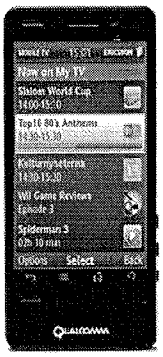
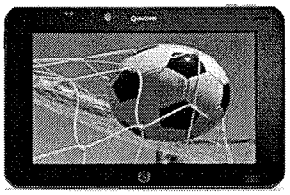
ERICSSON

BROADCASTING OVER LTE WITH EMBMS

A ROUTE TO MORE SPECTRUM EFFICIENT MASS MEDIA DELIVERY

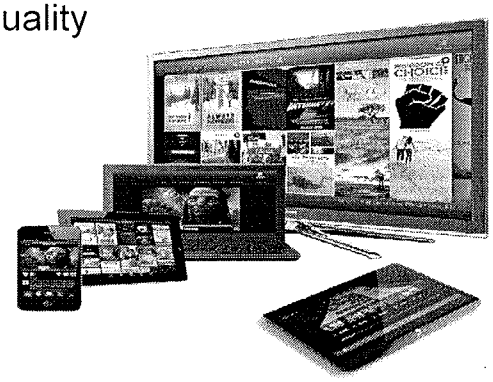




Jörg Huschke
Broadband for all Seminar 2012 – Technology Briefing
Ericsson Studio, 26 June 2012

OUTLINE

- LTE-MBMS overview:
  evolved Multimedia Broadcast/Multicast Service
- Service continuity
- Service probability example using DVB-T service quality requirements
- Transition to SFN, spectrum savings
- Possible future enhancements
- Summary



REGULATORY & MARKET CONTEXT

› Some dedicated mobile broadcasting technologies have not gained market support (DVB-H, MediaFlo)

› FCC national broadband plan had decided to make 120MHz of broadcast spectrum available for mobile broadband.

› WRC2012 has taken decision to allocate the 700MHz band also to the mobile service on a co-primary basis by 2015.

› Broadcasters start to realize they need to work on an evolution path for terrestrial media distribution urgently, also looking into LTE.

› EBU has started a strategic programme Cooperative Terrestrial Networks (CTN) with participation from companies like Qualcomm, ALu, Ericsson.

› eMBMS has been demonstrated at MWC 2012. Products announced for 2014. Increasing interest from mobile operators.

ERICSSON

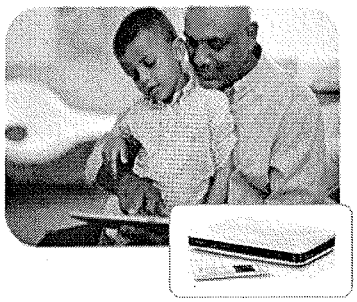
LTE-MBMS OVERVIEW

USE CASES

Linear TV &
Instant delivery

Deliver premium content to many users with secured QoS, over defined areas

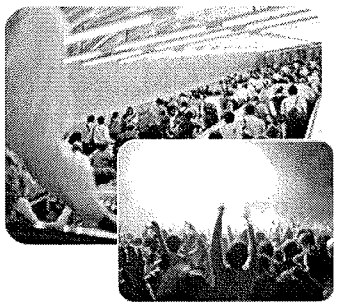
UE caching –
pushed content



Broadcast (Podcast) most popular Video, Appz and Webpages to device cache. Broadcast SW devices upgrades.

Enable M2M services that would benefit from broadcast.

Efficient use of LTE spectrum
& network investments



Broadcast most popular content in the geographical areas it makes sense.

Offer specialised services over dense areas as arenas etc.

Enable efficient mobile advertising

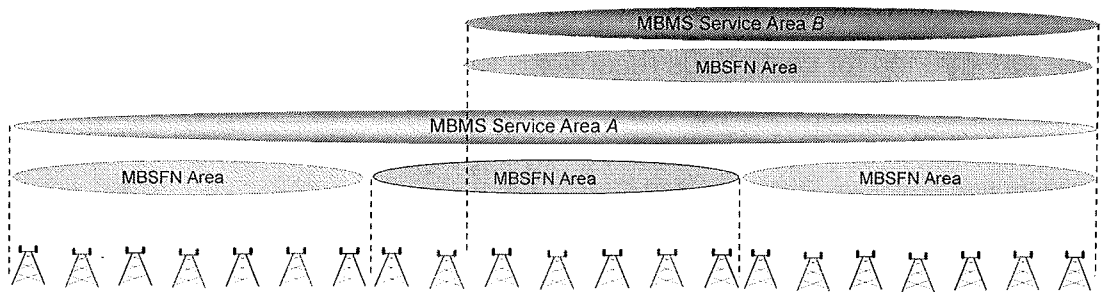
MBMS CODECS/SERVICE LAYER TOOLS

- CODECs: H.264, E-AAC+ or AMR-WB+
- Streaming delivery method for continuous reception
  - Re-use of existing Streaming Protocols (i.e. RTP)
- Download delivery method for file distribution
  - IETF file distribution protocols FLUTE and ALC
  - Also used for stream delivery based on DASH
- Auxiliary functions for content transmission methods
  - Post transmission File Repair function
  - Reception Reporting for files and streams
- Service access protection
  - Terminal/user authentication
  - Key Management via MIKEY
- Additional Forward Error Correction (FEC) on application layer (IP layer) supported
  - enables further reduced IP packet error rates
  - Raptor code, IETF RFC 5053

MBMS RADIO INTERFACE CHARACTERISTICS

- LTE-MBMS time multiplexed with unicast traffic
- Supported for FDD and TDD LTE
- Uses OFDM, like DVB-T, ISDB-T
  - OFDM parameters differ, LTE optimized for very high user mobility at 2.6GHz and above, based on rather low cellular transmitter separation
  - Longer guard interval than for LTE unicast, to avoid inter symbol interference from neighbor cells
- MBMS uses Single Frequency Network (MBSFN) transmission

MBMS SERVICE AREA / MBSFN AREA

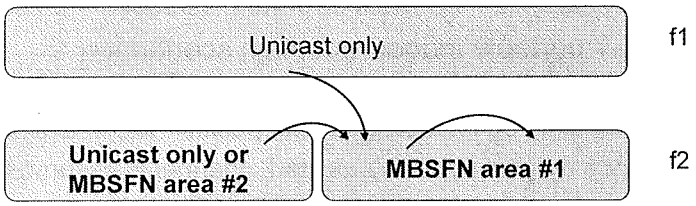


- MBMS Service Area allows service distribution in target regions
- eNBs transmitting MBSFN are required to be synchronized in time
- Overlap between MBSFN areas is supported
  - Enables local, regional, and national services
  - One cell can belong to several MBSFN areas

RELEASE 11 ADD-ON: SERVICE CONTINUITY WITH MULTIPLE FREQUENCY LAYERS

- User Service Description has information in which MBMS Service Area IDs (SAIs) and on which frequencies the service is provided
- Each cell in the network announces MBMS SAIs of cells for its own frequency and for its neighboring frequencies.
- UE can identify whether it is in coverage area of frequency layer providing MBMS service of interest without having to search the layers.

2 Frequency Layers (Example)



ERICSSON

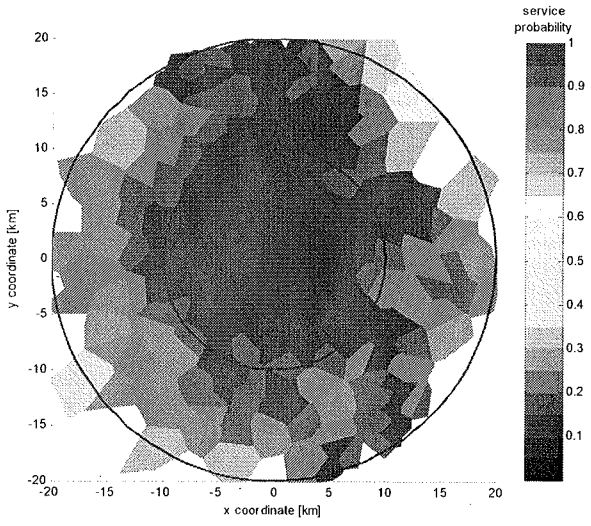
SERVICE PROBABILITY EXAMPLE USING DVB-T SERVICE QUALITY REQUIREMENTS

ASSUMPTIONS

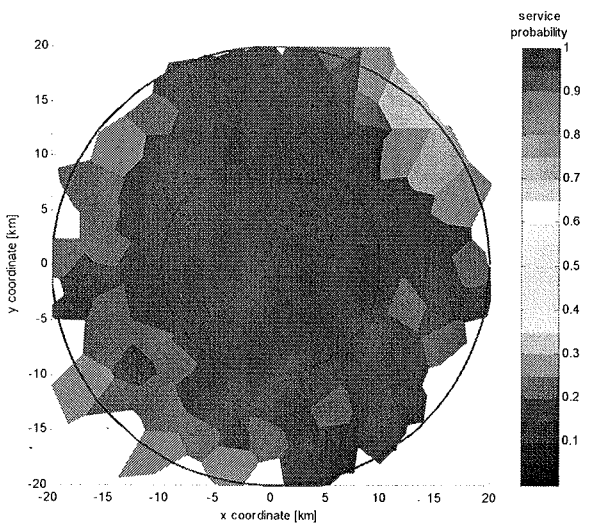
- Quality requirement
  - Quasi error free (QEF) reception: less than one uncorrected error-event per transmission hour
  - Requires use of application layer FEC (AL-FEC)
  - AL-FEC block covers 1s
  - tolerable AL-FEC block error rate: 1s/3600s = 2.78e-4
- DVB-T portable indoor reception scenario:
  Receiver is placed at optimum position in a disk of 0.5m radius.
  - Mimicked by choosing optimal position within a 1m straight line of the random initial user position.
  - once optimal position selected, channel is assumed to be static
- Propagation: 3GPP case 1, but 700MHz and only 8dB indoor loss, taken from DVB-T assumptions
- Inter-symbol-interference ("MBSFN-self-interference") not considered, expected to be low in present scenario.
- Results provided indicate technology potential. No implementation margins.

ESTIMATED SERVICE PROBABILITY IN 20KM AROUND COLOGNE/GERMANY

- Least robust MCS; 2% AL-FEC
- 3.1b/s/Hz



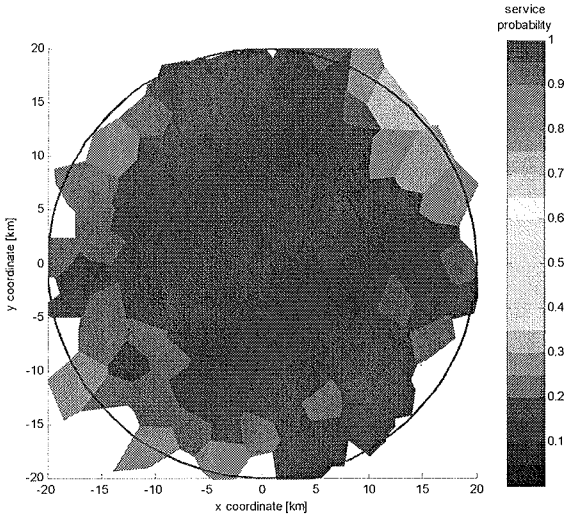
- More robust MCS. Spectral efficiency reduced to 1.6b/s/Hz



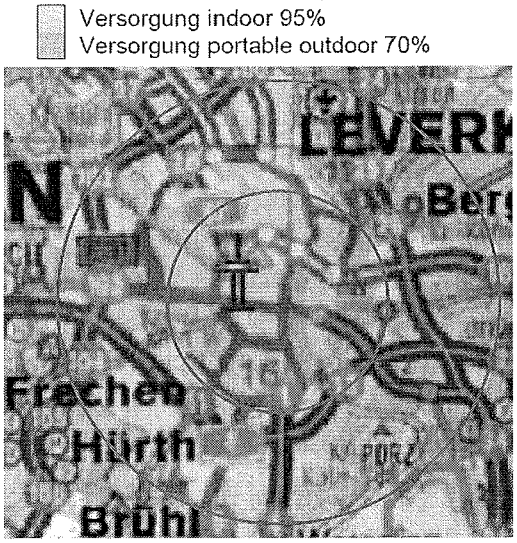
"mean ISD" method

COMPARISON TO DVB-T

› eMBMS; 1.6b/s/Hz
sites with service >95%:
– 100% in 10km; 93% in 20km

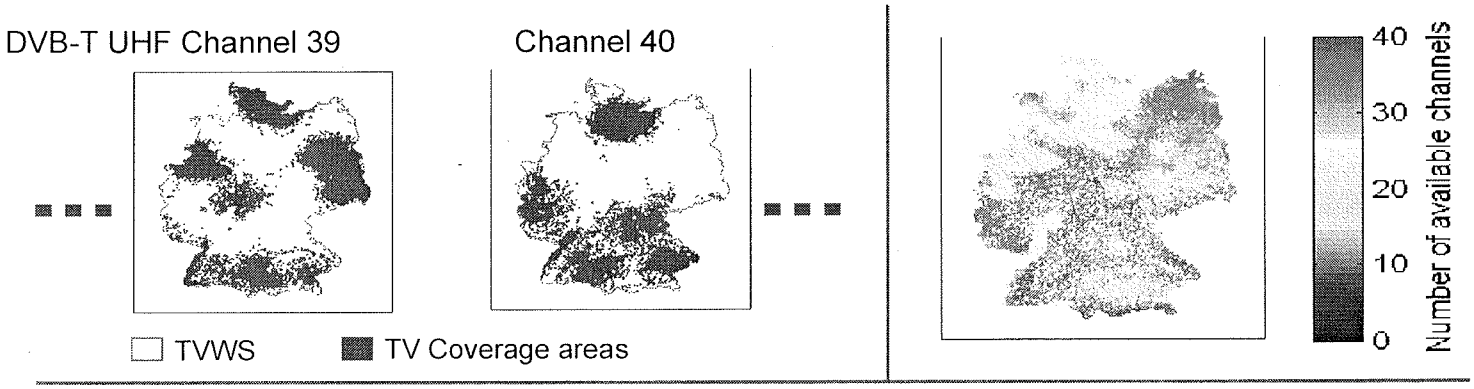


› DVB-T; 1.66b/s/Hz (13.27Mb/s)



source: LfM NRW

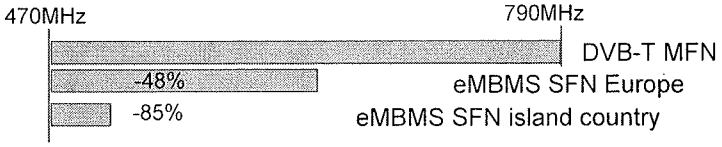
EMBMS CAN FREE UP TV SPECTRUM



› nation-wide SFN not used for DVB-T
– to prevent inter-symbol-interference due to very large transmitters distances

› MFN used instead
– requires many frequencies for one nation-wide coverage

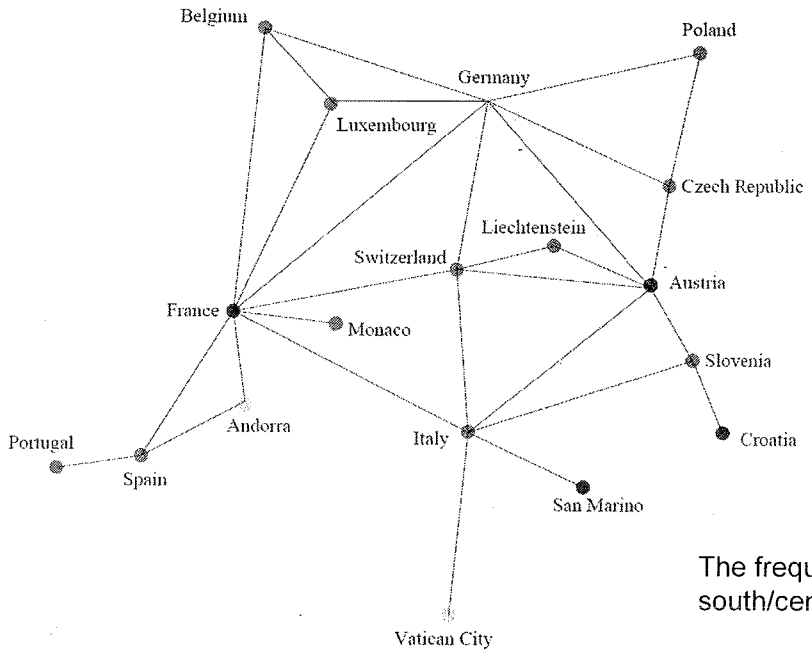
› eMBMS with the small cellular transmitter distances enables nation-wide SFN



EMBMS CAN FREE UP TV SPECTRUM

› Cellular SFNs enable nation-wide SFNs for nation-wide content.
› Germany: In main cities there are 6 DVB-T channels in use.
› 5 channels carry content for nation-wide distribution, but different frequencies used geographically
› eMBMS needs just 1 frequency per channel: nation-wide SFN.
› Low-tower low-power transmission used for eMBMS confines interference to neighbor countries to a few kilometers.
› To avoid cross-border interference entirely, could use a frequency reuse factor of 4 across Europe.
› 5 x 4 frequencies sufficient for nation wide content in Europe.
› Regional/local content: 1 TV program in Germany using 25% of a channel. With reuse-4, 1 channel needed to cover Europe.
› Total: (5*4+1)*8MHz=168MHz,
⟹ 48% saving of the 320MHz currently allocated to TV.

EXAMPLE: EU COUNTRY 4-COLORING



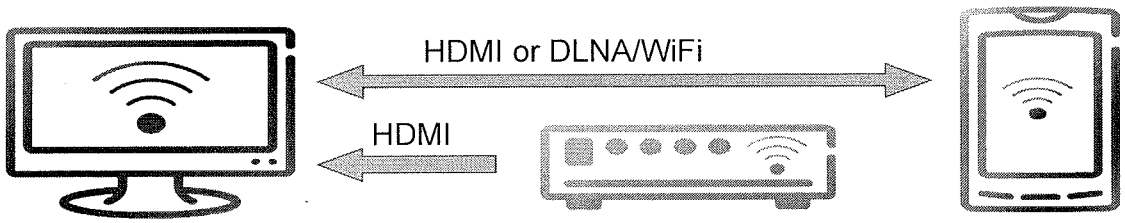
The frequency-problematic south/central Europe shown here.

POSSIBLE FUTURE ENHANCEMENTS

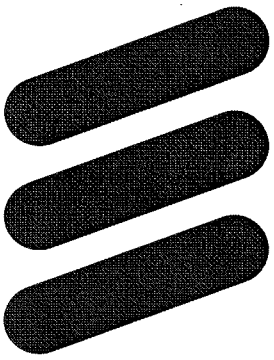
- Dedicated MBMS carrier to support dedicating 100% resources to MBMS
- MBMS spectral efficiency improvements e.g. MIMO for MBMS
- Enhanced Application Layer FEC
- Statistical multiplexing for variable bitrate streams from independent source coders.
- Enhanced user counting

CONCLUSIONS

- **LTE-MBMS integrated into cellular infrastructure**
  - **IP based** broadcast of TV, textual and audio streams
  - Enables **Hybrid / Interactive TV / Video on Demand**
  - Receivers types: LTE broadband terminals or LTE modem integrated into TV set-top boxes



- **LTE-MBMS** enables **spectrum savings** for broadcasting
  - **MBMS** based on Single Frequency Network principle
  - **Reusing the dense LTE cellular infrastructure for broadcasting enables higher practical transmission rates**



ERICSSON