Broadband Media Services

Definition and Overview

This tutorial describes the evolution and technologies involved in broadband media services delivery. A brief history tracing the evolution of broadband media services will be presented, along with descriptions of multimedia standards, potential services, and the roles of the various entities involved in creating broadband media services–network providers, content providers, services providers, and businesses and consumers. After working through the tutorial, participants will have a general understanding of the scope, technology, and benefits of broadband media services.

Broadband and bandwidth

"Broadband" refers to a type of network connection that supports a very high bit rate, as opposed to "narrowband," which supports a lower bit rate. The higher the bit rate, which is a measure of speed of transmission of bits per second (bps), the faster the transmission will occur in a given period of time. "Bandwidth" is a measure of capacity. Greater bandwidth allows more information to be communicated in a given period of time. Broadband media services delivery requires transmitting large amounts of information quickly, so the combination of fast broadband transmissions and large amounts of bandwidth required to deliver information are the foundation of broadband media services delivery. But this is just the beginning of the broadband media services story, because the true value of broadband media services lies in the actual services that can be delivered across these high-speed, high-bandwidth networks, the entirely new "on demand" way customers will access them and the customized and personalized ways that individuals will interact with these services. With that in mind, we can formulate a definition of broadband media services:

Broadband media services is the seamless, customized, "on demand" creation and delivery of multimedia services to homes, businesses, and mobile users, including entertainment services (movies, interactive games, broadcast TV), infotainment (e-learning, online training) through high-speed Internet protocol (IP) networks.

Beyond fast Internet access

"Broadband media" is sometimes called "streaming media" because the services, or "content," that is delivered via broadband networks is digitized, and received by users of the content in continuous real-time "streams." Broadband content is digitized and accessed utilizing IP, the standard protocol used for Internet access today. In fact, high-speed IP access through digital subscriber lines (DSL) that utilize existing voice lines for high-speed transmissions, is the foundation of the broadband media services network, and DSL is available in many parts of the world today. DSL is a group of increasingly high-speed technologies that enables fast Internet access in homes and businesses. DSL "always on" connections will also form the basis of the sophisticated broadband media services networks of tomorrow.

Fast Internet access barely scratches the surface of the powers of broadband, DSL, and IP technology, which, combined in broadband media services, will connect people and businesses around the world like never before. Broadband media services will put the consumer in total control by enabling personal, custom, on-demand viewing of entertainment, e-learning, video games, and other types of content. Individuals will choose what they want to hear, see, or be entertained by on their own, and people will no longer have to plan around preconceived broadcast schedules for home entertainment. Eventually, we will decide our own schedules for much of our entertainment. Furthermore, broadband media services will allow individuals to easily create their own content, personalize it, and distribute it for viewing on TVs, PCs, remote laptops, and mobile phones and other wireless devices around the world, instantly.

Broadband media services provides endless possibilities for consumers to choose and personalize their entertainment and infotainment. Broadband media services will also create new revenue streams for operators, media companies, and service providers through enhanced usage of existing networks, branded media portals, interactive "one-to-one" advertising and endless e-commerce possibilities. The proliferation of high-speed broadband IP access and broadband media services will require content creators to distribute large amounts of rich media to a global audience of high-speed users with increasingly greater demand for access to specific services. The challenges for broadband media development include understanding true consumer wants and needs for services and perfecting the technology standards behind the high data rates and significant bandwidth required for seamless delivery of high-quality multimedia services.

Topics

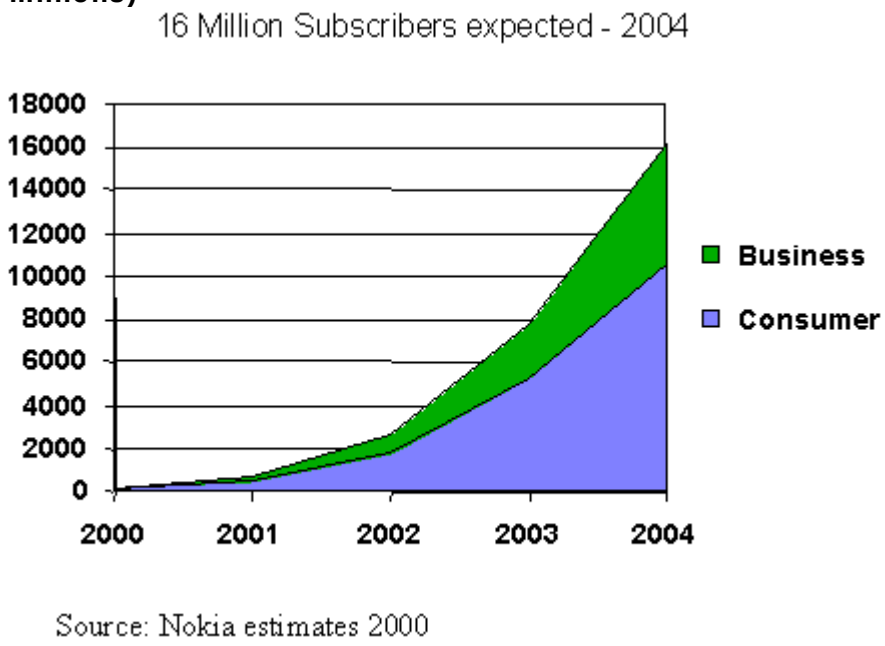
1. Broadband Media Services Evolution and Market Potential

It is estimated that by 2004 there will be more than 65 million DSL subscribers, and 16 million of those will subscribe to broadband media services. The market for broadband media services is driven by:

- content providers pushing new types of content to the Internet
- new broadband access technologies enabling cost-efficient media services
- broadband DSL services which will enable fixed operators to capture part of consumer's new TV and video services and bundle them with traditional voice services, helping to reduce customer churn and margin pressure
- increasing demand followed by growing market awareness

In addition to media revenues, broadband media services can provide new revenue sources such as advertising, interactive services, and e-commerce revenue sharing. How did the demand for next-generation IP services evolve? Why do telecom operators find broadband media services so compelling? To answer these questions, let's first take a brief look back at the evolution of broadband media services, and how broadband media services can create new opportunities for telecom operators.

Figure 1. Expected Broadband Media Services Subscriptions (in millions)



Source: Nokia estimates 2000

A little over 25 years ago, operators had no concept of using telephone lines as anything other than carriers of voice traffic to consumers. Before divestiture in the telecom world, and for many years after, the only service operators offered to consumers was basic voice service. The cable and home-video industries were also in their infancy. Other than network television and radio, entertainment meant that consumers went outside the home, to movie theatres, shows, or concerts. The cable industry consisted of a few small start-up companies, basically small groups of people positioning a large antenna, hooking up analogue line amplifiers to feed the signal, and routing the signal to multiple homes. The few cable operators that existed at the time were small and mainly focused on their growing cable-programming customer base. At the same time, telecom operators had a firm hold on voice service. While telcos and cable companies serviced many of the same customers with their respective services, there was otherwise little convergence in the entertainment and telecommunications industries.

Then, beginning in the early 1980's, and especially in the last 10 years, the telecommunications industry was forever changed. The proliferation of the wireless and home-entertainment industries, including cable, home computing, and widespread use of the Internet, has created both opportunities and challenges for traditional operators. Some have experienced bankruptcy or were merged with other companies. The few that remained were faced with new competition from start-up telecom companies, Internet service providers (ISP) and content providers for a share of the growing consumer telecommunications dollar. As many of these start-ups were forced out or merged, the dominant

companies that remained had tremendous opportunities to bring more value to the consumer than ever before by providing first dial-up, then high-speed, or broadband, Internet access. Today, substantial revenue increases for telcos derived solely from voice services are limited, because of market saturation. New revenue sources must be integrated into their existing product lines. Enter broadband media services.

Broadband Media Services Market Potential for Operators

The role and scope of the telecom, Internet, and entertainment industries as global powerhouses have played an important role in the emergence of broadband media services. While cable and satellite remain viable markets for home entertainment, broadband media services delivered via IP have applications above and beyond movies and music, for both homes and businesses, and offers several advantages. As Internet content becomes more sophisticated and media companies expand development of digital content in Internet-compatible protocols, the demand for broadband media services will grow exponentially. As a result of this growth, operators will have significant opportunities for generating additional revenue. The telcos' huge base of residential voice customers is a ready market for next-generation media services.

Some of the major benefits of broadband media services include the following:

- The infrastructure upgrades that are required for broadband media services do not involve significant civil and building-code regulation. In other words, to deploy broadband media services in an urban area, operators utilize their existing network infrastructure, so less land will need to be dug up to reinstall new infrastructure.

- Broadband media services revitalizes the revenue potential of the telcos' existing infrastructure by providing new opportunities to service existing customers.

- Broadband media services offers telcos a way to compete with cable (CATV) operators' packaged "voice + CATV services."

- A higher level of security is possible with IP networks. Since users are authenticated, or recognized, truly customized services and marketing opportunities based on specific user interests can be created. This is not possible with current broadcast networks.

- New levels of customization and interactivity are possible, combining Internet with broadcast television or DVD, for example. Bundles of services are no longer pre-defined and schedules become obsolete—users decide on the media they want, and determine on their own when they want to experience it.

- The power of the Internet is taken to a new level with broadband media services, in that individuals can create their own content and distribute it to electronic devices around the world (televisions, wireless phones, laptop computers, etc.) at the click of a button.

- Since services are individual and not bundled, upgrades are done on a per-customer basis, unlike CATV where fundamental changes require upgrades to all served on a common/shared infrastructure.

- Pay TV (CATV or satellite) is an established service in many countries, so there is reason to believe that telcos that offer broadband media services will find an eager customer base willing to pay, providing customers recognize the value of broadband media services over existing entertainment services.

Generating marketing messages that will convey the value of broadband media services to customers will be crucial to obtain new subscribers and for consumer word-of-mouth diffusion to kick in and grow the broadband media services market. In order for telcos to be ultimately successful in deploying broadband media services, they will need to work closely with network and content providers to ensure that services are deployed and marketed effectively to their customers.

2. Broadband Media Services Technology (Network, Components, Standards)

Just as the Internet will continue to bring people together and provide individualized services like never before, the IP network technology that enables broadband media services is rapidly improving and becoming more powerful. This section of the broadband media services tutorial will provide an overview of the network and component technology required for end-to-end broadband media services provision, as well as an overview of technology standards involved in digital multimedia content creation and transmission.

Next-Generation Networks

In a truly mobile information society, mobility, traditional fixed and mobile-network services, value-added services, and the Internet are all combined to offer

seamless services for end-users. As uniform services will be available through different access points and optimized for each device (TV, PC, wireless device, etc.), seamless roaming among multiple access devices will be required. Users won't have to be concerned with the underlying technologies used, but they will be concerned with being able to access the same services wherever they are and whenever they choose.

The Next-generation network, the first truly data-oriented broadband network supporting broadband media services, will be all IP, meaning all access to the network will occur via IP standards. The evolution of the broadband media services network can be characterized by six different transitions:

- Transition from a dial-up-like circuit-switched network to a data-oriented network
- Transition from connectivity to service-creation platforms
- Transition from a copper-based network towards an all-optical network
- Convergence of fixed networks
- Convergence of mobile and fixed networks
- Transition to IP version 6 (Ipv6) networks

In short, next-generation networks will evolve to better reflect the requirements of broadband media services. In practice this means bringing IP and other associated network functionalities in the network closer to the customers. The DSL technology and network components that enable high-speed IP access and basic broadband media services exist today, and will remain the foundation of the next-generation broadband media services network:

The major components of a broadband IP access network and next generation broadband media services network are

- high-speed DSL access multiplexers (DSLAM) equipment, located in the operator central 0ffice (CO) and/or in remote locations close to end-users
- broadband access servers
- DSL modems in the home and/or office providing fixed local-area networks (LAN) and wireless LAN (WLAN) network access
- Network- and service-management and provisioning products

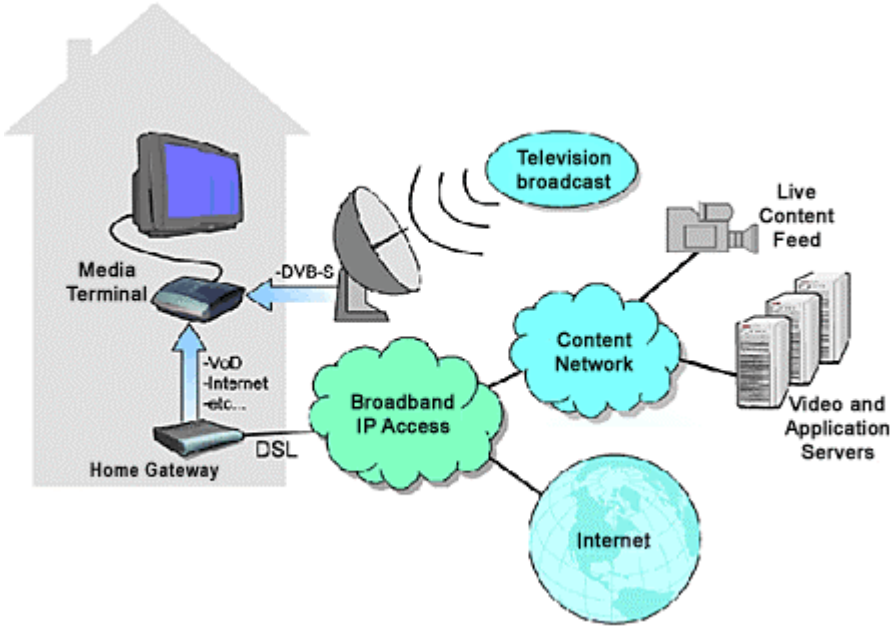
- loop management for managing DSL services in the local telecom loop
- IP network security and authentication products for network security and user identification

In addition to network infrastructure, network services will manage and enhance the physical network for broadband media services delivery. Broadband media services network integration services could include network capacity planning and business consulting for network optimization and interoperability, network installation setup and field-testing trials, customer-service support and training, and network validation and certification services.

Components

With the IP access network as a foundation, broadband media services–specific network enhancements are required. The broadband media services components can have varied functionality with just a minor change in the presentation of the feature, which is required for a modular and scalable solution as new services are created and consumer demand for additional services evolves. Essentially, broadband media services allows consumers to customize their viewing via network control devices. Each set of devices or "boxes" can support a unique content lineup map, which enables consumers to select and pay for only the media that interest them. Specific standards mentioned, such as moving pictures expert group (MPEG), are described in greater detail in the "Standards" section, and specific services, such as voice on demand (VOD), will be described in the "Services" section.

Figure 2. Broadband Media Services for the home



Video Encoders

Video encoders are devices that create digital video. Input to the encoders can be analogue video or a Digital Video Broadcasting Group (DVB) multiplex. Both are required because some video content will be statically loaded from video tapes and some content will be captured from a satellite (DVB) multiplex. Video encoders that are used to deliver broadband media services most often allow for the creation of MPEG content and have the ability to support IP multicast at varying bit rates, as well as the ability to decrypt video streams to remove conditional access.

Video Servers

Video servers perform two major functions. First, they act as content repositories for the material being streamed. Second, they are responsible for streaming out video and audio using the desired format and network protocol. Video servers can be scaled from streaming 20 to over 5,000 simultaneous video streams. Video servers generally support several different transport protocols for video delivery.

Interactive Television Application

Interactive TV (ITV) applications consist of many different applications. The core of the system is the application framework and the data-handling capabilities of the back-end systems. Highly scalable for add-on features, the fundamental applications in an ITV system are customer relationship management (CRM) software modules that track customer usage, profiles, buying characteristics, and application subscription information and create billing events that-can be exported to various billing systems. Applications that typically run on the application framework are VOD, time-shifted TV, web access integrated with video applications, e-mail, personalized user interfaces, broadcast multichannel TV, and pay-per-view applications. Variants of these fundamental applications include channel blocking; parental controls; instant web access associated with viewing preferences for an enhanced, interactive viewing experience; video special offers; and targeted advertising.

Set Top Box and Customer Premises Equipment

The set top box and customer-premises equipment (CPE) are devices that are placed in consumer homes or offices, either as two separate devices or as one device combining the home or office gateway functionality required for broadband media services delivery to fixed and wireless devices. A set top box is an electronic device that serves as an interface between a television set and a broadband network, providing VOD and interactive multimedia services. CPE is

any type of network device that sits in the home or office of the consumer, as opposed to the central network office or remote sites. User connections to broadband media services are made through modems and media terminals in the home and office, while the main infrastructure lies in the back-end networks, invisible to the end-user.

Standards

To help ensure the interoperability, modularity, and flexibility of services, network, content, and service providers are driving towards open standards for individual broadband media services. Standards forums meet regularly to enhance existing standards, incorporate new technological developments into current standards, agree on next steps for testing, and anticipate new developments that will affect standards. Some of the standards involved in broadband media services are

IP

This is a standard supported by major application providers, software companies, and computer manufacturers. Since the range and variety of broadband media applications are more important with respect to commercial revenue-bearing services than any one specific application, enabling the integration of a broad range of media services and applications, IP is crucial. Without IP as a unifying protocol, the set of applications could be limited. One of the features of broadband media services is that it takes full advantage of the guarantees provided by IP access products with respect to real-time IP data delivery. The network provides real-time guaranteed IP data delivery. This clearly removes the burden of bandwidth management off the consumer applications and enables the developers of consumer applications to focus on the usability issues as well as providing an enriched user experience. IP provides the path that allows applications to evolve, independent of the transport protocols selected for broadband delivery.

IPv6

This is the new IP to replace the current version, IP version 4 (IPv4). IPv6 has been designed to meet the challenges of the growing Internet and includes several improvements over IPv4. The main benefits of IPv6 include a larger address space, integrated security, support for auto-configuration of terminals, and support for mobility.

MPEG

This is a digital video and audio compression format that was defined as part of the International Standards Organization (ISO). MPEG is a compression method that uses interframe compression. Interframe compression assumes that although something is happening in the foreground, the background in most video frames remains the same. This means that it is not necessary to compress each entire frame, but only the differences between them.

MPEG–2

MPEG–2 is a widely used, standardized video coding and compression technology. MPEG–2 is used in DVD movies and digital satellite distribution. Non-compressed video stream is roughly 200 Mbps, but with MPEG–2 the video can be encoded at 1.5–18 Mbps. DVD quality can be reached between 5–9 Mbps, but 2–3 Mbps is enough to exceed VHS quality. MPEG–4 is also a video coding and compression technology.

MPEG–4

MPEG–4 is a compression/decompression technology that aims to achieve interactivity, efficiency, and stability in transmissions. The result of another international effort involving hundreds of researchers and engineers from all over the world, MPEG–4 offers higher video quality and resolution at a lower data rate than MPEG–2. Also, the MPEG–4 stream encoding rate range is wider (5 kbps–60 Mbps). MPEG–4 allows interactive objects in the stream, making it more multimedia ready. On a broader level, MPEG–4 aims to pave the way toward a uniform, high-quality encoding and decoding standard that would replace the many proprietary streaming technologies in use on the Internet today. MPEG–4 is also designed for low bit-rate communications devices, such as wireless mobile devices that can display video. MPEG–4 supports scalable content, which means content is encoded once and automatically played back and transmitted at different rates depending on the available network connection.

Real-Time Streaming Protocol (RTSP)

This defines the control interface between video server and video client. With RTSP, the end user can control the video server as he or she would control the home VCR (play, pause, fast forward, rewind, etc.) RTSP also initiates the video streams and identifies different streams in the network so that the information can be used in billing.

Internet Group Management Protocol (IGMP)

This is a protocol that supports IP multicasting, a method of broadcasting that authenticates end-users prior to receiving content.

Very High Bit Rate Digital Subscriber Line (VDSL)

This is an extremely high-speed DSL technology for transmitting digital information over short reaches of an existing phone line to homes and businesses. With VDSL, transmission rates are very dependent upon actual loop length. The maximum downstream rate is between 51 and 55 Mbps over lines up to 1000 ft (300 meters) in length. Initial upstream rate will be an asymmetric rate between 1.6 and 2.3 Mbps. The data channel will be a separate frequency than that of bands used for plain old telephone service (POTS) and integrated services digital network (ISDN), thus enabling service providers to overlay VDSL onto existing services. As needs arise for higher-speed upstream rates, VDSL may need echo cancellation.

3. Examples of Services

The variety of broadband media services that consumers will receive is only limited by the creativity of network, service, and content providers. While research is being conducted regularly to determine demand for specific services, one thing is clear—for broadband media services to have successful deployment, the services will have to add value to individual lives. User interface (UI) is an important component of this, and the interface and controls have to make sense for users. Ideally, users would control and access content with familiar remote-control devices and create and select content via customized on-screen menus according to their preferences. An example would be a single on-screen menu (viewable on the users TV, PC, etc) that provides access to the home DVD collection, music library, video game library, Internet and e-mail, e-greetings library, family photos, broadcast TV, pay-per-view options, and more. In the office, a single interface could provide access to employee-training videos, industry discussion forums, Internet and e-mail, and other company news and information. Since ease of use is a crucial part of the overall solution, companies are actively researching consumer preferences for integrated media interfaces to offer a variety of options that address individual tastes.

The three cornerstones of Broadband Media Services are

- truly customized "per customer," "per media type" access to multimedia content
- content "on demand"—what you want, when you want it

- advanced interactivity

With that in mind, broadband media services are probably best described as a mix of:

- Internet applications (interactive surfing of the WWW)
- e-commerce
- pay-per-view
- interactive targeted marketing

To better understand the potential of broadband media services, here are a few real-world examples of services that are being intensively developed and tested:

Media on Demand

On-demand experiences are a cornerstone of broadband media services in that users can consume content when it is convenient for them, as opposed to planning viewing or listening times around a preconceived, generic broadcast schedule. Generally, a media on demand (MOD) system's primary goal is for a client to request video or music and have it play back without interruptions, with little or no delay. MOD means that the content starts playing back from the beginning or from some specified point as opposed to joining a transmission in progress. An MOD server operating on the Internet today uses IP protocols to deliver the data. These protocols define how the server encapsulates the media file into packets and how a client decodes the received data. In MOD, content is "streamed" to the viewer in real-time. The recipient may choose whether to view the content the same time it is streamed (which is possible) or save the content in the video server to view another time.

Much more than movies or VOD, MOD could be anything—music, interactive games, university courses, vacation videos, replays from last night's hockey game, a scene from your favorite music video, a video phone call with grandma and the kids, your real-time stock portfolio with different scenarios e-mailed from your broker, a live Webcast for work. You get the idea! The premise of broadband media services is the same in that all digital content transmitted through IP networks can be "streamed" to devices and/or saved in servers, merged with other content, and ultimately viewed and interacted with. And, you will have fast, seamless access to it via a customized on-screen menu, viewable from different devices such as TV sets in different rooms of the house or PCs at the home or office. Here are two examples:

- It's Saturday night and you feel like staying home and watching a movie. You heard about a great foreign movie but you haven't been

able to find it near your home. You log on to your broadband media services because you know your personal video search engine will help you locate the movie online. Then you will buy it and have it "streamed" to you instantly, but only after you've seen a preview. After you watch the movie, you notice a personalized message from the provider indicating the release date of another movie by the same director, along with a preview of the movie and an offer for 20 percent off your next purchase. Since you enjoyed this movie so much, you go ahead and order it in advance and specify the date you'd like it to be sent to your home server. Then you click on your "late night music" selections on your entertainment menu and play a few tracks from your jazz music library before you finally doze off.

- Your daughter's friend from school just got a new interactive video game for her birthday and your daughter has been rightly chosen to be the first to play with her. The only problem is, your daughter is tired from a long day by the seaside and she doesn't want to get up from the sofa. So, you fire up the laptop and drop it in her lap while her friend streams the game from her home server to yours. As your daughter desperately tries to outwit her friend at the game with the help of your speedy WLAN laptop connection, her friend has unwittingly downloaded a few "hints" from a private Internet site only available to buyers of the game. Feeling guilty after beating your daughter five games in a row, her friend decides to send a quick video demonstrating the hints for a more even match tomorrow.

Live IP Broadcasting

Of course live broadcasts exist today, but broadcasting of live events in real-time over the Internet provides a completely new range of entertainment possibilities that can be offered to end-users. There are no channel limitations and the coverage is global. Live video feed can be captured using real-time video encoders and then streamed to video servers. Broadcasting of live streams could also mean receiving satellite, cable, or terrestrial TV channels and encoding them into the IP network. Here are some examples of what IP broadcasting will mean:

- You've recently moved out of the country. You like your new home and job but you miss the local news back in your hometown, and especially the extensive coverage of your old high school football team that recently made it to the playoffs. With IP broadcasting, you can watch your local news every night and you won't miss a thing. And, you can have the local broadcast of all the playoff games "streamed" to you via IP broadcasting.

- You have tickets to the symphony but your boss just handed you a last-minute business assignment so you won't be able to go. No problem. You can have the symphony "streamed" to you in real time and keep it on in the background, while you're working, hearing it just as if you were there live. Since you've saved it on your home server, you can replay it again and again for the full video experience later.

Regional production of global sports events, concerts, and local events in real-time will become a reality and will create new revenue streams for operators. For consumers, IP broadcasting will become as close to "being there" for the live event as one could possibly get and allow people to keep close ties with favorite local programming around the globe.

New revenue opportunities abound for service providers, as broadband media services will enable advanced targeted marketing messages. Broadband media services will create new classes of advertising such as on-demand marketing, where companies provide audio and video messages to consumers who express interest in a particular product. Automakers, for example, could offer one- or two-minute video clips demonstrating the features of specific new car models. Broadband media services will enable marketers to reach consumers near the time of the purchase consideration, with content targeted directly to the actual purchase decision-makers.

Some additional revenue-generating possibilities that operators and advertisers will enjoy are

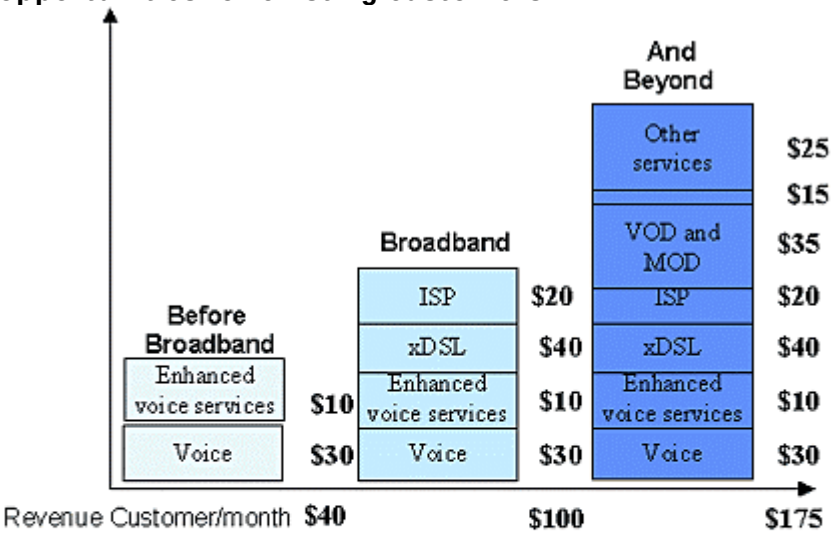
- **e-commerce**. Transaction commissions on e-commerce via retailers on the system.
- **real-estate charge**. Monthly "rent" charged to each retailer on the system including links to retail sites and a number of pages on cache memory.
- **network games**. End-users or groups of end-users pay for getting access to the latest games over the network.
- **sponsoring packages**. Arrangements for retailers to be primary or secondary service providers in a service category (hub) with exclusive exposure possibilities on portal and hubs (fixed monthly or quarterly fees).
- **pop-up specials**. Pop-up on-screen banners with save, open, or close functionality. An interactive alternative to TV program sponsorships or as interactive add-ons to traditional commercials. Sales synergies with hard-drive space sales.
- **Internet access**. Sales margin on fast Internet access sold via the system.
- **hard-drive space sales**. "Rent" charged to advertisers for hard-disk space necessary to display products, product catalogues, or other direct-marketing pieces via the TV. Based on alternative costs of traditional direct-marketing distribution.
- **subscription**. Membership fees for access to extra or enhanced services.
- **digital TV sales**. Sales of broadcast entertainment.

So while high speed and shared access to Internet services, media delivery, and local networks provide endless possibilities for consumers, it can also create new revenue streams for operators, media companies, and service providers, through, among other things, multiplied use of access networks, branded media portals, interactive advertising, and e-commerce.

Broadband media services enable operators to capture part of households' new TV and video services and bundle them with traditional voice services, reducing customer churn and margin pressure. Everyone will benefit. Operators and service providers will provide access to services; network providers will generate

revenues by maintaining and managing modular and scalable network enhancements and add-ons; content providers will create and license new content; advertisers will target customer user groups better than ever; and end-users will enjoy a new level of personalized services.

Figure 3. Example of broadband media services revenue-boosting potential for service providers with new service opportunities for existing customers.



Bundling opportunity	Low to medium	Medium	High
Customer retention	Low	Medium	High
Margin pressures	High	Medium	Low
Number of partners	None	Few	Many

4. Critical Issues in Broadband Media Services Deployment

While the many variables involved in creating commercially viable broadband media services are in place, there are still some challenges that need to be addressed and overcome by network and service providers. Building a scalable and reliable end-to-end network for on-demand entertainment is a large undertaking, and several technological and legal factors are involved in bringing large amounts of content to consumers.

Digital technology standards

While broadband media and IP standards are in rapid development and are given frequent enhancements, incompatible proprietary streaming-media technologies still exist. Similarly, not all content creators have adopted digital distribution strategies required for delivering broadband media services. This is changing quickly, however, as more large media conglomerates are signing deals with content providers to provide digital content to consumers.

Broadband content for mobile users

In the near future, third-generation mobile communication systems will extend the scope of today's Internet broadband solutions by introducing standardized broadband media services that target the mobile user's specific needs. Third-generation systems will provide high-quality streamed Internet content to the rapidly growing mobile market. These systems will offer value-added applications, supported by an underlying network that combines broadband media services with a range of unique mobile-specific services. Mobile application scenarios present many challenges, such as how to provide spectrum-efficient broadband media services over different radio-access networks to different types of end-user terminals and devices. Next-generation network architectures that fit seamlessly into third-generation mobile-communication systems are in development that will address the diversity and unique UI attributes of content on mobile devices.

Seamless content storage and retrieval

The amount of content involved in delivering broadband media services to businesses and consumers will be staggering. Research on indexing, storing, and creating retrieval mechanisms for multimedia archives inspires several directions for future developments and opportunities for additional revenues for

entrepreneurial companies. For example, existing genre-classification and topic-detection methods require processing and analyzing large parts of a document, an even greater challenge when performed on live streams. New ways of indexing and categorizing network content will be created to improve organization and access to content. Scalability plays an important role in deploying such systems, given the amount of computation required for simultaneous processing of multiple streams. Fortunately, rapid progress in CRM networking is enabling deployment of new systems for tracking, disseminating, and billing customers for content consumption.

Who owns the content?

Content rights and distribution have become one of the hottest issues in the industry as a result of several well-publicized cases of copyright infringement lawsuits. The questions include the following: Who owns the distribution rights? Who owns access to the customer? How does digital content distribution affect the industry business model? need to be worked out and real-life implementation of advanced media services will require legal documentation on the limits and extent of responsibilities of each participant in the broadband media services value chain. Other issues that are being addressed in broadband media services deployment include the following:

- **Maintaining a balance between data compression and media quality**. Enhancing MPEG standards as digital content develops by introducing new, better methods for compressing data size, yet maintain its quality.

- **Access in remote areas**. Ensuring widespread adoption of the client-server architecture to ensure network delivery of content across a broad geographic area, from cities to remote areas.

- **IP security network security**. Ensuring reliable, continuous security and authentication and verification of users in the network.

Self-Test

1. All are required for broadband media services delivery, over IP, except:

    a. high bandwidth.

    b. a broadband connection.

    c. a narrowband connection.

    d. DSL.

2. All are benefits operators will receive with large-scale deployment of broadband media services, except:

    a. new revenue potential utilizing existing infrastructure.

    b. new revenue streams that will enhance revenues from existing voice and data services.

    c. revenues received to dig up large areas of land for infrastructure upgrades.

    d. a way to compete with and add value to existing companies that offer pay entertainment services.

3. All are broadband media services except:

    a. video on demand.

    b. low-quality video.

    c. interactive video games.

    d. broadcast TV on a shared schedule.

4. All are cornerstones of all types of broadband media services except:

    a. on-demand experiences.

    b. advanced interactivity.

    c. surfing the Internet via a connection that is slower if many users are logged on.

    d. truly individual and custom services.

5. All are network components for broadband media services except:

    a. video server.

    b. CATV box.

    c. set-top box.

    d. video encoder.

6. Broadband content created by consumers, for example, a video greeting, cannot be disctributed to other devices.

    a. True

    b. False

7. Broadband media services will only be available in homes, not offices.

    a. True

    b. False

8. DSL technology will provide the digital, always-on network connection for broadband media services over IP.

    a. True

    b. False

9. IP technologies will enable next-generation broadband media services networks.

    a. True

    b. False

10. Network testing, management, and service are not important in broadband media services.

    a. True

    b. False

Correct Answers

1. All are required for broadband media services delivery, over IP, except:

    a. high bandwidth.

    b. a broadband connection.

    c. a narrowband connection.

    d. DSL.

See Definition and Overview

2. All are benefits operators will receive with large-scale deployment of broadband media services, except:

    a. new revenue potential utilizing existing infrastructure.

    b. new revenue streams that will enhance revenues from existing voice and data services.

    c. revenues received to dig up large areas of land for infrastructure upgrades.

    d. a way to compete with and add value to existing companies that offer pay entertainment services.

See Topic 1

3. All are broadband media services except:

    a. video on demand.

    b. low-quality video.

    c. interactive video games.

    d. broadcast TV on a shared schedule.

See Topic 3

4. All are cornerstones of all types of broadband media services except:

    a. on-demand experiences.

b. advanced interactivity.

c. surfing the Internet via a connection that is slower if many users are logged on.

d. truly individual and custom services.

See Topic 3

5. All are network components for broadband media services except:

a. video server.

b. CATV box.

c. set-top box.

d. video encoder.

See Topic 2

6. Broadband content created by consumers, for example, a video greeting, cannot be disctributed to other devices.

a. True

b. False

See Topic 1

7. Broadband media services will only be available in homes, not offices.

a. True

b. False

See Topic 3

8. DSL technology will provide the digital, always-on network connection for broadband media services over IP.

a. True

b. False

See Topic 1

9. IP technologies will enable next-generation broadband media services networks.

    a. True

    b. False

See Topic 1

10. Network testing, management, and service are not important in broadband media services.

    a. True

    b. False

See Topic 2

Glossary

Bandwidth
A measure of capacity. Greater bandwidth allows more information to be communicated in a given period of time.

Broadband
A network connection that supports a very high bit rate. Also, content that is streamed over a high-bit-rate connection can be described as “broadband content.”

Capture
The process of digitizing audio and video content from a non-digital or analog format.

CODEC
(compression-depression) Standard method of compressing and decompressing data, typically with audio or video files in which data is encoded or compressed to reduce file size. CODEC can be software-only or hardware assisted.

Compression
Reduction in size of content to save space or transmission time. Compression is performed by a program that calculates how to most efficiently compress and decompress the data.

Customer-Premises Equipment
Customer-premises equipment (CPE) refers to equipment that resides at the customers location (home or office). Examples include DSL modems, DSL gateways, and television set-top boxes.

Digital Subscriber Line Access Multiplexer
A digital subscriber line access multiplexer (DSLAM) is located in the central office (CO) that provides DSL services to consumers.

Internet Protocol
Internet Protocol (IP) is the standard signaling method used for all communication over the Internet. IP is supported by the major application providers, software companies and computer manufacturers. Broadband media services takes full advantage of the guarantees provided by IP access products with respect to real-time IP data delivery. IP provides the path that allows applications to evolve, independent of the transport protocols selected for broadband delivery.

Internet Protocol version 6
Internet Protocol version 6 (Ipv6) , designed by the IETF, is the new IP to replace the current version, IP version 4 (IPv4). IPv6 has been designed to meet the challenges of the growing Internet and includes several improvements over IPv4. The main benefits of IPv6 include a larger address space, integrated security, support for auto-configuration of terminals, and support for mobility.

IP Security
IP Security (IPSec) is a developing standard for security at the network layer. IPSec will enhance the security of virtual private networks (VPN) without requiring changes to each computer that needs connectivity to the network.

Local Loop
DSL is added to the local loop, turning copper wire into a high-speed data link and enabling broadband media services.

Local-Area Network
Local-area networks (LAN) connect a number of computers to each other or to a central server.

Moving Pictures Expert Group
Moving pictures expert group (MPEG) is a digital video and audio compression format that was defined by the International Standards Organization (ISO).

MPEG–2
MPEG–2 is a widely used, standardized video coding and compression technology. It is used in DVD movies and digital satellite distribution.

MPEG–4
MPEG–4 is a compression/decompression technology that aims to achieve interactivity, efficiency, scalability, and stability in transmissions. On a broader level, MPEG–4 aims to pave the way toward a uniform, high-quality encoding and decoding standard that would replace the many proprietary streaming technologies in use on the Internet today.

Multicasting
Multicasting is a broadcasting concept where the content is delivered only to the receivers (or end users) that have joined that particular multicast session group. Only one copy of the content passes over any link in the network content, and copies are only made where the paths diverge at a router.

Multimedia
Broadly described as the integrated presentation of text, graphics, audio, video, and animation for business or consumer use.

Rich Media
Media that has been enhanced with animation or video. Rich media ads are animated, and often streamed, so that they appear more like television commercials, as opposed to ads containing static images and text. They can be embedded in Web pages and inserted into or between video clips. Using synchronized multimedia integrated language (SMIL), they can be streamed concurrent to audio programming

Set-Top Box
An electronic device that serves as an interface between a television set and a broadband network, providing VOD and interactive multimedia services.

Streaming Media
The simultaneous transfer of digital media (video, voice, and data) that is received as a continuous real-time stream. A streamed file is simultaneously downloaded and viewed.

Very High Bit-Rate Digital Subscriber Line
Very high bit-rate DSL (VDSL) is a technology for transmitting very high-speed digital information over short reaches of an existing phone line to homes and businesses. With VDSL transmission rates are very dependent upon actual loop length. The maximum downstream rate is between 51 and 55 Mbps over lines up to 1,000 ft (300 meters) in length. Initial upstream rate will be an asymmetric rate between 1.6 and 2.3 Mbps. The data channel will be a separate frequency than that of bands used for POTS and ISDN thus enabling service providers to overlay VDSL onto existing services. As needs arise for higher speed upstream rates, VDSL may need echo cancellation.

Video on Demand
Video on demand (VOD) is a broadband service in which a viewer can order a specific program and have it delivered instantly.

Virtual Private Network
A virtual private network (VPN) uses encryption and other security methods to prevent information from being intercepted and guarantees that only authorized users can access the network.

Webcast
A live broadcast format over the World Wide Web.

Wide-Area Network
A wide-area network (WAN) is a network that interconnects geographically dispersed LANs.