DVB-T, DVB-T2, …
what’s coming next?

RATEM – iTVF Forum Istanbul
28 + 29 May 2015

jens.stockmann@gatesair.com
About Gatesair

- GatesAir is former Harris Broadcast
- **US based** company with unparalleled reliability for **nearly 100 years**
- provides world-wide complete over-the-air **Radio and Television** solution supporting **all TV & Radio Standards**
- **High efficient, reliable, easy to serve premium quality** for long term operation
- **Actively defining future of broadcasting** as member of all large broadcast organization
- www.gatesair.com
Performance roadmap from DVB-T to DVB-T2

- **4 times more capacity** (average) in DVB-T2/HEVC compared to DVB-T MPEG2

**Main miles tones:**

- **DVB-T2** – in average **50% more** capacity as DVB-T

- **H.265 HEVC** - The test results of **Subjective Performance Comparison** indicate that for relevant cases a **50%** or more bit rate reduction is achieved compared to **H.264/MPEG-AVC** High Profile

**Number of Programs per Channel (average)**

**Example:** DVB-T and -T2 same C/N ratio UHF

<table>
<thead>
<tr>
<th></th>
<th>DVB-T MPEG2</th>
<th>DVB-T MPEG4</th>
<th>DVB-T2 MPEG4</th>
<th>DVB-T2 HEVC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SD</strong></td>
<td></td>
<td></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td><strong>HD</strong></td>
<td></td>
<td>20</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>

- **DVB-T**
  - 23.42 Mbit/s
  - 64QAM, CR 2/3, GI 1/16
- **DVB-T2**
  - 37.00 Mbit/s
  - 265QAM, CR 2/3, GI 1/16
Next tasks?

Program provider need to:

- support all significant distribution ways as Satellite, Cable, Terrestrial, IPTV, OTT, 4G
- address all types of device used for watching TV (large screens, portable and mobile tablet PC, smart phones, ...)

→ Demand for Technologies to simplify, unify distribution

→ Demand for terrestrial transmission to increase data efficiency per channel in result of the 700 MHz spectrum issue

Next to expect – ATSC3.0

- IP distribution
- 1024/ 4096 QAM modulation
What's about mobile TV?
Forecast for mobile data traffic

- Increasing use of bandwidth from mobile phones
  - Studies from Ericsson and Cisco predict exponential growth of bandwidth need, driven largely from video consumption
- Drivers i.e. are TV Anywhere and widely usage of tablet PC & smart phones
- For Tablet PC using HEVC 1.4 Mbit/s required (1MB Video + 0.4MB Audio)
- 1 hour requires 630 Mbyte
- 1h every day requires 18.9 Gbyte/ month

Growth of mobile data traffic

If Live Video for mobile is required, following networks have to do the job:

**UMTS / LTE**
- Long Term Evolution (LTE) in Unicast mode
- Not with moderate costs

**Terrestrial DTV**
- **Limited success** to include broadcast tuners in mobile devices failed
- Remember MediaFLO and DVB-H
- Experience shows that a separate DTV tuner seems to be “hard to do”!
- The world of 3GPP and the world of broadcast exists still on different planets

**WiFi**
- WiFi experiences congestion in many built-up areas, especially indoor
- Cisco: ~ 30% Wifi offloading today, ~ 50% in 2018 → important delivery technology
- no predictable network with limited and fragmented coverage
Is LTE eMBMS ready for this challenge?

- **eMBMS** = evolved Multimedia Broadcast Multicast Services
- **Point to Multi Point (P2M)** broadcast and multicast in 4G LTE networks
- Only **60% of LTE cell data rate** can be used for eMBMS (6 of 10 Sub-Frames) because Unicast needs to be present too (fixed in the standard)
- **Bounded to cellular network structure** (max. 10km cell size supported)
- Allows **Single Frequency Network (MBSFN)** of multiple cells to cover larger
- **Carrier Aggregation** up to 20MHz bandwidth for increased data rate
- **Interference protection** needed on border of MBSFN area
- For large areas it may become inefficient

### LTE Radio frame

<table>
<thead>
<tr>
<th></th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
<th>#4</th>
<th>#5</th>
<th>#6</th>
<th>#7</th>
<th>#8</th>
<th>#9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unicast; Signaling; Sync.; Paging</td>
<td>Broadcast/ Multicast Service 1</td>
<td>Broadcast/ Multicast Service 1</td>
<td>Broadcast/ Multicast Service 1</td>
<td>Unicast; Paging</td>
<td>Broadcast/ Multicast Service 2</td>
<td>Broadcast/ Multicast Service 2</td>
<td>Broadcast/ Multicast Service 3</td>
<td>Unicast; Paging</td>
</tr>
</tbody>
</table>
LTE Mobile Offload

- Cellular networks will probably not be able to cope with the growing demand for data like live video.
- and will not be efficient to distribute live video and audio @ 1.4 Mbit/s or more in thousands of networks cells and possibly by several mobile network operators in parallel.

Let’s define a LTE Megacell overlaying the cellular network and broadcast high power from high tower to mobile receiver.

- Regular LTE cells, unicast P2P carrier
- Overlay LTE Megacell, broadcast/ multicast P2MP carrier
What is LTE Mobile Offload (LMO)?

- Technology envisioned / created by the Technical University of Braunschweig. Also known as “Tower Overlay”
- GatesAir has partnered with TUB to commercialize
- Basic idea is to offload popular services, especially live video, from cellular networks
- Utilizes High Tower, High Power (HTHP) transmitter sites so that...
  - HTHP transmitter coverage “over-lays” the many existing cellular towers
  - HTHP transmitters are typically operated by network operators or broadcasters
  - Provide native (i.e. LTE signal) to existing mobile receiver

Can we use existing broadcast infrastructure i.e. DVB-T2 broadcast sites?
Can we use existing broadcast infrastructure i.e. DVB-T2 broadcast sites?

**Tower Overlay with DVB-T2 using Future Extension Frames (FEF)**

- **DVB-T2 Future Extension Frames** (FEF, defined in the DVB-T2 Standard) enable time domain spectrum sharing with other wireless networks, e.g. a mobile access network
- Re-use of DVB-T2 as existing wireless carrier
A hybrid modulator / exciter can therefore be realized that broadcast DVB-T2 to fixed (home) receivers while video over LTE can be broadcast to mobile receiver.

- **Standard DVB-T2 content**
- **LTE-A+ formatted content is inserted into a broadcast DVB-T2 multiplex using the FEF, in a format that is native to the LTE device.**
- Time Multiplex of DVB-T2 and LTE content over one transmitter

8 MHz (DVB-T2)

5 MHz (LTE-A+)

554 MHz
Receive Devices Operate Normally


Hybrid Modulator/Tx

Transmission Path

DVB-T2 reception unaffected by LTE-A+ Signal!

Standard DVB-T2 TV

LTE-A+ reception unaffected by DVB-T2 Signal!

Modified LTE-A+ Device
Benefits for Mobile Network Operators

- Reduces significant the potential capacity gap
- No new network build-out required.
- No (or less) spectrum to pursue at auctions.
- Relieve network congestion, especially in dense populated areas.
- Pay-as-you-go or pay-per-use.
- Launch new services
- Mobile network operator still gets revenue from customer even though content is delivered “out of band”. The experience should be seamless to the user.
Benefits for Broadcast Network Operators

- New revenue stream via capacity lease / rent.
  - On demand or bits per unit time
- Similar to datacasting business models
- Expand reach to ever-growing nomadic viewing public with existing standards technology.
- Create synergistic partnerships with mobile network operators.
- Coverage within dense metro areas may be most important since there are fewer users outside of that where the broadcast signal strength is diminished and the LTE network may handle the load with ease.
On Eiffel Tower transmission of LTE-MO with DVB-T2
UHF Channel 54 (738 MHz, 8MHz)
Gatesair Transmitter 500W (2,7kW ERP)

- LTE-MO reception to mobile & portable receiver (tablets, cars)
- LTE-MO mobile coverage
- Different modulation parameter for both T2 and LTE-MO
- Different bandwidth share between T2 and LTE-MO (i.e. 50/50)
Summary

- The LTE Mobile Offload model is proven to work using the DVB-T2 broadcast standard today
- Similar possibilities exist for incorporation into ATSC 3.0
- Mobile operators can reduce costs while expanding reach and conserving bandwidth.
- Broadcast operators can leverage existing infrastructure and spectrum and cultivate new revenue models and business relationships.
- Consumers and the public benefit from optimal spectrum utilization and optimized services.
- LMO maximizes the use of existing spectrum and revenue opportunities for both broadcasters (network operators) and telecom operators
Thank you very much!

Jens Stockmann
Product Specialist Transmission
GatesAir

Jens.stockmann@gatesair.com