HLSG

High Level Strategy Group
for ICT

HLSG 99/33

HLSG Report No. 4

Strategic Recommendations
for
”Intelligent Multimedia Networking“

Edition 1.0 - 25.03.1999

Working Group for the HLSG project No. 4, ”Intelligent Multimedia Terminals“

Project leader and editor Göran WAHLBERG
Nokia Corporation

Project group members:

Göran WAHLBERG, Nokia	(EACEM)
Jean-Pierre EVAIN, EBU	(EBU/ACT)
Peter BUMANN, Bosch Telecom	(ECTEL)
Östen MÄKITALO, Telia	(ETNO)

Content

Executive Summary

The HLSG project No. 4 was established to further study barriers in the implementation process of the Information Society. The process of removing the barriers defined in the HLSG report 1, 2 and 3 has progressed more slowly than anticipated. Project 4 has therefore addresses some of the described barriers once more.

The project has identified that requirements set by the content and content related services are not well understood. Real time services set many requirements on the data transport system. This has in many cases not been considered enough and gaps in standardization can be found. Such can be found especially in cascaded broadband networking, in interoperability between networks and in interoperability of multimedia services in end-to-end systems.

The networks are often taken as transparent to the content and related services. This would be the ideal case, but is however not always the case, especially not for access networks. In controlled / managed network environments inside one operator such transparency can be found, but when more B-ISDN networks are connected to each other, or different types of network are cascaded this is not anymore the case. Managed core / backbone network usually as well can provide the quality required on leased lines. This report therefore uses rather much space to explain the services and the impact they represent to networking and service interoperability. A special focus has been on broadband real time data transport, as it represents the biggest challenge to networking.

The services in the Information Society are more and more getting a global nature, which means that the infrastructure should be based on global standards. This requires the standardization process to become more global than the case is today. The interoperability between circuit-switched networking and IP networking represents an area where a number of unsolved issues occur. IP networking is on the way to become real-time for voice communication, but not for real time multimedia. Data across network boundaries will ask for new solutions for content transport, signaling, billing, security etc.

The huge number of different services will as well create an even larger number of different terminals e.g. remote medical terminals, mobile phones, TV receivers, and computers. The range will be from single task to full features multi-task terminals. The major problem will be to transport the services from the service provision to the terminal. This project is therefore more addressing the important and often issues of the transport rather than the terminal. The project report does not include any work on e.g. PCs, radio and TV receivers as they are already in the implementation phase though there are still open issues on APIs for service navigation etc.

1. Introduction

HLSG has identified a number of barriers in the Information and Communication Technologies (ICT), which are restricting or delaying the implementation of the Information Society. Earlier HLSG projects have been analyzing related barriers and the result have been reported and a number of recommendations have been issued for removing the barriers:
Report No. 1: Barriers to Broadband Networking
Report No. 2: Barriers to Electronic Commerce
Report No. 3: Home Information Services

Project no. 1 describes the barriers of the full chain. The next paragraph and figure 1 are ported from project 1.
A number of gaps in Standards, Legislation and Policy can be observed which impede the deployment and use of European Broadband Networks
This section list the key issues to be addressed by standards bodies, legislators and regulators to enable a broadband information infrastructure to come about. It is not exhaustive but focuses on gaps in standards, legislation and government policy, which could seriously impede the spread of broadband applications in Europe. The interfaces are shown in Figure 1, together with 'stop signs' indicating barriers discussed in the following sections. Recommendation numbers from Section 5 are shown inside the stop sign. Red stop signs have resulted in high priority recommendations. Barriers considered lower priority are shown in orange. Barriers that are discussed but have not resulted in recommendations are shown in gray.

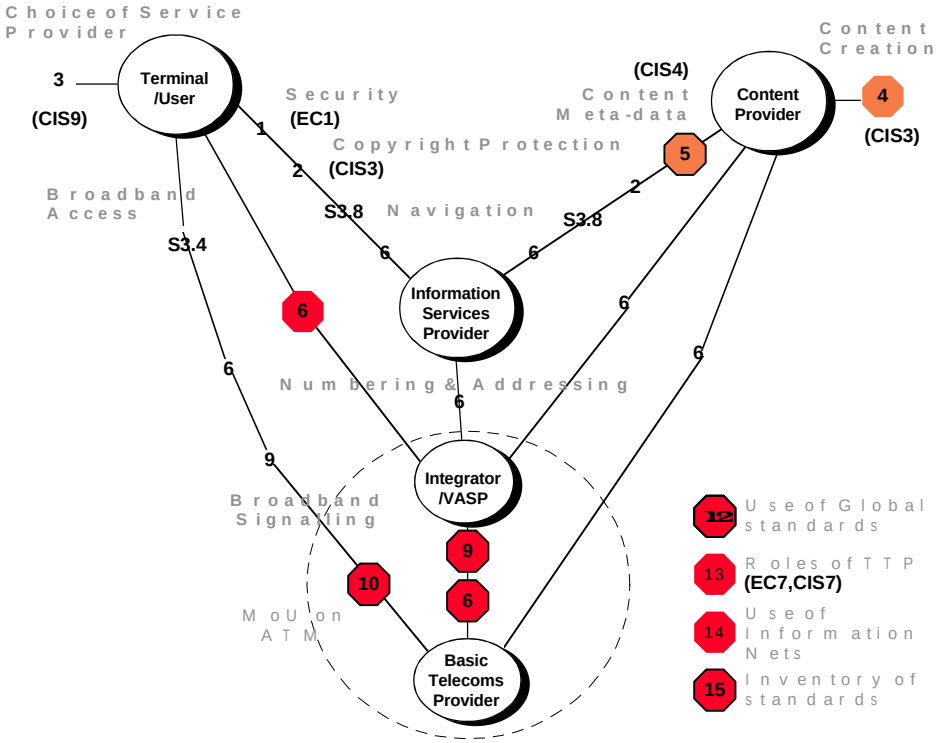

Figure 1.

Project No. 1 was not able to create recommendations to barriers like broadband access nor on many of the content related items, market with gray in figure 1. They are however

of crucial importance to access the content and services and hence to the implementation of the Information Society. The globalization of content related services and the growing number of network operators increase the complexity and shows clearly the need for global standards.

Further considerations by HLSG have shown that a number of important unsolved questions and impediments remain in many areas or that actions to remove the barriers have not have not reached the expected success or have not yet taken place. New broadband telecommunications carrier technologies have as well introduced new barriers.

In the past, technology development and standardization, as well as the related services used to be sector / vertical orientated. This was often with a strong regional or national and protectional flavor. Today's situation shows consumer media/content created by IT equipment being transported over telecommunications carriers. The ongoing convergence and globalization of services requires a horizontal and global type of standardization. This is well demonstrated by the global standardization activity 3GPP of the third generation mobile telecommunications system IMT-2000 / UMTS. This 3rd generation mobile/wireless partnership program combines the effort of the regional standardization into one global program. However the process has not yet included the interoperability of real-time broadband services over mixed networks.

HLSG has initiated this project to further study and analyze the impact of the areas described above and to make strategic recommendations to relevant bodies to consider actions to remove or lower the barriers.
The project "Strategic Recommendations for Intelligent Multimedia Terminals" has therefore set the focus on issues that have not been enough considered by the official standardization bodies or other relevant groups.

2. The Information Society - The move from the industry society to the information society

The Information Society represents a complex structure of a huge number of content creation, services provision, signal coding, networks for transport of content, terminals, related peripherals and user interfaces. A great number of standards, rules and agreements are needed to ensure the content creation and coding, data storing and transport. In addition rules and standards are needed on interconnectivity and interoperability between networks and between user equipment and services and the content service provision.
The information society will dramatically change the life in Europe and in other regions. The development toward the Information Society started long time ago. Many impediments to the implementation still remain. These are like missing bandwidth of transport networks and the lack of content, both of vital importance for a broad acceptance.

Internet is not the Information Society, but Internet is one of the important data and information carriers. Missing bandwidth and real time transport capabilities major

drawbacks and preventing real time or high bandwidth demanding Information Society services.
The major Internet user group has been the business world, where already the majority of companies are subscribers. Private and home applications have started much later. In Europe the saturation of private Internet subscribers was 1998 still below 10% of households, which means that only every third private owned computer is connected to the Internet. The subscription to telephony services is about 70% of households and to broadcast services about 95%.

High cost of installing broadband access networks is a major factor restricting the Information Society implementation on a broad scale. The acceptance by the public/private and the business users related to content and to cost of service are some of the major uncertainties today, which are slowing down the networking investments.

So far broadcasting has been the only main broadband access system to end-users. Broadcasting is from nature a distributional system, and has limited resources for interactivity. This drawback can be overcome by establishing the return channels via other transport media with required bandwidth. B-ISDN, the broadband telecommunications system using e.g. ATM technology is already used by many network operators in their core network area. New access technologies like xDSL will use ATM in the core network area and will enable ATM and IP service to private users with rather low investment cost.
The broadband wireless system UMTS/IMT-2000 is in development and will be in use during year 2002. Several wireless LAN systems to combine wired and wireless transport system with local equipment like DSSS, Bluetooth, Wireless Firewire and broadband DECT will increasingly be used. Some of them are already used, others in are in a development phase like BRAN.

2.1 Services in the Information Society

An almost unlimited number and types of services will occur in the information society. The number of equipment a user can afford to acquire and use is limited. In order to enable the user to have access to a large number of services, general-purpose equipment could be used. They but are mostly too expensive, clumsy and as well too complicated to use. General-purpose services would benefit from having specified and a reduced number of service classes in order to simplify the interoperability between services and network interconnections (gateways).

The list below describes services, which are or are expected to become the more popular ones.

* Voice telephony
* Broadcasting (DVB, DAB, Data) distributional

* Broadcasting on request (DVB, DAB, Data) from one to all on demand
* TV anytime, TV anywhere (DAVIC) universal boarderless TV
* Multicast / Narrowcast (DVB, DAB, Data) from one to many addressed
* On demand services
  - Video on demand, VoD
  - Music/speech on demand, MoD
  - Service on demand, SoD
* Video transfer from studio and/or service supplier to video theaters (VoD)
* Real time Network Computing
* Multiple site video conferencing
* Collaborative works (remote working, remote learning, remote editing etc.)
* Public information access (e.g. emergency service, tourist information, local government information, social service, libraries,)
* Remote/Electronic Healthcare (Healthcare information, teleconsulting, healthcare ordering)
* Video phone applications as point to point
* Transactional services (home banking, electronic commerce, electronic catalogs etc.)
* Real time applications like Telematics / Robotics and remote automatic control systems e.g. road traffic control
* Non real time and local storage (downloading of information, off-line information delivery etc.)

The above services show a huge implementation potential. Many of the services will however need fairly long time before reaching large popularity, in cases up to 10 years before reaching 50 % saturation. Mobile telephony is one of resent services to prove this. In countries, which to day have reached the 50% level, the services started some 15 years ago. Many of the Information Society services will set new requirement on the transport networks. Some services require real-time transport whereas other needs high bandwidth to reduce transport time. Services like video require high bandwidth and real time transport, but set as well strong requirements on other QoS parameters.

2.2 Business user preferences

An explosive growth in data communication is expected to happen during the next 5-7 years. Recent figures presented as industry views expect that data traffic will be 20 times that of voice calls by early next century, other figures describes 80% data traffic of all telecommunications traffic. Forecasts on E-commerce tell about growth rates like 20 fold within next 5 years and that business-to-business will represent 2/3 of all E-commerce traffic. The traffice figures above exclude radio and TV broadcasting. Applications like E-commerce, network computing etc. will hence plays an important role in the business world.

Strong requirements are set on data security but as well on the speed of the data transport. Today most of the high bandwidth and data security transports are done on leased lines or virtual leased lines. On demand services have till now not been very considered to the potential demand. This is especially an impediment for the growth of E-commerce for SMEs.

2.3 Home user preferences

Investigations on user requirements and preferences show that private users at home prefer entertainment as the primary type of service. Such are today TV, music, and games. New services like information services, home/remote shopping etc. will become commodities. However entertainment is be expected to continue as the main driver, but the variety and increased choice of entertainment will grow. The growth of new service provision will ask for technologies to simplify and harmonize issues on service accessibility and service navigation. Internet and other kind of on-line services will create new possibilities to create access to entertainment, but as well access to new services like information services, electronic home shopping, home banking, remote gaming and network computing.

3. Project No. 4

The target of Project 4 has been set to identify barriers in end-to-end broadband services environments and to develop recommendations for removing these barriers. Mature and used technologies as well as available and established services have not been included in the project except where a clear impact on the project has been identified.

Example on mature technologies and services is e.g. digital TV. The technology was developed early this decade and implementation for satellite, cable and terrestrial distribution is ongoing. The digital broadcasting systems for audio and TV are of a distributional nature and do have very restricted capabilities for services of a on demand type. B-ISDN technology can overcome this limitation, but the technologies are not yet mature and access networks to end-users are generally not available. The ability to ensure the QoS demands is rather limited as well.

Many B-ISDN technologies are available, of which however only a few do have real-time properties. At this moment ATM seems to have the highest potential for transporting real-time on demand type of services. The DVB Consortium/ETSI has developed standards for video transport over SDH and PDH networks using ATM technology. EBU-SMPTE Task Force has considered ATM as one technology to distribute studio quality video between studios. However the standards above focus on video transport in business-to-business applications, but not for distribution to the private end user. Such transport set stronger demand on the transport technology as the transport may happen over a number of different networks. Main reason is that the standards are based on the assumption that networks are quasi error free, which seldom is the case, especially not in the case of cascaded networks. The standards situation can hence be seen as a potential barrier for the implementation of real-time broadband services over fixed general-purpose telecommunications systems to the homes/private users.

Harmonization of available standards and new technologies need to be developed and standardized. Some work is ongoing on these issues at e.g. ITU-T SG-13 and SG-16 and

ATM Forum. Especially gaps in harmonization and standardization can be identified in the user access network area.

3.1 General considerations

The information society infrastructure will be a mixture of a large number of different networks and network technologies and services, often referred to as the European and the Global Infrastructure, EII / GII. Many of the information society services require high bit rate broadband networks, often in combination with real time properties. Today broadcasting is the only widely used broadband access network to private user. The general-purpose networks are high bandwidth only in the backbone area.
LANs used in the business environment may be broadband, but are seldom able to transport data in real time. Main access system for SMEs is still PSTN or ISDN.

Digital audio and video broadcasting technologies were developed early this decade. Digital TV over satellite and cable has been in use for some time. The terrestrial digital TV is just about to start, where service is available in UK, other countries following soon. Digital audio broadcast is still suffering from lack of equipment.

The multimedia transport/business chain from content creation to end-user generally involve a number of different cascaded transport mechanisms, see figure 2. In order to identify possible barriers in such end-to-end environments, the whole chain from content provision to user equipment has been considered as:

* Content
* Content related services
* LAN networks
* Backbone networks
* Access networks
* Home networks
* Terminals
* Peripherals
* User Interfaces
* Users

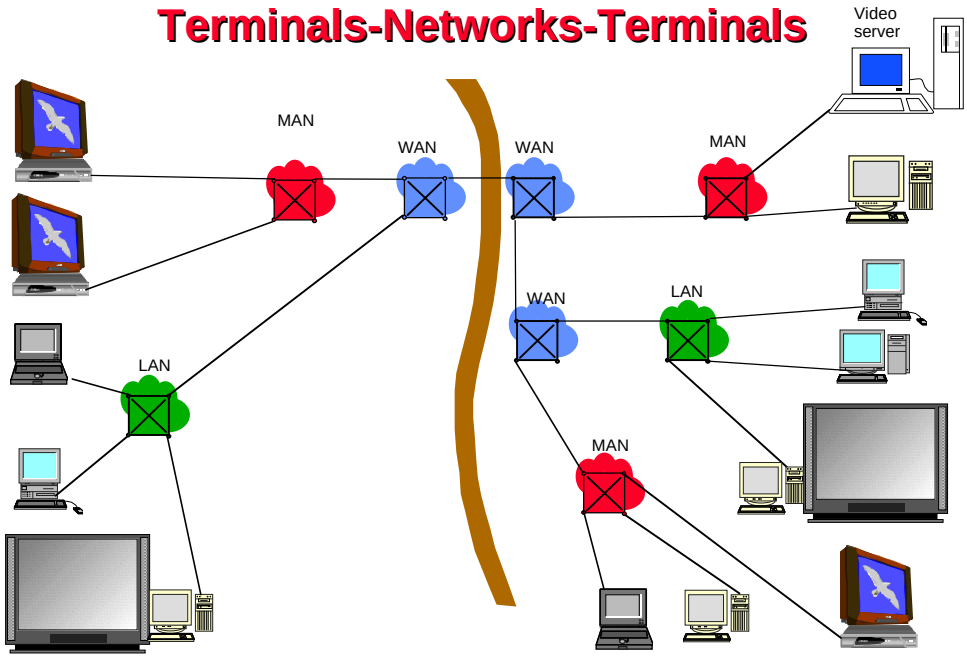

Figure 2.

Many of the above mentioned broadband network technologies are often well standardized for voice and non time-critical general-purpose use and for managed services over leased lines. Their ability to carry multimedia services as call up service is less developed and requires to be addressed. ITU-T has developed a number of recommendations for various kinds of multimedia services and terminals. Gaps can be found in e.g. transporting DVB video over cascaded B-ISDN / ATM networks and relevant access networks.

4. Impact of the convergence between telecommunications, IT and media

The convergence of telecommunications, IT and media will introduce a number of changes to the communications networking systems. New structure for service portability and interoperability especially across network boundaries service scalability and new schemes in addressing, naming, numbering and routing will be required:

* Scalability of services
* Intelligent name/address translation capabilities
* Multihoming/Virtual Home Environment (VHE)
* Privacy and security must be ensured and be in control by the user.

5. Scalable Service Architecture

In a multimedia – multiple service system integration it is important that users are able to have access to largest number of freely available services. This will ask for scalable service architecture where as many as possible services can be reached over different network and terminals.

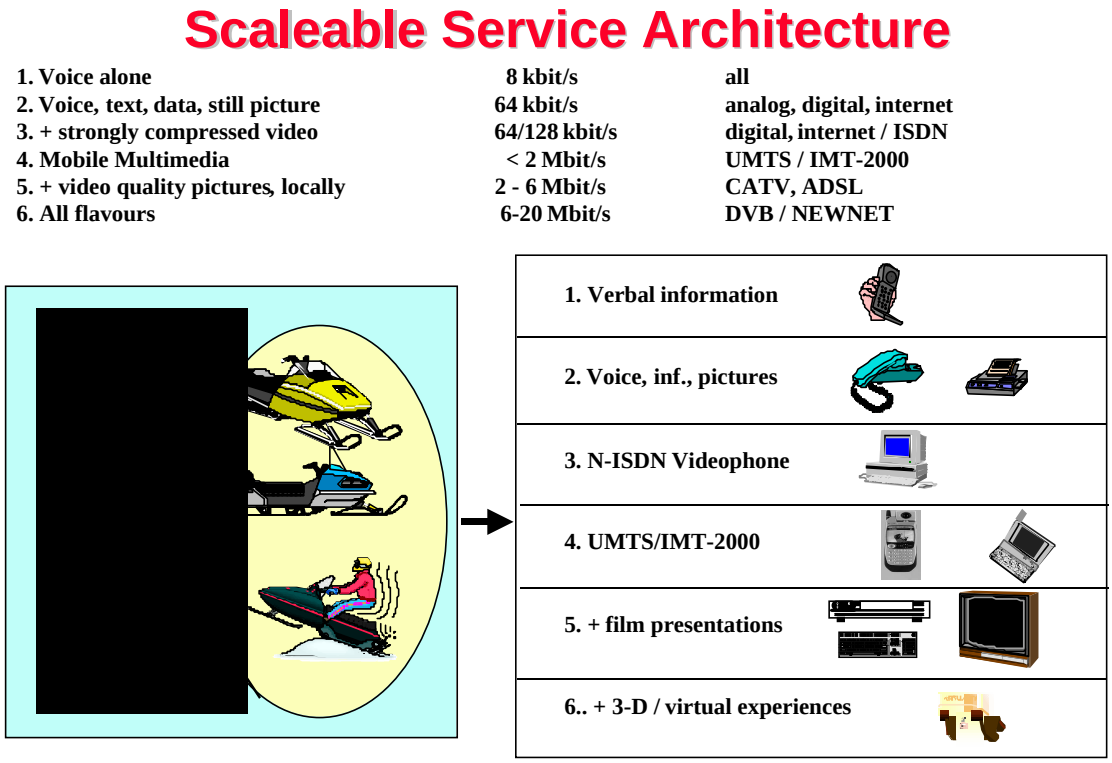

Figure 4.

Scalability is needed to enable services to be carried over different kinds of networks to end-user equipment with the quality and bit rates the chosen system allows for. Figure 4 gives a view on scalable service architecture with indications on bit rates required.
The recently matured MPEG-4 standard, which is under further developed into MPEG-7 gives from a systems point of view many needed tools for scalability and multimedia presentation.
In end-to-end environments the full business chain has to be considered. Figures 1 and 7 describe briefly main parts of such a chain. There may be a number of other issues to be considered like third party involvement e.g. on billing. It can be assumed that the charge for service will partly be based on requested quality and that quality requirements as well will transport tariffs.

Recommendation No. 1

Addressed to:	Recommendation
ETSI IETF DAVIC ISO/IEC	Create a minimum set of needed technologies and standards in order to create a flexible and scaleable service architecture, which takes in consideration new broadband technologies, like ATM and UMTS.

6. Naming, addressing and numbering

Internet and other IP based data transport systems will have an explosive growth. It is assumed that mid next decade the data traffic will represent 60 to 80% of all telecommunications traffic. Also the development towards voice over IP will move the focus on IP. As IP however is from nature a non real-time transport system, time critical services like video will still for a long time need other solutions.

New technologies like xDSL and UMTS increase the service capabilities for bit hungry applications for both real-time as well as IP traffic. Much of the services will take place of a mixture of transport technologies. To enable multimedia traffic over network boundaries, an intelligent naming, addressing, numbering and routing translation system is required. It should consider at least following:

* Ensure access to persons, equipment and applications
* Ensure access to content and services
* The scheme should include
  - Person/device/port/applications etc.
  - Personal ID(s) are needed. IDs must be fully portable (international) across networks, service providers, terminals and services.
  - Terminals should function as authorized ID of the user. This e.g. to support transactional services, secure information services, digital signature and other encryption/decryption technologies needed.
* Service addressability e.g. by using Metadata

Recommendation No. 2

Addressed to:	Recommendation
ITU/ETSI ICANN/IETF	To develop a generic system and/or an intelligent scheme for translation of addressing, naming and numbering across IP and traditional telecommunications network structures

Recommendation No. 3

Addressed to:	Recommendation
CEN/ISSS DAVIC, EBU ISO/MPEG	To create and standardize a description of content and services based on the use of Metadata, including attributes and locators and ensure the compatibility to MPEG-7

7. Broadband networking

The Information Society services will rapidly require broadband transport capability. Several different types of broadband network technologies will be used. Some new technologies under consideration and development like broadband (and possible real-time) IP networks and broadband radio access networks (BRAN) are still in early phase of development. The time schedule for technical development, standardization and implementation is outside the scope of this project and is therefore not considered in this project. Figure 3 below shows some end-to-end broadband networks used in the ACTS AMUSE pilot program.

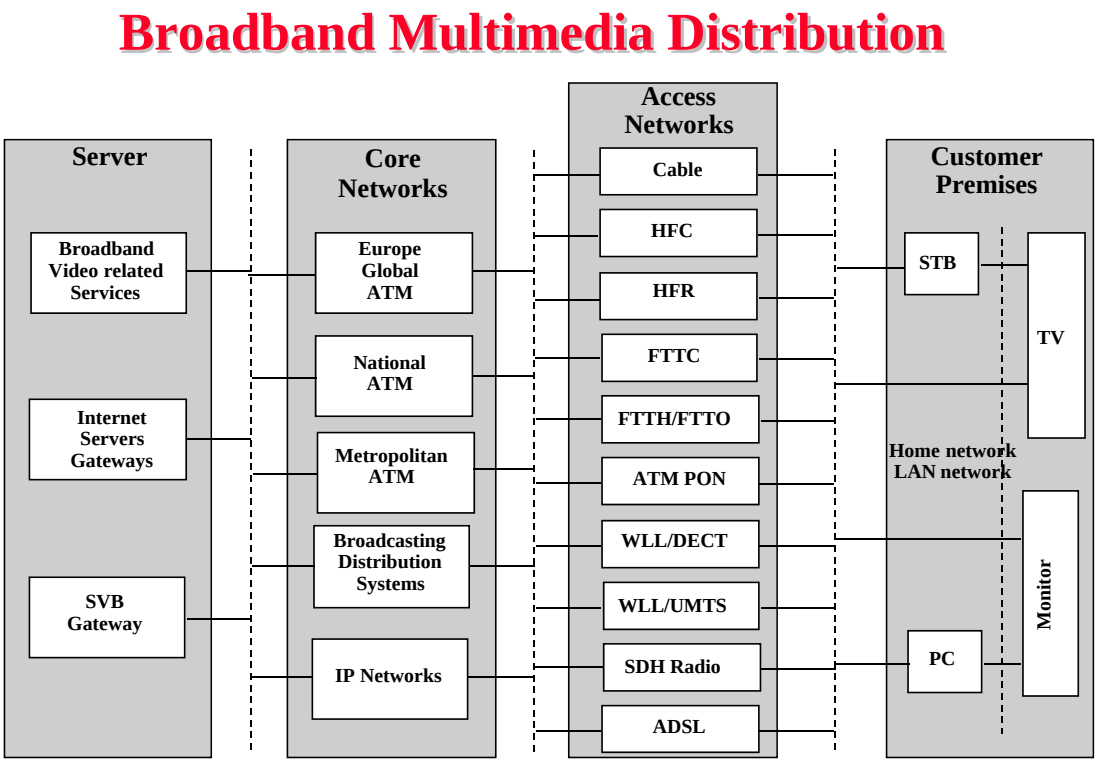

Figure 3.

7.1 Network bandwidth

*	Backbone networks in planning up to	>100 Gbps
*	Access networks e.g. UMTS - xDSL - LMDS - coaxial - satellite	1,5 - 40 Mbps
*	LANs: Ethernet and Token Ring	up to 1 Gbps
*	Home networks e.g. IEEE 1394	400 Mbps
*	Network between terminals and equipment e.g. USB.	12 Mbps
*	Wireless networks like DECT, HiperLAN, Bluetooth and UMTS	2 Mbps

7.2 Network transport technologies and architectures and related development bodies

*	ATM	(Asynchronous Transfer Mode)	ATM Forum, ITU-T, ETSI, Eurescom
*	PDH	(Plesiochronous Digital Networks e.g. E-1, E-2 and E-3)	
*	SDH	(Synchronous Digital Hierarchy)	
*	DVB	(Digital Video Broadcasting)	DVB Consortium
*	DAB	(Digital Audio Broadcasting)	World DAB
*	UMTS	(Universal Mobile Telecommunications System)	UMTS Forum, ETSI and ITU-T
*	DAVIC		DAVIC consortium
*	IP		ISOC / IETF
*	xDSL	(x = any, Digital Subscriber Line)	e.g. ADSL Forum

* Ethernet, Token Ring etc. There are a number of related LAN technologies for the local distribution, which may be connected to external networks e.g. ATM.
* A consortium developed DVD as an offline broadband access system based on evolutionary development of the optical carrier CD disk. Several formats have been developed for different applications.

Many of the above mentioned access network technologies for broadband multimedia distribution have been developed or are in the development phase. Figure 3 gives an overview of most the broadband networks under trials today. The result show that further development work is necessary before a broad implementation can take place. However the interoperability between networks regarding the ability of transporting real-time services is less often considered.
Present digital broadband technologies, which may be involved in providing access for end-user and business use to broadband services, are listed below as well as some of their related development groups:

7.3 Some network technologies with high to medium success potential

* Broadcasting networks: satellite, cable and terrestrial
* Native and various kind of hybrid ATM access networks
* xDSL and co-axial cable as IP and ATM access network
* IMT-2000 / UMTS for wireless applications
* Native IP over optical fiber for IP backbones
* WDM and DWDM for increased capacity over new and existing fiber in backbone networks

The above mentioned network technologies are all considered as broadband systems. They represent however very different capabilities for real-time traffic.

7.4 Broadcasting networks

Present broadcasting networking, terrestrial, cable and satellite are not considered in this project due to mature technology and ongoing implementation. New kind of broadcasting

structures using other transport media is processed in this project. Available telecommunications networks seldom do have the properties for a real-time transport, except in the core network area. In order to support the relevant development and standardization bodies to take actions towards removing these barriers, this report has processed some of the most important barriers.

7.5 ATM

ATM is rather well standardized, but missing technologies/standards can be identified in the area of real time content transport. This can be especially observed in multi-operator and cascaded network environments. Main use of ATM today is in business to business and ISP/IP traffic over leased lines. A growing usage will occur in the operators' area to carry high-speed data to xDSL and cable distribution nodes. The use of ATM in call-up types of services of video etc. has not yet taken place. This would offer a flexible broadband access system for all kind of information society services.
TV DVB / MPEG-2, real time multimedia in MPEG-4 or MPEG-7 or a digital camcorder video as DV or MPEG-1 are some of services to be transported error free from a server to the end-user equipment. From nature ATM is fully capable in transporting real time video error free and is used over leased lines as transport between studios or as cable TV distribution to head ends. To cure the errors caused by ATM a forward error correction (FEC) must be used. It is therefore urgently needed to establish standardization work on real-time content distribution over ATM network in end-to-end environment. The work should not only include fixed line transport capability and interoperability, but as well include the broadband mobile aspects.

HLSG project No. 1 addressed the present problem of interconnecting different types of networks or equipment from different vendors. It was identified that the number of unsolved questions here rises rapidly. In order to find solutions for this, the HLSG Project No. 1 addressed the need for establishing a MoU between relevant market players. ETNO established a working group to work out needed rules and technologies. ETSI established a project EP-EASI to make the necessary standardization work. As it now has become clear that the MoU could not be signed, ETSI has re-defined the task of the project EP-EASI. The ETSI Board has approved the modified ToR. This will enable EASI to include relevant work items of all necessary ATM networking relevant issues. In addition to the ongoing work on network-to-network, NNI, it is needed to include work on end-to-end interoperability. In order to do so the following items have to be included.

* Interconnection to user (UNI, user-to-network interface)
* Content related service interoperability over ATM networks
* ATM in mixed type of networking and cascaded networks
* The ATM over access networks like xDSL, cable modems etc. for real time services

Missing standards on interoperability in end-to-end systems has to be seen as major impediment to the broad implementation of the Information Society. The European

Commission has as well addressed this issue on several occasion related to the Global Information Society and the interoperability of services in Europe and between the global regions.

Recommendation No. 4

Addressed to:	Recommendation
ETSI ITU-T DVB Consortium DAVIC DVB/DAVIC Interoperability Consortium	To established work to create standards for real time broadband access to in B-ISDN ATM networking: - ATM as FTTH, FTTO - ATM as HFC - ATM over xDSL - ATM interconnected to LAN networks

7.6 Broadband wireless/mobile networks, UMTS / IMT-2000

GSM is an excellent carrier for narrow band voice communication and low bit rate data communication. New developments are enabling higher bit rates GSM and packet based services. Evolutionary developments of wireless technologies are expanding the bandwidth up to 2 Mbps that will also enable connectionless packet based services. ETSI is developing UMTS (Universal Mobile Telecommunications System) as a family member of the global wireless broadband system IMT-2000. A global partnership program, 3GPP has been established between standardization bodies in Europe, Japan and USA to develop the needed technologies and specifications. There may be used different names in different regions. The target is to create a global system, which would allow for an almost global coverage of services – maybe could be defined as global content roaming.

7.6.1 UMTS in the Information Society.

UMTS will play a decisive role in the Information Society. Due to the early phase of development, the focus is set on the telecommunications related issues, but less to include requirements the content may set on the content related communication. The interoperability of real-time services across fixed networks and mobile network has not yet become included in the standardization work to the level needed.

It can be assumed that the early broadband mobile/wireless applications will be business applications. Such are e.g. wireless intranet/network computing and wireless E-commerce. They are generally no of real-time nature, but require high bit rates. Multimedia transport will in addition set requirement on real-time and other QoS parameters.

The UMTS Forum has established a working group, ICTFG, Information and Communications Technology Focus Group, with the task to bridge the gap between wireless telecommunications and IT, content and content related services industries.

7.7 Home Networks / Small Office Networks

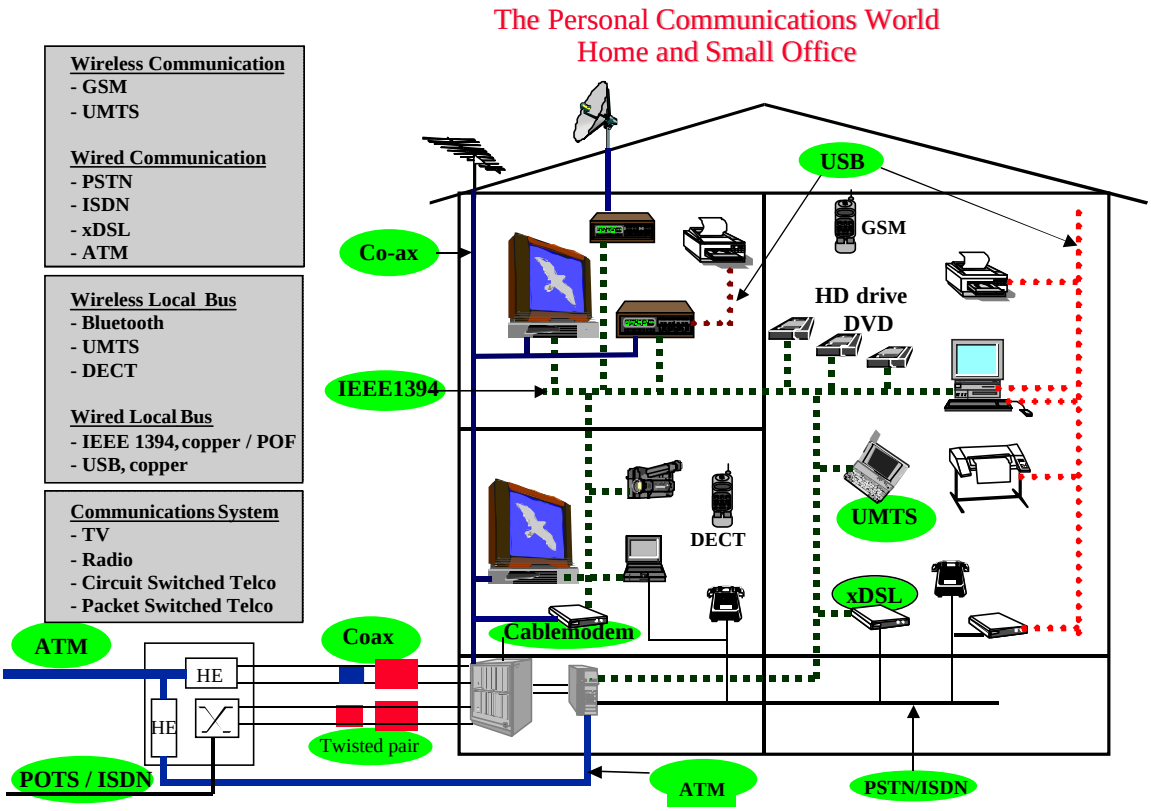

Figure 6.

Various kind of home buses/networks have been developed in USA, Japan and Europe. Till now most of them have been of narrow bandwidth type allowing only for control, low bit rate data and audio transport. Non of them have so far reached a broadly applied. In recent time new works have started to include broadband aspect with interconnectivity to most types of transport networks and applications. Indications on an industry consensus for using IEEE 1394, the Firewire, as the general-purpose standard seems to be happening. Many important parameters for the upper layers allowing for real time broadband transport are still missing. See figure 6 for more details. The network should be able to transport e.g. DVB, DAB, PSTN, ISDN and ATM signals, but also integrate systems like GSM, DECT and UMTS.

Recommendation No. 5

Addressed to:	Recommendation
VESA JTC1, IEC and CENELEC ISO/ISSS HBS Japan	To develop - Interface between transport networks to home busses - To consider questions on security, privacy - Signaling and operation models for security and copy management

8. Content related service communication and navigation

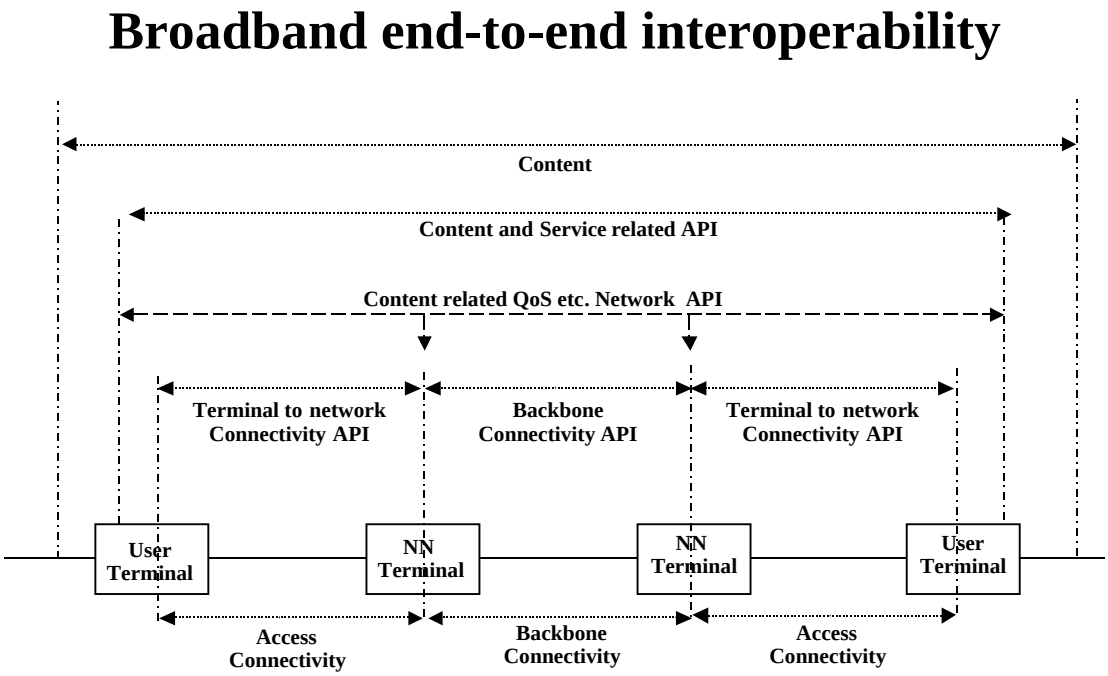

Figure 5.

End-to-end multimedia communications require higher level communications protocol stacks than has been used so far. The needed number of protocol layers is dependent on the type of service and type interconnectivity. The interworking between layers of such stacks need various kind of APIs. Figure 5, shows the basic principles of APIs and their interaction to service and networking.

To enable access to many different kind of services a navigation tool or API should be standardized or at least it should be of an open structure, of which parts can be integrated in to operation systems and applications software. From the figure can also be seen that content may set requirements on the transport like QoS. Figure 5 shows also the relations between services and transport.

In a multimedia transmission system, at least 3 different kind of APIs are needed:

* Connectivity APIs: Terminal to Access network and
* Network APIs: Access network to Core network
* Content, application and service related APIs: Service provision to user, e.g. browser/navigator/EPG

In addition there may be needed other “gateway” APIs, e.g. for interconnecting multiple networks in a cross boundary operation mode.

8.1 APIs

As described in chapter 6, gaps still occur in mature and implemented service environments. One such is an open standardized service access and navigation technology for digital video broadcasting, DVB. The development and standardization work on such APIs is ongoing in the MHP project of the DVB Consortium. Recommendation 2 addresses this issue.

For many applications however the APIs may be proprietary solutions like e-commerce payment authorization, banking terminals, medical care terminals etc. Such can be implement generic multimedia terminals as well, but then usually as dedicated and possible add-on applications.
APIs are also needed e.g. for access to services of highly copy-protected nature, which may be of user group specific nature. Such services may be electronic newspapers, magazines, books and other on demand type of services. This kind of services may need dedicated APIs and/or authentication and payment/billing systems.

Figure 7 describes the generic principle of the connectivity of a multimedia terminal. A multimedia terminal will not only receive and process the content related data, but in many cases as well perform a number of tasks like interfacing the transport network, authentication, establish access to services, service navigation etc. Figure 7. shows as well that a terminal may communicate with the user via some type of user interface and it has to be able to communicate with needed peripherals.

9. Multimedia terminals

The HLSG report No. 4 describes observed potential barriers to the intelligent multimedia transport services. The content and transport services can in most cases be categorized under the umbrella of the Information Society. The internal architecture of multimedia terminals is not considered in this project as terminals are dedicated to the services and can hence generally not be standardized. However terminal's technologies related to the services need to be standardized to enable access to the services and in cases as well to reduce fragmentation.
The title "Intelligent Multimedia Terminals" should therefore be seen as addressing issues related to the access to intelligent multimedia services in end-to-end systems by considering the full business chain from the content creation process till the end user interface.

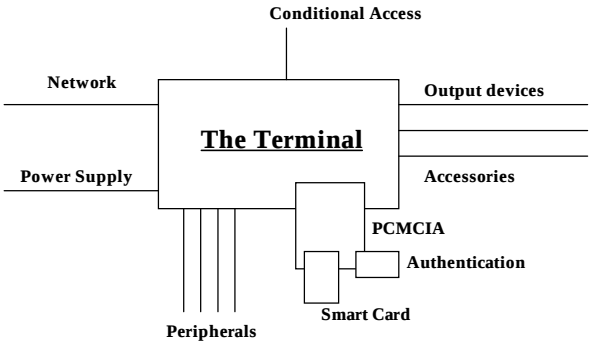

Figure 7.

The project does not consider services/terminals of a special non-multimedia nature. Such are e.g. remote medical care terminals, remote non-private telematic services and remote industrial control. It does not either consider services/terminals like PCs, radio and TV receiver/set-top boxes for satellite, cable or terrestrial reception, as they are based on implemented mature technologies

Major impediments to the implementation process of the Information Society can be found in areas of:

* Broadband information and data transport,
* Missing standards on interoperability between services and end user equipment in an end-to-end chain
* Interoperability between networks.
* Scalability as enabler for services independent source and content coding
* Application Programming Interfaces, APIs, related to content, services and data transport
* Missing content and related services

In addition to content and transport standards other technical standards and regulatory issues are of major importance:

* Mandatory standards e.g. electrical safety and EMC
* Legal and regulatory issues, approval procedures, conformance testing etc.
* Copyright, copy management and IPRs

Recommendation No. 6

Addressed to:	Recommendation
DVB, ETSI DAVIC, IETF W3C, WAP etc.	Develop needed APIs for multimedia transport, service access and service navigation systems. Ensure compatibility between circuit swithed, broadcasting and IP based systems.

9.1 The terminal in an end-to-end business chain

Figure 8 describes a generic architecture for the full business chain in a content related end-to-end environment. It highlights the content and service provision, the end user terminal and related peripherals. It also describes various types of interfaces needed between service provision and terminal terminal/user.

The multimedia end-to-end chain consists of two main parts:

* The Service Interface
* The Data Transport Interface (Network Interface)

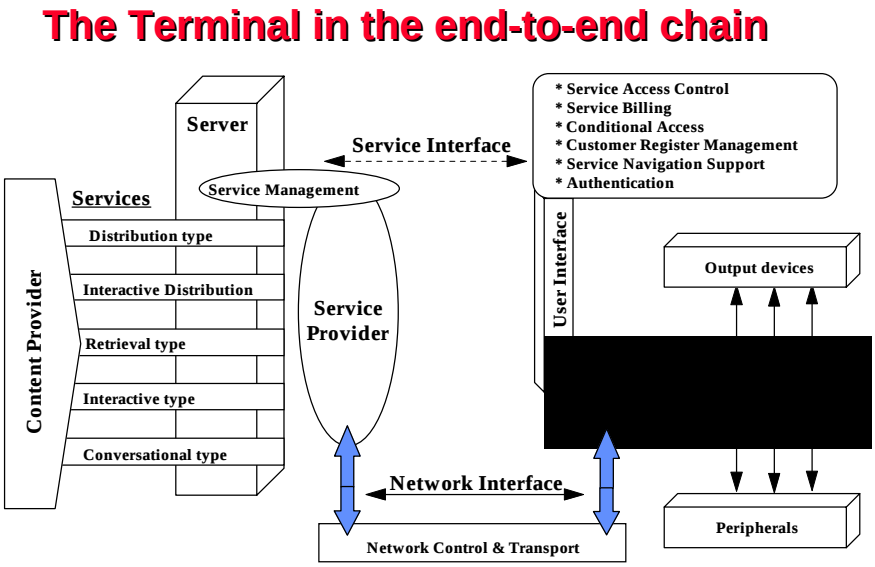

Figure 8.

In recent years many multifunctional multimedia products have been developed, produced and successfully marketed. Below a list of with a few examples:

* Personal portable communicators, small computers/organizers, many with a mobile telephone/communication module integrated
* TV receivers with build in PC functionality including Internet
* Set-top boxes with in addition to digital TV receiving functions integrated multimedia PC and Internet functionality
* PCs and laptops with build in TV functions and telecommunication software and modems build in or easy ad on mobile communication modules.
* Remote wireless medical care and monitoring equipment
* Road navigation systems with GSM and GPS functionality

Terminals with a multitude of integrated functions will be put into the market place in the next future on the choice of each market player. Standardized solutions like APIs etc. are

therefore needed or even from a user perspective mandatory to enable the market players to develop equipment with access to the open choice of the consumers for available and preferred services. On the other hand terminals for a single task or single function will as well be common. Such are e.g. terminals for remote medical care and remote robotics.

The network issues have been addressed in chapter 5 and the service issues in chapter 4. The terminal has to be seen as the gateway for the user to get access to the preferred or needed services and data. Therefore a modem together with relevant software in e.g. PC can be seen as the front-end of a multimedia terminal.

Recommendation No. 7

Addressed to:	Recommendation
DVB/DAVIC	Define local cluster and home network systems allowing the future use of local storage devices in proportion to the amount of information that will potentially be downloaded from broadband access networks.

10. Standardization and missing standards

The interoperability between broadband fixed networking and wireless networking will be a prerequisite for many multimedia services. The standardization bodies need a stronger focus on this.

Telecommunications development and standardization takes place in bodies like ETSI, ANSI, TTC and ITU-T, but as well in many for a and consortia like ATM Forum and ADLS Forum. The content and multimedia related standardization is mainly done within ISO, IEC, and JTC-1 with European bodies CEN/ISSS and CENELEC. The Internet development mainly happens in the Internet Society/IETF.

MPEG-4 will play an important role in multimedia and wireless communication. Internet and the Internet protocol, IPv6 may as well be one of the most important drivers for wireless IP communications as it allows for better addressing etc.

The multimedia data transport will often set requirements on the data transport, often referred to as QoS, quality-of-service. Due to the still very much vertical sector based standardization such parameters have not been considered enough as they are not know to people participating in the standardization work.

Recommendation No. 8

Addressed to:	Recommendation
ETSI 3GPP ISOC/IETF ATM Forum IEC/ISO JTC1	To establish work to ensure end-to-end multimedia content related interoperability across network boundaries of broadband fixed line and mobile networks. The work should as well cover interoperability of IP based broadband traffic in multi-homing environment and interoperability between traditional telecommunications and IP networking of multimedia content.

Recommendation No. 1

Addressed to:	Recommendation
ETSI IETF DAVIC ISO/IEC	Create a minimum set of needed technologies and standards in order to create a flexible and scaleable service architecture, which takes in consideration new broadband technologies, like ATM and UMTS.

Recommendation No. 2

Addressed to:	Recommendation
ITU/ETSI ICANN/IETF	To develop a generic system and/or an intelligent scheme for translation of addressing, naming and numbering across IP and traditional telecommunications network structures

Recommendation No. 3

Addressed to:	Recommendation
CEN/ISSS DAVIC, EBU ISO/MPEG	To create and standardize a description of content and services based on the use of Metadata, including attributes and locators and ensure the compatibility to MPEG-7

Recommendation No. 4

Addressed to:	Recommendation
ETSI ITU-T DVB Consortium DAVIC DVB/DAVIC Interoperability Consortium	To established work to create standards for real time broadband access to in B-ISDN ATM networking: - ATM as FTTH, FTTO - ATM as HFC - ATM over xDSL - ATM interconnected to LAN networks

Recommendation No. 5

Addressed to:	Recommendation
VESA JTC1, IEC and CENELEC ISO/ISSS HBS Japan	To develop - Interface between transport networks to home busses - To consider questions on security, privacy - Signaling and operation models for security and copy management

Recommendation No. 6

Addressed to:	Recommendation
DVB, ETSI DAVIC, IETF W3C, WAP etc.	Develop needed APIs for multimedia transport, service access and service navigation systems. Ensure compatibility between broadcasting and IP based systems.

Recommendation No. 7

Addressed to:	Recommendation
DVB/DAVIC	Define local cluster and home network systems allowing the future use of local storage devices in proportion to the amount of information that will potentially be downloaded from broadband access networks.

Recommendation No. 8

Addressed to:	Recommendation
ETSI 3GPP ISOC/IETF	To establish work to ensure end-to-end multimedia content related interoperability across network boundaries of broadband fixed line and mobile networks. The work should as well cover interoperability of IP based broadband traffic in multi-homing environment and interoperability between traditional telecommunications and IP networking of multimedia content.