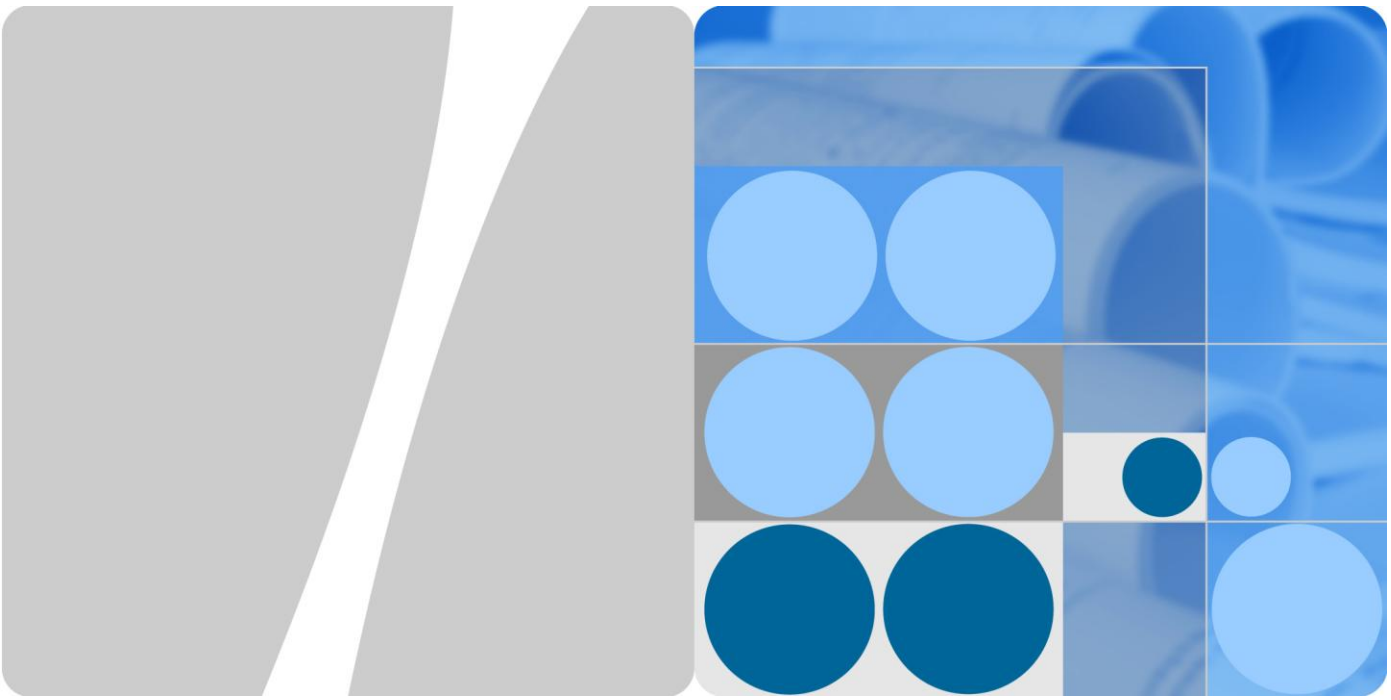

OptiX OSN 7500 II Intelligent Optical Switching System
V200R012C00
Product Overview

Issue 03

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Contents

1 Introduction

1.1 Network Application

The OptiX OSN 7500 II intelligent optical switching system (the OptiX OSN 7500 II for short) is the next-generation intelligent optical core switching (OCS) equipment and is developed by Huawei on the basis of the current situation and development trend of the metropolitan area network (MAN).

The OptiX OSN 7500 II is mainly used as a service scheduling node at the backbone layer of the MAN. That is, it functions as optical core switching equipment (OCS). As an intelligent optical transmission platform and core optical transmission system, the OptiX OSN 7500 II is located at the metropolitan backbone layer to schedule and transmit services of different types and granularities.

The OptiX OSN 7500 II is of a "universal switch" architecture. That is, the OptiX OSN 7500 II can be used in packet mode or in TDM mode. When used with the other equipment of Huawei, the OptiX OSN 7500 II supports various networking applications, such as the pure packet mode application, hybrid networking application (overlay networking of the packet mode and TDM mode), and pure TDM mode application. By using a proper networking solution, the data service and conventional SDH service can be processed in the optimal manner.

Technology

In packet mode, the OptiX OSN 7500 II supports the following technologies:

- Multiprotocol Label Switching Transport Profile (MPLS-TP)
- Multiprotocol Label Switching (MPLS)
- ETH PWE3 (Pseudo Wire Edge to Edge Emulation)
- TDM PWE3
- ATM PWE3

In TDM mode, the OptiX OSN 7500 II supports the following technologies:

- Synchronous digital hierarchy (SDH)
- Plesiochronous digital hierarchy (PDH)
- Wavelength division multiplexing (WDM)
- Ethernet
- Video

Equipment Exterior

Figure 1-1 shows the exterior of the OptiX OSN 7500 II.

Figure 1-1 Exterior of the OptiX OSN 7500 II

Network Application

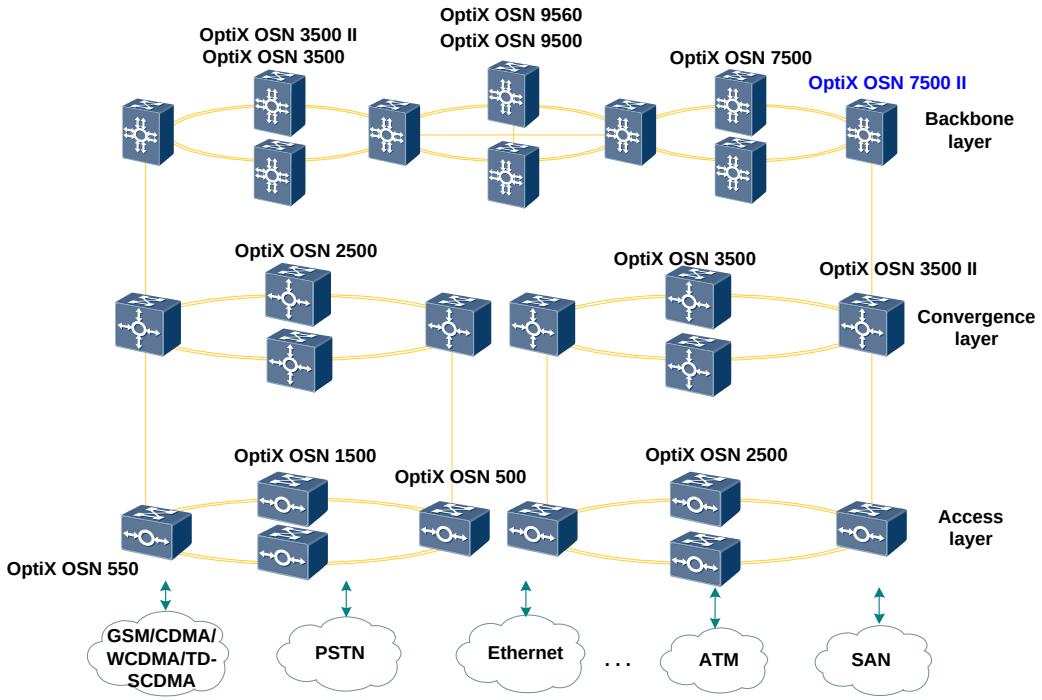
As shown in Figure 1-2, the OptiX OSN 7500 II is a high-end product in the next generation SDH (NG-SDH). The network application scenarios are described as follows:

- In TDM networking, can be networked with the other OptiX transmission equipment (the OptiX OSN 9560, OptiX OSN 9500, OptiX OSN 7500, OptiX OSN 3500, OptiX OSN 3500 II, OptiX OSN 2500, OptiX OSN 1500, OptiX OSN 500, and OptiX OSN

550) to optimize the carrier's investment, achieving a full range of networking solutions at the access layer, convergence layer, and backbone layer.

- With the packet switching technology, the OptiX OSN 7500 II can constitute a packet data transmission network with the other OptiX transmission equipment (the OptiX OSN 7500, OptiX OSN 3500, OptiX OSN 1500, OptiX OSN 500, OptiX OSN 550, and OptiX RTN 900) to meet the requirements for bearing IP services.
- Can be flexibly networked with WDM equipment and Metro equipment.
- Can be networked with intermediate third-party Layer 2 networks, allowing end-to-end configuration and management.

Figure 1-2 Application of the OptiX OSN 7500 II in the transmission network



1.2 Features

This section describes the features of the OptiX OSN equipment in the aspects of system architecture, networking, and technologies.

1.2.1 Universal Switch Architecture for Multiservice Grooming

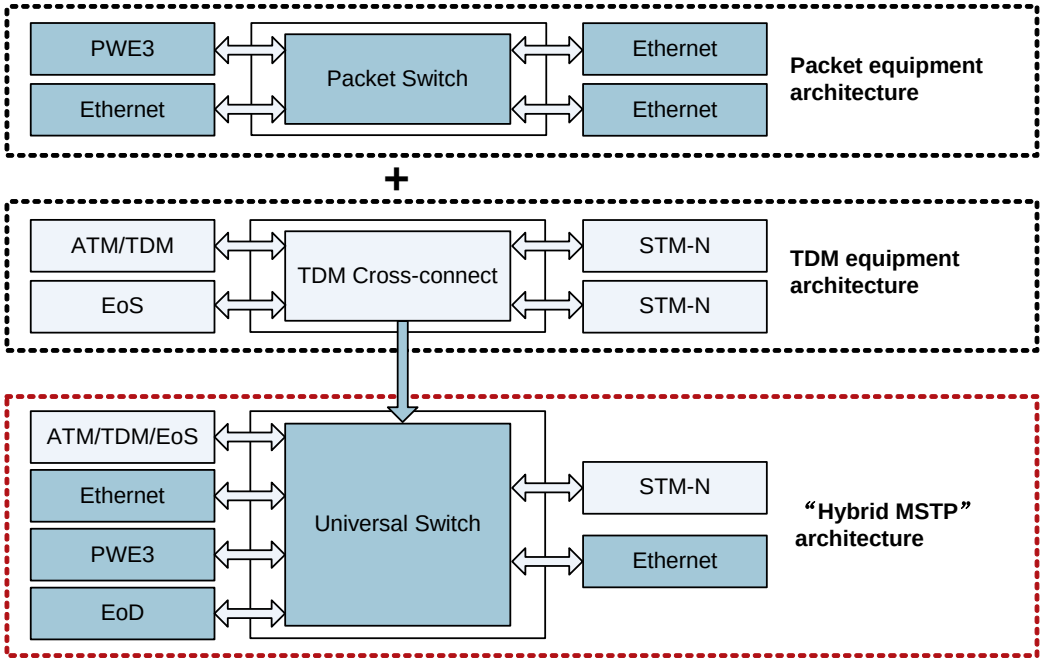
OptiX OSN equipment uses a universal switch architecture for unified grooming of packet services and TDM services. OptiX OSN equipment can work in packet mode, TDM mode, or dual-domain (packet+TDM) mode.

The three modes can be smoothly switched by upgrading the software of a service board so carriers' requirements on services and networks can be met. The smooth switching between the three modes supports carriers' distributed smooth investment based on the development of the technology and industrial chain.

Based on a universal switch architecture, OptiX OSN equipment uses the packet transmission technology to perform efficient statistical multiplexing on data services so the transmission cost of every bit is reduced. In addition, OptiX OSN equipment uses the Native technology to transmit TDM services so voice services are transmitted with high quality.

Figure 1-3 shows the OptiX OSN equipment architecture.

Figure 1-3 OptiX OSN equipment architecture



Based on a universal switch architecture, OptiX OSN equipment unifiedly transmits packet services such as 2G, 3G, and VIP private line services so network overlapping is avoided. In addition, OptiX OSN equipment transmits TDM services. Carriers can constitute an end-to-end packet network, dual-domain (packet+SDH) network, or hybrid (MSTP+routers) network that bears L2+L3 services. This complete packet transmission solution allows an evolution from TDM networks to all-IP networks.

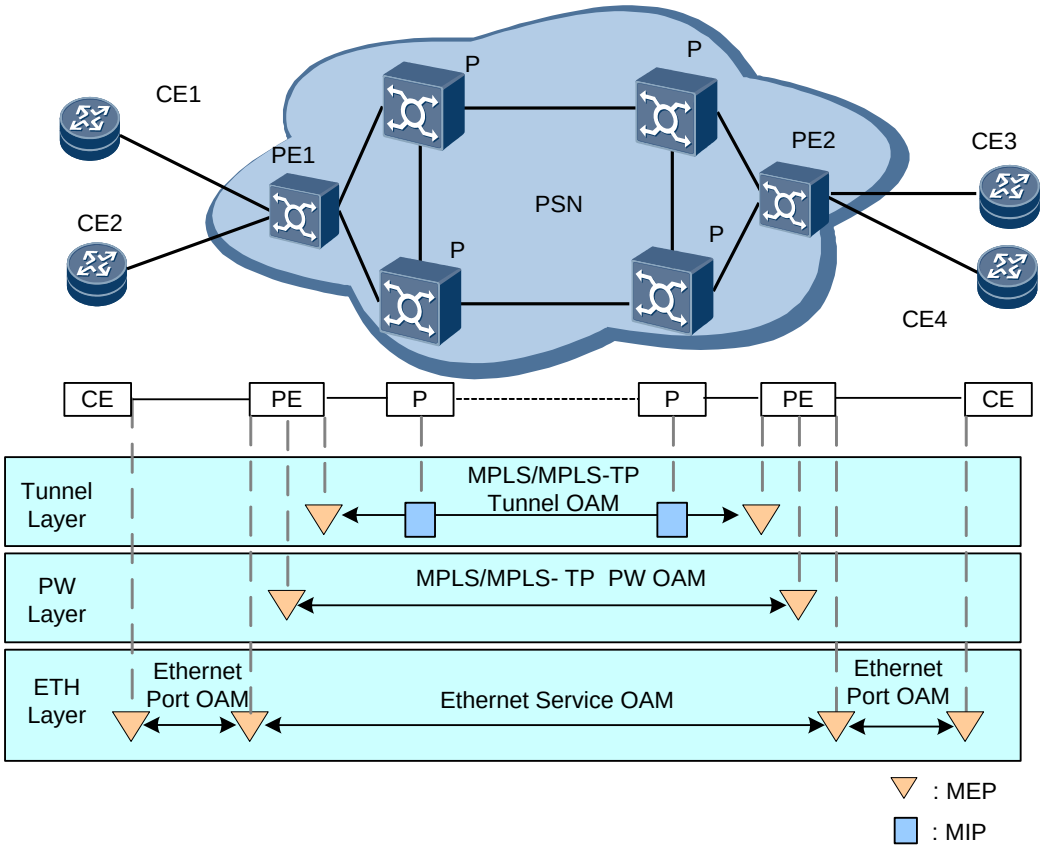
1.2.2 Hierarchical OAM Facilitating Fault Detection

The Hybrid MSTP equipment supports hierarchical OAM to rapidly detect and locate various faults, thereby improving network reliability. In addition, the Hybrid MSTP equipment supports distributed OAM and centralized OAM.

Application of Hierarchical OAM

As shown in Figure 1-4, MPLS OAM, MPLS-TP OAM, and ETH-OAM constitute hierarchical OAM at the tunnel layer, PW layer, and Ethernet layer.

Figure 1-4 Application of hierarchical OAM



CE: Customer Edge	MEP: Maintenance End Point
MIP: Maintenance Intermediate Point	P: Provider
PE: Provider Edge	-

Table 1-1 provides various levels of OAM and their functions.

Table 1-1 Various levels of OAM and their functions

Category	Level	Function
ETH OAM	Ethernet Port OAM	Ethernet port OAM (EFM) helps maintain point-to-point Ethernet links between two directly-connected devices, and it is not service-specific. Ethernet port OAM provides the following functions: • OAM auto-discovery • Link performance monitoring • Fault detection • Remote loopback • Self-loop detection
	Ethernet service	Ethernet service OAM (CFM) helps maintain

Category	Level	Function
	OAM	end-to-end Ethernet services. It specifies maintenance domains (MDs), maintenance associations (MAs), and maintenance points (MPs), allowing service flows to be managed by section and by layer. Ethernet service OAM provides the following functions: • Continuity check (CC) • Loopback (LB) test • Link trace (LT) test • Performance check
MPLS OAM	MPLS tunnel/PW OAM	MPLS tunnel/PW OAM detects, identifies, and locates defects or faults on MPLS tunnels/PWs on an MPLS network. Once a fault is detected, protection switching is triggered. MPLS tunnel/PW OAM provides the following functions: • Packet detection • Ping • Traceroute
MPLS-TP OAM	MPLS-TP Tunnel/PW OAM	MPLS-TP OAM detects, identifies, and locates faults on a packet network. Once a fault is detected, protection switching is triggered for improving network reliability. MPLS-TP OAM provides the following functions: • Active mode: – CC – Remote fault indication (RDI) – Alarm indication signal (AIS) • On-demand mode: – LB test – LT test – Packet loss measurement (LM) – Delay measurement (2DM) – TST test, including diagnostic test and throughput test

Distributed OAM and Centralized OAM

OAM is categorized into distributed OAM and centralized OAM.

- Distributed OAM: OAM messages are extracted and processed on service processing boards.
- Centralized OAM: OAM messages are extracted from service processing boards and then sent to a cross-connect board for centralized processing.

MPLS OAM can be distributed or centralized. MPLS-TP OAM can only be centralized. Before switching MPLS OAM to MPLS-TP OAM, ensure that MPLS OAM is centralized.

1.2.3 TP-Assist Solution Facilitating the O&M of Packet Services

Like the SDH equipment, Huawei Hybrid MSTP equipment supports a hierarchical operating & maintenance (O&M) system by using the TP-Assist solution, so packet services can be configured, commissioned, or maintained in an end-to-end manner.

Unlike an SDH network, a packet network brings the following challenges:

- More types of network topologies and more complex and time-consuming configurations, which impose higher requirements on O&M personnel
- Lack of overheads that indicate the physical status of a network to real-time monitor services or form a complete alarm system. Once a network is faulty, it is hard to locate the fault.

The TP-Assist solution addresses these challenges. It searches the Huawei intelligent expert database, facilitating O&M operations such as service configuration, installation and commissioning, and fault locating. Table 1-2 provides the functions of the TP-Assist solution.

Table 1-2 Functions of the TP-Assist solution

Stage	Subitem	Function
End-to-end service configuration	End-to-end packet service configuration	• Provides Configuring E-Line Services Carried by PWs in End-to-End Mode. • Provides Configuring E-LAN Services Carried by PWs in End-to-End Mode.
	Automatic deployment of alarm management	Once services are deployed, the continuity check (CC) function of services and tunnels is automatically configured and started, and alarm management is automatically deployed.
Installation and commissioning	One-click service connectivity tests	The NMS provides one-click service connectivity tests including: • ETH-OAM LB • Tunnel Ping • PW Ping
	One-click service performance tests	The NMS provides one-click service performance tests for packet loss, delay, and delay jitter at the following layer: • Ethernet service layer • Tunnel layer • PW layer The Ethernet service layer supports

Stage	Subitem	Function
		end-to-end performance tests.
Fault locating	Fault Location Using IP Ping	A UNI port at the transmission network boundary supports IP ping tests.
	E-LAN Service Loopback Detection	When service loop occurs on a Layer 2 Ethernet private network, the SRV_SHUTDOWN_LD alarm (indicating deactivation of the looped service) is reported and the looped service can be blocked to prevent broadcast storms.
	One-Click Intelligent Fault Diagnosis	Provides the diagnosis of service interruption faults and performance deterioration faults. The enhanced fault diagnosis function helps to lower fault handling requirements on O&M personnel and to raise their efficiency in fault handling.
	Performance statistics and monitoring	• Performance statistics: – Traffic statistics: Collects traffic statistics based on various granularities like ports, traffic classification, VLANs, PWs, tunnels, or queues. The NMS demonstrates statistical results in diagrams, so O&M personnel can view the current bandwidth usage or the bandwidth usage in the past week or month. – Statistics of packet loss due to congestion: Detects packet loss due to congestion and counts lost packets to facilitate problem locating. • Performance monitoring: – Traffic monitoring: traffic threshold-crossing alarms, including FLOW_OVER, PW_EXC_TRAFFIC, PORT_EXC_TRAFFIC, and BWUTILIZAT

Stage	Subitem	Function
		ION_OVER – No-traffic monitoring: alarms indicating no traffic, including PW_NO_TRAFFIC and ETH_NO_FLOW – Bandwidth usage: bandwidth usage threshold-crossing alarm BWUTILIZATION_OVER
	Alarm indicating the half-duplex mode	A warning alarm PORTMODE_MISMATCH is reported indicating that the Ethernet port that was configured to work in auto-negotiation mode is working in half-duplex mode.

1.2.4 Built-In WDM, Flexible Networking

The OptiX OSN equipment uses the built-in WDM technology to transmit several wavelengths over one optical fiber. In this manner, the OptiX OSN equipment can be interconnected with the WDM equipment.

For more information, click the following:4.5 Built-in WDM Technology

2 Hardware Structure and Software Architecture

2.1 Hardware Structure

The equipment can house various types of boards and can reside in only one type of cabinet.

2.1.1 Cabinet

The cabinet that complies with ETSI standards is used for housing OptiX OSN 7500 II subracks. A PDU is installed on the top of a cabinet to access -48 V or -60 V power.

2.1.2 Subrack

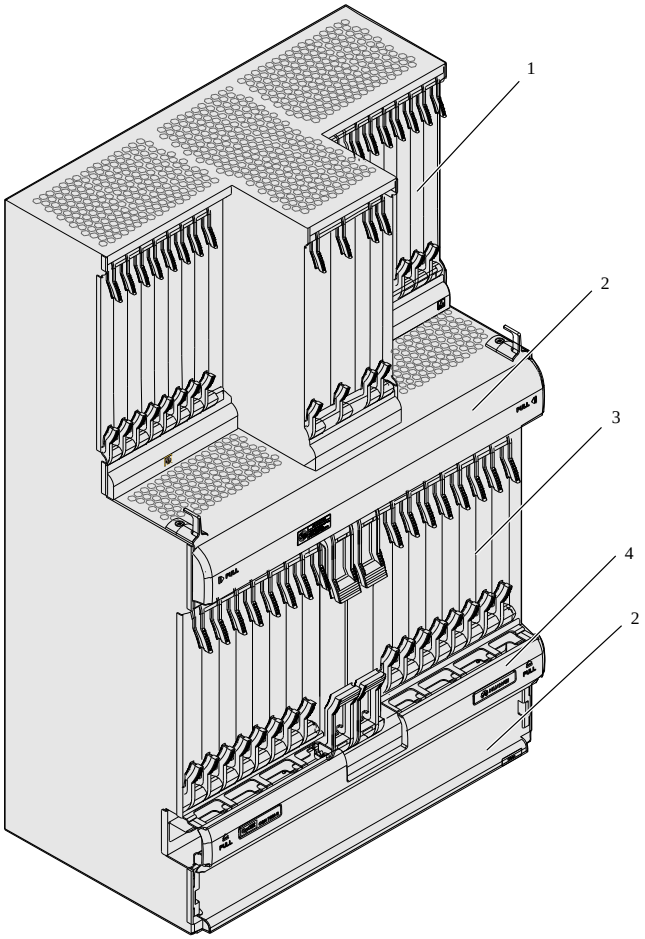
A subrack consists of slots and boards that can be configured.

2.1.2.1 Structure

An OptiX OSN 7500 II subrack has a two-layer structure. The subrack consists of a processing board area, an interface board area, a fan area, and a cable routing area.

Figure 2-1 shows the structure of an OptiX OSN 7500 II subrack.

Figure 2-1 Structure of an OptiX OSN 7500 II subrack



1. Interface board area
2. Cable routing area
3. Processing board area
4. Fan area

The functions of the areas are as follows:

- Interface board area: This area houses the interface boards of the OptiX OSN 7500 II.
- Cable routing area: This area houses fiber jumpers in a subrack.
- Processing board area: This area houses the processing boards of the OptiX OSN 7500 II.
- Fan area: This area houses one fan module, which dissipates heat generated by the equipment.

NOTE

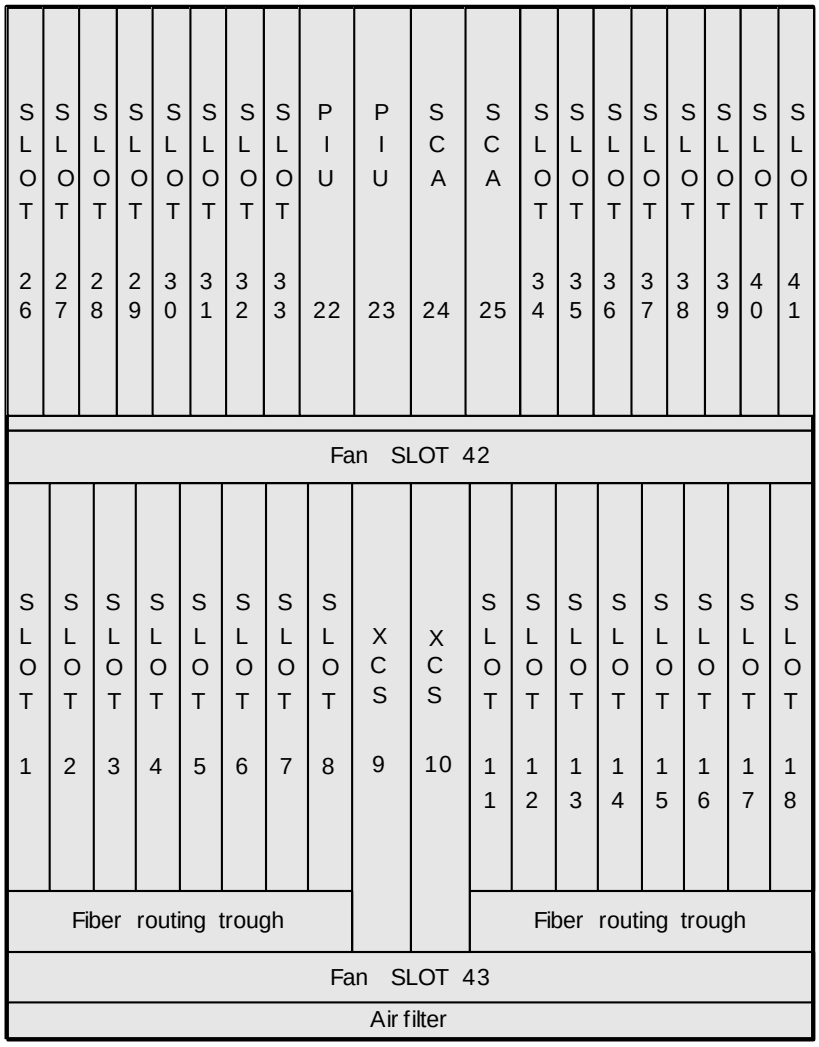
An interface board is also called an access board or a transit board. An interface board provides physical interfaces for optical signals and electrical signals, and transmits the optical signals or electrical signals to the corresponding processing board.

2.1.2.2 Slot Allocation

An OptiX OSN 7500 II subrack consists of an upper layer and a lower layer, wherein 40 slots are available. There are 20 slots at the upper layer and 18 slots at the lower layer. In addition, there are two slots for fan boards.

Figure 2-2 shows the slot layout of an OptiX OSN 7500 II subrack.

Figure 2-2 Slot layout of an OptiX OSN 7500 II subrack



The slots in an OptiX OSN 7500 II subrack are allocated as follows:

- Slots for service interface boards: slots 26-33 and 34-41
- Slots for service processing boards: slots 1-8 and 11-18
- Slots for cross-connect and timing boards: slots 9-10
- Slots for power interface boards: slots 22-23
- Slots for system control and communication boards: slots 24-35

Mapping Between Slots for Interface Boards and Slots for Processing Boards

Table 2-1 lists the mapping between slots for interface boards and slots for processing boards.

Table 2-1 Mapping between slots for interface boards and slots for processing boards

Slot for Processing Board	Slot for Interface Board
Slot 1	Slots 26-27
Slot 2	Slots 28-29
Slot 3	Slots 30-31
Slot 4	Slots 32-33
Slots 5-8	-
Slots 11-14	-
Slot 15	Slots 34-35
Slot 16	Slots 36-37
Slot 17	Slots 38-39
Slot 18	Slots 40-41

Paired Slots

If overhead bytes pass through the backplane bus between two slots, the two slots are called paired slots. Paired slots achieve automatic transparent transmission of overhead bytes such as K bytes, D bytes, and E1 overhead bytes. This improves multiplex section protection (MSP) switching performance and DCC communication with other NEs even after the system control board on the local NE cannot be detected. Table 2-2 lists paired slots.

Table 2-2 Paired slots

Slot	Paired Slot
Slot 1	Slot 2
Slot 3	Slot 4
Slot 5	Slot 6
Slot 7	Slot 8
Slot 11	Slot 12
Slot 13	Slot 14
Slot 15	Slot 16
Slot 17	Slot 18

2.2 Boards

The equipment supports various types of boards.

NOTE
For details on the board version replacement relationship between boards, see Board Version Replacement in the *Hardware Description*.

Cross-Connect Boards and System Control Boards

Table 2-3 List of cross-connect boards and system control boards

Board	Version	Description
SCA	TNN1	System control and auxiliary processing board
PSXCS	TNN1	Super Cross-connect and Synchronous Timing Board

NOTE
Only the TNN1PSXCS board support MPLS-TP OAM and centralized MPLS OAM.

Packet Processing Boards

Table 2-4 List of packet processing boards

Board	Version	Description
EX2	TNN1	2x10GE Ethernet processing board
EG8	TNN1	8xGE Ethernet processing board

Packet Interface Boards

Table 2-5 List of packet interface boards

Board	Version	Description
CO1	TNN1	8-port channelized STM-1 CES optical interface board
D75E	TNN1	32xE1 interface board (75 ohms)
D12E	TNN1	32xE1 interface board (120 ohms)
ETMC	TNN1	8xFE and 4xFE/GE

Board	Version	Description
		electrical interface board
AFO1	TNN1	8-port ATM STM-1 service interface board
EFF8	TNN1	8xFE optical interface board

SDH Boards

Table 2-6 List of SDH boards

Board	Version	Description
SLD64	N4	2xSTM-64 optical interface board
SL64	N4	1xSTM-64 optical interface board
SLO16	N4	8xSTM-16 optical interface board
SLQ16	N4	4xSTM-16 optical interface board
SL16	N3	1xSTM-16 optical interface board
SL16A	N3	1xSTM-16 optical interface board
SLH41	N3	16xSTM-4/STM-1 optical interface board
SLQ41	N3	4xSTM-4/STM-1 optical interface board
SLH1	N1	16xSTM-1 signal processing board
SLT1	N1	12xSTM-1 optical interface board
EU08	N1	8xSTM-1 electrical interface board
OU08	N1	8xSTM-1 optical/electrical interface board (LC)

PDH Boards

Table 2-7 List of PDH boards

Board	Version	Description
SPQ4	N2	4xE4/STM-1 electrical processing board
MU04	N1	4xE4/STM-1 electrical interface board
PQ3	N2	12xE3/T3 service processing board
D34S	N1	6xE3/T3 electrical switching interface board
PQ1	N2	63xE1 service processing board
PQM	N1	63xE1/T1 service processing board
D12B	N1	32xE1/T1 electrical switching interface board
D12S	N1	32xE1/T1 electrical switching interface board (120 ohms)
D75S	N1	32xE1 electrical switching interface board (75 ohms)
TSB8	N1	8-port electrical switching interface board

EoS Boards

Table 2-8 List of EoS boards

Board	Version	Description
EGS4	N4	4xGE Ethernet processing board
EFS0A	N1	16xFE Ethernet processing board
EFF8	N1	8x100M Ethernet optical interface board
ETF8	N1	8x100M Ethernet twisted-pair interface board
ETS8	N1	8x10/100M Ethernet twisted

Board	Version	Description
		pair interface switching board

WDM Boards

Table 2-9 List of WDM boards

Board	Version	Description
MR2	TN11	2-channel optical add/drop multiplexing board
MR4	TN11	4-channel optical add/drop multiplexing board
CMD2	N1	2-channel bidirectional optical multiplexer and demultiplexer board

Auxiliary Boards

Table 2-10 List of auxiliary boards

Board	Version	Description
FAN	TN81	Fan board

Optical Amplifier Boards and Dispersion Compensation Boards

Table 2-11 List of optical amplifier boards and dispersion compensation boards

Board	Version	Description
BPA	N2	One-channel power amplifier and one-channel pre-amplifier board
DCU	N2	Dispersion compensation board
OBU1	TN12	Optical booster amplifier board

Power Boards

Table 2-12 List of power boards

Board	Version	Description
PIU	TN81	Power interface board

3 Packet Functions and Features

3.1 Capacity

This section describes the switching capacity and slot access capacity of the OptiX OSN equipment in packet mode.

3.1.1 Packet Switching Capacity

The OptiX OSN equipment uses packet cross-connect boards to support packet switching.

Table 3-1 provides the maximum switching capacity of the OptiX OSN 7500 II.

Table 3-1 Maximum switching capacity of the OptiX OSN 7500 II

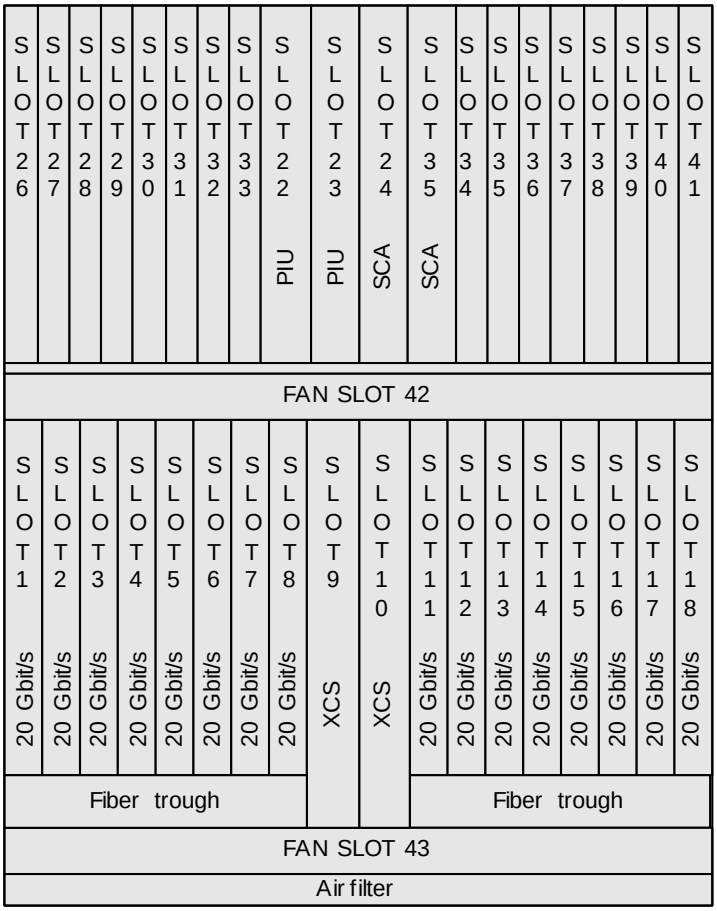
Board	Maximum Switching Capacity	Access Capacity of a Single Subrack
TNN1PSXCS	320 Gbit/s	320 Gbit/s

3.1.2 Slot Access Capacity in Packet Mode

When different cross-connect boards are used, the access capacity of each slot on the equipment varies.

Figure 3-1 shows the slot access capacity of the OptiX OSN 7500 II when the TNN1PSXCS board is used.

Figure 3-1 Slot access capacity of the OptiX OSN 7500 II when the TNN1PSXCS board is used



3.2 Services

This section describes the service types, interfaces, and maximum receiving capacity of each service type supported by the OptiX OSN equipment in packet mode.

3.2.1 Service Types

The OptiX OSN equipment can process the following Ethernet services, E1 ATM/IMA services and CES services in packet mode.

Types of Ethernet services:

- E-Line service
- E-LAN service

Types of CES services:

- E1 CES service
- STM-1 CES service

Types of ATM/IMA services:

- E1 ATM/IMA service
- STM-1 ATM/IMA service

3.2.2 Service Interfaces

This section provides the EthernetCES and ATM/IMA service interfaces supported by the OptiX OSN equipment in packet mode.

Table 3-2 lists the Ethernet service interfaces on the OptiX OSN equipment.

Table 3-2 Ethernet service interfaces on the OptiX OSN equipment

Type of Interface	Description
FE electrical interface	100BASE-TX
FE optical interface	100BASE-FX/LX/VX/ZX
GE electrical interface	1000BASE-TX
GE optical interface	• 1000BASE-SX/LX/ZX/VX • Colored optical interface types: CWDM (40 km), CWDM (80 km), and DWDM (120 km)
10GE optical interface	• 10GBase-LR/ER/ZR • Colored optical interface types: CWDM (70 km), DWDM (40 km), and DWDM (80 km)

Table 3-3 lists the CES and ATM/IMA service interfaces on the OptiX OSN equipment.

Table 3-3 CES and ATM/IMA service interfaces on the OptiX OSN equipment

Type of Interface	Description
CES (E1) interface	E1 electrical interface: DB44 connector
IMA (E1) interface	E1 electrical interface: DB44 connector
CES (STM-1) interface	STM-1 optical interfaces: S-1.1, L-1.1, and L-1.2
ATM (STM-1) interface	STM-1 optical interfaces: S-1.1, L-1.1, and L-1.2

3.2.3 Service Receiving Capacity

The capacities of services that the OptiX OSN equipment can receive vary according to the type and quantity of the configured boards.

Table 3-4 lists the maximum capacities of different services that the OptiX OSN equipment can receive. The maximum capacity refers to the maximum number of services when a single subrack receives only this specific type of service.

Table 3-4 Service receiving capacity of the OptiX OSN 7500 II (in packet mode)

Service Type	Maximum Number of Services Supported By a Single Subrack
Fast Ethernet (FE optical interface) services	128
Fast Ethernet (FE electrical interface) services	192
Gigabit Ethernet (GE optical interface) services	128
Gigabit Ethernet (GE electrical interface) services	128
10 Gigabit Ethernet (10GE optical interface) services	32
CES (E1) services	512
IMA (E1) services	512
CES (channelized STM-1) services	128
ATM (channelized STM-1) services	128

3.3 Clock Synchronization

The OptiX OSN equipment supports multiple synchronization technologies: traditional clock synchronization, 1588v2 time and clock synchronization, synchronous Ethernet and circuit emulation service (CES) adaptive clock recovery (ACR).

3.4 Equipment Level Protection

In packet mode, the equipment supports various equipment level protection schemes.

Table 3-5 lists the equipment level protection schemes supported by the OptiX OSN equipment.

Table 3-5 Equipment level protection schemes supported by the OptiX OSN 7500 II

Service Type	Protection Scheme	Description
Ethernet (in packet mode)	LAG	With no need for hardware upgrades, link aggregation binds several Ethernet ports as a logical port for higher link bandwidth and link reliability.

Service Type	Protection Scheme	Description
	MC-LAG	Multi-chassis link aggregation group (MC-LAG) is a supplement to the single-chassis link aggregation group (SC-LAG) and allows aggregation of inter-chassis links. On a 3G bearer network, MC-LAG can work with PW APS to implement dual-homing of E-Line or E-LAN services when a dual-homed node becomes faulty or an AC-side link or NNI-side service fails.
Others	1+1 hot backup for the cross-connect and timing board	For the OptiX OSN equipment, the cross-connect and timing units are integrated in the cross-connect and timing board. The cross-connect and timing board adopts a 1+1 hot backup mechanism so that the cross-connect and timing units are protected.
	1+1 hot backup for the SCC unit	The active and standby SCA boards form a 1+1 hot backup mechanism. When the active GSCC is working, the standby GSCC is in the protection state.
	1+1 hot backup for the power interface unit	The OptiX OSN equipment can access two -48/-60 V DC power supplies by using two TN81PIU boards. These two power supplies provide a mutual backup for each other. When either of them fails, the other power supply provides a backup to ensure normal operation of the equipment.
	1:N protection for the +3.3 V power of the board	The OptiX OSN equipment provides reliable power backup for the +3.3 V power supply of other boards by using the power backup unit on the TN81PIU board. When the power supply of a board fails, the backup power supply immediately provides backup to ensure the normal operation of the board.
	Intelligent fan	The OptiX OSN equipment uses three intelligent fan modules to realize heat dissipation. The power supplies of the three fan modules are of mutual backup. The intelligent fans provide the functions of intelligent speed regulation and failure detection. When one fan module becomes faulty, the other fan modules operate at the full speed. The running status of the fans is indicated by the corresponding indicators on the front panel of the fan module.
	Board protection modes under abnormal conditions	The board protection modes under abnormal conditions include resumable upload (protection against power down during software uploading), undervoltage protection and overvoltage protection, and over-temperature alarms.

3.5 Network Level Protection

The OptiX OSN equipment supports various network level protection schemes.

Table 3-6 lists the network level protection schemes supported by the OptiX OSN equipment.

Table 3-6 Network level protection schemes supported by the OptiX OSN 7500 II

Network Level	Protection Scheme	Description
Ethernet	Tunnel APS	Including the MPLS tunnel APS and MPLS-TP tunnel APS. In the case of tunnel APS, an tunnel is set to protect the working tunnel. In this case, when the working tunnel fails, services are switched to the protection tunnel for transmission and thus to realize the service protection.
	PW APS	Including the MPLS PW APS and MPLS-TP PW APS. The PW APS uses the protection PW to protect the working PW. When the working PW is faulty, the services are switched to the protection PW and remain unaffected.
	LPT Protection	With LPT enabled, service protection can be provided regardless of whether faults occur on a service access node, a service network, or both on a service access node and on a service network.
	MSTP	Like Spanning Tree Protocol (STP) and Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP) is used to prevent loops on a network and a resultant broadcast storm.
CES	Packet-based linear MSP	The packet-based linear MSP scheme is applicable to a point-to-point physical network, providing MS-layer protection for the service between two points.

4 Functions and Features in TDM Mode

4.1 Capacity

The capacity covers the cross-connect capacity and slot access capacity.

4.1.1 TDM Cross-Connect Capacity

Different cross-connect boards have different cross-connect capacities.

Table 4-1 lists the cross-connect boards and the corresponding cross-connect capacities supported by the OptiX OSN equipment.

Table 4-1 Cross-connect capacity of the OptiX OSN 7500 II

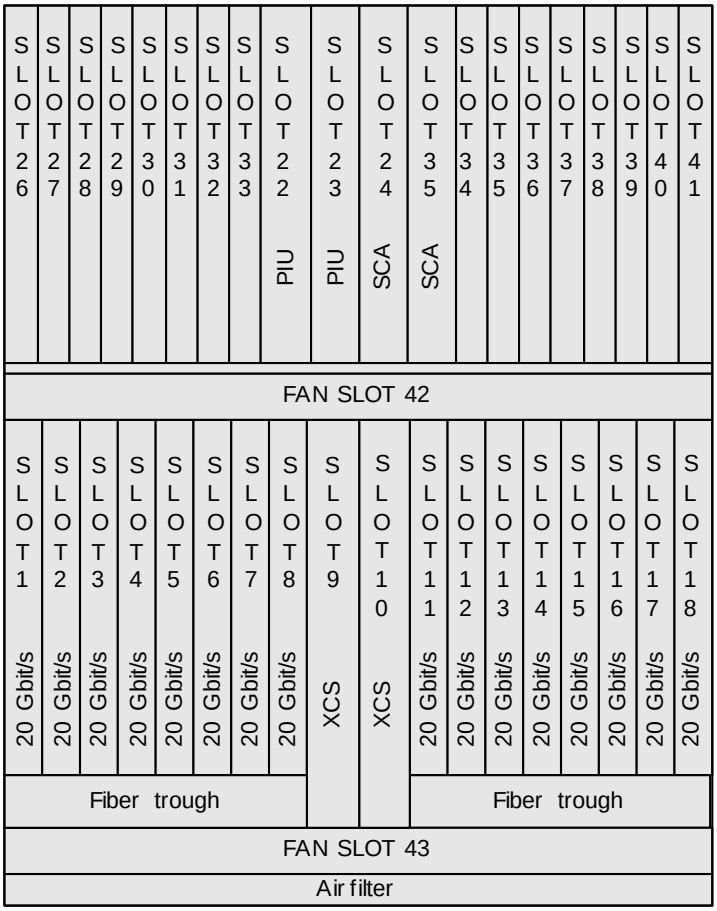
Board	Higher Order Cross-Connect Capacity	Lower Order Cross-Connect Capacity	Access Capacity of a Single Subrack
TNN1PSXCS	360 Gbit/s (2304×2304 VC-4s)	40 Gbit/s (256x256 VC-4s, which are equivalent to 16128x16128 VC-12s or 768x768 VC-3s)	320 Gbit/s (2048×2048 VC-4s)

4.1.2 Slot Access Capacity

When different cross-connect boards are used, the access capacity of each slot on the equipment varies.

Figure 4-1 shows the slot access capacity of the OptiX OSN 7500 II when the TNN1PSXCS board is used.

Figure 4-1 Slot access capacity of the OptiX OSN 7500 II when the TNN1PSXCS board is used



4.2 Service

The supported services are SDH services, PDH services and many other services.

4.2.1 Service Types

The OptiX OSN equipment can process the following types of services: SDH, PDH, Ethernet, and Video services.

For details about supported service types, see Table 4-2.

Table 4-2 Service types that the OptiX OSN 7500 II supports

Service Type	Description
SDH services	• Standard SDH services: STM-1/STM-4/STM-16/STM-64 • Standard SDH concatenated services: VC-4-4c/VC-4-8c/VC-4-16c/VC-4-64c/AU-3 • Standard SDH virtual concatenation services: VC-4-Xv (X≤8), VC-3-Xv (X≤24), VC-12-Xv (X≤63)

Service Type	Description
PDH services	• E1 (electrical)/T1 service • E3/T3 service • E4 service **NOTE** With the E13/M13 function, the equipment can perform multiplexing and demultiplexing between E1/T1 signals and E3/T3 signals.
Ethernet services	• Ethernet private line (EPL) service • Ethernet virtual private line (EVPL) service • Ethernet private LAN (EPLAN) service • Ethernet virtual private LAN (EVPLAN) service
Video services	• Digital video broadcast-asynchronous serial interface (DVB-ASI) service • High definition-serial digital interface (HD-SDI) electrical service • Standard definition-serial digital interface (SD-SDI) electrical service

4.2.2 Service Interfaces

Service interfaces include SDH service interfaces, PDH service interfaces and many other service interfaces.

Interface Types

Table 4-3 lists the service interfaces of the OptiX OSN equipment.

Table 4-3 Service interfaces of the OptiX OSN 7500 II

Interface	Description
SDH service interface	• STM-1 electrical interfaces: SMB connectors • 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 • STM-16 optical interfaces: I-16, S-16.1, L-16.1, L-16.2, L-16.2Je, V-16.2Je, U-16.2Je • STM-64 optical interfaces: I-64.1, I-64.2, S-64.2b, L-64.2b, Le-64.2, Ls-64.2, V-64.2b, P1L1-2D2 • CWDM colored optical interfaces: 40 km, 70 km, 80 km • DWDM colored optical interfaces: 40

Interface	Description
	km, 80 km, 120 km, 170 km, and 640 km • STM-16 and STM-64 optical interfaces that comply with ITU-T G.692 can output fixed wavelengths from 191.1 THz to 196.0 THz, and can be directly interconnected with the WDM equipment.
PDH service interface	• E1 electrical interfaces: DB44 connectors • T1 electrical interfaces: DB44 connectors • E3, T3 and E4 electrical interfaces: SMB connectors
Ethernet service interface	• 10BASE-T/100BASE-TX/1000BASE-T • 100BASE-FX/LX/ZX/VX • 1000BASE-SX/LX/ZX/VX
Video service interface	SMB electrical interfaces: DVB-ASI, HD-SDI, SD-SDI

NOTE
Le-64.2, Ls-64.2, L-16.2Je, V-16.2Je, U-16.2Je, Ve-1.2, and Ve-4.2 are optical technical specifications defined by Huawei.

Optical Module Types

The OptiX OSN equipment supports SFP, eSFP, and single-fiber bidirectional optical modules.

When the board is equipped with a single-fiber bidirectional optical module, the fiber connected to the optical module can transmit and receive optical signals. Therefore, a lot of optical fiber resources are saved.

NOTE
In the case of different single-fiber bidirectional optical modules, the transmit or receive wavelengths are different. Therefore, the single-fiber directional optical modules at the two ends must be of the same type.

For details about optical modules, see SFP/eSFP in *Hardware Description*.

4.2.3 Service Receiving Capacity

The capacities of services that the OptiX OSN 7500 II can receive vary according to the type and quantity of the configured boards.

Table 4-4 lists the maximum capacities of different services that the OptiX OSN 7500 II can receive.

Table 4-4 Service receiving capacity of the OptiX OSN 7500 II in TDM mode

Service Type	Maximum Number of Services Supported By a Single Subrack
STM-64 standard or concatenated services	32 channels
STM-16 standard or concatenated services	128 channels
STM-4 standard or concatenated services	256 channels
STM-1 standard services	256 channels
STM-1 (electrical) services	128 channels
E4 services	32 channels
E3/T3 services	96 channels
E1 services	504 channels
T1 services	504 channels
FE services	128 channels
GE services	64 channels

4.3 Equipment Level Protection

The OptiX OSN equipment provides several equipment level protection schemes.

Table 4-5 shows the equipment level protection supported by the OptiX OSN equipment.

Table 4-5 Equipment level protection

Object Protected	Protection Scheme	Description
Ethernet (in TDM mode)	PPS	BPS, a board-level 1+1 protection scheme, is used to protect services on an entire Ethernet board. When the working board fails, BPS enables services to be switched from the working board to the protection board in a customer-accepted period.
	PPS	PPS, a port-level 1+1 protection scheme, is used to protect services on specific ports. When the working port fails, PPS enables services to be switched from the working port to the protection port in a customer-accepted period.
	LAG	In an LAG, multiple links attached to the same equipment are aggregated to work as a logical link. This helps increase bandwidth and link availability.
	DLAG	A DLAG is a protection group that aggregates two corresponding ports on two boards of the same type. It

Object Protected	Protection Scheme	Description
		provides 1+1 protection for the inter-board ports.
Others	TPS protection	Tributary protection switching (TPS) enhances service reliability in a TPS protection group. When TPS detects a faulty working service board, it rapidly switches services to the protection service board.
	1+1 hot backup for the cross-connect and timing board	For the OptiX OSN equipment, the cross-connect and timing units are integrated in the cross-connect and timing board. The cross-connect and timing board adopts a 1+1 hot backup mechanism so that the cross-connect and timing units are protected.
	1+1 hot backup for the SCC unit	The active and standby SCA boards form a 1+1 hot backup mechanism. When the active GSCC is working, the standby GSCC is in the protection state.
	1+1 hot backup for the power interface unit	The OptiX OSN equipment can access two -48/-60 V DC power supplies by using two TN81PIU boards. These two power supplies provide a mutual backup for each other. When either of them fails, the other power supply provides a backup to ensure normal operation of the equipment.
	1:N protection for the +3.3 V power of the board	The OptiX OSN equipment provides reliable power backup for the +3.3 V power supply of other boards by using the power backup unit on the TN81PIU board. When the power supply of a board fails, the backup power supply immediately provides backup to ensure the normal operation of the board.
	Intelligent fan	The OptiX OSN equipment uses three intelligent fan modules to realize heat dissipation. The power supplies of the three fan modules are of mutual backup. The intelligent fans provide the functions of intelligent speed regulation and failure detection. When one fan module becomes faulty, the other fan modules operate at the full speed. The running status of the fans is indicated by the corresponding indicators on the front panel of the fan module.
	Board protection modes under abnormal conditions	The board protection modes under abnormal conditions include resumable upload (protection against power down during software uploading), undervoltage protection and overvoltage protection, and over-temperature alarms.
NOTE The OptiX OSN equipment supports coexistence of three TPS protection groups of different types.		

4.4 Network Level Protection

The OptiX OSN equipment supports several network level protection schemes.

Table 4-6 lists the network level protection schemes supported by the OptiX OSN equipment.

Table 4-6 Network level protection schemes supported by the OptiX OSN 7500 II

Network Level Protection	Protection Scheme	Description
SDH protection	Linear MSP	The Linear Multiplex Section Protection (LMSP) scheme is applicable to a point-to-point physical network, providing MS-layer protection for the service between two points. The OptiX OSN equipment supports 1+1 and 1:N LMSP.
	MSP ring	The multiplex section protection ring (MSP ring) scheme provides MS-level protection for services between nodes on a ring network. The OptiX OSN equipment supports three types of MSP ring: two-fiber unidirectional MSP, two-fiber bidirectional MSP, and four-fiber bidirectional MSP.
	Subnetwork connection protection (SNCP) and subnetwork connection tunnel protection (SNCTP)	• The SNCP scheme protects the service that is across subnets. The SNCP is based on the dual fed and selective receiving mechanism. The subnet can be a chain, a ring, or a more complex network. • The SNCTP scheme provides protection paths at the VC-4 level. When the working path is faulty, all its services can be switched to the protection path.
	Dual-node interconnection (DNI) protection	The DNI network topology protection scheme effectively enhances the reliability of inter-ring services. The DNI realizes the protection of services between two rings, which are networked by the equipment from different vendors and adopt different protection schemes. The DNI provides protection in the case of fiber failure and node failure.
Ethernet protection	LPT	As a protection scheme based on links, LPT enables the pass-through of the states of the point-to-point link and point-to-multipoint link. In this manner, LPT realizes the network level protection for the transmission of point-to-point private line services and for the transmission of the point-to-multipoint convergence services.
	LCAS	The LCAS function can be used to dynamically adjust the bandwidth and protect virtual concatenation, whereby making the network more robust and flexible.
	STP/RSTP	The STP and RSTP are used in the loop network. The two protocols realize routing redundancy by adopting certain algorithms and break the loop network into a

Network Level Protection	Protection Scheme	Description
		loop-free tree network, thus preventing packets from increasing and cycling in an endless manner in the loop network. In this manner, the application of the two protocols can prevent the occurrence of the broadcast storm and MAC address table flapping. The RSTP is an optimized version of the STP and implements all the functions of the STP. With the application of the RSTP, the network convergence is quicker. In addition, in the case of a link failure, the blocked ports can be enabled to restore services quickly.

4.5 Built-in WDM Technology

The equipment supports a built-in WDM technology, which enables the transmission of several wavelengths in one fiber.

The OptiX OSN provides the built-in WDM technology. The functions of the equipment are as follows:

- Standard DWDM wavelengths that comply with ITU-T G.694.1 can be added or dropped.
- Standard CWDM wavelengths that comply with ITU-T G.694.2 can be added or dropped.
- A set of equipment can be configured into an Optical Terminal Multiplexer (OTM) or an Optical Add/Drop multiplexer (OADM), or both.
- Optical add/drop multiplexing boards have concatenation ports which can be used for expansion or for adding/dropping multiple wavelengths through concatenation.
- The equipment supports Raman amplifiers which can be used in long-distance signal transmission.
- The equipment supports the automatic gain control technology, which enables the gain of each working wavelength to change within an allowed range in all scenarios.
- The equipment supports the forward error correction (FEC) technology, which can correct the errors generated during signal transmission and therefore improve the tolerance of signal-to-noise ratio at the receive end and extend the length of relay sections.

5 Products and Application Scenarios

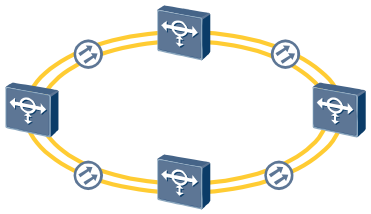
5.1 Overview of Network Topologies

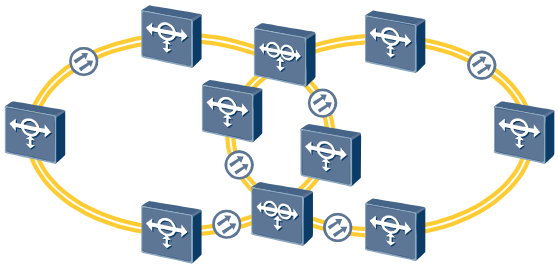
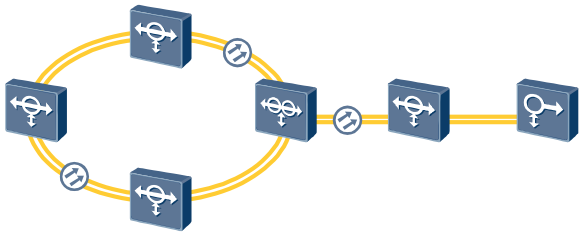
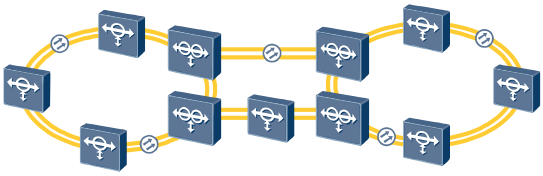
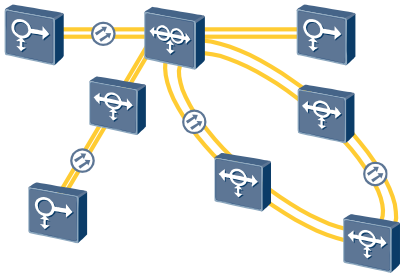
The OptiX OSN equipment supports a wide range of network topologies applicable to the packet mode, TDM mode, and hybrid mode. The OptiX OSN equipment supports end-to-end management by interconnecting with or traversing third-party equipment or a third-party network.

Basic Network Topologies

Table 5-1 lists the basic network topologies that the OptiX OSN equipment supports.

Table 5-1 Basic network topologies that the OptiX OSN equipment supports

Network Topology		Legend
1	Chain	
2	Ring	
3	Tangent rings	

Network Topology		Legend
4	Intersecting rings	
5	Ring with chain	
6	Dual node interconnection (DNI)	
7	Hub	
Legend:  MADM ADM TM		

NE Categories

The OptiX OSN equipment supports separate and combined configuration of the following types: terminal multiplexer (TM), add/drop multiplexer (ADM), and multiple add/drop multiplexer (MADM).

5.2 Typical Networking in Packet Mode

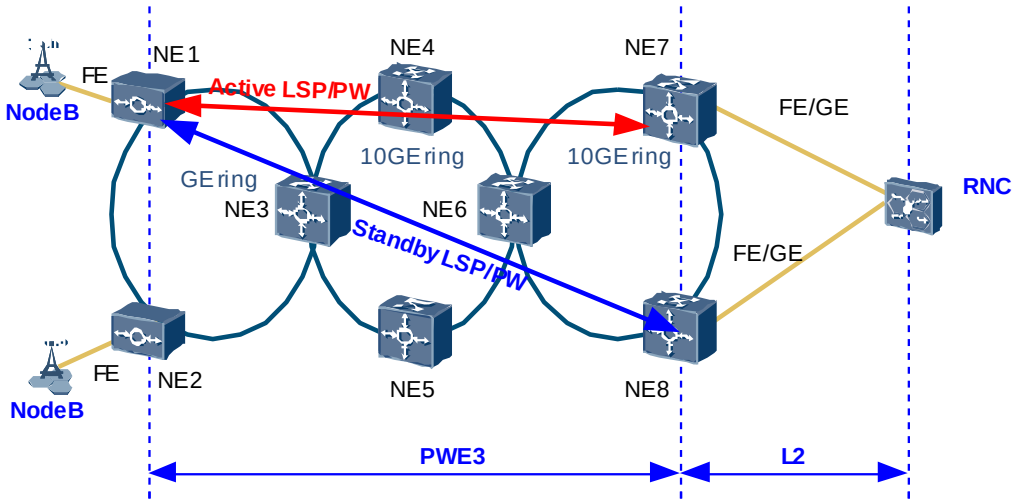
In packet mode, the equipment mainly supports two different typical networking scenarios, depending on whether routers are used.

5.2.1 Typical Networking Without Routers

OptiX OSN equipment can construct a network where TDM services and packet services are transmitted between base stations and the RNC without assistance from routers.

Figure 5-1 shows the typical networking diagram.

Figure 5-1 Typical networking diagram (without any routers)



As shown in Figure 5-1, NE1 and NE2 are generally OptiX OSN 1500 or OptiX OSN 500 or OptiX OSN 550 NEs; NE3, NE4, NE5, and NE6 are generally OptiX OSN 3500 or OptiX OSN 7500 or OptiX OSN 7500 II NEs; NE7 and NE8 are generally OptiX OSN 7500 or OptiX OSN 7500 II NEs.

FE services from NodeBs at the access layer are aggregated to the GE packet ring through NE1 and NE2, then to the 10GE packet rings through NE3 and NE6, and finally to the RNC.

5.2.2 Hybrid Networking with Routers

Hybrid MSTP equipment on a Layer 2 network can be connected to an RNC through routers, which provide powerful Layer 3 switching capabilities and enhance network scalability.

Service Bearing

This solution supports TDM services and Ethernet/IP services.

- TDM services are carried by single-homed SDH equipment.
- Ethernet and IP services are carried by an L2VPN on the Hybrid MSTP network, and are forwarded based on IP addresses or carried by an L3VPN on the CX network.

  The Hybrid MSTP network transmits E-Line or E-LAN services to its interconnected CX equipment. The CX equipment terminates Layer 2 VLANs and transmits services to Layer 3.

Network Topologies

The Hybrid MSTP equipment can be interconnected with routers to form a ring or chain network. There are various types of equipment applicable to each transmission layer.

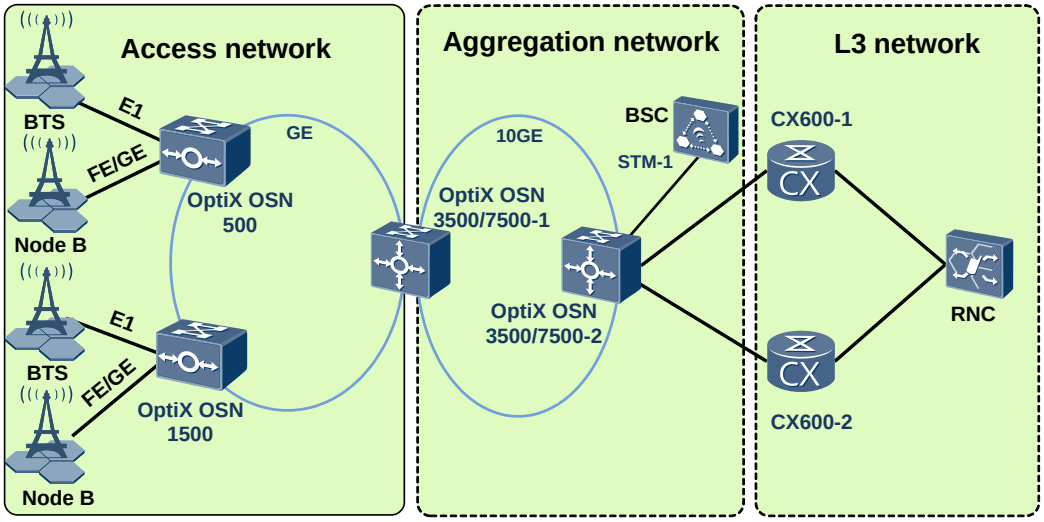
- Access layer: OptiX OSN 1500, OptiX OSN 500, or OptiX OSN 550
- Convergence layer: OptiX OSN 3500, OptiX OSN 7500, or OptiX OSN 7500 II
- Layer 3: OptiX OSN 7500, OptiX OSN 7500 II, or CX 600

Common network topologies are as follows:

- Triangle-shaped network

  Figure 5-2 shows a typical triangle-shaped network. MPLS tunnel/PW APS is configured between Hybrid MSTP access equipment and Hybrid MSTP convergence equipment. LAGs are configured on Hybrid MSTP convergence equipment and E-Trunks are configured on CX equipment to protect services on the links in between.

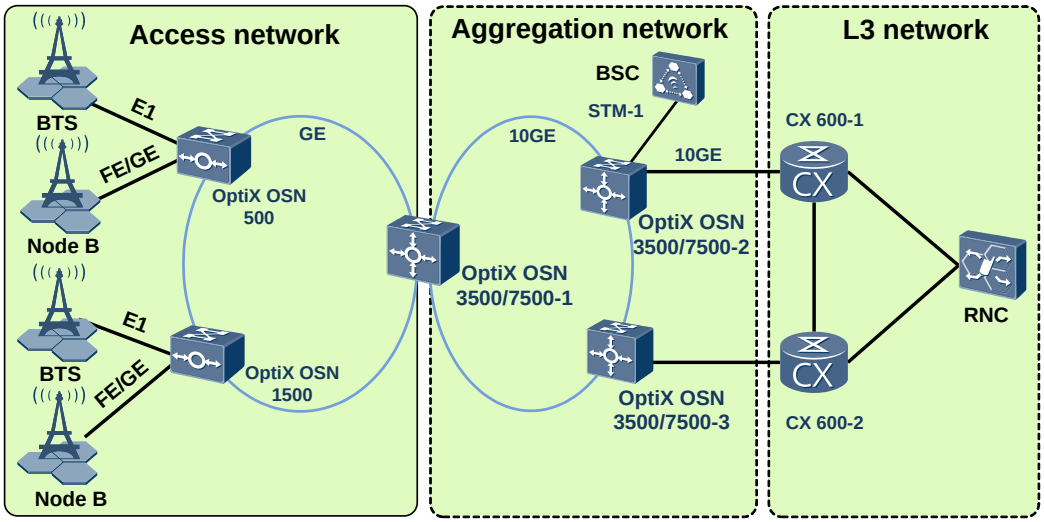
Figure 5-2 Triangle-shaped network



- Rectangle-shaped network

  Figure 5-3 shows a typical rectangle-shaped network. MPLS tunnel/PW APS groups that are co-sourced but not co-sinked are configured on the Hybrid MSTP equipment that is connected to base stations. Working and protection tunnels/PWs are separately terminated on two pieces of Hybrid MSTP equipment that is connected to CX equipment. E-LANs are configured on the Hybrid MSTP equipment connected to CX equipment and VRRP groups are configured on CX equipment to provide link-level and equipment-level protection. Convergence equipment is dual-homed to shed the risks that convergence and Layer 3 equipment faults bring about.

Figure 5-3 Rectangle-shaped network

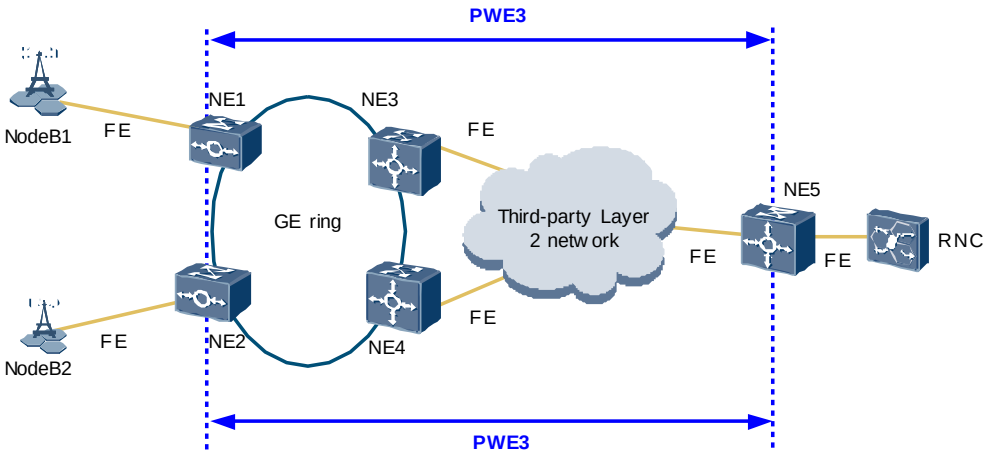


5.2.3 Traversing a Third-Party Layer 2 Network

The OptiX OSN equipment can add VLAN IDs specific to different MPLS tunnels. This enables services to traverse a third-party Layer 2 network in the packet domain.

Figure 5-4 shows the typical topology where services traverse a third-party Layer 2 network.

Figure 5-4 Typical topology where services traverse a third-party Layer 2 network



As shown in Figure 5-4, NE1 and NE2 are OptiX OSN 1500 or OptiX OSN 500/550 NEs; NE3, NE4, and NE5 are generally OptiX OSN 3500, OptiX OSN 7500, or OptiX OSN 7500 II NEs. On the access side, NE3 and NE4 form a GE ring with NE1 and NE2; on the network side, NE3 and NE4 are interconnected with a third-party network.

On the access side, FE services from the NodeBs enter the GE ring through NE1 and NE2. NE3 and NE4 add VLAN IDs specific to different MPLS tunnels. Then, the services traverse the third-party Layer 2 network and arrive at NE5. Finally, NE5 switches MPLS tunnel labels, and transmits the services to the RNC.

In the opposite direction, the RNC transmits services to NE5. NE5 adds VLAN IDs specific to different MPLS tunnels. Then, the services traverse the third-party Layer 2 network and arrive at NE3 and NE4. Finally, NE3 and NE4 switch MPLS tunnel labels, and transmit the services to the NodeBs.

The OptiX OSN equipment supports end-to-end configuration and management for its services that traverse a third-party Layer 2 network.

5.3 Networking with the Packet Domain Overlapping the TDM Domain

The packet features of the OptiX OSN equipment enable the equipment to overlap the Ethernet service network based in packet domain on the TDM network.

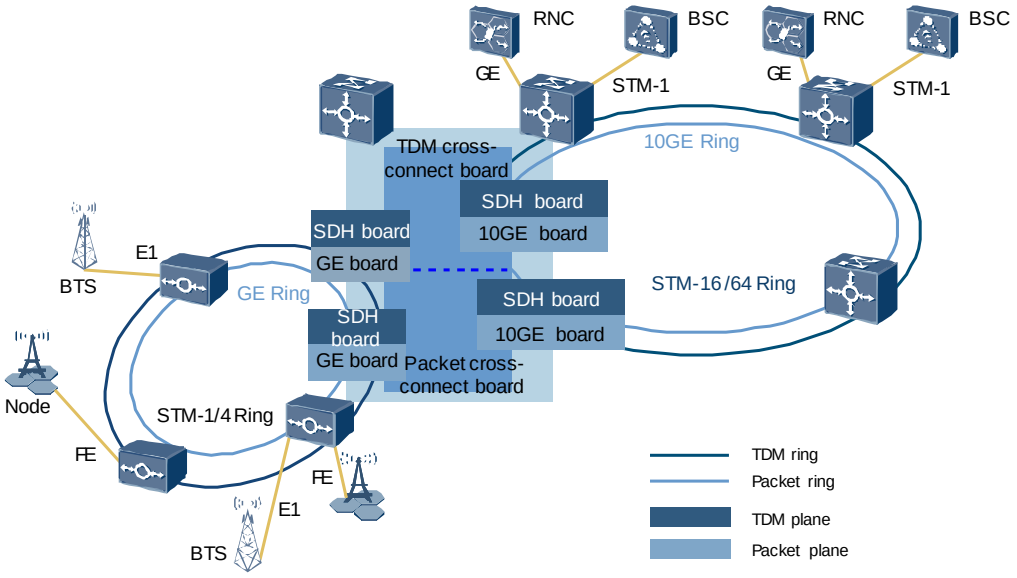
Access Layer Overlaid with the GE Ring, Convergence/Core Layer Overlaid with the 10GE Ring

The OptiX OSN equipment can be used to transmit Ethernet services in packet domain overlaying on the TDM network.

Figure 5-5 shows that the packet service and SDH service exist on the same network. The packet service is transmitted on the packet ring, and the SDH service is transmitted on the TDM ring. There is no interference between the two types of services.

After the IP-based telecommunication is realized, the OptiX OSN equipment can be smoothly upgraded to the pure packet domain. Hence, the increasing requirements for packet services can be satisfied.

Figure 5-5 The access layer overlaid with the GE ring and the convergence/core layer overlaid with the 10GE ring



- In the preceding typical networking diagram, the OptiX OSN 1500 or the OptiX OSN 500/550 is generally used at the access layer, and the OptiX OSN 3500/7500 is generally used at the convergence/core layer.
- At the access layer, SDH services are transmitted on the STM-1/STM-4 ring and packet services are transmitted on the GE ring. At the backbone/convergence layer, SDH services are transmitted on the STM-16/STM-64 ring and packet services are transmitted on the 10GE ring.
- SDH services are transmitted in TDM domain and packet services are transmitted in packet domain.
- In the overlay networking of the TDM domain and packet domain, the OptiX OSN equipment in TDM domain uses the end-to-end TDM service protection, and the OptiX OSN equipment in packet domain uses the end-to-end LSP/PW protection that realizes protection switching under 50 ms.

5.4 Hybrid Networking with Other Huawei Equipment

Universal switch OptiX OSN 7500 II can flexibly construct a network with other Huawei equipment.

OptiX OSN equipment supports the following hybrid networking scenarios:

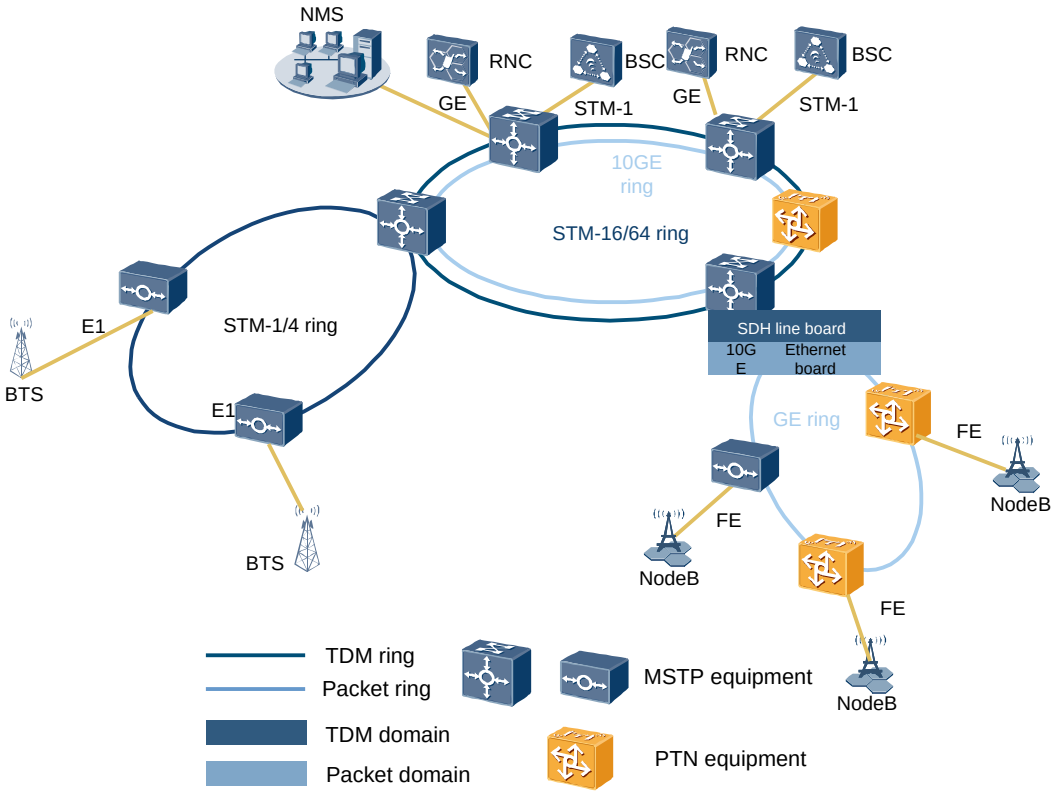
- Hybrid networking with OptiX PTN equipment
- Hybrid networking with OptiX RTN equipment

5.4.1 Hybrid Networking with the PTN Equipment

The OptiX OSN 7500 II supports hybrid networking with the PTN equipment, therefore implementing end-to-end management.

As shown in Figure 5-6, the hybrid networking allows more flexible reform of the existing network and optimal utilization of the network resources.

Figure 5-6 Hybrid networking with Huawei MSTP and PTN equipment



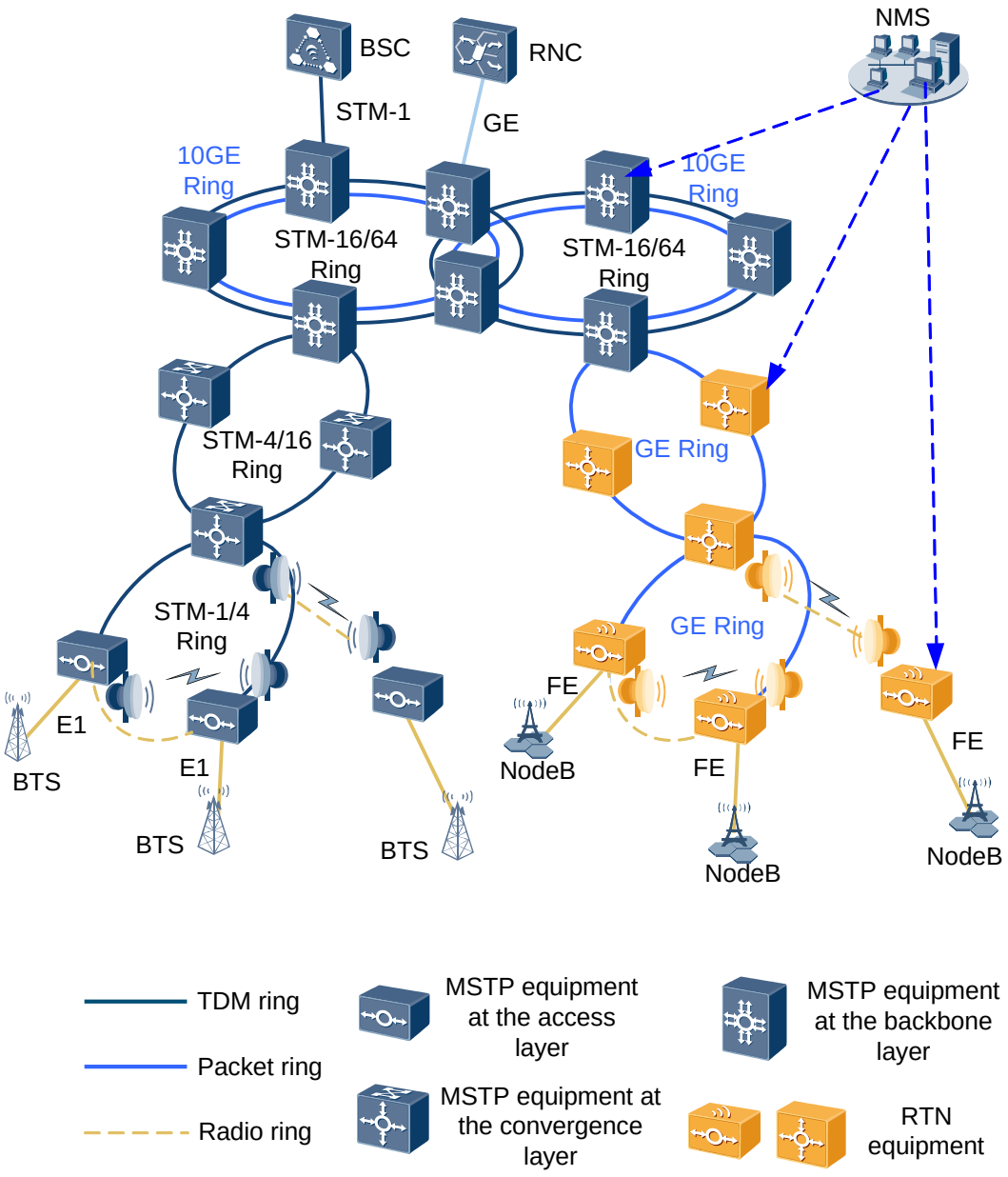
- In the preceding typical networking, the OptiX OSN 1500 or OptiX OSN 500/550 or the OptiX PTN 910/950/1900 is used at the access layer.
- At the backbone/convergence layer, the OptiX OSN 3500/7500 or the OptiX PTN 3900 is used.
- See Figure 5-6. In packet domain, the equipment at the access layer, such as the OptiX OSN 1500 or the OptiX PTN equipment, accesses the FE services from the 3G base stations, and transmits the FE services to the GE packet ring, then to the 10GE convergence/backbone ring, and finally to the RNC. In this manner, the FE services from the base stations are transmitted to the RNC in an end-to-end manner.
- See Figure 5-6. In TDM domain, the equipment at the access layer, such as the OptiX OSN 1500 or the OptiX OSN 500/550, accesses the E1 services from the BTS to the STM-1/STM-4 ring consisting of the MSTP equipment and then transmits the service to the STM-16/STM-64 ring consisting of the OptiX OSN equipment (convergence/backbone layer) and finally to the BSC. In this manner, the E1 services from the BTS are transmitted to the BSC in an end-to-end manner.
- In the hybrid networking of the OptiX OSN 7500 II, the MSTP equipment, and the PTN equipment, a unified NMS is used.

5.4.2 Hybrid Networking with the RTN Equipment

The OptiX OSN 7500 II supports hybrid networking with the RTN equipment, therefore implementing end-to-end management.

As shown in Figure 5-7, hybrid networking allows more flexible reform of the existing network and optimal utilization of the network resources.

Figure 5-7 Hybrid networking with Huawei MSTP and RTN equipment



- In the preceding typical networking, the OptiX OSN 1500 or OptiX RTN equipment is used at the access layer.
- The OptiX OSN 3500/7500 is often used at the convergence/backbone layer.

- See Figure 5-7. In packet domain, the equipment at the access layer, such as the OptiX OSN 1500 or the OptiX RTN equipment, accesses the FE services from the NodeB, and transmits the FE services to the GE packet ring, then to the 10GE convergence/backbone ring, and finally to the RNC. In this manner, the FE services from the base stations are transmitted to the RNC in an end-to-end manner.
- See Figure 5-7. In TDM domain, the equipment at the access layer, such as the OptiX OSN 1500 accesses the E1 services from the BTS to the STM-1/STM-4 ring consisting of the MSTP equipment and then transmits the service to the STM-16/STM-64 ring consisting of the OptiX OSN equipment (convergence/backbone layer) and finally to the BSC. In this manner, the E1 services from the BTS are transmitted to the BSC in an end-to-end manner.
- In the hybrid networking of the OptiX OSN 7500 II, the MSTP equipment, and the RTN equipment, a unified NMS is used.

6 OAM

6.1 Administration and Auxiliary Interfaces

The equipment provides several types of administration and auxiliary interfaces.

Table 6-1 lists the types of administration and auxiliary interfaces.

Table 6-1 Administration and auxiliary interfaces

Type of Interface	Description
Administration interface	One Ethernet interface (10M/100M) for network management (ETH) One NMS concatenation network interface (EXT) One serial interface for administration (F&f)
External clock interface	Two 75-ohm external clock interfaces (2048 kbit/s or 2048 kHz) Two 120-ohm external clock interfaces (2048 kbit/s or 2048 kHz)
External time interface	DCLS time input interface DCLS time output interface 1PPS+TOD time information input interface 1PPS+TOD time information output interface
Alarm interface	Four output interfaces for cabinet alarm indicators Four input interfaces for cabinet alarm indicator concatenation Eight input interfaces for alarm concatenation Shared ports for four alarm outputs and two alarm concatenation interfaces
NOTE The external clock interface and external time interface are used together. The two interfaces cannot be enabled at the same time.	

6.2 DCN Management Scheme

The OptiX OSN equipment supports two DCN modes: outband data communication network (DCN) and inband DCN.

6.3 Network Management

The OptiX OSN equipment is uniformly managed by the transmission network management system (NMS) and local craft terminal (LCT) through the ETH port. The OptiX OSN equipment supports the simple network management protocol (SNMP), which allows a third-party system to monitor the network. The time synchronization function on the NMS keeps NE time and NMS time consistent.

The NMS maintains the transmission network elements (NEs) on the entire network. The NMS can implement end-to-end configurations for TDM and packet services.

The OptiX OSN equipment complies with ITU-T recommendations. The equipment adopts the management information model and the object-oriented management technology. With the NMS, the equipment can exchange information with the NE software through the communication module to manage the alarms and performance events in a centralized manner. In addition, the end-to-end configuration on the management plane can be realized.

The OptiX OSN equipment supports the simple network management protocol (SNMPv2/SNMPv3), which solves the uniform NMS problem for the networking of equipment from different vendors.

NOTE

For contents that the third-party system monitored based on SNMP, consult field Huawei engineers.

The time synchronization function on the NMS allows NE time to be synchronized with NMS time. This ensures that the NMS can accurately record the time when an alarm or an abnormal event occurs. The time synchronization function is available in the following modes:

- If you use the scheme of synchronizing with the U2000 server, all NEs use the U2000 server time as the standard time. The NE time can be synchronized with the U2000 server time manually or automatically. The U2000 server time refers to the system time of the workstation or computer where the U2000 server is located. This scheme features easy operation, and is applicable in networks that require a low accuracy with regard to time.
- If you use the scheme of synchronizing with the NTP server or synchronizing with the standard NTP server, the NE time and the U2000 time are synchronized with the NTP server time or the standard NTP server time automatically. The NTP server can be the U2000 server or a special time server. This scheme enables the U2000 and NEs to have a time accuracy of one nanosecond in theory, and applies to a network with high requirement for time accuracy.

6.4 Alarm and Performance Management

The OptiX OSN equipment supports alarm and performance management, and this can help users locate and rectify faults quickly.

Alarm Management

- The system control board generates audible and visual alarms to instruct users to take proper measures in the case of an emergency.
- The SCA board provides one 4-output port for cabinet alarm indicators, one port for cascading four cabinet alarm indicators, two ports for 8-input alarms, and one port for output and cascading of two alarms to facilitate operation and maintenance of the equipment.
- Each board provides running status indicators and alarm indicators to help users locate and rectify faults quickly.
- The equipment supports alarm storm suppression. When more than 1860 alarms are reported, the NE returns a message indicating that too many alarms are reported.
- The equipment supports the alarm cutoff function. You can mute an alarm by pressing the specific button on the cross-connect board or by using the NMS.
- The equipment supports automatic connectivity monitoring for optical fibers between NEs. Once any fault is defected, alarms are reported automatically.
- The equipment supports the query of the working temperature of certain boards.
- When multiplex section protection (MSP) switching or tributary protection switching (TPS) switching occurs, the equipment can retain the state of an alarm or a performance event in the working path. This enables users to focus only on the service state.
- The equipment can detect alarms generated on power supply facilities and therefore protect these facilities.
- The equipment provides fan alarms and management. In addition, the equipment supports intelligent speed adjustment for fans.
- The equipment can detect the memory threshold crossing state and report an alarm. If more than 90% of the memory space is used, the equipment reports an alarm to indicate that the memory space is insufficient and to instruct you to replace the system control board.

Performance Management

- The OptiX OSN equipment can monitor and report various performance events to help users monitor and manage the equipment.
- The OptiX OSN equipment can monitor and report various SDH performance events and Ethernet performance events. SDH performance events include bit errors, jitters, and pointer justifications caused by jitters. Ethernet performance events include counts of transmitted and received packets and records of Ethernet service transmission quality.
- The equipment supports the setting of performance thresholds. By using this function, users can focus on performance events indicating severe service degradation and ignore performance events indicating normal changes.
- For 15-minute performance monitoring, the equipment can store a maximum of 16x15-minute historical performance data, namely, performance data over 4 hours and 15 minutes. For 24-hour performance monitoring, the equipment can store a maximum of 6x24-hour historical performance data, namely, performance data over 6 days and 24 hours.

7 Technical Specifications

7.1 Overall Specifications of the Equipment

The overall specifications of the equipment include the packet switching capability, TDM cross-connect capability, specifications of the cabinet, specifications of the subrack, power supply parameters, laser safety class, electromagnetic compatibility (EMC), and environmental specifications.

7.1.1 Cabinet Specification

The technical specifications of the cabinet include the dimensions, weight, number of permitted subracks, and PDU.

Table 7-1 lists the technical specifications of the ETSI cabinet.

Table 7-1 Technical specifications of the ETSI cabinet

Dimensions (mm)	Weight (kg)	Number of Permitted Subracks
600 (W) x 300 (D) x 2200 (H) (N63E)	45	2

The DC power distribution unit (PDU) is located on the top of a cabinet and is used to provide power to the equipment. Table 7-2 lists the technical specifications of the PDU.

Table 7-2 Technical specifications of the PDU

Board	Dimensions (mm)	Single-Cabinet Input Voltage (V)	Single-Cabinet Output Voltage (V)	Output Current (A)
DPD63-4-8 PDU	44.2 (W) x 79.6 (D) x 110 (H)	-48 (DC)	-38.4 to -57.6	8x32 A
		-60 (DC)	-48 to -72	
TN81PDU	535 (W) x 147 (D) x 133 (H)	-48 (DC)	-38.4 to -57.6	8x50 A
		-60 (DC)	-48 to -72	

Board	Dimensions (mm)	Single-Cabinet Input Voltage (V)	Single-Cabinet Output Voltage (V)	Output Current (A)
NOTE • Two power inputs that back up each other need to be provided, and they work in load-sharing mode. • In the telecommunications room, it is required that the PDU needs to provide power supply for an entire subrack. In this case, normal power supply can be guaranteed when either of the power inputs fails.				

NOTE
The number of subracks that a cabinet can house is determined by the subrack power consumption and the number of PDU inputs/outputs.

7.1.2 Subrack Specification

The technical specifications of the subrack include the dimensions, weight, and maximum power consumption.

Table 7-3 lists the technical specifications of the OptiX OSN 7500 II subrack.

Table 7-3 Technical specifications of the OptiX OSN 7500 II subrack

Dimensions (mm)	Weight (kg)
496 (W) x 295 (D) x 800 (H)	35 (net weight of the subrack that is not installed with boards or fans)

Table 7-4 lists the maximum power consumption of the OptiX OSN 7500 II subrack.

Table 7-4 Maximum power consumption of the OptiX OSN 7500 II subrack

Subrack Type	Maximum Power Consumption[a]	Fuse Capacity	Typical Configuration	
			Typical Power Consumption	Typical Configuration
OptiX OSN 7500 II subrack	2300 W	50 A (TN81PDU); 32 A (DPD63-4-8 PDU)	887 W	• Two TNN1EX2 boards • Three TNN1EG8 boards • Two TNN1ETMC boards • Two SSN4SL64 boards • Three SSN2PQ1 boards • Four SSN1D75S boards • Two TNN1SCA boards • Two TN81PIU boards • Two TN81FAN boards • Two TNN1PSXCS boards

Subrack Type	Maximum Power Consumption[a]	Fuse Capacity	Typical Configuration	
			Typical Power Consumption	Typical Configuration
a: The maximum power consumption refers to the maximum power consumption configuration that the subrack can support and the maximum heat dissipation capability of the subrack. In the actual application, the value is much higher than the power consumption of the subrack in typical configuration.				

NOTE

In the case of transmission equipment, power consumption is generally transformed into heat consumption. Hence, heat consumption (BTU/h) and power consumption (W) can be converted to each other in the formula: Heat consumption (BTU/h) = Power consumption (W) / 0.2931 (Wh).

Table 7-5 lists the predicted reliability specifications of the OptiX OSN equipment.

Table 7-5 Equipment predicted reliability

System Availability	Mean Time to Repair (MTTR)	Mean Time Between Failures (MTBF)
0.9999974	1 hour	43.40 years

7.1.3 Power Supply Specification

This section describes the parameters for the equipment.

Table 7-6 lists the power supply parameters.

Table 7-6 Power Supply Parameters

Item	Specification
Power supply mode	DC power supply
Nominal voltage	-48 V or -60 V
Voltage range	-38.4 V to -57.6 V or -48 V to -72 V
Maximum current	60 A

7.1.4 Packet System Performance

Different packet performance parameters are available for different packet performance items of the OptiX OSN equipment.

Table 7-7 lists the system packet performance parameters specified for the OptiX OSN equipment.

Table 7-7 System packet performance specifications

Item	Specifications		
Protection **NOTE** • For distributed MPLS APS, MPLS tunnel APS and MPLS PW APS share resources. • For centralized MPLS APS, MPLS tunnel APS, MPLS PW APS, MPLS-TP tunnel APS, and MPLS-TP PW APS share resources.	MPLS tunnel APS	Maximum number Maximum number: 4K	
	MPLS PW APS	Maximum number	4K
		Maximum number of bound members	512
	MPLS-TP tunnel APS	Maximum number Maximum number: 2K	
	MPLS-TP PW APS	Maximum number	2K
		Maximum number of bound members	512
	LPT	Maximum number: 96	
	LAG	Maximum number of LAGs	128
		Maximum number of members in each LAG	16
	MC-LAG	Maximum number: 64	
	MSTP	Maximum number of instances per port	16
		Maximum number of port groups	12
		Maximum number of MSTP-enabled ports supported by a device	100
Maintenance **NOTE** • For distributed MPLS OAM, MPLS tunnel OAM, MPLS PW OAM, and ETH-OAM share resources. • For centralized MPLS	MPLS tunnel OAM	Maximum number: 8K	
	MPLS PW OAM	Maximum number: 8K	
	MPLS-TP tunnel OAM	Maximum number: 4K	
	MPLS-TP PW OAM	Maximum number: 4K	
	ETH-OAM	MD	Maximum number: 64
		MA	Maximum number: 1K
		MEP	Maximum number: 2K

Item	Specifications		
OAM, MPLS tunnel OAM, MPLS PW OAM, MPLS-TP tunnel OAM, MPLS-TP PW OAM, and ETH-OAM share resources.	ATM OAM (VP/VC level)	Maximum number: 8K	
Service	Maximum number of E-Line services	8K	
	Maximum number of E-LAN services	1K	
	Maximum number of CES services	4K	
	Maximum number of ATM services	Local services	2K
		Remote services	4K
IGMP snooping	Maximum number of multicast groups	1K	
	Maximum number of members in each multicast group	6K	
HQoS	Maximum number of service WRED policies	127	
	Maximum number of port WRED policies	8	
	Maximum number of WFQ templates	256	
	Maximum number of	256	

Item	Specifications		
	V-UNI ingress policies		
	Maximum number of V-UNI egress policies	256	
	Maximum number of port policies	100	
	Maximum number of PW policies	256	
	Maximum number of QinQ policies	256	
	Maximum number of DiffServ domains	8	
	Maximum number of port flows	1600	
	Maximum number of V-UNI ingress flows	4K	
	Maximum number of traffic classification rules	20	
	Maximum number of ACLs	4K	
Others	MPLS tunnel	Size of the global ingress label space	32768 **NOTE** 0 to 15 are special labels and cannot be used for LSP services.
		Maximum number	Unidirectional: 16K **NOTE** Bidirectional tunnels and unidirectional tunnels share tunnel resources. A bidirectional tunnel is counted as two unidirectional tunnels.

Item	Specifications		
	Maximum number of static PWs	Bidirectional	16K
	Maximum number of MS-PWs	8192	
	Maximum number of split horizon groups supported by E-LAN	1	
	Maximum number of QinQ links	4K	
	Maximum number of ETH V-UNIs	16K	
	Maximum number of ETH V-NNIs	Maximum number of ETH V-NNIs = Maximum number of PWs + Maximum number of QinQ links + Maximum number of physical ports	
	Maximum number of ETH V-UNI groups	1K	
	Maximum number of members in each ETH V-UNI group	2000	
	Maximum number of virtual ports (including V-UNIs and V-NNIs) supported by E-LAN	256	
	Maximum number of virtual ports (including V-UNIs and V-NNIs) supported by a device	8K	
	MAC address	Maximum number of static MAC	2K

Item	Specifications		
		addresses supported by E-LAN	
		Maximum number of dynamic MAC addresses supported by E-LAN	65534
		Maximum number of dynamic MAC addresses supported by a device	256K
	Maximum number of members in a blacklist	2K	

7.1.5 Timing and Synchronization Performance

The clock scheme provided by the equipment meets the bearer network standard. It is also applicable to synchronization of the synchronous Ethernet clock, 1588v2 time, and 1588v2 clock. In addition, it can be used for high precision synchronization of wireless transmission networks.

Table 7-8 lists the timing and synchronization performance of a bearer network.

Table 7-8 Timing and synchronization performance

Performance	Description
Output Jitter	ITU-T G.813 compliant
Output Frequency in Free-Run Mode	ITU-T G.813 compliant
Long-Term Phase Variation in Locked Mode	ITU-T G.813 compliant

Table 7-9 lists the 1588v2 timing and clock synchronization performance.

Table 7-9 Specifications associated with IEEE 1588v2 time and clock synchronization

Item	Specifications
Support capability	Number of ports: 16
Precision in the case of single hop	±30 ns
Precision in the case of 30 stations	±1 us

Table 7-10 lists the synchronous Ethernet clock performance.

Table 7-10 Specifications associated with synchronous Ethernet clocks

Item	Specifications
Support capability	Number of ports: 64
Clock frequency accuracy (24 hours)	±1 ppm
Synchronization precision	Complies with ITU-T G.8262.

7.2 Power Consumption and Weight of Boards

This section lists the power consumption and weight of each board of the OptiX OSN series equipment.

Table 7-11 lists the power consumption and weight of each board.

Table 7-11 Power consumption and weight of each board

Board	Power Consumption (W)	Weight (kg)	Board	Power Consumption (W)	Weight (kg)
SDH boards					
N1SLQ41	12	0.6	N1SLD4	17	0.6
N1SF64A	33(the OptiX OSN 3500 supports) 26(the OptiX OSN 7500 supports)	1.1	N2SLD4	15	1.0
N1SF64	33(the OptiX OSN 3500 supports) 26(the OptiX OSN 7500 supports)	1.1	R1SLD4	11	0.5
N1SL64A	40	1.1	N1SL4A	17	0.6
N1SL64	30(the OptiX OSN 3500 supports) 22(the OptiX OSN 7500	1.1	N1SL4	17	0.6

Board	Power Consumption (W)	Weight (kg)	Board	Power Consumption (W)	Weight (kg)
	supports)				
N2SL64	32	1.1	N2SL4	15	1.0
T2SL64	40	1.1	R1SL4	10	0.5
N1SF16	26	1.1	R3SL4	11	0.5
N1SLO16	38	1.0	N1SEP1	17	1.0
N1SLQ16	20	0.9	N1SLH1	27	1.0
N2SLQ16	35	1.3	N1SLT1	22	1.3
N1SLD16	23	0.9	N2SLO1	26	1.1
N1SL16A	20	0.6	N3SLO1	20	1.2
N2SL16A	20	1.1	N1SLQ1A	15	1.0
N3SL16A	22	0.9	N1SLQ1	15	1.0
N1SL16	19	1.1	N2SLQ1	15	1.0
N2SL16	19	1.1	R1SLQ1	12	0.4
N3SL16	22	1.1	N1SL1A	17	0.6
N1SLQ4A	17	1.0	N1SL1	17	0.6
N1SLQ4	17	1.0	N2SL1	14	1.0
N2SLQ4	16	1.0	R1SL1	10	0.3
N1SLD4A	17	0.6	R3SL1	11	0.3
T2SL64A	40	1.1	N3SLQ41	16	0.7
N1EU08	11	0.4	N1EU04	6	0.4
N1OU08	6	0.4	N2OU08	6	0.4
N3SLH41	49	1.5	N1SLD64	41	1.2
N4SL64	15(the OptiX OSN 3500/7500 II supports) 14(the OptiX OSN 7500 supports)	1.1	N1SF16E	19.6	0.6
N4SLQ16	12	0.7	N4SLO16	21	1.0
N4SLD64	19	1.2	N4SF64	26	1.2
N4SFD64	37	1.1	-	-	-
PDH boards					

Board	Power Consumption (W)	Weight (kg)	Board	Power Consumption (W)	Weight (kg)
N1SPQ4	24	0.9	N2PL3	12	0.9
N2SPQ4	24	0.9	N1PQM	22	1.0
N1DXA	10	0.8	N1PQ1	19	1.0
N1DX1	15	1.0	N2PQ1	13	1.0
N1PQ3	13	0.9	R1PD1	15	0.6
N1PD3	19	1.1	R2PD1	15	0.6
N2PD3	12	1.1	R3PD1	8	0.4
N1PL3A	15	1.0	N1PL1	7	0.5
N2PL3A	12	0.9	R1PL1	7	0.5
N1PL3	15	1.0	N2PQ3	13	0.9
N1DM12	0	0.4	N1TSB8	0	0.3
N1TSB4	3	0.3	N1MU04	2	0.4
N1C34S	0	0.3	R1L12S	5	0.3
N1D34S	0	0.4	N1D12B	0	0.3
N1D75S	0	0.4	N1L75S	3	0.3
N1D12S	0	0.4	N1PFL1	17	1
Data boards (TDM mode)					
N1MST4	26	0.9	N2EFS4	30	1.0
N1IDQ1	41	1.0	N3EFS4	18	0.6
N1IDL4	41	1.0	N1EFS0A		0.7
N1ADQ1	41	1.0	N1EFS0	35	1.0
N1ADL4	41	0.9	N2EFS0	35	1.0
N1EAS2	70	1.2	N4EFS0	35	1.0
N1EMR0	47	1.2	N5EFS0	22	0.6
N2EGR2	40	1.1	N1EGT2	29	0.9
N1EGS4	70	1.1	N1EFT8A	26	1.0
N3EGS4	70	1.1	N1EFT8	26	1.0
N4EGS4	34	0.7	N1EFT4	14	0.5
N1EMS4	65	1.1	N1EFT8	26	1.0

Board	Power Consumption (W)	Weight (kg)	Board	Power Consumption (W)	Weight (kg)
N1EMS2	40	0.8	N1EFT4	14	0.5
N2EGS2	43	1.0	R1EFT4	14	0.5
N3EGS2	25	0.6	N2EMR0	50	1.2
N1EFS4	30	1.0	N1ETF8A	11	0.4
N1ETS8	0	0.4	N1EFF8A	15	0.4
N1EFF8	6	0.4	N1ETF8	2	0.4
N1IDL4A	46	1.5	N1VST4	37	0.8
N2EGT2	15	0.9	-	-	-
Packet boards					
R1PEFS8	12	0.3	N1PETF8	6	0.4
Q1PEGS2	9	0.6	N1PEG16	137	2.3
R1PEGS1	8	0.4	N1PEX1	107	2.4
N1PEG8	47	1.2	N1PEX2	49	1.4
N2PEX1	48	1.4	N1PEFF8	13	0.5
TNN1EX2	60	1.3	TNN1EG8	58	1.3
TNN1CO1	17	0.6	TNN1ETMC	11	0.5
TNN1D75E	15	0.4	TNN1AFO1	26	0.8
TNN1D12E	15	0.4	TNN1EFF8	16	0.6
R1PEF4F	15	0.4	-	-	-
EoD Boards					
N1EDQ41	70	1.0	-	-	-
CES boards					
N1MD75	12	0.5	N1MD12	12	0.5
N1CQ1	10	0.5	R1ML1A/B	16	0.4
WDM boards					
N1FIB	0	0.4	N1MR2B	0	1.0
N1MR2A	0	1.0	N1MR2	0	0.9

Board	Power Consumption (W)	Weight (kg)	Board	Power Consumption (W)	Weight (kg)
N1LWX	30	1.1	N1CMR4	0	0.9
N1MR4	0	0.9	N1CMR2	0	0.8
N1MR2C	0	1.0	-	-	-
Cross-Connect and system control boards					
N1PSXCS	90	2.1	R1PCXLN	60	1.0
T1PSXCSA	95	1.4	N4GSCC	19	1.0
N2PSXCSA	80	1.2	N3PSXCSA	74	1.5
T1SXCSA	96	2.2	N1SXCSA	63	2.0
TNN1SCA	27	1.0	TNN1PSXCS	140	2.4
N6GSCC	35	0.9	T2PSXCSA	95	1.8
Auxiliary boards					
N1FANA	19	1.2	R1AMU	8	0.5
XE1FAN	16	1.5	R1AUX	19	1.0
XE3FAN	10	1.2	R2AUX	19	1.0
R1FAN	20	0.8	Q1AUX	10	0.5
Q1SEI	10	0.9	N1AUX	19	1.0
N1SEI	1	0.9	T1AUX	3	0.4
Q1SAP	20	0.7	T1EOW	13	0.5
Q2SAP	25	1.0	R1EOW	10	0.4
TN81FAN	21	4.5	-	-	-
Optical amplifier boards and dispersion compensation boards					
N1DCU	0	0.4	62COA	75	8.0
N2DCU	0	0.4	N1COA	10	3.5
N1RPC02	110	4.2	N1BPA	20	1.0
N1RPC01	70	4.0	N2BPA	11	1.2
61COA	10	3.5	N1BA2	20	1.0
TN11OBU101	16	1.3	TN11OBU103	13	1.3

Board	Power Consumption (W)	Weight (kg)	Board	Power Consumption (W)	Weight (kg)
TN12OBU 101	10	1.1	TN12OBU 103	11	1.1
TN12OBU 2	14	1.6	-	-	-
Power interface boards					
R1PIUA	2	0.5	N1PIU	8	1.2
R1PIUB	4	0.4	Q2PIU	2	0.3
R1PIUC	5	0.5	Q1PIU	8	1.3
N1PIUA	3	0.5	R1PIU	2	0.4
T1PIU	8	1.3	UPM (EPS30-48 15AF)	-	10
UPM (EPS75-48 15AF)	-	15	TN81PIU	9	1.6
N1PIUB	6	0.6	T1PIUB	6	0.5

A Glossary

A

ACL	Access Control List
ACR	Allowed Cell Rate
ADM	Add/drop Multiplexer
AIS	Alarm Indication Signal
ALS	Automatic Laser Shutdown
APS	Automatic Protection Switching

B

BSC	Base Station Controller

C

CBR	Constant Bit Rate
CC	Continuity Check
CES	Circuit Emulation Service
CV	Connectivity Verification

D

DCC	Data Communication Channel
DDN	Digital Data Network
DiffServ	Differentiated Service
DNI	Dual Node Interconnection
DVB-ASI	Digital Video Broadcast- Asynchronous Serial Interface

E

E-AGGR	Ethernet Aggregation
E-LAN	Ethernet LAN
E-Line	Ethernet Line
EoD	Ethernet Over Dual Domains
EoS	Ethernet Over SDH
EPL	Ethernet Private Line
EPLAN	Ethernet Private LAN
ESCON	Enterprise Systems Connection
ETSI	European Telecommunications Standards Institute
EVPL	Ethernet Virtual Private Line
EVPLAN	Ethernet Virtual Private LAN

F

FC	Fiber Channel
FEC	Forwarding Equivalence Class
FEC	Forward Error Correction
FFD	Fast Failure Detection
FICON	Fiber Connection
FPGA	Field Programmable Gate Array
FPS	Fast Protection Switching

G

GE	Gigabit Ethernet
GFP	Generic Framing Procedure

I

IEEE	Institute of Electrical and Electronics Engineers
IGMP	Internet Group Management Protocol
IMA	Inverse Multiplexing for ATM
IMF	Interworking Function
IPA	Intelligent Power Adjusting
ITU-T	International Telecommunication Union - Telecommunication

	Standardization Sector
L	
LACP	Link Aggregation Control Protocol
LAG	Link Aggregation Group
LAN	Local Area Network
LB	Loopback
LC	Lucent Connector
LOF	Loss of frame
LP	Lower Order Path
LPT	Link State Pass Through
LSR	Label Switching Router
LT	Link Trace
M	
MAC	Medium Access Control
MPLS	Multi-Protocol Label Switch
MSP	Multiplex Section Protection
MSTP	Multiple Spanning Tree Protocol
MTU	Maximum Transmission Unit
N	
NMS	Network Management System
NNI	Network Node Interface
O	
OAM	Operations, Administration and Maintenance
P	
PDH	Plesiochronous Digital Hierarchy
PDU	Power Distribution Unit
PRBS	Pseudo-Random Binary Sequence
PW	Pseudo Wire

PWE3	Pseudo Wire Edge to Edge Emulation
Q	
QinQ	802.1Q in 802.1Q
QoS	Quality of Service
R	
RDI	Remote Defect Indication
REG	Regenerator
RMON	Remote Network Monitoring
RNC	Radio Network Controller
RPR	Resilient Packet Ring
RTN	Radio Transmission Node
rt-VBR	real time Variable Bit Rate
S	
SAN	Storage Area Network
SD	Signal Degrade
SDH	Synchronous Digital Hierarchy
SNCMP	Subnetwork Connection Multiple Protection
SNCP	Sub-Network Connection Protection
SNCTP	Subnetwork Connection Tunnel Protection
SNMP	Simple Network Management Protocol
T	
TDM	Time Division Multiplexing
TM	Terminal Multiplexer
TPS	Tributary Protection Switch
U	
UBR	Unspecified Bit Rate
UNI	User Network Interface

V

VBR	Variable Bit Rate
VCG	Virtual Concatenation Group
VLAN	Virtual LAN

W

WAN	Wide Area Network
WDM	Wavelength Division Multiplexing
WRED	Weighted Random Early Detection

X

XFP	10-GB small Form-factor Pluggable transceiver