


Your Gigabyte a Day

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Lauri Oksanen



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Let's start by taking a look back



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LTE got it right

LTE grows faster than any previous mobile technology

LTE was standardized fast and with good quality

Time to reach 1Bn subscribers

LTE	~7 years
WCDMA	~11 years
GSM	~12 years

Estimates by Strategy Analytics, May 2012

Fewer standard corrections

LTE Rel 8 : 42
WCDMA Rel 99 : 172

Approved Change Requests to Control Plane Protocol (RRC) in first year after Freezing

Did practice with 3G make perfect or was this just luck?


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Or did we just know what we were doing

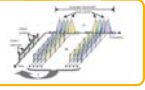
We knew the use case, the killer app

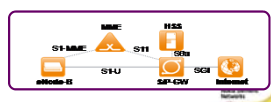
We knew the technology to optimize the air interface

We knew how to simplify the architecture



OFDMA/SC-FDMA and short framing





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Are we clear what 5G should do and how?



Let's take a look



Who are you in 2020+?

Independent machine?



Autonomous machine



Human



How will you connect?

Telepathy, with a little help?



With the blink of an eye?



Duke University
<http://www.bbc.co.uk/news/science-environment-21604005>

Poking at a screen?



And what do you want to do?



What could a machine want?

It can consume any amount of data in a short time

It can produce any amount of data in a short time

It can react in under a millisecond

It has no need for clumsy user interface like smartphone

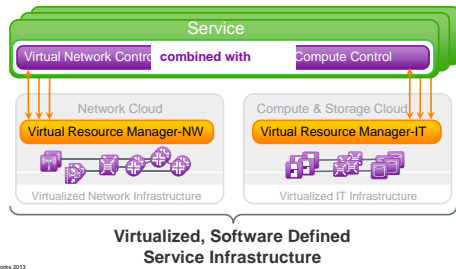
But it may also sleep for months and send a byte now and then



We need to look beyond current human requirements for future communication systems



Future service development and delivery technology needs to be much more flexible



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What do you get with a Gigabyte a day

300 songs
200 photos
200 Powerpoint presentations

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20 % of a Linux operating system
20 % of a game

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5 % of a Blue ray HD movie
5 % of a day's TV in HD

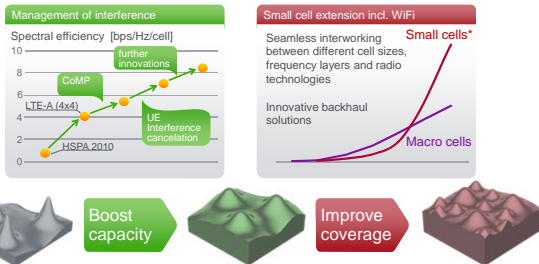
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**Because of video we can already fix one future requirement:
We anyway need to prepare for much more bandwidth**

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How to reach up to 1000 times more capacity 10x efficiency, 10x more sites, 10x more spectrum



* Small cells: micro + pico + public femto

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LTE evolution seems the right way to go for wide area but we could further optimize for super dense local area radio

10 Gbps, 1 ms RTT

Fluent support for access, self-backhauling and D2D

Always connected with low overhead

Low cost

Low power consumption

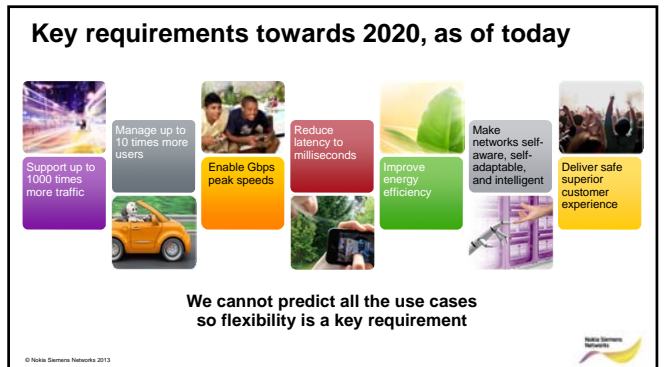
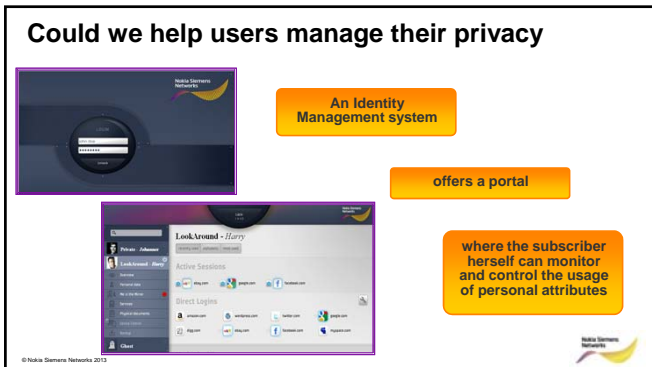
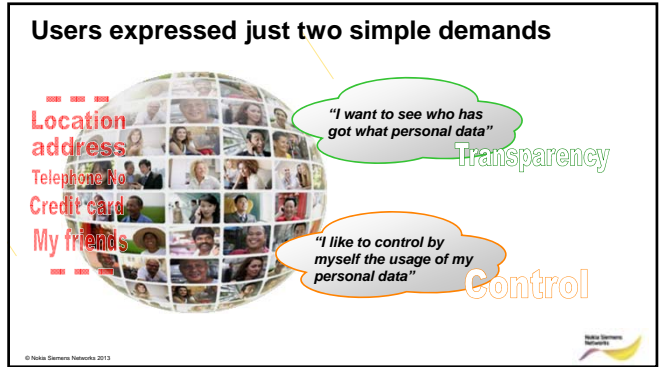
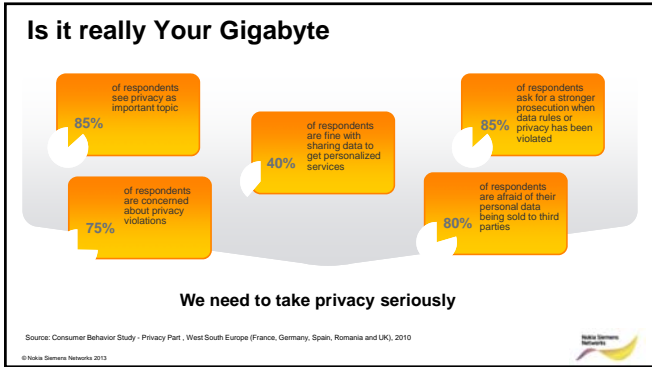
Flexible UL/DL duplexing

Flexible use of spectrum

mm wave spectrum

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Concluding

We are nowhere as clear as ten years ago about
The use case
The technologies to make a significant leap in performance

Neither are we in a big hurry as we have a good system in use already



Let's not rush into a 5G but make sure we understand and share the new demands and technology enablers

And a practical proposal to take things forward

**One potential technology enabler
is new spectrum above 10 GHz.**

**We propose to set up a forum to
share plans and results of
mm wave propagation studies
and offer to facilitate it.**