

# System Concept of a Novel Converging DVB-T and UMTS Mobile System

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**Abstract:** The EU funded project, Convergence of IP-based Services for Mobile Users and Networks in DVB-T and UMTS Systems (CISMUNDUS), is developing an innovative service concept of delivering rich multimedia content to mobile users simultaneously by using the DVB-T broadcast network and UMTS/GPRS mobile telecom network. The basic converging service concept is the co-operation between two complementary wireless access networks. One is a “point-to-point” mobile telecom network for specialised information and personal transactions, and the other is a “point-to-area” low cost broadcast network. This paper will present the system concept of this converging system for a typical service scenario. A service provisioning system is being built that will show how this service can be brought to end-users. A portable multimode multimedia mobile terminal which incorporates DVB-T reception equipment with a UMTS/GPRS transceiver device is being developed and will be used to demonstrate integrated convergent services.

## 1. Introduction

At present, service over DVB-T and UMTS/GPRS wireless transmission networks operates independently. However, the proposed convergence of DVB-T and UMTS/GPRS networks will enable novel services to be developed that benefits from the strengths of each system. UMTS/GPRS provides communication services at much less than 2 Mbits/second, whilst DVB-T provides broadcast services at much greater than 2 Mbits/second and is also a perfect multicast system with the ability to broadcast rich multimedia content to a huge population. By combining UMTS/GPRS and DVB services, the broadband of DVB-T is combined with the interactive medium band UMTS/GPRS to provide significant services. The EU funded project, Convergence of IP-based Services for Mobile Users and Networks in DVB-T and UMTS Systems (CISMUNDUS), is developing an innovative service concept of delivering rich multimedia content to mobile users simultaneously by using the DVB-T broadcast network and UMTS/GPRS mobile telecom network. The purpose of the CISMUNDUS project is to help create a new communications environment which combines multiple delivery tools for people on the move: individuals as well as groups of people. The basic converging service concept is the co-operation between two complementary wireless access networks. One is a “point-to-point” mobile telecom network (UMTS/GPRS) for specialised information and personal transactions and the other is a “point-to-area” low cost broadcast network (DVB-T). If the network is aware that there is a multicast need, then the server or the network may choose to supply this information via DVB-T broadcast network. The ultimate goal is to ensure a seamless and wireless interactive connection to various multimedia converging services for people on the move. One example of high-level system architecture is shown in Figure 1.

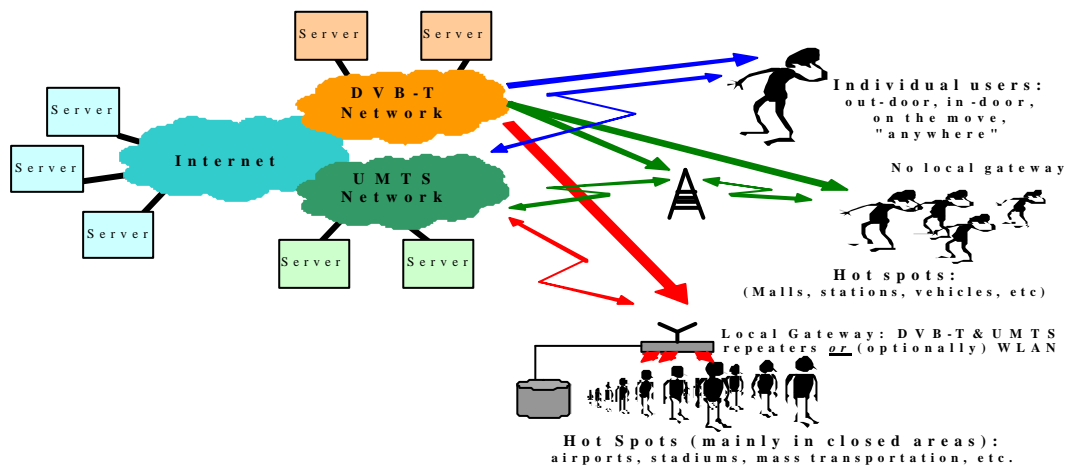


Figure 1: System Concept

A converging DVB-T and UMTS/GPRS Mobile system is being built to implement this service concept. This paper will present the system concept of this converging system. A number of service targets can be conceived for pedestrians in populated areas, such as stations, airports or sports stadiums, and also people in cars, trains, buses, metros and suchlike. An example service scenario - live sport has been designed and selected for implementation in the CISMUNDUS project. A service provisioning system is being built that will show how the services can be brought to end-users. A portable multimode multimedia mobile terminal is being developed and will be used to demonstrate these integrated convergence services. The terminal incorporates DVB-T reception equipment with a UMTS/GPRS transceiver device.

The rest of this paper is organised as follows. Section 2 describes a live sport service scenario. In section 3, we will illustrate the Service Provisioning System for the live sport service scenario. Section 4 introduces the overview of the multimode multimedia terminal. Finally, section 5 gives the concluding remarks.

## 2. Service Scenario

The live sport scenario focuses on services suitable for users in crowded places since this is considered to be the most stringent from both the service and technical perspectives. The scenario service components are summarised in the following list, namely:

- Familiar live TV broadcast: The CISMUNDUS terminal is also a fully functional TV set receiving TV signals from normal digital TV broadcast.
- Service discovery service provider's portal: A portal describes a number of (free and paid-for) services and may be broadcast to users and subscribers over DVB-T using the carousel.
- Message Alerts: An alert service allows subscribers to stay informed about events of their interests such as goal being scored. Demand dependant elective delivery of multimedia content over different networks: If many users request the delivery of the same information, the delivery is over DVB-T IP. Whereas if few users request the delivery, the Mobile IP network is used.
- Digital TV Program Related Content: Live TV broadcast is transmitted with program related contents, such as "my team" and "today's opponents".
- Multiple Live Views: Additional stadium TV channels, showing live views of the game from various interesting angles.
- Betting Service: An example of fast e-commerce services providing betting opportunities through a secure connection.
- DVB-T Service Continuity using mobile Telco network: If the user roams outside the DVB-T broadcast area then the mobile IP network provides a certain degree of service continuity with lower resolution content.

## 3. Service Provisioning System

Service Provision System (SPS) is required in order to prepare different kinds of content for transportation. Basically four kinds of content must be processed by the SPS: MPEG-2 content (encoded audio and video streams); MPEG-4 content (encoded audio, video and/or scene information); MPEG-7 content (descriptions and description schemes); Web-content (html pages).

Service Provisioning System for the live sport scenario is shown in Figure 2. The AV content from cameras 1, 2 and 3 will be encoded into an MPEG-2 TS using the MPEG-2 real-time encoders. A service discovery Internet page will be transmitted with live Xlet application that provides access to its service components via the client call-up server. In the real world, users will have previously subscribed to a message alert service of their interest through the payment of their subscriptions. For the purposes of the demonstration all users will be subscribed. All alerts are sent to all terminals and have free access to the related content. The alerts are randomly generated at the service provisioning system and the HTML, JPEG, MPEG-4 content related to the alerts is prepared off-line. The message alert is an MPEG-7 file which is sent to terminals via broadcast IP or mobile network IP and indicates the URL of MPEG-4 and HTML content that is related to the message event. Users can then view these MPEG-4/JPEG files and HTML pages. Depending on how many user terminals are presently switched on/off.:

- 1 terminals: related content (JPEG, HTML) transmitted over mobile IP network
- 2 terminals: related content (MPEG-4, HTML) transmitted over broadcast IP network

The broadcast program has an MPEG-7 file which is broadcast to all terminals over the carousel (IP or MHP carousel) to indicate the URL of MPEG-4, JPEG and HTML content that is related to the main program. All users can then view these MPEG-4/JPEG files and HTML pages. Again depending on how many user terminals are presently switched on/off:

- 1 terminals: related content (JPEG, HTML) transmitted over mobile network IP carousel
- 2 terminals: related content (MPEG-4, HTML) transmitted over broadcast MHP carousel

A program navigator will allow the user to select up to 3 MPEG-2 encoded AV streams showing 3 separate views of the game. The service discovery Internet page will allow viewers to access the betting e-commerce service Internet page to make and submit bets. Bets are submitted over the mobile IP network and the results of bets are broadcast to all user terminals over the broadcast IP network. A pre-prepared results/highlights program is stored onto the stream server. At the end of the live sporting event the ASI switch is used to switch broadcast delivery from the live program to the pre-prepared results/highlights program. During this program the aerial on the mobile terminal is disconnected. This simulates user movement outside the live broadcast coverage area. When this occurs a JPEG image of the updating results will be alternatively sent over the mobile IP network.

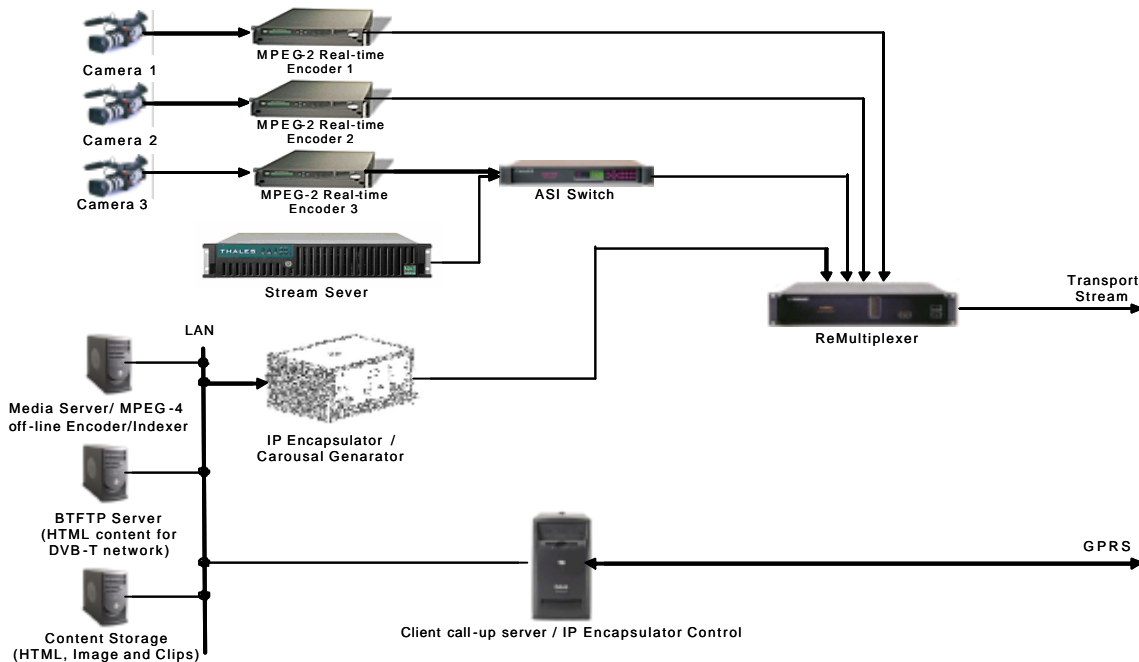


Figure 2: Service Provisioning System for live sport scenario

#### 4. Terminal architecture

This section will focus on the software components of the CISMUNDUS terminal. Figure 3 shows a simplified diagram of the CISMUNDUS terminal. The diagram shows the different layers of the terminal including the base hardware of the terminal, additional hardware specifically for the CISMUNDUS terminal and software components. The CISMUNDUS terminal will operate under the Linux operating system.

*System software:* Although some of these components already exist, the components that will have to be/currently implementing include:

- Network Manager: To establish GPRS network connects and controls the flow of IP packets.
- Storage Manager: To provide storage/retrieval mechanism for downloadable data i.e. via the GRPS channel or/and DVB object carousel and user's persistent data.
- User Manager: To provide and maintain user login and passwords, user accounts and user preferences.

*Middleware:* The MHP stack is used to provide a fully functional DVB MHP application including:

- DSMCC: Mechanism for the download and control of DVB object carousel
- Application Manager: Mechanism for providing resources and executing Java XLETS.
- DVB transport stream/DVB services tuning.

*Applications:* The primary DVB application on the CISMUNDUS terminal is a generic graphical user interface, which uses downloadable skins via GRPS or DVB object carousel and includes:

- Graphical skin loader: Used to generate graphical elements of the skin.
- Skin functionality mapping: Used to recognize user interaction of the skin and provide terminal functionality.

- Storage Manager and Decoder interface: Used to issue requests for retrieval/storage of data and to drive terminal AV decoders.

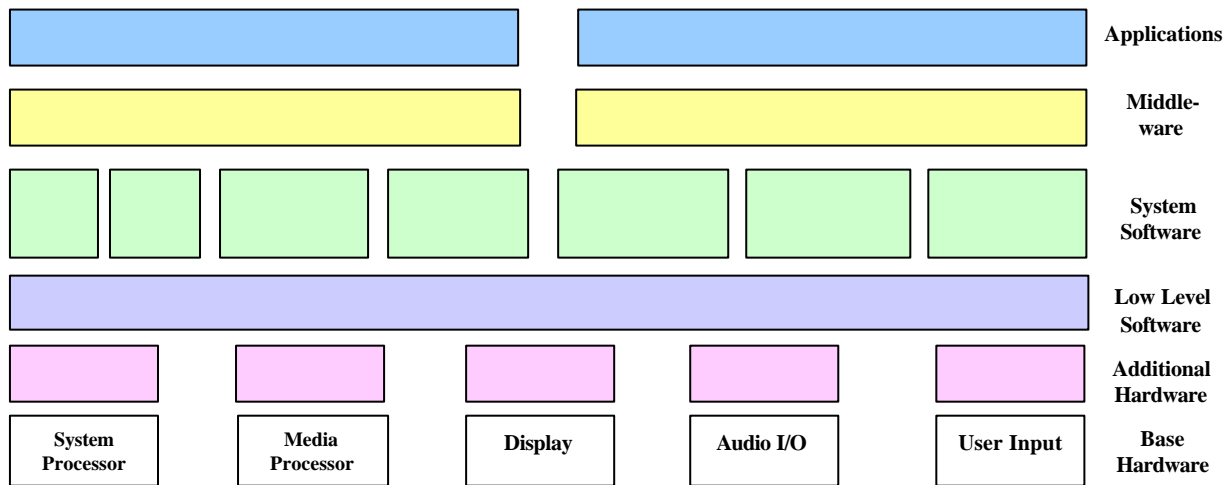


Figure 3: Software Components Overview

## 5. Conclusions

A novel system has been presented which delivers rich multimedia content to mobile users simultaneously by using the low cost DVB-T broadcast network and UMTS/GPRS mobile telecom network for specialised information and personal transactions. The live sport service scenario has been used to show what attractive services can be brought to general public. An overview of the service provisioning system and the mobile multimedia terminal has also been presented. This paper presents the novel service concept. However, to fully deploy this service over converged DVB-T and UMTS/GPRS networks, a network management layer is required to organise IP traffic routing and network protocols.

## 6. Acknowledgements

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