

# **ITU-D Regional Development Forum for the Asia Pacific Region**

**“NGN and Broadband, Opportunities and Challenges”  
Yogyakarta, Indonesia, 27 – 29 July 2009**

## **Wireless Broadband Technologies**

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**Head of Strategy & Business Development  
Nokia Siemens Networks, Indonesia**



**Business  
Drivers**

**Wireless  
Broadband  
Technologies**

**LTE**

**Summary &  
Conclusion**

# Our market vision 2015

## The world connected

**Applications  
predominantly  
in Internet**

**Multitude  
of business  
models**



**Broadband  
everywhere**

**100-fold  
traffic  
increase**

**Mobile Data  
Traffic increase  
300-fold**



# Growth Potential

Unending

## Mobile

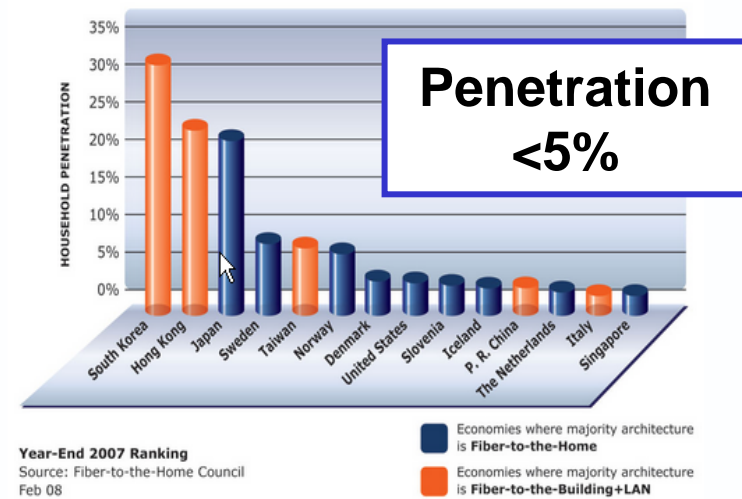
**Mobiles** 4B  
**GSM, 3G** 3.8B  
**HSPA** 126M  
**Penetration** 3.3%

Source

UMTS Forum, GSM Association  
*June 3, 2009*

## Fixed

Economies with the Highest Penetration of Fiber-to-the-Home / Building+LAN



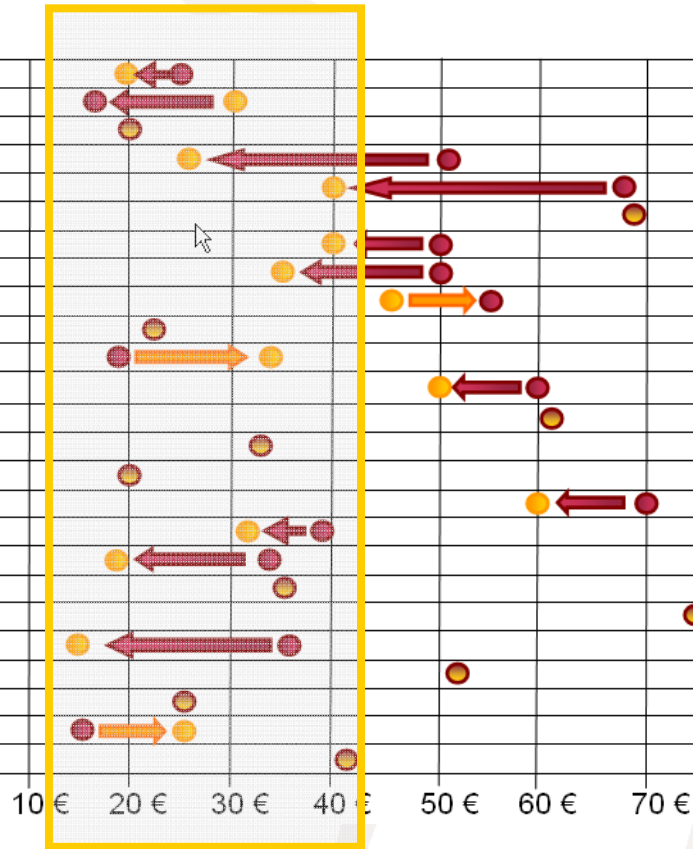
Source: FTTH Council, Feb 08

**Penetration negligible  
Lots of Room for Growth**

# Flat Rate HSPA

Jan 08 – Jan 09

Country	Operator	GB08	GB09
Australia	H3G	5	6
Austria	A1	5	10
Austria	One	3	15
Bulgaria	M-Tel	5	5
Croatia	Vipnet	3	3
France	SFR	3	3
Germany	T-Mobile	5	∞*)
Germany	Vodafone	5	5
Hong Kong	H3G	∞*)	∞*)
Hungary	T-Mobile	5	5
Italy	H3G	20	30
Italy	Vodafone	10	15
Kuwait	Wataniya	∞*)	∞*)
Lithuania	Omnitel	1	1
Malaysia	Maxis	∞*)	3
Netherlands	T-Mobile	∞*)	∞*)
Portugal	Vodafone	5	6
Singapore	M1	∞*)	∞*)
Singapore	StarHub	∞*)	∞*)
South Africa	Vodacom	5	5
Sri Lanka	Mobitel	5	7
Switzerland	Swisscom	5	5
U.K.	H3G	7	7
U.K.	O2	3	3
USA	AT&T	∞*)	5



● Jan 08  
● Jan 09

## Change

07 – 08 : >50% drop

08 – 09 : Stabilizing

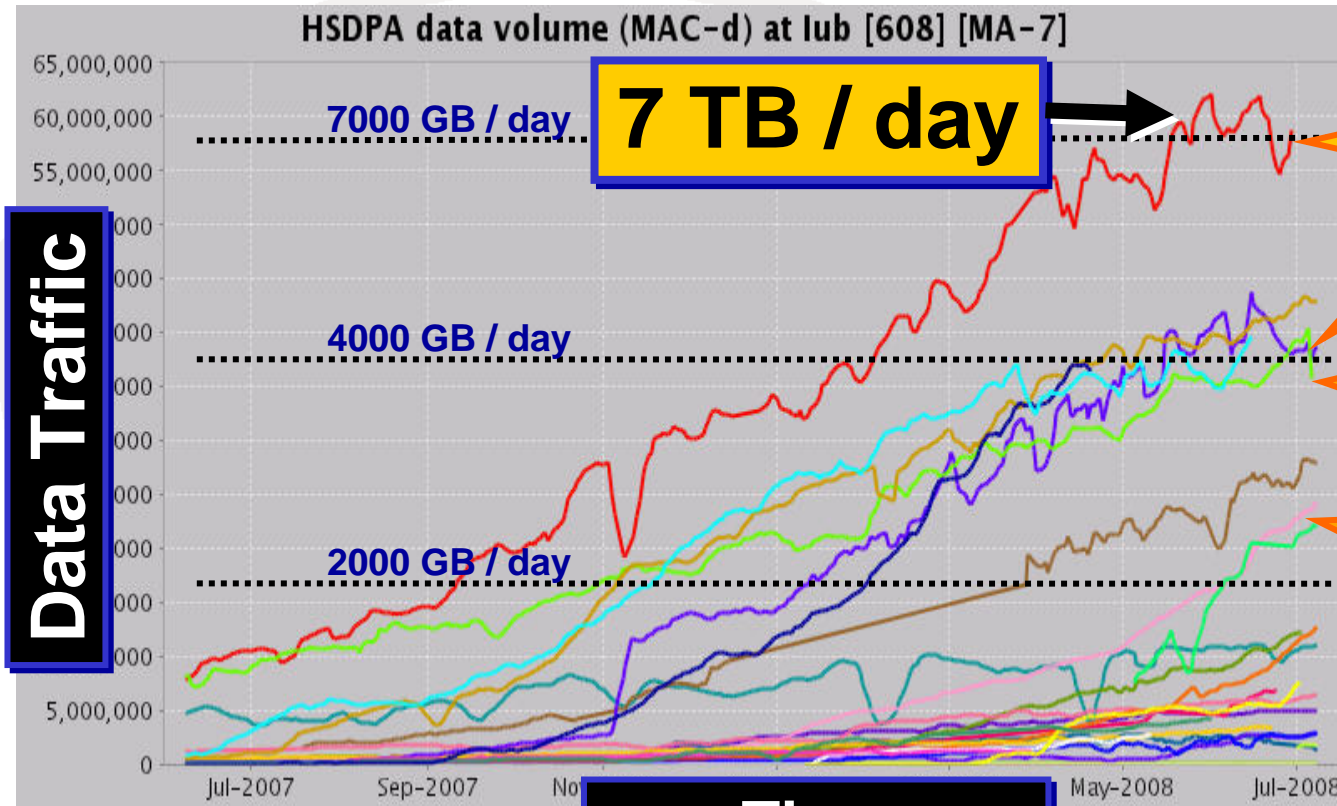
## Median

23.60€

\*Flat-rate HSPA 7.2Mbps with fair-use policies

**Rates stabilize**  
But traffic explodes

# Usage Explosion



Source: NSN analysis

Operator in Europe:  
Data Revenue +10%

Operator in APAC:  
Data Revenue +16%

Operator in APAC:  
Data Revenue +24%

Operator in APAC:  
Data Revenue +10%

Operator in Europe:  
Data Revenue +10%

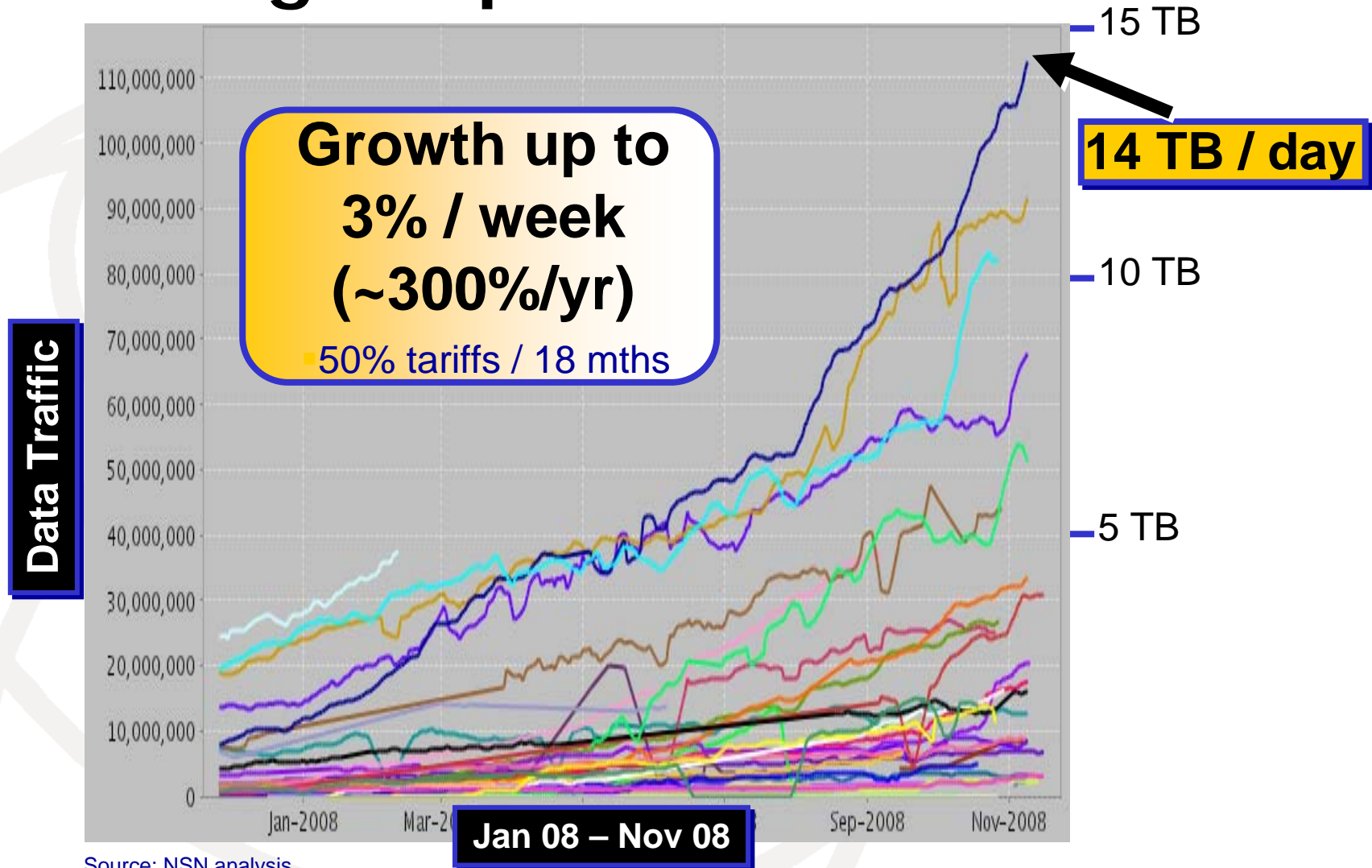
Source: Merrill Lynch, Global Wireless Matrix  
Mar07-Mar08, local currencies

From July '07 to July '08 median data price  
dropped by 45%

- Data traffic and revenue keep growing, though not at same proportions
- As traffic grows faster than revenue, networks must become more efficient



# and usage Explosion continues ...



## Wireless HSPA Volume

1 year Flat-Rate 7.2Mbps HSPA Traffic



Comparison with



ABC launched in **1948**

2008 - 1948 = **60** years

**3** networks X **60** years X **365** days/year X **24** hrs/day

= > **1.5 Mio** hours of programming

**YouTube produced more than this in 1H 2008**

**9232** hours uploaded everyday

**200,000** 3 mins videos

**88%** of the content is new & original



## **Apr 2009 Statistics**

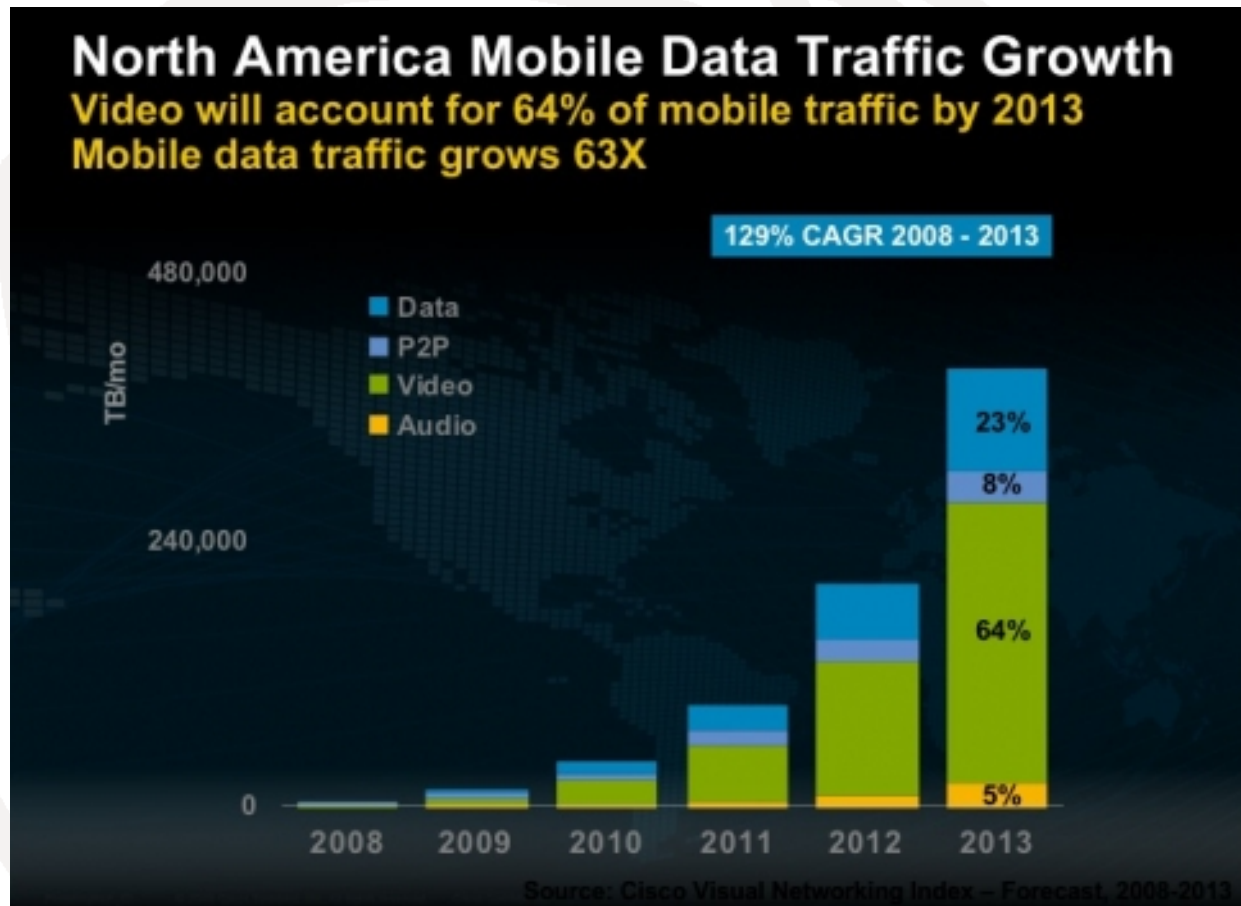
- 20 hours of videos uploaded every minute
- 1,728,000 mins per day
- 1,000 faster than you can watch time
- 493,714 videos uploaded per day on YouTube
- 200,000+ feature films released per week

**More than 1 Million videos are being  
uploaded every day on the Web**



# Cisco

## Visual Networking Index 2009



## Characteristics

- 2013: Global mobile traffic will exceed two *exabytes* per month
- 129% CAGR
- 64% Video
- APAC 1/3<sup>rd</sup> of world

**Global mobile data traffic reached one exabyte per month in half the time that fixed data traffic did**

An exabyte is equal to: 1 billion gigabytes; 1,000 petabytes; 250 million DVDs

# Most populous places in the world

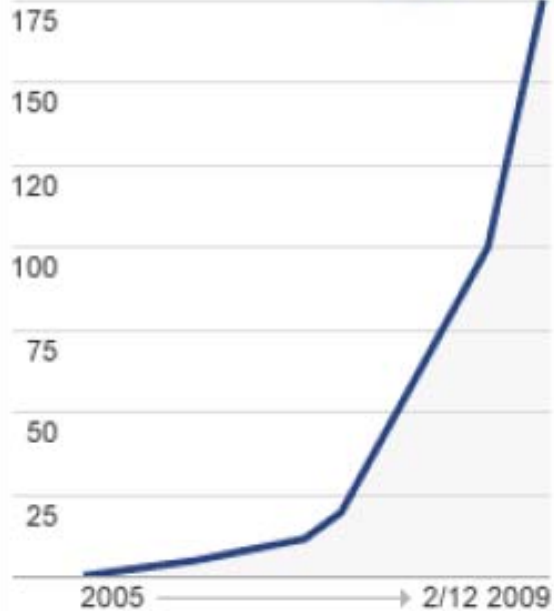
1		China	1,336 Mio
2		India	1,145 Mio
3		United States	306 Mio
4			250 Mio
5		Indonesia	235 Mio
6		Brazil	191 Mio

# Social Networking



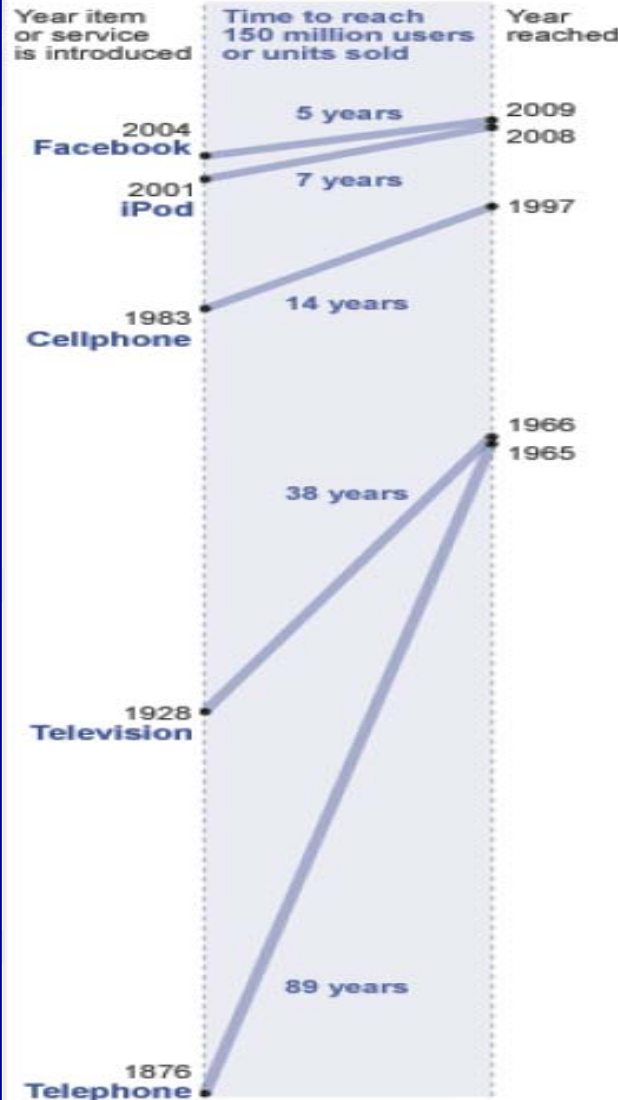
## Facebook members

In millions



SOURCE: FACEBOOK

## The Race to the Mass Market



## What a difference a year makes



A look at Facebook's growth in users and usage of the site.

	FEB. 2008	FEB. 2009
Total daily minutes of use	1.1 billion	More than 3 billion
Users who update status daily	4 million	15 million
Users who become "fans" each day	250,000	More than 3.5 million
Photos uploaded each month	250 million	More than 850 million
Pieces of content shared each month	13 million	More than 24 million

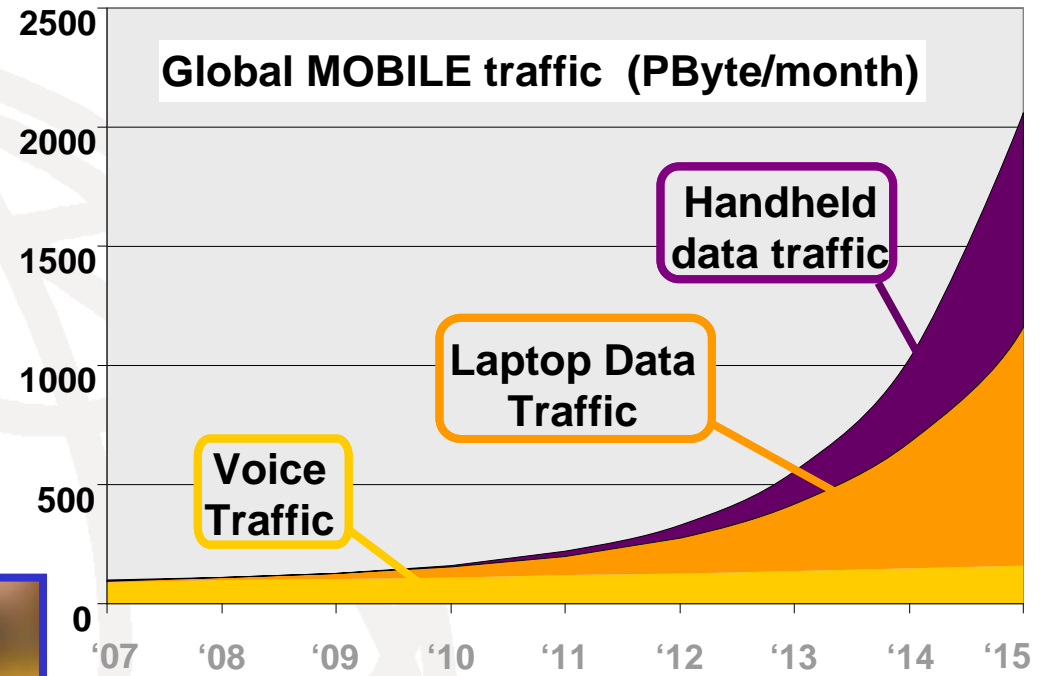
**A typical Facebook user spends 169 mins/month on its website**




- > 250 million active users
- > 120 Mn users log on at least once each day
- 70% of Facebook users are outside the United States
- > 66% Facebook users are outside of college
- Fastest growing demographic is those 35 years old and older
- >5 Bn minutes are spent on Facebook each day (worldwide)
- > 30 Mn users update their statuses at least once each day
- >1 Bn photos uploaded to the site each month
- > 10 Mn videos uploaded each month
- >350,000 active applications currently on Facebook
- > 15,000 websites, devices and applications have implemented Facebook Connect since its general availability in Dec 2008
- >30 Mn users accessing Facebook through mobile devices
- People using Facebook mobile are ~50% more active
- > 150 Mobile operators in 50 countries deploying Facebook

# Handsets will fuel further data growth

**Feature rich devices**  
*Phones are no more phones only*





**Handheld device data traffic will be close to laptop traffic in 2015**

Image source: Nokia Capital Markets Day Presentations, 4.12.2008



# India plans '\$10' laptops

Address  <http://www.google.com/hostednews/afp/article/ALeqM5hKHPUM1b44WGzXgy8vJzUOc54F5Q> 



[Go to Google News](#)



A second-hand computer shop in New Delhi



## India plans '10 dollar' laptop to promote computer skills

Feb 3, 2009

NEW DELHI (AFP) — India has unveiled plans to produce a laptop computer costing just 10 dollars in a bid to improve the skills of millions of students across the country.

The laptops will be mass-produced as part of a government-sponsored education scheme launched on Tuesday in the southern city of Tirupati.

Details about the computer remained scarce, but Higher Education Secretary R.P. Agrawal said last week that it would be available within six months.

"Once the testing is over, the computers will be made available on commercial basis," he told the Press Trust of India news agency.

"Its cost will be 10 US dollars. If the parents want to gift something to their kids, they can easily purchase this item."

The laptop will reportedly have a two gigabyte memory and wireless Internet capability, but officials have not publicly demonstrated a prototype -- or yet explained how it can be produced at such a low cost.

The government has earmarked more than 46 billion rupees (939 million dollars) to develop the low-power gadget to work in rural areas with unreliable power supply and

Source: download from google.com website on 11.2.2009

# Apps Store - iPhone

## iPhone Developer Program

The fastest path from code to customer.

**A new services delivery model?**

- ✓ You pick the price
- ✓ You get 70% of sales revenue
- ✓ Receive revenue checks monthly
- ✓ No charge for free apps
- ✓ No credit card fees
- ✓ No hosting fees
- ✓ No marketing fees

**500 Mn downloads in 8 months**

**1.5 Bn downloads in 1 year**

### 1. Develop

Develop your application with the iPhone SDK and a wealth of technical resources in the iPhone Dev Center. [Learn more](#) ▶

### 2. Test

Test and debug your code on iPhone using sophisticated and elegant tools to finalize your application. [Learn more](#) ▶

### 3. Distribute

Distribute on the App Store and reach millions of iPhone and iPod touch users. [Learn more](#) ▶

And others...



symbian



**“The App Store is like nothing the industry has ever seen before in both scale and quality,”**  
**(Steve Jobs, Apple’s CEO)**





# Google Voice



## Features

See how Google Voice works with your phone

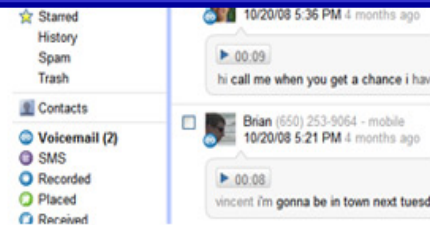
## A new operator?

**Google voicemail** - Voicemail as easy as email

- [Voicemail transcripts](#) - Read what your voicemail says
- [Listen to voicemail](#) - Check online or from your phone
- [Notifications](#) - Receive voicemails via email or SMS
- [Personalize greeting](#) - Vary greetings by caller
- [Share voicemail](#) - Forward or download voicemails

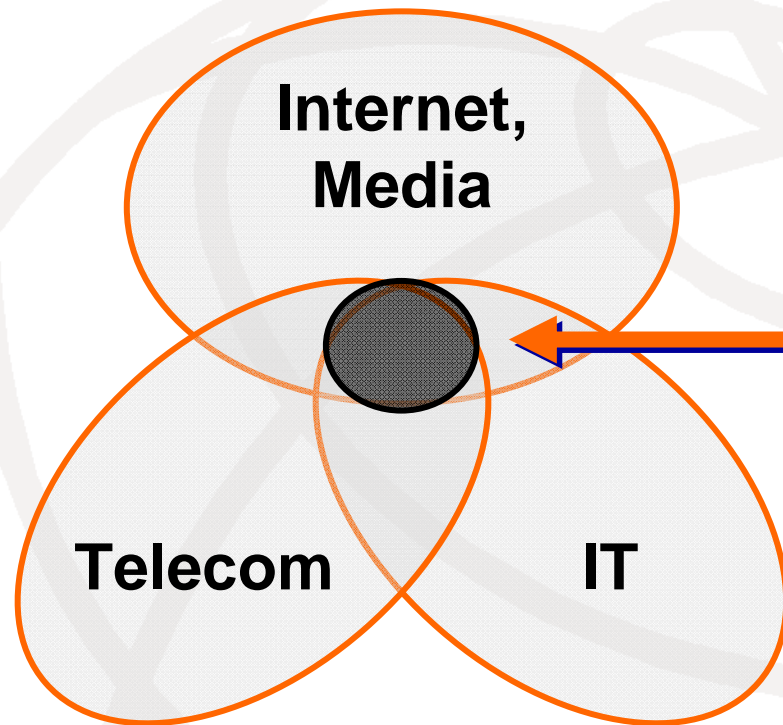
**Voice features** - More cool things you can do with Google Voice

- [Conference calling](#) - Join people into a single call
- [Call record](#) - Record calls and store them online
- [Call switch](#) - Switch phones during a call
- [Mobile site](#) - View your inbox from your mobile
- [GOOG411](#) - Check directory assistance
- [Manage groups](#) - Set preferences by group



- Voicemail (2)**
- SMS
- Recorded**
- Placed
- Received
- Missed

# Broadband accelerating Industry Convergence



● Broadband is here

## Implications:

- Operator & vendor learns Internet, media:
  - niche segmentation
  - simple web interfaces
- IT, Internet encroach into Telco
- Partnering increases

**It's an IT (not telco) space**

# How Operators are responding? Services Explosion



Home | 3Store™ | Mobiles | Pay Monthly | Pay As You Go | Mobile Broadband | **Products & Services** | 3 Business | Help & Support

Planet 3 Services | Music | Communicate | Add-ons | 3 X-Series | Abroad | Accessories

Log in to My3 >

Search

## Products & Services. Explore Planet 3.

**Shopping & Lifestyle.**

Bag yourself a bargain with gorgeous goods at a snip of the high street price. And whatever you're into, we've got the info to spice up your life.

[More on Shopping & Lifestyle](#)

Manage Add-ons with **My3.**

[Take me to My3](#)

Need help?

**Got a question?**

- Using the internet on your phone
- Windows Live Messenger
- Google and Yahoo!

[More questions](#)

Planet 3 has changed.

**24-7 Football**  
SKY SPORTS **Sun** WORLD  
With more football

Viva La Vida by Coldplay.

**3MusicStore™**

All tracks £1.69, Dual Download to your PC and Mobile.

£1.69

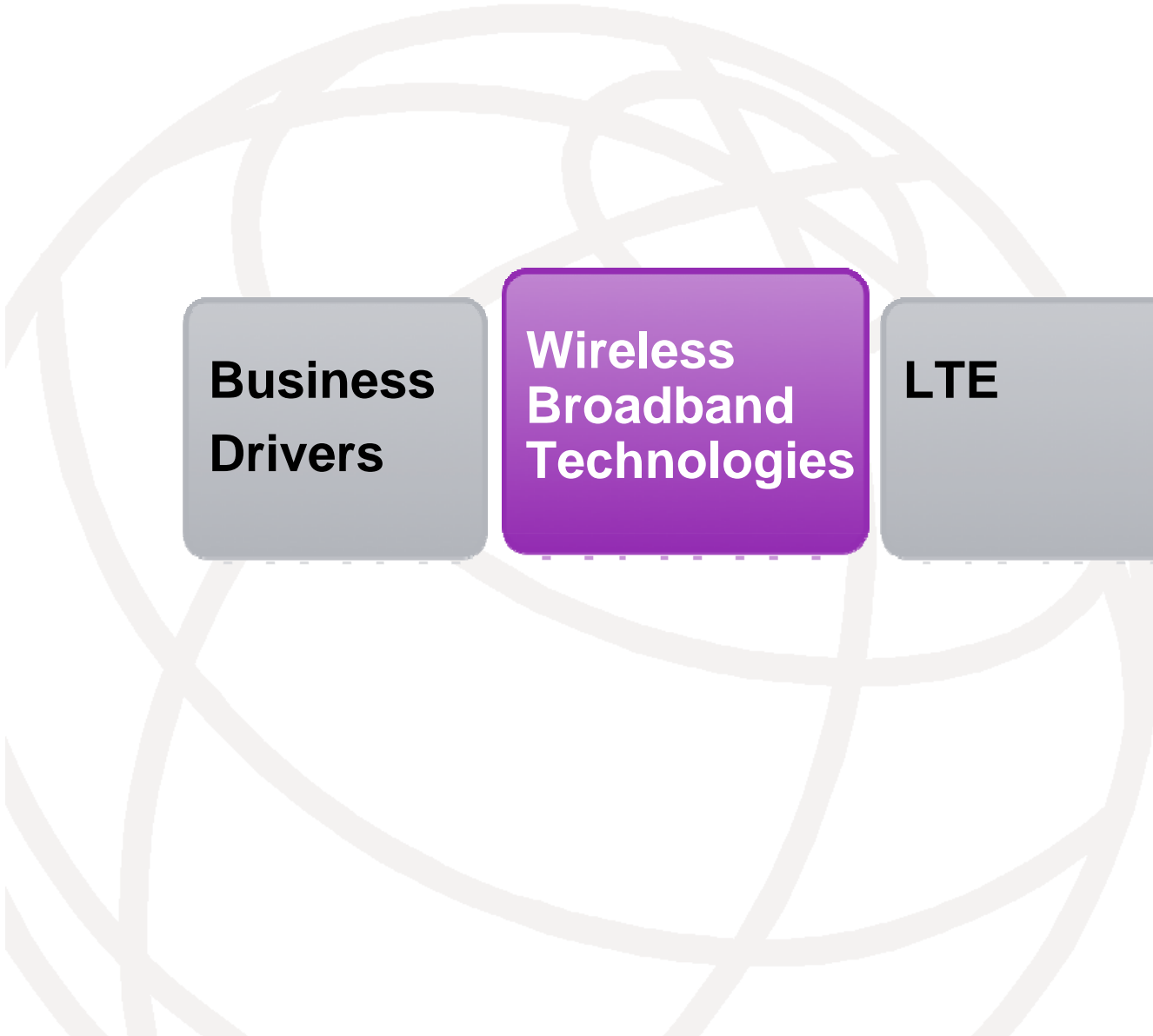
**Broadband on the move.** New plans available

Get online without a landline from just £10 a month.

**Is this a Media Company or Telecom Services Provider?**

[Accessibility](#) | [Contact us](#) | [Network Coverage](#) | [Price Guide](#) | [Store Locator](#)

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**Business  
Drivers**

**Wireless  
Broadband  
Technologies**

**LTE**


**Summary &  
Conclusion**

# Third Generation Partnership Project



## Release Overview

<b>Release 99</b> WCDMA MSC	<b>Release 4</b> TD-SCDMA MSC-Server	<b>Release 5</b> HSDPA IMS	<b>Release 6</b> HSUPA I-WLAN	<b>Release 7</b> HSPA+/ I-HSPA
2000	2001	2002	2005	2007

**Release 8** 

**LTE/HSPA++**

SAE "All-IP"


CDMA Inter-working

March 2009

**Release 9**

LTE-LCS, E911  
 SON, HSPA+++  
 H(e)NB

**Func. Freeze 12/09**  
**ASN.1 03/10**

**Release 10** 

**LTE-Advanced**

TBD

**~ 18 months post**  
**Rel-9 completion**



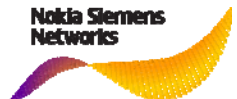
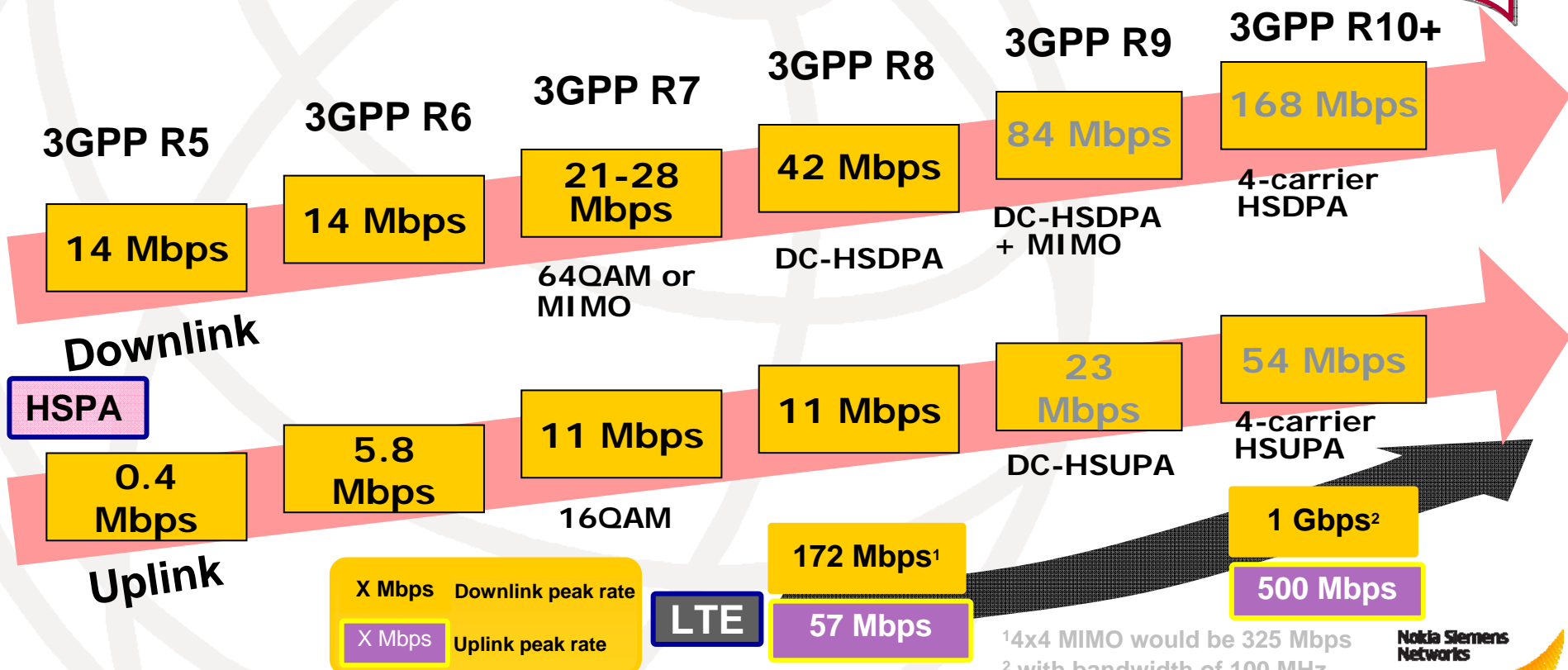
# HSPA/LTE Peak Data Rate Evolution



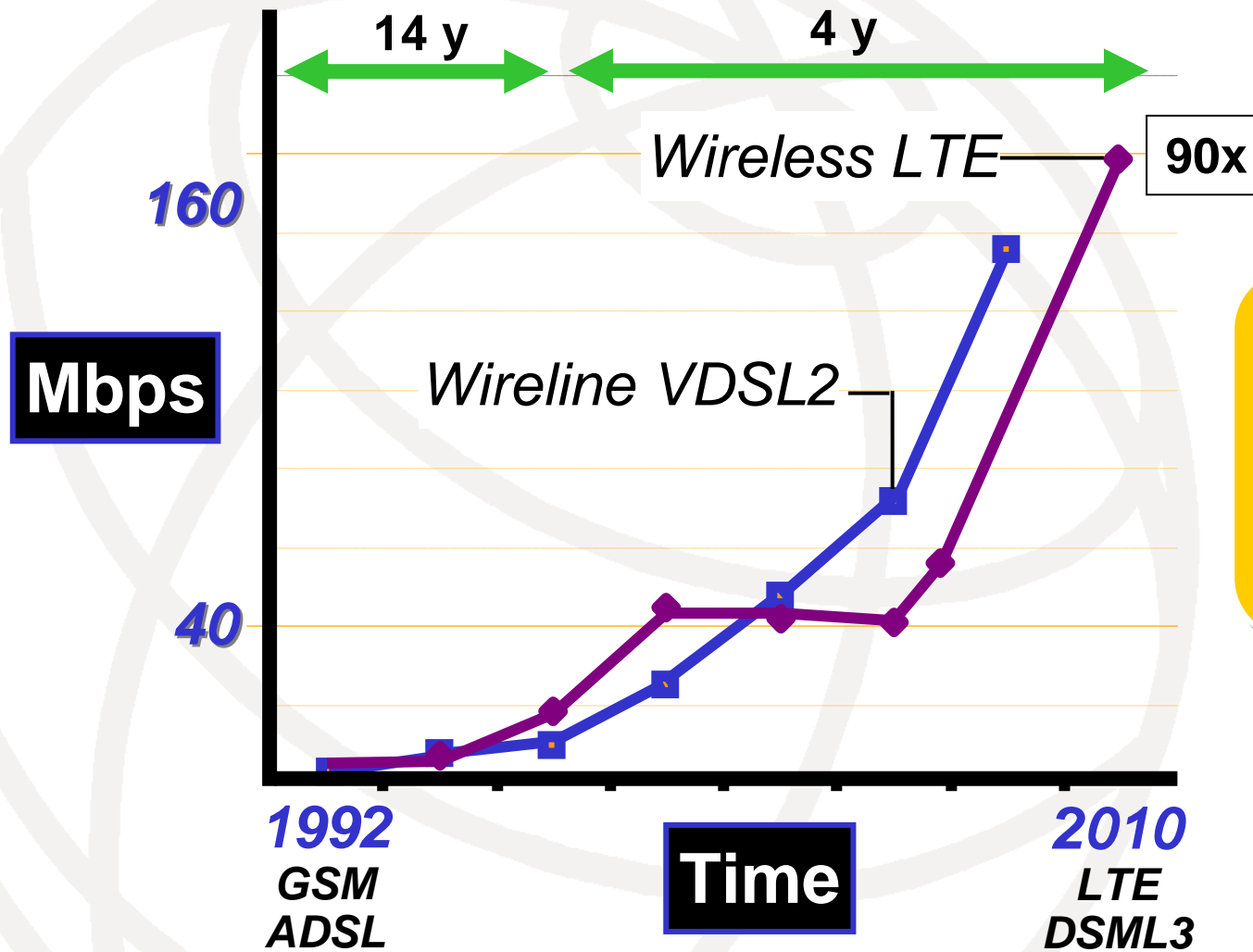
## Efficiency improvement in HSPA+

**HSPA data rates continue to increase**

- Rel-8 HSPA downlink data rate increases with 2x2 MIMO & 64QAM up to 42 Mbps  
Downlink & uplink data rate with 16QAM up to 11 Mbps
- Rel-8 Dual-Cell HSDPA with 64QAM gives 42 Mbps by aggregating 2 downlink carriers
- Rel-9 Downlink data rate increases to 84 Mbps with Dual carrier HSDPA + MIMO
- Rel-9 Uplink data rate increases to 23 Mbps with Dual carrier HSUPA
- HSPA has strong >100 Mbps evolution, thus remains a competitive broadband solution



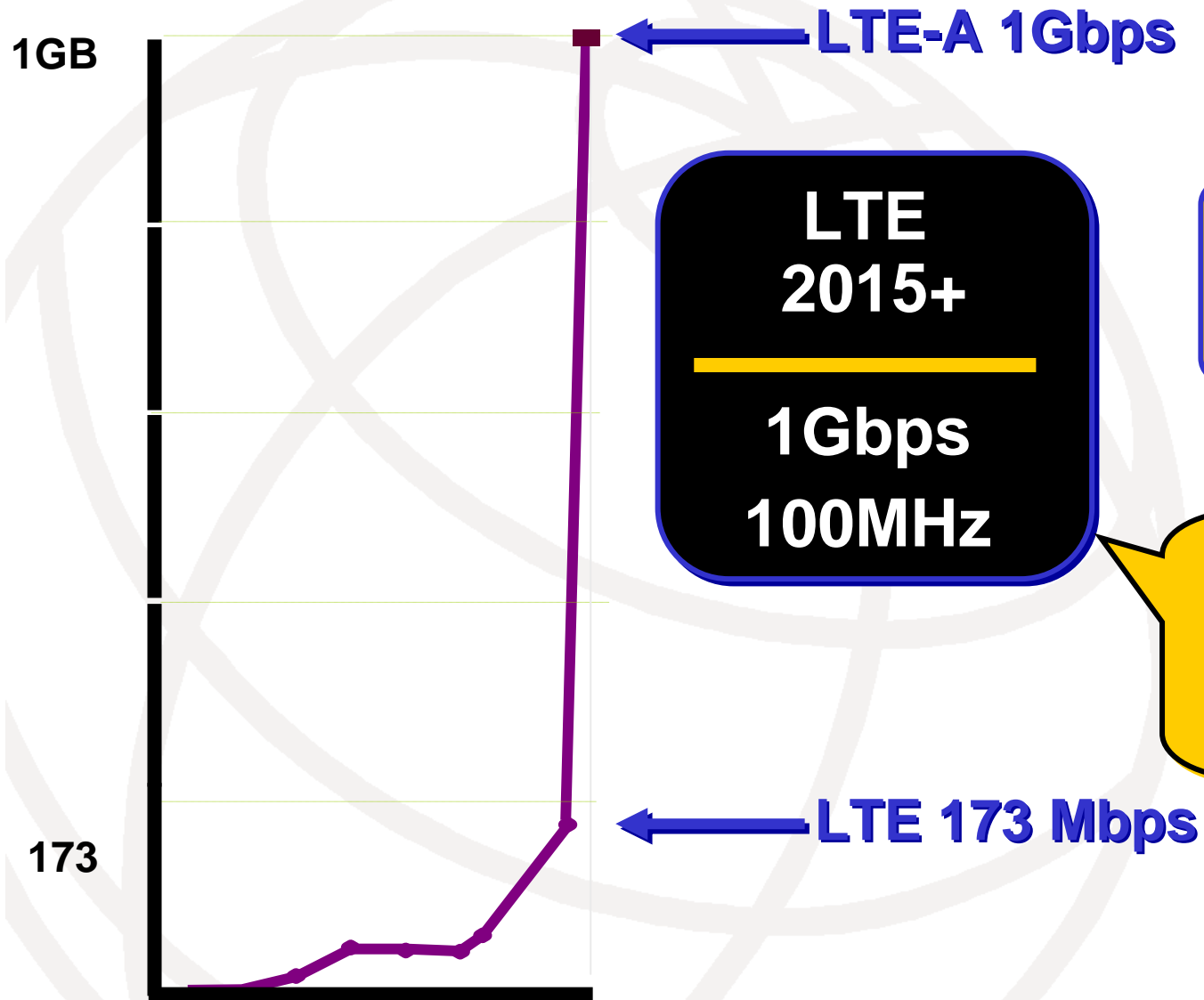
# Broadband Acceleration



**Fastest  
growth in  
history!**

# LTE, LTE-A

The Story Continues



**Bandwidth explosion**  
...it never stops!

Specifications in 3GPP R10, expected to be completed in 2011



# Wireless Broadband Technologies

## Head to Head Comparison

	WCDMA	HSPA R6	HSPA R7/8	I-HSPA	WiMAX <sup>1</sup>	LTE <sup>2</sup>
Peak data rate DL/UL: [Mbps]	0.4/0.4	14/5.7	43 <sup>4</sup> /11.5	see HSPA R6 & R7/R8	40/10	173/58
Latency [ms]	100- 200	40-60	25-35	25	30-50	10-20
Bandwidth [Mhz]	5	5	5	see HSPA R6 & R7&/R8	5-10 unpaired (TDD)	1.4-20
Spectral efficiency DL/UL: [Mbps/MHz/cell]	0.2/0.2	0.53/0.3	1.3/0.4	see HSPA R6 & R7&/R8	1.4/0.6	1.8/0.9
Voice efficiency DL/UL: [User/MHz/cell]	18	273/17	36/25	see HSPA R6 & R7&/R8	20	73/47
Architecture	RNC based	RNC based	RNC based	Flat	Flat	Flat
Services	CS and high speed PS	Broadband PS	Broadband PS and CS over HSPA	Broadband PS and CS over HSPA	PS only (VoIP)	PS only (VoIP)

**LTE: highest spectral efficiency**

<sup>1</sup>WiMAX with 2x2 MIMO@10 MHz TDD, DL/UL ratio: 29/18

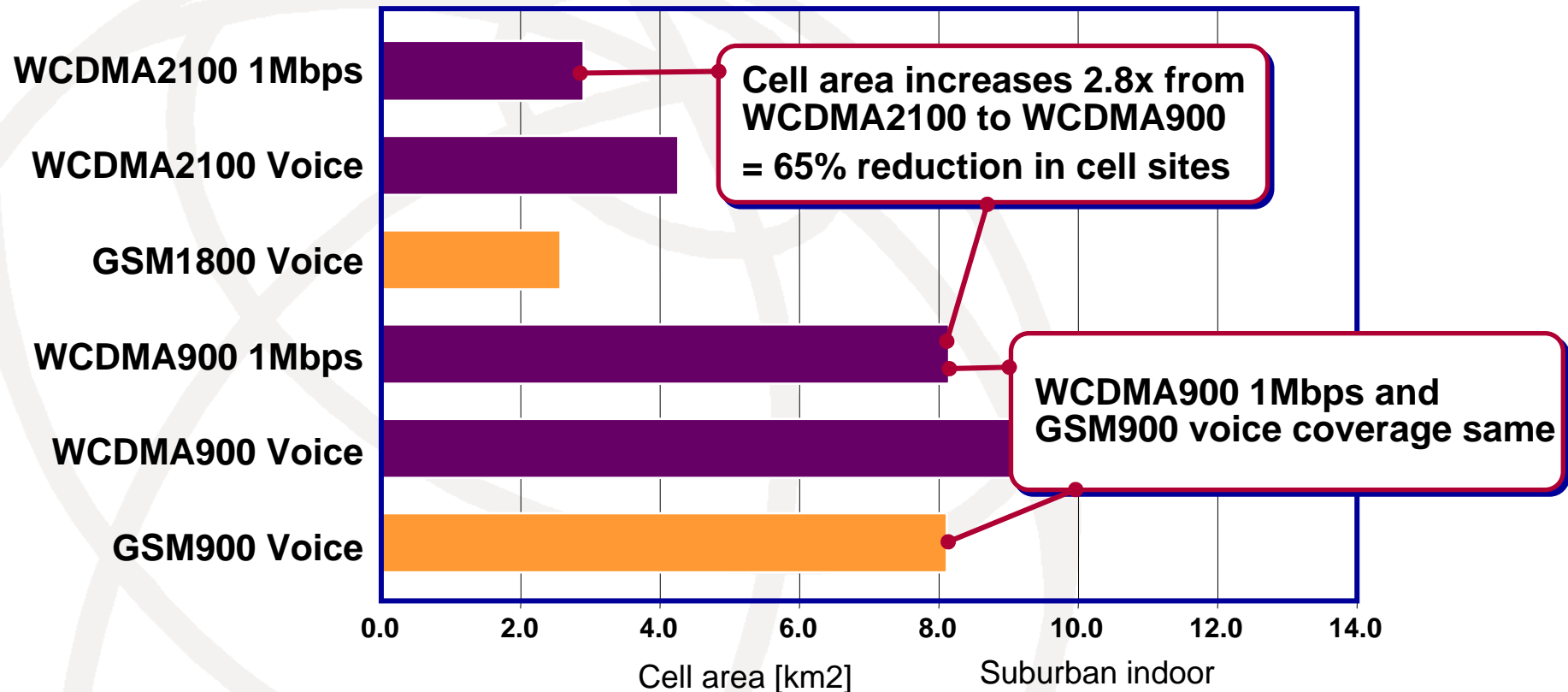
<sup>3</sup>HSPA with rake receiver terminals

<sup>2</sup>LTE with 2x2 MIMO @ 20MHz

<sup>4</sup>HSPA DL 28 Mbps with Rel7, 43 Mbps with Rel8

Table : The development of 3GPP wireless broadband technologies

# WCDMA in 900 MHz provides large coverage



Lower the radio signal frequency, the longer distance it propagates

WCDMA 900 provides 1 Mbps coverage with GSM 900 MHz footprint

# WCDMA 900 devices – March 2009

**Nokia**

21



**Sony Ericsson**

7



**HTC**

11



**Huawei**

18

**Option**

14

**Samsung**

8

**Sierra**

4

**LG**

8

**Novatel Wireless**

3

**ZTE**

7

**Others**

14

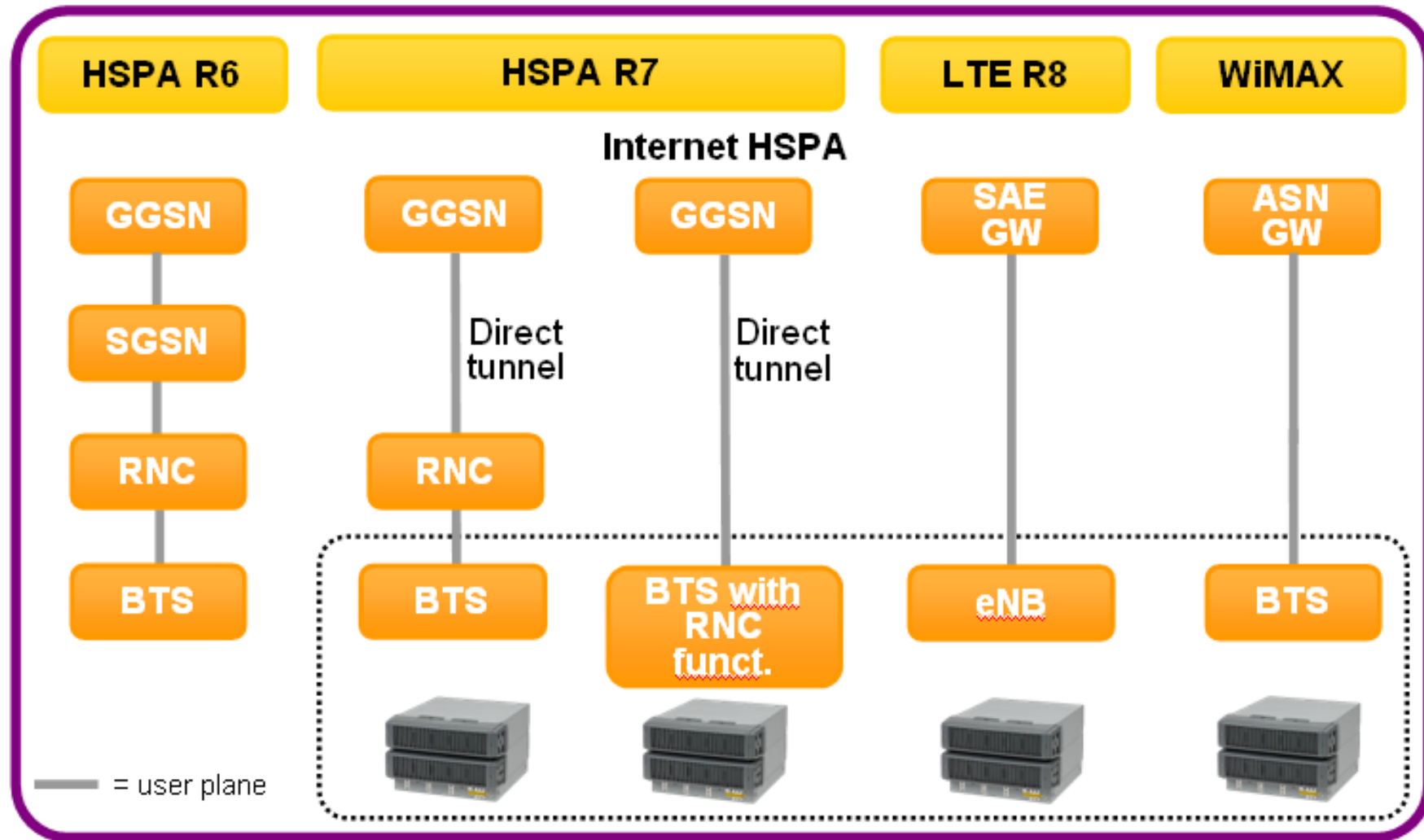


**115 devices announced by 21 suppliers**

**More handsets coming, PC-cards, USB-dongles coming from multiple vendors, Virtually all new 3G phones support 900 MHz**

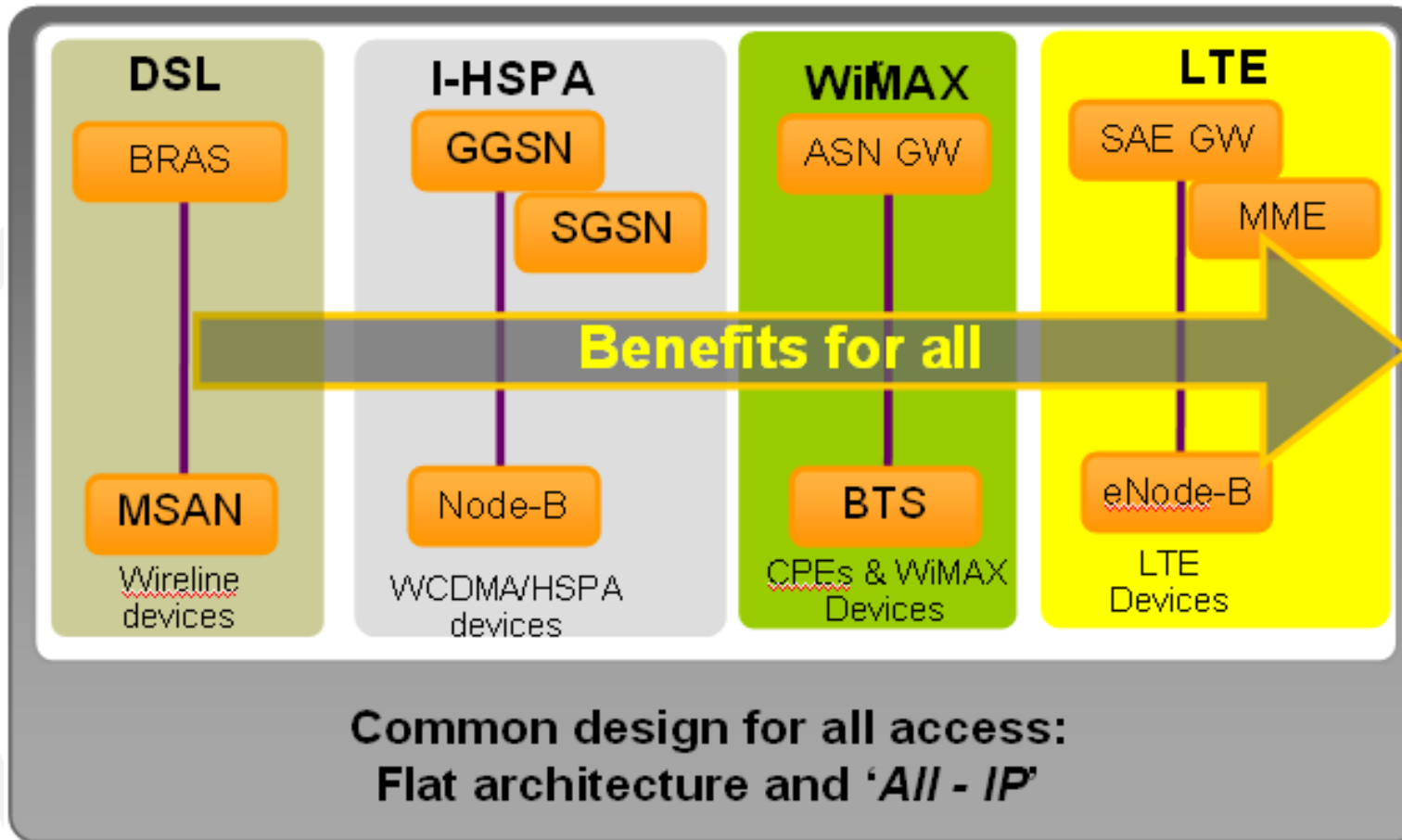
**Clear ecosystem for WCDMA850/900 developed**

# Flat network for flat-rate broadband business



# Flat architecture

*All Broadband Technologies following same architecture*



## Lower latency

- Improves service performance e.g. faster browsing, e-mail sync & online gaming

## No congestion

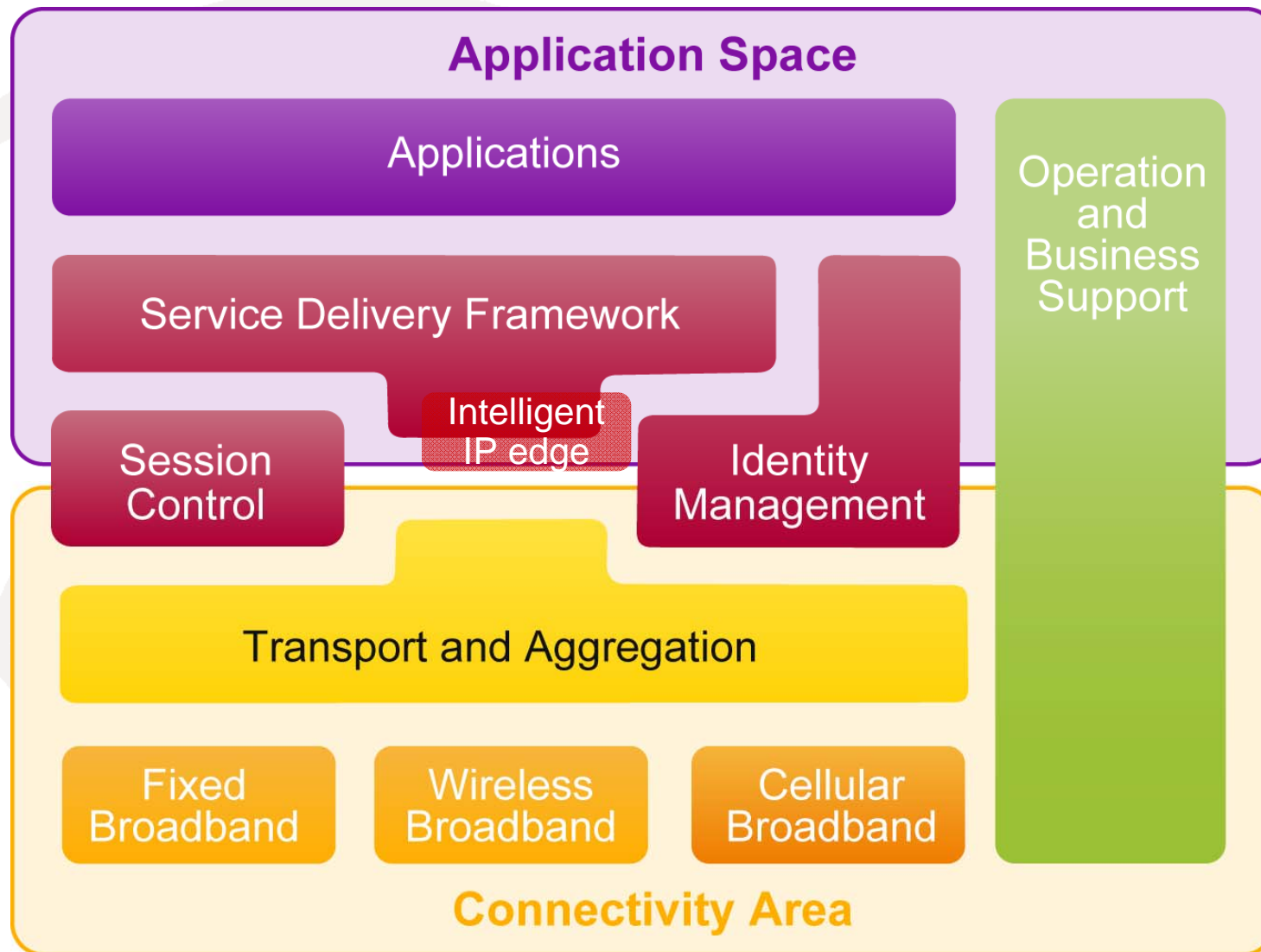
- Quality maintained for data hungry services

## Flat rate

- Flat rate business model can be maintained profitably

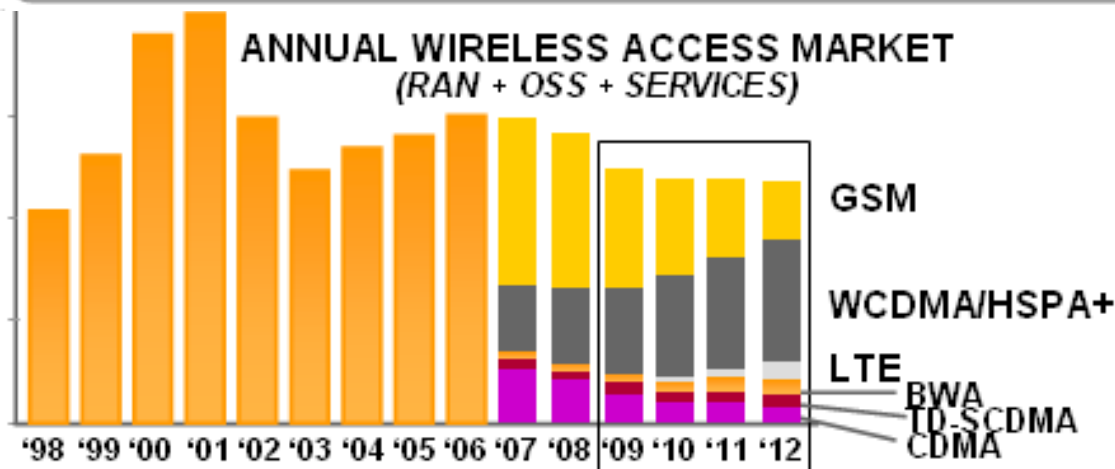
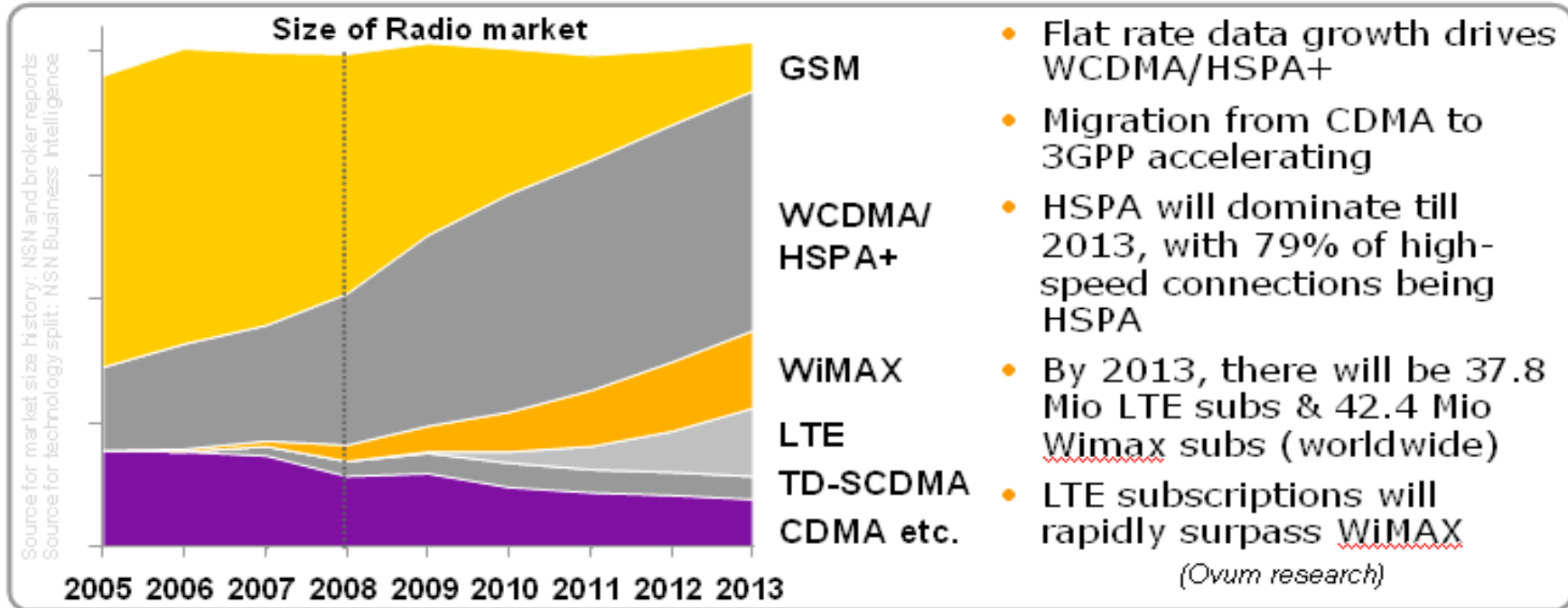
**Lower Costs & Efficient Networks for Operators translate into lower tariffs for consumers ...**

# Network Architecture Vision



# Mobile Broadband

## Which Technologies will prevail?

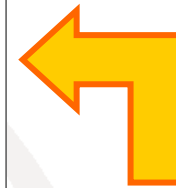


**Focus in HSPA/HSPA+  
in short term,  
GSM/EDGE still strong**

# Growth Potential

Technical

		Mbps
<b>Release 6</b>	16QAM	7, 14
<b>Release 7</b>	64QAM or MIMO	21, 28
<b>Release 8</b>	64QAM+MIMO	42
	DC 64QAM	42
	<i>10MHz Adjacent</i>	
<b>Release 9</b>	DC 64QAM+MIMO	84
	<i>10MHz Adjacent</i>	
	DC 64QAM	42
	<i>10MHz Not Adjacent</i>	
<b>Release 10</b>	MC 64QAM+MIMO?	168?
	<i>20MHz</i>	



**We are here.**

**Peak rates  
continue to  
evolve in 3G**

Releases align approximately with end of year of that release number, eg., R9 YE09, R10 YE10

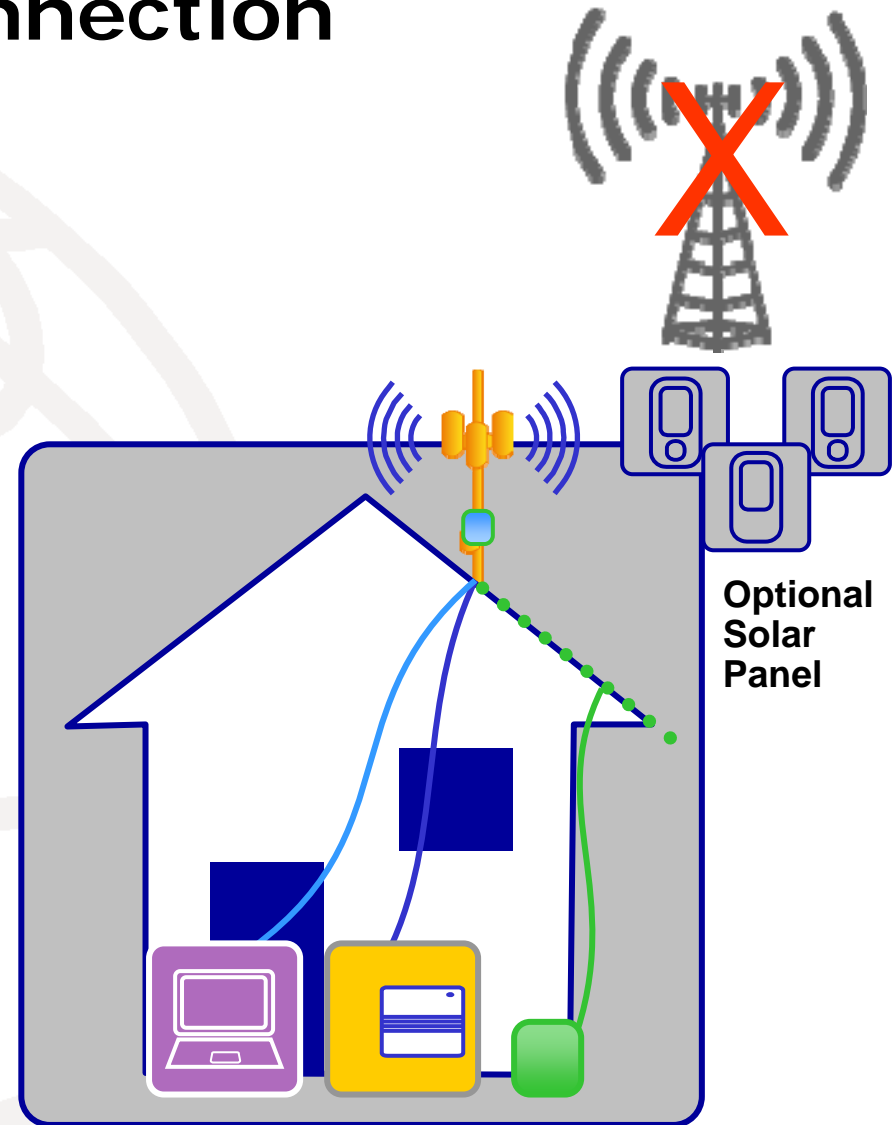


# Rural coverage with significantly lower TCO

## Village Connection

### GSM Access Point in a village

- Minimal site cost
- Wide area coverage
- Calls in village connected locally
- Cost-effective IP connectivity for long-distance calls
- Core network maintains control: regular charging and services
- Internet Kiosk: Shared Internet access for villagers



Internet  
Kiosk

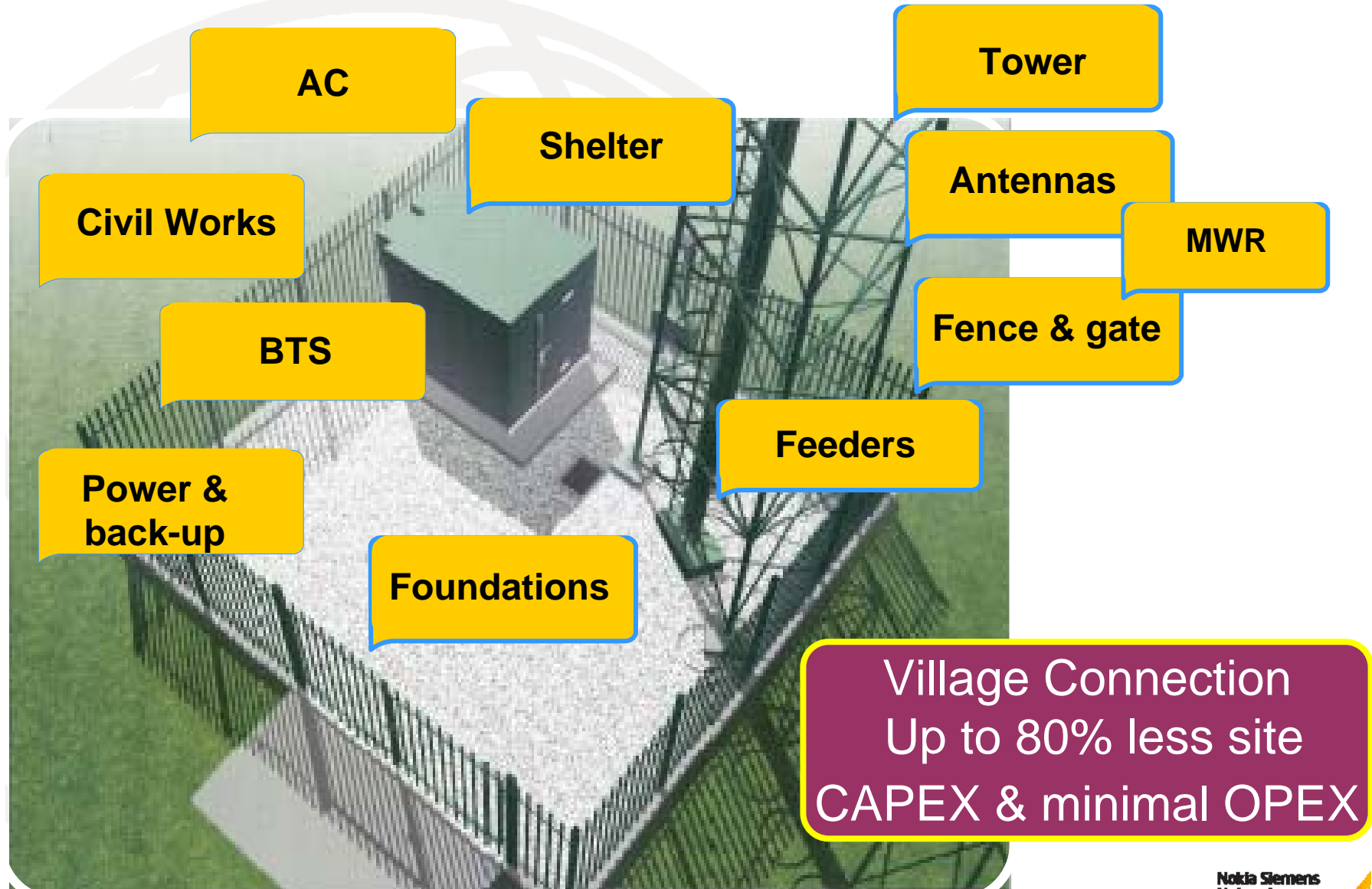
Voice  
& SMS

Battery

Nokia Siemens  
Networks



# Traditional rural sites: Civil Works dominate costs



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**Summary &  
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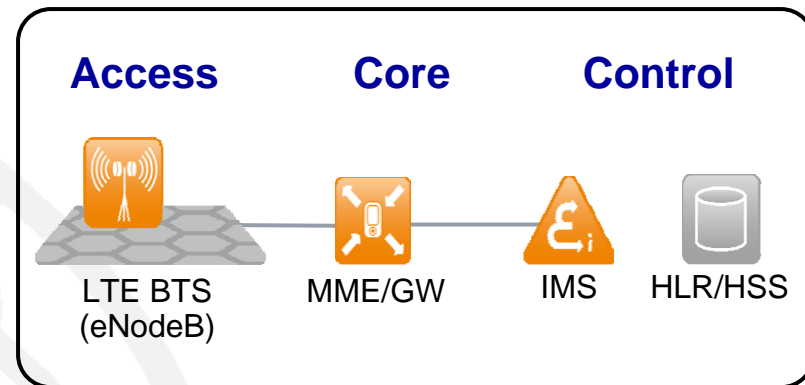
# LTE/SAE overview

## Flat Overall Architecture

- 2-node architecture - all-IP

## Improved Radio Principles

- Peak data rates [Mbps] : 173 DL , 58 UL
- Scalable BW: 1.4, 3, 5, 10, 15, 20 MHz
- Short latency: 10 – 20 ms



### Downlink: OFDMA

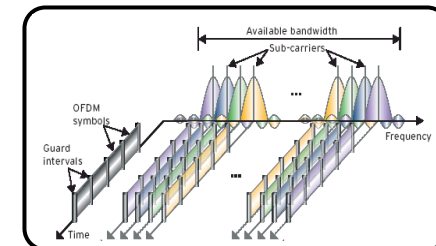
- Improved spectral efficiency
- Reduced interference
- Very well suited for MIMO

### Uplink: SC-FDMA

- Power efficient uplink increasing battery lifetime
- Improved cell edge performance due to low peak to average ratio
- Reduced Terminal complexity

## New Core Architecture

- Simplified Protocol Stack
- Simple, more efficient QoS



**LTE/SAE significantly improves performance for a next generation mobile network**

# LTE: Key benefits for operators & end-users

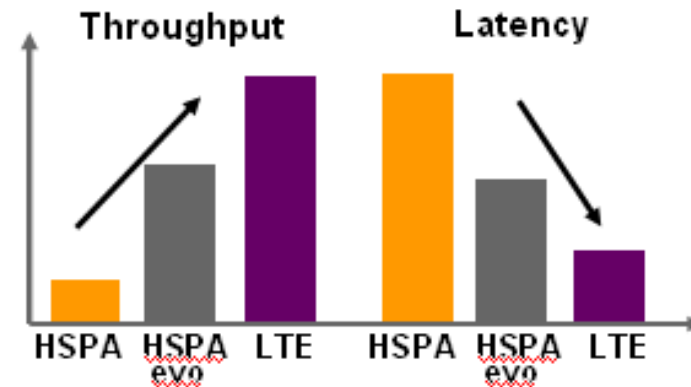
## Investment Protection

### Re-use of

- Sites and infrastructure
- Backhauling
- Frequency bands

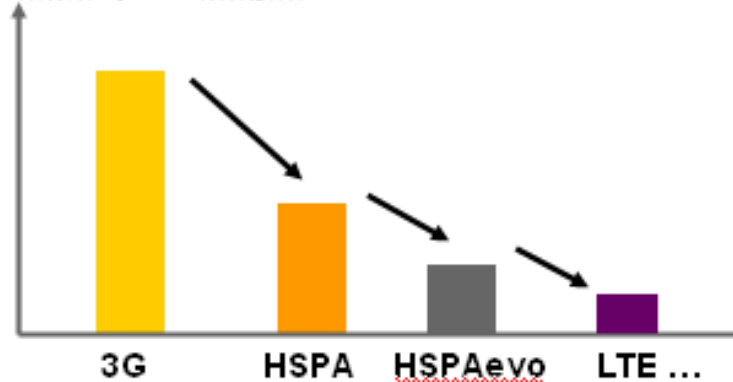


## User experience → ARPU



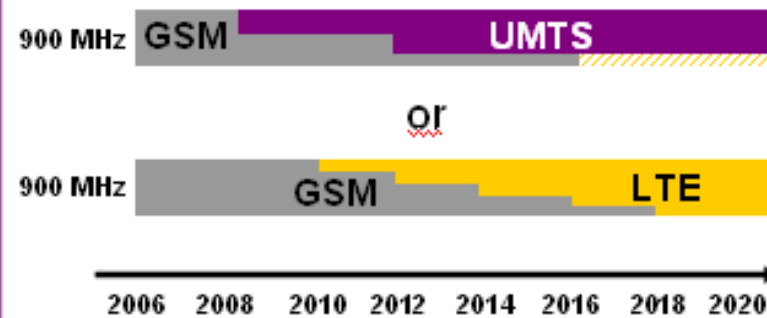
## Low Costs

### Cost per Mbyte



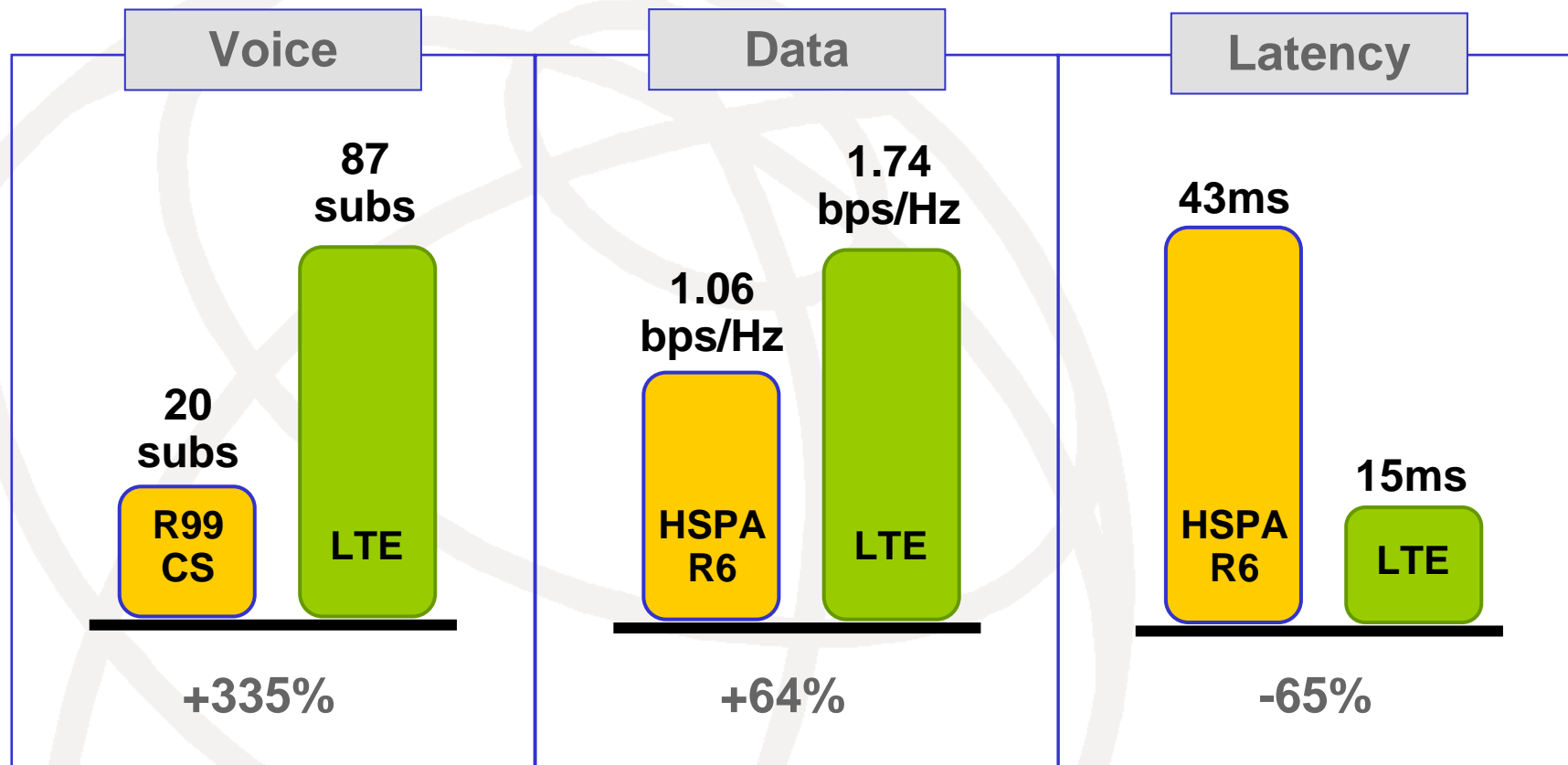
## Scalable bandwidth

### Optimized spectrum usage



# Performance

vs R99 Voice & HSPA R6



per MHz, 5.9Kbps, WCDMA CS Voice  
 LTE semi-persistent scheduler

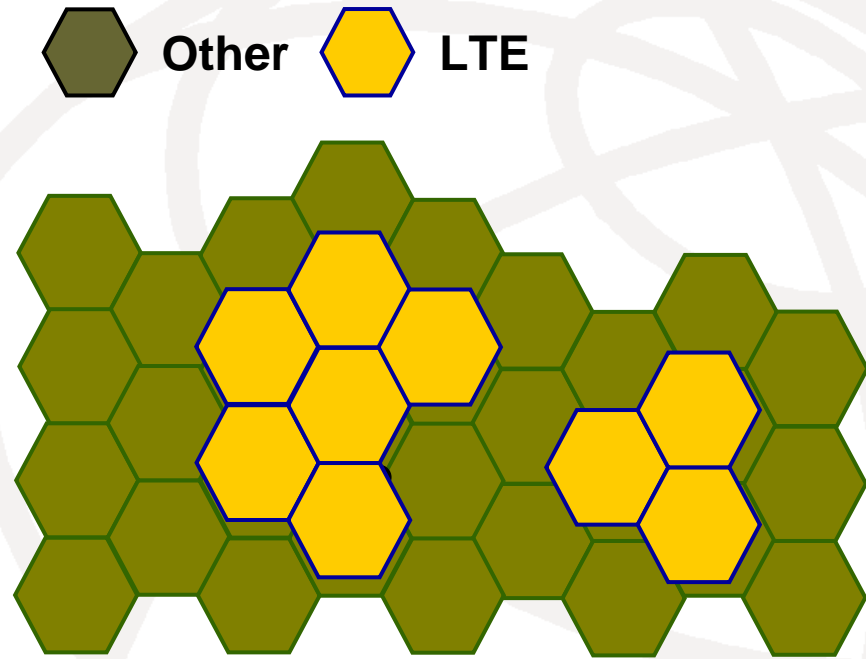
DL

RTD

**Lower Costs, Better Experience**



# Spectrum



Mixed-Mode Networks Likely

<u>Frequency</u> <i>GHz, MHz</i>	<u>Carriers</u> <i>MHz</i>	<u>Modes</u>
2.6	1.4	TDD
2.1	3	FDD
1.9	5	
1.8	10	
900	15	
850	20	
700		

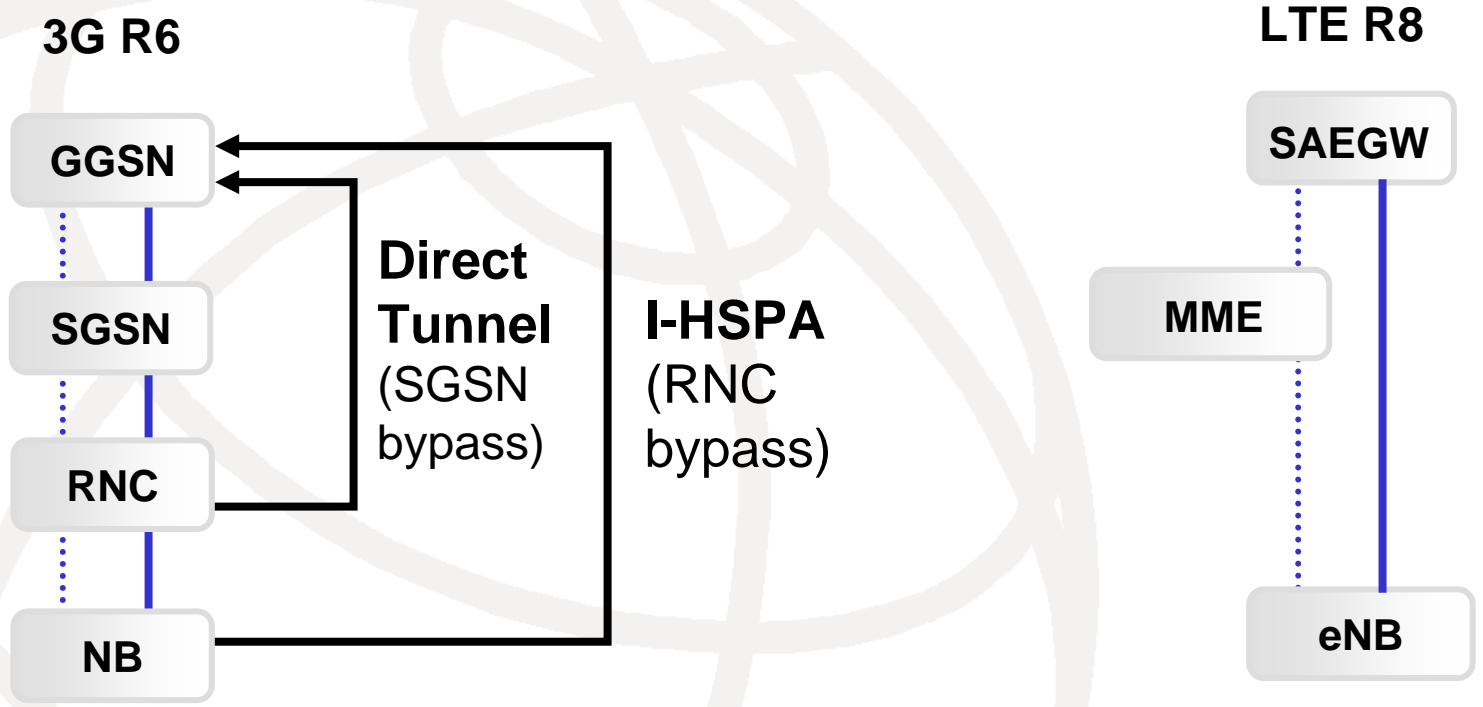
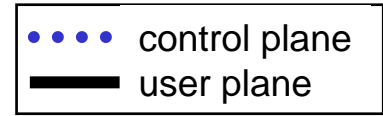
\*20 frequencies specified in 3GPP

## Flexible Frequency & Carrier Sizes

Permitting CDMA, GSM, WCDMA, WiMAX transition to one technology

# Data Strategy

## Graceful Transition



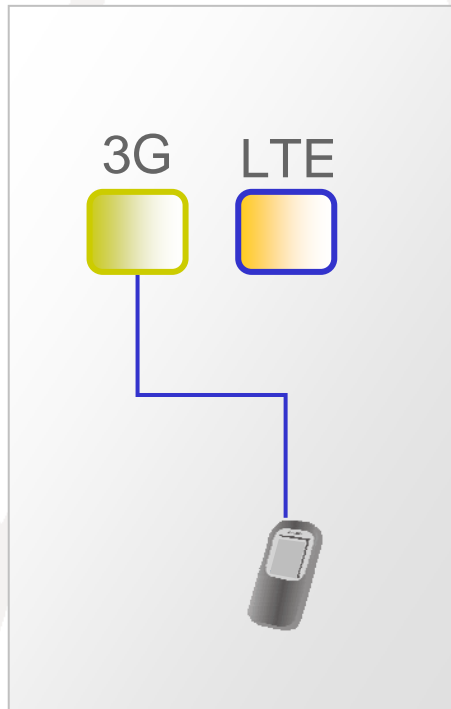
**Convenient, flexible upgrade options**



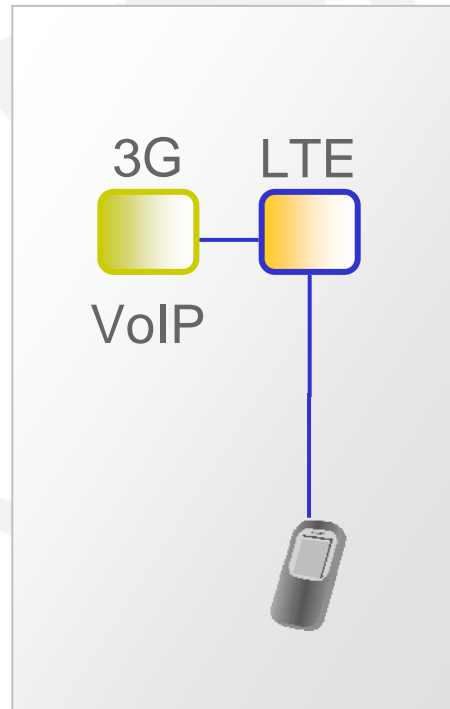
# Voice Strategy

Graceful Transition

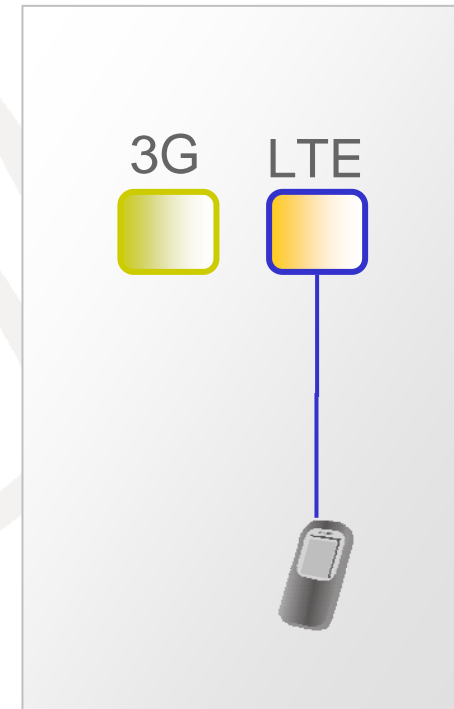
### 3G Fallback



### FastTrack VoLTE

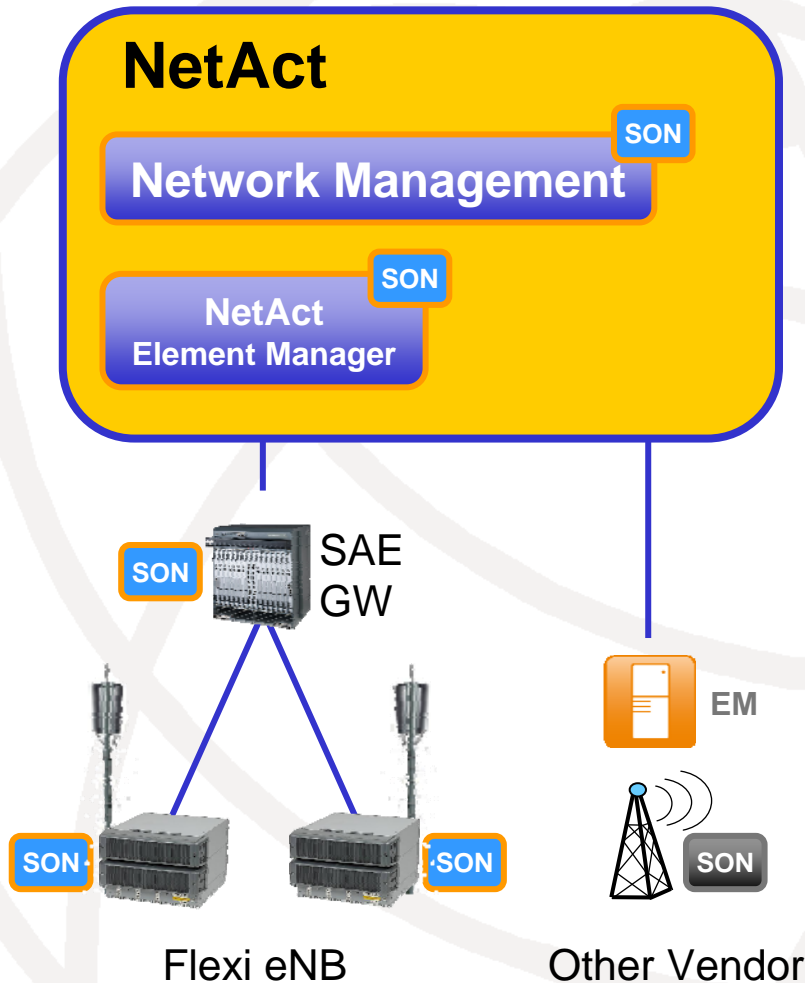


### LTE VoIP



**Convenient, flexible upgrade options**

# NSN Self-Organizing Networks



## Characteristics

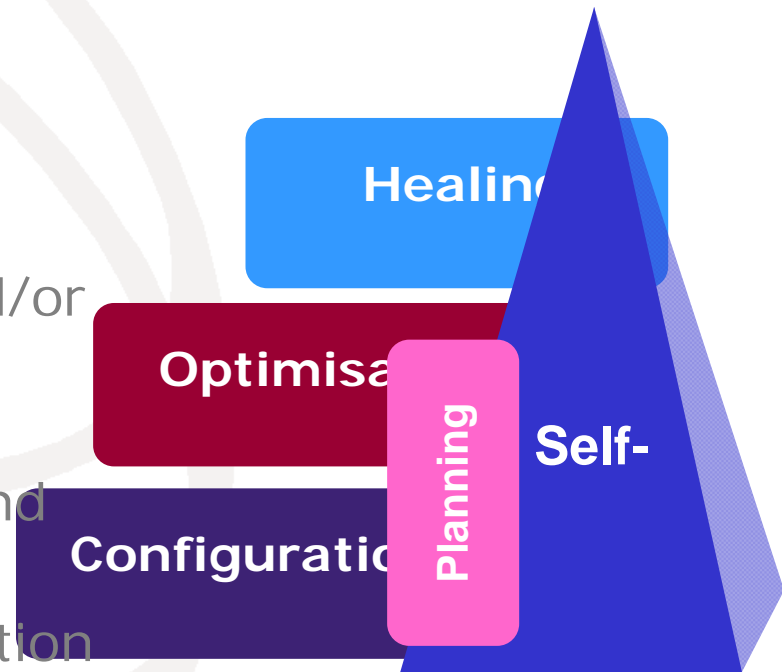
- Self-planning, configuration, optimization, healing
- Multi-Vendor

**Example** : 500 network planning parameters reduced to 10

**Significant OPEX reduction**

# Main Functionality of SON

- **Self-configuration:** automated network integration of new eNB by auto connection and auto configuration, core connectivity (S1) and automated neighbour site configuration (X2)
- **Self-optimisation:** auto-tune the network with the help of UE and eNB measurements on local eNB level and/or network management level
- **Self-healing:** automatic detection and localization and removal of failures
- **Self-planning:** dynamic re-computation of network plan, e.g. due to capacity extensions, traffic monitoring or optimization results



# Lower cost of Sites

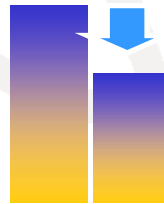
## Our Site Strategy

**Conventional AC Cooling**



**12 year battery life  
940W @ 35 C°**

**13% less site CAPEX**



**On-grid site<sup>1</sup>  
80% less power OPEX**



**SiteStar Battery Cooling**



**12 year battery Life  
40W @ +35 C°**

**Dramatic energy & site cost reduction**

# Nokia Siemens Networks' Flexi Multimode BTS

*SW defined HSPA/LTE Base Station – industry recognition*

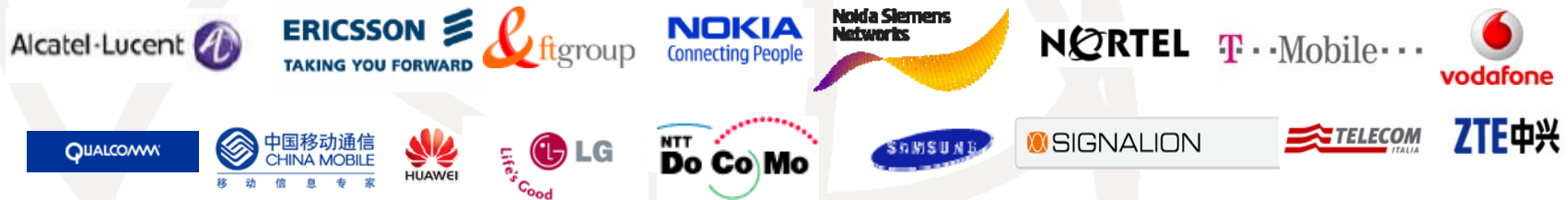


**Green Network  
Hardware and  
Infrastructure  
Winner 2009**

...40 active parties within LSTI

# TRIAL INITIATIVE

LONG TERM EVOLUTION      SYSTEM ARCHITECT EVOLUTION



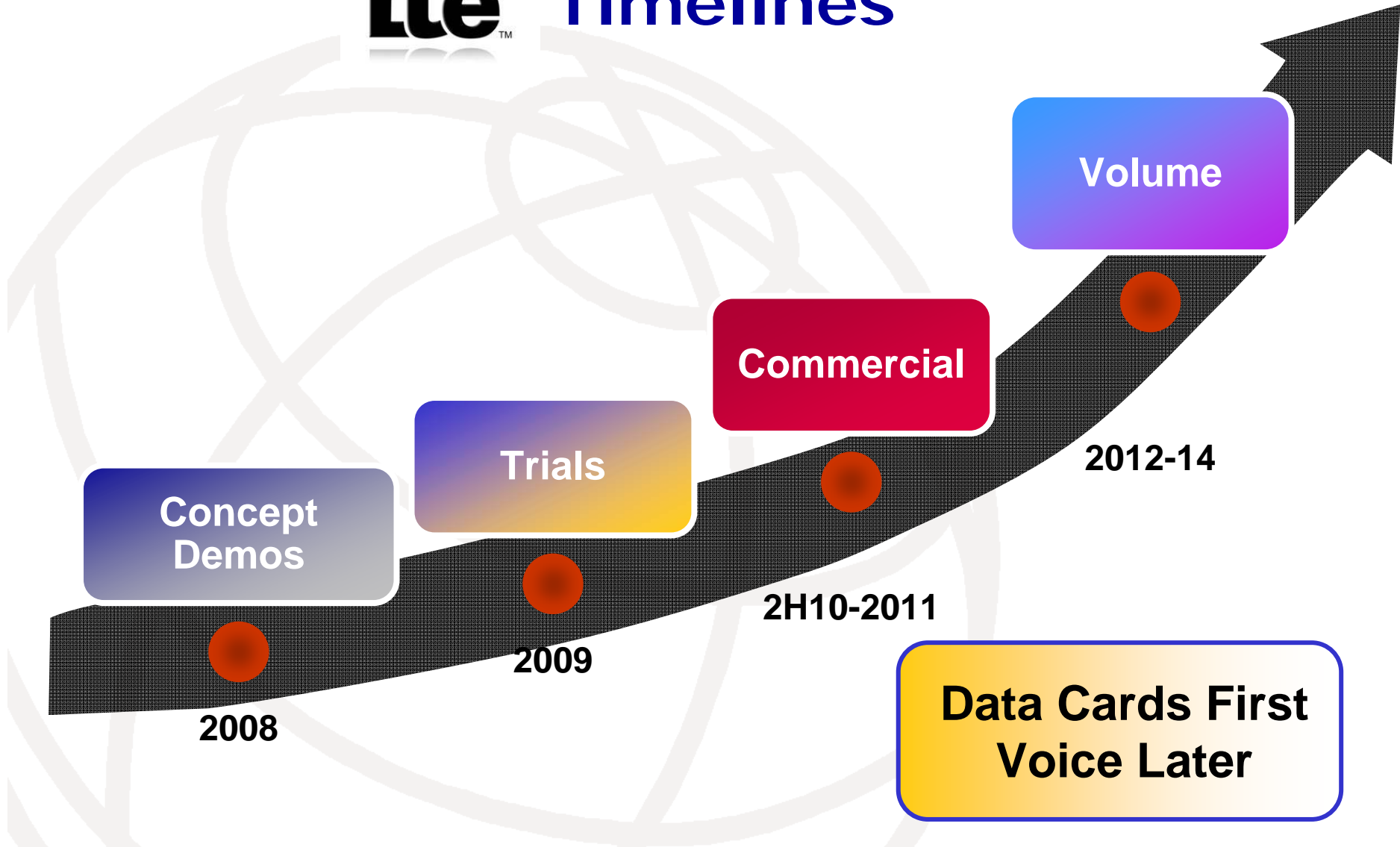
## LSTI initiatives goals/objectives

- Drive industrialization
- Verify 3GPP performance
- Develop the ecosystem

**NSN runs the LSTI Program Office!**



# Timelines



# Spectrum Options

New vs Re-Farming

## New Spectrum

- Must wait for regulator, which may be late

## Re-Farming

- Must have enough to “give” to LTE, without impacting existing business

**Country & Operator  
Dependent**



# Digital Dividend

The spectrum made available over and above that required to accommodate the existing analogue television services in a digital form in:

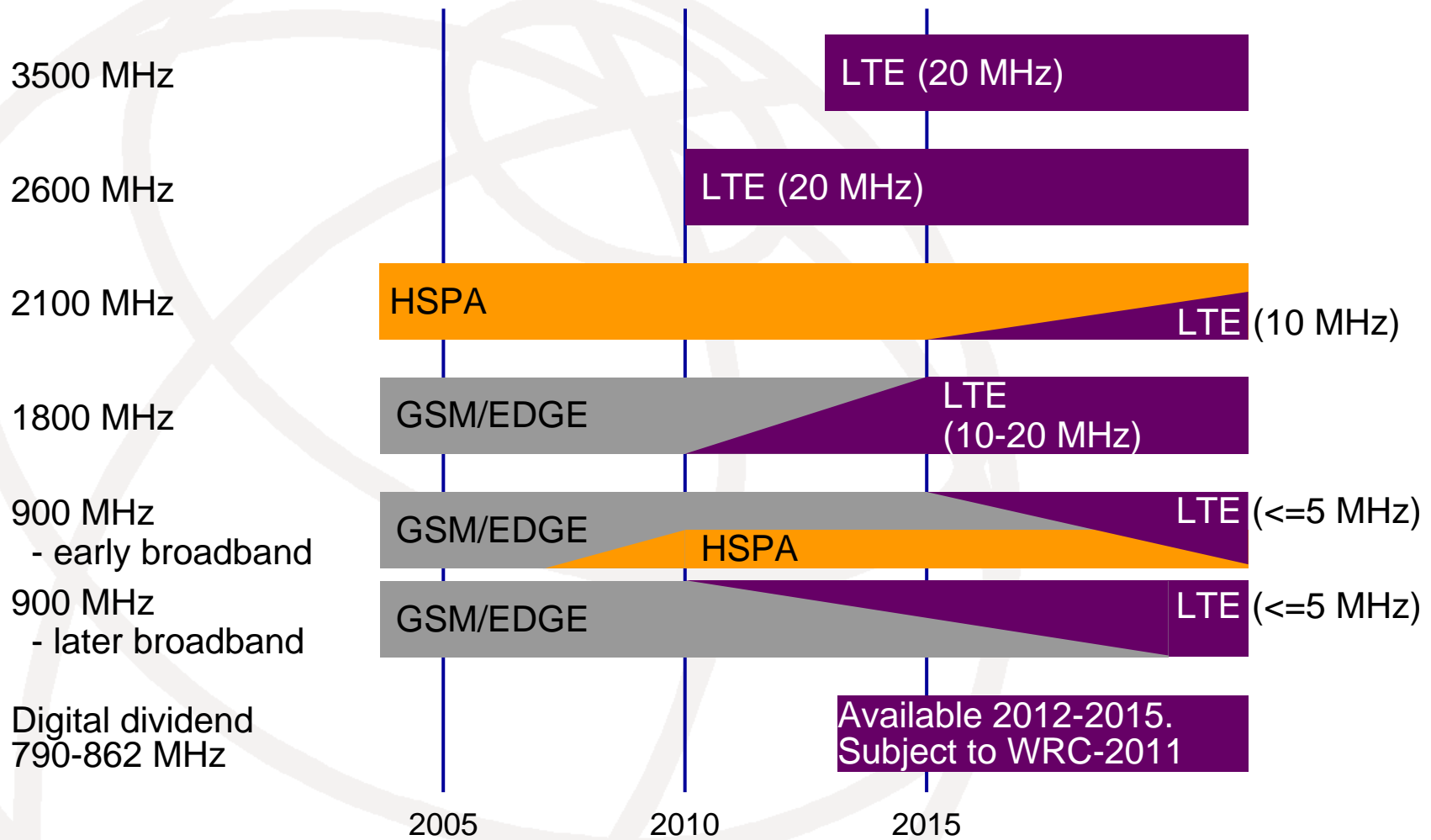
**VHF** (Band III: 174 - 230 MHz)

and

**UHF** (Bands IV & V: 470 - 862 MHz)

**Source: Radio Spectrum Policy Group (RSPG)**

# Our view of spectrum Evolution towards LTE

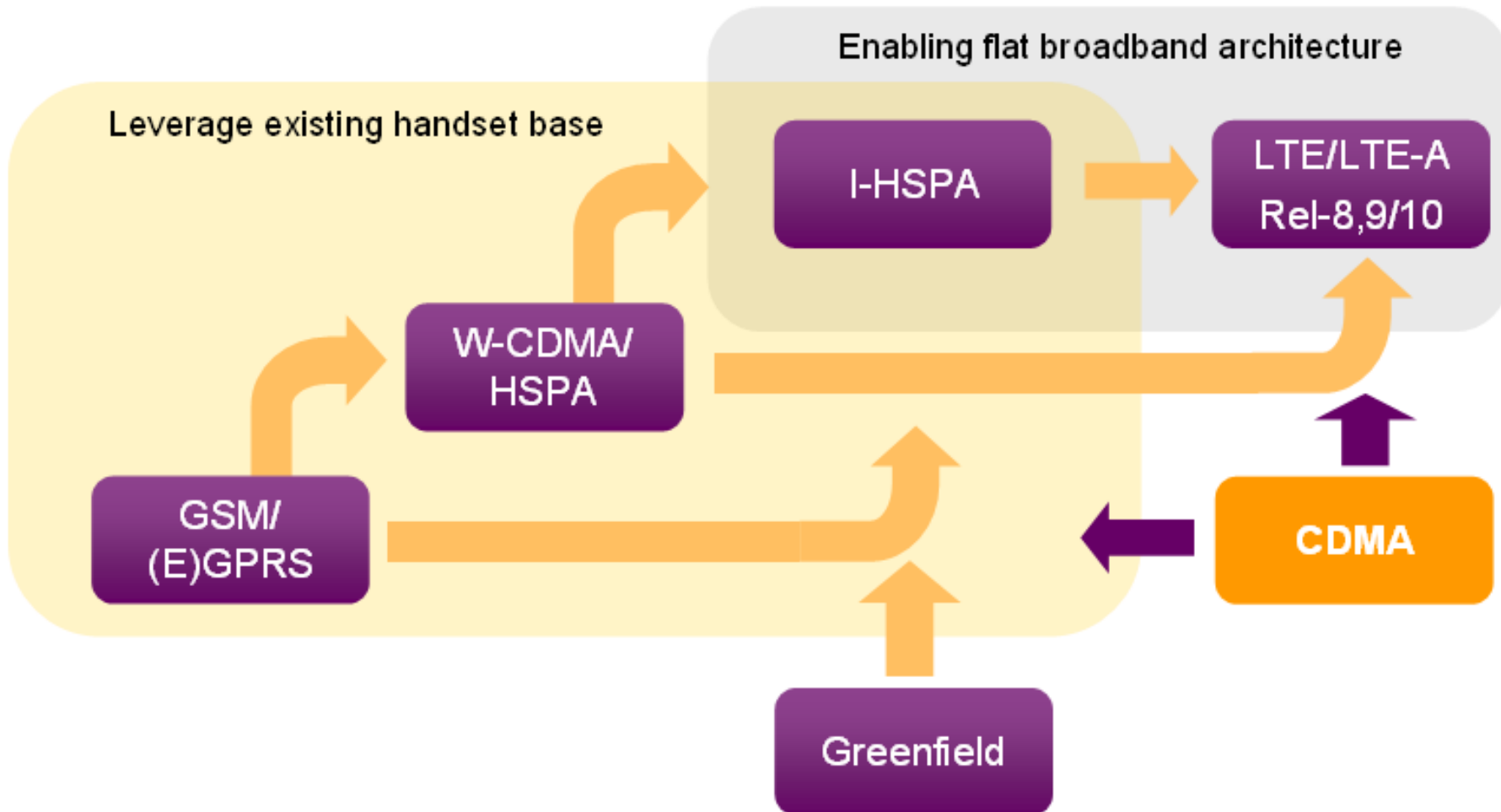


# Nokia Siemens Networks Vision for LTE/SAE

- ➔ **LTE/SAE as successor to all current cellular technologies**
  - Most robust and flexible solution for the next evolution of 3G
  - Achieve universal global roaming
  - Cost reduction via economies of scale and lowest cost/bit
- ➔ **Enhanced services offering delivered at reduced cost**
- ➔ **Level playing field for all operators adding LTE to existing network**

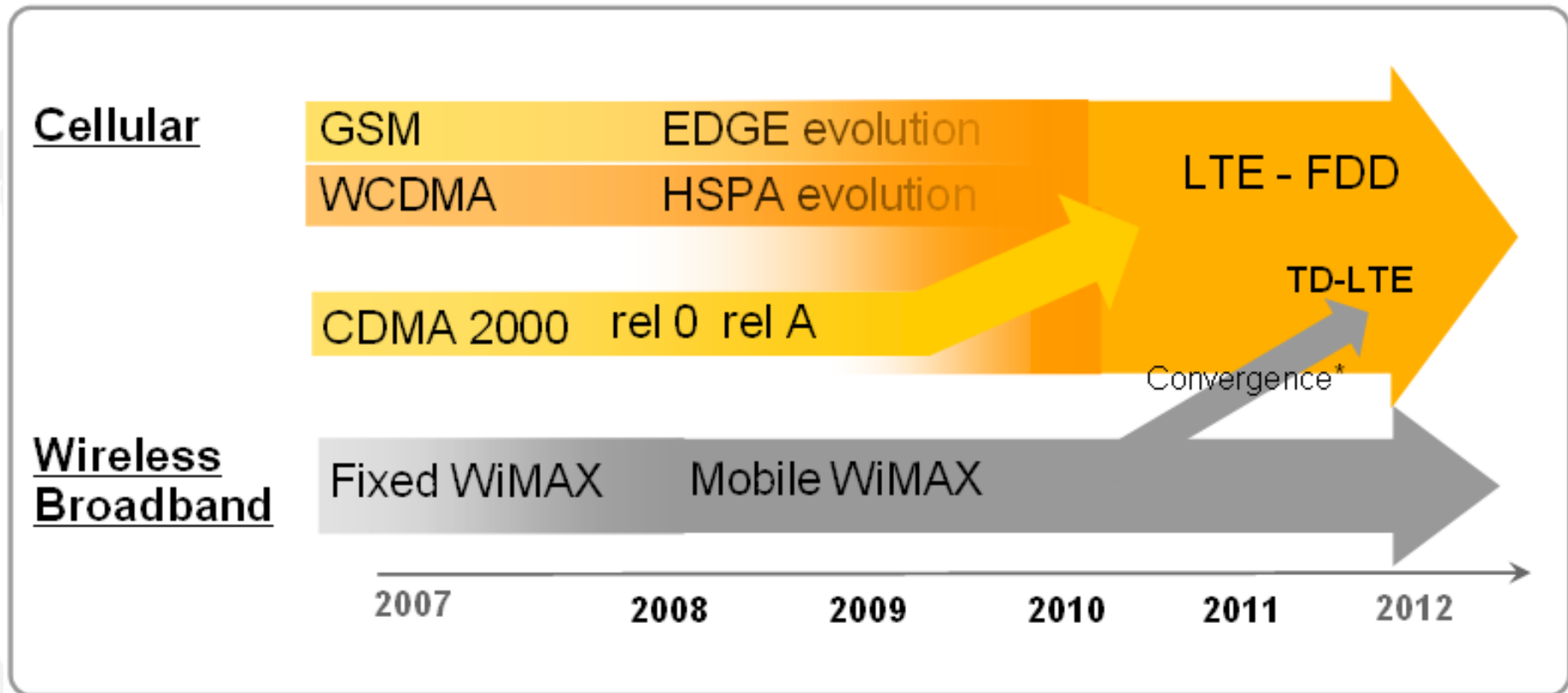
**Attractive for all operators regardless of current network starting point**

# 3GPP standards enable operator migration paths



All paths are open depending on the individual network needs

# Technologies converging to 3GPP path



\* operators with sufficient spectrum and mobile offering



**Business  
Drivers**

**Wireless  
Broadband  
Technologies**

**LTE**

**Summary &  
Conclusions**

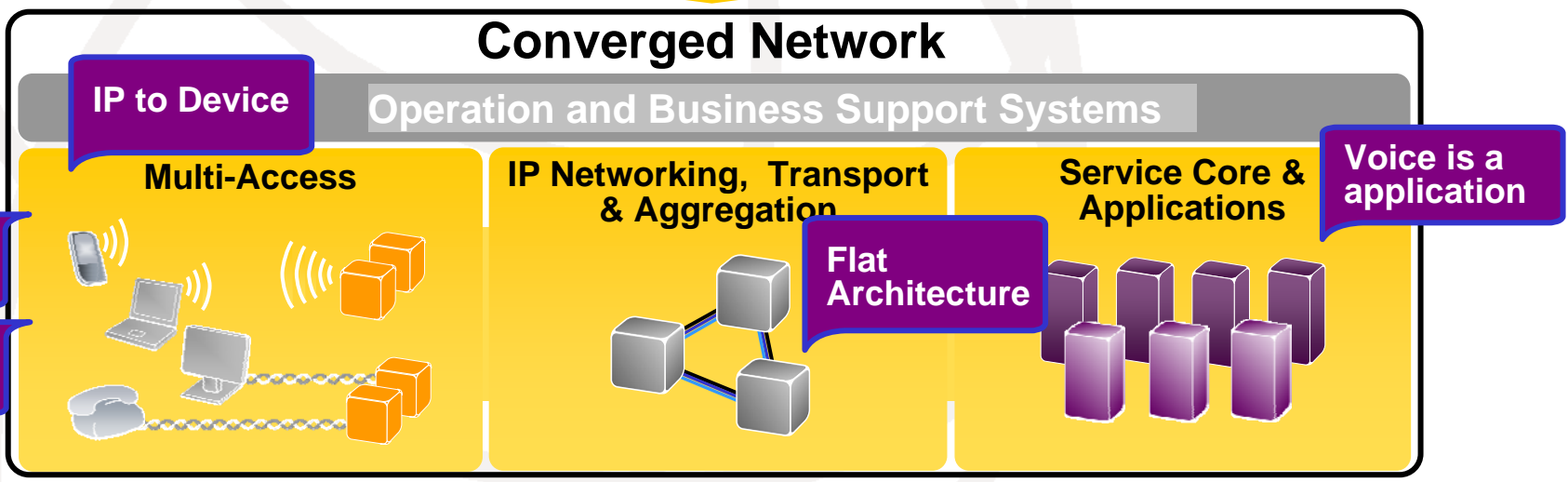
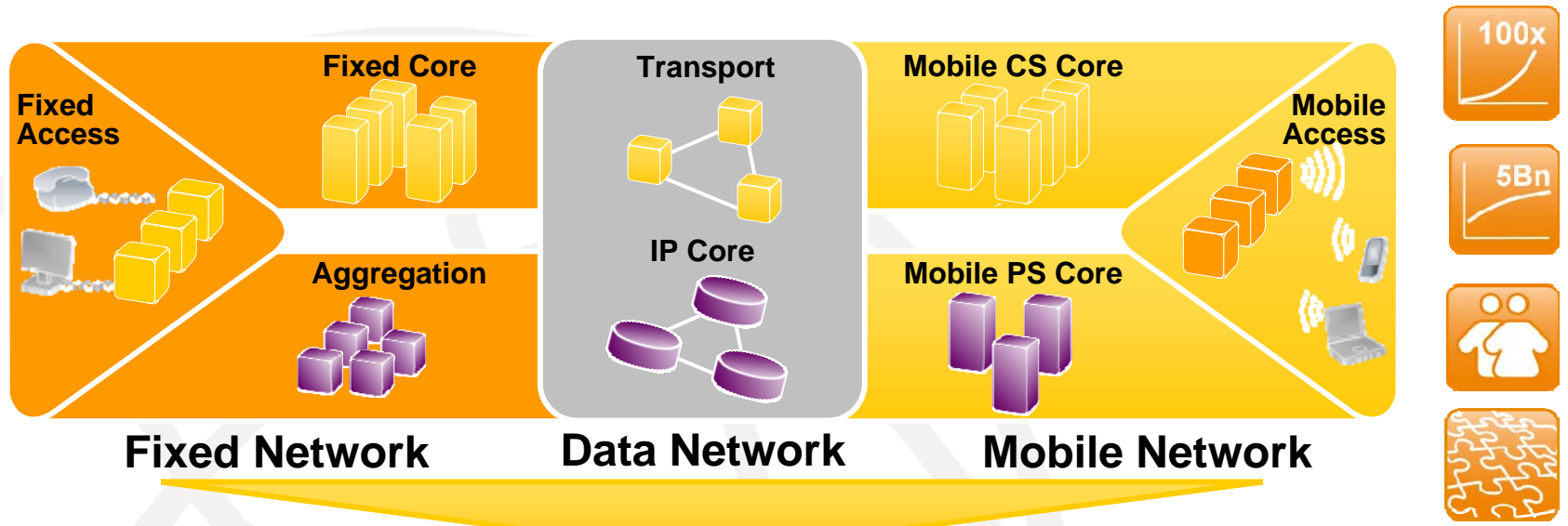
# Industry challenges & opportunities

Nokia Siemens Networks fully geared to support customers

## Reinventing the connected world



# Mega Trend: Network Transformation



**Network is multi-access, IP connection to Services/Applications**





# Telecoms Mega-trends

## Digitization

Analog to Digital transition



Network transformation  
(circuits to packets)



Telco 2.0

Technology Neutral  
Spectrum Licensing



North America  
Europe

Green Comms



# Summary & Conclusions

- **Broadband** is growing at fast rate, which is **changing telecom industry**
- **Speed of change** is unprecedented, with various **Technology choices**
- New **Players** & new **Business Models** emerging, forcing **Technology Evolution & Business Transformation**
- Network evolution to **Flat Architectures** driven by packet access economics which enables **any service** (not just voice) **on any access**
- **Energy efficiency** is essential to **lower costs**
- Nokia Siemens Networks is fully geared to support customers in this **Transformation** through our **Services and Solutions**

Nokia Siemens  
Networks

**Taking the right  
steps to transform  
with our customers**

# Thank You!



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## Nokia Siemens Networks: Reinventing the connected world