2]

at io.reactivex.internal.util.ExceptionHelper.wrapOrThrow
(ExceptionHelper.java:45)

at io.reactivex.internal.observers.BlockingMultiObserver.blockingGet
(BlockingMultiObserver.java:91)

at io.reactivex.Single.blockingGet(Single.java:2157)

at com.nokia.nsp.mdm.device.mrbts.model.impl.rest.adaptation.read.
ReadHelper.readLLDP(ReadHelper.java:254)

at com.nokia.nsp.mdm.device.mrbts.model.impl.rest.adaptation.read.
ReadHelper.read(ReadHelper.java:178)

at com.nokia.nsp.mdm.device.mrbts.model.impl.rest.adaptation.read.
ReadAdaptation.read(ReadAdaptation.java:71)
```

2.2.6 Modifications of Wavence L2 backhaul / L3 VPRN services do not appear in Radio Plane bindings or SRT_BindRadioPlane workflow

New/updated services (created on Wavence nodes or routers and visible in Original Service Fulfillment application) are only taken into account in the SRT backend table every 24 hours.

Workaround: perform the following steps.

1. In the Radio Plane Bindings table, click “Refresh Services”. The Workflow Manager opens the “SRT_RefreshServices” workflow.
2. Click Execute and wait for the workflow execution to finish.
3. In the Radio Plane Bindings table, click “Click to Update”.

2.2.7 Alarms on Wavence L2 backhaul services do not appear in Radio Plane bindings

Alarms on Wavence L2 backhaul services are only taken into account in Radio Plane bindings table every 24 hours.

Workaround: perform the following steps.

1. In the Radio Plane Bindings table, click “Refresh Services”. The Workflow Manager opens the “SRT_RefreshServices” workflow.
2. Click Execute and wait for the workflow execution to finish.
3. In the Radio Plane Bindings table, click “Click to Update”.

2.2.8 Updated BTS transport configuration does not appear in Radio Plane bindings

Workaround: upload MRBTS configuration in NetAct then launch a resynchronization of the BTS from the Device Administrator application.

2.2.9 Updated BTS alarms do not appear in NSP

MRBTS alarms may not be properly updated in NSP (Fault Management, Network Supervision, Radio Plane bindings table).

Workaround: launch a resync of the NetAct server acting as NE controller for this BTS from the Device Administrator application.

2.2.10 MRBTS is unreachable

The NSP is not aware when MRBTS are unreachable from NetAct. In this case, BTS resynchronizations launched from the Device Administrator application will show as successful, but any Radio Plane bindings will fail.

2.2.11 NetAct ResyncStatus = failed or PollerProblem alarm on NetAct

When the NSP is unable to successfully complete a BTS alarm resynchronization, the NSP will:

- set the ResyncStatus of the NetAct server acting as NEcontroller to “failed” (Device Administrator application)
- raise a PollerProblem alarm against the NetAct server acting as NEcontroller (Fault Management application)
- automatically relaunch the T-BTS FM full resynchronization at the next heartbeat reception from the affected NetAct server

Workaround: If the problem is not automatically resolved by the NSP (2 failed retries), the operator must resolve the issue by manually launching a resynchronization of the NetAct server acting as NEcontroller using the Device Administrator application.

2.2.12 Updated BTS software version or chassis type does not appear in Device Administrator

The MRBTS productVariant parameter value is displayed as chassis type in the Device Administrator application. Updating the software version or the productVariant in the BTS configuration is not reflected in Device Administrator, even after performing a resync of the BTS.

Workaround: Unmanage and rediscover the BTS from the Device Administrator application, or check updated values in Network Supervision / Equipment Inventory.

2.2.13 Service Supervision application view is empty for L2 backhaul or L3 VPN service

When a service supervision view/group has not been configured in the Group Manager, navigating from a Radio Plane in the bindings table to the related L2 backhaul service or L3 VPN service in the Service Supervision application will display an empty page.

Workaround: Configure a service supervision group/view in the Group Manager and relaunch the navigation. See *NSP Group Manager Application Help* for more information.

2.2.14 Crosslaunch of Service Supervision fails for L2 backhaul or L3 VPN service with error “cannot launch service list for the specified service”

When a service supervision view/group has not been configured in the Group Manager, navigating from a Radio Plane in the bindings table to the related L2 backhaul service or L3 VPN service in the Service Supervision application can display an error message such as “cannot launch service list for the specified service: *fdn:model:service:Service:xxx*”.

Workaround: Configure a service supervision group/view in the Group Manager and retry crosslaunching the Service Supervision application. See *NSP Group Manager Application Help* for more information.

3 SRT application views

3.1 RAN transport equipment and bindings summary in Network Health dashboard

3.1.1 Overview

You can view a summary of managed T-BTS and their associated transport bindings using the **Simplified RAN Transport Equipment and Bindings Summary** view in the Network Health dashboard. This view can be filtered to display all Radio Planes, only those associated with a transport slice, or only the “basic” applications that do not belong to a slice.

This view displays the following counters:

- total number of T-BTS
- total number of Radio Planes
- Bound Radio Planes (Radio Planes associated to a Transport Service via their vlanId in the same subnet)
- Affected Radio Planes (Radio Planes with active alarms)
- Misconfigured Radio Planes (Radio Planes associated to a Transport Service via their vlanId but with a configuration mismatch)
- Not Bound Radio Planes (Radio Planes configured with vlanId and transportIpAddress but with no associated Transport Service)
- Not Configured Radio Planes (Radio Planes with incomplete configuration information such as missing vlanId or transportIpAddress)

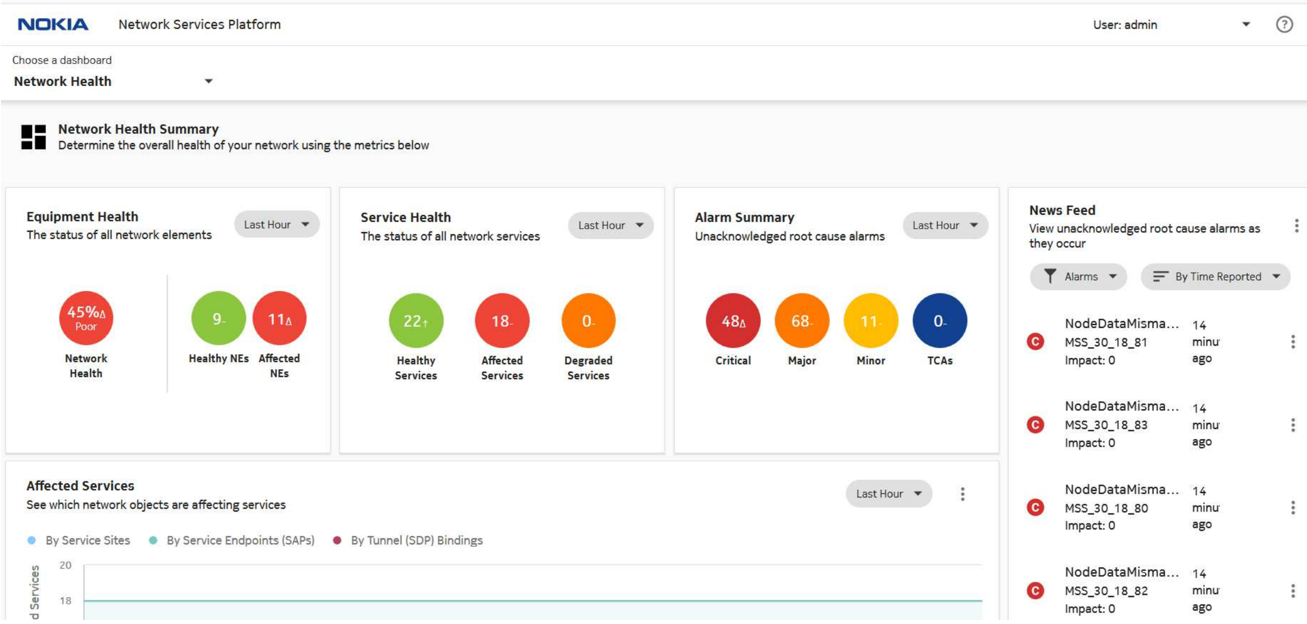
When the value of a counter is over 1000, the number displayed by the counter bubble is rounded down to the nearest 100 (for example, 8969 displays as “8.9k”). The mouse-over tooltip for the counter bubble displays the exact value.

Binding a Radio Plane to a transport service is possible only if there is a link between the BTS port and a Service Access Point (i.e a router port). The link can be a direct physical cable to the router’s port, or the two ports can be linked via a UBT-SA link (waveguide between two UBT Standalone Gears) or via MSS or other BTS nodes (via L2 backhaul services).

3.1.2 Fault management

The Network Health dashboard displays the overall health of the network, including the health of services and an at-a-glance view of alarms.

Figure 3-1 Network health dashboard display



SRT maps T-BTS alarms to the relevant equipment, such as ports and cards. The alarmed object ID displays the DN of the affected BTS or equipment (port or card).

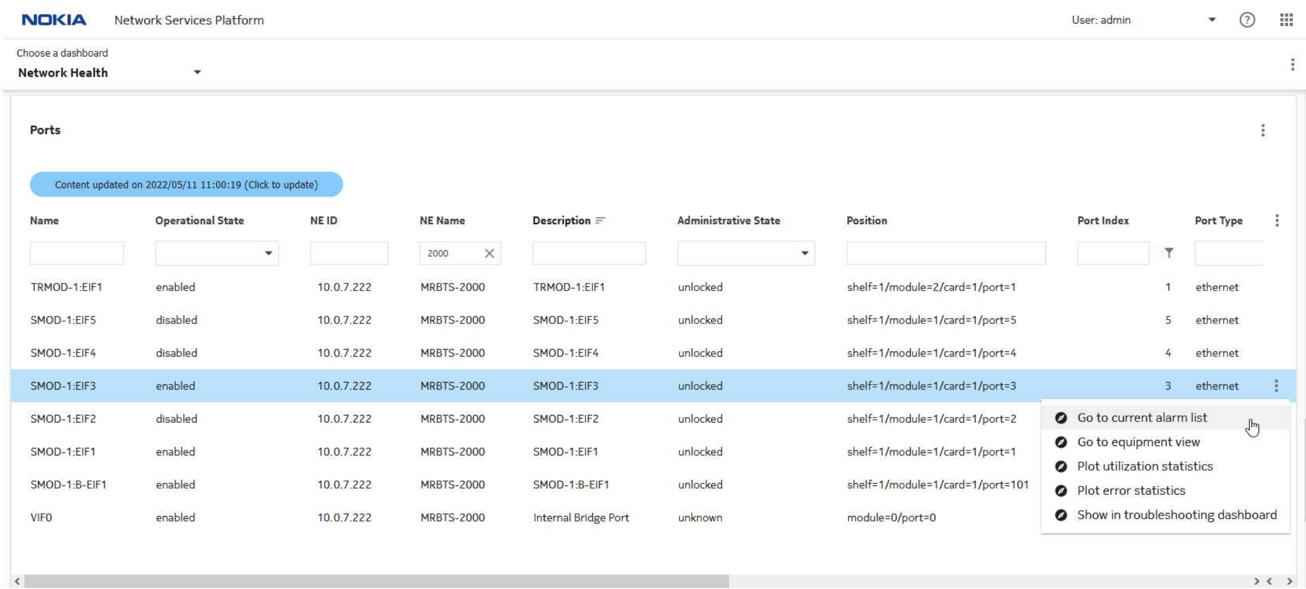
T-BTS alarms are updated in real time in the Fault management and Network Supervision applications. The alarm count in the Radio Plane Bindings table is updated for the following events:

- T-BTS discovery and deletion
- transport service discovery and deletion
- physical link creation, update, and deletion

After an event that affects the alarm list, such as the discovery of new T-BTS nodes, the alarm information in the Network Health dashboard may need to be refreshed to display the updated alarm list.

You can navigate directly from an MRBTS NE or Port list to a list of alarms raised against that type of equipment by clicking ⋮ and selecting “Go to current alarm list”. The list opens in the Fault Management application.

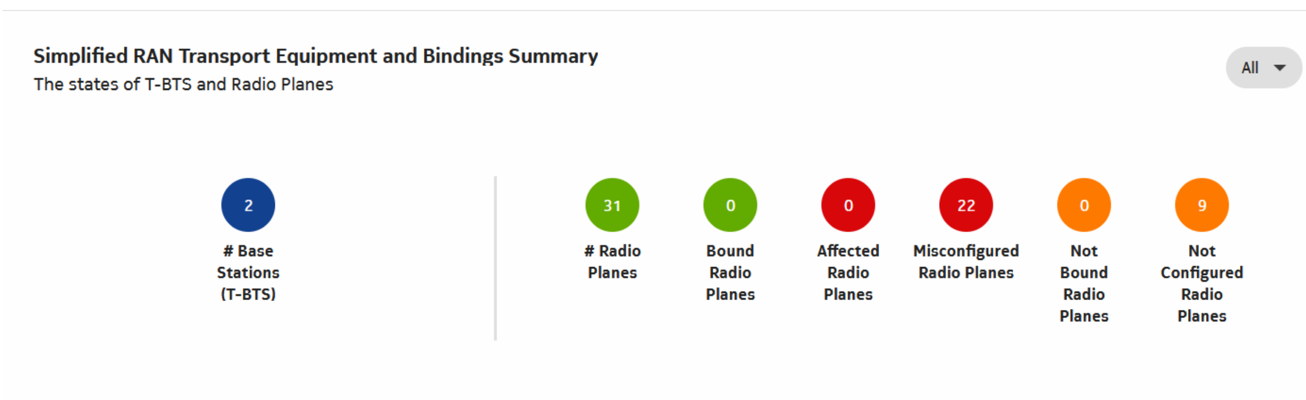
Figure 3-2 Navigation from filtered equipment list (displaying Ports) to alarm list



3.1.3 Radio Plane bindings

Specific to the SRT is the RAN transport equipment and bindings summary.

Figure 3-3 SRT RAN transport equipment and bindings summary



Clicking on the “Base Stations” counter bubble automatically navigates to a filtered list of T-BTS Network Elements. Clicking on the various Radio Plane counter bubbles automatically navigates to a filtered list in the Radio Plane Bindings Table. The table can be further filtered and sorted to help find specific entries.

Figure 3-4 Network Elements list with filter

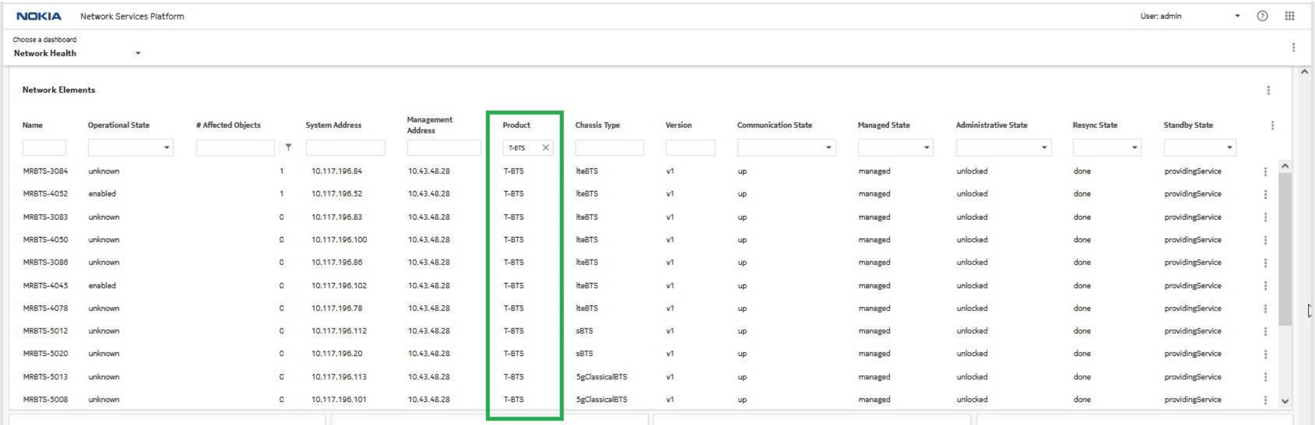
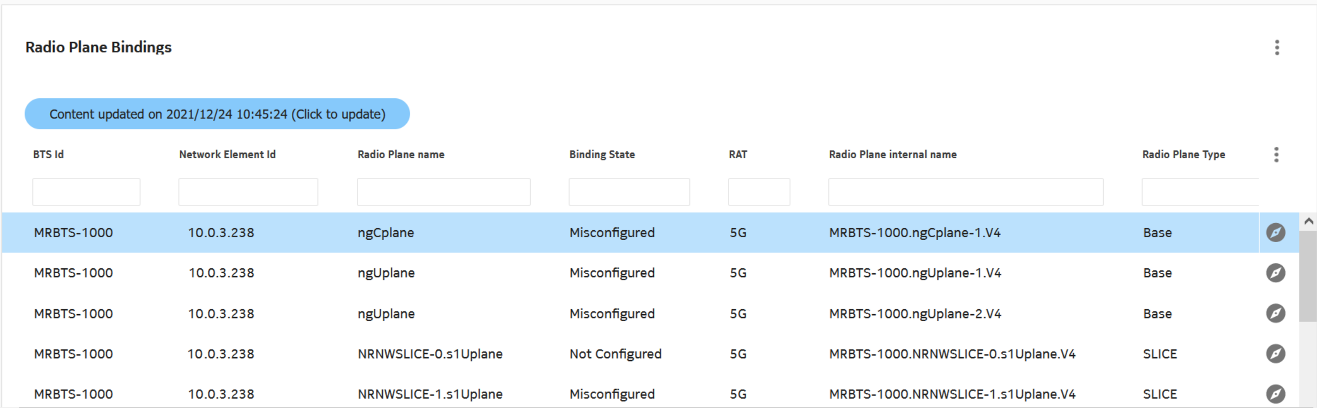


Figure 3-5 Radio Plane Bindings



You can navigate from a Radio Plane in the bindings table to:

- the related L3 VPN service in the Service Supervision application
- the related L2 Backhaul service in the Service Supervision application
- the related BTS alarms in the Fault Management application

The “RAT” column displays the Radio Access Technology of the Radio Plane (4G or 5G).

Binding State and Binding State Details

The Binding State column displays the status of each binding entry while the Binding State Details column provides a more detailed message on the status cause. The following table provides remedial action information for each possible binding state details message.

Note: A radio plane may have several binding state details, separated by commas.

Table 3-1 Binding States, details messages, and remedial actions

Binding State	Possible Binding State Details	Remedial action
Not Configured	T-BTS Transport IP Address not set	Bind the Radio Plane with the expected IP address and the expected VPRN/VLAN.
Not Configured	Vlan Id not configured for T-BTS Transport IP Address *ip_address*	Bind the Radio Plane with the same IP address and the same VPRN/VLAN.
Not Bound	No physical connectivity to backhaul	Check physical links between T-BTS and router. If physical links are OK but LLDP is not activated, create links between T-BTS and router via Network Supervision or Original Service Fulfilment.
Not Bound	T-BTS Port Name *T-BTS port name*: no L3 VPN found on Router *router NE ID router port name*	Create a L3 VPN with this VLAN on the router/port or bind the radio plane to another L3 VPN of this router/port.
Not Bound	T-BTS Port Name *T-BTS port name*: No L2 Backhaul service on Node *NE ID NE port name* leading to a Router	Check the L2 backhaul (with the same vlanId) between the T-BTS and the router (fix it or create it).
Misconfigured	Vlan Id is not configured on physical T-BTS Port Name *T-BTS port name*	Bind the Radio Plane with the same IP address and the same VPRN/VLAN.
Misconfigured	No route defined in T-BTS Routing Table	Add routing configuration in the MRBTS (via WEB EM or NETACT).
Misconfigured	T-BTS Transport IP Address and L3 VPN SAP IP Address are not in the same subnet	Bind the Radio Plane with the same VPRN/VLAN but correct IP address.

S-NSSAI in Radio Plane Bindings

5G BTS with S-NSSAI enabled have two entries displayed in the table for each configured SNSSAI object:

- *SNSSAI-X.ngUplane-1* (one IPv4 and one IPv6)
- *SNSSAI-X.xnUplane-1* (one IPv4 and one IPv6)

The “Slice Id” column of the table displays the S-NSSAI identifiers as *sst:sd* (Slice Service Type and Slice Differentiator).

See Appendix A, “Radio Plane to MRBTS configuration mapping” for mapping information between Radio Plane objects in NSP and MRBTS objects in the nodal configuration.

NWSLICE in Radio Plane Bindings

4G BTS with NWSLICE enabled have two entries displayed in the table for each configured NWSLICE object: *NWSLICE-X.Uplane-1* (one IPv4 and one IPv6).

The “Slice Id” column of the table displays the values of NWSLICE.operatorSpecificQciList separated by commas.

See Appendix A, “Radio Plane to MRBTS configuration mapping” for mapping information between Radio Plane objects in NSP and MRBTS objects in the nodal configuration.

NRNWSLICE_NSA in Radio Plane Bindings

5G BTS with NRNWSLICE_NSA enabled have two entries displayed in the table for each configured NRNWSLICE_NSA object: *NRNWSLICE_NSA-X.s1Uplane-1* (one IPv4 and one IPv6).

The “Slice Id” column of the table displays the values of NRNWSLICE_NSA.operatorSpecificQCIList separated by commas.

See Appendix A, “Radio Plane to MRBTS configuration mapping” for mapping information between Radio Plane objects in NSP and MRBTS objects in the nodal configuration.

Filtering using Slice Id

You can filter for slices with specific QCI list, SST, and SD values using the “Slice Id” column of the Radio Plane Bindings table. Using specific filter values with commas and/or colons returns specific types of results, as explained in the following table. In general, commas return 4G slice QCI list values while colons return 5G slice SST:SD values. Numbers on the left of a colon match SST and numbers on the right match SD.

Table 3-2 Slice Id filter examples and returned results

Filter value	Slices returned by filter	Specific values matched
3	NWSLICE.Uplane	QCI list contains qci=3
	NRNWSLICE_NSA.s1Uplane	QCI list contains qci=3
	SNSSAI.ngUplane	sst=3
	SNSSAI.xnUplane	sst=3
3,4	NWSLICE.Uplane	QCI list contains qci=3
	NWSLICE.Uplane	QCI list contains qci=4
	NRNWSLICE_NSA.s1Uplane	QCI list contains qci=3
	NRNWSLICE_NSA.s1Uplane	QCI list contains qci=4
3:	SNSSAI.ngUplane	sst=3
	SNSSAI.xnUplane	sst=3
3:4	SNSSAI.ngUplane	sst=3 and sd=4
	SNSSAI.xnUplane	sst=3 and sd=4
:4	SNSSAI.ngUplane	sd=4
	SNSSAI.xnUplane	sd=4

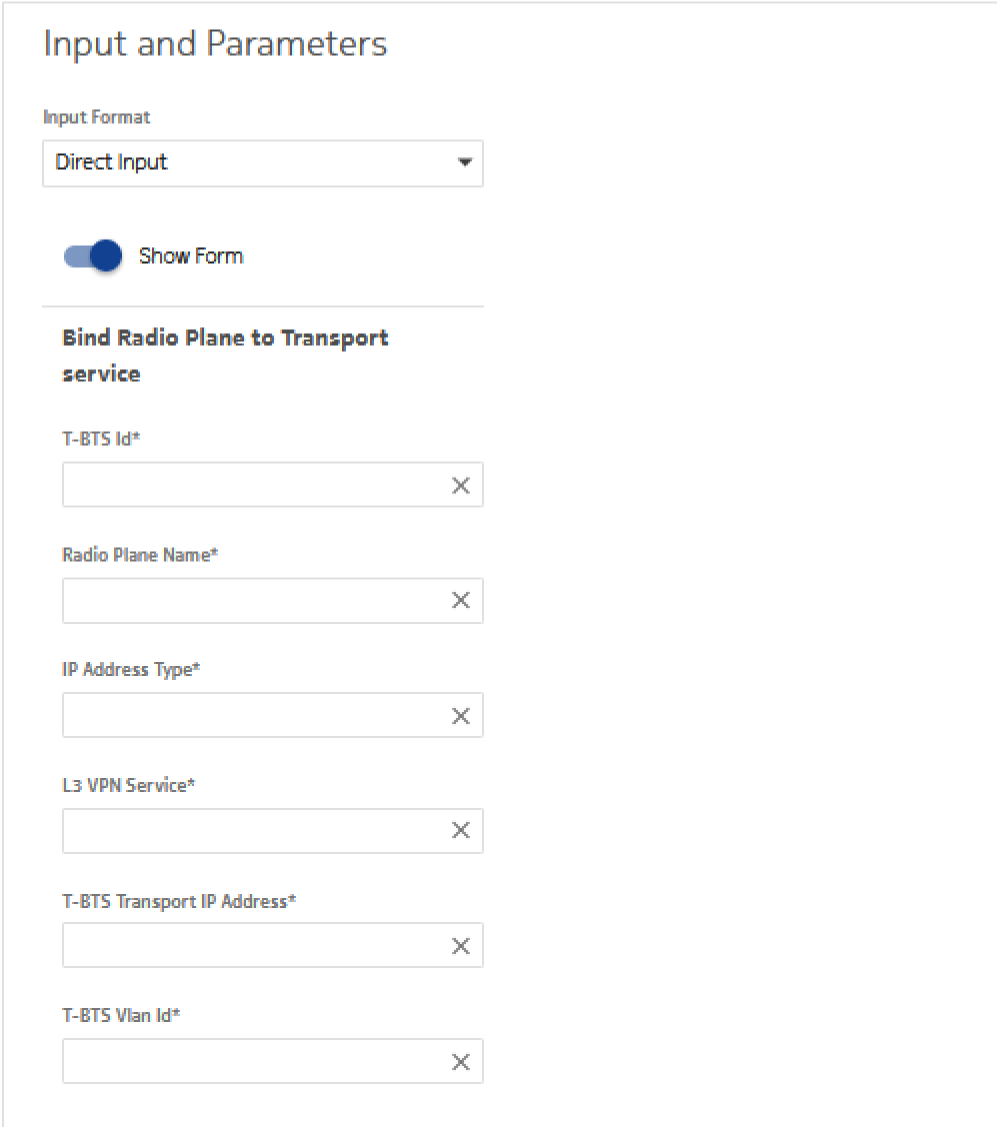
Table 3-2 Slice Id filter examples and returned results (continued)

Filter value	Slices returned by filter	Specific values matched
3,4,:5	NWSLICE.Uplane	QCI list contains qci=3
	NWSLICE.Uplane	QCI list contains qci=4
	NRNWSLICE_NSA.s1Uplane	QCI list contains qci=3
	NRNWSLICE_NSA.s1Uplane	QCI list contains qci=4
	SNSSAI.ngUplane	sd=5
	SNSSAI.xnUplane	sd=5
:	SNSSAI.ngUplane	Any sst:sd
	SNSSAI.xnUplane	Any sst:sd

3.1.4 Binding Radio Planes to transport services

You can bind a Radio Plane to a transport service when there is a physical link between a T-BTS port and a backhaul equipment port. To create the binding, choose a “Not Bound” or “Not Configured” Radio Plane and click **Bind to L3 VPN** in the Radio Plane Bindings view. This launches the Workflow Manager application, where you can enter the inputs required for the binding.

Figure 3-6 Creating Radio Plane binding in Workflow Manager



When the binding is executed, the NSP sends a configuration plan to NetAct with the specified inputs. In case of IPIF and/or VLANIF creation, userLabels are added to identify objects created via NSP. The binding creates IPIF objects with an ipMtu default value of 1500.

Note: Only single VLAN ranges (vlanId x, vlanId x) are added or removed from BRGPRT.l2VlanIdList during the binding operation. Multiple VLAN ranges (vlanId x, vlanId y) of BRGPRT.l2VlanIdList are not modified during the binding operation.

Note: When a BTS is linked to several routers containing the same L3 VPN with the same vlan ID, binding this BTS to the L3 VPN is not supported.

You can view the results of the binding workflow execution in the Workflow Executions history. Logs for this operation are also recorded in the NSP MdmServer.log file.

3.2 How do I bind a Radio Plane?

Note: Executing more than one binding operation at a time is not supported.

Note: The “Bind Radio Plane” action is not supported for radio planes with virtual IP addresses.

1

In the Network Health dashboard, scroll to the **Simplified RAN Transport Equipment and Bindings Summary**.

2

Click a bubble to automatically scroll to the **Radio Plane Bindings** table for that category, for example “Not Bound Radio Planes”. The table is set with a filter criteria matching the selected bubble.

3

Choose an entry in the list and click **Bind Radio Plane** . The Workflow Manager opens to create the Radio Plane binding for the selected entry.

Note: If you scroll away from the Radio Plane Bindings table and it is minimized, scroll back to it in the **Data Page**, click and select Expand Size.

4

In the Workflow Manager, enter the required parameter configuration and click **Execute**. Mandatory parameters are identified by a star.

Note: “T-BTS Transport IP Address” is the IP address of the L3 VPRN SAP, the value must be changed to another valid IP address in the same subnet.

Note: Parameters to configure a radio plane with a virtual IP address are not available or supported.

5

Wait until the end of the workflow execution (status will display success or error). In case of error:

- Click Quick View to view the reason for the error.
- Fix the error and repeat the binding operation.

In case of success, go back to the **Radio Plane Bindings** table and click on the “Content updated on... Click to update” bubble or wait for an automatic refresh. After a few minutes (the BTS may reboot), the table is updated.

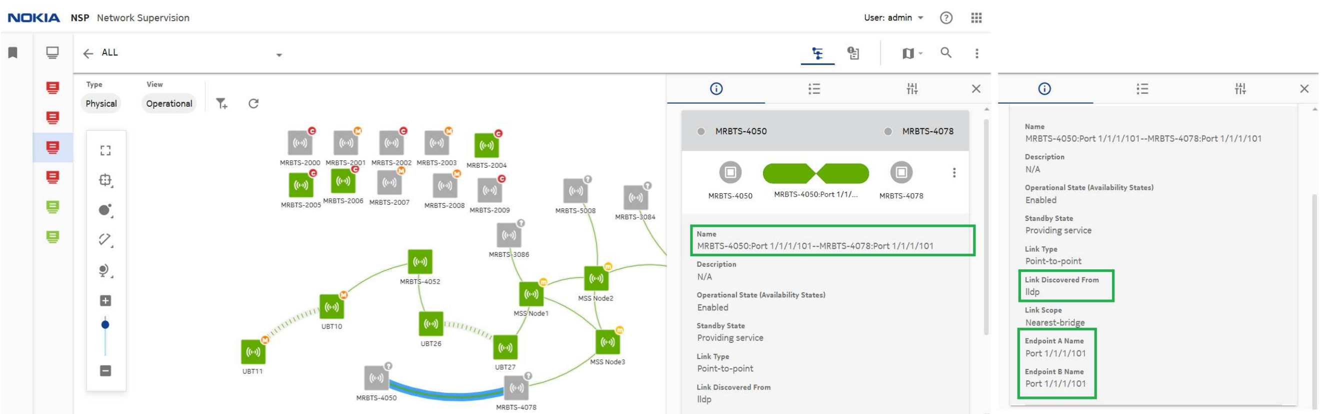
END OF STEPS

3.3 Link management using Network Supervision

3.3.1 Link discovery using LLDP

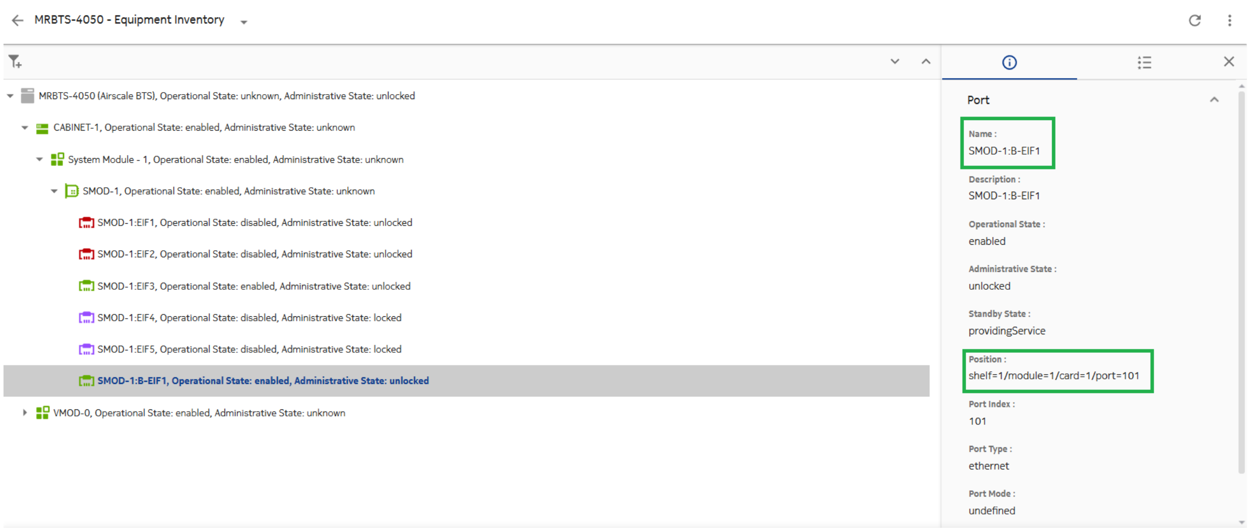
The NSP discovers physical links between BTS nodes using LLDP and displays them on the topology map in the Network Supervision application. Radio Planes are bound using the same port used for the physical link, displayed as the *T-BTS Port Name* in the Radio Plane Bindings table.

Figure 3-7 Physical link discovered via LLDP



The Equipment Inventory view for MRBTS-4050 displays the mapping between the port name and position.

Figure 3-8 T-BTS port name and position in Equipment Inventory



See *NSP Network Supervision Application Help* for more information.

3.4 L2 backhaul service management using Original Service Fulfillment

3.4.1 Service discovery

SRT discovers L2 backhaul services across BTS, microwave, and UBT nodes that are configured with the same VLAN and merges them into a new combined L2 backhaul service. These services are displayed in the Original Service Fulfillment application.

Navigating to the Service View of the application, you can view the following information:

- service endpoints of the selected service in “View Component”, including Admin and Operational State
- all nodes configured with a corresponding VLAN in “View Service Map”

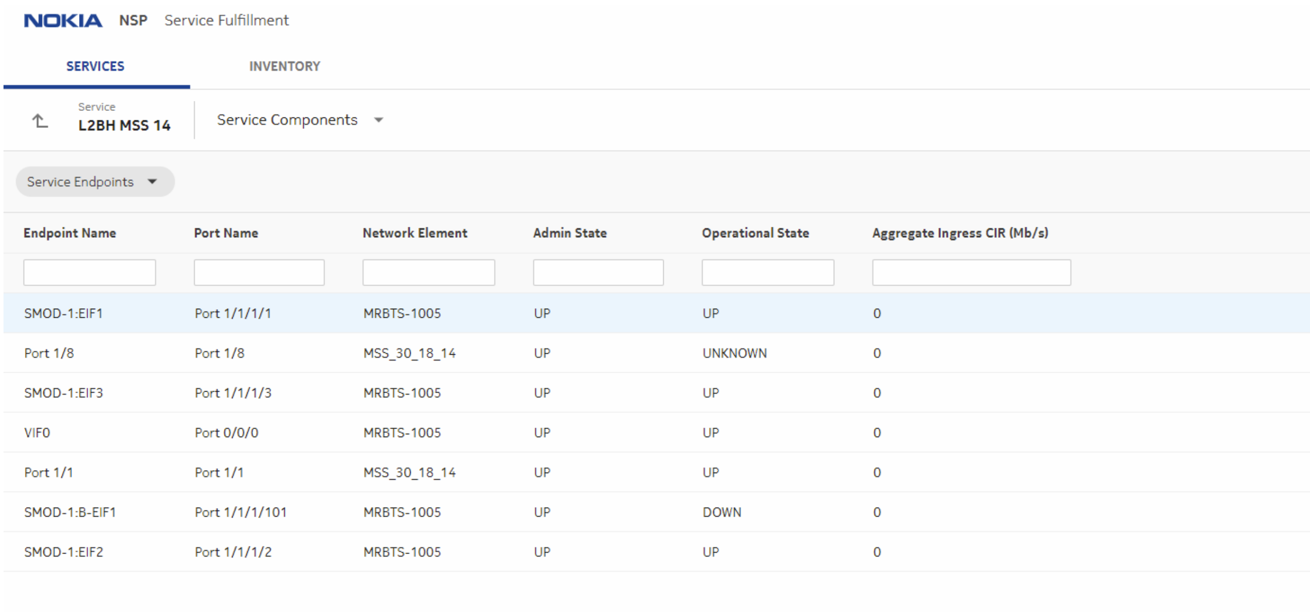
The L2 backhaul service list is updated for BTS configuration changes (for example, creation/ deletion of VLAN) and when BTS nodes are managed/unmanaged by the NSP.

Note: T-BTS L2 backhaul services are merged with the first available microwave L2 backhaul services. In cases where T-BTS L2 backhaul is connected to several microwave backhaul services, not all of these services will be merged.

Note: Only UBT nodes on microwave L2 services are displayed in the Service View of merged L2 backhaul services. All other UBT nodes are displayed in the Physical View.

See *NSP Original Service Fulfillment Application Help* for more information about managing services with the Original Service Fulfillment application.

Figure 3-9 Component view of L2 service displaying endpoints with Admin and Operational State



Endpoint Name	Port Name	Network Element	Admin State	Operational State	Aggregate Ingress CIR (Mb/s)
SMOD-1:EIF1	Port 1/1/1/1	MRBTS-1005	UP	UP	0
Port 1/8	Port 1/8	MSS_30_18_14	UP	UNKNOWN	0
SMOD-1:EIF3	Port 1/1/1/3	MRBTS-1005	UP	UP	0
VIF0	Port 0/0/0	MRBTS-1005	UP	UP	0
Port 1/1	Port 1/1	MSS_30_18_14	UP	UP	0
SMOD-1:B-EIF1	Port 1/1/1/101	MRBTS-1005	UP	DOWN	0
SMOD-1:EIF2	Port 1/1/1/2	MRBTS-1005	UP	UP	0

How BTS L2 services are created in NSP

The BTS requires one of the following for L2 backhaul service discovery:

- L2SWI.l2SwitchingEnabled set to “true” and L2SWI.vlanAwarenessEnabled set to “true” and the vlanId of the service configured on two ports of the BTS (in two BRGPRT.l2VlanIdList),
  OR
- L2SWI.l2SwitchingEnabled set to “true” and L2SWI.vlanAwarenessEnabled set to “true” and the vlanId of the service configured on one port of the BTS (in a BRGPRT.l2VlanIdList) and in a VLANIF

If adjacent BTSs (linked by physical links) with L2 BH Service using the same vlanId are present, the BTSs will exist in an aggregate L2 backhaul service with all endpoints and physical links inside.

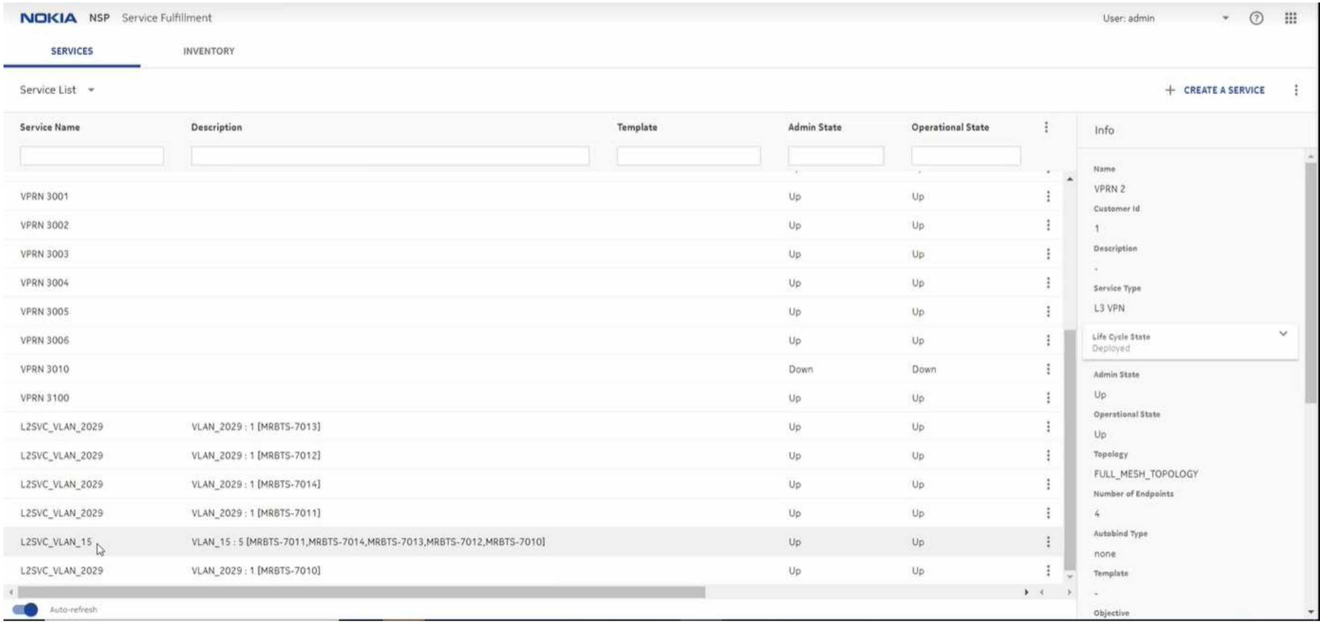
Only physical links present in the Original Service Fulfillment application are used to aggregate BTS L2 backhaul services. Physical links in Network Supervision are not taken into account.

BTS L2 backhaul service name at service discovery is set to the value L2SVC_VLAN_*XX*, with *XX* equal to the vlanId. It is possible to modify the name of the BTS L2 backhaul service using the Original Service Fulfillment application.

Service association

The “Description” field for an L2 service displays the VLAN identifier, the number of BTS associated with the service, and a list of BTS node names associated with that service. The Description field is updated accordingly when the service is modified.

Figure 3-10 L2 service VLAN with associated BTS nodes



Service and link configuration updates

To update the data displayed in the Original Service Fulfillment application, you must perform a **Sync with Network Data** action. Only the Admin State and Operational State values of L2 backhaul services and endpoints are updated dynamically without requiring a sync action.

A Radio Plane to MRBTS configuration mapping

Radio plane objects in the MRBTS configuration are abstracted in the NSP. The following tables display the mapping between NSP Radio Plane and MRBTS objects.

Note: T-BTS Transport IP Address may be empty if it is missing in the MRBTS configuration. In this case, the radio plane is displayed in SRT Table with a “Not Configured” Binding State to allow the operator to configure the radio plane IP address by launching a binding action.

Table A-1 NSP 4G Base Radio Planes mapping to MRBTS configuration

Radio Plane name	IP Address type	T-BTS Transport IP Address
TRSNW-i.cPlane-1	V4	TRSNW-i. cPlane. ipV4AddressDN1
TRSNW-i.cPlane-1	V6	TRSNW-i. cPlane. ipV6AddressDN1
TRSNW-i.cPlane-2	V4	TRSNW-i. cPlane. ipV4AddressDN2
TRSNW-i.cPlane-2	V6	TRSNW-i. cPlane. ipV6AddressDN2
TRSNW-i.uPlane-1	V4	TRSNW-i. cPlane. ipV4AddressDN1
TRSNW-i.uPlane-1	V6	TRSNW-i. cPlane. ipV6AddressDN1
TRSNW-i.uPlane-2	V4	TRSNW-i. cPlane. ipV4AddressDN2
TRSNW-i.uPlane-2	V6	TRSNW-i. cPlane. ipV6AddressDN2

Table A-2 NSP 5G SNSSAI SLICE Radio Planes mapping to MRBTS configuration

Radio Plane name	IP Address type	T-BTS Transport IP Address
SNSSAI-X.ngUplane-1	V4	SNSSAI-X. ngUplane. ipV4AddressDN1
SNSSAI-X.ngUplane-1	V6	SNSSAI-X. ngUplane. ipV6AddressDN1
SNSSAI-X.xnUplane-1	V4	SNSSAI-X. ngUplane. ipV4AddressDN1
SNSSAI-X.xnUplane-1	V6	SNSSAI-X. ngUplane. ipV6AddressDN1

Table A-3 NSP 5G NRNWSLICE_NSA SLICE Radio Planes mapping to MRBTS configuration

Radio Plane name	IP Address type	T-BTS Transport IP Address
NRNWSLICE_NSA-i.s1Uplane-1	V4	NRNWSLICE_NSA-i.s1Uplane.ipV4AddressDN1
NRNWSLICE_NSA-i.s1Uplane-1	V6	NRNWSLICE_NSA-i.s1Uplane.ipV6AddressDN1

Table A-4 NSP 4G NWSLICE SLICE Radio Planes mapping to MRBTS configuration

Radio Plane name	IP Address type	T-BTS Transport IP Address
NWSLICE-i.Uplane-1	V4	NWSLICE-i.ipV4AddressDN1
NWSLICE-i.Uplane-1	V6	NWSLICE-i.ipV6AddressDN1

Table A-5 NSP 5G Base Radio Planes mapping to MRBTS configuration

Radio Plane name	IP Address type	T-BTS Transport IP Address
NRBTS-i.ngCplane-1	V4	NRBTS-i.ngCplane.ipV4AddressDN1
NRBTS-i.ngCplane-1	V6	NRBTS-i.ngCplane.ipV6AddressDN1
NRBTS-i.ngUplane-1	V4	NRBTS-i.ngUplane.ipV4AddressDN1
NRBTS-i.ngUplane-1	V6	NRBTS-i.ngUplane.ipV6AddressDN1
NRBTS-i.s1Uplane-1	V4	NRBTS-i.s1Uplane.ipV4AddressDN1
NRBTS-i.s1Uplane-1	V6	NRBTS-i.s1Uplane.ipV6AddressDN1
NRBTS-i.x2Cplane-1	V4	NRBTS-i.x2Cplane.ipV4AddressDN1
NRBTS-i.x2Cplane-1	V6	NRBTS-i.x2Cplane.ipV6AddressDN1
NRBTS-i.x2Uplane-1	V4	NRBTS-i.x2Uplane.ipV4AddressDN1
NRBTS-i.x2Uplane-1	V6	NRBTS-i.x2Uplane.ipV6AddressDN1
NRBTS-i.xnCplane-1	V4	NRBTS-i.xnCplane.ipV4AddressDN1
NRBTS-i.xnCplane-1	V6	NRBTS-i.xnCplane.ipV6AddressDN1
NRBTS-i.xnUplane-1	V4	NRBTS-i.xnUplane.ipV4AddressDN1
NRBTS-i.xnUplane-1	V6	NRBTS-i.xnUplane.ipV6AddressDN1