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White Paper

Finding Success in a Multi-Screen World

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White Paper

Executive Summary

The amount of video content available over IP networks is staggering, and viewing it is rapidly gaining in popularity. Traditional broadcast television continues to provide the bulk of video entertainment, but alternative sources are increasingly available on the internet and mobile devices. At the same time, the explosive growth of IP networks is making it easier for consumers to watch video when and where — and on which device — they choose.

As consumers demand that video content be made available on multiple screens, vendors are responding quickly with new standards, technologies, and alliances that facilitate this capability. Technical challenges remain — in particular, the challenge of displaying the same content effectively on different brands of mobile devices — but progress has been rapid. At the same time, network operators and application providers are investing in multi-screen enablers and partnering with third-parties who can provide rich and exciting video content.

This white paper surveys the reasons why multi-screen services are so attractive, the role of the network operator in an expanded ecosystem, industry drivers, and technical challenges.

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Moving to a Multi-Screen World

The availability of internet-based content that is more than simple text, still photos, and rudimentary animation is accelerating, and consumers are enthusiastically embracing the multimedia trend. In April 2009, comScore reported that the average U.S. viewer watched 5.5 hours of online video, with Google Sites providing a staggering 5.9 billion videos, Fox Interactive Media providing 437 million, and Hulu 380 million [comScore].

The advent of IP-based networks capable of transporting massive amounts of rich digital content has revolutionized the way consumers interact with the internet, and they are particularly hungry for the vast amounts of both professional and personal video content that is now available. The explosion of interest in multimedia is fed not only by the recent proliferation of high-bandwidth IP-based networks, but also by the wide availability of technology for encoding and processing video that has made its creation and consumption increasingly easy around the world.

New opportunities for viewing seem to appear almost daily. Here are just a few recent developments:

- Seeing the latest movies need no longer be restricted by theatrical release schedules or "on demand" availability for home viewing. Movies can now be downloaded to a PC and streamed to an HD screen for viewing at any time.
- Sporting events are no longer exclusively available on TV and radio. Live "feeds" of entire games can now be streamed to a computer or mobile phone along with instant updates and replays. Mobile television services are being rolled out by network operators globally.
- TV programs can now be recorded on a DVR and then streamed to a PC for viewing anywhere – the deck, a friend's house, or an airport waiting room with hardware such as a Slingbox. Internet-based video aggregators, such as Hulu or Veoh, also provide access to a wide variety of professionally produced broadcasts.
- User-Generated Content (UGC), video content that was once circulated with some difficulty only among family and friends, is now available worldwide on YouTube and other video social networking sites. In late January 2009, Chad Hurley (Co-Founder and CEO of YouTube) reported that YouTube users upload 15 hours of video content every minute [TechCrunch], updated to 20 hours per minute in May [YouTube].

Meanwhile, consumers seem to be taking the revolution in stride, and are watching a wide variety of content wherever and whenever they choose. This flexibility is often described as time-shifting and place-shifting.

And Now – Device-Shifting

Perhaps the most important change in viewing patterns is "device-shifting," which is the ability to view video content on the device of choice — a television set, a computer screen, or a mobile device. Consumers increasingly expect content to be accessible on diverse devices, especially portable devices, and the market is already responding with integrated devices that support complex modes of content distribution and access. These include mobile phones with integrated MP3 players or broadcast receivers; TVs and gaming consoles with integrated internet connectivity; netbooks; laptop PCs with integrated wireless data chipsets; and Media Center PCs.

Choice of a preferred device for viewing video seems to depend on the age of the viewer. Not surprisingly, the group that spends the most time watching video content on a traditional television set is the more mature consumer (age 65 and older). Consumers age 25 to 34 are most likely to watch time-shifted content, using a service such as TiVo or on a DVR from their local network provider. Consumers between the ages of 18 and 24 like to watch video content on the internet (on computer screens), while consumers aged 13 to 18 have the highest percentage of viewing time on mobile devices [Nielsen].

Such age-related demographics suggest that, as the population matures, consumer preferences for "non-traditional" devices will continue to rise. Currently television remains by far the most popular device, with the average viewer watching more than 151 hours of television per month compared to an average viewing time of 4 hours per month on mobile devices, and 3 hours per month on the internet. [Nielsen]

The convergence of several market trends — incredible growth rates for IP video, produced by an increasing number of independent creators generating content specifically for IP networks, and an audience that wants to watch IP video content on their favorite devices — are fueling a need to deliver that content equally well on a wide variety of screen types and sizes. This paper takes a detailed look at what constitutes multi-screen (also called Three Screen) service and discusses the market forces driving the introduction of this capability as well as the technologies that are required for it to work effectively.

Multi-Screen and the Role of the Network Operator

Network operators can play a range of roles in supplying multi-screen services. At the most basic level, the network operator provides a conduit for third-part content or media applications that a content provider makes available independently over various channels. Access methods require little or no coordination, and the network operator has limited opportunity to add value to the content or the portal application.

This approach was typical of some early steps toward multi-screen service. For example, in 2005 ten benefit concerts called "Live 8" were held around the world and broadcast on several television networks. AOL, an internet service provider, also made the concerts available to its subscribers who could switch among the various venues, watching the content that most interested them. AOL's coverage is considered a watershed event, which showed how the internet could be used not only as a means of watching "television" programming, but also as a way to provide additional options.

America's NBC network offered unprecedented coverage of the 2008 Summer Olympic Games in Beijing. Along with normal television coverage on NBC network affiliates, many of NBC's cable television franchises devoted significant coverage to the event. NBC also provided a wide range of related options through its NBCOlympics.com website, where, for example, viewers could personalize the list of events that they wished to view. Features, such as "picture in picture" and simultaneous viewing of multiple events, made the internet viewing a richer experience than traditional television coverage, and the internet content was also available to wireless users who could access the online streams through their mobile devices.

Expanding the Network Operator Role in the Ecosystem

As consumers have responded positively to the availability of the same video content on television, the internet, and mobile phones, more integrated strategies are emerging that create the potential for network operators to add significant value. Mobile TV is an important example. For years, consumers in Japan and South Korea have had access to television content on their mobile phones, as broadcasters deployed alternative delivery technologies to stream video content to receivers built into mobile devices.

More recently, carriers in Switzerland, Germany, and Italy began offering mobile television services using a standard called Digital Video Broadcasting for Handhelds (DVB-H). United States carriers, such as AT&T and Verizon, are rolling out mobile television offerings using an alternative technology called MediaFLO, which was developed by Qualcomm. The inconsistency among standards and technologies used in Asia, Europe, and the United States is an obstacle for multi-screen service strategies, and various industry organizations are working on the issue.

Despite obstacles, many network operators are beginning to play an expanded role in multi-screen services to create a more integrated consumer experience. Here are some examples of how the ability to provide content across various display devices can allow network providers to take advantage of new opportunities for marketing and customer engagement:

- AT&T offers video coverage of the Masters Golf Tournament to its subscribers on IPTV, the internet, and mobile devices, which includes exclusive content not available on traditional television broadcasts.
- In October 2008, France Telecom Orange announced the Orange Cinéma Séries, which offers subscribers a selection of movie and television offerings that can be viewed across a variety of devices. The subscription price is 12 francs per month for television and internet availability, and an additional 6 francs per month for access through a mobile device. All the content can be viewed on demand, and on any device at any time
- In January 2009, Portugal Telecom formed a partnership with RTP and Sportinveste Multimedia to deliver multi-screen soccer matches. Portugal Telecom is currently offering TV and mobile viewing service while providing a selection of games on its website.
- Telemundo is moving beyond the typical model of providing similar content on different electronic venues. The Spanish-language broadcaster is delivering a multi-screen reality show and a telenovela (serial melodrama or "soap opera"), while encouraging viewers to interact with the telenovela by voting via the internet on the future direction of the storyline.

The examples cited here show how multi-screen service deployments typically require the cooperation of an ecosystem with both media and communications stakeholders. For example, the broadcasts that NBC offered of the 2008 Olympics from Beijing required an ecosystem similar to the one depicted in Figure 1. The "owner" of the content was the International Olympic Committee, from whom NBC licensed the rights to broadcast the event in Beijing. NBC then worked within an ecosystem that included television broadcasting affiliates, internet availability, and a mobile network operator. In this example, AT&T, another sponsor of the Olympics, was granted exclusive rights to create a "24/7 channel" on its mobile television service for live broadcasts of the NBC coverage. Other carriers, such as Verizon Wireless, were provided with a subset of the coverage available on the AT&T wireless network.

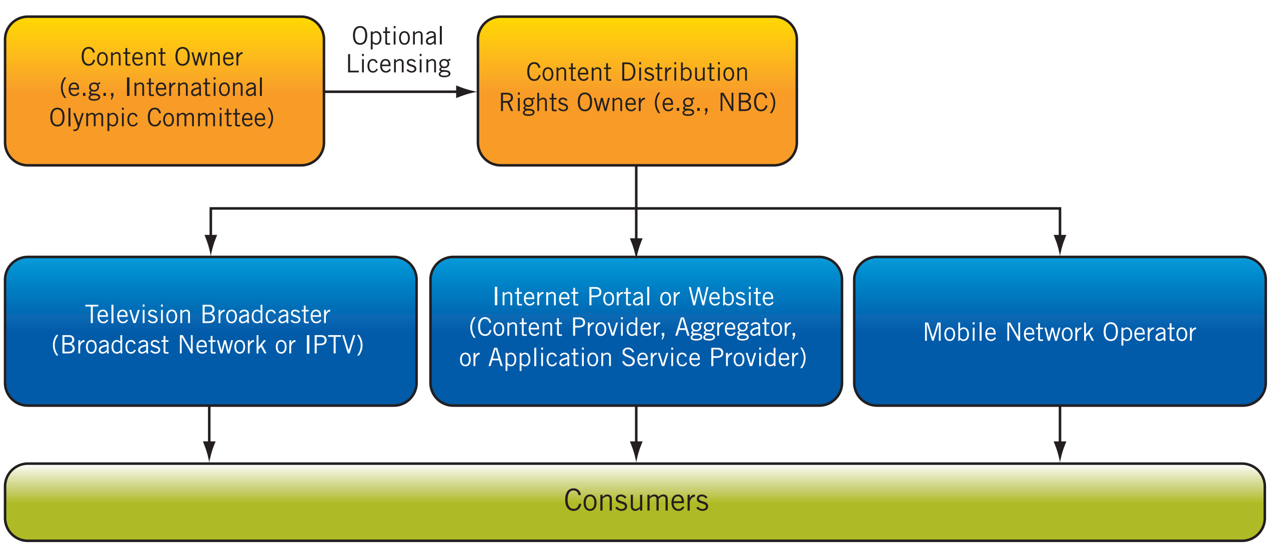

Figure 1. Multi-Screen Service Ecosystem Relationships

Working Toward an Integrated Approach

Because of consumer enthusiasm for multi-screen access to the same content, network operators are increasingly ready to tackle inherent technical and back-office complexities. As technologies and networks evolve and the ecosystem matures, multi-screen services should become increasingly simple, seamless, and integrated from a consumer point of view.

In the future, fully converged multi-screen services are expected to allow content to migrate easily across devices and networks in real time. Ultimately, a customer viewing a video on a television set should be able to pause it, and then resume watching it on a mobile device or on a PC. Achieving this level of service convergence requires more than adapting content in real time and routing it to the appropriate network and device. Such convergence necessitates a coordinated approach to:

- Pause/restart capabilities, available on all networks and devices
- Connections among networks (and network operators), both at the media and at the control level
- Management of user profiles, which include devices available, preferences, subscriptions, service levels, etc.
- Aggregated billing and a secure and seamless mechanism for licensing content that migrates across networks and devices. Back office systems will need to handle a complex menu of potential transactions involving different devices, networks, and service providers while presenting the customer with one simple, easy-to-understand monthly bill.

Industry Drivers

Because of consumer enthusiasm for video viewed on a variety of devices, content providers (including content owners, distributors, and aggregators) as well as advertisers and network service providers see tremendous opportunity.

Content providers can potentially find more demand for their media products, provided the additional services can be supplied securely, a critical requirement for the growth of their businesses. Advertisers can take advantage of new models for communicating with consumers in ways that are measurably more effective and more relevant than previous methods.

For network operators, multi-screen services represent an opportunity to shift their focus from deploying broadband IP-based networks to capturing the value of the content that flows over them. A multi-screen strategy is an early step toward a more extensive service convergence architecture that creates opportunities to:

- Increase operator share of consumer spending on bundled premium services
- Maximize revenue derived from the use of network bandwidth and resources for video and multimedia services
- Create differentiated service offerings that are in high demand and can attract and retain subscribers by adding personalization across a range of devices and media formats

Because carriers and cable operators own the relationship with the consumer, they are well positioned to use multi-screen services to compete with both existing and emerging distribution channels, such as satellite carriers, web service providers, and even device manufacturers.

Behind-the-Scenes Challenges

Some network operators have made a concerted effort to knit together fragmented multi-screen services into a more unified multi-screen service. AT&T, for example, offers a “U-verse” IPTV service with a Video on Demand library and DVR capability that can be controlled via the internet or a mobile handset, along with other services that make traditional broadcast video content accessible on subscriber PCs or mobile devices.

Behind the scenes, the emerging unified approach to content delivery presents numerous technical challenges. These challenges can be loosely grouped into three categories: continuity of experience, quality of experience (QoE), and integration and interoperability.

Continuity

A full, compelling implementation of multi-screen services requires the availability of a common set of access services across devices and the networks through which they are connected. For example, users do not want to be subjected to repeated sign-up or sign-in processes when accessing media content. Service providers need to synchronize content, policy, and billing across networks and devices, preferably without replicating functions.

In order for service to be seamless, some functions will have to be standardized in the consumer devices themselves. One group of consumer electronics, computer, and mobile device manufacturers called the Digital Living Network Alliance (DLNA) is working on a set of standards that will allow devices to share content across a home network without a complicated configuration process.

Other aspects of multi-screen service continuity are likely to take place in network operator or service provider equipment. The migration of almost all large wired and wireless network operators to an all-IP network architecture will be a key enabler in tackling this challenge.

Quality of Experience

With possible exceptions when handling UGC, multi-screen services must offer a consistent, rich user experience across devices, and various participants in the ecosystem have a stake in maintaining QoE to ensure success.

Content providers, particularly those who offer expensive, professionally produced material, must make every attempt to guarantee that a high-quality video product is displayed on the end user device. Similarly, advertisers expect their promotions to be associated with an excellent video experience. Content providers and advertisers also have a very strong interest in being able to verify and potentially filter video content. In particular, they will want to ensure that content (especially when accessed through search) fulfills expectations, and that ads are displayed only with appropriate content. In addition, network operators have both competitive and brand-value interests in monitoring and maintaining a high-quality experience.

Certain core capabilities are required to ensure QoE. For example, IP networks need robust protocol capabilities and the ability to adapt content in real time for individual end devices. Differences on these devices can include screen size and resolution, storage options and capacity, processing power, and supported media protocols and formats. The end-to-end network that delivers content from the owner or aggregator to the consumer must be able to recognize and adapt to these characteristics in a way that is transparent to the end user in order to guarantee appropriate quality of service (QoS) as well as overall QoE.

Video Compression

One of the most important QoE considerations when designing a video distribution system is video file compression. Digitizing video content generates huge file sizes, and transporting uncompressed files through an IP network can severely drain network resources. To increase efficiency, compression algorithms are used to reduce the file sizes dramatically, while maintaining high video quality.

Hundreds of algorithms are available for compressing video, and some of the more popular ones are widely deployed and their names are well known (for example, MPEG-2). When a digital file containing video content is being prepared for transmission, a compression algorithm is typically applied to the file, reducing its size so that it can be transported through the IP network more easily. When the file reaches its destination, the same algorithm is applied to decompress the file. Any content manipulation, such as compression and decompression, causes some loss of quality; however, sophisticated algorithms can keep this quality loss to levels that untrained eyes are unlikely to notice.

Because hundreds of compression algorithms are in use, equipment manufacturers must include a comprehensive selection of widely-used algorithms in their products. Signaling protocols can then be used to “negotiate” between the sending and receiving equipment, exchanging information about capabilities and choosing the best available algorithm to use.

H.264 for Multi-Screen Compression

Traditionally, incompatible compression algorithms were used for broadcast television, internet video, and mobile device transmissions, making it difficult to bring the same content to consumers using different devices. A compression algorithm, known as H.264, is proving to be a significant step forward for video delivery.

An international standard supported by both the International Telecommunications Union (ITU) and the Motion Pictures Expert Group (MPEG), and alternatively known as MPEG-4 Part 10 or MPEG-4 AVC (Advanced Video Coding), H.264 has been adopted for video compression across a wide range of applications and by a large number of equipment vendors.

H.264 has several advantages. The first is its ability to maintain video quality while compressing a file to half the size achieved by older algorithms. This allows a file compressed with H.264 to be sent across a network using half the bandwidth of a file compressed with an earlier algorithm, such as MPEG-2 or H.263.

Another advantage of H.264 is that it provides a wide range of “profiles” that support a very broad base of applications. For example, the H.264 standard contains a “baseline” profile for applications that only need limited processing power and low bandwidth. Also available is a “high” profile, which is well-suited to High-Definition Television broadcast and Blu-ray Disc production. Because it already contains definitions for very high-end profiles that exceed the capabilities of today’s consumer electronics products, the H.264 standard is likely to adapt easily to the introduction of new products with new capabilities without requiring a complete redesign of the algorithm

A third advantage is that the H.264 standard defines a “scalable” coding structure (Annex G). This feature allows a single video stream to contain several sub-streams, which can be separated so that each sub-stream still conforms to the H.264 standard. This structure allows H.264 to be used to encode video content and make it available for viewing across a wide range of device types.

Other Technical Challenges

Even with H.264 deployment moving ahead rapidly, technical challenges related to compression remain for multi-screen service support.

One important challenge is the display of video across a wide range of mobile device types. While television screens sizes and formats are well-defined (for example, 1920 x 1080 pixels in a 1080p High-Definition set), screen sizes and formats for mobile devices have not been standardized. The screen size of a Nokia phone is not the same as that of an LG phone, and both differ from an Apple iPhone. As a result, a video that displays properly on a Nokia phone may not display correctly on an LG or iPhone. Today, this problem is generally solved using “brute force” tactics, that is, by testing phones from different manufacturers in a lab environment, and changing the algorithm slightly until all phones display at the same level of quality. Future signaling protocols should become more robust and contain additional information to reduce this need for testing and adjustment.

Integration and Interoperability

Network operators are increasingly partnering with established experts in various aspects of content management and delivery, which allows providers to focus on their core business while rapidly expanding the range of content and services that they can offer. Bringing such third-party services into a network requires integration with a service provider’s core network functions, such as digital rights management, subscriber management, policy management, and billing.

Today’s rapidly changing environment suggests that it is more important than ever to implement network functions on platforms that use highly flexible and independently scalable components, and that support open standards interfaces. Such platforms ease the task of introducing new formats, interfaces, and advanced media and device capabilities that extend the reach and improve the quality of multi-screen services.

As multi-screen services continue to proliferate, the application and service delivery platform technologies, through which content and advertising reach the consumer, must also be powerful and flexible enough to support a wide range of applications, including

- Mobile social networking
- Video conferencing across device types
- Mass messaging and mass calling applications
- Video blogging
- Music and video on demand services

Dialogic: Making Innovation Thrive™ in Multimedia

Through its award-winning media products and the Dialogic® Media Labs, Dialogic is accelerating the reach of video across multiple screens. From transcoding, transrating, and trans-sizing technologies to flexible, scalable media processing platforms, Dialogic is building the components to enable video display technologies in a multi-screen world.

Dialogic also provides a wide variety of hardware and software components using open standards that support video and other types of multimedia applications.

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Dialogic Corporation
9800 Cavendish Blvd., 5th floor
Montreal, Quebec
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