European 4-Gbps VLBI and eVLBI

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Outline

- Introduction
- Goals for 4 Gbps
- Testing
- Results
- Product
- Conclusions and future

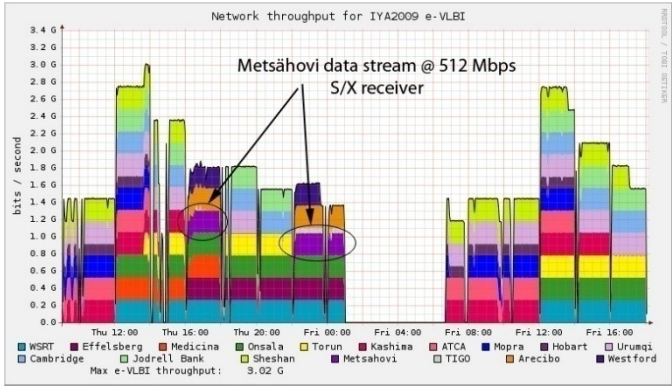
Introduction

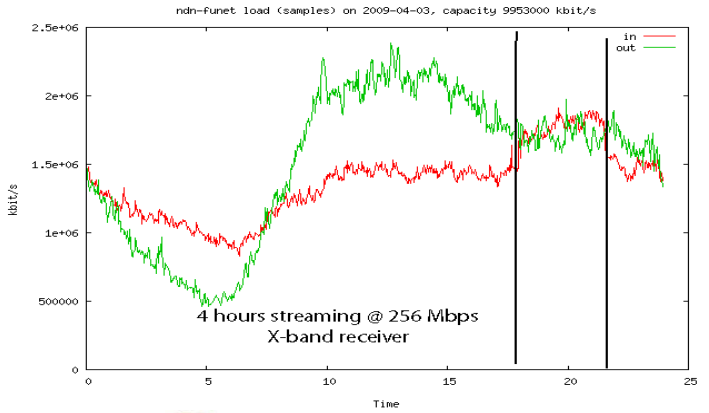
• During this year 2009 Metsähovi has been special active in e-VLBI opportunities:

  • We participated in IYA 2009 demo, 100 hrs of Astronomy demo and the e-VLBI ToO sessions (May/June/July).

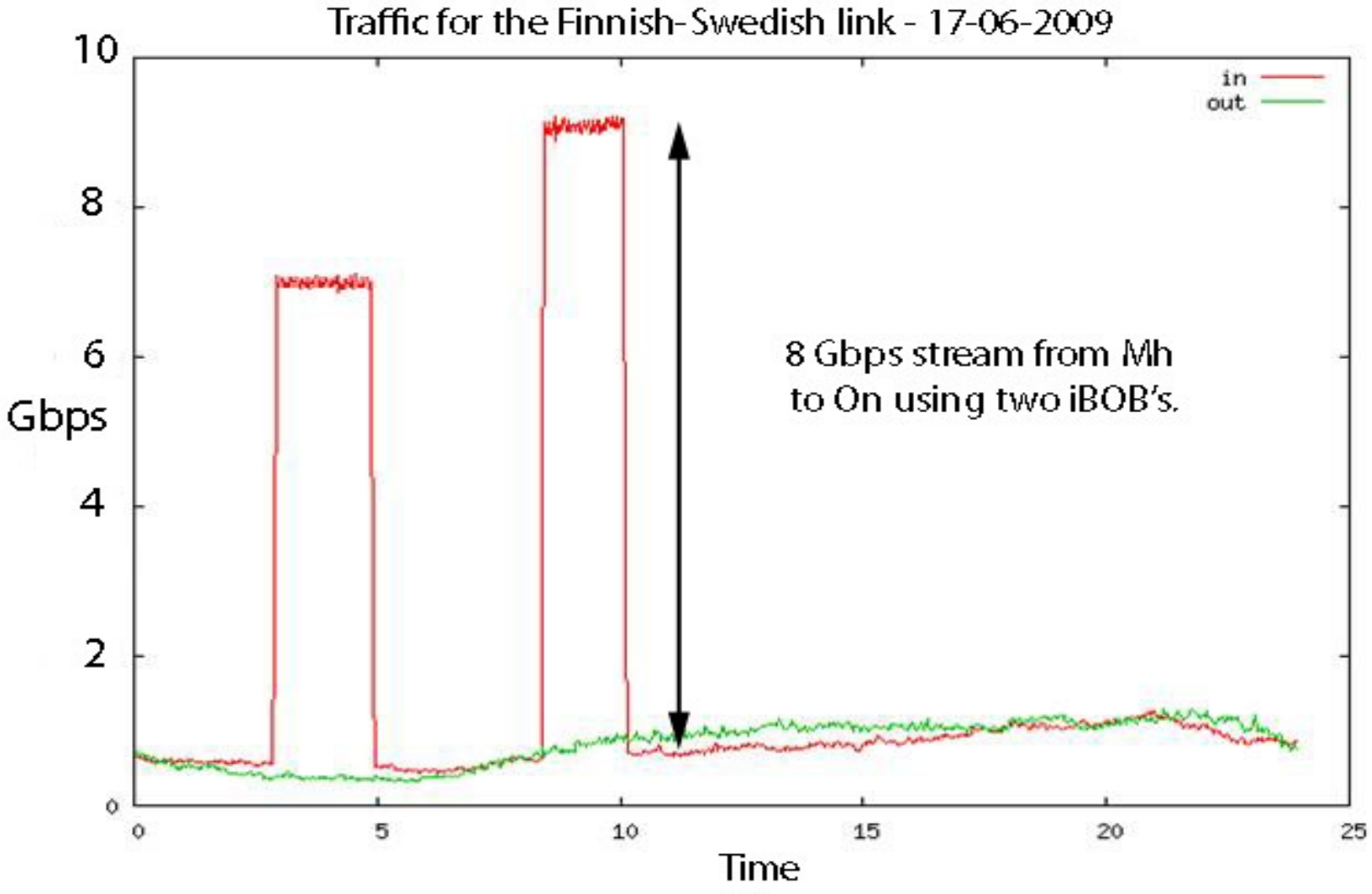
  • In addition last geo-VLBI session (EURO99 in May) was also done with real-time streaming to Bonn. PC-EVN + Tsunami UDP.

  • With a new 10 Gigabit card installed in Mark5A we have to perform 1024 Mbps soon with the EVN community.





Introduction



Goals for 4 Gbps

- Test the limits of commercial off-the-shelf computers.
- Test the new 10 Gbps devices: switches, Ethernet boards or FPGA devices as iBOB.
- Test the performance of plain old Internet in high-speed transfers.
  - Use of simple UDP transfers protocols: Tsunami-UDP, VDIF UDP packetizer, VSIB Multicast.
- Test the performance of hard disks, RAID disk controllers and Port Multipliers (PMP).
  - Detailed analysis at http://www.metsahovi.fi/en/vsib-docs/yebes_presentation.pdf
- Build a Data Acquisition System capable of streaming and recording at 4 Gbps.
  - Compatible and interactive with current Mark5 A/B/C .

Testing – equipment

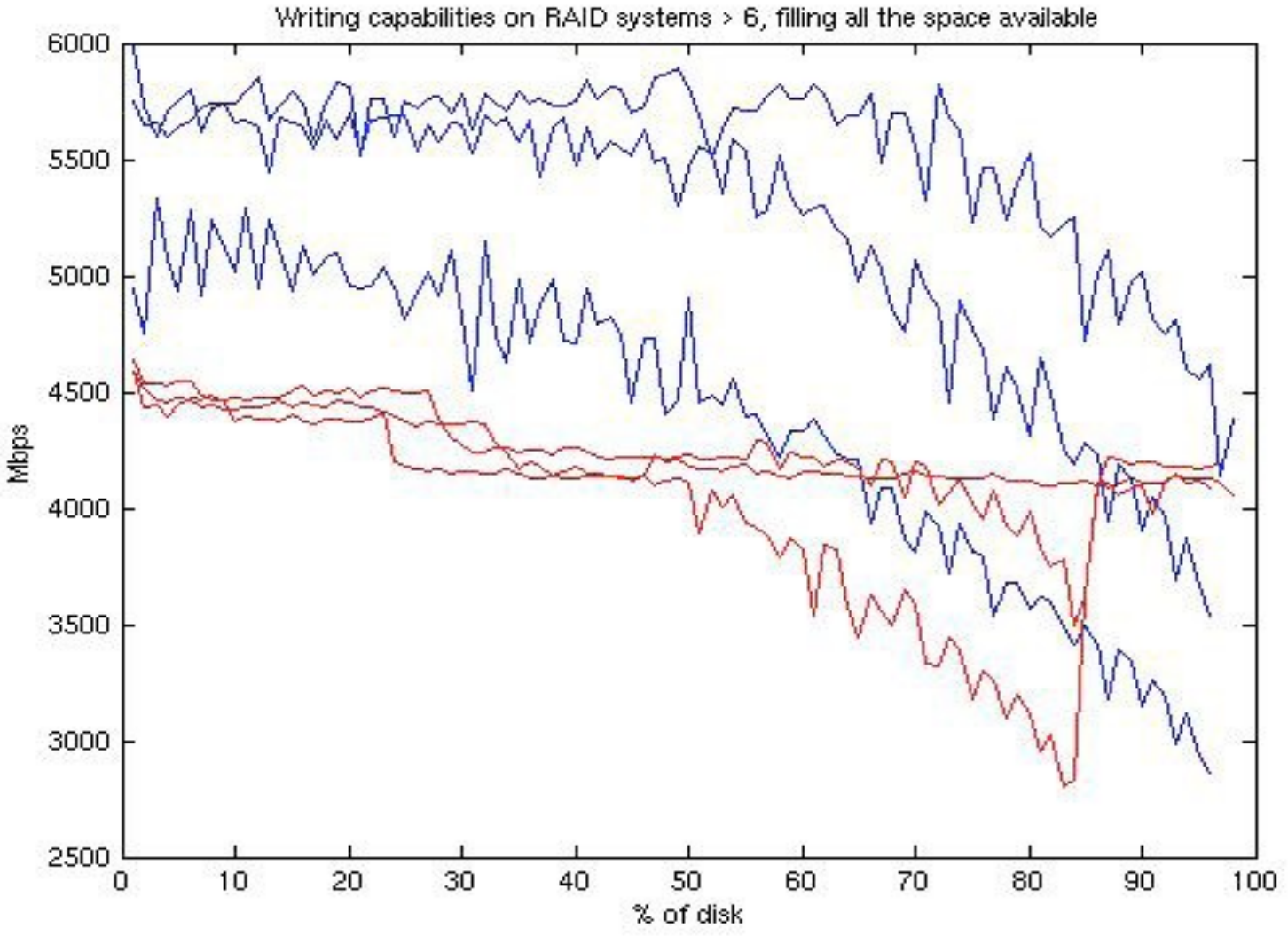
	System 1	System 2
Motherboard	Asus L1N-SLI WS	Rampage Extreme II
Processor	Two dual-core AMD	Pentium Quad-core
RAM memory	4 GB	4 GB
SATA controller	Native ports	HighPoint RR 2522
10 Gbps card	Chelsio 10 Gbps	Myrinet 10Gbps
Hard disks	Samsung F1 750GB	Samsung F1 1TB
Max capacity	24 TB (12 disks)	40 TB (20 disks)

(24h x 4Gbps)

Extra RAID controllers tested:

- Hewlett-Packard SC44Ge
- Addonics 4 x eSATA card ADSA3GPX8-4
- Addonics 5 internal SATA PMP

Results


Writing capabilities on RAID systems > 6, filling all the space available
Mbps
% of disk
6000
5500
5000
4500
4000
3500
3000
2500
0
10
20
30
40
50
60
70
80
90
100

Results II

- Eight Gbps continuous streaming over production network, no errors, no packet loss
  - Don’t forget to notify the network people before ;).
- Plain old Internet seems to work better than light paths
- FPGA-generated traffic is even safer than PC-traffic
  - e-VLBI at high rates matches with new FPGA based devices: dBBC, iBOB, iBOB2, ROACH…
- 100 Gbps Ethernet announced, demos Q3 2009, deployment 2010

Product II

- A full new equipment won't be necessary.
  - The new diskpack system could be compatible with the current Mark5 units that each station.
  - Minor upgrade is needed to have extra PCI-E ports.

www.metsahovi.fi/en/vlbi/10gbps/mark5_upgrade.html

➢ Mark5 could switch easily between both modes.

Conclusions

- 4 Gbps real-time observations already possible with the current networks.
- 4 Gbps recording possible with COTS.
  - Non-real-time VLBI transfer also possible.
- An eVLBI demonstration at 4 Gbps with several stations will be perform soon.
- eVLBI becomes easy with 100 Gbps trunk network.
  - 2010 100 Gbps link Finland-Estonia

Future work

- New applications: Kurtosis spectrometer for RFI mitigation
  - Estimates which parts of signal are RFI and removes them
  - First results extremely promising
- Bit compression for high data rates streams.
- VLBI spectroscopy and VLBI space satellite tracking.