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RAX701-GC (A)_RAX701-FC (A)

Product Description

(Rel_01)



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Preface

Objectives

This document describes the RAX701-GC and RAX701-FC (hereafter referred to as the RAX700 for brevity except for differences) in aspects of orientation, system structure, technical specifications, etc.

Versions





The following table lists the product versions related to this document.

Product name	Product version	Hardware version
RAX701-GC	P100R001	A.10 or later
RAX701-FC	P100R001	A.00 or later

Conventions

Symbol conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
 Warning	Indicate a hazard with a medium or low level of risk which, if not avoided, could result in minor or moderate injury.
 Caution	Indicate a potentially hazardous situation that, if not avoided, could cause equipment damage, data loss, and performance degradation, or unexpected results.
 Note	Provide additional information to emphasize or supplement important points of the main text.
 Tip	Indicate a tip that may help you solve a problem or save time.

General conventions

Convention	Description
Times New Roman	Normal paragraphs are in Times New Roman.
Arial	Paragraphs in Warning, Caution, Notes, and Tip are in Arial.
Boldface	Names of files, directories, folders, and users are in boldface . For example, log in as user root .
<i>Italic</i>	Book titles are in <i>italics</i> .
Lucida Console	Terminal display is in Lucida Console.

Change history

Updates between document versions are cumulative. Therefore, the latest document version contains all updates made to previous versions.

Issue 01 (2015-06-30)

Initial commercial release

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1 Overview

This chapter describes basic information about the RAX700, including the following sections:

- Introduction
- Characteristics
- Features
- Networking applications
- Ordering information

1.1 Introduction

As a Packet Transport Network (PTN) terminal, the RAX700 can be connected uplink to Raisecom iTN200/iTN2000/iTN8000 series devices or PTN devices from other vendors. It provides a complete intelligent group service access scheme and mobile backhaul scheme, thus realizing management and control of services on the entire network.

1.2 Characteristics

1.2.1 Multi-service access

The RAX700 provides abundant interfaces. It can meet requirements on accessing multiple services through PTN and Ethernet.

- Support MPLS-TP. The RAX700 can be connected to the local TDMoP emulation device to transmit leased line access services.
- Provide two uplink optical interfaces and one downlink Combo interface for transmitting Ethernet leased access services.
- With flexible software configurations, the RAX700 can work as a leased line access client-side device connected to the PTN.
- The RAX700 is a small and compact device, supporting multiple power supply modes, such as 220 VAC, -48 VDC, and universal power supply. It can be placed in the telecommunication room or in the device room that has higher requirements on power supply and space.

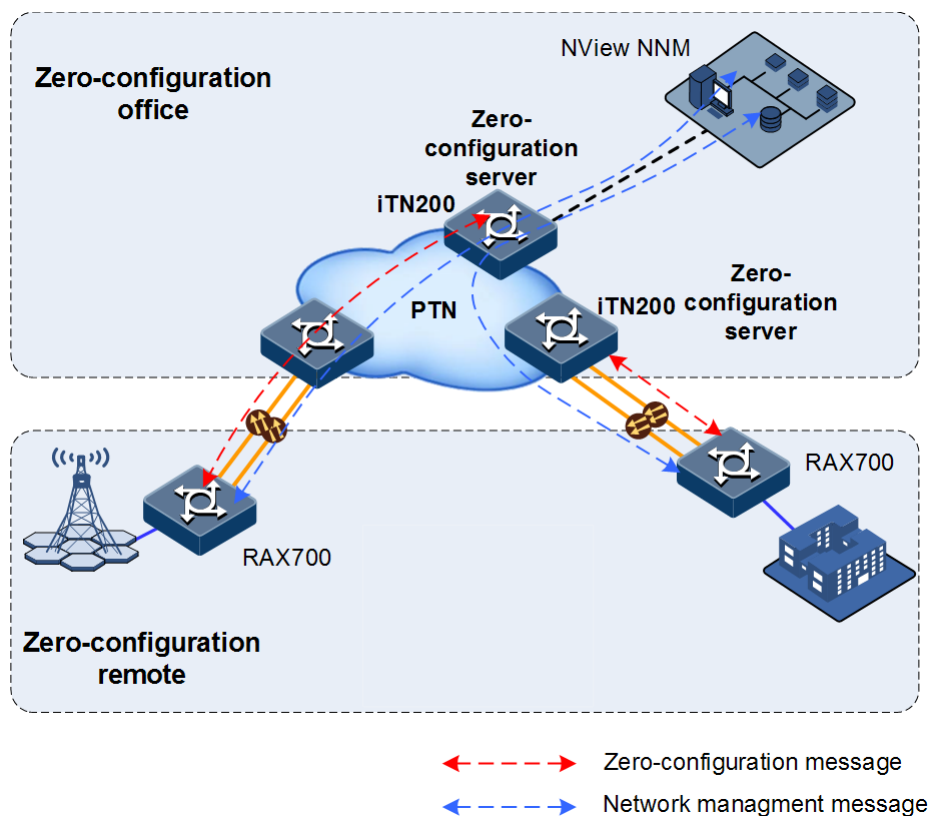
1.2.2 Remote zero-configuration

With zero-configuration, the local device automatically assigns parameters, such as the management IP address, management VLAN, and default gateway, for remote devices to manage them. In addition, users can activate services quickly.

Figure 1-1 shows the zero-configuration network topology. The network topology is composed of local zero-configuration servers, remote zero-configuration devices, and the NView NNM system.

As a remote zero-configuration device, after being powered on and connected to the network, the RAX700 can detect the zero-configuration server automatically. After finding the zero-configuration server, the RAX700 can obtain network management parameters, such as the management VLAN, management IP address, and gateway from the zero-configuration server. Then, the RAX700 will be discovered and managed by the NView NNM system.

Figure 1-1 Principle of zero-configuration



1.2.3 Network reliability

Ethernet protection

- Support interface backup. The uplink NNI can realize 1:1 dual-homed protection switching.
- Support interface-based failover. In the dual-uplink connection network, when the main link fails, the system will inform the downstream devices. Therefore, downstream devices can switch the link.

- Support ITU-T G.8031 Ethernet Linear Protection Switching (ELPS) 1:1 bidirectional protection switching. When the working link fails, both ends communicate through Automatic Protection Switching (APS) protocol and then switch services to the protection link simultaneously to transmit and receive services.
- Support ITU-T G.8032 Ethernet Ring Protection Switching (ERPS). When a fault occurs on the Ethernet ring, services are switched to the protection link quickly to recover services. Support two networking modes: single ring and tangent ring.
- Support Ethernet interface link aggregation group protection based the load sharing mode, including manual link aggregation and static Link Aggregation Control Protocol (LACP) link aggregation. The protection switching time is smaller than 200ms.

MPLS-TP protection switching

- Support Multiprotocol Label Switching Transport Profile (MPLS-TP) line protection switching.
- Support PW 1:1 linear protection switching.

1.2.4 Various security assurance

- Support basic QinQ and selective QinQ, which facilitate planning and deploying the network more flexibly.
- Support loopback detection, which ensures no loop in the network and stable network status.
- Support Access Control List (ACL), Remote Authentication Dial In User Service (RADIUS), and Terminal Access Controller Access Control System (TACACS+), which enhance the security of the network and the RAX700.
- Support Loss Of Signal (LOS) and Dying Gasp alarm, temperature anomaly alarm, and undervoltage/overvoltage detection and alarm, which facilitate discovering network faults and taking related actions.

1.2.5 Complete QoS mechanism

- Support rate limiting in ingress and egress directions.
- Support VLAN rate limiting, PW bandwidth management (egress direction of the uplink interface), and Tunnel bandwidth management (egress direction of the uplink interface).
- Support storm control, including broadcast storm control, multicast storm control, and Destination Lookup Failure (DLF) storm control, which prevents the whole network from failing to work due to an increasing number of broadcast packets.
- Support the following Quality of Services (QoS) functions:
 - Configure rule-based traffic classification.
 - Trust mode: trust the interface, Class of Service (CoS) priority, and Differentiated Services Code Point (DSCP) priority.
 - Priority mapping: include Ethernet priority mapping and priority mapping in the MPLS-TP network.
 - Support interface-based Strict Priority (SP), Weight Round Robin (WRR), Deficit Round Robin (DRR), SP+WRR, and SP+DRR queue scheduling modes.
 - Support congestion management based on the Weighted Random Early Detection (WRED) profile.
 - Support interface-based queue shaping.

1.2.6 Entire network manageability and controllability

The RAX700 can be managed and controlled through remote zero-configuration, NView Network Node Management (NNM) system, Web network management system, as well as Operation, Administration, and Management (OAM).

- Support multi-layer OAM, which realizes Ethernet in the First Mile (EFM) with other connected devices and private point-to-point Connectivity Fault Management (CFM).
- The NView NNM system can perform topology management, service management, and alarm management on the RAX700, as well as supports leased line service management.
- When acting as a remote device, the RAX700 supports reporting Dying Gasp and LOS alarms to the NView NNM system, which facilitates monitoring the device and network status.
- Support Layer 2 and Layer 3 Service Level Agreement (SLA), which is used to test network delay, jitter, and packet loss ratio and monitor the network performance.

1.3 Features

Table 1-1 lists features supported by the RAX700.

Table 1-1 Software features of the RAX700

Feature	Description
Basic feature	<ul style="list-style-type: none"> • CLI • Logging in to the device through USB Console/Telnet/SSHv2 • Remote zero-configuration • Time management • Interface management • SNMP • Static management route
Zero-configuration	<ul style="list-style-type: none"> • Support plug and play. • Support replacing the failed device quickly.
Leased line service management	Support managing leased line services and creating end-to-end services.
Ethernet	<ul style="list-style-type: none"> • Up to 8 K MAC addresses • Jumbo frame with the MTU of 13 KBytes • Up to 4094 VLANs • CVLAN • QinQ • 1:1 VLAN mapping • Loopback detection • L2CP • Up to 100 static ARP entries • Port mirroring
MPLS-TP	<ul style="list-style-type: none"> • Up to 128 static LSPs • MPLS L2VPN (SVC mode) • MPLS-TP OAM (G.8113.1) • MPLS-TP 1:1 linear protection switching • PW dual-homed protection switching • PW 1:1 protection switching

Feature	Description
Reliability	<ul style="list-style-type: none"> • Link aggregation (up to 3 LAGs) • Interface backup • ELPS (ITU-T G.8031) • ERPS (ITU-T G.8032) • Failover
DHCP	DHCP Client
OAM	<ul style="list-style-type: none"> • EFM (IEEE 802.3ah) • CFM (IEEE802.1ag/ITU-Y.1731) • SLA
Security	<ul style="list-style-type: none"> • ACL • RADIUS • TACACS+ • Storm control
QoS	<ul style="list-style-type: none"> • Priority trust • Priority mapping • Traffic classification • Traffic policy • Queue scheduling • Congestion avoidance • Queue shaping • Rate limiting based on interface, Tunnel, and PW
System management	<ul style="list-style-type: none"> • Management file (BootROM/system file/configuration file) • Load and upgrade • Syslog • Alarm management • CPU protection • CPU monitoring • RMON • Optical module digital diagnosis • Loopback • Extended OAM • LLDP • Fault detection



Note

For detailed features, see *RAX701-GC (A)_RAX701-FC (A) Configuration Guide*.

1.4 Networking applications

The RAX700 can be used for backhaul of the traditional router big customer access leased line, voice leased line, and base services.

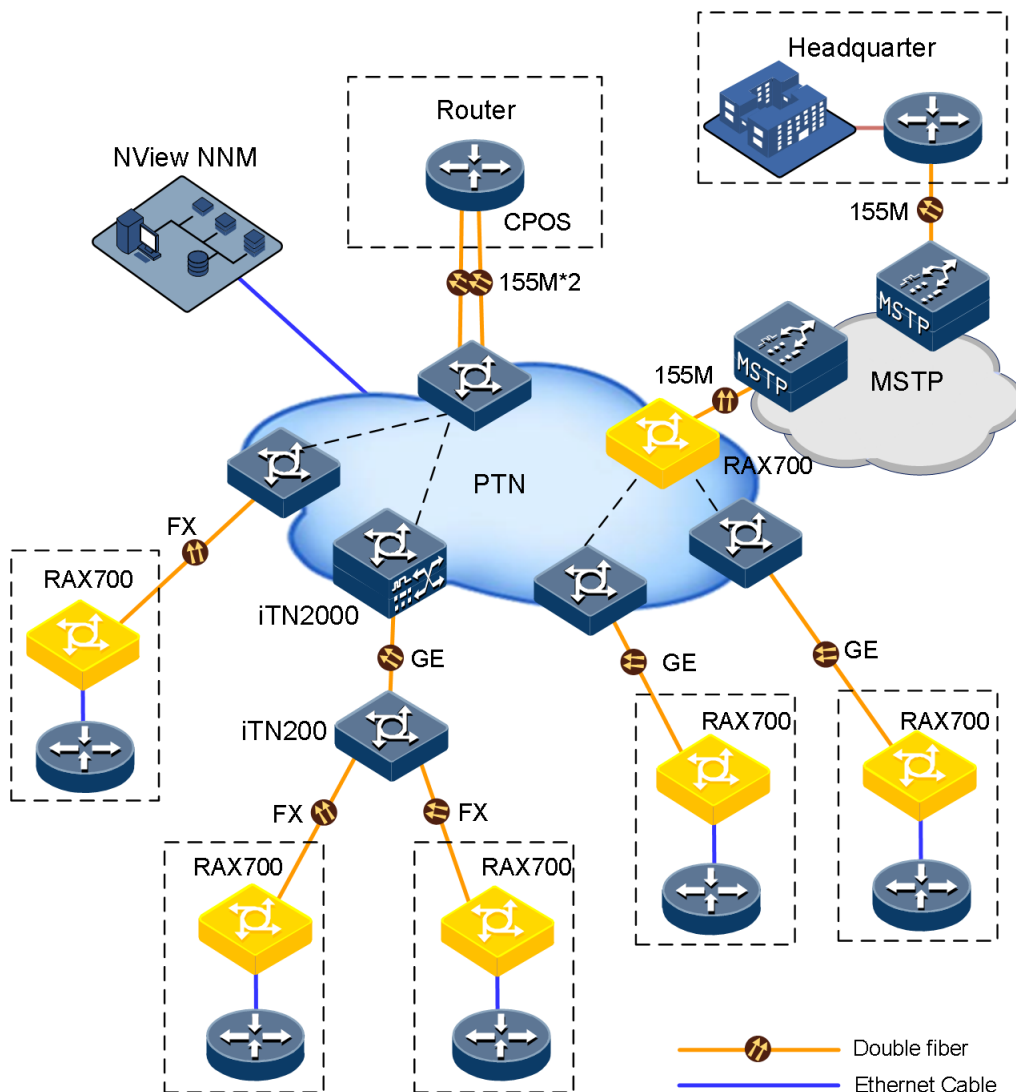
1.4.1 Leased line access

As shown in Figure 1-2, the RAX700 is used in 2 scenarios.

In one scenario, the RAX700 is directly connected to other device through the Ethernet interface. In the other scenario, the headquarter accesses through the MSTP network. PTN and MSTP network are connected through the Ethernet interface.

- The RAX700 is connected to Raisecom iTN200/iTN2000/iTN8000 series device, working as the leased line access client-side device.
- The RAX700 is connected to the PTN of other vendors, working as the leased line access client-side device.

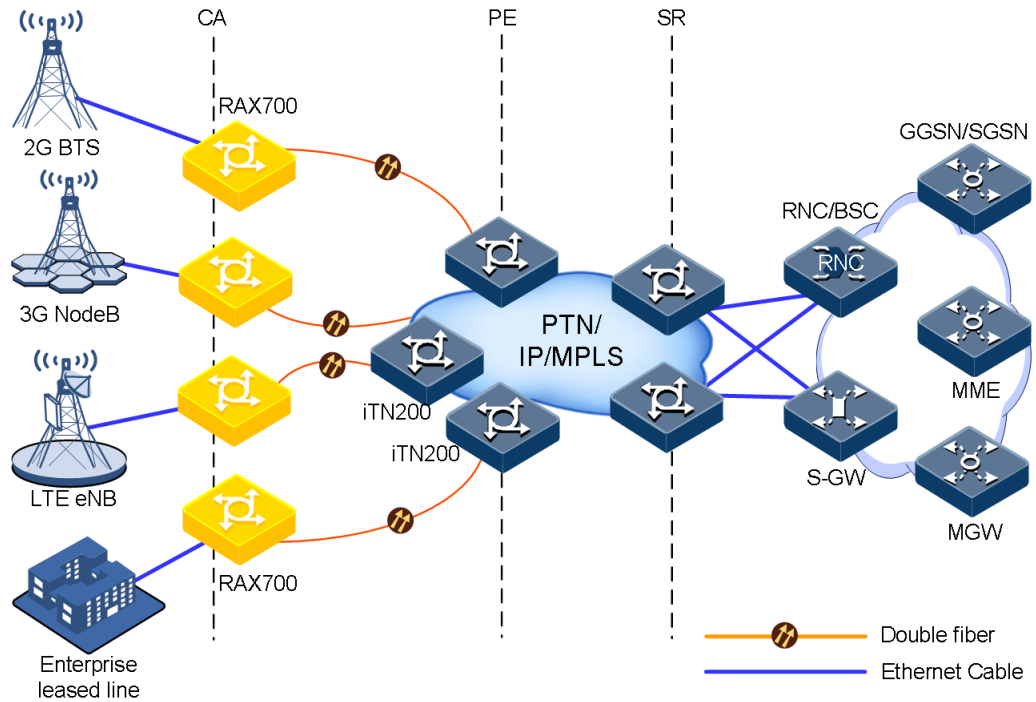
Figure 1-2 RAX700 leased line networking



1.4.2 Mobile backhaul

As shown in Figure 1-3, the RAX700 is placed at the Base Station (BS) user access side. The backhaul data of BS is received by the RAX700 and is sent to Raisecom iTN2000 or iTN200 through the uplink interface of the RAX700. Then, the backhaul data is sent to Carrier PTN/IP/MPLS Metropolitan Area Network (MAN) to realize backhaul of BS data.

Figure 1-3 RAX700 mobile backhaul networking



1.5 Ordering information

1.5.1 Ordering information about device

Table 1-2 lists ordering information about the RAX700.

Table 1-2 Ordering information about the RAX700

Model	Description
RAX701-GC	<ul style="list-style-type: none"> • Support two 100/1000 Mbit/s SFP uplink interfaces. • Support one 10/100/1000 Mbit/s Combo downlink interface. • Support the USB-form Console interface. • Support the SNMP interface for out-of-band network management. • Support the power supply of 220 VAC or -48 VDC, or universal power supply.
RAX701-FC	<ul style="list-style-type: none"> • Support two 100 Mbit/s SFP uplink interfaces. • Support one 10/100 Mbit/s Combo downlink interface. • Support the USB-form Console interface. • Support the SNMP interface for out-of-band network management. • Support the power supply of 220 VAC or -48 VDC, or universal power supply.

1.5.2 Ordering information about auxiliary parts

The auxiliary parts of the RAX700 are SFP modules.

For specifications of the SFP module, see section 4.2 Lookup table of optical/electrical module.

2 System structure

This chapter describes the system structure of the RAX700, including the following sections:

- Hardware structure
- Software structure

2.1 Hardware structure

This section introduces the overall structure of the RAX700, including the appearance, interface types, LEDs, power supply, and reset button.

2.1.1 Appearance

The RAX700 is a 1-U compact cartridge device with dimensions of 180 mm (Width) × 160 mm (Depth) × 43.6 mm (Height). All interfaces are located on the front panel. There is a reset button and a DIP switch on the rear panel.

Figure 2-1 shows the front panel of the RAX701-GC.

Figure 2-1 Front panel of the RAX701-GC

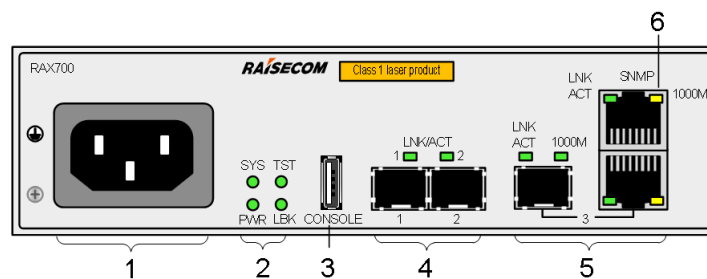


Figure 2-2 shows the front panel of the RAX701-FC.

Figure 2-2 Front panel of the RAX701-FC

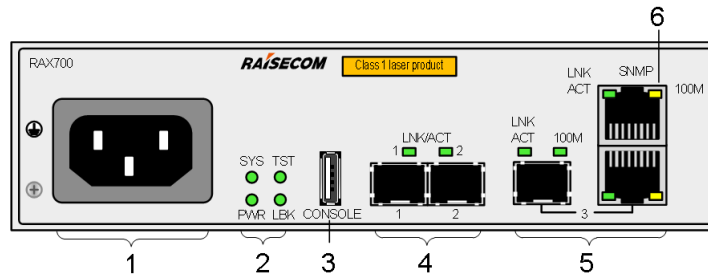


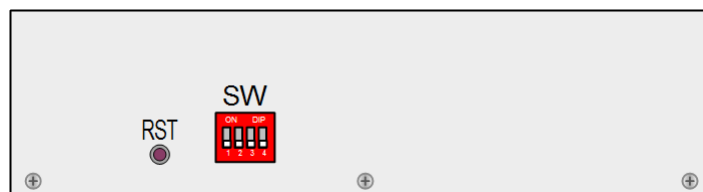
Table 2-1 describes interfaces on the front panel of the RAX700.

Table 2-1 Descriptions of interfaces on the front panel of the RAX700

No.	Print	Description
1	–	AC power interface
2	SYS	System LED
	TST	Test mode LED
	PWR	Power supply LED
	LBK	Loopback status LED
3	CONSOLE	Console interface (USB)
4	–	Service uplink interface (SFP)
	LNK/ACT	Service uplink interface (SFP) working status LED
5	–	Service downlink interface (SFP)
	LNK/ACT	Service downlink interface (SFP) working status LED
	1000M/100M	Service downlink interface (SFP) rate LED
6	SNMP	SNMP interface (RJ45)
	LNK/ACT	SNMP LED
	1000M/100M	SNMP interface rate LED

Figure 2-3 shows the rear panel of the RAX700.

Figure 2-3 Rear panel of the RAX700



2.1.2 Interface types

External interfaces of the RAX700 include the service interface and management interface.

Service interface

Table 2-2 lists services interfaces of the RAX700.

Table 2-2 Service interfaces of the RAX700

Interface	Description	Quantity
NNI	Service uplink interface (SFP), supporting SFP optical modules as below: <ul style="list-style-type: none"> • 1000Base-SX (multi-mode) (RAX701-GC) • 1000Base-LX (RAX701-GC) • 1000Base-ZX (RAX701-GC) • 100Base-FX (RAX701-FC) • 10/100/1000BASE-T • 1000BASE-T (RAX701-GC) • 10/100BASE-TX (RAX701-FC) 	2
UNI	Service downlink interface (SFP), supporting SFP optical modules as below: <ul style="list-style-type: none"> • 1000Base-SX (multi-mode) (RAX701-GC) • 1000Base-LX (RAX701-GC) • 1000Base-ZX (RAX701-GC) • 100Base-FX (RAX701-FC) Service downlink interface (RJ45): <ul style="list-style-type: none"> • 10/100/1000Base-T self-adaptive Ethernet electrical interface (RAX701-GC) • 10/100Base-T self-adaptive Ethernet electrical interface (RAX701-FC) 	1



Caution

The SFP service downlink interface and RJ45 service downlink interface cannot be used at the same time.

Management interface

Table 2-3 lists management interfaces of the RAX700.

Table 2-3 Management interfaces of the RAX700

Interface	Description	Quantity
Console interface (USB)	Assistant management interface, with which you can configure and manage the RAX700 initially through the terminal software, such as the Hyper Terminal in Windows	1

Interface	Description	Quantity
SNMP interface (RJ45)	Out-of-band management interface, which is connected uplink to the network management server	1

2.1.3 LEDs

Table 2-4 lists LEDs on the RAX700.

Table 2-4 LEDs on the RAX700

Interface	LED	Status	Description
–	PWR	Green	Power supply LED <ul style="list-style-type: none"> • Green: the power supply is normal. • Off: there is no power supply or the power supply is abnormal.
–	SYS	Green	System working status LED <ul style="list-style-type: none"> • Green: the system works improperly. • Blinking green: the system works properly. (Slow blinking green: the system works properly and IP 0 does not have the IP address; quick blinking green: the system works properly and the device is applying for the IP address through zero-configuration). • Off: the system works improperly or does not work.
–	TST	Green	Not supported temporarily
–	LBK	Green	Not supported temporarily
SNMP interface	LNKACT	Green	Interface working status LED <ul style="list-style-type: none"> • Green: SNMP interface works properly. • Blinking green: SNMP interface is sending/receiving data. • Off: SNMP interface is disconnected or connected improperly.
	1000M (RAX701-GC)	Yellow	Interface rate LED <ul style="list-style-type: none"> • Yellow: the electrical interface is working at 1000 Mbit/s. • Off: the electrical interface is working at 10/100 Mbit/s, or is disconnected, or is connected improperly.
	100M (RAX701-FC)	Yellow	Interface rate LED <ul style="list-style-type: none"> • Yellow: the electrical interface is working at 100 Mbit/s. • Off: the electrical interface is working at 10 Mbit/s, or is disconnected, or is connected improperly.

Interface	LED	Status	Description
NNI	LNK/ACT	Green	<p>Interface working status LED</p> <ul style="list-style-type: none"> • Green: the optical interface is connected properly. • Blinking green: the optical interface is sending/receiving data. • Off: the optical interface is disconnected or connected improperly.
UNI (RJ45)	LNK/ACT	Green	<p>Interface working status LED</p> <ul style="list-style-type: none"> • Green: the electrical interface is connected properly. • Blinking green: the electrical interface is sending/receiving data. • Off: the electrical interface is disconnected or connected improperly.
	1000M (RAX701-GC)	Yellow	<p>Interface rate LED</p> <ul style="list-style-type: none"> • Yellow: the electrical interface is working at 1000 Mbit/s. • Off: the electrical interface is working at 10/100 Mbit/s, or is disconnected, or is connected improperly.
	100M (RAX701-FC)	Yellow	<p>Interface rate LED</p> <ul style="list-style-type: none"> • Yellow: the electrical interface is working at 100 Mbit/s. • Off: the electrical interface is working at 10 Mbit/s, or is disconnected, or is connected improperly.
UNI (SFP)	LNK/ACT	Green	<p>Interface working status LED</p> <ul style="list-style-type: none"> • Green: the electrical interface is connected properly. • Blinking green: the electrical interface is sending/receiving data. • Off: the electrical interface is disconnected or connected improperly.
	1000M (RAX701-GC)	Green	<p>Interface rate LED</p> <ul style="list-style-type: none"> • Green: the electrical interface is working at 1000 Mbit/s. • Off: the electrical interface is working at 100 Mbit/s, or is disconnected, or is connected improperly.
	100M (RAX701-FC)	Green	<p>Interface rate LED</p> <ul style="list-style-type: none"> • Green: the electrical interface is working at 100 Mbit/s. • Off: the electrical interface is disconnected or is connected improperly.

2.1.4 Power supply

The RAX700 provides the following three kinds of power supply, as listed in Table 2-5.

Table 2-5 Input power supplies available for the RAX700

Type	Voltage range	Interface type
AC input voltage	Rated voltage: 220 V	Receptacle interface
	Voltage range: 100–240 V	
DC input voltage	Rated voltage: -48 V	2-pin fence terminal
	Voltage range: -36 to -72 V	
Universal power supply	Rated voltage: 220 VAC	Receptacle interface
	Voltage range: 100–240 VAC	
	Rated voltage: -48 VDC	
	Voltage range: -36 to -72 VDC	

2.1.5 DIP switch

There is one DIP switch on the rear panel of the RAX700 while it does not support being configured.

2.1.6 Reset button



Caution

Use the RST button with care. Services will be interrupted when you reboot the RAX700.

There is a RST button on the front panel of the RAX700, which works as below:

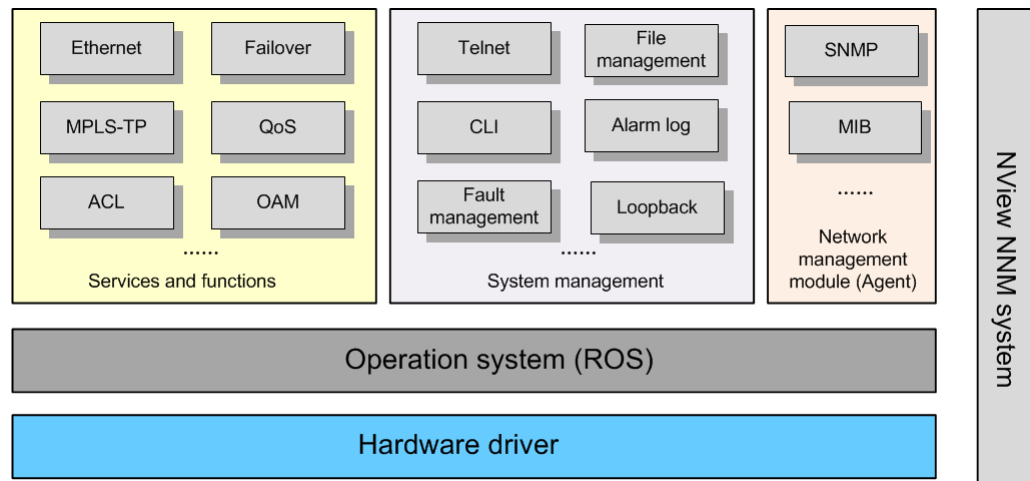
- Press the RST button (shorter than 3s): reboot the RAX700.
- Press the RST button (3s or longer): recover default configurations and reboot the RAX700.

2.2 Software structure

The Raisecom Operating System (ROS) platform is the core of Raisecom product software structure. It is responsible for managing the underlying hardware structure of all products and providing a uniformed operating platform for applications of the upper-layer software structure. It is of high reliability, instantaneity, self-healing capability, and maintenance capability.

Based on the ROS platform, the RAX700 provides the service and function module, system management module, network management module, and NView NNM system, as shown in Figure 2-4.

Figure 2-4 Software structure of the RAX700



Modules of the RAX700 work as below:

- Service and function module: provide multiple services and functions, including MPLS-TP, VLAN, MAC, static route, ACL, QoS, and OAM.
- System management: provide file management, remote login (Telnet and SSHv2), Command Line Interface (CLI), fault management, and alarm log for managing and maintaining the RAX700.
- Network management module (Agent): convert commands or requests sent by the NView NNM system to operation instructions special for the RAX700; finish commands sent by the NView NNM system; report alarms events generated on the RAX700 to the NView NNM system automatically.
- NView NNM system: the NView NNM system is Raisecom comprehensive network node management system. It is responsible for sending management commands, receiving management information from the Agent, resolving problems about Network Elements (NEs), such as centralized configuration, fault detection, topology management, and alarm management.

3 Technical specifications

This chapter introduces technical specifications of the RAX700, including the following sections:

- Overall specifications
- Interface specifications
- Laser security level
- Reliability specifications
- EMC specifications
- Security standard
- Environmental requirements

3.1 Overall specifications

Table 3-1 lists overall specifications of the RAX700.

Table 3-1 Overall specifications of the RAX700

Technical specifications		Description
Dimensions (mm)		180 (Width) × 160 (Depth) × 43.6 (Height)
Weight (kg)		< 1
Power consumption (W)		< 15
DC power input	Rated voltage (V)	-48
	Voltage range (V)	-36 to -72
AC power input	Rated voltage (V)	220
	Voltage range (V)	100–240
Universal power supply	Rated voltage (VDC)	-48
	Voltage range (VDC)	-36 to -72
	Rated voltage (VAC)	220

Technical specifications		Description
	Voltage range (VAC)	100–240
Operating temperature (°C)		-20 to +65
Operating humidity		20%–90% (RH, non-condensing)
Lightning protection level		<ul style="list-style-type: none"> • AC power: 6 kV in differential and common modes • DC power: no special requirements • Ethernet interface: 6 kV in common mode

3.2 Interface specifications

3.2.1 Optical interface

Table 3-2 lists parameters of the optical interface on the RAX700.

Table 3-2 Parameters of the optical interface

Parameter	Description
Connector type	LC/PC
Technical specifications	Depend on the selected SFP optical module.
Coding type	<ul style="list-style-type: none"> • 1000Base-SX/1000Base-LX/1000Base-ZX SFP: 8B/10B • 100Base-FX SFP: 4B/5B
Transmission rate	<ul style="list-style-type: none"> • 1000Base-SX/1000Base-LX/1000Base-ZX SFP optical module: 1.25 Gbit/s • 100Base-FX SFP optical module: 155 Mbit/s
Working mode	Full duplex

3.2.2 Ethernet interface

The Ethernet interface on the RAX701-GC is the RJ45 electrical interface compliant with the 10/100/1000Base-T standard. The Ethernet interface on the RAX701-FC is the RJ45 electrical interface compliant with the 10/100Base-T standard.

GE electrical interface

Table 3-3 lists parameters of the RJ45 GE electrical interface compliant with the 10/100/1000Base-T standard.

Table 3-3 Parameters of the RJ45 GE electrical interface compliant with the 10/100/1000Base-T standard

Parameter	Description
Connector type	RJ45
Rate	Support 10/100/1000 Mbit/s auto-negotiation.
Working mode	<ul style="list-style-type: none"> • 10/100/1000 Mbit/s auto-negotiation • Half/Full duplex mode auto-negotiation
Wiring	Support auto-MDI/MDIX.
Cable specifications	8-core cable A Cat. 5e STP cable is recommended.
Compliant standard	IEEE 802.3
Supported frame format	Ethernet-II, Ethernet-SAP, and Ethernet-SNAP
Support network protocol	IP

FE electrical interface

Table 3-4 lists parameters of the RJ45 FE electrical interface compliant with the 10/100Base-T standard.

Table 3-4 Parameters of the RJ45 FE electrical interface compliant with the 10/100Base-T standard

Parameter	Description
Connector type	RJ45
Rate	Support 10/100 Mbit/s auto-negotiation.
Working mode	Support half/full duplex mode auto-negotiation.
Wiring	Support auto-MDI/MDIX.
Cable specifications	8-core cable <ul style="list-style-type: none"> • A Cat. 5 or Cat. 5e UTP cable is recommended. • We recommend use a Cat. 5 STP cable when the operating environment has high requirements on electromagnetic compatibility.
Compliant standard	IEEE 802.3
Supported frame format	Ethernet-II, Ethernet-SAP, and Ethernet-SNAP
Support network protocol	IP

3.2.3 Management interface

SNMP interface

Table 3-5 lists parameters of the SNMP interface.

Table 3-5 Parameters of the SNMP interface

Parameter	Description
Connector type	RJ45
Rate	<ul style="list-style-type: none">• Support 10/100 Mbit/s auto-negotiation (RAX701-FC).• Support 10/100/1000 Mbit/s auto-negotiation (RAX701-GC).
Wiring	Support auto-MDI/MDIX.
Compliant standard	IEEE 802.3

Console interface

Table 3-6 lists parameters of the Console interface.

Table 3-6 Parameters of the Console interface

Parameter	Description
Connector type	USB
Working mode	Half duplex
Electrical properties	USB
Baud rate	9600 Baud
Cable specification	4-core cable

3.3 Laser security level

According to the Tx optical power, the security level of laser used by the RAX700 is Class 1, which means the Tx optical power of the optical interface cannot exceed 10 dBm (10 mW).



Warning

There is invisible laser in the fiber, which may cause eye injury. Therefore, you should not stare directly into the fiber end face.

3.4 Reliability specifications

Table 3-7 lists reliability specifications of the RAX700.

Table 3-7 Reliability specifications of the RAX700

Item	Description
System availability	99.999%, with the downtime not exceeding 5min
Average annual repair rate	< 0.2%
MTTR	< 2 hours
MTBF	100000 hours

3.5 EMC specifications

The RAX700 is developed according to the ETS 300386 and ETS 300127 recommendation, and has passed the EMC related tests.

3.6 Security standard

The RAX700 complies with the following security standards:

- EN 60950
- UL 60950

3.7 Environmental requirements

The RAX700 can be installed in the following scenarios:

- Telecommunication room
- Small telecommunication center or corridor
- Protected outdoor

The environment should meet the following requirements:

- ETSI EN 300 019

3.7.1 Storage environment

Climatic environment

Table 3-8 lists climatic environment requirements in storage.

Table 3-8 Climatic environment requirements in storage

Item	Description
Air pressure (kPa)	86–106
Storage temperature (°C)	-25 to +70
Operating humidity	10%–90% RH, non-condensing
Solar radiation (W/m ²)	≤ 1120
Heat radiation (W/m ²)	≤ 600
Wind speed (m/s)	≤ 20

Waterproof requirement

In general, the RAX700 should be installed indoor.

Ensure that there is no impounded water on the ground and avoid any liquid leakage above the device. Put the RAX700 away from the automatic fire-fighting facility and heating plants, etc.

If the RAX700 is installed outdoor, you need to ensure the following matters:

- Ensure that the packing case is intact.
- Take measurements to prevent water from entering the packing case.
- Ensure that there is no impounded water on the ground.
- Ensure no direct sunlight on the packing case.

Biotic environment

- Avoid reproduction of microbes, such as fungi and molds.
- Be away from the rodent, such as rats.

Air cleanliness

There should not be any explosive, electro-conductive, magneto-conductive, or corrosive substance.

Table 3-9 lists concentration requirements on the mechanical active substance in storage.

Table 3-9 Concentration requirements on the mechanical active substance in storage

Mechanical active substance	Concentration
Suspending dust (mg/m ³)	≤ 5.00
Droppable dust (mg/m ² h)	≤ 20.0
Grit (mg/m ³)	≤ 300

Table 3-10 lists concentration requirements on the chemical active substance in storage.

Table 3-10 Concentration requirements on the chemical active substance in storage

Chemical active substance	Concentration
SO ₂ (mg/m ³)	≤ 0.30
H ₂ S (mg/m ³)	≤ 0.10
NO ₂ (mg/m ³)	≤ 0.50
NH ₃ (mg/m ³)	≤ 1.00
Cl ₂ (mg/m ³)	≤ 0.10
HCl (mg/m ³)	≤ 0.10
HF (mg/m ³)	≤ 0.01
O ₃ (mg/m ³)	≤ 0.05

3.7.2 Transport environment

Climatic environment

Table 3-11 lists climatic environment requirements in transportation.

Table 3-11 Climatic environment requirements in transportation

Item	Description
Air pressure (kPa)	86–106
Temperature (°C)	-25 to +70
Temperature change rate (°C/min)	≤ 1
Operating humidity	10%–90% RH, non-condensing
Solar radiation (W/m ²)	≤ 1120
Heat radiation (W/m ²)	≤ 600
Wind speed (m/s)	≤ 20

Waterproof requirement

In transportation, you need to ensure the following matters:

- Ensure that the packing case is intact.
- Take measurements to prevent water from entering the packing case.
- Ensure that there is no impounded water on the vehicle.

Biotic environment

- Avoid reproduction of microbes, such as fungi and molds.
- Be away from the rodent, such as rats.

Air cleanliness

There should not be any explosive, electro-conductive, magneto-conductive, or corrosive substance.

Table 3-12 lists concentration requirements on the mechanical active substance in transportation.

Table 3-12 Concentration requirements on the mechanical active substance in transportation

Mechanical active substance	Concentration
Suspending dust (mg/m ³)	No requirement
Droppable dust (mg/m ² h)	≤ 3.0
Grit (mg/m ³)	≤ 100

Table 3-13 lists concentration requirements on the chemical active substance in transportation.

Table 3-13 Concentration requirements on the chemical active substance in transportation

Chemical active substance	Concentration
SO ₂ (mg/m ³)	≤ 0.30
H ₂ S (mg/m ³)	≤ 0.10
NO ₂ (mg/m ³)	≤ 0.50
NH ₃ (mg/m ³)	≤ 1.00
Cl ₂ (mg/m ³)	≤ 0.10
HCl (mg/m ³)	≤ 0.10
HF (mg/m ³)	≤ 0.01
O ₃ (mg/m ³)	≤ 0.05

3.7.3 Operating environment

Climatic environment



The temperature and humidity are measured 1.5 m above the ground and 0.4 m in front of the device.

Table 3-14 lists climatic environment requirements in operation.

Table 3-14 Climatic environment requirements in operation

Item	Description
Altitude (m)	≤ 4000
Air pressure (kPa)	86–106
Operating temperature (°C)	-20 to +65
Operating humidity	10%–90% RH, non-condensing
Temperature change rate (°C/min)	≤ 0.5
Solar radiation (W/m ²)	≤ 700
Heat radiation (W/m ²)	≤ 600
Wind speed (m/s)	≤ 5

Biotic environment

- Avoid reproduction of microbes, such as fungi and molds.
- Be away from the rodent, such as rats.

Air cleanliness

There should not be any explosive, electro-conductive, magneto-conductive, or corrosive substance.

Table 3-15 lists concentration requirements on the mechanical active substance in operation.

Table 3-15 Concentration requirements on the mechanical active substance in operation

Mechanical active substance	Concentration
Dust grain (grain/m ³)	≤ 3 × 10 ⁵
Suspending dust (mg/m ³)	≤ 0.2
Droppable dust (mg/m ³ h)	≤ 15
Grit (mg/m ³)	≤ 100

Table 3-16 lists concentration requirements on the chemical active substance in operation.

Table 3-16 Concentration requirements on the chemical active substance in operation

Chemical active substance	Concentration
SO ₂ (mg/m ³)	≤ 0.30
H ₂ S (mg/m ³)	≤ 0.10

Chemical active substance	Concentration
NH ₃ (mg/m ³)	≤ 3.00
Cl ₂ (mg/m ³)	≤ 0.10
HCl (mg/m ³)	≤ 0.10
HF (mg/m ³)	≤ 0.01
O ₃ (mg/m ³)	≤ 0.05

4 Appendix

The appendix includes the following sections:

- Cables
- Lookup table of optical/electrical module
- Terms
- Acronyms and abbreviations

4.1 Cables



The device is delivered without cables, so you need to purchase them as required.

4.1.1 Fiber

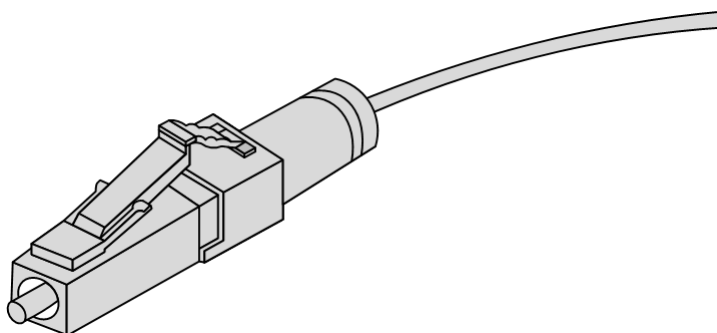
The RAX700 uses the 2 mm single-mode or 2 mm multi-mode fiber with the LC/PC fiber connector.



Choose the fiber length reasonably based on on-site requirements.

Figure 4-1 shows the appearance of the LC/PC fiber connector.

Figure 4-1 LC/PC fiber connector



When connecting or removing the LC/PC fiber connector, align the connector with the optical interface, and do not rotate the fiber. Operate as below:

- To connect the fiber, align the head of the fiber with the optical interface and insert the fiber into the interface gently.
- To remove the fiber, press down the clamping connector, and push the fiber head inwards, and then pull the fiber out.

4.1.2 Ethernet cable

The Ethernet cable of the RAX700 can be used to:

- Connect the Ethernet electrical interface of the RAX700 to other devices.
- Connect the SNMP interface of the RAX700 to the NView NNM system.

Figure 4-2 shows the appearance of the Ethernet cable.

Figure 4-2 Ethernet cable

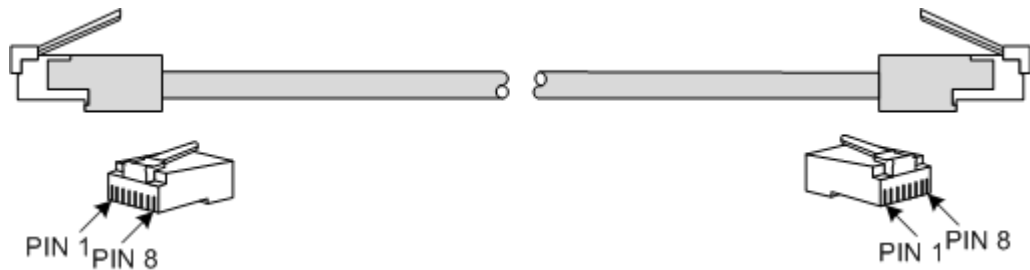


Table 4-1 lists EIA/TIA 568A wiring and EIA/TIA 568B wiring.

Table 4-1 Wiring of EIA/TIA 568A and EIA/TIA 568B

Connector (RJ45)	EIA/TIA 568A	EIA/TIA 568B
PIN 1	White/Green	White/Orange
PIN 2	Green	Orange
PIN 3	White/Orange	White/Green
PIN 4	Blue	Blue
PIN 5	White/Blue	White/Blue
PIN 6	Orange	Green
PIN 7	White/Brown	White/Brown
PIN 8	Brown	Brown

The 10/100/1000 Mbit/s straight-through cable requires that both two RJ45 connectors follow EIA/TIA 568B wiring, as shown in Figure 4-3.

Figure 4-3 Wiring of the straight-through cable

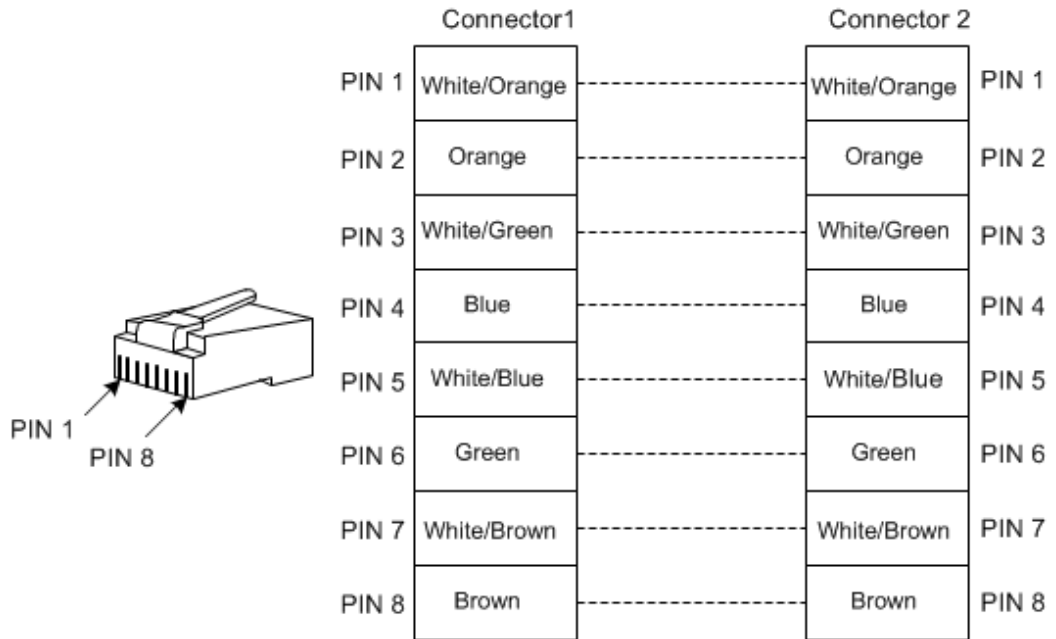


Figure 4-4 shows wiring of the 100 Mbit/s crossover cable.

Figure 4-4 Wiring of the 100 Mbit/s crossover cable

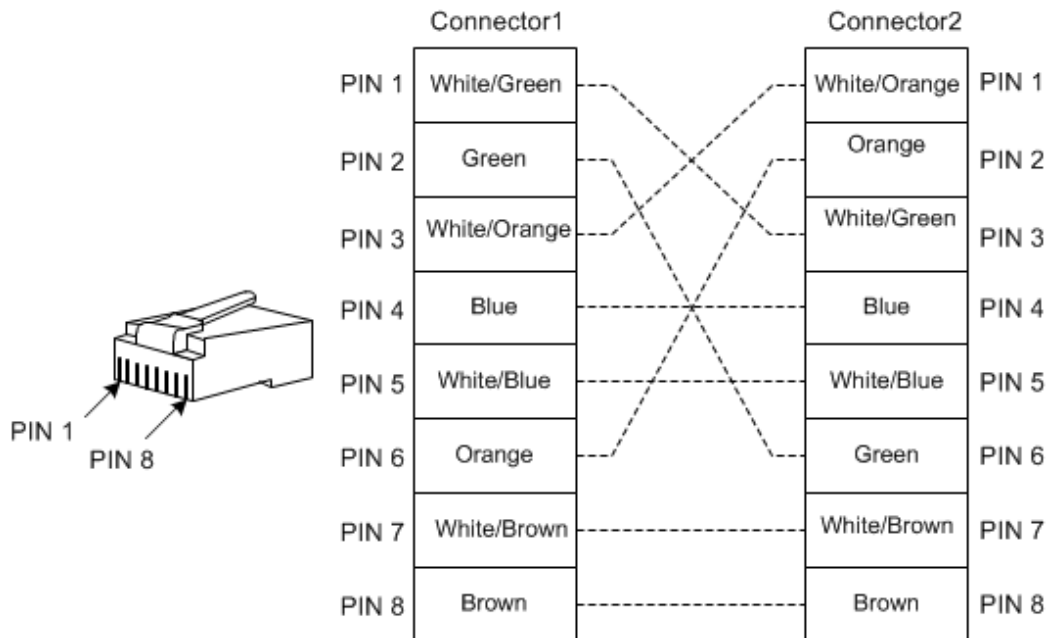


Figure 4-5 shows wiring of the 1000 Mbit/s crossover cable.

Figure 4-5 Wiring of the 1000 Mbit/s crossover cable

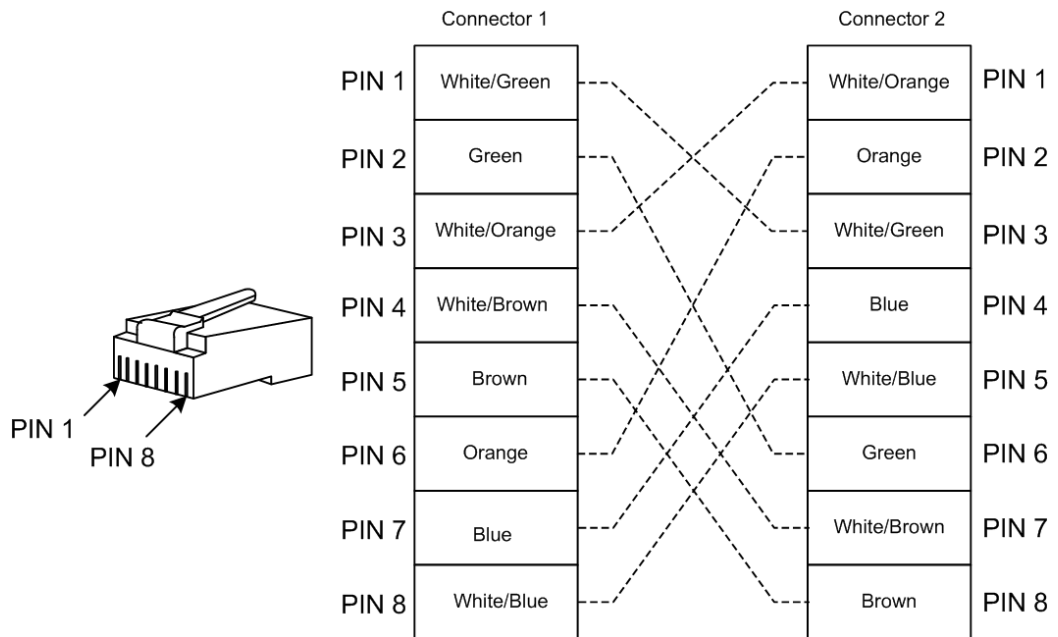


Table 4-2 lists technical specifications of the Ethernet cable.

Table 4-2 Technical specifications of the Ethernet cable

Item	Description
Name	<ul style="list-style-type: none"> • Straight-through cable: CBL-ETH-RJ45/RJ45-D • Crossover cable: CBL-ETH-RJ45/RJ45-X-D
Connector	RJ45 crystal head
Model	<ul style="list-style-type: none"> • Cat 5 or better UTP cables (UTP-5 and UTP-5e) • STP cables
Number of cores	8
Length	The letter D indicates the length, which is customized. For example, if the customer requires 2-meter cables, they are named CBL-ETH-RJ45/RJ45-2m.

4.1.3 Configuration cable

The configuration cable is used to connect the Console interface on the device and the PC.

Both two connectors of the configuration cable for the RAX700 are of the USB A male interface, as shown in Figure 4-6.

Figure 4-6 Configuration cable

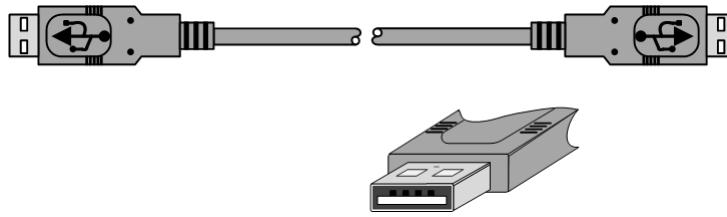


Table 4-3 lists technical specifications of the configuration cable.

Table 4-3 Technical specifications of the configuration cable

Item	Description
Name	USB configuration cable
Connector	USB A male interface connector
Model	CBL-USB-A(M)/A(M)-1.5m/straight-through
Length	1.5 m

4.1.4 Power cable

DC power cable

The DC power cable supplies -48 VDC power from the power sourcing equipment to the power interface on the front panel of the RAX700, and then transmits power to the entire device.

Figure 4-7 shows the DC power cable.

Figure 4-7 DC power cable



Table 4-4 lists technical specifications of the DC power cable.

Table 4-4 Technical specifications of the DC power cable

Item	Description
Name	POL-DC-U-shaped terminal/stripped-0.75mm ² -1.5m
Color	<ul style="list-style-type: none"> Red (+VIN) Black (-VIN)
Stripped	Stripped end 10mm tinning
U-shape terminal	22-16KT soldering lug
Wire gauge of the inner conductor	18 AWG

Item	Description
Cross-sectional area of the inner conductor	$2 \times 0.75 \text{ mm}^2$
Length	1.5 m

AC power cable

The AC power cable supplies 110/220 VAC power from the power sourcing equipment to the power interface on the RAX700, and then transmits power to the entire device. Types of the AC power cable of the RAX700 depend on different regional standards, as shown in Table 4-5.

Table 4-5 AC power cable of the RAX700

Regional standard	Name
European standard	POL-AC-European standard-3-pin/receptacle-0.75mm ² -1.5m/RoHS
American standard	POL-AC-American standard-3-pin/receptacle-18AWG-1.5m/RoHS

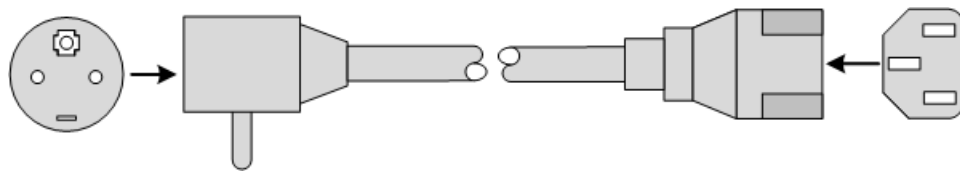


Note

Raisecom also provides the standard cable used in Brazil. If required, contact Raisecom technical support engineers.

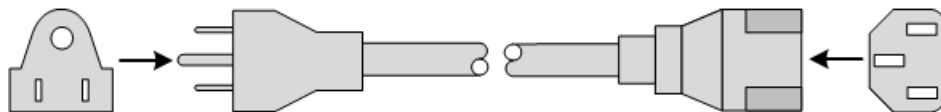
The AC power cable which meets the European standard is composed of a European standard French mode 3-pin plug and a receptacle connector, as shown in Figure 4-8.

Figure 4-8 European standard AC power cable



The AC power cable which meets the American standard is composed of an American standard 3-pin plug and a receptacle connector, as shown in Figure 4-9.

Figure 4-9 American standard AC power cable



4.1.5 Grounding cable

The grounding cable is used to ground the RAX700.

The grounding cable is composed of two round pressed terminals and the coaxial cable, as shown in Figure 4-10.

Figure 4-10 Grounding cable

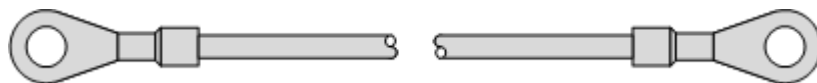


Table 4-6 lists technical specifications of grounding cable.

Table 4-6 Technical specifications of the grounding cable

Item	Description
Model (recommended)	PIL-grounding cable-Φ4-D
Conducting wire	Yellow/Green multi-strand copper-core conducting wire 16AWG (1.25 mm ²)
OT terminal	Protective grounding round pressed terminal (M4)
Cross-sectional area of conducting wire	16-15AWG (1.2-1.5 mm ²)
Length	The letter D indicates the length, which is customized. For example, if the customer requires 2-meter cables, they are named PIL-grounding cable-Φ4-2m.

4.2 Lookup table of optical/electrical module

4.2.1 FE SFP optical module

Table 4-7 lists parameters of the 100BASE-FX SFP optical module.

Table 4-7 Parameters of the 100BASE-FX SFP optical module

Model	Tx wavelength (nm) (laser)	Rx laser	Tx optical power (dBm)	Min. overload point (dBm)	Extinction ratio (dB)	Rx sensitivity (dBm)	Transmission distance (km)
USFP-03/M-D-R	1310 (LED)	PIN	-20 to -10	-14	9	-29	2
USFP-03/S1-D-R	1310 (FP)	PIN	-15 to -8	-8	9	-34	15
USFP-03/S2-D-R	1310 (DFB)	PIN	-5 to 0	-8	9	-34	40
USFP-03/S3-D-R	1550 (DFB)	PIN	-5 to 0	-10	9	-34	80

Model	Tx wavelength (nm) (laser)	Rx laser	Tx optical power (dBm)	Min. overload point (dBm)	Extinction ratio (dB)	Rx sensitivity (dBm)	Transmission distance (km)
USFP-03/SS13-D-R	TX1310/RX1550 (FP/DFB)	PIN	-15 to -8	-8	9	-28	15
USFP-03/SS15-D-R	TX1550/RX1310 (FP/DFB)	PIN	-15 to -8	-8	9	-28	15
USFP-03/SS23-D-R	TX1310/RX1550 (FP/DFB)	PIN	-5 to 0	-8	8.2	-32	40
USFP-03/SS25-D-R	TX1550/RX1310 (FP/DFB)	PIN	-5 to 0	-8	8.2	-32	40
USFP-03/SS34-D-R	TX1490/RX1550 (FP/DFB)	PIN	-3 to 2	-8	8.2	-32	80
USFP-03/SS35-D-R	TX1550/RX1490 (FP/DFB)	PIN	-3 to 2	-8	8.2	-32	80

4.2.2 FE SFP electrical module

Table 4-8 lists parameters of the FE SFP electrical module.

Table 4-8 Parameters of the FE SFP electrical module

Model	Application code	Auto-negotiation	Data interface	LOS alarm	Transmission distance (m)
USFP-FE/AN-R	10/100BASE-TX	Supported	SerDes	Supported	100

4.2.3 GE SFP optical module

Table 4-9 lists parameters of the 1000BASE-X SFP optical module.

Table 4-9 Parameters of the 1000BASE-X SFP optical module

Model	Tx wavelength (nm) (laser)	Rx laser	Tx optical power (dBm)	Min. overload point (dBm)	Extinction ratio (dB)	Rx sensitivity (dBm)	Transmission distance (km)
USFP-Gb/M-D-R	850 (VCSEL)	PIN	-10 to -3	-3	9	-15	0.55
USFP-Gb/S1-D-R	1310 (FP)	PIN	-10 to -3	-3	9	-21	15
USFP-Gb/S2-D-R	1550 (DFB)	PIN	-3 to 2	-3	9	-21	40
USFP-Gb/S3-D-R	1550 (DFB)	APD	-3 to 2	-9	9	-30	80
USFP-Gb/LH1-D-R	1310 (DFB)	PIN	-4 to -0	-3	9	-21	40
USFP-Gb/ZX-D-R	1550 (DFB)	PIN	-2 to 3	-3	9	-22	80
USFP-Gb/EX-D-R	1550 (DFB)	APD	0-5	-9	9	-30	120
USFP-Gb/SS13-D-R	TX1310/RX1550 (FP/DFB)	PIN	-10 to -3	-3	9	-21	15
USFP-Gb/SS15-D-R	TX1550/RX1310 (FP/DFB)	PIN	-10 to -3	-3	9	-21	15
USFP-Gb/SS13-4	TX1310/RX1490 (DFB)	PIN	-10 to -3	-3	9	-21	15
USFP-Gb/SS14-3	TX1490/RX1310 (DFB)	PIN	-10 to -3	-3	9	-21	15
USFP-Gb/SS24-D-R	TX1490/RX1550 (DFB)	PIN	-3 to 2	-3	9	-21	40
USFP-Gb/SS25-D-R	TX1550/RX1490 (DFB)	PIN	-3 to 2	-3	9	-21	40
USFP-Gb/SS34-D-R	TX1490/RX1550 (DFB)	PIN	-3 to 2	-3	9	-29	100

Model	Tx wavelength (nm) (laser)	Rx laser	Tx optical power (dBm)	Min. overload point (dBm)	Extinction ratio (dB)	Rx sensitivity (dBm)	Transmission distance (km)
USFP-Gb/SS35-D-R	TX1550/RX1490 (DFB)	PIN	-3 to 2	-3	9	-29	100

4.2.4 GE SFP electrical module

Table 4-10 lists parameters of the GE SFP electrical module.

Table 4-10 Parameters of the GE SFP electrical module

Model	Application code	Auto-negotiation	Data interface	LOS alarm	Transmission distance (m)
USFP-GE-R	1000BASE-T	–	SerDes	Supported	100
USFP-GE/AN-R	10/100/1000BASE-T	Supported	SGMII	Supported	100

4.3 Terms

1+1 protection	<p>A 1+1 protection architecture has one normal traffic signal, one working transport entity, one protection transport entity, and a permanent bridge.</p> <p>At the source end, the normal traffic signal is permanently bridged to both the working and the protection transport entities. At the sink end, the normal traffic signal is selected from the better of the two transport entities.</p> <p>Due to the permanent bridging, the 1+1 protection architecture does not allow an unprotected extra traffic signal to be provided.</p>
100BASE-T	<p>A FE standard for twisted-pair cables. Fast Ethernet refers to any network that supports transmission rate of 100Mbps/s. The Fast Ethernet is 10 times faster than 10BaseT, and inherits frame format, MAC addressing scheme, MTU, and so on. Fast Ethernet is extended from the IEEE802.3 standard, and it uses the following three types of transmission media: 100BASE-T4: 4 pairs of phone twisted-pair cables 100BASE-TX: 2 pairs of data twisted-pair cables 100BASE-FX: 2-core optical fibers.</p>
100BASE-TX	<p>100BASE-TX makes use of two pairs of twisted pair cable. One pair is used for transmission and the other pair is used for reception. Both the STP cable and Cat 5 UTP cable are allowed.</p>

A

Access Control List (ACL)	<p>A series of ordered rules composed of permit deny sentences. These rules are based on the source MAC address, destination MAC address, source IP address, destination IP address, interface ID, etc. The device decides to receive or refuse the packets based on these rules.</p>
Auto-negotiation	<p>The interface automatically chooses the rate and duplex mode according to the result of negotiation. The auto-negotiation process is: the interface adapts its rate and duplex mode to the highest performance according to the peer interface, that is, both ends of the link adopt the highest rate and duplex mode they both support after auto-negotiation.</p>
Automatic Protection Switching (APS)	<p>APS is used to monitor transport lines in real time and automatically analyze alarms to discover faults. When a critical fault occurs, through APS, services on the working line can be automatically switched to the protection line, thus the communication is recovered in a short period.</p>

B

Baud rate	<p>Times of signal changes every second on a transmission link. In general, there are only two types of signal status, so the baud rate is the number of bits transmitted every second. Since lower-layer transmission will occupy some bandwidth, so user data are not necessarily transmitted according to the rated baud rate.</p>
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C

Clock synchronism	<p>The Synchronous Digital Hierarchy (SDH) network adopts the hierarchical master-slave synchronization mode. Namely, a Primary Reference Clock (PRC) controls clock synchronization on the entire network through synchronization links. A series of hierarchical clocks are used and clocks at each hierarchy are synchronized to the clocks at the upper or same hierarchy.</p>
Connectivity Fault Management (CFM)	<p>CFM, defined by ITU-Y.1731 and IEEE802.1ag, is an end-to-end service-level Ethernet OAM technology. This function is used to actively diagnose faults for Ethernet Virtual Connection (EVC), provide cost-effective network maintenance solutions, and improve network maintenance.</p>

D

Dynamic Host Configuration Protocol (DHCP)	<p>A technology used for assigning IP address dynamically. It can automatically assign IP addresses for all clients in the network to reduce workload of the administrator. In addition, it can realize centralized management of IP addresses.</p>
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E

Electro Magnetic Compatibility (EMC)	EMC refers to the capability of a device or sub-system to work properly in an electromagnetic environment without causing unbearable electromagnetic disturbance on other devices or sub-systems. It is an important indicator of system reliability.
Ethernet	It is founded by Xerox Corporation and defined by DEC, Intel, and Xerox. Ethernet is the most widely used LAN. Its rates include 10 Mbit/s, 100 Mbit/s, and 1000 Mbit/s. Ethernet adopts CSMA/CD mechanism and complies with IEEE 802.3 standard.
Ethernet in the First Mile (EFM)	Complying with IEEE 802.3ah protocol, EFM is a link-level Ethernet OAM technology. It provides the link connectivity detection, link fault monitoring, and remote fault notification, etc. for a link between two directly-connected devices. EFM is mainly used for the Ethernet link on edges of the network accessed by users.
Ethernet Linear Protection Switching (ELPS)	It is an APS protocol, based on ITU-T G.8031 standard, used to protect the Ethernet link. It is an end-to-end protection technology, including two line protection modes: linear 1:1 protection switching and linear 1+1 protection switching.
Ethernet Ring Protection Switching (ERPS)	It is an APS protocol based on ITU-T G.8032 standard, which is a link-layer protocol specially used for the Ethernet ring. In normal conditions, it can avoid broadcast storm caused by the data loop on the Ethernet ring. When the link or device on the Ethernet ring fails, services can be quickly switched to the backup line to enable services to be recovered in time.
Extinction ratio	The extinction ratio refers to the smallest ratio of A and B in complete modulation under the worst reflection conditions, that is $ER=10\lg(A/B)$. Wherein, A refers to the average Tx optical power at high voltage level and B refers to that at low voltage level.
F	
Failover	Failover provides an interface linkage scheme, extending the range of link backup. Through monitoring upstream links and synchronizing downstream links, faults of the upstream device can be transferred quickly to the downstream device, and primary/backup switching is triggered. In this way, it avoids traffic loss because the downstream device does not sense faults of the upstream link.
Fiber	Filamentous optical waveguide composed of electrical materials, used to conduct electromagnetic energy in the form of optical wave.
Frame	It is a data transmission unit, composed of several parts, each of which has different functions.
Full duplex	In a communication link, both parties can receive and send data concurrently.

G

Grounding cable The cable to connect the device to ground, usually a yellow/green coaxial cable. Connecting the grounding cable properly is an important guarantee to lightning protection, anti-electric shock, and anti-interference.

H

Half duplex In a communication link, both parties can receive or send data at a time.

L

Light Amplification by Stimulated Emission of Radiation (LASER) A laser is a device that emits light through a process of optical amplification based on the stimulated emission of electromagnetic radiation.

Link Aggregation With link aggregation, multiple physical Ethernet interfaces are combined to form a logical aggregation group. Multiple physical links in one aggregation group are taken as a logical link. Link aggregation helps share traffic among member interfaces in an aggregation group. In addition to effectively improving the reliability on links between devices, link aggregation can help gain greater bandwidth without upgrading hardware.

Link Aggregation Control Protocol (LACP) A protocol used for realizing link dynamic aggregation. The LACPDU is used to exchange information with the peer device.

Link Aggregation Group (LAG) Multiple physical Ethernet interfaces are combined to form a LAG, which increases the bandwidth and realizes load balancing.

Loopback It is the process that a signal is sent out and then sent back to the sender. It is used to detect and analyze potential faults in a ring network.

M

Maintenance associations End Point (MEP) MEP is an edge node of a service instance. MEPs can be used to send and process CFM packets. The MA and the MD where MEP locates decide the VLAN and the level for packets received and sent by MEP.

Maintenance association Intermediate Point (MIP) MIP is the internal node of a service instance, which is automatically created by the device. MIP cannot actively send CFM packets but can forward and respond to Link Trace Message (LTM) and LoopBack Message (LBM).

Mapping A virtual data corresponding relationship

Metropolitan Area Network (MAN)	<p>A high-speed computer network which connects multiple LANs within the effective distance in the urban region. The coverage of MAN is larger than that of LAN and smaller than that of WAN. The transmission medium is fiber and the MAN can be used as the backbone network.</p>
Mobile Backhaul	<p>It is used to solve communication problems from BTS to BSC for 2G and from Node B to RNC for 3G.</p> <p>In 2G times, mobile backhaul is realized through TDM microwave or SDH/PDH device since voice services play a primary role and there is no high requirement on the bandwidth.</p> <p>In 3G times, IP services are involved since lots of data services like HSPA and HSPA+ exist, and voice services tend to change to IP services, that is, IP RAN. To solve mobile backhaul problems of IP RAN, you need to establish a backhaul network, which can meet requirements on both data backhaul and voice transmission over IP (clock synchronization).</p>
Multi-mode Fiber	<p>In this fiber, multi-mode optical signals are transmitted.</p>

O

Optical power	<p>The work done by light within a time unit</p> <p>Units of optical power include mW and dBm, of which the former is a linear unit and the latter is a logarithmic unit. The relationship between the two units is: $P(\text{dBm})=10\text{Log}(P(\text{mW})/1\text{mW})$</p>
Optical Distribution Frame (ODF)	<p>A distribution connection device between the fiber and a communication device. It is an important part of the optical transmission system. It is mainly used for fiber splicing, optical connector installation, fiber adjustment, additional pigtail storage, and fiber protection.</p>

P

Packet	<p>In data communication field, packet is the data unit for switching and transmitting information. In transmission, it will be continuously encapsulated and decapsulated. The header is used to define the destination address and source address. The trailer contains information indicating the end of the packet. The payload data in between is the actual packet.</p>
Packet Switching	<p>In packet switching network, data is partitioned into multiple data segments. The data segment is encapsulated by control information, such as, destination address, to form the switching packet. The switching packet is transmitted to the destination in the way of storage-forwarding in the network. Packet switching is developed based on the storage-forwarding method and has merits of both circuit switching and packet switching.</p>

Protection switching It is a feature of transport entities. It can transmit traffic of a failed device or link to another device or link, which is a bidirectional feature. After you establish M protection lines for N ($1 \leq M \leq N$) working lines, when the working line fails, one of the M protection lines is determined according to the usage of locally saved protection lines and protocol signaling transmission, to replace the working line.

Q

QinQ 802.1Q in 802.1Q (QinQ), also called Stacked VLAN or Double VLAN, is extended from 802.1Q and defined by IEEE 802.1ad recommendation. This VLAN feature allows the equipment to add a VLAN tag to a tagged packet. The implementation of QinQ is to add a public VLAN tag to a packet with a private VLAN tag, making the packet encapsulated with two layers of VLAN tags. The packet is forwarded over the ISP's backbone network based on the public VLAN tag and the private VLAN tag is transmitted as the data part of the packet. In this way, the QinQ feature enables the transmission of the private VLANs to the peer end transparently. There are two QinQ types: basic QinQ and selective QinQ.

Quality of Service (QoS) A network security mechanism, used to solve problems of network delay and congestion. When the network is overloaded or congested, QoS can ensure that packets of important services are not delayed or discarded and the network runs high efficiently. Depending on the specific system and service, it may relate to jitter, delay, packet loss ratio, bit error ratio, and signal-to-noise ratio.

R

Rapid Spanning Tree Protocol (RSTP) Evolution of the Spanning Tree Protocol (STP), which provides improvements in the speed of convergence for bridged networks

Relative Humidity (RH) The percentage of absolute humidity and saturated humidity in the air within a certain period

S

Sensitivity The minimum average input optical power received by the optical receiver when the frame loss rate of the fiber transceiver is zero in full-load data traffic conditions

Simple Network Management Protocol (SNMP) A network management protocol defined by Internet Engineering Task Force (IETF) used to manage devices in the Internet. SNMP can make the network management system to remotely manage all network devices that support SNMP, including monitoring network status, modifying network device configurations, and receiving network event alarms. At present, SNMP is the most widely-used network management protocol in the TCP/IP network.

Single-mode fiber	In this fiber, single-mode optical signals are transmitted.
Spanning Tree Protocol (STP)	STP can be used to eliminate network loops and back up link data. It blocks loops in logic to prevent broadcast storms. When the unblocked link fails, the blocked link is re-activated to act as the backup link.
SyncE	A technology that adopts Ethernet link code stream to recover clocks, and provides high-precision frequency synchronization for the Ethernet similar to SDH clock synchronization. Different from the traditional network which just synchronizes data packets on the receiving node, the internal clock synchronization mechanism of the SyncE is real-time.
T	
Time To Live (TTL)	A technique used in best-effort delivery systems to prevent packets that loop endlessly. The TTL is set by the sender to the maximum time the packet is allowed to be in the network. Each router in the network decrements the TTL field when the packet arrives, and discards any packet if the TTL counter reaches zero.
Time Division Multiplexing (TDM)	TDM is a method of transmitting multiple independent signals (digitalized data, voice, or video signals) over a common signal path by means of synchronized switches at each end of the transmission line so that each signal appears on the line only a fraction of time in an alternating pattern.
Topology	Topology includes routes and devices, describing the interconnection relationship among network nodes. It also refers to the network structure in general sense, that is, the physical layout of connected devices.
V	
Virtual Private Network (VPN)	Network scheme in which portions of a network are connected via the Internet, but information sent across the Internet is encrypted. The result is a virtual network that is also part of a larger network entity. This enables corporations to provide telecommuters and mobile professionals with local access to their corporate network or to another ISP network. VPNs are possible because of technologies and standards such as tunneling, screening, encryption, and IPsec.

4.4 Acronyms and abbreviations

3G 3rd-Generation

A

AC	Alternating Current
ACL	Access Control List
AN	Access Node
APD	Avalanche Photo Diode
APS	Automatic Protection Switching
ATM	Asynchronous Transfer Mode
B	
BC	Boundary Clock
BITS	Building Integrated Timing Supply System
BSC	Base Station Controller
BTS	Base Transceiver Station
C	
CBS	Committed Burst Size
CC	Continuity Check
CCM	Continuity Check Message
CE	Conformite Europeenne
CE	Customer Edge
CES	Circuit Emulation Service
CFM	Connectivity Fault Management
CIR	Committed Information Rate
CLI	Command Line Interface
CoS	Class of Service
CRC	Cyclic Redundancy Check
D	
DC	Direct Current
DFB	Distributed Feed Back
DHCP	Dynamic Host Configuration Protocol
DLF	Destination Lookup Failure
DRR	Deficit Round Robin
DS	Differentiated Services

DSCP	Differentiated Services Code Point
E	
EBS	Excess Burst Size
EFM	Ethernet in the First Mile
EIR	Excess Information Rate
E-LAN	Ethernet-LAN
E-Line	Ethernet-Line
ELPS	Ethernet Linear Protection Switching
EMC	Electro Magnetic Compatibility
EPL	Ethernet Private Line
ERPS	Ethernet Ring Protection Switching
E-Tree	Ethernet-Tree
ETS	European Telecommunications Standards
ETSI	European Telecommunications Standards Institute
EVC	Ethernet Virtual Connection
EVPL	Ethernet Virtual Private Line
F	
FE	Fast Ethernet
FP	Fabry-Perot
FP	Fault-Pass
G	
GE	Gigabit Ethernet
GPS	Global Positioning System
GUI	Graphic User Interface
H	
HDB3	High Density Bipolar of Order 3 Code
I	
IEC	International Electro technical Commission

IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
iTN	intelligent Transport Network
ITU-T	International Telecommunications Union-Telecommunication Standardization Sector
L	
LACP	Link Aggregation Control Protocol
LAN	Local Area Network
LB	Loop Back
LC	Little Connector
LED	Light Emitting Diode
LLDP	Link Layer Discovery Protocol
LLDPDU	Link Layer Discovery Protocol Data Unit
LOS	Loss of Signal
LSA	Link State Advertisement
LT	Link Trace
M	
MAC	Medium Access Control
MDI	Medium Dependent Interface
MEF	Metro Ethernet Forum
MEP	Maintenance association End Point
MIB	Management Information Base
MIP	Maintenance association Intermediate Point
MP	Maintenance Point
MPLS	Multi Protocol Label Switching
MPLS-TP	Multi-Protocol Label Switching in Transport Networks
MSTI	Multiple Spanning Tree Instance
MSTP	Multiple Spanning Tree Protocol
MTBF	Mean Time Between Failure
MTTR	Mean Time to Repair

N

NNI	Network Node Interface
NNI	Network to Network Interface
NNM	Network Node Management
NView NNM	NView Network Node Management

O

OAM	Operation, Administration, and Management
ODF	Optical Distribution Frame

P

PC	Personal Computer
PDH	Plesiochronous Digital Hierarchy
PDU	Protocol Data Unit
PIN	P type-intrinsic-n type
POS	Packet Over SDH
PSN	Packet Switched Network
PTN	Packet Transport Network
PVC	Permanent Virtual Circuit
PW	Pseudo Wire
PWE3	Pseudo Wire Emulation Edge-to-Edge

Q

QoS	Quality of Service
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R

RADIUS	Remote Authentication Dial In User Service
RED	Random Early Detection
RH	Relative Humidity
RNC	Radio Network Controller
RoHS	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
ROS	Raisecom Operating System

RSTP	Rapid Spanning Tree Protocol
S	
SDH	Synchronous Digital Hierarchy
SerDes	SERializer/DESerializer
SFP	Small Form-factor Pluggable
SLA	Service Level Agreement
SNMP	Simple Network Management Protocol
SP	Strict-Priority
SSHv2	Secure Shell v2
STP	Shield Twisted Pair
STP	Spanning Tree Protocol
T	
TACACS	Terminal Access Controller Access Control System
TDM	Time Division Multiplex
TDMoP	Time Division Multiplex over Packet
TE	Traffic Engineering
TLV	Type Length and Value
ToS	Type of Service
TTL	Time to Live
U	
UL	Underwriter Laboratories
V	
VCSEL	Vertical Cavity Surface-Emitting Laser
VLAN	Virtual Local Area Network
VPN	Virtual Private Network
W	
WCDMA	Wideband Code Division Multiple Access
WRED	Weighted Random Early Detection

WRR

Weight Round Robin

