WHITE PAPER

SERVICE CONTROL: THE NEXT STEP IN NETWORKING FOR CABLE OPERATORS

INTRODUCTION

Having successfully deployed high-speed cable modem service to millions of homes, cable operators now must move beyond providing commodity broadband access by introducing differentiated services and implementing the service control necessary to fully manage delivery over their broadband infrastructure. This paper describes the challenges the cable industry faces in moving toward intelligent, service control-enabled networks, and explains the requirements for meeting those challenges.

THE THREE PHASES OF BROADBAND IP SERVICE DEPLOYMENT

The cable industry has been at the forefront of building the broadband services industry. Since the mid-1990s it has made the investments necessary to upgrade the local plant to support two-way transmission, and cable is one of the primary access technologies behind the adoption of broadband services in the United States. Morgan Stanley Research estimates that cable accounts for 68 percent of the U.S. broadband market, and National Cable & Telecommunications Association data shows 17.3 million U.S. cable modem subscribers at the end of March 2004.

But subscriber growth alone will not sustain cable industry profits. Regional Bell operating companies (RBOCs), incumbent local exchange carriers (ILECs), satellite operators, and other competitors compete for the same subscribers. Cable operators must find ways to increase network efficiency and increase average revenue per user (ARPU) with new services such as IP telephony, video on demand (VoD), and interactive gaming. But to deliver these high demand dynamic services requires an intelligent network with IP service control.

The deployment of IP broadband services is taking place in three phases:

- Phase 1—Historical: Deployment of two-way networks that deliver basic connectivity.
- Phase 2—Current: Scaling DOCSIS networks and deployment of intelligent broadband management tools to enable the layering of additional IP services.
- Phase 3—Future: Leverage service control enabled networks to optimize network resources and revenue opportunities through bundling, highly adaptive bandwidth techniques and increased customer choice.

The challenge for cable operators today is to add the IP service awareness and control capabilities they need for phases 2 and 3 to address the next generation of IP service requirements, while optimizing their ability to manage network resources and leverage existing investment.

CABLE INDUSTRY BROADBAND SERVICE CHALLENGES

Although the growth of cable broadband data services has been impressive, the industry is facing challenging operational issues stemming from its very success as a result of rapidly expanding service growth. Data throughput use per subscriber is growing rapidly, and the character of that use is shifting. Meanwhile, operators are functioning without the operational information they need to make informed policy decisions, or to accurately capture revenue from subscribers whose applications and usage levels vary widely.

Managing Abuse and Unanticipated Use of Current Service

Data throughput consumption is growing out of proportion to subscriber growth. Operators are experiencing strains in their local hybrid fiber-coaxial (HFC), regional, and backbone networks. Although data throughput use is growing rapidly on a per-subscriber basis, a small percentage of the subscriber base is directing that usage and skewing peak load requirements—as few as 20 percent of subscribers are using as much as 80 percent of the capacity in some networks. With the current "all-you-can-eat" product offering, operators are facing rapidly increasing infrastructure costs without being able to extract more revenue. For operators to be successful in the long term, they need to either control that usage or use it effectively for profit.

Individual subscriber use of broadband service varies dramatically. Although most consumers may be using the service to access the Web and send and receive e-mail, others are using it to telecommute. Another subset of users are hosting Web servers, and still others are setting up always-on peer-to-peer (P2P) connections that introduce substantial automated load into the network. Most cable-operator acceptable use policies (AUPs) for high-speed data service require the service be used for residential, noncommercial activity. But that policy carries little weight for the following reasons:

- Today's cable networks offer limited mechanisms for identifying per-user or -application data-throughput usage.
- Even when data throughput abusive users are identified, operators often lack the resources to manually enforce AUPs.
- Operators do not have the hardware and software solutions in place to dynamically track and monitor IP traffic and enforce AUPs.

To date, operators have simply increased data capacity to address the problem, a costly and largely ineffective approach since P2P users would quickly consume the additional capacity.

The real need is to understand individual subscriber usage levels and to assign services and rates accordingly. Without accurate and detailed data about how customers are using the service and without the tools to enforce policy decisions or influence subscriber behavior, operators have little ability to manage their networks or optimize their return on investments. Cable operators need service control's subscriber and application awareness capabilities to control abuse, enforce policies, and profit from the traffic that heavy users generate.

Subscriber-Base Growth and Churn

To move away from commodity pricing and services, cable operators must find ways to precisely segment subscribers by measurable criteria. Most operators are currently experimenting with simple "fixed" tiering, which is a basic method for segmenting subscribers. Fixed tiering has only indirect effects on high data traffic, and it is inexact in its ability to steer customers into the appropriate tier based on how intensively they consume network resources. In addition, with a subscriber's bandwidth being fixed at specific levels, when that subscriber is not using the entire allocation the bandwidth cannot be leveraged by the operator for other revenue-generating services.

For example, peer-to-peer media-sharing applications such as KaZaA can use substantial network resources (especially on the upstream) because they take advantage of the always-on nature of the network and permit other KaZaA customers to access files constantly. The service works fine (although somewhat more slowly) with lower data rate tiers, but the same level of traffic is generated over a longer period of time, thereby increasing network load. As a result, subscribers could pay less for a lower tier of service, while at the same time introducing more load and thus more cost into the system.

To successfully manage widely varying levels of customer data throughput while adjusting revenue levels accordingly, cable operators need real-time network usage awareness and control at the customer and IP application levels.

Deploying and Scaling New Services

As operators gain better control of their services to increase revenue from existing offerings, they must also develop the capability to rapidly deploy and bill for new services such as VoD, voice over IP (VoIP), interactive gaming, videoconferencing, peer-to-peer applications, IP security and URL filtering on a dynamic personalized basis. Ideally, subscribers should be able to select additional services at their convenience, and pay only for the service they use.

For example, if subscribers want an additional two hours of high throughput for downloading, they should be able to request it and receive it immediately, and the service control system should automatically generate a usage record that ensures proper billing for the upgrade. By implementing such self-provisioned services, operators can also ease the task of segmenting their subscriber base by allowing users to self-segment through their own service activations and upgrades.

Service Awareness and Control

Cable operators have little trouble recognizing the need for service awareness and control, but implementing these capabilities has been labor intensive and expensive. Many cable operators remain strongly focused on subscriber growth, and their network development resources are focused on connecting new customers, initiating flat-rate billing for those subscribers, and keeping existing services running. A service control solution must be extremely easy to implement and manage.

In today's market, numerous vendors offer partial service control solutions. Some systems enable usage metering and billing. Others offer subscriber management, and still others offer rate shaping, load balancing, or other features. But to gain maximum service awareness and control at the lowest possible cost, operators should look for a single, integrated solution that offers a broad set of features that can scale to meet rapidly changing subscriber network demands.

SERVICE CONTROL SOLUTION REQUIREMENTS

Consumers do not naturally think of a broadband connection in terms of performance levels, but rather in terms of the applications they run and the tasks they accomplish. Cable operators should look for service control solutions that dynamically permit highly granular adjustments of service and billing levels by application or task. By reorienting service delivery around applications rather than speeds and feeds, operators can more easily shape subscriber purchasing and usage behavior into tiers that more accurately reflect the network resource demands. To achieve this level of service differentiation, a service control solution needs to:

- Be highly IP intelligent and scalable
- Define/monitor/enforce service plans based on applications and usage
- Quickly deploy and adapt services to meet changing demands
- Monitor and enforce usage within the service parameters
- Provide detailed real-time data per-subscriber usage monitoring and service billing

Although some solutions can assist an operator in controlling simple data flows, most of today's products have little intelligence and no ability to control traffic based on the individual subscriber's application usage. A comprehensive solution must classify—in real time—the content of an application that generates a traffic flow, associate it with a given subscriber, and apply policies as defined by the operator.

Application Awareness

A comprehensive service control solution allows the operator to track all subscriber data flows and categorize them in terms of protocol used (for example, FTP, HTTP, RSTP, etc.) and application accessed (for example, e-mail, Web browsing, video, voice). Most products rely on sampling techniques that capture only a percentage of critical data. Sampling may provide useful marketing data, but it is insufficient for managing policy compliance and service billing.

Many solutions on the market today enable operators to track and control the actual volume of bits flowing across the network, but they are blind to what protocols are being used and what type of application data is being transferred. As a result, these protocol-blind products cannot provide operators with the level of real-time control they need to create fully personalized service offerings for their customers.

High Performance

Application awareness is an asset only if it does not impact overall network performance. A viable service control solution should be able to process network traffic at line rate speeds suitable for the access network—for instance, 1 gigabit or higher— and fast enough to sit upstream from the cable modem termination system (CMTS), which is the logical place to monitor and control network flows. For true scalability, a hardware-based modular implementation is ideal, allowing service providers to simply add interface cards to support new users as their subscriber base grows and changes.

Open Architecture

Any viable service control solution must be deployable quickly without requiring significant network changes. The simplest way is to implement service control and awareness in a stand-alone network element that monitors and regulates traffic flows independently of other network elements. The solution should be fully interoperable with virtually all other IP networking equipment, and it should include standards-based interfaces that enable integration with third-party applications for billing, provisioning, and service-level agreement (SLA) packages, as well as middleware and custom operations support system (OSS) solutions.

Programmability

To give operators the service deployment velocity and flexibility they need to quickly identify and adapt to new types of traffic and services as they emerge, the service control solution should be fully programmable and extensible with an object-oriented language that enjoys broad support among the vendor community.

SERVICE CONTROL APPLICATIONS

With a service control solution, cable operators can better analyze and report overall service uses, manage aggregate network traffic more efficiently, guarantee levels of service for specific classes of customers or applications, implement per-subscriber security, easily deploy and manage QoS-based services, and create customized products for their subscribers.

Usage Analysis and Reporting

Cable operators can use service control solutions to help them better understand the characteristics of subscriber consumption of network resources without taking any automated action based on that information. Such information, collected using stateful deep packet inspection techniques, can help in future network planning, and can help operators identify the need for services or upgrade packages.

Service control supports service provider profitability by continuously gathering exact information about network traffic and application data throughput and reporting on their usage. Using strategically placed network elements that monitor applications and traffic in real time, the service control solution can examine applications and their underlying protocols, as well as subscriber use patterns by individual application or traffic flow. It can then analyze subscriber application usage based on parameters such as service level, duration, time of day, and type of transaction. Ideally, this information should be aggregated at intermediate analysis points, a method that ensures scalability by eliminating the need to transfer collected data to a central location.

The service control solution can also generate customized usage reports specifying how much throughput is used, what types of applications are used, patterns of individual subscribers and the quality of service on a session-by-session basis. The service provider can use these detailed reports to create action plans for product development, strategic planning, service sales, customer-retention efforts, and marketing. Reports can also be used for fraud detection, customer support, operations, billing, and sales support.

Traffic Optimization

Service control allows operators to efficiently manage the growth of their networks by giving them the data they need to proactively address issues. Operators use the tools at an aggregate level as well as a per-subscriber level. Operators can apportion the broadband pipe and dedicate particular amounts of throughput on aggregate to certain types of traffic, or even assign no throughput at all to some types of traffic. Using service control technology, an operator might restrict throughput of certain traffic or utilize shaping techniques to move it to off-peak hours ensuring improved performance during peak periods. Proactive policies such as these can be applied to prevent network bottlenecks and enforce SLAs or AUPs.

Tiered Services

Cable operators can use service control to manage access to other advanced services as they become available. For example, operators may decide to deploy IP VoD and sell it as an add-on service differentiated on levels of quality and access. A customer might subscribe to “best-effort” high-speed data access but decide to purchase a VoD subscription at higher price points to receive a guaranteed level of service. Video traffic for such “gold” subscribers could be mapped to high-speed, low-latency transport links, while, lower levels of service, such as a “bronze” subscriber’s video is sent through less-expensive, lower-performance connections. Service control solutions can automatically manage the pipe so that data capacity is allocated to enable higher-priority customers to receive video delivery according to the terms of their service contract.

With a service control-enabled network, cable operators can easily define a series of service tiers for its high-speed data subscribers based on applications to target different market segments at different price points. Operators can custom-configure application usage by defining use parameters. For example, an operator could allow individual subscribers or groups to access a defined number of video streams per day, limit downloads to a certain size, prevent subscribers from reaching high-throughput websites, or allow unlimited, unrestricted access. The terms of these service offerings might allow premium customers to send and receive any type of traffic regardless of time of day, limit other tiered subscribers to no more than three video or audio streams per day, and restrict basic users to beginning streaming sessions only between 8 a.m. and 5 p.m. or from downloading files larger than 5 MB during that time.

The number of combinations is unlimited, but an operator could create a basic or flagship service offering where subscribers have:

- Unlimited HTTP and e-mail traffic (byte cap at the abusive end of the scale and data-throughput throttling of any attempts to obtain Usenet feeds from off-net Usenet providers)
- No VPN tunneling permitted (basic service targeted at residential or consumer use only)
- Streaming permitted only at off-peak times of day and perhaps limited in quantity
- Peer-to-peer control and management

- Limited Usenet access (higher caps than provided in basic product and perhaps some off-net Usenet traffic permitted)
- VPN tunneling permitted (to enable telecommuting)
- SLAs
- Unlimited streaming

The service packages offered could be more sophisticated and highly targeted. Service differentiation could be quickly introduced into the marketplace and service control-enabled networks would enable operators to customize service levels to individual subscribers' needs.

Service-Level Network Security

An "always-on" connection and less security-conscious home users means operators are faced with a breeding ground for security threats impacting their networks and their subscribers. Subscribers are under a constant threat of DoS attacks and worm and virus infection. Recent attacks have created "security storms" resulting from popular viruses such as Sasser, Slammer, and Blaster.

The increased network traffic caused by the multiplicative effect of infected hosts results in increased administrative costs and technical support calls as operators seek to track, disable, and block the spread of a virus attack. Infected machines generate network congestion as they attempt to propagate a viral infection, resulting in performance degradation for all users. Service control-enabled networks stop and proactively mediate security threats that create unwanted traffic and network congestion while decreasing providers' operating and support costs.

Premium Service Enablement and QoS Frameworks

Operators are seeking to profitably deliver premium service offerings such as VoIP, online gaming, music downloads, VoD, and streaming television. These services offer the potential to dramatically increase average revenue per user (ARPU) for the cable operator. Integrating into existing QoS frameworks and communicating with policy servers and network transport elements, service control technology helps enable dynamic, real-time provisioning of network QoS based on application activity. This greatly simplifies integration and delivery costs associated with multiple service delivery. Service control's ability to identify subscribers, and classify applications coupled with application-level prioritization and per service or service bundle billing accelerates the delivery of higher margin, higher value premium services for cable operators.

CONCLUSION

Cable operators have been extremely successful in building high-quality cable modem service over the past few years. They have achieved the promise of phase 1 in the deployment of advanced broadband services. In phase 2, operators are delivering expanded services and increasing profitability through greater service differentiation. Service control solutions will help operators ensure the performance, network transparency, and deep packet processing required for true network awareness and control, cable operators can optimize their network resources and revenue opportunities for new and emerging services.

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 Website 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

De/LW7388 12/04

Printed in USA