

1 Overview

About This Chapter

[1.1 Equipment Introduction](#)

The OptiX PTN 3900 is new generation metropolitan optical transport equipment, which is developed by Huawei for packet transport.

[1.2 Network Application](#)

The OptiX PTN 3900 is applied at the convergence layer and the core layer of a metropolitan transport network.

1.1 Equipment Introduction

The OptiX PTN 3900 is new generation metropolitan optical transport equipment, which is developed by Huawei for packet transport.

As emerging data services are widely applied, operators require increasing bandwidth of the transport network and demand more flexibility of scheduling bandwidth. As a circuit-switching network, the traditional SDH-based multiservice transport network is inapplicable to the data services that feature burst and flexibility. In addition, the traditional connectionless-oriented IP network should not be used as a telecommunication carrier network because it cannot strictly ensure the quality and performance of important services.

With the ideal OAM and protection switching mechanism, the OptiX PTN 3900 is able to provide services of carrier-class quality in a packet transport network.

Figure 1-1 shows the OptiX PTN 3900 equipment.

Figure 1-1 Appearance of the OptiX PTN 3900



1.2 Network Application

The OptiX PTN 3900 is applied at the convergence layer and the core layer of a metropolitan transport network.

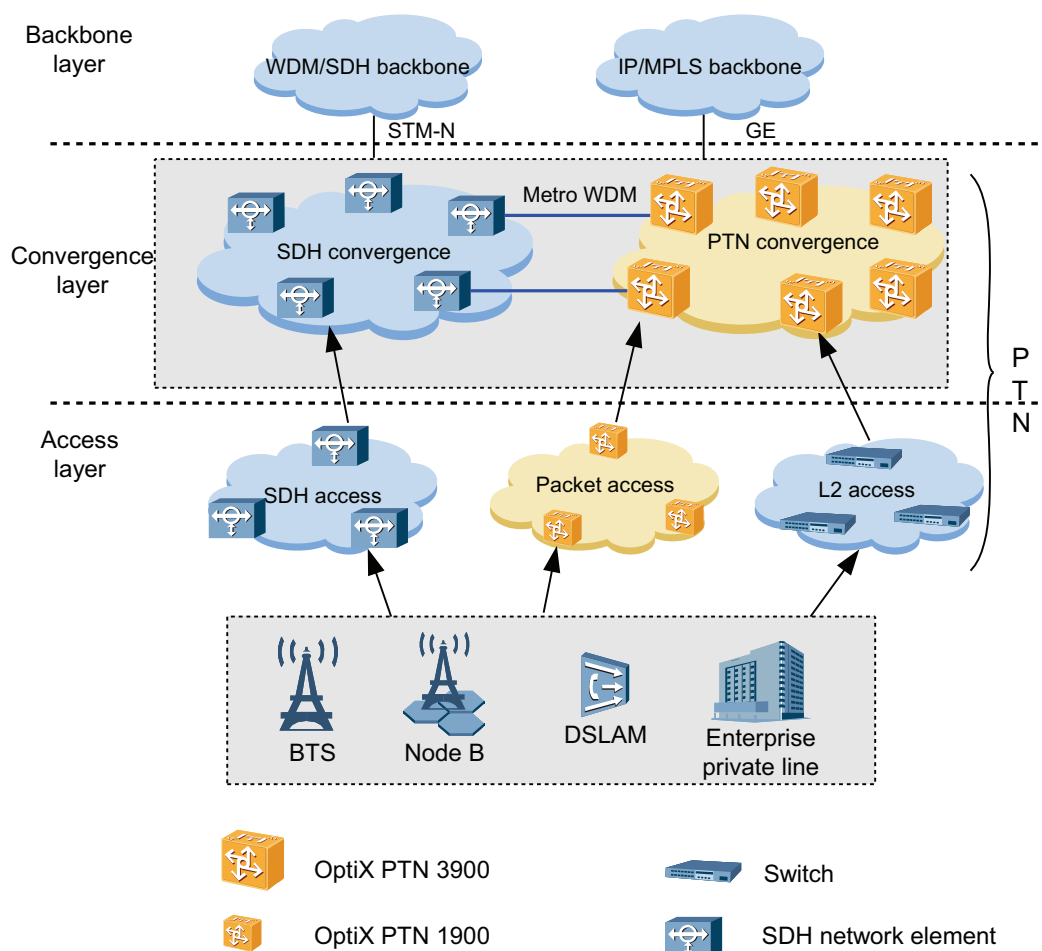
The OptiX PTN 3900 is mainly used in a metropolitan packet convergence network. It transports packet services in the network, and converges the services to an IP/MPLS backbone network.

The OptiX PTN 3900 also supports the CWDM networking and realizes the local wavelength grooming.

In later versions, the OptiX PTN 3900 supports the SDH boards of the OptiX OSN 1500/2500/3500/7500 product series and supports the DWDM boards of the OptiX OSN 3800/6800 product series, to realize the interconnection with a WDM/SDH backbone network. This facilitates the smooth evolution of the metropolitan transport network from a TDM switching network to a packet switching network.

Figure 1-2 shows the network application of the OptiX PTN 3900.

Figure 1-2 Network application of the OptiX PTN 3900



2 Functions and Features

About This Chapter

The OptiX PTN 3900 supports various types of services, and provides abundant functions and features to ensure service transport quality and efficiency.

2.1 Service Types

The OptiX PTN 3900 supports Ethernet services, asynchronous transfer mode (ATM) services, and circuit emulation services (CES).

2.2 Service Processing Capability

The service processing capability of the OptiX PTN 3900 is categorized into the switching capability and the service access capability.

2.3 Interface Types

The external interfaces of the OptiX PTN 3900 are categorized into service interfaces, and administration and auxiliary interfaces.

2.4 Networking Capability

The OptiX PTN 3900 supports various networking modes to apply to different scenarios.

2.5 Protection Capability

The OptiX PTN 3900 provides equipment level protection and network level protection.

2.6 QoS

The OptiX PTN 3900 provides hierarchical end-to-end quality of service (QoS) management, and thus provides high quality transports that are differentiated by service.

2.7 OAM Features

The OptiX PTN 3900 supports Ethernet operations, administration and maintenance (OAM) and MPLS OAM, to realize fast defect detection and to trigger protection switching. In this way, the carrier-class quality of service is guaranteed in the packet switching network.

2.8 NSF

With the non-stop forwarding (NSF) function, data forwarding can be properly performed even when the control plane of the equipment is faulty (for example, the CPU is restarted). In this case, key services on the network are protected.

2.9 Clock

The OptiX PTN 3900 supports the extraction of clock signals from the POS signals, channelized STM-1 signals, ATM STM-1 signal, E1 signals and synchronous Ethernet signals. The OptiX

PTN 3900 also supports the external clock input/output and provides the equipment internal clock.

2.10 DCN Scheme

The data communication network (DCN) is an integral part of network management, and is used to transmit the network management information. The OptiX PTN 3900 supports the inband DCN to ensure the intercommunication of network management information.

2.1 Service Types

The OptiX PTN 3900 supports Ethernet services, asynchronous transfer mode (ATM) services, and circuit emulation services (CES).

The OptiX PTN 3900 processes the following Ethernet services:

- E-Line services
- E-LAN services
- E-Tree services
- E-Aggr services

The OptiX PTN 3900 processes the following ATM services:

- ATM emulation service
- IMA emulation service

The OptiX PTN 3900 processes the TDM CES service.

2.2 Service Processing Capability

The service processing capability of the OptiX PTN 3900 is categorized into the switching capability and the service access capability.

2.2.1 Switching Capability

The OptiX PTN 3900 supports the packet-based service switching.

2.2.2 Maximum Access Capability

The OptiX PTN 3900 is able to access services through various interfaces.

2.2.1 Switching Capability

The OptiX PTN 3900 supports the packet-based service switching.

Table 2-1 shows the maximum switching capability of the OptiX PTN 3900.

Table 2-1 Maximum switching capability of the OptiX PTN 3900

Product	Maximum Switching Capability
OptiX PTN 3900	160 G
Note: The switching supported by the OptiX PTN 3900 V100R001 is packet switching.	

2.2.2 Maximum Access Capability

The OptiX PTN 3900 is able to access services through various interfaces.

Table 2-2 lists the access capabilities of different interfaces of the OptiX PTN 3900.

Table 2-2 OptiX PTN 3900 interface quantity

Interface Type	Access Capability (Board Name)	Processing Capability (Board Name)	Entire Equipment Access Capability	Accessed by Interface Board or Processing Board
E1 (including IMA E1, ML-PPP E1, and TDM E1)	32 (D75/D12)	32 (MD1) 63 (MQ1)	504	Accessed by interface board
Packet over SDH/SONET (POS) STM-1/4	2 (POD41)	8 (EG16)	32	Accessed by interface board
FE	12 (ETFC)	48 (EG16)	188	Accessed by interface board
GE	16 (EG16) 2 (EFG2)	16+8 (EG16)	160	The GE signals can be accessed by processing board (EG16) as well as interface board (EFG2)
Channelized STM-1	2 (CD1)	2 (CD1)	32	Accessed by processing board
ATM STM-1	2 (AD1) 2 (ASD1)	2 (AD1) 2 (ASD1)	32	Accessed by processing board

2.3 Interface Types

The external interfaces of the OptiX PTN 3900 are categorized into service interfaces, and administration and auxiliary interfaces.

2.3.1 Service Interfaces

The OptiX PTN 3900 can access services through various interfaces.

2.3.2 Administration and Auxiliary Interfaces

The administration and auxiliary interfaces include administration interfaces, external clock interfaces, and alarm interfaces.

2.3.1 Service Interfaces

The OptiX PTN 3900 can access services through various interfaces.

Table 2-3 lists the service interfaces supported by the OptiX PTN 3900.

Table 2-3 Service interfaces of the OptiX PTN 3900

Interface Type	Description
FE interface	Electrical interfaces: 10/100Base-TX

Interface Type	Description
GE interface	Optical interfaces: 1000BASE-SX, 1000BASE-LX, 1000BASE-ZX (40km), 1000BASE-ZX (70km)
POS interface	STM-1 optical interfaces: I-1, S-1.1, L-1.1, L-1.2, Ve-1.2 STM-4 optical interfaces: I-4, S-4.1, L-4.1, L-4.2, Ve-4.2
ATM STM-1 interface	I-1, S-1.1, L-1.1, L-1.2, Ve-1.2
Channelized STM-1 interface	I-1, S-1.1, L-1.1, L-1.2, Ve-1.2
E1 interface	75-ohm/120-ohm E1 electrical interfaces: DB44 connectors

2.3.2 Administration and Auxiliary Interfaces

The administration and auxiliary interfaces include administration interfaces, external clock interfaces, and alarm interfaces.

Table 2-4 lists the administration and auxiliary interfaces of the OptiX PTN 3900.

Table 2-4 Administration and auxiliary interfaces of the OptiX PTN 3900

Interface Type	Description
Administration interface	One Ethernet interface for network management (ETH) One extended Ethernet interface One F&f administration serial interface
External clock interface	Two 75-ohm external clock input interfaces (2048 kbit/s or 2048 kHz) Two 75-ohm external clock output interfaces (2048 kbit/s or 2048 kHz) Two 120-ohm input/output interfaces (2048 kbit/s or 2048 kHz)
Alarm interface	One cabinet indicator interface (4-channel) One cabinet indicator concatenation interface (4-channel) Two alarm input interfaces (totally 8-channel) One alarm output and concatenation interface (2-channel for output, 2-channel for concatenation)

2.4 Networking Capability

The OptiX PTN 3900 supports various networking modes to apply to different scenarios.

Networking Interface

The OptiX PTN 3900 supports the following interfaces for networking.

- GE
- POS STM-4
- POS STM-1
- ML-PPP

 NOTE

- It is recommended that the ML-PPP should be used to form the chain network.
- The FE interface can be used as networking interface, but the FE interface is not recommended to be used as networking interface.

Typical Backhaul Networking for Mobile Communication

Figure 2-1 and **Figure 2-2** show the typical backhaul networking modes of the PTN equipment for mobile communication. **Figure 2-3** shows the networking application of the PTN equipment in the offload solution.

Figure 2-1 Networking Mode I for Mobile Communication

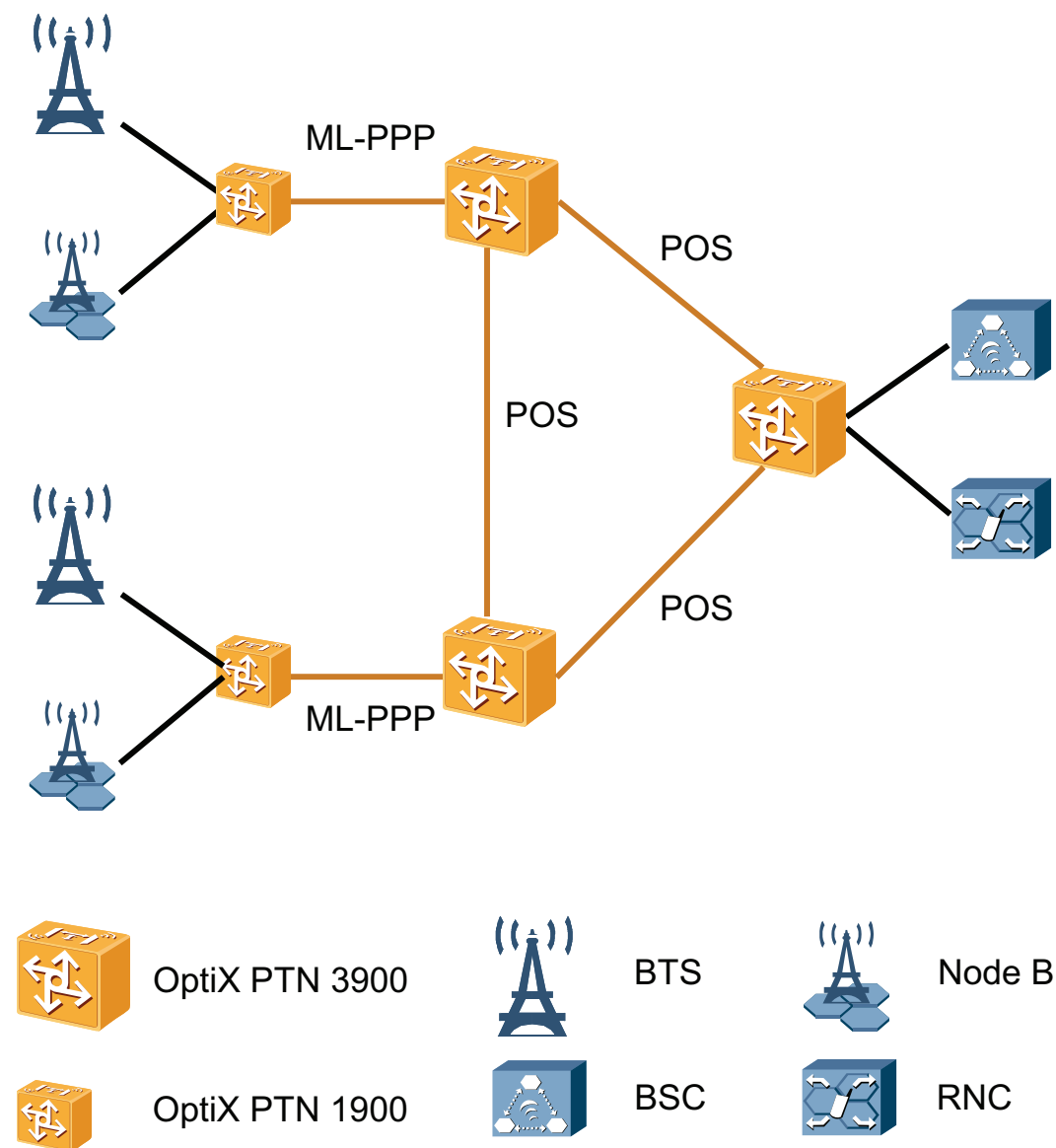


Figure 2-2 Networking Mode II for Mobile Communication

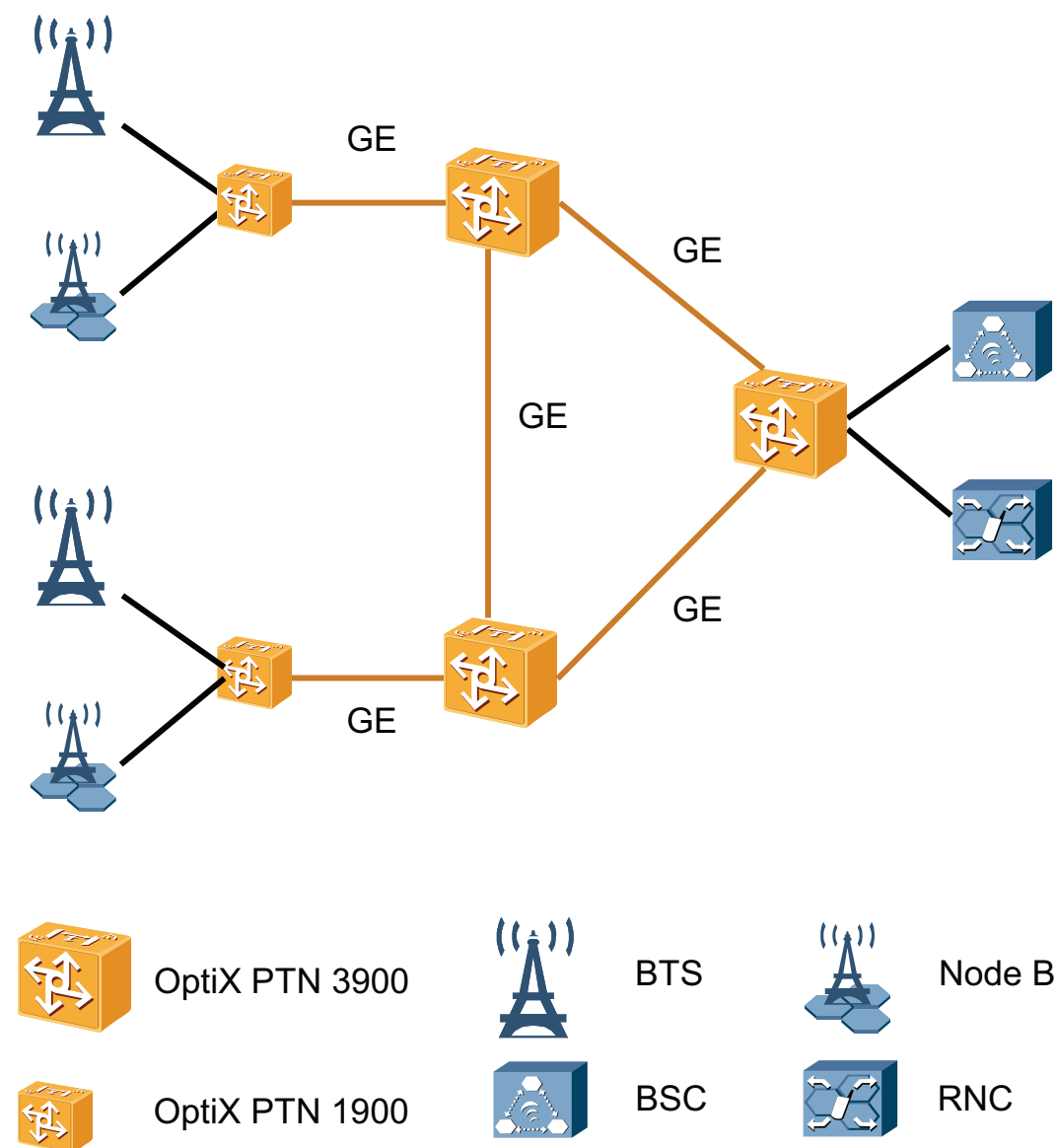
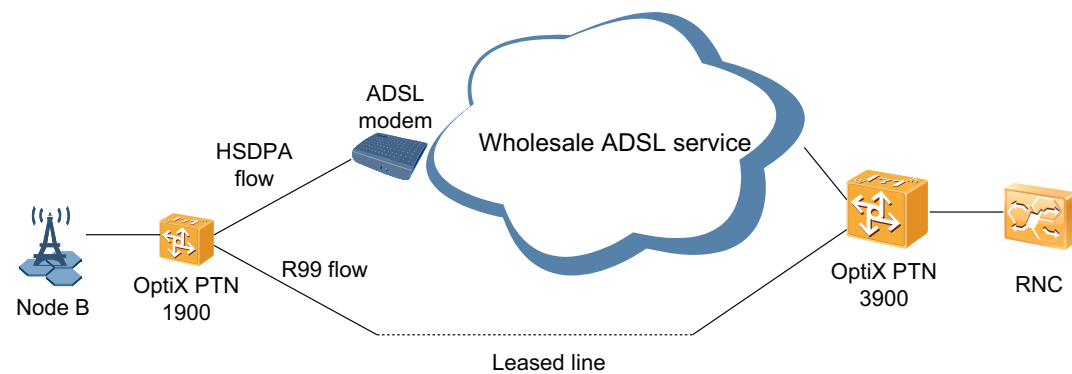


Figure 2-3 Networking Mode for offload solution



Typical Networking for Ethernet Services

Figure 2-4 shows the typical networking mode of the PTN equipment for E-Line services.

Figure 2-4 Networking Mode for E-Line Services

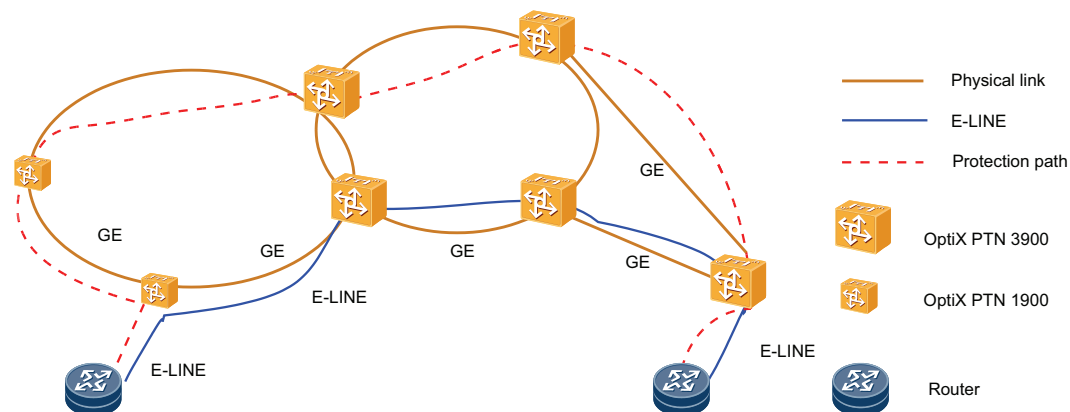
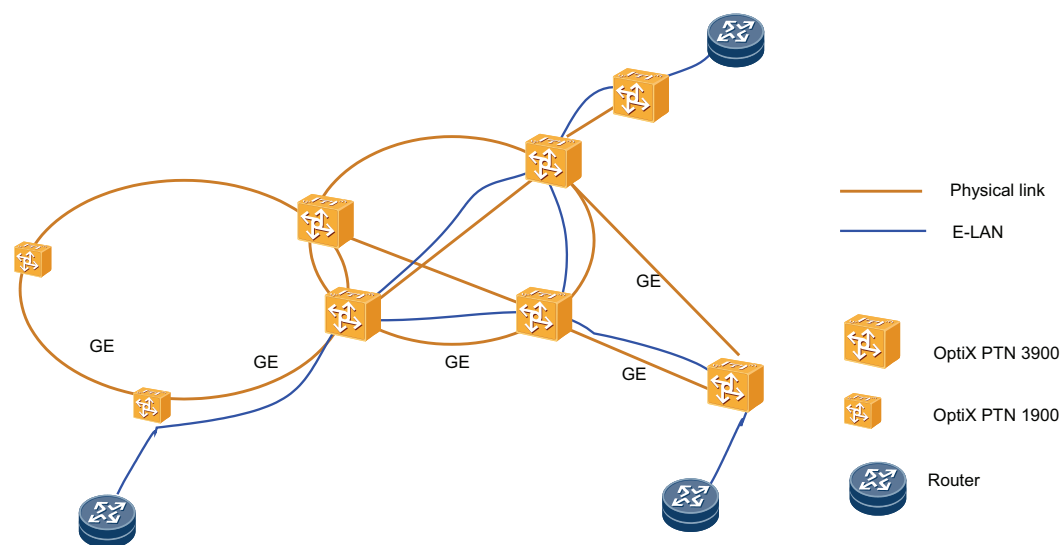


Figure 2-5 shows the typical networking mode of the PTN equipment for E-LAN services.

Figure 2-5 Networking Mode for E-LAN Services



2.5 Protection Capability

The OptiX PTN 3900 provides equipment level protection and network level protection.

The OptiX PTN 3900 provides various equipment level protection schemes, as listed in [Table 2-5](#).

Table 2-5 Equipment level protection

Protection Object	Protection Scheme	Revertive Mode
E1 service processing board	1:N ($N \leq 4$) TPS	Revertive

Protection Object	Protection Scheme	Revertive Mode
Cross-connect and timing board	1+1 hot backup	Non-revertive
System control, communication and auxiliary processing board	1+1 hot backup	Non-revertive
Power interface unit	1+1 hot backup	-
Note: The OptiX PTN 3900 supports the coexistence of two TPS protection groups.		

The OptiX PTN 3900 provides various network level protection schemes, as listed in [Table 2-6](#).

Table 2-6 Network level protection

Protected Object	Protection Scheme
MPLS Tunnel	1+1 protection
	1:1 protection
	RR protection
	FRR protection
Ethernet link	LAG protection
	MSTP protection
POS STM-1/ POS STM-4	1+1 linear MSP
	1:1 linear MSP
Channelized STM-1 (accessing ML-PPP)	1+1 linear MSP
	1:1 linear MSP
ATM STM-1 (using AD1)	1+1 linear MSP
ATM over E1	IMA protection
Packet over E1	ML-PPP protection

2.6 QoS

The OptiX PTN 3900 provides hierarchical end-to-end quality of service (QoS) management, and thus provides high quality transports that are differentiated by service.

The OptiX PTN 3900 provides complete QoS grooming mechanisms, which include the following:

- DiffServ mode based on flow classification. With the DiffServ mode, the OptiX PTN 3900 helps operators provide services of different quality classes for users. Hence, operators can provide an integrated network that can carry data, voice and video services.
- QoS for end-to-end services
 - Hierarchical QoS (HQoS) mechanism at the access side. The HQoS mechanism helps control the overall bandwidth for a single service type, a single service access point, multiple service access points, a single service or multiple services.
 - Traffic Engineering (TE) mechanism at the network side. The TE mechanism helps balance the network traffic to ensure the service quality.

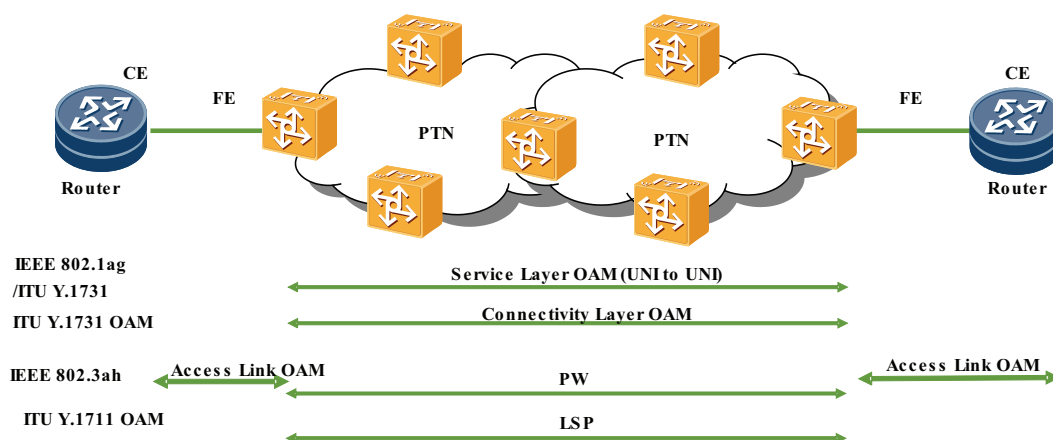
With the complete QoS mechanisms, the OptiX PTN 3900 ensures that the specifications of delay, delay variation, and bandwidth are satisfied for different services, and thus guarantees the provision of carrier-class services.

2.7 OAM Features

The OptiX PTN 3900 supports Ethernet operations, administration and maintenance (OAM) and MPLS OAM, to realize fast defect detection and to trigger protection switching. In this way, the carrier-class quality of service is guaranteed in the packet switching network.

Figure 2-6 shows the OAM mechanism of the OptiX PTN 3900.

Figure 2-6 OAM mechanism of the OptiX PTN 3900



At the network level, the OptiX PTN 3900 supports MPLS OAM and Ethernet OAM.

- The OptiX PTN 3900 supports the following MPLS OAM functions.
 - The equipment provides hardware support, to transmit and receive connectivity verification (CV)/ fast failure detection (FFD)/ backward defect indicator (BDI)/ forward defect indicator (FDI) messages, and to perform timeout judgment for these messages. In compliance with ITU-T Y.1710 and ITU-T Y.1711, the fast continuity check and failure indication are realized. The minimum period of OAM frame supported by the equipment is 3.33 ms.
 - The equipment supports the MPLS Tunnel Ping and TraceRoute commands, and also the VCCV commands for the ATM PW and CES PW. These commands can be used to detect and locate the faults.

- The equipment supports performance monitoring for MPLS Tunnel. In compliance with ITU-T Y.1731, the equipment provides hardware support for the monitoring of packet loss ratio, packet delay and packet delay variation.
- The OptiX PTN 3900 supports the following Ethernet OAM functions that are compliant with IEEE 802.1ag and ITU-T Y.1731.
 - The equipment provides hardware support for the Ethernet continuity check (ETH-CC) and the performance monitoring. The minimum period of OAM frame supported by the equipment is 3.33 ms.
 - The control plane of the equipment supports the Ethernet loopback (ETH-LB) and Ethernet link trace (ETH-LT) operations.
 - The equipment supports performance monitoring for the E-Line service. In compliance with ITU-T Y.1731, the equipment provides hardware support for the monitoring of packet loss ratio, packet delay and packet delay variation.

At the link layer, the OptiX PTN 3900 supports the following OAM mechanisms.

- The equipment supports Ethernet OAM that is compliant with IEEE 802.3ah. Each Ethernet port supports link discovery, link state monitoring, remote fault detection, and remote loopback.
- The equipment supports ATM OAM, including the fault management in the F4 OAM and F5 OAM.

2.8 NSF

With the non-stop forwarding (NSF) function, data forwarding can be properly performed even when the control plane of the equipment is faulty (for example, the CPU is restarted). In this case, key services on the network are protected.

The OptiX PTN 3900 supports the protocol level graceful restart (GR) technology. In the case of a fault, the neighbor nodes do not delete the route information. In this way, services are still forwarded and the network route oscillation is avoided.

The OptiX PTN 3900 supports the NSF function in the following cases:

- The warm reset of the processing board.
- The warm reset of the XCS board (the XCS board should be configured with 1+1 protection).
- The warm reset of the SCA board (the SCA board should be configured with 1+1 protection).

2.9 Clock

The OptiX PTN 3900 supports the extraction of clock signals from the POS signals, channelized STM-1 signals, ATM STM-1 signal, E1 signals and synchronous Ethernet signals. The OptiX PTN 3900 also supports the external clock input/output and provides the equipment internal clock.

The clock system of the OptiX PTN 3900 supports the following functions:

- Clock synchronization for circuit emulation services
- Extraction of clock signals from POS signals

- Extraction of clock signals from channelized STM-1 signals
- Extraction of clock signals from ATM STM-1 signals
- Extraction of clock signals from E1 signals
- Extraction of clock signals from synchronous Ethernet signals
- Processing and transfer of synchronization status messages (SSM)
- Input/output of two 75-ohm external clock sources
- Input/output of two 120-ohm external clock sources
- Three clock working modes, that is, the locked, hold-over, and free-run modes

**NOTE**

The synchronous Ethernet is a technology used to synchronize the clock frequencies at the Ethernet physical layer. Clock signals are extracted directly from the serial bit flow on the Ethernet link. These clock signals are then used for data transmission. In this way, the clock signals are transferred.

2.10 DCN Scheme

The data communication network (DCN) is an integral part of network management, and is used to transmit the network management information. The OptiX PTN 3900 supports the inband DCN to ensure the intercommunication of network management information.

The OptiX PTN 3900 adopts the inband DCN scheme. In this scheme, the setup of dedicated DCN channels is not required, and hence the network construction cost is greatly lowered.

The OptiX PTN 3900 supports the inband DCN through the following interfaces.

- GE
- FE
- POS STM-4/STM-1
- ML-PPP

**CAUTION**

The FE interfaces are not recommended to be used as networking interfaces.