User Manual

Basic Configuration
Dragon PTN Legacy Services

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1. INTRODUCTION

1.1 General

This document is valid as of Dragon PTN Release 4.3DR. This manual describes the OAM for so-called “legacy services” that can be used to transport “legacy applications” over the Dragon PTN network. Legacy services are all the services that are not pure Ethernet services (see Ref. [2Eth] in Table 2). The following legacy service (types) are described further on:

- Local Mode
  - Optical Low Speed Serial / C37.94
- Serial Ethernet
- Circuit Emulation (SAToP/CESoPSN)
  - E1 / T1 / C37.94 / Serial / 2W/4W Voice (only CESoPSN) / CODIR / Optical Low Speed Serial
- Voice
- Smart SFP (uses service type ‘Ethernet’ over Dragon PTN but transports STM/OC frames from an SDH/Sonet network)

Prerequisites:

- The HiProvision PC must have been configured/installed as described in Ref. [2Mgt] in Table 2;
- The Dragon PTN core network has been configured as described in Ref. [2Net] in Table 2. At least one tunnel must have been created (except for the Local Mode services);
- Before creating the service, it is always interesting to verify the bandwidth already configured through the WAN links and tunnels of your network, see §12.4.

Table 1 Legacy Application / IFM / Service Type Overview

Legacy Application	Required IFM (Refs. in Table 2)	Service Type	Chapter
Serial (RS232, RS422, RS485, X.21, V.35)	7-SERIAL	Circuit Emulation: Serial	§5
		Serial Ethernet	§4
64 kbps (ITU G.703)	4-CODIR	Circuit Emulation: CODIR	§5
2-Wire Voice, 4-Wire Voice, E&M Signaling	4-2/4WEM	Circuit Emulation: 2W/4W Voice	§5
E1	4-E1-L / 16-E1-L	Circuit Emulation: E1	§5
T1	4-T1-L / 16-T1-L	Circuit Emulation: T1	§5
Voice (FXO, SIP)	8-FXS, all Ethernet IFMs	Voice	§7
Optical Low Speed Serial	2-OLS	Local Mode: Optical Low Speed Serial	§2
		Circuit Emulation: Optical Low Speed Serial	§5
C37.94	2-C37.94	Local Mode: C37.94	§3
		Circuit Emulation: C37.94	§5
SHDSL	4-DSL-LW	Ethernet	§8
SDH/SONET (STM/OC)	Via smart SFPs on 4-GO-LW, 4-GC-LW/4-GCB-LW port 1	Ethernet	§9

1.2 Manual References

Table 2 is an overview of the manuals referred to in this manual. '&' refers to the language code, '*' refers to the manual issue. All these manuals can be found via the HiProvision Help Tile.

Table 2 Manual References

Ref.	Number	Title
[1]	DRA-DRM801-&-*	Dragon PTN Installation and Operation
[2Mgt]	DRA-DRM830-&-*	HiProvision Management Operation
[2Eth]	DRA-DRM831-&-*	Dragon PTN Ethernet Services
[2Net]	DRA-DRM833-&-*	Dragon PTN Network Operation
[3]	DRE-DRM806-&-*	Dragon PTN Interface Module: PTN-4-DSL-LW
[4]	DRE-DRM817-&-*	Dragon PTN Interface Module: PTN-4-GO-LW
[5]	DRE-DRM805-&-*	Dragon PTN Interface Module: PTN-4-E1-L/ PTN-4-T1-L
[6]	DRE-DRM809-&-*	Dragon PTN Interface Module: PTN-2-C37.94
[8]	DRE-DRM813-&-*	Dragon PTN Interface Module: PTN-7-SERIAL
[10]	DRE-DRM814-&-*	Dragon PTN Interface Module: PTN-4-2/4WEM
[11]	DRE-DRM816-&-*	Dragon PTN Interface Module: PTN-4-CODIR
[13]	DRE-DRM815-&-*	Dragon PTN Interface Module: PTN-2-OLS
[14]	DRF-DRM811-&-*	Dragon PTN TRMs (Transmit Receive Modules: SFP, XFP, QSFP+)
[22]	DRE-DRM818-&-*	Dragon PTN Interface Module: PTN-16-E1-L/ PTN-16-T1-L
[24]	DRG-DRM826-&-*	HiProvision Add-on: Generic Reporting Engine

2. LOCAL MODE: OPTICAL LOW SPEED SERIAL

2.1 General

Supported IFMs: 2-OLS: More information on this IFM in Ref. [13] in Table 2;

Local Mode at the source side means the conversion of incoming Serial signals into E1 signals, both at the front panel of the IFM. No IFM backplane or Dragon PTN network or Dragon PTN bandwidth is involved. The IFM just acts as a local Serial to E1 converter via an internal loopback. At the destination side, the conversion is just vice versa.

Prerequisite: make sure that you created links of type 'External E1 Link' (see figure below) between the two 2-OLS IFMs. These links can be created as via Dashboard → Network Hardware → Links → + → (Link type) 'External E1 Link'. More info in Ref. [2Net] in Table 2.

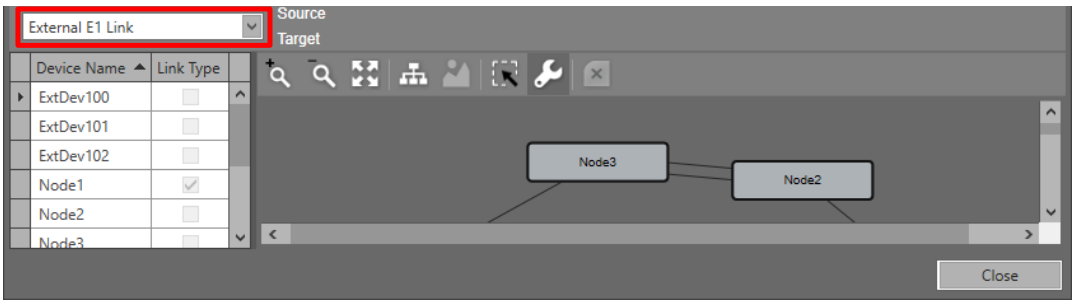
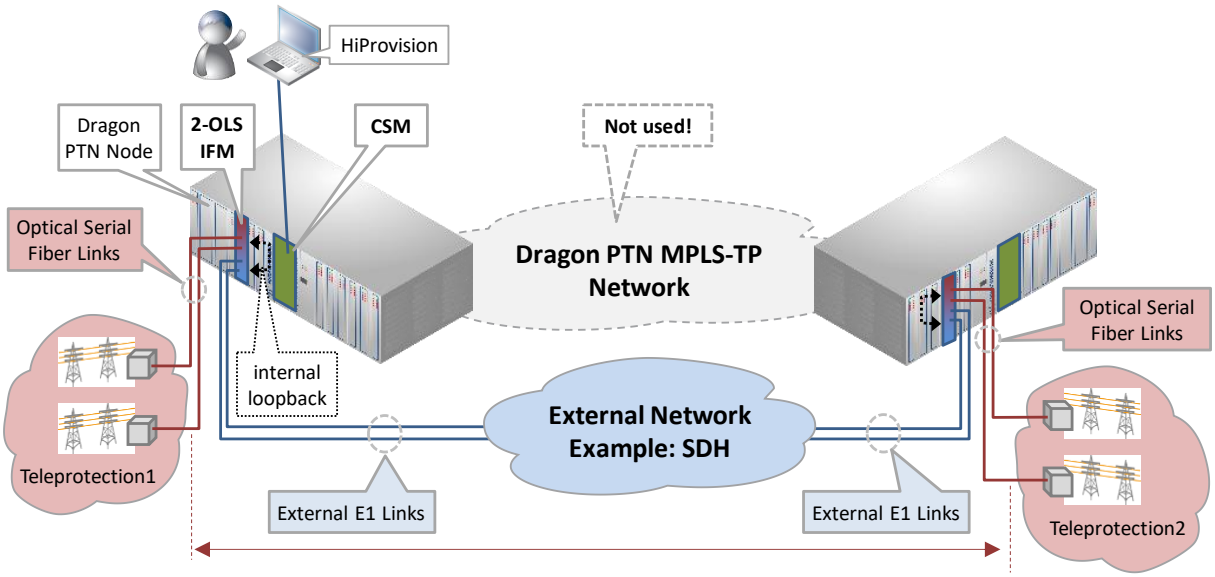


Figure 1 Create External E1 Link



Service: Local Mode → Optical Low Speed Serial

Figure 2 Local Mode: Optical Low Speed Serial via 2-OLS IFMs

2.2 Configure Service

2.2.1 Service Wizard

Click Dashboard → Configuration → Connections → Services → + to open the services wizard. See figure below.

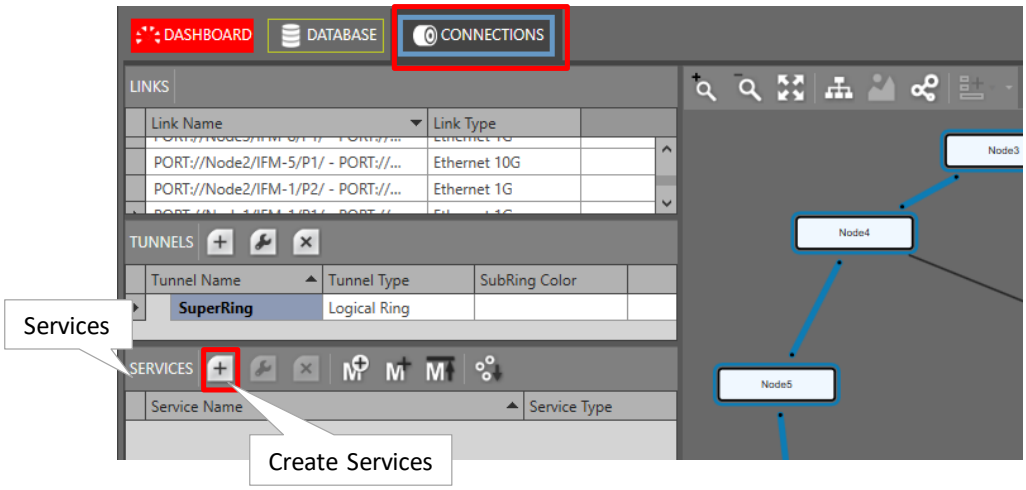


Figure 3 Create Services

The services wizard opens. The list below summarizes every page in the wizard:

- Page: Information: Click Next>>;
- Page: Service Name and Type Selection:
  - Service Name: enter a name for your service.
  - Service Type: Local Mode;

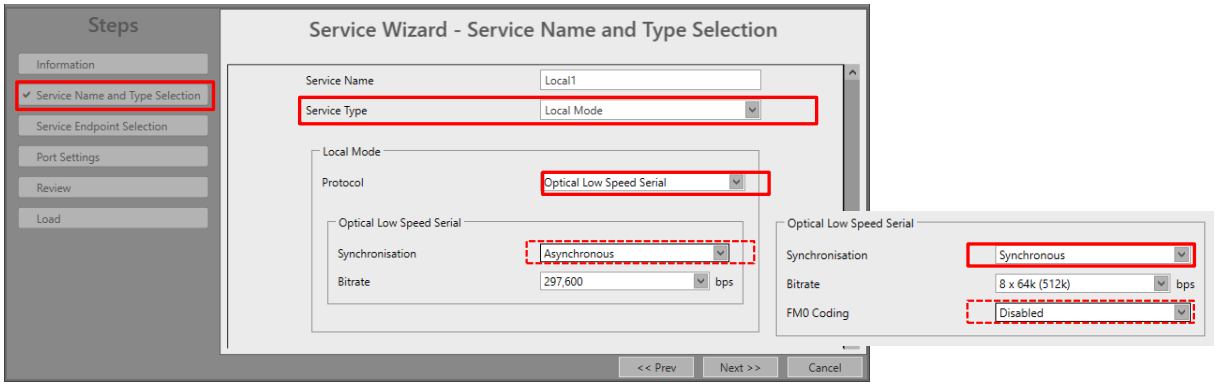


Figure 4 Service Type: Local Mode: Optical Low Speed Serial

- Protocol: Optical Low Speed Serial:
- Synchronisation:
  - Asynchronous (=default): When a bitrate is selected, an incoming serial signal with a lower bitrate will operate as well, because 2-OLS samples at 6.6 times the selected bitrate;
  - Synchronous: offers additional option to use FM0 Coding;
  - Bitrate: depends on the selected Synchronisation method, see overview in §8.
  - FM0 Coding (in Synchronous mode)
    - Disabled (=default): Normal data (without encoding) is expected at the optical serial RX ports. Normal data (without encoding) is generated at the optical serial TX ports;
    - Enabled: FM0 encoded data is expected at the optical serial RX ports. FM0 encoded data is generated at the optical serial TX ports. With FM0 Coding enabled, a 0-bit (='space') will always have an extra transition halfway its bit time (=2 phases = biphase) whereas a 1-bit will have no transition within its bit time.

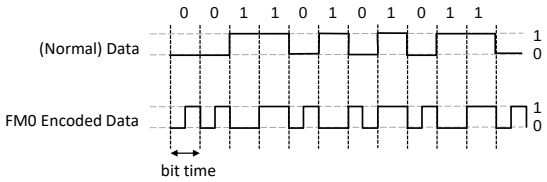


Figure 5 FM0 Coding

- Page: Service Endpoint Selection: It is point-to-point, so only select two end-points. The end-points are the optical serial ports of the 2-OLS IFMs connected to that External E1 link. Note: Within one 2-OLS IFM, [port 1 <-> port3] and [port 2 <-> port4] are always linked via a fixed local loopback including the conversion. E.g. It means that if port3 is used in the External E1 Link, port1 must be selected (and not port2) as end-point. Selecting ports can be done in two ways:
  - Via the table. The tree view can be expanded/collapsed via clicking the expand/collapse buttons. Just click the Selected checkbox to select the desired port;
  - Via clicking the node icons in the network drawing, see general example in §13;

NOTE: Per port, an extra Info field can be filled out later on via Network Hardware → Devices → Select Node/IFM/Port → Generic → Info.

- Page: (Tunnel Selection: No tunnel must be selected in this service setup. The Dragon PTN network will not be used. After this service setup, a special tunnel with tunnel type 'External' has been created automatically.)
- Page: Port Settings:
  - Short Haul Link: (refers to E1 ports on the 2-OLS IFM): Long E1 links (>200m, Long Haul) have more E1 signal attenuation than shorter E1 links (<200m, Short Haul). As a result, the E1 signal levels or sensitivity ('0' or '1') on the receiver side depend on the usage of Long Haul/Short Haul links. Check this parameter for Short Haul links and uncheck it (=default) for Long Haul links. This parameter can be set on port level in the IFM or at service creation.

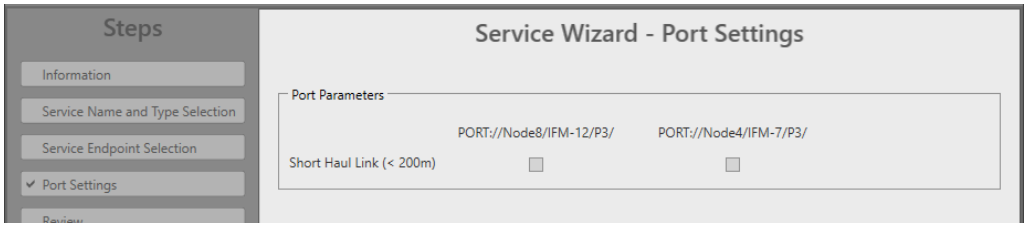


Figure 6 Port Settings: Short Haul

- Page: Review: The selected service ports will be shown: if ok, click Finish, the configuration load manager will be invoked.
- Page: Load: The configuration load manager is a tool that starts and monitors the load process of a HiProvision configuration. Click the Load button to load the new HiProvision configuration into the live network. See Ref. [2Mgt] in Table 2 for more info;

CAUTION: While the loading to the Dragon PTN network is in progress, do not turn off, shut down or restart the HiProvision Server or Agent, since this may cause database corruption and network problems!

- After this step, your customer applications connected to the front ports of the IFMs should be able to communicate.

2.2.2 Network Hardware → IFM Settings

After configuring the service via the service wizard, all IFM settings will be set according to the service configuration. Some individual IFM settings might need extra tuning or must be overruled. Find IFM settings via Network Hardware → Devices → 2-OLS.

a. Forced Power Mode

The powering of the 2-OLS IFM can be configured by the 'Forced Power Mode'. The setting of this parameter determines whether a CSM is required in the node for powering the 2-OLS IFM. Go to Network Hardware → Devices → 2-OLS → Specific → Forced Power Mode.

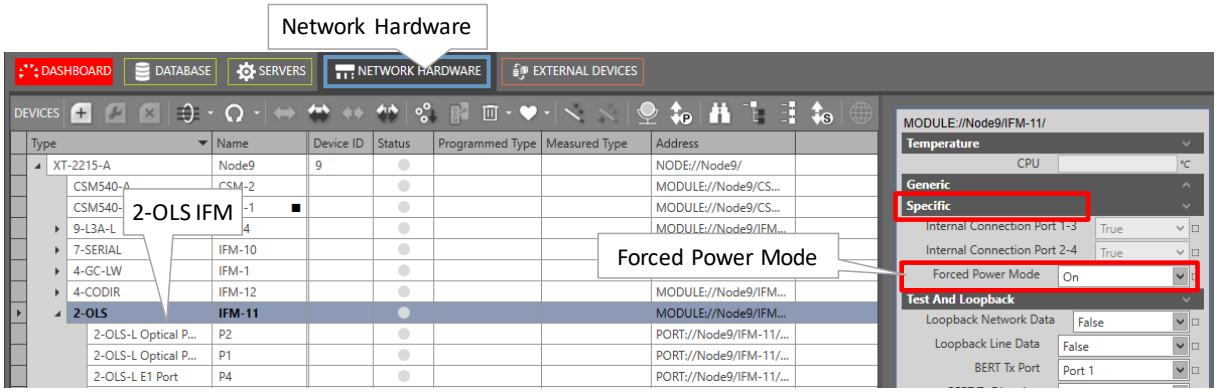


Figure 7 2-OLS IFM: Forced Power Mode

- Forced Power Mode:
  - On (=default): Once the 2-OLS IFM has been configured by the CSM, the CSM can be removed from the node if desired. After removing the CSM, the 2-OLS IFM remains powered and a configured Local Mode service on this IFM remains operational;
  - Off: the 2-OLS IFM always needs an operational CSM in the node for powering and for normal operation. After removing the CSM from the node, the 2-OLS IFM will be powered off automatically and goes out of service.
- Best Practice:
  - If a Local Mode service has been configured on the 2-OLS IFM and you want to remove the CSM from the node later on, set Forced Power Mode = 'On'. In any other case, set it to 'Off'.

2.2.3 Network Hardware → IFM-Port Settings

After configuring the service via the service wizard, all port settings of the endpoints in this service will be set according to the service configuration. Some individual port settings might need extra tuning or must be overruled. Go to Network Hardware → Devices → 2-OLS → (optical/E1) port.

a. Clock Source Settings

The ports of the 2-OLS IFM have by default the settings below which are OK if the IFM can slave to the external E1 network.

Within one 2-OLS IFM, the E1 ports will slave to the external network e.g. SDH (=Rx Clock). The optical serial ports uses the same clock as the clock on their associated E1 ports (=Through Timing). Port 1 is linked to Port3 and Port2 is linked to Port4;

- Clock Source:
  - Optical Serial Port1: Through Timing;
  - E1 Port3: Rx Clock;
  - Optical Serial Port2: Through Timing;
  - E1 Port4: Rx Clock;
- Apply your changes and load these changes into the Dragon PTN network.

2.3 Modify Service

After service creation, this service can be modified if needed via:

- Wizard: Dashboard → Configuration → Connections → Services → select service → ;
- Port settings, see §2.2.3;

2.4 Delete Service

After service creation, this service can be deleted if needed via:

- Dashboard → Configuration → Connections → Services → select service → ;

2.5 Troubleshooting: Test and Loopback

This service can be tested via loopback settings on IFM level and port level in the Network Hardware tab. See §14 for setting up loopbacks.

You also could use OLS testers, two 2-OLS IFMs and a direct E1 link between the 2 E1 ports (= exclude the external SDH network) to test your Local Mode. Configure the 'Clock Source' port settings as indicated in the figure. You could also play with the 'Link Enabled' port setting to enable/disable a link.

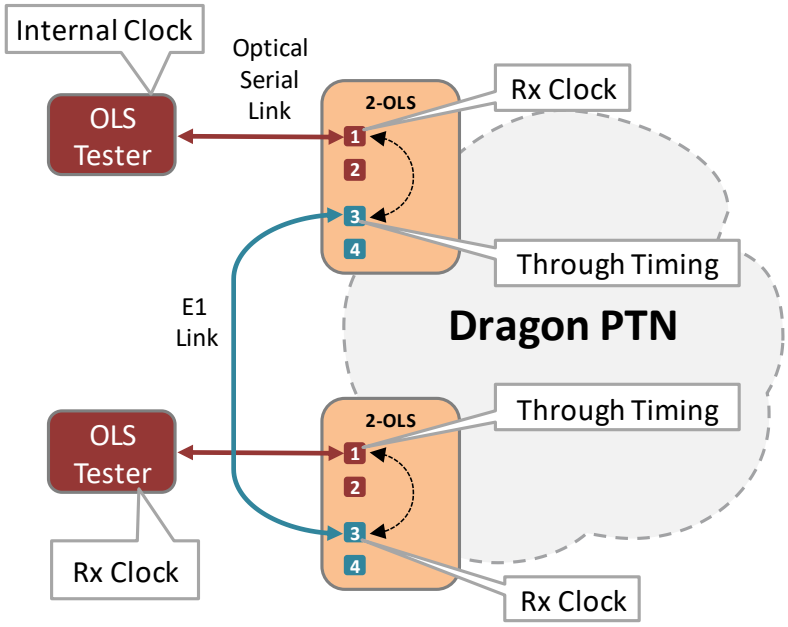


Figure 8 Local Mode: Troubleshooting and Testing

2.6 Monitoring

2.6.1 (Configuration) Network Hardware Tile

It can be verified if a local loopback or local mode is active on the IFM. Go to Dashboard → (Configuration) Network Hardware → Devices →IFM→ Specific → Internal Connection. If this parameter is 'True', a local loopback is active on your IFM.

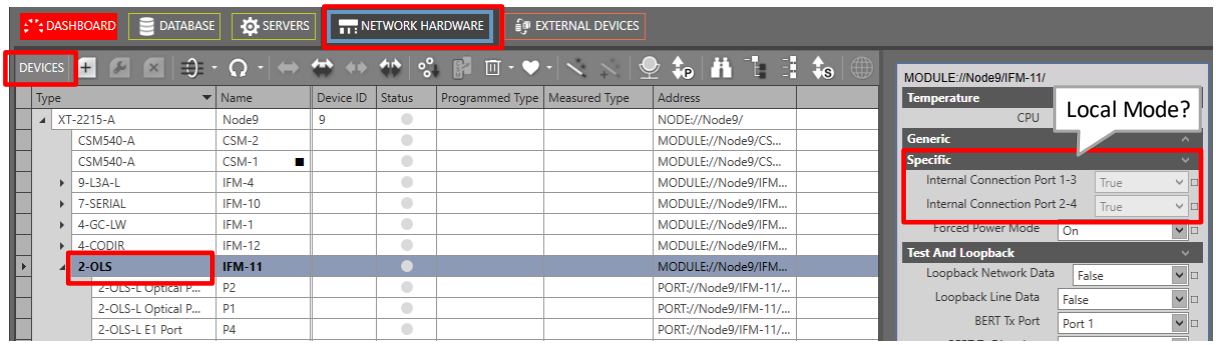


Figure 9 Local Mode Indication: Internal Connection

2.6.2 (Configuration) Connections Tile

What has been configured via the service wizard can also be viewed via Dashboard → Connections → Services → select service in the list. Some extra tabs (Service, Local Mode) with service configuration data will be shown.

CAUTION: The configuration that you see here is the service configuration done via the service wizard. Port settings could be tuned manually via §2.2.3 and as a result could be different from these service settings. Always verify these port settings, to know the exact port setting in the live network.

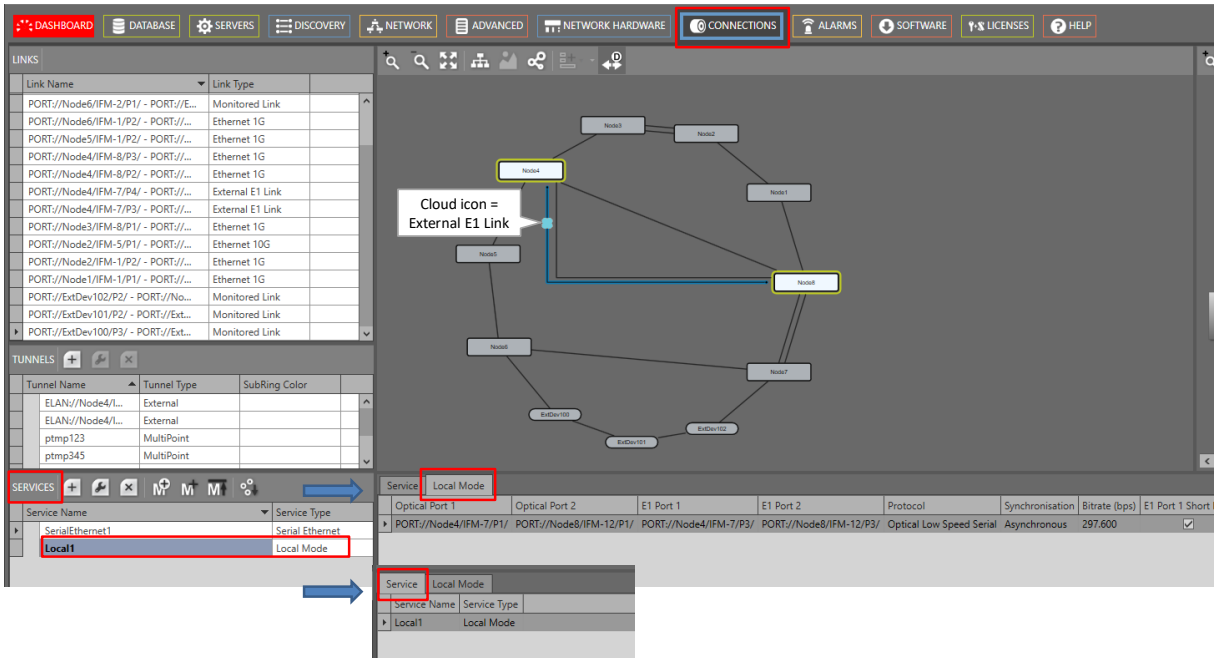


Figure 10 (Configuration) Connections Tile: Local Mode Service

2.6.3 (Monitoring) Network Tile

None.

2.6.4 Performance Counters

None. There are only counters available via Test and Loopback.

2.6.5 HiProvision Add-on: Generic Reporting Engine

Service and port reporting information is available via the Reporting Engine Add-on, see Ref.[24] in Table 2.

3. LOCAL MODE: C37.94

3.1 General

Supported IFMs: 2-C37.94: More information on this IFM in Ref. [6] in Table 2;

Local Mode at the source side means the conversion of incoming C37.94 signals into E1 signals, both at the front panel of the IFM. No IFM backplane or Dragon PTN network or Dragon PTN bandwidth is involved. The IFM just acts as a local C37.94 to E1 converter via an internal loopback. At the destination side, the conversion is just vice versa.

Prerequisite: make sure that you created links of type 'External E1 Link' (see figure below) between the two 2-C37.94 IFMs. These links can be created as via Dashboard → Network Hardware → Links → + → (Link type) 'External E1 Link'. More info in Ref. [2Net] in Table 2.

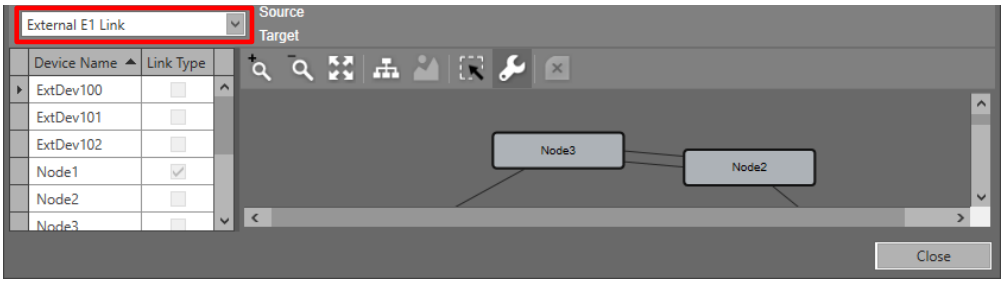


Figure 11 Create External E1 Link

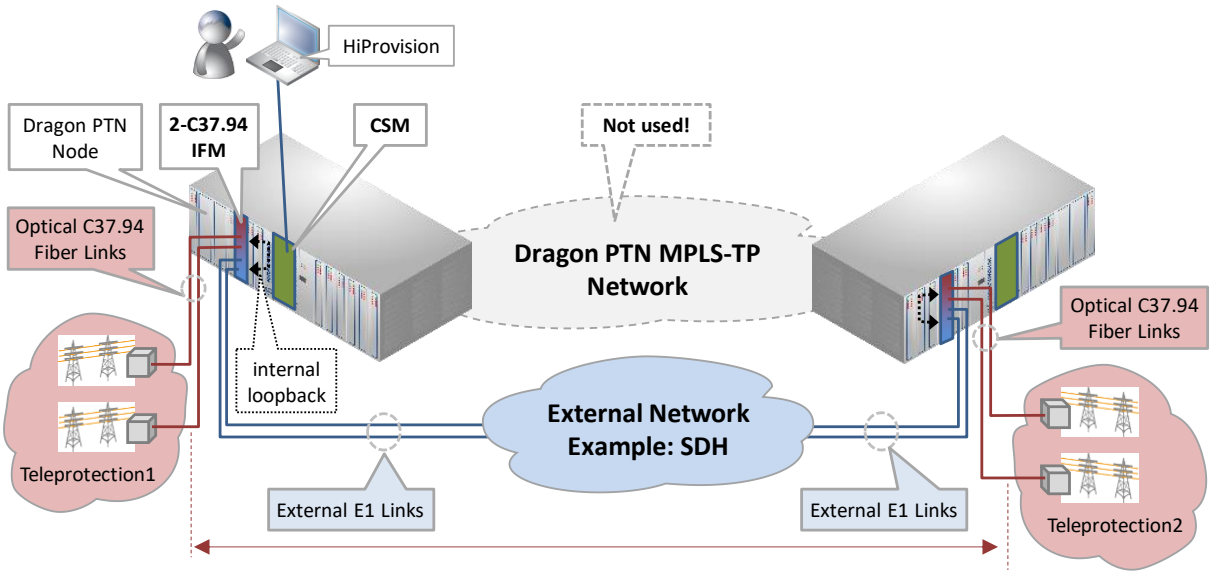


Figure 12 Local Mode: C37.94 via 2-C37.94 IFMs

3.2 Configure Service

3.2.1 Service Wizard

Click Dashboard → Configuration → Connections → Services → + to open the services wizard. See figure below.

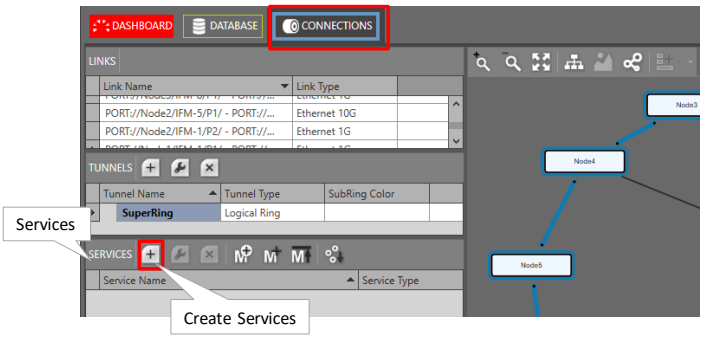


Figure 13 Create Services

The services wizard opens. The list below summarizes every page in the wizard:

- Page: Information: Click Next>>;
- Page: Service Name and Type Selection:
  - Service Name: enter a name for your service.
  - Service Type: Local Mode;

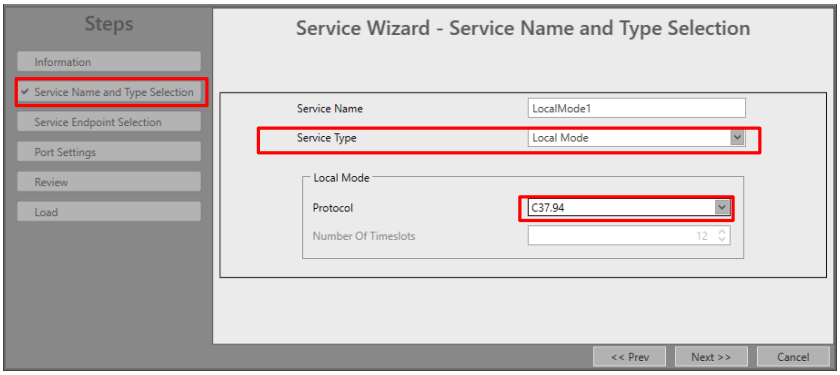


Figure 14 Service Type: Local Mode: C37.94

  - Protocol: C37.94:
  - Number of Timeslots: (=default, read-only). Not relevant.
- Page: Service Endpoint Selection: It is point-to-point, so only select two end-points. The end-points are the C37.94 ports of the 2-C37.94 IFMs connected to that External E1 link. Note: Within one 2-C37.94 IFM, [port 1 <-> port3] and [port 2 <-> port4] are always linked via a fixed local loopback including the conversion. E.g. It means that if port3 is used in the External E1 Link, port1 must be selected (and not port2) as end-point. Selecting ports can be done in two ways:
  - Via the table. The tree view can be expanded/collapsed via clicking the expand/collapse buttons. Just click the Selected checkbox to select the desired port;
  - Via clicking the node icons in the network drawing, see general example in §13;

NOTE: Per port, an extra Info field can be filled out later on via Network Hardware → Devices → Select Node/IFM/Port → Generic → Info.

- Page: (Tunnel Selection: No tunnel must be selected in this service setup. The Dragon PTN network will not be used. After this service setup, a special tunnel with tunnel type 'External' has been created automatically.)
- Page: Port Settings:
  - Short Haul Link: (refers to E1 ports on the 2-C37.94 IFM): Long E1 links (>200m, Long Haul) have more E1 signal attenuation than shorter E1 links (<200m, Short Haul). As a result, the E1 signal levels or sensitivity ('0' or '1') on the receiver side depend on the usage of Long Haul/Short Haul links. Check this parameter for Short Haul links and uncheck it (=default) for Long Haul links. This parameter can be set on port level in the IFM or at service creation.

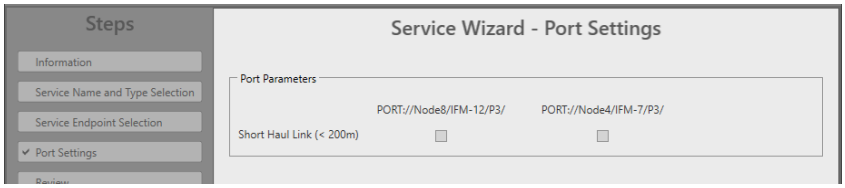


Figure 15 Port Settings: Short Haul

- Page: Review: The selected service ports will be shown: if ok, click Finish, the configuration load manager will be invoked.
- Page: Load: The configuration load manager is a tool that starts and monitors the load process of a HiProvision configuration. Click the Load button to load the new HiProvision configuration into the live network. See Ref. [2Mgt] in Table 2 for more info.

CAUTION: While the loading to the Dragon PTN network is in progress, do not turn off, shut down or restart the HiProvision Server or Agent, since this may cause database corruption and network problems!

- After this step, your customer applications connected to the front ports of the IFMs should be able to communicate.

3.2.2 Network Hardware → IFM Settings

None.

3.2.3 Network Hardware → IFM-Port Settings

After configuring the service via the service wizard, all port settings of the endpoints in this service will be set according to the service configuration. Some individual port settings might need extra tuning or must be overruled. Go to Network Hardware → Devices → 2-C37.94 → (C37.94/E1) port.

a. Clock Source Settings

The ports of the C37.94 IFM in Local Mode have by default the settings below which are OK if the IFM can slave to the external E1 network.

Within one 2- C37.94 IFM, the E1 ports will slave to the external network e.g. SDH (=Rx Clock). The C37.94 ports uses the same clock as their associated E1 ports (=Through Timing). Port 1 is linked to Port3 and Port2 is linked to Port4;

- Clock Source:
  - C37.94 Port1: Through Timing;
  - E1 Port3: Rx Clock;
  - C37.94 Port2: Through Timing;
  - E1 Port4: Rx Clock;
- Apply your changes and load these changes into the Dragon PTN network.

3.3 Modify Service

After service creation, this service can be modified if needed via:

- Wizard: Dashboard → Configuration → Connections → Services → select service → ;
- Port settings, see §3.2.3;

3.4 Delete Service

After service creation, this service can be deleted if needed via:

- Dashboard → Configuration → Connections → Services → select service → ;

3.5 Troubleshooting: Test and Loopback

This service can be tested via loopback settings on IFM level and port level in the Network Hardware tab. See §14 for setting up loopbacks. You could also use C37.94 testers, two 2-C37.94 IFMs and a direct E1 link between the 2 E1 ports (= exclude the external SDH network) to test your Local Mode. Configure the 'Clock Source' port settings as indicated in the figure. You could also play with the 'Link Enabled' port setting to enable/disable a link.

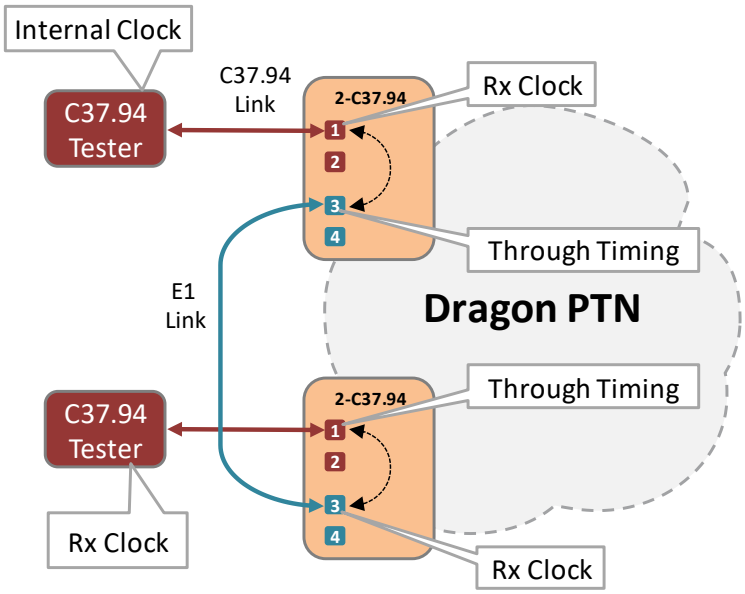


Figure 16 Local Mode: Troubleshooting and Testing

3.6 Monitoring

3.6.1 (Configuration) Network Hardware Tile

It can be verified if a local loopback or local mode is active on the IFM. Go to Dashboard → (Configuration) Network Hardware → Devices →IFM→ Specific → Internal Connection. If this parameter is 'True', a local loopback is active on your IFM.

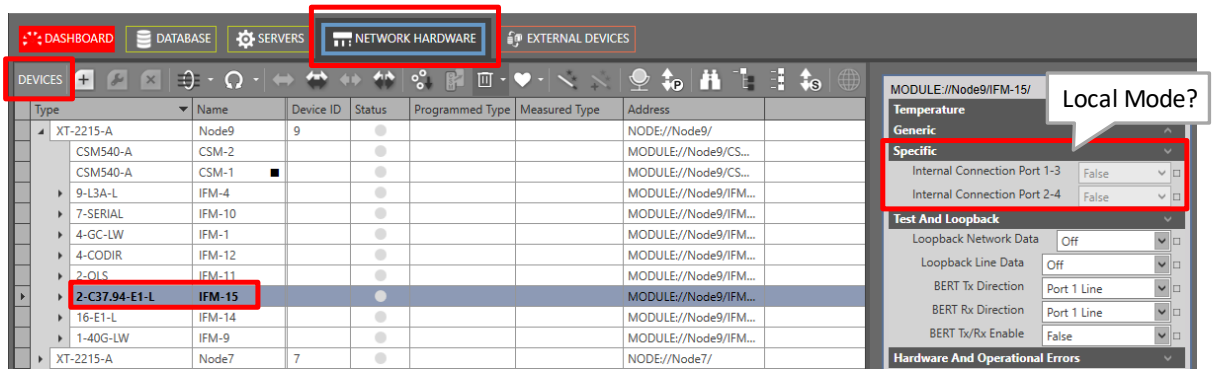


Figure 17 Local Mode Indication: Internal Connection

3.6.2 (Configuration) Connections Tile

What has been configured via the service wizard can also be viewed via Dashboard → Connections → Services → select service in the list. Some extra tabs (Service, Local Mode) with service configuration data will be shown.

CAUTION: The configuration that you see here is the service configuration done via the service wizard. Port settings could be tuned manually via §3.2.3 and as a result could be different from these service settings. Always verify these port settings, to know the exact port setting in the live network.

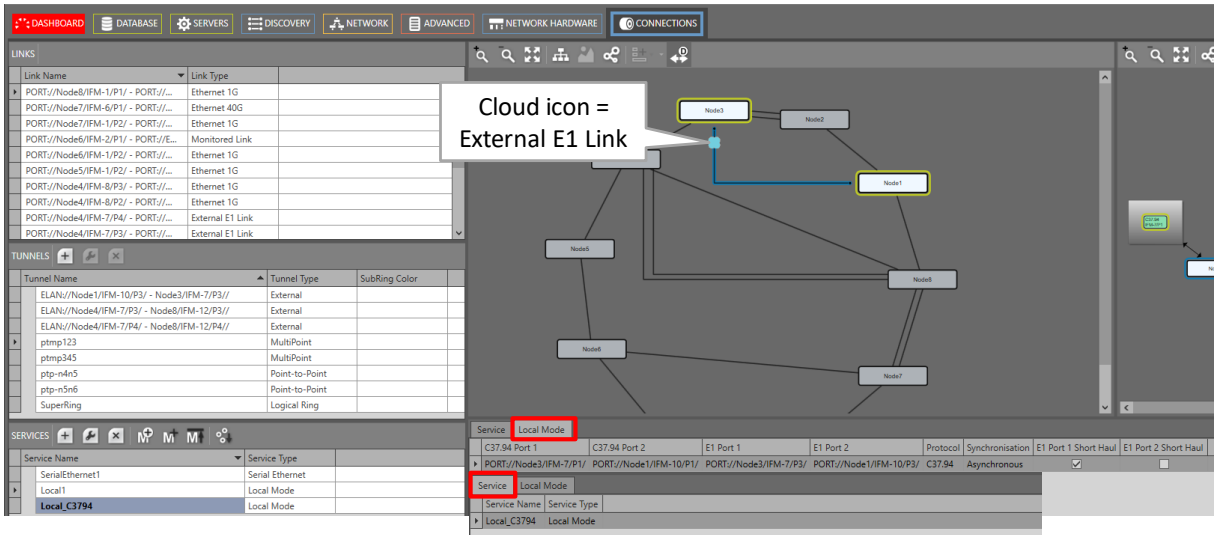


Figure 18 (Configuration) Connections Tile: Local Mode Service

3.6.3 (Monitoring) Network Tile

None.

3.6.4 Performance Counters

None. There are only counters available via Test and Loopback.

3.6.5 HiProvision Add-on: Generic Reporting Engine

Service and port reporting information is available via the Reporting Engine Add-on, see Ref.[24] in Table 2.

4. SERIAL ETHERNET

4.1 General

Supported IFMs: 7-SERIAL. More information on this IFM in Ref. [8] in Table 2.

7-SERIAL IFMs can use either 'Serial Ethernet' or 'Circuit Emulation → Serial' services. Depending on your needs and application, you can choose either one or the other. The table below compares both types. This chapter describes the Serial Ethernet, for a description of the Circuit Emulation → Serial service, see §5.

Table 3 7-SERIAL: Compare 'Serial Ethernet' ←→ Circuit Emulation

Parameter	Serial Ethernet	Circuit Emulation → Serial
Interface Types	RS232, RS422, RS485	RS232, RS422, RS485, X.21, V.35
Front ports	All 7 ports supported	Port support depends on the used interface type, see Figure 20
Hitless Switching	No	Yes
Data bits, parity, speed, …	Must be configured exactly	Easier configuration
Synchronization	Asynchronous only	Both Synchronous and Asynchronous
Clocking	No	Yes
Point-to-Point	Yes	Yes
Multidrop or Point-to-MultiPoint (master/slave)	Yes	No
Bandwidth Usage	Less	More
Control signals (RTS, CTS, …)	Only transmitted if data is transmitted	Always transmitted
Best Practice: Try to use Circuit Emulation for Point-to-Point and Serial Ethernet for Multi-drop services.		

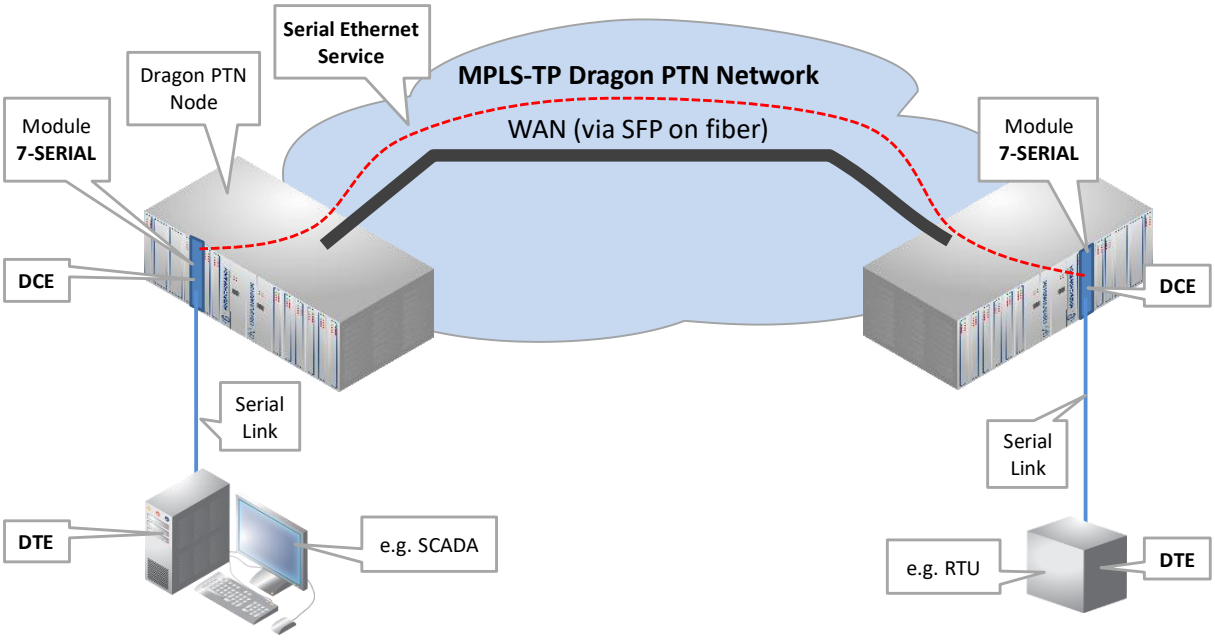


Figure 19 Serial Ethernet Service

	RS232			RS422			RS485		X.21		V.35	
	Async (Serial Ethernet)	Async (CES)	Sync (CES)	Async (Serial Ethernet)	Async (CES)	Sync (CES)	Async (Serial Ethernet)	Async (CES)	Optimised (CES)	Full (CES)	Optimised (CES)	Full (CES)
P1	✓	✓	✓	✓	✓	spare	✓	✓	✓	spare	✓	spare
P2	✓	✓	✓	✓	✓	✓ combi	✓	✓	✓	✓ combi	✓	✓ combi
P3	✓	spare	spare	✓	spare		✓	spare	spare		spare	
P4	✓	✓	✓	✓	✓	✓ combi	✓	✓	✓	✓ combi	✓	✓ combi
P5	✓	spare	spare	✓	spare		✓	spare	spare		spare	
P6	✓	✓	✓	✓	✓	✓ combi	✓	✓	✓	✓ combi	✓	✓ combi
P7	✓	spare	spare	✓	spare		✓	spare	spare		spare	

Figure 20 7-SERIAL Service Matrix

4.2 Configure Service

4.2.1 Service Wizard

a. Wizard Steps

Click Dashboard → Configuration → Connections → Services → + to open the services wizard. See figure below.

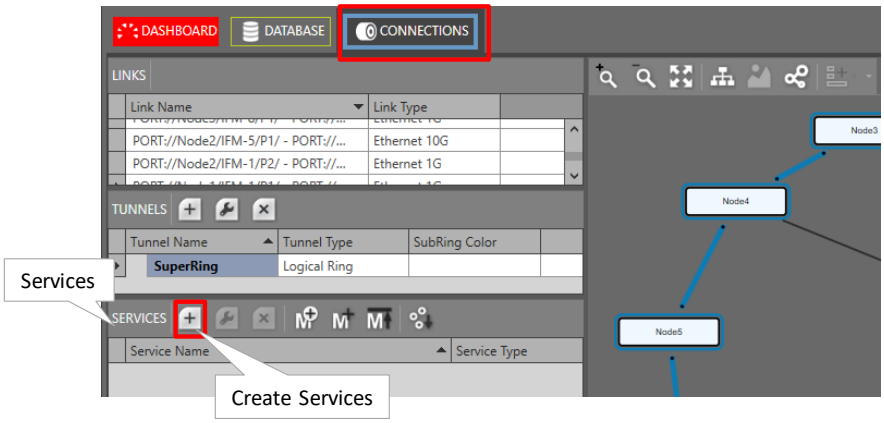


Figure 21 Create Services

The services wizard opens. The list below summarizes every page in the wizard:

- Page: Information: Click Next>>;
- Page: Service Name and Type Selection:
  - Service Name: enter a name for your service.
  - Service Type: Serial Ethernet;

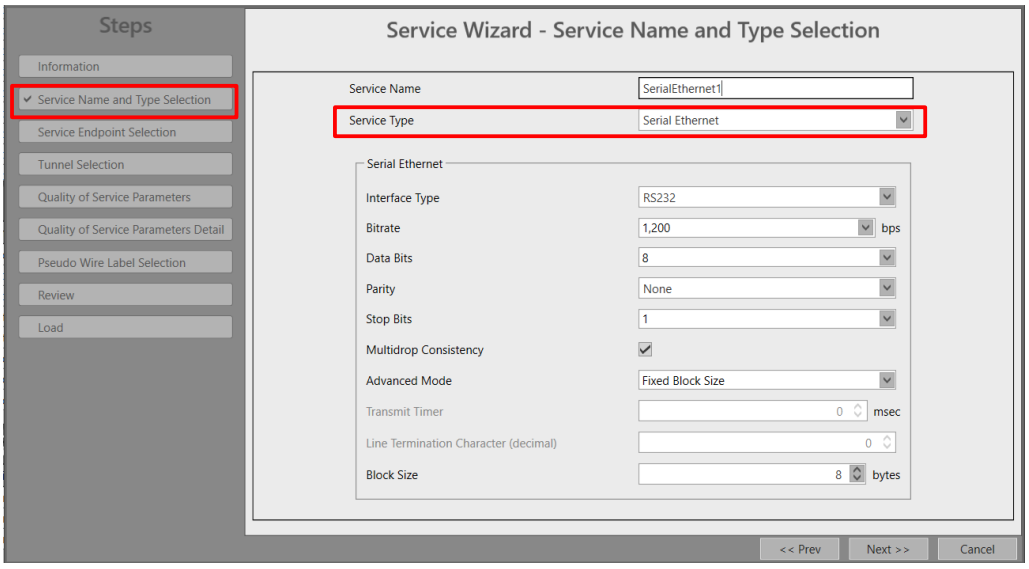


Figure 22 Service Type: Serial Ethernet

  - Interface Type: RS232 (=default) /RS422/RS485;
  - Bitrate: see overview in §8;
  - Data Bits: Amount of data bits: 6,7,8 (=default);
  - Parity: None (=default), Odd, Even, Mark, Space;
  - Stop Bits: Amount of stop bits: 1 (=default), 2;
  - Multidrop Consistency: is a polling mechanism between the master(s) port(s) and the slave ports to check whether the slaves are still alive (more info in §b).
    - Unchecked: polling disabled;
    - Checked (=default): polling enabled.

- Advanced Mode (see §c): Fixed Block Size; Fixed Transmit Timer; Delimiter Line Termination Character; Delimiter Timeout;

- Page: Service Endpoint Selection: Select the front ports on the involved IFMs that must be part of this service. Make sure to select the ports in nodes that are linked to a same tunnel. Selecting ports can be done in two ways:
  - Via the table. The tree view can be expanded/collapsed via clicking the expand/collapse buttons. Just click the Selected checkbox to select the desired port;
  - Via clicking the node icons in the network drawing, see general example in §13;

  NOTE: Per port, an extra Info field can be filled out later on via Network Hardware → Devices → Select Node/IFM/Port → Generic → Info.

  - A node can have a maximum of 32767 MAC addresses. By default, per new Serial Ethernet service, 256 MAC addresses will be added to each LER node of the tunnel in which the service resides (not for point-to-point tunnels). If the maximum number of MAC addresses on a node has been reached, an error warning will pop up. After this warning, you will have to decrease the number of MAC addresses in this node from the other services first via clicking the MAC limit button  (see Ref. [2Eth] in Table 2 for more info). See the figure below:

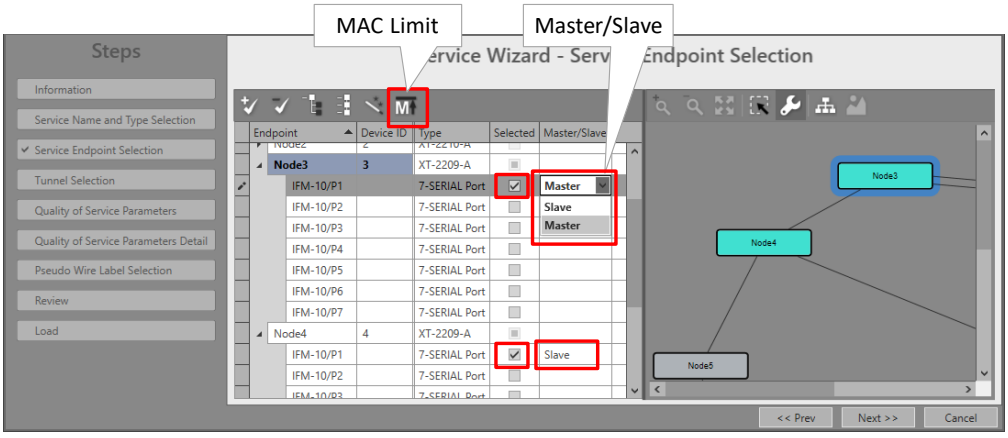


Figure 23 Serial Ethernet: MAC Limit, Master/Slave

- Master/Slave:
  - In this service, at least one master (maximum two masters) and one or more slaves (maximum 156 slaves) must be selected. By default, the end-point is set as Slave but can be changed to Master by clicking the Master/Slave cell of the desired end-point and selecting Master, see figure above. In some network drawings the Master will be indicated by the  icon.
  - When two masters are selected, one of them will be the active one and the other one will be the backup master. Which one is the active/backup master will be decided by the serial protocol itself.
  - The (active) master will initiate commands or requests to their slaves. The backup master and all the slaves will see this request. Only the addressed slave will process the request and send a response back to the (active) master. The backup master and all the other slaves will see the slave response.

- Only the (active) master will process the slave response. The backup master (if any) will be synchronized with the active master and will take over when the active master gets out of service.

- Page: Tunnel Selection: Allowed tunnels for this service type: point-to-multipoint, logical ring. See §11 to select the desired tunnel;
- Page: Quality of Service Parameters: QoS (=Quality of Service) is a service traffic handling process in order to provide sufficient service delivery and bandwidth for critical applications. HiProvision provides a few QoS mechanisms, based on the parameters below.
  - Priority (range [0..5], default = 4): priority that will be assigned internally in the Dragon PTN node. 0 indicates the lowest priority (=least important). In the Dragon PTN network, higher priority traffic will be processed before lower priority traffic so that high priority traffic will not be compromised.
  - Frame Size: The 7-SERIAL IFMs convert their incoming signals from the LAN side into Ethernet packets towards the CSM. The Frame Size is the size of these Ethernet packets. The better you know the traffic (and its frame sizes) in your network, the better you can tune the consumed bandwidth on the WAN side. The Frame Size indicates the Ethernet frame size = payload + Ethernet overhead.
    - Frame Size is read-only;
    - Frame Sized depends on settings in Page: Service Name and Type Selection;

Figure 24 Wizard: Serial Ethernet: Quality of Service Parameters

- Page: Quality of Service Parameters Detail: see §12. Leave this page as it is, defaults are OK;
- Page: Pseudo Wire Label Selection: leave this page as it is, defaults are OK;
- Page: Review: The selected service ports will be shown: if ok, click Finish, the configuration load manager will be invoked.
- Page: Load: The configuration load manager is a tool that starts and monitors the load process of a HiProvision configuration. Click the Load button to load the new HiProvision configuration into the live network. See Ref. [2Mgt] in Table 2 for more info.

CAUTION: While the loading to the Dragon PTN network is in progress, do not turn off, shut down or restart the HiProvision Server or Agent, since this may cause database corruption and network problems!

- After this step, your customer applications connected to the front ports of the IFMs should be able to communicate over the Dragon PTN network.

b. Multidrop Consistency

Multidrop Consistency is a polling mechanism, within a Serial Ethernet service, between the master(s) port(s) and the slave ports to check whether the slaves are still alive. The master IFM is the IFM connected to the master application, the slave IFM is the IFM connected to the slave application. Each slave will see the poll requests to other slaves as well, but only answers the poll request addressed to itself.

- Checked (=default): the polling occurs every 500 ms. If a polling error occurs, the necessary alarms will be raised. If there are two masters, both masters poll independently of each other;
- Unchecked: no polling occurs at all. No alarm will be raised or nothing will be reported in HiProvision when a slave is missing.

Polling results can be monitored, see §4.6.5.

c. Advanced Mode – Bandwidth/Delay Optimization

At service creation, fine-tuning the bandwidth and delay through the network is done via the Advanced Mode parameter. It allows to group payload data into bigger packets, allowing more bandwidth efficiency (= resulting in less bandwidth). But grouping the payload into bigger packets costs more time, resulting in more delay.

Serial data is collected at the front ports and the payload data bits are buffered until one of the Advanced Mode events below is triggered. After the trigger, the payload data is packetized and sent over the Dragon PTN network.

- Advanced Mode:
  - Number of payload data bytes (=block) received at the front (Fixed Block size);
  - Periodic transmit timer expires (Fixed Transmit Timer);
  - Detection of a line termination character (Delimiter Line Termination Character);
  - Timeout occurs after the last received byte (Delimiter Timeout).

Each mode is explained more in detail below:

- Fixed Block Size (=default): Whenever ‘N’ payload data bytes are received at the front port, a packet including ‘N’ bytes will be sent through the Dragon PTN network. Configure ‘N’ in the Block Size field (default=8 bytes, range[1..1000] bytes). If ‘N’ is never received, the packet will be sent anyway after a specific timeout based on ‘N’ and the bitrate. A small ‘N’ results in an inefficient bandwidth but a low delay and vice versa.
- Fixed Transmit Timer: Configure the Transmit Timer (default = 10 ms, range [0-10000] ms). This timer is started whenever a serial data message enters a front port of the

7-SERIAL IFM. When the timer expires, a packet is transmitted through the Dragon PTN network and the timer is started again. This periodical process is repeated until the entire serial data message has been transmitted. The timer will only be started again when a new serial data message enters the 7-SERIAL IFM.

- Delimiter Line Termination (=LT) Character: Whenever an LT character is received at the front port, a packet will be sent through the Dragon PTN network. Configure the decimal ASCII value in the 'Line Termination Character (decimal)' field. The LT character will be sent as well. E.g. two common LT characters are Line Feed ('\n' = ASCII decimal 10) and Carriage Return ('\r' = ASCII decimal 13). Also fill out the Minimum Message Size (default=8 bytes, range[1..1000] bytes), needed to calculate the required bandwidth. Attention: filling out a higher (incorrect) minimal value than the real minimum could cause data loss.
- Delimiter Timeout: Whenever a Timeout occurs after the last received byte at the front port, a packet will be sent through the Dragon PTN network. Configure the Timeout (default = 100000 µs, range [0-100000] µs). Also fill out the Minimum Message Size (default= 8 bytes, range[1..1000] bytes), needed to calculate the required bandwidth. Attention: filling out a higher (incorrect) minimal value than the real minimum could cause data loss.

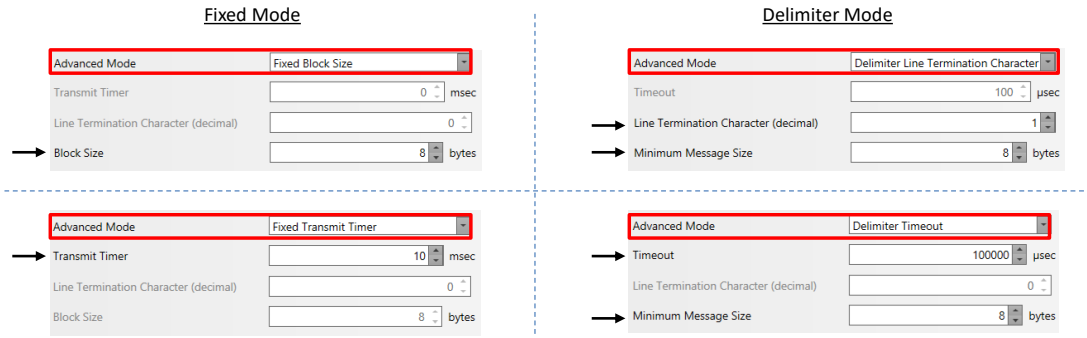


Figure 25 Serial Ethernet: Advanced Mode - Bandwidth Optimization

4.2.2 Network Hardware → IFM Settings

No extra settings must be done.

4.2.3 Network Hardware → IFM-Port Settings

After configuring the service via the service wizard, all port settings of the endpoints in this service will be set according to the service configuration. Some individual port settings might need extra tuning or must be overruled (e.g. DCE or DTE behaviour, or other settings…) via:

- Network Hardware → Devices → 7-SERIAL → 7-SERIAL Port:
  - Serial Ethernet Port Settings: values configured via the Serial Ethernet service wizard are visible, and can be overwritten manually if desired;
  - Generic Port Properties: Fill out these properties depending the use case you have. More information on these properties can be found in Ref. [8] in Table 2.
- Apply your changes and load these changes into the Dragon PTN network.

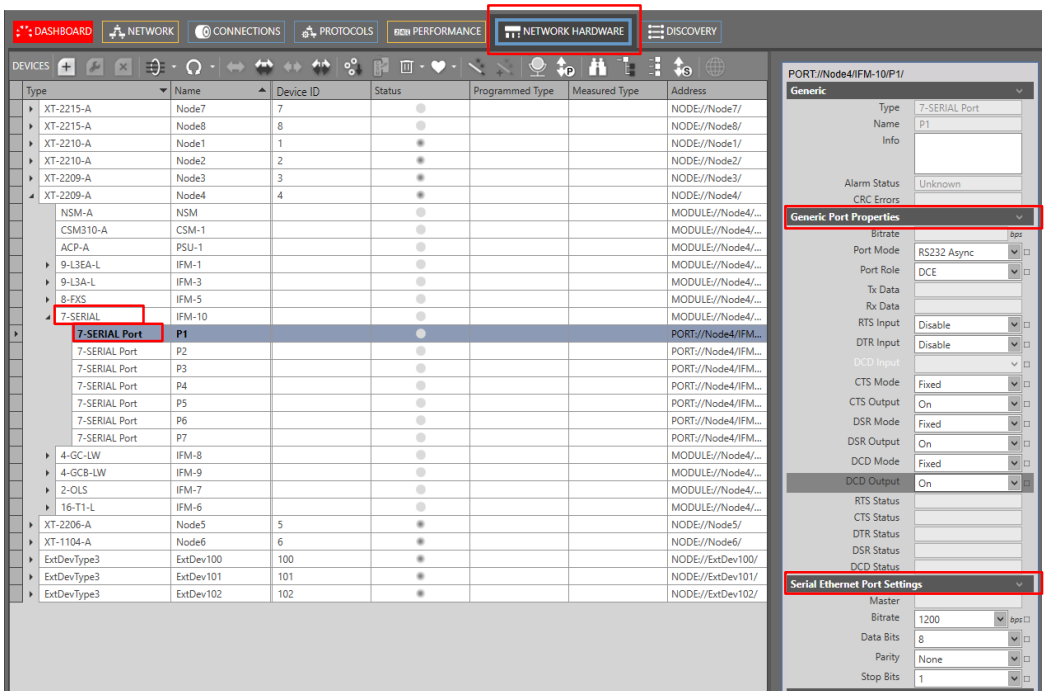


Figure 26 7-SERIAL Port Settings

4.3 Modify Service

After service creation, this service can be modified if needed via:

- Wizard: Dashboard → Configuration → Connections → Services → select service → ;
- Port settings, see §4.2.3;

4.4 Delete Service

After service creation, this service can be deleted if needed via Dashboard → Configuration → Connections → Services → select service → ;

4.5 Troubleshooting: Test and Loopback

This service can be tested via loopback settings on IFM level and port level in the Network Hardware tab. See §14 for setting up loopbacks.

4.6 Monitoring

4.6.1 (Configuration) Network Hardware Tile

None.

4.6.2 (Configuration) Connections Tile

What has been configured via the service wizard can also be viewed via Dashboard → Connections → Services → select service in the list. Some extra tabs (Service, Serial Ethernet) with service configuration data will be shown.

CAUTION: The configuration that you see here is the service configuration done via the service wizard. Port settings could be tuned manually via §4.2.3 and as a result could be different from these service settings. Always verify the port settings in §4.2.3 as well, to know the exact port setting in the live network.

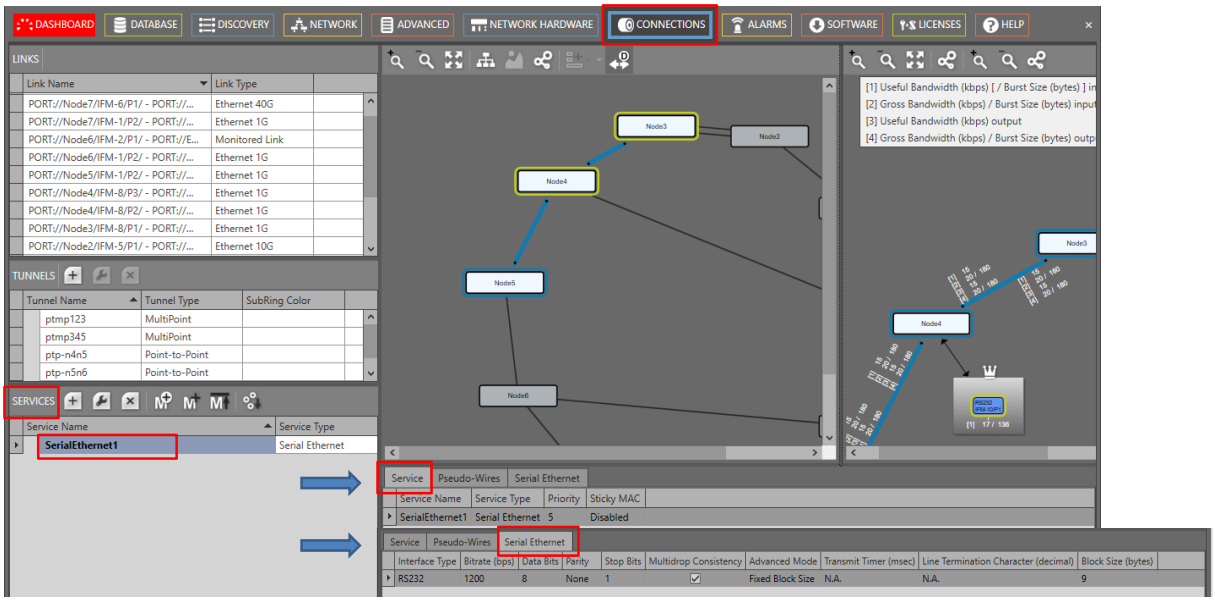


Figure 27 (Configuration) Connections Tile: Serial Ethernet

4.6.3 (Monitoring) Network Tile

Live service data can be monitored via the Dashboard → Network → Services → select service in the list. The service will be shown in the network drawing. Click  to show extra monitoring properties for this service. Click  to show the used nodes/links/tunnels.

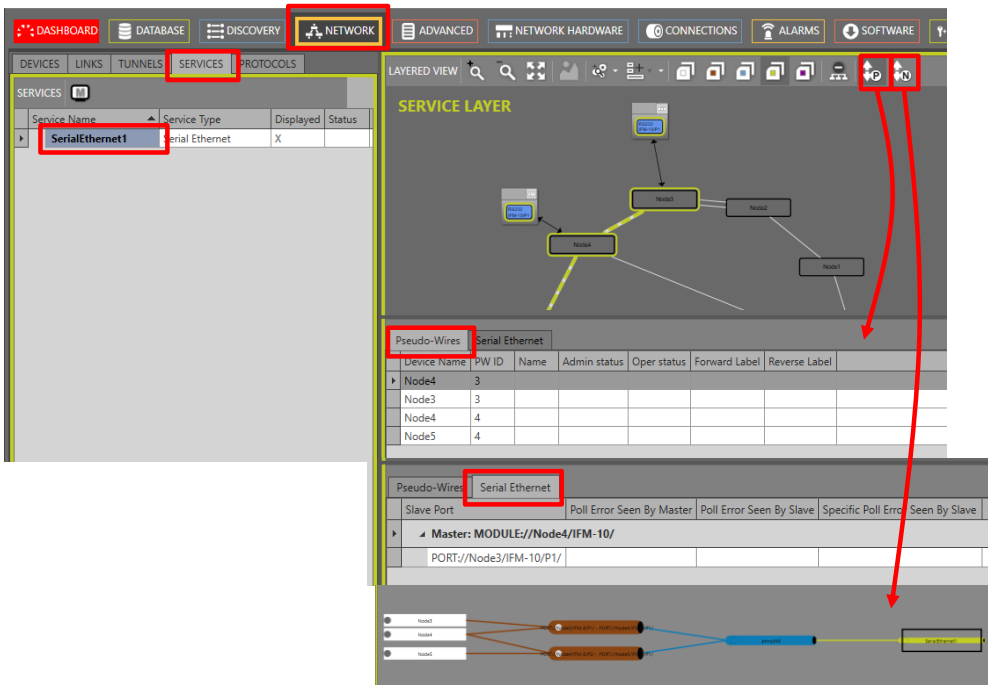


Figure 28 (Monitoring) Network Tile: Serial Ethernet

4.6.4 Performance Counters

Go to Dashboard → (Monitoring) Performance → Counter Control → Service Performance → Serial Ethernet Monitoring. See figure below.

A detailed and similar monitoring set-up description (adding counters to graphs etc…) can be found in 'Port Performance' → 'CSM Ethernet Port Monitoring' in Ref. [2Net] in Table 2.

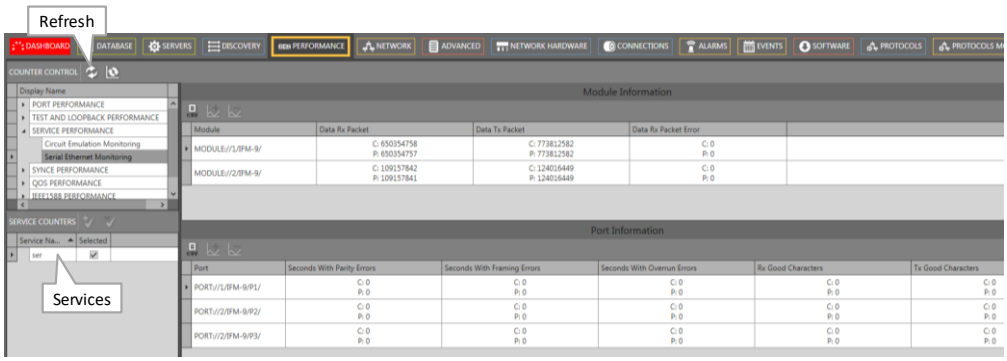


Figure 29 Performance Counters: Serial Ethernet Monitoring

Table 4 Services: Serial Ethernet Monitoring 'Module' Fields

Field	Values	Description
Module	value	Monitored module
Data Rx Packet (ingress)	packets	The number of received data packets.
Data Tx Packet (egress)	packets	The number of transmitted data packets.
Data Rx Packet Error (ingress)	packets	The number of received erroneous data packets. The packets had for example a CRC error.
Note: Click the Refresh button for the latest results; 'C' value in cell = current value; 'P' value in cell = previous value;		

Table 5 Services: Serial Ethernet Monitoring 'Port' Fields

Field	Values	Description
Port	value	Monitored port
Seconds With Parity Errors (ingress)	seconds	increasing = NOT OK: The total amount in seconds that frames with parity errors were received
Seconds With Framing Errors (ingress)	seconds	increasing = NOT OK: The total amount in seconds that frames with framing errors were received
Seconds With Overrun Errors (ingress)	seconds	increasing = NOT OK: The total amount in seconds that buffer overrun errors occurred
Rx Good Characters (ingress)	characters	The number of valid or good received characters. A good character contains 8 bits and has no errors in it. Character validation is based on start/stop/parity bits.
Tx Good Characters (egress)	characters	The number of valid or good transmitted characters. A good character contains 8 bits and has no errors in it. Character validation is based on start/stop/parity bits.
Note: Click the Refresh button for the latest results; **Note**: Clear the counter values by disabling and enabling the BERT via the IFM/port settings in the network hardware tile; **Note**: 'C' value in cell = current value; 'P' value in cell = previous value;		

4.6.5 Multidrop Consistency

The following poll results are reported per master and per slave in HiProvision and visible via the Dashboard → Network → Services → Click Service in the list → Click Serial Ethernet tab. The polling results can be updated via the refresh button .

- Poll Error Seen by Master:
  - False: Everything OK, slave IFM has answered the poll request of the master IFM;
  - True: Failure, slave IFM has not answered the poll request of the master IFM;
- Poll Error Seen by Slave:
  - False: Everything OK, the slave IFM receives all the poll requests to other slaves as well;
  - True: Failure, the slave IFM does not receive at least one of the poll requests addressed to other slaves;
- Specific Poll Error Seen by Slave:
  - False: Everything OK, slave IFM has received a poll request of the master IFM;
  - True: Failure, slave IFM has not received the poll request of the master IFM;

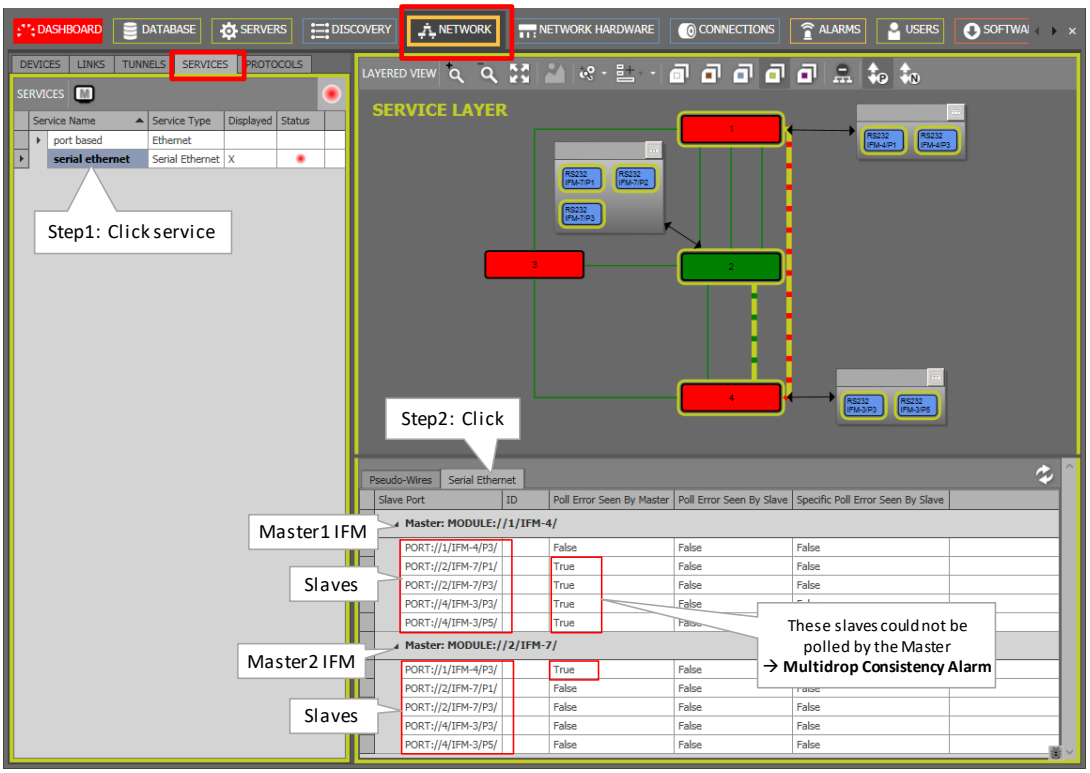


Figure 30 Monitoring: Multidrop Consistency: Polling Results

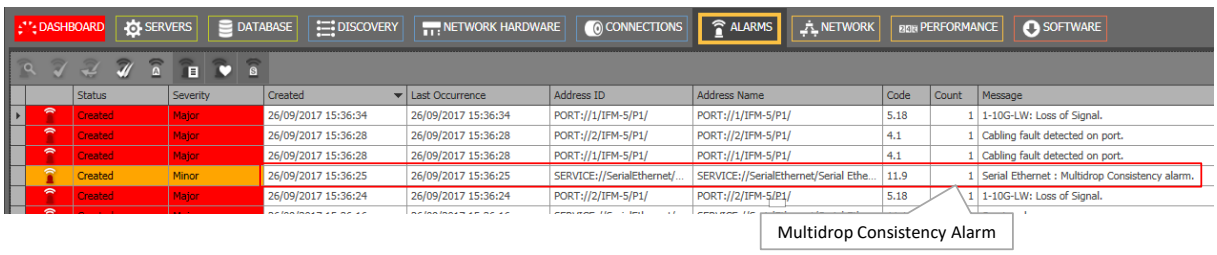


Figure 31 Multidrop Consistency Alarm

4.6.6 HiProvision Add-on: Generic Reporting Engine

Service and port reporting information is available via the Reporting Engine Add-on, see Ref.[24] in Table 2.

4.6.7 MAC Monitor

The MAC Monitor will show the MAC address table of the selected Node (=CSM). This table includes all MAC addresses used on this device except for the MAC addresses that are used in a point-to-point tunnel. More information can be found in Ref. [2Eth] in Table 2.

MAC Monitor via: Dashboard → (Monitoring) Network → Services →  ;

5. CIRCUIT EMULATION

5.1 General

A Circuit Emulation service (=CES) is a point-to-point packetized TDM service. The following CES types are available:

- SAToP (=Structured Agnostic TDM over Packet) → transport all channels transparently;
- CESoPSN (=CES over Packet Switched Network) → customized channel transport;
- Differential Clocking / Hitless Switching / Single Path;

The following protocols are supported:

- E1 / T1 / C37.94 / Serial / 2W/4W Voice / CODIR / Optical Low Speed Serial.

The involved IFMs convert the legacy data from the legacy links into MPLS-TP packets over the Dragon PTN network, and vice versa. The destination IFM must also compensate for possible jitter and network delays to keep everything synchronized, e.g. via SyncE. The example figure below shows a E1/T1 example but is similar for other protocols.

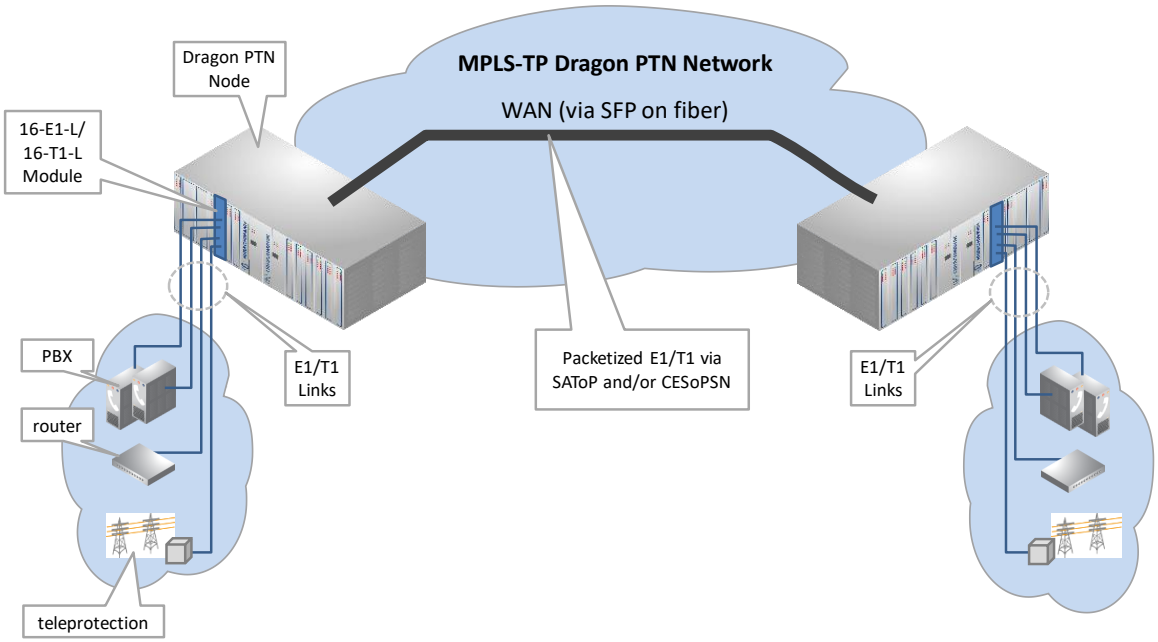


Figure 32 1 General Circuit Emulation Example with E1/T1

5.2 Configure Service

5.2.1 Service Wizard

Click Dashboard → Configuration → Connections → Services → + to open the services wizard. See figure below.

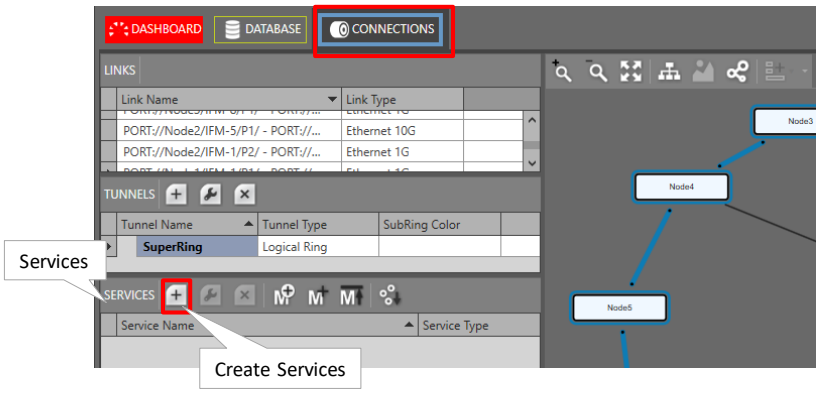


Figure 33 Create Services

The services wizard opens. The list below summarizes every page in the wizard:

Note: The referred IFM manuals in Table 2 often show a lot more info and pictures on the mentionned parameters and settings below. Read the manual of involved IFMs as well!

- Page: Information: Click Next>>;
- Page: Service Name and Type Selection: Example screen below with E1. An overview of all screens of this page per protocol, can be found in the table below.

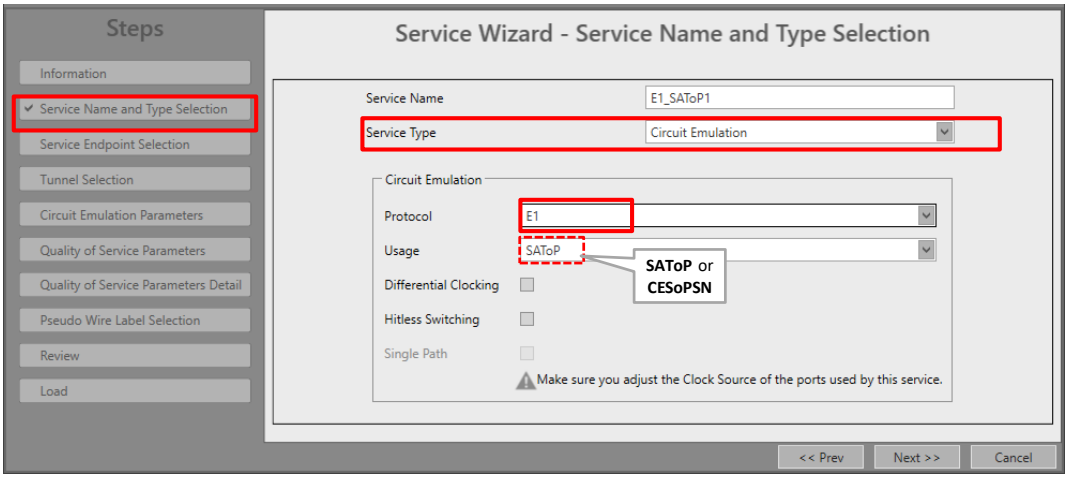


Figure 34 Service Type: Circuit Emulation Example Screen with E1 – SAToP

- Service Name: enter a name for your service.
- Service Type: Circuit Emulation;
- Protocol: E1 / T1 / C37.94 / Serial / 2W/4W Voice / CODIR / Optical Low Speed Serial. The table below shows each protocol screen. The second table shows a summarized overview and needed parameters in this page per protocol.

Table 6 Service Name and Type Selection: Protocol Screens Overview

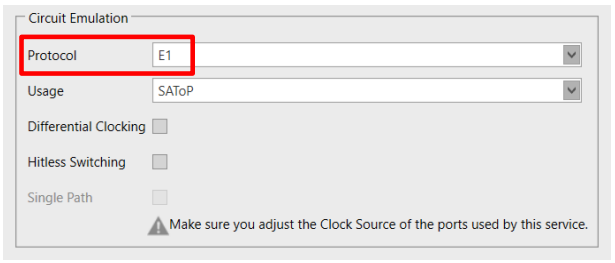
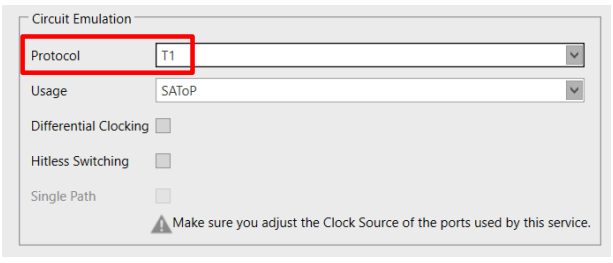
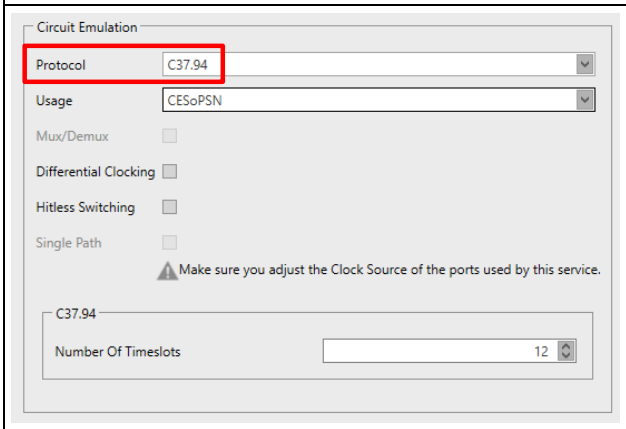
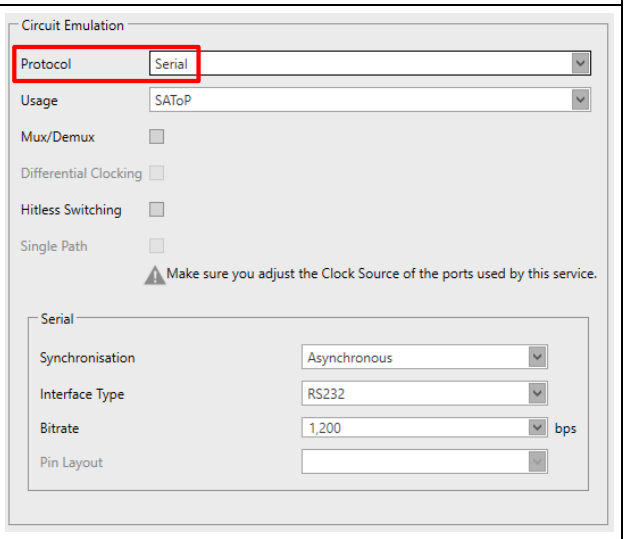
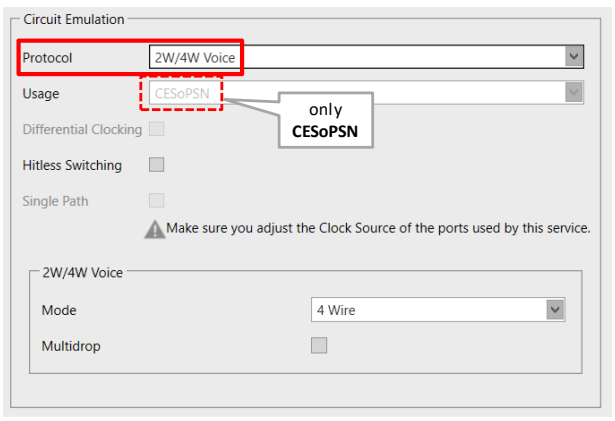
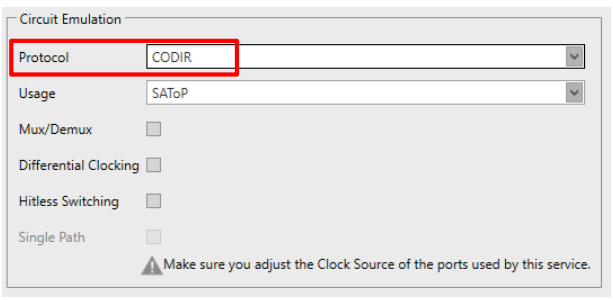
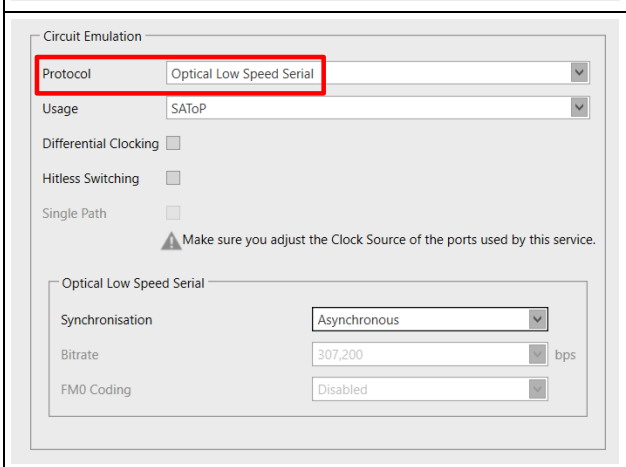
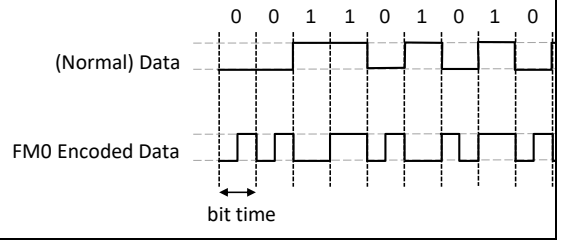
Service Name and Type Selection Screen	Service Name and Type Selection Screen
	
	
	
	

Table 7 Service Name and Type Selection: Protocol Overview

Protocol	Supported IFMs (Refs. in Table 2)	Supported Ports	Usage: SAToP	Usage: CESoPSN	Mux/ Demux (SAToP)	Diff. Clocking	Hitless Switching (+Single Path)	Specific Parameters
E1	2-OLS, 2-C37.94, 4-E1-L/4-T1-L, 16-E1-L/16-T1-L	E1	✓	✓	---	✓	✓	Page: Circuit Emulation Parameters: Short Haul on E1 Ports
T1	2-OLS, 2-C37.94, 4-E1-L/4-T1-L, 16-E1-L/16-T1-L	T1	✓	✓	---	✓	✓	Page: Circuit Emulation Parameters: Short Haul on T1 Ports
C37.94	2-OLS, 2-C37.94, 4-E1-L/4-T1-L, 16-E1-L/16-T1-L	C37.94, E1, T1 (at least one C37.94 port needed)	✓	✓	✓	✓	✓	Number of Timeslots: for CESoPSN, the number of timeslots that must be transported can be selected. Circuit Emulation Parameters: Short Haul on E1/T1 Ports
Serial	7-SERIAL	7-SERIAL	✓	✓	✓	---	✓	- Synchronisation: Synchronous / Asynchronous - Interface Type: RS232, RS422, RS485 (Async.), X.21(Sync.), V.35 (Sync.) - Bitrate: see §8 - Pin Layout (for X.21, V.35): Full, Optimized. Full means that all signals are used, Optimized means that a reduced set of the signals is used → See Ref.[8] for more info.
2W/4W Voice (See also §6)	4-2/4WEM	4-2/4WEM	---	✓	---	---	✓	- 2W/4W Mode: transportation mode 2W or 4W mode selector. - Multidrop: check if you want to use multidrop (=combining several PTP services with the same master), unchecked means one PTP service. Page: Service EndPoint Selection (See also §6): - Master/Slave: if multidrop is used, one port must be indicated as master.

Protocol	Supported IFMs (Refs. in Table 2)	Supported Ports	Usage: SAToP	Usage: CESoPSN	Mux/ Demux (SAToP)	Diff. Clocking	Hitless Switching (+Single Path)	Specific Parameters
								- Echo On Master: allows inter-slave communication when using multidrop. - Send Condition: condition when to send Voice data, E&M is always sent.
CODIR	CODIR	CODIR	✓	✓	✓	✓	✓	---
Optical Low Speed Serial	2-OLS	2-OLS	✓	✓	---	✓	✓	- Synchronisation: Synchronous / Asynchronous - Bitrate: see §8 - FM0 Coding (in Sync. mode): Disabled (=default): Normal data (without encoding) is used; Enabled: FM0 encoded data is used. With FM0 Coding enabled, a 0-bit (='space') will always have an extra transition halfway its bit time (=2 phases = biphase) whereas a 1-bit will have no transition within its bit time. 

- Usage:
  - SAToP (=default): one-to-one mapping of timeslots, protocol data is transported transparently. Use this type when a constant 'Differential Delay' is important for your application;
  - CESoPSN: customized mapping of timeslots, only transmit used timeslots with real payload;
- Mux/Demux (only for SAToP): mux/demux multiple services to/from a single E1 port.
  - unchecked (=default): Not possible to mux this service with other services to one E1 port.
  - checked: Possible to mux/demux this service with other services to/from an E1 port. These muxed/demuxed services can either have the same or a different protocol. E.g. Codir, Serial and C37.94 frames can be muxed together to that E1 port1.
    - The muxing/demuxing port will always be **port1** of a 4-E1-L IFM.
    - V.110 (for Serial protocol only):
      - Asynchronous: V.110 is always used to transport serial streams over Dragon PTN;
      - Synchronous: V.110 usage depends on the selected bitrate (see §10);
    - A maximum of 4 point-to-point SAToP services that have checked Mux/Demux, can be muxed/demuxed to/from that same E1 port1.
    - Per extra muxed service to that E1 port1, an extra available E1 port on that 4-E1-L IFM is required and will be disabled for other service connections. E.g, a second muxed service disables the next available port (starting with the lowest port number first) on that 4-E1-L IFM.

  NOTE: After having programmed a muxed service to port1 on the 4-E1-L IFM, this port 1 can only become available again after removing all the muxed services that were programmed to that port1.
- Differential Clocking (when the Clock Source field = adaptive/differential):
  - unchecked (=default): adaptive clocking
  - checked: differential clocking;

Note: The referred IFM manuals in Table 2 often show a lot more info on Differential Clocking, Clock Source settings etc.. (Synchronization / Clock Distribution / Network Timing). So make sure to read the required IFM manual as well.

- Hitless Switching:
  - unchecked (=default): possible data and/or synchronisation loss when switching from active to backup path or vice versa, e.g. because of cable break;
  - checked: no data and/or synchronisation loss when switching from active to backup path or vice versa, e.g. because of cable break;
- Single Path (Hitless Switching): The service can already start up with only one link up, coming out of a two-links-down situation with single path enabled. Do not use this option when 'Differential Delay' is important for your application.

- Specific Parameters per protocol: see previous table.

- Page: Service Endpoint Selection:
  - Select the front ports on the involved IFMs that must be part of this service. Make sure to select the ports in nodes that are linked to a same tunnel. Selecting ports can be done in two ways.
    - Via the table. The tree view can be expanded/collapsed via clicking the expand/collapse buttons. Just click the Selected checkbox to select the desired port;
    - Via clicking the node icons in the network drawing, see general example in §13;
    - (for 2W/4W Voice only:) For a 2W/4W Voice service in multidrop, master(s)/slave(s) must be selected. By default, the end-point is set as slave but can be changed to master by clicking the cell, see figure below. In some network drawings the master will be indicated by  see also figure below and §6.

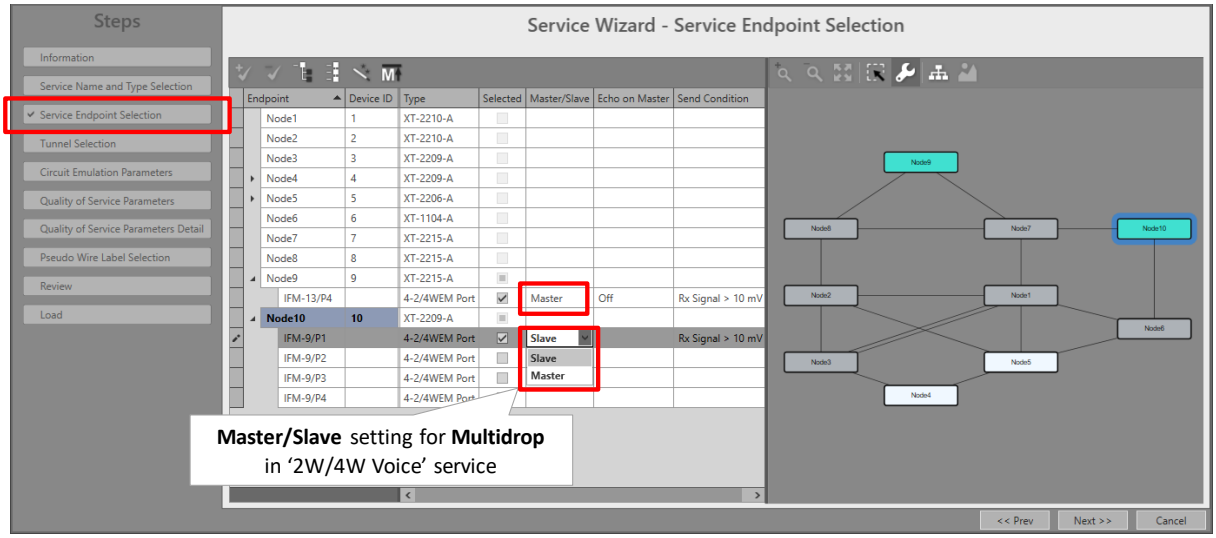


Figure 35 Master/Slave Setting for 2W/4W Voice

Note: Per port, an extra Info field can be filled out later on via Network Hardware → Devices → Select Node/IFM/Port → Generic → Info.

- Page: Tunnel Selection: Select the desired tunnels for your service. More info on tunnels, tunnel selection and allowed tunnels can be found in §11;
- Page: Hitless Tunnel Selection (only visible with 'hitless switching' enabled): if no tunnel is listed, it means that no point-to-point tunnel without protection is available anymore. This type of tunnel is needed to create the protection path for hitless switching. Create a new point-to-point tunnel without protection first.
- Page: Circuit Emulation Parameters:
  - Port Parameters (only on E1/T1 ports → in E1, T1, C37.94 protocol):
    - Short Haul Link: Long E1/T1 links (>200m, Long Haul) have more E1/T1 signal attenuation than shorter E1/T1 links (<200m, Short Haul). As a result, the E1/T1 signal levels or sensitivity ('0' or '1') on the receiver side depends on the usage of Long Haul/Short Haul links. Check this parameter for Short Haul links and uncheck

it (=default) for Long Haul links. This parameter can be set now at service creation or later on at port level in the IFM → port settings.

- Bundle Parameters: fine-tuning of parameters, defaults are OK. More info on these parameters can be found in the referred manuals above.
  - TDM Frames per Packet
  - Jitter Buffer Size
  - Maximum Network Path Delay Difference (only with 'Hitless Switching')
  - Calculated Packetization and Depacktization Delay.

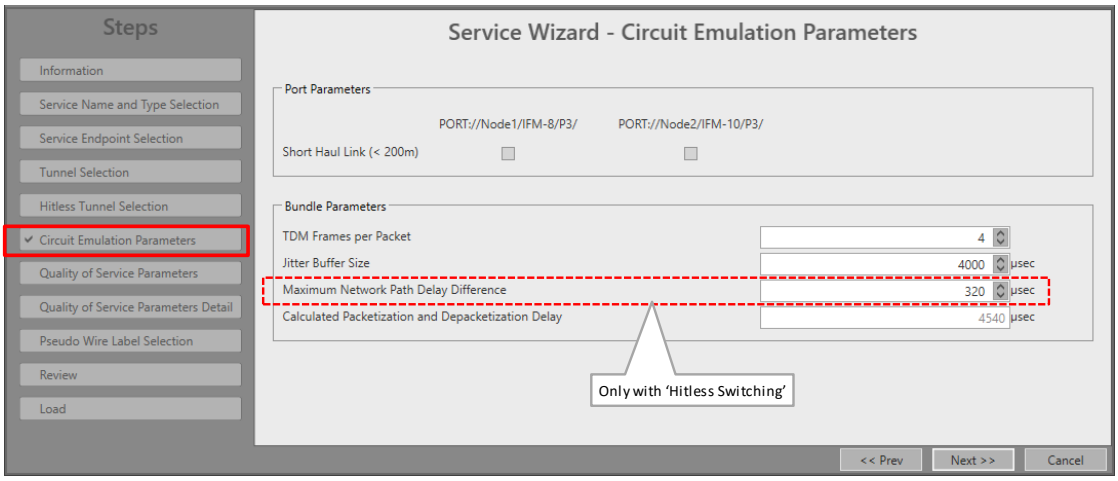


Figure 36 Circuit Emulation Parameters

- Page: Quality of Service Parameters: QoS (=Quality of Service) is a service traffic handling process in order to provide sufficient service delivery and bandwidth for critical applications. HiProvision provides a few QoS mechanisms, based on the parameters below.
  - Priority (range [0..5], default = 4): priority that will be assigned internally in the Dragon PTN node. 0 indicates the lowest priority (=least important). In the Dragon PTN network, higher priority traffic will be processed before lower priority traffic so that high priority traffic will not be compromised.
  - Frame Size: The CES IFMs convert their incoming signals from the LAN side into Ethernet packets towards the CSM. The Frame Size is the size of these Ethernet packets. The better you know the traffic (and its frame sizes) in your network, the better you can tune the consumed bandwidth on the WAN side. The Frame Size indicates the Ethernet frame size = payload + Ethernet overhead.
    - Frame Size is read-only;
    - Frame Sized depends on:
      - Page: Service Name and Type Selection → Differential Clocking on or off;
      - Page: Circuit Emulation Parameters → TDM Frames per Ethernet Packet.

Figure 37 Wizard: CES: Quality of Service Parameters

- Page: Quality of Service Parameters Detail: see §12. Leave this page as it is, defaults are OK;
- Page: Pseudo Wire Label Selection: leave this page as it is, defaults are OK;
- Page: Review: The selected service ports will be shown: if ok, click Finish, the configuration load manager will be invoked.
- Page: Load: The configuration load manager is a tool that starts and monitors the load process of a HiProvision configuration. Click the Load button to load the new HiProvision configuration into the live network. See Ref. [2Mgt] in Table 2 for more info.

CAUTION: While the loading to the Dragon PTN network is in progress, do not turn off, shut down or restart the HiProvision Server or Agent, since this may cause database corruption and network problems!

- After this step, your customer applications connected to the front ports of the IFMs should be able to communicate over the Dragon PTN network;

5.2.2 Network Hardware → IFM Settings

No extra settings must be done.

5.2.3 Network Hardware → IFM-Port Settings

Go to Dashboard → Network Hardware → Device → IFM → used ports → Circuit Emulation →

- Optimise Jitter Buffer (default = True): The default is OK for most applications. In some special cases, tuning this parameter might be necessary.

CAUTION: If differential delay is important and must be as low as possible then make sure to leave Optimise Jitter Buffer = True

CAUTION: If Optimise Jitter Buffer = True, the jitter buffer will be reset for optimal processing 15 or 120 (*) seconds after one of the events below occur. This reset will cause a minimal loss of data:

- **CES service creation/modification;**
- **CES service recovery after a possible service failure;**
- **Modifying clocking port parameters (clock source, bundle id for E1/T1) in HiProvision;**

(*): 120 seconds for 16-E1-L/16-T1-L IFMs and 15 seconds for the other IFMs.

- Send Data: It can be configured when an adaptive (*) SAToP service starts sending data.
  - Immediately (=default): Start sending immediately;
  - After Clock PreLocked: after 120 seconds for 16-E1-L/16-T1-L IFMs, after 15 seconds for the other IFMs;
  - After Clock Locked: after the 'Clock Recovery State' field on port level is in the 'Locked' state;

  NOTE: (*): One of the both service ports has property Clock Source set to 'Adaptive/Differential'

NOTE: Make sure that both ports of the service are configured the same.

- Clock Source: RX Clock, Adaptive/Differential, Internal Clock. This parameter needs to be tuned according to the description in the IFM manual, depending on the desired clocking and timing scenarios.
- CESoPSN Clock Source Bundle Id: Each CESoPSN service that is created in HiProvision will automatically get a 'bundle ID' assigned. The value of this 'Bundle ID' can be found in Dashboard → Network → Services → Monitoring Properties → Circuit Emulation (see figure below). This value must be filled out in the 'CESoPSN Clock Source Bundle ID' port property to indicate to which CESoPSN service this port must slave its clock (=adaptive).

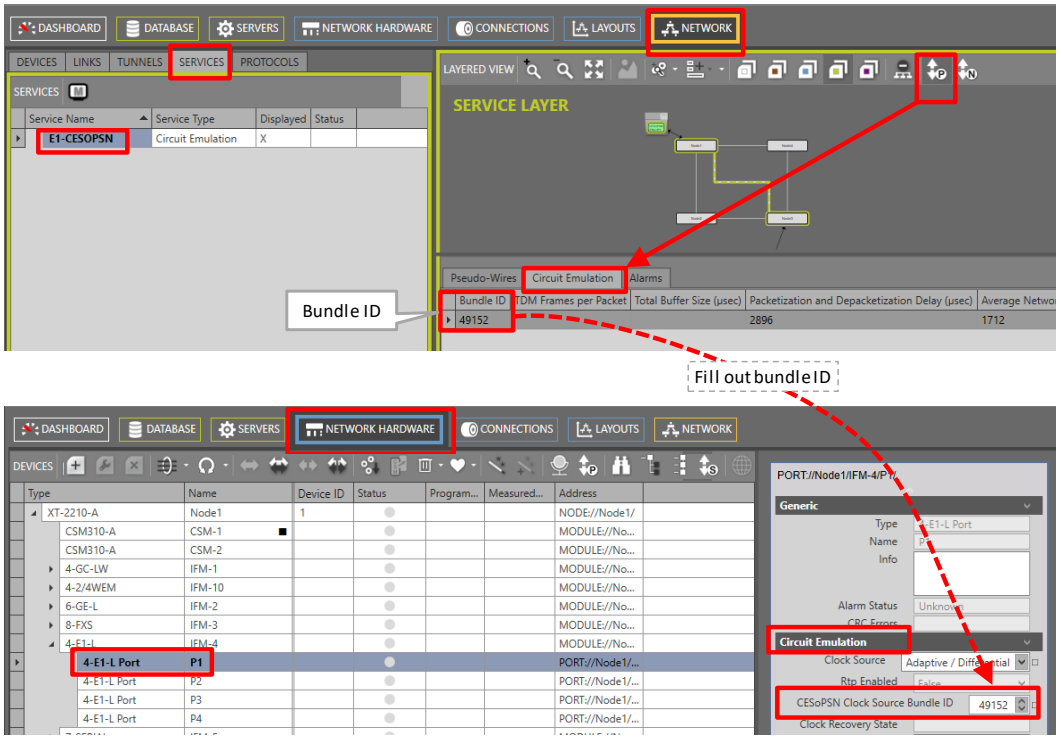


Figure 38 Find and Fill out the CESoPSN Bundle ID

- For 2W/4W-Voice service: extra parameters might be tuned, see §6.

5.3 Modify Service

After service creation, this service can be modified if needed via:

- Wizard: Dashboard → Configuration → Connections → Services → select service → ;
- Port settings, see §5.2.3;

5.4 Delete Service

After service creation, this service can be deleted if needed via Dashboard → Configuration → Connections → Services → select service → ;

5.5 Troubleshooting: Test and Loopback

This service can be tested via loopback settings on IFM level and port level in the Network Hardware tab. See §14 for setting up loopbacks.

5.6 Monitoring

5.6.1 (Configuration) Network Hardware Tile

None

5.6.2 (Configuration) Connections Tile

What has been configured via the service wizard can also be viewed via Dashboard → Connections → Services → select service in the list. Some extra tabs (Service, Pseudo-Wires, Circuit Emulation) with service configuration data will be shown.

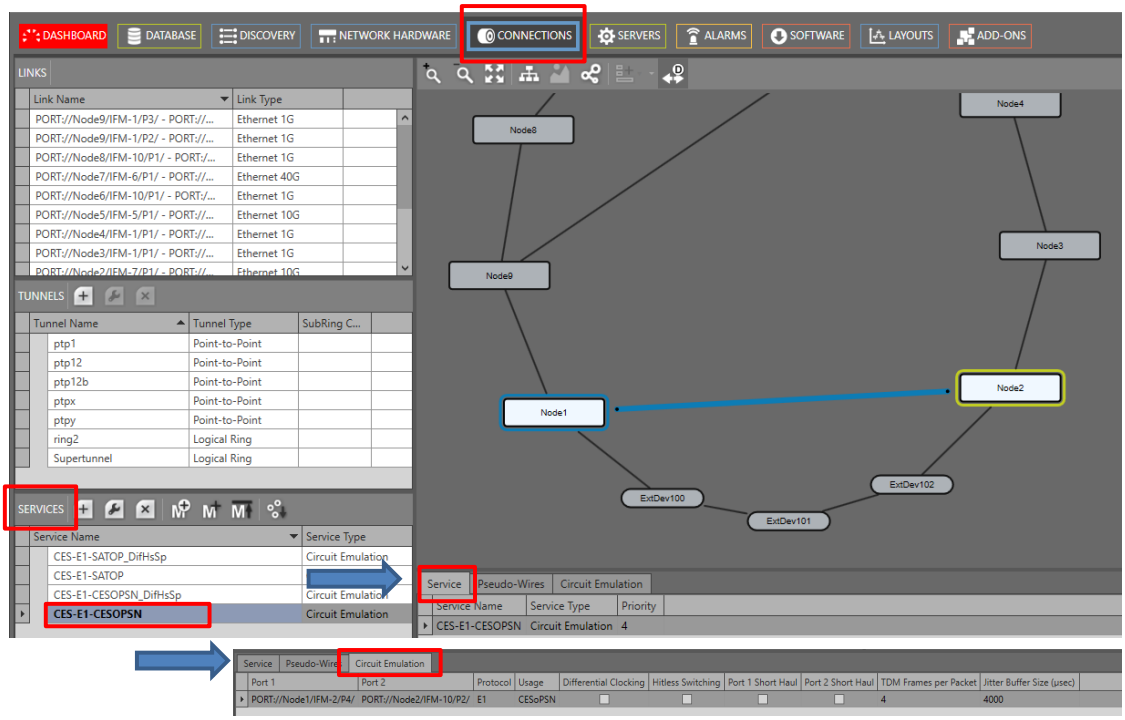


Figure 39 (Configuration) Connections Tile: Circuit Emulation Service

5.6.3 (Monitoring) Network Tile

Live service data can be monitored via the Dashboard → Network → Services → select service in the list. The service will be shown in the network drawing. Click P to show extra monitoring properties for this service. Click N to show the used nodes/links/tunnels.

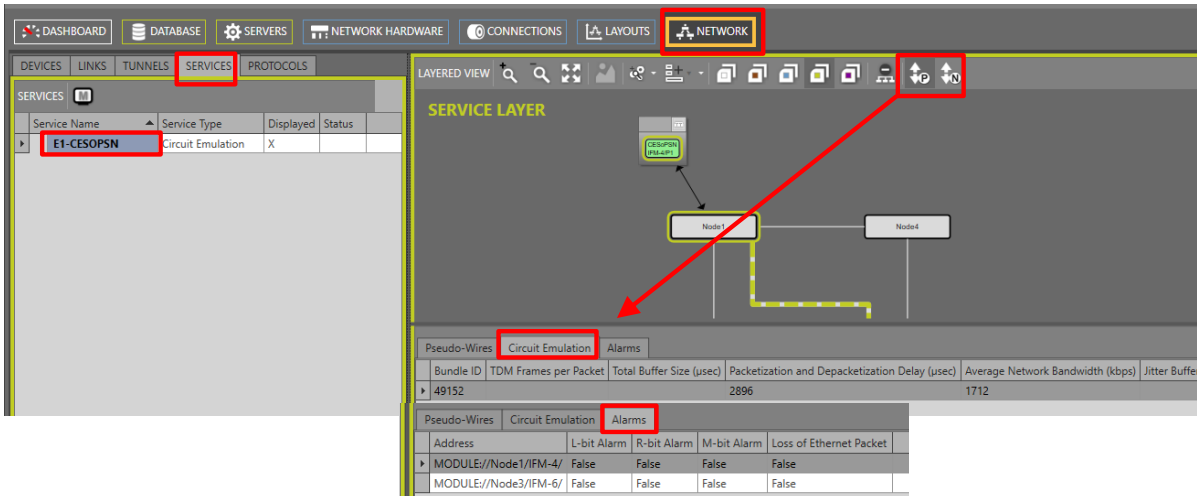


Figure 40 (Monitoring) Network Tile: Circuit Emulation

5.6.4 Performance Counters

Go to Dashboard → (Monitoring) Performance → Counter Control → Service Performance → Circuit Emulation Monitoring. See figure below.

A detailed and similar monitoring set-up description (adding counters to graphs etc…) can be found in 'Port Performance' → 'CSM Ethernet Port Monitoring' in Ref. [2Net] in Table 2.

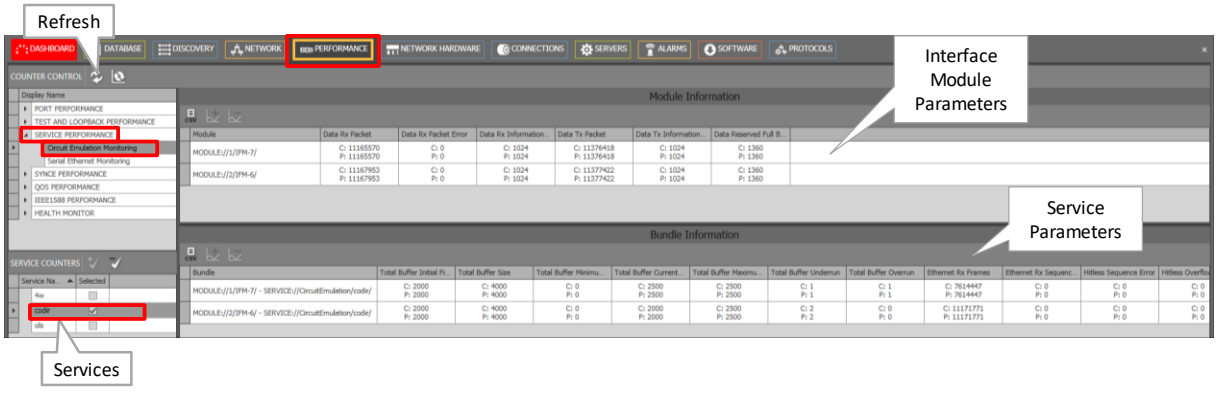


Figure 41 Services: Circuit Emulation Monitoring

Table 8 Services: Circuit Emulation Monitoring 'Module' Fields

Field	Values	Description
Module	value	Monitored module
Data Rx Packet	packets	The number of received data packets.
Data Rx Packet Error	packets	The number of received erroneous data packets. The packets had for example a CRC error.
Data Rx Information Bandwidth	kbps	The reserved module bandwidth for only the payload data on the ingress side. This value remains the same until the HiProvision bandwidth configuration changes.
Data Tx Packet	packets	The number of transmitted data packets.
Data Tx Information Bandwidth	kbps	The reserved module bandwidth for only the payload data on the egress side. This value remains the same until the HiProvision bandwidth configuration changes.
Data Reserved Full Bandwidth	kbps	The reserved full module bandwidth including both overhead and payload data. This value remains the same until the HiProvision bandwidth configuration changes.
Note: Click the Refresh button for the latest results; **Note**: Clear the counter values by clicking  ; **Note**: 'C' value in cell = current value; 'P' value in cell = previous value;		

Table 9 Services: Circuit Emulation Monitoring 'Bundle' Fields

Field	Values	Description	Curative Action
Bundle	value	The monitored bundle or stream	
Total Buffer Initial Fill Level	µs	The start level of the buffer right after resetting/rebooting the IFM	
Total Buffer Size	µs	This is the reserved jitter buffer size. It is the absolute maximum that a buffer level can reach. The size is based on the configuration parameters. If the current buffer level would increase above the buffer size (which is not possible), a buffer overrun occurs and packets are lost.	verify the Service wizard → Circuit emulation parameters / QoS configuration in HiProvision
Total Buffer Minimum Level	µs	The minimum (current) level that has been reached so far	no drifting, and close to minimum size (0) due to network jitter or hitless path interruption, verify buffers configuration, buffer too small?
Total Buffer Current Level	µs	The current fill level of the buffer	if this level is drifting, verify clocking settings master/slave
Total Buffer Maximum Level	µs	The maximum (current) level that has been reached so far	no drifting, and close to maxsize (=size buffer) due to network jitter, verify buffers configuration, buffer too small?
Total Buffer Underrun	count	The number of times that a buffer has underrun. A buffer underrun occurs when the buffer is filled slower than packets in the buffer are processed. As a result, the buffer will finally run empty which results in an underrun. If an underrun occurs, the buffer will be reset to the initial level.	verify clock settings master/slave, jitter buffer might be too small.... verify the Service wizard → Circuit emulation parameters in HiProvision

Field	Values	Description	Curative Action
Total Buffer Overrun	count	The number of times that a buffer has overrun. A buffer overrun occurs when the buffer is filled faster than packets in the buffer are processed. As a result, the buffer fill level will grow up to the maximum or buffer size, and finally will overflow or overrun. After an overrun, the buffer will be reset to the initial level.	verify clock settings master/slave, jitter buffer might be too small.... verify the Service wizard → Circuit emulation parameters in HiProvision.
Ethernet Rx Frames	frames	The number of received Ethernet frames.	
Ethernet Rx Sequence Number Drop Errors	frames	The number of received Ethernet frames that were dropped due to an invalid sequence number.	
Hitless Sequence Error	count	The number of times that a sequence number error occurred	
Hitless Overflow	count	The number of times that the hitless buffer (in FPGA) overflow occurred	verify the Service wizard → Circuit emulation parameters / QoS configuration in HiProvision
Hitless Timeout	count	The number of times that a timeout occurred on one of the hitless paths. E.g. pulling out the WAN link of the hitless path will increase the counter by one.	
Reserved Information Bandwidth	kbps	The reserved bundle bandwidth for only the payload data. This value remains the same until the HiProvision bandwidth configuration changes.	
Reserved Full Bandwidth	kbps	The reserved full bundle bandwidth including both overhead and payload data. This value remains the same until the HiProvision bandwidth configuration changes.	
Note: Click the Refresh button for the latest results; Clear the counter values by clicking  ; 'C' value in cell = current value; 'P' value in cell = previous value;			

5.6.5 HiProvision Add-on: Generic Reporting Engine

Service and port reporting information is available via the Reporting Engine Add-on, see Ref.[24] in Table 2.

6. CIRCUIT EMULATION: EXTRA INFO ON 2W/4W-VOICE

6.1 General

A point-to-point '2W/4W Voice' service can be configured via creating a Circuit Emulation Service (=CES) with protocol type '2W/4W Voice' and Multidrop unchecked. Check the multidrop checkbox if you want a multidrop service. The multidrop behavior is accomplised via combining individual PTP services with the same master, see further. The E-Signal (E&M signaling) will be transmitted together with the voice data in the '2W/4W Voice service. A maximum of 4 CESs can be configured per 4-2/4WEM IFM if only PTP services are configured. A multidrop service can configure up to 15 PTP services on the same master voice port with a total maximum of 16 CESs per IFM. The table below shows more settings that influence the 2W/4W Voice and E&M signaling behavior.

Table 10 2W/4W Voice E&M Settings

Type	Parameter	Values	Description
General			
Service	Usage	CESoPSN	
Service	Hitless Switching (optional)	No (=default) / Yes	Feature within CESoPSN that provides a safe redundant connection. **Yes**: switching between active and protection path stays synchronized.
Service	Single Path (optional)	No (=default) / Yes	Subfeatuer of Hitless Swithcing: **Yes**: The service can already start up with only one link up, coming out of a two-links-down situation with single path enabled. Do not use this option when 'Differential Delay' is important for your application.
Service	Mode	4 Wire (=default) / 2 Wire	Mode of voice transportation, via 4 wires or 2 wires.
Service	Multidrop	No (=default=PTP) / Yes	No = PTP = Point-to-Point. Yes = Multidrop: Accomplished by creating different PTP services that share the same master.
Service → Port	Master/Slave	Slave = default	If multidrop = Yes, at least one port must be configured as master whereas maximum 15 ports can be configured as slave.
Hardware → Port Property	Clock Source	See Ref. [10] in Table 2	See Ref. [10] in Table 2
Voice			
Service → Port	Echo On Master	Off (=default) / On	If Multidrop = Yes, Echo on Master will be configurable. This feature allows slaves to communicate with each other. If Echo on Master = On, slaves can communicate with each other.
Service → Port	Send Condition (only for Voice, not for E&M)	- Active E Signal - Rx signal > 50 mV - Rx signal > 10 mV (=default) - Never send	If Multidrop = Yes, the condition for sending or transmitting voice signals over the Dragon PTN network can be configured to one of the indicated values. NOTE: the Send Condition does not influence E&M, E&M will always be transmitted. For 2-Wire Voice, it is advised to use 'Rx signal > 50 mV'.
Hardware → Port Property	Tx Signal Level	-15 dB → +18 dB	0 dB = Default. Tx Signal can be amplified in the indicated range in steps of 3 dB.
Hardware → Port Property	Rx Signal Level	-15 dB → +18 dB	0 dB = Default. Rx Signal can be amplified in the indicated range in steps of 3 dB.
E&M Signaling			
NOTE: the Send Condition has only impact on the Voice/Data. E&M will always be transmitted.			
Service → Port	Echo On Master	Off (=default) / On	If Multidrop = Yes, Echo on Master will be configurable. This feature allows slaves to communicate with each other. If Echo on Master = On, slaves can communicate with each other.
Hardware → Port Property	E&M Signaling	Type 2, 3, 4, 5	Select the E&M signaling type.
Hardware → Port Property	M Signal Mode	Transparent / Fixed	**Transparent**: The E-signal on the other side is transmitted transparently to the M output. What comes in on the E side of the other side, goes out transparantly on the M side. If M = transparent on the slave, the E-signal on the master comes out transparently on the M of the slave. If M = transparent on the master, the E-signal of any of the slaves goes out transparently on the M of the master **Fixed**: The M output will be fixed Off or On depending the 'M Signal Ouput' setting.
Hardware → Port Property	M Signal Output	Off/On	The M output will be fixed Off or On.

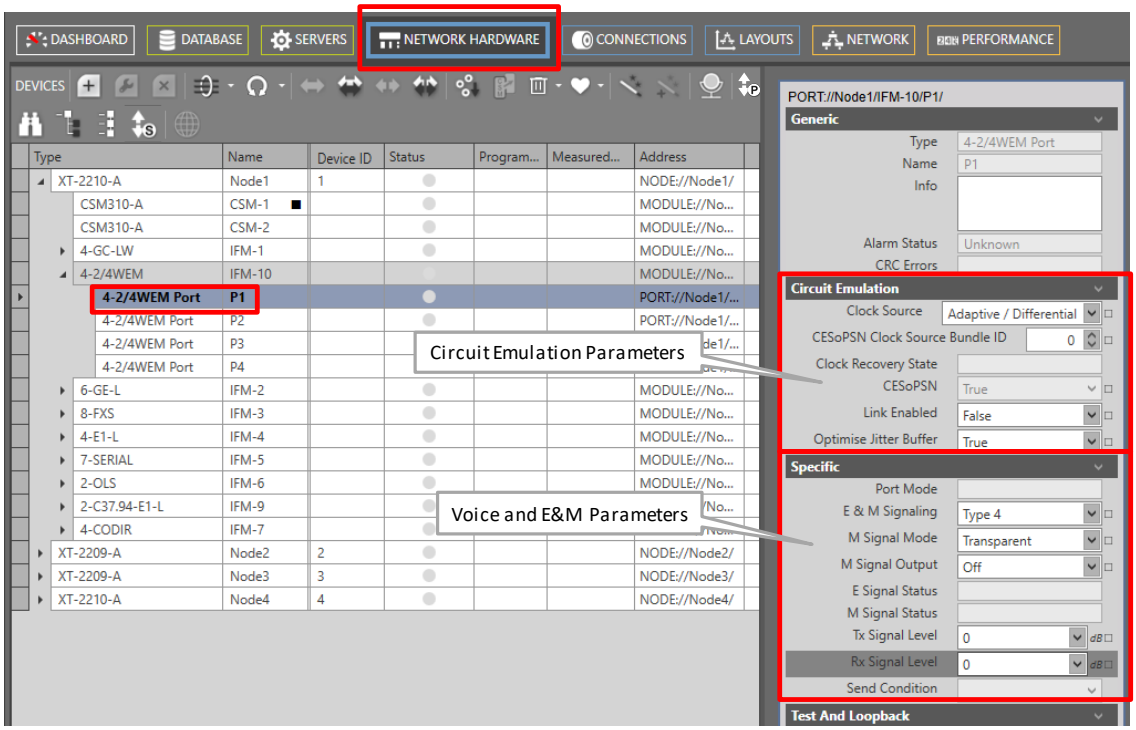


Figure 42 Hardware → Port Property: Voice and E&M

6.2 CES: CESoPSN (Point-to-Point)

CESoPSN (=Circuit Emulation Service over Packet Switched Network) is a point-to-point service between two voice ports that uses the timeslots of an E1 frame to transport the data over the MPLS-TP Dragon PTN network. Such a PTP service can be configured per port. This service transports the voice data into the first timeslot and the E&M signaling in the second timeslot of an E1 frame.

The destination module will receive the transported timeslots from the Dragon PTN network and regenerate the voice data and the E&M signaling from it to finally output it on its voice port. Indicate in the service creation if you want to use 4 or 2wire. Make sure that the Multidrop setting disabled. Each end-point or port must be located in a different node.

6.3 CES: CESoPSN (Multidrop)

A multidrop behavior between one master and 'n' (maximum 15) slaves is accomplished by creating 'n' individual CESoPSN Point-to-Point services in HiProvision, between each slave port and the same master port. All these point-to-point (=PTP) services within that multidrop:

- must be configured with the multidrop setting enabled;
- must have the same wire type usage, either 2 or 4wire;
- have exact one (shared) master and one slave The first created PTP service within that multidrop, defines the master. The 2nd, 3rd… PTP service that select the same master at service creation, will be part of that resulting multidrop service;
- Must have the master in a different node than the slave nodes.

CAUTION: Unused ports in a 2-Wire Voice multidrop service must be terminated with a 600Ω impedance.

The figure below shows a multidrop example between one master and three slaves.

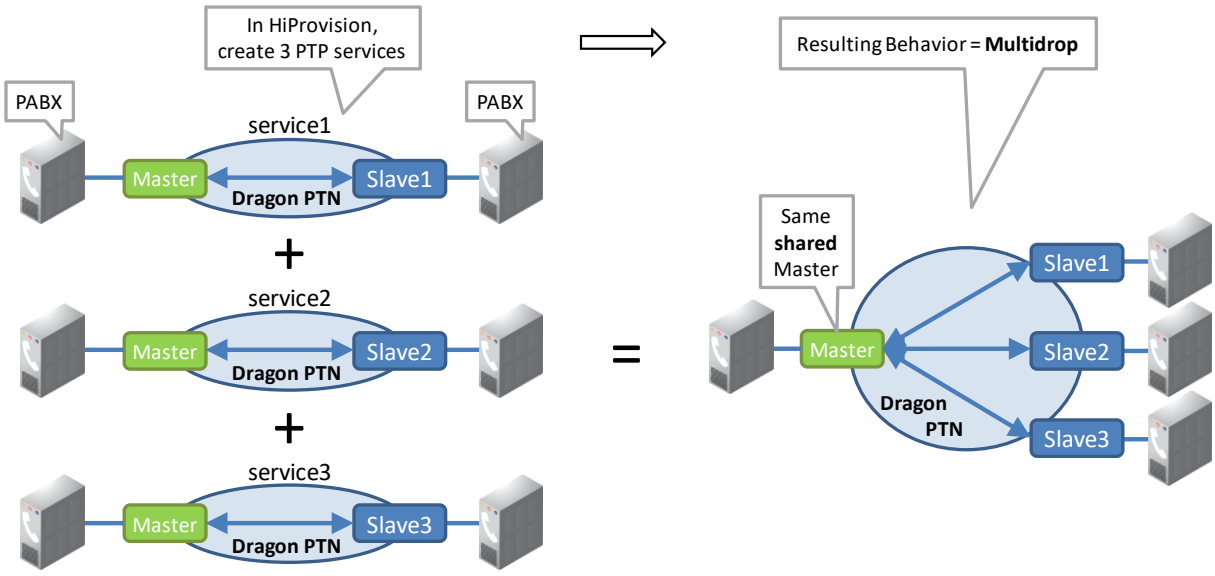


Figure 43 Multiple PTP Services with Same Master result in Multidrop Behavior

6.4 Tone Generation/Level Metering

It is possible to generate test tone signals, see §14.4

7. VOICE

7.1 General

Supported IFMs: 8-FXS (for analog voice), all IFMs with Ethernet ports (for voice over IP). More information on these IFMs can be found in Ref. [8] in Table 2.

A Voice service requires at least one analog (8-FXS) and one Ethernet (4-GC-LW, ….) port.

The Voice service can set up connections between both analog phones (via 8-FXS) and SIP elements (client, server, trunk) over the Dragon PTN network. SIP elements can be connected to the Dragon PTN network via Ethernet IFMs (e.g. 4-GC-LW, ..., 9-L3A-L). This service operates VLAN based and is routable (with Gateway IP address). Depending on where the call handling must be done, two different modes can be selected:

- Remote extension (FXO Gateway): call handling via FXO gateway to analog public or private telephone networks;
- SIP-server: call handling done in dedicated external SIP server;

A general analog Voice service example can be found in the figure below:

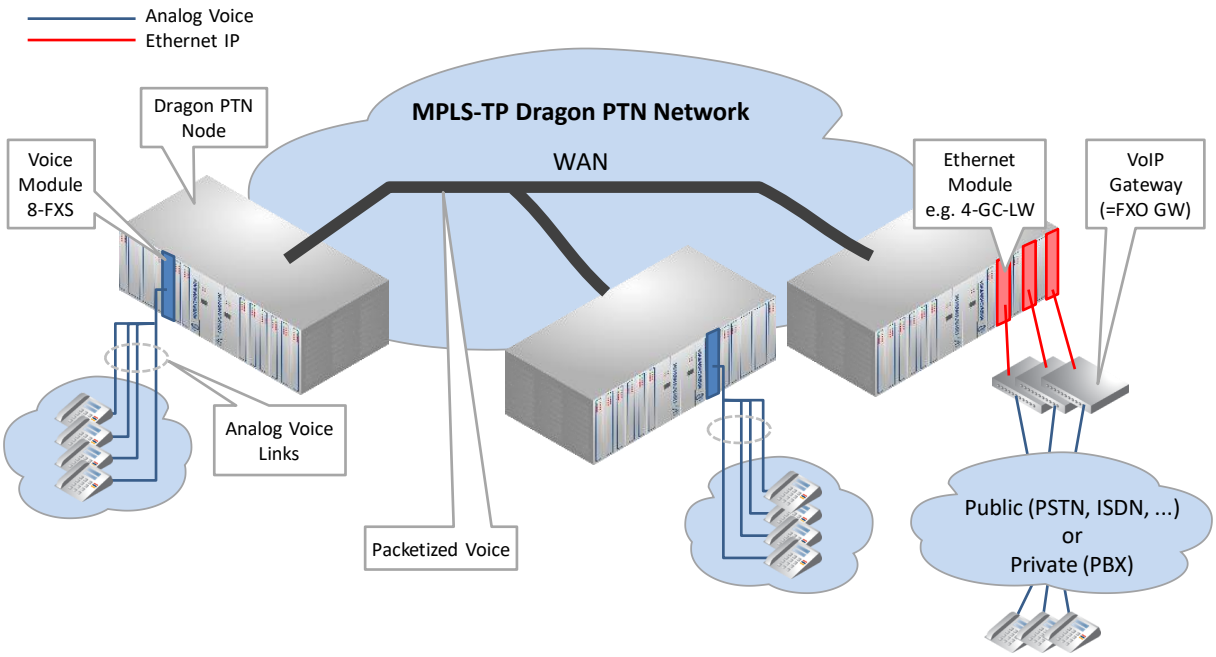


Figure 44 Analog Voice + Voice Over IP Example: Remote Extension

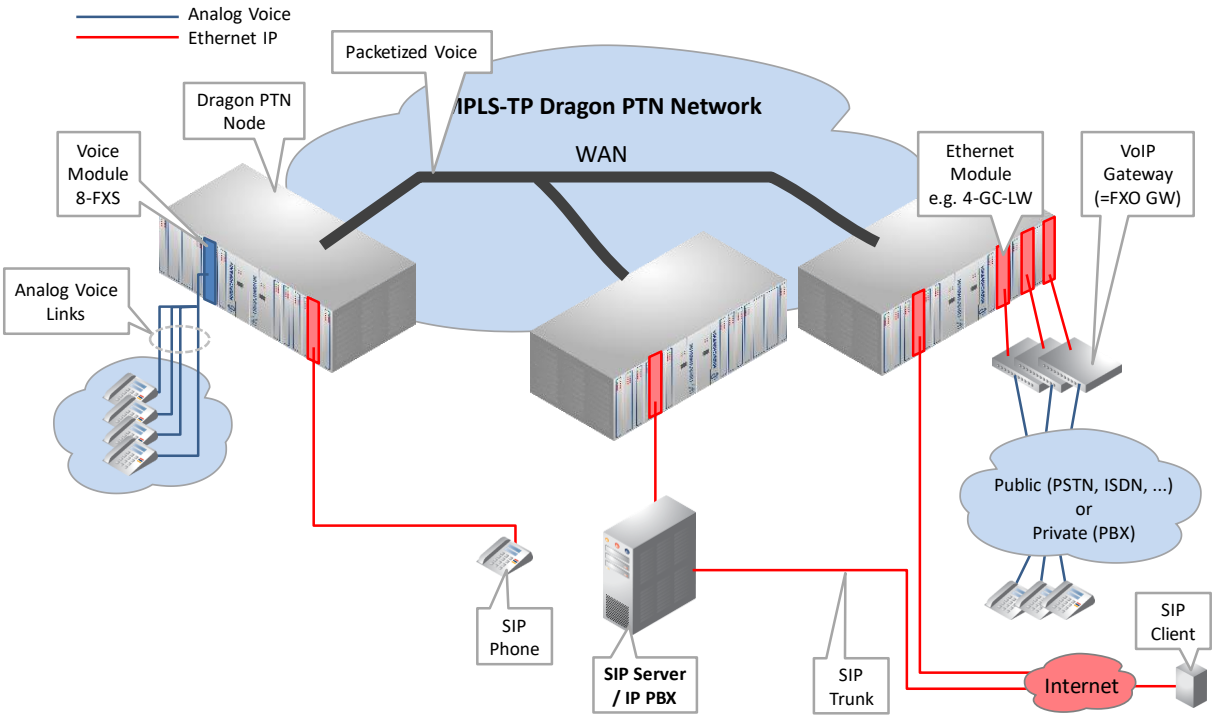


Figure 45 Analog Voice + Voice Over IP Example: SIP Server

7.2 Configure Service

7.2.1 Service Wizard

Click Dashboard → Configuration → Connections → Services → + to open the services wizard. See figure below.

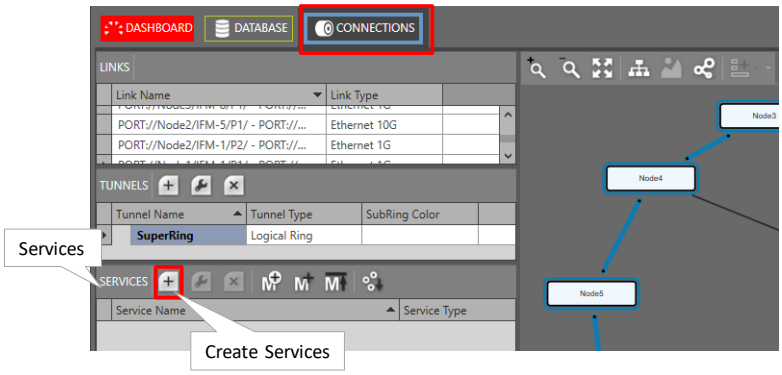


Figure 46 Create Services

The services wizard opens. The list below summarizes every page in the wizard:

- Page: Information: Click Next>>;
- Page: Service Name and Type Selection:
  - Service Name: enter a name for your service.
  - Service Type: Voice;

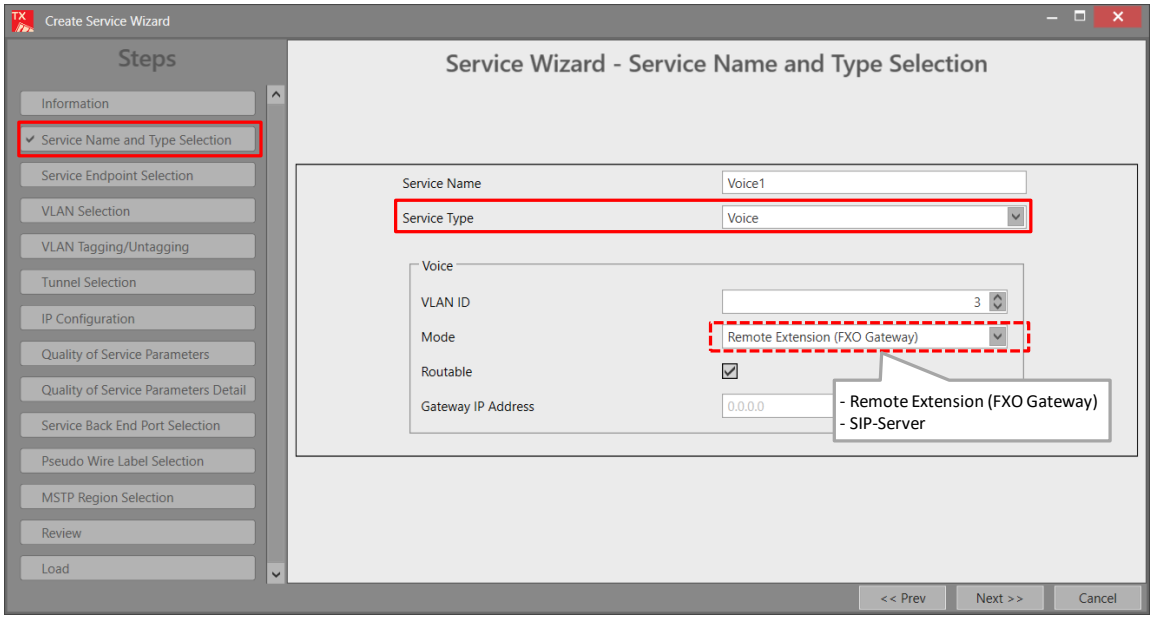


Figure 47 Service Type: Serial Ethernet

- VLAN ID: Set the default VLAN ID in the range [3-3699, 3802-4000] for the Ethernet ports in this service. Ethernet packets with this VLAN ID will be forwarded in this service, other VLAN IDs and untagged packets will be dropped. This behavior can be overruled by a more advanced VLAN processing in the 'VLAN Tagging/Untagging' feature further on this wizard;
- Mode: Remote Extension (FXO Gateway), SIP-Server, see §7.3 for more information;
- Routable (including Gateway IP address): Enable this when your 8-FXS IFMs, FXO Gateway or SIP Server are spread over multiple VLAN IP subnets. When enabling it, also fill out the Gateway IP address via which the FXO Gateway or SIP Server can be reached. One routed voice service is allowed per 8-FXS IFM.

- Page: Service Endpoint Selection: Select the front ports on the involved IFMs that must be part of this service. A Voice service requires at least one analog (8-FXS) and one Ethernet (4-GC-LW, ….) port. Make sure to select the ports in nodes that are linked to a same tunnel. Selecting ports can be done in two ways:
  - Via the table. The tree view can be expanded/collapsed via clicking the expand/collapse buttons. Just click the Selected checkbox to select the desired port;
  - Via clicking the node icons in the network drawing, see general example in §13;

NOTE: Per port, an extra Info field can be filled out later on via Network Hardware → Devices → Select Node/IFM/Port → Generic → Info.

- A node can have a maximum of 32767 MAC addresses. By default, per new Voice service, 256 MAC addresses will be added to each LER node of the tunnel in which the service resides (not for point-to-point tunnels). If the maximum number of MAC addresses on a node has been reached, an error warning will pop up. After this warning, you will have to decrease the number of MAC addresses in this node from the other services first via clicking the MAC limit button (see Ref. [2Eth] in Table 2 for more info). See the figure below:

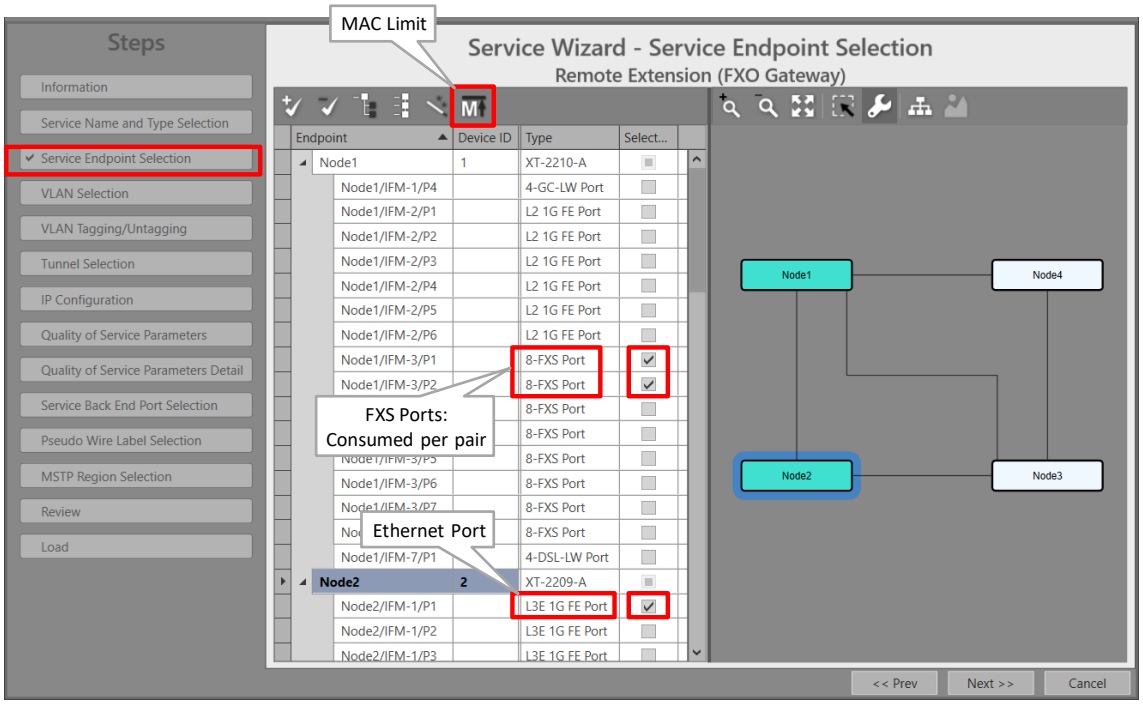


Figure 48 Voice: MAC Limit

- Page: VLAN Tagging/Untagging: HiProvision supports VLAN processing for voice services. The Voice service is always VLAN based.
  - ATTENTION: By default, the VLAN processing behavior in this wizard page is as described previously in the 'Service Name and Type Selection' page in this wizard: Only forward packets (ingress and egress) with the configured VLAN ID and drop all the other packets. When changing the settings in the 'VLAN Tagging/Untagging' page, it will overrule the default behavior.
  - The possible VLAN processing actions are described in the table below. Each port in the service can be configured with its own VLAN processing. For applying the same VLAN

processing to multiple ports at once, use the Multiple Settings Mode button. Configure the VLAN settings and click the apply button Apply.

Table 11 VLAN Tagging/Untagging

Ingress/ Egress	Possible Actions	Description
Note: A Prio Tag is a VLAN tag with VLAN ID = 0 Note: the actions are only valid for the configured endpoints in the configured service Note: Ingress and Egress VLAN ID: the configured VLAN ID is the same for both INGRESS and EGRESS		
Ingress	Untagged: Drop	Incoming untagged Ethernet packets will be dropped.
	Untagged: Tag and forward (<configured VLAN ID>)	Incoming untagged Ethernet packets will be tagged with the configured VLAN ID in the range [2-3699, 3802-4000] and forwarded.
	Priority Tagged: Drop	Incoming priority tagged Ethernet packets will be dropped.
	Priority Tagged: Tag and forward (<configured VLAN ID>)	Replace the priority tag (=VLAN ID 0) in the incoming Ethernet packet with the configured VLAN ID in the range [2-3699, 3802-4000] and forward it.
Egress	Keep Tag	The VLAN or Prio tag is kept when sending out the Ethernet packet (transparent transport of packets).
	Untag	The VLAN or Prio tag is removed from the Ethernet packet when sending out the packet.
	PrioTag	Replace the VLAN tag with a Priority tag.

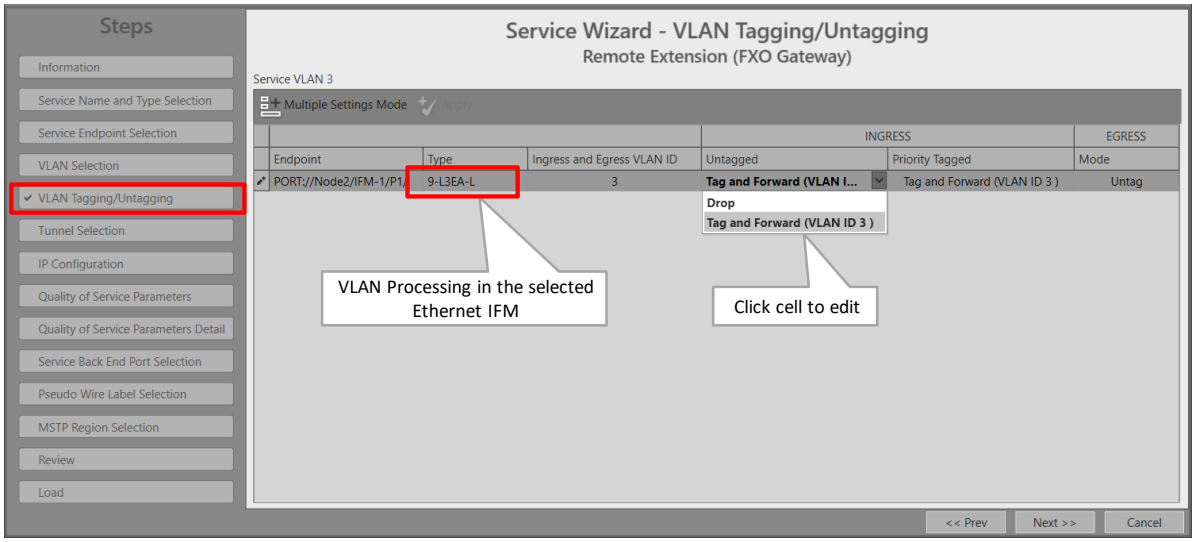


Figure 49 VLAN Based: VLAN Tagging/Untagging

- Page: Tunnel Selection: Allowed tunnels for this service type: point-to-multipoint, logical ring. See §11 to select the desired tunnel;
- Page: IP Configuration: Each 8-FXS module in a Voice service must be assigned an IP address to allow registration to the FXO gateway or the SIP Server later on. Fill out the IP Range Start and click the Auto Assign button. As a result, the 8-FXS modules will get an IP address assigned from this IP range. So all the phones connected to the ports within the

same 8-FXS module have the same IP address. The phones can be differentiated based on the SIP account on application level. These automatically assigned IP addresses can be overruled or manually changed/edited.

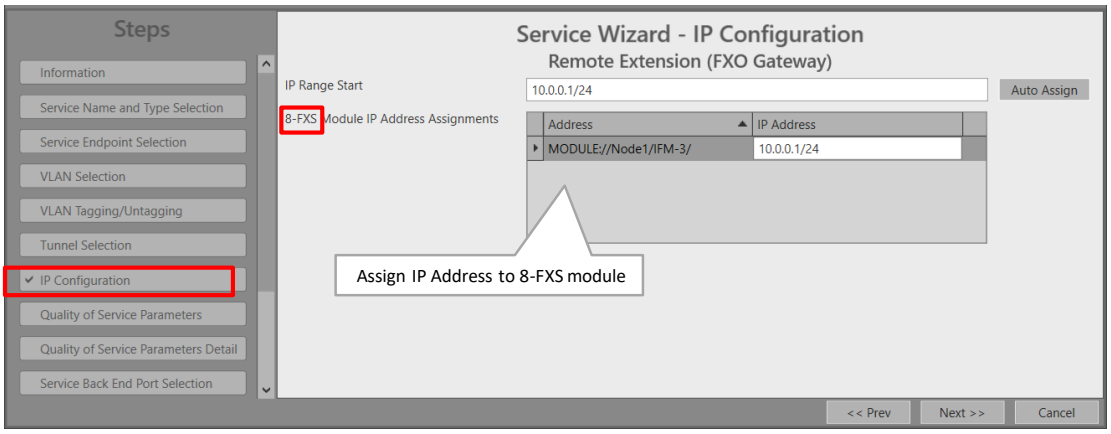


Figure 50 8-FXS: IP Configuration

- Page: Quality of Service Parameters: QoS (=Quality of Service) is a service traffic handling process in order to provide sufficient service delivery and bandwidth for critical applications. HiProvision provides a few QoS mechanisms, based on the parameters below.
  - Priority: configures the priority that will be assigned internally in the Dragon PTN node. 0 indicates the lowest priority (=least important). In the Dragon PTN network, higher priority traffic will be processed before lower priority traffic so that high priority traffic will not be compromised.
    - Normal (=Non-HQoS) tunnel used: priority range [0..4], default = 3.
    - HQoS tunnel used: priority is inherited from the Tunnel Application Priority [0..6], read-only.
  - Average Frame Size: The 8-FXS IFMs convert their incoming signals from the LAN side into Ethernet packets towards the CSM. The Average Frame Size is the size of these Ethernet packets. The better you know the traffic (and its frame sizes) in your network, the better you can tune the consumed bandwidth on the WAN side. The Average Frame Size indicates the Ethernet frame size = payload + Ethernet overhead.
    - Priority >1: Average Frame Size = 64 bytes, read-only.
    - Priority <=1: Average Frame Size is configurable.
  - Additional Ethernet Port Bandwidth: The Ethernet ports in a voice service consume a bandwidth which consists of voice channels and some additional bandwidth.
    - Number of Voice Channels: (default=1, maximum depends on the available bandwidth on the links) The number of voice channels that go via this port. HiProvision will reserve 100 kbps per voice channel;
    - Additional Bandwidth (kbps): (default=0, maximum depends on the available bandwidth on the links) The additional or extra bandwidth that this port requires in this service to serve non-voice or different applications if any e.g. FTP server, ...

- Burst Size (bytes): (default=0, maximum depends on the available bandwidth on the links) The maximum burst size in bytes that can be sent on the service via this port.

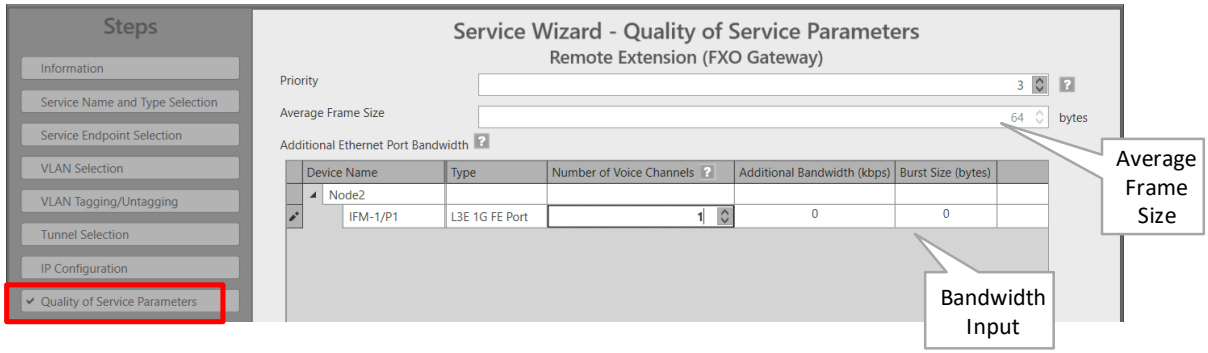


Figure 51 Voice: Quality of Service Parameters

- Page: Quality of Service Parameters Detail: see §12. Leave this page as it is, defaults are OK;
- Page: Service Back End Port Selection (only if Ethernet L2/L3 IFMs have been selected in the service): This page shows which Back Back End ports are used towards the CSM, in the participating L2/L3 IFMs in the Voice service. The line towards the CSM shows the bandwidth usage, 0% means all bandwidth still available on that port. Another Back End port can be selected if desired. More info on back end ports in Ref. [2Eth] in Table 2.

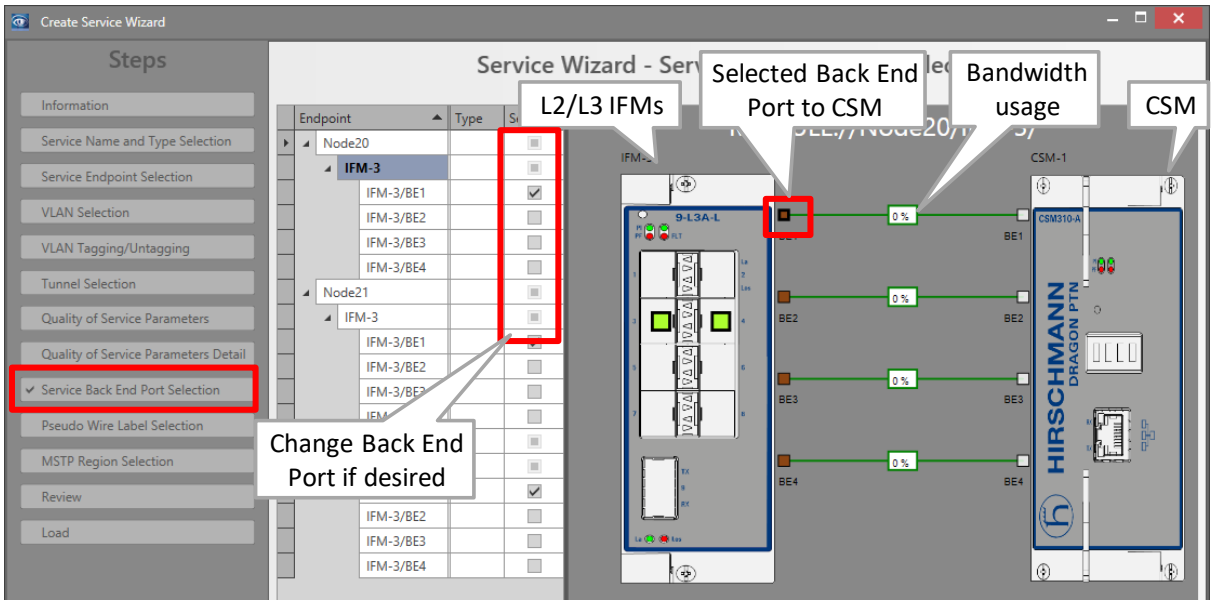


Figure 52 Voice: L2/L3 IFM Service Back End Port Selection

- Page: Pseudo Wire Label Selection: leave this page as it is, defaults are OK;
- MSTP Region Selection (only when modifying the Voice service involved in Regions/MSTP (see MSTP in Ref. [2Eth] in Table 2) and adding a L2/L3 IFM which is still part of the default MSTP Region): A configured Voice service can overlap different MSTP regions. When adding a L2/L3 IFM to this service, the IFM will run with default MSTP settings available on the IFM itself (not visible in HiProvision) and indicated by 'Default Region'. Loop protection is guaranteed via this 'Default Region'. If you want to assign this IFM immediately to an existing MSTP Region, select one from the Region drop-down list. If not, leave 'Default

Region' selected. Later on in the MSTP wizard, you can still assign this IFM to a new or existing Region.

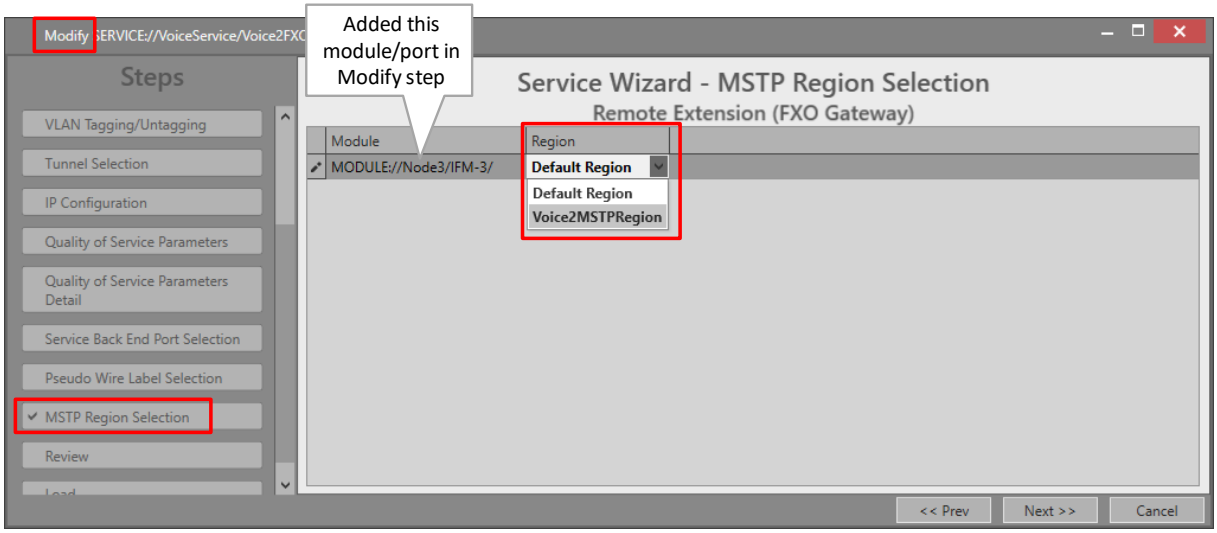


Figure 53 Voice (Modify): MSTP Region Selection

- Page: Review: The selected service ports will be shown: if ok, click Finish, the configuration load manager will be invoked.
- Page: Load: The configuration load manager is a tool that starts and monitors the load process of a HiProvision configuration. Click the Load button to load the new HiProvision configuration into the live network. See Ref. [2Mgt] in Table 2 for more info.

CAUTION: While the loading to the Dragon PTN network is in progress, do not turn off, shut down or restart the HiProvision Server or Agent, since this may cause database corruption and network problems!

- After this step, your customer applications connected to the front ports of the IFMs should be able to communicate over the Dragon PTN network.

7.2.2 Network Hardware → IFM Settings

No extra settings must be done.

7.2.3 Network Hardware → IFM-Port Settings

No extra settings must be done.

7.3 Configure Voice Protocol

7.3.1 General

The Voice Protocol must be configured to configure extra service properties. An overview can be found below:

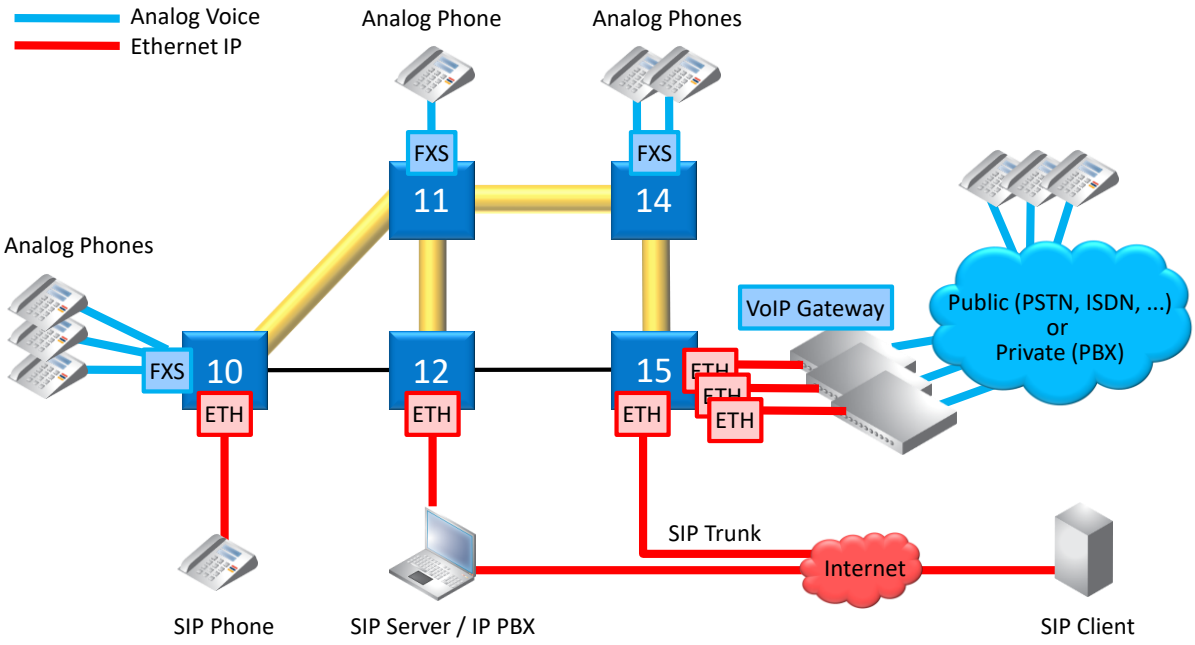


Figure 54 Voice Service Elements Overview

7.3.2 Prerequisite

A Voice service must have been created.

7.3.3 Configuration

Go to Dashboard → (Configuration) Protocols → Protocol Categories → Other → Voice Protocol → (Protocols) +.

Depending on the configured voice type in the service, the settings will differ:

- Remote Extension Mode: see §7.3.4;
- SIP-Server Mode: see §7.3.5;

7.3.4 Remote Extension (FXO Gateway) Mode

a. General

- See Figure 54: connections between FXS ←→ VoIP Gateway (=FXO Gateway);
- Analog phones in the Dragon PTN network are a remote extension of the public (PSTN) and/or private (PBX) telephone network. The extension is possible via a third party VoIP Gateway (e.g. Patton), in this case an FXO Gateway;
- Analog phones are connected to an FXS interface (8-FXS module);
- FXO Gateways are connected to an Ethernet interface (e.g. 4-GC-LW module);
- Voice switching and telephony feature handling between all phones are performed in the PSTN or PBX;
- DTMF (=Dual Tone Multi-Frequency) must be used for number dialing;
- Analog speech and signaling are converted and packetized by the FXS interface and the FXO Gateway towards the Dragon PTN network;

b. Configuration

- Information: Click Next>>;
- Service Selection: select the Voice service in the list for which you want extra configuration and registration settings. Only the voice services without Voice Protocol configuration yet will be listed. Click Next>>;

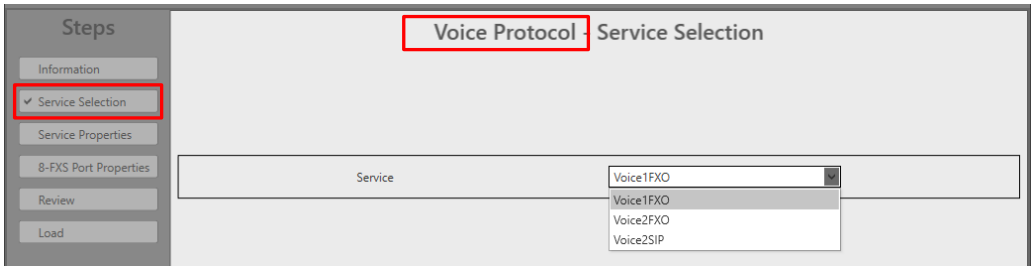


Figure 55 Voice Protocol FXO: Service Selection

- Service Properties:
  - DTMF Transmit Mode: DTMF is a voice-frequency signaling system that generates tones when the caller presses numbers on its phone. This field has only impact when the call has already been set up. During a call, when the caller is requested to enter some extra numbers for selecting a menu (e.g. press '1' for sales, '2' for services etc...), the selected DTMF Transmit Mode below configures how these entered numbers are transmitted on the line. Make sure that this setting matches the setting in the FXO Gateway. Click Next>>;
    - Audio Passthrough: Transports the DTMF tones transparently inband between the two SIP endpoints, the caller and callee. The tones are encoded within the voice. When using this method, it is strongly advised to use a G711 Audio Codec (G729 could compress the tones too much resulting in unrecognized tones at the receiving side);
    - Rtp (=advised for Remote Extension (FXO Gateway)): Inband method that sends DTMF tones separately in dedicated RTP packets, distinct from audio packets.
    - Sip (=default, advised for SIP server): Inband method that sends DTMF tones separately in dedicated SIP packets, distinct from audio packets.

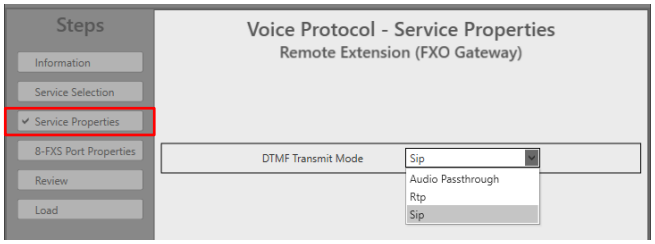


Figure 56 Voice Protocol FXO: Service Properties

- 8-FXS Port Properties: Each phone connected to an 8-FXS port has some properties that can be configured in this page. Click the arrow in the Device Name column to expand/collapse the node to show/hide the 8-FXS ports in this service. Configure the port property via clicking a cell in the port row and start typing to enter or select a value;

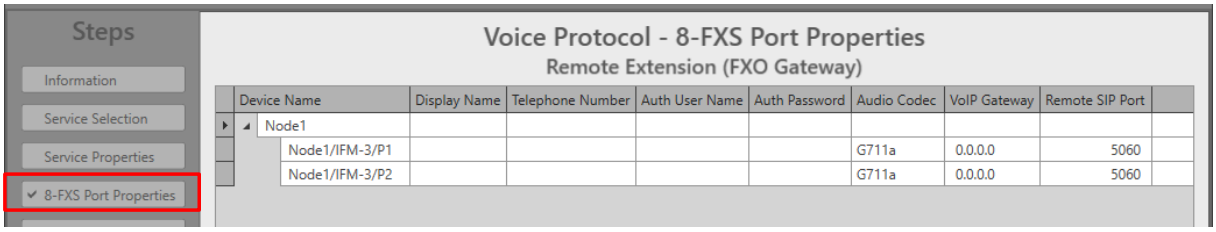


Figure 57 Voice Protocol FXO: 8-FXS Port Properties

Table 12 8-FXS Port Properties (Remote Extension)

Field	Values	Description
Device Name	<ports>	Shows the selected 8-FXS ports in the voice service that must be configured.
Display Name (=future support)	<text>	Name that must be displayed on the telephone display on the receiver side (=callee) when a call is set up.
Telephone Number	<number>	Telephone number that is assigned to the telephone connected to this 8-FXS port (=caller).
Auth User Name	<text>	User name assigned to this FXS port. This user name will be used in the SIP messages to authenticate this FXS port to the VoIP Gateway when it requests some client authentication.
Auth Password	<text>	Password assigned to this FXS port. This password will be used in the SIP messages to authenticate this FXS port to the VoIP Gateway when it requests some client authentication.
Audio Codec	G711a (=default) G711u G729	Encoding/Decoding standards that encodes/decodes analog voice into digital data or vice versa. G711a is the preferred Codec. Fallback to one of the other Codecs is possible if the SIP-server or remote side does not support this preferred Codec. The G711 codec provides an uncompressed high voice quality but requires almost 3 times more bandwidth (87 kbps) than the G729 codecs (32 kbps) which transmit a more compressed voice quality. So G729 calls have less voice quality than G711 calls, but are still good enough for most calls. So it is a tradeoff between voice quality and bandwidth. When using the Audio Passthrough DTMF transmit mode (see previous), it is strongly advised to use a G711 Audio Codec whereas the G729 could compress the tones too much resulting in unrecognized tones. The G711u (=µlaw) Codec is mostly used in Northern-America and Japan whereas G711a (=A-Law) is mostly used in the rest of the world.
VoIP Gateway	<ip address>	Default = 0.0.0.0. IP address of the VoIP Gateway (or SIP server port).
Remote SIP Port	<number>	Default = 5060. Indicates the remote SIP port that the VOIP Gateway is listening to for SIP traffic. The local SIP port on the 8-FXS IFM is not configurable and is by default 5060.

- Review: if ok, click Finish. The configuration load manager will be invoked.
- Load: The configuration load manager is a tool that starts and monitors the load process of a HiProvision configuration. Click the Load button to load the new HiProvision configuration into the live network. See Ref. [2Mgt] in Table 2 for more info.

CAUTION: While the loading to the Dragon PTN network is in progress, do not turn off, shut down or restart the HiProvision Server or Agent, since this may cause database corruption and network problems!

NOTE: Monitoring info available via Dashboard → (Monitoring) Protocols→ Other → Voice or via Dashboard → (Monitoring) Performance → Port Performance → CSM Ethernet Port Monitoring or CSM, L2 and L3 IFM Ethernet Port Monitoring.

7.3.5 SIP-Server Mode

a. General

- See Figure 54: SIP elements like a SIP Phone and VoIP gateways can be registered on and handled by the SIP Server;
- Analog phones are connected to an FXS interface (8-FXS module) which are registered on a SIP Server;
- Voice switching and telephony feature handling for all calls are performed in the SIP Server;
- Possible SIP telephony features depend on the used SIP devices and their interoperability.

b. Configuration

- Information: Click Next>>;
- Service Selection: select the Voice service in the list for which you want extra configuration and registration settings. Only the voice services without Voice Protocol configuration yet will be listed. Click Next>>;

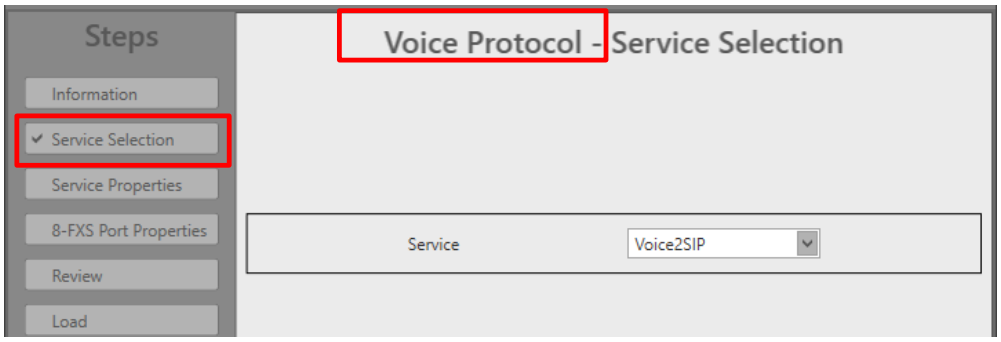


Figure 58 Voice Protocol SIP: Service Selection

- Service Properties:
  - DTMF Transmit Mode: See §7.3.4;
  - Dial Plan - Translation Pattern (default = e#r*~, use Reset button to set back to default): The Dial Plan specifies how a 8-FXS IFM must interpret digit sequences dialed by the caller, and how to convert the digit input into an outgoing dial string. The rules will be applied to all the 8-FXS IFMs in the service. Optional, click the Configure button to configure a more advanced Dial Plan - Translation Pattern. NOTE: it is also possible to overwrite this field manually without using the Dial Plan wizard (for advanced users!).

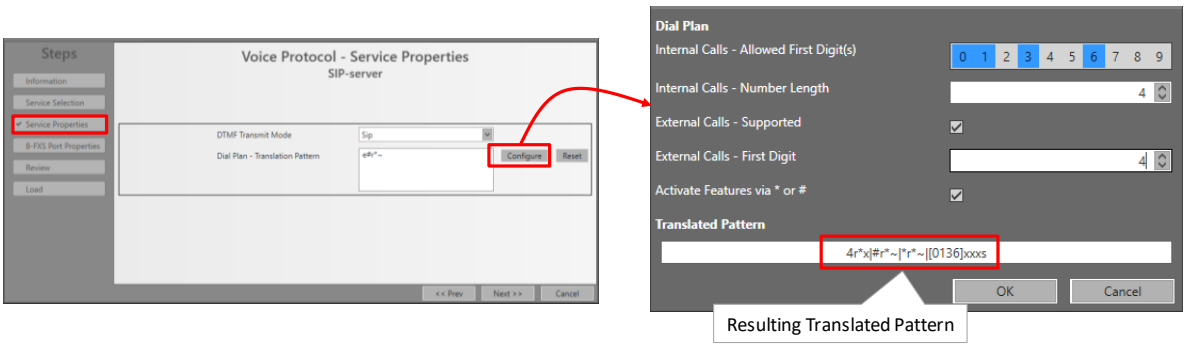


Figure 59 Voice Protocol SIP: Dial Plan - Translation Pattern

- Internal Calls - Allowed First Digit(s): (default = no allowed first digits = no internal calls allowed) Click the numbers that are allowed as first digit when dialing a number for an internal call.
- Internal Calls - Number Length: (default = 4, range [1..10]) Fill out the allowed dialed number length for internal calls e.g. internal number 4831 has length 4.
- External Calls - Supported:
  - Checked (=default): external calls supported;
  - Unchecked: external calls not supported.
- External Calls - First Digit: (default = 0, range [0..9]) If external calls are supported, fill out the number that must be used as first digit to set up external calls.
- Activate Features via */ #:
  - Checked (=default): telephone features are activated and can be accessed via dialing first the '*' or '#' key. See your SIP-server documentation to find the allowed feature codes;
  - Unchecked: telephone features are disabled.

- Example Resulting Translated Pattern: 4r*x|#r*~|*r*~|[0136]xxxs
  - 4r*x = Indicates that external calls (with first digit = 4) are supported;
  - r*~ = indicates allow any digit (0-9, a-d, *, #) until the timeout or the terminating character is found;
  - #r*~ = allows the digit string to start with '#';
  - *r*~ = allows the digit string to start with '*';
  - [0136]xxxs = Internal calls with a length of 4 characters and starting with 0, 1, 3 or 6 are allowed;

Table 13 Translated Pattern Parameters

Parameters	Description
|	separates different possible patterns
r	repeat by following a number (1-9), letter (a-z for 10 to 35 times) or "*", “+” or "." to mean any number of times (255 times)
.	repeat previous digit any number of times (0 to 255)
+	repeat previous digit any number of times (0 to 255)
x	match any numerical digit (0-9)
~	match any digit (0-9, A-D, *, #) excluding any specified terminators
!	disallows pattern
$	indicates secondary dialing to follow - used only by fixed dial strings
<:>	replace group to replace left digit(s) with right digit(s)
[]	selection group of candidate digits
[^]	exclusion group of digits
[0-9]	selection range of candidate numerical digits
[a-d]	selection range of candidate letter digits
s	seize on string as only candidate if match to this point
e	specify ending termination digit which follows (usually * or #)
f	pause timeout causes failure instead of dial

Parameters	Description
p	set digit pause to number of seconds which follow (1-9) for current pattern
t	set digit timeout to default for current pattern
-	human readable spacing which is ignored
<space>	human readable spacing which is ignored

- 8-FXS Port Properties: Each phone connected to an 8-FXS port has some properties that can be configured in this page. Click the arrow in the Device Name column to expand/collapse the node to show/hide the 8-FXS ports in this service. Configure the port property via clicking a cell in the port row and start typing to enter or select a value;

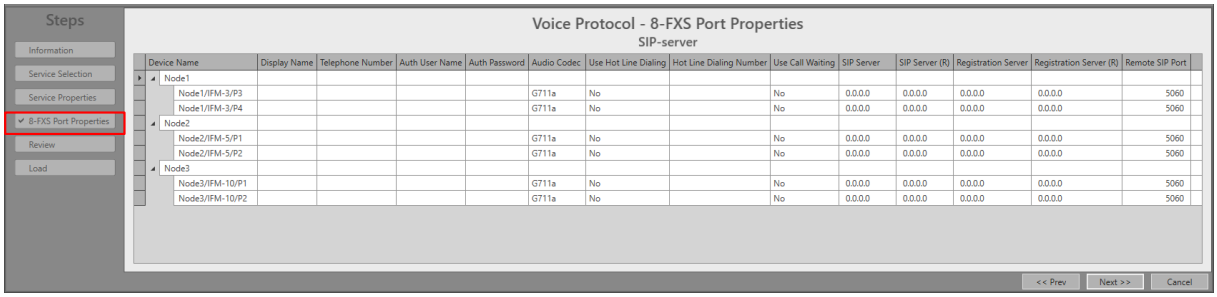


Figure 60 Voice Protocol SIP: 8-FXS Port Properties

Table 14 8-FXS Port Properties (SIP-Server)

Field	Values	Description
Device Name	<ports>	Shows the selected 8-FXS ports in the voice service that must be configured.
Display Name (=future support)	<text>	Name that must be displayed on the telephone display on the receiver side (=callee) when a call is set up.
Telephone Number	<number>	Telephone number that is assigned to the telephone connected to this 8-FXS port (=caller).
Auth User Name	<text>	User name assigned to this FXS port. This user name will be used in the SIP messages to authenticate this FXS port to the SIP Server when it requests some client authentication.
Auth Password	<text>	Password assigned to this FXS port. This password will be used in the SIP messages to authenticate this FXS port to the SIP Server when it requests some client authentication.
Audio Codec	G711a (=default) G711u, G729	See Table 12.
Use Hot Line Dialing	Yes/No	Hotline means that if you pick up a phone or initiate a call, an immediate direct connection will be set up with the configured 'Hot Line Dialing Number' without the need of manual dialing a number yourself. A client that has a hotline configured will not be able to call any other number besides the hot line number. No (=default): Hot Line dialing is disabled. Yes: Hot Line dialing is enabled.
Hot Line Dialing Number	<number>	Default = empty. Indicates the number that must be dialed when a client with 'Use Hot Line Dialing=Yes' picks up a phone to initiate a call.

Field	Values	Description
Use Call Waiting (future use)	Yes/No	No (=default): The call waiting feature is disabled on this client. This client cannot accept a second call when a first call is already in progress. Yes: The call waiting feature is enabled on this client. This client can temporarily suspend or set on hold the first call to accept a second incoming call. This client can switch between the two calls.
SIP Server	<ip address>	Default = 0.0.0.0. IP address of the SIP Server.
SIP Server (R)	<ip address>	Default = 0.0.0.0. IP address of the Redundant SIP Server.
Registration Server (=future use)	<ip address>	Default = 0.0.0.0. IP address of the Registration Server. Current behavior: Registration will be done on the SIP Server.
Registration Server (R) (=future use)	<ip address>	Default = 0.0.0.0. IP address of the Redundant Registration Server. Current behavior: Registration will be done on the SIP Server.
Remote SIP Port	<number>	default = 5060. Indicates the remote SIP port that the SIP server is listening to for SIP traffic. The local SIP port on the 8-FXS IFM is not configurable and is by default 5060.

- Review: if ok, click Finish. The configuration load manager will be invoked.
- Load: The configuration load manager is a tool that starts and monitors the load process of a HiProvision configuration. Click the Load button to load the new HiProvision configuration into the live network. See Ref. [2Mgt] in Table 2 for more info.

CAUTION: While the loading to the Dragon PTN network is in progress, do not turn off, shut down or restart the HiProvision Server or Agent, since this may cause database corruption and network problems!

NOTE: Monitoring info available via Dashboard → (Monitoring) Protocols.

7.4 Modify Service/Protocol

After service/protocol creation, this service/protocol can be modified if needed via:

- Service: Dashboard → Configuration → Connections → Services → select service →  ;
- Protocol: Dashboard → Configuration → Protocols → Protocol Categories → Other → Voice Protocol → select protocol in the protocols list  ;

7.5 Delete Service/Protocol

After service/protocol creation, this service/protocol can be deleted if needed via:

- Service: Dashboard → Configuration → Connections → Services → select service →  ;
- Protocol: Dashboard → Configuration → Protocols → Protocol Categories → Other → Voice Protocol → select protocol in the protocols list  ;

NOTE: A service can only be deleted if its linked protocol has been deleted first.

7.6 Troubleshooting

The protocols monitor can help in troubleshooting. See §7.7.5.

7.7 Monitoring

7.7.1 (Configuration) Network Hardware Tile

None.

7.7.2 (Configuration) Connections Tile

What has been configured via the service wizard can also be viewed via Dashboard → Connections → Services → select service in the list. Some extra tabs (Service, Voice, VLAN Tagging/Untagging/Address Assignments) with service configuration data will be shown.

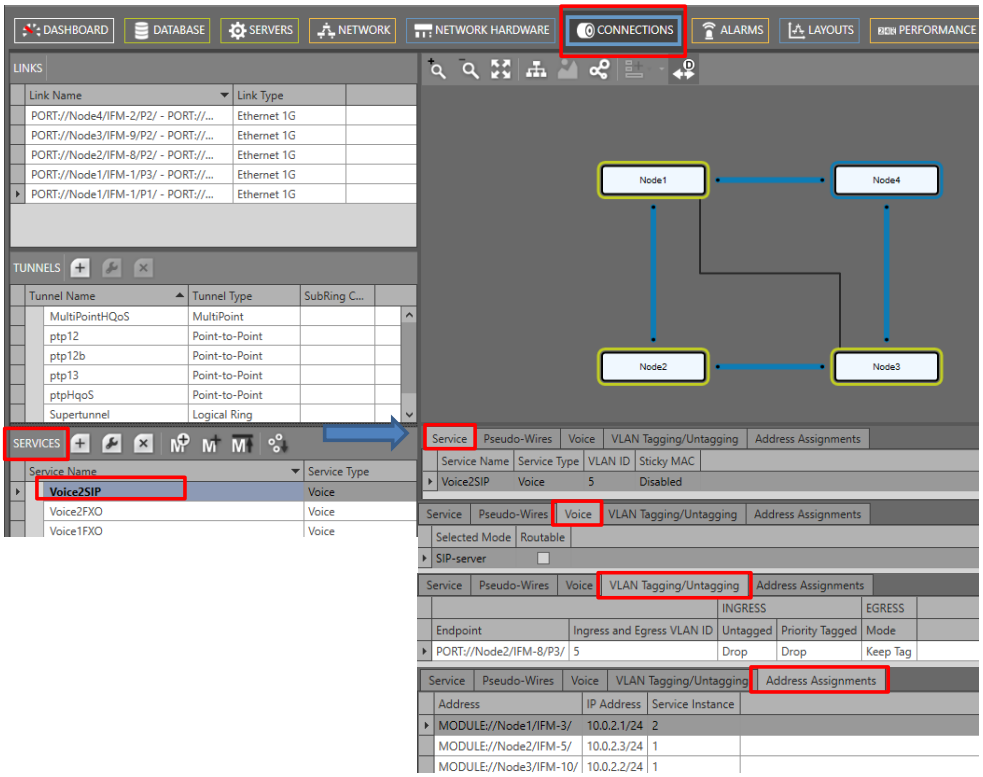


Figure 61 (Configuration) Connections Tile: Voice

7.7.3 (Configuration) Protocols Tile

Below, you can find the voice protocols monitor via Dashboard → (Configuration) Protocols→ Protocol Category → Other → Voice Protocol → Select Protocol….

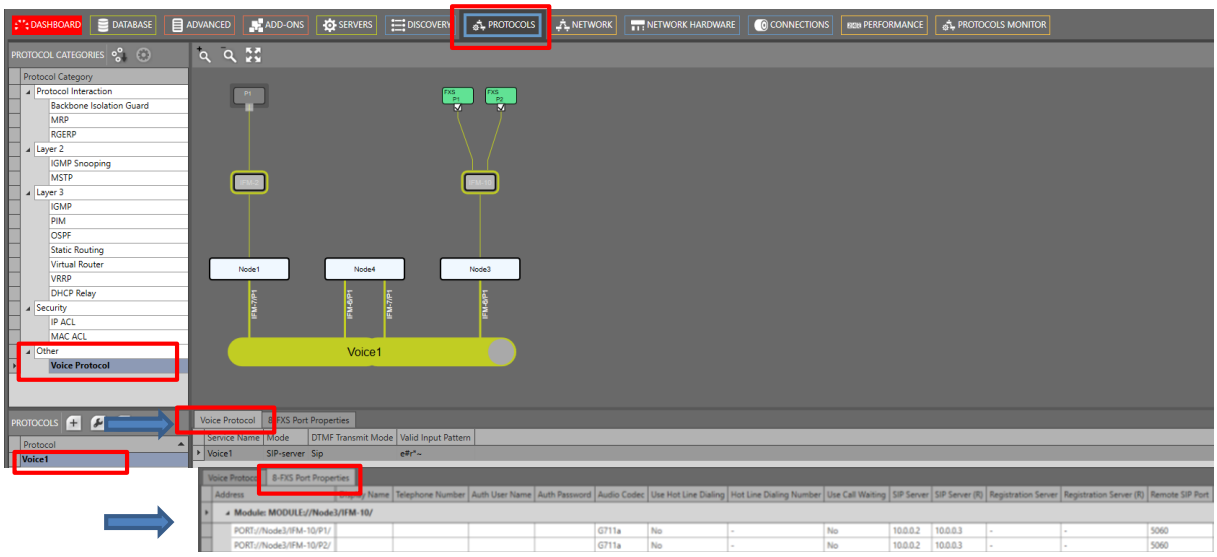


Figure 62 Protocols: Voice Protocol Monitor

7.7.4 (Monitoring) Network Tile

Live service data can be monitored via the Dashboard → Network → Services → select service in the list. The service will be shown in the network drawing. Click  to show extra monitoring properties for this service. Click  to show the used nodes/links/tunnels.

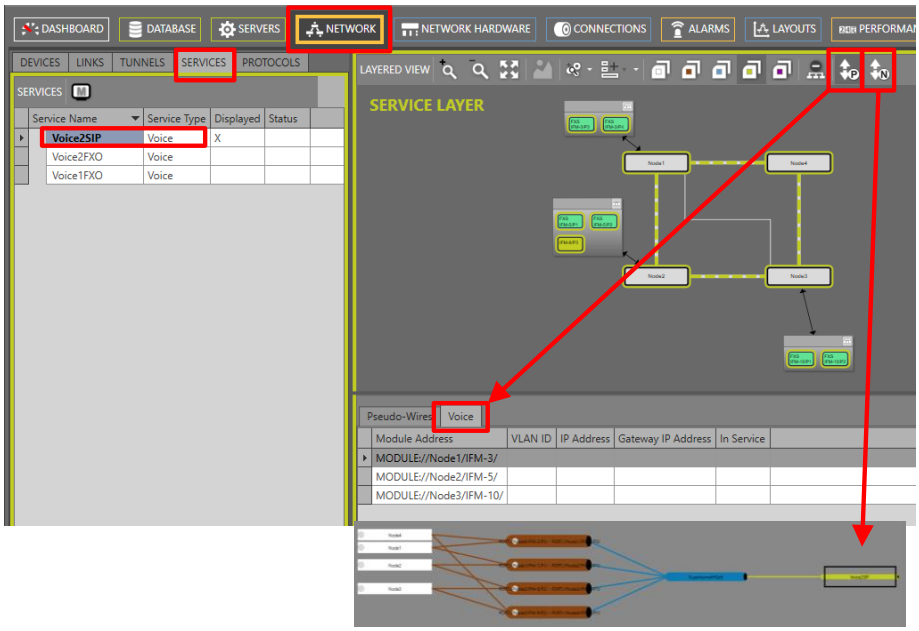


Figure 63 (Monitoring) Network Tile: Voice Service

NOTE: No extra monitoring info in the Dashboard → Network → Protocols available.

7.7.5 (Monitoring) Protocols Tile

Below, you can find the voice protocols monitor via Dashboard → (Monitoring) Protocols→ Protocol Category → Other → Voice Protocol → Select Protocol….

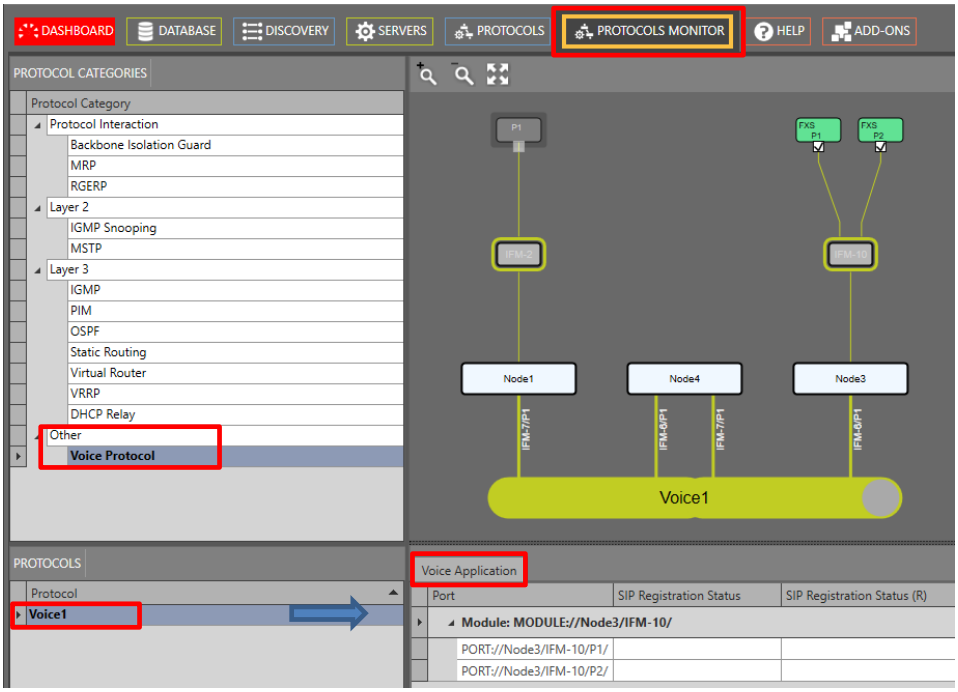


Figure 64 Protocols: Voice Protocol Monitor

7.7.6 Performance Counters

The used Ethernet ports (either 4-GC-LW … via CSM, or L2/L3) in this service can be monitored. Go to Dashboard → (Monitoring) Performance → Counter Control → Service Performance → 'CSM Ethernet Port Monitoring' or 'L2 and L3 IFM Ethernet Port Monitoring'. See figure below.

A detailed and similar monitoring set-up description (adding counters to graphs etc…) can be found in 'Port Performance' → 'CSM Ethernet Port Monitoring' in Ref. [2Net] in Table 2.

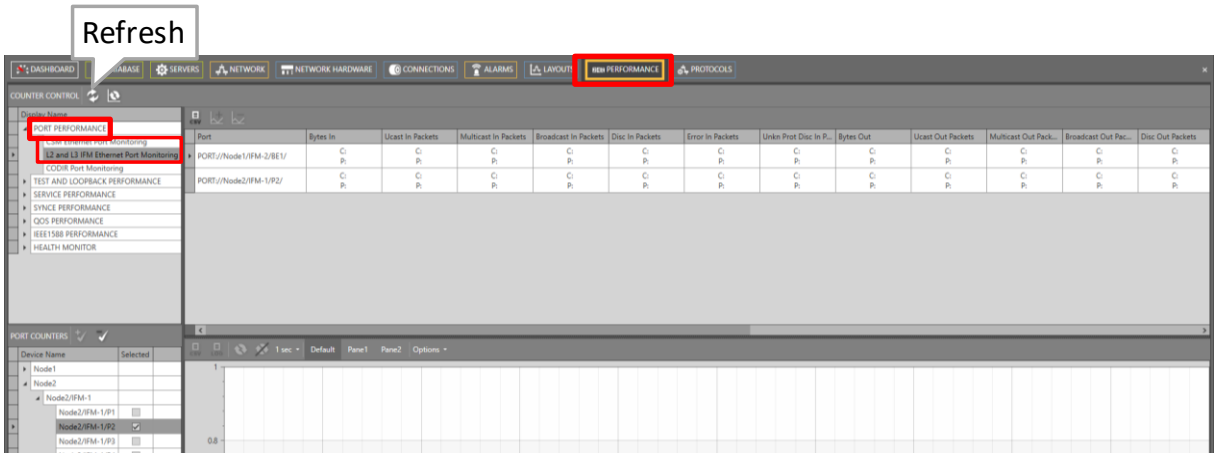


Figure 65 Performance Counters: Voice Service: Ethernet Ports Monitoring

7.7.7 HiProvision Add-on: Generic Reporting Engine

Service and port reporting information is available via the Reporting Engine Add-on, see Ref.[24] in Table 2.

7.7.8 MAC Monitor

The MAC Monitor will show the MAC address table of the selected Node (=CSM). This table includes all MAC addresses used on this device except for the MAC addresses that are used in a point-to-point tunnel. More information can be found in Ref. [2Eth] in Table 2.

MAC Monitor via: Dashboard → (Monitoring) Network → Services →  ;

8. SHDSL (VIA ETHERNET)

8.1 General

Supported IFMs: 4-DSL-LW, more information on this IFM can be found in Ref. [8] in Table 2.

In a general SHDSL link setup between a customer and network side, one link partner must act as the CO (=Central Office) and the other link partner must act as the CPE (=Customer Premises Equipment). Within the Dragon PTN solution, the 4-DSL-LW module is by default configured as CO. If both SHDSL link partners are configured in the same device mode, the SHDSL link will not synchronize and as a result will not come up. A general SHDSL example can be found in the figure below.

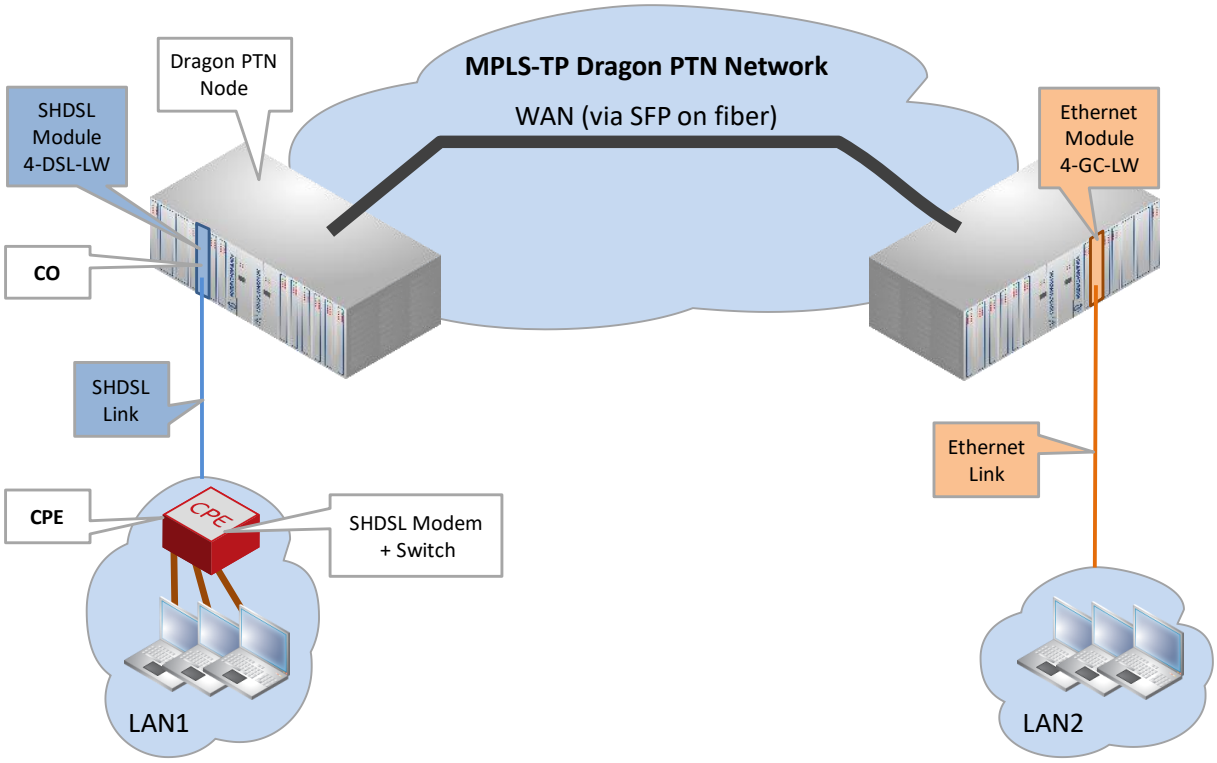


Figure 66 General SHDSL Example

8.2 Configure Service

8.2.1 Service Wizard

To transport SHDSL, an Ethernet service must be configured. Configuring this service in the service wizard is exactly the same as described in the 'Ethernet Services manual', see Ref.[2Eth] in Table 2.

8.2.2 Network Hardware → IFM Settings

After configuring the service via the service wizard, all IFM settings will be set according to the service configuration. Some individual IFM settings might need extra tuning or must be overruled. Find IFM settings via Network Hardware → Devices → 4-DSL-LW. Following two parameters can be configured (description further below):

- Unit Type.
- PAF Mode;

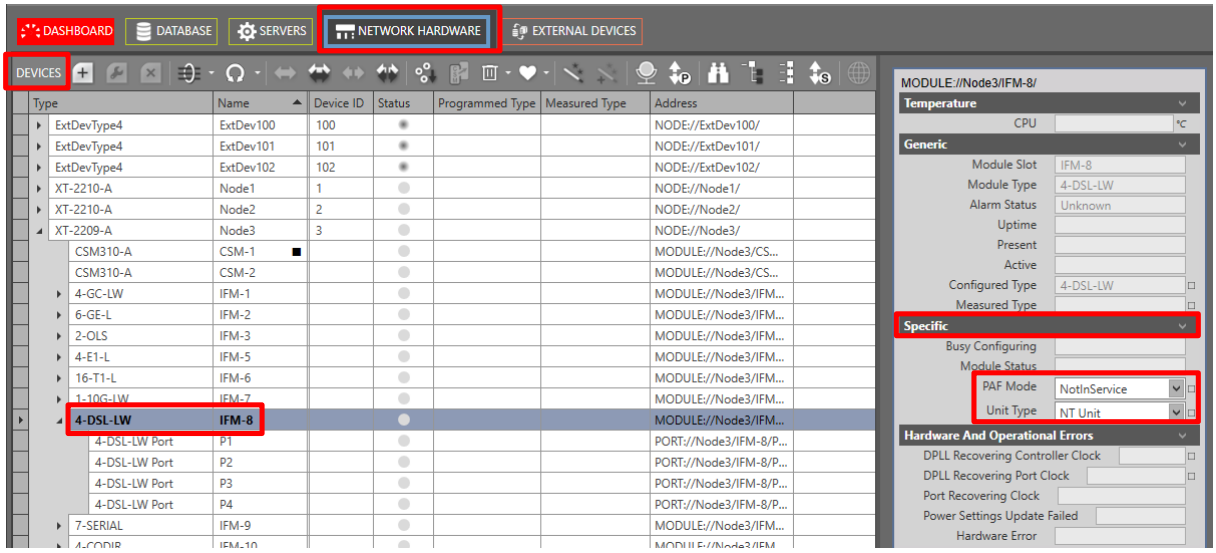


Figure 67 4-DSL-LW IFM: Unit Type/PAF Mode

a. Unit Type (=Device Mode)

In a general SHDSL link setup between a customer and network side, one link partner must act as the CO (=Central Office) and the other link partner must act as the CPE (=Customer Premises Equipment). Within the Dragon PTN solution, the 4-DSL-LW module is by default configured as CO. If both SHDSL link partners are configured in the same device mode, the SHDSL link will not synchronize and as a result will not come up.

The powering of the 2-OLS IFM can be configured by the 'Forced Power Mode'. The setting of this parameter determines whether a CSM is required in the node for powering the 2-OLS IFM. Go to Network Hardware → Devices → 4-DSL-LW → Specific → Unit Type.

The 'Device Mode' (CO or CPE) of the 4-DSL-LW module depends on the configuration in HiProvision and some DIP switch settings in on the IFM (see Ref. [3] in Table 2).

The 'Device Mode' configuration in HiProvision will always be the master setting. In HiProvision, configure the 'Unit Type' parameter on IFM level as follows:

- CO: Unit Type = 'LT Unit'; (LT = Line Termination);
- CPE: Unit Type = 'NT Unit'; (NT = Network Termination);

Only when there is nothing configured in HiProvision for this IFM, the DIP switch settings on the IFM board itself come into play.

b. PAF Mode

- PAF: PME Aggregation Function;
- PME: Physical Medium Entities.

PAF or Bonding is a technique where multiple SHDSL links, connected to the 4-DSL-LW module, are combined into one logical link. This results in redundancy and a higher bandwidth for the resulting combined link. Within the SHDSL link, bonding must be configured on either the CO or the CPE, see Table 15. The link partner without bonding configured will slave and negotiate with the link partner that has bonding configured. After the bonding has been negotiated between the CO and CPE, the bonded SHDSL links come up. Different line rates are possible within the bonded links, but the difference between the fastest and slowest link must be less than 4 Mbps. SHDSL ports can be combined or bonded in HiProvision as indicated in Table 15.

NOTE: When using the SHDSL link as LAN, make sure to configure the local and the remote LAN SHDSL links with the same bonding or PAF mode;

Table 15 Bonding Combinations

Bonding Mode	PAF Mode in HiProvision	Must be Configured on	Port1	Port2	Port3	Port4
No Bonding	NotInService (=default)	---	Single	Single	Single	Single
2 links	34	CO (or LT)	Single	Single	Bonding (P4)	
3 links	234	CO (or LT)	Single	Bonding (P4)		
4 links	1234	CO (or LT)	Bonding (P4)			
2 + 2 links	12 and 34	CPE (or NT)	Bonding (P2)		Bonding (P4)	
Single: No bonding is active on this port; Bonding (Px): The bonding aggregation is internally mapped on 'Port x'; Only 'Port x' must be used when configuring the service in HiProvision;						

When changing the bonding or PAF mode, in some cases the bonded SHDSL links will go down until the new mode has been negotiated again between the CO and CPE.

- Changing the bonding from '2 + 2 links' to another mode;
- Changing the bonding from '4 links' to '3 links' or '2 links';
- Changing the bonding from '3 links' to '2 links';

8.2.3 Network Hardware → IFM-Port Settings

After configuring the service via the service wizard, all port settings of the endpoints in this service will be set according to the service configuration. Some individual port settings might need extra tuning or must be overruled. Go to Network Hardware → Devices → 4-DSL-LW → 4-DSL-LW port.

a. Line Probing

Enable the parameter ‘Line Probing’. As a result, the port will automatically check the quality of the SHDSL link. The port will automatically decide which is the best possible bandwidth or Line rate for the available SHDSL link.

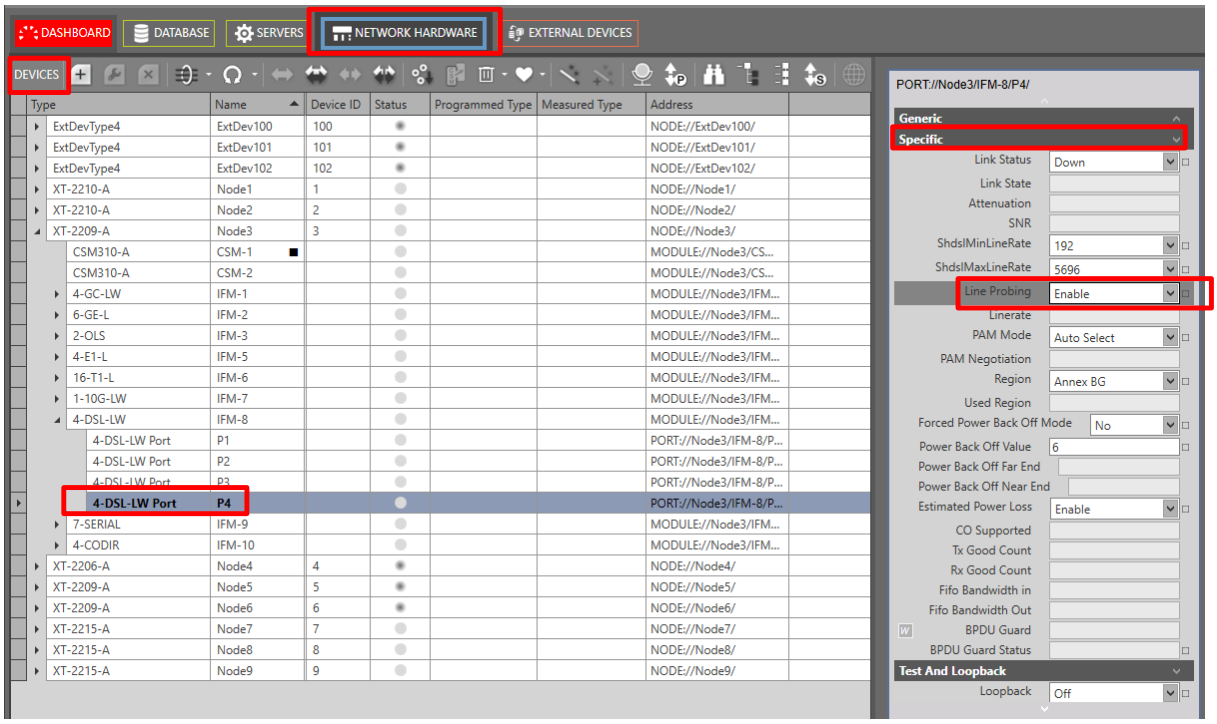


Figure 68 4-DSL-LW IFM: Line Probing

b. ShdslMinLineRate

Configure the SHDSL Minimum Line Rate (range [192…5696] kbps). The default value is 192 kbps. It can be configured in steps of 64 kbps.

c. ShdslMaxLineRate

Configure the SHDSL Maximum Line Rate (range [192…5696] kbps). The default value is 5696 kbps. It can be configured in steps of 64 kbps.

d. PAM Mode

The line coding or PAM (Pulse Amplitude Modulation) can be configured. When the value is changed, the link has to be disabled and enabled again.

- PAM Mode:
  - Auto Select (=default) ;
  - 16 Pam: uses 3 bits (16 codes) for encoding, possible between 192-3840kbps;
  - 32 Pam: uses 4 bits (32 codes) for encoding, possible between 768-5696kbps;

e. Region

The Region can be configured. When the value is changed, the link has to be disabled and enabled again.

- Region:
  - Annex BG (=default): Europe;
  - Annex AF: Nord America;

f. Forced Power Back Off Mode (No/Yes) / Power Back Off Value (0..31) (Future)

(Future support) The power back off algorithm enables 4-DSL-LW IFMs to adjust transmit power according to conditions on the line. Operators can use this feature to manage and reduce crosstalk noise on the network. When the value is changed, the link has to be disabled and enabled again.

- Yes: Lower the transmitter power level of the modem with the 'Power Back Off Value'. This reduces interference to other transmission systems operating on adjacent pairs bundled in the same cable. The transmit power will be reduced adaptively in function of the estimated cable attenuation.
- No: do not lower the transmitter power;

g. Estimated Power Loss (Enable/Disable) (Future)

Future support.

8.3 Troubleshooting: Test and Loopback

This service can be tested via loopback settings on port level in the Network Hardware tab. See §14 for setting up loopbacks on the 4-DSL-LW IFM ports.

8.4 Monitoring

8.4.1 (Configuration) Network Hardware Tile

The SHDSL link status can be verified via the port settings. Go to Dashboard → (Configuration) Network Hardware → Devices →select IFM→ select port → Specific:

- Link State: The link should come up. As a result, the link status should indicate 'up'.
- SNR: as a result of the line probing, the signal-to-noise ratio (=SNR) will be filled out automatically in dB. SNR is an indication of the quality of the signal on the SHDSL link. If the quality or the SNR is too poor, the SHDSL link will not come up. The longer the SHDSL link, and the higher the automatically selected line rate due to line probing, the lower the SNR will be. Make sure that the SNR is at least 6dB or higher. If the measured SNR is lower than 6dB, disable 'Line Probing' and set the Maximum Line Rate lower, until SNR is higher than 6dB.

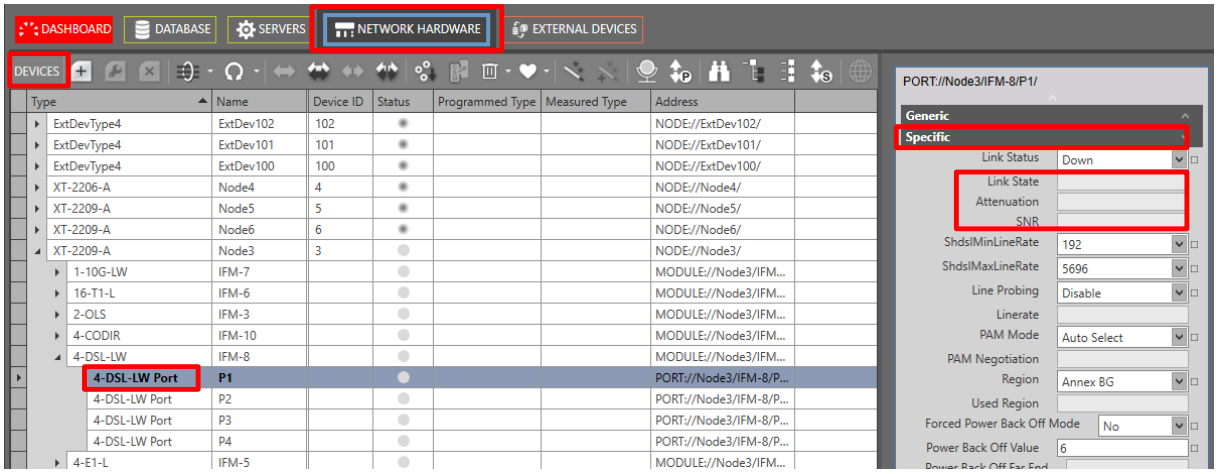


Figure 69 Local Mode Indication: Internal Connection

8.4.2 Other

Other monitoring info ethernet service related and is similar to the monitoring info in the manual Ref.[2Eth] in Table 2.

9. SMART SFP

9.1 General

Smart SFP is a hot-pluggable optical transceiver that converts incoming STM/OC frames from a fiber-optic SDH/SONET network into Ethernet frames or vice versa for outgoing frames. This conversion occurs at ports or IFMs that support smart SFP, see Ref.[14] in Table 2.

Smart SFPs must be used in a point-to-point (1st/2nd Smart SFP, see figure below) port based Ethernet service over Dragon PTN.

As a result, Dragon PTN allows to transparently transport synchronous digital bit streams from an SDH/SONET network via the IFMs that support smart SFP. The available Smart SFPs can be found in Ref. [14] in Table 2.

For clocking/synchronization, SyncE (see Ref. [2Net] in Table 2) must be configured in the nodes that have Smart SFPs plugged in.

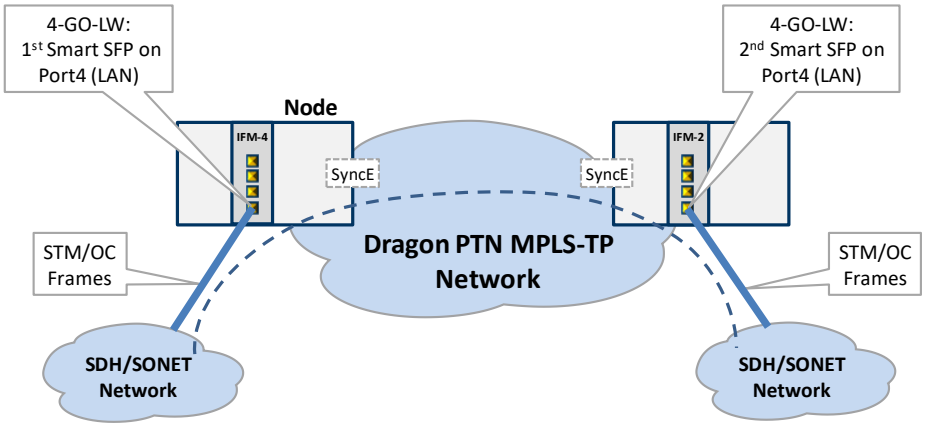


Figure 1 Example: Smart SFPs Setup / PTP

9.2 Configure Service and Monitor

Prerequisite: Make sure to have two Smart SFPs (with the right speed, see Ref. [14] in Table 2) plugged in somewhere in the Dragon PTN network in an IFM that supports smart SFP. These ports must have been configured as LAN port.

1. Configure SyncE (see Ref. [2Net] in Table 2) in the nodes that have plugged in the Smart SFPs;
2. In HiProvision, configure a point-to-point port based Ethernet service with these two Smart SFP ports.
   - Click Dashboard → Configuration → Connections → Services →  to open the services wizard. See figure below. The services wizard opens. The list below summarizes every page in the wizard

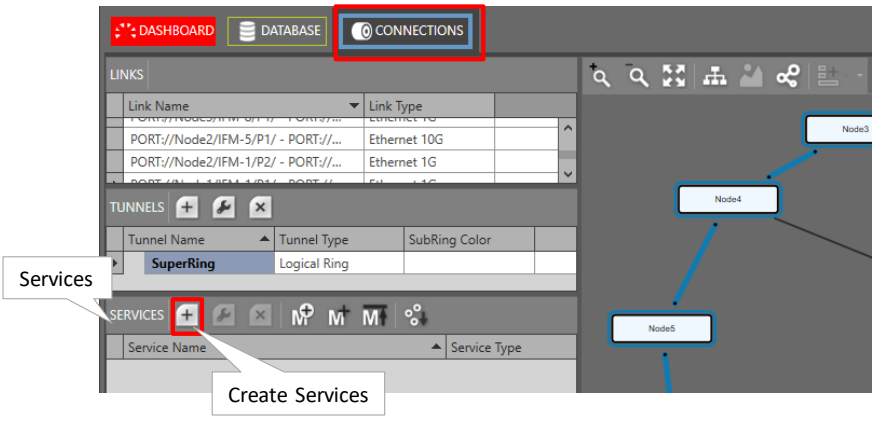


Figure 2 Create Services

- Page: Information: Click Next>>;
- Page: Service Name and Type Selection:
  - Service Name: enter a name for your service.
  - Service Type: Ethernet;

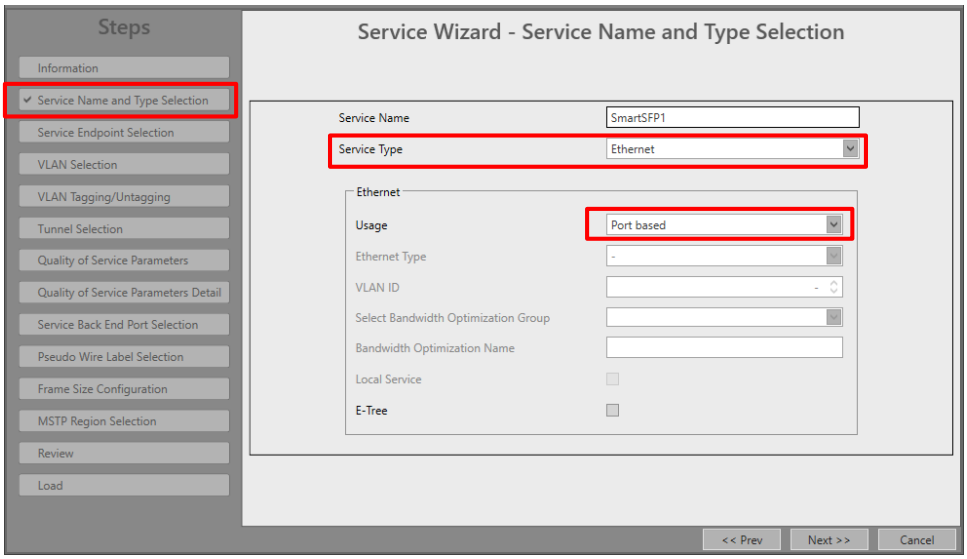


Figure 3 Smart SFP: Ethernet Service Type / Port Based

- Page: Service Endpoint Selection: Select the front ports on the involved IFMs that must be part of this service. Make sure to select the ports in nodes that are linked to a same tunnel. Selecting ports can be done in two ways:
  - Via the table. The tree view can be expanded/collapsed via clicking the expand/collapse buttons. Just click the Selected checkbox to select the desired port;
  - Via clicking the node icons in the network drawing, see general example in §13;

  NOTE: Per port, an extra Info field can be filled out later on via Network Hardware → Devices → Select Node/IFM/Port → Generic → Info

- Page: VLAN Tagging/Untagging: leave this page as it is, defaults are OK.
- Page: Tunnel Selection: Allowed tunnels for this service type: a normal point-to-point tunnel without HQoS. See §11 to select the desired tunnel;
- Page: Quality of Service Parameters: Configure the exact values below:
  - Priority = 1
  - Maximum Frame Size = 1522 bytes (=default)
  - Frame Size Mode = custom frames;
  - Small Frame = 1% : 64 bytes;
  - Custom Frame = 99%: 848 bytes;
  - Large Frame = 0%;
  - Bandwidth & Burst Size Mode: Endpoint Based;
  - Endpoint (useful) Bandwidth:
    - STM-1/OC-3 Smart SFP: 167 Mbps (or 167 000 kbps);
    - STM-4/OC-12 Smart SFP: 655 Mbps (or 655 000 kbps);
- Page: Quality of Service Parameters Detail: see §12. Leave this page as it is, defaults are OK;
- Page: Pseudo Wire Label Selection: leave this page as it is, defaults are OK;
- Page: Review: The selected service ports will be shown: if ok, click Finish, the configuration load manager will be invoked.
- Page: Load: The configuration load manager is a tool that starts and monitors the load process of a HiProvision configuration. Click the Load button to load the new HiProvision configuration into the live network. See Ref. [2Mgt] in Table 2 for more info;

CAUTION: While the loading to the Dragon PTN network is in progress, do not turn off, shut down or restart the HiProvision Server or Agent, since this may cause database corruption and network problems!

- After this step, your customer applications connected to the front ports of the IFMs should be able to communicate over the Dragon PTN network.

3. If your Smart SFPs are plugged in and the port is up, HiProvision must show both basic SFP and Smart SFP info after selecting the ports, see figure below. Also the Link Active (LA) LED of the IFM will blink immediately after plugging in the Smart SFPs.
4. Each Smart SFP has its own MAC address. It is possible to add extra security to the point-to-point connection. You can configure that the 1st Smart SFP only communicates with the 2nd one and vice versa. This can be done by filling out the **Destination MAC Address** of the

other Smart SFP and setting the **Destination MAC Check** to **true**. This must be done on both Smart SFPs. As a result, if you plug in another Smart SFP with another MAC address, the point-to-point connection will not work anymore.

5. Connect your two fiber-optic SDH/SONET points to the Smart SFPs;
6. If your link is up and running, the 'TSoP Tx/Rx' counters increase (refresh rate takes a few seconds). Counters can be cleared via the 'Clear Counters' drop down.
7. If you think the link is not up and running, you could reboot the smart SFP by selecting a warm (=no traffic loss) or a cold (=traffic loss) reboot in the 'Reboot' dropdown.

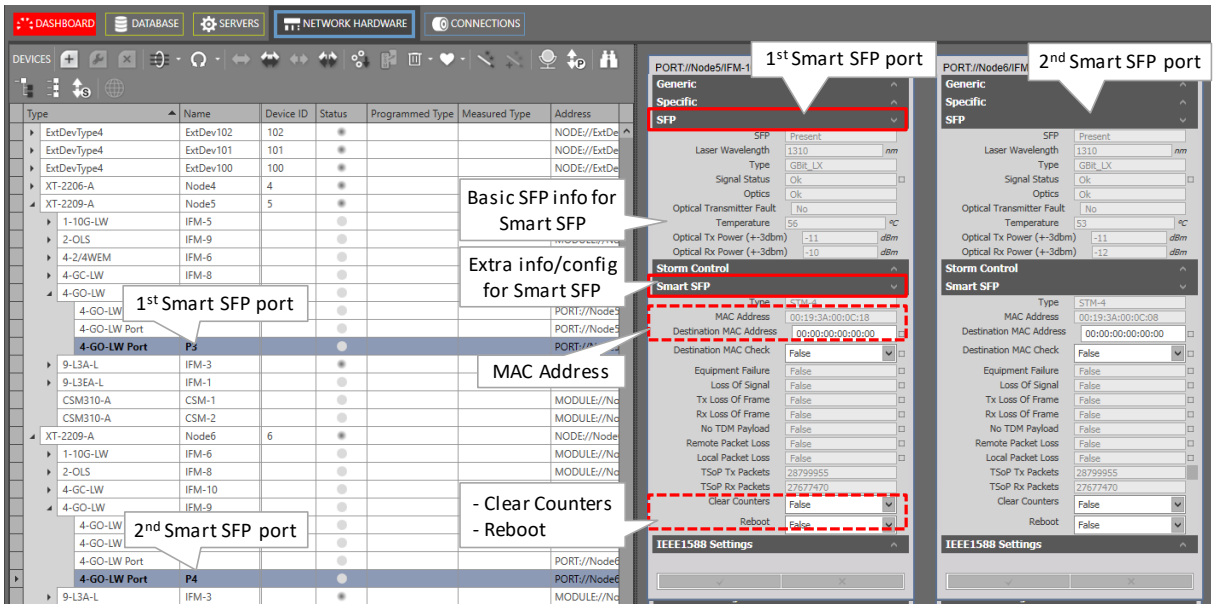


Figure 4 Example: Smart SFPs in HiProvision

9.3 Alarms

Some alarms are provided which can be found in the table below.

Table 1 Smart SFP Alarms

Condition	Alarm 1st Smart SFP	Alarm 2nd Smart SFP
Pull out Rx at 1st Smart SFP	Loss Of Signal, Rx Loss Of Frame	Tx Loss Of Frame, No TDM Payload
Pull out Tx at 1st Smart SFP	no alarms	no alarms
Pull out Rx & Tx at 1st Smart SFP	Loss Of Signal, Rx Loss Of Frame	Tx Loss Of Frame, No TDM Payload
Stop Ethernet traffic going to 1st Smart SFP	Local Packet Loss, Tx Loss Of Frame	Remote Packet Loss
Pull out WAN link between two Dragon PTN nodes	Local Packet Loss, TX Loss Of Frame	Local Packet Loss, TX Loss Of Frame
Pull out 1st Smart SFP	no alarms	Tx Loss Of Frame, No TDM Payload, Local Packet Loss

10. SERIAL BITRATES

Table 2 Bitrates (bps)

Service Type	Local Mode		Serial Ethernet	Circuit Emulation							
Protocol	Optical Low Speed Serial		---	Serial				Optical Low Speed Serial			
Usage	---		---	SAToP/CESoPSN				SAToP		CESoPSN	
Mux/Demux	---		---	No		Yes		---		---	
Synchronisation	Async.	Sync.	---	Async.	Sync.	Async.	Sync.	Async.	Sync.	Async.	Sync.
Bitrate (bps)	1200 2400 4800 9600 19200 38400 57600 76800 115200 297600	1x64k (64k) 2x64k (128k) 4x64k (256k) 8x64k (512k) 16x64k (1024k)	1200 2400 4800 9600 19200 38400 76800 115200	1200 2400 4800 9600 19200 38400 76800 115200	1x64k (64k) 2x64k (128k) … 29x64k (1856k) 30x64k (1920k) 300 600 1200 2400 4800 9600 14400 19200 38400 57600 115200	300 (*) 600 (*) 1200 (*) 2400 (*) 3600 (*) 4800 (*) 7200 (*) 9600 (*) 12000 (*) 14400 (*) 19200 (*)	600 (*) 1200 (*) 2400 (*) 4800 (*) 9600 (*) 19200 (*) 38400 (*) 1x64k (64k) 2x64k (128k) … 29x64k (1856k) 30x64k (1920k)	max bitrate is always 307200 bps	1x64k (64k) 2x64k (128k) 4x64k (256k) 8x64k (512k) 16x64k (1024k) 32x64k (2048k)	1200 2400 4800 9600 19200 38400 57600 76800 115200 297600	1x64k (64k) 2x64k (128k) 4x64k (256k) 8x64k (512k) 16x64k (1024k)

(*) With these selected bitrates, the V.110 standard will be used to transport the serial streams over the Dragon PTN network. Note: The BERT generator on the 4-E1-L IFM port1 does not support these V.110 speeds.

11. WIZARD PAGE: TUNNEL SELECTION

11.1 General

- Prerequisite: tunnels must have been created. See Ref. [2Net] in Table 2 for more info. Different tunnel types are possible:
  - Point-to-Point; MultiPoint; Logical Ring; Subring;

A service connects front ports on one side of the tunnel to the front ports on the other side of the tunnel. The service can be programmed within one tunnel or within multiple combined tunnels with each tunnel already configured before. See figures below:

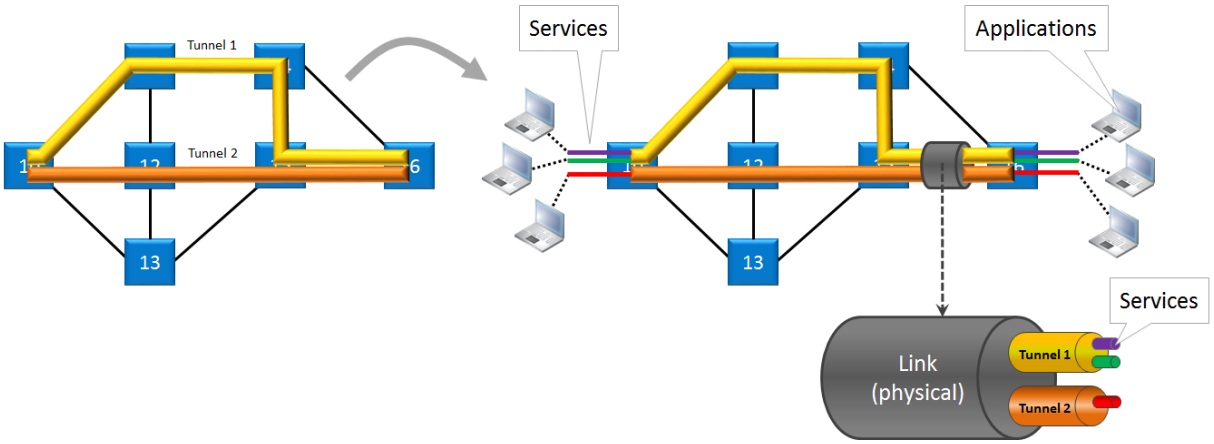


Figure 5 Service Creation in Tunnels

NOTE: A maximum of eight services can be programmed per tunnel;

NOTE: If one tunnel cannot cover the required service path, multipoint, logical ring and subring tunnels can be combined into one big tunnel to provide the path. Tunnels must be combined in a Tunnel Combination Point, which is a node in which one tunnel ends and the other tunnel starts, see figure below.

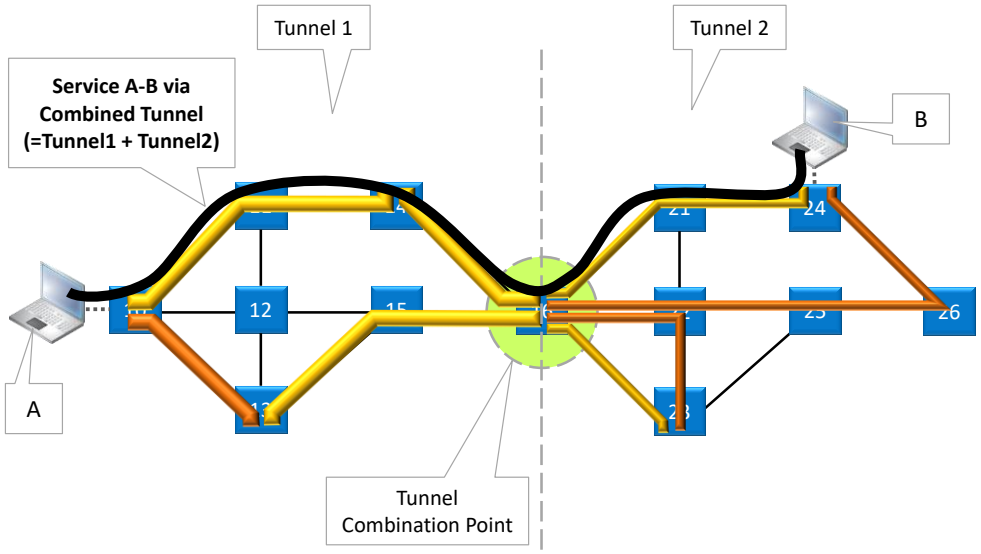


Figure 6 Service Via Combined Tunnels

11.2 Tunnel Selection

Select the required tunnel(s) from the available tunnels list, via checking the 'Selected' checkbox, to transport your configured service. See figure below.

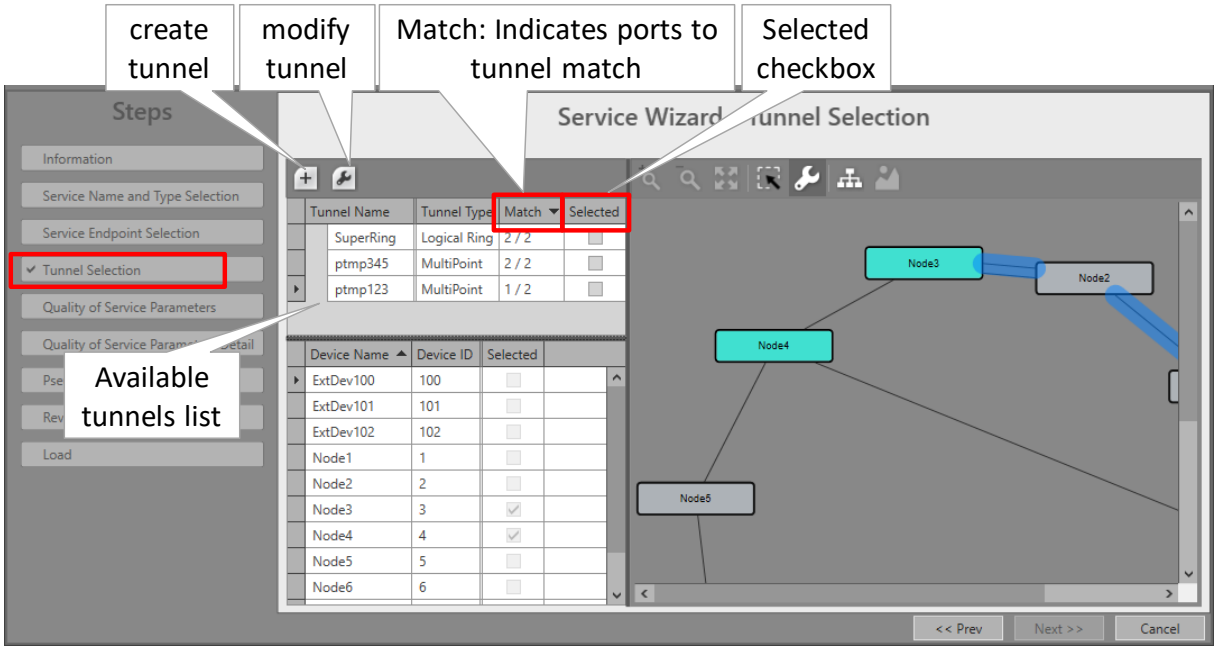


Figure 7 Ports to Tunnel Match

- Tunnels list: The allowed or shown tunnels in the tunnel list depend on your service type.

Table 3 Allowed Tunnel Types per Service Type

Service Type	Point-to-Point		MultiPoint		Logical Ring		Subring	
	Normal	HQoS	Normal	HQoS	Normal	HQoS	Normal	HQoS
Smart SFP (Ethernet)	✓	---	---	---	---	---	---	---
Voice	---	---	✓	✓	✓	✓	✓	✓
Serial Ethernet	---	---	✓	---	✓	---	✓	---
Circuit Emulation	✓	---	---	---	---	---	---	---
Local Mode (no tunnel needed)	---	---	---	---	---	---	---	---
✓ = allowed; --- = not allowed/not possible Note: A service can only use either a normal (=Non-HQoS) or HQoS tunnel, but not a mix of both.								

- Match (x/y):
  - x: number of reachable service ports (or termination points) via this tunnel;
  - y: number of selected service ports (or termination points);
  - Perfect match: e.g. 2/2: all the selected service ports belong to nodes that are all linked to this tunnel. This tunnel can transport the service;

- Mismatch: e.g. 1/2: at least one of the selected service ports belongs to a node that is not linked to this tunnel. A single selected tunnel with a mismatch cannot transport the required service;
- Selected: checkbox to select the tunnel.

- One tunnel: If only one tunnel is selected, this tunnel has to have a perfect match to transport the required service;
- Combined tunnels: multiple tunnels can be selected or combined (by just selecting them in the tunnel list) into one big tunnel to transport the required service. It is possible to combine single tunnels with a mismatch into one big combined tunnel that has a perfect match for the entire service. Point-to-point tunnels cannot be combined, see Figure 6;

NOTE: If no more tunnel with a perfect match is available in the tunnels list, it is also possible to create a new tunnel via clicking +. In doing so, the tunnel wizard will automatically select the needed devices for this service. After closing the tunnel wizard, the new tunnel will automatically appear in the tunnel list;

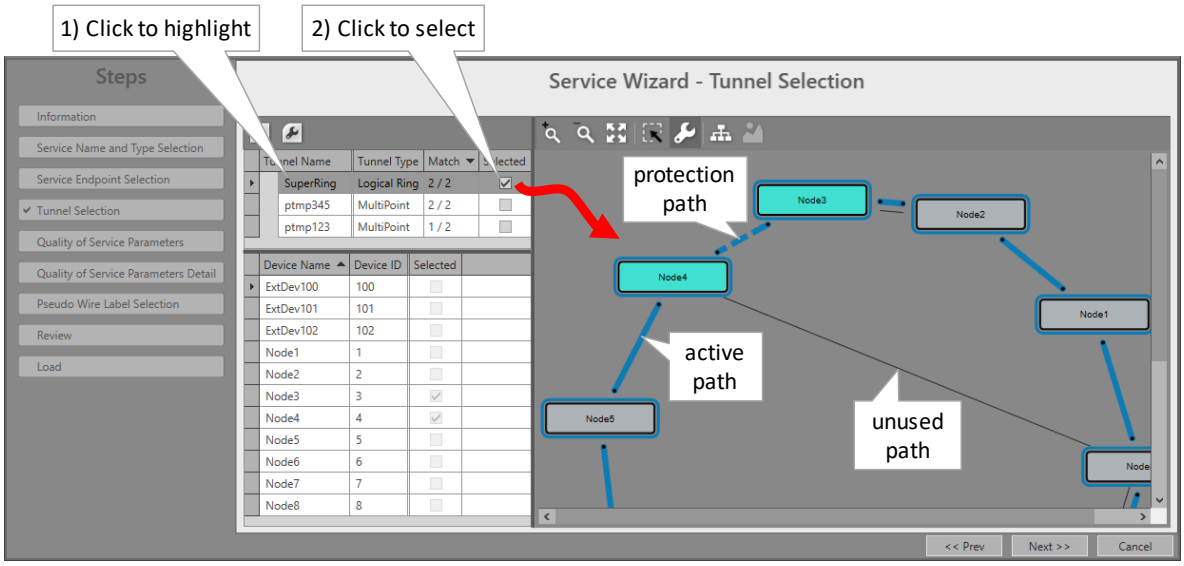


Figure 8 Selected Highlighted Tunnel

12. WIZARD PAGE: QUALITY OF SERVICE PARAMETERS DETAIL (READ-ONLY)

CAUTION:
When the real or measured average frame size is reasonably lower than the configured average frame size, extra delay and/or frame loss can occur! Frame loss can be detected and verified via the 'Disc In Packets'/'Disc Out Packets' counters, see 'Port Performance' → 'CSM Ethernet Port Monitoring' in Ref. [2Net] in Table 2.
When the real or measured average frame size is reasonably higher than the configured average frame size, a lower BWE will be obtained but traffic will not be influenced.

12.1 General

After configuring the 'Quality of Service Parameters' page in the service wizard and clicking Next>>, the page with 'Quality of Service Parameters Detail' shows up. See figure below. This

page by default shows a nice overview of the bandwidth and burst size usage of your configured service through the network.

Some values are configured, others are calculated by HiProvision based on the configured values. E.g. if the service values are configured, the according service port values will be calculated automatically. Both configured and calculated values are visible in both the network drawing and tables in the Ports and LSPs tabs.

CAUTION: For legacy services, this 'Quality of Service Parameters Detail' must not be adapted. The Ports and LSPs values should remain as calculated by HiProvision. Changing these values could result in packet loss.

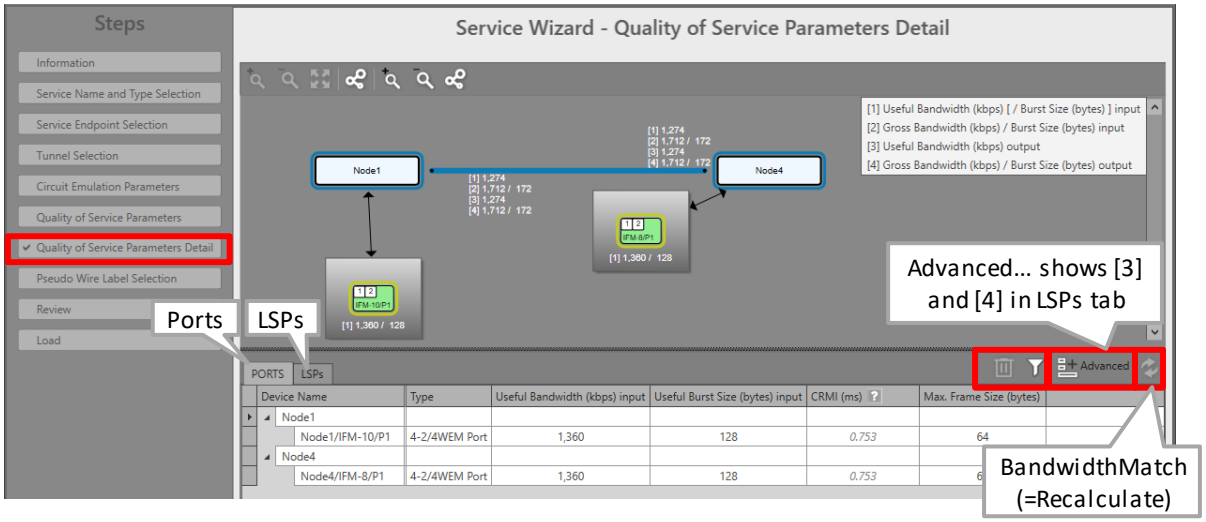


Figure 9 Bandwidth/Burst Size Parameters in Detail

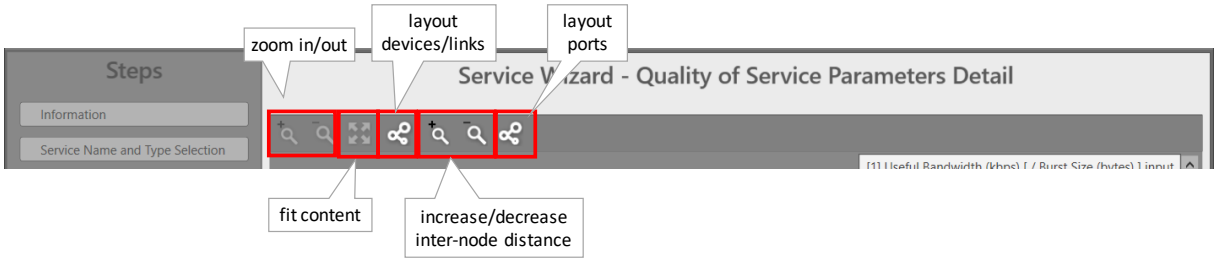


Figure 10 Grapic View Option Buttons

- Filter button : see §12.2.
- Clear Selection button : clears selected rows in the Ports/LSPs tab.
- Advanced button Advanced: not relevant for legacy services, do not use.
- BandwidthMatch button : not relevant for legacy services, do not use.

12.2 Filtering Tables

When a lot of nodes and/or links are in the network or in the tables, scrolling through the table records and comparing values of some records can sometimes be hard. Therefore to

avoid too much scroll work, you can easily filtering out your needed Ports/LSPs to show less records.

12.2.1 Filtering Nodes/Ports

- Via network drawing: Just click one node or one port in the network drawing. The Ports tab becomes active, with the clicked node or port filtered out. Note: Multiple select is not possible via the network drawing.
- Via table: Just click/select the port (device name column) in the Ports tab and click . Multiple records can be selected via holding the CTRL or SHIFT key and clicking/selecting ports followed by clicking .
- If you made a wrong selection, just click the button to clear the selection.
- Disable the filtering (and show all records) by just clicking the highlighted again.

12.2.2 Filtering Links (or LSPs)

- Via network drawing: Just click the link in the network drawing. The LSPs tab becomes active, with the clicked link filtered out. Note: Multiple select is not possible via the network drawing.
- Via table: Just click/select the LSP (direction column) in the LSPs tab and click . Multiple records can be selected via holding the CTRL or SHIFT key and clicking/selecting LSPs followed by clicking .
- If you made a wrong selection, just click the button to clear the selection.
- Disable the filtering (and show all records) by just clicking the highlighted again.

12.3 Values on the Network Drawing

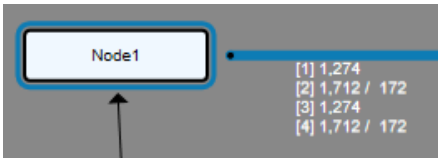


Figure 11 Bandwidth/Burst Size on WAN Side

- [1] = Node **input**: for this service, a useful bandwidth of 1274 kbps is available from link → node;
- [2] = Node **input**: for this service, a gross bandwidth of 1712 kbps and gross burst size of 172 bytes is available from link → node;
- [3] = Node **output**: for this service, a useful bandwidth of 1274 kbps is available from node → link;
- [4] = Node **output**: for this service, a gross bandwidth of 1712 kbps and gross burst size of 172 bytes is available from node → link;

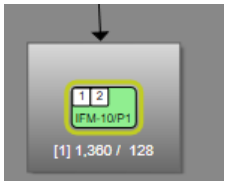


Figure 12 Bandwidth/Burst Size on LAN Side

- [1] = Node **input**: for this service, a useful bandwidth of 1360 kbps and a useful burst size of 128 bytes is available from application → node;

12.4 (Service) Bandwidth Already Configured on WAN Links

CAUTION: 'Bandwidth' in this paragraph always refers to the configured bandwidth!

12.4.1 General

If you want to configure new services, it is always nice to know how much bandwidth has been reserved (or configured) already on the link or how much is still available. This paragraph shows all the info you need to about bandwidth usage within Dragon PTN, in order to configure it as efficiently as possible.

WAN links in the Dragon PTN network are Ethernet 1G, 10G or 40G links. They can carry 1, 10 or 40 Gbps in both directions on the link.

Max. Service Bandwidth = Max. WAN link bandwidth – Reserved bandwidth

- Max. Service Bandwidth = Maximum available bandwidth on a link that a Dragon PTN user can configure in HiProvision when programming an Ethernet service. It also means that no other services are configured yet on this link.
- Max. WAN Link Bandwidth = Link Capacity:
  - The Link Capacity is by default the same as the original bandwidth of the selected link type (1 Gbps, 10 Gbps or 40 Gbps links). However, the Link Capacity can be downscaled to a lower bandwidth if desired, see Link Capacity in Ref. [2Net] in Table 2.
- Reserved Bandwidth depends on:
  - DCN Channel Bandwidth: The DCN channel bandwidth is by default 40 Mbps but can be downscaled to 1.5 Mbps if desired. It is advised to keep 40 Mbps. See DCN Channel in Ref. [2Net] in Table 2.
  - Configured Average Frame Size: Small Frames (64 bytes) is more overhead than Large Frames (1522 bytes).
  - MACsec (1-10G-LW): A link with MACsec on has more overhead than a link with MACsec off;
  - PHY Mode setting (LAN/WAN) (1-10G-LW): WAN setting has more overhead;

The less reserved bandwidth, the more service bandwidth can be configured for applications.

Point-to-point service: a service bandwidth of ‘x’ Mbps on the link automatically results in a possible endpoint bandwidth of ‘y’ Mbps on the access port and vice versa.

- ‘x’ = service bandwidth including ‘L2 Ethernet Frame’ data and MPLS-TP overhead;
- ‘y’ = endpoint bandwidth including only ‘L2 Ethernet Frame’ data;
- ‘y’ is always less than ‘x’ with the maximum of ‘x’ depending on all the existing overhead described above;

By default, the service bandwidth is configured the same in both directions, but can be tuned individually if desired.

The maximum bandwidth on the link is in both directions.

12.4.2 Connections Tab

a. Overview

Via the Connections tab, the bandwidth occupation (%, color) can be shown per link. Click a link in the Links table (see figure) to show the network drawing. The link is encircled in the network drawing and a cross-section of that link with all its details is split out at the bottom section. The link colors indicate the bandwidth occupation severity, which can be adapted via the color slider.

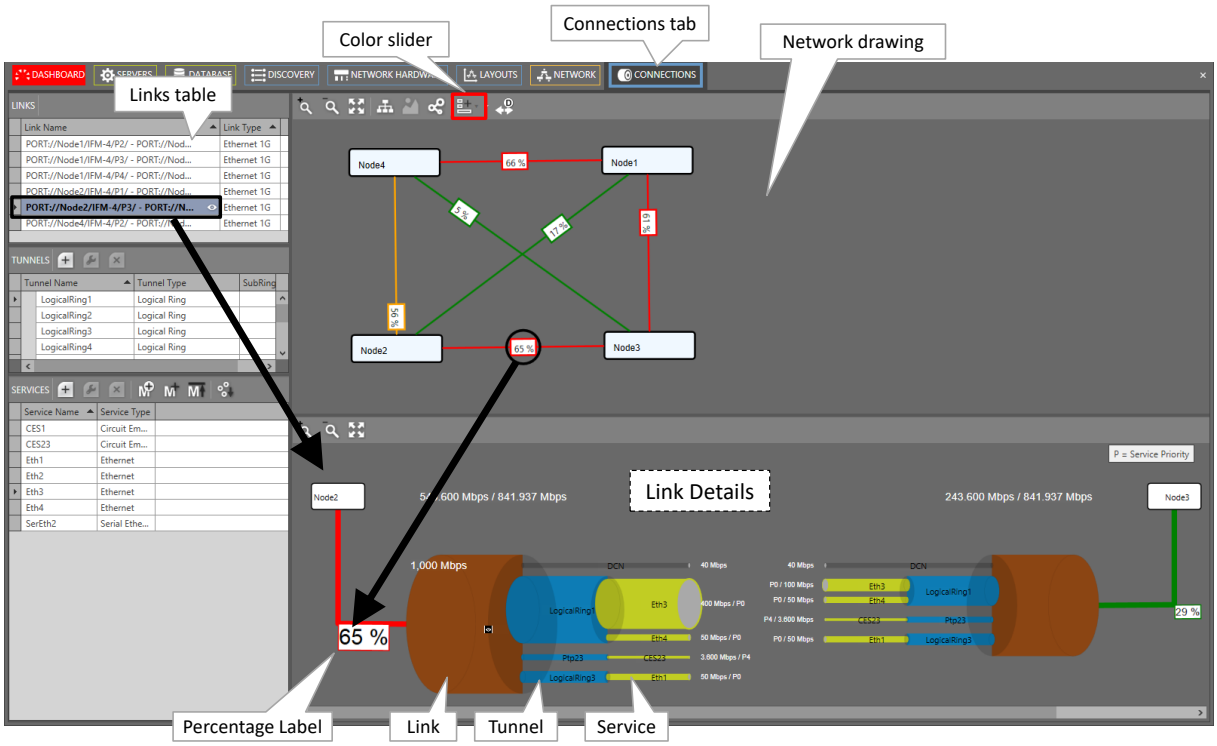


Figure 13 Connection Tab: Bandwidth Information

b. Link Bandwidth Occupation: Percentage, Status Color

- Percentage label:
  - x%: used bandwidth, x percent of the available link bandwidth;

- In the network drawing: If a percentage label hides another percentage label of an underlying link, the top label can be dragged aside after having it clicked first;
- In the network drawing: clicking the button relayouts the percentage labels on the link;

- Status color = color indication of the bandwidth occupation percentage. The list below shows the colors for the default occupation ranges. The ranges can be modified via the color sliders:
  - green (0-30%): low;
  - orange (30-60%): medium;
  - red (60-80%): high;
  - dark red (80-100%): critical;

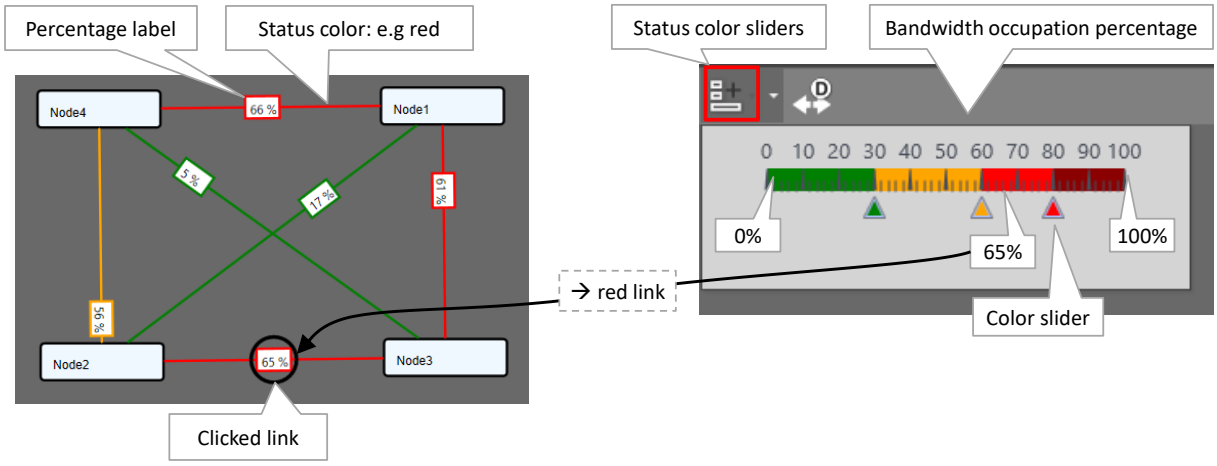


Figure 14 Bandwidth Percentage Label and Status Colors

c. Link Details

In the figure below, the selected link shows all its tunnels including all its configured services. Each service also shows its bandwidth. The total bandwidth for the link in one direction from Node x → Node y, is the sum of the DCN bandwidth and all individual service bandwidths in that link in that direction, see figures below.

The 'Min. Total Link Bandwidth' including DCN: Indicates the minimum bandwidth that the configured services can address when consuming the bandwidth in the least efficient way (small packets, frame size = 64 bytes). As a result, when programming an additional service in a more efficient way (e.g. frame size = 500 bytes), this value will increase. The more efficient you use the bandwidth, the more total bandwidth can be consumed.

The bandwidth occupation for this link in this direction is 65% (= 543.6/841.937). This results in a red status color for the link according to the color slider settings. The used DCN bandwidth is also shown and depends on the link type, see Ref. [2Net] in Table 2.

NOTE: The grey (=zoom in) 'eye icon' becomes visible when hovering over the tunnel or the service pipes. Click this icon to zoom in. It also shows more detailed information in the right-hand side of the Connections Tab. After zooming in, the black (=zoom out) 'eye icon' becomes visible. Click this icon to zoom out again. Hovering over the labels in the figure below will zoom in the labels for a better view.

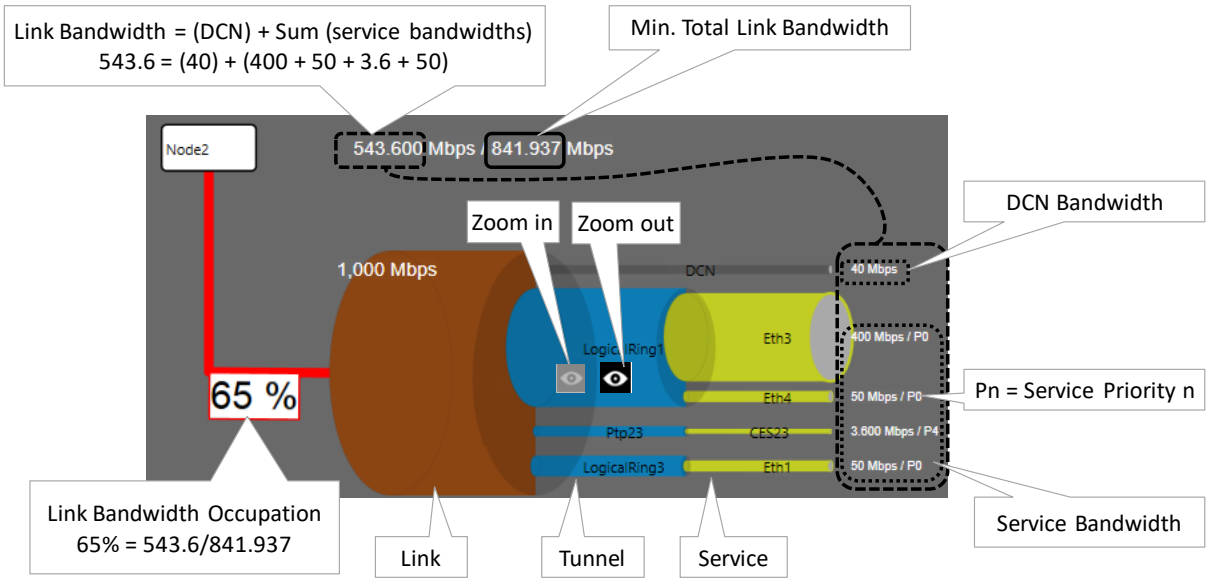


Figure 15 Link Details

d. Two Bandwidth Directions in one Link

The bandwidths for a service is by default the same in both directions, but can be tuned differently if desired at service creation time. In the figure below, the thicker a pipe (link, tunnel or service), the more bandwidth it reflects. If the pipe of 'service x' is thicker in one direction than the other, it means that both directions have different bandwidths. The resulting link color is the severest status color of both directions (e.g. red is more severe than green). Also the highest percentage value of both directions will be taken.

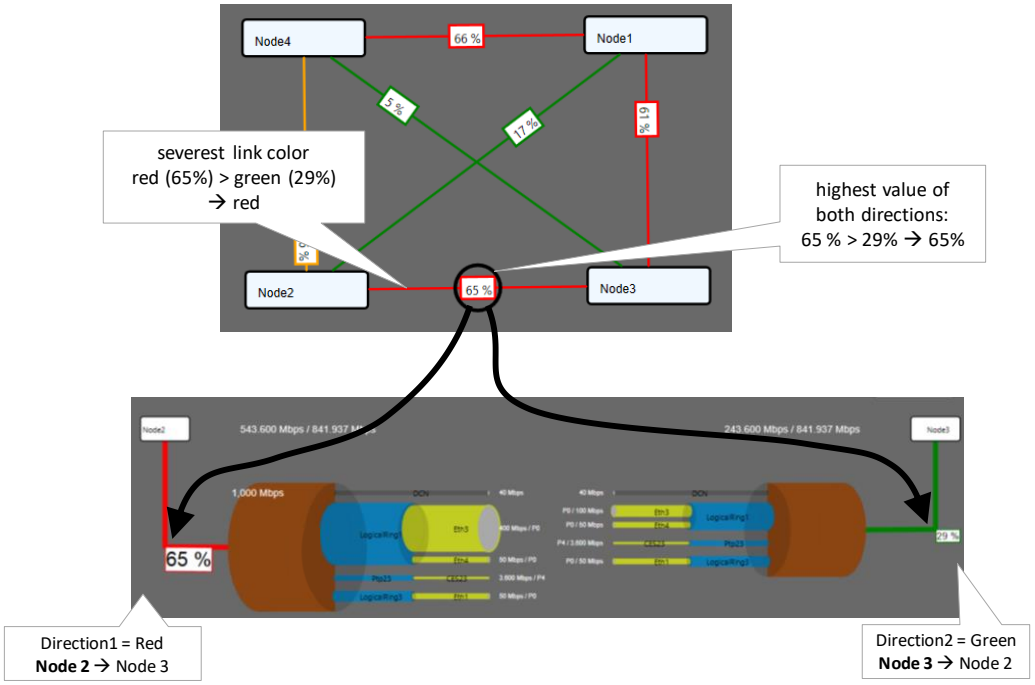


Figure 16 Highest Value and Severest Color

13. WIZARD PAGE: SERVICE ENDPOINT SELECTION VIA NETWORK DRAWING

This general example shows how to select service endpoints or ports on a 9-L3A-L IFM (= L3 IFM) via clicking the node icons in the network drawing. This way of working is similar for all services (Serial Ethernet, Circuit Emulation…) and IFM types (4-GC-LW, 7-SERIAL, 4-E1-L/4-T1-L, …). Below this figure, all possible port icons and colors are explained. Not all port icons are available for all IFM types, but this list just shows a total overview.

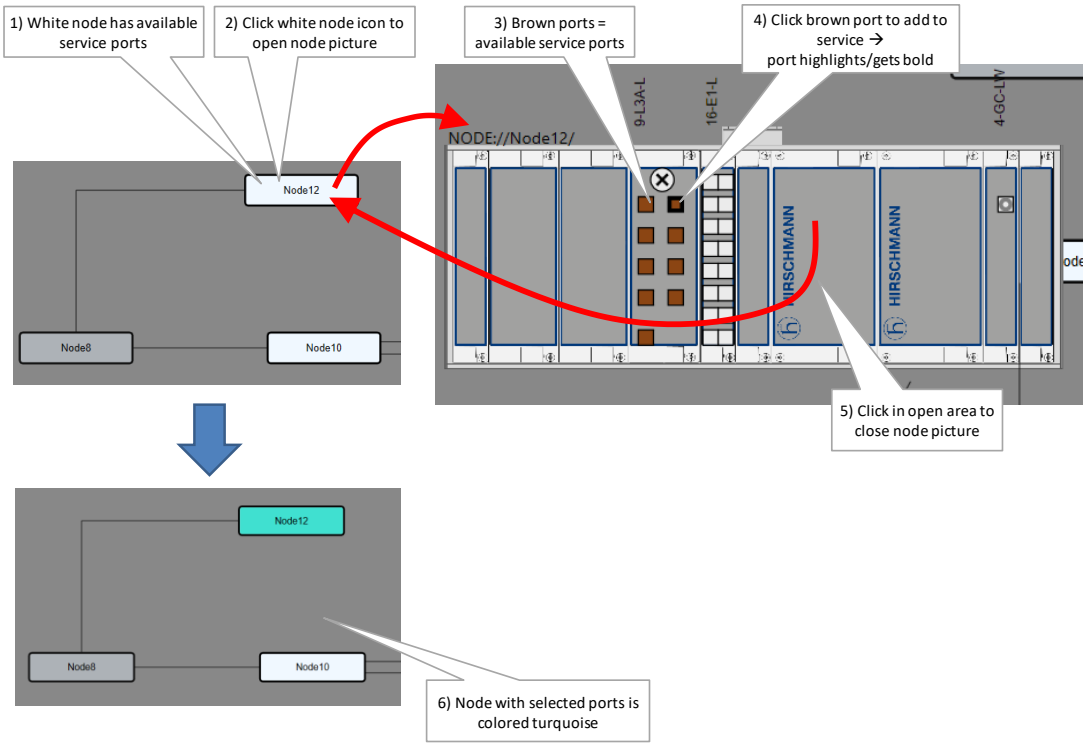


Figure 17 Example: Service EndPoint Selection via Network Drawing

A port icon overview can be found below:

- brown LAN port = available for this service, the port number is shown in the port icon when hovering over it;
- brown bold LAN port = selected for this service;
- white LAN port = unavailable for this service, cannot be selected (correct port type but already taken by another service or wrong port type);
- white filled WAN port = Cannot be selected. In most of the cases, available means not taken at all by any service. In case of an Ethernet IFM (see Ethernet service in Ref. [2Eth] in Table 2) it could mean a VLAN port as well which has already one or more VLAN based Ethernet services configured;
- Only on L2/L3 IFMs (see also Ref. [2Eth] in Table 2 for more info):
  - brown LAG port = available for this service;
  - brown LAG port = selected for this service;
  - white LAG port = unavailable for this service, cannot be selected (correct port type but already taken by another service or wrong port type);
- Only on L3 IFMs (see also Ref. [2Eth] in Table 2 for more info):
  - brown router : available VRF (=Virtual Routing and Forwarding) port which can be included in the service. Click this icon if this service must only reach possible virtual router and not the front ports in this IFM. If you click this icon, the front ports on this IFM will become unavailable for this service and vice versa.
  - white router : 1) unavailable VRF port for this service because already included in another service... or 2) automatic included VRF port because normal L3 IFM LAN ports are selected for this service in this IFM.

14. TEST & LOOPBACK CONFIGURATION

14.1 General

Test and Loopback self-tests can be performed in all Circuit Emulation services (=CES) or in the 4-DSL-LW Ethernet service or in the Serial Ethernet service, e.g. when configuring or troubleshooting a service. The available self-test functions are listed below. Where these functions are supported is listed in Table 4.

- Loopbacks: on backplane or front port both supporting two directions: towards line (=application) or network;
- BERT: test traffic generation and verification = Bit Error Ratio Tester;
- Tone Generation/Level Metering: test tone signal generation.

The table below shows which IFMs support the functionalities:

Table 4 Test & Loopback Support

IFM	Loopbacks		BERT		Tone Generation /Level Metering
	Backplane	Front Port	One Port per IFM	Per Port	
✓ = supported; --- = not supported					
4-E1-L/4-T1-L	✓	✓	---	✓	---
16-E1-L/16-T1-L	✓	✓	---	✓	---
4-DSL-LW	---	✓	---	---	---
2-C37.94	✓	✓	✓ (for C37.94 ports)	✓ (for E1/T1 ports)	---
7-SERIAL	✓	✓	✓ (for CES)	---	---
4-CODIR	✓	✓	✓	---	---
4-2/4WEM	✓	✓	---	---	✓
2-OLS	✓	✓	✓ (for OLS ports)	✓ (for E1 ports)	---

14.2 Loopbacks

14.2.1 General

A loopback can be configured on the backplane (=IFM settings) or front port (=port settings). It just loops back the received traffic on an Rx pin towards its associated Tx pin on a specific port. If a backplane loopback has been configured enabled, all the ports on the IFM will be in loopback. Each loopback can be enabled towards the line interface (=application side) or network side. An overview can be found in the figure below.

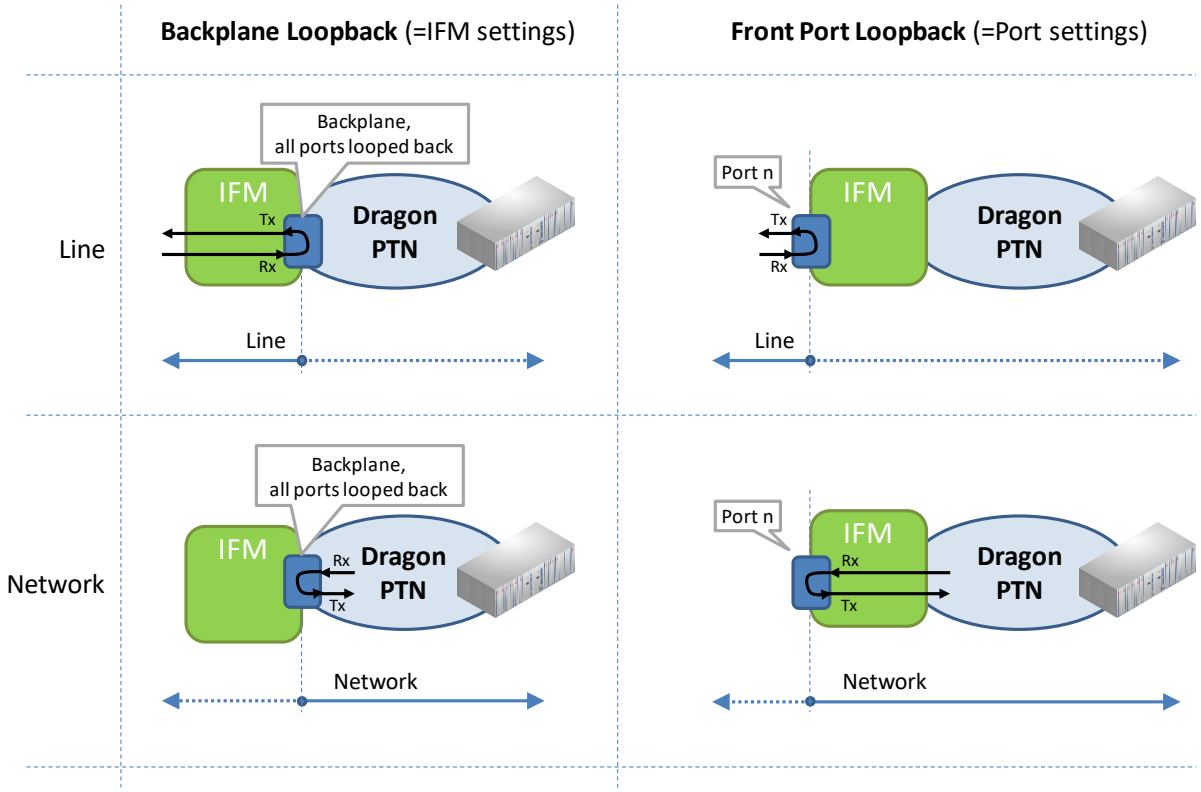


Figure 18 Loopback Functionality

14.2.2 Configuration

Go to Dashboard → Network Hardware and select a supported IFM or port (from Table 4) in the device list. The settings are shown in the 'Test and Loopback' section on the right-hand side. Always load the configuration into the network to activate it. Activating loopbacks will also generate a 'Test and Loopback active' alarm in HiProvision.

CAUTION: enabling/disabling loopbacks disables/resumes normal service traffic on a port. Verify alarms!

Table 5 Loopback Settings

Settings	Field	Values	Description
IFM(1)	Loopback Network Data	On/Off	Enable/Disable the backplane loopback towards the network. As a result, all/no ports in service will be looped back on the backplane!
	Loopback Line Data	On/Off	Enable/Disable the backplane loopback towards the line or application. As a result, all/no ports in service will be looped back on the backplane!
Port	Loopback(2)	Off Line Network	**Off**: Disable the front port loopback **Line**: Enable the front port loopback towards the line or application **Network**: Enable the front port loopback towards the network
Note: by default, all the loopbacks have been disabled (1): Supported on IFMs: 4-E1-L/4-T1-L, 16-E1-L/16-T1-L, 2-C37.94, 7-SERIAL, 4-2/4WEM, 4-CODIR, 2-OLS. (2): Supported on ports on IFMs listed in (1), including the ports on the 4-DSL-LW IFM. For 7-SERIAL, this setting will only become visible after this port has been configured in a service.			

14.3 BERT (=Bit Error Ratio Tester)

14.3.1 General

The BERT module allows the IFM to send test traffic on a selected service port towards the line interface (=application side) or network side. This module also allows to listen on a port for incoming test traffic and verify it.

The test results of the test traffic can be easily monitored via the 'Test & Loopback Performance' in the Dashboard → Monitoring → Performance tile, see also §14.6.

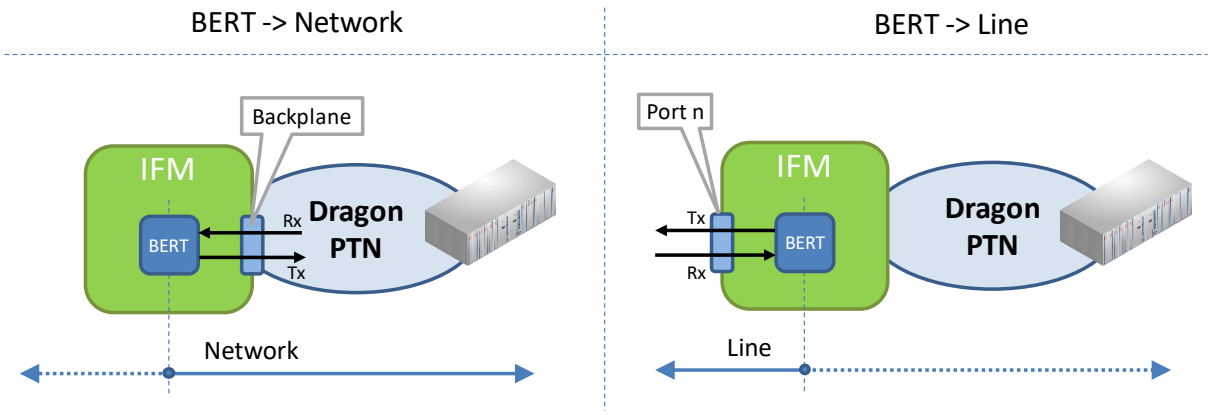


Figure 19 BERT Module

CAUTION:
- Enabling BERT to send test traffic on a service port will disable the normal service traffic on that port!
- Sending BERT traffic from a 4-E1-L IFM (port 1) using V.110 speeds is not supported, see §10.

14.3.2 Configuration

To configure BERT, go to Dashboard → Network Hardware and select a supported IFM or port (from Table 4) in the device list. The BERT settings are shown in the 'Test and Loopback' section on the right-hand side. Always load the configuration into the network to activate them. Activating BERT will also generate a 'Test and Loopback active' alarm in HiProvision.

CAUTION: enabling/disabling BERT disables/resumes normal service traffic on a port. Verify alarms!

Table 6 BERT Settings

Settings	Field	Values	Description
2-C37.94 IFM	BERT Tx Direction	Port 1 Line Port 1 Network Port 2 Line Port 2 Network	**Port n Line**: If BERT is enabled, BERT module transmits test traffic towards the line or application side via port n **Port n Network**: If BERT is enabled, BERT module transmits test traffic towards the network side via backplane port n
	BERT Rx Direction	Port 1 Line Port 1 Network Port 2 Line Port 2 Network	**Port n Line**: If BERT is enabled, BERT module listens to the line or application side to receive and verify test traffic via port n **Port n Network**: If BERT is enabled, BERT module listens to the network side to receive and verify test traffic via backplane port n
	BERT Tx/Rx Enable	True/False	Enable/Disable both the transmit and receive functionality on the BERT module, only for the C37.94 ports, not for the E1 and T1 ports.
7-SERIAL IFM 4-CODIR IFM 2-OLS IFM	BERT Tx Direction	Line Network	**Line**: If BERT is enabled, BERT module transmits test traffic towards the line or application side via the BERT Tx Port (=front port) **Network**: If BERT is enabled, BERT module transmits test traffic towards the network side via the BERT Tx Port (=backplane port)
	BERT Tx Port	Port 1..4 (4-CODIR) Port 1,2,4,6 (7-SERIAL) Port 1,2 (2-OLS)	The port on which the BERT module will transmit test traffic either on the front or backplane port, based on the selected direction.
	BERT Rx Direction	Line Network	**Line**: If BERT is enabled, BERT module listens to the line or application side to receive and verify test traffic via the BERT Rx Port (=front port). **Network**: If BERT is enabled, BERT module listens to the network side to receive and verify test traffic via the BERT Rx Port (=backplane port).
	BERT Rx Port	Same ports as BERT Tx Ports	The port on which the BERT module will listen to receive test traffic and verify it. Either on the front or backplane port, based on the selected direction.
	BERT Tx/Rx Enable	True/False	**True**: BERT module will transmit test traffic on the Tx port and listen on the Rx port to verify incoming test traffic.

Settings	Field	Values	Description
			False: BERT module will not transmit test traffic on the Tx port and not listen on the Rx port to verify incoming test traffic.
	BERT Bitrate (only CES on 7-SERIAL and 2-OLS IFM)	<value 1…n> 7-SERIAL: n=24 2-OLS: n=64	Set the bitrate for asynchronous CES. The resulting bitrate = n * 4800 bps. 4800 bps (with n=1) is ok if 1200 bps or 2400 bps are required. For synchronous CES, always the service bitrate is taken.
E1/T1 Port (3)	BERT Pattern Select	PRBS 2e9-1 PRBS 2e11-1 PRBS 2e15-1 QRSS	PRBS = Pseudo Random Bit Sequence; Select which bit test pattern must be generated by BERT: **PRBS 2e9-1**: Maximum of 8 consecutive zeros and 9 consecutive ones. Bit pattern length = 511 bits. **PRBS 2e11-1**: Maximum of 10 consecutive zeros and 11 consecutive ones. Bit pattern length = 2047 bits. **PRBS 2e15-1**: Maximum of 14 consecutive zeros and 13 consecutive ones. Bit pattern length = 32767 bits. **QRSS** (= Quasi Random Signal Source): Modified version of PBRS that allows 20 consecutive ones. Bit pattern length = 1048575 bits.
	BERT Tx/Rx Direction	Line Network	**Line**: If BERT enabled, BERT module transmits test traffic towards the line or application side and listens to the same side to receive test traffic and verify it. **Network**: If BERT enabled, BERT module transmits test traffic towards the network side and listens to the same side to receive test traffic and verify it.
	BERT Tx/Rx Timeslot	<number>	The number is a decimal representation of the timeslots that have BERT enabled. Each timeslot represents a bit of the 32/24 timeslots in E1/T1, with E1: timeslot 0, 1, …,31 = 1st, 2nd,…,32nd bit T1: timeslot 1, 2, …,24 = 1st, 2nd,…,24th bit **Example1**: Enable BERT module on all E1 timeslots: Binary (32 bits): 1111 1111 1111 1111 1111 1111 1111 1111 Decimal = <number> = 4294967295 **Example2**: Enable BERT module on E1 timeslots 1, 5, 6: Binary (32bits): 0000 0000 0000 0000 0000 0000 0110 0010 Decimal = <number> = 98
	BERT Tx Enable	True/False	BERT module will transmit/not transmit test traffic on the Tx port
	BERT Rx Enable	True/False	**True**: BERT module will listen on the Rx port and verify the incoming test traffic **False**: BERT module will not listen on the Rx port for incoming test traffic
Note: by default, all the test traffic generation has been disabled (2): Only ports that are not configured yet in a Serial Ethernet service will show up (3): E1/T1 port on either 4-E1-L/4-T1-L, 16-E1-L/16-T1-L, 2-C37.94 IFM or 2-OLS			

14.4 Tone Generator/Level Meter

14.4.1 General

Each port on the 4-2/4WEM IFM has a test tone generator that can generate two tones: 1000 or 1500 Hz. Each 4-2/4WEM IFM can measure an incoming voice signal on one selected port. The received voice signal level can be easily monitored via the 'Test & Loopback Performance' in the Dashboard → Monitoring → Performance tile, see also §14.6.4.

14.4.2 Configuration

Go to Dashboard → Network Hardware and select a 4-2/4WEM IFM or port in the device list. The settings are shown in the 'Test and Loopback' section on the right-hand side. Always load the configuration into the network to activate them. Activating it will also generate a 'Test and Loopback active' alarm in HiProvision.

Table 7 Tone Generator/Level Meter Settings

Settings	Field	Values	Description
4-2/4WEM IFM	Level Meter Enabled	True/False	The signal level meter on the 4-2/4WEM IFM will listen/not listen to an incoming voice signal on the selected port (Level Meter Port Selection).
	Level Meter Port Selection	Port1..4	Select the port which incoming voice signal must be measured. Example: test tones will be have approximately following levels: Test tone 1000Hz: 1V ptp @ 600 ohm results in -6.81dbm Test tone 1500Hz: 1.5V ptp @ 600 ohm results in -3.92dbm These measured levels can be viewed in §14.6.4.
4-2/4WEM Port	Tone Generator	No Tone Generator 1000 Hz /1500 Hz	**No Tone Generator**: Disable the test tone generation **n Hz**: The test tone generator will generate an n Hz test signal on this port
Note: by default, all the test tone generation has been disabled			

14.5 Combined BERT / Loopback Example

In the example below, activating BERT on one side and activating port loopback on the other side sets up a test traffic flow through a configured CES in the Dragon PTN network. The results can be easily monitored in §14.6.5.

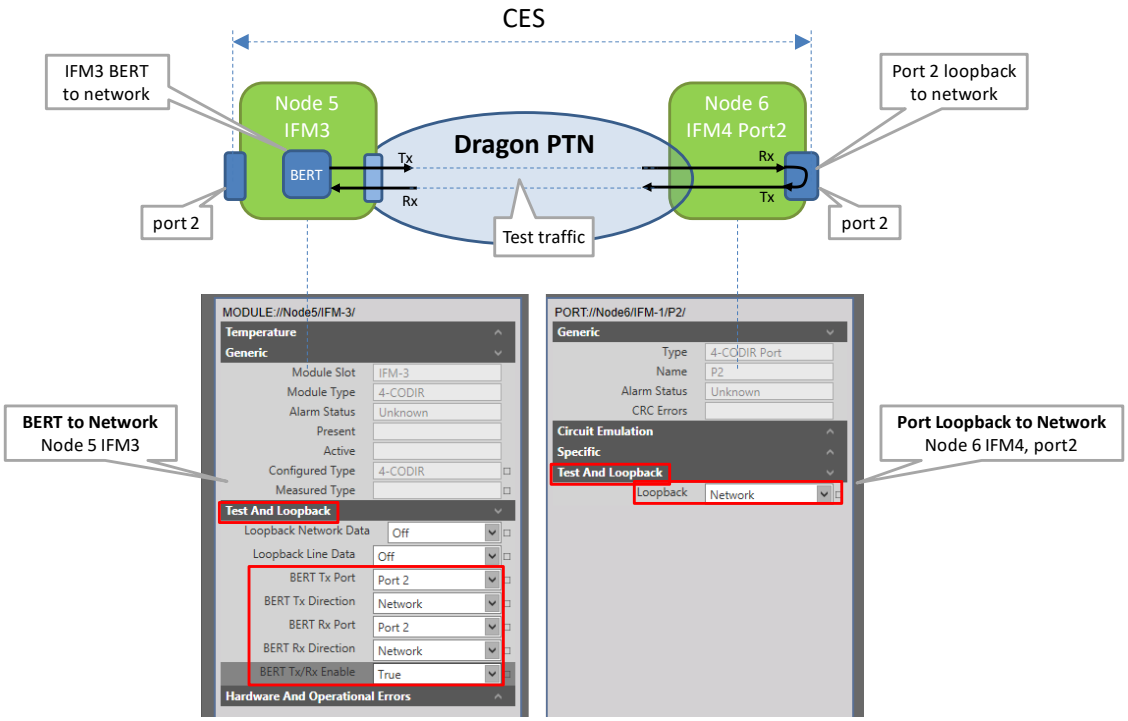


Figure 20 Combined BERT / Loopback

14.6 Monitoring: Test & Loopback Performance

Test and Loopback traffic can be monitored as well via the performance counters. Go to Dashboard → (Monitoring) Performance → Counter Control → Test and Loopback Performance → Select your desired protocol to monitor. Each protocol monitoring is described in more detail in the paragraphs below.

14.6.1 E1/T1 Monitoring

E1/T1 monitoring can be found in the figure below. A detailed and similar monitoring set-up description (adding counters to graphs etc…) can be found in 'Port Performance' → 'CSM Ethernet Port Monitoring' in Ref. [2Net] in Table 2.

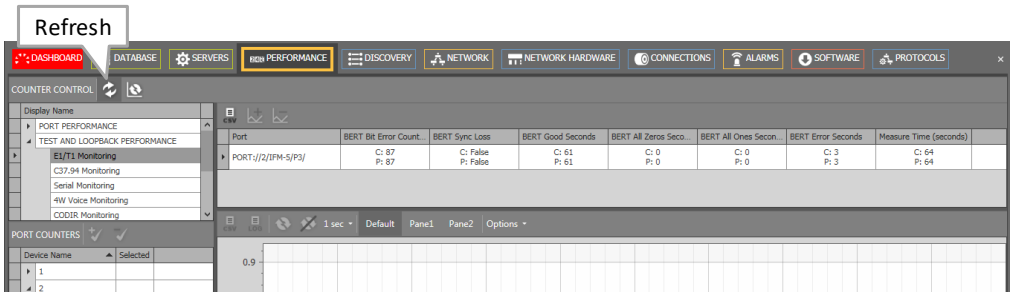


Figure 21 Test and Loopback: E1/T1 Monitoring

Table 8 Test and Loopback: E1/T1 Monitoring Fields

Field	Values	Description	Curative Action
Port	value	Monitored port	
BERT Bit Error Counter	bit errors	increasing = NOT OK: The number of bit errors received by the BERT receiver, this should be zero for a successful test.	
BERT Sync Loss	True/False	**True**: the BERT receiver is not synchronized with the BERT transmitter, the measurement is failing. **False**: the BERT receiver is synchronized with the BERT transmitter.	**True**: Verify the clocking settings, BERT settings, broken paths, ….
BERT Good Seconds	seconds	increasing = OK: The total amount in seconds that the test traffic received by the BERT receiver was OK, meaning synchronized and no errors	
BERT All Zeros Seconds	seconds	increasing = NOT OK: The total amount in seconds that the BERT receiver was receiving all zeros	
BERT All Ones Seconds	seconds	increasing = NOT OK: The total amount in seconds that the BERT receiver was receiving all ones	
BERT Error Seconds	seconds	increasing = NOT OK: The total amount in seconds that the BERT receiver was receiving bit errors, an increasing value does not result in synchronization loss	
Measure Time (seconds)	seconds	The total amount in seconds that the BERT receiver has been measuring	
Note: Click the Refresh button for the latest results; **Note**: Clear the counter values by disabling and enabling the BERT via the IFM/port settings in the network hardware tile; **Note**: 'C' value in cell = current value; 'P' value in cell = previous value;			

14.6.2 C37.94 Monitoring

C37.94 monitoring can be found in the figure below. A detailed and similar monitoring set-up description (adding counters to graphs etc…) can be found in 'Port Performance' → 'CSM Ethernet Port Monitoring' in Ref. [2Net] in Table 2.

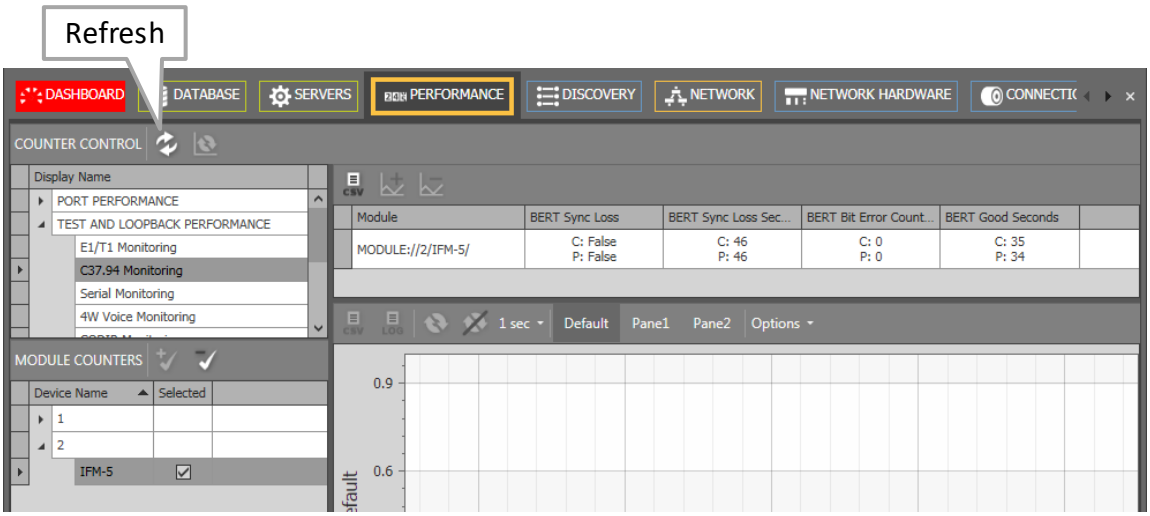


Figure 22 Test and Loopback Performance: C37.94 Monitoring

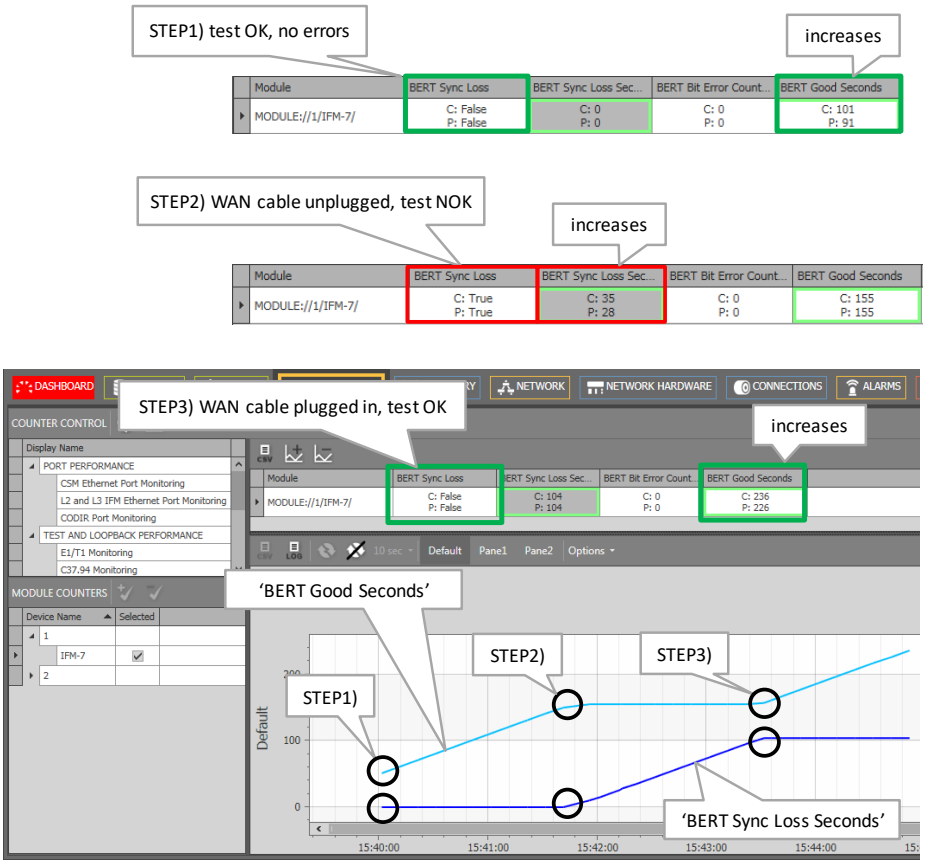


Figure 23 Analysing Counter Values

Table 9 Test and Loopback Performance: C37.94 Monitoring Fields

Field	Values	Description	Curative Action
Module	value	Monitored module	
BERT Sync Loss	True/False	**True**: the BERT receiver is not synchronized with the BERT transmitter, the measurement is failing. **False**: the BERT receiver is synchronized with the BERT transmitter.	True: Verify the clocking settings, BERT settings, broken paths, ….
BERT Sync Loss Seconds	seconds	increasing = NOT OK: The total amount in seconds that the BERT receiver is not synchronized with the BERT transmitter	True: Verify the clocking settings, BERT settings, broken paths, ….
BERT Bit Error Counter	number	increasing = NOT OK: The number of bit errors received by the BERT receiver, this should be zero for a successful test.	
BERT Good Seconds	seconds	increasing = OK: The total amount in seconds that the test traffic received by the BERT receiver was OK, meaning synchronized and no errors	
Note: Click the Refresh button for the latest results; **Note**: Clear the counter values by disabling and enabling the BERT via the IFM/port settings in the network hardware tile; **Note**: 'C' value in cell = current value; 'P' value in cell = previous value;			

14.6.3 Serial Monitoring

Exactly the same description as in §14.6.2.

14.6.4 2W/4W Voice Monitoring

2W/4W Voice monitoring can be found in the figure below. A detailed and similar monitoring set-up description (adding counters to graphs etc…) can be found in 'Port Performance' → 'CSM Ethernet Port Monitoring' in Ref. [2Net] in Table 2.

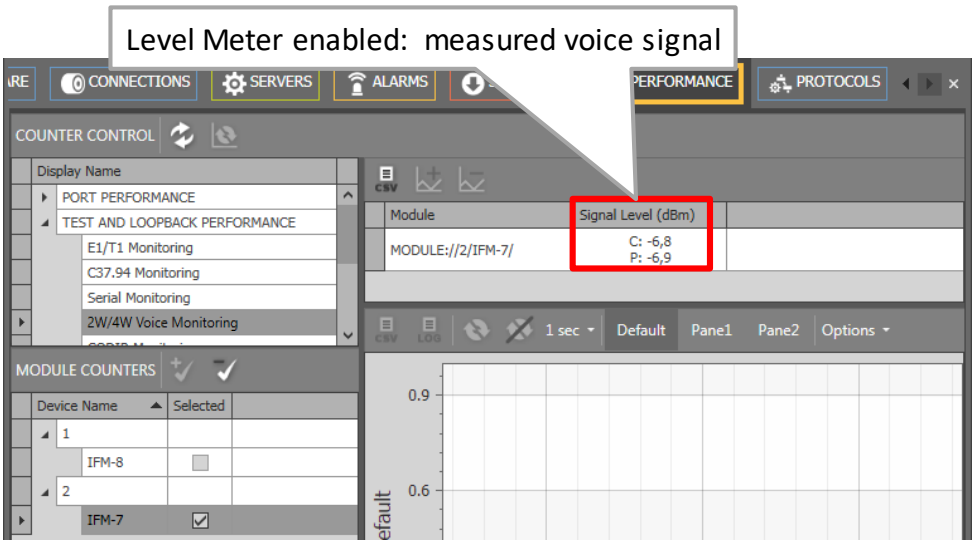


Figure 24 Test and Loopback Performance: 2W/4W Voice Monitoring

Table 10 Test and Loopback Performance: 2W/4W Voice Monitoring Fields

Field	Values	Description
Module	value	Monitored module
Signal Level (dBm)	dBm	The 'Signal Level (dBm)' of an incoming voice signal can be measured if 'Level Meter' has been enabled on a specific port, see also §**14.4** for more information and to know which port is being measured. The accuracy of the measurement is +/- 0.5 dBm.
Note: Click the Refresh button for the latest results; **Note**: 'C' value in cell = current value; 'P' value in cell = previous value;		

14.6.5 CODIR Monitoring

Exactly the same description as in §14.6.2.

14.6.6 Optical Low Speed Serial Monitoring

Exactly the same description as in §14.6.2.

15. ABBREVIATIONS

BWE	Bandwidth Efficiency
CAR IP	Central Alarm Reporter Internet Protocol
CES	Circuit Emulation Service
CESoPSN	Circuit Emulation Service over Packet Switched Network
CRMI	Committed Rate Measurement Interval
CSM	Central Switching Module
CSV	Comma Separated Values
DCN	Data Communication Network
HQoS	Hierarchical Quality of Service
IFM	InterFace Module
IP	Internet Protocol
L2	Layer2
LAN	Local Area Network
LER	Label Edge Router
LPS	Linear Protection Switching
LSP	Label Switched Path
LSR	Label Switching Router
MAC	Media Access Control

MPLS-TP	Multiprotocol Label Switching – Transport Profile
MSTP	Multiple Spanning Tree Protocol
MTU	Maximum Transmission Unit
NIC	Network Interface Card
NSM	Node Support Module
NTP	Network Timing Protocol
OAM	Operation and Maintenance
PAF	PME Aggregation Function
PAM	Pulse Amplitude Modulation
PME	Physical Medium Entities
PSU	Power Supply Unit
PTP	Precision Time Protocol
QoS	Quality of Service
QSFP	Quad SFP
SAToP	Structured Agnostic TDM over Packet
SDH	Synchronous Digital Hierarchy
SFP	Small Form Factor Pluggable
SONET	Synchronous Optical Network
TRM	Transmit Receive Module
TSoP	Transparent Sonet/SDH over Packet
TTL	Time to Live
HiProvision	Dragon PTN Management System
WAN	Wide Area Network
XFP	10 Gigabit Small Form Factor Pluggable