HUAWEI

U-SYS SoftX3000 SoftSwitch System
Technical Manual – System Description

V300R001

U-SYS SoftX3000 SoftSwitch System
Technical Manual

Volume	System Description
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Huawei Technologies Co., Ltd.

Address: Administration Building, Huawei Technologies Co., Ltd.,

Bantian, Longgang District, Shenzhen, P. R. China

Postal Code: 518129

Website: http://www.huawei.com

Email: support@huawei.com

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About This Manual

Release Notes

The manual applies to U-SYS SoftX3000 SoftSwitch System V300R001.

Related Manuals

The related manuals are listed in the following table.

Manual	Content
U-SYS SoftX3000 SoftSwitch System Technical Manual-System Description	It provides an overall introduction to SoftX3000, including product features, applications and technical specifications.
U-SYS SoftX3000 SoftSwitch System Technical Manual-Architecture & Principle	It details on the hardware architecture, component interworking mechanism, and subsystems of alarm, billing, and clock in SoftX3000.
U-SYS SoftX3000 SoftSwitch System Maintenance Manual-Routine Maintenance	It guides the maintenance engineers to perform daily maintenance, monthly maintenance, and yearly maintenance tasks on equipment.
U-SYS SoftX3000 SoftSwitch System Maintenance Manual-Emergency Maintenance	It guides the maintenance engineers to perform recovery operations in the case of emergencies, such as congestion of global service, AMG, and TMG, and failure of host and BAM.
U-SYS SoftX3000 SoftSwitch System Maintenance Manual-Parts Replacment	It guides the maintenance engineers on how to replace hardware components such as boards, fan frame, LAN Switch, and hard disk.
U-SYS SoftX3000 SoftSwitch System Hardware Installation Manual	It details the installation procedure of SoftX3000 hardware components, and matters needing attention during the installation process.
U-SYS SoftX3000 SoftSwitch System Software Installation Manual	It covers the detailed procedure of installing SoftX3000 software, including BAM server, emergency workstation and client, focusing on the key points that might cause installation failure.
U-SYS SoftX3000 SoftSwitch System Operation Manual-Traffic Measurement	It guides the engineers how to perform traffic measurement operations and how to analyze traffic measurement results.
U-SYS SoftX3000 SoftSwitch System Operation Manual-Configuration Guide	It guides the engineers how to configure various data in SoftX3000, including configuration steps, preparations, database table referencing relationships, and command parameters.

Manual	Content
U-SYS SoftX3000 SoftSwitch System Operation Manual-Configuration Example	It guides the engineers how to configure various data in SoftX3000, including networking example, configuration script, key parameters and debugging guidance.
U-SYS SoftX3000 SoftSwitch System Operation Manual-Service Application	It covers the voice services, IP Centrex services, multi-media services, IN services and value added services supported by SoftX3000, focusing on the meaning, operations, example and points for attention of various services.
U-SYS iGateway Bill User Manual	It elaborates on the functioning principle of the iGateway Bill. Also, it teaches you on how to install, maintain, and operate the product.

Organization

This manual introduces the product characteristics, system architecture, interfaces signaling and protocols, OAM system, services and functions, networking and applications, reliability and security design, technical specifications and environmental requirements of SoftX3000.

There are ten chapters in the manual.

- **Chapter 1 System Introduction** profiles the trends and importance of evolution of SoftX3000, a packet-based Next Generation Network from traditional circuit-based telecom network.
- **Chapter 2 System Architecture** introduces both the hardware structure and the software structure of SoftX3000.
- **Chapter 3 Interfaces, Signaling and Protocols** presents the various physical interfaces and signaling and protocols utilized in SoftX3000.
- **Chapter 4 OAM System** details the operation administration and maintenance system of SoftX3000 in the aspects of functions, man-machine language, terminal system, network management, and charging.
- **Chapter 5 Services and Functions** provides more information about the services and functions that are currently implemented in SoftX3000.
- **Chapter 6 Networking and Applications** focuses on the system networking and typical applications of SoftX3000.
- **Chapter 7 Reliability and Security Design** presents the reliability measures and security design of SoftX3000.
- **Chapter 8 Technical Specifications and Environmental Requirements** lists the technical specifications and environmental requirements of the system – SoftX3000 taking into account the actual conditions of Huawei-developed system.
- **Chapter 9 Compliant Recommendations and Standards** lists the ITU-T Recommendations and IETF Standards that the product complies with.

- **Chapter 10 Acronyms and Abbreviations** collects the definitions of terms and acronyms that are used in this manual.

Intended Readers

The manual is intended for the following readers:

- NGN network planning experts
- NGN network administrators
- NGN system engineers

Conventions

The manual uses the following conventions:

I. General conventions

Convention	Description
Arial	Normal paragraphs are in Arial.
Arial Narrow	Warnings, Cautions, Notes and Tips are in Arial Narrow.
Boldface	Headings are in **Boldface**.
`Courier New`	Terminal Display is in `Courier New`.

II. Mouse operation

Action	Description
Click	Press the left button or right button quickly (left button by default).
Double Click	Press the left button twice continuously and quickly.
Drag	Press and hold the left button and drag it to a certain position.

III. Symbols

Eye-catching symbols are also used in the manual to highlight the points worthy of special attention during the operation. They are defined as follows:

⚠ **Caution** Means reader be extremely careful during the operation.

🕮 **Note** Means a complementary description.

Table of Contents

Chapter 1 System Introduction

1.1 Introduction to U-SYS Solution

1.1.1 Overview of U-SYS Solution

NGN is a service-driven network, which realizes a relatively independent service system by separating service from call control, as well as call control from bearer, thus enabling service independent of network. NGN employs open and integrated network architecture.

With abundant service provisioning capabilities, NGN is able to provide a variety of services, such as voice, data and multimedia services, or integrated services. Depending on the U-SYS solution proposed by Huawei, NGN comprises four planes, namely edge access, core switching, network control and service management. The network architecture is shown in Figure 1-1.

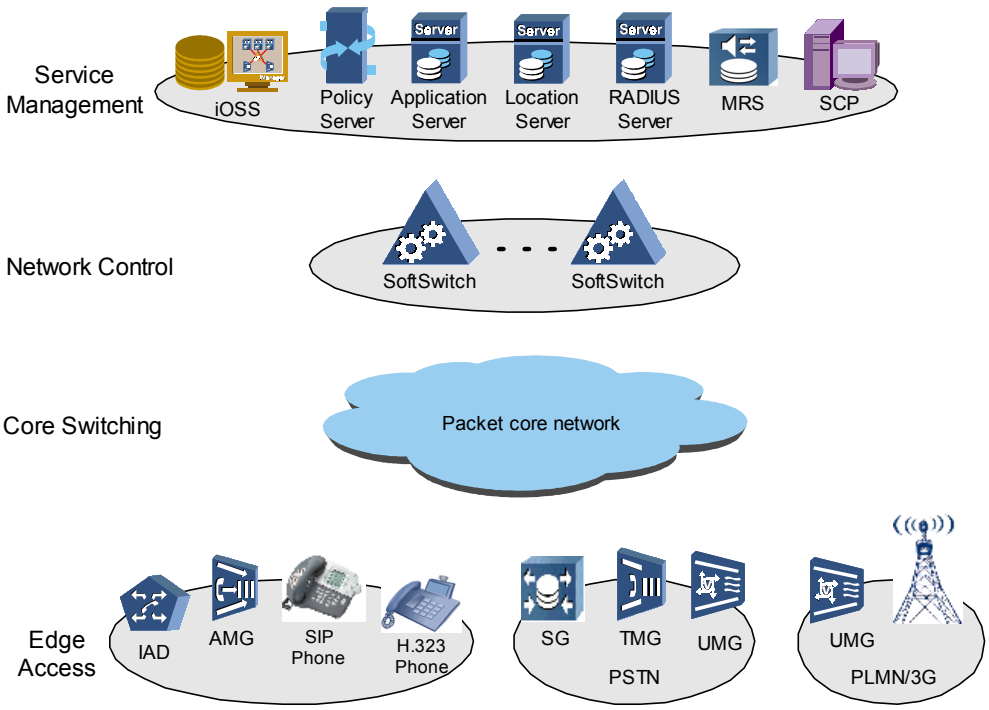


Figure 1-1 U-SYS solution proposed by Huawei

1.1.2 Network Components

I. Edge access layer

Edge access layer is used to connect subscribers and terminals to the network by a variety of means and convert the original information format to the suitable one that can be transferred over the network.

- Integrated Access Device (IAD): It is a type of subscriber access device used in the NGN architecture. It introduces data, audio, video and other services of the subscribers to the packet-based network. Each IAD provides a maximum of 48 subscriber ports.
- Access Media Gateway (AMG): It provides subscribers with a diversity of service access, such as analog subscriber access, Integrated Services Digital Network (ISDN) access, V5 access and x Digital Subscriber Line (xDSL) access.
- SIP Phone: It is a type of multimedia terminal device supporting the Session Initiation Protocol (SIP).
- H.323 Phone: It is a type of multimedia terminal device supporting the H.323 protocol.
- Signaling Gateway (SG): It is located at the interface layer of the Signaling System No. 7 network and the Internet Protocol (IP) network, achieving the signaling conversion function between the Public Switched Telephone Network (PSTN) and the IP network.
- Trunk Media Gateway (TMG): It is resident between the circuit switched network and the IP packet switched network. It provides functions of format conversion between Pulse Code Modulation (PCM) signal streams and IP media streams.
- Universal Media Gateway (UMG): It implements the functions of media stream format conversion and signaling conversion. It can act as a TMG, built-in SG or AMG. It can connect a variety of devices including PSTN exchange, Private Branch Exchange (PBX), access network, Network Access Server (NAS) and base station controller.

II. Core switching layer

Core switching layer adopts the packet technology, and is composed of the devices distributed over the backbone network and the Metropolitan Area Network (MAN), such as router and layer-3 switch. It is used to provide subscribers with a uniform and integrated transmission platform with high reliability, Quality of Service (QoS) assurance and a large capacity.

III. Network control layer

Network control layer is responsible for implementing call control. Its core technology is soft switching, which is used to achieve basic real-time call control and connection control functions.

SoftSwitch: As the core equipment of NGN, SoftSwitch mainly implements call control, media gateway access control, resource allocation, protocol processing, routing, authentication, and charging functions, and provides subscribers with basic voice services, mobile services, multimedia services and Application Programming Interfaces (APIs).

IV. Service management layer

Service management layer is mainly used to provide supplementary value added services and operation support based on established calls.

- iOSS is the acronym of integrated Operation Support System, which includes two parts: Network Management System (NMS) for managing the NGN network elements in a centralized way, and integrated charging system.
- Policy Server: It is used to manage the policies of the users, such as Access Control List (ACL), bandwidth, traffic, and QoS.
- Application Server: It is responsible for generating and managing logics of various value added services and intelligent network services, and providing innovation platform for developing third-party services by means of open APIs. As a physically separated component, Application Server is independent of the SoftSwitch equipment resident on the network control layer. This contributes to the separation of service from call control and is beneficial to the introduction of new services.
- Location Server: It is used to dynamically manage the routes between the SoftSwitch equipment in NGN, indicate reachability of the destinations of calls, ensure the best efficiency of the call routing table, prevent the routing table from being oversized and impractical, and abate the complexity of routes.
- Remote Authentication Dial-In User Service (RADIUS) Server: It is used to manage subscriber authentication, password encryption, service selection and filtering, and call charging in a centralized way.
- Media Resource Server (MRS): It is used to enable the media processing functions in the basic and enhanced services. The functions include service tone provision, conference service, Interactive Voice Response (IVR), recorded announcement and advanced tone service.
- Service Control Point (SCP): It is the core component of the Intelligent Network (IN), and is used to store subscriber data and service logics. According to the call events reported by Service Switching Point (SSP), SCP starts an appropriate service logic, retrieves the service database and the subscriber database based

on the started service logic, and then sends proper call control instructions to the corresponding SSP to instruct the SSP how to perform next, thus realizing various intelligent calls. That is the main function of SCP.

1.1.3 Major Technical Features

I. Open and distributed network architecture

NGN has an open and distributed network architecture where service is separated from call control and call control is separated from bearer. Thus service is independent of network. Through open protocols and interfaces, a variety of services can be provided flexibly and rapidly, and individual subscribers can customize their own service features without considering the network structure and the terminal type of the bearer services.

II. High-speed and packet switched core bearer

The packet switched core bearer network speeds up the integration of the telecommunication network, computer network and cable TV network. Meanwhile, the high-speed core bearer network supports a diversity of services including voice service, data service and video service.

III. Independent network control layer

The network control layer, that is, SoftSwitch, employs an open and independent control platform to isolate call control from media gateways. The independent network control layer implements by software the basic call control functions including call routing, management control and signaling interworking, so that service suppliers can customize bearer services and control protocols. The network control layer also provides open APIs to facilitate a third party to provide services in a rapid, flexible and efficient way.

IV. Internetworking and gateways

NGN can interwork with PSTN, Public Land Mobile Network (PLMN), 3rd Generation (3G), IN, Internet and other networks by means of access media gateway, trunk media gateway and signaling gateway. The interworking enables NGN to inherit all services from the original networks efficiently.

V. Diversified access modes

Ordinary subscribers can access the network through intelligent packet voice terminals and multimedia terminals. Enterprise users and corporate users can be connected to the network through access media gateways and integrated access devices, which fully meets the requirements of individual users for voice, data and video services.

1.2 Introduction to SoftX3000 Orientation

Developed by Huawei Technologies Co., Ltd., U-SYS SoftX3000 SoftSwitch System (hereinafter referred to as SoftX3000) adopts advanced software and hardware technologies and owns abundant service provisioning capabilities and powerful networking capabilities. SoftX3000 is applicable to the network control layer of the Next Generation Network (NGN).

1.3 Location of SoftX3000

As a large-capacity and high-performance SoftSwitch product, SoftX3000 is applicable to the network control layer of NGN and implements call control and connection management of voice, data and multimedia services based on the IP network.

SoftX3000 owns abundant service provisioning capabilities and powerful networking capabilities. On the way of the development and integration of the traditional PSTN networks to NGN, SoftX3000 can be used as an end office (C5 office), tandem office, toll office (C4 office), gateway office, and so on.

1) SoftX3000 is fully compatible with all service capabilities of PSTN exchanges and supports a variety of protocols including Media Gateway Control Protocol (MGCP), H.248, V5, Digital Subscriber Signaling No. 1 (DSS1), SIP and H.323. Traditional PSTN telephone terminals, ISDN terminals, MGCP packet terminals, H.248 packet terminals, SIP packet terminals and H.323 packet terminals can be connected to SoftX3000 which is capable of a diversity of service provision such as voice, data and multimedia. Therefore, SoftX3000 can be used as a multimedia end office.
2) SoftX3000 supports the traditional PSTN signaling, such as Signaling System No. 7 (SS7), R2 signaling, DSS1 signaling and V5 protocol. Coordination with SG, TMG, UMG and other gateways enables SoftX3000 to own various access networking capabilities and trunk networking capabilities which the existent PSTN exchanges have. SoftX3000 can function as a voice end office, tandem office or toll office.
3) SoftX3000 supports black and white lists, call authentication, call interception, and so on. SoftX3000 can act as a gateway office.
4) SoftX3000 supports the Message Transfer Part (MTP) and the Message Transfer Part 3 – User Adaptation Layer (M3UA), which enables SoftX3000 to serve as an integrated signaling gateway.
5) SoftX3000 supports the Intelligent Network Application Protocol (INAP), so it can be used as an SSP in the IN system.
6) SoftX3000 supports the H.323 protocol and can function as a gatekeeper (GK) in the traditional Voice over IP (VoIP) network.

1.4 Product Features

1.4.1 Abundant Service Provisioning Capabilities

SoftX3000 not only inherits the various service capabilities from the traditional PSTN and IN, but also provides value added services on the basis of the NGN architecture. SoftX3000 has abundant service provisioning capabilities as follows:

1) Completely inherits voice service capabilities from Huawei C&C08 Switch, which enables SoftX3000 to provide basic voice services and supplementary services.
2) Proposes an optimized IP Centrex solution and supports IP Centrex subscribers, IP console and wide area Centrex services.
3) Supports the T.38 protocol and provides high-quality IP fax services.
4) Supports multimedia communication protocols including SIP and H.323 to provide videophone, application share, electronic whiteboard and videoconferencing services.
5) Supports INAP. In cooperation with SCP intelligent platform, SoftX3000 fully inherits the traditional IN services, such as Free PHone (FPH), Account Card Calling (ACC), Virtual Private Network (VPN) and Universal Personal Telecommunication (UPT).
6) Supports SIP. In cooperation with SIP application server and third-party's or virtual carrier's application server, SoftX3000 provides subscribers with diversified value added services, third-party services or customized services, such as Unified Messaging (UM), Instant Messaging (IM), Click To Dial (CTD), Click To Fax (CTF), and Presence.
7) Supports Internet Personal Number (IPN).

1.4.2 Powerful and Flexible Networking Capabilities

SoftX3000 provides open and standard protocol interfaces. SoftX3000 not only supports a variety of NGN signaling protocols including MGCP, H.248, SIP, SIGTRAN, but also supports a number of traditional PSTN signaling systems such as SS7, R2, DSS1 and V5. SoftX3000 has powerful and flexible networking capabilities.

1) Supports both MGCP and H.248 as the media gateway control protocols, is able to interconnect with IADs, AMGs, TMGs and UMGs, and allows access to MGCP packet terminals and H.248 packet terminals.
2) Supports SIP, is able to interwork with other SoftSwitches and SIP application servers, and allows SIP packet terminals to access directly.
3) Supports H.323, is able to interconnect with traditional VoIP gateways and Multipoint Control Units (MCUs), and allows H.323 packet terminals to access directly.

4) Supports V5.2 protocol, DSS1 signaling and R2 signaling. Cooperation with UMG enables the access of PBX, NAS, access network devices and Base Station Controllers.
5) Supports MTP, Telephone User Part (TUP) and ISDN User Part (ISUP), is able to interconnect with Signaling Points (SPs) and Signaling Transfer Points (STPs) resident in the SS7 network, and provides No. 7 trunks to interconnect with PSTN exchanges.
6) Supports Signaling Connection Control Part (SCCP), Transaction Capabilities Application Part (TCAP), and INAP, provides Service Switching Function (SSF), and so can be used as an SSP in the IN.
7) Supports both M3UA and MTP protocols, and can function as a signaling point (interconnecting with a signaling gateway) or an integrated signaling gateway.
8) Supports the Message Transfer Part 2 – User Adaptation Layer (M2UA) protocol, and is able to directly interconnect with a TMG with built-in signaling gateway functions.
9) Supports Simple Traversal of UDP Through Network Address Translators (STUN), a Network Address Translation (NAT) protocol, to enable enterprise networks to pass through NAT devices such as firewalls and access the NGN.
10) Supports the Simple Network Management Protocol (SNMP) and Man Machine Language (MML) interfaces to access the network management center.
11) Supports the File Transfer Protocol (FTP) and the File Transfer Access and Management Protocol (FTAM) to access the billing center.

1.4.3 Large Capacity and High Integration

As advanced hardware and software design technologies are employed, SoftX3000 not only has a modularized hardware architecture, but also owns a high processing capability and a large capacity on the carrier-class level.

1) The Busy Hour Call Attempt (BHCA) value of a single service processing module is 400k. Each module supports up to 9,000 Time Division Multiplexing (TDM) trunks or equivalent 50,000 subscribers.
2) At the full configuration, SoftX3000 supports a maximum of 40 service processing modules; the BHCA value of the whole system is 16,000k; SoftX3000 supports a maximum of 360,000 TDM trunks or equivalent 2,000,000 subscribers.
3) SoftX3000 is also characterized by high integration. At the full configuration, only 5 cabinets are needed. The operation power consumption of the cabinets is less than 12 kW.

1.4.4 High Reliability

For the purpose of guaranteeing the high reliability of the system, a number of protective measures are taken in the hardware design, software design, system overload control and charging system of SoftX3000.

1) Hardware design: adopts active/standby mode, load sharing and redundancy configuration for the boards and optimizes fault detection and isolation techniques of the boards and the system to improve the maintainability of the whole system.
2) Software design: adopts hierarchical modularized architecture with protective performance, error tolerance capability and fault monitoring function.
3) System overload control: provides 4-level overload restrictions, dynamic code adjustment mode and traffic control to fully ensure the reliability of the system.
4) Charging system: iGWB Server developed by Huawei is employed as SoftX3000 charging gateway. iGWB Server adopts dual-system hot backup and is configured with Hot RAID5 hard disk array to implement dual backup and mass storage of bill data.

Depending on a reliable prediction method, the Mean Time Between Failures (MTBF) of SoftX3000 reaches 53 years and the yearly interruption time of the system is only 0.89 minute on average.

1.4.5 High Security

NGN is an open and distributed network where open protocols and interfaces enable it to interwork with various NGN network components. Networking applications over NGN are very flexible. However, this openness also results in inevitable network security issues as IP network is characterized by seamless connection.

For the purpose of ensuring the security of the network and all authorized subscribers, SoftX3000 is structured with a perfect security design against malicious attack, illegal registration, anonymous calling, wiretapping, stealing accounts and other illegal acts.

1) Security in the aspect of networking applications
- Protocol interfaces that are not in use can be closed.
- Supports the complete Internet Protocol SECurity extensions (IPSec) protocol to prevent the system from being attacked by means of Denial of Service (DoS).

2) Security in the aspect of protocols and communications

Supports the security of the protocols and the encryption processing of the protocol packets, including MGCP, H.248, SIP and H.323.

3) Security in the aspect of data
- Supports the real-time data backup mechanism between the active and standby boards.
- Supports the mechanism of automatically backing up the database of the active processing unit to a flash memory.
- Supports the automatic backup mechanism of the bills.

4) Security in the aspect of subscribers
- Supports certification and authentication on all the devices attempting to access SoftX3000.
- Supports encryption and ciphering of certification information.

5) Security in the aspect of operations and maintenance

- Supports dual-certification login security management pertaining to both account and workstation IP address.
- Supports multi-level user authority management.

1.4.6 Smooth Expansion Capability

SoftX3000 is designed with a smooth expansion capability in the aspects of hardware design and system processing capability, with the potential expansion requirements of the customers taken into account.

1) Hardware design: Open Standards Telecom Architecture Platform (OSTA) is the hardware platform of SoftX3000. The platform has a modular overlap structure. By expansion of processing frames in the mode of building blocks (frames are interconnected through LAN Switch), 1 to 18 frames can be configured freely and the customers' requirements for smooth expansion can be satisfied.
2) System processing capability: The BHCA value of SoftX3000 is up to 16000k. Enough space is reserved for future service expansion, so increasing service or expansion requirements of the customers can be satisfied.

1.4.7 Optimized Charging Capabilities and Bill Management Functions

SoftX3000 has optimized charging capabilities. SoftX3000 not only supports to charge voice, data and multimedia services with several charging modes and bill types, but also provides optimized bill management functions. The main characteristics are as follows:

1) Supports multiple charging modes based on call duration, bearer capability, time segment, time category, or chargeable party (calling, called or third party).
2) Supports charging of supplementary services.
3) Supports charging of prepaid card.
4) Supports to charge Centrex groups.
5) Supports quota restricted calling and timed restriction.
6) Supports a variety of bill types, such as detailed bill, subscriber charging meter bill, trunk charging meter bill, charging meter statistical bill, trunk occupation duration statistical bill, alarm bill, failure bill, complaint bill and intelligent bill.
7) Supports bill restricted calling functions.
8) Supports to store bills depending on respective modules, services and time.
9) Supports the automatic backup, dumping, sorting and format conversion functions of bills.
10) Supports standard FTP and FTAM charging interfaces.

1.4.8 Excellent Traffic Measurement Functions

SoftX3000 provides excellent traffic measurement (traffic statistics) functions and supports multiple measurement indices and flexible measurement tasks. SoftX3000 adopts lists and graphics to display the performance data in real time, for the purpose of fully reflecting the traffic loading information and running and operation of the equipment.

1) SoftX3000 has traffic measurement and record functions. A maximum of 256 statistical tasks can be registered and conducted at the same time.
2) The traffic measurement item can be scheduled and the testing time can be preset, so that the measurement can be started and stopped at the specified date and time automatically. The scheduled measurement item can also be cancelled.
3) For the scheduled traffic measurement item, the system supports more than 4 statistical durations every day. The statistical tasks can be automatically output to different terminals and the network management center.
4) Several traffic measurement items can be combined according to your requirements. Items can be measured individually or together at a time.
5) One statistical task has up to 32 measurement items.
6) A maximum of 1000 measured objects can be supported, such as destination signaling code and media gateway.

1.4.9 Convenient and Practical Operation and Maintenance

SoftX3000 provides convenient and practical operation and maintenance functions as follows:

1) Flexible and diversified management modes. SoftX3000 adopts a distributed structure based on Client/Server, providing multiple maintenance modes such as Graphical User Interface (GUI) and MML command line. SoftX3000 supports simultaneous access to the equipment by multiple local and remote clients. The related network management network can be constructed flexibly depending on the factors including the network structure, the management requirements and the investment scale.
2) Visualized graphical user interface. SoftX3000 provides operation and maintenance interfaces by using the unique navigation tree technology. In this way, many MML characteristics and GUI advantages are reserved: it is visualized, simple and quick to operate, easy to access NMS, easy to memorize. In addition, vivid graphic network component topology view and equipment panel view are provided, thus visualized operation is provided.
3) Optimized call tracing, signaling tracing, interface tracing and message interpretation functions. A signaling analysis tool software which is independently developed by Huawei is built in to offer customers with powerful fault analysis and location capabilities.

4) Real-time fault management capability. The system receives and displays network equipment fault report in real time, so that the maintenance personnel can diagnose the fault source rapidly and precisely and take proper measures to recover the system from the abnormal service.
5) Online software patching, online debugging, remote maintenance and dynamic data setting.

Chapter 2 System Architecture

2.1 Hardware Architecture

2.1.1 Physical Structure

I. Introduction to the OSTA platform

The OSTA platform is adopted in SoftX3000 as the hardware platform. The OSTA platform has both the shared resource bus and the Ethernet bus, and enables SoftX3000 to be in good universality and high reliability. This is applicable to the exchange and transfer of variable-length data packets of the SoftSwitch equipment.

The OSTA platform is structured in a standard frame which is 19 inches wide and 9U high. Front boards and back boards are installed as shown in Figure 2-1.

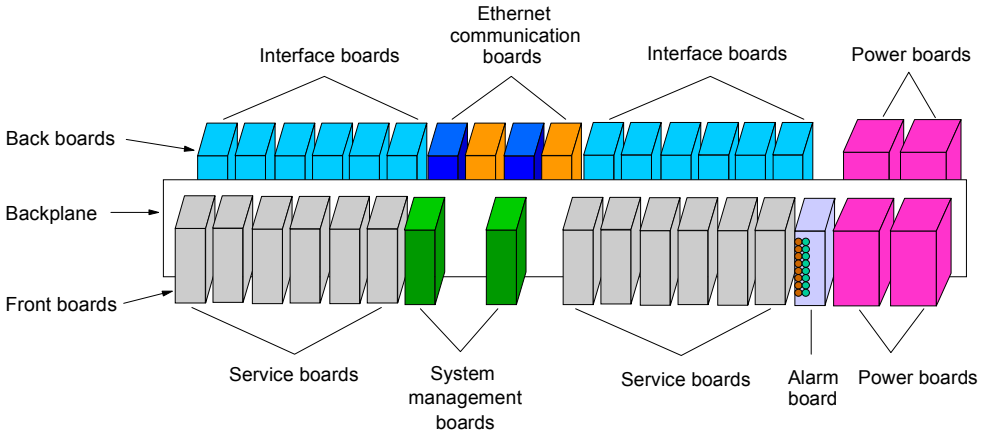


Figure 2-1 Overall structure of the OSTA frame

In the OSTA frame, front boards include service boards, system management boards and alarm boards; back boards are interface boards and Ethernet communication boards. Power boards can be installed either at the front or at the back. That front-back installation mode separates the functions of the front boards from the back boards, which simplifies the board design and orients the board functions towards unification. Therefore, the complexity of the hardware can be minimized and the reliability of the system can be improved. In addition, the board installation mode also widens the universality of the boards and enhances the flexibility of the system configuration.

In SoftX3000, all frames can be used universally in the aspect of the hardware. Each frame is designed in the width of 21 standard board slots. System management boards, Ethernet communication boards, alarm boards and power boards (occupying the width of 2 standard board slots) must be configured in the fixed slots of the frame, occupying the width of 9 standard board slots. The remaining 12 slots are used for service boards and interface boards.

II. Physical structure of SoftX3000

SoftX3000 is physically composed of OSTA frame, Back Administration Module (BAM) and iGWB (billing gateway). The OSTA frames construct the host of SoftX3000, implementing the functions of service processing and resource management. The BAM and the iGWB constitute the background of SoftX3000, implementing the functions of operation and maintenance and bill management.

The physical structure of SoftX3000 is illustrated in Figure 2-2.

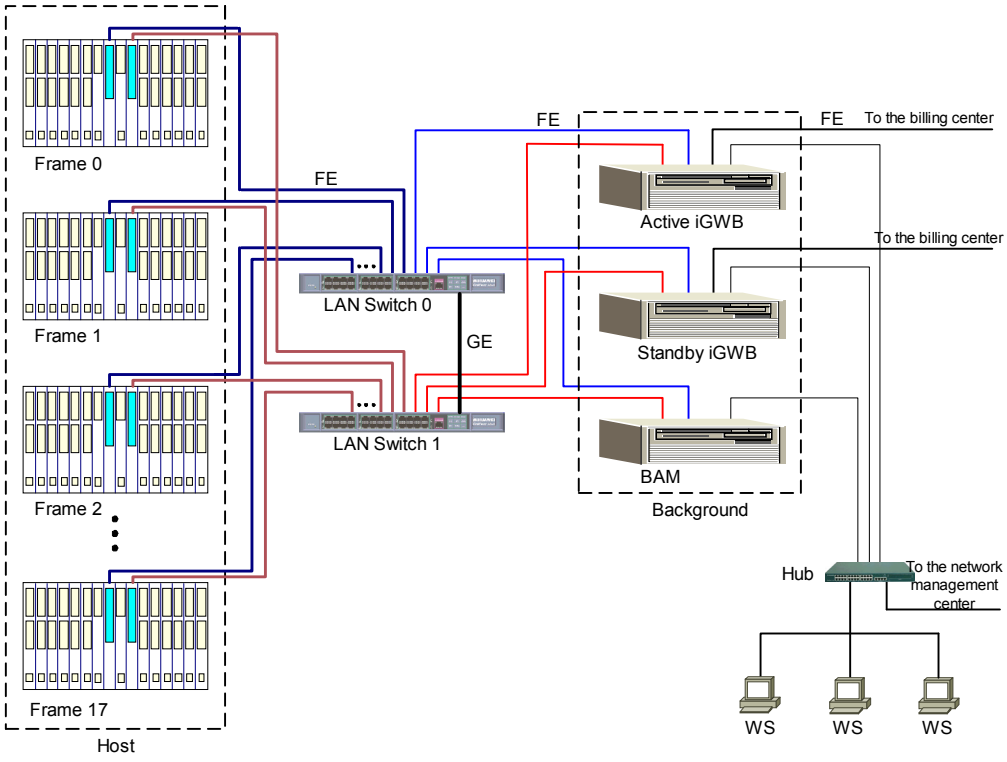


Figure 2-2 Physical structure of SoftX3000

1) Inter-device communication

- Communication between the frames is achieved through the internal Ethernet. Every frame is connected to the LAN Switches 0 and 1 through two network cables.

- Communication between the frames and the BAM/iGWB is achieved through the internal Ethernet. The BAM and the iGWB are connected to the LAN Switches 0 and 1 through two network cables.
- The BAM and the iGWB are connected to a hub through a network cable respectively. The workstations communicate with the BAM and the iGWB using the TCP/IP protocols by means of client/server.

2) Capacity characteristics of the system

In the actual applications, the capacity of the system depends on the number of configured OSTA frames ranging from 1 to 18, which fully meets the requirement of smooth expansion. For example, the configuration of one frame achieves the application of 10,000 TDM trunks or equivalent 60,000 subscribers; the standard configuration with a physically separate MRS achieves the application of 360,000 TDM trunks or 2,000,000 subscribers.

2.1.2 Logic Structure

From the functional point of view, the hardware structure of SoftX3000 is logically composed of five modules, namely line interface module, system support module, signaling processing module, service processing module and background administration module, as shown in Figure 2-3.

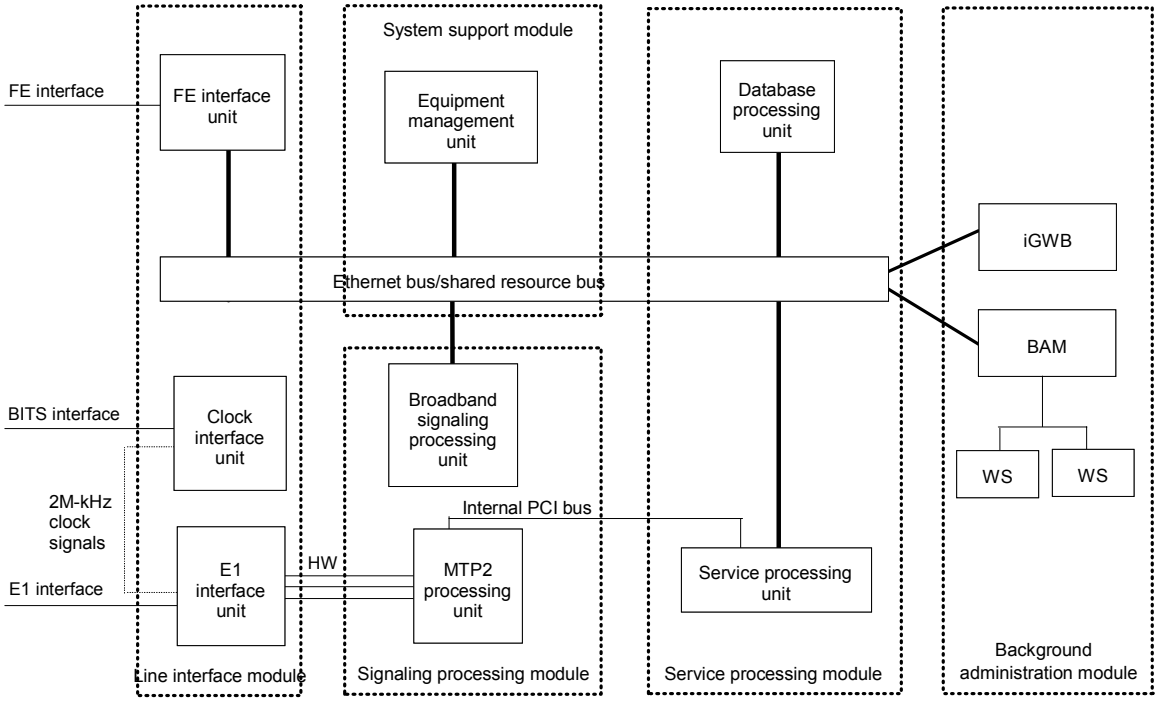


Figure 2-3 Logic hardware structure of SoftX3000

I. Line interface module

The line interface module provides a variety of physical interfaces to meet the system networking requirements, such as Fast Ethernet (FE) interface, E1 interface and Building Integrated Timing Supply (BITS) interface. Please refer to Chapter 3 for more information on the interfaces.

II. System support module

The system support module implements the functions of software loading, data loading, equipment management, equipment maintenance, inter-board communication and inter-frame communication.

III. Signaling processing module

The signaling processing module provides the lower layer processing functions pertaining to signaling or protocols, such as the processing of MTP, SIGTRAN, TCP/UDP, H.248/MGCP protocols.

IV. Service processing module

The functions of the service processing module are as follows:

- Implements the processing of layer 3 and higher protocols required for service features including MTP3, M3UA, TUP, ISUP, SCCP and TCAP.
- Provides application-layer call control functions and achieves service logics.
- Provides central database functions. Centralized resource data including inter-office trunk resources, context and termination dynamic table and MGW resource description table provides the query service of call resources for service processing.

V. Background administration module

The background administration module consists of the BAM, the iGWB and workstations. It is responsible for providing a number of maintenance and management interfaces such as man-machine interface, network management interface, billing interface. It mainly implements the functions of operation and maintenance and bill management.

2.2 Software Architecture

The software system of SoftX3000 is composed of host software and terminal Operation Administration and Maintenance (OAM) software, as shown in Figure 2-4.

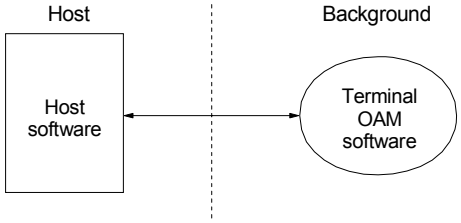


Figure 2-4 Software architecture of SoftX3000

2.2.1 Host Software

Host software runs on the main processor of SoftX3000. It is designed to implement signaling and protocol adaptation, call processing, service control and charging information generation. Along with the terminal OAM software, the host software can also perform a number of operations on the host as a response to the command from the maintenance personnel, such as data management, equipment management, alarm management, traffic measurement, signaling trace and bill management.

The host software consists of five parts: system support subsystem, database subsystem, signaling processing subsystem, media gateway control subsystem and service processing subsystem. Its overall structure is shown in Figure 2-5.

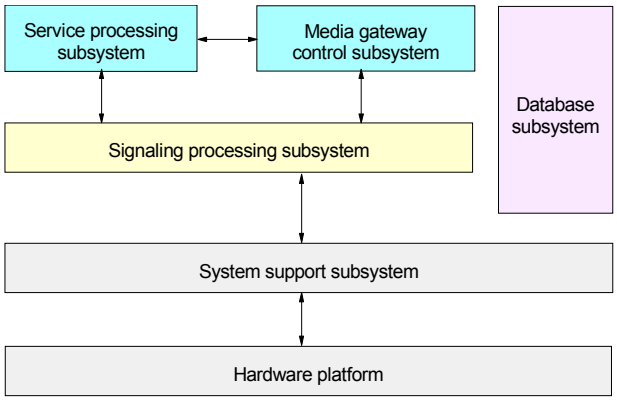


Figure 2-5 Overall structure of SoftX3000 host software

I. System support subsystem

The system support subsystem adopts the Distributed Object-oriented Programmable Realtime Architecture (DOPRA) platform of Huawei. As the software support platform of SoftX3000, it screens different operating system interfaces at the lower layers and provides unified VOS APIs for upper-layer applications. In addition, the system support subsystem also provides upper-layer applications with the realization mechanisms of

maintenance operations, alarm management, traffic measurement, call/signaling tracing, data backup, board switchover, online loading and other functions.

II. Database subsystem

The database subsystem provides a centralized database management platform where all data required for system running including hardware data, protocol data, routing data and service data are managed. The database subsystem provides messages or APIs for the service processing subsystem, the signaling processing subsystem and the media gateway control subsystem, used for query, addition, deletion and other operations.

III. Signaling processing subsystem

The signaling processing subsystem is mainly responsible for implementing bearing and processing of various signaling or protocols, such as SS7 signaling, call control signaling, signaling transport protocols and network routing protocols.

IV. Media gateway control subsystem

The media gateway control subsystem is used for management and maintenance of the gateways, as well as management and maintenance of the bearer resources on the gateways.

V. Service processing subsystem

The service processing subsystem is used to implement the variety of services provided by SoftX3000, such as basic voice services, supplementary services, IP Centrex services and multimedia services.

2.2.2 Terminal OAM Software

The terminal OAM software runs on the BAM, the iGWB and the workstations. Along with the host software, it supports maintenance personnel to implement the functions of data management, equipment management, alarm management, traffic measurement, signaling tracing and bill management on the host.

The terminal OAM software adopts the client/server model and consists of three parts: BAM server software, billing gateway software and client software. The BAM server software is installed in the BAM; the billing gateway software is installed in the iGWB. Both are considered Server. The client software is installed in workstations which are considered Client.

I. BAM server software

The BAM server software runs on the BAM. With communication server and database server integrated, the BAM server software forwards the operation and maintenance commands from all workstations to the host, and directs the response or operation results of the host to the corresponding workstation. It is the core of the terminal OAM software.

The BAM server software runs on Windows 2000 Server and uses SQL Server 2000 as the database platform. Through multiple parallel service processes, such as maintenance process, data management process, alarm process and traffic measurement process, main functions of the terminal OAM software can be achieved. The layered relationship among the BAM application program, the operating system and the database platform is illustrated in Figure 2-6.

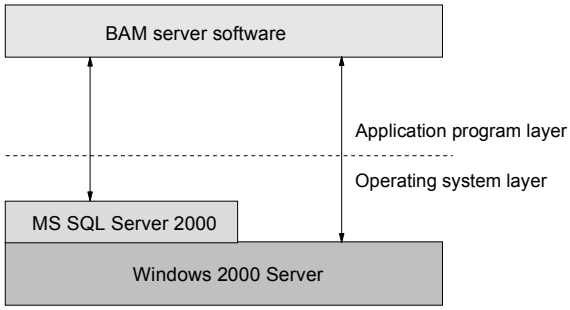


Figure 2-6 The layered relationship among the BAM software

II. Billing gateway software

The billing gateway software runs on the iGWB. As the core component of the whole bill management system, the billing gateway software stores and backs up all bills generated by the service processing modules of SoftX3000 in physical disks for billing purposes. The billing gateway software also provides billing interfaces to the billing center, supporting the FTP or FTAM protocol.

III. Client software

The client software runs on the workstations. It connects to the BAM and iGWB servers as a client in the client/server mode and provides users with MML-based service graphic terminals.

Through workstations, maintenance functions including data maintenance, equipment management, alarm management, traffic measurement, call/signaling tracing, bill management and report functions can be achieved.

Workstations can be located either locally or remotely. An example is a workstation which logs in the BAM server through a Wide Area Network (WAN) by means of dialup access.

Chapter 3 Interfaces, Signaling and Protocols

3.1 Physical Interfaces

3.1.1 Interface Types

SoftX3000 supports FE, E1 and clock interfaces. The quantity and purpose of the interfaces are shown in Table 3-1.

Table 3-1 The quantity and purpose of the physical interfaces

Interface type	Quantity (maximum)	Purpose
FE electrical interface	Host: 4	Provides bearer channels for IP-based service signaling or protocols, such as SIP, SIP-T, H.323, M2UA, M3UA, V5.2 – User Adaptation Layer (V5UA), ISDN Q.921 – User Adaptation Layer (IUA), and STUN.
	Background: 3Note	Provides bearer channels for TCP/IP-based network management or file transfer protocols, such as SNMP, MML, FTP, FTAM.
E1 interface	160	Provides both 64 kbit/s and 2 Mbit/s MTP links for SS7 signaling.
Clock interface	2.048 Mbit/s interface: 6	Connects the 2.048 Mbit/s input clock signals provided by the BITS equipment or E1 interface boards (link clock).
	2.048 MHz interface: 4	Connects the 2.048 MHz input clock signals provided by the BITS equipment.
	RS422 interface: 32	Provides 8 kHz output clock signals for the E1 interface boards of the service frames.

Note: These three FE electrical interfaces are provided by the BAM and the iGWB of the background, used for network management and billing networking.

3.1.2 Interface Specifications

I. Specifications of FE electrical interfaces

Table 3-2 Specifications of FE electrical interfaces

Item	Parameter
Compliant recommendation or standard	IEEE 802.3u
Transfer rate	10/100Mbit/s self-adaptation
Transferable distance	100 m
Frame format	10BASE-T / 100BASE-TX
Interface type	RJ-45
Nominal impedance	100 Ω

II. Specifications of E1 interfaces

Table 3-3 Specifications of E1 interfaces

Item	Parameter
Transfer rate	2.048 Mbit/s
Frame format	International Telecommunication Union – Telecommunication Standardization Sector (ITU-T) Recommendation G.703
Line code type	HDB_3
Transmission channel	32 (31 for transmission and 1 for synchronization)
Nominal impedance	75 Ω coaxial cable or 120 Ω twisted pair
Transferable distance	≥ 300 m
Interface type	SMB (when coaxial cable used)

III. Specifications of clock interfaces

Table 3-4 Specifications of clock interfaces

Item	2.048 MHz	2.048 Mbit/s
Interface type	SMB	SMB
Signal type	G.703.10	G.703.6
Detection threshold	≤ –24 dB	≤ –24 dB
Impedance matching	75 Ω	75 Ω
Balance mode	Unbalanced	Unbalanced
Electrical isolation	300 V / 50 Hz, > 1 minute	300 V / 50 Hz, > 1 minute

3.2 Signaling and Protocols

SoftX3000 provides open and standard protocol interfaces and supports a number of signaling and protocols, thus achieving interconnection or interworking with a variety of devices. SoftX3000 has powerful and flexible networking capabilities. Main signaling and protocols supported by SoftX3000 are shown in Table 3-5.

Table 3-5 Main signaling and protocols supported by SoftX3000

Protocol	Purpose	Compliant recommendation or standard
MGCP	Media gateway control protocol, used for SoftX3000 to control the media gateways and also to access MGCP packet terminals.	IETF, RFC2705, Media Gateway Control Protocol (MGCP) Version 1.2
H.248	Media gateway control protocol, used for SoftX3000 to control the media gateways and also to access H.248 packet terminals.	IETF, RFC3015, Megaco Protocol Version 1.0 (H.248)
SIP	Session initiation protocol, used for the interconnection between SoftX3000 and other SoftSwitches or SIP application servers and also to access SIP multimedia packet terminals.	IETF, RFC3261, Session Initiation Protocol (SIP)
SIP-T	The extension protocol of SIP, used for the transparent transfer of ISUP signaling.	IETF, RFC3372, Session Initiation Protocol for Telephones (SIP-T)

Protocol	Purpose	Compliant recommendation or standard
H.323	IP call and multimedia communication protocol, used for the interconnection between SoftX3000 and GKs, GWs, or MCUs in the traditional H.323 network and also to access H.323 multimedia packet terminals.	ITU-T, H.323, Packet-based multimedia communications systems
SIGTRAN	SCTP, used to provide the reliable data packet transfer service for the adaptation protocols of IP-based Switched Circuit Network (SCN) signaling.	IETF, RFC2960, Stream Control Transmission Protocol (SCTP)
	M2UA: used for the interconnection between SoftX3000 and TMGs or UMGs with built-in signaling gateway functions.	IETF, RFC3331, SS7 MTP2 User Adaptation Layer (M2UA)
	M3UA: used for the interconnection between SoftX3000 and SGs.	IETF, RFC3332, SS7 MTP3-User Adaptation Layer (M3UA)
	V5UA: used for the interconnection between SoftX3000 and UMGs with built-in V5 signaling gateway functions.	IETF, draft-ietf-sigtran-v5ua-03, V5.2-User Adaptation Layer (V5UA)
	IUA: used for the interconnection between SoftX3000 and UMGs with built-in DSS1 signaling gateway functions.	IETF, RFC3057, ISDN Q.921-User Adaptation Layer (IUA)
SS7	MTP: used for the interworking between SoftX3000 and the SS7 signaling network so that SoftX3000 can be interconnected to SPs or STPs in the SS7 signaling network.	ITU-T Q.701 to Q.707
	TUP: used for the interworking between SoftX3000 and the PSTN network so that SoftX3000 can provide TUP trunks through TMG to interconnect with PSTN exchanges.	ITU-T Q.721 to Q.725
	ISUP: used for the interworking between SoftX3000 and the PSTN so that SoftX3000 can provide ISUP trunks through TMGs and achieve the interconnection with PSTN exchanges.	ITU-T Q.761 to Q.764, Q.730
	SCCP: used to bear the INAP protocol so that SoftX3000 can be interconnected to SCPs in the IN through the SS7 signaling network.	ITU-T Q.711 to Q.716
	TCAP: used to provide the applications of SoftX3000 and SCPs with a number of functions and procedures which are not application specific, so that SoftX3000 can support the applications pertaining to IN services.	ITU-T Q.771 to Q.775
	INAP: used to define the information streams between the functional entities of the IN so that SoftX3000 can support the Service Switching Function (SSF), the Call Control Function (CCF), the Specialized Resource Function (SRF) and the Call Control Access Function (CCAF) and act as the SSP over the standard IN architecture.	ITU-T Q.1218, Q.122x, Q.123x ITU-T X.208, X.209
R2	A type of inter-office channel associated signaling, used for the interworking between SoftX3000 and exchanges of old mode so that SoftX3000 can provide R2 trunks through UMGs.	ITU-T, Q.400 to Q.499
DSS1	ISDN subscriber network signaling, used for the interworking between SoftX3000 and NASs or PBXs so that SoftX3000 can provide Primary Rate Interfaces (PRIs) through UMGs.	ITU-T I.430, I.431, Q.921, Q.931
V5	Subscriber network signaling, used for the interworking between SoftX3000 and the V5 access network or base station controllers so that SoftX3000 can provide V5.1/V5.2 interfaces through UMGs.	ITU-T G.964, G.965
STUN	Used to support the interconnection between SoftX3000 and STUN Servers (built in the BSGI board of SoftX3000).	IETF, draft-ietf-midcom-stun-02, Simple Traversal of UDP Through Network Address Translators (STUN)

Protocol	Purpose	Compliant recommendation or standard
IPSec	Used to protect the security of communications between SoftX3000 and the gateways under its control, such as IADs, AMGs, TMGs and UMGs.	IETF, RFC2401, Security Architecture for IP (IPSec) IETF, RFC2402, IP Authentication Header (IPSec) IETF, RFC2406, IP Encapsulating Security Payload (IPSec) IETF, RFC2411, IP Security Document Roadmap (IPSec)
SNMP	Used to support the interconnection between SoftX3000 and NMS devices (iManager N2000) so that SoftX3000 can provide network management interfaces (SNMP interfaces).	IETF, RFC1157, Simple Network Management Protocol (SNMP)
FTP	Used to support the interconnection between SoftX3000 and billing centers so that SoftX3000 can provide FTP interfaces.	IETF, RFC0959, File Transfer Protocol (FTP)
FTAM	Used to support the interconnection between SoftX3000 and billing centers so that SoftX3000 can provide FTAM interfaces.	ISO, ISO8571, File Transfer Access and Management Protocol (FTAM)

Chapter 4 OAM System

4.1 Introduction

4.1.1 Basic Functions of the OAM

Operation Administration and Maintenance (OAM) refers to the various tasks required to be performed by the operator on the SoftSwitch system which has been put in use. The purpose of OAM is to ensure the normal running and operation of the system so as to provide high-quality telecommunication services for users.

SoftX3000 provides MML-based man machine operation environments in a graphic way where a number of OAM functions can be achieved. The OAM functions include maintenance management, data management, alarm management, charging and bill management, trace management, signaling analysis, traffic measurement, environment and power supply monitoring.

I. Maintenance management

Maintenance management provides multiple maintenance control methods such as query, display, switchover, reset, isolation, block and activation. By using these maintenance control methods, efficient management and maintenance operations can be performed on the hardware components, system resources, signaling links, clock links and physical ports of the SoftSwitch system, as well as the gateways and terminals under its control.

II. Data management

Data management provides multiple database operation methods such as addition, deletion, modification, query, storage, backup and restoration. By using these database operation methods, efficient management and maintenance can be performed on the various data (including equipment data, gateway data, signaling data, routing data, charging data and subscriber data) which runs on the SoftSwitch system.

III. Alarm management

Alarm management receives and handles the variety of alarm information generated by the system. Depending on the category and severity level of the alarms, the appropriate alarm terminal device such as the alarm box or the alarm station will be driven to produce different audible and visual signals. Moreover, the corresponding

alarm message will be interpreted and then transmitted to the network management center through the network management interface. In addition, alarm management also has the functions to store the alarm information, query the alarm history and set the alarm processing mode.

IV. Charging and bill management

Charging and bill management provides functions to manage and operate the bill information which is stored in the host bill pool and the iGWB hard disk. The functions include updating the host charging meters, getting bills from the host, querying the bills, backing up the bills, converting the bill format, sending the bills to the billing center.

V. Trace management

Trace management provides functions such as connection tracing, signaling tracing, interface tracing and message interpretation. By using these functions, a real-time and dynamic trace can be conducted on the connection process, state transition, resource occupancy, telephone number information transfer and control information streams relating to the terminal users, trunk circuits, signaling links and interface protocols. The tracing information can be preserved for future reference. In this way, powerful fault analysis and location capabilities can be provided for users.

VI. Signaling analysis

Signaling analysis provides a built-in signaling analysis tool software which is developed independently by Huawei. The software works along with the trace management functions to analyze the signaling interaction processes in an online or offline way. Signaling analysis provides strong maintenance approaches to quickly locate the cause of a fault and also to optimize the configuration of signaling links.

VII. Traffic measurement

Traffic measurement (traffic statistics) performs measurements and statistics on the services and objects of a variety of call types. By analyzing the statistic data, the running conditions of the SoftSwitch, the gateways and the whole network can be known, which provides the basic data for the planning, design, operation, management and maintenance of the telecommunication network.

VIII. Environment and power supply monitoring

Environment and power supply monitoring performs monitoring and control, in a remote way, on the running environments, power supply devices and other intelligent devices in both central and remote equipment rooms.

4.1.2 MML Command Line

I. Characteristics of MML

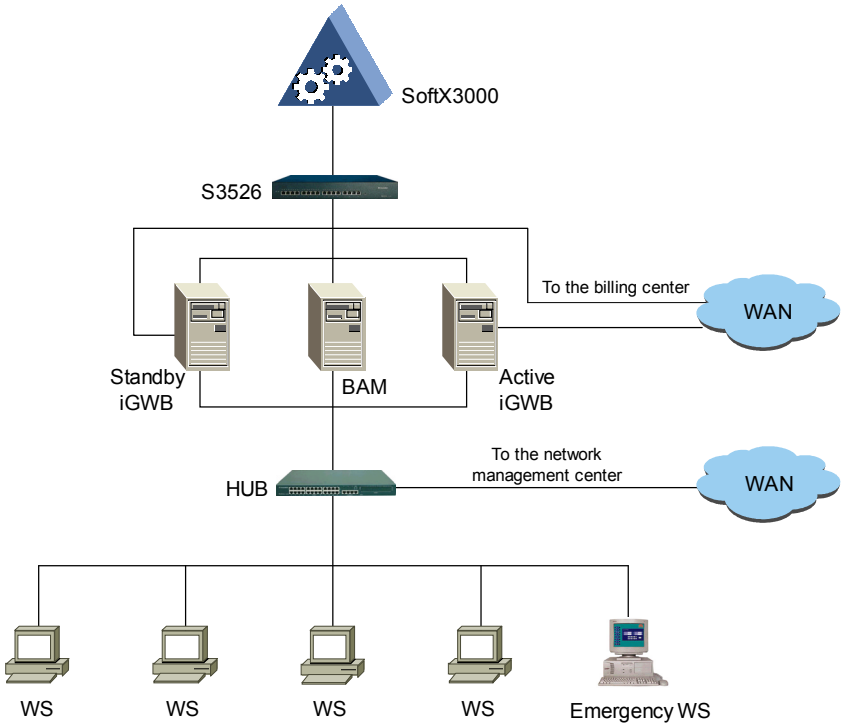
MML is a set of man-machine interactive interfaces which are compliant with the ITU-T Recommendations Z.301 to Z.341. MML provides users with a command set to operate and query SoftX3000. By means of the command set, users can perform monitoring and management on SoftX3000.

The characteristics of SoftX3000 MML are as follows:

1) The MML command set encapsulates the services of SoftX3000. One command corresponds to one function rather than a simple operation. For example, to add an ESL subscriber you should follow the steps: “modify the subscriber data index table → modify the subscriber data table → modify the subscriber equipment table → convert the format → set the host”. After the encapsulation of the MML commands, the steps become transparent. What is required is to execute one functional command to complete all the previous operations. It is unnecessary to learn what modifications are made to the database and how the modifications take effect.
2) The MML system performs the strict consistency check on the data. When a function is executed, a detection is done on the inter-table relationship, which is an effective way to avoid producing junk data.
3) The MML command set is equivalent to a group of APIs from the SoftX3000 point of view. Other application programs are all based on it. For a GUI terminal, the operations made through the terminal interfaces are translated to commands and then transferred to the MML system which is responsible for the execution of the commands and returns the results in the text way. Finally, the results will be converted to the suitable reflection on the graphical terminal. Accordingly, the stability of the system is guaranteed and the running of the whole system is influenced by a single application program issue.
4) The input and output of the MML system are based on pure character streams. Programs like TELNET are supported to interact with SoftX3000. Therefore, the client can override a variety of platforms, for example, supporting a dumb terminal without processing capabilities. It is beneficial to a centralized network management and follows the development trends of telecommunication products.

4.1.3 OAM Hardware Platform – Terminal System

The terminal system is the key hardware platform to implement OAM functions. It consists of the BAM, the iGWB and several workstations (WSs). Its structure is shown in Figure 4-1.



S3526: Ethernet switch of Huawei

Figure 4-1 Structure of the terminal system

The terminal system works in the client/server mode. The BAM and the iGWB function as the server; they are connected to the SoftX3000 host and the external computer network through the Ethernet. The WSs function as the client; they can be configured to the maintenance console, the data management console, the alarm console, the traffic measurement console and the bill console according to the specific requirements.

In the terminal system, the BAM is the hardware core to achieve the OAM functions. The BAM forwards the operation and maintenance commands from the WSs to the host and directs the response made by the host to the corresponding WS. The BAM plays the bridge role in the communications between the WSs and the host.

For the purpose of guaranteeing the reliability of the terminal system, the following measures are taken in SoftX3000:

1) Dual-plane mode is employed in the Ethernet connection between the BAM/iGWB and the host. The planes work in the active/standby way.
2) Two iGWBs work in the active/standby way, which ensures the security of bills.
3) An emergency workstation is designed as the online backup of the BAM. Whenever the BAM becomes faulty, the emergency workstation can substitute the BAM temporarily and meanwhile restore the BAM with the backup data stored on its own hard disk.

4.2 Network Management and Charging

SoftX3000 supports a variety of protocol interfaces such as SNMP, MML, FTP and FTAM. SoftX3000 can fully satisfy the networking requirements for network management and charging. A typical networking model is illustrated in Figure 4-2.

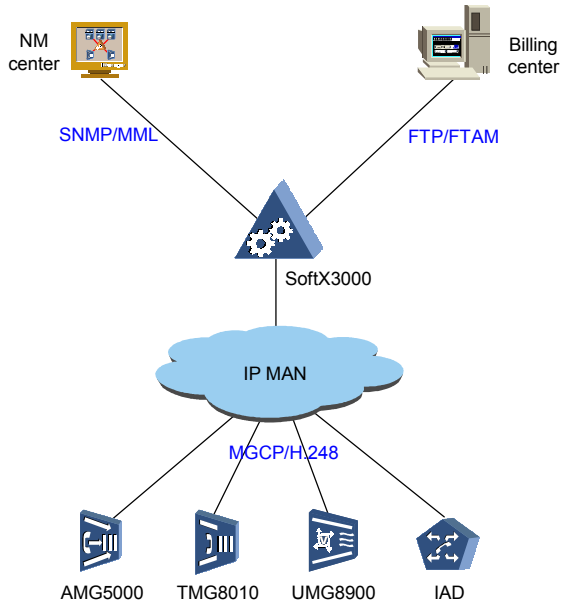


Figure 4-2 Networking model for network management and charging

4.2.1 Network Management

SoftX3000 provides SNMP/MML network management interfaces through the BAM, which enables SoftX3000 to be interconnected with the network management center. If Huawei iManager N2000 Integrated Network Management System is used at the network management center as the network management component of the whole network, the network management system has the following functions:

1) Provides MML interfaces to directly connect the BAM because iManager N2000 integrates the OAM client software of SoftX3000. It is equivalent to a remote workstation of the terminal system.
2) Provides a centralized management on the NGN network elements including AMG5000, TMG8010, UMG8900, SG7000 and IAD.
3) Provides NGN service management including registration of IAD services and management of the subscribers.
4) Provides NGN resource management including management of both equipment resources and service resources.

4.2.2 Charging

I. Charging networking

SoftX3000 supports the interconnection to the billing center using the FTP/FTAM protocol, thereby realizing the effective and fast collection of bills.

II. Bill management

- A stable storage mechanism of Call Detail Record (CDR) is provided to meet the billing requirements of the billing center.
- An automatic mechanism of fetching bills from the host bill pool is provided against overflow of the bill pool.
- A protective mechanism in the event of overflow of the host bill pool is provided in order to minimize the loss of the bills.
- A timing setting option of not automatically fetching bills is provided in order not to influence the call processing performance of the equipment at the busy hour.
- The dual-system hot backup mode is adopted in the iGWB and Hot RAID5 hard disk array is configured, which realize the dual backup and mass storage of the bill data.
- The charging meter values of subscribers and trunks can be saved in the database.
- The bills can be queried by using a number of parameters for the verification purposes.
- A classification mechanism of detailed bills, trunk bills and subscriber bills can be provided depending on the trunk group and the office direction.

Chapter 5 Services and Functions

5.1 Services

SoftX3000 provides services for users in the following ways:

I. Services provided by SoftX3000 independently

The services include basic voice services, supplementary services, IP Centrex service and IPN service.

II. Services provided by SoftX3000 along with application servers

1) Services provided by SoftX3000 with the cooperation of the SCP intelligent platform: By interconnecting with the SCP through the INAP protocol, SoftX3000 can completely inherit the existing voice intelligent network services such as FPH, ACC, VPN and UPT.
2) Services provided by SoftX3000 with the cooperation of the SIP application server: By interconnecting with the SIP application server through the SIP protocol, SoftX3000 can provide a number of value added services, which integrate voice, multimedia and Internet, such as Unified Messaging (UM), Instant Messaging (IM), IP800, presence, Personal Communication Assistant (PCA).
3) Services provided by SoftX3000 with the cooperation of the third-party or virtual carrier's application server: By interconnecting with such application servers through a Parlay gateway, SoftX3000 can provide third-party or customized services, such as enterprise workflow, enterprise schedule, personal schedule and enterprise package.

5.1.1 Voice Services

I. Basic voice services

SoftX3000 supports the basic voice services made among PSTN telephone terminals, MGCP packet terminals, H.248 packet terminals, SIP packet terminals and H.323 packet terminals.

1) Telephony calls made between the local network subscribers, including the urban subscribers, the rural subscribers and the town subscribers in the local network.
2) National/international toll auto direct-dialing outgoing calls, and national/international toll auto incoming calls.
3) Special service calls, including inquiry, complaint and fire emergency services.

4) Calls made both directly to PBX extensions and to PBX console.
5) Calls made from PBX extensions directly out.
6) Calls made with mobile subscribers and made to wireless paging subscribers.
7) Operation calls provided for the maintenance operation personnel.

II. Fax services

SoftX3000 supports group-2, group-3 and group-4 fax services. The characteristics are as follows:

1) AMG/TMG can report the fax tone.
2) AMG with fax machine attached supports the fax services.
3) Codec code switch function is supported. Codec codes can be converted to the T.38 format for the transparent transfer over the packet switched domain, for the purpose of providing users with end-to-end fax communication service of high quality.

III. Supplementary services

SoftX3000 can provide more than 40 types of supplementary services. Some frequently used supplementary services are described in Table 5-1.

Table 5-1 Supplementary services supported by SoftX3000

No.	Service type	Service description
1	Abbreviated dialing	1 to 2 digits can be used to substitute the actual telephone number which may be a local number, national toll number or international number. For example, in China 2 digits are typically adopted to substitute the actual telephone number, so one subscriber has a maximum of 100 abbreviated called numbers.
2	Hotline	This service means if a user does not dial any number in the specified time (for example 5 seconds) after picking up the phone the call will be automatically connected to a particular called party. If a user who has registered the immediate hotline service picks up the phone, the call will immediately reach the registered destination.
3	Outgoing call barring	A user can register to restrict some outgoing authorities (for example, toll calls) of a particular phone set by following a certain dialing procedure.
4	Do-not-disturb service	This service is provided for the user who does not want to be disturbed by incoming calls during some time. When a user applies for this service, all incoming calls will be answered by the exchange, but the originating services of the user will not be affected.
5	Malicious call identification	After applying for this service, a user can find out the originating telephone number by following a certain operation procedure whenever a malicious call is received.
6	Alert service	Once the alerting time set by the user arrives, the user will be alerted by the ringing.
7	Interception service	When a call is made to an absent number or a changed number or a route is blocked temporarily during the call or the user does not operate correctly to make a call, such calls will be automatically intercepted and directed to a pickup device, which avoids virtual connections of the switching equipment.
8	Call forwarding no reply	When a call is made to a certain phone set but it is not answered in the specified time, the call will be automatically forwarded to a pre-designated destination (voice mailbox or auto paging center) based on the forwarding list.
9	Call forwarding unconditional	This service enables a user to transfer incoming calls to another destination. If a user registers this service, when a call comes, the call will be automatically forwarded to a pre-designated destination (voice mailbox or auto paging center)

No.	Service type	Service description
		no matter the called subscriber is in any state.
10	Call forwarding busy	If a user registers this service, when a call comes but the called is busy, the call will be automatically forwarded to a pre-designated destination (voice mailbox or auto paging center).
11	Registered call on busy	If a user registers this service, when a call is made but the called is busy, the call will be registered. When the user wants to call this callee next time, the call will be automatically put through after the phone is picked up.
12	Absent service	If a user registers this service, when he is absent, the network will answer all his incoming calls by means of playing an announcement.
13	Call back on busy	After a user registers this service, when he dials a number but the called is busy, the served user will be automatically connected once the called becomes free.
14	Call transfer	This service enables the called user to transfer an established call to a third party in a hooking way for the purpose of establishing a new connection between the calling party and the new called party.
15	Call waiting	When user C attempts to establish a connection with user A who is in a conversation with user B, user A will be notified of an incoming call with an indication that there is a user waiting for the connection with him.
16	Three-party service	This service enables a user who is active on a call to hold that call, make an additional call to a third party, switch from one call to the other or join the two calls together into a three-way conversation.
17	Conference calling	This service enables a user to communicate simultaneously with multiple parties. SoftX3000 provides two types of conference calling: normal conference calling and auto list conference calling.
18	Designated pickup	This service allows a served user to answer a ringing phone set by dialing the corresponding prefix and the called number to be answered.
19	Secretary service	This service enables a served user to designate another telephone (secretary) to handle all his incoming calls. All incoming calls will be transferred to the secretary telephone and connections can only be established between the secretary and the calling numbers.
20	Secretary station service	This service is an enhanced type of the secretary service. When a telephone set is enabled this service, the incoming calls to the set will be queued. In other words, the incoming calls will be on-hold when the phone is busy and will be answered once the phone becomes idle. The secretary station service can hold a maximum of 5 incoming calls.
21	Calling line identification presentation	This service enables SoftX3000 to send the calling party's number to the called party and display the calling number on the called reading device.
22	Calling line identification restriction	This service enables the calling party to restrict presentation of the calling party's number to the called party.
23	Calling line identification restriction override	This service enables a served user to receive the calling party's number unconditionally.
24	Temporary reservation for calling line identification restriction	In normal cases, it is allowed to present the calling party's number to the called party; but by dialing a certain prefix before the called number, the calling party's number will not be presented to the called party in this call. (Class A subscribers)
25	Temporary reservation for calling line identification presentation	In normal cases, it is not allowed to present the calling party's number to the called party; but by dialing a certain prefix before the called number, the calling party's number will be presented to the called party in this call. (Class B subscribers)
26	Permanent reservation of calling line identification restriction	It is not allowed to present the calling party's number to the called party. That is, the calling party's number will not be presented to the called party even though the calling party dials the corresponding presentation prefix before the called number. (Class C subscribers)
27	Quota restricted calling	This service restricts a user's calling expenses. If the served user does not have enough money for the call, the system will prohibit the user to make a new call or forcedly terminate the on-going conversation. It should be noted that the quota restricted calling service is only used for chargeable calls and it has nothing to do with free calls such as special service numbers or intra-Centrex calls.

No.	Service type	Service description
28	Restriction alarm	This service enables the system to send an alarm to the BAM if the remaining chargeable fee of the served user is smaller than a certain threshold. If the served user belongs to a Centrex group, the system will send an alarm to the corresponding console simultaneously. After that, if the user continues the conversation, the system will not send any alarm until a new restriction value is set.
29	Timed restriction	This service restricts the conversation duration of each call made by a served user. Once the user's conversation expires, the system will forcedly release the call and prohibit the user from continuing the conversation.
30	Call timingly restriction	This service restricts the call authorities of Centrex subscribers in one or more time segments. That is, subscribers are allowed to make calls at the corresponding restriction level in the time segments. This service is operated by the operator through the console.

5.1.2 Multimedia Services

I. Point to point multimedia communication

SoftX3000 supports multimedia communications between SIP-based and H.323-based multimedia terminals including soft terminals. SoftX3000 supports multiple audio/video coding formats such as G.711, G.723, H.261 and H.263. Depending on the bearer network, the occupied bandwidth can be negotiated between the calling and called parties and then be adjusted dynamically.

The point to point multimedia communication services supported by SoftX3000 include:

1) Instant messaging: Allows real-time communication by means of text between one terminal user and another who has already logged in.
2) Video communication: With respective cameras installed, a terminal user can directly originate a video call to the opposite party and the appropriate video quality can be determined depending on the network bandwidth.
3) File transfer: Transfers files to another user or department where the received files can be saved under a particular directory or a specified directory.
4) Application share: A terminal user shares an application; then the opposite party can use this shared application remotely.
5) Electronic whiteboard: Both parties can write and draw on the same picture, for example, for discussion purposes. This is applicable to many occasions such as remote teaching and technical exchange.
6) Content release: The contents of advertisements and media streams can be released through a multimedia terminal, and a platform can be used to selectively locate the user or to immediately release.

II. Multimedia videoconferencing service

SoftX3000 has gatekeeper functions and supports the multimedia videoconferencing service under the control of the MCU.

1) Supports to hold the conference in reservation convening mode, and users can make reservation through telephone, e-mail or Web.
2) Supports a user to convene and control a conference by means of iDo software which runs on the user terminal and allows the user to manage the conference.
3) Supports data conferences with file transfer, electronic whiteboard, application share functions between terminals by introducing a data conference server.
4) Supports SIP packet terminals and H.323 packet terminals to act as conferencing terminals.
5) Supports both video conference and audio conference.

5.1.3 IP Centrex Services

Based on the IP network, IP Centrex services are a class of NGN value added services which inherits PSTN Centrex services and, based on them, integrates the flexibility of the IP network. Compared with the traditional Centrex services, IP Centrex services are not restricted to voice services. Instead, they integrate multimedia and data services and thus more conveniently provide an optimized and integrated communication solution for group users, such as factories, enterprises, schools, hospitals, government agencies, corporations, hotels and financial organizations.

SoftX3000 can provide a complete IP Centrex solution to support IP Centrex basic services, IP Centrex supplementary services and IP console services.

I. Major technical characteristics

1) IP Centrex service functions are all provided by the host software. There's no special requirement for separate user terminals.
2) PSTN telephone terminals are supported as IP Centrex subscribers. MGCP packet terminals, H.248 packet terminals, SIP packet terminals and H.323 packet terminals are also supported as IP Centrex subscribers. Therefore, the networking mode is very flexible.
3) IP Centrex subscribers can enjoy all PBX functions. In addition to all basic services provided for ordinary subscribers, IP Centrex subscribers can enjoy a number of supplementary services.
4) IP Centrex subscribers can be distributed on different media gateways, which help achieve the local network cross-region distribution and the wide area cross-region distribution. The latter is also known as wide area Centrex.
5) The system supports a maximum of 8000 Centrex groups. The length of the group short numbers ranges from 2 to 8 digits. The number of subscribers in each group only depends on the capacity of the controlling SoftSwitch equipment.

II. IP Centrex basic services

Table 5-2 IP Centrex basic services

No.	Service type	Service description
1	Intra-group calling out	It is possible to make a call between the subscribers in the same Centrex group by dialing the extension number (short number). The PSTN telephone number (long number) of the called party is unnecessarily dialed.
2	Out-group calling out	A Centrex subscriber dials an outgoing prefix, for example 3, and the called party's PSTN number to make a call to anyone outside his Centrex group. The outgoing prefix is determined by the Centrex subscriber.
3	Intra-group calling in	A Centrex subscriber dials the special number of the Centrex group to make a call to another subscriber in the same Centrex group. The length of the special number depends on the size of the Centrex group.
4	Out-group calling in	A subscriber outside a Centrex group dials the PSTN number of the called subscriber who belongs to the Centrex group.
5	Originating call screening	The Centrex group determines calls of which Centrex subscribers are restricted. Out-group calls of certain types can be restricted; out-group calls of all types can be restricted.
6	Emergency call	A Centrex subscriber directly dials the emergency number to make an emergency call without dialing the outgoing prefix, for example, to make a fire emergency call.
7	Distinctive ringing	SoftX3000 supports distinctive ringing for intra-group and out-group incoming calls. For example, the short ringing tone is played for intra-group incoming calls and the normal/special ringing tone is played for out-group incoming calls.
8	Call pickup	1) Co-group pickup: A Centrex group is divided into several subscriber sub-groups. If a call is made to an extension in a sub-group but no reply is received, the call can be answered by other subscribers in the same sub-group. 2) Designated pickup: If a call is made to an extension but no reply is received, the call can be answered by other extensions in the same Centrex group.

III. IP Centrex supplementary services

IP Centrex subscribers can not only enjoy all basic services and supplementary services provided for ordinary subscribers, but also can enjoy a number of new services specialized for them. Such specialized services include designated pickup, co-group pickup, remotely set call forwarding unconditional, remotely set call forwarding busy and remotely set call forwarding no reply.

IV. IP console services

SoftX3000 supports IP console services.

U-Path is an IP console product of Huawei. As a key component of the IP Centrex solution, U-Path, under the control of SoftX3000, achieves voice, data and other service functions through the pure packet switched IP network. Besides, U-Path manages the subscribers in the IP Centrex group and the services they enjoy, which contributes to the integration and abundance of Huawei IP Centrex services.

IP console services have the following technical characteristics:

1) IP access feature, which allows the console to access SoftX3000 across the IP network so that the console operator can be located far away from SoftX3000.
2) Call control functions such as call transfer, call assistance, incoming call queue, call hold and resume, re-dialing.
3) Call emergency override/transfer functions.
4) Transferring calls to a standby number in the event of console failure.
5) Calling by called party's name and calling name identification presentation functions.
6) Multi-language auto wakeup.
7) Do-not-disturb service.
8) Night service function.
9) Distinctive presentation for intra-group and out-group incoming calls.
10) Call forwarding to console on busy, no reply or do-not-disturb.
11) Forwarding charge not recorded in U-Path.
12) Console queue announcement.

5.1.4 IN Services

Fully compliant with the ITU-T Recommendations Q.122x and Q.123x series and the ITU-T Recommendation Q.1218, SoftX3000 supports SSF, so SoftX3000 can act as an SSP in the IN. With the cooperation of the SCP entity, SoftX3000 can provide users with abundant IN services.

I. Free PHone (FPH)

This service enables calls to the service subscriber to be paid by the called party. For example, if a commercial organization or a person applies for this service, the service subscriber will be charged for all the calls to the served user. As such outgoing calls are free for the calling party, they are usually called "Freephones".

II. Account Card Calling (ACC)

This service enables a user to make a call from any card reading telephone (Dual-Tone MultiFrequency phone set), and have the charges for the call automatically debited to an account number as defined by the card content. The service subscriber must be provided with a unique card number. When using this service, the subscriber should input the access code, card number and Personal Identification Number (PIN). After the network authenticates the card number and PIN input and returns the confirmative indication, the card user can make normal phone calls.

III. Virtual Private Network (VPN)

This service provides a logically private network for organizations and enterprises to make their services public by using the resources of the public telephone network.

VPN supports special numbering of the service subscriber and has flexible charging modes. The VPN special account number is charged for all outgoing calls except those made by means of personal account number by a VPN member.

IV. Universal Personal Telecommunication (UPT)

This service enables the service subscriber to access any network and originate and receive any type of calls across multiple networks by using a unique Personal Telecommunication Number (PTN), which is associated to mobility service. Depending on the requirements of the service subscriber, the UPT number can be translated into the corresponding communication number and routed for transferring the incoming calls to the proper place which is designated by the service subscriber.

V. Mass Calling (MAS)

This service is similar to the hotline service. It mainly features in the capability to prevent network congestion in the case of instant high traffic. For example, this service is probably used when it is advertised that anyone making a call to a particular telephone number during a specific time segment has a chance to be rewarded.

VI. Televoting (VOT)

This service is provided for consultation or opinion survey. The enterprises, government branches, or commercial organizations requiring opinion survey can apply for one or multiple televoting numbers for investigating mass opinions by means of the telephone network. Accordingly, people can dial the several specific televoting numbers to register their votes or dial one televoting number to express their opinions by following the recorded announcement to press phone set keys.

The network will perform statistics on the number of the calls to a specific televoting number as well as people's opinion information. The service subscribers can query the statistical information by means of a terminal or a DTMF phone set at any time.

There are three types of VOT:

- Simple VOT: Only televoting is provided. Other activities such as reward are not provided.
- Single VOT: Simple VOT and reward are provided.
- Multiple VOT: There are item codes, not opinion codes. A VOT number represents an item. People need to follow the system provided voice prompt to express their opinions. A service subscriber may apply for this service with or without reward.

VII. Wide Area Centrex (WAC)

This service enables a Centrex group distributed over different exchanges to operate on the same virtual private network. Calls between the WAC users under the same

Centrex exchange are completed in the exchange itself. Calls of independent users or across different Centrex exchanges are completed with the help of SSP and SCP.

VIII. Number Portability (NP)

This service enables a subscriber to retain the original number after the subscriber's geographical location, serving carrier or enjoyed services are modified.

All incoming calls to the NP subscriber's old number will receive a voice prompt indicating the original number has been changed, before the calls are automatically transferred to the new number. For outgoing calls, the calling number is the same.

A user demanding for this service can apply for it and specify the service life. During the specified service life, the subscriber's original number will be preserved, not allocated to others, until the subscribed service expires.

IX. IP800

This service enables all calls to the service subscriber, on the IP network, to be paid by the called party. The 800 service subscriber who applies for the service specifies the real destination number corresponding to the 800 number. The destination may be a PSTN telephone number, an IP terminal number, an IP address or the user's ID. The 800 service users who enjoy the service are the variety of users on the IP network. They can click the 800 number in a Web page or dial the 800 number to make a phone call.

5.1.5 IPN Services

A variety of NGN terminals are provided with uniform Internet personal numbers. Examples of supported terminals are Ephone subscribers directly connected to SoftX3000, Ephone subscribers connected through IAD or AMG, and PSTN subscribers or mobile subscribers connected through TMG. An IPN user may own several terminals. However through a uniform IPN number, the user can originate calls at any place by using any of the terminals through the same account (that is, the same IPN number). Meanwhile, others can make calls to that IPN number to find the user. According to the IPN rules, the calls are routed to the corresponding destination to achieve a roaming-like function.

SoftX3000 supports IPN calling service, IPN called service, IPN dynamic rule, IPN static rule, as well as an optimized IPN charging ability.

I. IPN calling service

The IPN calling service enables a service subscriber to originate calls by using the IPN number. In this case, the IPN calling service is similar to the pre-paid card service provided by the IN. The IPN number is charged for the calls.

It is unnecessary to register the IPN calling service. Once this service is enabled, the subscriber can enjoy it by using the allocated IPN number through various terminals. When a call is originated from an Ephone, or a PSTN phone set or an ordinary soft terminal, this service adopts the dual stage dialing IVR procedure to implement the call. When a call is originated from OpenEye (a soft terminal developed by Huawei), this service also supports the single stage dialing procedure to implement the call.

II. IPN called service

The IPN called service enables calling parties to originate calls to the service subscriber by dialing the subscriber's IPN number. In this case, SoftX3000 will route the calls to the called party (that is, the service subscriber) depending on the communication mode and the communication policy (such as a PSTN number, a mobile terminal number, a voice mailbox) pre-determined by the subscriber, so that the subscriber can receive the calls in any place at any time. The purpose is to achieve a flexible roaming function.

III. IPN dynamic rule

The IPN dynamic rule enables a service subscriber to register or cancel the IPN called service by using a phone set. For example, the subscriber dials 166 on a PSTN phone set. According to the prompting announcements, the subscriber inputs the IPN number, the IPN password, and then inputs 6 during the function selection. Subsequently, the subscriber can register the called destination number of the IPN. The called destination number may be the number of the phone set on which the registry is performed; the called destination number may also be a different telephone number. Once the dynamic rule is confirmed, all the calls to the service subscriber will be routed to this called destination number.

It should be noted that the IPN dynamic rule is prior to the IPN static rule. If no data is set in the IPN dynamic rule, the IPN static rule will take effect. If data is set in the IPN dynamic rule, the system will not use the IPN static rule even though the calls fail to be connected.

IV. IPN static rule

The IPN static rule enables a service subscriber to perform management operations by means of Web self-service. SoftX3000 supports to select a policy based on sequence

or based on time. The service subscriber can set different static policies, but only one of them takes effect at any time.

1) Sequence-based policy: The system supports a maximum of five destination numbers. If the calls fail to connect the first destination number or no reply is received from the first destination number, the calls will be routed to the second destination number. Such a selection will go on in this way until a reply is received or all the destination numbers cannot be connected successfully.
2) Time-based policy: The system supports five time segments per day to select a policy. During each time segment, this service enables the service subscriber to bind the IPN number with a different destination number.

V. IPN charging

There are two types of IPN charging, namely pre-payment and post-payment. The pre-payment type allows the service subscriber to transfer money to the IPN number in advance which will be charged for all the calls in the real-time way. The post-payment type is similar to the charging mode of an ordinary PSTN phone set, such as charging every month. The service subscriber must regularly pay the carrier the communication fee consumed in a specific period (for example, a month) by means of cash or through bank.

5.1.6 UC Services

Unified Communication (UC) services refer to the various value added services provided by SoftX3000 with the cooperation from an SIP application server and a third-party application server. The UC system of Huawei adopts the Info-Tech (IT) system developed by Microsoft or IBM as a third-party application server that cooperates well with the U-SYS solution to provide a variety of value added services for users.

I. Click To Dial (CTD)

This service enables a subscriber to be in a VoIP communication through the packet based network with another pre-determined subscriber by clicking a link on a Web page. These two subscribers can be IP telephone terminals which are identified by IP telephone terminal number, personal computers which are used by the users to view Web pages, or ordinary PSTN phone sets which are connected to the packet network through packet gateways and identified by E.164 telephone number.

II. Click To Fax (CTF)

This service enables a subscriber to transfer determined fax information to the called subscriber through the VoIP network by clicking a link on a Web page. SoftX3000

supports both the INAP extensions and the T.38, and can transfer fax information to a fax machine.

III. Unified Messaging (UM)

This service enables a subscriber to receive e-mail messages, voice mailbox messages, voice messages, video pictures, short messages and fax information, as well as viewing motion pictures.

IV. Instant Messaging (IM)

This service enables several subscribers to exchange content information in real time. Usually the content information is in the text format and does not need to store. The IM service is different from the e-mail messaging system. In the IM service the characteristic of real-time transfer of text messages is provided. The communication between IM subscribers are still based on text messages.

Combining instant messaging with mobile messaging, Internet messaging and fixed messaging, mobile subscribers, Internet subscribers and fixed terminal subscribers can have a chat in a multimedia manner.

V. Phone To IM

This service enables IM subscribers to communicate in the voice manner. With the proper IM number, telephone subscribers including PSTN telephone terminals, SIP packet terminals and H.323 packet terminals can be in a voice communication with IM subscribers.

After a telephone subscriber dials the IM access code, a voice prompt is played to the telephone subscriber and the dialed IM number is collected. The IM service makes a judgment on the current state of the IM subscriber, for example, whether the IM subscriber is on the Internet and whether the IM subscriber can receive voice communication. And then a voice channel is established between the telephone subscriber and the IM subscriber. Subsequently, the IM subscriber can communicate in a voice manner with the telephone subscriber, for example, by using an earpiece and a microphone connected to the computer; the IM subscriber can also communicate in the text way with other IM subscribers.

VI. Web self-service

This service integrates the next generation voice network and Internet technology. In Web pages, a subscriber can query the charge, bill, subscriber properties information conveniently, and customize supplementary services and online payment. Instead of the complicated operations of PSTN, this service enables the subscriber to customize personal services easily by means of Web GUI. In addition to the convenience for the

subscriber, Web self-service, as a special service featuring the advantages of NGN has advanced the applications of various services, thus increasing the service profit of the carrier.

VII. Presence

This service enables a subscriber to modify or publicize the current communication status of the subscriber himself, and even the feeling and the mood of the subscriber himself. Besides, this service enables other users to subscribe to the current status of the presence service subscriber. Whenever the communication status of the presence service subscriber changes, the presence service notifies the corresponding users of the change.

For example, user A subscribes to the telephone status of user B by the presence service. Once user B's telephone status moves from the conversation status to the available status (for example, the user hooks on), the presence service notifies user A of the change by means of e-mail, Short Message Service (SMS) or IM. And then user A can select the most appropriate communication way to contact user B.

The presence service can also be combined with other services and provide the subscriber's status information for those services. For example, the presence service is combined with the multimedia conferencing service. The multimedia conferencing service can display the attendance status of the conference members by using the status information provided by the presence service.

VIII. Personal Communication Assistant (PCA)

This service provides a number of functions to realize the management of personal information. For example, a subscriber can put all personal information in the network including the address book, schedule, e-mail address, voice mailbox, fax mailbox, preferred news, preferred stocks. The subscriber operates such information through Web pages or by means of voice interfaces to build a personal communication assistant.

IX. Integrated communication VPN service

The integrated communication VPN service not only inherits all the features of the VPN service based on the traditional PSTN, but also has new service features brought by the integration of the networks. These service features may be the enhancement of the original features, such as the communication between a PSTN telephone and a mobile telephone in the network. They may also be new service features, such as the multimedia communication capability. As NGN is an integrated and open network architecture, a variety of user terminals can be used in the integrated communication VPN service, such as PSTN telephones, mobile phones, SIP phones, pagers, personal computers, fax machines and even personal digital assistants. The integrated

communication VPN service subscriber is no longer restricted to voice calls. The service subscriber can also enjoy digital and video communications.

5.2 Functions

SoftX3000 supports multiple unique functions or features, satisfying the requirements of various networking or applications.

5.2.1 Support for Multi-Country-Code and Multi-Area-Code Functions

As NGN adopts a high-speed packet switched network as its core bearer, it is made possible for a carrier to network across several regions and countries by using SoftSwitch equipment. This is a good way to reduce the investment of the network construction and improve the marketing competitive power of the carrier.

In a pure software manner, SoftX3000 simultaneously supports multi-country-code and multi-area-code functions to fully satisfy the across-region and across-country networking requirements of the carrier:

1) Simultaneously supports 50 country codes, ensuring the correctness of calling number transmission and number analysis.
2) Simultaneously supports 500 area codes, ensuring the correctness of calling number transmission and number analysis.
3) The nature of service of the calls between multiple area codes is national toll calls, which can be flexibly charged.
4) The E.164 numbers of the users using different area codes can be the same, that is, E.164 numbers can be repeatedly used.

5.2.2 Support for Multi-Signaling-Point-Code Function

SoftX3000 can function as a gateway office, supporting a maximum of 32 local signaling point codes. This breaks through the limit of 4096 (2^{12} = 4096) SS7 trunk circuits supported by a single office direction at most, and extends the number of SS7 trunk circuits supported by a single office direction to 130000. This fully satisfies the requirements of a gateway office for a large capacity of trunks.

5.2.3 Support for Dual-Homed Bastion Host Function

As NGN is an open and distributed network, media gateways can access the SoftSwitch at any location through the IP packet network. However, because of the complexity issues of the network, a variety of natural disasters, and the reliability issues of the SoftSwitch, media gateways will lose the control of the SoftSwitch in the event of an interruption of the network, an earthquake where the equipment room is resident, or a fault of the SoftSwitch equipment; media gateways cannot provide services for users.

This will directly influence the service quality of the carrier, and then the users will complain about this.

To solve this problem, SoftX3000 provides a dual-homed bastion host control mechanism. That is, a media gateway device can simultaneously home at two independent SoftX3000s, one of which acts as an active Media Gateway Controller (MGC) and the other as a standby MGC. A real-time backup mechanism between the SoftX3000s guarantees the data consistency of the controlled media gateways. Whenever the active SoftX3000 becomes faulty, the standby one immediately receives the control of the media gateways against interruption of the services, so that the reliability of the system can be improved and the disaster-proof ability of the network can also be enhanced.

5.2.4 Support for Gateway Office Functions

SoftX3000 supports a number of gateway functions such as black and white lists, call authentication and call interception. Depending on the calling subscriber's number or incoming trunk's identifier, SoftX3000 can bar or allow incoming calls from certain calling subscribers or incoming trunks to certain destination numbers, including intra-network calls, national toll calls, international toll calls, and other voice services and multimedia services.

SoftX3000 acting as an inter-network gateway office has the following technical characteristics:

1) Comprehensive authentication and interception capabilities: SoftX3000 can conduct flexible authentication based on the calling number or calling number prefix, calling subscriber's category, outgoing/incoming trunk group identifier, nature of call service, destination number (called number or called number prefix), calling time. SoftX3000 provides authentication capability associated with black and white lists. The capacity of the black and white lists is up to 2,000,000.
2) Precise and flexible charging capabilities: SoftX3000 provides two charging modes, namely meter and detailed bill, and allows 100% calls to have a bill. The duration precision in the bill is 1 second. Bill statistics function is supported based on the tariff, date and time, destination number, trunk group and area code, for routine maintenance and settlement purposes.
3) Strong and secure bill storage and transmission capabilities: SoftX3000 adopts a three-level bill storage mechanism (host, bill server, billing settlement center), so that bills can be stored and transmitted securely, rapidly and reliably.

5.2.5 Support for IP Supermarket Function

IP supermarket refers to IP toll call services deployed by the carrier at telephone business outlets, for example, telecommunication business halls. The IP supermarket

function of SoftX3000 is provided in the IP Centrex manner. U-Path (IP console) is used to charge all calls made at the IP supermarket business hall. The technical characteristics are as follows:

1) High connection speed.
2) Precise charge.
3) Centralized management. One console is able manage tens of phone sets.
4) Simple and convenient operations. Telephone authorities can be enabled and disabled only by using the mouse of the computer. Whenever a telephone hooks on, a bill is printed immediately. In addition, deposit management and change returning function are completed.
5) Statistics and analysis functions.
6) Level and authority management functions, that is, authority management for logging on to the console.

Chapter 6 Networking and Applications

6.1 System Networking

6.1.1 Packet Multimedia End Office

Multimedia application is one of key characteristics of NGN. Being a large-capacity SoftSwitch equipment, SoftX3000 supports multiple media gateway control protocols and multimedia communication protocols such as MGCP, H.248, SIP and H.323. Therefore, SoftX3000 can act as a packet multimedia end office. A typical networking model is illustrated in Figure 6-1.

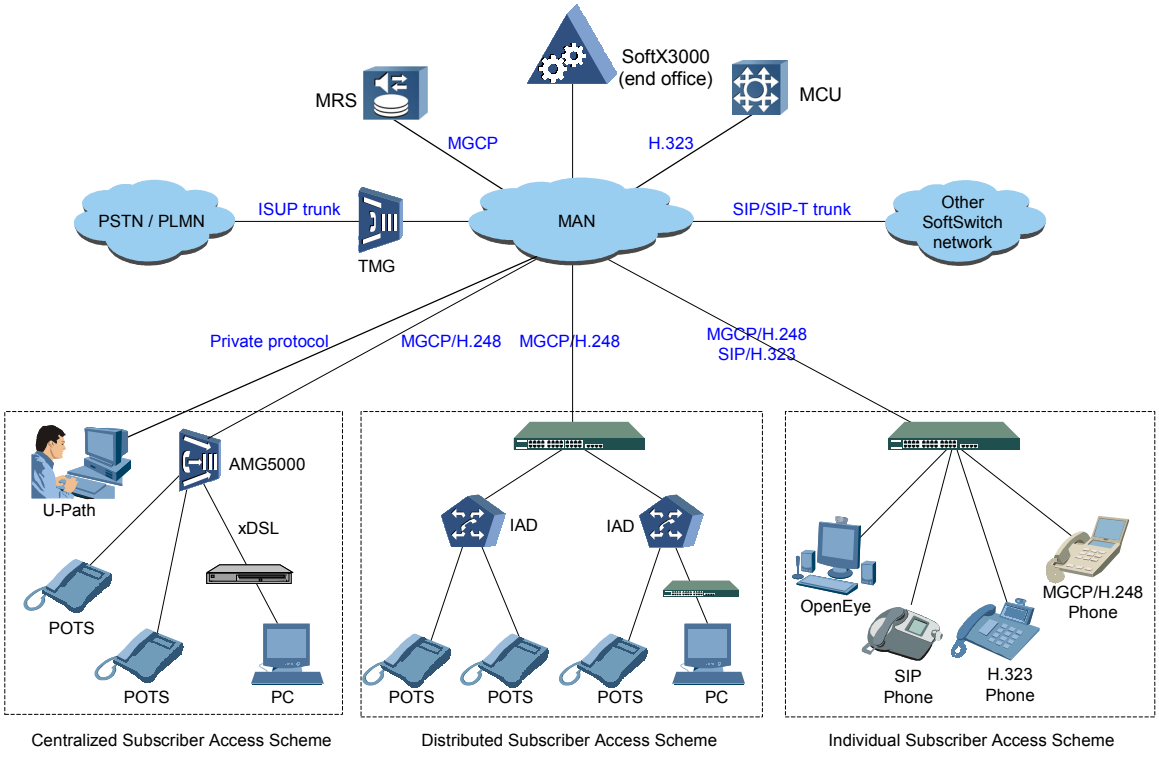


Figure 6-1 Typical networking model of packet multimedia end office

1) Centralized subscriber access scheme: This scheme is designed for the access of a high density of subscribers where an AMG5000 is used for the access realization. The AMG5000 is connected to SoftX3000 in the MGCP/H.248 protocol to achieve voice call and value added services. Meanwhile, the AMG5000

supports xDSL subscribers to achieve the integrated access of both voice and data.

2) Distributed subscriber access scheme: This scheme is designed for the access of a small capacity of voice and data subscribers who are relatively centralized. An IAD is used and connected to SoftX3000 in the MGCP/H.248 protocol to achieve voice call and value added services. Meanwhile, an IAD with data access functions can be used as a LAN Switch for the access of data subscribers in the Ethernet manner.

3) Individual subscriber access scheme: This scheme is designed for the access of OpenEyes, SIP Phones, H.323 Phones, MGCP packet terminals, H.248 packet terminals to SoftX3000 to achieve voice and multimedia services. Meanwhile, intelligent terminals can also implement a variety of individualized services and subscriber management.

6.1.2 Packet Tandem Office

SoftX3000 supports a number of routing functions such as the plane static routing, the layered static routing and the dynamic routing. SoftX3000 can act as a packet tandem office. A typical networking model is illustrated in Figure 6-2.

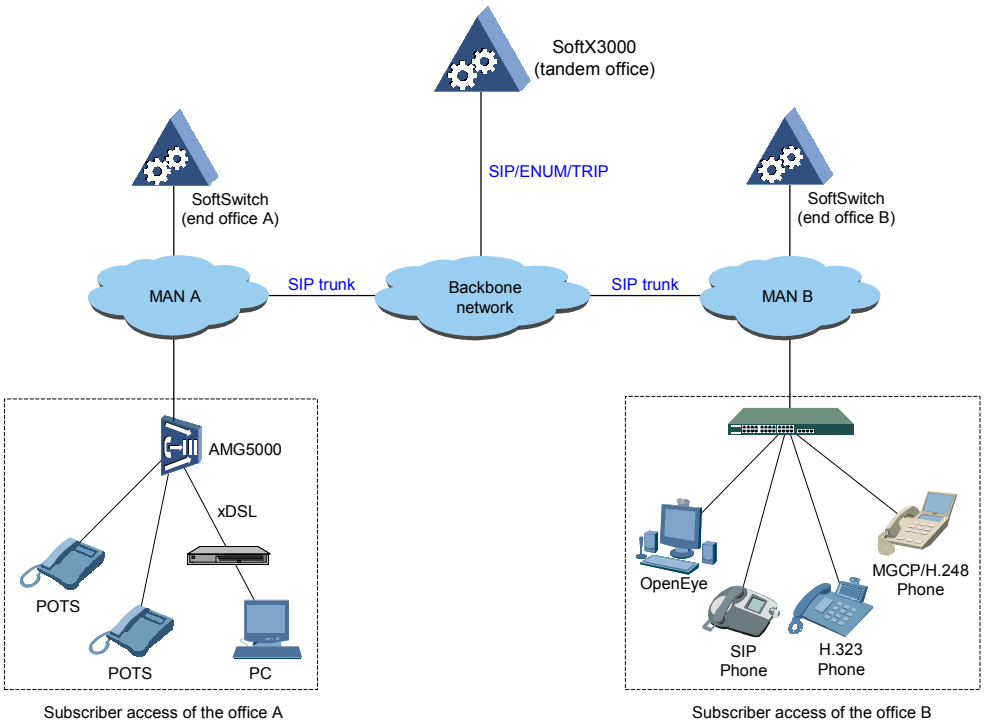


Figure 6-2 Typical networking model of packet tandem office

SoftX3000 satisfies two networking applications under the layered routing structure:

1) Layered SoftSwitch structure mode

In this mode, SoftX3000 adopts the plane static routing and transits the incoming calls from the end offices by means of SIP trunk.

2) Layered location server mode

In this mode, SoftX3000 adopts the layered static routing or the dynamic routing, equivalent to a location server. The end offices implement the routing function by sending an address resolution request to SoftX3000.

6.1.3 Packet Gateway Office

SoftX3000 supports gateway functions such as black and white lists, call authentication and call interception. SoftX3000 can act as a packet gateway office. A typical networking model is illustrated in Figure 6-3.

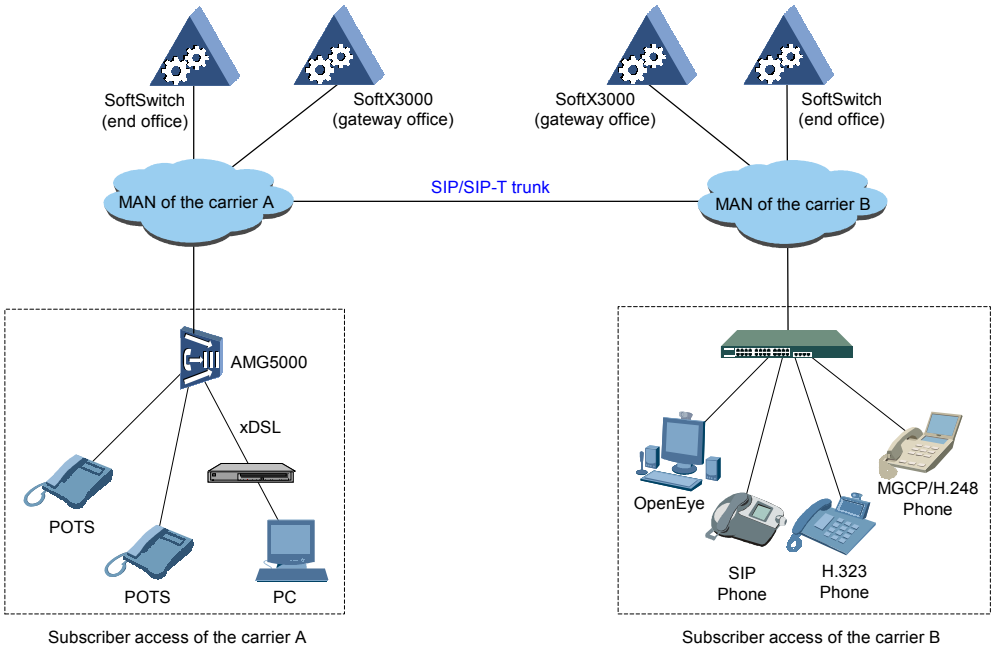


Figure 6-3 Typical networking model of packet gateway office

In the actual networking applications, the carrier can adopt any of the following modes to construct a gateway office:

1) In the case of a large-scaled local network, an independent SoftX3000 is used to act as the gateway office.
2) In the case of a small-scaled local network, a SoftX3000 is used to act as both the end office and the gateway office.

6.1.4 C5 Office (End Office)

SoftX3000 supports a number of signaling transport adaptation protocols including M2UA, V5UA and IUA, and supports a number of PSTN signaling including MTP, ISUP, R2, V5.2 and DSS1. When cooperating with Huawei UMG8900 and TMG8010, SoftX3000 can act as a C5 office (end office) in the traditional PSTN. A typical networking model is illustrated in Figure 6-4.

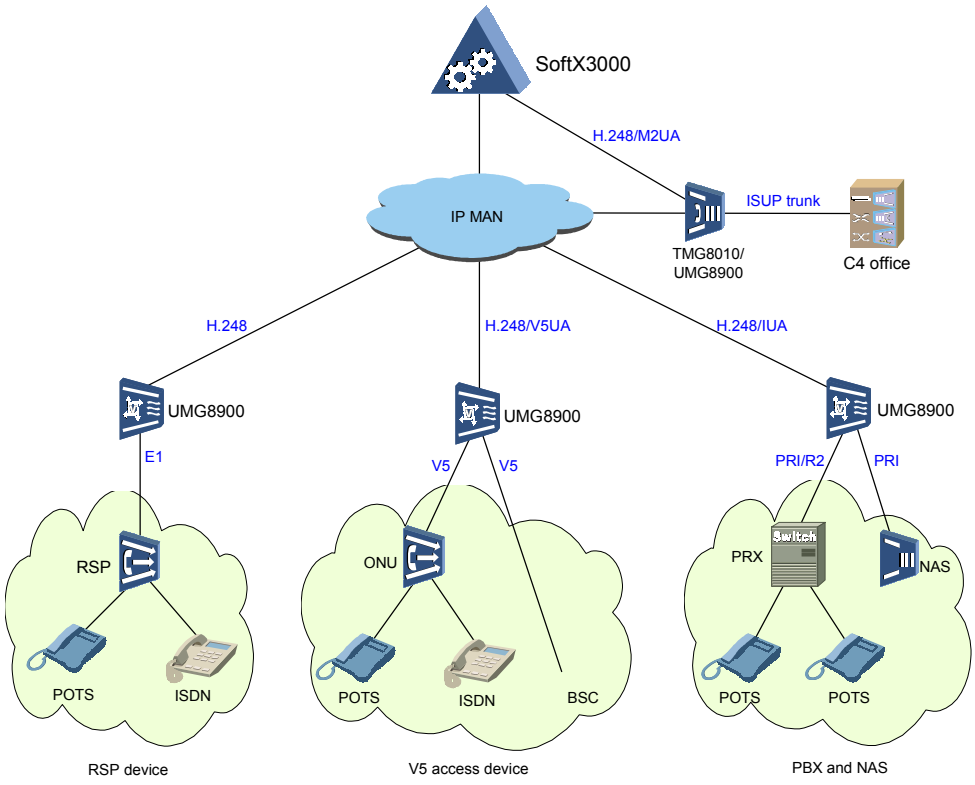


Figure 6-4 Typical networking model of C5 office (end office)

I. Interworking with Remote Subscriber Processor (RSP)

As part of the feature applications of UMG8900, the RSP device accesses UMG8900 through the internal protocol interface (called E1 interface physically). SoftX3000 controls the services in the H.248 protocol. A large-scale application can thus be achieved, for example 200,000 subscribers. This is a most applicable solution to re-build the existent PSTN exchange network.

II. Interworking with V5 access device

SoftX3000 can provide standard V5.1/V5.2 interfaces with the cooperation of Huawei UMG8900, achieving the interworking with access network devices and base station controllers (for example, Huawei ETS450).

III. Interworking with PBX and NAS

SoftX3000 can provide standard PRIs or R2 trunks with the cooperation of UMG8900, achieving the interworking with PBX and NAS.

6.1.5 C4 Office (Tandem Office)

SoftX3000 supports M2UA, M3UA, MTP and ISUP. When networking with Huawei UMG8900, TMG8010 and SG7000, SoftX3000 can act as the C4 office (tandem office) in the traditional PSTN network. A typical networking model is illustrated in Figure 6-5.

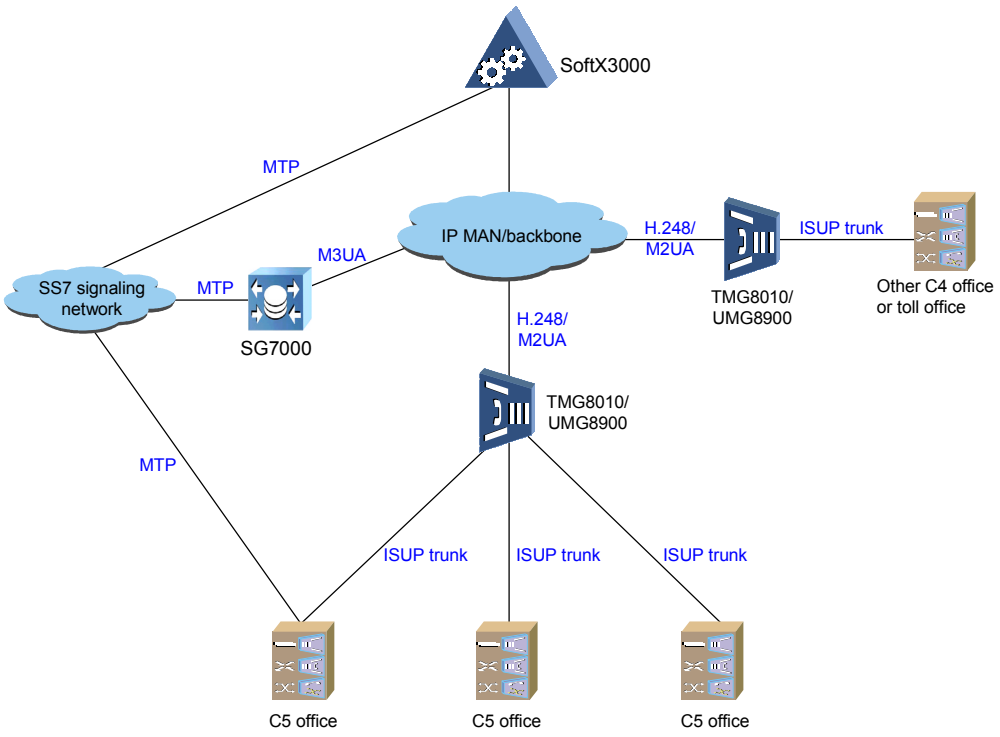


Figure 6-5 Typical networking model of C4 office (tandem office)

There are three networking cases for SoftX3000 to interwork with a C5 exchange.

1) In case of M2UA, SoftX3000 can interwork with a C5 exchange through Huawei TMG8010 (or UMG8900) as Huawei TMG8010 and UMG8900 have built-in signaling gateway functions. This networking model is a price-competitive solution.

2) In case of M3UA, SoftX3000 interworks with a C5 exchange through TMG8010 (or UMG8900) and SG7000. TMG8010 (or UMG8900) implements the media stream conversion functions. SG7000 achieves the signaling conversion functions.
3) In case of MTP, SoftX3000 interworks with a C5 exchange through TMG8010 (or UMG8900) and SS7 signaling network. TMG8010 (or UMG8900) only implements the media stream conversion functions. SoftX3000 achieves the signaling point functions, that is, providing MTP links.

6.1.6 Interworking with H.323 Network

As H.323-based IP telephone network is widely used, attention should be focused on the interworking with the existent H.323 network when constructing a softswitching network. SoftX3000 interworks with the existent H.323 network in the H.323 protocol, equivalent to a gatekeeper. A typical networking model is illustrated in Figure 6-6.

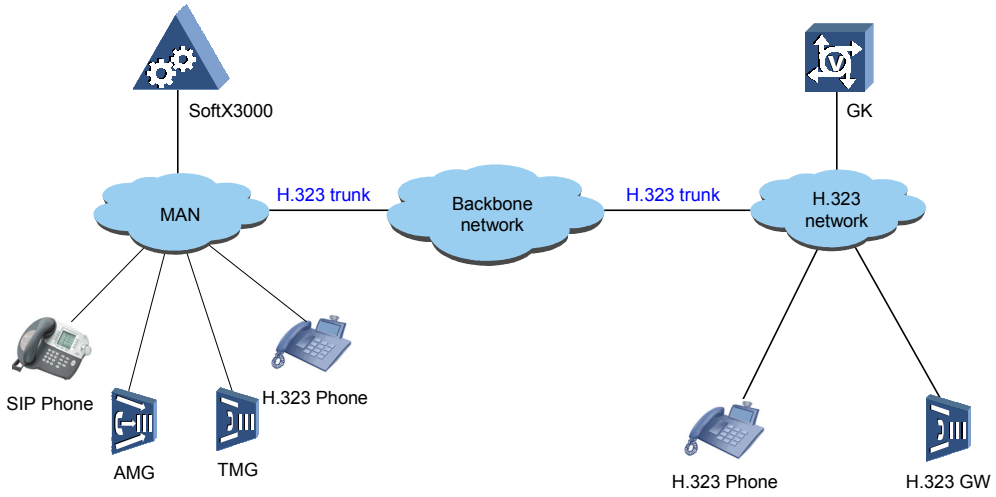


Figure 6-6 Interworking with H.323 network

When the SoftSwitch network and the H.323 network are owned by different carriers, the interworking point is resident between the local SoftX3000 and the top-level gatekeeper of the opposite party. When the SoftSwitch network and the H.323 network are owned by the same carrier, the interworking point is determined by the carrier depending on the actual conditions of the network construction.

6.1.7 Interworking with IN

SoftX3000 supports SCCP, TCAP, INAP, and provides SSF, CCF, SRF and CCAF. SoftX3000 can act as an SSP in the IN. A typical networking model for the interworking with IN is illustrated in Figure 6-7.

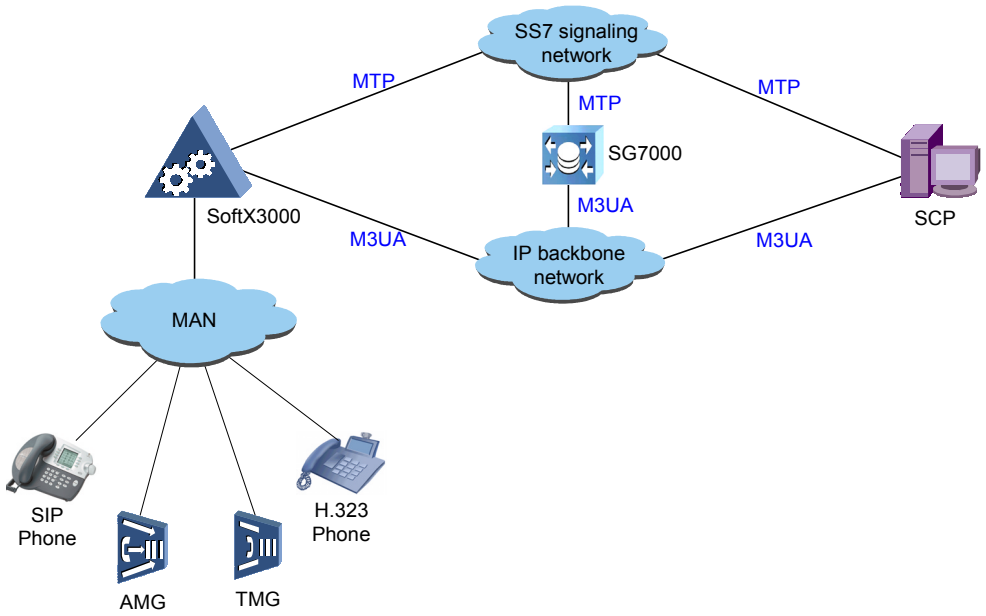


Figure 6-7 Interworking with IN

In the actual networking applications, the carrier can adopt any of the following modes for interworking with SCP:

1) Both SoftX3000 and SCP provide MTP links to the SS7 signaling network. The INAP protocol of both parties is borne over TCAP/SCCP/MTP.
2) Both SoftX3000 and SCP provide M3UA links to the IP core network. The INAP protocol of both parties is borne over TCAP/SCCP/M3UA/SCTP/IP.
3) SoftX3000 provides M3UA links to SG7000; SCP provides MTP links to the SS7 signaling network. SG7000 is responsible for the conversion of the protocols. At the SoftX3000 side, the INAP protocol is borne over TCAP/SCCP/M3UA/SCTP/IP; at the SCP side, the INAP protocol is borne over TCAP/SCCP/MTP.

6.1.8 Interworking with SIP Network

SoftX3000 supports the SIP protocol and can interwork with SIP application server in the SIP network. A typical networking model for the interworking with the SIP network is illustrated in Figure 6-8.

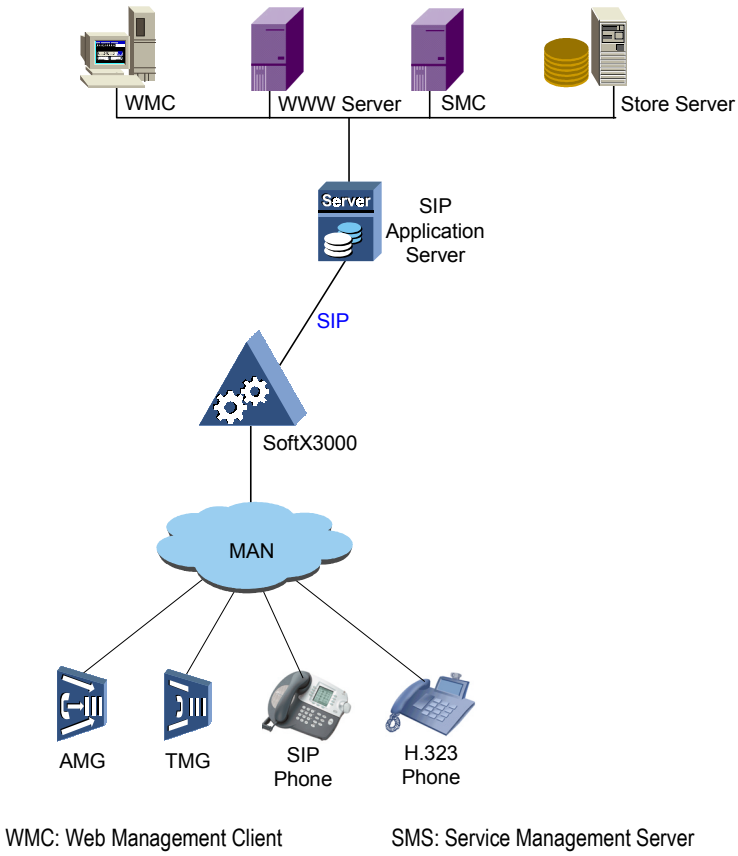


Figure 6-8 Interworking with SIP network

The SIP network application solution furthest reflects the bearer advantages of the packet-based services of NGN. In Figure 6-8, SoftX3000 provides call control functions, and the SIP network provides services. Their cooperation enables users to enjoy SIP-based voice services and other services with voice and Internet integrated.

6.1.9 Interworking with Parlay Gateway

The Parlay system provides resource positioning, certification and authorization functions for the external applications accessing the IP-based Parlay services, thus the development, management and application of value added services can be realized even without the upgrade of the SoftSwitch equipment.

SoftX3000 supports the INAP and SIP protocols, and can interwork through the Parlay gateway with the application servers provided by a third party or a virtual carrier. A typical networking model is illustrated in Figure 6-9.

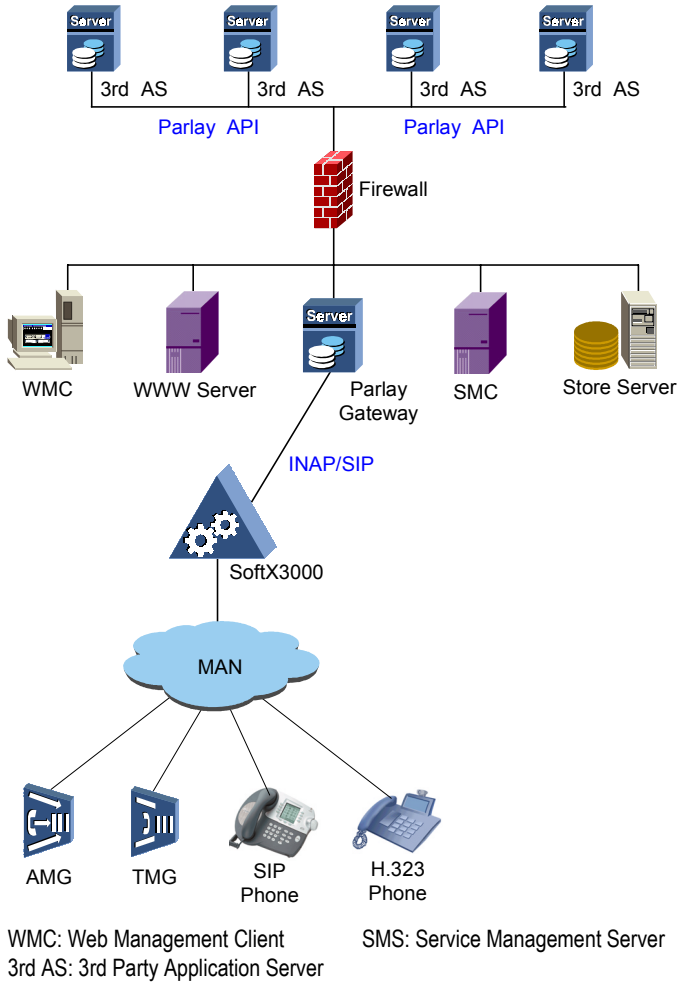


Figure 6-9 Interworking with Parlay gateway

Figure 6-9 illustrates a solution for the applications of an open network where the carrier provides a platform for service running purposes and open APIs. The programs of a specialized software company or a carrier can be easily loaded to the network through the APIs, so that a diversity of customized services can be provided for the users rapidly.

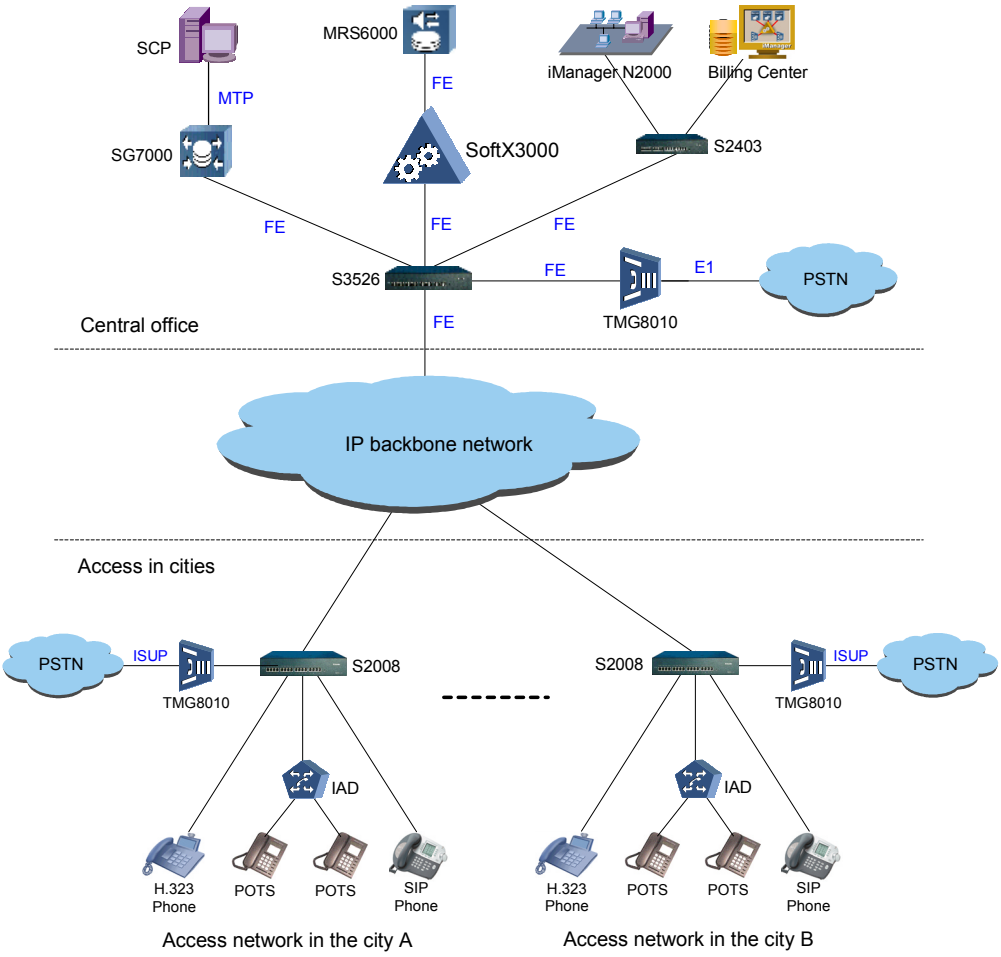
6.2 Typical Applications

With a customized design and optimized cost performance ratio, SoftX3000 shows its advantages in NGN markets and VoIP markets.

6.2.1 Commercial NGN of the Company S

It is expected by the company S to adopt Huawei U-SYS product series to construct a commercial NGN. In the phase I construction, IP toll calling, videophone and prepaid

card services are utilized in a number of cities. The system networking model is illustrated in Figure 6-10.



Note: S2008, S2403 and S3526 are Ethernet switches of Huawei.

Figure 6-10 Networking model of the company S's commercial NGN

The commercial NGN of the company S is composed of the SoftSwitch control center resident in the central office and a number of access networks distributed over a number of cities. The central office equipment is SoftSwitch and various servers, including one set of SoftX3000, one set of MRS6000, one set of SCP, one set of SG7000, one set of iManager N2000, one set of billing device and one set of TMG8010. The access network equipment is trunk media gateways and various terminals, including one set of TMG8010 and several sets of IAD.

The networking characteristics of the commercial NGN of the company S are as follows:

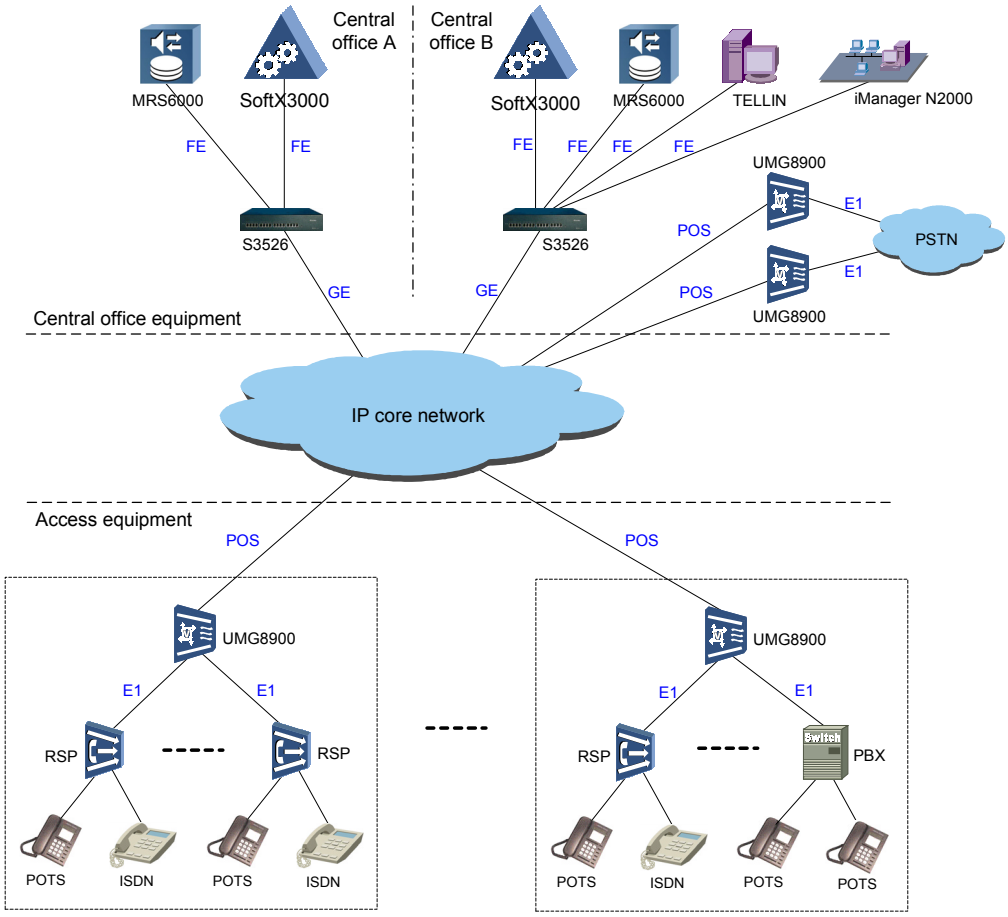
1) All the services enjoyed in the cities are controlled and provided by the SoftSwitch center in the central office.

2) SoftX3000 also functions as the SSP which interworks with the intelligent platform SCP through the SG7000 to provide the prepaid card service for the users.
3) The interworking between NGN and PSTN is realized by the TMG8010 which has built-in signaling gateway functions. Therefore, it is unnecessary to use a physically separate signaling gateway.
4) The iManager N2000 is adopted in the network as the integrated network management system to provide layer division and domain division management functions.

6.2.2 Commercial VoIP Network of the Country B

It is expected by a country B to adopt Huawei U-SYS product series including SoftX3000, UMG8900 with RSPs and MRS6000 to re-build the existent exchange network to a commercial VoIP network, for the purposes of decreasing the number of exchange sites, simplifying the network layer and minimizing the operation and maintenance cost.

In the phase I of the commercial VoIP network of the country B, two central office sites and 48 access network sites are established. The network capacity is planned to 100,000 subscribers. Mainly, POTS subscriber (analog subscribers) access and ISDN subscriber (2B + D) access are supported. The system networking model is illustrated in Figure 6-11.



Note: S3526 is Ethernet switch of Huawei.

Figure 6-11 Networking model of the country B's commercial VoIP network

The commercial VoIP network of the country B is composed of two parts: central office equipment and access equipment. The central office equipment is SoftSwitch and various servers, including two sets of SoftX3000, two sets of MRS6000, one set of SCP, one set of iManager N2000 and two sets of UMG8900. The access equipment is media gateways and remote subscriber processors, including thirteen sets of UMG8900 and forty-eight sets of RSP.

The networking characteristics of the commercial VoIP network of the country B are as follows:

1) In the dual-homed bastion host, all UMG8900s (gateway device) are connected to both SoftX3000 (SoftSwitch) through different links. In the normal conditions, each SoftX3000 controls half of the gateway devices. Whenever one of the SoftX3000s becomes faulty, all the services on it are handed to the other SoftX3000, which greatly improves the reliability of the system networking.
2) The interworking between the VoIP network and the PSTN is achieved by two UMG8900s which are installed at the central office. In this case, UMG8900s are

equivalent to TMGs in terms of functions. Besides, UMG8900s have built-in signaling gateway functions (supporting the M2UA and ISUP protocols), so it is unnecessary to use a physically separate signaling gateway.

3) UMG8900s at the access end are equivalent to AMGs in terms of functions. They not only support a number of PSTN signaling including V5, DSS1 and R2 to achieve the access of V5 access network devices and PBX devices, but also they support internal protocols to achieve the access of RSP devices.
4) The system adopts Huawei TELLIN as the SCP intelligent platform which interworks with SoftX3000 (functioning as SSP also) in the INAP over IP manner, for the purpose of providing the prepaid card service for users.
5) The system adopts Huawei iManager N2000 as the iOSS device of the whole network for the purpose of device management and billing management on a network wide basis.

Chapter 7 Reliability and Security Design

7.1 System Reliability Design

7.1.1 Hardware Reliability

SoftX3000 is structured in a distributed manner physically, where a number of reliability measures are taken to guarantee the reliability of the hardware system. For example, the boards in use are designed in the active/standby mode, in the load-sharing mode and with redundant configuration. What are used in SoftX3000 are qualified electronic components which are carefully selected and have passed the aging test.

I. Distributed processing

In SoftX3000 the distributed processing is achieved by means of modularized functions. The functions of the modules are relatively independent, and controlled by different processors. The fault of one processor does not influence the normal running and operation of the whole system.

II. Multi-processor redundant technique

The key components used in SoftX3000 adopt the multi-processor redundant technique. For example, the SMUI, FCCU and CDBI boards all adopt the active/standby processor running mode. In the normal conditions, the active processor controls the running of the modules; the standby processor keeps synchronized with the active one in real time. Whenever the active processor becomes faulty, the standby one is brought into service immediately. The standby one replaces the active one to control the running and operation of the modules against service interruption of the system.

III. Board-level hot backup

The board-level hot backup method is frequently used in communication products for the purpose of improving the reliability of the system. This method usually adopts the active/standby work mode and is mainly applicable to service processing, device management and resource management.

IV. Assistant work mode

Assistant work is also known as load-sharing. With the assistant work mode, two or more boards share the related functions during the normal working. Once one of the boards becomes faulty, the tasks imposed on the faulty board are taken to the hand of other boards on the premise that certain performance parameters such as call loss must be guaranteed.

7.1.2 Software Reliability

SoftX3000 software adopts a hierarchical modularized architecture with protective performance, error tolerance capability and fault monitoring function.

I. Protective performance

From requirement analysis, system design to software test, all stages of the development of SoftX3000 strictly follow the Capability Maturity Model (CMM) procedures. Code walk-through, inspection, review, unit test, system test and other useful quality assurance measures taken in SoftX3000 development improve the reliability of the software greatly.

II. Error tolerance capability

By means of timing detection for key software resources, real-time task monitoring, storage protection and data check, SoftX3000 effectively prevents minor software faults from imposing a great effect on the whole system, which greatly improves the error tolerance capability of the system.

III. Fault detection and handling

SoftX3000 is able to automatically detect and diagnose both software and hardware faults. The faulty components can be automatically switched, restarted and reloaded to avoid service interruption.

7.1.3 System Overload Control

The load control mechanism of SoftX3000 is as follows:

1) Provides 4-level overload restriction functions. When the CPU load reaches the threshold, the flow control mechanism is started and 25% subscribers are restricted at each level. When the CPU load grows heavier, the service level is degraded by one. Restoration is also conducted depending on the four levels.
2) Dynamically adjusts the coding mode according to the resource occupancy and network congestion, and notifies the gateways of the adjustment.

3) Preserves or immediately executes traffic control commands by analyzing the traffic measurement data and the equipment running state.
4) Restricts the call volume to particular outgoing trunks, destination codes by percentage depending on the calling category, calling number, time segment, incoming trunk group identification of the incoming calls, and also provides the corresponding control cancellation commands (the restriction percentage can be adjusted consecutively).
5) Restricts the maximum number of call attempts to particular outgoing trunks, destination codes in a pre-determined time interval depending on the calling category, calling number, time segment, incoming trunk group identification of the incoming calls (the restriction quantity can be adjusted consecutively).

7.1.4 Reliability Measures for Charging System

I. Hardware reliability

iGWB Server developed by Huawei is employed as the charging gateway of SoftX3000. The dual-system is adopted in the iGWB and Hot RAID5 hard disk array is configured, which realizes the dual backup and mass storage of the bill data.

The network cards of the iGWB Server are in different network segments, and there is no message transfer among them. In this way, external users are separated from internal private networks, thus ensuring the security of operations on the bill data.

II. Software reliability

1) Program reliability

The iGWB Server is capable of transferring detailed alarm information to the alarm box through the BAM in real-time mode for centralized alarming purposes, thus facilitating the removal of the faults of the iGWB Server in time.

2) Reliability of bill data

- Against bill loss or bill repetition

After saving the original bill data, the iGWB Server sends a confirmation message to the host. At the same time, the current bill confirmation state is recorded in detail against bill loss or bill repetition. The iGWB Server is restored after each start to ensure the consistency between the original bill data and the final bill data.

- Data backup

The iGWB Server is responsible for backing up bill files and other important data in it regularly.

3) Bill error tolerance

- A protective mechanism of the bill pool is provided.

- The system is able to create the bill directory automatically for recovery after it is deleted intentionally.
- Offline repair of error bills is available.

4) Transmission reliability

The iGWB Server transmits bills to the billing center by means of FTP or FTAM. Both retransmission and broken retransmission are supported.

III. Four-level buffer of bill information

From the completion of a call to the successful transfer of bill information to the billing center, there are four levels of bill buffer against bill data loss due to abnormal causes. The four levels are host bill pool buffer, original bill file buffer, final bill file buffer and automatic CD backup.

1) Host bill pool buffer

Every group of FCCU/FCSU boards provides a bill buffer for about 40,000,000 original bills.

2) Original bill file buffer

After transferred from the host bill pool to the iGWB Server, the original bills are stored first in the hard disk as the level-two buffer. At the full configuration, the iGWB Server can accommodate 3,000,000,000 bills.

3) Final bill file buffer

After having processed the original bills, the iGWB Server saves in the hard disk the final bill data to be sent to the billing center, thus implementing the level-three buffer.

4) Automatic disk backup

The iGWB Server regularly backs up the bill data in the hard disk to a magneto-optical disk to implement the level-four buffer.

IV. Security of bill console

1) Bill console lock

Username and password are protected by the bill console. If the user makes no operation for a long time, the bill console will automatically log off against unauthorized access.

2) Operation restriction of bill client

Bill data and logs can be viewed at the bill client, but they cannot be deleted or modified for the purpose of ensuring the security of bill data.

3) IP address restriction of bill client

By configuring the Web Server, it is possible to restrict the IP address of the bill client (workstation) to prevent unauthorized nodes from accessing.

7.2 System Security Design

7.2.1 Networking Application Security

I. Closing protocol interfaces that are not in use

SoftX3000 provides protocol interfaces externally. On these interfaces, except necessary services such as MGCP, H.248, SIP, H.323, INAP, any other unnecessary network services such as HTTP are disabled, so as to prevent intrusion by unauthorized users through invalid services.

II. Supporting the complete IPSec protocol against DoS attacks

SoftX3000 makes use of network routers to implement the firewall functions and supports a complete IPSec protocol, which effectively prevents the system from being attacked by unauthorized access by means of DoS.

7.2.2 Protocol and Conversation Security

SoftX3000 supports encryption processing on the security and packets of the MGCP, H.248, SIP and H.323 protocols for the purpose of guaranteeing the security of both protocols and call conversations.

7.2.3 User Security

I. Supporting certification and authentication on all the devices attempting to access SoftX3000

SoftX3000 supports certification processing on all media gateways, accessing gateways, packet terminals and soft terminals to avoid unauthorized registration.

II. Supporting encryption and ciphering of certification information

SoftX3000 supports encryption and ciphering processing on certification information and identification and tracing on malicious certification requests. SoftX3000 refuses any malicious certification requests.

7.2.4 Data Security

SoftX3000 provides strict data protection mechanisms:

1) SoftX3000 supports a synchronous data backup mechanism between the active and standby boards in the real-time manner. Whenever an active board goes

down, its standby board is automatically switched to be the active one. All programs and data on the board take effect immediately.

2) SoftX3000 supports the backup of the data from the active processor's database to a flash memory, which enables a quick restart of the active processor after getting data from the flash memory.
3) SoftX3000 supports an automatic backup mechanism of the bills.
4) The BAM initiates CRC check of foreground data regularly. If the BAM finds that the data of the foreground is inconsistent with that of the background, it will initiate a setting procedure to the foreground. If the setting procedure fails after pre-determined attempts, an alarm will be generated to indicate to the operation personnel to restore the data.

7.2.5 Operation and Maintenance Security

The following measures are taken in SoftX3000 to ensure the operation and maintenance security of the system:

1) SoftX3000 supports the dual-certification logon security management based on account and workstation's IP address, to avoid dormant troubles caused by account disclosure.
2) SoftX3000 supports the multi-level user authority management against authorized access.
3) All operations performed by the maintenance personnel are recorded in a log to ensure the locatability and traceability of the history operations.
4) Prompting alarms are available against system exceptions due to unintentional mistakes.
5) An excellent check function is available for operator's configuration activities. Unauthorized configurations will be refused.
6) The maintenance and operation system has a protection for usernames and passwords. If the user makes no operation for a long time, the system will automatically log off against unauthorized access.

Chapter 8 Technical Specifications and Environmental Requirements

8.1 Technical Specifications

8.1.1 System Capacity

Table 8-1 System capacity

Item	Specification
Maximum number of supported TDM trunks	360,000
Maximum number of supported gateways	2,000,000
Maximum capacity of supported black and white lists	2,000,000
Maximum capacity of supported external prepaid card numbers	1,000,000
Maximum number of supported subscribers	POTS subscribers: 2,000,000
	V5 subscribers: 2,000,000
	IPN subscribers: 200,000
	IP consoles: 100,000
Maximum number of supported multimedia terminals	SIP terminals: 2,000,000
	H.323 terminals: 1,000,000

8.1.2 System Processing Capability

Table 8-2 System processing capability

Item	Specification
BHCA of a single service processing module	400k
BHCA of the system	16000k
Call drop rate	≤ 0.01%
Call setup time	Calls between intra-domain subscribers: < 200 ms
	Calls between both intra-domain subscribers and out-domain subscribers: < 500 ms

8.1.3 Protocol Processing Capability

Table 8-3 Protocol processing capability

Item	Specification
Number of supported local signaling point codes	16
Maximum IP signaling bandwidth	4 x 100 Mbit/s
Maximum number of supported 64 kbit/s MTP links	1,280

Item	Specification
Maximum number of supported 2 Mbit/s MTP links	80
Maximum number of supported M2UA links	1,280
Maximum number of supported M3UA links	1,280
Packet dispatch ability of a single IFMI board	20,000 packets/second
SIP session holding capability of a single MSGI board	16,000
H.323 call holding capability of a single MSGI board	6,400
Number of SCTP associations of a single BSGI board	128
Capability of SCTP associations of a single BSGI board	1,500

8.1.4 Bill Processing Capability

Table 8-4 Bill processing capability

Item	Specification
Bill buffering capacity of the service processing module	192 Mbytes
Bill transfer capability of the service processing module	120 bills/second
Bill storage capacity of the iGWB	73 Gbytes
Bill transfer capability of the iGWB	4,000 bills/second

8.1.5 Reliability Specifications

Table 8-5 Reliability specifications

Item	Specification
Repair rate	0.3%
Usability	99.99983%
Mean time between failures (MTBF)	53 years
Mean time to recovery (MTTR)	48 minutes
Pause time	0.89 minutes/year

8.1.6 Power Supply and Power Consumption

I. Power supply

1) Rated voltage: –48 V DC
2) Voltage fluctuations: –57 V to –40 V

II. System power consumption

The power consumption specifications of the functional frames or components in a SoftX3000 cabinet are shown in Table 8-6.

Table 8-6 Power consumption specifications of SoftX3000

Functional unit	Power consumption (W)	Configuration
Power distribution frame	≤ 20	Single power distribution frame
Basic frame	≤ 480	(IFMI + BFII) x 2 + BSGI x 2 + CDPI x 2 + (SMUI + SIUI) x 2 + HSCI x 2 + (FCSU + EPII) x 6 + CKII x 2 + ALUI x 1 + UPWR x 4 + fan frame
Expansion frame	≤ 580	(SMUI + SIUI) x 2 + HSCI x 2 + (FCSU + EPII) x 12 + ALUI x 1 + UPWR x 4 + fan frame
Media resource frame	≤ 680	(SMUI + SIUI) x 2 + HSCI x 2 + (MRCI + MRII) x 12 + ALUI x 1 + UPWR x 4 + fan frame
MRS6000 frame	≤ 900	SCC x 1 + MPC x 12 + fan frame
BAM	≤ 250	Adopts HP/IBM DC Power server
iGWB	≤ 250	Adopts HP/IBM DC Power server
LCD monitor	≤ 50	/
LAN Switch	≤ 30	Adopts Huawei Quidway S3526 Ethernet switch
Hard disk array	≤ 200	When IBM server is used, it is required to configure 10 hot-swappable SCSI hard disks.

III. Example of calculation of power consumption

1) Integrated configuration cabinet (at full configuration with 1 basic frame and 1 media resource frame)

Maximum power consumption = power distribution frame x 1 + basic frame x 1 + media resource frame x 1 + LCD x 1 + hard disk array x 1 + BAM x 1 + iGWB x 2 + LAN Switch x 2 = 20 x 1 + 480 x 1 + 680 x 1 + 50 x 1 + 200 x 1 + 250 x 1 + 250 x 2 + 30 x 2 = 2240W

2) Service processing cabinet (at full configuration with 3 expansion frames and 1 media resource frame)

Maximum power consumption = power distribution frame x 1 + expansion frame x 3 + media resource frame x 1 = 20 x 1 + 580 x 3 + 680 x 1 = 2440W

3) Media resource server cabinet (with 1 MRS6000)

Maximum power consumption = power distribution frame x 1 + MRS6000 x 1 = 20 x 1 + 900 x 1 = 920W

8.1.7 Physical Parameters

Table 8-7 Physical parameters of SoftX3000 cabinets

Item	Parameter or model
Cabinet model	N68-22 cabinet complying with IEC297
Cabinet dimensions (height x width x depth)	2,200 mm x 600 mm x 800 mm
Weight of an integrated configuration cabinet (at full configuration)	400 kg
Weight of a service processing cabinet (at full configuration)	300 kg
Weight of a media resource server cabinet (with 1 MRS6000 configured)	250 kg
Designed bearing capacity of the floor in the equipment room	600 kg/m^2
Available height of cabinet	46 U (1 U = 44.45 mm)

8.1.8 Environmental Specifications

I. Environmental adaptation

SoftX3000 can operate normally for a long term in the following environmental conditions:

Table 8-8 Environmental adaptation

Height above sea level	≤ 4,000 m
Atmospheric pressure	70 kPa to 106 kPa
Temperature	+5 ℃ to +45 ℃
Relative humidity	5% to 85%
Earthquake-proof performance	Able to sustain Richter scale 9

II. Noise specifications

1) Compliant with NEBS requirements: Sound-pressure-level noise is not greater than 65 dBA (internally limited to 60 dBA).
2) Compliant with ETS requirements: Sound-power-level noise does not exceed 7.2 bels.

8.1.9 Electromagnetic Compatibility Specifications

I. Electromagnetic interference specifications

1) Conducted emission (CE)

Table 8-9 CE specifications through the –48 V power supply port

Frequency range	Limits (dBμV)	
	Average limit	Quasi-peak limit
0.02 MHz to 0.15 MHz	/	79
0.15 MHz to 0.50 MHz	66	79
0.50 MHz to 30 MHz	60	73

Note:

The CE tests are designed to demonstrate the interference signals of the product conducted from the cable port.

2) Radiated emission (RE)

Table 8-10 RE specifications

Frequency band (MHz)	Quasi-peak limit (dBμV/m)
30 to 230	40
230 to 1000	47

Note:

The RE tests are designed to demonstrate the interference signals of the product radiated from the shell port.

The measurement point is 10 meters away from the switching equipment.

II. Electromagnetic susceptibility specifications

1) Conducted susceptibility (CS)

These specifications are applicable to –48 V DC supply cable side and partial signal side. These specifications will be considered when the connection line between the ports exceeds 3 meters.

Table 8-11 CS specifications

Measured port	Frequency range	Voltage criterion	Performance criterion
DC side	150 kHz to 230 MHz	10 V	A
Signal side		10 V	A

Note:

The CS tests are designed to demonstrate the bearing capability of the product regarding the external interference through cable port coupling.

2) Radiated susceptibility (RS)

Table 8-12 RS specifications

Frequency range	Voltage criterion	Performance criterion
80 MHz to 1 GHz	10 V/m	A

Note:

The RS tests are designed to demonstrate the bearing capability of the product regarding the external interference through shell port coupling.

3) Electrostatic discharge (ESD)

These specifications are applicable to people's hands or other electrostatic sources which may influence the components of the product, such as boards, frames and cabinet chassis.

Table 8-13 ESD specifications

Discharge mode	Voltage criterion	Performance criterion
Air discharge	8 kV	B
	15 kV	R
Contact discharge	6 kV	B
	8 kV	R

Note:

The ESD tests are designed to demonstrate the bearing capability of the equipment regarding electrostatic interference. There are two discharge modes: contact discharge and air discharge.

4) Electrical fast transient (EFT)

These specifications are applicable to DC side and partial signal side (when the connection line between the ports exceeds 3 meters).

Table 8-14 EFT specifications

Measured port	Voltage criterion	Performance criterion
AC side	2 kV	B
DC side	2 kV	B
Signal side	1 kV	B

Note:

The EFT tests are designed to demonstrate the influence, performed on equipment interference, of the high-frequency small-scaled energy impulse caused by an inductive load changeover.

5) Surge

These specifications are applicable to DC supply cable side and partial signal side, such as the port of an indoor signal line, E1.

Table 8-15 Surge specifications

Measured port		Voltage criterion	Performance criterion
DC side		1 kV (differential mode) 2 kV (common mode)	B
Signal side	Indoor (cabling inside the system)	1 kV	B

Note:

1) Performance criterion A: SoftX3000 shall continue to operate as intended during and after the test without any software or equipment related data changed or any performance degraded. (Equipment related data refers to all the data stored in the memory and the data being processed.)
2) Performance criterion B: SoftX3000 shall continue to operate as intended after the test. During the test, a certain degradation of performance is allowed as specified by the manufacturer, but the software data and memorized data is not changed and the established communication links are not interrupted. After the test, SoftX3000 automatically recovers to the normal performance without manual intervention.
3) Performance criterion C: Temporary loss of function is allowed during the test, which can be restored after the test, typically after the shortest time required by system restart. But physical damage or degradation of system operational software does not occur.
4) Performance criterion R: SoftX3000 is not damaged physically or becomes faulty (including software damage) after the test. A certain damage of protective components caused by external interference signals is allowed; but after the damaged protective components are replaced and the relative operation parameters are reset, the equipment can operate normally.

8.2 Environmental Requirements

8.2.1 Storage Environment

I. Climate environment

Table 8-16 Climate environment requirements

Item	Range
Height above sea level	≤ 5,000 m
Atmospheric pressure	70 kPa to 106 kPa
Temperature	–40 °C to +70 °C
Temperature change rate	≤ 1 °C/min
Relative humidity	10% to 100%
Solar radiation	≤ 1,120 W/s²

Item	Range
Heat radiation	≤ 600 W/s²
Wind speed	≤ 30 m/s

II. Biological environment

1) It is required to avoid propagation of epiphyte, mildew and other microorganism.
2) It is required to prevent rodent animals, such as mouse.

III. Air cleanness

1) No explosive, conductive, magneto-conductive or corrosive dust.
2) The density of mechanically active materials should comply with the requirements shown in Table 8-17.

Table 8-17 Density requirements for mechanically active materials

Mechanically active material	Unit	Content
Suspending dust	mg/m³	≤ 5.00
Precipitable dust	mg/m²·h	≤ 20.0
Sand	mg/m³	≤ 300
Note: 1) Suspending dust: diameter ≤ 75 μm 2) Precipitable dust: 75 μm ≤ diameter ≤ 150 μm 3) Sand: 150 μm ≤ diameter ≤ 1,000 μm		

3) The density of chemically active materials should comply with the requirements shown in Table 8-18.

Table 8-18 Density requirements for chemically active materials

Chemically active material	Unit	Content
SO_2	mg/m³	0.30 to 1.00
H_2S	mg/m³	0.10 to 0.50
NO_2	mg/m³	0.50 to 1.00
NH_3	mg/m³	1.00 to 3.00
Cl_2	mg/m³	0.10 to 0.30
HCl	mg/m³	0.10 to 0.50
HF	mg/m³	0.01 to 0.03
O_3	mg/m³	0.05 to 0.10

IV. Mechanical stress

Table 8-19 Mechanical stress requirements

Item	Sub-item	Range	
Sinusoidal vibration	Offset	≤ 7.0 mm	/
	Accelerated speed	/	≤ 20.0 m/s²
	Frequency range	2 Hz to 9 Hz	9 Hz to 200 Hz

Item	Sub-item	Range
Non-stable impulse	Impulse response spectrum II	≤ 250 m/s²
	Payload	≤ 5 kPa
Note: 1) Impulse response spectrum: It refers to the maximum accelerated speed response curve generated by the equipment under the specified impulse motivation. Impulse response spectrum II means that the duration of half-sine impulse response spectrum is 6 ms. 2) Payload: It refers to the bearable pressure from the upper piled equipment with package in prescribed piling mode.		

8.2.2 Transportation Environment

I. Climate environment

Table 8-20 Climate environment requirements

Item	Range
Height above sea level	≤ 5,000 m
Atmospheric pressure	70 kPa to 106 kPa
Temperature	–40 °C to +70 °C
Temperature change rate	≤ 3 °C/min
Relative humidity	10% to 100%
Solar radiation	≤ 1,120 W/s²
Heat radiation	≤ 600 W/s²
Wind speed	≤ 30 m/s
Rain	≤ 6 mm/min

II. Biological environment

1) It is required to avoid propagation of epiphyte, mildew and other microorganism.
2) It is required to prevent rodent animals, such as mouse.

III. Air cleanness

1) No explosive, conductive, magneto-conductive or corrosive dust.
2) The density of mechanically active materials should comply with the requirements shown in Table 8-21.

Table 8-21 Density requirements for mechanically active materials

Mechanically active material	Unit	Content
Suspending dust	mg/m³	No requirement
Precipitable dust	mg/m²·h	≤ 3.0
Sand	mg/m³	≤ 100
Note: 1) Suspending dust: diameter ≤ 75 μm 2) Precipitable dust: 75 μm ≤ diameter ≤ 150 μm 3) Sand: 150 μm ≤ diameter ≤ 1,000 μm		

3) The density of chemically active materials should comply with the requirements shown in Table 8-22.

Table 8-22 Density requirements for chemically active materials

Chemically active material	Unit	Content
SO_2	mg/m^3	≤ 1.00
H_2S	mg/m^3	≤ 0.50
NO_2	mg/m^3	≤ 1.00
NH_3	mg/m^3	≤ 3.00
Cl_2	mg/m^3	≤ 0.30
HCl	mg/m^3	≤ 0.05
HF	mg/m^3	≤ 0.03
O_3	mg/m^3	≤ 0.10

IV. Mechanical stress

Table 8-23 Mechanical stress requirements

Item	Sub-item	Range		
Sinusoidal vibration	Offset	≤ 7.5 mm	/	/
	Accelerated speed	/	≤ 20.0 m/s^2	≤ 40.0 m/s^2
	Frequency range	2 Hz to 9 Hz	9 Hz to 200 Hz	200 Hz to 500 Hz
Random vibration	Spectrum density of accelerated speed	10 m^2/s^3	3 m^2/s^3	1 m^2/s^3
	Frequency range	2 Hz to 9 Hz	9 Hz to 200 Hz	200 Hz to 500 Hz
Non-stable impulse	Impulse response spectrum II	≤ 300 m/s^2		
	Payload	≤ 10 kPa		

Note:
1) Impulse response spectrum: It refers to the maximum accelerated speed response curve generated by the equipment under the specified impulse motivation. Impulse response spectrum II means that the duration of half-sine impulse response spectrum is 6 ms.
2) Payload: It refers to the bearable pressure from the upper piled equipment with package in prescribed piling mode.

8.2.3 Running Environment

I. Climate environment

Table 8-24 Temperature and humidity requirements

Equipment	Temperature		Relative humidity	
	Working for a long term	Working for a short term	Working for a long term	Working for a short term
SoftX3000	+5 °C to +45 °C	–5 °C to +55 °C	5% to 85%	5% to 95%

Equipment	Temperature		Relative humidity	
	Working for a long term	Working for a short term	Working for a long term	Working for a short term
Note: 1) The measurement points of temperature and humidity of SoftX3000 refer to the values measured 1.5 meters above the floor and 0.4 meter away from the front of SoftX3000 shelf when there are no protection panels in the front and back of SoftX3000 shelf. 2) Short term means that the consecutive working duration is not more than 48 hours and that the accumulated working duration of a year is not more than 15 days.				

Table 8-25 Other climate environment requirements

Item	Range
Height above sea level	≤ 4,000 m
Atmospheric pressure	70 kPa to 106 kPa
Temperature change rate	≤ 5 °C/h
Solar radiation	≤ 700 W/s²
Heat radiation	≤ 600 W/s²
Wind speed	≤ 1 m/s
IP level	IP50

II. Biological environment

1) It is required to avoid propagation of epiphyte, mildew and other microorganism.
2) It is required to prevent rodent animals, such as mouse.

III. Air cleanness

1) No explosive, conductive, magneto-conductive or corrosive dust.
2) The density of mechanically active materials should comply with the requirements shown in Table 8-26.

Table 8-26 Density requirements for mechanically active materials

Mechanically active material	Unit	Content
Dust particle	particle/m³	≤ 3×10^5
Suspending dust	mg/m³	≤ 0.2
Precipitable dust	mg/m²·h	≤ 1.5
Sand	mg/m³	≤ 30
Note: 1) Dust particle: diameter ≥ 5 μm 2) Suspending dust: diameter ≤ 75 μm 3) Precipitable dust: 75 μm ≤ diameter ≤ 150 μm 4) Sand: 150 μm ≤ diameter ≤ 1,000 μm		

3) The density of chemically active materials should comply with the requirements shown in Table 8-27.

Table 8-27 Density requirements for chemically active materials

Chemically active material	Unit	Content
SO_2	mg/m³	0.30 to 1.00
H_2S	mg/m³	0.10 to 0.50
NO_2	mg/m³	0.50 to 1.00
NH_3	mg/m³	1.00 to 3.00
Cl_2	mg/m³	0.10 to 0.30
HCl	mg/m³	0.10 to 0.50
HF	mg/m³	0.01 to 0.03
O_3	mg/m³	0.05 to 0.10
CO	mg/m³	≤ 5.0

IV. Mechanical stress

Table 8-28 Mechanical stress requirements

Item	Sub-item	Range	
Sinusoidal vibration	Offset	≤ 5.0 mm	/
	Accelerated speed	/	≤ 2.0 m/s²
	Frequency range	5 Hz to 62 Hz	62 Hz to 200 Hz
Non-stable impulse	Impulse response spectrum II	≤ 50 m/s²	
	Payload	0	

Note:
1) Impulse response spectrum: It refers to the maximum accelerated speed response curve generated by the equipment under the specified impulse motivation. Impulse response spectrum II means that the duration of half-sine impulse response spectrum is 6 ms.
2) Payload: It refers to the bearable pressure from the upper piled equipment with package in prescribed piling mode.

Chapter 9 Compliant Recommendations and Standards

SoftX3000 is compliant with the following recommendations and standards.

Table 9-1 SoftX3000 compliant recommendations and standards

Serial No.	Recommendation or standard	Issued by
G.703	physical/electrical characteristics of hierarchical digital interfaces	ITU-T
G.704	synchronous frame structures used at primary and secondary hierarchical levels	ITU-T
G.812	timing requirements of slave clocks suitable for user as node clocks in synchronization networks	ITU-T
G.964	V-Interfaces at the digital local exchange (LE) - V5.1-Interface (Based on 2048 kbit/S) for the support of access network (AN) - To be published	ITU-T
G.965	V-Interfaces at the digital local exchange (LE) - V5.2 interface (Based on 2048 kbit/s) for the support of access network (AN) - To be published	ITU-T
H.225.0	call signaling protocols and media stream packetization for packet based multimedia communications systems	ITU-T
H.245	control protocol for multimedia communication	ITU-T
H.248	Media Gateway Control Protocoll	ITU-T
H.323	(including H.225.0, H.245, H.450) Packet-based multimedia communications systems	ITU-T
H.450	supplementary services for multimedia	ITU-T
I.430	Basic user-network interface - Layer 1 specification	ITU-T
I.431	Primary rate user-network interface - Layer 1 specification	ITU-T
IEC 60297	Mechanical structures for electronic equipment - Dimensions of mechanical structures of the 482,6 mm (19 in) series	IEC
Q.1218	Interface Recommendation for intelligent network CS-1	ITU-T
Q.122x	Intelligent Network	ITU-T
Q.123x	Intelligent Network	ITU-T
Q.4xx	Specifications of Signaling System R2 - Provision of a forward-transfer signaling facility	ITU-T
Q.701	functional description of the message transfer part (MTP) of Signaling System No.7	ITU-T
Q.702	Signaling Data Link	ITU-T
Q.703	Message Transfer Part Signaling Link	ITU-T
Q.704	Message Transfer Part - Signalling network functions and messages	ITU-T
Q.705	Signaling network structure	ITU-T
Q.706	Message Transfer Part - Signaling performance	ITU-T
Q.707	Message Transfer Part - Testing and maintenance	ITU-T
Q.711	Functional description of the Signalling Connection Control Part (SCCP)	ITU-T
Q.712	Definition and function of SCCP messages	ITU-T
Q.713	SCCP formats and codes	ITU-T
Q.714	Signaling Connection Control Part Procedures	ITU-T
Q.715	Signaling Connection Control Part User Guide	ITU-T
Q.716	Signaling Connection Control Part (SCCP) Performance	ITU-T
Q.730	ISDN user part supplementary services	ITU-T
Q.761	Functional description of the ISDN user part of Signalling System No.7	ITU-T
Q.762	General function of messages and Signals of ISUP	ITU-T
Q.763	Formats and codes of ISUP	ITU-T
Q.764	Signaling procedures of ISUP	ITU-T
Q.767	Application of the ISDN user part of CCITT Signalling System No.7 for international ISDN interconnections	ITU-T

Serial No.	Recommendation or standard	Issued by
Q.771	Specifications of Signalling System No.7; Functional description of transaction capabilities (TC)	ITU-T
Q.772	Specifications of Signalling System No.7; Transaction capabilities information element definitions	ITU-T
Q.773	Specifications of Signalling System No.7; Transaction capabilities formats and encoding	ITU-T
Q.774	Specifications of Signalling System No.7; Transaction capabilities procedures	ITU-T
Q.775	Table of Contents and Summary of Recommendation	ITU-T
Q.921	ISDN user-network interface - Data link layer specification	ITU-T
Q.931	ISDN user-network interface layer 3 specification for basic call control	ITU-T
X.208	Specification of Abstract Syntax Notation One (ASN.1)	ITU-T
X.209	Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1)	ITU-T
draft-ietf-midcom-stun-02	Simple Traversal of UDP Through Network Address Translators (STUN)	IETF
draft-ietf-sigtran-v5ua-03	V5.2-User Adaptation Layer (V5UA)	IETF
RFC0768	User Datagram Protocol (UDP)	IETF
RFC0791	Internet Protocol (IP)	IETF
RFC0792	Internet Control Message Protocol (ICMP)	IETF
RFC0793	Transmission Control Protocol (TCP)	IETF
RFC0959	File Transfer Protocol (FTP)	IETF
RFC1035	Domain Names Implementation and Specification	IETF
RFC1157	Simple Network Management Protocol (SNMP)	IETF
RFC2327	SDP: Session Description Protocol	IETF
RFC2396	Uniform Resource Identifiers (URI): Generic Syntax	IETF
RFC2401	Security Architecture for IP (IPSec)	IETF
RFC2402	IP Authentication Header (IPSec)	IETF
RFC2406	IP Encapsulating Security Payload (IPSec)	IETF
RFC2411	IP Security Document Roadmap (IPSec)	IETF
RFC2543	SIP: Session Initiation Protocol	IETF
RFC2705	Media Gateway Control Protocol (MGCP) Version 1.2	IETF
RFC2719	Framework Architecture for Signaling Transport	IETF
RFC2871	A Framework for Telephony Routing over IP	IETF
RFC2897	Proposal for an MGCP Advanced Audio Package	IETF
RFC2916	E.164 number and DNS	IETF
RFC2960	Stream Control Transmission Protocol (SCTP)	IETF
RFC3015	Megaco Protocol Version 1.0 (H.248)	IETF
RFC3057	ISDN Q.921-User Adaptation Layer (IUA)	IETF
RFC3064	MGCP CAS Packages	IETF
RFC3261	Session Initiation Protocol (SIP)	IETF
RFC3309	Stream Control Transmission Protocol (SCTP) Checksum Change	IETF
RFC3331	SS7 MTP2 User Adaptation Layer (M2UA)	IETF
RFC3332	SS7 MTP3-User Adaptation Layer (M3UA)	IETF
RFC3372	Session Initiation Protocol for Telephones (SIP-T)	IETF

Chapter 10 Acronyms and Abbreviations

Abbreviation	Full name
3G	The Third Generation
3rd AS	3rd Party Application Server
A	
AAA	Authentication Authorization and Accounting
ACC	Account Card Calling
ACL	Access Control List
AM	Administration Module
AMG	Access Media Gateway
API	Application Programming Interface
ATM	Asynchronous Transfer Mode
B	
BAM	Back Administration Module
BHCA	Busy Hour Call Attempt
BICC	Bearer independent Call Control Protocol
BITS	Building Integrated Timing Supply
C	
CAS	Channel Associated Signaling
CCB	Call Control Block
CCC	Credit Card Calling
CDMA	Code Division Multiple Access
CDR	Call Detail Record
CE	Conformité Européene
C-INAP	China Intelligent Network Application Part
CMM	Capability Maturity Model
CN	Core Network
CODEC	Coder-decoder
CORBA	Common Object Request Broker Architecture
CS	Circuit Switched
CTD	Click To Dial
CTF	Click to FAX
D	
DC	Digital Center
DL	Digital Local
DNS	Domain Name Server
DOPRA	Distributed Object-oriented Programmable Realtime Architecture
DoS	Denial of Service
DSS1	Digital Subscriber Signaling No.1
DTMF	Dual-Tone Multifrequency
E	
EMC	Electromagnetic Compatibility
ETS	European Telecommunication Standards
F	
FAM	Front Administration Module
FE	Fast Ethernet
FPH	Free Phone
FTAM	File Transfer Access and Management Protocol
FTP	File Transfer Protocol
G	
GK	Gatekeeper
GUI	Graphical User Interface
GW	GateWay
H	
H.248	H.248/MECAMGO protocol

Abbreviation	Full name
HTML	Hyper Text Markup Language
HTTP	Hyper Text Transport Protocol
I	
IAD	Integrated Access Device
ICP	Internet Content Provider
ICW	Internet Call Wait(ing)
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
iGWB	iGateWay Bill
IM	Instant Messaging
IMAP	Internet Message Access Protocol
IN	Intelligent Network
INAP	Intelligent Network Application Protocol
iOSS	integrated Operation Support System
IP	Internet Protocol
IPN	Internet Personal Number
IPSec	Internet Protocol SECurity extensions
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
IUA	ISDN Q.921 - User Adaptation Layer
IVR	Interactive Voice Response
M	
M2PA	MTP2-User Peer-to-Peer Adaptation Layer
M2UA	Message Transfer Part 2 (MTP2) - User Adaptation Layer
M3UA	Message Transfer Part 3 (MTP3) - User Adaptation Layer
MAN	Metropolitan Area Network
MAS	Mass calling
MCU	Multipoint Control Unit
MG	Media Gateway
MGC	Media Gateway Controller
MGCP	Media Gateway Control Protocol
MML	Man Machine Language
MMU	Multimedia Management Unit
MRS	Media Resource Server
MTBF	Mean Time Between Failure
MTP	Message Transfer Part
MTTR	Mean Time To Repair
N	
NAS	Network Access Server
NAT	Network Address Translation
NEBS	Network Equipment Building System
NGN	Next Generation Network
NMS	Network Management System
NP	Number Portability
O	
OAM	Operation Administration and Maintenance
ONLY	One Number Link You
OSS	Operation Support System
P	
PBX	Private Branch Exchange
PCA	Personal Communication Assistant
PDA	Personal Digital Assistant
PGW	Parlay Gateway
PLMN	Public Land Mobile Network
POTS	Plain Old Telephone Service
PPS	Pre-Paid Service
PRI	Primary Rate Interface

Abbreviation	Full name
PS	Packed Switched
PSPDN	Packet Switched Public Data Network
PSTN	Public Switched Telephone Network
PTN	Personal Telecommunication Number
Q	
QoS	Quality of Service
R	
RADIUS	Remote Authentication Dial-In User Service
RAID	Redundant Arrays of Inexpensive Disks
RTP	Real-time Transport Protocol
S	
SAU	Signaling Access Unit
SCCP	Signaling Connection Control Part
SCN	Switched Circuit Network
SCP	Service Control Point
SCSI	Small Computer Systems Interface
SCTP	Stream Control Transmission Protocol
SDH	Synchronous Digital Hierarchy
SDP	Service Data Point
SG	Signaling Gateway
SIGTRAN	Signaling Transport
SIP	Session Initiation Protocol
SMP	Service Management Point
SMS	Service Management System
SNMP	Simple Network Management Protocol
SP	Signaling Point
SPM	Service Processing Module
SS7	Signaling System No.7
SSP	Service Switching Point
STP	Signaling Transfer Point
STUN	Simple Traversal of UDP Through Network Address Translators
T	
TCAP	Transaction Capabilities Application Part
TCP	Transport Control Protocol
TDM	Time Division Multiplex(ing)
TMG	Trunk Media Gateway
U	
UC	Unified Communication
UDP	User Datagram Protocol
UL	Underwriters Laboratories
UM	Unified Messaging
UMG	Universal Media Gateway
UNI	User Network Interface
U-NICA	Universal Network Intelligent Core Architecture
UPS	Uninterrupted Power Supply
UPT	Universal Personal Telecommunication
U-SYS	You Design Your System
UTP	Unshielded Twisted Pair
V	
V5UA	V5.2 - User Adaptation Layer
VoIP	Voice Over IP
VOT	Televoting
VPN	Virtual Private Network
W	
WAC	Wide Area Centrex
WWW	World Wide Web
X	
xDSL	x Digital Subscriber Line
XML	Extensible Markup Language