

Mobile Cloud Computing – Industry Keynote

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My background in brief

Erkka Ala-Tauriala

- MSc (eng), Aalto University, Electrical Engineering 1998
- MSc (eco), Aalto University, School of Economics 2003
- visiting student, Asian Institute of Technology, Bangkok 1997

- Various positions in System Technology,
System Marketing, Product Management 1998 – 2005
Nokia Networks, Espoo

- CBT Head of Technology (customer CTO) 2006 - 2010
Nokia Siemens Networks, Atlanta, USA

- **Head of Network Evolution Strategy,** Jan 2011 →
Customer Operations
Nokia Siemens Networks, Espoo

Content of the presentation

- Role of cloud computing in future mobile networks
- Mobile Broadband - wireless highway to public clouds
- Nokia Siemens Networks Liquid Net

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Role of cloud computing in future mobile networks

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Cloud computing adoption is on the rise

Consumers

- Low costs or free service often expected
- Ease of use
- Multiple devices in use
- "On-demand" type of usage
- Social networking / collaboration needs

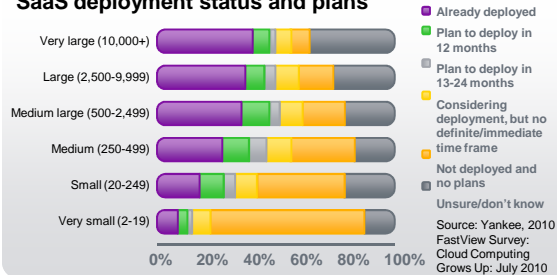
Small & Medium Enterprises

- No up-front investment, especially important for startups
- Business flexibility
- Ease of use
- Buy in expertise
- Across both small and large enterprise

Large enterprise

- Low TCO (low CAPEX is not enough)
- Uniform IT environment
- Ease of use
- Business flexibility

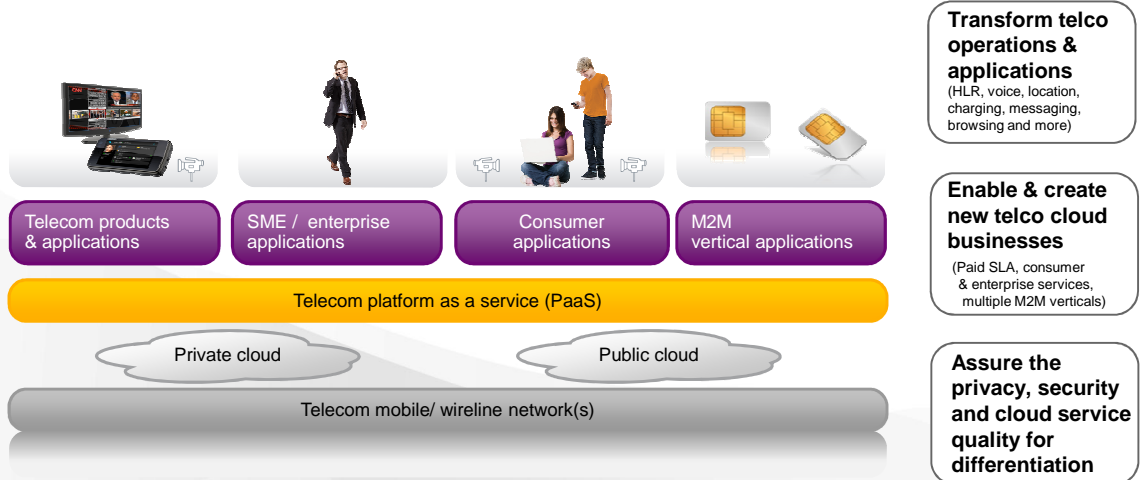
SaaS deployment status and plans



CSPs as cloud users

- Heavy cost pressure pushes use of cloud computing
- Low TCO as the main driver
- Business flexibility to offer new end-user services

Different cloud computing aspects in mobile networks



Cloud based smart phone/tablet services are reality today

iCloud

This is the cloud the way it should be: automatic and effortless. iCloud is seamlessly integrated into your apps, so you can access your content on all your devices. And it's free with iOS 5. [Learn more >](#)

To get started with iCloud, make sure all your devices are up to date. [Learn more >](#)

Photo Stream. Your photos on all your devices.

What is iCloud? Built right into your apps. Watch the iCloud video.

kindle cloud reader

Kindle Cloud Reader is a web app that lets you read your Kindle books, instantly.

[Sign in to get started >](#)

[Your web browser isn't supported yet. Download a browser below.](#)

Buy Once, Read Everywhere

- Instant access to your Kindle library
- Continue reading even when you lose your internet connection
- Optimized for iPad: shop the integrated Kindle Store for Tablets

iCloud: calendar, documents, e-mail, photos, iTunes music

“ Amazon Silk brings super fast, cloud-powered web browsing to Kindle Fire “

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“ Nokia Lumia and SkyDrive puts you in the cloud “

The Nokia Lumia 800 comes with free access to Microsoft SkyDrive, a cloud-based vault for all your documents, photos, videos and music.

Keeping your stuff here means you can access it from anywhere on any device via an Internet connection. For phone users, it's especially valuable since you can store thousands of pictures without filling up your phone.

NOKIA



End-user public cloud experience driven by Mobile Broadband connectivity !

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Mobile Broadband - wireless highway to public clouds



Strong momentum in mobile broadband



Devices



Services



Affordable & exciting MBB offerings

Networks



Over 5 billion mobile subscriptions

- Over 700 million mobile broadband with 50% y-o-y growth
- Operators global MBB service revenue grow annually 25%
- 150 million mobile Facebook users, 1 out of 4 all users
- YouTube generates 13% of global mobile data traffic
- Mobile internet subs predicted to overtake fixed internet in 2-3 years

Source: NSN BI, Industry analysts

Theoretical performance per Mobile Broadband Technology

	HSPA R6	HSPA+ R7	HSPA+ R8	HSPA+ R9	HSPA+ R10	LTE R8 ¹
Peak data rate DL/UL	14.4/5.7 Mbps	21/11 Mbps	42/11 Mbps	84/23 Mbps	168/23 Mbps	172/86 Mbps
Latency	40-60 ms ³	25-35 ms	25-35 ms	25-35 ms	25-35 ms	10-20 ms
Bandwidth	5 MHz FDD	5 MHz FDD	10 MHz FDD	10 MHz FDD	20 MHz FDD	20 MHz FDD
Spectral efficiency MHz/cell DL/UL	0.6-1.1 ² /0.3 Mbps	1.1/0.3 Mbps	1.3/0.5 Mbps	1.3/0.5 Mbps	1.5/0.6 Mbps	1.7/0.8 Mbps

¹FDD with 2x2 MIMO @ 20 MHz

²With Rake terminals 0.6 and with equalizer 1.1

³10-ms uplink frame size

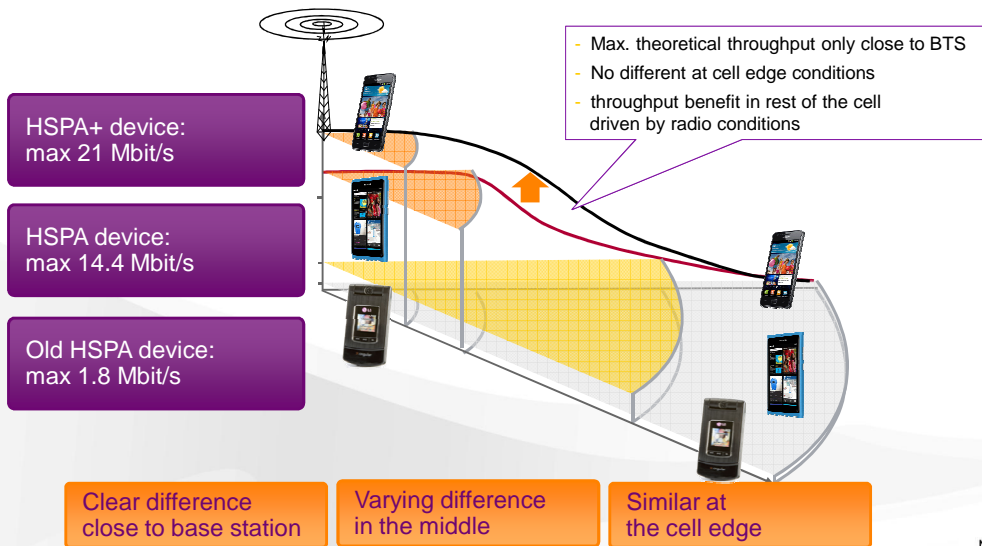
3GPP Releases = 3GPP Rel6, Rel7, Rel8, Rel9, Rel10, etc.



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Reality depends especially on your radio conditions



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Where is Mobile Broadband (MBB) technology today ?



TOP phones, Nov 16th 2011



Nokia N9
HSPA
DL: 14.4 Mbit/s
UL: 5.7 Mbit/s



Samsung Galaxy SII
HSPA+
DL: 21 Mbit/s
UL: 5.7 Mbit/s



SonyEricsson Xperia Ray
HSPA
DL: 7.2 Mbit/s
UL: 5.7 Mbit/s



Apple iPhone 4S

HSPA
DL: 14.4 Mbit/s
UL: 5.7 Mbit/s



Apple iPad2

HSPA
DL: 14.4 Mbit/s
UL: 2 Mbit/s



Novatel MC545

HSPA+
DL: 42 Mbit/s (DC)
UL: 11 Mbit/s



ZTE MF820D

LTE
DL: 100 Mbit/s
UL: 50 Mbit/s

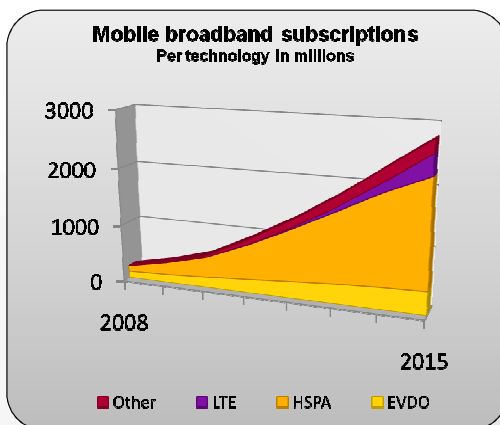
HSPA+
DL: 21 Mbit/s
UL: 5.7 Mbit/s



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Expected split between different MBB technologies



Source: Ovum

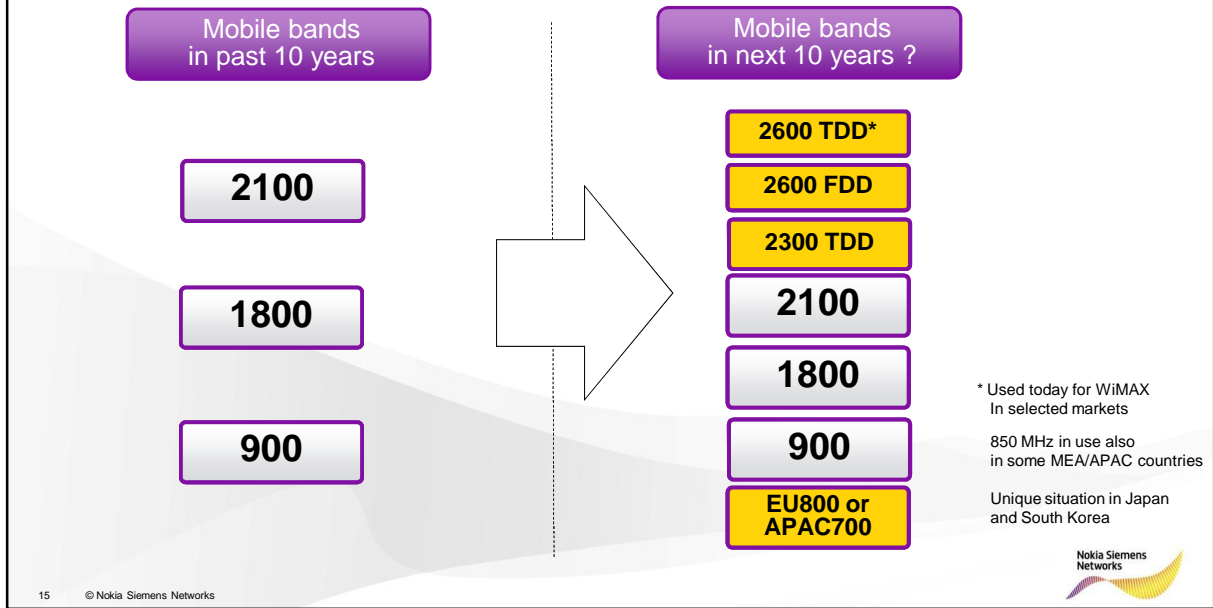
- HSPA overtook EVDO as top mobile broadband technology in 2008
- HSPA technology track will dominate for many years to come
- Lead markets USA, Japan, South Korea, Australia and West Europe
- China, India, Indonesia and Brazil with biggest growth
- Operators are aligned on LTE as the future technology for HSPA and EVDO networks
- WiMAX networks are not expected to gain a significant share of global users

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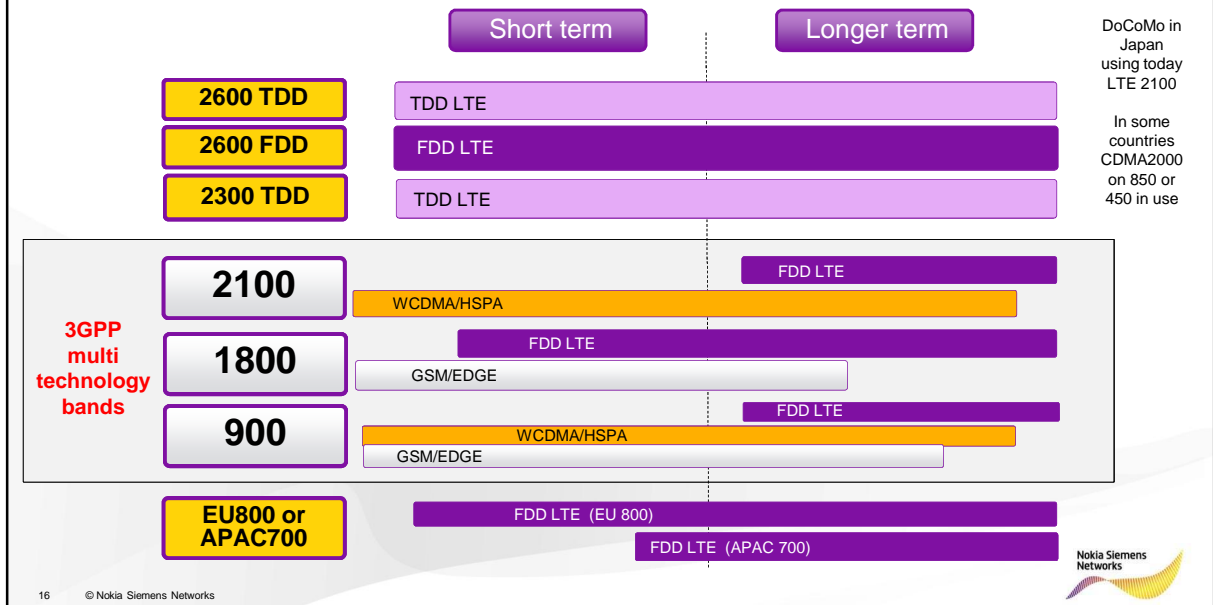
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Typical EMEA/APAC radio spectrum landscape for MBB

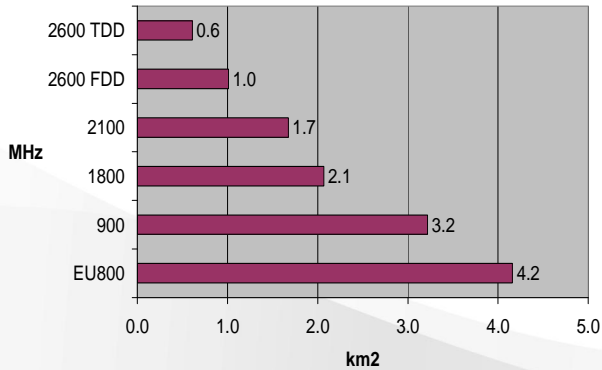


Typical EMEA/APAC radio spectrum landscape for MBB

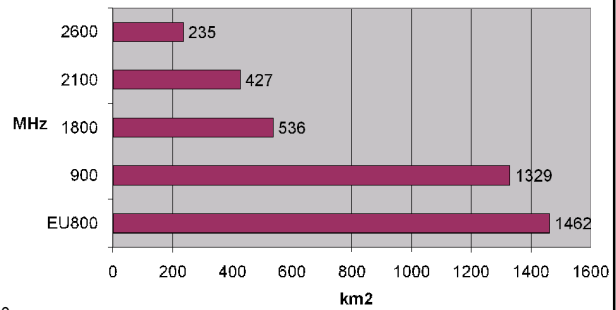


Lower the frequency, better the coverage!

Typical site coverage area in urban area



Typical site coverage area in rural area

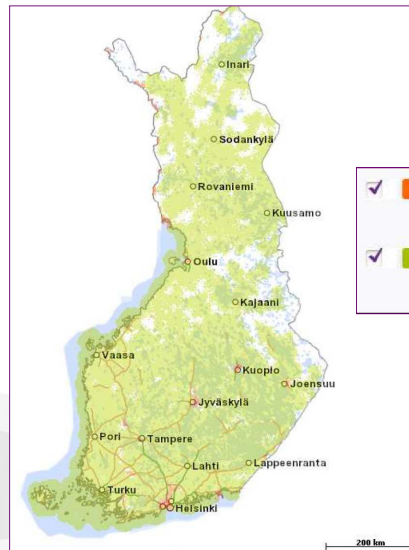


Urban		Rural	
BS antenna height [m]	30	BS antenna height [m]	80
MS antenna height [m]	1.5	MS antenna height [m]	1.5
Standard Deviation [dB]	8.0	Standard Deviation [dB]	8.0
Location Probability	95 %	Location Probability	90 %
Slow Fading Margin [dB]	8.8	Slow Fading Margin [dB]	5.6
Correction factor [dB]	-5	Correction factor [dB]	-15
Indoor loss [dB]	15	Indoor loss [dB]	0

Coverage areas for cell edge
1 Mbit/s DL, 64 kbit/s UL service



Example: TeliaSonera HSPA coverage in Finland



Coverage maps
Nov 14th, 2011



Did you know this key difference between iPad1 vs. iPad2 ?

Apple iPad
HSPA 2100, WiFi



Apple iPad 2
HSPA 900+2100, WiFi

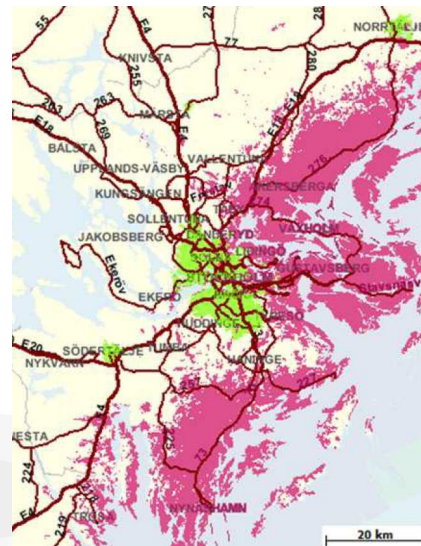
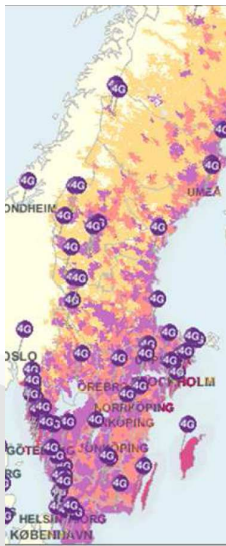


iCloud

Example: TeliaSonera LTE coverage in the Stockholm area



- 4G 10 MHz of LTE 800
- 4G+ 20 MHz of LTE 2600
- Turbo-3G+ DC-HSPA/HSPA+ 2100
- Turbo-3G "normal" HSPA 2100
- 3G+edge WCDMA 2100, EDGE 900/1800



Typical mobile broadband cell site in Mumbai, India



Multiple operators
base station
equipment

Impossible to get
fiber to the cell site
→ microwave radios
used for backhaul
towards core network

Antennas for
communication with
mobile devices

Where are mobile phone price points today per technology ?

Below 50 Euros



Nokia 100
20 Euros



Samsung E1080
25 Euros

GSM-only

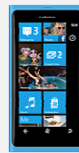
50 Euros →



Samsung
Hero E3213
HSPA 3.6 Mbit/s
~50 Euros



ZTE
Blade
HSPA 7.2 Mbit/s
~150 Euros



Nokia
Lumia 800
HSPA 14.4 Mbit/s
~420 Euros

HSPA-phones
(with also GSM)

400 Euros →



HTC
Vivid
LTE
~420 Euros
(AT&T, USA)



Samsung Galaxy
SII Skyrocket
LTE
~460 Euros
(AT&T, USA)

LTE-phones
(with also HSPA+GSM)

Example unsubsidized single unit retail prices, November 2011

Example MBB end-user pricing in different parts of world

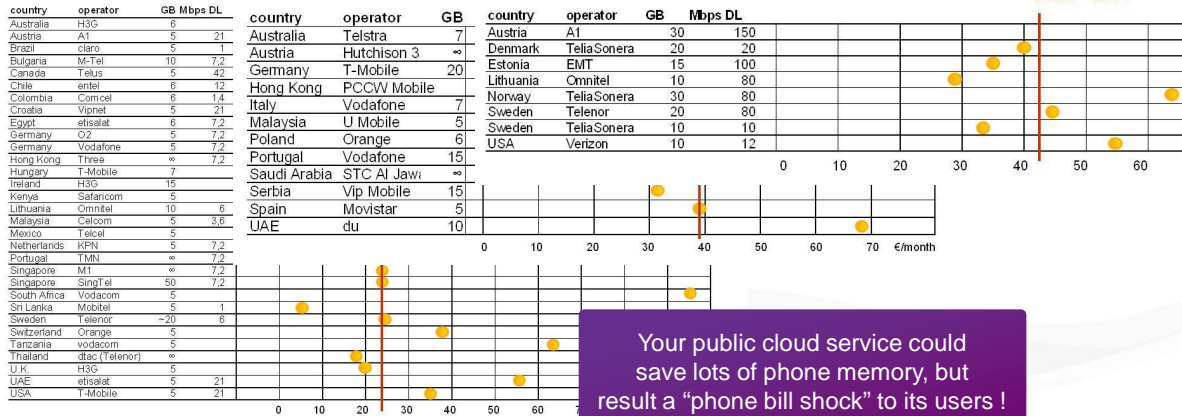
Median for 5 GB / month is 23.30 €

Median for 5 GB / month, 42 Mbps HSPA+ is 39 €

Median for 10 GB / month LTE is 42.35 €

Source: NSN Analysis, Spring2011

A1, 90 €/month



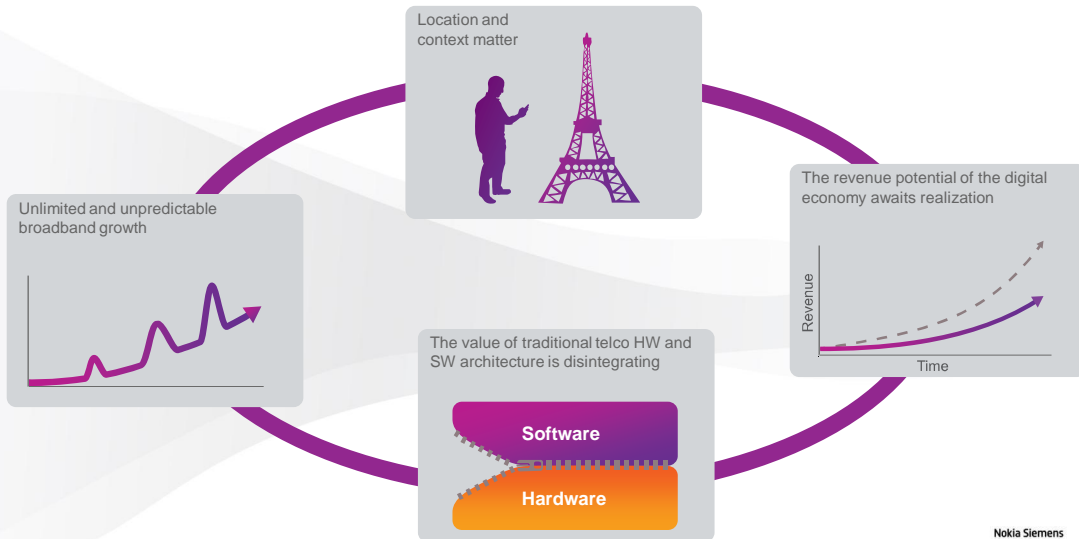
Summary on MBB connectivity reality to public clouds

- Good Mobile Broadband connectivity is key enabler for end-user public cloud service access
- Currently MBB-connectivity dominated by HSPA-technology. LTE also starting to emerge.
- Several “flavors” of HSPA from early 1.8 Mbit/s to today’s 42 Mbit/s to future HSPA+ speeds
- MBB radio technology average speeds typically ~40-50% of the top speeds
- The lower the MBB band the better for coverage → HSPA 900 and LTE 800 make a difference !
- Last mile backhaul connection to cell sites equally important as air interface technologies
- Unlimited MBB pricing getting more and more rare in the world
→ challenge with cloud based services not to cause “bill shock” for the end-users

Nokia Siemens Networks Liquid Net



Four broadband challenges in an increasingly dynamic world



Liquid Net

Unleashing the broadband opportunities of existing networks

What?

Network solutions from Nokia Siemens Networks that

- unleashes capacity frozen within the network
- adapts fluidly to unpredictable broadband demand

How?

Liquid Net:

- self-aware, self-adapting
- software-defined applications
- multi-purpose hardware
- interlinked architecture
- evolutionary

Why?

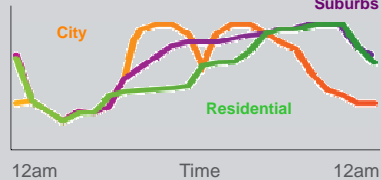
Enhance network's capital efficiency, releasing unused capacity

- up to 80% in radio
- up to 50% in core
- Superior customer experience
- New business potential



Demand is unpredictable

Different times, various locations



Sudden peaks



25-80% overcapacity

30-50% overcapacity



User



Radio



Core



Content



How to make existing communication networks flexible



Self-aware
self-adapting



Software-defined
applications on
multi-purpose
hardware



Inter-linked
architecture



Evolutionary



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Liquid Net: immediate business impact

Enablers



Self-aware
Self-adapting



Software-defined apps on
multi-purpose hardware



Inter-linked
architecture



Evolutionary

Liquid
Net

End-to-end network capabilities

Liquid resource allocation
for enhanced capital efficiency

Intelligent Broadband
Management for superior
customer experience

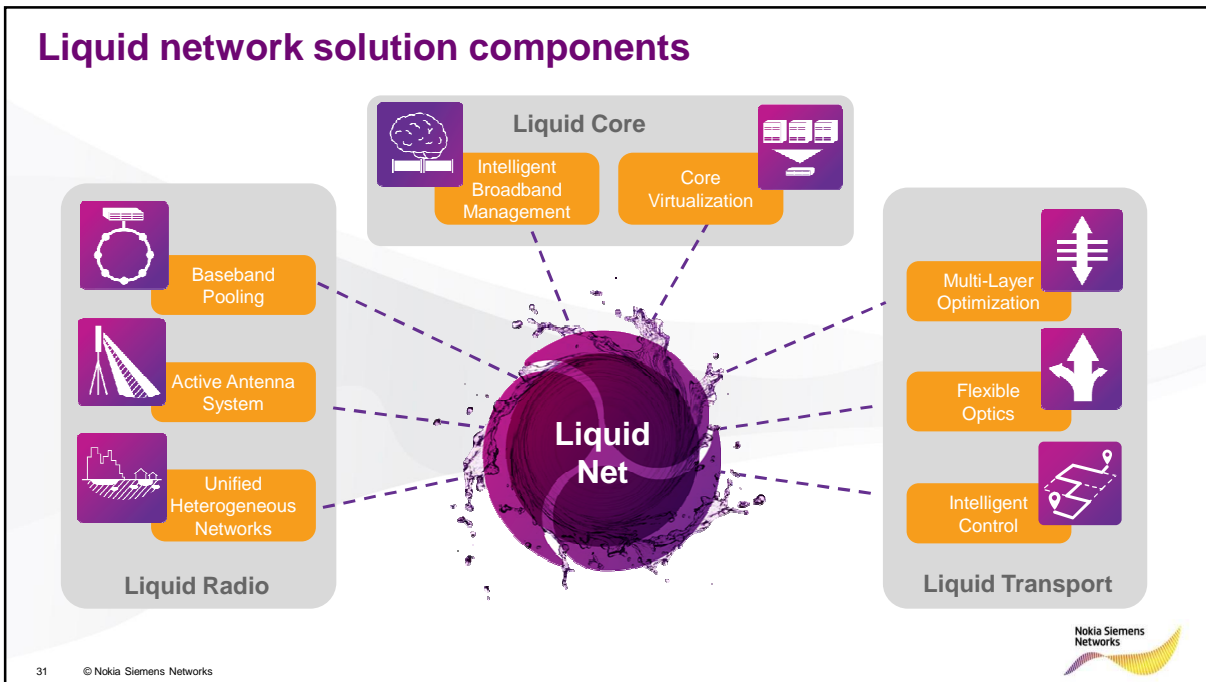


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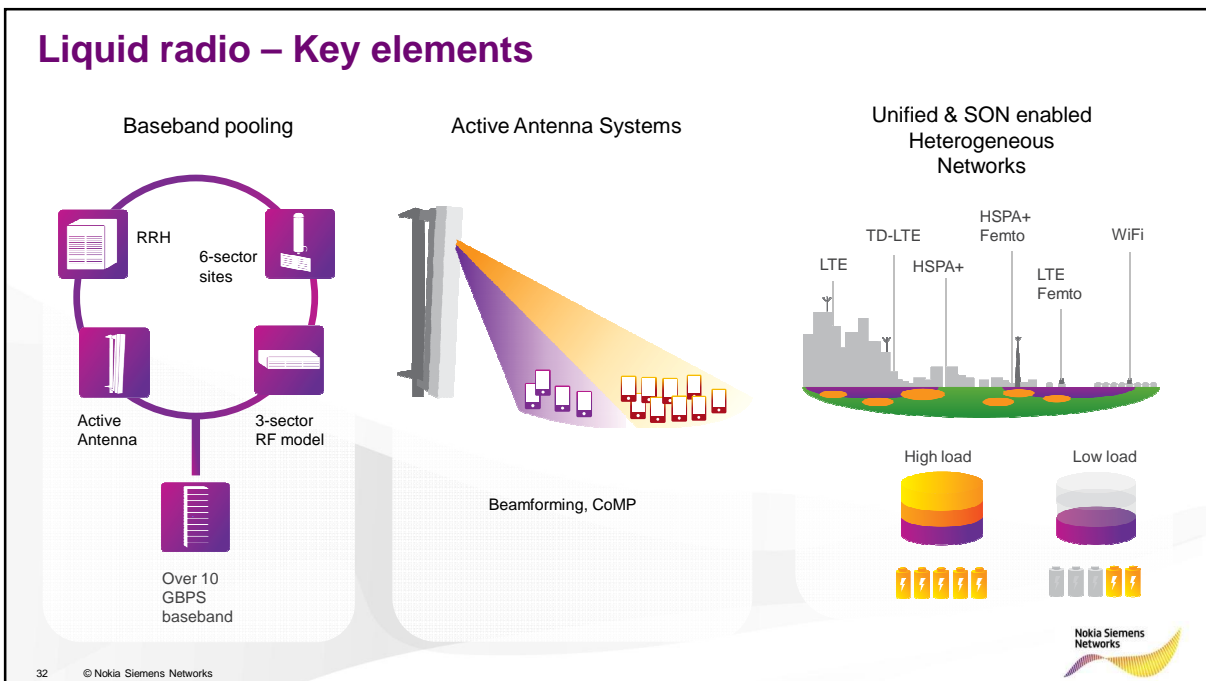
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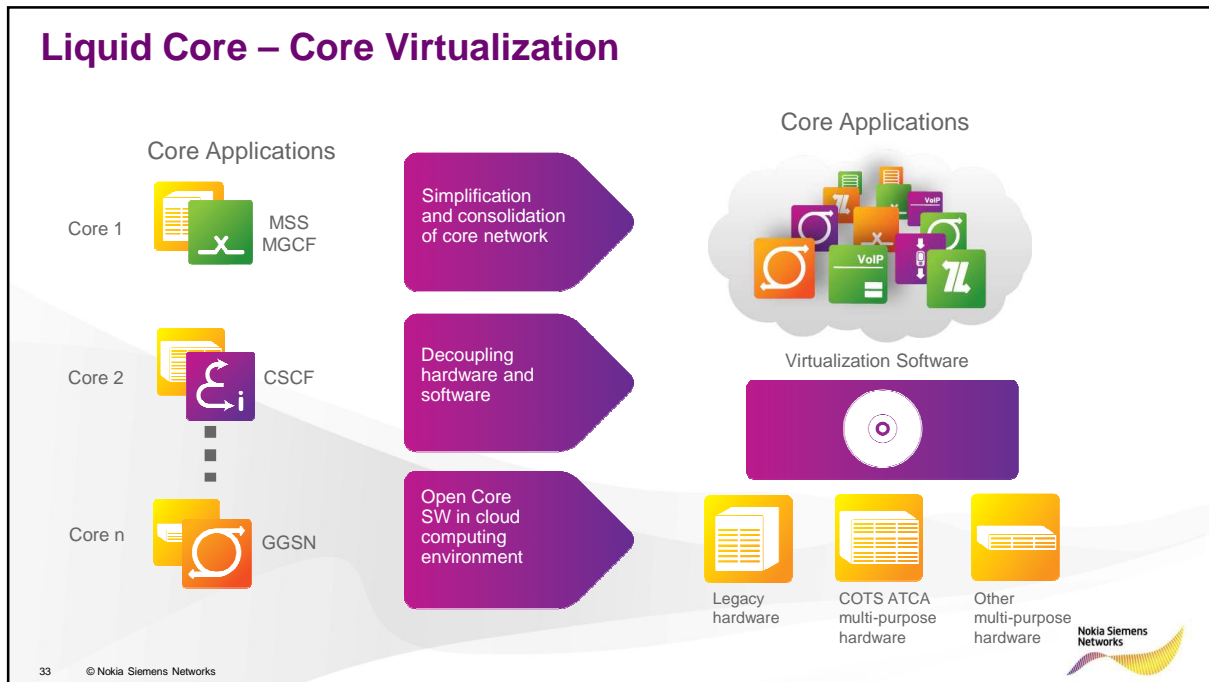
Liquid network solution components



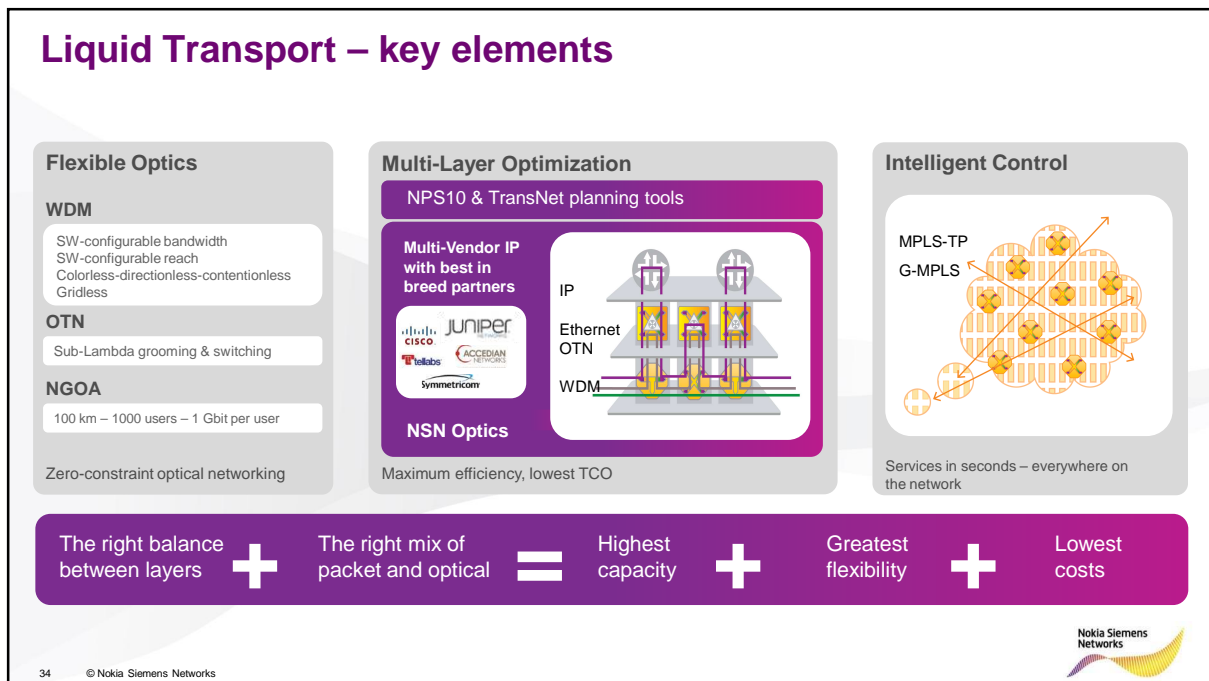
Liquid radio – Key elements



Liquid Core – Core Virtualization



Liquid Transport – key elements



With Liquid Net we innovate today's network to meet the forthcoming broadband wave

- Unleash frozen network capacity
- Fluidly adapt to meet unpredictable broadband demand
- Enhanced network capital efficiency
- Superior user experience and new revenues

Liquid Net



CEM 2.0



Total Expertise



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Thank You

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