

行動通訊的展望

4G國際標準趨勢與技術展示研討會 (2011.10.18)

Technology Revolution.....What's next ?

Just a Few Years Ago ...



My Mail



My Pictures



My Books



My Shopping



My Directory



My Friends



Technology Revolution Of Our Time



>1.8 B Internet Users



>1.5 B PC Users



>4.5 B Mobile Users



Source: Morgan Stanley Research, IDC

THE TALE OF THREE CALLERS



Frequent User



Essential User



Power User

- 
- Immediate Access to Network (Data or Social) Anytime, Anywhere
 - Affordable Content Rich (Data Intensive) Services
 - Ever-Improving Quality of Service (QoS) & Security
 - Smarter Smartphones: Seamless Integration of Voice, Data, Video and Location Services
 - Ubiquitous Interoperability and Roaming
 - Continuously Improving Ease-of-Use

CAN YOU IMAGINE....



The White House

THE COMPLEXITY AND CONFLICT



Standards

GSM/EDGE Evo

W-CDMA

C2K

TD-SCDMA

WiMAX™

LTE FDD

LTE TDD

LTE Advanced

802.11a/b/g/n/ac/ad ...

Bluetooth®

DVB

DigRF

GPS

GLONASS

FM/RDS

And more...



Device Infrastructure

Device Co-Existence Testing

InterRAT Validation

RAT: Radio
Access Tech

Multi-Vendor Inter-Operability

Larger Display

Lighter

Longer Battery Life

Enabling Technologies

OFDMA / SC-FDMA

MIMO

MIMO OTA Testing

Wider BW 20 → 100 MHz

Carrier Aggregation

Femtocells or Equivelant

MSR (Multi-Standard Radio)

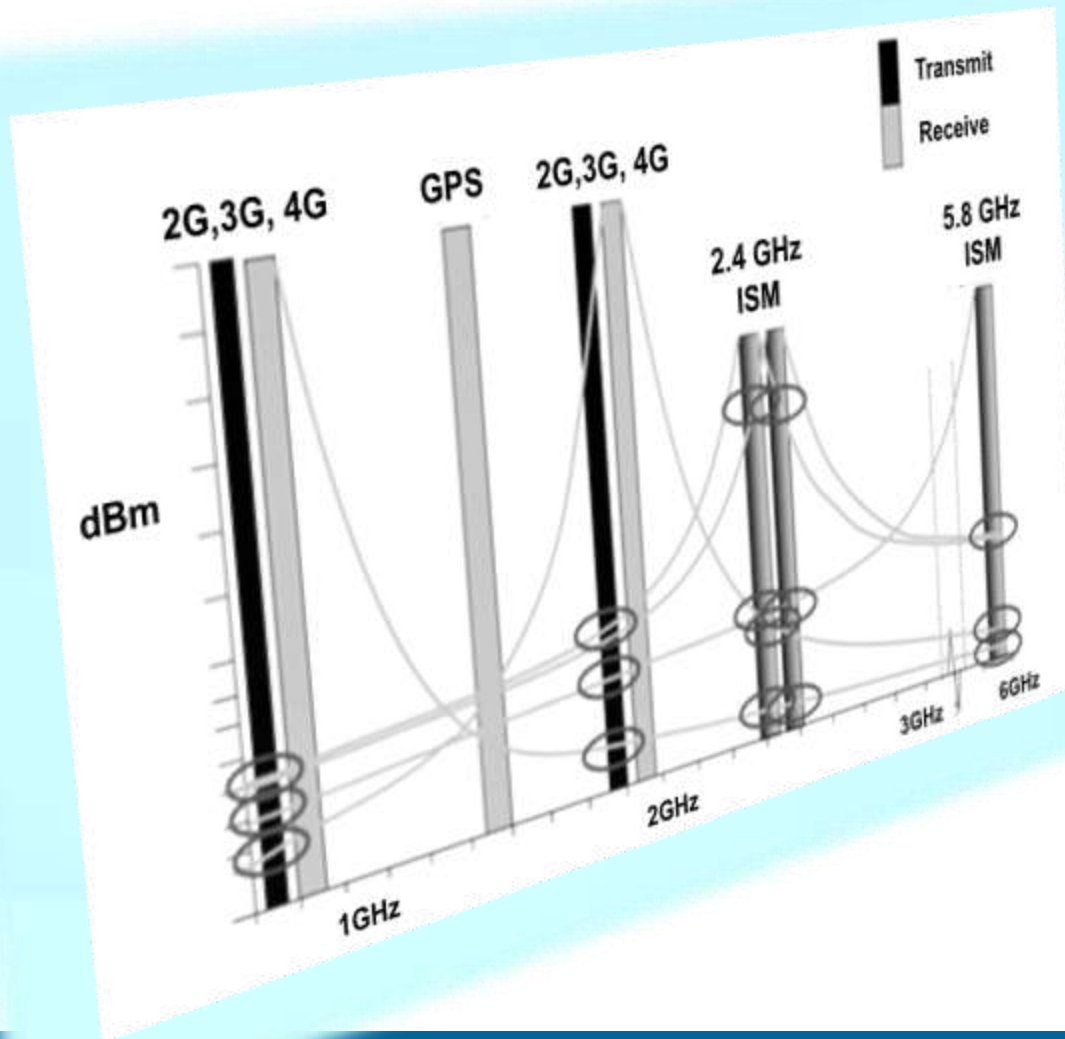
SDR (Software-Defined Radio)

Bluetooth and the Bluetooth logos are trademarks owned by Bluetooth SIG, Inc., WiMAX, and the WiMAX Forum logo, are US trademarks of the WiMAX Forum

THE BALANCING ACT



THE COMMON GROUND: SHARED SPECTRUM



Data Users and Transceiver Counts [Radios/UE] Continue to Grow Geometrically



Driving Greater Signal Density in the Available Spectrum



Which In-Turn Drives More and More “Creative” Engineering Solutions



THE COMMON GROUND: LTE TECHNOLOGY

**San Francisco to deploy
the nation's
first public safety
700 MHz LTE
interoperable broadband
network**



Source: MOTOROLA online Insights Article



THE COMMON GROUND: RADIO TECHNOLOGIES



Increasing deployment of 2G/3G/4G technologies within military equipment, air, sea and ground forces
(An Ongoing Challenge)

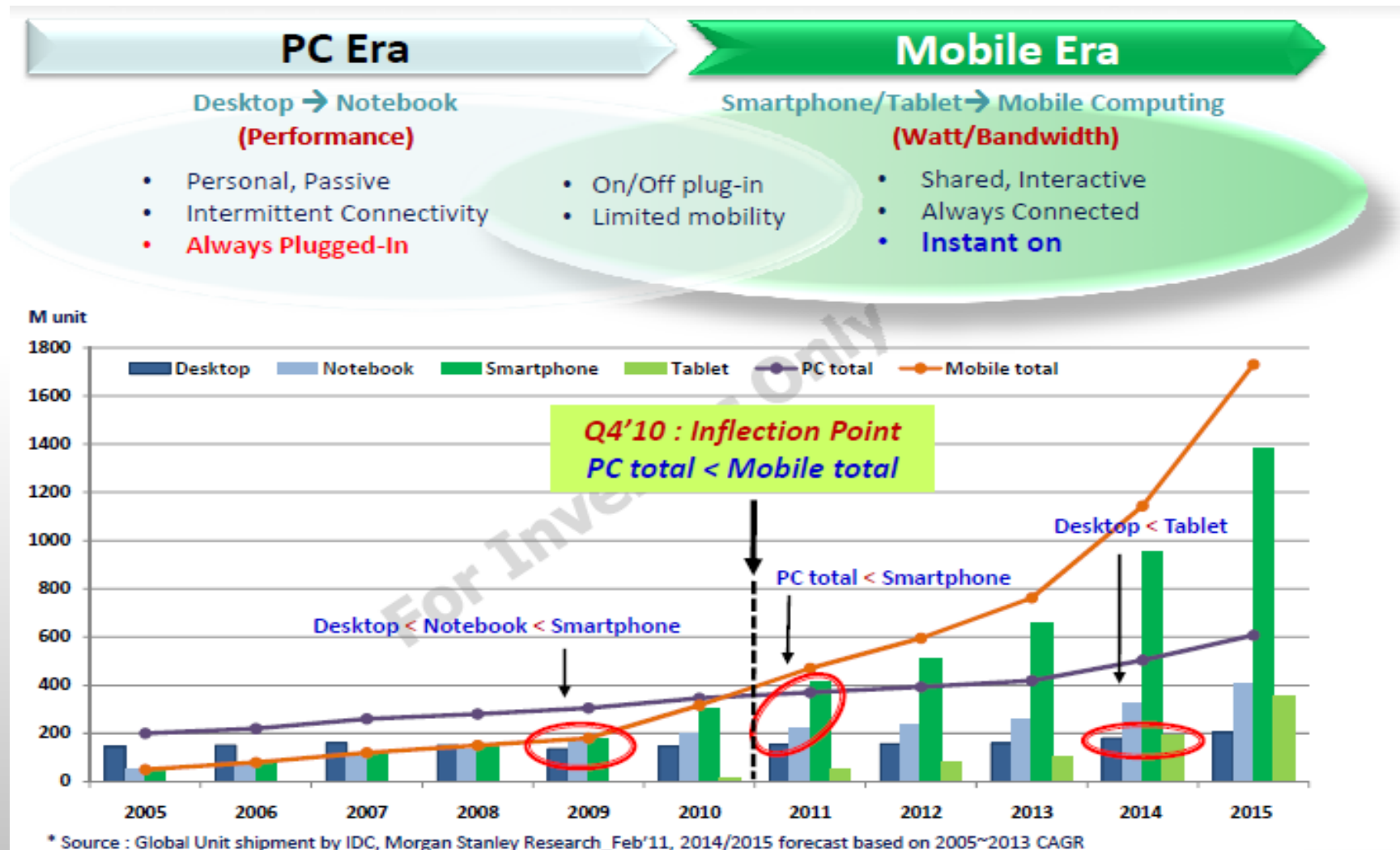
- Security/Encryption
- Link Robustness: Spread Spectrum, Frequency Agility, Jam Resistance, Fallback Modes
- Mobile Infrastructure



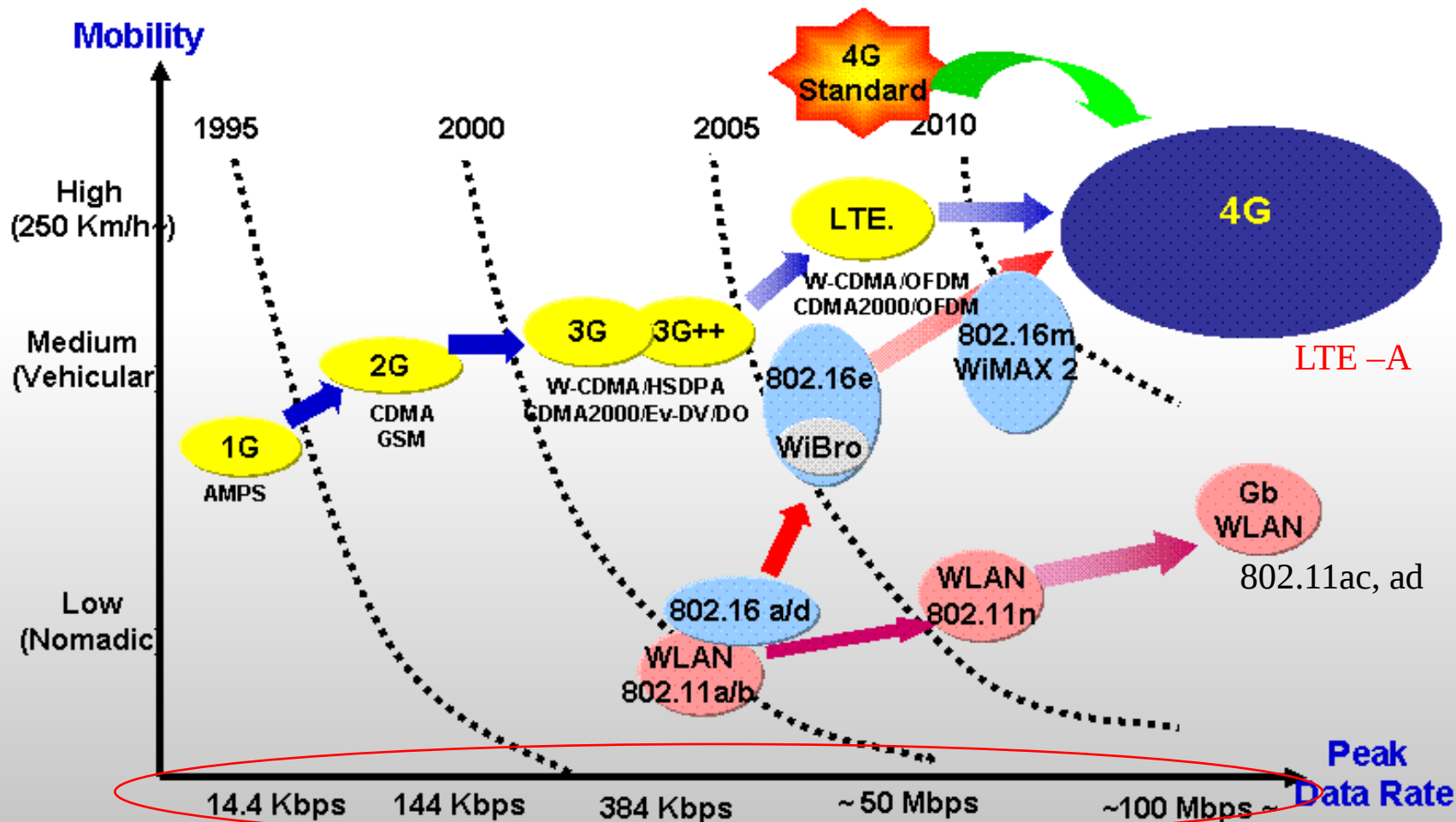
- **Needs of our Users are More Similar than Different**
- **Good Fences Make Good Neighbors**
 - Clear Standards
 - Judicious Regulation
 - Creative Engineering
- **Manage the Ever-Increasing Growth in Complexity**
 - Multi-format, Multi-Band Devices & Systems
- **Engineers Make this Happen**
- **Early Engagement**
 - High Quality Tools
 - Full Design Life-Cycle
 - Flexible
 - Creative
 - Timely
 - Easy-to-Use, Robust & Economically Viable Solutions



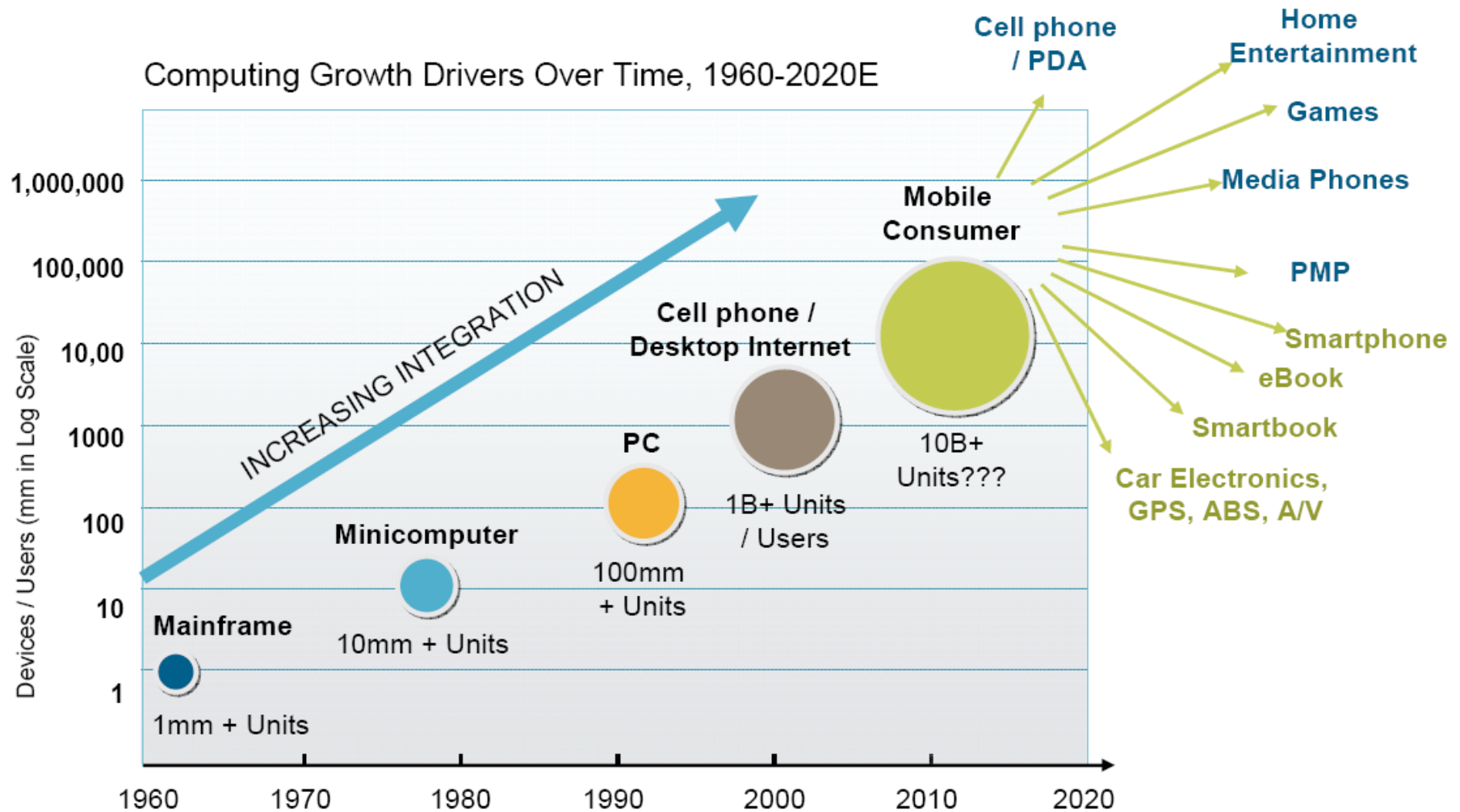
Industry Paradigm Shift from PC to Mobile



Wireless Evolution...What's next ? 5G ?



Computing Growth over Time....



Some Numbers

- **Apple start iPhone in 2007**
 - In 2009 Q3, apple iphone profit overtake Nokia (1.6b vs 1.1b)
 - In 2011 Q1, apple iphone revenue overtake Nokia
- **HTC start smartphone in 2002**
 - In 2011 Q1, HTC maket value overtake Nokia
- **By the end of 2011**
 - More than 5B people around the world have at least one mobile phone
 - Smart phone will out sell Feature phone
 - Worldwide smart phone sales the first time hit 100M in the fourth quarter of 2010
 - We can tell “How fast smart phone market is exploding
 - 60 million tablet been sold.
- **M2M create even more versatile device and usage**

Mobile world we belong



htc
quietly brilliant

“Online” to “Mobile”

- **Mobile Video**

- The fact that
 - 70% of global online consumers watch online video, with highest take up from China and Indonesia
 - Web base online video is establishing new way of TV and on demand video service
- Fast Mobile broadband sets the stage for uptake of mobile video services
 - Smartphone already consume more than 1/3 of video usage, youtube alone accounts for 13-15% of global mobile broadband

- **Mobile Social Network**

- There are more than 600M facebook users; more than 200M are mobile users

- **Mobile Content Consuming**

- **Mobile Gaming and Application**

Smart Phone Definition

A Smartphone is a mobile phone offering advanced capabilities, often with PC-like functionality (PC-mobile handset converge).

A Smartphone is a small all in one device used for communication & computing functions.

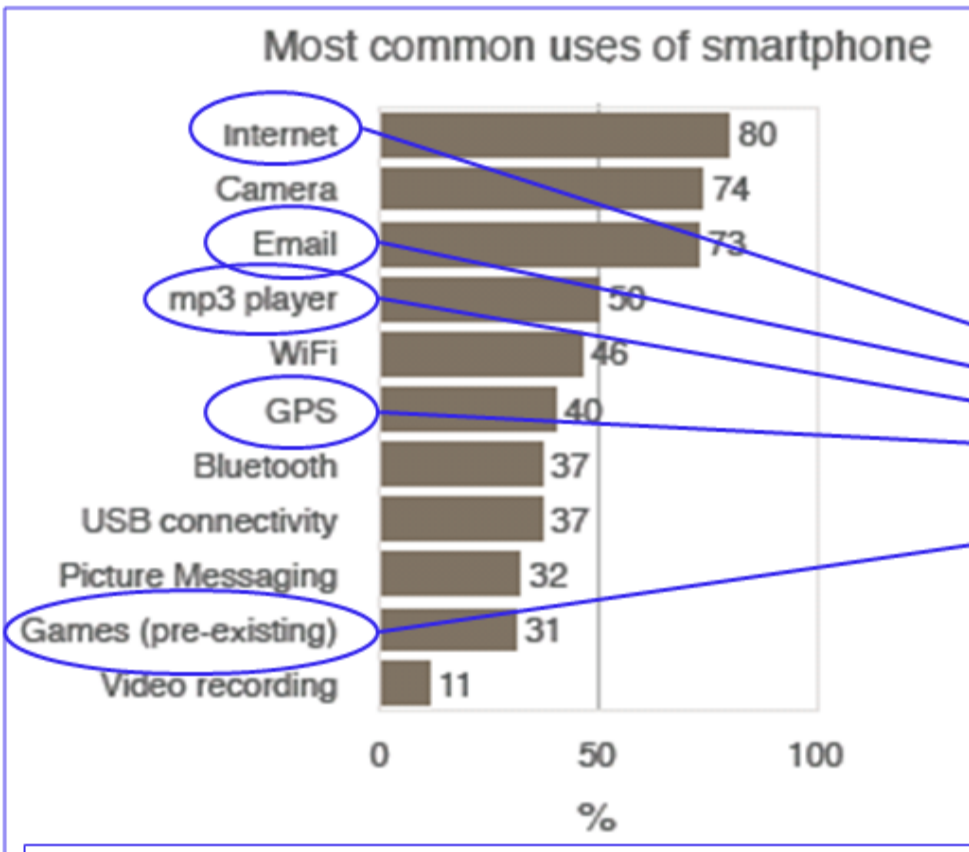


- Keeping you organized
- Flexible working
- Information at your finger tips
- Never out of reach
- Better information sharing
- Greater functionality
- Faster communication \
- Fashion

- Nokia
- Motorola
- Samsung
- Blackberry
- Android
- HTC
- I phone
- HP

- Small Screen -->
- High Cost ->
- Web Site Access →
- Addictive ->
- Less freedom (from Boss & Wife)
- >

Most Common Usage of Smart Phones



Apps

Augmented Reality

3D

Voice Recognition [Siri]

NFC related

eHealth

Source: Crowd Science (June 2009), Smartphone Usage and Brand Study

iPad 2



Xoom



TouchPad



PlayBook



Platform	iOS 4.3	Android 3.0	webOS 3.0	BB Tablet OS (QNX)
Display	9.7-inch LED-backlit IPS LCD	10.1-inch	9.7-inch	7-inch LCD
Resolution	1024 x 768	1280 x 800	1024 x 768	1024 x 600
Processor	1GHz dual-core Apple A5	1GHz dual-core NVIDIA Tegra 2	1.2GHz dual-core Qualcomm Snapdragon	1GHz dual-core Cortex-A9
Memory	?	1GB RAM	1GB RAM	1GB RAM
Storage	16GB / 32GB / 64GB	32GB	16GB / 32GB	16GB / 32GB / 64GB
Front camera	VGA	2 megapixel	1.3 megapixel	3 megapixel
Rear camera	720p / 30 fps video	5 megapixel AF with dual-LED flash, 720 / 30p video	none	5 megapixel, 720p video
Cellular radio	EDGE, plus quadband HSPA or CDMA / EV-DO Rev. A	3G with free upgrade to 4G LTE	3G and 4G	3G and 4G
WiFi	802.11a/b/g/n	802.11a/b/g/n	802.11b/g/n	802.11a/b/g/n
Bluetooth	2.1 + EDR	2.1 + EDR	2.1 + EDR	2.1 + EDR
Accelerometer	3-axis	3-axis	Yes	Yes
Gyroscope	Yes	Yes	Yes	--
Battery	25Wh	3,250mAh	6,300 mAh	5,300 mAh
Thickness	8.8mm	12.7mm	13.7mm	10mm
Weight	601g (WiFi), 607g (Verizon),	725g	740g	425g



Motorola XOOM

Apple iPad (32GB/3G)

Price	\$699	\$729
Processor	1GHz dual-core Tegra 2	1GHz single-core A4
Display	10.1"	9.7"
Resolution	1280x800 (160 dpi)	1024x768 (132 ppi)
RAM	1GB	256MB
Storage	32GB	32GB
Front Camera	2MP	None
Back Camera	5MP	None
Video	Records 720p	None
Video Playback	1080p	720p
Operating System	Android 3.0	iOS 4
Expandable Memory	32GB microSD	None
Flash Support	Yes	None
Ports	HDMI, USB 2.0	None
Sensors	Barometer, Accelerometer, Gyroscope	Accelerometer
Network	3G and 4G	3G
Speaker	Yes	Yes

LTE becomes more of a requirement

- **Consider Hundred fold growth of mobile data traffic by 2013**
- **LTE is**
 - more efficient
 - allows the operators to cut capex and bring more benefits to the consumers
 - already gaining momentum this year
 - 170 mobile operators around the world are committed to deploy LTE
 - Solve/Lessen data capacity issue

Release 10 LTE-A Down Link

Downlink physical layer parameter values set by the field ue-Category, V10.2.0

UE Category	Maximum number of DL-SCH transport block bits received within a TTI	Maximum number of bits of a DL-SCH transport block received within a TTI	Total number of soft channel bits	Maximum number of supported layers for spatial multiplexing in DL
Category 1	10296	10296	250368	1
Category 2	51024	51024	1237248	2
Category 3	102048	75376	1237248	2
Category 4	150752	75376	1827072	2
Category 5	299552	149776	3667200	4
Category 6	301504	149776 (4 layers) 75376 (2 layers)	3654144	2 or 4
Category 7	301504	149776 (4 layers) 75376 (2 layers)	3654144	2 or 4
Category 8	2998560	299856	35982720	8

UE Category	Max. DL data rate	UE Category	Max. DL data rate
Category 1	10Mbps	Category 6	300Mbps
Category 2	50Mbps	Category 7	300Mbps
Category 3	100Mbps	Category 8	~3Gbps
Category 4	150Mbps		
Category 5	300Mbps		

Release 10 LTE-A Up Link

Uplink physical layer parameter values set by the field ue-Category, V10.2.0

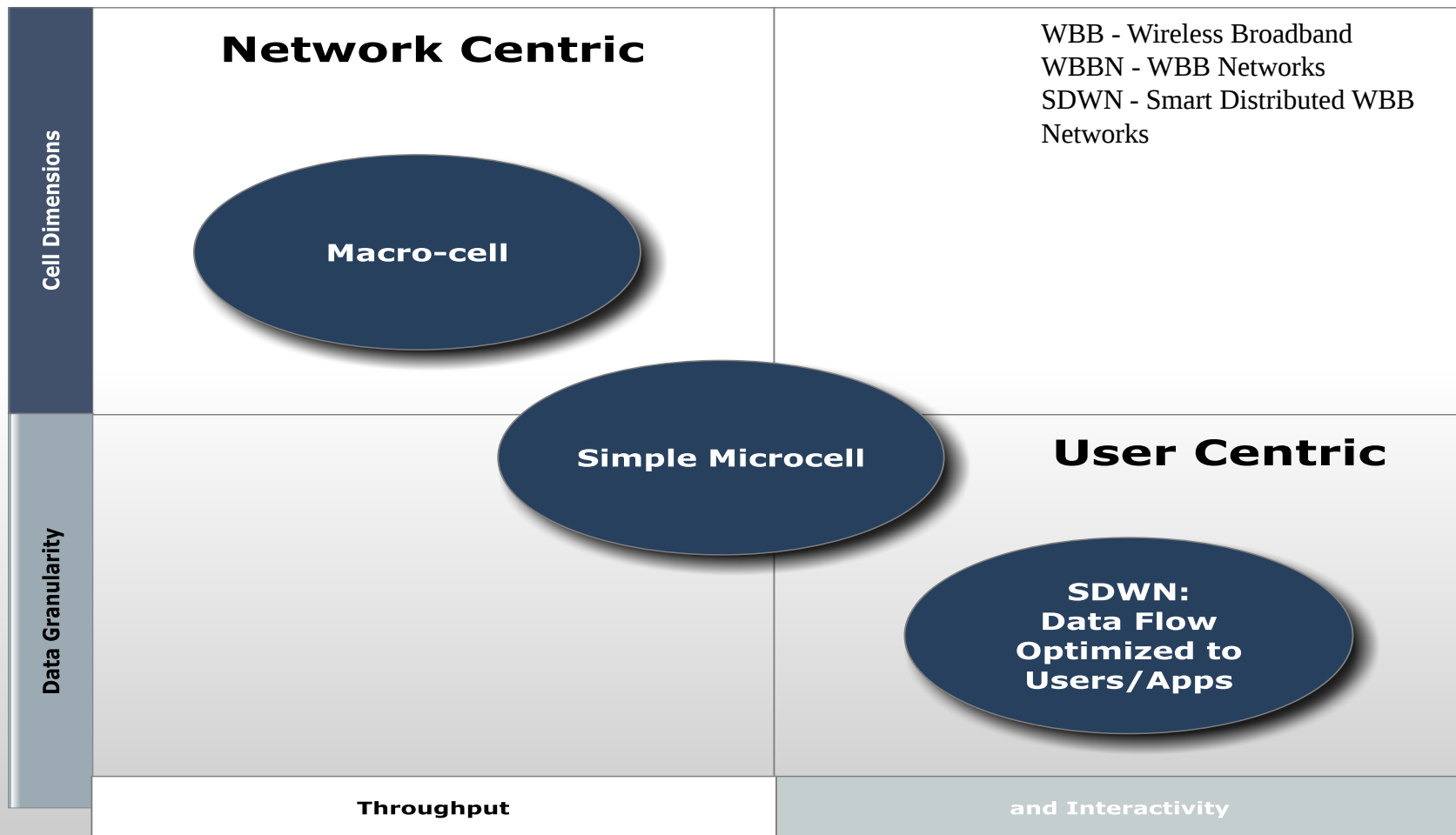
UE Category	Maximum number of UL-SCH transport block bits transmitted within a TTI	Maximum number of bits of an UL-SCH transport block transmitted within a TTI	Support for 64QAM in UL
Category 1	5160	5160	No
Category 2	25456	25456	No
Category 3	51024	51024	No
Category 4	51024	51024	No
Category 5	75376	75376	Yes
Category 6	51024	51024	No
Category 7	102048	51024	No
Category 8	1497760	149776	Yes

UE Category	Max. UL data rate	UE Category	Max. UL data rate
Category 1	5Mbps	Category 6	50Mbps
Category 2	25Mbps	Category 7	100Mbps
Category 3	50Mbps	Category 8	150Mbps
Category 4	50Mbps		
Category 5	75Mbps		

FEATURES/TECHNOLOGIES For LTE-A

- The key technology component of LTE-Advanced:
 - * Improved spectrum flexibility
 - Carrier Aggregation
 - * Multi-antenna Solutions
 - Single User **Uplink** MIMO & Multiple Access
 - Antenna configuration is 4x4 or less in UL
 - Single User **Downlink** MIMO
 - Antenna configuration is 8x8 or less in DL
- Multi-User MIMO
- Collaborative & Network MIMO
 - * Relays

Higher Capacity and Data-to-User



Operators and Spectrum

Operators' LTE Schedule

Taiwan: expected 2014

表：全球 24 張商用 LTE 網路

國家	營運商	商用時間	國家	營運商	商用時間
美國	Verizon Wireless	2010/12/05	烏茲別克斯坦	MTS	2010/7/28
美國	MetroPCS	2010/09/21	烏茲別克斯坦	Ucell	2010/08/09
瑞典	Tele2 Sweden	2010/11/15	丹麥	TeliaSonera	2010/12/09
瑞典	TeleNor Sweden	2010/11/15	波蘭	Mobyland & CenterNet	2010/09/07
瑞典	TeliaSonera	2009/12/15	奧地利	A1 Telekom Austria	2010/11/05
挪威	TeliaSonera	2009/12/15	香港	CSL Limited	2010/11/25
芬蘭	TeliaSonera	2010/11/30	愛沙尼亞	EMT	2010/12/17
芬蘭	Elisa	2010/12/08	日本	NTT DoCoMo	2010/12/24
德國	Vodafone	2010/12/01	菲律賓	Smart Communications	2011/4/16
德國	Deutsche Telekom	2011/4/5	立陶宛	Omnitel	2011/4/28
德國	O2	2011/7/11	南韓	SK Telecom	2011/7/1
新加坡	M1	2011/6/21	南韓	LG U+	2011/7/1

資料來源：GSA，主導產業顧問整理，2011/07

4G Spectrum Update Summary

- LTE is supported by many bands around the world and is quite fragmented
- Clear distinction between use of the 700MHz and 800MHz bands in Asia and Europe respectively
- Harmonisation with prevailing bands enables:
 - interoperability and roaming
 - fast and reliable vendor support
 - economies of scale in the production of handsets and network equipment
- Taiwan should focus on the deployment of LTE in the 700MHz and 2.6GHz bands
 - 2.6GHz spectrum is already allocated to WiMAX operators
 - China Mobile and Asia focused on the deployment of LTE in the 700MHz band

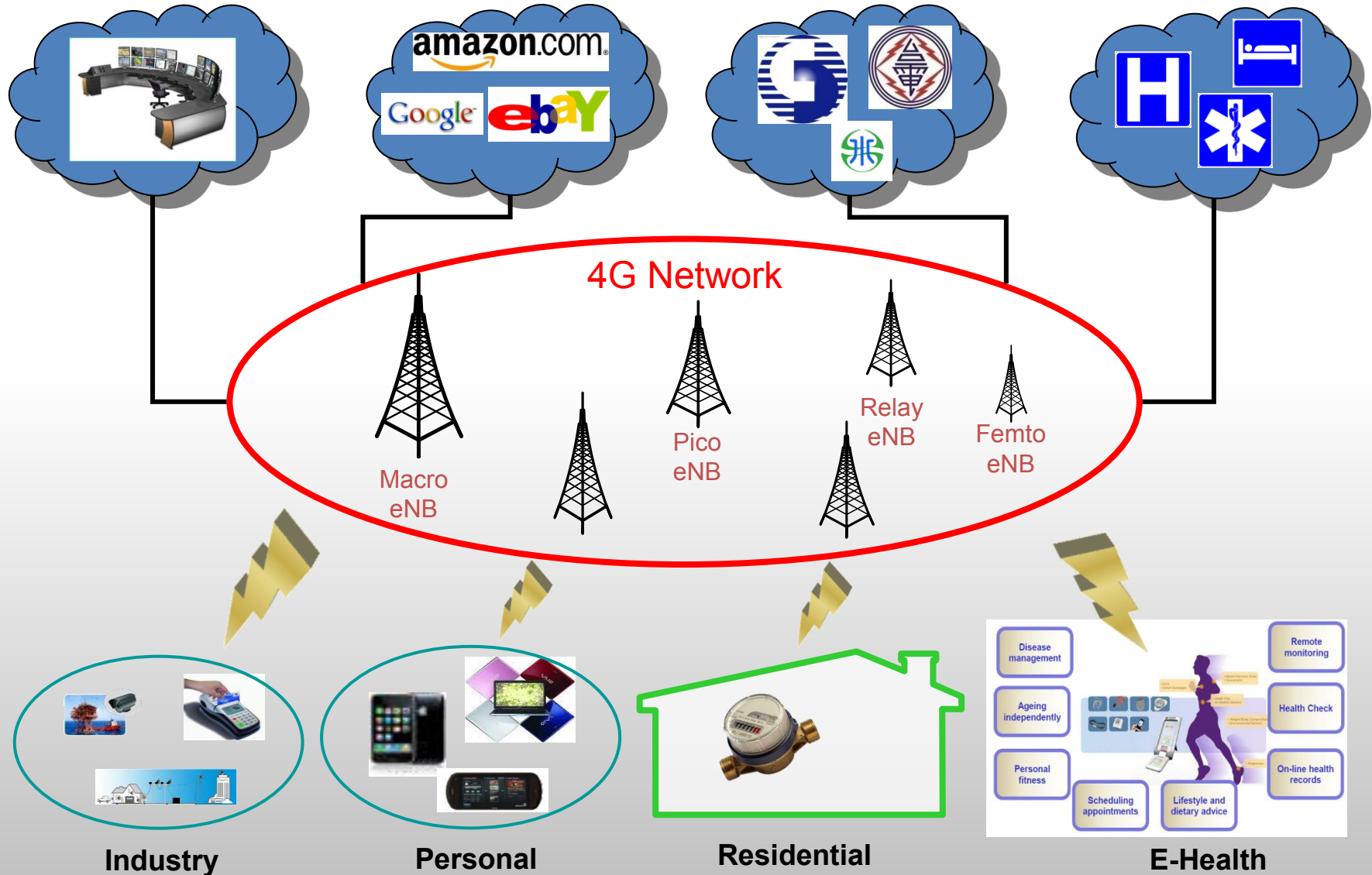
<i>Bands</i>	<i>Deployments and plans</i>
700MHz	Verizon (USA), with growing momentum in Asia (inc. China, Indonesia, Vietnam, Australia) for harmonisation on this band
800MHz	Vodafone (Germany), with plans in the EU for harmonisation on this band, T-Mobile (Germany), Telefonica (Germany)
850MHz	No deployments; potential trial by SK Telecom
1.5GHz	NTT DoCoMo (Japan)
1.8GHz	CSL (HK), Elisa (Finland), CenterNet (Poland), MobileOne (Singapore), Omnitel (Lithuania), TeliaSonera (Latvia)
2.1GHz	Glo (Nigeria), Metro PCS (USA)
2.6GHz	TeliaSonera (Denmark, Finland, Norway, Sweden, Uzbekistan), CSL (HK), Net4Mobility (Sweden), Telekom Austria (Austria), T-Mobile (Austria), VivaCell (Armenia), EMT (Estonia), Elisa (Finland)

Successful Ecosystem defines Smart Devices



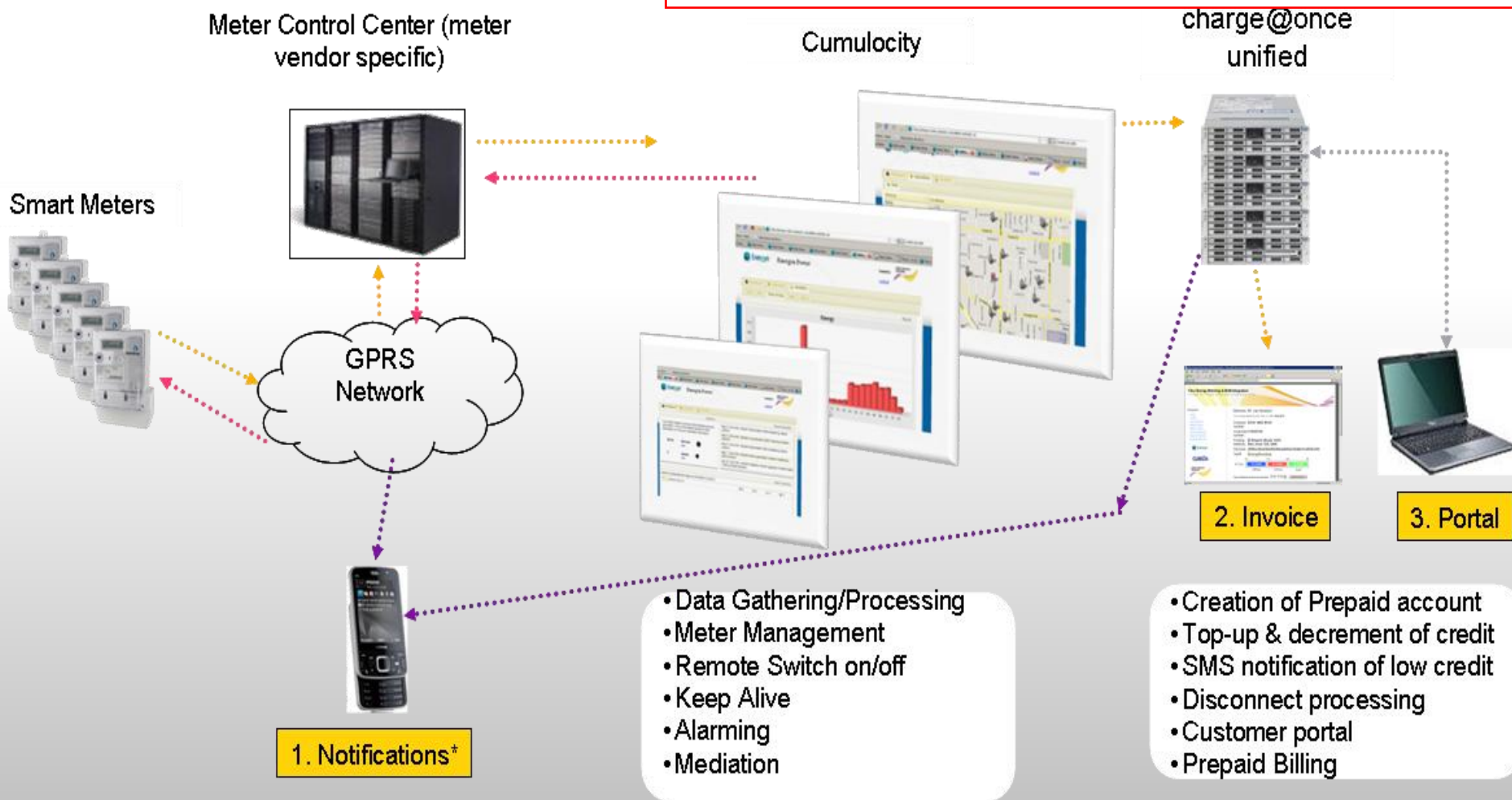
- **Users want:**
Rich, innovative apps/
content
- **Ecosystem owners want:**
Profit potential, Devices,
services, advertising

Mobile Going Broadband Into the Cloud



Delivering M2M Applications with Cloud Application Platform

M2M uses a device (such as a sensor or meter) to capture an event (such as temperature, inventory level, etc.), which is relayed through a network (wireless, wired or hybrid) to an application (software program), that translates the captured event into meaningful information (for example, items need to be restocked).



Executive Summary

- **3C – (Cloud – Connectivity – Client Devices) eco-system**
“Concept” Client Devices will result in different opportunities with different market segments in the coming years.
- **Contents in digital media with its channel & Internet service will be the king.**
- **To establish M2M with cloud concept into Smart Devices**
- **iPhone is more than a device, it is a market for content and apps. The user rather than technology based on QoS and involvement.**
- **Smart Devices Services**
 - Ease of Use**
 - Best Performance/Cost Ratio**
 - Worldwide network services**

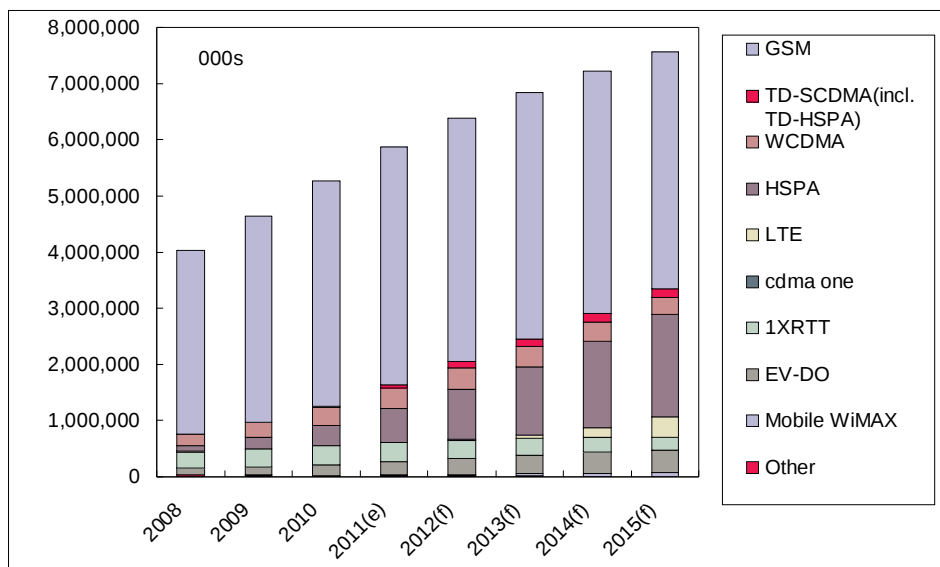
- **There may not be easy to have many spectrum available soon in 4G.**
- **4G/LTE TDD and FDD chipset will continue to be challenging in the handheld devices and fabless IC design due to the multiple antenna with carrier aggregation.**
- **Support for Heterogeneous Networks.**
- **Wireless market needs – Degree of mobility, Roaming, Flat IP, develop from user's perspective.**
- **Higher Capacity and Data-to-User**
 - **from Macro to Simple microcell (Femto), into user centric (smart distributed network). (like getting contents to each person)**

全球4G產業發展趨勢

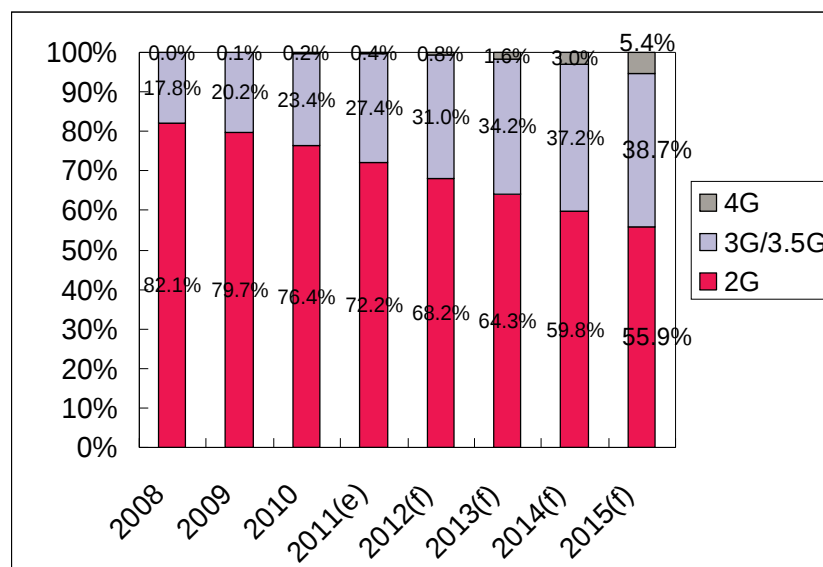
- 全球行動通訊市場發展概況
- 全球LTE產業發展分析
- 全球WiMAX產業發展分析

全球行動通訊用戶仍以2G為主， 3G/3.5G用戶比重持續增加

全球行動通訊用戶數預估



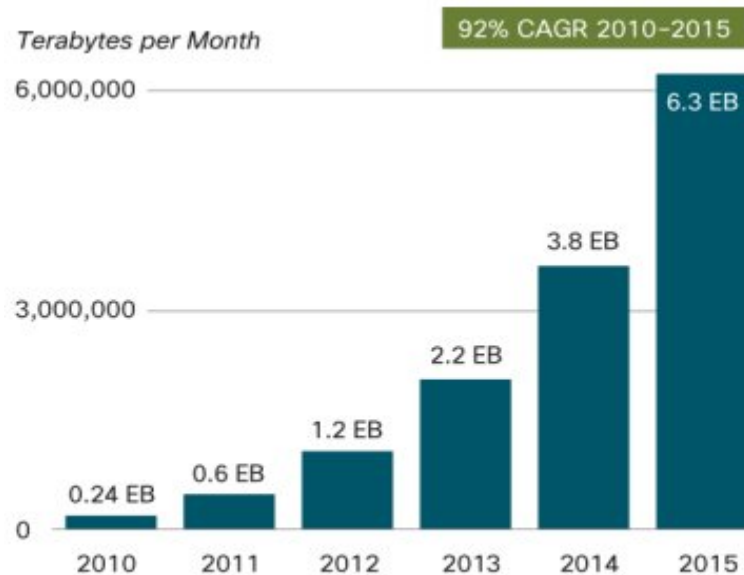
全球行動通訊用戶分類-依2G/3G/4G分類



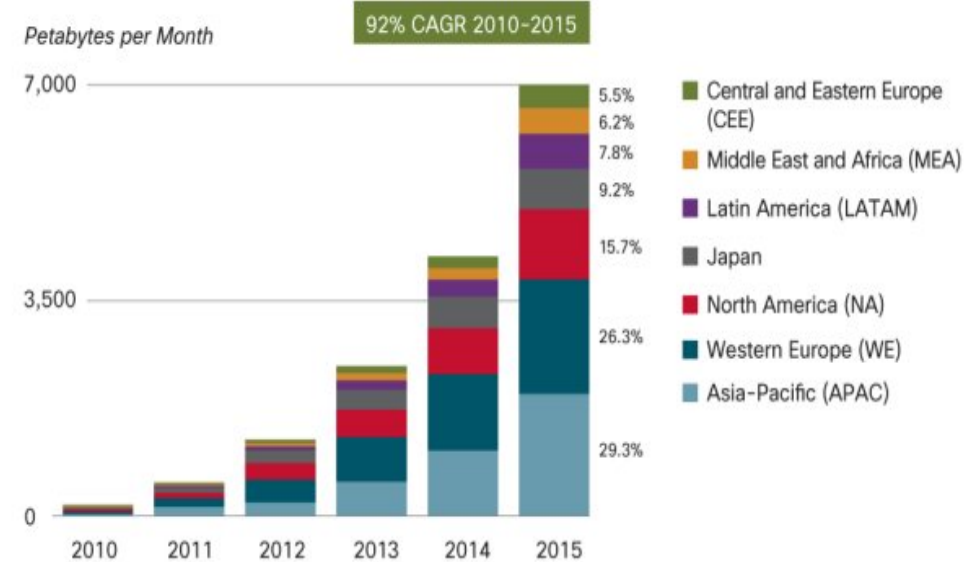
- 2011年全球行動通訊用戶為58億戶，年成長率為11.4%，其中GSM用戶所占比重仍為最高，約占72%。預估2015年全球行動通訊用戶將達到75億戶，雖然GSM所占比重仍為最高，但已下降為56%
- 從2008~2015年全球行動通訊用戶所使用的技術來看，2G所占比重正逐漸下滑，取而代之的為3G/3.5G和4G，這也顯示出行動數據服務需求正快速成長

Cisco預測：2015年全球行動數據流量將比2010年成長26倍

全球行動數據流量預估



全球行動數據流量分佈區域



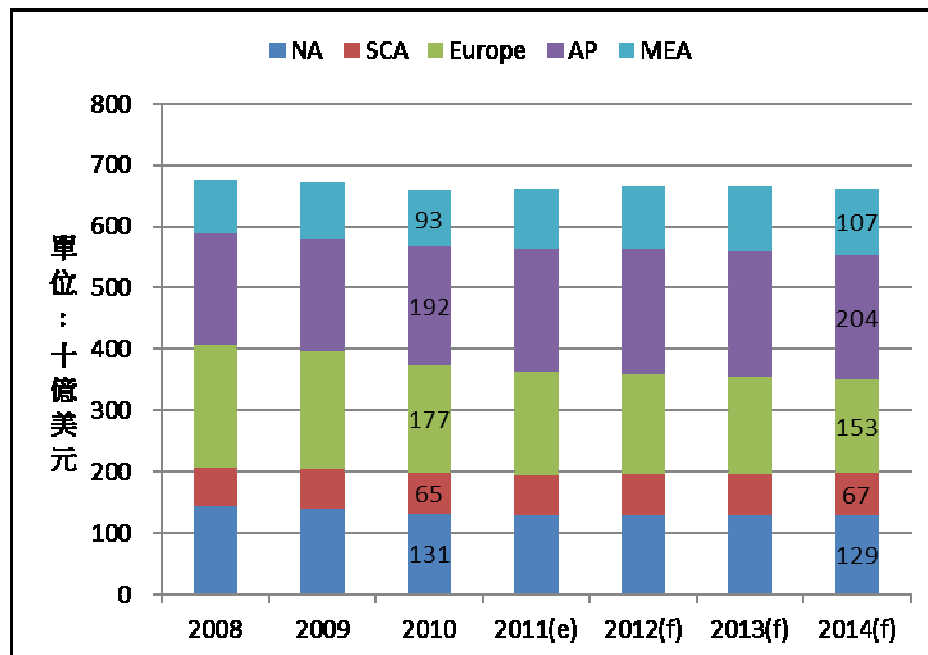
Source: Cisco VNI Mobile, 2011

- 根據Cisco年度發布的「視覺網路指標(Visual Networking Index, VNI)」2010年至2015年全球行動數據流量預測指出，行動影音服務的普及加上行動網路裝置(平板電腦、智慧型手機等)需求大幅成長的帶動下，2015年的全球行動數據流量將比2010成長26倍(平均複合年成長率高達92%)
- 2015年亞太(29.3%)和西歐(26.3%)每个月的行動流量將占全球一半比重
- 以成長率來看，中東與非洲將成為行動流量成長率最高地區，以平均複合成長率129%居冠，其次為拉丁美洲111%、亞太101%

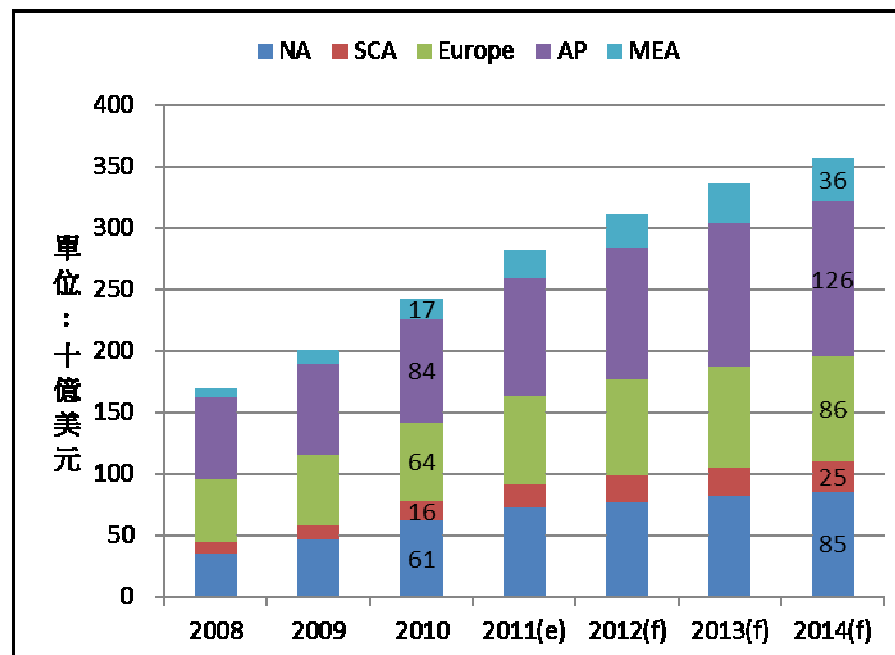
資料來源：Cisco(2011/06)

數據營收成為營運商主要成長動能

WW Voice revenue



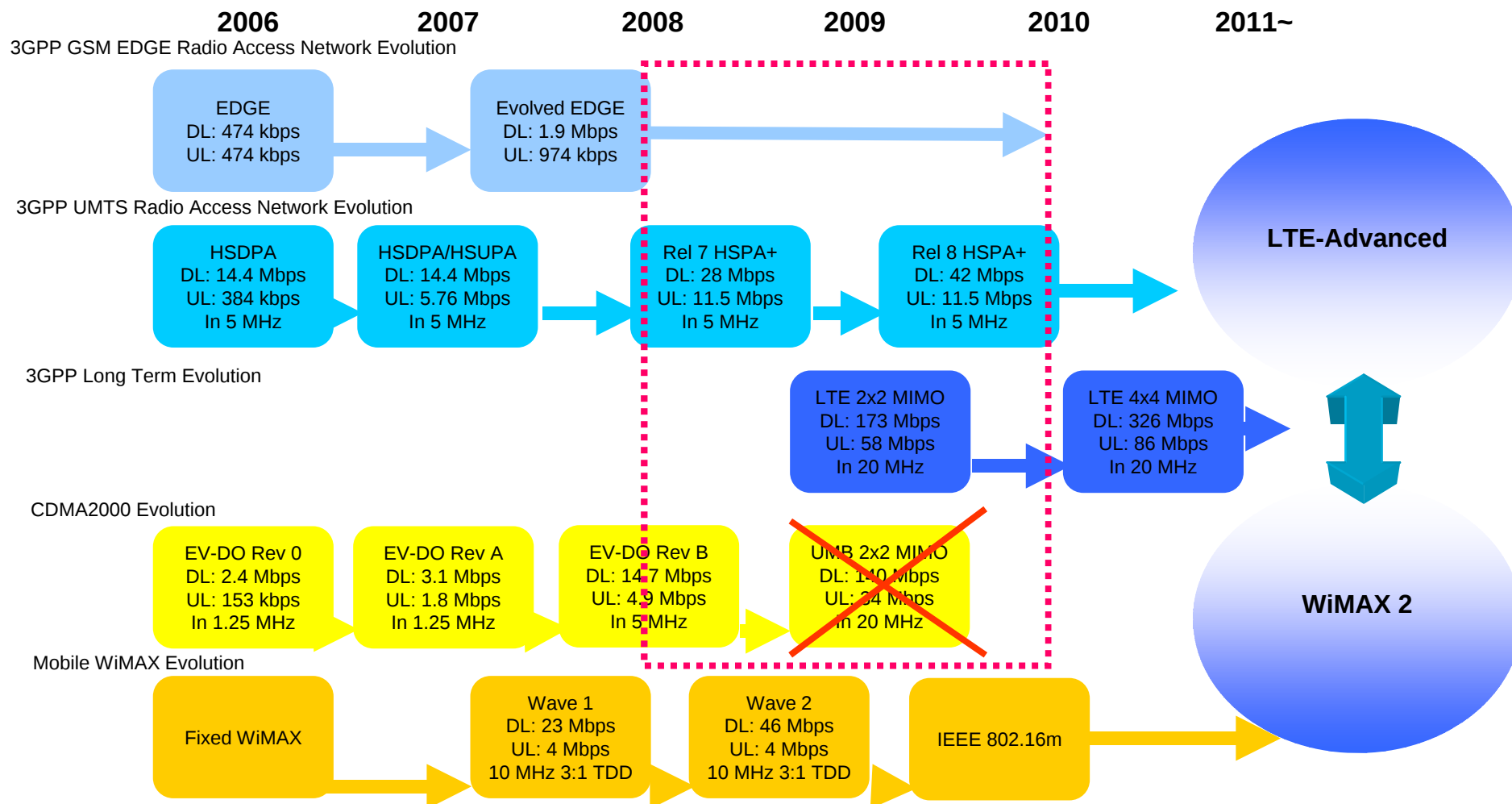
WW Data revenue



- 2010年全球行動電話服務達到9,006億美元。其中語音為主要獲利來源，總計約創造6,584億美元，佔比73%；而數據營收則在2,422億美元，佔比27%
- 2014年全球行動電話服務達到1兆163億美元。其中語音比重下滑至65%，總計約創造6,597億美元；而數據營收則在3,566億美元，佔比35%

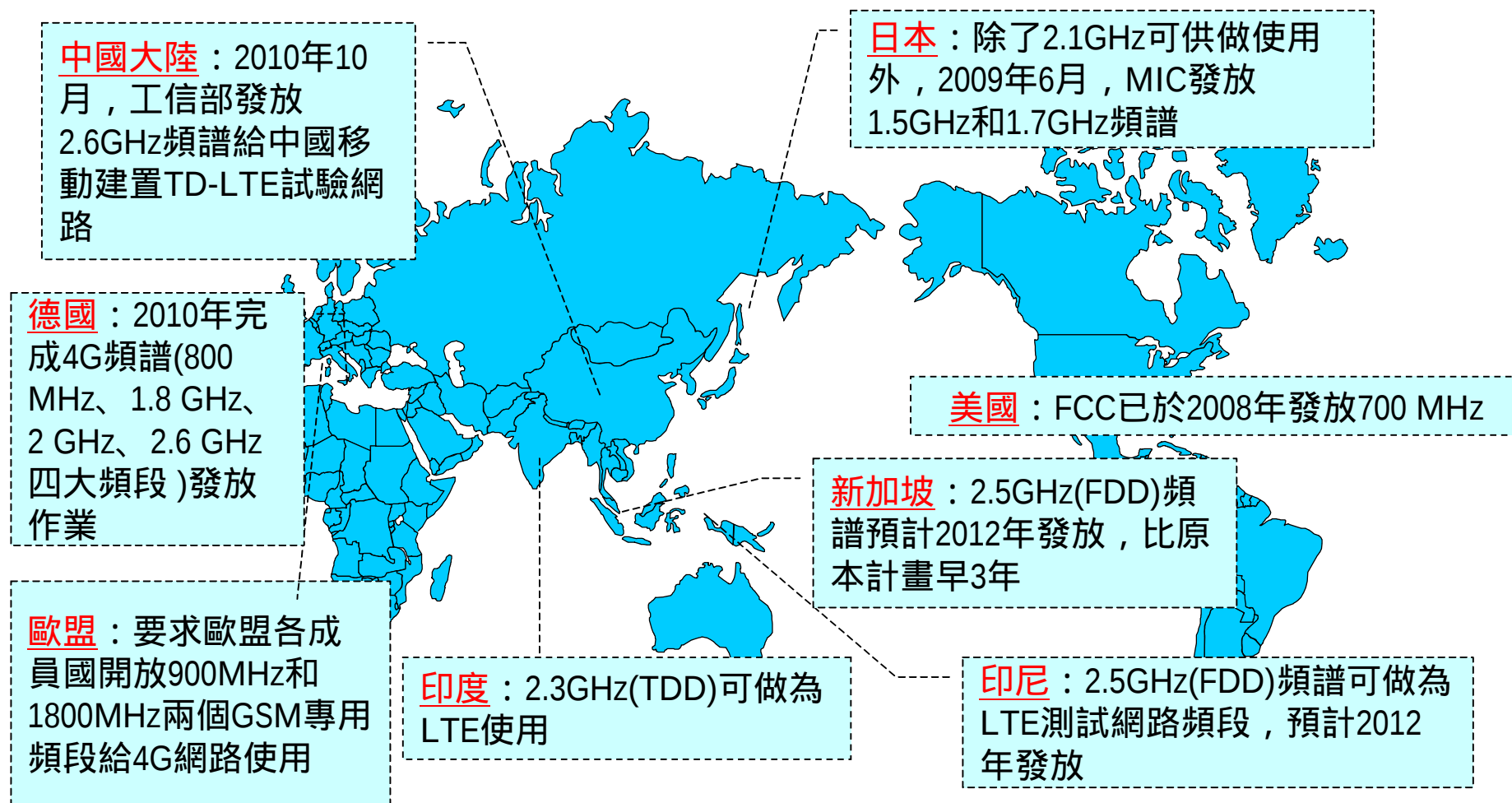
資料來源：Ovum；工研院IEK(2011/06)

4G網路競爭正式啟動



資料來源：GSA；工研院IEK(2011/06)

各國政府釋放頻譜的態度轉為積極

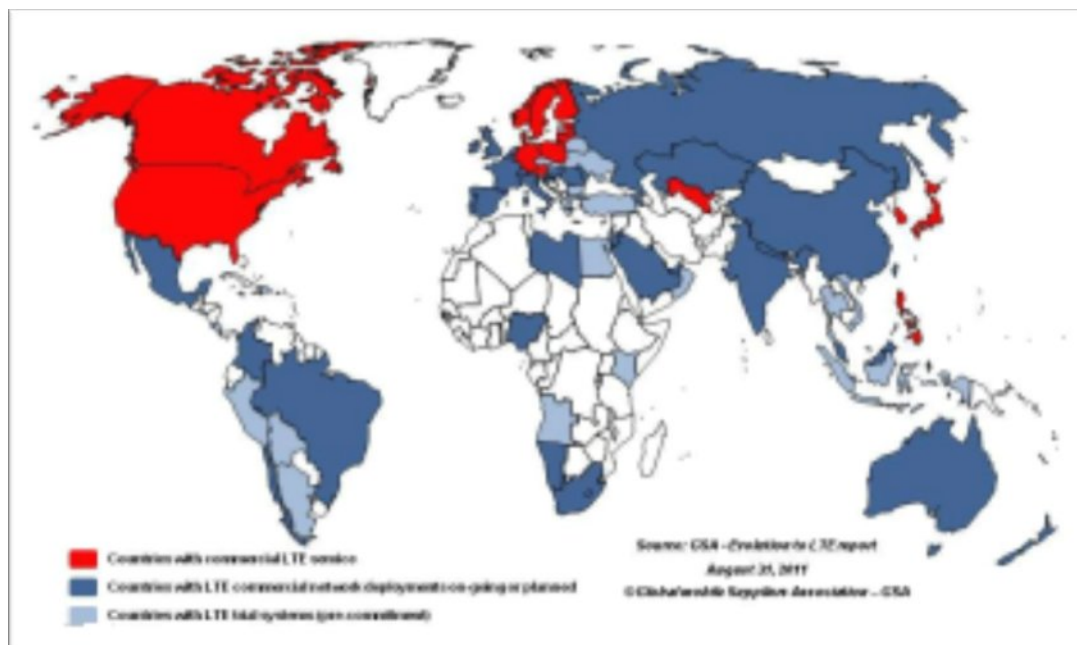


700MHz、900MHz、1.5GHz、1.7GHz、2.1GHz、2.3GHz、2.5GHz、2.6GHz

資料來源：各國家、Ovum；工研院IEK(2011/10)

2011年8月全球已有26個商用化LTE網路

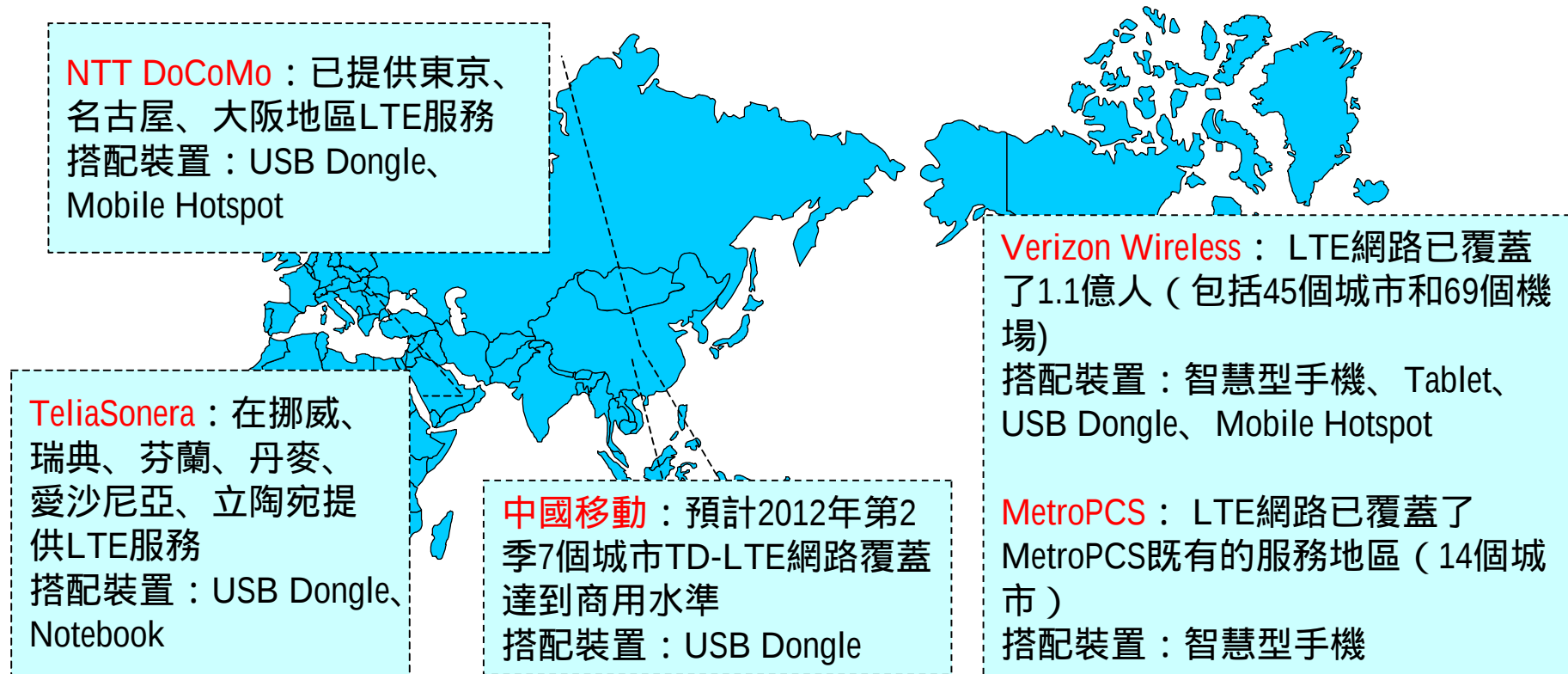
- ❑ 2011年8月，全球已有237個營運商在85個國家投入LTE建置，其中LTE FDD共計225家，TD-LTE則有12家
- ❑ 目前全球已有26個LTE網路商用化，且都以FDD為主
- ❑ 2012年前至少會有93個LTE網路商用化，其中LTE FDD有87家，TD-LTE則有6家



Country	Operator	Launched
Norway	TeliaSonera	15.12.09
Sweden	TeliaSonera	15.12.09
Uzbekistan	MTS	28.07.10
Uzbekistan	UCell	09.08.10
Poland	Mobyland & CenterNet	07.09.10
USA	MetroPCS	21.09.10
Austria	A1 Telekom Austria	05.11.10
Sweden	TeleNor Sweden	15.11.10
Sweden	Tele2 Sweden	15.11.10
Hong Kong	CSL Limited	25.11.10
Finland	TeliaSonera	30.11.10
Germany	Vodafone	01.12.10
USA	Verizon Wireless	05.12.10
Finland	Elisa	08.12.10
Denmark	TeliaSonera	09.12.10
Estonia	EMT	17.12.10
Japan	NTT DoCoMo	24.12.10
Germany	Deutsche Telekom	05.04.11
Philippines	Smart Communications	16.04.11
Lithuania	Omnitel	28.04.11
Latvia	LMT	31.05.11
Singapore	M1	21.06.11
South Korea	SK Telecom	01.07.11
South Korea	LG U+	01.07.11
Germany	O2	01.07.11
Canada	Rogers Wireless	07.07.11

資料來源：GSA；工研院IEK(2011/10)

LTE服務初期以人口集中地區為主， 搭配裝置以USB Dongle/Mobile Hotspot為主



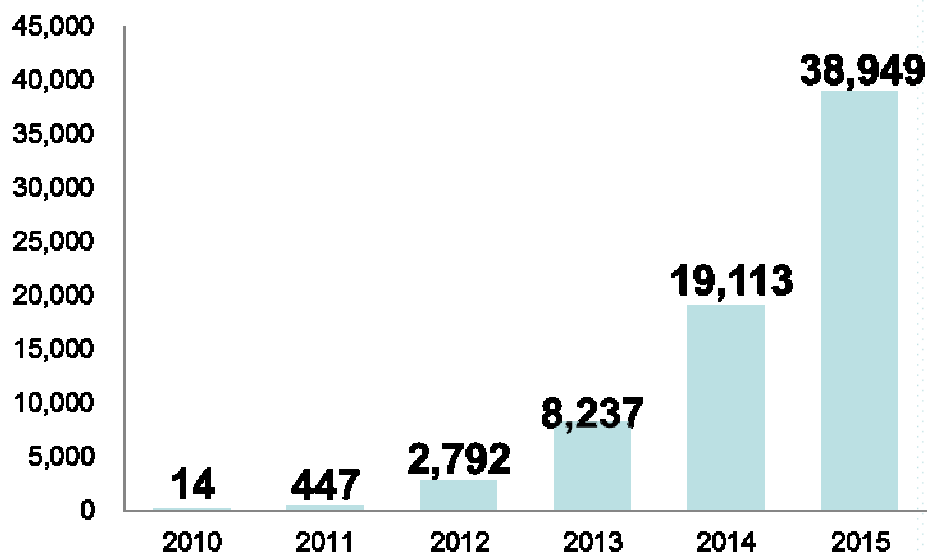
- ❑ LTE營運商初期以提供人口集中地區為主，再逐漸往其他地區擴展
- ❑ 目前營運商提供搭配的LTE裝置包括USB Dongle、Mobile Hotspot、智慧型手機、Tablet、Notebook。LTE提供數據服務，語音服務由3G提供
- ❑ 營運商服務模式從「吃到飽」轉變為「以量計價」模式，例如Verizon Wireless的LTE上網服務費率為20美元/1GB

資料來源：各國家、Ovum；工研院IEK(2011/10)

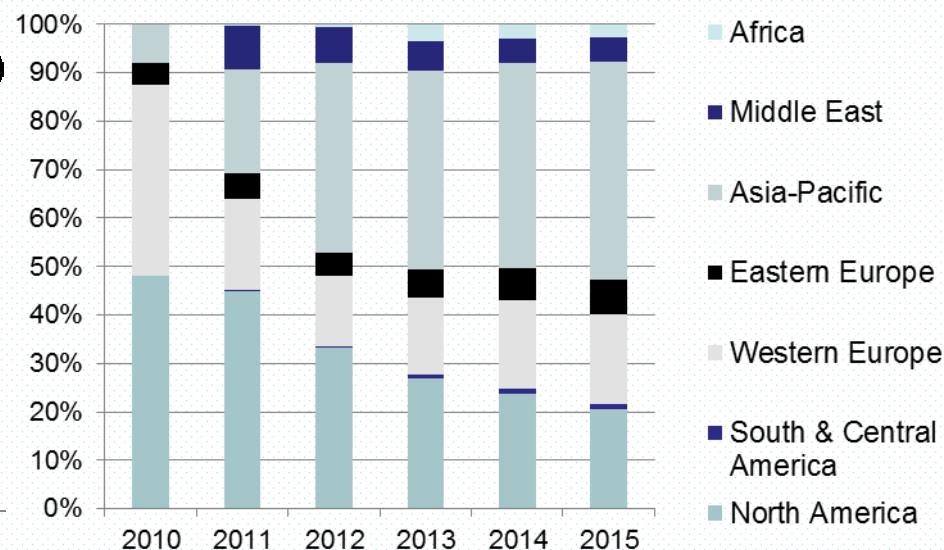
2011年全球LTE用戶可達400萬戶以上，多集中在北美、西歐、亞太地區

- 2011年全球LTE用戶將達到447萬戶，以北美所占比重最高，其次則為亞太地區
- 2015年全球LTE用戶可望達到3.89億戶，以亞太地區所占比重最高，其次則為北美和西歐

單位：萬戶 全球LTE用戶統計

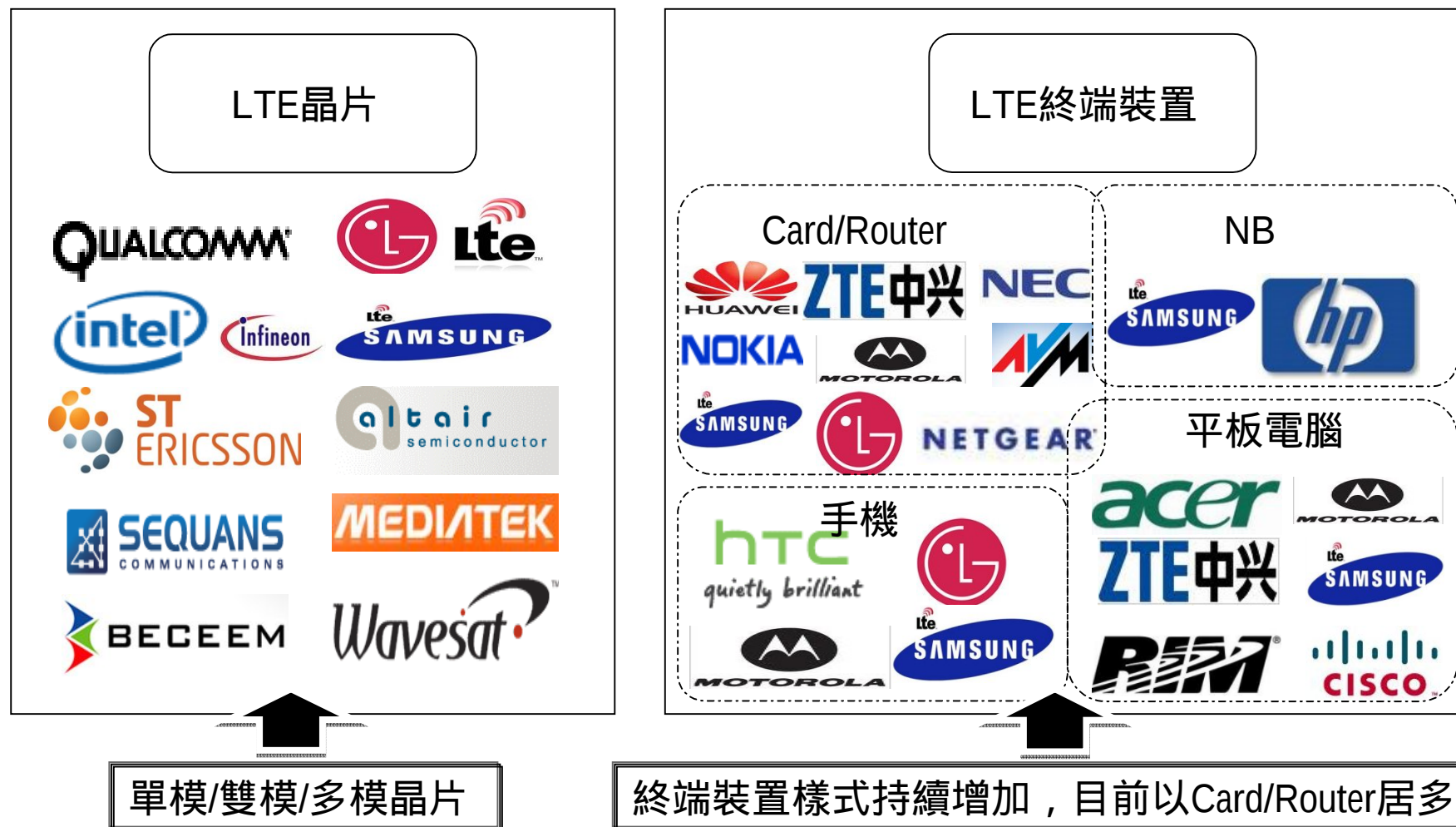


全球LTE用戶分布地區



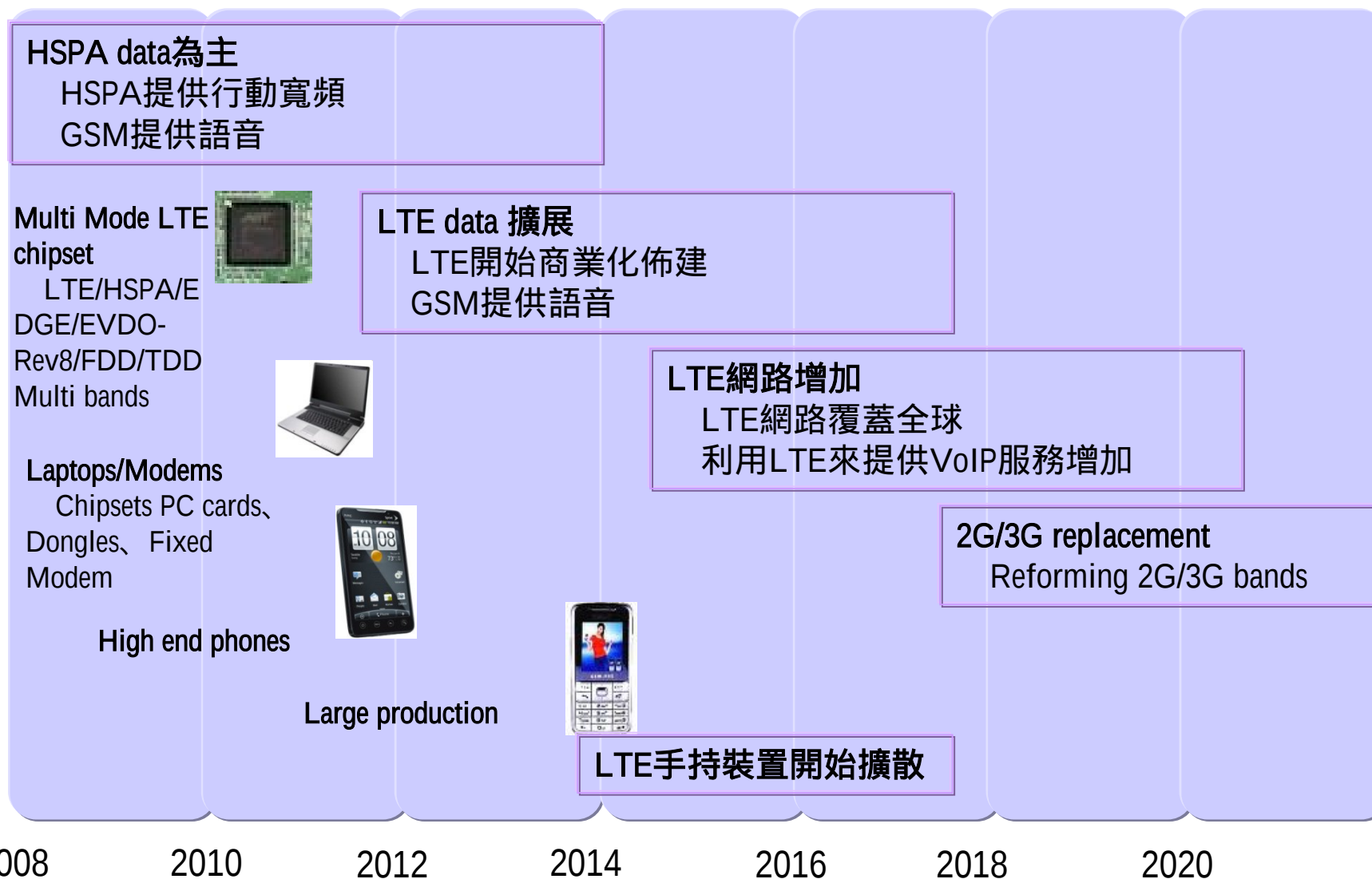
資料來源：Ovum；工研院IEK(2011/10)

晶片與設備商投入者眾，加速LTE服務普及時間點



資料來源：工研院IEK(2011/10)

2012年LTE手持裝置開始普及



資料來源：IDATE，工研院IEK整理（2011/05）

全球約有583個WiMAX網路建置案在150個國家，新增建置案呈現趨緩

2010年5月各區域WiMAX網路建置概況

Region	Deployments	Countries
CALA	116	32
Africa	117	43
Asia-Pacific	113	23
Eastern Europe	85	21
Western Europe	79	17
North America	53	2
Middle East	29	10
Total	598	148

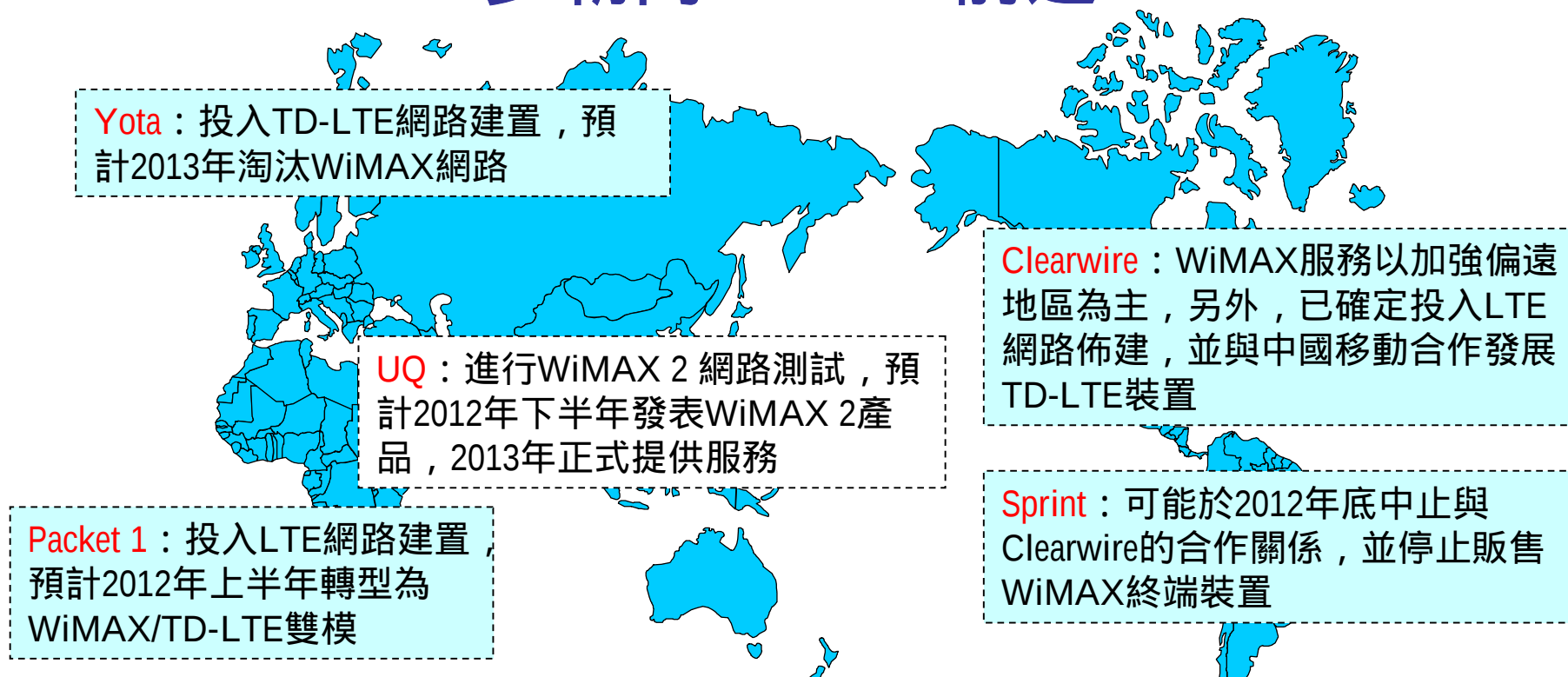


2011年5月各區域WiMAX網路建置概況

Region	Deployments	Countries
CALA	120	33
Africa	117	43
Asia-Pacific	98	23
Eastern Europe	86	21
Western Europe	77	18
North America	56	2
Middle East	29	10
Total	583	150

- ❑ 截至2011年5月，全球共有583個WiMAX網路建置案在150個國家，較2010年同期減少了15個WiMAX網路建置案，主要是因為亞太和西歐地區的營運商暫緩了網路投資或轉往LTE發展
- ❑ 在WiMAX網路建置案中，以中東/拉丁美洲、非洲、亞太地區的建置案最多，目前新增的建置案以中東/拉美和東歐為主

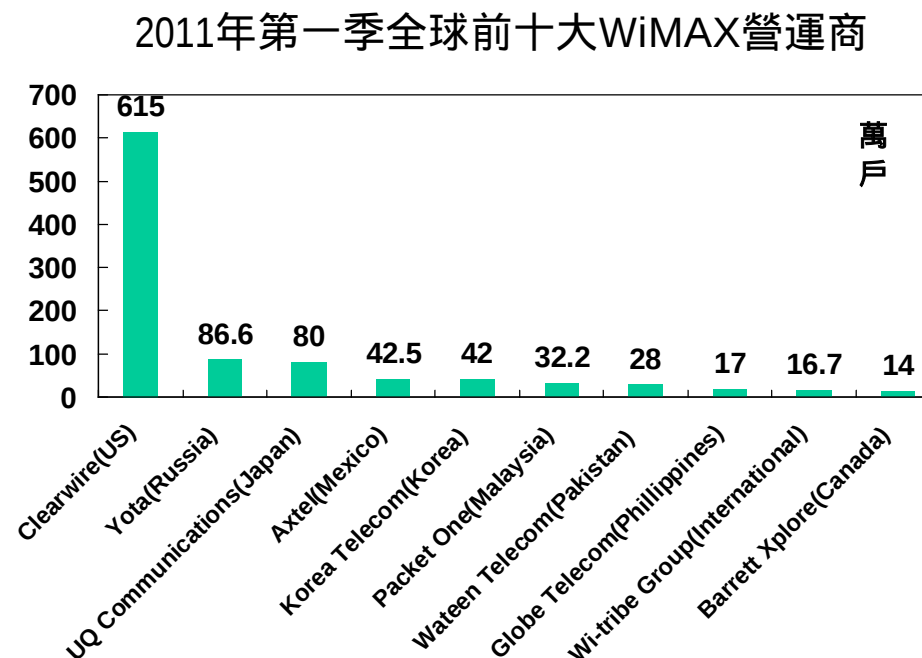
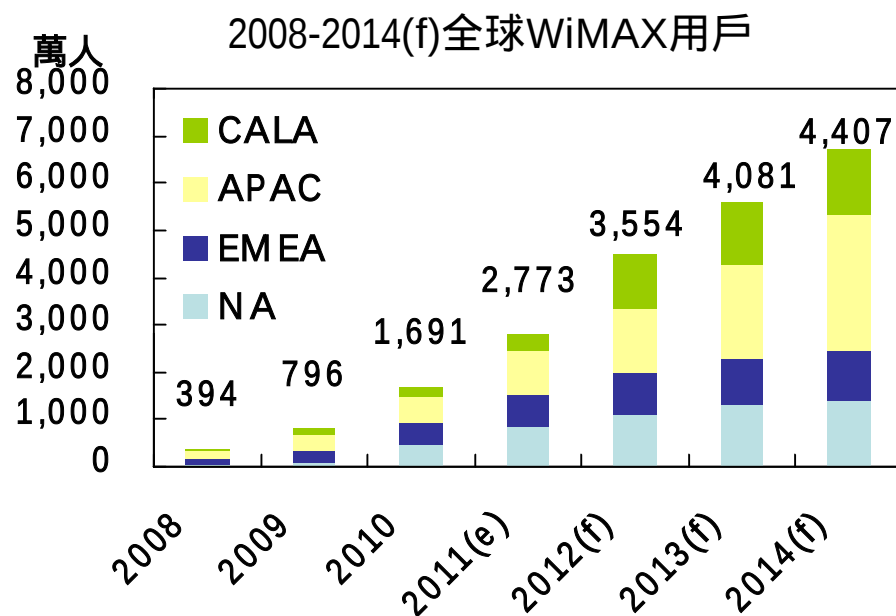
WiMAX營運商陸續改變網路建置策略， 多朝向TD-LTE前進



- ❑ 受到TD-LTE陣營的拉攏下，部分WiMAX營運商陸續轉變網路建置策略，目前Yota、Packet 1、Clearwire皆已確定投入LTE網路建置，並預期2012年開始提供服務，其中過渡時期將以WiMAX/TD-LTE雙模經營
- ❑ 目前僅有UQ Communications開始進行WiMAX 2網路測試，計畫2012年內在東京完成WiMAX 2 基地台佈建，2013年正式提供WiMAX 2網路服務

資料來源：各公司；工研院IEK（2011/10）

全球WiMAX用戶成長數將逐步趨緩



- ❑ Sprint預計於2012年停止與Clearwire合作關係，此將影響到Clearwire未來WiMAX用戶的成長概況，另外，亞太市場包括印度、印尼、南韓、菲律賓等國家的WiMAX用戶成長緩慢，故預估2011年全球WiMAX用戶僅會達到2,773萬戶
- ❑ 2011年第1季，Clearwire所擁有的WiMAX用戶為全球第一大（615萬戶），其次則為Yota和UQ Communication

資料來源：Infonetics、Ovum、Maravedis；工研院IEK（2011/10）

部份WiMAX晶片/設備業者暫緩WiMAX業務， 重心轉向LTE單模/雙模

晶片業者	
Broadcom	推出同時支援WiMAX和TD-LTE的雙模晶片(BCS500)，預計2011年量產
Sequans	- 維持WiMAX在智慧型手機的業務 - 將80%的研發投入WiMAX和LTE雙模晶片 - 積極尋找LTE測試網路合作機會，目標客戶放在美國、中國和印度，中國移動採用其TD-LTE晶片在上海世博會進行示範網路
GCT	推出WiMAX 2(GDM7225)晶片，目前正和UQ進行測試

雙模 / WiMAX 2晶片

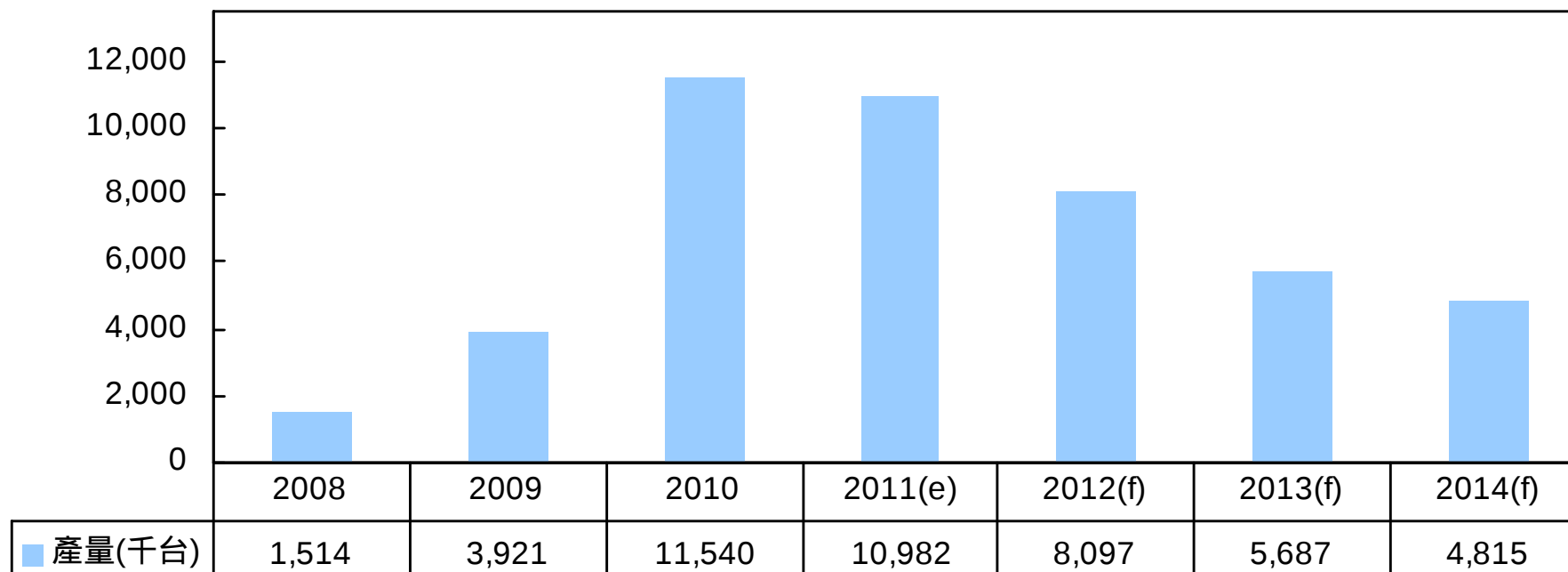
設備業者	
NSN	WiMAX業務以維持為主
HTC	持續與Sprint、KDDI合作，推出WiMAX智慧型手機
Samsung	- 與Sprint合作，推出Epic 4G - 投入WiMAX 2設備開發
Huawei	- 維持WiMAX業務 - 佈局新興市場（非洲、菲律賓）
Alvarion	佈局新興市場（墨西哥、烏克蘭、安哥拉）

- WiMAX業務以維持為主
- 市場重心轉移至新興市場

資料來源：各公司，工研院IEK整理（2011/10）

WiMAX終端設備市場面臨下滑挑戰

2008-2014全球WiMAX終端設備市場統計

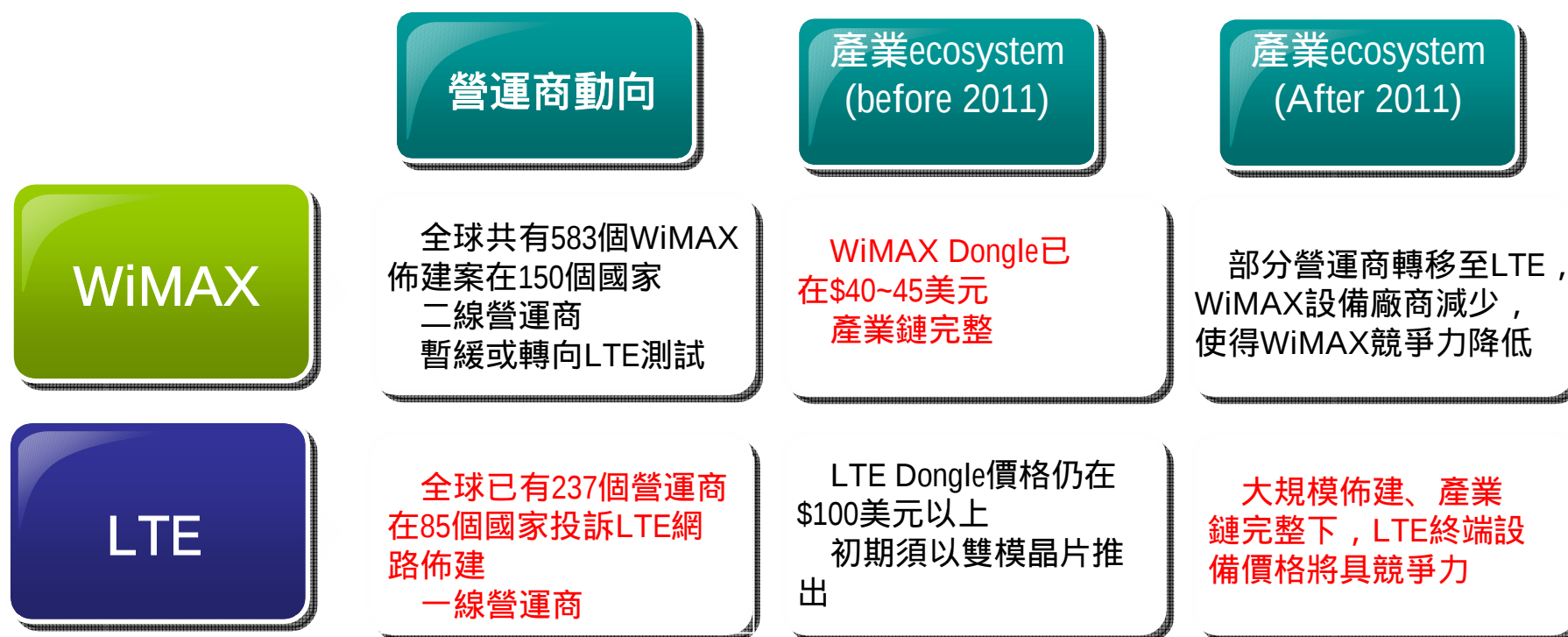


註：產量統計範疇包括WiMAX CPE、Dongle、模組和WiMAX手機

- 受到LTE技術和產品逐漸成熟，部分營運商放緩了WiMAX網路的建置，2011年所幸在北美Clearwire、墨西哥Axtel、日本UQ Communications等營運商的用戶數穩定成長下，2011年全球WiMAX終端設備產量將為1,098萬台，其中主要的成長動力來自於WiMAX智慧型手機；但是2012年後，Sprint恐與Clearwire終止合作關係，此將對於WiMAX終端設備出貨量造成負面影響

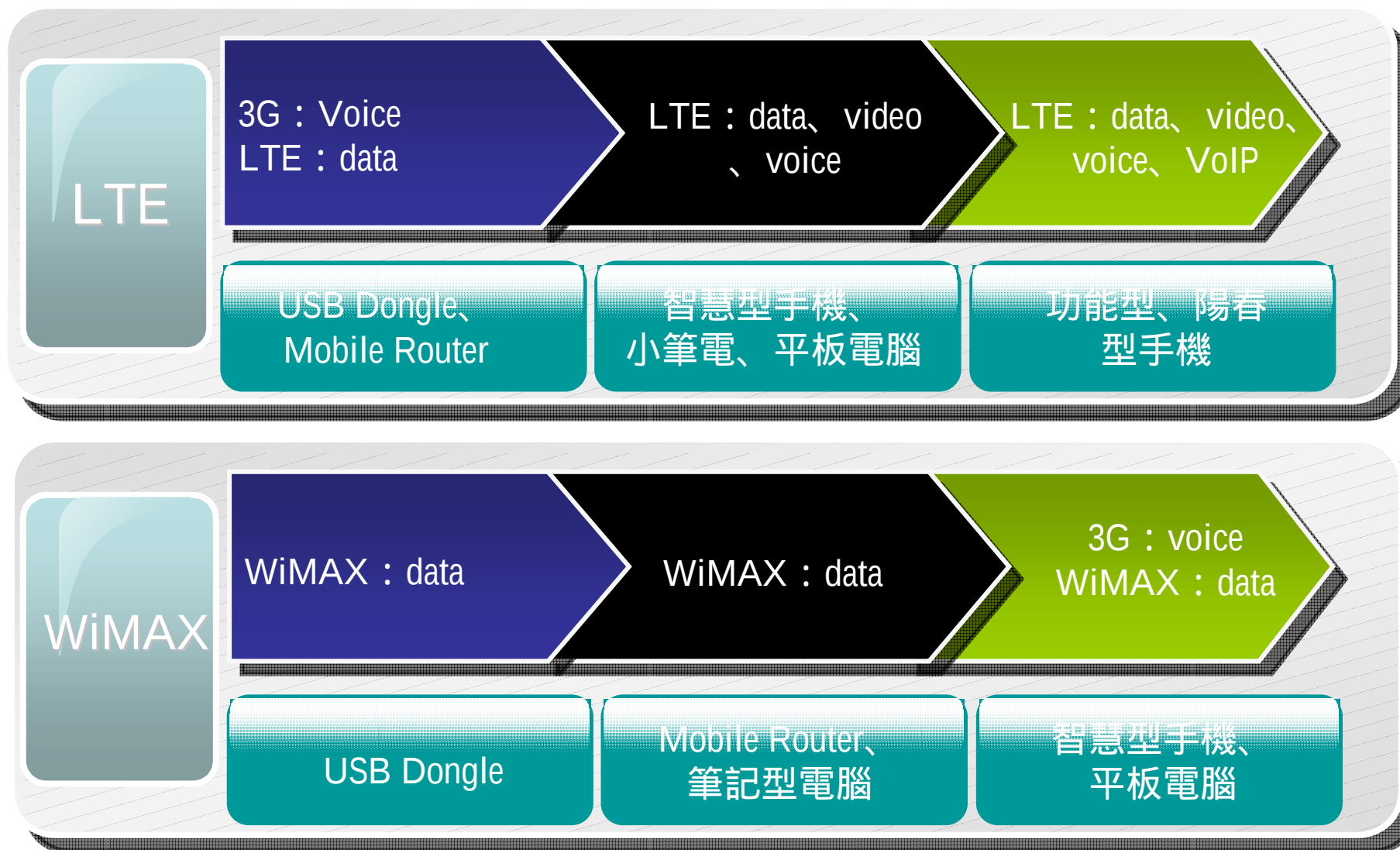
資料來源：工研院IEK（2011/07）

各國營運商陸續投入LTE建置，WiMAX面臨產業鏈鬆動挑戰



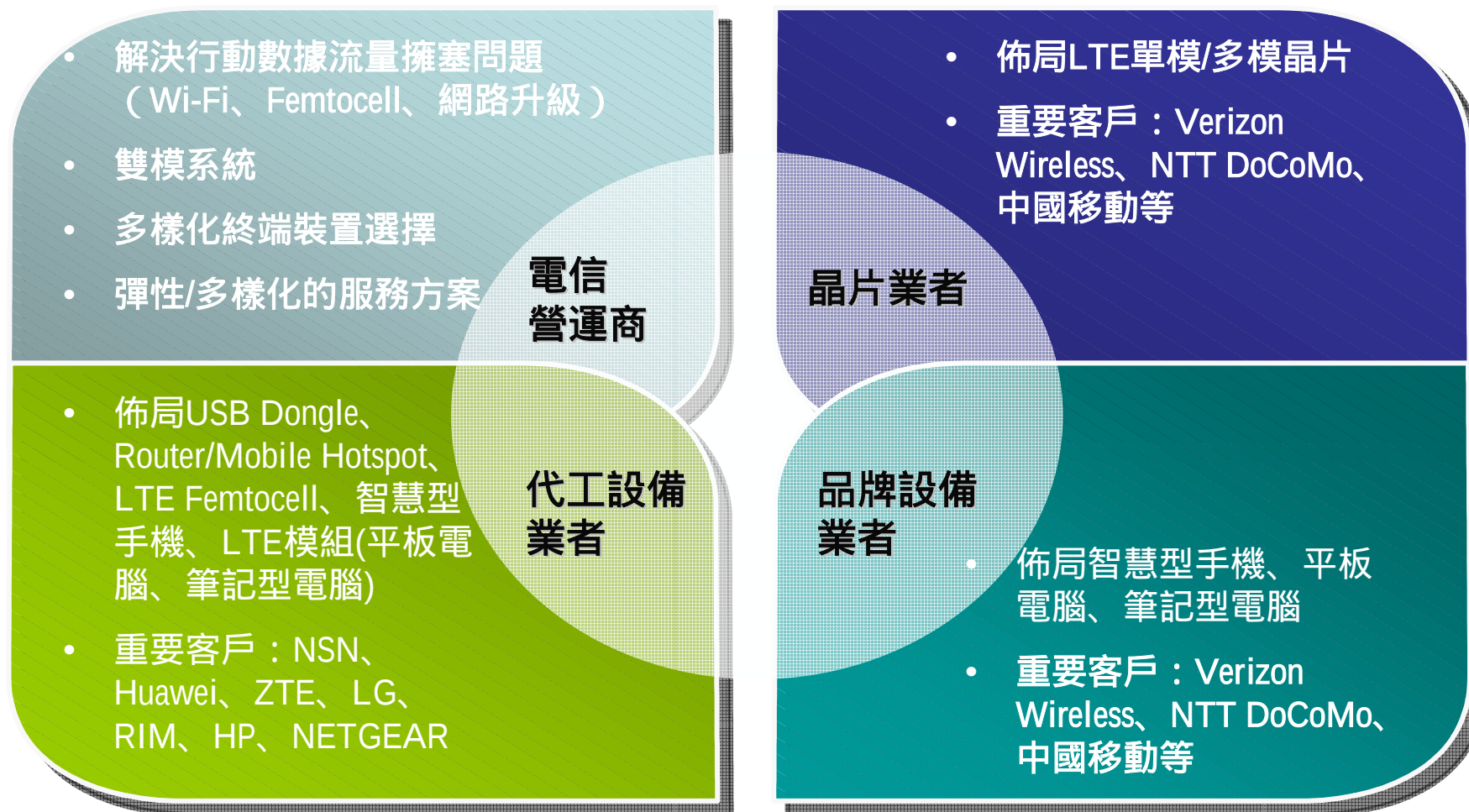
- 2011年5月，全球仍有583個WiMAX網路，倘若營運商要移轉至LTE，雖然局端設備僅需替換Baseband，但既有的用戶端裝置全部都要換掉，且目前WiMAX產業仍擁有較完整的ecosystem，終端設備價格也持續降低，2012年前WiMAX仍有一定市場
- LTE網路仍存在耗電量過高、IOT互通等問題，產業鏈仍要等到2012年才會更加成熟

4G服務內容與搭配裝置發展趨勢



資料來源：工研院IEK(2011/10)

4G產業發展方向

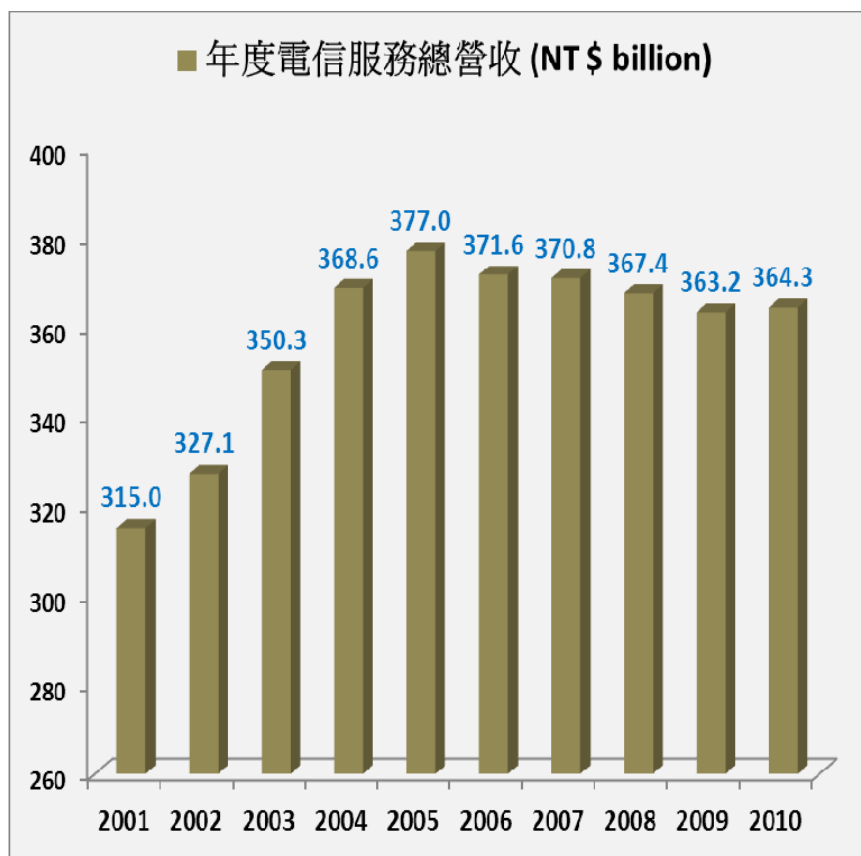


資料來源：工研院IEK (2011/10)

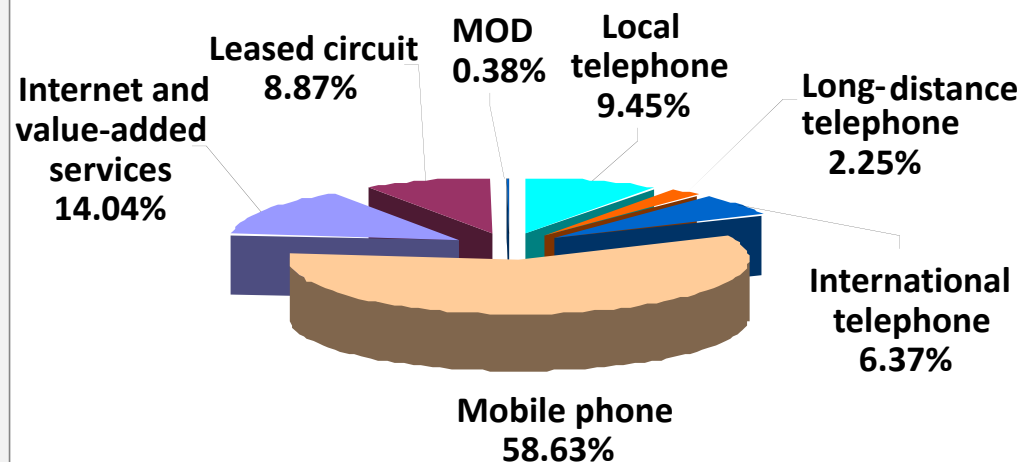
4G發展與挑戰

- 國內行動業務現況與挑戰
- **LTE/LTE-A**技術標準發展
- 全球**LTE**產業現況
- 國內**4G**發展機會與挑戰

台灣電信市場營收

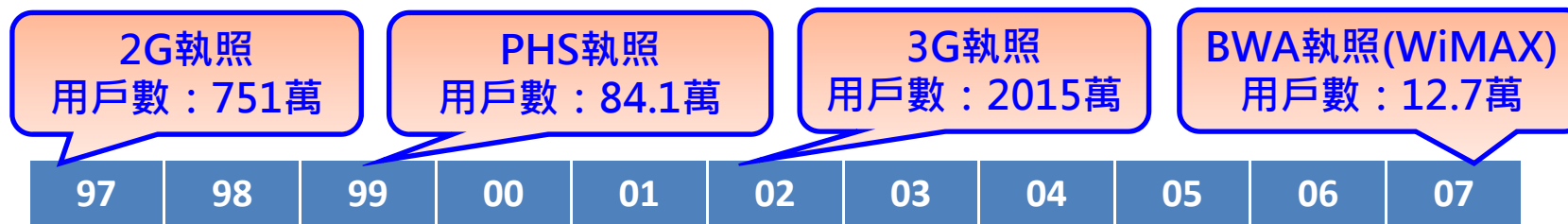


2010電信市場營收分佈



1. 行動語音分鐘數自2007年起超越固網
2. Prepaid用戶約佔總用戶數13.95%@2010

台灣行動業務開放歷程與業者現況



* 3G用戶數在2009Q3超越2G

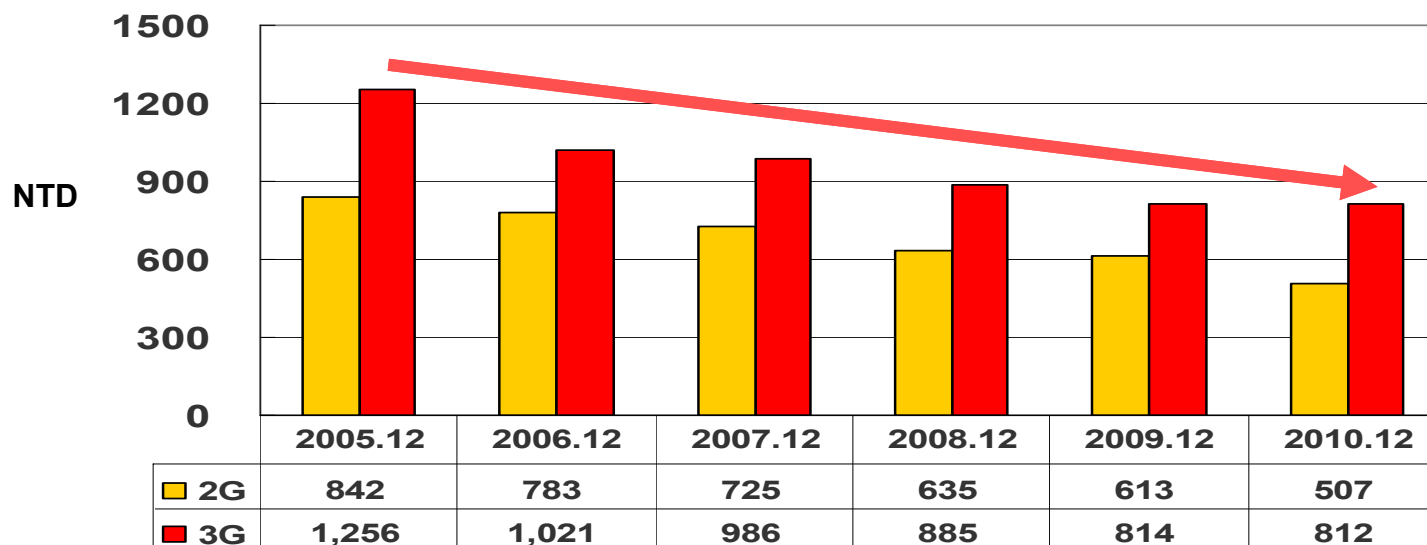


Source: NCC, 2011/9

台灣行動通信營收現況

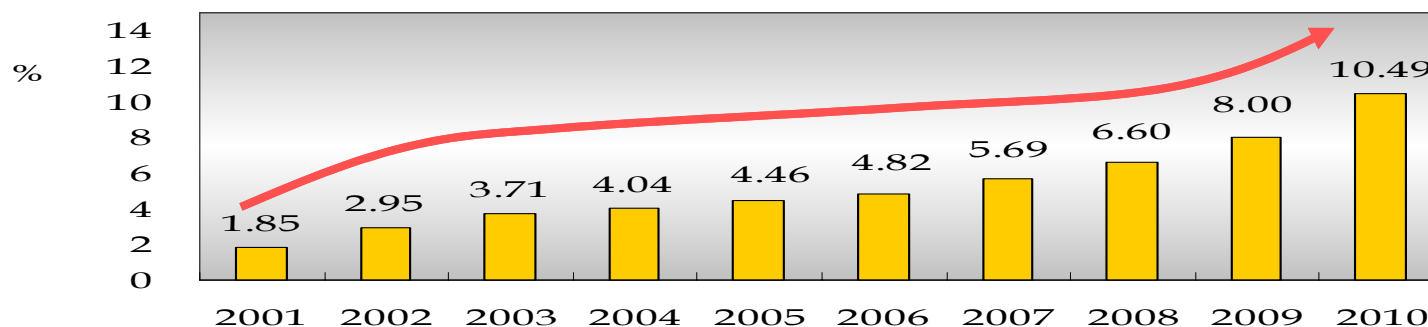
話務及數據訊務持續增加，但ARPU逐年降低!

ARPU : Average Revenue Per User



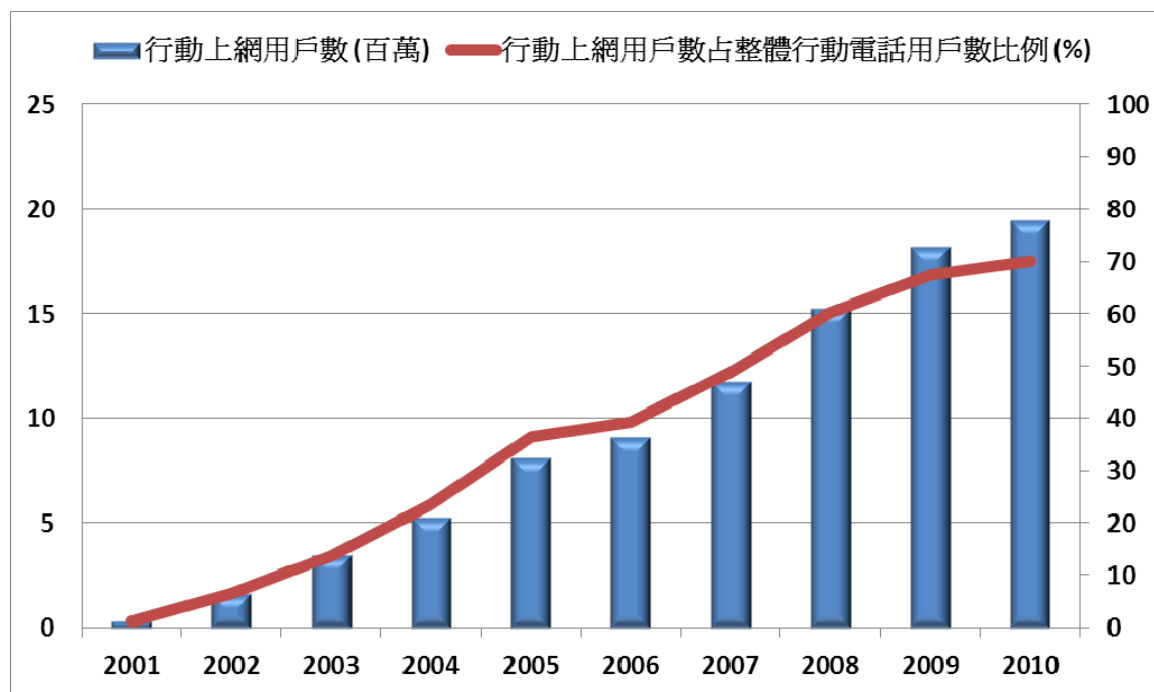
* Figures cover only the data of mobile operators who provide both 2G and 3G services

行動數據的營收占行動服務總營收比重逐年提升*



台灣具行動上網能力用戶快速增加

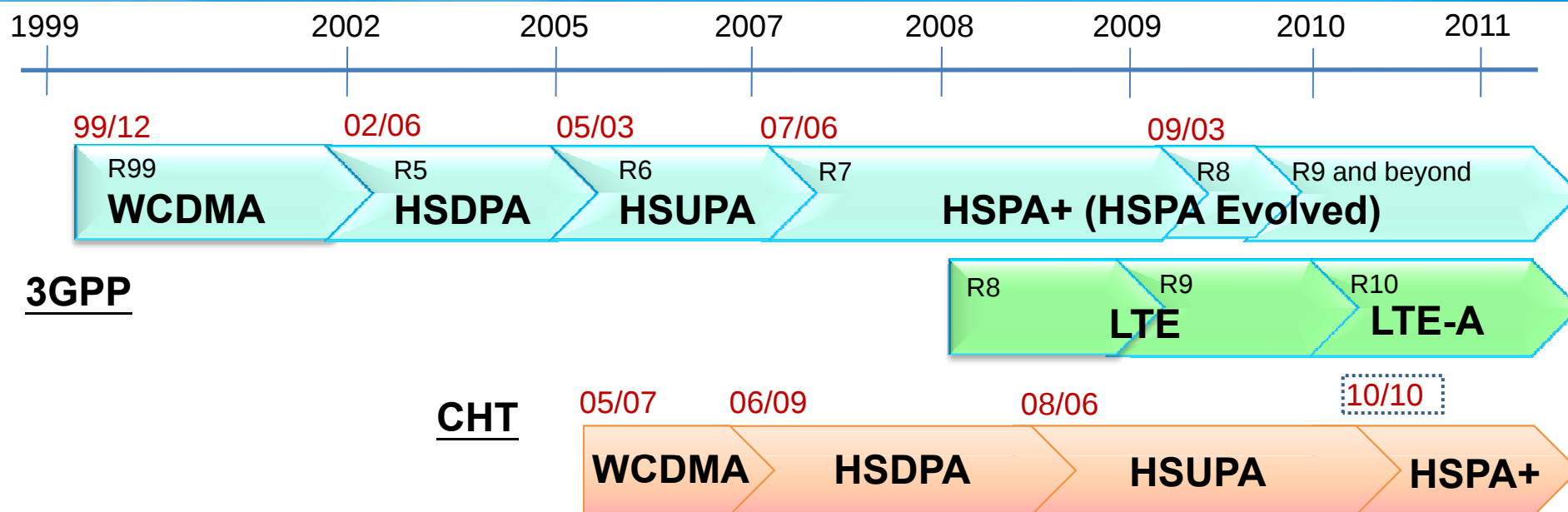
- ✚ 2009年台灣具行動上網能力用戶比例將近70%
- ✚ 低廉的PS費率，加上3G/HSPA寬頻行動網路速率不斷提升，使Smart-phone, Data card用戶快速增加



註：行動上網用戶包含WAP, GPRS, PHS, 3G可使用上網服務之用戶 (Source: NCC)



中華電信行動網路發展歷程



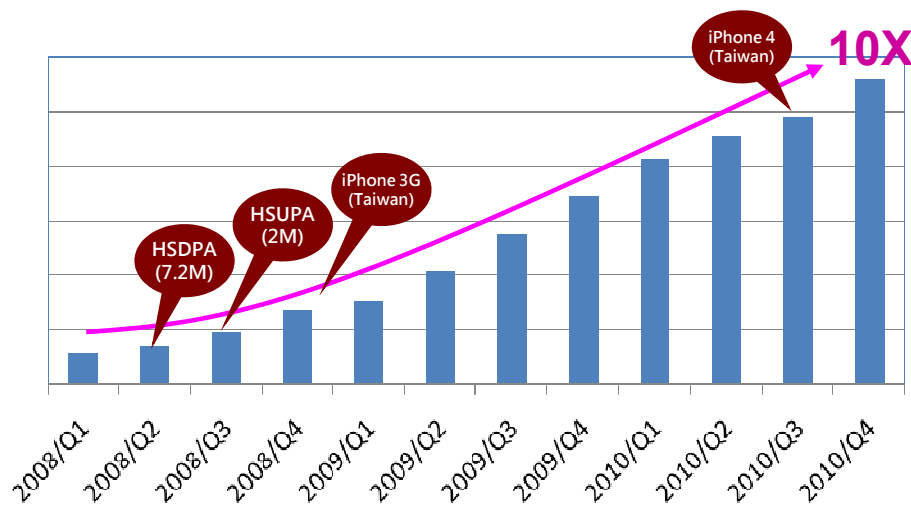
- ✚ 依循3GPP規格演進，中華電信快速引進最新網路技術，提供用戶最佳服務
- ✚ 配合行動寬頻網路升級，中華電信與全球Smartphone領導vendors合作，快速引進高功能UE，提供新穎增值服務
- ✚ 2011年第二季，行動電話客戶數為986萬，年成長4.4%

中華電信行動數據訊務快速成長

Smart-phone, data card用戶快速增加

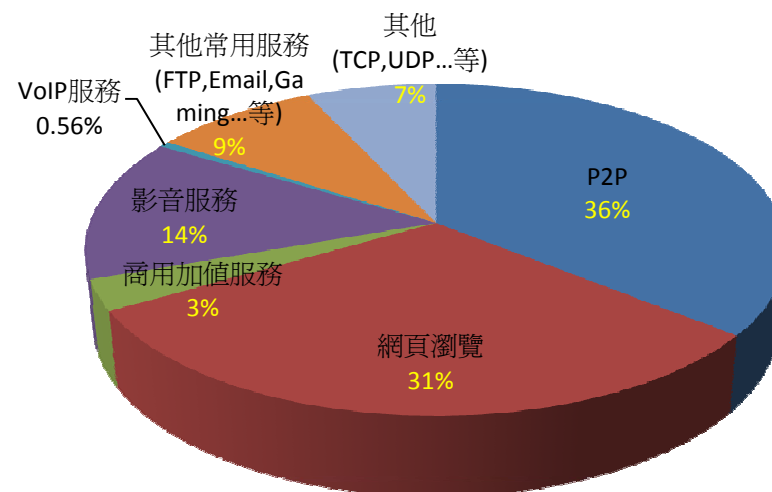


■ 2G+3G Total Data Volume



CHT 3G PS 訊務量過去三年成長10倍

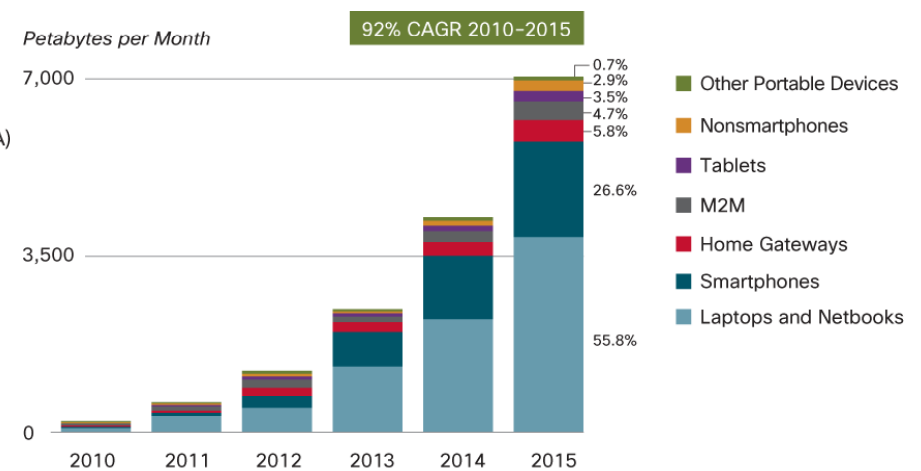
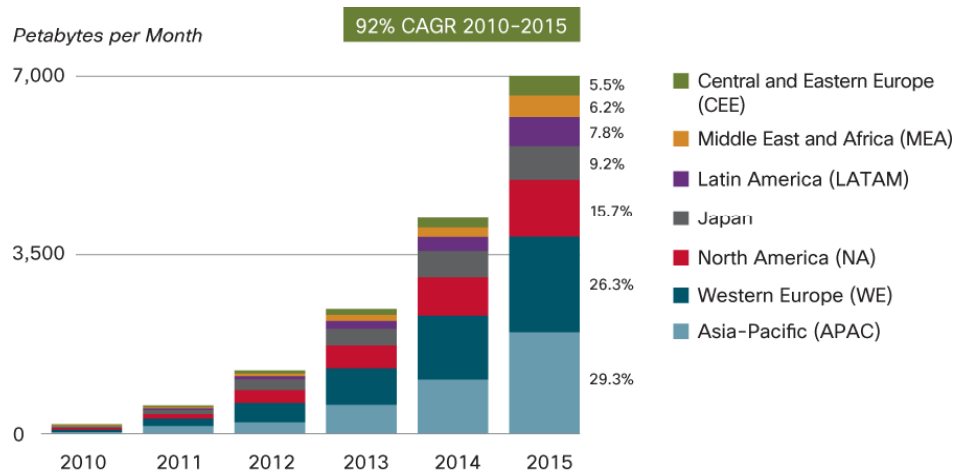
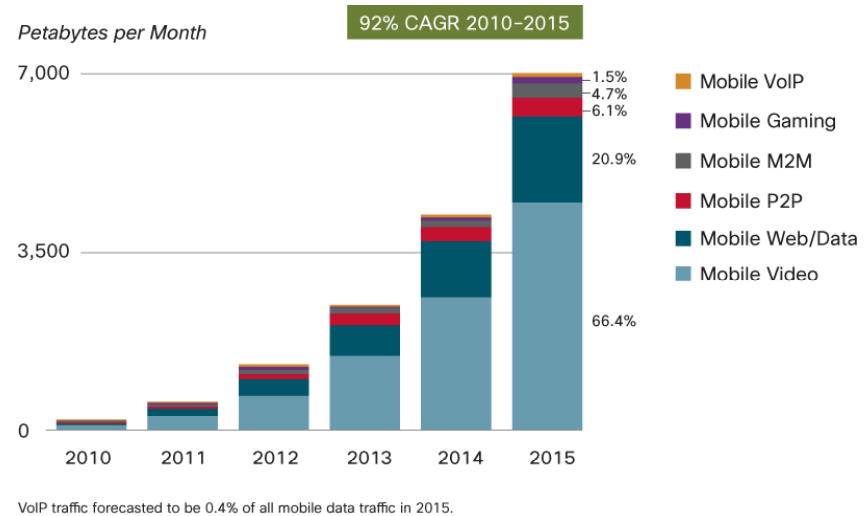
CHT 3G PS Traffic



P2P與Web browsing為主要訊務

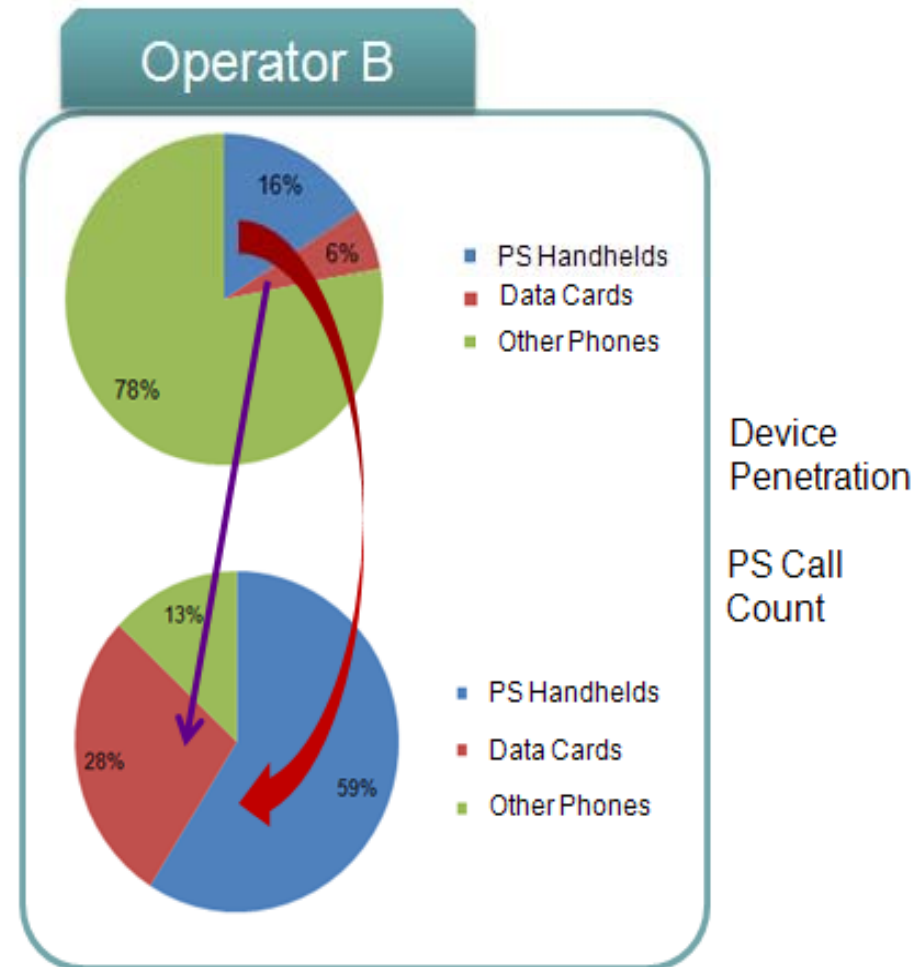
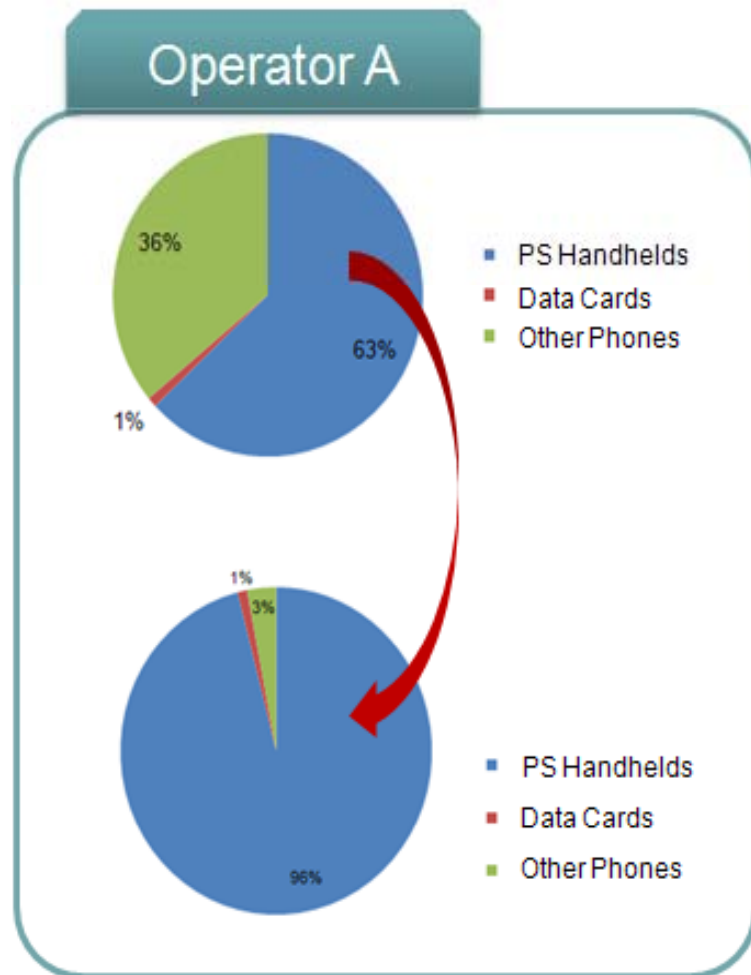
挑戰一：面臨爆炸性訊務成長

- Video will also dominate in mobile communication (66% by 2014)
- Globally, mobile data traffic will reach 2.2 Exabytes per month by 2013 and 6.3 Exabytes per month by 2015.
- Western Europe, Asia-Pacific and North America are the top 3 regions in term of volume.
- Laptop/Netbook is and will be the device that consumes most.
- Traffic migration from fixed to mobile is observed.



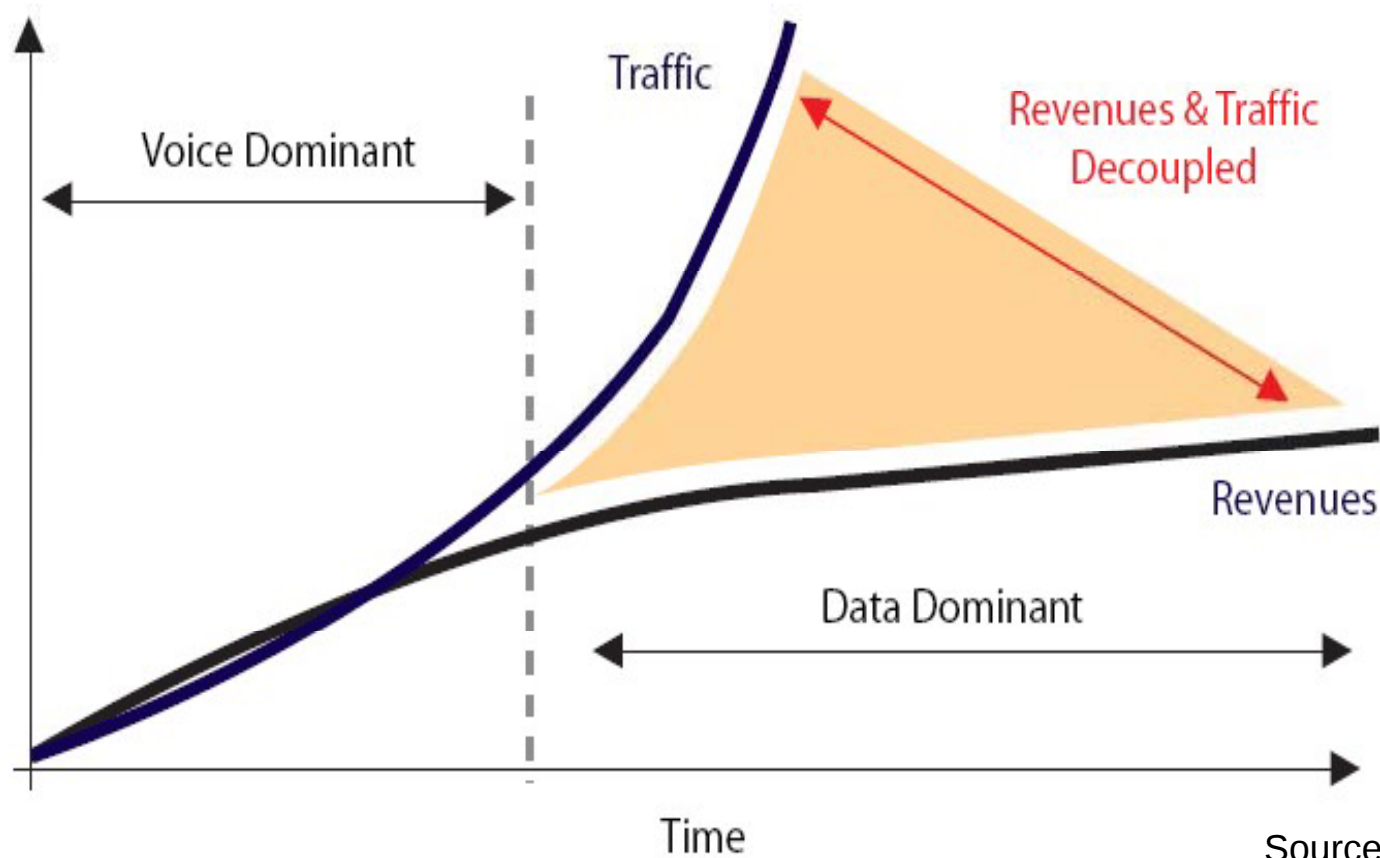
Multiples of bytes					v · d · e
SI decimal prefixes		Binary usage	IEC binary prefixes		
Name (Symbol)	Value		Name (Symbol)	Value	
kilobyte (kB/KB)	10^3	2^{10}	kibibyte (KiB)	2^{10}	
megabyte (MB)	10^6	2^{20}	mebibyte (MiB)	2^{20}	
gigabyte (GB)	10^9	2^{30}	gibibyte (GiB)	2^{30}	
terabyte (TB)	10^{12}	2^{40}	tebibyte (TiB)	2^{40}	
petabyte (PB)	10^{15}	2^{50}	pebibyte (PiB)	2^{50}	
exabyte (EB)	10^{18}	2^{60}	exbibyte (EiB)	2^{60}	
zettabyte (ZB)	10^{21}	2^{70}	zebibyte (ZiB)	2^{70}	
yottabyte (YB)	10^{24}	2^{80}	yobibyte (YiB)	2^{80}	

挑戰二：無線資源使用面臨公平性問題



Ref: 3GPP SA1 Contribution S1-111104 from Qualcomm

挑戰三：價量背離之剪刀效應



需有更高頻譜效率系統、有效的訊務分流(Traffic Offloading)技術、創新計價模式多管齊下

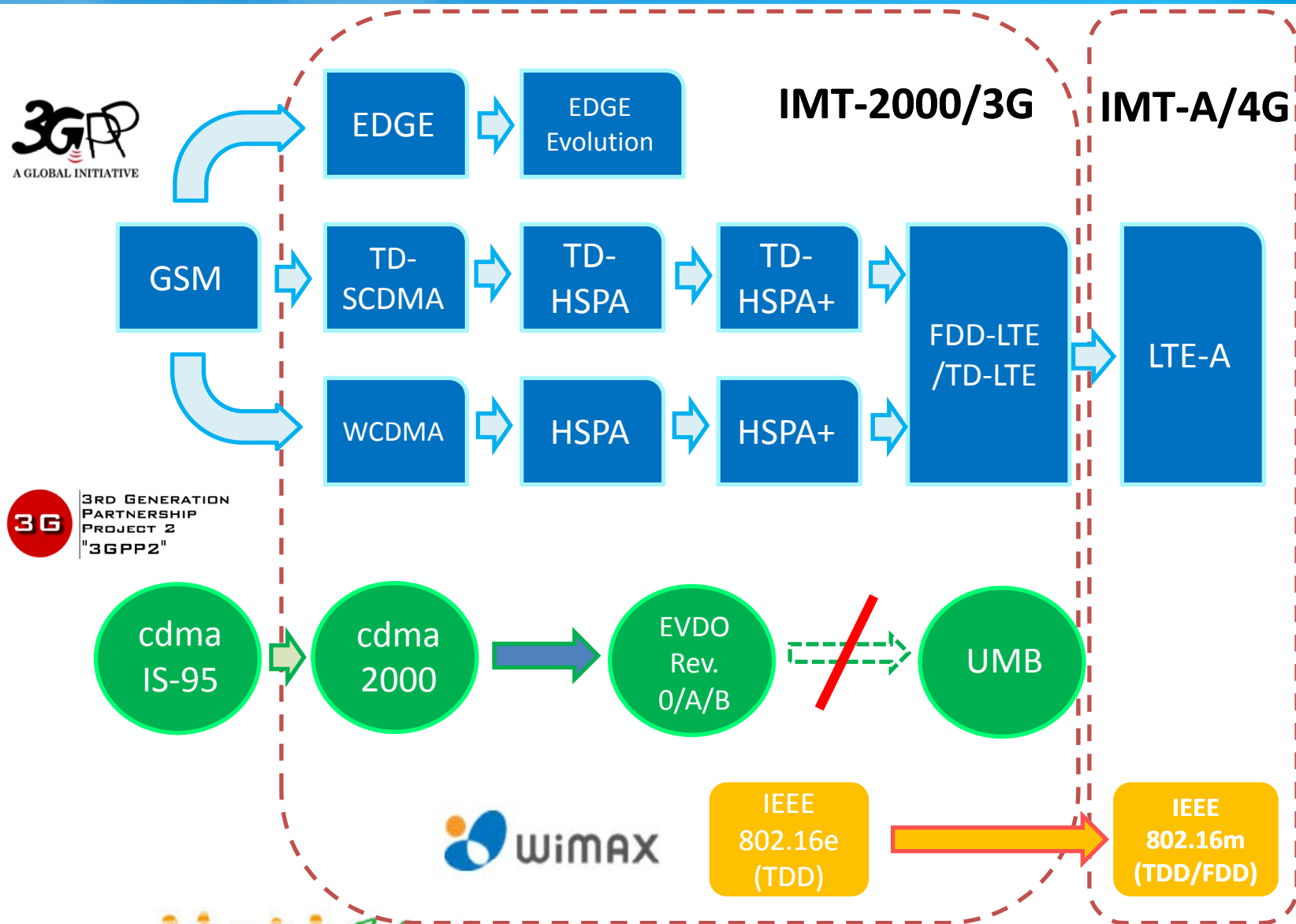


中華電信

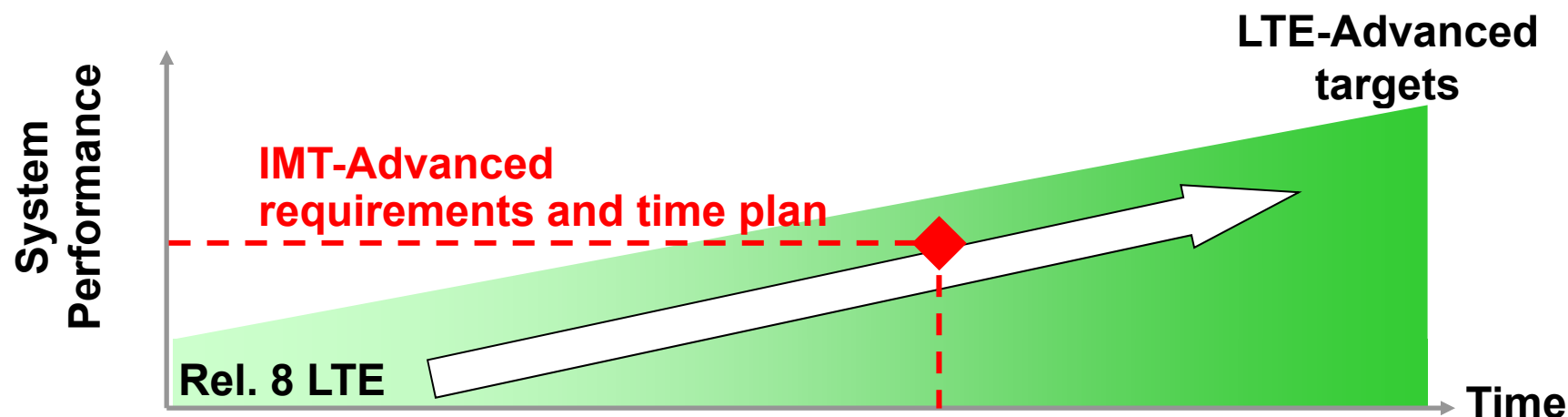


Refresh
your life

行動通信標準演進歷程



LTE/LTE-A發展主要驅動力



		Rel. 8 LTE	LTE-Advanced	IMT-Advanced
Peak data rate	DL	300 Mbps	1 Gbps	1 Gbps
	UL	75 Mbps	500 Mbps	
Peak spectrum efficiency [bps/Hz]	DL	15	30	15
	UL	3.75	15	6.75

→ 加強LTE以滿足ITU 4G的要求是LTE-A發展主要驅動力

ITU批准LTE-A及WiMAX2為4G技術

国际电联为下一代 4G 移动技术铺平道路

ITU-R 超级 IMT 系统的 4G 标准将迎来移动宽带通信的新时代

2010 年 10 月 21 日，日内瓦 – 国际电联无线电通信部门（ITU-R）已完成对六种候选的全球 4G 移动无线宽带技术（亦称超级 IMT 系统（IMT-Advanced））的评估。对这些建议进行协调后形成的两种技术，即“**LTE-Advanced**”¹和“**WirelessMAN-Advanced**”²，被正式统称为 IMT-Advanced，并被定性为真正的 4G 技术。

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国际电信联盟
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电话: +41 22 730 6039
传真: +41 22 730 5939
电子邮件: pressinfo@itu.int
网址: www.itu.int/newsroom

国际电联为下一代 4G 移动技术铺平道路
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最近在中国重庆召开的会议上，负责定义 IMT-Advanced 全球 4G 技术的 ITU-R 5D 工作组，通过为第一版 IMT-Advanced 确定上述技术，在其工作中取得了阶段性成果。即将发布的 ITU-R 报告确认，**LTE-Advanced** 和 **WirelessMAN-Advanced** 都成功达到了 ITU-R 为第一版 IMT-Advanced 制定的所有标准。国际电联成员国预计在 2010 年 11 月底在日内瓦举行的 ITU-R 第 5 研究组会议上批准这份报告。

国际电联秘书长哈玛德·图坎指出：“信息通信技术（ICT）和宽带网络已经成为类似于交通、能源和供水网络的国家关键基础设施，但其影响可能更为巨大，更为深远。这些重点的无线宽带强化技术可以推动社会和经济的发展，并加快联合国千年发展目标 MDG 的实现。”

“虽然有人认为，为 IMT-Advanced 设定的目标甚高，而我非常高兴地看到，移动无线行业的所有利益攸关方都在迎难而上。”国际电联无线电通信局主任瓦列里·吉莫弗耶夫在对这一全球行动表示赞赏时说，“我期待看到有关 IMT-Advanced 的 ITU-R 建议书，它们将对最先进的 4G 移动宽带技术的研发产生深远的影响。”

继国际电联定义的 IMT-2000（3G）系统取得成功，ITU-R 通过于 2002 年制定出具有战略意义的 IMT 未来展望，启动了 IMT-Advanced（4G）行动，并随后为 IMT-Advanced 确定了服务、频谱和性能要求，以及详细的评估程序。在与业界持续开展合作期间，国际电联 2009 年 10 月收到的六份提案逐一受到了严格评估，此举得到在世界各地建立的独立外部评估小组工作的支持。业界的共识和 ITU-R 在六份提案之间进行的协调，将提案汇总成为两项经认可的 IMT-Advanced 技术。这些技术将进入 IMT-Advanced 进程的最后一个阶段，这一阶段将为在 2012 年年初制定详细说明这些无线电技术的标准的 ITU-R 建议书做好准备。

IMT-Advanced（4G）提供了一个全球性平台，通过在平台上构建下一代互动式移动服务，提供更高速率的数据存取、强化的漫游功能、统一消息和宽带多媒体业务。

AT&T 公司的无线标准主任和 ITU-R 5D 工作组主席，也向所有为 IMT-Advanced 的成功付出的行业、政府和国际电联人员表示感谢。

ITU-R 成员和全球无线电行业围绕 IMT-Advanced 的工作开展的密切合作，将这些技术确定为经国际电联批准用于信息、通信和娱乐的卓越的 4G 移动无线宽带解决方案。

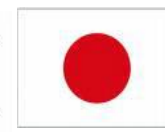
外行人对 IMT-Advanced 进程和计划的看法见
www.itu.int/itunews/manager/display.asp?lang=en&year=2008&issue=10&page=39&text=html



IMT-Advanced (4G)

LTE-A
FDD/TDD

802.16m



3GPP LTE 主要頻段

FDD		
Band	"Identifier"	Frequencies (MHz)
1	IMT Core Band	1920-1980/2110-2170
2	PCS 1900	1850-1910/1930-1990
3	GSM 1800	1710-1785/1805-1880
4	AWS (US & other)	1710-1755/2110-2155
5	850	824-849/869-894
6	850 (Japan)	830-840/875-885
7	IMT Extension	2500-2570/2620-2690
8	GSM 900	880-915/925-960
9	1700 (Japan)	1750-1785/1845-1880
10	3G Americas	1710-1770/2110-2170
11	UMTS 1500	1428-1463/1476-1501
12	US 700	698-716/728-746
13		777-787/746-756
14		788-798/758-768
17		704-716/734-746

TDD		
Band	"Identifier"	Frequencies (MHz)
33, 34	TDD 2000	1900-1920 2010-2025
35, 36	TDD 1900	1850-1910 1930-1990
37	PCS 1900 Center Gap	(1915)1910 -1930
38	IMT Extension Center Gap	2570-2620
39	China TDD	1880-1920
40	2.3 TDD	2300-2400

Additional (FDD&TDD)		
	3.5 GHz	3400 - 3600
	3.7 GHz	3600 - 3800

= Under study in 3GPP

Ref: TS 36.104 Base Station (BS) radio transmission and reception

近期全球行動寬頻頻譜拍賣狀況

	2006	2007	2008	2009	2010	2011	2012(預計)
700MHz (FCC), FDD		美國					
800MHz , FDD					德國	瑞士、愛爾蘭、瑞典、香港、英國、西班牙、挪威、法國	法國
900MHz, FDD			新加坡	法國	德國	瑞士、愛爾蘭、香港、西班牙	
1.5/1.7GHz (JPN), FDD				日本			
1.7/2.1GHz (FCC), FDD	美國		加拿大		新加坡		
1800MHz, FDD			新加坡			瑞士、新加坡、愛爾蘭、挪威、西班牙	
2100MHz, FDD					印度、德國		
2300MHz, TDD					印度		
2600MHz, FDD		挪威	瑞典	芬蘭、香港	荷蘭、丹麥、德國、英國	瑞士、英國、西班牙、法國	
2600MHz, TDD	台灣 (WiMAX)						

全球LTE商用概況

Source: GSA 2011/10/12

共計35家營運商	2009 (2)	2010 (15)	2011 (18+6)	2012(預計)
700MHz (FCC), FDD (3)		Verizon (USA)	Smart(PHI), AT&T(USA)	
700MHz (APT), FDD				
800MHz , FDD (5+1)		Vodafone (GER)	DT (GER), SKT(SK), LG U+(SK), O2(GER), KT(SK)	
850MHz, FDD				
900MHz, FDD				
1.5/1.7GHz (JPN), FDD				
1.7/2.1GHz (FCC), FDD (3)		MetroPCS (USA)	Rogers(CAN), Bell Canada(CAN)	
1800MHz, FDD (5+4)		Mobyland & CenterNet (POL)	Omnitel(LT), LMT(LAT), M1(SIN), Telstra (AUS), DT(GER), CSL (HK), TeliaSonera (FIN)	
1900MHz, FDD				
2100MHz, FDD (1)		docomo(JPN)		
2300MHz, TDD				CMCC (China)
2600MHz, FDD (15)	TeliaSonera (NOR, SE)	MTS, Ucell (UZB), CSL (HK), Tele2/ Telenor (SE), TeliaSonera (FIN, DK), Elisa(FIN), EMT(EST), A1(AUT)	T-Mobile(AUT), Etisalat(UAE), TDC (DK)	
2600MHz, TDD(3+1)			STC(SA), Mobily(SA) , Zain(SA)	CMCC (China)

LTE終端設備

目前已有161款LTE終端，包含8款LTE手機

Source: GSA 2011/7/29

Supplier	Model	LTE Operating Frequency	Other modes
MODULES			
AnyDATA	DTP9605 LTE	AWS, L-band	HSPA+
Cisco	EHWIC-4G-LTE-V	700	EV-DO
Cisco	EHWIC-4G-LTE-A	700, AWS, 2100	DC-HSPA+
Cisco	EHWIC-4G-LTE-G	800, 900, 1800, 2100, 2600	DC-HSPA+
Ericsson	F7500p	700, AWS	TBC
GCT	GDM7240 chipset	Quad	TBC
Franklin Wireless	M700 LTE/HSPA+	TBC	HSPA+
Franklin Wireless	M700 LTE/EV-DO	700	EV-DO
Huawei	EM920V	TBC	HSPA
LG	WM300	700	TBC
LG	L2000	700	TBC
Novatel Wireless	E162G	700	DC-HSPA+
Novatel Wireless	E172 4G LTE	700, AWS	DC-HSPA+
Novatel Wireless	Expedite E351	700	EV-DO
Novatel Wireless	Expedite E362	700	HSPA+
Novatel Wireless	Expedite E371	700, AWS	EV-DO
Novatel Wireless	Expedite E373	Multiband	DC-HSPA+
Qualcomm	MDM9625 chipset	Multiband	DC-HSPA+, TD-SCDMA
Qualcomm	MDM9225 chipset	Multiband	DC-HSPA+, TD-SCDMA
Renesas	SP2531 modem FDD and TDD	Multiband inc. TDD	DC-HSPA+
Renesas	MPS225	Multiband	DC-HSPA+
Sequans	SQ3010 TD-LTE	Bands 38, 40, 41	None
Sierra Wireless	Airprime MC7700	700, AWS	HSPA+
Sierra Wireless	Airprime MC7710	800, 900, 1800, 2100, 2600	HSPA+
Sierra Wireless	Airprime MC7750	700	HSPA+, EV-DO
ST-Ericsson	M710 Multimode LTE	Quad	HSPA
ST-Ericsson	Thor M720	Multiband	HSPA+
ST-Ericsson	Thor M700	Quad	None
ST-Ericsson	Thor M7400 FDD and TDD	Includes 700, 2600 inc. TDD	DC-HSPA+
M-TABLETS			
Acer	Iconia Tab A500	700	HSPA+
Cisco	Cius	700	EV-DO
Motorola	Xoom	700	EV-DO
RIM	4G Playbook	700	EV-DO
Samsung	Galaxy Tab LTE	700	EV-DO
ZTE	Light2	TBC	HSPA
ZTE	Light LTE	700	EV-DO
ZTE	V11L	800, 1800, 2600	HSPA
NOTEBOOKS			
Dell	Latitude E6420	700	HSPA
Dell	Latitude E6420 ATG	700	HSPA
Dell	Latitude E6420 XFR	700	HSPA
GammaTech	D12C	700	TBC

HP	Pavilion dm1-3010nr	700	EV-DO
HP	Compaq CQ10-68nr	700	TBC
Panasonic	Toughbook CF-53	TBC	HSPA, EV-DO
Samsung	N350	TBC	HSPA+
Samsung	N150	2600	HSPA
Samsung	X430	2600	HSPA
PC CARDS			
Fujitsu	Xi F-06C	1500	HSPA
IP Wireless	LTE BFM Card	inc. 700, 2600	None
PHONES			
HTC	Thunderbolt	700	EV-DO
LG	V5910 Revolution	700	EV-DO
Motorola	Droid Bionic	700	EV-DO
Samsung	Galaxy S 4G LTE Vibrant	700	EV-DO
Samsung	Craft SCH-R900	AWS	EV-DO
Samsung	Galaxy S SCH-R910 Indulge	AWS	EV-DO
Samsung	Droid Charge SCH-I510	700	EV-DO
ZTE	VSL	800, 1800, 2600	HSPA
PHONES			
Actontec	4GRN-DV	700 (Band 13)	None
Actontec	4GRN-D	700 (Band 13)	None
Actontec	4GRN-L	700 (Band 13)	None
Actontec	4GRN-LV	700 (Band 13)	None
Actontec	4GRN-DL	700 (Band 13)	None
Actontec	4GRN-DLV	700 (Band 13)	None
AVM	FRITZbox 6840	800, 2600	None
BandRich	BandLux PR51	2600, 1800, 800	DC-HSPA+
BandRich	BandLux PR55	700, AWS	DC-HSPA+
BandRich	BandLux PR58 with TDD	2300 TDD	DC-HSPA+
BandRich	BandLux PR59 with TDD	2600 TDD	DC-HSPA+
BandRich	BandLux RS01	800, 1800, 2600	DC-HSPA+
BandRich	BandLux RS05	700, AWS	DC-HSPA+
BandRich	BandLux RS08 with TDD	2300 TDD	DC-HSPA+
BandRich	BandLux RS09 with TDD	2600 TDD	DC-HSPA+
BandRich	BandLux RS10	AWS, 700 (B13)	EV-DO
BandRich	BandLux RS12	850, 1900	EV-DO
Buffalo	Xi BF-01C	Japan	HSPA
C-motech	CLR-960	700	EV-DO
Cradlepoint	CBA750	700	EV-DO
Cradlepoint	CTR500	700	HSPA, EV-DO
Cradlepoint	MBR1000	700	HSPA, EV-DO
Cradlepoint	CBA250	700	EV-DO
Cradlepoint	MBR1200	700	EV-DO
Cradlepoint	CTR335 Travel router	700	HSPA+
Dovado	4GR	Multiband	DC-HSPA+
Dovado	3GN	Multiband	DC-HSPA+
Dovado	TINY	Multiband	DC-HSPA+, EV-DO
Fujitsu	Si-R G200	Japan	HSPA
Huawei	E589 personal HS	700, 900, 1800, 2100, 2600	HSPA
Huawei	B390/B391	800	None
Huawei	B593	800, 900, 1800, 2100, 2600	HSPA

Huawei	Vodafone B1000	800	None
Lancom	1681-4G	700	HSPA+
LG	FM300	800	TBC
LG	Xi L-09C	Japan	HSPA
NEC	BBRide	TBC	HSPA
NetComm	Liberty LTE WiFi	TBC	HSPA+
Netgear	MBR1000	700	HSPA
Netgear	MBR1000 HSPA+	700	HSPA+
Netgear	MBR1515	Multiband	DC-HSPA+, EV-DO
Netgear	MBR1517	Includes 2600	HSPA+
Netgear	MBR2000	Multiband	HSPA+
Nexaira	Business Class II	TBC	HSPA+
Novatel Wireless	MP14510L	700	EV-DO
ProLink	PWH2004	TBC	HSPA
Samsung	4GLTE Mobile Hotspot SCH-LC11	700	EV-DO
Samsung	SHV-E100L	700	EV-DO
Sierra Wireless	AirCard 7545	700	HSPA+
Sierra Wireless	AirLink GX440	700	HSPA+, EV-DO
Teradek	CUBE-150	700	EV-DO
Teradek	CUBE-250	700	EV-DO
Ventus	V1000	Multiband	HSPA+, EV-DO
Ventus	V2000	Multiband	HSPA+, EV-DO
Ventus	V4100	Multiband	HSPA+, EV-DO
Ventus	V4200	Multiband	HSPA+, EV-DO
Ventus	V4500	Multiband	HSPA+, EV-DO
Vololink	VoioAccess VA126		DC-HSPA+
ZTE	MF91 mobile hotspot	TBC	DC-HSPA+
ZTE	MF92 mobile hotspot	TBC	HSPA+
ZyXEL	ZLR-2070S	700	TBC
ZyXEL	MWR-211	700	HSPA, EV-DO
ZyXEL	MWR-222	700	HSPA, EV-DO
USB Modems			
AnyDATA	ADU9605	TBC	HSPA+
BandRich	BandLux CS01	1800, 2600	DC-HSPA+
BandRich	BandLux CS02	800, 2600	DC-HSPA+
BandRich	BandLux CS05	AWS, 700 (B17)	DC-HSPA+
BandRich	BandLux CS06	700 (B13)	DC-HSPA+
BandRich	BandLux CS08	TDD 2300	DC-HSPA+
BandRich	BandLux CS09	TDD 2600	DC-HSPA+
BandRich	BandLux CS10	AWS, 700 (B13)	EV-DO
BandRich	BandLux CS12	850, 1900	EV-DO
Franklin Wireless	U700 LTE-EVDO	TBC	EV-DO
Franklin Wireless	U700 LTE-HSPA+	TBC	HSPA+
Huawei	E392	800, 900, 1800, 2100, 2600	DC-HSPA+
Huawei	E397	700, 2100	DC-HSPA+
Huawei	E398	700, AWS, 800, 1800, 2600	DC-HSPA+
Huawei	E398 T Mobile Speedstick	TBC	DC-HSPA+
Huawei	E398 Vodafone K5005	TBC	DC-HSPA+

IP Wireless	USB-032038-AL-03-E	800, 1800, 2600	None
IP Wireless	USB-121341-AL-03-U	700, 2600	None
IP Wireless	USB-041213-AL-03-U	700, AWS	None
IP Wireless	USB-40-AL-03-A	2300	None
LG	LD100	1500	None
LG	Xi L-02C	1500	HSPA
LG	VL600	700	EV-DO
LG	Adrenaline AD600	700, AWS	HSPA
Motorola	USB-LTE T110	TBC	TBC
Nexpring	LTE USB Modem	700, AWS	DC-HSPA+
Nokia	RD-3 multi mode	TBC	HSPA+
Novatel Wireless	Ovation MCS51	700	EV-DO
Novatel Wireless	US8551L	700	EV-DO
Pantech	UML290	700	EV-DO
Samsung	GT-B3730	2600	HSPA+
Samsung	GT-B3710	2600	None
Samsung	GT-B3740	800	None
Sierra Wireless	AirCard 313U	800, 1800, 2600	DC-HSPA+
Sierra Wireless	AirCard 320U	800, 1800, 2600	DC-HSPA+
ZTE	AL600	TBC	HSPA+, EV-DO
ZTE	AL620	TBC	HSPA+
ZTE	AL621	2600 plus 1800 later	HSPA+
ZTE	MF820	1800, 2100, 2600	HSPA+
ZTE	MF820D	800, 1800, 2600	HSPA+
ZTE	MF29L	TBC	HSPA+

公司	LTE終端種類
BandRich	18
Samsung	13
ZTE	12
Huawei	10
LG	9



全球指標業者LTE用戶數現況

✚ 截至2011Q2，全球LTE用戶數約200萬戶

✚ LTE指標業者用戶數現況

✓ Verizon：由2010Q4約6.5萬LTE用戶，2011Q1成長至約56.5萬

✓ NTT docomo：由2011/5的7.2萬LTE用戶成長至2011/7的20.5萬

Global LTE Subscriptions → 2Q 2011

1.9 Million Subscribers Worldwide



Source: Informa Telecoms & Media, June 2011 WCIS+

www.4GAmericas.org

Source: 4G Americas

Verizon:

2010 Q4	2011 Q1
65,000	565,000

≈ 8.7倍

NTT docomo :

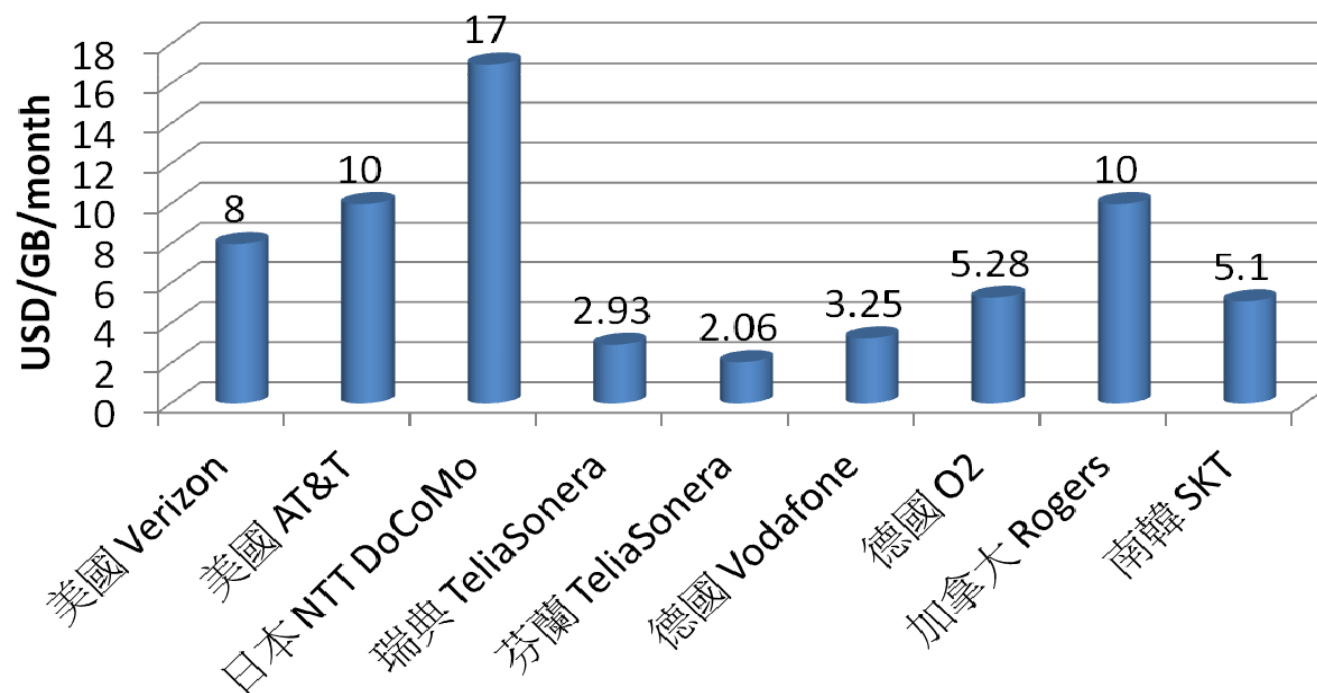
2011 May	2011 July
72,600	205,700

≈ 2.8倍

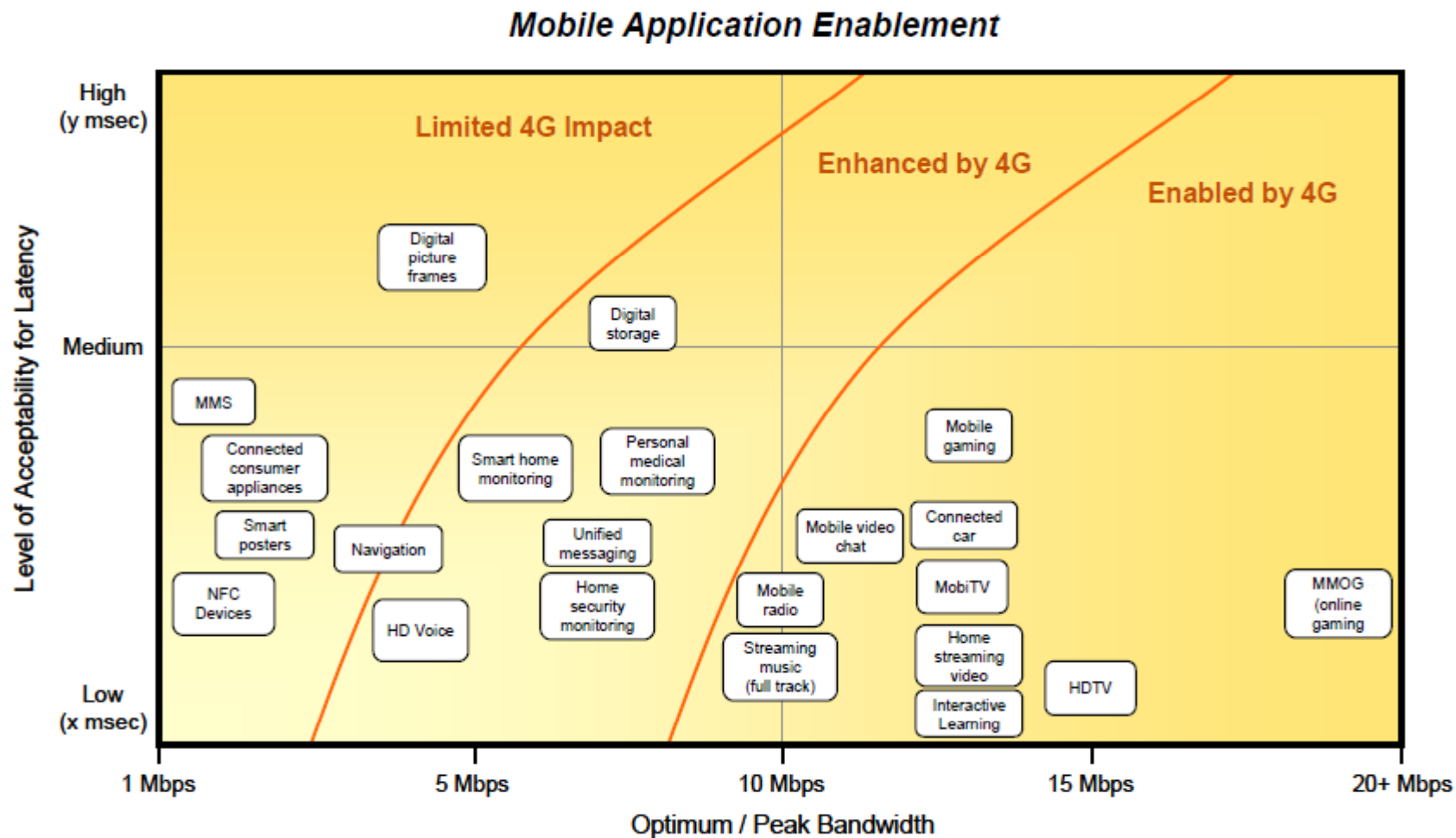
LTE商用服務比較

✚ 指標業者服務費率比較

- ✓ 目前LTE的應用以行動數據上網為主
- ✓ 大部分的LTE費率不再是 Flat Rate，而是以特定月費提供固定傳輸量的資費方案，超過部分再按GB單價計費
- ✓ 下表比較LTE指標業者所提供的最經濟月租資費方案



4G擴展無線應用範疇



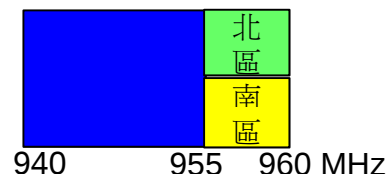
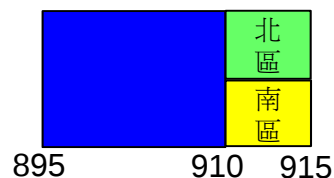
Source : CSMG "4G Services – Market Opportunities and Implications", 2010/03

國內行動通訊頻譜配置現況

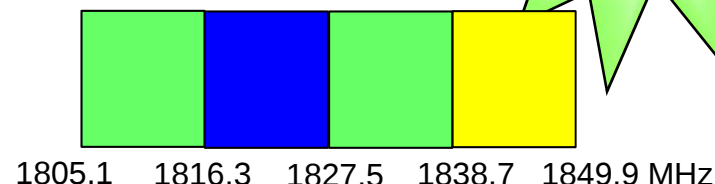
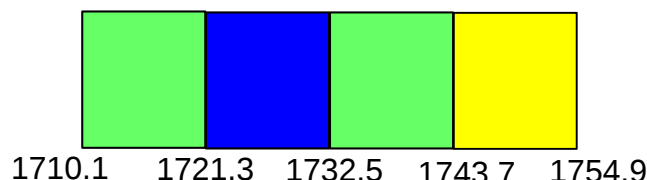
Source: NCC

總頻寬僅約
410 MHz

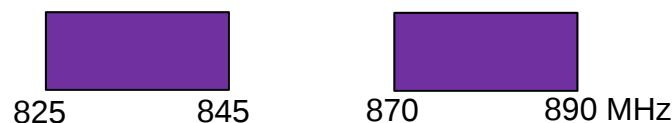
2G 900



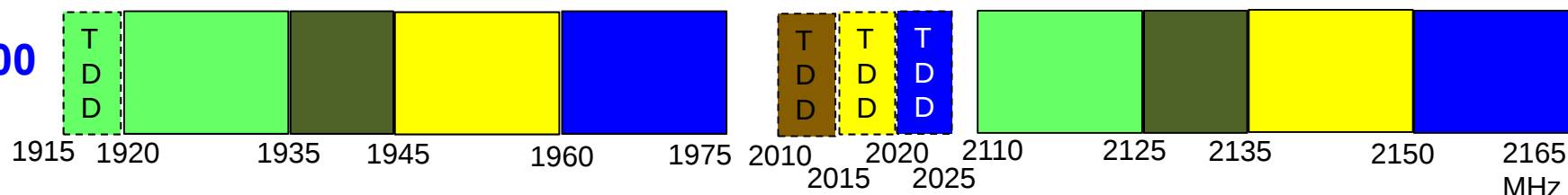
2G 1800



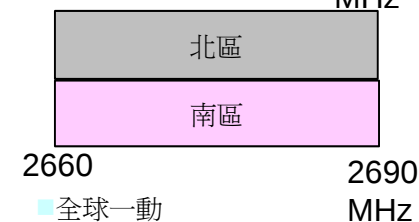
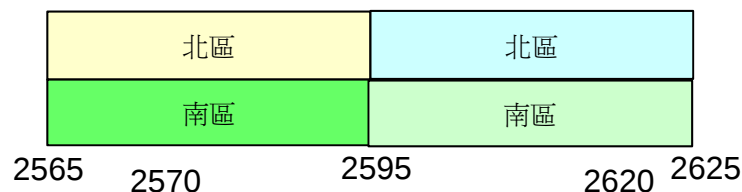
3G 850



3G 2100



WiMAX
2600

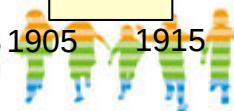


PHS



中華電信

1905 1915



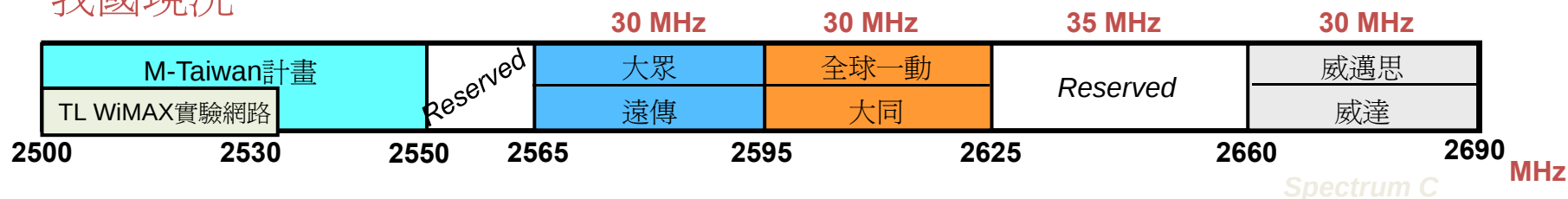
Refresh
your life

- 中華電
- 台灣大
- 遠傳/和信
- 威寶
- 亞太
- 全球一動
- 大眾
- 大同
- 威邁思
- 威達雲端

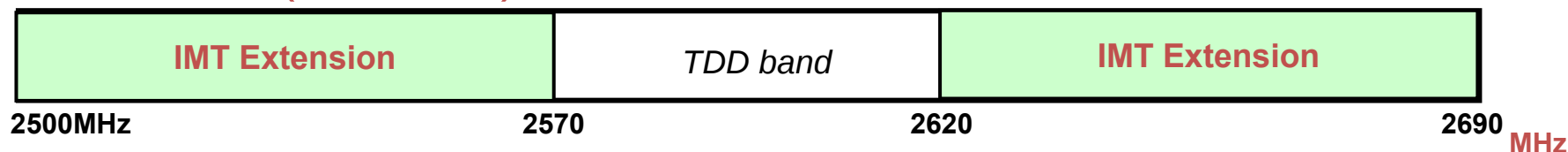
台灣與國際LTE主流頻段接軌不易

2.6GHz頻譜現況

我國現況



3GPP 頻段 (FDD/TDD)



700/800MHz頻譜現況

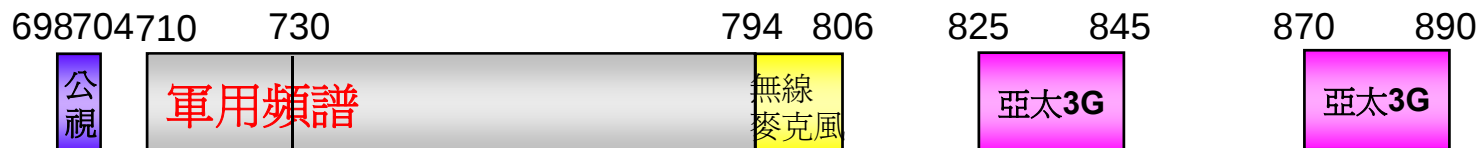
FCC



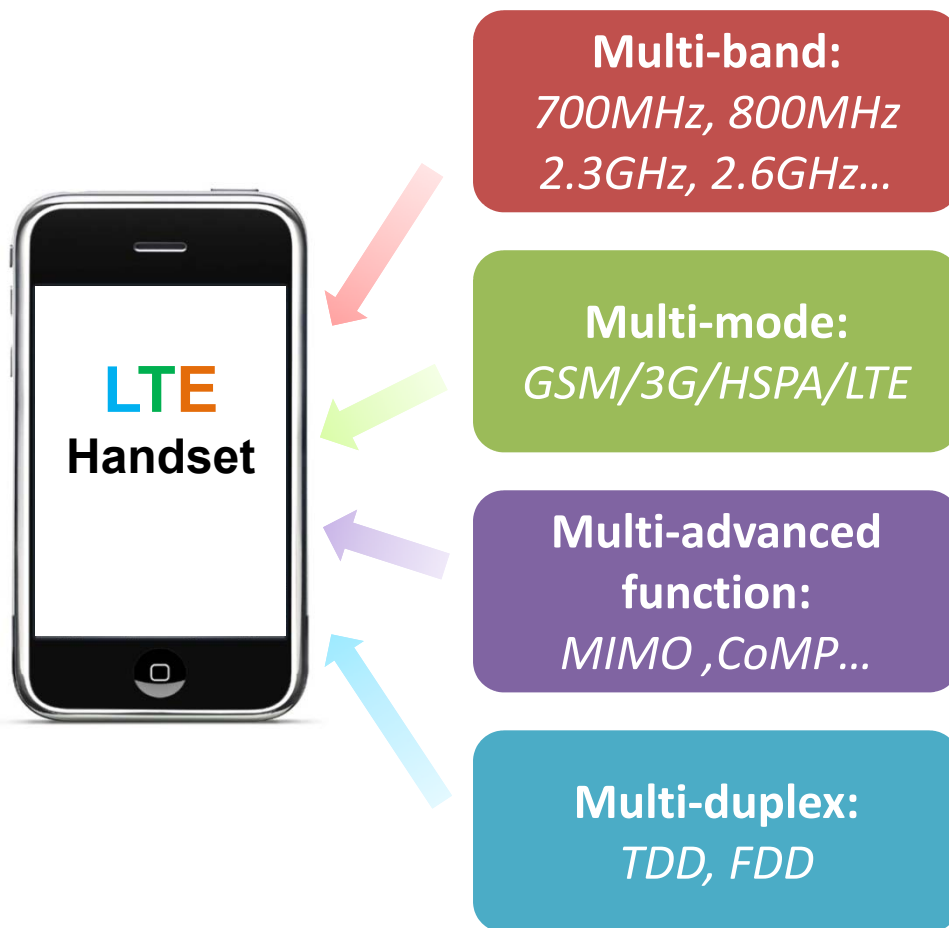
歐盟



我國現況



多模多頻段增加終端複雜度



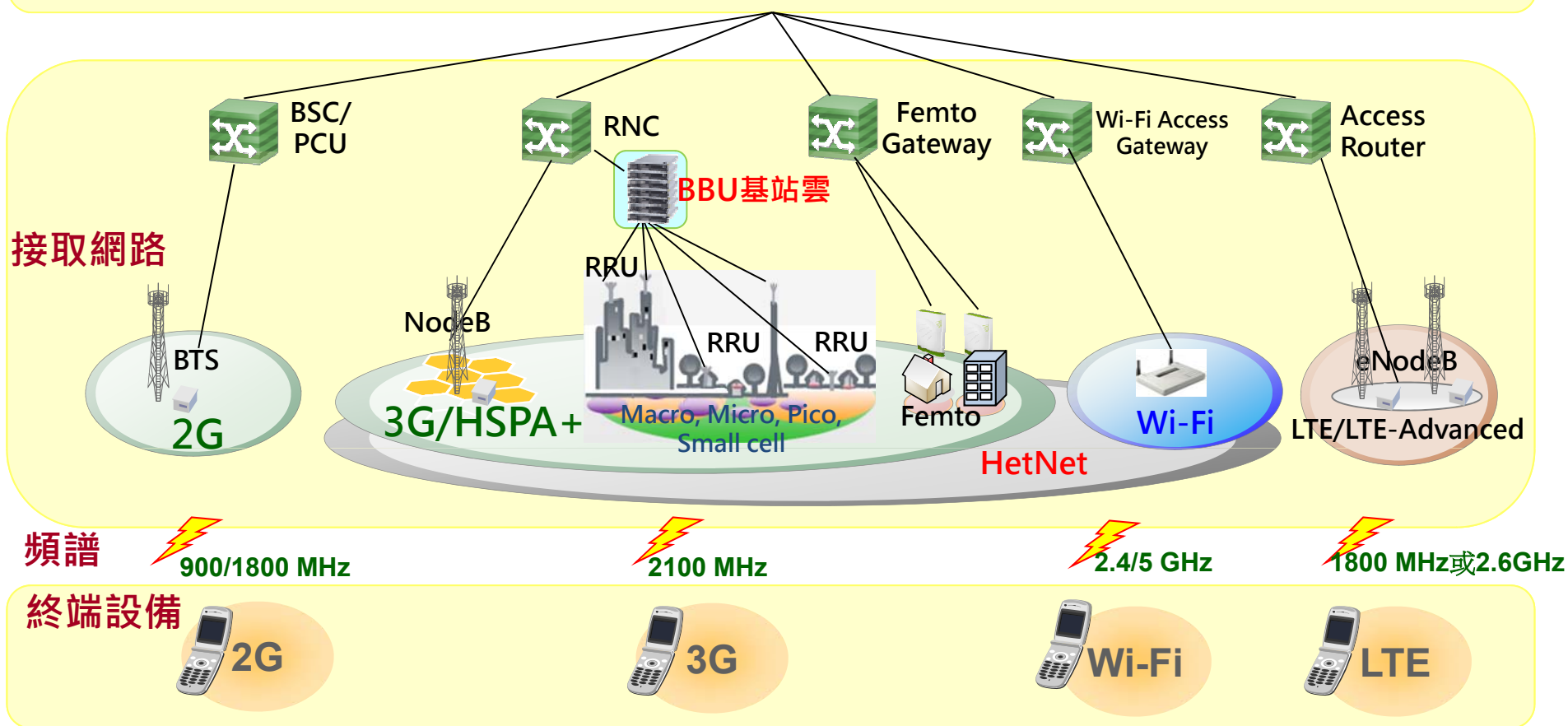
Squeeze above all in?

OR

Drop some of them?

高容量與節能效益兼具之接取網路

核心網路(CS/PS) 或 Intranet/Internet



結語

- ✦ 行動寬頻的發展帶來便利性及豐富多元的應用服務，但既有3G網路也面臨網路擁塞、訊務快速成長營收卻未相對提升的挑戰。4G技術有助於建構高容量、高品質與低成本的健康Ecosystem，以提供更優質的服務
- ✦ ITU正式通過LTE-A與IEEE 802.16m為4G技術，但LTE/LTE-A獲得全球絕大多數行動業者的支持
- ✦ 我國LTE/4G發照與商用時程相對落後於世界主要國家，宜加速頻譜規劃與發照時程，並發展適宜的資費機制
- ✦ 與國際接軌的主流LTE頻段除有助國際漫遊及頻譜有效運用外，藉由市場規模將可提供終端多樣性與加速技術普及
- ✦ 適切的業者數及充足的頻譜有助建構健康的經營環境、促進新技術的發展，我國4G釋照與頻譜規劃宜審慎