Seamless integration between mobile- and home network?

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Previous: MobileMonday, Telenor R&I, Telenor R&D
Outlook

• 5G Networks - and integrated access to the home
  ➡ Industry (secured wireless, Industry 4.0)
  ➡ Consumer (IoT, Entertainment)
  ➡ Individuals and Societies (...)

• Application specific routing

• Addressing the Digital Divide
  ➡ Societal Gap

• The indoor challenge & Security, Privacy, Trust
  ➡ The mobile dilemma
  ➡ Novel applications
5G expectations

- Extreme mobile broadband (eMBB)
  - 10 Gb/s peak
  - 100 Mb/s whenever needed

- Massive Machine Communications (mMTC)

- Critical machine communications

[source: Nokia https://networks.nokia.com/5g/get-ready]
5G access: radio and business dilemma

- The radio dilemma
  - outdoor to indoor

- The business dilemma
  - 5G access is expensive (range)
  - changing access means loosing revenue

“coverage cell”

“70-80% indoor usage”

[Original drawings: Jørgen Grinnes, Telenor, 2010]
Business perspective of home cells (femto cells)

- **Calculations**
  - ~60% cost reduction when 10-60% home access
  - flat optimum with 20-40% home access

- **Interference**
  - re-use of 2.6 GHz

- **Design error**
  - each operator own femto

Total Network Costs with Femto Cells
Operator with 40% market share

- Annual Network Costs [million $]
- percentage of customers with home cell
- 20 - 40% home usage
- home OPEX
- macro OPEX
- total network costs (CAPEX & OPEX)

[source: H. Claussen, 2007]
5G - eMBB analysis and conclusions

- Extreme mobile broadband (eMBB)
  - needs 10-60% of traffic to be taken by indoor
  - Return on investment

[source: Nokia https://networks.nokia.com/5g/get-ready]
### 5G Networks for Industry

- **Core demand**
- **Edge intelligence**
  - Edge/fog computing
- **End-to-end QoS and isolation**
  - Network slicing
  - Heterogeneity(?)

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<tbody>
<tr>
<td>1</td>
<td>5G may be disruptive for the manufacturing industry</td>
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<td>2</td>
<td>Edge computing for shifting intelligence to the network</td>
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<td>3</td>
<td>Network slicing for providing end-to-end QoS &amp; isolation</td>
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<td>4</td>
<td>Many industrial requirements not fully addressed yet</td>
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<td>5</td>
<td>Close interaction of the whole ecosystem needed</td>
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<td>6</td>
<td>Industry 4.0 may become THE killer application for 5G 😊</td>
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[Source: Andreas Mueller, Bosch, 2018]
Secured Connected Trustable Things (SCOTT)

- 15 industry-driven Use Cases (TRL 6-7)
- 40 Technology Building Blocks
- 25 Demonstrators
- 5 Domains: Automotive, Aeronautics, Home/Building, Rail, Healthcare, - truly “cross-disciplinary”
- 2017 – 2020 (started in May 2017)
High-level vision for each domain

- **Home/Infrastructures:** Cost-efficient monitoring and management for trusted services

- **Mobile:** Configurable networks providing reliable services

- **Automotive:** Security architecture for accident-free transport

- **Rail:** Highly flexible train composition

- **Aeronautics:** Security-Safety

SCOTT-project.eu
Future Services - home domain requirements

- **Future Service demands**
  - Energy, health, security
  - require

- **Cost-efficient monitoring and management for trusted services**
  - Wireless management
  - Security monitoring
  - Service harmonisation (5G@home)
5G - analysis and conclusions

- **Extreme mobile broadband (eMBB)**
  - needs 10-60% of traffic to be taken by indoor
  - Return on investment

- **Massive Machine Communications (mMTC)**
  - eSIM as authenticator
  - co-existence: Wifi/ZigBee/BLE and NB-IoT

- **Critical machine communications (URLLC)**
  - own networks/network slices

[source: Nokia https://networks.nokia.com/5g/get-ready]
5G business & digital inclusion

- 5G for digital inclusion?
  - cost of network, services
  - IoT, digitisation, automation
  - “the divide is bigger than ever”

[Source: Service Innovation through Smart Networks, Ericsson, 2018]
6G (#5GforAll) for digital inclusion

[Adapted from: Service Innovation through Smart Networks, Ericsson, 2018]

[Diagram showing different levels of internet access and services for all members of the society.]

Basic Internet.org
@Basic4all

“Freemium Model for Smart Networks”
Okt2018, Josef Noll
Home Domain for Digital Inclusion

- The digital Divide
  - 10x increase in Mobile Broadband (2013-2019) [1]
    - Netflix, YouTube, Hulu
  - 26% of NO-subscribers don’t have MB [2]
  - 8% (400,000) in Norway not connected to the Internet [3]

- Home access for digital inclusion
  - “Internet lite for all”
    - Free access to information everywhere
    - Premium access to broadband

[1] Service Innovation through Smart Networks, Ericsson, 2018
[2] Det norske ekommarkedet 2017, NKOM.no, 2018
[3] “Sauebonden som aldri…”, aftenposten.no, 7Okt2018
Conclusions: Seamless Integration of Mobile and Home Network

- Extreme mobile broadband (eMBB)
  - needs 10-60% of traffic to be taken by indoor

- Massive Machine Communications (mMTC)
  - eSIM as authenticator
  - co-existence: Wifi/ZigBee/Bluetooth Low Energy (BLE) and Narrowband Internet of Things (NB-IoT)

- Critical machine communications (URLLC)
  - own networks/network slices
  - Internet lite for all

- Digital Inclusion through Home Networks
  - Internet lite for all - the freemium model for access

Basis for an inclusive and innovative society