Next Generation Mobile Network
? What’s different and who needs it?

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Nokia Siemens Networks
Our Vision: 2015 – the World connected
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Current NGMN Advisor:
University of Surrey
Guildford
NGMN Members

NGMN Sponsors

NGMN Advisors

as of July 20th, 2007
INDUSTRY-WIDE IMPACT

<table>
<thead>
<tr>
<th>2002 - 3</th>
<th>2003-4</th>
<th>2005 - 6</th>
<th>2007 - 9</th>
<th>Next Decade</th>
</tr>
</thead>
<tbody>
<tr>
<td>64 - 144 kbps*</td>
<td>64 - 384 kbps*</td>
<td>0.384 - 4 Mbps*</td>
<td>0.384 - 7 Mbps*</td>
<td>50 - 100 Mbps*</td>
</tr>
</tbody>
</table>

- **GSM**
  - GPRS/EDGE
  - Initial Introduction
- **3G**
  - Download Enhanced
- **3G+HSDPA**
  - Download / Upload Enhanced + Overall Improvements
- **3G+HSDPA+HSUPA**
  - Broadband Radio, IP-based Wideband Peer to Peer Future Wireless Cellular

* Peak data rate reference values in good radio conditions
Priorities

- Spectrum efficiency desired to be 6 - 8 times HSPA and EVDO
- "Mobile broadband" user experience:
  - latency < 30ms e2e the radio system should not limit the user experience
  - Increased throughput across the coverage area: e.g., peak data rates > 50 Mbps & average rates > 10 Mbps
  - ‘Always On’ without significant network overhead or reduction of terminal battery life
- Efficient multicast and broadcast support & delivery of conversational services (e.g. speech, video call) over an all PS infrastructure
- All achieved at a cost/performance ratio comparable to xDSL
Performance Evolution

- NGMN is meant to be a big step in terms of performance
Technology Convergence

Broadband Mobile Communication

Rev. C / UMB

WiMAX

F-OFDM

TD-CDMA

WCDMA / UMTS / HSPA

CDMA / EVDO / Rev B

GSM / GPRS / EDGE

Next Generation Mobile Network
Expanding radio portfolio to address market needs

- GSM/GPRS, EDGE
  - WCDMA
  - HSPA
  - TD-SCDMA
  - HSPA+
  - I-HSPA (pre-LTE)
  - LTE
- EDGE Evolution
  - WiMAX-802.16d (Fixed)
  - WiMAX-802.16e (Mobile)
- HSPA MBMS
  - DVB-H
  - HSPA MBMS

Years:
- 2006
- 2007
- 2008
- 2009
- 2010
Multiradio environment
data speeds, technologies and connectivity options are multiplying

Cellular
"Seamless, trustworthy, global roaming"

Broadcasting
"CNN or Sugar Bowl on the road"

Hot Spot
"Highest data speeds over IP"

Seamless connectivity
Complexity hidden from user

Proximity
Local connectivity, info, commerce & services

- LTE
- HSPA
- I-HSPA
- WiMAX
- cdma1x
- EV-DO
- GPRS/EDGE
- WCDMA
- UMA
- WLAN
- FM radio
- Blue-tooth
- Wibree
- UWB
- RFID/NFC
- MBMS
- DVB-H
- Blue-tooth
- RFID/NFC
- DVB-H
Availability of access highways
... in terms of bit rate, coverage, quality, security

- DSL remains to be the benchmark for end-user experience today
- Requirements on network set by
  - Innovative services with high volume traffic (e.g. IP TV)
  - Attractive service packaging (e.g. triple/quadruple play)

- Increase of bitrates on copper cables utilizing the existing infrastructure
- Improvement of fiber optics to maximize performance-to-cost-ratio
- Radio access evolution is addressing performance and cost challenges
- Build-up of powerful and flexible backbones for high-volume traffic at high quality
Pressure on bit cost efficiency
... despite higher capacity

• Dramatically growing traffic based on IP connectivity
• Need to provide high bit rates / capacity at low cost
  • Limited radio resources by their nature
  • Limited bandwidth over copper
• But: moderate ARPU growth achievable only

Reduce cost of delivered MB/user
• Increase network capacity
  • Use fiber optics close to the end-user
  • Increase radio spectral efficiency
• Optimize network deployment and operational cost
  • Reduce network complexity
  • Apply multiple radio access technologies
• Increasing integration level of RF-parts
Complementarity > Co-existence > Convergence > …
The first / last „mile“ (or less) will be wireless
LTE has demonstrated >>100Mbps, IMT Advanced will do 1Gbps

Technology is ready to deliver …

<table>
<thead>
<tr>
<th>Senses</th>
<th>Bandwidth of Receptors</th>
<th>Neuronal Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes</td>
<td>200Gbit/s</td>
<td>200Mbit/s</td>
</tr>
<tr>
<td>Ears</td>
<td>4 Mbit/s</td>
<td>2 Mbit/s</td>
</tr>
<tr>
<td>Skin</td>
<td>1,5Gbit/s</td>
<td>10 Mbit/s</td>
</tr>
<tr>
<td>Tongue</td>
<td>150Mbit/s</td>
<td>11 Mbit/s</td>
</tr>
<tr>
<td>Nose</td>
<td>20 Gbit/s</td>
<td>30 Mbit/s</td>
</tr>
</tbody>
</table>

\[ \Sigma = \text{ca. 200 Gbit/s} \]

… more than you can handle
But, what about:

- Spectrum – sufficient & suitable?
- Range / Coverage?
- Backhaul – the second mile?
- Devices – battery power?
- …
Network Transformation (1)

Fixed Network

Fixed Access

Aggregation

Data Network

Transport

IP Core

Mobile Network

Mobile CS Core

Mobile PS Core

Converged Network

Operation and Business Support Systems

Multi-Access

IP Networking, Transport and Aggregation

Service Core and Applications
Network Transformation (2)

Service Core and Applications

IP Networking, Transport and Aggregation

Multi-Access

Network Vision

Applications

Service Delivery Platform
incl. Simulation of Voice Services & IN appl.

Identity Management
(HLR, HSS, AAA, ENUM, ...)

Session Control
(IMS & MSS)

all optical IP Transport and Aggregation
based on CE, incl. Mobility Support and Service Awareness

Fixed Broadband
(DSL ⇒ PON)

Cellular Broadband
(UMTS, HSPA ⇒ LTE)

Wireless Broadband
(WiFi, WiMAX)

Fixed Broadband
(DSL ⇒ PON)

OSS/BSS
(Charging; Provisioning, whole sale support)

Operation and Business Support Systems

Service Core and Applications

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Cellular Broadband
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Wireless Broadband
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Applications
The key architectural concepts (simplified) of NGMN/LTE aim at a flat and cost-effective network.
NGMN access is competitive with DSL and WiMAX by redistribution of Radio & Core functions.
Aggregation and Transport Strategy: IP service aware, converged flat network

**PS Solution 2006-2007**
- BTS
- BSC
- Node B
- RNC
- SGSN
- GGSN/IPPS

**Target Solution 2010:**
- Support of NGMN and Legacy
- 2G / 3G Legacy
- NGMN Radio eNode B (LTE)
- DSL, CATV, BWA

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Flat Cellular Broadband Access
Evolution towards a flat Packet Core architecture (SAE)

- HSPA R6
  - GGSN
  - SGSN
  - RNC
  - Node-B

- HSPA R7
  - GGSN
  - SGSN
  - RNC
  - Node-B

- Flat HSPA R7
  - ISN
  - SGSN
  - Node-B

- LTE R8
  - aGW
  - UPE
  - MME
  - eNode-B

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So, who is going to win the „battle of the bits“?

• Fixed Operator
• Mobile Operator
• Internet Provider
• Cable-TV Operator
• Broadcast Operator
• Broadband Access Provider
• …

… none of the above (alone)!
Ultimately, the consumer is in the driving seat

New business model: Internet at its core

- Listening to music
- Reading the Paper
- Browsing the Internet
- Gaming
- Talking on the Phone
- Watching TV
- Sending an Email
- Using a Database

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Observations

• Wireless is just another access pipe
• Mobility is access independent
• (R)AN and Core collapse to flat IP
• IMS control ensures service convergence
• Applications and content from the internet

• Inter-networking is taken for granted (!?)
Thank you very much for your attention

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