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# Terminal Equipment (TE); Broadband Multimedia Information Retrieval Service

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## Foreword

This ETSI Technical Report (ETR) has been produced by the Terminal Equipment (TE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, relating to the use or the application of ETSs or I-ETSs, or which is immature and not yet suitable for formal adoption as an ETS or an I-ETS.

Recent advances in transmission and coding technologies can allow Telecommunication Network Operators to provide residential customers with high bandwidth interactive multimedia services. This ETR describes a interactive generic platform on which applications such as Video On Demand (VOD), home shopping, entertainment and work at home can be supported.

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# 1 Scope

The aim of this ETR is to study the different technical options for implementation of Broadband Multimedia Information Retrieval Services and the applicability and upgrading of the Videotex protocols.

The following criteria are used to classify the Multimedia Information Retrieval Services (MIRS):

- service architectures;
- terminal architectures;
- used protocols.

Although the network architecture is out of the scope of ETSI TC-TE, examples are given in this ETR for clarification. This ETR identifies areas that still require standardization activities and these are highlighted in the conclusion to this ETR (see clause 13).

# 2 References

This ETR incorporates by dated and undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETR 173: "Terminal Equipment (TE); Functional model for multimedia applications".

[2] ETS 300 382: "Terminal equipment (TE); Videotex Enhanced Man Machine Interface (VEMMI)".

[3] ETS 300 072: "Terminal equipment (TE); Videotex presentation layer protocol Videotex presentation layer data syntax".

[4] ETS 300 073: "Terminal equipment (TE); Videotex presentation layer data syntax Geometric display (CEPT Recommendation T/TE 06-02, Edinburgh 1988)".

[5] ETS 300 074: "Terminal equipment (TE); Videotex presentation layer data syntax transparent data (CEPT Recommendation T/TE 06-03, Edinburgh 1988)".

[6] ETS 300 076: "Terminal equipment (TE); Videotex Terminal Facility Identifier".

[7] ETS 300 177: "Terminal equipment (TE); Videotex Photographic syntax".

[8] ITU-T Recommendation T.4: "Standardization of group 3 facsimile apparatus for document transmission".

[9] CCITT Recommendation T.6: "Facsimile coding schemes and coding control functions for group 4 facsimile apparatus".

[10] ETS 300 149: "Terminal equipment (TE); Videotex Audio syntax".

[11] ETS 300 075: "Terminal equipment (TE); Processable data File transfer".

[12] ETS 300 383: "Integrated Services Digital Network (ISDN); File transfer over the ISDN EUROFILE transfer profile".

[13] ETS 300 388: "Integrated Services Digital Network (ISDN); File Transfer Access and Management (FTAM) over the ISDN based on simple file transfer".

[14] ISO/IEC 10918-1: "Information Technology - Digital compression and coding of continuous tone still images: Requirements and guidelines".

[15] ISO/IEC 11544: "Information Technology - Coded representation of picture and audio information progressive bi-level image compression".

[16] ITU-T Recommendation H.261: "Video codec for audiovisual services at p x 64 kbit/s".

[17] ISO/IEC 11172-1 to 3: "Information Technology - Coding of moving pictures and associated audio for digital storage media up to about 1,5 Mbit/s".

[18] ISO/IEC DIS 13818-1 to 4: "Information Technology - Generic coding of moving pictures and associated audio information:

Part 1: Systems;

Part 2: Video;

Part 3: Audio;

Part 4: Compliance Testing".

[19] ITU-T Recommendation G.711: "Pulse code modulation (PCM) of voice frequencies".

[20] CCITT Recommendation G.722: "7 kHz audio-coding within 64 kbit/s".

[21] ITU-T Recommendation G.726: "40, 32, 24, 16 kbit/s adaptive differential pulse code modulation (ADPCM)".

[22] ITU-T Recommendation G.728: "Coding of speech at 16 kbit/s using low-delay code excited linear prediction".

[23] ITU-T Recommendation J.41: "Characteristics of equipment for the coding of analogue high quality sound programme signals for transmission on 384 kbit/s channels".

[24] ITU-T Recommendation J.42: "Characteristics of equipment for the coding of analogue medium quality sound-programme signals for transmission on 384 kbit/s channels".

[25] ITU-T Recommendation T.419/ISO/IEC 8613-9): "Information Technology - Open Document Architecture (ODA) and interchange format; Part 9: Audio content architectures".

[26] ISO/IEC 13522-1 to 5: "Information Technology - Coding of Multimedia and Hypermedia Information:

Part 1: MHEG Object Representation, Base notation (ASN.1) [DIS];

Part 2: Alternate notation (SGML) [DIS];

Part 3: MHEG Extensions for Scripting Language Support [CD];

Part 4: Registration procedure for MHEG format identifiers [CD];

Part 5: MHEG subset for base level implementations [CD]".

[27] ITU-T Recommendation T.107: "Videotex enhanced man-machine interface service".

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of this ETR, the following definition applies:

**Multimedia Information Retrieval Service (MIRS):** An interactive service which provides the users with the capability to access and interchange multimedia information.

## 3.2 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

| | |
|---|---|
| ADSL | Asymmetric Digital Subscriber Loop |
| API | Application Programming Interface |
| AS | Application Server |
| ATM | Asynchronous Transfer Mode |
| AVI | Audio-visual Interactive |
| CATV | Cable TV Network |
| CD-I | Compact Disk Interactive |
| COFDM | Coded Orthogonal Frequency Division Multiplexing |
| CS | Central Server |
| DAB | Digital Audio Broadcasting |
| DAN | Database Access Network |
| DAVIC | Digital Audio Visual Council |
| DSM | Digital Storage Media |
| DSM-CC | Digital Storage Media Control end Command |
| DVB | Digital Video Broadcasting |
| EBU | European Broadcasting Union |
| EMF | European Multimedia Forum |
| EPG | Electronic Programme Guide |
| GUI | Graphic User Interface |
| HDSL | High bit rate Digital Subscriber Loop |
| IC | Integrated Circuit |
| ILM | Intermediate Language for Manipulation |
| IMI | International Multimedia Association |
| IMS1 | Integrated Multimedia Services at 1 Mbit/s |
| IP | Information Provider |
| IS | Information Server |
| IVOD | Interactive Video On Demand |
| JPEG | Joint Photographic Expert Group |
| LIS | Local Information Server |
| M&H | Multimedia and Hypermedia |
| MARS | Multimedia Audio-visual Retrieval Service (RACE Project 1994-95) |
| MHEG | Multimedia and Hypermedia Expert Group |
| MHS | Message Handling Service |
| MIRS | Multimedia Information Retrieval Service |
| MPEG | Moving Picture Expert Group |
| NII | Network Independent Interface |
| NVOD | Near Video on Demand |
| OCAM | Object and Content Access Module |
| PDH | Plesiochronous Digital Hierarchy |
| PON | Passive Optical Network |
| POTS | Plain Old Telephone Service |
| PSTN | Public Switched Telephone Network |
| QAM | Quadrature Amplitude Modulation |
| QOS | Quality Of Service |
| SAN | Server Access Network |
| SC | Server Center |
| SDH | Synchronous Digital Hierarchy |
| SIR | Script Interchange Representation |
| TE | Terminal Equipment |

| | |
|---|---|
| VCR | Video Cassette Recorder |
| VEMNI | Videotex Enhanced Man Machine Interface |
| VOD | Video on Demand |

# 4 Service description

## 4.1 Generic service

MIRS provides the users with the capability to request multimedia information. This information can consist of movies (in the case of VOD), still or moving pictures (in the case of learning or leisure applications) or audio. The information is transferred from a server through a broadband network to the user Terminal Equipment (TE). The user can manipulate information taking advantage of interactive facilities.

Different levels of intelligence distribution between the server and the terminal can be found:

- Presentation level in the terminal (the media decoders are in the terminal, cursor tracking is under terminal control);

- Multimedia Information Management level in the terminal (sophisticated presentation, and actions triggered on end-user interaction such as presentation or deletion of objects on the screen are handled in the terminal);

- Script level in the terminal (computation on user input similar to what can be done with a programming language) can be made in the terminal.

The following functions are needed to build the framework for MIRS:

- Access Function;
- Management Function.

The Access Function is the functional entity which gives access to the service or application. In addition it may provide functionality like:

a) the generation of signalling information to set up the connection between the terminal and the application after application selection by the user;

b) access to management functions such as:

   1) access rights control (authorization);
   2) security management;
   3) accounting, charging and billing.

The Management Function is the functional entity which handles general purpose management issues in MIRS. It may provide functionality such as:

- optimisations of implementation elements (i.e. distribution of user access among several servers depending on geographical location, work load, cost and availability of communication);

- access control;

- accounting, charging and billing;

- directory services;

- copyright protection mechanisms;

- information provider, administration/management (if a directory function at service level is provided).

The functions described above can be centralised or distributed between several physical entities.

NOTE: The concept of Access Function and Access Point are not the same. An Access Point is a component of a given service implementation architecture which can support service management functions and in some cases may be at the same physical location as the Access Function. In distributed service architectures it might be necessary to have more than one Access Point.

The MIRS provides a path for communication between the TE and the application Server.

### 4.2 Examples of applications

Examples of MIRSs are VOD Services (Video On demand), Multimedia Product Catalogues (home shopping, reservations, etc,...), tele-education, home banking, leisure, etc,...

#### 4.2.1 Video On Demand

A VOD application provides residential users with the ability to select among a catalogue of pre-recorded programmes (films, news bulletins, sport events, music clips, documentaries, previews,...) to receive the chosen programme on a TV set and navigate through it, using control commands.

The catalogue of available programmes may have a tree or a multi-criterion structure. It may federate the catalogues of several content providers (i.e. programme providers). The service operator may also act as one service provider.

To access the application, the user needs to press a channel selection or specific service key on his remote control pad. Navigation through the catalogue can be provided via a graphical man-machine interface whose features may depend on the terminal's capabilities. Text, geometric features and icon display, interaction with scrolling lists and buttons are the most common features. Display of trailers of the programme might or might not be provided by the application.

The service may allow to book a programme beforehand so as to reserve the resources for a specific time. During the programme retrieval, navigation through the programme is allowed using functions which resemble VCR commands (play, fast forward, rewind, pause,...) possibly with extensions enabled by digital coding (e.g. direct access to a sequence).

This application is either a specific instance or a using application of a more general MIRS. However, unlike most existing retrieval applications, VOD is especially oriented towards residential users and requires specific elements in its architecture to cope with the bandwidth requirements and the real-time constraints of moving video. MIRS TE should anyway provide access to other retrieval services (e.g. "traditional" Videotex) of interest to residential users.

A less costly solution (from the server point of view) consists of having programmes which are available in many replicas (e.g. every 5 minutes); in that configuration a short waiting period (e.g. 2,5 minutes in average) is needed before receiving the programme and a random access capability within the programme is possible. This configuration is called staggered VOD (Near Video On Demand - NVOD). However, it is a broadcast service and is outside the scope of this ETR.

Other services are classified as Interactive VOD (IVOD)-like: music clips, previews, news on demand. In the case of music on demand only audio and data are transmitted, but the interactivity is very similar to VOD.

#### 4.2.2 Video shopping

When the user selects a particular tele-shopping programme channel using his regular TV equipment, he may access, among others, the following functions:

- view audiovisual broadcast advertising consisting for instance of commercial presentations;

- navigate through a catalogue (including especially extensive information on the currently advertised product);

- fill in and forward product order forms.

Among possible providers:

- mail order companies (selling general purpose home equipment, e.g. refrigerators, shoes);
- supermarkets and distributors;
- travel agencies (e.g. hotel rooms, flights);
- real estate agencies.

### 4.2.3 Tele-shopping

The user may access, among others, the following functions:

- consult an interactive database;

- navigate through a catalogue (including especially extensive information on the currently advertised product);

- fill in and forward product order forms.

Among possible providers:

- mail order companies (selling general purpose home equipment, e.g. refrigerators, shoes);
- supermarkets;
- travel agencies (e.g. hotel rooms, flights);
- real estate agencies.

Home shopping is very similar to tele-shopping, but supporting the video-ability is not mandatory.

### 4.2.4 Home banking

The user can access the following features (existing already in Videotex):

- browse through bank account(s) of the user;
- transfer money from one account to another account of the same user.

More advanced features:

- transfer money from one bank account of the user to the account of somebody else;
- payment of bills.

### 4.2.5 Games

Several scenarios can be thought of. First, the end-user is able to play a game interactively from a remote server with various controls. More than one user could play the same game, they are all connected to the same server. Another possibility is downloading the game into the user terminal. Downloading can be done if the level of interactivity in the game is low. A user can play against a server or another terminal, through a server. User to user games are conversational services and thus beyond the scope of this ETR.

### 4.2.6 Video books/encyclopaedia

The following features characterise encyclopaedic applications, electronic libraries and electronic books from a user's point of view. A user:

- consults a core encyclopaedia on CD-ROM, updates (subscription) through regular downloads, hot topics available on-line;

- consults yellow pages, tourist guides using electronic publishing of MHI material.

The following application parameters may be required:

- user identification;
- local storage of information;
- authentication/signature;
- copyright protection/copy control;
- charging.

### 4.2.7 Education

The following scenarios characterise interactive telematic training and education applications from a user's perspective. A user:

- consults pre-edited multimedia courseware;

- interacts with simulations;

- asks for an explanation of some demonstrated process and gets it through additional hyperlinks in the lessons;

- makes personal annotations about lessons;

- forwards remarks about some aspects of lessons to the lesson preparer or author.

The following application parameters may be required:

- user identification;
- access/control priority right management;
- all the user terminals are not on the same network;
- use of several services/media simultaneously;
- variable allocation of bandwidth for the media;
- charging.

### 4.2.8 Electronic Programme Guide

The Electronic Programme Guide (EPG) is the basic application made necessary by the availability of many channels. This is made possible due to the involvement of digital compression techniques in video broadcasting. This application both aims at helping users to find their way across the plethora of available events and at helping broadcasters to promote their programme supply.

The user of this application can ask for the presentation of information about the programmes and events on his TV screen. He can navigate through this information using his remote control pad. This information may be structured and presented to the user in several ways, according to the application design. In addition to traditional TV functions (audiovisual display, zapping, access control), the user can for instance:

- select a channel from a mosaic of available programmes within the whole network or within a bouquet;

- consult the timetable of next events within one or several programmes;

- ask for the display of information (duration, theme, target public, summary, language...) on a given event;

- search among the next events according to one or several criteria (theme, type of event, target public, language...), e.g. using scrolled lists;

- program his VCR so as to record a selected event;

- etc,...

This description could be extended with the video-facility. Once the user has selected a certain programme, he could ask for a preview. This preview is a short introduction to the programme. For this version of the EPG, the terminal should support moving picture.

#### 4.2.9 Point of information, point of sales

The following features characterise point of information and point of sales applications from a user's perspective. A user:

- consults information booths with a city guide including street maps and orientation help. The information is regularly updated (traffic situation, cinema and restaurant programmes, special events,...) from a remote source and may be combined with advertising;

- does tele-transactions (ticket and other reservations);

- does telebanking transactions (money orders);

- does tele-shopping.

The following application parameters may be required:

- local storage of information;
- local processing of information;
- authentication/signature;
- access/control priority right management;
- copyright protection/copy control;
- charging;
- all the user terminals are not on the same network;
- use of several services/media simultaneously;
- variable allocation of bandwidth for the media;
- heterogeneous multimedia platforms.

### 4.3 Application requirements

#### 4.3.1 Information Providers requirements

a) Information Providers (IP) have already their authoring tools and their own methodology for production of contents and applications. It is not sure that they will change their working practice for an emerging small market. This could imply that some tools need to be developed for an easy migration to the new services.

b) Some IP may also choose to produce audiovisual material (master) and then derive various products dedicated to specific distribution media: e.g. CD-ROM, MIRS, interactive television, etc,...

c) Impact on the data syntax and terminals:

   1) Level of functionality: the data syntax should be sufficient to express the capabilities of major multimedia applications and widely available devices such as CD-ROMs or Compact Disc Interactive (CDIs).

#### 4.3.2 Continuity of services

The MIRS are part of a continuum of services ranging from purely broadcast services like TV services, Near Video On Demand (NVOD), interactive TV services,... to conversational communication services such as videophony, co-operative work, user-to-user games,.... taking into account the evolution of telematics services like Videotex.

The information representation and data syntaxes used in MIRS should be open enough to allow further possible migration scenarios between the types of services.

### 4.3.3 Conclusion

Inside the MIRS domain, a wide range of services have been identified and they all need different kinds and amount of capabilities and resources. Furthermore, almost each of the identified services could be implemented by using different kinds of information representations and presentation resources (i.e.: home shopping, home banking and electronic books applications may use video representation or not) and therefore, different kinds of terminals. However, the user is likely to have only one terminal of a given type that best suits these requirements.

# 5 Functional architecture

## 5.1 General model

In order to describe all configurations, the following reference models are used:

- a communication model;
- a terminal model;
- an application model;
- a server model.

The communication model describes the relationships between the functional entities involved in the communication. It models the communication between a user and a MIRS in terms of terminal functions, access network functions and service functions.

## 5.2 Communication model

The communication model is derived from ETR 173 [1] developed by ETSI TC-TE. It is a refinement of the generic model for the case of MIRS.

In describing the communication model, the following entities can be identified:

- a User;
- a Terminal Function;
- an Access Network;
- an Access Function;
- a Server Access Network (SAN);
- a Server Function;
- a Database Access Network (DAN);
- a Database Function;
- Management Function Access Network;
- Management Function.

In all multimedia configurations, the **User** employs a terminal to communicate with a MIRS. The abstraction of the terminal is named **Terminal Function**.

The **Access Network** provides the link between the Terminal Function and the MIRS. It may consist of one or several networks of different types.

The **Access Function** is the functional entity which gives access to the MIRS. It is an integral part of the MIRS.

The **Server Access Network** (SAN), which is an optional functional entity, is the abstraction of the function, which connects the Access Function to one or more Server Functions. Depending on the actual topology used in a specific service, it may be void.

The **Server Function** is the abstraction of the multimedia applications.

The **Management Function Access Network**, which is an optional functional entity, is the abstraction of the function, which connects the Access Function to one or more Management Functions. Depending on the actual topology used in a specific service, it may be void.

The **Management Function** could provide the following functionalities:

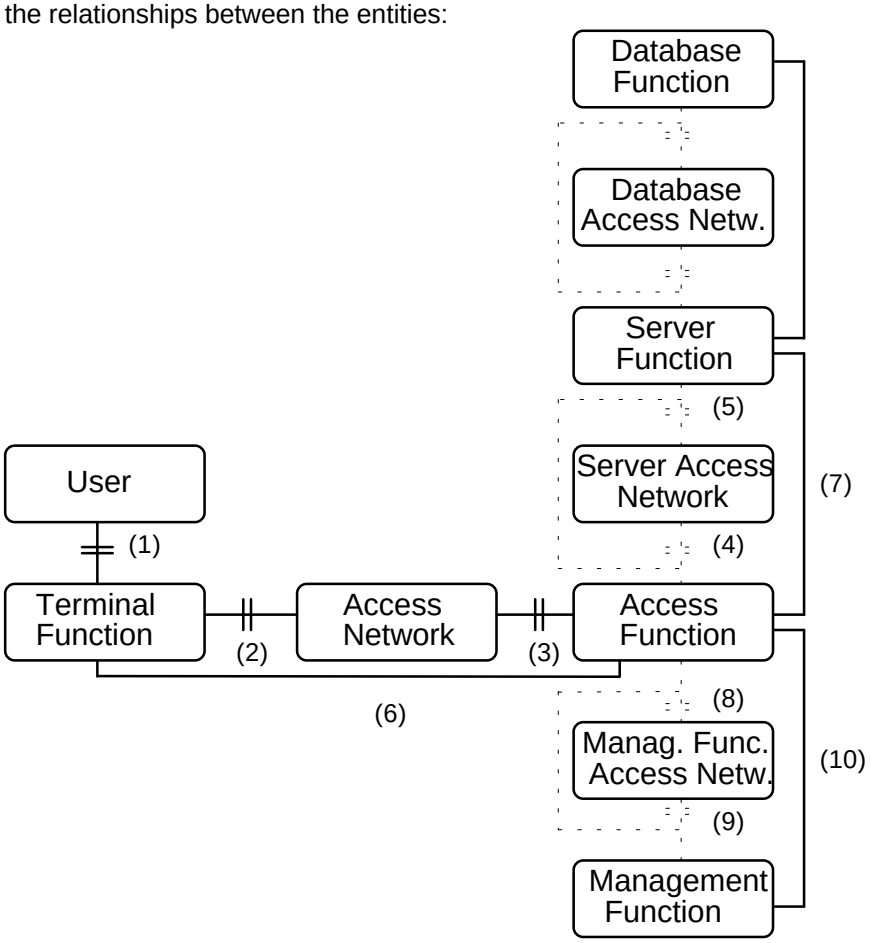
- user and server authorization;
- charging information;
- directory service;
- access control and copyright protection.

The Management Function of the service can be centralised or distributed in several physical units.

The **Database Access Network** (DAN), which is an optional functional entity, is the abstraction of the function, which connects the Server Function to one or more Database Functions. Depending on the actual topology used in a specific service, it may be void.

The **Database Function** is the abstraction of the collection of MIRS databases. It provides the Server Function with the capabilities to manage the information.

Figure 1 shows the relationships between the entities:




NOTE 1: The functionalities described in this functional model may be distributed in different physical entities.

NOTE 2 The dotted lines represent protocols which are optional.

**Figure 1: Communication functional model**

The interfaces and protocols defined between the functional entities are:

(1) User interface (Man Machine Interface);
(2) Terminal-Access Network interface;
(3) Access Function-Access Network interface;
(4) Access Function-Server Access Network interface;
(5) Server Function-Server Access Network interface;

(6) Terminal-Access Function protocol;
(7) Server Access protocol;
(8) Access Function-Management Function Access Network interface;
(9) Management Function-Management Function Access Network interface;
(10) Management Access protocol.

### 5.3 Service architecture

In order to offer the MIRS it is necessary to consider the overall architecture, composed by server (where programmes are stored), terminals (which allow users access information) and the networks. In a real implementation, we could have a distribution network a transport network and a internetworking unit to connect them. The internetworking unit may or may not be integrated with the Access Point. However, the service architecture is out of the scope of this ETR.

Many architectures can be designed for this kind of service. In this ETR, it is assumed that the applications are stored in several geographical locations called Service Centres (SC), structured in a multilevel hierarchical architecture. Figure 2 shows an example of a two-level hierarchical architecture. The upper level consists in a limited number of Central Servers (CS) hosting the Applications (also called Application Servers (AS), containing most of the programmes available in the network and a directory of associated Local Information Servers (LIS); the lower level consists in LIS containing only the most requested set of programmes and upgradable on the basis of local user needs.

Some services can be provided by a CS containing both application and information. Some others services can make use of a CS hosting the application and maybe part of the information and a number of associated LIS. In the latter case, the information could be distributed between the CS and the LIS.

A CS may be operated by one or several Information Providers (IPs).

An AS and an IS may be hosted in the same machine with only one transport network access.

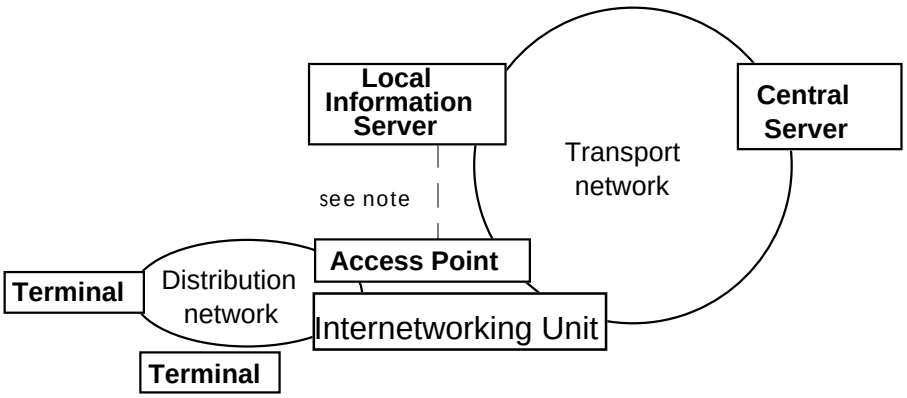
LIS could be linked via high capacity lines (using PDH, SDH or ATM transport) with a given Central Application Server. When the end-user requests information from the AS information (e.g. a movie) which is not available in the end-user LIS, the AS may propose different solutions with different costs to the end-user such as:

- immediate downloading of the required programme over the transport network either to the LIS or directly to the end-user;

- downloading over the transport network during the night;

- tape or disk transfer by mail to the LIS.

As soon as the first information arrives into the LIS, the user can be satisfied without waiting for the completion of the transfer.




NOTE: A link may exist between a particular local server and the Access Point when both are operated by the same company.

**Figure 2: Example of service architecture**

The Access Function and charging function may be located in the Access Point or outside and even remotely through any suitable telecommunication network. It can also support advanced features such as the selection of the appropriate server depending on its geographical location, traffic distribution, load conditions, etc,...

When LIS associated to the CS exist, an IP management capability could install the most requested programmes in the LIS.

The resources allocation into the LIS could be based on the minimisation of global cost including storage, operational and transport costs.

### 5.4 Application model

A general model to describe the operation of a Multimedia Information Retrieval Application is shown in the following figure 3:

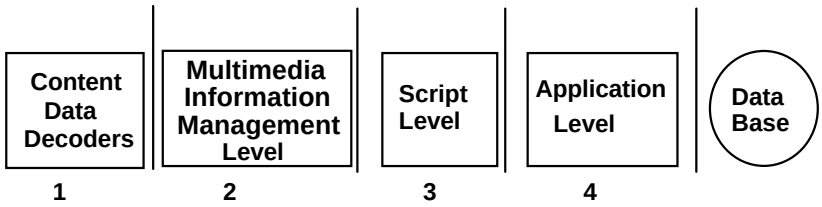



**Figure 3: Functional levels in applications**

This model introduces four functional levels for information structuration purposes. Depending on the characteristics of the application (bandwidth, real-time or no real-time constraints, amount of interactivity between the user and the application, storage and process capabilities in the terminal, available market products as decoders, etc,...) a network may be introduced between the terminal and the server for implementation purposes. As a result of the introduction of the network, several services/applications architectures may be identified and so several types of terminals.

1) Presentation Decoder Terminal which can decode various types of information (textual, graphics, audio, still and moving pictures). It handles only data syntaxes.

2) Multimedia Information Management Terminal which can manage structured multimedia information (multimedia objects). The capabilities of management of these pieces of information may be done by the server, by the terminal or by both.

   Depending on the way these capabilities are split between the terminal and the server, several kinds of implementation may be identified.

3) Script Terminal which can interpret a scripting language and relate with the application for interface with a database.

4) Application Terminal which includes all functional levels of the application except the database that stores multimedia objects or multimedia contents. It generates request to the database and handles the answers from the database.

## 6 Terminal architecture

### 6.1 Terminal model

The design, the functionalities and the cost of a TE for MIRS are strongly related to the kind of applications delivered over the MIRS.

Depending on the application and market segment entered the terminal could be a dedicated one and belong to the consumer goods market segment. If we consider other interactive services more related to an idea of Broadband Multimedia Retrieval Services the terminal could be more similar to a personal computer (equipped with dedicated PC boards), without excluding the use of a dedicated terminal.

Figure 4 shows the general architecture and the functional blocks of a MIRS terminal; the dashed line represents the border between the communication and the consumer world, sometimes known as a network termination.

The line termination (e.g., Asymmetric Digital Subscriber Loop (ADSL) equipment, fibre, coax, etc,...) could or could not be integrated in the terminal. This fact will depend on technical aspects (for example the availability of an ADSL chip) and regulatory aspects (the line termination could be under the responsibility of the Network Operator). If the terminal integrates the local line termination, a number of standardized terminal interfaces would have to be developed for the TE. The number of interfaces would depend on the number of different delivery methods adopted by Network Operators.

It is recommended that standardized interfaces should be developed between the TE and the Network Operator. This will allow portability of TE between different networks and customers premises and also reduce the cost to the consumer and TE manufacturer alike. It will also allow the network operator to deliver the MIRS to a customers premises utilising a number of different technologies depending on technological limitations. The Network Operator will need to develop network terminating equipment to offer a standardized interface for the MIRS.

In describing the terminal model, the following entities can be identified:

- a User;
- a Presentation Module;
- an Application Module;
- a Network Module;
- a Network.

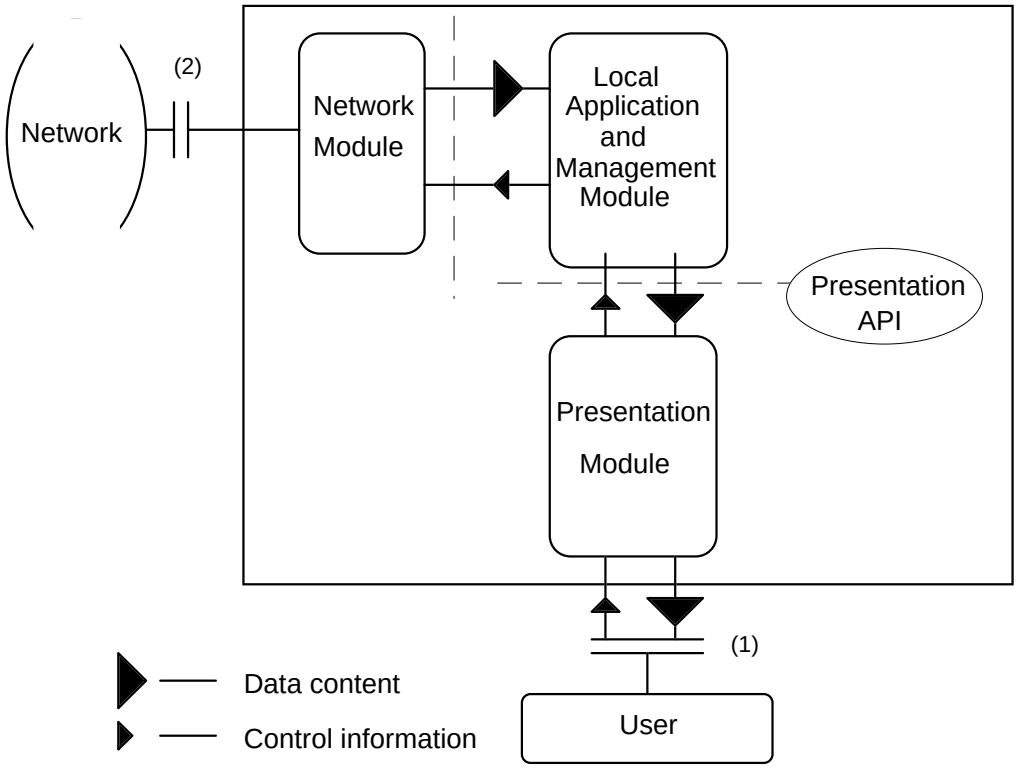



**Figure 4: Functional terminal architecture**

The following modules can be identified:

1) **Network Module:** The Network Module provides a network independent interface to the terminal. It will probably be contained in the Network Operator equipment, This will allow a single interface that is network independent to be standardized for the TE;

2) **Presentation Module:** The Presentation Module mainly consists of a set of media decoders (i.e. JPEG, MPEG, Videotex data syntax decoders) and interaction interfaces (i.e. keyboard, mouse, infrared module) that allows the presentation of information and the handling of the user interaction;

3) **Local Application & Management Module.** The Local Application & Management Module manages the logic of the terminal and the multimedia information. It controls the dialogue between the different modules as well as the dialogue with the Server application. The Local Application & Management Module can have different degrees of complexity according to the service implementation architecture.

The interfaces between these functional modules are:

a) **User interface:** The user interface is the man machine interface between the User and the TE. This could have a number of different physical representations such as monitor, keyboard, interactive voice, infra red controller, mouse, touch screen, etc,... The actual physical interface will depend on the applications being driven over the server and terminal implementation;

b) **Network interface:** The physical realisation of the network interface will depend on the physical access method (i.e. ADSL, coax fibre etc,...) used by the Network Operator. There will be more than one standard for this interface which in each case will be determined by technological limitations;

c) **Presentation Application Programming Interface (API):** The presentation API allows the Local Application & Management Module to access the services offered by the Presentation module. The services may include the display of data and the handling of user input.

Several operator access networks are foreseen for the connection to a customer, depending on the operators strategy and on the already installed networks (ADSL on copper pair, optical fibre, coax cable). A Network Independent Interface (NII) should be defined which permits change to the terminal network access equipment with minimal consequences on the customers terminals.

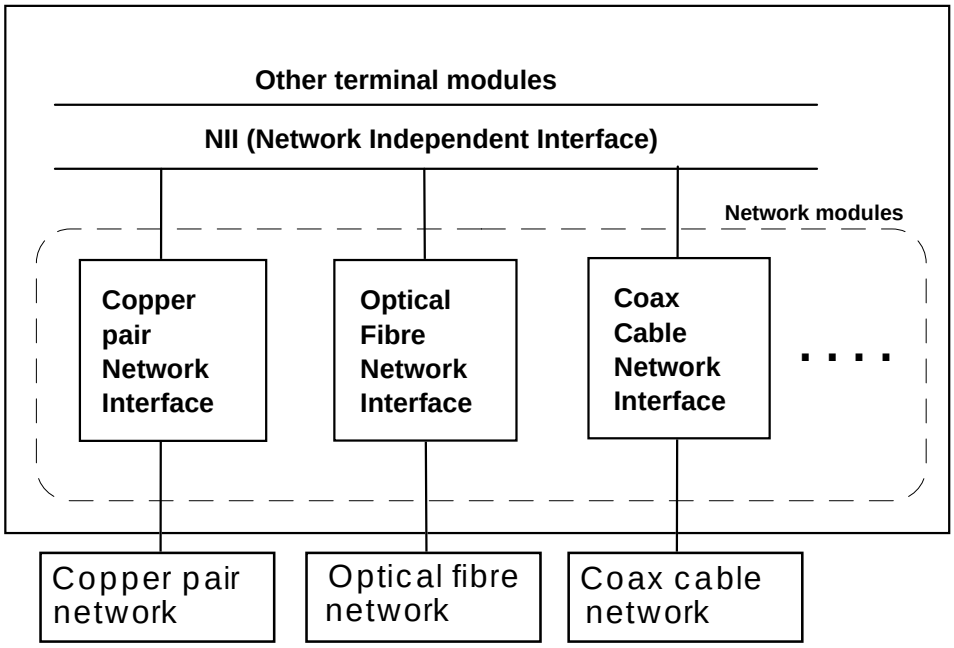



**Figure 5: Network Independent Interface**

### 6.2 Presentation terminal architecture

The Presentation terminal architecture is the most basic terminal architecture.

It consists of a Local Application & Management Module and a Presentation Module.

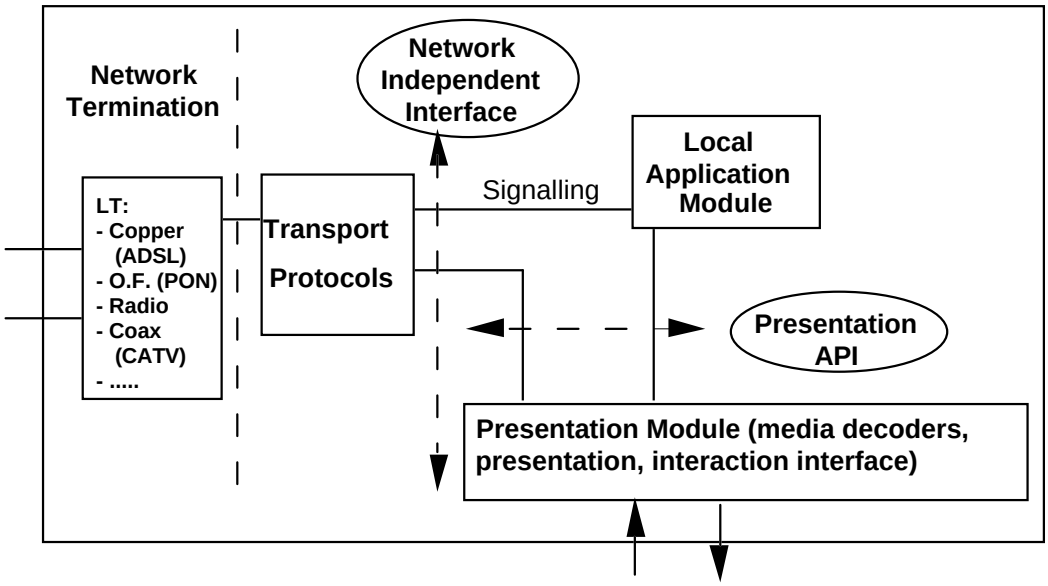



**Figure 6: Presentation terminal architecture**

The Local Application & Management Module consist only of a local application module that passes on the information to the Presentation Module as soon as it arises.

### 6.3 Multimedia Information management terminal architecture

The Multimedia Information management terminal architecture is a more advanced terminal architecture. It consists of a Local Application & Management Module and a Presentation Module. In this case, the Local Application and Management Module consists of a Local Application and a Multimedia Information Management Module.

Figure 7 presents a possible architecture for this terminal and shows the essential modules.

For the time being, two standards may be used to implement the Multimedia Information Management Module: Videotex Enhanced Man Machine Interface (VEMMI) and Multimedia and Hypermedia Expert (MHEG). Each of them may be used taking into account the requirements of the application.

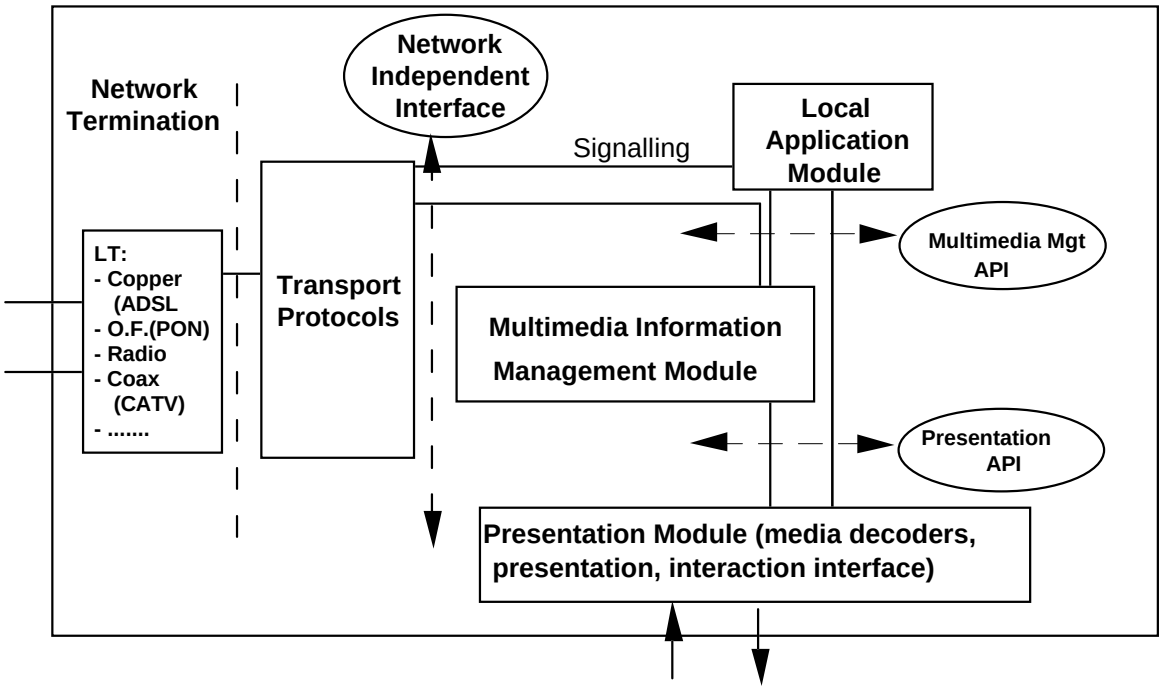



**Figure 7: Multimedia Information management terminal architecture**

The **Local Application Module** manages the logic of the terminal and the Application.

The **Multimedia Information Management Module** interprets multimedia objects and manages the relations between them. It triggers actions and forwards the users actions to the host under specific conditions. The multimedia objects may be stored in the terminal, as well as in the server or in an external Database.

The **Presentation Module** presents the information to the user in the appropriate way.

The **Multimedia Management API** allows the Local Application to access the services of the Multimedia Information Management Module. However, it may be very difficult (or impossible) to define this API.

### 6.3.1 VEMMI terminal architecture

The VEMMI (see subclause 8.3) terminal architecture consists of a Local Application, Multimedia Information Management Module called VEMMI Engine and a Presentation Module.

The VEMMI engine (see ETS 300 382 [2]) consists of a VEMMI Interpreter, a VEMMI Object Access Module and the VEMMI Management Module.

Figure 8 shows the terminal architecture:

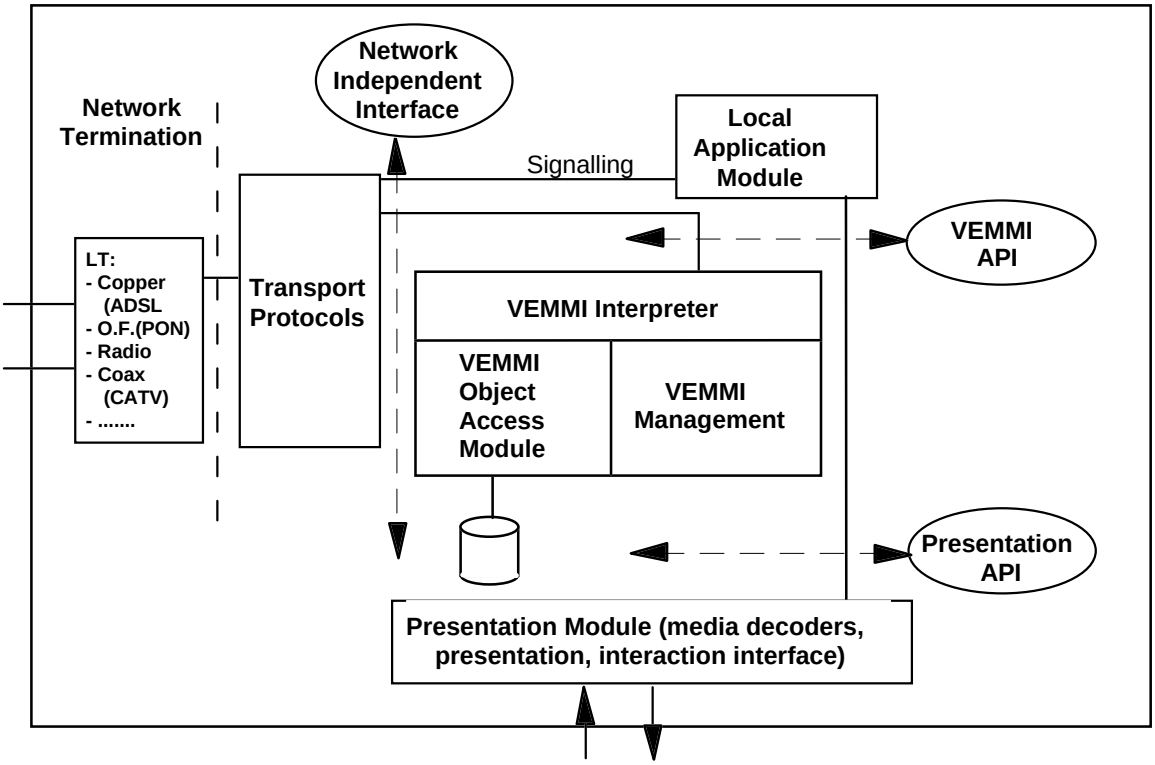



**Figure 8: VEMMI terminal architecture**

**The VEMMI Interpreter** acts as a parser for the VEMMI data received from the remote Server through the local application. These objects can be stored in the local data base or they are requested from the remote application.

**The VEMMI Object Access Module** provides the mapping that enables the access to the requested object. The requests can be referred to an object or to the content of the object in some specific cases.

**The VEMMI Management module** interprets the VEMMI objects, controls the access to the objects and interacts with the Presentation module to provide user interface.

### 6.3.2 MHEG terminal architecture

The MHEG terminal architecture consists of a Local Application, MHEG Engine, an Object Content Access Module (OCAM) and a Presentation Module.

This terminal is represented in figure 9:

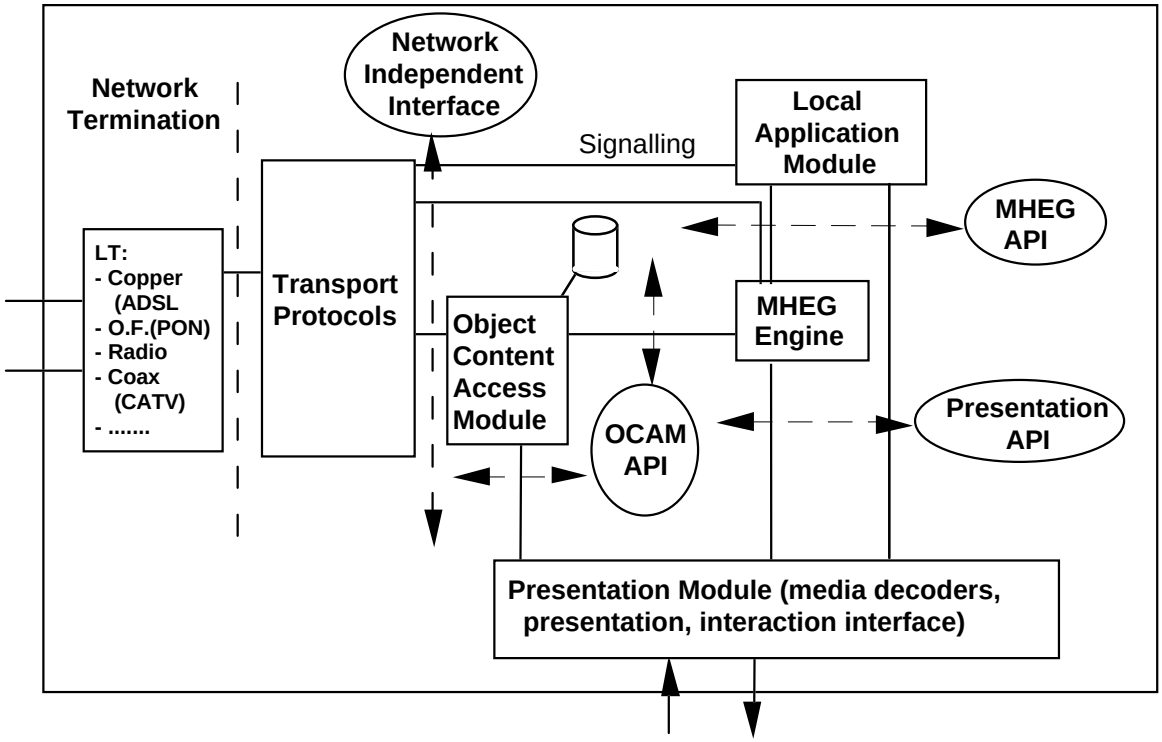



**Figure 9: MHEG terminal architecture**

Figure 9 presents the MHEG architecture for multimedia platforms and shows the essential modules.

The **OCAM** manages a table of indexes that enables it to locate the requested content: the content is either on the **Local Object Base** because it is resident or because it has been previously down-loaded, or it is located on a distant memory (distant multimedia server or cache memory in the network). In this last case the OCAM automatically sends the appropriate request through the **Network Interface** to get the content. The OCAM makes the localisation of the various objects (multimedia contents, MHEG objects or pieces of scriptware) totally transparent to their "clients" (the processors trying to access them).

The **MHEG Engine** receives MHEG Objects, decodes them and performs certain procedures attached to the objects such as link and action execution, synchronisation, content display and user interaction management.

The MHEG services are accessible through the **MHEG API.**

### 6.4 Script terminal

The Script terminal is a more complex architecture where a Script is running in the terminal.

In MIRS based on MHEG, a Script could be used for:

- external device control;
- external device control for data acquisition;
- manipulation of MHEG objects;
- access to external data;
- access to external advanced calculation capability;
- computations, variable handling and control structures.

Both types of Multimedia Information Management terminals can incorporate script interpretation capabilities that allow the server to download a part of the application in the terminal and/or to provide it with specific and sophisticated capabilities of information processing. However, simple terminals (normally without Multimedia Information Management Module functionality) addressed to the residential users, as set-top boxes, could incorporate some "script" capabilities.

### 6.4.1 Script/VEMMI terminal architecture

Very basic Script facility can be implemented using VEMMI Metacode Object. This terminal architecture is similar to the one in subclause 6.3.1.

### 6.4.2 Script/MHEG terminal architecture

The MHEG Script terminal architecture consists of a Local Application, MHEG Engine, an OCAM, a Script Interpreter and a Presentation Module.

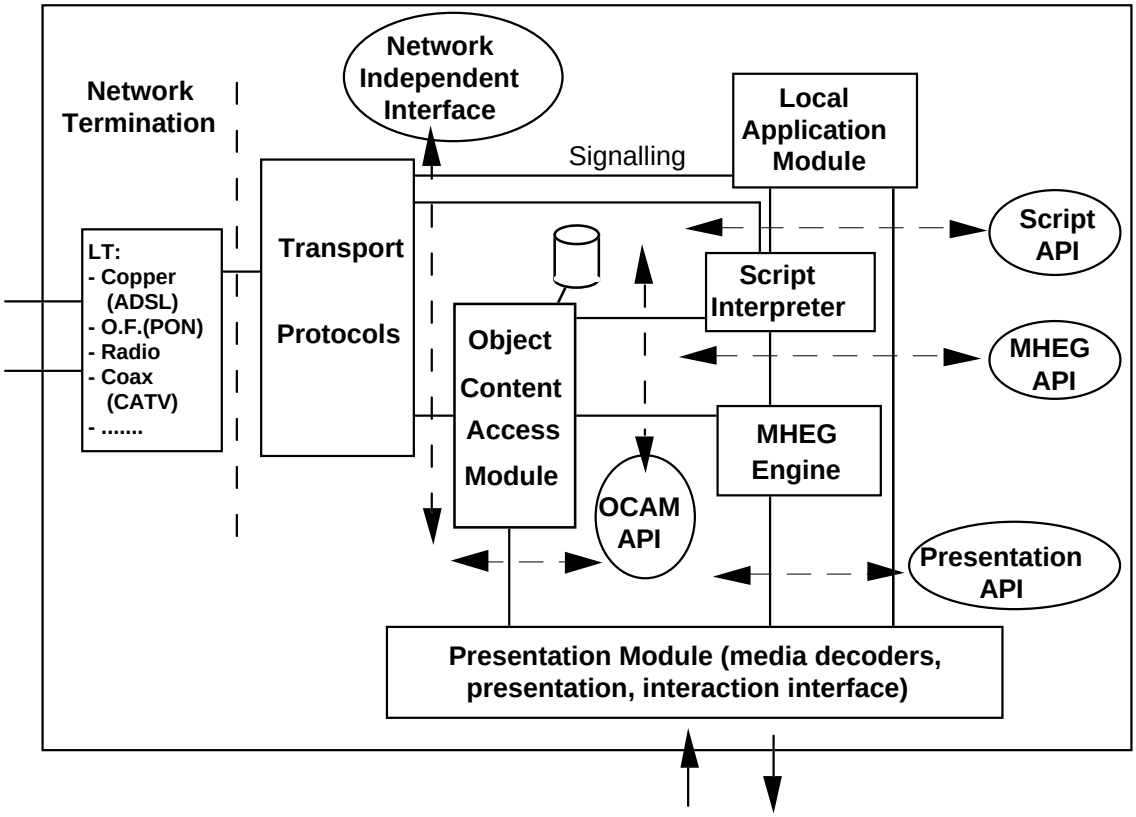



**Figure 10: Script terminal architecture**

The functional modules are the same as the description in subclause 6.3.2, the Script Interpreter excepted.

The Script Interpreter is able to run the Script functionality contained into MHEG Objects and to map to run time environments constraints.

## 6.5 Application terminal

This terminal architecture is application dependant.

The interface level to the network should be consistent with the other terminal architectures presented in the previous subclauses.

# 7 Server architecture

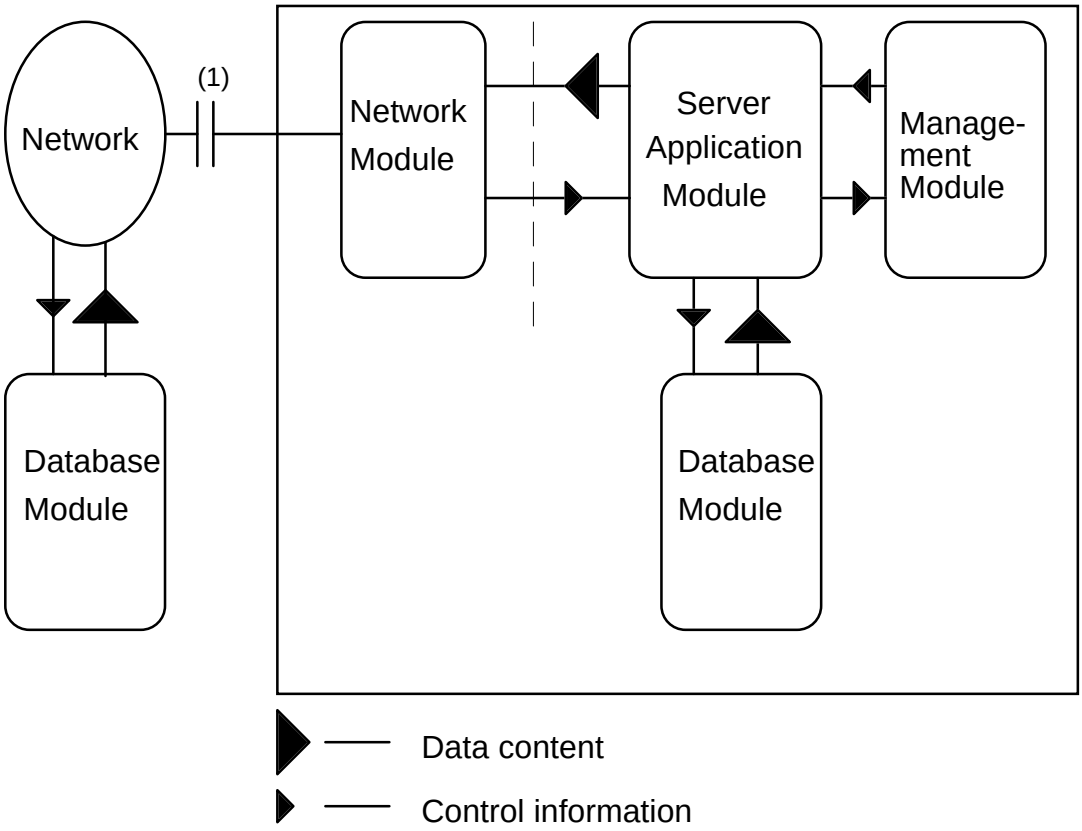



**Figure 11: Functional server model**

Figure 11 presents the general architecture and functional blocks for a MIRS server.

In describing the server model the following functional entities can be identified:

- an application module;
- a management module;
- a data base module;
- a network module;
- a network.

As in the terminal, the network module offers a NII to the other modules.

The **Server Application Module** controls the dialogue between the different modules as well as the dialogue with the terminal application. This module may include the functionality of an Access Function. The protocols need to support different data interchange scenarios according to the service architecture.

The **Management Module** provides the server and IPs with the capabilities to install and to support their applications in the server; and also controls and logs the different sessions existing in the server with the users and the IPs. The relationship between Application Module and Management Module is outside the scope of this ETR.

The **Database Module** provides stored information to the application. The Database Module can be located in the server or in other places. Database Modules outside the server can be accessed through a network. The relationship between the Server Application Module and the Database Module is outside the scope of this ETR.

# 8 Candidate standards for MIRS

This clause identifies standards that could be utilised in MIRS terminals and Servers. It concentrates on the functions in the Server and the terminal. This clause does not identify the transport network protocol.

## 8.1 Videotex protocols and data syntaxes

The representation of application data elements in syntax-based Videotex systems is accomplished by the use of defined data syntaxes. Videotex services have been implemented in different countries making use of defined data syntax profiles which have an equal status. These data syntax profiles are described in ETS 300 072 [3], ETS 300 073 [4], ETS 300 074 [5], ETS 300 076 [6].

In combination with any of these base data syntax profiles, two common enhancements are defined addressing audio and photographic. These common elements are described in ETS 300 177 [7] (based on Joint Photographic Exper Group (JPEG), ITU-T Recommendation T.4 [8] & CCITT Recommendation T.6 [9] coding schemes and JBIG is under study) and ETS 300 149 [10].

The switching mechanisms between data syntax profiles are described in ETS 300 072 [3].

Additionally, there are other protocols handling file transfer and external device management:

- ETS 300 075 [11];
- ETS 300 383 [12];
- ETS 300 388 [13].

## 8.2 Presentation data syntaxes

### 8.2.1 Still picture

#### 8.2.1.1 JPEG

The main method for coding of continuous tone colour still picture is specified in ISO/IEC 10918-1 [14], known as JPEG. It can be used for many different formats and both lossless and lossy coding. The build up of the picture quality can be done either hierarchically (progressive, gradually over the whole picture) or sequentially (directly part-by-part of the picture).

#### 8.2.1.2 Photovideotex

ETS 300 177 [7] (Photovideotex) is based on the JPEG standard (ISO/IEC 10918-1 [14]), and the ITU-T Recommendation T.4 [8] & CCITT Recommendation T.6 [9] coding schemes. JBIG is under study.

#### 8.2.1.3 JBIG

JBIG (ISO/IEC 11544 [15]) is a method for coding black and white images as well as images with very few grey levels.

### 8.2.2 Video coding scheme

Several video coding schemes are already standardized or are in the standardization process in the ITU-T and ISO/IEC:

- ITU-T Recommendation H.261 [16];
- ISO/IEC 11172-2 [17] (MPEG-1 Video);
- ISO/IEC DIS 13818-2 [18] (MPEG-2 Video) (Identical standards);
- ITU-T Recommendation H.26P;
- ITU-T and ISO/IEC are planning further work (ITU-T Recommendation H.26P/L and ISO/IEC MPEG-4 Video). These standards might end up being identical.

### 8.2.3 Audio coding scheme

Standards for audio data encoding:

- PCM linear;
- ITU-T Recommendation G.711 [19], μ law;
- ITU-T Recommendation G.711 [19], A law;
- ITU-T Recommendation G.726 [21];
- CCITT Recommendation G.722 [20], 48 Kbps;
- CCITT Recommendation G.722 [20], 56 Kbps;
- CCITT Recommendation G.722 [20], 64 Kbps;
- ITU-T Recommendation G.726 [21], 24 Kbps;
- ITU-T Recommendation G.726 [21], 40 Kbps;
- ITU-T Recommendation G.728 [22], (LD-CELP, 16 Kbps);
- ITU-T Recommendation J.41 [23];
- ITU-T Recommendation J.42 [24];
- ISO/IEC 11172, MPEG Audio [17];
- ITU-T Recommendation T.419/ISO/IEC 8613-9 [25]).

Industrial Standards:

- WAVE;
- Musical Instrument Digital Interface Device (MIDI).

## 8.3 VEMMI

### 8.3.1 Introduction

The VEMMI standard (ETS 300 382 [2]) specifies the data syntax that can be used by MIRS to provide end users with an easy and user-friendly interface similar to other commonly used Graphic User Interfaces.

The ETS, in its first version, was approved in December 1994. New tasks are being carried out in 1995, in order to add new features to the first version.

### 8.3.2 Main features of VEMMI

ETS 300 382 [2] defines:

- a set of objects compatible to terminal presentation capabilities;
- references data types to be presented inside these objects;
- a protocol to interchange the objects and/or their contents between a generic application and the terminal. It also enables the application to manage the VEMMI objects previously downloaded in the terminal.

**The objects** are the logical units which are used by an application to display data and/or to interact with the user. Some objects defined in ETS 300 382 [2] are: menus, dialogue boxes, presentation boxes,...

Each object can be composed of one or several components. For example, inside a Dialogue Box, the following components can be referenced: radio buttons, check boxes, lists, buttons, presentation areas,...

VEMMI objects and components are defined regarding to their functionality, position and dimension. They can carry different data content that either is defined by the VEMMI standard itself, or referenced from other standards. The VEMMI objects are mapped to the local Graphic User Interface (GUI). The final representation of the object/component is terminal dependent. Their behaviour is clearly defined by ETS 300 382 [2]. A set of **local actions** can be associated to an object or component when it is created or modified. The local actions enable the terminal to answer immediately to some user inputs without reporting them to the application. Objects can be sent in anticipation, in order to be able to display them immediately by user interaction. Permanent storage of objects between sessions and management of local storage in the terminal is also supported.

**The data types:** the following two basic data types are defined in VEMMI: high quality text and VEMMI bitmap.

The following data types can be referenced: Videotex, JPEG, MPEG, H261, GIF, Windows bitmap, sound (MIDI, WAVE).

**The protocol:** ETS 300 382 [2] standard defines a set of commands which enables the exchange of information between the application and the terminal.

Using these commands the application can invoke different management actions in the terminal: create, open, close, modify, destroy ... an object. In the same way, these VEMMI commands enable the terminal to request an object, or its content, or report the user inputs to the application.

## 8.4 MHEG

### 8.4.1 Introduction

The MHEG standard is currently being specified with JTC1/SC29/WG12, the same sub committee that has already developed the JPEG and MPEG standards. It defines the representation and encoding of data structures called multimedia and hypermedia objects, which can be exchanged between networking applications in a wide range of configurations (real-time communication, broadcasting, downloading through networks, storage on CD-ROM's, etc,...).

### 8.4.2 Structure

The MHEG standard is structured into several parts, as outlined hereafter.

**MHEG Part 1 (ISO/IEC DIS 13522-1 [26]): MHEG Object Representation, Base Notation (ASN.1)**

This Part corresponds to the most advanced project: the description and encoding of Multimedia and Hypermedia Objects. The MHEG ISO/IEC DIS 13522-1 [26] is under ballot, and the target date for IS publication was July 1995.

**MHEG Part 2 (ISO/IEC DIS 13522-2 [26]): MHEG Object Representation, Alternate Notation (SGML)**

This Part will develop, from the same Object Representation as in Part 1, an encoding based on the use of the Standardized Generalised Mark-up Language (SGML) language.

**MHEG Part 3 (ISO/IEC CD 13522-3 [26]): MHEG extensions for Scripting Language Support**

Part 3 defines a standardized representation for script interchange by extending the script object notation of Part I of the standard. This Part is also called MHEG-S and is being developed jointly with the ETSI.

**MHEG Part 4 [26]: Registration procedure for MHEG Format Identifiers**

This Part describes the appropriate procedure to register any Content Data Type (e.g. JPEG, GKS,...) or Script Data Type into a MHEG catalogue, for use in MHEG compositions.

**MHEG Part 5 (ISO/IEC CD 13522-5 [26]): MHEG Subset for Base Level Implementations**

This Part defines a simple profile for MHEG for the implementations of MHEG engines on consumer platforms.

### 8.4.3 Main features of MHEG I

The MHEG standard provides a generic approach to multimedia requirements. Its main features are briefly outlined hereafter:

**object orientation**: this approach in the design of the specifications allows for a better achievement of active autonomous and reusable objects.

**Encapsulation format**: the MHEG standard supports final form presentation of multiple media types. The media data can be encoded according to other internationally defined standards (JPEG, MPEG,...) or using proprietary coding techniques: the standard provides facilities for the identification of the coding technique to enable the use of the appropriate presentation resources on the user's platform.

**Composition**: the MHEG standard defines structures for the composition of different media types in a presentation. This composition takes the form of *timing Sequencing, Spatial Positioning* and *Logical Linking* between the media elements. The standard provides features for *Interaction* with, and *Modification* of media data and its associated presentation attributes (e.g. size, position, colour, volume,...). *Dynamic Updating* of media data as well as structural data in a composition is also supported.

**Behaviour**: for each object class, a corresponding behaviour is defined (e.g. spatial presentability, temporal presentability, selectability,...) through behaviour attributes and status values. The behaviour also precises the set of actions by which an object can be handled (e.g. set visible size, set temporal position, set interaction style,...).

**Macro facilities**: the MHEG standard allows the description of *reusable structures* and of *reusable behaviour*, which can be further instanciated with actual parameters in the case of frequent presentation (e.g. behaviour of a menu bar, a scrolling list, a spatial arrangement of pictorial information,...).

### 8.4.4 Main features of MHEG-III

MHEG-S defines a standardized Script Interchange Representation (SIR) which keeps application designers free to use the authoring language best suited to their needs to develop their scripts, i.e. use of user-friendly language which supports complex relationships amongst objects.

MHEG-S is then produced from a formatter at a final stage.

It contains the following functionality:

- a SIR as an encoded sequence of instructions;

- an Intermediate Language for Manipulation of MHEG objects (ILM) allowing access to MHEG objects;

- a mechanism allowing dynamic construct procedures calls enabling the calling of external script language functions not provided by an ILM.

## 8.5 MPEG2/DSM-CC

MPEG2 allows the automatic synchronisation of audio-video in real-time. In this way, the terminal is not in charge of this task. MPEG1 is only a data syntax, however MPEG-2 is also a transport frame which is able to convey, additionally to the data content, control information linked to it.

The DSM-CC Subgroup of MPEG is producing the Digital Storage Media Control end Command (DSM-CC) protocol which is an application protocol intended to provide the control functions and operations specific to managing ISO/IEC 11172 (MPEG-1) [17] and ISO/IEC DIS 13818 (MPEG-2) [18] bitstreams. MPEG-2 Systems (ISO/IEC DIS 13818-1) [18], annex A provides a specification of syntax and semantics for a simple environment of single-user-to-single-DSM applications. MPEG systems are also deployed,

however, in more diverse and heterogeneous network environments for many applications including, for example, VOD and interactive video. This subgroup is producing an extension of the DSM-CC protocol for supporting such applications in both stand-alone and heterogeneous network environments. The DSM-CC extension document reached the Working Document (WD) level in November 1994 and it is expected to be promoted to International Standard level in July 1996.

NOTE: A collaboration between DSM-CC and MHEG is currently going on to check the possibility to use the MHEG standard in the DSM-CC environment. A collaboration between DSM-CC and ITU-T control and signalling is currently under study.

User-to-user interfaces are:

- service, with interface: Open, Close;
- directory, with interface: Open, List, read, Close;
- stream, with interface: Open, Pause, Resume, Jump, Play, Next, Status, Prepare, Close;
- file, with interface: Open, Read, GetData, GetSize, Close;
- Wfile, with interface: File Interface plus create, Write, Delete;
- DBSQL, with interface: Exec, Fetch, Release;
- DBObject.

# 9 Standardization environment & projects

## 9.1 Standardization environment

ETSI was set up in 1988 in response to a Green Paper published by the Commission of the European Communities, to accelerate the process of technical harmonization across the whole area of telecommunications and, in co-operation with other European standardization bodies, the related fields of broadcasting and office information technology.

ETSI's task is to set common standards for Europe, linking networks and services and ensuring interoperability of equipment on a European basis. By relating its work to the developments on the global scene, ETSI is also helping to work towards establishing telecommunication standards world-wide.

The most relevant ISO working groups to be considered are:

- the MHEG group (ISO/IEC JTCI/SC29), producing a standard for the exchange of Multimedia and Hypermedia objects in "final form" (see subclause 8.4);

- the DSM-CC Subgroup of MPEG, producing a protocol for remote control of continuous data streams (see subclause 8.5).

## 9.2 Projects

Other European projects are:

- RACE Accompanying Measures AMMIS (EPG);

- RACE DIAMOND (VOD and tele-shopping over Cable TV Network (CATV) and Asymmetric Digital Subscriber Loop (ADSL) using a CD-I based terminal);

- RACE MARS (VOD, distance learning, multimedia catalogue using CATV, ADSL, Passive Optical Network (PON) as terminal access networks and ATM as server access network over the European ATM Pilot);

- RACE ACCOPI (Access Control and Copyright Protection for Images);

- ESPRIT/OMHEGA (Open MHEG Architecture). Supply of MHEG technology at European level.

Another major activity in the domain of multimedia service definition and experimentation is run under Eurescom (common research organisation for European Telecom Organisation) and in particular through the IMS1 project (Integrated Multimedia Services at 1 Mbit/s).

### 9.3 Other multimedia opinion forming bodies

**Digital Audio Visual Council (DAVIC)**

DAVIC has been set up by a group of individuals from 17 countries and various companies and organisations representing communities having a stake in digital audiovisual applications and services. It is an international organisation with the goal of promoting the success of emerging audiovisual applications and services in the immediate area of broadcast and interactive types, by the timely availability of internationally agreed specifications of open interfaces and protocols that maximise interoperability across countries and applications and services. The goals are realised through the open international collaboration of all players in the field.

DAVIC intends to establish collaboration with international standards bodies and organisations. To achieve its goals, DAVIC will make full use of existing interfaces and protocol standards and specifications, and will develop the missing ones. Complete specifications will be submitted to formal standards bodies for endorsement.

Specific Items of interest to ETSI TC-TE are the following DAVIC primary work items:

a) Architectures of:
   - distributive services;
   - VOD services;
   - stand alone applications.

b) Issues of interoperability between applications and services:
   - open interfaces and protocols for different delivery medium;
   - interoperable information structure, taking into account transport and management.

c) Interfaces and protocols for specific subsystems and major interest:
   - set top box (TE) - server dialogue;
   - user to service interfaces;
   - set top box;
   - access control.

The timetable DAVIC has is to complete the first phase of their work (specifications for the delivery of VOD and derivatives) by December 1995. DAVIC also has a longer term programme to develop MIRS standards. DAVIC is aware of the upgradability issues of TE so are keen to develop generic interfaces and protocols. DAVIC had their first meeting early in 1994 and this work is currently in progress. DAVIC was officially formed at the end of August 1994. In December 1994, 107 companies had joined the Association.

**European Multimedia Forum**

The European Multimedia Forum (EMF) is a non-governmental organisation representing all parties involved in the multimedia community who share a common request in the successful production, delivery and use of multimedia technology and services in Europe.

The main activities of the EMF are:

- to collect and disseminate information;
- to act as a think-tank;
- to promote multimedia technologies and services;
- to provide specific services to its members.

**International Multimedia Association**

The mission of International Multimedia Association (IMA) is to promote the development, application and use of interactive multimedia, to expand markets for interactive products and services, to encourage greater public awareness of the industry, and to demonstrate the uses and values of the new technologies. Membership in the IMA is open to organisations, institutions, and individuals who are actively involved in the production and use of interactive technology and optical media systems, who provide services to the industry, and those who wish to track the forward motion of this emerging technology.

# 10 Terminal characteristics

## 10.1 General remarks

VEMMI has been designed as a data syntax and a protocol between a host and a terminal in a connected mode.

MHEG is only a data syntax, and makes no assumption on the configuration, and is adaptable to interactive communication as well as broadcasting.

MHEG Objects encapsulate a part of the script of the application. For VEMMI, the script is supposed to be mainly on the host.

In the following analysis MHEG refers to the MHEG 1 provisions. It is assumed that MHEG 5 will basically support the same features with specific optimisations for low level implementations. For example, complex processing of actions might be simplified.

## 10.2 Presentation oriented analysis

**Table 1: Presentation oriented analysis**

| | **Terminal Type** | | | |
|---|---|---|---|---|
| **Characteristics** | **Presentation** | **VEMMI** | **MHEG** | **Script** |
| synchronisation basic | Y | Y | Y | Y |
| synchronisation advanced | N | N* | Y | Y |
| Hyper media links - basic | N | Y | Y | Y |
| Hyper media links -advanced | N | N | Y | Y |
| scaleability of objects | N | N | Y | Y |
| Local echo management | N* | Y | Y | Y |
| External device interface | N | N | N | Y |
| Interactive graphics user interface | N | Y | Y | Y |
| Enhanced text | N | Y | N* | N* |
| Graphics | N* | N* | N* | N* |
| Still picture | N* | Y | N* | N* |
| Moving picture | N* | N* | N* | N* |
| Audio | N* | N* | N* | N* |
| Identification of the data content | Y | Y | Y | Y |
| Advanced computing platform independent | N | N | N | Y |
| Final form encoding for real time presentation | Y | Y | Y | Y |
| Code optimised | Y | Y | Y | Y |
| Windows/ multiplane MM interface | N | Y | Y | Y |
| Transitions effects | N | N | Y | Y |
| Time models | N | N | Y | Y |
| Space models | N | Y | Y | Y |
| Support for re-use of object structures | N | Y* | Y | Y |
| *: see subclauses below | | | | |

### 10.2.1 Synchronisation in time

**Basic synchronisation**: It is a definition of a relation between multimedia contents in time or in space.

**Advanced synchronisation:** Following synchronisation mechanisms are examples for advanced synchronisation:

- chained synchronisation: a set of objects is to be presented one after another in the form of a chain;
- cyclic synchronisation: one or more objects will be repetitively presented;
- conditional synchronisation: the presentation of an object is linked to the satisfaction of a condition.

**VEMMI**: Some advanced synchronisation features are not directly implemented but could be implemented using VEMMI metacode.

### 10.2.2 Hypermedia links

**Basic hypermedia links:** The ability to access monomedia and multimedia information by navigating across links triggered by a limited set of events.

**Advanced hypermedia links:** The ability to access monomedia and multimedia information by navigating across links triggered by an enhanced set of events, states and logical combinations that are evaluated during runtime.

### 10.2.3 Scaleability of objects

The presentation size of objects can be changed under the control of the application.

### 10.2.4 Local echo management

User inputs are handled and echoed locally on the terminal and sent to the host on a specific event.

Presentation: Basic local echo management could be implemented according to the data syntaxes used.

### 10.2.5 External device interface

The syntax provides means to access external devices in a standardized way.

### 10.2.6 Interactive graphic user interface

The user interface is based on graphical elements (buttons, list boxes, etc,...) that can be manipulated in an interactive way.

### 10.2.7 Enhanced text

A definition of high quality text (fonts, sizes, text attributes, etc,...) is provided within the standard (syntax).

| | |
|---|---|
| MHEG: | text representation is not defined but can be referenced. |
| Script: | text representation is not defined but can be referenced. |

### 10.2.8 Graphics

A definition of graphical elements (line, circle, etc,...) is provided within the standard (syntax).

| | |
|---|---|
| Presentation: | representation is not defined but can be referenced. |
| VEMMI: | VEMMI can reference to CGM and Videotex graphics. |
| MHEG: | representation is not defined but can be referenced. |
| Script: | representation is not defined but can be referenced. |

### 10.2.9 Still pictures

A definition of still pictures is provided within the standard (syntax).

| | |
|---|---|
| Presentation: | representation is not defined but can be referenced. |
| MHEG: | representation is not defined but can be referenced. |
| Script: | representation is not defined but can be referenced. |

### 10.2.10 Moving pictures

A definition of moving pictures is provided within the standard (syntax).

| | |
|---|---|
| Presentation: | representation is not defined but can be referenced. |
| VEMMI: | representation is not defined but can be referenced. |
| MHEG: | representation is not defined but can be referenced. |
| Script: | representation is not defined but can be referenced. |

### 10.2.11 Audio

A definition of audio data is provided within the standard (syntax).

| | |
|---|---|
| Presentation: | representation is not defined but can be referenced. |
| VEMMI: | representation is not defined but can be referenced. |
| MHEG: | representation is not defined but can be referenced. |
| Script: | representation is not defined but can be referenced. |

### 10.2.12 Identification of data content

Data content that is not defined within the standard (syntax) can be identified, referenced and presented.

### 10.2.13 Advanced computing

The system (syntax) provides means to access and reference advanced platform independent computing algorithms existing on the terminal (needed for simulations, etc,...).

### 10.2.14 Final form encoding

The information is represented and coded for direct presentation, without requiring additional processing of its structure.

### 10.2.15 Code optimised

This means that code loading requires minimum size of memory at the terminal level.

### 10.2.16 Multiplane interface

The user interface is based on virtual planes that support overlapping and restoring mechanisms.

### 10.2.17 Transition effects

The system (syntax) provides a means to reference or trigger effects for the transition between certain states in the terminal (fade-in, fade-out, etc,...).

### 10.2.18 Reuse of object structure

The object structure can be used with different contents in multiple context.

### 10.2.19 Time model

It is a generic model in time that allows definition of temporal relationship between objects.

### 10.2.20 Space model

It is a generic model in space that allows definition of spatial (positioning of objects in a generic space) relationship between objects.

## 10.3 Service oriented analysis

**Table 2: Service oriented analysis**

| | Protocols | | Data Interchange Format | | |
|---|---|---|---|---|---|
| **Function** | **MPEG** | **VEMMI** | **VEMMI** | **MHEG** | **MPEG** |
| Security<br>Conditional access.<br>Copyright info in syntax. | <br>Y*<br>Y | <br>N<br>N | <br>N<br>N | <br>N*<br>Y | <br>Y*<br>Y |
| Encryption<br>downward<br>Upward | <br>Y*<br>N | <br>N<br>N | <br>N<br>N | <br>N<br>N | <br>Y*<br>N |
| Interleaving of objects. | Y | N | N | Y | Y |
| Separate retrieval of object description and object content. | Y | N | N | Y | Y |
| File downloading/ transfer | Y | Y | Out of scope | Out of scope | Y |
| Support of local storage | N | Y | Y | N | N |
| Minimal resource constraints<br>- Static<br>- Dynamic | <br>N<br>N | <br>Y<br>Y | <br>Y<br>Y | <br>N*<br>N* | <br>N*<br>N |
| Control of real-time data streams | Y | N | N | Y | Y |
| Reference of objects across several streams (data audio video) | | N | Out of scope | Y | Y |
| Integrity | | Y* | Y* | Y* | Y* |
| Resistance to reverse engineering | Out of scope | Out of scope | Y | Y | Y |
| Object identification for distributed applications | N | N | N | Y* | N |
| Access to real-time contents and objects | Y | N | N | Y | Y |
| Dynamic structure | | Y | Y | Y | |
| *: see subclauses below | | | | | |

### 10.3.1 Security

**Conditional access:** the system (syntax) provides means to control the access to an application or a specific part of an application.

MPEG (protocol): provided by DVB/MPEG2.
MHEG: the information attached to the object can be evaluated for conditional purpose.
MPEG (DIF): provided by DVB/MPEG2.

**Copyright information:** the system (syntax) provides means to associate copyright information and data.

MPEG (Protocol): tools available.

### 10.3.2 Encryption

**Downward Encryption:** the system (syntax) provides means to encrypt data that are sent from the host to a terminal.

MPEG(protocol & DIF): provided by DVB/MPEG2.

**Upward Encryption:** the system (syntax) provides means to encrypt data that are sent from the terminal to a host.

### 10.3.3 Interleaving of objects

The syntax provides means to interleave objects which are to be retrieved simultaneously so that large objects do not cause delays for other objects.

### 10.3.4 Separate retrieval of object description and object content

The syntax provides means to retrieve the object description without necessarily retrieving the content so that the system can use information about a set of objects to optimise the access for this set and resources needed for the access can be prepared.

### 10.3.5 File downloading/transfer

A definition of a file transfer syntax is provided within the standard (syntax) or a file transfer standard can be referenced.

### 10.3.6 Local storage

The system (syntax) provides means to access and reference local storage facilities existing on the terminal.

### 10.3.7 Minimal resource constraints

**Static:** the system (syntax) provides means to negotiate the minimum resource requirements for a given application only at the start of the application.

MHEG: the information attached to the object can be evaluated to negotiate the minimum resource.

**Dynamic:** the system (syntax) provides means to negotiate the minimum resource requirements for a given application at the start of the application and also during the application. If during an application a lack of resources is discovered graceful degradation mechanisms should take effect.

MHEG: the information attached to the object can be evaluated to negotiate the minimum resource.

MPEG: the data stream can be used to negotiate the minimum resource.

### 10.3.8 Control of real-time data-streams

The system (syntax) provides a Video Cassette Recorder (VCR) like interface.

### 10.3.9 Referencing of objects across streams

The system (syntax) provides a means to reference objects across several audio and/or video data streams.

### 10.3.10 Integrity

The system is able to detect modifications of information so as to protect the system from infection.

MPEG (Protocol & DIF), VEMMI, MHEG: it is still an open issue for scripts.

### 10.3.11 Object identification for distributed application

The system is able to associate object with application.

MHEG: it is the responsibility of the host to distribute application.

### 10.3.12 Access to real-time contents and objects

Access to multimedia information involving real-time constraints: audio, video.

### 10.3.13 Dynamic restructuring of objects

The object structure can be changed during the lifetime of the object.

(Dialogue with three buttons then with one button,...).

## 11 Protocol stacks

Different protocol stacks should be candidates to be used in MIRS taking into account the application characteristics and the service architecture chosen.

These application characteristics are basically:

- bandwidth requirements;
- real-time or no real-time requirements;
- level of interactivity;
- users skills: implying different levels of objects handling depending on the kind of user;
- object characteristics and ownership requirements: size, identification, etc,...;
- type of implementation of man machine interface to be offered;
- terminals cost constraints;
- target segment of the market;
- etc,...

Two types of flow put different requirements on the transport layer: sustained or not sustained throughput, error control, data re-transmission or not, priority or not, need for purge mechanism, etc,... These different flows fall in two different QOS categories:

- real-time flow from the server for audio only, video only and audiovisual sequences;
- non real-time flow for messages and commands between the terminal modules and the other modules located outside the terminal.

The protocols stacks should be supported as indicated in figure 12:

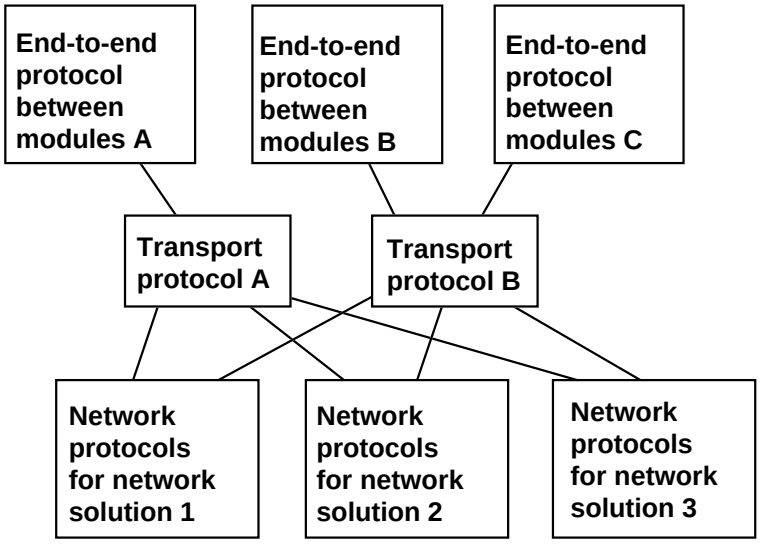



**Figure 12: Transport protocol solutions**

Taking into account the QOS requirements of the application, transport protocol A could be dedicated to real-time transmission and transport protocol B could be dedicated to non real-time transmission. For example, two OCAM modules (A modules) interchanging MPEG contents will require transport protocol A. Two modules interchanging binary files (B modules) only need transport protocol B.

Figure 13 shows a generic protocol stack approach for MIRS:

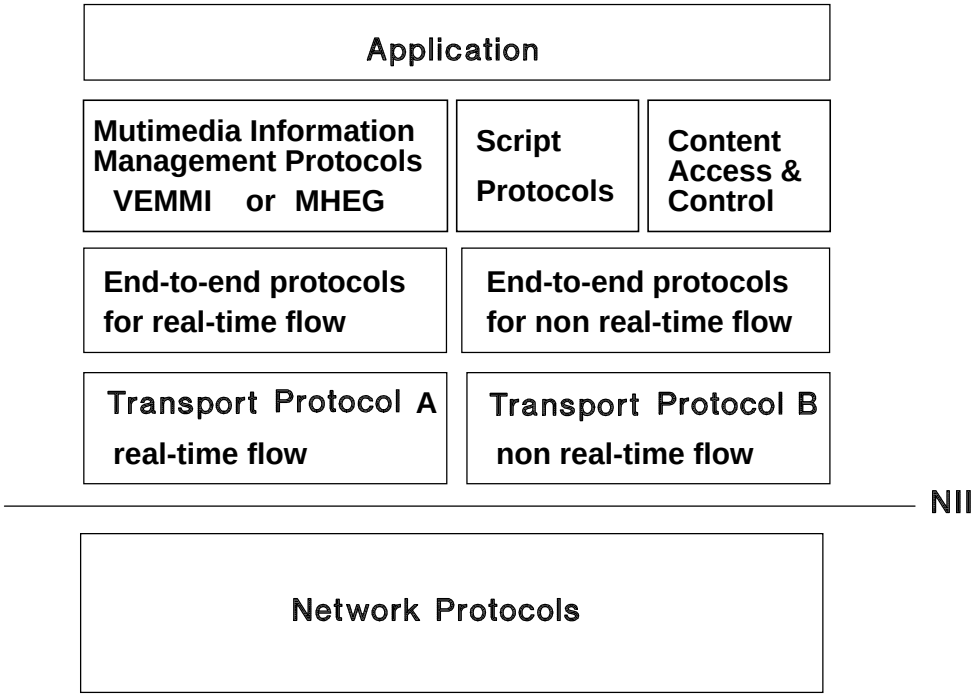



**Figure 13: Protocol stack**

# 12 Technologies

The video coding and compression techniques, the transmission technologies (in particular in the distribution network) and information technologies could be considered as key points for providing high bandwidth interactive services. In the following, some of them are mentioned.

**Video coding and compression techniques**

The MPEG1 standard offers a coding algorithm for compressing a digitized video signal to about 1,5 Mbit/s with VCR quality. MPEG2 provides better quality (for example standard TV quality) at a bitrate of some Mbit/s; it also offers a great flexibility in terms of quality and bandwidth. The MPEG1 is a stable standard and the first commercial decoders and encoders are already available but not yet at a low cost. We can expect that the MPEG decoders will be consumer products, integrated in the user's terminals. It is interesting to mention that real-time MPEG1 encoders are commercially available. The MPEG2 standard, except the protocol extension dealing with DSM-CC, is complete (International Standard level in November 1994) and an open question is whether to move directly to it.

Studies on digital TV have been done in the so-called Digital Video Broadcasting (DVB) group (more than 140 organisations, 90 % of them being members of the Joint Technical Committee (JTC) between ETSI and the EBU) which has established the specifications for the Digital Television with the aim to see the first implementations in 1995 for satellite and cable applications.

As far as the code source is concerned, they are based on MPEG-2 specifications as adopted in November 1994 (Singapore):

- MPEG-1 audio (already used by DCC);
- MPEG-2 video: Main profile at main level;
- MPEG-2 transport stream.

Several manufacturers have already announced Integrated Circuits (ICs) for MPEG-2.

**Access network transmission technologies**

It is important to underline that the overall network architecture should be independent, as far as possible, from the different choices related to the access network. In this ETR, references often made to the ADSL, in fact it could be considered as an interesting technique, but this does not mean that it is the only one.

ADSL is a technology capable to transport on a single twisted pair a downstream channel (1,5 Mbit/s or 2 Mbit/s), a bi-directional control channel (16 kbit/s) and the analogue Plain Old Telephone Service (POTS) (even if some ADSL boxes available on the market provide only a mono-directional channel). Future evolution of ADSL technology could allow the transport of a 6 Mbit/s downstream channel.

Concerning the ADSL modem based on ANSI T1/E1 specifications, some IC manufacturers claim this decoder should not be that complicated to perform because the "Discrete Multitone Technology" is very near the Coded orthogonal Frequency Division Multiplexing (COFDM) one used in Data Audio Broadcasting (DAB) (Eureka 147 project) (COFDM: multi carrier system with a modulation technique which may be different on each carrier e.g. 16QAM on a given carrier, 64QAM on another one, etc,...). ADSL modems were to have been available by the end of 1994.

Other examples of possible wideband access networks, supporting VOD services, can include Passive Optical Network (PON) and fibre/copper solutions (for example fibre to the curb and coaxial to the home). In any case, the choice of the proper solution depends on the network scenario in the different countries.

As far as the TV channel coding is concerned, the DVB group is dealing with the satellite, cable and terrestrial transmission. The specifications for satellite were approved on 17 December 1993 while the specifications for digital TV on cable TV were approved on 1st March 1994. The specifications for terrestrial are expected during 1995.

An ETSI PT was charged to make these documents available for an ETSI UAP with the corresponding ETSs being approved by the end of 1994. In the meantime, Generic MPEG-2 is due to be approved by CEN as EN(s).

On cable TV networks different modulation techniques are used. Within an 8 MHz channel, the following bit rates may be obtained:

- 16QAM: up to 25 Mbit/s;
- 32QAM: up to 31,9 Mbit/s;
- 64QAM: up to 38,1 Mbit/s.

As far as transmission is concerned the DVB specification contains 3 basic elements:

- a Reed Solomon decoder (IC available);
- a Forward Error Correction based on a Viterbi decoder (IC available by 3Q1994);
- a 16/64QAM modem (cable) (IC available before the end of 1994);
- a QPSK modem (satellite).

The manufacturers have already announced the aggregation of these functions within a single IC by 1995.

From the above, it is clear that the basic hardware components for multimedia on cable networks will be available this year (1995).

**Information technologies**

The MIRS can also take advantage of the storage technologies (including also Servers, etc,...), since the costs of these systems are decreasing considerably and, on the other hand, the performances are increasing. This is an important point because, for the provision of this high bandwidth interactive service, it is necessary to have systems with large storage capacity, high performances (in terms of speed), at a reasonable cost. This point becomes evident, if we consider that a MPEG1 film of 100 minutes needs a 1,2 Gbyte storage capacity and has to be shown at a bitrate of 1,5 Mbit/s, with interactive facilities.

**Access control**

In order to control the access to the services, the user could introduce a password and/or use a system like a smart card.

# 13 Conclusions and "recommendations"

## 13.1 Introduction

This ETR clearly shows that the definition of Multimedia Information Retrieval Services (MIRS) is a very complex problem.

A number of interfaces and flows between terminal modules and modules outside the terminal (Server and Access Function) have been identified.

Because technologies, standards and market products are (or will soon be) available, there is a strong interest in identifying/defining the protocols and interfaces to be used with the Multimedia Information Management Terminal.

Possible candidates to be used as software platforms should be VEMMI and MHEG engines.

## 13.2 Considerations about market

In the MIRS domain, there are number of proprietary solutions already promoted on the market. There are global consensus forming bodies and standards bodies who are actively developing standards in this area.

From the standardization point of view, we should be able to define a globally consistent approach for the end-to-end protocols of broadband MIRS, otherwise proprietary solutions will become dominant and would undermine any standardization activity.

Consequently:

- ETSI should define end-to-end protocols;

- duplication of standardization effort and development of competing standards in this area should be avoided, hence, close liaisons are required with DAVIC, ISO/IEC and ITU-T in the relevant areas;

- the respective scope and application domain of each standard should be well described;

- VEMMI (ETS 300 383 [12], ITU-T Recommendation T.107 [27]) should be promoted on a global scale thus helping to insure global standards for Broadband Multimedia Information Retrieval Services;

- if VEMMI standards are not accepted on a global scale then care should be taken that the VEMMI standards complement the global standards and do not compete with them.

VEMMI, having a Videotex and telecommunication background, was originally designed for narrow band applications. VEMMI has not been designed for applications which handle video information. However, other MIRS can be used and are currently designed using VEMMI.

The MPEG2 syntax has not been considered until now in the Videotex environment (Syntax-Based Videotex, VEMMI), but it should be identified and included in it. However, a new version of VEMMI is currently under discussion and it will support the management of video information (ITU-T Recommendation H.261 [16], MPEG1 and MPEG2).

MHEG data syntax has been designed to address broadband applications such as MIRS. However, the need for a simple profile for base level implementations of MHEG engines in consumer terminals has been recognised, and will be developed in the MHEG 5 standard.

MIRS will be at the crossing point of two driving forces:

- television services, moving to interactivity on broadband networks;

- telematics services that will evolve in the continuity of Videotex, adding video media to their applications, on narrow band and broadband networks.

To build applications in these domains the following components are needed:

- a transport network;
- transport protocols;
- end-to-end protocols;
- a presentation syntax or a multimedia object manager.

The purpose of this subclause is to identify the actions that have to be undertaken by ETSI to enable the development of both TV oriented and Videotex oriented applications. The network aspects and the transport protocol aspects are out of the scope of this ETR.

Four different terminal architectures have been identified in this ETR. They differ in functionality level and in complexity (cost of implementation). Technically all terminal architectures are candidate to be used for the target applications in both identified domains. This subclause will identify the terminal architectures that are best suited for use in the different domains.

### 13.2.1 Market consideration for "TV-oriented" applications

The analysis provided in clause 9 shows that there are two major tendencies for the introduction of MIRS into this segment, which are promoted by the major actors in that field (e.g. DAVIC):

a) the multimedia information is transferred from the server to the terminal using a file transfer method. Several proprietary "Viewers" for this information will emerge on the market; therefore, the terminal architectures presented in the subclauses 6.3.1, 6.3.2 and 6.4 will not have any market success. Real-time information is managed making use of DSM-CC;

b) the multimedia information is transferred from the server to the terminal using a file transfer method. There is an agreement concerning the "Viewer" that will be used to play the information and to interact with it; the MHEG terminal architecture presented in the subclauses 6.3.2 and 6.4 is accepted by the market. Real-time information is managed making use of DSM-CC.

NOTE: Scenarios e) and f) (see following pages) could also be applicable to scenario b) above.

For the time being it cannot be foreseen which of the presented scenarios will become reality. So the conclusion is to further investigate the two cases.

If case a) becomes a reality the actions that have to be taken by ETSI TC-TE are:

- liaison with DAVIC and other bodies in order to be able to follow the development. No additional standardization effort from ETSI TC-TE is needed.

If case b) becomes a reality the actions that have to be taken by ETSI TC-TE are:

- collaboration with ISO/IEC JTC1 SC29 and ITU-T SG8 to define a profile of MHEG (called MHEG 5). An official liaison should be established;

- collaboration with ISO/IEC JTC1 SC29 and ITU-T SG8 to define an interface between MHEG and DSM-CC. (e.g.: defining a MHEG elementary action that invokes a DSM-CC command (play, pause,...);

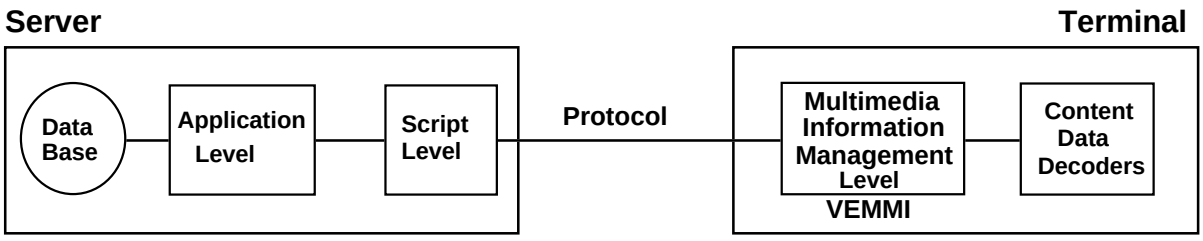
- liaison with DAVIC and other bodies in order to promote MHEG 5;

- identification or definition of a file transfer protocol to be used between terminal and server.

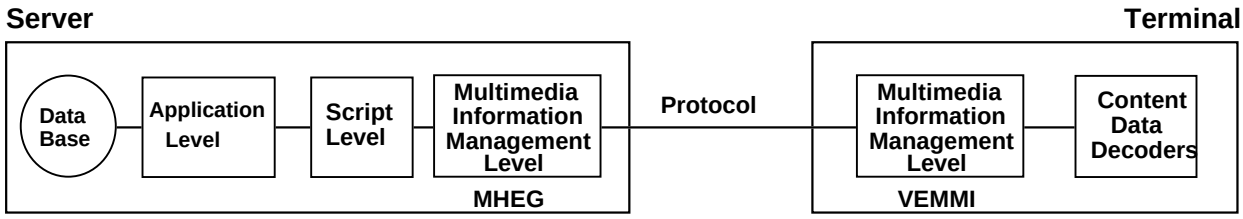
### 13.2.2 Market consideration for "Videotex-oriented" applications.

The analysis provided in this ETR shows that there are three different possible scenarios for the evolution of Videotex towards MIRS:

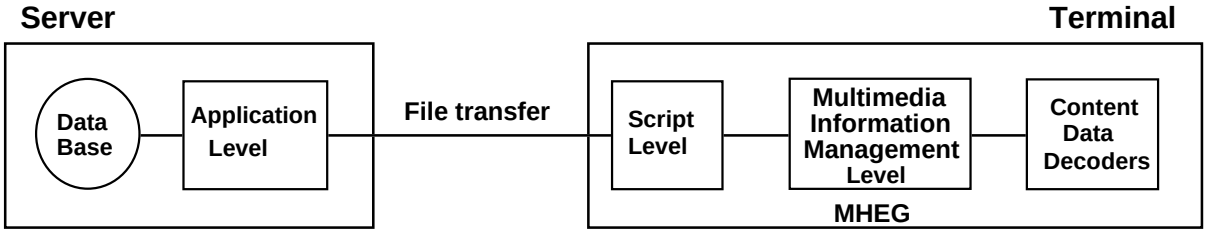
c) content data decoders and multimedia information management level are residing on the terminal side. An end-to-end protocol is used to transfer multimedia information to the terminal, to control the multimedia objects in the terminal and to get the user inputs back. The terminal architecture is based on the VEMMI model presented in subclause 6.3.1. The application on the host side is a VEMMI application using VEMMI encoded data and objects. Real-time information is managed making use of DSM-CC;



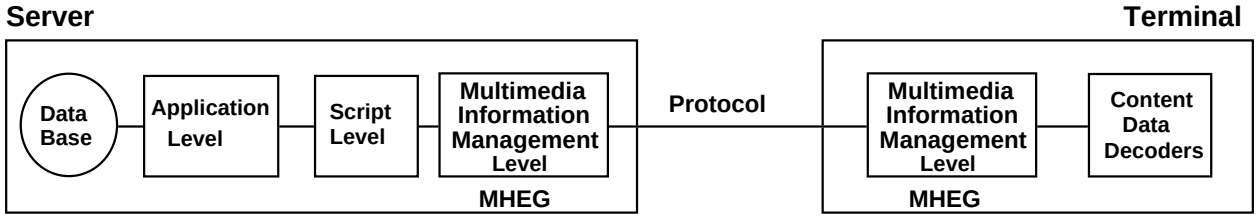
d) content data decoders and multimedia information management level are residing on the terminal side. An end-to-end protocol is used to transfer multimedia information to the terminal, to control the multimedia objects in the terminal and to get the user inputs back. The terminal architecture is based on the VEMMI model presented in subclause 6.3.1. The application on the host side is a MHEG application which uses data and multimedia objects encoded according to the MHEG standard. The MHEG engine needed to manage the MHEG objects is located on the server side. The MHEG engine uses the VEMMI terminal to display data (dialogue boxes, buttons, list boxes) and to collect user inputs. The result of the processing of MHEG objects by the MHEG engine in the host results in the display of multimedia information in the terminal. The protocol and data syntax used to transmit the multimedia information and to collect the user input is the VEMMI protocol. The functionality level of the VEMMI engine in the terminal corresponds to MHEG 5. Real-time information is managed making use of DSM-CC;




e) content data decoders, multimedia information management level and script level are residing on the terminal side. A file transfer method is used to transfer multimedia information and script to the terminal. The terminal architecture is based on the MHEG model presented in the subclause 6.4. All multimedia information are encoded according to the MHEG standard. Real-time information is managed making use of DSM-CC.




f) content data decoders are residing on the terminal side and multimedia information management level is splitted between terminal and server. The terminal architecture is based on the MHEG model presented in the subclause 6.3.2. All multimedia information are encoded according to the MHEG standard. A protocol supporting the MHEG API is used to allow the server MHEG engine to control the MHEG engine running on the terminal. Real-time information is managed making use of DSM-CC.




For the time being it is not possible to foresee which of the presented scenarios will become reality. So the conclusion is to further investigate the four cases.

NOTE 1: If VEMMI and MHEG are successful on the market scenario d) would allow all MHEG databases to be accessed by VEMMI terminals, just by integration of one MHEG engine at the database side and using the VEMMI protocol.

If case c) becomes reality, the actions that have to be taken by ETSI TC-TE are:

- definition of an end-to-end protocol for MIRS (connection establishment, service selection, etc,...);

- definition of an interface between VEMMI and DSM-CC, (e.g.: defining a VEMMI local action that invokes a DSM-CC command (play, pause,...));

- possible extension of VEMMI to cope with Broadband Multimedia Information Retrieval Service.

If case d) becomes reality the actions that have to be taken by ETSI TC-TE are:

- collaboration with ISO/IEC JTC1/SC29 and ITU-T SG8 to define a profile of MHEG (called MHEG 5). An official liaison should be established;

  NOTE 2: MHEG is a collaborative team between ITU-T SG8/Q11 and ISO/IEC/JTC1/SC29/WG12.

- definition of an end-to-end protocol for MIRS (connection establishment, service selection, etc,...);

- mapping between the presentation level of MHEG 5 and the VEMMI protocol. (e.g.: the MHEG engine request to the Presentation agent to display a MHEG composite object is mapped on the VEMMI primitive Create-Dialogue-Box);

- definition of an interface between VEMMI and DSM-CC. (e.g.: defining a VEMMI local action that invokes a DSM-CC command (play, pause,...)).

If cases e) and f become reality the actions that have to be taken by ETSI TC-TE are:

- collaboration with ISO/IEC JTC1/SC29 and ITU-T SG8 to define a profile of MHEG (called MHEG 5). An official liaison should be established;

  NOTE 3: MHEG is a collaborative team between ITU-T SG8/Q 11 and ISO/IEC JTC1/SC29. WG12.

- definition of an end-to-end protocol for MIRS (connection establishment, service selection, etc,...);

- collaboration with ISO/IEC JTC1/SC29 and ITU-T SG8 to define an interface between MHEG and DSM-CC. (e.g.: defining a MHEG elementary action that invokes a DSM-CC command (play, pause,...));

- identification or definition of a file transfer protocol to be used between terminal and server;

- definition of an encoding for the MHEG-API (a MHEG engine on the host can access the services offered by the MHEG engine of the terminal).

### 13.3 Priority list of actions

Taking into account the analysis of the previous subclause the following priority list for actions that need to be taken by ETSI TC-TE can be established (the list starts with the item of highest priority):

1) definition of an end-to-end protocol for MIRS to cover both the file transfer cases (scenarios b,e) and the Videotex scenarios (c,d,f);

2) liaison with DAVIC, ISO/IEC JTC1/SC29 and ITU-T SG8 to define an interface between MHEG and DSM-CC. (e.g.: defining a MHEG elementary action that invokes a DSM-CC command (play, pause,...));

   It is recommended that TC-TE participates in the DAVIC work and promotes the European standardization activities. This could be carried forward by a member of TE1 also attending DAVIC and reporting the progress of the work. TC-TE could supply contributions to the work of DAVIC. It is recommended that TC-TE should work in parallel. TC-TE should consider the **final DAVIC work** and eventually promote it as an ETSI standard;

3) collaboration with ISO/IEC JTC1/SC29 and ITU-T SG8 to define a profile of MHEG (called MHEG 5). An official liaison should be established;

4) definition of an interface between VEMMI and DSM-CC (ISO/IEC JTC1/SC29 WG11);

5) mapping between the presentation level of MHEG 5 and the VEMMI protocol;

6) definition of an encoding for the MHEG-API.

NOTE: This last action is useful in case of a MHEG application, a part of which resides on the server while another part is on the terminal.

## History

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|---|---|
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