Windsor Place Consulting

Introduction to LTE eMBMS: Evolution and Applications

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

Scott W Minehane

8 August 2015
Bangkok

Principal Company Office

22 Derby Street
Collingwood
Victoria 3066
AUSTRALIA

P: +61 3 9419 8166
F: +61 3 9419 8666
W: www.windsor-place.com

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?
2. LTE Network Architecture
3. LTE's evolution: eMBMS
4. Global LTE and eMBMS applications
5. Conclusion

What is LTE? - an overview

- LTE is 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

This compares with 572 operators deploying WCDMA (HSPA) in 213 countries with 384 HSPA+ networks deployed in 164 countries.

422 LTE networks commercially launched in 143 countries

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

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

GSA

www.gsacom.com

> 44% of LTE networks use 1800 MHz (band 3)

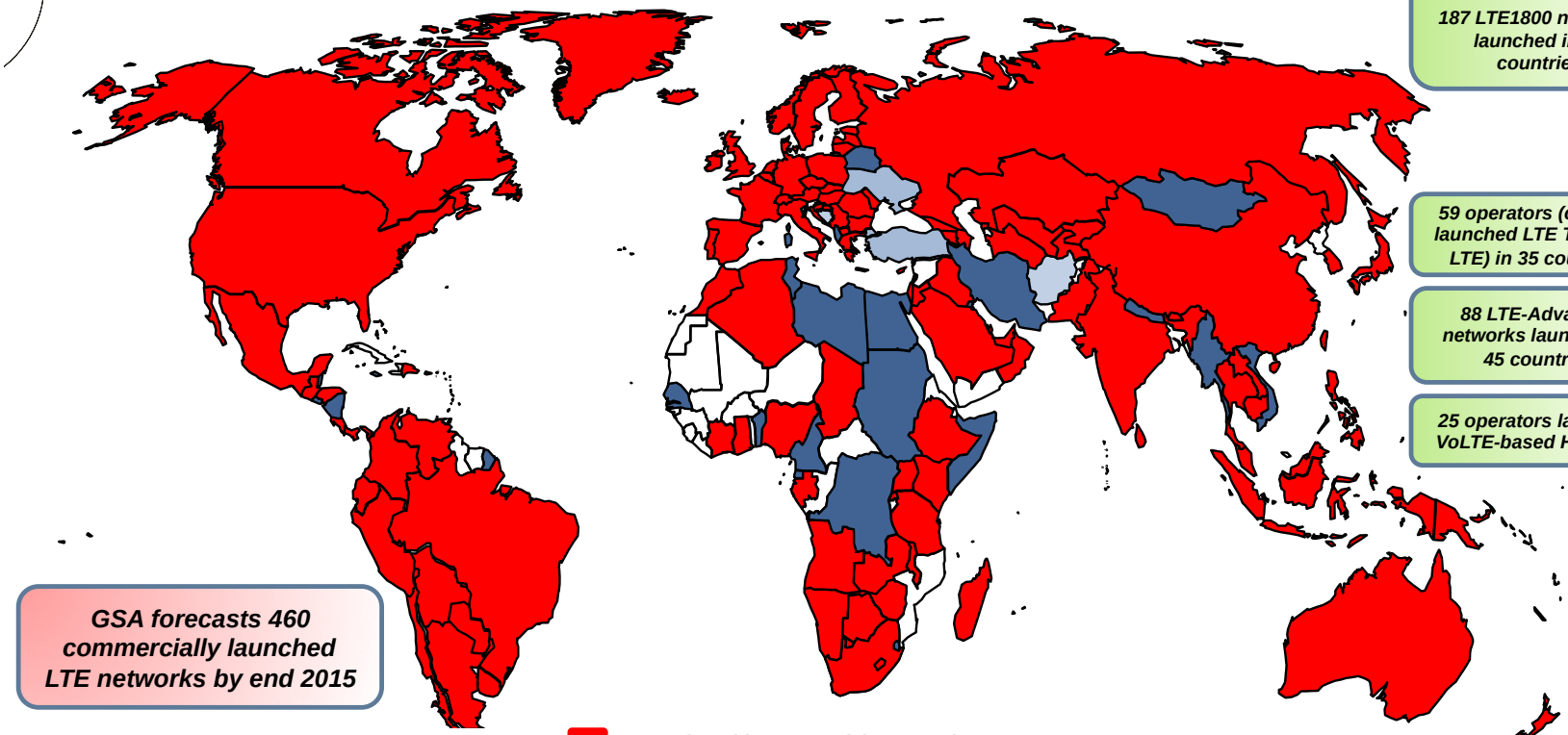
187 LTE1800 networks launched in 89 countries

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

GSA forecasts 460 commercially launched LTE networks by end 2015



Countries with commercial LTE service

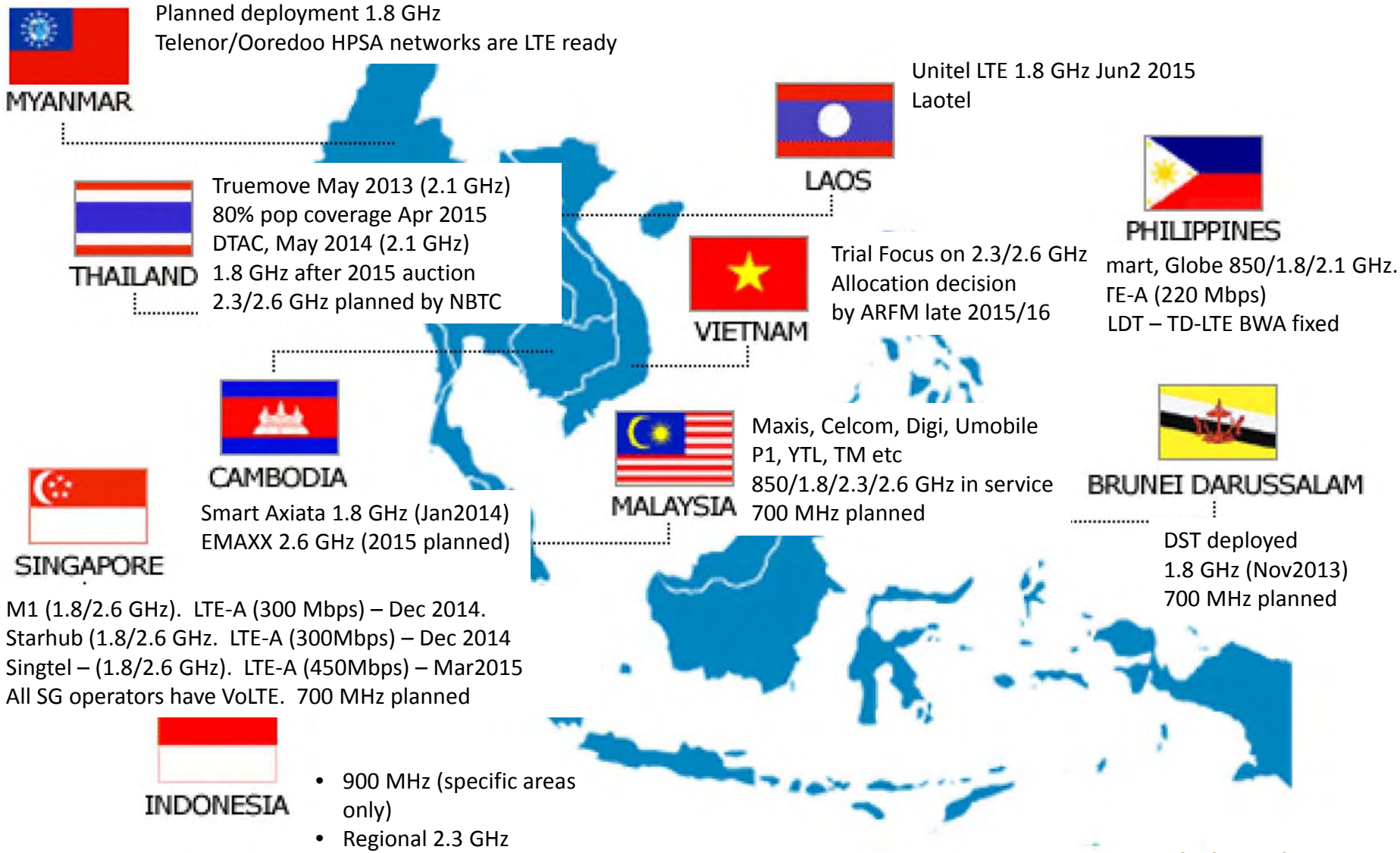
Countries with LTE in progress network deployments or planned

Countries with LTE trial systems (pre-commitment)

© Global mobile Suppliers Association – GSA

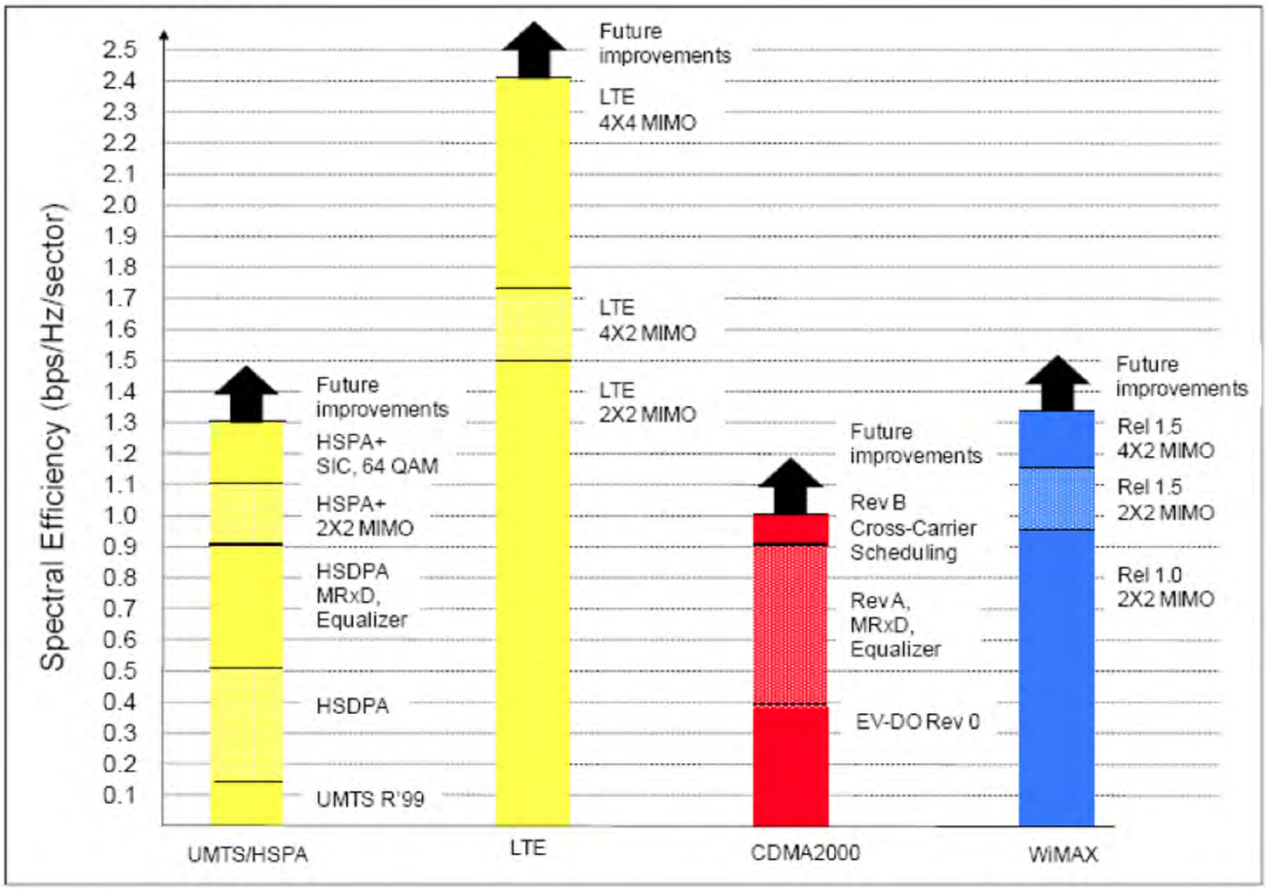
Number of LTE networks exceeded the number of HSPA+ networks in Q2 in 2015

Map: LTE Deployments in ASEAN



Replacement of legacy technologies with 4G

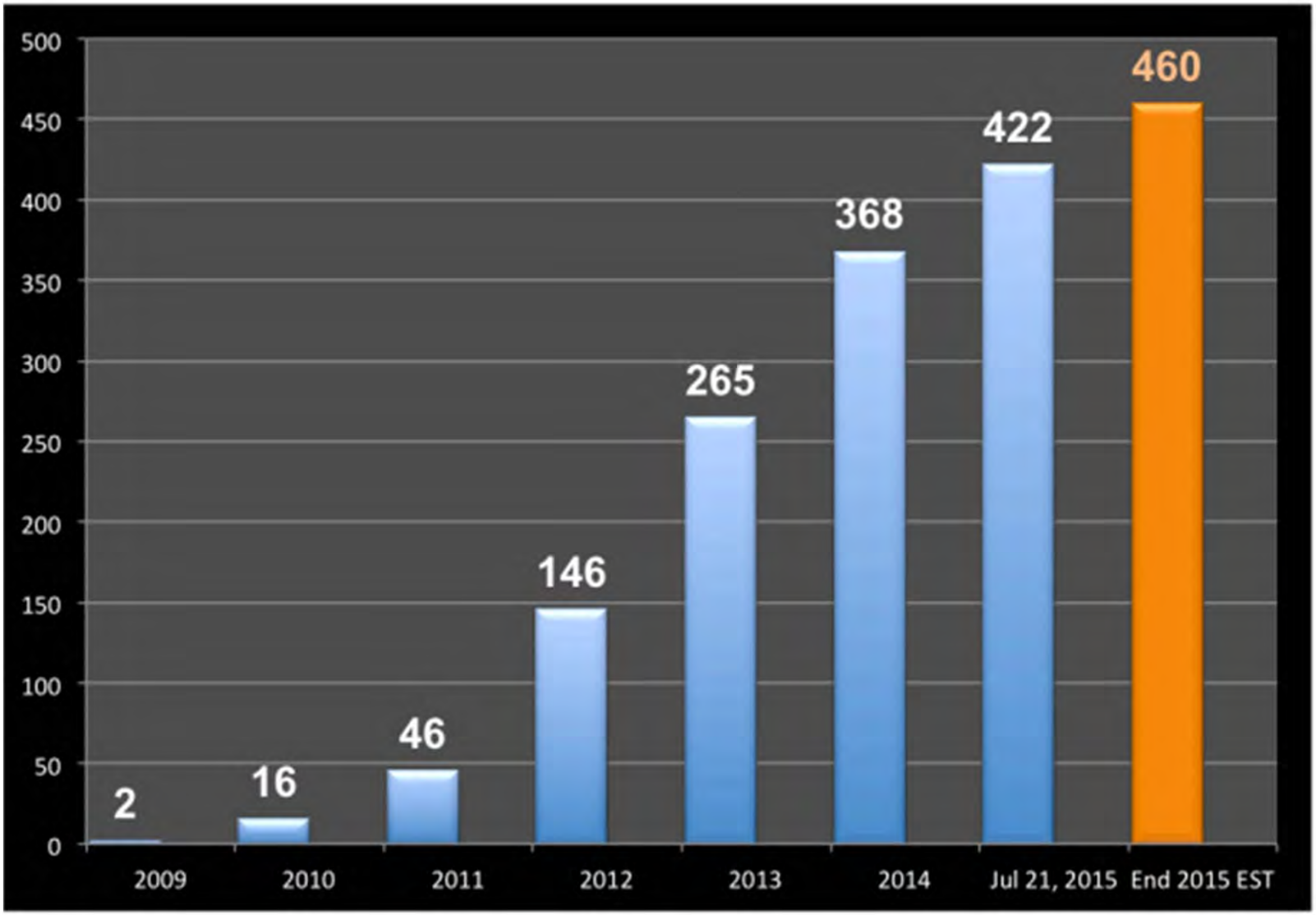
- Telecom carriers across the world are in the middle of replacing their 2G/3G technology with the LTE technology. This transition is almost complete in major markets such as the US, Korea, and China. In the US, about 79% of total data traffic on Verizon (VZ) is carried on its LTE network. Telstra has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



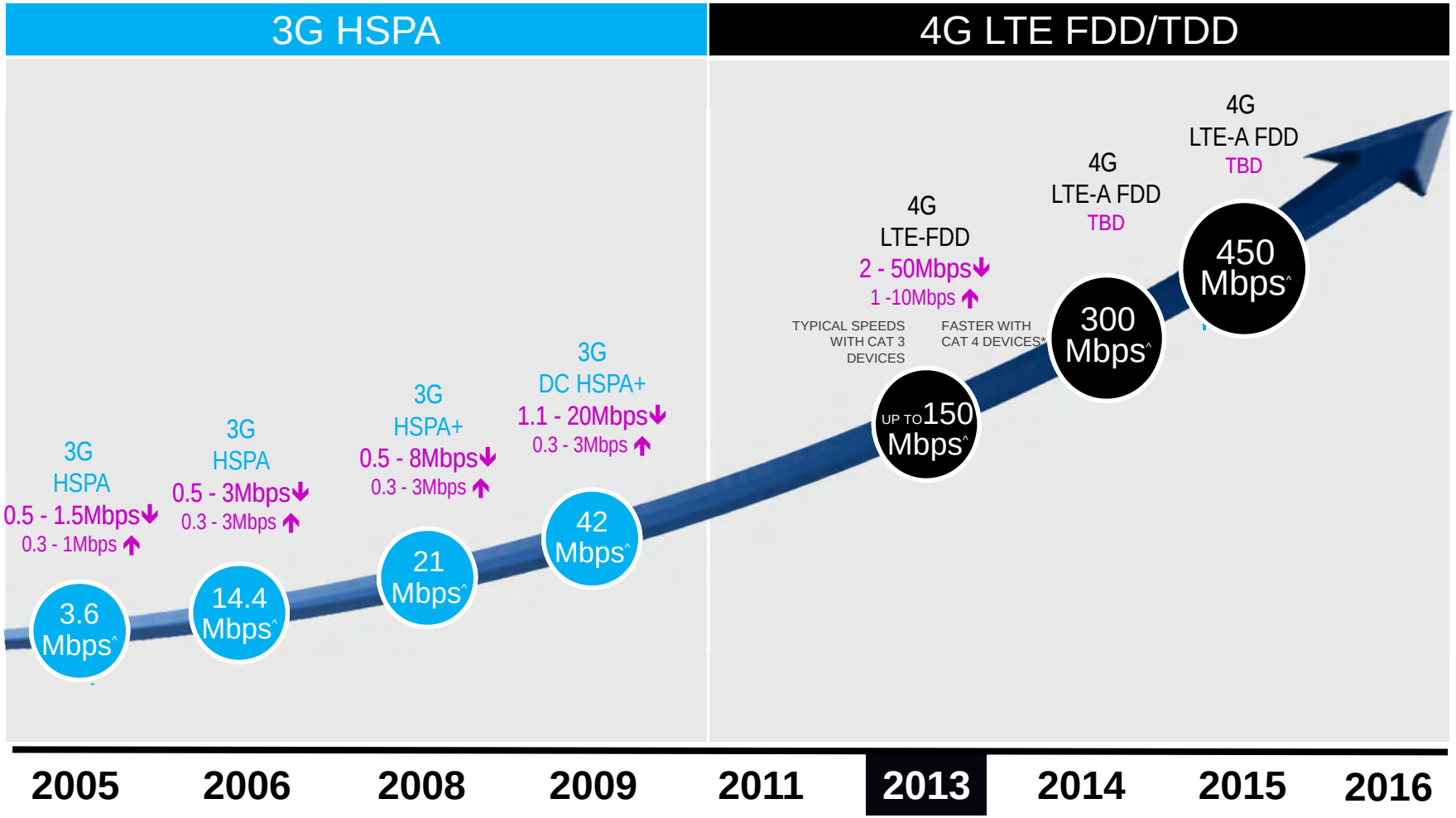
LTE is almost twice as spectrally efficient as WCDMA (HSPA+) 30 bps/Hz versus 16.8 bps/Hz

Growth of Global LTE Deployments

LTE network commercial launches: 2009 - 2015



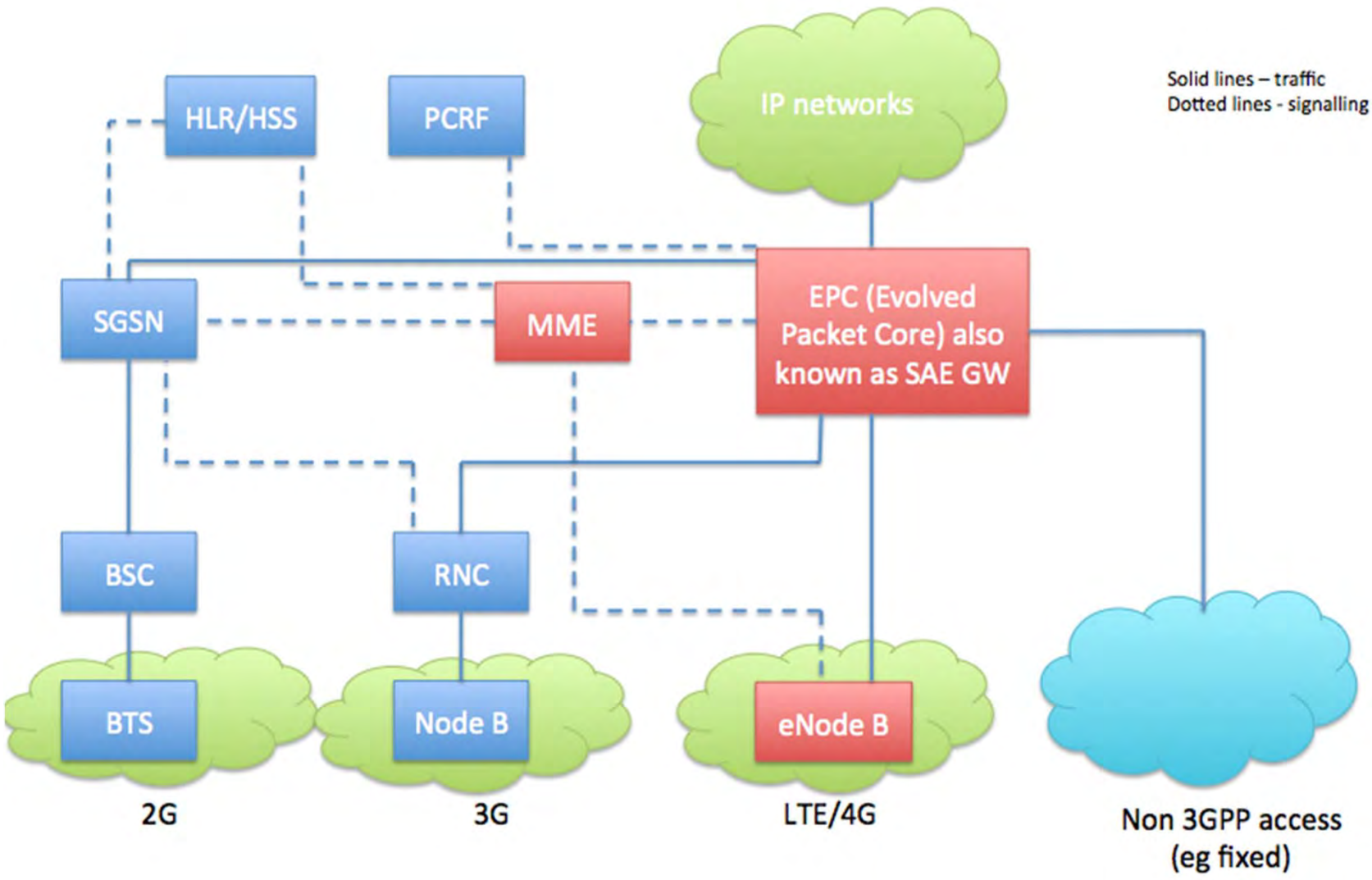
Major carrier technology roadmap



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.

1. What is LTE?
2. LTE Network Architecture
3. LTE's evolution: eMBMS
4. Global LTE and eMBMS applications
5. Conclusion

LTE's flat architecture versus current technologies

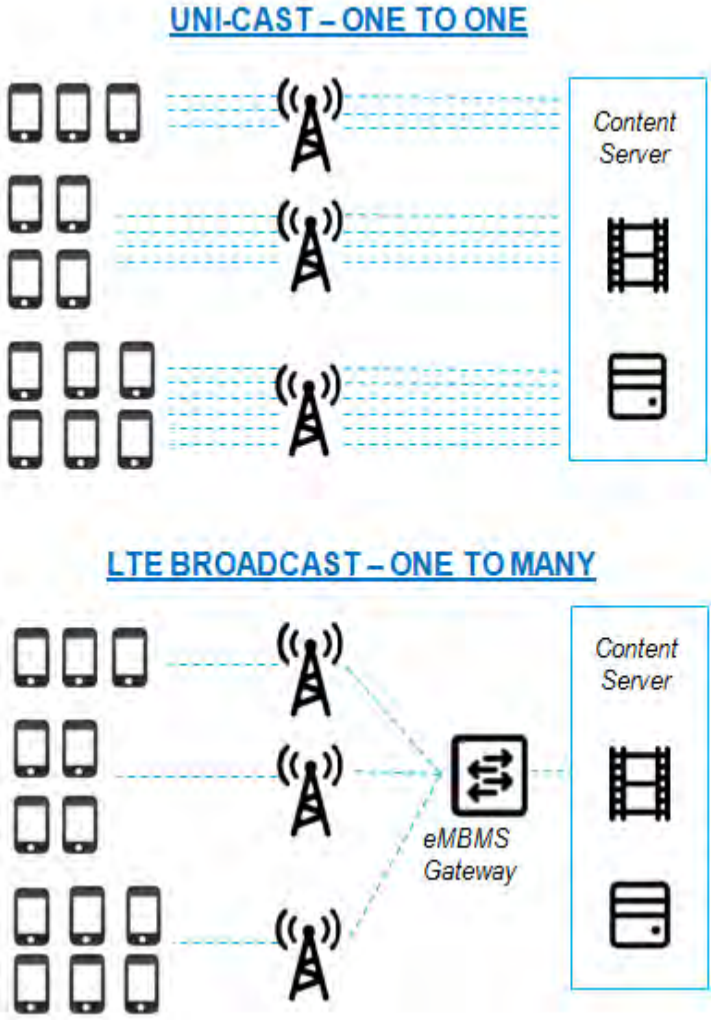


1. What is LTE?
2. LTE Network Architecture
3. LTE's evolution: eMBMS
4. Global LTE and eMBMS applications
5. Conclusion

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.

LTE-BROADCAST MULTIMEDIA SERVICES

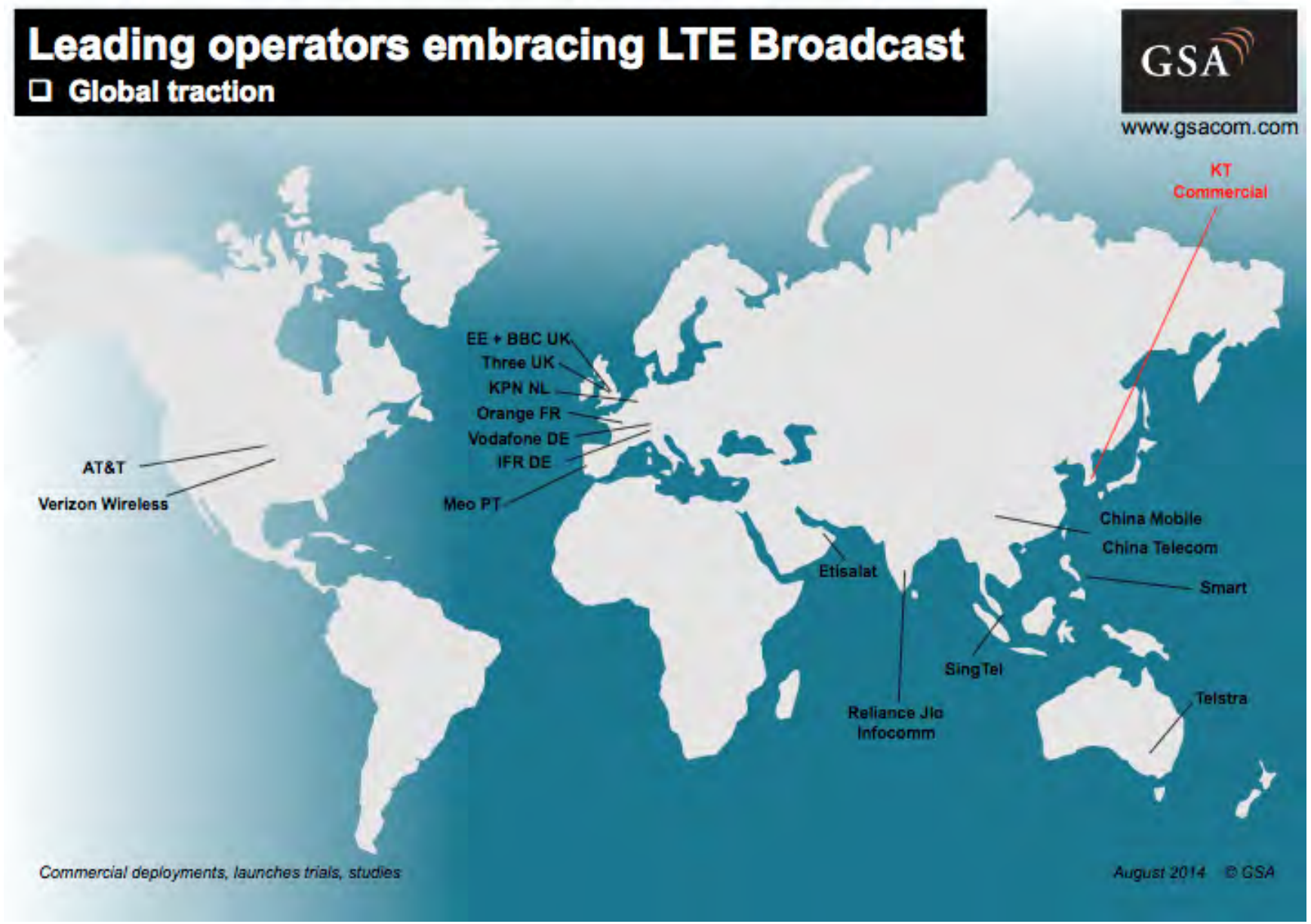


Global LTE-B developments

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

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

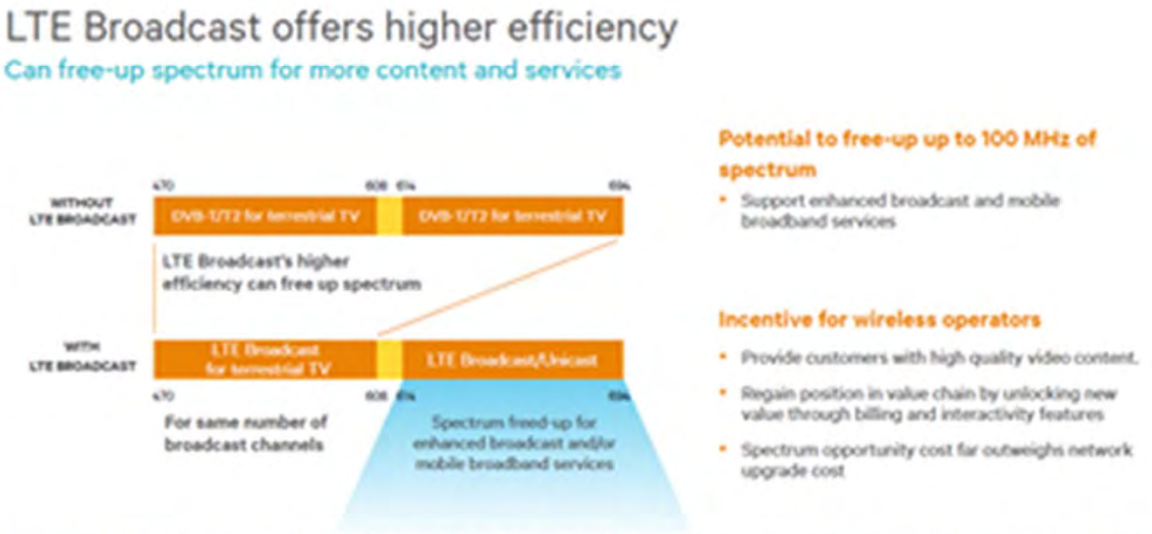
1. What is LTE?
2. LTE Network Architecture
3. LTE's evolution: eMBMS
4. Global LTE and eMBMS applications
5. Conclusion

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.

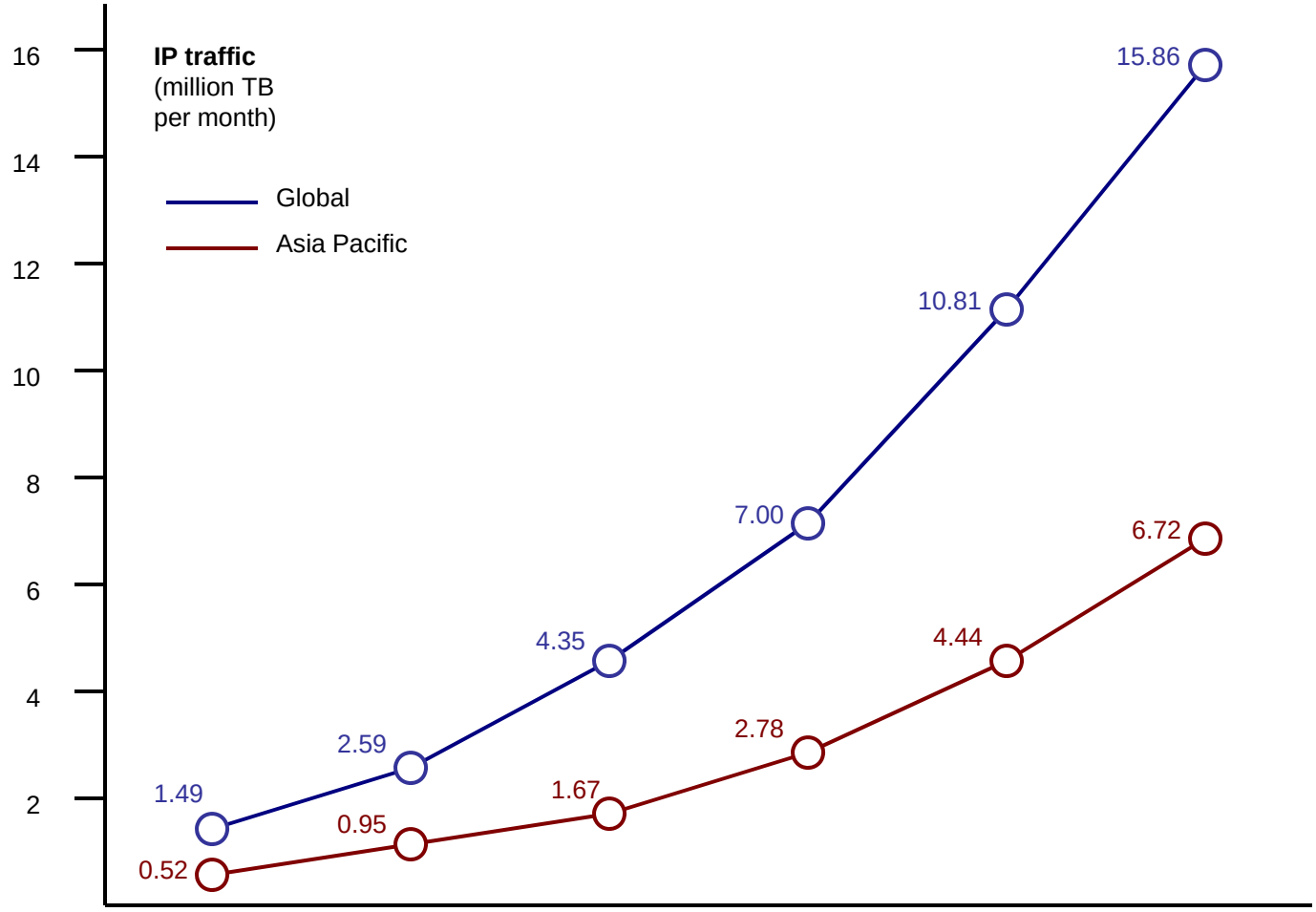
LTE Broadcast: Alternative for Digital Terrestrial TV?

- In Europe there is discussion considering LTE Broadcast as one of the alternatives for DVB-T
  - From a spectrum efficiency DVB-T2 would actually be better (4 ⇔ 2 bits/Hz)
  - Use of many small transmitters and device integration might favour LTE



Source: LTE Broadcast: Evolving and going beyond mobile, Qualcomm, August 2014

Driving demand for eMBMS: Video Data



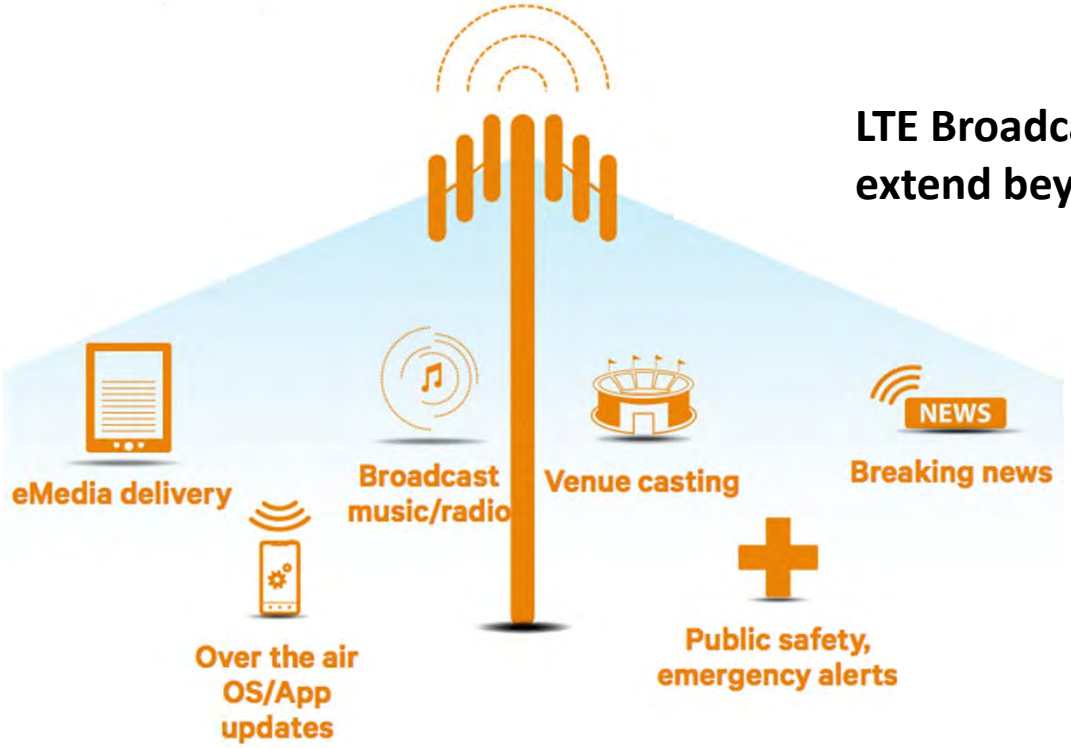
Selected segments (global)							CAGR
Data	0.61	0.96	1.44	2.07	2.83	3.53	42%
File sharing	0.07	0.13	0.22	0.31	0.39	0.47	48%
Video	**0.79**	**1.46**	**2.58**	**4.37**	**7.09**	**10.96**	**69%**
M2M	0.02	0.05	0.11	0.25	0.49	0.91	113%

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

1. What is LTE?
2. LTE Network Architecture
3. LTE's evolution: eMBMS
4. Global LTE and eMBMS applications
5. Conclusion

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