The Emergence of the Broadcast Internet

Introduction

Faced with increasing competitive pressures and a growing demand for leading edge multimedia services, today's broadcasters, cable operators and ISPs are searching for ways to profitably merge broadcasting's broadband reach to huge audiences with the Internet's rich content and broad access to information.

The broadcast industry has already put in place a digital infrastructure with the potential to handle Internet data. Hundreds of megabits of bandwidth have been allotted and large investments have been made in anticipation of digital TV. What has been missing, until now, is the ability to efficiently integrate and cost-effectively deliver new revenue-producing combinations of TV and web content across a combined network.

Today, we are seeing the emergence of the Broadcast Internet—a single dynamic network for delivering converged broadcast digital video, audio and web content to millions of simultaneous viewers. This paper discusses how the Broadcast Internet augments the current Internet and leverages the existing digital broadcast infrastructure to present far-reaching business opportunities for broadcasters, ISPs and other service providers.

New class of Internet content

As a global medium for communications, entertainment and commerce, the Internet has changed the way individuals and businesses communicate and exchange information. Today, increased Internet usage is being driven by the proliferation of new wired and wireless Internet-enabled devices and an increase in the availability and use of broadband Internet access services. Just as important, we are seeing the emergence of a new class of increasingly complex multimedia-rich content coupled with the emergence of new Internet-based applications, such as live webcasts and streaming audio and video, that are designed to reach huge numbers of viewers simultaneously.

As web content evolves from simple, static web pages to complex graphics and audio/video streams, delivery of this new class of content requires significantly more bandwidth. In addition, while the Internet has historically been used for point-to-point exchanges such as e-mail and basic information retrieval, new applications such as webcasts and online learning require that rich content to reach millions of users at the same time. These applications require high bandwidth, point-to-multipoint delivery, or multicasting, and depend on scalability and predictability of content delivery.

As competition for viewers becomes more intense, the breadth, complexity and frequency of multicasting rich content will inevitably increase, thus placing further demands on the Internet infrastructure in terms of bandwidth. Yet, as several recent live webcasts have shown, the current Internet infrastructure is simply not designed to efficiently handle the delivery of multimedia-rich content or to support the multicasting needs of these emerging applications. When large numbers of users access the same content at the same time, congestion is unavoidable somewhere along the line.

Result: packets are arbitrarily delayed or dropped, audio and video streams fall out of sync, and the user experience quickly degrades.

New opportunities for broadcasters and ISPs

In contrast to the Internet, broadcast infrastructures—including television, cable and satellite networks—are optimized for one way transmission of rich content to large numbers of users in a predictable, reliable and scalable fashion. They are designed from the ground up (or from the sky down) to deliver high-quality synchronized audio and video content, regardless of the number of simultaneous viewers. In addition, over the last five years, many of these networks have migrated from analog to digital transmission, thus greatly enhancing their ability to carry new types of digital content—including converged TV and web content, live multimedia webcasts, video-enriched e-commerce content and more.

All this suggests a wealth of opportunities for broadcasters, ISPs and other service providers to leverage existing broadcast networks in order to deliver new multimedia applications to consumers and businesses. The benefits extend in all directions:

- **Digital Cable operators** can elevate their bandwidth constrained data network with an augmented one that inserts data into the video band of the cable spectrum. They can enjoy optimum revenues from their existing plant while providing localized custom programming.
- **Satellite broadcasters and service providers** can maximize revenues from their existing broadcast spectrum while adding new subscribers and increasing revenues per subscriber-with lucrative data broadcasts applications.
- **ISPs, network operators and telcos** can augment their networks with a streaming broadcast pipe that can bring their customers richer high-quality web content closer to viewers.
- **Content Delivery Network Service Providers** can complement their terrestrial network backbones with a scalable broadcast network enabling them to deliver rich services to infinite numbers of client worldwide.

Clearing the roadblocks to convergence

As appealing as these scenarios may be, several hurdles still need to be cleared for broadcast network and Internet convergence to take place. The two major issues are:

- **Broadcast networks are populated by legacy equipment and services** - Current broadcast networks are built using systems that
SkyStream solutions include the following media routers and software:

- **SkyStream Source Media Routers** - Source Media Routers reside at the point where Internet content is packetized for broadcast transmission. Individual product lines exist for satellite (DVB), cable, or broadcast TV (ATSC) transmission while individual models are optimized for cost-effective webcasting, efficient IP data injection, and conditional access-based applications.

**Features:**

- No change to existing infrastructures - SkyStream's adherence to broadcast and Internet industry standards enables new services to be launched on top of an existing environment, with minimal incremental cost, no equipment replacement, and no complex new technologies to learn. Standards include DVB, ATSC, MPEG, ATVEF, IP, IETF, and UDP.

- Seamless interoperability with current environments - SkyStream media routers and software are purpose-built for interoperability with all industry standard digital video and Internet infrastructure equipment, including network management, subscriber management, digital video multiplexing and encryption systems, without affecting the quality of the underlying audio, video or Internet data being transmitted.

- 100 percent use of available bandwidth - SkyStream media routers are based on the most efficient methods for encapsulating IP and other data into MPEG-2 packets for broadcast transmission by injecting the packets into an existing DVB or ATSC-compliant transmission stream or creating a new transmission stream. This bandwidth optimization technology utilizes SkyStream's patented Null Packet Optimization™ (NPO) technology, which replaces all unused packets with useful data, and intelligent Section Packing technology, which ensures that each MPEG-2 packet is filled completely, no matter where IP packet boundaries may fall. Broadcasters can also create a new dedicated transmission stream for webcasting and high-speed data transmission.

The net results are rapid and low-cost deployment of new services, flexible operations, and full utilization of digital broadcast network investments.

Enabling the Broadcast Internet

The Broadcast Internet can be defined as:

1. A single dynamic network for delivering converged TV and web content to millions of concurrent viewers

2. An augmentation of the existing Internet that enables broadcasters, ISPs and other service providers to deliver bandwidth-intensive web content closer to the edges of the network for bottleneck-free viewing.

Ideally, such a network will deliver high-quality video programming to many users simultaneously while providing much of the personalization and interactivity that characterizes the Internet in order to enrich the individual user/viewer experience.

Now, how do we get there?

SkyStream has pioneered a new category of standards-based interoperable networking products called media routers™ to overcome the hurdles discussed above and enable a broad range of Broadcast Internet topologies and applications (Figure 1). Already, leading satellite and TV broadcasters are using these solutions to cost effectively combine digital video streams based on MPEG and data based on IP for transmission over the Broadcast Internet. ISPs, meanwhile, are already using these solutions to create incremental high-speed backbones to deliver multicast content and services more efficiently to their end users.

![Figure 1](image-url)

SkyStream Networks develops high-performance media routers and intelligent software to manage the flow of content over the Broadcast Internet to massive audiences. They are designed so that there is:

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The Broadcast Internet revolution.

Integrate and cost-effectively broadcast new combinations of TV and web content over a single network-can now move immediately to join the Broadcast Internet revolution.

**SkyStream Edge Media Routers** - Designed for low-cost mass deployment, SkyStream Edge Media Routers reside at a broadcast networks peripheries—at cable headends, Internet POPs, corporate data facilities, or local broadcasting facilities. There they receive content from source media routers and route it to viewers via existing data access infrastructures such as cable modems, Digital Subscriber Line (DSL) service, Ethernet LANs, and 56K dial-up modems.

**Features:**
- Provides live webcasts and store-and-forward applications
- Enables service scalability-designed and priced for large-network deployment
- Full administration of incoming streams-address re-mapping, IP-packet TTL modification and more
- Carrier-grade reliability
- Powerful remote management
- Service provider-friendly 1RU form factor

**zBand Advanced Content Distribution Management** - An easily deployed, complete content management and distribution system, zBand™ allows service providers and enterprise customers to intelligently manage and control distribution of digital content to consumers, employees and customers. zBand manages and controls the distribution of digital media assets using a complete set of components to manage content collection, aggregation and delivery. Leveraging the performance of SkyStream media routers, zBand consists of server software, along with customizable client software on the consumer's PC or set-top for receiving and caching content.

**Features:**
- Complete control over the distribution of content from collection and packaging to aggregation and delivery
- Scale from 10's to 1,000,000's of remote locations across multiple heterogeneous networks reliably and cost-effectively
- Content protection across all networks
- Easy integration with third party applications

**The Broadcast Internet goes "live"**

SkyStream solutions are enabling an increasing number of over-the-air TV broadcasters to begin inserting Internet content into broadcast streams, cable providers to aggressively improve their delivery of multimedia content to cable-modem users and set-top boxes, satellite TV providers to move into broadcasting Internet programming directly to PC receivers and television sets, and ISPs to "beam" and cache high-demand web content close to users. Leading customers include AnyTime TV, Cablecom, EchoStar, Granite Broadcasting, GTE, iBEAM, Loral CyberStar, Lucent Digital Video, Telefónica, and TPG Internet.

iBeam uses SkyStream media routers to broadcast Internet content to ISPs around the world. TPG broadcasts constantly refreshed content from popular United States web sites to Australia. Granite has added SkyStream media routers to its digital TV transmission system. Cablecom uses SkyStream media routers to build best-of-breed cable headends. And EchoStar has integrated SkyStream media routers into its existing multi-vendor video infrastructure. Hence, the Broadcast Internet is already becoming a profitable reality for service providers in all industry segments.

Ultimately, it is the subscribers, end users and viewers that gain the most, and will give the allegiance to the service providers that give them services based on dynamic multimedia content. As Broadcast Internet solutions are deployed throughout existing broadcast networks, broadcasters and ISPs gain the ability to quickly and inexpensively introduce popular new multimedia services, generate new revenues, and differentiate themselves from their competitors. At the same time, with SkyStream's interoperable architecture and bandwidth optimization techniques, companies can lower their service costs by harvesting otherwise wasted bandwidth, and by integrating existing legacy equipment with best-of-breed components from their suppliers of choice.

The content, the audiences, and the networks are all in place. Service providers looking to add the final piece-the ability to efficiently integrate and cost-effectively broadcast new combinations of TV and web content over a single network-can now move immediately to join the Broadcast Internet revolution.