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# Insight of LTE

[www.huawei.com](http://www.huawei.com)

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# Communications before & after



Game is Changing



1X



10X



500X

# Cloud Brings More to Mobile

**More Traffic**  
e.g. 1G local video  
changes to 1G traffic



**More Business to Trillions of Dollar**  
Cloud-based storage,  
entertainment, office,  
education, SNS...

**Always On-line**  
Simply share  
Ubiquitous  
broadband



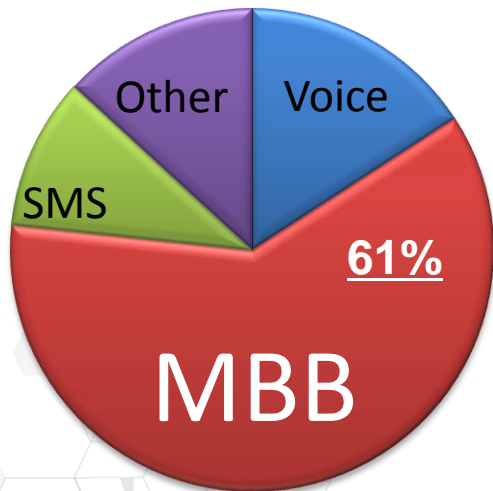
**Tablet brings tremendous traffic**



**More dependent on Mobile**

# MBB Drives the Revenue

with **61%**, MBB accounts for lion share of new mobile revenue 2010



Source: Huawei Market Analysis, 2011

**3X** Revenue of Investment for MBB  
Y2008 - Y2010

Bn\$	MOBILE CAPEX	MOBILE DATA REVENUE	REVENUE /CAPEX
SoftBank	7.7	27.2	3.5X
at&t	19.1	42.9	2.3X
vodafone	25.1	37	1.5X

Source: Operators' Annual Financial Report, 2008-2010

# LTE, Accommodate Mobile data tsunami

LTE Beyond Expectation

## Enhance Spectral Efficiency

- OFDM, MIMO, CoMP etc



## More Spectrum

- 700M, 800M, 900M, 1800M, 2.6G
- Carrier Aggregation



## Smaller Radius Cells

- Micro, Pico, Hotspot, Blindspot
- HetNet

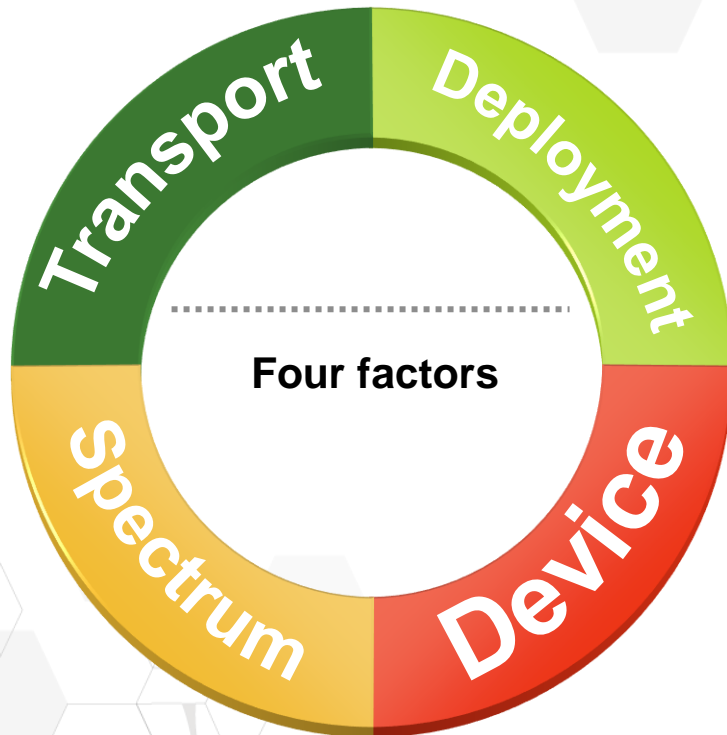


## E2E Guarantee User Experience

- Higher Speed than GSM/UMTS
- Better QoS than WiFi



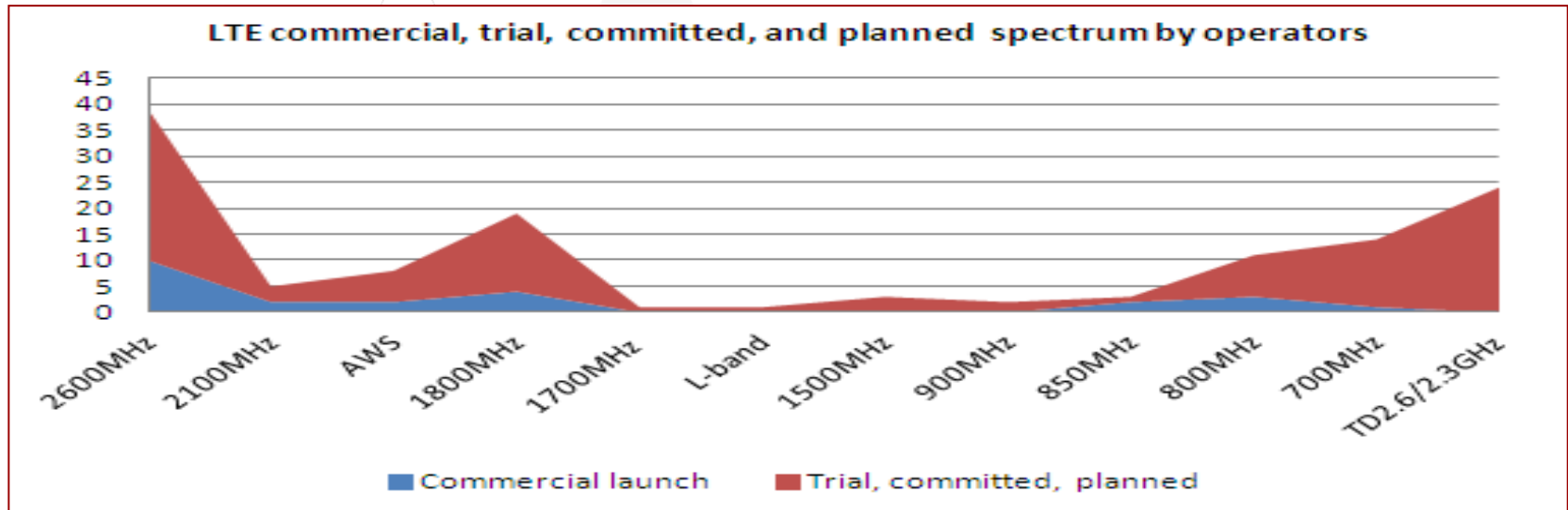
# LTE, Be ready for MBB era



## Contents

- New band, Refarming
- Bandwidth, Synchronization, Topology
- Macro, Micro, Pico, HetNet
- Dongle, Smartphone

# Spectrum, the 1st Concern for LTE



## LTE FDD Bands

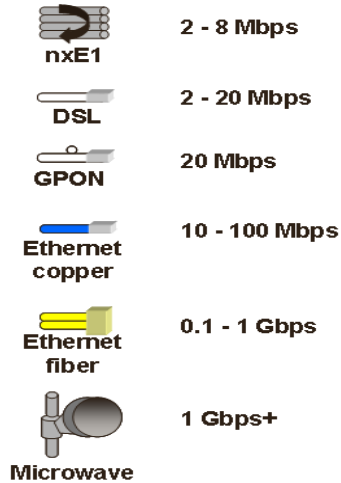
- **2.6GHz** lead the industry with deployments in Europe and APAC
- **700/DD800MHz** large commercial rollout in USA and Germany
- **1800MHz refarming** very promising in APAC, Europe

## LTE TDD Bands

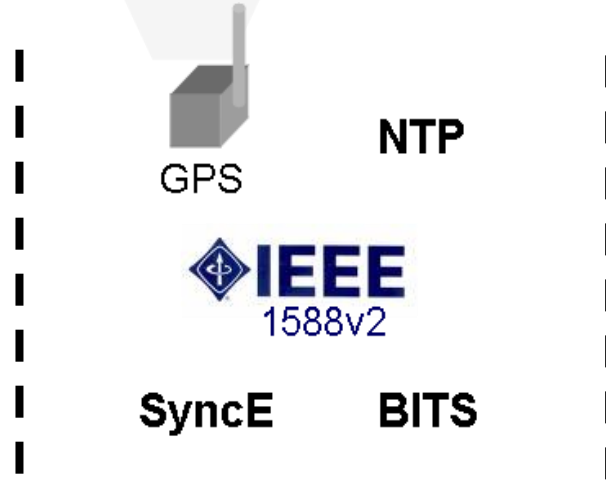
- 16 countries officially assigned TDD spectrum (**2.3GHz, 2.6GHz**) to operators
- First LTE TDD launch by the end of 2011

# Transportation, Essential for LTE

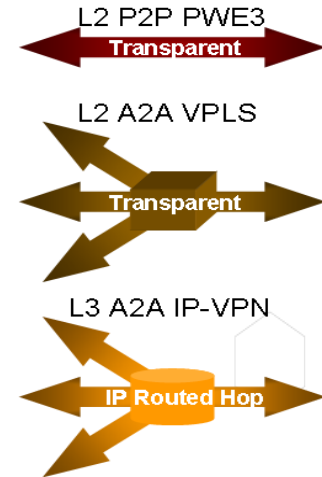
## Any Access



## Any Synchronization



## Any Topology



### Bandwidth Requirements

	Bandwidth per Sector	Bandwidth per BS
GSM	300kbps-2Mbps	900kbps-6Mbps
WCDMA	1.5Mbps-84Mbps	4.5Mbps-252Mbps
lte	100Mbps+	300Mbps+

### Synchronization

	Freq	Phase (FDD)	Phase (TDD)
GSM	0.05ppm	NA	NA
WCDMA	0.05ppm	NA	NA
lte	0.05ppm	NA	0.4us

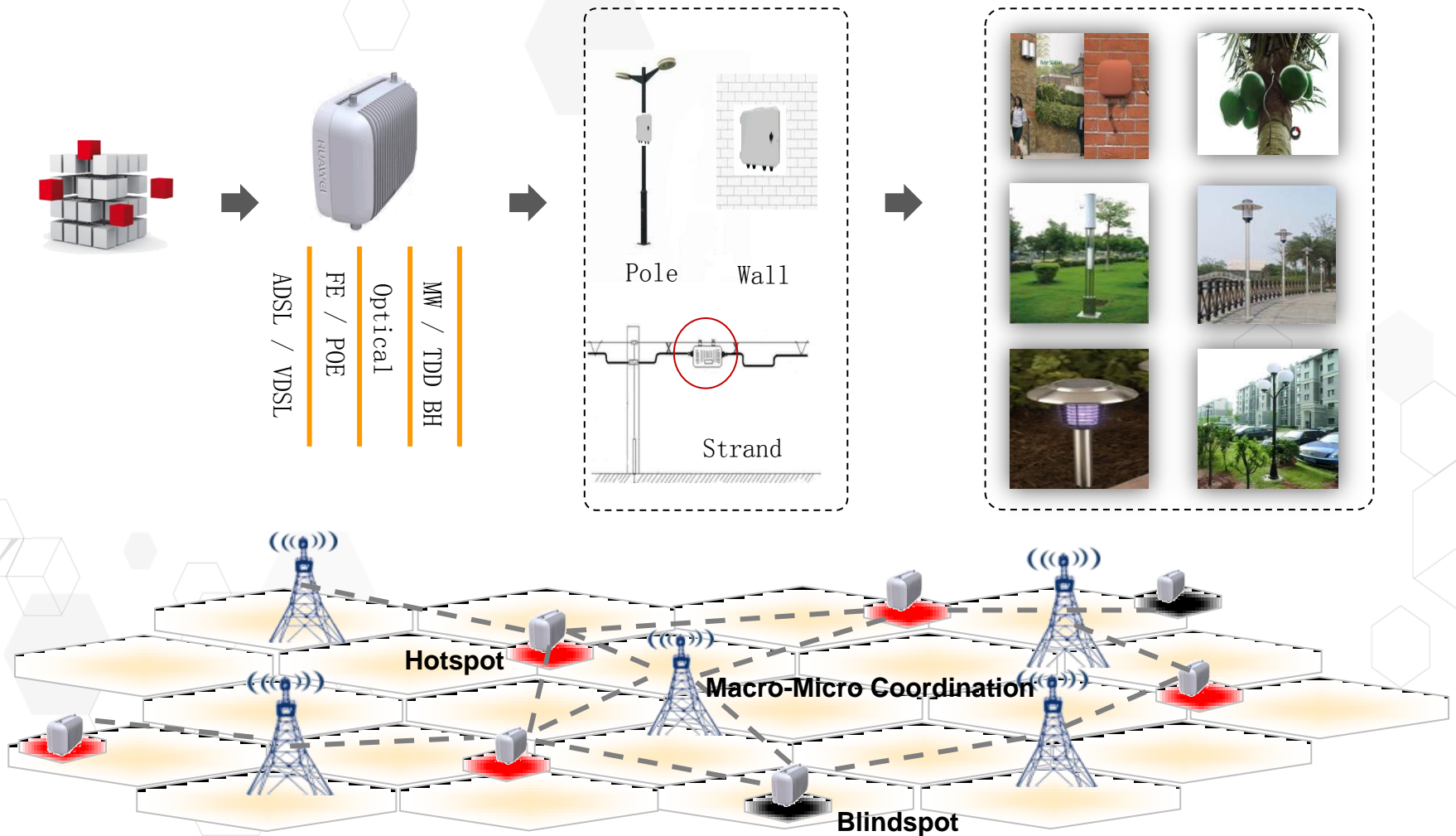
### Topology Requirements

	Name	Topology Log	Topology Phys
GSM	Abis	Star	P2P
WCDMA	lub	Star	P2P
lte	S1 X2	Star Mesh	Any

*Agile infrastructure transport network is mandatory for LTE*



# Deployment, Macro-Micro Coordination



# Great Achievements on SingleRAN

2009~: SingleRAN

*One for ALL, Reduce TCO*



**One Network**  
Long term viability



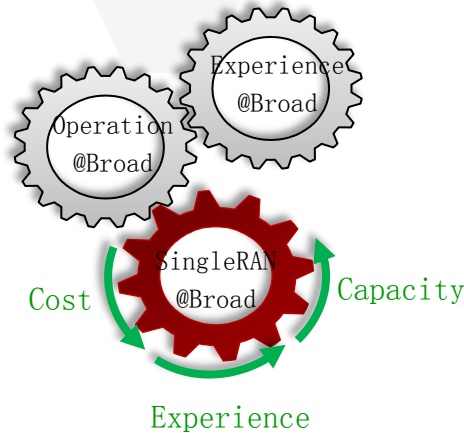
**One Deployment**  
Maximized TCO savings



**One Team**  
Optimized workforces

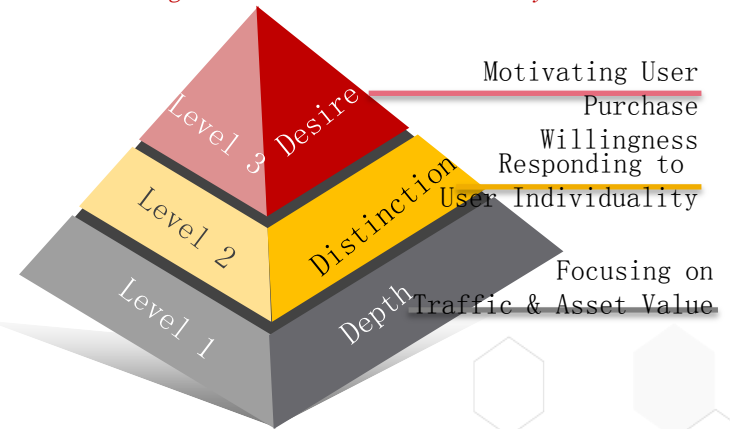
2010~: SingleRAN@Broad

*Stimulating Mobile Broadband*



2011~: SingleRAN@Smart

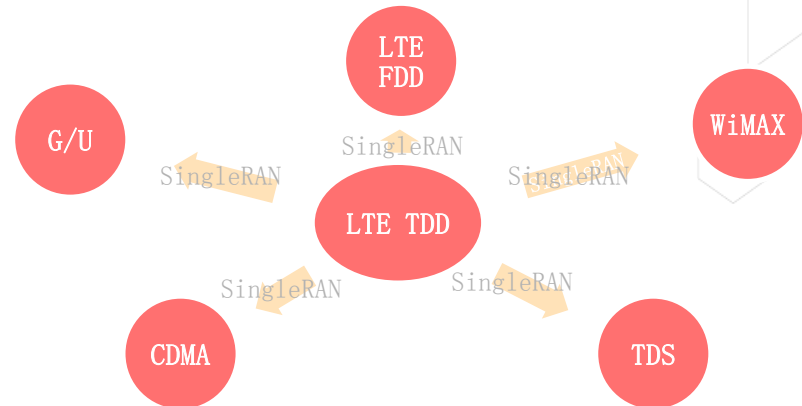
*Creating Mobile Internet Immediacy*



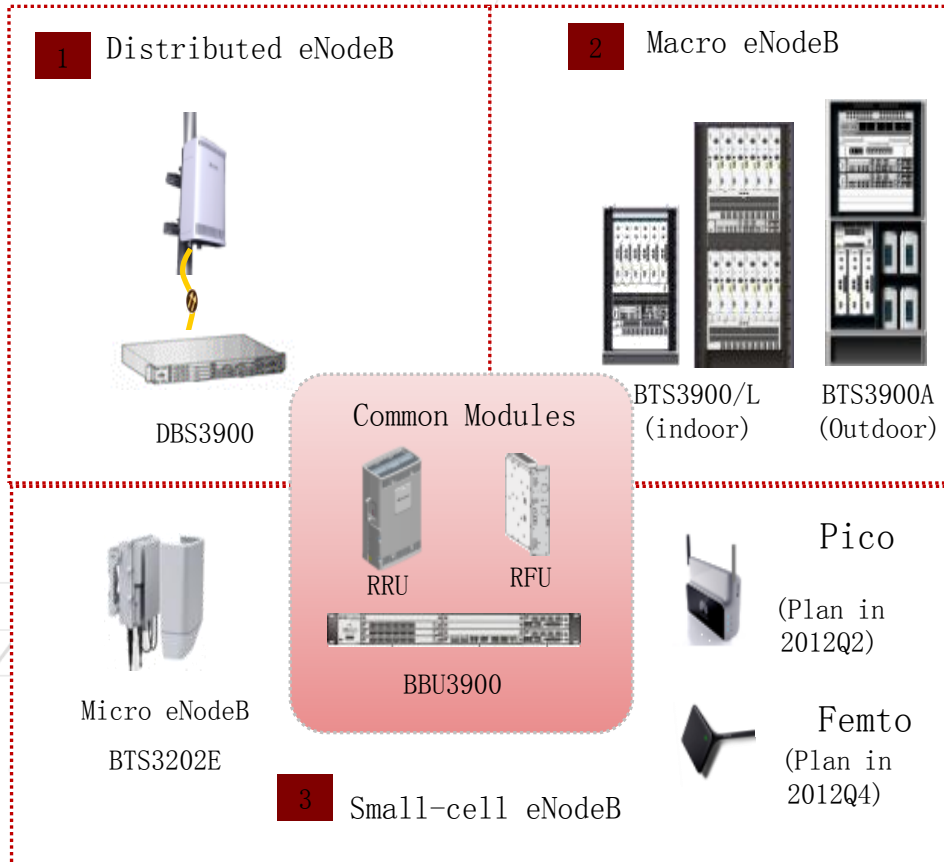
**Pioneering SingleRAN in 100+ commercial network**



**Leading SingleRAN Solution for all FDD & TDD**



# LTE Product Portfolio based on SingleRAN Platform

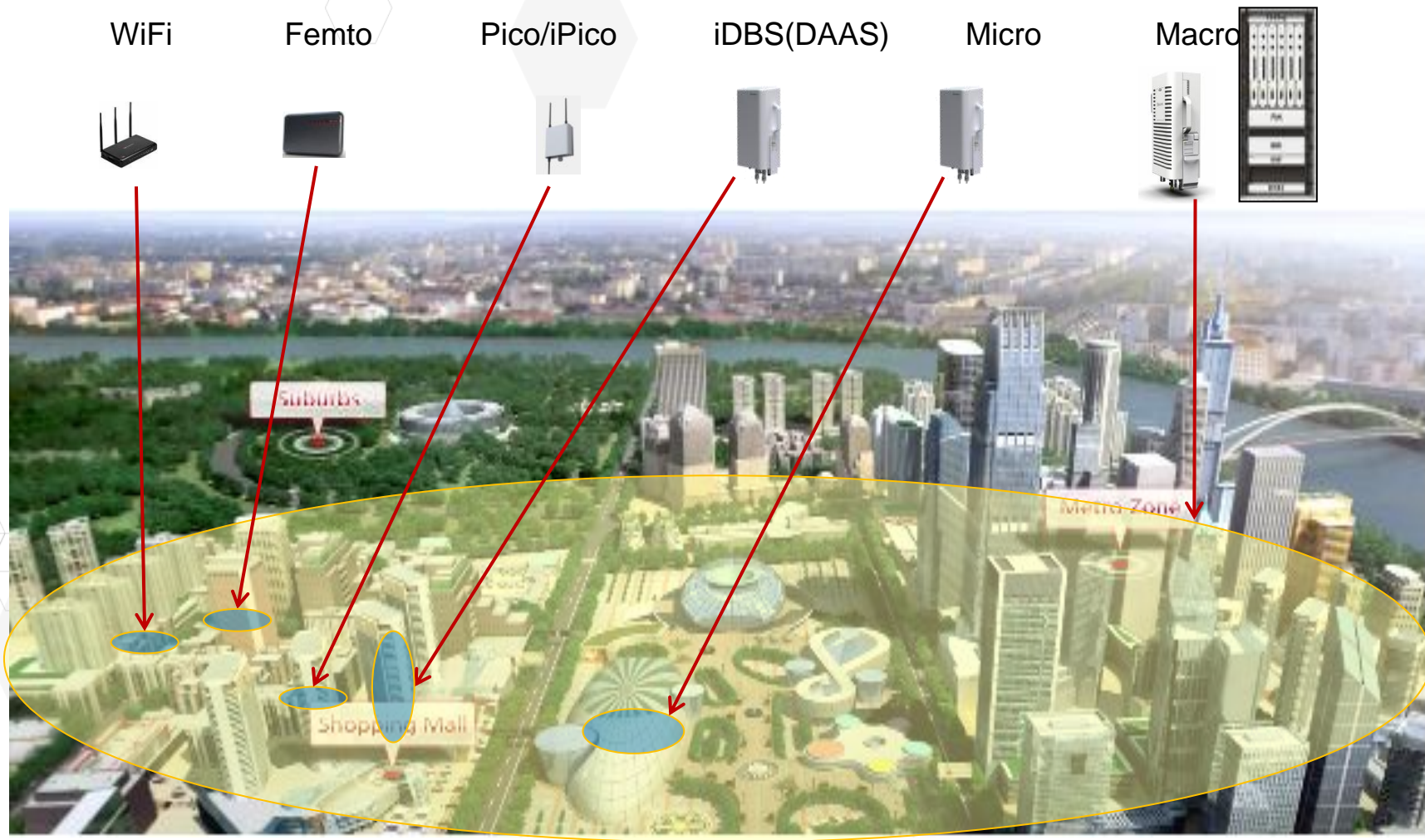


• Supporting All Technologies Evolution

<b>SingleRAN /LTE</b>	
<b>GSM-&gt;LTE</b>	
<b>UMTS-&gt;LTE</b>	
<b>CDMA-&gt;LTE</b>	
<b>WiMAX -&gt;LTE TDD</b>	
<b>TD-SCDMA -&gt;LTE TDD</b>	

Common SingleRAN Platform  
(GSM/UMTS/CDMA/Wimax/LTE)

# HetNet for Multi-band, -mode and -scenario



# Device, LTE ecosystem is building

## MBB Devices

E398s-81:  
2.3/2.6G dual-band  
USB Dongle  
(2.3G/2.6G Handover)



E392u-91:  
LTE TDD/FDD/UMTS/GSM  
Multi-mode/Multi-band  
USB Dongle



LTE  
FDD/TDD/UMTS/GSM  
Smart Devices



## Home & Enterprise Devices

B593s-82:  
2.3/2.6G dual-band CPE



B293s-83:  
Simple CPE



E598: Mobile WIFI



2011Q3

2011Q4

2012

## LTE-TDD Chipset and Terminal Vendors

QUALCOMM

HISILICON

Altair

SEQUANS COMMUNICATIONS

INNOFIBER

ST ERICSSON

HUAWEI

Sony Ericsson

NOKIA  
Connecting People

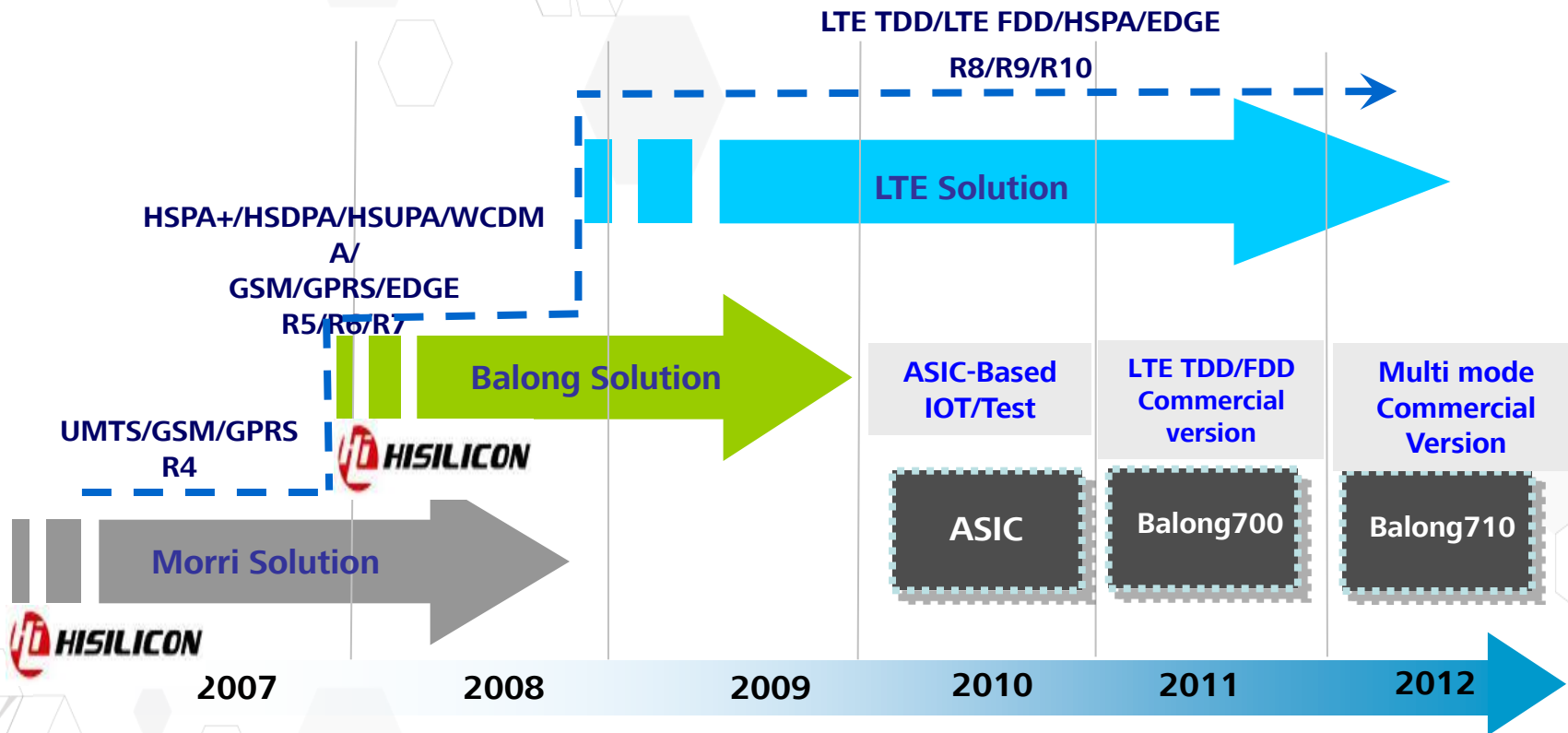
SAMSUNG

LG  
Life's Good

MOTOROLA

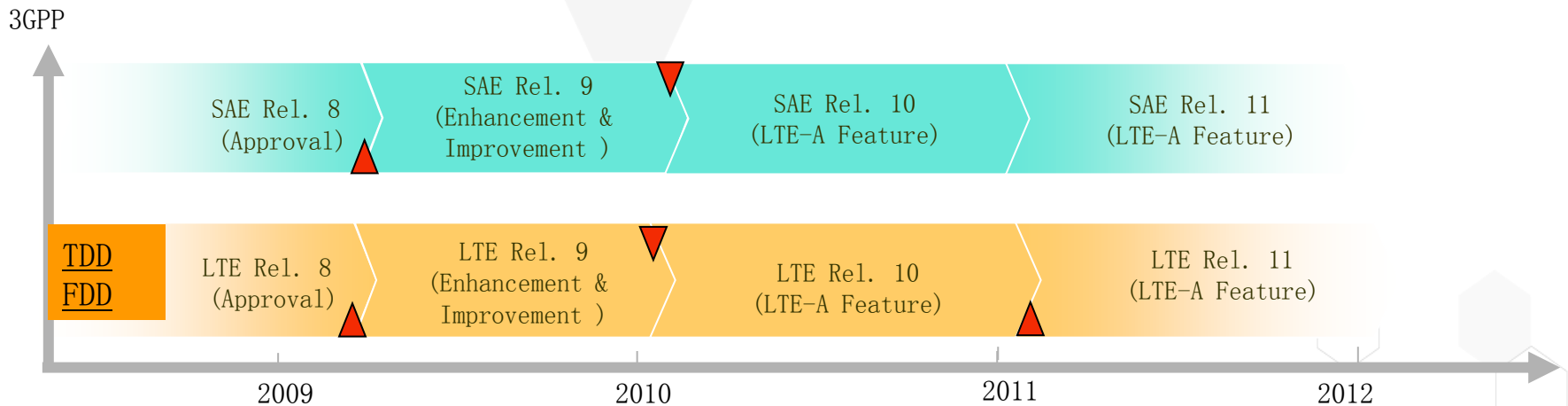
- The involvement of industry giants makes the LTE TDD industry more promising
- By end of 2011, **LTE TDD/FDD/2G/3G** chipset, device, Pocket WiFi and smart phone will come to market

# Huawei Chipset: Long-term eco-system contribution



- **1000+** employees dedicated for wireless chipset development. **150M+** chipsets have been shipped to the market
- **1st** LTE engineering chipset sample in **Dec 2009**, achieved **first data call** in **Jan 2010**
- Huawei LTE TDD terminal chipset got the **best** result in MIIT/CMCC 2.3G/2.6G testing
- **1st** chipset vendor to finish IOT test for CMCC large-scale field trial

# Standard Progress



- With identical standard release on 3GPP, both LTE FDD & TDD will evolve to LTE-Advanced;
- LTE FDD & TDD share identical protocol except some physical and MAC layer features;
- Rel11 is slow down for LTE-Advanced;

# LTE-A: evolution for future

4B Connection

Smart Phone

10B Connection

Smart Phone + Tablet

50B Connection

Smart Device + M2M

- Peak: 150Mbps
- Efficiency: 1.7bps/Hz

- OFDM
- MIMO
- 64QAM
- .....

- Peak: 1Gbps
- Efficiency: 2.4bps/Hz

- Carrier Aggregation
- 40M, 60M, 80M.....
- High-order MIMO: 8\*8
- Relay
- HetNet
- CoMP

- Peak: ~5Gbps
- Efficiency: 3.4bps/Hz



LTE

LTE-Advanced

LTE.....



# Applications, Innovative LTE Business



- LTE Ground-to-Air MBB



- Instant LTE Broadcast



- LTE Car



- LTE Connection at 430Km/h

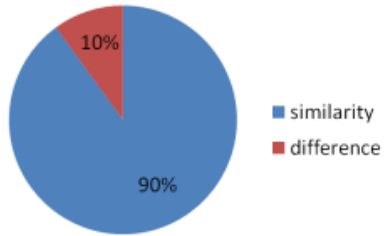


- Wireless video surveillance

# Global Cases, Pioneering LTE Commercialization



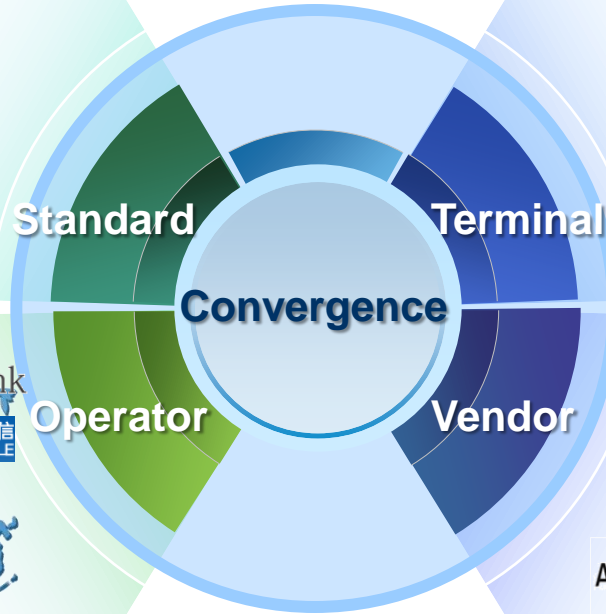
# TDD & FDD Convergence is Main Trend



90% similarity of Standard  
TDD/FDD same standard progress,  
BF/ CoMP/ MBMS features are more  
suitable for TDD



Big tier operators from huge market are  
investing in TDD, most of them are FDD  
operators, further promote the convergence



FDD+TDD+GSM+UMTS  
multi-band/multi-mode chipset / device.



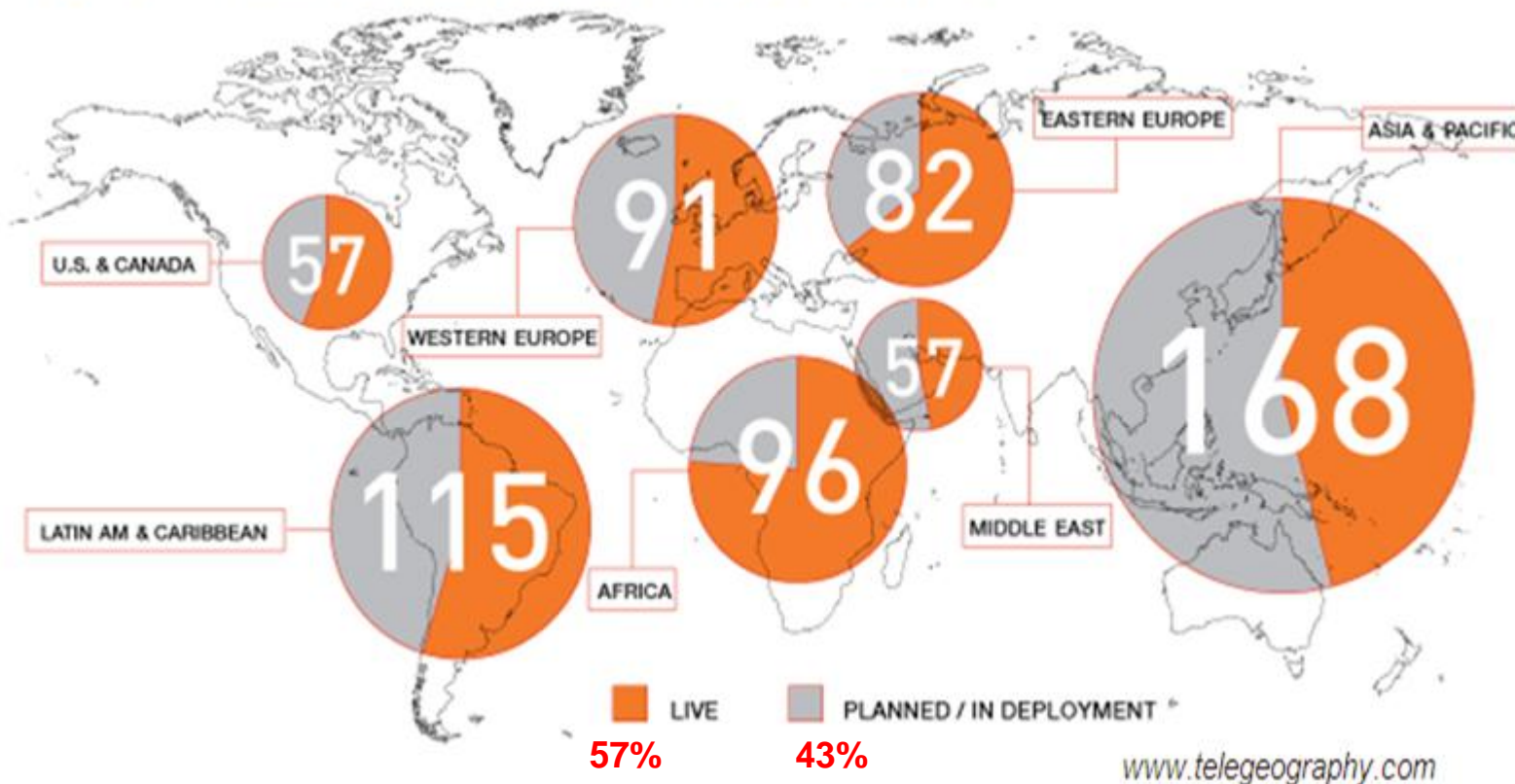
FDD+TDD, multi-mode is main trend  
to allow global roaming,  
**The most important factor.**



Main vendors have both TDD&FDD are  
engaged into TDD industry to fulfill the  
operators requirements.

# TDD Spectrum is Globally Available

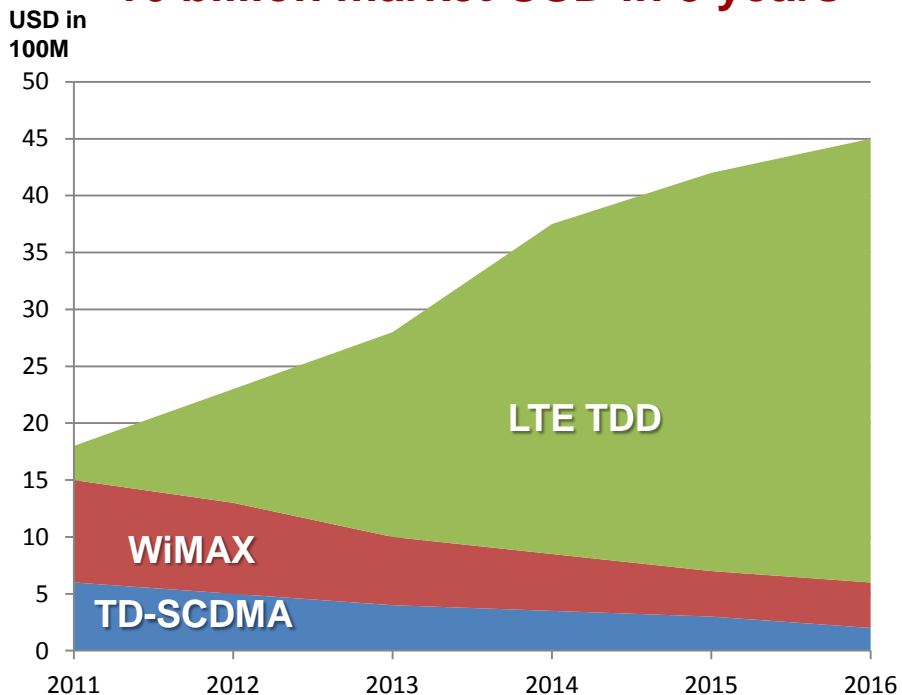
## World-Wide TDD Licenses Distribution by Regions



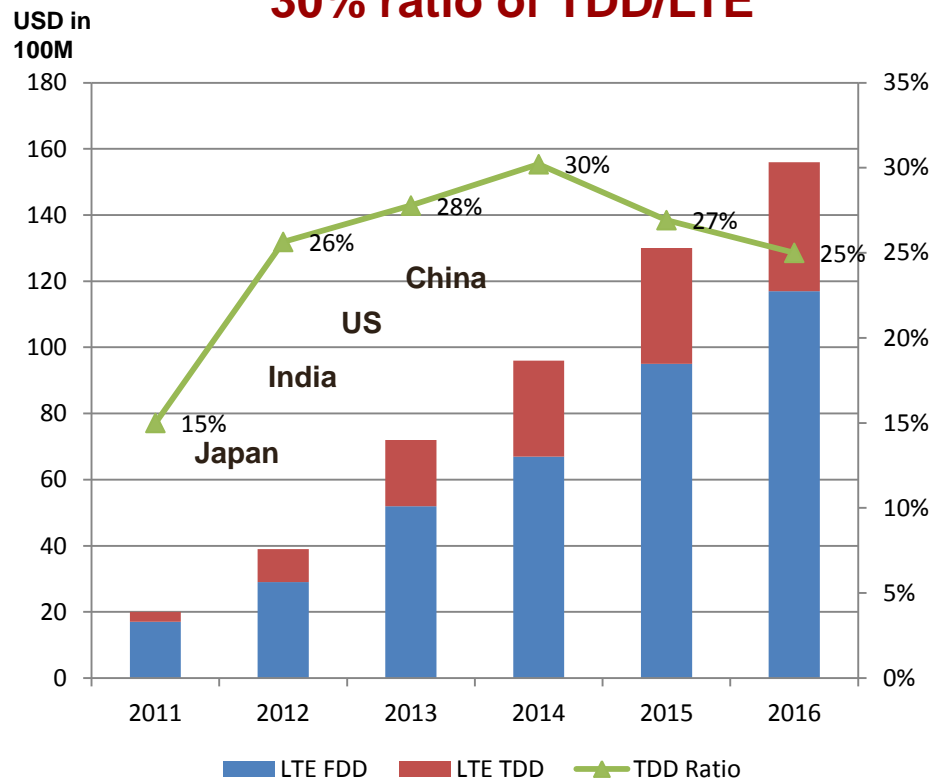
- There are **666** TDD licenses released worldwide, which means a big room for LTE TDD
- New licenses mostly are higher than 2G, TDD licenses have more chance

# TDD Market Will be Booming in Next 5 Years

16 billion market USD in 5 years



30% ratio of TDD/LTE

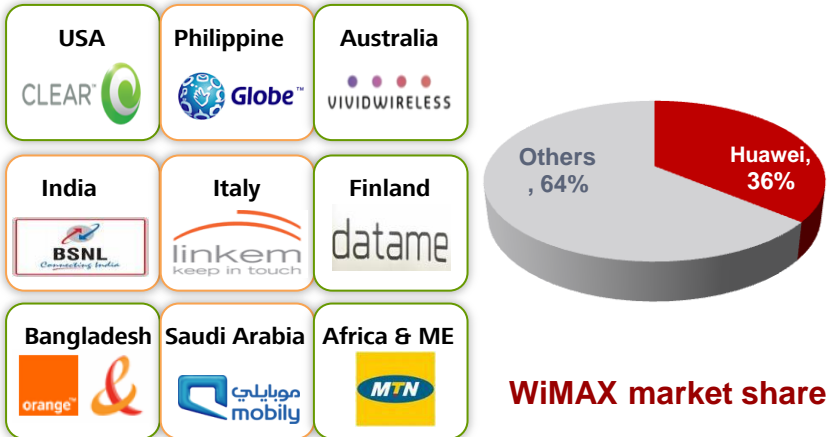


- **260%** (wireless is 10%) increasing rate of TDD
- LTE TDD is main stream of TDD industry

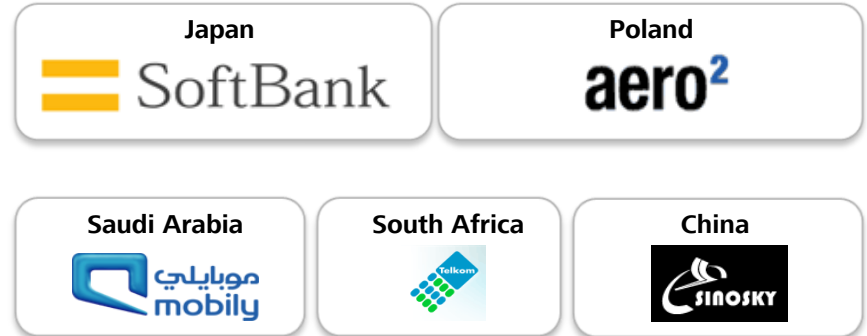
- TDD counts for 15% 2011, rapidly increase to 30%
- The population of the four countries count for nearly half of the world

# Huawei Drives TDD Commercialization

## 100+ Commercial WiMAX Contracts Globally

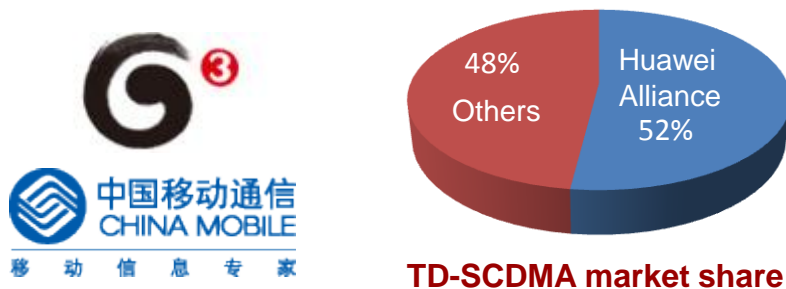


## Commercial Contracts



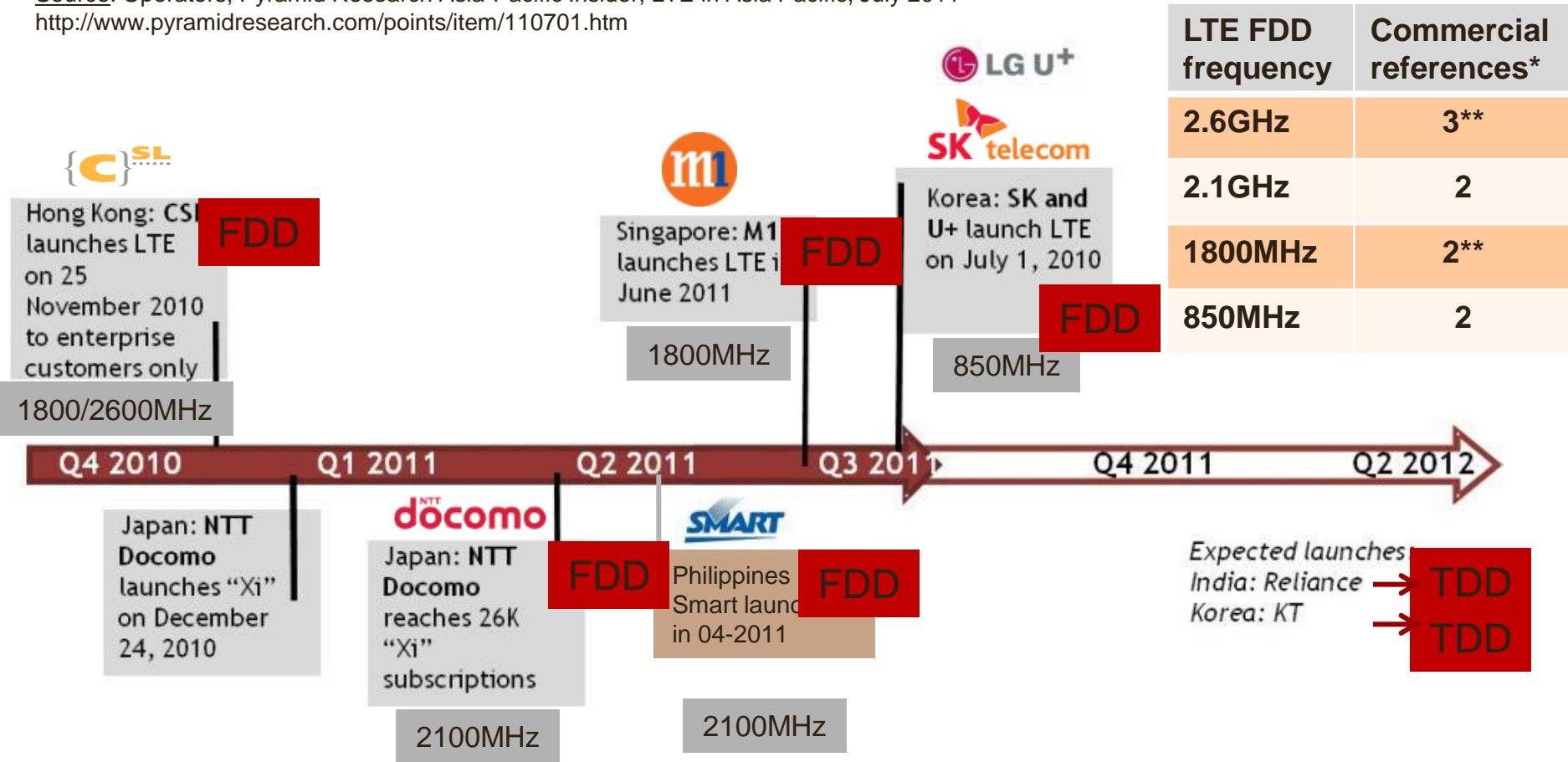
- World largest LTE TDD network – **Softbank**
- World 1<sup>st</sup> LTE TDD commercial – **Aero2**
- World 1<sup>st</sup> SingleRAN WiMAX/LTE – **Mobily**
- Africa 1<sup>st</sup> LTE TDD network – **Telkom**
- China 1<sup>st</sup> LTE TDD network – **Sinosky**

## Cooperation with CMCC for TD-SCDMA



# LTE FDD 在亞太區發展尚在初期階段

Source: Operators, Pyramid Research Asia-Pacific Insider, LTE in Asia Pacific, July 2011  
<http://www.pyramidresearch.com/points/item/110701.htm>

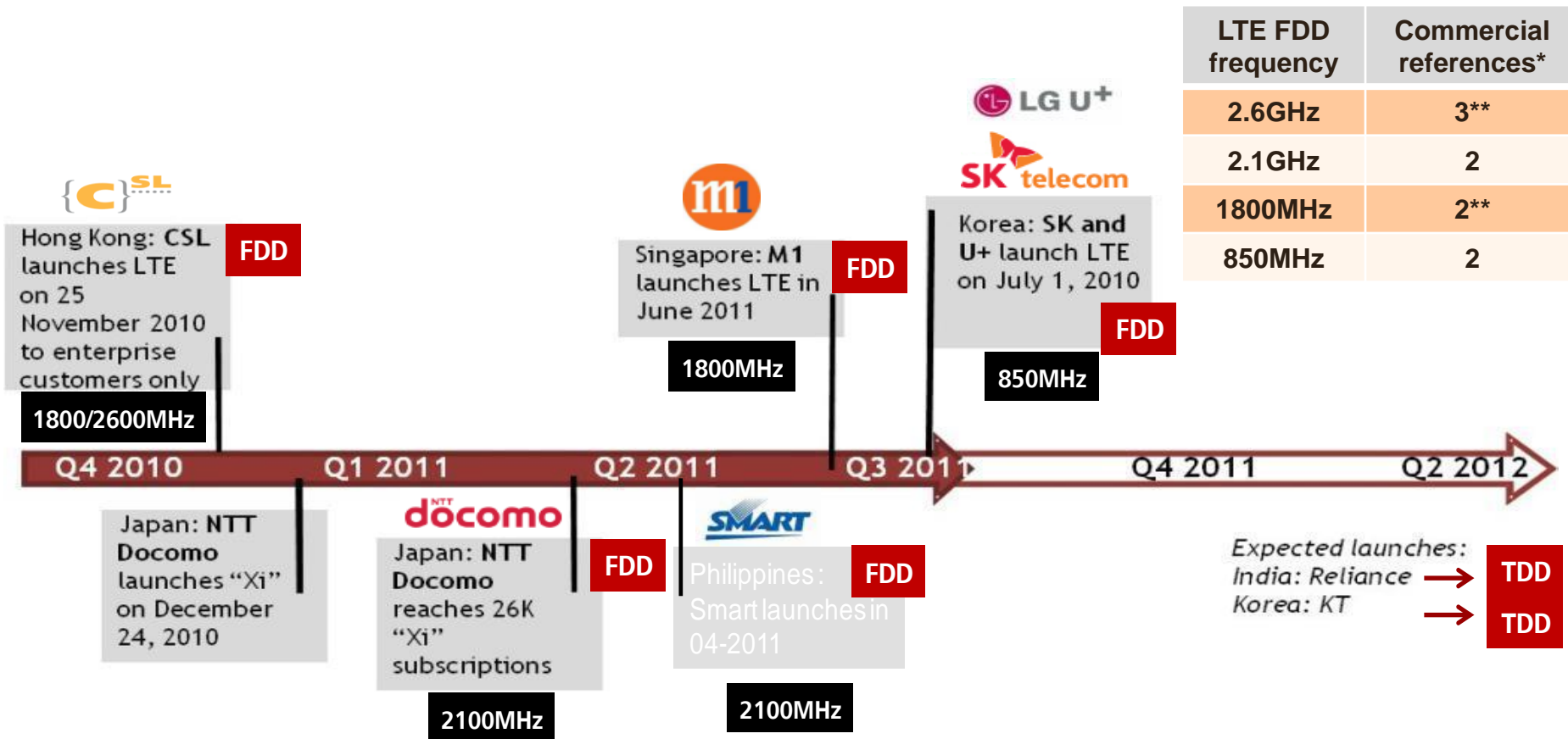


\*) Uzbekistan MTS and Ucell have launched commercial LTE services using 2.6GHz in 07-2010 and 08-2010 respectively

\*\*\*) CSL Hong-Kong LTE@1800/2600MHz rollout

**→ 2010/11 early LTE rollout mainly in developed countries; however few developing countries are adopting LTE now**

# 亞太區將扮演LTE TDD 發展的推手

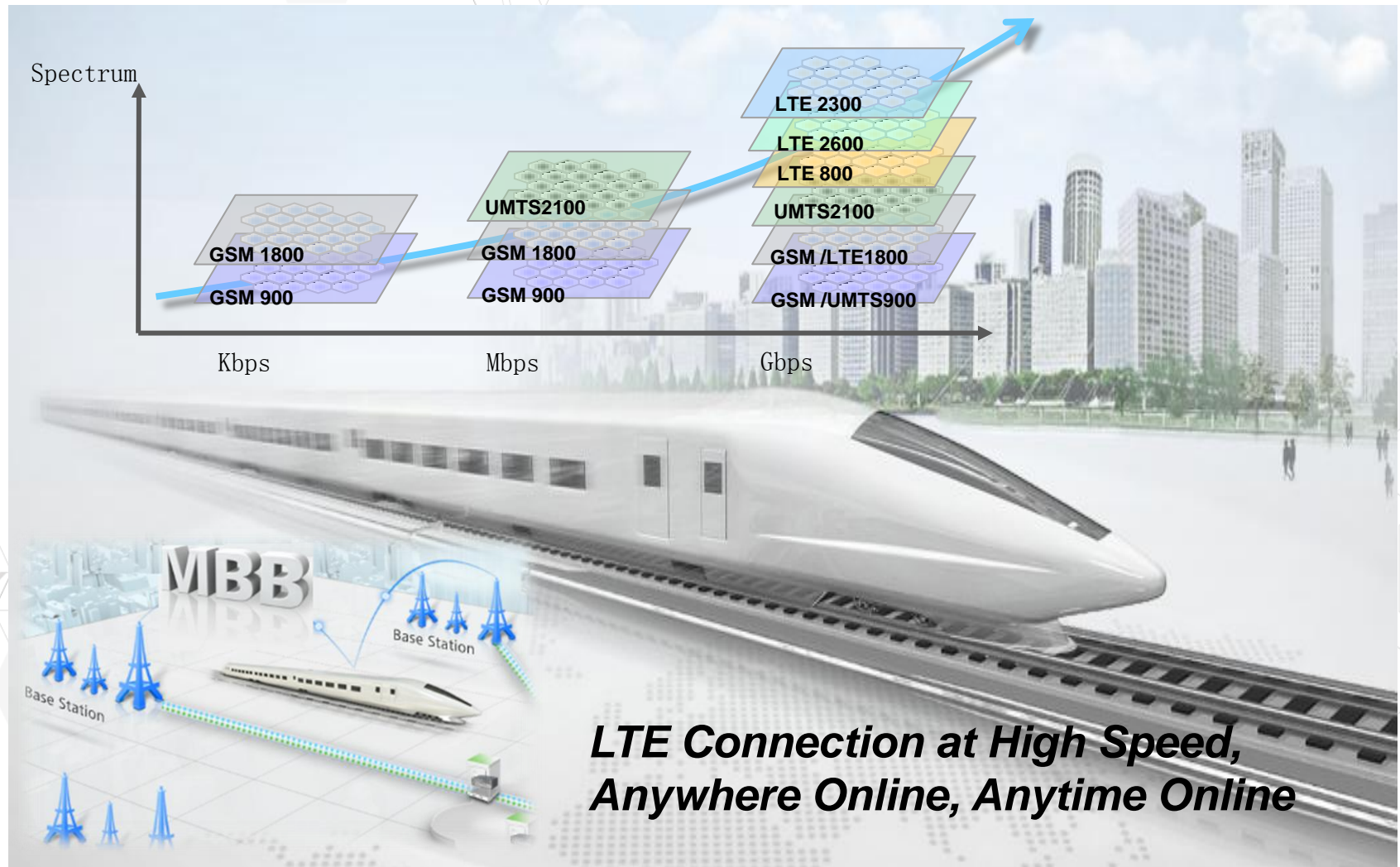


Source: Operators, Pyramid Research Asia-Pacific Insider, LTE in Asia Pacific, July 2011  
<http://www.pyramidresearch.com/points/item/110701.htm>

- LTE TDD is becoming a relevant option for many operators
- First commercial launches in 2011/12 (APAC region)



# LTE is Accelerating





**THANK YOU**

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