White Paper

Multiscreen Gateways: Paving the Way for IP Video

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November 2011

Make Way for the Golden Gateways

Over the next few years, cable operators will undertake the next great migration in the industry's 60-year history. Just one decade after beginning the last major technical transformation from analog to digital signal transmission, cable providers are already upgrading their plants, networks and equipment for the delivery of full IP video and other multimedia streams to subscribers.

It's not hard to see why. IP video technology offers cable providers several critical advantages over current quadrature amplitude modulation (QAM) technology. Providers can use IP video to bring new video services quickly to market and expand into over-the-top (OTT) video. They can rely on the technology to serve the growing array of IP-enabled consumer electronics (CE) devices, especially mobile devices. They can use IP technology to reduce high customer equipment outlays and improve their cost efficiencies. And they can use IP video to provide far better search and navigation experiences to their customers.

To be sure, the transition of every cable home to a ubiquitous, two-way, high-speed IP infrastructure will take considerable time, money and effort. Just as the industry's last major upgrade to digital technology required significant planning and investment, so will its upcoming upgrade to IP technology.

Fortunately, there is a hybrid IP solution that can be deployed today to help cable operators make the transition to an all-IP future in a controlled, cost-effective and relatively painless manner. Known as the multiscreen video gateway, this hybrid QAM and IP solution allows cable providers to pipe IP video throughout the home to the growing variety of IP-enabled consumer devices and existing QAM set-top boxes (STBs) without switching out any other equipment or overhauling their networks. As a result, cable operators can take advantage of IP video's many benefits without incurring huge bills or waiting years to overhaul their existing networks.
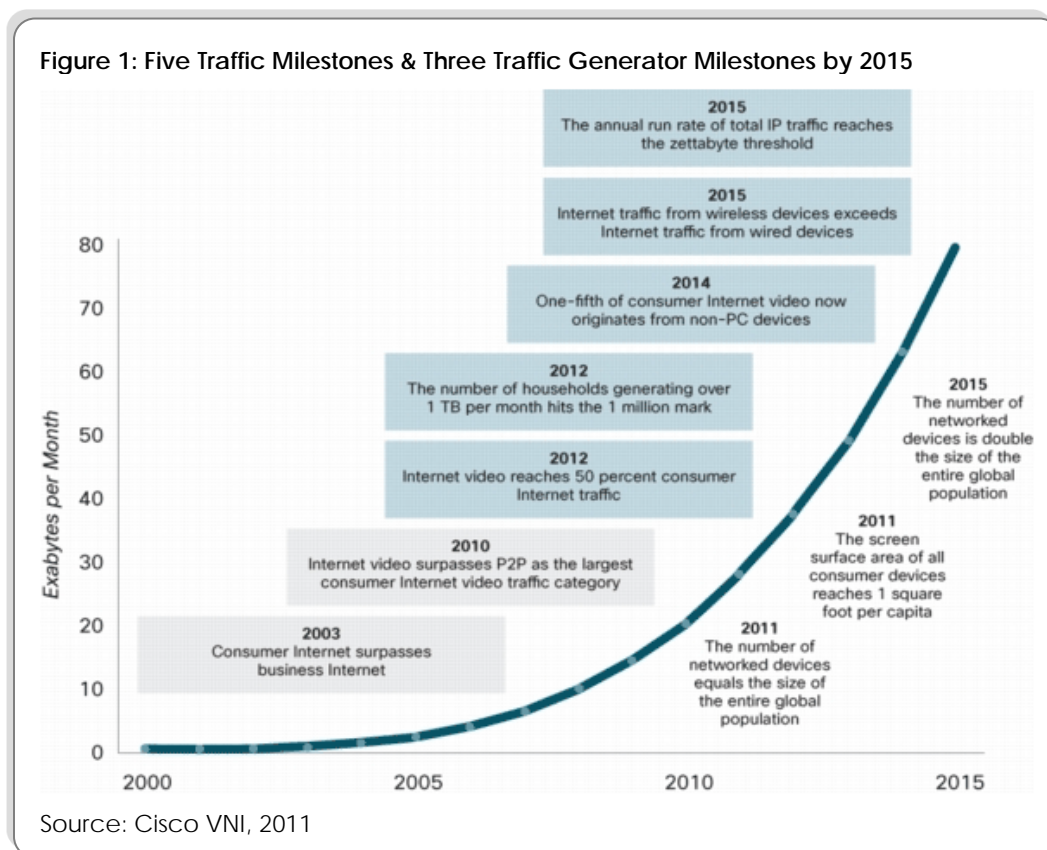
This white paper will explore the cable industry's increasing embrace of IP video technology and examine how cable operators can adapt their current hybrid fiber-coaxial (HFC) architectures to deliver IP video today. We will show how the transition to full IP service can occur and present the reasons for introducing multiscreen video gateways into subscribers' homes. We will examine the role that these hybrid QAM and IP gateways will play in transmitting IP video throughout the home and serving the growing number of IP-enabled consumer devices both in and outside the home, while continuing to support the huge installed base of digital set-top boxes. In particular, we will focus on the attributes of the Cisco 9800 Series Multiscreen Gateway and explain how these new multiscreen gateways fit into the company's overall Videoscape IP video architecture.

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What Consumers Want

Unlike engineers, most consumers really do not care how their multimedia entertainment services are delivered over their networks. Whether the transmission technology used is analog or digital, QAM or IP, consumers mainly care about the types of services that are offered, not the types of delivery systems or networks.

Which new types of video services do consumers crave the most? Consumer surveys and focus group research do not always agree on every point, but they strongly indicate that consumers want the chance to enjoy multi-room or network-based DVR service, with the more rooms and sets served the better. Research also shows that consumers want the freedom to move content transparently throughout the home, and particularly to move HD video from one type of screen to another. They do not want to be bound by the restrictions of different networks, transmission technologies, display devices, bandwidth limits or video formats.

Consumers also want the ability to bring in compelling content from third-party, OTT sources, such as Internet video powers Netflix, YouTube and Hulu, and watch that content on their TVs. They want to be able to view live, on-demand, recorded and online video together on the same screens, not separately on different display devices. Further, consumers want the capacity to watch the same video programming on all their display devices. That is significant because the number of IP-enabled devices is growing exponentially. Cisco predicts that the number of network-connected devices will scale to more than 15 billion, or twice the world's total population, by 2015, as shown below in **Figure 1**.

Figure 1: Five Traffic Milestones & Three Traffic Generator Milestones by 2015

2015
The annual run rate of total IP traffic reaches the zettabyte threshold

2015
Internet traffic from wireless devices exceeds Internet traffic from wired devices

2014
One-fifth of consumer Internet video now originates from non-PC devices

2012
The number of households generating over 1 TB per month hits the 1 million mark

2012
Internet video reaches 50 percent consumer Internet traffic

2010
Internet video surpasses P2P as the largest consumer Internet video traffic category

2003
Consumer Internet surpasses business Internet

2015
The number of networked devices is double the size of the entire global population

2011
The screen surface area of all consumer devices reaches 1 square foot per capita

2011
The number of networked devices equals the size of the entire global population

Source: Cisco VNI, 2011

In the fifth annual Cisco Visual Networking Index (VNI) Forecast (2010-2015), Cisco also projects that total global Internet traffic will quadruple by 2015. As a result, Web traffic will reach an astounding 966 exabytes per year, up from about 240 exabytes today.

Figure 2: Projected Global Internet Traffic by Year-End 2015 (in Exabytes)

	CONSUMER	BUSINESS	TOTAL
Internet	639.4	72.9	712.3
Managed IP	142.0	36.2	178.2
Mobile data	59.2	15.9	75.0
Total	840.6	124.9	965.5

Source: Cisco VNI, 2011

Moreover, consumers want to watch the content they like on whatever display device may be at hand, whether it is a flat-screen TV, PC, laptop, Macintosh, connected TV, Blu-ray player, game console, computer tablet or smartphone. They do not care whether these devices are managed or unmanaged by their service provider.

Finally, consumers simply want more and more video. Undoubtedly, much, if not most, of that video will be delivered through the Internet. Indeed, the latest Cisco VNI Forecast predicts that 1 million video minutes – the equivalent of 674 days – will traverse the Internet every second by 2015. That, in turn, will promote a huge increase in general Internet traffic (along with the swiftly growing number of connected devices, the continuing increase in Internet users and the spread of faster broadband speeds around the planet).

The one thing that consumers clearly do not want is another electronics box in the home, cluttering the already congested and confusing TV landscape – unless the box offers something truly new and different, such as the attributes outlined above.

What Service Providers Need

Cable operators, telcos and other video service providers care very much about how entertainment services are delivered over their networks. They want to use the transmission technology that offers the lowest costs, greatest efficiencies, least technical problems and best user experiences. Just as importantly, they want to use the transmission technology that allows them to stand out from their competitors, generate fresh revenue streams and pay back their investments.

Increasingly, many video service providers see IP as that transmission technology of the future. In a worldwide study conducted in 2010, for instance, *Heavy Reading* found that 40 percent of cable operators plan to launch some type of IP video service by 2012. Moreover, nearly 80 percent of cable providers said they had already begun or intended to start trials, pilots or full deployments of IP-based video solutions by 2012.

In another notable finding from the global survey, nearly half, or about 46 percent, of cable operators said they expected IP-based set-top boxes to become mainstream cable products by 2012. Further, a full 75 percent of respondents expected that development to occur by 2013, as shown below in **Figure 3**.

Figure 3: Cable Operator Plans for IP Video Service by 2012

Plan to launch IP video service	40.4%
Plan to start trials or deployments of IP-based video solutions	78.8%
Expect IP-based set-top boxes to become mainstream product	46.2%

Source: Heavy Reading, 2010
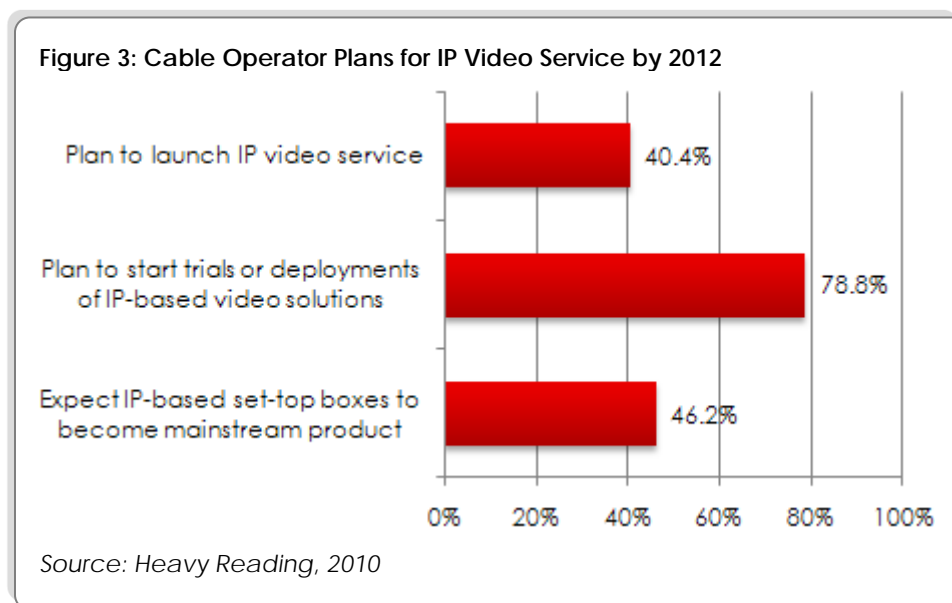
Why are cable operators, telcos and other service providers feeling so positive about IP video now after years of hesitation and reluctance to adopt the technology? There are several critical reasons.

- IP video offers service providers a potentially important competitive advantage. They can use it to launch new video services quickly to the growing array of IP-enabled CE devices in the home, serve mobile devices in and outside the home and deliver a much improved program guide and search experience to their customers.

- By using IP video, service providers can greatly simplify their existing distribution networks and extend the reach of those wired networks. Cable

operators, for instance, can rely on IP technology to transport all of their multimedia services, instead of needing separate, independent silos for data, voice and video, and serve multiple screens inside and outside the home.

- The adoption of IP video should allow video providers to cut their high home equipment and inventory costs. For instance, cable operators can replace their expensive digital cable set-top boxes with cheaper, more versatile IP-based versions. Better yet, they can replace the existing set-top boxes with other display devices that customers can buy directly at retail, such as connected TVs, game consoles and tablets.

Not surprisingly, then, some of North America's largest cable providers have started deploying IP video services to their customers. So far the biggest, boldest IP video initiatives have not focused on the TV, PC, laptop, gaming console or smartphone, as most industry observers once expected. Instead, they have mostly focused on the tablet computer, an IP-enabled consumer device that existed only in the late Steve Jobs' imagination just two years ago.

Over the last few months, both Cablevision Systems and Time Warner Cable have launched live TV feeds for Apple's innovative iPad tablet inside subscribers' homes. The two cable operators have made these moves despite fierce protests and threatened lawsuits over content licensing rights from such major cable program-mers as Viacom, Fox Cable Networks and Discovery Communications. In fact, Cablevision is preparing to stream live TV programming to iPads and other connected devices in and outside the home, including iPhones and iPods.

Similarly, Comcast and Cox Communications are getting ready to stream live TV channels to iPads and other tablets later this year, while Charter is working on an iPad application with TiVo. At the June 2011 Cable Show in Chicago, for example, Comcast presented its new, cloud-based Xcalibur TV guide and content naviga-tion service that will run on iPads and other connected devices.

But few cable operators have solved the vexing problem of how to convert their networks over to full IP video transmission without switching out their existing networks and equipment, incurring huge bills and wreaking havoc on their customers. So what they need is a well-thought-out transition plan that will allow them to make that move in a controlled, carefully coordinated fashion.

Moreover, few if any cable operators have started generating extra revenue from their fledgling IP video services. Thus, a crucial challenge that remains is determin-ing how to monetize these new services so that they do not become another loss leader for the industry, much as video on demand (VoD) largely has become.

Fortunately, both of these challenges can be overcome. The multiscreen video gateway offers the promise of doing just that in a cost-efficient way.

Defining the Multiscreen Video Gateway

"Home gateway" has become one of the most overused and least understood terms in the pay-TV and broadband markets. The term appears to mean something different to everyone, depending upon their perspectives. When some companies speak of home gateways, they are simply describing cable modems that can deliver data and voice services to subscribers and offer wireless home networking capabilities. Others are referring to more advanced Docsis 3.0 cable modems that can deliver data and voice services to customers, support IP video and provide wireless home networking. Still others are actually talking about enhanced digital set-top boxes that can offer IP capability and whole-home DVR service. And others are describing devices that can do all of the above.

A multiscreen video gateway does not quite fit any of those descriptions. What makes a multiscreen gateway different is that, unlike other types of gateways, it is purely focused on video services. Moreover, it can deliver video to all types of display devices, not just the big flat-screen TV in the customer's family room. Specifically, the multiscreen gateway can decode and then distribute live, on-demand, online and recorded IP and QAM video programming to other managed devices, such as existing digital cable set-top boxes. In addition, it can distribute the same types of video content to unmanaged devices, including PCs, laptops, Macintoshes, game consoles, connected TVs, tablets and smartphones.

The advantages of the multiscreen gateway are clear. In general, this hybrid gateway can promote and foster the cable industry's migration to an all-IP service delivery architecture, leading to lower capex, greater cost and bandwidth savings, higher operating efficiencies and numerous other benefits. How can the multiscreen gateway do this?

- The multiscreen gateway offers a critical first step for cable providers to begin the transformation to IP video service delivery by using their existing QAM and Docsis 3.0 infrastructure. Cable operators can start on the migration path immediately, rather than wait several years to make the move.

- The multiscreen gateway should greatly expand the number and kinds of video services that cable operators can offer today. For example, it allows providers to deliver HD whole-home DVR service to subscribers, including the ability to record and view up to six video streams simultaneously.

- This type of hybrid gateway can function with all the managed devices (such as set-top boxes and residential gateways) that sit in the home today, using MoCA-empowered links. At the same time, the gateway can also support new, smaller, thin-client, IP-only set-top boxes that do not require a separate Cable-Card to operate.

- The multiscreen gateway creates new opportunities for cable providers to expand their ecosystem by serving unmanaged CE devices, whether they are PCs, laptops, game consoles, smartphones or tablets. The services that can be delivered to new, unmanaged devices include everything that MSOs now deliver to older, managed devices, including live, on-demand and recorded video, as well as new services such as online video.

- The multiscreen gateway promises to be an investment that will not become outdated, even as cable operators upgrade their networks for full IP video service. As a result, the gateway should support a smooth transition from today's QAM delivery system to a hybrid IP and QAM environment over the next few years, and ultimately to an all-IP video architecture.

Cisco 9800 Series Multiscreen Gateway

Viewing the multiscreen video gateway as critical to the cable industry's IP video transition over the next few years, Cisco offers its 9800 Series Multiscreen Gateway as the foundation of its broader Videoscape IP video architecture and strategy. Cisco privately unveiled its first models of these multiscreen gateways at the June 2011 Cable Show in Chicago. The Cisco 9800 Series Multiscreen Gateway represents the latest offering in Videoscape customer premises equipment (CPE).

Known as a headed gateway, the Cisco Multiscreen Video Gateway features the video rendering and home networking functions of an HD DVR set-top box, allowing it to take incoming video on a QAM channel and convert it into IP unicast traffic that can be distributed around the home. Thus, the gateway can be connected directly to a TV or other video display device using a traditional output method such as HDMI, replacing the old digital set-top box. In contrast, a headless gateway has no video-rendering component, so it cannot be connected directly to any video device.

Like some other video gateways on the market, the Cisco 9800 Series Multiscreen Gateway offers several essential features, including Docsis 3.0 support configured with up to eight downstream channels and four upstream channels, six tuners, MPEG-2 and MPEG-4 transcoding, full HD and 3DTV support and options for Tru2way, native and, eventually, cloud-based guides. The gateway uses MoCA 1.1 or 2.0 connections for wired routing to small, thin-client set-top boxes, but it could also use an externally connected wireless access point.

One crucial difference from other video gateways is that the Cisco 9800 Series Multiscreen Gateway is designed to support both managed and unmanaged CE devices. To achieve this, the gateway capitalizes upon its internal transcoding capability and can work in complement with other components in the Videoscape portfolio described in the next section, including a content delivery network, adaptive bitrate streaming and soft client enablement.

The Cisco Multiscreen Gateway also includes a CableCard and supports all current conditional access systems (CAS). Now in field trials and lab tests, the Cisco Multiscreen Gateway is slated for commercial deployments in the second half of 2012.

Figure 4: Cisco 9800 Series Multiscreen Gateway

Source: Cisco Systems, 2011

With these attributes, Cisco believes that the 9800 Series Multiscreen Gateway could reduce capex for cable operators by letting them offer live and on-demand content on today's QAM-based set-top boxes, as well as on pure IP video boxes. The gateway could also help accelerate the transition of the in-home architecture to IP technology and enable the insertion of IP devices that do not require separate CableCards. In fact, even unmanaged devices could act as additional viewing screens for cable video programming, due to the platform's transcoding capabilities.

Besides cutting capex, Cisco thinks that the Multiscreen Gateway could reduce opex for cable providers while making them more competitive. For example, it could allow providers to deliver whole-home services, such as multiroom DVR, to subscribers in a more cost-efficient and bandwidth-efficient manner. The gateway allows cable operators to offer subscribers the ability to watch and record up to six video streams simultaneously, far more than the two streams that today's typical QAM-based DVRs support.

In addition, Cisco's Multiscreen Gateway features a unique dual-stage bootloader embedded in the hardware. This dual bootloader permits cable operators to swap middleware stacks at any time without sacrificing the hardware. So, instead of having to replace set-top boxes whenever they change middleware, cable operators could keep the boxes in place.

Finally, Cisco's Multiscreen Gateway will be interoperable with the company's Videoscape network and cloud platforms. As the cable network and cloud evolve toward an all-IP architecture over time, the gateway will continue to function in multiple architectures – QAM, hybrid IP and QAM, and pure IP video.

While the Cisco 9800 Series Multiscreen Gateway is specifically designed for cable operators, Cisco maintains that the generic platform could support other service providers, as well. So the concept is not limited to the cable industry.

The time for such gateways has come. Telco competitors are now offering advanced services such as multiroom DVR and faster broadband speeds and are deploying set-top boxes with greater capability for comprehensive program guides and interactive applications. At the same time, satellite TV providers are offering DVR set-top boxes with more features, while CE makers are introducing smart TVs and connected devices that make cable's existing set-top boxes seem ancient by comparison.

How the Cisco 9800 Series Gateway Functions Within Videoscape

Cisco views its Multiscreen Gateway as a global technology that could act as a critical first step for delivering and expanding into new IP video services, while maximizing the value of a cable operator's existing QAM and Docsis infrastructure.

The 9800 Series Multiscreen Gateway also fits neatly into Cisco's overarching Videoscape IP video architecture. Introduced in January 2011, Videoscape is designed to be an end-to-end platform for all-IP video service, encompassing cloud, network, software and hardware client assets. The idea is to put more intelligence in the centralized network and cloud, supporting the transparent use of more thin-client display devices, such as IP set-top boxes, tablets, smartphones and game consoles.

Cisco Videoscape consists of three main components:

- Cisco Videoscape Media Suite, the content management and transcoding element

- Cisco Conductor for Videoscape, a real-time messaging architecture that connects the TV to the network

- Three families of client devices, including media gateways, pure IP set-top boxes and software clients

The Cisco Multiscreen Gateway is interoperable with both the Videoscape network and cloud. As the network and cloud both move toward the Videoscape IP video architecture, the multiscreen gateway will continue to function in multiple delivery systems: QAM, hybrid IP and QAM, and IP video. **Figure 5** presents the Cisco Videoscape architecture, showing the essential role of the multiscreen gateways.

Figure 5: Role of Cisco 9800 Series Gateways in Videoscape Architecture
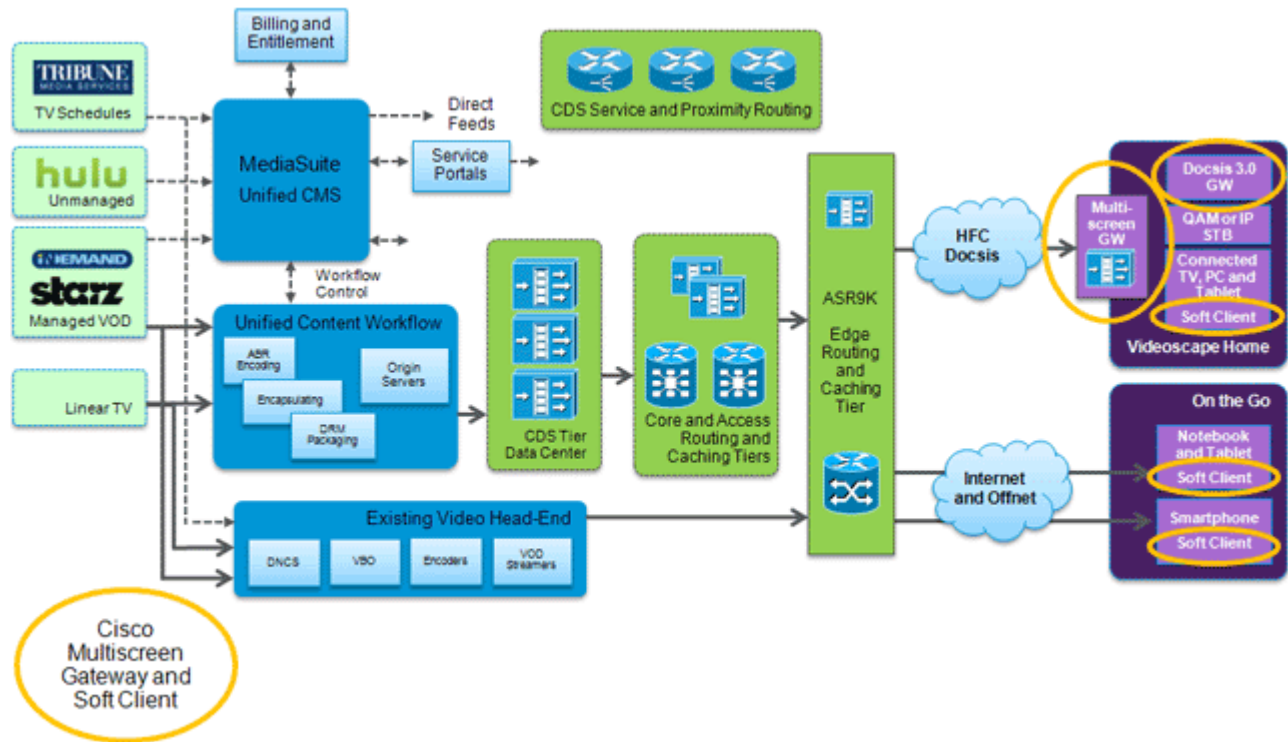
Source: Cisco Systems, 2011

Within the Videoscape architecture, the multiscreen gateway is designed to be a modular investment that will be compatible with future versions and can meet growing consumer demand for access to content anytime, anywhere, on any device now and in the future. With the very definition of content becoming more expansive in the IP video environment, the range of content that could be delivered includes live, on-demand, online, OTT and even user-generated video.

In the next section, four service feature bundles will demonstrate the range of capabilities for the Cisco Multiscreen Gateway, especially when further enhanced with Video-scape cloud and network assets. For example, with the help of Videoscape, the multiscreen gateway platform could:

- Extend a service provider's reach beyond its traditional managed device footprint to such unmanaged devices as smartphones, game consoles and tablets, including devices that are not linked to the provider's wired network

- Broaden IP video content distribution across both managed and unmanaged devices

- Connect through IP to the Videoscape cloud for remote user interface (RUI) access and addressable advertising

- Provide DRM support across both managed and unmanaged devices

Cisco emphasizes that the Videoscape architecture is modular in nature. As a result, cable operators need not adopt all the different components. Cable operators can pick the components they need and then match them with technology products from other equipment vendors, if they choose.

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Service Feature Bundles

Because Cisco's Multiscreen Gateway is designed to support multiple technology environments – QAM-only, hybrid and all-IP video – Cisco has developed four service feature bundles for cable providers to deploy, depending upon what video delivery systems they already use and where they stand on the migration path to full IP video. This section describes the four service bundles, or consumer use cases, that are available.

Bundle 1: Cisco Super DVR

For U.S. cable operators that are preparing to use IP technology, the Cisco 9800 Series Multiscreen Gateway provides a QAM-based platform with advanced functionality that will be compatible with future versions. This bundle offers advanced video services such as full high-definition TV (HDTV) and enhanced 3DTV, enhanced recording capability (up to six programs) and enhanced live streaming capability (up to six video streams). The bundle also provides better performance and multi-room drive capacity optimization.

In addition, this bundle supports streaming to Digital Living Network Alliance (DLNA) and Digital Transmission Content Protection over IP (DTCP-IP) devices, such as game players and connected TVs.

To support the transition to IP video in an OpenCable Applications Platform (OCAP) environment, Cisco has a software release strategy for QAM set-top boxes available today. Under this strategy, U.S. cable operators can deploy the hybrid set-top boxes with an OCAP middleware stack now and later switch to new middleware releases that support more comprehensive IP video capabilities.

Bundle 2: Managed IP STB Support

The second feature bundle release is designed to support managed IP set-top boxes in the subscriber's home. By using such managed IP STBs, cable operators can reduce the capex required for deploying multiple devices inside the home.

In this feature set, the Cisco 9800 Series Multiscreen Gateway will provide live streaming support and RUI services to IP STBs within the network. Because IP STBs will employ a browser-based user interface, the Cisco Multiscreen Gateway will also have an HTML-browser-based user interface for a consistent look and feel throughout the home. The addition of an HTML browser will enable a graphical user experience that's easily customizable using cascaded style sheets (CSS).

For cable operators in non-OCAP environments, Cisco offers its Reference Television Navigator software. For operators in an OCAP environment, this software release will include the OCAP middleware to manage the command and control of an OCAP QAM network while taking full advantage of the HTML browser presentation engine for user experiences. A Web-services interface will provide an interaction vehicle between user interface applications and OCAP command and control functions.

This feature bundle will incorporate all the functionality of Bundle 1, including support for DLNA and DTCP-IP devices and enhanced recording and streaming capability.

Bundle 3: Unmanaged Device Support

The third feature bundle release will target support for unmanaged consumer electronics devices throughout the home. In addition to IP STB support, this feature bundle will provide video services to tablets, PCs and other devices that do not have DTCP-IP capability. This bundle will provide digital rights management (DRM) support across both managed and unmanaged devices. It will also offer optional transcoding of live video streaming through a transcoder embedded in the multiscreen gateway.

Bundle 3 will incorporate the features of Bundles 1 and 2, and will provide a full hybrid integration between QAM-based services and Cisco Videoscape IP-based services, including reception and distribution of both QAM-based and IP-based video programming. Such a capability will give MSOs a way to start shifting their services from the traditional digital QAM system to the next-generation IP video system and take advantage of the full Cisco Videoscape offering.

Figure 6: Three Gateway Feature Bundles
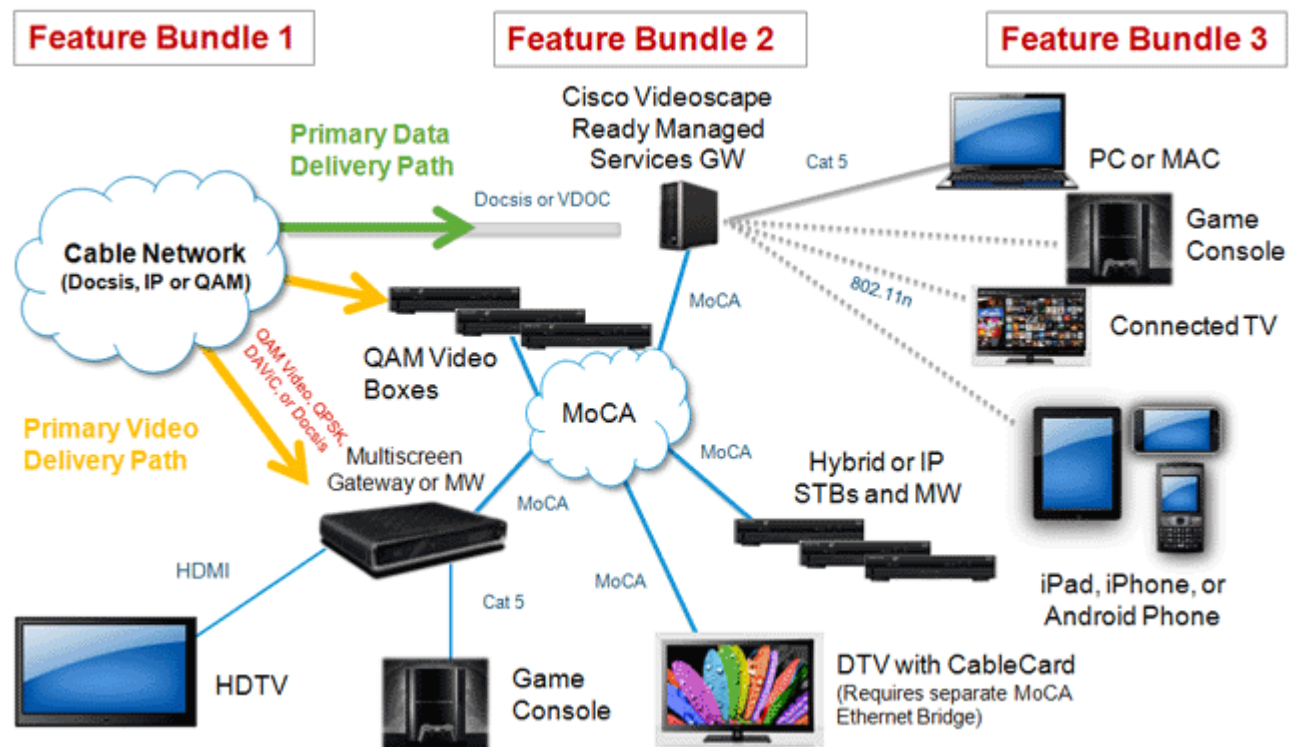
Source: Cisco Systems, 2011

Bundle 4: Cisco Videoscape Endpoint Device

Once a cable operator migrates its network to Videoscape, Cisco can migrate its software stack and shift the Cisco 9800 Series Multiscreen Gateway to an all-IP device and a full Videoscape endpoint, thereby expanding capabilities from Bundles 1 through 3. That is Cisco's vision of cable's ultimate IP video future.

Conclusion

For both cable providers and their telco rivals, the IP video evolution, or revolution, is well underway. With Internet video traffic accelerating and the number of connected CE devices soaring, there is no turning back. So the main question now is how to move forward into the new IP era and compete for video consumers.

As we have seen, the multiscreen video gateway represents the best approach. This hybrid IP and QAM solution offers the best of both worlds, allowing cable operators to send new IP video services throughout the home and reach the rapidly increasing number of IP-enabled consumer electronic devices while continuing to serve the tens of millions of existing QAM set-top boxes in the field. The multiscreen gateway can accomplish this without forcing providers to over-haul their networks, switch out any of their other home equipment and incur huge capex bills.

In particular, the Cisco 9800 Series Multiscreen Gateway Series provides some unique benefits to cable operators. For example, the Cisco gateway supports both managed and unmanaged devices, unlike many other video gateways on the market today.

The Cisco 9800 Series Multiscreen Gateway also fits neatly within Cisco's broader Videoscape architecture, which is designed to place more intelligence in the network and cloud and thereby make it easier for cable providers to serve a wide array of display devices. Yet the gateway can work outside Videoscape, as well, so providers need not adopt the entire Cisco IP video architecture when deploying it.

In short, the time for multiscreen video gateways has clearly arrived. Now it is just a matter of testing and deploying them before the competition does. Let the race begin.