IPTV White Paper

June 2008

The Standard for
Home Entertainment Networks
over Coax™

Contents

Multimedia over Coax Alliance

Overview

A traditional service provider, whether it is a telco, cable MSO or satellite (DBS) company, is no longer bounded by its core segment or original purpose. These service providers are quickly morphing into comprehensive purveyors of Triple and Quad Play services for telephony (landline and cellular), Internet access and video and digital television. As Charles Hall of Rider Research and publisher of the Online Reporter has suggested recently, the term digital service provider perhaps more accurately reflects this evolutionary process.

For the telco segment of the broadband industry, the emerging route to delivery of television and video services is via IPTV (Internet Protocol television). Indeed, most global telcos are making enormous strides in capturing market share of the video delivery business that has been the well-kept province of cable MSOs and DBS providers.

The entrance of telcos into the digital TV and VOD market has caused the industry to question the standard definition of the term IPTV. Presently there is no one accepted industry accepted meaning. Is IPTV now a market as well as a capability? Are IPTV services strictly the domain of the telco or is it of relevance to the cable MSO community as well?

This paper will attempt to re-define the term IPTV while providing both an explanation and discussion of what we believe is the best IPTV environment for digital service providers.

IPTV Defined

For purposes of this paper, IPTV is defined as a means of delivering enhanced video applications over a managed or dedicated network via Internet Protocol to the TV through a broadband connection. IPTV is not video over the public Internet.

IPTV is often misconstrued for lack of clear definition. Let's look at what IPTV is not:

- IPTV is not video over the public Internet.

  (Because the public internet is actually composed of several independent networks with separate controls, it is NOT a managed network. For this reason, it is not really capable of delivering multiple streams of high definition video in the manner subscribers now expect from a service provider.

- IPTV is not video compression
- (MPEG-2, MPEG-4, MPEG-4 Part 10, VC-1, AVC, JVT, H.264, etc.)
- IPTV is not video services
- IPTV should not be confused with the term "All Digital" which can apply to MSO and DBS services IPTV is not DOCSIS (although DOCSIS incorporates IP)
- IPTV isn't necessarily "better", "cheaper" or "newer" (although some IP set-tops are cheaper)

IPTV by the Numbers

According to ABI Research, networking capabilities will be embed in all manner of consumer electronic devices as the demand for digital content sharing, IPTV, HDTV, social networking and other services delivered over an IP-based connection continues. ABI also believes that TVs and DVD players will become the hub of this new connected network within a home network. The firm forecasts the number of networked TV shipments alone to grow to 65 million total units sold by 2012, a significant step up from the 3.6 million units sold in 2008 ("Television Integrating with Home IP Networks," Digital Lifescapes, March 31, 2008).

While ABI's numbers are bandied about and discussed within the industry, other projections differ based on the industry's inability to succinctly define IPTV as capability or market. Still overall trends among consumers and other data points indicate an upwardly growing market and capability set. For instance:

- In the U.S. alone, IPTV revenues are projected to reach $13.7 billion by 2012 (Strategy Analytics, "U.S. IPTV Forecast and Outlook, Broadband magazine, May 2008 issue, page 10).
- Worldwide IPTV revenues will exceed $42.6 billion by 2014, according to Global Industry Analysts.
- Infonetics forecasts worldwide IPTV equipment revenue to go from 1 billion in 2006 to 5.5 billion in 2010.
- Worldwide set top box unit shipments to go from $4million in 2006 to 17 million in 2011, per Strategy Analytics
- Yankee Group projects IPTV subscribers worldwide to exceed 248 million by 2014.
- The worldwide IPTV equipment market grew 47% year over year in 2007, according to a report from Synergy Research Group.
- Shipments of IP STBs will grow at a CAGR of 37.1 per cent through 2012 (IMS Research IPTV: A Global Market Analysis - 2008 Edition).
- Multimedia Research Group forecasts IPTV subscribers growing from 24.4 million to 92.8 million from 2008-2012, and service revenue totaling $37.1 billion by 2012.

IPTV Applications

The sheer number of possible applications and usage scenarios is almost beguiling if not daunting. This might also explain why interest, investments and forecasts are so startling and compelling.

Beyond the enthusiasm does it really matter if the home entertainment delivery mechanism is IP? IPTV matters if:

- IPTV enables a differentiated product or service;
- IPTV enables a new source of revenue;
- IPTV provides operational efficiency; or
- IPTV provides a cost savings in equipment as well as overall system implementation.

Possible applications that fall under this list include:

- Targeted advertising, such as banner advertising in an electronic programming guide (EPG) or sponsored advertising for on-demand content
- In-program electronic messaging
- Personal TV channels
- Sharing of photos, movies, and interests
- Walled garden portals – weather, sports, recipes, etc.
- EPG-based electronic messaging and social networking;
- Home security and management services
- Whole home DVR
- Network-based time shifting
- Voting
- Sports participation and gaming
- Integration with Voice over IP telephony for TV display of call information and call routing, as well as caller ID and blocking, displayed on the screen and call forwarding
- PVR programming via mobile phone

It's important to note that while initial implementation of IPTV has been primarily the domain of the telco firms they are not the only ones eyeing the future in IP. Cable MSOs can and are implementing IPTV. What's important is to provide a managed network in order to ensure QoS and reliability. The managed network needs to be controlled by a single source that can govern the flow of information, including priorities, delays, and queuing from end to end.

IPTV Requirements in the Digital Service Provider Environment

Quality of Experience

To ensure timely delivery of packets, Quality of Experience (QoE) is critical. Performance and features may attract consumers, but video quality is a must to maintain their loyalty. QoE is the evolutionary step beyond Quality of Service (QoS) incorporating important elements such as maximum delays in transport of IP streams and minimizing the difference between transport times for individual IP packets (jitter).

QoE also includes criteria for minimum downtimes and maintenance intervals, providing reasonable channel change times, and guaranteeing availability of on-demand services, interactivity, and delivery of network-based services such as time-shifted viewing with VCR-like functionality.

To meet viewer expectations for high quality services, QoE must be maintained across the entire IPTV architecture, from content source through delivery to multiple devices within the home. This level of controllability and diagnostic capability requires a management protocol that extends beyond service provider access, all the way to devices used by the customer.

Ease of use

Consumers are accustomed to easy access. When the predominant mode of reception was over-the-air broadcast, "rabbit ears" or a rooftop antenna was all that was needed in metropolitan areas with strong signals. As cable and satellite TV grew, coaxial cable connectors on TV sets provided another simple interface to outlets in rooms with TV sets.

Scalable

Video-based applications such as multi-room DVR, gaming, photo and personal content sharing, are creating demand for increased bandwidth in the home, which in turn will give rise to additional uses. It is a recursive environment borne out by history. There is no such thing as too much bandwidth.

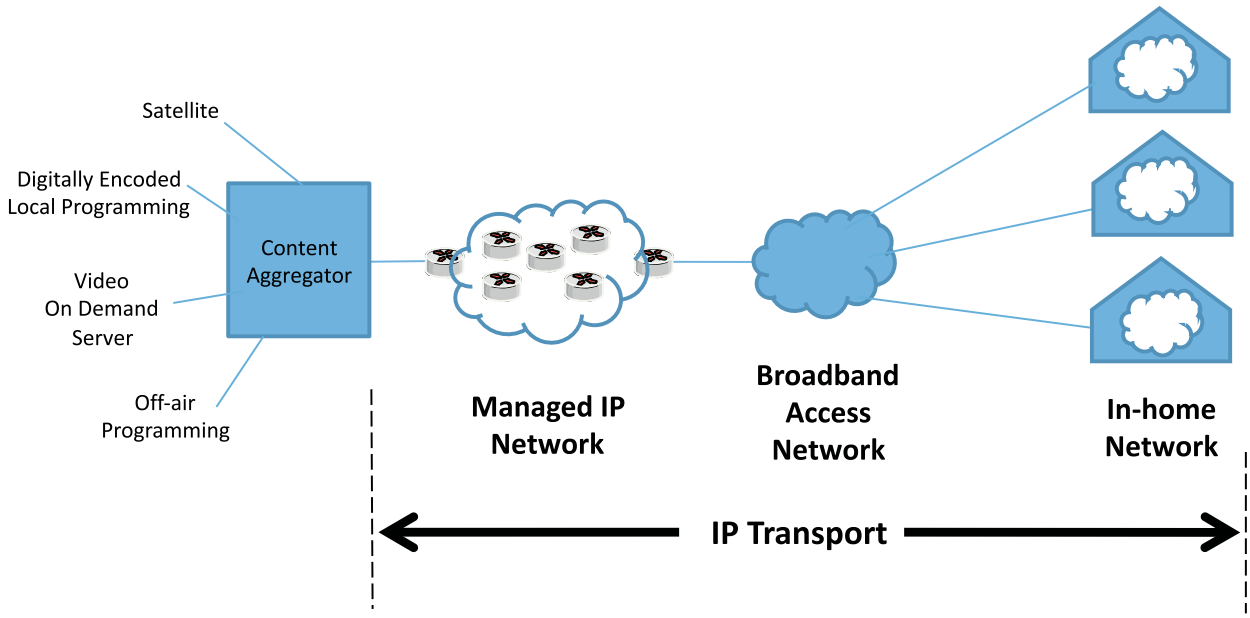


Figure 1

Figure 1 is an end-to-end view of an IPTV network, from source to an IP STB. It should be noted that this network is very similar to the public Internet, except that it is a managed network. IPTV content is delivered to IP STBs similar to the way a streaming video is sent to a PC. However, because the network is managed (including the access portion of the network), video QoE is maintained at a broadcast TV level, rather than on a best-effort basis like the public Internet.

The standard for home entertainment networking and IPTV is already in your house!

There are many home networking technologies attempting to address IP broadband and HD video content distribution inside a home. We believe that only one networking technology to date, MoCA, a new standard defining the digital networking capability of home entertainment networks over coax, has proven capable of seamlessly accommodating the increasing bandwidth demands commensurate with scalable IP applications.

A home distribution network supporting IPTV is best delivered via coaxial cable. It is a naturally shielded medium, immune to unwanted intrusions and natural causes. It is understood by service providers and end consumers as the medium for delivery of television and video in the home. Other technology standards and mediums are in consideration such as HomePNA.

While AT&T employs HPNA in its U-Verse program, not all service providers are convinced of HPNA's merits.

"The problem is that HPNA has to be done over virtually flawless wiring to deliver a good IPTV signal," James Player, network engineering manager for SureWest Communications, *Telephony's Guide to IPTV,* March, 2008.

MoCA is the only technology standard that meets all the requirements of end to end delivery of IPTV as specified previously. MoCA is native to coaxial cable, and coaxial cable is native to TV. Coaxial outlets are already installed where TV is most likely to be watched.

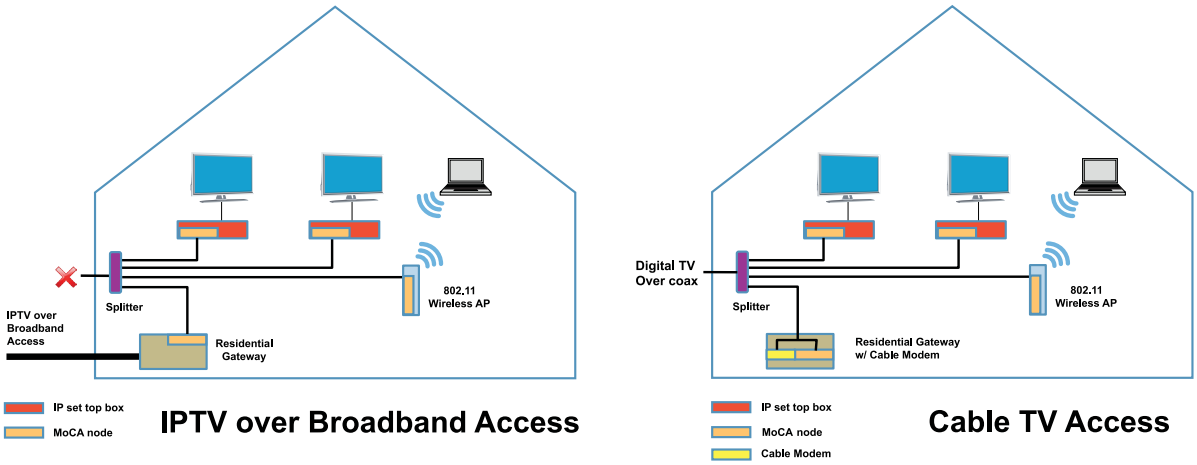


Figure 2

Figure 2 describes in-home distribution architecture for IPTV over broadband access as well as switched digital cable TV. Note that the two are very similar. MoCA is the only home networking technology capable of offering a native delivery mechanism for both scenarios. The main differences in these two environments are the type of STB and how the signals are directed at the entrance of the home.

Cable architecture does not require a gateway for separation of video and data signals, as these signals are already on separate frequencies. IPTV over broadband architecture includes a residential gateway, which uses either DSL or cable modem for the data path and network access.

While MoCA is only concerned with what goes on inside the home and not the précis of this paper, It is important to note that there are multiple forms of broadband access for an IPTV environment. These include ADSL over twisted pair as used by AT&T, fiber to the home (FTTH) as used by Verizon, and DOCSIS as used by cable MSOs.

ADSL over twisted pair is the dominant broadband access method for telephone companies. Verizon chose to deploy FTTH because of its greater bandwidth capabilities. MoCA is agnostic to any network access method and technology and works seamlessly with all of them.

Within the home, different STBs are used for different digital architectures. An IP set top is for IP end to end content and signaling. Cable digital STBs are for content that is QAM-modulated MPEG (Quadrature amplitude modulation). Even for digital cable architecture, QAM modulated MPEG boxes in a multi-room PVR configuration communicate with each other via IP. (See the Appendix for a more in-depth discussion)

Scalable and QoE

MoCA uses a robust multi-tone multiplexing method and operates in frequency spectrum where current and future expanded versions will not interfere with frequencies needed by service providers in the telephone, satellite, or cable industries. Multi-tone multiplexing more easily adjusts to adverse conditions in a medium than the single carrier used by some of the other home networking technologies.

Operation in spectrum with adjacent room for expansion means that more bandwidth can be added as applications grow beyond current technology. All together, this means that QoE will be protected from the adverse affects of bandwidth constraints and spectral impairments now and in the future.

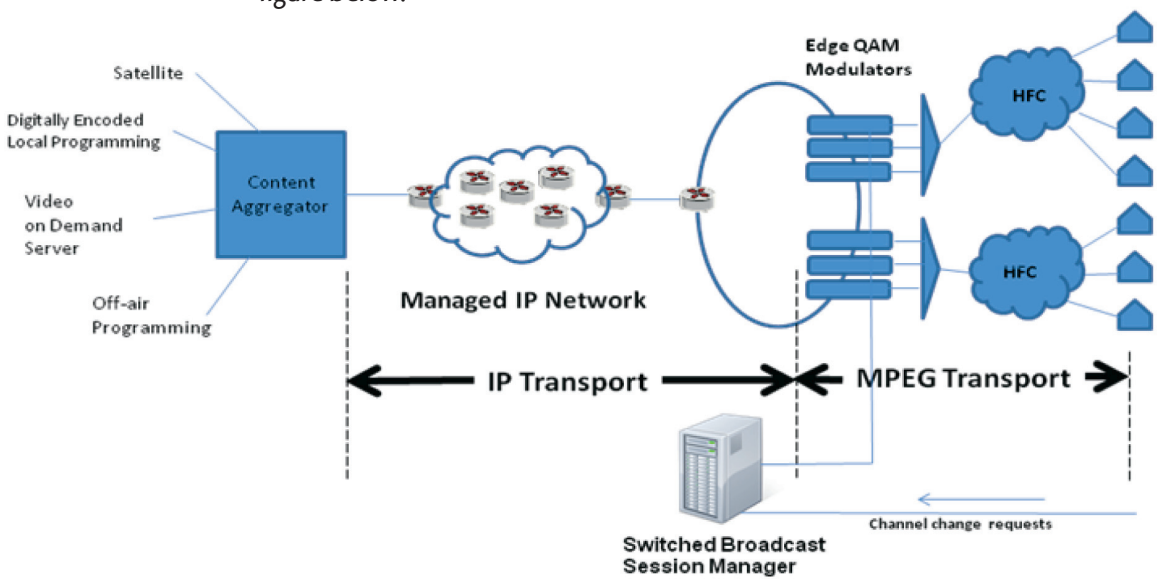
Summary

There is no doubt IPTV is an emerging means and technology for delivering high definition (HD) content around the home. It also requires a managed network that guarantees performance, reliability and overall QoE.

There are many technologies claiming delivery of HD video and seamless integration into an IPTV environment. Unlike other technology standards, MoCA was designed to operate over coax – the medium native to video. MoCA meets the requirements for an IPTV network and operates in all broadband industry segments thus making it the standard of choice for any service provider wishing to implement IPTV.

Appendix: IPTV in a Cable Environment

The cable telecommunications industry is using switched digital video technology to provide IPTV-like service without completely rebuilding its distribution plant. QAMs are a vital part of this structure, as shown in the figure below.



QAMs are essentially a bridge between digital TV and an infrastructure that was built upon allocation of 6 MHz RF channels dedicated to analog broadcast TV. QAMs enable a digital signal to be carried by RF on a TV channel, similar to the way that an analog TV signal is carried by RF.

Initial broadcast digital TV delivery permanently associates a QAM channel with a program stream, much like analog TV content is associated with a given channel frequency. Switched digital architecture is a far more flexible use of QAMs. Switched digital programming is assigned a QAM channel based upon demand from a group of homes. If there is no demand for a program, it does not get a QAM channel.

For switched digital service, the outputs of the content aggregation process at the head-end are digital MPEG video streams, transported as IP over gigabit Ethernet. They enter the cable operator's managed network via a head-end edge router and exit via an IP switch. The IP switch directs the MPEG over GigE streams to the appropriate GigE- enabled QAM, based upon requests from a session manager. Each QAM is associated with a 6 MHz RF channel on the cable access plant.

The session manager tells the subscriber's digital set top box to tune to the QAM channel where the requested content stream is located. Software in the STB translates the QAM channel frequency number to the channel number displayed on the TV.