Data Sheet

Cisco AS5850 Universal Gateway

The Cisco® AS5850 Universal Gateway is a high-density universal gateway, with carrier-class attributes, offering highest capacity and high availability in its class. This gateway is designed to meet the demands of large, innovative service providers, supporting up to 5 Channelized T3s (CT3s), 96 T1s, 86 E1s, or 2 STM-1 (108 E1s) of data, voice, and fax services, on any port at any time. It offers high-availability features such as hot-swap on all cards, load-sharing and redundant hot-swappable power supplies, redundant fans and fan banks, redundant route switch controller (RSC) cards, and Call Admission Control (CAC), all part of the carrier-class attributes required to provide a highly available system.

The Cisco AS5850 Universal Gateway supports a wide range of IP-based value-added services such as high-volume Internet access; corporate VPNs; long distance for Internet service providers (ISPs); international wholesale long distance; distributed prepaid calling; Signaling System 7 (SS7) interconnect; managed voice services such as hosted IP telephony; managed IP private branch exchange (PBX); multiservice VPNs; and IP contact centers.

Using the rich set of Cisco IOS® Software features and SS7 interconnection, service providers can quickly provision their networks for new services to meet the rapidly changing demands of the communications provider marketplace.

As a highly flexible voice gateway, the Cisco AS5850 supports any coder-decoder (codec) at 100 percent capacity, simplifying network engineering. An open programmable architecture simplifies rapid voice-service creation with H.323, Session Initiation Protocol (SIP), or Media Gateway Control Protocol (MGCP).

Cisco customers worldwide have proven that the Cisco AS5000 universal gateways provide the flexibility, scale, reliability, and suite of services needed to meet today's market demands. By providing the industry's broadest line of access-server products with universal-port digital signal processors (DSPs), Cisco Systems® enables customers to choose the right starting point for a "pay-as-you-grow" rollout 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 deployment solutions (Figure 1).

Figure 1
Cisco AS5850 Universal Gateway

The Cisco AS5850 Universal Gateway offers the following:

- Industry's leading intelligent gateway
  - Complete Cisco IOS Software feature support for H.323, SIP, and MGCP
  - Ideal for distributed architectures
  - Programmable for customized services
- The leader for wholesale services
  - Control features to maximize call completions
- Flexible and simple network engineering
  - Equal capacity for any codec; no preprovisioning
- Scalability
  - Up to 3360 concurrent users, 14 rack unit (RU)-chassis—three Cisco AS5850s per rack
  - High performance
  - Carrier-class attributes
- Cisco Any Service, Any Port
  - Migrate from dial services to dial and voice on one network

Primary Features

Cisco Any Service, Any Port

The economic environment is prompting service providers to generate revenues quickly, improve returns from invested capital, and adapt to changing demand for various services in the marketplace. 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 (ROI). Service providers can generate new revenue streams from multiple voice and data services such as long distance voice over IP (VoIP), hosted IP telephony, VPNs, and dialup Internet.

Cisco ASAP provides universal-port capability and enables the Cisco AS5850 Universal Gateway to operate simultaneously as a network access server and a voice gateway delivering universal services on any port at any time. The Cisco ASAP services on the Cisco AS5850 include dial access, real-time voice and fax, and unified communications on a call-by-call basis. The Cisco AS5850 achieves cost savings through optimized use 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 codec and modem algorithms on any DSP at any time. When the type of codec or modem required for a specific call is 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.

Capacity

The Cisco AS5850 Universal Gateway supports CT3, T1, E1, and STM-1 ingress interfaces and a Gigabit Ethernet egress interface. It supports up to 3360 (five CT3s) data, voice, or fax calls. With T1 interfaces, 2304 calls (96 T1s) are supported and with E1 interfaces, up to 2580 (86 E1s) calls are supported. Dual load-sharing redundant Gigabit Ethernet packet interfaces provide highly available backhaul.

The Cisco AS5850 chassis is designed to scale up to six times the current ingress capacity for future expansion.

High Availability

The Cisco AS5850 Universal Gateway is designed to meet the high-availability requirements found in carrier-class environments. Redundancy, hot-sparing, call-management, and self-management features are all part of the carrier-class attributes available in the Cisco AS5850.

Mean Time Between Failures

Mean time between failure (MTBF) statistics and data have been developed through extensive testing in Cisco development testing labs. For major software and hardware components of the Cisco AS5850 Universal Gateway, the MTBF has been extrapolated to be 146,000 hours.

RSC Redundancy

The RSC hosts the centralized functions of Layer 3 packet switching, time-division multiplexing (TDM), bus clock, and Stratum 4E timing generation, as well as external connections, including egress interface to the IP or packet-based network. Hardware is present on the RSC to detect critical faults and provide an auto-reboot capability. Each RSC provides dual redundant backhaul interfaces. These interfaces can be connected to the same core device or different core devices, depending on the type of interface resilience required.

When two RSCs are installed, chassis-management functions such as clock control and environmental monitoring benefit from redundant circuitry on the RSCs. Chassis management redundancy is automatically enabled any time two RSCs are present in a Cisco AS5850 Universal Gateway.

RSC High Availability

High availability on the high-end access-server platform is an increasingly important customer requirement. This is particularly true with the Cisco AS5850 Universal Gateway because it is deployed into the traditional telecommunications-carrier space with VoIP and other packet-based converged services at higher (and increasing) port and trunk densities.

The Cisco AS5850 offers high-availability features such as hot swap on all cards, hot spares, redundant hot-swappable power supplies, redundant switch fabrics, and redundant routers, all part of the carrier-class attributes required for a highly available system.

Fault Tolerance

The Cisco AS5850 Universal Gateway achieves fault tolerance through the use of hot-swappable DSP cards, power supplies, redundant RSCs, fan units, and Ethernet connections. RSC redundancy enables a system to keep running in the event of failure. Additional mechanisms enable redundant components to be built into the system and used when required without resulting in active call loss.

Call Admission Control

Call Admission Control (CAC) provides the ability for the platform to gracefully refuse calls based on local call-processing resources, such as CPU load, memory utilization, bandwidth availability, or measured congestion on the IP network. Such call control dramatically improves the reliability of the Cisco AS5850 Universal Gateway RSC by preventing CPU- and memory-overload conditions that could cause RSC functioning failure. The CPU adjusts "the DSP autobusy" algorithms when memory is low or CPU is high.

Hot-Swapping on all Cards and Modules

Hot-swapping 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 replaced, and only the calls on the card being removed are affected. "Soft busy" commands can be used to gracefully remove traffic before card removal.

The power entry modules (PEMs) are load sharing and fully redundant with separate power feeds and separate breakers. In the unlikely event of a PEM failure, the failed unit can be removed and replaced while the system continues normal operation. The thermal performance margin of the Cisco AS5850 Universal Gateway cooling system allows up to 15 minutes for a hot-swappable cooling module exchange. The optional AC supply has hot-swappable modules and N+1 power module redundancy.

Hot Spares

The Cisco AS5850 Universal Gateway can be configured with spare DSPs, RSCs, and trunk cards for added resiliency. Because DSPs are pooled and 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 the occurrence of "holes," or unused channels, within a hunt group. Having spare DSPs in the pool also allows DSP code to be updated without affecting active calls. There can be more DSPs in the DSP pool than available DS0s to cover for resources that are being upgraded or tested.

DSP Resource Recovery Feature

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 recovery feature can be turned on to recover defective DSPs in the recovery pool and add them back into the resource pool if possible.

Redundant Data Paths

The Cisco AS5850 Universal Gateway provides multiple paths for data packets from a DS0 to an external backbone device. Redundant packet buses exist from each feature card slot to both RSCs along with multiple separate TDM buses for expansion and resiliency. Backhaul redundancy to the IP core network is accomplished using the redundant backhaul interfaces provided on each RSC.

Power Management

Redundant load-sharing DC PEMs are standard on the Cisco AS5850 Universal Gateway. Voltage and current levels on each PEM can be monitored at the RSC console, and alarms for voltage and current thresholds are available for use by an element management system.

Thermal Management

Twelve adjustable-speed fans in three N+1 redundant banks provide cooling for the Cisco AS5850 Universal Gateway. If one fan in a bank fails, the others automatically increase speed (which increases airflow) to compensate for the lost fan. If a fan-controller fault occurs, all fans automatically run at full speed. A fan failure or fan-controller failure will cause the RSC to generate an alarm. Redundant power feeds to the fan controller help ensure power to the fans and controller.

Thermal sensors are installed on each card near the air inlet and outlet positions to monitor the inlet and outlet temperatures and temperature rise across each card. The fans increase speed in the event of high-temperature readings, providing additional cooling in extreme conditions. If an individual feature card within the dial shelf exceeds its maximum operating temperature, only the affected board is shut down. If the system continues to exceed its maximum operating temperature, the thermal sensors initiate further shutdowns, preventing damage to the unit or its surrounding environment from excessive heat. An incremental shutdown sequence targets DSP cards first and trunk interfaces last to avoid alarms at the central office.

Regulatory Compliance

The Cisco AS5850 Universal Gateway complies with Network Equipment Building Standards (NEBS) Level 3 requirements, as defined by Telcordia SR-3580; and European requirements, as defined by the European Telecommunication Standards Institute (ETSI).

Rich Protocol Support

The Cisco AS5850 Universal Gateway takes advantage of the full-feature richness and strong IP capabilities of Cisco IOS Software. The gateway was optimized for service-provider IP networks. In addition, it fully supports the specialized needs of AOL dialup services through Point-to-Point Protocol (PPP), Layer 2 Tunneling Protocol (L2TP), or Transmission Control Protocol (TCP) Clear connections. Through its support of all IP routing protocols, the Cisco AS5850 integrates easily into any service provider's aggregation layer.

V.92 and V.44 Support

V.92 and V.44 are the latest modem standards to be 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 Access Dial-In User Service (RADIUS) support for Modem on Hold allows 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," which enables Internet users to experience the qualities usually associated with broadband for the price of dialup or modem access.

Packet Telephony

The framework for voice services on the Cisco AS5850 Universal Gateway 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 the Cisco AS5850 because H.323, SIP, and MGCP support are all built in. This allows service providers to enable the call control protocol that is the best fit for their networks today, with confidence 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 AS5850 Universal Gateway supports the scalability enhancements introduced in H.323 Version 3 and H.323 Version 4. 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.

The Cisco AS5850 supports a broad array of proven, interoperable H.323-based solutions for service-provider networks: global long distance, distributed prepaid calling, SS7 interconnect, telephony applications, and unified communications.

SIP

SIP is the Internet Engineering Task Force (IETF) standard for multimedia conferencing over IP. SIP is an ASCII-based, application-layer control protocol (defined in RFC 2543) that can be used to establish, maintain, and terminate calls between two or more end points. The SIP implementation on the Cisco AS5850 Universal Gateway includes support for important features like 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 the Cisco AS5850 Universal Gateway has the ability to 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

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

The Cisco AS5850 Universal Gateway includes support for the MGCP network access server 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.

IP Signaling Transport

In addition to the signaling protocols already mentioned, the Cisco AS5850 Universal Gateway also supports the IETF Sigtran Working Group's Stream Control Transmission Protocol (SCTP) described in RFC 2960 and the ISDN Q.921-User Adaptation (IUA) layer protocol described in RFC 3057.

By supporting SCTP and IUA, the Cisco AS5850 can terminate a Primary Rate Interface (PRI) connection and then transport or backhaul the Layer 3 signaling (Q.931) information to an external signaling controller or media gateway controller (MGC). The signaling controller or MGC will process the PRI Q.931 call-control messages and then communicate with the Cisco AS5850 via MGCP to signal call-handling procedures.

SCTP and IUA can handle Facility Associated Signaling (FAS), Non-Facility Associated Signaling (NFAS), and NFAS with backup D channel.

Programmable Interactive Voice Response Using Tool Command Language 2.0

Integrated, programmable interactive voice response (IVR) extends the ability of the Cisco AS5850 Universal Gateway 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, and the prompts used in a TCL IVR 2.0 script can be either static or dynamic. The scripts are event-driven, and the flow of the call is controlled by a finite-state machine (FSM) that is defined by the TCL script. All verbs are nonblocking; 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. Support is available to companies that are developing or modifying TCL IVR 2.0 scripts through the Cisco Developer Support Program.

Voice Quality

Users can take advantage of the extensive voice and fax capabilities of the Cisco AS5850 Universal Gateway to build a reliable, high-quality VoIP network. Voice-quality tests confirm that the Cisco AS5850 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 AS5850 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 the Cisco AS5850 minimizes delay and packet loss during the voice encoding and packetization processes. The Cisco AS5850 introduces 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), and Weighted Random Early Detection (WRED), 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. The Cisco AS5850 supports ITU-T Recommendation G.168 for echo cancellation with a tail length up to 128 milliseconds (ms). Fixed and adaptive jitter buffering and comfort-noise generation further enhance voice quality.

Voice Codecs

The Cisco AS5850 Universal Gateway offers multiple codecs to meet interoperability, compression, and latency requirements for various 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, the Cisco AS5850 detects silence and stops transmitting packets when callers stop speaking. Variable frame sizing provides further control over speech packetization.

CAC for Voice Services

For VoIP to be a realistic replacement for standard PSTN telephony services, customers need to receive the same consistently high-quality voice transmissions they receive with basic telephone services. 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.

A variety of 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, fragmentation, and interleaving.

CAC extends the QoS tool suite to protect voice traffic from being negatively affected by other voice traffic, keeping excess voice traffic off the network. CAC allows the Cisco AS5850 Universal Gateway 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. Some CAC mechanisms include:

- Local CAC mechanisms—Call-admission decisions are based on individual gateway-resource conditions
- Measurement-based CAC mechanisms—Look ahead into the packet network to evaluate the state of network resources
- Resource-based CAC mechanisms—Calculate resources needed or available, and reserve resources

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. The Cisco AS5850 Universal Gateway supports the standards-based T.38 Real-Time Fax Relay, allowing greater interoperability between networks. The fax-detection capabilities of the Cisco AS5850 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. The Cisco AS5850 also supports fax passthrough for VoIP environments that cannot support T.38 Real-Time Fax Relay end to end.

TDM Switching

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 such applications as:

- SS7 and T1/E1 CAS to PRI grooming
- Local number portability support in Europe
- Meeting special provisionary requirements for test calls (for example, emergency-number call handling)

This feature does not require any DSP resource and hence has no impact on the dial, voice, and fax-handling capability of the platform. TDM switching plus network-side ISDN capability provides a means of grooming incoming traffic and passing selected calls to external devices, such as PBXs, test sets, VoIP gateways, or access servers. The Cisco AS5850 Universal Gateway is capable of switching calls between SS7, PRI, and channel associated signaling (CAS) trunks.

Manageability

The Cisco AS5850 Universal Gateway has a wide range of management tools designed to reduce operational costs. The Cisco Universal Gateway Manager is an element management system that supports the configuration, management, and troubleshooting of Cisco universal gateways. It supports the entire Cisco AS5000 universal gateways for voice, dial, and Cisco ASAP applications.

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

The Simple Network Management Protocol (SNMP) Version 2 and Version 3 management capability includes a rich call-tracking SNMP Management Information Base 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 service providers can use this performance-management data to establish service-level agreements (SLAs) with their retail ISP customers.

Network-Security Management

Cisco IOS Software network-security features allow authorized users dial 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) protocol RADIUS.

SS7 and Common Channel 7 Integration

Service providers around the world are deploying Cisco access servers with SS7 and Common Channel 7 (C7) interfaces. With SS7, carriers realize immediate benefits of improved scaling, reduced network costs, and faster time to market. The Cisco SS7 solution, implemented through the Cisco PGW 2200 Softswitch and Cisco BTS 10200 Softswitch, also guarantees investment protection in existing Cisco access servers while providing a smooth migration to IP packet telephony.

The Cisco PGW 2200 and Cisco BTS 10200 provide signaling connectivity to the SS7 network and provide all the functions for signaling and SS7 network management. The access servers provide digital interoffice trunk interfaces for completion of the calls. Control traffic is logically separated from management and customer data to provide greater information security and reliability. Resource management, call control, and system health monitoring complement SS7 to facilitate network scalability. The Cisco PGW 2200 or Cisco BTS 10200 can be at a centralized location or distributed.

To connect to the PSTN as a network element, the Cisco solution supports two- and four-wire continuity check and test calls at the access server. TDM switching plus network-side ISDN capability provide a means of grooming incoming traffic and passing selected calls to external devices, such as PBXs, test sets, or VoIP gateways.

The Cisco AS5850 Universal Gateway also works with several partner call agents and Cisco softswitches in an MGCP configuration providing centralized call-control architecture.

Full Cisco IOS Software Support for IP Services

The Cisco AS5850 Universal Gateway has two software-image options. The first is the IP Plus feature set, which is the full Cisco IOS Software Enterprise Feature Set with all non-IP functions removed (for example, Internetwork Packet Exchange [IPX], AppleTalk, Systems Network Architecture [SNA], and so on). This image option provides a complete palette of software functions to enable rapid deployment of feature-rich IP services using the Cisco AS5850 Universal Gateway. Important features include H.323v2, H.323v3, H.323v4, SIP, MGCP 1.0, interactive voice response (IVR), T.38 fax, fax and modem passthrough, carrier-sensitive routing, CAC, full RADIUS support (standard IETF plus third-party vendor proprietary extensions), L2TP, QoS, multicast, resource pool management for wholesale services, extended ACLs, AOL, and Prodigy support.

The second Cisco AS5850 Universal Gateway image option is an encryption image, which supports IP Security (IPSec) with 40- and 56-bit RC5, data encryption standard (DES), and Triple DES (3DES) plus automated key distribution.

Multivendor Back-Office Integration

The Cisco AS5850 Universal Gateway supports the RADIUS protocol for back-office integration, control, and network security. In addition to supporting the IETF-defined RADIUS attributes, Cisco IOS Software supports many vendor-proprietary RADIUS attributes for both preauthentication and user authentication. This means that the Cisco AS5850 can be integrated into any multivendor remote-access network with no changes to the back-office systems.

Worldwide Certification

The Cisco AS5850 Universal Gateway is homologated worldwide with all major T1 and E1 switch types. For ISDN PRI, the switch types and feature sets supported are listed in Table 1.

Cisco IOS Software Enables Rich Services

Cisco ASAP

The experience gained by Cisco in both data and voice is unique. Known industry-wide for its strength in data products, which is reflected in 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. The company's experience in building voice networks extends beyond millions of VoIP operating hours, and Cisco boasts the world's largest deployment.

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

Cisco ASAP provides easy 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 investments.

Table 1 Supported Switch Types and Features

Supported Switch Hardware	Supported Software	Supported Feature of Interest
5ESS (Lucent)	PRI custom and NI-2, Net5, NTT	Non-Facility-Associated Signaling (NFAS) with NI-2
4ESS (Lucent)	PRI custom	NFAS
DMS 100 (Nortel)	PRI custom	NFAS
DMS 250 (Nortel)	PRI custom	NFAS
GTD5 (GTE)	PRI custom and NI-2	NFAS with NI-2
AXE (Ericsson)	PRI custom and NI-2	NFAS with NI-2
EWSD (Siemens)	PRI custom and NI-2	NFAS with NI-2

Flexibility in Deploying New Services

Demand for new services can be easily accommodated with the Cisco AS5850 Universal Gateway whether the initial business opportunity is wholesale dial, prepaid calling card, global long distance, or any other application. The capability to use the gateway in multiple service environments provides unprecedented capital-investment protection. The 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 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 AS5850 Universal Gateway, combined with Cisco IOS Software, meets these needs by extending the core infrastructure by providing 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 as voice calls so that these calls will be billed at the lower voice rate. Cisco Resource Pool Management (RPM) on the Cisco AS5850 is used to configure a customer profile for DoVBS calls based on DNIS. This profile configures the Cisco AS5850 to treat all calls received on that number as ISDN data calls, even if they are signaled as voice calls by the PSTN.

Wholesale Dial

Many ISPs and content providers (or “portals”) must provide dialup Internet access as part of their service packages, and enterprise companies want to offer “private-label” Internet access to promote their brands. However, they do not have the experience, personnel, time, or money to build out a dialup-access infrastructure, or they cannot build it quickly enough, particularly when expanding into new regions. Service providers can now take advantage of this opportunity through 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 services that bring incremental revenue while holding down operations costs. The network infrastructure deployed for wholesale dial 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.

Access VPNs

The Cisco AS5850 Universal Gateway 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 support for VPNs in Cisco IOS Software, 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—because calls are terminated locally, long-distance charges are eliminated and infrastructure costs are reduced.

VPN Provisioning and Accounting

Service providers in the VPN environment need to both provision and account for the number of connections that are allowed by VPN customers. The Cisco Virtual Private Dialup Network (VPDN) session-counting software can keep track of the number of connections from the Cisco AS5850 Universal Gateway to the user’s home gateway. This software is provided in Cisco IOS Software running on the Cisco AS5850 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 AS5850 Universal Gateway 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 AS5850 also includes all the L2TP features necessary to support clients of AOL 7.0 and later.

Packet Telephony Services

Cisco Voice Infrastructure and Applications

The Cisco AS5850 Universal Gateway supports 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, application service provider (ASP) termination, dial access, voice mail, and unified communications.

The Cisco VIA solution scales easily for small and large voice networks. Using the Cisco AS5850 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 card 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 points of presence (POPs) in circuit-switched networks. The prepaid-calling-card solution supports IVR in different languages, so carriers can target specific markets.

Managed Voice Services

Telephony ASPs are emerging as an important market force, offering new, hosted, enhanced IP communications services that provide additional capability 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, click to dial, Internet call waiting, and content delivery. This creates new business-partnering opportunities for VoIP service providers. The Cisco AS5850 Universal Gateway enables interconnection between telephony ASPs and VoIP network-infrastructure providers to bring complete solutions to end users.

SS7 Interconnect

Using the Cisco PGW 2200 PSTN Softswitch or Cisco BTS 10200 Softswitch (or a third-party SS7 gateway), 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 and Cisco AS5850 Universal Gateway provide the interface needed to interconnect using Q.931 over IP or MGCP, allowing service providers to enter markets they otherwise would not have access to 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.

Service-Level Management

The Cisco AS5850 Universal Gateway supports Cisco RADIUS-based RPM. This enables service providers to offer guaranteed port availability across shared infrastructure, helping them to guarantee service levels to 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, and it also enables the Cisco AS5850 to support DoVBS.

Resource pooling can be configured on a per-gateway or per-network basis. In the former case, customer profiles stored on the Cisco AS5850 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 use across multiple Cisco AS5000 universal gateways or other vendors’ RADIUS-compliant gateways. When the Cisco AS5850 receives an incoming call, the Cisco RPMS determines whether the call should be accepted based on information in the customer profile.

Table 2 outlines some of the major benefits provided by the Cisco AS5850.

Table 2 Features and Benefits of the Cisco AS5850 Universal Gateway

Feature	Benefit
High Scalability	• Up to 3360 ports in a 14-RU chassis • Provides for six-times growth in same chassis • High density combined with a single administrative domain • Growth potential protects investment without incurring large initial costs
Multiple high-speed processors	• Enables the Cisco AS5850 Universal Gateway to easily sustain 3360 concurrent modem or voice sessions
Scalable chassis with MMP capable of carrying increased density and higher-speed traffic	• Allows customers to start small and stack additional servers as required, while still being able to dial into one telco hunt group
Hot-swappable cards and power supplies	• Redundant power supplies and power feeds • Redundant DSPs and RSC • Thermal/power management and redundant fans • DSP resource recovery feature • Improves network and service availability, reducing time and money lost because of outages • Supports H.323v2, H.323v3, H.323v4, SIP, and MGCP 1.0 • Provides architecture flexibility by supporting all currently deployed VoIP standards

Table 2 Features and Benefits of the Cisco AS5850 Universal Gateway

Feature	Benefit
Application-specific support	• Includes: – AOL traffic – Prodigy traffic • Provides capability to carry special types of traffic for wholesale dial applications
WAN optimization	• Includes: – Routing filters – Snapshot routing – Dial-on-demand routing (DDR) • Helps customers to reduce WAN costs, the single largest cost of internetwork operation
Cisco Universal Gateway Manager	• Extensive console commands • Call Tracker Management Information Base and console extensions • Conditional debug features • Syslog functions • Reduces problem detection and resolution time
Security management	• Includes: – RADIUS – Terminal Access Controller Access Control System (TACACS+) – Access lists – Anti-hacking and spoofing features – Violation logging • Provides comprehensive security throughout the customer's core network infrastructure • Full Cisco IOS Software support for IP services • Differentiates dial services • Allows expansion of addressable markets • Increases competitiveness, leading to more profitable operation • Provides the widest array of networking and routing protocol support in the industry for large-scale deployment • Full range of call-termination protocols • The same systems can be used in a wide variety of environments, simplifying management and procurement

Cisco AS5850 Distributed Processor Architecture

The Cisco AS5850 Universal Gateway provides all the hardware components that service providers have come to expect from carrier-class products and all the routing features that have been the hallmark of Cisco routing products.

The Cisco AS5850 architecture distributes processing between the RSC and individual feature boards for improved performance and availability. The routing and switching technology used on the RSC combines the best features of the highly successful Cisco 7206VXR Router and Cisco Catalyst® 8500 Series multiservice switch routers. The feature board on each system contains a R7000 RISC processor, which is used to run distributed Cisco IOS Software tasks such as IVR, virtual profiles, PPP processing, and dialer profiles.

Cisco AS5850 Components

The Cisco AS5850 Universal Gateway is made up of combinations of the following components:

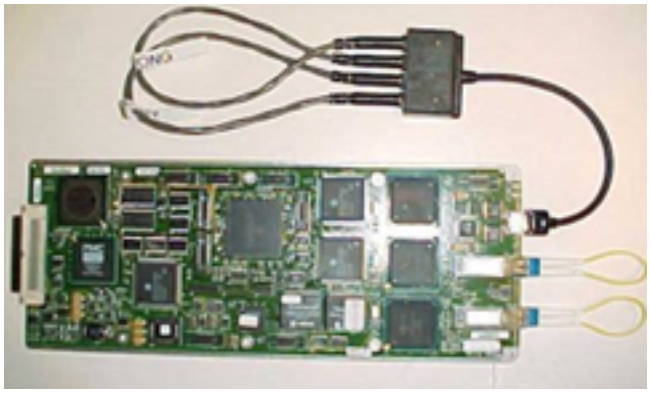
- Cisco AS5850 chassis
- Cisco AS5850 RSC
- Cisco AS5850 CT3 termination card (includes 216 universal ports)
- Cisco AS5850 24-port E1/T1 termination card

- Cisco AS5850 STM-1 termination card
- Cisco AS5850 324-port universal port DSP card

Cisco AS5850 STM-1 Termination Card

Cisco AS5850 provides the STM-1 interface for high-density PSTN connectivity. This card provides a maximum of 1890 (1953 in SS7/IMT configuration) DS0 channels (63 E1s) via a single STM-1 connection (Figure 2). This card is valuable to any customer who wishes to reduce the number of cables required to deliver 63 E1 (or 1953 channels) and take advantage of lower tariffs associated with purchasing a single STM-1 circuit versus 63 individual E1 circuits.

Figure 2
Cisco AS5850 STM-1 Termination Card



The SDH/STM-1 trunk card is a high-density multiplex/demultiplex card that takes in an STM-1 (Synchronous Digital Hierarchy [SDH]) pipe, used to transport up to 1890 (1953 in SS7/IMT configuration) DS0 channels. Digital calls are terminated onboard the SDH/STM-1 trunk card on HDLC controllers. There are 512 HDLC controllers and each HDLC controller can be used for either a D-channel or one digital call. The SDH/STM-1 trunk card can terminate a maximum of 512 digital calls, less the number of D-channels. For example, with 63 D-channels allocated, 449 digital calls can be terminated. Additional digital calls and analog modem-originated calls are passed over the TDM bus to an available modem resource pool.

The physical layer interface for the SDH/STM-1 trunk card is synchronous transport module (STM). Each SDH/STM-1 trunk card has two 155-Mbps STM physical layer interfaces which allow 1+1 fiber protection. Each SDH/STM-1 trunk card has two LC small form-factor type fiber receptacles to allow connection to single-mode optical fiber.

The SDH/STM-1 trunk card supports SDH MIB RFC 1595, DS1 MIB RFC 1406, and provides support for SNMPv1 agent (RFC 1155-1157), and Management Information Base (MIB) II (RFC 1213).

The SDH/STM-1 trunk card supports online insertion and removal (OIR), a feature that allows users to remove and replace trunk cards in the Cisco AS5850 Universal Gateway while the system is operating, without disrupting other cards and their associated calls.

A test port is provided to test drop-and-insert testing on any DS1/E1 from an external testing device including monitoring of both transmit and receive directions on any E1s with a built-in DS1/E1 interface.

Cisco AS5850 Chassis

- Fourteen slots with hot-swap on all cards
- TDM bus capacity to 8000 DS0s (OC-12); capable of double this density on same backplane
- Front-to-back airflow with redundant fans
- Active temperature and power management
- Redundant, load-sharing power (DC or external AC supply)
- One or two RSC cards

- Three Cisco AS5850s, which measure 14 rack units (RUs) tall, each will fit in a standard 7-foot (42 RU) rack in DC-only configuration

Cisco AS5850 Route Switch Controller

The Cisco AS5850 Route Switch Controller (Figure 3) includes the following:

- Integrated IP switching and routing functions
- High-performance programmable Layers 3 and 4 IP packet switch with 5-Gbps application-specific integrated circuit (ASIC)-based switch fabric
- Fully distributed Cisco Express Forwarding for optimal packet forwarding
- One or two RSCs per Cisco AS5850 chassis
- Building integrated timing supply (BITS) clock input
- Dual redundant Gigabit Ethernet egress fiber links

Figure 3
Cisco AS5850 Route Switch Controller

Cisco AS5850 CT3 Termination Card

Cisco provides the CT3 interface for high-density PSTN connectivity. This card provides a maximum of 672 channels via a single CT3 connection (Figure 4). This card is valuable to any customer who wishes to reduce the number of cables required to deliver 672 channels and take advantage of lower tariffs associated with purchasing a single CT3 circuit versus 28 individual T1 circuits. The CT3 card provides standards-based M13 multiplexer capability in conjunction with local High-Level Data Link Control (HDLC) or distributed DSP resources to fully terminate up to 28 T1s. The CT3 card also includes a channel service unit (CSU) for terminating a CT3 trunk directly from the telco network. This card also terminates 216 user connections.

Configuration of any T1 interface contained within the CT3 interface can be provisioned independently of other CT1 interfaces included within the same CT3 facility. Therefore, users can configure the CT3 card to carry ISDN PRI trunks (each connected to a different switch type), and a variety of North American robbed-bit signaling (RBS) types such as Loop Start and Ground Start all on the same Cisco AS5850 Universal Gateway platform. Configuring the CT3 interface and the accompanying PRI/T1 trunks can be performed using the standard Cisco IOS Software command-line interface (CLI).

This feature board also includes 216 DSP ports compatible with Cisco ASAP. The DSP ports are fully consistent with the any-to-any, fully pooled model for DSP resources in the Cisco AS5850.

Following is a brief description of the CT3 interface type and PRI/T1 trunk types supported:

- T3 (44,736-Mbps) links default to binary 3-zero substitution (B3ZS) line encoding and C-bit framing. Physical connection to a T3 circuit is provided on two standard 75-ohm, unbalanced, female BNC connectors.
- T1/PRI (1.544-Mbps) links are supported as described in the following section on the 24-port E1/T1 card. E&M, Loop-Start, and Ground-Start links are all supported.
- Universal access (analog modem or digital data and voice calls) is supported when an individual 1.544-Mbps interface contained within the CT3 circuit is configured for ISDN PRI signaling. PRI signaling is available on all 1.544-Mbps trunks. Up to a maximum of 256 individual B channels may be terminated via the CT3 integrated HDLC controllers and fully ISDN capacity supported with DSP resources.
- Non-intrusive monitoring of individual T1/PRI signals is available at the front of the CT3 card via standard 100-ohm bantam jacks.

Figure 4
Cisco AS5850 CT3/216 Termination Card

Cisco AS5850 24-Port E1/T1 Termination Card

The Channelized E1/T1 trunk card provides physical termination for up to 24 E1 R2s, PRIs, or intermachine trunks (IMTs). The Cisco AS5850 Universal Gateway using four 24-port interface cards can fully terminate up to 86 E1 trunks or 96 T1 trunks. Any of the E1/T1 interface ports on these trunk cards can be configured independently of any other interface. Therefore, users can configure a variety of E1 trunks and ISDN PRI trunks (each connected to a different switch type), all within the same Cisco AS5850 platform. The standard Cisco IOS Software CLI can be used to configure each trunk.

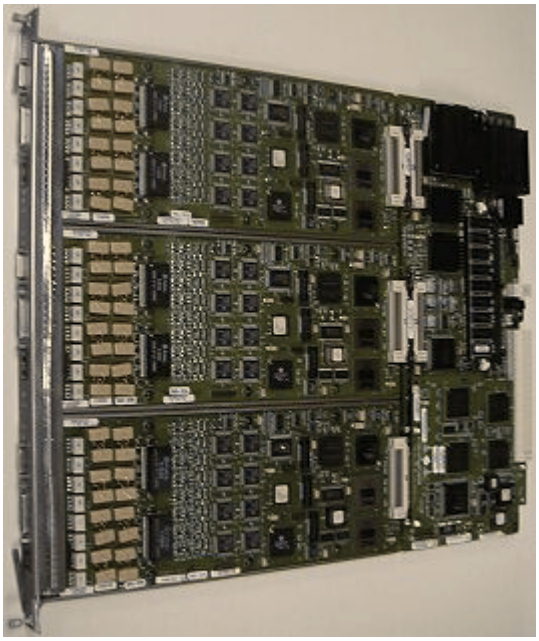
The following is a brief description of the trunk types supported:

- CAS is supported for T1 and 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. When configuring an interface for PRI signaling, the identity of the switch at the other end of the PRI circuit is imperative.

Nonintrusive monitoring of individual E1/T1 PRI signals is available at the front of the E1/T1 termination card via standard 100-ohm bantam jacks. Cisco supports all the major switch types and is actively pursuing new features of interest to service providers that can be supported by these switches. Table 1 lists supported switch types and their features.

Figure 5 shows the 24-port E1/T1 termination card.

Figure 5
Cisco AS5850 24-Port E1/T1 Termination Card

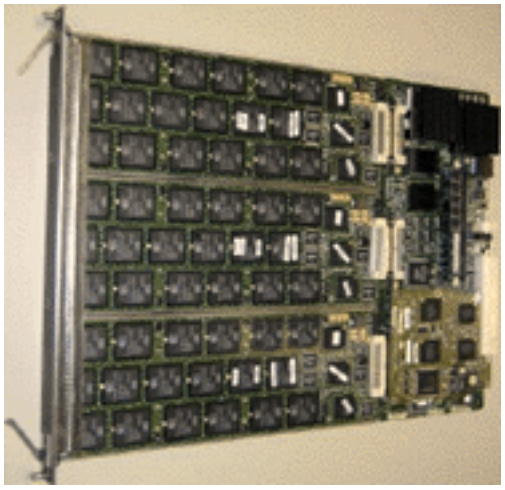


Cisco AS5850 324-Port DSP Cards

The Cisco AS5850 324-port DSP card (Figure 6) is a full-featured card that includes 324 DSP ports compatible with Cisco ASAP. The DSP ports are fully consistent with the any-to-any, fully pooled model for DSP resources in the Cisco AS5850 Universal Gateway.

Port-management features are available for troubleshooting, including DSP status, real-time call-in-progress statistics, resource activity log, hard or soft busy out, and DSP firmware upgrades. Additional information can be obtained through the console, SNMP, or RADIUS accounting via the Call Tracker feature.

Figure 6
Cisco AS5850 324-Port Universal Port Card



Summary

The Cisco AS5850 Universal Gateway is a high-density universal gateway, offering highest capacity and high availability in its class. The gateway is designed to meet the demands of large service providers, supporting up to 5 Channelized T3s (CT3s), 96 T1s, 86 E1s, or 2 STM-1s (108 E1s) of data, voice, and fax services, on any port at any time.

It offers high-availability features such as hot-swap on all cards, load-sharing and redundant hot-swappable power supplies, redundant fans and fan banks, redundant route switch controller (RSC) cards, and Call Admission Control (CAC), all part of the carrier-class attributes required to provide a highly available system.

It supports H.323, SIP, and MGCP call control protocols with extensive SNMP management and debugging capabilities. It works with Cisco PGW 2200 Softswitch, Cisco BTS 10200 softswitch, and several partner softswitches as well.

Tables 3 through 7 provide detailed specifications for the Cisco AS5850 Universal Gateway.

Table 3 Cisco AS5850 Universal Gateway System Data

Feature	Benefit
Processor type per RSC	• 266-MHz R7000 RISC processor plus 2 MB of Layer 3 cache Synchronous Dynamic RAM (SDRAM)
Switch fabric per RSC	• 5-Gbps throughput, Layers 3 and 4 switching
Memory per RSC	• 512-MB SDRAM with Error Correction Code (ECC)
Processor type per feature card	• 266 MHz R7000 RISC processor
Memory per feature card	• 128 MB SDRAM (with parity)
Slots	• 12 feature board slots • 2 RSC slots
Trunk cards	• One CT3 and 216 DSP feature board • G.703, G.704 • 24 CE1/CT1 feature board • One STM-1 feature board
Universal port card	• 324 DSP feature board
Egress ports	• Dual Gigabit load-balanced redundant Ethernet ports with gigabit interface controller (GBIC) interfaces for user traffic • One 10/100-Mbps Ethernet port with RJ45 connector for management traffic

Table 4 Overview of Cisco AS5850 Universal Gateway Protocols

Feature	Benefit
LAN protocols	• IP
Services support	• Port Policy Management and SS7/C7
Routing protocols	• Routing Information Protocol (RIP), RIPv2, OSPF, IGRP, EIGRP, BGPv4, IS-IS, Next Hop Resolution Protocol (NHRP)
Access protocols	• PPP, Serial Line Internet Protocol (SLIP), TCP Clear
Bandwidth optimization	• Multilink PPP (MP), MLP, TCP/IP header compression, Bandwidth Allocation Control Protocol (BACP), Bandwidth on demand, Nonfacility-associated signaling (NFAS), traffic shaping
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) • SNMPv2, SNMPv3

Table 4 Overview of Cisco AS5850 Universal Gateway Protocols

Feature	Benefit
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 • IP Precedence, policy-based routing
Channelized T1	• PRI, robbed-bit signaling; CAS, loop start, immediate start, and wink start protocols, SS7/IMT
Channelized EI	• CAS, E1 R2, PRI, SS7/IMT
ISDN protocols	• Sync mode PPP, V.120, V.110 at rates up to 38400 bps
Voice protocols supported	• G.711, G.723.1, G.726, G.729ab, G.Clear, and GSM-FR • H.323v2, H.323v3, H.323v4, SIP, MGCP 1.0 • T.38 real-time fax relay • ECAN up to 128ms • Fax detection • Fax and modem passthrough
Modem protocols supported	• V.90 or V.92 standard supporting rates of 56,000 to 28,000 in 1333-bps increments • V.44 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 56,000 to 32,000 in 2000-bps increments • ITU-T V.34 Annex 12 at 33,600 and 31,200 bps • ITU-T V.34 at 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, 14,400, 12,000, 9600, 7200, 4800, or 2400 bps • V.32bis 14,400, 12,000, 9600, 7200, 4800; V.32 9600, 4800; V.22bis 2400, 1200; V.21 300; Bell 103, 300; V.22 1200; and 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
ISDN protocols supported	• Sync mode PPP • V.120 • V.110 at rates up to 38,400 bps
Wireless protocols supported	• V.110
Console and auxiliary ports	• Asynchronous serial (RJ-45)

Table 5 Cisco AS5850 Universal Gateway Environmental Data

Feature	Benefit
NEBS certification	• Telcordia SR-3580 • GR-1089-CORE, Issue 2 • GR-63-CORE, Issue 1 • Level 3 certification based on usage and criticality of equipment • All equipment CLEI coded • Available in Trunk Information Recording Keeping System (TIRKS) database

Table 5 Cisco AS5850 Universal Gateway Environmental Data

Feature	Benefit
STM-1 Interface Specification	• Speed: 155Mbps • Channelised 63 E1 (1890 DS0s) • Small Form Factor • Single Mode (not multimode) • LC duplex Transceiver • Wavelength: 1300 nm • Compliant: ITU-T G.957, IR-1/S1.1, S4.1 • Transmit: min –15 dBm, max - 7dBm • Receive: min -28dBm, max -8dBm (exceeding -8dBm is not recommended, optical attenuating may be required to bring down power level • Standards: G.707 (SDH Bit Rate) and G.708 (Network Node Interface for the SDH) • Mapping: AU4/TUG-3/TUG-2/TU-12/E1 (asynchronous) & AU-3/TUG-2/TU-12/E1 (asynchronous) • MIB Support: RFC 1595 (SONET/SDH MIB) • Protocol: ISDN-PRI, E1-R2 & SS7-IMT • HDLC Controller: 512 Controllers for ISDN data termination • F/A-link Support: Using TDM switching
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
Electromagnetic emissions and immunity compliance	• EN 55022B (CISPR 22) • EN300386 • NZS/AS3548 Class B • VCCI B • FCC 47CFR15 Class B
Environmental specifications	• Heat dissipation (5 CT3 configuration) • AC power cable supplied • DC interconnect cable supplied • Storage temperature • Operating temperature (air inlet to power unit) • Acoustics • Humidity (noncondensing) • Altitude • Reliability (at 40ºC, 200 VAC, 1810W) • 6380 Btus per hour maximum • 12 American wire gauge (AWG), 16A • 6 AWG, two pairs (black and red) • 25.8 to 185 F (-40 to 85 C) • 32 to 104 F (0 to 40 C) airflow front to back • 60 decibels typical; sound pressure level at 1meter • 5 to 95 percent • -200 to 10,000 ft • 7500 FITS per TR-332, 1.5 x 10^5 hours MTBF per RIN

Table 6 Cisco AS5850 Universal Gateway Power Specifications (Standard DC)

Power	Description
Voltage, Power entry and Filter Module	• Minimum: -40 VDC • Nominal: -48 VDC • Maximum: -72 VDC
Current @ -48 VDC	• Minimum (SS): 13.0A • Maximum 5CT3 (SS): 39.5A
Circuit breaker	• 40A

The optional AC-input power supply operates between 100 and 260 VAC input voltage and supplies -48 VDC to the dial shelf. The AC-input power supply uses a power factor corrector that automatically adjusts for the input voltage that is supplied.

Table 7 Cisco AS5850 Universal Gateway Mechanical Data

Product	Specifications
Cisco AS5850 Universal Gateway	• Dimensions (H x W x D) – 24.5 x 17.4 x 24 in. (14 RU high) – 62.2 x 44.2 x 61 cm • Weight – Approx. 220 lb (100 kg) fully configured
Optional AC power supply unit	• Dimensions (H x W x D) – 3.5 x 17 x 12.5 in. – 8.9 x 43.2 x 31.75 cm (2 RU required) • Weight – 14.5 lb (6.6 kg)

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