ZTE中兴

ZXA10 MSAN
Technical Specification (V2.0)

中兴通讯股份有限公司

ZTE CORPORATION

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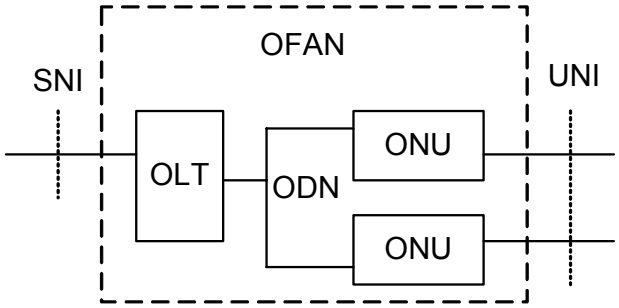
1 ZXA10 SYSTEM OVERVIEW

1.1 Architecture of the Optical Fiber Access Network system

The Optical Fiber Access Network (OFAN for abbreviation) serves as the junction between service network (SN) and the subscriber terminal equipment, and connects with service network through the service network interface (SNI). By means of V5 interface, OFAN can implement transparent digital connection between LE and the subscriber terminal equipment, thus providing POTS and ISDN services for the subscriber; and by means of FE/GE or ATM, OFAN can connect the backbone network and can provide high speed broadband data service to the subscriber; furthermore, via the leased line interface, OFAN can provide the dedicated line to some important group subscribers in different areas. In one word, OFAN can access the multi services in addition to ordinary voice services in the same platform. The functional structure of OFAN in actual use is shown in Fig. 1.



OFAN	: Optical Fiber Access Network	*OLT*	: Optical Line Terminal
ONU	: Optical Network Unit	*SNI*	: Service Node Interface
UNI	: User Network Interface	*ODN*	: Optical Distribution Network

Figure 1 OFAN functional structure

OLT is used to provide OFAN with the interface to the service network at the network side and to communicate with ONU of the subscriber side via optical transmission. OLT can completely isolate the switching function of LE from subscriber access. Usually OLT is placed at the exchange end together with LE, providing the maintenance and supervision on itself and ONU at the subscriber side. ZXA10 OLTC also can combine narrowband service and broadband service for the near end local users by cascading user unit, and provide uplink interface such as FE/GE for these near end local broadband users.

ONU is used to provide OFAN with interfaces at the subscriber side, which can be connected to a number of subscriber terminals. Meanwhile, ONU is capable of optical-electrical conversion and the corresponding maintenance and monitoring functions. Usually, ONU is placed in the vicinity of subscribers.

OLT and ONU are connected via Optical Distribution Network (ODN) which can be implemented with the standard optical transmission system.

1.2 ZXA10 Architecture

1.2.1 System Design Philosophy of ZXA10

As a leading corporation in Access Network area, taking all these new technologies and all kinds of service requirements into consideration, ZTE puts forward the new generation access network system ZXA10 OLTC and ZXA10 ONUC. The new generation ZXA10 is designed based on the following key factors:

- Abundant types of user interfaces

As the ZXA10 MSAN provides multiple access means including POTS, ADSL/ADSL 2/ADSL 2+, VDSL2, ISDN, DDN, SHDSL, Ethernet (100/1000M) and EPON/GPON it can meet the diversified service requirements of different users and offer the integrated access capability.

- Powerful networking capability

ZXA10 MSAN provides abundant networking and protection modes(such as ring, subtending, star) adapts to different network conditions, and can rapidly construct networks and provision services. For broadband services, ZXA10 MSAN adopts the FE/GE cascading broadband card to construct ring/star/subtending network. For narrowband services, ZXA10 MSAN provides STM-1 interface(IST card) to support different networking modes (ring, subtending, and star). For star topology, there is no limitation for MSAN number. For subtending, although the number is unlimited in theory, it is strongly recommended less than 10 sets is preferred considering the synchronization and QOS problem. For ring topology, 252 sets MSAN is the maximum number, no more than 10 sets is better for the synchronization and QOS problem..

- Series of products

The ZXA10 MSAN provides a series of ONUC equipment to adapt to different capacity and application environment requirements. It has powerful environment adaptability and can satisfy a variety of networking requirements.

- Convenient management

The full line of products support unified equipment management and service management with easy operation and use. While providing the topology management function, they support hierarchical management based on the equipment type and management layer to facilitate management by level and management by area. The end-to-end auto/semi-auto service configuration function at the network level makes service provisioning and adjustment much easier.

- Carrier-class reliability

The system is designed fully on the basis of carrier-class applications, and it has consolidated active/standby protection capability and flexible configuration capability. Its multiple QoS policies fully guarantee the communication quality of users.

- Full utilization of the existing network resources to speed up the network change process

The ZXA10 MSAN adopts modular design and can provide multiple kinds of standard interfaces to adapt to the actual network requirements. This not only makes capacity expansion and introduction of new services much easier, but also enables the system to be

fully compatible with the existing network technologies and utilize the existing network resources (such as copper cables of local subscribers, transmission media and Intranet technologies), thus effectively protecting the existing network investment and speeding up the process of change from a single-service network to an integrated service network.

- Smooth evolution to the next generation IP network

Based on the core IP+TDM technologies, the system can be smoothly upgraded to MSAG equipment and merged into the NGN.ZXMSG product shares the hardware platform with ZXA10, protecting operators' investment.

ZXA10 T600 system can be upgraded to ZXMSG 5600 with only updating the software and adding the relevant media processing board.

ZXA10 U300 system can be upgraded to ZXMSG 5200 with only updating the software and adding the relevant media processing board.

1.2.2 Modular architecture

The new-generation integrated AN system ZXA10 of ZTE Corporation comprises the optical line terminal ZXA10 OLTC (OLTC for abbreviation) and optical network unit ZXA10 ONUC (ONUC for abbreviation). OLTC and ONUC are connected with optical fiber. Optional optical transmission equipment includes the built-in STM-1/4/16 SDH and MSTP or various external optical transmission equipments. The hardware of the system features modularization, with a multi-layer structure, as shown in Fig. 2. One OLTC can connect with multiple ONUCs that can be used in the networking of point-to-point, chain, star and ring networks as required. Besides, every ONUC can be branched. ZXA10 OLTC also can combine narrowband service and broadband service at near end points, cascading user unit via cascading cables while near end local user access is provided.

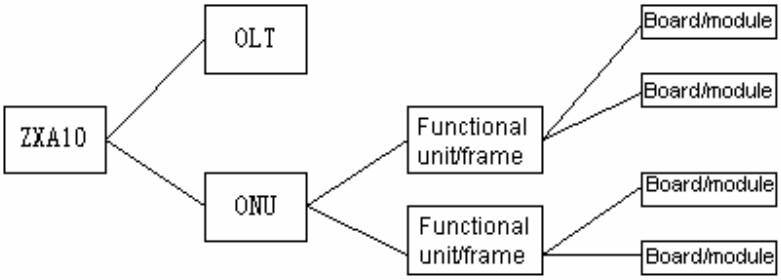


Figure 2 ZXA10 architecture

1. Various functional and service interface boards/modules constitute the functional units/frames for specific functions;
2. Different functional units are stacked to constitute a complete rack – OLTC and ONUC equipment;
3. Both OLTC and ONUC can be stacked smoothly;
4. OLTC and ONUC can form the ZXA10 integrated AN system of different network topologies via the optical transmission network.

5. Thanks to the modular system design, system capacity can be expanded and new functions introduced easily and flexibly, by replacing or adding functional boards, functional units and racks.

1.2.3 Overall Structure of ZXA10 System

ZXA10 integrated AN system includes the two major functional modules of OLTC and ONUC. OLTC can be directly connected to LE via V5 interface. ZXA10 OLTC also can combine narrowband service and broadband service for the near end local users by cascading user unit, and provide uplink interface such as FE/GE for these near end local broadband users.

All the maintenance functions of the ZXA10 system can be implemented on OLTC. The remote centralized subscriber test handling and remote centralized environment monitoring of the ZXA10 are implemented on OLTC. OLTC can either be connected to the local maintenance terminal, or included into the local subscriber test handling center or centralized environment monitoring center. In this way the operation & maintenance of the ZXA10 can be compatible with the existing NM. Besides, subscribers can also use the NETNUMEN N31 integrated network management system to implement unified NM on multiple A10 systems.

1.3 Components of ZXA10 System

1.3.1 COT Equipment -- ZXA10 OLTC

OLTC is the service Point of Presence (POP) of the Central Office Terminal (COT). By means of modular stacking design, the capacity of each module amounts to 252 E1s, of which the number of E1s used by V5 interface and that used for connecting ONUC(RT) can be configured flexibly based on the line concentration ratio. The capacity of OLTC can be expanded, in seamless manner, along with the stacking of modules.

OLTC is mainly used to provide various interfaces to connect to the existing networks: for example, via its V5 interface to connect to LE and then to PSTN/ISDN, via its V.24/V.35/G.703 interface to connect to public DDN.

OLTC can be upgraded to ZXMSG 5600 with only updating the software and adding the relevant media processing board to implement functions of the integrated access media gateway.

1.3.2 Built-in Transmission Systems

The built-in transmission system mainly performs the ODN function in the ZXA10 integrated multi services access network system. With ZXA10 system, many kinds of built-in transmission systems are proposed: ZXA10 S100, ZXA10 S200, ZXA10 S300 and the Integrated Service Transmission board (IST1T/ IST1A) as MSTP system which supports STM-1/4/16. For detail information, please refer to the relevant chapter within this Product Description.

1.3.3 RT Equipment -- ZXA10 ONUC

ONUC is the equipment used to implement FTTB (Fiber to the building), FTTC (Fiber to the curb) and FTTZ (Fiber to the zone). The main components of ONUC are the user unit and optical transmission unit; besides, its auxiliary functional units include subscriber line test, power supplies, and environment monitoring module, battery and distribution frame.

ONUC provides various interfaces to connect to the subscriber, supports various subscriber terminals such as POTS, ISDN, 2/4 lines audio, DDN, ADSL, ADSL2+,VDSL2,EPON, Ethernet and leased line. It also provides subscriber line test and environment & power supply monitoring functions.

Depending on the environment of use and subscriber capacity of ONU, the ZXA10 system offers several models of ONUC equipment to meet diversified demands. ONUC products are mainly available with the following models:

Indoor-model ONU: ZXA10 RACK1500E, ZXA10 19D06H20, ZXA10 ONU100. ZXA10 RACK1500E is designed with the integrated standard 19-inch rack, large-capacity user unit U300, built-in distribution frame and battery. Besides, it can monitor environment and power supply, and support the access of many subscribers by stacking units. ZXA10 19D06H20 is an indoor non-integrated rack. The ZXA10 ONU100 mini cabinet is compact, light, and good-looking. The standard configuration of the cabinet includes one mini user access unit (it has 4 user board slots, with an access capacity of up to 128 POTS user lines or 64 ADSL user lines; one switching processing board GIS/ICS and one test board TSLC), and one 1 power rectifier module POW AC/POW DC.

Outdoor-model ONU: ZXA10 OUT40E, ZXA10 OUT30, ZXA10 OUT30E, ZXA10 OUT40, ZXA10 OUT30F, ZXA10 OUT50, ZXA10 OUT60.Their unique structure design enables them to withstand harsh outdoor climates, with such features as rain-proof, windproof, corrosion preventive, and cold/heat resistance, as well as high security performance. These outdoor equipments are equipped with the user unit U300, built-in distribution frame, optical fiber connection equipment and battery. Besides, they can monitor the environment and power supply. They support different capacity.

1.3.4 NMS system -- NETNUMEN N31

ZTE develops the NETNUMEN N31 Integrated Network Management System that adopts the advanced NMS architecture, provides a complete set of Java-based trans-platform development tools, modules and APIs. As a highly customized, carrier-class, trans-platform integrated NMS with the bottom-to-up design, the NETNUMEN N31 can be easily integrated with multiple third-party systems, and provides a comprehensive solution for network management purpose. ZTE owns the complete intellectual property of this NETNUMEN N31 system, and has adopted multiple patent technologies to improve its functions. As required, the system can fast, flexibly, conveniently and economically manage different NEs, bringing about good social and economic benefits for the operators. Its flexible expandability ensures smooth system upgrade during system expansion or during addition of new network equipment so that it has the minimum impact on the existing system.

The NETNUMEN N31is an integrated NMS that currently manages different data equipment of ZTE in the service layer, the control layer, the core layer, the access layer, the multimedia terminal layer.

2 ZXA10 OLTC

2.1 Structure of ZXA10 T600

OLTC is usually installed in the Central Office, serving as the central rack of OFAN. Various services are introduced from different networks, and provided via the transparent transmission of the optical transmission system, to the subscribers at ONUC side, implementing FTTZ and FTTC.

The integrated service convergence node OLTC implements the convergence of the narrowband and broadband services accessed via each service access node ONUC and connect to the service networks such as PSTN/ISDN/DDN. It reduces the pressure on the network side and offers powerful service dispatching functions. The OLTC node equipment includes the S300/S200 with the broadband service (RT) convergence capability, the T600 with the narrowband service and broadband services convergence capability.

As the integrated service convergence unit, ZXA10 T600 can deal with not only narrowband services, such as POTS, ISDN, Audio-spec line, DDN etc., but also broadband services, such as ADSL/ADSL2+、VDSL2 etc.. The ZXA10 T600 system adopts the hierarchical modular design philosophy. Illustrated in Fig.4 is the system block diagram of the ZXA10 T600 system functions:

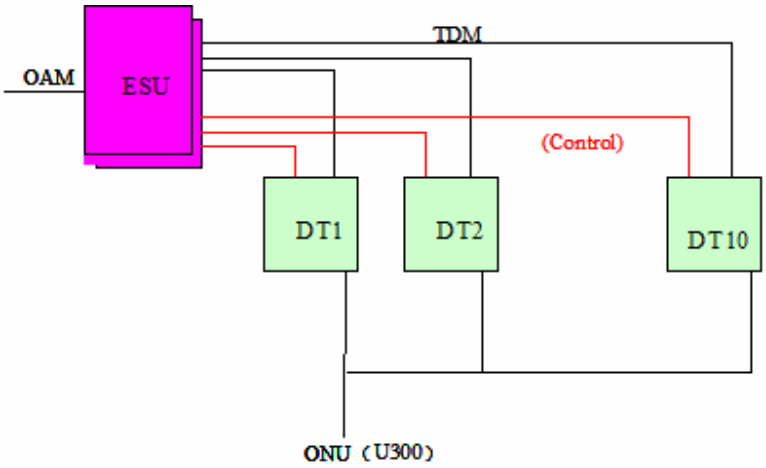


Figure 3 The system block diagram of the ZXA10 T600

The integrated service convergence node OLTC includes two parts.

First it is the system management part, managing and monitoring the entire system. Its main tasks are: internally, to provide the operation & maintenance platform for all functional modules of the system by means of an integrated environment; externally, to provide the management interface with local NM, subscriber test system, environment monitoring center, and Telecom Management Network (TMN). The system management and monitoring unit of OLTC is made up of the Access Network Management module (ANM), i.e., front-end industrial computer. The front-end industrial computer is mainly used as an NM front-end industrial computer, implementing in general the operation and maintenance of various functional sub-systems in OLTC service processing part, and providing the interface with NMS. In the meantime, the front-end industrial computer is also engaged in such management tasks as storage and loading of various system data files (including

configuration data, software version, etc.), in order to make the system run more reliably. When the monitoring and management tasks of the functional modules in the system are detached from their corresponding subsystems and become independent modules, these service subsystems can process services more efficiently, and run more reliably as well. Meanwhile, as the service capability and system capacity of the OLTC system are expanded by stacking functional modules, the operation & maintenance platform can also be extended as flexibly and conveniently as required. Abundant port resources of the front-end industrial computer: It provides more than two 10M/100M standard Ethernet interfaces, and up to 64 serial ports via the built-in multi-serial-port card. In terms of system internal management interface, the data communication port type between the front-end industrial computer and respective functional units depends on the specific hardware design. For example, Ethernet interface is used to connect ESU board in the POTS service element, the NOWC or TAB board in built-in MSTP system; the serial port is used to connect extension function modules such as CATV access unit, DDN access unit and power environment monitoring unit as well as built-in optical transmission equipment.

Second is the service processing part, implementing all the ZXA10 system functions on the service platform and transmission platform . The entire service processing part can be further divided into different functional units according to different service types: here the service platform mainly comprises sub-modules of voice service access unit, leased line service access unit, and power environment monitoring unit; the transmission platform mainly comprises the built-in MSTP unit (supporting STM-1/4/16 SDH, PDH, IP-FE/GE).

In the service processing part of OLTC system, the voice service access unit plays a key role, which implements principal services of the telecom network; leased line service access unit, and power environment monitoring unit are extension function modules, relatively independent of traditional telecom services. The leased line and monitor units maintain a loose coupling relationship in the OLTC system — they merge into an entire OLTC system by providing corresponding monitoring interfaces via serial ports or Ethernet. With its service platform divided into the corresponding service access units according to their service types, the entire OLTC system enjoys high flexibility in the extension of service functions: it can meet the service demands of various applications with the corresponding user ports added by stacking service elements. Meanwhile, the software/hardware of respective functional units can be implemented independently in most cases. Therefore, provided that the software/hardware interfaces between respective functional modules inside the system are reasonable, effective and extendable, the design, development and maintenance upgrading of the entire OLTC system will become highly flexible and efficient. Besides, the majority of functional modules, such as the leased line access units, can function as standalone equipment, independent of OLTC system.

2.2 Service Convergence Module of ZXA10 OLTC

2.2.1 Integrated Convergence Module --ZXA10 T600

ZXA10 T600 is mainly engaged in implementing the convergence function of PSTN service, ISDN service and leased line (both of analogue leased line and digital one) service.

The whole system of ZXA10 T600 comprises two switching networks. One is the 16K×16K TDM switching network, applicable for the traditional POTS services. The other is Ethernet-based switching network, for the switching and multiplexing of IP packets.

The hardware of one ZXA10 T600 unit module includes the following: mother board of control layer for T600 (MTBC), secondary power supply board (POWER K), Enhanced processing board (ESU), ten operation cards (include ODT /FDT).

ESU（ Enhanced processing unit） is the system's TDM exchange center, processing center of narrowband service, and the system's control center with its two boards working in active and standby status.

DT1~DT10 is a service board which can be inserted with the following boards: ODT(8 E1 trunk board); FDT (Optical trunk interface board). ODT provides E1 trunk interface, FDT provides STM-1 interface to connect exchange/DDN node machine or ONU; In addition, DT2~DT6 can be equipped with VOIP processing board of VCA which is used to upgrade to ZXMSG 5600.

Each ODT has eight channels of E1 interfaces, which is connected to the ESU via the 8M HW. ODT can either be connected to the remote ICS (EICS)/GIS at ONUC side via E1 interface, or connected to the V5 interface of the LE. The number of these two can be adjusted flexibly as required. The eight E1s on each ODT can be configured at will as internal digital trunk interface (connecting ICS/EICS/GIS) or V5 interface. ODT and ESU communicate in HDLC mode. ODT, when used to connect to V5 interface, processes the V5 layer-2 protocol and then sends it to ESU. One ODT, when used for remote connection, can connect to at most eight subscriber units.

ZXA10 T600 control part is constructed on the single-shelf with 19inch width and 6U high. As per actual requirement, ZXA10 T600 module can be stacked and in one OLTC rack 5 modules can be overlapped at most. The concentration ratio can be adjusted flexible from 1:1 ~ 1:12.8 thus the total capacity can also be changed according to the different traffic.

The diagram of the ZXA10 T600 module is illustrated in the following figure.

1～2	3	4	5	6	7	8	9	10	11~12		13	14	15	16	17~18
POWER K	ODT	ODT	ODT	ODT			ESU	ESU	ODT	ODT	ODT	ODT	FDT	FDT	POWER K

Figure 4 Alignment of ZXA10 T600 Boards

2.2.2 Built-in MSTP – ZXA10 S300/S200

ZXA10 S300/S200 is developed on the basis of SDH technology, implementing the processing and transmission of TDM service, Ethernet service and ATM service simultaneously. It offers multi-service node of the unified NM, provides flexible multi-service dispatching, and supports the evolution capacity to the next generation network.

As a built-in MSTP system, ZXA10 S300/S200 can also provide the Ethernet L2 packet switch and ATM cell switch function. Thus ZXA10 S300/S200 can implement the broadband data service convergence function via the relevant IP (FE/GE) or ATM uplink interface (STM-1).

Meanwhile, ZXA10 S300/S200, as built-in MSTP system, also implements the transmission function between the OLTC and ONUC. For the detail information, please refer to the chapter 4.2 and 4.3.

2.2.3 Uplink Interface to Service Provider

For narrow band voice and ISDN:

V5.1/V5.2, Over G.703 E1 interface

For digital leased line to DDN:

G.703 E1, V.35, V.24

For broadband data service to backbone:

IP (Ethernet FE, GE), ATM(via built-in MSTP)

2.2.4 subscriber service Interfaces

POTS, ISDN, DDN, AUDB, TRK

ADSL, ADSL2+, VDSL2, EPON, SHDSL(TDM/ATM),FE

2.2.5 Other Interfaces

Clock input interface

Support 2 interfaces of 2Mbit, 2MHz or 5MHz

RS232

One interface for out-of-band network management

2.3 Main Technical Features

1. Large capacity and high integration

- Using 19-inch standard rack, with every module composed of overlapped units (the units can be configured flexibly as desired). One shelf can provide the required minimum capacity and for large capacity the same shelves can be overlapped.
- The actual total subscriber capacity can be configured flexibly by adjusting the concentration ratio in the range of 1:1 ~ 1:12.8.
- At present, a single shelve of the ZXA10 T600 can provide at most 252 standard E1 processing capability and the interface can be both E1 electrical interface and STM-1 optical interface (The least system of T600 can provide at most 80 standard E1 processing capability and the interface only can be E1 electrical interface.) for the access of narrowband POTS, ISDN and DDN services, and the ZXA10 T600 can connect to the local switch via the V5.2 interface. The T600 unit can connect the integrated service access unit U300 (each subscriber unit provides at most 384 POTS subscriber lines). This facilitates the construction of a large-capacity access network, optimizes the

local network structure and reduces the occupied area of the equipment room. To adapt to the large-capacity subscriber networking cases, multiple shelves can be stacked to implement the stepless capacity expansion of the ZXA10 T600.

2. Powerful processing capability and rich services access capability

- Using a built-in 155M/622M/2.5G SDH or MSTP optical transmission system which provides multiple services (including TDM, IP and ATM) transmission ability;
- Supporting seamless interconnection with the existing telecom service networks;

3. Reliable performance

- The power supplies of the ZXA10 OLTC system support mutual aided backup in the same layer.
- All key circuit boards are backup and active/standby communication links are configured for communication between the ZXA10 OLTC and ONUC.
- Advanced production techniques, neat appearance, and full compatibility with the existing ONUC equipment in networking applications.
- The power environment supervision module monitors the power supply and environment in the equipment, the power equipment and air-conditioning facilities in the equipment room, and the environment in the equipment room like humidity, entrance control, smoke, fire and water.

4. Comprehensive network management

- In addition to easy and flexible O&M, the T600 provides powerful network management functions. It can both implement the local network management system at the office side and connect the local NMS or the 112 test and environment supervision center by means of DCN channels such as private line or dialup networking. It can also connect the Telecommunications Management Network (TMN) via the Q_3 or Q_c interface.
- The ZXA10 OLTC system provides diversified flexible means of management, such as configuration management, fault management, performance management, security management, charging management and test management.
- Network management (NM) is implemented in three modes: local NM at ZXA10 OLTC side through the operation and maintenance console; centralized NM by accessing the local NM system, complaint center and environment supervision center through the NM front end PC using leased lines or by dial-up; and access to the telecommunication management network (TMN) through the standard interfaces provided by the NM front end PC (the interface can be customized as per actual requirements).ZTE develops the

NETNUMEN N31 Integrated Network Management System .The NETNUMEN N31 system is composed of the unified NM platform and the NE processing module. Its server and client both adopt this structure, and its NE managers and management functional modules are embedded in the system platform as components.

- During the system installation, users can select all the types of equipment needing management and thus a system for managing multiple data products is customizable to users. The platform module provides the functions independent of the specific equipment type, such as topology, security and system management. During the installation, users can select all the types of equipment needing management and the functions independent of the specific equipment type can be provided. Each NE manager provides the extensive individualized operations for a certain type of NEs, such as configuration management, performance management and alarm management. With the increasing launch of new data products of ZTE, the NETNUMEN N31 system can flexibly and timely support the NMS of these new products. It possesses good expandability, sufficient capacity and upgrading capability to meet the increasing expansion and continuous development of the network scale.

5. Multiple Uplink Interfaces supporting

- V5.1/V5.2 Interface over G.703 E1 for POTS and narrowband ISDN
- G.703 E1, V.35, V.24 for digital leased line
- IP interface for backbone network (FE/GE)(via built-in MSTP)
- ATM for ATM backbone network(via built-in MSTP)

6. With built-in MSTP, providing powerful networking ability

- Using protocol-irrelevant high-speed serial backplane technology and semi-mesh general backplane structure. Hybrid boards. Smooth upgrade, high applicability, and strong scalability.
- Services of different features can be deployed conveniently, reliably, and quickly in this platform. Supporting integrated access and reliable transmission of TDM, and Ethernet services.
- Supporting 155M/622M/2.5G smooth upgrade and a maximum of 4 × 2.5G optical interfaces under dual system mode. It meets the access network development in the far future and protects the operator’s investment.
- EAT4E mainly fulfils the conversion between Ethernet packet and ATM cell
- Directly providing high bandwidth 10M/100M/GE Ethernet interfaces, supporting Ethernet service convergence and transmission and local Ethernet unblocked wire-rate switching.
- The system service management provides point-to-point network level automatic/semi-automatic service configuration of Ethernet service and TDM

service, provides graph-based configuration of SDH service and DCC/ECC, is capable of changing the board type and dynamically moving the board slots, all of which are conducive for NMS and maintenance operations. The system provides NE copy and board copy function, simplifying the system configuration.

- E1 electrical tributary board performs self-loop PRBS test without meters. The system provides E1 tributary bit error statistics.
- Smooth evolution from access network to NGN.

2.4 The RACK of ZXA10 OLTC

2.4.1 19” standard rack (19D08H20 or 19D06H20)

The ZXA10-OLTC adopts the 19’ standard Rack that is an indoor rack of the non-integrated structure generally placed on the equipment room floor. The effective space of the main equipment area totals 42U and can be flexibly configured as required. The rack is directly supplied power by –48V. If built-in S300, please use the 19D08H20. If built-in S200, the 19D06H20 will be chosen with every module composed of overlapped units (the units can be configured flexibly as desired). One shelf can provide the required minimum capacity and for large capacity the same shelves can be overlapped. ZXA10 T600 module can be stacked and in one OLTC rack 5 modules can be overlapped at most.

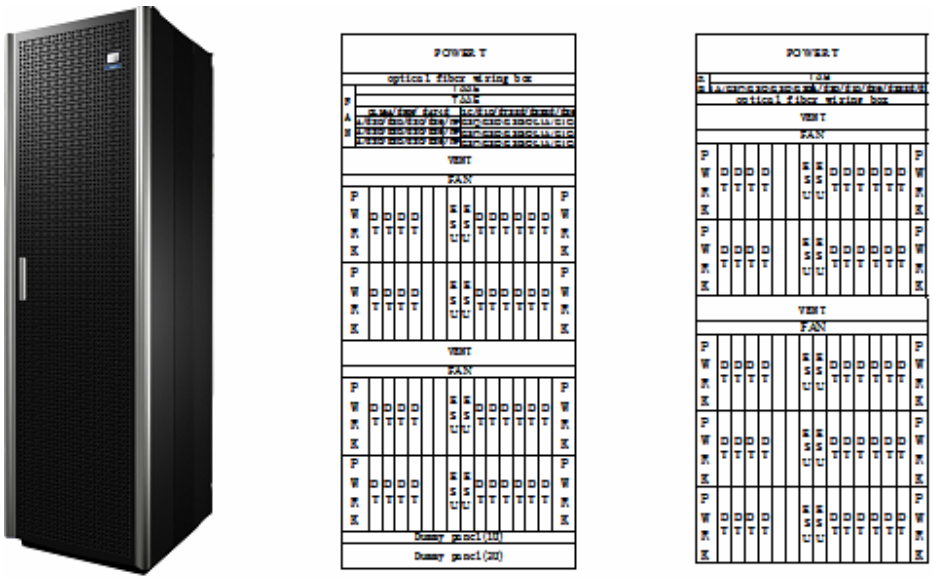


Figure 5 The configuration and shape of ZXA10 OLTC

2.4.2 Physical Indices

- Outer dimensions: 2,000mm × 600mm ×600mm (H × W × D)

  2,000mm × 600mm ×800mm (H × W × D)

- Weight: 220Kg(max)
- Operating voltage: -57VDC ~ -40VDC
- Ambient temperature:0°C~40°C
- Ambient humidity (RH): RH 20% - 80%
- Power consumption: Less than 500W
- Grounding resistance: One work ground and one protection ground. Grounding resistance <=3Ω

2.5 Introduction to ZXA10 OLTC Boards

2.5.1 Signaling and switch unit card SSUB

SSUB is the system's TDM exchange center, processing center of narrowband service. SSUB is the central control board，which is responsible for call processing, and the communication with boards such as ODT/FDT and as a processor of the entire POTS service element. The SSUB provides a 16K x 16K blocking switching network, performs N x 64K cross connect, and communicates with the ODT/FDT board and the HDLC of a remote ONU through HDLC. Furthermore，There is one control Ethernet bus between active/standby-SSUB and DT for transmission of software version and board running status as well as control and maintenance of messages. The SSUB provides a RJ45 debugging serial port. It also provides an Ethernet port for debugging and operation and maintenance.

The SSUB also performs system clock synchronization. Various clock synchronization signals required by the system are generated by external phase-locked clock reference signals. External clock sources include independent timing sources and switch V5 interface synchronization signals.

By means of external independent timing sources, the timing reference can be extracted from the 2Mbit or 2MHz signals of the BITS clock system or other independent timing systems, so that the timing module on ESU can generate the clocks needed by the system.

Clocks are extracted from the E1 interface of the switch. The synchronous 8k clock reference is extracted via ODT, from the V5 E1 interface signal code stream connected with the switch, so that the timing module on SSUB can generate the clocks needed by the system

When all external clock reference signals disappear, internal level 3 clock is automatically switched over. The switchover between different clocks references can be implemented on ESU automatically or as specified manually.

The active/standby SSUB adopts a hot backup mode. The SSUB provides a call protection function during active/standby switchover: The active and standby ESU boards are mutually connected through a 100M Ethernet control bus to ensure data synchronization and mutually monitor each other. When the active SSUB fails, the standby SSUB automatically becomes active, takes over the work of the original active SSUB, and provides call protection. The active/standby SSUB board provides a standard Ethernet interface for connection with the operation and maintenance console.

Technical and performance indexes:

- The 16K x 16 K switching network has realized non-blocking switching.
- Board power consumption: 20W

2.5.2 Digital trunk i board ODT

As an interface unit, 8-interface digital trunk board ODT is used in the digital transmission and connection of the corresponding service interfaces, such as the internal E1 interface between OLT and the remote ONUs and that between OLT and its upper-level service nodes (such as the switch, the national DDN and IP access server).

The ODT provides 2M link resources required by the system. Each ODT board has eight E1 interfaces. The ODT supports eight remote units at most. It communicates with the remote ODTI through its own HDLC controller. When the ESU board communicates with the remote ONU, the ODT board performs a message diversity function. The ODT has a 100M Ethernet to communicate with the ESU. When acting as a V5 interface link, the ODT processes protocols on level-1 physical layer and layer-2 data link layer of V5 interface. Major functions:

- Code conversion
- Clock extraction and timing again

Extract a clock from input data stream as its reference clock and as external reference clock source of local system clock.

- Frame/multiframe synchronization
- Control, detection, and alarm
- Signaling insertion and extraction

Technical index:

- Board power consumption: 10W

2.5.3 Optical trunk card with 2*GE optical and 1*STM-1 optical FDT

The FDT board provides one STM-1 interface. When inserted into slots DT1－DT4, each FDT board has 63 E1 trunks at most; when inserted into slots DT5－DT10, each FDT has 32 E1 trunks at most. They are used to connect with SPC switches or internal transmission boards in the ONU or to connect with ONU or E1 trunks of SPC switches through uplink and downlink 2M branches. The FDT uses its own HDLC controller to communicate with the remote ICS/EICS. When the ESU board communicates with a remote ONU, the FDT board performs a message diversity function. The FDT board has a 100M Ethernet to communicate with the ESU.

Technical index:

- Board power consumption: 25W (63E1)
- 20W (32E1)

2.5.4 Secondary Power Supply board POWER K

POWER K provides the secondary power to ZXA10 T600 module of ZXA10 OLTC. The POWER K outputs 4 voltages: +5VA(D), –5VA, -48V and ringing current 75VAC. Primary power feeding offers –48V through filter TBF, then offers the ringing current voltage by means of DC/DC converter or ringing-current module. Ringing current output: 75V+/-15V AC, 400mA, distortion <5%, 25Hz+/-2Hz.

1) Input characteristics:

- Input nominal voltage: -48 VDC
- Input voltage range: -60 VDC ~ -38 VDC
- Maximum input ripple peak: 250 mV
- Limit the maximum peak of the input start current to ten times of the normal working current.

2) Output characteristics:

- The following table shows the output voltage, stability, maximum working current, and peak voltage.

Table 1 Output Characteristics

Output Voltage	Nominal Value (V)	Stability (%)	Maximum Working Current (A)	Maximum Peak Voltage (mVpp)
+5 VA (D)	+5	0.5	30	100
−5 VA	−5	0.5	5	100
−48 V	−48		15	

Ringing current output: 75V+/-15V AC, 400mA, distortion <5%, 25Hz+/-2Hz.

In the event of discontinuous load, the instantaneous response of voltage is less than ±5% of the nominal value. When the input is connected or disconnected, the overshoot value of the output voltage is less than ±2% of the nominal value.

Technical index:

- board current: 0.2A

3 ZXA10 ONUC

3.1 Structure of ZXA10 ONUC

Remote ONUC is usually installed in places densely populated with subscribers, such as residential areas, downtown areas, high-rise buildings and villages. ONUC is composed of the processing nodes and transmission nodes of various services, serving as the direct service provider.

With the development of the access network, and the deployment of new networks and new services, the traditional telecommunications services such as telephone, fax and low-speed data can't meet the demands of the users. They are looking forward to the broadband services such as the high-speed Internet access, videophone, and VOD. Presently, the core networks of the PSTN, DDN, ATM and IP network, which are based on the transmission network, have been constructed. By deploying the integrated access mode on the access layer, it is avoided to overlap the networks and consequently, the investment in device is decreased. In this way, it facilitates operators to perform unified management on the devices and the services. Nowadays, the operators concern themselves deeply with how to select an integrated service access network suitable to the local development. To meet the above-mentioned requirements, ZTE Corporation puts forward a new integrated service access device, the ZXA10 ONUC new optical network unit, which fulfills the goals as follows:

Decrease the operation cost. With the reduction in the stock cost, service provision cost and maintenance cost, the operation cost is decreased. The open network system, the standard building block interfaces, and the processing system compatible with the industry specifications, attract more and more providers into the operation. The standard building blocks and more choices help the operators directly benefit from the stocking. The operators are required to perform maintenance on the sole network. The cost on the network maintenance is reduced consequently. The ONUC device can form the network with the existing access network devices so that the investment in the upgrade is decreased.

Provide multiple services. In the near future, operators will regard services as the fundamental element. Services provision in demand will become the reality. The access mode at the access layer keeps developing with the advancement of the technology. As an integrated service access device, ONUC is provided with strong adaptability to the development of the technology. It will become the basic device of the access network.

Meet the needs of the network integration and evolution. The integration of multiple networks and unification of voice, data and multi-media services will bring great changes to the telecommunications field. ONUC implements the effective integration of the broadband and narrowband services at the access network, providing a unified service platform.

The ONUC device is completely integrated with the SDH/MSTP/IP/ATM basic bear networks. On the user side, it not only supports the narrowband voice, data access at various rates, but also supports multiple broadband access modes such as xDSL, EPON and LAN, meeting various demands diversified users. Based on the diversity of telecom operators, services demand and customers, it provides personalized services. The ONUC device is provided with the real broadband and narrowband integrated access solution, which focuses on providing voice services to operators, and supports data services and broadband services as well.

The ONUC optical network unit implements the following functions:

The ONUC supports all narrowband functions. It supports V5 services, PSTN access services at Z interface, DDN connections. It supports the system configuration, performance management and system control.

ONUC is provided with functions of Ethernet convergence and switching and the capability of processing Ethernet Layer 2 protocol.

The system has the ability of taking tests on PSTN/ISDN subscriber lines. It can cooperate with the external DSL subscriber line tester and take tests on DSL subscriber lines.

The system can form the network with the built-in transmission devices such as MSTP, SDH.

The system can connect to the switch both via its V5 interface and through the OLTC, and can uplink to broadband network via Ethernet port, ATM port and IMA port etc.

The system provides power backup function within one layer and also the N+1 protection facility for power rectifiers. The main control board is provided with the ability of operation in active/standby mode. All these factors ensure the high reliability of the whole system.

ONUC supports SNMP network management (NM), and provides the maintenance on both the local serial port and network interface.

The system supports the local/remote upgrade and download of the software.

Normally, the ZXA10 ONUC is made up of some main function units, which are the subscriber unit ZXA10 U300, the built-in MSTP system ZXA10 S200, the power supply system (including the switch rectifier and the backup batteries) and centralized monitor system. For these components, the detail description is given in the subsequent parts.

For the ZXA10 ONUC is normally located in remote side close to the end users, the actual working environment for the system maybe not very good: high temperature, high humidity, rainy climate, dusty, and so on. Also, the service requirement and capacity requirement is different from here and there. To meet all these demands, ZTE put forward many kinds of the ZXA10 ONUC systems, including indoor type and outdoor type, large capacity and small capacity.

3.2 Subscriber access Unit of ZXA10 ONUC

The ZXA10 U300 (also U300 for short) new optical network unit is constructed on the single-shelf with 19inch width and 6U high. Dimensions of the standard 6 U plug-in box: 266.5 mm × 482 mm × 318.5 mm (H × W × D)The whole system comprises two switching networks. One is the 2K×2K PCM switching network, applicable for the traditional POTS and DDN services. The other is Ethernet-based switching network, for the switching and multiplexing of IP packets. Each subscriber shelf accommodates two control and switch cards, 12/11 subscriber interface cards, one TSLCC subscriber test card and one POWER H card (or one TSLCD subscriber test card and two POWER K card). Mixed plug-in is available for various subscriber interface cards and uplink service cards for narrowband/broadband services. The system provides power master/slave backup in bus mode within the U300 layer. Subscribers have access to the subscriber unit via the subscriber interface cards. The ALC/I card provides the PSTN service interface and the analog leased line service interface, RALC/I card provides analog subscriber line ports and supports the reverse polarity function, FLC/I card provides analog subscriber line ports and supports both reverse polarity subscribers and 16KC/12KC pulse charging subscribers. The DLCC card provides the ISDN BRA service interface and also digital leased line service interface. The subscriber board (A/DLC) slots can be inserted with

2/4 wire audio board (AUDB) and DDN subsystem subscriber interface board, such as DDN 64K G.703 (DIB), ONUC also support HDSL/SHDSL leased line service via HDB card, SDL/ GSDL provides SHDSL interfaces (ATM mode); especially the broadband subscriber board GADL/T,GADL/2+,GVDL,ETC/GETC can be inserted in any slot of U300 for providing ADSL and Ethernet service. And the EPOL board can be built-in ZXA10 to support EPON access.

Besides the existing narrowband uplink interfaces, the system provides the broadband uplink interfaces via the mix-insertion of the ATM reverse multiplexing interface card (IMAE) and Ethernet uplink transition interface card (GEI,GEIS,EUX, GEUF,FEI).

The IMAE card binds E1 links through 1 to 8 together, implementing the conversion between ATM cells and Ethernet frames. When one E1 link is used, the card can transfer services in pure cell mode.

The GEI card is worked with GIS to provide two 1000M optical port and two 100M BASE-TX for uplink. The GEIS card is worked with GIS in ONU100 to provide one 1000M optical port and one 100M BASE-TX for uplink. The EUX card is worked with ICS/EICS to provide two 100 BASE-TX ports. The GEUF card is worked with EICS to provide one 1000M optical port and one 100M BASE-TX for uplink. The FEI is worked with ICS/EICS to provide two 100M optical port for uplink. Both of them are available for the uplink of broadband subscribers.

As the control and switching control of the U300 subscriber unit, the control and switch card is used to manage the subscriber layer and complete the digital trunk and Ethernet bus convergence and switching functions. Each control and switch card can be configured flexibly with one to eight E1 interfaces. Through the use of the extended E1 interface board ODTI, the number of E1 interfaces can be expanded to 16. The GIS/EICS/ICS provides FE/GE uplink interfaces and supports port binding & the stack of at most five layers of subscriber units.

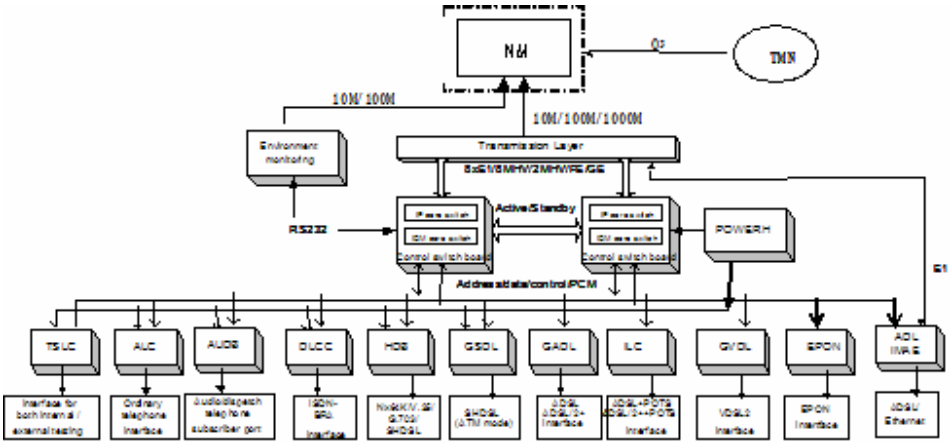


Figure 6 U300 block diagram

The U300 user unit provides POTS services and broadband data services. Narrowband and broadband user interface boards and uplink service boards can be intermixed in user interface slots.

The whole system includes two switching networks: a 2K × 2k TDM switching network that is used for traditional POTS and DDN applications and an IP Ethernet switching network up to 48gbps that is used for IP packet switching and multiplexing.

1. Clock bus

The system can either receive the BITS clock signal or extract a clock from the E1 interface of V5. Next, the Control Switch board provides a 8K or 2M clock to each board and the TSLC.

2. TDM bus

The TDM bus performs narrowband voice multiplexing and DDN service multiplexing. The two Control Switch boards use an active/standby mode to connect with each board and the TSLC over 2M HW cable.

3. Data bus

The data bus performs multiplexing and switching for Ethernet-based packets.

4. Multicast bus

The system increase multicast and unicast bandwidth.

3.2.1 The Subscriber access unit of U300

3.2.1.1 Hardware Structure

The U300 hardware system is composed of a control unit and a user unit. The control unit can perform all system functions. Adding the user unit can expand system capacity.

Base on the requirement of bandwidth and multi-cast function, ZTE provides different units with different control boards.

Control board of active unit and uplink subcard	Subscriber Layer Backplane
ICS/EICS+EUX/FEI/GEUF	Stacking interface:4FE Uplink interface:2FE electricity, 2FE optical,1GEoptical＋1FE electricity
GIS＋GEI	Stacking interface:4GE＋multi-cast(each unit with 1GE single-cast＋1GE multi-cast) Uplink interface: 2GEoptical＋2FE electricity

The overall hardware structure of the U300 is shown in Figure 7：

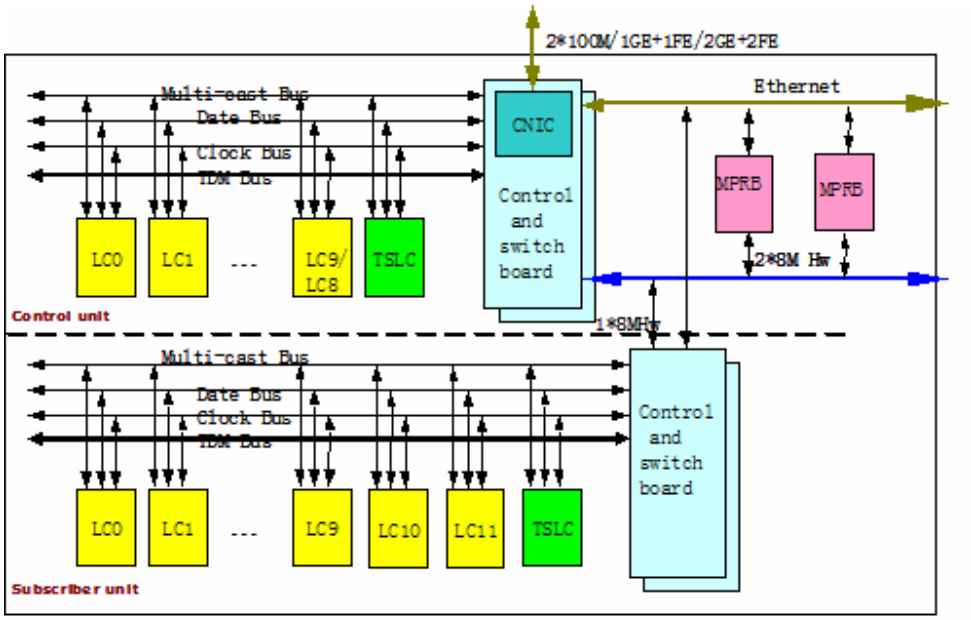


Figure 7 The Overall Structure of the U300

The U300 control unit provides POTS services and broadband data services: It usually adopts the MICS/MBSL backplane and its each subrack has two Control Switch boards at most, 12 line interface boards, one TSLC user test board, and one POWER H board. The user interface slot can support both narrowband and broadband boards. Power supplies between subracks on all layers in the network unit can perform mutual-aid backup in a bus mode.

The U300 support four slave layers at most and its slave subrack is a U300 user unit to completely protect the original investment of the carrier.

In the ZXA10 U300, the backplane MICS implements the electrical connection between cards and provides all kinds of external connectors. It is applicable to the standard 19-inch cabinet with the spacing between slots as 25 mm, and is hot swappable. The backplane is connected to the –48 V power supply through a 6-core power socket.

The subscriber lines of each subscriber card are routed out through U300 standard subscriber cables. Both the E1 interface (micro-coaxial cable) and the RS-232 interface are on the MICS/MBSL and connect to uplink 100M Ethernet interfaces that connect to the uplink EUX on the Ethernet.

In the subscriber shelf, the backplane MICSL implements electrical connection between cards and provides all kinds of external connectors.

Two types of cables are distributed on the backplane: service cable and control cable.

There are two kinds of service cables:

1) Circuit service cable: Each line card provides a 2M PCM HW to connect to the TDM switching center of the control board.

2) Broadband service cable: The line cards provide a total of 24 1000M cables to connect to the 24+2 switching chip of the control board.

U300 adopts the most advanced architecture to support the voice, data and video traffic.

- U300 is IP-based equipment, which can easily support multicast services in the future.
- U300 employs the whole GE bus large-capacity backplane. The capacity of the whole backplane is 280 Gbit/s. The capacity of the control and switching board is 48 G bit/s, and the bandwidth between slot and backplane is up to 1Gbps.The large capacity of U300 meets the high bandwidth need of IPTV,VOD services in the future
- U300 supports universal high speed access interfaces, such as ADSL2+, VDSL2, and GPON/EPON to facilitate the high speed services.
- U300 is able to easily migrate to AG to support VOIP with only adding multimedia processing card.
- U300 supports multi-level multicast mechanism to enhance the multicast performance.
- U300 adopts telecom-class reliability design, ensuring the security and reliability of the device. The entire major components are designed for redundancy, and all boards are hot-pluggable.

3.2.1.2 U300 Software Architecture

By functions, the system software of the U300 can be divided into the OSS (Operation Support Subsystem), the bearer subsystem, the call subsystem, the database subsystem and the NMS (Network Management System). These subsystems are independent of one another and communicate through the message mechanism.

Figure8 shows the function block diagram of the U300 software system.

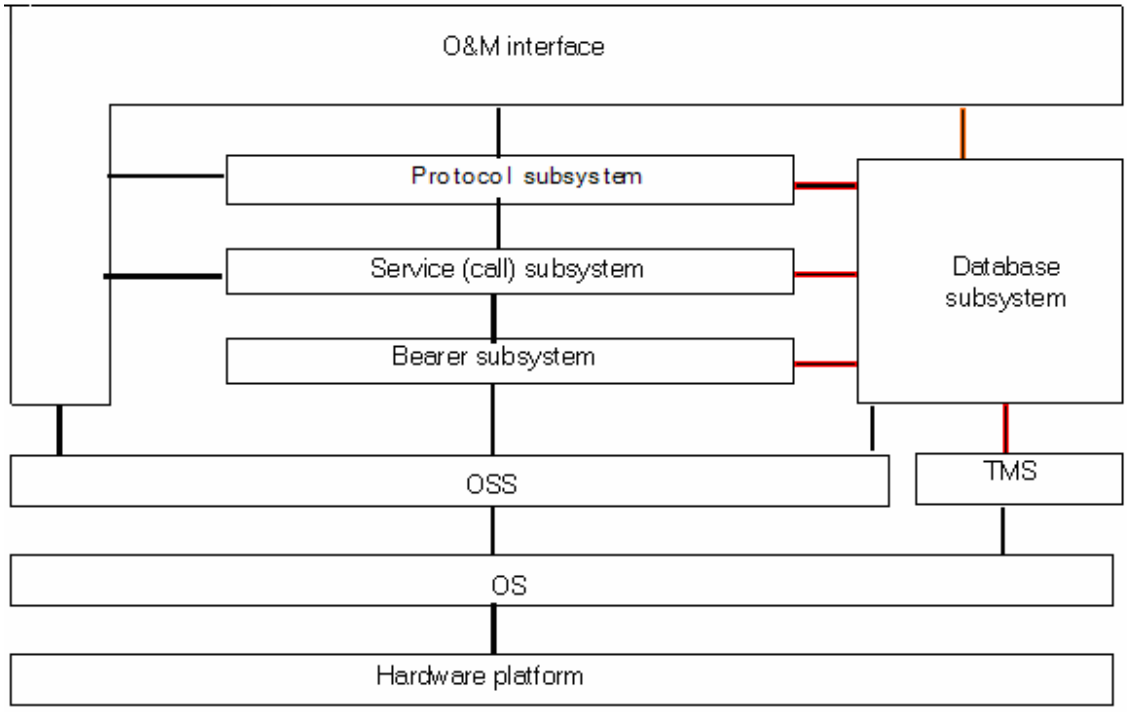


Figure 8 Function Blocks of the U300 Software System

Structurally, the U300 software is divided into seven parts: The bearer subsystem, the operation support subsystem, the service subsystem, the protocol subsystem, the database subsystem, the TMS subsystem and the O&M interface subsystem.

The bearer subsystem resides in the CPU of each hardware board, for example, the TPU of the extended shelf, the master process 8250 of the ICS, the slave processor 8031 of the ICS, and the CPU of the ADLG board. It completes such functions as onhook detection of subscriber circuits, subscriber circuit testing, announcement play, DTMF digit receiving and detection, ISDN user message collection & forwarding, 2K switching network connection and ADSL user configuration management. It provides interfaces of the specific functions to the upper layer so that they can be invoked by the other modules.

The operation support subsystem is based on the BSP, driver and real-time OS Vxworks. It provides a uniform platform to the upper-layer applications for completing such functions as task and process management, intra-board and inter-board communication, memory management and timer management. It also provides the functions of file system management, version loading, version management and system software management.

The TMS subsystem is an outsourced software package to complete the function of switch management. It is provided by the OS vendor, closely related to the OS and functionally independent.

The database subsystem manages system data and resources. It builds a memory database, offers uniform interfaces, provides configuration information to the protocol subsystem, the service subsystem, the TMS subsystem, the operation support subsystem and the bearer subsystem, and collects information from these subsystems. It also provides the data

management interface to the O&M subsystem and can manage data in two modes: CLI or SNMP.

The protocol subsystem processes protocols such as H.248, SCTP, IUA and V5UA. It implements the interaction between the AG and the SoftSwitch, and controls the signaling interoperability.

The service subsystem completes the operations according to the commands of the protocol subsystem, provides uniform service interfaces to the upper layer, shields hardware differences, breaks down protocol commands to send to the lower layer and carries out practical operations by invoking the interface of the bearer subsystem. The broadband services support the universal TCP/IP protocol stack, such as FTP、SNMP、TELENT etc.. The service subsystem also supports plenty of L2 protocols such as STP、RSTP、MSTP、LACP etc..

A uniform system control and network management system is used for broadband and narrowband services of the U300. The software system adopts the multi-task real-time operating system that features high processing efficiency, high security and high reliability.

3.2.1.3 The 19 inch Subscriber access unit of U300

Base on the requirement of international market, ZTE provides three versions of U300 unit which have the different physical structure: U300 Front access version, U300 standard rear access single power version, U300 standard rear access double powers version.

The U300 unit adopting a standard 19”,6U/9U subrack. The control unit can be put in the general 19-inch standard rack 19D06H20 or 19D08H20.

1. U300 standard rear access single power version

Each U300 user unit offers 17 effective slots for holding major boards such as POWER H board and user interface boards—all kinds of user interface can be mixed plug, control switching board GIS/ICS/GISE, and test board TSLCC/2. The POWER H can work together with the POWER H in another unit in the same rack/cabinet to make inter-layer power backup.

Figure 9 shows the board layout of the standard rear access single power version.

1～2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
POWER H	LC	LC	LC	LC	LC	LC	GIS/ICS/GISE	GIS/ICS/GISE	LC	LC	LC	LC	LC	LC	TSLCC

Figure 9 Boards Arrangement of the standard rear access single power version.

2. U300 standard rear access double powers version

Each U300 user unit offers 16 effective slots for holding major boards such as POWER K board and user interface boards—all kinds of user interface can be mixed plug, control switching board GIS/ICS/GISE, and test board TSLCD. The two POWER Ks can work redundancy.

Figure 10 shows the board layout of the standard rear access double powers version.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
POWERK	LC	LC	LC	LC	LC	LC	GIS/ICS/GISE	GIS/ICS/GISE	LC	LC	LC	LC	LC	TSLCD	POWERK

Figure 10 Boards Arrangement of the standard rear access double powers version.

3. U300 Front access version

Each U300 user unit offers 16 effective slots for holding major boards such as POWER K board and user interface boards—all kinds of user interface can be mixed plug, control switching board GIS/ICS/GISE, and test board TSLCD. The two POWER Ks can work redundancy.

U300 Front access version increase a Area of cable and correspondence Front access extend boards.

Figure 11 shows the board layout of the front access version.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
POWERK	LC	LC	LC	LC	LC	LC	GIS/ICS/GISE	GIS/ICS/GISE	LC	LC	LC	LC	LC	TSLCD	POWERK
PEB	SEB	SEB	SEB	SEB	SEB	SEB	IEBA	IEBC/IEBB	SEB	SEB	SEB	SEB	SEB		PEB

Figure 11 Boards Arrangement of the front access version

The GISE(used in the simple narrowband slave subscriber unit)/ICS/EICS/GIS is the control and switching core of the subscriber unit. It manages the user layers, and converges and switches the digital trunks and Ethernet buses. The ICS/EICS/GIS in each unit can be configured with 1~8 E1 channels, and provide V5 interfaces for accessing the PSTN network. The ICS/EICS/GIS also offers FE/GE uplink interfaces to transfer broadband network access data to the MAN. Besides, it supports port trunking and the stacking of up to five layers of user units.

Different types of user interface boards and aggregate interface boards can be configured in the slots for holding user interface boards according to the user demand. The boards support hot swap.

The following describes different types of narrowband user interface boards.

- Ordinary analog user board (international) ALC/I: Each board supports 32 channels of POTS users.
- Polarity reversal analog user board (international) RALC/I: Each board supports 32 channels of POTS users.

- Far distance analog user board (international) FLC/I: Each board supports 16 channels of POTS users. It also supports polarity reversal users and 16KC/12KC pulse charge users.
- Digital user board DLCC: Each board supports 8 channels of ISDN 2B+D users. It also supports remote feeding.
- 2/4-wire audio board AUDB: Each AUDB provides eight 2/4-wire audio subscriber interfaces and either the 2-wire or 4-wire mode can be selected.
- DDN digital interface board DIB: Each DIB provides four DDN subscriber interfaces at the rate of 64K or lower. The optional interface types include V.24, V.35 and G.703.
- Analog trunk interface board TRKB: Each TRKB provides 16 analog trunk circuit interfaces.
- SHDSL interface board HDB: Each HDB provides 4 SHDSL ports (TDM mode) and can provide the 2M private line and the V.35 N*64K private line function (N=3~31).

All the above narrowband subscriber interface boards can be used in all three U300 version subscriber units.

There are the following types of broadband subscriber interface boards:

- Integrated analogue line & ADSL or ADSL/2+ digital loop subscriber card with line hunting, ILC/T and ILC/2+: Each board supports 16 channels of ADSL users and 16 channels of POTS. It provides a built-in voice splitter and a line capture matrix. ILC/2+ supports ADSL2/ADSL2+ function. (It only can work in ICS/EICS for a while.)
- SHDSL interface board SDL: Each SDL provides 16 SHDSL interfaces (ATM mode). (It only can work in ICS/EICS)
- Ethernet interface board ETI: Each ETI provides 6 FE interfaces of either the optical or the electrical type. (It only can work in ICS/EICS and be stopped production and forbid to be recommended.)
- ADSL digital loop subscriber card with line GADL/T: Each board supports 16 channels of ADSL broadband data users. It provides a built-in voice splitter and a line capture matrix.
- ADSL2+ digital loop subscriber card GADL/2+: Each board supports 16 channels of ADSL/2+ broadband data users. It provides a built-in voice splitter and a line capture matrix.
- Integrated analogue line & ADSL or ADSL/2+ digital loop subscriber card with line hunting, GILC/T and GILC/2+: Each board supports 16 channels of ADSL users and 16 channels of POTS. It provides a built-in voice splitter and a line capture matrix. ILC/2+ supports ADSL2/ADSL2+ function. (It may be popularized at June, 2007.)

- VDSL2 digital loop subscriber card GVDL: Each board supports 16 channels of VDSL2 broadband data users. It provides a built-in voice splitter.
- SHDSL digital loop subscriber card GSDL: Each board offers 16 SHDSL interfaces (ATM mode). (It only can work in GIS.)
- Ethernet interface board GETI: Each GETI provides 6 FE interfaces of either the optical or the electrical type.
- long distance EPON interface card （1 port，20Km）EPOL: Each board offers 1 EPON interface. Single PON port supports 32 branches.

All above broadband subscriber interface boards adopt the mode of separate power supply from the backplane and they can be used in all three U300 version subscriber units.

There are the following types of line interface boards:

- FE Ethernet transfers board ETC: Each ETC provides 2 FE interfaces of the electrical type. (It can provide 2 FE interfaces at L5 and L6 slots. At the other slots, it only support 1 FE interface. It only can work in ICS/EICS and be sold under restriction.)
- GE Ethernet transfers board GETC: Each GETC provides 2 GE interfaces of the optical type. (It can provide 2 GE interfaces at L5 and L6 slots. At the other slots, it only support 1 GE interface. It only can work in GIS and be sold under restriction.)
- ATM interface board ATI: Each ATI board provides one ATM-155 optical interface. (It only can work in EICS/ICS and be stopped production and forbid to be recommended.)
- ATM interface board GATI: Each GATI board provides one ATM-155 optical interface. (It may be popularized at June, 2007.)
- Inverse Multiplexing ATM board (IMAE): Each IMAE provides 8 IMA E1 interfaces.
- Extended E1 interface board ODTI: Each ODTI board provides 8 E1 interfaces. It is used to expand the E1 interface capability of the ICS during the stack of multiple layers of subscriber units or to provide ISDN PRI interfaces.
- Integrated service transmission board IST: It implements the SDH/MSTP optical transmission in the form of a board. Each IST at the line side provides one STM-1 (IST1T) or two STM-1 (IST1A) optical interfaces and two FE interfaces and four 8M HW (16 E1s) interfaces internally (inside the unit, tributary side). (It only can work in EICS/ICS for a while.)

All the above line interface boards can be used in the U300 subscriber unit (Except ODTI, the also can be used in the OUT50 and ONU100 subscriber units.).

Type C user test board TSLCC/2 tests POTS and ISDN 2B+D users.

Type D user test board TSLCD tests POTS and ISDN 2B+D users. Be used in the U300 standard rear access double powers version and U300 front access version.

POWER H supplies power to the broadband and narrowband interface boards. If there are multiple layers of units in the same cabinet, the POWER H in the two adjacent can make inter-layer power backup.

POWER K supplies power to the broadband and narrowband interface boards. Be used in the U300 standard rear access two powers version and U300 front access version. The two POWER Ks can work redundancy.

Considering the small and mini capacity requirements, ZXA10 MSAN provides another two derived version of U300: U300 OUT50 compact version and U300 ONU100 mini version. The function of these two versions is same as the one of the standard U300 version and here it will not be detailed.

3.2.1.4 High reliability and Redundancy of U300

U300 is carrier-level reliability equipment with redundancy. To ensure the reliability,

The important board such as control switch board and VoIP resource processing board adopt an active/standby operation mode. The redundant component will automatically take control when there is a failure, and this procedure will not affect the normal operation, capacity and performance.

The control board manages 12 user boards separately. In switchover, the normal control board forces the abnormal control board to stop its running and give up its system control right. For the uplink is on the backplane, the automatically switchover of the control board will not affect any traffic on the network.

The interface modules include uplink card and subscriber line card.

1 For broadband uplink card, U300 adopts hot/standby operating mode. If one interface card is failure, then the other will work. Within one card, different interfaces support link aggregation function for the redundancy purpose. The time of switchover is less than 50ms, which will not have influence on the performance.

2 For narrowband uplink card, U300 can configure multiple V5 interfaces for redundancy. And within one V5, the E1 link is double configured. If the main link has failure, the other one will replace it and carry the voice traffic without any effect.

3 For subscriber line card, each card provides two physical ports for one subscriber. Once the main port is failure, the backup port will take over the traffic to ensure the service protection without any service interruption.

For power supply, there are two ways for secondary power redundancy. One way is that the two U300 shelves work in power aided mode while the other way is double power redundancy in one shelf.

All components are hot-swappable.

The software system adopts a real-time multiple task operating system with high processing efficiency, security, and carrier-level reliability.

3.2.2 The subscriber access unit for ZXA10 OUT50

The OUT50C/OUT50D control unit of the ZXMSG 5200 has two layers, adopting a 9-inch subrack of 12U. Each layer has a height of 6U.

The cabinet consists of three areas: storage battery area, main equipment area, and MDF area. The standard configuration includes one user access unit (it has 6 user board slots and an access capacity of up to 192 POTS user lines or 96 ADSL user lines. It also performs functions such as

processing primary power supply and centralized monitoring of environment and power), space of 1U for holding compact built-in MSTP optical transmission equipment S100 (if the user unit offers transmission function through a built-in IST board, the S100 need not be configured. In this case, the space can be used for hold other equipment), one 38AH battery group, one fan unit, and one power distribution box, one 1 fiber splice tray (optional), one heating module (optional), and corresponding MDF modules.

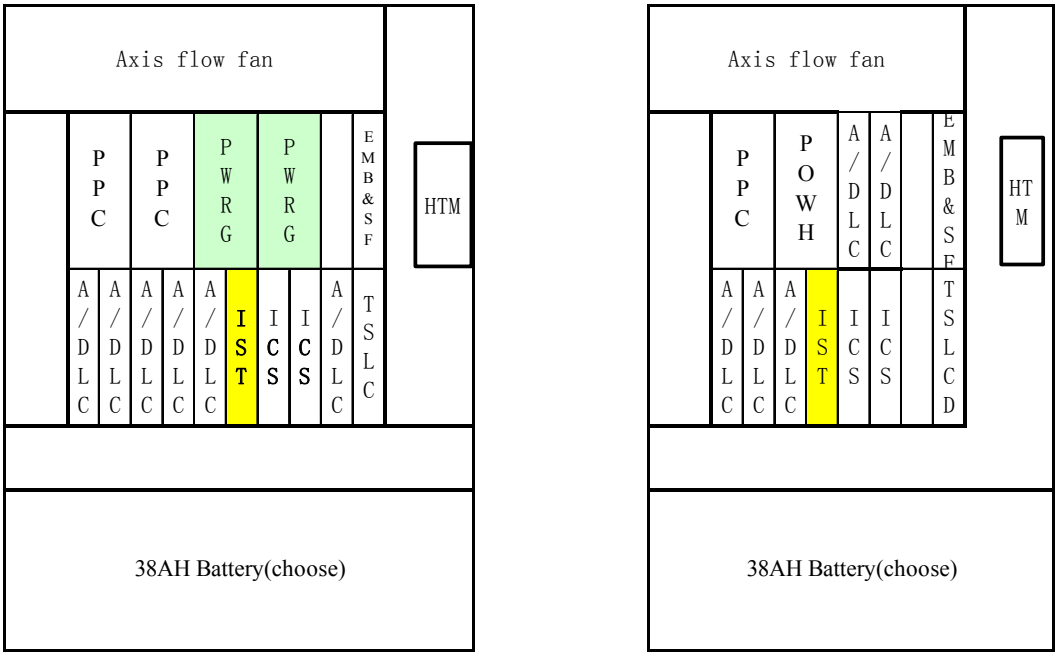


Figure 12 Board Arrangement of ZXA10 OUT50C/OUT50D unit

The POWG power board provides –48V, +5V, and –5V DC powers as well as 75V AC ringing current.

The PPC primary power board is responsible for processing primary powers and controlling storage batteries in the cabinet.

The EMB environment monitoring board provides integrated monitoring and control for the power environment. It performs functions such as power detection, environment monitoring, burglar and fire alarms, distribution frame check, and fan monitoring and control. It collects environment and power data. It processes man-machine commands. It reports alarm data and real-time data.

3.2.3 Mini subscriber access unit for ZXA10 ONU100

The ZXA10 ONU100 cabinet is composed of two parts: The main equipment area and the power supply area. The mini subscriber access unit provides four subscriber line board slots to allow the access of at most 128 POTS subscribers or 64 ADSL subscribers, one switching processing board ICS/GIS and one test card TSLC, and one rectifier module POWEAC. Among them, the subscriber line board slot nearest to the ICS/GIS board can use the IST to provide the built-in transmission function (When the IST is used, the slot of NO.6 can insert subscriber interface card). The POWAC is used to provide the functions of primary and secondary power supply, or alternatively, the POWDC can be used to provide DC power supply.

Its full configurations are shown in the following figure.

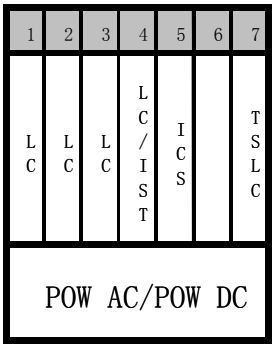


Figure 13 Board Arrangement of mini subscriber Layer for ZXA10 ONU100

3.2.4 The function of EPON in the U300

3.2.4.1 Overview of the system

The function of EPON can be supported by ZXA10 U300.To provide the Optical Fiber Access based the technology of EPON via add the board EPOL.

EPOL can be insert the slot of LC1～LC12 at will. It is easy to hold out Optical Fiber Access of EPON by upgrade the software.

3.2.4.2 Main functions

EPOL's functions feature shows as the following character.

Main Technical Parameters:

1. Equipment capacity

with 12 universal line card slots ,hold out 12PON ports.

Each EPOL provide one interface of EPON.

EPOL can mix-insert with the other line card of U300.

2. Uplink network interface

Uplink IP data network interface: supports GE or 100Base_T.

Uplink video network interface: optionally supports FE/GE interface, provides IPTV service and RF interface, external multiplexer provides video service.

3. PON port

Single PON port supports 32 branches (Maximum transmission distance: 20 km), 64 branches (Maximum transmission distance: 5 km),

Downlink wavelength: 1,490 nm, uplink wavelength: 1,310 nm

Video CATV wavelength: 1550nm

4. Functions

Compliance with 802.3ah-2004 standard.

Supports perfect DBA functions, provides such performance guarantee as minimally guaranteed bandwidth, maximally allowed bandwidth, maximum time delay, supports SLA.

Supports perfect remote OAM function, including link status detection, fault isolation, remote loop back and remote status detection.

Supports AES128 encryption and decryption of downlink service

Supports perfect management over user end equipment and user certification

Supports IEEE802.1x and PPPoE forwarding

Supports automatism discover of ONU

Supports dynamic measure distance of ONU

Supports multiple packet classification functions

Classification based on VLAN-ID

Classification based on IP TOS

Classification based on TCP/UDP port number

5. Switching characteristics at Ethernet layer 2

Supports 802.1Q VLAN

Supports VLAN Stacking (Q- in- Q)

Supports IGMP Snooping (supports IGMP V1, V2), Each PON port supports up to 256multicasts.

Supports IEEE802.3x Pause frame

Supports priority level of IP TOS and IEEE802.1p, and supports 8 priority queues.

6. Management and maintenance function of NETNUMEN N31 to ZXPON series ONT

Query of user terminal information, such as user ID, manufacturer ID, type and software version.

Maintenance for PON ports, including link status, performance parameter query and port loop back test.

Maintenance for user port, including setting/query of working modes of ports, and query of current port status.

Setup and query parameter remotely

7. EMI/EMC and security

ETSI EN300 386

ETSI 60950-1

8. Standards complied

IEEE802.3ah

IEEE802.3

IEEE802.1q

IEEE802.1p

ITU-T G.707

ITU-T G.703

3.2.5 Synchronization Features

U300 implements clock synchronization, with three timing modes available.

By means of external independent timing sources, the timing reference can be extracted from the 2Mbit or 2MHz signals of the BITS clock system or other independent timing systems, so that the timing module on control board GIS can generate the clocks needed by the system. The incoming clock references are 2Mbit/s according to ITU-T Recommendation G.703 § 6, and 2 MHz according to ITU-T Recommendation G.703 § 10.

The system is capable of deriving synchronization signals from any 2 Mbit/s link connected to it and it is possible to use any of these digital links as a controlling link and pre-select up to three links to be used as controlling links, and to assign an order of priority for their usage as the master source. The clocking arrangements within the MSAN are implemented so as to allow a changeover of timing source to be achieved without any affection o traffic.

Clocks are extracted from the E1 interface of the switch. The synchronous 8k clock reference is extracted via E1 board, from the V5 E1 interface signal code stream connected with the switch, so that the timing module on control board can generate the clocks needed by the system.

Internal clock source is used. When all the external clock reference signals are gone, the internal clock can take over automatically. The clock precision is at least stratum 3 clock standards. The equipment can continue working in such timing mode, yet its service quality may deteriorate to some extent. The switchover between different clock references can be implemented on control board automatically or as specified manually.

3.3 Centralized Supervision unit with monitor supporting equipment

The environment for the AN products is rather complicated, and the strict environment requirements, such as environment temperature, humidity and dust content, as required by telecom equipment may often fail to be met in practice. Furthermore, remote equipments of AN are often unattended. All these factors impose a higher demand on equipment safety. AN equipment itself must be capable of self-protection. That is, the equipment should be capable of monitoring its environment (such as environment temperature, humidity and airborne smoke content, whether the cabinet door is open, and unauthorized intrusion, etc.). And it should be capable of reporting any abnormal event to the remote monitoring center, and changing the environment to some extent (such as switching on the air-conditioning). Above-mentioned are the tasks of the environment monitoring system. The remote AN equipment is powered by the commercial power supply. In view of the uncertainty of the commercial power supply, the power supply system of the equipment should be backed up with emergency systems (such as battery and electric generator), in an effort to maintain the communication uninterrupted against abnormal commercial power supply. The tasks of CSV&SF are to ensure the power supply system to work normally within certain range, and to report abnormal events (such as electricity failure and inverter faults) to the monitoring center, and to start the emergency system to ensure normal running of the telecom equipment.

3.3.1 CSV&SF functional features

CSV&SF is a monitoring and control equipment, integrating power supply voltage measurement, environment monitoring, CATV equipment supervision and pre-warning for burglary and fire accidents. Besides, it has a port reserved for expansion and upgrading, while this environment test port can also be used for expansion and upgrading. It supports the

interconnection and internetworking of up to five types of equipment, as well as teleaction and remote control.

Generally, its function features are:

- Supports environment monitoring: environment temperature/ humidity, fire/smoke, water immersion extent and burglar alarm(door open, infrared detection);
- Secondary power supply monitoring: normal indication of the secondary power supply;
- Primary power supply monitoring: -48V output voltage and load current etc;
- AC voltage monitoring: Single-phase 220V AC voltage;
- Air-conditioning control: The temperature rise and drop of the air-conditioning;
- Board self-test: Test the self-running status of the board;
- Support multi-serial-port connection;
- Data interface supports Q3 Specification;
- Standard chassis of 19-inch 1 U high;
- -48V switching rectifier (single power supply).

CSV&SF system regularly collects the system variables and reports the results to the upper-level system through the multi-serial-port. Its use is illustrated the following figure. It can not only report data automatically, but also transfer and interpret commands.

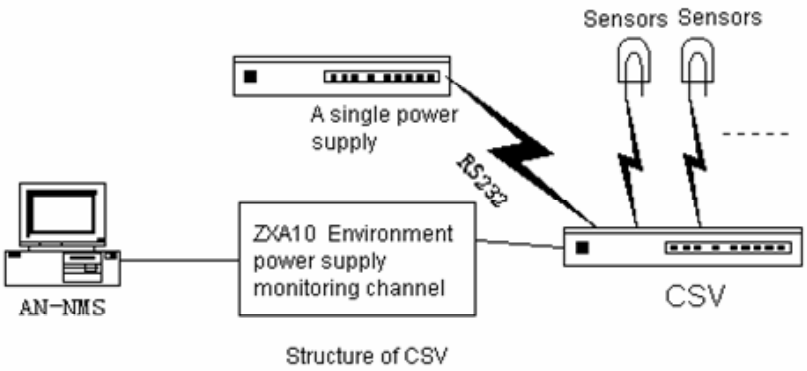


Figure 14 Structure of CSV&SF

The delay of CSV&SF man-machine commands is no more than five seconds, that of real-time data no more than 60 seconds, and that of alarm no more than 3 seconds.

3.3.2 The Environment monitoring board with monitor supporting equipment for OUT50: EMB&SF

EMB&SF is the special environment power monitoring and control board for outdoor type OUT50C. The main function of the EMB&SF is to monitor the environment and power status

of the remote ONUC system which is fulfilled by CSV&SF system in indoor type ONUC. For the detail function, please refer to above part for CSV&SF.

3.3.3 The Environment monitor board for ONUC:EPC

EPC is the special environment power monitoring and control board for outdoor type ONUC which is mix-plugged in the ZXA10 U300 line card slot. The main function of the EPC is to monitor the environment and power status of the remote ONUC system which is fulfilled by CSV&SF system in indoor type ONUC. For the detail function, please refer to above part for CSV&SF.

3.3.4 ZXDU45 Embedded Power System

In AC power supply mode switching power supply or embedded power systems must be configured depending on power consumption. Now the ZXA10 ONUC is configured with the built-in the ZXDU45/45A and ZXDU45/30A embedded power systems.

The ZXDU45 embedded power system is often put in the RACK 1500E, 19D06H20 or OUT40E/OUT30E/OUT30/OUT40/OUT30F cabinet. Each cabinet can hold one ZXDU45 power module to provide –48V power supply for other modules inside the cabinet. The ZXDU45 actually consists of three 15A switching powers and supports 1 + 1 and N + 1 protection. The ZXDU45 can be configured to be ZXDU45/45 A or ZXDU45/30 A on demand.

The appearance of the ZXDU45 embedded power system is shown in Figure 14:

Figure 15 ZXDU45 Embedded Power System

Major Technical Parameters：

1. Outline dimensions:

- 177 mm x 482.6 mm x 360 mm (Height x Width x Depth)

2. Weight:

- 20kg

3. Rectifier:

- Input voltage: 154VAC to 300VAC
- Floating charge: 53.5V (adjustable)
- Equalized charge: 56.4V (adjustable)
- Broad frequency noise voltage:

≤ 50 mV (3.4kHz~150kHz)
≤ 20 mV (0.15MHz~30MHz)

- Discrete frequency noise voltage:

≤ 5 mV (3.4kHz~150kHz)
≤ 3 mV (150kHz~200kHz)
≤ 2 mV (200kHz~500kHz)
≤ 1 mV (0.5MHz~30MHz)

- Efficiency: ≥ 99% (on-load voltage: 30%~100%)
- Soft start time: 3s to 8s

4. AC input:

- Voltage: single-phase three wire 130VAC to 300VAC
- Frequency: 45Hz to 65Hz
- Rated current: 12A
- Maximal current: 25A
- Efficiency: ≥ 99% (full load)

5. DC output:

- Voltage: 48V (42V~58V continually adjustable)
- Current: 45A (full load)
- Phone weighted noise: ≤ 2 mV
- Peak-to-peak noise voltage: ≤ 100 mV (20MHz bandwidth)
- Efficiency: ≥ 90% (full load)
- Security specifications: IEC950 Standards

6. Electromagnetic compatibility:

- Comply with EN5502 A Level Standards

7. Reliability:

- MTBF: ≥ 1.0 x 10^5h

3.3.5 ZXA10 MSAN Built-in Storage Battery

As a backup power of combined power supply and uninterrupted power system (UPS), the storage battery plays an important role in a power supply system for telecommunications. It provides power supply for telecommunication equipment when its AC commercial power fails.

In the ZXA10 ONUC system, different racks adopt different storage battery devices due to power consumption.

Table 2 ZXA10 ONUC Built-in Storage Battery

ZXA10 ONUC Rack	Storage Battery	Capacity of Storage Battery
IN1500/19”standard rack (600*600)	6-GFM-100 (T)	100AH
OUT40E	6-GFM-100 (T)	100AH
OUT30	6-GFM-100 (T)	100AH
OUT30E	6-GFM-100 (T)	100AH
OUT30F	6-GFM-200 (T)	200AH
OUT50	6-GFM-38	38AH
OUT60	6-GFM-100 (T)	100AH

Function Features:

- Sealing structure

Structure has been sealed reliably by using an advanced sealing technology..

- Long life

The valve sealed lead acid battery has an ultra long life and good durability because of the following characteristics.

- Have a lattice made from corrosion resisting lead-calcium alloy.
- Adopt a solid, durable shell made from ABS material
- Have a ultra fine, adsorptive partition board with high purity.
- Have a pressure safety valve to be opened accurately.
- Adopt an advanced integrated design and superior manufacturing process for the pole slab lattice.
- Have good high ratio performance
- Sealing structure

The valve control sealed lead acid battery has a small inherent resistance. It has good high ration performance in high ration pulse or continuous current discharge.

- Broad temperature range

Operating temperature range is –20˚C to +45˚C

- High energy density

It adopts a lean solution design and compact assembly process and has very high volume ratio energy and weight ratio energy.

- Low self-discharge

Adopting raw material with high purity, the valve control sealed lead acid battery seldom performs self-discharge in storage or out of use. Its self-discharge is smaller than 3% per month.

- Good recovery performance after complete discharge

It adopts a special electrolyte recipe and has good recovery performance after complete discharge.

Table 3 Major Technical Parameters:

Series Name	Battery Model	Rated Voltage (V)	Rated Capacity (Ah)	Outline Dimensions			Weight (kg)
				Length (mm)	Width (mm)	Height (mm)	
6-GFM-T series (12V communication series)	6-GFM-100T	12	100	403	169	215	35.05
6-GFM series (12V series)	6-GFM-38	12	38	197	165	170	14.65

3.4 Introduction to ZXA10 ONUC Boards

3.4.1 Integrated control & switch card with GE GIS

The GIS board adopts two CPUs, performs connections for narrowband switching networks, process access network V5 protocol functions, collects and switches broadband Ethernet buses, and handles layer 2 protocol functions of Ethernet.

- Support all the functions of the control switching board ICS/EICS.
- Adopt the 24-port Gigabit Ethernet switching module to meet high bandwidth requirements.
- Support 4K VLAN, 2 x GE + 2 x FE uplink interfaces, and GE star cascading between sub-racks.
- For redundancy, two GIS boards adopt an active/standby operation mode.
- Provide two RS232 interfaces: One is connected to the environment power monitoring unit for sending its information to the NMS server; the other is connected to the NMS computer for managing the local serial port HyperTerminal.
- There is a 10/100M Ethernet port(electrical interface) on the IS panel for local management, including status monitoring the NEs, configurations, database back-up, software upgrade , test, security access and so on. To run the LCT function, the normal PC or laptop with Windows 98/NT/2000/XP is needed.

<u>Index and hot swap:</u>

- Board power consumption: 25W
- Whether to allow hot swap: yes

3.4.2 Control Switching Board ICS

The ICS control switching board performs status scan, circuit connection, and status control for each user interface in this user unit. At the same time the ICS provides the E1 link to directly connect with the SPC switch via a standard V5 interface. The ICS can be connected to the T600 equipment via internal signaling. If the connection is very long, integrated service dispatching system or SDH transmission system may be used. The ICS adopts an active/standby operation mode. Normally the active ICS controls 12 user boards separately. In switchover, the normal ICS board forces the abnormal ICS to stop its running and give up its system control right, for example, the control right to manage user boards and RS-232 interfaces, and then takes over the system control right that is given up. In this way the system reliability is greatly improved.

The ICS board mainly provides the following functions:

- Scan the circuit status of downlink user boards and perform management functions.
- Provide four E1 interfaces for uplink narrowband services and V5 interfaces to the SPC switch side.
- Provide two RS232 interfaces: One is connected to the environment power monitoring unit for sending its information to the NMS server; the other is connected to the NMS computer for managing the local serial port HyperTerminal.
- There is a 10/100M Ethernet port (electrical interface) on the ICS panel for local management, including status monitoring the NEs, configurations, database back-up, software upgrade, test, security access and so on. To run the LCT function ,the normal PC or laptop with Windows 98/NT/2000/XP is needed.
- Support four uplink E1s and 12 downlink user boards, one user test board, and the switching function of 8M HWs in other slave subrack.
- Extract an 8K clock from E1 as a system clock. Normally the clock is extracted from the first E1. It may be extracted from the second E1 when the first E1 fails.
- Collect Ethernet buses, perform the switching function, process the layer 2 Ethernet protocol, and expand the third layer IP protocol.
- Support 256 VLANs, 2 x FE uplink interfaces, optional FE optical/electrical interface, and FE star cascading between subracks.
- For redundancy, two EIS boards adopt an active/standby operation mode

<u>Index and hot swap:</u>

- Board power consumption: 22W
- Whether to allow hot swap: yes

3.4.3 Simplified integrated control & switch card GISE

The simplified integrated control & switch card GISE is used in the narrowband slave user unit. The GISE Provides 2K × 2K switching network and performs V5 process, circuit initialization

of E1and switch network, switch network connection, narrowband cards management and users scan. Two GISE cards operate in the active/standby mode.

Index and hot swap:

- Board power consumption: 8W
- Whether to allow hot swap: yes

3.4.4 Enhanced Control Switching Board EICS

The enhanced control switching board EICS is the control and switching core of the system, performing the following functions:

- Support all the functions of the control switching board ICS.
- Support 4K VLAN, 2 x FE or 1 x GE + 1 x FE uplink interfaces, and FE star cascading between subracks

Index and hot swap:

- Board power consumption: 22W
- Whether to allow hot swap: yes

3.4.5 2GE + 2FE Ethernet Interface Subcard GEI

The GEI is plugged into the back of the MICS/MBSL backplane for expanding the main subrack. The GEI provides two uplink FE electrical ports and two uplink GE optical ports. In addition, the GEI can expand four slave sub-racks. Each slave sub-rack includes one or two GE and one pair of 8M HW LVDS.

The major functions of the GEI:

- Provide two uplink RJ45 100M Ethernet electrical ports
- Provide two uplink Gigabit Ethernet optical ports
- Terminate the LVDS, connect to the GIS via the four-channel TTL 8M HW, and provide the external side with the LVDS of four-channel 8M HW for stack
- Provide the external side with one or two Gigabit Ethernet ports (by high density pins) to one slave unit for broadband stack
- Each control unit or user unit is configured with one GEI board to provide the uplink interfaces of 2 x GE optical port and 2 x FE and 4 x FE electrical port, and work together with the GIS board.

3.4.6 2GE + 2FE Ethernet Interface Subcard GEIS

The GEIS is plugged into the back of the ONU100's backplane for expanding the main subrack. The GEIS provides one uplink FE electrical port and one uplink GE optical port.

The major functions of the GEIS:

- Provide one uplink RJ45 100M Ethernet electrical port
- Provide one uplink Gigabit Ethernet optical port

- Terminate the LVDS, connect to the GIS via the four-channel TTL 8M HW, and provide the external side with the LVDS of four-channel 8M HW for stack
- Each ONU100 unit is configured with one GEIS board to provide the uplink interfaces of 1 x GE optical port and 1 x FE ,and work together with the GIS board.

3.4.7 2FE Electrical Port Ethernet Interface Subcard EUX

The EUX card provides two 100M BASE-TX ports, compatible with IEEE 802.3 standards. Both of them are available for the uplink of ZXA10 U300 broadband services or the cascade of multiple ZXA10 U300 subscriber shelves. The EUX offers slots for cascading cables for the cascade of the maser and slave shelves.

The major functions of the EUX board:

- Provide two uplink RJ45 Ethernet electrical ports for the system
- Terminate the LVDS, connect to the ICS via the four-channel TTL 8M HW, and provide the external side with the LVDS of four-channel 8M HW for stack
- Provide the external side with four Ethernet ports (non-RJ45 port, provided by high density pins) for broadband stack
- Each control unit or user unit is configured with one EUX board, work together with the ICS and EICS boards, and provide two uplink FE electrical ports

3.4.8 1GE Optical Port + 1FE Electrical Port Ethernet Interface Subcard GEUF

Each control unit or user unit is configured with one GEUF board to provide the uplink interface of 1 x GE optical port and 1 x FE and 4 x FE cascading interface together with the ICS and EICS boards.

- Provide the uplink Gigabit Ethernet optical port of one LC interface and the uplink Ethernet electrical port of one RJ45 for the system
- Terminate the LVDS, connect to the ICS via the four-channel TTL 8M HW, and provide the external side with the LVDS of four-channel 8M HW for stack
- Provide the external side with four Ethernet ports (non-RJ45 port, provided by high density pins) for broadband stack

3.4.9 2FE Optical Port Ethernet Interface Subcard FEI

Each control unit or user unit is configured with one FEI board to provide two uplink FE optical ports and 4 x FE cascading interface together with the ICS and EICS boards.

3.4.10 Analog User Board ALC/I

The ALC can support analog Z interface and provide POTS access. Each ALC provides 32 user lines. Each U300 unit holds 12 ALC boards.

The ALC board has seven basic BORSCHT functions:

- B: (Battery) feed function

- O: (Over Voltage Protection) function, need to reach the industry standard K20 test requirements
- R: (Ringing) function
- S: (Supervision) function, monitor the DC working state of a user port
- C: (Codec) function, perform voice A/D and D/A conversions by the CODEC chip
- H: (Hybrid) 2-/4-wire hybrid conversion function
- T: (Test) function, provide internal and external test interfaces.

Technical index and hot swap:

- User feed voltage: –48V
- User feed current: 0.02A
- Ringing current voltage: 75V
- User lines: 32
- Power consumption: 13W
- Whether to allow hot swap: yes

3.4.11 Polarity Reversed User Board RALC

Each RALC board supports 32 analog user interfaces and provides the reverse polarity function and charges pulse of 16 KHz. Its design principles and functions are similar to the ALC.

3.4.12 Remote User Board FLC

Each FLC board provides 16 analog users and simultaneously supports reverse polarity users and 16KC/12KC pulse charging users. It is used for public telephone services that are paid in time. Its design principles and functions are similar to the ALC.

3.4.13 2/4 wire audio board (AUDB)

2/4 wire audio board AUDB mainly converts analog signal into PCM digital signal, to convert voice and data into digital form to be transmitted, achieving digital switching with the switching system directly. AUDB can be plugged in together with ALC in U300.

2/4 wire audio board AUDB offers the following functions:

- Each AUDB offers 8 voice ports.
- The gains of output/input levels are adjustable through software.
- Provides two transmission modes: 2-line and 4-line.

3.4.14 Digital User Board DLCC

The DLCC board provides basic rate interface for ISDN, receives and sends 2B + D data, and performs format conversion between 2B1Q stream at the U interface and PCM stream at the switch.

The DLCC board can be plugged in any user slot. One ZXA10 U300 unit supports 12 DLC boards. Each DLC board supports eight users. Thus one interface unit can hold 96 ISDN users.

The DLCC board has the following functions:

- Provide the 2B + D interface and perform the U interface function of the ISDN physical layer, including 2B1Q coding/decoding, 2-/4-wire conversion and echo suppression, B/D channel separation, self loop detection, and over voltage protection.
- Perform link layer processing for D channel separation based on the I440/I441 protocol, send the processed signaling to the ICS, and realize communication with the ISDN network layer.
- Allocate time slots for two B channels based on the ICS instruction.
- Provide test interfaces for user test boards
- Provide remote power supply. When the local side cannot provide power supply to an NT1, the DLCC can do so via the U interface.

Technical index and hot swap:

- The technical indexes of the DLC board are as follows:
- Feed voltage: –59VDC to –96VDC
- User lines: 8
- Board current: 0.1A, adding a remote user needs 0.07A.
- The transmission distance of the U port exceeds 5.5 km when the 0.4-mm diameter copper wire is adopted.
- Static power consumption: 6.5W, 20W at most
- Whether to allow hot swap: yes

3.4.15 Digital Interface Board DIB

The DIB board provides access and multiplexing for synchronous/asynchronous sub-rate data of smaller than or equal to 64kbps.

Its major functions:

- The DIB board can work together with various types of user data devices to form a 64kbps data stream for various data users by time division multiplexing. The data stream can enter the DDN access system to establish data communication with remote opposite users.
- The DIB board provides a 64kbps channel for DDN, four data interfaces for users with a data rate of 2.4kbps, 4.8kbps, or 9.6kbps, or two 19.2kbps data interfaces. The data transmission mode is synchronous or asynchronous. The interface is RS-232/V.24/V.35 user data channel.

- The DIB board provides a convenient maintenance function, supporting 64kbps interface loop test and low-speed channel loop test. Equipment operations are flexible and convenient.

Technical characteristics:

- Conversion of interface electrical level type

The interface of DIB to users complies with the V.24 (RS-232) and V.35 protocol. The electrical level of DIB is the TTL (or CMOS). It must perform conversion of interface electrical level type.

- The 64kbps signal to the main control board has a 2Mbps uplink and downlink channel
- The subrate data is multiplexed to the 64kbps signal.

According the standard X.50 frame structure, the DIB multiplexes (2.4kbps, 4.8kbps, 9.6kbps, and 19.2kbps) data to the 64kbps stream. The X.50 adopts 8-bit packet encapsulation interleaving multiplexing, where bit 1, that is, F bit, is a frame alignment bit, bits 2–7 are user information bits, and bit 8, that is, S bit, is a state bit.

- Control, detection, alarm

Technical index and hot swap:

- Board current: 0.1A
- User lines: 4
- Power consumption: 4W
- Whether to allow hot swap: yes

3.4.16 High Speed Digital User Line Interface Board HDB

Each HDB board provides four TDM-based SHDSL interfaces. It must be configured with an SHDSL interface subcard STD. It can perform 2M private line (via four uplink E1 interfaces) and V.35 N x 64K private line (via uplink ICS) functions. The HDB board integrates the transmission function and the user function. When performing the transmission function, the HDB can realize four 2M private lines; when performing the user board function, it can give out four 2-wire N x 64K SHDSL signals, which are changed into N x 64K V.35 signals at the user end via SLINK.

The HDB board has the following functions:

- Plug in a user slot to provide four SHDSL (2- or 4-wire).
- Support four 2.048M G.703 signal to SHDSL signal (2-wire or 4-wire), where G.703 signal may be channel PCM signal or non-channel 2M/1.5M signal.
- Support N x 64K SHDSL user, four channels
- When the board is under the control of the ICS, management contents include N x 64K rate configuration and interface state report.

<u>Technical index and hot swap:</u>

- Board power consumption: 10W

- Input power supply: +4.75V~+5.25V
- Whether to allow hot swap: yes

3.4.17 User Test Board TSLCC

The TSLCC board in the ZXA10 U300 is characterized by fast test speed and high accuracy. One TSLCC board can be used to test user lines in a multi-layer user unit whose test buses are interconnected via interfaces on the backplane.

The TSLCC board mainly performs the following functions:

- External line test: It can measure insulation resistance, AC/DC voltage, capacitance, and DC loop resistance between A and B, between A and ground, and between B and ground of user circuit external lines.
- Internal line test: It can measure the output voltage and frequency of ringing current, detect the signal tone, test equipment pulse number receiving and DTMF number receiving functions, and check the dialing tone.
- User telephone function test: It can test the telephone dialing pulse, DTMF signal, user feed voltage and its polarity.
- Interception function

Index and hot swap:

- Support 20 user units
- Board current: 0.06A
- Whether to allow hot swap: yes

3.4.18 Type D user test board TSLCD

The TSLCD board in the U300 front leading-out version and U300 rear leading-out version with two powers is characterized by fast test speed and high accuracy. One TSLCD board can be used to test user lines in a multi-layer user unit whose test buses are interconnected via interfaces on the backplane.

The function and index of TSLCD is the same as TSLCC.

3.4.19 ADSL User Board GADL/T

The GADL/T board can access ADSL users and connect to other Ethernet switching devices via Ethernet interfaces. The downlink ADSL rate reaches 8Mbit/s so that high speed Internet access can be realized.

The major functions of the GADL/T board:

- The GADL/T board follows such ADSL standards as ITU G.992.1 Annex (G.dmt) and ITU G.992.2 (G.Lite).
- The GADL/T board supports a maximum downlink rate of 8160kbps and a maximum uplink rate of 1024kbps. At the time the maximum transmission distance is 5km (0.4 wire diameter).

- Adopt a DMT modulation demodulation mode to adapt the rates: The rates are automatically adjusted based on circuit conditions. The adjustment step is 32kbps.
- Support the ADSL over POTS mode: It has 16 built-in splitters to separate voice from data.
- Support the uplink Ethernet mode, and provide one 100M Ethernet connected to the switching board via the backplane
- The GADL/T board supports communication with HDLC of the GIS/ICS board.
- The GADL/T board provides 16 ADSL interfaces and supports the ATM mode.

Index and hot swap:

- Board power consumption: 24W
- Whether to allow hot swap: yes

3.4.20 ADSL2+ User Board GADL/2+

The GADL/2+ board can access ADSL2/ADSL2+ users and connect to other Ethernet switching devices via Ethernet interfaces. The downlink rate of the ADSL2+ reaches 25Mbit/s.

The major functions of the GADL/2+ board:

- The GADL/2+ board is compatible with the original G.dmt, G.lite, and ANSIT.413 standards and complies with the ITU G.992.5 standard.
- The GADL/2+ board supports a maximum downlink rate of 23.22Mbps and a maximum uplink rate of 1024kbps. At the time the maximum transmission distance is 5km (0.4 wire diameter).
- Adopt a DMT modulation demodulation mode to adapt the rates: The rates are automatically adjusted based on circuit conditions. The adjustment step is 32kbps.
- Support the ADSL over POTS mode: It has 16 built-in splitters to separate voice from data.
- Support the uplink Ethernet mode, and provide one 100M Ethernet connected to the switching board via the backplane.
- The GADL/2+ board support communication with HDLC of the GIS/ICS board.
- The GADL/2+ board provide 16 ADSL interfaces and support the ATM mode.

Index and hot swap:

- Board power consumption: 24W
- Whether to allow hot swap: yes

3.4.21 The combo User board ILC2 and ILC/2+

The ILC and ILC/2+ are the combo cards with 16 ports which can support the broadband and narrowband services at the same time.

ILC supports ADSL, and ILC/2+ supports ADSL2+. The operator can enable/disable the broadband or narrowband service at any port in the combo card.

Index and hot swap:

- Board power consumption: 30W
- Whether to allow hot swap: yes

3.4.22 VDSL2 digital loop subscriber card GVDL

The GVDL board can access VDSL2 users and connect to other Ethernet switching devices via Ethernet interfaces.

The major functions of the GVDL board:

- The GVDL board Complies with the ITU G.993.2 standard.
- The GVDL board supports a maximum downlink rate of 64Mbps and a maximum uplink rate of 32Mbps. At the time the maximum transmission distance is1km (0.4 wire diameter).
- Adopt a DMT modulation demodulation mode to adapt the rates: The rates are automatically adjusted based on circuit conditions..
- Support the uplink Ethernet mode, and provide one 100M/1000M Ethernet connected to the switching board via the backplane.
- The GVDL board supports communication with HDLC of the GIS/ICS board.
- The GVDL board provides 16 VDSL2 interfaces.

Index and hot swap:

- Board power consumption: 33W
- Whether to allow hot swap: yes

3.4.23 SHDSL digital loop subscriber card GSDL

Each SDL board provides 16 SHDSL interfaces (in ATM mode).

Technical index:

- GSDL board Complies with the ITU G.991.2 standard.
- Board power consumption: 20W
- Interwork with a terminal modem: interwork with the ZXDSL732
- Modulation mode: TCP-PAM

3.4.24 SHDSL Interface Board SDL

Each SDL board provides 16 SHDSL interfaces (in ATM mode). It is worked with ICS/EICS.

Technical index:

- SDL board complies with the ITU G.991.2 standard
- Board power consumption: 20W
- Interworking with a terminal modem: interworking with the ZXDSL732

- Modulation mode: TCP-PAM

3.4.25 Integrated Voice Data User Board ILC/T

The ILC/T board integrates the major functions of the ALC and the ADSL and support broadband and narrowband functions. Each ILC/T board simultaneously provides 16 ADSL users and 16 POTS users, has a built-in voice splitter, and offers a line capture module.

Broadband part

- Support standards: T1.413 ISSUE 2 November 1998, ITU G.992.1 Annex A(G.dmt), and ITU G.992.2(G.Lite).
- Support the uplink Ethernet mode, and provide one 100M Ethernet connected to the switching board via the backplane or directly connected to the panel.
- Support a maximum downlink modem rate (ITU G992.1 Annex A) of 8160K and a maximum uplink modem rate of 32–1024K, where the maximum transmission distance is 5 km (0.4-diameter wire)
- Adopt a DMT modulation demodulation mode to adapt the rates: The rates are automatically adjusted based on circuit conditions. The adjustment step is 32kbps. Support ADSL over POTS, including a voice data splitter circuit.
- Provide an external interface to the backplane for user circuit test.

Narrowband part

- The narrowband part has seven basic BORSCHT functions:

B: (Battery) feed function

O: (Over Voltage Protection) function, need to reach the industry standard K20 test requirements

R: (Ringing) function

S: (Supervision) function, monitor the DC working state of a user port

C: (Codec) function, perform voice A/D and D/A conversions by the CODEC chip

H: (Hybrid) 2-/4-wire hybrid conversion function

T: (Test) function, provide internal and external test interfaces.

<u>Index and hot swap:</u>

- Board power consumption: 25W
- Whether to allow hot swap: yes

3.4.26 Integrated Voice Data User Board ILC/2+

The ILC/2+ board integrate the major functions of the ALC and the ADSL2+ and support broadband and narrowband functions. Each ILC/T board simultaneously provides 16 ADSL2+ users and 16 POTS users, has a built-in voice splitter, and offers a line capture module.

Broadband part

- The ILC/2+ board is compatible with the original G.dmt, G.lite, and ANSIT.413 standards and complies with the ITU G.992.5 standard.

- Support the uplink Ethernet mode, and provide one 100M Ethernet connected to the switching board via the backplane or directly connected to the panel.
- The ADLG/2+ board supports a maximum downlink rate of 23.22Mbps and a maximum uplink rate of 1024kbps. At the time the maximum transmission distance is 5km (0.4 wire diameter).
- Adopt a DMT modulation demodulation mode to adapt the rates: The rates are automatically adjusted based on circuit conditions. The adjustment step is 32kbps. Support ADSL over POTS, including a voice data splitter circuit.
- Provide an external interface to the backplane for user circuit test.

Narrowband part

- The narrowband part has seven basic BORSCHT functions:

B: (Battery) feed function

O: (Over Voltage Protection) function, need to reach the industry standard K20 test requirements

R: (Ringing) function

S: (Supervision) function, monitor the DC working state of a user port

C: (Codec) function, perform voice A/D and D/A conversions by the CODEC chip

H: (Hybrid) 2-/4-wire hybrid conversion function

T: (Test) function, provide internal and external test interfaces.

Index and hot swap:

- Board power consumption: 25W
- Whether to allow hot swap: yes

3.4.27 Ethernet Interface Board ETI

The ETI board performs Ethernet layer 2 switching function. Each ETI board provides six 100M Ethernet interfaces as user Ethernet interfaces, compatible with electrical and optical ports. The ETI board supports 2FE optical port + 4FE electrical port.

The major functions of the ETI board:

- Realize the Ethernet layer 2 switching function, and support multiple functions such as VLAN, QoS, TRUNKING, STP, and IGMP. Provide eight swappable Ethernet interfaces, where six are connected to output panel for users, cascading, or uplink and the other two are connected to the ICS via the backplane to perform the service switching of the ICS.
- HDLC channel: The message between the ETI board and the ICS board adopts an HDLC mode.

Index and hot swap:

- Board power consumption: 4W
- Whether to allow hot swap: yes

3.4.28 Ethernet interface board GETI

Each GETI provides 6 FE interfaces of either the optical or the electrical type.

3.4.29 FE Ethernet transfers board ETC

FE Ethernet transfers board ETC is used for providing downlink and expanding uplink FE interfaces. ETC work in U300 user unit. Each ETC provides 2 FE interfaces of the electrical type. It can provide 2 FE interfaces at L5 and L6 slots. At the other slots, it only support 1 FE interface. It only can work in ICS/EICS and be used limited.

Index and hot swap:

- Board power consumption: 1W
- Whether to allow hot swap: yes

3.4.30 GE Ethernet transfers board GETC

GE Ethernet transfers board GETC is used for providing downlink and expanding uplink GE interfaces. GETC works in U300 user unit. Each GETC provides 2 GE interfaces of the electrical type. It can provide 2 GE interfaces at L5 and L6 slots. At the other slots, it only support 1 GE interface. It only can work in GIS and be used limited.

Index and hot swap:

- Board power consumption: 1W
- Whether to allow hot swap: yes

3.4.31 Inverse Multiplexing ATM Board (IMAE)

The IMAE card provides IMA uplink for the system, available for any line card slot. The IMAE card offers 8 E1 interfaces for uplink, binding E1 links through 1 to 8 together, implementing the conversion between ATM cells and Ethernet frames. When one E1 link is used, the card can transfer services in pure cell mode.

3.4.32 Integrated service transmission board IST

Integrated Service Transmission (IST) board IST1T/ IST1A: It is a board for SDH/MSTP optical transmission that provides optical modules of the ordinary haul, medium haul, long haul and super long haul and the optical interface types are optional. Each IST at the line side provides one STM-1 (ST1T) or two STM-1 (IST1A) optical interfaces. At the tributary side, it provides four FE interfaces and four E1 interfaces to the outside. Its quantity depends on the actual needs. To use the IST board, the following equipment should be configured: Order wire telephone TEL: 1 (mandatory); IST interface card EFX (mandatory, used to provide external interface and order wire telephone interface); Octuple framing subcard OFC (optional, each OFC provides 2*8MHW and it is configured when the number of uplink E1s connecting the ICS and the IST exceeds 8) ; Optical jump with the length of 20 m (single mode) (mandatory), It is with the built-in transmission board IST, with 2PCS/optical interface.

3.4.33 Extended E1 interface board ODTI

Each ODTI board provides 8 E1 interfaces. It is used to expand the E1 interface capability of the ICS during the stack of multiple layers of subscriber units or to provide ISDN PRI interfaces.

3.4.34 Long distance EPON interface card (1 port，20Km)

The function of EPON can be supported by U300.To provide the Optical Fiber Access based the technology of EPON via add the board EPOL. Each EPOL provide one interface of EPON and Single PON port supports 32/64 branches. EPOL can be insert the slot of LC1～LC12 at will. It is easy to hold out Optical Fiber Access of EPON by upgrade the software.

1～2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
POWERH	LC	LC	LC	LC	LC	LC	ICS	ICS	LC	EPOL	LC	EPOL	LC	LC	TSLC

Figure 16 EPOL board insert in U300 user unit

EPOL's functions feature shows as the following character.

Main Technical Parameters:

1. Equipment capacity

with 12 universal line card slots ,hold out 12PON ports.

Each EPOL provide one interface of EPON.

EPOL can mix-insert with the other line card of U300.

9. Uplink network interface

Uplink IP data network interface: supports GE or 100Base_T.

Uplink video network interface: optionally supports FE/GE interface, provides IPTV service and RF interface, external multiplexer provides video service.

10. PON port

Single PON port supports 32 branches (Maximum transmission distance: 20 km), 64 branches (Maximum transmission distance: 5 km),

Downlink wavelength: 1,490 nm, uplink wavelength: 1,310 nm

Video CATV wavelength: 1550nm

11. Functions

Compliance with 802.3ah-2004 standard.

Supports perfect DBA functions, provides such performance guarantee as minimally guaranteed bandwidth, maximally allowed bandwidth, maximum time delay, supports SLA.

Supports perfect remote OAM function, including link status detection, fault isolation, remote loop back and remote status detection.

Supports AES128 encryption and decryption of downlink service

Supports perfect management over user end equipment and user certification

Supports IEEE802.1x and PPPoE forwarding

Supports automatism discover of ONU

Supports dynamic measure distance of ONU

Supports multiple packet classification functions

Classification based on VLAN-ID

Classification based on IP TOS

Classification based on TCP/UDP port number

12. Switching characteristics at Ethernet layer 2

Supports 802.1Q VLAN

Supports VLAN Stacking (Q- in- Q)

Supports IGMP Snooping (supports IGMP V1, V2), Each PON port supports up to 256multicasts.

Supports IEEE802.3x Pause frame

Supports priority level of IP TOS and IEEE802.1p, and supports 8 priority queues.

13. Management and maintenance function of NETNUMEN N31 to ZXPON series ONT

Query of user terminal information, such as user ID, manufacturer ID, type and software version.

Maintenance for PON ports, including link status, performance parameter query and port loop back test.

Maintenance for user port, including setting /query of working modes of ports, and query of current port status.

Setup and query parameter remotely

14. EMI/EMC and security

ETSI EN300 386

ETSI 60950-1

15. Standards complied

IEEE802.3ah

IEEE802.3

IEEE802.1q

IEEE802.1p

ITU-T G.707

ITU-T G.703

3.4.35 H power supply board POWER H

POWER H supplies power to the broadband and narrowband interface boards. If there are multiple layers of units in the same cabinet, the POWER H in the two adjacent can make inter-layer power backup.

POWER H unit outputs 4 voltages: +5V, –5V, -48V and ringing current 75VAC. Primary power feeding offers –48V through filter TBF, then offers the ringing current voltage by means of AC/DC converter or ringing-current module.

1) Input characteristics:

- Input nominal voltage: -48 VDC

- Input voltage range: -60 VDC ~ -38 VDC
- Maximum input ripple peak: 250 mV
- Limit the maximum peak of the input start current to ten times of the normal working current.

2) Output characteristics:

- The following table shows the output voltage, stability, maximum working current, and peak voltage.

Table 4 Output Characteristics

Output Voltage	Nominal Value (V)	Stability (%)	Maximum Working Current (A)	Maximum Peak Voltage (mVpp)
+5 VA (D)	+5	0.5	30	100
−5 VA	−5	0.5	5	100
−48 V	−48		15	

Ringing current output: 75V+/-15V AC, 400mA, distortion <5%, 25Hz+/-2Hz.

In the event of discontinuous load, the instantaneous response of voltage is less than ±5% of the nominal value. When the input is connected or disconnected, the overshoot value of the output voltage is less than ±2% of the nominal value.

Technical index:

- board current: 0.2A

3.4.36 K power supply board POWER K

POWER K supplies power to the broadband and narrowband interface boards. Be used in the U300 standard rear access two powers version and U300 front access version. The two POWER Ks can work redundancy.

3.5 Indoor 19 Inch Standard Open Rack

3.5.1 Overview of ZXA10 19” standard rack(600*600)

The 19-inch standard rack (600 x 600) of the ZXA10 is targeted to large capacity, non-integrated ONU equipment with an equipment room. The 19-inch standard rack (600 x 600) of the ZXA10 is a general rack in our company. It is characterized by large capacity, easy installation, convenient cabling, complete monitoring functions, strong anti-interference capability, good ventilation, and aesthetic appearance.

The general 19-inch standard rack (600*600) 19D06H20 is an indoor and non-integrated one and is often placed in the equipment room. The valid space of the primary equipment area is 42U, adopting a –48V power supply. Its standard configuration is: five user units, one built-in transmission unit S200 (optional, choosing the S200 can reduce a user unit), one ZXA10 -CSV centralized monitoring module, one power distributor, one fan subrack, one diversion subrack, and one cabling subrack.

The universal 19” standard rack (600mm*600mm) 19D06H20 is an indoor non-integrated rack. Also it can be used as indoor rack for front access. The effective space of the main equipment

area is 42U. The rack employs -48V power supply directly. The standard configuration of the rack includes three user units, one ZXA10-EPC&SF centralized monitoring module, one power distributor, two fan frames.

The power converter in rack is provided with a thermal release protection in case of overheating, and it will provide the alarm when there is an overheating. Protection circuits do not cause unintended trigging. The protection circuits which operate in the event of an overloading of the System is automatically reset when the parameters are restored to the nominal value. The equipment thereafter operate properly without readjustment. Particular precautions are taken to protect the equipment against dangerous high-frequency return paths, excess-voltages and excess-currents.

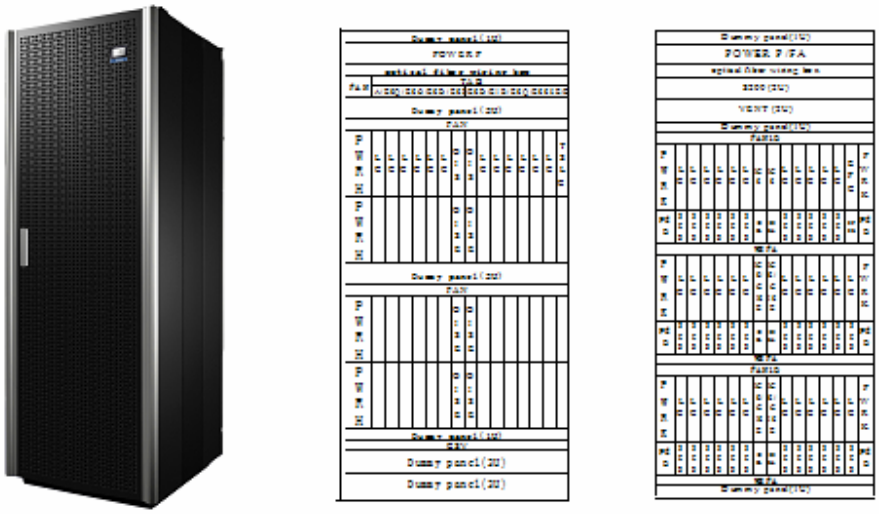


*Figure 17 Outside View and Internal Shelf Structure of the ZXA10 19" standard rack (600*600)*

3.5.2 Main Features of ZXA10 19"standard rack(600*600)

- Supports narrowband service; Provides broadband service flexibly as required by the operator and the customer; Smooth evolution from narrowband network to broadband network.
- Uses 19"standard rack (600*600) 1920 POTS or 960 ADSL interfaces at standard configuration (5 layers of subscriber units).
- Uses 19"standard rack (600*600) 1152 POTS or 576 ADSL interfaces at standard configuration (3 layers of Front Access subscriber units).
- Robust Interoperability
- Seamless Scalability
- Toll-quality Voice
- High Speed Broadband data
- Carrier-class Reliability
- Powerful Network Management
- Accurate remote line test

- Ability of evolution to NGN

3.5.3 Service Interfaces of ZXA10 19”standard rack(600*600)

- Analog Z interface
- ADSL /ADSL2+ interface
- ISDN interface
- PRI(30B+D) interface
- Ethernet interface: Provide two FE or GE ports to backbone packet network and some 10/100M Ethernet ports for LAN interconnecting
- ATM interface: STM-1
- IMA interface
- Clock input interface: Support 2 interfaces of 2Mbit,2MHz or 5MHz
- RS232: One interface for out-of-band network management
- Digital leased line: V.35/V.24/G.703
- SHDSL interface
- VDSL2 interface
- Analogue dedicated line: 2/4 wire interface
- EPON interface

3.5.4 Physical Indices of ZXA10 19”standard rack(600*600)

- Cabinet outline dimensions: 2000mm x 600mm x 600mm (Height x Width x Depth)
- Cabinet weight: 220kg (full configuration)
- Cabinet footprint: 0.36m^2
- Capacity: POTS, 1920L or ADSL, and 960L
- Power consumption (full load): single-cabinet power consumption is 670W and dual-cabinet power consumption is 1470W.
- Operating voltage: 220 ± 20% VAC；–57VDC to –40VDC
- Ambient temperature: 0˚C to 45˚C
- Relative humidity: 10% to 95%
- Grounding resistance: ≤ 1 ohm 0.36m^2
- Rainproof and dust-proof measures: meet IEC IP5.5

3.6 Indoor RACK 1500E Open Rack

3.6.1 Overview of ZXA10 RACK 1500E

The RACK 1500E consists of three parts: main equipment area, cabling area (at the left or right side), and the battery area below the main equipment area (optional). The total effective space of the main equipment area and the battery area is 42U, and it can be flexibly configured as required. RACK 1500E offers twenty four internal line modules at most with 768 loops and thirty eight external line modules at most with 960 loops (25 loops each).

The RACK 1500E is proposed to provide integrated configuration. The standard configuration of an integrated ZXA10 RACK1500E is: two user units (built-in MDF) , one built-in transmission unit S200 (optional, choosing the S200 can reduce a user unit), one single 45A switch power supply, one CSV&SF centralized monitoring module, one 100AH storage battery, one power distribution box, an auxiliary MDF cable distribution module, one fan subrack, and one cabling subrack.

The CSV&SF centralized monitoring module employs a standard 19" subrack of 1U. It is an integrated monitoring and control equipment. It integrates functions such as power and voltage measurement, environment monitoring, and built-in MDF, and theft alarm, and fire alarm. It performs functions such as collecting environment and power data, processing man-machine commands, and reporting alarm data and real-time data.

The 45A switch power supply is a standard subrack of 4U in height. It is responsible for processing primary powers and controlling storage batteries in the rack.

The storage battery has 100AH, provides –48V power supply, and consists of four 12V batteries. It is installed on the lowest layer of the primary equipment area. It is completely isolated from other equipment and tightly sealed. So it has good protection performance.

The built-in MDF cable distribution module has capacity: twenty four internal line modules at most with 768 loops and thirty eight external line modules at most with 960 loops (25 loops each).

The rack adopts an upward/downward cabling mode. There are cabling holes on both its top and bottom.

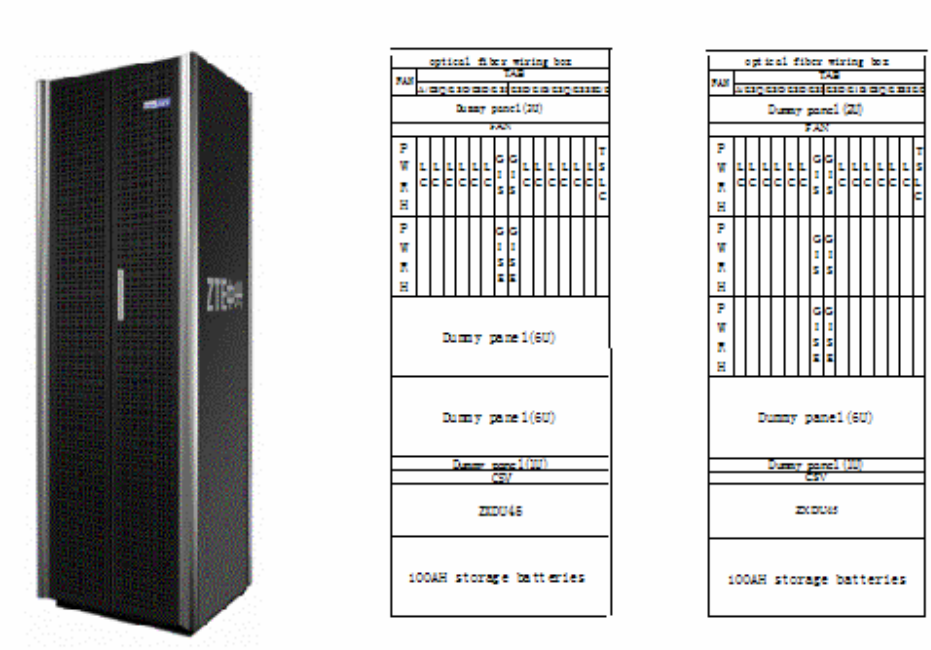


Figure 18 Outside View and Internal Shelf Structure of the ZXA10 IN1500

3.6.2 Main Features of ZXA10 RACK 1500E

- Robust Interoperability
- Seamless Scalability
- Multi Service access Capabilities, fully integrating broadband with narrowband service
- Advanced Technology
- Toll-quality Voice
- High Speed Broadband data
- Carrier-class Reliability
- Powerful Network Management
- Accurate remote line test
- Ability of evolution to NGN

3.6.3 Service Interfaces of ZXA10 RACK 1500E

- Analog Z interface
- ADSL/ADSL2+ interface
- ISDN interface
- PRI(30B+D) interface

- Ethernet interface: Provide two FE or GE ports to backbone packet network and some 10/100M Ethernet ports for LAN interconnecting
- ATM interface: STM-1
- IMA interface
- Clock input interface: Support 2 interfaces of 2Mbit,2MHz or 5MHz
- RS232: One interface for out-of-band network management
- Digital leased line: V.35/V.24/G.703
- SHDSL interface
- VDSL2 interface
- EPON interface
- Analogue dedicated line: 2/4 wire interface

3.6.4 Physical Indices of ZXA10 RACK 1500E

- Cabinet outline dimensions: 2000mm x 800mm x 650mm (Height x Width x Depth). The total height with a bottom support or top cover is 2190mm.
- Cabinet footprint:0.52m^2
- Cabinet weight: The weight of an empty rack is 205 kg (without storage battery). The full configuration weight is 600 kg (integrated cabinet, including storage battery).
- Operating voltage: 220 ± 30% VAC；–57VDC to –40VDC
- Ambient temperature: 0˚C to 45˚C
- Relative humidity: 10% to 95%
- Grounding resistance: ≤ 3 ohm
- Storage battery: four 12V/100Ah storage batteries
- Rainproof and dust-proof measures: meet IEC IP5.5

3.7 Mini Indoor Cabinet of the ONU100

3.7.1 Overview of ZXA10 ONU100

The ZXA10 ONU100 cabinet adopts a compact mini structure, occupies little space, and has a slim and appealing appearance. It can be mounted on the desk top, corners or wall. The cabinet is composed of two parts: The main equipment area and the power supply area. The standard internal configuration of the cabinet is as follows: One mini subscriber access unit (it provides four subscriber line board slots to allow the access of at most 128 POTS subscribers or 64 ADSL subscribers, one switching processing board ICS, one media processing board MPR that is used to transit to the MSAG product, and one test card TSLC), and one rectifier module POWEAC. Among them, the subscriber line board slot nearest to the ISC board can use the IST to provide the built-in transmission function. The POWAC is used to provide the functions of

primary and secondary power supply, or alternatively, the POWDC can be used to provide DC power supply.

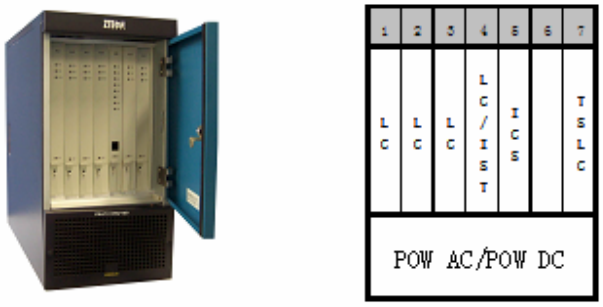


Figure 19 Outside View and Internal Shelf Structure of the ZXA10 ONU100

3.7.2 Main Features of ZXA10 ONU100

The major technical parameters of the ZXA10 ONU100 are as follows:

- Supports narrowband service; Provides broadband service flexibly as required by the operator and the customer; Smooth evolution from narrowband network to broadband network.
- Uses mini rack. 128 POTS lines or 64 ADSL lines at integrated standard configuration
- Robust Interoperability
- Seamless Scalability
- Toll-quality Voice
- High Speed Broadband data
- Carrier-class Reliability
- Powerful Network Management
- Accurate remote line test
- Ability of evolution to NGN

3.7.3 Service Interfaces of ZXA10 ONU100

- Analog Z interface
- ADSL /ADSL2+ interface
- ISDN interface
- Ethernet interface: Provide FE ports to backbone packet network and some 10/100M Ethernet ports for LAN interconnecting
- ATM interface: ST
- IMA interface

- Clock input interface: Support 2 interfaces of 2Mbit,2MHz or 5MHz
- RS232: One interface for out-of-band network management
- Digital leased line: V.35/V.24/G.703
- SHDSL interface
- VDSL interface
- EPON interface
- Analogue dedicated line: 2/4 wire interface

3.7.4 Physical Indices of ZXA10 ONU100

- Cabinet outline dimensions: 421mm x 218mm x 456mm (Height x Width x Depth)
- Cabinet weight: 18kg (full configuration)
- Capacity: POTS, 128L or ADSL, and 64L
- Power consumption: 100W
- Operating voltage:–57VDC to –40VDC；220 ± 30% VAC
- Ambient temperature: 0˚C to 40˚C
- Relative humidity: 20% to 80%

3.8 ZXA10 MSAN OUT40E

3.8.1 Product Appearance and Structure

The OUT40E cabinet consists of primary equipment area (including air conditioner), storage battery area, and cable distribution area. The valid space of the primary equipment area is 31U. It can be flexibly configured on demand. Its standard configuration is: three U300 user units, one built-in optical transmission unit ZXA10 S200, one ZXDU45, and one ZXA10-CSV&SF centralized monitoring module. Its other auxiliary equipment includes one 100AH storage battery, one or two fan sub-rack, one power distributor and its auxiliary MDF cable distribution module.

The built-in MDF cable distribution module has the capacity that can completely meet the maximum access capability of the cabinet, that is: 36 internal line modules at most with 1152 loops (32 loops each) and 60 external line modules at most with 1500 loops (25 loops each). They are on the front side and back side of the cabinet and can be conveniently used for jumpers.

The cabinet adopts the downward cabling mode and special cabling holes are available at the bottom of it.

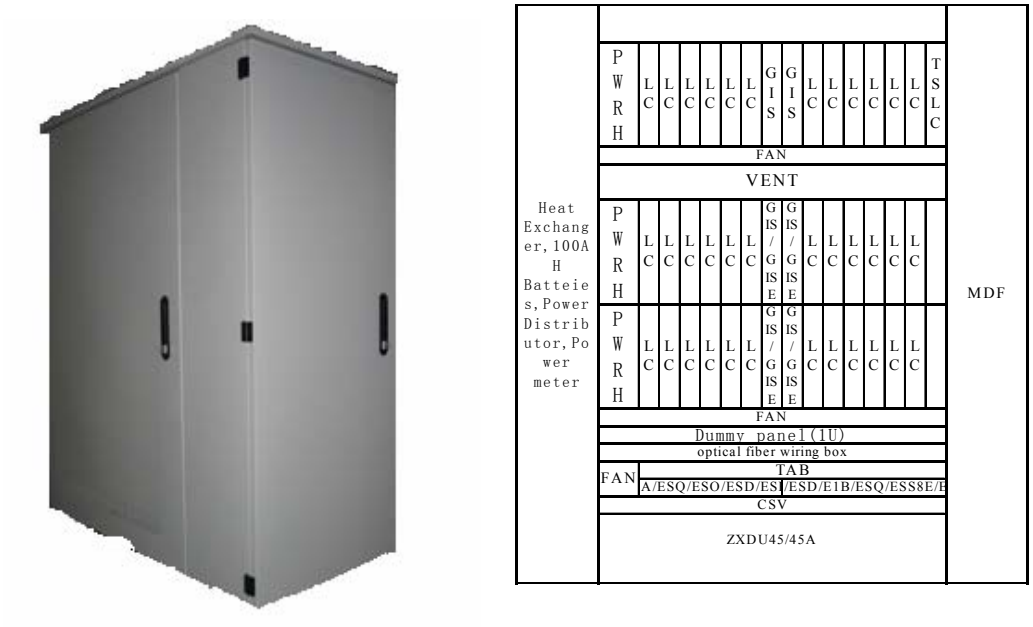


Figure 20 Outside View and Internal Shelf Structure of the ZXA10 OUT40E

3.8.2 Main Features of ZXA10 OUT40E

- Robust Interoperability
- Seamless Scalability
- Multi Service access Capabilities, fully integrating broadband with narrowband service
- Advanced Technology
- Toll-quality Voice
- High Speed Broadband data
- Carrier-class Reliability
- Powerful Network Management
- Accurate remote line test
- Strong adaptability to multi environment
- Compact shelf structure. High rigidity and high intensity. Good air-proof and heat insulation. Reliable connection. Electromagnetic compatibility with telecommunication equipment. Adaptability to voltage fluctuation.
- The cabinet uses close structure, anti-theft and 2-layer heat insulation measures for waterproof, dust-proof, anti-theft, anti-erosion purposes and to keep the equipment from sun radiation, heat exchange, and high temperature.
- Modular structure. Small volume. Easy to install and maintain.
- Anti-lightning and anti-static.

- Cost-effective and reliable temperature control to enhance the equipment's adaptability to the environment and its life.
- Ability of evolution to NGN.

3.8.3 Service Interfaces of ZXA10 OUT40E

- Analog Z interface
- ADSL interface
- ISDN interface
- Ethernet interface: Provide two FE or GE ports to backbone packet network and some 10/100M Ethernet ports for LAN interconnecting
- IMA interface
- Clock input interface: Support 2 interfaces of 2Mbit,2MHz or 5MHz
- RS232: One interface for out-of-band network management
- Digital leased line: V.35/V.24/G.703
- SHDSL interface
- VDSL2 interface
- EPON interface
- Analogue dedicated line: 2/4 wire interface

3.8.4 Physical Indices of ZXA10 OUT40E

- Cabinet outline dimensions: 1,600mm x 1,300mm x 650mm (Height x Width x Depth)
- Cabinet footprint:0.845 m^2
- Cabinet weight: 285kg (including storage battery)
- Capacity: POTS 1152L or ADSL 576L
- Operating voltage: 220 ± 30% VAC
- Temperature control method: industrial air conditioning equipment
- Ambient temperature: –35˚C to 55˚C
- Relative humidity: 5% to 95%
- MDF capacity: 1152 internal line loops and 1400 external line loops
- Grounding resistance: ≤ 3 ohm
- Rainproof and dust-proof measures: meet IEC IP5.5 and adopt a special process for major components to increase their corrosion-proof capability
- Storage battery: four 12V/100Ah storage batteries

3.9 Outdoor ZXA10 OUT30

3.9.1 Overview of ZXA10 OUT30

The ZXA10 OUT30 cabinet is composed of four parts. The uppermost part is the air conditioner cabin for installing an industrial air conditioner/heat exchanger plus the air cabin for air convection. The lower internal space is divided from left to right into three areas: The storage battery area, the main equipment area and the distribution frame area. The effective space of the main equipment area totals 26U and can be flexibly configured as required. The standard configuration of the ZXA10 OUT30 cabinet is as follows: three subscriber units (U300 rear access version, **see note**), one built-in optical transmission unit S300/S200 (optional), one ZXDU45, and one EPC&SF environment power control board. Its other auxiliary equipment includes one 100AH storage battery, one fan subrack, one power distributor and its auxiliary MDF cable distribution module.

The capacity of the built-in MDF modules can fully meet the requirements of the cabinet's maximum subscriber access capability, that is, there can be at most 36 internal line modules (each contains 32 loop lines and so there are a total of 1152 loop lines) and at most 56 external line modules (each contains 25 loop lines and so there are a total of 1400 loop lines). Jumper operations can be conveniently conducted in the front face and rear face of the cabinet.

The cabinet adopts the downward cabling mode and special cabling holes are available at the bottom of it.

The outside view and internal shelf structure of the ZXA10 OUT30 cabinet are shown in Fig.21

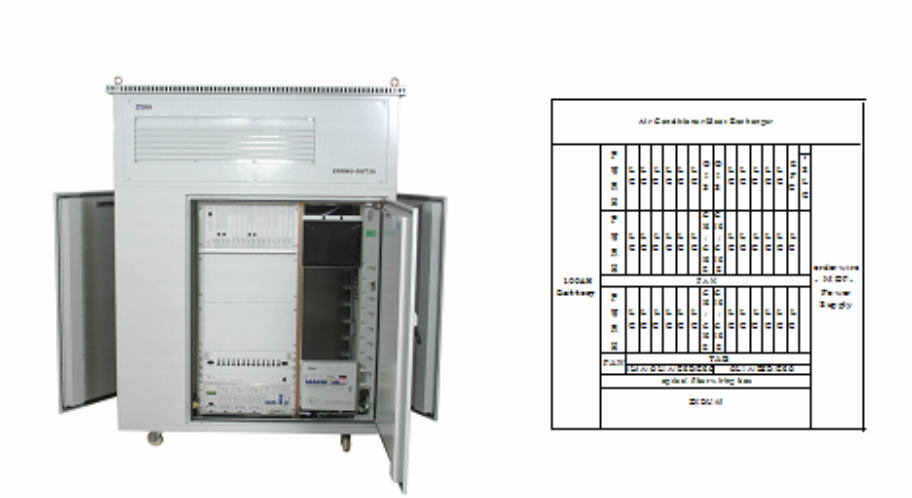


Figure 21 Outside View and Internal Shelf Structure of the ZXA10 OUT30

3.9.2 Main Features of ZXA10 OUT30

- Robust Interoperability
- Seamless Scalability
- Multi Service access Capabilities, fully integrating broadband with narrowband service
- Advanced Technology

- Toll-quality Voice
- High Speed Broadband data
- Carrier-class Reliability
- Powerful Network Management
- Accurate remote line test
- Strong adaptability to multi environment
- Compact shelf structure. High rigidity and high intensity. Good air-proof and heat insulation. Reliable connection. Electromagnetic compatibility with telecommunication equipment. Adaptability to voltage fluctuation.
- The cabinet uses close structure, anti-theft and 2-layer heat insulation measures for waterproof, dust-proof, anti-theft, anti-erosion purposes and to keep the equipment from sun radiation, heat exchange, and high temperature.
- Modular structure. Small volume. Easy to install and maintain.
- Anti-lightning and anti-static.
- Cost-effective and reliable temperature control to enhance the equipment's adaptability to the environment and its life.
- Ability of evolution to NGN.

3.9.3 Service Interfaces of ZXA10 OUT30

- Analog Z interface
- ADSL interface
- ISDN interface
- Ethernet interface: Provide two FE or GE ports to backbone packet network and some 10/100M Ethernet ports for LAN interconnecting
- ATM interface: STM-1
- IMA interface
- Clock input interface: Support 2 interfaces of 2Mbit,2MHz or 5MHz
- RS232: One interface for out-of-band network management
- Digital leased line: V.35/V.24/G.703
- SHDSL interface
- VDSL2 interface
- EPON interface
- Analogue dedicated line: 2/4 wire interface

3.9.4 Physical Indices of ZXA10 OUT30

- Cabinet outline dimensions: 1,992mm x 1,350mm x 710mm (Height x Width x Depth)
- Cabinet footprint: 0.9585 m2
- Cabinet weight: 600kg (including storage battery)
- Capacity: POTS1120 or ADSL 560L
- Power consumption: 350W + 1500W (for air conditioner)
- Operating voltage: 220 ± 30% VAC
- Temperature control method: industrial air conditioning equipment
- Ambient temperature: –35˚C to 55˚C
- Relative humidity: 5% to 95%
- MDF capacity: 1152 internal line loops and 1400 external line loops
- Grounding resistance: ≤ 3 ohm
- Rainproof and dust-proof measures: meet IEC IP5.5 and adopt a special process for major components to increase their corrosion-proof capability
- Storage battery: four 12V/100Ah storage batteries

3.10 Outdoor ZXA10 OUT30E

3.10.1 Overview of ZXA10 OUT30E

The ZXA10 OUT30E cabinet is composed of three parts and it is divided from left to right into three areas: The storage battery area, the main equipment area and the distribution frame area. The upper part of the main equipment area is the air conditioner cabin for installing an industrial air conditioner and the lower part is the space for main equipment. The effective space of the main equipment area totals 28U and can be flexibly configured as required. The standard configuration of the ZXA10 OUT30E cabinet is as follows: three subscriber units (U300 rear access version), one built-in optical transmission unit ZXA10 S200, one ZXDU45 45A switch power rectifier and one environment & power monitor module CSV box. The other auxiliary equipment of the cabinet includes one 100AH storage battery pack, two fan plug-in boxes one power distributor and the corresponding MDF modules.

The capacity of the built-in MDF modules can fully meet the requirements of the cabinet's maximum subscriber access capability, that is, there can be at most 6 internal line modules (each contains 200 loop lines and so there are a total of 1200 loop lines) and at most 9 external line modules (each contains 200 loop lines and so there are a total of 1800 loop lines).

The cabinet adopts the downward cabling mode and special cabling holes are available at the bottom of it.

The outside view and internal shelf structure of the ZXA10 OUT30E cabinet are shown in Fig.22

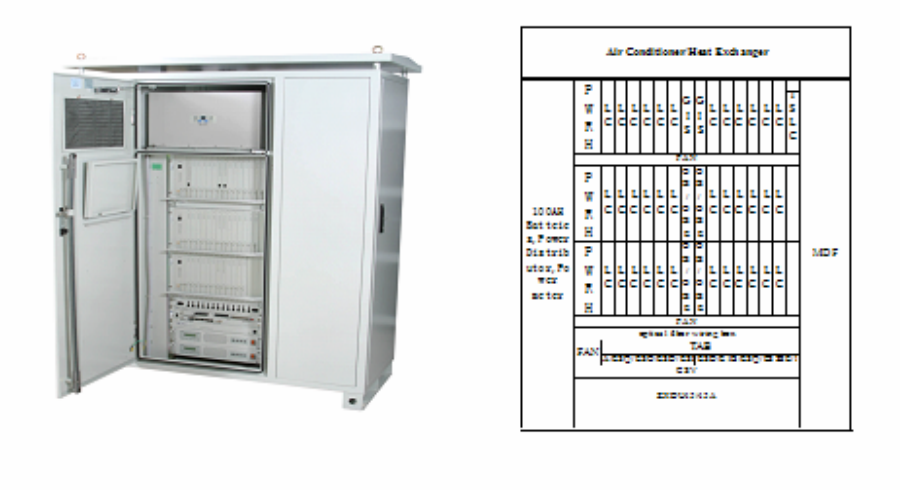


Figure 22 Outside View and Internal Shelf Structure of the ZXA10 OUT30E

3.10.2 Main Features of ZXA10 OUT30E

- Robust Interoperability
- Seamless Scalability
- Multi Service access Capabilities, fully integrating broadband with narrowband service
- Advanced Technology
- Toll-quality Voice
- High Speed Broadband data
- Carrier-class Reliability
- Powerful Network Management
- Accurate remote line test
- The operator can read the number displayed by the ammeter
- The rack has six doors, the designer make easy to input equipment and layout.
- Strong adaptability to multi environment
- Compact shelf structure. High rigidity and high intensity. Good air-proof and heat insulation. Reliable connection. Electromagnetic compatibility with telecommunication equipment. Adaptability to voltage fluctuation.
- The cabinet uses close structure, anti-theft and 2-layer heat insulation measures for waterproof, dust-proof, anti-theft, anti-erosion purposes and to keep the equipment from sun radiation, heat exchange, and high temperature.
- Modular structure. Small volume. Easy to install and maintain.
- Anti-lightning and anti-static.

- Cost-effective and reliable temperature control to enhance the equipment's adaptability to the environment and its life.
- Ability of evolution to NGN.

3.10.3 Service Interfaces of ZXA10 OUT30E

- Analog Z interface
- ADSL /ADSL2+ interface
- ISDN interface
- PRI (30B+D) interface
- Ethernet interface: Provide two FE or GE ports to backbone packet network and some 10/100M Ethernet ports for LAN interconnecting
- ATM interface: STM-1
- IMA interface
- Clock input interface: Support 2 interfaces of 2Mbit,2MHz or 5MHz
- RS232: One interface for out-of-band network management
- Digital leased line: V.35/V.24/G.703
- SHDSL interface
- VDSL2 interface
- EPON interface
- Analogue dedicated line: 2/4 wire interface

3.10.4 Physical Indices of ZXA10 OUT30E

- Cabinet outline dimensions: 2,073mm x 1,400mm x 650mm (Height x Width x Depth)
- Cabinet weight: 600kg
- Capacity: POTS: 1152L or ADSL: 576L
- Power consumption: 1200W (full configuration)
- Operating voltage: 220 ± 20% VAC
- Ambient temperature: –35˚C to +55˚C
- Relative humidity: 5% to 95%
- Grounding resistance: ≤ 3 ohm
- Rainproof and dust-proof measures: meet IEC IP5.5 and adopt a special process for major components to increase their corrosion-proof capability
- Storage battery: four 12V/100Ah storage batteries

3.11 Outdoor ZXA10 OUT40

3.11.1 Overview of ZXA10 OUT40

The ZXA10 OUT40 cabinet is composed of four parts. The uppermost part is the air conditioner cabin for installing an industrial air conditioner/heat exchanger plus the air cabin for air convection. The lower internal space is divided from left to right into three areas: The storage battery area, the main equipment area and the distribution frame area. The effective space of the main equipment area totals 20U and can be flexibly configured as required. The standard configuration of the ZXA10 OUT40 cabinet is as follows: Two subscriber units (U300 rear access version), one built-in optical transmission unit ZXA10 S200 and one ZXDU30 30A switch power rectifier. The other auxiliary equipment of the cabinet includes one 100AH storage battery pack, one fan plug-in box, one power distributor and the corresponding MDF modules.

The capacity of the built-in MDF modules can fully meet the requirements of the cabinet's maximum subscriber access capability, that is, there can be at most 24 internal line modules (each contains 32 loop lines and so there are a total of 768 loop lines) and at most 40 external line modules (each contains 25 loop lines and so there are a total of 1000 loop lines). Jumper operations can be conveniently conducted in the front face and rear face of the cabinet.

The cabinet adopts the downward cabling mode and special cabling holes are available at the bottom of it.

The outside view and internal shelf structure of the ZXA10 OUT40 cabinet are shown in Fig. 23.

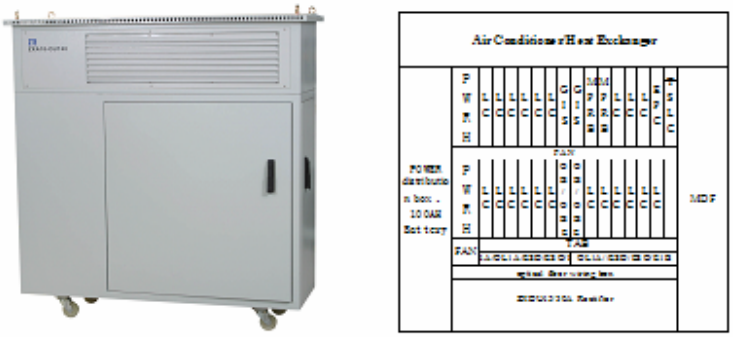


Figure 23 Outside View and Internal Shelf Structure of the ZXA10 OUT40

3.11.2 Main Features of ZXA10 OUT40

- Robust Interoperability
- Seamless Scalability
- Multi Service access Capabilities, fully integrating broadband with narrowband service
- Advanced Technology

- Toll-quality Voice
- High Speed Broadband data
- Carrier-class Reliability
- Powerful Network Management
- Accurate remote line test
- Strong adaptability to multi environment
- Compact shelf structure. High rigidity and high intensity. Good air-proof and heat insulation. Reliable connection. Electromagnetic compatibility with telecommunication equipment. Adaptability to voltage fluctuation.
- The cabinet uses close structure, anti-theft and 2-layer heat insulation measures for waterproof, dust-proof, anti-theft, anti-erosion purposes and to keep the equipment from sun radiation, heat exchange, and high temperature.
- Modular structure. Small volume. Easy to install and maintain.
- Anti-lightning and anti-static.
- Cost-effective and reliable temperature control to enhance the equipment's adaptability to the environment and its life.
- Ability of evolution to NGN.

3.11.3 Service Interfaces of ZXA10 OUT40

- Analog Z interface
- ADSL/ADSL2+ interface
- ISDN interface
- PRI (30B+D) interface
- Ethernet interface: Provide two FE or GE ports to backbone packet network and some 10/100M Ethernet ports for LAN interconnecting
- ATM interface: STM-1
- IMA interface
- Clock input interface: Support 2 interfaces of 2Mbit,2MHz or 5MHz
- RS232: One interface for out-of-band network management
- Digital leased line: V.35/V.24/G.703
- SHDSL interface
- VDSL2 interface
- EPON interface
- Analogue dedicated line: 2/4 wire interface

3.11.4 Physical Indices of ZXA10 OUT40

- Cabinet outline dimensions: 14,500mm x 1,500mm x 500mm (Height x Width x Depth)
- Cabinet weight: 520kg
- Capacity: POTS: 736L or ADSL: 368L
- Power consumption: 350W (full configuration)
- Operating voltage: 220 ± 20% VAC
- Ambient temperature: –35˚C to +55˚C
- Relative humidity: 5% to 95%
- Grounding resistance: ≤ 3 ohm
- Rainproof and dust-proof measures: meet IEC IP5.5 and adopt a special process for major components to increase their corrosion-proof capability
- Storage battery: four 12V/100Ah storage batteries

3.12 Outdoor ZXA10 OUT30F

3.12.1 Overview of ZXA10 OUT30F

The ZXA10 OUT30F cabinet is an outdoor type all-weather cabinet and its capacity can touch 1920 lines POTS which can meet the large capacity requirement of many operators. The OUT30F cabinet is composed of four parts: the air conditioner cabin, the batteries cabin, the main equipment cabin and the MDF cabin. In the front view, the left part is the air conditioner cabin for installing an industrial air conditioner plus the air cabin for air convection which may keep the system within the working temperature range; the middle part is the main equipment area which can mount up to 5 standard U300 shelves and one S200; the batteries cabin is located under the main equipment cabin and it can mount 1 group 200AH batteries; the right part is the MDF cabin and all cable operation is conducted in this area.

The standard configuration of the ZXA10 OUT30F cabinet is as follows: five subscriber units (U300 rear access version), one built-in optical transmission unit ZXA10 S200, one ZXDU45 45A switch power rectifier and one CSV plug-in box. The other auxiliary equipment of the cabinet includes one 200AH storage battery pack, four fan plug-in boxes, one power distributor and the corresponding MDF modules.

The capacity of the built-in MDF modules can fully meet the requirements of the cabinet's maximum subscriber access capability, that is, there can be at most 66 internal line modules (each contains 32 loop lines and so there are a total of 2112 loop lines) and at most 96 external line modules (each contains 25 loop lines and so there are a total of 2400 loop lines).

The cabinet adopts the downward cabling mode and special cabling holes are available at the bottom of it.

The outside view and internal shelf structure of the ZXA10 OUT30F cabinet are shown in Fig. 24.

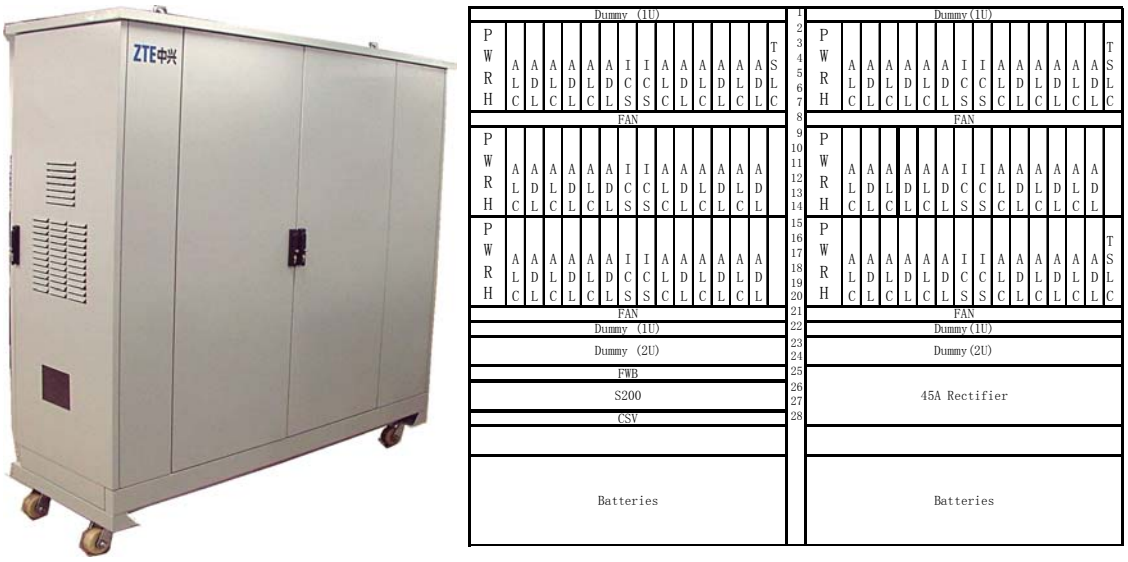


Figure 24 Outside View and Internal Shelf Structure of the ZXA10 OUT30F

3.12.2 Main Features of ZXA10 OUT30F

- Robust Interoperability
- Seamless Scalability
- Multi Service access Capabilities, fully integrating broadband with narrowband service
- Large capability
- Advanced Technology
- Toll-quality Voice
- High Speed Broadband data
- Carrier-class Reliability
- Powerful Network Management
- Accurate remote line test
- The operator can read the number displayed by the ammeter
- Strong adaptability to multi environment
- Compact shelf structure. High rigidity and high intensity. Good air-proof and heat insulation. Reliable connection. Electromagnetic compatibility with telecommunication equipment. Adaptability to voltage fluctuation.

- The cabinet uses close structure, anti-theft and 2-layer heat insulation measures for waterproof, dust-proof, anti-theft, anti-erosion purposes and to keep the equipment from sun radiation, heat exchange, and high temperature.
- Modular structure. Small volume. Easy to install and maintain.
- Anti-lightning and anti-static.
- Cost-effective and reliable temperature control to enhance the equipment's adaptability to the environment and its life.
- Ability of evolution to NGN.

3.12.3 Service Interfaces of ZXA10 OUT30F

- Analog Z interface
- ADSL /ADSL2+ interface
- ISDN interface
- PRI (30B+D) interface
- Ethernet interface: Provide two FE or GE ports to backbone packet network and some 10/100M Ethernet ports for LAN interconnecting
- ATM interface: STM-1
- IMA interface
- Clock input interface: Support 2 interfaces of 2Mbit,2MHz or 5MHz
- RS232: One interface for out-of-band network management
- Digital leased line: V.35/V.24/G.703
- SHDSL interface
- VDSL2 interface
- EPON interface
- Analogue dedicated line: 2/4 wire interface

3.12.4 Physical Indices of ZXA10 OUT30F

- Cabinet outline dimensions: 1,900mm x 1,850mm x 650mm (Height x Width x Depth)
- Cabinet weight: 750kg
- Capacity: POTS: 1920L or ADSL: 960L
- Operating voltage: 220 ± 20% VAC
- Ambient temperature: –35˚C to +55˚C
- Relative humidity: 5% to 95%
- Grounding resistance: ≤ 3 ohm

- Rainproof and dust-proof measures: meet IEC IP5.5 and adopt a special process for major components to increase their corrosion-proof capability
- Storage battery: four 12V/200Ah storage batteries

3.13 Outdoor ZXA10 OUT50

The OUT50 is targeted to small user capacity, lack of equipment room, and rapid deployment. It meets integrated ONU installation requirements. Its maximum number of access lines is 192 POTS users/96 ADSL users. The ZXA10 OUT50 has a good adjustment capability to adapt to the external environment and higher reliability. To make it universal in use, the cabinet has good performance. The ZXA10 OUT50 cabinet adopts good heat insulation measures. It also uses fan and air conditioner to control ambient temperature. It has small size.

3.13.1 Overview of ZXA10 OUT50

The OUT50C/OUT50D cabinet is compact, light, and good-looking. It employ fans for heat dissipation. It can be used in indoor environment in a temperate zone. It does not suit seaside areas with high temperature, high humidity, or high salinity.

The cabinet consists of three areas: storage battery area, main equipment area, and MDF area. The standard configuration includes one user access unit (it has 6 user board slots and an access capacity of up to 192 POTS user lines or 96 ADSL user lines. It has one VOIP process board MPRB. It also performs functions such as processing primary power supply and centralized monitoring of environment and power), space of 1U for holding compact built-in MSTP optical transmission equipment S100 (if the user unit offers transmission function through a built-in IST board, the S100 need not be configured. In this case, the space can be used for hold other equipment), one 38AH battery group, one fan unit, and one power distribution box, one 1 fiber splice tray (optional), one heating module (optional), and corresponding MDF modules.

The primary power supply board PPC is responsible for processing primary power supply for the rack and the charge and discharge of storage batteries.

The environment monitoring board EMB&SF monitors and controls the power supply environment. It integrates functions such as power monitoring, environment monitoring, theft alarm, fire alarm, MDF monitoring, and fan monitoring and control. It performs functions such as collecting environment and power data, processing man-machine commands, and reporting alarm data and real-time data.

The battery group offers power supply of 38AH and -48V. It consists of four 12V batteries. It is installed below the main equipment area. It is isolated from other equipment and is sealed, ensuring excellent protection performance.

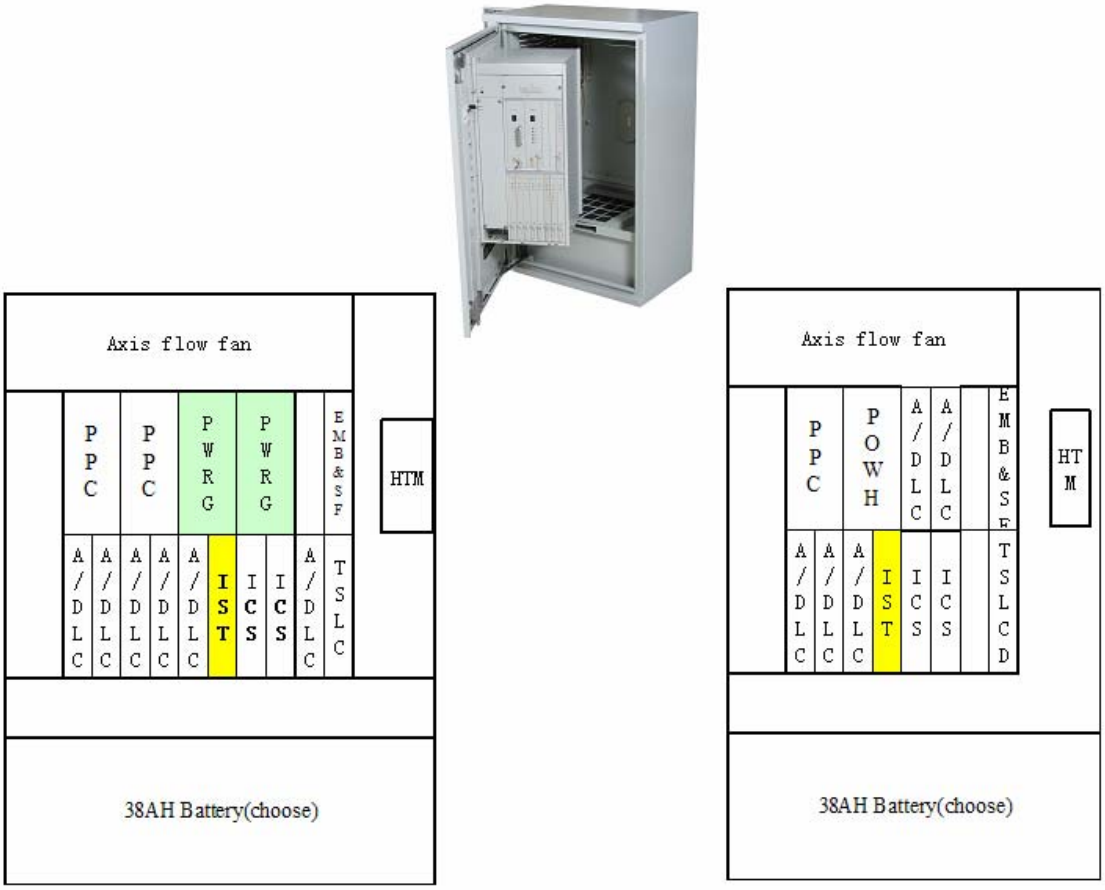
The capacity of the built-in MDF module meets the demand for the largest user access capability of the cabinet:

- There are 7 internal line modules, and each module offers 32 loops, so there are 224 loops in total.
- They are 9 external line modules, and each module offers 25 loops, so there are 225 loops in total.

Jumper operations can be easily performed at the left side of the cabinet. The cabinet employs downward cable access mode, and cable holes are available at the bottom of the rack.

The OUT50C is used in double powers requirement and the OUT50D is single power configured.

The cabinet adopts a downward cabling mode. There are cabling holes on its bottom.



ZXA10 OUT50C ZXA10 OUT50D

Figure 25 Outside View and Internal Shelf Structure of the ZXA1 -OUT50

3.13.2 Main Features of ZXA10 OUT50

- Robust Interoperability
- Seamless Scalability
- Multi Service access Capabilities, fully integrating broadband with narrowband service
- Advanced Technology
- Toll-quality Voice
- High Speed Broadband data
- Carrier-class Reliability
- Powerful Network Management

- Accurate remote line test
- Strong adaptability to multi environment
- Compact shelf structure. High rigidity and high intensity. Good air-proof and heat insulation. Reliable connection. Electromagnetic compatibility with telecommunication equipment. Adaptability to voltage fluctuation.
- The cabinet uses close structure, anti-theft and 2-layer heat insulation measures for waterproof, dust-proof, anti-theft, anti-erosion purposes and to keep the equipment from sun radiation, heat exchange, and high temperature.
- Modular structure. Small volume. Easy to install and maintain.
- Anti-lightning and anti-static.
- Cost-effective and reliable temperature control to enhance the equipment's adaptability to the environment and its life.
- Ability of evolution to NGN.

3.13.3 Service Interfaces of ZXA10 OUT50

- Analog Z interface
- ADSL/ADSL2+ interface
- ISDN interface
- Ethernet interface: Provide two FE or GE ports to backbone packet network and some 10/100M Ethernet ports for LAN interconnecting
- ATM interface: STM-1
- IMA interface
- Clock input interface: Support 2 interfaces of 2Mbit,2MHz or 5MHz
- RS232: One interface for out-of-band network management
- Digital leased line: V.35/V.24/G.703
- SHDSL interface
- VDSL2 interface
- Analogue dedicated line: 2/4 wire interface

3.13.4 Physical Indices of ZXA10 OUT50

- Cabinet outline dimensions: 1,100.0mm x 700.0mm x 400.0mm (Height x Width x Depth)
- Cabinet weight: 140kg (including storage battery)
- Operating voltage: 220 ± 30% VAC；–57VDC to –40VDC
- Ambient temperature: –35˚C to +50˚C
- Relative humidity: 5% to 90%

- MDF capacity: 192 internal line loops and 225 external line loops
- User convergence ratio: 1:1.0 to 1:6.4
- Grounding resistance: ≤ 4 ohm
- Rainproof and dust-proof measures: meet IEC IP5.5 and adopt a special process for major components to increase their corrosion-proof capability
- Power consumption (full load): 130W
- Storage battery: four 12V/38Ah storage batteries

3.14 Outdoor Front Access ZXA10 OUT60

3.14.1 Overview of ZXA10 OUT60

The OUT60 cabinet consists of two areas. The main equipment area, and cable area. The effective space of the main equipment area is 26U, and it can be flexibly configured as required. This kind of cabinet especially designs for front access.

The standard configuration of the cabinet includes three user units, one built-optical transmission unit ZXA10 S200, one ZXDU45 rectifier, and one ZXA10-EPC&SF centralized monitoring module. Other auxiliary equipment includes one 100AH battery group, two fan frame, one power distributor, one HEX, and corresponding MDF modules .

The capacity of the built-in MDF module meets the demand for the largest user access capability of the cabinet:

- There are at most 36 internal line modules, and each module offers 32 loops, so there are 1152 loops in total.
- They are at most 60 external line modules, and each module offers 25 loops, so there are 1500 loops in total.

Jumper operations can be easily performed at the front and back of the cabinet. The cabinet employs downward cable access mode, and cable holes are available at the bottom of the rack

The outside view and internal shelf structure of the ZXA10 OUT60 cabinet are shown in Fig.25.

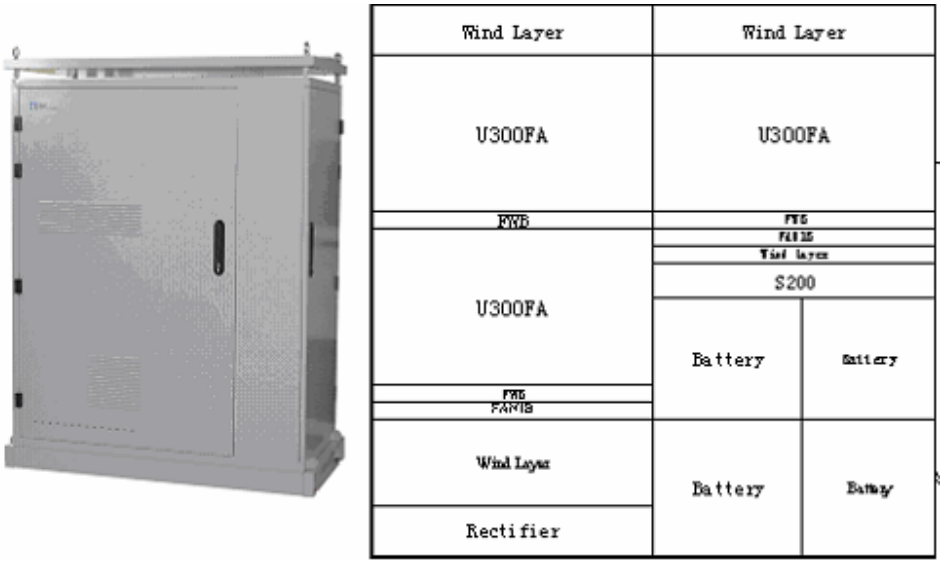


Figure 26 Outside View and Internal Shelf Structure of the ZXA10 OUT60

3.14.2 Main Features of ZXA10 OUT60

- Front access subscriber unit be used
- Robust Interoperability
- Seamless Scalability
- Multi Service access Capabilities, fully integrating broadband with narrowband service
- Large capability
- Advanced Technology
- Toll-quality Voice
- High Speed Broadband data
- Carrier-class Reliability
- Powerful Network Management
- Accurate remote line test
- The operator can read the number displayed by the ammeter
- Strong adaptability to multi environment
- Compact shelf structure. High rigidity and high intensity. Good air-proof and heat insulation. Reliable connection. Electromagnetic compatibility with telecommunication equipment. Adaptability to voltage fluctuation.
- The cabinet uses close structure, anti-theft and 2-layer heat insulation measures for waterproof, dust-proof, anti-theft, anti-erosion purposes and to keep the equipment from sun radiation, heat exchange, and high temperature.
- Modular structure. Small volume. Easy to install and maintain.

- Anti-lightning and anti-static.
- Cost-effective and reliable temperature control to enhance the equipment's adaptability to the environment and its life.
- Ability of evolution to NGN.

3.14.3 Service Interfaces of ZXA10 OUT60

- Analog Z interface
- ADSL /ADSL2+ interface
- ISDN interface
- PRI (30B+D) interface
- Ethernet interface: Provide two FE or GE ports to backbone packet network and some 10/100M Ethernet ports for LAN interconnecting
- ATM interface: STM-1
- IMA interface
- Clock input interface: Support 2 interfaces of 2Mbit,2MHz or 5MHz
- RS232: One interface for out-of-band network management
- Digital leased line: V.35/V.24/G.703
- SHDSL interface
- VDSL2 interface
- Analogue dedicated line: 2/4 wire interface

3.14.4 Physical Indices of ZXA10 OUT60

- Capacity: POTS：1120；ADSL：560L
- Outer dimensions: 1600mm×1594mm×780mm (H × W × D)
- Weight: 620kg
- Operating voltage: -57V~-40V or 220VAC±30%
- Ambient temperature: -35°C~+55°C
- Ambient humidity: 5%~ 95%
- Grounding resistance: One work ground and one protection ground. Grounding resistance ≤3 Ω
- Waterproof & Dustproof: Complies with IP5.5 of the International Electrical Committee (IEC)
- Temperature control: Industrial air-conditioner or heat exchanger
- Batteries: 4 12V/100AH storage batteries (as per the actual power consumption)

4 BUILT-IN TRANSMISSION SYSTEM

4.1 Overview

By virtue of a large transmission capacity of the optical communication system free from electromagnetic interference and with small transmission consumption, optical communication plays a significant part in the modern communication system. Optical fiber has been applied in the telecom backbone network, while the twisted pair remains the way for users to access the network. This has hindered communication development with the rapidly increasing demand for information capacity by people at the information times. It is imperative to construct an optical user AN focusing on optical fiber and combining multiple transmission means. It is through the optical transmission system that all users of the optical AN can communicate with LE, and that the users scattered in different areas can be connected, forming the framework of the whole optical AN.

SDH has become the mainstream of optical transmission in AN construction in recent years. Thanks to its advantages such as standard and high-performance network self-healing capability, large capacity and online upgrade, SDH has been widely used at the backbone layer of AN transmission. And with the development of communication technology, many operators want to provide more services other than the voice service, such as the data and the video. So for these service requirements, the new generation access network shall be a universal platform which can support TDM/ IP services simultaneously. This is new generation SDH technology – MSTP. As the best transmission platform of the convergence layer and access layer, MSTP is becoming the most popular technology for constructing the optical fiber network.

Thus, the ZXA10 OFAN consists of multi kinds of optical transmission systems independently developed by ZTE Cooperation, i.e. the ZXA10 S300/S200/S100 built-in integrated service dispatching equipment.

4.2 ZXA10 S200

4.2.1 Overview of ZXA10 S200

ZXA10 S200 is a kind of compact built-in MSTP system which can provide multi services transmission function. Similar to ZXA10 S300 (for detail, refer to 4.3 section), ZXA10 S200 is developed on the basis of SDH technology, implementing the processing and transmission of TDM service, Ethernet service simultaneously. It offers multi-service node of the unified NM, provides flexible multi-service dispatching, and supports the evolution capacity to the next generation network.

ZXIS200 is a plug-in box in 19-inch 2U structure. It can be located in the standard 19-inch rack (ZXA10 OLTC or ZXA10 RACK 1500E/ Indoor type 19 Inch Standard Open Rack) or the outdoor cabinet ZXA10 OUT40E, OUT30, OUT30E, OUT30F, OUT40, OUT60 of ZXA10 access network. The system is in the two-layer transverse front insertion card structure. It has high integration. S200 system provides customized services, satisfying the demands of various ONUC devices and ensuring the configuration with higher competition at lower price. The following figure shows the board configuration of S200.

FAN	TAB
	OL4A/OL1A/ESQ/ESO/ESD/ESB/E1B/RPR OL1A/ESD/E1B/ESQ/ESS8E/ETS8E

Figure 27 Board Configuration of S200 Unit

ZXA10 S200 supports all topology modes and protection modes of SDH technology, including two-fiber unidirectional channel protection ring, two-fiber unidirectional ring for MS protection, two-fiber bi-directional ring for MS protection, four-fiber bi-directional ring for MS protection, 1+1 or 1:1 line ring for MS protection.

The outline of S200 is as shown in the figure below.

Figure 28 Outline of S200

4.2.2 Main Features and advantages of ZXA10 S200

- Adopting the protocol-independent and highly open high-speed serial backplane technology and the semi-mesh universal backplane structure. The slot height is compatible and the system provides the smooth upgrade capability, high reusability and powerful expandability.
- Supporting the access and convergence of integrated services including TDM and Ethernet services, providing multiple service interfaces such as E1, STM-1/STM-4 SDH/POS, FE, GE and the FE/GE interface with embedded RPR, and implementing the seamless interconnection with a variety of MAN backbone networks and access nodes.
- Providing powerful expansion and service add/drop capability to fully meet the service development requirements of access networks and effectively protecting the investment of operators. The STM-1/STM-4line interfaces are optional and have the capability to be smoothly upgraded to STM-16 interfaces. The transmission aggregation board TAB provides 21 E1 interfaces to meet the basic service requirements and two line/service interface extension slots with powerful expansion capability. At most four STM-4 interfaces and eight STM-1 interfaces are supported in networking.
- Supporting at most the service add/drop capability of 84*E1 in terms of TDM services.
- Supporting the switching and transparent transmission of Ethernet services, optional virtual concatenation at the VC12/VC3 level and LCAS. The system provides optional uplink bandwidth N*VC12 ~ 2*VC4, has the expansion capability of 8*VC4/board and can maximally support the Ethernet access

capability of 8*FE + 2*GE. The encapsulation protocols can be GFP, LAPS or PPP. With the non-blocking wire-speed switching of the local Ethernet, the system has greatly enhanced the flexibility of application.

- Supporting the service self-healing protection by multiple means such as SDH, Ethernet STP and RPR.
- Providing the end-to-end auto/semi-auto service configuration of Ethernet and TDM services at the network level, and the graphical view of services, clocks and ECCs, thus greatly facilitating the provisioning and adjustment of services.
- Providing the comprehensive maintenance and performance monitoring functions, for example, online performance monitoring of optical interfaces, embedded environment temperature monitoring, fan alarm and the instrument-free payload PRBS test of the electrical tributaries. The system also provides two channels of Boolean value inputs and outputs for the expansion of the other equipment and control.
- Implementing the unified NMS of the other equipment in the ZXA10 MSAN integrated access network system to form the complete NM solution and facilitate the unified management and dispatching of services. The ZXA10 S200 also offers the ability to quick provision services and it adapts to the development trend of integrating the access layer network services and transmission functions.
- Featuring carrier-class reliability and support hot plugging of boards.
- Supporting the smooth evolution to the all-IP NGN

4.2.3 Main Interfaces of ZXA10 S200

4.2.3.1 Service Interface

1. SDH interfaces

ZXA10 S200 supports three kinds of SDH interfaces STM-1, STM-4 and STM-16, and supports various SDH protection types, so that it can provide reliable transfer of ATM, POS, Ethernet and PDH service, can serve as the physical link of the clock transfer network.

2. PDH interfaces

ZXA10 S200 provides E1 and E3 PDH interfaces for transparent transmission of the PDH service. The E1 interface system supports maximum configuration of not less than 63 channels (whole system), and the E3 interface supports maximum configuration of not less than 3 channels (per card).

3. Ethernet interfaces

ZXA10 S200 provides 10/100M Ethernet interfaces and 1000M Ethernet interfaces in L2 switching mode, as well as 10/100M Ethernet interfaces in transparent transmission mode.

4.2.3.2 Clock Interfaces

1. Reference timing input interface

The system provides clock input interfaces not less than 2 BITS, and supports optional 2048kHz synchronous clock input and 2048kbit/s synchronous clock input. The clock interfaces have an input impedance of 75Ω.

The timing clock system (implemented in TAB) works in four working modes: a. Quick capturing b. Normal tracing c. Holdover d. Free running. The timing clock provided by TAB can not only be from externally 2M timing resource but also the extracted clock locked in the STM-N and the 2M electric tributary as well as the clock generated by the free oscillator. In case all timing sources vanish, the system will work in the holdover mode.

2. Reference clock output interface

With one 2048kHz and one 2048kbit/s clock output interface, with an impedance of 75Ω.

4.2.3.3 Management Interface

The NM maintenance console interface implements message receiving/transmitting between the NM maintenance console and NEs via 10/100BASE-T adaptive Ethernet interfaces. NM can manage the equipment through DCN.

ZXA10 S200 is also configured with another 10/100BASE-T adaptive Ethernet interface, which provides the NMS channel for the ONUs in ZXA10 OFAN system. It delivers the management information the OLT side, thus realizing the centralized network management.

4.2.3.4 Auxiliary Interfaces

ZXA10 S200 is configured with multiple serial interfaces for some extended purposes such as debugging, environment power monitoring, and other equipment control. Besides, ZXA10 S200 also provides the order wire phone interfaces.

4.2.4 Technical Indices of ZXA10 S200

4.2.4.1 Physical Parameters

1. Outline dimensions and weight

Outline dimensions: (H * W * D): 88.1mm*482.6mm*320mm

Installed in a standard 19 inch cabinet, 2U high, about 22 Kg if fully configured

2. Operating temperature

Ensuring performance: 0°C ~+40°C

Ensuring operation: -5°C ~+50°C

3. Relative Humidity

Ensuring performance: 20%-80%

Ensuring operation: 10%-90%

4. Operating Voltage:

Voltage range (DC): -40VDC ~ -57VDC

5. Power consumption

Maximum overall consumption: 130W; Normal operation consumption: 80W~100W

4.2.4.2 Performance Indices

1. SDH crossing capability

High order: 41*41VC4; Low order: 1008*1008VC12

2. Maximum traffic capability of the equipment

- Maximum Optical Interface capability:
- 6×STM-4（2×STM-16＋2×STM-4）＋8×STM-1
- Maximum 2M traffic adding /dropping capability: 84×E1
- Maximum Ethernet access capability: 16×FE/2×GE, based on L2 switch or RPR

3. SDH performance indices

- Intra-ring protection switching time not larger than 50ms
- In networking of a single ring with 16 nodes, the clock source switching time should be less than 20.
- The system clock can support at least 20-grade node cascade, without affecting traffic.

4. Ethernet performance indices

- Packet loss ratio of Ethernet service

When the bandwidth configured for the transmission link is larger than the tested traffic bandwidth, 64-Byte packets are used for testing, and the packet loss ratio should not be larger than 0.02%.

- Packet transmission delay of Ethernet service

When the bandwidth configured for the transmission link is larger than the tested traffic bandwidth, 64-Byte packets are used for testing, and the end-to-end delay of the single-network node equipment should not be larger than 2.5ms.

- L2 switching address caching capability

L2 switching address buffer capability: /4K

- VLAN quantity

Number of VLANs: 4K and VLAN ranges from 1 to 4095.

- Assigned number of Trunking bandwidth

Trunking: Greater than 4 × FE for uplink/downlink convergence

- Transmission bandwidth configuration capability of Ethernet service

Maximum uplink/downlink assignable bandwidth for single-node L2 switching SDH should not be less than 155Mbit/s.

- Configured granularity of link transmission bandwidth for Ethernet service

Minimum granularity supports VC-12 and is compatible with VC-3.

5. Performance indices of Ethernet Transparent transmission service

- Packet loss ratio of Ethernet service

When the corresponding port for the equipment at subscriber premises goes through line-speed processing, and actual bandwidth of the SDH link is not less than the bandwidth for the

subscriber premises, 64-Byte packets are used for testing, and the packet loss ratio should not be larger than 10-6.

- Packet transmission delay of Ethernet service

When the bandwidth configured for the transmission link is larger than the tested traffic bandwidth, 64-Byte packets are used for testing, and the end-to-end delay of the single-network node equipment should not be larger than 2.5ms.

- Uplink transmission bandwidth for transparent transmission of Ethernet service

The uplink transmission bandwidth for transparent transmission of Ethernet service should not be less than 1xVC4.

- Configured granularity of link transmission bandwidth for Ethernet service

Minimum granularity should support VC-12 and is compatible with VC-3.

6. ATM performance parameter

- Bandwidth of the transmission uplink: Greater than 1 × VC4
- System's PVC capability: 8K PVC
- Service types: CBR, rtVBR, nrtVBR, and UBR

4.2.5 Introduction to ZXA10 S200 Boards

The ZXA10 S200 cards are divided into core processing cards, daughter cards, line cards, and backplanes. The following table lists types and names of the common cards supported by ZXA10 S200.

Table 5 Card List of the ZXA10 S200 System

Category	Sub-category	Card Name
Core processing card	Transport aggregation card	TAB
Daughter card	SDH daughter card	OD1H/4
		OD1H/2
		OD4H
Line card	PDH Line card	E1BU
		E1BB
	RPR disposal card	PRQ2G
	Ethernet Line Card	ESS8E
		ESDGE
		ESBGE
		ESQGE
		ESOGE
		EMHGE
		ETQGE
	SDH line card	OL1A/4
		OL4A
Back plane	ZXA10 S200 back plane	MB2U

4.2.5.1 TAB Core Processing Card

TAB is the core processing card of ZXA10 S200 , and its panel is shown in the following figure.

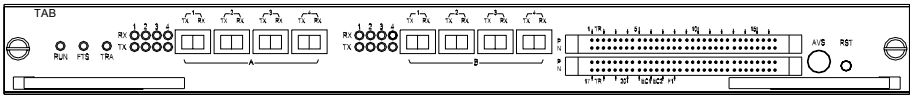


Figure 29 TAB Panel

From left to right: Dual-color running indicator RUN, fan state alarm indicator FTS, E1 service interface alarm indicator TR, DA daughter card interface, DB daughter card interface, E1 interface (including 21 E1 interfaces, system external clock interface, and F1 overhead interface), override ring switch AVS (alarm voice switch), and reset button (RST).

TAB is the core of the whole system service processing and the core of system management control and clock processing. Its functional structure, shown in the following figure, consists of five functional modules: service processing module, clock processing module, control module, overhead processing module, and power supply processing module.

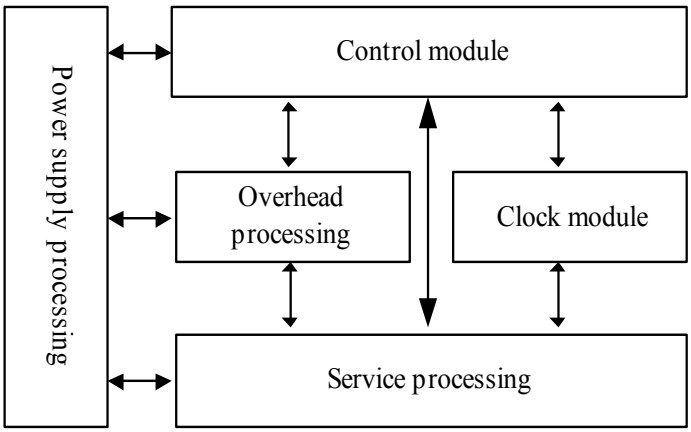


Figure 30 Functional Structure of TAB

1. Service processing module

The whole service flow is focused on space division crossing and provides unblocked service dispatching for the service passing in/out of daughter cards, service passing in/out of E1 interfaces, line card service added/dropped via the backplane, and service passing in/out of the time division module. The service modules are connected to the backplane through serial interfaces, so that the service of the line card slots is led into the space division crossing matrix for service dispatching and convergence. The dispatching granularity is 155M and could be one VC4 or three VC3s. For PDH and the Ethernet service demanding fine granularity, the granularity of the space division crossing matrix is too large to efficiently improve service dispatching and network bandwidth usage. Therefore, in addition to space division, time division is designed for the system, and the time division granularity can process TU12-level crossing at best.

2. Clock processing module

The clock module sends the external clock data to the overhead processing module, the line clock decoded from lines by the service module is sent to the clock module as the system clock source, and the clock module simultaneously provides the service module with various clock signals. The clock module is controlled by the control module via the CPU interface.

3. Control module

The control module communicates with the line cards and the service time division module via network ports, and controls the non-time division part of the service module, overhead processing module, clock processing module and daughter cards directly via the CPU interface. The daughter cards are controlled and managed directly by CPU on the TAB mother board.

4. Overhead processing module

The overhead processing module implements TAB overhead crossing and insertion/extraction in ZXA10 S200.

5. Power supply processing module

The power supply processing module implements power-related processing.

4.2.5.2 Daughter Cards

The ZXA10 S200 integrated Service Dispatching Equipment has its daughter cards embedded in TAB. The SDH daughter cards are classified into three types by interface rate: OD1H/4 of STM-1 interface, OD4H of STM-4 interface. At present, only OD1H/4 and OD4H are available, and other types will come out in succession.

4.2.5.2.1 STM-1 SDH Daughter Card OD1H/4

OD1H/4 is an SDH optical interface daughter card of the STM-1 interface. The OD1H/4 panel side provides four 155M SDH optical interfaces, and three single-color indicators for each optical interface. Two indicators are used for transmitting/receiving indication, and the other one is used to indicate whether an optical interface is configured. OD1H/4 can be configured with two or four STM-1 optical interfaces.

4.2.5.2.2 STM-4 SDH Daughter Card OD4H

OD4H is an SDH optical interface daughter card of the STM-4 interface. The OD4H panel side provides two 622M SDH optical interfaces, and three single-color indicators for each optical interface. Two indicators are used for transmitting/receiving indication, and the other one is used to indicate whether an optical interface is configured. OD4H can be configured with one or two STM-4 optical interfaces.

NOTE: the other card is show in 4.3.

4.3 ZXA10 S300

4.3.1 Overview of ZXA10 S300

ZXA10 S300 is developed on the basis of SDH technology, implementing the processing and transmission of TDM service, Ethernet service and ATM service simultaneously. It offers multi-service node of the unified NM, provides flexible multi-service dispatching, and supports the evolution capacity to the next generation network..

The cross connection is the core of S300, implementing the add/drop multiplexing of various services and the hybrid transmission of multiple services. The granularity of cross connection

can be VC3, VC4, VC4-4C and VC12. The open universal high-speed serial bus is used for the cross connection matrix and the motherboard bus interconnecting line cards, effectively supporting the hybrid access of Ethernet, ATM and TDM.

The device at one end provides 4×STM-16 optical ports (in dual-system mode), 6×STM-4 optical ports, 24×STM-1 optical ports or the combination of STM-1/STM-4 with the same capacity at the maximum. S300 offers 4×63 E1 interfaces. Ethernet ports provide 48×100MFE interfaces and 6×GE interfaces.

S300 is a plug-in box in 19-inch 5U structure. Butt plug-in cards are used. There are plug-in cards and wire routing in the front and back of S300. It is recommended to install S300 in the 19-inch rack. The board configuration of the front slots of S300 is as shown in Figure 62. The board configuration of the back slots of S300 is as shown in Figure30.

Fan plug-in box	TAAE	
	TAAE	
	OL16A/EMH/ EAT4E	OL16A/E1C/E1B/ETS8E/ESS8E/ESQ/ EAT4E
	OL4A/OL1A/ESD/ESB/ESO/ESQ/RPR/ EAT4E	ESQ/ESD/ESB/OL1A/E1C/E1B/ EAT4E
	OL4A/OL1A/ESD/ESB/ESO/ESQ/RPR/ EAT4E	ESQ/ESD/ESB/OL1A/E1C/E1B/ EAT4E
	OL4A/OL1A/ESD/ESB/ESO/ESQ/RPR/ EAT4E	ESQ/ESD/ESB/OL1A/E1C/E1B/ EAT4E

Figure 31 Board Configuration of S300 Unit (Front)

PCI	Fan plug-in box
NOWC	
LIU/LIB	
LIU/LIB	
LIU/LIB	
LIU/LIB	

Figure 32 Board Configuration of S300 Unit (Back)

ZXA10 S300 supports all topology modes and protection modes of SDH technology, including two-fiber unidirectional channel protection ring, two-fiber unidirectional ring for MS protection, two-fiber bi-directional ring for MS protection, four-fiber bi-directional ring for MS protection, 1+1 or 1:1 line ring for MS protection.

The outline of S300 unit is as shown in Figure 33.

Figure 33 Outline of S300 Unit

4.3.2 Main Features of ZXA10 S300

- Adopting the protocol-independent and highly open high-speed serial backplane technology and the semi-mesh universal backplane structure. The slot height is compatible and the system provides the smooth upgrade capability, high reusability and powerful expandability.
- Supporting the convergence and networking protection of integrated services including TDM and Ethernet services, providing multiple service interfaces such as E1, STM-1/4/16 SDH/POS, FE, GE and the FE/GE interface with embedded RPR, and implementing the seamless interconnection with a variety of MAN backbone networks and access nodes.
- Providing powerful expansion and service add/drop capability to fully meet the service development requirements of access networks and effectively protecting the investment of operators. The system adopts the 155M/622M/2.5G compatible structure and supports the construction of networks at the rate levels from STM-1 to STM-16. It maximally supports the flexible configuration of 4*STM-16/6*STM-4/24*STM-1 optical interfaces.
- Supporting 252*E1 service add/drop capability in terms of TDM services and optionally supporting the N:1 backup of E1 electrical tributary boards.
- Supporting the switching and transparent transmission of Ethernet services, optional virtual concatenation at the VC12/VC3 level and LCAS. The system provides optional uplink bandwidth N*VC12 ~ 2*VC4, has the expansion capability of 8*VC4/board and can maximally support the Ethernet access capability of 48*FE/24*FE + 6*GE. The encapsulation protocols can be GFP,

LAPS or PPP. With the non-blocking wire-speed switching of the local Ethernet, the system has greatly enhanced the flexibility of application.

- Supporting the service self-healing protection by multiple means such as SDH, ATM VP-Ring, Ethernet STP and RPR.
- Providing the end-to-end auto/semi-auto service configuration of Ethernet and TDM services at the network level, and the graphical view of services, clocks and ECCs, thus greatly facilitating the provisioning and adjustment of services.
- Providing the comprehensive maintenance and performance monitoring functions, for example, online performance monitoring of optical interfaces, embedded environment temperature monitoring, fan alarm and the instrument-free payload PRBS test of the electrical tributaries.
- Implementing the unified NMS of the other equipment in the ZXA10 MSAN integrated access network system to form the complete NM solution and facilitate the unified management and dispatching of services. The ZXA10 S300 also offers the ability to quick provision services and it adapts to the development trend of integrating the access layer network services and transmission functions.
- Enabling lowered maintenance cost since all the line interface boards and service interface boards except the STM-16 optical line interface board can be universally used in the ZXA10 S200.
- Adopting hot redundancy backup of the key components to enable carrier-class reliability, supporting dual power inputs and distributed power supply to ensure high reliability of the power supply, and supporting the hot plugging of boards.
- Smooth evolution to the all-IP NGN.

4.3.3 Main Interfaces of ZXA10 S300

4.3.3.1 Service Interface

1. SDH interfaces

ZXA10 S300 supports three kinds of SDH interfaces STM-1, STM-4 and STM-16, and supports various SDH protection types, so that it can provide reliable transfer of ATM, POS, Ethernet and PDH service, can serve as the physical link of the clock transfer network.

2. PDH interfaces

ZXA10 S300 provides E1 and E3 PDH interfaces for transparent transmission of the PDH service. The E1 interface system supports maximum configuration of not less than 252 channels (whole system), and the E3 interface supports maximum configuration of not less than 3 channels (per card).

3. Ethernet interfaces

ZXA10 S300 provides 10/100M Ethernet interfaces and 1000M Ethernet interfaces in L2 switching mode, as well as 10/100M Ethernet interfaces in transparent transmission mode.

4. ATM interfaces

ZXA10 S300 provides ATM STM-1 interface via EAT4E board.

4.3.3.2 Clock Interfaces

1. Reference timing input interface

The system provides clock input interfaces not less than 2 BITS, and supports optional 2048kHz synchronous clock input and 2048kbit/s synchronous clock input. The clock interfaces have an input impedance of 75Ω.

The timing clock system (implemented in PCI) works in four working modes: a. Quick capturing b. Normal tracing c. Holdover d. Free running. The timing clock provided by PCI can not only be from externally 2M timing resource but also the extracted clock locked in the STM-N and the 2M electric tributary as well as the clock generated by the free oscillator. Furthermore, the system can still extract the clock signal from the ATM interfaces. In case all timing sources vanish, the system will work in the holdover mode.

2. Reference clock output interface

With one 2048kHz and one 2048kbit/s clock output interface, with an impedance of 75Ω.

4.3.3.3 Management Interface

The NM maintenance console interface implements message receiving/transmitting between the NM maintenance console and NEs via 10/100BASE-T adaptive Ethernet interfaces. NM can manage the equipment through DCN.

ZXA10 S300 is also configured with another 10/100BASE-T adaptive Ethernet interface, which provides the NMS channel for the ONUs in ZXA10 OFAN system. It delivers the management information the OLT side, thus realizing the centralized network management.

4.3.3.4 Auxiliary Interfaces

ZXA10 S300 is configured with multiple serial interfaces for some extended purposes such as debugging, environment power monitoring, and other equipment control. Besides, ZXA10 S300 also provides the order wire phone interfaces.

4.3.4 Technical Indices of ZXA10 S300

4.3.4.1 Physical Parameters

1. Outline dimensions and weight

Outline dimensions: (H * W * D): 211mm*482.6mm*426mm

Installed in a standard 19 inch cabinet, 5U high, about 30 Kg if fully configured

2. Operating temperature

Ensuring performance: 0°C ~+40°C

Ensuring operation: -5°C ~+50°C

3. Relative Humidity

Ensuring performance: 20%-80%

Ensuring operation: 10%-90%

4. Operating Voltage:

Voltage range (DC): -40VDC ~ -57VDC

5. Power consumption

Maximum overall consumption: 500W; Normal operation consumption: 150W~250W

4.3.4.2 Performance Indices

1. SDH crossing capability

- High order: 56*56VC4; Low order: 756*756VC12

2. Maximum traffic capability of the equipment

- Maximum Optical Interface capability: 4×STM-16+8×STM-4+24×STM-1
- Maximum 2M traffic adding /dropping capability: 252×E1
- Maximum ATM access capability: 24×STM-1 or 4×STM-4
- Maximum Ethernet access capability: 48×FE+6×GE, based on L2 switch or RPR

3. SDH performance indices

- Intra-ring protection switching time not larger than 50ms
- In networking of a single ring with 16 nodes, the clock source switching time should be less than 20.
- The system clock can support at least 20-grade node cascade, without affecting traffic.

4. Ethernet performance indices

- Packet loss ratio of Ethernet service

When the bandwidth configured for the transmission link is larger than the tested traffic bandwidth, 64-Byte packets are used for testing, and the packet loss ratio should not be larger than 0.02%.

- Packet transmission delay of Ethernet service

When the bandwidth configured for the transmission link is larger than the tested traffic bandwidth, 64-Byte packets are used for testing, and the end-to-end delay of the single-network node equipment should not be larger than 2.5ms.

- L2 switching address caching capability

L2 switching address buffer capability: /16K

- VLAN quantity

Number of VLANs: 4K and VLAN ranges from 1 to 4095.

- Assigned number of Trunking bandwidth

Trunking: Greater than 4 × FE for uplink/downlink convergence

- Transmission bandwidth configuration capability of Ethernet service

Maximum uplink/downlink assignable bandwidth for single-node L2 switching SDH should not be less than 155Mbit/s.

- Configured granularity of link transmission bandwidth for Ethernet service

Minimum granularity supports VC-12 and is compatible with VC-3.

5. Performance indices of Ethernet Transparent transmission service

- Packet loss ratio of Ethernet service

When the corresponding port for the equipment at subscriber premises goes through line-speed processing, and actual bandwidth of the SDH link is not less than the bandwidth for the subscriber premises, 64-Byte packets are used for testing, and the packet loss ratio should not be larger than 10-6.

- Packet transmission delay of Ethernet service

When the bandwidth configured for the transmission link is larger than the tested traffic bandwidth, 64-Byte packets are used for testing, and the end-to-end delay of the single-network node equipment should not be larger than 2.5ms.

- Uplink transmission bandwidth for transparent transmission of Ethernet service

The uplink transmission bandwidth for transparent transmission of Ethernet service should not be less than 1xVC4.

- Configured granularity of link transmission bandwidth for Ethernet service

Minimum granularity should support VC-12 and is compatible with VC-3.

6. ATM performance parameter

- Bandwidth of the transmission uplink: 1~16 × VC4
- System's PVC capability: 32K PVC
- Service types: CBR, rtVBR, nrtVBR, and UBR

4.3.5 Introduction to ZXA10 S300 Boards

The ZXA10 S300 cards are divided into core processing cards, daughter cards, line cards, and backplanes. The following table lists types and names of the common cards supported by ZXA10 S300.

Table 6 Card List of the ZXA10 S300 System

Category	Sub-category	note
Transmission Convergence Board	TAAE	
Network Element Order Wire Control Board	NOWC	
Power Clock Interface Board	PCI	
SDH line card	OL1A/4	
	OL4A	
	OL16A	
PDH Line card	E1BU	
	E1BB	
	E1C	
E1interface sub-card	LIU	
	LIB	
Ethernet Line Card	ESS8E	2 × VC4,Providing the L2 switching function
	ESDGE	2 × VC4,Support private isolation
	ESBGE	2×VC4 ,Not support private isolation
	ESQGE	155M/622M uplink, Support private isolation
	EMHGE	1.25G uplink, Support private isolation
	ESOGE	2.5G uplink, Support private isolation
	EMHGE	2 × VC4,Providing the L2 switching function
	ETQGE	
RPR switch card	PRQ2G	4VC4，4KVLAN
Ethernet to ATM adapter card	EAT4E	4*FE electric to 2*155M
Back plane	MBE	

4.3.5.1 SDH line card

Standard LC interface STM-16/4/1 optical line board (OL16A, OL4A, OL1A/4) can implement the following simple logic control and configuration functions in addition to the service processing function:

1. Enabling/disabling the optical module
2. Collecting the SD signals of the optical module
3. Controlling the loopback and collecting the alarm signals
4. Processing the active/standby status and control signals of the TAAE board.

4.3.5.1.1 Standard LC Interface STM-16 Optical Line Board (OL16A)

The OL16A board includes the optical module for electrical/optical conversion, the service processing module, clock processing module and the MCU.

The two STM-16 standard SDH optical interfaces support the following types of services:

1. STM-16 service comprising 16 VC4s
2. STM-16 service comprising 48 VC3s
3. STM-16 service with VC4-4C, VC4 and VC3 combined
4. STM-16 service comprising VC4-16Cs.

The two optical modules are 2.5G transceiving modules. The user can select the 15km or 40km one as required.

The board adopts the distributed power supply mode. The –48 power provided by the backplane is converted into +3.3V power supply.

The panel of OL16A is shown in Fig. 33. On the panel, there are two STM-16 standard SDH optical interfaces and seven panel indicators. Of the seven panel indicators, six are service indicators and one is board-running indicator (RUN). Each optical interface corresponds to three service indicators, and each line stands for an optical interface.

Figure 34 Panel of the OL16A Board

4.3.5.1.2 Standard LC Interface STM-1 Optical Line Board (OL1A/4)

The major functions of the 155M optical line board are the same as those of the 2.5G optical line board, which are shown in Fig. 66. One such board can have at most four interfaces. Through the 155M optical line board, the POS and the transparent transmission ATM interface of an external device can be connected to the ZXA10 IS300 system. Then they can be connected to the ATM switching of the ATM board or the Ethernet switching of the ES board through space-division cross-connection by the TAAE board. The transparent transmission can also be implemented directly without switching.

One 155M optical line board can support at most four standard STM-1 SDH optical interfaces, which support the following types of services:

1. STM-1 service of the AU4 mapping structure in the TDM form.
2. STM-1 service of the AU3 mapping structure in the TDM form.
3. STM-1 service in the POS form.

The panel of the STM-1 optical interface board is shown in Fig. 34. It provides four standard STM-1 SDH optical interfaces and 13 indicators, including 12 service indicators and one board status indicator (RUN). Each line stands for one optical interface and corresponds to three service indicators, of which one is green and the other two are red. The optical board also provides a reset button (RST).

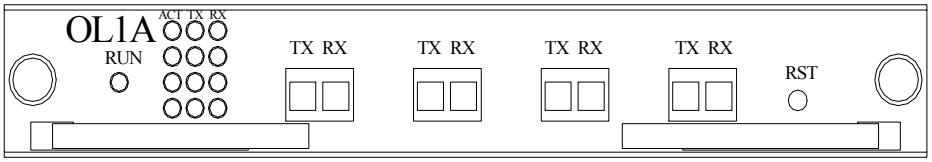


Figure 35 Panel of the OL1A/4 Board

4.3.5.1.3 Standard LC Interface STM-4 Optical Line Board (OL4A)

The working principle of OL4A is the same as that of the OL16A, which is shown in Fig. 66. The 622M optical board (OL4A) can support at most two standard STM-4 SDH optical interfaces. It supports the following types of services:

1. STM-4 service comprising 4 independent VC4s.
2. STM-4 service comprising VC4-4Cs, which can support 622M POS interfaces
3. STM-4 service comprising 12 independent VC3s.
4. Service with VC3 and VC4 combined.

As shown in Fig.35, the panel of OL4A provides four standard STM-1 SDH optical interfaces and 7 indicators, including 6 service indicators and one board status indicator (RUN). Each line stands for one optical interface and corresponds to three service indicators, of which one is green and the other two are red. The optical board also provides a reset button (RST).

Figure 36 Panel of the OL4A Board

Index and hot swap

- Power consumption: OL1A/4: 8 W, OL4A: 7 W, OL16A: 12 W.
- Whether to allow hot swap: yes
- Optical power index: show in the table 7

.

Table 7 Optical power index

Grade	Optical interface	Laser implement type	Wave length	Maximum optical power	Minimum optical power	Receiver sensitivity	Over loading optical power	Transmission distance	Limit Minimum distance	Special contract maximum satisfy distance
			nm	dbm	dbm	dbm	dbm	KM	km	Km
STM-1	S1.1	MLM	1310	-8	-14	-31	-8	30.0	0.0	
	L1.1	SLM	1310	0	-5	-34	-10	60.0	25.0	76.3
	L1.2	SLM	1550	0	-5	-34	-10	96.0	40.0	117.4
STM-4	S4.1	MLM	1310	-8	-14	-31	-8	30.0	0.0	
	L4.1	SLM	1310	2	-3	-31	-8	57.5	25.0	68.4
	L4.2	SLM	1550	2	-3	-31	-8	92.0	40.0	113.0
STM-16	S16.1	SLM	1310	0	-5	-21	0	25.0	0.0	
	L16.1	SLM	1310	3	-1	-28	-9	52.5	30.0	60.5
	L16.2	SLM	1550	3	-1	-28	-9	84.0	48.0	100.0

4.3.5.2 PDH Line card

4.3.5.2.1 63-channel E1 Tributary Board (E1C)

E1C is one of the most important electrical tributary boards of ZXA10 IS300. Its position in the system is shown in Fig. 70. As shown by the dotted box, it consists of E1 processing board and E1 cabling board. It must be used together with the LIU board. The alarm at the backplane interface of the E1C board will only be indicated on the panel indicator but will not be reported to the NMS.

The alarm test of the E1C board includes the following contents:

1. Low-order path tracing identifier mismatch: LP_TIM
2. Low-order path not equipped: LP_UNEQ
3. Low-order path remote defect indication: LP_RDI
4. Low-order path BER exceeds the threshold: LP_EXC
5. Low-order path payload mismatch: LP_PLM
6. Low-order path alarm indication signal: LP_AIS
7. Loss of signals: PDH_LOS

The items that require performance statistics on the E1C board include:

1. V5 BER statistics of VC_12: SDH_VC12_V5
2. V5 remote end BER statistics of VC_12: SDH_VC12_V5
3. Pointer statistics of TU_12: SDH_TU12_PJ

The E1C board provides the PRBS test function and supports the tributary PRBS BER test without BER tester.

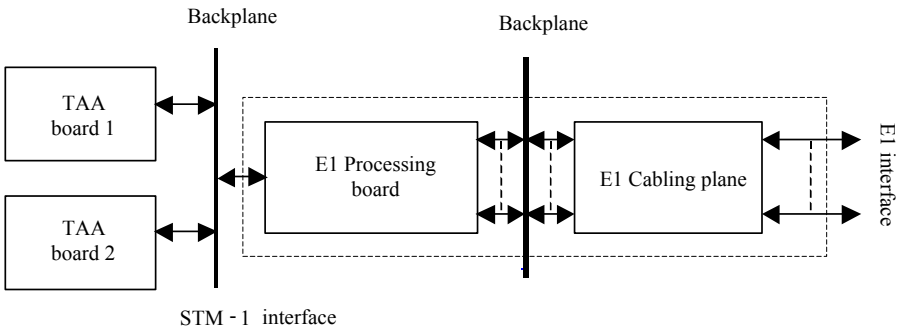


Figure 37 Position of the E1C Board in the System

Fig. 37shows the panel of the E1C board. The board provides two double-colored indicators: a service alarm indicator (ALM) and a board status indicator (RUN). The service alarm indicator indicates low-order service alarm and high-order backplane interface alarm. The different colors and the corresponding meanings of the indicator are shown in Table 10. The board status is shown in Table 8. The board also provides a reset button (RST).

Figure 38 Panel of the E1C Board

4.3.5.2.2 E1 Interface Board (LIU/LIB)

The major functions of LIU/LIB board include E1 signal DC isolation, level conversion and lightning surge/ESD protection. It must be used together with the E1C board. Provide unbalance and balance E1 interface.

The LIU/LIB panel is shown in Fig. 39. It provides 63×2M E1 interfaces. Each E1 interface consists of four pins. The left two are transmitting pins, while the right two are receiving pins. In the front view of the panel, E1s 1~16 are at the upper left corner, E1s 17~32 are at the lower left corner, E1s 33~48 are at the upper right corner and E1s 49~63 are at the lower right corner.

Figure 39 Panel of the LIU/LIB Board

4.3.5.2.3 32-channel E1 Tributary Board (E1BU/E1BB)

The ZXA10 S200 Integrated Service Dispatching Equipment typically uses E1BU as the E1 tributary card. E1BU provides 32 E1 tributaries (75Ω). and the cables can be led out from the front panel with no need of any additional E1 leading-out card. E1BU provides the STM-1 bus for connection with the core processing card, and implements mapping and demapping of 32 channels of E1 signal.

32*E1 balanced interface tributary board E1BB: Each E1BU provides 32 E1 interfaces (120Ω). The lines are led out from the front panel.

The E1BU panel is shown in Fig40

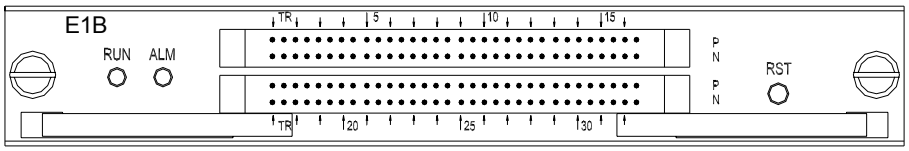


Figure 40 E1B Panel

Index and hot swap

- Power consumption: E1C+LIU/LIB: 23 W, E1BU/E1BB: 13 W.
- Whether to allow hot swap: yes

4.3.5.3 Ethernet Card

IS200 frequently uses the ESS8E, ESBGE/ESB4E, ESDGE, ESQGE, ESOGE,EMHGE and Ethernet switching cards, and the ETS8E/ETQGE Ethernet transparent transmission card. Those cards are all ES cards.

The Ethernet switching board implements the Ethernet L2 switching and the access of the Ethernet service to the SDH. The accessed service is dispatched by the core processing board and transmitted between the NEs through the optical boards, and the Ethernet service is encapsulated in the EOS (ETHERNET->HDLC->SDH) form during the transmission.

The transparent transmission of Ethernet means that the data frames from the Ethernet interface are directly mapped to the SDH Virtual Container (VC) after protocol encapsulation and rate adaptation without undergoing Layer-2 switching, and are sent to the SDH nodes for point-to-point transmission.

- 8FE electrical interface switching board ESS8E: It supports the Ethernet L2 switching functions. Each ESS8E provides eight 10/100M FE electrical interfaces. It supports 256 VLAN and its uplink bandwidth to aggregate interface is 1*VC4. (It supports private isolation)
- 8FE electrical interface transparent transmission board ETS8E: It accesses and processes the special railway line service of Ethernet. Each ETS8E provides eight 10M/100M Ethernet electrical interfaces, and uplink bandwidth of 1VC4.
- 1GE or 4FE electrical interface transparent transmission board ETQGE: It accesses and processes the special railway line service of Ethernet. Each ETQGE provides 1GE or 4FE Ethernet electrical interfaces, and uplink bandwidth of 4VC4. (It is forbid to be recommended for a while.)
- 1GE+4FE electrical interface switching board ESDGE: It supports the Ethernet L2 switching functions. Each ESDGE provides one GE interface and four FE interfaces. It supports 256 VLAN and its uplink bandwidth to aggregate interface is 2*VC4. (It supports private isolation)
- 1GE+4FE electrical interface switching board ESBGE: It supports the Ethernet L2 switching functions. Each ESBGE provides one GE interface and four FE

interfaces. It supports 4K VLAN and its uplink bandwidth to aggregate interface is 2*VC4. (It supports private isolation.)

- 1GE or 4FE electrical interface transparent transmission board ETQGE: It accesses and processes the special railway line service of Ethernet. Each ETQGE provides 1GE or 4FE Ethernet electrical interfaces, and uplink bandwidth of 4VC4. (It is forbid to be recommended for a while.)
- 2GE + 4FE electrical interface switching board ESQGE: It supports the Ethernet L2 switching functions. Each ESQGE provides two GE interface and four FE interfaces. It supports 4K VLAN and its uplink bandwidth to aggregate interface is 4*VC4/1*VC4. (It supports private isolation and not be recommended for a while.)
- 2GE + 4FE electrical interface switching board ESOGE: It supports the Ethernet L2 switching functions. Each ESQGE provides two GE interface and four FE interfaces. It supports 4K VLAN and its uplink bandwidth to aggregate interface is 8*VC4. (It supports private isolation and not be recommended for a while.)
- 2GE+4FE Ethernet processing board EMHGE: It supports the Ethernet L2 switching functions. Each EMHGE provides two GE interfaces and four FE interfaces. It supports 4K VLAN and its uplink bandwidth to aggregate interface is 16*VC4. (It not supports private isolation and please exchange the opinions with product planning engineer before configuration).

ESDGE, ESBGE/ESB4E, ESQGE, ESOGE,EMHGE,ESS8E and ETS8E are respectively shown in the following figures.

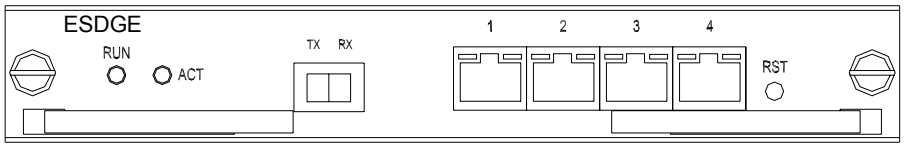


Figure 41 ESDGE Panel

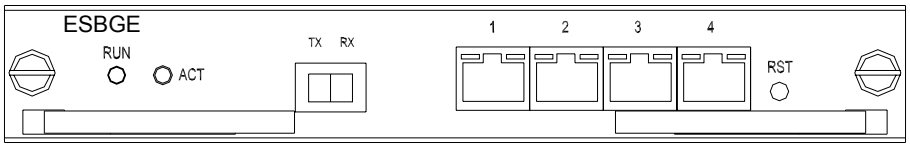


Figure 42 ESBGE Panel

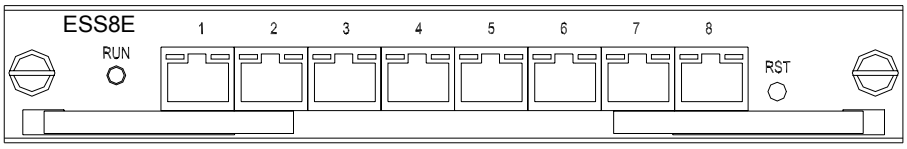


Figure 43 ESS8E Panel

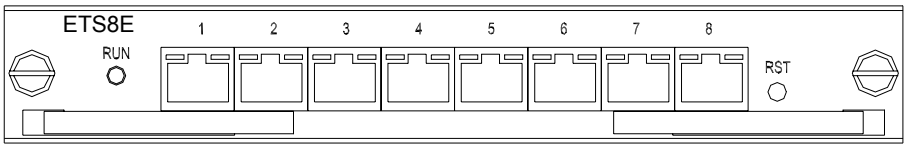


Figure 44 ETS8E Panel

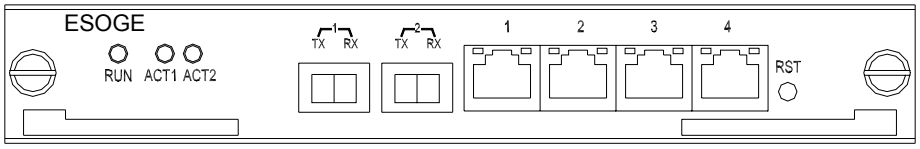


Figure 45 ESOGE Panel

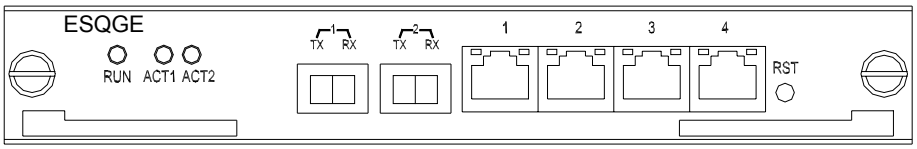


Figure 46 ESQGE Panel

Index and hot swap

- Power consumption: ETS8E: 22W, ESS8E: 20 W, ESDGE: 22 W, ESBGE: 22 W, ESB4E: 22 W, EMHGE: 33W, ESOGE：28W,ESQGE：24W.
- Whether to allow hot swap: yes

4.3.5.4 RPR switch card（2*GE）PRQ2G

RPR switch card PRQ2G provides two GE interface, 4K VLANs，256 broadcast groups. PRQ2G implements the Ethernet L2 switching.

The specialty of RPR is to divide the services into different priority grades based on the different principle and the whole net share the same transmit channel.

PRQ2G panel show in Fig47:

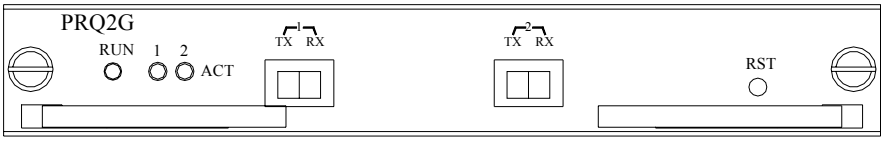


Figure 47 PRQ2G Panel

Index and hot swap

- Power consumption: 25 W.
- Whether to allow hot swap: yes

4.3.5.5 Ethernet to ATM adapter card（4*FE electric to 2*155M）EAT4E

EAT4E implements the Ethernet to ATM adapter. The EAT4E panel show in Fig48:

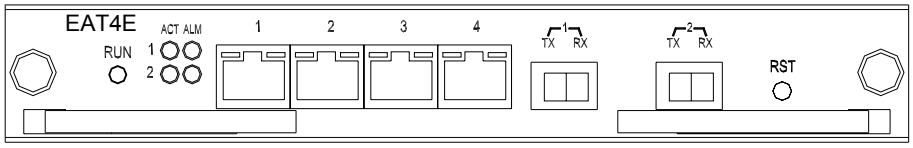


Figure 48 EAT4E Panel

Index and hot swap

- Power consumption: 15 W.
- Whether to allow hot swap: yes

4.3.5.6 Enhanced transport aggregation card type A (TAAE)

The major functions of TAAE include space-division and time-division cross-connection, overhead processing and clock processing. The TAAE board is responsible for the dispatching of the services in the whole system. It is the core of the system.

The TAAE board does not provide external service interfaces. Its panel is shown in Fig. 76. On the panel there are two double-colored indicators: one the master/slave indicator (M/S), while the other a board running status indicator (RUN). In addition, there is also a reset button (RST) on the panel.

Figure 49 Panel of the TAAE Board

Index and hot swap

- Intercross capability: 56×56VC4, 1008×1008VC12.
- Power consumption: 75 W.
- Whether to allow hot swap: yes

4.3.5.7 Standard NE order Wire & control card (NOWC)

The major function of the NOWC board is to conduct the management and control the whole Network Element (NE) and implement the order wire. It communicates with the line cards in Slot group A/B and the master/slave TAAE boards through the network interfaces, and controls the PCI board and the two fan boards through a dedicated control line. It also has two 8MDCC and E1/2 services lines to connect the master/slave TAAE boards respectively.

The panel of the NOWC board is shown in Fig. 50. On it there are two network interfaces and two serial ports. One of the network interfaces is a large F interface, which is used for the NMS to connect the background; the other (RES) is reserved for future use and its functions have not been defined yet. Of the two serial ports, one is a small f port, which is not used at present, while the other is the TEST port used for debugging. There are four indicators on the panel: the

NOWC status indicator (RUN), the running status indicator of the fans on the front (FANF), the running status indicator of the fans on the back (FANB) and the order wire hook-off status indicator (OW).

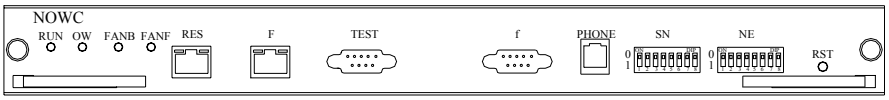


Figure 50 Panel of the NOWC Board

Index and hot swap

- Power consumption: 15 W.
- Whether to allow hot swap: yes

4.3.5.8 power & clock interface card (PCI)

The PCI board accesses the –48V power supply and external clock of the whole system.

The PCI panel is shown in Fig. 51. It provides two 2MBIT/S or 2MHZ/S clock input LOS alarm indicators. The red indicator will turn on when an LOS alarm is generated and the two indicators will be off in the normal case. There are four coaxial connectors on the panel. The indicators and connectors are described from left to right below:

1. Two 2MBIT/S or 2MHz/S clock input connectors and two 2MBIT/S or 2MHz/S clock output connectors.
2. Power indicator (PWR): The red indicator turns on when the power switch is turned on and there is power input and turns off when the power switch is turned off or there is no –48V power input.
3. Power switch: It is used to control the system power supply.
4. Two 6-core power sockets: for connecting -48V power supply.

Figure 51 Panel of the PCI Board

Index and hot swap

- PCI+FAN Power consumption: 39W.
- Whether to allow hot swap: no

4.4 ZXA10 S100

4.4.1 Overview of ZXA10 S100

The ZXA10 S100 is a compact equipment. It is 1U high. It is used to provide dedicated-line access for VIP customers. It offers E1 and Ethernet service interfaces to offer multi-service access.

The ZXA10 S100 usually acts as an end node of the star network or an end on a small-capacity ring. It can be networked with the ZXA10 S300/S200.

Figure 52 Outline of S100 Unit

4.4.2 Main Features of ZXA10 S100

The following describes the major functions of the ZXA10 S100.

- It can be configured as a TM or an ADM. It provides two 155M optical interfaces (TM/ADM) or one 622M optical interface (TM).
- It provides 12 ITU-TG.703-compatible 75Ω E1 interfaces.
- It provides six 10/100M Ethernet electrical interfaces, and transparently transfers Ethernet service through SDH.
- It supports optional virtual concatenation of VC12 and VC3 from Ethernet to SDH, and supports PPP/LAPS/GFP.
- It supports two-fiber unidirectional channel, two-fiber unidirectional multiplex section protection ring, and 1+1 protection chain (STM-1).
- It can be networked with the ZXA10 S300/S200 and the ZXA10 AS1/AS2.
- It provides optional order wire phone function for interworking with the ZXA10 S300/S200.
- It supports 220V AC and -48V DC, meeting different application requirements.
- It features small volume, powerful service access capability, and flexible and convenient configuration.

4.4.3 Main Interfaces of ZXA10 S100

- 155M TM Integrated service dispatching unit S1001T：Each unit provides 2 SDH 155M optical transmission interfaces. At the same time Each unit provides 12 E1 interfaces (75Ω) and 6 FE interfaces. It is available with the optical modules of the ordinary haul, medium haul, long haul and super long haul and the optical interface types are optional.

- 155M ADM Integrated service dispatching unit S1001A：Each unit provides 2 SDH 155M optical transmission interfaces. At the same time Each unit provides 12 E1 interfaces (75Ω) and 6 FE interfaces. It is available with the optical modules of the ordinary haul, medium haul, long haul and super long haul and the optical interface types are optional.
- 622M ADM Integrated service dispatching unit S1004T：Each unit provides 1 SDH 622M optical transmission interfaces. At the same time Each unit provides 12 E1 interfaces (75Ω) and 6 FE interfaces. It is available with the optical modules of the ordinary haul, medium haul, long haul and super long haul and the optical interface types are optional.

4.4.4 ZXA10 S100 physical parameter

- Cabinet outline dimensions: 43.6mm×482mm×355mm (Height x Width x Depth)
- Weight: 8kg
- Power consumption: 25W
- Operating voltage: AC: 220 ± 20% VAC；–57VDC to –40VDC
- Ambient temperature: assure performance: 0˚C to +45˚C, assure working : -5˚C to +50˚C
- Relative humidity: assure performance: 20% to 80% , assure working: 10% to 90%
- Grounding resistance: ≤ 3 ohm

5 NM – NETNUMEN N31

5.1 System Overview of NETNUMEN N31

The NETNUMEN N31 is an integrated NE (network element) and network management system developed by ZTE to implement unified management on the access products manufactured and sold by ZTE and to provide operators with unified management interfaces so as to optimize the management flow and cut down maintenance cost. The NETNUMEN N31 is designed to support modular structure and scalability. The system structure includes a platform module plus special NE processing modules for easy expansion and maintenance. It provides perfect network element management functions according to TMN related specification and multi management interfaces to OSS and other NMS platform.

The NETNUMEN N31 is an integrated NMS that currently manages different data equipment of ZTE in the backbone layer, the convergence layer, and the access layer.

The NETNUMEN N31 products feature the following:

1. The system strictly complies with ITU-T TMN series recommendations and RFC series NM protocols.

2. The system manages different data communication products of ZTE.

3. The system provides the load balancing function and allocates the load evenly to different hosts, thus the low-cost hosts can complete complex calculations. The system is highly flexible. When the user access increases, new servers can be added during the system operation, thus achieving the system expansion purpose without interrupting the operation. The system provides strong fault tolerance capabilities. When a server in the system is down, the other servers can take over its jobs so that the services will not be interrupted.

4. Based on the JAVA language, the system has the trans-platform feature and supports the Unix and the Windows OSs. The system supports MSSQL server and Oracle.

5. The system supports the standard SNMP, provides such interfaces as CORBA, XML and SNMP, and supports integration with the third-party system to facilitate the office party to deploy OSS applications.

6. Modular design is adopted for the system so that the system provides good expansion and upgrade functions.

7. The system can automatically discover devices by batch based on such information as the IP address range set by the user and the device type, and add them to the management system.

8. The system supports cluster structure and provides the data hot backup strategy. The system provides complete system management capabilities and can monitor the system operation.

9. The system provides comprehensive access right control functions and supports user access to the system by level and by area. That is, the system supports operations on limited NEs within the limited granularity. The system provides comprehensive security log records for local management

5.2 System structure of NETNUMEN N31

5.2.1 Distributed Processing Structure

The NETNUMEN N31 adopts the 3-level client/server structure, which is a typical distributed application system composed of three parts: The database server, the NM server and the NM client, as shown in Fig.53. The NM client exchanges information with the managed NE equipment and accesses the database via the NM server.

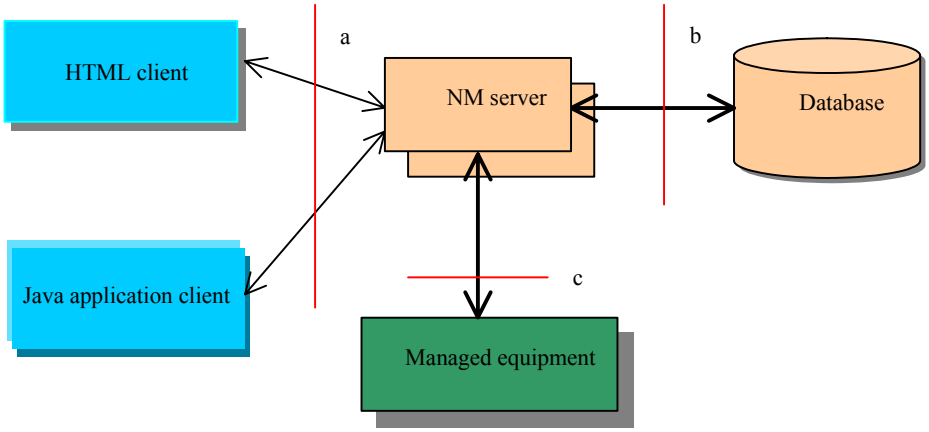


Figure 53 System Structure of the NETNUMEN N31V4

In the above figure, red dotted lines represent the protocols for interaction among different modules:

a —— XML/HTTP/CORBA/RMI

b —— JDBC

c —— SNMP/TELNET

The system supports the HTML client and the Java application client.

The HTML client adopts the HTML language and has good operability and expandability. The NM operators can access the NM center at any place via Internet or Intranet as a HTML client after passing the security authentication to conduct NM operations as required.

The Java application client provides all NM functions and has good user friendly feature.

The system server adopts Java and can run on multiple OS platforms, such as Windows and Unix ones.

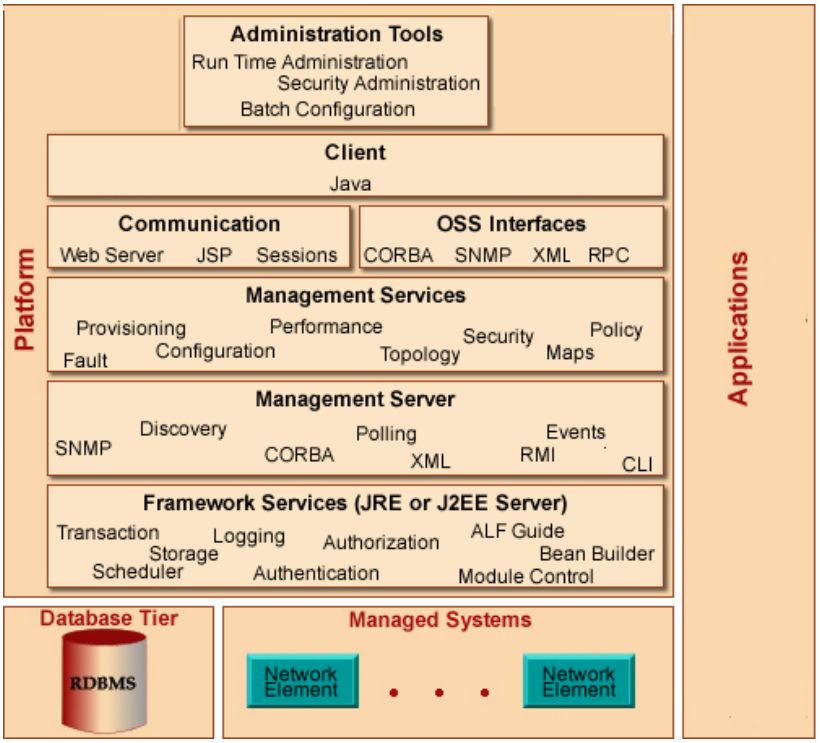
The system provides support for multiple database systems (such as Oracle and SQL-Server) via the standard database access interface JDBC. The database system can run on the same server platform together with the NM server, or it can run on an independent server platform.

The information flow of the system starts from the time when user information is received from the client. After operation rights authentication and input check, it is transferred to the server for processing. The server exchanges information with the NE and then is synchronized to the database data or directly accesses the database before returning the results to the client. Therefore, the client and the server cover all the system management functions.

5.2.2 Modular Structure

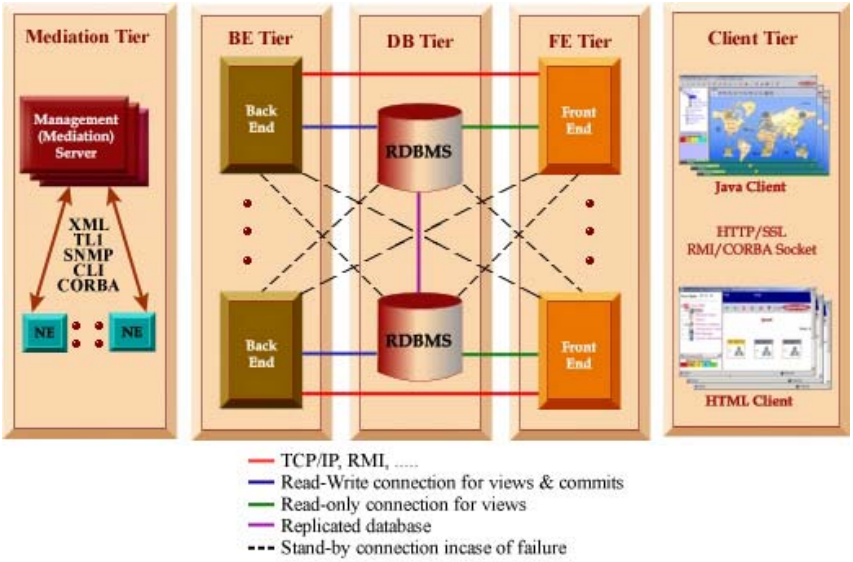
The NETNUMEN N31 system is composed of the unified NM platform and the NE processing module. Its server and client both adopt this structure, and its NE managers and management functional modules are embedded in the system platform as components.

The management platform architecture is shown below



NetNumen N31 provides the necessary infrastructure, with a comprehensive suite of J2EE and JMS based cross platform development framework, tools, modules, APIs as well as pre-packaged applications. NetNumen N31 leverages EJB, JMS, JFC, XML, JMX, HTTP, JSP, JDBC, JTA, CORBA and other standards to deliver the most comprehensive management solution available anywhere. To communicate with managed systems (network elements, systems and applications) it supports SNMP, TL1, XML, CORBA, Telnet/CLI protocols out-of-the-box. To facilitate integration with OSS and other decision support systems, NetNumen N31 support northbound interfaces like CORBA, RPC, SNMP, and XML etc.

The following diagram gives an overview of the different components in NetNumen N31 and the interactions between them.



Each one of the components of this n-tier design can be distributed. An overview of the key features and benefits of each component is given below.

Client tier: Java client (for rich GUI) are supported.

Front-end server tier: The front-end tier consists of the web container that provides web access to management information, the client communication management module and the session beans for the different management functions that generate views for the clients and forward commit requests to the back-end tier.

Back-end server tier: The back-end server tier consists of the core business logic related to management functions like fault, configuration, performance, security, service provisioning etc.

Management server tier: The management server provides XML mediation for all southbound management protocols like SNMP, TL1, CORBA, TFTP, XML, and CLI/Telnet etc

Database tier: Any RDBMS that provides a JDBC driver are supported.

During the system installation, users can select all the types of equipment needing management and thus a system for managing multiple data products is customizable to users. The platform module provides the functions independent of the specific equipment type, such as topology, security and system management. During the installation, users can select all the types of equipment needing management and the functions independent of the specific equipment type can be provided. Each NE manager provides the extensive individualized operations for a certain type of NEs, such as configuration management, performance management and alarm management. With the increasing launch of new data products of ZTE, the NetNumen N31 system can flexibly and timely supports the NMS of these new products. It possesses good expandability and sufficient capacity upgrading capability to meet the increasing expansion and continuous development of the network scale.

5.2.3 Redundancy Standby Solution

As the core application system for monitoring and managing the network, the NMS shall be able to run stably in a long run. However, the stability of system running is restricted by the following several factors:

Stability of the hardware platform

Stability of the software system including the system software (OS, DB system and virtual machine) and the NM application software

Status and stability of the network

Operating environment of the system (such as temperature, humidity, power supply and natural disaster)

Therefore, to guarantee the stable running of the system, the NETNUMEN N31 provides a hot standby redundancy solution for 1+1 backup.

Hot standby means that both the active system and the standby system run at the same time so that they can be switched over to each other in the case of faults to guarantee the uninterrupted service of the NMS. In the NETNUMEN N31, two solutions are available for hot standby: The local dual-system hot standby solution in which the active and the standby systems operate in the same place, and the remote dual-system hot standby solution in which the active and the standby systems operate in different places.

5.3 Network Topology Architecture

To ensure that the NMS can stably manage the equipment in it, reliable NM channels must be provided for the NMS. The NM channels generally fall into two kinds: In band NM channels and out band NM channels.

Since the TCP/IP is adopted as the transmission NM protocol between the NMS and the managed equipment, the only standard for judging the effectiveness of the NM channels is to check if TCP/IP links are established between the NMS (the NM server) and the managed equipment, whether the in band or out band channels. A simple method is to use the ICMP Ping tool to judge so.

There are two kinds of networking mode of NETNUMEN N31 V4: Centralized Management and Distributed Management.

5.3.1 Centralized Management

The NETNUMEN N31 is an NMS constructed over the data communication network. It can maintain and manage all kinds of network equipment in a centralized manner in a broad area and complex application environment. The centralized management mode is generally used for the networking, that is, the NMS manages plenty of equipment distributed in the managed network in a centralized manner.

In the centralized management mode, the NMS is composed of the client and the server and the whole managed network has only one server that exchanges management information with all the managed equipment. In contrast, there may be multiple clients and they connect with the server to implement man-machine interactions with users but cannot directly connect the equipment. The client configurations may take the following two modes: Local client and remote client.

Local client: Both the client and the server is located in the same LAN and they implement the centralized management of the entire network together.

Remote client: The client is connected with the server via the WAN and can be located in the remote equipment room to manage the local equipment by dividing management domains. Also, the remote client does not directly connect the managed equipment.

The remote client networking can implement hierarchical management in the centralized management mode, as shown in Fig 56. When the system manages a network across multiple

domains, the network is split into several subnets (generally these subnets are divided according to the areas or the equipment type) and all the equipment in the network are connected to the upper-level NMS to exchange management information with the NMS. In the upper-level NM center, administrators can monitor the running status of the entire network (including several subnets) through the local terminals.

The lower-level NM center for managing the subnets is extended from the remote client in the upper-level NM center to the local client to monitor the local subnet. In the lower-level NM center, no NM server is configured but there are only management terminals to exchange management information with all the equipment in the local subnet via the NM sever in the upper-level NM center. In the NM server, management rights can be set according to the management area and content, so that the management terminals in the lower-level NMS can only access the subnets within its management right scope after login to the NM server. The lower-level NM client can both monitor the network through graphical interactions and output a variety of reports, so this is equivalent to the Manager-Agent mode in terms of management content.

When the remote client mode is used to implement hierarchical management, the management rights of different subnets are assigned by the upper-level NMS and the data are uniformly maintained by the upper-level NMS, thus ensuring that the upper-level NMS can monitor the entire network and correct & reliable data are obtained.

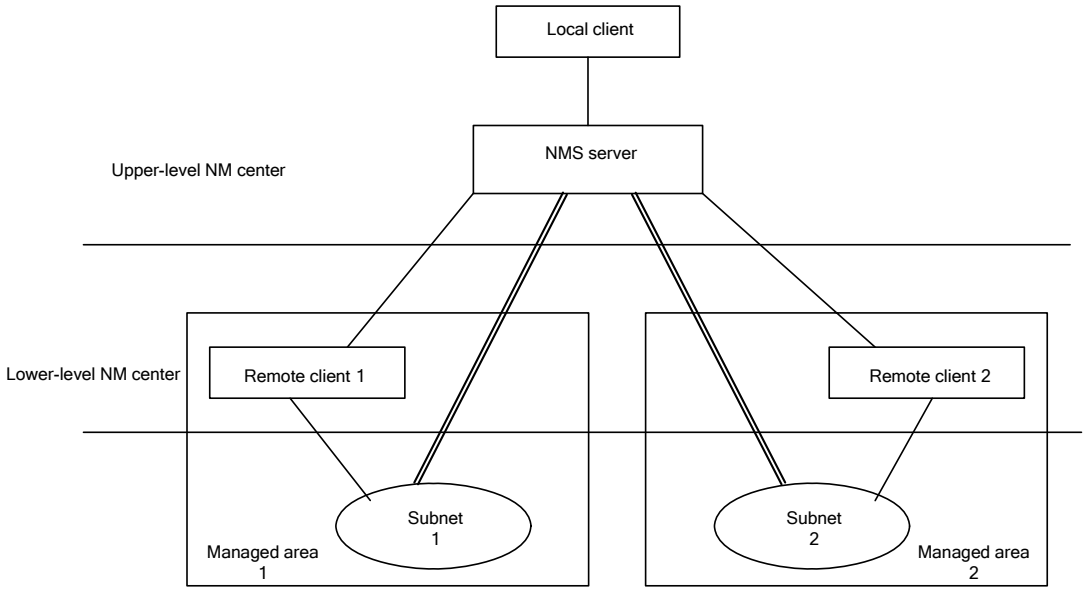


Figure 54 Remote Client Mode

Two issues exist when the remote client mode is used to implement hierarchical management:

High requirements for the server configurations. Since there is only one NM server in the entire network to exchange information with all equipment in the network, it has heavy processing load and so its configurations must be quite high. When the server is faulty, the management of

the entire network will be affected. It is necessary to provide data transmission channels for the remote clients with high bandwidth requirement (at least 512K).

5.3.2 Distributivity Management

In the distributive management mode, the NMS is composed of service-side and client-side. The whole managed system includes several sets of service-side, which face managed equipment in different area separately and perform the interaction of management information. Besides, it includes several sets of client-side, which connect their own service-side separately and perform the man-machine interaction with subscribers. The client-side doesn't connect the equipment directly and the configuration at the client side adopts local terminal mode in uniform.

- Local terminal: the client-side and service-side are in the same LAN and they realize the centralized management facing the whole network together.

Fig. 55 shows this management mode. When the system manages a cross-area network, the network is divided into several sub-nets (commonly it is divided by area and also by equipment type).All subnet equipment in this network are connected to corresponding lower level NMS and perform the interaction of the management information with the NMS. The lower level NM terminal realizes the management on the subnet equipment via the local NM server, while by cascading with the lower level server, the higher level NM center supervises the running status (including several subnets) via the local terminal of the higher server.

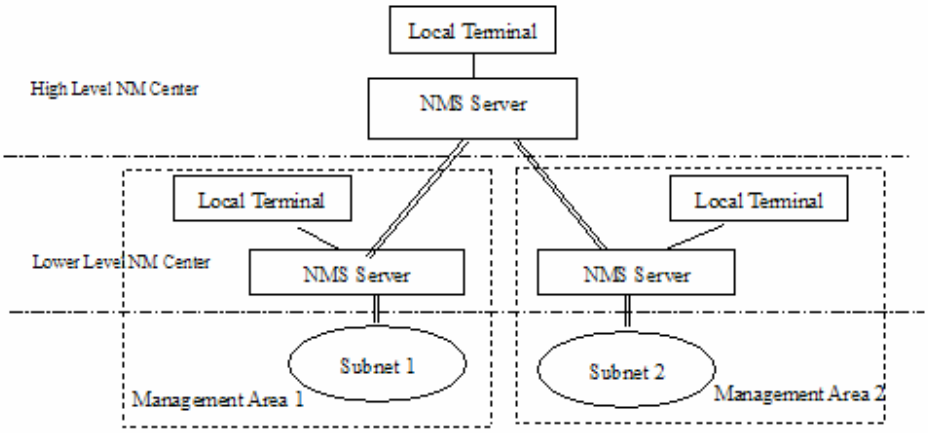


Figure 55 Distributive Management Mode

There exists a problem in adopting the distributive to realize the hierarchy management: since several NM servers are used, data is deployed distributive and the higher level NM center will have trouble in making some statistical data.

5.3.3 NMS Security

The NMS security depends on three aspects as follows:

Network security, that is, whether the NMS network can be physically or logically isolated from the user network so that it can only be accessed by the designated users while the unrelated users will be isolated and the information flowing in the entire NMS network will not

be monitored. Currently, the data product NMS adopts the SNMPV2 standard protocol which has poor security due to its inherent defects. The SNMPV3 has higher security but it has not been put into use in a large scale for the time being, so the NMS network security is the critical factor to affect the NMS security. If this is not well planned, the subsequent security guard measures will only play a very minor role. Network security is a complicated issue. If the NM information is transferred in the out band mode via the dedicated DCN network that is physically separate from the user network, the NMS security will be reliably guaranteed. However, effective measures must be taken for the in band NM mode. As far as the current common methods are concerned, the measures such as PVC (in the ATM network), VLAN (in the IP network) and ACL can all be regarded as different implementation modes of the VPN. In the transmission layer, the division of VLANs is a very good solution. For the IP mode, if the NMS and the managed equipment are confined within a subnet, these two can then be allocated within a VLAN to logically isolate from all the other systems. If the NMS and the managed equipment are not confined within one subnet, VLANs can be divided for them separately and these VLANs can then be bridged or we can configure a router or the ACL of BAS to restrict the access to the management equipment or NMS, so that the NMS and the managed equipment can manage each other while other nodes cannot access them. For the ATM mode, PVC is also a kind of VLAN but can conveniently provide security. In the network layer, we can also directly divide the managed equipment and the NMS into one or more private subnets and implement ACL to protect the NMS security. Generally, the ATM PVC mode has high security while the IP mode is weak in this respect.

Security of the NM OS, which relies on whether to allow access of remote users and whether strict control and tracing is implemented for remote user access. The security of the OS is also one of the important factors that affect the NMS security. If the OS is maliciously invaded, the applications running in it, including the NMS, will be monitored and destroyed without any security guarantee. In this respect, the security of the Unix system is far better than the Windows system. The NETNUMEN N31has excellent cross-platform features and it can run both on the Unix or the Windows OS. Which kind of OS to select shall be determined by the user according to its specific conditions because the price of the Unix system is largely different from that of the Windows system.

Security management of the NMS, that is, the security control of NM applications. This involves the allocation of user operation rights and the effective management of passwords.

5.4 NETNUMEN N31 Function

5.4.1 Topology and View Management

The topology and view management function provides the monitored network with integrated management of network topologies and multiple views so that the user can master the topological structure of the entire network and the operation state of network equipment vividly through the views. The NETNUMEN N31 supports multi-level topology of the entire network, as shown in Fig.

1) Network topology state monitoring

Automatic discovery

Topology structure and state refreshing

Node increase or decrease

Node state change

Alarm monitoring

Node management

Event notification

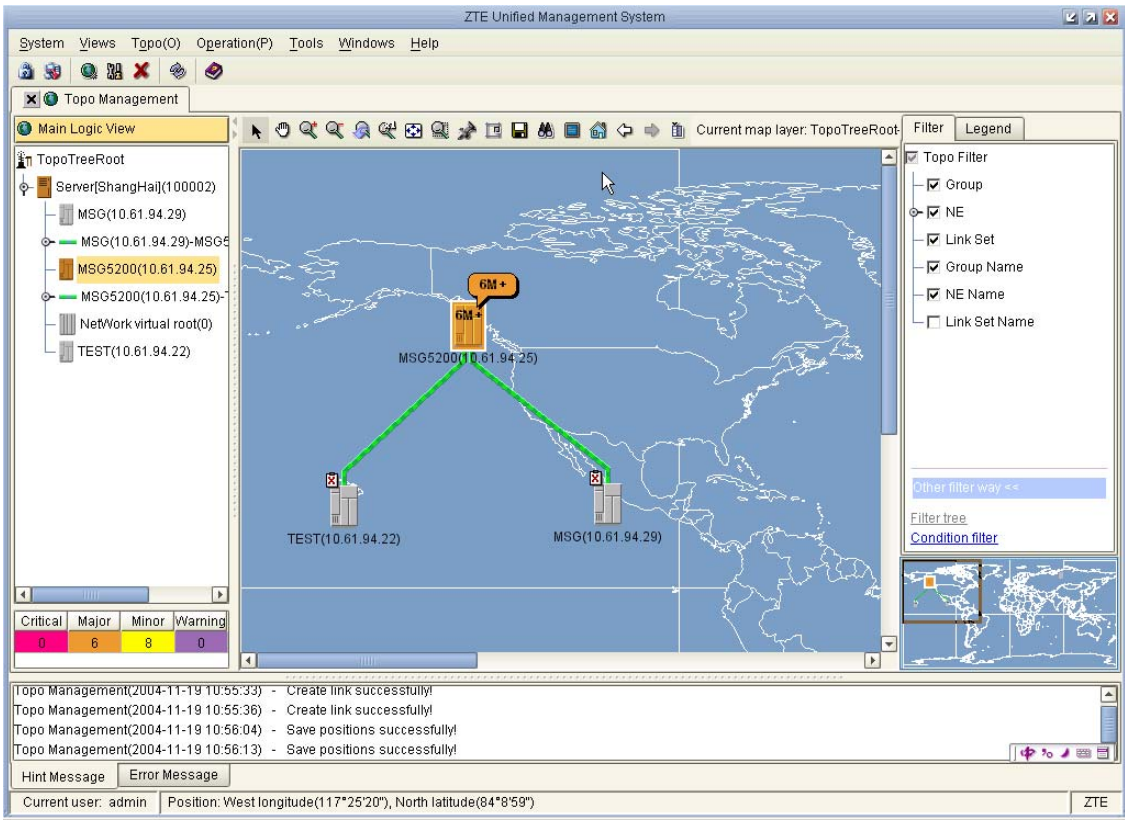


Figure 56 Topology of the NMS

2) View management

Tree display of the view levels

The network hierarchy is displayed in the tree structure and each subnet is represented by one view. The inclusion relations between subnets are reflected in the tree structure and the hierarchical display of the tree structure is supported by the system.

Support for node sequencing by English or Chinese in the view

Support fuzzy search by node name in the view

Zoom-in and zoom-out of views

Display mode of views

Division of views

Edit of the view identification

5.4.2 Fault Management

Through fault management the equipment alarms reported by all NEs of the entire network and the network event reports can be received and presented to the maintenance staff in real time in the visible and audible form, so that the maintenance can confirm and process such alarms and network event reports and store the collected alarm reports in the database for alarm statistics and query.

- Real-time Auto Report of Alarm Information

The system receives in real time the equipment fault alarms reported by all NEs of the entire network and the network event reports. All equipment alarms are reported in the form of trap messages, which are depacketized by the fault management module to get the relevant parameters: OID, alarm serial number, alarm code, alarm position, equipment ID, alarm level, alarm type, alarm time and alarm description, as shown in Fig. 60.

The system can automatically detect all alarm information, including the link status of all NEs in the network, plugging/unplugging alarms of all cards, the UP/DOWN status of user ports, link alarms of the uplink interface cards and the UP/DOWN alarms of the uplink ports.

The system stores in a centralized manner the collected alarm information in the database.

The original alarm reports shall be kept online in the system database for at least three months and the expired information can be backed up into database files or backed up with such media as CDs or magnetic tapes.

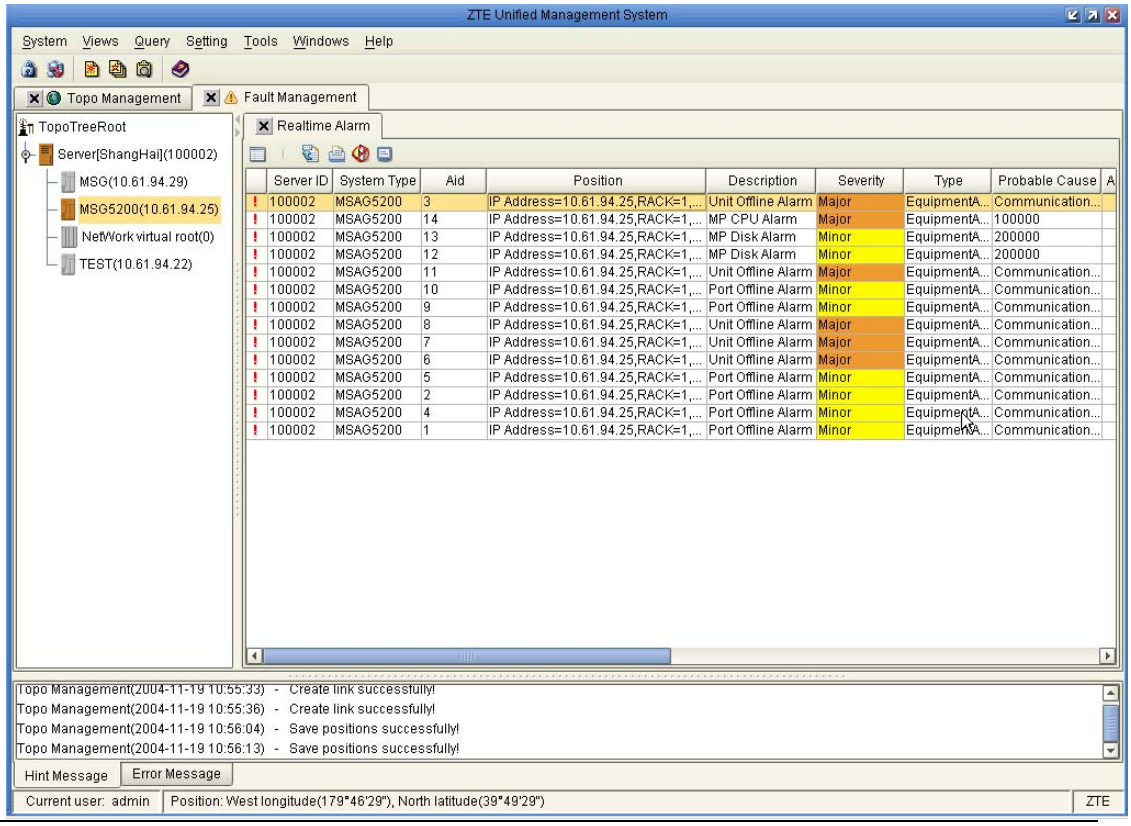


Figure 57 Display of the Current Alarm Information in the NMS

- Alarm Information Handling
- Alarm display

Alarm fault location and detail list

The detailed information of the alarms reported by the NE equipment is displayed in an alarm list and refreshed in real time.

- Alarm acknowledgement

Upon receipt of alarm prompt information, users are allowed by the system to confirm such alarms in the alarm list and the confirmed alarms will not have their original alarm levels displayed through the NE icon. Alarms in the system can also be manually recovered, because some alarms may be unable to recover automatically.

- Alarm filtering

Plenty of alarms that occur in a unit time can be filtered according to the specific user requirements and the actual management needs. The types of filter include filter of alarms entering the database, filter of global alarms and filter of user alarms.

- Alarm level redefinition

Users can redefine the level of a certain alarm type according to the actual application environment. The correlation conditions are the alarm code (the identification of a certain type of alarms) and the alarm level. After being redefined, the alarms will be displayed and handled according to the new level of alarm redefined.

- Query and Statistics of Alarm Information
- Query and of alarm information

Query of the history alarm information of an NE

The history alarm information can be queried by different query conditions: Alarm server, alarm position, alarm level, alarm type, alarm cause and alarm time. The information for query includes the position where the alarm occurred (such as NE/board/card), alarm level, alarm occurrence time and detailed alarm descriptions. The alarm results will be sorted and displayed and can be saved as reports, as illustrated inFig.58.

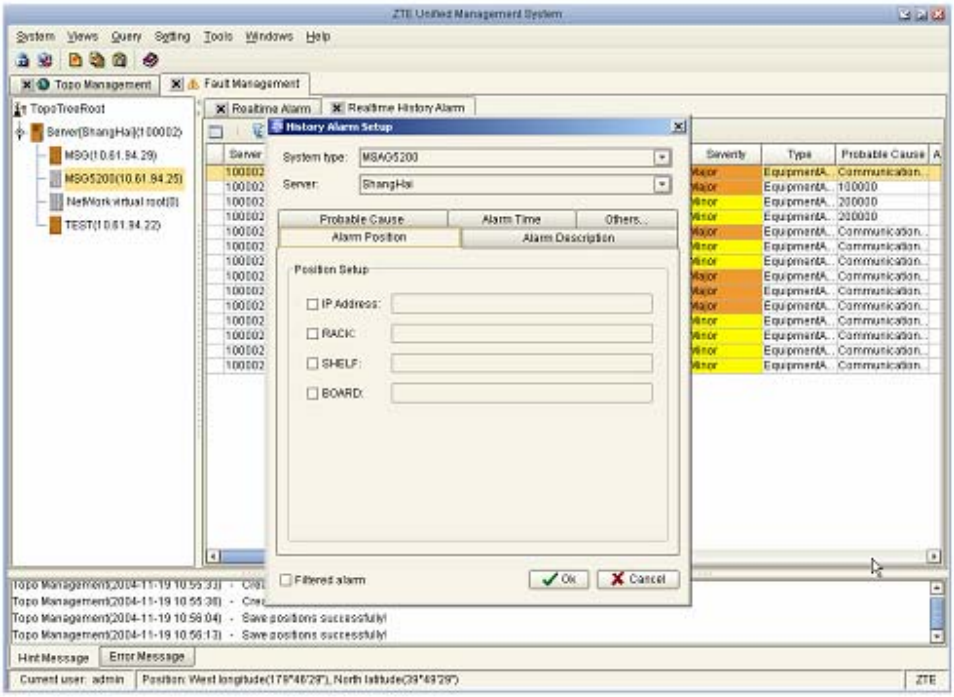


Figure 58 Query & Management of History Alarms

- Query of the current alarm information of an NE

The current alarm information can be queried by different query conditions: Alarm server, alarm position, alarm level, alarm type, alarm cause and alarm time. The information for query includes the position where the alarm occurred (such as NE/board/card), alarm level, alarm occurrence time and detailed alarm descriptions. The alarm results will be sorted and displayed and can be saved as reports, as illustrated inFIig.62.

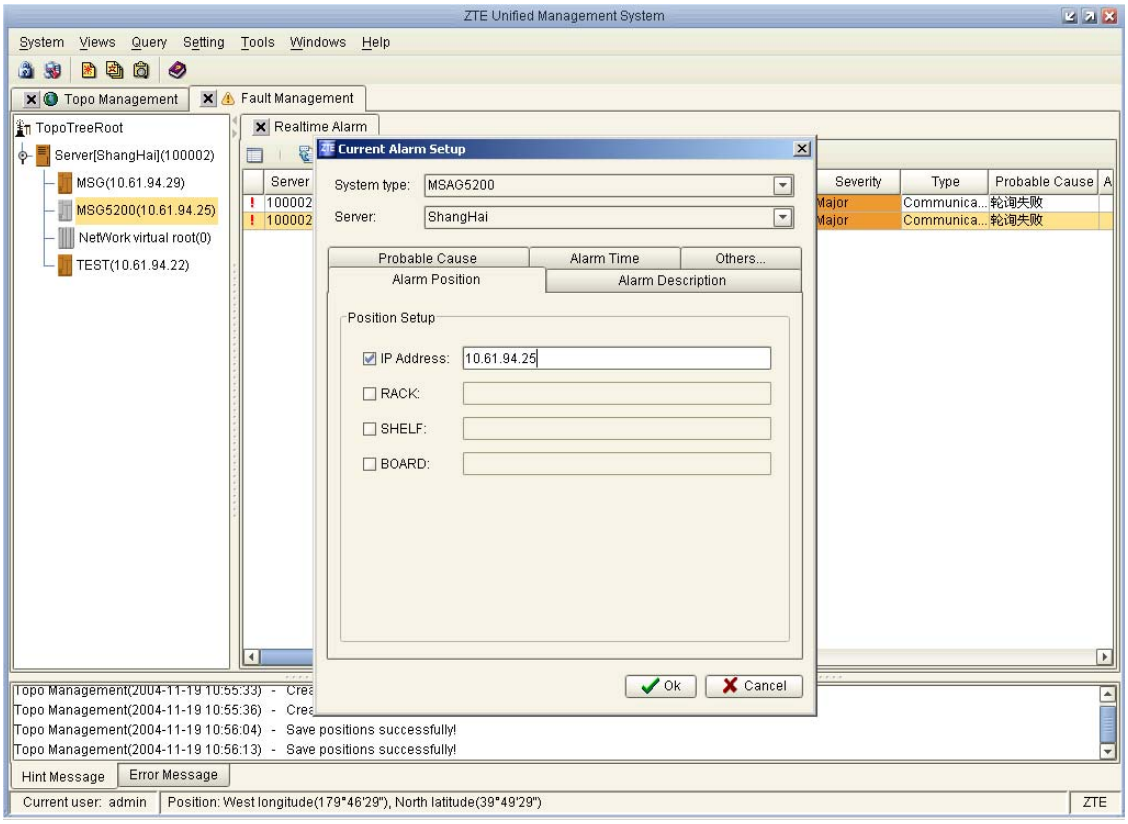


Figure 59 Query & Management of Current Alarms

5.4.3 Performance Management

The performance management module monitors and analyzes the performance of the network and equipment. It collects performance data from the NEs and generates performance reports after processing them, so as to provide information for the maintenance and management departments and guide the network engineering, planning and adjustment for improving the operation quality of the whole network.

Performance data collection

The performance data is collected by periodically polling the MIBs in the equipment foreground and the collection period and time are subject to the user settings. The polling policies are registered in the policy engine and triggered by it.

For the performance data collection of DSL equipment, multiple performance parameters (such as traffic) can be collected on the basic of the user ports and the uplink ports and can be displayed graphically, as shown in Fig.61 and Fig.63.

The data collection is implemented in the form of task registration. The NMS sets the corresponding MIB attributes (different MIB attributes correspond to different performance statistic items) of the designated equipment or executes the specified man-machine interface, and notifies the equipment to measure the performance data and prepare the data statistics in the performance MIB for the NMS to poll and collect.

The collected original performance data are sorted and stored in the database. They will be kept online for at least three months and can be backed up, deleted and recovered.

All the collected data can be displayed in the graphical or table forms and can be saved as files for later check at any time.

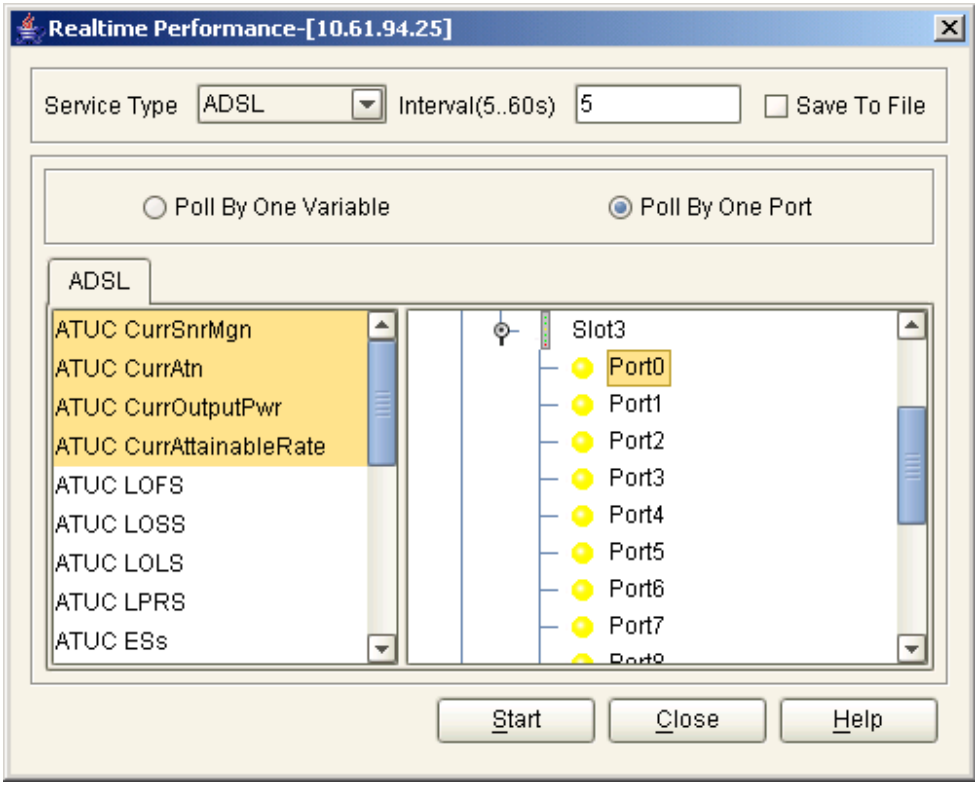


Figure 60 Performance Data Collection

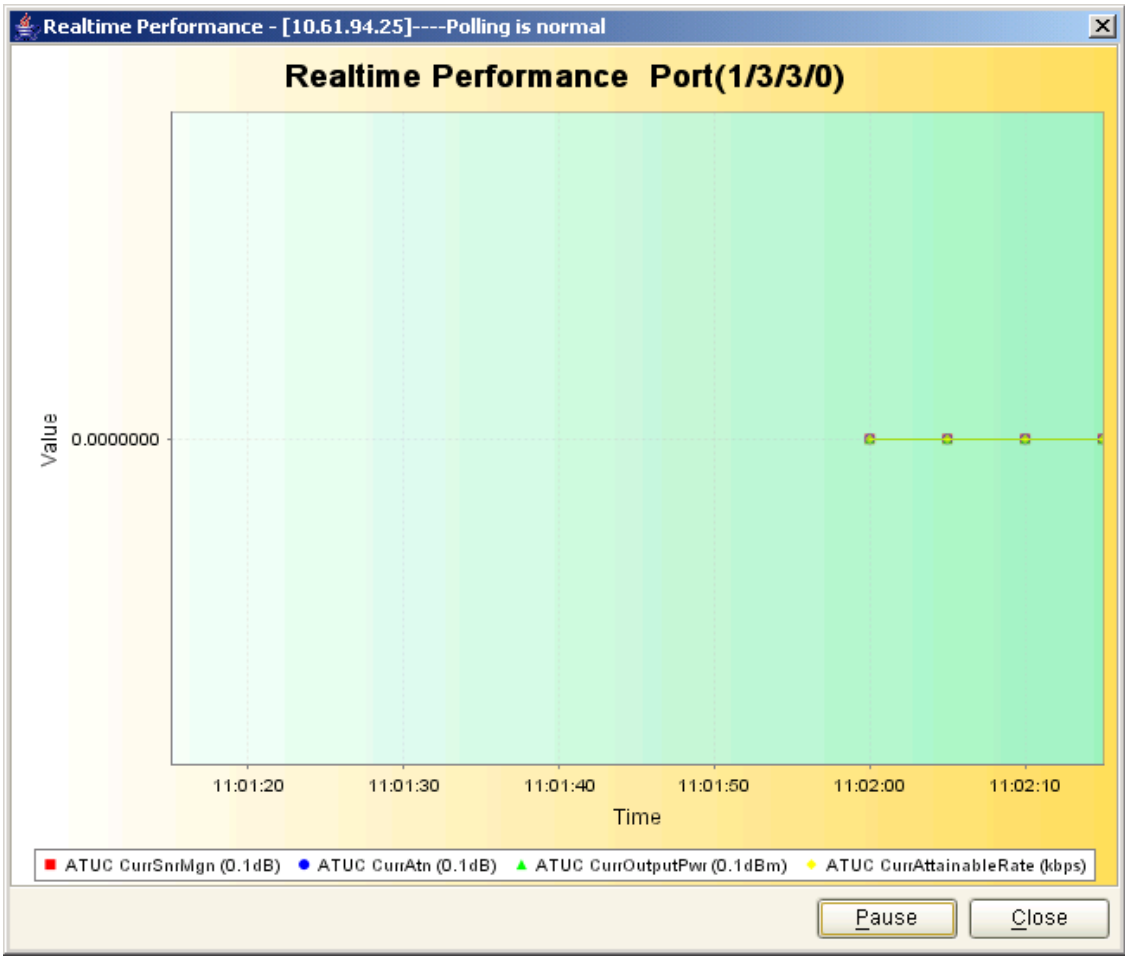


Figure 61 Performance Data Display

5.4.4 Configuration Management

The related attributes of the equipment and the services can be configured through configuration management, so as to put the network into operation and launch such services. The system supports the following types of configuration management tools:

1) GUI-based configuration management

ZXA10 MSAN and other products support GUI-based configuration management. For details, refer to the function lists of related products.

2) MML-based configuration management

All the managed equipment and devices in the NETNUMEN N31 support man-machine commands and so they can be remotely configured and managed in the Telnet mode.

5.4.5 Security Management

The purpose of security management is to guarantee the legal use of the system by users. It implements the management of users, user groups and roles, and provides security control for

the security management operations of operators through proper organization of the relations among these three. The log-in authentication mechanism prevents illegal users from accessing the system and the operation authentication method provides security control for the operations of operators.

Security management provides the security alarm presetting mechanism to predefine security alarm events, so that the security module will send out alarms to the users when any preset security event takes place to effectively avoid malicious attacks to the system.

The security module also provides the resources locking function, so as to lock the resources when a user conducts non-reenterable operations on such resources and unlock them when these operations are completed. In doing so, the resources will be exclusively occupied by the user and other users cannot operate them during the course of operating these resources.

Security management falls into role management, role set management, user management, department management and security policy management.

- Role management

A role is an aggregation of the managed object and the corresponding execution rights.

- Role set management

Multiple roles can be added to one role set.

- User management

A user has such attributes as name, password, validity period of the user, validity of the password and the department the user belongs to. The system supports the following user management functions:

- Department management

Departments can be created and the subordinate relationship among departments can be set.

- Security policy management

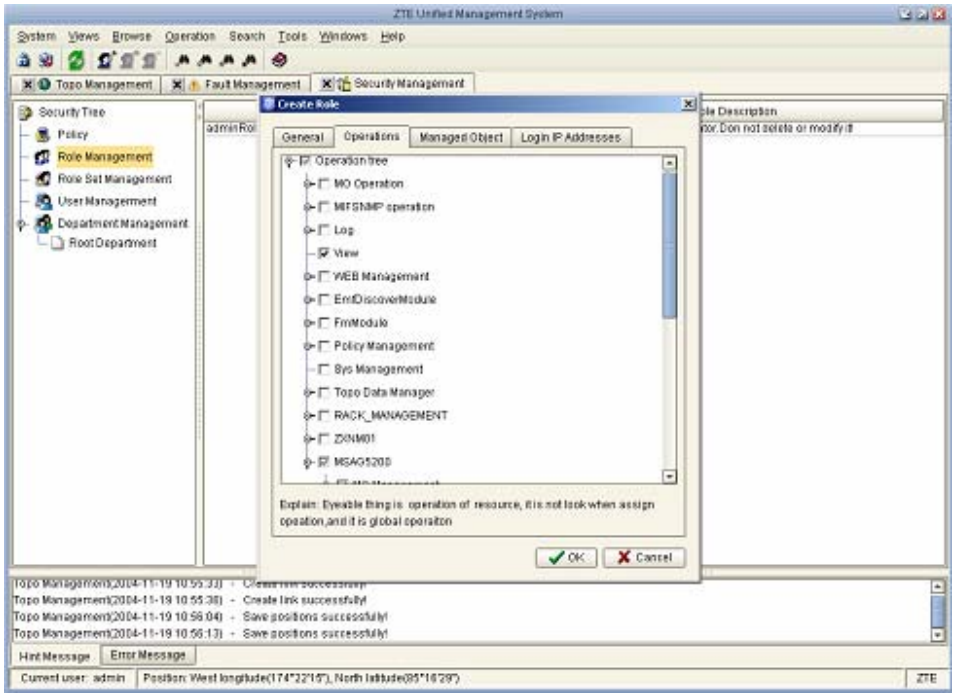


Figure 62 Security Management of the NMS

5.4.6 Rack State Monitoring

1) Data collection

- Rack configuration data

After the rack diagram system is started, it will collect the online configuration information (including rack, shelf, board and port information) of the rack from the MIB of the designated NE equipment and use such information as the data for formulating the rack diagram.

- Rack status data

After the rack diagram system is started, it will directly collect rack status data from the foreground to implement synchronization to the foreground rack information.

Figure 63 Rack Management and Status Monitoring of NEs

2) Rack diagram display

- Refreshing the rack diagram

After the rack diagram system is started, the fault management module will send any new alarm of the equipment to the rack diagram module, and the service terminal of the rack diagram module will send the alarm to the client for refreshing the display.

Other modules, such as fault management and port configuration modules, can be started through the rack diagram.

5.4.7 System Management

The system provides the function to manage its own software, including:

- Data management
- Database management

The major functions of database management are to manage all the database systems inside the NMS, check the database resources and backup/restore data tables and databases. The database server should be an independent one (separate from the J2EE platform) and does not need the installation of any extra service to implement remote maintenance.

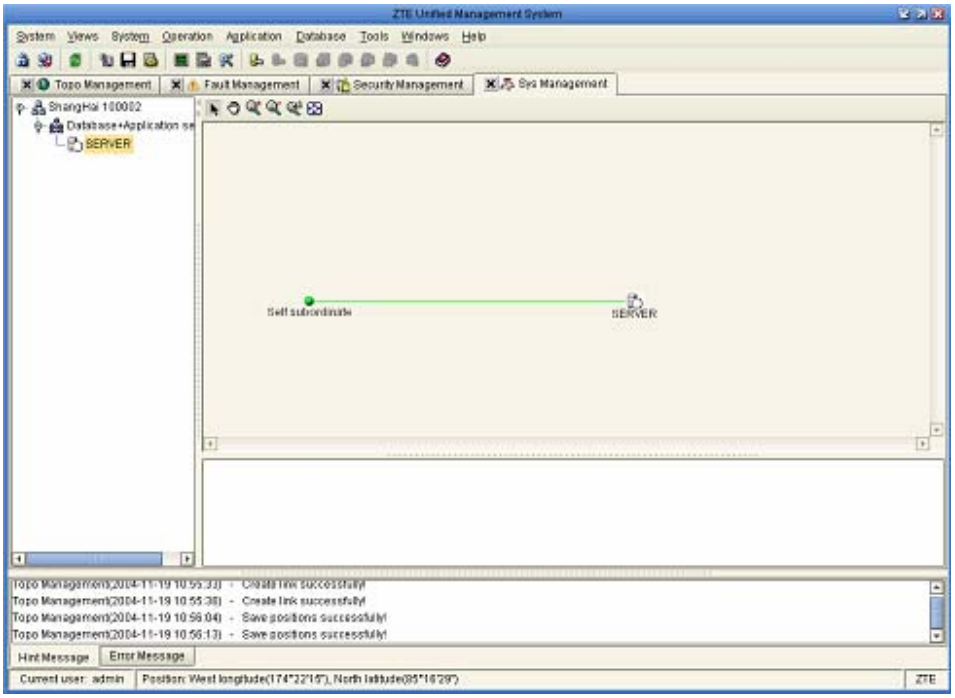


Figure 64 System Management

5.4.8 Log Management

Log management is to record, query and delete system logs and operation logs.

- Contents of system logs
- Contents of operation logs
- Query of logs

The system administrators can browse and query the system logs.

- Deletion of logs

The system can automatically delete the system logs on a regular basis.

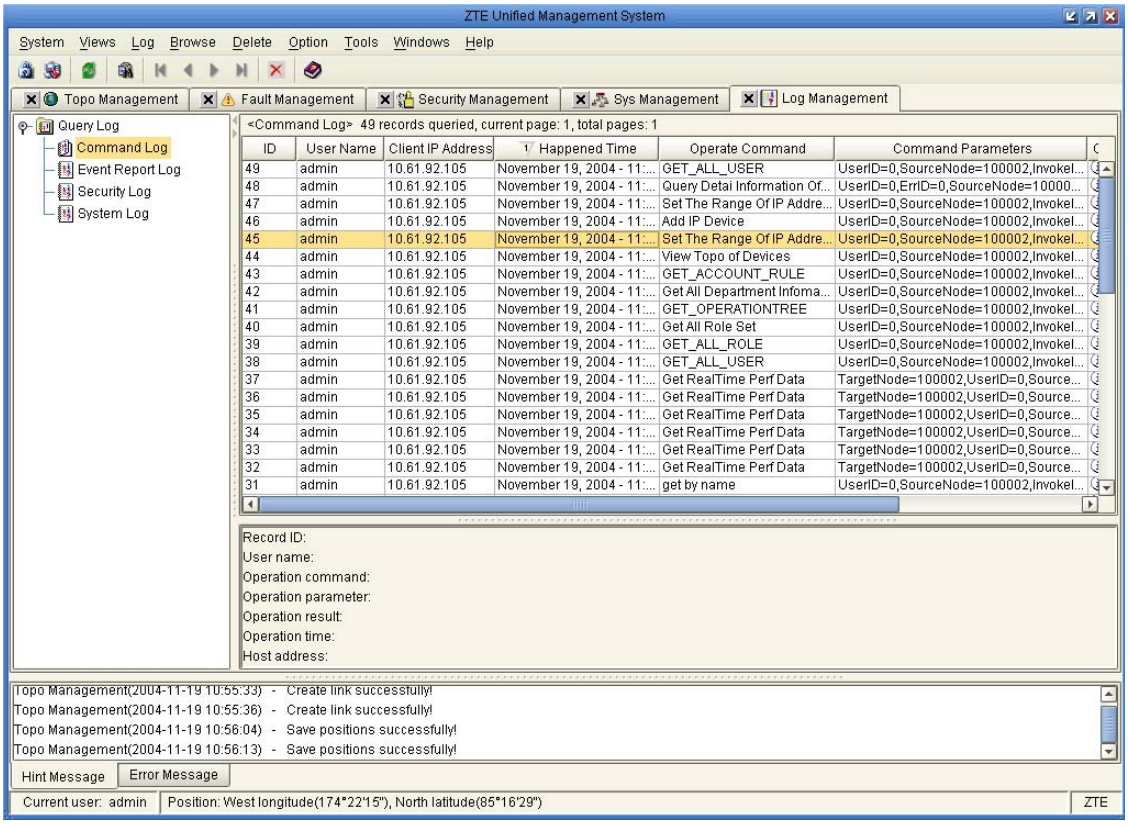


Figure 65 Log Management

5.5 NETNUMEN N31 Volumetric and Performance

5.5.1 Equipment Management Capacity

The NETNUMEN N31V4 adopts the SNMP protocol and the management is made by means of polling performance, configuration and status data to the managed equipment; therefore, the management model is established via the polling mode.

Suppose the NMS polls the managed NEs at an interval of T, then the number of NEs that can be managed by the NMS can be expressed as follows:

N = T/t

Where, t is the minimum time for executing a round of polling and it is equal to a+b+c+d+e+f.

a = The time needed for the NMS to send out a polling request packet

b = The network delay from the NMS to the NE equipment

c = The time needed for the NE equipment to receive and internally process the request packet

d = The time for the NE equipment to send out a response packet

e = The network delay from the NE equipment to the NMS

f = The time for the NMS to receive the return packet

For simplified description, suppose a = c = d = f and b = e, then t = 4a + 2b.

Thus:

N = T/ (4a + 2b)

Where, a = The processing time of the NMS towards the polling request packet

b = The network delay from the NMS to the NE equipment

The above formula is based on the polling mode. In practice, the NMS also involves plenty of Trap events (for alarms). Considering the effect of such Trap events on the system management capability (especially in the case of dense alarms), the above formula may be multiplied by a certain alarm processing weight coefficient according to the experience. Generally, this coefficient assumes the value of 0.4. Thus the number of NEs that can be managed is expressed as follows:

N = [T / (4a + 2b)] × 0.4

Note: According to the above formula, the number of NEs that can be managed by the system is subject to the influence from the following three parameters:

1) Polling time interval: T, for example, once every 5 minutes.

2) The polling packet processing time of the NMS: a, which is generally restricted by the hardware configurations of the NMS, that is, whether the NMS server uses the Unix or NT server and its configurations (the number of CPUs, memory capacity and memory access mode). To reach a certain system response capability (for example, the trap packet processing capability of 200 pieces/second and the MIB variable polling processing capability of 200 pieces/second), a group of specific hardware configurations (with different server classes) can be generated to satisfy the specific application requirements.

To ensure the normal and fast response of NM operations, the continuous CPU load of the computer shall be generally no more than 15%. If the processing speed of the CPU is high but the CPU load still keeps 15%, the number manageable NEs will increase linearly. For example, the PC server of P4 1.6GHz 2*CPU can manage more than 500 manageable NEs and its continuous load shall generally be no more than 45% for the Sun Unix workstation or server.

3) Network delay: b, which is subject to the influence from the WAN networking mode and the bandwidth allocation. Presented below are the specific bandwidth requirements of the NMS in the WAN networking mode.

We suggest that the management capacity of a large or super-large NMS be 3000 equivalent NEs.

5.5.2 Client Quantity

The NM server can connect at most 50 NM clients.

5.5.3 Polling Performance

To guarantee that the NMS can detect the status of NEs in real time, periodical polling of the NE status is usually needed. It is so in the NETNUMEN N31.

The following are poling indices of the link status between the NETNUMEN N31 and its NEs:

NE polling status period (the time interval between twice polling of an NE): 133 seconds by default and 30 seconds in the minimum. With this index, we can calculate the time needed for reporting the “ne down” alarm.

Polling period error: < 2 seconds.

NE performance parameter polling period: 300 seconds by default and 30 seconds in the minimum.

NE performance parameter polling capability: The maximum performance parameter (MIB parameter) processing capability of the normally running system is 200 pieces per second.

5.5.4 Alarm Handling Performance

The average alarm response time (from the NE alarm occurrence to the alarm display in the NMS) shall not be more than 20 seconds.

The alarm response time in the case of full system load shall be no more than 150% of the above index.

The maximum alarm processing capability of the system in normal operation is 300 pieces per second.

5.5.5 Query & Statistics Performance

The query & statistics information processing of the system in normal operation is 4000 pieces per minute.

5.5.6 Operation Performance

The operation performance of the NETNUMEN N31V4 NMS falls into the following categories:

Client startup time

Rack diagram open/switching time

Menu pop-up time

Typical operation interface pop-up time

The following table lists the typical test time of two types of NEs. Because the NETNUMEN N31 NMS is an application software based on Java language, there will be a loading process each before the program runs and this process is slightly longer than others. However, once the loading is complete, the later invocation of this program will be very fast. Therefore, the table given in the following table lists the relevant data for the first application and the second application for reference.

Table 8 Typical Test Data for the Operation Performance of the NETNUMEN N31

Typical Operation	Average Response Time (Seconds)		Remarks
	First Operation	Second Operation	
Client startup	< 45	——	
Rack slot switching	< 4	< 2	
Menu pop-up	< 3	< 1	
Configuration operation	< 2	< 2	The response time will be longer if the network is not in good condition
Query operation	< 30	< 30	The response time for the query involving little data volume is less than 10 seconds

5.5.7 Data Storage Period

Storage period of alarm data: Users can configure this parameter, which is three months by default.

Storage period of performance data: User-definable. Generally, the original performance data will be kept for three months and the statistical performance data for six months.

Storage period of system logs: User-definable, one month by default.

Storage period of security and operation logs: User-definable, three months by default.

5.5.8 Data Storage Capacity

The data storage capacity depends on the managed equipment type, the number of managed equipment, the MIB definitions and the hard disk capacity. When there are many NEs, external data backup tools are recommended, such as disk array, tape drive and MO disk, so as to support the online backup of data.

5.5.9 Network Bandwidth Requirements

The network bandwidth falls into two types: One is the bandwidth for the NM channel between the NM server and the NE; the other is for the NM channel between the NM server and the NM client. Generally, the first type of bandwidth is more important for the network planning, because the NMS will manage many NEs.

The NM channel bandwidth requirements shall depend on the network traffic generated by typical and important NM operations.

1) Required bandwidth between the NMS and the NE

The traffic generated between the NETNUMEN N31V4 and the NMS includes the following cases:

Link polling: This will generate little traffic (only several bytes) and is influenced by the polling period and the number of managed NEs.

Configuration operations: This will generate minor traffic (basically tens of bytes) and the operation frequency is random.

Data synchronization operations: This will result in large traffic (maximum 200 kbps) and the operation frequency is subject to influence from the statistical period.

Alarm data: This will bring burst traffic and is subject to influence from the NE running status and the number of managed NEs.

Through analysis of the traffic data for the above single NE, we can figure out the required bandwidth for the NM channel according to the following empirical formula:

$C = N \times P \times B/G$

Where:

C: Traffic convergence value, which is the bandwidth needed to guarantee the QoS and avoid congestion during the normal operation of the system.

N: The number of NEs.

P: Percentage of concentration, which is also the percentage of concurrent operations on the NE.

B: NM bandwidth of a single NE.

G: Gain factor, which represents the actual ratio of user bandwidth consumption and can be understood as an empirical factor. Generally, since the narrowband rate is very low, traffic is generated most in the period of operating the NEs and the gain factor is generally smaller than that of the broadband. In conventional calculations, we set the gain factor of narrowband in the range from 4 to 7 and the gain factor in the broadband network will be slightly larger.

According to the above empirical formula ($C = N \times P \times B/G$), we can figure out the bandwidth needed for the NM channels of 1000 NEs as follows:

$C = 1000 \times 10\% \times 200/8 = 2500$kbps

Where:

N: The number of NEs is 1000.

P: The probability of concurrent operations on the NE is 10%.

B: The bandwidth for NE operations assumes the maximum value of 200 kbps.

G: The gain factor assumes 8 (4~7 for the narrowband network; 8 is taken here because the NETNUMEN N31 NMS is used for the broadband network).

2) Required bandwidth between the NM server and the NM client

The volume of data transmitted between the NM server and the NM client is roughly the same as that between the NM server and the NEs, except that the client startup will involve more data volume and occupy about 2M bandwidth. Therefore, the total bandwidth between the NM server and the NM client is suggested to be 2M and shall be 1M at least, which should be guaranteed especially in the case of remote client networking.

5.6 Hardware and software Configuration

5.6.1 Division of the NM Scale

- Quantity of Equivalent NEs

The NETNUMEN N31V4 can manage multiple types of equipment. Due to the difference in what to manage and how to implement the management, the hardware configurations of different equipment vary. To unify the calculation methods, the concept of equivalent NEs is introduced to allow easy configuration. The so-called “equivalent NEs” can be considered as a managed object in the NMS, so that the NMS can distribute certain key resources to each managed object during its operation. We can take the key resources occupied by each managed object as a calculation unit and this is the purpose of introducing equivalent NEs. For each type

of equipment, different key resources are needed to manage a single NE of such equipment; therefore, each piece of such equipment can be converted into a specific number of equivalent NEs accordingly. The following table shows the correspondence between different equipment and the number of equivalent NEs.

NE Name	The Number of Equivalent NEs Corresponding to each NE
U300	1

Division of the NM Scale

Name	Model	Number of Equivalent NEs
EMS (small scale)	NETNUMEN N31V4-EXX-S-1.0	<300
EMS (medium scale)	NETNUMEN N31V4-EXX –M-1.0	>300, <800
EMS (large scale)	NETNUMEN N31V4-EXX –L-1.0	>800, <1500
EMS (super large scale)	NETNUMEN N31V4-EXX –U-1.0	>1500, <3000

5.6.1.1 NMS Configurations

The following table lists the recommended software and hardware configurations for different NMS scales. For details, refer to the NMS configuration template.

Table 9 Basic Configurations of the Small-scale NMS

The Configuration Scheme for a Small-scale NMS					
[illegible]	SN	Name	Model	Configurations	Remarks

	1	NM client	PC	P4 2.0G/512M/20G/CDROM/Floppy drive/Network adapter/Sound card (10M/100M)/17" color monitor (or 17" LCD)	Optional
	2	NM server	Brand server	XEON P4 2.0G/Memory 1G /36Gx2 hard disk/DVD/10-100M network adapter/Floppy drive/Display card/Monitor 17" (or 17" LCD), sound card	
	3	NM database software	Microsoft SQL Server	MS SQL Server 2000 Standard Edition (25 Users)	
	4	Operating system software	Windows	NM server: Windows 2000 Server（10Users) or WINDOWS 2000 ADVANCED SERVER (25 USERS) NM client: Windows 2000 Professional or the OS used by the NM server	
Unix platform (not recommended unless the Customer requires so)	1	NM client	PC	P4 2.0G/512M/20G/CDROM/Floppy drive/Network adapter/Sound card (10M/100M)/17" color monitor	Optional
	2	NM server	Sun	SUN Blade 2000 UltraSPARC III Cu 1.2G/1G memory/73G hard disk/DVD/10M\100M adaptive network adapter/Display card/19" color monitor/Keyboard/Mouse	
	3	NM database software	Oracle	Oracle 8i with 10 user for Unix Enterprise Edition	
	4	Operating system software	Sun and Windows	NM server: Solaris 8 NM client: Windows 2000 Professional	

5

Table 10 Basic Configurations of the Medium-scale NMS

The Configuration Scheme for a Medium-scale NMS					
Windows platform	SN	Name	Model	Configurations	Remarks
	1	NM client	PC	P4 2.0G/512M/20G/CDROM/Floppy drive/Network adapter/Sound card (10M/100M)/17" color monitor (or 17" LCD)	Optional
	2	NM server	Brand server	XEON P4 1.8G*2CPU /Memory 2G /36Gx2 hard disk/DVD/10-100M network adapter/Floppy drive/Display card/Monitor 17" (or 17" LCD), sound card	
	3	NM database software	Microsoft SQL Server	MS SQL Server 2000 Standard Edition (25 Users)	
	4	Operating system software	Windows	NM server: Windows 2000 Server (10Users) or Windows 2000 Advanced Server (25Users) NM client: Windows 2000 Professional or the OS used by the NM server	
Unix platform (not recommended unless the Customer requires so)	1	NM client	PC	P4 2.0G/512M/20G/CDROM/Floppy drive/Network adapter/Sound card (10M/100M)/17" color monitor (or 17" LCD)	Optional
	2	NM server	Sun	SUN Blade 2000 UltraSPARC III Cu 1.2G/2G memory/73G hard disk/DVD/10M\100M adaptive network adapter/Display card/19" color monitor/Keyboard/Mouse	
	3	NM database software	Oracle	Oracle 8i with 10 user for Unix Enterprise Edition	
	4	Operating system software	Sun and Windows	NM server: Solaris 8 NM client: Windows 2000 Professional	

Table 11 Basic Configurations of the Large-scale NMS

The Configuration Scheme for a Large-scale NMS					
	SN	Name	Model	Configurations	Remarks
Windows platform	1	NM client	PC	P4 2.0G/512M/20G/CDROM/Floppy drive/Network adapter/Sound card (10M/100M)/17" color monitor (or 17" LCD)	Optional
	2	NM server	Brand server	XEON P4 2.0G*2CPU /Memory 2G /36Gx2 hard disk/DVD/10-100M network adapter/Floppy drive/Display card/Monitor 17" (or 17" LCD), sound card	
	3	NM database software	Microsoft SQL Server	MS SQL Server 2000 Standard Edition (25 Users)	
	4	Operating system software	Windows	NM server: Windows 2000 Server (10Users) or Windows 2000 Advanced Server (25Users) NM client: Windows 2000 Professional or the OS used by the NM server	
Unix platform (not recommended unless the Customer requires so)	1	NM client	PC	P4 2.0G/512M/20G/CDROM/Floppy drive/Network adapter/Sound card (10M/100M)/17" color monitor (or 17" LCD)	Optional
	2	NM server	Sun	V880 4*UltraSPARC III Cu 1.2G/4G memory/2*36G optical interface hard disk/DVD/Network adapter/Display card/19" monitor/Keyboard/Mouse	
	3	NM database software	Oracle	Oracle 8i with 10 user for Unix Enterprise Edition	
	4	Operating system software	Sun and Windows	NM server: Solaris 8 NM client: Windows 2000 Professional	

Table 12 Basic Configurations of the Super Large-scale NMS

The Configuration Scheme for a Super Large-scale NMS					
	SN	Name	Model	Configurations	Remarks
Windows platform	1	NM client	PC	P4 2.0G/512M/20G/CDROM/Floppy drive/Network adapter/Sound card (10M/100M)/17" color monitor (or 17" LCD)	Optional
	2	NM server	Brand server	XEON P4 2.0G*4CPU /Memory 4G /36Gx2 hard disk/DVD/10-100M network adapter/Floppy drive/Display card/Monitor 17" (or 17" LCD), sound card	
	3	NM database software	Microsoft SQL Server	MS SQL Server 2000 Standard Edition (25 Users)	
	4	Operating system software	Windows	NM server: Windows 2000 Server (10Users) or Windows 2000 Advanced Server (25Users) NM client: Windows 2000 Professional or the OS used by the NM server	
Unix platform (not recommended unless the Customer requires so)	1	NM client	PC	P4 2.0G/512M/20G/CDROM/Floppy drive/Network adapter/Sound card (10M/100M)/17" color monitor (or 17" LCD)	Optional
	2	NM server	Sun	V880 8*UltraSPARC III Cu 1.2G/4G memory/2*36G optical interface hard disk/DVD/Network adapter/Display card/19" monitor/Keyboard/Mouse	
	3	NM database software	Oracle	Oracle 8i with 10 user for Unix Enterprise Edition	
	4	Operating system software	Sun and Windows	NM server: Solaris 8 NM client: Windows 2000 Professional	

Note:

1) For some small-scale applications (with less than 100 equivalent NEs), the server may be a top-grade PC (P4 2.0G/1G/20G/CDROM/Floppy drive/Network adapter (10M/100M)/Sound card/17" color monitor) rather than a brand server, considering the needs of cost reduction.

2) For some large-scale applications (with more than 100 but less than 1000 equivalent NEs), the medium-scale server configurations (2*CPU/2G memory) can be adopted to reduce the cost, but without considering the future capacity expansion needs.

3) To improve the reliability and stability of the system, it is recommended that the NM server and the NM client be placed in different PCs rather than in the same PC.

5.6.2 NM Configuration Upgrade Solution

As the network scale keeps expanding, the NETNUMEN N31V4 NMS has to face the issue of continuous upgrading. In the course of upgrading the NMS, an appropriate hardware upgrade solution is needed to guarantee the original hardware investment of the Customer. Because the NM server is the most important hardware for investment in the entire NMS, the following gives some principles regarding its upgrade:

1) Fully consider the future capacity expansion at the initial stage of construction and plan the expandability of the hardware configurations, so that the network scale can be expanded by adding CPUs and expanding the memory. For example, Dell PE2600 supports 2 CPUs, Dell PE6600 supports 4, Sun Blade2000 supports 2 and Sun V880 eight. They can be selected as per the practical conditions.

2) Consider adding another server if the original server hardware cannot be upgraded by adding CPUs and expanding its memory, so that one runs the NM server software while the other runs the NM database software to reduce the load of the original system and satisfy the requirements for managing the network of a larger scale.

3) As the network scale expands, use the original server as the hierarchical NM server and purchase another new central NM server if the Customer has the hierarchical NM requirement.

4) In addition to the above methods, you can also use the original server only as the NM client and purchase another new NM server for use.

6 THE SOLUTION OF SMOOTH MIGRATION TO NGN

With the development of the technology, the multi service access technique, including the xDSL, the Ethernet and all kinds of the FTTx technique, becomes more and more attractive; and also with the IP technology becomes more popular, the application of SoftSwitch and NGN is also becoming the reality day by day.

ZXA10 MSAN support smooth migration to the next generation IP network, adapting to the future development needs and protecting the investment of operators.

ZXA10 MSAN adopts multiplex service bus architecture to provide the best service, TDM for voice and IP for data. ZXMSG 5200 and ZXA10 MSAN ONUC are the same product in different applications. ZXMSG 5200 is used in NGN network, while MSAN is in PSTN.

ZXA10 OLT system can be upgraded to ZXMSG 5600 with only updating the software and adding the Broadband Switching Board with GE (GNU), relevant media processing board (VCD) which provide H.248/MGCP and FE/GE interface to connect to Softswitch network. The equipment of ONUC is keeping invariability.

ZXA10 ONU system can be migrated to ZXMSG 5200 with only updating the software and adding the relevant media processing board (MPRB) which provide H.248/MGCP and FE/GE interface to connect to Softswitch network directly.

6.1 OLTC migrate to large capability integrated access media gateway

The equipment of OLTC can be upgraded by adding corresponding VoIP modules (VCD) to implement transition of the voice coding from TDM to IP and provide H.248/MGCP and FE/GE interface to connect to Softswitch equipment. Adding GNUs to switch VoIP control streams. The data switching network is primarily used to switch broadband data services. The equipment of ONUC is keeping invariability. By this solution, ZXA10 MSAN can migrate to MSAG shortcut and smoothly.

This solution is highly adaptive to the initial stages smoothing. The workload, cost and influence are all little.

The solution show in following Fig：

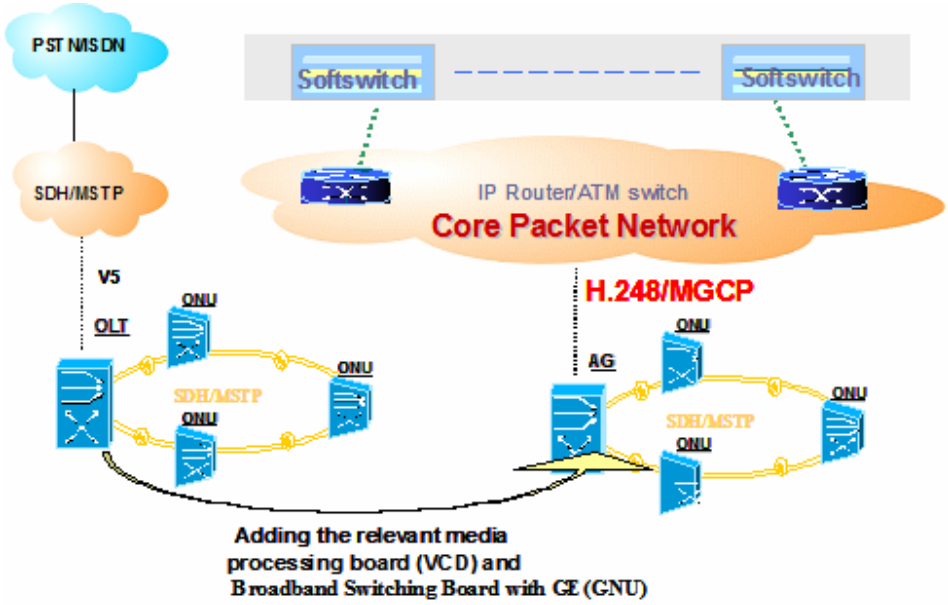


Figure 66 ZXA10 MSAN(OLTC) migrate to large capability integrated access media gateway

6.2 ONUC migrate to integrated access media gateway

With the perfect, grown up, grandness of the NGN network. We can adopt the solution of ONUC migrate to integrated access media gateway. The equipment of ONUC can be migrated by adding corresponding VoIP modules (MPRB) to implement transition of the voice coding from TDM to IP and provide H.248/MGCP and FE/GE interface to connect to Softswitch equipment directly. The ONUC's digital trunk interfaces change to IP package interfaces, migrate to NGN completely.

The integrated access media gateway provides users with various access methods, including POTS user access, ISDN access, xDSL access, LAN access, and so on. It also provides access to IP or ATM network. ZXA10 ONUC and MSG 5200 are the same equipment in different applications. Two equipments share the same hardware and software platform, while ZXA10 MSAN ONUC is deployed in PSTN network, MSG5200 is in NGN network.

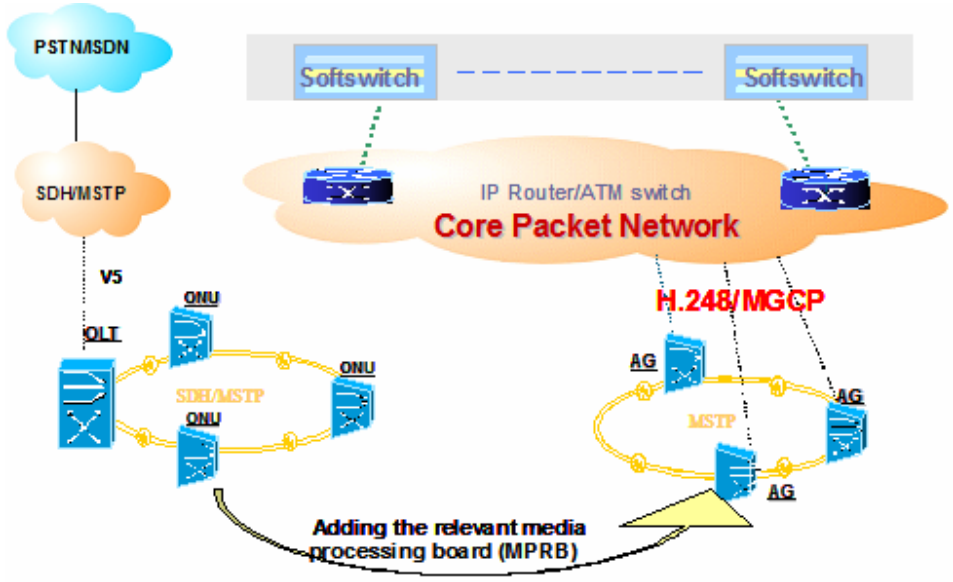


Figure 67 ZXA10 MSAN(ONUC) migrate to large capability integrated access media gateway

6.3 Equipment Management (NETNUMEN N31)

The NETNUMEN N31 is employed to manage all SS, MSAG and MSAN devices in a centralized manner.

7 ONLINE TEST

The 112 test plan of the ZXA10 MSAN falls into two parts: Narrowband 112 test implemented by the internal test card and broadband 112 test implemented by the external test head.

7.1 The 112 Test Function of ZXA10 MSAN

- The 112 test of PSTN users

The ZXA10 MSAN adopts a built-in test board to provide the 112 test function. The external line test speed is smaller than 3 s/line and the internal line test speed is smaller than 10 s/line. The dead zone for fault location is smaller than 20m. The error of a fault location point is ±10m (user line length < 1000m) or ±20m (user line length > 1000m). The fault test accuracy is ≥ 98% (where fault accuracy for broken line, hybrid line, grounding, short circuit, and touch to ground is 100% and other fault accuracy is ≥95%).

- The 112 test of ISDN users

The ZXA10 MSAN adopts a built-in test board to provide the 112 test function. The external line test speed is smaller than 3 s/line and the internal line test speed is smaller than 10 s/line. The dead zone for fault location is smaller than 20m. The error of a fault location point is ±10m (user line length < 1000m) or ±20m (user line length > 1000m). The fault test accuracy is ≥ 98% (where fault accuracy for broken line, hybrid line, grounding, short circuit, and touch to ground is 100% and other fault accuracy is ≥95%).

- ADSL user test

It provides ADSL user line test together with external test header and test system.

- ADSL2+ single-ended test

It provides ADSL2+ user line test together with external test header and test system, including line length, terminal status (open/short circuit), line type (diameter), and activation rate under different signal noise ratio tolerances.

- ADSL2+ dual-ended test

It provides ADSL2+ user line test together with external test header and test system, including line transmission feature, background noise power spectrum, signal noise ratio per subband, notice tolerance per subband, and number of bits that can be borne.

7.2 Narrowband 112 Test of the ZXA10 MSAN

The 112 test architecture of the traditional PSTN is inherited for the narrowband 112 test of the ZXA10 MSAN. The ZXA10 MSAN supports using the emulation test (with built-in 112 test card) to test the narrowband subscriber lines of the MSAG.

The ZXA10 MSAN of ZTE uses the built-in test card to constitute the test system. Each subscriber unit is equipped with one subscriber line test card or several subscriber units are equipped with one subscriber line test card. The subscriber line test card has a voice channel to transmit voice and has a command channel to transmit test commands and results. The test commands are sent via the 112 O&M console or the NMS server to test the subscriber lines. The built-in test card features integration of the test card and the access gateway equipment. The subscriber line test channel and the maintenance channel are shared without extra overheads, and the price is relatively lower. The test precision completely depends on the precision of the test card and the precision of the whole subscriber line test can be improved as long as the precision of the test card is improved. The built-in test card of ZTE ZXA10 MSAN has a high test precision for narrowband services and the expensive external test head is not necessary for the narrowband test.

The 112 test scheme of the ZXA10 MSAN is given as follows. It is composed of the 112 test center, the centralized NMS of the MSAG and the test board in the MSAG. The 112 test center sends subscriber line test protocol commands via the 97 network (TCP/IP) to the centralized NMS of the MSAG, the O&M console converts the commands into internal interfaces and requests the test card in the MSAG to complete the test, and the integrated NMS submits the test results after the test is completed to the 112 test center.

Mainly performs the following functions (no matter narrowband or broadband):

1) External line test: It can measure insulation resistance, AC/DC voltage, feeding voltage, feeding current and capacitance, and DC loop resistance between A and B, between A and ground, and between B and ground of user circuit external lines, insulation resistance, foreign voltage

2)Internal line test: It can measure the output voltage and frequency of ringing current, detect the signal tone, test equipment pulse number receiving and DTMF number receiving functions, and check the dialing tone.

3) User telephone function test: It can test the telephone dialing pulse, DTMF signal, user feed voltage and its polarity, subscriber private metering, ring subscribers and resistance loop, dialed digit

4) Loop-back test to check the capability of the system

Adequate line tests is carried out at call handling time, The installation resistance to earth is measured and compared to two limits, a lower value below which the line shall be either fault-marked or fault-blocked and a higher value below which the line shall only be fault-marked. These two limits is selectable in the range of 10 kOhms to 300 kOhms, in steps of 10 kOhms. If a foreign voltage exists and exceeds a given threshold the line is fault-blocked. For test and maintenance purposes all classes of subscriber lines is accessible either by directory number or by equipment number.

Figure 68 shows the networking structure of the narrowband 112 test of the ZXA10 MSAN.

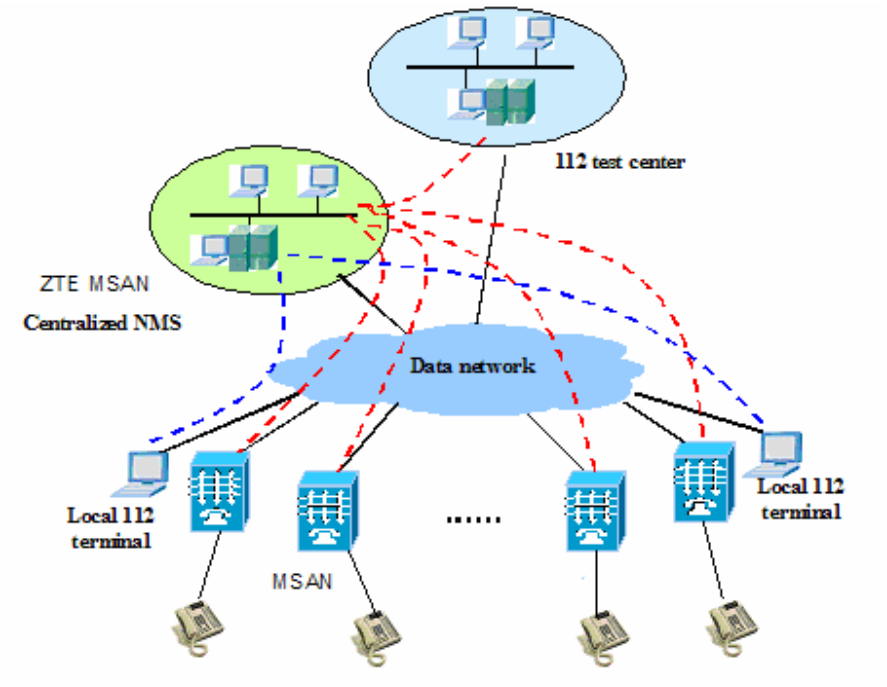


Figure 68 Networking for the Narrowband 112 Test of the ZXA10 MSAN

7.3 Broadband 112 Test of the ZXA10 MSAN

The broadband ADSL test of the ZXA10 MSAN is completed via the high-precision external test head device.

During the pre-test, the high-precision test head can initiatively capture the lines of the access device for a line test via the test bus and initiate routine test and fault test of the provisioned equipment. The ADSL subscriber board of the ZXA10 MSAN provides the internal line capture function and the function of cascading test buses.

Since the external line capture point of the ZXA10 MSAN lies at the outer side of the splitter while the internal line capture point lies at the inner side of the splitter, the influence of the splitter on the test results is avoided.

The test server may be connected in one of the following two ways with the test device:

- Directly via the test network, that is, a test network is separately built. In this connection mode, all test commands can be directly sent by the test server to the test head. Therefore, the commands to capture/release lines of the ZXA10 MSAN are flexibly processed and the test server can directly send line capture/release commands to the ZXA10 MSAN.
- Via the NMS network, that is, the NMS channel provided by the NMS is used to connect the test server and the test head. All control commands and data are forwarded by the NMS and the ZXA10 MSAN. This connection mode applies to the case where it is unable to construct a test network.

The test mainly performs the following functions:

1) Achievable bit rate for Upstream and Downstream channel dependent on different transmission mode profiles.
2) Achievable bit rate for Upstream and Downstream channel in the current time
3) The measured line noise
4) Signal-to-Noise ratio for an intended xDSL transmission mode
5) Average value of upstream noise power spectrum density.
6) Guidance for xDSL deployment by indicating: possible, uncertain or not possible
7) Far-end termination/CPE indicator
8) Operation mode (G.DMT, ANSI Issue 2, G.Lite).
9) Remote modem management(TR-069)

Figure 69 shows the networking structure for the broadband test of the ZXA10 MSAN using an external test head.

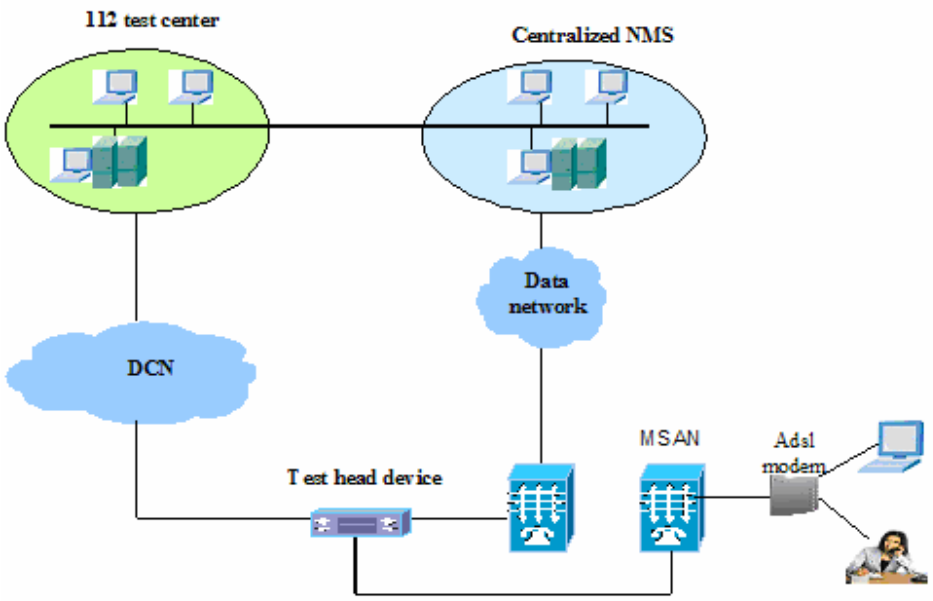


Figure 69 Networking for the Broadband 112 Test of the ZXA10 MSAN

8 SERVICE FUNCTION AND IMPLEMENTATION

ZXA10 MSAN integrated service access gateway supports existing narrowband services and digital services, high speed Internet access, IPTV, and VOD.

It protects the original investment and has high stability and easy maintenance and management. It supports future voice, data, and image services by upgrade.

8.1 Public Call Access

The RALC board supports public call access. Each RALC board supports 32 public paid users. In comparison with the ALC board, it has a reverse polarity function.

The FLC board supports public call access. Each FLC supports 16 public paid users. In comparison with the ALC board, it has a reverse polarity function and 16KC/12KC pulse control function. It supports remote user access.

8.2 ISDN User Access

ZXA10 MSAN provides ISDN PRA(2B+D) access via the DLC board. It supports all ISDN services, including videotext, fax, and Internet access, as well as multiple ISDN supplementary services under the coordination of SS.

Each DLCA digital user board supports eight ISDN 2B+D users.

8.3 SHDSL User Access

ZXA10 MSAN also provides the SDL board to support the SHDSL (based on ATM). Each SDL board provides 16 SHDSL interfaces. User information can be converted into IP packets to transmit over an IP network. They are connected to the uplink via the ZXA10 MSAN FE/GE interface.

ZXA10 MSAN provides the GSDL board to support the SHDSL (based on ATM). Each GSDL board provides 16 SHDSL interfaces. User information can be converted into IP packets to transmit over an IP network. They are connected to the uplink via the ZXA10 MSAN GE interface.

8.4 ADSL/ADSL2/ADSL2+

Each GADL/T board provides 16 ADSL broadband digital users, has a built-in voice splitter, and offers a line capture module. It complies with ITUT G.992.1 and G.992.2 standards. The GADL/T can support ADSL2 and ADSL2+ via software upgrade. ZXA10 MSAN also supports the GADL/2+ board to support ADSL2+.

The ADSL has a maximum downlink rate of 8.192Mbps and a maximum uplink rate of 1Mbps.

8.5 VDSL2 User Access

Each GVDL provides a capacity of 16-channel VDSL2 broadband data users. It complies with the ITUT G.993.2 standard. The board supports a maximum downstream rate of 66 Mbps, a maximum upstream rate of 33 Mbps, and a maximum transmission distance of 1km (0.4 core diameter).

8.6 LAN User Access

The ETC and GETC boards can be intermixed in the U300 user unit to provide FE/GE interfaces.

8.7 PON Access

ZXA10 MSAN provides the EPON function that is expanded based on the original function. You can directly add an EPON function card to provide fiber access based on the EPON technology. Single PON port supports 32 branches (20KM) and 64 branches (<5KM) and its downlink wavelength is 1490nm, its uplink wavelength is 1310nm, and its CATV wavelength 1550nm. It flexibly provides VoIP services, CATV services, IPTV multicast services, and high quality, broadband, and multiservice access for residential users and meets fiber-to-the-home (FTTH) broadband service requirements to truly realize the “three-in-one” target. The FTTH greatly promotes the development of the "digital home” industry.

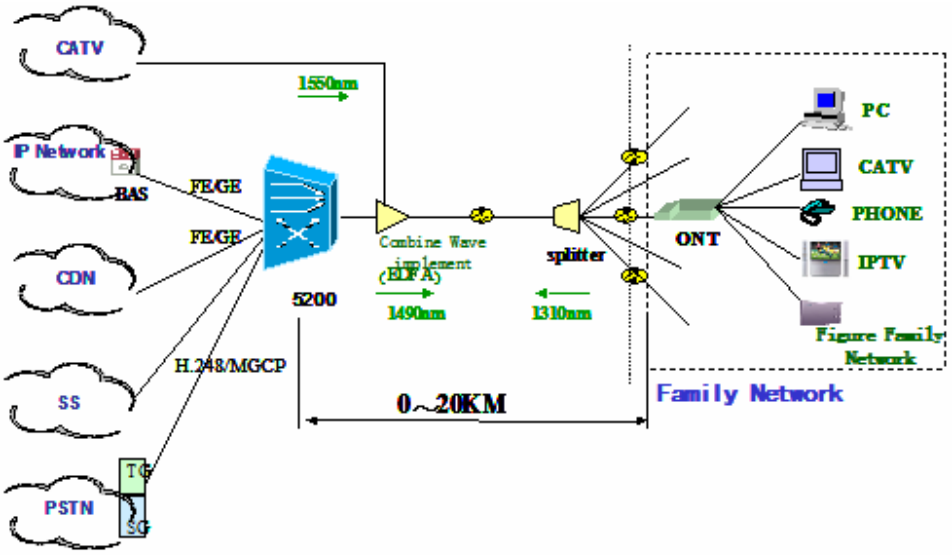


Figure 70 Built-in Board EPON Access

8.8 Multicast Services

Multicast refers to point-to-multipoint communication in the network. The multicast technology implements the point-to-multipoint effective data transmission in the network. The core of multicast technology is to copy the packet at the place near to the receiver as close as possible.

Function

Lighten the server load. The server need not process the request of each user.

Save the network bandwidth. Lessen the network equipment requirements.

The user scale is flexible. To enlarge the user scale will bring pressure on the network bandwidth.

Principle

The source host just sends one data whose destination address is the address of the multicast group. All receivers in the multicast group can receive the same data copy. Other hosts in the network can not receive the data except the host (destination host) in the multicast group. The multicast group is identified with Type D IP address (224.0.0.0 ~ 239.255.255.255).

ZXA10 MSAN supports IGMP Snooping, IGMP Proxy and controlled multicast.

8.8.1 IGMP Snooping

In Snooping mode, the system is not responsible for the management on the status of multicast member. It just implements IGMP message snooping and forwarding passively. It has a little influence on the system load. However, it greatly increases the protocol processing load of the uplink equipment.

IGMP snooping optimizes the distribution of multicast so multicast traffic is only sent on bridge ports where there might be active receivers and/or multicast routers.

- Monitors IGMP messages, to determine the port location of the multicast routers and active receivers within an IEEE bridged domain.
- Builds per port, per VLAN multicast forwarding tables.

- Dropping of all IGMP messages received on a user port and/or VLAN.
- Maintain basic IGMP membership state on ports to determine when a forwarding entry should be removed.

- Stop user ports injecting multicast traffic to the aggregation network.
- Forwards packets in the 224.0.0.0/24 range which are not IGMP messages on all ports.

- Discard IGMP queries received from user-facing ports on a multicast VLAN
- Forwards multicast packets with a destination IP address outside 224.0.0.0/24, which are not IGMP according to per VLAN, per port multicast forwarding tables.

8.8.2 IGMP Proxy

In Proxy mode, the system manages the status of multicast member actively, efficiently reducing the protocol load of the uplink device.

8.8.3 IGMP Router

Router mode is a simplified mode of Proxy mode. In case that the multicast service is directly sent to MSAN uplink port, the system does not require the uplink port for multicast service dynamically. The Host of Proxy can be shut down.

8.8.4 Controlled Multicast

The controlled multicast means to control multicast service packets, it implements user management and service management of multicast services, including multicast authorization and accounting, multicast monitoring and analysis, multicast QoS, multicast encryption and multicast address assignment. ZXA10 MSAN supports controlled multicast technology on the basis of completely complying with the standard multicast protocol. Presently, it supports multicast authorization.

Multicast authorization means that when the user joins one multicast group, ZXA10 MSAN authorizes the user and decides whether to take the user into the multicast group depending on the authorization result.

ZXA10 MSAN controlled multicast processes the flow following IGMP Proxy standards. It decides whether to add a user port to one multicast group according to the information such as user port, multicast group address, user MAC address, user IP address, fulfilling the objective of multicast authorization.

8.8.5 Multicast Package

Multicast package is channel package. Each package is a group of one channel. Each program in the package is specified with the right of “Permit” or “Preview”. One package can be configured with any channel. The package is applied on a specific port, affecting the multicast channel access right of the user port. One user port can employ multiple packages. If the rights of the same channel in different packages are different, the rights are combined based on the principal of using the highest right of all rights. The right level follows the sequence of “Permit” → “Preview” → “Reject”. “Permit” is the highest right.

8.9 QoS Service

Quality of Service (QoS) offers network service functions with different service qualities to meet various demands.

To ensure the QoS, the QoS insurance strategy must be implemented in the whole network.

The equipment in the border access layer supports the Diff-Serv model. It can identify service flows based on category in L2 and L3 so that the equipment in the NGN bearer network can provide related QoS insurance for different services based on IDs. You can allocate different VLAN for data and voice and ensure the priority of voice by accessing 802.1p provided by L2 and L3 switches. In this case, you can also control the number of access subscribers and traffic when the output bandwidth is greater than the full load, thus ensuring the QoS of NGN services.

Integrate service planning in the access layer of the data network. ZXA10 MSAN allocates different VLANs for different services. For example, the system puts voice service terminals in VLAN1, video service terminals in VLAN2, and Internet service terminal in VLAN3. After that, MSAN will allocate different priority to different service packages with the first 3 bits in

the third bytes of 802.1Q label. MSAN can define 0~7, totally 8 different priorities for the Ethernet frames. The voice and video packages is marked with the high priority, the data service with the low priority. In this case, the access equipment can sequence services based on VLAN No. and forward real-time services by preference, thus ensuring the QoS. If the equipment in the access layer does not support allocation of VLAN, distribute voice or video service terminals and Internet service terminals in different Internet so as to achieve physical isolation. This requires that IP addresses of different service terminals are assigned from different network segments.

8.9.1 QoS Strategy of ZXA10 MSAN

The system serves as the equipment in the access layer. The QoS mechanism of the equipment is as follows:

2. Support the 802.1Q VLAN technology and 802.1Q VLAN TAG, separating voice services from data services. ZXA10 MSAN allocates different VLANs for different services. For example, the system puts voice service terminals in VLAN1, video service terminals in VLAN2, and Internet service terminal in VLAN3. After that, MSAN will allocate different priority to different service packages with the first 3 bits in the third bytes of 802.1Q label(802.1p).MSAN can define 0~7 ,totally 8 different priorities for the Ethernet frames. The voice and video packages is marked with the high priority, the data service with the low priority. In this case, the access equipment can sequence services based on VLAN No. and forward real-time services by preference, thus ensuring the QoS
3. Support echo cancellation and delay variation. Echo cancellation mechanism is in accordance with ITU-T G.165 and G.168.
4. Silence suppression and comfort noise generation is supported in order to reduce usage of network resources, which is fully complied with ITU Recommendations G.711 Appendix II, G.723.1 Annex A, G.729A Annex B.
5. Obtain transmission information of related voice media streams and report it to the core Softswitch control equipment so that the SoftSwitch can make necessary controls when the network is busy.
6. The security provided by the ZTE SoftSwitch system can strengthen the QoS of voice services.
7. IEEE 802.1p supports levels 0 – 7.The whole system supports 8 COS.

Support the IEEE 802.1 priority. Represent priorities 0–7 by three bits in VLAN tag.

8. Support WRR, SP,WFQ

- WRR: (weighted round robin) serves all service queues and assigns priorities to queues with high priorities.
- SP: (strict priority)
- WFQ: (weighted fair queue)
- The whole system supports 8 queues.

9. Stream isolation function

Support the isolation function for control stream, narrowband media stream, and broadband data stream.

10. Stream classification capability (basic packet separating capability)

Classify layer 1–4 protocol packets EtherType. Classify protocol header fields such as physical port, logical port, layer 2/3 address, EtherType, TOS, and layer 4 port as well as self-defining fields.

11. Port speed limit

Limit the speed of information current based on the result of information current sorts.

12. Priority configuration

Set user packet priorities based on user ports. Support packet IP priority and DSCP, 802.1p priority settings according to service policies. Put packets in different sending queues based on mapping relations.

13. Redirection

Perform redirection processing for packets classified, that is, the system can redirect a packet to the CPU, a certain output port, or remote equipment and perform redirection according to different services.

14. Support the WRED

Support congestion control.

ZXA10 MSAN supports two-stage switch fabric, of which one is embedded in the main control board, the other in line card.

15. Traffic shaping and policing

Traffic shaping and policing functions are performed in both main control board and line cards. In main control board, each policer specifies the bandwidth limits for the identified stream, and traffic exceeding the limits is considered non-conforming and can be dropped or marked down to a lower priority. In line cards, rate control is performed for down streams per port

Scheduling algorithms: For switch I, SP(Strict Priority), WRR(Weighted Round Robin) , WFQ(Weighted Round Robin) and enhanced scheduling mechanism such as SP+WRR, WFQ+SP are supported. For switch II, SP and WRR are supported.

Number of queues: For switch I and switch II, each port has eight different transmit queues for different classification of network traffic.

Marking functions: Switch I distinguishes one kind of traffic from another by examining the 64 bytes fields in the packet header, which can be source MAC/IP address, destination MAC/IP address, VLAN tag, DSCP, Ethertype, Cos, Tos, Layer4 protocol type etc. Traffic classification of switch II is only VC-based.

Mapping of packets to queues: Mapping of packets to queues is configurable as required.

Congestion avoidance mechanisms: Switch I supports both tail-drop and RED mechanisms for discarding non-conforming packets. Switch II supports tail-drop for discarding.

All of the queuing, scheduling, policing, shaping and filtering mechanisms can be deployed based on classification and marking the 802.1q tag..

8.10 Security Characteristics

ZXA10 MSAN greatly guarantees user validity and network security.

Operation authority classification management

Support Layer 2 isolation and controlled exchange visits.

Restrict the quantity of added multicast groups on each port.

Restrict the quantity of connected computers on each port.

Support port check according to MAC address.

Support binding MAC address with port.

Support binding IP address with port and VLAN.

Support DHCP option82.

For each port (physical, VC or VLAN), ZXA10 MSAN is able(disable) to work as a Layer 2 DHCP Relay Agent (Option 82) function in conformance with DSL Forum WT-101 Revision 11. ZXA10 MSAN implements the trusted and untrusted profiles for each access port. For trusted port, the Layer 2 DHCP Relay Agent is able to relay packets with option 82 already filled in, add information into an already filled in option 82 and discard any broadcast(unicast) DHCP request packet containing an Option 82 that enters from an access port (physical, VC or VLAN). ZXA10 MSAN, when performing the function of a Layer 2 DHCP Relay Agent, adds Option 82 with the “circuit-id” and/or “remote-id” sub-options to all DHCP messages from the client before forwarding. The formats of the “circuit-id” and “remote-id” sub-options are configurable per port (physical, VC or VLAN). ZXA10 MSAN, when performing the function of a Layer 2 DHCP Relay Agent, removes the option 82 information from messages before forwarding to the clients, convert the DHCP request from the client from a broadcast to a unicast packet, and only forward DHCP requests to the upstream designated port(s) to prevent flooding or spoofing.

Support RADIUS authentication function.

Support binding user account and port.

Support ACL-based enable/disable access control.

Support MAC Address Spoofing.

i. MAC address already learned in the Forwarding Database can not be learned in other ports unless aging time for the entry has elapsed. Within one VLAN, the duplicated users service is denied.
ii. MAC address binding
iii. limiting the number of MAC address learned per xDSL port

When ZXA10 MSAN migrates to AG (ZXMSG 5200), the system is authenticated by its authentication ID, which is unique and is obtained by the MAC address through an encryption algorithm. As network-side equipment, when the AG is used in the network, the system needs to configure the AG authentication ID, telephone number of each port and binding relations of IP addresses in the database. When the AG powers on, it sends a registration message to the Softswitch, with the AG authentication ID carried in the message. The Softswitch takes out the authentication ID from the H.248 message and compares it with the one registered in the database. If they are consistent, the AG can be used; otherwise, the service requests from the AG users will be rejected.

Support dual homing. After MSAN migrates to AG(ZXMSG 5200), when the primary MGC fails, the AG connection to the secondary MGC will be up automatically and the second MGC will take control of the MSAN. SS1, SS2, Network1 are Network2 adopt 1+1 networking mode to implement dual homing. Normally, SS1 only controls network elements and subscribers of network 1, such as TG, AG, IAD, SIP Phone, IAD subscribers, etc. SS2 only controls network elements and subscribers of network 2. When SS1 happen an accident or disaster, AG of network1 can check the abnormity status of SS1 by heartbeat check of protocol, for example, audit message of H.248. Then all network elements of network1 will register in SS2 and resume original service. Total dual homing time includes malfunction check and register time, experience value is less than 3 minutes. Actually, Softswitch also supports manual dual homing mode, when SS1 receives switchover command, SS1 will check whether heartbeat message is normal between SS1 and SS2, then SS1 sends “register to SS2” to all network elements of network1; when network elements of network1 receives this command, they will execute “re-register” command and resume original service in SS2.

Support the data confidentiality and avoidance of the communicating entities.

Support the integrity of data

Support the prevention of DOS attack. ZXA10 MSAN adopts the following technical points to protect the equipment from DOS attack

(1) MAC address in-depth attack

The port-based or VLAN-based MAC address depth protection and limitation on number of addresses so that ports or VLANs can be immune from the attack.

(2) Unknown and broadcast packet attack

An option for discarding unknown packets can be set. The depth of unknown packets and broadcast packets in the queue of the CPU can be set to restrict the rate.

(3) ACL filter function

MSAN deploys ACL (access control list) to limit the number of specific packages from L2/L7 to protect from DOS attack, including MAC address, IP address, port number and so on.

8.11 Overload control

After migration to AG (ZXMSG 5200), under overload condition, the system is able to deploy the QOS mechanism to guarantee the voice service quality and automatically maximize effective throughput. The system will limit the call session or the subscribers to improve the performance. From the view of network, it cooperates with MGC to control the overloading traffic. MGC has integrated the real time traffic monitoring function and once the traffic is over predefined threshold, MGC will adopt some methods such as: select the codec, restrict the call originate from specific gateway, load sharing among gateways etc. to lower the traffic load.

At full load with MGC, Dial tone delay is less than 300ms in average; Probability of dial tone delay greater than 1 sec is less than 1%; Probability of dial tone delay greater than 3 sec is less than 0.2%. At full Load, the voice quality as measured by MOS value should be greater than 4.

8.12 Self-switching

ZXA10 MSAN has the ability of self-switching (standalone) in the same domain.

After ZXA10 MSAN migration to AG (ZXMSG 5200), when the uplink is faulty, internal calls will be inter-switched on the control board, and internal call within the AG can be used. ZXA10 MSAN can keep the record of call session time for charging. With the help of media gateway, the subscriber calling numbers outside MSAN will receive the announcement of the network condition (revised by the carrier).

9 SYSTEM PERFORMANCE INDEXES

9.1 System Performance Indexes

- Call traffic: 50K for a single system
- Switching capability: 8.8G/48G for broadband; 2k*2k for narrowband.
- VLAN quantity: 4K
- Number of MAC addresses in the system core switching: 16K
- Maximum capacity of single subrack equipment: 384L POTS or 192L ADSL/ADSL2+ (19-inch 6U in height)
- Support the integrated service access POTS/ISDN/ADSL/ADSL2+/EPON/VDSL2/SHDSL. All boards can be inserted in slots in intermixing way.
- Number of subracks in single rack: 5
- Number of slave subracks: One master subrack can be connected to four slave subracks in a star topology. The slave type is U300 user unit.
- Security policy: Key boards such as main control board adopt the active/standby backup.

9.1.1 Processing Capability

According to Bellcore LSSGR Section 12, TR-TSY- 000512, ZXA10 MSAN narrowband voice service supports 50K BHCA according to the lab test. And there are maximum 360 sessions (single direction) handled. The switching capacity of the broadband part is 8.8G/48G. The call drop rate of the ADSL port is not greater than 5% during a 24-hour test.

9.1.2 Capacity

A single rack supports to access 1920 analog users or 960 broadband users at most; 32 analog users or 16 broadband users at least.

9.1.3 Bandwidth

Maximal uplink bandwidth: 2x1 Gbps on backplane. Additional 4-6GE on general purpose user board slots if GIS boards are used.

9.1.4 Physical interfaces:

- POTS interface: for analog telephone access
- ISDN user interface
- DDN user interface

- ADSL user interface
- ADSL2/2+ user interface
- VDSL2 user interface
- EPON interface
- Combo user interface
- SHDSL user interface (ATM mode and TDM mode)
- 100BASE-T/FX interface: connecting a gateway with the IP network
- 100bps interface: connecting a gateway with the IP network
- Independent Ethernet NMS interface adopts the SNMP to access the NMS.
- Clock references: include 2Mbit, 2MHz, and 5MHz, 2
- RS232: is used for out band management of data network, 1

9.1.5 Power Index:

Operating voltage: –41VDC to +57VDC

Power consumption index:

- 384L POTS user full configuration of each unit: 120W

192L ADSL/ADSL2+ user full configuration of each unit: 300W

9.2 Protocols

The ZXA10 MSAN supports the following protocols:

- Signaling protocol: DTMF (RFC 2833) and MFC
- LAN protocol: adaptive 10/100M-TX/FX Ethernet standards: IEEE802.3 and IEEE 802.3u, TCP/IP protocols
- NMS: SNMP
- TCP/IP protocols: TCP protocol, UDP protocol, IP protocol, ICMP protocol, ARP protocol, RARP protocol; as well as FTP, SNMP, and TELENT
- General TCP/IP layer 2 protocol: STP, RSTP and LACP

9.2.1 Call Session Control Protocol

When ZXA10 MSAN migrates to AG (ZXMSG 5200), the real-time transmission control protocol RTP/RTCP meets the RFC1889/RFC1890 requirements.

The RTP/RTCP protocol has the following functions:

- Provide end-to-end real-time data transmission
- Support load identifier, message serial number, and time stamp.
- Support multicast
- Monitor quality of service and information about interaction session participators
- Support RTP/UDP/IP head compression (RFC2508)

9.2.2 Media Gateway Control Protocol

When ZXA10 MSAN migrates to AG (ZXMSG 5200),

Support H.248 V1/V2/V3 and MEAGCO protocol functions

Support MGCP protocol functions

9.2.3 Voice Coding/Decoding Algorithms

When ZXA10 MSAN migrates to AG (ZXMSG 5200),

Support the G.711A/μ coding/decoding algorithm

Support the G.723 coding/decoding algorithm

Support the G0.729 coding/decoding algorithm

Support Packet loss concealment algorithm complied with ITU-T standard G.711 Appendix I

9.2.4 FoIP Function

When ZXA10 MSAN migrates to AG (ZXMSG 5200),

Support fax in the T.30 VBD mode

Support fax in the T.38 trunk mode

9.2.5 Voice Quality

When ZXA10 MSAN migrates to AG (ZXMSG 5200),

Support the echo cancellation function meeting the G.168 requirements

Support the VAD (voice activity detection) function

Support the CNG (comfort noise generation) function

9.2.6 Signaling

DTMF

MFC

9.2.7 IP Addressing scheme

E.164 numbering; E.164 numbering with ENUM-like support;

TEL URI

9.3 Broadband Protocol Capability

9.3.1 General IP Protocol

Support the general TCP/IP protocol stack, including:

- UDP
- TCP
- TELNET
- DHCP

- SNMP V2
- BOOTP
- NTP
- DNS
- IP
- ICMP
- ARP
- RARP

9.3.2 Layer 2 Protocol

9.3.2.1 Ethernet Bridge Function

Support the Ethernet Bridge forwarding function.

9.3.2.2 MAC Address Learning and Address Aging

Support MAC address learning and address aging, where aging time can be configured.

9.3.2.3 Port-Based VLAN Meeting IEEE802.1Q Standards

Support port-based VLAN meeting IEEE802.1Q standards and 4K PVC port-based VLAN to realize broadcast control and to increase network security. Support VLAN stacking and Q-in-Q functions.

9.3.2.4 Priority Control meeting IEEE 802.1P Standards

Support advanced classification capabilities. It is able to support many attributes for packet classification, including DSCP, TOS, 802.1p, L2/3 address, logical and physical port, protocol, etc .The packages after classification will be assigned 0-7 different priorities(total 8 level,8 COS). Then System will put packets in different sending queues based on mapping relations.

9.3.2.5 Port MAC Address Limit Function

Support the port MAC address limit function to prevent illegal intrusion by a host with an illegal MAC address.

9.3.2.6 STP/RSTP Protocol

Support the STP/RSTP protocols

9.3.2.7 Port Enable Control

Support subscriber port enable control to provide a basis for user management.

9.3.2.8 Flow Control Function under Full-/Half-Duplex Mode at Ethernet Port

The system conforms to 802.3x and coordinates the rate of the data frame from the opposite side by sending a PAUSE control frame to set flow control status for an Ethernet port. The half-duplex flow control is via a back-pressure algorithm.

9.3.2.9 Static/ Dynamic Bundle Function of Uplink Ethernet Port (TRUNKING /LACP)

Support link aggregation function compliance with IEEE 802.3ad standards, and provide the TRUNKING function for one to eight ports and support LACP.

9.3.2.10 Port Mirroring

9.3.2.11 VBAS Protocol

Support backward learning for MAC addresses by BAS.

9.3.2.12 Viewing MAC Address Table

Support views the MAC address table in the switching chip.

9.3.2.13 Logical Port Broadcast Switch

Support a global port broadcast switch function.

9.3.2.14 Broadcast/multicast limit function

Support the broadcast/multicast limit function to avoid malicious broadcast/multicast limit packets and broadcast/multicast storm.

9.3.3 Multicast functions

- Support the IGMP V1, V2 protocol.
- Support the IGMP snooping function based on the multicast VLAN.
- Support the IGMP PROXY function.
- Support up to 256/1024 multicast groups, no limitation for multicast users
- Multicast mode

The system support two levels of multicast: The main control board (network card) performs level 1 multicast and the user board performs level 2 multicasts.

- Support limited multicast
- Support VLAN multicast
- Support rate limit IGMP messages received from user-facing ports on a multicast VLAN.

9.3.4 Protocol Adaption

- Support PPP over AAL5 according to IETF RFC2364
- Support PPP over Ethernet according to IETF RFC 2516
- Support PPPOE over ATM according to RFC 2516/2684
- Support Multiprotocol encapsulation over AAL5 according to RFC 2684
- Support IPoE over ATM (RFC 2684 bridge mode)
- Support IP over ATM(RFC 2684).

- Support PPP over ATM (RFC 2364).
- Support the auto-sensing function on a per port basis

9.4 IP Call Voice Performance

The dynamic switchover time of voice coding is smaller than 60 ms and the time delay of the IP network is smaller than 80 ms without voice interruption and jitter.

9.4.1 IP Coding/Encoding Algorithms

The ZXMSG 5200 service processing unit supports the following coding/encoding algorithms:

1. G.711 (5ms/10ms/20ms Ethernet packets)
2. G.729 (10ms/20ms Ethernet packets)
3. G.723.1 (30ms Ethernet packets)

9.4.2 Coding/Encoding Rate

The gateway should provide different rates for different coding/encoding algorithms:

1. For G.729a, the coding/encoding rate should be less than 18kbps.
2. For G.723.1(5.3), the coding/decoding rate should be less than 12kbps; for G.723.1(6.3), the coding/decoding rate should be less than 15kbps.

9.4.3 Objective Assessment on Voice

1. Good network conditions: The average PSQM value is less than 1.5.
2. Poor network conditions (packet loss rate = 1%, network jitter = 20ms, time delay = 100ms): The average PSQM value is less than 1.8.
3. Harsh environments (packet loss rate = 5%, network jitter = 60ms, time delay = 400ms): The average PSQM value is less than 2.0.

9.4.4 Subjective Assessment on Voice

1. Good network conditions: MOS > 4.0
2. Poor network conditions (packet loss rate = 1%, network jitter = 20ms, time delay = 100ms): MOS > 3.5
3. Harsh environments (packet loss rate = 5%, network jitter = 60ms, time delay = 400ms): MOS > 3.0

9.4.5 Time Delay Indexes (Loopback Time Delay)

IP call time delay includes coding/decoding time delay, input buffer time delay of receiving end, and internal queue time delay.

1. G.729 time delay is smaller than 150ms.
2. G.723.1 time delay is smaller than 200ms.

9.5 Generating and Detection of TONE

When ZXA10 MSAN migrates to AG (ZXMSG 5200), it is capable of generating and detecting in-band and out-band tones.

Dial tone:

The system is capable of generating and detecting in-band tones.

Frequency: 425 Hz. Cadence: continuous. Level: -5dBm0

Ring back tone:

A tone advising the caller that a connection has been made and that a calling signal is being applied to a telephone number or service point.

Frequency: 425 Hz. Cadence: on 1 sec, silence 4 sec, repeated. Level: -5 dBm0

Busy tone:

A tone advising the caller that the calling party is busy

Frequency: 425 Hz. Cadence: on 0.5 sec, silence 0.5 sec, repeated. Level: -5 dBm0

Congestion tone:

A tone advising the caller that the groups of lines or switching equipment necessary for the setting up of the required call or for the use of specific service are temporarily engaged

Frequency: 425 Hz. Cadence: on 0.2 sec, silence 0.2 sec, repeated. Level: -5 dBm0

Call waiting tone:

A tone advising the user of call waiting supplementary service

Frequency: 425 Hz. Cadence: on 0, 5 sec silence 8 sec, repeated. Level: -5 dBm0

Special information tone:

A tone advising that the MSAN is ready to receive call information and inviting the user to start sending call information, at the same time reminding the user that special conditions apply to the termination from which the call is being made.

Call Forwarding Unconditional; Call Forwarding on Busy; Call Forwarding on No Reply; Call Forwarding Timed; Selective Call Forwarding; Do Not Disturb; Outgoing Call Barring; Incoming Call Barring; Selective Call Acceptance; Selective Call Rejection; Callback busy; Call Trasferring,etc

9.6 MTBF indexes OF ZXA10 MSAN

ZXA10 mainly comprises of the following function modules: ZXA10 T600, ZXA10 U300, ZXA10 S300 and ZXA10 S200 etc. And the following parts are the typical reliability indexes for all these modules.

9.7 MTBF indexes of ZXA10 T600

Normally, ZXA10 T600 is composed of (singe shelf, full capacity):

Table 13 ZXA10 T600 Components

Device Name	Code	Qty (pcs)	Remark
Enhanced processing unit	ESU	2	Master/slave
Digital Trunk	DT	10	
Mother board of control layer	MTBC	1	
Power supply K	POWER K	2	Master/slave

ZXA10 T600 Reliability Block Diagram is shown as below:

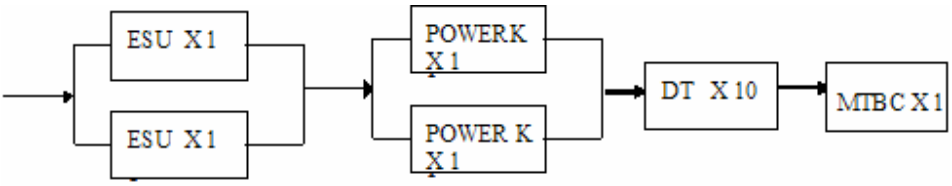


Figure 71 ZXA10 T600 reliability block diagram

The reliability prediction is conducted based on the authoritative software CARMES-2000, while the America Military Standard MIL-HDBK-217F, MIL-HDBK-217F2 , Bellcore TR-TSY-000512 and China Military Standard GJB/Z299B-98 are referred.

During prediction, some protection devices, such as ESD, SURGE, are not considered for they will contribute to the system lifecycle. Some other non-electrical devices, such as rack and frame, are not taken into account also.

System Reliability Prediction is shown as below:

Table 14 ZXA10 T600 Reliability Prediction

BOARD	λi（10^{-6}/h）	MTBFi (hrs)	AMOUNT	Σλi（10^{-6}/h）	ΣMTBFi（hrs）	REMARK
ESU	1.2	833333.3333	2	0.8	1250000	λi*2/3
ODT	0.6	1666666.667	7	4.2	238095.2381	λi*7
FDT	1.3	769230.7692	3	3.9	256410.2564	λi*3
POWERK	1.36	735294.1176	2	0.906666667	1102941.176	λi*2/3
MTBC	0.442369	2260556.232	1	0.442369	2260556.232	λi
TOTAL			12	10.24903567	97570.15514	

Annotation: λi：10^{-6}/h; MTBF: hrs

For mean time for repairing: MTTR≤30min, the system availability can be drawn with the equation: A=MTBF/（MTBF+MTTR）=97570/(97570+30/60)= 0.999994876.

9.8 MTBF indexes of ZXA10 U300

The reliability prediction is conducted based on the authoritative software CARMES-2000, while the America Military Standard MIL-HDBK-217F, MIL-HDBK-217F2 , Bellcore TR-TSY-000512 and China Military Standard GJB/Z299B-98 are referred.

Normally, ZXA10 U300 is composed of (single shelf, full capacity):

Table 15 ZXA10 U300 Components

Device Name	Code	Qty (pcs)	Remark
Analogue Subscriber Line Card	ALC	10	
Integrated Control Switch	ICS	2	Master/slave
Remote Subscriber Line test Board	TSLCC	1	
ADSL subscriber card	ADL	2	
Secondary Power Supply Board	POWERH	1	

ZXA10 U300 Reliability Block Diagram is shown as below:

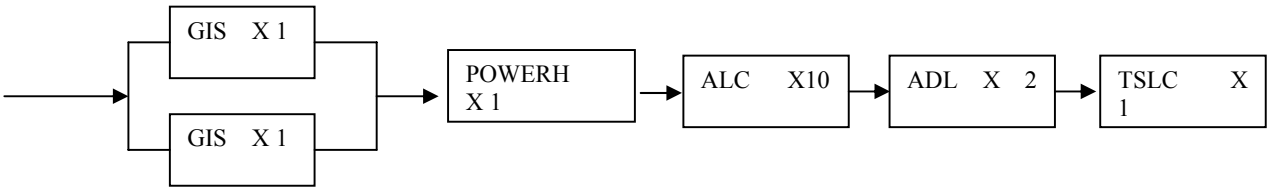


Figure 72 ZXA10 U300 reliability block diagram

The reliability prediction is conducted based on the authoritative software CARMES-2000, while the America Military Standard MIL-HDBK-217F, MIL-HDBK-217F2 , Bellcore TR-TSY-000512, China Military Standard GJB/Z299B-98 are referred.

During prediction, some protection devices, such as ESD, SURGE, are not considered for they will contribute to the system lifecycle. Some other non-electrical devices, such as rack and frame, are not taken into account also.

System Reliability Prediction is shown as below:

Table 16 ZXA10 U300 Reliability Prediction

BOARD	λi (10-6/h)	Board's MTBFi (hrs)	AMOUNT	Σλi (10-6/h)	ΣMTBFi (hrs)	REMARK
TSLCC	1.492	670241	1	1.492	670241	
MICS	0.387526	2580473	1	0.387526	2580473	
POWERH	1.097	911577	1	1.097	911577	
ALC	0.68	834725	10	6.8	147059	
GIS	0.34	29411764	2	0.2266667	4411765	λi*2/3
ADL	0.98	527704	2	1.96	510204	
TOTAL			17	11.9632	83590	

Annotation: λi：10-6/h; MTBF: hrs

For mean time for repairing: MTTR(MTRS)≤30min, the system availability can be drawn with the equation: A=MTBF/（MTBF+MTTR）=83590/（83590+30/60）=0.999994081. And then the block time within 1 years can be calculated: t=1×365×24-10×365×24×83590/（83590+30/60）=0.05hours. It means that the total block time will be about 3 minutes.

9.9 MTBF indexes of ZXA10 S200

Normally, ZXA10 s200 is composed of (STM-4, Standard configuration for IP and TDM):

Table 17 ZXA10 S200 Components

Device Name	Code	Qty (pcs)	Remark
Convergence card type B	TAB	1	
STM-1 optical sub card	OD1H/4	1	
STM-4 optical sub card	OD4H	1	
E1 tributary card	E1B	1	
Ethernet card	ESS8E	1	

ZXA10 S200 Reliability Block Diagram is shown as below:

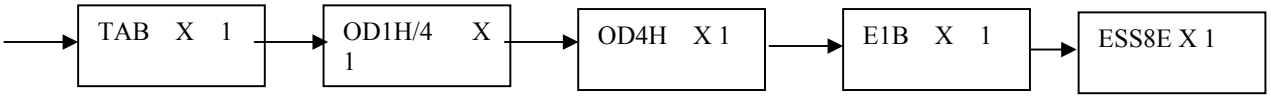


Figure 73 ZXA10 S200 reliability block diagram

The reliability prediction is conducted based on the authoritative software CARMES-2000, while the America Military Standard MIL-HDBK-217F, MIL-HDBK-217F2 and China Military Standard GJB/Z299B-98 are referred.

During prediction, some protection devices, such as ESD, SURGE, are not considered for they will contribute to the system lifecycle. Some other non-electrical devices, such as rack and frame, are not taken into account also.

System Reliability Prediction is shown as below:

Table 18 ZXA10 S200 Reliability Prediction

BOARD	λi (10-6/h)	Board's MTBFi (hrs)	AMOUNT	Σλi (10-6/h)	ΣMTBFi (hrs)	REMARK
TAB	10.26	97466	1	10.26	97466	
OD1H/4	1.355	738008	1	1.355	738008	
OD4H	1.241	805802	1	1.241	805802	
ESS8E	5.807	172206	1	5.807	172206	
E1B	3.515	284496	1	3.515	284496	
TOTAL			5	22.178	45090	

Annotation: λi：10-6/h; MTBF: hrs

For mean time for repairing: MTTR≤30min, the system availability can be drawn with the equation: A=MTBF/（MTBF+MTTR）= 45090/（45090+30/60）=0.999988911. And then the block time within 10 years can be calculated: t=10×365×24-10×365×24×45090/（45090+30/60）=0.9714 hours. It means that the total block time will be less than 1 hours.

9.10 MTBF indexes of ZXA10 S300

Normally, ZXA10 S300 is composed of (STM-4, Standard Configuration for TDM/IP/ATM):

Table 19 ZXA10 S300 Components

Device Name	Code	Qty (pcs)	Remark
Convergence card type A	TAAE	2	Master/slave
STM-4 Optical line card	OL4A	1	
E1 tributary card C	E1C	2	
Giga Ethernet card	ESDGE	1	
Power and Clock Interface card	PCI	1	
Network management and Orderwire Card	NOWC	1	
ATM card	ASB2S	1	

ZXA10 S300 Reliability Block Diagram is shown as below:

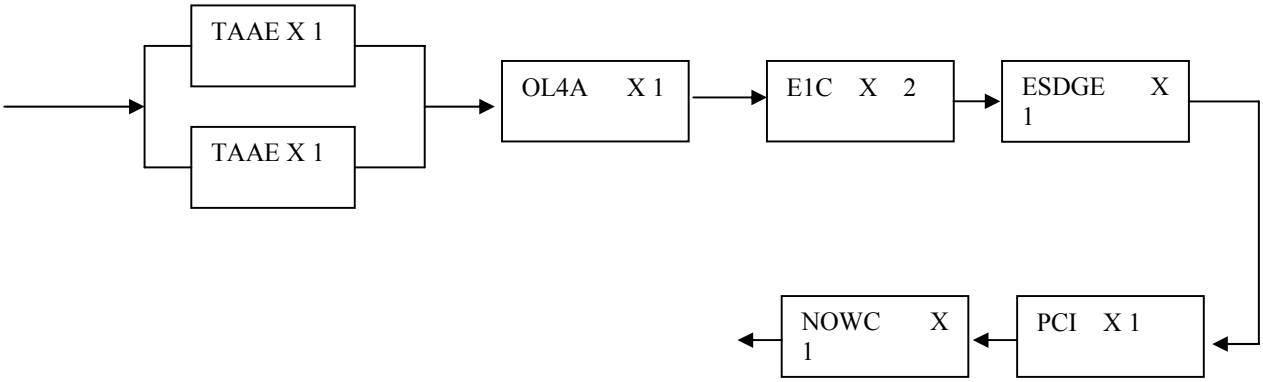


Figure 74 ZXA10 S300 reliability block diagram

The reliability prediction is conducted based on the authoritative software CARMES-2000, while the America Military Standard MIL-HDBK-217F, MIL-HDBK-217F2 and China Military Standard GJB/Z299B-98 are referred.

During prediction, some protection devices, such as ESD, SURGE, are not considered for they will contribute to the system lifecycle. Some other non-electrical devices, such as rack and frame, are not taken into account also.

System Reliability Prediction is shown as below:

Table 20 ZXA10 S300 Reliability Prediction

BOARD	λi (10-6/h)	Board's MTBFi (hrs)	AMOUNT	Σλi (10-6/h)	ΣMTBFi (hrs)	REMARK
TAAE	8.773	113987	2	5.848666667	170980	λi*2/3
OL4A	2.224	449641	1	2.224	449641	
E1C	5.364	186429	2	10.728	93215	
ESDGE	5.763	173521	1	5.763	173521	
NOWC	4.702	212676	1	4.702	212676	
PCI	2.014	496525	1	2.014	496525	
TOTAL			9	31.27966667	31969	

Annotation: λi：10-6/h; MTBF: hrs

For mean time for repairing: MTTR≤40min, the system availability can be drawn with the equation: A=MTBF/（MTBF+MTTR）=31969/（31969+20/60）=0.999989583. And then the block time within 10 years can be calculated: t=10×365×24-10×365×24×31969/（31969+20/60）= 0.913 hours. It means that the total block time will be about 1 hour.

10 SYSTEM UPGRADE STEP

The upgrade of the ZXA10 MSAN includes upgrades of control board card, other service cards and software. To avoid any effect on the equipment, two control boards are recommended to adopt.

The detail steps are described as follows:

- Preparation

1. The ZXA10 MSAN is installed. It can work normally.
2. 2. The foreground and background are connected normally.

- Procedures of version upgrade:

1. Insert the new cards.
2. Configure FTP server.
3. Upgrade BOOT program of the backup main control board.
4. Upgrade the running version and FPGA version of the backup.
5. Upgrade versions of service cards.
6. Verify results
7. Switch over the main control board

There is no influence on the availability of the equipment in the whole process.

11 APPENDIX: MAJOR STANDARDS COMPLIANT BY THE ZXA10 SYSTEM

The ZXA10 complies with the standards formulated by the following standardization organizations:

ITU-T	International Telecommunications Union-Telecommunication group
IEEE	Institute of Electrical and Electronics Engineers
ETSI	Europe Telecommunication Standards Institute
ISO	International Standardization Organization
IEC	International Electric Committee
ITU-T G.703	: Physical/electrical characteristics of digital hierarchy interface
ITU-T G.704	: Synchronous frame structure used by the hierarchy levels of primary group and secondary group
ITU-T G.706	: Frame location and CRC program related to the basic frame structure stipulated by G.704 recommendation
ITU-T G.711	: PCM (Pulse Code Modulation) for audio frequency
ITU-T G.712	: Transmission performance indexes for PCM
ITU-T G.707	: SDH network node interface
ITU-T G.773	: Q interface protocol of transmission system management
ITU-T G.774	: SDH NE-level management information model
ITU-T G.783	: Characteristics of SDH equipment functional block
ITU-T G.784	: SDH management
ITU-T G.803	: SDH-based transmission network structure
ITU-T G.813	: SDH equipment slave clock characteristics
ITU-T G.823	: Jitter and wander control over the 2048kbit/s hierarchy digital network
ITU-T G.825	: Jitter and wander control over the SDH-based digital network
ITU-T G.826	: Error performance parameters and objects of international constant bit rate digital channel of primary group and above rate
ITU-T G.831	: SDH-based transport network management capability
ITU-T G.841	: Category and characteristics of SDH network protection structure
ITU-T G.842	: Interconnection of SDH network protection architecture
ITU-T G.957	: Optical interfaces of the SDH-related equipment and system
ITU-T G.958	: SDH digital line system used for optical cable
ITU-T G.821	: International digital connection bit error performance for constructing ISDN
ITU-T G.902	: Frame architecture of the access network functional structure, functional block, access type, management and service node
ITU-T G.960	: Digit section used for ISDN basic access
ITU-T G.962	: Digit section used for ISDN primary group rate access
ITU-T G.964	: V interface of digital local exchange supporting V5.1 interface of access

	network
ITU-T G0.965	: V interface of digital local exchange supporting V5.2 interface of access network
ITU-T G0.982	: Optical access network supporting ISDN primary group rate or equivalent rate service
ITU-T G.992.1 (G.DMT)	: Telecommunication Standardization Asymmetric Digital Subscriber Line (ADSL) Transceivers
ITU G.992.2 (G.Lite)	: Telecommunication Standardization Transmission Systems and Media Splitterless Asymmetric Digital Subscriber Line (ADSL) Transceiver
ITU-T I.430	: The first layer specifications for ISDN basic subscriber-network interface
ITU-T I.431	: The first layer specifications for ISDN primary group rate subscriber-network interface
ITU-T Q.831	: Fault and performance management for V5 interface and related subscriber line
ITU-T Q.921	: Data link layer specifications for ISDN subscriber-network interface
ITU-T Q.931	: Product Descriptions for the third layer basic call control of ISDN subscriber-network interface
ITU-T K.11	: Protection principles of over voltage and over current
ITU-T K.20	: Protection requirements for over voltage and over current of telecommunication exchange equipment
IEC60664	: Insulation interworking of the equipment in low-voltage system
IEC61312	: Electromagnetic pulse against lightning strike
IEC61643	: Surge protector of low-voltage system
IEC60721	: Classification of environment conditions
IEC529	: Environment protection level
IEC60297	: Structure dimension of 19-inch series equipment
ETS300019	: Environment conditions and environment test of the communication equipment
ETS300119	: European equipment communication standard
ETS300386	: Electromagnetic compatibility requirements for communication network equipment
EN 300 347-1	: V-Interface at the digital Local Exchange (LE) V5.2 interface for the support of Access Network (AN)
TCN 68-185	: V5.2 interface between Local Exchange and Access Network - Technical requirements.