
# ATIS IPTV Exploratory Group Report and Recommendation to the TOPS Council

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*ATIS IPTV Exploratory Group Report and Recommendations to the TOPS Council*

Is an ***ATIS Report*** developed by the **IPTV Exploratory Group** for the **TOPS COUNCIL**.

**This document is a *work in progress* and subject to change.**

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**TABLE OF CONTENTS**

## 1 EXECUTIVE SUMMARY

The ATIS TOPS Council commissioned the creation of an IPTV Exploratory Group (IEG) with initial objectives of:

- Creating a consistent industry definition for IPTV;
- Identifying technical and operational issues surrounding the implementation of IPTV (e.g., interoperability, interconnecting, QoS, inter-carrier billing, etc.);
- Identifying stakeholders and current work programs with respect to industry's offerings of IPTV;
- Proposing steps towards establishing an internal ATIS initiative (if appropriate) to develop standards necessary for the deployment of interoperable end-to-end IPTV offerings.

Further, a report to the ATIS TOPS Council stating the IPTV Exploratory Group's findings, as well as its recommendations and proposed next steps towards the creation of an ATIS' initiative around IPTV was requested within 30-45 days after establishing the group.

This document is the requested report.

In this report, IPTV is defined as the secure and reliable delivery to subscribers of entertainment video and related services. These services may include, for example, Live TV, Video On Demand (VOD) and Interactive TV (iTV). These services are delivered across an access agnostic, packet switched network that employs the IP protocol to transport the audio, video and control signals. In contrast to video over the public Internet, with IPTV deployments, network security and performance are tightly managed to ensure a superior entertainment experience, resulting in a compelling business environment for content providers, advertisers and customers alike.

Further details are contained in Section 3 of the report.

The IEG identified the following technical issues that may impede the adoption of IPTV:

1. Need for an overall reference architecture for IPTV.
2. Need for industry accepted standardized metrics and requirements for content security (digital rights management) and the quality of content delivery (Quality of Customer Experience).
3. Need for End-to-End QoS functionality to support multiple services (voice, video and data) on the same network
4. Need for interoperability standards and testing of components in the video delivery network

Further details are contained in Section 4 of the report.

In Section 5, the IEG has provided sample representations of the IPTV Value Chain which is proposed as a tool to identify stakeholders and current work programs related to IPTV. A list of known current work programs is included in Appendix B.

While a considerable amount of activity in various forums and standards development organizations (SDOs) that relates to IPTV was identified, the IEG was unable to identify an organization that is providing a single venue for ATIS members to work the issues identified. Therefore, the IEG recommends[1] that a body of subject matter experts be formed under ATIS to give focus to issues that may impede the adoption of IPTV. To emphasize its focus on IPTV, we recommend it be named the IPTV Interoperability Forum (IIF). It is further recommended that the forum be placed under the Multimedia Functional Platform in the ATIS organizational chart.

The IEG proposes the following as the mission and scope of the IIF:

Mission: The IPTV Interoperability Forum (IIF) enables the interoperability, interconnection, and implementation of IPTV systems/services by developing ATIS standards and facilitating related technical and operational activities. This forum will place an emphasis on North American and ATIS Member Company needs in coordination with other regional and international standards development organizations.

The scope of the work in the IIF includes the following areas:

1. Coordinate standards activities that relate to IPTV technologies. This includes providing a liaison function between the various SDOs and forums that are each working on important components for multimedia, but may not have visibility to other aspects of the application.
2. Develop interoperability agreements, technical reports, or other ATIS standards where appropriate.
3. Provide a venue for interoperability activities.
4. Provide a venue for the assessment of IPTV issues in the context of NGN directions.

Further details of the recommendation are provided in Section 6 of the report.

Upon submission of this report to the TOPS council, the IEG considers its work complete and itself disbanded.

[1] This recommendation was approved by the ATIS Board of Directors on June 23, 2005.

## 2 OBJECTIVES OF ATIS IPTV EXPLORATORY GROUP

IPTV technology is gaining tremendous industry momentum as a technology for the deployment of (real-time) non-conversational, entertainment video/TV service offerings. More precisely, numerous ATIS member companies currently utilize or are expected to use IPTV for delivery of video/TV services.

As industry (and ATIS member companies) have progressed in their individual deployment of IPTV, it has become increasingly clear from the challenges they have faced that open industry standards towards the end-to-end implementation and deployment of IPTV are needed. In addition, of the IPTV-related initiatives currently underway, many efforts appear fragmented and uncoordinated. Finally, questions on the industry's and more importantly, the end users expectations of IPTV and the value of an IPTV service to a residential customer have arisen.

To explore this relatively new technology called IPTV with respect to its ability to deliver on industry's expectations for vital functionality, carrier-grade quality and user-expected service reliability, as well as to assess areas in which ATIS may play a role in the development of industry standards, an ad-hoc group under the ATIS Technology and Operations (TOPS) Council was created.

The ATIS TOPS Council commissioned the creation of an IPTV Exploratory Group with initial objectives of:

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- Identifying technical and operational issues surrounding the implementation of IPTV (e.g., interoperability, interconnecting, QoS, inter-carrier billing, etc.);
- Identifying stakeholders and current work programs with respect to industry's offerings of IPTV;
- Proposing steps towards establishing an internal ATIS initiative (if appropriate) to develop standards necessary for the deployment of interoperable end-to-end IPTV offerings.

Further, a report to the ATIS TOPS Council stating the IPTV Exploratory Group's findings, as well as its recommendations and proposed next steps towards the creation of an ATIS' initiative around IPTV was requested within 30-45 days after establishing the group.

This document has been prepared by the IPTV Exploratory Group for internal use by the ATIS TOPS council in deliberations regarding the need for further standardization work in the area of IPTV. It recommends the formation of a body to be called the IPTV Interoperability Forum (IIF), and structures as a technical committee of ATIS to fulfill the need for work in this area. While this document may form a starting point for scoping the work of the IIF, the IIF is expected to formalize its own, more detailed, work plans and schedules within ATIS procedural guidelines, and publicize/liaise its work program to avoid duplication with other standards bodies.

## 3 INDUSTRY'S DEFINITION OF IPTV

Traditional television was a service broadcast over the air, but today less than 12%[2] of consumers TV sets receive TV services over the air from local broadcasters with roughly 60%[1] of TV household subscribing to cable services and approximately 24%[1] subscribing to digital Satellite TV services. Broadcast television services are undergoing major transitions from basic analog 4:3 television to, for example:

- Digital Television (DTV) as a result of various governmental mandates and market pressures,
- Multiple formats, e.g., NTSC Standard Definition (SDTV 480i), PAL Standard Definition (PAL-SDTV 576i), Enhanced Definition (EDTV 480p), and High Definition (720p or 1080i) and different aspect ratios (Wide Screen is 16:9, SDTV is 4:3),
- An environment where new ancillary devices, such as digital video recorders, are being widely deployed[3].

Furthermore, the environment of the television set is changing from one where the TV is an isolated device encapsulating the service, to one where the TV is one of several devices in an entertainment network[4]. The consumer viewing environment is changing from simply having a TV in the living room to an environment where:

- 33% of US households have some form of Home Theater system[5],
- in vehicle video systems are becoming popular with 12% of new cars featuring screens and that expected to rise to 50% by 2010[6],
- video content can be received by mobile handsets and viewed by the consumer across the coverage footprint of major mobile wireless service providers.

In this context of change, service providers are looking to enter the video services arena by leveraging their broadband IP infrastructure. These new services are generally referred to collectively as IPTV.

In this report, IPTV is defined as the secure and reliable delivery to subscribers of entertainment video and related services. These services may include, for example, Live TV, Video On Demand (VOD) and Interactive TV (iTV). These services are delivered across an access agnostic, packet switched network that employs the IP protocol to transport the audio ,video and control signals. In contrast to video over the public Internet, with IPTV deployments, network security and performance are tightly managed to ensure a superior entertainment experience, resulting in a compelling business environment for content providers, advertisers and customers alike.

[2] see Darryl Wilkinson, "Who Cares if Analog TV goes Dark?" column in Home Theater, June 19th 2005, http://www.hometheatermag.com/news/062105CEA/ quoting Consumer Electronics Association statistics.
[3] Consumer Electronics Association, Digital America 2005 – Video.
[4] Consumer Electronics Association, TechHome Broadband.
[5] Consumer Electronics Association, Digital America 2005 - Home Theater.
[6] Consumer Electronics Association, Digital America 2005 - Mobile In-Vehicle Electronics.

At a minimum interpretation, IPTV refers to IP based television, but there are a number of other aspects to the service that should also be defined.

IPTV can be loosely partitioned into a definition that encompasses today's network constraints and a definition that builds upon what tomorrow's network will enable. Today's IPTV services reflect current deployment considerations. Tomorrow's IPTV services reflect what might be possible in the future based on standardization activities influenced by ATIS.

### 3.1 IPTV today

Internet Protocol Television (IPTV) today is a collection of video (and related) services primarily delivered to consumers for entertainment purposes. These video services may include:

- Live broadcast video.
- Content on Demand
- Interactive TV (iTV) services.

Today's IPTV services are delivered across a packet transport network based on the Internet Protocol with appropriate security, quality of service and reliability as needed. This end-to-end IP network transports the audio, video and control signals between the content source and the consumer. Today's end-to-end IP network also has the following general characteristics:

- It consists of a number of sections between the end consumer and the content source, e.g., a home network, an access network, a core network.
- The IP packets may be encapsulated by some layer 2 transport (e.g., Ethernet frames.)
- The access network portion of the IP network consists of different types of technologies for the physical transmission of the Layer 2 Protocol Data Units (e.g., various versions of DSL, fixed wireless and optical fiber.)
- The home network portion of the IP network consists of different types of technologies for the physical transmission of the Ethernet frames (e.g., point to point data cabling (Cat 5 or 6), Ethernet over Coax, Ethernet over electrical wiring and/or in-premises wireless options.)
- Other IP enabled services may be delivered in parallel to the current IPTV services using the same access.
- Other devices may be operating in the home network in parallel to and/or interacting with the current IPTV devices.

Figure 1 illustrates a typical IPTV environment today:

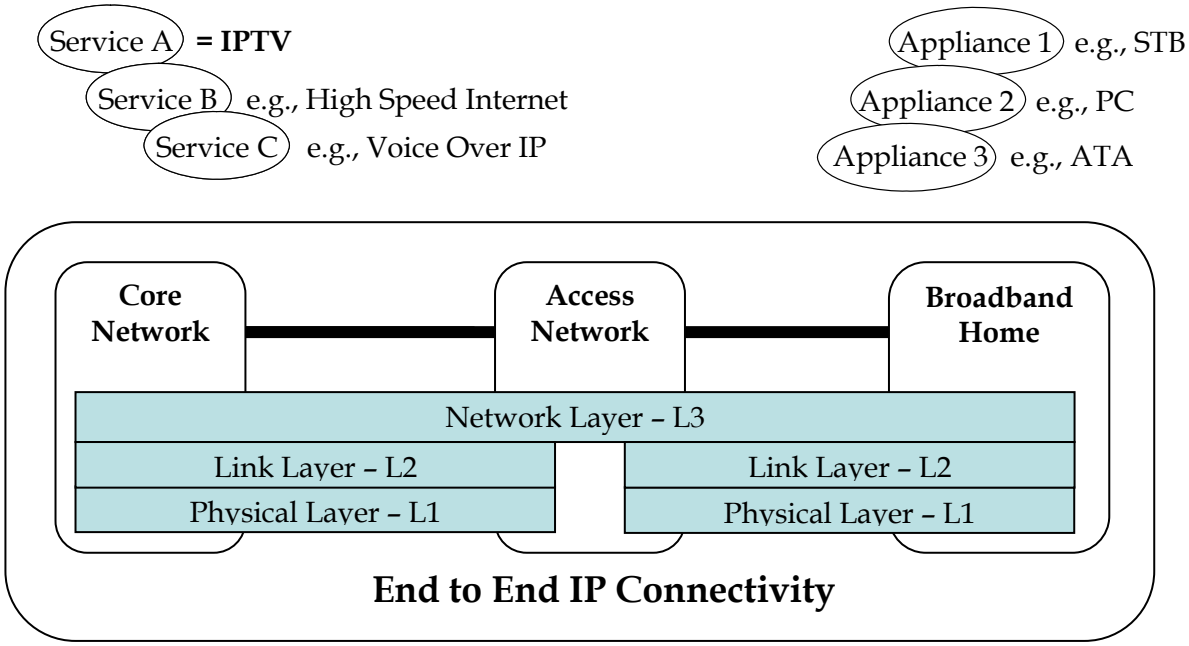


**Figure 1. IPTV "Today" reference diagram**

Today, the term IPTV does not encompass:

- Any video services originating from the public Internet.
- Two-way video conferencing.
- Transmission of "contribution" video between studios.
- Distribution to cinema
- Specialized point-to-point video services such as Instructional Television Fixed Service (ITFS)

### 3.2 IPTV Tomorrow

Going forward, IPTV is seen as a broader application than today's definition encompasses. In particular, it is envisioned that it will simply be one of many new applications supported by the Next Generation Network (NGN).[7] This view of IPTV extends beyond the home delivery model that is the focus of today's IPTV and also includes additional options for distribution of IPTV to wherever the consumer may be.

Thanks to the NGN, the domain of applications for IPTV will broaden to other environments (e.g., businesses and communities), requiring delivery from many different content creation sources and easier customization. It is envisioned that more pervasive delivery and ease of content creation will enable IPTV to be used for

[7] ATIS TOPS council NGN Focus Group has defined the NGN in "*ATIS Next Generation Network (NGN) Framework Part I: NGN Definitions, Requirements, and Architecture, Issue 1.0, November 2004*."

complementary services other than pure infotainment (e.g., education, healthcare, and security.)

As an NGN application domain IPTV will also benefit from communications-oriented capabilities, like holding real-time conversations or chats, sharing the experience through conferencing mechanisms (with appropriate business models in place), and intuitive multimodal-multimedia user interactions that can all be delivered in combination with the content by relying on well-coordinated NGN resources and devices capabilities.

The IPTV concept should be flexible enough to support the evolution of entertainment service concepts from the linear video formats of yesteryear to rich media environments supportive of interactivity and consumer engagement. The interactivity functionality should be capable of evolving into a rich communication context in order to enable a customer perception of communication with content. IPTV entertainment services are thus poised to provide not simply a broader distribution of existing content, but to enable a broader range of entertainment service options such as interactive games[8], augmented reality[9] and virtual environments for other communications services. In order to accommodate this broad range of content, IPTV will need to support a framework for multimedia data types (e.g., MPEG-4) rather than simply a single video format. The availability of metadata concerning the content (e.g., MPEG-7) will also be key in enabling IPTV service evolution. In addition, the IPTV concept should be further expanded to include delivery of content to portable devices over various types of wireless networks. It may also include using the mobile handsets to do some of the interactive features and control.

### 3.2.1 IPTV at the Network Interface (NI)

At the network Interface between the operator's network and the subscriber's network, the video information is to be transported over IP. While a specific infrastructure could be dedicated for the service, a more general interpretation would consider the IPTV service as consuming fungible bandwidth within a larger IP access facility. Specifically this interface would share bandwidth with other NGN services such as VoIP, High Speed Internet, and multimedia interactive services.

There may be a variety of NI's used for the IPTV service. Several operators currently have copper infrastructure in place with future upgrade plans for fiber infrastructure. The service architecture should be the same regardless of the nature of the physical layer is i.e copper (e.g., xDSL, bonded xDSL links, etc.), fiber (e.g., Pt-Pt or xPON) or wireless (e.g., 3G, WiFi, WiMax). The architecture should recognize that access network and terminal capability constraints may require adaptation of the video formats.

[8] See e.g., Wei-Teh Wang, Wan-Chun Ma, Kuo-Luen Perng, Meng-Jyi Shieh, Ming Ouhyoung", "A Novel MPEG-4 based Architecture for Internet Games" Proc. IEEE Game Technology Conference 2001, Hong Kong SAR, PRC, Feb. 2001

[9] See e.g., Demiris, A. M., M. Traka, E. Reusens, K. Walczak, C. Garcia, K. Klein, C. Malerczyk, P. Kerbiriou, C. Bouville, E. Boyle, N. Ioannidis, Enhanced sports broadcasting by means of augmented reality in MPEG-4, The International Conference on Augmented, Virtual Environments and Three-Dimensional Imaging, Ornos, Mykonos, Greece, May 30 - June 1, 2001.

The IPTV application domain should be independent of how the IPTV signals are transported. IPTV should also enable a smooth transition between the mobile and fixed world, as both residential and professional users will traverse the boundaries of access networks.

### 3.2.2 Architectural Context of the IPTV service

The IPTV service is but one service to be provided across a multi-service infrastructure. The NGN provides a generalized architecture for this multi-service infrastructure. A key deliverable for any new ATIS Technical Committee working on IPTV is to detail the potential overlap with other primary NGN services, ensure IPTV services are complementary to other NGN services and fit within the framework of NGN, and identify key requirements from IPTV that will potentially affect architectural and operational differences from the NGN as currently defined. This requires the identification of any of the NGN network enablers that can be used for the IPTV service

NGN functions for resource and admission control would seem to be one obvious area where consideration should be given. If authentication and resource management are provided by the NGN control plane, the IPTV should use compatible protocols e.g., SIP to start video sessions if it is determined that performance for such functions as channel change does not result in an unacceptable subscriber experience. The availability of multiple sources of content implies a need for a settlement arrangement for transit traffic at the IPTV NNI. There may be more than one type of NNI to permit connections to different types of sources, e.g., another (transit) operator, a commercial video service provider, or a non-commercial video service provider (e.g., video blogging / "podcasting" or community service channels).

Similarly at the NGN service plane, IPTV applications should rely on consistent standards supported by service enablers and implemented on a variety of servers. Applicability should be considered and would easily evolve to support the compelling user experience by exposing IPTV applications with the full capabilities of the NGN content and communications subsystems.

### 3.2.3 IPTV at the NNI

The value of an IPTV service (compared to traditional TV services) for the consumer lies in its ability to enable a wider selection of content than can be enabled by any one operator. A given service provider will operate a content library that they deem economic. By enabling 3rd party content providers, the aggregate service becomes significantly more attractive to consumers. An effective Network-to-Network Interface (NNI) is required to enable this "long tail"[10]. Consumers must be able to access video services from a variety of sources. Figure 2 shows an IPTV service deriving content from a variety of sources –

1. Traditional satellite broadcast downlinks
2. Commercial video server farms
3. Smaller scale video publishers ( e.g, Vlog)

[10] Chris Anderson, "The Long Tail", Wired News, October 2004.

In each case the content is expected to be appropriately protected by the DRM scheme. Uncontrolled redistribution of license restricted content is not to be supported

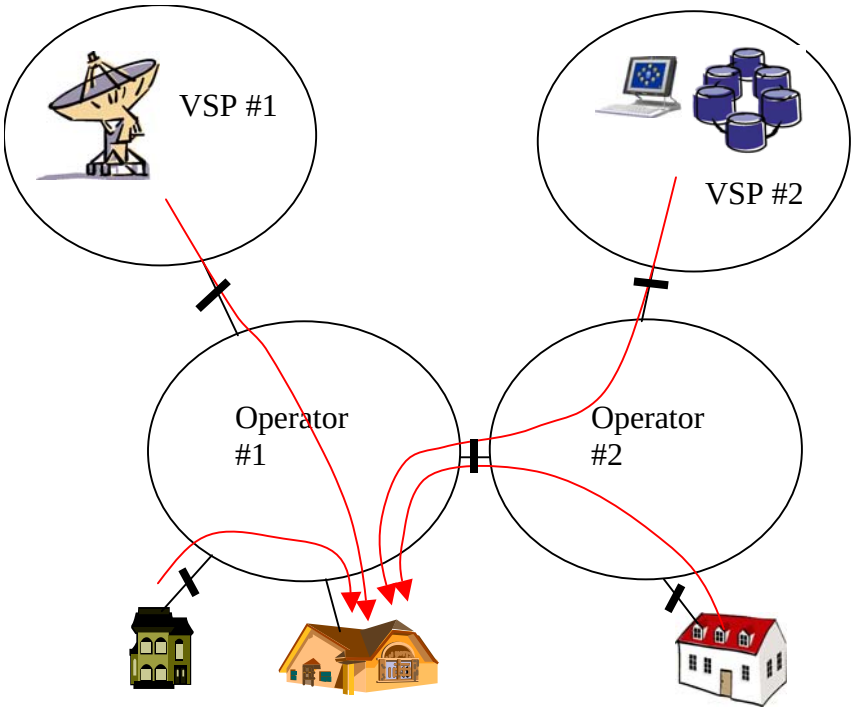


**Figure 2. Multiple content source model for IPTV**

### 3.2.4 Network Service Models for IPTV

While most commercial TV content is delivered via broadcast service, the IP infrastructure is not a broadcast medium. Some content will be relatively specialized and provided as a unicast stream, while other content will be so widely watched that multicast offers significant network efficiencies. The choice of whether to provide streaming IPTV content as unicast or multicast as well as the proportion of either mode should be an operator's choice.

A Video on Demand (VoD) IPTV service is not always required to stream the content, but may use traditional non-real time, bulk data transport mechanisms to deliver the content to the customer prior to its use. Where streaming IPTV services may be thought of as "live" or "continuous" services, a VoD service is essentially relying on stored content. Both streaming and VoD services rely on storage for buffering; the difference is one of degree. (How much of the content is buffered before playback). The location of the content storage is another option. This storage could be centralized, cached, or distributed across the CPE in a peer-peer or grid fashion. Where content is stored in distributed arrangements (refer Figure 4 for potential scope of distribution), the content must be suitably protected by the DRM scheme. Distributed storage may be required for reasons of network performance – e.g., jitter reduction or error correction.

Additional service models for IPTV are expected.

The Network-PVR service model is one example of the capabilities an NGN operator can offer in a differentiating manner, by managing and optimizing the storage needs for users content, as well as user interactions with the service. This should be facilitated by relying on a standard NGN application plane exposing interfaces to end users, devices and content providers in a consistent environment for application developers and supporting business model requirements for interoperability and content lifecycle (play, record, copy, transcode…).

The personalized services model is another example of the user-centric IPTV experiences which NGN operators can deliver. Whether it is channel programming, language selection, presentation customization, automating content selection for "my-channel" delivery, mixing personal content for delivery in a close community, or gaming or sharing within groups, these services illustrate the key benefits of IPTV: interactivity and communications capabilities available through the NGN application plane. IPTV would benefit from open application-level standards for content management, application creation, and user control of their IPTV experience.

The infrastructure required to provide a large-scale digital packet video service requires a coherent architecture. This architecture has to support a multitude of functions beyond the simple transmission of packets containing video samples. The architecture must recognize functions such as video codecs (of varying types and qualities), grooming and routing of video traffic, advertising insertion, viewership reporting, media adaptation etc. While various bodies (e.g., MPEG) have developed standards for components and references for pieces of this infrastructure, most of these have not been envisaged from the perspective of operating them at significant scale. The Operations, Administration, Maintenance and Provisioning (OAM&P) functions associated with the IPTV service will provide a key determinant of operational costs. Where traditional TV services were provided via analog, with a compatible set of operational procedures, a digital packetized video distribution infrastructure will require new tools and procedures to monitor and validate operations and to locate and isolate troubles at the video (e.g., MPEG) layer. The video application layer is sufficiently complex that it will impact the overall service availability. Video layer redundancy mechanisms may be required in addition to network layer protection mechanisms.

### 3.2.5 IPTV Terminal Assumptions

IPTV is commonly assumed to terminate in a set-top box attached to a TV screen and this may well be the initial deployment model. In the NGN context, the variety of terminals of interest may be considerably larger, including various forms of mobile terminals. For example, WiFi or 3G connected PDAs and cellphones should be able to receive, decode and display content (within their resolution limits). Portable media players and game terminals could also be considered examples of NGN terminals. With appropriate software enhancements, this type of device should be able to access the NGN IPTV service. It is expected that as new IPTV services evolve, new terminal types will come to market.

The IPTV applications (including derivative or enhanced IPTV services) would have access in a network-agnostic way through the NGN service plane to the same capabilities (or profile of capabilities) for diverse terminal and access specificities.

It should be key for the IPTV application architecture to rely on open standards interfaces to set-top boxes (and other end point devices) that can be exercised so that application logic can get distributed and well coordinated across the application and device planes.

Delivering a compelling end to end IPTV service will also require operators to manage the multivendor customer premises equipment like the set-top boxes described above, this should be considered as a critical area of need for creation and use of open standards (managing applications, DRM keys, functional modules, quality of experience, etc.).

### 3.2.6 Business Model Assumptions

The IPTV service may be offered using a number of business models. These may include subscription models, pay -per-view models, duration of viewing models, advertising supported models, multi-service bundles, or some combination thereof. Note that advertising supported business models may require additional architectural features to support the delivery of the advertising content to the customer as well as viewership metrics to the advertisers.

The IPTV service is primarily considered a consumer service. To facilitate consumer adoption of the service, it is expected that standardized set-top boxes, personal video recorders and other NGN terminal equipment must be available as retail consumer electronics devices and yet be identifiable as interoperable with the IPTV service. IPTV services may also be of interest to various business segments - e.g., retail businesses such as restaurants and hotels. While the consumer aspect is probably of widest interest initially, the narrowcasting capabilities inherent in the IPTV service may make it attractive for niche content delivery in a variety of other business settings.

The IPTV service would also benefit from a more customized or personalized content experience, at the user, community or enterprise level as the NGN brings the capability to separate the issue of IPTV delivery from geographical or access network limitations (e.g., consumers can watch home channels over roaming networks, professionals can get access to their Enterprise channels while at customers premises …). However, watching home channels outside the home geographic area may impose some regulatory or licensing issues; for example, in the Ku band satellite television, the FCC has placed restrictions on where the local broadcast networks can be received. These regulatory and licensing issues may come to play in a mobile IPTV environment.

Hence Operators can enable a wider set of customers to be creating content and send them to other communities/people not really 'local' to them. This should be facilitated by relying on open standards of content management, authoring, and interoperability.

It may be required to support multiple modes of advertising. The traditional timeslot insertion approach used by the MSOs is well understood by the advertising value chain

participants, but is also threatened by increasing adoption of digital video recorder technology. Traditional advertisers are reportedly moving towards media and advertising techniques where greater consumer interactivity is assured, advertising impact is more measurable, and better returns can be achieved from their advertising expenditures. Alternative mechanisms for advertising insertion may thus be required in the IPTV context. For example, the advertising material could be dynamically inserted in the media stream and rendered as part of the scene[11].

The architectural capability for service integration between communication and entertainment services creates the potential for a variety of new business model and service bundling arrangements.

A recent survey, conducted by InsightExpress[12], found that 82% of broadband users are interested in receiving "triple play" services - voice, video and high-speed data services - from a single provider. It is, therefore, a fairly safe assumption to make that service bundling will play a major role in the evolution of IPTV. Further, the ability to offer consumers simple, yet feature rich, packages and bundles will serve as a major competitive tool for operators and thus be an important success factor in the evolution of IPTV in general.

An important new angle on IPTV advertising is the utilization of the unicast/multicast (vs. broadcast) nature of IP to enable the use of TV based targeted advertising for small/medium business that cannot afford television advertising today. By enabling low production cost advertising similar to Internet advertising (static or animated graphics), and by limiting and targeting ads (low placement cost) to a pre-defined audience (by geography, special interest) it will be possible to offer small advertisers the ability to shift their marketing dollars to TV advertising and therefore generate new revenue streams for carriers.

In addition, the bi-directionality of IP enables the completion of transactions, which can serve as an additional source of revenue. Completing a transaction could mean in this case, anything from connecting the consumer to the advertiser for a voice call to completing a purchasing transaction for material or digital goods.

[11] See e.g., Chalil, M.; Sreekumar, K.P.; Sankar, M.; "MPEG-4 based framework for game engines to handle virtual advertisements in games " Proc. IEEE International Conference on Multimedia and Expo, 2003. ICME '03. 2003, Volume: 1 , 6-9 July 2003 Page(s): 413 -416

[12] InsightExpress, on behalf of SupportSoft Inc. June 8, 2005.
http://supportsoft.mediaroom.com/index.php?s=press_releases&item=295

# 4 DELIVERY & DEPLOYMENT OF IPTV – STATE OF THE INDUSTRY

The exploratory group membership includes service providers with varying degrees of experience with IPTV deployments. Some have turned up commercial services; some are in the process of doing so, while others are simply in the planning and trial stages.

## 4.1 Characteristics of IPTV deployments today

Network architectures for IPTV deployments today are quite varied. This is influenced by several factors, including the need to support customer network requirements[13] and legacy services. Many of today's IPTV deployments utilize DSL networks, which already employ a given architecture[14] for high-speed Internet access service. As such, the simultaneous support for customers of the existing services and the new customers of IPTV services is influencing the design of the upgraded network architecture.

Above the network layer, IPTV deployments are largely single vendor or single vendor group applications. These applications address the following common aspects or functionality:

- (E)lectronic (P)rogram (G)uide - EPG
- Delivery of live video content from a traditional broadcaster source
- (V)ideo (o)n (D)emand - VoD
- (C)ontent (P)rotection and (D)igital (R)ights (M)anagement - CP and DRM.
- Interactive TV - iTV.
- Operational and business support functions i.e., OSS's and BSS's.

## 4.2 Issues Identified with IPTV deployments today

As with any new technology, early deployments of IPTV have experienced a number of challenges that must be overcome. While most are relatively minor, several issues threaten the viability of IPTV deployments as they scale toward mass deployments in competitive markets.

### 4.2.1 Technical barriers to content

Some of the exploratory group members expressed concern that the content providers are putting up technical barriers to obtaining content that their cable peers do not experience. Some of these barriers are being introduced as existing contracts come up for renewal. Without a specification, requirements, or best practices document to rely on, these service providers are lacking the desired means to assert which of the technical requirements that the content providers are trying to impose are reasonable.

An example given was a requirement to encrypt content normally provided by the cable distribution networks as "free" (and analog) channels.

[13] Some of these IPTV deployments are in a campus environment where the customer dictated explicit IP network requirements.
[14] Refer to DSL Forum TR059

### 4.2.2 Lack of consensus on standards for DRM

Today, the solutions offered for digital rights management are largely proprietary: some software from the DRM vendor must be integrated into the set-top-box (STB). The proprietary nature of such solutions was seen to limit the ability of the service provider to select a desired STB, for example.

1. The ability of the service provider to select a desired STB,
2. The evolution of a retail market for a consumer electronics STB,
3. Consumer access to "long tail" content.

Going forward, it is expected that the existing DRM schemes would continue to be used, while at the same time, the IPTV standards work focus on a next-generation service architecture that includes DRM and support for multiple-operator, multiple-content provider networks. It should be noted that DRM is a major issue in the industry, and possible solutions are being worked in multiple industry forums (see Appendix B for examples.) The industry needs to synchronize the DRM requirements for IPTV with the efforts already underway to arrive at a single approach for DRM.

Similarly the user profile, identities and mobility/nomadicity management capabilities of NGN should be considered for key enablers of a more open and user-friendly set of DRM schemes.

## 4.3 Issues that may impede the adoption of IPTV

Overall, a need for an industry group to be focused on the technical issues surrounding IPTV and working with existing SDOs to coordinate requirements and standards was identified. The following technical issues were identified as items that this group should address:

1. Need for an overall reference architecture for IPTV.
2. Need for industry accepted standardized metrics and requirements for content security (digital rights management) and the quality of content delivery (Quality of Customer Experience).
3. Need for End-to-End QoS functionality to support multiple services (voice, video and data) on the same network
4. Need for interoperability standards and testing of components in the video delivery network

The following sub-sections provide more detail on each of these issue areas.

### 4.3.1 Reference Architecture

While many organizations are working on IPTV related activities, it is not clear that these efforts are all working in concert. The members felt that a missing element is an overarching reference architecture that addresses all elements of an IPTV solution. Such a reference architecture would address the following:

a. Service Descriptions and Capabilities
b. Models for Content Sourcing
c. Models for billing and settlement arrangements for video services
d. Content security
e. QoS

f. QoE
g. Network Architecture models (Core, Access, Home) [*not just network layer and below*]
h. Application Architecture models (Service Enablers, App servers, Resources, API and Protocols models, Device functions models)
i. IP network supporting infrastructure required to support IPTV. E.g., Domain Name Services (DNS), Network Time Protocol (NTP), network access authentication (RADIUS/LDAP).
j. Evolving nature of terminal devices (multi-resolution support)
k. Models for advertising insertion
l. Models for viewership reporting to advertisers
m. Service integration (e.g., caller id on the TV screen)
n. Content location mechanisms (e.g., Electronic Program guides, search capabilities, directories)
o. Content metadata assumptions and requirements ( e.g., XML/MPEG 7)
p. Content transformation services (e.g., changing resolution via MPEG 21 Digital Item Adaptation)
q. Interactive TV services (e.g., audience polling, information services[15], games)
r. OAM of the IPTV infrastructure ( e.g., at the MPEG layer)
s. IPTV protection/redundancy mechanisms (e.g., at the MPEG layer)
t. IPTV interworking between wireline-based distribution networks and wireless access networks.

A starting point for this reference architecture may exist in ETSI TS 102 034 v.1.1.1 (2005-03).

### 4.3.2 Industry definitions and metrics

As mentioned in the issues listing, because there are no accepted metrics for assessing requirements for content security and quality of content delivery, the content providers today are somewhat unilaterally establishing requirements in these areas and making them stipulations for obtaining rights to distribute the content via IPTV. While the development of a good reference architecture would address this issue, it was viewed as significant enough to warrant specific attention. At a minimum, a framework for assessing content security solutions is needed.

In the quality of content delivery area, while some standards exist (See Appendix A), the equivalent of an E-model[16] planning tool for video is needed. This technology independent metric would allow the service providers to engineer their content networks from an application layer to overcome impairments that may be specific to a particular technology.[17]

[15] http://www.bbc.co.uk/pressoffice/pressreleases/stories/2003/05_may/29/bbci_tv_services.pdf
[16] The E-model is a voice transmission planning tool, as specified in ITU-T Rec. G.107
[17] For instance, choosing a specific codec with error concealment algorithms to overcome specific access network characteristics.

### 4.3.3 End-to-End QOS

While today's deployments are finding pragmatic solutions, end-to-end QOS for multi-service (voice, video, data) networks is definitely viewed today as a work in progress, or perhaps better stated as "works in progress" because there is no single solution to the issue.

Service providers may have conflicting requirements: building a network that provides the easiest migration path for supporting today's legacy internet services vs. building a network that provides the easiest migration to the NGN.

Some of the issues identified with respect to QoS are:

- Identification of appropriate network architectures
- Identification of IPTV QoS requirements including but not limited to end to end IP packet loss, timing and synchronization, network and application availability, network and application security.
- QoS mappings between different network types.
- Identification and/or development of appropriate access agnostic signaling mechanisms for:
    - QoS, especially for multicast traffic
    - Authentication
    - Authorization
    - Resolution of contention for resources (e.g., admission control)

While industry standard definitions exist for QoS and network performance requirements for delivering video content (see Appendix A), some substantial challenges remain for QoS in the context of IPTV. As examples, lacking are proven, robust, and scalable standardized mechanisms for issues such as:

- Rapid and complete restoration of IP layer (not just physical layer) connectivity following severe outages (or attacks) of heavily loaded networks
- Path availability levels comparable to what users have become accustomed with circuit-based data flows
- Timing and synchronization mechanisms similar to those present in circuit–based networks that impact QOS and network performance.
- Assuring that satisfactory end-to-end IP performance is actually achieved, which could require seamless signaling of end-to-end QoS parameters across both network and user interfaces
- Path establishment (call set-up, channel-switching delays, network server responses) comparable to what users have experienced with non-IPTV services
- Reliability and robustness of service components and critical protocols (e.g., routing, especially multicast routing)
- Operation during, and recovery from, commercial power outages
- Assuring that satisfactory end-to-end performance is actually achieved, especially when disparate networks (e.g., fiber and wireless) are being traversed.

### 4.3.4 IPTV Application Interoperability Testing

While considerable work is underway on interoperability testing for some of the components of IPTV (DSL, for example), there appears to be little work on

interoperability testing at the IPTV application level. Some areas where interoperability standards would help in the delivery of IPTV services include:

- Customer - network interface specification for customer equipment (i.e STB)
- Content provider –network interface specification for 3rd party content providers.
- Encoder – STB compatibility for MPEG-4 AVC.
- Video Encoder – Network QoS standards for jointly optimization of the network and codec algorithms.
- OSS and BSS interfaces.

Once interoperability standards are available, service providers and consumers benefit from knowing that IPTV components meet those standards. This need can be met through the independent testing and certification of IPTV elements.

In addition to interoperability within the IPTV realm itself, IPTV coexistence with other services delivered over a common transport infrastructure will also be necessary.

#### 4.3.5 Wireless IPTV

With the future broadband capabilities of the wireless networks, it will be possible to provide quality TV services to wireless devices. Therefore, wireless issues should also be considered "in-scope" for the IPTV Interoperability Forum.

Broadcast video related standards (e.g., MBMS, and incorporation of MediaFLO™ or DVB-H into wireless devices) continue to evolve for wireless applications (e.g., 3G mobile networks such as UMTS/HSDPA, WLAN). The relevance of these standards in the broader context of IPTV is a key topic for consideration by the IIF. The IEG acknowledges the opportunity to leverage the ubiquity of support for IP-based applications and services across all access domains -- both fixed and wireless -- to drive compelling converged services that include IPTV.

One of the first issues that must be addressed for wireless IPTV is that of standardized architecture(s). Architecture alternatives could include:

1. delivery via the cellular networks (e.g., UMTS/HSDPA, EVDO)
2. delivery via separate transmission network to a cellular/video handset (examples: MediaFLO™, DVB-H)
3. Deliver via wireless MANs (IEEE 802.16e, IEEE 802.20)
4. Delivery via Wireless LAN (IEEE 802.11)

Another technical issue that must be addressed deals with requirements for reformatting of transmissions to fit bandwidth limitations of the access network and the form factor of the destination device. For example, it would be a waste of bandwidth to send HDTV to a display on a mobile handheld device that has substantially less than HDTV resolution.

### 4.3.6 Other issues

The following additional issues were identified by members of the group:

1. ADSL2+/VDSL2 pair bonding – DSLAM/Modem:
   - Interoperability between ADSL2+/VDSL2 pair bonding DSLAM vendors and Modem vendors
   - Includes Impacts to: xDSL, Network Management
2. Integration in the Head End between content providers and VOD servers:
   - Pitcher/Catcher vs. Full Access to Content
   - Wide choice of content should be available
   - Includes Impacts to: Architecture, Billing, Ordering
3. Device Interfaces in the home:
   - Access Network, Modem, Residential Gateway and Set Top Boxes
   - Application/specification of Interfaces, e.g.: MoCA, HPNA ver. 3.0, IEEE 802.3, 802.11
   - Includes Impacts to: Home Networking, Network Management
4. Remote-Management of devices within the home
   - Feature Rich management of both connectivity and application layers in the modem and STB. (e.g., TR-069)
   - Management of higher order functions in the modem, residential gateway (e.g., Packet snooping, etc.)
   - Extent of interaction with other UPnP devices within the home
   - Includes Impacts to: Architecture, Network Management
5. Thin vs. Thick clients on the Set Top Box:
   - Manageability vs. Quality of Service (e.g., boot up time)
   - Includes Impacts to: Architecture, Service Performance, and Management
6. Transport Methodology between Head End and DSLAM:
   - Wavelength, GigE, Analog/Digital RF, SONET, ATM, MPLS
   - Includes Impacts to: Transport, Network Management
7. Multicast vs. Unicast:
   - Setting appropriate point for Multicast vs. Unicast, e.g., Aggregation Point or DSLAM
   - Includes Impacts to Architecture (e.g., choice of UDP or TCP for conflict on upstream resources)
8. Integration of mobile, fixed and in-home wireless systems.

# 5 IPTV STAKEHOLDERS

## 5.1 IPTV Value Chain

A **value chain** is a set of sequential activities provided by various business entities (or stakeholder groups) that turn inputs into value-added outputs for their external customers. The **IPTV Value Chain** provides an end-to-end view of the stakeholder groups engaged in a set of activities specific to a domain of business and technology interest in implementation and deployment of IPTV services. The IPTV Value Chain starts with Content Creators and ends with Content Consumers. Domains of stakeholder groups in the IPTV Value Chain include: advertisers, programmers, content producers, rights owners, content aggregators, broadcast system vendors, web site owners, head end system vendors, service operators, TV network operators, broadband access operators, end-to-end system software, network equipment vendors, OEM & CE manufacturers, chipsets and component manufacturers, retailers, consumers, video systems integrators, data network integrators, backend system integrators, and full service integrators.

Each domain in the IPTV Value Chain represents a group with a potential set of needs for open industry standards. Some standards work to address the needs of certain domains in the IPTV value chain is underway in industry groups as identified in Appendix B. However, gaps exist. The IPTV Value Chain is a gap analysis and outreach identification tool. The IPTV Value Chain views below could provide a starting point for the proposed IIF, as it scopes its work, to identify potential outreach to stakeholder groups who have interest in the various domains of the IPTV Value Chain.

Sections 5.1.1-3 describe 5 different exemplary IPTV Value Chain views provided by industry analysts. Each adds a different perspective on the IPTV stakeholder domains and their interfaces. First are two evolutionary views: IPTV Current Players and IPTV Tomorrow's Players. This is followed by an economic view: IPTV Economic Exchange and two hierarchical views: the IPTV Service Chain and the IPTV Network Chain over which the Service Chain is delivered. The proposed IIF may wish to address the issue of whether a single standardized value chain model is required for their purposes going forward. Section 5.2 follows with a preliminary view of the motivations and interests of key IPTV stakeholder groups as a context for understanding their requirements

### 5.1.1 IPTV Value Chain - Evolution

Figures 3 and 4 depict the evolution of the stakeholder groups involved in taking content from the creators to the consumers via an IPTV service. Today's value chain shows the end-to-end relationships from the Content Creator/Producer to the Content Consumer of the various content domains (content producers, right owners, programmers, content aggregators, advertisers, and web site owners) hardware and software system and component vendor domains, as well as network and service operator domains. Tomorrow's value chain includes the addition of wireless operators providing IPTV delivery to mobile handsets as well as the potential development of broadband access operators who provide underlying broadband network access services. A view of tomorrow's value chain is useful for consideration in standards work toward consideration of potential extensibility of current standards activities. The IPTV

Exploratory Group does not endorse this predicted evolution, but offers it as a consideration.

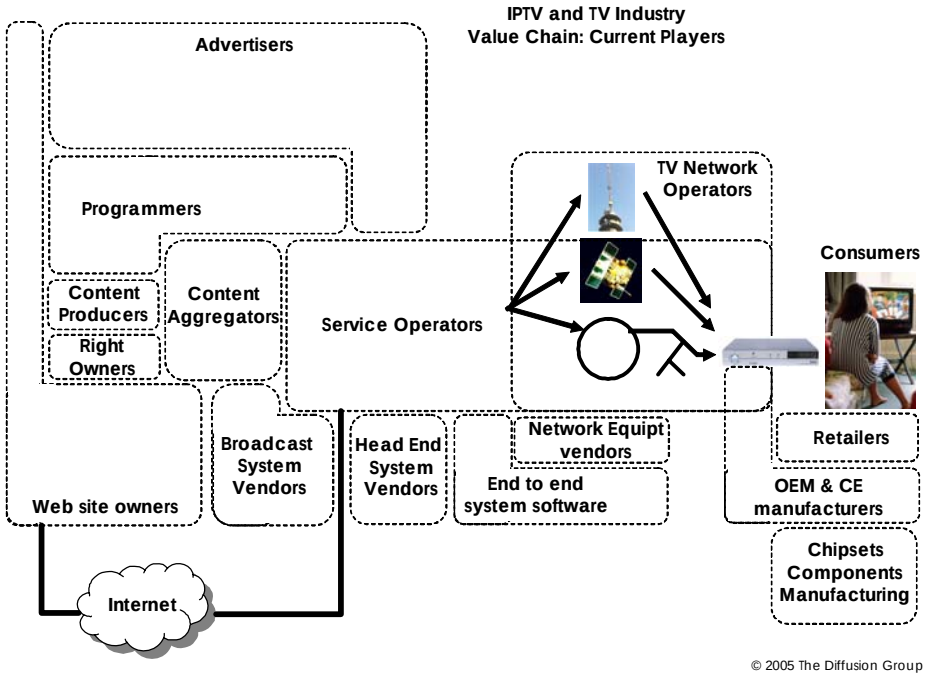


**Figure 3: Current TV Service Value Chain: Current Players[18]**

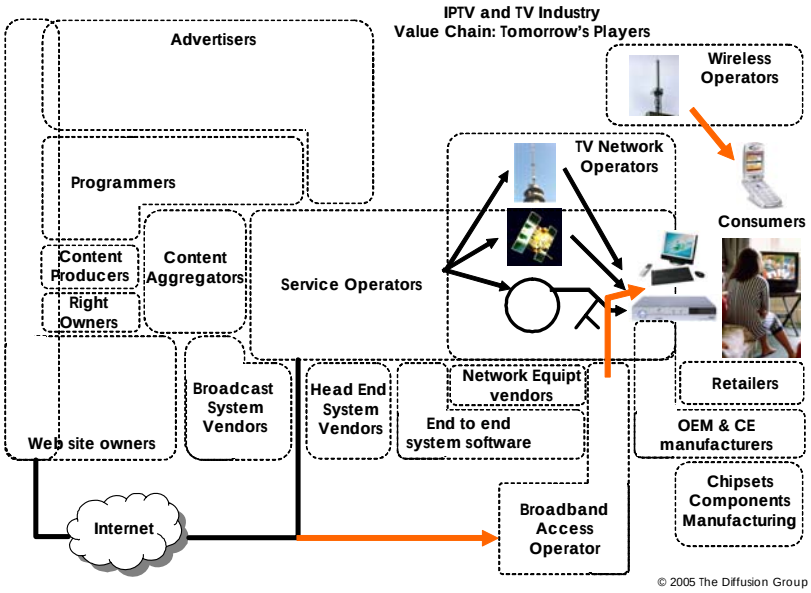


**Figure 4: IPTV Value Chain: Tomorrow's Players[19]**

[18] Provided by Herve Utheza, The Diffusion Group http://www.tdgresearch.com/programs_IPTV.htm .

[19] Provided by Herve Utheza, The Diffusion Group http://www.tdgresearch.com/programs_IPTV.htm .

### 5.1.2 IPTV Value Chain - Economic View

Figure 5 provides a view of the financial transactions that may be required between the various stakeholders in the value chain. Entertainment services may require different types of transactions than traditional communications services. For example, financial transactions may be required such as per viewer royalties to content rights owners. Standards activities may be required to provide the necessary measurements and evidentiary procedures to support these economic exchanges. The IPTV Exploratory Group does not endorse this specific economic view, but offers it as a consideration.

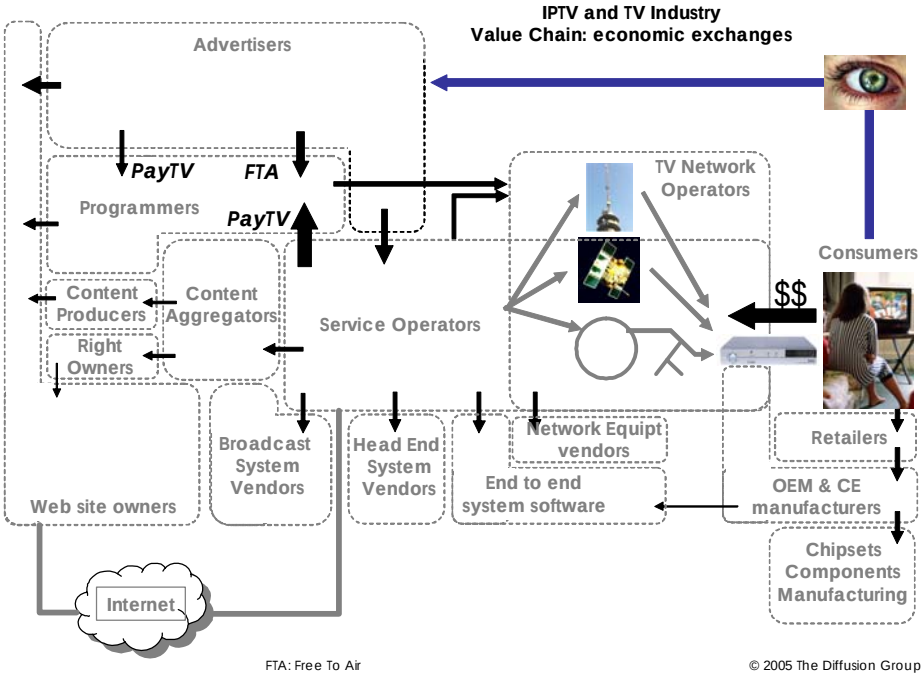


**Figure 5: IPTV Value Chain: Economic Exchanges[20]**

### 5.1.3 IPTV Value Chain - Service and Network Levels

Figures 6 and 7 are complementary views to Figure 3. Together, they provide a top down hierarchical view of the Current IPTV Value Chain - separating it in to a Service (Layer) Value Chain and an underlying Network (Layer) Value Chain. The IPTV Service Value Chain in Figure 6 further depicts a view of the type of data typically exchanged between the various domains and whether it is typically protected at the link level, protected end-to-end, or not protected. Standards activities will need to take into account these various requirements for data exchange protection.

Finally, Figure 7 depicts the interfaces between the various systems in the network and which domains of systems are typically associated with various System Integration stakeholder groups. Standards activities may be required to accommodate the higher

[20] Provided by Herve Utheza, The Diffusion Group http://www.tdgresearch.com/programs_IPTV.htm Note that in regulated environment, the network and service operators may be distinct.

level interfaces between domains of integrated systems. The IPTV Exploratory Group does not endorse this specific hierarchical model, but offers it as a consideration.

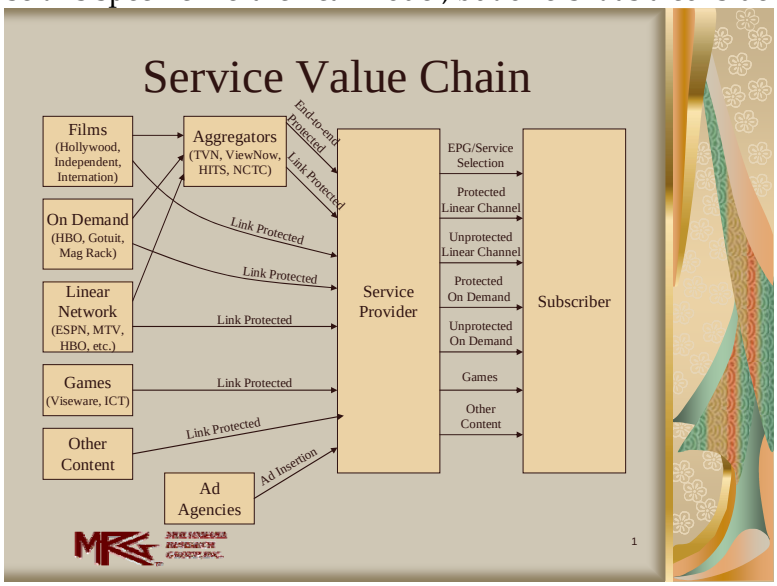


**Figure 6: IPTV Service Value Chain[21]**

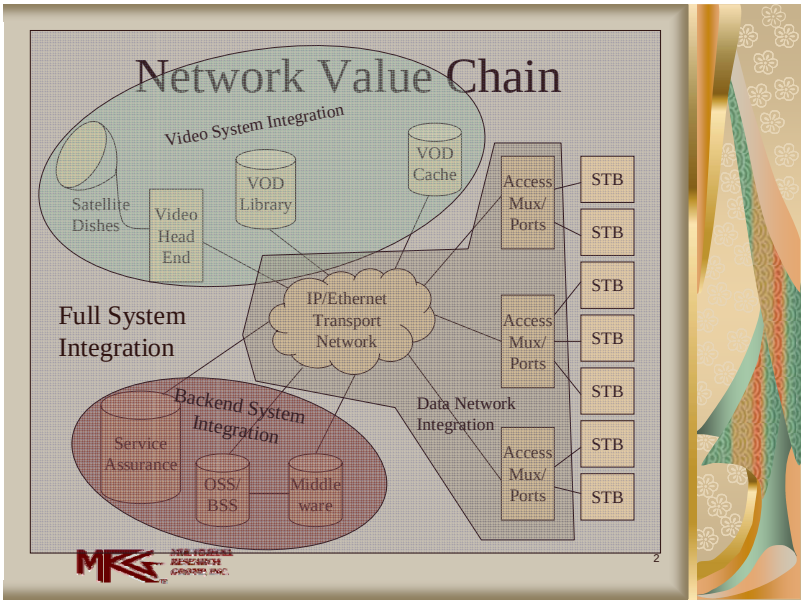


**Figure 7: IPTV Network Value Chain[22]**

## 5.2 Stakeholder motivations for IPTV

In order for a new service to survive in the long term, each member of the value chain for that service must have a reason to support the new service, (or else they are no longer part of the value chain of the new service. The following sections explore the

[21] Provided by Bob Larribeau, MRG Multimedia Research Group, Inc. http://www.mrgco.com/ .
[22] Provided by Bob Larribeau, MRG Multimedia Research Group, Inc. http://www.mrgco.com/ .

rationale for various value chain members to be interested in the IPTV service. Since TV services are already widely deployed in North America, this must be considered an established market with an incumbent value chain. A new competitive IPTV service offering must provide a significant (step function) improvement in utility for consumers if it is to be adopted on a large scale and achieve significant market share. An IPTV service that lacks scale and market share will be less attractive to the other value chain participants. A corollary therefore, is that while Plain Old Tv Service (POTS !) may establish some necessary minimum technical requirements, it alone is unlikely to provide sufficient functionality for an IPTV service to achieve market success.

### 5.2.1 Consumers

Consumers will be attracted to a given IPTV service that offers features and functions beyond those that are currently available in their area. These features may address the following areas:

- Breadth and diversity of content availability (e.g., enabling NNIs to enable access to the long tail),
- Immediate access to available content,
- Personalization of viewing experience(e.g., language selection, presentation customization)
- Service reliability and quality,
- Levels of interactivity (e.g., using the IP upstream capabilities)
- Portability of content (e.g., PVR, mobile integration) ,
- Integration with other services (e.g., caller ID presentation on TV screen).
- Expanded definition of entertainment content.

### 5.2.2 Network Operators

Network Operators are motivated to provide IPTV services in order to match the triple play (voice, data, entertainment) service bundles now offered by MSOs.

### 5.2.3 Content Owners and Content Aggregators

Content Owners and aggregators will gain access to another distribution mechanism. It is yet unclear exactly what impact IPTV will have on the Content Owners and Aggregators' business models, but it seems likely that there will be some impact on the traditional release windows of video assets (movies).

Today movies are released according to very rigid release windows: Theatrical, Hospitality and Airlines, Home Rental, PPV VOD, Broadcast Basic Cable, other. With IPTV enabling people to order movies on demand at home, it is possible there will be continued consumer pressure to, for example, move the VOD window to be at the same time as the Home Rental window or even to an earlier time even as early as the theatrical release.

Needless to say, DRM capabilities will be a very important factor in content providers' willingness to even consider such changes to their business model. Additional changes to the way content owners store, manage, transport and sell their assets in order to take advantage of the new ubiquitous IP infrastructure are expected to happen.

### 5.2.4 Equipment vendors

Significant new equipment deployments will be required by the network operators to deploy an IPTV service. This creates a market for equipment vendors.

### 5.2.5 Advertisers

Advertisers are moving away from broadcast media towards more targeted and interactive media where viewership and action results can be more specifically tied to advertising activities. A switched IPTV service provides a significant improvement in determining viewership compared to a broadcast service. IPTV service integration with other NGN capabilities enable more targeted advertising models.

IPTV systems could provide valuable info to organizations such as media research companies. This could represent another revenue stream for IPTV service providers. Refer to 3.2.6 for a discussion around the ability of new advertisers, small to medium local business, to join the TV advertising market.

### 5.2.6 Programmers/Content Developers

The content developers will gain a new distribution outlet for their media. An open, switched IPTV service will enable consumers to access a wider variety of content than the channelized current linear programming arrangements. The integration of IPTV services with other NGN services can potentially create a new medium for entertainment content with distinctly greater possibilities in terms of user interactivity. More information on affiliates can be found at http://www.affiliatewebinfo.com.

### 5.2.7 Retailers and Consumer Electronics Manufacturers

IPTV enables a retail market for a variety of sophisticated packet based consumer electronics devices such as set top boxes. The technology is now becoming viable for these types of devices to be manufactured in price ranges suitable for a wide-scale public retail market to develop.

# 6 IPTV EXPLORATORY GROUP RECOMMENDATIONS & NEXT STEPS

## 6.1 Background:

The TOPS Council commissioned IPTV Exploratory Group (IEG) has defined IPTV as service provider network subscriber services that deliver secure broadcast-quality audio and video to devices for display and/or recording. Services may include broadcast type services like Video On Demand (VOD) and Interactive TV (iTV) services. These services are delivered across an access agnostic, packet switched network that employs the IP protocol to transport the audio and video signals. In contrast to video over the public Internet, with IPTV deployments, network security and performance are tightly managed to ensure a superior entertainment experience, resulting in a compelling business environment for content providers, advertisers and customers alike.

In our brief time of existence, the IEG has identified a considerable number of issues that may impede the adoption of IPTV. The IEG has also identified a considerable amount of activity in various forums and standards development organizations (SDOs) that relates to IPTV. However, we were unable to identify an organization that is providing a single venue for ATIS members to work the issues identified.

## 6.2 Recommendation:

The IEG recommends that a body of subject matter experts be formed under ATIS to give focus to issues that may impede the adoption of IPTV. To emphasize its focus on IPTV, we recommend it be named the IPTV Interoperability Forum (IIF). It is further recommended that the forum be placed under the Multimedia Functional Platform in the ATIS organizational chart.

### 6.2.1 Mission & Scope:

The IPTV Interoperability Forum (IIF) enables the interoperability, interconnection, and implementation of IPTV systems/services by developing ATIS standards and facilitating related technical and operational activities. This forum will place an emphasis on North American and ATIS Member Company needs in coordination with other regional and international standards development organizations.

The scope of the work in the IIF includes the following areas:

1. Coordinate standards activities that relate to IPTV technologies. This includes providing a liaison function between the various SDOs and forums that are each working on important components for multimedia, but may not have visibility to other aspects of the application.
2. Develop interoperability agreements, technical reports, or other ATIS standards where appropriate.
3. Provide a venue for interoperability activities.
4. Provide a venue for the assessment of IPTV issues in the context of NGN directions.

### 6.2.2 Objectives (Initial):

The IEG has identified an initial set of issues that need resolution. These issues will be deferred to the IIF as initial objectives. As efforts in the IEG continue, other objectives may be identified. The following is a partial listing of these issues, a complete list is found in Section 4 of the full report:

1. An industry overall reference architecture for IPTV, including interface definitions and support of multiple access technologies.
2. Creation of standardized metrics/requirements for content security (digital rights management) and the quality of content delivery (Quality of Customer Experience).
3. Creation of interoperability standards and testing requirements of components in the video delivery network.
4. Best practices for rapid and complete restoration of IP layer (not just physical layer) connectivity following severe outages (or attacks) of heavily loaded networks.
5. Assuring that satisfactory end-to-end IP performance is actually achieved, which could require seamless signaling of end-to-end QoS parameters across both network and user interfaces.
6. Path establishment (call set-up, channel-switching delays, network server responses) comparable to what users have experienced with non-IPTV services.
7. Reliability and robustness of service components and critical protocols (e.g., routing, especially multicast routing).
8. Operation during and recovery from commercial power outages.
9. Establishment of user expectations (e.g., via a user group entity).

## 6.3 Participants/Stakeholders:

To effectively resolve issues surrounding broadband video deployment, this forum needs to attract participation from all of the relevant stakeholders. In particular, it is important that the middleware vendors and content providers are involved in discussions surrounding DRM, so that they will embrace any recommendations, interoperability agreements or standards produced by this body.

## 6.4 Proposed Timeframe:

The IPTV Exploratory Group recommends that the formation and establishment of the IIF be placed on a fast-track with its first meeting held within 3 months of ATIS Board/TOPS Council approval. This aggressive timeline is based on industry's momentum around IPTV, existing and future work programs by multiple international interest groups relevant to this initiative, and the identification of several areas in which work among ATIS members deploying IPTV is critical.

## 6.5 Next Steps:

With the completion of its report to the ATIS TOPS Council, the IPTV Exploratory Group will have had achieved its mission and, hence, as a group, is expected to dissolve. Members of the IPTV Group have been encouraged to participate in the IIF to provide a business-sense and strategic perspective to industry's implementation of IPTV.

## 7 ACRONYMS & ABBREVIATIONS

Note: Organization name acronyms have not been included in this glossary.

| | | | |
|---|---|---|---|
| 3G | Third Generation | LDAP | Lightweight Directory Access Protocol |
| ATA | Analog Terminal Adapter | MOS | Mean Opinion Score |
| AVC | Advanced Video Codec | NGN | Next Generation Network |
| BPON | Broadband Passive Optical Network | NI | Network Interface |
| BSS | Business Support System | NNI | Network to Network Interface |
| CP | Content Protection | NTP | Network Time Protocol |
| CPE | Customer Premises Equipment | OSS | Operational Support System |
| DNS | Domain Name System | PDA | Personal Digital Assistant |
| DRM | Digital Rights Management | PON | Passive Optical Network |
| DSL | Digital Subscriber Line | QoE | Quality of Experience |
| E2e | End to end | QoS | Quality of Service |
| EPG | Electronic Program Guide | RADIUS | Remote Authentication Dial In User Service |
| FEC | Forward Error Correction | SDO | Standard Development Organization |
| FG | Focus Group | STB | Set Top Box |
| GPON | Gigabit Passive Optical Network | VOD | Video on Demand |
| IA | ?? | VoIP | Voice over Internet Protocol |
| IP | Internet Protocol | WDM | Wavelength Division Multiplexing |
| IPTV | Internet Protocol Television | WiFi | Wireless Fidelity |
| iTV | Interactive Television | XML | Extended Markup Language |

## 8 IPTV EXPLORATORY GROUP MEMBERS

### Co-Chair

| | |
|---|---|
| Kevin Schneider | ADTRAN |
| Bill DeMuth | SureWest |

### ATIS Staff

| | |
|---|---|
| Susan Miller | ATIS |
| Tim Jeffries | ATIS |
| Martha Ciske | ATIS |
| Crystal Blue | ATIS |

### Members

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| Marc Kimpe | ADTRAN |
| Fred Skoog | Alcatel |
| Ken Biholar | Alcatel |
| Fred Shay | ALLTEL |
| Chuck Dvorak | AT&T |
| Al Morton | AT&T |
| Eran Wagner | Amdocs |
| Martin Cullum | Bell Canada |
| Mark Dowker | Bell Canada |
| Steven Wright | BellSouth |
| Wesley Waite | Billing Concepts |
| Simon Jones | British Telecom |
| Kevin Blyth | British Telecom |
| Joe Berthold | Ciena |
| Mike Koons | Cisco |
| Stuart Kirkwood | D&E Communications |
| Philip Theis | D&E Communications |
| Asok Chatterjee | Ericsson |
| Marlis Humphrey | Harris Corporation |
| Jean-Philippe Caradec | HP |
| Harry Louis Beane | HP |
| Chris Mankle | HP |
| Marc Brandt | HP |
| Kurt Melden | Juniper |
| Donald Crowe | Lucent |
| Tim Verzilli | N. Pittsburgh Telephone Co |
| Craig Forbes | Net.com |
| Sasha Cirkovic | Net.com |
| Richard Brand | Nortel |
| Jim McEachern | Nortel |
| Doug Turner | Nortel |
| Mike Fargano | Qwest |
| Ronnie Dhaliwal | Qwest |
| Chuck Bailey | SBC |
| Pierre-Yves Sibille | Siemens |
| David Francisco | Siemens |
| Vandana Upadhyay | Symmetricom |
| Ken Paker | TDS Telecom |
| Beau Atwater | Telcordia |
| Dan O'Callaghan | Verizon |
| Greg Evans | Verizon |

# Appendix A QoS

## A.1 Definitions and Framework for Overall Assessment of IPTV

Obviously, addressing the needed application quality of any service is important. However, it is not the same as addressing overall service quality. *Quality of Service* (QoS) of course involves adequate transport performance to support the application, but "real" QoS also entails many other service aspects that affect customer satisfaction. This point is elaborated upon below.

The term QoS is frequently used in industry standards, reports and specifications, but usually not well defined. Sometimes reference is made to ITU-T Recommendation E.800—one of the few standardized definitions. In the spirit of trying to add some consistency to this situation, the E.800 QoS framework is a useful start to approaching the QoS of any new service.
E.800 defines QoS as:

> "*the collective effect of service performance which determine the degree of satisfaction of a user of the service*."

This definition is fairly widely accepted. This definition is an exceptionally broad one that encompasses (among others) service support performance attributes such as provisioning time, operational attributes such as ease of use, service accessibility and reliability attributes, and the more traditional call-based quality attributes. The E.800 definition is intended to include the performance effects of all elements (terminals, LANs, access networks, core networks, gateways etc.) in an end-to-end path between human users or application programs, and all types of communicated media (e.g., voice, data, video).

Related to QoS is the term *Quality of Experience* (QoE), also widely used and mis-used, which is clearly what the original E.800 definition of QoS was trying to capture. In any event, ITU Study Group 12 recently restated its support for the E.800 definition of QoS, while also expanding the scope of QoS to include other effects, such as context, environmental effects, etc. The broadened notion of the user experience is called QoE.

However, while the *definition* of QoS in E.800 is fairly widely used, the overall E.800 *framework* is not widely used because it is primarily operational in nature and is not sufficiently application- oriented. Accordingly the E.800 definition of QoS has been elaborated in other ITU-T standards. Recommendations I.350 relates the three most fundamental QoS criteria (speed, accuracy, and dependability) with the three most fundamental network functions (access, user information transfer, and disengagement) in a 3x3 matrix and defines a set of generic performance parameters that can be used in characterizing the resulting nine combinations of performance attributes at any boundary. ITU-T Recommendation G.1000 expands the 3x3 matrix to encompass additional QoS criteria (e.g., security, simplicity) and additional network functions (e.g., service management, billing). There are thus standardized definitions of QoS, as well as standards that make the multidimensional nature of real QoS quite clear.

In the next section, the transport performance of "video over IP" is addressed, to emphasize that much has been done to date on this topic—and to contrast this progress with the many other aspects of IPTV QoS requiring much more attention, which are mentioned thereafter.

### A.2 Video over IP: Transport Performance

A common concern with IPTV is the fact that video is transmitted via packets, and thus much of the attention on IPTV is on packetized transport and how well video will play over it. While supporting various video applications over IP certainly has its challenges, one of the messages of this report is that video transmission over IP has been studied in significant detail and is currently being addressed by several forums; it is thus expected that IP video transport can be satisfactorily realized (with robust design and proper engineering, of course). Detailed evidence of this is provided below.

Successful IPTV delivery and deployment will require sufficient network transport quality to meet the expectations of TV Content Providers (it is not user tolerance establishing requirements here, but the providers who will withhold programs if delivery is not satisfactory). This section reviews the quality expectations that have been shared with the industry, and maps these expectations into numerical transport QoS objectives.

Television program transport requirements can be categorized according to a hierarchy of transport profiles, depending on the source of program material and its intended uses:

1. Contribution - Exchange of Program Content among studios/remote locations and between network studios and their affiliates for re-broadcast (most demanding).
2. Primary Distribution - Used to feed Program Content from Local Network Affiliates to Cable Head ends for re-broadcast, or for Studio-to-Transmitter Links.
3. Access Distribution - Used to deliver Program Content to the Final User, via radio broadcast or Cable Hybrid Fiber-Coax (HFC) network (least demanding).

The Video Services Forum has summarized the end delivery requirements over a range applicable to each TV Transport Profile. To map between TV application delivery and IP packet defect ratio (loss or error), they assumed a nominal bit rate and packetization for each profile, and then determined the necessary packet defect ratio from the ratio of performance hits per day.

In Table A-1, it is assumed that there are 7 MPEG TS packets in each IP packet and that *every* lost packet will cause a noticeable impairment, or "performance hit". The numbers in Table A-1 were derived from references [1][2][3][23].

Table A-1- Packet Loss Ratios Corresponding to Delivery Requirements

| Transport Profile (nominal bit rate) | Content Provider's Delivery Requirements | | |
|---|---|---|---|
| | 1 performance hit per 10 days | 1 performance hit per day | 10 performance hits per day |
| Contribution (270 Mbps) | $4x10^{-11}$ | $4x10^{-10}$ | $4x10^{-9}$ |
| Primary Distrib. (40 Mbps) | $3x10^{-10}$ | $3x10^{-9}$ | $3x10^{-8}$ |
| Access Distrib. (3 Mbps) | $4x10^{-9}$ | $4x10^{-8}$ | $4x10^{-7}$ |

These packet loss ratios represent very demanding performance for an IP transport network to achieve. However, the loss ratio requirements may be alleviated somewhat by adopting one or more forms of loss mitigation.

The Pro-MPEG Forum Code of Practice (COP-3) recommendation has defined a variety of Forward Error Correction/Interleaving settings that provide a range of correction strengths. The highest correction capability can correct bursts of 20 or fewer lost packets, as long as the bursts are separated by at least 80 error-free packets. The cost of this strong correction is a 25% bandwidth overhead. The same FEC/I can correct bursts of 5 or fewer packets when separated by 50 good packets, and requires 10% bandwidth overhead at this level. With the latter FEC/I, it is believed that a Network Packet Loss ratio of $10^{-5}$ will satisfy all but the most demanding Contribution Profile Loss Ratio ($4x10^{-11}$). This packet loss ratio has been adopted in ITU-T Rec. J.241 and provisionally included in Rec. Y.1541 (where the new classes are also intended to support hi-capacity TCP transfers and digital circuit emulation). This level of standards development indicates that transport performance sufficient to support IPTV services should be achievable.

Many digital TV decoders contain error/loss concealment algorithms designed to use the redundant information in a video or audio stream to make lost information less evident to the user. However, the variable effectiveness of loss concealment depends on

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23

[1] T1A1/2003-238 QoS Parameter Recommendation for Video/IP. ATIS PRQC. 2003. http://contributions.atis.org/upload/PRQC/PRQC/3A102380.xls
[2] Delayed Document 44, 2005-01-07 SBC Communications Inc. Proposed Draft of New Annex to Recommendation Y.1541 . ITU-T SG 12. 2005.
[3] T1A1/2003-173 Professional Video Over IP Network Performance Recommendations. ATIS PRQC. 2003. http://contributions.atis.org/upload/PRQC/PRQC/3A101730.ppt

many factors beyond the transport provider's control. Many concealment schemes are proprietary, so therefore not generally available in a standards-based platform.

Packet Loss events that extend for many seconds are beyond the category of performance hits; these events constitute unavailable time. In general, Content Providers seek "five-nines" availability, where 99.999% implies < 1-second outage per day and < 26 seconds per month.

## Appendix B IPTV related Standards Development Organizations (SDOs) and Industry Forums

This appendix contains a non-comprehensive list of organizations and activities that may be applied to or may affect IPTV deployment.

### B.1 Organizations Directly Impacting IPTV

Any ATIS Technical committee established to consider IPTV standards should consider the establishment of liaison relationships with the following organizations:

#### B.1.1 Advanced Television Systems Committee (ATSC) (http://www.atsc.org/ ):

An international, non-profit organization developing voluntary standards for digital television. The ATSC member organizations represent the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

#### B.1.2 ATIS (http://www.atis.org/):

ATIS PRQC (Performance, Reliability, and Quality of Service Committee) is working on performance requirements for IPTV.

Other indirect work includes:
NGN Focus Group (and follow on work)
DSL work in NIPP Committee (formerly T1E1), e.g., VDSL2
Optical work in OPTIX formerly (formerly T1X1) Committee

Task Force: QoS Task Force
Issue: Enhanced IP-Based Video QoS Performance Objectives

Current relevant work: This committee has concurred with the need to create an enhanced IP QoS performance standard. The SBC proposal has been used as the foundation of possible changes. It is unclear whether the PRQC will adopt a new standard specifically for IP Video requirements or recommend an addendum to the Y.1541 specification.

Current relevant standards:
T1.502

T1.801.03-2003: Digital Transport of One-Way Video Signals - Parameters for Objective Performance Assessment (Revision of T1.801.03-1996): September, 2003.

This standard provides a video performance estimation method for one-way compressed video signals transported digitally on an error-free network or storage system. This video performance estimation method is for possible use with end-user systems, carriers, information and enhanced-service providers, and customer premise equipment.

#### B.1.3 Broadband Services Forum (www.broadbandservicesforum.org):

Though not exclusively an IPTV focused organization, this organization has spent a significant amount of time recently on IPTV.

### B.1.4 Consumer Electronics Association (CEA) (http://www.ce.org):

CEA's mission is to grow the consumer electronics industry. Its membership unites more than 2000 companies within the U.S. consumer technology industry. CEA has a division focused on video and is exploring IPTV.

### B.1.5 Digital Video Broadcasting (DVB) Project (http://www.dvb.org/ ):

The DVB project has considerable activity ongoing pertaining to IPTV They have published a first edition of a set-top-box interface specification (sent to ETSI). They have established a commercial module subgroup focused on IPTV (CM-IPTV) which is responsible for establishing the commercial requirements that are needed for a technical module to develop the technical requirements. Much of the IPTV technical work is done in the IP infrastructure technical module (TM-IPI). In addition, the DVB project has both commercial and technical efforts focused on digital rights management. The commercial module is called Copy Protection (CM-CP) and the technical module is called Copy Protection Technologies (TM-CPT). According to some of the IPTV module leadership, the effort is focused on interface specifications from the IP layer up. It, in general does not address specifics of the network, focusing more on the endpoints that run over it.

Specifications that the organization generates are typically standardized by ETSI. However, the ETSI TISPAN NGN effort has not influenced the IPTV specifications. While the group specifies many of the interfaces of the IPTV application, it does not, in general, address interoperability testing.

Some of the areas that are the subject of current work projects are: Specifications for delivering video using H.264, IP-layer FEC, Broadband Program Guide, Background content delivery, and direct IP transport (no MPEG2-TS. In addition to the regular work of the committees, DVB recently conducted a workshop on IPTV. Some of the issues identified at this workshop were:

Carriage of all DVB A/V formats over MPEG-2 Transport Streams (inc.H264/AVC)
- Implementation of end-to-end IPQoS plus IP level FEC, as an option
- Downloading of content to PVRs
- Hybrid services using a combination of IPTV and over-air delivery
- An extended metadata specification allowing for live TV, content downloaded to PVRs and hybrid delivery
- A common approach to application environments plus authoring guidelines for 'network service provider' applications aimed at TVs
- Home Networking specification allowing for wired and wireless networks that is easy to setup and use (building on DLNA guidelines)
- Specification for an interface to a residential home gateway
- Remote configuration and management
- Content security and DRM covering IPTV access and home network (building on the DVB-CPCM specifications)
- Network level security (including authorization, authentication, DDoS attacks etc.)

• Carriage of all DVB A/V formats directly over IP

The DVB organization has fairly good worldwide representation from content and equipment manufacturers, but does not have any participation from North American operating companies. The group provides a significant amount of technical input into the EC regulators.

The organization also has a fairly strict legal team and IPR policy that appears to make it difficult for it to share any in-progress information with other groups. It is in the process of establishing liaisons with the DSL Forum and DLNA, but it is unclear whether that relationship will involve the DVB sharing any draft documents.

### B.1.6 DSL Forum (http://www.dslforum.com/):

WT-100 & WT-105 "ADSL2+ Interoperability Test Plans" – ADSL2+ may provide sufficient bandwidth to support video/IP. The line codes are developed at the ITU, the interoperability details are worked out at the DSL Forum.

Core Transport – WT-101 "Migration to Ethernet Based ADSL Aggregation" will specify an architecture for future transport between the DSLAM and the video head end. This will cover multicast options, VLAN strategies, etc.

TR-069, WT-121 "CPE WAN Mgmt Protocols". These docs and others are being developed to provide a non-proprietary method to manage devices such as xDSL CPE and home networking elements.

WT-113 "VDSL Network Element Mgmt" specifies line code independent MIB variables, in sync with IETF draft MIB.

TR-059 "End-to-End IP-with-QoS Architecture"

TR-092 "BRAS functional requirements"

WT-126: "Triple-play Services Quality of Experience (QoE) Requirements and Mechanisms"

### B.1.7 EBU (http://www.ebu.ch/en/index.php):

European Broadcasting Union
The European Broadcasting Union (EBU) is the largest professional association of national broadcasters in the world.

### B.1.8 ETSI (European Telecommunications Standards Institute) (http://www.etsi.org):

The European Telecommunications Standards Institute (ETSI) on behalf of the TV-Anytime forum has published a series of new specifications. "Broadcast and On-line Services: Search, select and rightful use of content on personal storage systems" is divided into a series of eight parts covering Benchmark Features, System Description, Metadata, Content Referencing, Delivery of Metadata over a bi-directional network and Bi-directional Metadata Delivery protection. The forum works on local and mass storage of audiovisual material and is involved in the setting of specifications for use with Electronic Programme Guides.

The Technical Specifications are numbered TS 102 822-1...TS 102 822-7.

In addition, ETSI TISPAN covers the definition of the ETSI NGN, architecture of content delivery subsystems

### B.1.9 Full Service Access Netork (FSAN) (http://www.fsanweb.org/default.asp):

The FSAN group was created by a group of service providers in order to facilitate the creation of suitable access network equipment standards and hence reduce the price of affordable equipment[24].

The FSAN Optical Access Network Working Group is tasked with identifying and forwarding issues related to optical and other transport networks, and liaising with the SG15/Q2 of the ITU -- responsible for studies relating to the optical access network technology and transport.

FSAN has created a "GPON CTS" Task Group. The objective of this Common Technical Specification (CTS) Task Group is to identify the broadest common system specification consensus based on the GPON standard series (ITU-T G.984.x). The aim is to reduce the number of implementation options and thus ease the implementers work and speed up early order volumes

### B.1.10 IETF (http://www.ietf.org/):

Internet and related infrastructure
RTS (Real Time Streaming) Protocol: RTP Payload Format for MPEG1/MPEG2 Video, RFC 2250
The IETF has recently (February 2005) completed a payload packetization format for carrying H.264/AVC video using its Real-Time Protocol (RTP): RTP Payload Format for H.264 Video, RFC 3984
Differentiated Services Architecture (DSA); intended to address the provision of end-to-end QoS over complex networks
VPLS mcast working group

Current relevant standards:
MPLS (Y.MPLS_Sperf_08)
IP Multicast
RTP (MS MFRTP)
RFC 2733

### B.1.11 ITU-T (http://www.itu.int):

Focus point for international telecom standards
Collaborative relationship with other standards bodies/forums

Direct Support – Study Group 12, Question 17 "Performance of IP-based networks"

[24] From FSAN website

Current relevant work: Creating a new appendix to Y.1541 in order to accommodate the new Video requirements on IP networks. This work is to be in addition to the tightening of performance specifications for Y.1541.

Current relevant standards:
Y.1541
BT 500
VQEG J.144

Indirect Support – BPON (G.983.x) , GPON (G.984.x), xDSL (G.99x.x), FS-VDSL work (H.610, H.611).

ITU-T's Y.1541 specifies a number of performance classes which are intended to cover a broad range of applications for which the transport requirements are known. Examples of applications not covered by the classes are high-quality consumer television broadcast, distribution video, and contribution video, where very low loss, low network delay, and low delay variation are essential.

The Video/IP Ad Hoc Group of the Video Services Forum has performed evaluations based on input from providers and consumers (users) of video services. This has resulted in specifications required to deliver the type of service that these users and providers would demand if the services were available today. These are being incorporated into an updated version of Y.1541 for application to QoS issues in video services over IP networks.

In this work a new QoS class for video services is being proposed. This new class would reference performance parameters for a "corrected network" and an "uncorrected" network. This new class of service would contain sub-classes based on the desired QoS level. A specific Forward Error Correction (FEC) mechanism for the "corrected" network is being proposed.

Digital technology has only fairly recently supplanted the use of analog technology for creating video and audio content. In addition, digital technology has even more recently become available for video and audio content transmission. Rapid advances in these areas have caused television broadcasters to try to shift their notions of television "quality" from a world where all processes were analog in nature to one where television is analog only at the edges of the system; if at all (the trend is for digital systems to replace analog systems). The most classic example of this shift occurred in the definition of new video quality metrics for compressed digital television signals, as the well-established analog test and measurement techniques were not detecting obvious artifacts in the television signal resulting from compression and decompression.

Similar consequences are manifested when comparing the "goodness" of an analog video transmission to a digital video transmission. There is no equivalent to a "bit error" in an analog television signal, as the effect of channel noise in such a television transmission manifests itself as "snow" in the received video signal or hiss in the audio signal, effects readily correlated with channel signal-to-noise ratio. However, a specific bit error, or sequence of bit errors, can cause effects ranging from no visual or audible

impact on the signal whatsoever, to audible pops and visual sparkles or momentary black areas in the picture, to total collapse of the transmission system requiring a cold restart of video compression codecs. These manifestations of error events also exhibit other properties that are unusual or unfamiliar to television engineers, such as the possibility of immediate fluctuation from a perfect video signal to total outage and back again, or temporary frozen frame appearances at the receive end of a link. This behavior is in stark contrast to the typical behavior of analog television systems, where increases in channel noise result in gradual (over a period of seconds or longer) degradation in visual performance. Thus broadcasters find it challenging to succinctly state what levels of error performance they expect out of digital video transport systems, as it is difficult to correlate their behavior under error conditions with the behavior of the analog video systems that they are replacing.

### B.1.12 Internet Streaming Media Alliance (http://www.isma.tv) [25]:

The Internet Streaming Media Alliance (ISMA), aims to accelerate the adoption and deployment of open standards for streaming rich media content such as video, audio, and associated data, over Internet protocols. For this task, a multitude of industry standards, ranging from MPEG to IP, must be combined into an overall, consistent system standard.

ISMA's explicit goal is to use existing standards and contribute to those still in development to complete its specifications. When required building blocks are missing, however, ISMA also produces its own technical specifications—such as ISMACryp2—and makes those available for the market.

ISMA provides its interoperability tests and conformance program as a platform for developing multi-vendor streaming products.

### B.1.13 ISO IEC MPEG (http://www.chiariglione.org/mpeg/):

The Moving Picture Experts Group (MPEG) a working group of ISO/IEC in charge of the development of standards for coded representation of digital audio and video. Established in 1988, the group has produced MPEG-1, the standard on which such products as Video CD and MP3 are based, MPEG-2, the standard (ISO/IEC 13818-1) on which such products as Digital Television set top boxes and DVD are based, MPEG-4, the standard for multimedia for the fixed and mobile web allowing amongst other things a user to interact with multimedia objects (ISO/IEC 14496-1) and MPEG-7, the standard for description and search of audio and visual content. Work on the new standard MPEG-21 "Multimedia Framework" has started in June 2000, and the initial elements of MPEG-21 are now available.

### B.1.14 Open Mobile Alliance (www.openmobilealliance.org):

The Open Mobile Alliance (OMA) is focused on specifications for facilitating mobile data services. The OMA Digital Rights Management V2.0 Candidate Enabler is their specification for DRM. According to the document, the OMA DRM enables content providers to grant permission for media objects that define how they should be consumed. The DRM system is independent of the media object formats and the given

[25] John R. Smith , "ISMA Interoperability and Conformance", IEEE Multimedia, April 2005.

operating system or run-time environment. The media objects controlled by the DRM can be a variety of things: games, ring tones, photos, music clips, video clips, streaming media, etc. A content provider can grant appropriate permissions to the user for each of these media objects. The content is distributed with cryptographic protection; hence, the Protected Content is not usable without the associated Rights Object on a Device. Given this fact, fundamentally, the users are purchasing permissions embodied in Rights Objects and the Rights Objects need to be handled in a secure and un-compromising manner.

The OMA DRM 2.0 Enabler Release defines the protocols, messages and mechanisms necessary to implement the DRM system in the mobile environment. It builds upon the OMA DRM 1.0 Enabler Release with significantly improved security and functionality for a robust, end-to-end DRM system that takes into account the need for secure distribution, authentication of Devices, revocation and other aspects of the OMA DRM 1.0.

The Broadcast (BCAST) Sub-Working Group (SWG) will examine the needs of "Mobile Broadcast Services" and the environments needed for their delivery. The term "Mobile Broadcast Services" refers to a broad range of broadcast services, which jointly leverage the unidirectional one-to-many broadcast paradigm and the bi-directional unicast paradigm in a mobile environment. Thus, mobile broadcast services include one-to-many services ranging from classical broadcast to mobile multicast.

Based on the needs identified the implications on service and client provisioning, network infrastructures, including existing infrastructures, and terminals must be identified. The BCAST SWG will define the set of necessary enablers for mobile broadcast services, including but not limited to service discovery, electronic program/service guides, charging and content/service protection. These enablers will be bearer independent in order to be useful for a diverse and heterogeneous infrastructure. The specifications will ensure the interoperability of various components.

OMA is also involved in defining DRM schemes and specifying application level protocols and behaviors that provide transactional and life cycle management of content and applications on mobile devices.

#### B.1.15 Pro-MPEG (http://www.pro-mpeg.org/):

Professional-MPEG Forum
Digital Interoperability in the Professional Environment

#### B.1.16 Society of Motion Picture and Television Engineers (SMPTE) (http://www.smpte.org/):

Current relevant work: this organization is looking to standardize some the HD formats for both Broadcast and Digital Cinema. Both of these applications are believed to be migrating to IP transport.
Current relevant standards:
SMPTE 259M
SMPTE 192M
SMPTE 240M

SMPTE 274M
SMPTE 295M
SMPTE 125M
SMPTE 272M
SMPTE 291M

**B.1.17 TV Anytime Forum (http://www.tv-anytime.org/):**
As part of its formation, the TV-Anytime Forum has established four fundamental objectives for the organization, which are:

The TV-Anytime Forum will define specifications that will enable applications to exploit local persistent storage in consumer electronics platforms.

The TV-Anytime Forum is network independent with regard to the means for content delivery to consumer electronics equipment, including various delivery mechanisms (e.g., ATSC, DVB, DBS and others) and the Internet and enhanced TV.

The TV-Anytime Forum will develop specifications for interoperable and integrated systems, from content creators/providers, through service providers, to the consumers.

The TV-Anytime Forum will specify the necessary security structures to protect the interests of all parties involved.

The web site indicates that the final meeting of this group is July 2005 with a potential follow-up as a user group.

**B.1.18 UNH-IOL 3Play Interop Initiative (http://www.iol.unh.edu/3play/ ):**
The University of New Hampshire InterOperability Laboratory 3Play Interop Initiative is inviting companies interested in delivering on the promise of the "triple play" of broadband voice over IP (VoIP), video and data services to participate in building a multi-vendor network of these services in a series of group test events. The laboratory is prepared to hold the first event in the 3Play Interop series in August of 2005, which will be focused on the deployment of Triple Play solutions over access networks, with attention to DSL and WLAN technologies.

**B.1.19 Video Services Forum (http://www.videoservicesforum.org/index.html):**
Video Services Forum, Inc. (VSF) is an international association dedicated to video transport technologies, interoperability, quality metrics and education. VSF is composed of service providers, users and manufacturers. The organization's activities include:

- Providing forums to identify issues involving the development, engineering, installation, testing and maintenance of audio and video services
- Exchanging non-proprietary information to promote the development of video transport service technology and to foster resolution of issues common to the video services industry
- Identifying video services applications and educational services utilizing video transport services
- Promoting interoperability and encouraging technical standards for national and international standards bodies

Current relevant work: much effort and coordination has taken place to acquire user's requirements (Satellite, Telcos) to standardize the transport of contribution and primary distribution Video. This forum was instrumental in starting the Video / IP QoS work that was ultimately adopted as working questions in ITU and ATIS.

### B.2 Organizations Indirectly Impacting IPTV

Any ATIS technical committee established to consider IPTV standards may find reference to the works of the following organizations helpful.

#### B.2.1 3GPP (www.3gpp.org)/3GPP2 (www.3gpp2.org):

NGN support via IMS (IP Multimedia Subsystem) and standards for underlying enablers for IPTV (e.g., broadcast).

#### B.2.2 AACSLA (www.aacsla.com):

Advanced Access Content System Licensing Administrator (AACS LA) is developing the Advanced Access Content System, a specification for managing content stored on the next generation of prerecorded and recorded optical media for consumer use with PCs and CE devices. A draft version of the specification is available at their web site.

From the specification:

AACS is designed to meet the following general criteria:

- Meet the content owners' requirements for robustness and system renewability
- Content encryption based on a published cryptographic algorithm.
- Limit access to protected content to only licensed compliant implementations.
- Support revocation of individual compromised devices' keys.
- Limit output and recording of protected content to a list of approved methods.
- Suitable for implementation on both general-purpose computer and fixed-function consumer electronics platforms.
- Applicable to both audio and video content, including high-definition video.
- Applicable to various optical media formats.
- Transparent to authorized use by consumers.

To meet these general objectives, AACS is based in part on the following technical elements:

- Robust encryption of protected content using the AES cipher.
- Key management and revocation using advanced Media Key Block technology.

#### B.2.3 Digital Living Network Alliance (www.dlna.org):

The Digital Living Network Alliance (DLNA), formerly called the Digital Home Working Group (DHWG), has developed interoperability guidelines that define the design principles necessary to move content from one consumer electronics (CE), personal computer (PC) or mobile product to another in a wired or wireless home network. It is likely that IPTV STB's will be required to work within such an environment.

#### B.2.4 IEEE 802 (http://www.ieee.org/portal/site):

Ethernet working Group (802.3).
Wireless LAN working group (802.11).
Mobile Wireless LAN working group (802.16) & WiMAX (802.16e)
Mobile Broadband Wireless Access Working Group (802.20)

### B.2.5 Metro Ethernet Forum (http://www.metroethernetforum.org/):

The Metro Ethernet Forum (MEF) focuses on Carrier Class Ethernet Networks and Services.

### B.2.6 TeleManagement Forum (www.tmforum.org):

The TeleManagement Forum (TM Forum) is focused on improving the management and operation of information and communications services. The TM Forum has a number of current work projects that may be relevant to IPTV.

The IP Network Management team defines management approaches for IP related services. Recent work has focused on the management of VPN and VOIP services. The team has now begun a project on the management of IPTV services.

The SLA Management team has been working for several years defining the structure and approach for setting and managing Service Level Agreements. Recently the team has produced a specific application note on managing SLA's for VOIP and is now considering other IP services such as IPTV.

The Services over IP (SOIP) team has the objective of enabling carrier-grade management of Services over IP. In order to achieve this, the goal is to trigger the development and delivery of resource management interface specifications that can be used for procurement by Service Providers for SoIP Business Agreement compliant products. The SoIP Business Agreement delivers a set of common business requirements needed to support the operational functions in managing and monitoring both the physical, logical resources and the specifications of their corresponding Customer Facing Services and Resource Facing Services Management Interfaces. This SoIP document provides a set of requirements and use cases that the TMF modeling teams can independently build a set of coherent (service and) Resource Management Interfaces to support service providers' SoIP offerings.

### B.2.7 Video Quality Experts Group (VQEG) (www.vqeg.org):

The Video Quality Experts Group (VQEG) is a group of experts from various backgrounds and affiliations, including participants from several internationally recognized organizations, working in the field of video quality assessment. One activity of the group is to evaluate the accuracy of objective video quality assessment tools with respect to subjective assessment methods and make recommendations on preferred assessment tools. The majority of participants are active in the International Telecommunication Union (ITU) and VQEG combines the expertise and resources found in several ITU Study Groups to work towards a common goal.

### B.2.8 WiMAX Forum (http://www.wimaxforum.org/index.asp):

Wireless Broadband

## B.3 Other Organizations

### B.3.1 Digital Hollywood (www.digitalhollywood.com):

Digital Hollywood brings together experts in the entertainment and technology industries. Of particular interest is its recent emphasis on delivering entertainment content via telephone companies, mobile and wireline. Presentations include many aspects of IPTV including digital rights management, content delivery, encoding/decoding issues and home entertainment networks. Companies represented at the conferences include IPTV providers, equipment vendors, content providers and software vendors.

### B.3.2 IPTV World Forum (www.iptv-forum.com):

The IPTV World Forum meets each spring in London. The forum brings together participants from the telcommunications, content, and technology industries to discuss IPTV service delivery and deployment, marketing and content. Sessions include marketing aspects of IPTV, IPTV deployment, and technologies that support IPTV deployments.

### B.3.3 Interactive TV Alliance (www.itvalliance.org):

The Interactive TV Alliance is an advocacy group for interactive television. The alliance is an independent, self-funded organization. Its relevance to IPTV lies in the fact that the success of IPTV is predicated in part on real-time controls that consumers will enjoy, from ordering food to playing along with game shows.

### B.3.4 rtsp.org (www.rtsp.org):

rtsp.org is the central repository for Real Time Streaming Protocol (RTSP) initiatives. RTSP is an Internet Engineering Task Force (IETF) initiative. The proposed standard (RFC 2326) describes control of streaming media on the internet. The repository includes information on RTSP deployments, relationships to other streaming standards, and an FAQ.