Mobile Broadband Networks under Mobility

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Motivation

- Enables many services
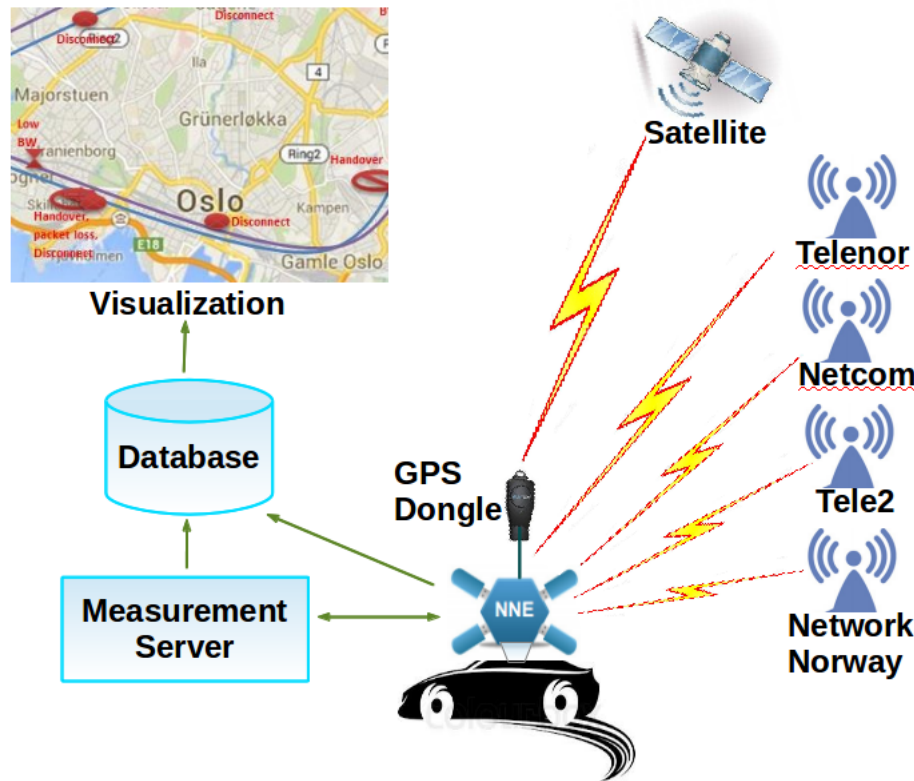 - Telemedicine
  - WIFI on board (public transport)

Effect of Mobility on MBB Performance

- How mobility affects the user experience?
  - Connectivity
  - Packet Loss
  - Delay
  - Applications
- How does it compare to the static scenario?
- How does the performance change in rural areas compared to city center?

Experiment Setup and Coverage

- On busses and trams
- City center
- More than 10 repetitions
- 1400B UDP packet every second

Measurement Parameters/Procedure

- **Connectivity Test**
  - Node sends UDP echo packet each second to server
  - Server replies packet back to node upon arrival
  - Data are logged in both uplink and downlink
  - Repeated measurement for reliability and validity
- **Parameters**
  - Packet Loss: packet sent but not received
  - Consecutive packets received without loss
  - Delay: Round-Trip Time (RTT)
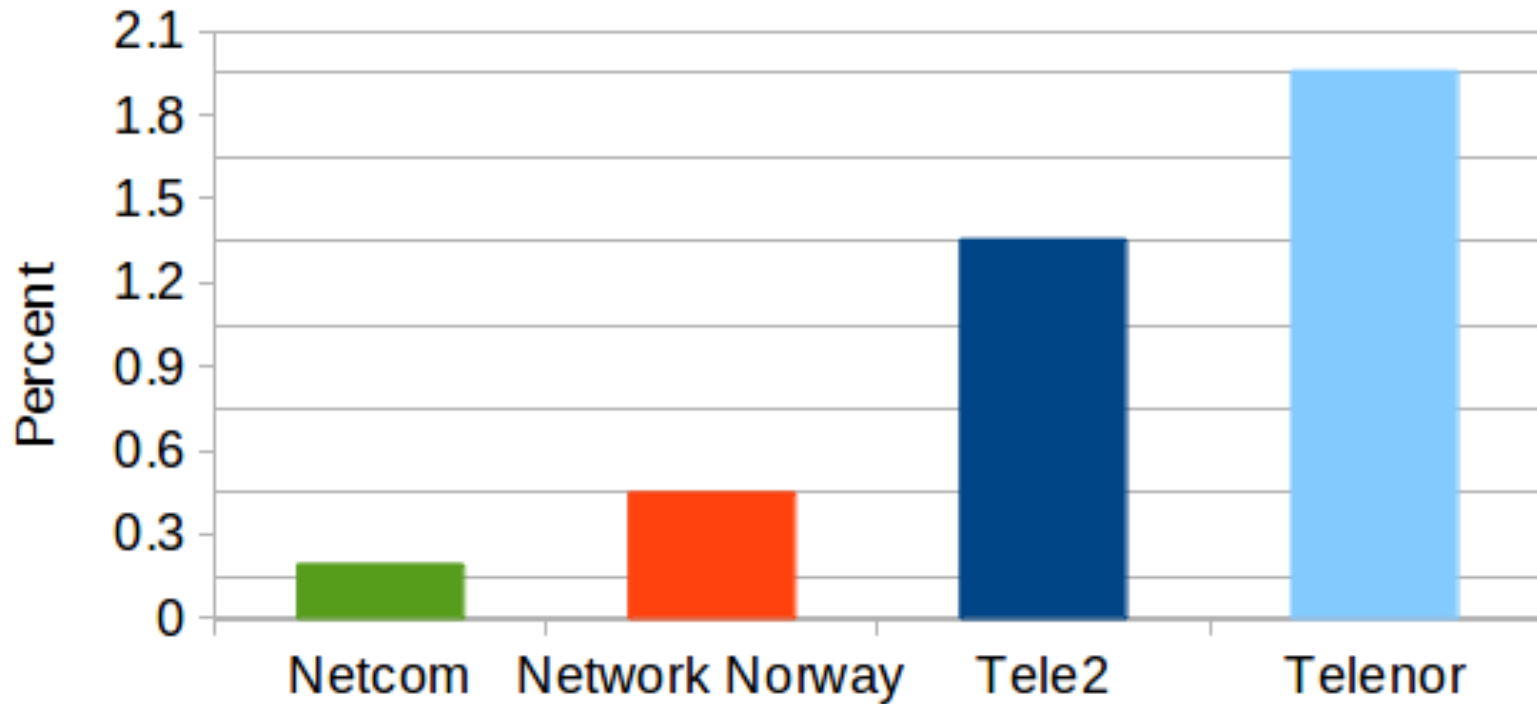 - MBB radio conditions: Mode/Sub-mode, LAC/Cell, RRC

Delay
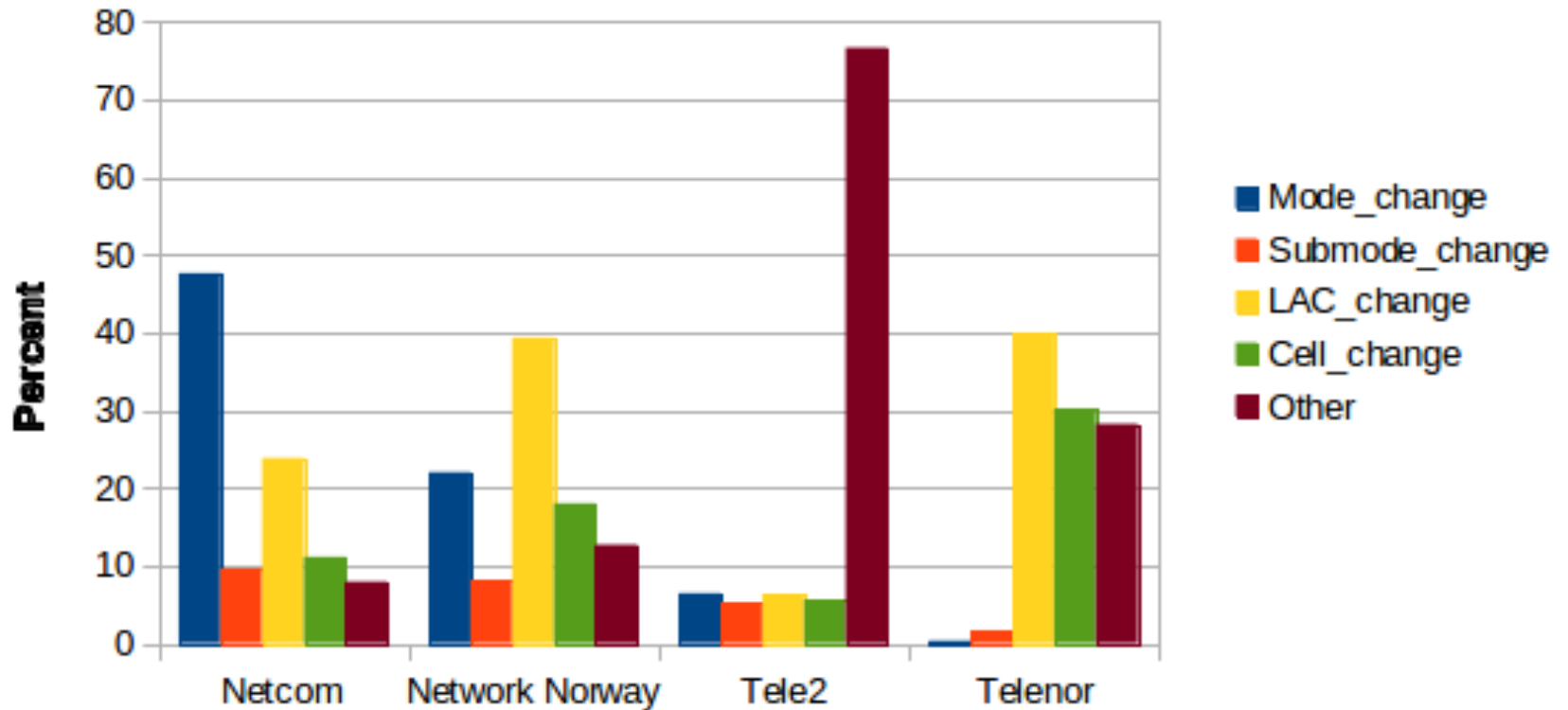

Boxplots of RTT: Mobility Vs Static
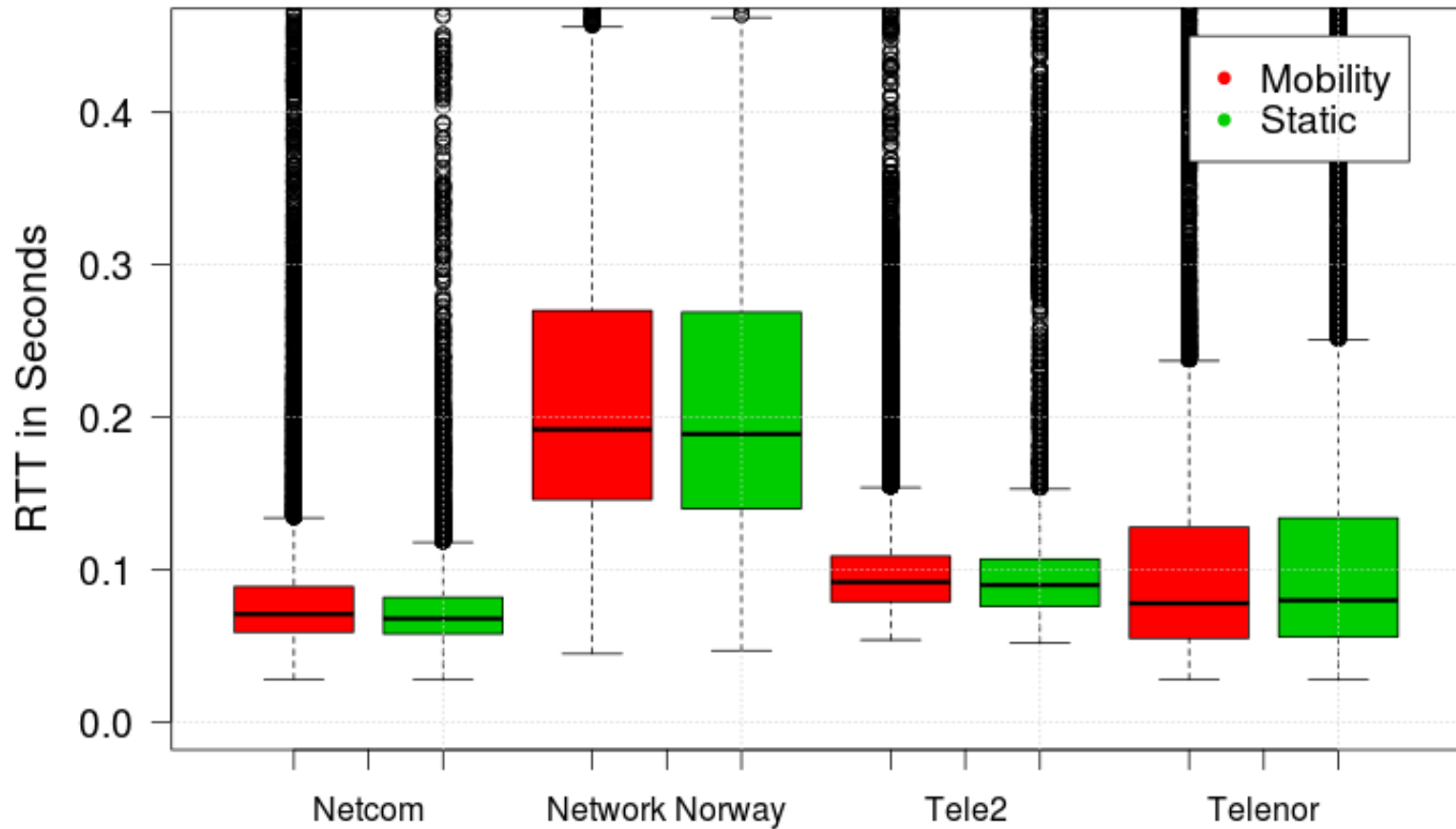
Packet Loss

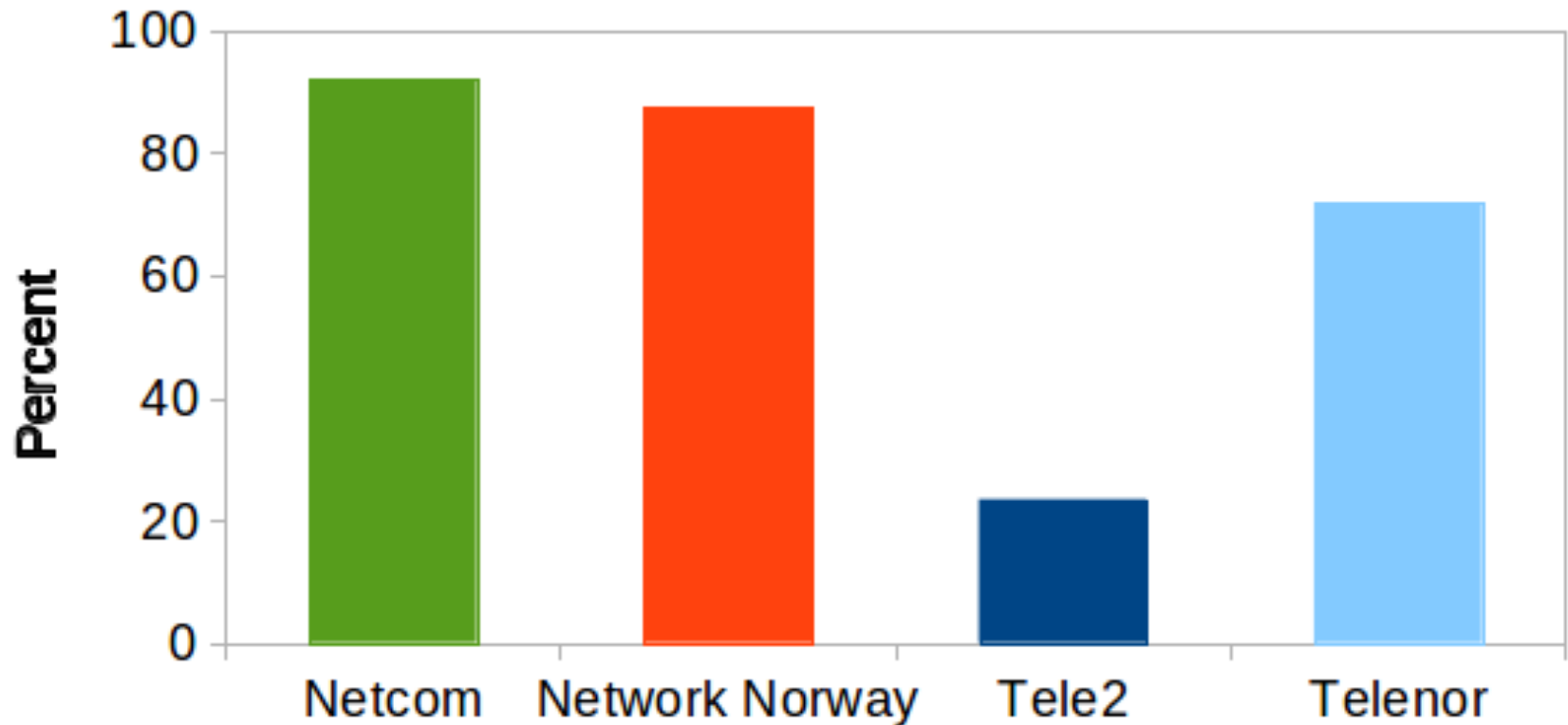**Total Percentage Packet Loss**

Distribution of Loss

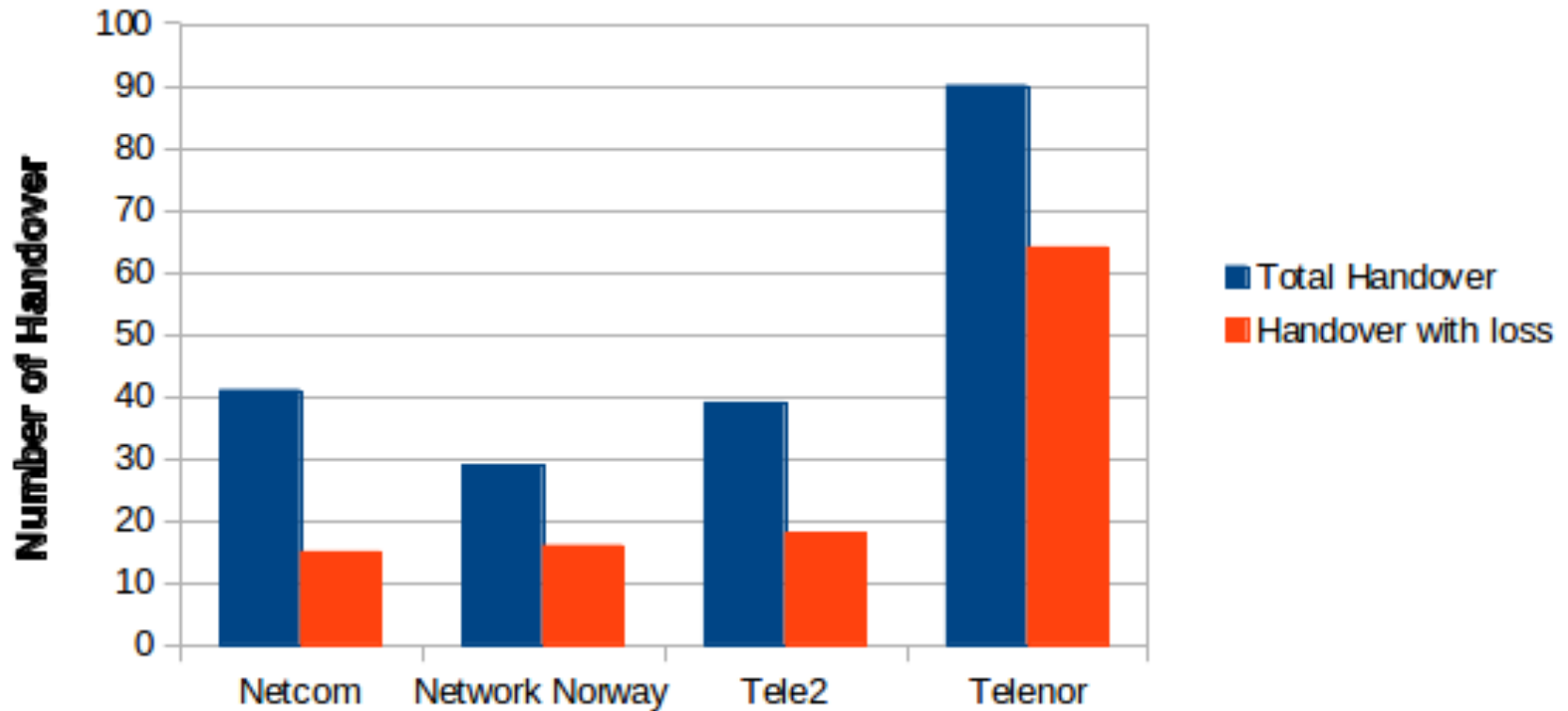Percent Packet Loss contributed by different events

Loss mostly due to handover

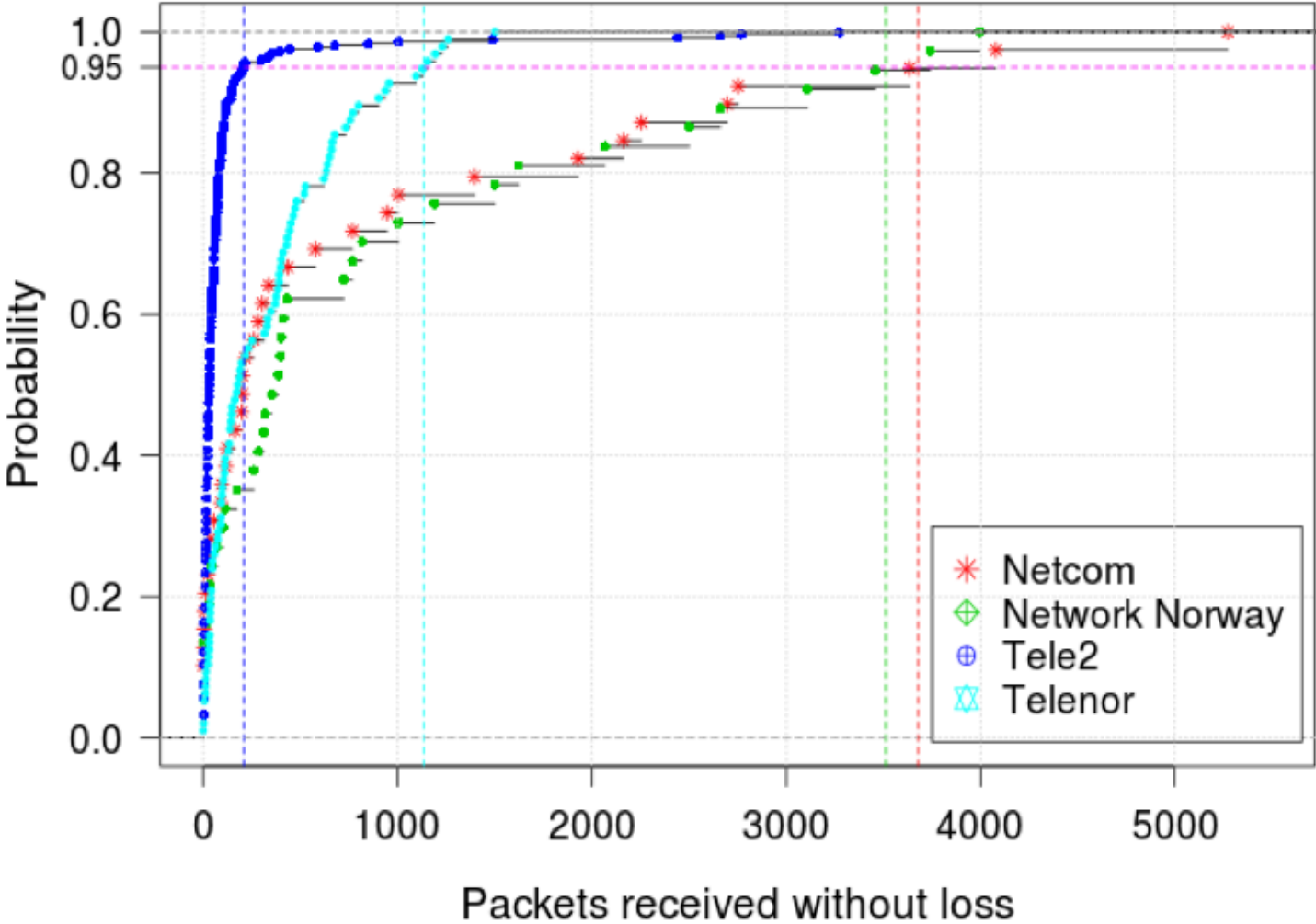**Percent Loss Contributed by Handover in Total Loss**

Not all handovers cause loss

Handover with and without loss (Packet sent 32000 plus)

Consecutive Packet Reception

Nodes on the Trains

- Collaboration with NSB and NOMAD Digital
- 4 nodes already deployed to trains
- Targeting 5 more nodes with LTE support next month

Loss: Static vs Mobility

CDF of Percentage Loss: Static Vs Mobility

Uptime: Static vs Mobility

UPTIME four networks in 3G: Static Vs Mobility
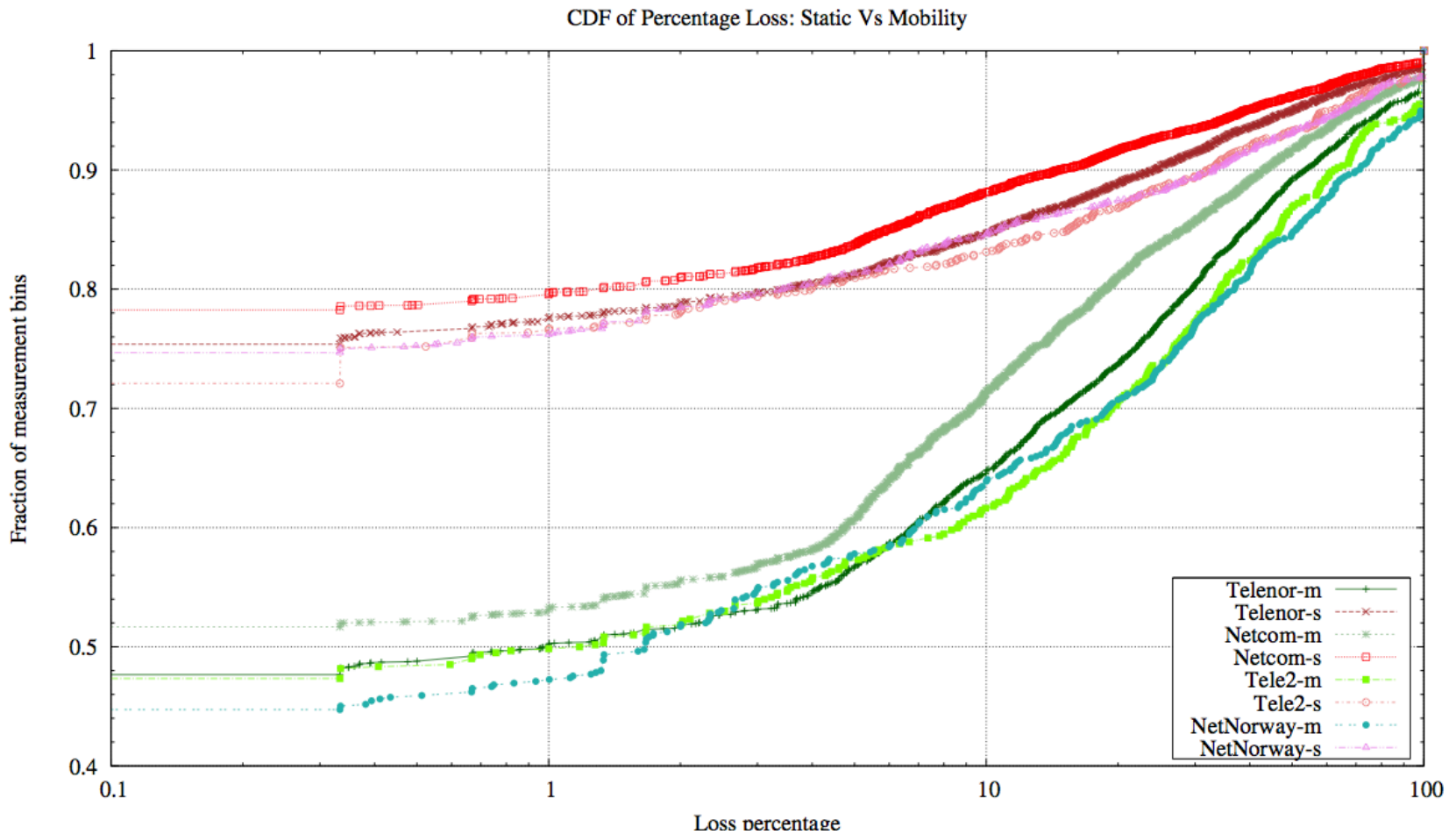
What is next?

- Application performance is of great importance
  - HTTP Download
  - Audio
  - Video Streaming
- Transport protocols behavior
- Different technologies (2G, 3G, 4G/LTE) and their performance under mobility