Wireless World Research Forum (WWRF)

(a) Title of the research item: Interactive Broadcast Services within IMT-2000 and beyond Systems

Experts:

Thorsten Lohmar, Frank Hundscheidt, Ralf Keller, Ralf Tönjes
Ericsson Eurolab Deutschland GmbH
Ericsson Allee 1, 52134 Herzogenrath
{ Thorsten.Lohmar | Frank.Hundscheidt | Ralf.Keller | Ralf.Toenjes }
@eed.ericsson.se

(b) Subject Area: 3. Going Wireless - New Technologies

(c) Objectives of the required research

(Why has the topic been chosen? Where will the results be applied?)

Many emerging multimedia applications, such as sports-clips distribution, regional news, traffic and tourist information services, one-to-many video and audio streaming may demand for interactive broadcast service capable networks. The demand depends on whether the number of users, which demand time-bounded information, scales above the capabilities of point-to-point operation. Obvious enablers for broadcast services are broadcast and multicast transmission. Broadcast and multicast transmission technology provides a number of features. The main benefits for mobile operators and mobile users are

- Saving capacity and resources in the network, in the terminal and on the radio interface
- Saving processing and line capacity on servers and terminals because of sending packets only once
- Enabling technology for all kind of “Push-Services” and synchronized on-demand services
- Enabling technology for all kind of interactive broadcast applications, if combined with return communication capabilities
- Enabling technology for all kind of multicast services

Note that the degree of interactivity may vary between different types of interactive broadcast services, hence also different technical solutions could be selected. However, it is of course an objective of this research to develop best a single solution which enables all types of interactive broadcast services.

Challenges of Mobile Broadcast Services

Today’s mobile networks have been optimized for mobile unicast services. Cell broadcast services are only available for low data rates. For high data rates audio and video broadcast the Digital Audio Broadcast (DAB) and Digital Video Broadcast (DVB) services have been developed. Meanwhile they have been evolved for data distribution (data casting). However these systems have not been optimized for battery consumption and use in a mobile environment.

Therefore today no integrated system exists, providing mobile broadband uni-and broadcast services.

Due to the lower reliability of radio links, the system has to cope with packet losses. Hence different techniques have been proposed in digital broadcasting systems such as error resilient codes or the use of data carousels to repeat the data packets.

Additional research needs to be done to extend the architecture of mobile networks to enable interactive broadcast services together with the provisioning of personalized services to users on small mobile terminals.

The key issue for content distribution are the availability of techniques for Digital Rights Management (DRM), charging, service continuity, network dimensioning, security, etc.

	Content Advertisement p2m	Content Distribution p2m
Location dependent	• On site live event • Reg. Advertise. (Shops, Restaurants,..)	• Streaming of last goal • Regional news (traffic, weather,..)
Location independent	• Off site live event • News	• MP3 music, • software updates

Table: Example applications for interactive broadcast services

Efficient Resource Management

To allow spectrum efficient IMT-2000and beyond based broadcast and multicast services the efficient support of broadcast in the radio access system has to be investigated. Moreover efficient support for broadcast like content distribution in the core network is needed.

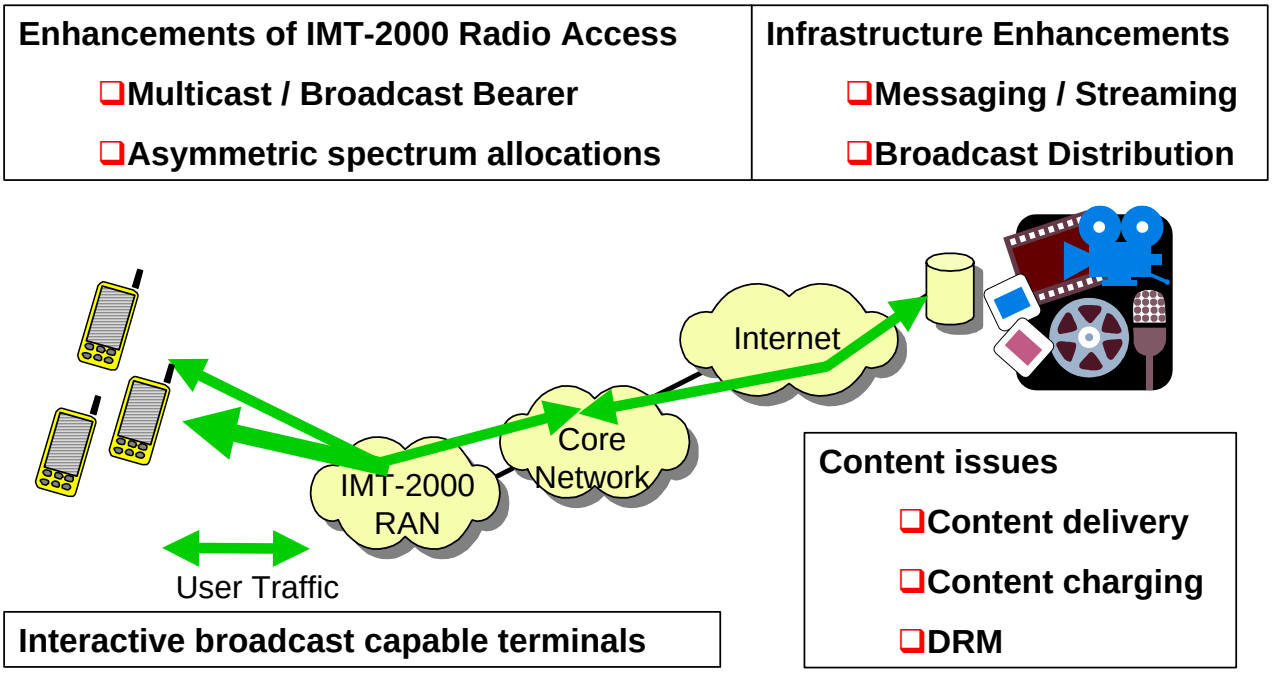

Figure 1: Research areas for interactive broadcast services

(d) State of the art in the area (including important references)

Cell Broadcast

Cell Broadcast is a technology that allows a text or binary message to be defined and distributed to all mobile terminals connected to a set of cells. Whereas SMS messages are sent point-to-point, Cell Broadcast (SMS-CB) messages are sent point-to-area. This means that one SMS-CB message can reach a huge number of terminals at once. In other words, SMS-CB messages are directed to radio cells, rather than to a specific terminal. SMS-CB is an unconfirmed push service, meaning that the originator of the message does not know who has received the message, allowing for services based on anonymity. A Cell Broadcast Entity (CBE) is a multi-user front-end that allows the definition and control of SMS-CB messages. A CBE can be located at the site of a content provider. At the site of the operator a so-called Cell Broadcast Centre (CBC) is located. The CBC is the heart of the Cell Broadcast System and acts as a server for all CBE clients. It takes care of the administration of all SMS-CB messages it receives from the CBEs and does the communication towards the GSM network. The GSM network itself takes care of delivering the SMS-CB messages to the mobile terminals.

Cell Broadcast is ideal for delivering local or regional information which is suited to all the people in that area, rather than just one or a few people. Examples include hazard warnings, cinema programs, local weather, flight or bus delays, tourist information, parking and traffic information.

3GPP MBMS – Multimedia Broadcast/Multicast Service

According to the current status of IP multicasting in the PLMN, the GGSN either transparently forwards IGMP messages, when the PLMN is not aware of the use of multicasting, or the GGSN takes only care of group administration. In this case the GGSN terminates IGMP and the corresponding multicast routing protocols, and replicates the data. According to 29.061 (R'99), the GGSN handles IGMP. The GGSN provides multicast proxy functionality.

To provide efficient multicasting and broadcasting 3GPP is currently standardising multicast/broadcast under the term Multimedia Multicast/Broadcast Services (MBMS).

The MBMS is defined as an unidirectional point to multi-point bearer service in which data is transmitted from a single source entity to multiple recipients. Thus MBMS provides transport efficiency for multicast and broadcast services. MBMS work has been progressed in SA1-Services and SA2-Architecture in documents TS 22.146 "Service requirements" [5] and TR 23.846 "MBMS Architecture and Functional Description" [7], respectively. It has also been agreed to start work on MBMS within the RAN groups. MBMS distinguishes a broadcast and multicast mode:

Broadcast mode:

- Content delivered to all users in a service area
- Not to be confused with Cell Broadcast Service
- No activation or subscription required
- Charging of service provider should be possible
- Advertisement, welcome message

Multicast mode:

- The content is delivered to all registered users in a service area
- Generally requires subscription and activation from user
- Charging of user and service provider should be possible
- Multi-user services

MBMS is currently foreseen for Release 6.

DAB

The work on digital UKW with better frequency utilisation started in 1981. On a German national level DAB went into operation in 1998. DAB employs MPEG-2 (MUSICAM) audio compression. The radio bearer uses OFDM with a DQPSK modulation. It is designed for a mobile reception till 250 km/h. The maximum datarate for mobile reception ranges from 864 kbit/s to 1.024 Mbit/s. In addition to audio it supports following data services.

- PAD - Program Associated Data (max. 64 kbit/s in addition to audio programme)
- Radiotext (RDS), still images (weather maps), news ticker, sound files

- Data broadcast services (news-, service-, traffic information)
- CA – Conditional Access (e.g. information for travelling salesmen)

The Multimedia Object Transfer (MOT) Protocol turns DAB into DMB (Digital Multimedia Broadcast) supporting varies data formats, such as HTML, GIF, MPEG Audio/Video, Java, etc.

DVB

In 1990 first projects to develop digital TV started. DVB [2] distinguishes Satellite (DVB-S), cable (DVB-C) and terrestrial services (DVB-T). Since 2000 terrestrial DVB services are broadcasted in Britain, Spain, and parts of northern Germany. DVB is based on MPEG-2 for video and audio compression. It employs OFDM and is designed for stationary and portable use. However it was shown that mobile use is possible up to 200 km/h when a lower modulation (16 QAM) is used. The maximum data ratefor mobile reception is 4.98 Mbit/s(QPSK)and 9.95 Mbit/s(16QAM) respectively. DVB provides followingg services

- Digital TV
- Multimedia data services (push/cache services)

Interactive broadcast

To provide interactive TV allowing for example voting from observers, back channels for DVB have been defined. The picture below shows a possible architecture.

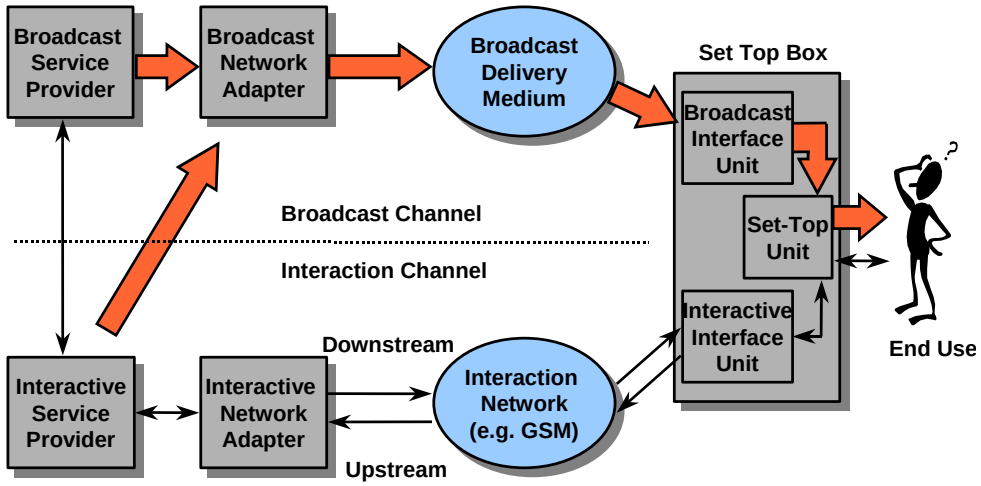

Figure2: Architecture for interactive DVB

(e) Possible approach

The default operation in IMT-2000 is point-to-point, both in the core network and in the radio access network. The provision of mobile broadcast requires further research in following areas:

- Study the inclusion of broadcast radio technology as an additional downlink radio access network to support asymmetric traffic

- Study the integration of broadcasting capabilities in IMT-2000 and beyond networks. Any solution from a single server, via replicated servers, and local service execution on the terminals should be considered. Use of data carousels for content distribution in IMT-2000 networks has to be investigated.
- Study of broadcast session initiation and session advertisement in a mobile environment
- Study of DRM for content distribution
- Study of content adaptation including smart caches and proxies for media adaptation and transcoding, format adaptation, and presentation adaptation.
- Study the support of user preferences

(f) Expected results

The proposed enhancement of IMT-2000 and beyond will result in a interactive broadcast capable IMT-2000 system, which enables mobile operators to provide also low-cost broadcast services to their mobile subscribers.

(g) Time frame to get the expected results

5-10 years

List of References

[1] R. Keller, T. Lohmar, R. Tönjes, and J. Thielecke. “Convergence of Cellular and Broadcast Networks from a Multi-Radio Perspective”, *IEEE Personal Communications*, 8(2):51-56, 2001

[2] U. Reimers. Digital Video Broadcasting - Current Status, Future Developments. IEEE Multimedia Newsletter, pp. 8--11, December 1996.

[3] J. C. Pasquale, G. C. Polyzos, E. W. Anderson, and V. P. Kompella. The Multimedia Multicast Channel. In P.~V. Rangan, editor, Network and Operating System Support for Digital Audio and Video (Third International Workshop, La Jolla, California, USA, November 1992), Lecture Notes in Computer Science 712, pp. 197--208. Springer-Verlag, 1993.

[4] 3GPP TS 23.060 v4.1.0 (2001-06); 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; General Packet Radio Service (GPRS); Service description; Stage 2 (Release 4)

[5] 3GPP TS 22.146 v1.0.0 (2001-07); 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Multimedia Broadcast/Multicast Service; Stage1 (Release 5)

[6] 3GPP TS 25.324 v4.0.0 (2001-03); 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Broadcast/Multicast Control BMC (Release 4)

[7] 3GPP TR 23.846 v1.0.0 (2001-01); 3rd Generation Partnership Project; Technical Specification Group Services and Systems Aspects, Multimedia Broadcast/Multicast Service, Architecture and Functional Description (Release 6)

[8] T. Lohmar et al., "Multi-User Services in IMT-2000", Networks 2002, Munich, June 2002.