

# Release Notes

## Dragon PTN Release 4.3 and HiProvision 4.33.2.256



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## 1. INTRODUCTION

This page documents new features, enhancements and changes included in this Dragon PTN release. For detailed information on using any of Dragon PTN features, please refer to the user manuals.

## 2. RELEASE DATE

Dragon PTN R4.3DR has been released on May 29th, 2020.

## 3. REQUIREMENTS

The Dragon PTN products in Dragon PTN Release R4.3DR require the following hardware editions and firmware versions:

Dragon PTN Product	Description	Minimal Hardware Edition	Released Firmware Version	Firmware File
PTN2215	Core Node with dual PSU position, dual CSM position and 15 interface module positions	1	Not Applicable	Not Applicable
PTN2210	Aggregation Node with dual PSU position, dual CSM position and 10 interface module positions	1	Not Applicable	Not Applicable
PTN2209	Aggregation Node with dual PSU position, dual CSM position, 9 interface module positions and optimized 9-L3A-L support	1	Not Applicable	Not Applicable
PTN2206	Aggregation Node with dual PSU position, dual CSM position and 6 interface module positions	1	Not Applicable	Not Applicable
PTN1104	Aggregation Node with single PSU position, single CSM position and 4 interface module positions	1	Not Applicable	Not Applicable
PTN-CSM310-A	Central Switching Module for aggregation node	7	4.12.0.1020 *	CSM310-A_Q500_<FW-VERSION>.zip
PTN-CSM540-A	Central Switching Module for core node	4	1.3.0.1020 *	CSM540-A_Q501_<FW-VERSION>.zip
PTN-1-10G-LW	1 port 10Gbit Ethernet interface module	4	6.9.0.889 *	1-10G-LW_Q202_<FW-VERSION>.zip
PTN-4-GC-LW	4 ports Gbit Ethernet copper-combo interface module with PoE support	8	6.8.0.1023 *	4-GC-LW_Q203_<FW-VERSION>.zip
PTN-4-GCB-LW	4 ports Gbit Ethernet copper-combo interface module	1	6.8.0.1023 *	4-GC-LW_Q203_<FW-VERSION>.zip
PTN-4-GO-LW	4 ports Gbit Ethernet optical interface module	2	1.6.0.1023 *	4-GO-LW_Q209_<FW-VERSION>.zip
PTN-4-E1-L	4 ports E1 interface module	4	6.10.0.768	4-E1T1-L_Q201_<FW-VERSION>.zip

Dragon PTN Product	Description	Minimal Hardware Edition	Released Firmware Version	Firmware File
PTN-4-T1-L	4 ports T1 interface module			
PTN-4-DSL-LW	4 ports SHDSL interface module	5	6.5.3	4-DSL-LW_Q200_<FW-VERSION>.zip
PTN-2-C37.94	2 ports C37.94 interface module with 2 additional E1/T1 ports	4	6.9.0.755	2-C37-94_Q204_<FW-VERSION>.zip
PTN-7-SERIAL	7 ports Serial interface module	2	6.9.0.788	7-SERIAL_Q206_<FW-VERSION>.zip
PTN-4-2/4WEM	4 ports 2/4 wire E&M interface module	4	6.8.3	4-2W-4WEM_Q205_<FW-VERSION>.zip
PTN-4-CODIR	4 ports 64kbps codirectional module	2	6.8.0.818	4-CODIR_Q207_<FW-VERSION>.zip
PTN-2-OLS	Optical Low Speed module	2	2.6.3	2-OLS_Q208_<FW-VERSION>.zip
PTN-16-E1-L PTN-16-T1-L	16 ports E1 interface module 16 ports T1 interface module	1	1.5.4	16-E1T1-L_Q215_<FW-VERSION>.zip
PTN-8-FXS	8 ports FXS analog voice module	6	2.6.0.832 *	8-FXS_Q216_<FW-VERSION>.zip
PTN-9-L3A-L	9 ports Layer 3 interface module	4	1.11.0.875 *	9-L3A-L_Q300_<FW-VERSION>.zip
PTN-9-L3EA-L	9 ports Layer 3 Extension interface module	4	See 9-L3A-L	N/A
PTN-6-GE-L	6 ports Gbit Ethernet interface module	9	1.6.0.755	6-GE-L_Q217_<FW-VERSION>.zip
PTN-4-10G-LW	4 ports 10 Gbit Ethernet interface module	8	1.0.5	4-10G-LW_Q218_<FW-VERSION>.zip
PTN-1-40G-LW	40 Gbit Ethernet interface module	6	1.0.4	1-40G-LW_Q219_<FW-VERSION>.zip
PTN-NSM-A	Node Support Module with PoE support	3	Not Applicable	Not Applicable
PTN-NSM-B	Node Support Module	2	Not Applicable	Not Applicable
PTN-FAN	Fan Module	4	Not Applicable	Not Applicable

The Dragon PTN Network Management System (HiProvision) support table:

HiProvision Version	HiProvision File
4.33.2.256	Dragon_PTN_R4.3DR_HiProvision_<HiProvisionVersion>_80730953.zip

Install HiProvision as described in  
 Dragon PTN Management System: HiProvision Quick Install Guide.pdf.

#### 4. NEW FEATURES IN R4.3.2

- Support for Dragon PTN2215 and new interface cards.
- HiProvision automatic database backup feature. Backup can be stored on local and network path.
- Fast Ethernet support (using a CuSfp module) on the 4-GO-L modules.
- The Permanent Monitoring add-on allows advanced monitoring in the DRAGON PTN network over a longer period of time of specific properties. Extra alarming and trigger threshold values can be configured on these monitored properties. As a result, it is easier to detect trends in the network behavior when monitoring/troubleshooting the network and act accordingly.
- HiProvision can act as an LDAP client that authenticates HiProvision users to an Active directory server via the LDAP protocol.

#### 5. DRAGON PTN CHANGES IN R4.3.2

- The HiProvision default password for user “admin” is “admin”.
- The HiProvision Reporting Engine Add-on is by default available in HiProvision and does not require a license anymore.
- Propagate Topology Change feature is by default enabled. This feature propagates a topology change from a subring to the major ring.
  - When migrating a database created before 4.3.2, an additional scripting command "MigrateTopologyChangePropagation" can be used to enable this feature on all existing subrings.
  - Loading of the configuration is necessary after executing the scripting command.

## 6. RESTRICTIONS/KNOWN ISSUES IN R4.3.2

- At startup of the node connected directly to HiProvision, the node can report an 'NTP unreachable' problem if HiProvision is configured as NTP server for this node. The node is not able to connect to the NTP server. This alarm will disappear automatically after 1 hour maximum and the date/time on the node will be synchronized.
- When changing a port of a remote node from WAN to LAN mode, the node may become unreachable through other WAN connections to that node. This can be resolved by changing the port mode of the connected node from LAN to WAN, load the configuration and change it back to LAN mode.
- If the clock settings of a synchronous RS232 port are changed from internal to adaptive and back to internal clock it is possible that bit errors occur in the serial data traffic. Rebooting the 7-SERIAL interface module or interrupting the WAN link for a short time will restore the service.
- When creating an Ethernet service on a 1-10G-LW interface port with a high bandwidth (typical more than 4 Gbit/s), the default burst size may be too low, depending on the traffic behavior of the connected devices. This can lead to traffic loss in the network. The burst size can be changed when creating the service or modifying the service.
- Connecting a remote HiProvision client to the module in the second CSM slot (CSM-2) can result in communication loss between the remote HiProvision client and HiProvision server. Connect a remote HiProvision client to CSM-1 if possible.
- The following fields only allow alphanumeric character sets (a-z, A-Z, 0-9, <space>, \_, -): name of tunnels and services, PoE description field.
- IEEE1588v2 is supported on 4-GC-LW, 4-GCB-LW, 4-GO-LW, 1-10G-LW (full-duplex ports) with following restrictions:
  - Only Ethernet encapsulation on Port 1 and 2 of 4-GC-LW, 4-GCB-LW, 4-GO-LW
  - Any change in link down/up, configuration, or CSM switchover, results in an automatic reset of IEEE1588v2.
  - Bit errors can result in corrupt IEEE1588v2 packets causing faulty IEEE1588v2 handling. In that case, reset IEEE1588v2 in the port properties of HiProvision Network Hardware. Traffic will be interrupted for respectively 10 seconds maximum on 4-GC-LW, 4-GCB-LW, 4-GO-LW and 1 second on a 1-10G-LW IFM.
- In very rare cases, a 10G link (1-10G-LW) can generate "remote alarm" with no data being sent after a module reboot or port enable/disable. Workaround: reboot the module again.
- MRP ring protocol cannot be used in combination with a multiple VLAN service.
- On 6-GE-L module the multiple VLAN service is not flushing for the RGERP/MRP ring protocols
- 1-10G-LW module is currently not supported in the core node.
- Fast Ethernet is not supported on the 4-GO(C)-L modules in a 10G slot.
- CSM switch over times are increased when a MACSec is enabled on the links.

## 7. NEW FEATURES IN R4.3.1 (NO OFFICIAL RELEASE)

- HiProvision multiple element properties window added. This multi property view allows to monitor/trace any status parameter of any network element in the Dragon PTN Network.
- Gratuitous ARP (=GARP) support on 9-L3A-L. A GARP is a sort of notification in advance, it updates the ARP cache of other systems before they ask for it via a normal ARP request.
- Gradual upgrade of Dragon PTN network is supported by HiProvision. Mixed networks are supported. Part of the network is still running older Dragon PTN release and other part is running Dragon PTN release V4.3.1.
- HiProvision support the German/Spanish language.
- Mux/Demux functionality added on 4-E1-L module. This functionality can mux/demux multiple (SATO P) services to/from a single E1 port.
- SAToP service supported on the 2-C37.94 module.
- SAToP service supported on the 7-SERIAL module.
- The V.110 mapping is added on the 7-SERIAL module.
- HiProvision supports ETS-4GS24GP and ETS-4XS24GP devices.
- Configuration files of the ETS-4GS24GP, ETS-4XS24GP, ETS-2GS8GP can be backed up and restored in the External Devices add-on.

## 8. CHANGES IN R4.3.1 (NO OFFICIAL RELEASE)

- HiProvision supports now a devices summary tab. The Devices Summary is an extra monitoring table in the Network Hardware tile that shows some extra handy statistics when monitoring and/or bringing up your Dragon PTN network.
- Additional check is built in to supervise the ERPS domain level value, if mismatches are detected in the network HiProvision will raise an alarm. Loading the network again will resolve the alarm.
- CAUTION: All nodes in the network should be reachable before you load. Partial loading is not allowed.
- HiProvision performance is increased. Calculation of load scenarios are optimized.
- 4-CODIR G703 added byte alignment functionality.

## 9. RESTRICTIONS/KNOWN ISSUES IN R4.3.1 (NO OFFICIAL RELEASE)

- At startup of the node connected directly to HiProvision, the node can report an 'NTP unreachable' problem if HiProvision is configured as NTP server for this node. The node is not able to connect to the NTP server. This alarm will disappear automatically after 1 hour maximum and the date/time on the node will be synchronized.
- When changing a port of a remote node from WAN to LAN mode, the node may become unreachable through other WAN connections to that node. This can be resolved by changing the port mode of the connected node from LAN to WAN, load the configuration and change it back to LAN mode.

- If the clock settings of a synchronous RS232 port are changed from internal to adaptive and back to internal clock it is possible that bit errors occur in the serial data traffic. Re-booting the 7-SERIAL interface module or interrupting the WAN link for a short time will restore the service.
- When creating an Ethernet service on a 1-10G-LW interface port with a high bandwidth (typical more than 4 Gbit/s), the default burst size may be too low, depending on the traffic behavior of the connected devices. This can lead to traffic loss in the network. The burst size can be changed when creating the service or modifying the service.
- Connecting a remote HiProvision client to the module in the second CSM slot (CSM-2) can result in communication loss between the remote HiProvision client and HiProvision server. Connect a remote HiProvision client to CSM-1 if possible.
- The following fields only allow alphanumeric character sets (a-z, A-Z, 0-9, <space>, \_ , -): name of tunnels and services, PoE description field.
- IEEE1588v2 is supported on 4-GC-LW, 4-GCB-LW, 4-GO-LW, 1-10G-LW (full-duplex ports) with following restrictions:
  - o Only Ethernet encapsulation on Port 1 and 2 of 4-GC-LW, 4-GCB-LW, 4-GO-LW
  - o Any change in link down/up, configuration, or CSM switchover, results in an automatic reset of IEEE1588v2.
  - o Bit errors can result in corrupt IEEE1588v2 packets causing faulty IEEE1588v2 handling. In that case, reset IEEE1588v2 in the port properties of HiProvision Network Hardware. Traffic will be interrupted for respectively 10 seconds maximum on 4-GC-LW, 4-GCB-LW, 4-GO-LW and 1 second on a 1-10G-LW IFM.
- In very rare cases, a 10G link (1-10G-LW) can generate “remote alarm” with no data being sent after a module reboot or port enable/disable. Workaround: reboot the module again.
- MRP ring protocol cannot be used in combination with a multiple VLAN service.
- On 6-GE-L module the multiple VLAN service is not flushing for the RGERP/MRP ring protocols
- 1-10G-LW module is currently not supported in the core node.

**10. NEW FEATURES IN R4.2.\* (NO OFFICIAL RELEASE)**

- 7-Serial supports 1200bps synchronous signals
- HiProvision support for Microsoft Windows Server 2019
- HiProvision can now be configured as a windows service. This feature will start HiProvision automatically at startup of the MS Windows OS.
- HiProvision support generic device discovery based on LLDP (as specified in IEEE 802.1AB and IEEE 802.3). The generic device needs to support LLDP.
- The ETS configuration web page can be opened in HiProvision.
- IEEE 802.1AE MacSec support on 1-10G-LW interface module
- This version supports in-service firmware upgrade for the CSM310-A module. Note that this feature can only be used when upgrading from version 4.2.2 to a higher version.
- C37.94 local mode
- 4-CODIR G703 SAToP mode
- Link Aggregation Group (LAG) supported on CSM310-A aggregated node.
- IGMP snooping supported on the 6-GE-L module.

**11. CHANGES IN R4.2.2 (NO OFFICIAL RELEASE)**

- Additional check is built in to supervise the ERPS domain level value, if mismatches are detected in the network HiProvision will raise an alarm. Loading the network again will resolve the alarm.
- CAUTION: All nodes in the network should be reachable before you load. Partial loading is not allowed.
- 4-CODIR G703 added byte alignment functionality.

**12. RESTRICTIONS/KNOWN ISSUES IN R4.2.2 (NO OFFICIAL RELEASE)**

- At startup of the node connected directly to HiProvision, the node can report an 'NTP unreachable' problem if HiProvision is configured as NTP server for this node. The node is not able to connect to the NTP server. This alarm will disappear automatically after 1 hour maximum and the date/time on the node will be synchronized.
- When changing a port of a remote node from WAN to LAN mode, the node may become unreachable through other WAN connections to that node. This can be resolved by changing the port mode of the connected node from LAN to WAN, load the configuration and change it back to LAN mode.
- If the clock settings of a synchronous RS232 port are changed from internal to adaptive and back to internal clock it is possible that bit errors occur in the serial data traffic. Rebooting the 7-SERIAL interface module or interrupting the WAN link for a short time will restore the service.
- When creating an Ethernet service on a 1-10G-LW interface port with a high bandwidth (typical more than 4 Gbit/s), the default burst size may be too low, depending on the traffic behavior of the connected devices. This can lead to traffic loss in the network. The burst size can be changed when creating the service or modifying the service.



- Connecting a remote HiProvision client to the module in the second CSM slot (CSM-2) can result in communication loss between the remote HiProvision client and HiProvision server. Connect a remote HiProvision client to CSM-1 if possible.
- The following fields only allow alphanumeric character sets (a-z, A-Z, 0-9, <space>, \_, -): name of tunnels and services, PoE description field.
- IEEE1588v2 is supported on 4-GC-LW, 4-GCB-LW, 4-GO-LW, 1-10G-LW (full-duplex ports) with following restrictions:
  - Only Ethernet encapsulation on Port 1 and 2 of 4-GC-LW, 4-GCB-LW, 4-GO-LW
  - Any change in link down/up, configuration, or CSM switchover, results in an automatic reset of IEEE1588v2.
  - Bit errors can result in corrupt IEEE1588v2 packets causing faulty IEEE1588v2 handling. In that case, reset IEEE1588v2 in the port properties of HiProvision Network Hardware. Traffic will be interrupted for respectively 10 seconds maximum on 4-GC-LW, 4-GCB-LW, 4-GO-LW and 1 second on a 1-10G-LW IFM.
- In very rare cases, a 10G link (1-10G-LW) can generate “remote alarm” with no data being sent after a module reboot or port enable/disable. Workaround: reboot the module again.
- MRP ring protocol cannot be used in combination with a multiple VLAN service.
- On 6-GE-L module the multiple VLAN service is not flushing for the RGERP/MRP ring protocols
- 1-10G-LW module is currently not supported in the core node.
- LAG on CSM ports in combination with VLAN service has some traffic issues.

**13. NEW FEATURES IN R4.1.\* (NO OFFICIAL RELEASE)**

- Extended QoS with hierarchical scheduling – Fixed classification based on Vlan Priority or DSCP values.
- Extended QoS with hierarchical scheduling - Fixed HQoS using strict priority queuing
- 4-2/4WEM: Signaling EM signaling standard version types 2-5 supported
- 4-2/4WEM: 2W option configuration available
- 4-2/4WEM: 2W4W Multi drop max 15 non hitless/hitless in 1 multi drop
- 4-2/4WEM: Combination of hitless and non-hitless point to point services are allowed.
- Security: SSH access configurable.
- Bandwidth assignment configuration is made more user friendly.
- Create 'Bandwidth Optimization groups' in the network design phase for optimized bandwidth usage.
- L3 multicast hardening PIM, IGMP improvements.
- QoS configuration on 9-L3A-L and 6-GE-L.
- Improved L3 protocol monitoring.
- Scalability: Supports 60 nodes in one logical ring.
- Scalability: Limit is 15 subrings connecting one main ring.
  - On node level there is a maximum of 13, since there is a limit of 15 WAN links on one node.
- CSM540-A: 720 GBit/s module”
- 4-10G-LW: 4x10 GBit/s Ethernet interface module
- 1-40G-LW: 1x40 GBit/s Ethernet interface module
- Multi VLAN Ethernet services
- Backbone Isolation Guard to prevent loops in case of multiple parallel ETS rings on a single node

**14. CHANGES IN R4.1.\* (NO OFFICIAL RELEASE)**

- Additional check is built in to supervise the ERPS domain level value, if mismatches are detected in the network HiProvision will raise an alarm. Loading the network again will resolve the alarm.
- CAUTION: All nodes in the network should be reachable before you load. Partial loading is not allowed.

**15. RESTRICTIONS/KNOWN ISSUES IN R4.1.\* (NO OFFICIAL RELEASE)**

- When you start your HiProvision Agent and you get the pop-up below, it means that you have installed your MySQL in a wrong way. The HiProvision agent will just block and not go any further. You will not be able to start up HiProvision. Please contact PTN Systems when you have this problem.
- At startup of the node connected directly to HiProvision, the node can report an 'NTP unreachable' problem if HiProvision is configured as NTP server for this node. The node is not able to connect to the NTP server. This alarm will disappear automatically after 1 hour maximum and the date/time on the node will be synchronized.

- When changing a port of a remote node from WAN to LAN mode, the node may become unreachable through other WAN connections to that node. This can be resolved by changing the port mode of the connected node from LAN to WAN, load the configuration and change it back to LAN mode.
- If the clock settings of a synchronous RS232 port are changed from internal to adaptive and back to internal clock it is possible that bit errors occur in the serial data traffic. Rebooting the 7-SERIAL interface module or interrupting the WAN link for a short time will restore the service.
- When creating an Ethernet service on a 1-10G-LW interface port with a high bandwidth (typical more than 4 Gbit/s), the default burst size may be too low, depending on the traffic behavior of the connected devices. This can lead to traffic loss in the network. The burst size can be changed when creating the service or modifying the service.
- In some conditions it is possible that the 'Mac conflict alarm' is raised for a short time during upgrade of the redundant CSM module. In this case the alarm does not indicate an error.
- Connecting a remote HiProvision client to the module in the second CSM slot (CSM-2) can result in communication loss between the remote HiProvision client and HiProvision server. Connect a remote HiProvision client to CSM-1 if possible.
- The following fields only allow alphanumeric character sets (a-z, A-Z, 0-9, <space>, \_, -): name of tunnels and services, PoE description field
- IEEE1588v2 is supported on 4-GC-LW, 4-GCB-LW, 4-GO-LW, 1-10G-LW (full-duplex ports) with following restrictions:
  - Only Ethernet encapsulation on Port 1 and 2 of 4-GC-LW, 4-GCB-LW, 4-GO-LW
  - Any change in link down/up, configuration, or CSM switchover, results in an automatic reset of IEEE1588v2.
  - Bit errors can result in corrupt IEEE1588v2 packets causing faulty IEEE1588v2 handling. In that case, reset IEEE1588v2 in the port properties of HiProvision Network

**16. SCALABILITY AND PERFORMANCE**

Area	Parameter	Reached Level	Unit
Services	Terminating unprotected services	64	node
Services	Terminating protected tunnels (BFD protected)	16	node
Services	LSP	512	node
Services	Labels	2048	node
Services	PW in an LSP	32	LSP
Services	BFD Sessions	128/64/8/2(*)	link
Logical Ring	Logical rings (ERPS instances)	16	node
Logical Ring	Logical ring size (nodes that terminate service)	16	local ring
Logical Ring	Subrings	5	subrings
Logical Ring	Ring/Subring depth	4	deep
RGERP Support	RGERP protocol interactions	32	network
RGERP Support	RGERP protocol interactions	4	node
MRP	Media Redundancy Protocol	8	rings/node
MSTP	Multiple Spanning Tree Protocol	16	rings/node
LPS 1:1	LPS instances on one node that have switchover < 50msec	8	node
7-SERIAL	Masters supported for Serial Ethernet PTMP	2	service
7-SERIAL	Slaves supported for Serial Ethernet PTMP	156	service

**Table 1: Scalability and Performance and Matrix**

(\*): dependent on DCN Bandwidth profile.

## 17. OPEN SOURCE SOFTWARE USED IN THE PRODUCT

The product contains, among other things, Open Source Software files, as defined below, developed by third parties and licensed under an Open Source Software license.

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Hirschmann Automation and Control GmbH

Head of R&D

Stuttgarter Strasse 45-51

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**18. PROTOCOL SUPPORT**

Table below details all protocols supported on the Interface Modules (IFMs).

**Table 1 Protocol and Feature Support Matrix**

Protocol, Feature	IFMs					
	8-FXS	4-2/4WEM, 4-CODIR, 7-SERIAL, 2-OLS, 4-DSL-LW	4-E1-L/4-T1-L, 16-E1-L/16-T1-L, 2-C37.94	Ethernet IFMs: 4-GC-LW, 4-GCB-LW, 4-GO-LW, 1-10G-LW, 4-10G-LW, 1-40G-LW	Layer2 IFMs: 6-GE-L	Layer3 IFMs: 9-L3A-L 9-L3EA-L
<b>Backbone MPLS-TP Network</b>						
WAN Ports	---	---	---	Yes	---	---
MACsec (Only in Aggregation Node)	---	---	---	Yes on 1-10G-LW WAN ports	---	---
<b>Synchronisation</b>						
SyncE	---	Yes on 2-OLS E1 ports	Yes	Yes	---	---
PTP IEEE 1588v2 (Only in Aggregation Node)	---	---	---	Yes: as Transparent Clock, not as Grandmaster, Boundary clock nor Ordinary Clock (not for 4-10G-LW, 1-40G-LW)	---	---
<b>Hardware</b>						
LAG + LACP (Only LAN ports)	---	---	---	In Aggregation Nodes: LAG: Yes / LACP: No In Core Nodes: LAG: No / LACP: No	Yes	Yes
PoE	---	---	---	Yes, on 4-GC-LW	---	---

Protocol, Feature	IFMs					
	8-FXS	4-2/4WEM, 4-CODIR, 7-SERIAL, 2-OLS, 4-DSL-LW	4-E1-L/4-T1-L, 16-E1-L/16-T1-L, 2-C37.94	Ethernet IFMs: 4-GC-LW, 4-GCB-LW, 4-GO-LW, 1-10G-LW, 4-10G-LW, 1-40G-LW	Layer2 IFMs: 6-GE-L	Layer3 IFMs: 9-L3A-L 9-L3EA-L
Smart SFP	---	---	---	Yes on 4-GO-LW ports or 4-GC-LW/4-GCB-LW front port 1 (not for 4-10G-LW, 1-40G-LW)	---	---
<b>Services</b>						
Ethernet	Yes	Yes on 4-DSL-LW	---	Yes	Yes	Yes
Ethernet: Local Service	---	---	---	---	Yes	Yes
Circuit Emulation	---	Yes (except for 4-DSL-LW)	Yes	---	---	---
Serial Ethernet	---	Yes on 7-SERIAL	---	---	---	---
Voice	Yes (analog Voice)	---	---	Yes (VoIP)	Yes (VoIP)	Yes (VoIP)
Local Mode	---	Yes on 2-OLS	Yes on 2-C37.94	---	---	---
<b>Protocol Interaction (Layer2 Access Ring Protection Protocols)</b>						
MRP	---	---	---	Only MAC flush on topology change, immediate switchover. Port based and VLAN based services.	Only MAC flush on topology change, immediate switchover. Port based and VLAN based services.	Only MAC flush on topology change, immediate switchover. Port based and VLAN based services.
<b>Layer2</b>						
LLDP	---	---	---	Yes	Yes	Yes
IGMP Snooping	---	---	---	---	Yes, MAC based	Yes, IP based



Protocol, Feature	IFMs					
	8-FXS	4-2/4WEM, 4-CODIR, 7-SERIAL, 2-OLS, 4-DSL-LW	4-E1-L/4-T1-L, 16-E1-L/16-T1-L, 2-C37.94	Ethernet IFMs: 4-GC-LW, 4-GCB-LW, 4-GO-LW, 1-10G-LW, 4-10G-LW, 1-40G-LW	Layer2 IFMs: 6-GE-L	Layer3 IFMs: 9-L3A-L 9-L3EA-L
MSTP	---	---	---	MAC flush on topology change, immediate switchover. Port based service: Network wide	Yes Port based service: Network wide VLAN based service: Local in Node	Yes Port based service: Network wide VLAN based service: Local in Node
<b>Layer3</b>						
Virtual Router	---	---	---	---	---	Yes
Static Routing	---	---	---	---	---	Yes
VRRP	---	---	---	---	---	Yes
OSPF	---	---	---	---	---	Yes
L3VPN	---	---	---	---	---	Yes
PIM	---	---	---	---	---	Yes
IGMP	---	---	---	---	---	Yes
DHCP Relay	---	---	---	---	---	Yes
<b>Traffic Control / Security</b>						
Ethernet: E-Tree	---	---	---	Yes	Yes, only back end ports	Yes, only back end ports
Storm Control	---	---	---	Yes, Port Properties	Yes, Port Properties	Yes, Port Properties
BPDU Guard	---	---	---	Yes, Port Properties	Yes, included in Layer2 MSTP Wizard	Yes, included in Layer2 MSTP Wizard
IP ACL	---	---	---	Yes (max. 1 rule)	Yes (max. 128 rules)	Yes (max. 128 rules)

Protocol, Feature	IFMs					
	8-FXS	4-2/4WEM, 4-CODIR, 7-SERIAL, 2-OLS, 4-DSL-LW	4-E1-L/4-T1-L, 16-E1-L/16-T1-L, 2-C37.94	Ethernet IFMs: 4-GC-LW, 4-GCB-LW, 4-GO-LW, 1-10G-LW, 4-10G-LW, 1-40G-LW	Layer2 IFMs: 6-GE-L	Layer3 IFMs: 9-L3A-L 9-L3EA-L
MAC ACL	---	---	---	Yes (max. 1 rule)	Yes (max. 128 rules)	Yes (max. 128 rules)
Sticky MAC	Yes	---	---	Yes	Yes (Back End Ports)	Yes (Back End Ports)
MAC Limit (Only in Aggregation Node)	Yes	---	---	Yes (not for 4-10G-LW, 1-40G-LW)	Yes	Yes
Static MAC Table	Yes	---	---	Yes	Yes (Back End Ports)	Yes (Back End Ports)
Test & Debugging						
Test & Loopback	---	Yes	Yes	---	---	---
Loss Measurement (LM) (Only in Aggregation Node)	Yes	Yes	Yes	Yes (not for 4-10G-LW, 1-40G-LW)	---	---
Delay Measurement (DM) (Only in Aggregation Node)	Yes	Yes	Yes	Yes (not for 4-10G-LW, 1-40G-LW)	---	---
Tunnel Ping	Yes	Yes	Yes	Yes	---	---
Tunnel Traceroute	Yes	Yes	Yes	Yes	---	---
Port Mirroring	Yes, intra node: - can only be a source, can be mirrored to Ethernet IFMs	Yes, intra node: - can only be a source, can be mirrored to Ethernet IFMs	Yes, intra node: - can only be a source, can be mirrored to Ethernet IFMs	Yes, intra node: - source can be any IFM except L3 IFM - destination: Ethernet IFMs	Yes, same IFM: source and destination must be same L2 IFM	Yes: source and destination can be a mix of main and extension L3 IFM
MAC Monitor	Yes (Node level)	Yes on 7-SERIAL (Node level)	---	Yes	Yes	Yes