The NorNet Edge Testbed for Mobile Broadband Measurements

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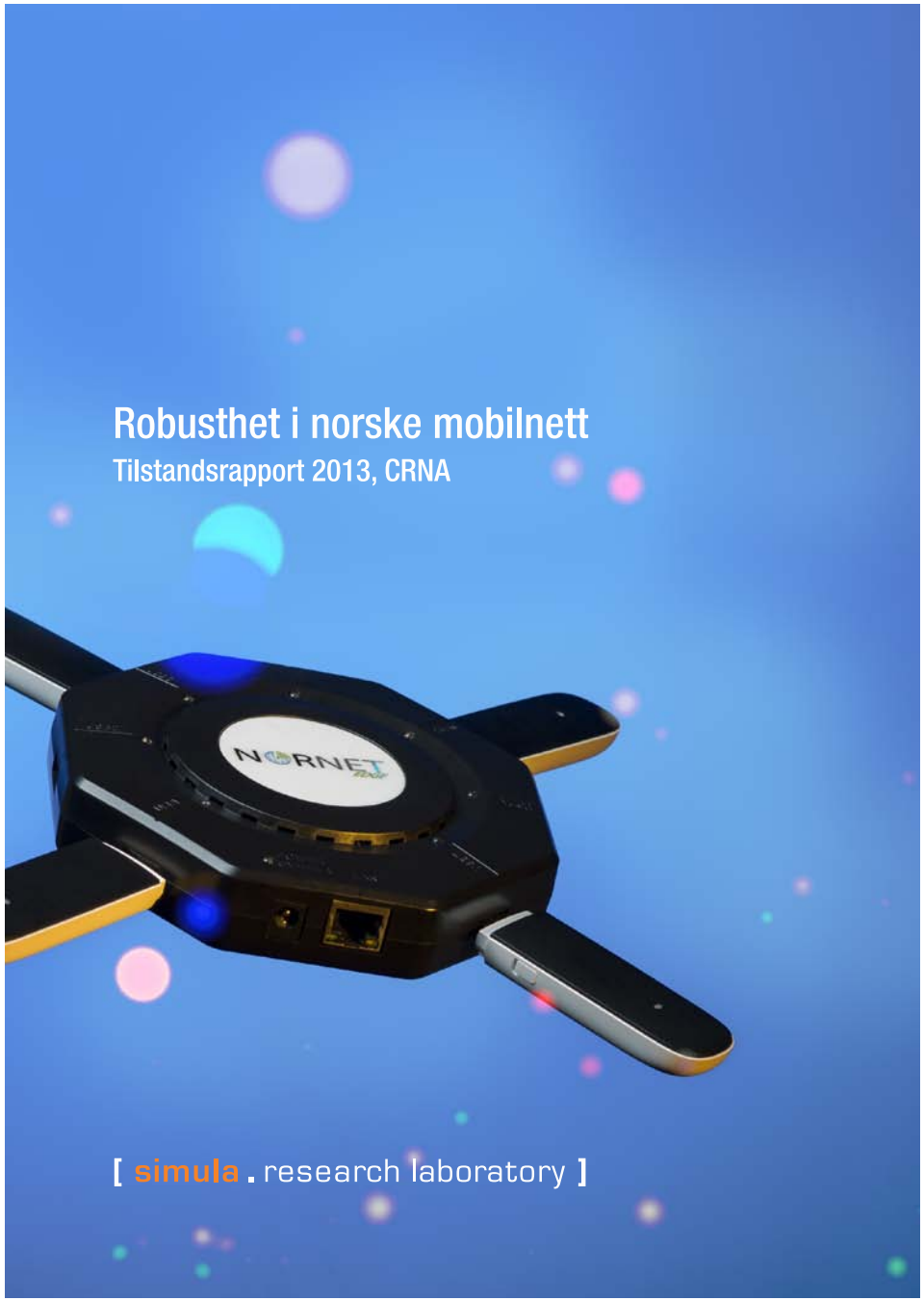
2014-08-28

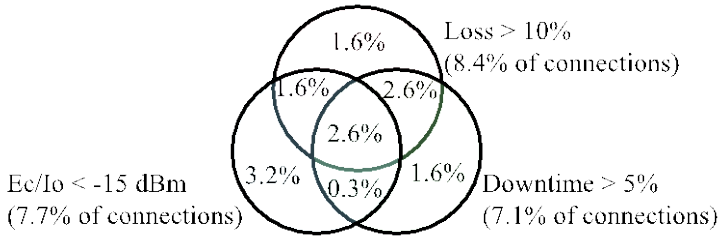


NORNET

The NorNet Edge (NNE) testbed for mobile broadband measurements

Overview of NNE

Ongoing activites



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

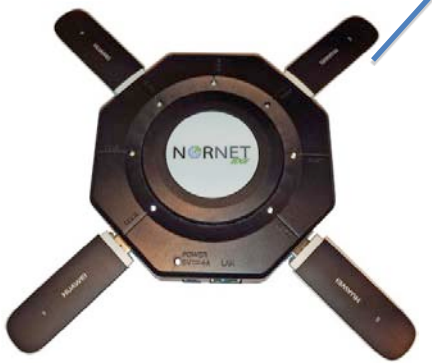
Management and data repository

Measurement traffic

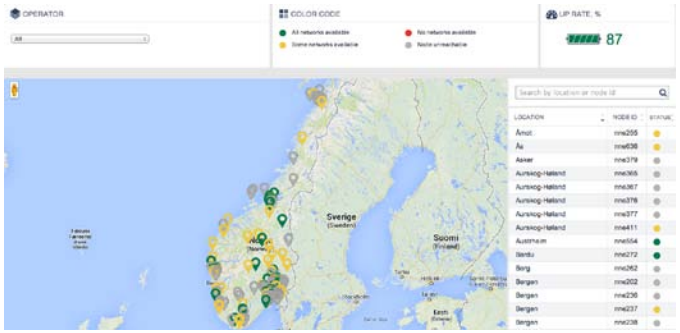
Management traffic

Measurement results

Database queries

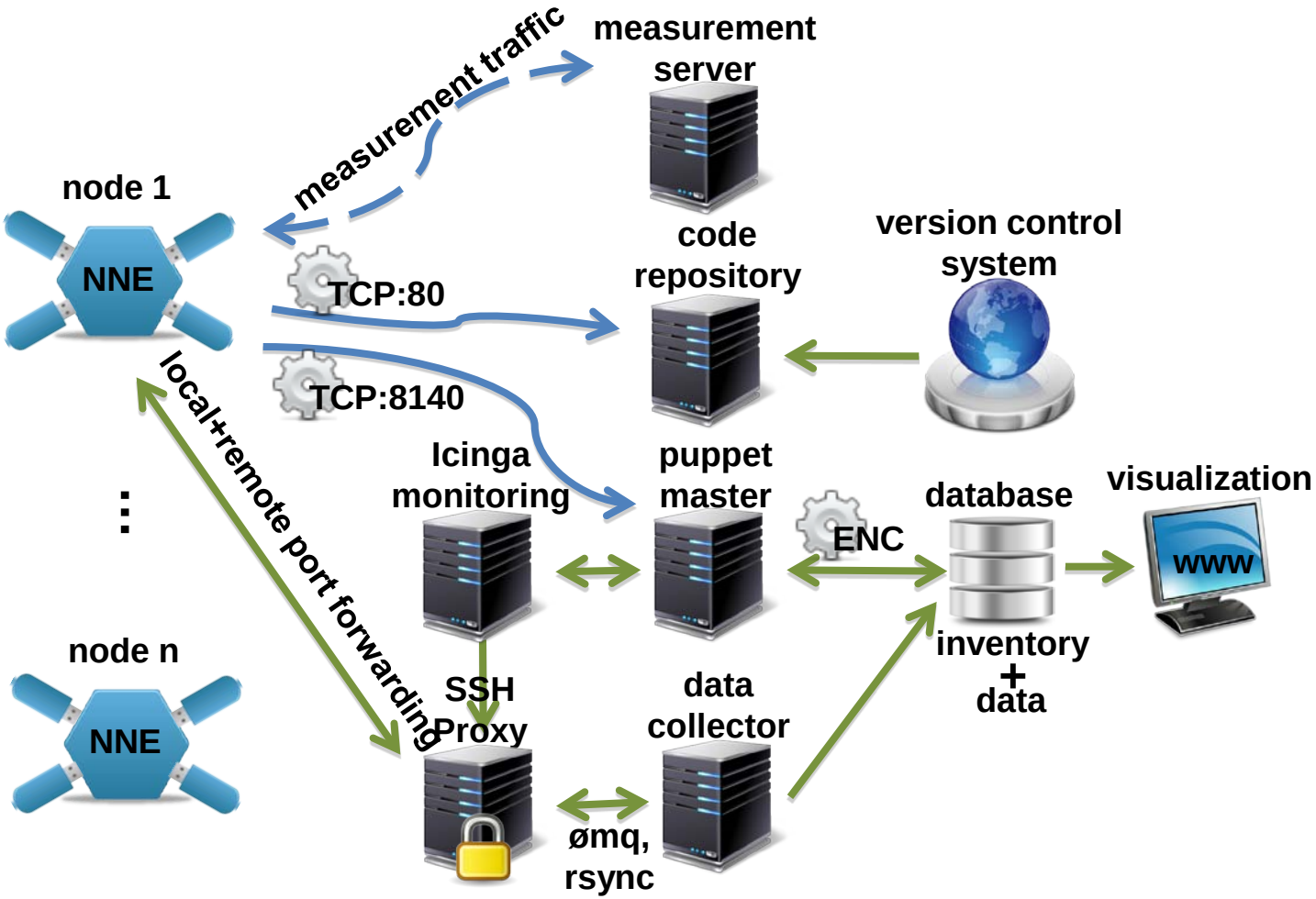


Measurement nodes



Visualization

Infrastructure



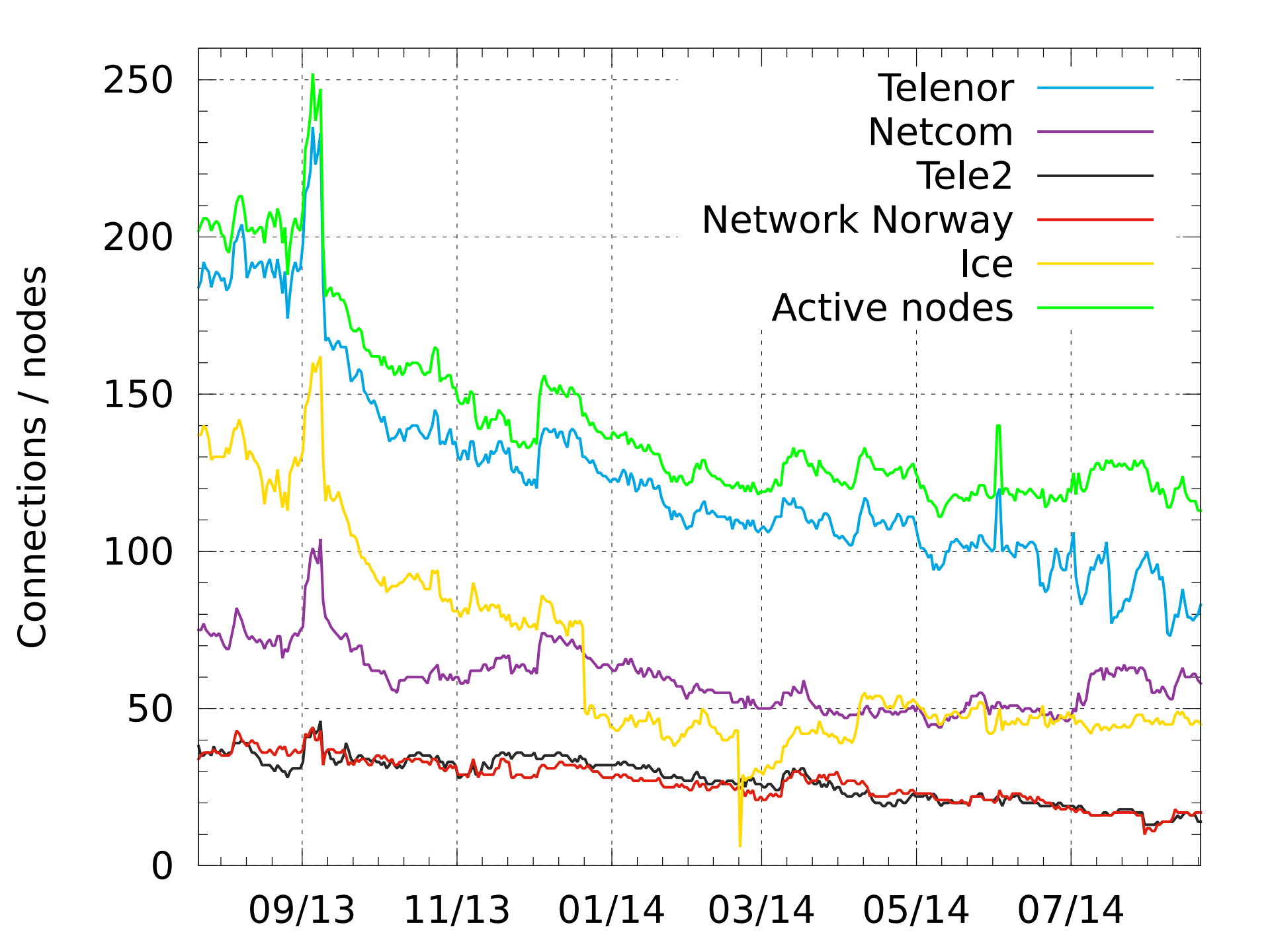
Measurement node: what's inside

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

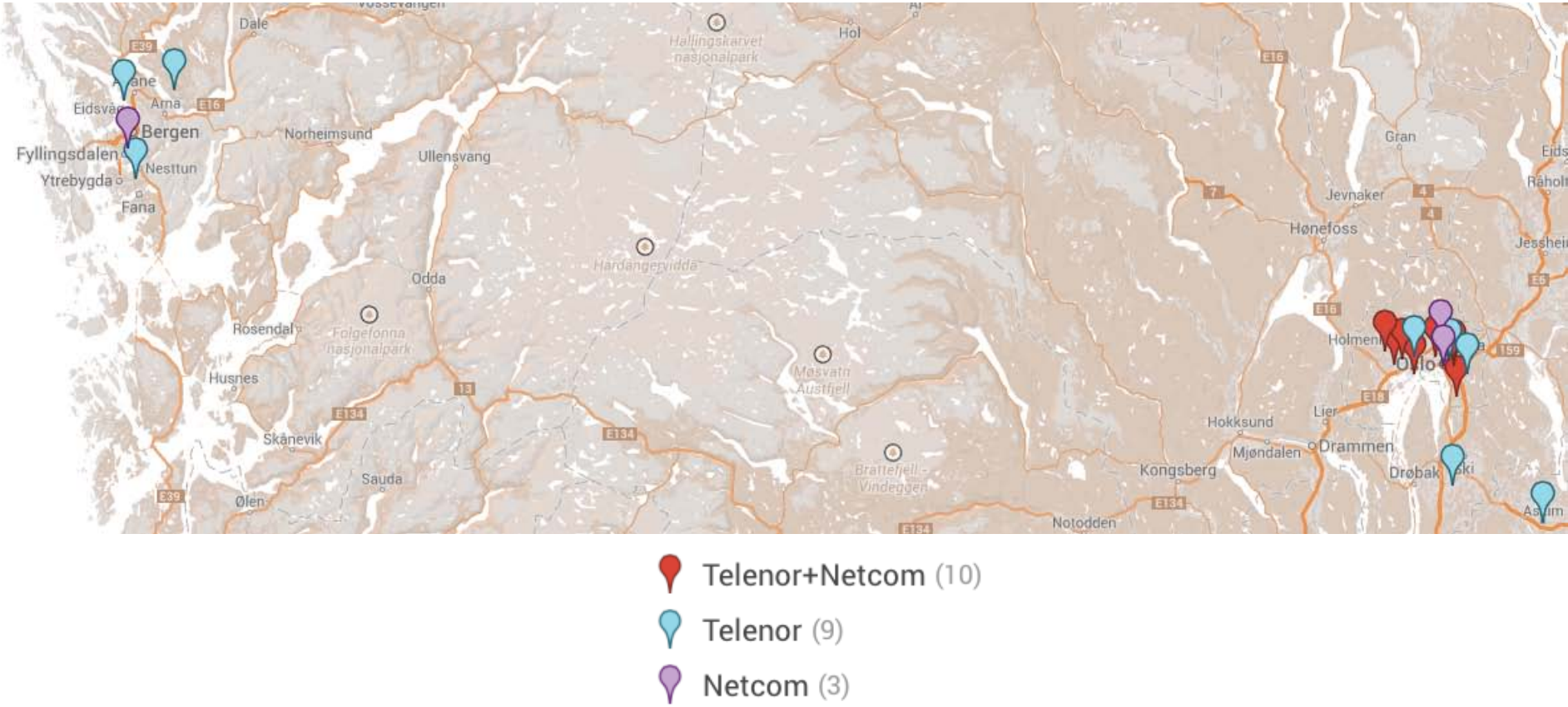
- MBB connection manager with recovery and metadata support
- Reverse tunnel to an SSH proxy with local and remote port forwards
- Measurement framework, node monitor and watchdog


Connections / nodes
250
200
150
100
50
0
09/13
11/13
01/14
03/14
05/14
07/14
Telenor
Netcom
Tele2
Network Norway
Ice
Active nodes

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

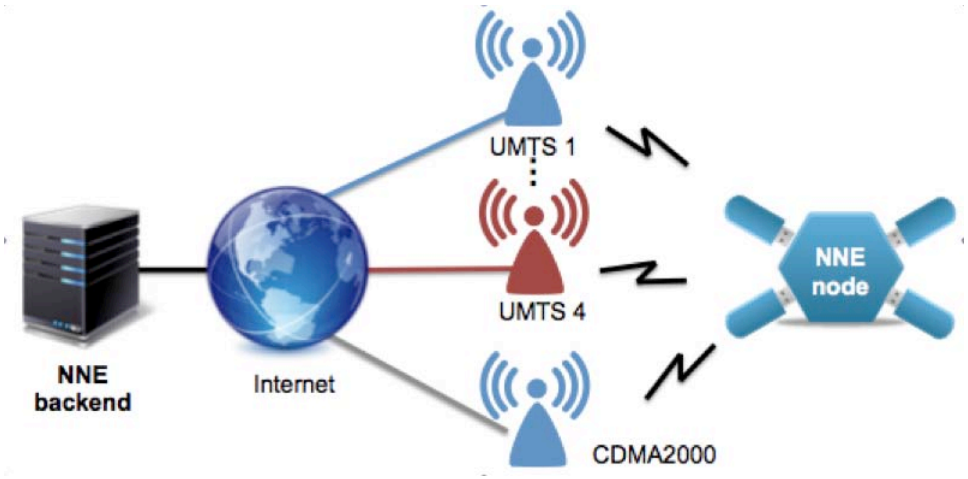
Ongoing work + plans

- 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

Node ID	Location	Status	SSH	Puppet	Icinga	Modems	Lan
227	Tor´s home	DEPLOYED	✓	✓	✓	2 / 2	✗
293	NSB trains	DEPLOYED	✓	✓	✓	1 / 2	✓
442	Håkon Stensland's home	DEPLOYED	✓	✓	✓	2 / 2	✓
497	Thomas's home	DEPLOYED	✓	✓	✓	2 / 2	✓
539	Ozgu Alay's home	DEPLOYED	✓	✓	✓	2 / 2	✗
443	Håvard Espeland´s home	DEPLOYED	-	-	✗	0 / 2	-

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

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Questions?