Overall Technical Proposal For GAS PIPELINE Project

TELECOMMUNICATION SYSTEMS

OVERALL TECHNICAL PROPOSAL

HUAWEI TECHNOLOGIES CO., LTD.

HUAWEI

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Revision Record

Date	Version	Description	Author	Reviewer
2012-9-17	V1.0	Initial version Finished.	Yu Haitian, Wang Xiaochuan, Yuan Yongliang, Ke Xue, Huangdongjie, Sun Zhongcheng	Li Ying
2012-9-29	V1.1	Modified according to review	Yu Haitian, Wang Xiaochuan, Yuan Yongliang, Ke Xue, Huangdongjie, Sun Zhongcheng	Li Ying
2012-10-12	V1.2	Delete information of project and place	Houshaofeng	jiangyufang 00181125;liying 00118822;ouyangqiuhua 00106686;xuaidong 00167658;chencailin 00151667;zhangmingguan 00210866;yangfaliang 00165645;kexue 00143811;yangyaoping 00121557;huangdongjie 65653

1 Introduction

1.1 Purpose

This document is the technical solution proposal of the Gas Pipeline Telecommunication system project. The main purposes of this document are as follows:

1） Propose the overall design for the Gas Pipeline telecommunications system. Specify the general design requirement, design principle and overall solution. The system context and each subsystem are also specified.

2） Propose high-level design for each subsystem to specify the function, architecture, key parameter, system configuration and interfaces.

1.2 Abbreviations

Table 1 List of abbreviations

Abbreviations	Full Spelling
BVS	Block Valve Station
CCTV	Closed Circuit Television
CS	Compressor Station
EPC	Engineering Procurement Construction
EPC-C	Engineering Procurement Construction-Compressor Station
EPC-E	Engineering Procurement Construction-Emergency Response Centers
EPC-L	Engineering Procurement Construction-Linear Part
EPC-S	Engineering Procurement Construction-SCADA & Telecommunications
ERC	Emergency Response Center
ESD	Emergency Shutdown System
F&G	Fire & Gas
FOC	Fiber Optic Cable
FOCL	Fiber Optic Communication Line
FRTS	Fiber Remote Test System
GMS	Gas measuring station
HMI	Human Machine Interface
LAN	Local Area Network
LCD	Liquid Crystal Diode (display)
MC	Maintenance Centre
MCC	Main Control Centre
MPa	Mega Pascal
MS	Metering Station
OTN	Open Transport Network
OTN	Optical Transport Network
PABX	Private Automatic Branch Exchange
PSTN	Public Subscriber Telephone Network

Abbreviations	Full Spelling
PTS	Pig Trap Station
RFQ	Request for Quotation
RTU	Remote Terminal Unit
SCADA	Supervisory Control And Data Acquisition
SCS	Station Control System
SDH	Synchronous Digital Hierarchy
STM	Synchronous Transfer Mode
VoIP	Voice over Internet Protocol
VPN	Virtual Port Network
VSAT	Very Small Aperture Terminal

1.3 Prerequisites and assumptions

The assumption and dependence condition of this design is:

1） When carrying out the sit test of telecommunication subsystem, one optical cable with 24 fibers along the Pipeline has been deployed.

2） Power Supply for stations has been deployed.

1.4 Document Scope and Structure

This document consists of 9 chapters. The content of each chapter is described as follows:

Chapter 1 is the general introduction of purpose, abbreviation, dependence condition and assumption, document scope and structure.

Chapter 2 describes the project background, including Gas Pipeline project information, stations and Main Control Center location, and project scope.

Chapter 3 describes general requirements. Each subsystem requirements are analyzed through operation point of view, and the basic telecommunication network requirements are also summarized.

Chapter 4 describes the overall solution of the project, including design principle, system context, general logical architecture, physical architecture and the highlights of overall solution.

Chapter 5 to Chapter 10 describes the subsystem design of backbone network, station network, IP Telephony, video conference, Trunked Radio and Integrated Security respectively. Each subsystem design is described in several perspectives including design criteria, subsystem function, solution architecture, key parameter, equipment configuration and solution highlights.

2 Project Background

2.1 Project Introduction

A-I Gas Pipeline Construction Project starts in A village, and ends in the I region. Total length of pipeline is *xxx* km, diameter *xxx* mm (X70), maximum throughput 15 BCMA.

Length of pipeline section from A village to C village is *xxx* km, design pressure 7.35 MPa.

Length of pipeline section from C village to I region is *xxx* km, diameter *xxx* mm, design pressure 9.81 MPa.

The entire scope of work for the Gas Pipeline Project is distributed to the following EPC Contract Packages:

- EPC-L for the Linear Part (more than one EPC Contracts)
- EPC-C for the Compressor Stations
- EPC-E for the Emergency Response Centers
- EPC-S for the SCADA & TELECOM

2.1.1 Overview information

The Gas Pipeline starts at A, ends near I region with two short branches which joining to the other Gas Pipeline.

The pipeline route is shown as follows:

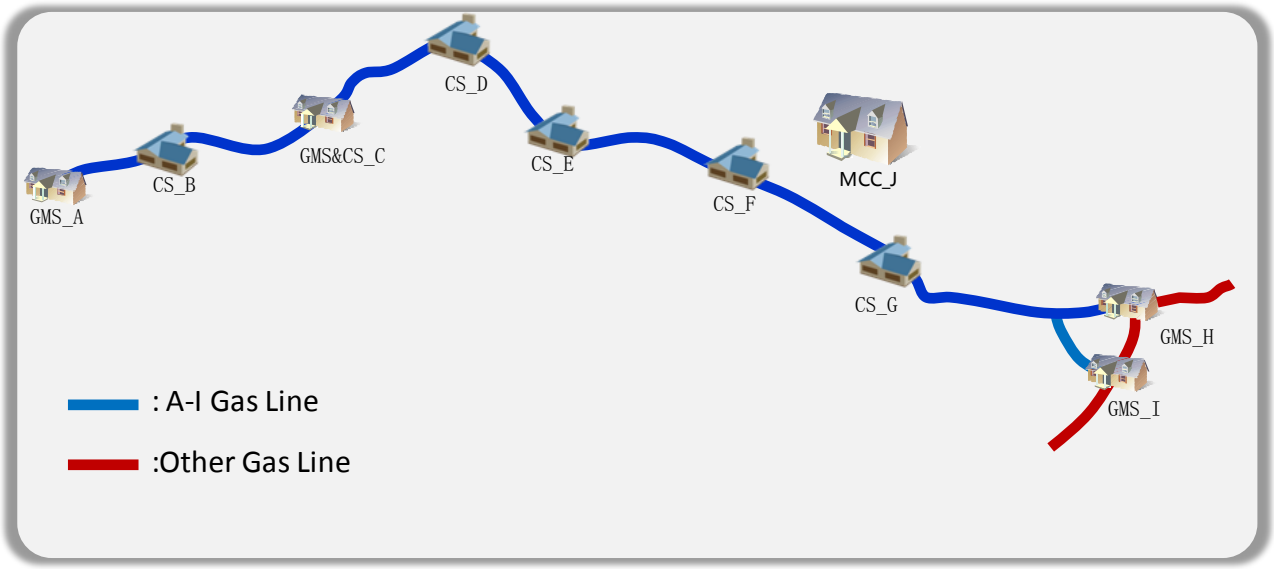


Figure 1 Gas Pipeline Overview

2.1.2 Branch-Off station reservation

It is foreseen that along the pipeline, a number of Branch-Off Stations will be erected. The Contractor shall prepare the necessary interfaces in preparation of the requirement for these Branch-Off Stations in his detailed design. The SCADA software shall be capable of incorporating these future requirements and shall be prepared to accept the necessary information. For further information, please refer to the SCADA Specification. Subject to detailed design of the pipeline, the fiber-optic backbone network of the Branch-Off Stations will be prepared such that, the fiber-optic network is capable of accepting the necessary extensions to the network at the points of interface between the operating parties. These sites are expected to obtain and relay metering data in addition to control and safety system information.

2.2 Project Scope

2.2.1 The SCADA and Telecommunication System

Below is a list of the CONTRACT Scope of Work:

- Supply and installation of a FOC line along the trunk Pipeline and the OTN-based transmission system which provides the capability for transmitting/receiving all telecom and SCADA sub systems. The Fiber Optic Cable will be free issued by the OWNER to the CONTRACTOR. All other items of the FOCL e.g. HDPE Pipe, Ball Markers, Concrete markers, splices, patch panels, manholes etc. be supplied by the CONTRACTOR.
- Supply and installation of fiber-optic transmission equipment.
- Supply and installation of the Backup VSAT System for SCADA and voice
- Supply and installation of a UHF Trunked Radio System along the pipeline.
- Supply and installation of a Fiber Remote Test System (FRTS) which will monitor the state of the Fiber continuously
- LAN/WAN Network System
- Video Conference System
- VoIP PABX Systems
- CCTV System
- Supply and Installation of the complete SCADA SYSTEM for the Project.
- Supply and installation of fiber optic junction boxes for future tie-ins along the route;
- The TELECOMMUNICATION SYSTEMS for the 7 Emergency Response Center (ERC)s;
- The integration of the station control, ESD, F&G System for Compressor Stations of the SCADA system , Hardware and software for Compressor Stations is provided by the EPCS- Contractor;
- Design Engineering and the supply of the necessary hardware and software for the SCSs of CSs-Dot matrix A3 alarm printer and A3 laser colour printer at each of the facilities.
- Installation of RTUs in shelters of BVSs, the shelters, shall be provided by the EPCS Contractors and partially shall be provided by the CONTRACTOR as per the drawing
- 7 Emergency Communication Vehicles for ERCs as specified in Section 4.5.6.6;
- Video Conference facilities on each MCC, CS, ERC, and the Operation Offices ;
- IP-PABX, LAN, WAN at each Compressor Station, Metering Station and ERC's.;
- Hot Line Telephone System, 1 lines at each MCC, CS, MSs, BVS, PTS, ERCs and the pipeline interfaces with other pipelines.
- Interfacing with Telecommunication Service Provider, and assisting the OWNER to negotiate a long-term contract for the satellite channel.

- 20 mobile handheld telephones using satellite communication, to be used by the emergency teams.
- Interfacing with telecom and other public telecom operators to ensure that a link of suitable bandwidth is provided for the SCADA system taking information to GAS PIPELINE Monitoring Center. Furthermore providing the link equipment and interfacing with the FOC cable to provide the link for the SCADA system.
- Two SCADA terminals for each of the Monitoring Stations.
- Laser printers for each of the Monitoring Stations.

3 Overall System Requirements

3.1 Pipeline Services ICT Requirements Analysis

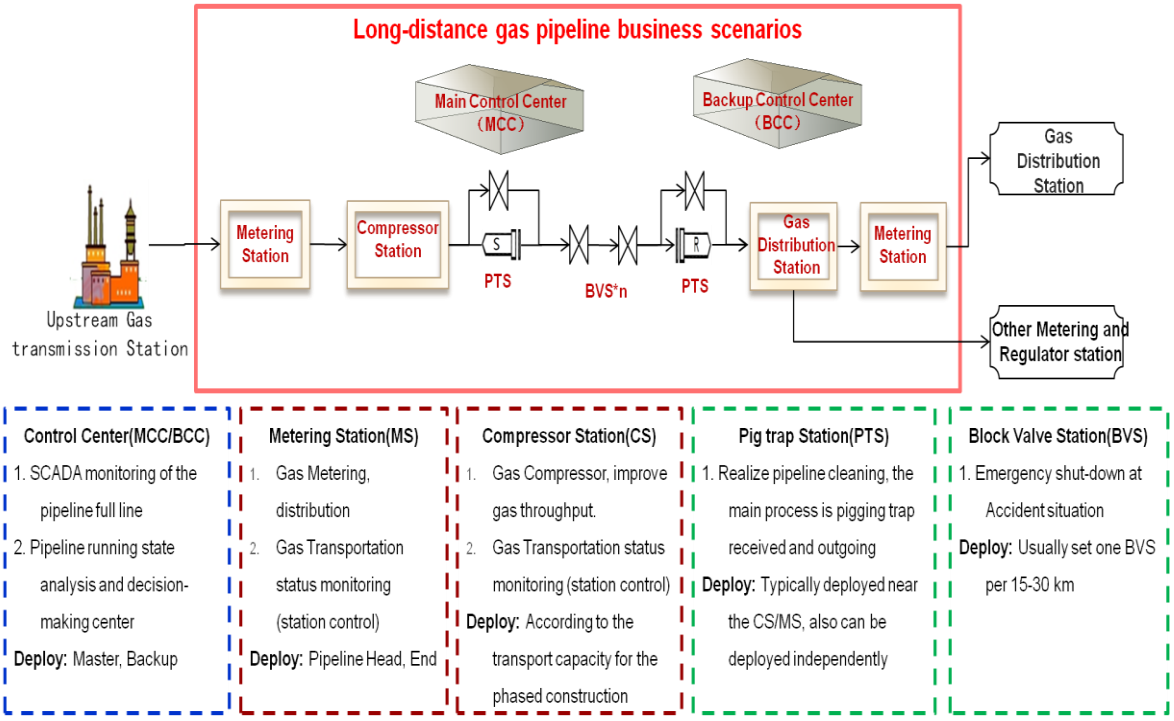


Figure 2 Long-distance gas pipeline business scenarios

In order to build a modern long-distance pipeline, the project should solve network and communication coverage of the pipeline, to realize digital production management and dispatching command.

Control center and main stations telecommunication requirements are as follows:

3.1.1 Control Center ICT Requirements

A-I Gas Pipeline will be established a Main Control Centre where all main systems will be sited. This site will form the operational control of the pipeline and Compressor Station with the SCADA system. It

will be duplicated at another site in case of failure. The MCC site will be deployed at J region in this project.

The telecommunication requirements for MCC show as follows:

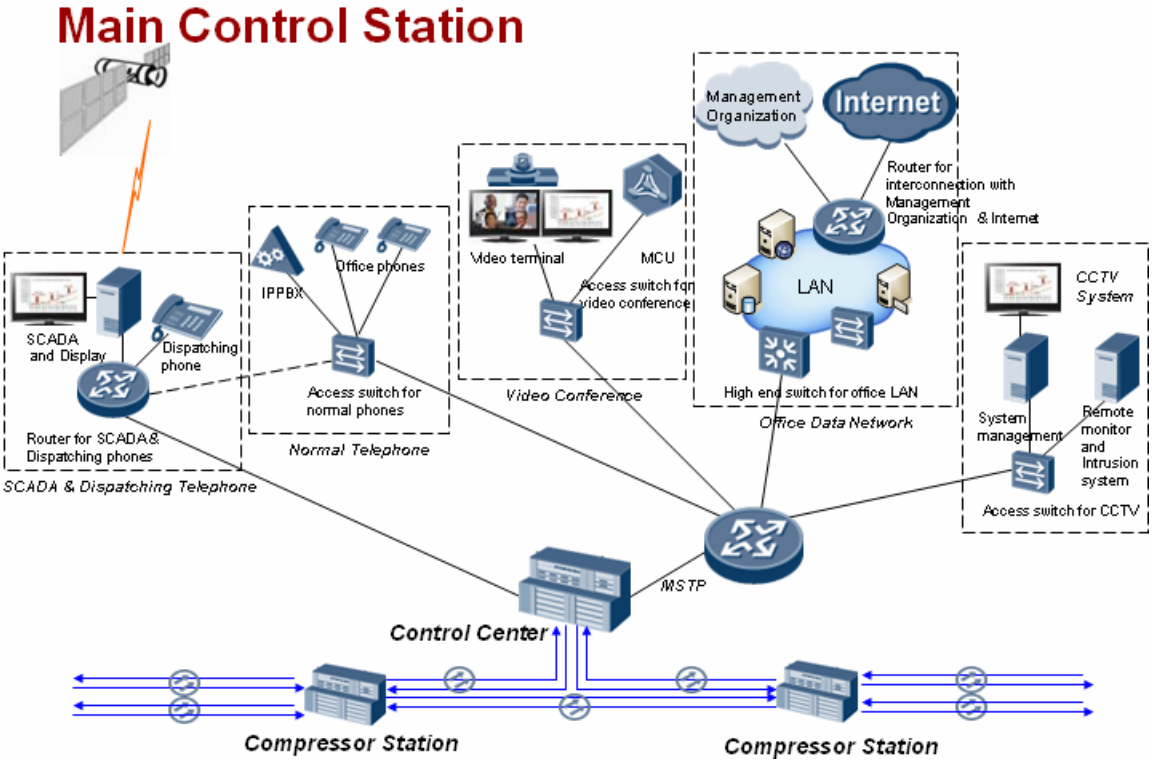


Figure 3 Control Center ICT requirements

1. Office telecommunication requirements:
   a) Office network, voice (IP-PBX), video conference.
   b) Internet access and branches (such as operation office) access.
2. Production telecommunication requirements:
   a) Production Supervisory Control system (SCADA): to achieve remote production Supervisory control of the full pipeline.
   b) Production dispatching: dispatching voice, trunked radio, satellite phones. Different subsystems can interoperate in order to achieve a unified command and dispatch.
3. Data center requirements:
   a) Centralized storage of production and office data.
   b) Centralized servers of the telecommunication subsystems.

3.1.2 Stations (Metering Station /Compressor Station / Emergency Response Center) ICT Requirements

A-I Gas Pipeline has 4 Gas Metering Stations, 6 Compressor Stations and 7 Emergency Response Centers totally. Main stations list as follows:

Table 2 MS/CS/ERC Station List

Type	Station	Location
GMS(MS)	GMS_A	0km
	GMS_C	*XXX*k
	GMS_H	*XXX*km
	GMS_I	*XXX*km
CS	CS_B	*XXX*km
	CS_C	*XXX*km
	CS_D	*XXX*km
	CS_E	*XXX*km
	CS_F	*XXX*km
	CS_G	*XXX*km
ERC	ERC_A	0km
	ERC_C	*XXX*km
	ERC_D	*XXX*km
	ERC_E	*XXX*km
	ERC_F	*XXX*km
	ERC_G	*XXX*km
	ERC_I	*XXX*km

The telecommunication requirements for MS/CS/ERC show as follows:

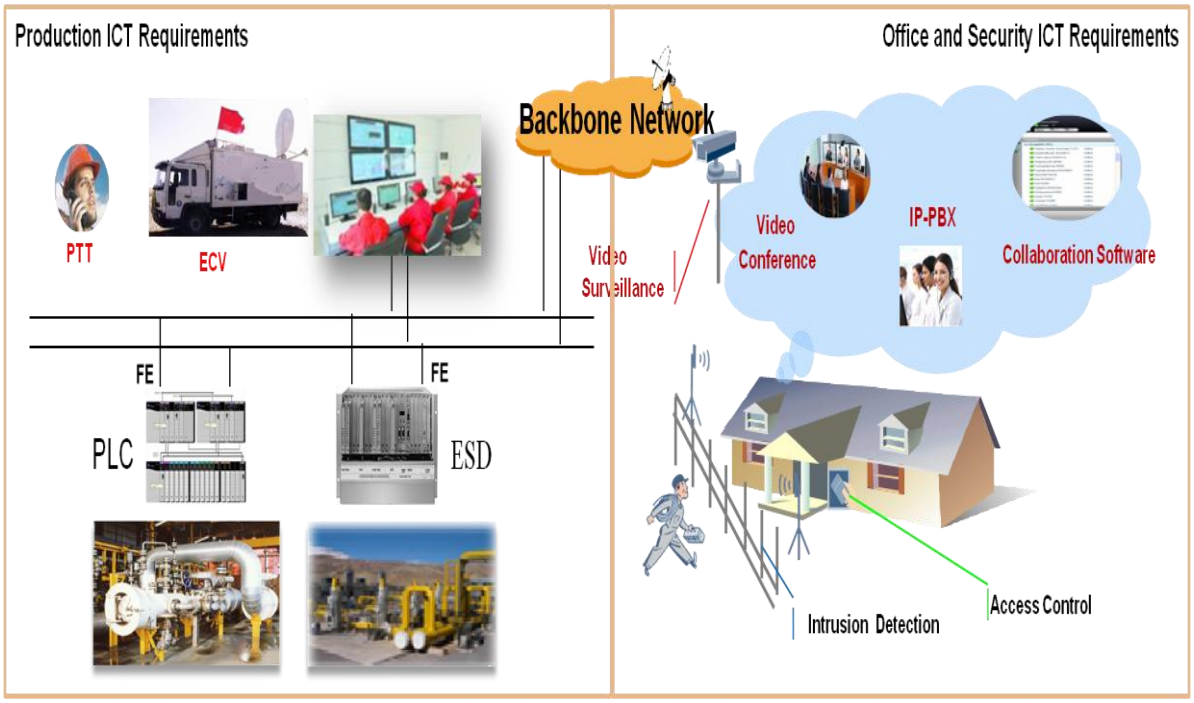


Figure 4 Stations (MS /CS /ERC) ICT Requirements

1. Production telecommunication requirements:
   a) Production Supervisory Control System (Station Control System): to achieve production Supervisory Control of the station.
   b) Production dispatching: dispatching voice, trunked radio, satellite phones. Different subsystems can interoperate in order to achieve a unified command and dispatch.
2. Office telecommunication requirements:
   a) Office network, voice (IP-PBX), video conference.
   b) Office network and production network should be physically isolated, to ensure the production security;
3. Security requirements:
   a) Station intrusion detection.
   b) Station video surveillance (perimeter and production equipments / valve).

3.1.3 BVS (Block Valve Station)/PTS (Pig Trap Station) ICT Requirements

A-I Gas Pipeline has 47 Block Valve Stations (25 of them need to implement remote control) and 11 Pig Trap Stations totally. The BVS/PTS stations list as follows:

Table 3 BVS/PTS Station List

Type	Station	Remote Control	Location (km #)

BVS	BVS-1	Yes	xxx
	BVS-2		xxx
	BVS-3	Yes	xxx
	BVS-4		xxx
	BVS-5	Yes	xxx
	PTS-1	Yes	xxx
	PTS-2	Yes	xxx
	BVS-6		xxx
	BVS-7	Yes	xxx
	BVS-8		xxx
	BVS-9	Yes	xxx
	BVS-10		xxx
	BVS-11		xxx
	BVS-12	Yes	xxx
	BVS-13	Yes	xxx
	BVS-14	Yes	xxx
	BVS-15	Yes	xxx
	BVS-16		xxx
	BVS-17	Yes	xxx
	BVS-18	Yes	xxx
	BVS-19		xxx
	BVS-20	Yes	xxx
	BVS-21		xxx
	BVS-22	Yes	xxx
	BVS-23		xxx
	BVS-24		xxx
	BVS-25	Yes	xxx
	BVS-26		xxx
	BVS-27	Yes	xxx
	BVS-28		xxx
	BVS-29	Yes	xxx
	BVS-30		xxx

	BVS-31		xxx
	BVS-32	Yes	xxx
	BVS-33		xxx
	BVS-34	Yes	xxx
	BVS-35		xxx
	BVS-36		xxx
	BVS-37	Yes	xxx
	BVS-38	Yes	xxx
	BVS-39		xxx
	BVS-40		xxx
	BVS-41	Yes	xxx
	BVS-42		xxx
	BVS-43	Yes	xxx
	BVS-44	Yes	xxx
	BVS-45	Yes	xxx
	BVS-46	Yes	xxx
	BVS-47		xxx
PTS	PTS-1	Yes	xxx
	PTS-2	Yes	xxx
	PTS-3	Yes	xxx
	PTS-4	Yes	xxx
	PTS-5	Yes	xxx
	PTS-6	Yes	xxx
	PTS-7	Yes	xxx
	PTS-8	Yes	xxx
	PTS-9	Yes	xxx
	PTS-10	Yes	xxx
	PTS-11	Yes	xxx

The telecommunication requirements for BVS/PTS show as follows:

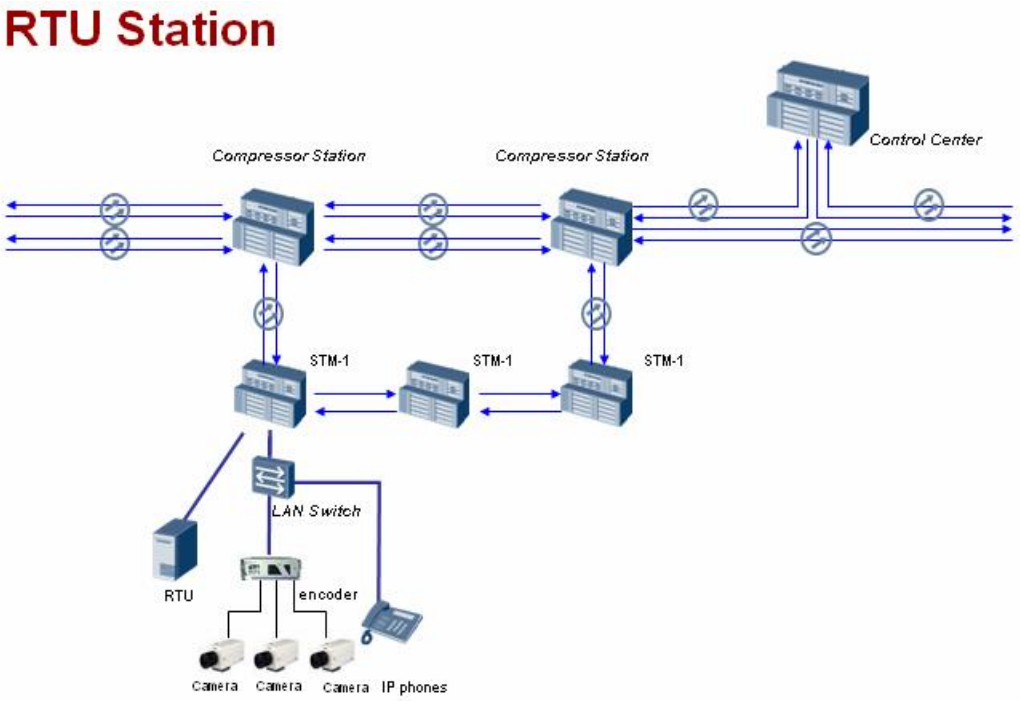


Figure 5 BVS/PTS ICT Requirements

1. Production telecommunication requirements:
   a) Production Supervisory Control system (RTU): Can be remotely controlled by station control system.
   b) Production dispatching: dispatching voice, trunked radio. Different subsystems can interoperate in order to achieve a unified command and dispatch.
2. Security requirements:
   a) Station video surveillance (perimeter and production equipments / valve).

3.1.4 Overall ICT Requirements for A-I Gas Pipeline

The overall ICT requirements for A-I Gas Pipeline show as follows:

Table 4 Overall ICT Requirements for A-I Gas Pipeline

System	Subsystem	Requirements
Infrastructure Network	Fiber transmission network	Provides backbone optical transmission network between the stations by the FOC along the pipeline. Primary backbone network channel
	Backup VSAT network	Provides backup satellite communications link, the production and dispatching communication can be carried on when the fiber transmission network is interrupted.
	Station LAN Network	Provides stations (MCC, GMS, CS, PTS, BVS) office and production LAN Network

Convergence Communication	IP telephony	Provides stations (MCC, GMS, CS, PTS, BVS) office voice communication system.
	Video Conference	Provides stations (MCC, GMS, CS) office video conference system.
	Dispatching Phone	Provides stations (GMS, CS, PTS, BVS) ddispatching phone system.
	Trunked Radio	Provides wireless trunked radio system along the full pipeline.
	Emergency Communication vehicle(ECV)	Provides a trunk radio and satellite radio communication system for emergency repairs to use.
Integrated Security	Integrated video surveillance	Provides video surveillance for the perimeter of the stations and production environment / equipments.
	Intrusion Detection System	Provides intrusion detection for the perimeter of the stations.

The ICT requirements includes Backbone network, station LAN network, Office IP-PBX voice, office video conferencing, production dispatching system, integrated security subsystem. The requirements of each subsystem are describe in the following section 3.2 to 3.7.

3.2 Backbone Network Design Requirement

After the deep analysis of RFP & Technical Specifications of A-I Gas Pipeline project, and the network development requirements, we have briefed the network development requirements that the project is looking for. We are providing the best solution according to your requirements.

3.2.1 SDH Network Requirement

- Transmission equipment in this project should be Multi-Service Transport Platform (MSTP) based on SDH, which can directly access Ethernet service and TDM service. MSTP nodes based on SDH should satisfy the basic requirements of SDH node and all kinds of requirements of SDH equipment expounded in ITU-T. All of the equipment shall be tested according international standards and codes, except the special specification of the tendering documents that are not specified in the international standards and codes.
- SDH equipment should connect the pipeline stations, include MCC, compressor stations, meter stations and some of the block valve stations needed, by fiber optic cable along with the pipeline. The maximum distance of single hop should be *xxx* km.
- SDH equipment should provide all interfacing with other system such as SCADA, Data network, CCTV, IPPBX, Video Conference, Trunk Radio.
- The whole topology of SDH system should be a 1+1 MSP STM-16 chain, with this chain there will be 9 STM-1 rings. This topology could provide high reliability to the whole system. And the public part of STM-16 and STM-1 equipments should be redundant configured, including power block, Central Control Board, Crossing board and so on.

- The equipment shall be Multiple Service Transmission Platform to directly provide IP interface. In framework of MSTP based SDH, the part of VC mapping shall be in compliance to the request of concatenation and virtual concatenation in ITU-T G.707 criterion, including provide continual concatenation or virtual concatenation on low-order VC12 lever and high-order VC4 lever and provide interconnect function in concatenation condition.

3.2.2 VSAT requirements

The main purpose of VSAT is to provide a backup for SCADA Data and Dispatching Voice in case of full or partial malfunction of the fiber-optic backbone for the A-I Gas Pipeline project. The VSAT system is consists of 10 VSAT station located at GMS_A, CS_B, CS_C, CS_D, CS_E, CS_F, CS _G, GMS_H, GMS_I and MCC_J Main Control Centre.
The requirements for VSAT system service is listed in the table below

Table 5 The requirements for VSAT system service

Station	Data service 64kbit/s	Voice（dispatching） service
MCC_J	9 channels	9 channels
GMS_A	1 channels	1 channel
CS_B	1 channels	1 channel
CS_C	1 channel	1 channel
CS_D	1 channel	1 channel
CS_E	1 channels	1 channel
CS_F	1 channels	1 channel
CS _G	1 channel	1 channel
GMS_H	1 channel	1 channel
GMS_I	1 channel	1 channel

3.3 Station LAN Network Design Requirement

Data communication network subsystem will be constructed for following main services provisioning:

SCADA data network,

VoIP service,

Office data communication service for data exchange,

Video conference service,

CCTV,

Trunk Radio

The data communication network will use Ethernet over SDH transport for data transportation between the pipeline stations.

This network should cover all sites, including MCC_J Main Control Center, 6xCS (including CS_B, CS_C, CS_D, CS_E, CS_F, CS _G), 3xGMS (including GMS_A, GMS_H, GMS_I)and 25xValve Stations (RTU sites).

This network should have interface with internet by the network of telecom operator.

3.4 IP Telephony

3.4.1 Scene Description

Through the deployment of IP-PBX and voice terminals, the control center and the production pipeline site staff phone to achieve interoperability. MCC_J control Center and other stations along the pipeline need to be equipped with IP-PBX equipments. Besides, there are 24 Block Valve Stations need to be equipped with IP single phone as remote extension of nearby processing station IP-PBX. And the IP-PBX in MCC_J control Center should be connected with local PSTN network in order to realize telephone communication between public network and the project.

After the IP PBX solution is adopted, the internal calls of the group are completely free of charge. When the internal users make long distance calls, only the expenses for local calls should be paid. In this way, the operating cost is greatly decreased. The flexible solution improves the communication efficiency between the staff members of the enterprise. Furthermore, compared with the traditional telephone system, the scalability and manageability of the voice system based on IP is more convenient.

3.4.2 Ambient Conditions

- **Outdoor Ambient Conditions**

The local ambient conditions are listed below. All equipment shall meet the ambient requirements respectively which are specified on the relative data sheets.

Average annual rainfall	137-616 mm
Ambient temperature, min / max	-41 °C / +49 °C
Relative humidity, min / max	17%- /84%
Thickness of frozen soil	0.52~2.34 m
Standard wind loading	0.38-0.48 kPa
Snow force	0.5-1.0 kPa (кgc/м^2)
Elevation, min / max	196m/852m
Intensity of earthquake, degree	6-9

- **Indoor Ambient Conditions**

Ambient conditions in MCC_J Control Center, Compressor Stations and Metering Stations: Indoor temperature min. /max.: 18°C/ 28°C. Indoor Minimum/maximum relative humidity: 40%/65%.

Ambient conditions in RTU valve stations: Indoor temperature min. /max. : 0 °C / 40°C. Indoor Minimum/maximum relative humidity: 20%- /80%.

3.4.3 Power supply

220VAC（±10％，50Hz）power supply for the IP-PBX System shall be from the Uninterruptible Power Supply (UPS) that has been supplied by other CONTRACTOR in MCC_J Control Center, Compressor Stations and Metering Stations.

In RTU Valve Stations, the power is +24VDC for IP telephone.

This is to ensure that all essential items of the equipment in the system shall be powered from batteries on float charge such that the performance of the system shall not deteriorate in any way on failure of the electricity mains supply. However, if the IP-PBX System requires a DC power supply system, the required conversion shall be designed, supplied, installed, tested and commissioned by the SUPPLIER.

3.4.4 Functional requirements

System structures shall be modular and scalable, based on open technology with support of Integrated Voice, Video, Data and FAX.

The IP-PBX System shall have fully Integrated Services Digital Network (ISDN) capability. It shall comply with common signaling capability in accordance with CCS(Common Channel Signaling) and ITU No. 7 Recommendations, Support the PRI (Primary Rate Interface) as defined by ITU – T recommendations, 23B + D/30B + D trunk interface to PSTN networks. It shall be provided with flexible numbering plan, data communication, Management Information System for systems planning and traffic analysis, reporting, call duration, call failures and performance report.

The IP-PBX system itself shall possess good security and reliability. SUPPLIER shall describe in detail the safety and reliability of equipment suggested.

The IP-PBX system shall possess good scalability, in line with the development trend of telephone IP-PBX technology. A good scalability to achieve a smooth expansion without any operation interruption in the future system expansion process and no affection to the realization of business functions.

The IP-PBX system shall have a complete redundancy backup mechanism and key equipment and modules shall adopt 1+1 hot backup mode to ensure stable and secure operation of the system.

The system shall take full advantage of IP network bandwidth resources to establish an integral IP communication system with voice and data service.

Capable of seamless connection with the existing SDH(MSTP) transmission network.

Phone numbering shall be flexible and may be prepared in accordance against user requirements, supporting numbering both by integral network equivalent digital and by the station.

Shall support T.38 IP fax services on the IP-PBX network, identify G3 fax signal and convert automatically.

System shall possess a complete QoS handling mechanism. The SUPPLIER shall provide QoS handling mechanism of its system and voice quality can be achieved, such as indexes of maximum delay, jitter, and packet loss rate and so on.

The largest analysis digital number of the IP-PBX system recommended shall not be less than 12 while the sent shall not be less than 24.

Independent exchange capability in local station, the IP-PBX can still work by self exchange style when the fault of contact with central IP-PBX in MCC_J.

1) Central IP-PBX

- User line conditions

  Analog user busy traffic: 0.18Erl/user

  Digital user busy traffic: 0.18Erl/user

- Relay conditions

  Relay traffic: 0.7Erl/line

  Call loss rate: <1%

- Supporting abundant voice businesses: call waiting, call forwarding busy, call forwarding no answer and so on.

2) IP-PBX

- Independent exchange capability in local station, the IP-PBX can still work by self exchange style when the fault of contact with central IP-PBX in MCC_J.
- Supporting abundant voice businesses: call waiting, call forwarding busy, call forwarding no answer and so on.

3) IP telephone

- The IP hardware telephone shall possess such functions as hand-free calling, abbreviated dialing, caller name and number display and redialing.
- IP telephone shall have the capability to be powered by PoE mode, also can be powered by DC +24V.

4) Analogue telephone

- Use of analogue signaling and transmission techniques.
- Have timed loop break recall facility.
- Have adjustable volume and pitch/tone ring control.
- Be provided with flashing light indication when telephone is being called (receiving ring current).
- Be provided with storage of a minimum of 6 programmable key functions (codes).
- Be provided with a last number redial facility.
- Be provided with a mute switch.
- Be provided with on-hook dialing.

5) Administrate & Maintenance Terminal workstation

- It sets a separate centralized PC based Maintenance and Administration Terminal for the purpose of fault status monitoring, database configuration and reconfiguration, system diagnosis and troubleshooting, minor and major alarm reporting, display of trunk line and line circuits' status shall be provided. It shall be provided with PC, printer, complete software and hardware units, cables.

6) Facsimile set

- The machines shall be Super G3, ITU-T V.34, utilize laser printing, and be equipped with a minimum thirty sheet capacity automatic document feeder. Minimum memory shall be of sufficient size to store the entire contents of the sheet feeder. The minimum paper tray capacity will be fifty A4 sized sheets. They will be capable of connection to an IP-PBX or the PSTN, feature auto-answer, auto-redial, transmit and remote terminal identification, transmission and activity reporting, and operate on 220VAC, 50 Hz.

7) Voice gateway

- FXS interface number: 2 FXS interface.
- LAN interface number: not less than 1 LAN interface.
- WAN interface number: not less than 1 WAN interface.
- LAN/WAN interface transmission rate: self-adapting 10Mbps/100Mbps.

- Support MGCP and SIP.
- Support general voice businesses. (For example: Call waiting, Call forwarding)
- Support FAX unvarnished transmission.
- Be provided with plentiful information instruction function.
- Voice gateway shall be powered by 220VAC, 50 Hz.

3.4.5 Deployment requirements

Stations	Traffic capacity	Remarks
MCC_J Main Control Center	Central IP-PBX, not less than 200 lines	To be installed together with Central Dispatcher Room, Back-up configuration
Compressor Stations and Gas Metering Stations	IP-PBX, not less than 100 lines per station	GMS_A, CS_B, CS_C, CS_D, CS_E, CS_F, CS _G, GMS_H, GMS_I
Block Valve Station and Pig Trap Station	One lines per station	24 BVS and 3 PTS

3.5 Video Conference System

3.5.1 Project Requirements and User Scale

According to the Customer's technical requirements the video conferencing system (VCS) shall be adopted on the major serviced offices of the Dispatch Control Center (DCC) and Gas Transportation Administration (GTS). It shall integrate video, speech and data communication by means of IP-network and other transmission platform to implement audio and video calls and multilateral video conferences between administrations, compressor plants and other facilities of the company in order to conduct business and production conferences, lectures, remote teaching, etc.
Connection between the Central Dispatch Administration (CDA) and other platforms shall be implemented through data communication IP-network with a bandwidth of 3 Mbit/s. Connection to Data Communication Network shall be implemented by means of FE interface.
The video conferencing system shall comply with ITU-T H.323 recommendations.
The video conferencing system shall be elaborated, shipped, installed, tested and commissioned as an integral system. The system shall include all required peripheral equipment, including microphones, LCD television set, remote control devices, etc.

There are some places that need video conference equipment, including GMS_A, CS_B, CS_C, CS_D, CS_E, CS_F, CS _G, GMS_H, GMS_I and MCC_J control Center.

3.5.2 Application Requirements

- Immersive Experience

With the development of videoconferencing technologies, HD video conferencing systems that provide better and better user experience must meet ever-growing user requirements for an immersive experience. This requires video to be in true-to-life dimensions with the ability to give the impression of making eye contact, as well as providing hi-fi audio and sound localization.

- Low-bandwidth HD

A video conferencing system places high demands on network bandwidth. To reduce the network costs of an enterprise, the video conferencing system must be able to achieve HD effects with low bandwidth.

- Outstanding Network Adaptability

Transmission faults such as packet loss, delay, and jitter are inherent on IP networks. Enterprises require a videoconferencing system with outstanding network adaptability to ensure a better participant experience, allowing sites to communicate with each other more smoothly, anytime and anywhere.

- Outstanding Ease-of-use

To meet enterprise requirements, the videoconferencing system must be integrated with the existing office system of the enterprise. It must also support the following functions:

- Convenient conference scheduling (for example, using Outlook)
- Conference notification using text messages and emails
- One-click to join conference

Simple conference control using a remote control or touch panel with a user-friendly user interface (UI).

- Stability and Maintainability

To mitigate the operation and maintenance (OM) pressure on system administrators, the HD videoconferencing system must provide multiple reliability mechanisms, including backup of the management system, Multipoint Control Unit (MCU) control, media processing, power supply, network ports, and E1/IP lines on the bearer network. When the active equipment or line becomes

faulty, the system automatically switches to the standby equipment or line to quickly rectify the fault.

➢ Open Standard and Convergent Interoperation

To protect enterprises' early investments, the HD videoconferencing system must:

- Support standard H.320, H.323, and SIP.
- Be compatible with devices provided by mainstream video conference vendors.
- Provide diverse third-party interfaces for convergence with existing office systems.
- Converge and interoperate with video systems, such as Microsoft Lync and video conferences supporting telepresence Interoperability Protocol (TIP), on heterogeneous networks.

➢ Support for Multiple Line Access Modes

To allow the enterprise employees to participate in conferences more conveniently and reduce the investment costs, the HD conferencing system must:

- Allow multiple access modes, such as local area network (LAN), xDSL, and E1.
- Support wired networks, such as IP, E1, and 4E1.
- Support wireless networks, such as 3G and Long Term Evolution (LTE).
- Converge with multiple types of terminals to achieve the best networking effects.

These features allow the enterprise to implement more convenient communication, anytime and anywhere.

➢ Customization

The HD videoconferencing system provides industry-specific and customized solutions. In addition, the system must support customized software development to meet customer requirements for optimizing or adding system functions. The videoconferencing system must also support extension to meet future customer requirements for constructing and using different and emerging services.

From the professional perspective, the videoconferencing system must provide not only an integrated hybrid networking solution but also a professional integrated conference room decoration solution to meet diverse customization requirements.

3.6 Trunking Communication System Requirement

3.6.1 Function Requirement

1) Group Call

Group call is point-to-multi-points half-duplex voice call, allowing the calling party with authority to establish a bi-directional call to the called group users.

2) Broadcast Call

Broadcast call is point-to-multi-points unidirectional voice call between the dispatching station and MS, and PTT in the called terminal is prohibited, making it only be able to receive but not transmit.

3) Emergency call

The emergency call has the highest call priority, when initiates, if the network system resources are insufficient, then needs to tear down the priority low ordinary call and assign-in-advance preference call (according to priority from low to high demolition), to guarantee establishment of emergency call.

4) Call forwarding

When the colony users do not know the called number, may call the control station, the dispatcher will talk to switch over according to the colony user's request to the goal use.

5) Support priority

Words power hand-off control, the user was divided into the different priority, carries on the different turning on priority to control to the different priority's user.

6) intercommunication

The Trunking system can realize intercommunication with PSTN or PBX.

3.6.2 Performance Requirement

Groups：not less than 16 group in one base station;
Support priority：common user, top-priority ,emergency user;
Call connection time：250ms;
MTBF：20years;

3.6.3 Coverage Requirement

1) Frequency Requirement

403~520MHz

2) Coverage Distance

Pipe line have *xxx* km，35 base stations.
The distance between the 2 stations is 20~60km.

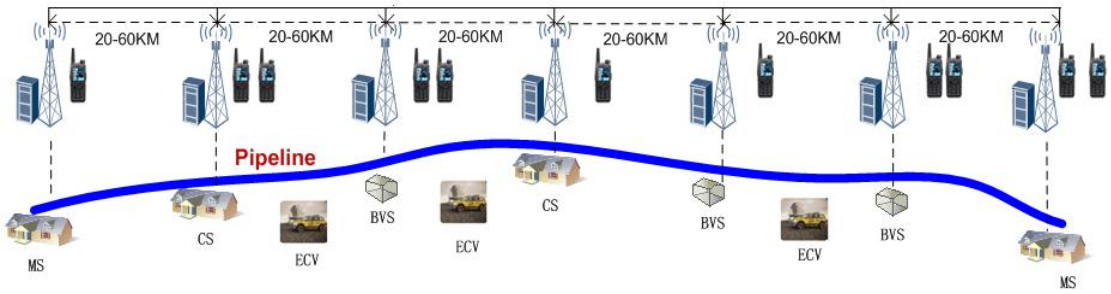


Figure 6 Coverage Distance

3) Station Trunking Communication Requirement

Cell radius can reach 5km in MS, CS, BVS,PTS, and support15~50 users.

4) Pipeline Trunking Communication Requirement

Cell radius can reach 30km along the pipeline, and support5~10 users.

3.6.4 Deployment Requirement

Base station will be installed in MS, CS, BVS and PVS;
Base station Control system and trucking control system will be deployed in the MCC.

3.6.5 Explosion proof

The camera or PTT Terminal need support the Explosion-proof Ex(ib)IIC T4 in the risk area of MS,CS,PTS.

3.6.6 Climatic Requirement

Table 6 Environmental condition

Working conditions temperature	indoors：0°C～45°C，outdoors：-40°C～65°C
Work humidity	10%～90%
Anticorrosion	Needs to have the anticorrosion measure in the equipment that having under the corrosion gas or liquid environment works
Anti-radar	The equipment needs the anti-radar measure
Protection rank	indoors：IP31；outdoors：IP65

3.7 Integrated Security Systems

3.7.1 CCTV Subsystem

【Service requirements】

5) Video monitoring for critical areas

- Purpose is to monitor the main production activities, and to protect surroundings of producing stations, to alarm on important events, and to provide video evidence about some events.
- Provide CCTV Cameras and Recording Systems at CSs, MSs, MC&ERCs, MCC.
- Provide CCTV Cameras at BVSs with RTU.

6) Integrate with Intrusion Detection System

- CCTV system at CSs, MSs, MC&ERCs, MCC provide an interface to Intrusion Detection System to report alarms.

7) Intelligent analysis and alarm linkage

- Provide a variety of automatic monitoring and analysis of target behavior. Meet the analysis needs in a variety of scenarios. Improve the analysis efficiency for target behavior.
- Safety and security of the system can be realized with automatic alarms, events or procedures from the endpoint cameras. Such as:
  - Automatic call of certain number and playing recorded message or sending alerting SMS or e-Mail
  - Activating audio or sound alarms at remote location
- All alarm events are from 3rd layer forward to layer 2 and 1, where are stored based on agreed scenario. For bigger safety and security, it is recommended that all events recorded on layer 2 will be parallel stored on layer 1.

8) Operations Management

- Provide local HMI and operation panels/consoles at CSs, MSs, MC&ERCs.
- CCTV system at CSs, MSs, MC&ERCs provides an interface to remote HMI in the MCC.
- Provide pipeline wide Master System at MC&ERCs and MCC with interface to remote stations.

9) Camera Selection

- All cameras will be IP Based and will be chose based on needs. It is recommendation that system use High Definition Cameras.
- To increase efficiency and modularity, as well and to reduce total costs, it is recommended to use intelligent “Smart Cameras” which don’t request Software Platform at 3rd layer of the system. These cameras can independently control type of alarms, activate recording, can be remotely control or configure.
- Some camera has built-in speaker and can be used that administrator can announce some information through that speaker.

4 Overall System Design

4.1 Design Principle

The Communication solution of A-I Gas Pipeline shall comply with the international-recognized pipeline industrial standards to fulfill the functional and performance requirement of the project. The project aims to deliver a safe, advanced and cost-effective solution.

The whole solution shall be with high reliability and scalability to support upgrade and seamless evolution in later stage. During design stage, the subsystems are used to be easily maintained and upgraded.

The overall design of solution is designed from various perspectives including operation modal, operation bearing network, reliability design, operational security, performance and E2E QoS.

4.2 Overall System Solution

4.2.1 System Context

The external systems interacting with the A-I Gas Pipeline Telecommunications System are External PSTN system, SCADA system and external network system (Internet/ Intranet). The overall telecommunication system context is shown in the following figure: (IF X is the identifier of the external interface)

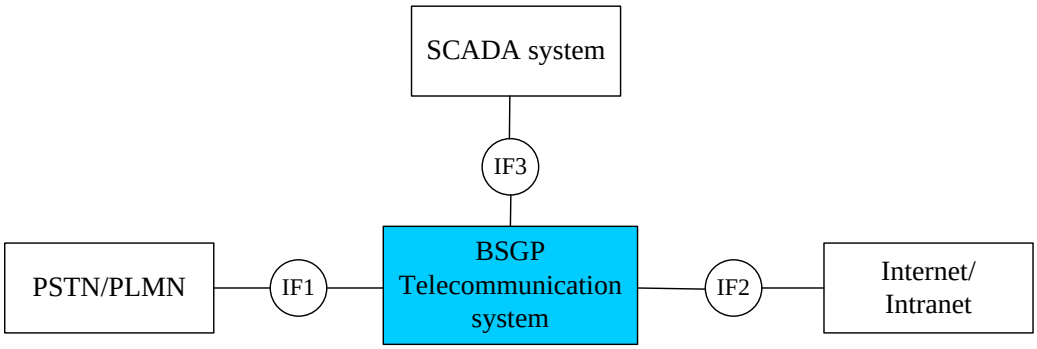


Figure 7 Overall telecommunication system context figure

The interface description is shown in the following table：

Table 7 External interface description

Interface ID	Function	Interface Type
IF1	The stations IP-PBX needs to connect to the external PSTN. It connects PSTN /PLMN network via E1 cable, using PRI or SS7 protocol;	E1, FXO, AT0, SIP

IF2	The stations office network needs to connect to the external Internet/Intranet. It connects Internet/Intranet via fiber cable based on IP protocol;	FE, GE
IF3	The stations SCADA system needs to connect by the network. So the main control center SCADA system can monitor the production process of the remote metering / processor / valve station.	FE

4.2.2 Overall Logical Architecture

For A-I Gas Pipeline requirements, the whole solution logical architecture is shown as follows:

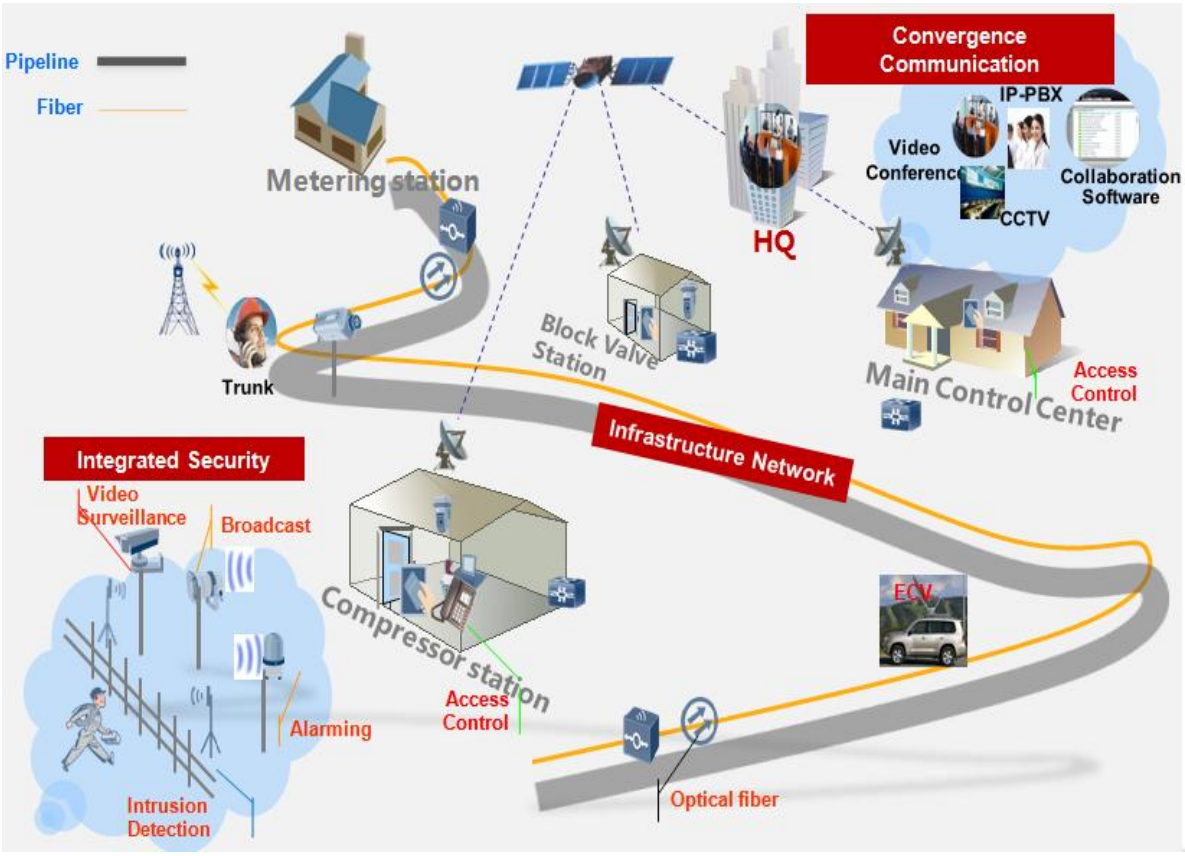


Figure 8 Solution Architecture

1. Infrastructure Network: Backbone Network(Including Fiber transmission network and backup VSAT network), Station LAN Network
2. Convergence Communication: IP telephony, Video Conference, Trunked Radio
3. Integrated Security: Integrated video surveillance, Intrusion Detection System

The various subsystems need to be deployed different functions at different stations. Each subsystem can be further decomposed into function modules. The whole A-I Gas Pipeline telecommunication system function modules overview map is shown as follows:

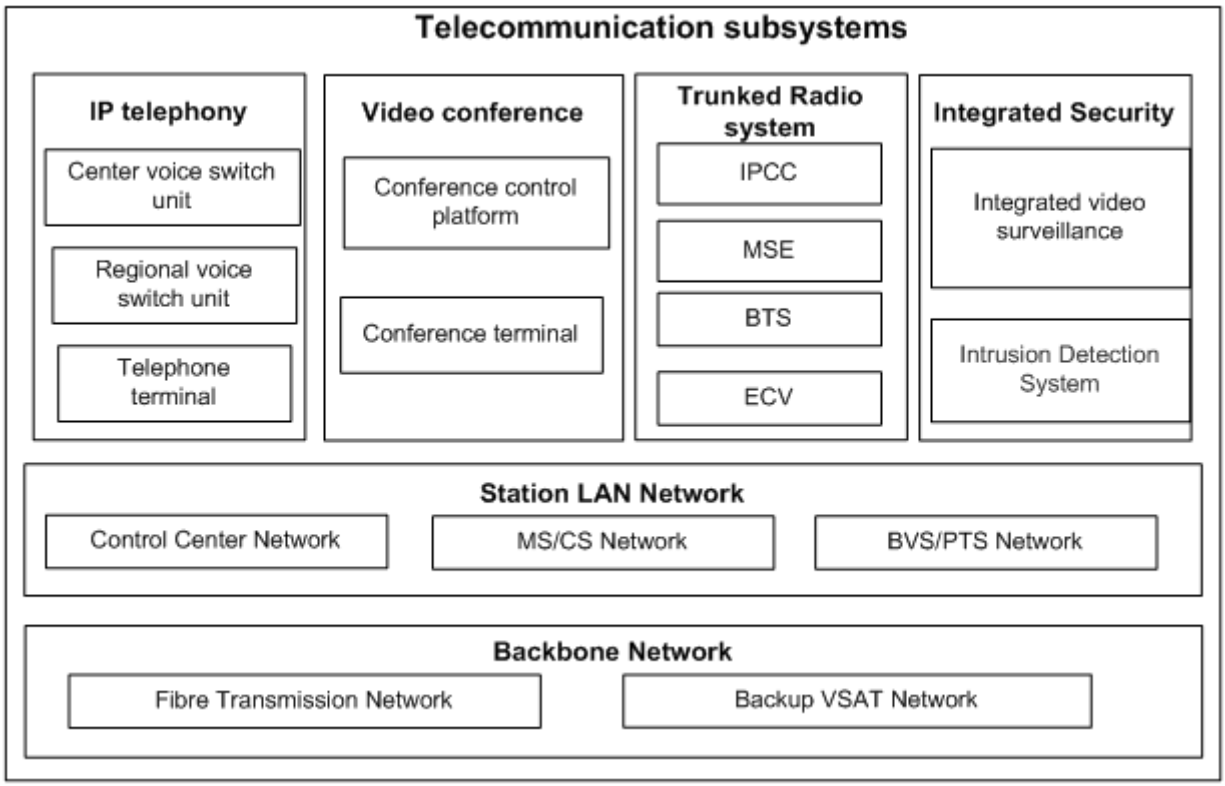


Figure 9 Subsystem composition

The function of each module in each subsystem is briefly described as below. Detailed introduction will be listed in the chapter 5 to Chapter 10.

1） Backbone Network

- Fiber Transmission Network: Provides various interfaces to connect SCADA production network and office LAN network implements the data transmission of communications services.
- Backup VSAT Network: Provides backup satellite communications link, the production and dispatching communication can be carried on when the fiber transmission network is interrupted.

2） Station LAN network

- Control Center Network: Provides control center office network and production monitoring network (Main control).
- MS/CS Network: Provides Metering Station and Compressor Station office network and production monitoring network (Station control).
- BVS/PTS Network: Provides BVS/PTS remote monitoring network (RTU access).

3） IP telephony

- Center voice switch unit: As a central server, it provides voice services for the whole network users to exchange voice services.
- Regional voice switch unit: As the second layer node, it provides voice services for regional users when it disconnected with the central server.
- Telephone terminal: Provide the voice call function for end users.

4） Video conference

- Conference control platform::Edits and distributes audio video signal to each terminal, provides background management for whole video conference system.
- Conference terminal: Collects and encodes audio, video and data information.

5） Trunked Radio

- MSE: Implements the call relay, billing, mobility management.
- BTS: Implements the CDMA trunked radio link management and the conversion between wireless links.
- IPCC: Contain dispatch server, terminals; it is used for dispatch user to communicate with related person.
- ECV: Provides Emergency Communication Vehicle for Pipeline emergency repairs.

6） Integrated Security

- Integrated video surveillance: Provides video surveillance for the perimeter of the stations and production environment / equipments.
- Intrusion Detection System: Provides intrusion detection for the perimeter of the stations.

4.2.3 Overall Physical Architecture

A-I Gas Pipeline has different communication function requirements at the metering station, compressor station, block valve station, pig trap station, control center and pipeline side. According to the above section subsystem function decomposition, we deploy different subsystem function modules into different physical sites (stations and pipeline side), the telecommunication overall physical architecture is shown as follows:

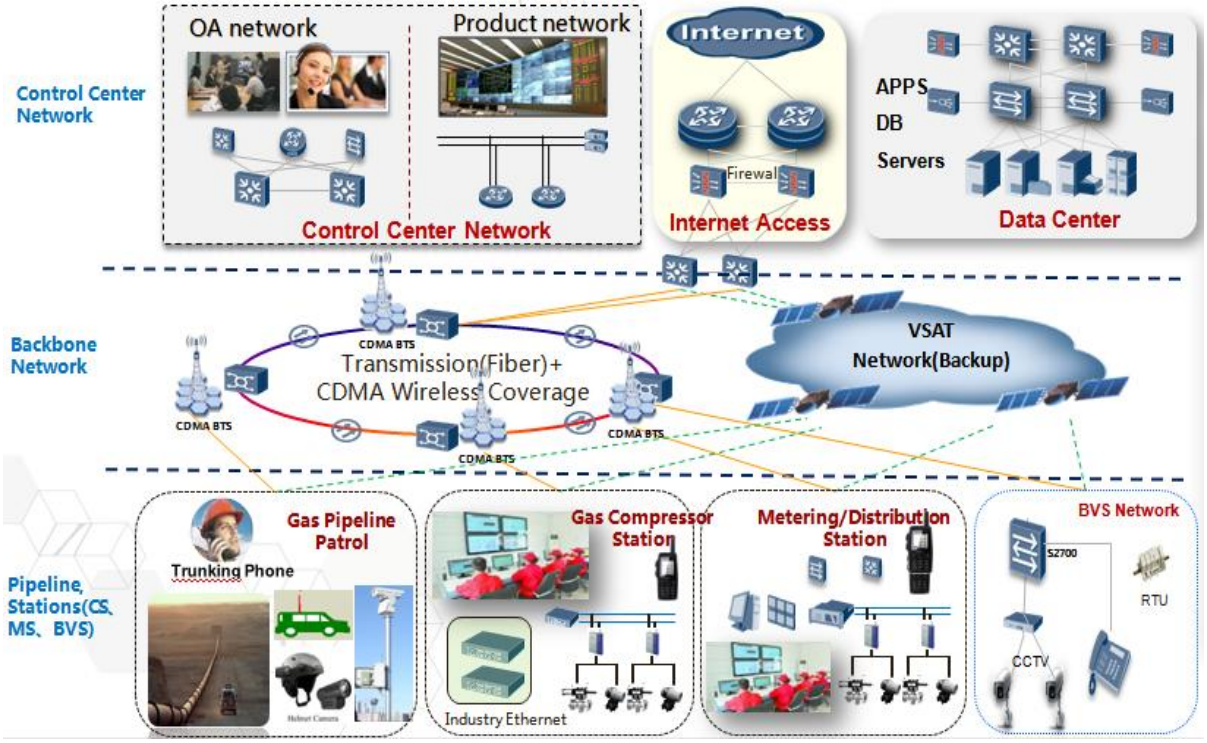


Figure 10 Physical Architecture

4.2.4 E2E QoS Assurance

From the overall perspective, the different services are classified. The key services are guaranteed in high priority. When designing system, the whole network is end-to-end planed to provide multi-serviced based E2E QoS assurance method.

Firstly, the services are classified into different priorities. For this project, the services are listed as follows according to the priorities: SCADA> Video Surveillance> Trunked Radio> IP telephony> Video Conference> Office application> Internet access. The different priorities of service use different scheduling strategies, and ensure the high-priority service access to network resources.

4.2.5 Reliability Design

System design should take into account of the high reliability of the communications network of the whole network. The high reliability of the system depends on the high reliability of each subsystem. For critical subsystems, various measures are designed to improve the reliability which is listed as follows:

- **Backbone**: Besides fiber transmission network, independent backup VSAT network is designed to provide reliable backup transmission channel.
- **Fiber Transmission**: 1 +1 protection network
- **LAN**: Equipment / links, and key module redundancy, loop protection protocol
- **IP telephony**: Off-site backup, local survivable

4.3 Overall System Highlights

4.3.1 High Security and Reliability Guarantee

1） Service Security Isolation

The network design for high Security, the production network and office network is physically isolated. Production data can be transferred independent.

For the office network, LAN network provides the end-to-end service isolation between different services and different departments through adopting the VLAN + MPLS L3 VPN solution. Each service has its own VLAN. Each VLAN correspond to each MPLS L3VPN Tunnel.

2） High Reliability

The system provides multi-level reliability protection including network level, equipment level and service level, to meet the high reliability and high security operational requirements of the pipeline.

Network-level: The system provides various technologies to improve network-level reliability such as redundant server backup on different location for IP PBX subsystem, device redundancy, link redundancy, VRRP and RRPP for LAN network.

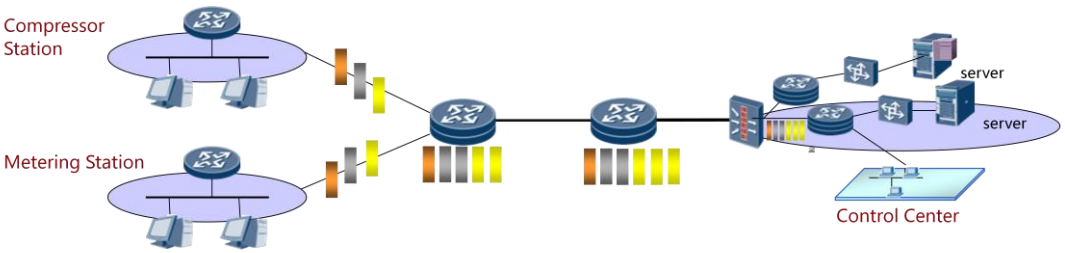
Equipment-level: The core equipments provide redundancy backup for key components such as MCU, power and fan module.

Service-level: The LAN network supports VPN FRR, E-VRRP, VLL FRR, Ethernet OAM and PW Redundancy to provide service-level reliability protection.

4.3.2 Multi-service E2E QoS Guarantee

In order to meet the different transmission requirements of the different types of services (bandwidth, priority, delay, throughput, etc.), and utilize network resources rationally, the telecommunication system plans for the whole network and provides end-to-end QoS guarantee.

The LAN network provides various technologies to implement service classification and QoS priority through setting appropriate the DSCP, 802.1P and EXP according to the service type, and supports rich queue scheduling such as PQ, WRR, DRR, PQ + WRR, PQ + DRR to achieve E2E QoS.



Service category	Service	Class of Service	MPLS Exp	Qos (Quality of Service) on Demand
Real-time services	SCADA/ Dispatching Phone CCTV Voice Video conference/	Gold	5,6	Bandwidth strictly ensured; low delay; low jitter; no packet loss
None real-time services	Office application Large volume data transmission	Sliver	1,2,3,4	Bandwidth non-strictly ensured; low delay; low jitter, no packet loss
Data	Internet File transfer	Bronze	0	No bandwidth ensured; high delay; high jitter, little packet loss

Figure 11 E2E QoS Assurance

- Flexible scheduling policy to protect various types of services: PQ queues and WFQ queues works together, to ensure the reliability of voice services and the distinction between scheduling of video, data and other services.
- Guaranteed bandwidth reuse high-quality: when congestion, ensure that the critical services are not affected; when idle, share bandwidth to the other PW / Tunnel.

4.3.3 E2E unified management solution for Saving OPEX

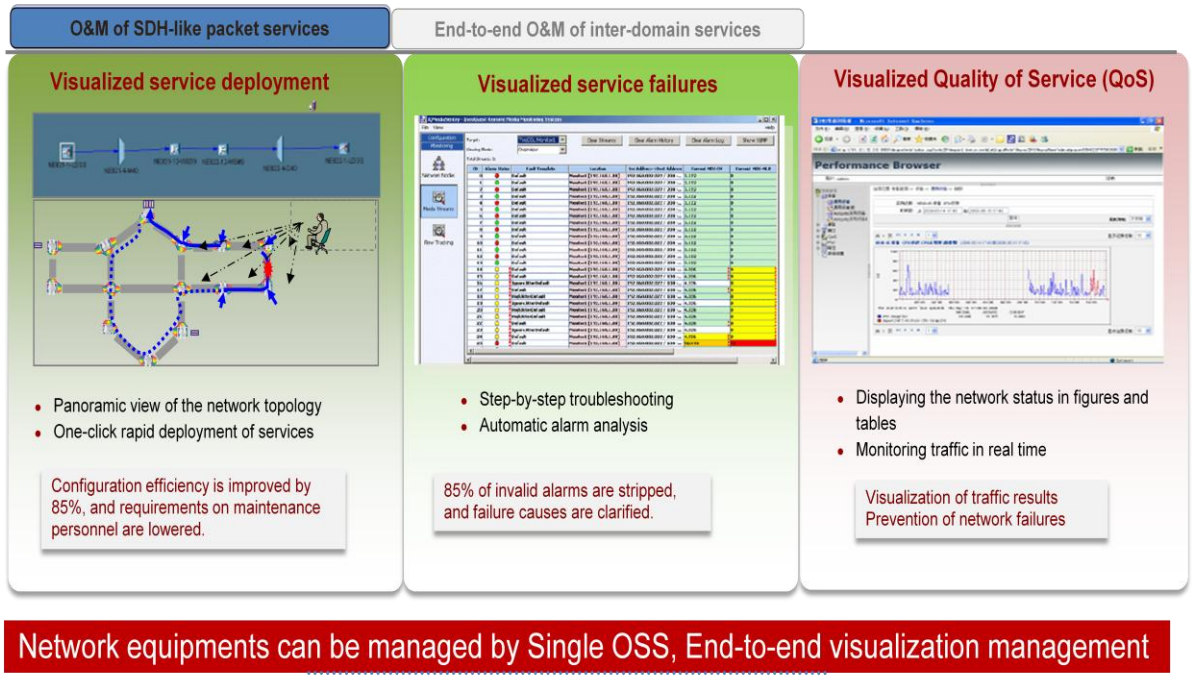


Figure 12 E2E unified management solution

Network equipments can be managed by Single OSS, End-to-end visualization management.

1. Visualized service deployment: configuration efficiency is improved by 85%, and requirements on maintenance personnel are lowered.
2. Visualized service failures: 85% of invalid alarms are stripped, and failure causes are clarified.
3. Visualized Quality of Service (QoS): Visualization of traffic results Prevention of network failures.

5 Backbone Network Design

5.1 Design Criteria

The international and industry standard which the subsystem complies with:

1） ITU-T G. 707, Network node interface for the synchronous digital hierarchy (SDH)

2） ITU-T G.803, Architectures of transport networks based on the Synchronous Digital Hierarchy (SDH)

3） IEEE 802.3, Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specification

5.2 Subsystem Function

According to the service requirements, the transmission subsystem shall transfer digital signals including SCADA data, office data, voice, CCTV, trunk Radio, video conference, intranet data, etc.

5.3 Solution Architecture

5.3.1 Transport Solution and Network Design

According to the project's RFQ, We fully understands the provided two scenarios and the typical configurations described in the RFQ and propose an outstanding solution which comprises of MSTP series with a unified network management system. The proposed solution is based on Huawei unified platform of transport network. This integrated solution guarantees the bandwidth requirements and provides an overall convergent solution.

Huawei has made out this proposal in accordance to the telecom part of the project's RFQ and relevant ITU-T recommendations.

The network consists of OptiX^{TM} OSN series equipment and Network Management System supplied by Huawei Technologies.

The proposed network solution is illustrated in the following figures:

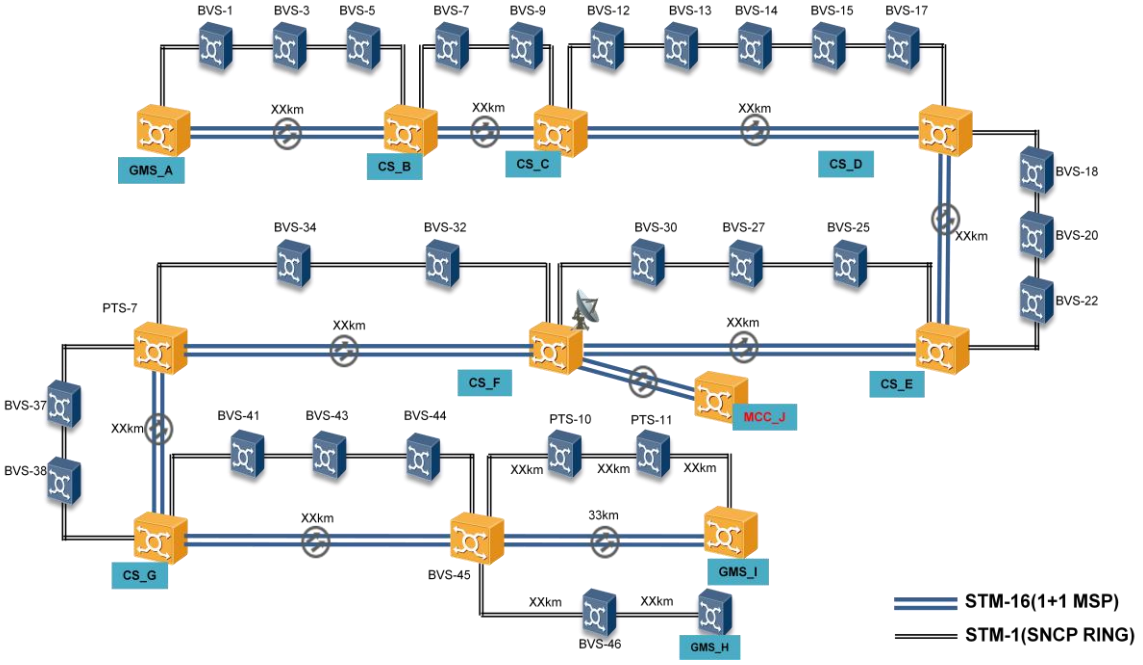


Figure 13 Backbone network solution

SDH system is the backbone of the entire communication system network, all of the subsystems will be interconnected through the SDH network. The network topology is a chain-like network with many rings. A-I gas pipeline compressor stations, meter station and MCC stations are STM-16 site.
In order to ensure the distance for each hop is average, BVS45, PTS7 also are designed to be STM-16 site. The main link capacity is 2.5G, and in order to increase reliability, the main link is designed as a 1 +1 MSP protection. As for the other 24 BVS, PTS10, PTS11 and GMS_H site are designed as STM-1 site. Some STM-1 sites and STM-16 sites, are formed a ring networks, so as to provide most site SNCP protection.
MCC_J is connection to CS_F with capacity of 2.5G, access to main link network.

5.3.2 Quoted Equipment in A-I Gas Pipeline Project

Following equipments are quoted in this project:

Table 8 Huawei FOTE

OptiX™ OSN 1500	OptiX OSN 1500 STM-1 Multi-Service Optical Transmission Platform	27 sets
OptiX™ OSN 3500	OptiX OSN 3500 STM-16 Multi-Service Optical Transmission Platform	11 sets
OptiX™ Synlock BITS	Synlock BITS – BITS system with GPS receiver	2 sets
OptiX™ iManager U2000	Huawei Network Management System for Transmission Network	1 set

OptiX™ iManager U2000-LCT	Huawei Local Craft Terminal	3 sets

Spare Units:

Spare units quoted for 2 year operation support. At least one unit for all type of units are quoted as spare for SDH Equipment, excluding the units with very small failure rate such as rack and subrack.

ODF and DDF:

Huawei's Optical Fiber Distribution Frame (ODF) consists of rack, distribution units, splice units or splice & distribution units, which are used for connecting and patching the optical signals. A sum of 11 distribution units is offered in this project.

A sum of 38 Huawei's Digital Distribution Frame (DDF) unit offered.

Tools and Documentation:

Two sets of tool kit are offered.

2 copies of Equipment Documentation, 2 copies of Network Management System Documentation are offered.

Test Instruments:

One set of Reflect Meter and one set of Optical Power Meter are offered as testing instruments.

5.3.3 Network Design Concept

5.3.3.1 Network Design assumptions

To create the appropriate design with respect to power budget constraints, fiber distances among sites, fiber parameters and client signals, minimal add/drop capability and traffic matrices, the following assumptions are made:

Single fiber mode is used (G.652).

The loss per km is 0.22dBm/km.

5.3.3.2 Network Topology

As requested by the procurement documents, the newly built network should be a STM-16 chain with 9 STM-1 ring which is able to support STM-16/STM-1 signals and Ethernet signals efficiently.

The main chain includes 2 STM-16 lines, one for work, the other for hot backup. If the work line is broken,the backup line will start work in 50ms. In addition, there are 9 small STM-1 rings which are comprised by STM-1 device installed in the RTU station. These small STM-1 rings can provide communication path for RTU stations and supply emergent path for CS or MS station.

5.3.3.3 STM-1 SNCP Ring

STM-1 SNCP Ring includes 9 (nine) OptiX™ OSN 1500 network elements.

5.3.3.4 STM-16 Linear 1+1 MSP Link

There are 11* (eleven) OptiX™ OSN3500 network elements at following 11 sites linked with STM-16

optical lines: GMS_A, CS_B, CS_C, CS_D, CS_E, CS_F, CS_G, GMS_H, GMS_I, and PTS7, BVS45 and MCC_J.

5.3.3.5 Protection Scheme

Equipment Protection

Following redundancy backup protection to key functional blocks are provided in this project:

- Cross Connection and Timing Units
- Power Supply System
- 1:N Protection for 3.3V Board Power Supply

The OptiX™ OSN1500 provides 1:N power protection for other 3.3V board power supplies through the power backup unit of the AUX board.

5.3.3.6 Attenuation Budget

Following formulas are applied in calculation:

Me = Ps – Pr – Ac – Mc – Lc

Lc = D*(Af + As)

Where:

Mc -- Cable margin (ageing and other factors), 3dB

Ps -- Mean launched power, worth value

Pr -- Minimum receiver sensitivity, worth value

Ac -- Optical connector loss, 0.5dB*2=1dB

Me -- System margin (equipment ageing and other factors)

Lc -- Cable loss

D -- Transmission distance (km)

Af -- Optical fiber attenuation per kilometer, 0.22dB/km in this project

As -- Spice loss, 0.025dB/km in this project (0.1dB/splice, 1splice/4km)

5.3.3.7 Synchronization

ITU-T compliant SSM (Synchronous Status Message) technology can be applied in this project. When SSM is applied in the network, co-operation of BITS is needed. Proposed BITS equipment is synchronized from satellite GPS signal or 2 input reference source clock signals from terrestrial networks. BITS managed by special NMS have 2 output clock interfaces and transmits NTP signals directly to 7 clients.

Synchronous Configuration

Master/slave synchronization mode was adopted in this project, where OptiX™ OSN 3500 at CS_C and CS_G is tracing external timing source BITS, and all the rest elements are tracing OptiXTM OSN 3500 at CS_C and CS_G.

5.3.4 VSAT Network Structure and System

The service requirements of VSAT system is mainly the SCADA Data and Dispatching Voice communication. The MCC_J Control Center is the core of the SCADA Data service, the SCADA Data from all the stations will be transmitted to MCC_J Control Center directly, and the dictate from MCC_J Control Center is also transmitted to all the other stations. Comparatively the quantity of VSAT stations is few, and there are little SCADA Data to transmit. The hub station should not be built to save on the charge, it will adopt SCPC (Single Channel Per Carrier). point-to-point mode to communicate between MCC_J Control Center and all the other stations.

5.3.5 VSAT SCADA Data Service

The SCADA Data Service is all point-to-point communication. The SCADA Data from all the stations will be transmitted to MCC_J Control Center directly through one-jump satellite link, and the dictate from MCC_J Control Center is also transmitted to all the other stations. The SCADA Data Service requires fix channel and real time, so the data channels will adopt SCPC.

SCADA data between MCC_J Control Center and each remote is 64kb/s (information rate) in each direction.

5.3.6 VSAT Voice Service

The Dispatching Voice service is mainly between MCC_J Control Center and all the other stations. The Dispatching Voice service shall adopt IP Voice technology. The VSAT equipment will connect to IP-PBX with RJ45 interface in MCC_J Control Center, and at all the other stations IP-phones will connect to VSAT equipment with RJ45 interface, and the voice service will be transmitted in the same channel with the SCADA Data service. Each channel of such voice traffic would need 34.4Kb/s (IP rate for G.729) in each direction.

The voice service from MCC_J Control Center to all the other stations will be communicated through one-jump satellite link, but the voice service between the other stations will be communicated through two-jump satellite link.

5.3.7 VSAT Design Proposal

Based on the “Application Description” and the functionalities of telecom iSCPC, we propose to use telecom equipment to deploy the 9 SCPC links from MCC_J Main Control Centre to GMS_A, CS_B, CS_C, CS_D, CS_E, CS_F, CS_G, GMS_H and GMS_I.

The final network diagram could be,

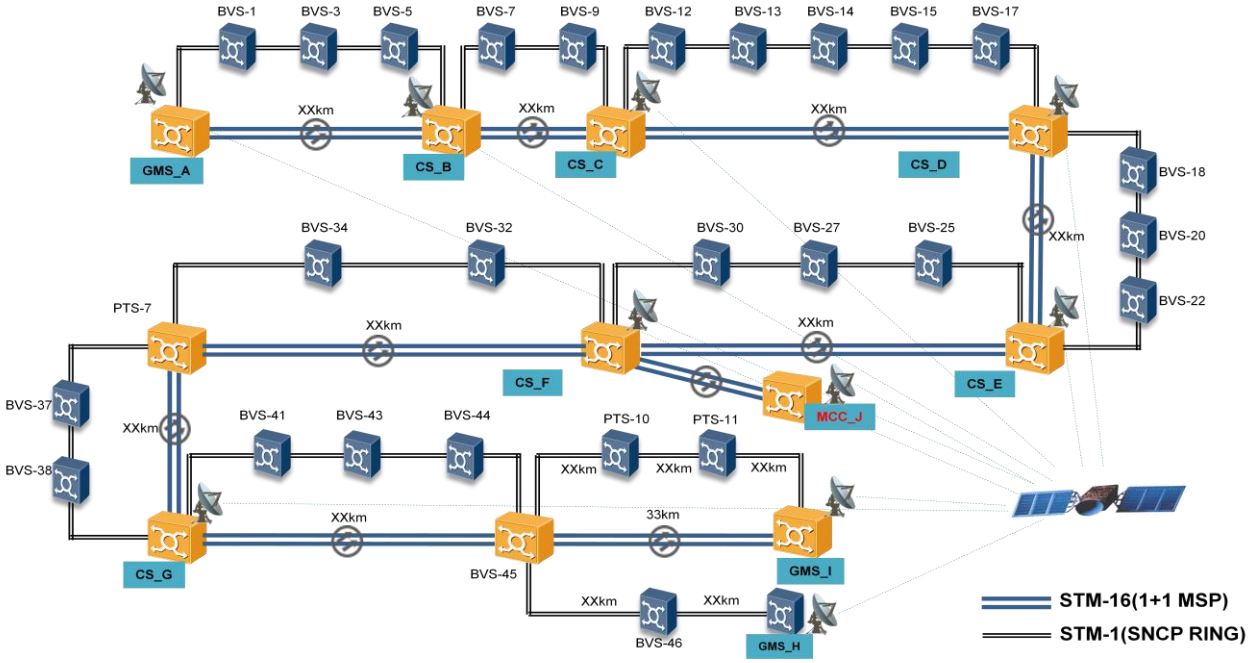


Figure 14 VSAT network

5.3.8 Satellite Bandwidth Allocation

For the SCPC link between the central site MCC_J Main Control Centre) and each remote, the transmission bandwidth required is the sum of the bandwidth for SCADA plus the bandwidth for voice.

For each Tx or Rx direction per remote,

SCADA data is 64kb/s IP rate, around 65.64Kb/s info rate, and 80KHz (with QPSK + TPC 0.533 + 1.3 carrier spacing) carrier bandwidth

34.4Kb/s IP date for voice coding is around 35.3Kb/s info rate, around 43KHz carrier bandwidth.

From MCC_J Main Control Centre, the bandwidth for SCPC carrier to other remotes (GMS_A, CS_B, CS_C, CS_D, CS_E, CS_F, CS_G, GMS_H, GMS_I) is 80 + 43 =123 KHz.

5.3.9 Satellite Station Hardware Configuration

We did the link budget using the info rate (65.64 + 2* 14.4 = 94 Kb/s) + QPSK + TPC 0.533 (Eb/No 3.9) under the satellite of SESAT 1

In order to reserve enough margins for future possible satellite choices, and also for the future network expansion, we propose to use

16K Ku-band BUC + 3m Ku-band antenna at MCC_J Main Control Centre

4W Ku-band BUC + 1.8m Ku-band antenna at other 9 remotes.

Also we propose to use L-band as IF frequency.

(1) For each remote

Each remote would have the following components:

1.8m Ku-band antenna

4W Ku-band BUC

Ku-band LNB

Modem

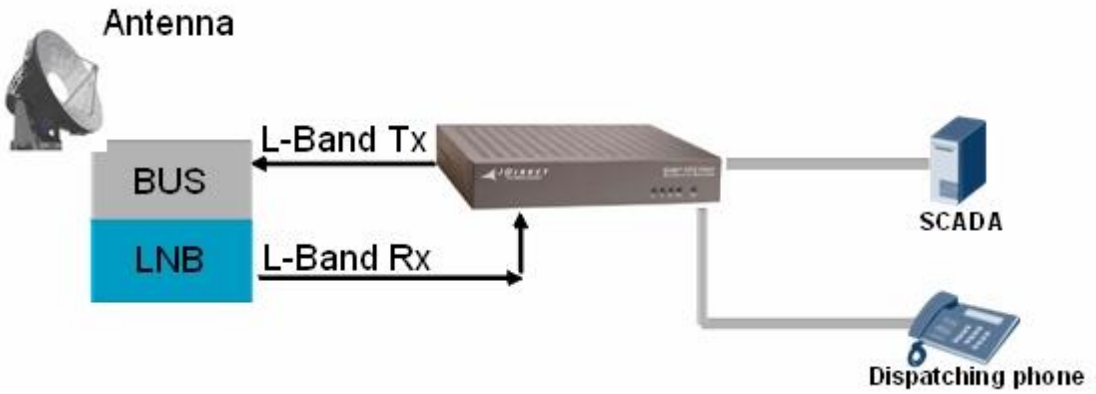


Figure 15 Remote Site Configuration

(2) For Central site (PLACE_C Main Control Centre)

This central site would have the following components:

3m Ku-band antenna

16W Ku-band BUC

Ku-band LNB

Modem

The system connection diagram could be shown as:

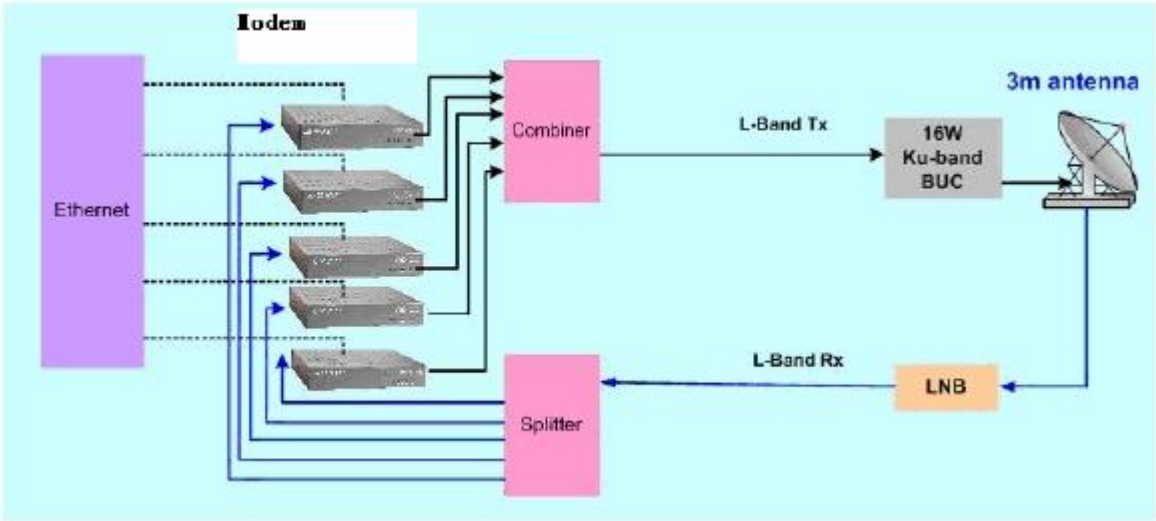


Figure 16 Hub Site Configuration

5.3.10 SCPC Network Management System

Network Management System (NMS) enables all essential monitor and control operations from a centrally-located network operations center (NOC). NMS is a comprehensive solution that manages all features from one console. It is completely GUI based and allows for easier configuration, problem identification, problem isolation and problem remedy. NMS has won numerous accolades from its existing customer base for its superior technology and overall cost reduction in successfully deploying and managing an advanced broadband VSAT network.

NMS can provide all configuration and control capabilities, including the ability to send software and firmware updates over-the-air to remote locations. This product provides graphical views of network layout and allows all system parameters to be viewed and configured from an intuitive, easy-to-use graphical user interface(GUI).

Features that are supported by the NMS include, but not limited to the following:

Real-time monitoring of the status of all network components. The VSAT network must be centrally controlled, enabling centralized monitoring and configuration. All remote stations can be fully controlled from a central Network Management System (NMS);

Multiple levels of warnings, alarms and informational message color options available;

Commands to change the VSAT frequency or mode of operation remotely (e.g., port speed, protocol port configuration and software version);

Ability to configure per site application QoS, separately in both directions;

Software and firmware upgrades are be downloadable to the VSATs;

The NMS has a graphical user interface (GUI), that optionally color coded and user customizable displays

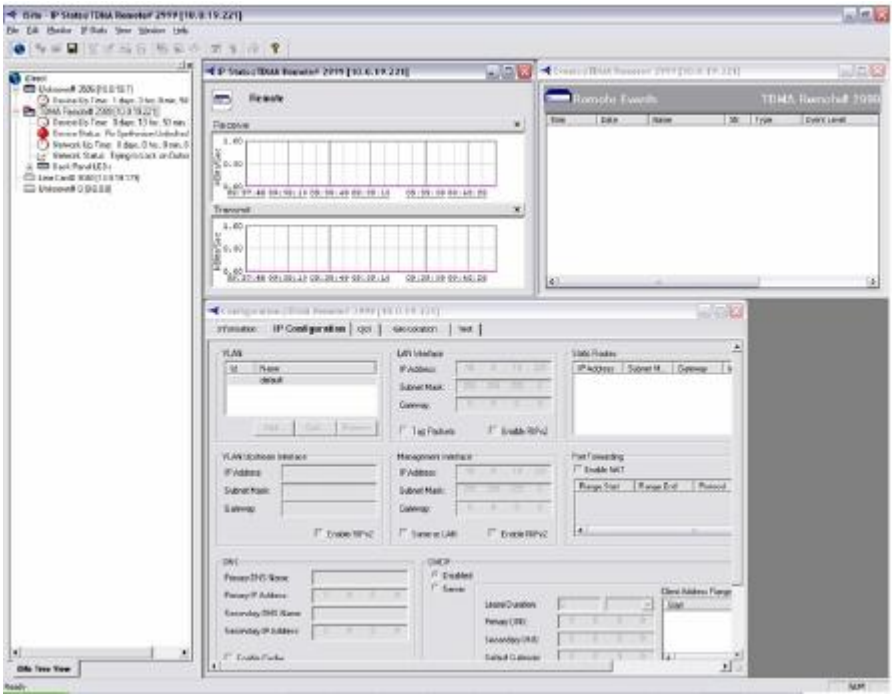


Figure 17 NMS Interface

5.4 Key Parameter

5.4.1 Optical Interface Parameters

Table 9 STM-1 optical interface parameter specifications

Item		Unit	Value			
Nominal bit rate		Mbit/s	STM-1 155.520			
Classification codes			I-1	S1.1	L-1.1	L-1.2
Operating wavelength range		nm	1260-1360	1261-1360	1263-1360	1480-1580
Type of optical source			MLM	MLM	MLM	SLM
Character of transmit reference point	Spectral Width(RMS)	nm	14.5	2.5	2.0	-
	Maximum -20dB spectral width	nm	-	-	-	1
	Minimum side mode suppression ratio	dB	-	-	-	30
	Maximum average optical output power	dBm	-8	-8	0	0

Item		Unit	Value			
	Minimum average optical output power	dBm	-15	-15	-5	-5
	Minimum extinction ratio	dB	8.2	8.2	10	10
Character of receicver reference point	Minimum Sensitivity	dBm	-23	-28	-34	-34
	Minimum Saturation	dBm	-8	-8	-8	-8
	Maximum optical path penalty	dB	1	1	1	1
	Receiver reflectance	dB	NA	NA	-14	-27

Table 10 STM-16 optical interface parameter specifications

Item		Unit	Value				
Nominal bit rate		Kbit/s	STM-16 2488320				
Classification codes			I-16	S-16.1	S-16.2	L-16.1	L-16.2
Operating wavelength range		nm	1266-1360	1260-1360	1430-1580	1280-1335	1500-1580
Type of optical source			MLM	SLM	SLM	SLM	SLM
Character of transmit reference point	Spectral Width(RMS)	nm	4	-	-	-	-
	Maximum -20dB spectral width	nm	-	1	1	1	<0.75
	Minimum side mode suppression ratio	dB	-	30	30	30	30
	Maximum average optical output power	dBm	-3	0	0	+3	+3
	Minimum average optical output power	dBm	-10	-5	-5	-2	-2
	Minimum extinction ratio	dB	8.2	8.2	8.2	8.2	8.2
Character of optical path	Attenuation range	dB	0-7	0-12	0-12	10-24	10-24
	Maximum dispersion	ps/nm	NA	NA	NA	NA	1200-1600
	Minimum return loss at the transmit point	dB	24	24	24	24	24

Item		Unit	Value				
	Maximum disperse reflectance	dB	-27	-27	-27	-27	-27
Character of receicver reference point	Minimum Sensitivity	dBm	-18	-18	-18	-27.5	-27.5
	Minimum Saturation	dBm	-3	0	0	-9	-9
	Maximum optical path penalty	dB	1	1	1	1	2
	Receiver reflectance	dB	-27	-27	-27	-27	-27

5.4.2 Jitter

1） STM-N interface

Table 11 Optical interface jitter parameter

Interface	Measure filter	Peak-peak value
STM-1(E)	500Hz～1.3MHz	0.50UI
	65kHz～1.3MHz	0.075UI
STM-1(O)	500Hz～1.3MHz	0.50UI
	65kHz～1.3MHz	0.10UI
STM-4(O)	1000Hz～5MHz	0.50UI
	250kHz～5MHz	0.10UI
STM-16(O)	5000Hz～20MHz	0.50UI
	1MHz～20MHz	0.10UI

STM-1: 1UI=6.43ns STM-4: 1UI=1.61ns STM-16: 1UI=0.40ns

5.5 Equipment Configuration

For the configuration of equipments, the greatest need for traffic and on tracks that would later become the backbone of network will equipped with OSN3500. The access service will equip with OSN1500, it depending on the slot and bandwidth requirements. iManager U2000 will be adopted as the NMS and configure LCT (local craft terminal).

5.6 Solution Highlights

The following clauses briefly describe the features of the transmission network solution.

5.6.1 Hot Standby to Increase Network Service Security

For the configuration of equipments, 1+1 hot standby are used for system control boards, cross-connect and synchronous timing boards, power supply modules. 1+1 protections are used for FE boards of main stations in order to increase network service security maximally.

5.6.2 Multi Services Accessibility

OSN series produce has multi services accessibility, which can support STM-n (1/4/16/64), E1/T1, E3/T3, FE/GE, STM-1/4 ATM, E3 ATM and SAN (Storage Area Network) such as FICON, FC and ESCON. And OSN series can provide built-in OADM function. So one platform is enough for access various service.

5.6.3 Uniform Platform

All the MSTP series equipments are based on same hardware and software platform. This will help engineers to learn fast as all functional boards can be used from OSN1500 to OSN7500. Also for spare parts, customer does not have purchase different kinds of boards.

5.6.4 End to End Management

The highlights of Huawei end to end management system are as follows:

- E2E service management, simpler and more effective management simpler with lower TCO
- E2E OAM, providing more reliable services
- E2E QoS, providing flexible services managed by NMS
- End to end service provisioning across MSTP, OTN and RTN networks
- In band or out of band DCN support

5.6.5 Synchronous Solution

Synchronous State Message is essential for the synchronous network, MSTP support SSM Over Ethernet and Enhanced SSM, MSTP supports SSM over Ethernet , this function can be used to prevent synchronization loops when backhaul networks is migrated to Ethernet networks. SSM is just suitable for link & ring topologies, MSTP enhanced SSM function support mesh & hybrid topologies.

6 Station LAN Network Design

6.1 Design Criteria

LAN network complies with following standards and regulations:

1） IEEE 802.3 Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications

2） IEEE 802.1Q IEEE Standards for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks

3） IEEE 802.1D Standard for Information technology--Telecommunications and information exchange between systems--IEEE standard for local and metropolitan area networks--Common specifications--Media access control (MAC) Bridges

4） RFC3376 Internet Group Management Protocol， Version 3

5） RFC 1157 Simple Network Management Protocol (SNMP)

6） IEEE 802.3af Power over Ethernet

6.2 Subsystem Function

According to the service requirements, the LAN subsystem shall transfer digital signals including SCADA data, office data, voice, CCTV, trunk Radio, video conference, internet data, etc.

6.3 Solution Architecture

6.3.1 General

Following equipment are quoted in this project:

Table 12 Equipment list

Quidway AR 2220	Quidway AR 2220 router	21 sets
Quidway Eudemon 1000E	Quidway Eudemon 1000E Firewall	3 sets
Quidway S9700	Quidway S9700 Core LAN Switch	2 set
Quidway S2700	Quidway S2700-26TP-EI-AC LAN Switch	78 sets
	Quidway S2700-26TP-PWR-EI LAN Switch	53 sets
Quidway S5700	Quidway S5700-28C-EI-24S LAN Switch	36sets
	Quidway S5700-52C-EI LAN Switch	3 sets

6.3.2 Proposed Network Structure

The whole network can be divided into two layers: Core Layer and Access Layer.

Network core layer, placed in MCC_J, serve as a central node for each remote LAN, as well as for connecting point to application servers and other external network, including Internet. All the services mainly centralized services which are terminated in MCC_J.

In the core layer of office LAN high performance L3 core switch will be deployed. The core switch will interconnect with other LANs through special Ethernet lines provided by fiber optic transmission system, realizing the isolation of each LAN based on VLAN technology. At the same time L3 core LAN switch will provide FE/GE ports for office LAN servers interconnection.

The core layer will be central point and will serve as a connection node to external networks. Internet access center are planning to be set in MCC_J. So in order to ensure security of whole network we propose to deploy one set of router and firewall in MCC_J at the egress of data network.

All other nodes except MCC_J are Network access layer. Every node needs to set up a LAN network in the office building, so several sets of L2 LAN switches will be placed in the same LAN. The computers are connected to the switch directly in every station, in the same broadcast areas. LAN switches in each station interconnect with the L3 core switch of MCC_J through FE or GE interface via special Ethernet lines provided by fiber optic transmission system.

In order to isolate and control office LAN users' access from/to other important services and ensure security of whole network we propose to deploy one set of firewall in each CS&GMS and MCC at the egress of LAN network.

For IP-PBX telephone network we have proposed to use PoE LAN switches in order to provide enough quantity of FE ports for IP phone devices.

For CCTV and Videoconference service we have proposed to use independent L2 LAN switch for MCC_J in order to provide enough quantity of FE ports for corresponding equipments, such as MCU, Video terminal, CCTV devices and so on.

In order to guarantee high availability of Dispatching Phone and SCADA services we propose to use independent dedicated routers for each station. In this way we can avoid the impact of other non-critical services to SCADA and Dispatching Phone services and increase resilience and convergence time for them via routing protocols.

iManager U2000 will be used to manage the equipments of data communication network.

The nodes in Data Network we can classify into typical 3 types:

1. Main control station in MCC_J (1 site –MCC_J)
2. GMS_A, CS_B, CS_C, CS_D, CS_E, CS_F, CS_G, GMS_H, GMS_I (9 CS&MS sites)
3. 25 Valve stations

6.3.3 MCC_J Data Communication Network

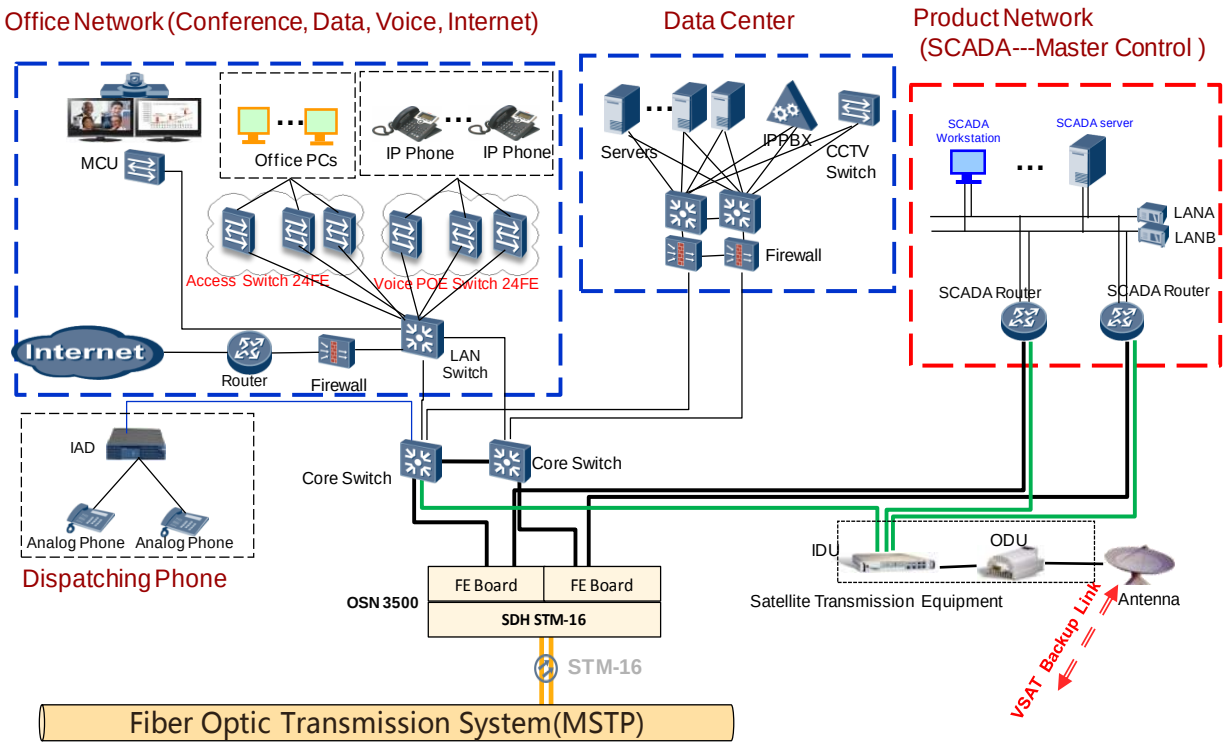


Figure 18 LAN structure of MCC_J

The MCC_J is a center of the pipeline data communication network. The office network in MCC_J contain several parts: office LAN, Office Telephone LAN, as well as VC, CCTV and SCADA & Dispatching phone services network.

Office LAN will be constructed based on 4 sets Quidway S2700 L2 LAN switches, each of them provide 24 10/100 Ethernet ports to connect to office PCs and other LAN devices and 2 GE Combo uplink interfaces.

All these L2 LAN switches will be connected to L3 core LAN switch with optical GE interfaces.

In order to isolate and control office LAN users' access from/to other important services we propose to deploy one set of firewall in MCC at the egress of LAN network.

For Office Telephone LAN network we propose to use 5 sets of Quidway S2700-26TP-PWR-EI series PoE LAN switches. These PoE LAN switches will be interconnected with other sites IP phone networks and at the same time will provide FE PoE access port to connect with PoE IP phones. These PoE LAN switches will be connected to dedicated S5700-28C-HI-24S optical LAN switch via optical GE interface and at the same time will provide FE PoE access port to connect with PoE IP phones.

For CCTV and Videoconference service we have proposed to use independent L2 LAN switch in order to provide enough quantity of FE ports for corresponding equipments, such as MCU, Video terminal, CCTV devices and so on.

In order to guarantee high availability of Dispatching Phone and SCADA services we propose to deploy independent dedicated routers. These routers will be interconnected with SCADA datacom network via optical transmission system, and at the same time will have a link to VSAT for back-up. In this way we can avoid the impact of other non-critical services to SCADA and Dispatching Phone services and increase resilience and convergence time for them via routing protocols.

For SCADA LAN network we propose to use 2 sets of S5700-52C-EI LAN switches. These LAN switches will be used for interconnection of business network devices.

In the core layer of MCC_J LAN network we propose to deploy Quidway S9703 high performance L3 LAN switch. S9703 LAN switch will interconnect with other remote stations LANs through special Ethernet lines provided by fiber optic transmission system, realizing the isolation of each LAN based on VLAN technology as well as inter-VLAN routing in according to certain policy defined by network administrator. Core LAN switch will provide 24xSFP GE and 96 10/100/1000BASE-T GE electrical interfaces to access servers and other important LAN devices. Application servers and core switch will be interconnected through 10/100/1000 GE interface, so as to ensure the receiving and dispatching of the high-speed data.

In order to provide connectivity with outside networks we propose a router, the outside interface of the router links with external Internet, the internal interface links with core switch. A firewall will be installed in order to improve the security of the whole network.

On Main control station placed in MCC_J will be installed:

2 set of S9703 L3 LAN switch with redundancy for power modules and main control units;
3 sets of S5700 L3 LAN switches;
6 sets of S2700 series L2 LAN switches;
5 sets of S2700 series PoE LAN switches;
3 sets of AR2200 Router;
3 sets of Eudemon1000E Firewall;
1 set of iManager U2000 Network Management System;

Equipment and port configuration are given in following tables:

Table 13 Equipment and port configuration for MCC_J

Usage	Equipment	Equipment configuration	Quantity
For external network connection	AR 2220 Router	4 ports of routed 10/100M Ethernet; 4 ports of switched 10/100M Ethernet	1
	Eudemon 1000E Firewall	5 built-in FE interfaces	1
For SCADA & Dispatching phones	AR 2220 Router	4 ports of routed 10/100M Ethernet; 4 ports of switched 10/100M Ethernet	2
Internal office LAN	S9703 Core LAN Switch	24 ports 1000BASE-X SFP; 96 ports of 10/100/1000BASE-T	2

network	S5700-52C-EI LAN Switch	48 10/100/1000Base-T ports	1
	S2700-26TP-EI-AC LAN	24 10/100 BASE-T ports and 2 Combo GE ports	4
	Eudemon 1000E Firewall	5 built-in FE interfaces	2
For CCTV	S2700-26TP-EI-AC LAN	24 10/100 BASE-T ports and 2 Combo GE ports	1
For VCS	S2700-26TP-EI-AC LAN	24 10/100 BASE-T ports and 2 Combo GE ports	1
For Data Center	S5700-52C-EI LAN Switch	48 10/100/1000Base-T ports	2
For Office Telephone LAN (PoE)	S2700-26TP-PWR-EI	24 10/100BASE-TX PoE ports and 2 Combo GE ports	5

Total access interfaces table for MCC_J LAN network

6.3.4 CS and MS Data Communication Network

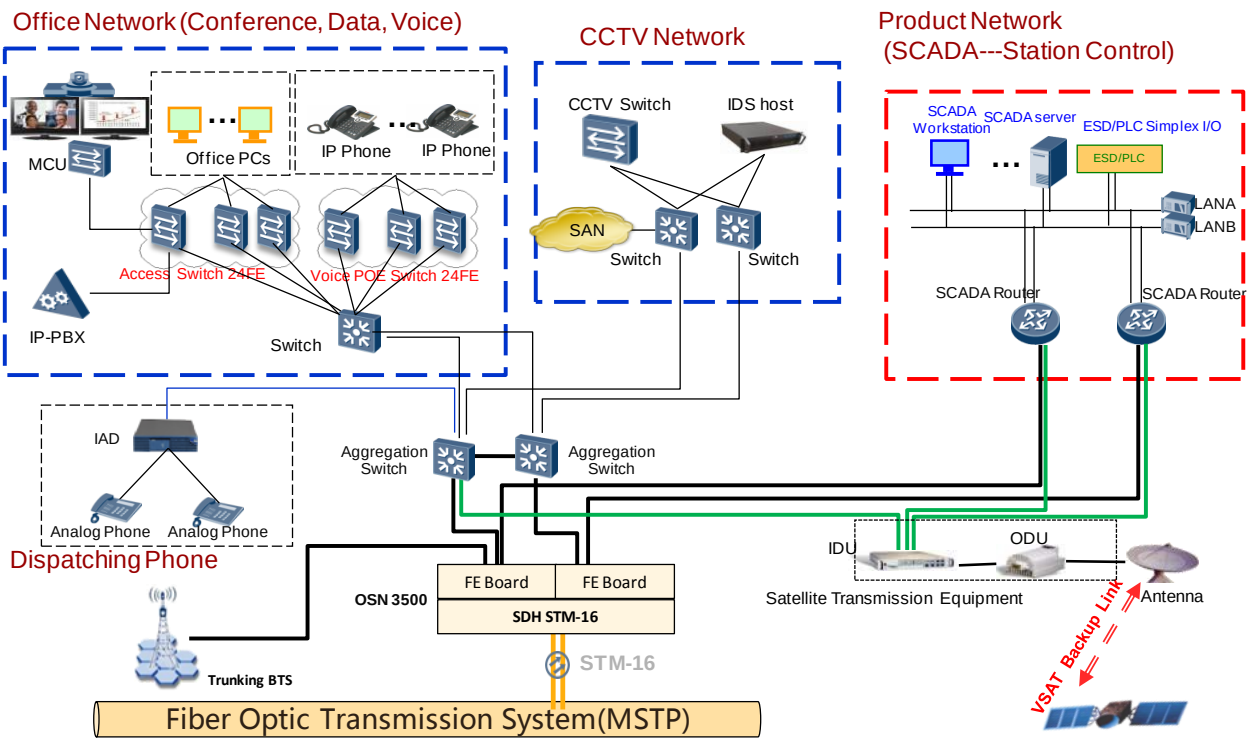


Figure 19 CS and MS stations office network

The Office network in CS and MS stations can be divided into two parts: office LAN and Office Telephone LAN.

Office LAN network part will be constructed:

For CS_B, CS_C, CS_D, CS_E, CS_F and CS_G based on 6 sets Quidway S2700 L2 LAN switches, each of them provide 24 10/100 Ethernet ports (S2700-26TP-EI) to connect to office PCs and other LAN devices and GE uplink interfaces;

For GMS_A, GMS_H and GMS_I based on 4 sets Quidway S2700 L2 LAN switches, each of them provide 24 10/100 Ethernet ports (S2700-26TP-EI) to connect to office PCs and other LAN devices and GE uplink interfaces;

These LAN switches will be connected to central S5700-28C-HI-24S optical LAN switch via optical GE interface.

In order to isolate and control office LAN users' access from/to other important services we propose to deploy one set of firewall at the egress of LAN network for each station.

For Office Telephone LAN network we propose to use:

For CS_B, CS_C, CS_D, CS_E, CS_F and CS_G 6 sets Quidway S2700 PoE L2 LAN switches, each of them provide 24 10/100 Ethernet ports (S2700-26TP-PWR-EI) to connect to PoE IP phones and GE uplink interfaces;

For GMS_A, GMS_H and GMS_I 4 sets Quidway S2700 PoE L2 LAN switches, each of them provide 24 10/100 Ethernet ports (S2700-26TP-PWR-EI) to connect to PoE IP phones and GE uplink interfaces;

These PoE LAN switches will be connected to dedicated S5700-28C-HI-24S optical LAN switch via optical GE interface and at the same time will provide FE PoE access port to connect with PoE IP phones.

In order to guarantee high availability of Dispatching Phone and SCADA services we propose to deploy independent dedicated routers. This routers will be interconnected with MSTP, and at the same time will have a link to VSAT for back-up.

For SCADA LAN network we propose to use 2 sets of S5700-52C-EI LAN switches. These LAN switches will be used for interconnection of business network devices.

Equipment and interface configuration for CS_B, CS_C, CS_D, CS_E, CS_F and CS_G are given in following tables:

Table 14 Equipment and interface configuration for CS

Usage	Equipment	Equipment configuration	Quantity
For SCADA & Dispatching phones	AR 2220 Router	4 ports of routed 10/100M Ethernet; 4 ports of switched 10/100M Ethernet	2
For CCTV	S2700-26TP-EI LAN Switch	24 10/100 BASE-T ports and 2 Combo GE ports	3
Internal office LAN network	S5700-28C-HI-24S LAN Switch	24 100/1000Base-X SFP ports and 4 Combo GE ports	3

	S2700-26TP-EI LAN Switch	24 10/100 BASE-T ports and 2 Combo GE ports	6
For Office Telephone LAN network	S5700-28C-HI-24S LAN Switch	24 100/1000Base-X SFP ports and 4 Combo GE ports	1
	S2700-26TP-PWR-EI LAN Switch	24 10/100BASE-TX PoE ports and 2 Combo GE ports	6

Equipment and interface configuration for GMS_A, GMS_H and GMS_I are given in following tables:

Table 15 Equipment and interface configuration for GMS

Usage	Equipment	Equipment configuration	Quantity
For SCADA & Dispatching	AR 2220 Router	4 ports of routed 10/100M Ethernet; 4 ports	2
For CCTV	S2700-26TP-EI LAN Switch	24 10/100 BASE-T ports and 2 Combo GE	3
Internal office LAN network	S5700-28C-HI-24S LAN Switch	24 100/1000Base-X SFP ports and 4 Combo GE ports	3
	S2700-26TP-EI LAN Switch	24 10/100 BASE-T ports and 2 Combo GE ports	4
For Office Telephone LAN (PoE)	S5700-28C-HI-24S LAN Switch	24 100/1000Base-X SFP ports and 4 Combo GE ports	1
	S2700-26TP-PWR-EI LAN Switch	24 10/100BASE-TX PoE ports and 2 Combo	4

6.3.5 RTU Station

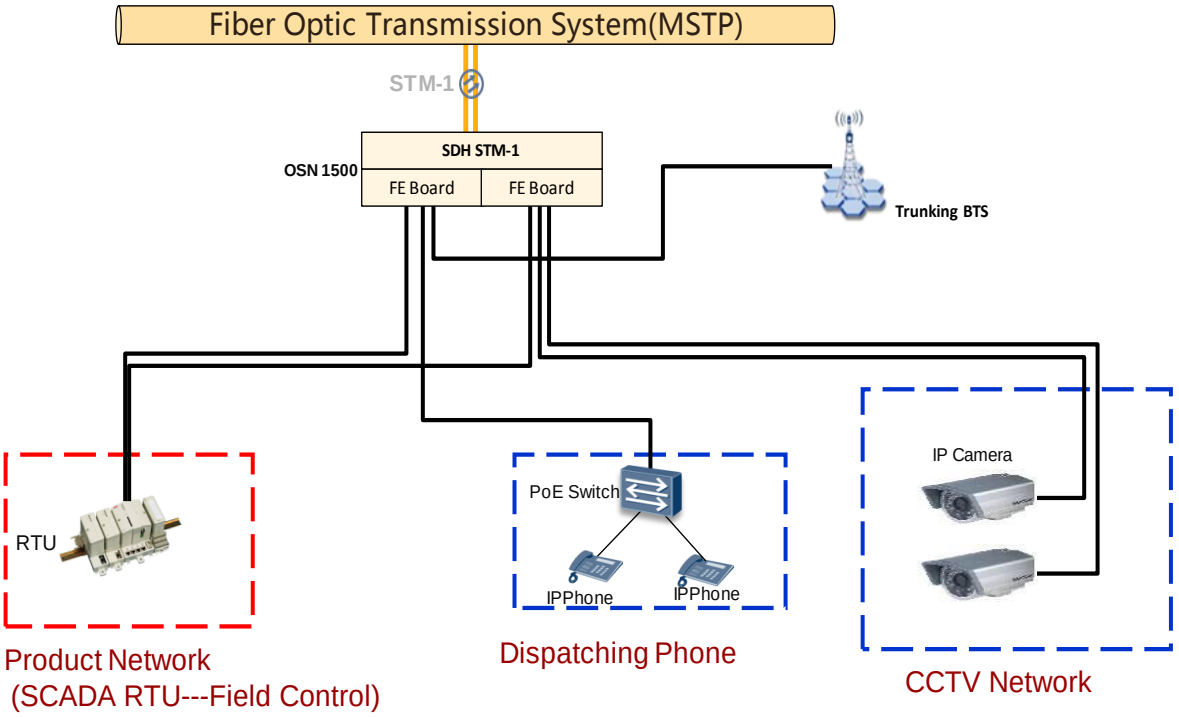


Figure 20 Data network RTU station

On RTU sites will be installed 1 set of S2700-9TP-PWR-EI series PoE LAN switch with 8 FE ports. These PoE LAN switch will be interconnected to other sites via Ethernet uplinks provided by optical transmission system and at the same time will provide FE PoE access ports to connect with PoE IP phone. At the same time this LAN switch can serve for connection of other devices such as CCTV system and so on. In this project assumed to use AC power on RTU stations, so to this LAN switch requires 220V AC power which should be provided by customer.

6.3.6 Power Consumption

Data communication equipments' power consumption for corresponding sites in this project has been given below:

MCC_J, CS_B, CS_C, CS_D, CS_E, CS_F and CS_G: power consumption 3800W, 220V AC

GMS_A, GMS_H and GMS_I: power consumption 2800W, 220V AC

24 Valve stations RTU sites: power consumption 100W (in full load*), 220V AC

7 IP Telephony System Design

7.1 Design principles

IP-PBX System shall meet or exceed the requirements of the latest edition of codes，regulations and standards. In cases where more than one code, regulation or standard applicable to the same condition, the most stringent one shall be followed.

The reference codes, regulations and standards are included but not limited as follows:

- ITU-T G.729
- ITU-T G.723
- ITU-T P.563
- ITU-T P.862
- ITU-T H.323
- ITU-T H.248
- ITU-T MGCP
- IEEE 802.2
- IEEE 802.3
- IETF RFC2543(SIP)
- RFC 3261 (SIP)
- RFC 2543
- ISO 9001, ISO 9002 Quality systems – a model of design, development, manufacture, installation and technical maintenance quality guarantee.
- ISO 9003 - Quality systems of quality guarantee model of final inspection and testing.

7.2 Solution Architecture

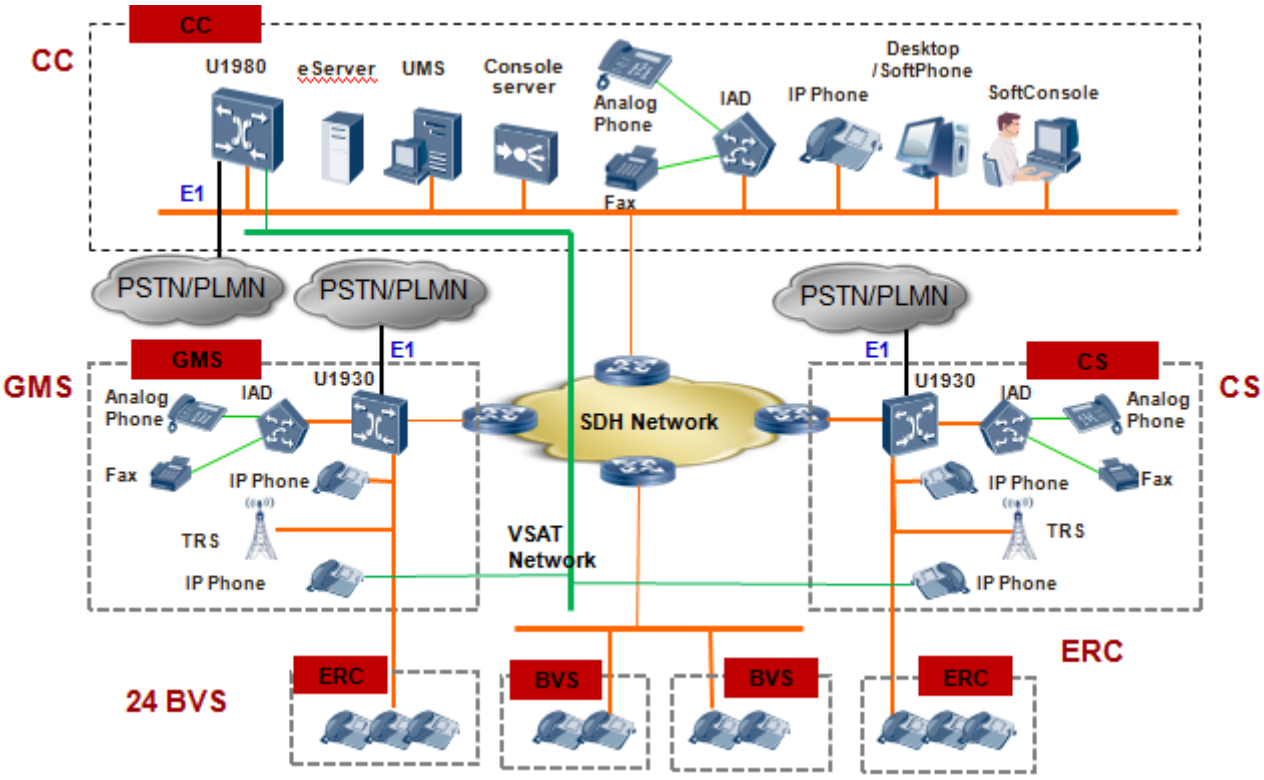


Figure 21 IP Telephony Networking solution

1) IPPBX U1980 is deployed at MCC_J control center to provide inter-office voice communications, which can ensure reliability with its backup mechanism: 1+1 backup of main control board and IP network port, load sharing of resource board and backup of power modules;
2) IPPBX U1930 are deployed at Compressor Stations and Gas Measurement Stations to provide standard inter-office voice telecommunications;
3) 24 block valve stations, 3 segment management department and 7 emergency response center will be equipped with single IP Phones as remote extension of nearby processing station IP-PBX;
4) IPPBX in MCC_J control center will be connected with local PSTN network in order to realize telephone communication between public network and this project;
5) Compressor Stations and Gas Measurement Stations will be connected to PSTN as backup trunk circuits of MCC_J;
6) In MCC_J the IP PBX will connect with MCU equipment from video conference subsystem, the users from IP-PBX system can take part in conference through this connection;
7) At each compressor station, SIP interface is used to connect IPPBX U1930 and TRS base;
8) UMS server is provide at MCC_J control center to deliver Voicemail services;
9) Network management server and CTI server will be deployed at MCC_J control center to manage the whole system and provide operator service.

NO	Equipment	Unit	total	MCC_J	GMS_A	CS_B	CS_C	CS_D	CS_E	CS_F	CS_G	GMS_H	GMS_I	24BVS and 3 PTS
1	Central IP-PBX	set	1	1	-	-	-	-	-	-	-	-	-	-
2	IP-PBX	set	9	-	1	1	1	1	1	1	1	1	1	-
3	IP telephone	set	600	150	50	50	50	50	50	50	50	50	50	27
4	Analogue telephone	set	500	50	50	50	50	50	50	50	50	50	50	-
5	Administrate & Maintenance Terminal workstation	set	1	1	-	-	-	-	-	-	-	-	-	-
6	Voice gateway	Set	10	1	1	1	1	1	1	1	1	1	1	
7	Facsimile set	set	11	2	1	1	1	1	1	1	1	1	1	-
8	P-PBX cabinet	set	1	1	-	-	-	-	-	-	-	-	-	-

7.3 Solution Overview

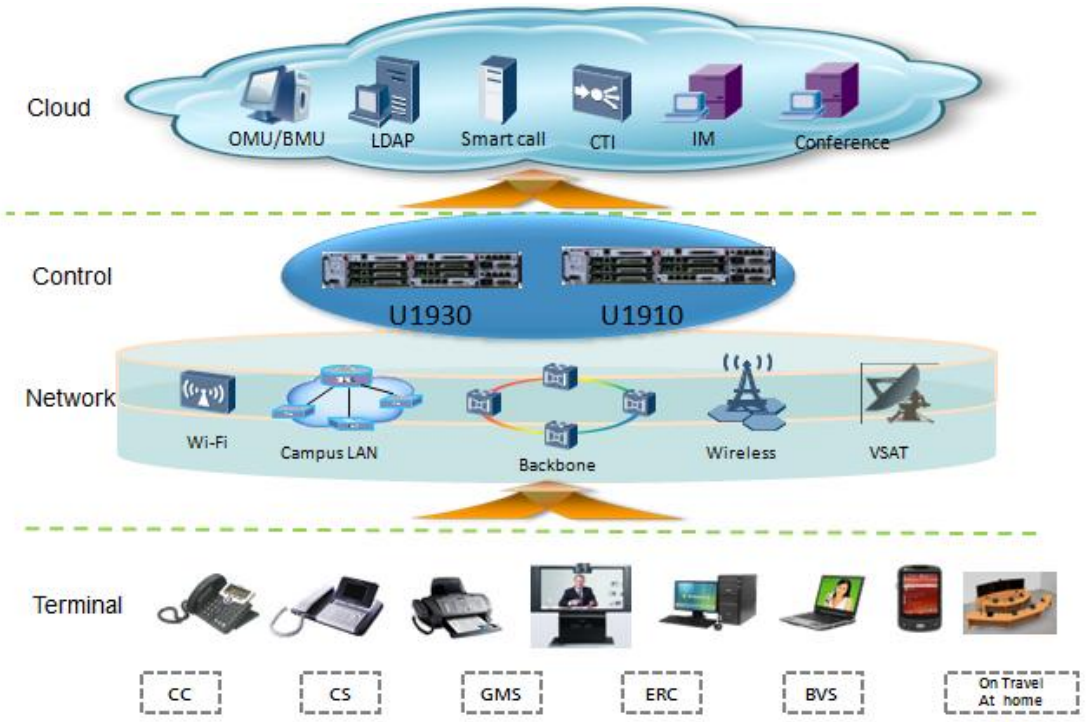


Figure 22 Solution Overview

- An IP PBX system includes 3 major parts. One is IPPBX which is the core soft switch equipment, and it can establish calls. Second part is application servers, like management system, CTI server and so on. Third part is terminals, like IP Phone, analog phone, access gateway, video phone.
- Huawei enterprise telecommunication solutions take the IPPBX comprehensive soft switch product family as the IPPBX. The traditional analogue technology and the IP technology are integrated perfectly. Multiple service-switching functions such as data, voice and video are provided. Except being compatible with the various services of the traditional private branch exchange (PBX), the system also provide multiple services such as distributive networking, mobile office, voice and video conference, IP PBXs, and unified messages based on IP, consequently improving the communication efficiency, decreasing the communication costs, and enhancing the core competence
- Application servers are based on IPPBX. OMU (Operate Management Unit) server is the IPPBX management system, and it manages IPPBX through telnet protocol.
- BMU (Business Management Unit) can provide self service for subscriber. Through BMU, subscribers can configure its service, schedule voice conference, and query communication fee using web browser.
- Billing server can download CDR from IPPBX, analyze CDR and provide billing report according to the predefined charge rules.
- UMS (Unified Message Server) provides voice mail and fax mail function. UMS is an industry computer and it connects to IPPBX using E1 cable. CTI server is a simple

- CTI platform and it can provide a simple Call Center function. Through MCU (Multi Control Unit), video phones which are registered on IPPBX can own video conference service.
- Subscriber can use IP phone, Video phone, Soft phone and Analog phone as the terminal.

7.4 Redundancy design

7.4.1 Adv Dual redundancy

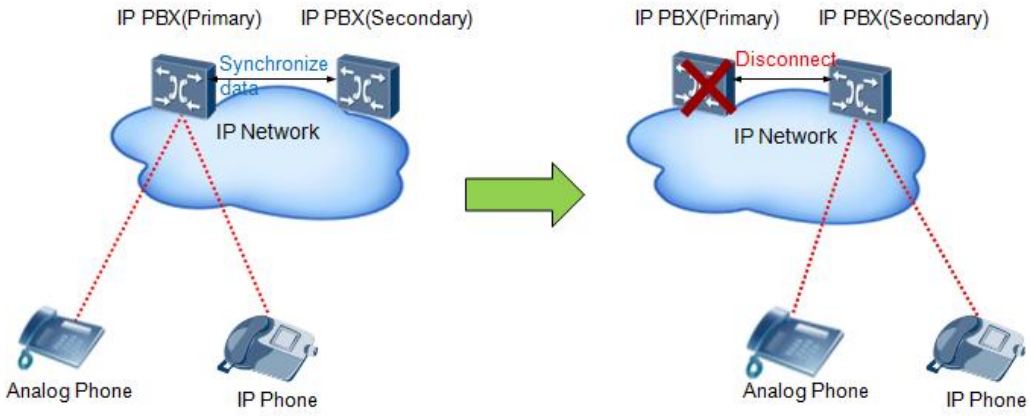


Figure 23 Adv Dual redundancy

- Services are registered with the active IP PBX, which is the core node on the entire network. The active IP PBX processes voice services.
- The active IP PBX backs up all static data tables on the standby IP PBX, which implements dual redundancy.
- When the active IP PBX fails, the DR function takes effect. All services are switched to the standby IP PBX, and the local gateway is connected to the standby IP PBX. The standby IP PBX does not synchronize data to the local gateway. When the active IP PBX recovers, the data generated during when the active IP PBX fails is lost.
- The active node synchronizes data to the standby node. Assume that data on the active node reaches the maximum specification, and there is no data on the standby node. The first full backup takes 25 minutes to 30 minutes. The subsequent full backup takes less than three minutes.

Note:

eSpace U1980 functions as the voice control servers at the headquarters, and supports dual redundancy.

7.4.2 Local Regeneration

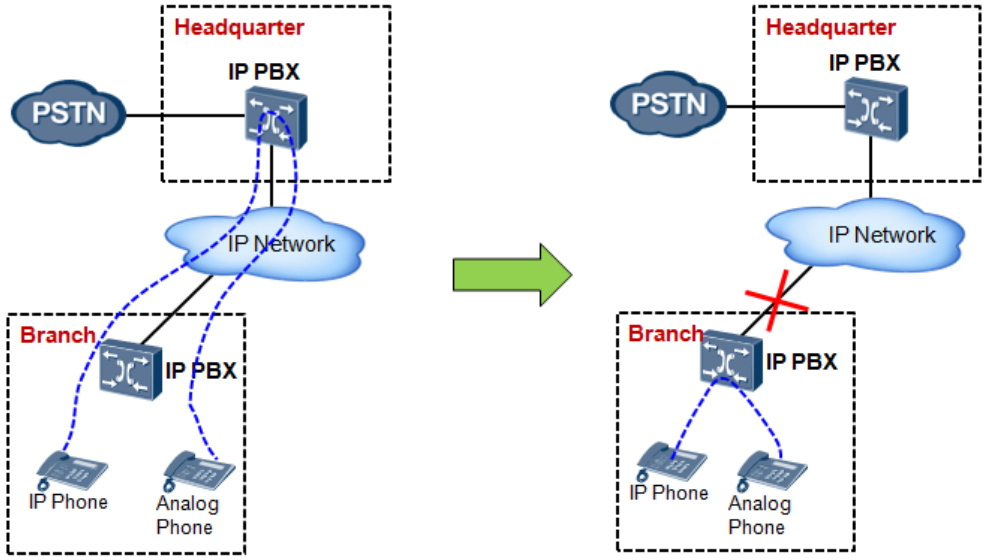


Figure 24 Local Regeneration

- Generally, all users register with the IP PBX at the headquarters and the IP PBX processes voice services.
- When the communication between a branch and the headquarters fails, the local gateway provides local regeneration to provide local voice control functions. When this happens, users in this branch register with the local gateway.
- The branch nodes synchronize data from the headquarters. The synchronization of the user data table containing 1000 users' records from the headquarters to a branch node takes about 4–5 minutes.

Note:

Both eSpace U19xx function as the local gateway and support local regeneration.

7.4.3 Local Switch and Power-Off/Network Interruption Survival

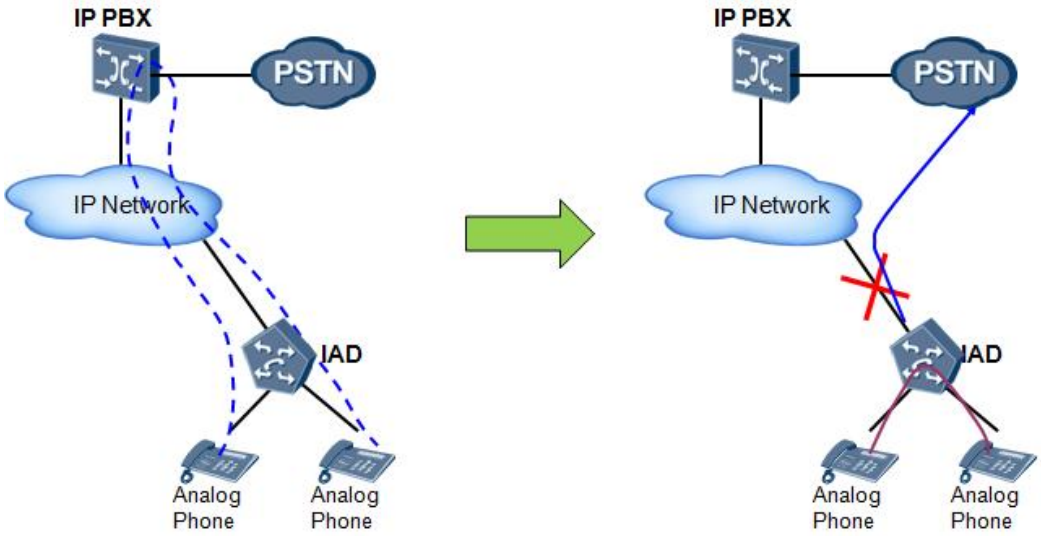


Figure 25 Network Interruption Survival

- Generally, all users register with the IP PBX at the headquarters and the IP PBX processes voice services.
- When the IAD works without soft-switch or is disconnected with the soft-switch, the IAD can work in local switch mode and provide basic voice communication capabilities.
- When the IAD powers off, the IAD supports power-off survival. The users under the IAD can call PSTN users through the PSTN survival channel.
- When the IAD is disconnected from the network at the headquarters, the IAD supports network interruption survival. Users under the IAD can call PSTN users through the FXO port.

Note:

IAD208, IAD132, and IAD1224 support local switch.

7.5 Connecting to video conference

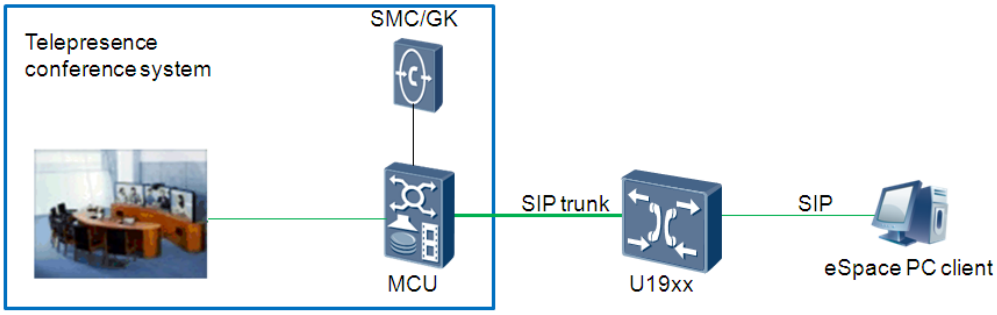


Figure 26 connected to the video conference

U19xx gateway is connected to the video conference system MCU through the SIP trunk and supports the audio and video conferences. Users can log in to eSpace Desktops to join the telepresence video conferences. Local and mixed conference videos can be displayed on the eSpace Desktop.

7.6 Technical Specifications

7.6.1 IP Voice Integrated Exchange

As the core device of Huawei unified communications, the IP PBX performs operations such as call control, media gateway access control, resource allocation, protocol processing, routing, and authentication, providing voice services of high reliability and quality. Huawei UC solution provides series of U19xx gateway products to meet the requirements of enterprises of different sizes.

Figure 27 Huawei U19xx Gateway

eSpace U1930

➢ U1930 Appearance

U1930 adopts the standard 2U (1U = 44.45mm) shelf. The following figure shows the front views of the U1930.

Figure 28 Huawei U1930

➢ U1930 Features

- Highly integrated, single device supports 224 analog users;
- Integrated access capabilities, supports the access of analog users and IP users;
- AC and DC power capability, and support for 1 +1 backup;
- Support unified network management, local network management, and with a visualization tool (1 hour deployment);
- Built-in voice mailbox, a maximum of 10 concurrent;
- Built-in web management page providing configuration functions, such as conference scheduling, forwarded-to number changing, and ONLY number changing

➢ U1930 Technical Specifications

Parameter	Specification
User capacity	300(224 analog users or 300 IP users)
Digital trunk capacity	60 channels
Analog trunk capacity	50(5 OSU board)
Maximum number of concurrent intra-office calls	60
BHCC	28.8k
Conference capacity	4 conferences and 12 participants
MTBF	30,000 hous
Protocols	SIP，E1/SS7, E1/R2，E1/PRI，E1/QSIG，T1/PRI，T1/QSIG
Interfaces	7 slots of service and interface boards
	2 E1/T1
	2 FE

Parameter	Specification
	FXO: 12FXO/12FXS OSU board FXS: 32FXS ASI board
Dimensions	442 mm in width, 310 mm in depth, and 86.1 mm in height
Weight	8 KG (full configuration)
Power voltage and frequency	AC: 100-240 V AC, 50 Hz or 60 Hz DC: -48V
Maximum power consumption	220 W

eSpace U1910

➢ U1910 Appearance

U1910 adopts the standard 2U (1U = 44.45mm) shelf. The following figure shows the front views of the U1910.

Figure 29 Huawei U1930

➢ U1910 Features

- Highly integrated, single device supports 96 analog users;
- Integrated access capabilities, supports the access of analog users and IP users;
- AC and DC power capability, and support for 1 +1 backup;
- Support unified network management, local network management, and with a visualization tool (1 hour deployment);
- Built-in voice mailbox, a maximum of 10 concurrent;
- Built-in web management page providing configuration functions, such as conference scheduling, forwarded-to number changing, and ONLY number changing

➢ U1910 Technical Specifications

Parameter	Specification
User capacity	100(96 analog users or 100 IP users)
Digital trunk capacity	30 channels
Analog trunk capacity	24(2 OSU board)
Maximum number of concurrent intra-office calls	30

Parameter	Specification
BHCC	14.4k
Conference capacity	4 conferences and 12 participants
MTBF	30,000 hous
Protocols	SIP, E1/SS7，E1/R2，E1/PRI，E1/QSIG，T1/PRI, T1/QSIG
Interfaces	3 slots of service and interface boards
	2 E1/T1
	2 FE
	FXO: 12FXO/12FXS OSU board FXS: 32FXS ASI board
Dimensions	442 mm in width, 310 mm in depth, and 86.1 mm in height
Weight	10 KG (full configuration)
Power voltage and frequency	AC: 100-240 V AC, 50 Hz or 60 Hz DC: -48V
Maximum power consumption	200 W

7.6.2 IAD Integrated Access Device

The IAD is a gateway for accessing voice and fax resources (that is, VoIP and FoIP) through IP. The IAD provides voice services of high efficiency and high quality based on the global IP networks (Internet or enterprise intranets). Huawei provides series of IAD, which can network with IP PBX or NGN through SIP protocol, to meet the access requirements of different user capacities and scenarios.

- eSpace IAD Features

  - Connect POTS users to the IP network.
  - Connect data users to the IP network. (only for IAD102H、IAD104H、IAD208E(T))
  - Support analog trunk interface FXO.(only for IAD132E(T)(8O8S/16O16S/8O24S)、IAD1224)
  - Support the traditional PSTN phone services, such as CLIP, call forwarding, and call waiting.
  - Cooperate with the IP PBX to obtain intelligent and feature services, such as ONLY service, etc.
  - Support Web management (not for IAD102H, IAD104H), TR069 management.

- eSpace IAD Technical Specifications

Parameter	eSpace IAD102H	eSpace IAD104H	eSpace IAD208E	eSpace IAD132E(T)	eSpace IAD1224
Appearance					
Port	2 FXS ports 1 LAN port	4 FXS ports 1 LAN port	8 audio/data integrated port (RJ45)	16 FXS ports 32 FXS ports 8 FXO ports and 8 FXS ports 16 FXO ports and 16 FXS ports 8 FXO ports and 24 FXS ports	32 to 224 FXS ports and 12 to 84 FXO ports
Long-time call	> 48 hours	> 48 hours	> 48 hours	> 48 hours	> 48 hours
MTBF	> 1.1 year	> 1.1 year	> 2.3 year	> 3.4 year	> 3.4 year
Audio	G.711 (A-law and μ-law), G.729				
Data	PPPoE, NAT		PPPoE		
Fax	T.38 fax service and transparent fax transmission, modem transparent transmission				
Reliability	Dual-homing Power-off survival and network interruption survival. These functions are available only for IAD102H, IAD132E (T) (8O8S/16O16S/8O24S), and IAD1224. Local switch (Only for IAD208E, IAD132E (T), and IAD1224)				
Dimensions	H x W x D: 36 mm x 190 mm x 146 mm	H x W x D: 36 mm x 234 mm x 170 mm	H x W x D: 57 mm x 283 mm x 206 mm	H x W x D: 42 mm x 436 mm x 365 mm	H x W x D: 86.1 mm x 442 mm x 310 mm
Weight	0.5 kg	0.5 kg	0.5 kg	5 kg	< 15 kg
Power voltage and frequency	Input: 100–240 V AC Output: 5 V DC	Input: 100–240 V AC Output: 12 V DC	Input: 100–240 V AC, 1 A, 50 or 60 Hz Output: 12 V DC, 2 A PoE	100–240 V AC, 1 A, 50 or 60 Hz	AC power supply: 110 or 220 V AC, 50 Hz or 60 Hz DC power supply: -48 V DC
Maximum power consumption	6.1 W	7.4 W	20 W	86 W	200 W

7.7 Solution Highlights

- Take full advantage of the internal network resources, and unified communications platforms simultaneously carry voice, video, data and multimedia information, reduce the cost of business investment;
- Fully consider both narrowband voice PBX and analog landline.
- Integrated telephone, conferencing, instant messaging and other means of communication, to improve the efficiency of communication among employees;
- Business management system is user-friendly, easy to operate, reduce maintenance costs and improve efficiency.

8 Video Conference System Design

8.1 Design principles

➢ Advanced

The videoconferencing system is designed to meet with the following requirements to work with advanced technologies:

- Strictly complies with international and local standards.
- Strictly complies with local communications industry regulations.
- Follows developing video and communications technology trends.
- Utilizes the most mature product technologies.
- Utilizes the most advanced technologies in all systems, ensuring that those chosen will not quickly become outdated.
- Avoids using non standards-based devices and devices manufactured by small-sized suppliers.

➢ Open

The video conferencing system is designed to meet with the following requirements for openness:

- Complies with H.323, H.320, and SIP.
- Complies with industry standard audio-visual codec protocols.
- Uses standards-based design to ensure interoperability with other standards-based videoconferencing systems and devices manufactured by other suppliers.
- Allows future capacity expansion.
- Uses the devices of popular communications suppliers to ensure continual technical support and reliable service.

➢ Reliable

The videoconferencing system is designed to meet with the following requirements for reliability:

- Provides the highest level of security and is not susceptible to software virus infection.
- Imposes low operating environment requirements.
- Has strong environmental adaptability.
- Is easy to install and use.
- Requires no professional maintenance.

- Operates unattended 24 hours a day, 7 days a week.

➢ Cost- Effective

The design must take into consideration the cost and performance of the videoconferencing systems, and have a higher price-to-performance ratio than competing systems under the same conditions.

8.2 Solution Architecture

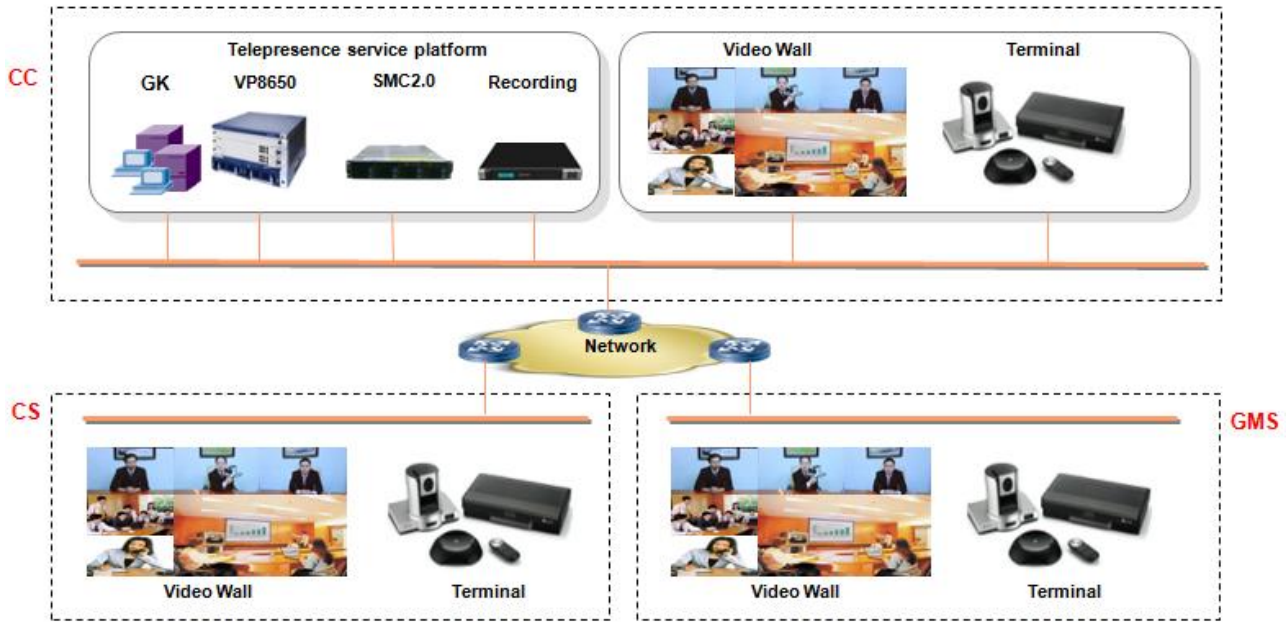


Figure 30 Solution Architecture

➢ **Overall solution**

Having thoroughly studied the Customer's requirements to the VCS, Huawei shall propose the following technical solution. Functionally they may be divided into the following types:

1. VCS switching equipment implements switching and processing of video flows, received from video terminals, and integrates them into conferences.
2. The central control system implements signaling processing and VCS equipment control function. It ensures synchronized operation and implementation of common system function, such as video conference management and conference convocation.
3. Video terminal equipment implements voice and image processing of conference members and transceiver function for the VCS system. It also provides user interface to convene and manage video conferences.

VP 8650-32 equipment, supporting 32 ports, shall be used as a MCU. It allows simultaneous connection of 32 audio and video terminals to one or more video conferences at the speed of 2Mbit/s. VP8650-32 is installed at the network center, located in DCC of MCC_J region. It is connected to the data communication network of the company by 10/100Base-T and E1 interfaces.

ViewPoint SMC shall be used as a central control system of VCS system. ViewPoint SMC is a software application, which is installed on the administrator's server of VCS network. Control system is also installed in the network center, located in DCC of MCC_J region. It is connected to the data

communication network of the company by means of 10/100Base-T interface. The provided configuration includes a pre-configured administrator's VCS server.

VP 9030 equipment shall be used as a video terminal. ViewPoint 9030 is a coding-decoding equipment with a Superwell VCC-HD90 HD video camera. Highly sensitive all-directional microphone array M200 shall be adopted. Microphones are equipped with an enlightened switch.

LCD TV-sets on a stand with an audio system are recommended in addition to video terminals as a display and sound output system. According to the requirements the size of LCD TV-set for the network center of MCC_J shall be equal to 52 inches. 46 inches - for other locations.

It is proposed to install 11 sets of video terminals in conference-halls of administrations and remote facilities of the company.

ViewPoint 9030 is connected to the data communication network of the company by means of 10/100Base-T interface, Microphones are connected to the system by means of RJ-45 interfaces. To output sound, video and images the system is connected to LCD TV-set by means of DVI, YPrPb, S-Video, RCA and SXGA OUT outputs. PC of the video conference member is connected by means of SXGA IN interface to transmit the desktop image.

2 sets of video terminal equipment including 2 video terminals VP 9030, 2 video cameras VCC-HD90P and 2 microphone arrays M200 are suggested for spare parts.

NO	Equipment	Unit	total	MCC_J	GMS_A	CS_B	CS_C	CS_D	CS_E	CS_F	CS_G	GMS_H	GMS_I
1	MCU	set	1	1	-	-	-	-	-	-	-	-	-
2	VP-SMC	set	1	1	-	-	-	-	-	-	-	-	-
3	video terminals VP 9030	set	20	2	2	2	2	2	2	2	2	2	2
4	video cameras VCC-HD 90P	set	20	2	2	2	2	2	2	2	2	2	2
5	microphone arrays M200	set	20	2	2	2	2	2	2	2	2	2	2

8.3 Functions and features of VCS system

8.3.1 System Architecture and Functions

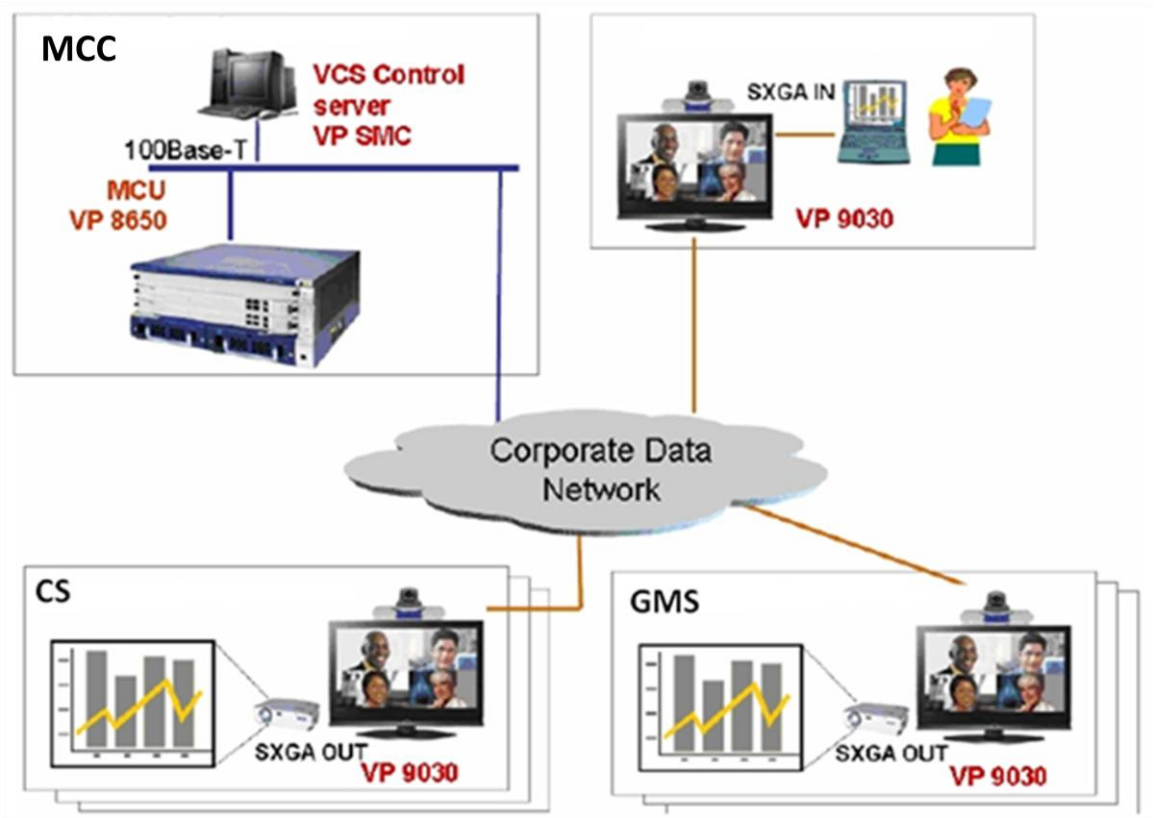


Figure 31 System Architecture

- **Modes of conference conducting**

VP SMC control system together with VCS VP 8650-32 MCU and VP 9030 switch supports conference implementation in different preset modes: free discussion “Forum”, videoselector communication “RollCall”, broadcasting mode from one facility “Broadcast”, “Voice activation”, simultaneous display of images from multiple users “Continuous Presence”, etc.

User interface for conference control is provided to each conference member by means of a console and video terminal control menu. Commands, input on a video terminal, are transmitted to VP SMC control system. It implements synchronized implementation with the help of VP 8650-32 and VP 9030 video terminal.

Name of each facility is demonstrated in the corner of each facility image. Name color and position may be configured by the terminal user.

- **Chairman Control**

Any of the conference members may act as Conference Chairman.

The system provides extended conference control functions to the Chairman. In this mode Chairman may choose a conference mode: “Forum”, “RollCall”, “Broadcasting”, “AutoView”, “Voice activation”, “Continuous presence”. The Chairman may also configure these modes, for example, determine amount

and output location for the images of conference members. The Chairman may extend or terminate a conference.
The Chairman may change the amount of conference members, disconnect or add a new member, turn on/off member's sound or microphone.
The Chairman may designate any end point as a "speaker". In this case all other end points shall act as "listeners".
The Chairman may choose any location to view and manage a remote camera.
The Chairman may designate any end point as a "narrator", whose image will be transmitted to all other members.
Any of the participants wishing to speak must send a request to the Chairman. The Chairman may satisfy/decline a request.
The Chairman may leave his position; in this case the system shall switch to administrator-controlled mode.

- **Voice activation mode**

The loudest voice shall be taken as a current speaker. After that there will be a 1-3 minute delay (adjustable function) before the switch to the next speaker who is louder.

- **Broadcasting mode**

The lecturer may see the listeners in multi-window mode and the listeners may see the full-screen image of the narrator.

- **SiteCall function**

SiteCall function allows VCS network subscribers to organize a video conference directly from their video terminals. In order to do that subscriber needs to choose conference members from an address book and press «SiteCall» button. Information about input video conference data is transmitted to the control system, which convenes a conference automatically.

8.3.2 ViewPoint 8650 MCU features

ViewPoint 8650 equipment fully complies with ITU-T and ISO/IEC standards. It is fully compatible with a broad range of already installed equipment. H.264 video compression; 1080p, 1080i and 720p definition, 4CIF, 50/60 fields, CIF and QCIF, as well as G.711, G722, G.728 and AAC-LD voice transmission protocols.
Connection speed of each MCU port may vary from 64 kbit/s to 2 Mbit/s.
The MCU supports multi-window output and "Continuous Presence" function, which supports output of 16 images from remote video conference members to one monitor. In this case the screen is divided into 2/3/4/5/6/7/8/9/10/13/16 windows and 42 variants of window location re supported.
Adaptation and transcoding function implements supplementary processing function for video streams, received from terminals. Conversion of connection speed, sound and image transmission protocol, image size and frame rate is supported. It allows terminals with different parameters to participate in one video conference.
ViewPoint 8650 adopts switching architecture, which supports high stability and quality of operation.
Integrated operation system implements effective network attack prevention. "Hot" backup for power units ensures reliable and stable operation of the system.

Super Error Concealment (SEC) and Intelligent Rate Control (IRC) patented technologies diminish the impact of packet loss and jitter on network operation and guarantee quality of service (QoS).
Patented SNP technology allows binding of video call subscribers of public and private communication networks.
VP 8650 MCU supports transmission of two video streams (dynamic video, graphic images (1280x1024)) according to H.239 Double Stream standard in the process of video conference. In this case bandwidth of each channel may be dynamically configured in accordance with the transmitted data volume.
Data flows may be encoded with the help of H.235 protocol, AES. GK registration process, conference organization, conference control and configuration data are protected with the help of a password.
VP 8650 MCU supports TV-wall function. It allows output of image from all 12 video conference members to one monitor.
VP 8650 MCU provides the following maintenance functions:

- System temperature identification and warning
- Monitoring of the state of key components in teal-time mode
- Remote system software update
- Configuration data back-up
- System event protocol
- Management with the help of a command line

System administrator can view image from any facility without disturbance to the current conferences.
VP 8650 chassis has vacant spaces for further capacity expansion and switch capability expansion as requirements grow.
VCS switch is equipped with IP interfaces to connect PBX audio subscribers.

8.3.3 Features of ViewPoint 9030 video terminal

Convenient design and absence of video camera give much freedom in the process of selection and more preferable location. User interface of the terminal supports several methods of video conference gathering and management without a help of administrator. Video terminal management, including local and remote video cameras, is implemented by means of a control console or through an in-built WEB-server. In this case management menu may be displayed to a main or to an additional screen.
VP 9030 equipment supports H.263/H.264 advanced video compression standards, which ensure high-quality video data with 720p, 576p, 448p, 480p, 384p, 4CIF, QCIF, SQCIF and CIF definition with 30 frame/s. AEC, ANS, AGC, VoiceClear and AudioEnhancer digital sound processing technologies ensure precise broadband sound for the video conference system.
VGA/SXGA input/output allows transmission and display of PC desktop image of the remote conference member, for example, PowerPoint presentation, WORD document, EXCEL table, WEB-page, etc. with a definition of 1280x1024 pixels simultaneously with «live» picture. This function is often used to accompany speeches with different kinds of slides, graphs and tables in the course of video conferences. For that purpose different applications are used.
Using H.239 standard ViewPoint9030 equipment can support simultaneous transmission of two high-quality images. User may configure bandwidth of each data channel.

To ensure security and confidentiality of transmitted video flows they may be encoded with the help of H.235 and AES protocols. Adoption of combination of terminal number/H.323 ID and different passwords helps to protect the video conference data.

With SNP technology, developed by Huawei, NAT and Firewall traversal can be realized between different networks.

Such technologies as DiffServ, ToS, jitter compensation, packet rearrangement and packet loss compensation guarantee high quality of video transmission interference congested networks. Automatic data rate suppression reduces bandwidth requirements and shall be effective in case of high network load.

The terminal supports a broad range of diagnostics and maintenance means, which help to identify and locate a fault and determine its cause. Internal and external buses are supported for transmission of sound, image and test signals, as well as event protocol, remote software update, system configuration backup and upload in the form of a configuration file.

Video terminal is equipped with audio and video inputs/outputs (DVI, YPrPb, S-Video, RCA, SXGA) to connect different kinds of peripheral equipment, including record devices for local and remote video conference data.

8.4 Technical Specifications

8.4.1 ViewPoint 8650 HD MCU

- **Compliant Standards**

· Video communications standards: ITU-T H.323/H.320
· Line type: IP, E1, 4E1
· Video format: ITU-T H.261/H.263/H.264
· Audio protocol: ITU-T G.711/G.722/G.728 and AAC-LD
· Video resolution: QCIF, CIF, 2CIF, 4CIF, 480p, 720p, 1080i, 1080p
· Video (active): VGA (640 x 480) and SVGA (800 x 600)
· Video (still): XGA (1024 x 768) and SXGA (1280 x 1024)
· Video frame rate: 25 fps (PAL), 30 fps (NTSC)
Dual-Stream: ITU-T H.239

- **System Capacity**

· IP: 256 x 2 Mbit/s
· 4E1: 32 channels
· E1: 128 channels

- **Network Interfaces**
  - · 2 x GE, 10 M/100 M/1000 M, RJ-45
  - · 1 x FE, 10 M/100 M, RJ-45
  - · 1 x RS232, RJ-45
  - · 2 x SFP, Gigabit optical fiber interface
  - · 4E1, 1-4E1 bundling, 750 ohm, SMB
  - · E1, 750 ohm, SMB

- **Physical Features**
  - · 19-inch standard chassis
  - · Height: 5 U
  - · Width: < 500 mm
  - · Weight: < 35 Kg

- **Environmental Requirements**

  Operating temperature: 0 to 45

  Relative humidity: 5%–90% RH

  Air pressure: 70–106 KPa

- **Reliability**

  MTBF: 100,000 hours

  MTTR: 0.5 hours

  Certificates: CE, RoHS

- **Stream Broadcasting**

  Multicast live broadcasting

  Play the video of any site

- **MCU Functions**

  Holding conference: by management console, by SiteCall, by scheduling

  Attending conference: call through MCU, call through terminals, IVR alert tones

  Call mode: all through IP address, call through site number

  Continuous presence: 42 CP layouts; voice activation; manual settings; auto polling function

- **External Interfaces**
  - · Interfaces developed by a third party
  - · CDR bill

- **Maintenance and Diagnosis**
  · System management: through management console, through telnet command lines
  · Site surveillance
  · Statistics of packet loss
  · Nlog, visualized bi-directional network status statistics in real time
  · Loopback diagnosis

- **Network Adaptability**
  · Intelligent rate control (IRC)
  · Super error concealment (SEC)
  · Auto adaptation enabling
  · Priority settings of QoS
  · SNP transversal between private and public networks

- **Security Management**
  · Conference password
  · H.235
  · Advanced Encryption Standard (AES)

- **Electric Features**
  · AC input: 90–260 V, 50/60 Hz
  · DC input: 36–75 V
  · Power consumption: < 750 w

8.4.2 ViewPoint 9035 HD Group Video End point

- **Compliant Standards**
  Video communications standards: ITU-T H.323/H.320
  Video standards: H.263/H.264
  Audio standards: G.711/G.722/G.728/AAC-LD
  Dual-stream standard: H.329

Network standards: TCP/IP, DHCP, Telnet, HTTP, PPPoE, RTP, RTCP

- **Video Features**

  Video resolution: 720p and 4CIF
  Data content resolution:
  VGA (640 x 480)
  SVGA (800 x 600)
  XGA (1024 x 768)
  SXGA (1280 x 1024)
  Video frame rate: 720p and 30 fps
  VideoIntensifier, ViewProcessing

- **Audio Quality**

  Acoustic echo cancellation (AEC)
  Acoustic noise suppression (ANS) 12 dB
  Automatic gain control (AGC) ±6 dB
  VoiceClear
  AudioEnhancer

- **Video Input Interfaces**

  1 x CVBS
  2 x DVI/SXGA/YPrPb

- **Video Output Interfaces**

  1 x CVBS
  2 x DVI/SXGA/YPrPb

- **Audio Input Interfaces**

  1 x LINE IN
  2 x MIC
  1 x LAN

- **Audio Output Interfaces**

  2 x AUX OUT
  1 x L/R OUT

- **Camera Control Interfaces**
  2 x RS-232/RS-422

- **Network Interfaces**
  IP: 10/100 Base-T, 2 x RJ-45
  E1: G.703, G704, 4 x RJ-45

- **Conference Bandwidth**
  IP, E1: 64 kbit/s to 2 Mbit/s

- **Security Features**
  H.235 signaling and media-stream encryption
  Conference access password
  Conference control password
  IP address and number binding
  H.323 ID and number binding

- **Digital Caption**
  16 optional colors
  Area auto adjustment
  Adaptive real scenery editing
  Modifiable background transparency/color/font
  Caption rolling mode setting
  Site name display and position shift
  English input by using the remote control
  External character generator

- **User Operations**
  Language: Chinese/English
  User control mode: remote control and Telnet

- **Special Features**
  H.239 dual stream
  HD desktop display
  HD video
  Picture-in-picture: 1/16 picture size, optional position

Bi-screen and tri-screen display
SiteCall (HD dual stream)
Call record
SNP traversal public and private network
Active caption
Intelligent rate control (IRC)
Super error concealment (SEC)

- **Maintenance Management**

Loopback function: Local and remote loopback
Test signals: providing test sound and standard test stripes
Volume input indication
IP network test
Telnet: user and administrator login accounts
Software upgrade: Local and remote upgrades
Embedded WebServer: maintenance and management
Event log record
Default settings restoration

- **Electric Features**

100–240 VAC, 50–60 Hz, 100 W

- **Environmental Requirements**

Temperature:
0°C to 40°C (working state)
Relative humidity:
10%–80% (working state)
Peripheral noise: < 46 dBA SPL
Lowest illuminance: 7 lux
Recommended illuminance: > 300 lux

- **Physical Features**

Dimensions: 436 mm x 270 mm x 65 mm
Weight: 6.2 kg

8.4.3 HD Video Camera VCC-HD90

Sensor	HD CMOS 1/3
Dimension	2-Mpix (16:9)
Format	HD 1080i/720p
Optic	10x Zoom, f=5.1 ~ 51 mm
Minimum distance	10 - 800 mm
View angle	3 ~ 42 degree for HD
Focus	auto/manual
Min. illumination	3 lx F 1.4
Exposition	Auto/Manual/AE priority/Compensation/Brightness
Shutter speed	1/2 ~ 1/10000 per sec.
Sensitivity	Auto/manual (-3 ~ +18 dB)
White balance	Auto/indoor/outdoor/auto one touch/manual
S/N ratio	50 dB
Pan	+/-340 degree
Tilt	+/-90 degree
Presets	32 positions
Video output	HD Y/P/Pr SD - VBS, Y/C
Power	12 V DC (10.8 ~ 13,2 V DC)

8.4.4 ViewPoint M200&M100 Microphone Array

Item	Sub-Item	Specification
Compliant standards	Network interface	802.3af standard, RJ-45, 10/100 full-duplex network interface
	Audio input/output interface	GB/T-14197-93 standard
Audio	Sampling rate	8 kHz, 16 kHz, 32 kHz, 48 kHz
	Frequency response	100 Hz to 20 kHz
	AEC	Supports the single-audio-channel AEC function. Supports the dual-audio-channel AEC function. The specifications of the AEC meet the requirements of G.167.
	ANS	The maximum value of the ANS is no less than 18 dB.
	AGC	Dynamic value range of the AGC is –6 dB to 6 dB (the target level can be configured dynamically).
Microphone	Sensitivity	38 ± 2 dB heart-shaped directional microphone
	Sound pickup distance	6m
	Sound pickup range	360°
Power supply	Input voltage range	100–240 VAC 50–60 Hz
	Output voltage	12 VDC
	Power	<6 W
Physical features	Environmental temperature	0 to 40
	Dimensions (diameter x height)	250 mm x 47mm
	Weight	About 0.5 kg

Consumtion	12 W
Working temperature	0 ~ 40 degree
Size	132x144x144 mm

8.5 Solution Highlights

8.5.1 Outstanding Network Adaptability

Huawei's proprietary technologies ensure ultra-strong network adaptability for building a stable HD system, which fully guarantees that conferences are conducted securely and reliably.

- **Super Error Concealment**

Using Super Error Concealment (SEC) 2.0, the Huawei HD videoconferencing system ensures good quality of service (QoS) for the videoconferencing service on a live network. With this technology, video conferences can run smoothly even when the packet loss rate reaches 5%.

SEC 2.0 fully guarantees IP QoS. Based on test results and the running status of the typical live network, video quality is normal at a packet loss rate of 5% and is acceptable at a packet loss rate of 10%. Voice conferences can be held at a packet loss rate of 20%.

The following table compares Huawei products' video quality against that provided by other vendors' products at different packet loss rates.

Table 16 Video quality comparison

Packet Loss Rate	Huawei Product	Other Vendor Product
< 0.5%	Deterioration is unnoticeable.	Deterioration is noticeable but not obvious.
0.5% to 1%	Deterioration is unnoticeable.	Deterioration is obvious.
1% to 3%	Deterioration is unnoticeable.	Video quality is seriously deteriorated.
3% to 5%	Deterioration is noticeable but not obvious.	Video quality is poor and communication cannot continue.

- **Intelligent Rate Control**

The Huawei HD videoconferencing system collects statistics on the audio and video packet loss in real time. When the packet loss ratio reaches the predefined threshold, the system enables the intelligent rate control (IRC) strategy, to deliver the best possible performance with the bandwidth currently available.

A Huawei proprietary technology, IRC automatically detects changes in the bandwidth occupied by network services and intelligently selects the best resolutions for the current network bandwidth to maintain good video quality during conferences.

The following figure shows the IRC characteristics.

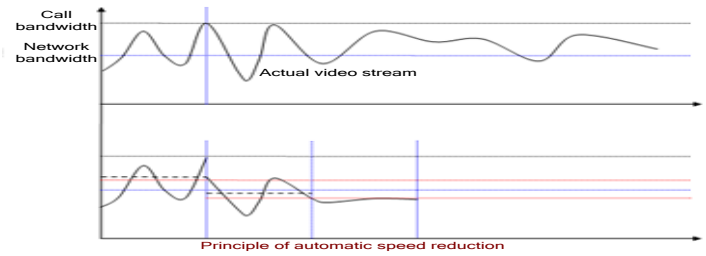


Figure 32 IRC characteristics

➢ **Reconnect on Disconnect**

When a network connection is disconnected, Huawei HD video terminals respond as follows:

- If the connection restores within 30 seconds, the terminals recover the conferencing functions and continue the conference.
- If the disconnection lasts longer than 30 seconds, the terminals exit the conference.

When the network recovers, the video terminal dials the special service number to re-join the conference. In the case of power failure, video terminals can automatically rejoin the conference when their power supply is restored. If the MCU where the video terminals reside loses power, the video terminals can still rejoin the conference after the power is restored.

➢ **Automatic Repeat Request**

The Huawei HD videoconferencing system adopts Automatic Repeat reQuest (ARQ) technology. ARQ uses acknowledgments and timeouts to achieve reliable data transmission over an unreliable service. If a sender does not receive an acknowledgment before the timeout, it usually re-transmits the frame/packet to ensure a high degree of smoothness in the video.

8.5.2 Easy of Use

➢ **Simple and Modern UI**

Huawei has been dedicated to research of the habits of videoconferencing products users. Taking the excellent design concepts of a leading UI design company as a reference, Huawei has developed a brand-new UI that is both intuitive and modern. The UI provides clear guidance to users. The icons and text index are self-explanatory, which enables users to perform operations promptly and correctly. Administrators and end customers have different UI views to more easily access their respective services and functions. The remote control provided with the video terminal is compact and sleek, and has buttons easy to see and read. The remote control's design reflects the concept of using the fewest buttons to implement the richest functions.

The following figure shows the Frog-designed remote control.

Figure 33 Frog-designed remote control

The following figure shows a Huawei video terminal UI.

Figure 34 Huawei video terminal UI

- **Intelligent Control Platform Using a Tablet**

The Huawei HD videoconferencing system uses an Android-based tablet or iPad as the intelligent control platform to provide conference control functions from a graphical user interface. Users can tap the screen to power on or off all devices and control devices such as the power supply, HD display, HD camera, and codec.

Figure 35 Intelligent Control Platform

Users can easily control the conference. They can tap a single button on the tablet to mute or unmute the microphones and speakers. Additional diverse conference control functions include:

- Request and release chair control rights
- View a site
- Give the floor
- Enable or disable voice activation
- Broadcast a site
- Viewing sites in turn
- Switch between panes (continuous presence selection)
- Share a presentation

Compared with a traditional conference, a Huawei HD video conference does not require multiple control devices or complex steps such as repeatedly navigating multi-level menus. The simple and clean UI is naturally integrated with the applications in a traditional conference.

➢ **Captions and Banners**

- Site name display

  Huawei HD video terminals provide a function to display site names, allowing conference participants to identify the site that they are viewing. The site name can be displayed on the top, bottom, left, or right of the screen in any of 16 colors. Users can set whether to display a site name and the duration for displaying the site name.

- Digital banner and caption

  Huawei video terminals provide the most powerful function in the industry of editing the digital banner. Users can easily assign the banner content to the upper, middle, or lower area of the remote sites' screens. The video terminals provide functions such as automatic adjustment of the banner area, real-time editing, picture insertion, modification of

background transparency, color, and font, multiple modes of caption rolling, and banner preview. Users can set banners to display in any of 16 colors.

Sharing captions enhances communication between sites. In conferences, captions are often used for important hints, conference notifications, or greetings. Captions can be created and edited at the chair site during a conference or beforehand. During a conference, captions can be displayed at the local site in scroll mode or sent to other sites in other modes.

The following figure shows a scrolling caption sent from the main site.

Figure 36 Scrolling caption sent from the main site

8.5.3 Security and Stability

- **Mature Products**

With a carrier-class product design, Huawei videoconferencing products have passed the telecom equipment network access certification by the Ministry of Information Industry of PLACE_X, 3C certification, and tests conducted by the Data Communications Product Quality Supervision & Inspection Center of the Ministry of Information Industry.

With a mean time between failures (MTBF) as high as 100,000 hours, Huawei HD MCUs have low requirements for operating conditions and environment, provide carrier-class stability, and can operate 24 hours a day, 7 days a week without interruption.

Huawei HD videoconferencing products have passed ISO 9001 and TL 9000 quality system certifications and ISO 14001 environment system certification to ensure stable product quality.

Huawei HD videoconferencing products have been widely used on live networks. With a large number of users and formal user testing, the products have become highly mature. By the end of 2011, global orders of Huawei videoconferencing devices have exceeded 120,000, with total telepresence system sales accounting for over 2100 units.

- **System Stability**

With embedded real-time operating systems, instead of an off-the-shelf systems, such as Windows or Linux, Huawei video products deliver higher performance than that of industrial-PC architecture, which completely prevents virus attacks. As a carrier-class device, the MCU is designed as a rack structure with slots which can be filled with hot-swappable boards. Boards can be inserted to the MCU to expand capacity, which facilitates future access capacity expansion and reduces costs and points of failure. Huawei HD video terminals are highly stable and with dual network ports and 1+1 hot spare capability, able to work 24 hours a day, 365 days a year without interruptions.

- **Multiple Encryption**

When H.323 networking is implemented, the Huawei HD videoconferencing system supports H.235 signaling encryption, media stream encryption, and decryption using the advanced encryption standard (AES). When SIP networking is implemented, the Huawei HD videoconferencing system supports TLS signaling encryption and SRTP media stream encryption. The system is integrated with Huawei MCUs and SMC to provide network-wide full-service signaling and media stream encryption from end to end, from end to the system side, and for multi-point conferences. This capability firmly guarantees conference security and secure use.

The Huawei HD videoconferencing system also supports third-party encryption methods, including the Huawei Eudemon series firewall and encryption methods used by Huawei routers and switches.

8.5.4 Convenient Maintenance

- **Nlog Real-Time Monitoring of Network Lines**

The QoS of the bearer network greatly affects the experience achieved with a videoconferencing system. The audio and video quality achieved in a videoconferencing system may be affected when a network fault causes packet loss, and mosaic or pause occurs on the video.

Using NLog, the Huawei HD videoconferencing system performs end-to-end monitoring on the MCUs and terminals and records the packet loss rates and state changes during a conference in real time. The system categorizes the statistics and records by video, audio, and presentation data for graphical display. During a conference, the packet loss rates are updated in real time. When video or audio faults occur at certain sites, the system analyzes the video/audio packet loss rates at specific times using the site packet loss statistics tool. The ability to accurately locate the causes of the faults and improve the network QoS based on the fault recovery improves conference quality.

is an example of the real-time network status at a site.

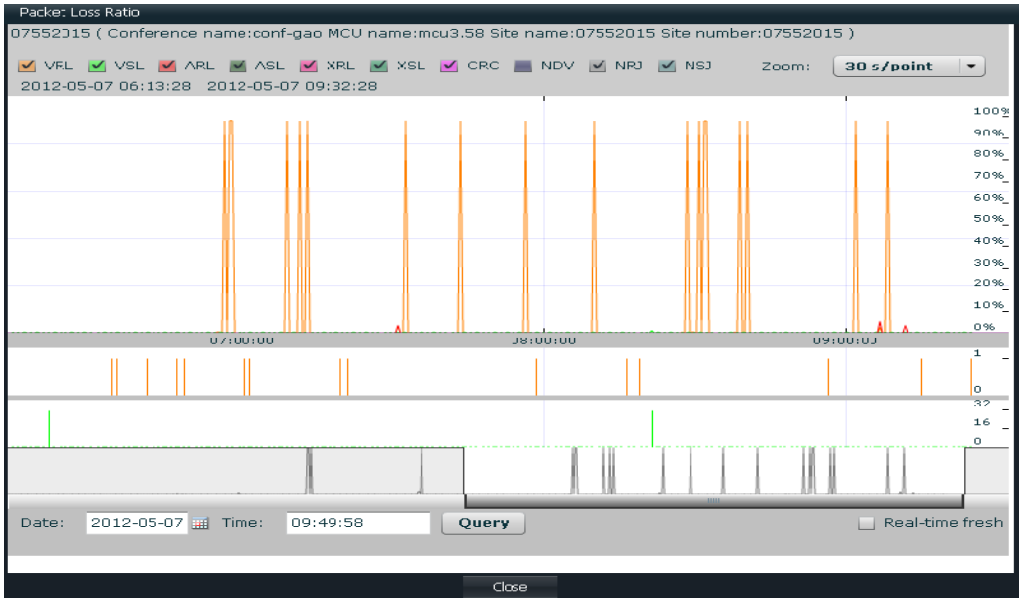


Figure 37 Real-time network status at a site

The following figure shows the real-time monitoring and packet loss alarms at a site.

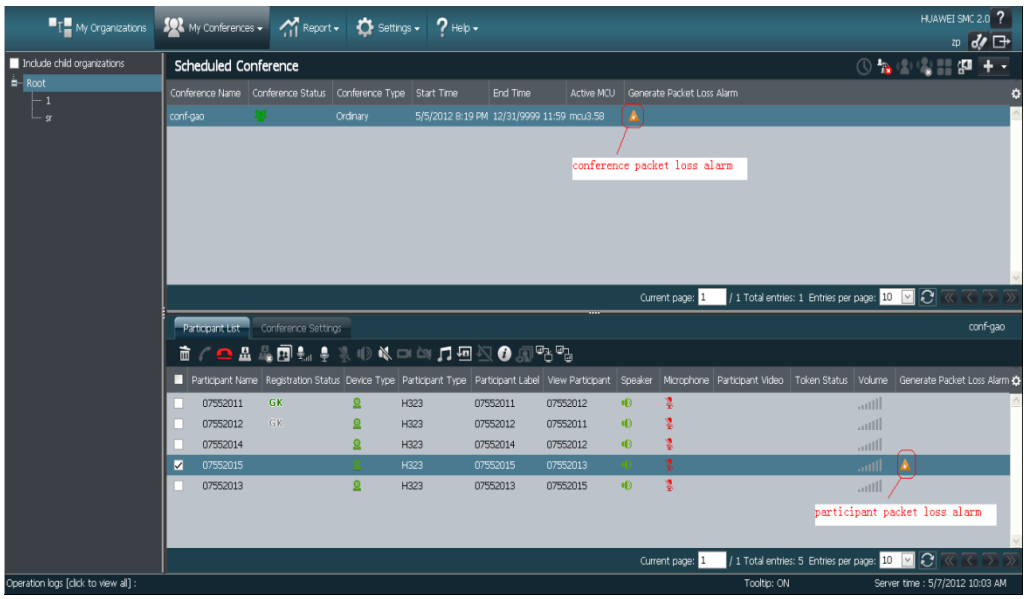


Figure 38 real-time monitoring and packet loss alarms at a site

- **Real-Time Monitoring and Management Using the Video Wall**

The Huawei HD videoconferencing system supports video wall output. The system can directly output site-monitoring videos in a video wall format, to facilitate unified control of the entire conference. The video wall function is applicable to customers, such as armed forces, government institutions, public security organs, and electric power companies. The Huawei HD MCU ViewPoint 8650 supports a maximum of 24 SD or 16 HD video feeds for the video wall. The Huawei HD MCU ViewPoint 8660 supports a maximum of 48 SD or 32 HD video feeds for the video wall.

The following figure shows real-time monitoring and management using the video wall.

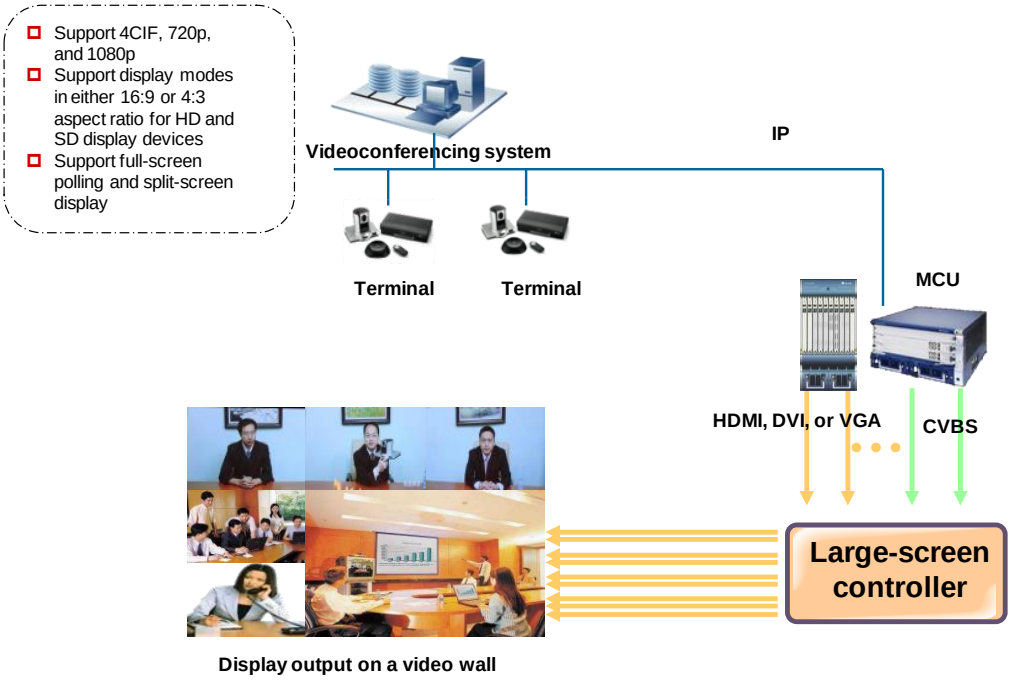


Figure 39 real-time monitoring and management

➢ **Web-Based Management**

The Huawei HD videoconferencing system supports the following management functions on a web user interface:

- Implement hierarchical and role-based site management
- Monitor local and remote videos in real time

Adjust camera parameters, viewing the effects after adjustment in real time, capturing and automatically saving HD images.

9 Trunk Radio System Design

9.1 Design principles

Design based on:

- BSGP-BD-E-RT-SP-0001-000-0 eng.pdf （YD/T 1171-2001）
- IEC 61662
- IEC 61024-1
- BSGP-BD-E-TE-DW-0002-001-0.pdf
- BSGP-BD-E-TE-DW-0003-001-0.pdf

Design Target:

- Coverage fraction: 95%
- Cell radius: Up to 30km.

- Station site: deployment along the pipeline。Does not need the engine room resources, significantly reduces cost..

9.2 Networking solutions

9.2.1 Network Topology

According the project requirement，we will use HUAWEI LitePTT solution to realize the PTT in the MS,CS,BVS,PTS and the pipeline.

In figure 41, the system divided into 3 layers.

1) Access Layer
2) Transport layer
3) Core Layer

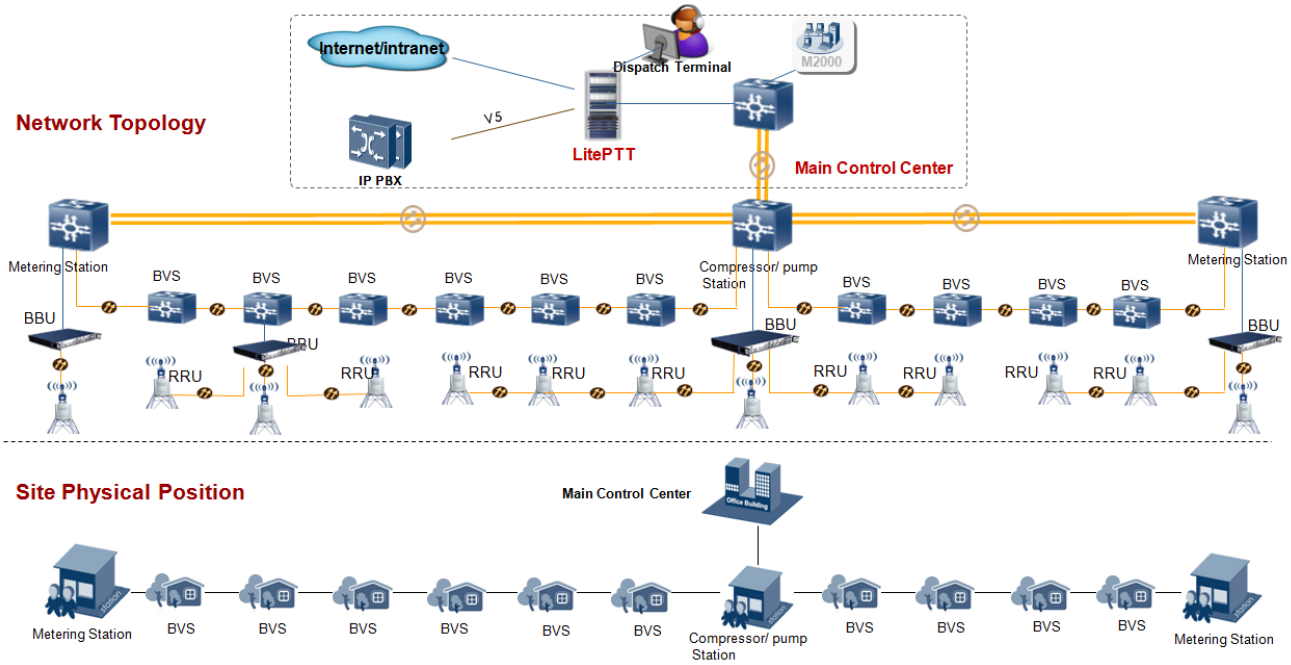


Figure 40 Network Topology

9.2.2 Interface

Table 17 Interface information

Interface	In-connect Device	type*nub	width*num	service
base station	SDH/MSTP Device	FE *1	10M*1	Voice
Trucking core network	SDH/MSTP Device	FE *1	100M*1	Voice
	IP-PBX	V5	--	voice

9.3 Wireless Coverage Plan

9.3.1 Basic Infomation

Table 18 Basic Information

System Basic information	
Frequency Range (MHz)	463.625~464.875（Forward） 453.625~454.875（Reverse）
Channel band width (MHz)	1.25
Available frequency spot	1

9.3.2 Antenna Information

The antenna shaping is in the network planning very important step, mainly bases on the cover demand and isolation request, based on this project, will use the following antenna：

Table 19 Antenna information

Antenna	
Antenna type	Directional antenna
Frequency range（MHz）	450~470
Polarization mode	Double pole
Antenna gain (dBi)	15
Antenna horizontal half-power angle	65°

9.3.3 Frequency Plan

Single Frequency in the CDMA wireless network be used.

Table 20 Frequency Plan

Station Frequency(MHz)	Terminal Frequency(MHz)
463.625~464.875	453.625~454.875

9.3.4 Link budget

Table 21 Link budget（antenna height：30m）

Scenario	FL	RL	
Network Technology	TRUSTAR(RC4/RC3)		TRUSTAR(RC4/RC3)
Traffic type	PTT(Group call)		PTT(Group call)

Morphology	Rural		Rural
Sectorise	3 Sector		3 Sector
Channel Model	Mixed Channel		Mixed Channel
User Environment	Outdoor		Outdoor
TMA Used	No		No
Target Load	75%	75%	
TX	FL	FL	
Max Transmitting power(dBm)	33.21	33.21	a
Tx total Loss (dB) include cable & Connector &Jumper	2.26	2.26	b
TX Body Loss (dB)	/	/	c
TX Antenna Gain (dBi)	15	15	d
EIRP (dBm)	45.95	45.95	e=a-b-c+d
RX	FL	FL	
Background Thermal Noise Density(dBm/Hz)	-174	-174	f
RX Antenna Gain(dBi)	0	0	g
Rx total Loss (dB) include cable & Connector &Jumper	0	0	h
RX Body Loss (dB)	3	3	i
Noise Figure (dB)	8	8	j
Processing Gain (dB)	21.07	21.07	k=10log(W/R)
Required EbNt	6.40	6.40	l
Receiver Sensitivity (dBm)	-119.78	-119.78	m=10log(10^(f/10)*W) +j+l-k
Minimum Signal Strength Required (dBm)	-116.78	-116.78	n=m-g+h+i
Pass Loss	FL	FL	
Soft HandOver Gain Again Slow Fading (dB)	2.65	2.65	o
Inteference Margin (dB)	6.65	6.65	p
Shadow Fading Margin (dB)	3.32		3.32
Building Penetration Loss (dB)	0		0
Max Allowed Propagation Loss For Cell Radius(dB)	155.41	155.41	s=e-n+o-p-q-r
Cell radius	FL	FL	
AT antenna height (m)	1.5		1.5
BS antenna height (m)	**30**		30
Frequency (MHz)	463	463	v
Propagation Model	Okumura-Hata (Huawei)		Okumura-Hata (Huawei)
Cell Radius (km)	29.04	29.04	z=function(s,t,u,v,w,x)
Cell Radius Counting Earth Curvature (km)	27.64	27.64	
Site Area (km^2)	1489.68	1489.68	
Cell Area Coverage Probability	90.00%	90.00%	
Which Direction Limited	No	No	
Coverage Balanced	Yes		Yes

Table 22 Link budget（antenna height：50m）

Scenario	FL	RL	
Network Technology	TRUSTAR(RC4/RC3)		
Traffic type	PTT(Group call)		
Morphology	Rural		x
Sectorise	3 Sector		y
Channel Model	Mixed Channel		
User Environment	Outdoor		
TMA Used	No		
Target Load	75%	50%	
TX	FL	RL	
Max Transmitting power(dBm)	33.21	21.54	a
Tx total Loss (dB) include cable & Connector &Jumper	2.26	0	b
TX Body Loss (dB)	/	3	c
TX Antenna Gain (dBi)	15	0	d
EIRP (dBm)	45.95	18.54	e=a-b-c+d
RX	FL	RL	
Background Thermal Noise Density(dBm/Hz)	-174	-174	f
RX Antenna Gain(dBi)	0	15	g
Rx total Loss (dB) include cable & Connector &Jumper	0	2.26	h
RX Body Loss (dB)	3	/	i
Noise Figure (dB)	8	2.50	j
Processing Gain (dB)	21.07	21.07	k=10log(W/R)
Required EbNt	6.40	4.12	l
Receiver Sensitivity (dBm)	-119.78	-127.56	m=10log(10^(f/10)*W) +j+l-k
Minimum Signal Strength Required (dBm)	-116.78	-140.30	n=m-g+h+i
Pass Loss	FL	RL	
Soft HandOver Gain Again Slow Fading (dB)	2.66	2.66	o
Inteference Margin (dB)	6.65	3.01	p
Shadow Fading Margin (dB)	3.44		q
Building Penetration Loss (dB)	0		r
Max Allowed Propagation Loss For Cell Radius(dB)	155.30	155.06	s=e-n+o-p-q-r
Cell radius	FL	RL	
AT antenna height (m)	1.5		t
BS antenna height (m)	**50**		u
Frequency (MHz)	463	453	v
Propagation Model	Okumura-Hata (Huawei)		w
Cell Radius (km)	41.07	41.07	z=function(s,t,u,v,w,x)
Cell Radius Counting Earth Curvature (km)	**34.21**	**34.21**	

Site Area (km^2)	2282.47	2282.47	
Cell Area Coverage Probability	90.00%	90.00%	
Which Direction Limited	No	Yes	
Coverage Balanced	Yes		

According the Link budget, the coverage range can reach 34.21km（antenna height: 50m）and 27.64km（antenna height: 30m）.
Tower altitude will be decided by the base station coverage range and the distance between the MS,CS,BVS,PTS.

9.4 Key Parameter

9.4.1 LitePTT

1) Functions

The LitePTT solution integrates the functions of RAC, TSC, GLMS, PDSN, AAA, UAP, and CTI in the N68E-22 cabinet which has space of 46 U. It provides voice services, trunking services, and data services. The following figure shows the integrated structure.

PARC cabinet
DCDU/AC power module
Filler panel
RAC subrack
Filler panel
TSC subrack

Air intake vent of the subrack
KVM
LAN switch
Ethernet cable tray
LAN switch
1588V2 clock
Cable trough
PDSN
UAP

- The cabinet integrates subracks of the RAC, TSC, PDSN, and UAP, and 1588V2 clock.
- The cabinet supports DC and AC power supplies.
- The internal devices use reliability-ensuring networking for communication.
- The RAC subrack integrates the functions of GLMS, and AAA devices and provides voice local switching function.
- The UAP subrack integrates the CTI server.
- The device maintenance window is uniform.

The space occupied in the LitePTT solution decreases from six cabinets to one cabinet, and the power consumption reduces to 1/3.

The following table describes the NEs and their functions in the LitePTT solution.

NE	Function
RAC	It provides a radio access system for telecommunications services by replacing circuit connections between phones and switchers with radio connections.
TSC	It processes trunk call signaling and distributes trunk call media. One TSC can be connected to multiple PCFs.
GLMS	It is used to manage the information about trunk group, trunk service subscribers, subscriber trunk service, dispatcher, and virtual private network (VPN).
IPCC	It is the all-IP-based intelligent call center and provides the dispatcher function. It implements call establishment and call routing between the dispatcher client and the MSE9830. It consists of the CTI and UAP.
PDSN	It locates between the CN PS and CDMA2000 RAN. It is used to manage subscriber status, forward subscriber data, and assign IP addresses to subscribers.
AAA	It locates in the CN PS and performs authentication, authorization, and accounting functions.

Voice services between subscribers using the same cabinet is supported through local switching. The connection to the switch in the PSTN or NGN over V5 is supported, which provides interconnection with the enterprises' current network or operators' network. The connection to other RACs over A3 or A7 is supported, which improves the voice service quality.
The services except the voice services are optional. Based on the subscribers' requirements, the NEs in the LitePTT solution can be removed.

According the requirement in A-I Gas Pipeline Project，the NEs in LitePTT include：

Table 23 NEs LitePTT

Service	NE
Voice service	RAC
Trunking service	TSC, GLMS
Dispatcher	IPCC (UAP+CTI)
High-speed data service/Video	PDSN, AAA

2) Specifications

With the adjustment of the active and standby boards in the RAC subrack, the board quantity, and the LitePTT traffic specifications, the following four types of configurations are supported:

- High configuration and reliability solution (RAC-1000, 260 Mbit/s, 200 PICO base stations): All boards are in active/standby mode. 1000 outgoing activated speech channels, 260 Mbit/s downlink throughput, and 200 PICO base stations are supported.
- High configuration solution (RAC-1000, 260 Mbit/s, 200 PICO base stations): Some interface boards are not in active/standby mode. 1000 outgoing activated speech channels, 260 Mbit/s downlink throughput, and 200 PICO base stations are supported.
- Low configuration and high reliability solution (RAC-500, 100 Mbit/s, 100 PICO base stations): Almost all boards are in active/standby mode. The network capacity is reduced. 500 outgoing activated speech channels, 100 Mbit/s downlink throughput, and 100 PICO base stations are supported.
- Low configuration and reliability solution (RAC-500, 100 Mbit/s, 100 PICO base stations): Almost all boards are not in active/standby mode. The network capacity is reduced. 500 outgoing activated speech channels, 100 Mbit/s downlink throughput, and 100 PICO base stations are supported.

Based on the specifications of the original system, the following table shows the specifications of the MSE in the trunking dispatching system.

Table 24 Specifications of the MSE

Maximum number of subscribers registered at a time	50,000
BHCA	450,000
Maximum number of online subscribers at a time	4000
Maximum number of sessions	500
Maximum number of dispatchers	150
Maximum number of recording conferences at a time	100
Maximum number of groups	50,000
Maximum number of subscribers in a group	1024 (dispatcher included)
Maximum number of dispatchers in a group	3
Maximum number of VPNs	5000
Maximum number of groups in a VPN	1000
Maximum number of subscribers in a VPN	10,000
Maximum number of dispatchers in a VPN	200

3) Integrated System Specifications

The following table lists the integrated system specifications.

Table 25 Integrated system specifications

Item	Specifications
Cabinet	N68E-22
External dimensions (H x W x D)	2200 mm x 600 mm x 800 mm
Floor bearing capability	> 400 kg/m^2
Number of cabinets in full configuration	1
Power input	–48 V DC (–57 V to –40 V) 220 V AC (UAP3300)
Noise (sound pressure level noise)	≤ 65 dBA (varying with the ambient temperature)

4) Environmental Specifications

The LitePTT environment involves the storage environment, transport environment, and operating environment. The environmental specifications comply with the following standards:

- GB 4798 Environmental conditions existing in the application of electric and electronic products
- ETS 300019 Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment
- IEC 60721 - Classification of environmental conditions

  The following table lists the climate environmental requirements.

Table 26 Environmental requirements

Item	Storage Environment	Transport Environment	Operating Environment
Temperature	–40°C to +70°C	–40°C to +70°C	Long-term operation: 15°C to 30°C
			Short-term operation: 0°C to 45°C
Temperature gradient	≤ 1°C/min	≤ 3°C/min	≤ 3°C/min
Relative humidity	10% to 100%	5% to 100%	Long-term operation: 40% to 75%
			Short-term operation: 20% to 90%
Elevation	≤ 5000 m	≤ 5000 m	≤ 4000 m
Atmospheric pressure	70 kPa to 106 kPa	70 kPa to 106 kPa	70 kPa to 106 kPa
Solar radiation	≤ 1120 W/s²	≤ 1120 W/s²	≤ 700 W/m²

Heat radiation	≤ 600 W/s²	≤ 600 W/s²	≤ 600 W/m²
Wind speed	≤ 30 m/s	≤ 30 m/s	≤ 1 m/s
NOTE • *The temperature and humidity are measured 1.5 m above the floor and 0.4 m ahead of the rack when it works under normal environmental conditions and has no protection plate on the front or at the rear.* • *Short-term operation means that the consecutive working time does not exceed 48 hours, and the annual accumulated working time does not exceed 15 days.*			

9.4.2 Distributed Base Station(DBS3900)

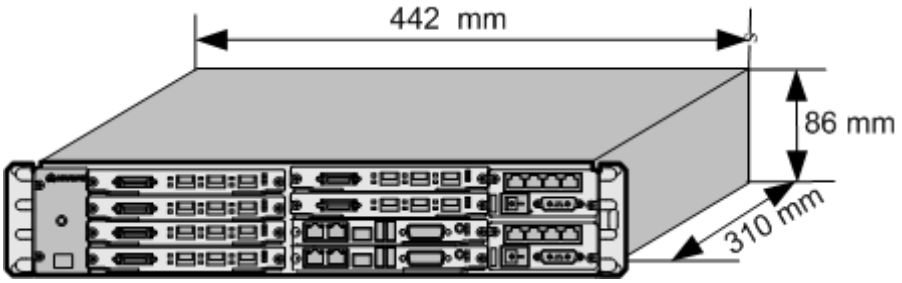
DBS3900 have two parts: Baseband Uint,BBU3900 and Radio Remote Unit,RRU3606。

5) BBU3900

Table 27 Technical specifications of the BBU3900

Item	Specification
Voltage	• +24 V DC (+21.6 V DC to +29 V DC) • -48 V DC (-57 V DC to -38.4 V DC)
Power consumption	full configuration: ≤ 250 W
Weight	• Empty cabinet (including the FAN and UPEU) ≤ 8 kg [17.64 lb] • Full configuration: ≤ 12 kg [26.46 lb]
Cabinet dimensions (height x width x depth)	86 mm [3.39 in.] x 442 mm [17.40] x 310 mm [12.20], as shown in Figure 1.
Temperature	-10℃[14°F] to +55℃[131°F]
Relative humidity	5%RH to 95%RH

Figure 1 Dimensions of the BBU3900



6) RRU3606

RRU3606（DC）support Band Class 0 (800MHz)、Band Class 1 (1900MHz)、Band Class 5(450MHz)、Band Class 6 (2GHz)、Band Class 14 (US PCS 1.9GHz) and Band Class 15 (AWS)。

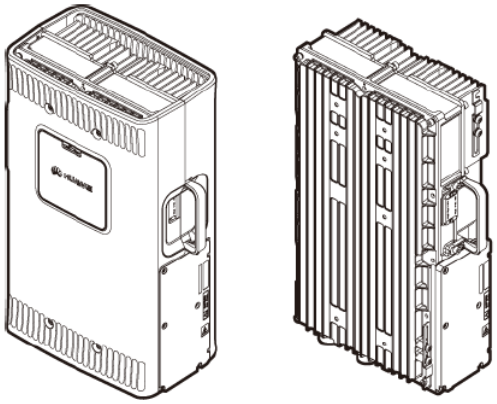


Figure 41 RRU Shape

Table 28 Transmit specifications in band class 5 (450 MHz)

Item	Specification
Operating band class	460 MHz to 470 MHz
Channel bandwidth	1.2288 MHz
Channel precision	25 kHz, 20 kHz
Frequency tolerance	≤ ± 0.05 ppm
Transmit power	≤ 60 W

Table 29 Receive specifications in band class 5 (450 MHz)

Item	Specification
Operating band class	450 MHz to 460 MHz
Channel bandwidth	1.2288 MHz
Channel precision	25 kHz, 20 kHz
Signal receiving sensitivity	Better than -127 dBm (main and diversity receiving at RC3)

Table 30 Technical specifications of the DC RRU3606

项目	指标
Voltage	-48 V (-36 V DC to -57 V DC)
Weight	• Weights of the RRU that works in the 800 MHz AB and 450 MHz band classes: ≤ 19 kg [41.90 lb] (with the shell) • Weights of the RRU that works in other band classes: ≤ 17 kg [37.49 lb] (with the shell)
Cabinet dimensions (height x width x depth)	Dimensions of the RRU that works in the 800 MHz AB and 450 MHz band classes • 485 mm [19.10 in.] x 285 mm [11.22 in.] x 200 mm [7.87 in.] (with the shell) • 480 mm [18.90 in.] x 270 mm [10.63 in.] x 170 mm [6.69 in.] (without the shell) Dimensions of the RRU that works in other band classes: • 485 mm [19.10 in.] x 285 mm [11.22 in.] x 170 mm [6.69 in.] (with the shell) • 480 mm [18.90 in.] x 270 mm [10.63 in.] x 140 mm [5.51 in.] (without the shell)
Ambient temperature for running	-40°C [-40°F] to +52°C [125.6°F] (solar radiation not considered)

7) RRU3606 Cascading Specifications

Table 31 RRU3606 cascading specifications of the DBS3900

Item	Specification
Maximum distance of single-level cascading	70 km [43.50 mi]
Maximum number of cascading levels	Three
Maximum total cascading distance	90 km [55.93 mi]

8) Reliability Specifications of the DBS3900

Item	Specification
Availability	≥ 99.999%
Mean Time Between Failures (MTBF)	BBU3900: ≥ 280000 hours RRU3606: ≥ 260000 hours
Mean Time To Repair (MTTR)	≤ 1 hour (excluding the time needed for the engineers to arrive at the site) ≤ 3 hours (including the time needed for

Item	Specification
	the engineers to arrive at the site)

9.4.3 Trunking Terminal (HC9000e)

Highlights:
-CDMA 450MHz or 800MHz
-2.0” QVGA TFT
-2M camera
-GPS (Optional)
-Waterproof/dustproof/shockproof
-Push to talk (HUAWEI Trustar)
-DMO
-Long standby time
-Internal encryption module (optional)

Figure 42 Terminal Shape

HW			
Chipset	Qualcomm QSC1110	Micro SD	No
Band	CDMA 450MHz (or 800MHz)	Antenna	Stick
LCD	2.0" QVGA TFT	I/O	5pin mini USB
Camera	2M CMOS	R-UIM	Yes
Bluetooth	No	Proof	Waterproof/Dustproof/Shock proof
GPS	Optional		
Push to talk	Yes (HUAWEI Trustar)	Knob Selector	Yes
DMO	Yes	Waistband clip	Yes
Internal encryption module	Optional	Battery	3600mAh
SW			
Platform	Brew3.1.5	Video player	MPEG4,H.263
Language*	English/Chinese (or Arabic, Russian)	Tools	Alarm clock/schedule/ notepad/calculator/Ebook/ Stopwatch/world time/ currency exchange
Phone book	1000 entries (Vcard)		
SMS	1000 entries		
Audio player	MP3, AAC, AAC+, enhanced AAC+, MIDI	Value added service	WAP/UTK (optional)/voice mail

9.4.4 Vehicle Mobile Station eAccess C100（450M）

1) Introduction

The HUAWEI eAccess C100 Vehicle Mobile Station (referred to as the eAccess C100) is a standard 1-DIN sized CDMA TruStar mobile station developed by Huawei. It supports Huawei CDMA TruStar trunking service and the CDMA 2000 1x EVDO Rev.A services.

The HUAWEI eAccess C100 provides abundant functions and powerful media processing capabilities, including:

- PTT
- DMO point-to-point mode and trunk mode
- E2E encryption
- MMS, email, and website browsing
- Data modem
- GPS
- Audio recording
- Expandable memory through Micro-SD card
- In the CDMA network or the EVDO network, you can use the HUAWEI eAccess C100 to make/receive calls, send/receive SMS/MMS, browse the Internet send/receive emails and schedule personal information.

Higher speed, more reliable performance, and easier operations of the HUAWEI eAccess C100 allow you to get the most of the wireless network.

2) Appearance

3) Physical Specifications

The following table lists the physical specifications of the HUAWEI eAccess C100.

Table 32 Physical specifications of the HUAWEI eAcess C100

Item		Specifications
Dimensions (W × H × D)		60㎜×185㎜×175㎜
Weight		< 2 kg
Antenna		External
UIM		R-UIM mode and ROM-UIM mode
Micro SD		Providing a micro SD card holder and placing it in the deck center.
Power supply		10 V to 32 V
Maximum power		< 20 w（Non-high-power mode）
Display	Pixel	240x 320
	Type	TFT/TRANSMISSIVE
	Color	65k TFT color
	Size	2.83"(43.2×57.6)
Connector	Audio/PTT/data connector	Supports microphones with the PTT function and supports data transfer using USB flash drives.
	DMO RF connector	SMA Female
	CDMA RF connector	SMA Female
	GPS RF connector	SMA Female
Storage		1GB RAM+4GB ROM
External Storage		32 GB miro SD max
RoHS		Compliant with RoHS

4) Installation

HUAWEI eAccess C100 provides different kinds of accessories to support the following scenarios:

- Desktop mounting
- Car dashboard mounting
- Car standard DIN mounting
- Motorcycle front or rear mounting

5) Working Environment

The following table lists the requirements on the working environment of the HUAWEI eAccess C100.

Table 33 Requirements on the working environment of the HUAWEI eAccess C100

Item	Specifications
Operating	–25°C to +55°C
Storage and transportation	–40°C to +70°C
Humidity	ETS 300 019-1-5 class 5.1 and 5.2 EIA/TIA 603 (95%)
Dust and Water	Control panel: IP67 Main body: IP54
Shock, drop and vibration	ETS 300 019-1-5 class 5M2 and 5M3 MIL 810 C/D/E/F

6) Performance Specifications

The following table lists the CDMA performance specifications of the HUAWEI eAccess C100.

Table 34 CDMA performance specifications of the HUAWEI eAccess C100

Item	Specifications
Frequency band	TX: 452.500 MHz to 457.475 MHz RX: 462.500 MHz to 467.475 MHz Supporting the frequency band of BC0 *Depending on customer requirements
Voice rate	EVRC and 13 K QCELP
Language	Supporting multiple language input modes

7) Certifications

Certifications of the HUAWEI eAccess C100:

- CE
- RoHS

8) RF Specifications

The following table lists the CDMA RF transmission and reception specifications of the HUAWEI eAccess C100.

Table 35 CDMA RF transmission and reception specifications of the HUAWEI eAccess C100

No.	Item	Specifications
1	Maximum transmission power	CDMA BC5/BC0>=23dBm
2	Reception sensitivity	< = –104 dBm

The following table Table 36lists the DMO RF reception specifications of the HUAWEI eAccess C100.

Table 36 DMO RF reception specifications of the HUAWEI eAccess C100

No.	Item	Specifications
1	DMO Mode	Normal（Half-duplex） Repeater mode（Communicate with the repeater）
2	DMO Frequency	Normal ： 452.500 MHz to 457.475 MHz Repeater mode： TX: 452.500 MHz to 457.475 MHz RX: 462.500 MHz to 467.475 MHz *Depending on customer requirements
4	Maximum transmission power	37 dBm

9.5 Solution Highlights

1) Various Services

The LitePTT supports various voice services, short message services (SMSs), high-speed data services, and trunking call services.

For voice services, the LitePTT supports intra- and inter-network calls and calls with other network subscribers after subscribers access the fixed network.

For SMSs, the LitePTT supports common SMSs and broadcast SMSs.

For data services, the LitePTT supports local data download, video surveillance, and public network access.

For trunking call services, the LitePTT supports wide applications and services based on basic digital trunking call services, for example, group calls, private calls, temporary group calls, preemption calls, emergency calls, function number service, late entry, dynamic regrouping, virtual private network (VPN), area restriction, calls by a dispatcher, subscriptions by a dispatcher, forced break-in by dispatchers, forced release by dispatchers, call transfer by a dispatcher, call invitation by a dispatcher, call authorization by a dispatcher, emergency calls by a dispatcher, trunking short messages, automatic reply, and manual reply.

2) High Integration and Low Power Consumption

All boards use advanced integrated circuits, such as the ASIC, PLD, and FPGA, reducing system complexity and increasing system integration. The LitePTT uses only one cabinet instead of six cabinets to provide a full range of services, which reduces power consumption to 1/3 of the traditional solution.

3) Large Capacity

The LitePTT uses dedicated carrier-class hardware, high-performance chips, and high-speed bus technologies. The high-speed PowerPC processor further improves the processing capability of the LitePTT.

4) High Reliability

All boards support hot backup and smooth switchover to ensure system security and reliability. The RAC, TSC, PDSN, UAP, BAM, and GLMS communicate with each other on dual planes to ensure service security.

5) Distributed Base Station

Flexible deployment along the pipeline 。Does not need the engine room resources, significantly reduces cost.

10 CCTV Subsystem

10.1 Design Principles

10.1.1 High Availability

The CCTV system should run 24-hours uninterruptedly and the surveillance cameras should have a long work-life.

10.1.2 Easy Maintenance

The hardware can conveniently implement remote management and maintenance. The software uses the modularization design and provides friendly man machine interface (MMI) to ensure that the system is easy to maintain.

10.1.3 Flexible Expandability

It is unrealistic to establish a network once and for all; therefore, customers are mainly concerned about how to reasonably establish the network by stages and in groups. Based on normal use and investment protection, smooth expansion involves the following problems: how to use the existing video surveillance network, how to establish new video surveillance network by stages, how to

dynamically add the front-end encoder and camera, how to expand the number of back-end surveillance clients, how to expand system capacities as services and peripheral equipment units increase, and how to handle the changed network structure. These problems should be carefully considered in the initial phase of establishing the system. Meanwhile, solving these problems will guarantee long-term stable system operations and ultimately protect users' investment.

10.2 Requirement Research and Analysis

10.2.1 Surveillance Point

There are 4 types of places that cameras need to be deployed at:

- **Video Cameras Inside the Operation Room**

Including control rooms, guard rooms, office rooms and store rooms of compressor station and metering stations.

Monitored objects of these rooms are the operators and operation bench inside the room. The monitored area in the operation room is small and fixed. The operation room can be deployed with good-looking and practical semi-dome cameras due to good indoor illumination conditions..

- **Video Cameras for Station Perimeter and Gate Monitoring**

Perimeter and gates of compressor stations and metering stations need to be monitored for security reason, and for these places operator sometimes need to adjust angle and aperture of a camera, so there should be deployed with outdoor PTZ cameras.

- **Video Cameras for High Explosion Risk Area**

These places include compressor equipment area of compressor stations, and must be deployed with explosion-proof cameras.

- **Video Cameras for Outdoor Equipment Area**

These places include cooling unit of CS, Block Valve Station, Pig Trap Station and so on, and these places should be deployed with outdoor none PTZ cameras.

10.2.2 Surveillance Definition

To get a clear view of fields, a D1-upper image definition is suggested. We propose 720p high-definition in this project.

10.2.3 Surveillance Center

Core surveillance and command center:

The core surveillance and command center is the collection center of the image surveillance system all over the pipeline and manages area surveillance and command center along the pipeline. The central surveillance center has the highest right to invoke the video images within the surveillance range.

Area surveillance and command center:

Each ERC&MC needs to establish a surveillance management platform (including a surveillance terminal, a level-2 software platform, and CUs). The surveillance resources subject to an ERC are connected to the area surveillance management platform. The area surveillance and command center manages audio and video resources and alarm information invoking and applies to the core surveillance center for image resource management right.

10.2.4 Surveillance TV Wall and Required Devices

In this project, surveillance TV walls in the central and area surveillance and command centers should have the following qualities:

- High brightness
- Contrast
- High resolution
- Wide angle
- Even color and brightness
- Stable and safe
- Cost-effective
- Easy to maintain

10.2.5 Storage Deployment

Historical video images of at least 30 days must be stored. The storage management device must have the intelligent marking and fuzzy searching functions so that surveillance personnel can find out the key video data and alarm information in a quick manner from the mass of files.

10.2.6 Transmission Network

Peripheral cameras use the digital access mode. The uplink rate is 2 Mbit/s to 10 Mbit/s. The uplink rate for a class-2 access surveillance and command center is 1000 Mbit/s. The uplink rate for an area or central surveillance and command center is 1000 Mbit/s. The access rate of the analog video signal must be the same as the rate of the video optical transceiver.

10.2.7 External Access

The video surveillance subsystem of A-I Gas Pipeline should have the capability to share video to external office.

10.3 Solution Design

10.3.1 System Architecture

The management platform adopts the hierarchical and modular design mode and the multi-level and multi-area logical structure. The number of levels and the number of areas at each level can be set based on the actual application situations.

For this project, we propose 3-level hierarchical solution: 1 pipeline wide monitor center at MCC_J, 7 regional monitor centers at ERC1~ERC7, end station (MCs, CSs, BVSs with RTU) at each monitor point.

The first-level monitor center, set at the control center in MCC_J, can browse live video of cameras pipeline wide and control the cameras pipeline wide through the network. The second-level monitor center, set at ERC1~ERC7, control and browse live video of cameras inside each region. The end station only deploys cameras, CS/MS end station also deploy with local HMIs.

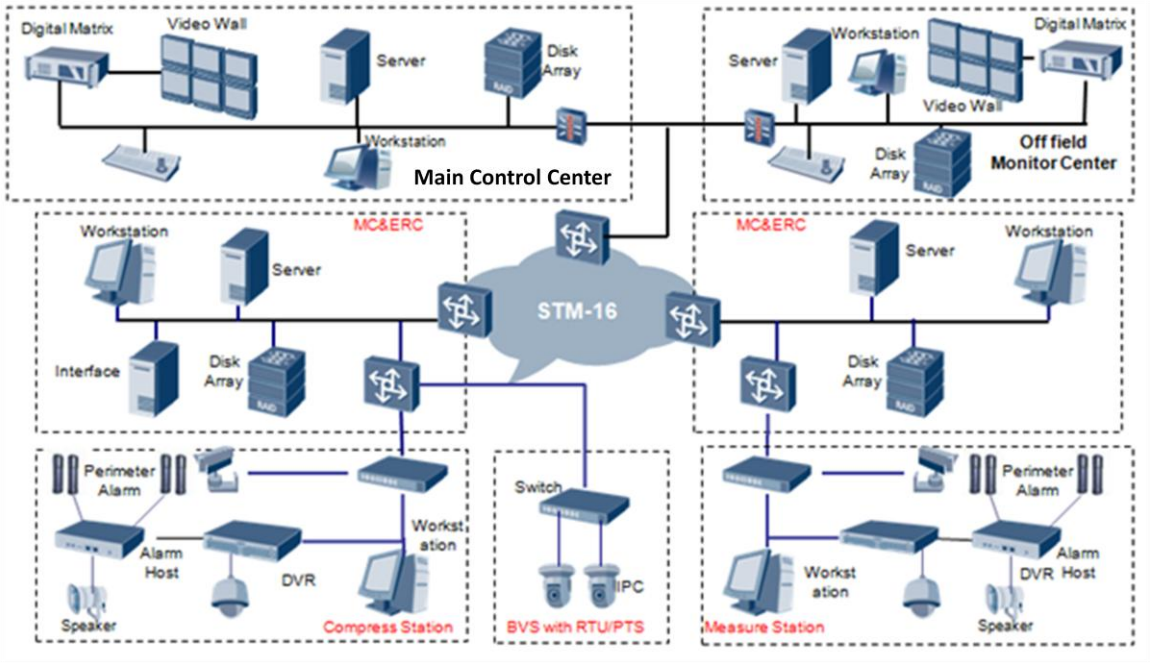


Figure 43 Topology of the IVS system

10.3.2 Front-end Design

1) Design Principles

Base on the actual situation, collect information adhering to the following principles:

Collect maximize information

Optimize target information feature

Fasten the target information input

2) Cameras Selection

According to 4 types of places, 4 types of cameras are selectd as follows:

- **Video Cameras Inside the Operation Room**

eSpace IPC2701-P semi-dome Network Camera.

- **Video Cameras for Station Perimeter and Gate Monitoring**

eSpace IPC2601-P gun type Network Camera with PTZ

- **Video Cameras for High Explosion Risk Area**

eSpace IPC2702-VF-VP explosion-proof HD camera

- **Video Cameras for Outdoor Equipment Area**

eSpace IPC2601-P gun type Network Camera without PTZ

3) Total cameras summary

Camera of all stations summarized as follows:

Table 37 sub-regional monitor centers position and cameras:

Level 3 stations		Indoor dome cameras	Outdoor PTZ gun type cameras	Explosion-proof PTZ gun type cameras	Outdoor gun type cameras
1	GMS_A	5	5	0	0
2	PTS-1	0	0	0	2
3	BVS-1	0	0	0	2
4	BVS-3	0	0	0	2
5	BVS-5	0	0	0	2
6	SVS-1	0	0	0	2
7	PTS-2	0	0	0	2
8	CS_B	13	11	10	5
9	SVS-2	0	0	0	2
10	BVS-7	0	0	0	2
11	BVS-9	0	0	0	2
12	SVS-3	0	0	0	2
13	GMS_C	5	6	0	2
14	CS_C	13	11	10	5

15	SVS-4	0	0	0	2
16	BVS-12	0	0	0	2
17	BVS-13	0	0	0	2
18	BVS-14	0	0	0	2
19	BVS-15	0	0	0	2
20	BVS-17	0	0	0	2
21	SVS-5	0	0	0	2
22	CS_D	13	11	10	5
23	SVS-6	0	0	0	2
24	BVS-18	0	0	0	2
25	BVS-20	0	0	0	2
26	BVS-22	0	0	0	2
27	SVS-7	0	0	0	2
28	CS_E	13	11	10	5
29	SVS-8	0	0	0	2
30	BVS-25	0	0	0	2
31	BVS-27	0	0	0	2
32	BVS-29	0	0	0	2
33	SVS-9	0	0	0	2
34	CS_F	13	11	10	5
35	SVS-10	0	0	0	2
36	BVS-32	0	0	0	2
37	BVS-34	0	0	0	2
38	PTS-7	0	0	0	2
39	BVS-37	0	0	0	2
40	BVS-38	0	0	0	2
41	SVS-11	0	0	0	2
42	CS_G	13	11	10	5
43	SVS-12	0	0	0	2
44	BVS-41	0	0	0	2
45	BVS-43	0	0	0	2
46	BVS-44	0	0	0	2
47	BVS-45	0	0	0	2
48	PTS-10	0	0	0	2
49	BVS-46	0	0	0	2
50	SVS-13	0	0	0	2
51	GMS_H	5	5	0	0
52	PTS-11	0	0	0	2
53	GMS_I	5	5	0	0
54	Total	98	87	60	118

Table 38 regional monitor centers position and cameras:

Level 2 stations		Indoor dome cameras	Outdoor PTZ gun type cameras	Explosion-proof PTZ gun type cameras	Outdoor gun type cameras
1	**ERC1**	5	**5**	**0**	**0**

2	**ERC2**	5	**5**	**0**	**0**
3	**ERC3**	5	**5**	**0**	**0**
4	**ERC4**	5	**5**	**0**	**0**
5	**ERC5**	**5**	**5**	**0**	**0**
6	**ERC6**	**5**	**5**	**0**	**0**
7	**ERC7**	**5**	**5**	**0**	**0**

Table 39 monitor center position and cameras:

Level 1 stations		**Indoor dome cameras**	**Outdoor PTZ gun type cameras**	**Explosion-proof PTZ gun type camera**	**Outdoor gun type cameras**
1	**PLACE_O**	**20**	**20**	**0**	

10.3.3 Monitor Center and Station Design

1) Main Monitor Center

For Main Monitor Center, we will use LCD Wall Display in a size of 4 x 2m to display video from cameras.

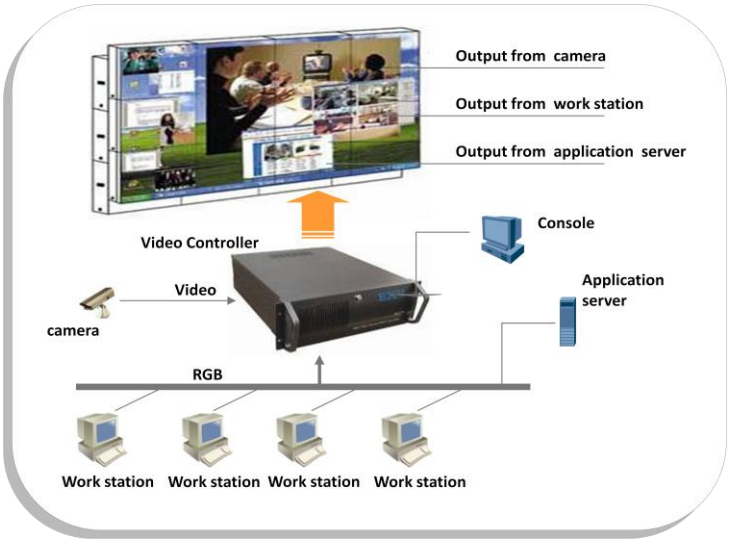


Figure 44 Monitor Center Design

- Transmission network

Requirements for transmission part:

4Mbps for each camera for real-time surveillance;

Display 100 cameras for real-time surveillance at the same time ;

- Front-end cameras

The Core monitor center will control and manage all the 401pcs cameras.

2) Regional Monitor Center

For Regional Monitor Center, we will use 1 large display screen to display video from cameras.

- Transmission network

Requirements for transmission part:

4Mbps for each camera for real-time surveillance;

Display 50 cameras for real-time surveillance at the same time;

- Front-end cameras

Level 2 Station	Quantity of Cameras
ERC_A	26
ERC_C	119
ERC_D	63
ERC_E	57
ERC_F	61
ERC_G	63
ERC_I	42

3) CS, MS Station

For Level CS, MS station, we will use workstation display to display video from cameras.

- Transmission network

Requirements for transmission part:

4Mbps for each camera to storage;

Display 40 cameras for real-time surveillance at the same time;

10.3.4 System Storage Design

The system has defined two types of storage;

A, Continuous storing: to have 24 hours/day continuous daily recording, records will be saved for 7~10 days (taking 10 days by default);

B, Alarm storing: to record when alarm happens, records will be saved for 30~60 days (taking 30 days by default; and hypothetically, we take alarm happens at a chance of 20% among all cameras);

In each station, continuous storing will be applied to direct linked cameras; alarm storing will cover both direct linked cameras and cameras from demonstrated lower level stations;

As level 3 end points do not have storage sever, level 3 devices will be directly linked to upper level station servers;

For High Definition cameras, both Continuous video and alarm video recording is made 720P@30fps, with recommended data rate 4Mbps.

Storage capacity calculation:

Storage= [number of Direct linked camera]*[Camera data rate]*[extension coeffeciency]*[continuous storing time]*[nunit transfer factors] + [number of Direct linked cameras & lower level cameras]*[Camera data rate]*[extension coeffeciency]*[alarm storing time]*[alarm chance rate]*[nunit transfer factors]

Calculation sample: Level1 MCC_J Station,

Effective Storage Capacity

=40*4Mpbs*1.1*10day*3600s*24hrs/day*(1/8Byte/bit)*(1/1024/1024Byte/TB)*1.1+ (40+361)*4Mpbs*1.1*30day*3600s*24hrs/day*(1/8Byte/bit)*(1/1024/1024Byte/TB)*20%*1.1

=128.0TB

The calculated results on storage for various level stations are shown in below table;

Level 1 Station		Direct linked cameras	Lower level cameras	Effective Storage
1	**MCC_J**	40	361	128.0TB
Level 2 Station		Direct linked cameras	Lower level cameras	Effective Storage
1	**ERC_A**	26	0	13.0TB
2	**ERC_C**	119	0	59.4TB
3	**ERC_D**	63	0	31.5TB
4	**ERC_E**	57	0	28.5TB
5	**ERC_F**	61	0	30.5TB
6	**ERC_G**	63	0	31.5TB
7	**ERC_I**	42	0	21.0TB

10.4 Subsystem Main Function

The functions of Huawei e-IVS product are as follows:

- Real-time image on demand

- This function provides real-time image on demand according to a specified device and channel, supports display, zoom, snapshot, and recording of the demanded image, and supports simultaneous demand of the same image resource by multiple users.

- Image information storage and backup
  - The peripheral distributed storage policy is adopted. The surveillance center database can store simultaneously detection information related to video materials, such as device, channel, time, and alert information.
  - The system shall be able to store the following information and keep it for a corresponding period of time.
    - Audio and video information recorded within a certain period of time before and after occurrence of alert;
    - Audio and video information about the site specified manually by operators in a surveillance center or by specified regularly by programs.

- Local SD memory card
  - Some cameras have local SD memory card. The SD card can keep some alarm events locally when the connection fails and transfer the data to the center when connection is established

- Various cameras accessed
  - Various IP based HD cameras adapt to various scenario. The video surveillance will cover bridges, tunnels, some critical parts, shunting yards, platforms

- Remote control
  - The actions of a PU can be controlled remotely through manual or automatic operations. The control priority can be set, and corresponding measures are taken to guarantee preferential response to a user request with higher priority.

- History image retrieval and replay
  - History image materials can be retrieved, replayed and downloaded by specified device, channel, time, and alert information. The replay function should support normal play, speed play, slow play, frame-by-frame forward and backward movement, picture pause, and image snapshot. In addition, replayed image can be zoomed in and out.

- Man-machine interaction
  - With a visual, friendly, and concise man-machine interaction interface, it is easy to use.
  - With necessary processing functions, such as split display of video pictures, information indication.
  - Display of its own running status, and an indication of normal, alarm, and fault status.

- User and right management
  - A surveillance center should be able to authorize and authenticate connected users. User and right management can be performed separately by individual levels of surveillance centers or centrally by a specified surveillance center. The user and right management module shall define the device operation, data access, and program use rights of each user.
  - Surveillance center users have rights to obtain history images and real-time surveillance images in the areas under their authorization, but must be authorized validly when obtaining history and real-time images from those areas beyond their authorization.

- The system enables user-defined locking/unlocking of exclusive control of a PU.

- Alarm cooperation
  - Support the alarm function. When an alarm is generated at the surveillance point, you can get the alarm information in time. The e-IVS system supports various alarm notification modes, such as SM alarm, MM alarm, and E-mail alarm.
  - Support various alarm cooperation strategies. You can specify the alarm events and alarm response activities. When the specified alarm event happens, the front-end devices make relevant operations according to the specified alarm response activities.

- Voice
  - Support the voice function. You can make voice communication or voice broadcasting through the client software. The voice volume is controllable.

- Mobile surveillance
  - Supports real-time video surveillance on multiple terminals, including mobile phone, tablet, and PC.
  - Seamlessly switches between terminals.

  You can watch real-time video and receive alarm information through the mobile client software at any time.

- Intelligence
  - After an intelligent analysis detection rule is configured on a camera, an alarm is reported when an exception occurs. Currently, supports the following intelligent analysis detection rules: intrusion detection, tripwire detection, abandon detection, removal detection, route detection, etc.
  - Intelligent Search: Collects video information by time, event, and feature. Constructs an information library that facilitates multiple keywords queries.

- High-Definition
  - Mainstream: 720p
  - HD video images provided using low illumination, Wide Dynamic Range (WDR), and noise reduction technologies.

The application software can supervise the running status of each device in the system and, according to its running status, provide its running diagnosis information, including device fault information and link fault information. When the system fails, it automatically enables the dual-host backup function to continue normal running, preventing a single-point fault from breaking down the whole system.

10.5 Design Criteria

Standards & Regulations	Remarks
ITU-T H.264 (MPEG 4 part 10)	Digital video encoding standard
RFC0872	Transmission Control Protocol (TCP)
RFC1356	Internet Protocol (IP)
	TCP and User Datagram Protocol (UDP)

Standards & Regulations	Remarks
ISOC/RFC2068	Hypertext Transfer Protocol (HTTP), version 1.1, January 1999
CCITT G.711 Recommendations (1988)	Pulse Code Modulation (PCM) of audio signals
RFC1889/RFC1890	Real-Time Transport Protocol (RTP) and Real-Time Transport Control Protocol (RTCP)
H.323	IP-based audio and video communication protocol suite
RFC2326	Real-Time Streaming Protocol (RTSP)
RFC2327	Session Description Protocol (SDP)
RFC3261	Session Initiation Protocol (SIP)
ONVIF	Network video interface standard protocol

10.6 Solution Highlights

10.6.1 Multi-level and Multi-area Hierarchical

The IVS adopts a multi-layered hierarchical architecture and is designed based on the carrier-class network management and charging principles. The IVS provides the following functions to meet the requirements for manageability, operability, and maintainability:

- Centralized or distributed management of services in the network
- Service statistics collection
- Data backup
- Video distribution
- Routing and scheduling

10.6.2 Standard Platform Structure

The IVS uses the modular design for easy configuration, modification, and capacity expansion to adapt to service changes. The modules use the standard interfaces for communication. Maintenance and upgrade of a module or addition of a new module does not affect other modules.

10.6.3 High Reliability

The IVS runs on the Linux operating system and Oracle database and has a large capacity. The IVS is highly stable and reliable and suitable for carrier-class applications. In addition, the IVS provides the active/standby working mode and the load balancing mechanism that ensures reliability when accessing a large number of services. Huawei IVS solution is verified by Huawei IPD process.

Any solution should have elements of high availability in its entirety, so it has 100% reliability, operating with only scheduled maintenance shutdowns.

10.6.4 Good Compatibility

The IVS is compatible with encoders of multiple leading vendors, including Hikvision, Dahua Tech, HH Digital, Santachi, and Tmvideo. More vendors will be included.

The IVS offers a complete software development kit (SDK) that provides the industrial software system of the customer with multimedia information, including video, voice, and data. The IVS is integrated with a number of systems, such as the electronic surveillance system for cargo inspection and quarantine at the customs and the real-time body temperature surveillance system.

10.6.5 Good Extensibility

The IVS uses a structure that features distributed deployment and centralized management. Thus, the IVS is highly extensible.

The IVS uses a flexible network structure to enable centralized processing at the IVS and deploy devices in remote areas. Thus, the IVS can adapt to multiple application environments.

10.6.6 High Security

The solution covers measures on multiple aspects, such as the host, data, and network, to ensure that the system is highly secure.