Data Sheet

Cisco AS5400 Series Universal Gateways

Cisco AS5400 Series Universal Gateways offer unparalleled capacity in only two rack units (2RUs) and provide universal port data, voice, and fax services on any port at any time. High-density (up to 1 CT3), low-power consumption (7.2A at 48 VDC per CT3), and universal port digital signal processors (DSPs) make the Cisco AS5400 Series Universal Gateways ideal for many network deployment architectures, especially colocation environments and mega points of presence (POPs).

Cisco Any Service, Any Port

Today's tough economic environment is forcing service providers to generate revenues quickly, improve returns from invested capital, and adapt to changing demand for various services in the market place. Cisco Any Service, Any Port (ASAP) the architecture for rapid deployment of concurrent services on Cisco AS5000 universal gateways—allows service providers to meet these challenges. Cisco ASAP enables faster service introduction using a common platform for quick return on investment. Service providers can generate new revenue streams from multiple voice and data services such as long distance voice over IP (VoIP), hosted IP telephony, virtual private networks (VPNs), and dial-up Internet.

Cisco AS5400 Series Universal Gateways

The Cisco AS5400 Series consists of two models, the Cisco AS5400 Universal Gateway and the Cisco AS5400HPX Universal Gateway. The Cisco AS5400 offers unparalleled dial capacity and scalability for MLPPP, L2TP, and V.120 sessions, whereas the Cisco AS5400HPX provides enhanced performance for processor-intensive voice and fax applications.

Cisco AS5400 Series Universal Gateways support a wide range of IP-based value-added services including high-volume Internet access, regional or branch-office connectivity, corporate VPNs, long distance for Internet service providers (ISPs), international wholesale long distance, distributed prepaid calling, Signaling System 7 (SS7) interconnect, and enhanced voice services (See Figure 1).

Figure 1 Cisco AS5400 Series Universal Gateways

Cisco AS5400 Series Universal Gateways support three primary universal gateway configurations: 8 CT1/CE1, 16 CT1/CE1, and 1 CT3. Two 10/100 autosensing Ethernet LAN ports are provided for LAN connectivity. Two high-speed serial ports support Frame Relay, Point-to-Point Protocol (PPP), and High-Level Data Link Control (HDLC) backhaul. All backhaul interfaces support Hot Standby Router Protocol (HSRP), and all cards are hot-swappable for carrier-class resiliency. Integrated signaling link termination (SLT) is available to provide Cisco distributed message transfer part (MTP) SS7 signaling functionality.

The rich set of Cisco IOS® Software features available in the Cisco AS5400 Series enables ISPs and enterprise network managers to meet traditional dial-in needs, including Internetwork Packet Exchange (IPX) and AppleTalk, while supporting the migration to new universal port services. The Cisco AS5400 Series supports widely deployed routing protocols, including those generally found in high-end access servers and routers: Border Gateway Protocol Version 4 (BGPv4), Open Shortest Path First (OSPF), Enhanced Interior Gateway Routing Protocol (EIGRP), and Intermediate System-to-Intermediate System (IS-IS).

Cisco customers worldwide have proven that Cisco AS5000 universal gateways provide the flexibility, scale, reliability, and suite of services required to meet market demands. By providing the industry's broadest family of access server products with universal port DSPs, Cisco makes it easy for customers to select the right starting point for a phased rollout based on revenue generation, without compromising future capabilities. Complemented by the industry's highest-rated service and support, Cisco can also provide assistance with startup, maintenance, and marketing tasks, as well as advanced and custom solutions.

Key Features

Cisco ASAP

Cisco ASAP architecture enables Cisco AS5400 Series Universal Gateways to operate simultaneously as a network access server (NAS) and a voice gateway, delivering universal services on any port at any time. Cisco ASAP services on the Cisco AS5400 Series Universal Gateways include dial access, real-time voice and fax for local or long-distance transport, managed services (hosted IP telephony, for example), and unified communications on a call-by-call basis. Cisco AS5400 Series Universal Gateways achieve cost savings through optimized utilization of the universal port access infrastructure. Service providers can now quickly capitalize on new opportunities and realize multiple revenue streams from a single access infrastructure.

The Cisco ASAP architecture is based on universal DSP technology. The universal DSP can execute multiple coder/decoder (codec) and modem algorithms on any DSP at any time. When the type of codec or modem required for a specific call has been determined, the DSP activates the appropriate service type in real time. When the call type is determined, different signaling schemes and modem negotiations are used to determine the actual firmware code to be downloaded onto the DSP for that particular call.

Modular Architecture

All feature cards can be upgraded in the field to accommodate future technologies while providing a solution to meet today's needs.

Packet Telephony

The framework for VoIP services on the Cisco AS5400 Series is based on open interfaces and standards, and it allows an ecosystem of partners to work together to develop innovative network services.

Service providers are not locked into a single VoIP signaling technology when they choose Cisco AS5400 Series Universal Gateways—H.323, Session Initiation Protocol (SIP), Media Gateway Control Protocol (MGCP), and Trunking Gateway Control Protocol (TGCP) support are all built in. This allows service providers to enable the call-control protocol that is the best fit for their network today, with the assurance that they can respond to evolving market requirements whenever necessary.

H.323

Leading the industry through the adoption of new standards-based H.323 technology, the Cisco AS5400 Series supports the scalability enhancements introduced in H.323v3 and H.323v4. For example:

- Multiple concurrent calls can be supported over a single H.225 call-signaling channel to reduce call- setup and call-clearing times and increase network call capacity.
- H.225 messages can be transported over TCP or User Datagram Protocol (UDP) as described in H.323 Annex E. Using UDP for call-signaling transport effectively enables media cut-through in a single round trip.
- Ability to report capacity statistics to the gatekeeper on a per-call basis for each DS0, trunk group, or carrier associated with the PSTN-side interfaces to assist in routing decisions.

Cisco AS5400 Series Universal Gateways support a broad array of proven, interoperable H.323-based solutions for service provider networks, including global long distance, distributed prepaid calling, SS7 interconnect, telephony application hosting, and unified communications.

SIP

SIP is the Internet Engineering Task Force (IETF) standard for multimedia conferencing over IP. Defined in RFC 2543, SIP is an ASCII-based, application-layer control protocol that can be used to establish, maintain, and terminate calls between two or more endpoints. The SIP implementation on Cisco AS5400 Series Universal Gateways includes support for key features such as third-party call control and RFC 2833 dual-tone multifrequency (DTMF) relay, for interconnection with application service provider (ASP) networks.

Similarities between H.323 and SIP

- Both were designed to address session control and signaling functions in a distributed call-control architecture
- Both are especially well suited for communication with intelligent network end points

Although SIP messages are not directly compatible with H.323, both protocols can coexist in the same packet telephony network because Cisco AS5400 Series Universal Gateways can process individual SIP and H.323 calls simultaneously. This allows service providers to integrate complementary H.323 and SIP services in the same network.

MGCP and TGCP

MGCP 1.0 is a protocol for centralized control of VoIP calls by external call-control elements known as media gateway controllers (MGCs) or call agents. MGCP is described in the informational RFC 2705, published by the IETF.

Cisco AS5400 Series Universal Gateways include support for the MGCP NAS package. This allows the platform to operate simultaneously as a network access server and a voice gateway to deliver universal port services in an MGCP network. Standards-based T.38 Fax Relay and RFC 2833 DTMF Relay are available with MGCP.

Cisco AS5400 Series Universal Gateways also support the PacketCable Trunking Gateway Control Protocol (TGCP) 1.0. PacketCable is an industry-wide initiative to develop interoperability standards for multimedia services over cable facilities using packet technology. PacketCable developed the TGCP protocol, which contains extensions and modifications to MGCP while preserving the basic MGCP architecture and constructs.

Voice Extensible Markup Language Solution Infrastructure

Cisco AS5400 Series Universal Gateways have the ability to interpret Voice Extensible Markup Language (VoiceXML) documents. VoiceXML is an open standard markup language used to create voice-enabled Web browsers and interactive-voice-response (IVR) applications. Just as HTML enables users to retrieve data with a PC, VoiceXML enables subscribers to retrieve data with a telephone. The accessibility of the telephone and its ease of use make VoiceXML applications a powerful alternative to HTML for accessing the information and services that the Internet provides. The Cisco VoiceXML Solution Infrastructure takes advantage of Cisco AS5400 Series Universal Gateways DSP resources, signaling, and media conversion capabilities to execute VoiceXML application logic at the edge of the network, offloading servers and the network to support unified communications services. Cisco VoiceXML gateways support two standard audio formats for recording and playback: .au (audio/basic) and .wav (audio/wav). The VoiceXML Store and Forward feature allows streaming-based voice recording and playback features for various media including local memory, HTTP, Extended Simple Mail Transfer Protocol (ESMTP), and Real-Time Streaming Protocol (RTSP) for fourteen different Cisco codecs and the two standard audio file formats.

Programmable Tool Command Language IVR 2.0

Integrated, programmable IVR extends the ability of Cisco AS5400 Series Universal Gateways to support unique and differentiated voice services. Voice application software developers can use the Tool Command Language (TCL) IVR 2.0 application programming interface (API) to create customized TCL scripts that control calls coming into or going out of the gateway. IVR systems collect user input in response to recorded messages. The prompts used in a TCL IVR 2.0 script can be either static or dynamic. The scripts are event driven, and the call flow is controlled by a finite-state machine that is defined by the TCL script. All verbs are nonblocking—meaning they can execute without causing the script to wait. Prompts can be played and digits can be collected over telephony or VoIP call legs. Real-Time Streaming Protocol (RTSP)-based prompts are supported. TCL IVR 2.0 offers enhanced multilanguage support by providing the capability to add new languages and text-to-speech (TTS) notations to the core IVR infrastructure. The Cisco Developer Support Program supports companies developing or modifying TCL IVR 2.0 scripts.

Voice Quality

The extensive voice and fax capabilities of Cisco AS5400 Series Universal Gateways can help build a reliable, high-quality VoIP network. Voice quality tests confirm that the Cisco AS5400 Series delivers end-to-end voice-quality performance that meets the high standards established for toll-quality voice services in the public switched telephone network (PSTN). Comprehensive voice-quality testing is a critical component in the Cisco AS5400 Series Universal Gateway development process. Cisco conducts subjective voice-quality tests to determine mean opinion scores using a methodology derived from International Telecommunication Union Telecommunication Standardized Sector (ITU-T) Recommendations P.830 and P.831. Objective voice-quality tests are also conducted using the Perceptual Analysis Measurement System.

The high-performance design of Cisco AS5400 Series Universal Gateways minimize delay and packet loss during voice encoding and packetization processes. The Cisco AS5400 Series Universal Gateways introduce minimal delay as voice data is received from the PSTN and transmitted to the IP network for G.711 calls. Cisco quality-of-service (QoS) features, including IP Precedence, Resource Reservation Protocol (RSVP), Weighted Fair Queuing (WFQ), Weighted Random Early Detection (WRED), and Multichassis Multilink PPP (MMP) fragmentation and interleaving, implemented on both the universal gateway and backbone routing infrastructure, can provide a low-latency, high-reliability path for sensitive voice traffic through today's networks.

Echo control is essential for packet-switched networks to carry voice traffic successfully. Cisco AS5400 Series Universal Gateways support ITU-T Recommendation G.168 for echo cancellation with a tail length up to 128 ms. Fixed and adaptive jitter buffering and comfort-noise generation further enhance voice quality.

Voice Codecs

The Cisco AS5400 Series offers multiple codecs to meet interoperability, compression, and latency requirements for a variety of phone-to-phone and PC-to-phone applications—G.711, G.723.1 (5.3K and 6.3K), G.726, G.729ab, G-Clear, and GSM-FR. The same number of calls is supported across all codec types, to simplify network engineering. Enabling voice activity detection (VAD) reduces packet traffic through the network. With VAD enabled, Cisco AS5400 Series Universal Gateways detect silence and stop transmitting packets when callers stop speaking. Variable frame sizing provides further control over speech packetization.

Call Admission Control

For VoIP to be a practical replacement for standard PSTN telephony services, customers need to receive the same consistent, high quality of voice transmission they receive with basic telephone service. For real-time, delay-sensitive traffic such as voice, it is better to deny network access under congestion conditions than to allow traffic onto the network to be dropped and delayed, causing intermittent impaired QoS and resulting in customer dissatisfaction.

Numerous QoS mechanisms exist in Cisco IOS Software to allow service providers to design and configure packet networks that provide the necessary low latency and guaranteed delivery required for voice traffic. These mechanisms include tools such as queuing, policing, traffic shaping, packet marking, and fragmentation and interleaving.

Call admission control (CAC) extends the QoS tool suite to protect voice traffic from being negatively affected by other voice traffic, keeping excess voice traffic off of the network. CAC allows Cisco AS5400 Series Universal Gateways to make deterministic and informed decisions before a voice call is established based on whether the required network resources are available to provide suitable QoS for the new call. CAC provides:

- Voice call admission decisions based on overall CPU utilization and call arrival rate at the individual gateway
- Voice call admission based on the prevailing conditions in the packet network such as end-to-end latency, jitter, or the ability to reserve the resources required to handle the call and assure quality
- Reporting information about only the available circuits to H.323 gatekeepers, taking into account the circuits in use for data, voice, or fax services, to achieve higher call success rates

Remote Access Capabilities

The Cisco AS5400 Series takes advantage of the full-feature richness and strong routing capabilities of Cisco IOS Software. The Cisco AS5400 Series can be deployed in various architectures, from multiprotocol corporate networks (IP, IPX, AppleTalk, and NetBEUI for example) to service provider IP networks. In addition, the Cisco AS5400 Series fully supports the specialized needs of AOL, MSN, and other content-oriented dialup services through PPP, Layer 2 Tunneling Protocol (L2TP), or Transmission Control Protocol Clear (TCP Clear) connections.

The Cisco AS5400 Series supports the most complete set of access protocols of any access server in the industry, including PPP, IPX Control Protocol (IPXCP), AppleTalk Control Protocol (ATCP), AppleTalk Remote Access (ARA), NetBIOS Frame Control Protocol (NBFCP), NetBIOS over TCP/IP, NetBEUI over PPP, and protocol translation.

V.92 and V.44 Support

V.92 and V.44 are the latest modem standards adopted by the industry. The standards specify a set of features that allow modems to mimic many of the benefits of broadband:

- V.44 increases throughput by more than 100 percent when surfing the Internet
- V.92 Modem on Hold suspends an Internet session to place or receive a phone call
- V.92 Quick Connect provides a faster connect time to the Internet

Service providers can offer revenue-generating services and increase subscriber retention with V.92 and V.44 standards. Cisco Remote Authentication Dial-In User Service (RADIUS) support for Modem on Hold will allow premium subscribers to suspend their Internet sessions for longer periods of time to place or receive phone calls. Quick Connect saves the line conditions of the last number dialed, encouraging subscribers to dial into the same ISP to reduce connection time. Combined with greater compression and connection speeds, V.92 and V.44 allow service providers to offer their subscribers a "broadband-lite" experience, which enables Internet users to experience the qualities usually associated with broadband for the price of dialup or modem access.

Fax Features

Fax transmission over an IP infrastructure is an important and growing service opportunity, especially in international markets where fax represents a large percentage of network traffic. Cisco AS5400 Series Universal Gateways support standards-based T.38 Real-Time Fax Relay and T.37 Fax Store and Forward, allowing greater interoperability between networks. The fax detection capabilities of the Cisco AS5400 Series allow service providers to offer a single E.164 number for subscriber voice and fax services. Half as many subscriber phone numbers are needed, resulting in significant cost savings. Cisco AS5400 Series Universal Gateways also support fax passthrough for VoIP environments that cannot support T.38 Real-Time Fax Relay end to end.

Time-Division Multiplexing Switching

Time-division multiplexing (TDM) switching is the ability to take an incoming call on a given DS0 and send it out on a different DS0 before the call is answered by the gateway. This feature is used in applications such as:

- SS7 to Primary Rate Interface (PRI) grooming
- Local-number portability (LNP) support in Europe
- Meeting special provisionary requirements for test calls (for example, 911 call handling)

This feature does not require any DSP resource and hence has no impact on the dial, voice, or fax handling capability of the platform. TDM switching plus network-side ISDN functionality provides a means of grooming incoming traffic and passing selected calls to external devices, such as private branch exchanges (PBXs), test sets, VoIP gateways, or access servers. The Cisco AS5400 Series is capable of switching calls between SS7, PRI, and channel-associated signaling (CAS) trunks.

Security Management

Cisco IOS Software security features allow authorized users dialup access while preventing access to intruders. These features include multilevel password protection, user authentication such as Password Authentication Protocol (PAP) and Challenge Handshake Authentication Protocol (CHAP); access control lists (ACLs); IP address spoofing prevention and logging; and support of the industry-standard authentication, authorization, and accounting (AAA) protocols; RADIUS; and Terminal Access Controller Access Control System (TACACS+).

Manageability

The Cisco AS5400 Series has a wide range of management tools designed to reduce operations costs. The Cisco Universal Gateway Manager (UGM) is an element management system that supports the configuration, management, and troubleshooting of Cisco AS5000 universal gateways.

The console-management features include a comprehensive set of debugging commands that can be enabled on a specific calling-line identification (CLID) or automatic number identification (ANI), called number (dialed-number identification string [DNIS]), user or interface to immediately isolate only the relevant debugging output.

The Simple Network Management Protocol (SNMP) v2 and v3 management capability includes a rich call-tracking SNMP Management Information Base (MIB) that provides highly detailed records for active and historical calls, with a configurable call-history buffer. Call records can also be obtained via syslog or RADIUS as an alternative to polling via SNMP. Call records include connect rate, connect duration, disconnect codes, end-to-end delay, and line statistics. This information allows service providers to debug problems for individual users. Wholesale dial and voice service providers can use this performance management data to establish service-level agreements with their retail ISP customers.

The Cisco UGM is a next-generation element management system offering robust, scalable, carrier- class capabilities for the Cisco AS5000 universal gateways. Providing comprehensive fault, configuration, accounting/inventory, performance, security (FCAPS) capabilities, the Cisco UGM enables operators to effectively

configure, manage, and maintain dial-access networks. The Cisco UGM facilitates the rapid deployment of new services and provides quick and effective network diagnostics to meet the rigorous demands of today's fast-moving marketplace.

Reliability

DSP Sparing and Pooling

The Cisco AS5400 Series is designed to meet high- availability requirements. Modem and voice DSPs are pooled and can be configured as hot spares. Because DSPs are allocated on a call-by-call basis, a DSP failure will not cause a DS0 or B channel to be left without a DSP to terminate the call. This prevents occurrence of "holes" (unused channels) within a hunt group. Having spare DSPs in the pool also allows DSP code to be updated without affecting active calls. DSP resources are tested at power up and after disconnect to check for defects. Any defective DSPs found are moved to the resource recovery pool. An automatic DSP recovery process can be activated to recover DSPs in the recovery pool and add them back into the resource pool if possible.

Hot-Swappable Cards

Hot-swap capability on all cards allows hardware maintenance to be performed on an active access server with little or no service interruption. During a hot-swap, any card may be removed, inserted, or replaced, and only the calls on the card being removed are affected. The Cisco AS5400 Series chassis provides four high-capacity fans with front-to-back airflow to cool the chassis.

Redundant Backhaul Methods

Three redundant methods, which can be used to backhaul traffic from the server to the network, are included by default on the Cisco AS5400 Series. The first method uses the two Fast Ethernet ports. These can be configured to run different types of traffic on each link or use the HSRP in a redundant mode for increased reliability. The second method uses the two high-speed, 12-in-1, 8-Mbps serial ports on the rear of the chassis. These ports support all the Cisco serial routing protocols for flexibility in connecting to remote networks. The third method uses trunk feature cards as possible backhaul interfaces.

Environmental Monitoring

Thermal sensors monitor the inlet and outlet temperatures and temperature rise across each card. If the operating temperature of the system exceeds its maximum, the thermal sensors initiate a shutdown of the feature cards, starting with the modem cards and finishing with the trunk cards. The trunk cards are shut down last, so the system has a chance to recover before putting the trunks into alarm status at the central office. If the system continues to exceed its maximum operating temperature, the thermal sensors initiate a shutdown, preventing damage to the unit or its surrounding environment from excess heat.

The power system comprises a fully redundant switching power supply with two AC (or two DC) inputs to the main power modules. Each input and output is 100-percent fully redundant, with dual fans for added reliability and a mean time between failure (MTBF) of more than 500,000 hours. The power supply has internal protection features: overcurrent, overvoltage, and thermal shutdown. Operational parameters are all monitored via internal sensors to the power supplies, and alarm status is provided to the system.

Regulatory Compliance

The Cisco AS5400 Series complies with Network Equipment Building Standards (NEBS) Level 3 requirements, as defined by Telcordia SR-3580 and also complies with European requirements as defined by the European Telecommunication Standards Institute (ETSI).

Multivendor Back-Office Integration

The Cisco AS5400 Series supports RADIUS and TACACS+ protocols for back-office integration, control, and security. In addition to supporting the IETF-defined RADIUS attributes, Cisco IOS Software supports many vendor- specific RADIUS attributes for both preauthentication and user authentication. This means that the Cisco AS5400 can be integrated into any multivendor remote-access and voice network with no changes to the back-office systems.

Worldwide Certification

The Cisco AS5400 Series is homologated worldwide with all major T1 and E1 switch types.

Cisco IOS Software Enables Rich Services

Cisco ASAP

The Cisco experience in both data and voice worlds is unique. Known industry-wide for its strength in data products, the position Cisco holds is clearly reflected in its majority market share in all segments of the remote-access marketplace. Cisco has also taken a leadership role in the VoIP gateway market since analysts first started tracking that product category. Cisco experience in building voice networks extends beyond millions of VoIP operating hours and boasts the world's largest deployments.

Cisco is taking advantage of this experience to provide the next generation in technology—Cisco ASAP—the architecture for rapid deployment of concurrent services on Cisco AS5000 universal gateways.

Cisco ASAP provides seamless integration and migration by using a standards-based architecture for all applications and lowers operational costs through common equipment, call control, billing, and management. Only Cisco ASAP allows service providers to easily adapt to changing markets with minimal additional investment.

Flexibility in Deploying New Services

Demand for new services can be easily accommodated with Cisco AS5400 Series Universal Gateways whether the initial business opportunity is wholesale dial, prepaid calling card, unified communications, hosted IP telephony, or any other application. The flexibility to use Cisco AS5400 Series Universal Gateways in multiple service environments provides unprecedented capital investment protection. It also ensures that remote access equipment can promptly adapt itself to any change in business environment or demand for new services. The ability for service providers to offer innovative new services that allows differentiation from competition.

Remote Access Services

Internet Connectivity

Enterprises and service providers need to extend network access to a broad range of remote users, including employees, customers, and partners. Successful remote access means being able to connect these users from practically any location, almost transparently. The Cisco AS5400 Series, combined with Cisco IOS Software, meets these needs by extending the core infrastructure through secure, reliable dial-in connections.

Data-over-voice-bearer service (DoVBS) is used in areas where ISDN data calls are charged at a higher rate (or tariff) than ISDN voice calls. The ISDN customer premises equipment (CPE) device (terminal adapter or router) must support DoVBS operation—most popular ISDN devices available today support DoVBS. The ISDN CPE device is programmed to signal all ISDN data calls, to ensure that these calls will be billed at the lower voice rate. Cisco Resource Pool Management (RPM) on the Cisco AS5400 Series is used to configure a customer profile for DoVBS calls based on DNIS. This profile configures the Cisco AS5400 Series to treat all calls received on that number as ISDN data calls, even if they are signaled as voice calls by the PSTN network.

Wholesale Dial

Many ISPs and content providers (or "portals") must provide dialup Internet access as part of their service package, and enterprise companies want to offer "private-label" Internet access to promote their brand. However, they do not have the experience, personnel, time, or money to build out a dialup access infrastructure, or they cannot build it fast enough—particularly when expanding into new regions. Service providers can now take advantage of this opportunity through the Cisco wholesale dial solutions.

The Cisco wholesale dial outsourcing solution delivers "virtual-port" capability across any number of Cisco remote-access servers. Coupled with sophisticated port policy management that guarantees port availability to wholesale customers, Cisco enables carriers and ISPs to offer unique service offerings that drive incremental revenue while keeping operations costs low. The network infrastructure deployed for wholesale dialup can also be used to offer standard retail dialup services, plus other value-added services such as corporate dial outsourcing, Internet gaming, unified communications, VoIP, and VPNs.

Regional and Branch Office Connectivity

The Cisco AS5400 Series is ideally suited for deployment in branch offices for providing remote access for telecommuters and mobile users. The CT1, CE1, and PRI interfaces can be used for remote access; the Ethernet ports can be used for LAN connectivity; and the serial ports can be used for access to the corporate site or to the Internet. Using the IP Plus Cisco IOS Software, firewall functions can be enabled to protect internal servers. Using the Enterprise Plus feature of Cisco IOS Software, desktop protocols can be enabled.

Access VPNs

The Cisco AS5400 Series is ideally suited to providing wholesale dial services to both large corporations and ISPs who do not want to support their own dial pools. With Cisco IOS Software support for VPNs, service providers can take advantage of their existing infrastructures to deliver local dialup access for users of enterprise networks. By providing virtual dialup solutions, service providers can offer a full range of services closer to the remote user. Local calls can now be placed to gain access to the core infrastructures. Virtual dialup services not only attract more users of this service, but because calls are terminated locally, long-distance charges are eliminated and infrastructure costs are reduced.

VPN Provisioning and Accounting

Of importance to service providers in the VPN environment is the need to both provision and account for the number of connections that are allowed by VPN customers. Cisco Virtual Private Dialup Network (VPDN) session-counting software can keep track of the number of connections from the Cisco AS5400 Series to the user's home gateway. This software is provided in Cisco IOS Software running on the Cisco AS5400 Series and in the Cisco access control server to provide comprehensive accounting and billing information to ISPs about the virtual connections that their customers make.

AOL Support

The Cisco AS5400 Series offers 100 percent coverage for dedicated AOL dial installations, as well as other services that use the TCP Clear or autocommand TELNET method of carrying dialup data. Domain Name System (DNS) round robin is also supported to allow load balancing of connections across multiple AOL hosts. The Cisco AS5400 Series also includes all the L2TP features necessary to support clients with AOL 7.0 and later versions.

Packet Telephony Services

Cisco Voice Infrastructure and Applications

The Cisco AS5400 Series Universal Gateways support Cisco Voice Infrastructure and Applications (VIA), an ideal solution for service providers building next generation networks. Cisco VIA is a VoIP solution designed to lower network costs and rapidly deliver a multitude of revenue-generating carrier-class voice transport services. These include: national and international transport, prepaid and postpaid calling card services, ASP termination, dial access, and voicemail/unified communications.

The Cisco VIA solution scales easily for small and large voice networks. Using the Cisco AS5400 Series Universal Gateways and Cisco VIA, service providers with existing data networks can quickly and easily add voice services to their portfolios, while carriers who offer voice services over existing TDM networks can expand their coverage more cost-effectively. Cisco VIA extends network reach through worldwide compatibility and operability, and is a field-proven solution that has been deployed in over 80 countries worldwide.

Distributed Prepaid Calling

The Cisco Prepaid Calling Card Solution gives Internet telephony service providers a competitive advantage in the prepaid calling market. By tapping the intelligence embedded in IP network components, the solution allows service providers to centralize the service application in a single location at a low cost while bandwidth-intensive call connections are handled at the network edge in Cisco gatekeepers and gateways. The benefit: lower costs than traditional debit-card applications, which are based on service points in large POPs in circuit-switched networks. The prepaid calling card solution supports IVR in different languages so carriers can target specific markets.

SS7 Interconnect

Using the Cisco PGW 2200 PSTN Signaling Gateway (or a third-party SS7 gateway), and the Cisco AS5400 Series Universal Gateways with integrated SLT functionality, service providers can interconnect their data and VoIP network with the PSTN via SS7 links. In many countries carriers must interconnect via SS7 to qualify for reciprocal compensation. The Cisco PGW 2200 PSTN Signaling Gateway and Cisco AS5400 Series Universal Gateways provide the interface needed to interconnect using Q.931 over IP, allowing service providers to enter markets previously unavailable to them because of signaling requirements. SS7 trunks are more efficient than CAS trunks, and they typically cost less than PRI trunks. With SS7, call setup time decreases, increasing the amount of billable traffic carried by the network.

Managed Voice Services

Telephony ASPs are emerging as an important market force offering new, hosted enhanced IP communications services that provide additional functionality beyond the services offered by the PSTN. Example applications hosted by telephony ASPs include hosted IP telephony, managed IP PBX, PC-to-phone services, unified communications, multiservice VPN, IP contact center, IP teleconferencing, voice-enabled Web commerce, and content delivery. This creates new business partnering opportunities for VoIP service providers. The standards-based Cisco AS5400 Series Universal Gateways enable interconnection between telephony ASPs and VoIP network infrastructure providers to bring complete solutions to end users.

Unified Communications

Unified communications uses the IP infrastructure to unify the communications methods that were previously disjointed—e-mail applications, fax machines, voice-mail systems, cellular phones, and Web communications. This gives users a common method to both access messages and initiate real-time communications—all using familiar devices.

Service providers can implement unified communications solutions by deploying Cisco AS5400 Series Universal Gateways between traditional PSTN or wireless networks and their packet-based telephony network and adding application servers that support unified-communications services. Cisco has partnered with several industry-leading developers to provide these solutions.

Following are some of the cost-effective services that carriers can offer to build brand identity and increase customer loyalty while reducing churn:

- Unified voice mail, fax, and e-mail
- Voice, fax, and e-mail retrieval by phone
- Integration of electronic documents with faxes
- Personal message agents
- Caller access to Web-based content through VoiceXML-enabled applications
- Never-busy fax lines
- Broadcast fax

Service-Level Management

The Cisco AS5400 Series supports RADIUS-based Cisco RPM. This enables service providers to offer guaranteed port availability across a shared infrastructure, which translates to guaranteed service levels for their customers. In addition, Cisco RPM offers the ability to ensure "fairness" across multiple customers for the same shared ports when there is no service-level guarantee.

Resource pooling can be configured on a per-gateway or per-network basis. In the former case, customer profiles stored on Cisco AS5400 Series Universal Gateways determine how resources are allocated to each of the wholesale service provider's customers. Each customer is identified based on a list of dialed numbers from DNIS. When network-wide service levels are required, external Cisco Resource Policy Management System (RPMS) Software running on a Sun Solaris server holds the customer profiles and keeps track of port utilization across multiple Cisco AS5000 universal gateways and/or other vendors' RADIUS-compliant gateways. When the Cisco AS5400 Series Universal Gateways receive an incoming call, the Cisco RPMS determines whether the call should be accepted based on information in the customer profile.

Cisco AS5400 Series Architecture

The architecture of the Cisco AS5400 Series has all the features that service providers have come to expect from carrier-class gateways:

- Hot-swappable feature cards
- Redundant load-sharing power supply
- Interface for external source clock (building integration timing supply [BITS]; Synchronization Supply Unit [SSU])
- Alarm jack for external alarm monitoring
- Error checking and correction (ECC) for single-bit parity errors
- DSP sparing and pooling
- Environmental monitoring
- Functionality of a high-end router
- Primary, secondary, and tertiary caching for increased performance

Two Cisco AS5400 Series Universal Gateways are available: the Cisco AS5400 and the Cisco AS5400HPX. The gateways share the same architecture; the primary difference is the processing capability of the two platforms:

- The Cisco AS5400 uses a 250-MHz RISC microprocessor with 256-KB secondary and 2-MB tertiary caching. The main CPU in the Cisco AS5400 is also used in the Cisco 7200 VXR high-end router: NPE-300 Network Processing Engine.
- The Cisco AS5400HPX uses a 390-MHz RISC microprocessor with 256-KB secondary and 8-MB tertiary caching to enhance platform performance. The Cisco AS5400HPX is the most appropriate choice for service providers who plan to deploy CPU-intensive voice and fax applications. The main CPU in the Cisco AS5400HPX is also used in the Cisco 7200 VXR high-end router: NPE-400 Network Processing Engine.

The Cisco AS5400 and Cisco AS5400HPX support up to seven feature cards. There are two types of feature cards: trunk and universal port. The Cisco AS5400 Series architecture uses distributed processing between the feature cards and the motherboard to optimize the processing path for unparalleled performance.

Egress Interfaces

The Cisco AS5400 Series provides three redundant WAN backhaul methods for moving packets out to the network:

- Two 10/100 autosensing Fast Ethernet ports
- Two 8-Mbps serial ports
- Any T1 or E1 port on a trunk feature card

Ingress Interfaces

The Cisco AS5400 Series accepts and consolidates all types of traffic, including dial-in analog, digital ISDN, wireless, voice, Global System for Mobile Communications (GSM) V.110 calls, V.120, and fax calls. The Cisco AS5400 Series currently supports:

- Eight-port CT1, CE1, PRI termination
- CT3 termination
- Serial ports

Cisco AS5400 Series Eight-Port CE1, CT1, PRI, and CT3 Trunk Feature Cards

When provisioned as Channelized E1 trunks, eight-port CT1, CE1, and PRI cards provide physical termination for E1 R2, E1 PRI, or inter-machine trunks (IMTs). When provisioned as Channelized T1 trunks, the eight-port or CT3 interface cards provide physical termination for CAS, PRI, or IMTs, and include channel service units (CSUs) that connect directly to the telco network (See Figure 2 and Figure 3). The CT3 interface card provides physical line termination for a Channelized T3 ingress trunk line. It uses an onboard multiplexer to multiplex 28 Channelized T1 lines into a single Channelized T3 line. Nonintrusive monitoring of individual T1/E1 signals is available at the front of the T1/E1 termination card via standard 100-ohm bantam jacks. An optional 19-inch 1RU rack mount is available to hold up to six DFC-8CT1/CE1 breakout cables—anywhere in the rack (See Figure 4).

Figure 2 Cisco AS5400 Series Eight-Port Termination Feature Card

Figure 3 Cisco AS5400 Series CT3 Termination Feature Card

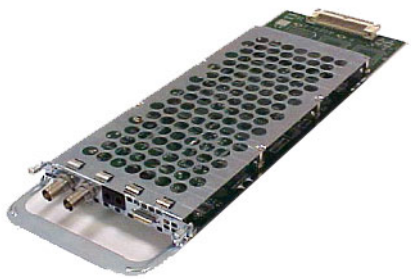
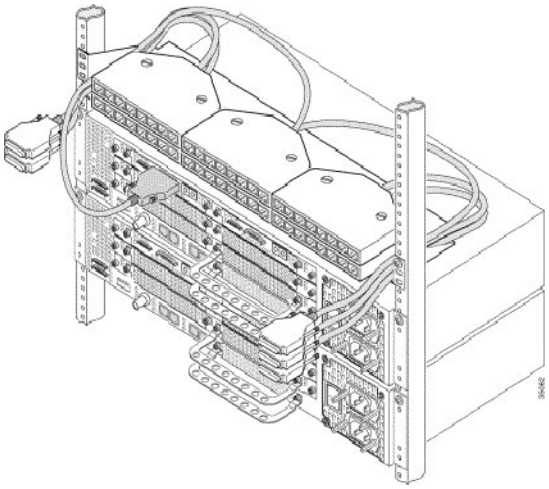


Figure 4 Optional Rack Mount Feature



Integrated SLT

The trunk cards also have a serial and RJ45 interfaces for integrated SLT functionality. With integrated SLT, the Cisco AS5400 provides distributed Message Transfer Part (MTP) SS7 signaling functionality directly on the gateway. Like the Cisco 2600 Series-based SLT, the integrated SLT backhauls upper-layer SS7 protocols across an IP network using Cisco Reliable UDP (RUDP), terminating the MTP1 and MTP2 layers of the SS7 protocol stack. Integrated SLT support is available through a software upgrade--no new hardware is required. MTP3/ISUP backhaul is included. Pricing is on a per-platform basis.

Trunk Types Supported

The following is a brief description of the trunk types supported:

- North American robbed-bit signaling (RBS) is supported on T1 trunks, including a variety of North American RBS protocol, framing, and encoding types on these trunks.
- CAS is supported for E1 trunks, with R2 signaling.
- IMT is supported when used with an SS7 signaling controller.
- Many countries require an E1 R2 variant; per-country defaults are provided for supervisory and inter-register signaling.
- Universal access (analog modem or digital calls) is supported when an interface is configured for ISDN PRI signaling; PRI signaling is available for both T1 and E1 trunks.

Cisco AS5400 Series 60- and 108-Universal Port Feature Cards

The Cisco AS5400 Series 60- and 108-universal port cards are full-featured DSP-based cards that support 60 (on the former) or 108 (on the latter) modem, ISDN, V.120, wireless, voice, and fax calls. Port management features are available for troubleshooting, including DSP status, real-time call-in-progress statistics, resource activity log, hard/soft busy out, and DSP firmware upgrades. Additional information can be obtained through the console, SNMP, or RADIUS accounting via the call-tracker feature (See Figure 5).

Figure 5 Cisco AS5400 Series 60- and 108-port Feature Card

Summary

The Cisco AS5400 Series provides cost-effective platforms that combine routing, remote access, voice gateway, firewall, and digital modem functionality.

Cisco AS5400 Series Universal Gateways achieve cost savings through optimized utilization of the universal port access infrastructure. This reduces the overall number of access ports as compared to data-only and voice-only ports required to deliver services to a specific number of customers. Savings in access port capacity are compounded by savings in the number of trunks required to deliver QoS to customers, as well as reduced maintenance and operation expenses. Improved utilization increases the effective density of Cisco AS5400 Series Universal Gateways and the overall number of users each can serve.

Tables 1–6 provide detailed specifications for Cisco AS5400 Series Universal Gateways.

Table 1 Overview of Cisco AS5400 Series Protocols

Protocols	
LAN Protocols	• IP, IPX, AppleTalk, DECnet, ARA, NetBEUI, bridging, HSRP, 802.1Q
WAN Protocols	• Frame Relay, PPP, HDLC (leased line)
Routing Protocols	• Routing Information Protocol (RIP), RIPv2, OSPF, IGRP, EIGRP, BGPv4, IS-IS, AT-EIGRP, IPX-EIGRP, Next Hop Resolution Protocol (NHRP), AppleTalk Update-Based Routing Protocol (AURP)
QoS Protocols	• IP Precedence • Resource Reservation Protocol (RSVP) • Weighted Fair Queuing (WFQ) • Weighted Random Early Detection (WRED) • Multichassis Multilink PPP (MMP) fragmentation and interleaving • 802.1P
Access Protocols	• PPP, Serial Line Internet Protocol (SLIP), TCP Clear, IPXCP, ATCP, ARA, NBFCP, NetBIOS over TCP/IP, NetBEUI over PPP, protocol translation (PPP, SLIP, ARA, X.25, TCP, local-area transport [LAT], Telnet), and XRemote
Bandwidth Optimization	• Multilink PPP (MLPPP), TCP/IP header compression, Bandwidth Allocation Control Protocol (BACP), Bandwidth on demand, Traffic shaping
Voice Compression	• G.711, G.723.1 (5.3K and 6.3K), G.726, G.729ab, G-Clear, GSM-FR

Table 1 Overview of Cisco AS5400 Series Protocols (Continued)

Protocols	
DSP Voice Features	• G.168 echo cancellation, programmable up to 128 ms • Transparent transcoding between A-law and mu-law encoding • Voice activity detection, silence suppression, comfort noise generation, fixed and adaptive jitter buffering • Call progress tone detection and generation—Dial tone, busy, ring-back, congestion, and re-order tones, with local country variants • Continuity Testing (COT) • DTMF, MF
Voice and Fax Signaling Protocols	• H.323v2, H.323v3, H.323v4, SIP, MGCP 1.0, TGCP 1.0, VoiceXML, RTSP, ESMTP • T.37 fax store and forward • T.38 real-time fax relay • Fax passthrough • Modem passthrough • Fax detection • Open Settlements Protocol (OSP) • Media Recording Control Protocol (MRCP) • Text to Speech (TTS) Servers • Automatic Speech Recognition (ASR) Servers
SS7	• Integrated SLT functionality
Network Security	• RADIUS or TACACS+, PAP or CHAP authentication, local user/password database • DNIS, CLID, call-type pre-authentication • Inbound/outbound traffic filtering (including IP, IPX, AppleTalk, bridged traffic) • Network Address Translation (NAT) and Dynamic access lists • SNMPv2, SNMPv3
Virtual Private Networking	• IP Security (IPSec) and Policy enforcement (RADIUS or TACACS+) • L2TP, Layer 2 Forwarding (L2F), and generic routing encapsulation (GRE) tunnels • Firewall security and intrusion detection
Channelized T1	• Robbed-bit signaling; loop start, immediate start, and wink start protocols
Channelized EI	• CAS, E1 R1, E1 R2, leased line, Frame Relay, G.703, G.704
ISDN Protocols Supported	• Sync mode PPP, V.120, V.110 at rates up to 38400 bps • Network-side ISDN and user-side ISDN • DoVBS • QSIG • NFAS with backup D-channel

Table 1 Overview of Cisco AS5400 Series Protocols (Continued)

Protocols	
Modem Protocols Supported	• V.90 or V.92 standard supporting rates of 56000 to 28000 in 1333-bps increments • V.92 Modem on Hold and Quick Connect • V.44 compression supporting increased throughput by more than 100 percent for Internet browsing • Fax out (transmission) Group 3, standards EIA 2388 Class 2 and EIA 592 Class 2.0, at modulations V.33, V.17, V.29, V.27ter, and V.21 • K56Flex at 56000 to 32000 in 2000-bps increments • ITU-T V.34 Annex 12 at 33600 and 31200 bps • ITU-T V.34 at 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, or 2400 bps • V.32bis 14400, 12000, 9600, 7200, 4800; V.32 9600, 4800; V.22bis 2400, 1200; V.21 300; Bell 103, 300; V.22 1200; V.23 1200/75 • ITU-T V.42 (including Microcom Networking Protocol [MNP] 2-4 and Link Access Procedure for Modems [LAPM]) error correction • ITU-T V.42bis (1000 nodes) and MNP 5 data compression • Async-mode PPP
Wireless Protocols	• V.110 and V.120
Full Cisco IOS Support	• IP Plus and Enterprise Plus feature sets
Console and Auxiliary Ports	• Asynchronous serial (RJ-45)

Table 2 Cisco AS5400 Series System Data

Data	Cisco AS5400	Cisco AS5400HPX
Processor	• 250-MHz RISC processor	• 390-MHz RISC processor
Main Memory	• 256-MB default • 512-MB maximum	• 256-MB default • 512-MB maximum
Shared I/O Memory	• 64-MB default • 128-MB maximum	• 64-MB default • 128-MB maximum
Boot Flash Memory	• 8-MB default • 16-MB maximum	• 8-MB default • 16-MB maximum
System Flash Memory	• 32-MB default • 64-MB maximum	• 32-MB default • 64-MB maximum
Layer 3 Cache	• 2MB	• 8MB
Feature Card Slots	• Seven slots	• Seven slots
Trunk Feature Cards	• Eight CT1, CE1, PRI • CT3	• Eight CT1, CE1, PRI • CT3
DSP Feature Cards	• 60 universal ports • 108 universal ports	• 60 universal ports • 108 universal ports

Data	Cisco AS5400	Cisco AS5400HPX
Calls Supported	• Voice or Universal port services—to 480 concurrent calls (to 20T1s/16E1s) or • Remote access service—to 648 calls (to 1CT3/16E1s)	• Voice or Universal port services—to 648 concurrent calls (to 1CT3/16E1s) or • Remote access service—to 648 calls (to 1CT3/16E1s)

Table 3 Cisco AS5400 Series Chassis Data

Data	
Dimensions (H x W x D)	• 3.5 x 17.5 x 18.25 in./8.89 x 44.45 x 46.36 cm (2 RU)
Weight	• 35 lb maximum (15.8 kg)
Normal Operating Conditions	• 0 to 40º C • 5 to 95 percent humidity, noncondensing • -200 to 10,000 ft elevation

Table 4 Cisco AS5400 Series Power Supply Data

Input Description	Input Specifications
Input Power (AC unit)	• 200 to 345W (maximum)
Input Voltage (AC unit)	• 100 to 240VAC
Input Current (AC unit)	• 5 to 2A
Input Frequency (AC unit)	• 50 to 60 Hz
Power Factor (AC unit)	• 0.850 at 50 percent of full load; 0.90 at full load
Input Power (DC unit)	• 200 to 345W (maximum)
Input Voltage (DC unit)	• -48 to -60VDC
Input Current (DC unit)	• 2.0 to 4.0A typical, 9.0A max

Table 5 Cisco AS5400 Series Compliance Data

Certification	Requirements
NEBS Certification	• Telcordia SR-3580 • GR-1089-CORE, Issue 2 • GR-63-CORE, Issue 1 • Level 3 certification based on usage and critical nature of equipment • All equipment CLEI coded • Available in TIRKS database
Safety Certifications	• UL 1950, third edition • CSA 950, third edition • EN 60950, with Amendments 1, 2, 3, and 4 • IEC 60950 • AS/NZS 3260 • TS 001

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Certification	Requirements
Electromagnetic Emissions and Immunity Compliance	• EN 55022B (CISPR22) • EN 300386 • NZ/AS3548 Class B • VCCI B • FCC 47CFR15 Class B

Environmental Specifications	Data
Heat Dissipation	683-1177 Btu/hr
AC Power Cable Supplied, Dual Cables for Redundant Version	18 American wire gauge (AWG), 15-amp IEC 320 standard cable
DC Power Cable Required for DC Systems	12-14 AWG, stranded copper wire
Storage Temperature	25.8 to 185 F (-40 to 85 C)
Acoustics	59 dBA typical; sound pressure level at 1m
Humidity (noncondensing)	5 to 95 percent
Altitude	-200 to 10,000 ft
Reliability (at 40 C, 120 VAC, and -48VDC, 255W)	7500 FITS per TR-332 (FIT=1/MTBF) 1.5 x 10^5 hours MTBF per RIN