The FutureTV Project: MHP Compliant Software Development

Artur Lugmayr, Seppo Kalli, Teemu Lukkarinen, Arttu Heinonen, Perttu Rautavirta, Mikko Oksanen, Florina Tico, Jens Spieker, and Mathew Anurag

Digital Media Institute
Technical University of Tampere
P.O. Box 553, Hermiankatu 3A, 33101 Tampere
FINLAND
Tel. +358-40-821 0558, Fax: +358-3-365 3966
E-mail: {*}@tut.fi

ABSTRACT

In Europe Digital, Interactive Television (digiTV), based on the Multimedia Home Platform (MHP) [1] as specified by the Digital Video Broadcast (DVB) group, is going "on-air" in the next few months and seems to be a rich platform for the next generation of television. The MHP is an excellent starting point in the development of services and covers a complete technical solution of technologies involved in digi-TV. Service and content development will be the major issues in enhancing this new type of multimedia. This paper describes our research work and results done within the FutureTV project, to enrich this platform with value added, content synchronized applications and their development.

1. INTRODUCTION

Fig. 1 shows an overview of the sub-parts of the FutureTV project done at the Digital Media Institute, Tampere. It can be divided in three major groups: Transmission Media and Transport Protocols, Application Development Environments, and Value Added, Content and Content Synchronized Applications.

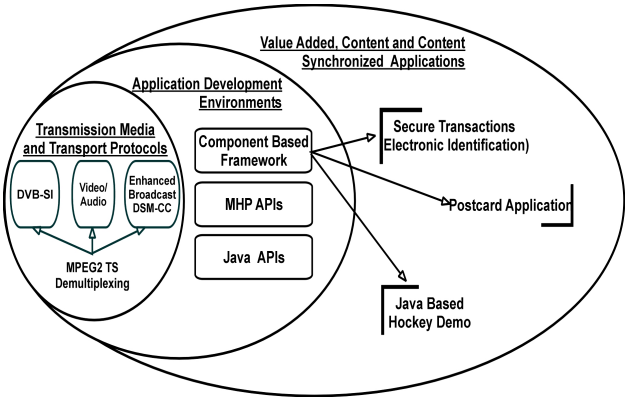

Fig. 1. FutureTV's Sub-Projects.

The following sections will describe them more detailed and allow a quick overview of our experiences and results done to converge digiTV to a complete integrated multimedia solution.

2. TRANSMISSION MEDIA AND TRANSPORT PROTOCOLS

A complete digiTV environment utilizes two different network channels. The high-bit-rate broadcast channel carries a MPEG2 *Transport Stream (TS)*, which consists of multiplexed audio, video, and data. Data can be arbitrary, such as objects, applications, content information, service content, applications, etc. On the end-user side the first essential task is to retrieve information about the stream structure, to be able to access its content.

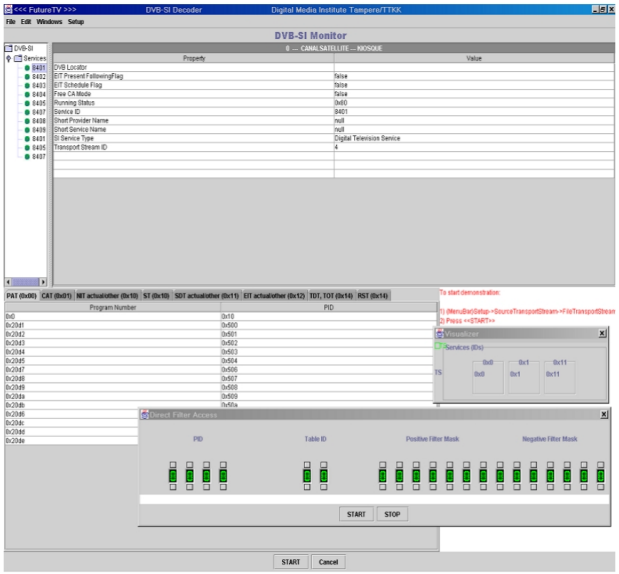

Fig. 2. SI Decoder.

The information needed for this process is called *Program Service Information (PSI)*. Additional information about stream content, pure data transmission and its description, and content can be found in *DVB-Service Information (DVB-SI)*. This part of the project focused on the signaling of DVB transmissions, live stream access from a satellite receiver card, and transmitting of signaling information over the Internet. The data is organized and described in tables, which are split into a stream of sections encapsulated within TS packets. On the client

side, the whole SI has to be decoded to demultiplex the content of the TS, and to be stored in a database from where it can be accessed by applications that rely on SI.

The current SI decoder can be configured to retrieve SI from different sources: satellite receiver card, data storage, or the Internet by utilizing RTP or UDP as transmission protocol. The sources deliver a MPEG2 TS or a section stream that has to be filtered to obtain the different tables and their content, encoded as descriptors.

The Digital Audio-Video Council (DAVIC) standard specifies this major integral task and defines how interfaces between SI sources and higher application layers have to look like. The current software system implements a subset of DAVIC's reference APIs. Where DAVIC standards mainly cover access to sources and filtering aspects, MHP defines how SI tables and their content can be re-assembled and stored in a database. The current implementation is capable of this task and provides a simple database for accessing SI asynchronously. The SI framework has different use scenarios: firstly a common used scenario is where SI feeds the navigator for visualizing services deployed within the TS multiplex; secondly as centralized server home solution for distributing SI in a LAN environment; and last as multicast source for TV-on-demand solutions by utilizing real-time streaming protocol solutions.

3. VALUE ADDED, CONTENT AND CONTENT SYNCHRONIZED APPLICATIONS AND THEIR DEVELOPMENT

Xlets, the lightweight version to Applets in web-based applications, represent the basic structure for digi-TV applications. Their life cycle is well defined and they provide comprehensive solutions for distributing applications to MHP compliant devices over the interaction- or broadcast-channel. Based on this technical solution sample content synchronized value added services have been developed and tested on currently available MHP compliant devices: Firstly an "Electronic Postcard Application" enables end-users to send and retrieve the electronic version of postcards over this platform; Secondly a hockey demonstration shows how content data can be synchronized with video and audio content of a hockey game; third - based on the experiences of the previous projects - how MHP compliant application development and the component based paradigm could enhance the process of compliant software development.

3.1. Hockey Demonstration

The Hockey-Demonstration illustrates how information about players, game scores, etc. can be retrieved and synchronized with a video/audio broadcast of a currently running game. Future trends in user-interface design, content synchronization, information access has been shown. The implementation allows stopping, pausing, fast forward playback, and browsing through the information during a digiTV broadcast. The whole framework is based on pure Java and utilizes the Java Media Framework API and MHP compliant APIs.

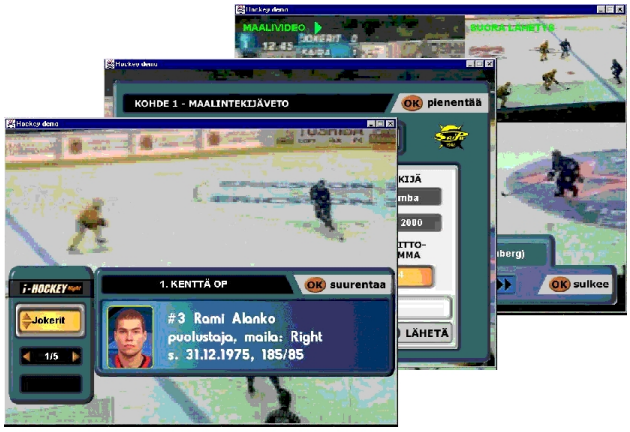

Fig. 3. Hockey Demonstration.

3.2. Electronic Postcard Exchange Tool

A more functionality-oriented development of an Electronic Postcard Exchange Tool has been established. The basic idea is to be able to exchange simple greeting cards over a MHP compliant device. It allows the end-user to load motives from multiple sources, manage the cards via a card management system, various transmission protocols (e.g. SMTP, POP3, etc.), and editing greeting texts.

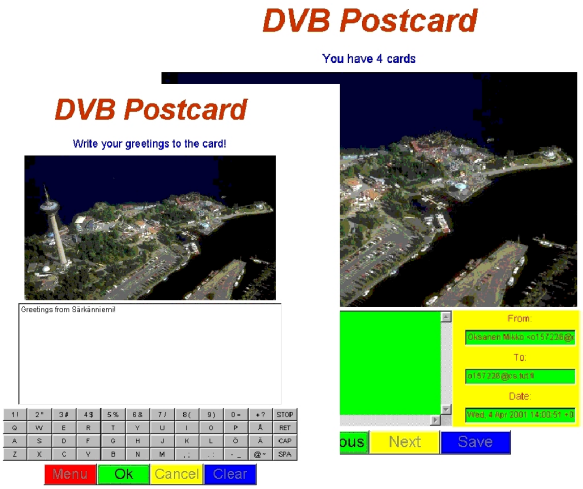

Fig. 4. Electronic Postcard Exchange Tool

The motives can be accessed either from the broadcast or interaction channel, hard disk, or from a linked camera.

3.3. Converging digiTV with the Component-Based Software Development Paradigm

Based upon the previous applications the goal was to present a complete solution for combining different

multimedia entities, such as graphics, text, video, audio, data, and interaction possibilities within a component based development software editor. Application development enhancements considers the following question: "How can services for MHP compliant platforms developed more rapidly and provide an integral solution for content, rather than application development?", was the question considered by this group of the project. Involving component-based paradigms into the life cycle of the software-development of digi-TV services should provide a generic, reusable framework for rapid content production and service deployment.

Fife major groups have been identified, that are involved in the process of developing MHP compliant software: Creative *Content Contributors* or authors focus on the development of content and not on underlying software and hardware technology. *Content Management* deals with the production and re-production of content by utilizing a content repository. It compromises content acquisition, authoring, service management, multi-platform support, the production of multiple services, managing the interaction between end-user and content, providing a set of rules and processes for content navigation, and life-cycle issues. The maintenance and realization of components is obeyed by the *Application Programmer*. His responsibility is to deploy a well tested, domain dependent, and utilizable set of components that are utilized by the content contributors or application engineers. The later group - the *Application Engineers* - interconnects and parameterizes single entities taken out of a component repository by utilizing an appropriate component-authoring tool. The development of the whole component based framework is the main responsibility of the *Architecture Group*, which designs, defines, and specifies the completely component-based repository.

A component-based application development approach seems to provide several advantages in comparison to current solutions: it gains productivity, minimizes required coding, allows visualized programming, reduces time-to-market, involves software behavior models, re-use of software sub-parts, and the development of a concurrent component repository. The aim of this research group was to point out how such a framework might look like, by utilizing the *Unified Modeling Language (UML)*, the JavaBeans concept, and exploring visualized programming environments.

4. ELECTRONIC IDENTIFICATION AND SECURE APPLICATIONS

The basic considered question was how it is possible to guarantee a secure environment for the end-user. Two aspects where covered by our research work: electronic identification and secure applications.

Electronic Identification (EID) based on a smart card solution allows identity proving of the end-user and secure transmissions between him and a third party. This provides comprehensive solutions for secure transaction management. To prevent applications causing damages to the digi-TV system a mechanism have to be introduced, validating the authentication and rights of one application. Therefore, our research work tried to evolve strategies for chain-of-trust based, certified applications and introduced security mechanisms to restrict resource access rights.

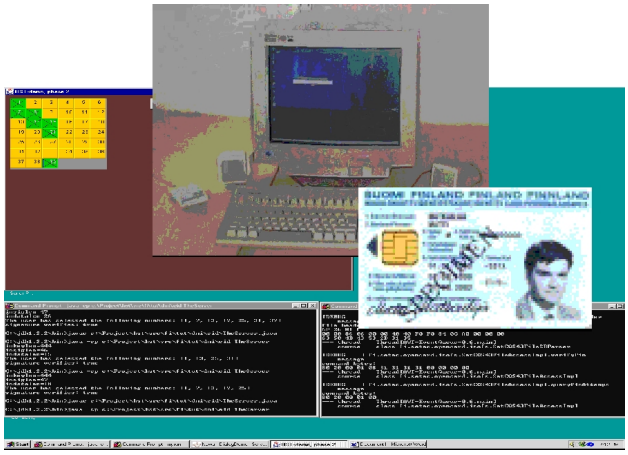

Fig. 5. Electronic Identification

To converge Electronic Identification (EID) with MHP based digiTV environments allows identification of the end-user based on a identification card. EID compromises solutions for electronic identification and digital signatures. The current implementation was tested and deployed firstly for a PC environment, where reusability and full MHP compliance were major integral requirements.

The development was divided in three steps: The first was to test and explore the possibilities of the EID card; by utilizing, the Java based OpenCard Framwork (OCF) as interface between card reader and the application. The second step extended this solution to a fully network solution of a lotto application, that should ensure secure transfer and identification of the end-user. The final step was the deployment of the application onto a fully MHP compliant device, therefore was migrated to an Xlet and embedded in a DVB-J application.

4.1 Secure Applications

With the introduction of Java JDK 1.2 a more flexible possibility was given for tailoring the security manger to fit own needs and to emphasis secure application development. The MHP defines both, keystore creation, and certificate factory therefore provides a unified solution for the realization of certified Xlets, remote resource access within certain access rights, and involving trusted java source code.

The strategies, how rights are assigned to applications is defined firstly by MHP, OS level pre-defined

configuration, and run-time assignments by authorized authorities. They rely on three different types of messages: Cryptographic hash codes, Signatures delivered by a master hash code, and certifications to enable the *Chain of Trust*.

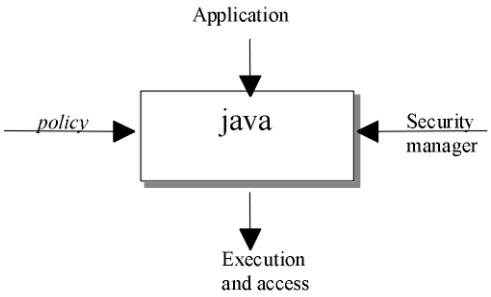

Fig. 6. Secure Applications

Once an application requests some additional rights, the procedure goes as shown in Figure5. The security manager will read all specified policy files and evaluates for this application whether rights can be granted; if yes, the code execution continues as desired, in case of an authentication failure any continuation is not permitted.

A MHP compliant demo application is currently under development and will be used to illustrate secure application development and show, how different security settings enhance security policies for this platform.

5. CONCLUSIONS AND FUTURE WORK

We presented our research work done within the FutureTV project and pointed out firstly, which enhancements in MHP still have to be made and how common applications could look like. MHP is going to be realized, but it will highly depend on the customer which services he accepts and whether television stays a pure broadcast medium or shifts to a full interactive multimedia home platform. Fore more detailed information about our research work, we would like to reference to your publications [2, 3, 4, 5, 6, 7, 8].

Our future research work focuses on the enhancement of application development, emphasizes security and identification issues, and will try to find possibilities and limitations given by MHP to develop content and services.

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