Overview of Cisco VG450 Voice Gateway

Cisco High-Density Analog Voice Gateway provide enterprises, managed services providers, and service providers the ability to directly connect public-switched telephone networks (PSTNs) and existing telephony equipment to Cisco 4000 Series Integrated Services Routers. These fixed-port (FXS and FXO) modules provide Dual-Tone Multifrequency (DTMF) detection, voice compression and decompression, call progress tone generation, Voice Activity Detection (VAD), echo cancellation, and adaptive jitter buffering. Cisco VG450 Voice Gateway is a high-density analog voice gateway. It is an intermediate path that enables TDM to IP transition.

The Cisco VG450 Voice Gateway supports the following interfaces:

- Gigabit Ethernet (GE)
- USB
- Network Interface Module (NIM)
- Single-Wide Service Module (SWSM) interface
- Double-Wide Service Module (DWSM) interface

This chapter contains the following sections:

Features and Benefits of Cisco VG450 Voice Gateway

Cisco VG450 Voice Gateway provides VoIP connectivity to analog devices, such as analog desk phones, analog conference room phones, fax machines and modems. Cisco 450 Voice Gateway provides several improvements from the previous high-density analog and digital extension modules (EVMs), in the following ways:

- **On-board Digital Signal Processor (DSP)**—The FXO and FXS service modules contain an onboard DSP and don't require the router to have a dedicated packet voice DSP module (PVDM) on the motherboard. The DSP on the voice module is necessary for the voice features. It also provides for echo cancellation of up to 128-ms echo-tail length for demanding network conditions.
- **Support for Online Insertion and Removal (OIR)**—The FXS and FXO service modules support Online Insertion and Removal (OIR), reducing the downtime required for new or replacement modules. The

service modules can be inserted into the SM-X slot on the supported Cisco 4000 Series ISRs without powering off the router.

- **FXS-E (extended loops) support**—FXS ports on the new modules support FXS-E with the following details:

  - Higher loop current (35 mA) to accommodate specialty phones
  - Longer loop length for loops with 26 AWG wire, up to 11,000 feet (3400 meters)
  - Higher ringing voltage (65 Vrms, no load)

> **Note** Switching between the modes requires reload of the ISR chassis.

- **FXO failover bypass ports**—A failover bypass port, also called a failover trunk bypass, provides a way to use designated analog phone ports to make phone calls through the PSTN during a power outage.

In addition to these features, Cisco 450 Voice Gateway supports the following features:

- Caller line ID
- G.711, G.729a, and G.726
- G722, iLBC, GSMAMR-NB, and Internet Speech Audio Codec (iSAC)
- Fax detection, pass-through, and relay (T.38)
- Modem pass-through
- DTMF detection
- Echo cancellation
- Voice activity detection
- Comfort noise generation
- Real-Time Control Protocol (RTCP)
- Acoustic shock protection
- Real-Time Transport Protocol (RTP)
- RFC 4733 Digit Relay
- Noise reduction is on the roadmap
- The FXS features include:
- Support for either FXS or DID functionality
- Message-Waiting Indicator (MWI)
- Cable detection: GR909 line test
- The FXO features include:
- Support for both ground-start and loop-start modes
- Support for FXO CAMA signaling type
- Call Detail Record (CDR) information
- Support for interworking with Cisco Unified Communications Manager (Skinny Client Control Protocol [SCCP]), H.323, Session Initiation Protocol (SIP), and Media Gateway Control Protocol (MGCP) 0.1
- Cable detection
- Overload protection

Analog Phone Connectivity

Cisco 450 Voice Gateway are ideal for analog phone deployments ranging from centralized to sparsely concentrated or distributed topologies. Cisco 4000 Series Integrated Services Routers offer many supplementary analog calling features, depending on the call control and signaling type used. All supplementary analog features are supported through the FXS and FXO service modules. The analog interface on Cisco 4000 Series also supports Feature Access Codes (FACs) for invoking supplementary services.

Fax and Modem Connectivity

FXS ports on Cisco 450 Voice Gateway support fax machines and modems. When using fax machines, the gateways support T.38 fax relay and fax pass-through. T.38 fax relay technologies allow transfer of faxes across the network with high reliability using less bandwidth than a voice call. All modems can be connected to the Cisco VG Series Gateways and are transferred over the network using modem pass-through.

Protocols Supported

The voice gateways support the following protocols:

- SCCP
- H.323v4
- MGCP
- SIP
- Real-Time Transport Protocol (RTP)
- Secure Real-Time Transport Protocol (SRTP)
- Trivial File Transfer Protocol (TFTP)
- HTTP server
- Simple Network Management Protocol (SNMP)
- Telnet
- Dynamic Host Configuration Protocol (DHCP)
- DNS
- Cisco Unified Communications Manager or Cisco Unified Communications Manager Express redundancy support using Hot Standby Router Protocol (HSRP)
- Call survivability: MGCP failover to an H.323 connection to the Survivable Remote Site Telephony (SRST) router
- T.38 fax relay and modem pass-through
- Codec support: G.711, G.729. G.729a will be used if the gateway does not support G729 annex b
- RADIUS and TACACS+ for Telnet and authorization

The following table lists the feature specifications for Cisco 450 Voice Gateway.

*Table 1: Cisco SM-X Single-Wide Service Module Feature Specifications*

Feature	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
Tip and Ring Interface for each FXS port				

| Feature	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
Interface	FXS/FXO (RJ-21)RJ-21 ports 0 to 7: FXSRJ-21 ports 8 to 19: FXO	FXS/FXO (RJ-21)RJ-21 ports 0 to 15: FXSRJ-21 ports 16 and 17: FXO	FXS (RJ-21), FXO (RJ-11)RJ-21 ports 0 to 23: FXSRJ-11 ports 24 to 27: FXO	FXS (RJ-21)
Address signaling format	In-band DTMF Out-of-band pulse (8 to 12 pps)	In-band DTMF Out-of-band pulse (8 to 12 pps)	In-band DTMF Out-of-band pulse (8 to 12 pps)	In-band DTMF Out-of-band pulse (8 to 12 pps)
FXS signaling formats	FXS loop-start, ground-start, and DID signaling	FXS loop-start, ground-start, and DID signaling	FXS loop-start, ground-start, and DID signaling	FXS loop-start, ground-start, and DID signaling

Cisco VG450 Voice Gateway Chassis

The following figures show the front and back panels of the Cisco VG450 Voice Gateway Chassis:

Figure 1: Front Panel of the VG450 Voice Gateway
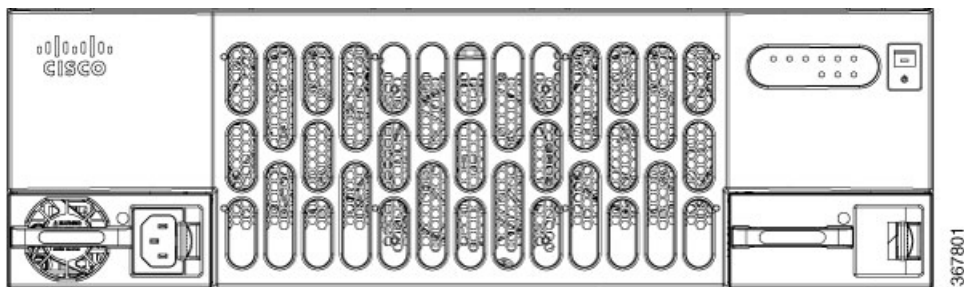
Figure 2: Back Panel of the VG450 Voice Gateway
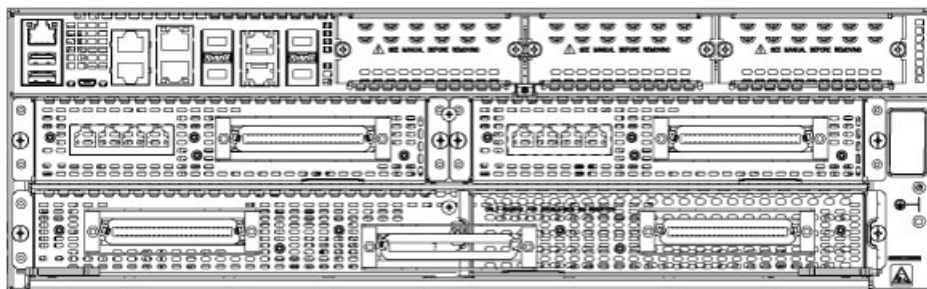
Slot, Bay, and Ports

The FXO port is used to connect to PBX or key systems, or to provide off-premises connections to the PSTN. It supports battery reversal detection and caller ID. The FXO port is also used to connect to analog Centralized Automatic Message Accounting (CAMA) trunks to provide dedicated E-911 service (only in North America).

The FXS port is used to connect analog phones, modems, fax machines, and speaker phones to an enterprise IP voice system, and to use them as extensions to your Cisco or third-party IP call-control system. Having these devices tightly integrated with the IP-based phone system is advantageous for increased manageability, scalability, and cost-effectiveness. The Direct Inward Dialing (DID) port is used to provide off-premises DID connection from the central office. It serves only incoming calls from the PSTN. The Caller ID feature is not supported in DID mode.

Cisco 450 Voice Gateway supports the following:

- Slot 0/1, 0/2, 0/3:

    - NIM-1MFT-T1/E1
    - NIM-2MFT-T1/E1
    - NIM-4MFT-T1/E1
    - NIM-8MFT-T1/E1
    - NIM-2FXO
    - NIM-4FXO
    - NIM-4EM
    - NIM-2BRI-NT/TE
    - NIM-4BRI-NT/TE
    - NIM-2FXSP
    - NIM-4FXSP
    - NIM-2FXS/4FXOP

- SM Slots 1 and 2:

    - SM-X-8FXS/12FXO
    - SM-X-16FXS/2FXO
    - SM-X-24FXS/4FXO
    - SM-X-72FXS

- SM slot 3:

    - SM-X-72FXS
    - No Skye SM is supported.
    - No DSP Farm is supported
    - No CUBE and CME are supported
    - Old D3 analog FXS and combo FXS/FXO NIMs are not supported.
    - T1/E1: channel-group CLI is not supported
    - CME: telephone service CLI is not supported.

The following table provides information about Cisco 450 Voice Gateway SKU:

Table 2: Cisco 450 Voice Gateway

Interface	Maximum Number of FXS-E Ports	Maximum Number or RENs	LED	Number of Failed-over Ports
SM-X-8-FXS/12FXO	8	16	EN LED (Amber/Green) ACT LED (Green)	8 ports on RJ-21

Interface	Maximum Number of FXS-E Ports	Maximum Number or RENs	LED	Number of Failed-over Ports
SM-X-16-FXS/2FXO	16	16	EN LED (Amber/Green) ACT LED (Green)	2 ports on RJ-21
SM-X-24-FXS/4FXO	16	16	EN LED (Amber/Green) ACT LED (Green)	4 ports on RJ-11
SM-X-72FXS	• 16 for 72FXS mode • 56 for 56FXS-E mode	• 40 • 30	EN LED (Amber/Green) ACT LED (Green)	—

The slot, bay, and port information for Cisco 450 Voice Gateway FXS module is as follows:

Interface	Slot	Bay	Port
SM-X-8-FXS/12FXO	1-2	0	0-7
SM-X-16-FXS/2FXO	1-2	0	0-15
SM-X-24-FXS/4FXO	1-2	0	0-23
SM-X-72FXS	1 and 3	0	17-0 55-0

The slot, bay, and port information for Cisco 450 Voice Gateway FXO module is as follows:

Interface	Slot	Bay	Port
SM-X-8-FXS/12FXO	1-2	0	8-19
SM-X-16-FXS/2FXO	1-2	0	16-17
SM-X-24-FXS/4FXO	1-2	0	24-27

Technical Specifications

Table 3: Cisco VG450 Voice Gateway Technical Specifications

Description	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
Physical				
Dimensions (H x W x D)	1.58 x 7.44 x 7.6 inches	1.58 x 7.44 x 7.6 inches	1.58 x 7.44 x 7.6 inches	1.58 x 15.57 x 7.57 inches
Weight	1.90 lb (0.86 kg)	1.98 lb (0.90 kg)	2.12 lb (0.96 kg)	4.94 lb (2.24 kg)
Power				

Description	SM-X-8FXS/12FXO	SM-X-16FXS/2FXO	SM-X-24FXS/4FXO	SM-X-72FXS
AC power	53.55W	70.32W	79.37W	128.16W
Current	4.46A on 12V	5.86A on 12V	6.61A on 12V	10.68A on 12V
Voltage	12V from backplane	12V from backplane	12V from backplane	12V from backplane
On-hook voltage	-44V	-44V	-44V	-44V
Off-hook loop current	25 mA (maximum) for short loop-length-port35 mA for long loop-length-port	25 mA (maximum) for short loop-length-port35 mA for long loop-length-port	25 mA (maximum) for short loop-length-port35 mA for long loop-length-port	25 mA (maximum) for short loop-length-port35 mA for long loop-length-port
Operating temperature	32 o to 104 o F (0 o to 40 o C)	32 o to 104 o F (0 o to 40 o C)	32 o to 104 o F (0 o to 40 o C)	32 o to 104 o F (0 o to 40 o C)
Nonoperating temperature	-40 o to 158 o F (-40 o to 70 o C)	-40 o to 158 o F (-40 o to 70 o C)	-40 o to 158 o F (-40 o to 70 o C)	-40 o to 158 o F (-40 o to 70 o C)
FXS loop resistance	Up to 600 ohms for short loop-length-portUp to 1400 ohms for long loop-length-port	Up to 600 ohms for short loop-length-portUp to 1400 ohms for long loop-length-port	Up to 600 ohms for short loop-length-portUp to 1400 ohms for long loop-length-port	Up to 600 ohms for short loop-length-portUp to 1400 ohms for long loop-length-port
DID loop resistance	Up to 1400 ohms	Up to 1400 ohms	Up to 1400 ohms	Up to 1400 ohms
Ring frequency	20, 25, 30, and 50 Hz	20, 25, 30, and 50 Hz	20, 25, 30, and 50 Hz	20, 25, 30, and 50 Hz
REN loading	5 RENs per port (short-loop-length port)2 RENs per port (long-loop-length port)	5 RENs per port (short-loop-length port)2 RENs per port (long-loop-length port)	5 RENs per port (short-loop-length port)2 RENs per port (long-loop-length port)	5 RENs per port (short-loop-length port)2 RENs per port (long-loop-length port)
Impedance	600c, 600r, 900c, 900r, complex1, complex2, complex3, complex4, complex5, and complex6	600c, 600r, 900c, 900r, complex1, complex2, complex3, complex4, complex5, and complex6	600c, 600r, 900c, 900r, complex1, complex2, complex3, complex4, complex5, and complex6	600c, 600r, 900c, 900r, complex1, complex2, complex3, complex4, complex5, and complex6
FXS loop length	Short-loop-length port: 3000 ft (900 m) with 26 AWG, 5500 ft (1700 m) with 24 AWGLong-loop-length port: 11,000 ft (3400 m) with 26 AWG, 18,000 ft (5500 m) with 24 AWG	Short-loop-length port: 3000 ft (900 m) with 26 AWG, 5500 ft (1700 m) with 24 AWGLong-loop-length port: 11,000 ft (3400 m) with 26 AWG, 18,000 ft (5500 m) with 24 AWG	Short-loop-length port: 3000 ft (900 m) with 26 AWG, 5500 ft (1700 m) with 24 AWGLong-loop-length port: 11,000 ft (3400 m) with 26 AWG, 18,000 ft (5500 m) with 24 AWG	Short-loop-length port: 3000 ft (900 m) with 26 AWG, 5500 ft (1700 m) with 24 AWGLong-loop-length port: 11,000 ft (3400 m) with 26 AWG, 18,000 ft (5500 m) with 24 AWG
Cables	Category 3 and Category 5	Category 3 and Category 5	Category 3 and Category 5	Category 3 and Category 5

Platform and Software Requirements

Cisco 450 Voice Gateway is supported on Cisco 4461 Integrated Services Router effective with Cisco IOS XE Fuji 16.9.1 or later. The service modules provide gateway services for Cisco Unified Communications using Cisco Unified Communications Manager with SRST or Cisco Unified Communications Manager Express. The following table provides information about the software version that is compatible with FXO and FXS service modules.

Table 4: Compatible Software Versions with the FXO and FXS Service Modules

Product Category	Software Version
Cisco IOS XE Software	Cisco IOS XE Fuji 16.9.1
Cisco Unified Communications Manager	10.5.2(SU8), 11.5.1(SU6) and 12.5
Cisco Unified Communications Manager Express	Any version that is compatible with Cisco IOS XE Fuji 16.7.1
Third-party Call Control	IP-based trunk; SIP and H.323

Configuration Methods

After the Cisco VG450 Voice Gateway is operational, use the procedures described in the *Cisco Voice 450 Gateway Software Configuration Guide* to configure specific services and functions, or to make changes to an existing configuration.

You can configure the Cisco VG450 Voice Gateway by one of the following methods:

- System configuration dialog
- Configuration mode: Cisco IOS software CLI
- Setup command facility: Remote configuration through a LAN
- SNMP-based application: CiscoView or HP OpenView
- HTTP-based configuration server: Provides access to the CLI from a web browser