NIGHT SCENE LIVE – A MULTIMEDIA APPLICATION FOR MOBILE REVELLERS ON THE BASIS OF A HYBRID NETWORK, USING DVB-H AND IP DATACAST

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ABSTRACT

The combination of the emerging Digital Video Broadcasting – Handheld (DVB-H) standard with cellular communication like UMTS produces a hybrid network with enormous potential for mobile multimedia applications. In order to optimize the performance of hybrid networks, the characteristics of different individual networks have to be considered. Our prototypical hybrid network infrastructure employs smart access management for an optimal usage of both broadcast and point-to-point network. Our demonstrator – "night scene live", a multimedia event portal – is an excellent example of an application exploiting the potential of future hybrid networks.

1. INTRODUCTION

Mobile phones and mobile applications have become a part of our everyday life. Making phone calls, sending text and multimedia messages (SMS), surfing the net, and exchanging photos wirelessly from almost anywhere can be achieved using cellular technologies such as GSM, GPRS and also UMTS. However, if many people at the same time and place wish to use multimedia applications with high data rate requirements, e.g., streaming a video showing the winning goal in the world soccer championship finals, even 3G point-to-point networks like UMTS encounter their limitations.

This is where Digital Video Broadcasting (DVB) comes into play [1], a standard for high bandwidth point-to-multipoint communication. DVB is designed to transmit high volume data and to be used simultaneously by a large number of users [2]. DVB-Handheld (DVB-H) enables digital television as well as data broadcasting to mobile devices. As next generation devices will be equipped with a cellular network, it is likely to combine both networks. By employing smart access management along with a cost function to estimate the available data rate of both networks [3], an effective hybrid network can be achieved. This enables the creation of new types of multimedia applications, like our prototype "night scene live", which utilizes the advantages of a hybrid network: Videos from parties are broadcasted to party-revellers, attracting them to current events and helping them to stay informed with what is going on where. Videos and additional information for each event, such as who is performing, the music style and happy hours can be selected in a web portal.

We would like to thank Christoph Heuck, University of Brunswick, Germany, who designed and realized the network access management function in the Niccimon competence center

2. PROJECT BACKGROUND

Our demonstrator "night scene live" is part of our research at the Lower Saxony Competence Center for Information Systems for Mobile Usage (Niccimon [4]) in Oldenburg, Germany. In this competence center, partners from three different locations in the State of Lower Saxony are involved: the Institute for Communications Technology (IfN) at the Technical University of Brunswick, the Oldenburg Research and Development Institute for Information Technology Tools and Systems (OFFIS), the Institute for Global Communications Engineering (IANT), and the Institute for Theoretical Communications Technology and Information Processing (TNT) at the University of Hanover. The aim of the Niccimon competence center is to intensify the cooperation between research and industry in the field of mobile applications and systems. In addition to the research in the field of DVB-H and IP Datacast, the competence center works in the different areas such as the development of a modular mobile system platforms [5] and its application in tourism [6] or mobile gaming [7], information systems for usage in cars like car-to-car communication and 3D acquisition and reconstruction [8], e.g., for car navigation systems.

3. HYBRID NETWORK

DVB-H is a data broadcasting system optimized for mobile devices such as PDA's and cellular phones, with data rates up to 10 Mbit/sec and a broadcast coverage ranging anywhere from localized areas to vast regional networks [9]. The standard is based on DVB-T, Digital Video Broadcast

– Terrestrial, which is just on train to be settled in Germany now. But whereas DVB-T is laid out for stationary systems with larger display sizes, DVB-H is targeted at highly limited mobiles devices. Due to the smaller size of the displays, the broadcast data rate can be divided into 15 instead of 4 channels. To reduce the power consumption of mobile DVB-H receivers a time slice mechanism is used. Time slices are slots where the relevant data is transmitted in high data rate bursts, enabling the receiver to be powered down for up to 95% of the time, reducing its average power consumption [3].

The combination of such powerful point-to-multipoint broadcast to reach mobile devices like smartphones with a supplementary point-to-point interactive communication network forms a *hybrid network*. To make use of the advantages of both communication networks a network access management function has to control the data transfer. This management function, in addition to others, was developed as a part of the Niccimon project.

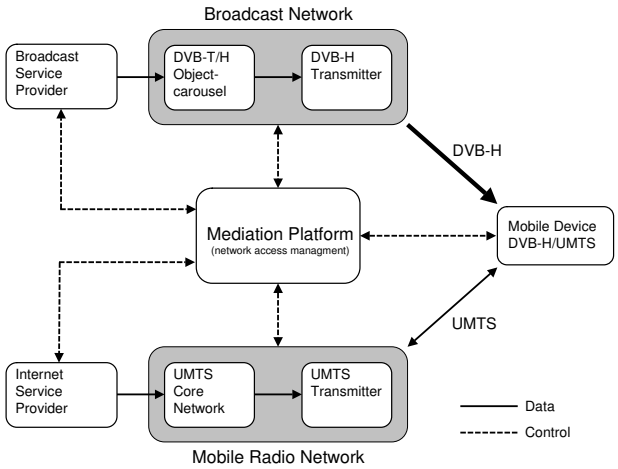

Fig. 1. Structure of a hybrid network (see [3])

Figure 1 illustrates the structure of a hybrid network which comprises a mobile device/station with access to a DVB-H and UMTS network. Broadcast and mobile radio network are connected to the mediation platform, which contains the network access management function. The mobile device sends its request via mobile radio network to the network management function, where all request are collected, counted and estimated regarding their size and number of requests now and expected. Data with the need for high data rate and many requesters will be send via the broadcast network whereas less popular data will be directed to the mobile radio network.

Regarding the network and transport layer, there is a new standard called IP Datacast [10], which we, in its current specification state [11], currently implement in the Niccimon competence center. It integrates the dissemination of digital content over a broadcast network to the masses with the individual communication provided by a mobile phone network. The access to the respective communication networks is hidden, whereby the user remains in control of the associated costs. More details about DVB-H system and the performance of hybrid networks can be found in further publications related to our project [3, 12, 10, 13].

4. APPLICATION SCENARIO: MOBILE ENTERTAINMENT

Our demonstrator "night scene live" demonstrates the potential and special features of the hybrid network in the domain of mobile entertainment and exemplifies the prospect for such applications. The application meets a new trend among teenagers and young people: they do not plan anymore in advance what they will do on a particular evening; they rather decide spontaneously once they are already downtown. Expensive phone calls and SMS messages are used to discuss where to go and finally decide on the assumedly hippest event of night. However, today the decision is based on messages and maybe descriptions of those, who are already at one of the sites. Up-to-date multimedia content for the different ongoing events that gives a better impressions of the different locations and events are lacking.

To aid the revellers in their decision on where to go, the "night scene live" demonstrator provides them with up-to-date multimedia information about local ongoing events, primarily through the transmission of (live) videos from parties and other events in the vicinity.

5. SYSTEM ARCHITECTURE

While DVB-H and the standard for IP data broadcast (IP Datacast) are still under development, we developed a simulation environment and architecture using DVB-T as broadcast network (see Figures 2-4). It is similar to the original DVB-H architecture, however, some of the system components are transferred from the mobile phone to a computer.

Fig. 2. Mobile phone and computer client

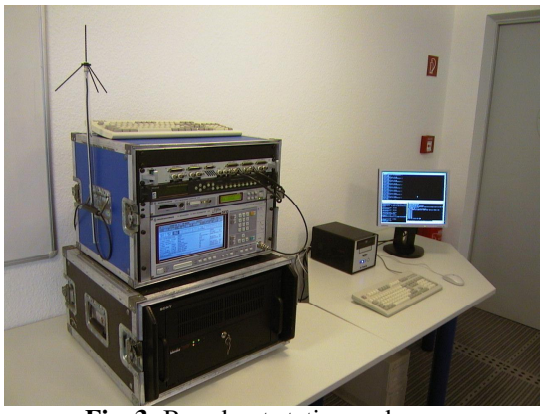

Fig. 3. Broadcast station and server

Fig. 4. Overview of the demonstration setting

5.1. Server

The "night scene live" client/server architecture consists on the server side of a three-layer-architecture (see Figure 5) with an extended Web portal, which provides information about forthcoming events and enables access to real-time, broadcasted videos. To manage the hybrid network, we developed a network access management function [3]. This function monitors every file/video that is to be transmitted. Based on statistical algorithms the selection of media in the broadcast changes dynamically: for example, highly requested videos are integrated into the broadcast whereas rarely requested videos can only be retrieved via the mobile point-to-point network. This is done in order to optimize the usage rate of the broadcast channel and cost for both the content provider and user. Due to limited resources (data and play out rate) of the DVB-H broadcast, not all data can be sent via this network. The mobile network can be used to transmit the data, but in our case, a different content type is selected, to be transmitted to the user. If a video can not be transmitted via broadcast, a picture preview of the video is presented using the interactive point-to-point communication network.

5.2. Client

When transmitting the content over DVB-H, a Digital Rights Object (DRO) is sent to the mobile device. It contains information regarding billing and decryption and the position of the requested object in the broadcast stream. With this information, the network access function on the client device can extract the object from the broadcast stream and store it in a local cache for further use. This cache function reduces the latency and power consumption of the mobile phone. On receiving of an object the network access function informs the counterpart on the server side about each successful and failed object transfer. With this information, a model about the current network status can be built to be used to further optimization of the hybrid network.

A middleware on top of the hybrid network acts as a central access and exchange point for all applications. It consists of a proxy to communicate with the hybrid network and the aforementioned cache to hide the complexity of the hybrid network from the applications as well as from the user. Throughout the entire object transfer process the proxy gathers status information in order to inform the above applications and the user about the current situation.

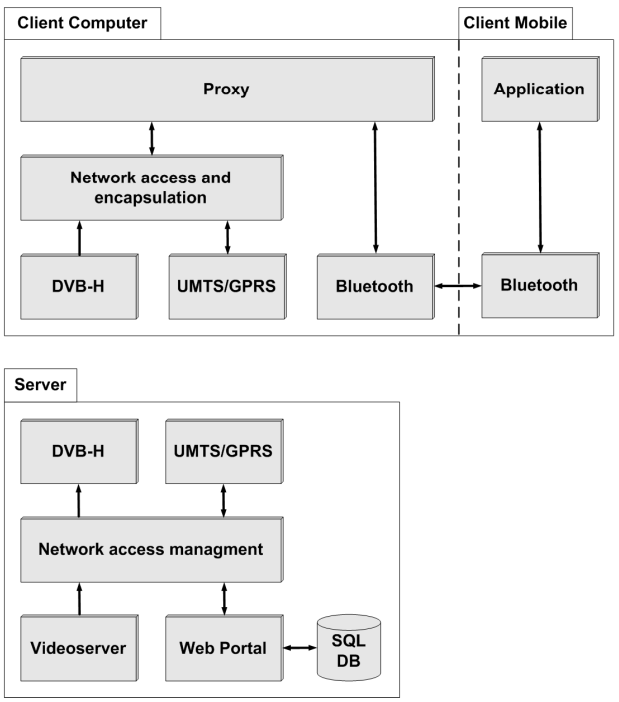

Fig. 5. The "night scene live" client/server architecture

Fig. 6. "night scene live" on a mobile phone

In our first version of the prototype, we connected a mobile phone via Bluetooth to a computer, which provides a DVB-T receiver and the above mentioned network access function and middleware. On the mobile phone we used a standard web browser and media player as applications to display the portal and video content. Figure 6 shows the Web portal and playback of a video from a discotheque on a mobile phone.

6. COMMERCIAL AND SCIENTIFIC POTENTIAL

A hybrid network enables a whole new array of multimedia applications for mobile devices. Until now, such applications were either impossible to realize or were too expensive or time consuming for mobile users. With a hybrid network using IP Datacast and DVB-H it is possible to provide users with combined media-objects using data broadcasting as well as a mix of live-stream and cached information – obtained using different wireless transfer technologies. Hence, broadcasting formats can be augmented with individualized services. With this approach, live content as well as data files can be transferred more quickly and cost-effectively. The possibilities are endless and offer the mobile user as well as event coordinators additional value. Now, an appealing mobile service for the world soccer championship becomes possible in which mobile users can review the last goal with all the other fans in the stadium all at the same time while being offered the results of his or her individual favorite soccer team.

7. REFERENCES

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