

PRELIMINARY INFORMATION ON BROADBAND TELEVISION

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1 - Preamble

1.1. Broadband Television (BTV) represents a *new alternative possibility for distribution of TV channels* to the home consumers. Whereas digital broadcast services using satellite, cable and terrestrial delivery continue to develop, Broadband networks (which are part of telecommunication networks) emerge as a *fourth platform* for digital television services.

1.2. BTV uses the existing telephone infrastructure¹ and conventional TV sets (rather than the computer screens). From the user's perspective, Broadband television is not too dissimilar to that of the traditional digital broadcasting television.

1.3. Broadband Television (BTV) is driven mainly by telecom and cable operators. Telecommunication operators started their business with phone services, extended them to data services and are starting now to offer television services. Cable operators started their business with television services, extended them to data services and are starting now to offer phone (voice over IP - VoIP) services. Key for both operators is the "Triple Play" offer, i.e. to propose all three services on one unique bill to their customers².

1.4. Broadband is the fastest growing medium in the home. Broadband services which are in the process of embracing BTV may potentially impact adversely the viewing of the conventional broadcast television. As their markets grow rapidly, BTV may delay or even hamper the rollout of digital terrestrial television (DVB-T) in some European countries.

1.5. The purpose of this document is to bring the BTV developments to the attention of the EBU Members. Members need to understand the importance of these developments and develop their own position about these developments, taking into account their specific economic, cultural and political environments.

2 - Introduction to Broadband services

2.1. Today Broadband operators offer a broad range of telecom services. These include telephone (now increasingly using Voice over IP), fast internet, Video on Demand (VoD), network storage, a variety of interactive services (e.g. games, e-government, e-commerce), etc. Since 2001, several Broadband operators have commenced some trials to embrace a variety of *linear television ("broadcast") channels*.

2.2. These trials have demonstrated that distribution of large number of linear television channels over conventional telecom circuits is technically feasible. It may be commercially attractive as it extends telecoms' traditional offer. In fact, Broadband networks may become a universal medium capable of carrying all telecommunication and broadcasting services. Broadband has a potential to become an "*all-in-one*" service.

2.3. As Broadband has a native capability to provide two-way services, it is ideally suited to provide *interactive services*, whereby the user interacts with the service provider. Broadband is capable of providing personalised content, sophisticated content search, comprehensive content description, a wide range of payment methods, a range of technical qualities, and advanced monitoring of consumer preferences and media usage.

2.4. Several Broadband operators have shown that Broadband television services can be cost efficient and can bring additional revenues to Broadband operators, thus compensating the declining income from the voice services. The necessary investments needed to upgrade the existing Broadband infrastructure to enable Broadband television are reasonable. Users are attracted by the fact that they pay only one bill for a bundle of services (rather than multiple bills to different service providers); the service bundle includes not only the usual telecom services but also "broadcast" television.

¹ In this document emphasis is given to DSL (digital subscriber line) technology.

² In some countries, notably the UK, cable was initially offered together with telephone on a separate twisted pair line. Later, starting from 1997 or so, telephony over coax became available. A part of Belgium, Flanders, is almost entirely "cable-phone ready" and the company offering it, Telenet, has over 220'000 customers (9% market share). This cable-telephony service is not VoIP. VoIP may actually undermine the conventional telephone business model.

2.5. Interest in BTV has increased significantly over past years, as they are seen by many Broadband operators as a means to drive revenue growth. Datamonitor believes that around 15 million households will be accessing BTV services by the end of 2007 – a significant increase over the 600'000 homes accessing these services at the end of 2003. It is predicted that the revenues will exceed \$7.5 billion in 2007.

3 - What is Broadband Television

3.1. BTV is the linear (“live”) and/or non-linear (“on-demand”) digital television service delivered over the IP-based Broadband networks³ in a controlled manner, using dedicated device such as a STB and a normal TV set (as opposed to PC). BTV resembles the conventional digital TV in terms of “look-and-feel” as a consumer experience and offers the user a possibility to interact with the content/service provider including On-Demand Television.

3.2. A BTV service is part of a Broadband services bundle. The target coverage zone is usually a small local area covering several hundreds to several thousands of households. The service provision is often organised vertically; a single provider takes care of all elements of the value chain.

3.3. The BTV services could be delivered not only on traditional TV screens but also on PCs, PDAs, Mobile phones and other embedded devices. In order to optimize rendition on such devices, the video and audio content should be repurposed to adjust optimally to the presentation capabilities of these devices. An interesting scenario proposed by the Savant project should be considered⁴.

3.4. Personal Video (Versatile) Recording and network storage functionalities should be considered. A PUSH Media-On-Demand has been proposed, which consists of a combination of network and local storage: a lineup of popular films is stored locally on a PVR-enabled STB and played instantly upon request. Service provider can supply PVRs with preloaded films by simultaneous downloading them on a regular basis to a group of subscribers.

3.5. BTV is to be distinguished from Broadband ("fast") Internet streaming. It is interesting to note the main differences between the two. They are summarised in the table below:

	Broadband Internet	Broadband Television
Coverage	worldwide	local (limited coverage)
Users	any	with a known IP address
Video Quality	best effort, not guaranteed	digital TV quality
Connection bandwidth	generally below 1 Mbit/s	between 1 and 4 Mbit/s
Video format	WM, Real, QT	MPEG-2, VC9
Receiver device	PC	TV set (with a STB)
Resolution	QCIF/CIF	full TV display
Reliability	subjected to contention	stable
Security	unsafe	protected
Copyright	often unprotected	protected
Customer relationship	generally no	yes
Mode	live and on demand	live and on demand

4 - Broadband value chain

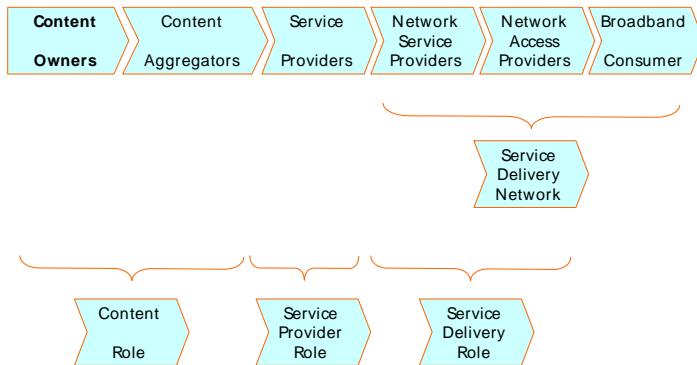
4.1. Broadband will enable the widest range of possible business models ranging from free-to-view, subscription, one-off purchase to any other innovative models. It should be possible for operators and service providers to retain their existing business models and to develop new models to keep pace with the evolving market.

4.2. Broadband is considered to be a user-centric model, whereby the end-user can choose what they want to see, and when and how they will watch it. Many different business models can be conceived to facilitate the access to content, improve user-friendliness and also a more efficient use of the distribution resources.

³ Since the Internet Protocol (IP) is used, Broadband TV is often called IPTV.

⁴ A parallel use of the main plasma (LCD) screen for the linear part of the programme and the PDA (or a mobile phone) for the individual interactive part.

4.3. The Broadband value chain can be split into three basic roles: content provider, service provider and service delivery provider⁵. The figure below shows these basic roles:



4.4. Content owners: produce content and are copyright owners.

4.5. Content aggregators: ensure that content coming from different content owners is suitably aggregated in a service package and delivered at the right quality level and without copyright infringements.

4.6. Service providers: are the entity that interfaces the customer. The service provider provides the consumer with the experience and that typically relies on large brand awareness. The networked version of content consumption brings new opportunities such as more flexible payment options and more advanced monitoring of consumer preferences. Several service providers can be aggregated into a so called service packager. Service providers may generate, compile and distribute some value-added services for the end user: service and channel information, weather forecasts, information bulletins, tourist information, etc.

4.7. Network service providers: provide reliable bandwidth-on-demand, presence information (who is connected to the network), billing and content hosting.

4.8. Network access providers: provide the physical connectivity, be it through fixed-line networks or mobile networks. While today's networks are mainly designed and provisioned for best-effort services, network access providers are increasingly upgrading their networks to handle audio-visual services that require a guaranteed quality of service from the network.

4.9. Broadband consumer is the ultimate reason for the above players to exist. An important concept is the increasing importance of home networks, which can include content servers, communication hubs and routers and networked consumer electronics devices. Appliances are spread over the home and interconnect via a private home network.

5 - What is the current status of Broadband Television in Europe and elsewhere

5.1. Following several experiments towards the end of the 90's, a breakthrough was made by Fastweb in Italy in 2000. Currently several experimental and operational services are being carried out in France, Germany, Italy, Spain and the UK. The most advanced BTV country is France with 6 projects being implemented or considered in the forthcoming months.

⁵ This value chain applies to both broadband internet and broadband TV.

5.2. The Table below gives an overview of the existing BTV projects in Europe.

European Broadband Television Projects (Status: May 2004)					
<i>FC: Free Channel PTV: Pay TV VOD: Video On Demand</i>					
Operator	Name of project	Start	Offer		
FRANCE					
Free	Freebox	November 2003	FC	PTV	
France Télécom et TPS	TPSL/MaLigne TV	December 2003	FC	PTV	VOD
UPC France	UPC TV Numérique	March 2003			
Neuf Telecom -Canal+		March 2004	FC	PTV	
Tiscali France		July 2004	FC	PTV	VOD
ITALY					
Fastweb	Fastweb TV	October 2002	FC	PTV	VOD
Wind TV	Wind (Enel)	March 2004			
Digital Television	NC	2004	FC	PTV	VOD
Posi-TV	NC	2004	FC	PTV	VOD
GERMANY					
T-Online	Vision on TV	March 2004			VOD
Hansenet Telekom	MovieStar	July 2002			VOD
UNITED KINGDOM					
Video Networks	Home Choice	October 1999			VOD
Kingston Communications	KIT	September 2000	FC	PTV	VOD
SPAIN					
Telefónica	Imagenio	March 2002	FC	PTV	VOD
CYPRUS					
Cyta	InterComms	May 2004	FC	PTV	VOD
MONACO					
Monaco Télécom	Libello	Q1 2003	FC	PTV	VOD
AUSTRIA					
Telekom Austria	Aon.TV	June 2003	FC	PTV	VOD
NORWAY					
Telenor	Telenor Broadcast	October 2003			

5.3. Fastweb (Italy)

- Operated by e.Biscom, the first triple play operator in Italy
- VoD trials from 2000, jointly by e.BisMedia and RAI Click
- August 2003: start of multicast TV channels, several football channels, covering some 60'000 subscribers
- Offers 7 terrestrial and 80 satellite live channels
- EPG: Picture-in-picture preview and scheduling
- From 2002: VoD server contains more than 3000 titles
- VoD: 6 areas: Film, Sport, Kids, Music, Lifestyle, Documentaries; Games, T-commerce, interactive areas, interactive advertising
- Customer profiling: analyze detailed usage reporting in order to design a better product, profile customer communication such as banners, video, localized information and create a "Customer Care Online"
- Interactive TV. GiveMe5 Quiz game, Mini BMW, Interactive films
- Video Communications: TVcam; Multi-party conversations, video messages, video galleries, chat & forums

5.4. Free (France)

- Started in December 2003
- Operated by Internet Free
- Coverage area in Paris and Lyon
- Triple play services(simultaneous VoIP, fast internet 2 Mbit/s and BTV – MPEG-2 of 3.5 Mbit/s). No VoD. No "picture-in-picture" and no network storage
- New Freebox model in Q2 2004 (which will include Wi-Fi)
- Subscribers only pay for telephone and internet charges: €29.99/month, BTV service (including a Freebox) comes for free
- More than 100 TV channels, including France 2, 3 and 5, TV5 Monde, Arte, Euronews
- 25 channels for free, others are paid up individually and some as a package
- An EPG provided together with TV Magazine
- Until March 2004, 100'000 Free boxes were distributed

5.5. HomeChoice (UK)

- Operated by Video Networks in North London
- It offers "always-on" fast internet of 1 Mbit/s , digital television channels and on-demand movies
- These services are delivered to PC and TV through BT phone line via a small stylish STB
- The TV channel line-up includes BBC, Paramount Comedy, Discovery and Eurosport
- There is a selection of on-demand TV channels such as C-One (which features some of the best recent TV hits from the US and UK)
- There are also hundreds of new film releases and V:MX music channels covering a range of music genres including hits, pop, urban, easy and dance channels
- You can create your own playlist
- There is "Scamp" - the new kids channel
- With a Personal Identification Number (PIN) issued for each member of the household it is possible to control viewing
- Cost: £35 a month and £1 for installation. The STB is for free

5.6. T-Online (Germany)

- Operated by T-Online
- VoD and video via T-DSL: blockbusters and T-Online archives
- Flat rate for DSL: €16.99/month, all fee-based services charged to the Deutsche Telekom phone bill
- TV channels are available via cable/satellite: Themes (choice of news, sports and entertainment), separate payment of €29.99.
- PIN (personal identification number) for parental control
- Basic EPG: up to 3 weeks in advance, TV recording control, convenient search functions
- WebMail service via TV set

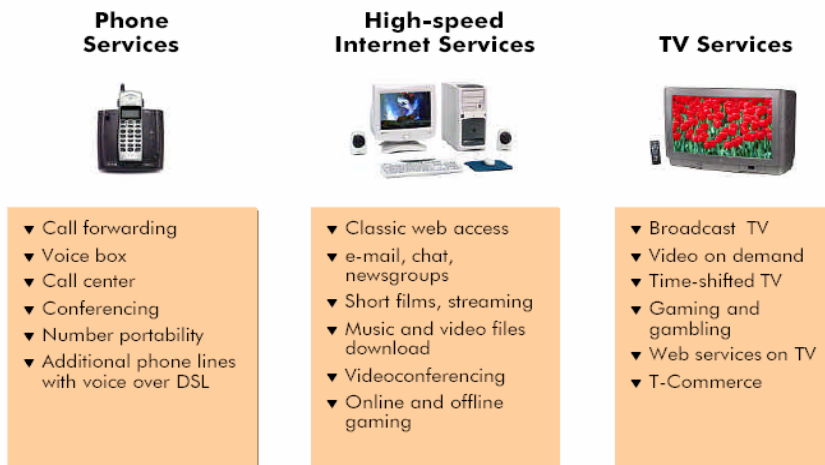
- Activy Media Centre by Fujitsu Siemens: PVR (240 hours), time-shift function, DVD player and recorder⁶, fast internet connection, LAN connectivity, satellite/cable receiver, two tuners, price: beginning at €99

5.7. MaLigneTV/TPLS (France)

- Operated by France Télécom, responsible for the network aspects, and TPS, responsible for TV programming
- TPS is owned by TF1 (66%) and M6 (34%)
- Two contracts: one for the access: MaLigneTV, the other for TPS content: TPSL
- Coverage area: La Part Dieu Lyon (September 2003) and Paris (Q2 2004), followed by services in other large cities in France by Q4 2004.
- No limitation due to last-mile unbundling (dégroupage)
- Cost of MaLigneTV: €16 and @64 for the activation of service, €75 deposit
- Cost of TPSL: €21 and €40 for the activation of service.
- BTV: 48 TV channels including TPS Star (which is the premium TPS channel), 6 cinema channels and all national TV channels
- VoD: films, TV archive, TF1 news, M6 magazines and children programmes costing between €0.5 and €7
- TV centric services, no PC involved

6 - Which services can be made available over Broadband

6.1. Broadband operators typically offer telephone and high speed internet services. Increasingly, they offer a "Triple Play", i.e. a combination of phone, fast internet and television services. See figure below:



6.2. Broadband is able to provide not only conventional communication services but also a variety of value added services. Specifically, the following services can be included in the Broadband offer:

- **Communication services:** phone including VoIP, email (possibly with pop-up notification messages), Instant Messaging (IM) and discussion forums, emergency warnings, remote wake-up services, favourite programme reminders and birthdays
- **Interactive services:** navigation, user interface, interactive gaming, e-government, targeted advertising, personal video recorder (networked), videoconferencing
- **Interactive television (iTV):** non-linear TV, time-shifted TV, PVR service, with the user capability of significantly influencing the flow and rendition of the programme, e.g. selection of camera viewing angle, choosing ancillary information, using trick mode, etc.
- **On-demand Television (VoD):** delivery of films and other programme items, available on-

⁶ Recorder is included in Activy Media Centre model 350.

demand individually by each subscriber (either continuous streams or downloadable files - in case of local PVR). Near-VoD (same film on a different channel, starting every 15 minutes, say) and Scheduled-VoD (a film distributed to a group of users/PVRs, possibly overnight when there is less network traffic) are interesting variants.

- **"Broadcast" digital television:** multi-channel linear (live) television services, served according to an advance schedule of programmes and viewed on a TV set

7 - Broadband business models

7.1. In order to understand the business incentives behind the launch of BTV, it may be instructive to consider the situation in France. The launch of BTV on ADSL was engineered by two important organisations. TF1, a French national broadcaster, and France Télécom. TF1 launched the BTV services in order to complement (and enhance) their TPS (Télévision par Satellite) in urban areas where satellite reception is less viable. France Télécom, on the other hand, wanted to boost the use of fixed lines by introducing TV on ADSL, as their business figures on voice communications were in decline during recent years.

7.2. The second factor that contributed to the advent of BTV in France was a successful process of last-mile "unbundling" which potentially opens competition for ISPs and drives prices down. All major geographical areas of France have been unbundled: Paris, Lyon, Marseille, Nice, Toulouse, Bordeaux, Lille, and others.

7.3. The third factor is the sharp fall of equipment prices; DSLAMs, modems, coders and decoders are for a factor of 2 cheaper than two years ago.

7.4. Network providers: Network providers gain most from BTV. They all have one main objective: to gain additional profits due to BTV. As the telephone cable infrastructure is already in place, the investment costs are relatively low. Nevertheless, network providers have to invest into DSL Access Multiplexer (DSLAM) and other special network elements which allow BTV services. In order to provide authentication, authorisation and accounting (billing) services, each user connected through a DSLAM must have a connection to a Broadband Access Server (BAS). To facilitate this connection, DSLAM can be connected to the BAS directly or via an aggregator to reduce the number of links to the BAS.

7.5. Payment models: Broadband environment can provide several ways for the users to pay for the services offered. The users can choose the mode of payment that matches their needs and this helps to reduce churn. The most popular model of payment today is a *prepaid account*; where users decide in advance how much they are willing to spend. More conventional models are *monthly subscriptions* or *fixed-price sales*. In order to increase revenues, operators offer attractive offers such as *bundling services* and *bonus schemes*. Bundles allow segmenting of package pricing, so that users may choose a package that matches their expectations. Bonus schemes aim at increasing the consumption by offering higher bonuses.

7.6. Possible models for broadcasters: There are, or may be, opportunities for broadcasters and possible synergies with other players are duly addressed. For example, a broadcaster may provide TV/video content and package it, and may act as a BTV service provider. In addition, broadcasters have extensive production facilities and can produce high-quality contents (drama, reportage, news, entertainment, etc.) or could offer their archives as part of the BTV service.

7.7. User costs: Broadband is basically a "one-stop shop" which can deliver a variety of different services over a single transport infrastructure. BTV is one service, among many others. The user cost situation for broadband is similar to that of the cable delivery. Generally, the user has to pay for the modem or set-top box, access and the content packages. Often the user may benefit from paying one bill for the bundle of services received. Different countries have different payment arrangements, but in addition to a subscription for the broadband services received, the end user has to pay also a separate license fee for the public broadcaster's television services which must be carried by the BTV service⁷ (see Section 8.5). Often a network fee is charged separately (example: T-Online).

⁷ The licence fee is the essential form of funding of public service broadcasting in most European countries; the obligation to pay the licence fee is laid down by law, and usually in the law regarding radio and television broadcasting. In certain countries the requirement to pay this fee is linked to the possession of reception equipment (a radio or television receiver). In the view of the EBU Legal Department, the obligation to pay the fee should, in principle, be independent of the transmission means and reception technology used, but attention should be given to the concrete wording of national provisions.

8 - Some regulatory matters

8.1. As BTV uses Broadband connections, it is affected by the regulatory provisions surrounding the rollout of Broadband. Countries follow different approaches to regulate Broadband, ranging from the "light touch" to "cooperative" and "government – led" approach. Countries which have adopted the light touch approach take only small-scale actions to support Broadband rollout. This is done by creating transparent regulatory frameworks that facilitate competition and access. There are no direct government subsidies to Broadband. The "cooperative" approach involves some economic levers to incentivise Broadband rollout. For example, in the US this has included direct subsidies and tax reductions. Direct funding of infrastructure expansion has been adopted in Korea, Japan and Sweden. The objective of these countries is to conduct comprehensive government-funded education and training programs with explicit social and development objectives. Reforms of the regulatory structure to ensure a competitive industry in Broadband delivery have been carried out.

8.2. As BTV is still in its infancy, the regulatory matters associated with it are not fully considered by the media/telecommunications regulatory bodies. For example, it is still being discussed in many countries which authorities should be entrusted to regulate the Broadband content.

8.3. The EBU⁸ supports the distinction between the communications infrastructures and the content conveyed over such infrastructures – as a basis for future regulation. Having different regulations addressing the infrastructure/transmission aspects and the content aspects should not, however, be interpreted as being a complete separation of both. Coordination of the regulatory frameworks is needed to take account of the many links between content and transport, particularly as far as access to content is concerned. The regulation of communications infrastructures must ensure that the networks continue to fulfil their vital function for the distribution of audiovisual media and other content services.

8.4. In a number of countries, TV channels are subject to regulatory constraints relating to content, child protection and a mandate to support original and sometimes local production. To this end, if we perceive the telephone network as a "broadcasting" network, it must then be addressed like cable or satellite, i.e. it does not involve the creation of new forms of distribution (a channel is a channel, regardless of its broadcasting mode).

8.5. Generally speaking, then, is the sector regulated by the telecom regulator or by audiovisual regulators? Making homogenous rules for content, regardless of transmission platform, represents a key issue whose evolution will differ from one country to the next.

8.6. The EU Television Without Frontiers (TVWF) Directive stipulates that television channels (public and private) are subject to a certain number of rules related to the content of programmes in terms of, for instance, the protection of minors, advertising, sponsorship and promotion of European works. The development of digital television and new interactive audiovisual services raise the question of whether the current scope of the Directive and the definition of television broadcasting are still adequate. The current EU regulatory framework makes a distinction between television broadcasting services (covered by the Directive) and information society services, supplied on individual demand (covered, in particular, by the e-commerce Directive). In comparison with the Directive, the e-commerce Directive is a much lighter framework. At any rate, the present definition of television broadcasting in the Television without Frontiers Directive is too narrow to deal with new developments. It is a major challenge to adopt a regulatory framework for television broadcasting and new interactive television services which is as coherent as possible, it being acknowledged that this may include a graduated approach. Technological developments involve no change to the general interest content objectives which have to be respected by all audiovisual services.

8.7. Must-carry: Must-carry rules are a crucial element in ensuring that all viewers continue, in the new technological environment, to receive at least some free-to-air services, no matter which platform they choose. Must-carry rules place an obligation on the network operators to distribute certain radio and television channels whose purpose is to fulfil public interest objectives for society. Under certain conditions laid down in Article 31 of the EU Universal Directive of the new regulatory framework for electronic communications networks and services (adopted in March 2002), Member States have the possibility of extending the must-carry rules beyond the cable networks and covering other networks. Thus, must-carry rules should apply to BTV.

8.8. Copyright: Contrary to the open Internet services which are available to everyone with an Internet connection, Broadband services (including BTV) are available only to a traceable (e.g. subscription-based) user base, usually located in a closed geographical area within a radius of a few kilometres. To this end, it is possible to limit access to Broadband services to a given territory, which would meet territorial constraints of copyright

⁸ See EBU Comments on the EC 1999 Communications Review.

licences if such limits were put by the copyright licensor. While streaming of copyrighted material (such as the broadcast of sport events or music) over the internet may prove to be difficult or even impossible, for legal reasons, Broadband networks have generally much less of such difficulties, subject to successful negotiations between rights owners and Broadband providers⁹. If there are simultaneous transmissions of broadcast television by Broadband operators, this could be regarded – from the regulatory point of view – analogous to cable transmissions, which implies that the broadband operator is responsible for clearing the necessary rights from all rights holders before it can use any TV channel on its services.

8.9. Digital Rights Management (DRM): Copy protection mechanisms may include more or less sophisticated usage control systems. DRM can allow, for example, users to view a movie once, a number of times or indeed without any limitation during a specified period or for a lifetime. Users can purchase the right to create one or more copies. Allowing for a fine granularity of media consumption, DRM may become a tool for creating new pricing models. The decryption key is delivered upon request by the user through a secure interactive channel from a license server. However, any DRM system must be acceptable to all stakeholders, including consumers.

8.10. Conditional Access (CA): is a mechanism to protect media during its transport from the media server to the user. The use of CA here is similar to the one used in conventional digital television (DVB).

8.11. Privacy: In traditional broadcasting end users remain anonymous. Broadband operators, on the contrary, can trace the usage of their services and assemble statistics of users' behaviour. This personal data should be suitably protected in accordance with the applicable laws and not misused for commercial or similar purposes.

8.12. Parental control: In DVB a parental control signal is embedded in the signal, potentially slowing down zapping. In Broadband, it is possible to prevent that a TV item is sent to a user who does not fulfil the required criteria. Thus, BTV can provide a tighter control than conventional television.

9 - Broadband Television versus Broadcast Television: possible differences and synergies

9.1. The main distinction between BTV and conventional broadcasting television such as satellite, cable and terrestrial lies in the delivery mechanisms. Whereas the broadcasting delivery mechanisms are one-way channel (transporting the signals in "down-stream" direction, i.e. from the studio to the user), Broadband is intrinsically a two-way service, which includes both "down-stream" direction and "up-stream" (or return channel) from the end user to the studio. The Interactivity is a natural functionality of Broadband Television and does not require any particular adjustments and additional equipments.

9.2. Another characteristic of Broadband is that it is capable of *carrying simultaneously* voice (telephone conversations), high-speed data, Ethernet (IP data) as well as video and a multitude of live television "channels"¹⁰.

9.3. For this reason, Broadband is seen by many as a universal, future-proof, and common platform which will cater for all communication services needed by the end user, including radio and television,. Initially, Broadband will use the existing physical supports such as twisted phone lines (using DSL) and television cable (using Docsis), but increasingly Broadband will use fibre to the home (FTTH).

9.4. As a home may have two or three television sets, it is important that different channels can be displayed by these television sets at the same time. This can be readily achieved in broadcasting, however in Broadband a special provision needs to be made to accommodate two or three simultaneous television streams in the access network.

9.5. Depending on the relative commercial success of BTV and DTT services in a local or national market, it could be interesting to explore possible synergies between BTV and DTT in terms of complementary coverage, common set of services and common set-top boxes.

⁹ Broadband operators can relatively easily control the reach (coverage) of their services, as every user can be identified by an IP number. The coverage is usually limited to a contained geographical area, therefore a risk of right infringement is minimal, contrary to conventional broadcasting where "technically unavoidable overspill" may imply some uncontrolled access to contents.

¹⁰ As explained in the Appendix, the choice of television channels is limited by the capacity of the core network. The number of channels that are simultaneously available to the end user, however, depends on the capacity of the access network. Typically, only one or two TV channels are available to the end user at any given time due to the limitations of the last mile ADSL network.

9.6. For example, DTT is generally capable of providing several high-quality television channels over a large area. The number of channels will vary from country to country and will depend on the spectrum available and sharing constraints with other services. Whereas DTT covers the whole territory, reception indoors (within buildings) without external aerials may require excessive transmit power. In such cases BTV could help and provide the same channels (plus any value-added services), so that both television services can be considered complimentary. The rationale for complementarity of BTV and DTT can work in the opposite direction as well; it is probably not viable to implement BTV services over a whole territory, as the number of DSLAMs required would be very large, and thus expensive. DTT could help, so that television services could be integrated in the Broadband services offer.

9.7. A common set-top box for both DTT and BTV should be developed in order to enable this "synergetic" scenario to materialize. Example: Kreatel: IP-STB 1520. Another condition may be that both DTT and BTV provide similar set of television services of comparable service quality, so that the end user will not notice any significant difference.

10 - Broadband Television and home networks

10.1. In a not-so-distant future different entertainment user devices will be connected in a home network. This implies that television and radio sets with set-top boxes, personal video recorders (PVR), DVD players, game consoles, digital cameras, stereo and home theatres with hard disk drives (music and film servers), audio storage appliances, camcorders, wireless devices, multimedia mobile phones, computer equipment with accessories such as printers, will be interoperable and will be able to communicate between themselves. The multitude of these Internet, mobile and broadcast devices requires transparent, reliable and interoperable home connectivity.

10.2. It is essential that all devices of the network are able to communicate with each other and with the outside world. To this end, all devices should use the Internet protocol (IP). However, while home entertainment devices are increasingly moving from analogue to digital formats and interfaces, not all of them are already digital. Some of analogue devices such as TV sets and AV amplifiers/receivers may use IEEE 1394 for short-distance media transfer and control. As 1394 has the ability to transport IP, all analogue and digital devices may become part of the home network.

10.3. The home networks based on standardized *home gateways/media servers* will be important for the commercial success of the Broadband systems. Digital Home servers provide media acquisition, recording, storage as well as content protection.

10.4. One of the important features is user-friendliness. To this end, auto-configuration and plug-and-play are needed for easy installation of the equipment on both terminal and network server sides. This eliminates the need for users to manually configure a device for each service.

10.5. A Universal Plug and Play (UPnP) is an open standard architecture which simplifies home networking by providing auto-configuration and automatic discovery of any new equipment in the home LAN network. This architecture is independent of the operating system and network technology.

10.6. There may be reasons for the access network to be able to deliver two (or more) separate streams: In the case of local storage available by the user's PVR, one stream is used for watching, and another one for recording. Watching TV simultaneously at different locations in the home (e.g. living room, children room, kitchen) also requires multiple streams.

10.7. One of the perceived advantages of the home network approach – compared with the conventional "unconnected" broadcasting - is the user-friendliness for the whole family. In particular, the users can

- set up their personal profiles (which may vary for the different members of the family),
- customize the presentation of the media,
- set up the preferred choices of services,
- monitor the usage, ratings, charging and billing (a "self-management" functionality)
- exercise parental control,

10.8. In case the home network is connected to the open internet, there is a risk of viruses, Trojans and other kinds of intrusion. Suitable firewall and security measures should therefore be taken.

11 - Service Guides

11.1. A Service Guide¹¹ allows the user to discover the available services, fetch the description information for each channel, and select the available services. The users should be able to pre-set their own preferences (e.g. channel order). Optionally, a Service Guide may assist the user to resolve any rights issues in order to be able to access the content and perform payments.

11.2. Service Guides may be set up by the service provider, network access provider, network service provider or set-top box manufacturer, depending on whether BTV services are deployed in a horizontal or vertical market. In some cases an independent authority could maintain a web site of all BTV services available in a given territory.

11.3. Should several Service Guides be available to the user, they should have freedom to choose a preferred one.

11.4. In practice there may be some competition among the providers concerning their branding and "visibility" for the end user (e.g. visibility of brand names and logos).

11.5. It is important that the zapping time (switching between channels) be reasonably short.

12 - Which middleware should be used

12.1. The middleware (sometimes called API – Application Program Interface) is an interface layer between the services/applications and the system platform. For the reasons of interoperability, middleware should be an open standard, so that, ideally, any system platform could render any service or application.

12.2. The use of common API at the content provider level may alleviate unnecessary repurposing and may significantly reduce content production costs. It is thus advisable to agree a common API. Content providers need a flexible API approach to target different digital television platforms such as DTT, BTV, Mobile TV and others.

12.3. Similar to digital television broadcasting, an open API should be agreed for the consumer devices. Given that Broadband Television may use the same (or similar) applications as Broadcast Television, it would be advantageous to adopt the same API in both areas.

12.4. As the Broadband Television market is still largely a "green field" market, it is advantageous to adopt the open API based on DVB MHP. The business advantage of adopting the same open API standard across all digital television platforms will be - due to economy of scale - an essential asset. MHP provides a standardised, future-proof, flexible and cost-efficient solution for television-centred applications.

12.5. It is recognised that a different API could cater for the various telecommunications functionalities if low-cost options are a prime objective. Such API could be based on the Internet-based technologies such as enhanced HTML.

13 - Will BTV embrace HDTV?

13.1. High Definition is becoming a regular service in the US and Japan and is now gaining momentum also in Europe. Satellite HD transmissions are already taking place (Euro1080 digital satellite services started in January 2004), HDTV systems are fully standardised within ITU-R, flat panel displays WideXGA are cheaper and cheaper, the penetration of HD-DVD players is rapidly increasing. By the same token, multichannel audio installations (based on Dolby Digital and DTS) grow fast.

13.2. With increasing competition from satellite and cable operators which offer triple play of voice, video and data, Broadband providers must find a way to provide increased video quality more efficiently and economically than today. Typically, households now contain several television sets, each showing a different channel. Sports and music video programmes require high video and audio quality resulting in potentially high bit rates.

13.3. New compression technologies openly standardised within ITU such as H.264/AVC for video and HE AAC for audio should be used for Broadband television. These new formats may reduce the bandwidth required by as much as 50% compared to MPEG-2 and are potentially capable of delivering HDTV and content on demand to more subscribers.

¹¹ Service Guide is equivalent to EPG (Electronic Programme Guide) used in digital broadcasting.

13.4. The number of live television channels available is limited by the capacity of the core network (see Section 16). As HDTV requires more bandwidth per channel than SDTV, less channels could be fitted into an STM-1 carrier. In order to implement HDTV, the core networks capacity should be augmented and/or a new compression technology should be used.

13.5. The limited capacity of the DSL access network, often limited to 1 Mbit/s or below, is the principal constraint for the introduction of HDTV, as the latter typically requires more bandwidth than standard definition TV (SDTV). Should there be a need to supply more than one HDTV stream to the home, the problem becomes even more difficult. Of course, the use of advanced coding schemes may help ease this problem.

14 - Some open issues

14.1. The first open issue is related to the *technology and infrastructure* of BTV networks. There are two parallel processes: development of networks and development of more efficient compression technologies. Both processes will determine how quickly BTV could offer several concurrent TV programmes to the user and whether or not standard TV quality could be replaced with enhanced or high definition TV.

14.2. It may seem trivial but one of the most annoying practical problems is the place of telephone sockets in a house. Usually these are located at different places than cable television or satellite sockets, so it is necessary to draw a cable between the telephone socket and the TV set across the room. More recent building architectural designs may overcome this problem.

14.3. In the area of technology the following main issues apply:

14.4. Providing open and standardised interfaces between the different equipments used in the value chain: content aggregator, third-party application provider, network access provider and user

14.5. Not all DSLAMs now in operation are video enabled. Network providers need to upgrade their existing networks, should they want to carry BTV services.

14.6. Which standardised middleware should be used to allow consistent rendering and presentation of media? Is DVB MHP or a subset of it a suitable candidate for television-related services?

14.7. Which user-friendly interface including the electronic programme guide should be used in the home?

14.8. How quickly will the access networks migrate towards ADSL2Plus and GigaEthernet?

14.9. How soon will MPEG-2 coding technology be replaced with MPEG-4 AVC or Windows media 9?

14.10. There are several *regulatory issues* related to the nature of Broadband networks and to the "must-carry". **These issues are to be resolved at a national level in the regulatory framework of electronic media.**

14.11. There are also issues of *commercial viability*.

14.12. Is this business sustainable in the long term?

14.13. Is it sustainable and commercially viable to adopt a model, as it is done by Free in France?

14.14. Which services, apart from a multitude of television channels, will become the most popular on Broadband networks?

14.15. Which is the optimal model to allow fruitful collaboration of the telecom operators, television bouquet operators, public and commercial television broadcasters, content producers and other players?

14.16. Is BTV to be a niche market or could become a mass market ?

14.17. There may be a sensitive question of a *license fee* (fr. *redevance*) to be paid by the end user (see Section 7.7). This question needs to be addressed, as BTV allows the user to access "broadcast television" through a telecom network, rather than through a conventional broadcast network, and through computers, mobile phones and other personal devices, rather than conventional TV set¹².

¹² A similar question applies for the case of putting broadcast channels over mobile networks such as UMTS.

15 - Concluding remarks

15.1. This document was prepared to provide a "wakeup warning" to those EBU Members who have not already started to give some serious consideration to Broadband Television and their early implementations in the market. The document draws attention to some potentially critical issues related to the broadcasters' role in these developments.

15.2. As any other new development, BTV may be considered as a potential opportunity to some and a potential threat to others. Generally, telecoms consider it an opportunity and potential new revenue stream. Many broadcasters consider it a competition to their core business.

15.3. Today Broadband networks experience high increase in penetration in many European markets and BTV services started some initial services from the year 2000 onwards. It is very difficult to predict whether BTV will be a niche market or could become a viable, mainstream television service in the future. As always, this will depend on the content and services made available, the cost and convenience for the user and the regulatory arrangements.

15.4. The situation on BTV varies from country to country. The most advanced country in BTV is France. The advances in BTV have probably slowed down the progress of rolling out Digital Terrestrial Television (DTT) in France.

15.5. Today BTV is considered as an appropriate new distribution medium primarily for local services in highly build-up urban areas where terrestrial receiving antennas are not possible or allowed. In this respect, BTV can be considered as complementary to other delivery methods.

15.6. BTV faces a number of challenges, both technical and regulatory, calling for quick resolution. With little or no legacy issues, BTV is ideally suited to embrace high compression technologies for audio and video.

15.7. The EBU Members should pro-actively embrace BTV, launch technical and commercial trials, gather experiences and acquire new markets. In particular, they should investigate into new interactive programme formats and develop some personalised services to attract new audiences (particularly among younger generations).

15.8. Broadband enjoys a significant political and regulatory support from many European governments and European Commission. It is seen as a means for increasing media plurality and competition, and is positioned as the future "all-in-one" service bundling all communications and broadcasting services together in a single "media package".

15.9. It is clear that Broadband is likely to change the traditional broadcast landscape. Broadcasters will need to adapt and adjust themselves in order to be able to survive and prosper in the future.

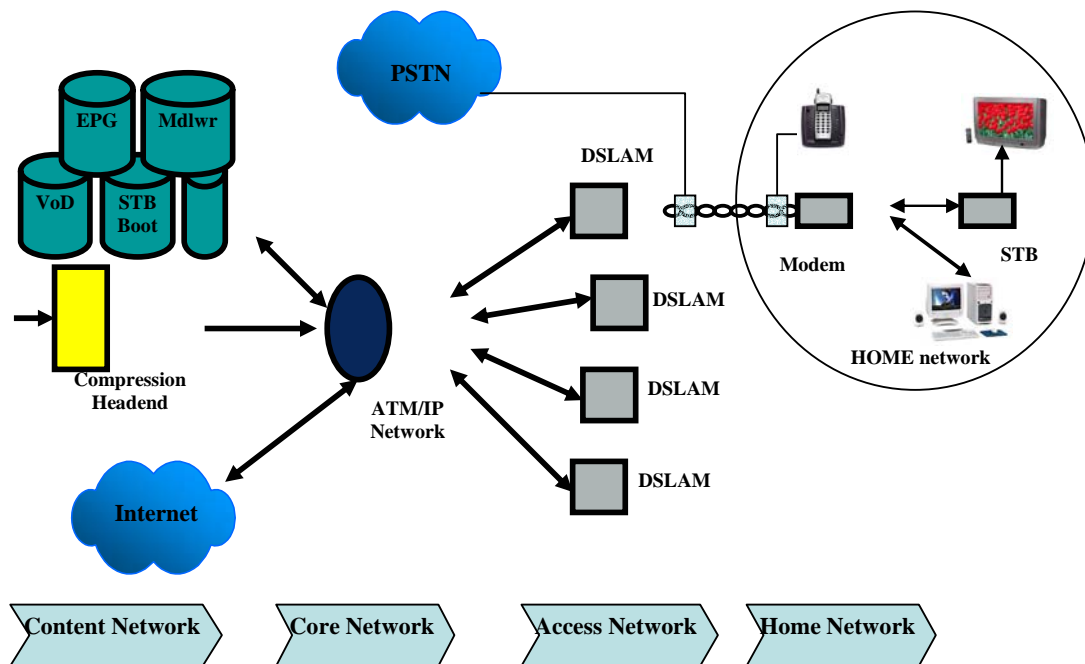
Appendix

16 - Main technical characteristics of Broadband Television

16.1. A BTV system consists of a content network, a core network, access network and home network. The core network adapts all the media sources to the access network (also called the last-mile network) which brings the media to the end user. The access network may use several DSL (Digital Subscriber Lines) technologies which differ primarily in their spectrum masks and the number of tones used for transmission in each direction. These technologies are steadily improving and new generations continue to be developed:

- ADSL,
- ADSL2,
- Reach Extended ADSL2 (READSL2),
- ADSL2Plus
- Very High Bitrate DSL (VDSL). Two variants of VDSL have been standardised based on single carrier Quadrature Amplitude Modulation (QAM) and multi-carrier Discrete Multi Tone (DMT) modulation. DMT offers advantages over QAM in terms of performance, robustness to noise and spectrum flexibility. It also allows interoperability with ADSL.

16.2. An essential element of a BTV network is the Digital Subscriber Line Access Multiplexer (DSLAM). This new unit is normally located at the local exchange and is used to concentrate the traffic of the last-mile network onto a higher carrier such as STM-1 of the core IP network. IP-enabled DSLAMs with built-in aggregation functionality reduce significantly required bandwidth in the core network, since IP multicast is used for TV channel distribution from the ISP head-end to the DSLAM. Thus, one TV channel is distributed to each DSLAM only once. For example, consider an ISP who delivers 30 TV channels to its subscribers. Assuming 4 Mbit/s per TV channel, a total capacity of 120 Mbit/s is required for the core network. This will fit into an STM-1 carrier.



16.3. The number of TV channels that can be accommodated only depends on the capacity of the core network. The number of subscribers is limited by the unicast traffic allocated to each subscriber. Typically, up to 1000 subscribers can be connected to one DSLAM.

16.4. The use of IP multicasting is essential; without this it would only be possible for about 35 subscribers to be terminated at the DSLAM. This is because each user requires a 4 Mbit/s dedicated pipe allocated from the DSLAM to the aggregation point to carry the TV channel. To this end, the STM-1 carrier bandwidth becomes the limiting factor.

16.5. In addition to IP multicasting, the Routed Bridge Encapsulation model is used with DSL video deployments. The RBE model implies that all packet forwarding is carried out at Layer 3: IP layer. DHPTV relay forwarding and auto-instantiation of routing table entries in the aggregation device help eliminate the potential issues with IP address allocation and routing.

16.6. At the customer premises, the copper pair is terminated in a DSL modem. This modem connects to the telephone and uses 10/100-Base-T Ethernet to the TV STB and the PC.

16.7. The DSL network architecture can gracefully migrate towards other last-mile technologies without changing the core technology. One last-mile access alternative is Ethernet which is used in FTTH (fiber to the home) networks. In FTTH networks the copper wire (linking the edge router with the subscriber's DSL modem) is replaced with optical fibre which allows for a symmetrical delivery of several Gbit/s to the end user. Thus, fibre can bring several dozens of concurrent TV channels to the home, allowing for seamless switching between them.

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