IAD196

V300R002

Product Description

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Contents

1 Product Positioning and Features

1.1 Positioning

This document applies to Integrated Access Device (IAD) V300R002.

As an important component in the Huawei Next Generation Network (NGN) ,IP Multimedia Subsystem (IMS) solutions, and enterprise-oriented IPT/UC solutions, the IAD196 provides a large-capacity Voice over IP (VoIP) solution for customers such as enterprises.

As the VoIP/Fax over IP (FoIP) media access gateway, the IAD196 works at the user access layer of the NGN and IMS solutions. It carries out conversion between analog voice signals and Internet Protocol (IP) packets, and transmits data over the packet switching network. When networking with the SoftSwitch or Call Session Control Function (CSCF) through Session Initiation Protocol (SIP), the IAD196 can set up calls between calling and called parties under the control of the SoftSwitch or CSCF. Figure 1-1 shows the network where the IAD196 resides.

Figure 1-1 Position of the IAD196 on the network

1.2 Features

The IAD196 has the following features:

- Configuration flexibility

- High audio quality

- Various call modes

- Easy installation and easy maintenance

- High reliability

- High security

Flexible Deployment

The IAD196 provides four slots, one of which is allocated for the main control board and the others are allocated for service boards. This modular design enables customers to deploy several Analog Subscriber Interface (ASI) boards as required. An ASI board with 32 Foreign Exchange Subscriber (FXS) interfaces allows access for 32 voice calls.

High-Quality Voice

The IAD196 provides efficient, high-quality voice services over the global IP network based on the following technologies:

- Voice Activity Detection (VAD)
- Comfortable Noise Generation (CNG)
- Dynamic Jitter Buffer (JB) adjustment
- Echo Cancellation (EC)
- Packet Loss Compensation (PLC)

Easy Installation

The IAD196 uses a case-shape design, and is usually installed in telecommunications rooms or corridors. The IAD196 is provided with standard external ports that are clearly labeled to facilitate installation and cable connection. It uses standard connection parts and does not require a dedicated installation tool.

Easy Management

The IAD196 can be managed in the following ways:

- Using a local serial port

    After connecting the IAD196 to a PC running the Windows 98, Windows NT, Windows 2000, or Windows XP operating system through a local serial port, use the operating system's HyperTerminal software to manage the IAD196.

- Using Telnet

    Use a Telnet client program to connect to the IAD196 through a network port and manage the IAD196 remotely on the IP network.

- Using the eSight

    The eSight can manage multiple IADs simultaneously through Simple Network Management Protocol (SNMP). The EMS consists of a server and client, and the eSight client can be flexibly deployed anywhere. In addition, the ESIGHT manages the system, faults, configurations, security, logs, maintenance, and northbound interfaces.

- Using the Web

    Rich configuration functions as well as embedded help information are provided on Web interface.

Easy Maintenance

The IAD196 provides maintenance operations for the equipment as follows.

- With the maintenance serial port, the setting and status detection of the equipment can be much quicker and simpler.
- Besides the serial port loading mode, the File Transfer Protocol (FTP)/Trivial File Transfer Protocol (TFTP)/File Transfer Protocol over SSL (FTPS) mode is used for the loading through the network port.
- Equipment maintenance and fault detection functions
- Web-based maintenance functions including one-key equipment information collection and web-based version upgrade via HTTP protocol

High Reliability

The IAD196 ensures high reliability with the following:

- Provides a complete fault detection and alarm mechanism to monitor the power supply status and device temperature, shortening the fault recovery time.

- Uses the Watch Dog Timer (WDT) technology so that the IAD196 can be restored automatically when a software exception occurs.

- Provides over-current and over-voltage protection for the power supply and ports.

- Supports data backup on the Flash memory so that data can be obtained quickly during restart when a fault occurs.

- When an IAD196 is put into service, the device ID, authentication key, and IP addresses or domain names of the ESIGHT and SoftSwitch are written to the IAD196 so that the information is not lost even if the IAD196 is powered off.

High Security

The IAD196 provides the following functions to ensure high security:

- User authorization and authentication

  The ESIGHT performs user authorization and authentication to prevent unauthorized users from logging in to and operating the IAD196. Users are classified into four levels as common user, operator, administrator, and super administrator. Different rights are assigned to the four levels, and the commands that can be executed by users of different levels are also different even if they access the same mode.

- Log management

  The IAD196 provides various logs to record the system's operation and maintenance information, including operation logs, alarm logs, and debug logs. Operation logs record the login information of operators (such as the user name, login time, login mode, and IP address) and the operations performed on the device after login. Alarm logs record the problems that may occur during system running. Debug logs collect debugging information.

2 Architecture

2.1 Hardware Structure

Front Panel

Figure 2-1 IAD196 front panel

Figure 2-2 IAD196 slot layout

On the right side of the IAD196 panel, there is a power supply slots, into which you can insert AC or DC power supply boards. In actual operations, one power supply module is enough to meet the requirements for power supply and reliability. In the middle area of the IAD196 panel, four slots are provided. Slot 3 is allocated for the Control and Voice Process (CVP) board. Slots 0 to 2 are allocated for the ASI board with 32 FXS interfaces. Each slot provides access for 32 Plain Old Telephone Service (POTS) users.

A fan tray assembly is vertically mounted on the left side of the IAD196. Air exhaust vents are provided on both sides of the device for heat dissipation.

Table 2-1 describes the external ports of the IAD196.

Table 2-1 External interfaces of the IAD196

Port	Number
Uplink Ethernet port	1

Port	Number
Downlink Ethernet port	2 One downlink Ethernet port (LAN) port can function as the commissioning Ethernet port (100 Mbit/s, unavailable when remote packet capture is enabled), and the other downlink Ethernet port can be used for cascading.
FXS	32 to 96 Each ASI board has 32 FXS interfaces. A maximum of three ASI boards can be inserted.
Serial port	1

CVP Board

Figure 2-3 CVP board of the IAD196

Table 2-2 Interfaces on the IAD196 CVP board

Name	Label	Description
1 - Broadband port	FE1, FE2, LAN	100 Mbit/s broadband port
2 - Maintenance serial port	CONSOLE	Board configuration and maintenance

Table 2-3 Indicators on the IAD196 CVP board

Indicator	Name	Color	Status	Description
PWR	Power indicator	Green	On	Power is on.
			Off	Power is off.
RUN	Running indicator	Green	Blinking (0.5s on and 0.5s off)	The board is being started.
			Blinking (0.25s on and 0.25s off)	The board is writing data into the Flash memory while the system is being started or running.

Indicator	Name	Color	Status	Description
			Blinking (1s on and 1s off)	The board is running normally.
			Off	No power supply or the board is faulty.
ALM	Alarm indicator	Red	Blinking (0.25s on and 0.25s off)	An alarm exists.
			Blinking (0.125s on and 0.125s off)	A major alarm exists.
			Off	No alarm exists.

ASI Service Board

Figure 2-4 Figure 2-7ASI board of the IAD196

An ASI board (POTS interface board) provides 32 FXS interfaces.

1	Indicator	2	Debugging serial port	3 (ASI panel)	FXS port
4	Ejector handle	5	Reset button		

Table 2-4 Interfaces on the IAD196 ASI board

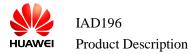| Name	Label	Quantity	Description
User port on the ASI board	FXS 1-32	1	Used to connect a maximum of 32 POTS phones.
Debugging serial port	CONSOLE	1	Used to configure and debug boards.

Table 2-5 Indicators on the IAD196 ASI board

Indicator	Name	Color	Status	Description
PWR	Power indicator	Green	On	Power is on.
			Off	Power is off.

Indicator	Name	Color	Status	Description
RUN	Running indicator	Green	Blinking (0.125s on and 0.125s off)	The board is loading software.
			Blinking (0.25s on and 0.25s off)	A user picks up the phone.
			Blinking (1s on and 1s off)	The board is in an idle state when it is running normally.
			Off	No power supply or the board is faulty.
ALM	Alarm indicator	Red	Blinking (0.25s on and 0.25s off)	An alarm exists.
			Blinking (0.125s on and 0.125s off)	A major alarm exists.
			Off	No alarm exists.

AC Power Supply Module

Figure 2-5 AC power supply module of the IAD196

Table 2-6 Interfaces on the IAD196 AC power supply module

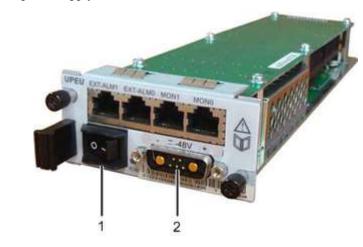| Name	Description
1 - Power switch	AC module input switch
2 - AC power socket	100V–240 V AC input

DC Power Supply Module

Figure 2-6 DC power supply module of the IAD196

Table 2-7 Interfaces on the IAD196 DC power supply module

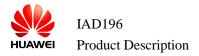| Name	Description
1 - Power switch	DC module input switch
2 - DC power socket	-48V DC input

2.2 Software Structure

The IAD196 software is based on the Distributed Object-oriented Programmable Realtime Architecture (DOPRA) and VxWorks, and consists of the CPU software and Data Signal Processor (DSP) software. See Table 2-8.

Table 2-8 IAD196 software structure

Software	Function
CPU	Core component of the IAD196, which is responsible for call control, management and maintenance, and forwarding of media streams.
DSP	Implements voice processing functions such as encoding and decoding, detection and generation of Dual Tone Multi-Frequency (DTMF) and Frequency Shift Keying (FSK), VAD, and CNG.

From the perspective of software functions, the IAD196 is divided into the following functional modules:

- Management and maintenance module
- Service access module

- Data service processing module
- VoIP service processing module
- Protocol processing module
- Operating system module (DOPRA+VxWorks)
- Bottom-layer driver processing module
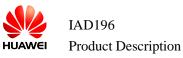
Figure 2-7 shows the relationship among the modules.

Figure 2-7 IAD196 functional modules

Table 2-9 describes the functions of each module in the IAD196.

Table 2-9 Module functions in the IAD196

Module	Function
Management and maintenance module	Responsible for the operation, maintenance, and management of the whole IAD196 system.
Service access module	Complete analog user information selecting, concluding and reporting; meanwhile pass the message from service module.
Data service processing module	Processes data services, including Wide Area Network (WAN) and Local Area Network (LAN) data services, cascading, and flow control.
VoIP service processing module	Controls the signaling interaction between users; controls the Time Division Multiplexing (TDM) and DSP modules; implements call connections under the control of NGN or IMS.

Module	Function
Protocol processing module	Implements SIP-based processing and protocol adaptation.
DOPRA+VxWorks module	Supplies the operating system and operating system adaptation, providing a basic running environment for software.
Bottom-layer driver processing module	Drives the components on the CVP and ASI boards, including the main chips (CPU and DSP), Flash memory, network ports, LanSwitch (LSW), and indicators.

3 Functions and Application Scenario

3.1 Overview

The IAD196 supports 32–96 channels IP voice access for POTS users. It also provides one uplink Ethernet port and two downlink Ethernet ports.

3.2 Service Functions

The IAD196 provides rich voice services, including:

- Connecting POTS users to IP network
- 802.1p/q
- T.38 fax, Voice Band Data (VBD) transparent transmission of fax, and T.30 transparent transmission of fax
- Traditional Public Switched Telephone Network (PSTN) services, such as call transfer, Calling Line Identification Presentation (CLIP), and call waiting
- SIP-based voice call process
- Basic voice services and supplementary services under the control of NGN or IMS
- Three-party call with local voice mixing
- G.711 and G.729 codecs
- IP address allocation by static mode, Point-to-Point Protocol over Ethernet (PPPoE), or Dynamic Host Configuration Protocol (DHCP)
- Voice Activity Detection (VAD)
- Comfort Noise Generation (CNG)
- Dynamic Jitter Buffer (JB) adjustment
- Echo cancellation (EC)
- Packet loss compensation (PLC)
- DTMF detection and generation
- RFC 2833
- Precedence/Differentiated Services Code Point (DSCP) label
- Local exchange
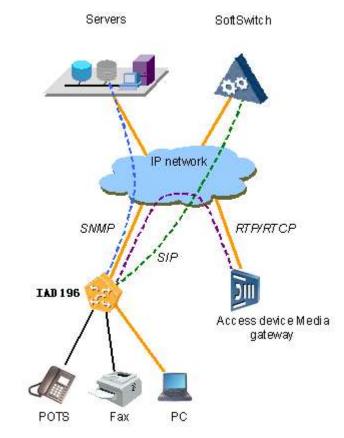- DHCP client
- DNS client
- SNTP

- SNMP v2c
- Dual-homing
- Virtual Local Area Network (VLAN) segmentation. Different VLANs can be segmented for signaling, media, and network management through the IP address of the same physical port.

📖 NOTE

> The VLAN segmentation temporarily does not apply to PPPoE environment. The signaling, media, and network management need to be marked with VLAN Tag at the same time.

3.3 Application Scenario

3.3.1 Integrated Access for Voice and Data

Figure 3-1 Integrated access for voice and data

As shown in Figure 3-1, the IAD196 provides voice and data integrated access for users.

The main application scenario of the IAD196 is networking with SoftSwitch (such as SoftCo). The IAD196 provide edge access and media conversion functions under the control of SoftSwitch. Besides, the IAD196 support local exchange.

The IAD196 also provide broadband data access, in which case the IAD196 functions as a local broadband switch with a few extra ports.

In above networking diagram, the servers mainly include the ESIGHT server and unified communications application servers. The ESIGHT server manages and maintains the IAD196 through SNMP protocol. The SoftSwitch controls the IAD196 through SIP protocol. The media data is directly transmitted between the IAD196 and other access device or media gateway through Real-Time Transport Protocol (RTP) / Real Time Control Protocol (RTCP) protocols.
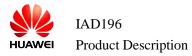
4 Technical Standards and Specifications

4.1 Technical Specifications

Table 4-1 lists the technical specifications of the IAD196.

Table 4-1 IAD196 technical specifications

Item	Specification
Max. number of users	96 analog phone users
Power supply	AC input voltage: 100V–240 V Frequency: 50Hz–60 Hz DC power: -48V
Max. power consumption	200 W
Dimensions	Standard 19-inch 1 U shelf that allows boards to be inserted horizontally 442 mm (length) x 310 mm (width) x 44 mm (height)
Weight	< 15 kg
Temperature	Long term: 0°C–45°C
Relative humidity	Long term: 5%–95% (non-condensing)
Altitude	≤ 3000 m
Atmospheric pressure	70–106 kPa
DSP convergence ratio	1:3.5
Call put-through capability	Call put-through rate > 99% One-hour call hold capacity > 99%
Voice codec switch time	< 60 ms

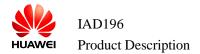| Item	Specification
Anti-jitter delay	> 80 ms
Voice quality	Objective voice assessment: • Perceptual Speech Quality Measurement (PSQM) average < 1.5 on a high-quality network • PSQM average < 1.8 on a poor-quality network (packet loss rate = 1%, network jitter = 20 ms, and delay = 100 ms) • PSQM average < 2.0 on a worst-quality network (packet loss rate = 5%, network jitter = 60 ms, and delay = 400 ms) Subjective voice assessment: • Mean Opinion Scores (MOS) > 4.0 on a high-quality network • MOS > 3.5 on a poor-quality network (packet loss rate = 1%, network jitter = 20 ms, and delay = 100 ms) • MOS > 3.0 on a worst-quality network (packet loss rate = 5%, network jitter = 60 ms, and delay = 400 ms)
Reliability = MTBF/(MTBF+MTTR)	> 99.99%
Mean Time Between Failures (MTBF)	> 30000 h
Mean Time To Repair (MTTR)	< 30 min

4.2 Standards and Protocols

The IAD196 complies with the following standards and protocols.

Tone Detection/Generation

- DTMF and calling tones (such as dialing tone, busy tone, ring back tone, and off-hook tone)
- V.17, V.21, V.27ter, and V.29

Voice/Multimedia Digital Signal Codec

- ITU-T G.711 μ-Law (64 kbit/s)
- ITU-T G.711 A-Law (64 kbit/s)
- ITU-T G0.729

Call Signal (Call Control) Protocol
- SIP (RFC3261~3265)

Voice Packet Encapsulation/Decapsulation Protocol
- RTP/RTCP (RFC1889)

Internet Protocol
- TCP (Transmission Control Protocol)/IP
- UDP (User Datagram Protocol)/IP
- ARP (Address Resolution Protocol) / RARP (Reverse Address Resolution Protocol)
- ICMP (Internet Control Message Protocol)
- Telnet
- DNS (Domain Name Server) Client
- DHCP (Dynamic Host Configuration Protocol) Client
- FTP/TFTP Client

IP Address Allocation
- Static
- DHCP
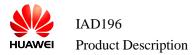- PPPoE (Point-to-Point Protocol over Ethernet)

A Acronyms and Abbreviations

Table 4-2 Acronyms and abbreviations

Abbreviation	Full Name
3rd Party Server	Third Party Server
A	
AAA	Authentication Authorization Accounting
AMG	Access Media Gateway
ARP	Address Resolution Protocol
ASI	Analog Subscriber Interface
ATI	Analog Trunk Interface
ATU	Analog Trunk Interface Unit
B	
BGCF	Breakout Gateway Control Function
BHCA	Busy Hour Call Attempts
C	
CNG	Comfortable Noise Generation
CRTP	Compressed Real-Time Protocol
CSCF	Call Session Control Function
D	
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Server
DSCP	Differentiated Services Code Point
DSLAM	Digital Subscriber Line Access Multiplexer
DSP	Data Signal Processor

Abbreviation	Full Name
DTMF	Dual Tone Multi-Frequency
E	
ETG	Edge Trunk Gateway
F	
FMIU	100Base-FX Multi-Mode Fast Ethernet Interface Unit
FSIU	100Base-FX Single Mode Fast Ethernet Interface Unit
FTIU	100Base-TX Fast Ethernet Electrical Interface Unit
FoIP	Fax over IP
FSK	Frequency Shift Keying
FTP	File Transfer Protocol
FTP	File Transfer Protocol over SSL
FXS	Foreign Exchange Subscriber
G	
GGSN	Gateway GPRS Support Node
H	
HSS	Home Subscriber Server
HTTP	Hyper Text Transport Protocol
I	
IAD	Integrated Access Device
ICMP	Internet Control Message Protocol
IGMP	Internet Group Management Protocol
IMS	IP Multimedia Subsystem
iOSS	Integrated Operation Support System
ITU-T	International Telecommunication Union - Telecommunication Standardization Sector
J	
JB	Jitter Buffer
M	
MGCP	Media Gateway Control Protocol
MGCF	Media Gateway Control Function
MGW	Media Gateway

Abbreviation	Full Name
MOS	Mean Opinion Scores
MRF	Media Resource Function
MRS	Multimedia Resource Server
N	
NGN	Next Generation Network
NTP	Network Time Protocol
P	
PBX	Private Branch Exchange
PCM	Pulse Code Modulation
POTS	Plain Old Telephone Service
PPPoE	Point-to-Point Protocol over Ethernet
PSQM	Perceptual Speech Quality Measurement
PSTN	Public Switched Telephone Network
Q	
QoS	Quality of Service
R	
RARP	Reverse Address Resolution Protocol
RTP	Real-time Transport Protocol
RTCP	Real Time Control Protocol
S	
SGW	Service GateWay
SCP	Service Control Point
SG	Signaling Gateway
SGSN	Serving GPRS Support Node
SIP	Session Initiation Protocol
SNMP	Simple Network Management Protocol
T	
TCP	Transmission Control Protocol
TDM	Time Division Multiplexing
TFTP	Trivial File Transfer Protocol
TMG	Trunk Media Gateway

Abbreviation	Full Name
U	
UDP	User Datagram Protocol
V	
VAD	Voice Activity Detection
VBD	Voice Band Data
VDSL	Very-high-data-rate Digital Subscriber Line
VDU	Very high rate DSL Interface Unit
VLAN	Virtual Local Area Network
VoIP	Voice over IP