Mobile Television

Frank Hartung
Ericsson GmbH, Germany

Markus Kampmann
Ericsson GmbH, Germany

Uwe Horn
Ericsson GmbH, Germany

Jan Kritzner
Aachen University, Germany

INTRODUCTION

During the last 10 years, the TV landscape has changed quite significantly. With a relatively low investment, consumers can get access to several hundreds of TV channels. Free TV stations are trying to establish new revenue sources in order to become less dependent on revenues from advertisements. FreeTV and PayTV service providers operating via cable or satellite networks are faced with competition from IPTV service providers, which are offering video-on-demand services to broadband Internet users.

An important emerging trend is Mobile Television (MobileTV). The basic idea of delivering TV services to mobile users has been around for quite some time. Between 1982 and 1985 Seiko sold a wristwatch including a small TV screen, which had to be connected to an external receiver carried at the belt. The display size was very small, roughly half the size of a modern smartphone, and also the quality of the monochrome display was limited. Later, when LCD displays became available at cheap prices, several manufacturers started to build handheld TV receivers. However, this approach failed for a number of reasons: First the additional TV reception equipment was often too large and heavy to be carried around all the time. Secondly, it was often difficult to receive noise-free pictures, simply because terrestrial TV networks had not been engineered for portable reception.

Nowadays, mobile phones with multimedia capabilities and excellent display qualities have become commodities (Lee, Byun, Lee, & Kim, 2003; Koike, Matsumoto, & Kokubun, 2006), and third-generation (3G) cellular networks like UMTS provide sufficient capacity and data rates to deliver multimedia services to mobile users. Those networks also provide very good coverage, which gives mobile users access to MobileTV services wherever they are. Upcoming mobile broadband technologies like HSDPA will give further quality improvements due to increased data rates. With 3GPP MBMS and 3GPP2 BCMCS, broadcast/multicast extensions have been added to 3G standards and will become commercially available during 2007/2008 (Toenjes, 2004; Bakhuizen & Horn, 2005).

Apart from the cellular broadcast/multicast evolution, also digital TV transmission standards have produced variants addressing broadcast delivery to mobile devices (Weck & Wilson, 2006). DVB-T for instance has produced a variant called DVB-H, where the *H* stands for *handheld*. Even the digital transmission standard DAB, originally developed as a digital replacement for analog FM radio, developed a variant called T-DMB, which allows broadcasting of multimedia content to mobile devices.

This article gives an overview of the main technology and service trends in MobileTV. We start with an overview about existing MobileTV services. We then discuss the various transport options for delivering MobileTV services. At the end we go through some important service layer components.

MobileTV

MobileTV Services Today

During 2004 and 2005 many mobile operators launched commercial MobileTV services. In the simplest case, this is just a re-broadcast of existing TV channels.

In order to get access to a MobileTV offering, users have to pay a monthly fee. The basic package contains access to live TV channels; for on-demand premium content (for instance, sports channels), end users must pay separately.

However, existing TV channels are using formats that are not adapted to the behavior of mobile users. Studies have shown that mobile users consume MobileTV services in a very different way than fixed TV services (Södergard, 2003). Most noticeable, they spend less overall time per viewing session. The time spent per session is typically around 5

minutes in the mobile case. Likewise the time spent on individual programs is around 1-2 minutes. This behavior makes it necessary to develop new content formats, better tailored to the needs of mobile users. This was addressed during 2005 by some operators, which started to add mobile-specific content provided by existing TV channels to their offerings. An example is a 20-minute summary with the highlights of the week combined with the latest news which is looped over the day and updated once or twice per day.

The services provided by mobile operators today also show a clear trend towards combined offerings including not only live channels, but also personalized video-on-demand content.

Delivering MobileTV services to the mobile phone as an interactive communication device opens up a lot of opportunities for creating new services around the TV experience, and novel services emerge (Rauchenbach, 2005).

An example is interactive MobileTV. Already today there are many formats in traditional TV allowing users to interact with a TV show by sending back SMS for voting, chatting, purchase of ring tones, and so on. Those formats are often used by music stations, targeting younger people. On a mobile device, it is possible to seamlessly integrate the interaction and the program. For instance, a voting request can be presented as an interactive menu from which the user can easily make his selection. By browsing to the right answer and confirming the choice, voting services becomes much more convenient to use, compared to creating and sending an SMS which requires a lot of typing. This demands for advanced user interfaces (e.g., Knoche, 2005).

Systems for Delivering MobileTV Services

Commercial MobileTV services today are delivered over cellular networks. In particular, 3G cellular networks like UMTS provide sufficient capacity and data rates to achieve a good quality of experience. Those networks also provide very good coverage, which gives mobile users access to MobileTV services wherever they are. Upcoming mobile broadband technologies like HSDPA will give further quality improvements due to increased data rates.

Most of the existing MobileTV services are built upon the packet-switched streaming service (PSS) as it was standardized by 3GPP (3GPP TS 26.234, 2004; Elsen, Hartung, Horn, Kampmann, & Peters, 2001). The advantage of 3GPP PSS is its wide availability and support in existing mobile multimedia phones, and some effort has been made to bring PSS's services to unidirectional links (Yoshimura & Ohya, 2004). Since PSS uses a point-to-point connection between each client and a media server, it does not scale very well with an increasing number of simultaneous users.

Therefore, in 2003 3GPP and 3GPP2 started to address broadcast/multicast services in GSM/WCDMA and CDMA2000, respectively. In 3GPP the work item is called Multimedia Broadcast and Multicast Service (MBMS) (3GPP TS 23.246, n.d.; 3GPP TS 26.346, n.d.). In 3GPP2 it is called BroadCast and MultiCast Service (BCMCS). The specifications of cellular broadcast services were functionally frozen during 2004. 3GPP MBMS and 3GPP2 BCMCS have many commonalities. Both of them add the following capabilities to cellular networks:

- A set of functions that control the broadcast/multicast delivery service; MBMS uses the term Broadcast/Multicast Service Center, whereas in BCMCS it is called "BCMCS Controller."
- Broadcast/multicast routing of data flows in the core network.
- Efficient radio bearers for point-to-multipoint radio transmission within a cell.

Both MBMS and BCMCS are introducing only small changes to the existing radio and core network protocols. In the higher protocol layers, the same media codecs and associated transport protocols as for packet-switched streaming are used. This reduces the implementation costs both in terminals and in the network, and makes cellular broadcast a relatively cheap technology. Another advantage of cellular broadcast is that mobile operators can retain their established business models. Current services, such as MobileTV, will greatly benefit from the capacity-boosting effect of broadcast capabilities. Certainly cellular broadcast will also stimulate the development of new, mobile, mass-media services. Likewise, cellular broadcast will enable operators to provide a full triple-play service offering—telephony, Internet, and TV—for mobile handheld devices in a cost-effective way over a common service and network infrastructure.

Not only cellular networks have addressed mobile broadcast services, also digital TV transmission standards have produced several variants addressing mobile broadcast extensions.

One of them is DVB-H (Digital Video Broadcasting for Handheld—Faria, Henriksson, Stare, & Talmola 2006; ETSI EN 302 304, 2004), which can be regarded as an extension to DVB-T (Ladenbusch, 2006), an European standard for conventional terrestrial video services. DVB-H adds new features to the physical and link layer to reduce the power consumption in the receiver and to allow for a more robust transmission as it is needed for mobile devices. DVB-H may reuse the frequencies of old analogue television services, but competes with digital non-mobile television services for the spectrum.

T-DMB (terrestrial digital multimedia broadcasting) is a Korean extension of the digital audio broadcasting (DAB) standard for digital radio. Many countries allocated radio frequencies for DAB, but in most countries the commercial success was limited. This spectrum can now be reused by