Introduction to LTE eMBMS: Evolution and Applications

NBTC/ITU Regional Seminar on “Delivery Technologies and Business Models for Mobile Television and Multimedia Services

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Outline of WPC’s Presentation

1. What is LTE?

2. LTE Network Architecture

3. LTE’s evolution: eMBMS

4. Global LTE and eMBMS applications

5. Conclusion
1. What is LTE?

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What is LTE? - an overview

LTE is a standard for wireless communication of high-speed data for mobile devices developed by the 3GPP and specified in Release 8. It was finalised in December 2008 and first launched commercially in 2009.

LTE is a successor technology to GPRS/EDGE and CDMA network technologies but has been optimized for data.

As of July 2015, LTE or LTE advanced networks have been commercially launched on 422 networks in 143 countries. As of Q1 2015, GSA estimates there were 635 million LTE subscribers (an additional 354.6 million since Q2 2014).

LTE networks are capable of theoretical speeds of 300 Mb/s for download and 75 Mbits/s for upload and are compatible with both FDD and TDD architectures.

LTE is optimal migration choice for both GSM & CDMA operators providing additional capacity & high speed wireless broadband in a spectrum efficient manner.

LTE is a global standard that will help ensure affordable prices for CPE for consumers.

LTE is very flexible can be used in different spectrum bands with bandwidths ranging from 1.4, 2.5, 5, 10 & 20 MHz using both FDD and TDD.
The global move to LTE

422 LTE networks commercially launched in 143 countries
- 639 operator commitments in 181 countries (of which 422 networks are launched)
- 146 LTE networks commercially launched in the past year
- Latest territories where LTE service is launched: Romania, Guernsey, Laos, Malawi, Morocco
- 635 million LTE subscriptions worldwide: Q1 2015

(Source of data: GSA’s Evolution to LTE report: 21 July 2015)

- More than 44% of LTE networks use 1800 MHz (band 3)
- 187 LTE1800 networks launched in 89 countries
- 59 operators (c. 1 in 7) launched LTE TDD (TD-LTE) in 35 countries
- 88 LTE-Advanced networks launched in 45 countries
- 25 operators launched VoLTE-based HD Voice

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Number of LTE networks exceeded the number of HSPA+ networks in Q2 in 2015

This compares with 572 operators deploying WCDMA (HSPA) in 213 countries with 384 HSPA+ networks deployed in 164 countries.
Map: LTE Deployments in ASEAN

- **Myanmar**
  - Planned deployment 1.8 GHz
  - Telenor/Ooredoo HPSA networks are LTE ready

- **Thailand**
  - Truemove May 2013 (2.1 GHz)
  - 80% pop coverage Apr 2015
  - DTAC, May 2014 (2.1 GHz)
  - 1.8 GHz after 2015 auction
  - 2.3/2.6 GHz planned by NBTC

- **Cambodia**
  - Smart Axiata 1.8 GHz (Jan2014)
  - EMAXX 2.6 GHz (2015 planned)

- **Laos**
  - Trial Focus on 2.3/2.6 GHz Allocation decision by ARFM late 2015/16

- **Vietnam**
  - Maxis, Celcom, Digi, Umobile P1, YTL, TM etc
  - 850/1.8/2.3/2.6 GHz in service
  - 700 MHz planned

- **Philippines**
  - Smart, Globe 850/1.8/2.1 GHz.
  - LTE-A (220 Mbps)
  - LDT – TD-LTE BWA fixed

- **Singapore**
  - M1 (1.8/2.6 GHz). LTE-A (300 Mbps) – Dec 2014
  - Starhub (1.8/2.6 GHz. LTE-A (300Mbps) – Dec 2014
  - Singtel – (1.8/2.6 GHz). LTE-A (450Mbps) – Mar2015
  - All SG operators have VoLTE. 700 MHz planned

- **Brunei Darussalam**
  - DST deployed 1.8 GHz (Nov2013)
  - 700 MHz planned

- **Indonesia**
  - 900 MHz (specific areas only)
  - Regional 2.3 GHz
  - 1800 MHz transition by Nov 2015


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Replacement of legacy technologies with 4G

- Telecom carriers across the world are in the middle of replacing their 2G/3G technology with the LTE technology. This transition is almost complete in major markets such as the US, Korea, and China. In the US, about 79% of total data traffic on Verizon (VZ) is carried on its LTE network. Telstra has announced its 2G network switchoff from 2016 and all Singapore carriers from 2017.

- In the medium to long term it is highly likely that ALL mobile networks will be LTE, because...

![LTE spectrum efficiency chart]

LTE is almost twice as spectrally efficient as WCDMA (HSPA+): 30 bps/Hz versus 16.8 bps/Hz
Growth of Global LTE Deployments

LTE network commercial launches: 2009 - 2015
Access to these enhanced speeds also depends on the category of LTE capable phone. Current standard is Category 3 with a number of Category 4 devices also available, which make use of 20 and 40 MHz respectively. Category 6 devices are planned for release, and will make use of up to 60 MHz of spectrum.
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LTE’s flat architecture versus current technologies
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Emerging technology: LTE-Broadcast

- LTE-B (also known as eMBMS) is an emerging technology for LTE that will allow efficient distribution of high bandwidth services to customers.

- Multicast can provide radio capacity gain (over uni-cast) when several users require the same content, at the same time, in the same cell e.g. watching game replays in sporting stadiums.

- By introducing LTE-B, network resources are used more efficiently and free up network capacity.

- The first LTE Broadcast service was commercially launched in January 2014 and the eMBMS-capable devices ecosystem is building, however more devices are needed. Several operators announced planned service launched in 2015.
Global LTE-B developments

<table>
<thead>
<tr>
<th>Country</th>
<th>Network</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Telstra</td>
<td>Deploying</td>
</tr>
<tr>
<td>China</td>
<td>China Mobile</td>
<td>Trialled</td>
</tr>
<tr>
<td>China</td>
<td>China Telecom</td>
<td>Largescale user trial</td>
</tr>
<tr>
<td>France</td>
<td>Orange</td>
<td>Trialled</td>
</tr>
<tr>
<td>France</td>
<td>TDF</td>
<td>Trialling</td>
</tr>
<tr>
<td>Germany</td>
<td>Vodafone</td>
<td>Trialled</td>
</tr>
<tr>
<td>Germany</td>
<td>IRT</td>
<td>Trialling</td>
</tr>
<tr>
<td>India</td>
<td>RJIL</td>
<td>Trialled</td>
</tr>
<tr>
<td>Italy</td>
<td>RAI</td>
<td>Trialling</td>
</tr>
<tr>
<td>Italy</td>
<td>TIM</td>
<td>Trialling</td>
</tr>
<tr>
<td>Netherlands</td>
<td>KPN</td>
<td>Trialled</td>
</tr>
<tr>
<td>Philippines</td>
<td>Globe</td>
<td>Deploying</td>
</tr>
<tr>
<td>Philippines</td>
<td>Smart</td>
<td>Trialled</td>
</tr>
<tr>
<td>Poland</td>
<td>Polkomtel Plus</td>
<td>Trialled</td>
</tr>
<tr>
<td>Portugal</td>
<td>Meo</td>
<td>Trialling</td>
</tr>
<tr>
<td>Singapore</td>
<td>SingTel</td>
<td>Trialling</td>
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<tr>
<td>South Korea</td>
<td>KT</td>
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<tr>
<td>Spain</td>
<td>Vodafone</td>
<td>Trialled</td>
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<td>UAE</td>
<td>Etisalat</td>
<td>Trialling</td>
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<tr>
<td>UK</td>
<td>EE &amp; BBC</td>
<td>Trialling</td>
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<td>UK</td>
<td>Three UK</td>
<td>Trialling</td>
</tr>
<tr>
<td>USA</td>
<td>AT&amp;T</td>
<td>Deploying</td>
</tr>
<tr>
<td>USA</td>
<td>Verizon</td>
<td>Deploying</td>
</tr>
<tr>
<td></td>
<td>Wireless</td>
<td></td>
</tr>
</tbody>
</table>

Source: GSA, 2015
MAP: global LTE-B deployments
Case Study: Telstra’s rollout of LTE-B

* Telstra launched the **global first trial** of LTE-B at the MCG in January 2014 at a T-20 cricket match

* Subsequently it conducted LTE-B trials at larger events **outside of stadiums** such as the Melbourne Cup horse race

* Telstra has deployed LTE-B equipment **across its LTE network footprint as of May 2015**, with plans for commercial trials followed by a **full-scale commercial launch later in 2015**

* This launch will be centred around events and locations such as stadiums which will make **best use of LTE-B technology** which will all have permanent LTE-B channels in place

* Telstra has partnered with Ericsson as its supplier for the rollout of its LTE-B and VoLTE network upgrades
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Spectrum usage and LTE-B as replacement for DVB-T2

- It is also possible that LTE-B will replace DVB-T2 as a preferred technology. It is more spectrally efficient. This issue is currently reviewed by regulators in a number of markets.
Driving demand for eMBMS: Video Data

<table>
<thead>
<tr>
<th>Selected segments (global)</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>CAGR</th>
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<tbody>
<tr>
<td>Data</td>
<td>0.61</td>
<td>0.96</td>
<td>1.44</td>
<td>2.07</td>
<td>2.83</td>
<td>3.53</td>
<td>42%</td>
</tr>
<tr>
<td>File sharing</td>
<td>0.07</td>
<td>0.13</td>
<td>0.22</td>
<td>0.31</td>
<td>0.39</td>
<td>0.47</td>
<td>48%</td>
</tr>
<tr>
<td>Video</td>
<td>0.79</td>
<td>1.46</td>
<td>2.58</td>
<td>4.37</td>
<td>7.09</td>
<td>10.96</td>
<td>69%</td>
</tr>
<tr>
<td>M2M</td>
<td>0.02</td>
<td>0.05</td>
<td>0.11</td>
<td>0.25</td>
<td>0.49</td>
<td>0.91</td>
<td>113%</td>
</tr>
</tbody>
</table>
LTE-B and MTV Services: Considerations (1)

- In contrast to other MTV systems, eMBMS allows the network operator to **dynamically include or exclude individual base transceiver stations** - the operator can broadcast on a temporary basis and in selected parts of the LTE network’s total footprint.

- **LTE-B leverages investment in LTE networks**, it sits on top of the LTE core network and is an extension of the core capabilities.

- Under practical test conditions a single LTE-B subframe out of a 20MHz allocation can carry **12-13 384kbps broadcast services**.

- Successful testing of LTE-B at major sporting and entertainment events (E.g. the MCG, Melbourne Cup by Telstra) has **led to permanent deployment of LTE-B** at stadiums and similar venues in Australia.

- Demand for mobile (and general) video content is primarily driven by **Video-on-Deman (VOD)**, where demand is driven by live content this is extremely likely to be for **premium one-off content such as major sporting events**.

- **Economies of scale are beginning to dictate a convergence towards use of LTE wherever possible**.
LTE-B and MTV Services: Considerations (2)

- LTE-B allows network operators to dynamically **switch to broadcasting of content for which there is a significant spike in demand**: e.g. major sporting events

- Outside of these events, the network can **revert to unicast mode** to cater for the demand for VOD traffic. By allowing dynamic assignment, there is **never a period where spectrum is inefficiently assigned** to either broadcast or unicast services

- As LTE becomes ubiquitous the end result is that (almost) **all user devices will be LTE-B enabled by default** (latest SnapDragon processors are enabled and other devices only require a firmware update)

**LTE Broadcast opportunities extend beyond venues**
LTE-B and MTV Services: Considerations (3)

- Ubiquity of LTE-B consumer devices combined with established trends in demand for VOD and live video content mean that operators of LTE networks will have extremely high incentives to roll-out LTE-B capability on them.

- From a regulatory perspective LTE-B represents the convergence of mobile data services and traditional broadcast services.

- In a world where video traffic demand is defined by VOD and spikes for individual premium content, dynamic assignment represents a spectrally efficient means of providing video services - on top of this, LTE in general and LTE-B in particular is spectrally efficient to begin with.

- There are queries as to how LTE-B services can be effectively monetized, there has not yet been significant research into the willingness of consumers to pay for LTE-B above and beyond the price of their existing services.

- Thailand is a distinct market even within Asia, the population density and public transport use dynamics which support MTV services in Japan, Korea etc are not analogous to those in Thailand.

- LTE’s deployment is only expected to grow, with the long time until the availability of 5G technology LTE will be a staple of global communication technologies for many years going forward.
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Conclusions

Key Conclusions:

- LTE generally will be *globally ubiquitous* in the medium term and is expected to have significant longevity

- LTE-B is a natural evolution of LTE which has a low additional cost of rollout compared to dedicated broadcast spectrum and which has a rapidly expanding ecosystem of available devices - **going forward LTE-B capability will be standard**

- LTE-B naturally fits with trends in demand for video content, which in the short term will make up at least 70% of all data traffic

- LTE-B is spectrally efficient both naturally and due to its ability to be dynamically allocated and returned

- In this context, it may be queried if proprietary and specialised broadcasting deployments requiring dedicated spectrum are viable or desirable in the medium term, let alone the long term
Thank you

I am happy to answer any questions