The NorNet Edge Testbed for Mobile Broadband Measurements

Džiugas Baltrūnas
Ahmed Elmokashfi
Simula Research Laboratory
2014-08-28

Robusthet i norske mobilnett
Tilstandsrapport 2013, CRNA

[simula.research.laboratory]
The NorNet Edge (NNE) testbed for mobile broadband measurements

Overview of NNE

Ongoing activities

Plans for the future
NNE testbed

Features
- hundreds of dedicated measurement nodes all over Norway
- connected to 4 UMTS and 1 CDMA networks in Norway
- running standard Linux distribution
- backed by server-side infrastructure and measurement framework

Deployment as of today
- 100+ nodes with 3G connections
- 20+ nodes with LTE connections
- 4 mobile nodes on trains
System overview

Measurement servers

Management and data repository

Measurement nodes

Visualization

Measurement traffic

Management traffic

Measurement results

Database queries
Infrastructure

node 1

TCP:80

TCP:8140

measurement traffic

measurement server

code repository

puppet master

data collector

data inventory

version control system

visualization

www

node n

local remote port forwarding

SSH Proxy

ømq, rsync

Icinga monitoring

database

inventory + data
Measurement node: what’s inside

Hardware
- Samsung Cortex A8 1 GHz processor
- 512 MB RAM + 512 MB NAND flash
- 7 USB + 1 Ethernet ports
- 16GB SD card
- 1-4 x USB 3G (UMTS) modems:
  - Huawei E353u-2 (HSPA+)
  - Huawei E392u-12 (DC-HSPA+ and LTE)
- 1 x CDMA Ev-Do modem
- 1 x USB WiFi adapter (optional)

Tools
- MBB connection manager with recovery and metadata support
- Reverse tunnel to an SSH proxy with local and remote port forwards
- Measurement framework, node monitor and watchdog
LTE deployment

Started June 2014
20+ nodes
Currently hosted by Simula & UiB employees
NwN@Telenor and Tele2@Netcom upcoming

Huawei E392-u12
LTE Cat.3 (2x2 MIMO)
Mobile nodes on trains

Started April 2014
4 nodes
Stability is the major concern
Infrastructure changes since last year

**Improved MBB connection manager**
- better network connection recovery
- connection metadata by *polling* the modems
- LTE attributes: RRC state, RSRP, RSRQ
- added support for Ice U-90 USB modems

**Measurement framework**
- HTTP download and SIP measurements
- GPS data collection from trains

**Upgraded VMware cluster**
- 2x Dell PowerEdge R710 servers (12 cores, 128 GB RAM)
- RAID 10 storage with 14.5 TB of effective disk space
- Monitored data center
Ongoing work + plans

- Redeployment of nodes to new hosts
- 70 LTE nodes by the end of September 2014
- 10 mobile nodes by the end of year 2014
- Look into stability and performance when mobile and/or on LTE
- Tilstandrapport 2014
- Start researching the new hardware for measurement nodes
- An updated version of robustenett.no (+more measurements)
- Understanding and improving stability with better monitoring

Overview

<table>
<thead>
<tr>
<th>Node ID</th>
<th>Location</th>
<th>Status</th>
<th>SSH</th>
<th>Puppet</th>
<th>Icinga</th>
<th>Modems</th>
<th>Lan</th>
</tr>
</thead>
<tbody>
<tr>
<td>227</td>
<td>Tor’s home</td>
<td>DEPLOYED</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2/2</td>
<td>✗</td>
</tr>
<tr>
<td>293</td>
<td>NSB trains</td>
<td>DEPLOYED</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>1/2</td>
<td>✔</td>
</tr>
<tr>
<td>442</td>
<td>Håkon Stensland’s home</td>
<td>DEPLOYED</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2/2</td>
<td>✔</td>
</tr>
<tr>
<td>497</td>
<td>Thomas’s home</td>
<td>DEPLOYED</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2/2</td>
<td>✔</td>
</tr>
<tr>
<td>539</td>
<td>Ozgu Alay’s home</td>
<td>DEPLOYED</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>2/2</td>
<td>✗</td>
</tr>
<tr>
<td>443</td>
<td>Håvard Espeland’s home</td>
<td>DEPLOYED</td>
<td>-</td>
<td>-</td>
<td>✗</td>
<td>0/2</td>
<td>-</td>
</tr>
</tbody>
</table>
NorNet Edge is a powerful multi-homed platform for measuring MBB networks

Connected to five different 3G/4G Norwegian MBB networks

Supports large-scale measurements at control, data and application planes

Contains measurement framework for easier experimentation

Questions?