

Cisco Voice Infrastructure and Applications

This document provides answers to frequently asked questions about the Cisco Voice Infrastructure and Applications (VIA) solution.

Q. What is the Cisco Voice VIA solution?

A. Cisco VIA enables a broad portfolio of voice services over an IP network. The voice services are applications that are independent of the underlying infrastructure; they allow the separation of call control from bearer channels and enable the support of both Cisco and partner call control. The fundamental building blocks of Cisco VIA are the Cisco media gateway, call control (Cisco gatekeeper, Cisco SIP Proxy Server, Cisco PGW 2200 softswitch, or partner call control), IP-to-IP-interconnect (using the Cisco Directory Gatekeeper or SIP Proxy Server) and operations support systems (OSSs) to manage and provision the entire network. These building blocks allow Cisco VIA to support the following services:

- Prepaid and postpaid calling card services
- National and international transport
- Termination services for Application service providers (ASPs)
- Voice mail and unified communications
- Dial access

Q. Which service providers have implemented this solution?

A. Cisco VIA has been deployed in more than 80 countries and by hundreds of service providers, including:

- BT Ignite
- China Unicom
- iBasis
- ITXC
- Singtel
- Tele2
- Telecom of Thailand (TOT)

Q. What is the high-level architecture for the solution?

A. The solution provides a flexible architecture that can be adapted to meet your transit needs. The Cisco gateway provides the flexibility to interconnect to the Public Switched Telephone Network (PSTN) or to a time-division multiplexing (TDM) switch using a variety of interconnect methods:

- Analog foreign exchange office (FXO) or station (FXS)
- T1 and E1 digital trunking with channel associated signaling (CAS) or R2, Primary Rate Interface (PRI), or Signaling System 7 (SS7) signaling
- DS3 or OC-3 interconnect using the carrier-class Cisco MGX[®] 8000 Series carrier voice gateways

The Cisco gateways provide the foundation for flexibility in call control. The gateways offer imbedded H.323 and Session Initiation Protocol (SIP), and they support Cisco H.323 gatekeepers, the Cisco SIP



Proxy Server, or provide the flexibility to use the Media Gateway Control Protocol (MGCP) to interface to a Cisco or partner softswitch. Cisco gateways provide the flexibility to evolve and grow your network and your services to meet your customers' needs.

Because Cisco gateways are built upon industry-leading network routers, they can provide the voice quality that is comparable or better than the PSTN, all over an efficient IP infrastructure. Cisco provides the latest echo cancellation technology, adaptive jitter buffer, priority queuing, packet loss concealment, silence suppression, and several more features to meet your desirable service level.

Q. What is the difference between configuring the Cisco PGW 2200 to run in “signaling mode” versus “call control mode”?

The Cisco PGW 2200 is designed to provide maximum support for different IP network architectures. This flexibility enables the Cisco PGW 2200, running in signaling mode, to provide an SS7 interconnect for H.323- or SIP-based networks where the call control resides in the gateway. The Cisco PGW 2200, running in call control mode, can also act as a softswitch and provide intelligent call control and routing functions for MGCP-based gateways while concurrently providing an H.323 or SIP interface for maximum flexibility and interoperability.

For more details, see the Cisco PGW 2200 Data Sheet at:

http://www.cisco.com/en/US/products/hw/vcallcon/ps2027/products_data_sheet09186a0080091b59.html

Q. Which Cisco gateways should I choose?

A. It depends on your needs and capacity. To help, Cisco has divided the gateways into three categories: customer premises equipment (CPE) gateways, midrange service provider gateways, and high-end service provider gateways.

- *Cisco CPE gateways*—The Cisco 1751 and 1760 modular access routers, Cisco 2600XM Series, Cisco 2691 Multiservice Router, Cisco 3660, 3725, and 3745 multiservice access routers, and Cisco 7200 Series CPE gateways reside on the customer's “premises”—in a regional or branch office, factory, or home. They offer the interfaces required for the following environments: FXO, FXS, network- and user-side voice Basic Rate Interface (BRI), direct inward dial (DID), and T1 and E1. When selecting CPE gateways, consider the PSTN interfaces offered, channel capacity, and feature set.
- *Midrange service provider gateways*—Cisco AS5000 Series voice gateways—Residing in a service provider point of presence (POP), Cisco midrange service provider gateways offer high-capacity trunking interfaces (T1, E1, and DS3) to the PSTN. These gateways connect to the PSTN using SS7, PRI, or CAS or R2 signaling, and they provide options of H.323, SIP, or MGCP.
- *High-end service provider gateway*—The Cisco MGX 8000 media gateways are high-end voice gateways that provide support for both ATM and IP interfaces and provide T1, E1, DS3, and OC-3 TDM interfaces. The MGX 8000 uses MGCP.

Q. What are some of the newer features of Cisco VIA?

A. The newest features of the VIA solution follow:

- *ISDN User Part (ISUP) signaling transparency and interworking in H.323 networks*—This release of the solution supports the transport and interworking of ISUP signaling parameters in the core voice-over-IP (VoIP) network using the Cisco PGW 2200 in signaling control mode. ISUP parameters are normalized in a generic fashion and



then, using the underlying VoIP call-signaling messages, are transported to nodes within the network. Breaking the limitations imposed by H.323 signaling, nodes within the distributed call control network can use ISUP parameters as needed to make call routing decisions, such as partner route servers.

- *Addition of Cisco PGW 2200 softswitch to architecture*—The Cisco VIA solution now supports the option of MGCP call control in addition to the traditional imbedded gateway call control using H.323 and SIP protocols. The Cisco PGW 2200 can support terminating both H.323 and SIP to allow interfacing to other networks.
- *Dial peer gateway circuit selection algorithms*—In this release of Cisco IOS[®] Software, support for the most common PSTN circuit-selection methods and algorithms was added. The circuit selection reduces the chance of glare conditions between the IP and PSTN networks, improving call setup time and increasing call success rate. This is especially important as call volume (minutes) increases on the VoIP network.
- *Integrated Signaling Link Terminal on the Cisco AS5350 and AS5400*—The Cisco Signaling Link Terminal (SLT) is now available as an option on the Cisco AS5350 and AS5400 voice gateways. With the integrated SLT option, the Cisco AS5350 and AS5400 voice gateways function as both the SS7 link termination point and the voice gateway. The integrated SLT reduces cost, rack space, and installation time over a standalone SLT and gateway. The integrated SLT still supports the same features as the standalone SLT and works with the Cisco PGW 2200 in either signaling control mode or in call control mode.
- *Improved network management*—Cisco VIA supports centralized end-to-end provisioning, fault, and performance management through the Cisco Internet OSS for VoIP Infrastructure Manager solution:
 - Supports administration mobility through a Web-based management console
 - Provisions the network-level H.323 gateway, gatekeeper, and Cisco PGW 2200 from a single point
 - Provides northbound industry-standard interface from single network level management interface or element management interface
 - Offers end-to-end dialing plan provisioning and management
 - Supports fault Cisco IOS syslog event and Simple Network Management Protocol (SNMP) event correlation
 - Monitors all faults from a single management console
 - Filters out unwanted SNMP and syslog fault events for gateways, gatekeepers, Cisco PGW 2200 softswitches, and Sun hardware platforms
 - Provides performance data for gateway call legs
 - Provides generic Management Information Base (MIB) retrieval and threshold setting interface to in-house OSS and third-party performance application integration
 - Supports a distributed network deployment architecture
- *Cisco VIA supports H.323, SIP, MGCP, and dial access*—Using Cisco AS5000 voice gateways, Cisco VIA now supports, on a call-by-call basis, H.323, SIP, or dial termination. The dynamic call control on the Cisco AS5000 voice gateways terminates dial, fax, or voice calls and translates them to IP for transport. The gateways determine the codec type, modem modulation, or the voice protocol (H.323 or SIP) to ensure call completion. Today's VoIP traffic relies on a variety of signaling protocols. The Cisco VIA-based networks using the Cisco AS5000 voice gateways can interconnect and interoperate with other networks regardless of the protocol used. With this capability, service providers can integrate complementary H.323 and SIP services in the same network. Cisco's multiprotocol strategy has several facets:



- Cisco has implemented support for SIP in the Cisco AS5000 Series of voice gateways that have existing support for H.323. This extension of the gateway functionality allows service providers to take advantage of the rich features of the gateway, including: a variety of codec support, Voice Extended Markup Language (VXML), sophisticated quality-of-service (QoS) algorithms, and existing operations, administration, and maintenance (OA&M) capabilities.
- This solution also enables service providers to deploy services based on different protocols using the same network infrastructure components. For example, Cisco IOS Software can be configured to run H.323, SIP, or both simultaneously. Also, the Cisco VIA solution also offers dial services. Dial capabilities give service providers the ability to lease ports to Internet service providers (ISPs) for data traffic or to offload their own data traffic from the PSTN.

However, if you wish to control your gateway by a softswitch, MGCP is also available on the Cisco AS5000 Series of universal gateways and on the Cisco MGX 8000 Series of voice gateways. The main distinguishing attribute of MGCP is that it enables softswitch control of the gateway within the packet telephony architecture. MGCP allows a service provider to deploy a packet telephony system (VoIP, voice over ATM, voice over Frame Relay) with an architecture that is comparable to the centralized call-control architecture of telephony systems based on circuit-switched technology.

Q. What are the network elements in this solution?

A. The Cisco VIA solution includes the products listed in Table 1.

Table 1 Cisco VIA Solution Products

Components	Role	Description	Cisco or Partner Products
Media gateways	Required in packet-voice networks	<p>Cisco VIA supports a range of small- to large-scale gateways that support a broad range of codecs for high-quality voice transit, as well as fax, modem, and DTMF transit.</p> <p>The gateways support an interactive-voice-response (IVR) function that provides voice prompts and digit collection or speech input for user authentication and call destination identification for applications such as pre- and postpaid calling card services. These products support standard VXML and customized Toolkit Command Language (TCL) scripts. Optional speech recognition and text-to-speech capabilities are available.</p>	<ul style="list-style-type: none"> • Customer premises gateways: <ul style="list-style-type: none"> - Cisco 1750 Modular Access Router - Cisco 2600 Series multiservice platforms - Cisco 3600 Series multiservice platforms - Cisco 7200 Series voice gateways • Midrange service provider gateways: <ul style="list-style-type: none"> - Cisco AS5000 Series universal gateways • High-end service provider gateways: <ul style="list-style-type: none"> - Cisco MGX 8000 Series of voice gateways



Table 1 Cisco VIA Solution Products

Components	Role	Description	Cisco or Partner Products
H.323 gatekeepers	Optional	Used to scale larger H.323 wholesale networks, Cisco gatekeepers provide address translation, admission control, resource monitoring, bandwidth management, and zone management. These products offer cost-effective routing, resource management for increased availability, and support for alternate gatekeepers for greater reliability.	<ul style="list-style-type: none"> • Cisco 2600 Series multiservice platforms • Cisco 3600 Series multiservice platforms • Cisco 3700 Series multiservice platforms • Cisco 7200 Series multiservice platforms • Cisco 7400 Series multiservice platforms
H.323 directory gatekeepers	Optional	Used to scale a wholesale network to large sizes, directory gatekeepers provide inter-regional call routing. These products enable cost-effective scaling, with dedicated call throughput and alternate directory gatekeepers for increased reliability.	<ul style="list-style-type: none"> • Cisco 3600 Series multiservice platforms • Cisco 3700 Series multiservice platforms • Cisco 7200 Series multiservice platforms • Cisco 7400 Series multiservice platforms
Cisco SIP proxy servers	Optional	Used to scale SIP wholesale networks, Cisco SIP proxy servers provide route management and admission control.	<ul style="list-style-type: none"> • Cisco SIP Proxy Server
Softswitch	Required in MGCP networks	Used to provide centralized call control in MGCP networks, the softswitch provides number analysis, advanced routing, and carrier-class call detail records (CDRs). Additionally, the softswitch supports an H.323 and SIP interface for interoperability with other IP-based networks. The signaling link terminal is integrated into the Cisco PGW 2200.	<ul style="list-style-type: none"> • Cisco PGW 2200 (call control mode)
Signaling controller	Optional	Used to provide SS7 interface for Cisco IOS call control environments, the signaling controller allows SS7 connectivity to the Cisco IOS control gateway. The signaling controller provides ISUP transparency for H.323 networks, and has limited signaling transparency for SIP networks. The signaling controller supports both A and F links and is ideal for small and large network deployments.	<ul style="list-style-type: none"> • Cisco PGW 2200 (signaling control mode) • Cisco SLT (note: the Cisco SLT is integrated into the Cisco AS5350 and AS5400 gateways)
Billing mediation servers	Recommended	Ecosystem partner OSS servers interface with Cisco gateway, gatekeeper, SIP proxy server, and PGW 2200 components through the various accounting interfaces used by these network elements.	See: www.cisco.com/go/telephony for partner information
Trivial File Transfer Protocol (TFTP) servers	Optional	These servers are used to store audio files, Cisco IOS Software or configuration files, dial plans, and so on.	Any standard TFTP server, such as Windows NT or 2000, or Solaris



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Components	Role	Description	Cisco or Partner Products
Management systems	Optional	Both Cisco Internet OSS and third-party network management systems are supported, including element management systems and network management systems.	See: www.cisco.com/go/telephony for partner information See: http://www.cisco.com/go/sposs for information on Cisco's Internet OSS

Q. What VoIP protocols does this solution support?

A. Cisco VIA supports H.323v2, H.323v3, H.323v4, and SIP on a single gateway on a call-by-call basis using the Cisco AS5000 Series of voice gateways. Also, Cisco VIA supports MGCP for softswitch-controlled networks using the Cisco MGX 8000 or AS5000 series of gateways.

Q. What new Cisco AS5000 Voice Gateway platform features are available as of September 2002?

A.

- *Integrated SLT*—The Cisco AS5350 and AS5400 provide the ability to terminate A or F links directly onto the gateway and back-haul the SS7 signaling to the Cisco PGW 2200 signaling controller or call agent, reducing the cost of ownership. The benefits of the integrated SLT include:
 - Lower costs because it reduces the amount of equipment needed for small POPs
 - Ease of management—less equipment to manage
 - Reduced deployment time

The integrated SLT provides the same level of features as the standalone SLT and supports the drop-and-insert feature from TDM interface cards (T1, E1, or CT3).

- *More codecs*
 - New: G.726, 16,000, 24,000, 32,000, and gigabit switch module (GSM) for Frame Relay
 - Existing: G.711, G.729a/b, and G.723.1
- *Select new Cisco IOS features*
 - Support for a variety of new circuit selection algorithms, including least idle, least used, longest idle, random, round robin, sequential, supporting even or odd, and up or down methods
 - Support for access control lists for improved network security
 - New number translation method using SED-like expressions
 - Carrier ID field
 - H.323v4
 - Multiple trunk groups per gateway
 - ENUM support on the gateway
 - Enhancement to TCL script to allow access to ISUP message for advanced scripting



- *Modem pass through*—Modem pass-through capabilities allow the transport of a modem session across a VoIP network using G.711 frames, turning off echo cancellation, voice activity detection, and comfort noise generation. The Internet Engineering Task Force's (IETF's) RFC 2198 (found at www.ietf.org) packet redundancy enhances modem pass-through reliability.
- *Fax pass through*—Fax pass-through capabilities allow the transport of a fax session across a VoIP network using G.711 frames, turning off echo cancellation, voice activity detection, and comfort noise generation. RFC 2198 packet redundancy enhances fax pass-through reliability. Fax pass-through support on Cisco AS5000 universal gateways enables fax interoperability with other products that do not support T.38 Fax Relay.

Q. What are other benefits of the Cisco VIA solution?

A. The Cisco VIA solution has been successful in the market for several reasons:

- *Field-proven and time-tested solution*
 - Used by hundreds of carriers, including the largest VoIP carriers such as iBasis, China Unicom, and ITXC
 - First introduced in 1998
 - Installed in over 80 countries
- *Worldwide interoperability and compatibility*
 - Supports multiple standards-based PSTN signaling protocols for worldwide solution implementation
 - SS7, R2, PRI, and CAS signaling
 - Supports SIP, H.323, and MGCP
- *Rapid revenue-generation service creation and deployment* for transport services
 - Highly scalable to ensure ease of growing the network and adding services
 - Ability to add services with minimal hardware investment
- *Flexibility of scale and size* because Cisco VIA supports both large and small networks
- *Excellent voice quality*—Quality is primarily a function of the ability of the gateway to handle a full load of calls with high-quality, low-latency encoding and, when needed, echo cancellation. Based on the Cisco routing technology, Cisco gateways provide necessary tools to deliver high-quality voice over an IP network. Features such as adaptive jitter buffer automatically adjust, depending upon the latency of the network. Also, packet concealment intelligently analyzes missing packets and generates a reasonable replacement packet to improve the voice quality. These are a few of the many features that Cisco delivers to provide the highest quality of speech over either a private, managed network or a public, unmanaged Internet.
- *Interoperable, open, standards-based architecture*—Cisco's VIA network is an open, standards-based infrastructure that allows service providers to easily evolve their network and their services as end-users needs change.
- *Free membership in the Cisco Service Carrier Community*—The Cisco Service Carrier Community is a worldwide network of Cisco product-based VoIP service providers interested in exchanging traffic among themselves. For more information, go to: www.cisco.com/go/csc
- *Cisco 7 x 24 worldwide support*—Cisco supports business-critical networks through 7 x 24 worldwide network support.

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