Cisco Systems

CISCO MULTISERVICE BROADBAND CABLE GUIDE

FALL 2004

AVAILABLE ON CD-ROM AND
THE WORLD WIDE WEB

Table of Contents

Preface

Preface

Cisco Multiservice Broadband Cable Guide

Purpose and Scope

All complex networks are built on essential building blocks that, when organized and constructed in a way that uses the full potential of each individual unit, create an intelligent, efficient, full-functioning system. As cable operators expand their offerings to include data and voice to complement their traditional video services, they require an expert partner to bring new solutions to market quickly.

The opportunity facing cable operators in bringing new services to market and changing the way residential and commercial customers work, think, and play, presents a unique set of challenges. Cisco Systems® is committed to helping cable operators succeed by taking full advantage of its experience building complex networks for every type of user. Cisco® works with cable operators to integrate its broad array of products—the building blocks—into a single, effective, and productive Internet Protocol (IP)-based solution. These intelligent, complex networks are the result of a shared vision between cable operators and Cisco Systems.

Cisco offers a complete portfolio of standards-based cable solutions and network management systems that enable cable operators to integrate data, voice, and video services on a single, multiservice cable IP network. In addition, Cisco offers a strong set of tested commercial solutions, including VPNs, Metro Ethernet, and virtual LANs, for enterprise, small, and medium-sized businesses. Cable operators can look to Cisco to deliver flexible, scalable, and cost-effective solutions that extend from a cable headend or distribution hub, regional core or data center, all the way to the subscriber.

With Cisco technologies and solutions, cable operators can build a single, scalable architecture that will help preserve their infrastructure investments while creating an opportunity to deploy new commercial and residential services that can increase revenue streams and position them to compete against traditional telecommunications companies.

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

Because of the breadth of Cisco products and the company's continual innovations, new products, solutions, and programs may not be included in this guide upon publication. For up-to-date information, refer to:

http://www.cisco.com/en/US/netsol/index.html

or consult a Cisco representative.

Overview

This cable guide is structured to easily assist cable operators as they determine the products and solutions they need to build next-generation networks for serving residential and commercial markets. The Solutions section describes the solutions—such as IP telephony, optical transport, and video networking—that can be deployed within target markets, and includes an alphanumeric, detailed description of each Cisco product needed to deploy each solution. The alphanumeric product listing links products to the overview at-a-glance and helps improve the guide's ease of use.

The guide begins with an overview of the next-generation intelligent cable IP network. Subsequent sections include:

- Market Trends and Opportunities
- Business Drivers
- Technology
- Service Delivery Architecture for Data, Voice, and Video

- Cisco Products
  - CMTSs
  - Cable CPE
  - IP Telephony
  - Video Networking
  - Routers
  - Optical Transport
  - Ethernet Switching
  - Cisco IOS® Software
  - Cable Services and Programs

Summary

The broadband cable market holds the promise of great profitability through value-added services. To gain access to new revenue streams, 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 Systems brings powerful, flexible, comprehensive networking solutions to the cable industry. Years of IP networking experience, products, and know-how unequalled by any vendor uniquely qualify Cisco 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.

CHAPTER 1

Next-Generation Cable IP Network

Cisco Cable Offering

Cisco Systems® delivers the end-to-end products, solutions, and network management systems that give cable operators demonstrable return on investment. With more than 400,000 cable modem termination system (CMTS) upstream ports deployed and a complete portfolio of advanced Internet Protocol (IP) products, only Cisco® has the products and expertise to build intelligent, large-scale, multiservice cable IP networks. Using the rich set of field-proven Cisco products and solutions based on the DOCSIS® standard, cable operators can easily integrate new technologies and services, increase revenue with effective incremental investment, and offer more services over the same cable IP infrastructure.

Market Trends

The advent of DOCSIS standards-based IP networking has revolutionized the cable industry. It has allowed cable operators to quickly deploy and launch new services, thereby transforming themselves from broadcast video content distributors to multiservice broadband providers for residential and commercial markets. From 1995 through 2003, the cable industry spent $75 billion on infrastructure improvements, at an average cost of more than $1,000 per subscriber.[1] The revamped infrastructure provides a vastly improved network with increased bandwidth and two-way communications supporting such services as high-speed data (HSD), video on demand (VoD), and voice over IP (VoIP). IMS Research Database reports that the number of broadband subscribers worldwide exceeded 100 million for the first time in January 2004—and that this will grow to 337 million by 2009.[2]

1. Mintel International Group: December, 2003 Market Report.
2. IMS Research Database, December, 2003.

In North America at the end of 2003, approximately 18.2 million cable modem subscribers existed versus approximately 10 million residential digital subscriber line (DSL) subscribers.[3] While DSL subscribers outpace cable subscribers on a worldwide basis because of a more extensive network footprint, cable operators have established a clear differentiation in profit and performance as a result of their hybrid fiber-coaxial (HFC) infrastructures. Cable operators are aggressively investing and expanding networks to meet the projected growth demand for broadband services.

Major cable operators have migrated from proprietary CMTS technology to DOCSIS and PacketCable™ technology. Ongoing efforts include migrating to DOCSIS 1.1, DOCSIS 2.0, PacketCable Multimedia, and CableHome™ technologies. Euro-DOCSIS and J-DOCSIS have gained a foothold in other markets as well.

While continuing to focus on the residential market, the cable industry is also turning its attention to the lucrative commercial services segment space. Cable operators across the globe have an immediate opportunity to generate new revenues by luring small and medium-sized businesses (SMBs) away from telecommunications companies. Many SMBs want to extend company access to telecommuter homes, branch offices, partners, and end customers. Cable operators can serve these businesses with little incremental investment. Multiple system operators (MSOs) in the United States have been the most aggressive in pursuing the commercial market. Their cable plants pass more than 2.5 million SMBs, representing a near-term potential market opportunity of $30 billion annually.[4] Cablevision Systems, Charter Communications, Comcast, Cox, and TimeWarner Cable have been the most aggressive. TimeWarner Road Runner offers a choice of three levels of service to 104,000 commercial U.S. customers. By the end of 2003, Cox Business Services had approached the $300 million revenue mark.[5]

In the video arena, cable operators have or plan to launch high-definition TV (HDTV), interactive TV, VoD, and personal video recording (PVR) applications. While cable operators are moving toward these all-digital platforms, full migration is still years away. The legacy video infrastructure is an area of concern for the cable industry. Analog broadcast programming continues to occupy half of the cable spectrum, constraining the amount of programming and services cable operators can provide. The analog network requires management and maintenance separate from the IP network. It is limited in its ability to scale and adapt to new service models,

3. Current Analysis CMTS Market Assessment, March 30, 2004.
4. Robert Tahmassebi and Ron Hranac: "Commercial Services: Successful Strategies for Selling Into Vertical Businesses," June, 2004.
5. Cable Datacom News, September, 2003: "Getting Down to Business: Cable Chases Commercial Customers."

holding back on-demand services for consumers and the associated potential revenue for cable operators. Most cable operators agree that migrating to an all-digital, IP-based network is desirable.

As competition intensifies among broadband service providers, cable operators have an incentive to offer VoIP. Churn is an ongoing concern for all service providers. Bundling multiple services is an effective way to retain customers. VoIP can help cable operators retain subscribers who are being courted by satellite-based video providers or telecommunications companies. Most cable operators have successfully offered video and HSD services, whereas telecommunications companies have countered with their natural complement of voice and HSD. Offering VoIP gives cable operators the "triple play" of data, voice, and video services, and a solid advantage over their competitors.

Multimedia Research Group (MRG) Inc. reports the cable telephony market will surpass $3.9 billion in service revenue worldwide by 2007.[6] Around the world, cable operators such as Cox, Comcast, Telewest, UPC, Telstra, and many others have offered telephony for some time, albeit mainly circuit-switched technology. They have built a strong experience base and large numbers of voice subscribers. In the United States, for example, MSOs have more than two million voice subscribers, or roughly two percent of wireline subscribers.[7]

Indicators point to 2005 as being the year VoIP launches in earnest for cable. Numerous VoIP trials and early-stage deployments are underway with many more planned. These efforts are based predominantly on PacketCable technology that enables primary line voice with lifeline capabilities that compete with offerings from telecommunications companies. As of late 2004, Rogers, RCN, Mediacom, HOT, TDC, Shaw and many others have joined Comcast, Cox, Cablevision, and TimeWarner Cable in unveiling VoIP. At the time of this printing, TimeWarner counts more than 30,000 VoIP-based digital phone customers in Portland, Maine and plans to rollout VoIP to all of its 31 operating divisions by the end of 2004.[8] This acceleration of voice deployments has created an unprecedented demand for VoIP expertise and technologies by the cable industry. VoIP is expected to radically change cable operators' competitive positions, as well as their competitive positions, revenues, and profitability.

6. MRG, Inc., December, 2003 Cable Telephony Report.
7. Frost and Sullivan, January, 2004, Market Report.
8. CED, January 23, 2004, "TimeWarner Cable Launches Voice Division."

Business Drivers

Widespread adoption and consumer demand for broadband technology has caused a rapid increase in bandwidth utilization. To increase their revenue streams, cable operators are looking at diversifying service offerings and entering new markets.

The cable industry has reached a strategic and technological stage where several major technologies and architectures for data, video, and voice delivery are being evaluated. Considerations and issues for cable operators include:

- How best to evolve residential broadband offerings in the face of increasingly aggressive DSL marketing and pricing by telecommunications companies, and the rapid emergence, deployment, and adoption of alternative broadband technology such as Ethernet to the home (ETTH) or fiber to the home (FTTH). Operators in Asia and Europe face high-speed (26 and 50 Mbps) xDSL variants. Examples include Japan, with 130,000 FTTH adopters in the first year of service, and Korea, with more than one million adopters of symmetric Ethernet service in the first year of service.
- How best to overcome challenges when introducing VoIP. VoIP is a real-time service that requires end-to-end quality of service (QoS) to help ensure its successful implementation. In contrast to data, voice is sensitive to delay, requiring low network latency and a predictable end-to-end packet delivery mechanism. For primary line voice services, high availability (99.999 percent uptime) is a requirement.
- How best to pursue commercial service opportunities. Businesses are a largely untapped market that offer substantially more revenue per subscriber. To penetrate this market, cable operators must typically meet service-level agreements (SLAs) and service expectations set by incumbent private line, ATM, and Frame Relay offerings.
- How best to incorporate VoD. With consumer demand for “any content, anytime, anywhere,” VoD is a primary initiative for many cable operators, resulting in an extensive architectural discussion where IP, Ethernet switching, and fiber have emerged as the key enabling components. To scale the service and move to extensions such as switched narrowcasting, alternative architectures must be explored and deployed.
- How to reclaim spectrum as cable operators transition from analog channels to digital and reuse it for digital services in a manner that maximizes revenue contribution.

- Customer premises equipment (CPE) evolution; cable operators have a significant business opportunity to "own" their subscribers' in-home networks (i.e.; behind the cable modem), but the business offering varies widely and is mainly predicated on the long-term direction that operators wish to take in terms of service and support. Other factors include IP-enabled set-top boxes (STBs), streaming media delivery to cable modems, and the emergence of converged home gateways.

The cable mindset has changed from "building for growth" to "building for profitability." Cable operators want to take advantage of earlier HSD investments and obtain the full potential and power of their RF spectrums and networks. Converging services can bring about significant benefits in capital reduction, bandwidth scalability, and operational efficiency. Transitioning to "all-digital" will enable cable operators to reclaim valuable analog bandwidth without undergoing another expensive rebuild. Using DOCSIS IP networks will help enable cable operators to obtain economies of scale.

Cable operators are in a unique position to challenge incumbent telecommunications companies and satellite video providers by delivering VoIP; high-definition, broadcast-quality video; interactive gaming; videophones, and many other innovative services over a converged IP infrastructure. Bundling services incrementally increases revenue per customer and builds loyalty among the subscriber base. Selecting the right mix of products, solutions, and technologies based on individual company goals is critical.

Technologies/Specifications

To help cable operators pursue new technologies and integrate technical advancements into their business objectives, CableLabs®, a non-profit consortium comprised of members from the North American cable television industry, was founded in 1988. Its DOCSIS standard has not just been a North American initiative however. Since early 1998, operators worldwide have deployed DOCSIS architectures.

To expand options overseas and mesh with existing European platforms, an addition to the DOCSIS standard was developed—Euro-DOCSIS. Euro-DOCSIS supports an Annex A, 8 MHz channel, rather than DOCSIS Annex B, 6 MHz channel operation. Euro-DOCSIS also supports ITU-T J.83 Forward Error Correction. On the upstream, bandwidth is increased from the DOCSIS range of "5 to 42 MHz" to "5 to 65 MHz." tComLabs is the nonprofit organization, comprised of European cable operators, founded in 2000, to promote this open standard.

Japan also has its own DOCSIS version that has been officially adopted by the ITU and a number of cable operators in China and selected regions. J-DOCSIS supports Annex B, 6 MHz channel operation, but with extensions. J-DOCSIS supports 70 to 860 MHz downstream, rather than the DOCSIS 88 to 860 MHz range, and extends the DOCSIS upstream frequency range from "5 to 42 MHz" to "5 to 55 MHz."This version of DOCSIS has yet to be approved as a standard.

The CableLabs and tComLabs organizations have simplified and accelerated the deployment of cable IP services, helping to lower equipment costs and to facilitate a competitive, standardized environment. Cable operators are poised to be the first service provider segment to take full advantage of the benefits of broadband in enabling converged networks and "triple play" service offerings. This section briefly describes CableLabs' and tComLabs specifications and their relationship to services.

DOCSIS and Euro-DOCSIS 1.0 were designed to support basic HSD Internet access. Since HSD is not a real-time application, QoS was not a component. DOCSIS and Euro-DOCSIS 1.1 include QoS, packet fragmentation capabilities, and improved security, needed to support VoIP and video applications. DOCSIS and Euro-DOCSIS 2.0 accommodate increased upstream bandwidth and higher-order modulation formats to increase network capacity and improve statistical multiplexing. DOCSIS and Euro-DOCSIS 2.0 provide a 50-percent increase in spectral efficiency and a 300-percent increase in the throughput of a single carrier over DOCSIS/Euro-DOCSIS 1.0 to better handle videoconferencing and peer-to-peer networking.

Accelerated demand and rollout of new applications such as streaming video and gaming will soon push the current generation of DOCSIS- and Euro-DOCSIS-based modems and CMTS equipment beyond their limits. The DOCSIS/Euro-DOCSIS 1.0, 1.1, and 2.0 specifications focus on solving upstream traffic issues. While this works well for HSD and limited multimedia services, the ability of these specifications to deliver the new generation of multimedia applications such as streaming full broadcast-quality video, real-time interactive gaming, and end-to-end VoIP is limited.

PacketCable specifications define interfaces for providing packet-based voice, video, and other high-speed multimedia services. PacketCable builds on top of the DOCSIS infrastructure. Euro-PacketCable is based on the CableLabs PacketCable version. Deviations between the European and North American versions are due to the differences in traditional telecommunication systems used in Europe versus North America. These are mainly related to the use of V5.2 and the differences in Signaling System 7 (SS7) implementation. Another area of difference is the POTS-interfaces and supported CLASS-features.

PacketCable and Euro-PacketCable 1.0 implement a solution for single-zone voice services belonging to one operator with interfaces to the PSTN network. PacketCable and Euro-PacketCable 1.1 define requirements for primary line voice. PacketCable and Euro-PacketCable 1.2 define components and interfaces to communicate between 1.0 networks using an IP transport or backbone network.

PacketCable Multimedia and Euro-PacketCable Multimedia specifications enable IP-based multimedia services that require QoS-based network resources such as video telephony, standalone multimedia terminal adapters (MTAs), online gaming, and bandwidth on demand. These specifications define a delivery framework that provides QoS, event-based accounting, and security founded on mechanisms in PacketCable 1.x.

CableLabs' CableHome is developing an infrastructure that allows cable operators to extend high-quality, value-added broadband services to subscribers over any available home network media. CableHome 1.1 focuses on an interoperable CableHome Residential Gateway (CRG) and CableHome-compliant hosts. The goal is to support a cable operator-configurable CRG-centric environment that interacts with IP-based home devices, whether or not they are CableHome-compliant.

When cable operators want to bundle service packages that include advanced data, video, and voice, high availability and end-to-end QoS are serious challenges. For voice services, the Dynamic QoS (DQoS) mechanism defined by PacketCable addresses part of the QoS challenge, but DQoS only specifies the HFC access part of the network. Voice quality is an end-to-end issue, including managed IP networks or the public switched telephone network (PSTN) with various network equipment protocols and policies. QoS options for IP access networks and backbone networks are left up to the cable operator. To provide end-to-end QoS, cable operators must manage appropriate QoS levels across all network segments.

Advanced multimedia offerings also require end-to-end QoS. Both time- and volume-based network resource authorizations are needed, along with event-based network resource auditing and management mechanisms. Network issues such as traffic shaping and management of peer-to-peer (P2P) traffic must be considered. A robust security infrastructure is vital to help ensure integrity and appropriate levels of protection across all interfaces.

Service Delivery Architectures

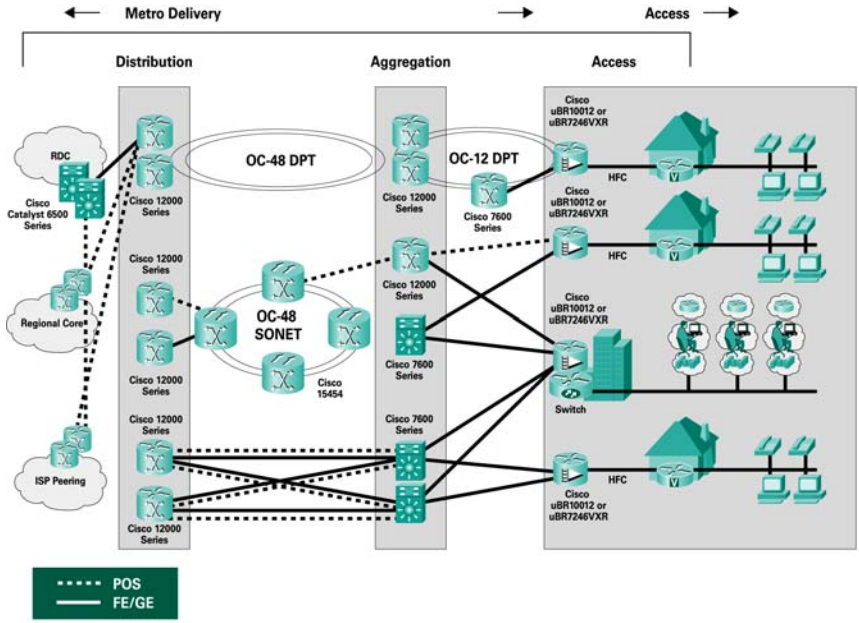
Cisco has developed baseline architectures that enable the end-to-end delivery of converged high-speed data, video, and voice services in a cable environment. These architectures are based on a combination of products, which are linked together as a functioning system to deliver the respective services. Each architecture has been fully tested for interoperability and feature consistency in Cisco's scale cable test labs; in addition, they are retested as new capabilities, standards/specifications, and features are built into the architecture. These architectures represent widely deployed systems in numerous real-world customer networks. Wrapped into each architecture is a robust offering of professional services, including deployment services to increase the velocity of new service rollouts, as well as ongoing technical and customer-specific support services to help ensure that the system operates reliably and efficiently on a long-term basis.

Cisco has worked closely with customers to determine how the move to an "all digital" environment will affect each of these service architectures. The company has created a granular migration plan that defines the steps that operators need to take to converge these services onto a single network capable of delivering each service with its expected quality, plus scale, to meet the needs of future rich multimedia service offerings. The following section explains each individual service architecture. Your Cisco account team and/or partner can provide you with detailed information on the migration plan to an all-digital next-generation network.

High-Speed Data Solutions

Figure 1-1 depicts a Cisco intelligent broadband edge high-speed data architecture. Cisco offers several cost-effective, standards-based products that extend from a cable headend or distribution hub, from a regional core or data center, all the way to the subscriber. The Cisco portfolio includes industry-leading CMTSs, cutting-edge business class and home CPE, and advanced IP backbone and edge products. Cisco HSD solutions blend high-speed broadband cable RF technology with the scalable, secure, and flexible technology that Cisco is known for in the IP core. Cisco's high-performance and high-availability products allow cable operators to maximize the efficiency of their HFC networks and add leading-edge IP services.

Figure 1-1 Cisco Intelligent Broadband Edge High-Speed Data Architecture



A high-speed digital backbone network connects an MSO's network to different regions of the cable IP network, as well as to external networks. Using IP routers or switches for statistical multiplexing or virtual trunking, high-speed data is transported over several possible technologies that include separate OC-12 or OC-48 Dynamic Packet Transport (DPT)/Resilient Packet Transport (RPT) rings or Gigabit Ethernet. Core and edge routers such as Cisco 12000 or 7600 series routers are found at distribution hubs or at aggregation points of the network to pass traffic between external sources and the internal network. Cisco 7600 Series routers offer wide-area and metropolitan-area networking (WAN and MAN) services with comprehensive IP/Multiprotocol Label Switching (MPLS) edge services. IP/MPLS services can be applied to rate-limit, shape, and account for traffic flows, allowing for maximum revenue generation per connection. Cisco 12000 Series routers are intelligent, 10-Gbps routers that provide a next-generation, high-end platform that offers high capacity in the regional or core network.

Large multiservice networks might also contain the Cisco ONS 15216 to bring the capacity of the metropolitan segment up to the same level as the core, overcoming a services bandwidth barrier that strands capacity in the core, preventing it from reaching the end customer. Many MSOs are faced with the need to further segment portions of their HFC residential access network segments with the same existing fiber infrastructure. Cisco coarse wavelength-division multiplexing (CWDM) and

dense wavelength-division multiplexing (DWDM) gigabit interface converter (GBIC) solutions allow MSOs to maximize the capabilities of existing fiber resources, while keeping optical transmitter and multiplexing costs to a minimum. The solutions enable cable operators to achieve high-margin revenue growth by offering new data services while enabling further segmentation of the HFC plant using existing fiber infrastructure. Cisco CWDM/DWDM GBIC solutions allow cable operators to provide scalable, easy-to-deploy Gigabit Ethernet services in their networks.

In the access portion of the network is the Cisco CMTS. Cisco CMTS choices include the Cisco uBR7100 Series in small operations, Cisco uBR7246VXR in midsize to large operations, or the Cisco uBR10012 in large operations. The Cisco CMTS connects subscribers on the HFC plant to the backbone network through numerous LAN and WAN interfaces. The Cisco uBR7100 Series, uBR7246VXR, and uBR10012 universal broadband routers combine a CMTS with a fully integrated Cisco IOS® Software router.

Cisco evolves the traditional Layer 2 DOCSIS CMTS to one that contains a greater level of intelligence and increased processing power needed to support next-generation IP data, video, and voice services. Cisco is the only vendor to offer multiple PacketCable 1.1-, Euro-DOCSIS 2.0 [for advanced time division multiple access (A-TDMA) only], and DOCSIS 1.1-qualified Layer 3 CMTSs. We continue to advance our products and obtain the latest CableLabs and tComLabs qualifications.

New cable line cards—broadband processing engines—for the Cisco uBR7246VXR and uBR10012 are more than traditional line cards. They offer integrated upconverters to minimize capital expenditures, as well as the most sophisticated RF feature set on the market today. The advanced RF feature set includes A-TDMA support and ingress noise cancellation technology patented by Cisco that enables cable operators to gain more effective throughput from existing transmission systems. Cisco CMTSs offer advanced automated intelligence that include P2P traffic management, packet inspection for congestion mitigation, and configuration flexibility.

As the CMTS evolves to take on new services and demands, it must have the ability to process diverse routing protocols such as MPLS, Open Shortest Path First (OSPF), Intermediate System-to-Intermediate System (IS-IS), or Border Gateway Protocol (BGP), as well as IP version 6 (IPv6) and Virtual LAN (VLAN). It must accommodate rapidly evolving standards such as DOCSIS Set-Top Gateway (DSG) and PacketCable Multimedia. This flexibility is important—different types of service offerings are likely to demand different bandwidth mixes on the HFC plant.

Voice Solutions

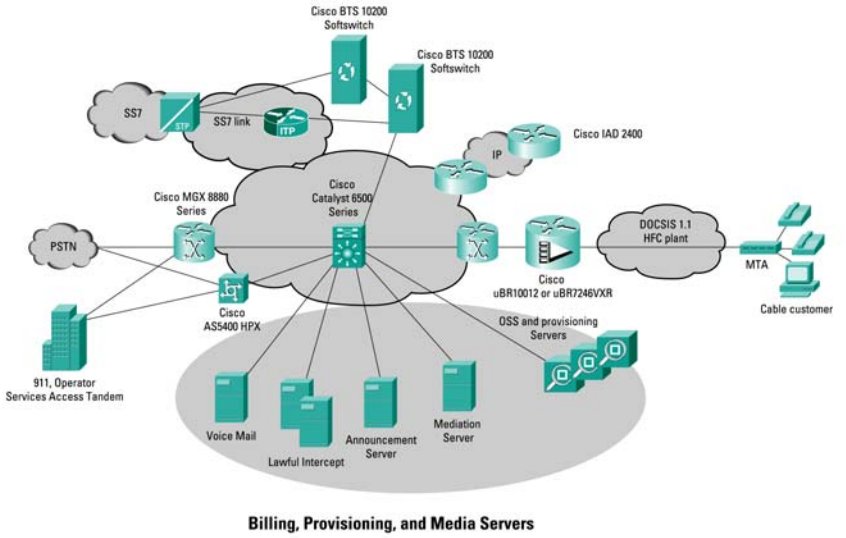
With access to a vast number of households and the service potential of IP-based networks, cable operators are in an excellent position to offer IP telephony services to their residential and commercial customers. Experienced in building both robust IP telephony networks and cable architectures, Cisco has the expertise and products to assist you in delivering end-to-end cable VoIP services.

Cable operators have several alternatives for delivering voice over their cable infrastructures. The approach generating the most interest is a solution complying with PacketCable and Euro-PacketCable specifications. Cisco has actively pursued qualification of its individual component products against the PacketCable specification, and has developed and tested an end-to-end VoIP solution based on these specifications. By fully converging voice and data networks into a single IP-based infrastructure, operators can benefit from lower operating expenses and can begin to offer enhanced services based on the integration of voice and data services, such as unified messaging and other multimedia services.

Cisco Broadband Local Integrated Services Solution for Cable

The Cisco Broadband Local Integrated Services Solution (BLISS) for Cable is based on the PacketCable architecture framework. The solution builds upon the capabilities of DOCSIS networks and allows the adoption of future PacketCable standards once they are completed. The solution provides the resources to make calls between residential and business access gateways, over cable access networks, over an aggregation network, through an IP backbone, and to the PSTN over IP links (Figure 1-2).

Figure 1-2 Cisco Broadband Local Integrated Services Solution (BLISS) for Cable



The IP telephony architecture includes the following components:

- Cisco BTS 10200 PacketCable-based softswitch
- Cisco uBR10012 or uBR7246VXR CMTS
- Cisco MGX® 8880 Media Gateway and VISM-PR Voice Gateway Line Card
- Cisco AS5400HPX Universal Gateway
- Cisco IP Transfer Point (signaling gateway)
- Consumer endpoints (E-MTAs) from Linksys and Cisco partners
- Partner media servers for Communications Assistance for Law Enforcement Act (CALEA), announcements, voice mail, and unified messaging services
- Network management systems and operations support systems (NMSs/OSSs) from Cisco and Cisco partners

The Cisco PacketCable Solution supports the following PacketCable features:

- DQoS
- Network Controlled Signaling (NCS)
- Event messaging
- Trunking Gateway Control Protocol (TGCP)
- OSS/provisioning
- PacketCable Security
- Electronic surveillance
- Audio server

Subscriber Features

Cisco BLISS for Cable delivers the following telephony feature set to residential subscribers:

Subscriber Features
- Call Forwarding Unconditional (CFU)
- Call Forwarding On Busy (CFB)
- Call Forwarding on No Answer (CFNA)
- Call Waiting (CW)
- Cancel Call Waiting (CCW)
- 3-Way Calling (TWC)
- Usage-Sensitive 3-Way Calling (USTWC)
- Calling Number Delivery (CND)
- Calling Number Delivery Blocking (CNDB)
- Calling Name Delivery (CNAM)
- Calling Name Delivery Blocking (CNAB)
- Calling Identity Delivery and Suppression (CIDS)
- Calling Identity Delivery on Call Waiting (CIDCW)
- Calling Identity Delivery Blocking (CIDB)
- Customer Originated Call Trace (CT)
- Multiple Directory Numbers (Teen Service) (MDN)

Class of Service Restrictions
- Casual Call Restrictions (101XXXX)
- NANP Call & Toll Restrictions
- NANP Black and White Lists (Number Blocking)
- Blocking of 900, 976 Calls
- Blocking of DA Calls
- Blocking of NANP Operator Assistance Calls
- Blocking of International Operator Assistance Calls
- Number Blocking

Enhanced Services
- Anonymous Call Rejection (ACR)
- Automatic Callback (Repeat Dialing) (AC)
- Automatic Recall (Call Return) (AR)
- Hotline and Warmline Services
- Selective Call Forwarding (SCF)
- Selective Call Rejection (SCR)
- Selective Call Acceptance (SCA)
- Remote Activation of Call Forwarding (RACF)

Numbering Plan and Dial Procedures
- Casual Dialing (Dial Around) (101XXXX + Digits)
- Directory Services (411, 555-1212, 0 + Listing Services)
- Easily Recognizable Codes (500, 700)
- Information Service Calls (900, 976)
- N11 Support (311, 411, 611, 711, 811)
- Operator Services Access (0, 00, 0+, 01+, CAC+0+, CAC+01+)
- Busy Line Verification and Operator Interrupt
- Vertical Service Codes
- Dialing Parity (IntraLATA Toll Pre-subscription)
- Toll-Free Service

Regulatory and Operational Features
- Emergency Services (911)
- Local Number Portability (LNP)
- NPA Split Support
- Test Calls (958, 959)

Cisco BLISS for Cable also delivers the following business telephony services:

Business Customers Package
- Account Code
- Authorization Code
- Direct Inward Dialing (DID) - PBX
- Direct Outward Dialing (DOD) - PBX
- Direct Inward Dialing (DID) - Business Group
- Direct Outward Dialing (DOD) - Business Group
- Multi-Line Hunt (MLHG)
- Call Hold (CHD)
- Call Park (CPRK)
- Call Retrieve (CPRK-RET)
- Do Not Disturb (DND)
- Directed Call Pickup With Barge-In (DPU)
- Directed Call Pickup Without Barge-In (DPN)
- Distinctive Ringing for Direct Inward Dial (DID)
- Distinctive Ringing/Call Waiting (DRCW)
- Directory Number Hunting (DNH)
- Speed Call (8 and 30)

GR-303/V5.2 Cable Overlay Voice Solutions

Cable operators may deliver voice services from a traditional telephony switch via a GR-303 or V5.2 interface. The GR-303/V5.2 architecture is a hybrid TDM/VoIP approach for providing cable telephony and is appropriate for overlay on networks with installed Class 5 switches. The solution is ideal for cable operators who already offer telephony services via a traditional TDM Class 5 switch and who have spare capacity and want to take advantage of the operational economics of VoIP. The architecture allows cable operators to gain operational and economic efficiencies by using IP over the HFC plant. The GR-303 standard is required in the United States and Hong Kong; the V5.2 standard is used in most other areas of the world.

The GR-303 interface defines the connection between a Class 5 switch or equivalent, and a remote digital terminal (RDT) which aggregates line-side subscriber connections. GR-303 provides a means to concentrate bandwidth between the switch and the RDT. For example, GR-303 can support up to 2048 line-side subscribers using only 28 T1 circuits between a local digital switch (LDS) and an RDT. In a cable VoIP environment with Network Control Signalling (NCS), the RDT can be tightly integrated with an NCS call agent to create a GR-303 gateway for delivering IP telephony access to cable subscribers with embedded MTAs or stand alone MTAs.

In the GR-303/V5.2 architecture, the EMTA uses VoIP protocols such as MGCP to communicate with a gateway. This gateway is effectively a translator to the GR-303 or V5.2 protocol, which then routes the calls through the switch and out to the PSTN.

Figure 1-3 GR-303/V5.2 Architecture and Comparison to PacketCable

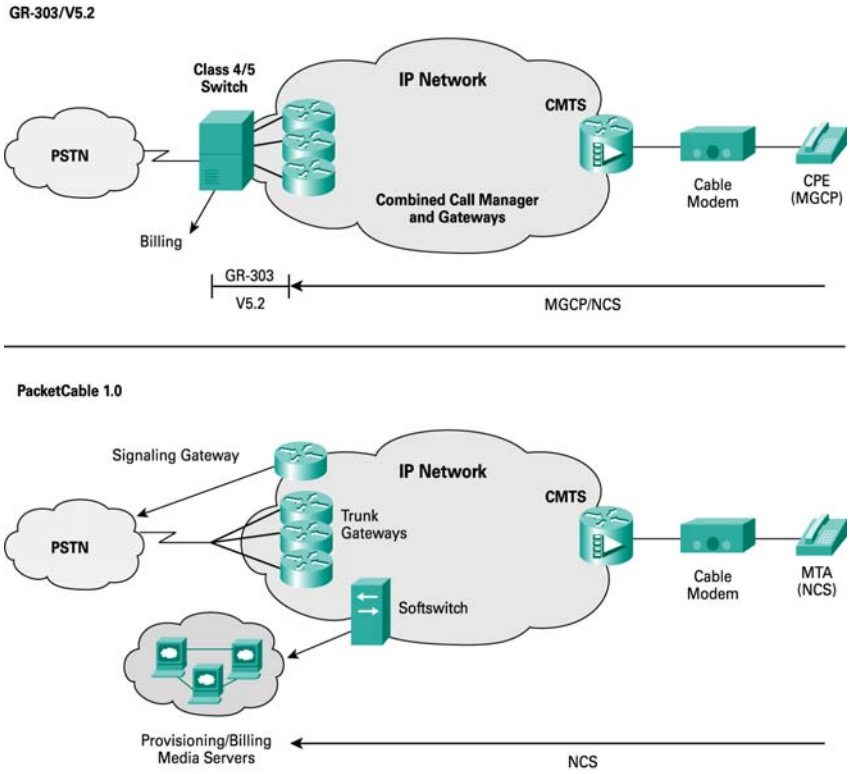


Figure 1-3 compares the GR-303/V5.2 and PacketCable architectures. The MGCP/NCS signaling in GR-303/V5.2 is very similar to the PacketCable NCS specifications; the EMTA also uses similar NCS signaling in both architectures. These similarities preserve investments in software-upgradable CPE when migrating to PacketCable, an important factor because CPE costs comprise a significant portion of the capital expenditure associated with deploying voice solutions.

The most obvious difference in the two architectures lies in the Class 5 TDM switch. In the GR-303/V5.2 network, the Class 5 switch controls all call setup and tear-down functionality and features. In the PacketCable network, a CMS replaces the Class 5 switch functionality.

A strategy for moving from a GR-303/V5.2 network to a PacketCable network might entail capping all new subscriber growth on the GR-303/V5.2 network, and instead supporting all new subscribers on the PacketCable-based solution for new markets.

Video Solutions

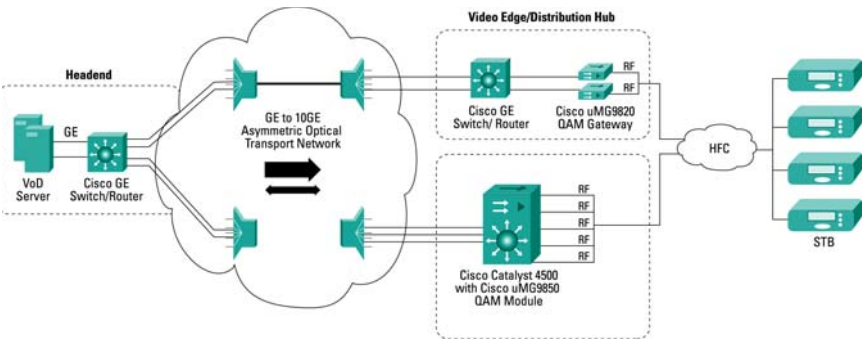
The new digital video infrastructure of cable operators beckons with promises of unprecedented revenues and profitability from exciting new services. Cable operators must now select a mix of new, differentiated services to attract and hold subscribers. Cisco offers cable operators next-generation digital video networking products and solutions that enable them to easily and cost-effectively deliver new, profitable, and scalable digital video services.

VoD

Interactive VoD services are likely to give cable operators a competitive advantage for increasing customer loyalty. Figure 1-4 shows the Cisco Gigabit Ethernet Optimized VoD Solution.

A technology shift is taking place in the video infrastructure today. The de facto video transport standard is shifting away from Digital Video Broadcasting / Asynchronous Serial Interface (DVB/ASI) to Gigabit Ethernet. In contrast to DVB-ASI infrastructures, Gigabit Ethernet delivers more bandwidth per interface and significantly lowers costs due to reduced interface costs and fewer required wavelengths and fibers. The switched Gigabit Ethernet connections between the VoD server and quadrature amplitude modulators (QAMs) enable the optimization of each VoD server's port, resulting in the need for fewer overall VoD server ports.

Figure 1-4 Cisco Gigabit Ethernet Optimized VoD Solution



Gigabit Ethernet switches are deployed at the headend, connected to the video server, to provide additional transport savings. Many of today's VOD servers cannot send out a full Gigabit Ethernet worth of streams on a single port. The Gigabit Ethernet switch aggregates the sub-rate Gigabit Ethernet VOD server ports together so a full Gigabit Ethernet of traffic can be transported across the network, saving on fiber and equipment costs.

The move to Gigabit Ethernet is about more than just economical transport. It is a fundamental shift in the network architecture. Cable operators are moving from a hard-wired DVB/ASI point-to-point configuration to an intelligent, switched infrastructure and all the benefits that this can bring. The Next-Generation Digital Video Network:

- Enables cable operators to more easily and economically deliver content to where it is needed, when it is needed.
- Scales from small networks to large, requiring new equipment purchases only as the subscriber base grows.
- Protects your investment by providing a flexible video networking system which embraces evolving architectures and services.
- Reduces operational costs and complexity by building intelligence into the network.

The Cisco uMG9800 Series digital video networking products offer cable operators ideal, cost-effective solutions for VoD services. The series is comprised of the Cisco uMG9850 QAM Module, a line card that fits into a Cisco Catalyst® 4500 Series Switch, and the Cisco uMG9820 QAM Gateway, a 1RU chassis. The products perform QAM modulation and up-conversion of digital video streams and function as IP-to-MPEG-2 gateways between the Gigabit Ethernet transport network and the HFC access network. The products enhance scalability, allowing the custom configuration of QAM densities based on VoD service deployment needs.

The Cisco uMG9820 QAM Gateway and the Cisco uMG9850 QAM Module are high-density products that provide product flexibility for customers to incrementally increase QAM densities. Both QAM products extend the life of existing capital investments by enabling operators to purchase product components as service demands increase, thereby reducing the cost to scale. Adding more QAM modules rather than requiring the purchase of entire fixed-configured systems reduces the number of devices to manage and brings down the overall cost per video stream. High-availability features offer hot-swappable online insertion and removal of QAM modules on active systems.

Optimized for Gigabit Ethernet technology, the products accept full line-rate video feeds and introduce networking functionality to environments and legacy architectures that traditionally have been hardwired. The Cisco uMG9800 Series simplifies video architecture design, eases network operations, and offers solutions for next-generation digital video networks.

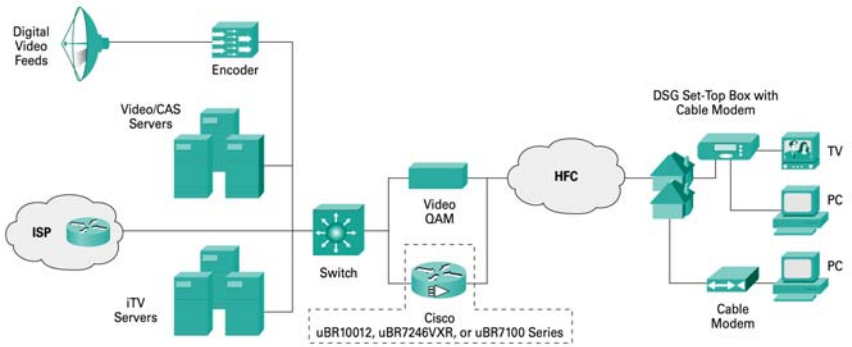
DOCSIS Set-Top Gateway (DSG)

Cable operators are eyeing different technologies that will enable 100-percent digital networks, end-user platforms, and services. A new specification, DOCSIS Set-Top Gateway (DSG), provides an evolutionary path to the digital future. As a part of CableLabs® OpenCable™ initiative, DSG is a new specification that helps standardize digital set-top-box (STB) transport. DSG bridges traditional proprietary video technology with open, standards-based DOCSIS technology.

DSG provides higher downstream and upstream bandwidth that accelerates rollout of new interactive video services and in turn yields higher revenues for cable operators. It helps cable operators migrate from legacy, technology-based video networks to standards-based IP networks. Operators can reduce costs by using their DOCSIS networks to combine cable modem and STB operations over one common, open network. The idea is to use a CMTS to deliver out-of-band (OOB) messaging such as conditional access (CA), system information (SI), electronic program guide (EPG), emergency alert system (EAS) and other STB command and control messages to digital STBs. A DOCSIS cable modem embedded in a digital STB with DSG client software handles OOB video control signaling at the subscriber location. Legacy STBs can continue to operate with their existing OOB system.

Figure 1-5 depicts a network with DSG. Using DSG, cable operators can take full advantage of their existing CMTS platforms, provisioning and network management systems, and reduce costs. Operators can better support interactive services since DOCSIS offers higher capacity.

Figure 1-5 Digital Video Architecture Using DSG



Cable operators can migrate to DSG on a time-frame that fits their schedule. DSG opens the door to layering advanced services and rich interactive content onto the STB platform, using the DOCSIS infrastructure to do so. DSG gives the industry a common OOB specification and architecture for today and the future.

PacketCable Multimedia Services

Cable operators hold a unique advantage over traditional telephone carriers, because their IP-based infrastructure is ideally suited to carry rich multimedia services that capitalize on the robust PacketCable architecture. CableLabs has devised a multimedia architecture, building upon the PacketCable voice architecture and adding network capabilities that allow for the interconnection of new communications devices and help ensure QoS delivery, regardless of the application.

Once employed, these capabilities dramatically expand the services available through the network. Cable operators can begin offering rich-content consumer services such as videophone, audio/video chat, gaming services, bandwidth on demand, and phone-to-STB integration. Additionally, PacketCable Multimedia enables a full suite of business voice services suitable for commercial customers, by delivering network QoS to endpoints that are not involved in the setup of QoS.

Business Services

Cisco is the industry leader in enterprise network deployments in all the business markets that cable operators may target. Cisco understands the unique needs of these markets, including the applications and services required, thanks to two decades developing and delivering a comprehensive portfolio of products to meet the business needs of small, midsize, and large business customers.

Business customers require multiple services to be delivered over a single connection offered by their service providers. As businesses grow, so do the IT requirements and the need for higher levels of service, easier network management, more robust and flexible connectivity options, and faster deployment times. While many still maintain multiple networks (data, telephony, and videoconferencing, for example) to meet these needs, most are preparing to migrate to a more efficient, cost-effective, converged service model. With Cisco's leadership in high-speed data over cable, Metro Ethernet, and Metro Optical, integrating with a business customer's existing ATM and Frame Relay deployments is no longer an extraordinary challenge. Additionally, Cisco's industry-defining expertise in traffic management and engineering, with techniques such as QoS, class of service (CoS), and Network-Based Address Recognition (NBAR), cable operators are now able to offer a complete suite of services tailored specifically to the needs of their business markets.

With a completely separate line of services focused on the business market, untapped revenue opportunities become available to cable operators. With an increased demand for bandwidth, security, and cost savings, cable operators are poised to effectively compete for business, which has traditionally been owned by ILECs, IXCs, and PTTs around the globe.

A recent research report (Sage Research, 2003) revealed that more than 50 percent of all respondents identified the WAN as the major bottleneck in their existing network infrastructures. The same respondents identified the need for increased bandwidth for their WANs, increased security for site-to-site and site-to-extranet connections, and an overall lower cost in ownership. Reducing monthly recurring expenses is critical to any business cash flow model. By offering these business customers more bandwidth and more security at reduced costs, cable operators can successfully compete against the ILECs, IXCs, and PTTs.

Approximately 82 percent of today's existing business access lines are being delivered with less than 5-Mbps access rates and can be delivered today by cable operators via their HFC systems. Approximately 18 percent of today's existing business access lines are being delivered with greater than 5-Mbps access rates and can be delivered today by cable operators via Metro Ethernet and Metro optical solutions.

As with previous service deliveries, approaching this new market will require cable operators to become educated on several factors, including:

- Addressable vertical business segments
- Addressable services
- Methods of service delivery
- Deployment options

Addressable Vertical Business Segments

Within the numerous vertical business segments that cable operators service are common and unique service requirements that cable operators are already well-positioned to address. Understanding which services are required by each vertical market, and what options a cable operator has to deliver those services, is critical to properly targeting these new markets.

Addressable vertical business segments include:

- Business parks
- Educational
- Financial
- Government
- Hospitality
- Legal
- Manufacturing
- Medical
- Multi-tenant/dwelling units
- Research
- Retail
- Small to large businesses

Addressable Services

In order to understand which services a particular business segment requires, cable operators should be familiar with the types of applications and network traffic the business segment employs for its day-to-day activities. Below is a list of some common applications and network traffic types, followed by the services that cable operators can offer to support them today.

- Database access: Structured Query Language (SQL), Open Database Connectivity (ODBC)
- Name resolution: WINS, Domain Name System (DNS)
- File transfer: FTP, backups, off-site
- Internet/intranet applications
- Legacy: AppleTalk, Internetwork Packet Exchange (IPX), Systems Network Architecture (SNA)/Synchronous Data Link Control (SDLC)
- Network management: Simple Network Management Protocol (SNMP)
- E-mail: Simple Mail Transfer Protocol (SMTP)/POP3
- Security: Biometric, surveillance systems
- Telephony: VoIP, IP Centrex, IP PBX
- Video services: Conferencing, Web-casting

Addressable services include:

- CoS/QoS guarantees
- Disaster recovery
- Distance learning
- E-commerce
- E-mail hosting services
- Internet connectivity: Document Interchange Architecture (DIA)
- Layer 2 topology delivery
- Layer 3 topology delivery
- Online/offline storage
- Remote-access/dial
- Transparent LAN services
- Wireless LAN
- Telephony: IP Centrex, IP PBX
- Videoconferencing, VoD, broadcast
- VPNs: Branch office, IP Security (IPSec), MPLS, 802.1Q, tunneling
- Web hosting services

Methods of Service Delivery

- HFC—Using the QoS capabilities of DOCSIS 1.1 and the advanced upstream capabilities of DOCSIS 2.0 A-TDMA, cable operators can easily deliver multiple tiers of service, with greater economies of scale and increased performance, while introducing new cost savings to the business customer. HFC access can easily be used to deliver access up to 5 Mbps; for access rates greater than 5 Mbps, more emphasis is placed on Ethernet and optical access methods. In the near future, new technologies pioneered at Cisco, such as Wideband DOCSIS (submitted to CableLabs for inclusion in future DOCSIS specifications), will enable up to 50 Mbps over an existing HFC architecture (without plant modifications) and can improve current economies of scale by delivering 10 times the bandwidth at one-tenth of the cost.

Cable operators can use HFC today to deliver services such as high-speed Internet access and transparent LAN services for HFC-to-HFC or HFC-to-Ethernet deployments. With little incremental capital expenditures (CapEx), cable operators can deliver these services to business customers already serviced by their current HFC footprints.

- Ethernet—When greater than 5 Mbps is required, Ethernet is the perfect medium, whether via copper or optical delivery. Scaling access rates from 10 Mbps to 10 Gigabit Ethernet over various copper and fiber topologies, Ethernet has the ability to compete with existing access technologies such as Frame Relay and ATM. With more robust QoS, service flexibility, protocol efficiency, optimization for IP traffic, optimized provisioning solutions, and the lowest-cost CPE and per-Megabit pricing, Ethernet will continue to outpace Frame Relay and ATM deployments for business services. Research predicts (Yankee Group/IDC, 2003) that Ethernet-based access will approach the $1 billion mark in the United States and Western Europe by 2007, while the Asia Pacific market is expected to approach $10 billion in the same time-frame. Ethernet is no longer the technology of choice simply for the desktop network—it has become the technology of choice for WAN, MAN, and campus area network topologies, as well.

- Optical—For low-latency, highly available, resilient, pure SONET/SDH transport solutions, traditional optical carriers such as OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, OC-192/STM-64, and (in the future) OC-768/STM-256 may be used. Resilient packet ring technologies such as RPR/802.17 provide increased bandwidth efficiency by delivering dual, counter-rotating rings achieving a 2x bandwidth increase for OC-12/STM-4, OC-48/STM-16, and OC-192/STM-64 deployments. With sub-50-ms failover times, optical technologies provide business customers with the option of purchasing raw transport, to be provisioned and configured to their liking, with the assurance of a highly available network infrastructure.

Deployment Options

Using the reference architecture in Figure 1-6 and the associated reference table (Table 1-1), locate the products that best meet your business objectives. For details and specifications on these products, please refer the appropriate sections within this guide.

Figure 1-6 Business Reference Architecture

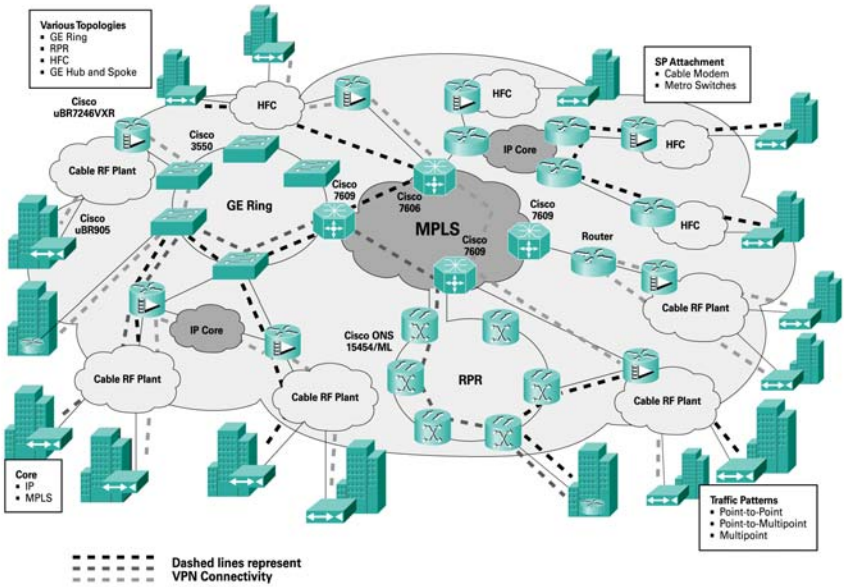


Table 1-1 Associated Business Products

Customer	Access		Distribution			IP Core
CPE	Cable Modem	CMTS	Aggregation	Transport	Edge	
Cisco 1600/1700 Series	Cisco uBR905	Cisco uBR7100 Series	Cisco 6500 Series	Cisco 3550 Series	Cisco 7600 Series	Cisco 7600 Series
Cisco 2600/3600 Series	Linksys® Cable GW	Cisco uBR7246VXR	Cisco 7200 Series	Cisco 3750 Series	Cisco 12000 Series	Cisco 12000 Series
Cisco 7200/7500 Series	Any DOCSIS 1.1 Cable Modem	Cisco uBR10012	Cisco 7600 Series	Cisco ONS 15454	Cisco ONS 15327, 15302, 15305	Cisco 12400 Series
Cisco 3550 Series	N/A		Cisco 10720	N/A		Cisco 12800 Series
Cisco 3750 Series			Cisco ONS 15327			Cisco CRS-1
			Cisco ONS 15454			

Summary

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

With a proven track record in the development of cable standards and advanced technologies, Cisco brings powerful, flexible, end-to-end solutions to the cable industry. Years of IP networking experience and products unequalled by any vendor uniquely qualifies Cisco 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.

CHAPTER 2

Cisco Cable Product Offering

Cisco Cable Offering

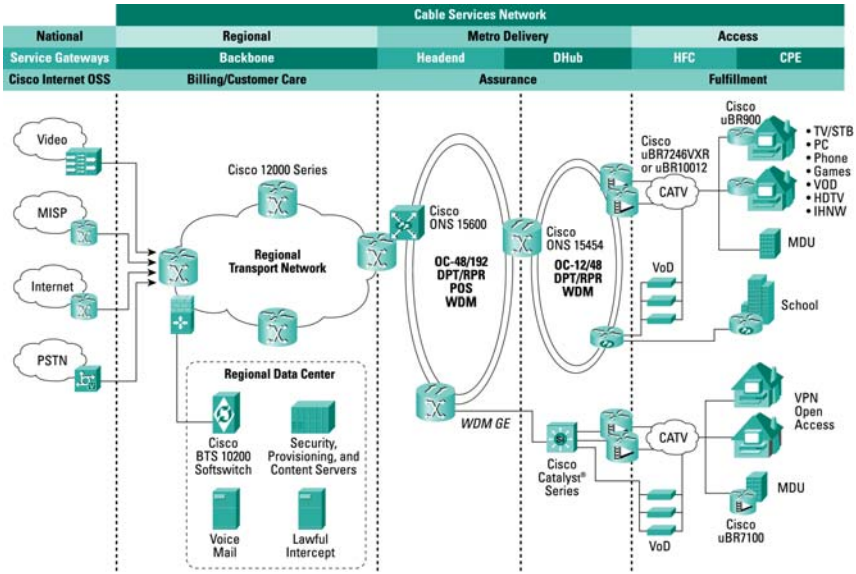
All complex networks are built on essential building blocks that, when organized and constructed in a way that uses the full potential of each individual unit, create an intelligent, efficient, full-functioning system. As cable operators expand their offerings to include data and voice to complement their traditional video services, they require an expert partner to bring new solutions to market quickly.

The opportunity facing cable operators in bringing new services to market and changing the way residential and commercial customers work, think, and play, presents a unique set of challenges. Cisco Systems® is committed to helping cable operators succeed by taking full advantage of its experience building complex networks for every type of user. Cisco® works with cable operators to integrate its broad array of products—the building blocks—into a single, effective, and productive IP-based solution. These intelligent, complex networks are the result of a shared vision between the cable operators and Cisco Systems.

This chapter describes Cisco's products, solutions, and network management systems. Each product plays a unique role in combining data, voice, and video solutions over an IP infrastructure. An all-IP network helps strengthen existing applications while paving the way for the introduction of new ones, creating a competitive edge for cable operators as they expand their services and revenue opportunities.

Cisco delivers the end-to-end products, solutions, and network management systems that give cable operators demonstrable return on investment. Only Cisco has the offering and expertise to build large-scale, multiservice cable IP networks. Using the rich set of Cisco products and solutions, cable operators can easily integrate new technologies and services, increase revenue with effective incremental investment, and offer more services over the same cable IP infrastructure (see Figure 2-1).

Figure 2-1 Large Multiservice Cable IP Network



The Cisco portfolio includes cable modem termination systems (CMTSs); cable customer premises equipment (CPE); IP backbone, edge, data center, and service gateway equipment; and evolutionary multiservice switching systems. Cisco also offers high-speed data (HSD), voice, and video solutions.

Because of the breadth of Cisco products and the company's continual innovations, new products, solutions, and programs may not be included in this guide upon publication. For up-to-date information, refer to:

http://www.cisco.com/en/US/netsol/ns341/ns396/ns289/networking_solutions_packages_list.html

or consult a Cisco representative.

CMTS Systems

Overview

Cisco Systems offers the industry's broadest and most complete line of standards-based CMTSs. The Cisco uBR Family brings intelligence to the cable network. The product line offers tremendous value by:

- Enabling the cost-effective deployment of advanced routing capabilities deep into the cable network

- Taking full advantage of industry-standard routing hardware and Cisco IOS Software to deliver communications-grade, advanced network services and applications

Cisco offers the highest port capacity and performance on the market today for a CMTS, and continues to enhance its communications-grade CMTSs—the Cisco uBR10012 and uBR7246VXR universal broadband routers. For smaller cable deployments or multiunit (MxU) applications, the Cisco uBR7100 Series allows cable operators and businesses to quickly and cost-effectively construct an advanced digital broadband network that supports high-speed Internet access. All Cisco CMTSs offer a broad choice of network interfaces that allow network-layer capabilities to be extended to a wide range of network configurations and environments.

Cisco has shipped more than 400,000 upstream CMTS ports, setting a cable industry milestone and affirming its CMTS leadership. The successful deployment of more than 17,000 CMTS platforms reflects Cisco's unmatched experience and expertise. Cisco products support an array of capabilities that enable delivery of differentiated services with guaranteed service levels to large numbers of subscribers. Cost-effective market-entry and network-scaling alternatives are available. Figure 2-2 shows the different applications of Cisco CMTSs.

Figure 2-2 Cisco Universal Broadband Routers

Cisco uBR 3x10 RF Switch

As part of its high-availability CMTS solution set, the Cisco uBR 3x10 RF Switch works with the Cisco uBR10012 and uBR7246VXR to enable cable operators to achieve PacketCable system availability, minimize service disruptions, and simplify operations. With a Cisco communications-grade CMTS, the Cisco uBR 3x10 RF

Switch delivers unprecedented levels of availability, scalability, and flexibility for deployment of advanced, revenue-generating services. The following table is a list of features for Cisco CMTS products.

CMTS Products 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 fixed-configuration models that include: – Cisco uBR7111 – Cisco uBR7111E – Cisco uBR7114 – Cisco uBR7114E • Integrated upconverter/modulator on the cable interface • Embedded dual 10/100BASE-T Ethernet network interface • Additional network interface with a variety of LAN and WAN options • Supports up to 2000* data customers	3-73
Cisco uBR7246VXR Universal Broadband Router	• Modular, standards-based, communications-grade CMTS and integrated router for high-growth broadband cable deployments • PacketCable 1.1 and 1.0, DOCSIS 1.1 and 1.0 qualified, and Euro-DOCSIS 2.0 qualified communications-grade CMTS • Supports up to 10,000 subscribers* and a large variety of LAN and WAN interface options and processors	3-75
Cisco uBR10012 Universal Broadband Router	• Highest-capacity, communications-grade CMTS and integrated router on the market today • PacketCable 1.1 and 1.0, DOCSIS and Euro-DOCSIS 1.1 and 1.0 qualified communications-grade CMTS • Supports 1,000 to 64,000 subscribers	3-77
Cisco uBR 3x10 RF Switch	• Enables a fully redundant CMTS—Cisco uBR10012 or uBR7246VXR—with N+1 redundancy • Maximizes density with more than 250 MCX-type connector	3-70

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

Video Networking

Overview

The cable industry is experiencing tremendous growth for advanced services, especially video on demand (VoD). The products to enable this new service architecture are being designed to leverage the cost effective advantages of Gigabit Ethernet technology.

Cisco is committed to providing cable operators with next-generation digital video networking products and solutions that will enable them to easily and cost-effectively deliver new, profitable, and scalable digital video services and take advantage of the entire portfolio of Cisco products.

Cisco uMG9800 QAM Product Series

Video Products at a Glance

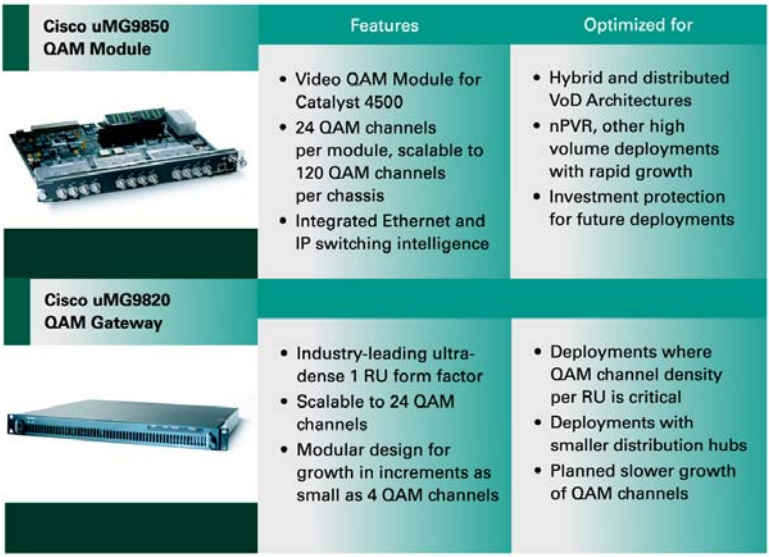
Product	Features	Page
Cisco uMG9850 QAM Module	• Video quadrature amplitude modulation (QAM) module for Cisco Catalyst 4500 Series switches – IP-to-MPEG-2 gateway – QAM modulation and up-conversion – 24 QAM channels per module • Intelligent video edge – Integrated switching, optics and edge QAM – High-availability features – Redundant GE ports, power supplies, supervisor modules • Proven platform – Cisco Catalyst 4500 Series is most widely deployed Gigabit Ethernet switch – Scalability from 1 GE to 10 GE – Foundation for next-generation digital video network	3-80
Cisco uMG9820 QAM Gateway	• Stackable video QAM gateway – IP-to-MPEG-2 gateway – QAM modulation and up-conversion • Ultra-dense 1RU form factor – 24 QAM channels per chassis – High-availability features • Modular chassis – Hot-swappable power supplies, fan tray, QAM cards – Redundant GE ports and power supplies	3-79

The Cisco uMG9800 Series evolves the next-generation digital video network with high-density GE-optimized, QAM products. The Cisco uMG9820 QAM Gateway and the Cisco uMG9850 QAM Module are high-density products that provide product flexibility for customers to incrementally increase QAM densities. Both QAM products extend the life of existing capital investments by enabling operators to purchase product components as service demands increase, thereby reducing the cost to scale. Adding more QAM modules rather than requiring the purchase of entire fixed-configured systems reduces the number of devices to manage and brings

down the overall cost per video stream. High-availability features offer hot-swappable online insertion and removal of QAM modules on active systems. Optimized for Gigabit Ethernet technology, the products accept full line-rate video feeds and introduce networking functionality to environments to legacy architectures that traditionally have been hardwired. The Cisco uMG9800 Series simplifies video architecture design, eases network operations, and offers solutions for next-generation digital video networks.

Figure 2-3 Cisco uMG9800 Series Intelligent QAM Products

- Optimized for Gigabit Ethernet networking
- High-density Edge QAMs for video on demand services
- Modular designs for greater flexibility and higher availability
- Choice of standalone system or high-capacity, versatile, scalable platform



IP Telephony

Overview

With access to a vast number of households and the service potential of IP-based networks, cable operators are in an excellent position to offer IP telephony services to residential and small- and midsize-business customers. Experienced in building both robust IP telephony networks and cable architectures, Cisco has the expertise and products to deliver end-to-end cable VoIP networks.

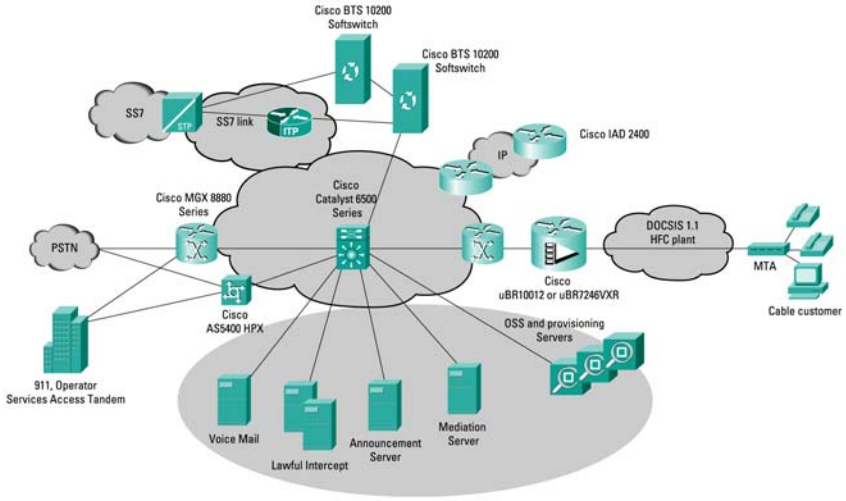
Cable operators have several alternatives for delivering voice over their cable infrastructures. Some cable operators have experimented with solutions employing time-division multiplexing (TDM) switches using GR-303 or V5.2 interfaces. These solutions are complex, expensive, and do not enable service convergence over a common transport technology. The majority of these efforts have given way to alternative approaches employing VoIP.

The approach garnering the most interest, particularly in the United States, is deploying a solution complying with CableLabs PacketCable specifications. The PacketCable initiative addresses how to enable real-time, interactive, voice and multimedia services on top of a DOCSIS 1.1 access infrastructure. Cisco has actively pursued PacketCable qualification of its individual component products, and has developed and tested an end-to-end VoIP solution based on PacketCable specifications. By fully converging the voice and data networks into a single IP-based infrastructure, operators can benefit from lower operating expenses and begin to offer enhanced services based upon the integration of voice and data services such as unified messaging and other multimedia services.

Cisco Broadband Local Integrated Services Solution (BLISS) for Cable

The Cisco solution is based on the PacketCable architecture framework. The solution builds upon the capabilities of DOCSIS networks and is designed to allow the adoption of future PacketCable standards once they are completed. At a high level, the solution provides the resources to make calls between residential and business access gateways, over cable access networks, over an aggregation network, through an IP backbone, to the PSTN over IP links. Figure 2-4 provides a high-level depiction of Cisco's PacketCable voice solution.

Figure 2-4 Cisco Broadband Local Integrated Services Solution (BLISS) for Cable



The IP telephony architecture includes the following components:

- Cisco BTS 10200 Softswitch meeting PacketCable standards
- Cisco uBR7246VXR and Cisco uBR10012 CMTS
- Cisco MGX 8880 Media Gateway with VISM-PR Voice Gateway Line Card
- Cisco AS5400HPX Voice Gateway
- Cisco IP Transfer Point (signaling gateway)
- Consumer endpoints (E-MTAs) from Linksys and Cisco partners
- Partner media servers for CALEA, announcements, voice mail, unified messaging services
- Network management system (NMS)/OSS systems from Cisco and Cisco partners

The Cisco PacketCable Voice solution employs the use of numerous PacketCable-qualified components (Cisco BTS, uBR7246VXR and uBR10012, and partner products) and also support the following PacketCable features:

- Dynamic QoS (DQoS)
- Network-controlled signaling (NCS)
- Event messaging (EM)
- Trunking Gateway Control Protocol (TGCP)
- OSS/provisioning
- PacketCable security
- Electronic surveillance
- Audio server

Subscriber Features

The Cisco' PacketCable Voice solution delivers the following telephony feature set to the residential subscriber:

Subscriber Features
• Call Forwarding Unconditional (CFU) • Call Forwarding On Busy (CFB) • Call Forwarding on No Answer (CFNA) • Call Waiting (CW) • Cancel Call Waiting (CCW) • 3-Way Calling (TWC) • Usage-Sensitive 3-Way Calling (USTWC) • Calling Number Delivery (CND) • Calling Number Delivery Blocking (CNDB) • Calling Name Delivery (CNAM) • Calling Name Delivery Blocking (CNAB) • Calling Identity Delivery and Suppression (CIDS) • Calling Identity Delivery on Call Waiting (CIDCW) • Calling Identity Delivery Blocking (CIDB) • Customer Originated Call Trace (CT) • Multiple Directory Numbers (Teen Service) (MDN)
Class of Service Restrictions
• Casual Call Restrictions (101XXXX) • NANP Call & Toll Restrictions • NANP Black and White Lists (Number Blocking) • Blocking of 900, 976 Calls • Blocking of DA Calls • Blocking of NANP Operator Assistance Calls • Blocking of International Operator Assistance Calls • Number Blocking

Enhanced Services
- Anonymous Call Rejection (ACR)
- Automatic Callback (Repeat Dialing) (AC)
- Automatic Recall (Call Return) (AR)
- Hotline and Warmline Services
- Selective Call Forwarding (SCF)
- Selective Call Rejection (SCR)
- Selective Call Acceptance (SCA)
- Remote Activation of Call Forwarding (RACF)

Numbering Plan and Dial Procedures
- Casual Dialing (Dial Around) (101XXXX + Digits)
- Directory Services (411, 555-1212, 0 + Listing Services)
- Easily Recognizable Codes (500, 700)
- Information Service Calls (900, 976)
- N11 Support (311, 411, 611, 711, 811)
- Operator Services Access (0, 00, 0+, 01+, CAC+0+, CAC+01+)
- Busy Line Verification and Operator Interrupt
- Vertical Service Codes
- Dialing Parity (IntraLATA Toll Pre-subscription)
- Toll-Free Service

Regulatory and Operational Features
- Emergency Services (911)
- Local Number Portability (LNP)
- NPA Split Support
- Test Calls (958, 959)

In addition to this consumer feature set, the solution also delivers services suitable for business customers - including hosted or managed business voice services, PBX interconnection, VPNs, and remote tele-worker based services. The following business telephony services are supported by the solution:

Business Customers Package
- Account Code
- Authorization Code
- Direct Inward Dialing (DID) - PBX
- Direct Outward Dialing (DOD) - PBX
- Direct Inward Dialing (DID) - Business Group
- Direct Outward Dialing (DOD) - Business Group
- Multi-Line Hunt (MLHG)
- Call Hold (CHD)
- Call Park (CPRK)
- Call Retrieve (CPRK-RET)
- Do Not Disturb (DND)
- Directed Call Pickup With Barge-In (DPU)
- Directed Call Pickup Without Barge-In (DPN)
- Distinctive Ringing for Direct Inward Dial (DID)
- Distinctive Ringing/Call Waiting (DRCW)
- Directory Number Hunting (DNH)
- Speed Call (8 and 30)

Many cable operators in the United States have successfully deployed Cisco's PacketCable Voice solution—demonstrating both the technical and economic feasibility of deploying voice services through use of the PacketCable specifications. The Cisco solution has helped expand the portfolio of high-revenue services cable

operators can offer, and positions operators to deliver new services such as unified messaging and rich multimedia services that cannot be delivered over a traditional telephony infrastructures. (See IP Telephony Products at a Glance.)

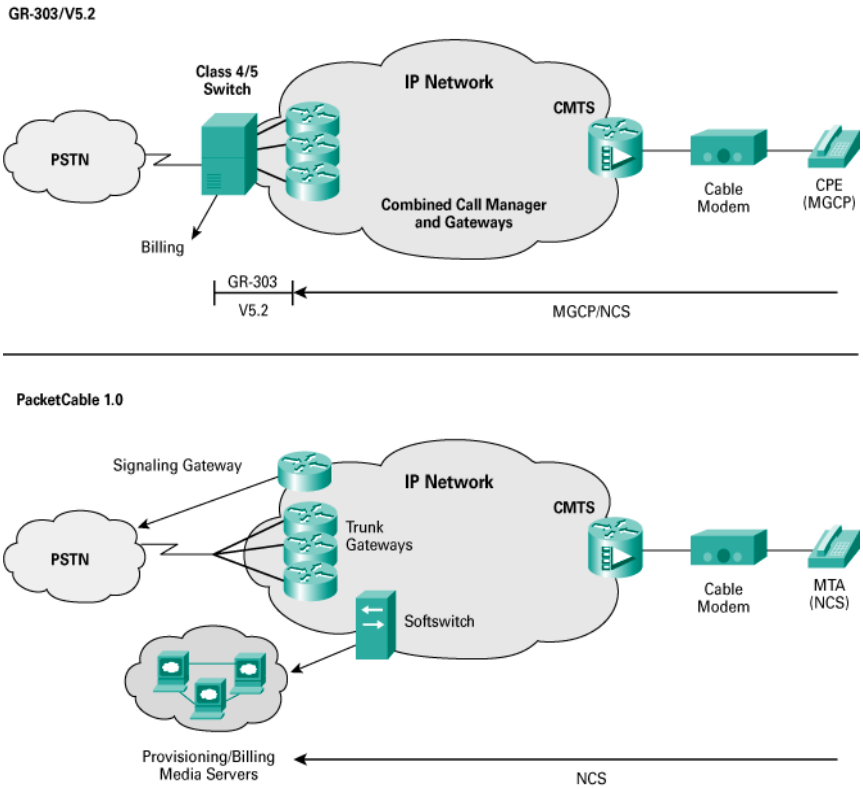
GR-303/V5.2 Cable Overlay Architecture

The GR-303/V5.2 architecture is a hybrid TDM/VoIP approach for providing cable telephony. The solution is ideal for cable operators who already offer telephony services via a traditional TDM Class 5 switch and who have spare capacity and want to take advantage of the operational economics of VoIP. The architecture allows cable operators to gain operational and economic efficiencies by using IP over the HFC plant. The GR-303 standard is required in the United States and Hong Kong; the V5.2 standard is used in most other areas of the world.

The GR-303 interface defines the connection between a Class 5 switch or equivalent, and a remote digital terminal (RDT) which aggregates line-side subscriber connections. GR-303 provides a means to concentrate bandwidth between the switch and the RDT. For example, GR-303 can support up to 2048 line-side subscribers using only 28 T1 circuits between a local digital switch (LDS) and an RDT. In a cable VoIP environment with Network Control Signalling (NCS), the RDT can be tightly integrated with an NCS call agent to create a GR-303 gateway for delivering IP telephony access to cable subscribers with embedded MTAs or stand-alone MTAs.

In the GR-303/V5.2 architecture, the EMTA uses VoIP protocols such as MGCP to communicate with a gateway. This gateway is effectively a translator to the GR-303 or V5.2 protocol, which then routes the calls through the switch and out to the PSTN.

Figure 2-5 GR-303/V 5.2 Cable Overlay Architecture



The figure 2-5 above compares the GR-303/V5.2 and PacketCable architectures. The MGCP/NCS signaling in GR-303/V5.2 is very similar to the PacketCable NCS specifications; the EMTA also uses similar NCS signaling in both architectures. These similarities preserve investments in software-upgradable CPE when migrating to PacketCable, an important factor because CPE costs comprise a significant portion of the capital expenditure associated with deploying voice solutions.

The most obvious difference in the two architectures lies in the Class 5 TDM switch. In the GR-303/V5.2 network, the Class 5 switch controls all call setup and tear-down functionality and features. In the PacketCable network, a CMS replaces the Class 5 switch functionality.

The best strategy for migrating from a GR-303/V5.2 network to a PacketCable network is not a migration strategy at all, but a cap and grow strategy. An operator should max out the capacity of the existing Class 5 switch and use a PacketCable

solution for new markets. The Class 5 switch can continue to serve existing customers or eventually be replaced by trunking gateways. The IP backbone, HFC plant, and CMTS can be redeployed to support the PacketCable network.

While each standard covered above involves a different signaling protocol, the core cable infrastructure essentially remains the same. This makes it possible for cable operators to use one protocol in initial deployments and migrate to another one later.

IP Telephony Products at a Glance

Product	Features	Page
Cisco BTS 10200 Softswitch	• Provides call-control intelligence for establishing, maintaining, routing, and terminating voice calls • Serves as call management server (CMS) and media gateway controller (MGC) in PacketCable architecture • Serves as an interface to enhanced, converged, voice and data services and application platforms such as voice mail and unified messaging	3-17
Cisco IP Transfer Point	• Serves as an interface to enhanced, converged voice and data services, and application platforms such as voice mail and unified messaging – Serves as signaling gateway for PacketCable architecture – Provides support for transporting SS7 over IP (SS7oIP) using Signaling Transport (Sigtran) – High-reliability and high-performance architecture • Industry-standard support: M2PA (SS7 Message Transfer Part Layer 2 – Peer to Peer Adaptation Layer), M3UA (SS7 Message Transfer Part Layer 3 User Adaptation Layer, SUA (Signaling Connection Control Part User Adaptation Layer)	3-54
Cisco MGX 8880 Media Gateway	• Provides high-capacity, carrier-class voice gateway that offer standards-based support for VoIP services • Provides the industry's highest-density and most scalable gateway platform—supporting up to 120,000 redundant DS-0s per 7-foot rack • Provides a full range of high-availability features, including active call preservation, in-service software upgrades, and load sharing – Supports full set of VoIP features, including toll-quality voice, fax, and modem – Multiprotocol support, multi-codec support – Supports up to 8 T1/E1s per module	3-56
Cisco AS5400HPX Universal Gateway	• High-performance, 2RU universal gateway • Universal port technology for data, voice, and 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 asynchronous, ISDN, VoIP, fax, and wireless protocols • SS7 interconnect for voice and dial	3-10

Routers

Overview

Cisco Carrier IP/MPLS solutions are comprised of a suite of carrier-class routing systems based on industry-leading IP/MPLS capabilities, Cisco technology innovation, and 20 years of experience in building the largest global packet networks. The focus on intelligent services, performance, and evolutionary infrastructure enables Cisco to work with operators to create networks that are faster, smarter, and longer-lasting.

At the heart of Cisco Carrier IP/MPLS solutions is the Cisco CRS-1 Carrier Routing System, which provides unparalleled system longevity by scaling to 92 Tbps of system capacity while offering continuous system operation and unmatched service flexibility. The Cisco CRS-1 and the Cisco 12000, 10000 and 7600 Series Routers provide the most comprehensive packet solutions for carrier IP/MPLS networks – including core, peering, aggregation, and edge network functions. Learn more about how these solutions enable you to capture new business revenue, increase market reach, and lower your total cost of network operations.

Cisco Router Port Matrix

	Cisco CRS-1	Cisco 12000 Series	Cisco 10000 Series	Cisco 10720 Router	Cisco 10000 Series
LAN Ports					
10-MB Ethernet				x	x
10-MB Ethernet (fiber)				x	x
100-MB Ethernet					x
100-MB Ethernet (fiber)				x	x
ATM					x
WAN Ports					
Packet over SONET/SDH (POS)	x	x	x	x	x
ATM		x	x		x
Gigabit Ethernet	x	x	x	x	x
Fast Ethernet		x	x		
Channelized		x	x		x
DPT/RPR		x		x	x
Voice Ports					
Digital		x		x	

For More Information

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

Routers at a Glance

Product	Features	Page
Cisco CRS-1 Carrier Routing System	• The Cisco® Carrier Routing System (CRS-1) is the first multi-terabit distributed routing system built to meet and exceed service provider requirements for Next Generation Networks that will combine services including data, voice, and video over highly-available, highly-scalable converged-packet infrastructures. The Cisco CRS-1 is the industry's only carrier routing system that scales up to 92 terabits per second (Tbps).	3-46
Cisco 12000 Series Router	• A portfolio of intelligent routing solutions that scale from 2.5-Gbps/slot to 40-Gbps/slot capacity, enabling carrier-class IP/MPLS core and edge networks. This portfolio uses advanced silicon and software technologies, delivering high standards of routing performance and QoS capabilities, comprehensive high-availability support, ATM and Frame Relay transport, and an integrated core and edge feature set.	3-7
Cisco 10000 Series Router	• Reduces the cost of broadband subscriber services with line-rate delivery of 60,000 sessions tightly coupled with QoS and other service-enabling features. This unique combination improves operational efficiency and increases revenue potential for broadband subscriber services. The Cisco 10000 Series delivers consistent, high-performance features for carriers deploying broadband and leased-line IP/MPLS services. Built upon proven high availability and innovative, adaptive network processing technology, the Cisco 10000 Series delivers the highest total session capacity and robust provisioning capabilities available.	3-3
Cisco 10720 Router	• Metro-edge access routers designed to optimize optical transport with Dynamic Packet Transport (DPT), Cisco's Resilient Packet Ring (RPR) technology. The Cisco 10720 integrates full IP routing and services and delivers intelligent Ethernet subscriber interfaces for simple, scalable, and reliable networks.	3-5
Cisco 7600 Series Router	• Delivers robust, high-performance IP/MPLS features for an unmatched range of service provider edge and enterprise MAN/WAN applications and services. The Cisco 7600 Series is the industry's first router to offer integrated, high-density Ethernet switching, carrier-class IP/MPLS routing, and 10-Gbps interfaces coupled with robust broadband aggregation, allowing providers to deploy revenue-generating services.	3-1

Cisco Router Port Matrix

	Cisco 7600 Series	Cisco 10000 Series	Cisco 10720	Cisco 12000 Series
LAN Ports				
10-MB Ethernet	X		X	
10-MB Ethernet (fiber)	X		X	
100-MB Ethernet	X			
100-MB Ethernet (fiber)	X		X	
ATM	X			
WAN Ports				
Packet over SONET/SDH (POS)	X	X	X	X
ATM	X	X		X
Gigabit Ethernet	X	X	X	X
Fast Ethernet		X		X
Channelized	X	X		X
DPT/RPR	X		X	X
Voice Ports				
Digital	X		X	

Ethernet Switching

Overview

Many cable providers are turning to Ethernet technology to support their service offerings. Today Cisco's intelligent Ethernet equipment delivers advanced security and rich QoS capabilities, enabling service providers to offer customized services. The Cisco's Ethernet Switching portfolio encompasses a variety of technologies and product options and offers optimized network availability and performance.

Ethernet Switching Products at a Glance

Product	Features	Page
Cisco Catalyst 2950 Series Switches with Enhanced Image Software	• Fixed-configuration 10/100 and Gigabit Ethernet switching – High-performance switch – Standalone and stackable switching – Enhanced image software includes intelligent services such as enhanced security, high availability, and advanced QoS – Cisco switch clustering capable; Cisco Cluster Management Suite (CMS) enhanced with configuration wizards – Low price per port – Flexible uplink options: 100BASE-FX, fixed 10/100/1000BASE-T, GBIC-based ports, SFP-based ports (Catalyst 2950 LRE), 100BASE-LX (Catalyst 2955 Switch) – Ruggedized for harsh deployment environments (Catalyst 2955) – Long-Range Ethernet (LRE) support for Ethernet over Category 1/2/3 wiring (Catalyst 2950 LRE)	3-20
Cisco Catalyst 3550 Series Intelligent Ethernet Switch	• A line of stackable, multilayer switches that provide high availability, QoS, and security to enhance the operation of the network. With a range of Fast Ethernet and Gigabit Ethernet configurations, the switches offer a powerful option for enterprise and metro access applications.	3-25
Cisco Catalyst 3750 Series Ethernet Switch	• An innovative product line that improves LAN operating efficiency by combining industry-leading ease of use and the highest resiliency available for stackable switches. This new product series represents the next generation in desktop switches, and features Cisco StackWise™ technology, a 32-Gbps stacking interconnect that allows customers to build a unified, highly resilient switching system—one switch at a time.	3-31
Cisco Catalyst 3750 Metro Series Switches	• The Cisco Catalyst 3750 Metro Series Switch is a new line of premier, customer-located switches that brings greater intelligence for Metro Ethernet access, enabling the delivery of more differentiated Metro Ethernet services. The switches feature hierarchical QoS and traffic shaping, intelligent 802.1Q tunneling, VLAN translation, MPLS and EoMPLS support, and redundant AC or DC power. These switches are ideal for service providers seeking to deliver profitable business services, such as Layer 2, Layer 3, and MPLS VPNs, in several bandwidths and with different SLAs.	3-29
Cisco Catalyst 4500 Series Switches	• The Cisco Catalyst 4503, Catalyst 4506, Catalyst 4507R, and Catalyst 4510R switches are cost-effective, modular chassis ideal for Ethernet aggregation and high-density access: – Up to 384 ports of Ethernet, Fast Ethernet, and Gigabit Ethernet of fiber or copper – Hardware-based Layer 2 and Layer 3-4 switching up to 72 Mbps – Up to 96 Gbps of switching capacity – Network scalability through high-performance IP routing	3-34

Ethernet Switching Products at a Glance (Continued)

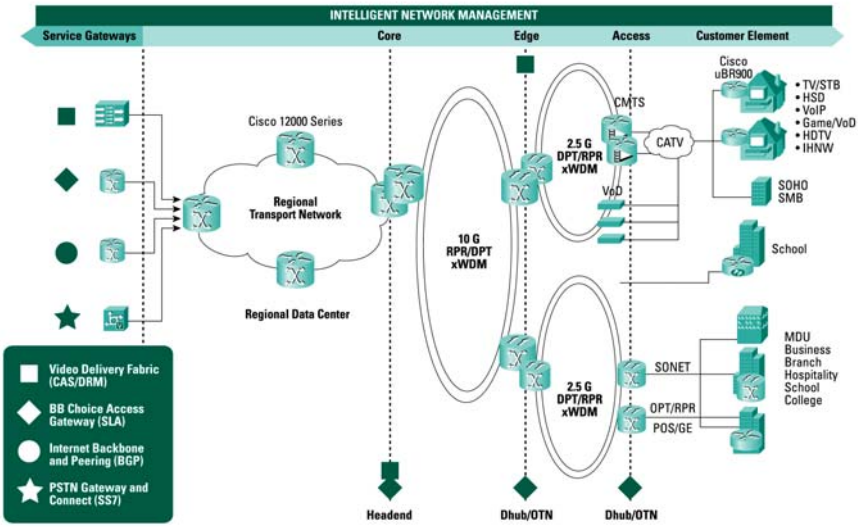
Cisco Catalyst 6500 Series Switches	• Delivers highly available, secure converged network services connecting enterprise networks. The Cisco Catalyst 6500 Series is designed to address increased requirements for gigabit scalability, high availability, rich services, and multilayer switching in backbone, 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 Gigabit density: 142 – LAN/WAN interfaces (to OC-48) – Layer 2-7 switching – Integrated in-line power – Integrated redundant power	3-37
Cisco CWDM GBIC/SFP Solution	• The Cisco CWDM and the DWDM 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 Cisco Catalyst 2950, Catalyst 3550, Catalyst 4500, and Catalyst 6500 series switches, as well as the Cisco 7600 Series and Cisco 12000 Series routers – High optical link budget of 30 dB allows for extended link lengths	3-48

Optical Transport

Overview: Cisco Optical Solutions for Cable Operators

Cisco optical solutions offer a breadth of platforms that enable the convergence of dense wavelength-division multiplexing (DWDM), SONET/SDH, DS-1/DS-3, E1/E3, Ethernet, and IP applications and services from a single network. Convergence allows cable operators to lower capital expenditures (CapEx) and operating expenses (OpEx) while maximizing the efficiency of the existing infrastructure and supporting the introduction of new revenue-generating services. Cisco optical equipment may be strategically deployed to interoperate with Cisco switches and routers to provide a highly scalable, flexible, and cost-effective end-to-end solution for residential and commercial voice, video, and data services (see Figure 2-6).

Figure 2-6 Sample Cable Operator Architecture



Cisco optical platforms enable the convergence of DWDM, SONET/SDH, TDM, Ethernet, and IP applications and services.

- Cisco ONS 15454 Multiservice Provisioning Platform (MSPP) or Multiservice Transport Platform (MSTP) delivers transponder interfaces for multi-rate 2.5-Gbps to 10-Gbps wavelength services, including multi-rate interfaces, Enterprise Systems Connection (ESCON), IBM Fiber Connection (FICON), Fibre Channel, and video
- Cisco ONS 15454 delivers DS-1/DS-3, E1/E3, OC-3/STM-1 to OC-192/STM-64, 10/100/1000-Mbps Ethernet private line and switched Ethernet, and IP functions

- The Cisco ONS 15327 SONET Multiservice provisioning platform (MSPP) interoperates with the Cisco ONS 15454 and provides a smaller, more economical metro access and customer located solution. This platform delivers DS1 to OC-48 functionality as well as 10/100/1000 Mbps Ethernet transport
- The Cisco ONS 15216 FlexLayer solution delivers cost-effective passive DWDM applications for solutions that integrate International Telecommunication Union (ITU) pluggable optics and switches
- Cisco Transport Manager provides a common element management system (EMS) across all Cisco optical platforms that support Layer 1–3 applications and services

Cisco optical platforms reduce costs while maximizing the efficiency of the existing infrastructure and supporting the introduction of new services by:

- Lowering CapEx by delivering multiple services over a single platform
- Reducing OpEx through simplified networking, common management, and lower power consumption; and the deployment of Ethernet services eliminates truck roll upgrades
- Simplifying networking through topology discovery, wavelength provisioning, auto-optical power management, and A-to-Z (any location-to-any location) provisioning
- Protecting investments through highly scalable platforms, common equipment, and in-service upgrades
- Lowering management training costs through a common element management system (EMS)
- Providing a converged architecture to easily add and deploy multiple services and thus enhance customer loyalty and reduce customer turnover

Cisco optical platforms interoperate with Cisco switches and routers to provide a highly scalable, flexible, and cost-effective end-to-end solution for voice, video, and data services.

- Common ITU pluggable optics across optical and switch/router platforms helps ensure interoperability between the transport and data domains
- Common QoS mechanisms provide improved service-level agreements (SLAs) and the ability to deploy new services quickly
- Management costs are decreased through the future integration of management functions between switches and routers and optical platforms

Optical Transport Products at a Glance provides a list of Cisco optical transport products and their features.

Optical Transport Products at a Glance

Product	Features	Page
Cisco ONS 15216 Metropolitan/Regional DWDM 100-GHz FlexLayer	• Service provider-class DWDM solutions • Ultra-flexible filter architecture • In-service upgrade without pre-provisioning channels not required • May be deployed in transmit-only applications	3-58
Cisco ONS 15302 SDH Multiservice Access Platform	• Optical transport platform based on Cisco ONS 15454 technology – Highly cost efficient for delivering multiservice traffic to the metro edge/access in an SDH architecture – Aggregates and switches TDM, Ethernet, and ATM services – Very small footprint (1RU)	3-60
Cisco ONS 15305 SDH Multiservice Access Platform	• Optical transport platform based on Cisco ONS 15454 technology – Highly cost efficient for delivering multiservice traffic to the metro edge/access in an SDH architecture – Aggregates and switches TDM, Ethernet, and ATM services – Very small footprint (1RU)	3-61
Cisco ONS 15327 SONET Multiservice Provisioning Platform (MSPP)	• Optical transport platform based on Cisco ONS 15454 technology – Highly cost-efficient for delivering multiservice traffic to the metro edge/access in an SONET architecture – Aggregates and switches TDM, Ethernet – Very small footprint (3RU)	3-63
Cisco ONS 15454 Multiservice Transport Platform (MSTP)	• Comprehensive suite of transparent wavelength service interfaces, including: – SAN: 1- and 2-Gbps Fibre Channel, ESCON, FICON – Ethernet: Gigabit Ethernet, 10 Gigabit Ethernet (LAN/WAN) – SONET/SDH: OC-3/STM-1 to OC-192/STM-64 – Video: D1, HDTV • Support for multiple network architectures, node configurations, in-service scalability, and protection options, including: – Network architectures – Rings (open and closed, single and multi-hub) and linear point-to-point – Hub, add/drop, line amplifier, and terminal node configurations – 1 to 32 wavelengths (scalable to 64), supporting 1 to 64 channels for networks of 10s to 100s of kilometers – Unprotected, Y-protection, 1+1 – Integrated Cisco Transport Controller super craft management tool for simple, fast, and easy operation	3-64
Cisco ONS 15454 SDH Multiservice Provisioning Platform (MSPP)	• Aggregation and transport of services from E1 to STM-64 • Switched 10/100/1000-Mbps Ethernet for improved bandwidth utilization • Line-rate Gigabit Ethernet transport • Flexible networking support including rings, linear point-to point, linear add/drop, star, and hybrid topologies • Restoration choices: SNCP, 2-fiber and 4-fiber MS SPR, 1+1 APS, unprotected span, and Cisco PPMN • Compact footprint for deployment flexibility (3 can fit in a 2000-mm ETSI rack/cabinet) • Integrated Cisco Transport Controller super craft management tool for simple, fast, and easy operation	3-66

Optical Transport Products at a Glance (Continued)

Cisco ONS 15454 SONET Multiservice Provisioning Platform (MSPP)	• Aggregation and transport of services from DS-1 to OC-192 • Switched 10/100/1000-Mbps Ethernet for improved bandwidth utilization • Line-rate 10-Mbps, 100-Mbps, and Gigabit Ethernet transport • Flexible networking support including rings, linear point-to point, linear add/drop, star, and hybrid topologies • Restoration choices: Unidirectional-path switched ring (UPSR), 2-fiber and 4-fiber Bidirectional line switched ring (BLSR), 1+1 automatic protection switching (APS), unprotected span, and Cisco Path-Protected Mesh Networking (PPMN) • Compact footprint for deployment flexibility (up to 4 shelves per 7-foot bay frame) • Integrated Cisco Transport Controller super craft management tool for simple, fast, and easy operation	3-68
Cisco Transport Manager (CTM)	• Advanced EMS that intelligently manages the entire Cisco ONS Family of products • Supports configuration, fault, performance, and security management functional areas, and serves as a foundation for integration into a larger, overall OSS environment.	3-69

OSS/Network Management

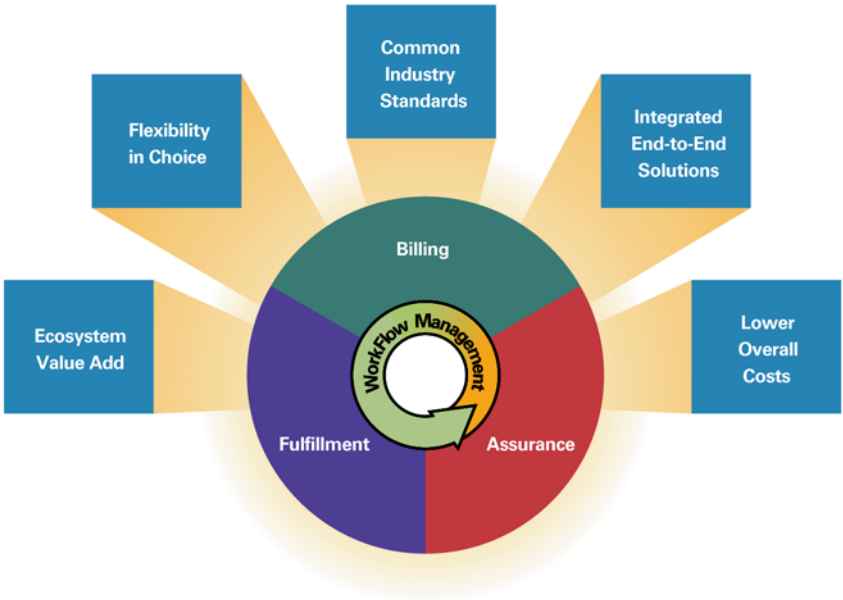
Overview

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

- Service fulfillment
- Service assurance
- Service billing

Traditional 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 Network Management for Cable



Network Management Products at a Glance

Product	Features	Page
Cisco Broadband Access Center for Cable	• Provides a single platform for provisioning multiple technologies and devices such as DOCSIS, PacketCable, and CableHome™ • Scales to support over 35 million subscriber devices • Designed to support PacketCable and ETTx VoIP • Includes a robust provisioning application programming interface (API) for integration with OSS	3-12
Cisco Broadband Configurator	• Provides a user interface to collect information needed to generate DOCSIS or PacketCable configuration files	3-13
Cisco Broadband Troubleshooter	• Provides a diagnostic tool for RF technicians to quickly and easily isolate problems in the cable 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	3-14
Cisco CNS Network Registrar	• Delivers the highest DNS and DHCP performance and scalability in its class • Supports client-class processing for customization of DHCP client configuration • DHCP failover for high availability • Dynamically updates LDAP directory or other data store • Dynamic DNS updates to help ensure up-to-date naming information • Seamlessly integration with Cisco IOS • Supports for VPN deployment • Integrates with vendor's application via extension points and Java API	3-42

Network Management Products at a Glance (Continued)

Product	Features	Page
Cisco Cable Diagnostic Manager	• Provides fault, configuration, and performance management for Cisco CMTS products and DOCSIS and Euro-DOCSIS 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	3-19
Cisco Info Center	• Cisco Info Center is a multi-vendor, multi-technology, business assurance and service-level management solution that provides event collection and correlation, trouble isolation, real-time service and process visibility and business intelligence 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	3-52
Cisco WAN Manager	• Cisco WAN Manager is a high-performance carrier class element management product for the Cisco MGX 8800 Media Gateway products. The Cisco WAN Manager can deploy, configure, and manage multiple Cisco MGX 8800 Media Gateways in one or more points of presence (POPs), providing a single interface for fault, configuration, performance, and security management. It can operate as a standalone element management system or integrated with external applications using its northbound interfaces for highly efficient flow-though operations. • Cisco WAN Manager will support the MGX 8800 Media Gateway with VISM-PR 3.1 until the Media Gateway Manager (MGM) 5.0 is available in September 2004. Once MGM 5.0 is available, it will supersede CWM beginning in September 2004.	3-81
Cisco CNS Configuration Engine	• Automates the configuration of Cisco CPE products during initial deployment and subsequent reconfigurations • Provides an end-to-end, hands-free deployment solution for Cisco CPE products, integrated with Cisco Configuration Express manufacturing ordering solutions	3-40
Cisco IP 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	3-53
CiscoWorks Resource Manager Essentials (RME) **Cisco LAN Management System (LMS) or Routed WAN Manager**	• Provides a Web-based human interface for Cisco AS5400HPX, AS5350, and AS5850 Universal Gateways and Catalyst Switches • Centrally manages and deploys configuration changes and software image updates to multiple devices • Provides Chassis view, diagnostic and configuration views	3-83
Cisco Extensible Provisioning and Operations Manager	• Provides GUI to the Cisco BTS Element Manager System	3-50

Business, Residential and Home Networking CPE

Overview

Cisco offers a broad range of cable CPE for both residential and business subscribers. All of these products follow industry standards and specifications and are certified in most versions of DOCSIS, Euro-DOCSIS, and/or CableHome.

Cisco residential and consumer products are available from the worldwide leader in home networking, Linksys, a division of Cisco Systems. These products offer functionality ranging from the basic cable modem to full-featured residential gateways. They are designed to provide basic connectivity to the broadband connection, but the primary focus at Linksys is to enable the in-home network through wireline and/or wireless connectivity. Most of the Linksys product line is available at retail; however, the residential gateway router products (which are CableHome-certified) are only available through cable operators because they are the primary component to a managed home networking service. Each of the home networking products works as a foundation to enable in-home communications between IP-based devices, including the numerous Linksys consumer electronics products that deliver audio, video, gaming, and monitoring content from the broadband connection to cable subscriber's legacy consumer electronics devices such as the home stereo and home theater.

For business customers, Cisco has a unique understanding of their needs and has been rewarded with market leadership in routing and switching products in this space. There are two approaches to business-class routers for cable operators and Cisco offers both: The first option is a business-class router that has an embedded cable modem. For the purposes of this guide, attention is focused on that product (Cisco uBR905). The second option is a two-box solution in which the cable operator bundles a basic cable modem with a higher-end business class router. The two-box options are quite diverse and, because of their wide variety, will not be discussed in this guide; however, your Cisco account team or partner can work with you to determine the ideal product combination for the business customers that you target. Additionally, Cisco has exceptional joint marketing programs designed to assist cable operators in winning business customers (ask your Cisco sales team about those programs).

Business, Residential, and Home Networking CPE Products At a Glance

Product	Features	Page
Cisco uBR905 Cable Access Router	• Integrated DOCSIS-based cable modem and business-class router with hardware-accelerated IPSec VPN tunneling support • Includes 4 Ethernet and 1 CATV port that supports DOCSIS-based data and VPN services	3-72
Linksys BEFCMU10 Cable Modem with USB and Ethernet Connection	• Built-in 10/100 Ethernet port and USB connection • Stackable with all Linksys routers • CableLabs-certified DOCSIS 2.0 • Free 24-hour technical support, with toll-free U.S. calls • 1-year limited warranty	3-85
Linksys WCG200 Wireless-G Cable Gateway	• Integrated Wireless-G access point (also compatible with all Wireless-B devices) • Security Parameter Index (SPI) [CHECK EXPANSION] firewall with denial-of-service (DoS) attack prevention • Wireless access lists to enhance wireless security • USB port for systems without a wired or wireless network card	3-86

CHAPTER 3

Cisco Cable Products

Overview

This chapter provides an alphanumeric listing of Cisco standards-based cable solutions and network management systems to integrate data, voice, and video services. A complete list of Cisco cable products covered in this section can be found in the Table of Contents under Chapter 3.

Given the breadth of the Cisco product offering and the company's continual innovations, there may be new products, solutions, and programs not included at the time this guide was published. For up-to-date information, please refer to

http://www.cisco.com/en/US/products/index.html

or consult a Cisco representative.

Cisco 7600 Series Router

The Cisco® 7600 Series Router delivers robust, high-performance IP/MPLS features for an unmatched range of service provider edge and enterprise MAN/WAN applications and services. The Cisco 7600 Series offers integrated, high-density Ethernet switching, carrier-class IP/MPLS routing, and 10-Gbps interfaces coupled with robust broadband aggregation, allowing providers to quickly deploy revenue-generating services.

The Cisco 7600 Series combines optical WAN/MAN networking and high-density, high-volume Ethernet aggregation that is ideal for CMTS aggregation or commercial services. The Cisco 7600 Series provides customers the flexibility of four different form factors: Cisco 7603, 7606, 7609, and 7613 Routers. Each router provides the ability to bring DS-0 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

next-generation route processor enables hardware-based delivery of a rich suite of MPLS VPNs, and QoS-enabled IPv4 and IPv6 services, including multipoint Ethernet VPLS services and 10-Gbps IPv6 Ethernet services.

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 7613	• 13 slot (horizontal) chassis • 256 Gbps backplane bandwidth • 30 Mpps forwarding rate • NEBs Compliant
Cisco 7600 Series solutions	• Consolidated WAN/MAN/LAN in one platform • High-volume aggregation of Ethernet/Gigabit Ethernet traffic (server farms) • Multiple high-speed/Optical/SONET/DPT WAN connections range from NxDS-0, T1, T3 to OC-48 with line-rate services • High speed IP QoS and MPLS features, as well as service modules for IPSec, firewall, Cisco Network Analysis Module (NAM), and SSL • MWAM module offers subscriber management services for broadband aggregation capability • High-speed WAN aggregation, Metro aggregation, consolidated POP, Internet data center (IDC), broadband aggregation
Cisco 7600 Series solutions	• Integration with the PSTN and multi-vendor 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 • Fast deployment of advanced service • Rapid development and deployment of lucrative customized services • Reduced operational costs

Primary 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-, 9-, and 13-slot for different space requirements and applications
- Compatible with Cisco Catalyst 6000 Series LAN interfaces, offering 10 Mbps Ethernet to 10 Gbps
- Wide range of WAN/MAN/DPT interfaces—DS-0 to OC-48
- Uses standard Cisco 7200 and 7500 Series port adapters with Enhanced FlexWAN module

- High-performance, high-density OSMs—OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, 4-port Gigabit Ethernet WAN services, channelized OC-12/T3/DS-0, channelized OC-48/T3/DS-0, OC-3 and OC-12 ATM
- "Adaptive" network processing—Parallel Express Forwarding (PXF) IP services processors on each OSM for flexible IP service implementation
- Ethernet over MPLS for LAN/VLAN extensions across MANs
- Layer 2 to Layer 7 service modules and WMAW module for broadband aggregation
- System high availability through redundant router processors for quick service recovery
- Supports the ability to monitor service levels delivered to customers under SLAs

Specifications

Features	Specifications
Modular slots	• 4 chassis sizes provide the option of 3, 6, 9, or 13 modular slots
High-speed backplane capacity	• Cisco Catalyst 6500 Series/Cisco 7600 Series Supervisor Engine 720-3BXL provides a backplane capacity of 720 Gbps
Interfaces	• Wide range of interface types available, including Gigabit Ethernet, SONET and ATM line cards, OSMs, Enhanced FlexWAN modules, LAN Ethernet modules, and services modules supporting firewall, network analysis, content switching, and SSL
Boot memory	• 16 MB boot Flash, 2 MB programmable Flash
DRAM memory	• 256 MB to 512 MB (max)
Optional PCMCIA Flash cards	• 16 MB to 20 MB
Physical dimensions (H x W x D)	• 7603–7 x 17.37 x 21.75 in. (17.78 x 44.12 x 55.25 cm)7606–12.25 x 17.37 x 21.75 in. (31.11 x 44.12 x 55.25 cm)7609–36.7 x 17.2 x 20.7 in. (93.3 x 43.1 x 53.3 cm)7613–33.3 x 17.2 x 18.1 in. (82.3 x 42.5 x 44.7 cm)
Power	• AC or DC power available

For More Information

http://www.cisco.com/go/7600

Cisco 10000 Series Router

The Cisco 10000 Series Router is a carrier-class, industry-leading service provider edge aggregation router that offers a single solution for leased-line, ATM, Frame Relay, Ethernet, and broadband aggregation applications, delivering the highest total session capacity and robust provisioning capabilities. The Cisco 10000 Series dramatically reduces the cost of broadband subscriber services, as well as leased-line services, with line-rate delivery of 60,000 sessions, tightly coupled with QoS and other service-enabling features. The

product provides high-performance IP services, maximum platform scalability, and high availability. This enables carriers worldwide to expand services and enter new markets while reducing network complexity and operational and capital requirements.

When to Use

Use This Product	When You Need
Cisco 10000 Series	• Nonstop, line-rate performance, maximum platform scalability, and high availability for leased-line, ATM, Frame Relay, Ethernet, and broadband aggregation applications • To support thousands of DS-0, DS-1, and E-1 connections in a single system

Primary Features

- High-performance IP services
  - The Cisco 10000 Series helps enable service providers to deploy revenue-generating services without compromising performance.
  - The Cisco 10000 Series utilizes PXF, patented by Cisco. PXF offers customers the ability to turn on multiple IP services, while maintaining line-rate performance. PXF is a programmable network processor technology; customers can add new service functions without upgrading hardware.
  - The Cisco 10000 Series supports many critical edge services, including QoS, MPLS, Multilink Point-to-Point Protocol (MLPPP), broadband aggregation, and access control lists (ACLs).
- Carrier-class high availability
  - Designed from the ground up to support 99.999 percent availability, the Cisco 10000 Series minimizes costly network outages and maximizes customer satisfaction.
  - The Cisco 10000 Series is designed for nonstop performance. Full hardware redundancy, online insertion and removal (OIR), Cisco Route Processor Redundancy Plus (RPR+), Cisco Stateful Switchover (SSO), and Cisco Nonstop Forwarding (NSF) are the key features of the Cisco 10000 Series that provide carrier-class high availability.
  - The Cisco 10000 Series also supports single-router automatic protection switching (APS), as well as multi-router APS.
- Maximum scalability
  - With a 10-slot chassis, the system can support two routing engines and up to eight line cards or 16 half-height line cards. The Cisco 10000 Series takes full advantage of service providers' current investments by enabling network growth while minimizing network complexity.

– The Cisco 10000 Series supports thousands of DS-0, DS-1, and E-1 connections in a single system, enabling service providers to increase their customer base. For broadband applications, the Cisco 10000 Series supports more than 60,000 subscribers in a single system. Because the Cisco 10000 Series supports Frame Relay, ATM, leased line, Ethernet, and broadband aggregation in a single platform, cable operators can provision multiple types of services to end users without having to maintain multiple edge devices.

Specifications

Features	Specifications
Modular slots	8 slots for line cards; 16 slots for half-height line cards2 slots for Cisco Performance Routing Engine (PRE) modules (1 active, 1 redundant)
Hot-swappable	Yes
Backplane capacity	51.2 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)
Weight	130 lb (59.02 kg) fully configured chassis
Rack-mounting	19 to 23 in. (48.3 to 58.4 cm) (front, middle, or back)
Power	• DC input voltage: -48/-60 VDC • AC input voltage: 100-240 VAC, 50/60 Hz, single phase • Maximum power consumption: 1200W
High availability	• Redundant AC or DC supplies • Redundant cooling • Redundant point-to-point backplane connections to each chassis (payload) slot • Online OIR; full hot-swap for all system elements • Automatic protection switching (APS) for all SONET modules • Redundant PREs with advanced failover capabilities • Error checking and correction (ECC) support on all PRE memory • Engineered for 99.999-percent availability

For More Information

http://www.cisco.com/go/10000

Cisco 10720 Router

The Cisco 10700 Series Routers are the only metropolitan (metro) edge access routers designed to optimize optical transport with Dynamic Packet Transport (DPT), Cisco's market-leading Resilient Packet Ring (RPR) technology, to integrate full IP routing and services and to deliver intelligent Ethernet subscriber interfaces for simple, scalable, and reliable networks.

The Cisco 10720 Router enables providers to extend their existing carrier IP/MPLS infrastructure into the metro edge to deliver rich Ethernet and IP services. The Cisco 10720 Router 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. The Cisco 10720 delivers highly programmable, high-end routing features in a compact, 2RU form factor, making it ideal for CMTS aggregation and commercial services.

When to Use

Use This Product	When You Need
Cisco 10720 Router	• To offer high-performance IP services as part of the business strategy • To simplify current networks and implement simple, scalable, reliable features of DPT/RPR technology while maximizing fiber usage
Cisco 12000/10720 Router Manager	• An element management solution to increase service velocity and decrease operational cost

Primary Features

- Redundant AC or DC power supplies; the Cisco 10720 Router is equipped with dual power supplies by default
- Dual OC-48 STM-16 uplink ports in either ring (Spatial Reuse Protocol [SRP]) or point-to-point (packet over SONET [POS])
- Console/auxiliary port to be used together with either 24-port Fast Ethernet or combined 4 Gigabit Ethernet+8 Fast Ethernet for an Ethernet-only router
- 24-ports Fast Ethernet in TX, FX MM or FX SM access module
- Combined 4 Gigabit Ethernet+8 Fast Ethernet TX ports access module
- SRP-specific features—Intelligent protection switching (IPS) with <50 ms restoration time and SRP MIB support
- Multicast support including Protocol Independent Multicast (PIM) sparse mode (SM), PIM dense mode (DM), MBGP
- L2VPN - L2TPv3 or EoMPLS
- QoS—Modular QoS CLI (MQC), CAR, WRED, VTMS traffic shaping, and access lists
- Ethernet features—MDI-MDI-X support, 10/100 speed autonegotiation
- HDX-FDX negotiation and time delay reflectometry (TDR) for 10/100BaseTX
- Hot Standby Routing Protocol (HSRP)/Multiple HSRP (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 MIBs include SNMP, SRP, and SONET
- Network management includes CiscoView, Cisco CNS 2100 Series Intelligent Engine, Cisco VPN Solution Center, and Cisco Element Management System

Specifications

Features	Specifications
Security features	• AAA • RADIUS authentication • TACACS+ • Encrypted passwords
Management	• Cisco IOS Software CLI • TACACS+ and RADIUS • Configuration and administration features including Telnet and Cisco Discovery Protocol • CiscoView, Cisco CNS 2100 Series Intelligent Engine, Cisco VPN Solution Center • Serial (aux) and console ports for local and remote administration • Remote software download using TFTP and RCP • IP over DCC for remote management of the Cisco ONS 15104 OC-48/STM-16 Optical Regenerator, where applicable
Physical Interfaces	• Interface modules: The Cisco 10720 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 multi-mode fiber deployments within MTUs and the FX-SM allows for deployment of the Cisco 10720 Router in a central location covering Ethernet connectivity to buildings for a radius of up to 15 km. • Also available for the lower slot is a combined 4 Gigabit Ethernet+8 Fast Ethernet TX access module. The Gigabit Ethernet ports are Small Form Factor Plug-able (SFP) optics with optical power monitoring capabilities. The Fast Ethernet ports support 10/100 Mbps and the Time Domain Reflectometer (TDR) feature.
Dimensions	3.5 x 17.25 x 18.25 in. (8.9 x 43.81 x 46.35 cm)

For More Information

http://www.cisco.com/go/10720

Cisco 12000 Series Router

The Cisco 12000 Series Routers provide a portfolio of intelligent routing solutions that scale from 2.5 Gbps/slot to 40 Gbps/slot capacity, enabling carrier-class IP/MPLS core and edge networks. This portfolio uses advanced silicon and software technologies, delivering high standards of routing performance and QoS capabilities, comprehensive high-availability support, ATM/Frame Relay transport, and an integrated core and edge feature set. With a fully upgradable modular switch fabric, Cisco 12000 Series Routers help protect investments and reduce total cost of ownership (TCO).

IP/MPLS applications for the Cisco 12000 Series include:

- IP/MPLS core (long-haul and regional)
- Peering
- Optical private line aggregation (OC-48 to DS-0)
- ATM/Frame Relay transport services (over an IP/MPLS core)

When To Use

Use This Product	When You Need
Cisco 12000 Series	• 2.5 to 40 Gbps/slot, from 80 Gpbs to 1.28 Tbps of non-blocking switching capacity • Support for high-density, high-speed interfaces: ATM, DPT/RPR, POS, Gigabit Ethernet/Fast Ethernet ranging from channelized DS-1/E-1 through 2x OC-192c/STM-64c
Latest addition—Cisco 12800 Routers (40G)	• Two 20G platforms to choose from: – 12816bps, 1.28 Tbps, 16 slots, 40 RU – 12810, 800 Gbps, 10 slots, 20 RU • Trunking services (ATM or Frame Relay transport over IP/MPLS core) • Support for industry-leading QoS/CoS features ideal for peering, transit, cable headend POP consolidation, and IDC bandwidth aggregation as well as latency-sensitive applications such as voice and video • Support for IP or MPLS forwarding • Support for hundreds of thousands of routes • Proven carrier-class reliability and availability through enhanced features such as OIR, high availability (RPR+, NSF and SSO), and APS/MPS
Cisco 12400 Routers (10G)	• Four 10G platforms to choose from: – 12416, 320 Gbps, 16 slots, 40 RU – 12410, 200 Gbps, 10 slots, 20 RU – 12406, 120 Gbps, 6 slots, 10 RU – 12404, 80 Gbps, 4 slots, 5 RU • Same full range of IP/MPLS core and edge features as Cisco 12800 • 12410 and 12416 upgradable to 1.28 Tbps systems via an easy, field-installed switch fabric upgrade kit-no need to pull out existing line cards
Cisco 12000 Routers (2.5G)	• 2.5 Gbps/slot, from 30 to 80 Gbps switching capacity • Support for high-density, high-speed interfaces: ATM, DPT/RPR, POS, GbE/FE ranging from channelized DS1/E1 through OC-48c/STM-16c • 3 chassis to choose from: – 12016, 80 Gbps, 16 slots, 40 RU – 12010, 50 Gbps, 10 slots, 20 RU – 12006, 30 Gbps, 6 slots, 10 RU • The Cisco 12016 Router is upgradable to 1.28 Tbps or 320 Gbps or via an easy, field-installed switch fabric upgrade kit; no need to pull out existing line cards • *New:* The 12010 Router is upgradable to 200 Gbps with a simple software key upgrade • *New:* The 12006 Router is upgradable to 120 Gbps with a simple software key upgrade
Cisco 12000/10720 Router Manager	• An element management solution to increase service velocity and decrease operational costs

Primary Features

- Capacity and scale—The Cisco 12816 Router scales the Cisco 12000 Series to an aggregate switching capacity of 1.28 Tbps per rack. With the Cisco Performance Route Processor-2 (PRP-2), the Cisco 12816 Router scales to more than one million prefixes and up to 256,000 multicast groups, providing scalability for numerous IP/MPLS services without requiring facility or power and cooling upgrades.
- Leading-edge software and silicon technology—The Cisco 12816 Router uses the latest in ASIC and serialization/de-serialization (SERDES) technology to provide 1.28 Tbps of switching capacity within the existing 12016 and 12416 chassis with a 1.2 Tbps switch fabric field upgrade, requiring no modifications to existing Cisco 12000 Series chassis or facility power and cooling.
- Proven investment protection—Offering full forward compatibility for all line cards, and the only high-end system with a modular, replaceable switch fabric for field-installed capacity upgrades.
- A fully distributed, non-blocking architecture—With its unique crossbar switch fabric, it provides the lowest possible latency and jitter, allowing service providers to meet the strictest SLAs while scaling existing services, especially delay-sensitive, real-time services such as voice and video.
- Maximizes the value of line-rate edge applications with 10G uplinks—By deploying Cisco 12000 Series IP Services Engine (ISE) line cards in Cisco 12400 Routers, service providers benefit from line cards optimized for edge applications, while removing the bandwidth bottleneck with full 10 Gbps uplinks using cost-effective VSR optics or 10 GbE for cable headend/distribution hub and intra-POP connections.
- Carrier-class redundancy and compliance—Fully compliant with NEBS requirements for a carrier-class network device. The chassis includes redundant route processors, switch fabric cards, clock scheduler cards, blower assemblies, and power supplies for maximum network availability.
- Carrier-class availability—Features such as Cisco Nonstop Forwarding (NSF) and Cisco Stateful Switchover (SSO) eliminate single points of failure, help maintain system performance, and prevent service interruption. With these features, packet forwarding remains uninterrupted before, during, and after a route processor switchover on the Cisco 12000 Series. Coupled with OIR, a faulty route processor can be replaced without affecting operations.

Specifications

Features	Specifications
Switching capacity	• 30 Gbps to 1.28 Tbps
Modular slots	• Available in 4-, 6-, 10- and 16-slot configurations
Capacity per slot	• Available in 2.5, 10, or 40 Gbps. Systems can be upgraded in the field to higher capacity.
Interfaces	• Wide range of line cards available, including OC-3c/STM-1c, OC-12c/STM-4c, OC-48c/STM-16c, OC-192c/STM-64c, POS, Ethernet, Dynamic Packet transport/Resilient Packet Ring (DPT/RPR), Channelized, and ATM
Supported protocols	• IPv4, MPLS, BGPv4, IS-IS, OSPF v. 2.0, EIGRP, RIP v2, IGMP, DVMRP, PIM DM/SM
Management	• CLI, SNMP, Cisco 12000 Manager
Reliability and availability	**System redundancy:** • Fabric card redundancy 4:1 • CSC redundancy 1:1 • Power-supply redundancy (1:1 for DC, AC is load balancing) • Route-processor redundancy 1:1 • Alarm-card redundancy 1:1 • Dual homing with line cards • Support for APS **MTBF:** • CSC = 240,078 hr • SFC = 276,062 hr
Physical dimensions (H x W x D)	• 12006/12406–18.5 x 18.9 x 28 in. (47 x 48 x 71.1 cm) • 12010/12410/12810–37.5 x 19 x 24 in (95.25 x 48.26 x 61 cm) • 12016/12416/12816–72.5 x 18.75 x 24 in. (184.2 x 47.6 x 61 cm)
Power	• AC or DC power available

For More Information

http://www.cisco.com/go/12000

Cisco AS5400HPX Universal Gateway

The Cisco AS5400HPX Universal Gateway offers unparalleled capacity in only two rack units (RUs) and provides data, voice, and fax services on any port at any time. High density, low power consumption (7.2A at 48 VDC per CT3), and universal port digital signal processors (DSPs) make the 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 VPNs, 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 AS5400HPX	• High voice and dial density (16 T1/E1 voice or one CT3 dial) in 2RU form factor • Enhanced performance for processor-intensive voice and fax applications • Low power consumption per port • 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

Primary Features

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

Specifications

Features	Specifications
Voice compression 1	• G.711, G.723.1 (5.3K and 6.3K), G.726, G.729ab, G-Clear, GSM-FR
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 reorder tones, with local country variants • Continuity testing (COT) • Dual tone multifrequency (DTMF), MF
Voice and fax signaling protocols	• H.323v2, H.323v3, H.323v4, SIP, MGCP 1.0, TGCP 1.0, VoiceXML, Real-Time Streaming Protocol (RTSP), ESMTP • T.37 fax store and forward • T.38 real-time fax relay • Fax pass through • Modem pass through • Fax detection • Open Settlements Protocol (OSP) • Media Recording Control Protocol (MRCP) • Text-to-speech (TTS) servers • Automatic speech recognition (ASR) servers

Specifications (Continued)

SS7	• Integrated SLT functionality
Channelized T1	• Robbed-bit signaling; loop start, immediate start, and wink start protocols
Channelized EI	• CAS, E1 R1, E1 R2, leased line, Frame Relay, G.703, G.704

For More Information

http://www.cisco.com/en/US/products/hw/univgate/ps505/products_data_sheets_list.html

Cisco Broadband Access Center for Cable

Cisco Broadband Access Center for Cable is a distributed carrier-class, subscriber device provisioning application that supports automated flow-through provisioning of subscriber services in a fully redundant environment. The product 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 Access Center for Cable	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 Broadband Access Center for Cable addresses this need.

Primary 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
- Distributed device provisioning engines to provide true scalability with a simple way to extend provisioning to additional subscribers and new markets
- Distributed architecture with redundant caching of device information
- 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 1.0, DOCSIS 1.0 and 1.1, 2.0, and CableHome 1.0 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 and loadsharing for redundancy and superior performance

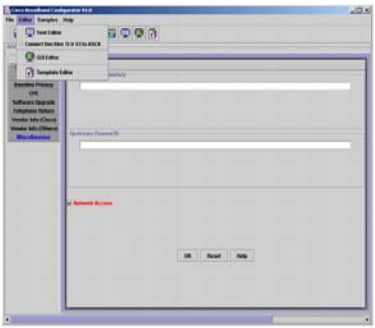
Specifications

Features	Cisco Broadband Access Center for Cable
Operating System	• Sun Solaris 9 operating systems
Minimum Recommended Configuration of the RDU Installation	• SunV210 Class Workstation with 1 GB of RAM and 18 GB of hard drive; This will support up to 500,000 devices
Minimum recommended configuration for DPE (distributed caching engine)	• Sun v210 workstation with 1GB of RAM and 18GB hard drive, this will support 500,000 devices
CNR	• SUN V210 workstation, 1GB RAM and 5 GB hard drive

For More Information

http://www.cisco.com/en/US/products/sw/netmgtsw/ps529/index.html

Cisco Broadband Configurator



Cisco Broadband Configurator is an easy-to-navigate, Java-based application that simplifies the creation and maintenance of configuration files for PacketCable 1.0 media terminal adapters (MTAs) and DOCSIS 1.0 and 1.1 CMs. The product provides a simple-to-use, forms-based approach that leads cable operators through the process of configuring or editing values of a configuration file. These values include RF parameters, vendor information, DOCSIS 1.0 class of service (CoS), DOCSIS 1.1 service flow or Service Flow Identifiers (SFIDs), SNMP values, DOCSIS 1.0 baseline privacy (BPI), DOCSIS 1.1 BPI+, as well as CPE data.

When to Use

Use This Product	When You Need
Cisco Broadband Configurator	• Hide the complexity of creating a DOCSIS or PacketCable configuration file • Easily modify CM or MTA configuration values

Primary Features

- Easy to navigate and build full organization-unique identifier (OID) tree, identifying the unique CM or MTA MAC address in the network, and create or modify a PacketCable 1.0, DOCSIS 1.0, and DOCSIS 1.1 configuration file for the specific CM or MTA
- Color-coded data validation: green check marks next to screens that have been validated and accepted as part of the configuration; red X marks for screens that have been submitted, but found to have missing or unusable input
- Sample templates, text editor, and ability to edit and create multiple configuration files simultaneously
- CLI and capability to open and save files in ASCII and binary formats
- Context-sensitive online help

Specifications

Features	Specifications
Server hardware	• Windows 2000 and Windows XP • Red Hat Linux Version 7.2 • Solaris versions 2.6 and 2.8
Client software	• Netscape and Internet Explorer supported on Windows, Linux, and Solaris • Pentium Class PC or Ultra-5 Solaris workstation
Memory	• 32 MB for PCs • 64 MB for UNIX
Disk space	• 50 MB

For More Information

http://www.cisco.com/en/US/products/sw/netmgtsw/ps819/index.html

Cisco Broadband Troubleshooter

Cisco Broadband Troubleshooter is an easy-to-use tool that gives network administrators and technicians a GUI that streamlines RF problem resolution. The tool dynamically monitors RF characteristics on a per-modem or per-upstream basis, provides a measurement interface for the upstream that looks and feels like a spectrum analyzer, decentralizes RF monitoring and analysis, and automatically sorts and categorizes RF problem conditions. The product provides a fault-analysis

tool that enables network managers and RF technicians to quickly and easily isolate performance, cable plant, and CM problems. On-demand and scheduled diagnostics can be issued.

Cisco Broadband Troubleshooter automates reporting and expert analysis of the measured RF statistics. Diagnostics are available from both customer-account and network-event perspectives. 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 To
Cisco Broadband Troubleshooter	• Improve network reliability • Proactively solve problems before subscribers are affected • Query summary statistics information on persistent CPE problems • Troubleshoot upstream spectrum

Primary Features

- Advanced upstream spectrum management capabilities including trace window, spectrogram, CNR analysis, and data playback for Cisco MC16S line cards and the new Cisco Broadband Processing Engines (BPEs)
- 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

Features	Specifications
Server hardware	**Recommended Linux Server Requirements** • 1 GHz Pentium III workstation • Red Hat Linux 7.2 OS installed • 18 GB of available disk space • 2 GB of memory • CD-ROM drive • SNMP connectivity between the server and the managed CMTSs • Connectivity between the server and the location of subscriber and provisioning information **Recommended Solaris Server Requirements** • Ultra 5 Solaris workstation • Solaris 2.8 OS installed • 18 GB of available disk space • 2 GB of memory • CD-ROM drive • SNMP connectivity between the server and the managed CMTSs • Connectivity between the server and the location of subscriber and provisioning information **Recommended Windows Server Requirements** • 1 GHz Pentium III workstation • Windows NT or Windows 2000 OS installed • 18 GB of available disk space • 2 GB of memory • CD-ROM drive • SNMP connectivity between the server and the managed CMTSs
Server software	• Sun Solaris 2.8 • Windows NT, 2000 (Professional and Server with SP2) • Red Hat Linux 7.1
Client hardware	• PCs or UNIX workstation
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

http://www.cisco.com/en/US/products/sw/netmgtsw/ps530/index.html

Cisco BTS 10200 Softswitch

The Cisco BTS 10200 Softswitch provides call-control intelligence for establishing, maintaining, routing, and terminating voice calls. The Cisco BTS 10200 Softswitch also serves as an interface to enhanced, converged voice-and-data services and application platforms such as voice mail and unified messaging. Harnessing the power of packet networks while seamlessly operating with legacy circuit-switched infrastructures, the Cisco BTS 10200 Softswitch empowers service providers and carriers to gracefully transition to packet-based technology. Implementing the Cisco BTS 10200 Softswitch helps ensure rapid service deployment, carrier-grade reliability, service flexibility, scalability for large deployments, and cost savings through operational efficiencies and investment optimization. Above all, it provides the infrastructure for a packet based network for enhanced network based services that is far beyond the capabilities of a traditional TDM based switching network.

The Cisco BTS 10200 Softswitch incorporates a comprehensive feature set, including call control for local voice services that previously required implementation of large, complex telephone switches. Compared to traditional switching systems, the Cisco BTS 10200 Softswitch gives providers and their subscribers the benefits of significant savings in equipment and transmission costs, space, and the required time to deploy services. The Cisco BTS 10200 is a class-independent SoftSwitch, supporting applications for local and transit services and Signaling System 7 Primary Rate Interface/TDM (SS7 PRI/TDM) offload.

The Cisco BTS 10200 SoftSwitch enables IP interconnections to the PSTN using SS7, Media Gateway Control Protocol (MGCP), Session Initiation Protocol (SIP) and H.323 interfaces. In addition it is also certified by CableLabs as the MGC with TGCP control to the Trunking Gateway. The Cisco BTS 10200 system integrates call-control and services software on an open UNIX platform. All Cisco BTS 10200 SoftSwitch equipment and paths are fully redundant with an architecture that eliminates single-point failures and is designed for 99.999-percent reliability. The unit delivers the call-throughput capabilities required for even very large subscriber bases.

Cisco BTS 10200 is fully certified by CableLabs as the PacketCable 1.0 compliant CMS and MGC.

When to Use

Use This Product	When You Need
Cisco BTS 10200 Softswitch	• Integration with the PSTN and multi-vendor 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

Primary Features

- PacketCable 1.0 certified as the CMS and MGC
- Deployed in live networks to provide VoIP services over DOCSIS 1.1 HFC
- Comprehensive industry-standard protocol support
- Supports many International ISUP variants
- Carrier-grade reliability with Network Equipment Building Systems (NEBS) compliance and redundant platform components Based on ITU CS-2 call model
- Deployed on Sun Solaris based commercial platforms
- Software architecture provides the separation of call control and service logic
- Interoperability with a large number of commercial application servers

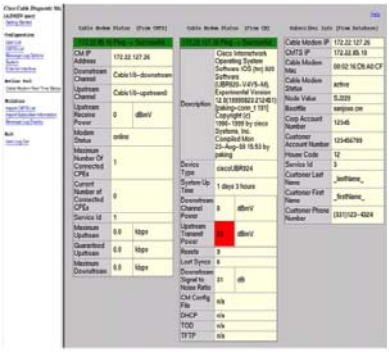
Specifications

Features	Benefit
Comprehensive Industry-standard Protocol Support	• Integration with the PSTN and multi-vendor 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

For More Information

http://www.cisco.com/en/US/products/hw/vcallcon/ps531/index.html

Cisco Cable Diagnostic Manager



Cisco Cable Diagnostic Manager is an automated, Web-based tool that enables customer service representatives (CSRs) to quickly diagnose problems with DOCSIS networks, better handle subscriber inquiries, and improve the routing of trouble tickets. The tool provides first-line CSR troubleshooting and support.

Cisco Cable Diagnostic Manager enables a CSR to quickly identify to a customer reporting a problem with their cable modem service if the problem resides with the CM, STB, HFC cable plant segment, the CMTS, or a provisioning server. The CSR simply enters a customer identifier such as the customer's phone number, assigned IP address, or cable modem MAC address to obtain relevant information.

Cisco Cable Diagnostic Manager uses SNMP, DOCSIS, and Cisco MIBs to retrieve real-time information from the CMTS and CM or STB. The product uses scripts to poll subscriber and provisioning information from appropriate databases. Gathered information is presented using color-coding to help CSRs identify problems at a glance. CSRs can then know how to route problems appropriately.

When to Use

Use This Product	When You Need
Cisco Cable Diagnostic Manager	• An automated tool to simplify CSR support activity

Primary Features

- Color-coded, easy-to-understand CM status and statistics summary, as well as subscriber, neighborhood, and fiber node information
- On-demand interrogation of the CMTS and CM
- Real-time polling of device to extract needed information if subscriber or provisioning databases are not available
- Client-server architecture supporting concurrent, multiuser access by CSRs and field technicians

Specifications

Server	Client
Recommended Linux server requirements • 1 GHz Pentium III workstation • Red Hat Linux 7.2 OS installed • 18 GB available disk space • 2 GB memory • CD-ROM drive • SNMP connectivity between the server and the managed CMTSs • Connectivity between the server and the location of subscriber and provisioning information	**Linux client with:** • 128 MB memory • IP connection to the Cisco Cable Diagnostic • Manager server • Web browser for Linux • Netscape 4.78
Recommended Solaris server requirements • Ultra 5 Solaris workstation • Solaris 2.8 installed • 18 GB available disk space • 2 GB memory • CD-ROM drive • SNMP connectivity between the server and the managed CMTSs • Connectivity between the server and the location of subscriber and provisioning information	**Ultra 4 workstation with:** • 128 MB memory • IP connection to the Cisco Cable Diagnostic • Manager server • Web browser for Solaris
Recommended Windows server requirements • 1 GHz Pentium III workstation • Windows NT or Windows 2000 installed • 18 GB available disk space • 2 GB memory • CD-ROM drive • SNMP connectivity between the server and the managed CMTSs • Connectivity between the server and the location of subscriber and provisioning information	**Pentium II with Windows 98, Windows NT, or Windows 2000 with:** • 128 MB memory • IP connection to the Cisco Cable Diagnostic Manager server • Web browser for Windows (Netscape 4.5 or a later release; Internet Explorer 5.0 or a later release)

For More Information

http://www.cisco.com/en/US/products/sw/netmgtsw/ps3825/index.html

Cisco Catalyst 2950 Series Switches with Enhanced Image Software

The Cisco Catalyst 2950 Series is a line of fixed-configuration, stackable, and standalone switches that provide wire-speed Fast Ethernet and Gigabit Ethernet connectivity. For networks with requirements for additional security, advanced QoS and high availability, the Enhanced Image (EI) Software delivers intelligent services such as rate limiting and security filtering for deployment at the network edge.

For harsh network environments, the new Cisco Catalyst 2955 Series introduces industrial-grade switches that are ideal for market applications where the environmental conditions exceed the specifications of other commercial switching products.

The Cisco Catalyst 2950 Long-Reach Ethernet (LRE) dramatically extends intelligent Ethernet services over existing phone wiring, at distances of up to 5,000 feet.

Embedded in all Cisco Catalyst 2950, 2950 LRE, and 2955 switches is the Cisco Cluster Management Suite (CMS) Software, which allows users to simultaneously configure and troubleshoot multiple Catalyst desktop switches using a standard Web browser.

When to Use

Use This Product	When You Need
Catalyst 2950G Series	• Desktop connectivity or residential Metro Ethernet service networks • Wire-speed performance • Advanced intelligent services • Cisco Cluster Management
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/Date Communications Network (DCN) environments • NEBS compliant • Medium port density
Catalyst 2950G-12-EI	• Desktop connectivity or residential Metro Ethernet service access • Low port density
Catalyst 2950T-24	• Wire speed • Standalone 10/100 switching • 10/100/1000BASE-T uplinks • Advanced intelligent services and clustering capabilities
Catalyst 2950C-24	• Wire speed, standalone 10/100 switching • High-speed uplink flexibility over extended distances with 100BASE-FX connections using MT-RJ connectors • Advanced intelligent services and clustering capabilities
Catalyst 2955 Series	• 10/100 connectivity in harsh environments • Industrial-grade components, compact form factor, convection cooling, relay output signalling • Wire-speed performance • Advanced intelligent services • Cisco Cluster Management
Catalyst 2950 LRE Series	• Cisco LRE connectivity over category 1/2/3 wiring • 24- and 8-port densities with two 10/100/1000BASE-T ports + two SFP ports • Advanced intelligent services • Cisco Cluster Management

Primary Features

For enterprises:

- Wire-speed performance in connecting end stations to the LAN
- Ideal for midsize networks
- Harsh environment support (Cisco Catalyst 2955 Series switches)
- Powerful Gigabit-uplink options—Gigabit interface converter (GBIC)-based or 1000BASE-T
- Superior control through advanced intelligent services—Advanced QoS based on Layer 2 through Layer 4 parameters
- Superior security features based on Layer 2 through Layer 4 access control parameters (ACPs)
- Sophisticated multicast management using IGMP snooping
- Scalability and high-availability features
- Cisco CMS offers superior manageability, ease of use, ease of deployment, and enhanced configuration wizards
- Enhanced Cisco IOS Software Services
- Support for Cisco RPS 300 Redundant Power System
- 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 ACPs
- Enables service management through Cisco CNS 2100 Series Intelligence Engine support and SNMP

Specifications

Features	Catalyst 2950G-48-EI	Catalyst 2950G-24-EI	Catalyst 2950G-24-EI-DC
Fixed ports	• 48-port 10/100 auto-sensing and two GBIC-based Gigabit Ethernet ports	• 24-port 10/100 auto-sensing and two GBIC ports	• 24-port 10/100 auto-sensing and two GBIC ports and DC power
Modular slots	• None	• None	• None
Backplane	• 13.6 Gbps	• 13.6 Gbps	• 13.6 Gbps
Forwarding rate	• 10.1 Mpps	• 6.6 Mpps	• 6.6 Mpps
Stackable	• Yes	• Yes	• Yes
Full-duplex capabilities	• All ports	• All ports	• All ports
VLAN maximum	• 64-port-based VLANS	• 64-port-based VLANS	• 64-port-based VLANS

Specifications (Continued)

Features	Catalyst 2950G-48-EI	Catalyst 2950G-24-EI	Catalyst 2950G-24-EI-DC
FEC	• Yes	• Yes	• Yes
802.1Q	• Yes	• Yes	• Yes
Multicast	• 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
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
Flash memory	• 8 MB	• 8 MB	• 8 MB
CPU DRAM	• 64 MB	• 64 MB	• 64 MB
Embedded RMON	• 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. [Metrics?]	• 1.72 x 17.5 x 9.52 in.	• 1.72 x 17.5 x 9.52 in.

Specifications

Features	Catalyst 2950G-12-EI	Catalyst 2950T-24	Catalyst 2950C-24
Fixed ports	• 12-port 10/100 auto-sensing and two GBIC ports	• 26-port (24 10/100 auto-sensing and two ports 1000BASE-T	• 26-port (24 10/100 auto-sensing and two ports100BaseFX)
Modular slots	• None	• None	• None
Backplane	• 13.6 Gbps	• 8.8 Gbps	• 8.8 Gbps
Forwarding rate	• 4.8 Mpps	• 6.6 Mpps	• 3.9 Mpps
Stackable	• Yes	• No	• No
Full-duplex capabilities	• All ports	• All ports	• All ports
VLAN maximum	• 64-port-based VLANS	• 64-port-based VLANS	• 64-port-based VLANS
FEC	• Yes	• Yes	• Yes
802.1Q	• Yes	• Yes	• Yes
Multicast	• 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
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
Flash memory	• 8 MB	• 8 MB	• 8 MB
CPU DRAM	• 64 MB	• 64 MB	• 64 MB
Embedded RMON	• History, events, alarms, statistics	• History, events, alarms, statistics	• History, events, alarms, statistics
Dimensions (H x W x D)	• 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.

Specifications

Features	Catalyst 2955 Series	Catalyst 2950 LRE Series
Fixed ports	• 12-port 10/100 autosensing and fixed (10/100/1000BASE-T) & fiber (LX, SX) uplink options	• 24 and 8 LRE port models with 2 10/100/1000BASE-T ports + 2 SFP ports
Modular slots	• None	• None
Backplane	• 13.6 Gbps	• 8.8 Gbps
Forwarding rate	• 4.8 Mpps	• 3.5 Mpps (24-port model), 3.2 Mpps (8-port model)
Stackable	• No	• No
Full-duplex capabilities	• All ports	• All ports
VLAN maximum	• 64-port-based VLANS	• 64-port-based VLANS
FEC	• Yes	• Yes
802.1Q	• Yes	• Yes
Multicast	• IGMP snooping	• IGMP snooping
QoS	• 802.1P, four egress queues, WRR	• 802.1P, four 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
Flash memory	• 8 MB	• 8 MB
CPU DRAM	• 32 MB	• 32 MB
Embedded RMON	• History, events, alarms, statistics	• History, events, alarms, statistics
Dimensions (H x W x D)	• 3.78 x 8.07 x 5.03 in.	• 1.72 x 17.5 x 9.7 in.

For More Information

http://www.cisco.com/go/catalyst2950

Cisco Catalyst 3550 Series Intelligent Ethernet Switch

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

When to Use

Use This Product	When You Need
Catalyst 3550 Series	• Enterprise-class intelligent services such as access control lists (ACLs), advanced QoS, and rate limiting • Basic or advance IP routing • Cisco Cluster Management
Catalyst 3550-48-EMI (Enhanced Multilayer Software Image)	• Advanced 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
Catalyst 3550-48-SMI (Standard Multilayer Software Image)	• Basic IP routing, upgradable to advanced IP routing • High port density • Powerful access layer switch for a medium enterprise wiring closet or as an access switch for Metro Ethernet service networks
Catalyst 3550-24-EMI (Enhanced Multilayer Software Image)	• Advanced 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
Catalyst 3550-24-SMI (Standard Multilayer Software Image)	• Basic IP routing, upgradable to advanced IP routing • Medium port density • Powerful access layer switch for a medium enterprise wiring closet or as an access switch for Metro Ethernet service networks
Catalyst 3550-24-DC -SMI (Standard Multilayer Software Image)	• Basic IP routing, upgradable to advanced IP routing • 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
Catalyst 3550-24PWR-EMI (Enhanced Multilayer Software Image)	• Advanced IP routing • Medium port density • Integrated in-line power • Powerful access layer switch for a medium enterprise wiring closet with routed uplinks or as an access switch for Metro Ethernet service networks
Catalyst 3550-24PWR-SMI (Standard Multilayer Software Image)	• Basic IP routing, upgradable to advanced IP routing • Medium port density • Integrated In-line Power • Powerful access layer switch for a medium enterprise wiring closet or as an access switch for Metro Ethernet service networks
Catalyst 3550-24-FX -SMI (Standard Multilayer Software Image)	• Basic IP routing, upgradable to advanced IP routing • 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

When to Use (Continued)

Use This Product	When You Need
Catalyst 3550-12G	• Advanced IP routing • Gigabit Ethernet aggregation using fiber • Stack aggregation, server aggregation, or as a backbone switch in a midsize network, or as an aggregation switch in Metro Ethernet service networks
Catalyst 3550-12T	• Advanced IP routing • Gigabit Ethernet aggregation using Category 5 copper cabling • Stack aggregation, server aggregation, or as a backbone switch in a midsize network, or as a aggregation switch in Metro Ethernet service networks

Primary Features

For enterprises:

- Network control and bandwidth optimization through advanced QoS, granular rate limiting, ACLs, and multicast services
- Network security through a wide range of authentication methods, data encryption technologies, and access restructuring features based on users, ports, and MAC addresses
- Network scalability through advanced routing protocols such as EIGRP, OSPF, BGP, and PCM (requires Enhanced Multilayer Software Image [EMI])
- Intelligent adaptability through Cisco Identity-Based Network Management Services (IBNS) offering greater flexibility and mobility to specified users
- Lower TCO for IP telephony and Wireless LAN deployments through integrated in-line power (Cisco Catalyst 3550 24 PWR only)
- Easy switch configuration and deployment for advanced services through the Cisco CMS Software
- Stackable up to nine switches with the GigaStack® GBIC

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 resiliency enhancements and ACLs
- Enables service management through Cisco CNS 2100 Series Intelligence Engine support and SNMP

Specifications

Features	Catalyst 3550-48	Catalyst 3550-24	Catalyst 3550-24 PWR	Catalyst 3550-24-DC
Fixed ports	• 48 10/100 ports 2 GBIC-based Gigabit Ethernet ports	• 24 10/100 ports 2 GBIC-based Gigabit Ethernet ports	• 24 10/100 ports 2 GBIC-based Gigabit Ethernet ports	• 24 10/100 ports 2 GBIC-based Gigabit Ethernet ports
Switching fabric	• 13.6 Gbps	• 8.8 Gbps	• 8.8 Gbps	• 8.8 Gbps
Full duplex	• All Ports	• All Ports	• All Ports	• All Ports
VLAN maximum	• 4000	• 4000	• 4000	• 4000
FEC/GEC	• Yes	• Yes	• Yes	• Yes
GBICs	• GigaStack, 1000BASE-T, SX, LX/LH, ZX, CWDM	• GigaStack, 1000BASE-T, SX, LX/LH, ZX, CWDM	• GigaStack, 1000BASE-T, SX, LX/LH, ZX, CWDM	• GigaStack, 1000BASE-T, SX, LX/LH, ZX, CWDM
802.1Q and ISL	• Yes	• Yes	• Yes	• Yes
In-line power	• No	• Yes	• Yes	• No
High-performance IP routing	• Basic IP routing (static, RIPv1, RIPv2), Advanced IP routing (OSPF, IGRP, EIGRP, BGPv4)-requires EMI	• Basic IP routing (static, RIPv1, RIPv2), Advanced IP routing (OSPF, IGRP, EIGRP, BGPv4)-requires EMI	• Basic IP routing (static, RIPv1, RIPv2), Advanced IP routing (OSPF, IGRP, EIGRP, BGPv4)-requires EMI	• Basic IP routing (static, RIPv1, RIPv2), Advanced IP routing (OSPF, IGRP, EIGRP, BGPv4)-requires EMI
802.1Q Tunneling	• Yes	• Yes	• Yes	• Yes
QoS	• 802.1p, DSCP, four egress queues, WRR, strict priority queuing, WRED	• 802.1p, DSCP, four egress queues, WRR, strict priority queuing, WRED	• 802.1p, DSCP, four egress queues, WRR, strict priority queuing, WRED	• 802.1p, DSCP, four egress queues, WRR, strict priority queuing, WRED
Multicast	• IGMP snooping, PIM (requires EMI), DVMRP tunneling (requires EMI), CGMP server (requires EMI)	• IGMP snooping, PIM (requires EMI), DVMRP tunneling (requires EMI), CGMP server (requires EMI)	• IGMP snooping, PIM (requires EMI), DVMRP tunneling (requires EMI), CGMP server (requires EMI)	• IGMP snooping, PIM (requires EMI), DVMRP tunneling (requires EMI), CGMP server (requires EMI)
Management capabilities	• SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, Cisco CNS 2100 support	• SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, Cisco CNS 2100 support	• SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, Cisco CNS 2100 support	• SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, Cisco CNS 2100 support
Flash memory	• 16 MB	• 16 MB	• 16 MB	• 16 MB
CPU DRAM	• 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)	• 1.75 x 17.5 x 16.3 in	• 1.75 x 17.5 x 14.4 in	• 1.75 x 17.5 x 17.4 in	• 1.75 x 17.5 x 14.4 in
DC power	• No	• No	• No	• Yes

Specifications

Features	Catalyst 3550-12G	Catalyst 3550-12T	Catalyst 3550-24-FX
Fixed ports	• 10 GBIC-based Gigabit Ethernet ports • Two 10/100/1000 ports	• 10 10/100/1000 ports • Two GBIC-based Gigabit Ethernet ports	• 24 10/100 FX ports • Two GBC-based Gigabit Ethernet ports
Switching fabric	• 24 Gbps	• 24 Gbps	• 8.8 Gbps
Full duplex	• All ports	• All ports	• All ports
VLAN maximum	• 4000	• 4000	• 4000
FEC/GEC	• Yes	• Yes	• Yes
GBICs	• GigaStack, 1000BASE-T, SX, LX/LH, ZX, CWDM	• GigaStack, 1000BASE-T, SX, LX/LH, ZX, CWDM	• GigaStack, 1000BASE-T, SX, LX/LH, ZX, CWDM
802.1Q and ISL	• Yes	• Yes	• Yes
In-Line power	• No	• No	• No
High-performance IP routing	• Static, RIPv1, RIPv2, OSPF, IGRP, EIGRP, BGPv4	• Static, RIPv1, RIPv2, OSPF, IGRP, EIGRP, BGPv4	• Same as Catalyst 3550-24
802.1Q tunnelling	• Yes	• Yes	• Yes
QoS	• 802.1p, DSCP, four egress queues, WRR, strict priority queuing, WRED	• 802.1p, DSCP, four egress queues, WRR, strict priority queuing, WRED	• 802.1p, DSCP, four egress queues, WRR, strict priority queuing, WRED
Multicast	• IGMP snooping, PIM, DVMRP tunneling, CGMP server	• IGMP snooping, PIM, DVMRP tunneling, CGMP server	• IBMP snooping, PIM (requires EMI),DVMRP (requires EMI), CGMP server (requires EMI)
Management capabilities	• SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, IE2100 support	• SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, IE2100 support	• SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, IE2100 support
Flash memory	• 16 MB	• 16 MB	• 16 MB
CPU DRAM	• 64 MB	• 64 MB	• 64 MB
Embedded RMON	• History, events, alarms, statistics	• History, events, alarms, statistics	• History, events, alarms, statistics
Dimensions (H x W x D)	• 2.63 x 17.5 x 15.95 in	• 2.63 x 17.5 x 15.9 in.	• 1.75 x 17.5 x 16.3in
DC power	• No	• No	• No

For More Information

http://www.cisco.com/go/catalyst3550

Cisco Catalyst 3750 Metro Series Switches

Cisco Catalyst 3750 Metro Series switches are a line of premier, customer-located switches that bring greater intelligence for Metro Ethernet access, enabling the delivery of more differentiated Metro Ethernet services. The switches feature hierarchical QoS and traffic shaping, intelligent 802.1Q tunneling, VLAN translation, MPLS and EoMPLS support, and redundant AC or DC power. They are ideal for service providers seeking to deliver profitable business services, such as Layer 2, Layer 3, and MPLS VPNs, in several bandwidths and with different SLAs. With flexible software options, the Cisco Catalyst 3750 Metro Series offers service providers a cost-effective path for meeting current and future service requirements from enterprises and commercial businesses.

When to Use

The Cisco Catalyst 3750 Metro Series Switch is ideal for service provider Metro Ethernet access deployments, allowing providers to offer Layer 2 or Layer 3 VPN services to their enterprise or commercial customers.

Use This Product	When You Need
Layer 2 VPN using enhanced 802.1Q tunneling	• 802.1Q tunneling enables service providers to create a Layer 2 VPN service, often called Layer 2 transparent LAN services (TLS) or Ethernet LAN services, by using a VLAN-in-VLAN hierarchy and tagging the tagged packets.
Layer 2 VPN using VLAN translation	• VLAN translation is also used for Layer 2 VPN service. Instead of double-tagging the packet, the VLAN translation feature simply translates a customer VLAN ID to a service provider VLAN ID as the packet enters the service provider network, and vice versa as the packet exits the service provider network.
Layer 2 VPN using EoMPLS	• EoMPLS is a tunneling mechanism that allows service providers to tunnel customer Layer 2 traffic through a Layer 3 MPLS network.
Layer 3 VPN using multi-VRF customer edge	• On the Cisco Catalyst 3750 Metro Series, multi-VRF CE (virtual routing forwarding customer edge), also called VRF-lite, enables the creation of a Layer 3 VPN service by keeping separate routing tables for each VPN customer without needing to run MPLS on the switch.
Layer 3 VPN Using MPLS VPN	• The Cisco Catalyst 3570 Metro Series supports MPLS VPNs, allowing service providers to build true end-to-end MPLS networks and to offer MPLS VPN services to their enterprise and commercial customers.

Primary Features

- New built-in Gigabit Ethernet and enhanced services ports—Cisco Catalyst 3750 Metro Series switches enhanced services ports support enhanced features such as hierarchical QoS and traffic shaping, intelligent 802.1Q tunneling, VLAN translation, MPLS, and EoMPLS. These ports can serve as uplinks to metro aggregation points, including the Cisco Catalyst 4500 and Catalyst 6500 series, and the Cisco 7600 Series, and they provide greater intelligence at the network edge.

- Flexible software licences—Cisco Catalyst 3750 Metro Series switches are shipped with the Metro IP Base Software license. The license includes Layer 2 switching and basic routing such as static routing, RIP, intelligent 802.1Q tunneling, VLAN translation, and hierarchical queuing framework. The following optional software feature licenses are available on the Cisco Catalyst 3750 Metro Series:
- Cisco Catalyst 3750 Metro Advanced IP Feature license (MPLS, EoMPLS, MPLS VPN, and BGP; also includes the Cisco Catalyst 3750 Metro IP Services license and IP Base license)
- Cisco Catalyst 3750 Metro IP Services Feature license (EIGRP, OSPF, IS-IS, policy-based routing [PBR], multi-VRF CE, HSRP, PIM, and DVMRP tunneling; also includes IP Base license.)
- Upgrade license from Cisco Catalyst 3750 Metro IP Services to Advanced IP Services (requires IP Service feature license)
- Greater service breadth and network flexibility—Cisco Catalyst 3750 Metro Series switches offer additional software feature licenses that provide a cost-effective "pay-as-you-grow" service upgrade path. With the software feature license options on the Cisco Catalyst 3750 Metro Series, service providers are able to maximize the ROI for their metro Ethernet networks by adding features as their profitability increases and service offerings expand.

Specifications

Features	Catalyst 3750 Metro Series Switch
Fixed ports	• 24 10/100 ports 4 SPF uplinks
Switching fabric	• 32 Gbps
Full duplex	• All ports
802.1Q and ISL	• Yes
In-line power	• No
High-performance IP routing	• Basic IP routing (static, RIPv1, RIPv2), advanced IP routing (OSPF, IGRP, EIGRP, BGPv4)-requires EMI
802.1Q tunneling	• Yes
QoS	• 802.1p, DSCP, 4 egress queues, S/SRR, strict priority queuing, weighted tail drop
Multicast	• IGMP snooping, PIM (requires EMI), DVMRP tunneling (requires EMI), CGMP server (requires EMI)
Management capabilities	• SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, Cisco CNS 2100 support
Flash memory	• 16 MB
CPU DRAM	• 128 MB
Embedded RMON	• History, events, alarms, statistics

Specifications (Continued)

Features	Catalyst 3750 Metro Series Switch
Dimensions (H x W x D)	• 21.73 x 17.5 x 14.68 in.
DC power	• 36 to 72 VDC @ 3A

For More Information

http://www.cisco.com/go/catalyst3750metro

Cisco Catalyst 3750 Series Ethernet Switch

The new Cisco Catalyst 3750 Series switches are an innovative product line that improves LAN operating efficiency by combining industry-leading ease of use and the highest resiliency available for stackable switches. This new product series represents the next generation in desktop switches, and features Cisco StackWise technology, a 32-Gbps stacking interconnect that allows customers to build a unified, highly resilient switching system—one switch at a time.

When to Use

Use This Product	When You Need
Catalyst 3750 Series	• Highest levels of resilient stacking • Intelligent Ethernet services • Gigabit Ethernet optimized
Catalyst 3750G-24TS-E (Enhanced Multilayer Software Image)	• Advanced IP routing • 24 ports of 10/100/100 with four SFP uplinks • Powerful access layer switch for a medium enterprise wiring closet with routed uplinks or as an aggregator for servers in a space-constrained rack
Catalyst 3750G-24TS-S (Standard Multilayer Software Image)	• Basic IP routing, upgradable to advanced IP routing • 24 ports of 10/100/100 with four SFP uplinks • Powerful access layer switch for a medium enterprise wiring closet or as an aggregator for servers in a space-constrained rack
Catalyst 3750G-24T-E (Enhanced Multilayer Software Image)	• Advanced IP routing • 24 ports of 10/100/100 • Powerful access layer switch for a medium enterprise wiring closet with routed uplinks or as an aggregator for servers in a space-constrained rack
Catalyst 3750G-24T-S (Standard Multilayer Software Image)	• Basic IP routing, upgradable to advanced IP routing • 24 ports of 10/100/100 • Powerful access layer switch for a medium enterprise wiring closet or as an aggregator for servers in a space-constrained rack
Catalyst 3750-48TS -E (Enhanced Multilayer Software Image)	• Advanced IP routing • 48 ports of 10/100 with four SPF uplinks • Powerful DC powered access layer switch for a medium enterprise wiring closet
Catalyst 3750-48TS-S (Standard Multilayer Software Image)	• Basic IP routing, upgradable to advanced IP routing • Medium port density • 48 ports of 10/100 with 4 SPF uplinks • Powerful access layer switch for a medium enterprise wiring closet

When to Use (Continued)

Use This Product	When You Need
Catalyst 3750-24TS-E (Enhanced Multilayer Software Image)	• Advanced IP routing • 24 ports of 10/100 with two SFP uplinks • Powerful access layer switch for a medium enterprise wiring closet
Catalyst 3750-24-TS -S (Standard Multilayer Software Image)	• Basic IP routing, upgradable to advanced IP routing • 24 ports of 10/100 with 2 SFP uplinks • 100 FX multimode fiber access • Access layer switch for a medium enterprise wiring closet

Primary Features

For enterprises:

- Ease of use—Immediately active configuration; a self-managing and self-configuring working stack. When switches are added or removed, the master switch automatically updates all the routing tables to reflect changes. Upgrades are applied universally and simultaneously to all members of the stack.
- Scalability—Fast Ethernet to Gigabit Ethernet. The Cisco Catalyst 3750 Series stacks up to nine switches as a single logical unit for a total of 468 Ethernet 10/100 ports or 252 Ethernet 10/100/1000 ports. Individual 10/100 and 10/100/1000 units may be joined in any combination to evolve with network needs.
- Mix-and-match switch types—Purchase equipment as you expand your network; stacks can be created with any combination of Cisco Catalyst 3750 switches. Customers who need a mixture of 10/100 and 10/100/1000 ports can incrementally develop the access environment, paying only for what they need.
- Availability—Nonstop performance at Layer 2 and Layer 3. The Cisco Catalyst 3750 Series increases availability for stackable switches. Each switch can operate both as master controller and forwarding processor. Each switch in the stack can serve as a master, creating an N+1 availability scheme for network control. In the unlikely event of a single unit failure, all other units continue to forward traffic and maintain operation.
- Smart multicast—A new level of efficiency for converged networks. With Cisco StackWise technology, the Cisco Catalyst 3750 Series offers greater efficiency for multicast applications such as video. Each data packet is put on to the backplane only once, which provides more effective support for more data streams.
- Superior QoS—Across the stack and at wire speed. The Cisco Catalyst 3750 Series offers Gigabit Ethernet speed with intelligent services that keep everything flowing smoothly—even at 10 times normal network speed. Industry-leading mechanisms for marking, classification, and scheduling deliver best-in-class performance for data, voice, and video traffic—all at wire speed.

- Security—Granular control for the access environment. The Cisco Catalyst 3750 Series supports a comprehensive set of security features for connectivity and access control, including ACLs, authentication, port-level security, and identity-based network services with 802.1x and extensions.
- Single IP management—Many switches, one address. Each Cisco Catalyst 3750 Series stack is managed as a single object and has a single IP address. Single IP management is supported for activities such as fault detection, VLAN creation and modification, security, and QoS controls.
- Jumbo frames—Support for high-demand applications. The Cisco Catalyst 3750 Series supports jumbo frames on the 10/100/1000 configurations for advanced data and video applications requiring very large frames.

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 resiliency enhancements and ACLs.
- Enables service management through Cisco CNS 2100 Series Intelligence Engine support and SNMP.

Specifications

Features	Catalyst 3750G-24TS	Catalyst 3750G-24T	Catalyst 3750-48TS	Catalyst 3750-24TS
Fixed ports	• 24 10/100/1000 ports • Four SPF uplinks	• 24 10/100/1000 ports	• 48 10/100 ports Four SFP uplinks	• 24 10/100 ports • Four SFP uplinks
Switching fabric	• 32 Gbps	• 32 Gbps	• 32 Gbps	• 32 Gbps
Full duplex	• All ports	• All ports	• All ports	• All ports
VLAN maximum	• 4000	• 4000	• 4000	• 4000
FEC/GEC	• Yes	• Yes	• Yes	• Yes
SFPs	• SX, LX	• SX, LX	• SX, LX	• SX, LX
802.1Q and ISL	• Yes	• Yes	• Yes	• Yes
In-line power	• No	• No	• No	• No
High-performance IP routing	• Basic IP routing (static, RIPv1, RIPv2), Advanced IP routing (OSPF, IGRP, EIGRP, BGPv4)-requires EMI	• Basic IP routing (static, RIPv1, RIPv2), Advanced IP routing (OSPF, IGRP, EIGRP, BGPv4)-requires EMI	• Basic IP routing (static, RIPv1, RIPv2), Advanced IP routing (OSPF, IGRP, EIGRP, BGPv4)-requires EMI	• Basic IP routing (static, RIPv1, RIPv2), Advanced IP routing (OSPF, IGRP, EIGRP, BGPv4)-requires EMI
802.1Q tunneling	• Yes	• Yes	• Yes	• Yes

Specifications (Continued)

Features	Catalyst 3750G-24TS	Catalyst 3750G-24T	Catalyst 3750-48TS	Catalyst 3750-24TS
QoS	• 802.1p, DSCP, four egress queues, S/SRR, strict priority queuing, weighted tail drop	• 802.1p, DSCP, four egress queues, S/SRR, strict priority Queuing, weighted tail drop	• 802.1p, DSCP, four egress queues, S/SRR, strict priority queuing, weighted tail drop	• 802.1p, DSCP, four egress queues, S/SRR, strict priority queuing, weighted tail drop
Multicast	• IGMP snooping, PIM (requires EMI), DVMRP tunneling (requires EMI), CGMP server (requires EMI)	• IGMP snooping, PIM (requires EMI), DVMRP tunneling (requires EMI), CGMP server (requires EMI)	• IGMP snooping, PIM (requires EMI), DVMRP tunneling (requires EMI), CGMP server (requires EMI)	• IGMP snooping, PIM (requires EMI), DVMRP tunneling (requires EMI), CGMP server (requires EMI)
Management capabilities	• SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, Cisco CNS 2100 support	• SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, Cisco CNS 2100 support	• SSNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, Cisco CNS 2100 support	• SNMP, Telnet, RMON, CWSI, CLI-based out-of-band, embedded CMS, Cisco CNS 2100 support
Flash memory	• 16 MB	• 16 MB	• 16 MB	• 16 MB
CPU DRAM	• 128 MB	• 128 MB	• 128 MB	• 128 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)	• 2.59 x 17.5 x 11.6 in	• 1.73 x 17.5 x 12.83 in	• 1.73 x 17.5 x 11.83in	• 1.75 x 17.5 x 11.83 in
DC power	• No	• No	• No	• No

For More Information

http://www.cisco.com/go/catalyst3750

Cisco Catalyst 4500 Series Switches

The Cisco Catalyst 4500 Series switches with integrated resiliency are designed specifically for both aggregation of business services and subscriber access in metropolitan-area networks (MANs) that take advantage of the simplicity and flexibility of optical Ethernet in the First Mile (EFM). These switches deliver integrated resiliency combined with the mechanisms for per-subscriber traffic management, security, performance, and QoS, which network operators and service providers need to deliver revenue-generating data, voice, and video services. With the Cisco Catalyst 4500 Series, network operators can now extend control and intelligence to large and small sites at the MAN edge in their EFM networks.

When to Use

Use This Product	When You Need
Catalyst 4510R	• Redundant Supervisors • Port density up to 384 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 96Gbps, 72 Mpps
Catalyst 4507R	• Redundant Supervisors • 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 4506	• 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 4503	• Port density up to 96 10/100, 100-FX, or 10/100/1000BASE-T with modular investment protection • Layer 2 switching up to 28 Gbps, 21 Mpps

Primary Features

Supervisor engine redundancy	The Cisco Catalyst 4507R and Catalyst 4510R switches support 1+1 supervisor engine redundancy for integrated resiliency. Redundant supervisor engines help to ensure that network downtime is minimized. Minimal network downtime facilitates business continuance and increased employee productivity. When using the Cisco Catalyst 4500 Supervisor Engine V, 336 ports are supported. The Catalyst 4510R can support up to 384 ports with future supervisor engines. When Supervisor Engine V is used in the Catalyst 4510R chassis, slot 10 (flex-slot) will support a subset of line cards: 2-port GBIC (WS-X4302-GB) and access gateway module (WS-X4604-GWY). This is because of the switching capacity of the Supervisor Engine V, and not a limitation of the Catalyst 4510R chassis. Future supervisor engines will allow slot 10 to accommodate any and all line cards.
Power over Ethernet (PoE)	The Cisco Catalyst 4500 Series supports the 802.3af standard for PoE on 10/100 or 10/100/1000 ports with new line cards allowing customers to provide PoE to 802.3af-compliant devices including telephones, wireless base stations, video cameras, and other appliances. PoE makes it possible to place devices in unique locations without having to provide new outlets and costly electrical circuits. Moreover, PoE allows businesses to isolate critical devices on a single power system, enabling the entire system to be supported by UPS backup. All new Catalyst PoE line cards can support 15.4W of power per port simultaneously. Not only do the cards support the IEEE standard, including the optional power classifications, the Cisco pre-standard power implementation is also supported to help ensure compatibility with existing Cisco powered devices. The cards are compatible with any Catalyst 4500 Series chassis and Supervisor Engine. Most importantly, the Catalyst 4500 Series has the power supplies and accessories to support 15.4W per port on every port simultaneously in any fully loaded chassis.
Advanced security	Enabling security features such as 802.1x, ACLs, Secure Shell (SSH) Protocol, port security, dynamic ARP inspection (DAI), IP source guard, and private virtual LANs (PVLANs) on the Cisco Catalyst 4500 Series enhances control and flexibility in the network. By enabling these features selectively or collectively, a network administrator can prevent unauthorized access to servers or applications, allow different people to use the same PC and have different capabilities, prevent hackers from stealing usernames and passwords to access switches, or prevent a deliberate or accidental broadcast storm.

Primary Features (Continued)

Investment protection	The flexible modular architecture of the Cisco Catalyst 4500 Series provides cost-effective interface upgrades for desktop connections in the wiring closet or the branch-office backbone. Customers deploying the Catalyst 4503 and Catalyst 4506 with the Supervisor Engine II that desire higher performance and enhanced features can seamlessly upgrade to the Supervisor Engine II-Plus, IV, or V. Compatible sparing between Catalyst 4003, Catalyst 4006, and Catalyst 4500 chassis provides commonality of power supplies and switching line cards, lowering the overall deployment, migration, and support costs.
Functionally transparent line cards	Cisco Catalyst 4500 Series systems can easily upgrade all system ports to higher-layer switching functions by simply adding a new supervisor engine such as the Supervisor Engine II-Plus, IV, or V. Higher-layer functional enhancements are possible on all system ports without replacing existing line cards and wiring, unlike conventional switching products where complete equipment upgrades are typical during migration. This architecture advantage extends the useful deployment life of Cisco Catalyst 4500 Series line cards.
Cisco AVVID (Architecture for Voice, Video and Integrated Data) integration	PoE line cards, combined with the access gateway module (AGM) that integrates Cisco CallManager voice services, enable the Cisco Catalyst 4500 Series to support Cisco AVVID in the enterprise headquarters and branch office.
Gigabit to the desktop	The Cisco Catalyst 4500 Series already provides numerous 1000 Mbps desktop and server switching solutions. The scope of the gigabit solutions of the Cisco Catalyst 4500 Series system is easily extended to the desktop, with 48- and 24-port triple-speed auto-sensing and auto-negotiating 10/100/1000 BASE-T line cards for the Cisco Catalyst 4500 Series. The triple-speed 48- and 24-port modules, with auto-sensing technology, provide wiring-closet investment protection by allowing Fast Ethernet desktops to migrate to Gigabit Ethernet in the future without replacing the line cards.
Hardware-based multicast	Protocol Independent Multicast (PIM), dense and sparse mode, IGMP, and Cisco Group Management Protocol support standards-based and Cisco product-enhanced efficient multimedia networking without compromising performance.
Shared-memory architecture	The low-latency, centralized, shared-memory switching fabric architecture delivers leading-edge, wire-speed broadcast and multicast capabilities, eliminating any possibility of head-of-line blocking.
Manageability	The Cisco Catalyst 4500 Series is supported by the CiscoWorks product line, which provides innovative tools to centrally manage critical network characteristics such as availability, responsiveness, resilience, and security for the intelligent switching infrastructure. A common modular QoS CLI (MQC) simplifies the creation of policy traffic maps and delivers a consistent interface across large and small Cisco Catalyst switches. Network operations are enhanced with flexible Web-, GUI-, and CLI-based management alternatives. Best of all, behind every Cisco Catalyst 4500 Series switch are award-winning Cisco service and support solutions.
Cisco NetFlow Services	The Cisco NetFlow Services Card for the Supervisor Engine IV supports statistics capture in hardware for flow-based and VLAN-based statistics monitoring. This data can be exported, collected, and analyzed for network traffic accounting, usage-based network billing, network planning, network monitoring, and data mining capabilities for both service provider and enterprise customers.
Bandwidth protection for mission-critical applications	When deploying the Supervisor Engine II-Plus, IV, or V, there is no degradation of forwarding performance with QoS or security features enabled; the Cisco Catalyst 4500 Series platform continues to forward at full line rate.
Fiber to the desktop	The Cisco Catalyst 4500 Series 24- and 48-port 100BASE-FX line cards offer the security and resiliency features of fiber-optic cable plants, making them ideal for networks with concerns for distance limitations, intrusion, or radio frequency interference. Enterprise customers or government agencies that process confidential information or offer e-commerce will appreciate the security benefits of these line cards.

Specifications

Features	Catalyst 4503	Catalyst 4506	Catalyst 4507R	Catalyst 4510R
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)	• 240 (10/100 Fast Ethernet)240 (100-FX Fast Ethernet)240 (10/100/1000BASE-T)	• 384 (10/100 Fast Ethernet)384 (100-FX Fast Ethernet)384 (10/100/1000BASE-T)
Modular slots	• 3 (1 for Supervisor)	• 6 (1 for Supervisor)	• 7 (2 for Supervisors)	• 10 (2 for Supervisors)
Available modules	• Supervisor Engine V (also supports Sup II+, IV)	• Supervisor Engine V (also supports Sup II+, IV)	• Supervisor Engine II+, IV and V	• Supervisor V only
Backplane Capacity	• 28 Gbps	• 64 Gbps	• 64 Gbps	• 96Gps
Stackable	• No	• No	• No	• No
Hot-swappable power supplies	• 2 bays (1 required, 1 for redundancy)	• 2 bays (1 required, 1 for redundancy)	• 2 bays (1 required, 1 for redundancy)	• 2 bays (1 required, 1 for redundancy)
Embedded RMON	• Statistics, history, alarm, events	• Statistics, history, alarm, events	• Statistics, history, alarm, events	• Statistics, history, alarm, events
Dimensions (H x W x D)	• 10.5 x 17.25 x 12 in.	• 17.5 x 17.25 x 12 in.	• 19.19 x 17.31 x 12.50 in.	• 24.35 x 17.31 x 12.50 in.

For More Information

http://www.cisco.com/go/catalyst4500

Cisco Catalyst 6500 Series Switches

The Cisco Catalyst 6500 Series Switch consists of the Catalyst 6506, Catalyst 6509, Catalyst 6509-NEBS, and Catalyst 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 Cisco 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 functionalities such as Q-n-Q tunneling, 802.1s/w, CWDM GBICS, and other enhancements make the Cisco Catalyst 6500 Series ideal for metro and regional metro aggregation and intercampus connectivity.

When to Use

Use This Product	When You Need
Catalyst 6513	• A high-capacity chassis for Ethernet connectivity, with slots to spare for service modules; port density 576 10/100 or 10/100/1000 ports, 290 gigabit ports, 20 10-Gigabit Ethernet ports; up to 720 Gbps of switching capacity, and packet throughput scalable to 400 Mpps
Catalyst 6509	• A traditional chassis for the wiring closet, distribution and core, data center and WAN edge; port density 384 10/100 or 10/100/1000 ports, 194 gigabit ports, 32 10-Gigabit Ethernet ports; up to 720 Gbps of switching capacity, and packet throughput scalable to 387 Mpps
Catalyst 6506	• A traditional chassis for the wiring closet, distribution and core, data center and WAN edge; port density 240 10/100 or 10/100/1000 ports, 122 gigabit ports, 20 10-Gigabit Ethernet ports; up to 480 Gbps of switching capacity, and packet throughput scalable to 243 Mpps
Catalyst 6503	• A low-density chassis for the wiring closet; port density 90 10/100 or 10/100/1000 ports, 50 gigabit ports, 8 10-Gigabit Ethernet ports; up to 240 Gbps of switching capacity, and packet throughput scalable to 99 Mpps

Primary 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- and dCEF-based switching with the SFM, with 32-Gbps and 256-Gbps backplane with up to 210 Mpps
- Feature-rich Cisco Catalyst OS for the wiring closet and Cisco IOS Software 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 without SVIs, VACLs on WAN interfaces, CWDM GBIC support, and serial 1550nm and 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 10 Gigabit Ethernet, MPLS and EoMPLS, enhanced private VLANs, integrated intrusion detection, 802.1x & port security, dynamic VLAN
- Includes support for RIP I, RIP II, OSPF, IGRP, 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 Layer 3, 4000 VLANs, private and dynamic VLANs

Specifications

Features	Catalyst 6506	Catalyst 6509	Catalyst 6509-NEBS	Catalyst 6513
Modular slots	• 6	• 9	• 9	• 13
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 eight non-contiguous ports; supports multi-module channeling	•	•	•
Management capabilities	• Element Manager for Cisco Catalyst 6500 leverages the Cisco Element Management Framework, CiscoWorks, RMON, Enhanced Switchport Analyzer (ESPAN), SNMP, Telnet, BOOTP, and Trivial File Transport Protocol (TFTP)	• Same as Catalyst 6506	• Same as Catalyst 6506	• Same as Catalyst 6506
Integrated In-Line power	• Yes	• Yes	• Yes	• Yes
Dimensions (H x W x D)	• 20.1 x 17.25 x 18.4 in.	• 25.5 x 17.25 x 18.4 in.	• 33.5 x 17.25 x 18.1 in.	• 33.15 x 17.3 x 18.1 in.
NEBS compliant	• No	• No	• Yes	• No
Power options	• 1300W (AC & DC), 2500W (AC & DC), 4000W (AC & DC)	• Same as Catalyst 6506	• Same as Catalyst 6506	• Same as Catalyst 6506

For More Information

http://www.cisco.com/go/catalyst6500

Cisco CNS Configuration Engine

Cisco CNS Configuration Engine is a secure and scalable deployment and configuration management application that supports up to 5000 CPE devices and that provides an intelligent network interface to application and users. Integrated with the Cisco Configuration Express ordering system and select Cisco Channel Partners, the Cisco CNS Configuration Engine offers an end-to-end, zero-touch deployment solution for the entire portfolio of Cisco IOS Software-based CPE. Cisco CNS Configuration Engine, using SSL, securely interfaces Cisco devices through embedded agents in Cisco IOS Software, offers a deployment solution for CPE-based network services, and provides centralized template-based configuration management and a programmatic interface to customer OSS systems.

Cisco CNS Configuration Engine automates the configuration of CPE devices during initial deployment and subsequent reconfigurations. Cisco CNS Configuration Engine is an automatic device configuration solution that helps lower cable operators operating expenses. Automating initial deployment provides immediate savings in the form of reduced truck rolls and eliminated manual installation errors while increasing end-customer satisfaction through the installation experience. Fast activation of new services and subscribers enables cable operators to more cost effectively meet demand for new subscriber services. Network administrators, managing large enterprise networks or service provider infrastructures, can also take advantage of the solution to intelligently group equipment and users, quickly assign or change network passwords, and easily manage customer premises or remote equipment from a central location.

The Cisco CNS Configuration Engine is also designed to deliver immediate productivity. As a self-contained, rack-mountable 1RU device, it requires minimal configuration and can be installed within minutes of opening the box. Through its intuitive, task-oriented user interface, network engineers can immediately begin automating routing deployment and configuration tasks with minimal training. The appliance provides an open publish and subscribe Extensible Markup Language (XML) interface for easy integration into existing OSSs and business support systems (BSSs) or workflow systems. This enables customers to immediately begin creating new service offerings or enhancing existing service offerings with new functions such as ready-to-use deployment, meaning that the product will work as soon as it is active in the network.

When to Use

Use This Product	When You Need
Cisco CNS Configuration Engine	• Scalable, zero-touch deployment solution for cable operators offering business services using the Cisco uBR900 Series or managed services using Cisco IOS Software-based CPEs such as the Cisco 800, 1700, 2600, 3600, 3700, 7200, and 7400 series routers • Programmatic interface to customer OSS systems to enable service provisioning • Configuration management for the Cisco uBR900 Series

Primary Features

- Each Cisco CNS Configuration Engine can support up to 5000 CPE devices. This scalable solution enables large-scale secure deployment of Cisco CPE over SSL, resulting in greatly reduced deployment costs and time.
- Common deployment solution across multiple access technologies, including cable, leased line, Frame Relay, ATM, and Ethernet for zero-touch deployment across Cisco CPE devices (including Cisco uBR900, 800, 1700, 2400, 2600, 2950, 2955, 3550, 3600, 3700, 7200, 7300, and 7400 series switches).
- Dynamic templates provide a framework to merge zero-touch deployment with users' OSS applications by enabling the Cisco CNS Configuration Engine to access customized data (and where subscriber data may change daily).
- XML interface to Cisco devices through Cisco intelligence agents within Cisco IOS Software.
- Programmatic interface to customer OSS systems to enable flow-through service provisioning.
- Integrated Cisco Configuration Express to enable cable operators to specify direct shipment from Cisco manufacturing to end customers.
- Device Module Development toolkit that uses the same infrastructure used for communicating with Cisco intelligence agents to interface to other types of devices for enhanced network manageability. The toolkit is usable across a variety of programming languages (C++, Java, Perl, and TCL) and protocols (Telnet, HTTP/HTTPS, SNMP, TL1, and X25).
- Distribution and activation of software images to a wide variety of devices, thus improving productivity without cumbersome scripting.
- Support for Cisco PIX® security appliances zero-touch deployment, incremental configuration updates, and image distribution.

Specifications

The Cisco CNS Configuration Engine is shipped as a Linux appliance with all software components already installed.

Features	Specifications
Fixed ports	• 10/100/1000 Mbps Ethernet (x2) • C2T (x2) - Cable Chaining Technology • Other ports: serial, USB (x3), RS485, keyboard, mouse, video
Modular slots	• 2 PCI (64-bit/33MHz; 1 full length, 1 half length)
Management capabilities	• Remote supervisor adapter: Dialup/Ethernet function • IBM Tivoli • IBM Director
CPU	• Intel Xeon Processor – 2.8 GHz
DRAM	• 512 MB (standard) / 8GB (maximum)
Storage	• 36.4 GB (standard) / 72.8 GB (maximum) (hot-swappable disks)
Power supply	• 200 W (115-230 VAC)
Dimensions (H x W x D)	• 1.72 x 17.32 x 25.72 in.

For More Information

http://www.cisco.com/en/US/products/sw/netmgtsw/ps4617/index.html

Cisco CNS Network Registrar®

The Cisco CNS Network Registrar product is Cisco's IP address-management provisioning product, providing highly scalable and reliable Domain Name System (DNS), Dynamic Host Configuration Protocol (DHCP), and Trivial File Transfer Protocol (TFTP) services to enable efficient and effective provisioning of network devices and services. Its rich and extensible feature sets easily distinct Cisco CNS Network Registrar from DHCP and DNS servers packaged with Microsoft operating environment. Cisco CNS Network Registrar can help reduce operational cost with the central management capability, which simplifies administrative tasks and reduces tedious and error prone operations associated with network and device configuration.

The Cisco CNS Network Registrar product implements a complete DNS, DHCP, and TFTP server, and provides both graphically-based and scriptable CLI administrative functions to help customers configure, automate, and streamline IP networking services. It supports business-critical tasks, such as client configuration and provisioning for numerous devices and service models for both service provider and enterprise customers. Its ability to interoperate with Microsoft-based client devices

and Active Directory allows customers to use the Cisco CNS Network Registrar product in a complementary role with the basic Microsoft DHCP and DNS servers. Cisco CNS Network Registrar is based on a distributed architecture that delivers the highest DNS and DHCP performance in its class. Moreover, its carrier-class reliability is widely recognized as demonstrated in many service provider networks handling tens of thousands of network clients

The Cisco CNS Network Registrar product automates common tasks such as IP address assignment and management, DHCP and client policy definition and distribution, and day-to-day server maintenance to simplify and streamline IP network configuration and administration. Features such as the Lightweight Directory Access Protocol (LDAP) directory interface facilitate integration of DNS and DHCP services with other network management and client- or service-provisioning applications. Performance-optimized functions provide fast setup and task execution, and an availability-tuned architecture helps to ensure reliable and consistent client services delivery.

When to Use

Use This Product	When You Need
Cisco CNS Network Registrar	• High performance of standard DNS and DHCP implementation • Reliable and scalable naming and addressing services for network connectivity, high-speed broadband access, premium services, such as VoIP, and mobile communication • Integration with third-party application using Java API and extension scripts • IP address management capability • Transparent integration with Cisco routers

Primary Features

- Scalable, multi-threaded DNS server to handle fast-growing subscriber communities and increasing service loads
- DHCP Safe Failover Protocol to eliminate single points of failure and to avoid use of duplicate address assignments
- Web-based user interface simplifies configuration and management of DNS/DHCP protocol servers
- CLI for enhanced administrative control
- SNMP trap support for integration with other network management systems
- VPN-aware DHCP
- Support for transaction signature (TSIG) for message authentication
- Granular administration capabilities
- IP address management features simplify administrative tasks

- Integration with Cisco routers through the Cisco Router Interface Configuration Server (RICS)
- Comprehensive subnet utilization and IP history reporting capability for auditing and planning
- IP address block push and pull from a central location
- Centralized management of local Cisco CNS Network Registrar clusters deployed throughout the network

Specifications

Features	Cisco CNS Network Registrar
Address management functionality	• Regional cluster provides central management capability • Aggregate management server for up to 100 local clusters, therefore providing a consistent and unified IP address policy implementation • Address space management allows administrator to break an address block into small units and push the smaller blocks to a local cluster. Similarly, the administrator can also roll up address blocks in the local cluster under their parent to provide a unified view of the address space • Flexible reporting allows centralized collection of IP lease history and usage data from local clusters • Central management of local clusters, such as creating, pushing, and pulling VPNs, client classes, scope templates and policies to local clusters • Subnet utilization and IP lease history data from the local clusters can be collected from a central location • Integration with Cisco uBR7246VXR and uBR10000 Series through the RICS • Support for Telnet and SSH as communications to the Cisco CMTS
DHCP functionality	• Support for automatic, dynamic, and manual allocation methods • DHCPINFORM packet support • Bootstrap Protocol (BOOTP) and dynamic BOOTP support • DHCP Fully Qualified Domain Name (FQDN) option 81 and option 82 • DHCP vendor class identifier and vendor-specific options • VPN-aware DHCP • DHCP Subnet allocation • Inhibiting lease renewal • Enhanced support for client-class • Unavailable lease reduction • Name space configuration for client or client-class to facilitate MPLS deployment • Enhanced extension points to allow changes to client-class data and to receive control whenever a lease changes state • Enhanced extension points to allow changes to client-class data and to receive control whenever a lease changes state • New lease allocation: first available and by priority • Improved DHCP server performance

Specifications (Continued)

Features	Cisco CNS Network Registrar
DNS functionality	• DNS Naming Authority Pointer (NAPTR) resource record type • Notify protocol • Incremental and full zone transfer protocol • Subzone hiding • Preconfigured root server • Record scavenging support • DNS server performance enhancement • Support for negative caching • BIND 8 and BIND 9 named.conf files import • Administrative addition and deletion of dynamic resource records • Improved DNS reload performance to allow server queries, zone transfers, and dynamic updates to be processed upon server startup • Support for negative caching to reduce response time for negative answers and to decrease the number of messages between resolver and servers • BIND 8 and BIND 9 named.conf file import • Administrative addition and deletion of dynamic resource records • Support for TSIG-based DNS zone transfer and dynamic DNS update • Restricted query ACLs feature to constraint clients to querying only certain servers based on the source IP address, source network address • New metrics to provide more details on DNS server health
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 • Transaction signature support to authenticate dynamic DNS request and response messages • Use of ACL to assign security keys to DNS server or to individual zones • Web-based user interface for ease of server administration • Granular roles and access constraints for flexible administration • Transaction signature support to authenticate dynamic DNS request and response messages • Use of ACL to assign security keys to DNS server or to individual zones • Web-based GUI for ease of server administration • Granular roles and access constraints for flexible administration
Platform support and system requirements	• Sun Solaris: [Sun Netra AC200 or greater] Solaris 8 or 9 with at least 512 MB RAM and 18 GB disk space and 100 MB free swap space • Microsoft Windows 2000: [Intel Pentium III or greater], Microsoft Windows 2000, with SP1 Server with at least 512 MB RAM and 18 GB disk space • Red Hat Linux 7.3: [Pentium III or greater] Kernel version 2.4 with Package Manager (RPM) 4.0.4 or Red Hat Linux Enterprise ES or WS 2.1 (kernel version 2.4.9-e.24) with 512 MB RAM, and 18 GB disk space Specific system requirements depend on the particular customer environment. Please see the Cisco CNS Network Registrar User Guide for more information.

For More Information

http://www.cisco.com/en/US/products/sw/netmgtsw/ps1982/index.html

Cisco CRS-1 Carrier Routing System

The Cisco CRS-1 Carrier Routing System is the first multi-terabit distributed routing system built to meet and exceed service provider requirements for next-generation networks that will combine services including data, voice, and video over highly available, highly scalable, converged packet infrastructures. The key attributes of the Cisco CRS-1 include:

Unparalleled System Longevity

The Cisco CRS-1 is the industry's only carrier routing system that scales up to 92 terabits per second (Tbps), powering the first OC-768c/STM-256c IP interface and supporting up to 1152 40-Gbps line-card slots. It simplifies today's networks while protecting investments for decades to come.

Continuous System Operation

The Cisco CRS-1 is built on Cisco IOS XR Software, the industry's only self-healing operating system for multi-shelf, multi-terabit carrier infrastructure. This microkernel-based operating system provides granular process independence, and fault containment and isolation. With these unique capabilities, the Cisco CRS-1 can be maintained, upgraded, enhanced, and scaled without any service interruptions.

Unprecedented Service Flexibility

The Cisco CRS-1 combines the Cisco Silicon Packet Processor (SPP), the world's most sophisticated 40-Gbps ASIC, and Cisco IOS XR Software with a unique Service Separation Architecture and Service-Intelligent Switch Fabric—to provide maximum service flexibility and capability. With comprehensive service separation and complete line-rate feature flexibility, the Cisco CRS-1 provides the capabilities required to deliver converged network services today.

When to Use

Use This Product	When You Need
Cisco CRS-1 Carrier Routing System	• A highly scalable, highly available core IP/MPLS routing solution for high-density 10 Gigabit Ethernet, OC-48, OC-192, and OC-768 requirements • High-density, high-speed routing solutions for POP consolidation, "greenfield" core routing, and converged packet network requirements

Primary Features

- A unique multi-terabit, multi-shelf distributed architecture that allows a single system to scale in service from 1.2 to 92 Tbps while retaining a single-system character
- Exceptional control-plane power and flexibility, allowing cable operators to add and allocate processing resources as necessary to meet the needs of specific customers, peers, protocols, or services
- Logical routing capabilities that allow operators to completely isolate control-, management-, and data-plane processes for individual customers or services as necessary
- The power, flexibility, and resilience of Cisco IOS XR Software, which allows operators to deploy converged packet infrastructures with the scalability, availability, and flexibility to meet the requirements of next-generation networks

Specifications

Features	Specifications
Components	• Each CRS-1 16-Slot Line-Card Chassis includes: – Two route processors (CRS-16-RP) – Two CRS-1 16 fan controllers – Eight CRS-1 16 fabric cards – Two power shelves (either DC, AC type Wye, AC type Delta) – Two alarm cards – Two fan trays – One fan filter • Optional items are: – 16 CRS-1 line cards – 16 CRS-1 PLIMs
Cards, ports, and slots	• 1-port OC-768c/STM-256c packet over Synchronous Optical Network (POS) • 4-port OC-192c/STM-64c POS/Dynamic Packet Transport (DPT) • 16-port OC-48c/STM-16 POS/DPT • 8-port 10 Gigabit Ethernet • 4-port 10 Gigabit Ethernet
Memory	• 2 GB or 4 GB per CRS-16-RP • 2 GB per CRS-MSC
Performance	• 1.2 Tbps switching capacity, expandable in service to 92 Tbps

Specifications (Continued)

Features	Specifications
Reliability and availability	• System redundancy – Power shelf redundancy 1:1 – Fan tray redundancy 1:1 – Fan controller redundancy 1:1 – Alarm card redundancy 1:1 – Route processor redundancy 1:1 – Fabric card redundancy 1:8 • Software features – NSF using graceful restart for—ISIS, OSPF, BGP, LDP, and RSVP – SONET automatic protection switching (APS) (1:1) – Line-card online insertion and removal (OIR) support – Fabric card OIR support – Out of resource management – Process restartability – MPLS Fast Reroute (FRR) – Hot Standby Router Protocol/Virtual Router Redundancy Protocol (HSRP/VRRP)
Dimensions and weight	• 84 in. (213.36 cm) H • 23.6 in. (59.944 cm) W • 36 in. (91.44 cm) D, 39.718 in. (100.844 cm) with cable-management and covers • 939 lb (425 kg) as shipped, chassis only with fan trays installed • 1595 lb (723kg) chassis fully configured
Power	• Maximum DC = 14.98KW@51,124 BTU/hr. • Maximum AC = 16.56KW@56,520 BTU/hr.

For More Information

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

Cisco CWDM GBIC/SFP Solution

The Cisco Coarse Wavelength-Division Multiplexing (CWDM) Gigabit Interface Converter (GBIC) Solution allows service providers and enterprise companies to provide scalable and easy-to-deploy Gigabit Ethernet services in their networks. The product set enables the flexible design of highly available multiservice networks.

When to Use

Use This Product	When You Need
Cisco CWDM GBIC/SFP Solution	• Multi-Gigabit Ethernet campus extension (point-to-point architecture) over pair of single mode fiber • Multi-Gigabit Ethernet metro access services (ring deployments) over pair of single mode fiber

Primary 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 Cisco Catalyst 2900, Catalyst 3500, Catalyst 2948G, Catalyst 2980G-A, Catalyst 2950, Catalyst 3550, Catalyst 4500, and Catalyst 6500 series switches, Cisco 7600 Series routers, and Cisco 12000 Series routers.
CWDM OADMs	• Passive OADM adds/drops 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 two OADM modules.

Specifications

Features	Cisco CWDM GBIC/SFP Solution
Service	• Gigabit Ethernet
Number of wavelengths	• 8 (1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610 nm)
Channel bandwidth	• 1.25 Gbps, 2.12 Gbps Fiber Channels
OADM options	• 1, 4, and 8 wavelengths
Supported topologies	• Point-to-point, hubbed ring, meshed ring, dual-homed ring
Protection	• Client-side (EtherChannel, UDLD, HSRP)
Optical budget (GBIC transmit > GBIC receive)	• 30 dB
Connectors	• CWDM GBIC - 1000BASE-CWDM/dual SC - CWDM OADM - dual SC

For More Information

http://www.cisco.com/en/US/products/hw/modules/ps4999/prod_module_series_home.html

Cisco DWDM GBIC Solution

The Cisco DWDM GBIC allows service providers and enterprise companies to build integrated, highly scalable Gigabit Ethernet WDM transport networks.

When to Use

Use This Product	When You Need
Cisco DWDM GBIC Solution	• Multi-Gigabit Ethernet metro access services (ring or hub deployments) over fiber pair

Primary Features

DWDM GBICs	• The DWDM GBICs have an optical link budget of 26-28 dB and can operate on fiber optic link spans of 100 km in length, and more. Cisco DWDM GBICs can be intermixed with other 802.3z- compliant Cisco GBICs on the same chassis. The DWDM GBICs are currently supported on the Cisco Catalyst 4500 and Catalyst 6500 series switches.
DWDM OADMs	• Passive OADM add/drop allows all 32 DWDM wavelengths available at every node. Added/dropped channels are interfaced to the color-matching DWDM GBICs on the equipment side. The DWDM chassis has a 1-RU form factor and can hold up to four OADM modules. Can be optimized for either amplified or non-amplified networks.

Specifications

Features	Cisco DWDM GBIC Solution
Service	• Gigabit Ethernet
Number of wavelengths	• 32 100-GhZ ITU grid DWDM
Channel bandwidth	• 1.25 Gbps
Supported topologies	• Hubbed ring, meshed ring, dual-homed ring
Protection	• Client-side (EtherChannel, UDLD, HSRP)
Optical budget (GBIC transmit > GBIC receive)	• 26-28 dB
Connectors	• WDM GBIC -1000BASE-DWDM/dual SC

For More Information

http://www.cisco.com/en/US/products/hw/modules/ps5420/prod_module_series_home.html

Cisco Extensible Provisioning and Operations Manager

Cisco Extensible Provisioning and Operations Manager (EPOM) is a Web-based application for real-time provisioning of the Cisco BTS 10200 Softswitch that allows authorized users to show, add, modify, delete, and check the status of Cisco BTS 10200 components.

When to Use

Use This Product	When You Need
Cisco Extensible Provisioning and Operations Manager	• Cisco EPOM reduces the need to learn CLI commands and syntax when interacting with the Cisco BTS 10200

Primary Features

- Start and stop the Cisco EPOM Web server software.
- Add, modify, and delete users, user groups, and domains.
- Assign domain access (either read/write or read-only) to groups.
- Assign a Cisco BTS login to a Cisco EPOM group. This restricts a Cisco EPOM user's access to that of the assigned Cisco BTS user login.
- Set up the network initially.
- Show, add, modify, and delete single or multiple Cisco BTS 10200 devices.
- Create and apply templates to add multiple Cisco BTS 10200 devices to the Cisco EPOM inventory.
- Set up custom navigation trees.
- Create custom provisioning flows.
- View reports and download them to a Cisco BTS EMS server.
- Troubleshoot problems.

Specifications

Cisco EPOM Server Requirements	• Sun Ultra-5 workstation (440 MHz or faster) • 512 MB RAM • 256 MB disk space • Sun Solaris 8 operating system
Default Port Assignments	• MySQL port is 3310 • Tomcat non-secure port is 8080 • Tomcat secure port is 443 • Tomcat shutdown port is 8041
Cisco EPOM Client Requirements	• Microsoft Internet Explorer for Windows, Version 5.5 or later • Netscape 6.2 or later
Cisco BTS 10200 Server Requirements	• Cisco BTS 10200 EMS Server 4.1 or Cisco BTS 10200 EMS Server 3.5

Cisco BTS 10200 and Cisco EPOM Compatibility

Cisco BTS 10200 Release Number	Cisco EPOM Release Number
Cisco BTS 10200 Release 3.2	• Cisco EPOM Release 1.1
Cisco BTS 10200 Release 3.3	• Cisco EPOM Release 1.3
Cisco BTS 10200 Release 3.5.x with Visigenics CORBA	• Cisco EPOM Release 1.3
Cisco BTS 10200 Release 3.5.x with OpenOrb CORBA	• Cisco EPOM Release 1.5
Cisco BTS 10200 Release 4.1 with OpenOrb CORBA	• Cisco EPOM Release 2.1

For More Information

http://www.cisco.com/en/US/products/sw/netmgtsw/ps5506/index.html.

Cisco Info Center

Managing network events proactively allows cable operators to maintain the uptime of their IP-based services. Because the network infrastructure has become instrumental to the delivery of business services, resolving network faults quickly is essential. The Cisco Info Center suite helps improve business efficiencies. Cisco Info Center provides real-time monitoring, management, and event de-duplication, and helps cable providers proactively manage their IT infrastructures to help ensure the continuous uptime of business services and applications.

The Cisco Info Center suite of products offers an integrated solution for end-to-end fault management and service-level assurance, which allows your business to maintain and improve the quality of network services, retain customers, and sustain a competitive advantage. With a distributed architecture enabling Cisco Info Center to scale to accommodate any size network, Cisco Info Center is positioned for cable providers that want a fully integrated solution for helping to ensure that their network, network-based services, and business are operating at maximum productivity without increasing the cost of day-to-day operations.

When to Use

Use This Product	When You Need
Cisco Info Center	• Integration with the PSTN and multi-vendor voice and data networks • Reduced operational costs • Consolidated view of your network and services

Primary Features

- Passive event collection and proactive monitoring of event conditions
- Intelligent event-reduction and suppression
- Correlation of network events to services impacted
- Web-based dashboards
- Immediately available support for Cisco devices and element management system (EMS)
- Multi-vendor support
- Ability to manage and partition views for a converged network

Specifications

Features	Specifications
Server operating system	• Solaris 9
Desktop client	• Motif • Windows • Web
Hardware requirements	• 2 GB RAM (recommended minimum) • 4 GB available disk space • 1+ CPUs

For More Information

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

Cisco IP 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 IP Solution Center is a carrier-class network and service-management solution for rapid and cost-effective management of IP VPN services. Cisco IP Solution Center 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 IP Solution Center	• Cost-effective integration of VPN services, allowing service providers to quickly plan, provision, operate, and bill for these services

Primary Features

- Flexible service activation
- High-performance service auditing for validating IP VPN service configuration, monitoring performance, and identifying faults to help ensure high network integrity and service quality. Cisco IP Solution Center generates reports on the status
- Service quality assurance to help ensure that IP VPN target devices remain provisioned correctly and that the VPN itself is operational. Reports and alarms can be generated based on pre-configured 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 product's 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

Features	Specifications
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

http://www.cisco.com/en/US/products/sw/netmgtsw/ps2327/index.html

Cisco IP Transfer Point

The Cisco IP Transfer Point (ITP) is a comprehensive solution for transporting SS7 traffic over traditional TDM networks or next-generation SS7-over-IP (SS7oIP) networks. Because Cisco ITP supports legacy, next-generation, and combined legacy/next-generation networks, operators can completely control their migration to next-generation networks and help ensure the migration is aligned with business needs and goals.

In TDM mode, the Cisco ITP product family provides outstanding value for transporting SS7 traffic over legacy TDM networks because the Cisco ITP products contain the complete feature set found in legacy signaling transfer points (STPs).

In SS7oIP mode, using Internet Engineering Task Force (IETF) Signaling Transport Protocol (SIGTRAN) industry standards, the Cisco ITP products connect to legacy SS7 nodes and/or IP-enabled signaling nodes, and offload this traffic to reliable and cost-efficient IP networks.

Cisco ITP products are also capable of operating in a mixed TDM/SS7oIP mode. Additionally, by incorporating the IETF's SIGTRAN M3UA and SUA standards, the Cisco ITP products provide complete signaling-gateway functionality between legacy TDM networks and IP-enabled signaling end points (SEPs). The Cisco ITP products provide superior value over legacy SS7 transport solutions while providing the foundation infrastructure for next-generation signaling transport.

When to Use

Use This Product	When You Need
Cisco IP Transfer Point	• Solution for transporting SS7 traffic over TDM networks or IP networks • Access support to legacy and next-generation signaling networks • Feature sets found in traditional signaling transfer points • Support for mixed TDM/VoIP modes • Sigtran support (IETF standard) for SS7 transmission over IP • Signaling gateway functionality between TDM networks and IP enabled signaled end points

Primary Features

- Signaling infrastructure cost reduction
- Superior value and flexible scalability for signaling capacity expansion (TDM or IP)
- Integrated, leading IP routing features, including IP, WAN media support, and QoS
- Reliability and performance characteristics demanded by signaling infrastructures
- Legacy STP feature set, including GTT and gateway screening
- Open industry standards, M2PA, M3UA and SUA
- High-speed link support
- IP investment protection
- Portfolio of industry-leading legacy SS7 and SS7oIP solution partners
- Cisco Signaling Gateway Manager (SGM): GUI-rich domain management software product that enables network administrators to discover, manage, and troubleshoot Cisco ITP networks

Specifications

Features	Specifications
STP functionality	• MTP3: Routing, management, screening, accounting • SCCP: Full GTT, management, screening, accounting • SS7oTDM transport: Standard low- and high-speed links • SS7 variants: ANSI, ITU, Japan TTC, China (w/national options) • High availability: Five 9s availability (Cisco 7500 Series Router chassis)
NextGen signaling support	• SS7oIP transport: IETF Sigtran M2PA, M3UA, SUA • Multiple network instances: Partitions ITP in up to 8 instances • Multiple point codes per instance: Primary, secondary capability • Instance translation: Conversion of messages between instances of the same variant • Multi-layer routing: Based on SMS-MO parameters • Radius to MAP gateway: WLAN SIM authentication gateway • CS7 monitor • Industry-leading QoS: Guaranteed bandwidth or latency for high-priority SS7 or IP traffic

For More Information

http://www.cisco.com/en/US/products/sw/wirelssw/ps1862/index.html

Cisco MGX 8880 Media Gateway

The Cisco MGX 8880 Media Gateway is part of the Cisco IP/MPLS product portfolio that offers service providers the capability to consolidate their core infrastructure and deliver differentiated IP communications services.

With its superior density, scalability, and performance, the Cisco MGX 8880 Media Gateway helps service providers to deploy a comprehensive set of VoIP applications that help lower operational expenses and generate new services revenue.

The Cisco MGX 8880 Media Gateway enables a range of packet voice applications for wireline, wireless, and cable. With its comprehensive suite of QoS features and high-availability hardware and software, the Cisco MGX 8880 Media Gateway allows service providers to optimize their existing network infrastructure and lay the foundation for the delivery of advanced services and applications.

When to Use

Use This Product	When You Need
MGX 8880 Media Gateway	• Provide PSTN gateway functionality for Cisco Broadband Local Integrated Services Solutions (BLISS) • Carrier-grade high-density, high-performance, and scalable media gateway functionality supporting high availability along with call preservation • Broad range of network interfaces (packet and TDM) • Broad range of packet voice features such as voice compression, echo cancellation, fax, modem, and other bearer services • Support for PacketCable features such as TGCP, CALEA, and security

Primary Features

- Broad range of carrier class packet voice applications for wireline and wireless solutions
- Industry-standard VoIP and VoATM implementations on the same hardware and software
- High density supporting up to 120,000 DS0s along with high call-handling capacity, supporting more than 2000 calls per second per 7-foot rack
- High availability features: Active call preservation during switchover, APS, load-sharing network interfaces
- Fully integrated network management application suite providing comprehensive device management, intuitive GUI, and open north-bound interfaces for flexible integration with OSSs
- Customer investment protection with its broad application support, evolutionary design, and compatibility with various premises, edge, and core network equipment

Specifications

Features	Specifications
System	• High-density, high-performance, scalable, 45G non-blocking switching platform • Support 12 double-height (24 single-height) slots for service modules
Network interfaces	• Packet Ethernet, Fast Ethernet, Gigabit Ethernet, POS OC-12/STM-4, T1/E1, T3/E3, OC-3c/STM-1, OC-12c/STM-4, OC-48c/STM-16 • TDM - T1/E1, T3, STM-1/OC-3
Network protocols	• IPv4, MPLS, BGPv4, IS-IS, OSPFv2, EIGRP, RIPv2, and IGMP
Signaling and call control	• MGCP, TGCP, H.248, H.323, and SIP; ISDN PRI; channel-associated signaling (CAS) • Feature group D multifrequency support for Emergency 911 and operator services
QoS	• Connection admission control • DiffServ-aware traffic engineering • LLQ, WRED, CBWFQ

Specifications (Continued)

Features	Specifications
Bearer services	• G.168 programmable echo cancellation up to 128 ms on all channels • G.711, G.723.1, G.726, G.729a/b, and clear channel codecs • Silence suppression and comfort noise generation • Fax and modem tone detection, T.38 Fax Relay • DTMF detection and generation • Onboard announcements and tones • Lawful intercept (CALEA) support for call content • On-board conferencing
Management interfaces	• SNMP, CLI, Telnet, Secure Shell Protocol

For More Information

http://www.cisco.com/en/US/products/hw/switches/ps1938/products_data_sheet09186a008023fb62.html

Cisco ONS 15216 Metropolitan/Regional DWDM 100-GHz FlexLayer

The Cisco ONS 15216 FlexLayer architecture allows for deployment of point-to-point, point-to-multipoint, ring, bus, and tree-and-branch architectures. These networks can be deployed as unprotected or protected networks, and they may also be deployed in transmit-only applications for broadcast networks. This flexibility is inherent in the design of the FlexLayer architecture. All Cisco ONS 15216 FlexLayer modules can be populated in a 1RU, 19- or 23-inch rack-mountable chassis. This unit offers four module slots arranged horizontally. Each slot can accommodate one multiplexer, demultiplexer, combiner, or splitter module. Two slots, either the two rightmost or two leftmost, can accommodate a variable optical attenuator (VOA) module. The FlexLayer filters consist of 2-channel and 8-channel add/drop multiplexers; two-, three-, four-way combiner or splitter; and variable optical attenuators.

The Cisco ONS 15216 Erbium Doped Fiber Amplifier 2 (EDFA-2) is a C-band amplifier, which allows all of the 32 channels to be amplified. This is a unidirectional device and is packaged in a 1RU, 19- or 23-inch rack-mounted shelf. The amplifier's high gain and performance allows for the design of systems that have channels which span hundreds of kilometers. Using the automatic gain control, designs and systems can gracefully grow from 1 to 32 channels without complete equipment upgrades. This amplifier has active monitoring capabilities through its Ethernet or RS-232 interfaces. It also incorporates an output tap for unobtrusive monitoring of the launched DWDM signal and contact closure outputs for alarm reporting. Note that

for 10-Gbps applications the EDFA3 is available with mid-amplifier access for inclusion of dispersion compensation without impacting the available span loss budget.

When to Use

Use This Product	When You Need
Cisco ONS 15216 Metropolitan/Regional DWDM 100-GHz FlexLayer	• Passive optical solutions where transponding is done on a separate platform • "Pay-as-you-grow" networks with the flexibility to upgrade in-service without pre-provisioning channels that are not required

Primary Features

- Lowers transport costs through an integrated optical transport infrastructure when extensive Layer 1 management capabilities are not required
- EDFA2 support for a range of applications from point-to-point DWDM, to more advanced OADM rings scaling, to several-hundred-kilometer ring circumferences
- EDFA3 support for 10-Gbps networks with mid-amplifier access for dispersion compensation
- Small footprint
- Easy channel upgrades
- Network management integration. The active components in the solution—the EDFA2 and EDFA3—are managed through the Cisco Transport Manager element management system
- Two-channel and eight-channel add/drop multiplexers
- Two-, three-, four-way combiner or splitter
- Variable optical attenuator

Specifications

Features	Specifications
Channel plan	• "4 skip 1": ITU 21-24, 26-29, 31-34, 36-39, 41-44, 46-49, 51-54, 56-59
Channel spacing	• 100 GHz
EDFA2 & EDFA3	• +17dBm output power, low noise with TL1/SNMP management

For More Information

http://www.cisco.com/en/US/products/hw/optical/ps1996/products_data_sheet09186a0080179158.html

Cisco ONS 15302 SDH Multiservice Access Platform

The Cisco ONS 15302 Multiservice Access Platform extends the optical access network to the customer premises. With an STM-1 uplink to SDH optical networks, the Cisco ONS 15302 can collect voice and data traffic for switched services, Internet access, and private networks. In only 1RU, the Cisco ONS 15302 combines data and voice traffic by transporting Ethernet and TDM channels inside an SDH STM-1 frame structure. A Layer 2 switch fabric allows native 10/100BASE-T Ethernet mapping into VC-12 (2 Mbps) containers for point-to-point, or point-to-multipoint transport. The bandwidth of the Ethernet channel can be configured in up to 63 VC-12 containers.

The Cisco ONS 15302 management solution is based on an embedded SNMP agent. A local craft interface, called Cisco Edge Craft, and the element management system, Cisco Transport Manager, allow remote supervision and provisioning for Cisco ONS 15302 devices. The Cisco ONS 15302 also provides a simple VT100 CLI for initial setup and direct management of the unit. Administrators can manage the system by accessing it locally through the VT100 RS-232 port or the dedicated Ethernet management port. Remote access is possible over IP PPP-based DCN or in band using one of the LAN or WAN ports.

When to Use

Use This Product	When You Need
Product name change: Cisco ONS 15302 SDH Multiservice Access Platform	• CPE in small- and medium-size business; collecting voice and data traffic from each site for switched services, interoffice connections, and Internet access • 10/100 Ethernet over SDH transport; 2 Mbps SLAs

Primary Features

- Collection and transport of E1 services
- Line-rate 10 Mbps and 100 Mbps Ethernet transport
- Flexible networking support for point-to-point and point-to-multipoint Ethernet connectivity
- Restoration choices: 1+1 LMSP, and unprotected span
- Carrier-class reliability

Specifications

Features	Specifications
Protection	• 1+1 line multiplexer section protection (1+1 LMSP)
Node configurations	• Terminal—protected or unprotected
Performance monitoring (SDH and Ethernet)	• MS and RS PM at the STM-1 level: B1 near end, B2 near and far end, VC-4 level: B3 near and far end, VC-12: BIP-2 near and far end
Ethernet features	• MAC switching, self-learning MAC addresses, static MAC entries, support of up to 24,000 MAC addresses, automatic aging for MAC addresses, MAC multicast, transparent bridging, port-based VLANs, VLAN by port and VLAN by port and protocol, IEEE 802.1Q VLAN tagging compliance, no head-of-line blocking, back pressure and flow control handling, IGMP support, IGMP snooping, STP per device, STP per VLAN according to IEEE 802.1s, mirroring port, IEEE 802.1p priorities, Generic Attribute Registration Protocol (GARP), GARP VLAN Registration Protocol (GVRP), wire-speed filtering, forwarding interface speed limited by WAN bandwidth
Network management interface support	• SNMP Versions 1 and 2c, CORBA Version T1M1.5

For More Information

http://www.cisco.com/en/US/products/hw/optical/ps2001/ps5116/index.html

Cisco ONS 15305 SDH Multiservice Access Platform

The Cisco ONS 15305 Multiservice Access Platform transports Ethernet and TDM traffic inside an SDH frame for metropolitan-area network (MAN or metro) applications. The Cisco ONS 15305 can be used as a central office aggregator, consolidating STM-1 access links from Cisco ONS 15302 CPE as well as directly connected customer TDM or data traffic from electrical interfaces. The Cisco ONS 15305 can also be deployed as CPE for medium- and large-sized businesses—collecting voice and data traffic from each site for switched services, interoffice connections, and Internet access—for transport over an STM-1, STM-4, or STM-16 SDH uplink to the central office.

The Cisco ONS 15305 management solution is based on an embedded SNMP agent. A local craft interface, Cisco Edge Craft, and the element management system, Cisco Transport Manager, allow remote supervision and provisioning for Cisco ONS 15305 devices. Administrators can manage the system by accessing it locally over the dedicated Ethernet management port. Remote access is possible using IP PPP-based DCN, or in band over one of the LAN or WAN ports.

When to Use

Use This Product	When You Need
Product name change: Cisco ONS 15305 SDH Multiservice Access Platform	• Small CO aggregation consolidating TDM and Ethernet traffic • CPE in medium- and large-size business; collecting voice and data traffic from each site for switched services, interoffice connections, and Internet access • 10/100/1000 Ethernet over SDH transport; 2 Mbps SLAs

Primary Features

- Aggregation and transport of services from E1 and E3 to STM-16
- Line-rate 10 Mbps, 100 Mbps and Gigabit Ethernet transport
- Flexible networking support including rings, linear point-to point, linear add/drop, star, and hybrid topologies
- Restoration choices: SNCP, 1+1 LMSP, and unprotected span
- Carrier-class reliability

Specifications

Features	Specifications
Protection	• Subnetwork connection protection (SNCP), 1+1 line multiplexer section protection (1+1 LMSP), uni- or bidirectional, SNCP
Node configurations	• Linear ADM, ring, multi-ring (mixed SNCP), terminal, regenerator, star
Performance monitoring (SDH and Ethernet)	• G.826, MS/ RS PM-STM-n level: B1 near end, B2 near and far end, VC-3 and VC-4 level: B3 near and far end, VC-12: BIP-2 near and far end
Ethernet features	• MAC switching, self-learning MAC Addresses, static MAC entries, support of up to 24,000 MAC addresses, automatic aging for MAC addresses, MAC multicast, transparent bridging, VLAN by port and VLAN by port and protocol, full IEEE 802.1Q VLAN tagging compliance, head-of-line blocking, back pressure and flow control handling, IGMP snooping, STP per device, mirroring port, IEEE 802.1p priorities, GVRP
Network management interface support	• SNMP Versions 1 and 2c, CORBA Version T1M1.5

For More Information

http://www.cisco.com/en/US/products/hw/optical/ps2001/ps5381/index.html

Cisco ONS 15327 SONET Multiservice Provisioning Platform (MSPP)

The Cisco ONS 15327 is the first metro-edge optical transport platform, supercharging SONET/SDH with integrated optical networking and unprecedented multiservices on demand. The Cisco ONS 15327 combines industry-leading bandwidth capacity and service diversity in a tiny footprint to enable service providers to achieve economic value at the metro edge.

When to Use

Use This Product	When You Need
Product name change: Cisco ONS 15327 SONET Multiservice Provisioning Platform (MSPP)	• 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

Primary Features

- Aggregation and transport of services from DS-1 to OC-48
- Switched 10 and 100 Mbps Ethernet for improved bandwidth utilization
- Line-rate 10/100/1000 Mbps Ethernet transport
- Flexible networking support including rings, linear point-to point, linear add/drop, star, and hybrid topologies
- Restoration choices: Unidirectional Path Switch Ring (UPSR), 2-fiber Bidirectional Line Switched Ring (BLSR), 1+1 Automatic Protection Switching (APS), unprotected span, and Cisco's Path Protected Mesh Networking (PPMN)
- Compact footprint for deployment flexibility (3 RU)
- Fully redundant chassis
- Integrated Cisco Transport Controller super craft management tool for simple, fast, and easy operation
- Carrier-class reliability

Specifications

Features	Specifications
Protection	• UPSR, 2-fiber BLSR, 1+1 APS, uni- or bidirectional, PPMN
Node configurations	• Linear ADM, ring, multi-ring (mixed UPSR and BLSR), terminal, regenerator, star
Performance monitoring (SONET and Ethernet)	• SONET, Ethernet, 15 minute (32 entries), 24 hour (1 entries), near- and far-end reporting, provisionable threshold crossing alerts, intermediate path performance monitoring (IPPM), SNMP RMON
Ethernet features	• VLAN (802.1Q and 802.1Q in 802.1Q), Priority (802.1P), STP and RSTP (802.1D and 802.1W)
Network management interface support	• SNMP Versions 1 and 2c, TL1 (GR-189-CORE & GR-833-CORE), CORBA Version T1M1.5

For More Information

http://www.cisco.com/en/US/products/hw/optical/ps2001/index.html

Cisco ONS 15454 Multiservice Transport Platform (MSTP)

The Cisco ONS 15454 Multiservice Transport Platform (MSTP) takes full advantage of the network intelligence introduced by the industry-leading Cisco ONS 15454 Multiservice Provisioning Platform (MSPP) to deliver intelligent DWDM functionality for metropolitan and regional networks. The ONS 15454 MSTP solution provides a comprehensive suite of transparent wavelength service interfaces.

The Cisco ONS 15454 MSTP is designed to simplify operations by providing a comprehensive selection of DWDM transmission elements, enabling support for multiple network architectures, node configurations, in-service scalability, and protection options.

The Cisco ONS 15454 MSTP incorporates the powerful network-based Cisco Transport Controller GUI craft interface, allowing point-and-click, A-to-Z wavelength provisioning with nodal control. Integration with EMSs and OSSs is easily accomplished through the Cisco Transport Manager element management system, which supports the entire Cisco Complete Optical Metro Edge and Transport (COMET) product line. Cisco's MetroPlanner DWDM optical design tool simplifies network engineering and deployment by confirming designs, automatic bill-of-material creation, and provides node configurations, fiber connections, and exportable and uploadable optical set-up files, speeding node turn-ups for improved deployment accuracy.

When to Use

Use This Product	When You Need
Cisco ONS 15454 Multiservice Transport Platform (MSTP)	• DWDM 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

Primary Features

- Scalable 1 to 32 wavelengths in a single network for superior cost-versus-growth trade off.
- Transport of 150 Mbps to 10 Gbps per wavelength, as well as sub-rate multiplexing of TDM and data services, for maximum service flexibility. The Cisco ONS 15454 MSTP supports G.709 standard encapsulation, allowing wavelength transport independent of the transport protocols embedded in the wavelength.
- Transmission distances from tens to hundreds of kilometers (up to 600 km) without regeneration through the use of advanced amplification, dispersion compensation, and FEC technologies. Enhanced FEC on future products will extend this range further without the need for regeneration.
- Flexible 1- to 32-channel OADM detail, supporting both band and channel OADMs, for greater ease in network planning and reduced reliance on service forecasting.
- Integration of pre- and post-amplification.

Specifications

Features	Specifications
Service Interfaces	• SAN: 1- and 2-Gbps Fibre Channel, ESCON, FICON, Ethernet: Gigabit Ethernet, 10 Gigabit Ethernet (LAN/WAN), SONET/SDH: OC-3/STM-1 to OC-192/STM-64, Video: D1, HDTV
Optical modules	• Multiplexer and demultiplexer filters: 32-wavelength multiplexers & demultiplexers (100 GHz), 4 wavelength multiplexer/demultiplexer, 100 GHz • Optical amplifier: Preamplifier (50-GHz capable), booster amplifier (50-GHz capable) • Optical add/drop multiplexer: 1-band, 4-band • Optical add/drop multiplexer: 1-channel, 2-channel, and 4-channel (100-GHz) • Optical service channel, dispersion compensation, Y-protection

Specifications (Continued)

Features	Specifications
Advanced intelligent software features	• Network topology discovery, automatic power control, automatic node setup, and wavelength path provisioning
Service monitoring	• SONET/SDH, a G.709 digital wrapper, and an optical service channel
Protection	• Unprotected, Y-protection, 1+1
Node configurations	• Terminal, hub, line amplifier, optical add/drop multiplexer
Network configurations	• Linear point-to-point, open ring, single hub, open ring, multi-hub, closed ring, no hub

For More Information

http://www.cisco.com/en/US/products/hw/optical/ps2006/ps2010/index.html

Cisco ONS 15454 SDH Multiservice Provisioning Platform (MSPP)

The Cisco ONS 15454 SDH Multiservice Provisioning Platform (MSPP) provides the functions of multiple network elements in a single platform. The Cisco ONS 15454 SDH MSPP provides TDM solutions with interfaces such as E1, E3, E4, DS-3, STM-1E, data solutions with 10/100/1000 Mbps Ethernet, SAN transport solutions with 1/2-Gbps Fibre Channel/FICON, and SONET client/transport interfaces of with STM-1 to STM-64 optical transport bit rates including integrated DWDM wavelengths.

When to Use

Use This Product	When You Need
Cisco ONS 15454 SDH Multiservice Provisioning Platform (MSPP)	• A multiservice transport solution for interconnecting headends, central offices, POPs, and multi-tenant business offices, that is 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 SDH infrastructure

Primary Features

- Aggregation and transport of services from E1 to STM64
- Switched 10/100/1000 Mbps Ethernet and RPR transport for improved bandwidth utilization
- Line-rate Gigabit Ethernet transport
- Flexible networking support including rings, linear point-to point, linear add/drop, star, and hybrid topologies
- Restoration choices: SNCP, 2-fiber and 4-fiber multiplexer section-shared protection ring (MS-SPR), 1+1 linear multiplexer shared protection (LMSP), and unprotected span
- Compact footprint for deployment flexibility (3 can fit in a 2000-mm ETSI rack/cabinet).
- Carrier-class reliability

Specifications

Features	Specifications
Protection	• SNCP, 2-fiber MS-SPR, 4-fiber MS-SPR, 1+1 LMSP (uni- or bidirectional), dual-ring interconnect-SNCP
Node configurations	• Linear (ADM, ring, multi-ring (mixed SNCP and MS-SPR), terminal, regenerator, star
Performance monitoring (SDH and Ethernet)	• SDH (G.707), Ethernet, 15 minute (32 entries), 24 hour (1 entries), near- and far-end reporting, provisionable threshold crossing alerts, IPPM, SNMP RMON
Ethernet features	• RPR, 802.1 compliant, dedicated or shared transport, single- or multi-card networking, VLAN (802.1Q and 802.1Q in 802.1Q), priority (802.1P), spanning tree and rapid spanning tree (802.1D and 802.1W), fast and Gigabit EtherChannel, flexible packet classification, priority marking, per-class queuing, WDRR, admission control
Layer 3 capabilities	• IP switching, static routing, RIPv2, EIGRP, OSPF, BGP, IS-IS, HSRP, VPN routing and forwarding (VRF-lite), QoS, IP multicast
Network management interface support	• SNMP Versions 1 and 2c, CORBA via CTM EMS, TL-1

For More Information

http://www.cisco.com/en/US/products/hw/optical/ps2006/ps2008/index.html

Cisco ONS 15454 SONET Multiservice Provisioning Platform (MSPP)

The Cisco ONS 15454 SONET Multiservice Provisioning Platform (MSPP) provides the functions of multiple network elements in a single platform. The Cisco ONS 15454 SONET MSPP provides TDM solutions with interfaces such as DS-1, DS-3, EC-1, data solutions with 10/100/1000 Mbps Ethernet, SAN transport solutions with 1/2Gbps Fibre Channel/FICON, and SONET client/transport interfaces of OC-3 to OC-192 optical transport bit rates including integrated DWDM wavelengths.

When to Use

Use This Product	When You Need
Cisco ONS 15454 SONET Multiservice Provisioning Platform (MSPP)	• A multiservice transport solution for interconnecting headends, central offices, POP, and multi-tenant business offices that is 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 infrastructure

Primary Features

- Aggregation and transport of services from DS-1 to OC-192
- Switched 10/100/1000 Mbps Ethernet and RPR transport for improved bandwidth utilization
- Line-rate 10 Mbps, 100 Mbps, and Gigabit Ethernet transport
- Flexible networking support, including rings, linear point-to-point, linear add/drop, star, and hybrid topologies
- Restoration choices: UPSR, 2-fiber and 4-fiber BLSR, 1+1 APS, unprotected span, and Cisco PPMN
- Compact footprint for deployment flexibility (up to four shelves per 7-foot bay frame)
- Integrated Cisco Transport Controller super craft management tool for simple, fast, and easy operation
- Network Equipment-Building System (NEBS) Level 3 and Operations System Modifications for the Integration of Network Elements (OSMINE) compliant
- Carrier-class reliability

Specifications

Features	Specifications
Protection	• UPSR, 2F-BLSR, 4F-BLSR, 1+1 APS, uni- or bidirectional, PPMN, dual-ring interconnect UPSR
Node configurations	• Linear ADM, ring, multi-ring (mixed UPSR and BLSR), terminal, regenerator, star
Performance monitoring (SONET and Ethernet)	• SONET, Ethernet, 15 minute (32 entries), 24 hour (1 entry), near- and far-end reporting, provisionable threshold crossing alerts, IPPM, SNMP RMON
Ethernet features	• RPR, 802.1 compliant, dedicated or shared transport, single- or multi-card networking, VLAN (802.1Q and 802.1Q in 802.1Q), priority (802.1P), spanning tree and rapid spanning tree (802.1D and 802.1W), fast and Gigabit EtherChannel, flexible packet classification, priority marking, per-class queuing, WDRR, admission control
Layer 3 capabilities	• IP switching, static routing, RIPv2, EIGRP, OSPF, BGP, IS-IS, HSRP, VRF-lite, QoS, IP multicast
Network management interface support	• SNMP Versions 1 and 2c, transaction language 1 (TL1) [GR-189-CORE & GR-833-CORE), CORBA via Cisco Transport Manager EMS

For More Information

http://www.cisco.com/en/US/products/hw/optical/ps2006/ps2010/index.html

Cisco Transport Manager (CTM)

Cisco Transport Manager is an advanced element management system (EMS) that intelligently manages the entire Cisco ONS Family of products. Cisco Transport Manager supports configuration, fault, performance, and security management functional areas, and serves as a foundation for integration into a larger, overall operations support system (OSS) environment. Highly available configuration, self-healing processes, and comprehensive management across the Cisco ONS Family provides service providers and large enterprises with a resilient, adaptable, and integrated carrier-class EMS solution.

Cisco Transport Manager is a powerful tool that increases the productivity of network operations staff. Cisco Transport Manager provides GUI-based point-and-click management of the network. It is easy to learn, yet provides advanced management capabilities such as A-to-Z circuit provisioning. Microsoft Explorer-style navigation, the extensive use of wizards, tool tips, legends, and online help make it easy for an operator to perform tasks quickly and efficiently. Many otherwise tedious, time-consuming, and error-prone tasks can be fully streamlined using Cisco Transport Manager's intuitive tools.

When to Use

Use This Product	When You Need
Cisco Transport Manager (CTM)	• EMS functionality to support Cisco ONS15000 Series network elements • Optical networks containing many network elements or many different models to prevent the need to use multiple craft interface tools • Where OSS integration is required for automated flow through provisioning

Primary Features

- Cost-effective management of the Cisco optical domain
- Intuitive GUI
- OSS integration through TMF 814CORBA northbound interface
- Uses industry-standard platforms: Sun, Oracle, Veritas
- Client-server architecture in standalone or redundant configurations
- Supports multiple technologies from a single platform
- Up to 2500 network elements, 100 concurrent clients

Specifications

Features	Specifications
Operating system	• Solaris 8 hardware release 02/02
Database	• Oracle 8i (8.1.7.4 patch)
Client	• Solaris 8, Windows 2000, Windows NT 4.0, Windows XP
Server hardware (high end)	• 8-900 Mhz CPU, 48 GB RAM, 924 GB disk space
GateWay/CORBA	• TMF 814 v2.0: Multi-technology network management solution set

For More Information

http://www.cisco.com/en/US/products/sw/opticsw/ps2204/index.html

Cisco uBR 3x10 RF Switch

Cisco uBR 3x10 RF Switch works with the Cisco uBR10012 and uBR7246VXR universal broadband routers to provide a fully redundant system that enables cable service providers to achieve PacketCable system availability, minimize service disruptions, and simplify operations. Cisco uBR 3x10 RF Switch is part of the company's high-availability N+1 redundancy solution set. In combination with the Cisco uBR10012 and uBR7246VXR, the Cisco uBR 3x10 RF Switch enables a fully redundant CMTS. The Cisco RF Switch is a multiplexing system that can reroute any of the RF cables connected to active Cisco cable line cards to a spare or backup set of line cards. The product maximizes density

with more than 250 MCX-type connectors that interface the Cisco uBR10012 or uBR7246VXR and the cable plant. The Cisco uBR 3x10 RF Switch contains RF combiners/splitters, RF switch logic, and RF switch drivers.

When to Use

Use This Product	When You Need
Cisco uBR 3x10 RF Switch	• As cable service providers enter the VoIP market, high availability (24-hour service) for broadband cable IP services is becoming a requirement. Cisco uBR 3x10 RF Switch enables cable service providers to achieve PacketCable system availability, minimize service disruptions, and simplify operations.

Primary Features

- Front-panel serviceability with module hot-swap capability that eliminates downtime for RF paths
- Most comprehensive set of high-availability features and configuration flexibility available to complement the efforts of cable operators to improve operational efficiency
- Unmatched RF performance designed to support DOCSIS, Euro-DOCSIS, and PacketCable specifications
- 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
- 10BASE-T Ethernet control

Specifications

Feature	Specifications
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	• 10Base-T Ethernet—SNMP • Switching time from active (working) to standby (protect): 150 mS maximum after SNMP command

Specifications (Continued)

Feature	Specifications
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. (48.2 x 38.4 x 13. 2 cm) • Weight: 36 lbs (16.4 kg)
RF specifications	• Input/output impedance: 75 ohms • Maximum RF input power: +15 dBm (63.75 dBmV) • Switch type: Electromechanical, 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

http://www.cisco.com/en/US/products/hw/cable/ps2929/index.html

Cisco uBR905 Cable Access Router

The Cisco uBR905 Cable Access Router integrates a DOCSIS cable modem and business-class Cisco IOS Software router in a single box. The standards-based Cisco uBR905 operates in bridge mode similar to any DOCSIS-compliant cable modem. But by enabling Cisco IOS IP routing and other advanced features such as hardware-accelerated VPN and IPSEC, and a 4-port 10BaseT Ethernet hub with firewall, cable operators can utilize this product for broadband services in the most demanding environments such as enterprises, small businesses, branch offices, or homes for telecommuters. The Cisco uBR905 is CableLabs-certified to DOCSIS 1.0 and 1.1 specifications.

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

Primary Features

- Integrated high-speed cable modem and router that operates with any DOCSIS 1.1 or DOCSIS 1.0-compliant CMTS.
- 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 builds on existing knowledge

Specifications

Features	Specifications
Ports	• 4-port 10BASE-T Ethernet hub • 1-port console • 1-port CATV (female F connector)
Routing features	• NAT/PAT, DHCP server
Security features	• 56-bit IPSec • 3DES IPSec optional • IPSec hardware acceleration • Firewall optional
Voice support	• No

For More Information

http://www.cisco.com/en/US/products/hw/cable/ps2221/index.html

Cisco uBR7100 Series Universal Broadband Router

The Cisco uBR7100 Series Universal Broadband Router is a complete, compact, easy-to-use product that enables cost-effective, high-speed Internet access in the hospitality multi-dwelling (MDU) and multi-tenant (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. 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 1.1 specifications. The Cisco uBR7111E and Cisco uBR7114E models are tComLabs-qualified to Euro-DOCSIS 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. The product supports DOCSIS Set-Top Gateway (DSG).

When to Use

Use This Product	When You Need
Cisco uBR7100 Series	• For MxU customers: the Cisco uBR7100 Series enables high-value Internet services over a DOCSIS or Euro-DOCSIS cable infrastructure • For cable operators: the 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

Primary Features

- Complete package that includes a full Layer 3 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 and Euro-DOCSIS
- Reliable operation to help ensure the system remains online
- Uses Cisco IOS Software

Specifications

Features	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: 1 downstream and 4 upstreams	• uBR7111E: 1 downstream and 1 upstream • uBR7114E: 1 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 10/100BaseT Ethernet (TX FE) provided • Supports one additional PA	• 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

http://www.cisco.com/en/US/products/hw/cable/ps2211/index.html

Cisco uBR7246VXR Universal Broadband Router

The Cisco uBR7246VXR Universal Broadband Router, a member of the Cisco uBR7200 Series, combines the functionality of a CMTS with an advanced router. The Cisco uBR7246VXR provides a single, multiservice, scalable platform that gives cable operators the ability to deliver IP data, voice, and commercial services to DOCSIS or Euro-DOCSIS-compliant cable modems and set-top boxes. The Cisco uBR7246VXR is CableLabs-qualified to DOCSIS 1.1 and PacketCable 1.0 specifications, as well as tComLabs-qualified to Euro-DOCSIS 2.0 specifications. New Broadband Processing Engine (BPE) cable interfaces for the chassis also support J-DOCSIS operations.

Cisco continues to evolve this communications-grade CMTS, increasing performance. The Cisco uBR7200-NPE-G1 Network Processing Engine (NPE)—the highest NPE for the Cisco uBR7246VXR—offers twice the performance of the Cisco NPE-400. The Cisco uBR7200-NPE-G1 dramatically increases processor capacity, offers three on-board Gigabit Ethernet/Fast Ethernet ports that do not take up backplane bandwidth, and eliminates the requirement for an I/O controller.

The product also supports DSG.

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 3.2-Gbps backplane* • 4 line card slots, 2 port adapter single-width slots, 1 I/O controller slot, 1 NPE slot, and 1 clock card slot for VoIP

* Some de-rating applies due to (a) multiplexing address and data on a PCI bus, (b) mix of read (slow) versus write (fast) operations, and (c) burst transfer sizes.

Primary Features

- Standards-based—Supports PacketCable 1.1 and 1.0; DOCSIS/Euro-DOCSIS 2.0, 1.1, and 1.0; new BPEs support J-DOCSIS
- Modularity allows for customized configuration-per-plant characteristics for optimization of topology and network bandwidth.
- Cisco IOS Software—Delivers proven end-to-end stability and 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 easy upgrades of port adapters, line cards, and power supplies without service interruption. Provides single, centralized point of administration for remote devices.

Specifications

Features	Specifications
Cable line cards and number of slots	• 4
Supported cable line cards (cable plant interfaces)	• Cisco uBR7200 Series MC28U, MC28X, MC16U, and MC16X BPEs;MC14C, MC16C; MC16E; MC16S; MC28C
Port adapter slots (LAN/WAN interfaces)	• 2
Supported PA categories	• Ethernet: Fast Ethernet; Gigabit Ethernet • Serial (V.35, E1-G.703/G.704, T3/E3) • Serial Multichannel T1 • ATM T3/E3 ((PCI-based) • ATM OC-3c (PCI-based) • POS OC-3c • DPT OC-12c/STM4c
Power supply slots	• 2
Power supply option	• AC; Dual AC; DC; Dual DC
Input/Output (I/O) controller	• Cisco uBR7200-I/O • Cisco uBR7200-I/O-FE • Cisco uBR7200-I/O-2FE/E
I/O flash options for PCMCIA slots	• Flash disk (48 MB) Flash disk (128 MB)
Network processing engines (NPE)	• Cisco uBR7200-NPE-G1, NPE-400, and NPE-225
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 • 1 GB, 512 MB, 128 MB for uBR7200-NPE-G1 only
Router bandwidth	• 3.2 Gbps*

* Some de-rating applies due to (a) multiplexing address and data on a PCI bus, (b) mix of read (slow) versus write (fast) operations, and (c) burst transfer sizes.

For More Information

http://www.cisco.com/en/US/products/hw/cable/ps2217/index.html

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 unique architecture of the Cisco uBR10012 brings unparalleled flexibility and intelligence to the cable network. The product delivers carrier-class reliability with fully redundant components, redundant backplane connections, and stateful switchover for DOCSIS networks to enable uninterrupted service. The Cisco uBR10012 is CableLabs-qualified to DOCSIS 1.1 specifications, as well as PacketCable 1.0-qualified. The product is also tComLabs-qualified to Euro-DOCSIS 1.1 specifications. New Broadband Processing Engine (BPE) cable interfaces for the chassis also support J-DOCSIS operations.

The product also supports DSG.

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

Primary Features

- Highest-capacity CMTS that uses the proven stability of the industry-standard Cisco uBR7200 Series, the highly scalable architecture of the Cisco 10000 Series 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—Supports PacketCable 1.1 and 1.0; DOCSIS/Euro-DOCSIS 2.0, 1.1, and 1.0; new BPEs support J-DOCSIS

- 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 help 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

Features	Specifications
Modular slots	• 8 slots for cable line cards • 4 slots for LAN/WAN interfaces; includes Cisco's new OC-48 DPT interface module set • 2 slots for performance routing engines (PREs) • 2 slots for Cisco Timing Communication and Control Plus (TCC+) modules
Supported cards	• Cable line cards such as the Cisco 5x20U BPE • TCC+ card • Gigabit Ethernet network uplink card • OC-12 POS network uplink card
Processor type	• PXF
Flash memory	• PRE-2: 64- or 256-MB flash per PRE
DRAM memory	• PRE-2: 2 MB
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

http://www.cisco.com/en/US/products/hw/cable/ps2209/index.html

Cisco uMG9820 QAM Gateway

The Cisco uMG9820 QAM Gateway is a high-density, Gigabit Ethernet-optimized video quadrature amplitude modulation (QAM) product that offers nonstop, high-performance operation for video-on-demand (VoD) services. The chassis is configurable from two to six QAM cards for a maximum of 24 QAM channels in 1RU. Each QAM card contains two RF ports capable of generating two QAM channels per port; its versatility allows the ports to be split across multiple service groups, providing even greater flexibility and easier spectrum management. Fully tested and interoperable with Cisco's industry-leading networking equipment, and complemented by the industry's highest-rated service and support, the Cisco uMG9820 QAM Gateway is a primary element in delivering the next-generation digital video network.

When to Use

Use This Product	When You Need
Cisco uMG9820 QAM Gateway	• Deployments where QAM channel density per RU is critical • Deployments with smaller distribution hubs • Planned slower growth of QAM channels

Primary Features

Modular, single-rack-unit chassis design

- Scalable up to 24 QAM
- 12 RF ports (2:1 block up-converter)
- Four QAM channels per QAM card
- Hot-swappable QAM cards, power supplies, and fan assembly
- Redundant Gigabit Ethernet interfaces
- Dual power supplies
- Field-upgradable software
- Standards-based interoperability

Specifications

Features	Specifications
RF ports	• 12 x F-connector, nominal impedance 75 ohms
QAM modulation	• ITU-T J.83 Annex B
Modulation type	• 256 QAM
Center frequency range	• 225–900 MHz
Output level	• 47–57 dBmV per QAM channel

Specifications (Continued)

Features	Specifications
Return loss (in channel)	• 14 dB
BER (worst case)	• 1 x 10-10

For More Information

http://www.cisco.com/en/US/products/hw/video/ps5648/ps5245/index.html

Cisco uMG9850 QAM Module

Cisco uMG9850 QAM Module integrates switching, optics, and QAM functionality on one platform—the Cisco Catalyst 4500 Series Switch—to simplify cable operator network architectures delivering VoD services. Providing high-performance operation for QAM modulation and up-conversion, the Cisco uMG9850 QAM Module consists of 12 RF ports capable of generating two QAM channels per port for a total of 24 QAMs.

Taking advantage of the modularity of the Cisco Catalyst 4500 Series Switch, up to five QAM modules can be accommodated, offering a maximum of 120 QAM channels. The Cisco uMG9850 QAM Module can be mixed with other Cisco Catalyst 4500 Series line cards adding to the flexibility of the solution. With high-availability features built for the platform, the module offers redundant power supplies and cooling fans, along with two switched Gigabit Ethernet ports. The Cisco uMG9850 and the Cisco Catalyst 4500 Series are emerging as the foundation for the next-generation digital video network.

When to Use

Use This Product	When You Need
Cisco uMG9850 QAM Module	• Hybrid and distributed VoD architectures • High volume deployments with rapid growth • Investment protection for future deployments

Primary Features

- 24 QAMs channels per line card, 12 ports carrying up to 2 QAMs each
- 64 and 256 QAM modulation
- Two switched Gigabit Ethernet ports per module (RJ-45, SFP)
- Network jitter reduction—Up to 200 ms, user configurable
- MPEG-2 re-multiplexing—PID filtering and remapping, PSI generation and insertion, PCR re-stamping

- Video session management—Session timers and statistics
- Network management—Cisco CLI, SNMPv1, SNMPv2c; Cisco Video MIB
- Software-configurable ASI video monitor port

Specifications

Features	Specifications
RF ports	• 12 x F-connector, nominal impedance 75 ohms
QAM modulation	• ITU-T J.83 Annex B
Modulation type	• 64/256 QAM
Center frequency range	• 50–860 MHz
Output level	• 45–55 dBmV per QAM channel
Return loss (in channel)	• 14 dB (50–750 MHz); 13 dB (750–860) MHz
BER (worst case)	• 1 x 10-10

For More Information

http://www.cisco.com/en/US/products/hw/video/ps5648/ps5649/index.html

Cisco WAN Manager

Cisco WAN Manager is a high-performance, carrier-class element management product for the Cisco MGX 8000 Series Media Gateway products. The Cisco WAN Manager can deploy, configure, and manage multiple Cisco MGX 8800 Series media gateways in one or more POPs, providing a single interface for fault, configuration, performance, and security management. It can operate as a standalone element management system, or be integrated with external applications using its northbound interfaces for highly efficient flow-though operations.

When to Use

Use This Product	When You Need
Cisco WAN Manager	• Element management for the Cisco MGX 8000 Series Media Gateway • Fast deployment of advanced services • Reduced operational costs

Primary Features

- Comprehensive fault, configuration, performance, and security management support for the Cisco MGX 8000 Series Media Gateway
- Carrier-grade scalability
- High availability and reliability
- Open northbound interfaces
- Workflow-optimized GUIs

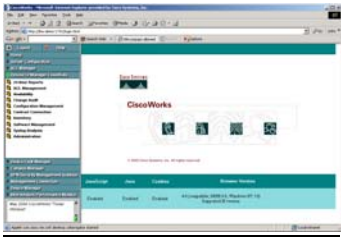
Specifications

Features	Specifications
System	• Client-server architecture (Sun/PC – Sun) • Operating systems: Sun Solaris 8, Windows • JAVA Web-based GUIs
Network monitoring	• Network-level view and status of the discovered Cisco MGX nodes and their subtending components
Configuration management	• End-to-end provisioning of all logical and physical entities of the Cisco MGX media gateway (e.g. cards, lines, ports, connections)
External interfaces	• SNMPv1, CLI, FTP, SSH for communication to Cisco MGX switch • SNMP for integration with upstream applications such as Cisco Info Center
Diagnostics	• GUI-based access to diagnostic functions including real-time statistics and test tools
MGX chassis view	• Up-to-date graphical displays of the front and back panels of the individual Cisco MGX media gateway node
Performance management	• Historical statistics collection, display, and export
System administration	• Software upgrade • Configuration save and restore
Security management	• User access control and profiles • Audit logs • SSH to Cisco MGX nodes
Data persistency	• Informix RDBMS

For More Information

http://www.cisco.com/en/US/products/sw/netmgtsw/ps2340/index.html

CiscoWorks Resource Manager Essentials (RME)



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

When to Use

Use This Product	When You Need
LAN Management Solution	• A set of tools for managing Cisco's award-winning Cisco 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

Primary Features

- Cable-specific configuration templates to easily configure 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 resources

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 applications are installed and/or configured.

Description	Specifications
Server	**Hardware operating system** **UNIX** • System: Sun UltraSPARC III (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 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 Software routers, access servers, hubs, and switches; specific devices supported by the LMS applications are available on the Cisco Software Support Center Website under each product's planner page.
Supported Cisco IOS Software Versions	• Generally supports Cisco IOS Software Release10.3 and above; Cisco Catalyst Supervisor code 2.1 and above; please see the specific application documentation and release notes for more detailed information.

For more detailed system requirements and recommendations for tuning the management system for performance, refer to individual LMS application quick start guides and release notes at the following URLs. CCO user name and password required.

Minimum System Requirements

http://www.cisco.com/en/US/partner/products/sw/cscowork/ps2425/products_quick_start09186a008017b359.html#75640

Quick Start Guide & Release Notes

http://www.cisco.com/en/US/partner/products/sw/cscowork/ps2425/ps5202/index.html

Linksys BEFCMU10 Cable Modem with USB and Ethernet Connection

The Linksys Cable Modem enables cable operators to take advantage of the control and performance benefits of DOCSIS 1.1 and 2.0, while maintaining backwards compatibility with your existing DOCSIS 1.0 systems.

Designed to make end-user deployments as simple and quick as possible, the Linksys Cable Modem connects directly to any computer with an available USB or Ethernet port. The Linksys Cable Modem is fully compliant with all industry standards—DOCSIS 1.0, 1.1, and 2.0.

When to Use

Use This Product	When You Need
Linksys BEFCMU10 Cable Modem with USB and Ethernet Connection	• Bridged high-speed cable modem services

Primary Features

- DOCSIS 1.1- and 2.0-certified cable modem
- Built-in 10/100 Ethernet port and USB connection
- Stackable with all Linksys routers
- Free 24-hour technical support
- 1-year limited warranty

Specifications

Features	Specifications
Certifications	• DOCSIS 1.1 • DOCSIS 2.0 • WHQL (USB driver)
Ports	• 1-port 10/100 Base-T Ethernet • 1-port USB 1.1 (type-B) • 1-port CATV (Female F Connector)
Routing features	• None
Security features	• None
Wireless support	• No
Parental controls	• No
Management	• DOCSIS MIBs

For More Information

http://www.linksys.com/

Linksys WCG200 Wireless-G Cable Gateway

The Linksys Wireless-G Cable Gateway is the all-in-one solution for Internet connectivity in your subscriber's home. It is a full-featured "Residential Gateway" (CableHome certified) that includes an embedded cable modem, wireless access point, wireline switch ports, firewall, DHCP, NAT, and many other features that enable a complete home network deployment. Cable operators can offer this to their subscribers on a resell/lease basis or as part of a CableHome-compliant managed home networking service.

The basic computer connectivity to the Wireless-G Cable Gateway can be done by USB or by taking advantage of the built-in 4-port 10/100 Ethernet Switch. Once connected to the WCG200, subscribers can share files, printers, hard drive space, and other resources, or play head-to-head computer games. Users have the option to connect four computers directly, or connect out to more hubs and switches to create as big a network as they need. Plus, the built-in Wireless-G Access Point allows up to 32 wireless devices to connect into the home network at 54 Mbps (802.11g), without running cables through the house. It is also compatible with Wireless-B devices at 11Mbps (802.11b). The gateway's router function ties it all together and lets the whole network share that high-speed Internet connection.

To protect your subscriber's data and privacy, the Wireless-G Cable Gateway features an advanced firewall to keep Internet intruders and attackers out. Wireless transmissions can be protected by powerful data encryption. Cable operators can help to safeguard their subscriber's family with parental control features like Internet access time limits and key word blocking.

Cable operators can choose to offer the Gateway in conjunction with a managed service or not. Either way, it is a high-value solution for subscribers' in-home connectivity needs. By offering this product, cable operators enable their subscribers to jump-start a home network, providing clear added value. If a cable operator wishes to provide this as a managed service, the CableHome specification has created an elegant way to leverage your existing DOCSIS provisioning and management infrastructure and turn the home network into a revenue source for your business.

When to Use

Use This Product	When You Need
Linksys WCG200 - Wireless-G Cable Gateway	• Data broadband services for more than one computer • Integrated router functionality • Wireless AP support • Provider manageable

Primary Features

- DOCSIS 1.1- and 2.0-certified cable modem
- CableHome 1.0- and 1.1-certified cable gateway
- Integrated Wireless-G (802.11g) Access Point (Also compatible with all Wireless-B (802.11b) devices)
- SPI firewall with denial-of-service (DoS) attack prevention
- Wireless access lists to enhance wireless security
- USB port for systems without a wired or wireless network card
- E-mail and Web-based logging of security events
- Supports VPN pass-through for IPSec, PPTP, and L2TP Protocols
- MAC address filtering, port forwarding, and DMZ support

Specifications

Features	Specifications
Certifications	• DOCSIS 1.1 • DOCSIS 2.0 • CableHome 1.0 • CableHome 1.1 • WHQL (USB driver)
Ports	• 4-port 10/100 Base-T Ethernet switch • 1-port USB 1.1 (type-B) • 1-port CATV (female F connector)
Routing features	• NAT/PAT • DHCP server • Port forwarding • DMZ
Security features	• SPI firewall • DoS attack prevention • VPN pass-through
Wireless support	• 802.11g • 802.11b • MAC address access list • WEP encryption (64 bit, 128 bit)
Parental controls	• Time of day • Keyword blocking
Management	• DOCSIS MIBs • CableHome MIBs • Web browser

For More Information

http://www.linksys.com/

CHAPTER 4

Cisco IOS Software

Overview

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 infrastructure software 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 a 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, and billing
- Wide range of routing protocols
- IPv6
- Multicast

Quality of Service

Cisco IOS QoS capabilities enable complex networks to control and predictably service a variety of applications. Every network needs QoS for optimum efficiency. QoS helps ensure 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 enabling services—particularly for converged data and voice networks, videoconferencing over IP, and for future business applications in service provider, WAN, and campus 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 helps 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
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

Key QoS Categories

Converged LAN/WAN and Telephony Networks

A broad range of Cisco products support standards-based voice over packet implementations. This enables highly efficient, converged IP-based telephony in today's service provider and enterprise networks, thereby eliminating the need for legacy telephone equipment and overlay networks (including PBXs, and central office circuit switched network equipment). In addition, Cisco voice-over-packet technologies enable service providers to leverage 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 network
- Cable Solutions
- Frame Relay, X.25
- ATM
- SONET, OC-x/STM-x, packet-over-SONET
- Broadband services aggregation (including large-scale PPPoE, PPPoA,
- L2TP tunneling)
- Dial access (including ISDN, modem, fax, voice)
- VoIP, VoFR, VoATM

Security

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

Security

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

Security (Continued)

Digital Signature Standard (DSS) and digital certification	• Positively authenticates users or devices
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 Quality of Service.

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

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)
- Multiprotocol Label Switching (MPLS)

Multiprotocol Label Switching (MPLS)

Cisco IOS MPLS fuses intelligent routing capabilities with the performance of switching. It provides significant benefits to networks with pure IP architectures and 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 growth needs and to rapidly correct link fault 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 help 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 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 helps ensure 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

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 videoconferencing, 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.

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:

Multicast Features

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)	• Cisco-developed 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 Features (Continued)

Bi-dir PIM	• An extension to the PIM suite of protocols that implements shared sparse trees with bi-directional flow of data
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

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.

Cisco IOS Software for Cable

Cisco IOS Software for cable transparently bridges the differences between HFC and IP domains. Cable operators can leverage existing DOCSIS HFC infrastructures to offer value-added IP-based services. Cisco IOS Software for cable offers stability, investment protection, reliable performance, and enhanced features. Its features accent the performance and scalability of the uBR product family, elevating Cisco to be the leader in the cable CMTS equipment market. With Cisco, cable operators can deliver differentiated and revenue-generated services including VoIP and managed VPN services. The chart below identifies Cisco CMTS Intelligent Edge Differentiators.

Intelligent Broadband Edge Differentiation

Features	Cisco Intelligent Edge	Advanced CMTS	Basic CMTS
Bandwidth Management and Traffic Control	• NBAR • STM • Load balancing • Virtual interfaces	• DQoS • Policy Routing • Tunneling	
Advanced RF	• Ingress Noise Cancellation • Spectrum Management • Dynamic Bandwidth Management • A-TDMA/2.0 • Switchable DOCSIS/E-DOCSIS	• DOCSIS 1.1 • Integrated Upconverter	• DOCSIS 1.0
Monitoring and Data Collection	• NetFlow Collector • SAMIS		
VoIP	• PCMM Support • CALEA • DQOS • Diff Serv	• PacketCable	
Security	• DMIC; TFTP enforce • Turbo ACL • Cable source verify • IPSEC • SSH • AAA	• 'ID' • 'DOS'	• ACL
Management and Provisioning	• CBT • CCDM • BAC • CBC • CNR • SNMPv3	• SNMPv2	• CLI, Element Management

Intelligent Broadband Edge Differentiation (Continued)

Features	Cisco Intelligent Edge	Advanced CMTS	Basic CMTS
Routing and Forwarding	• DSG • MPLS/VPN • Multicast • Route Maps • BGP, OSPF, IS-IS		• RipV2
High Availability	• HCCP • DOCSIS SSO • IP Resiliency	• N+1 • 1+1 CPU	

With this feature set, cable operators can translate the promise of multiservice networking into profitable services today. Cable operators can develop and deploy network architectures that last. They can build architectures that:

- Scale to handle evolving standards and growth in devices, ports, and bandwidth capacity:
  - Cisco CMTSs offer an Advanced RF feature set that accommodates services today, as well as future innovative services. DOCSIS 2.0 A-TDMA feature support on the Cisco uBR-MC16U/X, Cisco uBR-MC28U/X, and Cisco MC5x20U Broadband Processing Engine (BPE) cable line cards enable cable operators to achieve density improvements that allow two times to even four times the number of subscribers, without turning on full DOCSIS 2.0 functionality. DOCSIS 2.0 A-TDMA support offers additional upstream capacity and improved robustness. Cisco continues to innovate in this area.
  - Cisco BPEs use technology patented by Cisco to detect and combat impulse and burst noise; the cards feature a digital implementation that eliminates in-channel impairments such as tuner noise and pass-band ripple. Dynamic interference cancellation is supported via advanced signal processing algorithms. Available channels are continuously monitored for noise-free performance. If noise impairments are detected at the operating frequency, cable modems are directed to a new frequency.
  - Offer high availability (HA)—99.999% up time:
  - Cisco uBR10012 and uBR7246VXR deliver the highest availability with line card redundancy and stateful switchover support that helps ensure uninterrupted service.
  - Solutions on the Cisco uBR10012 and uBR7246VXR, including the Cisco uBR 3x10 RF Switch, meet PacketCable HA requirements
- Help ensure security with CMTS features such as:

- Patent-pending Dynamic Message Integrity Check (DMIC); this feature gives cable operators a higher level of security for their DOCSIS networks. By using randomized, single-use shared secrets to verify the DOCSIS configuration files that are downloaded to each cable modem, DMIC helps ensure that a DOCSIS configuration file can never be used by any other modem or reused by the same modem at a later time. This thwarts piracy and prevents hackers from spoofing a valid configuration file to steal service.
  The DMIC feature is enabled using the cable dynamic-secret interface configuration command. This command creates a unique DOCSIS shared secret on a per-modem basis, creating a one-time use DOCSIS configuration file that is valid only for the current session. This helps guarantee that all registered modems use only the QoS parameters that have been specified by the DOCSIS provisioning system for that particular modem at the time of its registration.
- Access control lists (ACL) which determine user access permission to the network. Cisco provides robust, integrated security and intrusion detection functionality for every perimeter of the network.
- Other DOCSIS security measures include issuing commands to the Dynamic Host Configuration Protocol (DHCP) provisioning system to validate every new source IP address; baseline privacy interface (BPI) modem authentication to authenticate all modems that engage in BPI, improved CMTS responses to address resolution protocol (ARP) requests outside the cable network. Since hackers can use ARP requests to flood a network with broadcast storms, Cisco CMTSs act as a proxy ARP device for cable modems and hosts. This reduces the number of broadcast packets on a cable network and protects the devices on the network. Every host on the cable network uses the media access control (MAC) address of the CMTS cable interface for all communications, thus preventing ARP broadcast storms from bringing down the network.
- Trivial File Transfer Protocol (TFTP) is enforced to help ensure no modem is activated unless it has completed download of a valid DOCSIS configuration file.
- Administer bandwidth and services management through features such as:
- Policy routing and Network Based Application Recognition (NBAR) support on the Cisco uBR7246VXR to intelligently identify and classify traffic
- Advanced Subscriber Traffic Management on the Cisco uBR10012 and uBR7246VXR to monitor, analyze, and respond in real-time to subscriber traffic usage. The popularity of peer-to-peer (P2P) file sharing is creating problems for cable operators. Subscribers who use P2P applications are

draining the bandwidth flow away from other subscribers, causing an inequality of price/usage. Cisco has developed a number of traffic analysis, metering and billing tools to assist cable operators in managing this traffic problem. Cable operators can utilize bandwidth management tools that analyze traffic, monitor abusers' usage, and apply policies to those users that exceed their quota. Benefits of metering and traffic control include higher levels of network efficiency and the ability to capture direct revenue from per-use charges. Through the use of subscriber traffic management, cable operators can:

- Know what traffic exists on the network (including port level, application level, and destination metrics) on a per-subscriber basis
- Differentiate services and/or service levels based on traffic patterns and usage
- Identify abusers of acceptable use policy.

The feature allows cable operators to identify and control subscribers who exceed the maximum bandwidth allowed under their registered QoS profiles. This supplements current techniques such as NBAR and ACLs to help ensure a minority of users do not consume a majority of the cable network's bandwidth. Current subscriber controls, such as NBAR and ACLs, examine all packets coming into the CMTS. They can curb a large volume of problem traffic, but they are not as effective in dealing with the latest generation of P2P file-sharing applications that can swamp a network's available bandwidth. The Subscriber Traffic Management feature allows cable operators to focus on a minority of potential problem users, without impacting network performance or other users who are abiding by their service agreements.

- Improved bandwidth management through CMTS load balancing to assign or reassign modems across channels to maximize bandwidth efficiency. Load balancing is the ability to assign a cable modem, as it comes online, to a specific channel in order to utilize the downstream and upstream bandwidth effectively. Load balancing on Cisco CMTSs allows cable operators to optimally use both downstream and upstream bandwidth. This feature helps reduce network congestion due to the uneven distribution of cable modems across the cable network and due to different usage patterns of individual customers. This feature set is supported on the Cisco uBR7246VXR and uBR10012. By default, Cisco CMTS platforms use a form of load balancing that attempts to equally distribute the cable modems to different upstreams when the cable modems register. Operators can refine this form of load balancing by imposing a limit on the number of cable modems that can

register on any particular upstream, using the cable upstream admission-control command. Customers can load balance downstream interfaces, allowing cable modems to be re-assigned to a different channel (frequency) based on a predetermined time interval, specific events, or interface load situation. As cable operators migrate to DOCSIS 1.1 and begin offering PacketCable voice services, upstream load balancing becomes critical to better utilize upstream bandwidth. Cable operators must be able to have multiple upstream channels per fiber node.

- QoS to achieve require levels of service by managing delay, delay variation (jitter), bandwidth, and packet loss parameters on a network which are vital to multi-service networks and critical for advanced VoIP and multimedia services. Cisco uBR10012 and uBR7246VXR offer PacketCable Multimedia QoS features that include DQoS, communicating with a call server for authentication, signaling message encryption, and CALEA.
- Accounting including:

  Data such as:

  - CMTS hostname, IP, and sys up time
  - Cable modem MAC and IP
  - CPE IP
  - Service flow ID
  - Service class
  - Number of packets/octets passed upstream and downstream per service flow
  - Data stored in XML format as per IPDR schema
  - Data exported to Billing Mediation Agents
  - SAMIS for DOCSIS per CM/SFID-based billing
  - Summary

Cisco offers solutions compliant with all major standards for data-over-cable, voice, and video. With Cisco advanced feature sets, cable operators can offer differentiated services with guaranteed service levels that meet customer demands. We offer integrated solutions and flexible deployment across our CMTSs, cable business-class CPE, routers, switches, specialized appliances, desktops, and hosts. These solutions allow cable operators to protect productivity gains, reduce overall operating costs, and enable mission-critical deployment of new and existing technologies.

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).

CHAPTER 5

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 loyalty. The Cisco team can contribute to success during the complete network lifecycle: planning, design, implementation, deployment, and operation. Cisco offers services and programs that maximize your return on investment (ROI) in Cisco products, solutions, and network management systems.

Cisco Cable Services and Programs at a Glance

Cable Marketing Programs

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:

http://www.cisco.com/en/US/netsol/ns206/networking_solutions_program_category_home.html

Joint marketing—Provides marketing consulting designed to help service providers create and market new services. Refer to:

http://www.cisco.com/en/US/netsol/ns341/ns417/ns316/networking_solutions_program_category_home.html

Joint Marketing Online Toolkit (JOLT)—A free, comprehensive Website consisting of service-specific content and tools designed to help eligible service providers take services, which are based on Cisco products and solutions, successfully to market. The program is designed to be self-sufficient—no Cisco personnel support is required for account application, user registration, or toolkit use. Apply through your Cisco account manager.

Cisco Channel Partner Program

Whether you provide services, solutions, or a combination of both, Cisco is committed to its resellers' and distributors' 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, the Cisco specialization programs provide a structured training roadmap with access to free online technical education and video-on-demand (VoD) content through the Partner E-Learning Connection. Refer to:

http://www.cisco.com/warp/public/10/wwtraining/pec/peclogin.html

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

http://www.cisco.com/en/US/partners/pr11/index.shtml

The Channel Partner Program certifications require partners 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

http://www.cisco.com/en/US/partners/pr11/pr8/partners_pgm_category_page.html

Reseller and Customer Support

Reseller Sales and Technical Assistance Contact Information

Customer Help Lines	Contact Information
Presales—Partner/Reseller Help Line	• 1 800 553 6387, option 2 (within U.S.) • +1 408 526 7208, option 2 (outside U.S.) • http://CiscoPartner.custhelp.com/
Postsales—Technical Assistance Center (TAC)	• 1 800 553 2447 (within U.S.) • +1 408 526 7209 (outside U.S.) • http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml • tac@cisco.com (e-mail)

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.

Services and Support Offerings

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, the Cisco 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 the Cisco Technical Assistance Center (TAC) and logistics infrastructure • Cisco Brand Resale—This program allows partners to provide Cisco services (Cisco SMARTnet services, 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 available through distributors/2-tier):

Product	Description
Maintenance Services	
Cisco SMARTnet Maintenance	• Provides customers with software maintenance, registered access to Cisco.com, advance replacement of hardware, and technical support required for self maintenance. Cisco 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.

Packaged Resalable Service Products
(Only available through distributors/2-tier): (Continued)

Product	Description
Cisco SMARTnet Onsite	• Provides all the benefits of Cisco 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 Cisco 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.com, 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)	• SASU 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	
Implementation Services	• To implement a networking solution, Cisco can provide as much support as needed to integrate devices without disrupting the network or creating points of vulnerability. For more information: http://www.cisco.com/en/US/products/svcs/ps11/ps5542/services_segment_group_home.html

For More Information

See the Partner and Reseller Support Services Web page at:

http://ciscopartner.custhelp.com/cgi-bin/CiscoPartner.cfg/php/enduser/entry.php

(Cisco.com login required).

Cisco Systems® Capital® Financing

Today's organizations need to make the most of their resources to compete successfully in an increasingly competitive business world. Companies must do more with less, help ensure that their technology is up to date, and safeguard their capital expenditure budgets. At Cisco Systems Capital Corporation—a wholly owned subsidiary of Cisco Systems—our expert financial consultants can help meet your company's financial needs. We specialize in financing networks by providing innovative, flexible, and worldwide financial services to Cisco customers and channel partners alike.

For More Information

Visit the Cisco Systems Capital Website:

http://www.cisco.com/en/US/ordering/or6/order_finance_and_payments_concept_home.html

Within the United States, call toll-free (800) 730-4090.

Cisco Authorized Refurbished Equipment (U.S. and Canada Only)

The Cisco Authorized Refurbished Equipment (United States 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® support 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

http://www.cisco.com/en/US/ordering/or6/or17/order_refurbished_equipment_high_level_listing.html

Cable Education and Certifications

Cisco certifications and educational programs are 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 diverse needs, the curriculum is designed in a modular format with a remote lab that gives Cisco Learning Partners with cable certifications the ability to offer truly customized training.

For More Information

http://www.cisco.com/en/US/learning/le3/learning_career_certifications_and_learning_paths_home.html

Cable carriers that are members of the Cisco Powered Network Program can take advantage of additional Cisco cable curriculum that is optimized specifically for the needs of the service provider. Using the members-only resource link, engineers can use the online training library, help themselves to self-paced training, and sign up to attend free instructor-led classes on service provider topics such as implementing cable solutions in an end-to-end operational environment.

Cisco Powered Network Program members are also invited to attend an exclusive, members-only program--the annual Operations Symposium. This educational forum brings 600-1000 service provider engineers together each year to hone their technology skills, take free certification exams, and share information with peers throughout the world. Attendance is free to this exclusive program, which provides individual attendees with more than US$10,000 in educational value.

For More Information

http://www.cisco.com/cpn

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.

For More Information

http://www.cisco.com/en/US/learning/le3/le2/le41/le76/le1/learning_certification_type_home_extra_level.html

Cisco Communications and Services (CCIE® and CCIP™) certifications meet the growing demand for skills and talent from the telecommunications sector by identifying talented professionals who can plan, design, implement, or operate next-generation 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 and IP telephony.

For More Information

http://www.cisco.com/en/US/learning/le3/le30/le15/learning_learning_path.html

http://www.cisco.com/en/US/learning/le3/le2/le37/le8/learning_certification_type_home.html

http://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. Cisco offers:

- A 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, 24-hour onsite service, and other onsite professional services. Services include:
  - Consulting services: Solutions consulting and knowledge transfer
  - Cisco Advanced Services: Cisco Network Optimization Support, Cisco Focused Technical Support, Cisco Technology Application Support
  - Cisco Technical Support Services: Technical Assistance Center (TAC) and high- touch technical support
  - Knowledge transfer, including established and emerging technology mentoring
- Corporate commitment—Cisco is making substantial investments in all customer services. Cisco sets goals for and measures customer satisfaction each year.
- Experience—All Cisco support teams are staffed by experienced customer service engineers, professionals, and certified consultants and partners. Cisco's rigorous certification programs help 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 help ensure that qualified local service is available no matter how remote the location. Cisco Partner representatives follow rigorous certification programs to help 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.

For More Information

http://www.cisco.com/en/US/ordering/or3/o31/ordering_transactional_customer_service_contacts.html

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 Cisco ATP program focuses on two types of partners:

- Reseller/integrators who focus on selling, designing, implementing, and often providing Gold certification-level, postsales 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

For More Information

http://www.cisco.com/en/US/partners/pr46/pr0/partners_pgm_summary.html

Cable Technology Specialization

The Cable Technology Specialization requires that our partners have skills covering presales, basic deployment, and postsales operational support. Cisco believes that cable operators should receive the same quality of support from our partners as they would expect from Cisco directly.

In the cable market, 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.

For More Information

http://www.cisco.com/en/US/partners/pr11/pr66/pr5/partners_pgm_concept_home.html

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 250,000-homes-passed cable headend, provide insight into a variety of network configurations, and resolve customer problems rapidly in a controlled environment.

The lab features more than 5000 dedicated modems and STBs 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 launches.

For More Information

http://www.cisco.com/warp/public/779/servpro/solutions/cable/flash/Cisco_Cable_Lab/CiscoCableLab136.htm

Cisco Service Provider Solutions Ecosystem Partner Program

The Cisco Service Provider Solutions Ecosystem Partner Program includes industry-leading partners teaming with Cisco to offer products, solutions, and services— providing tangible benefits to service providers.

Membership in the Cisco Service Provider Solutions Ecosystem Partner Program is offered to companies that exhibit market leadership and utilize Cisco's industry-leading technology while sharing in Cisco's commitment to customer service and satisfaction.

For More Information

http://www.cisco.com/en/US/partners/pr46/pr63/partners_pgm_concept_home.html

CHAPTER 6

Reference Information

Reference Information at a Glance

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: http://www.cisco.com/univercd/cc/td/doc/pcat/
Cisco.com Online	• For even more complete information, please go to Cisco.com at http://www.cisco.com (and click on "Solutions for Your Network," choosing "Cable"). In addition to product, technology, and network solutions support, Cisco.com 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 • Cisco.com 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 Cisco.com-based pages beyond the public level. Alternately, Guest-level Cisco.com access provides a subset of the information available to Partners and Resellers

1. To become an authorized Cisco Reseller, submit an online application. See http://www.cisco.com/en/US/partners

Helpful Cisco Websites

Cisco Website	URL[1]
Cable Solutions Cisco.com **Cable Products Cisco.com**	• http://www.cisco.com/en/US/netsol/ns341/ns396/ns289/networking_solutions_packages_list.html • http://www.cisco.com/en/US/products/hw/cable/index.html
Worldwide Contacts Cisco office locations; directions; maps; and sales, partners, and channel contacts	• http://www.cisco.com/warp/public/687/Directory.shtml
Partner Relationship Central Find a Channel Account Manager (CAM), Distributor, apply to the Cisco Channel Partner Program, or update your profile	• http://tools.cisco.com/WWChannels/GETLOG/welcome.do

Helpful Cisco Websites (Continued)

Cisco Website	URL[1]
Technical Support For customer support tips, software center, online documents, and more	• http://www.cisco.com/en/US/support/index.html
Cisco Products Quick Reference Guide This guide is available on line (in PDF and HTML); it is continually updated between bi-yearly printings. Cisco.com login required	• http://www.cisco.com/warp/public/752/qrg/
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.)	• http://www.cisco.com/go/subscription
Worldwide Distributors Website List, by country, of authorized Cisco Distributors who stock and resell Cisco products	• http://tools.cisco.com/WWChannels/LOCATR/jsp/distributor_locator.jsp
Distribution Product Reference Guide (DPRG) Complete list of pricing information, part numbers, and more for distribution (2-tier) products. Data is refreshed nightly. Cisco.comlogin required	• http://www.cisco.com/appcontent/echannels/pbc/
Partner Business Central—Browse and Configure Products An e-commerce Website 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. Cisco.com login required—click on "Browse and Configure Products"	• http://www.cisco.com/appcontent/echannels/pbc/
End-of-Life Matrix Last order and end-of-life dates for Cisco products.	• http://www.cisco.com/en/US/products/products_end-of-life_policy.html
Sales Tools Central Helpful, easy-to-use Website with detailed product information, sales tools, sample configurations, and more	• http://www.cisco.com/warp/public/779/smbiz/service/
Training Cisco offers 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.	• http://www.cisco.com/en/US/learning/ • http://www.cisco.com/warp/public/10/wwtraining/pec/peclogin.html

1. Additional Cisco.com 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 help 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

All Cisco hardware and software products are covered for a minimum of 90 days. Some products have a longer or more appropriate coverage, ranging from One Year Hardware to 3-Year Hardware/1-year Software Limited Warranties. Cisco's Warranty and License terms and conditions may differ from country to country. Note that "Lifetime" Warranty is limited to original owner only and support is subject to product end-of-life terms.

For More Information

http://www.cisco.com/en/US/products/prod_warranties_listing.html

Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

European Headquarters
Cisco Systems International BV
Haarlerbergpark
Haarlerbergweg 13-19
1101 CH Amsterdam
The Netherlands
www-europe.cisco.com
Tel: 31 0 20 357 1000
Fax: 31 0 20 357 1100

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-7660
Fax: 408 527-0883

Asia Pacific Headquarters
Cisco Systems, Inc.
168 Robinson Road
#28-01 Capital Tower
Singapore 068912
www.cisco.com
Tel: +65 6317 7777
Fax: +65 6317 7799

Cisco Systems has more than 200 offices in the following countries and regions. Addresses, phone numbers, and fax numbers are listed on the Cisco.com Web site at www.cisco.com/go/offices.

Argentina • Australia • Austria • Belgium • Brazil • Bulgaria • Canada • Chile • China PRC • Colombia • Costa Rica • Croatia • Cyprus • Czech Republic Denmark • Dubai, UAE • Finland • France • Germany • Greece • Hong Kong SAR • Hungary • India • Indonesia • Ireland • Israel • Italy Japan • Korea • Luxembourg • Malaysia • Mexico • The Netherlands • New Zealand • Norway • Peru • Philippines • Poland • Portugal Puerto Rico • Romania • Russia • Saudi Arabia • Scotland • Singapore • Slovakia • Slovenia • South Africa • Spain • Sweden Switzerland • Taiwan • Thailand • Turkey • Ukraine • United Kingdom • United States • Venezuela • Vietnam • Zimbabwe

Printed in the USA 4917/RDA/0904