The Rising Preference to Real-Time Broadcasting Effects upon Traditional Multi-Media Broadcasting Solutions

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The Rising Preference to Real-Time Broadcasting
Effects upon Traditional Multi-Media Broadcasting Solutions

By
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Degree of Master of Science in Information Technology

Rochester Institute of Technology
B. Thomas Golisano College
Of
Computing and Information Sciences

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Abstract

Originally the Internet was a research-based arena but today the applications available are greatly diversified and extremely advanced. Media broadcasting on a real-time basis is that which characterizes many providers business base in service, applications, soft and hardware needs. Today’s engineers are driven toward making provisions of new and superior applications to make the Internet stronger and more serviceable. Along with the new dimension of today’s Internet come new challenges. Videoconferencing and video broadcasting are mainstream entrant applications. These applications specifically those of videoconferencing and broadcasting place previously unheard of demands on the response-load of the network effecting data in terms of efficiency and effectiveness in data delivery. The new analog type delivery used today has opened the Internet up for new usefulness. This work explores the changes and the new technologies unleashed as well as observing how other advantages in IP networks still need to be realized, making determination of the roadblocks in achieving a competitive advantage in IP networks and evaluate the developments in broadcasting; determining other resources that need to be realized and identifying the chances that traditional broadcasting technology will revolutionize and catch up with IP broadcasting. Finally this work will assess what it would take to achieve the development of broadcasting technologies.
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Effects upon Traditional Multi-Media Broadcasting Solutions

- Chapter One -

Overview

The intricately engineered and woven Internet web is one that is remarkably flexible and as well the Internet continually evolves and reshapes. Originally the Internet was a research-based arena but today the applications available are greatly diversified and extremely advanced. Media broadcasting on a real-time basis is that which characterizes many providers business base in service, applications, soft and hardware needs. Today’s engineers are driven toward making provisions of new and superior applications to make the Internet stronger and more serviceable. Along with the new dimension of today’s Internet come new challenges. Videoconferencing and video broadcasting are mainstream entrant applications. These applications specifically those of videoconferencing and broadcasting place previously unheard of demands on the response-load of the network effecting data in terms of efficiency and effectiveness in data delivery.

Delivery of data has changed from an analog method to that of digital delivery, which requires that network designers ensure that the network is capable of supporting reliable and timely delivery of data. The new applications have allowed individuals to be online more often and supported more serviceable delivery methods through diversity in data delivery. The delivery of this data has replaced television, radio, cable and other more traditional broadcasting structures.
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Background of the Study

Users around the world are increasingly turning to the Internet for various reasons, such as information gathering or entertainment purposes. IP broadcasting has allowed users to access live events or pre-recorded contents not only through their Personal Computers (PCs), but also through their mobile phones and wireless-personal digital assistants (PDA). This has provided users with extremely rich data in audio and video quality, which was previously not available by conventional broadcasting systems. As a result, these high quality broadcasts are able to create a new range of value-added services to multiple users.

In the past, real-time broadcasting was limited or non-existent due to technological restrictions, mainly because there was a limited amount of IP networks available at that time. Today, IP networks are seen as the new cost-effective means to disseminate a wide range of multi-media content to a variety of users. It has been expected that North America will be the strongest overall regional market for Professional Video-over-IP services. In the Store & Forward category, Content Delivery Networks (CDNs) used by corporations to deliver streaming video services are expected to experience a strong Compound Annual Growth Rate of 36%. (Kaufhold, 2004)

Streaming Media (e.g. video camera audio/video out connectors)

The deployment of satellite video broadcasting or standard video transmission technologies to broadcast live corporate events to the masses has been the general application however with streaming technology available as well as networking support technologies (e.g. IP Multicast and Quality of Service [QoS] the facilitation of live events
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can be done via the IP network. Enterprises are able to reduce costs as well as costs in terms of equipment, which are associated with the traditional technology in video broadcasting.

There are two existing sets of services in Live Broadcasting over IP solutions, which are (1) the application services, and (2) the network services. Network administrators are able to easily and quickly configure the live event through a graphic user interface (GUI), which is a user-friendly application. The transport of the live event is handled by the network services, which simplifies and isolates program creation, source server configuration and run-time allowances for live events. The live event is the responsibility of the network in terms of transport from the IPTV Broadcast server to the IPTV Clients. Stated in the work entitled "Live Broadcasting over IP in the Enterprise: Solution Reference Network Design" is "The network is responsible for transporting the digitized live event from the IPTV BS to the IPTV Clients. Beyond traditional L2 and L3 forwarding, the network must also afford IP Multicast and QoS services to the applications above. Layer 2 devices must support IGMP Snooping and QoS tagging/queuing. Layer 3 devices must support IP Multicast routing protocols and QoS tagging/queuing. Figure 1-1 illustrates the Live Broadcasting over IP service architecture. Although at a high level a Live Broadcasting over IP solution requires a small number of services, enabling those services is not a trivial task. For example, both IP Multicast and QoS technologies mandate an end-to-end configuration, which implies that each networking device must be at least considered a candidate for additional configurations or even upgrades.

When a live feed is connected physically to an IPTV Broadcast Server capture
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card, the signal is in analog form (NTSC or PAL) the analog signal is then converted by the BS to a stream of digital bits in preparation for transport over an IP network. This process is what is referred to as 'encoding'. The CODEC is the encoding device. The broadcast server supports several encoding and compression algorithms, in other words there are multiple CODECs available on the broadcast server. The quality requirements for the production are what determine the algorithm. While it is generally acceptable to use MPEG-1 video stream encoded at 128-512 Kbps by most enterprises used with the audio stream encoded at 64Kbps, the needs of enterprises vary a great deal just as do capabilities of networks. More bandwidth is required for a single stream as the chosen encoding rate is higher. Administrators must weigh the options carefully in planning for a live network event. Generally, the available band work is that which must be qualified since "an IPTV BS is capable of generating very high quality live broadcast streams (e.g. .2 Mbps encoding)" There are four existing primary CODECS which are standard and suitable for use in the SRND which are (1) MPEG-1; (2) MPEG-2; (3) MPEG-4; and (4) H.261. Further stated is that "The key point to remember when choosing a particular technology is that each CODEC has a sub-range within its operating range where it is most efficient."
The following chart illustrates each service and its' components:

**Table 1-1 Application Services Components**

**IPTV Content Manager**
- Controls most configuration aspects at the application services layer
- Hosts an administrator's GUI
- Serves as master to all logically attached Broadcast Servers
- Serves as master to all logically attached IPTV Clients

**IPTV Broadcast Server** • Serves as physical attachment point of analog live event feed
- Responsible for encoding/compression of live feed
- Serves as IP Multicast source for live broadcasts over IP network
- Hosts a simple box-specific configuration GUI/utility
- Points to primary and/or secondary CM for live broadcast event information (BS – specific information such as start time, run time, encoding rate, etc.)

**IPTV Client:** • Acts as live broadcast event receiver
- Loaded onto individual client desktops
- Available as either standalone IPTV client software or browser plug-in
- Serves as IP Multicast destination of live event stream
- Points to primary and/or secondary CM for live broadcast event information (aka Program information)

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**Source:** *Live Broadcasting over IP in the Enterprise: Solution Reference Network Design*
The following chart illustrates the network services and their components:

**Table 1-2 Network Services Components**

**IP Multicast:**
- IP Multicast routing protocol configured on each L3 device in the Network
- Serves as transport technology for all live events as they exit IPTV Broadcast Server
- Protocol Independent Multicast (PIM) technology uses L3 routing Protocol resiliency
- Ensures efficient utilization of network bandwidth
- Allows a single live broadcast to scale to entire enterprise audience

**Quality of Service**
- Tagging and queuing configured on each L2 and L3 device in the network
- Offers live broadcast stream preferential treatment over regular data traffic
- Uses proven Differentiated Services architecture
- Ensures that IPTV Clients receive live event in an acceptable manner

**Layer 3 Services** Standard IP forwarding based on whatever IP routing protocol(s) are Enabled on each device

**Layer 2 Services** Standard frame forwarding

Source: *Live Broadcasting over IP in the Enterprise: Solution Reference Network Design*
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Streaming is an area of technology that is applicable to many various applications such as E-learning. "Live broadcasts, scheduled broadcasts, and video on demand are some examples of solutions that require streaming. There are six basic steps to creating streaming content" although all six steps are not required in all streaming applications.

The following are the steps necessary to create and video and publish it on the Internet:

**Step 1** Shoot the video using an analog or digital camera.

**Step 2** Capture the video using a capture card on a personal computer.

**Step 3** Edit the video using a video-editing tool.

**Step 4** Compress and encode the video to make it suitable for an IP network.

**Step 5** Distribute the video over the network.

**Step 6** Play the video at the client desktop.

“Steps 4, 5, and 6 are of interest to the scope of this chapter because Cisco’s product portfolio supports those areas. Steps 1 through 3 can be addressed with a variety of third-party commercial and freeware applications.” “Steps 4, 5, and 6 are of interest to the scope of this chapter because Cisco’s product portfolio supports those areas. Steps 1 through 3 can be addressed with a variety of third-party commercial and freeware applications.” *(Live Broadcasting over IP in the Enterprise: Solution Reference Network Design)*

Encoding is the process of the conversion of analog video and/or analog audio data
into digital data (bit stream). Compression of data occurs after the digital encoding.

CODEC means compression or decompression processes. Codec’s may either exist as a software application or as a device that is of a specialized nature however, both with the same functionality in terms of hardware. The Codec receives the bit stream and processes it and then compresses it on the side of the server, which is the compression phase. Then the bit stream is decompressed on the client side and it is reverted to the original bit stream. The clients can decompress Video/audio CODECS at the time the compressed stream is received.

Basic Types of network communication

The basic types of network communication consist of one-to-one sessions between two computers, called unicasting. These one-to-one sessions allow a great control of the data traffic between the source and the receiver, allowing for acknowledgment of receipt, requests for retransmission of data, changes in transmission rate and other features. Currently, most audio and video data fall under unicast. However, many Internet applications involve one-to-many or many-to-many (multipoint) communications, where one or more sources are sending data to multiple receivers.

To further describe the success and growth of real-time broadcasting, the research will elaborate on the main types of IP networks, which provide transmissions of data to multiple receivers in three different ways:

1. **Unicast:** This is where a separate copy of the data is delivered to each recipient. (Kosiur, 1998)
2. **Broadcast:** This is where a data packet is forwarded to all portions of the network even if only a few of the destinations are intended recipients (Kosiur, 1998)

3. **Multicast:** This is where a single packet is addressed to all intended recipients and the network replicates packets only as needed. (Kosiur, 1998)

**Recent Advancements**

In the past few years, it has been reported that vendors of all types of hardware and software services are coming up with new mechanisms to deliver streaming media content, especially providing large video over the Internet with rich video and audio quality. For example, Sony developed a new Ethernet port for their IMX studio digital video recorder. This Ethernet port was able to achieve transportation of digital video streams to numerous computer based video tools that were especially instituted around digital broadcasting facilities. Time-scales are still uncertain, but it looks as if the Ethernet will become truly ubiquitous over the next few years; it already is in countries such as Korea, where government funding has allowed the mass delivery of broadband Internet access into homes, with Ethernet as a key enabling technology. (Broadhead, 2003) It has also been reported that Microsoft TV’s planned IPTV solution will use industry-leading video compression technology to dramatically reduce bandwidth requirements, enabling Bell Canada to deliver broadcast quality video services to a variety of devices over its broadband network. (Blair, 2003)
Jim Chiddi, President of interactive personal video for AOL Time Warner, advocated as a speaker for Society of Cable Engineers, stated the need for the cable industry to establish an IP based broadband network to seamlessly connect all cable services on one unified network. A unified network simplifies network design and allows for improved bandwidth allocation among services (Birkmaier, 2002).

Competition, advancement in technology, networks and users needs are leading ways to enhance IP communications. “Sun has been committed to helping Telco’s like SaskTel introduce new services like video-on-demand that leverage their investments in DSL and broadband network infrastructure,” said Phil Sasso, senior director of the Telecommunications Industry at Sun Microsystems. “Working closely with Kasenna, Sun is helping deliver on the promise of triple play services, video, voice and data, over a coverage IP network.” (Evans, 2003)

Furthermore, a collaboration of Apple, Cisco, Kasenna, Philips Electronics, and Sun was assembled in 2000 in order to promote open standards for developing end-to-end media streaming products over IP. The emerging reality is that IP networking is the driving force for the future of virtually every form of digital communications. (Birkmaier, 2002)

**Objective of the Study**

The objective of this study is the focus of the evolution of TCP/IP and specifically examined will be the following:

(1) What exactly is TCP/IP?

(2) Why is TCP/IP critical for real-time broadcasting?
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(3) What are the effects of real-time broadcasting and the future of real-time broadcasting when compared to traditional methods of data delivery?

Finally, this study has gather information that will serve to weigh the need of making provision of an interactive medium, disseminate information and analyze how users might be expected to respond.

Questions of the Research

Questions of the research in this study are as follows:

(1) What are the factors that influence certain users to turn to interactive media?

(2) Are there any existing competitive advantages in IP networks that are yet unrealized? If so what barriers block the implementation of these advantages? What resources are needed toward this implementation?

(3) What are the chances that traditional broadcasting technologies will revolutionize and catch up with IP broadcasting? What barriers exist in this initiative? What is the need for traditional broadcasting to revolutionize itself?

Hypothesis

This study will seek to test the following hypothesis:
• There is no significant relationship between the rising preference in Real Time Broadcasting and Traditional Multi-Media Broadcasting solutions.

• There is no significant relationship between the roadblocks in achieving any competitive advantages in IP networks and the developments in traditional broadcasting solutions.

• There is no significant relationship between the resources needed to achieve this realization and the steps in achieving the development of Real time broadcasting.

Significance of the Study

This study is significant in that it will add to the very little existing knowledge in this area of research.

Scope and Limitations

There is little existing research in relation to this area of study therefore primary and secondary research is utilized in the compilation of this research. Limitations exist in the available literature for which to review and disseminate this area of research.

Methodology

The study intends to investigate the effects of IP networks on traditional multimedia broadcasting. For this thesis, primary research and secondary research will be
used. Primary research will be conducted using anonymous survey questionnaires that will be sent to randomly selected IP end-users.

Survey questionnaires will be used to collect quantitative data and the interviews will be used to provide qualitative insights into the data collected. A limited number of responders will be used for this research, due to the time constraints. However this small sample would be able to represent the general population that is being studied.

Finally the data will be analyzed and compiled for the correlation of the hypothesis; it will then be presented by means of tabular and graphical representations, illustrating the results and the difference that would be explained in details. Through the use of different statistical tools, the researcher will be able to determine the different factors on the implications of real time and traditional multimedia broadcasting solutions.
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Chapter Two

Review of the Literature

Introduction

In this chapter, the researcher has reviewed the write-ups, readings, and studies that are related to the present studies and importance of real time broadcasting. Furthermore, it looks at the relevant networking technologies used to determine the similarities and differences from the past and present studies. The aim is to gain insight into the aspects of the problem that are critical and controversial from the various literature studies regarding real-time broadcasting. Likewise, it gives a review of related reading, literature and studies that have provided the researcher a good background regarding the aspects that have or have not been studied.

What is Internet Protocol (IP)?

IP, by definition, is a network of systems that are separated into several layers, and within each individual layer, there are single or multiple entities performing its functionality. These entities have the ability to interact directly with the layer immediately beneath them and provide facilities to the layer above them. The protocols allow any one of the entities in a single host to interact with any other corresponding
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entity, as long as it's in the same layer as the remote host. This will eventually allow the IP number, which is a four-byte destination address, to move the packets of data from one node to another node.

IP, along with User Datagram Protocol (UDP) and Real-time Transport Protocol (RTP) is used to conduct telephone calls and supply real-time characteristics over the Internet. One form of IP was called IP telephony, which allows making telephone calls over the Internet. IP telephony was possible by using the UDP instead of the Transmission Control Protocol (TCP).

In short, TCP is a connection oriented end-to-end protocol while UDP is a connectionless end-to-end protocol. This allows UDP to be used instead of TCP, in order to avoid delays in retransmission of lost or corrupted packets. Furthermore, RTP is able to supply end-to-end delivery services for data with real-time characteristics. These are some of the core features, which make IP a key enabling technology towards the development of real-time broadcasting.

Dynamics of IP

To further understand the relationship of IP and real-time broadcasting, the researcher explored the technical details of how IP works. It is important to understand that IP is the main function for TCP/IP protocol suite. IP is a data-oriented protocol, which is used by various types of sources and destination hosts to communicate data across a packet-switched inter-network. The data in the IP inter-network is distributed in blocks of data called packets, also known as IP datagrams. Some good examples are
Transport Control Protocol (TCP), User Datagram Protocol (UDP), Internet Control Message Protocol (ICMP) and Internet Groups Management Protocol (IGMP) data.

IP has two key features, which makes it unique, IP provides ‘unreliable’ and ‘connectionless’ datagram delivery service. ‘Unreliable’ stands for IPs ‘best effort’ to deliver IP datagrams. Routers could temporarily run out of buffers, packets could arrive damaged, duplicated, out of order, or could be entirely dropped off. When this happens, IP performs a simple error handling logic, it throws away the corrupted packets and tries to re-send an ICMP message back to its original source. The Transmission Control Protocol (TCP) in the Transport Layer is able to repair the errors, handle lost packets or regenerate transmission until the packets are securely and completely received, but guaranteeing no reliability. Hence, IP provides its ‘best effort’ to deliver packets.

IP is ‘connectionless’, it does not have to sustain any form of information to deliver successive packets. Each packet is independent from the other packet and is also handled independently. Distinctively, if a host has not communicated with the other host prior to sending packets, a setup is not required to be established. For this reason, connectionless protocols are efficient because no time is used in establishing and tearing down connections.

Delivery of IP Datagrams is crucial for real-time broadcasting. The quality of real-time broadcasting depends on how effectively and efficiently packet switches are used to forward packets across different interconnected layer 2 (Data Link) networks. In short, “the layer 2 is divided into two sublayers, the Media Access Control (MAC) layer and the Logical Link Control (LLC) layer. The MAC sublayer controls how a computer on the network gains access to the data and gains permission to transmit it. The LLC
layer controls frame synchronization, flow control and error checking.” (Webopedia, 2004) If the network drops, re-orders or damages the packets, the results viewed by the end user would be poor in quality and distorted. Sometimes there are occasional and minor errors, but these errors are hardly ever noticable by end-users. However, it is important for most networks to try hard and to avoid these inconsistencies.

The Evolution of the TCP/IP

Before we indulge into the research, the researcher studies the importance on why TCP/IP is created and how it evolved. By understanding the roots of the Internet, it will give us the insight into the development of TCP/IP and many of its rules and standards. There are several network protocols (such as NetWare’s IPX/SPX and IBM’s SNA, for example), but this paper will only be concerned with the protocols collectively known as the IP or TCP/IP protocols. (Kosiur, 1998)

The predecessor of today's Internet was Arpanet; a super network that was created by the Advanced Research Projects Agency (ARPA) launched in 1969. (G.Blank, 2002) The United States Department of Defense (DoD) initially created the ARPA in response to the potential threat of nuclear attack from the former Soviet Union. Mainly, ARPA was a military branch that was used during the Cold War to develop top-secret systems and weapons, which eventually lead to design a fault-tolerant network that would enable U.S. military leaders to stay in contact with each other in case of a nuclear war. (G.Blank, 2002)

The protocol or language of choice, used on the Arpanet was called Network Control Protocol (NCP). (G.Blank, 2002) As the Arpanet grew rapidly, a new protocol
was needed, simply because NCP did not fulfill the needs of a larger network. (G.Blank, 2002) The concerns where that the language could only enable a few people to communicate, had many limitations and was not robust enough for the super network, which was growing at an exponential rate. Thus the protocol had to be improved as the number of users grew, eventually leading to the research and development of a new network language.

Eventually in 1974, two Internet pioneers called Vint Cerf and Bob Kahn published “A Protocol for Packet Network Interconnection,” in which it described the TCP, which was a protocol in the protocol suite that described communication between hosts. This would eventually replace NCP and revolutionize the protocol structure. (G.Blank, 2002)

The key highlight of TCP was its ability to communicate between two hosts, while staying in touch with each other and making sure that there was a reliable delivery of data. NCP was unable to resolve the above issues to the extent that TCP was able to. Also, TCP was able to keep track of what was being sent, and even retransmit anything that did not get through. If the message was too large for one package, TCP was able to split the message into several packages and would then make sure that they would all arrive correctly. Concurrently, after the several packages would arrive to the other host at the other end, the TCP would be able to put all the packages back together in the same proper order.

By 1978, testing and further development of this language led to a new suite of protocols called Transmission Control Protocol/Internet Protocol (TCP/IP). In 1983, it was decided that TCP/IP would replace NCP as the standard language of the Arpanet and
the network continued to grow exponentially to this day. (G.Blank, 2002) Although the Arpanet ceased to exist in 1990, the Internet still has and continues to evolve and meet new changing requirements.

From its beginning in 1969, the output of the agency provided a test-bed for networking research and development (Bellis, 2001), linking many universities and research centers. Eventually, this output from Arpanet became extremely successful among several clients and service systems because it offered basic and simple services that everyone needed, such as file transferring, sending electronic mail to one another and remote logins. This eventually led to the development of the Internet where applications running across different network protocols were able to find ways to communicate with each other. TCP/IP was able to communicate with various entities and structure their information exchange, creating a matrix of networks.

As the demand and need for the Internet grew and with the assemblage of numerous and different organizations, the Internet authorities took on an important role to convey a range of numbers to different organizations. These numbers were further assigned to collected groups, which permitted the IP (operating on gateway machines) to move data from various departments. Furthermore, this would allow data to network through several organizations and cross-vast regions and eventually global. This process allowed TCP/IP to be predominantly utilized by the public and providing real time communications.

It became widely accepted as a medium of communication, information, and interaction because of its flexibility in connectionless protocol, which allowed the data to be interpreted over and over again as it traveled across the network. The Internet even
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gained more popularity after the 1990s, when graphical interfaces became widely available and commercial interests were allowed to participate. (DiMaggio, 2001) This eventually led to the establishment of a network of networks.

Types of IP’s, IPv4 and IPv6

There were several protocols that are found within the network and transport layer, also known as the TCP/IP protocol suite. Some of the IP versions that were assigned were IP version 0 (IPv0) to IPv3 and IPv5. IPv0 to IPv3 were either reserved or unused by certain organizations. IPv5 was only used as an experimental stream protocol and the two IP versions currently in use and in demand are IPv4 and IPv6. Other versions do exist, but they were either used for experimental protocols, or are not used frequently.

Currently IPv4 is widely used as the standard for Internet communication, and has been used to provide the basic communication mechanisms of TCP/IP and the Internet for around 20 years. (Kosiur, 1998) However, newer versions have been developed, mainly because of IPv4's incapabilities to handle the influx of Internet users and its inflexibility to allow the Internet to grow and function efficiently (both in size and number). (Kosiur, 1998) As these Internet addresses grew limited, the proposed successor to IPv4 was IPv6, enabled it to be introduced in the realm of TCP/IP.

Conceptually, IPv6 differs little from IPv4, however many details have changed. For example, IPv6 provides larger addresses and replaces the IPv4 variable-length options field with a series of fixed-format headers (which leads to faster processing). The major change is that IPv6 consists of a 128-bit source and destination addresses as
compared to IPv4, which uses a 32-bit source. A new flexible header format uses a fixed-format header with a set of optional headers; network resources can be reallocated instead of using IPv4's type-of-service specification; IPv6 can more easily accommodate future extensions than IPv4. (Kosiur, 1998)

The basic functions of IPv6 and IPv4 are quite similar, but the main differences in IPv6 are found in its form, such as the addressing, security and configuration. Primarily, IPv4 uses a 32-bit source that is too inadequate for the long-term growth of the Internet. This has currently opened doors for many large organizations, such as Cisco and Microsoft to test the new IPv6 and develop potential real-time broadcasting technologies that could be released to the general public.

### Importance of TCP/IP for Real-Time Broadcasting

Most computers that are able to connect to the Internet use some type of protocol, mainly from a large collection of protocols called TCP/IP suite. TCP/IP has evolved to become a critical player in the future of media broadcasting; especially for peer-peer digital networking and offers many advantages over many other network protocols and protocol suites.

One of the strengths and contributing aspect to its growth is how TCP/IP became widely available to the public. TCP/IP is based upon having open standards and is not proprietary or corporation owned. This makes it flexible enough to allow any computer engineer to improve or enhance the protocol by publishing an RFC. Therefore, TCP/IP makes it possible to work with various computers and communicate with other system.
TCP/IP is robust, as it can be configured to work with any type of hardware and network created. It has the ability to figure out the path for every data or packet, regardless of size and as it moves through the network, mainly because TCP/IP is a routable protocol. TCP/IP can scale to any size environment and is robust enough to connect to different types of LANs. TCP/IP is reliable and can guarantee data to be efficiently transferred to another host.

TCP/IP uses a single and relatively simple addressing scheme in order to forward data to the appropriate destinations(s), which makes it easy to transfer knowledge of TCP/IP to any TCP/IP network without re-learning the addressing scheme. The addressing scheme allows the network protocols to receive the data or inform the source host of a change in the network or undeliverable messages.

Most computers that are able to connect to the Internet commonly use a 32-bit integer called the IP address for each host on an inter-network. The latest version of the IP protocol, IPv6, provides 128 bits for addresses. This allows TCP/IP to utilize its 32-bit IP address within the Transport Layer to consistently locate and identify the destination in the network. Thus, the adequate level of a 32-bit IP address confers consistency in determining the destination in the network.

IP has made it possible for the rapid growth of the Internet, which has become a necessity for today’s business and home use and is eventually becoming the key language for real-time broadcasting. All computers are connected to the Internet and use TCP/IP as the protocol of choice for their internal networks. The commercial implications of the Internet have already changed the dynamic of every business model that has ever been
taught and continues to bring real-time broadcasting to every home and business, making TCP/IP a standard communication protocol for the Internet.

**IP Unicasting, Broadcasting and Multicasting**

According to Roeder (2000), there has been an ongoing debate on whether IP broadcasting will take over television broadcasting. But while most agree that it will still be a long time to develop, it is assumed that IP broadcasting will continue to be an integral part of content delivery. As a result, it will see phenomenal growth in the next few years. In addition, Birkmaier (2002) also recognizes the competition among several giant corporations to improve their IP broadcasting technologies.

Microsoft Corporation and Bell Canada announced that these two companies intend to work together to test and deploy television services based on new Internet Protocol television (IPTV) technology. With Bell ExpressVu digital programming, Bell Canada plans to be the first telecommunications company in Canada and among the first in the world to trial the delivery of services over an IP broadband network, using IPTV technology that is being developed by Microsoft® TV. (Blair, Thibodeau, Perry, 2003)

To further understand the growth of multi-media broadcasting, it would be important to understand the three main types of multipoint communications: unicasting, broadcasting and multicasting. Unicasting is when any single source sends an individual copy of a message to each recipient, also referred to as multipoint unicasting. In some cases the numbers of recipients are limited to the sender’s bandwidth. (Kosiur, 1998) For example, in a set up of a videoconference, the number of simultaneous point-to-point
sessions are limited to the participants. Otherwise the network would become over saturated and reduce the bandwidth.

The widely used example of unicasting is when users transfer files through FTP (File Transfer Protocol) file server to their computers. The user is able to transfer any file over the network, from any server and to his or her own computer. However, if there were several users who would need to do the same type of transfer at the same time through FTP, the FTP server would have to send the file to each of the recipients, separately. It would cause a repeated usage of bandwidth for each transfer to each user, causing an unnecessary use of bandwidth.

Most of the applications used on the Internet use unicasting, perhaps more than 90%. These applications involve one-to-one communicating. An example would be a client/server application setup. The advantage of unicasting is that it offers control to both, the sender and receiver and provides the recipient a way to acknowledge delivery of data or ask for retransmission of missing packets. (Kosiur, 1998) In many cases where the same data is sent to more than one recipient at the same time, unicasting works well, as long as there are a limited number of recipients.

However, the downside of unicasting is when it’s used for data distribution and replication. The unicast protocol is not able to support the large number of parallel sessions. This would cause the system to become extremely slow, would need a large amount of server processing and large buffering overheads. In addition, it would cause an unnecessary use of bandwidth. In these situations a high-performance and dedicated server would typically be required. (Kosiur, 1998)
Another type of an alternative network spectrum is IP broadcasting. In IP broadcasting the message is copied and transmitted to all network nodes. There the receiving nodes are able to decide if they need to receive the message or not. (Kosiur, 1998) A copy of the message is transmitted to all network loads. By distributing the task of duplicating the packets among the network hosts provides an advantage towards the sender, rather than focusing the task at the sender’s host machine.

Currently, there are several types of network technologies (hardware) that are able to send packets to multiple destinations, simultaneously. An example would be the Ethernet LAN, where broadcast delivery can be accomplished within a single packet transmission over the wire. The hardware interface on each host computer (attached to any Ethernet cable) is able to observe the net for packets that are bearing a broadcast address. Once these packets are noticed, they are accepted. The other software that is operating on the host’s machine is able to determine if the broadcast data is actually needed by the host or not, saving resources on the computer. By filtering the broadcast, it provides a suitable compromise between the network and host’s resources.

Routers or other network devices are able to duplicate packets and distribute data among the subnets for any WAN (wide area network) based broadcasting or inter-networks. Once on the Ethernet (LAN), these systems are able to utilize the Ethernet and deliver the packets to each computer. (Kosiur, 1998)

The scale back to broadcasting is that the network traffic can swiftly grow out of control. This would cause a further reduction in the bandwidth for other critical applications and affect the regular flow of the daily traffic. The over saturation of the
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bandwidth would eventually crash the network. To overcome this issue, it would be necessary to restrict such broadcasts to a single subnet.

However, broadcasting still places an unnecessary computational load on workstations, where the host is not interested in receiving. (Kosiur, 1998) To determine if the message is needed, a part of the message is processed (by checking if the message is needed or not), causing some usage of the network and computational resources. (Kosiur, 1998)

Through IP broadcasting, end-users are able to access and monitor a broad range of live events through the Internet by using real-time technologies, preventing end-users to have no constraint in accessing channels and most notably, the flexibility to have global coverage. Global coverage could be received by means of satellite or cable that are encoded into the IP network. A good example of live IP broadcasting technology is Digital Video Broadcasting (DVB). This is the European version of a high-speed digital television, which has the ability to supply video and audio as well as handle the many megabytes per second needed for real-time broadcasting, simultaneously.

Another type of an alternative network spectrum is IP multicasting, similar to IP broadcasting. If unicasting and broadcasting were two extremes, than multicasting would fall in the center. Various types of LAN technologies can also support it and the network devices, such as the Ethernet, are able to monitor and receive data throughout a series of multicast addresses, parallel to broadcast addresses. Rather than sending the data to a single host as in unicasting or to all hosts on a network through broadcasting, multicasting aims to deliver the data to a selected group of hosts called the host group.
The host group is identified by a specified multicast address that is assigned to it. The host’s monitors the LAN and is able to accept the packets that are addressed to the multicast address. The multicast address is able to identify the host groups to which it belongs and allows each host to choose whether it wants to participate in a multicast, unlike broadcasting.

Using multicasting on a WAN may also have some similar features to how LAN multicasting operates. Multicasting aims to deliver data to host groups where the membership information’s concerning these host groups is maintained across the entire WAN. The procedures for joining and maintaining a host group may be different from LAN because routers need to get involved. The routers pass information among themselves to maintain the fabric of the multicast inter-network. (Kosiur, 1998)

Finally when a host group is set up, the sender starts to transmit the packets to the established host group address. The packet streams are delivered to all members of the groups throughout the network infrastructure. To conserve the bandwidth in multicasting, only one copy of a multicast message is used and is passed over the router, for example, any other link in the network is used unless the message needs to be passed over to another router.

IP multicasting can only be used for certain applications on the Internet although there are many different kinds of applications developed for IP multicasting. These applications can be categorized according to whether they’re real-time applications that use only single media data or multimedia. Some examples of real-time applications that use multimedia for web casting applications are file transfers electronic software distribution such as GroupWare applications in videoconferencing, Internet audio and
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graphics. Other examples of real-time applications that use single applications are shared whiteboards, interactive gaming, stock quotes or news feed.

However, IP multicasting provides no advantages to Web browsing, sending e-mail, or running TELNET for remote access to a host computer, for instance. (Kosiur, 1998) The main issue is that if more than two or three people are sharing common data in a given application, then IP multicasting can help reduce the demand on network bandwidth.

The downside of IP multicasting is that there are still several issues that remain to be solved to promote IP multicasting for commercial purposes. Some of these issues involve scalability problems that can occur as the multicasting network grows. The routers not only have to deal with the dynamic topological changes common to inter-networks, but they also have to deal with the dynamics of host groups as members join and leave the groups. IP multicasting depends on the traditional best-effort delivery method of IP, which renders delivery unreliable. Although efforts are under way to develop a better protocol for reliable delivery of multicast traffic, there is no single reliable multicast protocol that is capable of handling the wide variety of group distributions, amount of feedback required, or the various types of data involved.

Quality of Service (QoS) for multicast traffic is an important issue. This will be of immense importance for the distribution of multimedia and real-time data over the Internet. But many types of multimedia have special timing and delay requirements, which have to be guaranteed by the network, if the delivered data is to be useful. (Kosiur, 1998) Combining QoS reservations with multicasting is still an active area of research as
network developers seek to combine multicasting with multimedia data distribution on IP networks. (Kosiur, 1998)

IP Multicasting is a much simpler way for service providers to manage and monitor their real-time and multimedia broadcasting transmissions. Streaming multimedia, particularly audio, video or combined audio and video can be distributed to a multicasting group. There are several products like Progressive Networks’ RealAudio and Real Video, which were designed to use multicasting when it’s available. Recordings of conference sessions, concerts, and interviews use multicast over the Internet. Mainly because multicasting sends data from one single server to many users at the same time, allowing the end user to select the broadcast they want after they have received the required limitations from their service provider.

When comparing IP broadcasting and IP multicasting, IP broadcasting is the inadequate replacement for multicasting. In practice, broadcasts are usually used where multicasts are needed. Packets are broadcasted at the hardware level, but filtering software in the receiving hosts gives the effect of multicasting. IP broadcasting sends data to everyone at the same time while IP multicasting provides a better way to control the stream of data and to send it to receivers who really need them.

What’s holding up Real-time Broadcasting?

The usage of information technology has increased dynamically, due to the availability of user-friendly applications, affordability and efficient software/hardware packages, and major advances in telecommunication capabilities. Over the past few years there have been various types of emerging access technologies developed. One
such area is in broadband networking, where competitors are always seeking ways to replace incumbent technologies by improved performance, reliability, speed, recognition, and probably most important of all, cost.

Over the years, the Ethernet has been the key player, not only in the business environments but also at home. This is mainly because these components have become more affordable and effective, but as these technologies progress, it can lead towards other potential and efficient versions. Some of these examples are GigE and Fiber Channel, which continues to allow the growth towards real-time broadcasting.

Currently, Gigabit Ethernet has the ability and the bandwidth room to run applications. If more is needed, then equipment supporting a newer version of the technology that operates at 10 Gbps faster is already available to the market. However, many industry experts believe that from its track record, installation base, and the price per megabyte, Ethernet will be the ultimate and final protocol that will win out Asynchronous Transfer Mode (ATM) in the wide area. (Carty, 2002)

ATM is a dedicated connection switching technology that organizes digital data into 53 – bytes cell units and transmit them over a physical medium using digital signal technology. Speeds on ATM networks can reach up to 10 Gbps. (Power Net Global Communications, 2004) however; this was first developed unsystematically and did not come close to the development of true real-time delivery of video.

Fiber Channel (FC) is another technology that is used for transmitting data between computer devices at data rates between 100 to 400 mbps, over optical fiber or copper. These optical fibers are optimized to connect servers to shared storage devices and for interconnecting storage controllers and drives. FC provides a high-speed
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collection and is bi-directional. It’s topology independent and provides a high scalable interconnection between computers, peripherals, and networks. Mostly, FC takes its place alongside the development of video servers.

The Gigabit Ethernet technologies are able to offer greater bandwidth and more flexible channels than standard Ethernet. Improvements in Gigabit Ethernet technology are replacing the older, slower Asynchronous Serial Interface (ASIs) connections that could be important in Video on Demand network development. It is the next hope for extending data transfers over existing systems with the prospect of integrating pocketsize video on a more conventional topology.

In early 2001, the server manufacturers began offering alternative simultaneous bit stream output formats with transport stream inputs over topologies such as GigE, Fiber Channel and the more conventional Ethernet over IP or FTP. These extended capabilities are clearly moving the modern video server out of the pure "video" domain and into the true "store-and-forward" media-server domain. Companies like Metro Ethernet are developing technologies that can and according to analysts, bring real-time broadband connectivity directly to the office or home through fiber cables. (Broadhead, 2003) More importantly, this will allow the integration of the Internet as a core strategy initiative for numerous businesses. However, there are still delays for many end-users to incorporate real-time broadcasting on a daily basis, such as affordability, network management, inter-operability, and reliability.

In the early development of FC, it was once regarded as the most probable method of intra-facility interconnection for the high-speed transfer of video and data around the broadcast plant. However, the implementation of FC that is currently used in
video servers is a small subset of the entire range of capabilities of FC. FC has been a key developer in the video/media server marketplace, but the development of Gigabit Ethernet and 10-Gigabit Ethernet may effect the continued development of FC. (Paulsen, 2001)

During the 1980s, Internet engineers and scientists realized the inefficiencies of unicast in developing media distributions, leading ways to develop multicasting. Most of the Internet streaming today uses unicast, the designated Internet transport protocol. To improve this quality and provide large scale streaming, the service provider needs to incorporate the price for extra bandwidth use, which would be very expensive.

The differences between unicast and multicast is that multicast allows a copy of a stream to be sent through any link, allowing the routing protocol to replicate the streaming media packets inside the network and sending data to selected end-users. Providing distribution at a lower cost. Currently, multicasting also has been widely used by organizations to send IP Datagram (i.e. audio or video) stream over the Internet from one location to many locations, simultaneously.

The growth for broadcasting technologies depends on affordable systems, such as low equipment cost for installing, maintaining, operating and making capacity changes. Conversely, service provider have to be concerned about how end-users will be effected by having these services transformed from one system to another, making sure the transfer for media data are seamless, with minimal disruption of services, and unobservable by the end-users. To successfully do that, a powerful network management system is required.
"Between 2002 and 2006, Ethernet will make major inroads into metro telecom equipment spending, accumulating $18bn.” This spending is being driven by the fact that more users are demanding Ethernet services, lower prices and the convenience of incremental bandwidth from their service providers. (Broadhead, 2003)

To establish a powerful network management system, it would require the inter-operability among equipment used by multiple service providers and the various types of IP network typologies. Inter-operability means that the equipment in the network should not just co-exist in the same networks, but also productively share the responsibility of providing connectivity. Furthermore, it should also support live or on-demand streaming video services, as well as well-defined protocol for inter-connecting these elements, ensuring that all-common network management models can coexist. With inter-operability, data can be seamlessly transformed from one another, even if the network or equipment fails. However, effective use of these fields would require a stringent agreement between vendors and will present new inter-operability issues in the future.

In recent times, the Metro Ethernet inter-operability demonstrations at the Supercomm 2003 trade show in the US stressed on this belief. This was the largest and most comprehensive service inter-operability demonstration of Metro Ethernet services to this date. This was probably one of the first times the general public was able to see a genuine multi-supplier solution running real applications. (Broadhead, 2003)

A create a well-established network management system, it would require reliability. Carrier call systems should be reliable enough to ensure that their systems don’t fail to deliver data at any given point of time. Providing the end-users with the availability of manufacturing materials, efficiency, establishing service support and
having an effective software-quality management system. Furthermore, this would allow the end-user to minimize their system downtime.

To ensure that these services are available for end-users, carrier call systems should be robust. They should be able to detect problems at any time, repair them and provide an extensive service recovery. Providing a high level of fault tolerance for end-users. Conversely, if the system goes down, end-users would loose the service and would cause a heavier cost on the service providers.

Other than the Internet, new compression methods could reduce the data size and maintain the sound and image quality at its best. Service providers should provide end-users with adequate software decoding, and improved broadband services to deliver high quality continuous media data-streams. In addition, they should provide advanced technologies for sorting large volume of data and the wide spread adoption of the server client architecture to ensure the delivery of content across a broad geographic area. More importantly, providers need to establish a powerful network management system by maintaining inter-operability among networks, affordability and reliability to end-users. Therefore, a solid network management foundation is clearly the nucleus of the over all solution.

Effects on Organizations

Recently, multimedia broadcasting has been revolutionized by the continuing advancement of IP broadcasting technologies. “Corporate video services are already embracing IP infrastructures and the broadcast industry will gradually move to IP services, as well,” said Gerry Kaufhold, principle analyst with In-Stat/MDR. “IP
networks provide a great deal of bandwidth at low cost, when compared against traditional professional quality real-time video connections, which must adhere to very strict technical requirements. (Kaufhold, 2004). More importantly, IP has been associated with every decision being made about the future of broadcasting.

Birkmaier (2002) stated that the Internet has been threatening television, radio, cable and other broadcast distribution infrastructures and the numbers of people who have turned to the Internet, rather than broadcasting media, have increased throughout the years. “Enabled by the IP concept, the Internet has emerged as a massive threat to TV, radio, cable, DBS and other broadcasting distribution infrastructures.” (Birkmaier, 2002)

With a hyper-turbulent competitive environment and the ability of large organizations to squeeze out smaller competitors, competition has become challenging. Providers will have to be competitive in pricing, provide promotional campaigns, and establish cooperation between businesses and organizations to survive. Furthermore, they need to enhance there standing and legitimacy in the firm’s local environment, develop new technology enhancements, affordability and establish improvements in broadcasting technologies, such as establishing a powerful network management system. However, the autonomy-seeking behavior characteristic of entrepreneurs and the self-directed behavior that drives small business owners would seem to be at odds with the increased interdependence. The rising cooperation and changes in the competitive environment has been posed by an increased technology usage.

Already large organizations, such as AOL Time Warner have stressed the importance in finding ways to re-develop the cable industry and make it a critical part in developing IP-based broadband network that can seamlessly unite all cable services on to
one network. (Birkmaier, 2002). Delivering a live streaming event over the Internet would be efficient for a server to route one stream to many users. Unfortunately most Internet routers cannot do this because the server needs to duplicate this for every server, (Birkmaier, 2002). Existing router needs to be upgraded to support the IP multicast protocol. Once this is achieved, it will lead ways to develop a unified network, which will be able to simplify the network designs and allow improved bandwidth allocation among services.

Corporate networks and broadcast video delivery services are taking advantage of improvements, such as MPLS and IPv6, as well as using video encapsulated products to send real-time quality video over IP virtual networks. However, the evolution to IP will take some time to accomplish. Many traditional delivery services are provided through long-term purchases agreements, causing a delay to implement IP solutions until the time periods of previous contracts have expired. (Kaufhold, 2004).

Electronnic Media and the Sociological Aspects

The main theoretical traditions of sociology have come up with various viewpoints about electronic media and how it influences end-users. The Internet tends to complement rather than displace existing media and patterns of behavior because it integrates both styles of communication (reciprocal interaction, broadcasting, individual reference-searching, group discussion, person/machine interaction) and different kinds of content delivery (text, video, visual images, audio) in a single medium. This versatility renders plausible claims that technology will be implicated in many kinds of social changes, perhaps even more deeply than television and radio. (DiMaggio ET Al, 2001)
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Some viewpoints about electronic media and how it influences end-users are from the Durkheimians, Marxist and Weberians. They stress on the changes in electronic media and how it affects the sociological aspect. Although there may have been a wide variety of studies done in the past on broadcasting technologies, this study will seek to contribute an in-depth analysis of the factors that influenced the proliferation and rising preference on interactive media channels.

The Durkheimians state that when using different kinds of point-to-point communications, such as the telephone, radio or television, it would tend to create a different kind of implication towards each user. For example, when using the telephone it would reinforce organic solidarity. When using the radio or television, it would yield to create a powerful and cooperative representation. Real-time broadcasting would provide both, solidarity for when end-users are using the telephone through the Internet, or create huge gatherings when IP broadcasting is transmitted to many end-users at one time, perhaps in the same place. The influence of the Internet to the society from the Durkheimians perspective sensitizes us to the new media’s impact on community and social capital.

When television appeared in the United States, it had a rapid impact on the use of other media devices. Audience abandoned their radio sets, movie theatre closed, and general-interest magazines stopped publishing fiction and eventually folded. (DiMaggio ET Al, 2001) Enforcing declines in out-of-home socializing, in-home conversation, housework, personal care activities, and even sleep. (DiMaggio ET Al, 2001) If television, a unidirectional mass medium, displaced so many activities, then it stands to reason that the Internet, which permits interactive as well as one-way communication,
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might substitute even more. Observers have expressed particular concerns that Internet users may reduce the time devoted to off-line social interactions and spend less time with print media, as well as the television and other media. (DiMaggio ET Al, 2001)

The Marxists argue that the corruption and abuse of communicational media would lead to augment control on politics and production through cultural supremacy and improved observation. The Weberians would argue that any form of point-to-point media would advance rationalization by reducing the limits of time and space, thus allowing broadcast media to create distinctive status cultures. The Marxian and Weberians traditions about the influence of the Internet on the society are concerned about power and inequality in the access to the new technology. The Weberians tradition raises the question of the effect of the Internet technology on bureaucracy and economic institutions. (DiMaggio ET Al, 2001)

Technological determinists argue that any change or improvements made to the features of traditional media would create a social change. Such as how real-time broadcasting has challenged our traditional broadcasting methods and opened a new medium for IP broadcasting through the Internet. These changes will induce a new way to communicate, refining distinctive skills and bringing awareness. In the 1960s, the students of social change suggested that any new development towards the communication technology would cause the industrial society to yield towards the "information society," thus causing a change in every institution existing. Proofs of this are present in every society these days.

The social impact of digital communications media (as predicted from Daniel Bell in 1977) derived two related developments. One would be the invention of hand held
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smaller electronic devices and the other would be through optical circuit. Optical circuits are extremely effective to increase the speed the flow of information through networks. The second would be the future integration of computer processing and telecommunications, also known as “communication” technology.

As we have seen in recent times, a powerful network management system would improve broadcasting technologies. In the past, Bell anticipated the democratization of electronic mail, Tele-faxing, as well as digital transmission of newspapers and magazines, and currently it is happening. Hence, he explored and stated that these changes would cause “the social organization of the new “communications' technology, the most central issue ”for the postindustrial society”.

It has become clear that real-time broadcasting has changed the vision on how the Internet, the traditional telecommunications devices/services and media oriented television sectors would interact with one another. This interaction would allow the converging of two sectors and allow the end-users to view any real-time broadcasting, either through television, mobile phones or personal computers.

The Internet’s integration of print, oral, and audio-visual modalities into a single system promises an impact on society comparable to that of the alphabet, creating new forms of identity and inequality, submerging power into a decentralized flow and establishing new forms of social organization. (DiMaggio ET Al, 2001) Changing the current traditional methods for end-users and enhancing the dynamic broadcasting technologies.

New technologies have allowed end-users to send and receive emails, watch live events, shop or even play interactive games through the Internet on their own television
sets or mobile phones. As improved Internet services offer better audio, quality, speed and bring TV to your PC, it would cause consumers to become more interactive, changing their lifestyle pattern and expanding their media communications and delivery of information. The nature of this impact will vary depending on how economic factors; government regulations and users would collectively evolve to organize this Internet technology.

Within a small time period, the Internet has been molded into becoming a major point-to-point communicator through the demands of society, end-users and public policies and through economic competition. Choices are being made, systems developed, money invested, laws passed, regulations promulgated, which have shaped the system’s technical and normative structures.

Many of these choices are based on behavioral assumptions on how people and the Internet interact with one another. Through public policies, the Internet has grown to become an established median for end-users, available for anyone from any social class because of its affordability. Enthusiasts predicted that the Internet would reduce inequality by lowering the cost of information and enhancing the ability of low-income men and women to gain human capital find and compete for good jobs, thus enhancing their careers. (DiMaggio ET AI, 2001) Strover in 1999 compared dial-up-connectivity in four rural US countries and concluded that low levels of commercial investments in telecommunications infrastructures in sparsely populated areas have been generating less choices among service providers and higher connection fees. (DiMaggio ET AI, 2001)

The relationships between technology and society have never been integrated. Technological changes have been lead through the responses of rapid growing interest of
end-users, customizing the technologies for their own personal interests. The access of information services, such as the telephone and the cable tends to contrast to the rapid growth of information through other traditional means. The radio, TV and VCRs have all reached saturation levels relatively quickly, because the former requires ongoing expenditures, whereas the later are based on one-time purchases. This would make society the key leader in creating inequalities among social classes and starting new trends for potential technologies.

When looking back into the history of breaking technologies, such as the telephone or radio, the telephone was initially invented as a business tool or as a broadcast device. Throughout its early stage in life, it developed into a widely accepted instrument of sociable interaction. The radio was invented as an interactive medium that was tailored to the needs of military communication. This eventually grew it into a point-to-point communication system. Providing several main features, such as a growing commercial broadcast system to a specialized musical broadcasting system for various distinct subcultures and market subdivisions.

The Internet has grown to become more elastic because of its ability to create point-to-point and broadcast capabilities into a single network. Through the networks the Internet can be used as a viable means of communication, such as a telephone, or as a source of sending emails or connecting to chat-rooms or other forms of real-time communication devices. However, the Internet is creating and reproducing cross-national inequalities in newspapers, telephones, radio and television because it largely depends on economic development, research and investments that are unequally distributed across societies. (DiMaggio ET Al, 2001)
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It can also be used as a library to create specialize Web sites, compiled with information to allow end-users to access the information or use search engines to find queries they require. It can be a source for users to discuss issues on chats or send e-mails back and forth or it can be used as a conventional mass medium, such as AOL. Allowing the users to broadcast information to large numbers of users across the world and simultaneously, making the Internet extremely compliant. "What happens inside companies is important, but clusters reveal that the immediate business environment outside companies plays a vital role as well. The role of locations has long been overlooked, despite striking evidence that innovation and competitiveness success in many industries is geographically concentrated." (Porter, 1999: 78)
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Effects upon Traditional Multi-Media Broadcasting Solutions

Chapter 3 –

Methodology

Introduction

This chapter will present the various types of procedures and strategies used in identifying the sources that are needed to gather information about real-time broadcasting and its effect on traditional multi-media broadcasting solutions. It will describe the type of research method used by the researcher and the types of research designs that will be followed. Furthermore, it will explain how the researcher determined the sample, data gathering procedures and the statistical treatments applied.

Method of Research

The style of research method used by the researcher is descriptive. Descriptive research method uses observations and surveys to determine the end results. This method does not only produce faster results, when compared to other methods, but is cost effective, although unanticipated hypotheses may occur during the research. Nonetheless, it will be challenging to rule out alternative explanations and infer causation. Thus, the use of descriptive approach would be best suited for this study.

Descriptive research utilises observations from the study and the researcher gathers information from the present existing condition. (Creswell 1994) The purpose of employing this method is to describe the nature of a situation, as it exists at the time of
the study and explore the causes of a particular phenomenon. Allowing the researcher to obtain firsthand data from the respondents and formulate rational and sound conclusions.

The data gathering method used for descriptive research is partially based on quantitative and qualitative research method. Quantitative data provides flexibility and a more iterative approach to the study. During the data gathering process, the researcher has the flexibility to choose and be able to constantly modify the methods, based on how the ongoing analysis continues. This allows the researcher the option to investigate important new issues, answer the questions as they appear and to drop unproductive areas of research from the original research plan.

The researcher also uses qualitative research method, mainly because this type of research intends to find and build theories that could explain the relationship of one variable to another through qualitative elements. These qualitative elements do not have standard measures but rather have behaviors, attitudes, opinions, and beliefs. Furthermore, a qualitative research involves an interpretative and naturalistic approach to its subject matter. The researcher can study the questionnaires in their natural settings and attempt to interpret how people would perceive them to be as. Accordingly, a qualitative researcher deploys a wide range of interconnected methods and expects a better fix on understanding the subject matter.

Qualitative data usually refers to raw but descriptive information about a product. (Paton, 1987) There are three types of data gathering strategies that would typically be characterize as qualitative methodology. In-depth analysis, Open-ended interviews (direct observation) and Written documentation’s (including product records, personal diaries, logs, etc.)
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The use of gathering data from fieldwork is the central activity of qualitative data, to be in the field means that the researcher has direct and personal contact with the responders in their environments. It is the researcher's desire to document the program and capture important results, such as the effects and outcomes of certain issues, which cannot be captured through standardized measures.

The quantitative approach requires a large-scale of measuring ideas, beliefs, and attitudes. Generally, the sets of questions are limited, facilitating the comparison and statistical aggregation of the recorded data. It helps to establish a general set of findings and conclusions. By contrast, qualitative method typically produces a wealth of detailed information from a well-defined number of responders, who may or may not fit into predetermined responses, which characterize most surveys, questionnaires and tests.

The result from a quantitative research can be very simple, as they are generally reduced to a few numerical statistics and interpreted into a few short statements. Therefore, a mix of qualitative and quantitative data gathering methods enriches the evaluation, where the open-ended comments provide a way to elaborate and document statistical facts.

The primary source of the data will be used from survey questionnaires and random interviews conducted personally by the researcher. Survey questionnaires will be given to randomly selected personalities with the assumption that they have some technical experience and knowledge about the existing Internet technologies, such as IP, IP Broadcasting, IP multicasting, etc. The geographic focus studied for this research will be in North America.
The secondary sources of data will be used from published articles, information technology journals, articles and books related to the branding of real time broadcasting. This will serve as the basis of the researchers’ assumptions and will be able to relate with the data collected from surveys and interviews.

**Research Design**

This study will use a descriptive design and will focus on the present condition. In descriptive-survey design, the purpose is to find a new truth about the study. The truth may have in different forms, such as:

- Increased quantity of knowledge.
- New generalization.
- Increased insight into factors.
- Discovery of new relationships.
- More accurate formulation of the problem to be solved.

This approach is appropriate where the object of any one class may vary among themselves. The researcher is interested in knowing what will be the extent to which another different condition may be used. In descriptive-surveys, it is important to know that the psychological and sociological aspects of research may be easily interpreted and implemented between the fact and influences. It includes empirical observation through survey-questionnaires and is analyzed to determine the functional and significant relationship between the rising preference of real-time broadcasting and its effect on traditional multi-media solutions.
Determination of the Sample

The study will use a combination of cluster and random samples. The respondents will grade their statements based on how the users perceive them to be, by using a Likert-scale (details described below). From the survey questionnaires, the researcher will study and develop a conclusion based on the significance of the gathered responses. Furthermore, it will provide a specific description from the answers imparted by the respondents and finally make reasonable recommendations.

For this research design, the researcher will gather data, collate published studies and analyze articles from social science journals. They will distribute sampling questionnaires; arrange interviews and collect information gathered from documentaries and verbal materials. Subsequently, the researcher will summarize the information, make a sound conclusion based on the null hypotheses and provide an insightful recommendation on the effects of real-time broadcasting to traditional media broadcasts.

Determination of the sample size is based on the researcher’s decision. There are no specific ways to determine the sample size in a given population scientifically. However, the rule of thumb is to have a healthy set of responders so that the researcher will be able to develop a sound conclusion from the data collected.

The Subject

The subjects for this research are the end-users of broadcasting technologies. The researcher’s decision is to focus on the rising preference of real-time broadcasting and its effects on traditional multi-media solutions. The following are the factors that will be used for this study, which influence certain users to turn to interactive media:
• Observe how other advantages in IP networks still need to be realized.

• Determine what are some of the roadblocks in achieving a competitive advantage in IP networks and evaluate the developments in broadcasting.

• Determine what are some of the resources that need to be realized.

• Identify the chances that traditional broadcasting technology will revolutionize and catch up with IP broadcasting.

• Assess what it would take to achieve the development of broadcasting technologies.

Research Instruments

The researcher will collect primary data by meeting and interviewing a sample of the responders. Consequently, the interview will then be reviewed and the information will be analyzed. The result from this information will become the basis of this study. The first step will be to create a self-administered questionnaire containing several questions, which will be eventually filled out by the respondents. Ideally, the respondents will grade each statement in the survey-questionnaire by using a Likert scale. The scale will have five-responses, wherein the respondents will have to choose from each one of them.
The equivalent weights to each answer is as follows:

<table>
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<th>Range</th>
<th>Interpretation of Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between 0.00 and 1.49</td>
<td>Strongly Disagree</td>
</tr>
<tr>
<td>Between 1.50 and 2.49</td>
<td>Disagree</td>
</tr>
<tr>
<td>Between 2.50 and 3.49</td>
<td>Uncertain</td>
</tr>
<tr>
<td>Between 3.50 and 4.49</td>
<td>Agree</td>
</tr>
<tr>
<td>Between 4.50 and 5.00</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

The researcher will most likely use the survey questionnaire technique as an important tool for research because the rules and principles for construction are straightforward and efficient. Moreover, copies of the questionnaire will be able to reach a considerable amount of respondents either by e-mail or by personal distribution. The responses from each questionnaire will be objectionable and standardized, making it easy to create a tabulate. More importantly, the respondents’ replies will be of their own free will with no influences from the interviewer, avoiding further biases from the interviewer.

Validation of the Instrument

The researcher will initially submit a sample of the survey questionnaire to several respondents and a structured interview will be conducted. The structure interview will consist of specific questions and no further deviation from the list of questions or extra remarks will be added. Throughout the process, the researcher will clarify vague statements and will further elaborate the brief comments of the respondents. However,
the researcher will attempt to be objective and will try not to influence the respondent’s statements.

After the survey questionnaire are answered, the researcher will ask the respondents if they have any further suggestions or if any corrections need to be made. This will further improve the validity of the survey. The researcher will re-examine the content of the interview questions and make appropriate changes to it, excluding irrelevant questions and issues. Finally the researcher will tally the scores and tabulate all the responses from the provided interview questions.

**Statistical Treatment and Formulas used**

Once the date has been collected from the surveys, the researcher will process the raw data into quantitative and qualitative details. Data processing means that the data will be analysed using statistical procedures and techniques, by calculating the weighted-mean and chi-square from the data collected. The output of the data will consist of the results of the study and will then be presented as a data matrix where further explanations will be added. It is important that the researcher diagnoses each problem through correct analysis and appropriate statistical tools.

To evaluate the information gathered from the respondents, the following statistical calculations will be applied to help analyze the information and establish conclusions. The statistical instruments are as follows, percentage, Weighted-Mean and Chi-Square analysis.

I. **Percentage:** Percentage is used as a descriptive statistics, which is used in relating a part of the population to the whole population. It describes some of the
The Rising Preference to Real-Time Broadcasting

personal characteristics of the respondents in the study, such as age, gender, civil status, and educational attainment. The basic formula used is as follows:

\[
\text{Percentage} \% = \left( \frac{n}{N} \right) \times 100
\]

Where \( n \) = Number of Responses

Where \( N \) = Total Number of Respondents

II. **Weighted Mean**: This is commonly used in finding the averages from the respondents and to determine the level of responses from each respondent as prepared by the researcher.

\[
X = \frac{[(f_1 \times x_1) + (f_2 \times x_2) + (f_3 \times x_3) + (f_4 \times x_4) + (f_5 \times x_5)]}{X_t}
\]

Where \( f \) = Weight Given to Each Response

\( X \) = Number of Responses

\( X_t \) = Total Number of Responses

III. **Chi-Square Test**: Chi-square is a family of distributions that vary with degrees of freedom. In general, as the degrees of freedom become infinitely large, chi-square approaches normality. The expected value of each chi square distribution (mean) is equal to the number of degrees of freedom for that curve. This is used to determine the relationship between two variables that have some type of relationship. The formula for this is as follows:

\[
\chi^2 = \sum \frac{(o_i - e_i)^2}{e_i}
\]

Where \( \chi^2 \) = Chi-Square Value

Where \( o_i \) = Observe Frequency

Where \( e_i \) = Expected Frequency
The Rising Preference to Real-Time Broadcasting
Effects upon Traditional Multi-Media Broadcasting Solutions

-Chapter 4 -

Interpretation, Presentation & Conclusion of Results

Introduction

After several months of sending out surveys and collecting the data, the researcher will analyze the data and interprets the findings. The collected data will aid the researcher’s study and provide support to prove the hypothesis. The hypothesis states that there is no significant relationship between the rising preference of Real Time Broadcasting and Multi-Media Broadcasting.

The targeted populations for this research are the end users of a wide variety of technologies used on the Internet and who have a good understanding of IP and broadcasting technologies. There were almost 200 surveys completed. The main focus of this research is to focus on the factors that influenced certain users to turn to real time interactive media and the roadblock in achieving this advancement.

To understand this study in details, the researcher will divide the collected data into several parts. The first part will provide a general description about the respondents and aid us to analyze the types of respondents being studied. This will include descriptions about their age groups, gender, educational attainment, employment status, and other relevant information.
The second and third part of this study will take a deeper dive into the data and discuss the information collected from the surveys and interviews. This will allow the researcher to provide details as an interactive-medium, disseminate information and analyze how users will react.

Finally, the researcher will conduct a statistical analysis, along with graphs and details to test the hypothesis and prove to reject the null hypothesis. The graphs and figures will be used to provide a descriptive clarity of the discussions and form strong conclusions.

Part I

Profile of Respondents

To further understand the population, the researcher narrowed down the population to limit the respondents to not more than 200 respondents. This will allow the researcher to narrows down the population to targeting selected pockets for this study. Some exclusion that were applied are as follows:

- Excluding ages that were less than twenty years old.
- Excluding employment status and backgrounds that were not related to technology.
- Excluding education levels that were lower than the first year in college.
- Excluding responders who are not working or not studying or both.
From the type of respondents used for this research, most of them had recently started their careers. Some of them were from well-established professional background, related to a technology-related background. The rest of them were from an academic background that were currently enrolled or were continuing their graduate degrees. This helped the researcher establish a conclusion based on a young adult group who were well informed about the significance of real time broadcasting and its effects on traditional Multimedia broadcasting solutions.

The population has a 1:5 ratio of women to men. This is not a surprise, since most of the respondents were mostly men from either India or China. Most of the workforce in the US is mostly men rather than women. It's also important to know the educational accomplishments of these respondents. This plays an important role for this study in establishing reliability of the data, which depends on the technical and educational background of these respondents. Most of the respondents were from a well-educated, technical background, where some had a Computer Science or Information Technology background and others were from networking, telecommunication or multimedia. Lastly, some of the respondents had a technology-related job, mostly as IT consultants. Below is the figure, which summarizes the distributions of the respondent's by age.
In Exhibit 1, we can see that the age ranges of the respondents that is categorized into four groups. All other age groups have been excluded. The ages of the respondents are well targeted towards a younger group in the population, with majority of the respondent’s between the ages of 27 and 32 years old (38% of the total population selected). Majority of the age group is also between the ages of 20 and 32 years old, with a cumulative percentage of 68% of the total volume and a total of 34 respondents. The lowest age group was between the ages of 40 to 46 years old, which was only 6 respondents (12% of the total population selected). This was mainly due to the selection criteria, where majority of the responders would be selected from the younger group of the population. The rest of the population fell into the ages between 33 and 39 years old (20% of the total population). The population is well diversified for this research.

The next type of information to be taken into consideration is the gender of the respondents. Most of the respondents are male, which was mainly due to the targeting of the surveys. The distribution of the surveys was distributed from one male respondent to another and also that most of the responders selected were male. However, for this study, the type of gender does not infer the causation for this research.

The following is a pie chart, depicting the percentage of male and female users. Exhibit 2 shows the gender of the respondents. Based on the exhibit, the majority of the respondents were male, with a percentage distribution of 66%. This is 32% more than the female responder’s, who were 34% of the total population selected.
The following pie chart shows (Exhibit 3) what type of civil status the respondents come from. This will allow the researcher to understand the population selected and the background of the responders. Most of the population is single and with a job, almost 40% of the total population making them a dominating response. 20% of the population was single and currently involved in some type of academia. The single population was mostly studied for this researcher by the researcher, which was 60% of the population. The respondents who were married and with a job were 18% of the population and married and continuing in some type of academia were 12% of the population. The rest were only 10% of the population, for example, were either married or with a job or were studying at the same time. Most of responders were single because of the younger age groups selected for the research. 58% of the respondents are currently employed, so the respondents of this study are mostly professionals and the rest of the 42% of the respondents may be unemployed but are academically enrolled. This shows that the selected population is from a strong technical, professional and academic background.
The following graph below breaks down the population between the educational attainment of each responder and their job status. During the survey the respondents were asked about their educational background. Exhibit 4 shows a detailed report of the educational distribution of the responders.
Most of the respondents are either single or married and currently enrolled in some sort of further education program, which makes up 32% of the population. Altogether, 64% of the population has at least obtained an undergraduate degree. 90% of the populations have either completed their undergraduate or graduate degree. The rest of population have continued their studies to a higher level such as a Ph.D. program or have completed some type of technical certification program. This shows that the population is highly educated and technical, as required by the researcher.

**Part II**

**Survey questionnaires**

The researcher prepared a set of survey questions for each responder, along with a set of interview questions, which were used while interviewing the selected respondents. The respondents had the option to select a number from the scale to grade each statement in the survey-questionnaire. These decisions were based from the choices of a Likert scale, either showing that the responder agreed, disagreed or was uncertain.

The data was then collected, processed and computed to calculate the weighted-mean. After the weighted-mean was computed, the results were analyzed from the results of the Likert scale and presented in a tabular form. Below is the tabular presentation consisting of several questions asked to the responders and what they’re perceptions is on the rising preference of Real Time Broadcasting and the effects on traditional multi-media broadcasting technologies. The table below shows the results from the survey questionnaires.
## The Rising Preference to Real-Time Broadcasting

<table>
<thead>
<tr>
<th>Questions</th>
<th>Preference of Real-time Broadcasting</th>
<th>SCALE</th>
<th>Calculated Weighted Mean</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IP is seen as the new cost-effective means to disseminate a wide range of multi-media content to a variety of end users.</td>
<td></td>
<td>3.73</td>
<td>AGREE</td>
</tr>
<tr>
<td>2</td>
<td>Real-time Broadcasting has already found a niche in automated professional quality store-forward-and-store downloading and caching of audio and video files.</td>
<td></td>
<td>3.50</td>
<td>AGREE</td>
</tr>
<tr>
<td>3</td>
<td>Usage of real time broadcasting has increased greatly due to more user-friendly applications.</td>
<td></td>
<td>2.68</td>
<td>UNCERTAIN</td>
</tr>
<tr>
<td>4</td>
<td>Usage of real time broadcasting has increased greatly due to lower costs and efficient software and hardware solutions.</td>
<td></td>
<td>2.83</td>
<td>UNCERTAIN</td>
</tr>
<tr>
<td>5</td>
<td>Has usage increased greatly due to major advances in telecommunication capabilities and usability.</td>
<td></td>
<td>2.63</td>
<td>UNCERTAIN</td>
</tr>
<tr>
<td>Questions</td>
<td>Preference of Real-time Broadcasting</td>
<td>SCALE</td>
<td>Calculated Weighted Mean</td>
<td>Interpretation</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------------------</td>
<td>-------</td>
<td>--------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>6</td>
<td>More business are including real time broadcasting as a key strategy.</td>
<td><img src="image" alt="SCALE" /></td>
<td>3.65</td>
<td>AGREE</td>
</tr>
<tr>
<td>7</td>
<td>IP is responsible for moving packets of data from node to node and forwarding each packet, based on the IP number or a four-byte destination address.</td>
<td><img src="image" alt="SCALE" /></td>
<td>4.03</td>
<td>AGREE</td>
</tr>
<tr>
<td>8</td>
<td>Internet is even more pliant because it combines point-to-point and broadcast capability within a single network.</td>
<td><img src="image" alt="SCALE" /></td>
<td>3.65</td>
<td>AGREE</td>
</tr>
<tr>
<td>9</td>
<td>IP broadcasting will grow and become an integral part of content delivery in the future.</td>
<td><img src="image" alt="SCALE" /></td>
<td>3.58</td>
<td>AGREE</td>
</tr>
<tr>
<td>10</td>
<td>Advances in information technology, especially in the development of IP broadcasting and IP networking is the driving force for the future of virtually every form of digital communications.</td>
<td><img src="image" alt="SCALE" /></td>
<td>3.53</td>
<td>AGREE</td>
</tr>
<tr>
<td>11</td>
<td>These types of applications such as video or audio data streams bring new demands on a network's response and its ability to deliver data efficiently and effectively.</td>
<td><img src="image" alt="SCALE" /></td>
<td>3.78</td>
<td>AGREE</td>
</tr>
<tr>
<td>12</td>
<td>Network designers are now faced with the challenges of supporting the timely and reliable delivery of any kind of digital data to multiple users, especially in real-time and multimedia data delivery.</td>
<td><img src="image" alt="SCALE" /></td>
<td>3.73</td>
<td>AGREE</td>
</tr>
<tr>
<td>13</td>
<td>The growth of Real-time and Multi-media broadcasting users via IP networks continue to challenge and alter the way how users interact with traditional multimedia broadcasting methods and medians. As a result, this has allowed users to access the Internet on a more regular basis, as opposed to using traditional distribution networks, such as radio, television, cable or other broadcasting distribution infrastructures.</td>
<td><img src="image" alt="SCALE" /></td>
<td>2.80</td>
<td>UNCERTAIN</td>
</tr>
<tr>
<td>14</td>
<td>Has the Internet changed the culture of multimedia participation by creating the necessity of dynamic and interactive devices.</td>
<td><img src="image" alt="SCALE" /></td>
<td>3.78</td>
<td>AGREE</td>
</tr>
<tr>
<td>15</td>
<td>IP broadcasting has allowed users to access live events or pre-recorded contents not only through their Personal Computers (PCs), but also through their mobile phones and wireless-personal digital assistants (PDAs).</td>
<td><img src="image" alt="SCALE" /></td>
<td>3.85</td>
<td>AGREE</td>
</tr>
<tr>
<td>16</td>
<td>Today, IP networks are seen as the new cost-effective means to disseminate a wide range of multi-media content to a variety of users.</td>
<td><img src="image" alt="SCALE" /></td>
<td>3.55</td>
<td>AGREE</td>
</tr>
<tr>
<td>17</td>
<td>Today, IP networks are seen as the new cost-effective means to disseminate a wide range of multi-media content to a variety of users.</td>
<td><img src="image" alt="SCALE" /></td>
<td>3.78</td>
<td>AGREE</td>
</tr>
<tr>
<td>18</td>
<td>One key solution is that providers should use industry-leading video compression technology to dramatically reduce bandwidth requirements, enabling the delivery of broadcast quality video services to a variety of devices over the broadband networks.</td>
<td><img src="image" alt="SCALE" /></td>
<td>3.58</td>
<td>AGREE</td>
</tr>
</tbody>
</table>
The Rising Preference to Real-Time Broadcasting

Analysis of the results

The table above represents the perception of the responders on the rising preference of real-time broadcasting. From the results of the surveys, the researcher found that most of the responders agreed to the questions about IP technology and real time broadcasting. Most of the responders calculated weighted-mean was between 3.50
and 4.49. In the Likert scale the results between 3.50 and 4.49 show that the most of the responders agree.

The responders agree that IP networking is seen as a new cost-effective means to disseminate a wide range of multi-media content to a variety of end users. IP networks provide a great deal of bandwidth at low cost, when compared against traditional professional quality real-time video connections. The responders agree that IP has already found a niche in the automated professional quality store-forward-and-store downloading and caching of audio and video files in today’s market. They agree that the Store & Forward category, Content Delivery Networks (CDNs) used by corporations will experience a strong growth in the coming years.

The responders agree that there is a rising preference of real-time broadcasting in business, which is making it a core strategy in their objectives. IP broadcasting has allowed users to access live events or pre-recorded contents not only through their PCs, but also through their mobile phones and wireless-PDAs. With this type of coverage, business can create a competitive advantage over other competitors. However, the responders agree that there are still delays for many end-users to incorporate real-time broadcasting, such as affordability, network management, inter-operability, and reliability.

The respondents are uncertain if the usage of real time broadcasting has increased greatly due to more user-friendly applications and if IP networks are cheaper or have had any efficient software and hardware applications developed. Furthermore, the respondents were uncertain if there were any major advances in telecommunication and usability in the recent years. Although, the developments in telecommunication
The Rising Preference to Real-Time Broadcasting

technology, Voice Over IP has grown over the past few years because of falling cost of communications, such as using SMS that has impacted cultures in the US, Europe and Asia.

IP networks are still seen as the new cost-effective means to disseminate a wide range of multi-media content to a variety of users. The growth for broadcasting technologies depends on affordable systems, such as low equipment cost for installing, maintaining, operating and making capacity changes. More users are demanding Ethernet services, lower prices and the convenience of incremental bandwidth from their service providers. However, once these roadblocks are achieved, the responders agree that the development of IP broadcasting would be an integral part of content delivery.

From the technical point of view, the responders agree that IP is responsible for moving packets of data from node to node and for forwarding each packet based on the IP number or a four-byte destination address. Moreover, it is perceived that the respondents agree that the Internet is even more pliant because it combines point-to-point and broadcast capability within a single network. Responders agree that new types of data, such as video and audio data streams are putting new demands on a network’s response and its ability to deliver data efficiently and effectively.

To establish a powerful network management system, it would require the inter-operability among equipment used by multiple service providers and the various types of IP network typologies. Network designers are now faced with several challenges to support the timely and delivery of any kind of digital data to multiple users, especially in real-time and multimedia data broadcasting, as mentioned from the survey. New
The Rising Preference to Real-Time Broadcasting

compression methods can reduce the data size and maintain the sound and image quality at its best and deliver high quality continuous media data-streams. The responders agree that the advances in information technology, especially in the development of IP broadcasting and IP networking (telephony) will become the driving forces for the future of virtually every form of digital communications.

The responders are uncertain if the development of real-time and multi-media broadcasting through IP networks will continue to challenge and alter the way how users will interact with traditional multimedia broadcasting methods. Users may depend heavily on the Internet, however the development of streaming video content over the Internet still needs to be further developed, such as in delivering sound, visual quality and audio data over the IP networks.

Furthermore, the Internet has changed the culture of multimedia participation by creating the necessity of dynamic and interactive devices through PCs, PDAs, mobile phones and wireless technology where users around the world are increasingly turning to the Internet for various reasons, such as watching live events or pre-recorded contents. However, with several issues around Intellectual Property, media companies are providing services like media on demand but still need to make sure that it is not reproducible by users.

Responders agree that the cable industry needs to establish an IP based broadband network to seamlessly connect all cable services on one unified network. A unified network would simplify the network designs and allow for an improved bandwidth allocation among services. By allowing cables services on one unified network, users can use technologies such as DVR, which is not really media on demand but more like media
control. The people have a lot more control over what they want to watch on TV. There are a lot of issues around this regarding people skipping advertising and so the advertisers are not getting the exposure out of this that they are paying for. This will lead to another roadblock towards its development in the future.

The responders are uncertain if the traditional broadcasting technologies will revolutionize and catch up with IP broadcasting. With all the advances in IP network technology and the rapid growth of IP broadcasting, it will still take a long time to develop, however it is assumed that IP broadcasting will continue to be an integral part of content delivery. As a result, it will see phenomenal growth in the next few years. Further developments in the Gigabit Ethernet technologies are able to offer greater bandwidth and more flexible channels when compared to the standard Ethernet. The growth for broadcasting technologies depends on affordable systems, such as low equipment cost for installing, maintaining, operating and making capacity changes.

The responders were uncertain if the Internet tends to complement rather than displace existing media and patterns of behavior because it integrates both styles of communication and different kinds of content delivery in a single medium. Internet telephony has created a cheaper and effective option for various users, especially students. Starting from the basic, such as yahoo voice chat to all the way to the more sophisticated solutions that are coming up now from companies like Vonage. Vonage technology enables anyone to make and receive phone calls, worldwide and with a touch-tone telephone. Offering quality phone service bundled with enhanced IP communications services and an innovative, feature-rich and cost-effective alternative to traditional telephony services. This versatility renders plausible claims that technology
will be implicated in many kinds of social changes, perhaps even more deeply than traditional broadcasting solutions.

The responder were also certain that real time broadcasting is creating and reproducing cross-national inequalities in newspapers, telephones, radio and television because it largely depends on economic development, research and investments that are unequally distributed across societies. Government funding to enhance network capabilities is crucial for the development of real time broadcasting. Users are demanding FC that have been seen as a key developer in the video/media server marketplace, but the development of Gigabit Ethernet and 10-Gigabit Ethernet may effect the continued development of FC. However, the lack of funding and regulations will delay the development of real time broadcasting.

Part III

Roadblocks in achieving a competitive advantage in IP Networking

A second survey questionnaire was distributed to the responders and several questions were asked about the roadblocks in achieving any type of competitive advantages in IP networking. A similar five-point Likert scale was used to answer the questions, as used before. Once the data was collected, the weighted-mean was calculated and the results were presented in a tabular form as seen below.
The Rising Preference to Real-Time Broadcasting

SURVEY
Roadblocks in Achieving Competitive Advantages in IP Network

<table>
<thead>
<tr>
<th>Number</th>
<th>Roadblocks</th>
<th>SCALE</th>
<th>Weighted Mean</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Traditional media broadcasting is one of the biggest roadblocks in achieving a competitive advantages in IP networking.</td>
<td>2 6 20 20 12</td>
<td>2.43</td>
<td>DISAGREE</td>
</tr>
<tr>
<td>2</td>
<td>Competitive pricing from tradition media broadcasting is one of the biggest roadblocks in achieving a competitive advantage in IP networking.</td>
<td>19 22 8 6 5</td>
<td>3.73</td>
<td>AGREE</td>
</tr>
<tr>
<td>3</td>
<td>IP Network follow paths selected through struggles among groups seeking to turn technologies to their own interests</td>
<td>15 26 12 5 2</td>
<td>3.78</td>
<td>AGREE</td>
</tr>
<tr>
<td>4</td>
<td>IP Network shape themselves to the contours of customer demands</td>
<td>12 13 2 32 1</td>
<td>3.05</td>
<td>UNCERTAIN</td>
</tr>
<tr>
<td>5</td>
<td>Innovation and competitiveness success in many industries is geographically concentrated</td>
<td>5 29 24 1 1</td>
<td>3.60</td>
<td>AGREE</td>
</tr>
<tr>
<td>6</td>
<td>Exploitation of communications media and enhancing the networks would enhance the elite control of both politics and production through cultural hegemony and enhanced surveillance through regulation authorities.</td>
<td>12 12 23 9 4</td>
<td>3.32</td>
<td>UNCERTAIN</td>
</tr>
</tbody>
</table>

From the results of the table above, the responders agree that many providers were seeking ways to turn the technologies to their own interests, rather that promoting it for their users in demand. IP networks may be seen as the new cost-effective means to disseminate a wide range of multi-media content to a variety of users. The growth in government and private institutions funding and interaction has allowed the mass delivery of broadband Internet access into the homes and other areas, with Ethernet as a key enabling technology. Many responders believe that the installation base and the price per megabyte will also play a critical role in the expansion.
The Rising Preference to Real-Time Broadcasting

The responders agree that most of the competitive advantages in IP networking and innovation is geographically concentrated. Service providers in certain areas are able to provide end-users with adequate software decoding and improved broadband services to deliver high quality continuous media data-streams. In addition, providers should provide advance technologies for sorting large volume of data and the wide spread adoption of the server client architecture to ensure the delivery of content across a broad geographic area. Whereas, some areas lack the government and private institutions funding and conservative regulations, causing a disadvantage to certain user in areas that have long been overlooked.

However, responders were uncertain if the competitive pricing from traditionally used applications were causing a huge constrain towards the development of IP networking. Although, IP networks provide a great deal of bandwidth at low cost, when compared against traditional professional quality real-time video connections. Moreover, respondents were uncertain if the exploitation of communications media and enhancing the networking by using broader storage capabilities would enhance the elite control on production through cultural hegemony and enhanced surveillance from regulation authorities. This will allow real time broadcasting to be regulated through certain constraints, such as to avoid unofficial use of these technologies and allowing adequate levels of viewing advertisements by users, as advertisements provide a great deal of funding for service provides and others.

Furthermore, the respondents disagree that traditional media broadcasting was one of the biggest roadblocks in achieving any competitive advantages of IP network. They also agree that there were no chances that traditional broadcasting technologies will
revolutionize and catch up with IP broadcasting; in fact it will be integrated. Traditional broadcasting and real time broadcasting are independent in their developments and would rather complement each other than contradict each other. The responder sees no significant relationship between the rising preference in Real Time Broadcasting and Traditional Multi-Media Broadcasting solutions.

Part IV - Chi-Square Analysis and Conclusion

To find the relationship between two different variables, a chi-square test was used. Chi square analysis is most frequently used to test the statistical significance of results reported in bi-variat tables. This performed test of statistical significance lets the researcher know the degree of confidence they can use in accepting or rejecting the hypothesis. Typically, the chi-square tests whether or not two different samples of responders are different enough in some characteristic or aspect of their behavior. (Linton, 2003)

Chi-square test requires the data from the responders to be randomly drawn from the population and the data should be in raw frequencies and not as percentages. The measured variables must be independent from each other and the values of each independent and dependent variables should be mutually exclusive and exhaustive. Finally, the volume of responders or observed frequencies should not be too small to perform a chi-square test. (Linton, 2003)
Hypothesis and Chi-square Tests

The tables below consist of all the key calculations that were used to determine the chi-square tests. These tests were done to find out if there were any significant relationships in the following hypothesis:

1. To find out if there were no significant relationship between the rising preference of Real Time Broadcasting and Traditional Multi-Media broadcasting solutions
2. If there were no significant relationship between the roadblocks in achieving any competitive advantages in IP networks and the developments in traditional broadcasting solutions and what are the chances that traditional broadcasting technologies will revolutionize and catch up with IP broadcasting
3. There are no significant relationship between the resources needed to achieve this realization and the steps in achieving the development of Real time broadcasting

Conclusion of chi square tests

The first step is to determine the threshold of tolerance for error. That is, what are the odds the researcher is willing to accept that they are wrong in generalizing from the results of the selected sample to the population it represents? The answer depends largely on the research question and the consequences of being wrong. For these tests, the probability of error threshold is 1 in 20, or p < .05. The second step is to calculate the total of all the rows and columns of the data collected from the responders for each three-hypothesis test.
The Rising Preference to Real-Time Broadcasting

- **Hypothesis Test 1:** To find out if there were no significant relationship between the rising preference of Real Time Broadcasting and Traditional Multi-Media broadcasting solutions

<table>
<thead>
<tr>
<th>Observation</th>
<th>Students</th>
<th>Professional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>14</td>
<td>31</td>
<td>45</td>
</tr>
<tr>
<td>Disagree</td>
<td>20</td>
<td>11</td>
<td>31</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>34</td>
<td>42</td>
<td>76</td>
</tr>
</tbody>
</table>

- **Hypothesis Test 2:** If there were no significant relationship between the roadblocks in achieving any competitive advantages in IP networks and the developments in traditional broadcasting solutions and what are the chances that traditional broadcasting technologies will revolutionize and catch up with IP broadcasting

<table>
<thead>
<tr>
<th>Observation</th>
<th>Students</th>
<th>Professional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>33</td>
<td>14</td>
<td>47</td>
</tr>
<tr>
<td>Disagree</td>
<td>13</td>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>46</td>
<td>29</td>
<td>75</td>
</tr>
</tbody>
</table>

- **Hypothesis Test 3:** There are no significant relationship between the resources needed to achieve this realization and the steps in achieving the development of Real time broadcasting

<table>
<thead>
<tr>
<th>Observation</th>
<th>Students</th>
<th>Professional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>22</td>
<td>44</td>
<td>66</td>
</tr>
<tr>
<td>Disagree</td>
<td>25</td>
<td>21</td>
<td>46</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>47</td>
<td>65</td>
<td>112</td>
</tr>
</tbody>
</table>
Chi-Square compares what actually happened to what hypothetically would have happened if all other things were equal, basically, the null hypothesis. If the responder’s actual results were sufficiently different from the predicted null hypothesis results, the researcher would reject the null hypothesis and claim that a statistically significant relationship exists between our variables. (Linton, 2003)

The next step is to calculate how chi-square derives a representation of the null hypothesis. The expected frequency in each cell is the product of that cell's row total multiplied by that cell's column total, divided by the sum total of all observations.

- **Hypothesis Test 1: **To find out if there were no significant relationship between the rising preference of Real Time Broadcasting and Traditional Multi-Media broadcasting solutions

<table>
<thead>
<tr>
<th>Expected</th>
<th>Students</th>
<th>Professional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>20.13</td>
<td>24.87</td>
<td>45</td>
</tr>
<tr>
<td>Disagree</td>
<td>13.87</td>
<td>17.13</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>42</td>
<td>76</td>
</tr>
</tbody>
</table>

The expected values are calculated as follows:

Responder who agree & are students = \((34*45)/76 = 20.13\)

Responders who agree & are professional = \((42*45)/76 = 24.87\)

Responders who disagree & are students = \((34*31)/76 = 13.87\)

Responders who disagree & are professional = \((42*31)/76 = 17.13\)
The Rising Preference to Real-Time Broadcasting

- **Hypothesis Test 2**: If there were no significant relationship between the roadblocks in achieving any competitive advantages in IP networks and the developments in traditional broadcasting solutions and what are the chances that traditional broadcasting technologies will revolutionize and catch up with IP broadcasting.

<table>
<thead>
<tr>
<th>Expected</th>
<th>Students</th>
<th>Professional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>28.83</td>
<td>18.17</td>
<td>47</td>
</tr>
<tr>
<td>Disagree</td>
<td>17.17</td>
<td>10.83</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>46</td>
<td>29</td>
<td>75</td>
</tr>
</tbody>
</table>

Responder who agree & are students = (46*47) / 75 = 28.83

Responders who agree & are professional = (29*47) / 75 = 18.17

Responders who disagree & are students = (46*28) / 75 = 17.17

Responders who disagree & are professional = (29*28) / 75 = 10.83

- **Hypothesis Test 3**: There are no significant relationship between the resources needed to achieve this realization and the steps in achieving the development of Real time broadcasting.

<table>
<thead>
<tr>
<th>Expected</th>
<th>Students</th>
<th>Professional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>27.70</td>
<td>38.30</td>
<td>66</td>
</tr>
<tr>
<td>Disagree</td>
<td>19.30</td>
<td>26.70</td>
<td>46</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>47</td>
<td>65</td>
<td>112</td>
</tr>
</tbody>
</table>

Responder who agree & are students = (47*66) / 112 = 27.70

Responders who agree & are professional = (65*66) / 112 = 38.30

Responders who disagree & are students = (19.30*46) / 112 = 19.30

Responders who disagree & are professional = (65*46) / 112 = 26.70
The results above show the researcher a comparison of the observed results versus the expected results we would expect if the null hypothesis were true. The next step would be is to measure how different our observed results are from the null hypothesis. The researcher needs to determine whether to reject the null hypothesis and the degree of confidence a mistake would occur when generalizing from the sample results, as compared to a larger population. This would require measuring the size of the difference between the pair of observed and expected frequencies in each cell. The researcher would calculate the difference between the observed and expected frequency in each cell, square that difference and then divide that product by the difference itself. The formula can be expressed as follow:

\[
((\text{Observed} - \text{Expected}) \text{ Square} / \text{Expected})
\]

- **Hypothesis Test 1**: To find out if there were no significant relationship between the rising preference of Real Time Broadcasting and Traditional Multi-Media broadcasting solutions

<table>
<thead>
<tr>
<th>CHI SQUARE</th>
<th>Students</th>
<th>Professional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>1.87</td>
<td>1.51</td>
<td>3.38</td>
</tr>
<tr>
<td>Disagree</td>
<td>2.71</td>
<td>2.19</td>
<td>4.91</td>
</tr>
<tr>
<td>Total</td>
<td>4.58</td>
<td>3.71</td>
<td>8.28</td>
</tr>
</tbody>
</table>

The sum of all products of this calculation on each cell is the total chi square value for the table, which are 8.28.

- **Hypothesis Test 2**: If there were no significant relationship between the roadblocks in achieving any competitive advantages in IP networks and the developments in
traditional broadcasting solutions and what are the chances that traditional
broadcasting technologies will revolutionize and catch up with IP broadcasting

<table>
<thead>
<tr>
<th>CHI SQUARE</th>
<th>Students</th>
<th>Professional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>0.60</td>
<td>0.96</td>
<td>1.56</td>
</tr>
<tr>
<td>Disagree</td>
<td>1.01</td>
<td>1.61</td>
<td>2.62</td>
</tr>
<tr>
<td>Total</td>
<td>1.62</td>
<td>2.57</td>
<td>4.19</td>
</tr>
</tbody>
</table>

The sum of all products of this calculation on each cell is the total chi square value for the table, which are 4.19.

- **Hypothesis Test 3**: There are no significant relationship between the resources needed to achieve this realization and the steps in achieving the development of Real time broadcasting

<table>
<thead>
<tr>
<th>CHI SQUARE</th>
<th>Students</th>
<th>Professional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>1.17</td>
<td>0.85</td>
<td>2.02</td>
</tr>
<tr>
<td>Disagree</td>
<td>1.68</td>
<td>1.22</td>
<td>2.90</td>
</tr>
<tr>
<td>Total</td>
<td>2.85</td>
<td>2.06</td>
<td>4.92</td>
</tr>
</tbody>
</table>

The sum of all products of this calculation on each cell is the total chi square value for the table, which are 4.92.

The researcher now needs to measure the table's chi square value, which tells us whether or not it is significant. We need to know how much larger than 0 (the absolute chi square value of the null hypothesis) our table's chi square value must be before we can confidently reject the null hypothesis. The probability we seek depends in part on the degrees of freedom of the table from which our chi square value is derived. Mechanically, a table's degrees of freedom (df) can be expressed by the following formula:
The degree of freedom for all three hypothesis is \( \frac{(2-1)}{(2-1)} = 1 \)

The next step would be to find out what the critical values of Chi-Square would be for the hypothesis tests.

As previously chosen, the probability of error threshold is \( p < .05 \). If the chi square values are larger than the critical value in that cell, then the data present a statistically significant relationship between the variables in your table.

Hypothesis test 1’s chi square value of 8.28, with 1 degrees of freedom, handily clears the related critical value of 3.84. We can reject the null hypothesis and affirm the claim that students and professionals agree that there is a no significant relationship between the rising preference of Real Time Broadcasting and Traditional Multi-Media broadcasting solutions.

Hypothesis test 2’s chi square value of 4.19, with 1 degrees of freedom, handily clears the related critical value of 3.84. We can reject the null hypothesis and affirm the claim there is no significant relationship between the roadblocks in achieving any competitive advantages in IP networks and the developments in traditional broadcasting solutions and that traditional broadcasting technologies will revolutionize and catch up with IP broadcasting.

Hypothesis test 3’s chi square value of 4.92, with 1 degrees of freedom, handily clears the related critical value of 3.84. We can reject the null hypothesis and affirm the claim there is no significant relationship between the resources needed to achieve this realization and the steps in achieving the development of Real time broadcasting.
It has become clear that the various types of IP technologies, such as IP telephony, encompass the convergence of voice, video, and data on today’s IP based communication networks. A unified and powerful network is serving to radically transform communications, as we know it on the Internet, broadband DSL, cable systems and corporate LANs and WANs across the country. This is creating a host of new opportunities for consumers and businesses looking for more choice, more value, and powerful new communications capabilities and applications.

Today, more and more Americans can get digital television from a telephone company, voice service from the cable company, wireless Internet from a whole other set of companies dealing with Internet telephony. AT&T’s VOIP services are now available nationwide in 170 US markets and is in trials overseas for use by remote workers of multinational companies. These days VOIP uses user-friendly applications, such as a telephone adapter, which enables users to talk over high-speed Internet connections instead of traditional circuit-switched phone networks.

Every year, as more legacy equipment’s reaches the end of its life cycle, there’s a greater incentive for companies to move in the direction of IP technology. Why would service providers want to spend money on legacy replacement equipment? It’s only a matter of time when enterprises of all types and sizes will move to IP and replace legacy equipment. Years ago, video conferencing systems would generally cost around $35,000 to $50,000 and were exclusively relegated to corporate boardrooms. Today, thanks to convergence, the pervasiveness of IP networking, and vast improvements in the price/performance equation, high quality “video calling” is affordable for practically anything in business, whatever the size.
The Rising Preference to Real-Time Broadcasting

IP has made advance applications accessible to the customer with high quality audio and video and ease of use. Before IP specific media types such as voice, video, and data were sent over desperate networks. Today, as these can all run over a single IP network, enterprises now have a viable means to deploy these applications cost-effectively and in a highly integrated manner. It is clear that IP technologies can deliver immediate cost savings and offer an array of new features that promise to boost corporate productivity and efficiency.

The two areas that are most critical for a successful deployment of IP technologies in the future require the ensuring that the infrastructure gets supported appropriately from a WAN/LAN prospective. The rest is on creating an environment through training where the end users will become highly qualifies and successful. Without the first, things just will not work. And without the second, people would be inflexible to the business process change that is essential for enterprises to enjoy the maximum cost savings and benefits of IP technology.

Streaming Media and Impact

According to the work entitled: "Transport Telecommunications Carriers and Entertainment Services 2006-2011: A Market Research Report": "Carriers will soon be offering video and other value-added services geared to spur spending in the consumer and business segments. Streaming media - the IP transmission of on-demand rich media that gives the user the ability to listen to audio and view video and graphics animation files from the network without downloading the content - is but one of several
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technologies being used to deliver information and entertainment services." (Transport: Telecommunications Carriers and Entertainment Services 2006-2011)

Stated as well is that it will be made possible through IPTV to: “move beyond the multicast 'time-shift' capabilities of cable's video-on-demand models so as to deliver true interactivity to unicast, multicast, and broadcast audiences and give carriers a slice of the more than $250 billion forecasted to be spent each year on mass advertising."

(Interactivity to unicast, multicast, and broadcast audiences and give carriers a slice of the more than $250 billion forecasted to be spent each year on mass advertising) (Transport Telecommunications Carriers and Entertainments Services 2006-2001) The method of transferring rich digital media across a network however there is no requirement of data storage locally.

The report relates that over the past two years the streaming media "landscape has changed dramatically" and "as an industry, streaming media has survived the introductory phase and evolved to the point at which there are proven business models, a sufficient number of consumers ready to buy, and stable technologies to support the industry’s future growth." (Transport: Telecommunications Carriers and Entertainment Services 2006-2011: A Market Research report) In the view of the consumer the "most important factor driving the consumer segment is content on demand." (Ibid) The reason is that consumers want to be able to listen and watch anything they want, at any time and in any place." (Ibid)

Related in the Market Research report is that consumers have been conditioned by the web to expect services at all times. Consumers do not mind paying for these services.
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Two types of existing streaming media services are those of: (1) paid; and (2) ad-supported content.

By 2005 56% of households had broadband Internet, which "created a potential audience of critical mass for advertisers." (Ibid) The report states that Zenith Opt media holds that Internet spending will rise from 2.5 percent of total advertising in 2004 to 4.5 percent by 2007." (Ibid) Finally the report states that the positive growth of streaming media can be linked to the fact that "the entertainment industry has finally hit upon a few business models related to their content distribution that consumers can understand and value." (Ibid)

In the work entitled: "Net Insight – Net Media Solutions" stated is that the "media Industry, primarily defined.... as the Television broadcasting industry is rapidly migrating from working in analogue formats towards digital formats." (Net Insight – Net Media Solutions, 2001) The benefits are stated to be that media content will be enabled to be "more easily ...edited, stored and transported, thereby leading to new workflow processes and more efficient production and distribution of content." (Net Insight – Net Media Solutions, 2001) Satellite links are dependable however point-to-point transport can be realized for distances that are short or medium in length through the transport of microwave links. Point-to-point fiber-based solutions "Typically allocate a dark fiber or an entire wavelength between each pair of sender and receivers. (Net Insight, 2001)

The Net Insight report states further that: "The internet and telecommunications industries are converging. Around the world many of the telecommunications carriers have moved into the provision of Internet services while in parallel, facilities based and
The Rising Preference to Real-Time Broadcasting

non-facilities based providers have emerged to provide Internet and data services - and from there to voice services that represent both an opportunity and a threat to the incumbent telecommunications carriers." (Net Insight, Net Media Solutions, 2001)

DWDM is stated by Bell Labs - Lucent Technologies to be "a technology that uses multiple wavelengths or colors of light to transmit information on a single strand of optical fiber." (Bell-Labs - Lucent Technologies, 1999) Stated as well is that "The researchers have succeeded in adding DWDM compatible optics to the prototype GigaChannel Ethernet multiplexer shown at the Networld+Interop conference in May and demonstrated the enhanced experimental system at the National Fiber Optics Engineers Conference (NFOEC) last week." (Bell-Labs - Lucent Technologies, 1999) However as the point-to-point connections become more and more affordable the use of the DWDM technology is seeing a decrease.

In 2002 Nortel announced deployments of Optical Ethernet Solutions in connection with educational institutions. The Optical Ethernet solution is stated to be "increasingly becoming a key tool for universities and K-12 school systems that intend to leverage the Internet and new educational applications to enhance the learning process and decrease telecommunications costs." (GRID Today, 2002) Beggs and Thede (2001) state that: "Internet streaming media changed the Web as we knew it --changed it from a static text- and graphics-based medium into a multimedia experience populated by sound and moving pictures." The cost for streaming media added to a website "can range from free to hundreds of thousands of dollars..." (Beggs & Thedes, 2001)
The costs of point-to-point connections are down as reported by the University of Michigan who has just purchased "very high-speed point-to-point connections to two national and international points in Chicago." The costs stated to be associated with this is a "marginal cost of establishing these connections" quote at approximately $100,000 - $150,000 with very little additional recurring cost." (Connell, 2004) National Instruments reports in the work entitled: "Building an Efficient, Low-Cost Test System for Bluetooth Devices" (2006) that "Bluetooth is a low-cost, point-to-point wireless technology intended to eliminate the many cables used to connect consumer electronic devices. Initially, Bluetooth defined a way to communicate wirelessly with cellular phones, PDAs, and laptop computers. Over time, Bluetooth expanded to applications in automotive, communications, home, and office. IBM, Toshiba, Ericsson, Nokia, and Intel founded the original Bluetooth special interest group, and it later expanded to included Microsoft, Motorola, and 3Com. There are hundreds of associate and adopter members as well." (National Instrument, 2006) Bluetooth is being used in many applications and across many industries.
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