

VIDEO AND TV
SERVICES:
BRINGING MORE
POWER TO THE
REMOTE

September, 2010

EXECUTIVE SUMMARY

INTRODUCTION: VIDEO IS DEFINING THE FUTURE NETWORK TODAY

Service providers and network operators face a two-fold challenge to drive profitability over the next decade. First, they must not only grow their subscriber base, but increase revenue per user. Second, they need the bandwidth and capacity to provide the premium services residential and business subscribers want that will fuel revenue and profit margin growth.

High-quality video services have emerged as the game changer to drive subscriber penetration and average revenue per user (ARPU). Video is king in attracting customers, *if* service providers have in place the right business model and a robust network architecture that will allow them to easily and economically scale their network to stay ahead of the demand curve.

Recent industry reports from Yankee Group, Parks Associates and Cisco all draw the same conclusion: the evolution of premium video services is fundamental to growing ARPU and overall profitability on the network.

But to profitably provision, manage and bill these advanced video services, operators need a robust network architecture that can easily and economically scale as bandwidth demands increase and address the unique technical challenges of video. IP/Ethernet-based network architectures that bring fiber to the home and business are best positioned to serve this need. When building a video capability, your focus must be on what you will have to deliver tomorrow, rather than today.

WHAT DO I HAVE?

Regardless of whether it is an ISP/telco new to video that is looking to upgrade an existing DSL network, a cable operator wondering how far DOCSIS can take them, or a municipality that has never before deployed any kind of telecom service, the same considerations apply; the first step to appraise what you have, or don't have, what you will need and whether or not any existing equipment investment can be salvaged and repurposed in the new network.

For example, you may have an existing video head end, an existing billing system, an existing operations support system, or a specialized alarm management system on your network. Can any or all of these existing investments work on a new next-generation access network that will introduce new or better services?

WHAT WILL I NEED?

Again, the key point when building a video capability, is not what you want to deliver today, but what you will have to deliver tomorrow to stay ahead of subscribers' expectations. So exactly what video services will be driving these substantial increases in bandwidth and capacity?

While next-generation copper and coax solutions such as VDSL and DOCSIS 3.0 can extend the useful life and bandwidth capabilities of this legacy infrastructure, subscriber demand for more bandwidth intensive services will inevitably drive up costs and erode profit margins until this business model is no longer viable. Only fiber provides the "future-proof" pipe with the almost unlimited bandwidth that will keep operators ahead of the demand curve.

100+ HDTV CHANNELS: You may source content from multiple services providers to ensure that you have the best video offering in your coverage area. While 100 HDTV channels are topping service offerings today, you may need to add even more channels in the future to remain competitive and continue to grow services and revenues.

IPTV: With fiber to the premises, IPTV can be more efficient than digital broadcast to provision premium and interactive video services such as Video on Demand (VoD) and Applications on Demand that create new streams of revenue.

OTT AND CONNECTED TV: More and more, consumers want to source content directly from the Internet and watch it in high-quality on their television. What do you need to provide for and monetize this consumer trend?

THE YOUTUBE FACTOR: More and more, consumers of content are also creators of content. Youtube typifies the demands that have been placed on operators to provide ultra-fast symmetrical connectivity with upstream speeds equal to the downstream. Youtube's move to incorporate higher definition video adds that much more bandwidth demand in each direction.

ADVANCED VOD: For traditional interactive TV Services such as VoD, this explosion in the volume and variety of content is driving consumer demand for more sophisticated cataloguing systems that are capable of serving hundreds of subscribers simultaneously with a reliable HD experience.

3D TV: The emergence of 3D TV creates another bandwidth hog that will put additional strain on network capacity as it becomes more mainstream and follows a logical evolution into large screen projection 3D-HD formats.

VIDEO CALLS: Residential video calling services that require no other device other than the television set are also a hot area of innovation heading into the next decade that, if realized, will add to the bandwidth burden placed on the network.

LOCAL PROGRAMMING: And don't forget local programming as a means to differentiate yourself from larger competitors by focusing on the community.

PART III: WHAT ARE VIDEO'S TECHNICAL CHALLENGES?

While FTTx networks are best positioned to address these demands and ensure sufficient service quality, not all optical network architectures are created equal, or designed with the same standards in mind. How transport and access is managed in the network's central office (see our Architecture white paper, "Under the Hood"), as well as the robustness of the element management system (EMS) – the software layered on top of that hardware – will have a direct bearing on how profitably the network can deploy premium video services.

THE EMS: HOW EASY IT IS TO ROLL OUT AND MANAGE NEW VIDEO SERVICES?

A sophisticated and easy to use EMS allows you to give subscribers what they want, when they want it, with seamless billing system integration. Enablence's EMS solutions provide the carrier-grade functionality that reduces the amount of manual "touch" by technicians to provision new services and provide specific service levels to specific subscribers.

SEAMLESS HEAD END INTEGRATION AND SIGNAL INTERCEPT

The EMS also plays a crucial role in how easy it is to provision multiple content streams from multiple service providers over both broadcast and IPTV. Integrating RF signals from a new or existing head-end, as well as integrating digital HD and IP signals from the head end, should be seamless. With Enablence, it is.

SUPERIOR PICTURE QUALITY A MUST

Subscribers expect superior picture quality. Enablence has achieved a number of technological firsts when it comes to ensuring superior picture quality. And isn't video all about the quality of picture and sound?

ELEGANT RF RETURN

Unlike most equipment vendors, Enablence digitizes the RF return at the home and puts the digitized data in a return packet to the video head end. This eliminates the need for external RF return equipment.

KEEP THE TRAFFIC MOVING

Video, by any measure, is *the* bandwidth hog. Provisioning the advanced, quality services that subscribers want cannot come at the expense of other services such as high-speed Internet and telephone. A multi-criteria and multi-dimensional optimization of traffic is hard to do, but where Enablence excels to ensure quality of service.

CONCLUSION

Video is king when it comes to attracting subscribers, driving revenues and providing the premium services that will lead to increased profitability on the network, provided it is deployed with a sound business and service strategy.

An FTTx network is far superior to legacy copper or coax when it comes to deploying advanced video with highest standards of quality and reliability. But it needs a robust management system that allows service providers to easily and economically provision these new video services in a manner that will reduce OPEX over the long term. This frees staff resources dedicated to support to focus on developing, marketing and provisioning new valued-added services rather than troubleshooting and managing existing services.

Enablence has years of proven technical expertise and industry leadership when it comes to provisioning video and television services over all-optical networks, as well as next-generation or advanced copper, that will drive revenue and profitability for years to come.

INTRODUCTION: VIDEO IS DEFINING THE FUTURE NETWORK TODAY

Service providers face a two-fold challenge to drive profitability on their fiber networks over the next decade. First, they must not only grow their subscriber base, but increase revenue per user. Second, they need the bandwidth and capacity to provide the premium services residential and business subscribers want that will fuel revenue and profit margin growth.

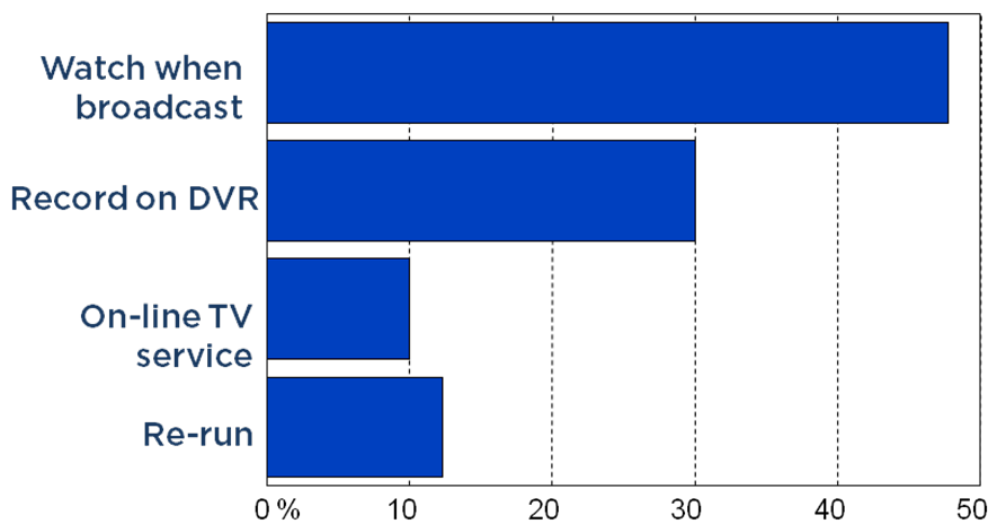
It is this balance between providing new value-added services and incenting subscribers to take up multiple services over the network that is crucial to driving profitability. High-quality video services have emerged as the game changer to drive subscriber penetration and average revenue per user (ARPU). Video is king in attracting customers, *if* service providers have in place the right business model and a robust network architecture that will allow them to easily and economically scale their network to stay ahead of the demand curve.

The 2009 “Broadband Services: Global Outlook” study from Parks Associates found that multi-service bundles boost customer satisfaction – and the more services, the greater the satisfaction. This study also determined that a highly satisfied broadband subscriber is 46 percent less likely to churn. A 2009 report from Yankee Group, “Next Generation Access Services: Analysis of Portfolios,” also asserted that subscribers with multiple service bundles are “stickier.”

This Yankee Group report also found that advanced broadband services delivered over fiber enjoy ARPU rates that are on average 30 percent higher, or more, than DSL, with HD TV and a variety of premium programming the key attractions. And the evolution of premium video services such as ultra high-speed Internet access for OTT video, video on demand (VoD), interactive TV through IPTV, real-time conferencing and collaboration, e-health and unlimited HD offers the greatest opportunity to drive ARPU.

According to a June 2010 forecast from Cisco, the sum of all forms of video, (TV, VoD, Internet and Peer2Peer) will exceed 91 per cent of global consumer Internet traffic by 2014. Advanced Internet video (HD and 3D) will increase 23-fold between 2009 and 2014 and by 2014, will comprise 46 per cent of consumer Internet video traffic.

HOW VIEWERS WATCH TV:



Source: The Diffusion Group, www.tdgresearch.com

However, being able to cost-effectively provision, manage and bill these advanced video services, in a manner that will improve profit margins rather than erode them, requires a robust network architecture that can easily and economically scale as bandwidth demands increase. Video is the big bandwidth hog that puts the greatest strain on a network and poses a number of unique technical challenges.

Service providers must invest in IP/Ethernet-based network architectures that can provision the necessary bandwidth and easily scale as needed to ensure a high-quality, latency-free viewing experience for many years to come. When building a video capability, your focus must be on what you will have to deliver tomorrow, rather than today.

In this paper, we will explore what service providers of different stripes typically have, what they need and how only an all-optical FTTx network has the bandwidth capacity to provide a true “future proof” video capability, provided it has been architected to carrier-grade standards that make it easy, and profitable, to provision, manage and bill new revenue-generating services.

PART I: WHAT DO I HAVE?

Service providers may be at one of a number of different starting points when it looking at deploying an advanced network architecture that can deliver high-bandwidth video services. Regardless of the individual circumstances, the first step to appraise what you have, or don't have, what you will need and whether or not any existing equipment investment can be salvaged and repurposed in the new network.

VIDEO FROM SCRATCH

For services providers who have only provided POTS and Internet over DSL, video is a brave new world that poses a number of questions, from the technical capabilities that are needed to effectively provision and manage it, to the various business models for how programming content must be, and can be, obtained from different providers.

Two options for these operators is to either upgrade their legacy DSL infrastructure to Very High Bit Rate DSL (VDSL), or make the leap to an all-optical fiber network to the subscribers' premises (FTTx).

For Municipalities who are for the first time looking to deploy any kind of telecommunications network, they are starting with a clean state with an even greater learning curve before them. Nonetheless, they do have the advantage of customer relationships, a model for service delivery, an existing billing system and rights of way for deploying equipment. In addition, they do not have a vested interest in legacy architecture. They can start fresh with fiber without having to worry about recouping a previous investment in a less “future-proof” technology.

Large institutions, such as colleges and universities, also have unique advantages to embark on an advanced broadband access deployment to bring fiber to the desk and to the dorm. They have a captive subscriber base that is more than eager to take advantage of the ultra-high symmetrical bandwidth provided by fiber.

VDSL: THE AFFORDABLE FIX FOR THE NEAR-TERM?

VDSL does allow service providers to maximize the useful life of their existing copper plant and can be an effective short- to medium-term solution to squeeze out the necessary network capacity for rolling out advanced video services. However, VDSL can only provide connectivity speeds of up to 50 Mbps within three kilometers of the node, assuming the copper plant is in good condition. Beyond that distance service quality degrades.

In addition, one must consider the aggregation needs of the outside plant. To maintain that 50 Mbps service level, the network operator may have to invest in new nodes and redeploy existing nodes depending on the geographical spread of the homes and businesses it serves.

It must also be noted that any existing copper build is in a state of decay that will inevitably drive up maintenance and operating costs to maintain service levels. Even when maximum traffic capacity is achieved, 50 Mbps may not be enough for the bandwidth demands of the next decade, or to meet the targets set forth by key initiatives such as the U.S. National Broadband Plan.

The services that can be delivered over the existing copper plant may be sufficient for some subscribers, while others want more advanced services that are only possible with fiber. In this case

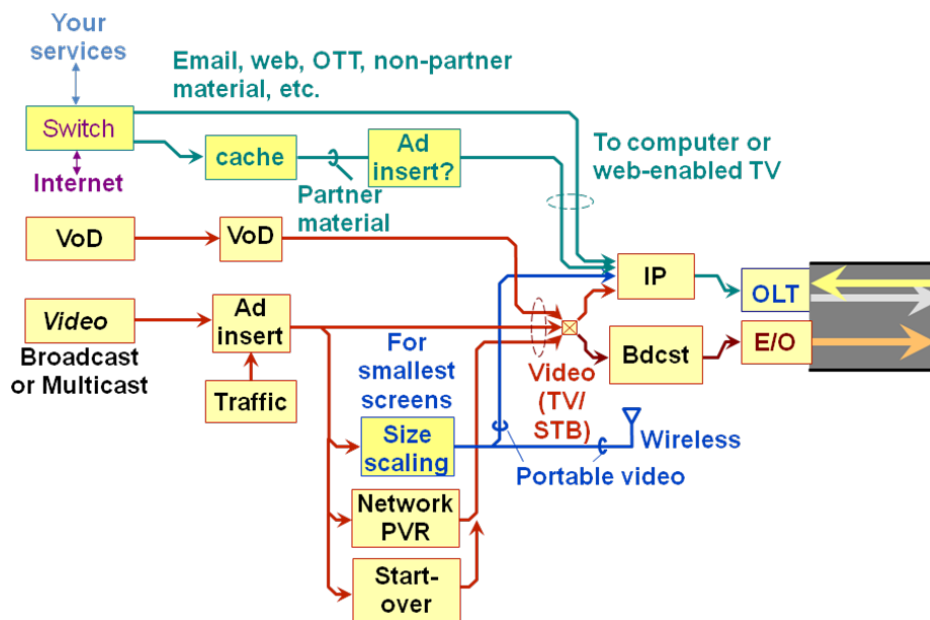
you may consider a network and management system that can handle both fiber and VDSL to gradually transition subscribers from one set of services to the other.

FTTx: THE FUTURE-PROOF SOLUTION

An FTTx network, on the other hand, provides the “future-proof” pipe that has almost unlimited bandwidth, with connectivity speeds of up to 100 Mbps or more. A robust carrier-grade optical line terminal can serve far more subscribers from a single chassis, up to 4,500, compared to a couple of hundred with a VDSL node (depending on the communications protocol and network architecture). This requires far less equipment that must be purchased, deployed and maintained in the field.

VIDEO FROM A LEGACY BUILD

For Telcos and Cable Operators who already provide a cable TV service over coax, they have an existing investment in a video head end that could be worth \$1 million or more. They also have in place agreements and contracts with providers of programming content. For these operators, the key concern is how to maximize the value of their existing investment and how far Data Over Cable Service Interface Specification (DOCSIS) can take them.



DOCSIS: FOR HOW LONG CAN IT HOLD ITS OWN?

The various DOCSIS standards have been key to maximizing the usable bandwidth and capacity of coax. The industry continues to pin its hopes on the latest iteration, DOCSIS 3.0. While DOCSIS 3.0 offers significant improvements in bandwidth availability over its predecessors through channel bonding, an operator must always make tradeoffs between downstream channel allocation and the type of traffic that will be carried on a network, be it video or data.

Such advance network planning might meet the short-term traffic patterns of the network and the bandwidth allocation to the node. However, as consumers demand more and more bandwidth-intensive and interactive television services, having sufficient bandwidth to allocate will become increasingly difficult, if not impossible. DOCSIS 3.0 sharing might see as many as 150 subscribers on a node, with shared bandwidth approaching 160 Mbps, at a cost of 40 standard definition or eight HD video programs. The data represents an average speed per subscriber of only about 1 Mbps.

All this pertains to only the downstream capacity. A fundamental challenge, and limitation, with DOCSIS 3.0 is its upstream capacity. This is dictated by the actual plant, the issue of noise funneling depending on how many homes and businesses are on the same channel, and the condition of in-home wiring. This can be addressed to some degree by reducing the number of subscribers per channel, but again, that requires costly investments in new gear, as well as frequent reengineering of the network.

FTTX: STILL THE BETTER CHOICE ... AND IT CAN LEVER YOUR EXISTING NETWORK BUILD

Fiber, on the other hand, provides more flexibility and requires less on-going network management planning for channels and bandwidth. Take for example, a network on one of the common FTTx standards, Gigabit Passive Optical Network (G-PON), in which 32 subscribers are served from a single node. These 32 subscribers will share a 2.4 Gbps connection, for an average download speed of approximately 75 Mbps per subscriber.

To achieve similar performance with DOCSIS 3.0, the number of subscribers per node would have to be limited to two. That's going to require a lot of new investment in hardware and cable runs which, in the final analysis, makes a fiber deployment much more economical.

Cable operators have already run fiber to the node and make the last mile link to the subscriber's premises with coax. This can be a cost-effective approach to migrate to a full FTTx network in stages that are easier to budget. You can maintain the current fiber runs and network architecture if it makes sense in the final analysis including all nodes or reduce the number of nodes if you wish. Enableness's unique temperature hardened optical line terminals (OLTs) can serve from 250 to 4,500 subscribers per node letting you maximize all the optical capacity such multiple fiber links to each node if available. They offer the flexible designs and robust management systems required for an economical migration from an HFC to an all-fiber network that makes the most of your existing equipment investment.

RFOG: IS THERE A HAPPY MEDIUM?

RFoG, Radio Frequency over Glass, has also emerged as new option for cable providers, in which RF transmission over fiber is used in both directions. This is intended to provide some of the capabilities and benefits of FTTH, such as lower maintenance, no radiation or ingress, and, most importantly, faster and cleaner upstream transmission. However, it is still a DOCSIS-bound solution, subject to DOCSIS's inherent shortcomings compared to fiber.

WHAT ARE MY CHALLENGES?

"Entertainment. Entertainment. Entertainment." This is what subscribers want. This is what your network must be able to deliver. Unlimited HD in which multiple channels are streamed simultaneously to different devices

throughout the home, VoD, the arrival of 3DTV and its logical evolution into large screen projection 3D-HD formats, as well as low-latency services such as HD gaming, is redefining what constitutes “high-speed.”

Add to this list real-time video-conferencing and collaboration for business communication, research and remote healthcare, as well as mobile video and video telephony for residential use.

As a service provider, you must ask yourself how you can provide, and monetize, these bandwidth-intensive services. How do you compete with the Skypes of the world? Is it with premium services that can allocate bandwidth to deliver an otherwise unavailable QoS guarantee? What kind of network architecture and management system do you need to do that? How do you lever the bandwidth advantage of an FTTx network? And don't forget any existing transport links and routers you may have deployed; do they have the right capacity?

FAST FACTS

- 93% still watch traditional broadcast TV each week
- People spend up to 35% of their leisure time watching content
- More than 70% time shift programs each week
- More than 50% are using Internet-based on demand video every week
- On demand had 60% time share but 40% wallet share
- 40% think on-demand access is important
- > 50% think simplicity is important

Source: Ericsson Consumer Lab, TV Consumer Insights, London, August 2010. Survey from multiple countries

PART II: WHAT WILL I NEED?

Deploying new network architecture and provisioning advanced video services that were not possible over the legacy network means the business model of the network operator/service provider must change. With the ability to provide a greater variety of programming content, more HD and more interactive services, new agreements will have to be negotiated and/or old ones retired with existing content providers. The operator may have to part ways with these old partners entirely and find new ones who are better positioned to monetize the capabilities of the new network.

And while the new network and its new services may have come in response to subscriber demand, the new business model must be able to provide consistency in service, operations, support and billing between the old and the new. Meeting these customer service expectations is not only crucial to grow and retain the subscriber base, but also to increasing average revenue per user (ARPU).

The network must also have the technical sophistication to reduce the complexity of the network. To grow revenues and profit margins, testing and deploying new services, as well as managing subscriber packages and service levels, should be easy and intuitive, with as little manual touch by technicians as possible.

WHAT DO I NEED TODAY?

A LOT OF BANDWIDTH

How much? One HD program consumes up to five times the bandwidth of a standard definition program. And it is becoming the norm to have two simultaneous HD feeds to the home.

MULTIPLE CONTENT SOURCES

Ease of use to handle and provision multiple content streams from multiple service providers over both broadcast and IPTV is a must. In addition, subscribers want the flexibility to easily pick and choose from among various alternative content providers.

RELIABILITY

The network must be highly reliable to ensure clear and crisp picture and sound quality, as well as smooth operation of interactive services such as VOD that require two-way communication with the set-top box via an RF return.

VARIETY

Subscribers want flexibility and variety, with different programming packages, price points, and value adds such as PVRs, time-shifted programming and interactive program guides.

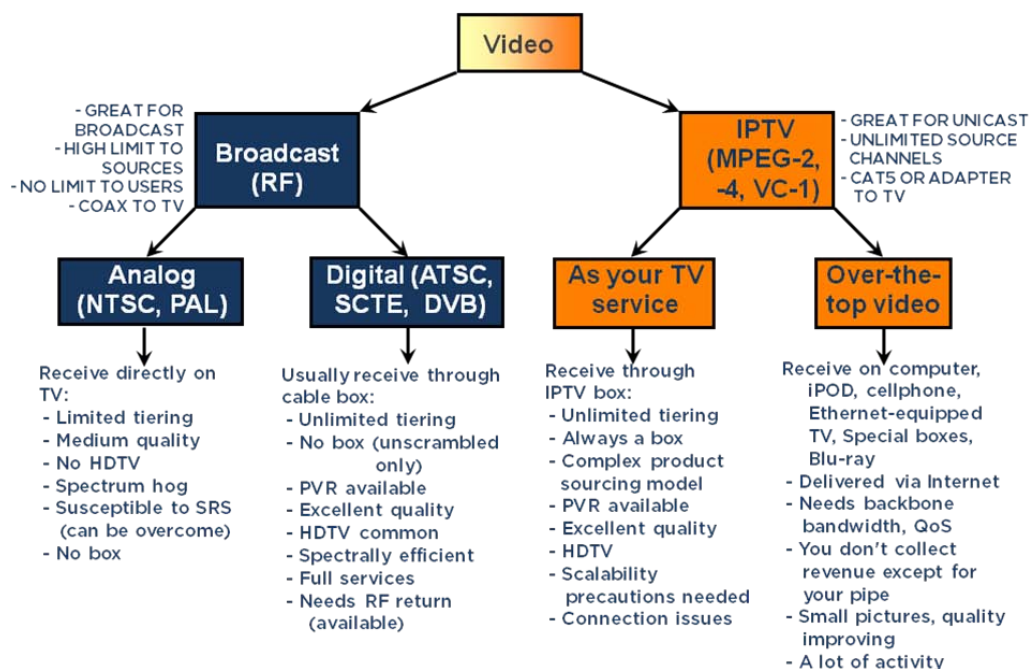
TRAFFIC PRIORITIZATION

Give video traffic the priority it is due. There is a distinction between optimizing overall traffic on the network to ensure SLAs are met and going that one step further to prioritize the bandwidth allotted to video in order to maintain the service and quality viewers expect.

BUT WHAT ABOUT TOMORROW?

According to a June forecast from Cisco, the sum of all forms of video, (TV, VoD, Internet and P2P) will exceed 91 per cent of global consumer Internet traffic by 2014. Advanced Internet video (HD and 3D) will increase 23-fold between 2009 and 2014 and by 2014, will comprise 46 per cent of consumer Internet video traffic.

Video communications traffic is also accelerating. Though it remains a small fraction of overall Internet traffic, Cisco forecasts video over instant messaging and video calling will grow sevenfold from 2009 to 2014. Real-time video is also growing in importance, with Internet TV expected to account for more than eight percent of consumer Internet traffic by 2014. Ambient video (persistent video streams such as nannycams, petcams and home security cams) will account for another five percent.



Lastly, Cisco expects VoD traffic to double every two-and-a-half years through 2014, with a CAGR of 33 percent between 2009 and 2014.

These data points emphasize the statement made in the introduction to this paper: When building a video capability, you focus must be on what you will have to deliver tomorrow, rather than today.

So exactly what video services will be driving these substantial increases in bandwidth and capacity?

IPTV: WHAT IS IT AND WHY SHOULD I CARE?

With IPTV, the same video that is sent over RF as digital broadcast is put in IP packets and sent over an IP network. However, unlike digital broadcast, in which all content is sent to all viewers and receiver tuning is employed to select the desired content, IPTV makes more efficient use of bandwidth by sending down the fiber only the specific programming the viewer has requested. This results in lower bandwidth load on the network, but the network is involved in every tuning action, as opposed to broadcast, in which the network is unaware of the program to which the subscriber is tuned.

IPTV also makes it more efficient to offer, in addition to VoD, Applications on Demand (AoD), as well as personalized content and inserted advertising that can be used to promote specific goods and services to viewers depending on their choices. Want a pizza to go with that movie downloaded tonight? You might order it right now from your TV screen. How about games on demand, e-shopping, e-learning, network-based recording, time-shifted programming and interactive program guides?

All of these interactive services have been tried with digital broadcast, with some success. However, in many cases, the cost has been punitive. But with the right third-party middleware applications for the set-top box, and the big symmetrical bandwidth pipe that only FTTH can provide, provisioning these interactive services can be more economically feasible and profitable with IPTV than has been the case with digital broadcast.

IPTV also makes it easier to move video around the home and between a TV, computer, and portable device, provided you have a robust network with sufficient capacity. An IPTV set-top box works as a home network Ethernet gateway that makes it easy for content (including HD movies) to stream from one device to another throughout the home.

OTT AND THE CONNECTED TV

IPTV also manifests as OTT – content streamed directly from the Internet to a TV. This is the dire threat to content programmers, who fear the same digital rights management challenges that faced the music industry with online downloads. How to monetize this consumption of online content remains a fundamental challenge. Nonetheless, it is a paradigm shift that service providers cannot afford to ignore. Today's youth and young adults are turning to the Internet more and more at the expense of broadcast television.

According to another report from Parks, interest in viewing television programming on the Web is so strong that consumers are making their own connections through PCs, laptops and video game consoles. Last year, the number of U.S. households using Web-connected game consoles rose by 64 percent, while the number of households connecting a PC to a TV increased by 36 percent. More than three in four households with PC-to-TV connections and a third of households with Microsoft Xbox 360 consoles are using the technology to stream online video.

In its June 2010 market studies report, the FTTH Council Asia Pacific also noted that Connected TV services that allow subscribers to access online content from their television is driving the evolution of televisions with built-in Wi-Fi or Ethernet access capabilities and a web browser. Strategic partnerships are already forming between content providers and electronics manufacturers, such as between LG Electronics and Netflix for video purchases and pay-per-view subscriptions.

As a service provider, you must consider how you can monetize these trends with valued-added services that take advantage of that big bandwidth fiber pipe, or even develop competitive services.

THE YOUTUBE FACTOR

From a bandwidth capacity and traffic management standpoint, it must be noted that this growing preference for online content goes both ways; more and more, consumers of content are also creators of content. Youtube typifies the demands that have been placed on operators to provide ultra-fast symmetrical connectivity.

Youtube itself, which now offers 1080p HD, reports that more than two billion videos are viewed per day on its service, nearly double the combined prime-time audience for all three major U.S. television networks. Twenty-four hours of video are uploaded every minute. In fact, Youtube claims that more video content is uploaded in 60 days than all three major U.S. networks have created in 60 years. As a service provider, you must consider how you can take advantage of this trend by offering tiered service levels at different price points, as well as SLAs, for users who demand faster upstream and downstream connectivity.

ADVANCED VOD

For traditional interactive TV Services such as VoD, this explosion in the volume and variety of content is driving consumer demand for more sophisticated cataloguing systems that are capable of serving hundreds of subscribers simultaneously with a reliable HD experience. Priority traffic management, huge bandwidth capacity and an elegant RF return solution for real-time two-way communication through the set-top box is crucial.

3D TV

In its report, FTTH Council APAC also cites the emergence of 3D TV, another bandwidth hog that will put additional strain on network capacity as it becomes more mainstream and follows a logical evolution into large screen projection 3D-HD formats. Panasonic, Sony, LG and other leaders are rolling out 3D-enabled solutions, not only for televisions, but for computers and mobile devices as well. Various TV networks have also announced 3D projects, such as ESPN in the U.S., Sky in the U.K. and Canal Plus in France.

VOICE AND VIDEO

Residential video calling services that require no other device other than the television set are also a hot area of innovation heading into the next decade that, if realized, will add to the bandwidth burden placed on the network. The FTTH Council APAC report cites several efforts to develop consumer HD-quality versions of videoconferencing solutions used by business, such as Cisco's TelePresence. Among these is a video calling product being developed by Skype in partnership with LG Electronics and Panasonic.

LOCAL PROGRAMMING

And don't forget local programming as a means to differentiate yourself from larger competitors by focusing on the community. With today's digital technology and the quality of consumer video cameras, this can be quite affordable to set up and creates part-time jobs for young people as videographers.

"Going local" can raise your profile in the community in a way that will drive subscriber loyalty and create new sources of revenue from advertising by local businesses. Under this umbrella, your network could also provide fixed cameras at schools for security, local traffic views and coverage of city council meetings.

PART III: WHAT ARE VIDEO'S TECHNICAL CHALLENGES?

The FTTH Council APAC notes in its report that FTTx networks are undeniably the best suited for interactive video offerings and/or for those that require a great deal of bandwidth. Consumers want interactivity options that take them beyond simply being passive viewers, as well as access to premium services such as HD and 3D TV.

To meet these demands for premium and interactive video services, an FTTx network provides:

- Unprecedented speeds, both upstream and downstream
- Equal quality of service for all subscribers (no bandwidth sharing)
- Ability to access multiple services simultaneously (such as watching different content on different screens or recording one program while viewing another)
- Increased network agility with low latency

But while FTTx networks are best positioned to address this demand and ensure sufficient service quality, not all optical network architectures are created equal, or designed with the same standards in mind.

How transport and access is managed in the network's central office (see our Architecture white paper, "Under the Hood"), as well as the robustness of the element management system (EMS) – the software layered on top of that hardware – will have a direct bearing on how profitably the network can deploy premium video services.

Quality of Service is essential. A broadcast VoD service with excessive jitter, or lost IP packets that freeze the picture or corrupt the audio, tend to leave subscribers frustrated and questioning the value of their spend on your bundled service package. When selecting a fiber network system, chose a vendor that has extensive experience with, and proven technical solutions for, addressing these issues.

THE EMS: HOW EASY IT IS TO ROLL OUT AND MANAGE NEW VIDEO SERVICES?

While services over the network can be managed from the command line interface on the central office equipment, an EMS provides much greater utility for the service provider to provision and manage subscriber services over the network.

A sophisticated and easy to use EMS allows you to give subscribers what they want, when they want it, with seamless billing system integration. When looking at an EMS, ask, "how effectively can it manage different service levels among subscribers with different bandwidth requirements to ensure QoS and SLA agreements are consistently met?"

Enableness's EMS solutions provide the carrier-grade functionality that reduces the amount of manual "touch" by technicians to provision new services and provide specific service levels to specific subscribers. We provide the flow-through provisioning, flexible policy settings, pre-set templates and seamless billing integration that is fundamental to reducing operating costs and growing profit margins over the long-term.

Through standard APIs, it is easy to integrate your OSS/BSS and ensure that they work in tandem.

SEAMLESS HEAD END INTEGRATION AND SIGNAL INTERCEPT

The EMS also plays a crucial role in how easy it is to provision multiple content streams from multiple service providers over both broadcast and IPTV.

Network operators need the freedom and flexibility to operate with as few limitations as possible. The ideal network architecture should easily provision content streams from multiple service providers, terrestrial or even satellite. Integrating RF signals from a new or existing head-end, as well as integrating digital HD and IP signals from the head end, should be seamless. With Enableness, all of this is possible.

SUPERIOR PICTURE QUALITY A MUST

Subscribers expect superior picture quality. What proven technical expertise does a vendor have for ensuring a crisp picture and implementing error correction to deal with effects such as SRS distortion? Look for a vendor that has documented leadership in this area with proprietary research and patents. Enableness has achieved a number of technological firsts when it comes to ensuring superior picture quality. And isn't video all about the quality of picture?

(32 home PON, three TVs per home, 50% HD, MPEG-2, 2 voice lines per home, 50% voice simultaneous usage)

	IP Video	RF & IP Video	RF Video
Top 20 broadcast (multicast) programs - 10 SD X 4 Mb/s = 40 Mb/s - 10 HD X 12 Mb/s = 120 Mb/s	160 Mb/s	0	0
20% view other programming - 20% of 96 = 20 programs - 10 SD X 4 Mb/s = 40 Mb/s - 10 HD X 12 Mb/s = 120 Mb/s	160 Mb/s	0	0
25% DVR/PI/OTT households - 25% of 32 = 8 programs - 4 SD X 4 Mb/s = 16 Mb/s - 4 HD X 12 Mb/s = 48 Mb/s	64 Mb/s	64 Mb/s	0
50% VOD - 50% of 32 = 16 programs - 8 SD X 4 Mb/s = 32 Mb/s - 8 HD X 12 Mb/s = 96 Mb/s	128 Mb/s	128 Mb/s	0
Video total	512 Mb/s	192 Mb/s	0
High Speed Data (15 Mb/s, average 300 kb/s)	9.6 Mb/s	9.6 Mb/s	9.6 Mb/s
Active voice (each family 2 lines, 50% simultaneous use, 127 kb/s per line)	4.1 Mb/s	4.1 Mb/s	4.1 Mb/s
Total	526 Mb/s	206 Mb/s	14 Mb/s

This chart estimates the bandwidth required on a PON (not to an individual subscriber) under three conditions: all video programming on IP; basic video programming on broadcast and premium video on IP; and everything on broadcast. The conditions assumed are shown at the top. We assumed MPEG-2 encoding, so there is a significant reduction in bandwidth if you use MPEG-4 encoding. We assumed 32 homes in the PON, with each having three TVs or other devices actually receiving video. We assumed each home had two voice lines and half of all lines were in use. We also assumed data usage using oversubscription ratios similar to those used by cable TV networks when they are NOT overloading their DOCSIS channels (that is, subscribers are not complaining about data slow-down). We assumed that 50% of all TV viewing was on high definition channels.

We assumed that the top 20 channels were always in use in at least one home on the PON, and likely were in use in more than one home. In IPTV, we assumed they were multicast, so that only one copy had to exist on the PON - it was "grabbed" by every ONT needing it. We assumed that there were another 20 channels being watched that were unique to one home. That is, the bandwidth was being taken on the PON in order to reach one subscriber only. The next row is for other uses of unique video, such as for over-the-top (OTT, internet-delivered video), video going to a personal video recorder (PVR) or feeding a picture-in-picture feature. Note that the likelihood of OTT video running at the high MPEG-2 speed is extremely small, so this is one of several ways the chart is conservative. In the final video row, we assumed that 50% of the homes were watching video-on-demand. This is a much higher number than experienced by the cable TV industry at peak, but we wanted to be conservative and allow for growth.

We totaled the video bandwidth used in the three cases, then we added in data and voice usage. We assumed an average data service of 15 Mb/s, and a 50:1 oversubscription ratio. The cable industry uses this ratio or higher. Of course, this will not work with business applications: this is a residential calculation. We then added the phone usage, making reasonable assumptions about VoIP data rate. (VoIP data rate is a lot higher than is switched circuit data rate due to the IP and Ethernet overhead that must be added.)

The totals at the bottom are the data rate on the PON for each of the assumed conditions. The assumptions regarding video are very conservative. We assumed MPEG-2 encoding rather than the more efficient MPEG-4 encoding that is gaining more market share today. We assumed enough video streams that 95% of all the TVs on the PON were pulling unique video, sent only to that TV. In addition, we assumed that 20 programs were being viewed by more than one TV. The net result is that we have provided more video streams than there are TVs on the PON. This will include an allowance for PVRs or other usage.

ELEGANT RF RETURN

When FTTH networks are used with an RF overlay, an upstream path for control signals is typically needed from set top box connected to the subscriber's television. This upstream path, known as RF return, supports VoD and other premium interactive services. The network operator should look for a vendor solution that supports all RF return standards, and does it in a most friendly, economical manner.

Unlike most equipment vendors, Enablence digitizes the RF return at the home and puts the digitized data in a return packet to the video head end. This eliminates the need for external RF return equipment. The bandwidth required is negligible, since the set-top box typically requires only one data packet for the upstream transmission. This approach has proven to be reliable, seamless and cost effective.

KEEP THE TRAFFIC MOVING

Video, by any measure, is *the* bandwidth hog. Provisioning the advanced, quality services that subscribers want cannot come at the expense of other services such as high-speed Internet and telephone. The ideal network architecture and EMS should be able to manage traffic demands without additional equipment.

However, in the process of vendor selection, the network operator must understand the difference between a solution that simply optimizes overall traffic on the network to ensure SLAs are met and one that can go one step further to prioritize the bandwidth allotted to video at any one time to maintain QoS.

A multi-criteria and multi-dimensional optimization of traffic is hard to do, but where Enablence excels.

CONCLUSION

Video is king when it comes to attracting subscribers, driving revenues and providing the premium services that will lead to increased profitability on the network, provided it is deployed with a sound business and service strategy. It is the anchor for bundled service packages that provide subscribers with the multi-play that includes ultra high-speed Internet and advanced voice.

But the revenue and margin potential of video is equalled by the technical challenges that it presents in terms of having sufficient network capacity, priority traffic management, an economical upgrade path to scale the network and a robust EMS that can easily provision, manage and bill for these services.

An FTTx network is far superior to legacy copper or coax when it comes to deploying advanced video with highest standards of quality and reliability. But it needs a robust management system that allows service providers to easily and economically provision these new video services in a manner that will reduce OPEX over the long term. This frees staff resources dedicated to support to focus on developing, marketing and provisioning new valued-added services rather than troubleshooting and managing existing services.

Careful vendor selection is vital when sourcing network software and hardware to ensure the technical capability and long-term service and support is there to meet the unique needs of video.

ENABLENCE CAN HELP: CONTACT US TO LEARN MORE

Enablence has years of proven technical expertise and industry leadership when it comes to provisioning video and television services over all-optical networks, as well as next-generation or advanced copper.

We have always thought that any innovation must come with an added element of practicality to offer more than just a standard solution. Our products reflect that through their compliance with multiple standards, ease of use and wide ranging compatibility to maximize the return on your network investments.

We work closely with our customers to tailor a solution that best serves current and future needs. It is an approach characterized by openness and transparency and a proven program of technical and business support that extends far beyond the planning and implementation phases of the network.

Enablence is committed to becoming a long-term, strategic partner to deliver a future-proof Next-Generation Network solution that will provide you with a strong return on the investment for years to come.

Contact us to learn more about how we can help you build a future-proof video and television capability as part of an advanced broadband access network. For more information, please visit www.Enablence.com.

**For more information
visit www.enablence.com**

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