

## CISCO GATEWAY GPRS SUPPORT NODE

The Cisco® GPRS Gateway Support Node (GGSN) is a high-performance data gateway connecting General Packet Radio Service (GPRS) and Universal Mobile Telecommunications Service (UMTS) mobile operators' Public Land Mobile Networks (PLMNs) to external data networks (Internet, corporate intranet, multimedia services, etc.). The Cisco GGSN supports General Packet Radio Service (GPRS, 2.5G) and UMTS (third-generation [3G]) connected mobile networks. The Cisco GGSN software runs on industry-leading Cisco routing platforms and is based on Cisco IOS® Software technology. The Cisco GGSN connects the GPRS Tunneling Protocol (GTP) tunnel directly from the mobile subscriber to the external data network.

The Cisco GGSN is a highly scalable and versatile solution that offers a wide range of enhanced features. It allows operators to maximize revenue potential by offering tailor-made solutions for their mobile subscribers. The Cisco GGSN uses Cisco IOS Software to provide standards-based interconnection offerings across a wide range of interface and protocol options.

The Cisco GGSN forms part of the Cisco Mobile Exchange architecture. The Cisco Mobile Exchange offers mobile operators a complete solution for connectivity, control, and charging. The Cisco Mobile Exchange delivers very flexible billing methods ranging from flat-rate, volume-based billing to content-aware per-download or per-click billing. The Cisco Mobile Exchange uses the proven Cisco 7600 Router platform to deliver all the connectivity needs required, including support for GPRS, UMTS, wireless LAN (WLAN), packet data serving node (PDSN), and tunneling protocols such as generic routing encapsulation (GRE), IP Security (IPSec), and Layer 2 Tunneling Protocol (L2TP).

### CISCO GGSN FEATURE OVERVIEW

Cisco GGSN Release 4.0 is a standards-based GGSN that supports all the relevant 3GPP standards for R97, R98, and R99. It supports the Gn, Gi, Ga, and Gp interfaces as per the 3GPP standards. It also supports per-user authentication and accounting and produces GGSN-Call Detail Record (G-CDR) billing tickets.

The Cisco GGSN functions are embedded in the Cisco IOS Software, which differentiates the Cisco GGSN solution from other industry alternatives. The Cisco IOS Software within the Cisco GGSN provides a sophisticated suite of networking capabilities that reside at the heart of internetworking devices. The Cisco GGSN software, combined with its routing capability, offers the same level of quality, reliability, and scalability that has made Cisco Systems® a leader in the Internet and data networking industry.

In addition to the standard features, the Cisco GGSN offers value-added features such as VPN services and dial-like services as well as consumer-based services. One example of these features is the Point-to-Point Protocol (PPP) regeneration using the L2TP tunneling feature, which helps enable operators to provide remote access using PPP between enterprises and their employees or Internet service providers (ISPs) and their subscribers. With this feature, operators can help enable their corporate customers to:

- Manage their own remote access corporate users with private IP addresses
- Reuse their back-end dial or L2TP infrastructure already deployed for land-line remote access purposes
- Route to remote devices beyond the mobile subscriber device

The Cisco GGSN also supports overlapping private IP addressing, in turn helping mobile operators enable their corporate customers to use their own private IP address ranges. This not only provides additional security for corporate VPN connections but also eases the overhead on operators for provisioning and managing IP address space for corporate customers or ISPs.

The Cisco GGSN 4.0 release supports both 2.5G and 3G functions in the same platform. This allows operators to deploy the Cisco GGSN 4.0 solution in their UMTS network without GGSN software change, and support roaming GPRS subscribers. Operators who currently have a GPRS network deployed and plan to upgrade to a UMTS network may do so without changing their GGSN platform. For operators who have the Cisco GGSN 1.4 or 3.0 versions installed, the 2.5G-to-3G migration for the Cisco GGSN is simply a software upgrade.

By implementing Cisco GPRS and UMTS products and mobile-related solutions, mobile operators can optimize their networks today by deploying high-quality mobile voice and data services. They also can benefit from new operating efficiencies, peer-to-peer IP-based architecture for scalability, and IP standard interfaces to billing (pre- and postpaid). Moreover, the Cisco GGSN 4.0 is supported by the CiscoWorks for Mobile Wireless and Cisco Mobile Wireless Center (MWC) network management suites, which are equipped with fault management Access Point Name (APN) management, and configuration management tools.

#### **Cisco GGSN Feature Summary**

- Full GTP support
- Internet and intranet interworking
- GPRS and UMTS-defined packet routing and transfer functions
- Charging data collection and charging data record generation
- IPv4 and PPP Packet Data Protocol (PDP) types support
- High subscriber numbers and performance throughput
- Support for GTPv0 and GTPv1
- Full UMTS quality of service (QoS)
- R99 UMTS charging support
- Wide range of VPN support (802.1q, GRE, L2TP, IPSec)
- PPP regeneration (L2TP on Gi)
- PPP PDP type terminated in Cisco GGSN
- L2TP tunneling to L2TP extensions

- Virtual APN (single APN feature)
- Industry-leading IP routing
- Per-APN and per-customer routing tables
- IP route aggregation
- GPRS and UMTS QoS
- QoS mapping per standards for GTPv0
- Enhanced switching of GTP packets
- Load balancing
- RADIUS support and enhancements
- Enhanced security features (antispoofing, packet redirect, foreign subscriber protection)
- Highly customizable APN settings
- Network-initiated PDP context support
- MIB and Simple Network Management Protocol (SNMP) management for R99
- Full backward compatibility

### **Network Management**

Network management functions provide mechanisms to support operations, administration, and maintenance (OA&M) functions related to the Cisco GGSN. The Cisco GGSN management has a wide range of console and SNMP management tools designed to reduce operational costs. The Cisco GGSN Release 4.0 is supported by the Cisco MWC, which helps enable remote fault management, APN management, and configuration management for the Cisco GGSN. The Cisco MWC is a suite of element-management-system (EMS) applications that enhance the delivery of new mobile wireless services. Based on CiscoWorks, the Cisco MWC addresses the element management requirements of mobile operators and provides fault, configuration, accounting, performance, and security (FCAPS) functions as mobile operators transition their service delivery networks from 2G circuit-based traffic to 2.5G and 3G IP-based services. For more details about the Cisco MWC, go to:

<http://www.cisco.com/en/US/products/sw/netmgts/ps820/index.html>.

### **GTP SLB**

The Cisco GPRS solution includes the Cisco IOS Server Load Balancing (SLB) feature to provide an even distribution of PDP context among a Cisco GGSN server farm. This increases availability and redundancy in smaller-scale solutions when using multiple Cisco GGSNs and distributes load in large- and small-scale solutions with dynamic feedback mechanisms to monitor Cisco GGSN performance.

Cisco IOS SLB allows mobile operators to represent a group of network servers (a server farm) as a single server instance, balance the traffic to the servers, and limit traffic to individual servers. The single server instance that represents a server farm is referred to as a virtual server. The servers that comprise the server farm are referred to as real servers.

In a Cisco GPRS environment, the clients (Serving GPRS Support Nodes [SGSNs]) issue the PDP context activation requests to an IP address of the Cisco GGSN virtual server on the Cisco IOS SLB router. Cisco IOS SLB uses the Dynamic Feedback Protocol (DFP) to calculate the weight for each Cisco GGSN node based on the currently active

number of PDP contexts, CPU use, and processor memory on each Cisco GGSN. It then forwards the PDP context activation requests to real Cisco GGSN servers based on the calculated weights. The Cisco IOS SLB feature provides a highly available level of Cisco GGSN service, through the use of DFP and Hot Standby Router Protocol (HSRP). Cisco IOS SLB detects Cisco GGSN failures and immediately removes the failed GGSN node from the load-balancing list, so all new connection requests are redirected to a serviceable Cisco GGSN. Therefore, Cisco GGSN software upgrades and hardware maintenance can be performed without any disruption to service.

### **Standard Compliance**

The Cisco GGSN 4.0 is fully compliant to R97, R98, and R99 as specified in the 3GPP standards. Cisco GGSN 4.0 supports all the Cisco GGSN 3.0 features with respect to Release 98 PDP contexts or user sessions.

The Cisco GGSN Release 4.0 is compliant with the following R98 standards:

- 3G TS 03.03 Version 7.6.0 Release 98 after TSG 14
- 3G TS 03.60 Version 7.7.0 Release 98 after TSG 14
- 3G TS 04.08 Version 7.14.0 Release 98 after TSG 14
- 3G TS 09.60 Version 7.8.0 Release 98 after TSG 14
- 3G TS 09.61 Version 7.4.0 Release 98 after TSG 14
- 3G TS 12.15 Version 7.6.0 Release 98 after TSG 8

The Cisco GGSN Release 4.0 is compliant with the following R99 standards:

- 3G TS 23.003 Version 3.9.0 Release 99 after TSG14
- 3G TS 23.060 Version 3.9.0 Release 99 after TSG14
- 3G TS 24.008 Version 3.9.0 Release 99 after TSG14
- 3G TS 29.060 Version 3.11.0 Release 99 after TSG14
- 3G TS 29.061 Version 3.7.0 Release 99 after TSG14
- 3G TS 32.015 Version 3.7.0 Release 99 after TSG14
- 3G TS 23.107 Version 3.6.0 Release 99 after TSG14

TSG 14 corresponds to December 2001.

The detailed limitations regarding standard compliance are described in the Cisco GGSN Standard Compliance document.

### **Cisco GGSN Functional Interfaces Supported**

The Cisco GGSN supports the following interfaces:

- Gn—GTP tunnel (between Cisco GGSN and Cisco SGSN)
- Gp—PLMN to PLMN (between two GPRS networks)
- Ga—Interface to the charging gateway (GTP)
- Gi—IP networking, initially IPv4 (between Cisco GGSN and external data networks)

## CISCO GGSN HARDWARE PLATFORMS

The Cisco GGSN is supported on two standard Cisco routing platforms, the high-end Cisco 7600 Series Router and the market-entry Cisco 7200 Series VXR routers. These platforms are unchanged from the normal routing platform except they require special Cisco IOS Software to run the Cisco GGSN function. An overview of the hardware platforms follows (refer to Figure 1).

The Cisco 7600 Series Router is a high-performance router deployed at the network edge, where performance, IP services, redundancy, and fault resiliency are critical. Combined with a central route processor and forwarding engine, the Cisco 7600 Series provides 30-Mpps forwarding rates and up to 256 Gbps of total throughput.

The versatile Cisco 7600 Series system scales WAN connectivity from OC-48/STM-16 to DS-0 and LAN connectivity from 10 Gigabit Ethernet through 10-Mbps Ethernet. The Cisco 7600 Series delivers these capabilities while implementing high-touch, hardware-accelerated IP services through the Cisco Parallel Express Forwarding (PXF) network processor.

**Figure 1**  
Cisco 7600 Series Router



The Cisco 7600 Series delivers up to 13 slots of optical LAN, WAN, and metropolitan-area network (MAN) networking at the network edge, helping enable service providers to offer high-value, Differentiated Services. It provides mobile service providers with the ability to deploy the advanced network infrastructure necessary to succeed in demanding, high-traffic environments. The Cisco 7600 Series enhanced chassis delivers design improvements that incorporate redundant, tiered-speed fan trays with configurable options for route processor, switch fabric, and power supply redundancy.

The Cisco 7600 Series routers accommodate a broad selection of line cards supporting numerous applications, including:

- Optical services modules (OSMs):
  - OC-3/STM-1
  - OC-12/STM-4
  - OC-48/ STM-16 packet over SONET (POS)

- OC-12/STM-4 ATM
- Gigabit Ethernet WAN
- Channelized T3 (CT3)
- OC-12/STM-4
- FlexWAN module: Supports Cisco 7200 Series and Cisco 7500 Series WAN port adapters for DS-0 to OC-3
- LAN Ethernet modules:
  - 10/100 Mbps
  - Gigabit Ethernet
  - 10 Gigabit Ethernet
- Services modules:
  - Firewall, network analysis, content switching, and Secure Sockets Layer (SSL), providing the foundation for a powerful combination of speed and services

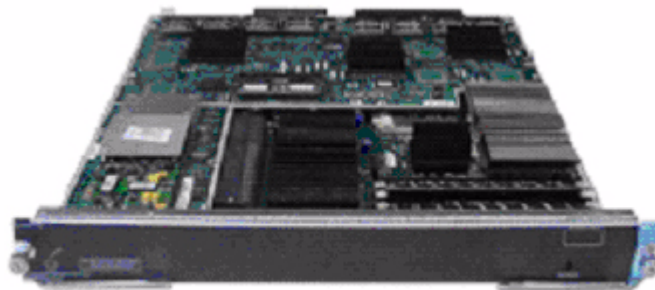
The Cisco 7600 Series Router is an outstanding choice for multiple applications. When combined with the Cisco 7600 Multiprocessor WAN Application Module (MWAM) and Cisco GGSN software, it delivers a high-performance, highly flexible, redundant platform for mobile service delivery.

For more information about the Cisco 7600 Series, visit <http://www.cisco.com/go/7600>.

#### Cisco GGSN MWAM

The Cisco MWAM is a Cisco IOS Software application module that can be installed in the Cisco Catalyst® 6500 Series Switch or the Cisco 7600 Series Router (refer to Figure 2). The module runs multiple instances of a Cisco application; for example, the Cisco PDSN, the Cisco GGSN, or the Cisco Service Selection Gateway (SSG).

**Figure 2**  
Cisco MWAM Card



#### Processor Complexes

A Cisco MWAM can run five instances of Cisco IOS Software. Each Cisco MWAM has one Cisco IOS application image—all processors on the MWAM are loaded with the same image. Mixed applications (for example, PDSN, GGSN, and SSG) on the same MWAM are not supported. The Cisco Catalyst 6500 Series chassis and Cisco 7600 Series chassis can accommodate up to four Cisco GGSN MWAMs and additional cards. Therefore, multiple applications could run in the same chassis on different MWAMs.

### **CISCO 7200 SERIES WITH NPE-400 PROCESSOR**

The Cisco 7200 Series Router delivers exceptional performance and price, modularity, and scalability in a compact form factor with a wide range of deployment options. With processing speeds up to 400,000 packets per second, port adapters ranging from n x DS-0 to OC-12, and an unparalleled number of high-touch IP services, the Cisco 7200 Series is the ideal GGSN platform for smaller service providers.

The Cisco 7200 Series addresses the mobile service provider solution requirements by integrating functions previously performed by separate devices into a single platform. Through this integration, the Cisco 7200 Series provides a single, cost-effective platform that supports:

- High-density LAN and WAN interfaces
- Service aggregation, including PPP, RFC 1483 termination, and L2TP tunneling
- Digital T1/E1 time-division multiplexing (TDM) trunk termination for data, voice, and video
- High-density, multichannel T3/E3 and T1/E1 with integrated channel service unit (CSU) and data service unit (DSU)
- ATM, POS, and Dynamic Packet Transport (DPT) connectivity
- Direct ATM Circuit Emulation Standard (CES) connectivity for data, voice, and video
- Light-density Layer 2 Ethernet switching

The Cisco GGSN software is supported only on the Cisco NPE-400 Network Processing Engine. The Cisco 7200 Series NPE-400 offers customers tremendous value for important applications, including customer premises equipment (CPE) and DS-1/DS-3 aggregation. Key benefits include:

- Raw data throughput of up to 400 kpps in Cisco Express Forwarding switching
- Processor modularity and upgradeability
- Increased Cisco 7200 Series value proposition

**Figure 3**

Cisco 7206 Router



### **I/O Controllers**

The Cisco NPE-400 is supported on the following Cisco 7200 Series I/O controllers:

- Cisco 7200 Series Input/Output Controller
- Cisco 7200 Series 2-Port 10/100 Auto-Sensing Fast Ethernet Input/Output Controller
- Cisco 7200 Series 1-Port Gigabit Ethernet and 1-Port Ethernet Input/Output Controller

### Key Features of the Cisco NPE-400

- 350-MHz RM7000A RISC processor
- 4-MB Layer 3 cache
- 128-MB synchronous dynamic RAM (SDRAM) default memory (expandable to 512 MB)
- 16-MB packet memory on 128- and 256-MB SDRAM and 32-MB packet memory on 512-MB SDRAM
- ECC support

### Capacity and Performance

Cisco 7600 Series MWAM performance information (for one MWAM card) is given in Table 1, and Cisco 7200 Series GGSN performance information is given in Table 2.

Table 1 Cisco 7600 MWAM Performance

Scalability Factor	Limit
Maximum capacity of IP PDP-type sessions (authenticated number of PDP sessions)	300,000
Maximum number of APNs	1,500
Aggregate throughput (512-byte payload)	500 Mbps (aggregate)
Maximum packet throughput (512-byte payload)	122,000 pps (aggregate)
Maximum PDP context activation rate (IPv4)	1,000/sec
Maximum number of IPSec tunnels (on VPN service module [VPNSM])	8,000
Maximum number of L2TP tunnels per PPP regeneration session	40,000

Table 2 Cisco 7200 GGSN Performance

Scalability Factor	Limit
Maximum number of IPv4 PDP contexts (static address allocation, with no traffic)	180,000
Maximum number of IPv4 PDP contexts (with RADIUS authentication and Dynamic Host Configuration Protocol [DHCP] address allocation)	60,000
Maximum number of APNs	1,500
Aggregate throughput (512-byte payload)	245 Mbps (aggregate)
Maximum packet throughput (512-byte payload)	60,000 pps (aggregate)
Maximum PDP context activation rate (IPv4)	200/sec
Maximum number of GRE tunnels	8,000
Maximum number of IPSec tunnels	2,000

## ORDERING INFORMATION

Ordering information for the Cisco 7206 GGSN 4.0 and the Cisco GGSN 4.0 are given in Tables 3 and 4, respectively.

Table 3 Cisco GGSN 4.0 Software on Cisco 7206 (Cisco IOS Release 12.3(2)XB)

Product Code	Product Description
S72AW-12302XB	Cisco 7200 Series GGSN 4.0 (base)
S72AK8W-12302XB*	Cisco 7200 Series GGSN 4.0 (base)
S72AK9W-12302XB*	Cisco 7200 Series GGSN 4.0 (IPSec)
S72AW-12302XB	Cisco 7200 Series GGSN 4.0 (IPSec)
S72AK8W-12302XB=*	Cisco 7200 Series GGSN 4.0 (Triple Digital Encryption Standard [3DES])
S72AK9W-12302XB=*	Cisco 7200 Series GGSN 4.0 (3DES)

Table 4 Cisco GGSN 4.0 Software for Cisco MWAM Card

Product Code	Product Description
SC-SVC-GG40	Cisco MWAM Series GGSN 4.0
SC-SVC-GG40=	Cisco MWAM Series GGSN 4.0
SC-SVC-GG40IM	Cisco MWAM Series GGSN 4.0 single image
SC-SVC-GG40IM=	Cisco MWAM Series GGSN 4.0 single image

Hardware must be ordered additionally.

## SERVICE AND SUPPORT

Cisco Systems is unmatched in the breadth and depth of its access to resources, shared intellectual capital, and leading data and telecommunications products and expertise. This combination helps enable Cisco to provide the highest quality available in carrier-class support, solutions, and vision for its service provider customers. Cisco service and support solutions enhance the value of your investment in network infrastructure, resulting in an overall reduced cost of doing business. Now you can deliver fully on the promise of internetworking technology, with the backing of world-class support and service.

## FOR MORE INFORMATION

For more information about Cisco Mobile Wireless products, including the Cisco Mobile Exchange, go to <http://www.cisco.com/go/mobile>.

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