Mobile Network Improvements for Machine Type Communications
Our mission statement: Innovation with ICT

About us
• Established: 1 January 2003
• Bundling of former KPN Research with TNO’s ICT related departments
• One of the largest ICT knowledge centres in Europe

Key figures
• Annual turnover: EUR 40 Mio
• 375 professionals
• Locations in Delft, Enschede and Groningen

M2M activities
• Standardisation and standards reporting
• Strategy and architecture support for operators
• Support M2M users (e.g. in energy and mobility) with definition of M2M solutions and sensor networking
Three phases of Machine Type Communications

Vertical Applications
1st Wave

“Regulatory” Applications
2nd Wave

Internet of Things
3rd Wave

2010

2015

2020
Network improvements for Machine Type Communications

Current mobile network is optimised for H2H traffic not for Machine Type Communications

Optimisations for MTC are necessary

- Lower costs to reflect lower MTC ARPU's
- Differentiate between MTC applications
- Protect against overload by MTC
- Prepare for number and IP address shortages
Cost drivers for MTC are different from H2H traffic

<table>
<thead>
<tr>
<th>Cost Drivers</th>
<th>Network Cost Component</th>
<th>Example Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td># of subscriptions</td>
<td>• SIM cards</td>
<td>Applications that rarely send data and are mobile originated only (e.g. eCall)</td>
</tr>
<tr>
<td></td>
<td>• MISDNs/MSIs numbers</td>
<td></td>
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<tr>
<td></td>
<td>• HLR capacity</td>
<td></td>
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<tr>
<td># of simultaneous attached devices</td>
<td>• PS-attached users</td>
<td>Applications that rarely send data but have to be reachable for triggering (e.g.</td>
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<tr>
<td></td>
<td>• CS-attached users</td>
<td>motor management)</td>
</tr>
<tr>
<td></td>
<td>• Mobility management signalling</td>
<td></td>
</tr>
<tr>
<td># of always on connections</td>
<td>• SGSN/GGSN capacity for PDP contexts</td>
<td>Applications that need to send and receive data (e.g. remote control)</td>
</tr>
<tr>
<td></td>
<td>• Number of IP addresses</td>
<td></td>
</tr>
<tr>
<td># of data sessions</td>
<td>• Connection set up signalling</td>
<td>Applications that regularly set up a connection to send a small amount of</td>
</tr>
<tr>
<td></td>
<td>• Radius capacity</td>
<td>data (e.g. metering)</td>
</tr>
<tr>
<td></td>
<td>• CDR processing</td>
<td></td>
</tr>
<tr>
<td>Volume of data throughput</td>
<td>• Radio and network capacity</td>
<td>High bandwidth applications or applications where large numbers of devices send data</td>
</tr>
<tr>
<td></td>
<td>• SGSN/GGSN capacity for data volume</td>
<td>simultaneously</td>
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</table>
Many different MTC applications with different characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Data volume</th>
<th>Quality of Service</th>
<th>Amount of Signalling</th>
<th>Time sensitivity</th>
<th>Mobility</th>
<th>Server initiated communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example Applications</td>
<td></td>
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<td></td>
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<tr>
<td>Smart energy meters</td>
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<td>Road charging</td>
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<td>eCall</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
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<td>Remote maintenance</td>
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<td>Asset tracking</td>
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<td>Mobile payments</td>
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<td>Media synchronisation</td>
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<td>yes</td>
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<td>Surveillance cameras</td>
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<td>yes</td>
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</tbody>
</table>

- There is not one type of MTC application with one set of requirements
- Operators should be able to differentiate their MTC portfolio
Protection against overload by MTC

A current day scenario
• A badly implemented retry scenario in devices results in 50,000 devices re-establishing a data connection every 12 seconds. Other data communications applications on the packet switched network are disrupted.

Daily traffic issues
• MTC devices that need to send data every hour, do so at exactly every hour, resulting in peaks several times average load.

A future nightmare scenario?
• When after a power outage electricity comes back on, millions of MTC devices simultaneously re-connect, bringing down the mobile network.

MTC overload
• Because of the automated nature of MTC applications they can generate very high simultaneous network loads, causing disturbances of higher value services or even network outages.
• With an increasing number of MTC applications, it will become more and more difficult to prevent overload by addressing individual MTC applications service providers.
• Overload can also be generated by MTC devices that are roaming onto operators network.

Daily pattern of Radius usage (source KPN)
Prepare for number and IP address shortages

- 3GPP SA1 has required solutions to cater for at least 2 orders of magnitude more devices compared to human to human

- Shortage of telephone numbers
  - Mid term solution: longer telephone numbers
  - Long term solution: no telephone numbers for M2M

- Shortage of IPv4 addresses can be expected with always on M2M applications
  - IPv6 addresses are a solution

- IMSI range seems large enough for most operators
  - Larger operators may require an increase of IMSI length in standardisation
3GPP - Machine Type Communication activities

- **3GPP SA1**
  - Technical Specification 3GPP 22.368 Release 10 complete
    - Defines general requirements and specific MTC Features
  - New study items
    - Alternatives to the use of E.164 for MTC
    - Study on enhancements for MTC in 3GPP TR 22.888

- **3GPP SA2**
  - Technical Report 3GPP 23.888 with key issues and proposed solutions
  - Release 10 change requests related to congestion and overload control
  - All other Release 10 features from 3GPP 22.368 will be postponed to later releases

- **3GPP SA3**
  - Technical Report 3GPP 33.868 delayed until Release 11

- **3GPP RAN groups**
  - Study on RAN Improvements for MTC in 3GPP TR 37.868 on hold
  - New Work Item “RAN mechanisms to avoid CN overload due to MTC”

- **3GPP GERAN groups**
  - Study on GERAN Improvements for MTC in 3GPP TR 43.868
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