

THE MCP TERMINAL

A FUTURE PLATFORM FOR MOBILE SERVICES

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Abstract

With the introduction of the first digital broadcast services in the early 1990ies, manufacturers started to develop platforms which offer interactive services to the consumer. Various incompatible and proprietary solutions avoided the breakthrough of such endeavors. With the goal to create a single open standard software platform, the DVB Project developed the MHP (Multimedia Home Platform) [1]. Almost three years after the publication of the specification, the MHP was adopted by most of the European countries, by several Asian countries as well as in North America (CableLabs, ATSC) as the standard platform.

The Internet in the car, mobile multimedia and integrated car related services – these buzz words describe the current research issues aiming the ubiquitous, mobile information society. The MCP (Multimedia Car Platform) project, which runs from the beginning of 2000 until the end of 2001, has provided a powerful architecture for multimedia services in the car. The MCP project has designed a set of specifications, both for the car terminal and for integrated mobile communication and broadcast networks to support enhanced broadcasting, mobile communications and positioning services in the car.

As we have been involved in the MHP activities for a long time, we know the possibilities and limits of the existing MHP specification. Although we consider a mobile approach in general, we started our activities with the car as “hardware platform”, also due to the fact that fewer restrictions apply regarding power consumption and component sizes.

The work on extensions of the MHP for mobile appliances now leads to two international working groups. The MHP Automotive Forum group fosters the use of MHP in the car, and the new DVB ad-hoc group DVB MHP-Automotive is searching for commercial requirements for MHP in the car.

An MHP Automotive Terminal specification would create a common platform for all companies and institutions interested in the creation and provision of mobile and location-

based services for the car. It would enable a horizontal market for broadcasters, service and content providers, equipment and car manufactures, and would be completely based on open standards.

This paper describes in detail all our approaches and solutions which extend or change the existing MHP software stack towards a mobile software platform – also for the car.

Keywords

Multimedia Home Platform, Multimedia Car Platform, Software Platform, Java, Mobile Enhancements, Application Programming Interface

MHP – STAGE OF AFFAIRS

After the publication of the first version of the MHP 1.0 specification in summer 2000, many companies started to work on practical implementations of this standard. At the same time, applications for test purposes as well as first commercial applications were developed. The practical usage of the standard detected some problems, ambiguities and errors in the first version of the specification. These issues were collected by a DVB-TM subgroup – TAM (Technical Aspects of the MHP). As a result of the expensive corrigenda process, a new version of the MHP 1.0.2 was published in spring 2002. This version is also the fundament for the MHP-Test-Suite. This Test-Suite, which is basically a collection of test applications and test procedures, has to be passed successfully by every MHP implementation to get the MHP logo.

In parallel to these activities, the corrigenda process described above is proceeding with the MHP version 1.1. In this version of the specification, the most advanced profile of MHP is described – the Internet Access Profile.

Based on the current developments in Europe and due to the fact that the research institution of the American cable network provider (US CableLabs) with their OCAP – Open Cable Application Platform – as well as the ATSC Group (US terrestrial television community) with their DASE (DTV Applications Software Environment) adopted MHP as the basis for their software platforms, it is safe to say that MHP is a global success.

The activities of the DVB-GEM-Group (Globally Executable MHP) shall aim at the MHP compliance in all countries world-wide even if the underlying network structure is non DVB compliant.

Currently, first set-top boxes and iDTVs with the MHP logo are on the market all over Europe. First MHP services were already launched – e.g. in Germany, first of all, via satellite and in Finland via DVB-T.

Recently, the DVB Project defined their strategy for the next years in the paper DVB 2.0. This document describes the future work items including the way towards MHP 2.0. Here, the vision describes a further convergence of Internet technologies (e.g. streaming) with the classical TV world, in-home networking aspects as well as the consideration of new mobile application areas for MHP. Based on this document, the Commercial Module of DVB defined scenarios how a mobile version of MHP could look like. The newly founded sub-group MHP-

Automotive is currently working on commercial requirements for an MHP solution within a car as a pre-development work for a more general mobile approach.

CHALLENGES TO MEET ON THE WAY TOWARDS MOBILE MHP

To provide the user with the security and functionality he knows from MHP in the living room, a lot of open issues on the way towards a mobile version have to be solved. Such issues are for example the mobile connections and the mobile terminal itself.

- A transmission via DVB-T or GSM/UMTS is normally disturbed. In case of a video stream, single transmission errors just freeze the picture or blocking artefacts occur. Even more critical are errors during the transmission of applications, due to the fact that a single error in a class file can make the whole application un-executable.
- Normally a mobile terminal is restricted to low screen resolutions, low CPU performance (compared to standard PCs), limited memory and also a limited battery life time.
- Especially the automotive application stresses the specific requirements for the human-machine-interface. An automatic adaptation of the application to various user interfaces seems to be as necessary as the use of human speech to control the applications.
- Furthermore, new service classes (e.g. location-based services) require interfaces to get access to the relevant information (e.g. current location, speed, etc.) of the mobile terminal.

ENHANCEMENTS FOR MOBILE MHP

During several projects the Institute for Telecommunication Technologies investigated the conditions in a mobile environment and in what way they could have an impact on an MHP terminal and what kinds of problems could occur. Based on the existing standard, we discussed enhancements to solve the discovered problems.

Below, some of these detected problems will be introduced and a corresponding method of resolution will be presented.

Mobile Interaction Channel

The interaction channel of the current MHP specification is an abstract description of the hardware and the network resources. It is optimised for pure data connections. An access to the physical parameters of the connection is not possible. Furthermore, the status of the mobile terminal (e.g. status of the battery) is not considered. Obviously, there are no methods to access classical mobile phone services like SMS or MMS, either.

A view of the current developments world-wide regarding software platforms for mobile devices like PDAs or mobile phones shows a broad spectrum of approaches. There are different proprietary solutions (but used by many mobile phone manufactures) like Symbian as well as more open platforms like MIDP (Mobile Information Device Profile) or Personal Java. 3GPP (Third Generation Partnership Project) started to define a platform for third generation mobile phones (UMTS). This platform called MExE (Mobile Execution Environment) represents three profiles (basically: WAP, PersonalJava, MIDP) addressing different kinds of terminal classes. Even if most of the mobile device manufactures are

members of the 3GPP, there seems to be no process in generating a final version of the MExE specification for a common use later on – at least for the time being.

Within the DVB Project the DVB-UMTS group considers all the aspects of a possible co-operation of DVB and UMTS networks. This includes the network side as well as the terminal and the software platform side. Here, they consider various “mobile” interaction channel APIs which might be suitable for a converged platform.

Following all these activities we defined some requirements for a mobile interaction channel interface:

- This interface should support all core functionality of the classical mobile communication.
- An access to the underlying physical layer enables the application to react on situations like decreasing field strength or changing networks.
- An application must be able to use very easily the known datagram services (e.g. SMS) without the detour via a remote server.
- Especially for time-critical services like streaming applications Quality of Service mechanisms should be supported or the QoS parameter of the underlying network should be assessable.
- Due to the fact that the use of the return channel normally causes costs and may be misused by an application, it is essential to consider the MHP security framework.

Mobile Reception of MHP applications

During the transmission of data via the DVB-T or DVB-S channel transmission, errors can occur. While short video dropouts are less critical, an error during the transmission of an application can prevent an application from being executable. We are investigating a number of different approaches to reduce the effects of these transmission errors. Examples are the use of methods like application error concealment and layered application structures, optimisation of the DSM-CC object carousel and downloading of missing parts of the application via an interaction channel.

In MHP, applications are transmitted using a carousel which is cyclic-iterated. MHP applications consist of (compiled) Java-class files plus the attendant resources (data, pictures, sound ...). Transmission errors during the transmission of an application can affect the availability of all these files in the terminal. The simplest form of optimisation is error concealment, which can be done by the application itself. If the application is written in a way, where a “kernel”, a minimum part of the application, can detect which files are missing, it can silently reduce its own functionality. This must happen in a way such that the remaining application keeps consistent.

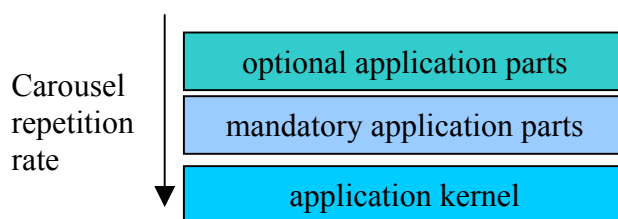


Figure 1. Layered application structure

The next step in optimisation is related to the structure of the files in the carousel. I. e. important files (like the kernel part of the application) should be repeated more often to become more robust against distortions. Depending on the application, it may be possible to separate the content into a mandatory and an optional part.

This leads to a layered structure of the application, with a kernel, a mandatory and an optional part of the application.

Based on this structure, we started to develop a hybrid architecture, which allows the use of a return channel (e.g. GPRS) for loading missing parts of applications. If only small parts of the overall application are missing, it showed to be a very effective mechanism, which could also significantly improve the start-up time of the (mandatory part of the) application. The decision (if and when) which missing file of the application (from optional or mandatory parts) should be re-loaded, is a complex decision depending on parameters like the individual carousel repetition rate, the file size, the costs and the part of the application the file belongs to.

The loading of the missing parts can as well be done by the MHP implementation itself or by the application kernel, which has exact knowledge of which files are missing and needed. But currently, the latter solution is not supported by the APIs of the MHP.

Adaptive HMI – GUIMAN

Especially within the car industry, there is a new trend towards the integration of multimedia services into the car. As HMI is a unique selling point of each car, the question comes to ones mind how a broadcasted service can be adapted to the different target systems.

The solution we developed, named Graphical User Interface Manager (Guiman), is an XML based multi-modal user interface description language. It supports various types of different input devices like e.g. keyboard, colour buttons, touch screens, pointing devices or speech (which is described in the next section). The “Look & Feel” of the user interface can be exchanged before runtime to allow e.g. an adaptation to the car brand or day or night design. The MHP based rendering engine (written in DVB-J) is completely modular to allow a minimal configuration for each service according to its requirements. Together with the small footprint of our JAVA components the GUIMAN is very resource-friendly.

Because the GUIMAN-engine is able to fulfil all tasks of graphics representation and surveillance of user input, the underlying control application becomes relatively small. A simple command-based interface between the GUIMAN-engine and the control engine allows the latter to react on inputs from the user and to interactively change the user interface (e.g. display of videos, change text, etc.).

A further benefit is the reduction of the development time for the HMI, without loosing the full control of the application behaviour, as it might happen when using of-the-shelf authoring tools.

As already stated, our implementation is based on MHP (or more exact, on its HAVI (Home Audio Video Interoperability) components) but it could be easily transferred to other software platforms.

Based on our current GUIMAN implementation, we develop a number of example services like e.g. MHP navigator, car navigation, travel guide or a media player.

Speech Control for MHP Services

In addition to the graphical representation of a service, many companies started to concentrate also on the usage of human speech in order to control this service. These

tendencies are reflected by implementations in upper class cars and in much smaller implementations in modern mobile phones.

Against this background we developed a small and simple Speech-API enhancing the existing user input concept of MHP. Furthermore, it was also necessary to extend the MHP event model. Beside the introduction of so-called “launch strings”, which enable the control of applications (independent from the input focus) additional speech priorities help to classify the speech outputs (the output of the navigations system to “turn to the right now” is more important than the weather forecast).

Depending on the priority, the speech output can be paused or finished.

The developed speech interface enables the user - beside the speech synthesis and speech recognition - to switch between different languages and speakers (e.g. male/female).

To get a flexible management of the words to recognise (grammar) the Java Speech Grammar Format (JSGF) is supported.

Supported by the Java Speech Mark-up Language (JSML) it is possible to make the speech output a little bit more „natural“ – in the sense of the application designer. This includes the stressing or expanding of specific words as well as the lifting or lowering of the voice of the speaker.

The implementation of this API is almost and the integration in the MHP stack is already finished. The implementation already supports all features of the Guiman described above. That means, by adding some simple speech tags an application is able to provide speech functionality.

Extensions for location-based services for MHP

Already some time ago, in the EU-funded project Multimedia Car Platform (MCP), one of the first MHP extensions which were developed was a software interface (API) for location-based services. The API has the aim to ease the development of location-based broadcast-services, or more exactly the personalisation of broadcast service through the availability of the terminal's (i.e. cars) position (speed, direction, ...).



Figure 2. Interaction between the location-based service and the car navigation system

Further, the API offers a set of commands to interface with a (maybe non-MHP compliant) on- or off-board navigation system which may already be available within the terminal. A location-based MHP service could then easily guide the user to a number of locations by just starting the navigation system via the API. If the location is reached, the application is informed with a message and could then offer the user its location-based service. In addition, the location based service can acquire map-images via the API.

One of the most interesting aspects of the API is security. Without proper certificates, an MHP application is neither allowed to request position information, nor can it gain full control of the navigation system. However, even without any certificates the MHP service may carry out its service, by passing a list of possible positions (e.g. fuel stations) to the navigation system. The navigation system can then select the nearest position and guide the user there. In this case, the MHP service itself did not get in touch with the users position and could therefore not be a security risk.

Application transfer between MHP terminals

Today, the user is getting in touch with a large number of different terminal devices, offering him services at home, in the car and on the move. For the communication between these devices, world-wide different architectures are under development like e.g. Universal Plug and Play (UPnP) or Home Audio Video Interoperability (HAVi). MHP-based devices will soon be able to access these architectures using the MHP Home Networking interfaces, which are currently under development by DVB. These interfaces will allow MHP services on different devices to communicate with each other.

But there is a number of scenarios, where the user may want to move a complete MHP-based services from one terminal to the other. For example an MHP-based travel guide could be offered on the TV at home. On the TV screen, e.g. a tour through a city can be planned, and the whole application can afterwards be moved onto a PDA. There, the MHP service could interface with the navigation and guide the user to the places he wants to visit. Another scenario would be a mobile office or working environment, which automatically follows the user on every device he uses, without any additional user interaction.

Both scenarios requires a technical mean of copying MHP applications from one terminal to the other, together with its current state information (e.g. the planned route).

We have developed a system, which allows the copying of applications or part of applications even during their runtime. Also the security aspects of the MHP are covered by also copying all relevant security files onto the target device. Of course, the application transfer imposes some restrictions and requirements to the application itself. The application has to be compliant to all MHP-based terminals it runs on, and has to adopt to the different screen sizes and user input devices. But the MHP, which is hardware independent and well defined, offers the perfect basis for such a development.

Multimedia Car Platform

The approaches described above were already shown in different projects. The European MCP project, which was started beginning of 2000 and was finished two years later, aimed at the convergence of entertainment, communication and navigation – especially in the car environment. The project was divided in two main activities: the design of a hybrid network structure based on broadcast systems and mobile communication systems on one side and a converged software platform based on MHP on the other side.

In the following, only the second issue is described:

The mobile car platform – compared to the classical stationary MHP execution environment – enables the definition of new service classes. These are for example location-based services as well as services accessing the data bases of the car (e.g. in car data bus CAN). Based on this access new test services were built. A so-called Travel Guide offers the driver among other things a classical sight seeing tour through a specific city. In co-operation with an on- or off-board navigation system the Travel Guide guides the driver to specific sights and describes them. Just arrived, the driver (or passenger) gets information with videos, pictures and texts. Furthermore, location-based event notes (e.g. the current cinema schedule with the option to start a navigation to the cinema) were implemented.

Additionally, services – including the corresponding interface implementations – with a strong relationship to the car were shown. Depending on the current fuel fill level, the driver can check on a local map the distance to the nearest (reachable) petrol stations and the current fuel prices at these stations.

The transition of data - independently from the used network - and the network transparency from the user's point of view was one of the main issues of the MCP project. So it is possible for an MCP terminal to receive, beside the classical DVB-T or DAB services, also data services via these networks or other radio interfaces like GPRS or Bluetooth.

Within this project a lot of foundation stones of the above described MHP enhancements were set. Using several demonstrators (two stationary, one integrated in a BMW 5 series, one integrated in a SEAT Alhambra) we showed at IFA 2001 that mobile services in cars are possible and useful.



Figure 3. MCP demonstration cars: SEAT Alhambra (left picture) and BMW (right picture)

As a follow-up project based on MCP and other European projects dealing with mobility and communication and entertainment platforms, the current Confluent project tries to evaluate all the different platform and transmission approaches and to define a set of optimal solutions for a converged mobile multimedia platform. The transferability and adaptability of applications

on different kinds of terminals as well as the improvement of the mobile DVB-T reception are also in the focus of this project.

NICCIMON

This national project is somewhat more academic but also shows – at least in the first phase - some scenarios for a mobile MHP-based platform on small devices like PDAs or smart phones.

NICCIMON stands for „Niedersaechsische Kompetenzzentrum Informationssysteme fuer die mobile Nutzung“ – Lower Saxony Competence centre for information systems for mobile usage. This center was founded in 2001 by three academic institutions in Lower Saxony – Oldenburg, Hannover and Braunschweig. It is funded by the government of the state Lower Saxony. Actually, the goal of this project is the concentration of know-how related to mobile information systems. This includes for example the experiences in mobile software platforms in Braunschweig, the handling of geographic data (for navigation purposes) in Oldenburg and the user localisation as well as the three dimensional recording and reconstruction of images (Hannover).

A second goal of Niccimon is the support of companies which just started to enter the market of mobile services and to provide knowledge and manpower to realise first test beds or demonstrators.

During the first phase of Niccimon (the second has just begun and will be finished in 2004) a first prototype of a personal mobile assistant was realised (Figure 4). This MHP-based component architecture provides the user with a broad spectrum of location based services – mainly for pedestrians. The added value compared to a classical navigation systems are elements like a 2-D and also a 3-D navigation, a panorama view of selected locations and a selection of various points of interest with the option to get additional information about these points.

The main goal of the second project phase is the development of a modular platform that integrates the technologies already in use (W-LAN, GPS navigation, etc) with further technologies. One focus will be on hybrid networks (W-LAN, GPRS, UMTS, DVB-T) so that the user can use his/her terminal independently from one specific existing network. The modular concept will allow for an enormous flexibility so that the platform can be easily adapted to new applications (mobile assistant, catastrophe management terminal, car-connected terminal, etc). This is very important taking into account the objective of attracting industrial partners for co-operations.



Figure 4. Mobile Niccimon demonstrator

CONCLUSION

The current development in the market of mobile end user devices shows that terminals are getting cheaper and offer more performance. More and more functions and interfaces are available and this has the effect of new services classes being executable on the terminals. As at the moment a DVB-T receiver is as big as a classical PCI card, the market introduction of power-saving one-chip solution will be very soon. A lot of field tests and investigations proofed that DVB-T and other radio networks are capable of mobile reception of data. Therefore, the launch of small, combined (DVB-T, UMTS) end user devices for the car as well as in terms of PDAs and mobile phones from the technical point of view seems to be very soon.

Concerning software platforms, we can realise that MHP has already started the triumphal procession on digital set-top-boxes and iDTVs world-wide. While considering and possibly enhancing the existing standards and techniques it is feasible to develop a terminal which can - beside the presentation of audio and video content – execute classical MHP and also enhanced services (e.g. location-based or with an adaptable HMI).

The goal of a mobile MHP version can be reached by enhancing the existing API resp. standard to fulfil the complex requirements of a mobile environment. In spite of the current hardware developments, a profiling with small modules might be necessary to address different terminal classes. Backwards compliance and interoperability must be the major design goals of such a new MHP version.

Different projects have already shown that the usage of MHP in a mobile environment is possible and that enhancements for a mobile scenario are useful and necessary. The first approaches (technical as well as commercial) to integrate an MHP terminal into the car could be the base for further steps toward a more general mobile MHP version.