Analysing LTE-A as a Communication Infrastructure for Smart Grid

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Content

- Smart Grid
  - Scenarios
  - Communication Requirements
- LTE-Advanced Machine Type Communication
- Research @LKN
Smart Grid: Scenarios

- Wide Area Monitoring, Protection and Control
- Local Utility Network
- Substation Network
- Wide Area Network
- Industrial Area Network
- Business Area Network
- Home Area Network
- Utility Monitoring and Control
- Advanced Metering Infrastructure
- Control of Distributed Power Generation
- Electrical Vehicle Charging

Cellular: LTE-Advanced

- Demand Side Management
- Neighborhood Area Network
- Field Area Network
- Neighborhood Area Network
- Cellular: LTE-Advanced
- Advanced Infrastructure
- LTE-Advanced
- Utility Monitoring and Control
- Advanced Metering Infrastructure
- Control of Distributed Power Generation
- Electrical Vehicle Charging
### Smart Grid: Requirements

<table>
<thead>
<tr>
<th>Category</th>
<th>E2E Latency</th>
<th>Reliability</th>
<th>Datarate</th>
<th>Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wide Area Monitoring, Protection and Control</td>
<td>5-20ms</td>
<td>99.999%</td>
<td>100 Mbps</td>
<td>Indoor &amp; Outdoor</td>
</tr>
<tr>
<td>Control of Distributed Power Generation</td>
<td>50-500ms</td>
<td>99.99%</td>
<td>50-200 kbps per site</td>
<td>Indoor &amp; Outdoor</td>
</tr>
<tr>
<td>Advanced Metering Infrastructure</td>
<td>1s</td>
<td>99%</td>
<td>10 kbps per site</td>
<td>Indoor / Basements</td>
</tr>
<tr>
<td>Demand Side Management</td>
<td>1min</td>
<td>99%</td>
<td>100 kbps per site</td>
<td>Indoor / Basement</td>
</tr>
<tr>
<td>Electrical Vehicle Charging</td>
<td>500ms</td>
<td>99.5%</td>
<td>9.6-56 kbps per site</td>
<td>Indoor &amp; Outdoor</td>
</tr>
</tbody>
</table>

[2] Siemens Whitepaper, Smart Communications for Smart Grid
Machine Type Communication: LTE-A

Machine-to-Machine

Data-only subscriptions
no voice service required

Wide range of performance requirements
from utility meters to automotive

Low cost devices
<10$ per modem

Enhanced coverage
indoor and basement installations

Larger amount of devices
orders of magnitude higher than conventional devices

Longer battery life
up to 10 years

Machine Type Communication: Challenges

- Longer battery life
  - Release 12
  - Release 13

- Low cost devices
  - Release 12
  - Release 13

- Enhanced coverage
  - Release 13

- Larger amount of devices
  - Release 13

- Wide range of performance requirements

- Data-only subscriptions

- Low mobility

Signaling reduction

New class of devices:
- Lower bandwidth / data rate
- 50% / 25% complexity

In research / study announced

Research @LKN

Further releases
Research @LKN
Applicability to SmartGrid: LTE and Beyond

- Massive Connectivity problem

- How scalable is LTE:
  - Amount of devices to be accommodated in one cell without violating the requirements
  - C-plane

- LTE performance evaluation:
  - Latency
  - Reliability
  - U-plane & C-plane

- Coexistence of H2H and M2M traffic:
  - with/without differentiation
  - QoS degradation in a loaded cell

- Data aggregation using 802.15.4g standard (Smart Utility Networks)
  - Coverage extension
  - Radio resource saving
  - Device clustering
Questions?
References

[2] Siemens Whitepaper, Smart Communications for Smart Grid