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WASHINGTON, D.C. 20005-2301
(202) 371-6000
FAX: (202) 371-6279

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October 30, 2000

VIA HAND DELIVERY

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, S.W., Room TW-B204
Washington, D.C. 20554

RE: NOTICE OF *EX PARTE* SUBMISSION, APPLICATIONS OF AMERICA ONLINE, INC. AND TIME WARNER, INC. FOR TRANSFERS OF CONTROL, CS DOCKET NO. 00-30.

Dear Ms. Salas:

On behalf of The Walt Disney Company, submitted herewith pursuant to Section 1.1206(b)(1) of the Commission's rules are an original and one copy of public documents that were provided to Ms. Royce Dickens of the Cable Services Bureau on Friday, October 27, 2000.

If you have any questions, please do not hesitate to contact me.

Sincerely,

Lawrence R. Sidman

Lawrence R. Sidman

Attachments

No. of Copies rec'd 0+1
List A B C D E

cc (w/attachments): Deborah Lathen
Royce Dickens
Linda Senecal
James Bird
Darryl Cooper

WHITE PAPER

Controlling Your Network—A Must for Cable Operators

Executive Overview

This white paper describes how multiple system operators (MSOs) can control the traffic on their multiservice network to ensure that their users receive consistently high levels of service. In addition, it discusses how to prevent outside content providers from disrupting the cable network by delivering broadband content without authorization granted by the MSO.

The Opportunities for MSOs

Today, the volume of networked data traffic has bypassed that of voice traffic, and the demand for data access is still climbing steadily for both business and residential subscribers. The demand for high-bandwidth video access is beginning to undergo a similar upswing. Further, there is a strong subscriber interest in bundled data, voice, and video services offered by a single provider. MSOs are in an excellent position to take advantage of these unprecedented revenue opportunities.

Such a move requires being able to deliver data, voice, and video to all your subscribers through a single converged network of integrated components designed for this type of service deployment—an Internet Protocol (IP) network.

A converged network delivers substantial benefits, such as resource sharing not only of bandwidth, but also of capital expenditure, operational costs, and training. A converged network gives you the freedom to offer bundles of data, voice, and video services, and today you can offer these services with new confidence in your abilities to control service quality.

And today you can do this with new confidence in your abilities to deliver service quality.

For example, converged network enables you to create "virtual" networks to ensure that different types of traffic do not interfere with each other. You get the advantages of a converged network with the service-delivery confidence of separate networks—but without the gross inefficiencies and future-limiting isolation of separate networks.

Cisco Systems and its strategic partners have made a no-compromise commitment to delivering end-to-end, carrier-class, high-bandwidth IP networks to meet these New World opportunities.

Elements of a Multiservice Cable Network

New World IP networks are the most advanced, flexible, and cost-efficient solution available for delivering data, voice, and video over cable—the types of services your customers want. New World networks are also designed to leverage the common infrastructure you already have to optimize your time to market and profitability in developing, deploying, billing, maintaining, and expanding these services over time.

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WFQ, on the other hand, adds the capability to provide expeditious handling for high-priority traffic requiring low delay while fairly sharing the remaining bandwidth between lower-priority traffic sources. WFQ divides link traffic into high-priority and low-priority flows (based on metrics including IP Precedence and traffic volume). High-priority flows receive immediate handling, whereas low-priority flows are interleaved and receive proportionate shares of the remaining bandwidth.

Random Early Detection for Congestion Management

Random early detection (RED) gives you the ability to flexibly specify traffic-handling policies to maximize throughput under congestion conditions. RED helps you intelligently avoid network congestion by implementing algorithms that provide a host of protections, including the ability to:

- Distinguish between acceptable temporary traffic bursts and excessive bursts likely to swamp network resources
- Work cooperatively with traffic sources to avoid TCP slow-start oscillation, which can create periodic waves of network congestion
- Provide fair bandwidth reduction to reduce traffic sources in proportion to the bandwidth being utilized
- Set minimum and maximum queue depth thresholds as well as packet drop probability

Thus, RED works with TCP to anticipate and manage congestion during periods of heavy traffic to maximize throughput via managed packet loss.

Go Forward and Grow with Safety and Control

Cisco QoS gives you complete control over all your content and services while at the same time protecting your available bandwidth and minimizing delays for time-sensitive voice and video applications.

QoS can also propel you forward by giving you the information you need to offer advanced differentiated services at a profit. For example, time- and usage-based billing via NetFlow measurements provide you with a means of encouraging (or shifting) demand during periods of light network loading by offering off-peak discount pricing.

Traffic classes and prioritization allow you to encourage business subscribers to classify their traffic and transport only the highest-value bits during peak usage periods and heavy congestion conditions.

Bandwidth allocations via the CAR feature let you carefully engineer network capacity to meet bandwidth commitments during periods of congestion.

With QoS, you can optimize service profits by marketing "express" services to premium customers ready to pay for superior network performance. Enterprise customers are already leveraging virtual private networks (VPNs) and other advanced services provided by broadband MSOs to optimize communications with customers, suppliers, branch offices, and mobile/telecommuting employees.

Cisco QoS services help you pursue a New World Internet business model for profitable revenue growth by:

- Offering and charging for targeted, differentiated services
- Maximizing network utilization
- Maximizing revenue per carried bit
- Generating incremental billing for new services

Every competitive MSO has been challenged to plan and build an IP infrastructure that can deliver a full range of differentiated network services and provide absolute network control, from the edge to the backbone. Now, that's exactly what you can do.

For more information on Cisco Cable Solutions, visit our web site at: www.cisco.com/cable.

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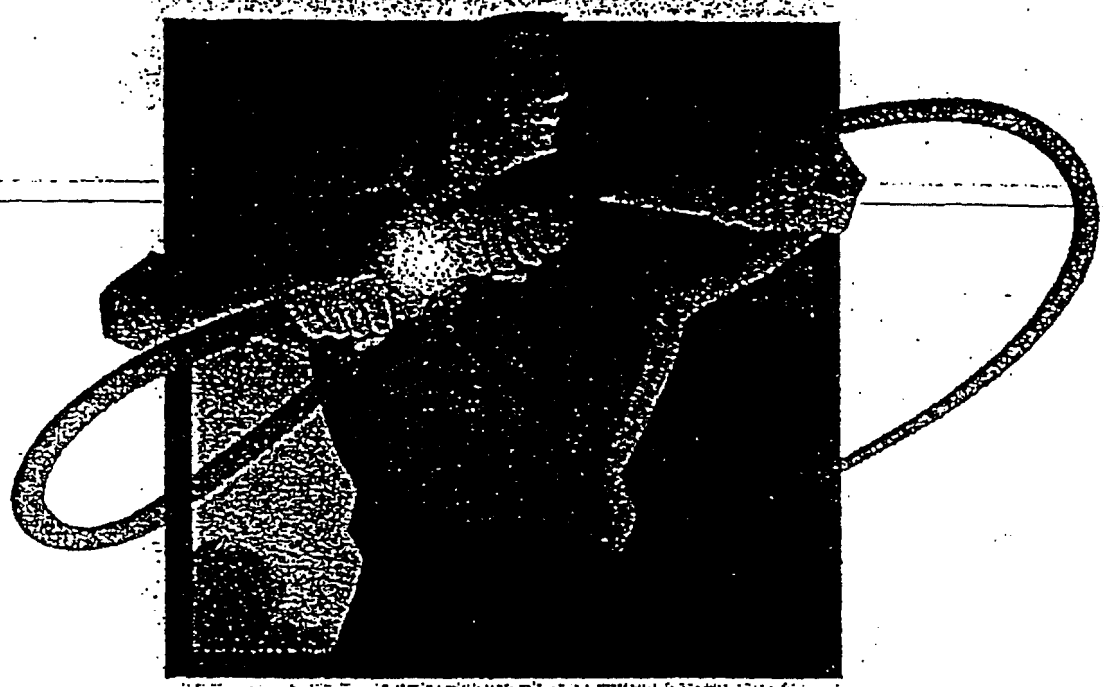


CABLE FOR A NEW WORLD

A CABLE PROVIDER'S GUIDE TO DIGITAL BROADBAND DEPLOYMENT

GREEN STREET

New Revenue Opportunities through New Services and Markets

Cable operators have an opportunity today to generate significant revenues from new services in the residential, business, and education markets. The demand for information, entertainment, and communications has exploded, and the cable network presents the single best medium for delivering these services reliably, cost-effectively, and profitably. In fact, analysts predict that the demand for cable modems will grow by almost ten times in the next few years (Figure 1). Cable operators have the opportunity to take advantage of this tremendous growth by providing advanced services at a fraction of the cost of traditional telco solutions. The range of potential services is limited only by the needs of the customer.

The cable industry is in a state of rapid transition from the old-world model based on closed systems providing a single product offering—broadcast television programming—to a new world driven by competition and choice. Cable operators can now offer a multitude of services based on an integrated platform of data, voice, and video capabilities.

Cisco cable solutions enable operators of all sizes to derive new revenue streams from their existing cable systems and, more importantly, to leap well ahead of other local access providers in terms of service offerings and customer mindshare. Being the first to offer these new services is critical in a local-access market expected to become fiercely competitive. The first provider to enter these new markets will acquire speed-hungry customers at a much lower cost than that of the competing access providers that follow.

Figure 1: North America Cable Modem Forecast

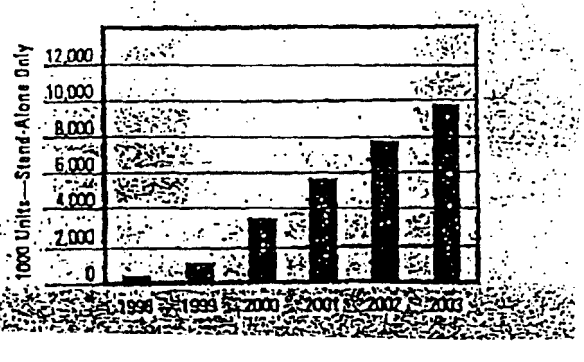
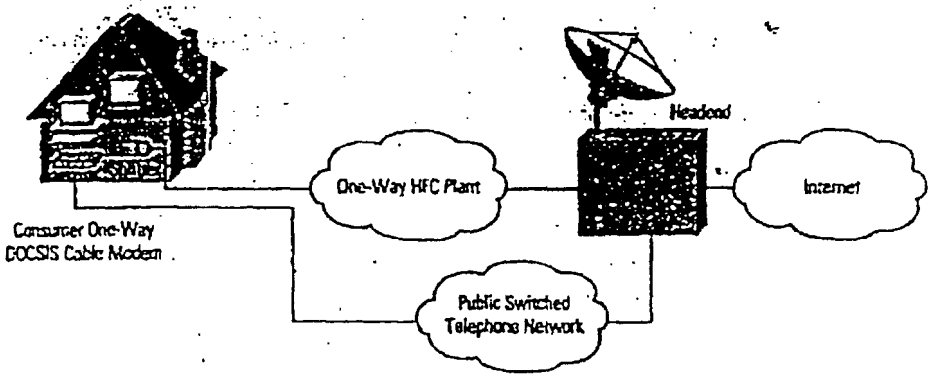


Figure 3: Internet Access over One-Way Cable with Telco Return



demand (VOD). These services require varying levels of bandwidth for peak performance. Through QoS, cable operators can easily charge incrementally for higher bandwidth, further boosting revenues.

To allow cable operators to take advantage of these consumer market opportunities, Cisco has established an industry-leading partnership strategy and a complete end-to-end solution.

Interoperability Partners

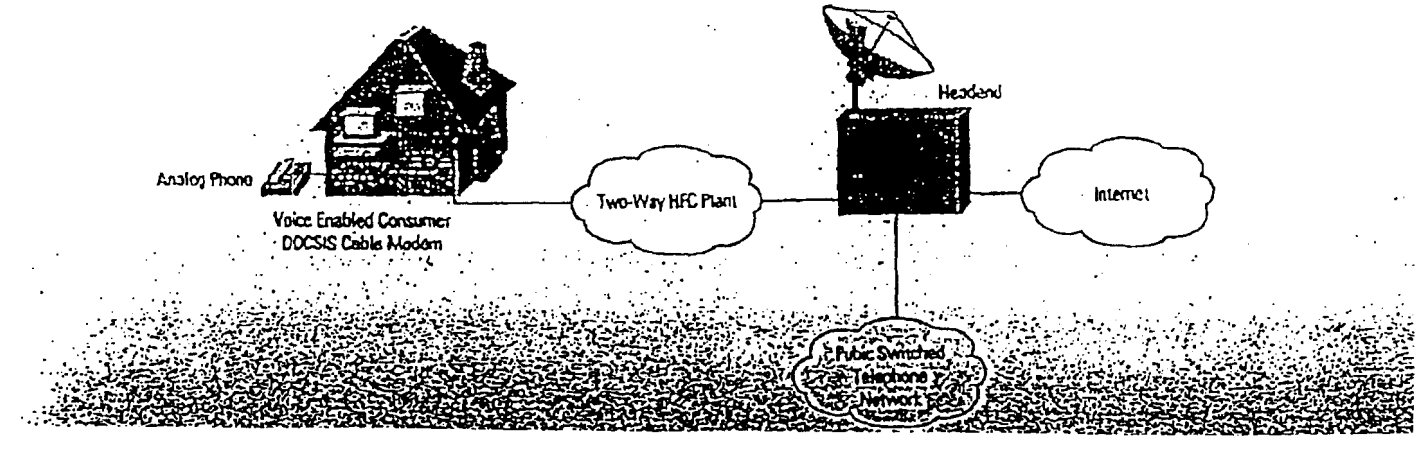
Cisco is working with leading companies in the cable industry such as General Instruments (GI), Thomson RCA, and Com21 to assure interoperability of our products. This allows you to take advantage of the consumer market by leveraging the expertise of multiple vendors. Whether they are consumer cable modems or digital set-top boxes, cable operators can be assured that Cisco partners' devices will interoperate with Cisco headend equipment.

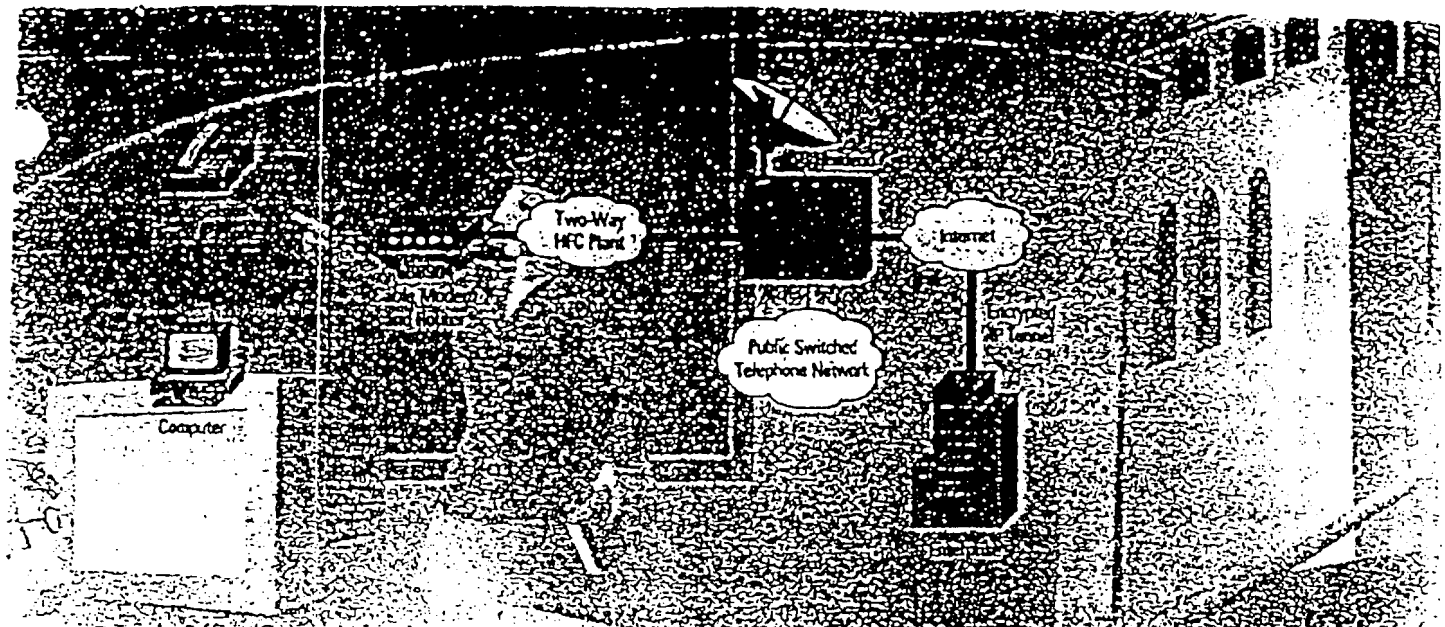
Cisco NetWorks Partners

Through the NetWorks program, Cisco is partnering with leading companies around the world including world-famous consumer electronics manufacturers such as Sony and Samsung; leading European set-top box manufacturers such as Pace; leading modem manufacturers such as Askey; and leading suppliers of integrated delivery systems for cable operators such as ADC Telecommunications.

Cisco NetWorks is a technology licensing program that incorporates Cisco technologies into its partners' cable modems, digital set-top boxes, and external network interface units (NIUs). As participants in the program, Sony, Samsung, Pace, ADC, and Askey proudly display the Cisco NetWorks brand mark—a guarantee of Cisco reliability, network connectivity, and interoperability. The Cisco NetWorks program allows cable operators to leverage the combination of Cisco technology with the respective core competencies of its partners, both those who are a part of the program today as well as those who join in the future, to ensure their success in the consumer market.

Figure 4: Voice over IP





Branch-Office Communications

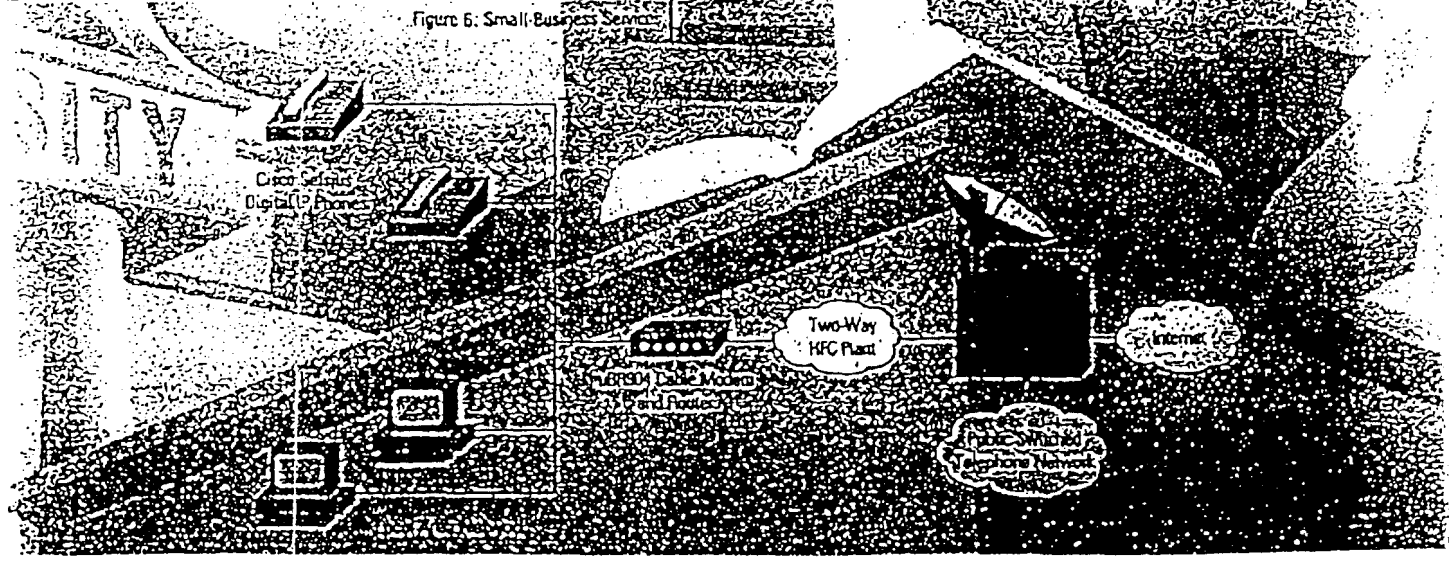
Branch offices of large enterprises represent another lucrative market for cable operators. Recent progress in data over cable standards, as well as voice and fax over IP technologies, makes it possible for cable operators to merge the currently separate voice and data networks typically used to connect a branch office to headquarters. Replacing multiple vendors and circuits with a single cable modem connection allows cable operators to deliver cost savings to the enterprise while benefiting from a new and highly profitable revenue stream. Using Cisco equipment, cable operators can charge on a per-service basis or, through QoS, guarantee levels of bandwidth at incremental rates based on the needs of the branch office. Ninety-nine percent of all corporate intranets in the Fortune 500 are built on Cisco technologies and products. Cisco can help ensure cable operators' success in this new market by leveraging its enterprise account presence to generate greater awareness of broadband remote access solutions.

Small and Medium-Sized Business Applications

Although tiny in comparison, small and medium-sized businesses have many of the same information technology needs of the largest enterprises. They require local area networks (LAN), LAN security, guaranteed level of Internet access speed (even during peak hours), Web page hosting, e-mail, and voice and fax solutions.

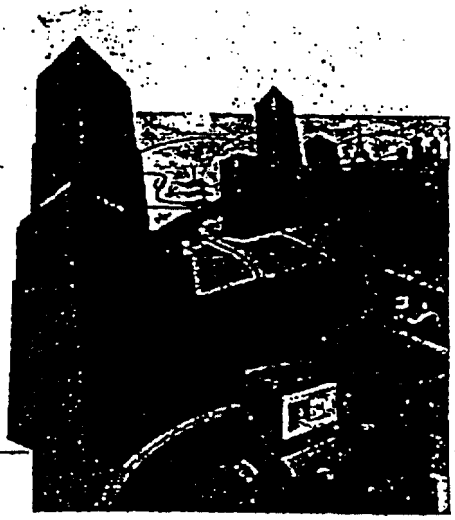
Cisco solutions give cable operators the power to address these needs (Figure 6). Cisco IP phones offer digital phone and voice-mail services over IP while the uBR904 cable modem provides a fully integrated firewall. Cisco can also leverage its strong presence with the value added reseller (VAR) community to help cable operators meet the needs of small and medium-sized businesses. At the same time, they seek their networking and computer solutions from value added resellers (VARs). This simplifies the buying experience for the end user and improves lead generation for the cable operator.

Figure 6: Small-Business Service



Strategic Concerns when Deploying an Integrated Multiservice Network

The hybrid-fiber-coax (HFC) network that cable operators have today is undoubtedly their single most strategic and valuable asset—one that should be maximized. In extracting the optimum value from their plant, operators must ensure that their cable network maximizes both revenue per subscriber and the number of subscribers and minimizes capital expenditures and operating costs. It should also help sustain their competitive edge by enabling cable operators to build a reputation for delivering best-in-class total service quality.



Maximizing Revenue Per Subscriber

One way to achieve high revenue per subscriber is by segmenting the market and charging what the market will bear within each market segment. It is not enough, however, for marketing to devise different service offerings. The network must be capable of supporting these offerings through meaningful policing and enforcement mechanisms.

Maximizing the Number of Subscribers

If cable operators build a high-speed network and offer very attractive prices, customer demand will skyrocket. But without the logistical capabilities to automatically provision cable modems into the network, adding new customers will be a slow and tedious process. In order to avoid this pitfall, scalability and advanced self-provisioning are needed, enabling customers to purchase a modem, plug it in, and subscribe immediately. The system should be sufficiently scalable with adequate capacity to handle large numbers of new users and should be capable of provisioning the new subscriber with as little operator intervention as possible.

Minimizing Capital Expenditures and Operating Costs

The cable modem rented out to the customer constitutes a large part of today's capital expenditures. To reduce this expense in the near term, the operator must be able to buy cable modems at the lowest possible price per unit based on rapid cost reductions as modem vendors ramp up to high-volume production. And in the medium to long term, operators must eliminate the capital expenditures for cable modems from their books entirely.

Cable operators incur large operating costs in three areas: truck rolls, customer support, and maintenance of the cable plant. The solution should support cable operators in minimizing their costs in these three areas.

Building and Sustaining a Competitive Edge

While maximizing revenue and minimizing costs is a desirable short-term goal, building a reputation for best-in-class service will boost customer retention and accelerate subscriber numbers through referrals from satisfied customers. Best-in-class service requires:

- Performance through a scalable system
- Reliability with minimal service outages ensured by reliable components and rapid fault resolution
- Security to protect the cable network and cable customer networks against malicious attacks and protect customer data through encryption services, even for multicast data

Efficient Provisioning of Advanced Services

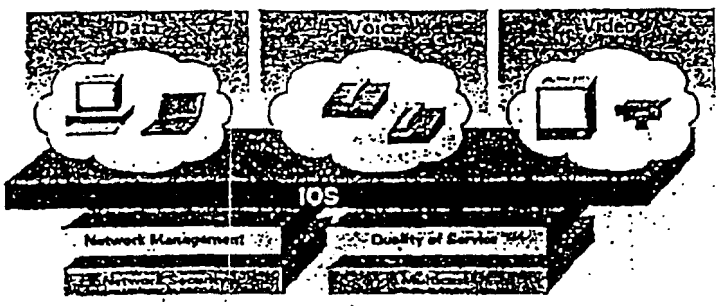
In deploying a multiservice network, delivering the right services to the right customers is fundamental in order to take advantage of the revenue opportunities outlined earlier. When a customer requests a new service, the operator must be able to deliver that service with minimal delay and minimal interruption to existing services.

In addition to offering superior responsiveness when delivering a new service, the operator must minimize the cost of delivering that service. This includes the reduction or elimination of truck rolls as well as the number of staff-hours required to provision the service in the back-office billing system—especially as the demand for service rapidly ramps up. Cisco helps operators address these issues through two key initiatives: integrating Layer 3 intelligence with Cisco IOS™ software and advanced billing and provisioning.

Integrating Intelligence with Cisco IOS Software

Cisco IOS software powers 80 percent of the Internet. IOS software allows cable operators today to seamlessly and efficiently deliver advanced services such as VPNs, VoIP, and multicast to their customers.

Figure 9: How Service Providers Deliver New Services over IOS



In addition, the QoS functionality that exists today in IOS software allows the operators to tailor the service to the needs of their customers. Operators are thus able to take control of what is happening in their network and provide meaningful restrictions to prevent some subscribers from impairing the service of others who may be paying a premium. This prevents the problems that other systems have today where a few bandwidth hogs can effectively "steal" service from others and cause network performance to suffer.

Because IOS software is tightly integrated into the Cisco equipment that resides at the headend, as well as in the rest of a Cisco network, delivering new services over IOS software will appear just as seamless to cable customers (Figure 9). As future revisions to IOS software become available, the delivery of new revenue-generating services becomes a simple matter of a software upgrade, thereby protecting the operator's system investment.

Advanced Billing and Provisioning with Cisco Network Registrar and NetFlow

While IOS software lets operators seamlessly integrate new services into their multiservice network, Cisco Network Registrar and NetFlow help efficiently monitor and bill for those services. Even in dynamic, nonlinear growth markets, such as the one predicted for broadband services, Cisco software technology lets cable operators easily scale their provisioning and billing to take full advantage of revenue opportunities.

Network Registrar is a highly scalable provisioning tool that helps manage customer information and the services to which they subscribe. This tool will ultimately enable customers to self-provision network services through a simple Web interface. This means that customers can simply purchase a modem, plug it in, and subscribe immediately with no operator intervention required (Figure 10). This will allow the installation to be performed without a truck roll, thus helping operators realize a substantial reduction in customer acquisition costs. In addition, the Cisco solution is highly scalable and has enough capacity to handle large numbers of new users.

Providing Best-in-Class Service Quality

A customer does not care why their network or telephone connection went down—they care only that it is down. For cable operators to remain competitive, they must provide highly-reliable, highly-available services equivalent to what customers expect from their telephone company.

Figure 12 illustrates the chain of equipment that must function flawlessly to provide the cable customer with quality service. Equipment, by its very nature, will break down. But a cable system should meet the following minimum requirements:

- Equipment that rarely fails
- Alarms that enable the operator to take action should equipment be on the verge of failing
- Easy-to-locate points of failure
- Easy-to-fix equipment to prevent or minimize disruption to the system

In addition, the system should be safe from human failure factors, such as hacker attacks or customer errors so that customers feel that their data is secure.

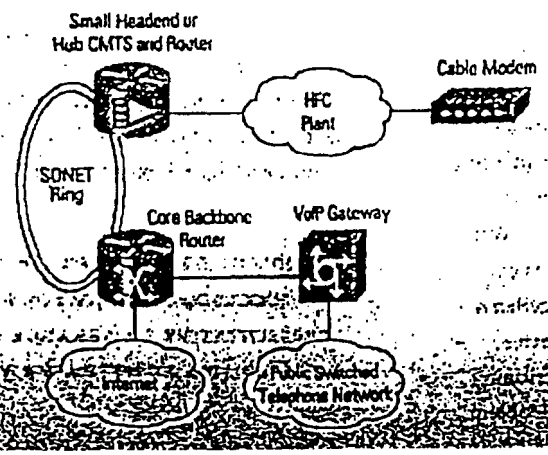
High Availability and Reliability in the Data Network

A reliable service is built from reliable equipment. Cisco offerings have enhanced hardware and software fail-safe reliability features with very high meantime between failure (MTBF) specifications. Software crashes may often be the most frequent cause of system failures, especially for systems with large quantities of untested and unproven code. Cisco products run on highly stable, time-proven IOS software, which is used by every level of Cisco products, all the way to the high-end Cisco routers that form the heart of the Internet.

Cisco dependability also extends to the hardware. Redundant power supplies as well as time-proven and stable hardware designs contribute to this stability, with field-replaceable, hot-swap capabilities for all cards, processors, and other components of the system.

Tying hardware and software together into a very high-availability system is the Hot Standby Routing Protocol (HSRP). Cisco is continually working on still higher standards of reliability and availability that will help cable operators move even further into new-age telecommunications.

Figure 12: Different Points of Failure within the Network



New Revenue Opportunities For Cable Operators From Streaming-Media Technology

COPY FOR YOUR INFORMATION

A Case for Leveraging IP Technologies in Implementing VoD

Summary

The demand for video media and audio entertainment, coupled with new forms of advertising and communication, is creatin exciting opportunities for cable operators. Cable operators are positioned to capture significant new revenue from services th stream media to the home. North American two-way cable modem subscribers are expected to surpass three million by the y 2002.[1] The term "streaming-media" is used to refer to audio or video that is "streamed" over a network. This technology, w originated on the Internet, augments the Motion Picture Experts Group (MPEG)2-TS-based digital video infrastructures that r operators are currently deploying.

Cable operators are positioned to be the first to offer advanced streaming-media services to TV sets and the first to creat broadband portals that can be TV- as well as PC-oriented. Incremental revenue gains for cable Multiple System Operators (M that develop streaming-media platforms will surpass the incremental costs of building out the necessary networks. In fact, streaming-media platforms will leverage much of the infrastructure that MSOs are putting in place for other services, such a high-speed data services, digital television services, and voice services.

This paper discusses the opportunities that streaming-media technologies offer for the cable operator, as well as the archite needed to support streaming-media services, and the economics of building out the required infrastructure and offering basic streaming-media services.

New Streaming-Media Technologies: Opportunities For MSOs

The Emergence of Streaming Video Technologies

Streaming-media technologies were developed on the Internet to enable users to view rich media (for example, audio, video, a on) without having to first download an entire piece of content. When this technology first emerged on the Internet in 1995, met with a great deal of skepticism. Many felt that there was no way that the Internet could carry even low-quality audio si Today, near-CD quality audio is available at many prominent Web sites, 50 million people have registered RealNetworks' RealPlayer, and streaming video is commonly available on the Internet, although at low (but rapidly improving) video quali

Now, with the infrastructure for high-speed data services already being deployed, the cable industry is positioned to har this trend to create services that combine on-demand, interactive, and broadcast services into a unique service offering. By of both on-demand services and broadcast services, cable operators can effectively differentiate themselves from competitive pro who can offer only on-demand delivery (for example, digital subscriber line [DSL]) or who can offer only broadcast services large footprint (for example, digital satellite).

1. Data Source: Cable Modem Information Center, Cable Modem Market Stats and Projections, April 1999.

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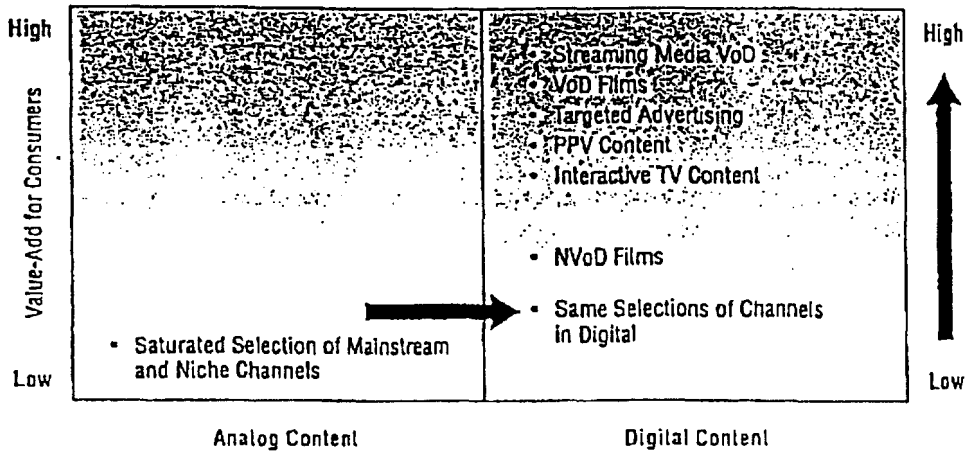
How Cable Operators Can Succeed in the Streaming Media Market

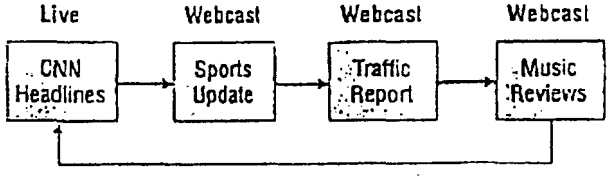
Cable operators will not be able to compete in this expanding market of broadcast, entertainment, and streaming-media simply by offering their traditional analog video content in digital form. The real value of broadband cable will be derived from a combination of broadcast video, on-demand video content, personalized content, and Internet content (Figure 1).[2] By adding personalized TV content to their traditional broadcast media, cable operators will be able to increase revenue from subscribers and increase advertising revenue through new forms of advertising.

Figure 1 Service Opportunities and the Value Proposition of Television



Personalized TV offerings leverage the flexibility of streaming-media to provide a customized service offering. Short video clips can be stored, assembled, and delivered to subscribers based on user profiles and requests; video content can be mixed with live broadcast TV and Web pages; and impulse e-commerce offers a fast, convenient way to purchase products via TV and the Internet (Figure 2).

Figure 2 Personalized TV Multitiered Service Offerings

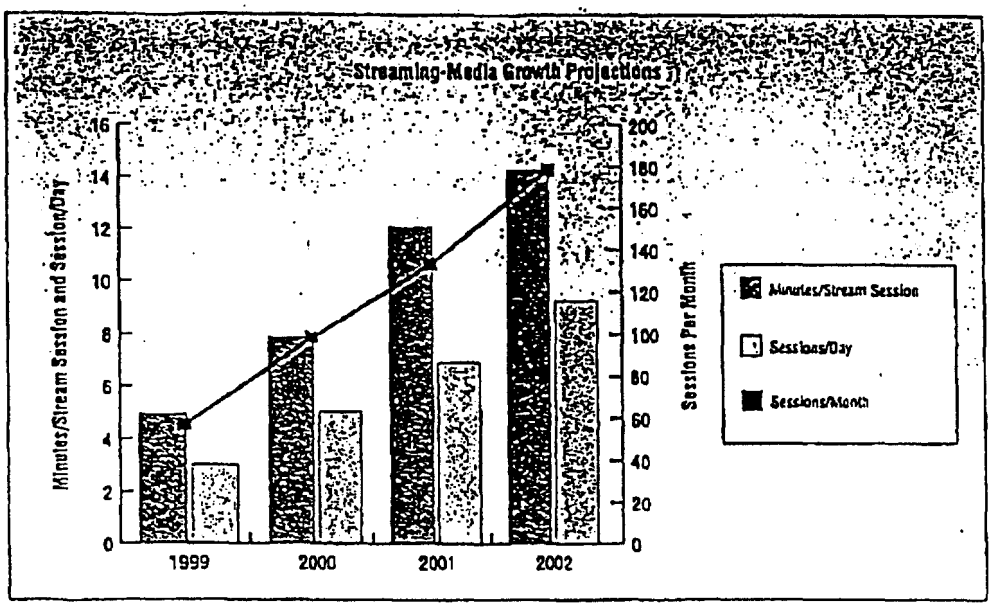


Growth Projections for Streaming Video

Growth projections for streaming-media and personalized TV content are impressive (Figure 3).[3] As consumers become acquainted with the service value of streaming-media, usage will increase rapidly. Today, streaming-media users watch an average of three sessions per day with a maximum video clip length of about five minutes. Over the next four years, the length of the video clips, and the frequency with which consumers watch them, is projected to increase by a factor of 2.5.

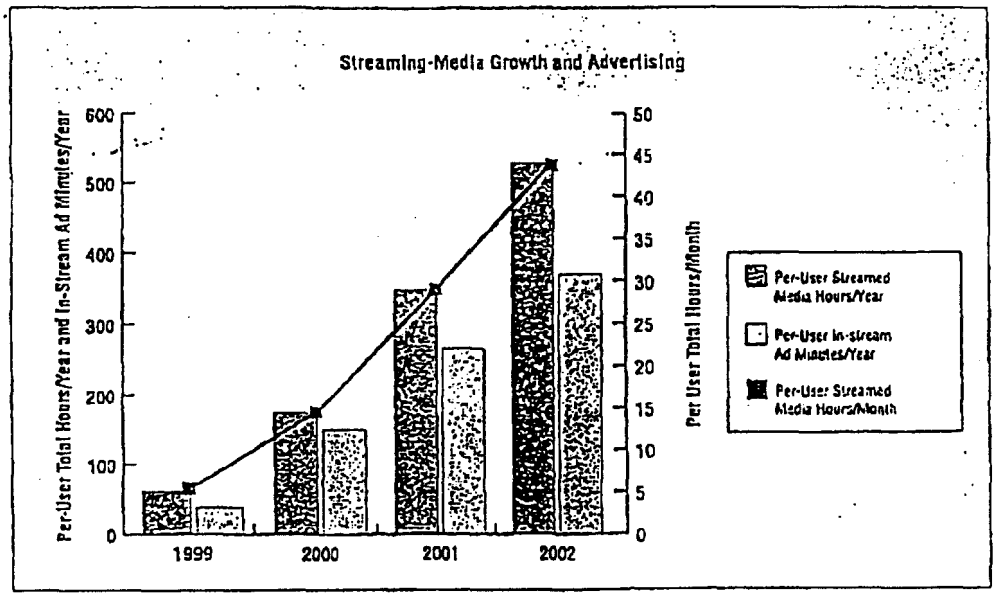
2. DataMonitor; Consumer Interactive Services through 2002, January 1999.
3. Data Source: Paul Kagan Associates Inc.; March 1999.

Figure 3 Streaming-Media Growth Projections



As the use of streaming-media services grows, advertising revenue will also grow. Per-user in-stream ad minutes are projected to increase rapidly from thirty five per year to over 377 per year by the year 2002 (Figure 4).[4] This increase represents a significant potential source of revenue for cable operators, because these ads can be easily targeted at specific types of consumers, resulting in significantly higher advertising rates.

Figure 4 Streaming-Media Growth and Advertising Projections



4. Data Source: Paul Kagan Associates Inc.; March 1999.
Cisco Systems Cable Solutions Marketing, March 1999.

The Impending Shift from PC-Oriented to TV-Oriented Media Streaming

Today, the delivery of streaming-media is PC-centric. MediaOne—New England Cable News (http://www.necnews.com), Broadcast.com, Roadrunner, FasTV, and other service providers are supplying value-added services and on-demand streaming-media content to PCs. Soon, however, these services will target TV. Cable operators will be able to offer a mix of streaming-media content that includes headline news, local/national/international news, weather, sports, entertainment, music, educational programming, and other services.

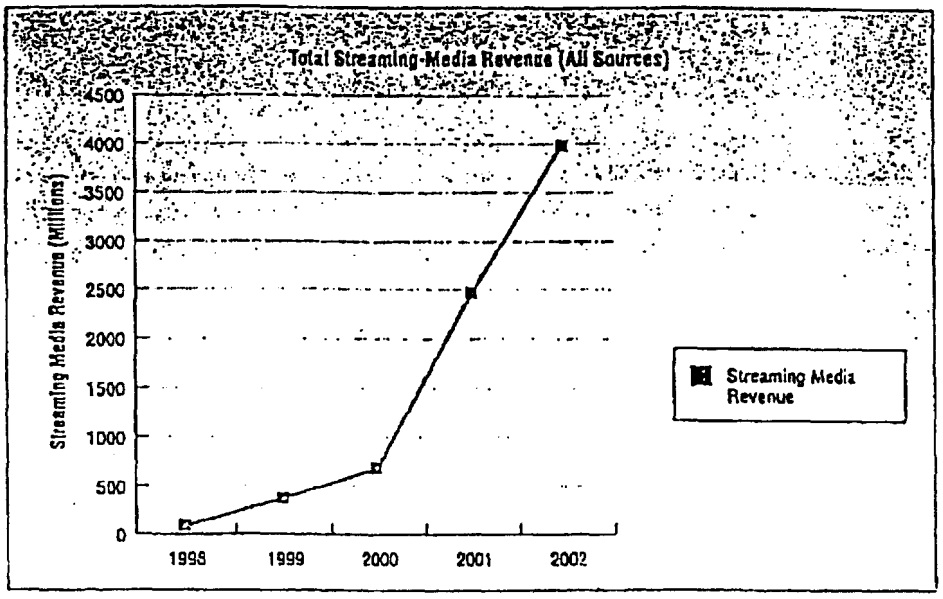
For example, a subscriber accesses a broadband portal (Figure 5) with many choices of on-demand content. The subscriber may access the entertainment section of the portal, read current music or entertainment news, watch a music video clip, buy the CD of the clip, and even buy the kinds of clothes that the artists in the video are wearing. As owner of the network, the cable operator can derive revenue from these service opportunities—higher subscriber fees, increased advertising, and percentages of commerce transactions.

Figure 5 Example of Broadband Portal (www.necnews.com)

Streaming-Media Revenue Projections

Total streaming-media revenue is projected to pass $4 billion by the year 2002 (Figure 6).[5]

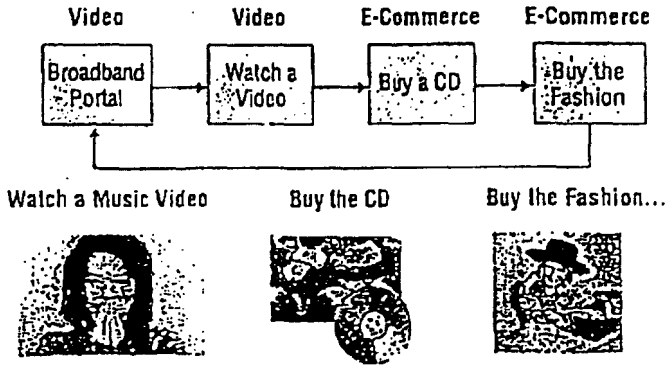
Figure 6 Total Streaming-Media Revenue 1998–2002



Cable operators can expect increased revenue from four major areas:

1. Higher subscription fees for advanced service offerings will result in increased revenue.
2. Revenue from MPEG2 broadcast-quality video-on-demand services delivered over an IP network can be realized.
3. E-commerce revenue associated with streaming-media-on-demand content can be gained; as an example: a subscriber accesses the cable operator's broadband portal on TV to watch entertainment videos or news. While watching music videos on demand, he or she can order a CD of the video with a mouseclick or click on the singer's outfit to buy it or find out which store sells it—Gap, Banana Republic; BeBe, for example (Figure 7).
4. Cable operators will generate advertising revenue based on Web portal ad revenue, targeted Internet ad revenue, and reverse ad revenue based on consumer pull rather than advertising push.

Figure 7 Example of Broadband Portal E-Commerce Opportunities



Additional Revenue from Related Services

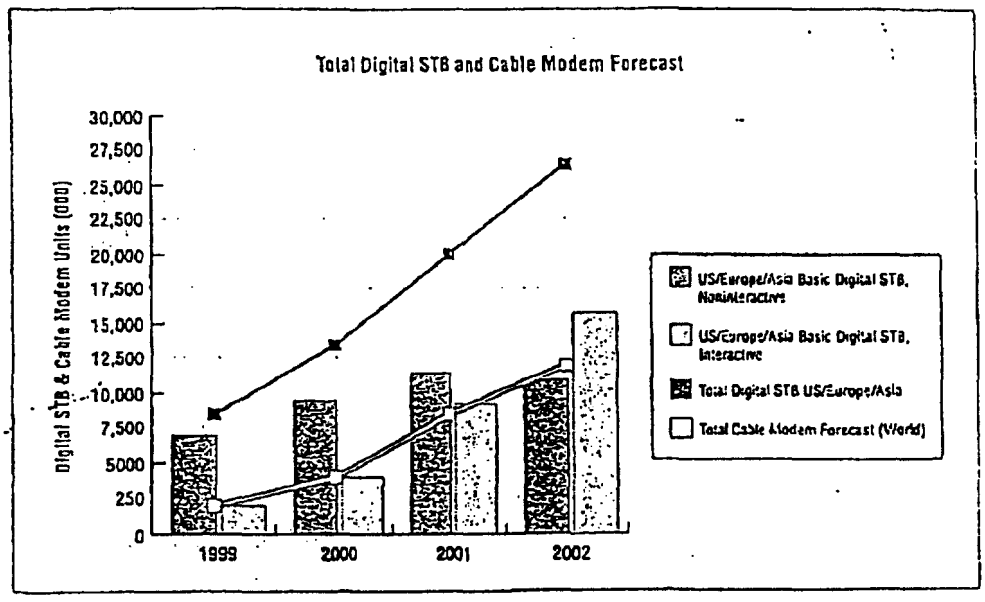
Cable operators that offer streaming-media services will be able to add many kinds of revenue-generating services through customized and on-demand media content. Some are obvious and offer a high value proposition, such as a personalized subscriber portal that offers news/video/information on demand (for example, New England Cable News, Broadcast.com, and Yahoo-type portals). Others include video on demand (VoD), enhanced video (ATVEF, or Advanced Television Enhancement Forum-type services), and Web surfing functionality, all of which can be controlled and managed by the cable operator.

The Streaming-Media Opportunity

The market potential for streaming-media services must match the potential numbers of interactive-capable set top boxes (STB) that can handle high-bandwidth services. Initially, digital STBs will be basic, with little to no Web surfing and interactive capability. By 2002, however, the increase of advanced, fully interactive digital STBs will surpass that of basic digital noninteractive boxes and reach over 15 million units worldwide (Figure 8).[6] It is worth noting that the installed base of advanced interactive STBs is forecast to surpass the installed base of cable modems by 2002. As network owners, cable operators will be uniquely positioned to attain mind and market share for traditional broadcast services as well as new interactive services such as streaming-media. VoD services in particular are expected to be very powerful revenue generators for cable operators.

The next two years are critical for this market. Cable operators must have a fundamental understanding of the economics of streaming-media on demand.

Figure 8 Worldwide Interactive Digital Set Top Box and Cable Modem Forecast

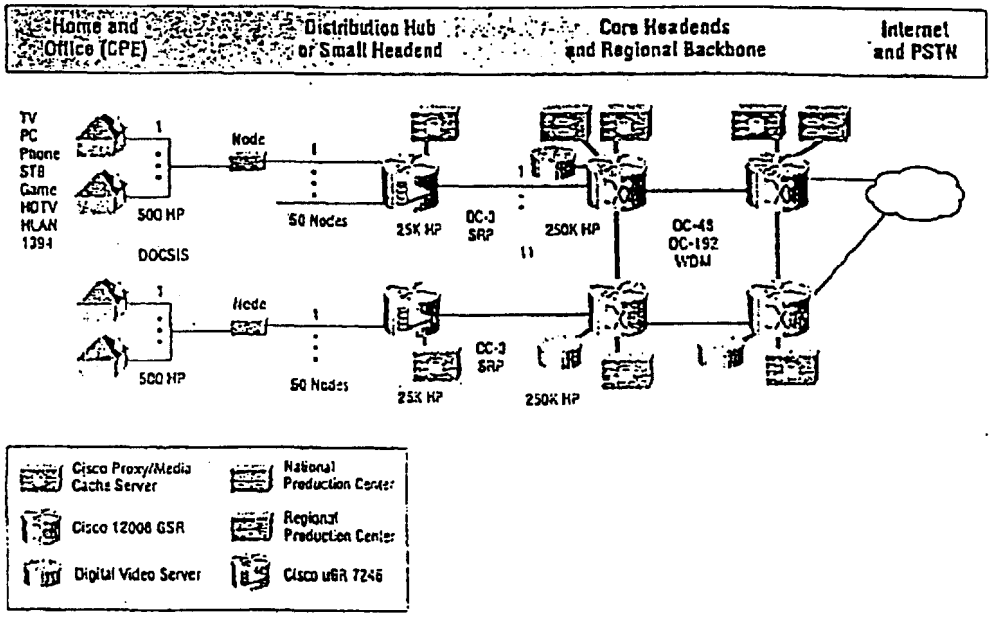


6. DataMonitor; Consumer Interactive Services through 2002, January 1999.
Inside Cable & Telecoms Europe, February 1999.
DataMonitor, Asia Digital Set Top Box Market, January 1999.
Cisco Systems Cable Solutions Marketing, March 1999.

Streaming-Media Architecture for Cable Operators

The architecture for streaming-media networks leverages many of the same components that cable operators are already building out for advanced data services (Figure 9).[7] The basic components of the existing high-speed data network and the streaming-media-capable network include high-speed gigabit switch routers (such as the Cisco 12000 series gigabit switch router) for the core headends and regional backbone, proxy and media cache servers for distributed content, cable modem termination systems (CMTS) or other RF-enabled edge routing functionality to connect the hybrid-fiber coaxial (HFC) network to the core IP network (Cisco uBR7200 series universal broadband router), and streaming-media technologies in customer premises devices. Streaming-media over an IP network is achievable today with existing products and technologies from Cisco Systems.

Figure 9 Architecture for a High-Speed Data and Streaming-Media Service



On the network side, cable operators will need to add media servers, cache engines, and clients. On the consumer side, digital set-top boxes must have the capability to handle streaming-media. STBs with IP connections and the ability to transfer content efficiently from the IP connection to the digital signal processor (DSP) hardware (MPEG decoding capability, for example) will be required. Some STB manufacturers are currently integrating this capability, which typically adds very little to no cost, into future designs.

7. Cisco Systems Cable Solutions Marketing, March 1999.

Service Availability: "Stay Home Happy"

One of the worst experiences customers can experience is a "busy signal" indicating that they cannot receive the service that they would like to because of a lack of resources. (Hence Blockbuster Video's campaign "Go Home Happy"—the analogy to the server or network being "busy" when you want to watch a video is Blockbuster being out of the movie that you would like to watch.) Streaming-media architecture addresses this problem in two critical ways. First, the flexibility of an IP network means that streaming content can be brought from other servers if a server happens to be busy. IP networks also automatically route around congestion, so if there is an alternative route around a congested link, the content is still delivered.

The second way that this architecture addresses this problem is through economies of scope. Because resources can be shared across multiple services (for example, streaming-media, high-speed data, voice over IP), it is less likely that service will need to be refused during a particularly busy time for a particular service. For example, if an unusually large number of people are ordering VoD movies at a particular time, resources can be borrowed from other services in order to meet immediate VoD demand. When compared with needing to statically allocate resources among services and overprovision each service, this approach provides a much more efficient way to manage network resources.

Streaming-Media Standards

One of the advantages that streaming-media can offer is the ability for a wide variety of IP-enabled devices to be able to deliver streaming-media services. To realize this advantage, it is critical that strong standards be established for streaming-media. Fortunately, numerous important standards have been established in this area. Of central importance is the Real-Time Protocol (RTP) and Real-Time Control Protocol (RTCP). RTP defines a packet format for transmitting real-time data (such as streaming-media) on IP networks; it was defined by the Internet Engineering Task Force (IETF) in January 1996 (RFC 1889). RTCP defines a control protocol for RTP sessions, and is also defined in IETF RFC 1889.

Video-specific standards have also been established, augmenting the general real-time capabilities in RTP. IETF RFC 2250 defines standardized ways of transporting system, program, transport, elemental streams using RTP.

Together, these standards provide a framework for delivering MPEG video in a standardized way across IP networks.

Quality Of Service And Network Control

Two of the biggest technical concerns for cable operators in offering streaming-media services to subscribers are quality of service (QoS) and control of content flow across the network. Both can be ensured with existing Cisco products and technologies.

Quality of Service

QoS for the cable network encompasses four main areas: network engineering, identifying traffic types, admission control and policing, and preferential queuing:

- Network engineering—The network must be engineered to allow for specifying and predicting application traffic as well as deriving link bandwidth requirements.
- Identifying traffic types—Cisco products give cable operators the ability to identify and distinguish traffic types by application, such as Web, e-mail, voice, or streaming video; by user, via interface or address; or by the type of Internet protocol used.
- Admission control and policing—Admission control refers to decisions on whether the network can support a specific application. Policing ensures that the application honors its reservation.
- Preferential queuing—Cable operators can establish priority for the bits that flow through the network. For example, e-mail and Web traffic are very tolerant of delays and packet drops within the network. Voice and video are not, and must receive priority.

With current technologies, engineering a network to deliver streaming-video services of extremely high quality is not a technical problem. It is simply a matter of economics and good network design.

Controlling Streaming-Media

Cable operators need to design intelligent networks that can distinguish flows and treat them differently. They can design high-speed data networks that permit control of streaming-media content flow—the flow of incoming content from other networks (the Internet, for example) and flows within the network (to differentiate services). Committed access rate (CAR) is an example of the technologies that are used to control the flow of content into and out of networks. Using CAR, a cable operator can define specific types of traffic and control how much bandwidth they consume.

Cable operators must build into the network the ability to monitor network traffic in detail. As new applications emerge, cable operators can capitalize on innovation by monitoring network usage and developing new services around these applications. The Cisco Systems NetFlow technology is an example of the products that exist today that can monitor traffic patterns and technology in detail.

Economics Of Streaming-Media Networks

On the network side, the only real costs to a cable MSO for streaming-media capability are incremental costs for additional routers, servers, and cache engines within the network. On the equipment side, the basic needs for streaming-media services (including VoD services) are video servers, systems management and modulation systems, network infrastructure (which includes routing and caching), and STB capability to demodulate the video streams.

The economics for streaming over an IP network are advantageous—especially since each cost for video delivery via IP is an incremental cost to a cable operator who is already building out the cable infrastructure for high-speed data services. By equipping the network to deliver streaming-media services, cable operators are positioned to generate revenue not only from traditional VoD services but also from streaming-media portal revenue (commerce and advertising) and high-speed data services. By building a single network instead of two (one for VoD and one for data), cable operators can create a cost-competitive network design that can be built out incrementally as streaming-media services grow.

As an example, assume that in a hypothetical video streaming operation each video stream runs at 3 Mbps at QAM 256 modulation, meaning that each QAM 256 channel can accommodate 12 video streams. Our hypothetical cable headend has 160,000 basic subscribers, of which 80,000 have digital set top boxes. We will assume that 50 percent of those homes—40,000 subscribers—use VoD service. We will also assume that peak usage patterns for VoD are 10 percent. For planning purposes, therefore, the system requires 4,000 video streams. In the business model below (Table 1 and Table 2, on the following page), the payback period is very reasonable from the cable operator's perspective. It would equal 2.2 years if VoD were implemented today with existing equipment. With Moore's Law and the rapid maturity of Data over Cable System Interface Specifications (DOCSIS) technology, the payback period shrinks to 1.6 years by the year 2000.

Table 1 Cisco VoD Model and Cash Flow[8]

Cisco VoD Model	
VoD Cable System Assumptions	
Homes Passed	200,000
Basic Penetration	80%
Basic Subs	160,000
Digital Penetration	40%
Digital Homes	80,000
VoD Penetration (percentage of digital homes)	50%
VoD Homes	40,000
Peak VoD Usage	10%
Streams Needed	4,000
Capacity (Mbps) per DOCSIS Downstream	38
Movie Encode Rate (Mbps)	3
VoD Model Economics and Cash Flow	
Average Nonadult Rental	$3.95
Nonadult Market Share	85%
Average Adult Rental	$5.95
Weighted Average Rental	$4.25
Studio Split (nonadult)	55%
Studio Split (adult)	35%
Weighted Studio Split	52%
Average VoD Buys Per Month	3.5
New Titles Per Month	10
Processing Cost Per New Title	$3,000
Bad Debt Assumption	2%
Annual Gross VoD Revenue	$7,140,000
Bad Debt	$(142,800)
Annual Net VoD Revenue	$6,997,200
VoD Revenue Per Household (before studio split)	$14.58
Studio Split Payments (annual)	$3,712,800
New Title Processing Costs (annual)	$360,000
Total Operating Costs	$4,072,800
VoD Cash Flow	$2,924,400
VoD Cash Flow Margin	41%

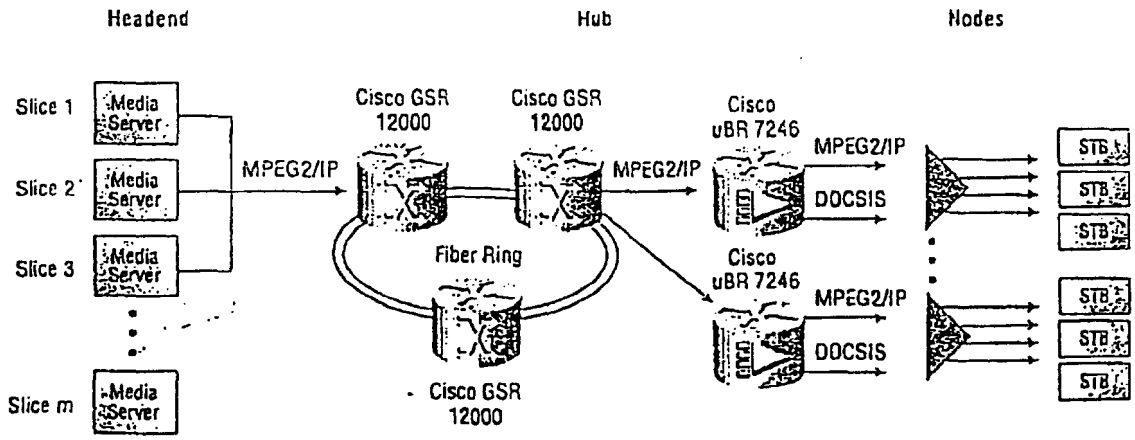
8. VoD Investor, December 8, 1998.

Table 2 Cisco VoD Capital Expenditures[9]

Capital Expenditures	Streaming-Media Solution Today	Streaming-Media Solution 6-9 Months
Video Server Cost/Stream	$300	$300
Upconverters Cost/Stream	$100	$100
Transport Cost/Stream	$200	$150
Modulation Cost/Stream	$1,000	$500
Total Cost per Stream per Subscriber	$1,600	$1,115
Total Equipment Cost	$6,400,000	$4,600,000
Total Capital Costs	$6,400,000	$4,600,000
Payback (Years)	2.2	1.6

The cost of a streaming-media video-on-demand solution will depend on the incremental costs of moving the video through the network to subscribers. In our example architecture, this means Cisco gigabit switch routers (GSRs), the Cisco uBR 7246 universal broadband router, and upconverters (Figure 10).

Figure 10 Streaming-Media VoD Architecture



An advantage of this solution is that it is incremental. Cable operators are already building out the cable infrastructure for delivery of high-speed data services. The incremental costs for routing, servers, and cache components to transport video through an IP network is reasonable today. The economics will only get better as Moore's Law continues to drive equipment prices downward.

It should be noted that this network can be used for any streaming-media services cable operators may want to deploy in the future. Cable operators can build out their networks incrementally as demand and capacity increase. They also have a network advantage, because the data and video services operate over the same network and use the same equipment.

For cable operators who plan to deliver streaming-media services in addition to traditional broadcast programming, the future is very promising. Moore's Law will continue to make network bandwidth cheaper for the foreseeable future. In any case, a cable plant is capable of more than 3Gbps per node. The economics of HFC bandwidth should, therefore, not hinder the delivery of on-demand services to consumers.

9. VoD Investor, December 8, 1998.

Conclusion

The cable industry is in a state of rapid transition from the old-world, closed-system model that offers broadcast television programming to a new world driven by competition and choice. Good planning and network design will ensure that streaming-media is not a threat to cable operators, but a new platform for the easy deployment of highly customized and valued on-demand content and services. Streaming-media services will complement the digital video deployments of the cable industry.

A streaming-media platform will be a source of sustainable advantage against operators with lower effective bandwidth to the home, as well as newer broadband portal companies that are vying for cable-subscriber mind and market share. The economics for streaming-media look reasonable and will continue to ride a steep curve as Moore's Law continues to impact network equipment costs and performance. Streaming media will evolve from being strictly PC-oriented today to TV-centric tomorrow. Cable operators are in a unique position to capitalize on this trend by creating a set of valued services for residential users. Cisco products and services can help them to succeed in this enterprise.

For more information about Cisco Cable Products and Solutions, visit us on the Web at: www.cisco.com/cable.

Data Source

1. DataMonitor; Consumer Interactive Services through 2002, January 1999.
2. Inside Cable & Telecoms Europe, February 1999.
3. DataMonitor, Asia Digital Set Top Box Market, January 1999.
4. Data Source: Cable Modem Information Center, Cable Modem Market Stats and Projections, April 1999.
5. Data Source: Paul Kagan Associates Inc.; March 1999.
6. Cisco Systems Cable Solutions Marketing, March 1999.
7. VoD Investor, December 8, 1998.

Cisco Systems

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

European Headquarters
Cisco Systems Europe s.a.r.l.
Parc Evolic, Batiment L1/L2
16 Avenue du Quebec
Villebon, BP 706
91961 Courtaboeuf Cedex
France
http://www-europe.cisco.com
Tel: 33 1 69 18 61 00
Fax: 33 1 69 28 83 26

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

Asia Headquarters
Nihon Cisco Systems K.K.
Fuji Building, 9th Floor
3-2-3 Marunouchi
Chiyoda-ku, Tokyo 100
Japan
http://www.cisco.com
Tel: 81 3 5219 6250
Fax: 81 3 5219 6001

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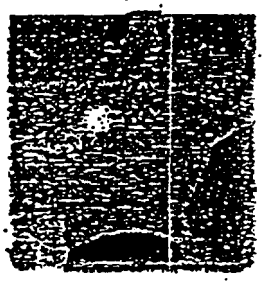


@HOME NETWORK DELIVERS HIGH-SPEED INTERACTIVE SERVICES USING THE CABLE PLANT INFRASTRUCTURE AND ITS OWN NETWORK ARCHITECTURE. OFFERING INFORMATION SOLUTIONS FOR CABLE OPERATORS, MEDIA COMPANIES, BUSINESSES, AND RESIDENTIAL CUSTOMERS, THE @HOME NETWORK GIVES HIGH-SPEED, "ALWAYS-ON" ACCESS TO DATA SERVICES, THE INTERNET, MEDIA-RICH APPLICATIONS, AND CONSUMER-FRIENDLY CONTENT.

Less than five years old, @Home Network currently serves more than 500,000 cable subscribers. Through its @Home partners, @Home can claim exclusive access to more than half of all cable homes passed in North America. The company attributes much of its success to the design and implementation of a flexible, highly scalable network. This carrier-class design, using networking equipment from Cisco Systems, helps @Home easily modify and expand its service offerings to continually leverage the latest in technology and market opportunities.

Background

From its beginnings, @Home planned to differentiate itself by building a high-performance platform capable of multiple-service delivery. Milo Medin, @Home Network's Senior Vice President and Chief Technical Officer explains: "It would be foolish for anybody in this business to predict which products will be most successful in five years. So what we tried to do was to create a general-purpose platform that allows new services to evolve—a platform on which operators can easily try out new service models."

Challenge

"To be successful rolling out cable data services for Internet browsing as well as for all of the other potential services," Medin continues, "you really have to have a flexible, IP-centric platform that's operating across the hybrid fiber coaxial (HFC) plant. And, consumers expect the service to be a utility, so it must be of high quality, highly reliable, and maintainable. The big challenge before our company is all about execution—delivering on the value proposition to the customer."

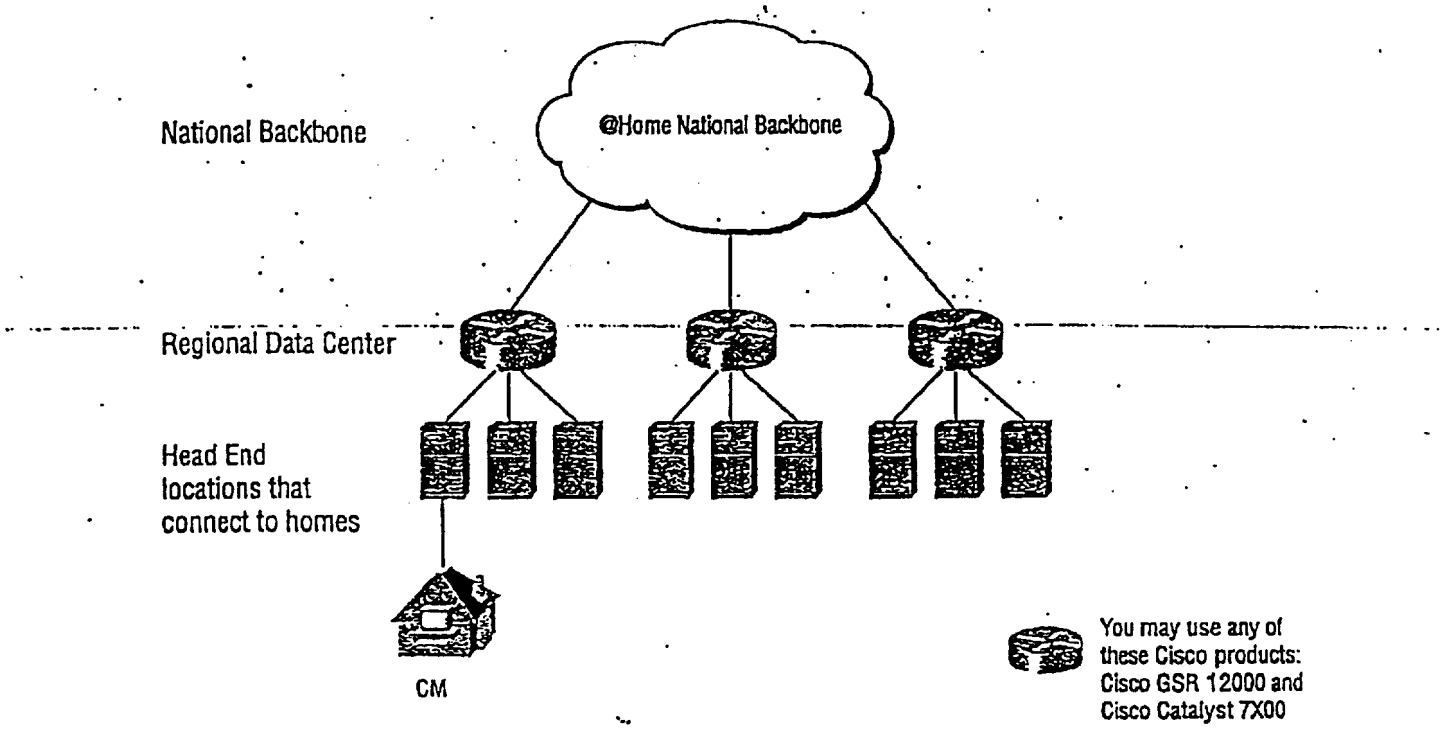
> "CISCO'S RELIABLE PLATFORM AND INTERNET-AWARE SOFTWARE HAS ALLOWED US TO DEPLOY AN EFFECTIVE DOCSIS INFRASTRUCTURE. CISCO'S WORK WITH STANDARDS GROUPS AND OTHER PROVIDERS IN THE CABLE MODEM SPACE ALSO ENSURES THAT AVAILABLE SOLUTIONS DELIVER NOT JUST WEB BROWSING, BUT A WHOLE HOST OF SERVICES ON TOP OF THE INTERNET-CAPABLE DATA INFRASTRUCTURE."
>
> *—Milo Medin*
> *@Home Network*
> *Senior Vice President*
> *and Chief Technical Officer*

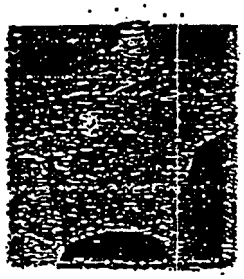
Solution

Two key themes differentiate @Home's network strategy. First, the company chose to implement a hierarchical, distributed network architecture that uses special caching and replication techniques to ensure that information is always as close as possible to the customer. Second, @Home designed its systems to provide proactive, end-to-end network management with visibility from the @Home or partner servers all the way to the customer PC.

To accomplish these goals, @Home looked to Cisco Systems to provide intelligent networking equipment as well as IP expertise to help implement the networking strategy. Built on a Cisco router backbone, the @Home network now incorporates a full span of Cisco equipment, including gigabit switch routers, high-end core routers, Cisco Ethernet switches, and Cisco customer premise router equipment "To manage the customer experience from end to end, we believe you have to have an end-to-end architecture," Medin remarks. "It simplifies the problem and lets us deliver advanced services that would be virtually impossible to deliver with a fragmented system connected by a generic Internet provider backbone." (See figure 1)

Figure 1 @Home Backbone Architecture





ROAD RUNNER, THE NATION'S LARGEST HIGH-SPEED ONLINE SERVICE, IS BUILDING TO MEET THE EXPANDING GROWTH OF ITS BROADBAND SERVICE. THE RAPIDLY GROWING ONLINE PROVIDER PLANS TO ENHANCE SERVICE REGISTRATION AND ACTIVATION FOR NEW SUBSCRIBERS THIS YEAR. NEW AUTOPROVISIONING AND SELF-PROVISIONING SOLUTIONS FROM CISCO SYSTEMS, INC. WILL PROVIDE THE FOUNDATION FOR THESE ENHANCEMENTS.

Road Runner's new autoprovisioning solution will help ensure customers have faster, easier access to personalized Road Runner multimedia content, communications services, and entertainment applications. With Cisco Subscriber Registration Center (CSRC) users will eventually be able to subscribe to services, select service levels, and activate their registration instantly—all without operator intervention.

CSRC is a key element in Road Runner's growth and business plans. With CSRC new Road Runner subscribers will register instantly without scheduling in-home technician visits to set up and install the product. For Road Runner the savings from reduced truck rolls, technician time, and customer revisits are significant. For the users the eventual instant fulfillment will further reinforce the unique out-of-box Road Runner experience.

CSRC ENABLES NEW CUSTOMER SELF INSTALLATION AND PROVISIONING WHILE SUPPORTING ROAD RUNNER'S CONTINUING GROWTH AND HIGH SATISFACTION GOALS.

Background

Road Runner high-speed online services are provided by a joint venture ServiceCo LLC of Time Warner, Inc., MediaOne Group, Inc., Microsoft Corporation, Compaq Corporation, and Advance/Newhouse. This venture combines the resources and talent of five world leaders in media, broadband networking, computer software, and personal computing. The compelling personalized multimedia experience Road Runner has created is delivered via affiliate hybrid fiber-coaxial cable networks nationwide.

Challenge

Road Runner is growing quickly. Maintaining very high customer satisfaction levels in any fast-growing enterprise is challenging. For Road Runner the key is to sustain and improve those satisfaction levels while reaching mass market penetration levels. To achieve these goals a strategy using automated self-provisioning and supporting retail channels was chosen.

Solution

The Road Runner team selected the Cisco CSRC solution to meet its goals. CSRC is a powerful subscriber-centric solution that enables mass-market deployments using subscriber self-registration and activation.

With CSRC users can eventually purchase a modem, set-top, or other broadband appliance, carry it home, and self-install their device and service. Secure, easy-to-use Web-based interfaces enable the registration and configuration of their device to support a selected service level. End-to-end security features eliminate theft of service, spoofing, and other potential quality-of-service (QoS) issues.

CSRC is an integrated middleware solution for broadband service providers built to enable mass-market rollouts. CSRC automates broadband appliance provisioning for modems, set-top boxes, thin clients, game players, hybrid fiber coax (HFC) telephony, and other devices. The system seamlessly integrates with most traditional cable operational support and billing systems. Support for conditional access systems is also planned.

The solution is an open, modular, carrier-class platform for broadband operators. CSRC is also a directory-enabled solution that works with either Cisco Network Services for Active Directory (CNS/AD) or industry-standard Lightweight Directory Access Protocol (LDAP) Version 3 servers.