



Ehangcom iSX4000 Universal Application Platform

System Introduction

Version 2.0.5

Revision History

Version	Date	Change
VER 2.0	January 11, 2007	Created this document
VER 2.0.1	January 3, 2008	Added the description of the STM-1 optical interface daughter board and VoIP daughter board
VER 2.0.2	September 19, 2008	Added relevant descriptions of the iSX1000 switch
VER 2.0.3	October 31, 2008	Adjusted some descriptions
VER 2.0.4	October 28, 2009	Added relevant descriptions of 3G functions
VER 2.0.5	March 9, 2010	Amended some textual errors in the document

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About This Manual

Welcome to this document. It describes the iSX4000 multi-purpose service platform system. The software-related usage purpose, intended audience, document description and relevant information.

iSX1000 switch is seamlessly integrated into the existing iSX4000 multi-purpose service platform, any subsequent iSX4000 multi-purpose service platform is a multi-purpose service platform that supports both the iSX4000 and iSX1000 switches.

Purpose

This manual introduces the iSX4000 multi-purpose service platform. The purpose is to describe the following contents in the simplest language:

- System Introduction
- Components & Architecture
- Characteristics
- System Performance Parameters
- Support Services
- Support

Intended audience

1. Distributors
2. System Integrators
3. Toolkit Developers
4. Independent Software Vendors (ISVs)
5. Original Equipment Manufacturers (OEMs)
6. Technician

How to use this manual

This manual is concomitant with the software installation. This document mainly includes the following sections:

- 1 *Document Description*: This section includes the document contents and the document content introduction.
- 2 *Terms and Abbreviations*: This section includes the introduction of terms and abbreviations used in this document.
- 3 *System Overview*: This section briefly describes and summarizes the system.
- 4 *System Composition*: This section describes the components of the system in detail.
- 5 *System Architecture*: This section describes the architecture of the system in detail.
- 6 *Hardware Introduction*: This section describes the hardware components of the system in detail.
- 7 *Software Introduction*: This section describes the software components of the system in detail.
- 8 *System Interfaces and Compatibility*: This section describes the interfaces and compatible standards of the system in detail.

- 9 *System Features*: This section describes the features of the system in detail.
- 10 *Performance Parameters*: This section describes the performance parameters of the system.
- 11 *Typical Applications*: This section describes multiple typical applications of the system in detail.
- 12 *Help*: This section describes how to obtain system-related help in detail.

Relevant Information

For relevant information of this manual, refer to the following document:

- 1 *ISX4000 Getting Start*

Terms and Abbreviations

- MC
Master Control software
- BC
Backup Control software, which is mutually backed up with MC
- PRD
Play and Record Device software
- OAM
Operations, Administration, and Maintenance software
- CallSim
Calling Simulate Software
- SMCap
Signaling Message Capture Software
- Host
Application server
- User Application
Service application program developed on the basis of the APIs of this system
- UAP
Universal Application Platform
- iSX4000 API
The joint name of APIs provided by this system
- iSX4000 Switch/ iSX1000 Switch
Hardware equipment of this system
- SRL API
Standard Runtime Library API
- GC API
Global Call Library API
- VOICE API
Voice Library API
- AG API
Analog Library API
- PRD API
Stream Play And Record Library API
- OAM API
Operations, Administration, and Maintenance Library API
- Low Level Communication Module
Low level communication module
- Matrix Control & Clock
Exchange matrix control and clock processing
- ISDN-PRI Signaling daughter boards
ISDN-PRI signaling daughter boards
- SS7-ISUP Signaling daughter boards
SS7-ISUP signaling daughter boards

- SIP Signaling daughter boards
SIP signaling daughter boards
- Multi Functional DSP daughter boards
Multi-functional DSP daughter boards
- VoIP daughter boards
VoIP daughter boards

Note: It is also written as XoIP in other documents of this system and has the same concept as XoIP.

- M3G/3G-VIDEO Board
3G-video gateway board
- M3GC
M3G-video gateway control
- DSP-CAP
Signaling capture daughter board
- Optical Fiber daughter board
Optical fiber daughter board
- E1/T1/J1 daughter board
E1/T1/J1 interface daughter board
- Inter-Node Voice
Inter-node voice stream
- Circuit Voice
Circuit switching network voice stream

1 System Overview

The iSX4000 universal application platform system is an operation-level programmable intelligent service switch platform with excellent scalability, high performance, high density and small unit factor. It is based on the distributed and modularized advanced design philosophy, strict observance and support of main industrial standards and protocols, and DNS (Double Network Star) architecture. It integrates abundant access resources (trunk interface, STM-1 optical access, analog line access and VoIP access), powerful voice enhancement resources and comprehensive signaling processing capability. It provides a voice value-added service solution platform with cost effective, flexible configuration, strong scalability and high reliability for the user to meet the requirements of increasing telecommunication and enterprises for telecommunication value-added services, 3G, NGN and soft switching services.

The iSX4000 switch provides the interface capability of the highest density in the industry. A single switch simultaneously provides 64 E1/T1/J1PCM trunk interfaces, 1 STM-1 optical interface (connecting 63 E1s) and 1920 channels of VoIP ports.

The iSX4000 switch also provides strong multi-functional DSP processing capability, including up to 4096 DSP resource channels and up to 768 G3FAX resource channels. Each DSP resource channel provides functions such as echo cancellation, automatic noise reduction, voice record and play, multiparty conference and streaming record and play.

The iSX1000 switch aims at the low to medium capacity and enterprise level. It inherits the excellent scalability and strong resource capacity of the iSX4000 switch. A single switch simultaneously provides 8 E1/T1/J1 PCM trunk interfaces, 120 channels of analog line interfaces, up to 500 DSP resource channels, 500 VoIP resource channels and 700 G3 FAX resource channels.

Both the iSX4000 and iSX1000 switches support the call control signaling of the PSTN and VoIP networks (including ISDN-PRI, SS7, SIP, H.323, MGCP and H.248) for most variants. They combine the advantages of the PSTN and VoIP networks to ensure that the fixed network and mobile operators accelerate development and deployment of emerging services. In addition, the iSX1000 switch supports analog line, which enable much flexible solution for integrator in the enterprise-level market.

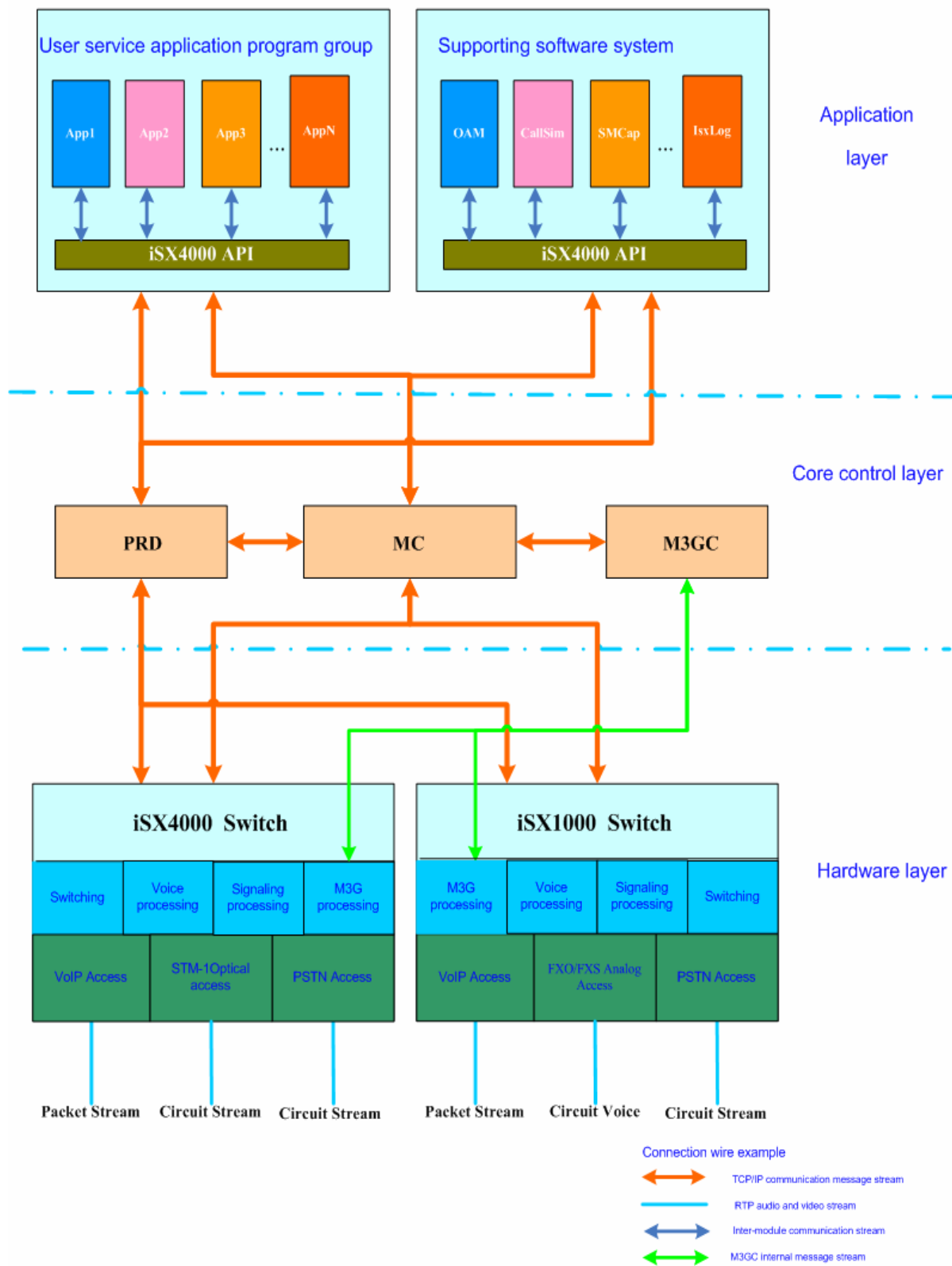
Various value-added services of the PSTN and VoIP networks can be achieved by application software according to specific requirements. In addition, new services can be continuously upgraded and expanded without additional system hardware, thus achieving pay as you grow.

2 System Architecture

This system is based on the distributed and modularized advanced design philosophy, strict observance and support of main industrial standards and protocols, and DNS (Double Network Star) architecture. It integrates abundant trunk interface and VoIP interface resources, powerful voice quality enhancement resources and strong signaling processing capability and exchange capacity. It is a voice value-added service solution platform with high performance, low cost, flexible configuration, strong scalability and high reliability.

This system logically consists of 3 layers, i.e. application layer, core control layer and hardware layer. For the structure logic diagram of the whole system, refer to the following figure.

System structure logic diagram



2.1 Application Layer

The top layer is the application layer that mainly consists of the user service application programs and the supporting software system of this system. This layer is constructed based on the secondary development interface iSX4000 API of this system. The secondary development interface iSX4000 API communicates with the core control layer through TCP/IP.

2.1.1 iSX4000 API

This system provides 3 groups of independent APIs, i.e. IsxApi, PrdApi and OamApi. IsxApi is divided into SRL, Voice, DTI, Global Call, IPM, etc. in terms of different function groups. IsxApi is an API required for most voice applications. For the function description of the APIs, refer to the following table:

iSX4000 API description table

S/N	Component	Description
1	SRL	Standard Runtime Library (SRL) is the basis of ISX SDK application and includes functions such as SDK initialization, event management and error information.
2	Voice	This API provides functions for control of the multi-functional DSP daughter board, including functions such as play and record, volume adjustment, conference, echo cancellation and DTMF test, voice switching, etc.
3	DTI	This API provides functions for control of the digital trunk interface, including functions such as digital trunk channel switching, couple channel switching, etc.
4	Global Call	This API provides call control functions, including functions such as incoming call, outgoing call, off-hook, on-hook, etc. It provides a uniform control interface for signaling such as ISDN-PRI, SS7, SIP and analog loop.
5	PRD	This API provides streaming play and record functions to enable the user to achieve functions such as ASR, TTS, etc.
6	OAM	This API provides relevant functions for operations, maintenance and administration of the switch.
7	AG	This API provides functions for control of the analog line interface.
8	IPM	This API provides functions for control of the VoIP trunk interface (i.e. VoIP daughter boards) to enable the user to achieve functions such as RTP port establishment and turnoff.
9	M3G	This API provides functions for control of the M3G-video gateway interface (i.e. M3G daughter board to enable the user to achieve functions such as H324M call establishment and removal, media format conversion, etc.

2.1.2 Service Application Program

There may be one or more user service application programs, depending on the actual need of user. User service programs control a service flow through invoking of the iSX4000 API to achieve functions with business logic to the requirements. The system supports the

software hot plugging function and allows user service programs to dynamically read and write without effect on the operation of the entire system. User service programs are mutually independent and do not interfere with each other to achieve distributed design philosophy.

2.1.3 Supporting Software System

The supporting software system mainly consists of software such as OAM, CallSim, SMCap and IsxLog and provides sound supporting environment for hardware and software configuration, call simulation, signaling analysis and API development assistance for this system. The functions of supporting software are described as follows:

- OAM
OAM is a supporting application based on iSX4000 API. It provides a visual environment for operations, administration and maintenance of the iSX4000 system to achieve all configuration, administration and monitoring functions of the iSX4000 system. This software provides a uniform and simple interface for the user.
- CallSim
CallSim is a supporting application based on iSX4000 API. It can simultaneously initiate or receive large-volume call to simulate call cases in various real environments. This software mainly is used to assist the secondary development and demonstration of the system functions. CallSim enables developers and end users to experience each function of the system. In addition, the user can rapidly finish development of the service programs (or service platform) and save the total costs of secondary development by means of the strong call analog function of CallSim.
- Signaling message capture software (SMCap)
SMCap is a supporting application based on iSX4000 API. It provides the collection, analysis and diagnosis functions of various signaling. Applying this software can establish a signaling network and solve various signaling problems rapidly, which plays an outstanding assisting role in putting the application site into operation.
- iSX4000 API log view software (IsxLog)
IsxLog is a supporting application based on iSX4000 API. It provides the real-time view, analysis and saving functions of ISX4000 API logs. Applying this software can track and record the cases of application service programs using iSX4000 API, which plays an outstanding assisting role in solving various problems during the use of iSX4000 API.
- iSX4000 error code view software (ErrorLookup)
ErrorLookup is a supporting application that assists the user to perform troubleshooting. It provides the ISX4000 system error code translation function that intuitively reflects error positions and basic error causes, which plays an outstanding assisting role in solving various problems of iSX4000 API.

2.2 Core Control Layer

The middle layer of the system is the core control layer that consists of MC, PRD and M3GC. The communication of the software and hardware layer of the core control layer is performed through TCP/IP.

2.2.1 MC

MC is the control core of the whole system and achieves all control functions on the iSX4000/iSX1000 switch/M3GC (including system configuration management, call control, media gateway control and media resource management, etc.).

In non-3G applications, all control commands initiated by the server application programs of the application layer is routed to a specified iSX4000/iSX1000 switch through MC and the iSX4000/iSX1000 switch finally finishes specified operations. Operation results are returned to the service application programs through MC. Control signals initiated by the iSX4000/iSX1000 switch are sent to specific service application programs through MC. After being processed by the service application programs, the control signals are returned to the iSX4000/iSX1000 switch through MC.

In 3G applications, MC forwards the service instructions of 3G service application programs to M3GC and returns the processing results of M3GC to the service application programs. Control signals initiated by the M3GC are sent to specific service application programs through MC. After being processed by the service application programs, the control signals are returned to M3GC through MC.

In the whole system, only one MC operates to control the whole system.

2.2.2 PRD

PRD is a core software that helps iSX4000/iSX1000 to achieve dynamic play and record function and generally operates on a dedicated server. For a small system, PRD can also operate on an ordinary PC.

PRD transfer play and record data through TCP/IP and the DSP resource board of iSX4000/iSX1000. PRD adopts advanced technology to ensure smooth transmission of voice data and avoid packet drop resulting voice discontinuity or distortion during multiple play and record channels. Besides the play and record of local hard disk files, PRD supports the streaming play and record that is very suitable for applications requiring real-time processing of voice data such as TTS and ASR.

In the whole system, there can be 0-32 PRDs operate simultaneously to jointly achieve the function of service application program voice streaming.

2.2.3 M3GC

M3GC is a core software that helps iSX4000/iSX1000 to achieve media processing and H324M call processing. It is located between the MC and M3G boards. It processes API commands transmitted by MC, converts them into service control commands of the M3G board and sends them to the M3G board. In addition, it monitors the service state change of the M3G board, converts the change into API messages and sends them to MC.

M3GC generally operates on a dedicated server. For a small system, M3GC can also operate on an ordinary PC.

One M3GC controls multiple M3G boards, but one M3G board can be controlled by only one M3GC.

In the whole system, 0-32 M3GCs operate to jointly achieve the function of service application program media and H324M call processing.

2.3 Hardware Layer

The lowest layer of the system is the hardware layer, i.e. iSX4000/iSX1000 switch. The hardware layer mainly consists of the access sub-layer and the resource sub-layer. The access sub-layer includes the PSTN access subsystem, VoIP access subsystem, STM-1 optical interface subsystem and analog loop access subsystem. The resource sub-layer includes the multi-functional DSP voice processing subsystem, signaling processing subsystem and switching subsystem.

Note: Only the iSX4000 switch supports the STM-1 optical interface subsystem.

Only the iSX1000 switch supports the analog loop access subsystem.

The functions of each part of the hardware layer are achieved by different daughter boards. Each part of the hardware layer and the physical daughter boards to achieve their functions are shown in the following comparison table.

S/N	Subsystem Name	Physical Function Achieving daughter board
1	PSTN access subsystem	Trunk interface daughter board
2	VoIP access subsystem	VoIP resource daughter board
3	Multi-functional DSP voice processing subsystem	DSP resource daughter board
4	Signaling processing subsystem	Different signaling processing functions are achieved by the PRI – ISDN, SS7-ISUP, SIP, H323 and H248 signaling daughter boards respectively
5	Switching subsystem	The function is achieved by the switching matrix of the mother board
6	STM-1 optical access subsystem	The function is achieved by the optical interface daughter board on the rear IO board of iSX4000
7	Analog loop access subsystem	The function is achieved by the iSX1000 analog daughter board
8	Video and H324M processing subsystem	M3G daughter board

Note:

H323, H248, MGCP and other signaling daughter boards will be supported in future.

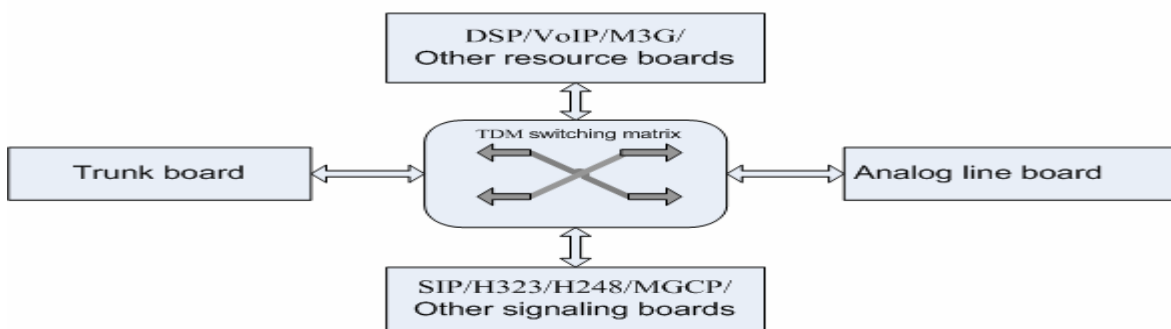
2.3.1 DNS Architecture

The hardware layer is provided with two core networks that are the TDM star switching network with the TDM switching matrix chip as the core and the IP switching network with the Ethernet switch as the core. Both networks are the basis of the system. This system architecture is called DNS (Double Network Star) architecture.

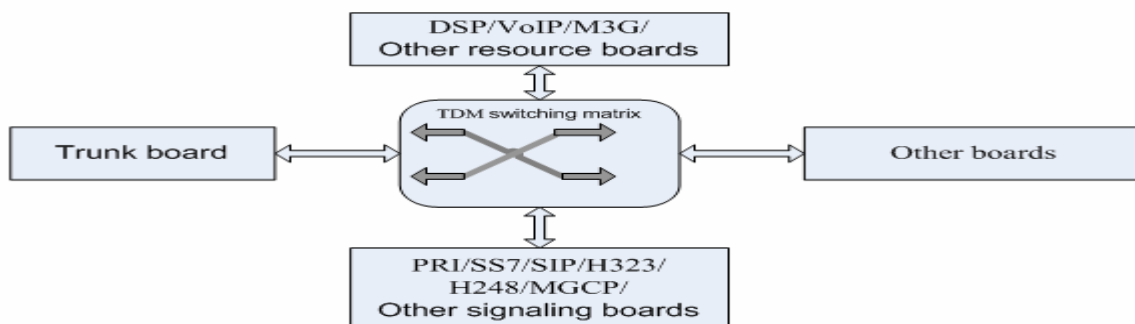
Several daughter boards of iSX4000 are fixed as modules of iSX1000, the TDM start switching network and the IP switching network are further simplified.

The principle of the TDM star switching network is very simple. The architecture logic diagram is shown below:

iSX1000 System TDM Network Structure Diagram

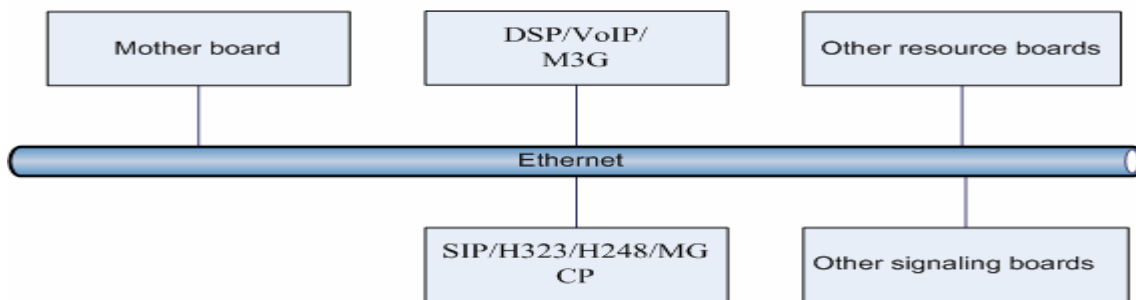


iSX4000 System TDM Network Structure Diagram

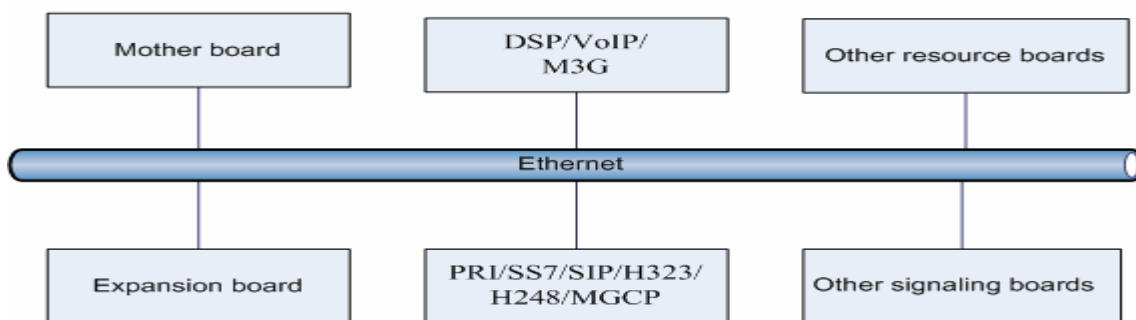


The architecture logic diagram of the Ethernet switch IP network is as follows:

iSX1000 System IP Network Structure Diagram



iSX4000 System IP Network Structure Diagram



2.3.2 Hardware Components

All core hardware in the hardware layer is constructed based on DNS. The main components in the hardware layer are as follows:

2.3.2.1 iSX4000 Hardware Components

- Chassis
It provides basic hot plugging slot positions and a power supply interface for the system. It also provides good radiating environment for internal components. Each chassis provides two mother board slot positions (The mother board has the same for factor as the expansion board), four signaling slot positions and one rear I/O slot position for the system. In addition, the chassis is provided with installation supports for 19" standard racks.
- Mother board
The mother board integrates a high-performance RISC processor, a 16K×16K non-blocking switching matrix, three independent full line speed Ethernet switches, an internal clocking module, a large current—48V DC—DC power module (power supply for the functional daughter boards and backing board of the mother board), a trunk interface board slot position and a DSP resource board slot position.
- Expansion board
It integrates a large current—48V DC—DC power module (power supply for the functional daughter boards and backing board of the expansion board) and provides eight DSP slot positions.
- Trunk daughter board
The trunk board provides various PSTN network interface functions including frame synchronization, signaling processing, clock recovery and alarm detection. All channels on the trunk board support the conversion of A-law to U-law and U-law to A-law to conform to the global network environment.
- DSP daughter board
It provides functions such as echo cancellation, voice quality enhancement, DTMF detection, conference, file play and record, streaming play and record, etc.
- VoIP daughter board
It provides functions for various voice codecs, FAX over IP, voice/FAX/data automatic identification, RTP/RTCP support, etc.
- PRI signaling daughter board
It provides complete ISDN-PRI signaling processing capability and strong signaling capture function.
- SS7 signaling daughter board

It provides complete ISDN-PRI signaling processing capability and strong signaling capture function.

- SIP signaling daughter board
It provides complete SIP signaling processing capability and strong signaling capture function.
- Rear I/O board
It provides a physical communication interface between the chassis and the exterior. It provides four SCSI-3 interfaces for PSTN line connection and four RJ45 Ethernet interfaces for application host system connection.
- STM-1 optical interface daughter board
It provides the SDH STM-1/OC3 (155.52M/s) access capability and the E1/T1 multiplex/de-multiplex function. It bears 63 E1 lines or 84 T1 lines.
- VoIP media transmission daughter board
It provides the two-way conversion and transmission function of PCM voice data and IP packet voice data between the circuit switching network and Ethernet.
- M3G daughter board
It provides the video access and processing capability and 3G-324M access capability to meet the audio and video value-added service requirements in the NGN/3G environment.
- Signaling capture daughter board
It provides the signaling collection function based on the TDM circuit.

2.3.2.2 iSX1000 Hardware Component

- Chassis
The front board of the chassis is provided with a panel indicator, panel button and power supply on/off LED. The rear board of the chassis is provided with a network interface, trunk interface and analog loop interfaces. A dust filter screen and a large-power fan are fixedly provided in the chassis to provide good heat dissipating environment. Each chassis is provided with an AC/DC power supply and a ringing current module adapting slot. In addition, the chassis is provided with installation supports for 19" standard racks.

Note: Analog loop interfaces are RJ48 female sockets. Each analog loop interface can be connected to four interior or exterior lines. If being used as a four-line EM interface, each analog loop interface can be connected to only two EM loops.

- Mother board
The mother board integrates a high-performance RISC processor, a 4K×4K

non-blocking switching matrix, an independent full line speed gigabit Ethernet switch, an internal clock module, a trunk interface board slot position and three DSP resource board slot positions. The mother board also integrates the SS7/PRI signaling function.

- **Trunk daughter board**
The trunk board provides various PSTN network interface functions including frame synchronization, signaling processing, clock recovery and alarm detection. All channels on the trunk board support the conversion of A-law to U-law or U-law to A-law to conform to the global network environment.
- **DSP daughter board**
It provides functions such as echo cancellation, voice quality enhancement, DTMF detection, conference function, file play and record, streaming play and record, etc.
- **VoIP daughter board**
It provides functions such as various voice coders and decoders, FAX forwarding, voice/FAX/data automatic identification, RTP/RTCP support, etc.
- **Analog daughter board**
It provides the FXO and FXS functions and processes DTMF and call progress voice detection/generation related to the analog loop. The analog resource board provides the power failure protection function. It automatically connects FXO and FXS during power failure to ensure that a call can be put through. In addition, the analog resource board as the carrier board of the analog module can be inserted with various analog modules.
- **Analog trunk module(FXO)**
Each module processes four analog trunk channels to achieve the analog line access function.
- **Analog user module(FXS)**
It provides the agent function. Each module is provided with four channels of agent resources.
- **Magneto module**
It is equal to a magneto telephone that is a dedicated telephone. Communication can be made by using only a pair of magneto telephones and a pair of lines. Because magneto telephones are provided with batteries, the call distance exceeds that of program-controlled telephones.
- **Two-line EM module**
Two-line E&M module supports audio interface (i.e. service bearing channel) of the two-line mode that receive and transmit are performed on a pair of balance lines.

- Four-line EM module

Four-line E&M module supports audio interface (i.e. service bearing channel) of the four-line mode that receive and transmit are separated on two pairs of balance lines.

Note:

Magneto module, two-line EM module and four-line EM module will be supported in future.

- M3G daughter board

It provides the video processing capability and 3G-324M access capability to meet the audio and video value-added service requirements in the NGN/3G environment.

- Signaling capture daughter board

It provides the signaling collection function based on the TDM circuit.

3 System Interfaces and Compatibility

The system is developed and manufactured strictly in accordance with the domestic, international and industrial specifications to provide products with steady quality, uniform specification and compatibility of main interface standards to the user.

3.1 Trunk Interface

Interface type: BNC (75Ω unbalance) or RJ45(120Ω balance)

Number of iSX1000 interfaces: 1-8

Number of iSX4000 interfaces: 1-64

The following standards are supported:

GB/T 7611-2001, Characteristics of the Electrical Interface at Hierarchical Bit Rate for Digital Network

ITU: G.703, G.704, G.706, G.736, G.775, G.823, G.932, I.431, O.151, O.161

ETSI: ETS 300 011, ETS 300 166, ETS 300 233, CTR4, CTR12

3.2 Network Interface

Interface types: RJ45

Number of iSX1000 interfaces: 4 (Note: three 10M/100M interfaces and one 10M/100M/1000Mbps interface)

Number of iSX4000 interfaces: 4 (Note: Version2 iSX4000 :4 10M/100Mbps interfaces; Version3 iSX4000 :2 10M/100Mbps interfaces and 2 10M/100/1000Mbps interfaces)

Transmission rate: 10M/100M/1000Mbps

The following standards are supported:

IEEE802.1p、IEEE802.3 、10Base-T、IEEE802.3u、100Base-TX。

IEEE802.1p, IEEE802.3, 10Base-T, IEEE802.3u, 100Base-TX

3.3 Console Interface

Interface type: four-pin USB connector and DB-9 connector

Number of interfaces: 1

The pin leads are as follows:

USB connector	Signal	DB-9 connector
1	RX	3
3	Ground	5
4	TX	2

3.4 -48V Power Supply Interface

Interface type: -48V DC – DC power supply interface

Number of interfaces: 2, with redundant backup supported

The iSX4000 switch uses the -48V DC power supply.

3.5 Optical Fiber Interface

Interface type: LC

Number of interfaces: 1

3.6 AC Power Supply Interface

The iSX1000 switch uses the AC power supply.

3.7 Analog Line Interface

Interface type: RJ48 (Each interface can be connected to four analog exterior or interior lines)

Number of interfaces: 30

4 System Features

4.1 Reliability

- Motherboard, Extension board , rear I/O board and Signaling Boards support hot plugging
- Redundant –48VDC external power supply
- Advanced STAR-NET™ technology to avoid single point of failure. In case of any local fault, the effect on the whole system is minimized
- Four dedicated signaling board slots; ISDN-PRI and SS7 signaling board redundancy backup
- The optical fiber interconnection between nodes providing redundancy backup
- The central switching node supports redundancy backup of the switching board
- Host redundancy backup
- Multiple application servers to help the system to provide application redundancy backup
- Multiple PRD servers to help the system to provide PRD redundancy backup

4.2 High Density and High Performance

- A single node provides up to 64 PCM trunks. Each channel of trunk can be dynamically set to E1/T1/J1
- A single node provides up to 1920 channels of VoIP ports
- single node provides up to 4096 multi-functional DSP resource channels
- single node provides up to 768 channels of FAX receiving and sending resources
- Up to 16 nodes can be connected through optical fiber to form a single system with a maximum system capacity of 60,000 telephone channels
- Simultaneous support for ISDN-PRI, SS7 signaling and H.323, SIP, MGCP and H.248 protocols; simultaneous connection to the PSTN and VoIP networks
- A single node simultaneously supports four types of signaling boards
- Each SS7 signaling board simultaneously supports four types of SS7 variant standards
- Each SS7 signaling board can be simultaneously configured with four OPC point codes

4.3 High Usability

- The ISX4000 1U platform is simply designed and easy to use
- Convenient OAM tools ensure iSX4000 UAP is easy to configure and maintain. The system supports remote maintenance
- The secondary development interfaces are similar to mainstream platform APIs and easier to use than these board APIs. The synchronous and asynchronous control modes are provided for convenience of system development and transplanting
- Global Call APIs hide call signaling interaction details, which ensures that programmers need not understand specific signaling details. A group of Global Call APIs simultaneously apply to PSTN and VoIP call control
- Each channel of multi-functional DSP daughter board is a full functional resource for

the convenience of programming of the user

- PRD supports both the file and streaming play and record functions
- The streaming play and record function directly supports TTS and ASR real-time applications

4.4 High Scalability

- In a single node (1U), any of the following resources can be added
 - 48-1984 channels of PSTN ports
 - 24-1920 channels of VoIP ports
 - 12-768 channels of FAX resources
 - 64-4096 channels of multi-functional DSP resources
- Up to 16 switching nodes can be connected through optical fiber to form a single system with a maximum system capacity of 4,000-60,000 telephone channels
- Any number of applications and application servers
- 1-32 PRD play and record servers

4.5 Flexibility

- Each channel of trunk can be set to the E1/T1/J1 mode
- Each channel of trunk can be dynamically enabled or disabled
- Signaling of each channel of trunk can be dynamically configured
- Channel D of each channel of trunk can be separately configured as various PRI variant standards
- Each channel of PSTN or VoIP port can be set to A-law or u-law
- The coding and decoding formats can be dynamically selected for each channel of VoIP port
- The size of RTP packing can be dynamically selected for each channel of VoIP port
- All boards support online upgrade of firmware
- All boards support online upgrade of License
- Online addition of switching nodes to achieve system capacity expansion
- Online addition of PRD servers to achieve system capacity expansion
- Online addition of applications and application servers to achieve system capacity expansion
- All media resources of the system are dominated and managed by the application programs
- All call flows of the system are controlled and managed by the application programs
- The conference function supports flexible MASK operations to achieve flexible conference control
- All popular commercial operating systems including SUN Solaris, Windows2000 and Linux
- Host-free applications such as high-density VoIP gateways and media servers

5 Performance Parameters

5.1 Electrical Parameters

Power supply requirement

-48VDC (-40 V DC to -60 V DC), up to 5A

Power consumption: less than 250W

External redundant power supply

Safety Specifications

US: UL60950 (2000)

Europe: EN 60950 (2000)

International: IEC60950 (1999)

EMC (Electro Magnetic Compatibility)

FCC 47 CFR Part 15, Subpart B:1999 (Class A)

EN55022:1998 for Class A

EN55024:1998

5.2 Mechanical Parameters

Appearance

Height: 44.3 mm (1U)

Width: 443.0 mm

Depth: 531.8 mm

Weight

10 kg (full-configuration chassis)

5.3 Digital Trunk Interface

- Eight trunk interface daughter board can be added for a single node.
- Each digital trunk interface daughter board is provided with eight PCM trunks
- Each channel of trunk in each digital trunk interface daughter board can be separately set to the E1/T1/J1 mode through software without hardware jumpers.
- The state of each trunk of each digital trunk interface daughter board is indicated by the LED indicator on the mother board panel
- Short and long line applications
- Automatic adjustment of receiving sensitivity to avoid over current impact
- 50mA short circuit limitation on the transmitter to protect the interface devices
- Circuit clock and circuit built-in jitter elimination functions
- Remote, local and analog loops; local channel loop
- T1/J1 features:
 - Frame format: D4 (SLC-96) and ESF. Especially, CRC6 and Yellow Alarm are supported for J1
 - Line code: B8ZS and AMI
 - Line impedance: 100 Ω twisted pair
- E1 features:
 - Frame format: dual frame, CRC4 multi-frame
 - Line code: HDB3 and AMI
 - Line impedance: 75 Ω coaxial cable and 120 Ω twisted pair

5.4 DSP Resource Board

- 16 multi-functional DSP daughter boards can be added for a single node

- Each multi-functional DSP resource daughter board provides 32-256 multi-functional DSP resource channels
- Each DSP channel is a full function channel that provides the following functions

Echo cancellation	<ul style="list-style-type: none"> ✓ 128/256 channels echo cancellation ✓ Electrical and acoustic echo cancellation ✓ Conformance to ITU G.168 2002 ✓ Upgrade of DSP algorithm ✓ 128 ms tail for each channel
Voice quality enhancement	<ul style="list-style-type: none"> ✓ Manual gain control ✓ ITU G.169 standard automatic level control ✓ DC level elimination ✓ Automatic noise cancellation
Telephone application function	<ul style="list-style-type: none"> ✓ G168 signal sound detection ✓ G168 specification 2100Hz (V.2x) phase reversal echo cancellation outage ✓ G168 specification 2100Hz(V.2x) phase-reversal-free NLP outage ✓ Advanced user programmable signal sound detection, for example: <ul style="list-style-type: none"> ◦ V.25/V.8 response sound (with or without phase reversal) ◦ Text telephone signals V18 Annex A ◦ SF signal (2600Hz) ◦ SS7 COT signal sound ◦ Q.323 specification MF R1 signal sound ◦ Q.323 specification MF R2 signal sound ◦ Q.24 specification DTMF signal sound ✓ User programmable signal sound generation ✓ VAD voice energy detection function that supports detection in a noisy environment ✓ Large-capacity voice prompt playback. A board supports 1000 prompts
Conference function	<ul style="list-style-type: none"> ✓ 256 conference parties are accommodated for each conference ✓ The number of conferences that a board supports is not limited ✓ The number of parties who only listen is not limited ✓ Flexible receiving shielding (MASK) control
File and streaming play and record	<ul style="list-style-type: none"> ✓ Play and record in G.711 and G.726 ADPCM 48Kbps, 32 Kbps, 24 Kbps and 16 Kbps coding formats ✓ Play and record can be achieved by connecting DSP and PRD servers through Ethernet ✓ The streaming play and record function is used for applications requiring real-time processing of play and record data, such as TTS and ASR

5.5 VoIP Resource Board

- 16 multi-purpose VoIP daughter boards can be added for a single node
- Each multi-function VoIP resource daughter board provides 24-404 multi-function VoIP resource channels
- Each VoIP channel provides the following functions:
 - Voice coder and decoder
 - G.729 A CS-ACELP 8 kbps
 - G.723.1 MP-MLQ 6.3 kbps
 - ACELP 5.3 kbps

- G.726 / G.727 ADPCM 16-40 kbps
- G.711 PCM (μ /A-law) 64 kbps
- L8 (Linear PCM)
- GSM 6.10 FR 13.2 kbps
- FAX forwarding, 2.4-14.4kbps, conformance to T.38 specification or automatic switchover to PCM
- Modem at a maximum V.92 rate, automatic switchover to PCM
- Automatic identification and differentiation of voice/fax/data signals
- Echo cancellation, conformance to G.168-2000, 32 ms, 64ms and 128ms rhyme optional
- Voice energy detection
- Generation of comfortable noise
- Caller ID detection and generation, including BellCore Type 1&2, ETSI Type 1&2 and NTT number indication
- Detection and generation of signals in a voice band, including DTMF(TIA464B), MFR1, MFR2, AC15, SS4, SS5, user-defined signal sound and call progress sound
- RTP/RTCP (RFC1889, 1890,2198 and 2833)
- Input/output gain control -31dB to +31dB, 1.0dB increasing
- real-time switchover of voice coding and decoding algorithm
- Real-time control of voice RTP packet size
- Silence compression
- QOS

5.6 ISDN-PRI Signaling Board

- Four ISDN/PRI signaling boards can be added for a single node
- Each board provides the processing capability of 64 channels D and corresponding channels B
- ITU Q.921 LAPD linkage layer
- ITU Q.931 ISDN-PRI call control layer
- Channel D of each channel of trunk supports dynamic configuration as various signaling variants.

The following variants are supported on the user side:

Euro-ISDN ETSI NET5 (French, German Delta, UK, China, Hong-Kong, and Korea)

Lucent 4ESS and 5ESS, Nortel DMS-100, Nortel DMS-250

The following variants are supported on the network side:

Euro-ISDN ETSI NET5 (French, German Delta, UK, China, Hong-Kong, and Korea)

Lucent 4ESS and 5ESS, Nortel DMS-100, Nortel DMS-250

- Each channel of trunk can be dynamically configured as the user or network side
- Call capability of each board: 100Calls/s
- Board redundancy backup

Note: The ISDN-PRI signaling board of the iSX1000 switch is integrated in the iSX1000 mother board.

5.7 SS7-ISUP Signaling Board

- Four SS7/ISUP signaling boards can be added for a single node
- Each board provides 64 linkages and supports four OPCs.
- Dynamic configuration of circuit and protocol stack
- The following ISUP standards are supported:
 - ITU 88, ITU 92, ITU 97
 - Telcordia (formerly Bellcore)
 - ANSI 88, ANSI 92, ANSI 95

- ITU, Q.767
- Singapore Telecom
- ISUP-S, Telecom of Italy
- ETSIv2 and ETSIv3
- FTZ
- Russia
- NTT (Japan variant)
- Call capability of each board: 100Calls/s
- Board redundancy backup

Note: The SS7-ISUP signaling board of the iSX1000 switch is integrated in the iSX1000 mother board.

5.8 SIP Signaling Board

- Four SIP signaling boards can be added for a single node
- The following standards are supported:
 - IETF RFC 3261
 - SIP: Session Initiation Protocol

Note: The SIP signaling board of the iSX1000 switch is an independent subsystem integrated in the iSX1000 mother board and equal to an independent SIP board.

5.9 STM-1 Optical Interface daughter board

- One STM-1 optical interface daughter board can be added for a single node
- Each daughter board has an access capability of 63 E1s or 84 T1s.
- The daughter board provide the following functions:
 - Is set to slave or master clock
 - light wave wavelength of 1310nm or 1550nm
 - Flexible J0, J1 and J2 configuration. Configuration can be performed after the other party's value is obtained
 - Flexible C2 and V5 configuration. Configuration can be performed after the other party's value is obtained
 - C-12 supports the asynchronous floating mapping, bit synchronization mapping and byte synchronization mapping
 - The frame structure of the C-12 mapping supports the CCS and CAS modes with CRC, the CCS and CAS modes without CRC, and frameless format
 - Strong alarm and alarm linkage functions that can be flexibly configured
 - C-12 is mapped as a virtual trunk for use convenience
 - Line loopback and diagnosis loopback for convenience of external and internal connection testing

5.10 VoIP Media Transmission daughter board

- 16 VoIP media transmission daughter boards can be added for a single node
- Each daughter board provides the coding and decoding capability of 60 channels of PCM alaw
- Each channel provides the following functions:
 - G.711 PCM (A-law) 64 kbps voice coding and decoding

- Real-time dynamic configuration of voice RTP packet size
- RTP/RTCP (RFC1889 and 1890) standards

5.11 3G daughter board

- 16 M3G media transmission daughter boards can be added for a single node
- Each daughter board provides the capability of 64 multi-purpose channels
- Each multi-purpose channel provides the following functions:

Channel Type	Function	Coder and Decoder	Other Characteristics
Voice processing channel	<ul style="list-style-type: none"> ✓ TDM – IP mutual conversion ✓ IP transcode channel ✓ Streaming play and record 	<ul style="list-style-type: none"> ✓ G.711 Alaw/Ulaw ✓ G.726 ✓ G.729AB ✓ G.723.1 ✓ iLBC ✓ Linear 16-bit samples, 8000HZ sample rate ✓ GSM FR/EFR ✓ AMR-NB ✓ AMR-WB ✓ EVRC 	<ul style="list-style-type: none"> ✓ EC with tail 128ms ✓ VAD/CNG ✓ PLC ✓ AGC/ALC ✓ Tone/DTMF detection and generation ✓ RFC-2833
Fax processing channel	<ul style="list-style-type: none"> ✓ T.38 specification network faxing 	<ul style="list-style-type: none"> ✓ V.17 ✓ V.29 ✓ V.27ter ✓ V.21 	<ul style="list-style-type: none"> ✓ UDP encapsulation ✓ TCP encapsulation
Video processing channel	<ul style="list-style-type: none"> ✓ Streaming play and record ✓ Stream media service transcode 	<ul style="list-style-type: none"> ✓ H.263 Baseline profile ✓ MPEG-4 Simple Profile ✓ H.264 	<ul style="list-style-type: none"> ✓ Frame Rate: 1 ~ 30fps ✓ Bit Rate: CBR/VBR ✓ Resolution: CIF/QCIF/SQCIF/4CIF/VGA/D1
3G-324M channel	<ul style="list-style-type: none"> ✓ 3G-324M call ✓ 3G-324M media multiplex 	<ul style="list-style-type: none"> ✓ G.711/G.723/AMR ✓ H.263/H.264/MPEG-4 	<ul style="list-style-type: none"> ✓ Media file: 3gp/3g4/asf/avi Supported linkage transmission protocols: SRP, NSRP and WNSRP

5.12 DSP-CAP Signaling Collection Daughter board

- 16 DSP-CAP signaling collection daughter boards can be added for a single node
- Each daughter board can simultaneously process 128 64K linkages or four 2M linkages

Each channel supports the following protocols:

- SS7 linkage: 64K, N×64K and 2M;
- ISDN-PRI linkage: 64K;
- Frame trunk linkage: 64K and N×64K;
- H.223 linkage: 64K and N×64K;
 - ✧ AL1 interface data: e.g. LAPM/V.42 and LAPF/Q.922 data or control signaling;
 - ✧ AL2 interface data: e.g. audio coding data;
 - ✧ AL3 interface data: e.g. video coding data.

6 Typical Applications

This system is a strong programmable switching platform that integrates abundant voice and conference value-added service resources and supports various PSTN and VoIP signaling. The following services can be easily achieved through value-added service application programming:

- Individualized ring-back tone (RBT)
- Background music
- IVR
- IVVR
- 3G H324M gateway
- Call center
- High-end telephone conference system
- ASR Automatic Speech Recognition
- TTS Text to Speech
- Telephone real-time messaging
- Voice email and voice message
- Voice telephone book service
- Uniform message system
- One number links you
- Voice quality enhancement system
- Signaling monitoring system
- Pre-payment and post-payment telephone card
- Payment system by the third party
- Intelligent call routing
- International call forwarding
- International dial-back system
- Bandwidth wholesale
- WebCall
- Other services

In addition, the customer can use this system to provide some attractive services according to the actual market needs.

In actual application, the ASR voice identification application has an outstanding performance due to excellent voice processing features.

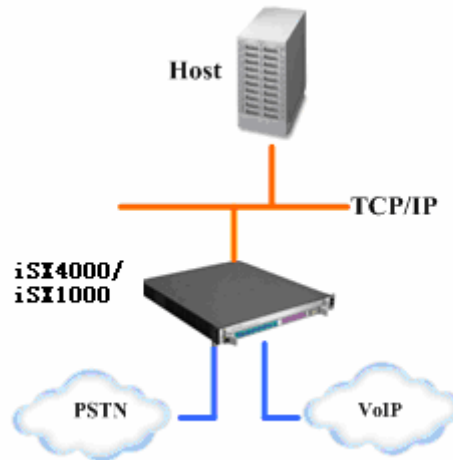
7 System Networking Mode

iSX4000 has excellent system scalability. The actual networking modes are very flexible. The following sections describe the single-node system networking mode, dual-node system networking mode and multi-node system networking mode.

In actual application, the user can make adjustment according to the system capacity to achieve the optimal configuration and application effects.

7.1 Single-node iSX4000/iSX1000 System

The following shows a single-node iSX4000/iSX1000 system that consists of one iSX4000/iSX1000 hardware switch and one host server (User App). All software on the host includes the MC, User App and PRD software. The system has a processing capability of access, voice and conference of up to 1920 channels of PSTN ports.



Host application server

It may be a PC, PC server, mini-computer or other computers. MC, User App and PRD run in it. Among the software, PRD is optional and may run or not run according to actual application requirements.

iSX4000 hardware

It integrates 1 – 64 E1/J1/T1 hardware devices for trunk processing, signaling processing, voice and conference.

iSX1000 hardware

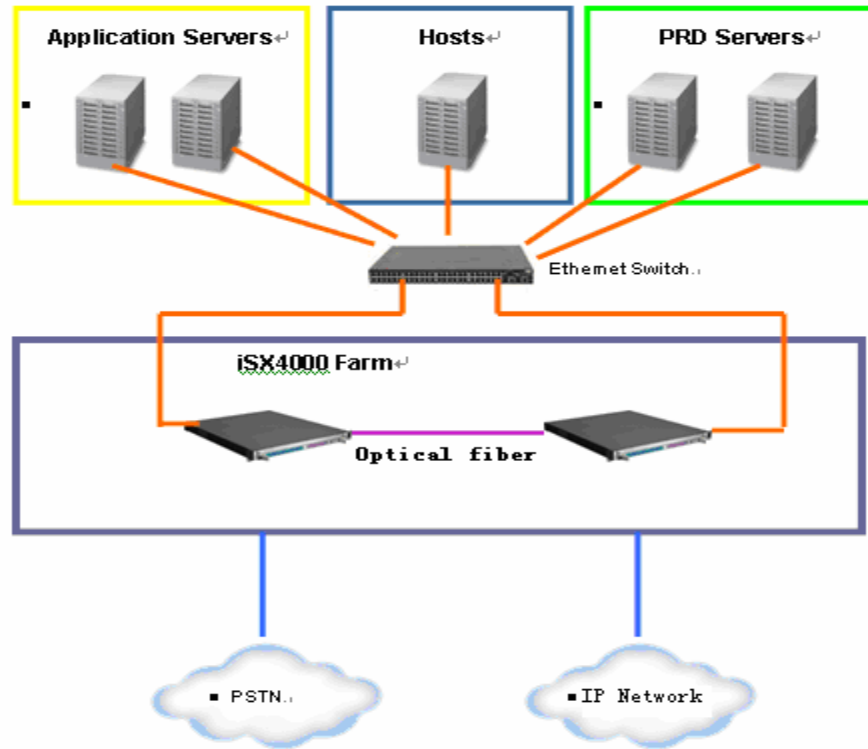
It integrates 1-8 hardware devices for E1/J1/T1 trunk processing, 1-120-channel analog line processing, signaling processing, voice and conference.

PSTN

Public Switched Telephone Network

7.2 Dual-node iSX4000 System

The following figure shows a dual-node iSX4000 system that consists of one host, two application servers, two PRD servers and one iSX4000 array that is composed of two iSX4000 hardware nodes. Both iSX4000 hardware nodes of the switching array can be directly connected with optical fiber. This system simultaneously provides the access capability of up to 3840 channels of PSTN ports.

**Application Servers**

Servers with user application.

Hosts

Servers with MC

PRD Servers

Servers with PRDs are running.

Ethernet Switch

Ethernet switch for control networks.

iSX4000 Array

iSX4000 platform array.

PSTN

Public Switched Telephone Network

IP Network

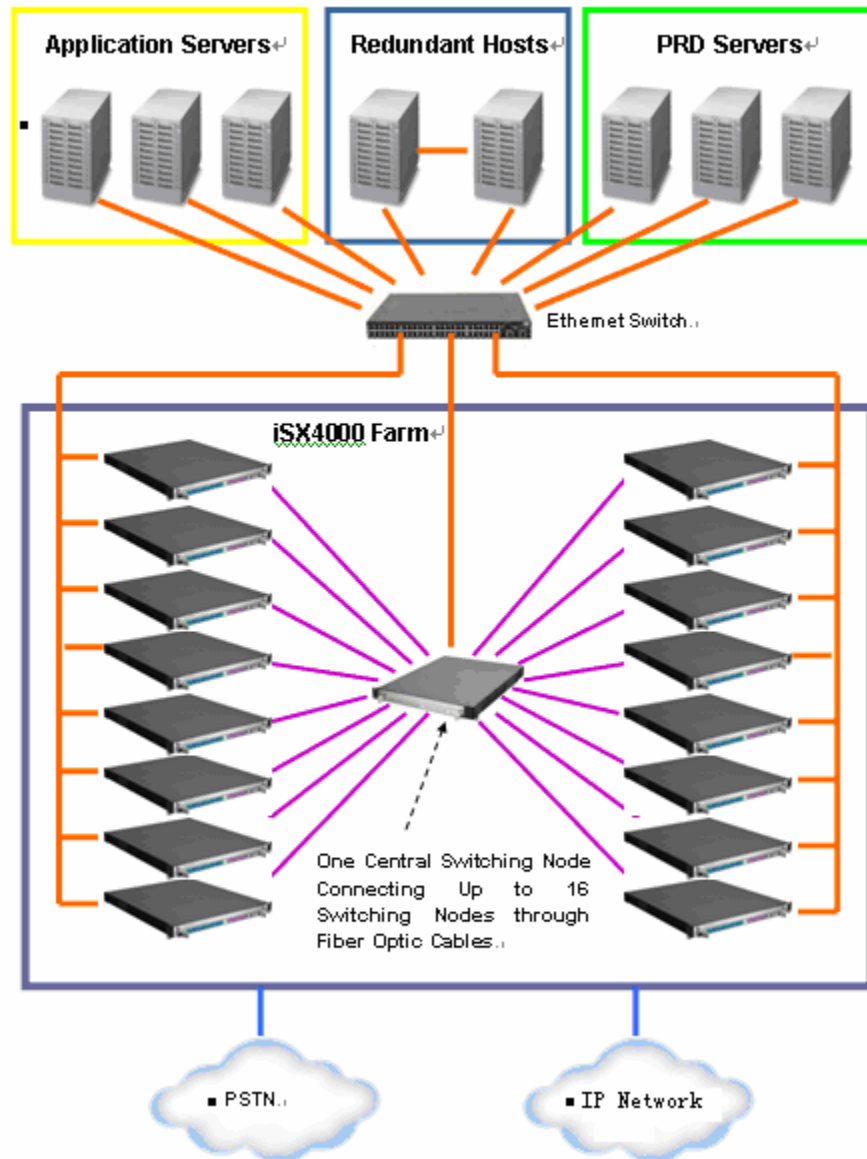
Ethernet for VoIP packets and SIP messages.

7.3 Multi-node iSX4000 System (Under development)

Note:

16-node iSX4000 system will be supported in future.

The following figure shows a 16-node iSX4000 system that consists of two mutual-backup hosts, three application servers, three PRD servers and one iSX4000 array that is composed of sixteen iSX4000 switches and one central switching node. The central switching node provides the cross-node switching capability. This system simultaneously provides the access capability of up to 31744 channels of PSTN ports.

**Application Servers**

Servers run with user application

Redundant Hosts

Server runs with MC.

PRD Servers

Servers run with PRDs.

Ethernet Switch

Ethernet switch.

iSX4000 Array

iSX4000 platform array.

Central Switch (Under Development)

Central switch that can be connected to up to sixteen iSX4000 voice switches.

PSTN

Public Switched Telephone Network for TDM calls.

IP Network

Ethernet network for VoIP voice packets and SIP messages.

8 Help

Thank you for your attention to and use of our products. We hope that our products help you and meet your need.

If you have any questions, please read relevant documents of this system, especially relevant FAQ where correct troubleshooting methods of typical problems are available.

If you find no solution to the problems, please visit our website to search the latest news or solutions at <http://www.ehangcom.com>, or contact us at the technical support telephone number in the “Contact us” column in our website.