Cisco **Multiservice Broadband** Cable Guide

June 2002

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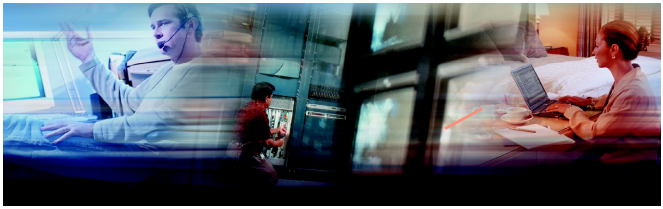

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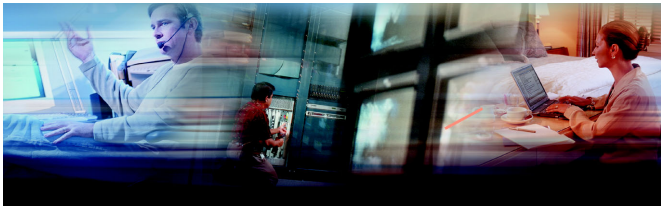


Overview

Cisco Multiservice Broadband Cable Guide

Purpose and Scope

Cisco Systems offers a complete portfolio of standards-based cable products, solutions, and network management systems that enable integration of data, voice, and video services on a single multiservice cable Internet Protocol (IP) network. Cable service providers can look to Cisco to deliver flexible, scalable, and cost-effective choices that extend from a cable headend or distribution hub, regional core or data center, all the way to the subscriber. With Cisco, cable service providers can expand their services, diversify their revenue streams, and become more competitive and successful.

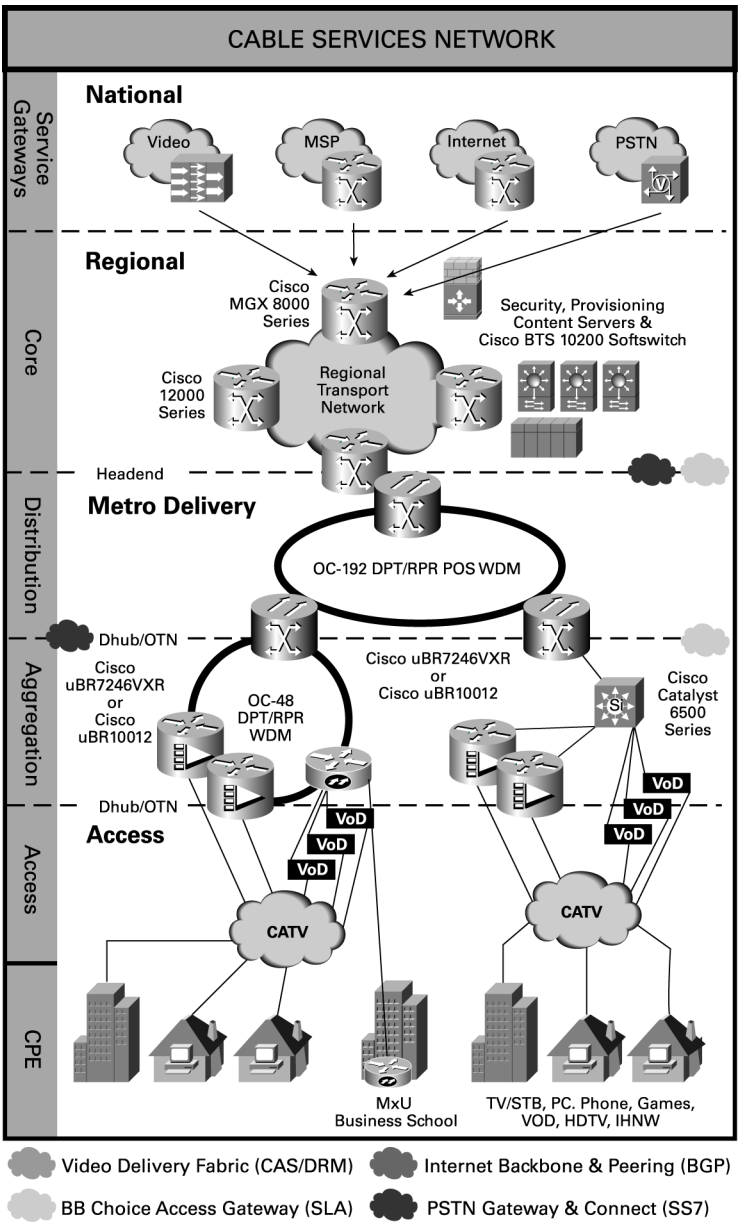
The *Cisco Multiservice Broadband Cable Guide* describes the Cisco products used to build the next generation cable IP network. This guide is intended for Cisco cable service providers, partners, resellers, and sales account teams that need a broad, high-level overview of Cisco cable products, solutions, network management systems, and programs.

Given the breadth of the Cisco offering and our continual innovations, there are likely to be new products, solutions, and programs not included when this guide was published. For up-to-date information, please refer to www.cisco.com/warp/public/779/servpro/solutions/cable/ or consult a Cisco representative.

Cisco Cable Offering

Cisco delivers the end-to-end products, solutions, and network management systems that give cable service providers demonstrable return on investment. We bring intelligence to the network. Only Cisco has the offering and expertise to build large-scale, multiservice cable IP networks. Leveraging the rich set of Cisco products and solutions, cable service providers can seamlessly integrate new technologies and

services, increase revenue with effective incremental investment, and offer more services over the same cable IP infrastructure. The following figure illustrates a large multiservice cable IP network:



IP has become the service convergence protocol of choice for business and residential customers. Flexible and media-independent, IP networking contains robust control mechanisms that lend themselves well to multiservice networking.

Cable service providers are uniquely positioned to rapidly deploy and sell leading-edge IP services because they own and control both the high-bandwidth infrastructures and the services sent across them. Internet service providers (ISPs) and telephone companies do not enjoy this built-in, ready-to-go advantage. With control over both infrastructure and service delivery, cable companies are strongly positioned to rapidly provision and deploy leading-edge IP services less expensively than time division multiplexed (TDM)-based providers. Cable service providers can use the same cable plant to deliver data, voice, and video services, and the same network management systems to provision and operate them. The per-port cost of provisioning voice-over-IP (VoIP) service is dramatically lower than public switched telephone network (PSTN) service. The result is cable service providers and their customers have greater flexibility, integration, and control over services.

Consolidating data, voice, and video capabilities onto a single cable infrastructure is just the beginning. The true promise of multiservice networking is the integration of data, voice, and video into powerful new applications. With Cisco, cable service providers can translate the promise of multiservice networking into profitable services today. Cable service providers can develop and deploy network architectures that last. They can build architectures that:

- Scale to handle growth in devices, ports, and bandwidth capacity
- Accommodate services today, as well as future innovative services
- Offer high availability—99.999% up time
- Administer bandwidth and services management through quality of service (QoS) which dynamically allocates bandwidth as needed for optimal efficiency and committed access rates (CAR) which rate-limit bandwidth on a per user basis
- Provide security through reverse path forwarding (RPF) checks which prevent denial-of-service attacks and through access control lists (ACL) which control user access permission to the network
- Support high transport technologies such as Dynamic Packet Transport (DPT) and Resilient Packet Rings (RPR), wave division multiplexing (WDM), synchronous optical network (SONET) / synchronous digital hierarchy (SDH)

The Cisco cable offering seamlessly blends high-speed broadband cable RF technology with the scalable, secure, and flexible technology we're known for in the IP core. We offer products and solutions compliant with all major standards for data-over-cable, voice, and video. Supported cable standards include Data-Over-Cable Service Interface Specifications (DOCSIS), European DOCSIS (EuroDOCSIS), and PacketCable.

Our high-performance and high-availability products and solutions allow cable service providers to maximize the efficiency of their hybrid fiber coaxial (HFC) networks and add leading-edge IP services that provide access to new markets and revenue streams. Cisco proven platforms, industry-leading market share, and comprehensive support give cable service providers an unprecedented array of capabilities. We enable delivery of differentiated services with guaranteed service levels.

The Cisco portfolio includes Cable Modem Termination Systems (CMTSs), cable customer premises equipment (CPE), IP backbone, edge, data center, service gateway equipment, and evolutionary multiservice switching systems. The Cisco offering includes:

- **CMTS systems**
  - The Cisco uBR7100 Series, Cisco uBR7200 Series, and Cisco uBR10012 Universal Broadband Routers combine a CMTS with a fully integrated Cisco IOS® Software router. Cisco introduced the first standards-based DOCSIS 1.0-qualified CMTS in 1998. Since then, Cisco developed key QoS technologies that are now part of DOCSIS 1.1 and PacketCable. We are the first vendor to offer multiple DOCSIS 1.1-qualified Layer 3 CMTSs. Cisco was the first to demonstrate critical PacketCable functionality including dynamic quality of service (QoS) in an end-to-end PacketCable-based VoIP architecture.
  - Cisco RF Switch works with the Cisco uBR10012 to offer a new level of high availability suited for DOCSIS, EuroDOCSIS, or PacketCable applications. Together with the Cisco uBR10012, the Cisco RF Switch enables a fully redundant CMTS with no single point of failure, including the upconverter.

- **Cable CPE**
  - Cisco uBR900 Series Cable Access Router offers a fully integrated business-class Cisco IOS Software router and DOCSIS 1.1 standards-based cable modem. The Cisco uBR900 Series integrates hardware-accelerated IP Security (IPSec) functionality, allowing cable service providers to support commercial and residential customers.
  - Cisco has identified and tested a number of third-party residential multimedia terminal adapters (MTAs) as part of its Residential VoIP CPE Partner Program. These products support VoIP standards including H.323, Network Control Signaling (NCS)/PacketCable, and GR303/V5.2 protocols.
- **Video**
  - Equipment such as the Cisco 6920 RateMUX® Advanced MPEG-2 Multiplexer—an advanced Moving Pictures Experts Group (MPEG) multiplexer that assists cable operators in creating customized digital program lineups, while maximizing the quantity and quality of programming in their digital tier.
- **IP Telephony**
  - Cisco AS5850 and Cisco AS5350 Universal Gateway
  - Cisco BTS 10200 Softswitch
  - Cisco MGX 8850 and MGX 8230 Multiservice Switch
  - Cisco 3660 Multiservice Platform

  Cisco designs and builds products that specifically address VoIP applications. Along with the Cisco uBR925 Cable Access Router, the products above can be used to support VoIP via a cable plant. Open Packet Telephony technology offers carrier-class voice quality and separates call control from switching functionality. The separation of these functions enables Cisco and an ecosystem of partners to develop new and innovative VoIP services and solutions on top of a DOCSIS or EuroDOCSIS infrastructure.

- **Cisco Cable-Ready Solutions**
  - The Managed Access Cisco Cable-Ready Solution enables cable service providers to grant subscribers their choice of ISP. For cable operators, there is new revenue opportunity in wholesale services. ISP partnerships can deliver the kind of extended reach and scale no single cable company can typically achieve by itself.
  - The MxU High-Speed Access Cisco Cable-Ready Solution allows cable service providers and multi-unit (MxU) businesses such as hotels, convention centers, apartment complexes, and the like, to leverage a cable infrastructure to quickly and cost-effectively construct an advanced broadband cable IP network that offers fast Internet access or virtual private networking (VPN) services.
  - The Basic H.323 Residential VoIP Cisco Cable-Ready Solution enables cable service providers to offer residential VoIP services. The solution gives operators an opportunity to gracefully migrate from a basic data service to higher-margin, highly differentiated value-added services. Cable operators can support VoIP, increase the utilization of the cable plant, reduce per-subscriber capital and operating costs, and support service level agreements. Subscriber experience and perception of cable service is enhanced—all, at minimal incremental cost.
- **Routers**
  - Cisco 7600 Series Internet Router offers wide area networking (WAN) and metropolitan area networking (MAN) services with comprehensive IP services at the network edge. IP services can be applied to rate-limit, shape, and account for traffic flows, allowing for maximum revenue generation per connection.
  - Cisco 10000 Series Internet Router is the premier edge aggregation product family from Cisco. The family offers Internet edge router choices that deliver highly available, line-rate performance without compromise for service providers deploying IP services to broadband, leased-line, ATM, and frame relay customers.
  - Cisco 12000 Series Internet Router offers a premier next generation high-end platform for service providers building the highest capacity and highest value IP networks in the regional or core network.

Adding new IP services such as VoIP, VPNs, IP multicast, and premium QoS can create considerable strain on existing resources and network designs. Cisco routers help you deliver IP services without compromise. We offer a full portfolio of products that include a broad range of transport interface choices and service modules.

- **Optical Transport**
  - Cisco ONS 15327 Edge Multiservice Provisioning Platform
  - Cisco ONS 15454 Multiservice Provisioning Platform
  - Cisco 10720 Internet Router

  Cisco optical transport products maximize service velocity, capacity, and variety from the metro edge to the long-haul network. The products offer complete optical restoration, topology, and transmission support to maximize service velocity. They deliver multiple services to maximize service density. They offer edge support for all optical interfaces to maximize service variety.
- **Ethernet Switching**
  - Cisco Catalyst® 3550 Series Intelligent Ethernet Switches
  - Cisco Catalyst 4000 Series
  - Cisco Catalyst 6500 Series

  Cisco switches used in cable network architectures support 10/100/GE/10GE Ethernet and WAN switching. We offer the highest density 10/100 Ethernet systems available.
- **OSS/Network Management**
  - Cable operational and support systems (OSS)
  - Cisco Address and Name Registrar
  - Cisco Broadband Provisioning Registrar
  - Cisco Broadband Troubleshooter
  - Cisco Building Broadband Service Manager
  - Cisco Cable Diagnostic Manager
  - Cisco Cable Manager
  - Cisco DOCSIS CPE Configurator
  - Cisco Info Center
  - Cisco Network Registrar
  - Cisco VPN Solution Center
  - CiscoWorks RME

Cisco provides the industry's most comprehensive alternatives to manage and provision advanced cable IP services. In addition to providing carrier-grade and scalable OSS components from Cisco and third-party partners, Cisco provides a flexible and complete OSS supporting cable business processes and models. The Cisco Cable Internet OSS approach is to manage the whole network—not just parts of it—to ensure integrity of offered services.

- **Cisco IOS® Software**
  - Cisco IOS Software is the industry-standard and most widely-deployed network system software that delivers intelligent network services. Cisco IOS Software enables today's cable service providers to efficiently deliver advanced services such as VPN, VoIP, and multicast. The QoS functionality in Cisco IOS Software allows service providers to tailor services to the needs of customers. Service providers are able to provide meaningful restrictions to prevent some subscribers from impairing the service of others who may be paying a premium. Because Cisco IOS Software is tightly integrated into Cisco equipment, delivering new services via future software is seamless to cable customers. As future releases of software become available, the delivery of new revenue-generating services becomes a simple matter of a software upgrade, thereby protecting the cable service provider's investment.
- **Services and Programs**
  - Turn-key, customizable marketing programs accelerate return on investment. Cisco offers a suite of high-speed acquisition programs, events, and campaigns that cable service providers can use to drive residential and commercial data, voice, and video subscription.
  - Certifications and education programs, acknowledged and respected worldwide, offer a complete suite of cable certifications designed for organizations and individuals supporting and maintaining two-way HFC cable IP networks.
  - Full Technical Assistance Center (TAC) support, advanced services, and cable solutions consulting allow cable service providers to choose from standard service packages or customized solutions tailored for unique environments. When cable service providers take advantage of Cisco support offerings, they are assured of rapid deployment, high-availability, and long life for the network.

Summary

The broadband cable market holds the promise of great profitability through value-added services.To tap it, cable service providers need the products, solutions, and technologies that enable them to offer and deliver scalable, secure, and reliable voice, data, and video services over a single, unified cable IP network.

With a proven track record in development of cable standards and advanced technologies, Cisco brings powerful, flexible, and end-to-end solutions to the cable industry. Years of IP networking experience, products, and know-how unequalled by any vendor uniquely qualify us to help you deliver leading-edge IP data, voice, and video services. See how Cisco can improve your business opportunities today and position your company for higher service levels, revenue growth, and market leadership for years to come.

CMTS Systems

Overview

Cisco offers the industry's broadest and most complete line of standards-based CMTS systems. Cisco brings intelligence to the DOCSIS or EuroDOCSIS network with integrated IP routing. All Cisco CMTS products leverage the same Cisco IOS Software that offers investment protection, reliable performance, and enhanced features.

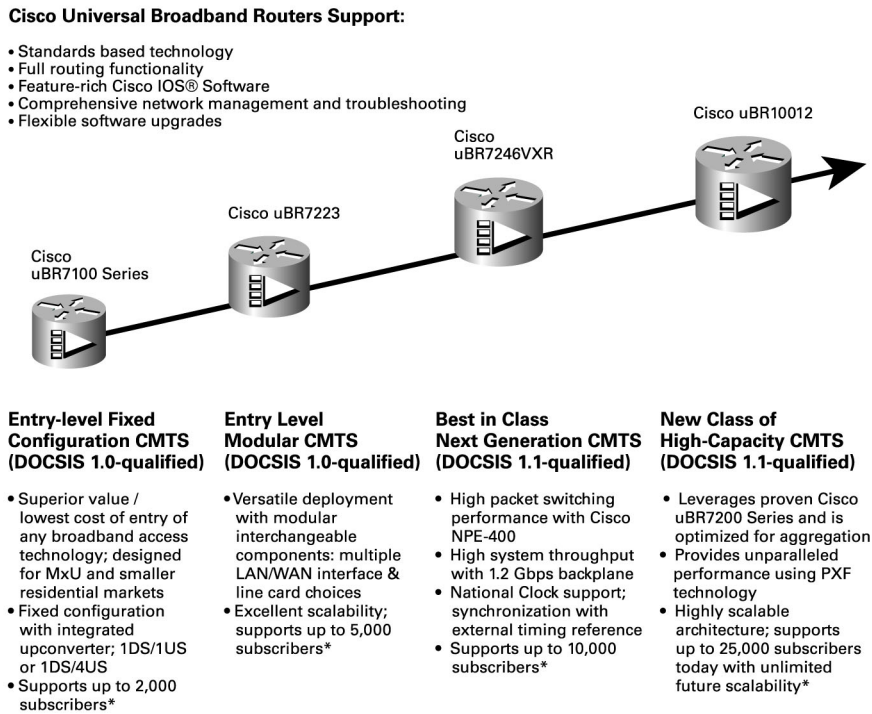
Cisco Universal Broadband Routers

The Cisco Universal Broadband Routers bring tremendous value to the digital broadband network by:

- Enabling the cost-effective deployment of advanced routing capabilities deep into the cable network
- Leveraging industry-standard routing hardware and Cisco IOS Software to deliver advanced network services and applications

The Cisco Universal Broadband Routers offer the highest port capacity and performance on the market today for a CMTS. Cisco has shipped one quarter million upstream CMTS ports, setting a cable industry milestone and affirming its CMTS leadership. With the successful deployment of over 250,000 upstream ports, Cisco enables cable operators to build an intelligent IP cable network that supports advanced services. Our products support an unprecedented array of capabilities that enable delivery of differentiated services with guaranteed service levels to large numbers of subscribers. The Cisco Universal Broadband Routers give cable service providers cost-effective market entry and network scaling alternatives.

The figure below positions respective products:



Cable Line Cards

Cisco provides a full set of cable line cards that interface the cable plant. The line cards support DOCSIS and EuroDOCSIS error correction encoding, modulation types, and formats. Policy-based and dynamic spectrum management features are offered. The cards give service providers differing downstream and upstream signal combining and splitting options.

The table below identifies line cards:

Line Card	Number of Upstream Ports	Number of Downstream Ports	Feature Differentiator
Cisco uBR-MC28C	8	2	Highest line card port density; supports dual 1x4 downstream-to-upstream port ratio DOCSIS (Annex B)
Cisco uBR-MC28C-BNC	8	2	Like the Cisco uBR-MC28C, offers the highest line card port density, but contains BNC connectors instead of F-connectors Supports dual 1x4 downstream-to-upstream port ratio DOCSIS (Annex B)
Cisco uBR-MC16S	6	1	Software and hardware spectrum management enhancements DOCSIS (Annex B)
Cisco uBR-MC16E	6	1	EuroDOCSIS (Annex A) support
Cisco uBR-MC16C	6	1	DOCSIS (Annex B)
Cisco uBR-MC14C	4	1	DOCSIS (Annex B)
Cisco uBR-MC11C	1	1	Cost-effective market entry for one-way cable plants; DOCSIS (Annex B)

Cisco was the first to introduce a line card that integrates a DOCSIS-qualified cable interface with an onboard spectrum analyzer. This card—the Cisco uBR-MC16S—maximizes spectrum utilization, improves response time to ingress and noise impairments, and provides intelligent "look ahead" capability to hop to a new center frequency in clear spectrum. The card increases cable plant availability and reduces reliance on costly spectrum analyzers at every headend or hub.

Cisco developed and introduced the industry's highest-density line card. Offering a total of two downstream and eight upstream ports each, the Cisco uBR-MC28C and Cisco uBR-MC28C-BNC significantly increase the number of subscribers a Cisco uBR7246VXR, Cisco uBR7223, or Cisco uBR10012 can support. Deploying advanced cable IP services means cable operators must be able to scale network bandwidth and support large numbers of subscribers efficiently and cost-effectively. The Cisco uBR-MC28C and Cisco uBR-MC28C-BNC line cards meet these needs.

Network Interfaces

Cisco Universal Broadband Routers offer a broad choice of network interfaces, allowing network-layer capabilities to be extended to a wide range of network configurations and environments. Most of the common LAN and WAN technologies are supported, such as:

- Ethernet, Fast Ethernet, Gigabit Ethernet
- Serial (T1/E1 and T3/E3)
- High-Speed Serial Interface (HSSI)
- ATM (T1/E1, T3/E3, OC3)
- Packet over Sonet (POS, OC3)

The network interfaces connect to the IP backbone and external networks, and meet requirements for high-performance Layer 3 services at affordable prices. Cisco gives service providers choices to meet planned and installed subscriber base, service offering, and external network connections.

Cisco RF Switch

Cisco also offers the Cisco RF Switch that works with the Cisco uBR10012 to support N+1 Hot Standby Redundancy. With connections to both the Cisco uBR10012 and the cable plant, the compact three-rack-unit (3 RU) Cisco RF Switch supports more than 250 connections. The Cisco uBR10012 and Cisco RF Switch, together, offer a new level of network redundancy suited for DOCSIS, EuroDOCSIS, or PacketCable high-performance, high-density applications.

Cisco CMTS Systems at a Glance

Product	Features	Page
Cisco uBR7100 Series Universal Broadband Router	Entry-level, fixed-configuration CMTS and integrated router for lower-density residential and MxU customers serviced by Tier 2/Tier 3 cable operators or ISPs. Choice of four DOCSIS- and EuroDOCSIS-qualified, fixed-configuration models that include: • Cisco uBR7111 • Cisco uBR7111E • Cisco uBR7114 • Cisco uBR7114E Integrated upconverter/modulator on the cable interface Embedded dual 10/100 BaseT Ethernet network interface Additional network interface with a variety of LAN and WAN options Supports up to 1,000*data customers	1-5
Cisco uBR7200 Series Universal Broadband Router	Modular, standards-based CMTS and integrated router for high-growth broadband cable deployments Two DOCSIS and EuroDOCSIS-qualified models that share cable line cards, LAN and WAN interface options, and processors: • Cisco uBR7223 supports up to 5,000 subscribers* • Cisco uBR7246VXR supports up to 10,000 subscribers*	1-7
Cisco uBR10012 Universal Broadband Router	Highest-capacity CMTS and integrated router on the market today that delivers the services, performance, scale, and carrier-class reliability large cable operators and ISPs demand High-performance aggregation platform that uses Parallel Express Forwarding technology Eight line cards that include support for two downstreams and eight upstreams each Four network interfaces that include support for 1 Gbps over Gigabit Ethernet or 622 Mbps over OC-12 Packet over SONET Cisco uBR10012 supports up to 25,000 subscribers*	1-9
Cisco RF Switch	Exceeds PacketCable Availability Requirements with N+1 Standby Redundancy Enables a fully redundant CMTS with no single point of failure Maximizes density with more than 250 MCX-type connector	1-11

* Numbers are for reference only. Actual numbers for specific systems will vary depending on network/service loading, traffic, and other parameters.

Cisco uBR7100 Series Universal Broadband Router

The Cisco uBR7100 Series is a complete, compact, easy-to-use product that enables cost-effective, high-speed Internet access in the hospitality multidwelling (MDU) and multitenant (MTU) market space using the coaxial cable already in a building. The product requires exceptionally low capital investment and minimal setup time to provide online Internet access and support residential voice services. For Tier 2 or Tier 3 cable operators, it is the industry's most cost-effective, feature-rich CMTS and integrated router. The Cisco uBR7111 and Cisco uBR7114 models are CableLabs qualified to DOCSIS 1.0 specifications. The Cisco uBR7111E and Cisco uBR7114E models are tComLabs qualified to EuroDOCSIS 1.0 specifications. The Cisco uBR7111 and Cisco uBR7111E contain one downstream port and one upstream port. The Cisco uBR7114 and Cisco uBR7114E contain one downstream port and four upstream ports. All models support bidirectional or telco-return traffic.

When to Use

Use This Product	When You Need
Cisco uBR7100 Series	• For MxU customers: the Cisco uBR7100 Series enables high-value Internet and residential voice services over a DOCSIS or EuroDOCSIS cable infrastructure • For cable operators: the Multi-tenant/dwelling Unit (MxU) market represents an untapped opportunity to expand broadband cable service. Given the small subscriber base of a typical MxU setting, the challenge has been to deliver robust services quickly and cost-effectively for an accelerated break-even point and a quicker return on investment—enabled by the Cisco uBR7100 Series

Key Features

- Complete package that includes a combined router and CMTS with an integrated upconverter, embedded Network Interface, and configuration tools to provision hosts, cable modems, and set top boxes
- Standards-based: DOCSIS 1.0 and DOCSIS 1.1-based; EuroDOCSIS models available
- Reliable operation to ensure the system remains online
- Uses Cisco IOS Software

Specifications

Feature	Cisco uBR7111 and uBR7114	Cisco uBR7111E and uBR7114E
Memory	Flash: 48 MB; System: 128 MB	Flash: 48 MB; System: 128 MB
Line Card with Integrated Upconverter (Cable Plant Interface)	uBR7111: 1 downstream and 1 upstream uBR7114: 2 downstream and 4 upstreams	uBR7111E: 1 downstream and 1 upstream uBR7114E: 2 downstream and 4 upstreams
Integrated Upconverter	DOCSIS Annex B, 6 MHz High level output: =+61dBmV, 55 to 858 MHz Optimized for 64 and 256 QAM	DOCSIS Annex A, 8 MHz, High level output: = +61 dBmV, 55 to 858 MHz Optimized for 64 and 256 QAM
Port Adapter (WAN or backbone Interface)	Embedded dual 10/100 BaseT Ethernet (TX FE) provided Supports one additional PA; options include the following using Cisco IOS Release12.1(8)EC minimum: Ethernet: • PA-4E-4-port Ethernet 10BASE-T Fast Ethernet: • PA-FE-TX-1-port 100BASE-TX Fast Ethernet • PA-FE-FX-1-port 100BASE-FX Fast Ethernet • PA-2FE-TX 2-port 100BASE-TX Fast Ethernet • PA-2FE-FX 2-port 100BASE-FX Fast Ethernet Serial: • PA-MC-4T1 4-port multichannel T1 Port Adapter with integrated CSU/DSUs • PA-MC-2T1 2-port multichannel T1 Port Adapter with integrated CSU/DSUs • PA-E3-1-port E3 serial Port Adapter with E3 DSU • PA-T3-1-port T3 serial Port Adapter with T3 DSU • PA-2E3-2-port E3 serial Port Adapter with E3 DSUs • PA-2T3-2-port T3 serial Port Adapter with T3 DSUs • PA-4T+-4-port serial Port Adapter, enhanced • PA-4E1G-75-4-port E1-G.703 serial Port Adapter (75-ohm/unbalanced) • PA-4E1G-120-4-port E1-G.703 serial Port Adapter (120-ohm/balanced) HSSI: • PA-2H-2-port HSSI ATM: • PA-A3-8T1IMA, 8-port ATM inverse T1 multiplexer Port Adapter • PA-A3-OC3SML—1-port OC-3c ATM, PCI-based single-mode long reach port adapter • PA-A3-OC3MM, 1-port ATM enhanced OC3c/STM1 multimode Port Adapter • PA-A3-OC3SMI—1-port OC-3c ATM, PCI-based single-mode intermediate reach port adapter POS: • PA-POS-OC3SMI, 1-port Packet/SONET OC3c/STM1 single-mode Port Adapter	Same as Cisco uBR7111 and Cisco uBR7114
Power Options	Single; 100 to 240 VAC input voltage	Single; 100 to 240 VAC input voltage
Minimum Cisco IOS Software Release	12.1(5)ECI minimum	12.1(7)EC minimum

For More Information

www.cisco.com/warp/public/cc/pd/rt/ub7100/index.shtml

Cisco uBR7200 Series Universal Broadband Router

The Cisco uBR7200 Series combines the functionality of a CMTS with an advanced router. The Cisco uBR7200 Series provides a single, multiservice, scalable platform that gives cable companies and ISPs the ability to deliver IP data and VoIP services to DOCSIS or EuroDOCSIS-compliant cable modems and set-top boxes. The Cisco uBR7200 Series is CableLabs qualified to DOCSIS 1.0 specifications. The Cisco uBR7246VXR is CableLabs qualified to DOCSIS 1.1 specifications. The product is also tComLabs qualified to EuroDOCSIS 1.0 specifications. The Cisco uBR7200 Series enables service providers to build cable network architectures that support two-way or one-way NTSC, PAL, or SECAM channel plans.

The products deliver a smooth migration path as cable operators upgrade their cable plants or expand their broadband service offerings. Because the products are designed with current and emerging standards, they offer scalability, flexibility, and investment protection.

When to Use

Use This Product	When You Need
Cisco uBR7246VXR	• Positioned for high-growth cable deployments • Flexible port expansion for multiservice deployment options • Supports up to 10,000 subscribers* per chassis with 1 Gbps back plane • 4 line card slots, 2 port adapter slots, 1 I/O controller slot, 1 NPE slot, and 1 clock card slot for VoIP
Cisco uBR7223	• Positioned for mid-to-small cable deployments • Compact and modular to give service providers a choice in configuration • Supports up to 5,000 subscribers* per chassis with 600 Mbps back plane • 2 line card slots, 1 slot for single-width port adapter, 1 I/O controller and 1 NPE slot

Key Features

- Standards-based—Supports DOCSIS/EuroDOCSIS 1.0 and DOCSIS 1.1
- Modularity allows for customized configuration per plant characteristics for optimization of topology and network bandwidth
- Cisco IOS Software—Delivers proven stability and offers advanced features such as multiprotocol routing, tunneling, bandwidth management, QoS, guaranteed service levels, service-level monitoring and many CPE management options

- Ease of management and upgrades—Supports online insertion and removal of components to allow seamless upgrades of port adapters, line cards, and power supplies without service interruption. Provides single, centralized point of administration for remote devices

Specifications

Feature	Cisco uBR7246VXR	Cisco uBR7223
Cable Line Cards and Number of Slots	4	2
Supported cable line cards (Cable Plant Interfaces)	uBR-MC11C; uBR-MC14C; uBR-MC16C; uBR-MC16E; uBR-MC16S; uBR-MC28C; uBR-MC28-BNC	uBR-MC11C; uBR-MC14C; uBR-MC16C; uBR-MC16E; uBR-MC16S; uBR-MC28C; uBR-MC28-BNC
Port Adapter Slots (LAN/WAN interfaces)	2	2
Supported PA categories	Ethernet: Fast Ethernet; Gigabit Ethernet Serial (V.35, E1-G.703/G.704, T3/E3) Serial Multi-channel T1 HSSI ATM T3/E3 ((PCI-based) ATM OC-3c (PCI-based) POS OC-3c DPT OC-12c/STM4c	Fast Ethernet Serial (V.35, E1-G.703/G.704, T3/E3) Serial EIA/TIA-232 Serial X.21 Serial Multi-channel T1 Serial Multi-channel E1 Serial Multi-channel T3/E3 HSSI ATM T3/E3 ((PCI-based) ATM OC-3c (PCI-based) POS OC-3c
Power Supply Shots	2	1
Power Supply Option	AC; Dual AC; DC; Dual DC	AC; DC
Input/Output (I/O) controller	uBR7200-I/O uBR7200-I/O-FE	uBR7200-I/O uBR7200-I/O-FE
I/O flash options for PCMCIA slots	Flash memory (20MB) Flash disk (48 MB) Flash disk (128 MB)	Flash memory (20MB) Flash disk (48 MB) Flash disk (128 MB)
Network processing engines (NPE)	NPE-400, and NPE-225	NPE-225 and NPE-200
Add-on processor memory options	SDRAM (128 MB, 256 MB) for NPE-225 only SDRAM (128 MB, 256 MB = 512 MB) for NPE-400 only	SDRAM (128 MB, 256 MB) for NPE-225
Router Bandwidth	1 Gbps	600 Mbps

For More Information

www.cisco.com/warp/public/cc/pd/rt/ub7200/

Cisco uBR10012 Universal Broadband Router

The Cisco uBR10012 Universal Broadband Router is a new class of CMTS, that handles the volume, capacity, and complexity of large cable headends or distribution hubs. It combines the revenue-generating features and stability of the market-leading Cisco uBR7200 Series with an architecture that is optimized for aggregation and virtually limitless future growth. The Cisco uBR10012 goes beyond the traditional "carrier class" definition, to deliver the highest level of service availability and capacity of any production CMTS available today. It employs a mix of distributed, centralized, and parallel processing to enable consistently high, real-world performance. The Cisco uBR10012 is CableLabs qualified to DOCSIS 1.0 and DOCSIS 1.1 specifications. The product is also tComLabs qualified to EuroDOCSIS 1.0 specifications.

When to Use

Use This Product	When You Need
Cisco uBR10012	• High-end throughput, capacity, and service handling for a mix of IP data, voice, and video services over cable—supporting a wide variety of applications, media, session types, subscriber profiles, and access devices • Support for advanced feature sets, varying QoS requirements, service-level differentiations, and transport strategies (MPEG, IP, multicast, unicast, broadcast) that include implementing flow control to various cable CPE devices

Key Features

- Highest-capacity CMTS that leverages the proven stability of the industry-standard Cisco uBR7200 Series, the highly scalable architecture of the Cisco 10000 Internet Router, and feature-rich Cisco IOS Software
- Multiservice support, optimized to provide high throughput and accelerated processing using PXF technology; exceptional throughput on each connection in the chassis is achieved
- Standards-based design, support includes DOCSIS 1.0 and DOCSIS 1.1
- Reliability—Designed to eliminate single points of failure and allow technicians to swap out cards online; architected to provide redundancy throughout the system that includes redundant processing engines, bus interconnects, and power supplies

- Secure, scalable choices protect your investment and ensure current and future business growth can be accommodated; the architecture supports planned system and network expansion, including scaling IP services forwarding capacity, increasing connection speeds and densities, and extensive route scaling techniques

Specifications

Feature	Cisco uBR10012
Modular Slots	8 slots for cable line cards that include support for 2 downstreams and 8 upstreams each 4 slots for LAN/WAN interfaces 2 slots for Performance Routing Engines (PREs) 2 slots for Timing Communication and Control Plus (TCC+) modules
Supported Cards	Cable line cards with a Cisco Line Card Processor (LCP) Timing, Communications, and Control Plus (TCC+) card Gigabit Ethernet (GE) network uplink card OC-12 Packet Over SONET (POS) network uplink card
Processor Type	Parallel Express Forwarding (PXF)
Flash Memory	48 MB (default); 128 MB (maximum)
DRAM Memory	512 DRAM (default)
Software Supported	Minimum software requirement: Cisco IOS Software Release 12.2(2)XF
Power Supply	DC, AC
Hot-Swappable	Yes
Backplane Capacity	51.2 Gbps
Physical Dimensions (H x W x D)	Height: 31.25 in. (79.4 cm)—18 rack units (RU) Width: 17.2 in. (43.7 cm) Depth: 22.75 in. (57.8) Mounting: 19 in. rack mountable (front or rear), 2 units per 7 ft. rack Note: Mounting in 23 in. racks is possible with optional third-party hardware
Weight	Weight: 235 lb (106.6 kg) fully configured chassis

For More Information

www.cisco.com/warp/public/cc/pd/rt/ub10012/

Cisco RF Switch

The Cisco RF Switch works with the Cisco uBR1002 Universal Broadband Router to provide a fully redundant DOCSIS system that enables cable service providers to achieve PacketCable system availability, minimize service disruptions, and simplify operations. The Cisco RF Switch is part of the company's newest high-availability N+1 solution set. In combination with the Cisco uBR10012, the Cisco RF Switch enables a fully redundant CMTS with no single point of failure. The product maximizes density with more than 250 MCX-type connectors that interface the Cisco uBR10012 and the cable plant. The Cisco RF Switch contains RF combiners/splitters, RF switch logic, and RF switch drivers. The product offers ten upstream switch modules, three downstream switch modules, an Ethernet controller module, an AC or DC power supply, and color coding, preterminated cabling.

When to Use

Use This Product	When You Need
Cisco RF Switch	As cable service providers enter the VoIP market, high availability (24x7 service) for broadband cable IP services is becoming a requirement. The Cisco RF Switch enables cable service providers to achieve PacketCable system availability, minimize service disruptions, and simplify operations.

Key Features

- Front-panel serviceability with module Hot Swap capability that eliminates downtime for RF paths
- Modular upstream and downstream capacity with ten upstream, three downstream, and one blank slot that optimizes the serviceability of the CMTS; each of the 14 modules represent a port on a cable line card. Each switch module contains seven working or "active" inputs, plus one protect or "standby" input and seven protected outputs. Inputs are connections from the Cisco uBR10012 to the Cisco RF Switch. Outputs are connections from the Cisco RF Switch to the HFC plant. The Cisco RF Switch supports independent switching of upstream ports
- Fully passive working path; hardware components do not affect data and VoIP services
- Active components only in protect path; servicing of protect cards offer no disruption to data and VoIP services
- Position-sensing latching relays; robust design maintains operation during power disruptions

- Flexible, external design with more than 250 connectors—unmatched port density
- N+1 redundancy
- 10BaseT Ethernet control

Specifications

Feature	Cisco RF Switch
Input Power Requirements	• AC: 100 to 240 VAC, 50 or 60 Hz, operating range: 90 to 254 VAC • DC: -48 to -60 VDC, operating range: -40.5 to –72 VDC, 200 mVpp ripple/noise
Environmental	• Operational temperature range: 0 to +40°C • Operating temperature range: -5 to +55°C
Unit Control	• 10BaseT Ethernet—SNMP • Switching time from active (working) to standby (protect): 150 mS maximum after SNMP command • Cisco uBR10012
Connectors	• RF connectors: MCX • AC power: IEC320 type • DC power: Three terminal block • Ethernet: RJ-45 • RS-232 Bus: 9-pin male D
Reliability	• 41,000 MTBF @ +50°C as calculated by Bellcore 5, 80 percent confidence factor
Physical	• Dimensions (H x W x D): 19 x 15.5 x 5.25 in. (842 x 384 x 132 mm) • Weight: 36 lbs
Input Power Requirements	• AC: 100 to 240 VAC, 50 or 60 Hz, operating range: 90 to 254 VAC • DC: -48 to -60 VDC, operating range: -40.5 to –72 VDC, 200 mVpp ripple/noise
Environmental	• Operational temperature range: 0 to +40°C • Operating temperature range: -5 to +55°C
RF requirements	• Input/output impedance: 75 ohms • Maximum RF input power: +15 dBm (63.75 dBmV) • Switch type: Electro-mechanical, absorptive for working path, non-absorptive on the protect path • Switch setting time per switch module: 20 ms maximum • Downstream frequency range: 54 to 860 MHz • Typical downstream insertion loss: +/-1.1 dB from CMTS to cable plant; +/- 2.1 dB from protect to cable plant; 5.5 dB from working to output; 8.0 dB from protect to output • Downstream insertion loss flatness: +/- 1.1 dB from CMTS to cable plant; +/- 2.1 dB from protect to cable plant • Downstream output return loss: >15.0dB at <450 MHz, > 12.0 dB at >= 450 MHz • Downstream input return loss: >15.0 dB • Downstream isolation: > 60 dB from channel to channel in working mode; > 52 dB from CMTS to protect when in protect mode • Upstream frequency range: 5 to 70 MHz • Typical upstream insertion loss: 4.1 dB from cable plant to CMTS; 5.2 dB from cable plant to protect • Upstream insertion loss flatness: +/- 0.4 dB from cable plant to CMTS, +/- 0.6 dB from cable plant to protect • Upstream input return loss:> 16 dB • Upstream isolation: > 60 dB from channel to channel in working mode; > 60 dB from CMTS to protect when in protect mode • Protect mode: CMTS return loss >10 dB, cable plant return loss: >10dB

For More Information

www.cisco.com/warp/public/cc/pd/ifaa/rfswitch/

Cable CPE

Overview

Cisco offers cable CPE products that integrate a DOCSIS or EuroDOCSIS cable modem and business-class Cisco IOS Software router in one box. Fully standards-based, Cisco CPE products can operate in bridge mode similar to any DOCSIS or EuroDOCSIS-compliant cable modem. By enabling Cisco IOS IP routing and other advanced features, cable operators can transform these products into powerful CPE or enterprise devices to support small businesses, branch offices, or telecommuters.

Two models are offered: one supporting data; the other supporting data and VoIP. Both models support virtual private networking (VPN) to enable cable service providers to supply reliable, high-speed Internet and intranet access to businesses, telecommuters, branch offices, and residences.

Cable CPE Products at a Glance

Product	Features	Page
Cisco uBR900 Series Cable Access Routers	Integrated DOCSIS-based cable modem and router with hardware accelerated IPSec VPN tunneling support that includes: • Cisco uBR925 with 4 Ethernet, 1 CATV, 1 USB and 2 FXS ports that support telecommuter and small office DOCSIS-based data, VoIP, and VPN services • Cisco uBR905 with 4 Ethernet and 1 CATV port that supports DOCSIS-based data and VPN services	2-2
Cisco VoIP Residential CPE Partner Program	Designed to meet service provider needs for low-cost residential VoIP modems; Through collaborative interoperability testing within Cisco, we have identified low-cost, third-party MTAs that perform IP telephony control functions	2-3

Cisco uBR900 Series Cable Access Routers

The Cisco uBR900 Series Cable Access Routers provide commercial services for cable operators, allowing them to expand their broadband service offerings. The Cisco uBR925, an integrated DOCSIS cable modem and business-class Cisco IOS Software router, provides an easy-to-manage solution for telecommuters and small offices. It offers voice-over-IP (VoIP), virtual private networking (VPN), and router functionality in a one-box solution. Both the Cisco uBR905 and Cisco uBR925 are CableLabs-certified to DOCSIS 1.0 specifications and support IP data transmission over a cable plant. Both Cisco uBR900 Series models offer hardware-accelerated IPSec VPN support.

Key Features

- Integrated high-speed cable modem and router that operates with any DOCSIS 1.1 or DOCSIS 1.0-compliant CMTS; both Cisco uBR900 Series models are DOCSIS 1.1-ready
- Integrated Cisco IOS Software router, cable modem, and four-port Ethernet hub that offers advanced networking capabilities and investment protection
- Cisco IOS Software-based, simplifies training and leverages existing knowledge

When to Use

Use This Product	When You Need
Cisco uBR905 Cable Access Router	• Data-only broadband services (or voice separately via Ethernet) • High-speed, secure remote tunneling via hardware accelerated IPSec VPN
Cisco uBR925 Cable Access Router	• Two voice (VoIP) connections via RJ-11 ports • Data broadband services, router functionality, and VPN support

Specifications

Feature	Cisco uBR905	Cisco uBR925
Ports	4-port 10Base-T Ethernet hub 1-port console 1-port CATV (Female F Connector)	4-port 10Base-T Ethernet hub 1-port USB 2 ports RJ-11 (telephone) 1-port console 1-port CATV
Routing Features	NAT/PAT, DHCP Server	Same as Cisco uBR905
Security Features	56-bit IPSec 3DES IPSec optional IPSec hardware acceleration Firewall optional	Same as uBR905
Voice Support	No	Yes

For More Information

www.cisco.com/warp/public/cc/pd/rt/900/

Cisco VoIP Residential CPE Partner Program

To help drive deployment of residential VoIP services to market, Cisco offers a program that identifies low-cost residential VoIP modems that have passed interoperability testing with Cisco. Cable service providers should contact their sales representatives for vendors, models, pricing and volume discount opportunities. The Cisco sales teams should work directly with partners. For details on this program, please email: cablecpe@cisco.com

Video

Overview

Integrating advanced digital video functionality into its offering, the Cisco 6920 RateMUX® is the first in a series of Cisco products designed to allow cable service providers to maximize bandwidth efficiency and distribution of digital video. The Cisco 6920 RateMUX combines digital programming from a variety of sources into a single, multiplexed optimized MPEG transport stream for distribution over an HFC cable network. The product provides advanced MPEG-2 stream manipulation including real-time bit-rate manipulation, splicing, statistical multiplexing, and customized channel line ups.

The Cisco 6920 RateMUX supports:

- Grooming of digital program lineups—Operators are able to customize local channel lineups from a variety of sources to align their services with the preferences of their subscriber base
- Enhanced television—Electronic program guides and other "interactive" data can be multiplexed into the MPEG transport for use by the set-top box (STB)
- HDTV service—The Cisco 6920 RateMUX can multiplex in HDTV with statistically multiplexed SDTV programs to maximize the HDTV's output transport
- Ad insertion in the digital tier—Local insertion of digital advertising, station promotions, or other digital programming into a source program stream through Digital Program Insertion (DPI) is supported in the Cisco 6920 RateMUX

Video at a Glance

Product	Features	Page
Cisco 6920 RateMUX Advanced MPEG-2 Multiplexer	Specialized multiplexing device that performs advanced MPEG2 stream manipulation to allow cable, satellite and broadcast operators to support: • Customized channel lineups • Real-time bit rate manipulation • Rate reduction/splicing functionality and standards-based API support to interoperate with Ad Servers for local ad insertion in the digital (MPEG) video domain • Re-stat muxing • TV program grooming or add/drop • Ad insertion in the digital tier	3-2

Cisco 6920 RateMUX Advanced MPEG-2 Multiplexer

The Cisco 6920 RateMUX® is an advanced Moving Pictures Experts Group (MPEG) multiplexing device that assists cable operators in creating customized digital program lineups. The product extends the life of existing cable plant and set-top equipment by providing a smooth migration path to new digital services such as “enhanced” television and HDTV. The Cisco 6920 RateMUX aggregates or multiplexes the digital program streams from satellite receivers and local encoders and produces standard MPEG-2 transports which are exported to conditional access (CA)/quadrature amplitude modulation (QAM) devices for distribution through the cable RF plant.

The Cisco 6920 RateMUX accepts discrete MPEG-2 input through interfaces compliant with Digital Headend Interface (DHEI) or Digital Video Broadcasting-Asynchronous Serial Interface (DVB-ASI) standards. It then uses a powerful digital signal processor (DSP) engine to produce MPEG-compliant transport streams that have been optimized (statistically multiplexed) through the use of intelligent buffer management and selective bit rate reduction during bit rate peaks.

When to Use

Use This Product	When You Need
Cisco 6920 RateMUX Advanced MPEG-2 Multiplexer	• Cable operators who are interested in the ability to increase the number of programs in their existing digital tier • The upgrade of cable plants from 64 to 256 QAM provides another opportunity for operators to add programming to their digital tier • The rollout of HDTV presents a need to support SDTV in the unused portion of the HDTV transport

Key Features

- Overall
  - Transport grooming to allow cable operators to customize digital program lineups
  - Statistical remultiplexing to optimize output transport bandwidth
  - Bit-rate reduction:

    Statistical multiplexing

    Peak rate management

    Matching digital ad to source program stream rate
- Packet Identifier filtering and remapping to accept programming from multiple sources
- Program Clock Reference jitter correction to ensure smooth display of video on set-top boxes
- Preserve selected program quality to ensure sustained video quality
- Set relative picture quality among all channels to gain flexibility for channel use while protecting high-profile program quality
- Settable output rate to customize output bandwidth to match a specific modulation scheme

- DPI capabilities:
  - MPEG splicing to support local ad insertion without the expense and effort of decoding, splicing, and re-encoding satellite feeds
  - DPI API support to allow for interoperability with third-party ad servers
  - Digital cue detection to enable time-accurate insertion of ads into the digital stream
- HDTV capabilities:
  - Pass-through of HDTV to meet FCC mandates for carrying off-air HDTV broadcast programs
  - Remultiplexing data tables from PSIP-generator to provide support for advanced digital services deployed on PSIP-compliant STBs
- Data capabilities:
  - Remultiplex conditional access and EPG information to incorporate architecture-specific data in the MPEG transport stream, including data associated with video scrambling
- Configuration capabilities:
  - Web browser graphical user interface for easy configuration; dedicated management PC is not required
  - Simple Network Management Protocol (SNMP) support for standards-based network monitoring

Specifications

Feature	Cisco 6920 RateMUX
Input/Output Specifications	
Digital video format	MPEG-2 main profile at main-level bit rate </=15 Mbps for SD transcoding; MPEG-2 main profile at high-level bit rate </=20 Mbps for HD pass-through
Video resolution, vertical	480, 240 (NTSC), and 576, 288 (PAL)
Video resolution, horizontal	704, 544, 352
Video aspect ratios	4:3 or 16:9
Digital audio formats	Musicam, Dolby AC3
Ethernet Port	
Interface	10BaseT
Protocol	Transmission Control Protocol/Internet Protocol (TCP/IP)
Debug/Config Port	
Interface	RS-232
Input Interface	
Number of inputs	Up to 15 per chassis
Interface	DHEI, DVB-ASI
Information rate	38.8 Mbps for DHEI, 216 Mbps for DVB-ASI
Output Interface	
Number of outputs	Up to four per chassis
Interface	DHEI, DVB-ASI
Information rate	38.8 Mbps for DHEI, 76 Mbps for DVB-ASI
Chassis	7 in. (17.8 cm) height 4RU 19 in. (48.3 cm) width 19 in. (48.3 cm) depth Fully configured chassis weight is 40 lb (18.4 kg)
Power	100 to 240 VAC, 50/60 Hz, 7A 55W fully loaded
Temperature	32°F (0°C) to 104°F (40°C)

For More Information

www.cisco.com/warp/public/cc/pd/mxsv/rmux/index.shtml

IP Telephony

Overview

With access to a vast number of households, cable operators are in an excellent position to offer residential IP telephony services. Experienced in building both robust IP telephony networks and cable architectures, Cisco has the expertise and products to build end-to-end Cable VoIP networks. Cisco is a vital contributor to CableLab's PacketCable specification designed to seamlessly integrate cable and telephony products over DOCSIS-based networks.

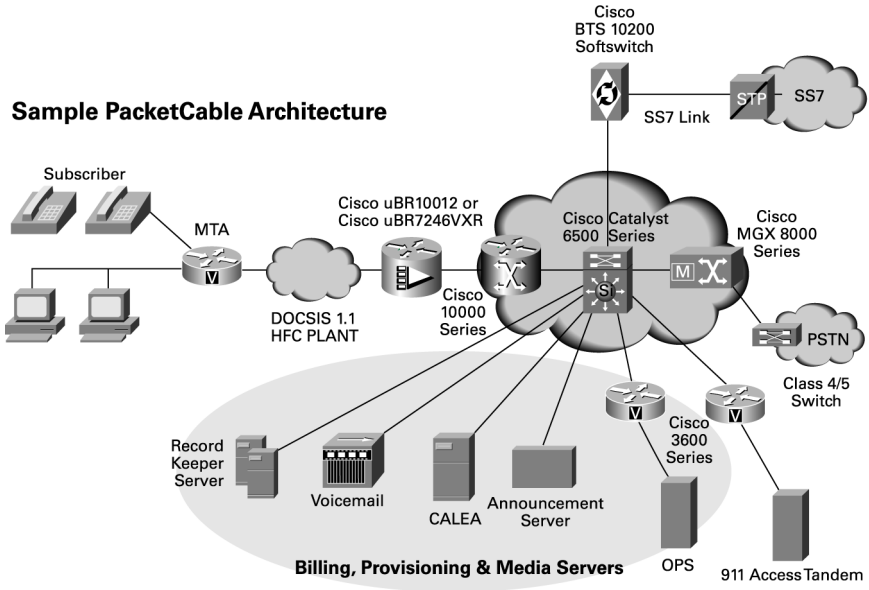
PacketCable-compliant networks use Multimedia Gateway Control Protocol Network-based Call Signaling (MGCP-NCS) to provide centralized call control via an intelligent call agent. To allow seamless mixing of voice, video, and data in a unified data stream, the HFC plant should meet DOCSIS 1.1 specifications. DOCSIS 1.1 offers enhanced Quality of Service (QoS) features that give priority for real-time traffic such as voice and video.

Key components of a multiservice cable IP network include:

- The Cisco uBR10012 or Cisco uBR7246VXR Universal Broadband Router that provide multiple functions in the architecture including Dynamic Quality of Service (DQoS), event messaging and security
- Multimedia Terminal Adapters (MTAs) located at subscriber residences that communicate with the Cisco uBR7246VXR or Cisco uBR10012
- The Cisco BTS 10200 Softswitch that provides call-control intelligence for establishing, maintaining, routing, and terminating voice calls; it also serves as an interface to enhanced, converged voice-and-data services and application platforms such as voice mail and unified messaging
- Media gateways, also called trunking gateways, that provide connectivity to the PSTN
- Cisco Broadband Provisioning Registrar that provisions telephony service

Cisco partners with third-party vendors to provide other media and billing mediation services that comprise an end-to-end IP telephony solution. The provisioning component in the telephony design not only includes standard DOCSIS provisioning components such as DNS, DHCP, TFTP, and TOD servers, but also adds in a Kerberos server for security. Provisioning and Kerberos servers act together to provide a secure provisioning environment to provision vendor-independent CPE. The media servers are add-on components that make the service offering more robust. They add functionality on top of the architecture, providing services such as lawful intercept requirements for CALEA; announcement and conference servers such as voice mail. The record-keeping server is a billing mediation device that collects events from various points in the network, collates them, and forms call detail records for use by a billing system.

The figure below illustrates a cable VoIP architecture.



IP Telephony at a Glance

Product	Features	Page
Cisco AS5350 Universal Gateway	High performance, 1RU, universal gateway Universal Port technology for data/voice/fax on any port, at any time 2,4, & 8 T1/E1/PRI configurations for 48 to 214 channels Supports broad range of async/ISDN/VoIP/wireless protocols Redundant 10/100 Ethernet ports, Redundant 8 Mbps serial backhaul ports SS7 interconnect for voice and dial Flexible, redundant backhaul methods BITS clock interface Hot swappable feature cards	4-3
Cisco AS5400HPX Universal Gateway	High performance, 2RU, universal gateway Universal Port technology for data/voice/fax on any port, at any time 8 to 16 T1/E1/PRI or 1 CT3 configuration for 192 to 648 channels Low power and high availability design Supports a broad range of async/ISDN/VoIP/fax/wireless protocols SS7 interconnect for voice and dial Flexible, redundant backhaul methods BITS clock interface Hot swappable feature cards	4-7
Cisco AS5850 Universal Gateway	High performance, 14RU, universal gateway Universal Port technology for data/voice/fax on any port, at any time Supports 1 to 4 CT3s, 24 to 96 T1s (86 E1s) Supports a broad range of async/ISDN/VoIP/fax/wireless protocols SS7 interconnect for voice and dial Flexible, redundant backhaul methods BITS clock interface Hot swappable feature cards	4-10
Cisco BTS 10200 Softswitch	Provides call-control intelligence for establishing, maintaining, routing, and terminating voice calls Serves as an interface to enhanced, converged voice-and-data services and application platforms such as voice mail and unified messaging	4-13
Cisco MGX® 8000 Series Carrier Voice Gateways	The Cisco MGX 8000 Series Carrier Voice Gateways are high capacity, carrier-class voice gateways that offer standards-based support for VoIP and voice over ATM (VoATM) services. The Cisco MGX 8000 Series combine the industry's highest quality packet voice with the extensible architecture and measured greater than 99.999 percent network availability of the Cisco MGX 8000 Next Generation Multiservice Switches	4-15
Cisco 3600 Series	Cisco's full line of multiservice routers also provide analog and digital voice gateway functionality through use of network modules and voice interface cards. The Cisco 3660 Multiservice Platform is typically used in cable configurations to serve as a voice gateway.	4-16

Cisco AS5350 Universal Gateway

The Cisco AS5350 Universal Gateway is the industry's only one-rack-unit, two, four, or eight-port T1/E1 universal gateway that provides universal port data, voice, and fax services on any port at any time. The Cisco AS5350 offers high-performance and high-reliability in a compact, modular design. This cost-effective platform is ideally suited for ISPs and enterprises that require innovative universal services.

Cisco AS5350 supports a wide range of IP-based value-added services such as high-volume Internet access, regional/branch-office connectivity, corporate virtual private networks (VPNs), mobile wireless solutions, long distance for ISPs, international wholesale long distance, distributed prepaid calling, Signaling System 7 (SS7) interconnect, and enhanced voice services.

When to Use

Use This Product	When You Need
Cisco AS5350	• 1 RU modular high-performance two to eight channelized T1/E1/PRI system • Universal Gateway—remote access server and voice gateway • Universal DSPs—data, voice, and fax services on any DSP, at any time • Tier 2/3 ISPs and enterprises requiring innovative universal services

Key Features

- 1 RU modular high-performance two to eight channelized T1/E1/PRI system
- Universal Gateway—Remote Access Server and Voice Gateway
- Universal DSPs—Data, voice, and fax services on any DSP at any time
- Ideal for Tier 2/3 ISPs and enterprises requiring innovative universal services
- Feature cards:
  - two, four, or eight CT1/CE1/PRI feature cards (ISDN calls terminated on the card)
  - 60 or 108 channel Universal Port feature card
- Redundant 10/100BaseT autosensing Ethernet LAN ports
- CT3 feature card support
- Redundant 8 Mbs serial WAN ports for Frame Relay, HDLC, or PPP WAN backhaul
- One fast console port for local administrative access; one auxiliary port for remote administrative access
- Carrier-class resiliency:
  - All feature cards and fan trays are hot swappable
  - AC or DC internal power supply with dual fans
  - Redundant LAN/WAN backhaul ports
  - Thermal management and environmental monitoring
- Cisco SS7 signaling gateway interoperability
- ETSI/NEBS Level 3 compliant

Specifications

Feature	Cisco AS5350
Processor	250 MHz RM7000 RISC processor
Memory	SDRAM: 128 MB (default), 512 MB (maximum) Shared Input/output (I/O): 64 MB (default), 128 MB (maximum) Boot Flash: 8 MB (default), 16 MB (maximum) System Flash: 32 MB (default), 64 MB (maximum) Layer 3 Cache: 2 MB
Feature Card Slots	Three slots
Egress Ports	Redundant 10/100-MB Ethernet ports Redundant 8-MB serial ports T1, E1 DS1 trunk feature cards
LAN Protocols	IP, IPX, AppleTalk, DECNet, ARA, NetBEUI, bridging, HSRP, 802.1P, 802.1Q
WAN Protocols	Frame Relay, PPP, HDLC (leased line)
Routing Protocols	RIP, RIPv2, OSPF, IGRP, EIGRP, BGPv4, IS-IS, AT-EIGRP, IPX-EIGRP, Next Hop Resolution Protocol (NHRP), AppleTalk Update-Based Routing Protocol (AURP)
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 (MP), MLP, 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.729ab, GSM-FR, G.726, G.Clear
DSP Voice Features	Echo cancellation, programmable up to 128ms 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 Multifrequency (MF), Continuity testing (COT) DTFM relay using RFC 2833 Modem/fax passthourgh
Voice and Fax Signaling Protocols	H.323v2/v3, SIP, MGCP 1.0, TGCP 1.0 T.38 real-time fax relay T.37 fax store and forwad Open Settlements Protocol (OSP) Fax detection
Network Security	RADIUS or TACACS+ PAP or CHAP authentication Local user/password database DNIS, CLID, call-type preauthentication Inbound/outbound traffic filtering (including IP, IPX, AppleTalk, bridged traffic) Network Address Translation (NAT) Dynamic access lists
Virtual Private Networking	IP Security (IPSec) Policy enforcement (RADIUS or TACACS+) L2TP, Layer 2 Forwarding (L2F), and generic routing encapsulation (GRE) tunnels Firewall security and intrusion detection QoS features (committed access rate [CAR], Random Early Detection [RED], IP Precedence, policy-based routing)
Channelized T1	Robbed-bit signaling; Loop Start, Immediate Start, and Wink Start Protocols
Channelized E1	CAS, PRI, E1 R1, E1 R2, leased line, Frame Relay

Feature	Cisco AS5350
ISDN Protocols Supported	Sync mode PPP, V.120, V.110 at rates up to 38400 bps Network- and User-side ISDN NFAS with backup D-channel QSIG, Feature Group B, Feature Group D DoVBS
Modem Protocols Supported	V.92 Modem on Hold, Quick Connect V.90 or V.92 standard supporting rates of 56000 to 28000 in 1333-bps increments K56Flex at 56000 to 32000 in 2000-bps increments V.44 compression Async-mode PPP 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 ITU-T V.34 Annex 12, ITU-T V.42bis, V.32bis and many others
Wireless Protocols Supported	V.110 and V.120
Full Cisco IOS Support	IP Plus and Enterprise Plus feature sets
Console and Auxiliary Ports	Asynchronous serial (RJ-45)
Chassis Dimensions (H x W x D)	1.75 x 17.5 x 22.5 in.
Chassis Weight (fully loaded)	22 lb maximum (10kg)

For More Information

www.cisco.com/go/as5350

Cisco AS5400HPX Universal Gateway

The Cisco AS5400HPX Universal Gateway offers unparalleled capacity in only two rack units (RUs) with 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 Cisco AS5400HPX Universal Gateway ideal for many network deployment architectures.

The Cisco AS5400HPX provides enhanced performance for processor intensive voice and fax applications. It supports a wide range of IP-based value-added services such as high-volume Internet access, regional/branch-office connectivity, corporate virtual private networks (VPNs), mobile wireless solutions, long distance for Internet service providers (ISPs), international wholesale long distance, distributed prepaid calling, Signaling System 7 (SS7) interconnect, and enhanced voice services.

When to Use

Use This Product	When You Need
Cisco AS5400HPX	• High voice and dial density (16 T1/E1 or 1 CT3) in 2RU form factor • Cisco Any Service, Any Port (ASAP) services • Enhanced performance for processor intensive voice and fax applications • Low power per port consumption • High performance async/ISDN/VoIP/Wireless • T.38 real-time fax relay, T.37 fax store and forward, fax detection, unified communications • Flexible redundant backhaul methods

Key Features

- The industry's only 2RU, CT3-capable universal gateway on the market with hot-swappable cards, internal redundant power supply and environmental monitoring
- Universal Gateway-Remote Access Server and Voice Gateway
- Universal DSPs-Data, voice, and fax services on any DSP at any time
- Ideal for Tier 2/3 ISPs and enterprises requiring innovative universal services
- Feature cards:
  - 8 or 16 CT1/CE1 feature cards
  - 60 or 108 channel Universal Port feature card
- Redundant 10/100BaseT autosensing Ethernet LAN ports
- Redundant 8 Mbs serial WAN ports for Frame Relay, HDLC, or PPP WAN backhaul
- One fast console port for local administrative access; one auxiliary port for remote administrative access
- Carrier Class Resiliency:
  - All feature cards and fan tray are hot swappable
  - AC internal power supply with dual fans
  - Redundant LAN/WAN backhaul ports
  - Thermal management and environmental monitoring
- Cisco SS7 signaling gateway interoperability
- ETSI/NEBS Level 3 compliant

Specifications

Feature	Cisco AS5400HPX
Processor Type	390-MHz RISC processor
Memory	SDRAM: 256 MB (default), 512 MB (maximum) Shared input/output (I/O): 64 MB (default) 128 MB (maximum) Boot Flash: 8 MB (default) 16 MB (maximum) System Flash: 32 MB (default) 64 MB (maximum) Layer 3 cache: 8 MB
Feature Card Slots	7
Trunk Feature Cards	8 Channelized T1/E1/PRI 1 CT3
DSP Feature Card	60/180 Universal ports feature card
LAN Protocols	IP, IPX, AppleTalk, DECnet, ARA, NetBEUI, bridging, HSRP
WAN Protocols	Frame Relay, PPP, HDLC (leased line)
Routing Protocols	RIP, RIPv2, OSPF, IGRP, EIGRP, BGPv4, IS-IS, AT-EIGRP, IPX-EIGRP, Next Hop Resolution Protocol (NHRP), AppleTalk Update-Based Routing Protocol (AURP)
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, LAT, Telnet), & 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.729ab, GSM-FR, G.726, G.Clear
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 relay using RFC 2833 Modem/fax passthrough Multifrequency (MF)
Voice and Fax Signaling Protocols	H.323v2/v3, SIP, MGCP 1.0 TGCP 1.0 T.37 fax store and forward T.38 real-time fax relay Fax detection Open Settlements Protocol (OSP)
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
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 E1	CAS, PRI, E1R1, E1 R2, leased line, Frame Relay
ISDN Protocols Supported	Sync mode PPP, V.120, V.110 at rates up to 38400 bps Network- and User-side ISDN DoVBS QSIG NFAS with backup D-channel

Modem Protocols Support	V.92 Modem on Hold, Quick Connect V.90 or V.92 standard supporting rates of 56000 to 28000 in 1333-bps Increments V.44 compression Async-mode PPP K56Flex at 56000 to 32000 in 2000-bp increments Fax out (transmission) Group 3, standards EIA 2388 Class 2 an EIA 592 Class 2.0, at modulations V.33, V.17, V.29, V.27ter, and V.21 ITU-T V.34 Annex 12, ITU-T V.42bis, V.32bis and many others
Wireless Protocol	V.110 and V.120
Full Cisco IOS Support	IP Plus and Enterprise Plus feature sets
Console and Auxiliary Ports	Asynchronous serial (RJ-45)
Chassis Dimensions (H x W x D)	3.5 x 17.5 x 18.25 in.
Chassis Weight (fully loaded)	35 lb maximum (15.8 kg)

For More Information

www.cisco.com/go/as5400

Cisco AS5850 Universal Gateway

The Cisco AS5850 Universal Gateway is the industry's highest-density universal gateway, offering unparalleled capacity and high availability. It is specifically designed to meet the demands of large, innovative service providers, supporting up to 2688 calls (4 x CT3s), 96 T1s or 86 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 route processing cards and call admission control to ensure 99.999-percent availability. As a highly flexible voice gateway, the Cisco AS5850 supports any CODEC at 100 percent capacity simplifying network engineering. An open programmable architecture streamlines rapid voice service creation with H.323, SIP or MGCP protocols.

The Cisco AS5850 supports a wide range of IP-based value-added services such as high-volume Internet access, corporate virtual private networks (VPNs), mobile wireless solutions, long distance for Internet service providers (ISPs), international wholesale long distance, distributed prepaid calling, Signaling System 7 (SS7) interconnect, and enhanced voice services. Using the rich set of Cisco IOS Software

features and SS7 interconnection, service providers can quickly provision their network for new services to meet the rapidly changing demands of the communications provider marketplace.

When to Use

Use This Product	When You Need
Cisco AS5850	• Up to 2688 calls (4 x CT3s), 96 T1s or 86 E1s of data, voice, and fax services on any port, at any time • Service provider or IP-focused installations • Highly available single system with multiple redundancy • Wholesale dial/voice, retail dial/voice, TDM grooming or wireless applications

Key Features

- ASAP services-enables the Cisco AS5850 to operate simultaneously as a network access server and voice gateway, delivering universal services on any port at any time
- High-availability architecture, with redundancy and hot swap capability
- Density remains the same regardless of modem protocol, voice codec type, ECAN or VAD settings
- Up to 3072 DS0s can be groomed through the TDM Switching feature
- Up to 4 CT3, 96 T1s or 86 E1s/PRI interfaces
- Port management features for large-scale wholesale dial applications
- ETSI/NEBS Level 3 compliant
- Distributed, multiprocessor design for maximum performance and growth
- Cisco SS7 signaling gateway interoperability
- Redundant 10/100BaseT autosensing Ethernet LAN ports
- Redundant 8 Mbs serial WAN ports for Frame Relay, HDLC, or PPP WAN backhaul
- One fast console port for local administrative access; one auxiliary port for remote administrative access
- Redundant LAN/WAN backhaul ports
- Thermal management and environmental monitoring
- ETSI/NEBS compliant
- V.110 protocol support for wireless applications

Specifications

Feature	Cisco AS5850
Slots	12 feature board slots 2 RSC slots
Processor Type	266 MHz RISC processor plus 2B of L3 cache SDRAM
RSC Switch Fabric	5 GBps, Layer 3 / 4 switching
Memory	512 MB with ECC per RSC 128 MB SDRAM (with parity) per feature card
Trunk Cards	One CT3 and 216 DSP feature card 24 CE1/CT1 feature card
Universal Port Card	324 DSP-feature card
Egress Ports	Dual Gigabit load-balanced redundant Ethernet ports with GBIC interfaces for user traffic One 10/100-Mbps Ethernet port with RJ45 connector for management traffic
Voice Compression	G.711, G.729a, G.723.1 (5.3K and 6.3K), G.729ab
Voice Protocols	H.323v2/v3, SIP, MGCP 1.0, TGCP 1.0 ECAN can be configured up to 128ms on all ports T.38 real-time fax relay Open Settlements Protocol (OSP) Fax detection GSM-FR, G.726, G.Clear Modem/fax passthrough DTMF relay using RFC 2833
Modem Protocols	V.90 or V.92 standard supporting rates of 56000 to 28000 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 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; and V.23 1200/75 ITU-T V.42 (including MNP 2-4 and LAPM) error connection ITU-T V.42bis (1000 nodes) and MNP 5 data compression Async-mode PPP
ISDN Protocols	Sync mode PPP, V.120, V.110 at rates up to 38400 bps
Wireless Protocol	V.110 and V.120
Console and Auxiliary Ports	Asynchronous serial (RJ-45)
Chassis Dimensions (HxWxD)	24.5 x 17.5 x 24 in.
Chassis Weight	220 lb (100 kg)

For More Information

www.cisco.com/go/AS5850

Cisco BTS 10200 Softswitch

The Cisco BTS 10200 Softswitch gives service providers the ability to introduce converged communications services, while reducing costs through implementation of a single platform that efficiently supports many non-segregated types of traffic. Studies have shown that IP and ATM technologies can reduce costs in half compared to costs associated with implementing and maintaining conventional circuit switches. The Cisco BTS 10200 Softswitch combines an innovative architecture, an open platform, and interfaces that can operate in a multivendor network.

When to Use

Use This Product	When You Need
Cisco BTS 10200 Softswitch	• Seamless integration with the PSTN and multivendor voice and data networks • Telephony-grade quality with the flexibility of packet-switched technology • Fast deployment of advanced services • Rapid development and deployment of lucrative customized services • Reduced operational costs

Key Features

- Comprehensive industry-standard protocol support
- Carrier-grade reliability with Network Equipment Building Systems (NEBS) compliance and redundant platform components
- Interoperability with a large number of commercial feature servers
- Feature server architecture which provides an open protocol
- Current PacketCable-compliant features include NCS Signaling, IVR support via PacketCable BAU, and CALEA support (call identification over RADIUS). With Release 3.3, the Cisco BTS 10200 will comply with DQoS, Event Messaging, CALEA (Call Content over COPS). TGCP compliance and Security compliance are roadmapped for a future release

Feature	Cisco BTS 10200
Comprehensive industry-standard protocol support	Seamless integration with the PSTN and multivendor voice and data networks; enables implementation of best-of-breed network components
Carrier-grade reliability with Network Equipment Building Systems (NEBS) compliance, redundant platform components	Telephony-grade quality with the flexibility of packet-switched technology
Interoperable with a large number of commercial feature servers	Fast deployment of advanced services
Feature server architecture, which provides an open protocol	Rapid development and deployment of lucrative customized services
Streamlined maintenance, provisioning, and service activation	Reduced operational costs
Integrated access device support	Reduced subscriber costs with single-line delivery and billing for voice and data services; provides flexible bandwidth allocation to meet varying or peak traffic demands
Command-line interface	Intuitive system setup and administration
Comprehensive reporting features, including billing record	Sophisticated billing capabilities and integration with standard billing systems
Network scalability through deployment of multiple, centrally managed call agents	Economical startup and future-proof deployments to support expanding subscriber bases and services; reduced infrastructure costs

Specifications

Technical Features	Specifications
Call model	ITU-CS2 model
Numbering plan	One 10-digit North American Numbering Plan (NANP), support service codes (N11), and private numbering plan
Provisioning	File Transport Protocol (FTP), Telnet, CLI
Management	Simple Network Management Protocol Version 1 (SNMPv1) agent, Common Object Request Broker Architecture (CORBA), CLI
Billing interface **Software interface**	Call-detail record, third-party billing

For More Information

www.cisco.com/warp/public/cc/pd/unco/10200/index.shtml

Cisco MGX® 8000 Series Carrier Voice Gateways

The Cisco MGX 8000 Series Carrier Voice Gateways are high capacity carrier-class voice gateways that offer standards-based support for voice over IP (VoIP) and voice over ATM (VoATM) services. The Cisco MGX 8000 Series Carrier Voice Gateways consist of the Voice Interworking Service Module (VISM) deployed in the Cisco MGX 8230, 8830, 8250, and 8850 Next Generation Multiservice Switches. The Cisco MGX 8000 Series Carrier Voice Gateways combine the industry's highest quality packet voice with the extensible architecture and the measured greater than 99.999-percent network availability of the Cisco MGX 8000 Next-Generation Multiservice Switches.

Key Features

The Cisco MGX 8000 Series Carrier Voice Gateway incorporates high-performance switching, full Layer 2 and Layer 3 networking capabilities, narrowband interfaces, broadband interfaces, and integrated voice modules. Some of the key features that support these capabilities include:

- Support for standards-based Voice over IP (VoIP) and Voice over ATM (VoATM)
- Choice of Fast Ethernet, Gigabit Ethernet / Packet over SONET (POS), ATM, and time-division multiplexing (TDM) network interfaces
- Industry's highest-quality packet voice
- Wide range of channel associated signaling (CAS) interfaces (dual tone multifrequency [DTMF], MF, Media Gateway Control Protocol [MGCP] CAS support using standards-based RFC 3064 packages)
- ISDN Primary Rate Interface (PRI) interfaces with signaling backhaul
- Session Initiation Protocol (SIP) and H.323 interoperability
- Multihosted softswitch support
- Standards-based softswitch interfaces
- Full Layer 3 routing with complete Multiprotocol Label Switching (MPLS) support
- Integrated network management with open interfaces such as Simple Network Management Protocol (SNMP) and Common Object Request Broker Architecture (CORBA)

For More Information

www.cisco.com/warp/public/cc/pd/ga/ps3869/

Cisco 3600 Series

The Cisco 3600 Series is a family of modular, high-performance multiservice access routers for medium and large-sized branch offices and Internet service providers. With over 90 modular interface options (shares modular interfaces with the 2600 Series), the Cisco 3600 Series provides solutions for voice/data integration, virtual private networks (VPNs), dial access, and multiprotocol data routing. Using Cisco's digital and analog voice/fax network modules, the Cisco 3600 Series allows customers to consolidate voice, fax, and data traffic on a single network. Its architecture protects customers' investment in network technology and integrates the functions of several devices into a single, manageable solution. Cisco 3600 Dial Bundles are also available to also address specific dialup remote access server requirements.

When to Use

Use This Product	When You Need
Cisco 3620	• Medium-density LAN connectivity • Low-density voice over Data • Low-density ATM connections • Mid-density modem-over-PRI bundles
Cisco 3640	• Medium- to high-density LAN connectivity • Mid-density voice over Data • Low- to mid-density ATM connections • Low-density modem-over-BRI bundles
Cisco 3660	• High-density LAN connectivity • Mid-density Voice over Data • Mid-density ATM connections • Mid- to high-density modem-over-PRI and BRI connectivity

Key Features

- Combines dial access, advanced LAN-to-LAN routing services, ATM connectivity, and multiservice integration of voice, video, and data in a single platform
- Modular, scalable design provides performance, scalability, flexibility, and investment protection
- High-density ISDN PRI capabilities
- Preconfigured BRI and PRI modem bundles available
- Support for modem-over-BRI functionality
- Integrated Cisco IOS Software (base price includes IP IOS software)
- Full VPN and firewall support

Specifications

Feature	Cisco 3620	Cisco 3640	Cisco 3660
Fixed Ports	None	None	1 or 2 10/100 Fast Ethernet
Network Module Slots	2	4	6
Advanced Integration Module (AIM) Slots	None	None	2
LAN/Combo Modules	See part numbers and ordering information	Same as Cisco 3620	Same as Cisco 3620
WAN Modules	See part numbers and ordering information	Same as Cisco 3620	Same as Cisco 3620 (Hardware compression support only through AIM-COMPR4)
ATM Modules	See part numbers and ordering information	Same as Cisco 3620	Same as Cisco 3620
Voice/Fax Network Modules	See part numbers and ordering information	Same as Cisco 3620	Same as Cisco 3620
WAN Interface Card (WIC) Modules	See part numbers and ordering information	Same as Cisco 3620	Same as Cisco 3620
Multiflex Voice/WAN Interface Cards	See part numbers and ordering information	Same as Cisco 3620	Same as Cisco 3620
Voice Interface Card (VIC) Modules	See part numbers and ordering information	Same as Cisco 3620	Same as Cisco 3620
Modem Modules	See part numbers and ordering information	Same as Cisco 3620	Same as Cisco 3620
Performance	40 kpps	50-70 kpps	100-120 kpps
Flash Memory	8 MB (default); 32 MB (max)	Same as Cisco 3620	8 MB (default); 64 MB (max)
DRAM Memory	32 MB (default)		
64 MB (max)	32 MB (default)		
128 MB (max)	32 MB SDRAM (default)		
256 MB SDRAM (max)			
Power Supply	AC, DC optional	AC, DC optional	Single or dual AC/DC
Dimensions (HxWxD)	1.75 x 17.5 x 13.5 in.	3.44 x 17.5 x 15 in.	8.7 x 17.5 x 11.8 in.

For More Information

http://www.cisco.com/go/360

Cisco Cable-Ready Solutions

Overview

Cisco Cable-Ready Solutions offer fully tested, preconfigured, best-of-breed hardware and software that enables cable service providers to quickly and easily deploy a breadth of revenue-generating services. Cisco data and VoIP Cable-Ready Solutions support leading-edge cable industry standards, provide network and device interoperability now and in the future, and scale to support growth.

Cisco Cable-Ready Solutions at a Glance

Managed Access Cisco Cable-Ready Solution

To tap into the large high-speed data (HSD) market, ISPs are pushing to gain access to HFC cable plants. Cable service providers stand to gain many operational and scalability benefits from deploying a Managed Access Cisco Cable-Ready Solution. Cable operators can position themselves to grow revenues, while supporting open access. They can partition the cable plant and create scalable VPNs that support varying QoS requirements for multiple ISPs and their subscribers. Cable companies can give ISPs access to their HFC networks. ISPs can build value-added services on top of the HFC infrastructure. Subscribers can select services from multiple service providers. As subscribers team up with their preferred ISP and choose services from multiple providers, loyalty increases. Incremental revenue opportunities develop a more stable and wider customer base for cable companies.

Implementation choices include:

- Policy-based routing (PBR), which uses standard routing protocols to route a packet based on the destination address
- Multiprotocol Label Switching (MPLS), which uses an innovative technique for high-performance packet forwarding based on a label applied at the edge of an MPLS domain.

When to Use

Use This Managed Access Choice	When You Need
PBR	• Faster rollout • To use standard routing technology
MPLS	• A more robust solution; Cisco recommends this approach • Hard QoS guarantees • Fast reroute for protection, resiliency, and reliability

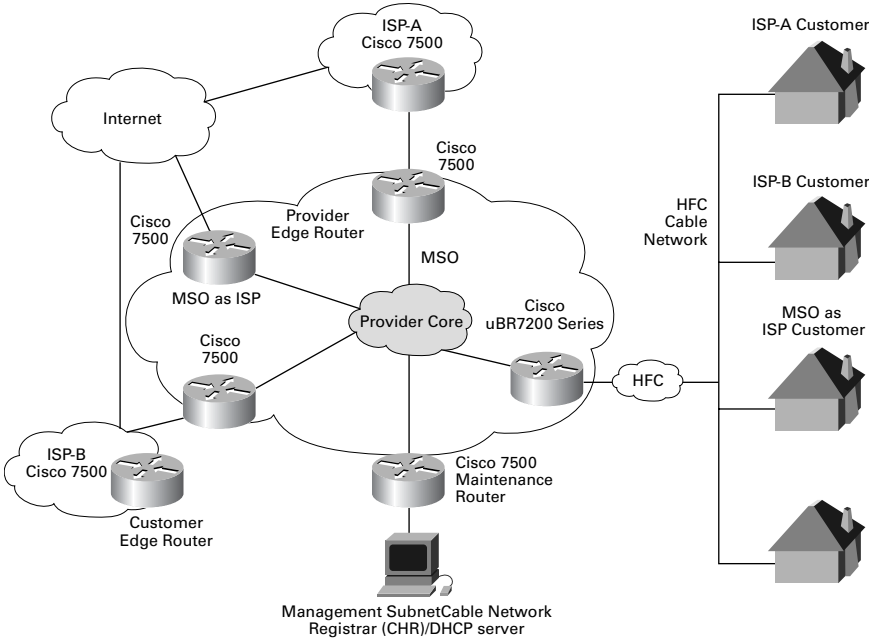
Choice Comparisons

Approach	Strengths	Weaknesses
PBR	• Quicker time to deploy	• PC-assigned commercial customer address by cable operator provisioning system • Requires configuration and routing expertise to ensure that both the cable operator and ISP route packets properly in both directions • Somewhat difficult to scale due to complexities of management
MPLS	• Provides virtual routing table (one for each ISP) • Full QoS and traffic engineering available; new QoS/CoS revenue opportunity • Fast reroute for protection, resiliency, and reliability • Guaranteed bandwidth for hard QoS guarantees • Service-level agreements (SLAs)	• Requires MPLS on the entire backbone

PBR

PBR uses standard routing protocols to determine how to route a packet. Standard routing is done based on the destination address of a packet With PBR, the routing decision is based on the source address of the packet. Depending on the cable operator's objective, PBR can occur as the packet enters the network (ingress router which is the CMTS), at an aggregation router, or as the packet leaves the network (egress router). If the goal is to keep some traffic segregated from other traffic within the cable operator's network, PBR must be done on every router along the packet's path.

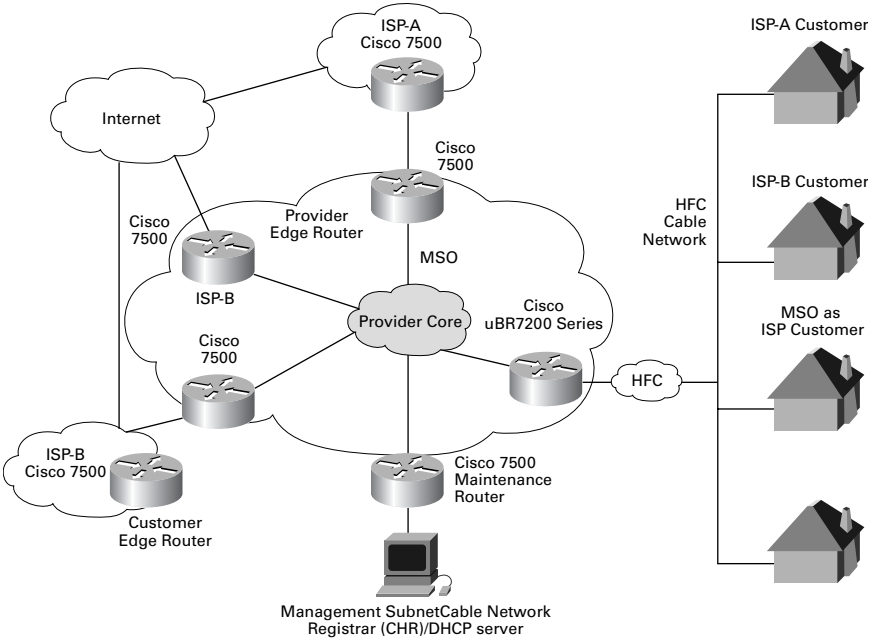
PBR Managed Access Sample Network Architecture



Multiple Protocol Label Switching (MPLS)

MPLS is an innovative technique for high-performance packet forwarding. Using MPLS VPN, service providers deliver IP services using Layer 3 QoS and a label-based forwarding paradigm that ensures privacy. Labels indicate route and service attributes. Cable operators build VPNs for ISPs to move traffic over their cable plants. ISPs use the HFC network to supply service to their customers.

MPLS Managed Access Sample Network Architecture



For More Information

www.cisco.com/warp/public/779/servpro/solutions/cable/managed-access.html

MxU High-Speed Access Cisco Cable-Ready Solution

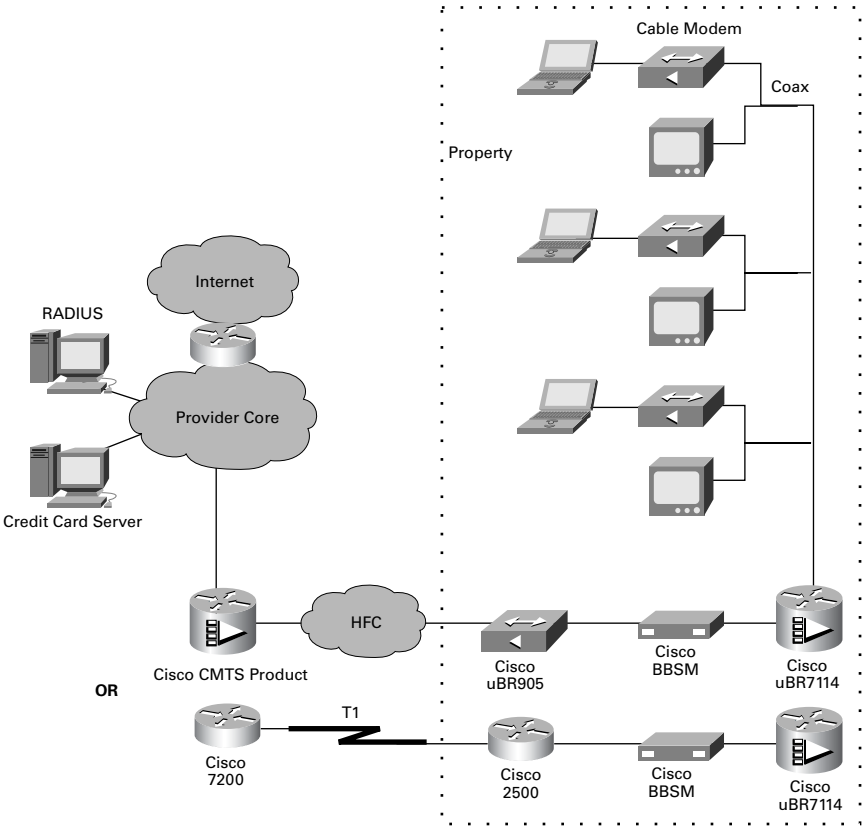
The integrated, single-vendor, end-to-end MxU High-Speed Access Cisco Cable-Ready Solution enables cable service providers and MxU businesses to maximize time-to-market and support fast Internet and intranet access. Cable companies can serve the MxU market directly or partner with an ISP to offer services. MxU businesses can differentiate themselves from their competitors and gain marketshare or recognition through new service introductions. Hotels and convention centers can offer automated registration/check-ins for rooms or seminars, deliver customized content such as local advertising, or support online payment.

By leveraging the cable already installed in a building, costly rewiring of existing serviceable properties and the associated downtime is avoided. Service providers and MxU businesses can mix-and-match components of the MxU High-Speed Access Cisco Cable-Ready Solution to meet needs. The solution offers the lowest cost entry of any broadband access technology today.

When to Use

Use This Solution	When You Need
MxU High-Speed Access Cisco Cable-Ready Solution	• Cable service providers want to expand into the MxU market: Given the relatively small subscriber base of an MxU setting, the challenge has been to deliver robust services quickly and cost-effectively for an accelerated break-even point and a higher return on investment. The Cisco MxU High-Speed Access Cisco Cable-Ready Solution provides this • MxU businesses want to attract new opportunities and revenue streams through introduction of new services. For instance, hotels can deliver customized content such as local advertising, offer automated registration/check-ins, and support online payment s that yield new revenues from increased customer satisfaction and repeat business. The Cisco uBR7100 Series can be installed as an on-premises mini-headend. Broadband cable connections can support connectivity to multiple rooms on multiple floors. Depending on the services the hotel supports, a cable modem and laptop, as well as a set-top box and TV, can reside in each room

MxU High-Speed Access Sample Network Architecture



For More Information

www.cisco.com/warp/public/779/servpro/solutions/cable/speedy-access.html

Basic H.323 Residential VoIP Cisco Cable-Ready Solution

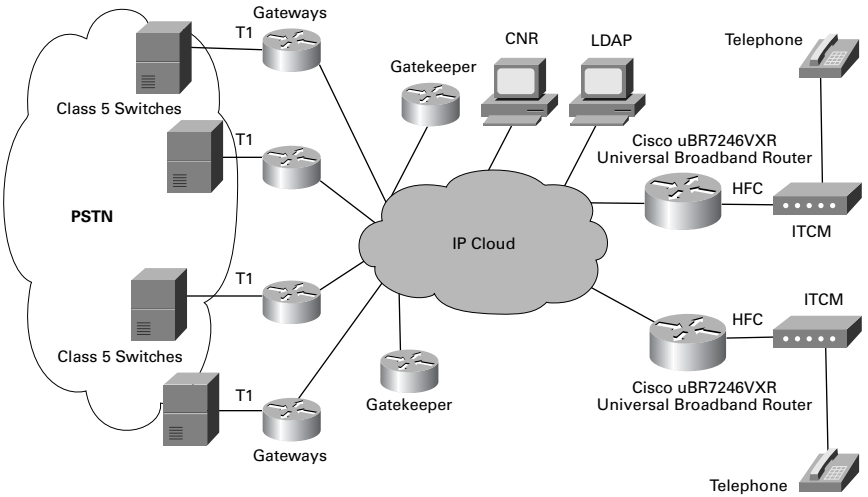
The Basic H.323 Residential VoIP Cisco Cable-Ready Solution enables cable service providers to introduce cable IP telephony services. The solution is based on:

- H.323—The H.323 specification for the delivery of multi-media applications including voice is a well-known, mature industry standard.
- DOCSIS and EuroDOCSIS standards

When to Use

Use This Solution	When You Need
Basic H.323 Residential VoIP Cisco Cable-Ready Solution	• To offer secondary line service for early first-time VoIP experience over HFC cable plants or in markets outside of the United States. • Want to implement robust second-line voice services using an existing HFC cable plant without the expense and operational costs associated with deploying a traditional TDM Class 5 switch

Basic H.323 Residential VoIP Sample Network Architecture



For More Information

www.cisco.com/warp/public/779/servpro/solutions/cable/voip.html

Routers

Routers at a Glance

Product	Features	Page
Cisco 7600 Series Internet Router	Service provider-class router delivering optical-wide and metropolitan area network services with high-touch IP services at the network edge • Consolidated LAN/WAN/MAN in a single platform • Scalable backplane bandwidth from 32 Gbps to 256 Gbps and performance from 15 Mpps to 30 Mpps • High-volume aggregation of Ethernet traffic (server farms) • Wide range of WAN/MAN interfaces from NxDS0, T1, T3 to OC-48 with line rate services • Ideal for high-speed WAN and metro aggregation, Consolidated POP, Internet data center (IDC) • Also supports Cisco Catalyst 6000 Series line cards	6-3
Cisco 10000 Series Internet Router	Service provider-class edge services router • Optimized for aggregating high volume (thousands) of dedicated, IP leased-line sub DS-3/E3 circuits • Consistent line-rate performance; scales to thousands of interfaces with comprehensive set of embedded IP services • Rich Cisco IOS Software-based QoS/CoS features including IP to ATM interworking; high availability, fully redundant architecture, designed for 99.999% availability • Broad range of channelized, clear channel, ATM and LAN interfaces. Physical interface speeds from E1/T1 up to OC-48c/STM-16c • Next-generation MPLS provider edge product that supports scalable, feature-rich MPLS feature set.	6-5
Cisco 10720 Internet Router	Service provider-class metro access services router • Optimized building block for the next generation metro IP network • Equipped with 24 ports of Ethernet technology for customer access and dynamic packet transport (DPT) technology for metro optical connectivity • Powered by Cisco IOS Software and the Parallel Express Forwarding (PXF) architecture • Cost-effective, reliable platform supporting full suite of IP routing protocols • With DPT architecture, enables optimal fiber connectivity as well as features such as IP class of service, TLS, VoIP and VPN services	6-9

Product	Features	Page
Cisco 12000 Series Internet Router	Premier Internet routing platform for service provider backbone and high-speed edge applications. With its unique modular distributed system architecture, the Cisco 12000 Series, leads with the industry's only portfolio of 10G systems: • Seven chassis options that fit your scaling and real estate requirements offering the only complete solution for small to large POPs; backbone or edge • The only platforms supporting backbone—or edge-optimized line cards in the same chassis, maximize the value of line-rate edge applications with 10G uplinks, and sustain line-rate performance as they scale to maximum capacity • Proven Investment Protection with simple, low-cost field upgrades to higher switching capacities • Guaranteed Priority Packet Delivery—the industry's only complete IP QoS implementation that uniquely enables premium real time IP services such as VoIP and video. • Extensive portfolio of line cards offering leading edge technologies (POS, ATM, DPT, GE/FE, etc.), support a wide range of networking speeds (DS1-OC192c/STM64).	6-12

Cisco Routers Port Matrix

	7600 Series	10000 Series	120000 Series
Fixed and Modular Ports	X		
Modular Ports Only		X	X
LAN Ports			
10-MB Ethernet	X		
10-MB Ethernet (fiber)	X		
100-MB Ethernet	X		
100-MB Ethernet (fiber)	X		
ATM	X	X	
Gigabit Ethernet	X	X	X
WAN Ports			
Sync Serial	X		
Sync Serial w/ CSU		X	
ISDN PRI/Ch T1	X		
ISDN PRI w/ CSU	X		
HSSI	X		
DS3	X	X	X
ATM OC-3	X	X	X
ATM OC-12	X	X	X
ATM	X	X	X
ATM - T1/E1	X		
SONET OC-x/STM-x	X	X	X
DPT	X	X	X
Voice Ports			
Digital	X		

Cisco 7600 Series Internet Router

The Cisco 7600 Internet Router combines optical WAN/MAN networking and high-volume Ethernet aggregation with a focus on line-rate delivery of high-touch IP services at the edge of service provider networks or large data centers. It provides customers the flexibility of three different form factors: Cisco 7603, 7606, and 7609. As the most scalable system in the industry, each router offers the ability to bring DS0 to OC-48 WAN connectivity, and 10-Mbps Ethernet to 10-Gigabit Ethernet LAN connectivity to the Internet data center, metropolitan aggregation, WAN edge aggregation, and enterprise networking applications. The Cisco 7600 Internet Router is an important component of Cisco's end-to-end IP+Optical offerings, helping service providers break through service and bandwidth barriers to increase new revenues and profits.

When to Use

Use This Product	When You Need
Cisco 7603	• 3 slot (horizontal) chassis • 32 Gbps backplane bandwidth • 15 Mpps forwarding rate • NEBs Compliant
Cisco 7606	• 6 slot (horizontal) chassis • 160 Gbps backplane bandwidth • 30 Mpps forwarding rate • NEBs Compliant
Cisco 7609	• 9 slot (vertical) chassis • 256 Gbps backplane bandwidth • 30 Mpps forwarding rate • NEBs Compliant
Cisco 7600 Family Solutions	• Consolidated WAN/MAN/LAN in one platform • High-volume aggregation of Ethernet traffic (server farms) • Multiple high-speed/Optical/SONET WAN connections • Wide range of WAN/MAN interfaces from NxDS0, T1, T3 to OC-48 with line-rate services • High-speed WAN aggregation, Metro aggregation, consolidated POP, Internet data center (IDC)

Key Features

- High-touch, line-rate IP services at 6 Mpps per slot—QoS, Hierarchical Traffic Shaping, Destination Sensitive Services (accounting, billing and QoS), MPLS
- 15 to 30 Mpps forwarding processor and up to 512 MB DRAM for Internet routing
- Modular and scalable from 32 Gbps to 256 Gbps switch fabric
- Chassis options: 3-, 6-, and 9-slot for different space requirements and applications
- Compatible with Catalyst 6000 LAN interfaces, offering 10 Mbps Ethernet to 1 Gbps
- Wide range of WAN/MAN interfaces—DS0 to OC-48

- Leverages standard 7200/7500 series port adapters with flex WAN cards
- High performance, high-density Optical Services Modules (OSMs)—OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, 4-port GE WAN services, Channelized OC-12/T3, Channelized OC48/T3
- "Adaptive" network processing—PXF IP Services Processors on each OSM for flexible IP service implementation
- Industry's first Ethernet-over-MPLS implementation for LAN/VLAN extensions across MANs
- Supports the ability to monitor service levels delivered to customers under service level agreements (SLAs)

Specifications

Feature	Cisco 7603	Cisco 7606	Cisco 7609
Routers per Chassis	1	1	1
Fixed Ports	None	None	None
Modular Slots	3	6	9
Gigabit Ethernet (GE)	4-port Gigabit Ethernet WAN (GBIC)	Same as Cisco7603	Same as Cisco 7603
SONET Port Adapters	See Part Numbers and Ordering Information	Same as Cisco7603	Same as Cisco7603
ATM Port Adapters	2-port OC12-c, STM-4c ATM MM and SM-IR	Same as Cisco7603	Same as Cisco7603
Processor	Supervisor Engine 2 w/MSFC2 and PFC2 (Multiservice Feature Card 2 with Policy Feature Card 2)	Same as Cisco7603	Same as Cisco 7603
High-Speed Backplane	32 Gbps	160 Gbps	Scalable backplane from 30 Gbps to 256 Gbps
Boot Memory	16 MB boot Flash, 2 MB programmable Flash	Same as Cisco 7603	Same as Cisco 7603
Optional PCMCIA Flash Card	16 MB to 20 MB	Same as Cisco 7603	Same as Cisco 7603
DRAM Memory	128 MB (default), 512 MB (max) (same for Sup2, MSFC2, PFC2)	Same as Cisco 7603	Same as Cisco 7603
Power Supply	AC or DC (950 W)	Same as Cisco7603	AC or DC (1300 or 2500 V)
Dimensions (HxWxD)	7 x 17.37 x 21.75 in. (17.78 x 44.12 x 55.25 cm)	12.25 x 17.37 x 21.75 in. (31.11 x 44.12 x 55.25 cm)	25.2 x 17.2 x 18.1 in. (64.0 x 43.7 x 46.0 cm)

For More Information

www.cisco.com/go/7600

Cisco 10000 Series Internet Router

Combining Parallel Express Forwarding (PXF) technology with industry-leading high availability software and hardware, the Cisco 10000 Series Internet Router is a high-density integrated edge router that reliably and efficiently delivers multiple, simultaneous, high-performance, value-added services. The Cisco 10000 Series aggregates a large number of connections at the edge of a service provider network, while maintaining high throughput. The Cisco 10000 Series includes two models: the Cisco 10008 and the Cisco 10005.

When to Use

Use This Product	When You Need
Cisco 10000 Series	• Non-stop, line-rate performance without compromise to aggregate high volume (thousands) of connections • To apply services, such as quality of service (QoS) and Multiprotocol Label Switching/Virtual Private Network (MPLS/VPN), and hand off traffic to a service provider core router

Key Features

- Industry-leading High Availability—The Cisco 10000 Series is the first Internet router designed for non-stop performance, with a complete set of reliability features for high availability beyond "five 9's" (99.999%). Full hardware redundancy, hot-swappable elements, and seamless route processor cutover are combined to provide session maintenance and continuous traffic forwarding, even in the case of mechanical, electrical, or software failure
- Lowest Total Cost of Ownership—The Cisco 10000 Series offers the highest leased line and broadband session densities on a single platform for reduced capital expenditures. Its high reliability reduces network downtime, customer churn, and other operational expenses
- Broad Portfolio of Line-Rate IP Services—The PXF design guarantees consistent line-rate throughput with multiple IP services enabled. Value-added services, such as quality of service (QoS), Multi-Protocol Label Switching (MPLS), Multi-Link PPP (MLPPP), and Access Control Lists (ACLs) have been performance-optimized to deliver exceptional throughput for each and every IP leased line and broadband subscriber

- Wide Range of High-density Interface Options—The Cisco 10000 Series provides high-density DS0, DS/E1 or clear-channel DS3 connections. The Cisco 10000 Series lets service providers serve a rapidly growing number of broadband customers

The following table lists the port densities of the Cisco 10008 and 10005 chassis:

Features	Cisco10008	Cisco10005
Slots per chassis / slots available	20/16	14/10
Chassis per 7' rack	6	6
DS1 (ChOC12)	2352	1344
DS1 (CT3)	1176	672
DS3 (ChOC12)	84	48
DS3 (CT3)	42	24
E1 (ChSTM1)	1764	1008
ChE1/T1 density/module	168	96
OC3 SONET (full height card)	42	24
OC3 ATM	28	16
OC3/OC12 SONET	16	10
OC12 ATM	8	5
GigE	16	10
FE	112	64

Software Specifications

IP Services

- IP routing protocols, such as Border Gateway Protocol (BGP), RIP, IGRP, EIGRP, Intermediate System-to-Intermediate System (IS-IS), Open Shortest Path First (OSPF), and more
- Datalink encapsulations, including high-level data link control (HDLC), point-to-point protocol (PPP), ATM, Frame Relay, and Ethernet 802.1Q
- Multicast support, including PIM, IGMP, CGMP, DVMRP, MSDP, multicast forwarding, tunnel support, DVMRP tunnels
- Comprehensive MPLS support, including edge label switch router (LSR), VPNs, and traffic engineering
- Load sharing capabilities at layer 2 (multi-link PPP) and Layer 3 equal cost routing, with support for per-packet load balancing (PPLB) and per-session load balancing (PSLB)

- Quality of service (QoS), including class-based weighted fair queuing (CBWFQ), random early detection (RED) (precedence/diffserv), policing, traffic shaping (including Frame Relay traffic shaping), and full support for Cisco modular QoS command line interface (CLI)
- Advanced forward features, such as policy based routing (PBR) and generic routing encapsulation (GRE) tunneling
- Security, including access control lists (ACLs), reverse path forwarding check, ICMP throttling, authentication, authorization, and accounting (AAA) support, TACACS+ and secure shell (SSH) support
- Accounting-Cisco NetFlow accounting, and an extensive set of MIBs covering interfaces, environmental, and protocols

Broadband Services

- 32,000 PPP over ATM (PPPoA), PPP over Ethernet (PPPoE), and routed bridge encapsulated (RBE) sessions
- Support for Point-to-Point Termination and Aggregation (PTA)
- 32,000 ATM virtual circuits (VCs)
- 3,200 Layer 2 Tunneling Protocol (L2TP) tunnels as L2TP Network Server
- RFC1483/2684 routed IP packets
- PPP and RBE autosense for encapsulation
- Input and output access list (ACL) support for PPP and RBE sessions, and for L2TP tunneled PPP sessions
- Unicast reverse path forwarding (RPF) check

Management and Administration

- Cisco IOS CLI and SNMP, Cisco NetFlow accounting
- Configuration and administration features, including Telnet, Cisco Discovery Protocol, and Response Time Reporter (RTR)
- Serial and console ports for local and remote administration
- TACACS+ and RADIUS
- Remote software download via TFTP, RCP, and HTTP
- 32-MB Flash per PRE for storing software and configuration files
- PCMCIA interface per PRE for software load via external Flash card

Hardware Specifications

Specification	Cisco 10008	Cisco 10005
Modular Slots	Eight slots for interface modules Two slots for PRE modules (one active, one redundant)	Five slots for interface modules Two slots for PRE modules (one active, one redundant)
Hot-Swappable	Yes	Yes
Backplane Capacity	51.2 Gbps	32 Gbps
Physical Dimensions (H x W x D)	21.75 x 17.5 x 12 in.(55.2 x 44.5 x 30.5 cm)	11.9 x 17.5 x 24 in.(30.2 x 44.4 x 60.9 cm)
Weight	130 lb (59.02 kg) fully configured chassis	130 lb (59.02 kg) fully configured chassis
Rack Mounting	19 in. to 23 in. (front, middle, or back)	19 or 23 in. (front or mid mount)
Power	DC input voltage: –48 VDC/–60 VDC· AC input voltage: 100–240 VAC, 50/60 Hz, single-phase Maximum power consumption: 1200W	DC input voltage: –48 VDC/–60 VDC· AC input voltage: 100–240 VAC, 50/60 Hz, single-phase Maximum power consumption: 1200W

For More Information

www.cisco.com/go/10000

Cisco 10720 Internet Router

The Cisco 10720 Internet Router is a high-performance router and a principle building block in the metro IP network. It enables service providers to offer innovative and differentiated IP services to their customers at optical speeds. Equipped with Ethernet technology for customer access and the innovative Dynamic Packet Transport (DPT) technology for metro optical connectivity, the Cisco 10720 allows service providers to offer IP services closer to the user, enabling them to better control admission to network resources. This allows service providers to bypass traditional DS1 and DS3 access options. The dual counter rotating ring technology of DPT is also cost effective, since it uses both rings and can be deployed over dark fiber and still maintain the less than 50ms restoration common in SONET/SDH systems. For multiservice applications, DPT can also be deployed over traditional SONET/SDH ADMs and wavelength division multiplexing (WDM) systems.

The Cisco 10720 is a cost-effective, reliable platform that not only supports the full suite of IP routing protocols such as IS-IS, OSPF and BGP, but also allows advanced IP features to be introduced efficiently, without compromising on performance. Although primarily designed for high-speed Internet services for multitenant and business-park applications in the metro, the Cisco 10720 Internet Router is also suitable for a range of other applications such as Internet data center applications, cable multisystem operator (MSO) internetworking, and voice-over-IP (VoIP) aggregation.

When to Use

Use This Product	When You Need
Cisco 10720 Internet Router	• To offer high-performance IP services as part of their business strategy • To simplify current networks and implement simple, scalable, reliable features of DPT technology while maximizing fiber usage • Any customer already using DPT technology in their network, most likely with DPT cards on the 12000 Internet Router

Key Features

- Redundant AC or DC power supplies; the Cisco 10720 Internet Router is equipped with dual power supplies by default
- Dual OC48 STM 16 Uplink Ports in either Ring (SRP) or Point-Point (POS)
- Console/Auxiliary Port to be used together with either 24 Port Fast Ethernet or Combined 4GE+8FE for an Ethernet only router
- 24 ports Fast Ethernet in TX, FX MM or FX SM Access Module
- Combined 4 Gigabit Ethernet+8 Fast EthernetTX ports Access Module
- SRP specific features—IPS with <50 ms restoration time and SRP MIB support
- Multicast support including PIM SM, PIM DM, MBGP
- TLS—UTI/L2TPv3 or EoMPLS for Layer 2 to Layer 2 LAN extension
- QoS—Modular QoS CLI, CAR, WRED, VTMS traffic shaping, and access lists
- Ethernet features—MDI-MDI-X support, 10/100 speed auto negotiation,
- HDX-FDX negotiation and time delay reflectometry (TDR) for 10/100BaseTX
- Hot Standby Routing Protocol (HSRP)/Multiple Hot Standby Routing Protocol (MHSRP) and VRRP
- 64-MB built-in Flash for software and configuration load
- Optical receive power monitoring support on OC-48/STM-16 Interface and Gigabit Ethernet Small Form Factor
- Supported management information bases (MIBs) include SNMP, SRP, SONET
- Network management includes CiscoView, Cisco IE2100 Series Intelligent Engine, Cisco VPN Solutions Center and Cisco Element Management Framework

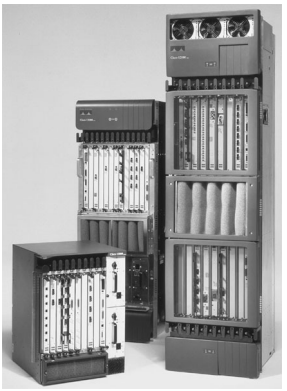
Specifications

Feature	Cisco 10720
Security Features	Including AAA, RADIUS authentication, TACACS+, and encrypted passwords
Management	Cisco IOS Software CLI TACACS+ and RADIUS Configuration and administration features including Telnet and Cisco Discovery Protocol CiscoView, Cisco IE2100 Series Intelligent Engine, Cisco VPN Solutions Center Serial (aux) and console ports for local and remote administration Remote software download via TFTP and RCP IP over DCC for remote management of the Cisco ONS 15104 OC-48/STM-16 Optical Regenerator, where applicable
Physical Interfaces	Uplink Modules: 2-port single-mode OC-48c/STM16c DPT [SR 2 km (1.2 miles), IR 15 km (9.3 miles)], LR1 40km (25 miles) and LR2 80km (50 miles) Interface Modules—The Cisco 10720 Internet Router has two dedicated slots for interface modules—modules are not interchangeable or hot swappable: • Upper slot is dedicated for SRP/POS Uplink module equipped with two physical ports of OC-48c/STM16c that provide an aggregate bandwidth of approximately 5 Gbps. The cards are available in four versions of optics, short reach (SR) and intermediate reach (IR), with two small form-factor OC-48 ports with LC connectors • Lower slot is dedicated for 24-port Fast Ethernet module—available in TX (100 m reach), FX-MM (2 km reach) or FX-SM (15 km reach). The TX module is equipped with RJ-45 connectors while the FX-SM and FX-MM modules are equipped with MT-RJ connectors. The TX and the FX-MM versions of the 24-port Fast Ethernet modules accommodate copper or multimode fiber deployments within MTUs and the FX-SM allows for deployment of the Cisco 10720 Internet Router in a central location covering Ethernet connectivity to buildings for a radius of up to 15 km Also available is a combined 4GE+8FE TX Access Module. The GE ports are SFP (Small Form Factor Plug-able) with Optical Power Monitoring capabilities. The FE ports support 10/100 Mbps and the TDR (Time Domain Reflectometer) feature
Dimensions	3.5 x 17.25 x 18.25 in. (8.9 x 43.81 x 46.35 cm)

For More Information

www.cisco.com/go/10700

Cisco 12000 Series Internet Router



For cable operators who face the challenge of building high capacity data infrastructures, the Cisco 12000 Series offers the only portfolio of 10 Gigabit systems with the capacity, performance, and operational efficiencies to build the most competitive data networks.

The Cisco 12000 Series is the premier high end routing platform for backbone and headend applications. With its unique modular distributed system architecture, the Cisco 12000 Series leads the industry with the:

- Only 10 Gigabit portfolio
  - The only complete solution for small to large applications, backbone or headend applications.
  - The only platforms that maximize the value of line-rate headend applications with 10 Gigabit uplinks
- High-end systems with proven investment protection
  - Only vendor who delivers simple, low-cost field upgrades to higher switching capacities
  - All line cards are forward compatible
  - Latest Cisco 12000 Series ISE line cards work in all Cisco 12000 Series chassis
- Highest backbone and headend performance
  - The only high-end systems that sustain line-rate performance as they scale to maximum capacity
  - The only high-end solution that eliminates the trade-off between density and performance
- Only complete priority packet delivery solution set
  - The industry's only high-end systems with a complete IP QoS implementation that uniquely enables premium real-time IP services such as VoIP and video on demand

Cisco 12000 Series Chassis

The Cisco 12000 Series offers unparalleled design flexibility and investment protection for cable operators with seven chassis options that range in size and capacity. These include four 10-Gbps-per-slot chassis and three 2.5 Gbps chassis. Industry-leading products in the 10 Gbps per slot 12400 series include:

- Cisco 12416—highest capacity router, with two-fold improvement in regional data center scalability vs. nearest competitor
- Cisco 12410—highest capacity and performance half-rack system in the industry.
- Cisco 12406—only quarter-rack 10G router in the industry with five times the performance of the nearest competitor.
- Cisco 12404—at one-eighth of a rack, the smallest footprint 10 Gigabit router in the industry with the highest switching capacity per rack unit

When to Use

Use This Product	When You Need
Cisco 12400 Internet Routers **Cisco 12404, Cisco 12406, Cisco 12410, Cisco 12416**	10 Gbps/slot, 80 to 320 Gbps switching capacity Support for ATM, DPT, POS, GE/FE technologies ranging from sub-DS1 through OC-192 10 Gbps carrier class networking in a eighth rack, quarter-rack, half-rack and full rack, low-power configuration Support for industry-leading QoS and CoS features and ideal for peering, transit, POP consolidation, and IDC bandwidth aggregation as well as latency-sensitive applications like voice and streaming video
Cisco 12008 and 12012 Internet Routers	40 and 60 Gbps total switching capacity in 8 or 12 slots Support for ATM, DPT, POS, GE/FE technologies ranging from sub-DS1 through OC-48
Cisco 12016 Internet Routers	80 Gbps switching capacity upgradable to 320 Gbps via an easy, field-upgradable switch fabric upgrade kit Support for ATM, DPT, POS, GE/FE technologies ranging from DS1 through OC-192
Cisco 12000 Manager	An element management solution to increase service velocity and decrease operation costs

Cisco 12000 Series Line Cards

The Cisco 12000 Series offers an extensive portfolio of line cards supporting Dynamic Packet Transport (DPT), Electrical Interface (DS3/E3), Gigabit Fast Ethernet, and Packet over SONET (POS), Channelized POS and ATM technologies with speeds from DS1 or E1 (64 kbps) through OC-192/STM-64. These line cards deliver high performance, a complete priority packet delivery solution set, and service-transparent online-insertion and removal (OIR) required by cable operators to build networks that offer high Return On Investment and meet customer demand for services.

Cisco 12000 Series Line Card Technologies

Description	Specification	Line Cards
Packet over SONET/ Synchronous Digital Hierarchy (POS/SDH)	POS interfaces on the Cisco 12000 Series enable connections between Cisco next generation Internet routing products via optical interfaces. These interfaces can be circuits provisioned over a SONET/SDH infrastructure or dark fiber (native fiber links) connections or wavelengths of Wave Division Multiplexing (WDM) systems Line cards range from OC-3c/STM-1c to OC-192c/STM-64c	4 Port OC-3c/ STM-1c POS/SDH 8 Port OC-3c/ STM-1c POS/SDH 16 Port OC-3c/ STM-1c POS/SDH 16 Port OC-3c/ STM-1c POS/SDH ISE 1 Port OC-12c/ STM-4c POS/SDH 4 Port OC-12c/ STM-4c POS/SDH 1 Port OC-12c/ STM-4c POS/SDH ISE 1 Port OC-48c/STM-16c POS/SDH 1-Port OC-48c/STM-16c POS/SDH ISE 4 Port OC-48c/STM-16c POS/SDH 1 Port OC-192c/STM-64c POS/SDH
ATM	ATM interfaces on the Cisco 12000 Series enable connections between Cisco next generation Internet routing and IP+ATM products via ATM networks. Line cards range from OC-3/STM-1 to OC-12/STM-4.	4 Port OC-3c/STM-1c ATM 1 Port OC-12c/STM-4c ATM 4 Port OC-12c/STM-4c ATM
Gigabit and Fast Ethernet	Optical Gigabit Ethernet (GE) and Fast Ethernet (FE) interfaces on the Cisco 12000 Series are available in 1,3 and 10 Port GE and 8 Port FE options	8 Port Fast Ethernet 1 Port Gigabit Ethernet 3 Port Gigabit Ethernet 10 Port Gigabit Ethernet
Dynamic Packet Transport (DPT)	Dynamic Packet Transport (DPT) is a resilient packet ring technology, which, drawing on Cisco's IP+Optical expertise, combines the intelligence of IP routing with the bandwidth efficiencies of optical rings. Designed primarily for metropolitan area networks, DPT delivers scalable Internet service, reliable IP-aware optical transport, and simplified network operations DPT interfaces on the Cisco 12000 Series enable connections to other Cisco 12000, 7200, and 7500 Internet Routers, as well as the ONS 15190 IP Transport Concentrators. Line cards supported by the Cisco 12000 Series include OC-12, OC-48, and OC-192 interfaces	2 Port OC-12c/STM-4c DPT 1 Port OC-48c/STM-16c DPT
Channelized	Channelized interfaces enables the Cisco 12000 Series Internet Router to exchange packets with other routers using high-speed OC-48/STM-64, OC-12/STM-4, OC-3/STM-1 that channelize OC-12c/STM-4c down to DS1/E1 connections and take advantage of the multiplexing capability of SONET/ SDH networks. These channelized interfaces allow the Cisco 12000 Series Internet Router to connect directly to ADMs or digital cross-connects	2 Port Ch OC-3/STM-1 (DS1/E1) 6 Port Ch T3 (T1) 1 Port Ch OC-12/STM-4 (OC-3/ STM-1) 1 Port Ch OC-12 (DS3) 4 Port Ch OC-12/STM-4 (DS3/E3, OC-3c/STM-1c) POS/SDH ISE 1 Port Ch OC-48/STM-16 (DS3/E3, OC-3c/STM-1c, OC-12c/STM-4c) POS/SDH ISE
DS3 E3 COAX	DS3 and E3 cards provide IP and MPLS connectivity services over DS3/E3 co-axial connections in locations where optical services are not available	6 Port DS3 12 Port DS3 6 Port E3 12 Port E3

Key Features and Benefits

With more than 20,000 systems deployed worldwide, the Cisco 12000 Series is the industry's premier Internet routing platform based on a unique, modular distributed system architecture that offers:

- Configuration versatility
- 10 Gigabit portfolio
- Highest backbone and headend performance
- Complete priority packet delivery solution set
- Proven investment protection

Lowest operations costs; The Cisco 12000 Series is designed with standard cost reduction features such as an integrated cable management system, flexible power configuration options, front maintenance accessibility, and the Cisco 12000 Manager—an element management system that efficiently deploys, configures, and manages system resources. Reduction in operation costs leads to increased profitability and better ROI.

High performance and a complete priority packet delivery solution set through a superior distributed architecture; Key components are distributed across line cards, ensuring higher performance and system stability. Distributed packet forwarding based on a simple memory-less crossbar switching matrix and individual line card forwarding engines with packet buffers deliver line-rate performance per slot. Multicast replication performed in the fabric, priority-based congestion control (WRED), and dedicated low latency queuing (MDRR) support broadcast and multicast video-streaming services while non-performance-impacting class-of-service (CoS) features on the line cards enable services that require minimal latency and jitter. By offering line-rate performance, reliable packet delivery, and CoS features, the Cisco 12000 Series delivers both quantity and quality bandwidth.

Real-time service delivery; Because of its high performance and reliable packet delivery, the Cisco 12000 Series supports real-time services such as VoIP and video on demand. Key to delivering true multiservice networking is the Cisco MPLS feature suite that includes support for traffic engineering, VPNs, and connection services. The standards-based Cisco IP multicasting software has been deployed in networks for more than five years, bringing stability in this key technology area for real-time video distribution.

Line-card flexibility and investment protection: Cisco 12000 Series offers an industry-leading portfolio of line cards, including the 10 Gbps Cisco 12000 Series One-Port OC-192c/STM-64c and Four-Port OC-48c/STM-16c POS/SDH Line Cards. This broad range of interfaces and their interchangeability between systems guarantees that the Cisco 12000 Series can deliver needed interface technologies, while offering investment protection for legacy line cards.

Carrier-class redundancy and compliance: The Cisco 12000 Series supports redundant route processors and power supplies. Network-level redundancy is supported by Synchronous Optical Network automatic protection switching (SONET APS) and Synchronous Digital Hierarchy multiservice switching path (SDH MSP). All chassis are designed to meet Network Equipment Building Systems (NEBS) requirements to ensure compliance with industry safety regulations and standards. Combined with the Cisco 12000 Series distributed architecture that removes single points of failure and provides nonservice-impacting online insertion and removal (OIR) of line cards, MSO's can easily maintain service-level agreements (SLAs) by delivering high network availability.

Industry-recognized software: To enable the delivery of services, the Cisco 12000 Series supports Cisco IOS Software. Proven in customer networks and known by network engineers worldwide, Cisco IOS Software is a necessary component for building next generation networks.

The Cisco 12000 Series Internet Router is part of Cisco's family of multimillion packets-per-second (pps) routing platforms for building profitable networks in today's communications economy. The Cisco 12000 Series is the premier high-end routing platform for backbone and headend applications, enabling MSOs to meet the challenge of building packet networks to satisfy services demand while increasing profitability. The Cisco 12000 Series offers the only portfolio of 10Gbps systems and interfaces (including POS, DPT/RPR, and GbE), delivering 10G economies of scale anywhere in the network. The Cisco 12000 Series provides the highest reliability, the richest set of service enablers, lowest total cost of ownership, and the only proven investment protection including systems that can be upgraded in the field to increase switching capacity. This innovative combination of features and capabilities enables MSOs to build the most competitive high capacity data networks

Specifications

Chassis	Switching Capacity	Chassis Size	Chassis Slots	Dimensions	Minimum Cisco IOS Version
Cisco 12404 Internet Router	80 Gbps	1/8 rack	4 slots	8.75 x 18.9 x 27.5 in. (22.23 x 48.01 x 69.85 cm)	12.0(21)S or ST
Cisco 12406 Internet Router	120 Gbps	1/4 rack	6 slots	18.5 x 18.9 x 28 in. (47 x 48 x 71.1 cm)	12.0(17)S or ST
Cisco 12410 Internet Router	200 Gbps	1/2 rack	10 slots	37.5 x 19 x 24 in (95.25 x 48.26 x 61 cm)	12.0(16)S or ST
Cisco 12416	320 Gbps	Full rack	16 slots	72.5 x 18.75 x 24 in. (184.2 x 47.6 x 61 cm)	12.0(8)S 12.0(9)ST 12.0(15)S 12.0(16)ST
Cisco 12008 Internet Router	40 Gbps	1/8 rack	4 slots	8.75 x 18.9 x 27.5 in. (22.23 x 48.01 x 69.85 cm)	12.0(5)S 12.0(9)ST
Cisco 12012 Internet Router	60 Gbps	1/4 rack	6 slots	18.5 x 18.9 x 28 in. (47 x 48 x 71.1 cm)	12.0(5)S 12.0(9)ST
Cisco 12016[1]	80 Gbps; 320 Gbps	Full rack	16 slots	72.5 x 18.75 x 24 in. (184.2 x 47.6 x 61 cm)	12.0(8)S 12.0(9)ST 12.0(15)S 12.0(16)ST

1. The Cisco 12016 can be field upgraded to a Cisco 12416 via a Switch Fabric Upgrade kit.

Item	Value
Supported Protocols for Cisco 12000 Series	IPv4, MPLS, Border Gateway Protocol Version 4 (BGPv4), Intermediate System-to-Intermediate System
Management for Cisco 12000 Series	CLI, SNMP, Cisco 12000 Manager

For More Information

www.cisco.com/go/12000

Optical Transport

Optical Transport Products at a Glance

Product	Features	Page
Cisco ONS 15194 Transport Concentrator	Scalable, high density solution for resilient packet ring (RPR) and packet-over-SONET/SDH (POS) infrastructures • Supports management functions for POP, regional metro IP and business-class metro access rings • Supports OC-48/STM-16 data rates at different optics reach distances (maximum 64 ports) • Reduces operation costs • Enhances the serviceability, scalability, and manageability of the network	7-2
Cisco ONS 15200 Optical Metro DWDM Series	Service-provider class DWDM solution • Modular architecture • High transmission efficiency for more channels and nodes, and greater distances • Very small footprint	7-3
Cisco ONS 15454 Multiservice Provisioning Platform	Industry-leading optical transport platform Highly cost-effective for delivering multiservices in the metro core network • Wide range of service interfaces – DS1, DS3, DS3 T-Mux, EC1/STS1, OC-3/c, STM-1, OC-12/c, STM-4, OC-48c, STM-16 – 10/100 BaseT and Gigabit Ethernet (switched or private line) – ATM and video via DS1, DS3, OC-3c, OC-12c, OC-48c • Flexible transport speeds and network configurations – OC-12, OC-48, OC-192 transport speeds including DWDM optics – Rings (UPSR, 2F- and 4F-BLSR), mesh, star – ADM, terminal, regenerator	7-4
Cisco ONS 15327 Edge Multiservice Provisioning Platform	Optical transport platform based on ONS 15454 technology • Highly cost-efficient for delivering multiservices to the metro edge • Aggregates and switches TDM, Ethernet, and ATM services • Very small footprint	7-4

Product	Features	Page
Cisco ONS 15540 Extended Services Platform	Highly modular and scalable next-generation Dense Wave Division Multiplexing (DWDM) platform • Ideal for enterprises and service providers • Delivers the integration of data, storage and metro networking • Ultra-high bandwidth intelligent optical infrastructure • Supports any packet on any wavelength from any platform	7-8
Cisco 10720 Internet Router	Service provider-class metro access services router • Optimized building block for the next generation metro IP network • Equipped with 24 ports of Ethernet technology for customer access and dynamic packet transport (DPT) technology for metro optical connectivity • Powered by Cisco IOS Software and the Parallel Express Forwarding (PXF) architecture • Cost-effective, reliable platform supporting full suite of IP routing protocols With DPT architecture, enables optimal fiber connectivity as well as features such as IP class of service, TLS, VoIP and VPN services	7-9

Cisco ONS 15194 Transport Concentrator

The Cisco ONS 15194 is a high-density, high-performance IP transport management platform offering Internet service providers and IP operators carrier-class IP transport services within the point of presence (PoP), regional metro, and metro access rings. Designed with support for OC-48/STM-16, it is a superior scaling and management solution for RPR and POS networks, and is also a central management point.

For More Information

www.cisco.com/go/ons15194

Cisco ONS 15200 Optical Metro DWDM Series

The Cisco ONS 15252 and 15201 are part of the Cisco ONS 15200 Metro DWDM family, the first solution to deliver instant wavelengths to buildings, premises, or PoPs. The ONS 15252 and 15201 may be used to realize many sub-network topologies and can handle a mixture of point-to-point, hubbed, and meshed traffic patterns. Capacity may be added channel-by-channel in a highly cost-effective manner. Since they feature broadband transponders, a wide range of traffic types may be handled (SONET/SDH, Gigabit Ethernet) over a range of line rates up to 2.5 Gbs. Channel protection options include unprotected, client-protected, and (optical channel) fiber protection. The ONS 15252 is a multichannel unit and the ONS 15201 is a single channel unit node. Both have exceptionally small footprints and low power consumption.

The Cisco ONS 15216 supercharges wavelength services by supporting from 18 to 34 ITU-grid wavelengths, and provides unprecedented transport flexibility with optical filtering, Optical add/drop multiplexing (OADM), Optical Performance Monitoring and Amplification. It allows service providers to deliver more services per wavelength and more wavelengths per fiber.

For More Information

www.cisco.com/go/ons15200

Cisco ONS 15327 Edge Multiservice Provisioning Platform and Cisco ONS 15454 Multiservice Provisioning Platform

The Cisco ONS 15454 Multiservice Provisioning Platform (MSPP) and Cisco ONS 15327 Edge MSSP are part of the Cisco Complete Optical Multiservice Edge and Transport (COMET) product portfolio. These multiservice provisioning platforms maximize service velocity, density, variety, and capacity, building the foundation to accelerate IP+Optical networking. Supporting TDM Ethernet, IP, Storage, and Wavelength services over SONET and DWDM with integrated bandwidth management and end-to-end provisioning, the Cisco COMET portfolio offers efficient, unprecedented flexibility, and capacity.

The Cisco ONS 15454 is the industry's leading SONET MSPP with over 700 customers and 30,000 systems deployed worldwide. The ONS 15454 provides the functions of multiple traditional legacy SONET network elements in a single platform, combining next generation SONET/SDH transport, integrated DWDM optical networking, and multiservice interfaces including Ethernet and traditional TDM. The Cisco ONS 15454 combines the capacity of next-generation optical transport with the intelligence of IP to cost effectively deliver next generation voice and data services. The Cisco ONS 15327 Edge MSPP efficiently aggregates data, voice, and video services to break the services bandwidth barrier at the metro edge. The platform easily supports any service, including TDM, 10/100 Gigabit Ethernet, and provides integrated data switching and cross-connect functionality. Various data streams can be carried separately or together and transported in a one-for-one dedicated bandwidth mode or in a concentrated mode with no limit on the over-subscription ratio. The Cisco ONS 15327 combines industry leading bandwidth capacity and service diversity in a tiny footprint to enable service providers to achieve CAPEX and OPEX reductions at the metro edge.

When to Use

Use This Product	When You Need
Cisco ONS 15454 and Cisco ONS 15327	• Multiservice transport solutions that are easy to provision and manage and will seamlessly scale to meet increased metro traffic requirements • A competitive advantage in today's metropolitan environment • Flexible solutions to meet the demands of increased data traffic in carrier networks • Significant reductions in their CapEx and OpEx spending • Transport solutions that are compatible with legacy SONET/SDH infrastructure

Key Features

Protection

- Unidirectional path switched ring (UPSR)
- 2 fiber bidirectional line switched ring (2F-BLSR)
- 4 fiber bidirectional line switched ring (4F-BLSR)
- 1+1 automatic protection switching (1+1 APS), uni or bidirectional
- Path-protected mesh networking (PPMN)

Node Configurations

- Linear add/drop multiplexer (ADM)
- Ring
- Multiring (mixed UPSR and BLSR)
- Terminal
- Regenerator
- Star

Cisco ONS 15454 MSPP Specifications

Interface Cards	Ports per Card	Protection
Electrical Interfaces:		
DS-1	14	1:1, 1:N, 0:1
DS-3	12	1:1, 1:N, 0:1
DS-3 transmux	6	1:1, 0:1
EC1/STS-1	12	1:1, 0:1
Data Interfaces:		
10/100 Base Ethernet, Layer 2 Switching (E100T-12)	12	0:1
Gigabit Ethernet, Layer 2 Switching (E1000-2)	2	0:1
Gigabit Ethernet, Layer 1 Transport (G1000-4)	4	0:1, 1:1[1]
Optical Interfaces:		
OC-3/STM1 IR, 1310nm, 4 ports	4 Tx/Rx	1+1, 0:1
OC-12/STM4 IR, 1310nm	1 Tx/Rx	1+1, 0:1
OC-12/STM4 LR, 1310nm	1 Tx/Rx	1+1, 0:1
OC-12/STM4 LR, 1550nm	1 Tx/Rx	1+1, 0:1
OC-48/STM16 IR, 1310nm	1 Tx/Rx	1+1, 0:1
OC-48/STM16 LR, 1550nm	1 Tx/Rx	1+1, 0:1
OC-48/STM16 ELR, 15xx.xxnm, 37 wavelengths	1 Tx/Rx	1+1, 0:1
OC-192/STM64 LR, 1550nm	1 Tx/Rx	1+1, 0:1

1. Port protection leveraging Gigabit Etherchannel/Link Aggregation Protocol on external device.

Common Equipment	
Timing, Communications and Control Card	
Cross Connect Card	
XC-VT	288 STS1 and 672 VT1.5
XC-10G	1152 STS and 672 VT1.5
Alarm Interface Controller Card	Eight Provisionable alarm contacts— 4 Inputs, 4 outputs
Fan Tray Assembly	
FTA3-T	High volume, Industrial temperature
Electrical Interface Adapters (A+B)	
BNC	DS3 and EC1, 96 transmit and receive
SMB	DS3, EC1 and DS1 (with balun), 168 (max.) transmit and receive
AMP	DS1, 168 (max) transmit and receive
Wirewrap	SMB to wirewrap, 168 (max) transmit and receive

Cisco ONS 15327 Edge MSPP Technical Specifications

The following specifications apply to Version 3.3 of the Cisco ONS 15327.

Hardware

- XTC-28-3: (STS/VT Matrix, Timing/Control, 28 DS-1, 3DS-3)
- XTC 14 (STS/VT Matrix, Timing/Control, 14 DS-1)
- 4-port OC-3 IR 1310
- OC-12 IR 1310/OC-12 LR 1550
- OC-48 IR 1310/OC-48 LR 1550
- 4-port 10/100 BaseT Switched Ethernet
- MIC-28-3 (BITS, Alarms, Power, DS-1, DS-3)

Software

- SONET/DS-3/DS-1
- SDH tunneling
- UPSR, 2 fiber BLSR, PPMN, 1+1 Bi-directional and Unidirectional
- Complete equipment and facility maintenance
- Complete performance monitoring per GR-499, GR-253 and GR-820
- Full Ethernet switching (802.1p priority, 802.1q VLANs, 802.1d spanning tree)

Management

- Cisco Transport Manager
  - Scalable client/server element management system (EMS) for Cisco ONS 15000 series products
  - Integrated element management of the Cisco ONS 15327 and Cisco ONS 15454
  - Java-based client; Solaris-based server; Oracle database
  - Full fault, configuration, performance, and security management
  - Tree-based network explorer; topology map; graphical cross-connect map
  - CORBA, TL1, SNMP northbound interfaces for OSS integration
- Cisco Transport Controller
  - Java-based node and sub-network control
  - Unified GUI for the Cisco ONS 15327 and Cisco ONS 15454
  - Full node control: provisioning, alarm, maintenance, performance
  - Sub-net control: auto-discovery; topology map with drill-down; A-Z circuit provisioning; sub-net alarm control

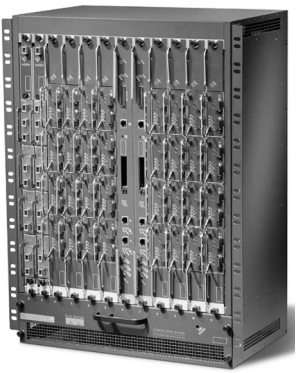
Chassis

- Modular, 3RU chassis
- Dimensions: 5.16 in. x 16.94 in. x 11.06 in. (13.1 cm x 43.0 cm x 28.1 cm) (H x W x D)
- Fully redundant architecture
- 4 flexible high-speed slots
- Integrated Cross Connect/Timing/Control/DSn card (XTC)
- All front access
- No ring service interruption for tributary maintenance
- Wall- and rack-mount design (wall mount cabinet available)
- Regulatory (UL, CSA, FCC, NEBS III)
- Environmental (-40° to +65° C, non-condensing)
- DC power: 130-W (for average configuration)
- Alarm contacts
- BITS input and output

For More Information

www.cisco.com/warp/public/cc/pd/olpl/metro/on15454

Cisco ONS 15540 Extended Services Platform



The Cisco ONS 15540 is targeted at building metropolitan networks capable of managing data, storage, and SONET/SDH service requirements for enterprise and service provider applications. It combines data multiplexing, switching and packet processing with the bandwidth, reach, reliability, and resiliency of optical networking; providing both service termination and OADM. The Cisco ONS 15540 protocol independent DWDM technology allows customers to increase backbone bandwidth with enhanced capability for Storage, ESCON, Fiber Channel, Gigabit Ethernet, 10 Gigabit Ethernet, SONET/SDH and Digital Video applications. The Cisco ONS 15540 solution has been qualified by a variety of industry leaders such as Compaq, IBM, EMC, and Brocade, for storage networking and data disaster recovery applications.

For More Information

www.cisco.com/go/ons15540

Cisco 10720 Internet Router

The Cisco 10720 Internet Router is a high-performance router and a principle building block in the metro IP network. It enables service providers to offer innovative and differentiated IP services to their customers at optical speeds. Equipped with Ethernet technology for customer access and the innovative Dynamic Packet Transport (DPT) technology for metro optical connectivity, the Cisco 10720 allows service providers to offer IP services closer to the user, enabling them to better control admission to network resources. This allows service providers to bypass traditional DS1 and DS3 access options. The dual counter rotating ring technology of DPT is also cost effective, since it uses both rings and can be deployed over dark fiber and still maintain the less than 50ms restoration common in SONET/SDH systems. For multiservice applications, DPT can also be deployed over traditional SONET/SDH ADMs and wavelength division multiplexing (WDM) systems.

The Cisco 10720 is a cost-effective, reliable platform that not only supports the full suite of IP routing protocols such as IS-IS, OSPF and BGP, but also allows advanced IP features to be introduced efficiently, without compromising on performance. Although primarily designed for high-speed Internet services for multitenant and business-park applications in the metro, the Cisco 10720 Internet Router is also suitable for a range of other applications such as Internet data center applications, cable multisystem operator (MSO) internetworking, and voice-over-IP (VoIP) aggregation.

When to Use

Use This Product	When You Need
Cisco 10720 Internet Router	• To offer high-performance IP services as part of their business strategy • To simplify current networks and implement simple, scalable, reliable features of DPT technology while maximizing fiber usage • Any customer already using DPT technology in their network, most likely with DPT cards on the 12000 Internet Router

Key Features

- Redundant AC or DC power supplies; the Cisco 10720 Internet Router is equipped with dual power supplies by default
- Dual OC48 STM 16 Uplink Ports in either Ring (SRP) or Point-Point (POS)
- Console/Auxiliary Port to be used together with either 24 Port Fast Ethernet or Combined 4GE+8FE for an Ethernet only router
- 24 ports Fast Ethernet in TX, FX MM or FX SM Access Module
- Combined 4 Gigabit Ethernet+8 Fast EthernetTX ports Access Module
- SRP specific features—IPS with <50 ms restoration time and SRP MIB support
- Multicast support including PIM SM, PIM DM, MBGP
- TLS—UTI/L2TPv3 or EoMPLS for Layer 2 to Layer 2 LAN extension
- QoS—Modular QoS CLI, CAR, WRED, VTMS traffic shaping, and access lists
- Ethernet features—MDI-MDI-X support, 10/100 speed auto negotiation,
- HDX-FDX negotiation and time delay reflectometry (TDR) for 10/100BaseTX
- Hot Standby Routing Protocol (HSRP)/Multiple Hot Standby Routing Protocol (MHSRP) and VRRP
- 64-MB built-in Flash for software and configuration load
- Optical receive power monitoring support on OC-48/STM-16 Interface and Gigabit Ethernet Small Form Factor
- Supported management information bases (MIBs) include SNMP, SRP, SONET
- Network management includes CiscoView, Cisco IE2100 Series Intelligent Engine, Cisco VPN Solutions Center and Cisco Element Management Framework

Specifications

Feature	Cisco 10720
Security Features	Including AAA, RADIUS authentication, TACACS+, and encrypted passwords
Management	Cisco IOS Software CLI TACACS+ and RADIUS Configuration and administration features including Telnet and Cisco Discovery Protocol CiscoView, Cisco IE2100 Series Intelligent Engine, Cisco VPN Solutions Center Serial (aux) and console ports for local and remote administration Remote software download via TFTP and RCP IP over DCC for remote management of the Cisco ONS 15104 OC-48/STM-16 Optical Regenerator, where applicable
Physical Interfaces	Uplink Modules: 2-port single-mode OC-48c/STM16c DPT (SR 2 km (1.2 miles), IR 15 km (9.3 miles)), LR1 40km (25 miles) and LR2 80km (50 miles) Interface Modules—The Cisco 10720 Internet Router has two dedicated slots for interface modules—modules are not interchangeable or hot swappable: • Upper slot is dedicated for SRP/POS Uplink module equipped with two physical ports of OC-48c/STM16c that provide an aggregate bandwidth of approximately 5 Gbps. The cards are available in four versions of optics, short reach (SR) and intermediate reach (IR), with two small form-factor OC-48 ports with LC connectors • Lower slot is dedicated for 24-port Fast Ethernet module—available in TX (100 m reach), FX-MM (2 km reach) or FX-SM (15 km reach). The TX module is equipped with RJ-45 connectors while the FX-SM and FX-MM modules are equipped with MT-RJ connectors. The TX and the FX-MM versions of the 24-port Fast Ethernet modules accommodate copper or multimode fiber deployments within MTUs and the FX-SM allows for deployment of the Cisco 10720 Internet Router in a central location covering Ethernet connectivity to buildings for a radius of up to 15 km Also available is a combined 4GE+8FE TX Access Module. The GE ports are SFP (Small Form Factor Plug-able) with Optical Power Monitoring capabilities. The FE ports support 10/100 Mbps and the TDR (Time Domain Reflectometer) feature
Dimensions	3.5 x 17.25 x 18.25 in. (8.9 x 43.81 x 46.35 cm)

For More Information

www.cisco.com/go/10700

Ethernet Switching

Ethernet Switching at a Glance

Product	Features	Page
Cisco Catalyst 2950 Series Intelligent Ethernet Switch	Fixed-configuration 10/100 and Gigabit Ethernet switching • Wire speed, high performance switch • Stand-alone and stackable switching • Includes intelligent ethernet switching with advanced Quality of Service, rate-limiting, security filters, and multicast management capabilities • Cisco switch clustering capable. Cisco Cluster Management Suite (CMS) enhanced with configuration wizards • Low price per port • Flexible uplink options: 100BaseFX, fixed 10/100/1000BaseT, GBIC-based ports	8-3
Cisco Catalyst 3550 Series Intelligent Ethernet Switch	Fixed configuration, multilayer 10/100 and Gigabit Ethernet switching • 24 or 48 10/100 ports with 2 GBIC-based Gigabit Ethernet ports • 24 10/100 ports with 2 GBIC-based Gigabit Ethernet ports with DC power • 24 100FX multimode fiber ports with 2 GBIC-based Gigabit Ethernet ports with DC power • 10 10/100/1000BaseT ports and 2 GBIC-based Gigabit Ethernet ports or 10 GBIC-based Gigabit Ethernet ports with 2 10/100/1000BaseT ports • Network control through advanced quality of service and rate-limiting based on L2-L4 information • Network security through Cisco ACLs based on L2-L4 information • Network scalability through high performance IP routing • Stackable up to 9 switching with GigaStack GBIC • Simplified network management through the Cluster Management Suite (CMS)	8-6
Cisco Catalyst 4000 Series	The Catalyst 4003 and 4006 are cost-effective modular chassis ideal for Ethernet aggregation and high-density access • Up to 240 ports of Ethernet, Fast Ethernet and Gigabit Ethernet of Fiber or Copper • Hardware based Layer 2 and Layer3/4 switching up to 48 Mpps • Up to 64 Gbps of switching capacity • Network scalability through high-performance IP routing	8-9

Product	Features	Page
Cisco Catalyst 6500 Series	Delivers highly available secure converged network services, connecting enterprise networks. The Cisco Catalyst 6500 Series is designed to address increased requirements for gigabit scalability, high-availability, rich services, and multilayer switching in backbone, distribution, and wiring closet topologies, as well as data center environments The Cisco Catalyst 6500 Series delivers exceptional scalability and performance. The product offers a wide range of interface densities and integration of powerful service modules • Highest Switching Capacity • Highest Port Density • Optional Services Modules • High Availability—Stateful Failover • Redundant Supervisor, Fabric • 10 Gigabit Ethernet Interfaces • Non-Blocking Gig Density: 142 • LAN/WAN Interfaces (to OC-48) • L2-L7 Switching • Integrated In-Line Power • Integrated Redundant Power	8-11
Cisco CWDM GBIC Solution	The Cisco Coarse Wave Division Multiplexing (CWDM) GBIC solution allows scalable and easy to deploy Gigabit Ethernet services • Up to 8 Gbps over a pair of single mode fiber • Support for point-to-point, meshed ring, hubbed ring architectures • Standard GBIC format; supported in Catalyst 2950, Catalyst 3550, Catalyst 4000, and Catalyst 6500 • High optical link budget of 30dB allow for extended link lengths	8-14

Ethernet Switching Port Matrix

	Catalyst 2950	Catalyst 3550	Catalyst 4000	Catalyst 6500
Fixed and Modular Ports	X	X	X	
Modular Ports Only				X
Ports				
10BASE-T Switched	X	X	X	X
10BASE-FL Switched				X
100BASE-T Switched	X	X	X	X
100BASE-F Switched			X	X
10/100 Autosensing Switched		X	X	X
10/100 TELCO				X
10/100/1000 BASE-T Autosensing			X	
ATM				X
Gigabit Ethernet		X	X	X
10 Gigabit Ethernet				X
In-Line Power		*	X	X
Integrated In-Line Power			**	X
Integrated Server Load Balancing				X
Integrated Intrusion Detection				X
Integrated Network Analysis				X
Integrated Voice Gateway				X
DC Power	X	X	X	X
Redundant Power			X	X
Redundant Supervisor				X
Redundant Backplane				X

* 3524-PWR-XL only

** Requires Power Expansion Module

Cisco Catalyst 2950 Series Intelligent Ethernet Switch

The Cisco Catalyst® 2950 Series Intelligent Ethernet Switch is a line of fixed-configuration, stackable and standalone devices that provide wire-speed Fast Ethernet and Gigabit Ethernet connectivity. This is the most affordable Cisco switching product line, providing intelligent services for mid-sized networks and metro access applications. The Cisco Catalyst 2950 Series enables intelligent services at the network or metro access edge.

When to Use

Use This Product	When you need
Catalyst 2950G-48-EI	• Desktop connectivity or residential metro Ethernet service access • High Port Density
Catalyst 2950G-24-EI	• Desktop connectivity or residential metro Ethernet service access • Medium Port Density
Catalyst 2950G-24-EI-DC	• Telco/DCN environments • NEBS compliant • Medium Port Density
Catalyst 2950G-12-EI	• Desktop connectivity or residential metro Ethernet service access • Low Port density
Catalyst 2950G Series	• Wire-speed performance • Advanced QoS, Security, High availability and STP enhancements • Cisco Cluster Management
Catalyst 2950T-24	• Wire speed, high performance switch for delivering 10Mbps or 100Mbps speed connectivity to desktop PCs, servers and other systems • Enhanced Quality of Service and multicast management capabilities • High speed uplink flexibility with 10/100/1000BaseT ports • Low price per port
Catalyst 2950C-24	• Wire speed, high performance switch for delivering 10Mbps or 100Mbps speed connectivity to desktop PCs, servers and other systems • Enhanced Quality of Service and multicast management capabilities • High speed uplink flexibility over extended distances with 100BASE-FX connections using MT-RJ connectors • Low price per port

Key Features

For Enterprises:

- Wire-speed performance in connecting end-stations to the LAN
- Ideal for mid-sized networks
- Catalyst 2950T-24 switch is a component of the Cisco Gigabit Ethernet over copper solution, offering 10/100/1000BaseT uplinks
- Powerful Gigabit-uplink options—GBIC-based or 1000BaseT
- Superior control through advanced intelligent services—advanced quality of service based on Layer 2 through Layer 4 parameters
- Superior Security features: based on Layer 2 through Layer 4 Access Control Parameters
- Sophisticated Multicast Management via IGMP Snooping
- Scalability and high availability features
- Cisco Cluster Management (CMS) Software offers superior manageability, ease-of-use and ease-of-deployment and enhanced configuration wizards
- Enhanced Cisco IOS Services
- Support for Cisco Redundant Power System 300 (RPS 300)

For Service Providers:

- Provides service breadth through advanced QoS, rate limiting, and voice and multicast features
- Delivers service availability and security through Spanning Tree Protocol enhancements and access control parameters (ACPs)
- Enables service management through Cisco IE 2100 Series Intelligence Engine support and Simple Network Management Protocol (SNMP)

Specifications

Feature	Catalyst 2950G-48-EI	Catalyst 2950G-24-EI	Catalyst 2950G-24-EI-DC	Catalyst 2950G-12-EI
Fixed Ports	48 port 10/100 autosensing & 2 GBIC-based Gigabit Ethernet ports	24 port 10/100 autosensing & 2 GBIC ports	24 port 10/100 autosensing & 2 GBIC ports and DC Power	12 port 10/100 autosensing & 2 GBIC ports
Modular Slots	None	None	None	None
Backplane	13.6 Gbps	13.6 Gbps	13.6 Gbps	13.6 Gbps
Forwarding Rate	10.1 Mpps	6.6 Mpps	6.6 Mpps	4.8 Mpps
Stackable	Yes	Yes	Yes	Yes
Full-Duplex Capabilities	All Ports	All Ports	All Ports	All Ports
VLAN Maximum	64-port-based VLANS	64-port-based VLANS	64-port-based VLANS	64-port-based VLANS
FEC	Yes	Yes	Yes	Yes
802.1Q	Yes	Yes	Yes	Yes
Multicast	IGMP Snooping	IGMP Snooping	IGMP Snooping	IGMP Snooping
QoS	802.1P, 4 egress queues, WRR	802.1P, 4 egress queues, WRR	802.1P, 4 egress queues, WRR	802.1P, 4 egress queues, WRR
Management Capabilities	SNMP, Telnet, RMON, CWSI, (CLI)-based out-of-band, embedded CMS	SNMP, Telnet, RMON, CWSI, (CLI)-based out-of-band, embedded CMS	SNMP, Telnet, RMON, CWSI, (CLI)-based out-of-band, embedded CMS	SNMP, Telnet, RMON, CWSI, (CLI)-based out-of-band, embedded CMS
Flash Memory	8 MB	8 MB	8 MB	8 MB
CPU DRAM	64 MB	64 MB	64 MB	64 MB
Embedded RMON	History, Events, Alarms, Statistics	History, Events, Alarms, Statistics	History, Events, Alarms, Statistics	History, Events, Alarms, Statistics
Dimensions (H x W x D)	1.72 x 17.5 x 13 in.	1.72 x 17.5 x 9.52 in.	1.72 x 17.5 x 9.52 in.	1.72 x 17.5 x 9.52 in.
Feature	Catalyst 2950T-24	Catalyst 2950C-24	Catalyst 2950-24	Catalyst 2950-12
Fixed Ports	26-port (24 10/100 autosensing & 2 ports 1000BaseT	26-port (24 10/100 autosensing & 2 ports100BaseFX)	24-port 10/100 autosensing	12-port 10/100 autosensing
Modular Slots	None	None	None	None
Backplane	8.8 Gbps	8.8 Gbps	8.8 Gbps	8.8 Gbps
Forwarding Rate	6.6 Mpps	3.9 Mpps	3.6 Mpps	1.8 Mpps
Stackable	No	No	No	No
Full-Duplex Capabilities	All Ports	All Ports	All Ports	All Ports

Feature	Catalyst 2950G-48-EI	Catalyst 2950G-24-EI	Catalyst 2950G-24-EI-DC	Catalyst 2950G-12-EI
VLAN Maximum	64-port-based VLANS	64-port-based VLANS	64-port-based VLANS	64-port-based VLANS
FEC	Yes	Yes	Yes	Yes
802.1Q	Yes	Yes	Yes	Yes
Multicast	IGMP Snooping	IGMP Snooping	IGMP Snooping	IGMP Snooping
QoS	802.1P, 4 egress queues, WRR	802.1P, 4 egress queues, WRR	802.1P, 4 egress queues, WRR	802.1P, 4 egress queues, WRR
Management Capabilities	SNMP, Telnet, RMON, CWSI, (CLI)-based out-of-band, embedded CMS	SNMP, Telnet, RMON, CWSI, (CLI)-based out-of-band, embedded CMS	SNMP, Telnet, RMON, CWSI, (CLI)-based out-of-band, embedded CMS	SNMP, Telnet, RMON, CWSI, (CLI)-based out-of-band, embedded CMS
Flash Memory	8 MB	8 MB	8 MB	8 MB
CPU DRAM	64 MB	64 MB	16 MB	16 MB
Embedded RMON	History, Events, Alarms, Statistics	History, Events, Alarms, Statistics	History, Events, Alarms, Statistics	History, Events, Alarms, Statistics
Dimensions (H x W x D)	1.75 x 17.5 x 16 in.	1.75 x 17.5 x 11.8 in.	1.75 x 17.5 x 11.8 in.	1.75 x 17.5 x 9.52 in.

Cisco Catalyst 3550 Series Intelligent Ethernet Switch

The Cisco Catalyst® 3550 Series Intelligent Ethernet Switch is a line of stackable, multilayer switch that provides high availability, QoS and security to enhance the operation of the network. With a range of Fast Ethernet and Gigabit Ethernet configurations, the switch is a powerful option for enterprise and metro access applications.

When to Use

Use This Product	When You Need
Cisco Catalyst 3550 Series	• Enterprise-class intelligent services such as ACLs, advanced QoS, and rate-limiting • Cisco Cluster Management
Cisco Catalyst 3550-48-EMI (Enhanced Multilayer Software Image)	• High performance IP routing • High Port Density • Powerful access layer switch for a medium enterprise wiring closet with routed uplinks or as an access switch for metro Ethernet service networks
Cisco Catalyst 3550-48-SMI (Standard Multilayer Software Image)	• High Port Density • Powerful access layer switch for a medium enterprise wiring closet or as an access switch for metro Ethernet service networks
Cisco Catalyst 3550-24-EMI (Enhanced Multilayer Software Image)	• High performance IP routing • Medium Port Density • Powerful access layer switch for a medium enterprise wiring closet with routed uplinks or as an access switch for metro Ethernet service networks
Cisco Catalyst 3550-24-SMI (Standard Multilayer Software Image)	• Medium Port Density • Powerful access layer switch for a medium enterprise wiring closet or as an access switch for metro Ethernet service networks

Use This Product	When You Need
Cisco Catalyst 3550-24-DC -SMI (Standard Multilayer Software image)	• Medium Port Density with DC power • Powerful DC powered access layer switch for a medium enterprise wiring closet or as an access switch for metro Ethernet service networks
Cisco Catalyst 3550-24-FX -SMI (Standard Multilayer Software image)	• Medium Port Density • 100 FX multimode fiber access • Access layer switch for a medium enterprise wiring closet or as an access switch for metro Ethernet service networks
Cisco Catalyst 3550-12G	• High performance IP routing • Gigabit Ethernet aggregation using fiber • Stack aggregation, server aggregation, or as a backbone switch in a mid-sized network, or as a aggregation switch in Metro Ethernet service networks
Cisco Catalyst 3550-12T	• High performance IP routing • Gigabit Ethernet aggregation using Category 5 copper cabling • Stack aggregation, server aggregation, or as a backbone switch in a mid-sized network, or as a aggregation switch in Metro Ethernet service networks

Key Features

For Enterprises:

- Network scalability through high performance IP routing
- 24 10/100 ports with 2 GBIC-based Gigabit Ethernet ports with DC power
- 24 100FX multimode fiber ports with 2 GBIC-based Gigabit Ethernet ports with DC power
- Network control through advanced quality of service and rate limiting based on Layer 2 through Layer 4 information
- Network security through Cisco access control lists (ACLs) based on Layer 2 through Layer 4 information
- Gigabit Ethernet (1000Base T) connectivity as a component of the Cisco Gigabit Ethernet over copper solution
- Network availability with the Cisco optional Redundant Power System 300 (RPS 300)
- Simplified network management through the Cisco Cluster Management Suite (CMS) Software

For Service Providers:

- Provides service breadth through high-performance IP routing, 802.1Q tunneling, advanced QoS, and rate limiting
- Delivers service availability and security through Spanning Tree Protocol enhancements and ACLs
- Enables service management through Cisco IE 2100 Series Intelligence Engine support and Simple Network Management Protocol (SNMP)

Specifications

Feature	Cisco Catalyst 3550-48	Cisco Catalyst 3550-24	Cisco Catalyst 3550-12G	Cisco Catalyst 3550-12T	Cisco Catalyst 3550-24-FX
Fixed Ports	48 10/100 ports 2 GBIC-based Gigabit Ethernet ports	24 10/100 ports 2 GBIC-based Gigabit Ethernet ports	10 GBIC-based Gigabit Ethernet ports 2 10/100/1000 ports	10 10/100/1000 ports 2 GBIC-based Gigabit Ethernet ports	24 100FX multimode fiber ports. 2GBC-based Gigabit Ethernet Ports
Switching Fabric	13.6 Gbps	8.8 Gbps	24 Gbps	24 Gbps	Same as 3550-24
Full-Duplex	All ports	All ports	All ports	All ports	Same as 3550-24
VLAN Maximum	4000	4000	4000	4000	Same as 3550-24
FEC/GEC	Yes	Yes	Yes	Yes	Same as 3550-24
GBICs	Gigastack, 1000BaseT, SX, LX/LH, ZX, CWDM	Gigastack, 1000BaseT, SX, LX/LH, ZX, CWDM	Gigastack, 1000BaseT, SX, LX/LH, ZX, CWDM	Gigastack, 1000BaseT, SX, LX/LH, ZX, CWDM	Same as 3550-24
802.1Q and ISL	Yes	Yes	Yes	Yes	Same as 3550-24
In-Line Power		*			Same as 3550-24
802.1Q Tunnelling	Yes	Yes	Yes	Yes	
QoS	802.1p, DSCP, 4 egress Queues, WRR, Strict Priority Queuing, WRED	Same as Catalyst 3550-48	Same as Catalyst 3550-48	Same as Catalyst 3550-48	Same as 3550-24
Multicast	IGMP Snooping, PIM (requires EMI), DVMRP (requires EMI), CGMP Server (requires EMI)	IGMP Snooping, PIM (requires EMI), DVMRP (requires EMI), CGMP Server (requires EMI)	IGMP Snooping, PIM, DVMRP, CGMP Server	IGMP Snooping, PIM, DVMRP, CGMP Server	Same as 3550-24
Management Capabilities	SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, IE2100 support	Same as Catalyst 3550-48, IE2100 support	Same as Catalyst 3550-48, IE2100 support	Same as Catalyst 3550-48, IE2100 support	Same as 3550-24
Flash Memory	16 MB	16 MB	16 MB	16 MB	Same as 3550-24
CPU DRAM	64 MB	64 MB	64 MB	64 MB	Same as 3550-24
Embedded RMON	History, Events, Alarms, Statistics	Same as Catalyst 3550-48	Same as Catalyst 3550-48	Same as Catalyst 3550-48	Same as 3550-24
Dimensions (H x Wx D)	1.75 x 16.3 x 17.5 in.	1.75 x 14.4 x 17.5 in.	2.63 x 15.9 x 17.5 in.	2.63 x 15.9 x 17.5 in	1.75 x 16.3 x 17.5 in
DC Power		Yes, Catalyst 3550-24-DC			

*Use Catalyst 3524-PWR-XL

For More Information

www.cisco.com/go/cat3550

Cisco Catalyst 4000 Series

The Catalyst 4003 and 4006 are cost-effective modular chassis ideal for metro Ethernet aggregation and high-density access. The products enable service providers to accelerate their growth and profitability with a service portfolio that brings optical Ethernet connections to its customers.

New Catalyst 4000 Family capabilities include a next-generation supervisor engine for the 4006, high density 10/100/1000BASE-T and 1000-BASE-LX, voice services, and high density 100-FX.

When to Use

Use This Product	When You Need
Catalyst 4006	• Port density up to 240 ports (10/100, 10/100/1000BASE-T, 100-FX, 1000BASE-LX) with modular investment protection • Layer 2 and Layer 3 Cisco Express Forwarding (CEF)-based switching up to 64 Gbps, 48 Mpps
Catalyst 4003	• Port density up to 96 10/100, 100-FX, or 10/100/1000BASE-T with modular investment protection • Layer 2 switching up to 24 Gbps, 18 Mpps; Layer 3 up to 8 Gbps, 6 Mpps with Layer 3 Services Module

Note: Compatible sparing between Catalyst 4003 and 4006 chassis provides investment protection with commonality of power supplies and switching line cards.

Key Features

- Supervisor I and II
  - Single IP-Address Management, and security (TACACS+, port lockdown, RADIUS, Kerberos)
  - VLANs (4,096) with 802.1Q support on all ports, 16,000 MAC Addresses, and Spanning-Tree Protocol (802.1D) enhancements (UplinkFast, PortFast, and BackboneFast) for deterministic/fast failover
  - Fast and Gigabit EtherChannel aggregation (up to 8 Gbps), load balancing and failover on every port, and port filtering
- Supervisor III
  - Integrated Layer 2/3/4 CEF based switching at 64Gbps and 48Mpps
  - Feature rich and proven Cisco IOS Software
  - Port based enhanced QOS with multiple queues, bandwidth management, policing and Access Control Lists

- VLANs (4,096) with 802.1Q and ISL support on all ports, 32,000 MAC Addresses, and Spanning-Tree Protocol (802.1D)
- Supports RIP I, RIP II, Open Shortest Path First (OSPF), Interior Gateway Routing Protocol (IGRP) Enhanced IGRP (EIGRP), BGP4, Hot Standby Router Protocol (HSRP), Cisco Group Management Protocol (CGMP), IGMP v1 and II, Internet Control Message Protocol (ICMP), and both Protocol Independent Multicast (PIM) sparse and dense modes, and Distance Vector Multicast Routing Protocol (DVMRP) interoperability
- Optional compact flash memory cards

Specifications

Feature	Catalyst 4003	Catalyst 4006
Fixed Ports	None	2 Gigabit uplink ports on Supervisor Engine II and Supervisor III
Maximum Port Density	96 (10/100 Fast Ethernet) 96 (100-FX Fast Ethernet) 96 (10/100/1000BASE-T)	240 (10/100 Fast Ethernet) 240 (100-FX Fast Ethernet) 240 (10/100/1000BASE-T)
Modular Slots	3 (1 for Supervisor)	6 (1 for Supervisor)
Available Modules	Supervisor Engine I	Supervisor Engine II, Supervisor III
Backplane Capacity	24 Gbps	64 Gbps
Stackable	No	No
Hot-Swappable Power Supplies	2 bays (1 required, 1 for redundancy)	3 bays (2 required, 1 for redundancy)
Embedded RMON	Statistics, History, Alarm, Events	Same as Catalyst 4003
Dimensions (H x W x D)	10.5 x 17.25 x 12 in.	17.5 x 17.25 x 12 in.

For More Information

www.cisco.com/go/cat4000

Cisco Catalyst 6500 Series

The Catalyst 6500 Series consists of the Cisco 6506, 6509, 6509-NEBS, and 6513 platforms. The Cisco Catalyst 6500 Series delivers highly available secure converged network services for service provider networks. The Cisco Catalyst 6500 Series is designed to address the increased requirements for gigabit scalability, high-availability, rich services, and multilayer switching in backbone, distribution, and AVVID wiring closet topologies, as well as data center environments. The Cisco Catalyst 6500 Series delivers exceptional scalability and performance. The products offer a wide range of interface densities and integration of powerful service modules. The new 10 Gigabit Serial 1550nm (40k), EoMPLS, 802.1q, Q-n-Q tunneling, 802.1s/w, CWDM GBICS, and other enhancements make the Cisco Catalyst 6500 ideal for Metro and Regional Metro aggregation and intercampus connectivity.

When to Use

Use This Product	When You Need
Catalyst 6500 Series	• High availability and a scalable and versatile platform that meets the requirements of the most demanding multilayer switching environments; industry's leading performance over Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet and WAN interfaces from T1/E1 to OC-48, with intelligent IP services • Ability to leverage existing ATM and Frame-Relay infrastructures to deliver high touch Metro Ethernet Aggregation and Regional Metro Ethernet Aggregation • Ability to deliver Metro solutions based on either Transparent Lan Services (TLS) or Ethernet Virtual Circuit Services (EVCS) • Integrated Intrusion Detection, Server Load Balancing, or Network Analysis
Catalyst 6513	• Up to 194 GE GBIC (non blocking) • Up to 290 SX/LX Gigabit Ethernet ports • Up to 192 OC-3 ports • 576 Fast Ethernet ports • Forwarding performance up to 210 Mpps (w/ QoS, ACLs enabled) • Layer 2 - 7 multilayer switching with intelligent IP Services • Packet over SONET (POS) • Channelized OC-48

Key Features

- Scalable wire-speed Layer 3 switching support for IP and IPX, with additional support for AppleTalk, DECnet, and Vines; optional MSFC/MSFC2 and PFC on Supervisor 1A and MSFC2 on Supervisor Engine 2 (includes PFC2)
- Integrated Layer 2/3/4-7 CEF & dCEF based switching with the Switch Fabric Module (SFM), with 32 Gbps and 256Gbps backplane with up to 210 Mpps
- Feature-rich Catalyst OS for the wiring closet and Cisco IOS for large or mission critical backbone, distribution, data centers or WAN aggregation deployments

- Metro: 802.1Q Tunneling (protocol tunneling and q-in-q to EoMPLS), Port Transparent EoMPLS, 4K VLAN ID, Spanning Tree Enhancements (802.1d, 802.1s, 802.1w), Port Security – MAC aging, WCCP, CISCO-ENVMON-MIB, VACLs w/o SVIs, VACLs on WAN interfaces, CWDM GBIC Support, and Serial 1550nm & 1310nm 10 Gigabit Ethernet
- Security: AAA Services (RADIUS & TACACS+) on a per command / per-user for authentication, Secure Shell, SNMPv3, Unicast Reverse Path Forwarding, Wire-Rate ACLs even on 10GE, MPLS & EoMPLS, Enhanced Private VLANs, Integrated Intrusion Detection, 802.1x & port security, Dynamic VLAN
- Includes support for RIP I, RIP II, Open Shortest Path First (OSPF), Interior Gateway Protocol (IGRP), Enhanced Interior Gateway Protocol (EIGRP), IP-BGP, IP-ISIS, IP-PBR, ICMP, Netflow, MPLS, Per VLAN Spanning Tree (PVST), PVRST, RSPAN, WCCP, and IGMP snooping
- Scalable wire-speed Layer 3 switching support for IP and IPX, with additional support for AppleTalk, DECnet, and Vines with optional MSFC/MSFC2 and PFC on Supervisor 1A and MSFC2 on Supervisor Engine 2 (includes PFC2)
- Fast EtherChannel and Gigabit EtherChannel technologies with Port Aggregation Protocol (PAgP)
- Policy server, Virtual Management Policy Server (VMPS), Jumbo Frame support for Gigabit Ethernet - Layer 2 & 3, 4000 VLANs, private & dynamic VLANs

Cisco Catalyst 6500 Series Specifications

Cisco Catalyst 6500 Series Specifications	Cisco Catalyst 6506	Cisco Catalyst 6509	Cisco Catalyst 6509-NEBS	Cisco Catalyst 6513
Modular Slots	6	9	9	13
Available Modules	**Supervisor Engines** • SUP1 & SUP2 with optional Policy Feature Card (PFC) and Multilayer Switch Feature Card (MSFC). • Switch Fabric Module (scales backplane to 256 Gbps), requires SUP2 • Distributed Forwarding Card (enables dCEF on Fabric enabled cards) **Ethernet** • 1-Port 10 Gigabit Ethernet (Serial 1330nm & Serial 1550nm (40k)) • 8- and 16-port Gigabit Ethernet, Classis & Fabric Enabled • 16-port 1000BASE-T Gigabit Ethernet • 24-port 10BASE-FL (MT-RJ) • 24-port 100FX Ethernet (multimode or single mode) • 48-port 10/100TX Ethernet (RJ45), In-Line Power • 48-port 10/100 Ethernet (RJ-21 or TELCO), In-Line Power **Integrated Services Modules** • Network Analysis Module • Content Switching Module • Intrusion Detection Module **Voice Integrated Services Modules** • 24 port FXS Analog Station Interface Module • 8 port Voice T1 or E1 Services Module **Integrated WAN Services Modules** • Flex Wan Module (supported a wide range of Cisco 7200/7500 Series WAN Port Adapters) • 2 & 4-port OC-12c/STM-4 Packet over SONET/SDH • 8 & 16-port OC-3c/STM-1 Packet over SONET/SDH • 1-port OC-48c/STM-16 Packet over SONET/SDH • 1 & 2-Port CHOC48/DS3 • 4 & 8-Port CHOC12/DS3 • 4-port Gigabit Ethernet WAN	Same as Cisco 6506	Same as Cisco 6506	Same as Cisco 6506
Backplane	32 Gbps—Scalable to 256 Gbps	32 Gbps—Scalable to 256 Gbps	32 Gbps—Scalable to 256 Gbps	32 Gbps—Scalable to 256 Gbps
Stackable	No	No	No	No
Multilayer Performance	15 Mpps—Scalable to 100+ Mpps	15 Mpps—Scalable to 100+ Mpps	15 Mpps—Scalable to 100+ Mpps	15 Mpps—Scalable to 100+ Mpps
VLAN Maximum	4000	4000	4000	4000
FEC/GEC	Up to 8 non contiguous ports; support multimodule channeling			

Management Capabilities	Element Manager for Cisco Catalyst 6500 leverages the Cisco Element Manager Framework (CEMF), CiscoWorks 2000, RMON, Enhanced Switchport Analyzer (ESPAN), SNMP, Telnet, BOOTP, and Trivial File Transport Protocol (TFTP).	Same as Cisco 6506	Same as Cisco 6506	Same as Cisco 6506
Integrated In-Line Power	Yes	Yes	Yes	Yes
Dimensions (HxWxD)	20.1x17.25x18.4 in.	25.5x17.25x 18.4 in.	33.5x17.25x 18.1 in.	33.15x17.3x 18.1in.
NEBS Compliant	No	No	Yes	No
Power Options	1300W (AC & DC), 2500W (AC & DC), 4000W (AC & DC)	Same as Cisco 6506	Same as Cisco 6506	Same as Cisco 6506

Cisco CWDM GBIC Solution

The Cisco Coarse Wave Division Multiplexing (CWDM) GBIC solution allows scalable and easy to deploy Gigabit Ethernet services. The CWDM Gigabit Interface Converters (GBICs) and CWDM Optical Add/Drop Modules (OADMs) enable the design of a flexible and highly available multiservice network.

When to Use

Use This Product	When You Need
CWDM CBIC Solution	• Multi GbE campus extension (point-to-point architecture) over pair of single mode fiber • Multi GbE metro access services (ring deployments) over pair of single mode fiber

Key Features

- CWDM GBICs
  - The CWDM GBICs have an optical link budget of 30 dB and can operate on ordinary single mode fiber optic link spans of 100 km in length and more. Cisco CWDM GBICs can be intermixed with other 802.3z- compliant 1000BASE-SX, 1000BASE-LX, or 1000BASE-ZX Cisco GBICs on the same line card or chassis. The CWDM GBICs are currently supported on the Catalyst 2948G, 2980G-A, 2950, 3550, 4000, and 6500 Series platforms.
- CWDM OADMs
  - Passive Optical Add/Drop Modules (OADM) add/drop one, four or eight wavelengths from network traffic and passes the other wavelengths. Added/dropped channels are interfaced to the color matching CWDM GBICs on the equipment side. The CWDM chassis has a 1 RU form factor and can hold up to 2 OADM modules.

Specifications

Feature	CWDM GBIC Solution
Service	Gigabit Ethernet
Number of Wavelengths	8 (1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610nm)
Channel bandwidth	1.25 Gbps
OADM Options	1, 4, and 8 lambdas
Supported Topologies	Point-to-point, Hubbed Ring, Meshed Ring, Dual Homed Ring
Protection	Client side (Etherchannel, UDLD, HSRP)
Optical Budget (GBIC transmit -> GBIC receive)	30dB
Connectors	CWDM GBIC - 1000BASE-CWDM/dual SC CWDM OADM - dual SC

For More Information

www.cisco.com/warp/public/cc/so/neso/olso/nesocdwm/

OSS/Network Management

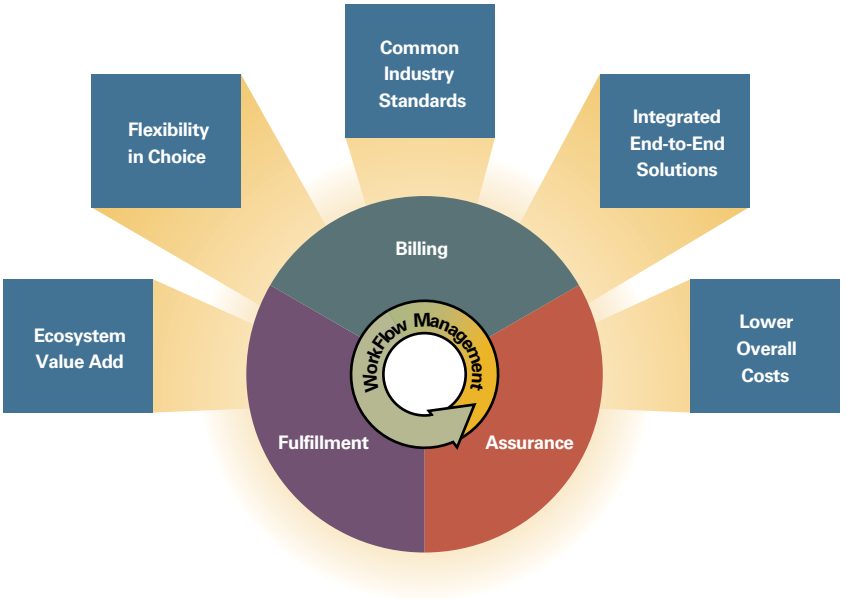
Overview

Cisco provides a flexible and complete offering that meets administration, operations, and maintenance requirements of cable service providers. Cisco Internet OSS integrates architectures, standards, and products to provide a foundation and framework for service providers who want to rapidly deploy profitable new services. Cisco Cable Internet OSS leverages existing cable business processes and installed technologies to protect cable operators' current OSS investment. As business models evolve, Cisco Cable Internet OSS is flexible enough to adopt new technologies and support additional advanced IP service offerings. Cisco Cable Internet OSS provides management of the HFC plant, DOCSIS/EuroDOCSIS domain, and the IP/WAN portion of the network. Cisco Cable Internet OSS provides a "plug-and-play" architecture for:

- Service fulfillment
- Service assurance
- Billing

Legacy applications and new applications can be easily integrated. Cisco puts together the tools and procedures to help you manage your network end to end.

Cisco Cable Internet OSS—Foundation for Advanced IP Services and Higher Revenue



Network Management Products at a Glance

Product	Features	Page
Cisco Address and Name Registrar	• Automates IP distribution and configuration management of network elements: – Allows service providers to tailor policies to automatically distribute IP addresses based on utilization triggers – Dynamically configures Dynamic Host Control Protocol (DHCP) servers and CMTSs – Eliminates the manual and inefficient portion of IP address management • Automates the monitoring and reporting of IP address space; helps predict trends in IP consumption by monitoring and tracking IP usage over customized time periods	9-4
Cisco Broadband Provisioning Registrar	• Provides a single platform for provisioning multiple technologies and devices such as DOCSIS 1.0 and DOCSIS 1.1 CMs, STBs, MTAs, and CallManagers • Scales to support over 5 million devices at regional distribution unit (RDU) and 500 thousand devices at device provisioning engine (DPE) • Designed to support PacketCable and ETTx VoIP • Includes robust provisioning application programming interface (API) for integration with OSS	9-6

Product	Features	Page
Cisco Broadband Troubleshooter	• Provides a diagnostic tool for RF technicians to quickly and easily isolate problems in the RF plant • Analyzes and sorts RF conditions into specific categories: – attenuation, provisioning, noise – packet corruption (CRC) errors • Provides dashboard views of network health, CMTS and CM statistics, and CM snapshots • Correlates CM to subscriber information • Works with an optional tool to map CMs and status to subscriber street-level views	9-7
Cisco Building Broadband Service Manager	• Provides plug-and-play access, allowing customers to self-provision services to reduce support requirements and increase usage • Offers customizable portals, advertising platforms, and tiered service levels that allow property owners and service providers to generate incremental revenue • Supports multiple authentication and billing options, including credit card, RADIUS, property management systems, and access codes through either existing interfaces or open APIs	9-9
Cisco Cable Diagnostic Manager	• Runs appropriate diagnostics and returns important customer-specific data relating to the high-speed data and advanced services gathered from the CMTS, CM, MTA, and subscriber database	9-12
Cisco Cable Manager	• Provides fault, configuration, and performance management for Cisco CMTS products and DOCSIS and EuroDOCSIS CMs via proactive network surveillance • Supports CM software image downloads • Offers topology tree map of CMTS and CMs • Provides tabular and graphical historical utilization and performance reports • Offers color-coded chassis views to provide at-a-glance status	9-13
Cisco DOCSIS CPE Configurator	• Provides a user interface to collect information needed to generate and download configuration files for DOCSIS and EuroDOCSIS CMs or STBs.	9-14
Cisco Info Center	• Offers a service-level monitoring and diagnostics tool that provides network fault and performance monitoring, trouble isolation, and real-time service-level management for large networks • Helps operators focus on important network events, offering a combination of alarm reduction rules, filtering, customizable alarm viewing, and partitioning • Provides a highly configurable client/server application that can consolidate, filter, and correlate fault information from a wide range of management platforms and technologies	9-14
Cisco Network Registrar	• Offers a high performance DHCP: – Up to 1,800 leases per second (dual processor NT configuration) in stand-alone configuration – Supports both steady-state and spikes of DHCP traffic – Dynamic updates of 1000+ resource records per second – Response to 3600+ queries per second • Offers IP history server	9-15

Product	Features	Page
Cisco VPN Solution Center	• Offers a carrier-class network and service management tool for rapid and cost-effective management of IP VPN services • Provides a flexible solution set to integrate service provider and customer premises networks; offers open APIs and OSS interfaces that enable service providers to easily integrate IP VPN services into their OSS and management infrastructures	9-17
CiscoWorks Resource Manager Essentials	• Provides web-based interface for monitoring and reporting hardware, configuration, and inventory changes for Cisco devices • Centrally manages and deploys configuration changes and software image updates to multiple devices • Integrates with network management systems such as Hewlett Packard OpenView and Tivoli Netview	9-19

Cisco Address and Name Registrar

Cisco Address and Name Registrar (ANR) provides an IP address management solution to ease the inherent complexities of IP address distribution, configuration, and monitoring. Cisco ANR Version 2.0 specifically meets the requirements of cable service providers by delivering an automated system to reduce administrative processes, easing the management of scarce IP addresses.

Through Cisco ANR, an administrator can assign an owner to a particular address block, and distribute that address block across the network in a customized manner. Cisco ANR then monitors that IP address space, tracks utilization, and performs customizable actions based on specified triggers.

When to Use

Use This Product	When You Need
Cisco Address and Name Registrar 2.0	• Simplify IP address management by using ANR customized policies to drive intelligent IP subnet allocation and reclamation decisions • Automate IP address management, freeing up valuable time of system administrators and allowing more strategic planning and management for cable service providers • Turn complex IP utilization data into meaningful management information • Promote efficient IP usage and distribution

Key Features

- Address space allocation and reclamation to:
  - Dynamically allocate and reclaim IP address space for multiple administratively assigned owners.
  - Support the creation and management of multiple IP address blocks for each owner, allocating subnetted address space to a Cisco Network Registrar DHCP server and among CMTS interfaces as defined by user-customized policy and parameters.

  - Implement event triggers to perform customizable actions (including "alert administrator" and "allocate additional IP address space") when configurable IP utilization thresholds have been reached
- Cisco Network Register configuration
  - Add DHCP scopes to the Cisco Network Register server upon IP address space allocation
  - Use owner-specific templates to assign policies and selection tags to new DHCP scopes in Cisco Network Register
  - Maintain synchronization between Cisco ANR and Cisco Network Register, ensuring that Cisco ANR will recognize any manual changes made to a Cisco Network Register server
  - Support IP address allocation into DHCP failover configurations (both simple and symmetric)
- CMTS configuration and MPLS VPN integration
  - Leverage the sub-interface features of Cisco IOS Software as a way to organize IP address space on the CMTS for each administratively assigned IP owner
  - Create a new sub-interface per owner on the appropriate CMTS interface when it initially allocates IP address space
  - Maintain synchronization between Cisco ANR and CMTSs, ensuring that Cisco ANR will recognize manual changes made to a CMTS
  - Fully interoperate in an MPLS-VPN environment working with the Cisco VPN SolutionsCenter (VPN-SC) to configure CMTSs for MPLS VPN tunnels across the network
- Utilization reporting
  - Provide IP address utilization information on a per DHCP scope, per CMTS, per interface, per address block, and per owner basis.
  - Provide utilization data to help predict trends in IP consumption by monitoring and tracking IP usage over customized time periods

Specifications

Feature	Cisco Address and Name Registrar 2.0
Operating System	Sun Solaris 8 operating system
Minimum Recommended Configuration	Sun Ultra 5 workstation with 256 MB of RAM, 512 MB of swap space, and 120 MB of disk space

For More Information

www.cisco.com/warp/public/cc/pd/nemnsw/anr/

Cisco Broadband Provisioning Registrar

Cisco Broadband Provisioning Registrar (BPR) is a distributed carrier-class, subscriber-device-provisioning application that supports automated flow-through provisioning of subscriber services in a fully redundant environment. Cisco BPR automatically recognizes devices, assigns class of service, dynamically creates and generates device configuration files, and activates subscribers.

When to Use

Use This Product	When You Need
Cisco Broadband Provisioning Registrar	Automate the configuration and provisioning of subscriber devices based on service provider business policies.—As service provider infrastructures increase rapidly in size and complexity, management systems that enable and simplify the task of operating the network and its services become more essential. Cisco BPR addresses this need

Key Features

- Embedded high-performance data store, optimized for device provisioning
- Java-based provisioning API to easy integrate to customer OSS, billing application, or workflow and mediation software
- Appliance-based distributed device provisioning engines to provide true scalability with a simple way to extend provisioning to additional subscribers and new markets
- Distributed architecture
- Technology extensions to provide easy means to extend this single platform to provision new devices and technologies to meet changing network and subscriber requirements
- PacketCable compliant, DOCSIS 1.0 and 1.1 support
- Dynamic DOCSIS file generation to offer means to build unique DOCSIS files for individual subscriber devices, meeting needs of tiered service provisioning and true IP voice requirements
- Simple gateway control protocol (SGCP) support
- Digital set-top-box support
- Safe failover

Specifications

Feature	Cisco Broadband Provisioning Registrar
Operating System	Sun Solaris 8 operating system
Minimum Recommended Configuration of the Cisco BPR RDU Installation	SunE220 Class Workstation with 1 GB of RAM and 18 GB of hard drive; This will support up to 250,000 devices
CNR	Requires a Netra T-1 workstation with 512 MB of RAM and a 5-GB hard drive

For More Information

www.cisco.com/warp/public/cc/pd/nemnsw/brdpvnrg/index.shtml

Cisco Broadband Troubleshooter

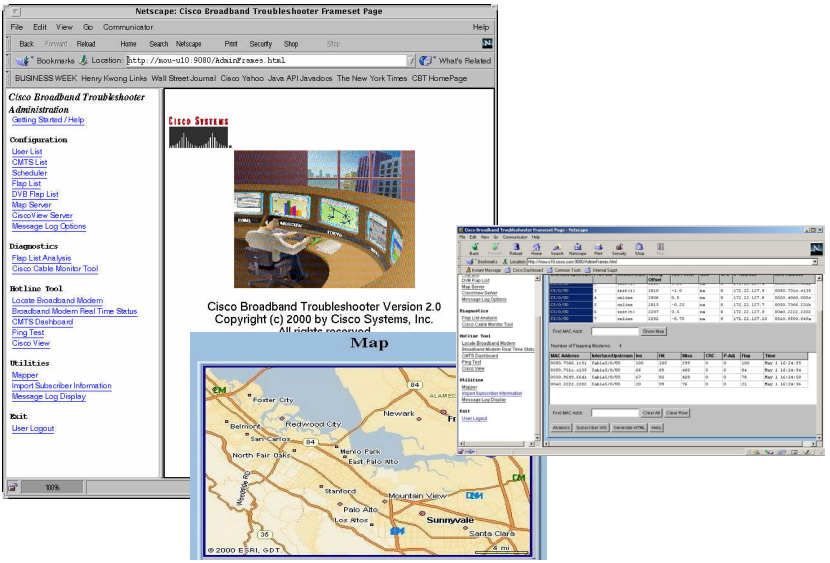
Cisco Broadband Troubleshooter provides an efficient tool to help network operations center (NOC) personnel and field technicians detect, diagnose, and isolate problems between the cable plant and connected DOCSIS CPE devices. The product allows a technician to characterize upstream and downstream trouble patterns and quickly identify "flapping" CPE devices that are experiencing persistent connectivity problems. Operators can quickly discern CPE connectivity impairments by identifying noise, attenuation, provisioning, and packet-corruption issues.

When to Use

Use This Product	When You Need
Cisco Broadband Troubleshooter 2.3	Improve network reliability Proactively solve problems before subscribers are impacted Query summary statistics information on persistent CPE problems

Key Features

- Automatic monitoring of the cable plant, CMs and STBs
- Summary statistics on each upstream port, showing total and percentage of CPEs online and the minimum and maximum power levels the CMTS receives
- Correlates device-specific statistics with subscriber names and locations
- Flap list identifies CMs and STBs experiencing persistent problems
- Tabular displays allow operators to quickly identify problems in provisioning, noise or attenuation in the reverse path and/or packet corruption



Specifications

Server Hardware	Solaris Ultra-5 workstation configured with CD-ROM drive, 256 MB RAM, minimum 50 MB hard disk space Desktop or laptop PC, 64MB RAM, 50MB hard disk space
Server Software	Sun Solaris 2.8; Windows NT, 2000 (Professional and Server with SP2); RedHat Linux 7.1
Client Hardware	PCs or UNIX workstation
Client Software	Sun Solaris 2.8; Windows NT, 98, 2000 (Professional and Server with SP2)
Client Browser	Internet Explorer 4.0 or later releases, Netscape 4.5 or later releases for Windows operating systems; Netscape 4.5 or later releases for Solaris operating system

For More Information

www.cisco.com/cable/products/troubleshooter.html

Cisco Building Broadband Service Manager

Cisco Building Broadband Service Manager (BBSM) is the software-based service creation platform for the Cisco Building Broadband Solutions for hotels, apartments, office buildings, campuses, and other MxU Segments. Cisco BBSM works with Cisco cable products to provide a complete solution that enables cable service providers or MxU property owners to create, market and operate broadband access services

Cisco BBSM provides plug-and-play access. The product allows customers to self-provision services to reduce support requirements and increase usage. Customizable portals, advertising platforms, and tiered service levels allow property owners and service providers to generate incremental revenue

Cisco BBSM supports multiple authentication and billing options, including credit card, RADIUS, property management system and access codes, through either existing interfaces or open APIs. A comprehensive software developers kit allows customization. Cisco BBSM is also available as a preloaded server appliance.

When to Use

Use This Product	When You Need
Cisco Building Broadband Service Manager	An integrated, single-vendor MxU application bundle—Together with the Cisco uBR7100 Series, Cisco BBSM delivers a cable-based, in-building platform for plug-and-play Internet access, self-service activation, tiered service levels, and integrated billing for multi-unit (MxU) applications

Key Features

- Enables user access regardless of network interface configurations. Computer users can connect to the network using interfaces configured for Dynamic Host Configuration Protocol (DHCP) or static IP addressing methods. This plug-and-play capability provides access to the greatest number of users.
- Supports multiple authentication methods that include: Remote Access Dial-In User Service (RADIUS) authentication to either local or remote RADIUS servers for prepaid users or service subscribers, credit card authentication, access code authentication (e.g., hotel meeting rooms), and automated authentication based on known port location in a specific room.
- Accounts for usage and collects payment using multiple methods, including:
  - Direct posting of charges to a hotel property management system (PMS) for users connecting from guest rooms
  - Charge processing by a remote credit card processing service; this enables payment from any location on a property

  - Subscription or prepaid users can authenticate and have their usage tracked via RADIUS and pay through offline methods
  - Per minute broadband access can be pre-paid for via access codes
- Redirects all users through two steps during connection. First, they are directed to a Connect Screen, which explains the services available to them, including potentially multiple bandwidth and price options. Once users select and purchase service, they are directed to a portal page as their first location on the Internet. This provides a second branding and marketing opportunity
- Pre-authentication of specified domains that includes a "transparent proxy" feature which allow service providers to force all Web requests to go through the Microsoft Proxy Server installed on the Cisco BBSM server. When logging is turned on in the Microsoft Proxy Server application, that allows the software to capture a list of Web sites visited. This information can be later mined to determine popular Web sites
- Features to support network installation, configuration, and testing such as switch discovery; enforced line testing to ensure ports can not be mapped until the connection meets quality standards, and a limited set of local network performance monitoring tests to enable proactive quality assurance

Enhancements in Cisco BBSM version 5.1 include:

- RADIUS accounting support, allowing Cisco BBSM to automatically transmit accounting records to a RADIUS server
- Port hopping, allowing users to transparently hop from wired port to wired port, providing user mobility within a site
- Supports unlimited walled garden entries, which are entered as an individual IP addresses or an entire subnet
- Provides installations with limited-bandwidth WAN links a maximum sessions limit. If a user starts a session that exceeds the configured limit Cisco BBSM redirects the user to a "system busy" Web page that can be customized
- Cisco Building Broadband Service Director (BBSD) support for multiple BBSM servers in the field. BBSD allows a service provider or large property owner/manager to centrally maintain, manage and report on multiple BBSM servers

Specifications

Feature	Cisco Building Broadband Service Manager
Platforms	Cisco BBSM pre-loaded server (BB-SM-Server-96) Cisco BBSM on CD (BB-SM-CD-96) Cisco BBSM Upgrade v5.0 to v5.1 (BB-SM-5.1-UPG) BBSM Small Property Bundle (BB-SM-Bundle-48=) BBSM for small properties including 48 port license, MS Windows 2000 server, MS Multiple ISA Server Recommended server specifications for all BBSM applications Pentium processor (750MHz or greater) Minimum 9Gb disk drive Minimum 256MB memory Ethernet 10/100 NIC card for External LAN (any vendor) Internal NIC 3Com—3C905B-TX and 3C905C-TXM Intel—PRO/100+ PCI and MiniPCI D-Link—DFE-550TX RS 232 Serial Port for optional PMS connections
Available Software	Cisco BBSM version 5.1 Cisco BBSM Software Developers Kit (SDK) Recovery CD Microsoft Windows 2000 Server Operating System Microsoft ISA server MSDE database Keyview Pro must be purchased to enable network printing BBSM-LIC-24=additional 24 port license pack for BB-SM-Server 96 or BB-SM-CD-96 or BB-SM-Bundle-48=
Dimensions and Weight (H x W x D)	Height: 1.75 in. (1U) Width: 16.75 in. Depth: 22.00 in. including bezel 19 in. Rackmount Kit

For More Information

www.cisco.com/warp/public/cc/pd/nemnsw/bbsm/

Cisco Cable Diagnostic Manager

The Cisco Cable Diagnostic Manager is an easy-to-use, web-based diagnostic tool for customer service representatives (CSRs). Given a piece of subscriber-identifying information such as a phone number, a media access control (MAC) address, or an IP address, the Cisco Cable Diagnostic Manager presents in one graphical interface all relevant subscriber-specific information gathered from the CMTS, Cable Modem/CPE, and provisioning database server. The information presented highlights the status of a subscriber's cable modem and aids CSRs in determining the next step to better support the customer.

When to Use

Use This Product	When You Need
Cisco Cable Diagnostic Manager 1.0	• Easy-to-use customer support tool for CSRs • Improve CSR productivity • Enhance customer satisfaction • User-friendly display of information for quick assessment of CPE status

Key Features

- On-demand query of cable modem status
- Flexible search capability that allows lookup of subscriber information and cable modem status
- Tabular displays that allow operators to quickly identify the status of the subscriber's cable modem

Specifications

Server Hardware	Solaris Ultra-5 workstation configured with CD-ROM drive, 256 MB RAM, minimum 50 MB hard disk space Desktop or laptop PC, 64MB RAM, 50MB hard disk space
Server Software	RedHat Linux 7.1
Client Hardware	PCs or UNIX workstation
Client Software	Sun Solaris 2.8; Windows NT, 98, 2000 (Professional and Server with SP2)
Client Browser	Internet Explorer 4.0 or later releases, Netscape 4.5 or later releases for Windows operating systems; Netscape 4.5 or later releases for Solaris operating systems

For More Information

www.cisco.com/warp/public/779/servpro/operate/csm/products/cableoss/index.html

Cisco Cable Manager

Cisco Cable Manager is a client/server application that helps cable service providers deploy, maintain, monitor and troubleshoot cable equipment on an HFC network. The product manages DOCSIS and EuroDOCSIS-compliant CMTS and CPE, providing both operations center visibility, as well as technician access.

When to Use

Use This Product	When You Need
Cisco Cable Manager 2.3	• Remotely manage, monitor, maintain and troubleshoot their Cisco CMTS and any DOCSIS CPE equipment • Automate distribution of new CMTS and Cable Modem images and configurations • Analyze network usage patterns and provide capacity planning

Key Features

- Scale—100,000 cable modems per Cisco Cable Manager-2.3 server
- Security—Task-based and device-based partitioning of user groups
- Performance reporting—Multiple statistics in a single graphical display
- Fault management—Formula-based and user-configurable alarm thresholds
- Configuration—DOCSIS 1.0 CPE Configuration Editor

Specifications

Feature	Cisco Cable Manager 2.3
Server Hardware	Solaris Ultra-60 or E250 server configured with: CD-ROM drive, minimum 512 MB RAM, minimum 2 GB hard disk space and two processors
Server Software	Sun Solaris 2.8
Client Hardware	PCs or UNIX workstation that have native support for X/Motif displays, 256-MB memory; 250-MB hard disk space; Sun Ultra-5 workstation with Solaris 2.6 operating system
Client Software	X-emulator for PCs—Reflection X (recommended) or Exceed; Windows 95, Window 98 or Windows NT PCs

For More Information

www.cisco.com/cable/products/cable_manager.html

Cisco DOCSIS CPE Configurator

Cisco DOCSIS CPE Configurator is a GUI-based tool designed to collect information needed to generate and download configuration files for DOCSIS or EuroDOCSIS cable modems and set-top boxes. There are two versions of the tool: a free, web-based version accessible via Cisco.com, and a stand-alone Java-based desktop version. Cisco DOCSIS CPE Configurator enables point and click configuration of CPE values for RF, class of service, vendor information, SNMP parameters, BPI, TFTP, telco-return attributes, and CPE data.

For More Information

www.cisco.com/go/docsis

Cisco Info Center

Cisco Info Center is a service-level alarm monitoring and diagnostics tool that provides network fault and performance monitoring, network trouble isolation, and real-time service-level management for large networks. Cisco Info Center is designed to help operators focus on important network events, offering a combination of alarm processing rules, filtering, customizable alarm viewing, and partitioning. Cisco Info Center provides a highly configurable client/server application that can consolidate, deduplicate, filter, and correlate fault information from multiple network layers.

Cisco Info Center is the fault management component of the Cisco Service Management infrastructure that provides end-to-end service management solutions for service provider and large enterprise networks. Operating at the service and network levels, Cisco Info Center interacts with other management tools within the Cisco Service Management product suite to provide customer-focused, service-level monitoring and network partitioning for virtual private network (VPN) and customer network management (CNM) services. Cisco Info Center works with network element management software such as wide-area network (WAN) Manager to provide fault and alarm management across local area network (LAN) and WAN networks.

Cisco Info Center consists of the Netcool technology from Micromuse at its core plus Cisco enhancements. Cisco enhancements at Layer 2 include a customized WAN manager mediator (SV+ mediator) and Cisco developed and tested correlation rules and tools. Layer 3 events are received through the Syslog mediator.

For More Information

www.cisco.com/go/cic

Cisco Network Registrar

Cisco Network Registrar provides comprehensive Domain Name System and Dynamic Host Configuration Protocol administrative functionality to help cable service providers automate and streamline IP networking services. Services include client configuration and provisioning.

Cisco Network Registrar automates IP address assignment and maintenance to simplify and streamline administration. Features such as the Lightweight Directory Access Protocol (LDAP) directory interface facilitate integration of DNS and DHCP services with other network management applications. Performance-optimized functions provide fast setup and task execution, and an availability-tuned architecture ensures reliable, consistent client services delivery. A robust set of Cisco Network Registrar DNS and DCHP utilities ensure configuration flexibility to meet demanding, fluctuating business requirements. From high performance and availability, to process automation, device provisioning, and directory integration, Cisco Network Registrar provides the essential functionality for maintaining a responsive IP infrastructure.

When to Use

Use This Product	When You Need
Cisco Network Registrar	Automate IP address assignment and maintenance to free up valuable time for System Administrators and allow more strategic planning and management for service providers

Key Features

- Scalable, multithreaded DNS server to handle fast-growing subscriber communities and increasing service loads
- Support for industry-standard DOCSIS or EuroDOCSIS cable modems for faster service deployment
- Flexible, customizable device support and provisioning to accelerate service delivery
- DHCP Safe Failover Protocol to eliminate single point of failure and to avoid use of duplicate address assignment
- Directory services integration through LDAPv3 for application integration
- Extension points API for callouts to user-written logic
- Easy-to-use graphical user interface which simplifies configuration and management of DNS/DHCP protocol servers
- Command-line interface for enhanced administrative control

- Simple Network Management Protocol (SNMP) traps support for integration with other network management systems
- DHCP Server Performance Enhancements
- DHCP Forwarding/Switching
- Windows 2000 Phase I Extensions (userclass & FQDN)
- DHCP Vendor Specific Option Support
- Extension Point Chaining

Specifications

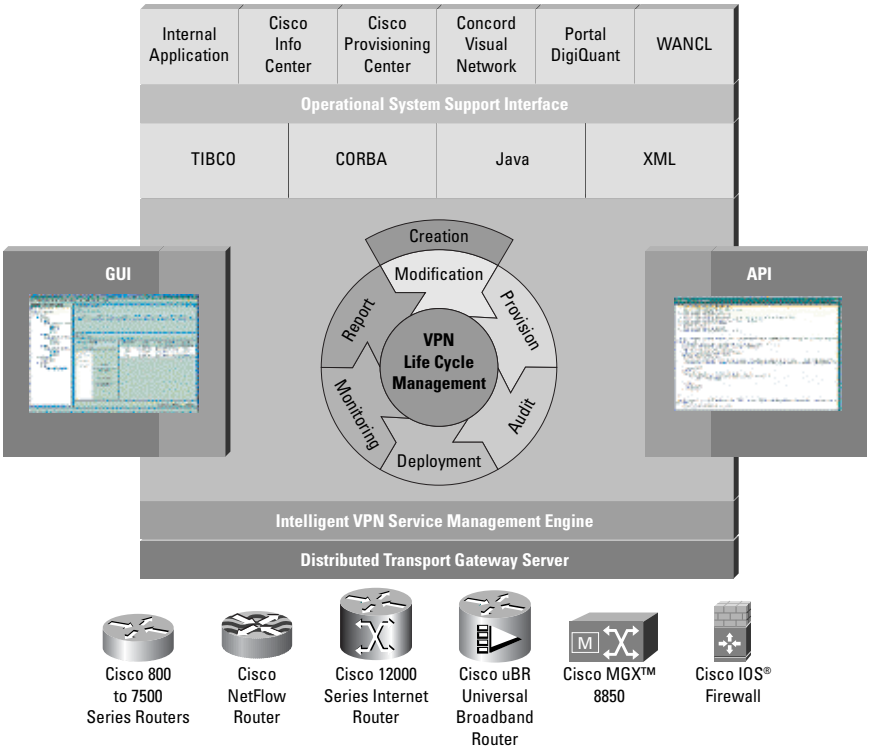
Feature	Cisco Network Registrar
DHCP Functionality	• Support for automatic, dynamic, and manual allocation methods • DHCPINFORM packet support • Bootstrap Protocol (BOOTP) and dynamic BOOTP support • DHCP user class option (option 77) • DHCP Fully Qualified Domain Name (FQDN) option 81 and option 82 • DHCP vendor class identifier and vendor-specific options • DHCP extension point chaining
DNS Functionality	• DNS Naming Authority Pointer (NAPTR) resource record type • DNS default Time To Live (TTL) • Notify protocol • Incremental Zone Transfer protocol • Subzone hiding • Preconfigured root server
Additional Functionality	• Multiple data import/export formats, including DNS zone files (BIND format), UNIX-style files, JOIN files, and Open Database Connectivity (ODBC) database exports • Resolution exception (or selection forwarding, to restrict internal traffic from traversing public Internet) • Persistent cache • Built-in reporting
Platform Support and System Requirements	• Sun Solaris: SPARC, SPARCStation 20 or greater • Microsoft Windows NT: [Intel Pentium 200 MHz or greater, Pentium Pro or greater recommended] • Microsoft Windows 2000: [Intel Pentium 200 MHz or greater, Pentium Pro or greater recommended] • Hewlett-Packard HP-UX: PA-RISC (GUI not available) • IBM AIX: PowerPC (GUI not available)

For More Information

www.cisco.com/warp/public/779/servpro/operate/csm/nemnsw/cnr/prodlit/index.shtml

Cisco VPN Solution Center

Dedicated IP VPNs enable service providers to lay the foundation for delivering differentiated services such as telephony, videoconferencing, e-commerce, and application hosting. For a complete service offering, service providers must be able to quickly and effectively plan, provision, operate, and bill for the VPN-based services they offer. The Cisco VPN Solution Center (VPNSC) is a carrier-class network and service management solution for rapid and cost-effective management of IP VPN services. Cisco VPNSC provides a flexible solution set for integrating with service provider and customer premises networks. Open APIs and OSS interfaces enable service providers to easily integrate IP VPN services into their OSS and management infrastructures.



When to Use

Use This Product	When You Need
Cisco VPN Solution Center	• Cost-effective integration of VPN services, allowing service providers to quickly plan, provision, operate, and bill for these services

Key Features

- Flexible service activation
- High-performance service auditing for validating IP VPN service configuration, monitoring performance, and identifying faults to ensure high network integrity and service quality. Cisco VPNSC generates reports on the status
- Service quality assurance to ensure that IP VPN target devices remain provisioned correctly and that the VPN itself is operational. Reports and alarms can be generated based on preconfigured designated requirements, such as SLA thresholds
- Easy service enhancement to easily change IP VPN topologies and upgrade target VPN devices to accommodate changing customer needs. The Cisco VPNSC intelligent service management engine simply generates new Cisco IOS software instructions for targeted VPN devices to match new VPN requirements
- SLA monitoring and reporting
- QoS provisioning and measurement for service differentiation
- Templates that enable real-time provisioning

Specifications

Feature	Cisco VPN Solution Center
System Requirements	For current Solaris-Based Network Management product hardware requirements, please refer to the Sun Cisco Optimized Platform Recommendations Table for hardware and part numbering ordering information at www.cisco.com/warp/public/756/partnership/sun/products/sun_cisco_part_numbers.pdf
MPLS Provider-Edge Equipment Support	Cisco IOS Software Release 12.1 (5a)T and above
MPLS Customer-Edge Equipment Support	Cisco IOS Software Release 12.0 and above
IPSec Customer Premises Equipment Support	Cisco IOS Software Release 12.2(1) and above, k8 or k9 images

For More Information

www.cisco.com/warp/public/779/servpro/operate/csm/nemnsw/vpn/prodlit/

CiscoWorks Resource Manager Essentials

CiscoWorks Resource Manager Essentials is a powerful suite of web-based applications, offering network management solutions for Cisco switches, access servers, and routers. CiscoWorks Resource Manager Essentials allows a centralized view of information critical to network uptime and simplifies time-consuming tasks of software and configuration update management. CiscoWorks Resource Manager Essentials includes the following applications Inventory Manager, Change Audit, Device Configuration Manager, Software Image Manager, Availability Manager, and Syslog Analyzer.

CiscoWorks Resource Manager Essentials is sold as part of the CiscoWorks LAN Management Solution and the CiscoWorks Routed WAN Management Solution.

When to Use

Use This Product	When You Need
LAN Management Solution	• A set of tools for managing Cisco's award winning Catalyst switches • Time saving user tracking and path trace analysis tools with support of IP Phones • Automated process of inventorying network devices, updating device software, and managing configuration to reduce the time and errors involved in network updates • Browser-accessible, graphical tool for configuring and monitoring Cisco device components and operational status • VLAN, ATM or LANE service management tools • RMON traffic monitoring and analysis capability • Active fault monitoring of Cisco devices
Routed WAN Management Solution	• Manage key security and performance aspects of the WAN edge, access routers and WAN access network devices • Simplify administration of access lists and configuration changes for optimizing bandwidth and utilization across critical WAN links • Troubleshoot network response time and availability, both through private and public network connections

Key Features

- Cable-specific configuration templates to ease configurating a CMTS
- Quickly builds a complete network inventory
- Monitors and reports on hardware, configuration, and inventory changes
- Manages and deploys configuration changes and software image updates to multiple devices
- Simplifies monitoring and troubleshooting of critical LAN and WAN resources
- Basic VPN management

Specifications

The following table contains general system requirements for the CiscoWorks management server and its client components. System requirements may increase depending on how individual LMS or RWAN applications are installed. For more detailed system requirements and recommendations for tuning the management system for performance, refer to individual LMS or RWAN application quick start guides and release notes at

www.cisco.com/univercd/cc/td/doc/product/rtrmgmt/cw2000/

Description	Specification
Server	Hardware Operating System **UNIX:** System: Sun UltraSPARCIII (Sun Blade 1000 Workstation or Sun Fire 280R Workgroup Server) running Solaris 2.8 (Dual processor system required for hosting multiple management solutions) Memory: 1 GB RAM for workstations, 2 GB RAM for servers, 8 MB E-cache Available disk: 36 GB internal FC-AL disk drive fro workstation and dual drives of this type for server configurations **Windows:** System: IBM PC-compatible with 550 MHz or higher Pentium III processor running Microsoft Windows 2000 Server or Professional Edition with Service Pack 2 (Dual processor system required for hosting multiple management solutions) Memory: 1 GB RAM Available disk: 9 GB with 2 GB swap recommended Note: The system requirements above are based on managing 500 devices with RWAN and LAN Management solutions loaded on a single server. Please refer to the Installation documentation for more information on required operating system patches
Client	Hardware Operating System **UNIX:** System: Sun Ultra 10 running Solaris version 2.7 or 2.8 System: HP9000 Series running HP-UX 11.0 System: IBM RS/6000 workstation running AIX 4.3.3 Memory: 256 MB **Windows:** System: IBM PC-compatible with 300 MHz or higher Pentium processor Windows NT4 (Workstation and Server) with Service Pack 6a, Win 98, or Windows 2000 Professional and Server with Service Pack 2 Memory: 256 MB Note: Please refer to the Installation documentation for more information on required operating system patches Web browser: **UNIX:** Solaris: Netscape v4.76 HPUX: Netscape v4.77, 4.78, 4.79 AIX: Netscape v4.77, 4.78, 4.79 Windows: Windows 98/NT/2000: Netscape v4.77, 4.78, 4.79 Windows 98/NT/2000: Internet Explorer v5.5 with Service Pack 2, 6.0 Note: Please refer to the Installation documentation for more information on required operating system patches, browser plug-ins or Java Virtual Machine (JVM) versions

Supported Devices	Most Cisco IOS routers, access servers, hubs, and switches; Specific devices supported by the LMS and RWAN applications are available on Cisco Software Support Center web site under each products Planner Page
Supported Cisco IOS Versions	Generally supports Cisco IOS Software Release10.3 and above; Catalyst Supervisor code 2.1 and above; please see the specific application documentation and release notes for more detailed information

For More Information

www.cisco.com/warp/public/cc/pd/wr2k/rsmn/index.shtml

Cisco IOS Software

Overview

The Cisco IOS® Software is a feature-rich network operating system that provides network intelligence for the majority of today's Internet and business-critical networking applications. Supporting Cisco's extensive range of platforms, Cisco IOS Software provides a common IP fabric, functionality, and command-line interface (CLI) across network infrastructures. This common IOS enables a vast array of key routing functions, multiservice capabilities, traffic shaping, connections, security/firewall, traffic monitoring, and highly flexible network and product configuration.

Below is an abbreviated list of key capabilities, intelligent network technologies, and architectures enabled by Cisco IOS Software:

- Quality of service (QoS)
- Converged data, voice, and video over IP
- IP/ATM/Frame Relay network connectivity and scalability features
- Security/firewall/IPSec/access lists
- Traffic monitoring and NetFlow based monitoring, accounting, billing
- Wide range of routing protocols (including MPLS)
- IPv6
- Multicast

Quality of Service

Cisco IOS QoS capabilities enable complex networks to control and predictably service a variety of applications. QoS expedites the handling of mission-critical applications, while sharing network resources with non-critical applications. QoS also ensures available bandwidth and minimum delays required by time-sensitive multimedia and voice applications. It also gives network managers control over network applications, improves cost-efficiency of WAN connections, and enables advanced differentiated services.

QoS technologies are elemental building blocks for other Cisco IOS Software enabling services—particularly for converged data and voice networks (LAN/WAN + telephony), video conferencing over IP, IBM networking, as well as for future business applications in campus, WAN, and service provider networks.

Key QoS Capabilities

Committed Access Rate (CAR)	Performs two QoS functions: • Bandwidth management through rate limiting, which allows you to control the maximum rate for traffic transmitted or received on an interface • Packet classification through IP precedence and QoS group setting, which allows you to partition your network into multiple priority levels or classes of service (CoS)
Differentiated Services (DiffServ)	QoS architecture that divides traffic into a small number of classes and provides QoS to large aggregates of traffic by treating some traffic better than the rest (faster handling, more bandwidth on average, lower loss rate on average). This is a statistical preference, not a hard and fast guarantee
Expedited Forwarding (EF)	Per-Hop Behavior (PHB) in the DiffServ standard, used to create a virtual leased line service
Integrated Services (IntServ)	A QoS architecture in which each network element is required to identify the coordinated set of QoS control capabilities it provides in terms of the functions it performs, the information it requires, and the information it exports.
Random Early Detection (RED)	Monitors traffic levels on very large networks to prevent congestion and guarantee priority traffic delivery
Resource Reservation Protocol (RSVP)	A protocol that supports the reservation of resources across an IP network
Weighted Fair Queuing (WFQ)	Adds new levels of control to previous queuing methods
Weighted Random Early Detection (WRED)	Combines the capabilities of the Random Early Detection (RED) algorithm with IP Precedence or the DiffServ Code Point (DSCP). This combination provides for preferential traffic handling for higher-priority packets

Key QoS Categories

Classification	• Commited Access Rate (CAR) • Policy Based Routing (PBR) • QoS Policy Propagation through BGP
Congestion Management	• First in First Out (FIFO) • Priority Queueing (PQ) • Custom Queueing (CQ) • Weighted fair Queueing (WFQ) • Weighted Random Early Detection (WRED)
Policy and Shaping	• Commited Access Rate (CAR) • Generic Traffic Shaping (GTS) • Frame Relay Traffic Shaping (FRTS)
Link Efficiency Mechanisms	• Compressed Real Time Protocol (cRTP) • Link Fragmentation and Interleaving (LFI) • Data Compression

Converged LAN/WAN and Telephony Networks

A broad range of Cisco products support standards-based voice over packet implementations, including H.323 based VoIP. This enables highly efficient, converged IP-based telephony in today's enterprise and service provider networks, thereby eliminating the need for legacy telephone equipment and overlay networks (including PBXs, and central office circuit switched network equipment). Furthermore, a single IT organization can now support campus and enterprise requirements—regardless if for data, voice, or video requirements.

In addition, Cisco voice-over-packet technologies enable businesses and service providers to avoid long distance telephone charges by leveraging their existing data networks, instead of paying for dedicated voice connections and circuits.

Cisco Connectivity and Scalability Solutions

A wide range of access solutions are enabled via the Cisco IOS Software, including:

- Virtual private networking
- Frame Relay, X.25
- ATM
- SONET, OC-x/STM-x, Packet-over-SONET
- DSL
- Broadband services aggregation (including large-scale PPPoE, PPPoA, L2TP tunneling)
- Dial access (including ISDN, modem, fax, voice)
- VoIP, VoFR, VoATM
- Cable solutions

Security

Cisco's powerful suite of Cisco IOS Software-embedded security and firewall technologies includes:

Digital Signature Standard (DSS) and digital certification	Positively authenticates users or devices
Network Address Translation (NAT) and Port Address Translation (PAT)	Hides private topology and IP addresses from an external network
IPSec	Enables secure communications of data over public networks
Time-based Access Control Lists (ACLs)	Implements access lists based on time of day
Password Authentication Protocol (PAP)	Allows a remote node to establish its identity using a two-way handshake
Terminal Access Controller Access Control System Plus (TACACS+) and Remote Access Dial-in User Service (RADIUS)	Gives complete network access security for dial-in connections, for enterprise and service provider applications
Challenge Handshake Authentication Protocol (CHAP)	Allows a remote node to establish its identity using a three-way handshake
Calling Line Identification (CLID)	Uses calling line identification to compare the telephone number of a calling device against a list of known callers
Access Lists	Check source address of packets (standard access lists) and check source and destination addresses and other parameters (extended access lists)
Context-Based Access Control (CBAC)	Provides secure, application-based stateful filtering for the most popular protocols and a wide variety of advanced applications; available in the Cisco IOS Firewall feature set

Cisco IOS NetFlow

NetFlow technology provides the metering base for a key set of applications including network traffic accounting, usage-based network billing, network planning, network monitoring, outbound marketing, and data mining capabilities for both service provider and enterprise customers. Cisco provides a set of NetFlow applications to collect exported NetFlow data, to perform data volume reduction, and to post-process and display data. Cisco is currently working with a number of partners to provide customers with comprehensive solutions for NetFlow-based billing, planning, and monitoring. NetFlow also provides the measurement base for Cisco's new Internet Quality of Service (QoS) initiatives. NetFlow captures the traffic classification or precedence associated with each flow, enabling differentiated charging based on QoS.

Furthermore, the combination of NetFlow data along with Cisco IOS Software-based routing information can prove key to developing effective denial-of-service (DoS) prevention measures and security policies.

IP Routing Protocols

Cisco IOS Software also offers the industry's widest variety of enterprise and service provider-class routing protocols including:

- On Demand Routing (ODR)
- Routing Information Protocol (RIP)
- Interior Gateway Routing Protocol (IGRP)
- Open Shortest Path First (OSPF)
- IP Multicast
- Integrated IS-IS
- Enhanced Interior Gateway Routing Protocol (EIGRP)
- Border Gateway Protocol (BGP)
- MPLS

MPLS (Multiprotocol Label Switching)

Cisco IOS MPLS fuses the intelligence of routing with the performance of switching. It provides significant benefits to networks with pure IP architectures as well as those with IP and ATM or a mix of other Layer 2 technologies. MPLS technology is key to implementing scalable virtual private networks (VPNs) and end-to-end QoS, enabling efficient utilization of existing networks to meet future growth and rapid fault correction of link and node failure. This technology also helps deliver highly scalable, differentiated IP services with simpler configuration, management, and provisioning for both Internet service providers and end-user customers.

Common MPLS Applications Available with Cisco IOS Software

- Traffic engineering is enabled through MPLS mechanisms that allow traffic to be directed through a specific path, which may not necessarily be the least-expensive path. Network managers can implement policies to ensure optimal traffic distribution and improve overall network utilization
- Guaranteed bandwidth is a value-added enhancement to traditional traffic-engineering mechanisms. MPLS lets service providers deliver guaranteed pipes and bandwidth allocations. Guaranteed bandwidth also allows bookkeeping of quality-of-service (QoS) resources to traffic engineer both premium and best-effort traffic such as voice and data
- Fast reroute (FRR) allows extremely quick recovery if a node or link fails. Such fast recovery prevents end-user applications from timing out and also prevents loss of data

- MPLS VPNs greatly simplify service deployment compared to traditional IP VPNs. As the number of routes and customers increases, MPLS VPNs easily scale, while providing the same level of privacy as Layer 2 technologies. In addition, they can transport non-unique IP addresses across a public domain
- MPLS class-of-service (CoS) capability ensures that important traffic is given the appropriate priority over the network and that latency requirements are met. IP QoS mechanisms can be seamlessly implemented in an MPLS environment

MPLS Mechanisms

Cisco IOS MPLS delivers both Traffic Engineering and VPN solutions built on the following mechanisms:

- Cisco AutoBandwidth Allocator: Automatically increases or decreases MPLS TE tunnel bandwidth based on measured traffic load
- Constraint-based Routing Label Distribution Protocol (CR-LDP): A signaling mechanism used to support traffic engineering across a MPLS backbone
- Fast Reroute (FRR): Enables quick recovery in case of link failures, which prevents end-user applications from timing out and also prevents loss of data
- Label Distribution Protocol (LDP): Provides communication between edge and core devices. It assigns labels in edge and core devices to establish Label Switched Paths (LSPs) in conjunction with routing protocols such as OSPF, IS-IS, EIGRP, or BGP
- Transmission Control Protocol (TCP): Connection-oriented transport-layer protocol that provides reliable full-duplex data transmission. TCP is part of the TCP/IP protocol stack

For More Information

www.cisco.com/go/mpls

IP Multicast and Multicast Solutions

IP Multicast is a bandwidth-conserving technology that reduces traffic by simultaneously delivering a single stream of information to thousands of corporate recipients and homes. Applications that take advantage of multicast technologies include video conferencing, corporate communications, distance learning, and distribution of software, stock quotes, and news.

Multicast technology is key to preventing severe network slowdown and Cisco IOS Multicast is the gateway to Internet broadcasting applications. Internet service providers (ISPs) and content providers today use Cisco IOS multicast solutions successfully to host events such as live concerts, radio shows, and football games.

Another exciting application of multicast technologies relates to replacing dedicated point-to-point telephone/voice circuits and specialized bridging and mixing multi-user audio conferencing telephone equipment for "always-on" service (referred to in some industries as "Hoot & Holler" systems). This eliminates the need for dedicated, costly, overlay voice networks and point-to-point telephone company circuits, and allows the same capabilities to be implemented over a converged IP network without requiring users to dial in.

Multicast Solutions

Cisco IOS Multicast solutions are classified as Multicast-Lite, Core Multicast, and Enhanced Multicast, and are the building blocks for Internet broadcast. Customers can start with Multicast-Lite, then add more sophisticated interactive communication capabilities, as needed.

- Multicast-Lite provides for one-to-many broadcast capability with no back channel. This solution is eminently suitable for content distribution and broadcasting over the Internet. It does not require setting up of source discovery across domains and autonomous systems. Multicast Lite includes Protocol Independent Multicast version 2 (PIMv2), Internet Group Management Protocol (IGMPv1/v2/v3) and/or Universal Resource Locator Rendezvous Directory (URD)
- Core Multicast provides interactive, reliable campus multicast for interactive distance learning, corporate videoconferencing, inventory updates, software distribution, and content distribution. Core Multicast includes PIM, IGMP, Cisco Group Management Protocol (CGMP), and now Pragmatic General Multicast (PGM)

- Enhanced Multicast provides interactive Internet Multicast across domains for network gaming, inter company conferencing, Internet software distribution, and extranet content distribution. Enhanced Multicast includes Multicast Border Gateway Protocol (MBGP) and Multicast Source Discovery Protocol (MSDP) in addition to all the protocols supported in Core Multicast

Multicast is currently available across all Cisco IOS Software-based platforms, including Cisco routers and Cisco Catalyst family switches. Multicast-supported routing platforms include the following: Cisco 1600, 2500, 2600, 3600, 3800, 7200, 7500, and 12000 series; also available on Catalyst 6000 and 8500 platforms.

Multicast Features

Cisco has the greatest depth of experience with IP Multicast in the industry, and offers multicast features such as:

Bi-dir PIM	An extension to the PIM suite of protocols that implements shared sparse trees with bi-directional flow of data
Cisco Group Management Protocol (CGMP)	Ciscodeveloped protocol that allows Layer 2 switches to leverage IGMP information on Cisco routers to make Layer 2 forwarding decisions
Internet Group Management Protocol v2 (IGMP)	Used by IP routers and their immediately connected hosts to communicate multicast group membership states: • Query: IGMP messages originating from the router(s) to elicit multicast group membership information from its connected hosts • Report: IGMP messages originating from the hosts that are joining, maintaining or leaving their membership in a multicast group
Internet Group Management Protocol v3 (IGMP)	Version 3 of IGMP adds support for "source filtering," that is, the ability for a system to report interest in receiving packets *only* from specific source addresses, or from *all but* specific source addresses, sent to a particular multicast address
IGMP Snooping	Requires the LAN switch to examine, or "snoop," some Layer 3 information in the IGMP packet sent from the host to the router. When the switch hears an IGMP Report from a host for a particular multicast group, the switch adds the host's port number to the associated multicast table entry. When it hears an IGMP Leave Group message from a host, it removes the host's port from the table entry
Inter-domain Multicast	Supports inter-domain routing and source discovery across the Internet or across multiple domains comprising an enterprise
Intra-domain Multicast	Supports multicast applications within an enterprise campus
Multicast Source Discovery Protocol (MSDP)	A mechanism to connect multiple PIM sparse-mode (SM) domains. MSDP allows multicast sources for a group to be known to all rendezvous point(s) (RPs) in different domains
Multicast Routing Monitor (MRM)	A management diagnostic tool that provides network fault detection and isolation in a large multicast routing infrastructure
Multi-protocol Extensions for Border Gateway Protocol (MBGP)	Also known as BGP+, MBGP adds capabilities to BGP to enable multicast routing policy throughout the Internet and to connect multicast topologies within and between BGP autonomous systems
Pragmatic General Multicast (PGM)	A reliable multicast transport protocol for applications that require ordered, duplicate-free, multicast data delivery from multiple sources to multiple receivers. PGM guarantees that a receiver in a multicast group either receives all data packets from transmissions and retransmissions, or can detect unrecoverable data packet loss

Protocol Independent Multicast (PIM)	A multicast routing architecture that enables IP multicast routing on existing IP networks: • SM = Spare Mode (RFC 2362): Relies upon an explicitly joining method before attempting to send multicast data to receivers of a multicast group • DM = Dense Mode (Internet Draft Spec): Actively attempts to send multicast data to all potential receivers (flooding) and relies upon their self-pruning (removal from group) to achieve desired distribution
Unidirectional Link Routing Protocol (UDLR)	A routing protocol that provides a way to forward multicast packets over a physical unidirectional interface (such as a satellite link of high bandwidth) to stub networks that have a back channel
URL Rendezvous Directory (URD)	Directly provides the network with information about the specific source of a content stream. It enables the network to quickly establish the most direct distribution path from the source to the receiver, thus significantly reducing the time and effort required in receiving the streaming media. URD allows an application to identify the source of the content stream through a web page link or web directly

For More Information

www.cisco.com/go/multicast

IPv6

The Internet Protocol version 6 (IPv6), most notably offers expanded IP addresses to accommodate the proliferation of Internet devices such as personal computers, personal digital assistants, wireless devices, and new Internet appliances—as well as the expansion of Internet access—particularly "always-on" connections throughout the world. IPv6 also provides integrated auto-configuration for plug-and play capabilities, enhanced mobility and end-to-end security.

Incorporating IPv6 into Cisco IOS Software enables continued growth of the Internet and its expansion into new applications and capabilities, in a way that maintains compatibility with existing Internet services.

For more information regarding IPv6, see

www.cisco.com/go/ipv6

Cisco IOS Software General Release Process

There are three categories of Cisco IOS Software releases: Early Deployment, Major, and General Deployment releases.

- Early Deployment releases (i.e. T, S, X, E release families)—Provide advanced networking technologies to customers for delivery of leading-edge Internet applications. They offer new software capabilities, new platforms, and interface extensions. Customers for whom receiving a new feature is critical to their competitive advantage will benefit from these releases
- Major releases (i.e. Release 12.2)—Consolidate features, platform support, and functionality from early deployment releases, and emphasize stability. Regular maintenance releases do not introduce new functionality or platform support, but provide continuous improvement and greater quality, leading ultimately to general deployment
- Releases with General Deployment certification (i.e. Release 12.0)—Have had extensive market exposure in a wide range of network environments. They are qualified through extensive metrics that analyze stability, software defect trends, and customer satisfaction surveys. General deployment releases are used for major, business-critical applications

At some point, GD releases are replaced by newer releases with the latest networking technologies. Therefore, a release retirement process has been established with three principal milestones: End of Sales (EOS), End of Engineering (EOE), and End of Life (EOL).

For More Information

www.cisco.com/go/ios

Cisco Cable IOS

Cisco IOS Software used in Cisco Universal Broadband Router (uBR) products is an extension of Cisco IOS Software that lays the foundation for:

- Service providers to reliably and effectively deliver differentiated services
- Corporations to safely conduct businesses and daily operations

Cisco IOS Software for cable transparently bridges the differences between HFC and IP domains. Cable operators can leverage existing HFC infrastructure to offer value-added IP-based services. Cisco IOS Software for cable offers enhanced stability, investment protection, reliable performance, and enhanced features. Its features accent the performance and scalability of the uBR product family. These features coupled with the proven uBR products elevate Cisco to be the leader in the cable equipment market.

Cisco uBR products fall under one of the following categories:

- CPE—Cisco cable CPE devices support only the 12.0T Cisco IOS Software releases and a few Early Deployment (ED) releases
- CMTS—there are a variety Cisco IOS Software trains for Cisco CMTS products. The Cisco uBR7100 Series and Cisco uBR7200 Series can support 12.1EC, 12.2T, and 12.2BC trains, while the Cisco uBR10012 can only run the 12.2BC release

Cisco IOS Software for Cisco Cable CPE

The Cisco uBR900 Series Cable Access Router supports a number of feature sets. Each feature set provides specific functionality, such as firewall or advanced encryption. All feature sets support base IP bridging as required by DOCSIS. This allows the Cisco uBR900 Series to transmit data over HFC networks.

The Cisco uBR925 Cable Access Router also supports VoIP. Real-time traffic such as voice requires different handling than data. Data traffic can be sent on a “best-effort” basis because it can accept some loss or delay in the transmission of packets. Such losses and delays are unacceptable for voice calls.

For this reason, the Cisco uBR925 supports DOCSIS QoS enhancements that give higher priority to IP packets containing voice traffic. This ensures that real-time traffic is delivered more reliably than “best-effort” data traffic. The telephones and fax machines connected to the Cisco uBR925 can route their calls over the Internet using either the H.323v2 (Gateway/Gatekeeper), Simple Gateway Control Protocol (SGCP), and Media Gateway Control Protocol (MGCP) voice control protocols.

Depending on the protocol used and the level of support provided by the service provider, these calls can be made either to other VoIP devices or to phones connected to the PSTN.

The following Cisco IOS feature sets support data-only traffic for the Cisco uBR905 and both data and voice traffic for the Cisco uBR925:

- Base IP DOCSIS-Compliant Bridging—Provides full DOCSIS 1.0-compliant cable modem support for customers who want a basic high-speed connection to the Internet. This feature set is included in all Cisco IOS images available for the Cisco uBR900 Series
- Value Telecommuter—Adds IP routing support, DHCP support, NAT and Port Address Translation (NAT/PAT), 56-bit DES IPSec encryption, and layer 2 tunneling support to DOCSIS-compliant bridging. This allows businesses to establish secure high-speed Internet connections between employees' homes and an office LAN. This is the default software image for the Cisco uBR900 Series
- Performance Telecommuter—Adds advanced 168-bit 3DES IPSec encryption to functions provided by the Value Telecommuter image. This enables high-speed and high-security Internet connections between employees' homes and the office LAN
- Value Small and Branch Office—Adds the Cisco Secure Integrated Software (firewall) feature set to functions provided by the Value Telecommuter image. This allows customers to establish secure connections across the Internet. This feature set also protects the office network from intrusion and interference and preserves the permanent high-speed access to the Internet
- Performance Small and Branch Office—Adds advanced 168-bit 3DES IPSec encryption to the functions provided by the Value Small and Branch Office image. This allows customers to establish high-security connections across the Internet. This feature set also protects the office network from intrusion and interference and preserves the permanent high-speed access to the Internet

The following table summarizes the features and benefits of Cisco IOS Software running on the Cisco uBR900 Series.

Feature	Benefits
Authentication, Authorization, and Accounting (AAA)	Allows centralized servers to provide user authentication, authorization, and accounting. Compared to router-based authentication, AAA provides for increased flexibility and control of access configuration, scalability, the possibility of multiple backup servers, and standardized authentication methods, such as RADIUS
Cable Monitor Web Diagnostic Tool	Used to display the current status and configuration of the Cisco uBR900 Series. The Cable Monitor can also be used when the cable network is down, providing an easy way for subscribers to provide necessary information to service technicians
Cisco Cable Clock Card Support	The Cisco uBR925 automatically supports the use of the Cisco Cable Clock Card on the Cisco uBR7246VXR. The Cisco Cable Clock Card enables the Cisco uBR7246VXR to use a primary and secondary external clock derived from a Stratum 1 source. This provides a high-quality clocking signal that minimizes jitter and other timing problems that can interfere with real-time traffic such as VoIP calls
Cisco IOS Firewall	The Cisco IOS Firewall feature set provides firewall-specific security features to the Cisco uBR900 Series. When this feature is enabled, the router acts as a buffer between the Internet, other public networks, and the private network that is connected to the router The firewall-specific security features include the following: • Authentication proxy services to intelligently apply specific security policies on a per-user basis without impacting performance • Checking packet headers and dropping suspicious packets to detect and prevent denial of service attacks, such as ICMP and UDP echo packet flooding, SYN packet flooding, half-open or other unusual TCP connections, and deliberate mis-fragmentation of IP packets • Context-Based Access Control (CBAC) which gives internal-to-the-firewall users secure, per-application-based traffic control across the Internet/Intranet. This includes protection against Simple Mail Transfer Protocol (SMTP) attacks, one of the most common attacks against computers connected to the Internet • Dynamic port mapping to allow network applications with well-known port assignments to use customized port numbers. This can be done on a host-by-host basis or for an entire subnet, providing a large degree of control over which users can access different applications • Intrusion Detection System (IDS) that recognizes the signatures of the most common attack profiles. When an intrusion is detected, IDS can perform a number of actions: send an alarm to a syslog server or to NetRanger Director, drop the packet, or reset the TCP connection • Java blocking to protect against destructive Java applets. Applets can be allowed only from known and trusted sources or blocked completely • Real time and configurable alerts and audit trail capabilities to record and timestamp source and destination hosts • Support for a broad range of commonly used protocols, including H.323 and NetMeeting, FTP, HTTP, MS Netshow, RPC, SMTP, SQL*Net, and TFTP • User-configurable audit rules, real-time alerts, and audit-trail logs
DOCSIS-Compliant Bridging	DOCSIS-compliant bridging allows the Cisco uBR900 Series to operate as a DOCSIS 1.0 cable modem to interoperate with any DOCSIS-qualified CMTS
DOCSIS Baseline Privacy Interface	The DOCSIS Baseline Privacy Interface (BPI) feature provides data privacy across the HFC network by encrypting traffic flows between the CM and the CMTS Available in DOCSIS 1.1, BPI+ provides more secure authentication of cable modems through the use of digital certificates. Also, a cable modem can use a digital signature to verify that the software image it has downloaded has not been altered or corrupted in transit
DHCP Server	Include both Intelligent DHCP Relay and DHCP Client functionality A DHCP Relay Agent is any host that forwards DHCP packets between clients and servers—this enables the client and server to reside on separate subnets. If the Cisco IOS DHCP server cannot satisfy a DHCP request from its own database, it can forward the DHCP request to one or more secondary DHCP servers defined by the network administrator

DHCP Proxy Support	The DHCP Proxy Support feature is useful in two situations: • When the cable access router is configured for routing mode, an IP address must be assigned to its Ethernet interface. The DHCP Proxy Support feature allows an external DHCP server to assign an IP address to the Ethernet interface, as opposed to assigning it manually with the appropriate CLI commands • When network address translation (NAT) is used, an inside global address pool must be created on the Ethernet interface. The DHCP Proxy Support feature allows a DHCP server to assign an IP address that automatically creates the NAT address pool, as opposed to manually specifying a static IP address with the appropriate CLI commands.
Enhanced Bridging	Can connect up to 256 devices in bridging mode
H.323v2 (Gatekeeper/Gateway)	Support VoIP traffic as an H.323v2 gateway. This capability maps an IP address to an E.164 telephone number, allowing VoIP calls to terminate either on other VoIP devices or on devices on the PSTN
IPSec Network Security	This feature provides robust authentication and end-to-end encryption of IP packet. Both levels of encryption—56-bit and 168-bit—are available, depending on the software image used By default, the Cisco uBR900 Series use their onboard hardware accelerator for all IPsec encryption and decryption. This offers greatly increased performance over software-based encryption techniques
Media Gateway Control Protocol	Available on the Cisco uBR925, this feature enables the Cisco uBR925 to function as a Residential Gateway (RGW), providing an interface between analog FXS phone or fax systems and the Voice over IP (VoIP) network. The RGW uses a Trunking Gateway (TGW) to contact the call agent, which in turn provides access to the PSTN The Cisco uBR925 supports both call waiting and caller ID when using either MGCP or SGCP for call control. Each of the two voice ports on the router can be configured with the IP address provided by a single MIB (XGCP-MIB)
Intrusion Detection System (IDS)	Support for NetRanger IDS that monitors network traffic and detects unauthorized access to the cable router
NAT and PAT	Enable all devices connected to the Internet sharing a single IP address
Quality of Service	The Cisco uBR900 Series supports the following QoS features: • Resource Reservation Protocol (RSVP)—Layer 3 QoS signaling protocol that provides for the reservation of resources across an IP network • Distributed Open Signaling Architecture/Session Initialization Protocol (DOSA/SIP)—Call flow protocol that uses the AT&T VoIP over cable architecture • DOSA/QoS—Quality of service mechanism used on the AT&T VoIP over cable architecture • Committed Access Rate (CAR)—Specifies the minimum bandwidth that is guaranteed for a particular type of traffic • Multiservice Identifier (SID)—Allows a service provider to offer different classes of service to its customers, so that different types of traffic can be given different priorities of service • Traffic Shaping—Process of delaying packets that would otherwise be dropped because they exceed the rate limit on a particular cable modem's upstream. The router buffers the upstream packet until bandwidth is available. This is particularly important with TCP/IP traffic because when a TCP packet is dropped, the destination device automatically drops all other packets it currently contains in its receive buffer and then requests the retransmission of those packets. This retransmission of packets increases the congestion that already exists in this situation, drastically reducing overall throughput
Routing Information Protocol – version 2 (RIP v2)	When configured for routing mode, the Cisco uBR900 Series default to using the Routing Information Protocol Version 2 (RIPv2). In routing mode, the cable access router automatically configures itself to use the headend's IP address as its IP default gateway. This allows the router to send packets not intended for the Ethernet interface to the headend RIPv2 routing is useful for small internetworks because it optimizes Network Interface Center (NIC)-assigned IP addresses by defining Variable-Length Subnet Masks (VLSMs) for network addresses, and it allows Classless Interdomain Routing (CIDR) addressing schema

Secured Shell Version 1 (SSH v1)	Allows network administrators to make a secure Telnet connection with the router. SSH provides for authentication and encryption at the application layer, providing a secure connection even when BPI or IPSec authentication and encryption are not used at the network layer. The cable access router can function as both an SSH server and an SSH client By default, the SSH feature uses 56-bit DES encryption. Higher security 168-bit 3DES encryption is available when using Cisco IOS images that support 3DES IPSec encryption. (The SSH client must also support the same level of encryption.)
Simple Gateway Control Protocol	SGCP provides for control call setup and teardown for VoIP calls made through the Internet or a local Intranet. SGCP uses call control agents to communicate with voice gateways, allowing customers to create a distributed system that enhances performance, reliability, and scalability while still appearing as a single VoIP gateway to external clients
Triple Data Encryption Standard	Increases the security from the standard 56-bit IPSec encryption to 168-bit encryption. This provides a level of security suitable for highly sensitive and confidential information such as financial transactions and medical records

Cisco IOS Software for Cisco CMTS Products

Cisco CMTS IOS software gives cable operators the ability to deliver differentiated and revenue-generated services such as VoIP, Internet access, managed VPN services. A version of Cisco IOS Software running in a Cisco CMTS can be part of Software Release 12.2 BC, 12.1(EC), or 12.0 SC.

12.0 SC Release Train

Cisco IOS Software Release 12.0 SC is the Cable "stable" release train and is based on Cisco IOS Software release 12.0 S. This release supports DOCSIS 1.0 only and has reached End-of-Engineering status. As a result, no new functionality is added to the 12.0 SC release.

Cisco IOS Software Release 12.0 SC introduced the following software features:

- BPI Encryption and Encrypted Key Exchange
- Burst Profile Configuration
- Cable Interface Bundling and Subinterface Support
- cdxCmtsCmOnOffTrapEnable Object
- Cisco Network Registrar
- DHCP Cable Modem Host ID
- DHCP Client ID/Remote ID Options
- DOCSIS 1.0 Quality of Service
- DOCSIS Ethernet MIB Objects Support (RFC 2665)
- DOCSIS OSSI Objects Support (RFC 2233)
- Downstream Channel ID
- Downstream Frequency OverrideDownstream Rate Shaping with IP Type of Service Bits
- Downstream Traffic Shaping
- Dynamic Mobile Hosts
- SNMP and Cable-Specific MIBs, including:
  - DOCS-IF-MIB Enhancements (see Management Information Bases)
  - Multicast Baseline Privacy Interface MIB Support
  - Per-Modem Filters (Per-Modem and Per-Host Access Lists)
- LinkUp/Down Traps Support (RFC 2233)
- Input Power Levels
- Secure Shell (SSH)
- Show Command Enhancements
- SNMPv2C
- SNMPv3
- SNMP Objects for Clear Host, Clear Cable Modem, and Show Current CPEs
- Spectrum Management Features
- Upstream Address Verification
- Upstream Traffic Shaping

12.1 EC Release Train

The 12.1 EC train is the Cisco cable-specific early deployment release vehicle that introduced several new feature sets and supported new cable line cards. The latest release of this train is 12.1(11)EC.

This train can only be used with the Cisco uBR7100 Series and the Cisco uBR7200 Series. The feature set introduced in the 12.1EC train resulted in Cisco being the first vendor to receive DOCSIS 1.1 qualification.

Features available with 12.1EC train include:

- Cable Interface Setup Facility
- Cable map-advance Command Enhancements
- Cable monitor Command
- cdxCmtsCmOnOffTrapEnable Object
- Cisco Network Registrar
- Cisco Network-Based Application Recognition
- Configurable Alternate Termination System Information Messages
- DOCSIS Ethernet MIB Objects Support (RFC 2665)
- DOCSIS OSSI Objects Support (RFC 2233)
- Downstream Frequency Override
- Dynamic Map-Advance
- Dynamic Ranging Support
- Dynamic Upstream Modulation
- HCCP Support for the Cisco uBR-MC16S Cable Interface Line Card
- Hot-Standby 1+1 Redundancy
- Input Power Levels
- Internal Modem Configuration File Editor
- LinkUp/Down Traps Support (RFC 2233)
- Manual MAX-CPE Override
- MPLS VPN Support for Subinterfaces and Cable Interface Bundles
- Multicast Baseline Privacy Interface MIB Support
- Overlapping Subinterface IP Addresses
- Per-Modem Error Counter Enhancements
- Per-Modem Filters (Per-Modem and Per-Host Access Lists)
- Server Support for these Network Server Types:
  - DHCP Server
  - Time-of-Day Server
  - Trivial File Transfer Protocol Server
- Show cable modem summary Command Enhancements
- SNMP Warm Start Trap
- SNMP Cable Modem Remote Query
- SNMP Objects for Clear Host, Clear Cable Modem, and Show Current CPEs
- SNMP and Cable-Specific MIBs (multiple)
- Turbo Access Control Lists (Turbo ACL)

12.2 BC Release Train

12.2 BC is an interim release train that provides DOCSIS 1.1 support on the Cisco uBR7246VXR, along with select new features. The 12.2 BC release train is based on Cisco IOS Software Release 12.2(4)B, which in turn is based on 12.2(4)T1.

Cisco IOS Software Release 12.2(4)BC1 provides a migration path from the earlier 12.2 XF releases, which included a selected subset of the features supported for the Cisco uBR7100 Series, Cisco uBR7200 Series, and Cisco uBR10012:

- Cisco IOS Software Release 12.0 SC
- Cisco IOS Software Release 12.1 EC
- Cisco IOS Software Release 12.1(7)CX1

The 12.2BC train contains the following software features:

- Cable ARP and Proxy ARP
- Cable Flap List
- Cable intercept Command
- Cable Interface Setup Facility
- Cable Source Verification (cable source-verify Command)
- Cisco Network Registrar
- DOCSIS 1.0 Support, including:
  - DOCSIS 1.0 Baseline Privacy Interface Interoperability
  - DOCSIS 1.0 Quality of Service
  - DOCSIS Customer Premises Equipment Configurator
  - DOCSIS 1.0 Quality of Service
- Extensions to DOCSIS 1.0
- DOCSIS 1.1 Support, including:
  - DOCSIS 1.1 Two-way Transmission (Cisco uBR7246VXR Router)
  - DOCSIS 1.1 Quality of Service
  - Internal Modem Configuration File Editor
- DOCSIS Ethernet MIB Objects Support (RFC 2665)
- Dynamic Map-Advance
- Dynamic Mobile Hosts
- Dynamic Ranging Support
- Dynamic Upstream Modulation
- Frame Relay Enhancements
- LinkUp/Down Traps Support (RFC 2233)
- Manual MAX-CPE Override
- MPLS VPN Support for Subinterfaces and Cable Interface Bundles
- Overlapping Subinterface IP Addresses
- PPPoE Termination Support on Cable Interfaces
- Server Support for these Network Server Types:
  - DHCP Server
  - Time-of-Day Server
  - Trivial File Transfer Protocol Server
- Spectrum Management Features, including:
  - Dynamic Upstream Modulation
- SNMP Cable Modem Remote Query

IP Routing

Cisco CMTS products support IP routing with a wide variety of protocols and combinations of media such as Ethernet, Fast Ethernet, Gigabit Ethernet, serial, High Speed Serial Interface (HSSI), Packet over SONET (POS) OC-3 and OC-12, and ATM. IP routing features supported in the uBR products include:

DHCP Server

Cisco CMTS products support full DHCP server implementation that enables a DOCSIS-compliant cable modem to retrieve IP address, a subnet mask, and other IP related parameters—all of which are needed by the cable modem to successfully come online.

DRP Server Agent

The DRP Server Agent are border routers that support Director Response Protocol (DRP). This UDP-based protocol enables the Cisco DistributedDirector, a stand-alone application, to provide dynamic, scalable, and "network intelligent" Internet traffic load distribution between multiple geographically dispersed servers.

Easy IP (Phase 1)

Easy IP (Phase 1) feature, a combination of NAT and PPP/Internet Protocol Control Protocol (IPCP), enables a Cisco router to negotiate automatically its own registered WAN interface IP address from a central server and to enable all remote hosts to access the Internet using this single registered IP address. This feature is necessary in order for multiple LAN devices to use the same globally unique IP address so that these devices can access the Internet using the registered IP address.

Hot Standby 1+1 Redundancy

The Hot Standby 1+1 Redundancy enables a Cisco uBR7100 Series, Cisco uBR7200 Series, or Cisco uBR10012 to wait in hot standby mode to take over service processing for a primary CMTS in case of system failure. The 1+1 redundancy feature provides high availability capability essential for VoIP where lack of redundancy can result in loss of voice calls.

PPPoE Termination

Beginning with Cisco IOS Software Release 12.2(4)BC1, Cisco IOS Software for cable added support for Point-to-Point Protocol over Ethernet (PPPoE). This feature allows a direct connection to cable interfaces. The support of PPPoE on cable interfaces of a Cisco CMTS allows CPE behind a cable modem to use PPP as a mechanism to obtain their IP address and use this for all subsequent data traffic similar to a dial-up PPP client. In a PPP dial-up session, the PPPoE session is authenticated and the IP address is negotiated between the PPPoE client and the server, which can be either a Cisco CMTS or a Home Gateway.

Per Modem Filter

Per-modem filters give cable operators the ability to filter incoming packets from individual hosts or cable interfaces based on the source MAC or IP address. This allows access lists to be specified on a per-interface and per-direction basis. The packets received from cable interfaces and/or individual hosts are filtered based on the cable interface or the host the packets are received from.

HSRP over ISL in Virtual LAN Configuration

Inter-Switch Link protocol (ISL) is a Cisco protocol for interconnecting multiple switches and maintaining VLAN information as traffic goes between switches. ISL provides VLAN capabilities, while maintaining full wire speed performance on Fast Ethernet links in full- or half-duplex mode. ISL operates in a point-to-point environment and will support up to 1000 VLANs. With this feature, cable operators can define virtually as many logical networks as are necessary for their environment. For configuration information for Hot Standby Router Protocol (HSRP) over Inter-Switch Link (ISL) protocol, refer to the chapter titled *"Configuring Routing Between VLANs with Inter-Switch Link Encapsulatio*n," contained in the *Cisco IOS Switching Services Configuration Guid*e, Release 12.2 at

www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/fswtch_c/

IP Network Address Translation / Port Address Translation

NAT is a mechanism for conserving registered IP addresses in large networks and simplifying IP address management tasks. As its name implies, Cisco IOS NAT translates IP addresses within private "internal" networks to "legal" IP addresses for transport over public "external" networks (such as the Internet). Incoming traffic is translated back for delivery within the inside network. Thus, Cisco IOS NAT allows an organization with unregistered "private" addresses to connect to the Internet by translating those addresses into globally registered IP addresses. Cisco IOS NAT also increases network privacy by hiding internal IP addresses from external networks. The cable operator can configure several internal addresses with NAT to only one or a few external addresses by using a PAT feature—also referred to as "overload," a subset of NAT functionality.

Management

All CMTS/routers have management capabilities built-in to ease configuration, management, DOCSIS support, and troubleshooting.

DOCSIS MIB Support

Cisco CMTS products support many Management Information Base (MIB) as specified in DOCSIS. These MIBs include:

- DOCSIS Ethernet MIB Objects Support (RFC 2665)
- DOCSIS Operational System Support Interface (OSSI), including support for LinkUpDown Traps (RFC 2233)
- Multicast Source Discovery Protocol MIB (MSDP)
- RF Interface MIB
- SNMP and Cable-specific MIBs such as SNMPv2-SMI.my, IF-MIB, DOCS-IF-MIB.my, DOCS-BPI-MIB.my

Additionally, Cisco IOS Software for Cable supports SNMP, SNMPv2, and SNMPv3.

To obtain lists of supported MIBs by platform and Cisco IOS release and to download MIB modules, refer to the *Cisco MIB* Web page on Cisco.com at

www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

Cable Interface Setup Facility

The Cable Interface Setup facility supports a number of functions to ensure cable interfaces and line cards are fully operational after setup. These include:

- Ability to configure each interface on the system as part of the CMTS configuration
- Ability to configure the CMTS manually should the user prefer not to use the autoinstall feature
- Ability to specify a range of interfaces to which subsequent commands are applied and support the definition of macros that contain an interface range.

The Setup Facility transforms the complicated task of configuring a CMTS, making it simple.

Enhanced Modem Status Display

Cisco CMTSs support polling of cable modems to obtain parameter and status information. This capability enables the user to poll and display:

- Downstream receive power levels
- Downstream signal/noise ratios (SNRs)
- Upstream power levels
- Transmit timing offsets
- Micro reflection (in dB)

Internal Modem Configuration File Editor

This feature adds support for internal DOCSIS cable modem configuration file storage and generation. The cable modem configuration file is generated and stored as part of the Cisco IOS configuration file. The DOCSIS configuration files are not stored in Flash memory but are automatically generated when requested for TFTP downloads to cable modems.

SNMP Cable Modem Remote Query

The remote query feature allows Cisco CMTSs to use SNMP requests to periodically poll online cable modems to gather signal-to-noise ratio (SNR), upstream power value, transmit timing offset, micro reflection value, and modem state. After all statistic parameters are collected, an SNMP trap can be generated to inform the SNMP manager that the remote query poll is complete.

Interface Bundling

To reduce the number of subnets consumed per Cisco CMTS, cable interface bundling is used. Multiple cable interfaces can share a single IP subnet. An IP subnet is required for each bundle. The user can bundle all cable interfaces on a Cisco CMTS into a single bundle.

Up to four interface bundles can be configured. In each bundle, exactly one interface must be specified as the master interface, using the “master” keyword. In the case of a subinterface over a cable bundle, ‘x’ is the interface number of the bundle master. The subinterface number starts from 1.

Cisco Network Based Application Recognition

This feature is available today only on the Cisco uBR7100 Series and the Cisco uBR7200 Series. The NBAR feature is a new classification engine that recognizes a wide variety of network applications that dynamically assign TCP or UDP port numbers. NBAR enhances existing methods of application-recognition by adding several new classification features:

- Classification of applications that use statically or dynamically assigned TCP/UDP port numbers or protocols other than TCP and UDP
- Classification of HTTP traffic by URL, host, or MIME type
- Classification of Citrix ICA traffic by application name
- Classification of application traffic using subport information

NBAR can also classify static port protocols.

After NBAR recognizes an application, the Cisco uBR7100 Series or Cisco uBR7200 Series can invoke specific services appropriate for that application. These services can provide QoS features such as:

- Guaranteed bandwidth
- Bandwidth limits
- Traffic shaping
- Packet coloring

The Cisco IOS Software NBAR feature can also be used to detect and respond to denial-of-service and other types of network attacks.

DOCSIS 1.0 QoS

All Cisco CMTSs support QoS as defined by DOCSIS 1.0. Service class profiles can be configured through the CLI to support the QoS profile number, traffic priority, maximum upstream bandwidth, guaranteed upstream bandwidth, maximum downstream bandwidth, maximum transmit burst length, baseline privacy enable/disable, and type of service (ToS) overwrite byte.

DOCSIS 1.0 QoS Enhancement

A number of DOCSIS QoS enhancements were added to early Cisco IOS Software releases. These features paralleled some of those that were expected in the DOCSIS 1.1 specification prior to finalization.

- Concatenation Support—DOCSIS Concatenation combines multiple upstream packets into one packet to reduce packet overhead and overall latency. Using concatenation, a DOCSIS cable modem makes only one bandwidth request for a concatenated packet, as opposed to making a different bandwidth request for each individual packet. This technique is especially effective for burst-intensive real-time traffic such as voice. Concatenation is enabled by default for current cable line cards, but can be disabled with the Cisco IOS Software command
- Embedded Client Signaling (dynamic SIDs)—Supports the dynamic creation, configuration, and deletion of Service Identifiers (SIDs) to accommodate different classes of service. This allows cable modems to request high-priority or high-bandwidth data streams as needed, such as when a voice call is made
- IP Precedence-Based Rate Limiting that can be used to ensure traffic, such as data, does not exceed a preset rate limit and interfere with higher-priority real-time traffic
- Support for Unsolicited Grants

DOCSIS 1.1 QoS

DOCSIS 1.1 modifies the DOCSIS 1.0 specification to provide better performance, in particular for voice. DOCSIS 1.1 features are supported in the Cisco IOS 12.2 BC release train, with additional DOCSIS 1.1 features being supported in certain earlier Cisco IOS 12.1 EC and 12.0 SC release trains.

DOCSIS 1.1 Service Flow

DOCSIS 1.1 offers enhanced QoS features:

- The DOCSIS 1.0 QoS model (SID) associated with a QoS profile has been replaced with a service flow model that allows greater flexibility in assigning QoS parameters to different types of traffic and in responding to changing bandwidth conditions
- Multiple service flows per CM in either direction due to packet classifiers
- Support for multiple service flows per cable modem allows a single cable modem to support a combination of data, voice, and video traffic
- Greater granularity in QoS per cable modem in either direction, using unidirectional service flows
- Dynamic MAC messages that can create, modify, and tear-down QoS service flows dynamically when requested by a DOCSIS 1.1 cable modem

Support for Upstream QoS Models

Supported QoS models for the upstream are:

- Best-effort data traffic
- Committed Information Rate (CIR)—Guaranteed minimum bandwidth
- Unsolicited Grants (UGS)—Constant bit rate (CBR) traffic, such as voice, that is characterized by fixed size packets at fixed intervals
- Real Time Polling (rtPS)—Real Time service flows, such as video, that produce unicast, variable size packets at fixed intervals
- Unsolicited Grants with Activity Detection (USG-AD)—Combination of UGS and RTPS, to accommodate real time traffic that might have periods of inactivity (such as voice using silence suppression).
- Enhanced time-slot scheduling mechanisms to support guaranteed delay/jitter sensitive traffic on the shared multiple access upstream link

Concatenation

Concatenation allows a cable modem to send multiple MAC frames in the same time slot, versus making an individual grant request for each frame. This avoids wasting upstream bandwidth when sending a number of very small packets, such as TCP acknowledgement packets.

Dynamic MAC Messages

Dynamic Service MAC messages allow dynamic signaling of QoS between the cable modem and the CMTS. These messages are DOCSIS link layer equivalents of the higher layer messages that create, tear down, and modify a service flow. These messages are collectively known as DSX messages. The DSX state machine module on the CMTS manages the several concurrent dynamic service transactions between cable modems and the CMTS. It include state machine support for all three DOCSIS1.1 DSX MAC messages:

- Dynamic Service Add (DSA)—This message is used to create a new service flow
- Dynamic Service Change (DSC)—This message is used to change the attributes of an existing service flow
- Dynamic Service Deletion (DSD)—This message is used to delete an existing service flow

Fragmentation (Layer 2)

Layer 2 fragmentation on the upstream prevents large data packets from affecting real-time traffic, such as voice and video. Large data packets are fragmented and then transmitted in the timeslots that are available between the timeslots used for the real-time traffic.

Payload Header Suppression

Payload Header Suppression (PHS) conserves link-layer bandwidth by suppressing unnecessary packet headers on both upstream and downstream traffic flows.

Dynamic Map-Advance

A CMTS administrator can enhance the upstream throughput from a CM connected to a Cisco CMTS. The system employs a new algorithm that automatically tunes the lookahead time in MAPs, based on several input parameters for the corresponding upstream channel. The use of dynamic and optimal lookahead time in MAPs significantly improves the per-modem upstream throughput.

Improved Upstream QoS

Supported QoS models for the upstream are:

- Best-effort—Data traffic sent on a non-guaranteed best-effort basis
- Committed information rate (CIR)—Guaranteed minimum bandwidth for data traffic
- Unsolicited grants (UGS)—Constant bit rate (CBR) traffic, such as voice, that is characterized by fixed size packets at fixed intervals.
- Unsolicited grants with activity detection (USG-AD)—Combination of UGS and RTPS, to accommodate real time traffic that might have periods of inactivity (such as voice using silence suppression). The service flow uses UGS fixed grants while active, but switches to RTPS polling during periods of inactivity to avoid wasting unused bandwidth

Upstream Address Verification

This feature prevents the spoofing of IP addresses. Using the CLI, administrators can determine the IP and MAC address of a given cable interface, and the SID number that shows the IP and MAC addresses learned in the cable interface's MAC table. The CMTS verifies the source IP address against the MAC address for the CM. CM and PC IP addresses are verified to ensure that SID and MAC addresses are consistent. Using customer databases, administrators can cross-reference a spoofing CM and PC and prevent further usage.

Cisco uBR-MC16S-based Spectrum Management

Cisco offers a cable line card—the Cisco uBR-MC16S—supported on the Cisco uBR7200 Series and Cisco uBR10012 that offers advanced spectrum management. Spectrum management is used to prevent service interruptions due to upstream noise.

Because of the nature of CATV technology, upstream noise management is a significant issue. Frequency bands must have a sufficient carrier-to-noise ratio (CNR) and carrier-to-ingress power ratio to support the transmission of quadrature phase-shift keying (QPSK) and quadrature amplitude modulation (QAM) data. DOCSIS sets the minimum value for both these ratios to 25 dB in the 5 MHz to 42 MHz frequency range. If CNR drops below 25 dB on a particular channel due to noise, the cable modem on that channel degrades and can drop off the network.

The Cisco uBR-MC16S line card features advanced spectrum management capability that records signal-to-noise (SNR) information from 5-to-42 MHz for each upstream port to determine the noise level and identify clear spectrum should an automatic frequency hop be required. When the number of missed station management messages exceed a configured threshold, an upstream channel frequency reassignment is initiated. The Cisco uBR-MC16S scans the upstream spectrum and locates a clean, available upstream channel within the defined spectrum group.

Dynamic Upstream Modulation

The Cisco uBR-MC16S supports dynamic upstream modulation. This feature reduces the risks associated with transitioning to QAM 16 in the return path, and provides assurance that subscribers remain online and connected during periods of return-path impairments.

Intelligent Spectrum Management Enhancements

Intelligent spectrum management enhancements to the Cisco uBR-MC16S line card were introduced in the Cisco IOS Release 12.1 EC train. Initial support for the Cisco uBR-MC16S card also appeared in Cisco IOS Releases 12.0(7)XR3, 12.1(1a)T1, and 12.1(2)EC. Additions:

- Integrates a DOCSIS cable interface line card with an onboard spectrum analyzer that continuously analyzes upstream spectrum quality in the DOCSIS frequency range of 5 to 42 MHz
- Includes hardware-assisted frequency hopping, providing for more intelligent and faster frequency selection than software-only solutions
- Reduces the response time to ingress noise that can cause modems to drop offline.
- Eliminates blind frequency hopping by initiating frequency hops to known clean channels
- Improves frequency agility to help eliminate dropped packets and thereby maintain full upstream data rates
- Supports frequency agility in dense-mode combining environments across a shared spectrum
- Restricts frequency hopping to a set of discrete frequencies or to a range of frequencies, as desired
- Allows frequency hopping conditions to be customized for specific plant environments and requirements
- Optionally schedules frequency hops to take advantage of known usage patterns or plant conditions
- Optionally dynamically reduces channel width to allow cable modems to remain online, even in noisy upstream conditions

Advanced Spectrum Management Features

Advanced spectrum management features for the Cisco uBR-MC16S cable interface line card appeared in Cisco IOS Release 12.1(7)CX as a software-only upgrade. These enhancements:

- Support proactive channel management to avoid the impacts of ingress and keep subscribers online and connected
- Offer flexible configuration choices, allowing users to determine the priority of the actions to be taken when ingress noise on the upstream exceeds allowable thresholds. The configurable actions are frequency hopping, switching the modulation profile, and reducing the channel width

- Perform carrier-noise ratio (CNR) calculations using Digital Signal Processor (DSP) algorithms in real-time on a per-interface and a per-modem basis
- Intelligently determine when to modify the frequency, channel width, or modulation profile, based on CNR calculations in the active channel, number of missed station maintenance polls, correctable FEC errors, or uncorrectable FEC errors
- Enhance the Dynamic Upstream Modulation feature for the Cisco uBR-MC16S line card. This feature supports dynamic modulation using two upstream profiles. The primary profile remains in effect at low noise conditions. If upstream conditions worsen, cable modems switch to the secondary profile to avoid going offline. When noise conditions improve, modems are moved back to the primary profile
- Provide an SNMP interface so that a network management workstation or other graphical tool can obtain spectrum information for a particular cable modem or for an entire upstream. The frequency resolution can be as fine as 12 KHz
- Support the DOCSIS Cable Modem Test Analyzer (DCMTA) tool from Acterna. The DCMTA software provides spectrum analyzer capability for an individual upstream port or an individual cable modem

Downstream Traffic Shaping

Downstream traffic shaping (to include Type-of-Service) allows traffic shaping from the CMTS on a DOCSIS downstream channel. Downstream traffic shaping limits surges on output interfaces to reduce downstream congestion.

Downstream rate limiting with ToS enables you to partition downstream traffic for a CM into multiple classes of service and multiple data rates by using the three precedence bits in the ToS byte in the IP header to specify a class of service assignment for each packet. Those packets with the precedence bit set in the ToS field are given higher priority.

Upstream Traffic Shaping

Upstream traffic shaping allows the CMTS to perform rate limiting on a DOCSIS upstream channel. Upstream traffic shaping enables the CMTS to enforce the peak upstream rate for each CM without degrading overall TCP performance for the subscriber CMs.

Security

The Cisco CMTS routers support DOCSIS and other security features, including authentication, the Cisco IOS firewall, encryption, user-level configuration, and additional security features.

Cisco IOS Firewall Feature Enhancements

Cisco IOS Software used in Cisco CMTS products enhance the Cisco IOS Secure Integrated Software feature set with the following set of features:

- Context-Based Access Control (CBAC) that intelligently filters TCP and UDP packets based on the application-layer protocol
- Detection and prevention of the most common denial of service (DoS) attacks, such as ICMP and UDP echo packet flooding, synchronize/start (SYN) packet flooding, half-open or other unusual TCP connections, and deliberate misfragmentation of IP packets
- Support for a broad range of commonly used protocols, including H.323 and NetMeeting, FTP, HTTP, MS Netshow, RPC, SMTP, SQL*Net, and TFTP
- Authentication Proxy for authentication and authorization of web clients on a per-user basis
- Dynamic port mapping that maps the default port numbers for well-known applications to other port numbers. This can be done on a host-by-host basis or for an entire subnet, providing a large degree of control over which users can access different applications
- Configurable alerts and audit trail
- Intrusion Detection System (IDS) that recognizes the signatures of 59 common attack profiles
- User-configurable audit rules; configurable real-time alerts and audit trail logs

MPLS VPN Support for Subinterfaces

The Cisco CMTS offer MPLS VPN support for subinterfaces and cable interface bundles. Using MPLS VPN technology, service providers can create scalable and efficient private networks using a shared hybrid fiber coaxial (HFC) network and Internet protocol (IP) infrastructure.

Cisco Cable Services and Programs

Overview

Cisco services and programs enable cable service providers to leap well ahead of other providers in terms of service offerings and customer mindshare. The Cisco team can contribute to success during the complete network life cycle: planning, design, implementation, deployment, and operation. Cisco offers services and programs that maximize your return on investment in Cisco products, solutions, and network management systems.

Cisco Cable Services and Programs at a Glance

Cable Marketing Programs

Cable Specific Marketing Programs

Cisco provides turn-key, customizable marketing programs to accelerate ROI on Cisco's high-performance, high-quality products. These "add water and stir" programs only require cable service providers to drop in their logo and phone number to launch an effective, successful sales campaign! View the Customer Marketing Programs 2002 presentation (80 slides) at
www.cisco.com/warp/public/cc/general/present/solution/servprod/acqs_pg.pdf
to obtain program details.

For an overview of the programs, refer to
www.cisco.com/warp/public/cc/serv/mkt/sup/sp/gen/jolta_ov.pdf

If you are a Cisco Powered Network member, the program fee is paid by Cisco Powered Network. Cisco Powered Network is a joint program between Cisco and a select group of service providers who power their networks with Cisco equipment. If you are not a Cisco Powered Network member, a low program fee is assessed for the use of the program. The program fee is a fraction of the cost it would take to develop a campaign!

To view Cisco's suite of high-speed acquisition programs, events, and campaigns you can use to drive residential and commercial Internet service subscription, refer to:
www.spectrummarketing.net/cisco/

Click on "non-member" to view all important details. From this site, you can access:

- Programs such as the Internet Learning Center—Internet classroom for residential prospects and Internet Business Solutions center for business owners
- Events such as:
  - Retail sales demo to host events at locations such as a local computer store to give consumers a chance to test-drive cable's high-speed Internet service, ask questions, and sign up for service
  - Shopping Mall Tour to hold convenient parking lot events for live demonstrations and lead generation
  - Mobile Bus Tour to take presentations and hands-on demonstrations on the road

- Campaigns such as:
  - VPN teleworker for small-medium and branch office applications to demonstrate fast, secure VPN connections between businesses and teleworkers
  - Internet access for small businesses such as law firms, doctor's offices, and accounting agencies to demonstrate Internet service productivity

All campaigns contain easy-to-customize advertising tactics including direct mail, postcards, print advertising, bill inserts, door hangers, radio scripts, and television commercials.

General Cisco Service Provider Marketing Programs

Cisco Powered Network—Cisco's primary partnering program for key service provider accounts. The program provides many benefits for you to market your services more effectively using Cisco resources. Refer to: www.cisco.com/warp/public/779/servpro/cpn/

JumpStart—Provides marketing consulting designed to help service providers create and market new services. Refer to: www.cisco.com/warp/public/779/servpro/programs/jumpstart/

JOLT (JumpStart On-Line Toolkit)—A free, comprehensive web site consisting of service-specific content and tools designed to assist eligible service providers in taking Cisco-based services more successfully to market. The program is designed to be self-sufficient, in that no J.O.L.T. personnel support is required for account application and user registration and usage. Apply through your Cisco Account Manager.

Cisco VoIP Residential CPE Partner Program

The Cisco VoIP Residential CPE Partner Program is designed to meet needs for low-cost residential VoIP modems to help drive deployment of residential VoIP services to market. Through collaborative interoperability testing within Cisco, we have identified low-cost, third-party MTAs that perform IP telephony control functions using three different voice protocols.

The Cisco VoIP Residential CPE Partner Program is designed as a referral program only. Cable service providers should contact their sales representatives for pricing and volume discount opportunities. The Cisco sales teams should work directly with partners. For details and identification of third-party MTAs approved in this program, please email cablecpe@cisco.com. Each MTA vendor provides complete order fulfillment and support for their respective products.

Cisco Channel Partner Program

Whether you provide services, solutions or a combination of both, Cisco is committed to your success. The Cisco Channel Partner Program can help partners create a sustainable business model in a fast-changing environment, where customers require value-added services, focused technical expertise, and higher levels of satisfaction. Furthermore, Cisco's Specialization Programs provide a structured training roadmap and access to free online technical education and video-on-demand content via the Partner E-learning Connection (**http://cisco.partnerelearning.com**).

The Partner Program integrates the technology focus of each Cisco Partner Specialization, flexible individual career certification requirements, customer satisfaction targets, and pre- and post-sales support capabilities. These elements make up the points-based structure of the overall program requirements. There are three partner certification levels: Gold Certification, Silver Certification, and Premier Certification. If you are interested in reselling Cisco product without becoming certified or specialized, see **www.cisco.com/go/reseller**.

The Channel Partner Program certifications require every partner to specialize in technology areas. You may choose the technology area for Specialization, but must earn a minimum number of Specialization points to become certified. You may decide to be strictly a specialized partner or specialize your organization as a means to achieving certification.

For More Information

www.cisco.com/go/channelprograms

Reseller and Customer Support

Reseller Sales and Technical Assistance Contact Information

Customer Help Lines	Contact Information
Presales—Reseller Help Line[1]	800 553-6387 (within U.S.) 408 526-7208 (outside U.S.) www.cisco.com/go/presaleshelp reseller-help@cisco.com (e-mail)
Post-Sales—Technical Assistance Center (TAC)	800 553-6387 (within U.S.) 408 526-7209 (outside U.S.) tac@cisco.com (e-mail)

1. Follow voice prompts to access: Pre-sales Assistance of Network Validation & Product Information, Reseller Support, Customer Service, Service Contract Sales, Reporting a technical problem/open a trouble ticket, and Seminars, Events, Training & Certification

Partner and Reseller Service and Support Offerings

Various partner and reseller service and support programs are available according to certification level and method of purchase from Cisco:

Method of Purchase	Service and Support Offerings
Direct from Cisco (only available to Partners with Direct contracts)	• *System Integrator Support*—System Integrator Support 98 (SIS98) program is designed for Silver and Gold partners who wish to provide their own brand of support to their end customers with back-end support from Cisco – SMARTspares provides partners using SIS98 the opportunity to leverage Cisco's logistics infrastructure to provide their customers with enhanced delivery services • *Shared Support*—Currently only available in the US, Cisco's Shared Support program is designed for Silver and Gold partners who wish to provide their own brand of support to their end customers while leveraging Cisco's Technical Assistance Center (TAC) and logistics infrastructure • *Cisco Brand Resale*—Program allows partners to provide Cisco's services (SMARTnet, etc.) directly to their end customers.
2-Tier (through a Distributor)	• *Packaged Services*—Partners and Resellers may purchase warranty extension, hardware replacement, installation and configuration, technical support, software upgrades, and online services. Several of these services have been bundled together to offer convenient service solutions for Cisco customers

Packaged Resalable Service Products (only via Distributors/2-Tier):

Product	Description
Maintenance Services	
SMARTnet Maintenance	Provides customers with software maintenance, registered access to CCO, advance replacement of hardware, and technical support required for self-maintenance. SMARTnet maintenance has three delivery options • SMARTnet 8x5xNBD (Next Business Day)—8 hours/day, 5 days/week, next-business-day hardware replacement • SMARTnet 8x5x4—8 hours/day, 5 days/week, 4-hour hardware replacement • SMARTnet 24x7x4—24 hours/day, 7 days/week, 4-hour hardware replacement Available through resellers and distributors.
SMARTnet Onsite	Provides all the benefits of SMARTnet maintenance, plus one of the following onsite hardware services for repairs: • SMARTnet Onsite 8x5xNBD—8 hours/day, 5 days/week, next-business-day response • SMARTnet Onsite 8x5x4—8 hours/day, 5 days/week, 4-hour response • SMARTnet Onsite 24x7x4—24 hours/day, 7 days/week, 4-hour response Packaged SMARTnet OnSite 24x7x4 provides SMARTnet OnSite 24x7x4 service in a shrink-wrapped package, allowing it to be effectively marketed through resellers.
Cisco Advance Replacement	Advance Replacement offers customers the flexibility to cover their equipment with an advance replacement service only. Cisco Advance Replacement comes with a full year of advance replacement coverage, guest access to the public portion of Cisco Connection Online (CCO), and a single technical support incident. This service is intended to be used by customers who need to supplement service offered by their reseller with a replacement option from Cisco
Software Application Support plus Upgrades (SASU)	Software Application Support plus Upgrades provides customers with software upgrades and maintenance releases for Cisco Application Software, registered access to Cisco.com plus technical support, for one year. For when a customer needs investment protection on software purchases and/or access to the latest software while eliminating unexpected budget revisions
Noncontract and Consulting Services	Cisco provides noncontract services at current time-and-materials rates. For more information contact Customer Services at 1-800-553-NETS or 1-415-326-1941
Startup Services	
Total Implementation Services (TIS)	Cisco Total Implementation Solutions (TIS) is a portfolio of services that deliver the tools, expertise, and resources needed to install, configure, and implement Cisco equipment. TIS is intended to supplement services that resellers provide, either directly or indirectly, to their customers. Product Components: Installation, Configuration, and Implementation. For more information, see www.cisco.com/go/tis

For More Information

See the Partner and Reseller Support Services Web page at:
www.cisco.com/warp/customer/765/support/ (CCO login required).

Cisco Capital Financing

Cisco Systems Capital offers a variety of financing and equipment leasing alternatives, both short term and long term, to customers and partners in the United States, Canada, Europe, Asia, Australia, and Latin America. Cisco Capital's financial solutions offer customers the ability to acquire new technologies or refresh existing equipment through flexible, easy-to-use programs.

For More Information

See the Cisco Systems Capital Web site: **www.cisco.com/go/financingprograms**

Within the United States, call 800 730-4090.

Cisco Authorized Refurbished Equipment (US and Canada Only)

The Cisco Authorized Refurbished Equipment (US and Canada Only) Program fulfills today's demand for refurbished, fully-warranted Cisco equipment. Customers who have a limited budget, or do not require Cisco's latest generation equipment, can now buy Cisco refurbished equipment with the same warranty protection and option to add SMARTnet as new Cisco equipment. In addition, all Cisco Authorized Refurbished Equipment comes loaded with authorized current revision software and Cisco IOS Software license.

For More Information

End Users/Customers: **www.cisco.com/warp/public/csc/refurb_equipment**

Resellers: **www.cisco.com/go/refurb** (click on "Cisco Refurb Information")

Cable Education and Certifications

Cisco has certifications and education programs acknowledged and respected worldwide. Cisco is the first to offer a complete suite of cable certifications designed for organizations and individuals supporting and maintaining two-way HFC data networks.

The **Cisco Cable curriculum** provides hands-on and self-paced training covering Cisco products in an end-to-end operational environment. To meet our customer's needs, the curriculum is being designed in a modular format with a remote lab allowing Cisco Cable Certified Cisco Learning Partners the ability to offer truly customized training.

www.cisco.com/cable/training/

The **Cisco Cable Communications Specialist Exam and Designation** is the first in the industry to measure the knowledge of an individual across the breadth of Cable infrastructure including: cable standards (DOCSIS, Euro-DOCSIS, and DVB), RF architecture and fundamentals, TCP/IP, and Cisco IOS Software.

www.cisco.com/cable/training/cable_comm_spec.html

www.cisco.com/warp/public/10/wwtraining/certprog/cqs/cable

Cisco Communications and Services certifications (CCIE® and CCIP®) meet the growing demand for skills and talent from the telecommunications sector by identifying talented professionals who can plan, design, implement or operate, New World service provider networks. Exams qualify individuals who demonstrate competencies in infrastructure or access solutions in a Cisco end-to-end environment. Certified individuals have a detailed understanding of the diverse technologies in the telecommunications arena including IP routing, IP multicast, cable, DSL, content networking or IP telephony.

For More Information:

www.cisco.com/warp/public/10/wwtraining/certprog/c_and_s/ccip/

www.cisco.com/warp/public/625/ccie/certifications/services.html

Customer Support

Cisco customer support solutions offer extensive flexibility. Cable service providers can choose from standard service packages or customized solutions tailored for unique environments. We offer:

- Broad range of services and programs—the broadest choice of network services in the industry, including self-maintenance, assistance, online resources, remote TAC, remote consultation, 24x7 onsite service, and other onsite professional services. Services include:
  - Consulting Services: solutions consulting and knowledge transfer
  - Advanced Services: network optimization and support, technology applications and support
  - Technical Support Services: Technical Assistance Center (TAC) and Advanced Network Services
- Corporate commitment—Cisco is making substantial investments in all customer services. Cisco sets goals for and measures customer satisfaction each year
- Experience—All of Cisco's support teams are staffed by experienced customer service engineers, professionals, and certified consultants and partners. Cisco has rigorous certification programs to ensure that all technical personnel have the knowledge they need to support customers' mission-critical applications

- Global presence, experience, and capability—Cisco has a network of global service partnerships to ensure that qualified local service is available no matter how remote the location. Cisco Partner reps follow rigorous certification programs to ensure that they have the knowledge needed to support Cisco customers. Cisco has depots located in the United States, Canada, Europe, Latin America, and Asia so that parts are quickly available when customers need them

Cisco Advanced Technology Program

The Cisco Advanced Technology Provider (ATP) program qualifies integration partners as having comprehensive skills addressing Cisco cable infrastructures, network management and provisioning solutions who have met a certain level of cable certification. Participation in this program is by invitation-only.

The ATP program focuses on two types of partners:

- Reseller/integrators who focus on selling, designing, implementing, and often providing Gold certification-level, post-sales support for key technologies
- Services-only partners who do not sell or support products, but have extensive and proven experience in planning, design and, in some cases, implementation in specific key technologies

www.cisco.com/warp/public/765/partner_programs/atp/

Cable Technology Specialization

The Cable Technology Specialization requires that our partners have skills covering pre-sales, basic deployment and post-sales operational support. Cisco believes that our cable operators should receive the same quality of support from our partners as they would expect from Cisco directly. In the cable space, we now require that our partners achieve the Cable Communications Specialist designation in order to operate in the cable space and support our customers. By choosing a Cable Technology Specialized partner, customers know they have the core knowledge and skills required to deploy the technology.

www.cisco.com/warp/public/765/partner_programs/specialization/cable

Cisco Advanced Cable Network Lab

Cisco has built one of the world's largest cable laboratories to facilitate testing and validation of cable network architectures and components. The Cisco Systems Advanced Cable Network Lab can replicate real-world challenges of a 4500-subscriber cable IP network, provide insight into a variety of network configurations, and resolve customer problems rapidly in a controlled environment.

The lab features thousands of dedicated modems and set-top-boxes and more than 100 miles (161 km) of a fiber backbone. This extensive infrastructure gives Cisco the ability to respond to customer requests for testing environments and reconfigure the plant to customer specifications quickly. These industry-leading capabilities allow Cisco to address critical customer challenges before deployment, dramatically reduce costs, and accelerate service launch.

For More Information

www.cisco.com/go/cableebc

Reference Information

Reference Information at a Glance

Cable IP Network Architecture Description

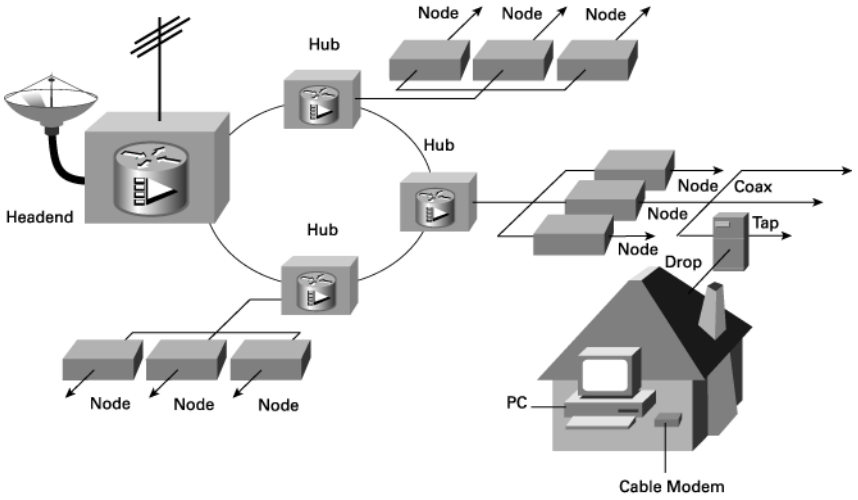
This section overviews basic cable architectures associated with each of the main service types—data, voice, and video—and discusses Cisco products used in the deployment of these services. Cisco solutions make it possible for cable service providers to augment existing HFC infrastructures and introduce two-way cable IP data, voice, and video services. Since all services employ an IP-based backbone, much of the initial investment required can be leveraged among multiple services.

Basic Broadband Access Architecture

To evolve an existing HFC network for two-way services, the architecture for the cable network needs to have the following components:

- The high-speed network backbone transports data, voice, and video to external networks which support these applications
- The headends pass data, voice, and video between the backbone and hub/HFC network. Centralized equipment such as provisioning servers, OSS servers, and billing support system servers typically reside at the headend. If the cable service provider offers voice services, call gateways and call agent software are required at the headend

- The hubs/HFC network connect the subscriber premises to the headend/backbone infrastructure. They convert the traditional digital packets (seen in the headends and on the backbone) into the RF format used to transmit the information through the fiber coaxial portions of the plant
- DOCSIS or EuroDOCSIS-compliant CPE reside at the customer premises and convert the RF data streams generated at the hub and carried over the HFC network into the usable data, voice, and video information supplied to the end-user. Examples of CPE include cable modems (CMs), set-top boxes (STBs), multimedia terminal adapters (MTAs), and VoIP telephones



High-Speed Network Backbone

A high-speed digital backbone network connects the network of a large cable operator to the rest of the world (in very large cable service provider networks, backbones also are used to carry data between different regions of the cable IP infrastructure). The backbone connects to other networks such as the PSTN, other cable system backbones, and Internet connection points. See Overview, page viii, for illustration of a large multiservice network.

Headend

The principle role of the headend is to bring external services—satellite video, off-the-air video, Internet data, and voice—into the cable operator's access network. In some instances, several headends will be used in each region, each with somewhat different roles in voice, video content, and Internet connectivity. Typically, headends contain a gigabit switch router such as the Cisco 12000 Series Internet Router to pass

traffic between external sources and the internal network. Multiservice networks might also contain the Cisco ONS 15454 or Cisco ONS 15327, part of the Cisco Complete Optical Multiservice Edge and Transport (COMET) product portfolio. These products bring the capacity of the metropolitan market up to par with the core and overcome what has been referred to as a "services bandwidth barrier" that strands capacity in the core from reaching the end customer. Cisco Catalyst® switches can be used to route local traffic between the gigabit switch router and the servers—OSS, billing system servers, and so on—located at the headend. If a cable service provider chooses to offer voice services, a key component of the headend is the telephony gateway. This component gives the broadband network the ability to interoperate with the PSTN. Other elements in the headend include: IP/MPEG remuxes, MPEG compressors, analog receivers, satellite receivers/scramblers, and descramblers.

Hub/HFC Network

Hubs contain equipment that converts between the backbone format and the format required for a particular data, voice, or video access network. Internal components of the hub include modulators, receivers, scramblers/descramblers, remuxes, codecs, and cache servers. Hubs may additionally receive off-the-air video streams in analog format or digital video from satellite feeds.

At the center of the Cisco two-way hub architecture is the Cisco CMTS/router—the Cisco uBR7100 Series in small operations, Cisco uBR7200 Series in small-, mid- to large-sized operations, or the Cisco uBR10012 in large operations. The Cisco CMTS/router connects subscribers on the HFC plant to the backbone network through both local area network (LAN) and wide area network (WAN) interfaces. If traffic demands are high, more than one CMTS/router may be required based on the CMTS platform chosen. In some instances, a Cisco 10000 Series may be used to aggregate traffic before it is passed to the headend.

Multiservice networks must accommodate a mix of network support features based on packet type. Data is bursty, requiring error-free, high-bandwidth service on an occasional basis. Voice is time-sensitive, requiring a small amount of bandwidth all the time, and precise metering to assure quality reception. Video is both bandwidth-hungry and time-sensitive, requiring high bandwidth at a steady rate. Unlike data, both voice and video can accommodate low error rates with little impact on perceived quality.

How to Get More Complete Product, Solution, Network Management, and Cisco IOS Software Information

Cisco Product Catalog	For more comprehensive information on all of Cisco's products, please refer to the Cisco Product Catalog at: www.cisco.com/univercd/cc/td/doc/pcat/
Cisco Connection Online (CCO)	For even more complete information, please go to CCO at www.cisco.com (and click on "Solutions for Your Network", choosing "Cable") In addition to product, technology, and network solutions support, CCO provides a wealth of information including how to find an authorized representative or partner (see "Partners & Resellers" link), how to order products, technical support/customer service, Cisco Corporate news and information, and links to training/events/seminars CCO provides varying levels of access to information depending on your organization's entitlement. For example, authorized Partners and Resellers[1] can log-in to have greater levels of access to CCO-based pages beyond the public level. Alternately, Guest level CCO access provides a subset of the information available to Partners and Resellers

1. To become an authorized Cisco Reseller, submit an online application located at: www.cisco.com/go/reseller. Contacts with valid email addresses will receive CCO access notification within three to five days. If you are already registered but do not have your login information, please send an email to cdbadmin@cisco.com with your company name and address, and request your CCO access numbers

Helpful Cisco Web Sites

Cisco Web Site	URL[1]
Cable Solutions CCO **Cable Products CCO**	www.cisco.com/warp/public/779/servpro/solutions/cable/ www.cisco.com/warp/public/44/jump/cable.shtml
Worldwide Contacts Cisco office locations; directions; maps; and sales, partners, and channel contacts	www.cisco.com/go/wwcontacts
Partner Relationship Central Find a Channel Account Manager (CAM), Distributor, apply to the Cisco Channel Partner Program, or update your profile	www.cisco.com/go/prc
Technical Support For customer support tips, software center, online documents, and more	www.cisco.com/go/support www.cisco.com/public/Tech_support.shtml www.cisco.com/public/technotes/serv_tips.shtml
Cisco Products Quick Reference Guide This guide is available on line (in PDF and HTML); it is continually updated between bi-yearly printings. CCO login required	www.cisco.com/go/guide
Cisco Subscription Service Ordering service for one-time purchase of or annual subscriptions to this guide or other Cisco documents and CDs; order online, or order by phone by calling 800 768-7162 (U.S. or Canada) or 925 327-4072 (outside the U.S.)	www.cisco.com/go/subscription
Worldwide Distributors Web Site List, by country, of authorized Cisco Distributors who stock and resell Cisco products	www.cisco.com/go/disti
Distribution Product Reference Guide (DPRG) Complete list of pricing information, part numbers, and more for distribution (2-tier) products. Data is refreshed nightly. CCO login required	www.cisco.com/dprg

Cisco Web Site	URL[1]
Partner Business Central—Browse and Configure Products An ecommerce web site with a configuration tool to validate channel product options; also select and compare products, check price and availability, and submit your order to your distributor online. CCO login required—click on "Browse and Configure Products"	www.cisco.com/go/partner/bizcentral
End-of-Life Matrix Last order and end-of-life dates for Cisco products.	www.cisco.com/go/eol
Sales Tools Central Helpful, easy-to-use Web site with detailed product information, sales tools, sample configurations, and more	www.cisco.com/go/tools
Training Cisco University—Offers detailed course material on the latest technical topics throughout the year targeted for Resellers, Partners and Cisco Sales representatives. Also see the Partner E-Learning Connection	www.cisco.com/go/ciscou cisco.partnerelearning.com

1. Additional CCO access required for most URLs.

Cisco Systems Overview

Cisco Systems, Inc. is the worldwide leader in networking for the Internet. Cisco's IP networking solutions are the foundation of the Internet and most corporate, education, and government networks around the world. Cisco provides the broadest line of solutions for transporting data, voice and video within buildings, across campuses, or around the world.

Today, the Internet and computer networking are an essential part of business, learning and personal communications and entertainment. Virtually all messages or transactions passing over the Internet are carried quickly and securely through Cisco equipment. Cisco solutions ensure that networks both public and private operate with maximum performance, security, and flexibility.

Cisco was founded in 1984 by a group of computer scientists from Stanford University. Since the company's inception, Cisco engineers have been prominent in advancing the development of IP—the basic language to communicate over the Internet and in private networks. The company's tradition of innovation continues today with Cisco creating leading products and key technologies that will make the Internet more useful and dynamic in the years ahead. These technologies include: advanced routing and switching, voice and video over IP, optical networking, wireless, storage networking, security, broadband, and content networking.

In addition to technology and product leadership, Cisco is recognized as an innovator in how business is conducted. The company has been a pioneer in using the Internet to provide customer support, sell products, offer training, and manage finances. Drawing upon the company's own Internet best practices and core-value of customer focus, Cisco has established the Internet Business Solutions Group (IBSG) dedicated to helping top business leaders transform their own businesses into e-businesses.

Product Warranty Information

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