

# Disk to Network Streaming at 42 Gbit/s

Ronald van der Pol <[rvdp@sara.nl](mailto:rvdp@sara.nl)>

Paul Wielinga <[wielinga@sara.nl](mailto:wielinga@sara.nl)>



# Outline

- Goal of the project
- Streaming server
- GLIF demo over 40G 1650 km cross border fiber
- SC10 demo over local 2x 40GE
- Conclusions



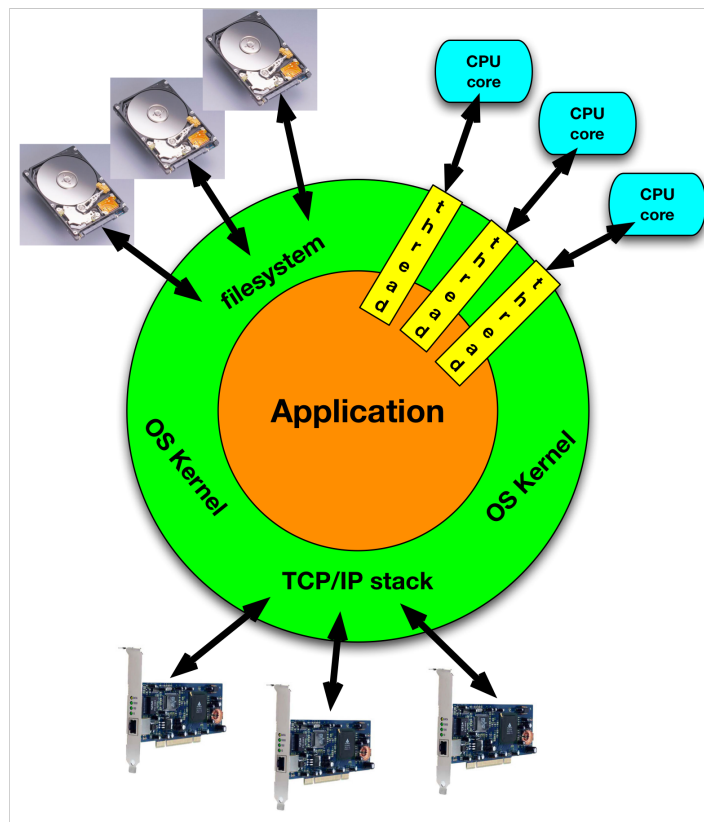


# Goal of the project

- Exploring the limits of a modern off the shelf server
  - What network I/O can be reached from a single server?
  - What disk I/O can be reached from a single server?
- Give demo at GLIF using SURFnet's 40G cross border fiber
- Explore availability of 40GE equipment
- Getting hand-on experience with 40GE equipment

# Multiple Disks, Cores and NICs

- Storage I/O speedup with multiple disks (RAID-1/RAID-Z)
- Compute speedup with multi-core systems
- Network I/O speedup with multiple NICs

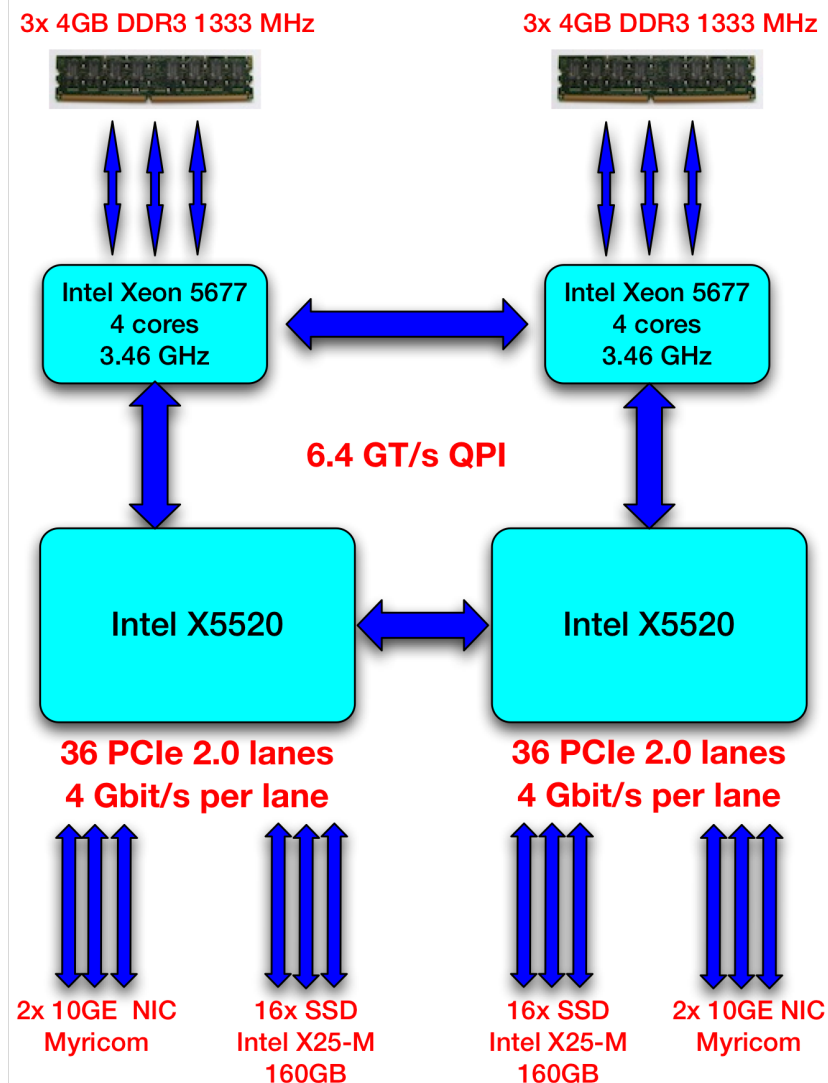




# Streaming Server Architecture

Supermicro X8DAH+-F motherboard  
2x PCI-E 2.0 x16  
4x PCI-E 2.0 x8  
1x PCI-E 2.0 x4  
8 cores @ 3.46GHz (Intel Xeon 5677)  
24GB DDR3 @ 1333 MHz  
4x 10GE Myricom (2 dual port NICs)  
32x SSD Intel X25-M 160GB

Eur 22,000 (June 2010)  
SSDs take up 50% of price





# SARA's 5x3 Tiled Panel



- 15x LCD 2560x1600
- 12,800x4,800 pixels
- 8x Dell T5500 servers
  - 10GE NIC
  - Nvidia GeForce GTX460
  - 2 LCDs per server

CineGrid Workshop, 12-15 dec, La Jolla, USA



# CosmoGrid

- Dutch supercomputing challenge project
  - prof. Portegies Zwart (University of Leiden)
- Simulation of  $256^3$  and  $2048^3$  bodies of dark matter
- Simulation shows formation of clusters after big bang
- Distributed application using several European and Japanese supercomputers, including Huygens @ SARA



CineGrid Workshop, 12-15 dec, La Jolla, USA



# CosmoGrid Visualisation

- Pre-rendered images
- 15 movies (1 movie for each screen)
- Movies stored on SSD disks on streaming server
- 24 bit RGB uncompressed
- Each movie streamed from server with UDP
- 15 MPI threads, synchronized at sending side (MPI barrier)



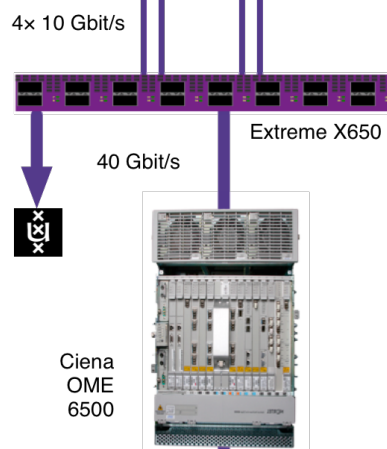
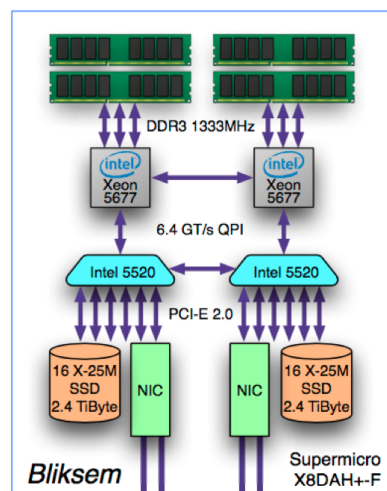
# GLIF Streaming Demo

- Annual Global LambdaGrid Workshop
  - 13-14 October @ CERN in Geneva
- Streaming demo over SURFnet's 40G cross border fiber between Amsterdam and Geneva
- Streaming from a single server in Amsterdam to the TPD in Geneva
- 4x 10GE in streaming server
- 15 UDP streams evenly balanced over 4x 10GE NICs of streaming server

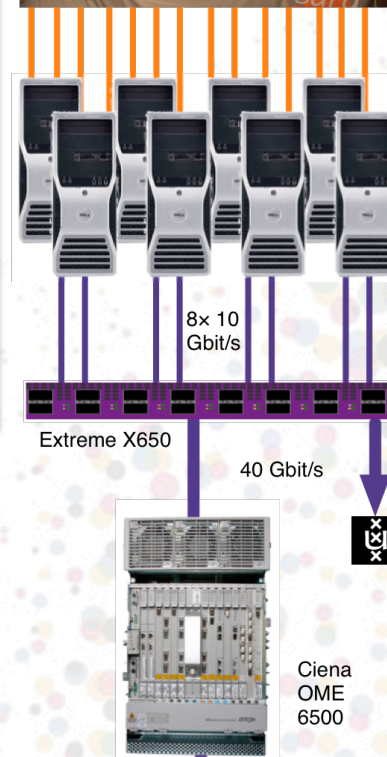




# Topology GLIF Demo



Amsterdam to Geneva  
1650 km 40G link  
4x 10GE client side  
Extreme x650  
Ciena 65000  
33 Gbit/s disk to network  
38 Gbit/s disk to network (no synch)



Science Park Amsterdam

Brussels

40 Gbit/s

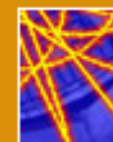


1650 km

Paris

CERN, Geneva

CineGrid Workshop, 12-15 dec, La Jolla, USA



[Home](#) > [iSGTW - 3 November 2010](#) > Feature - Ultra-fast networks: the final frontier

## Feature - Ultra-fast networks: The Final Frontier

Researchers from Holland have demonstrated a network infrastructure that could potentially help scientists save time and even transform the movie business. This could be done without the need for large computer clusters or grids, just off-the-shelf hardware components combined with human ingenuity and one of the world's fastest research networks. The team were from [SARA](#), a Dutch supercomputing and e-science support center.



A network researcher in awe of the billions of dark matter particles simulated on 15 ultra-high definition monitors. Image courtesy Freek Dijkstra



# SC10 Streaming Demo

- Supercomputing 2010 in New Orleans
- Streaming server and tiled panel locally at booth
- Two Extreme Networks x650 switches
  - 2x 40GE between switches
- Two topologies tried
  - 6x 10GE in streaming server
  - 2x 40GE in streaming server





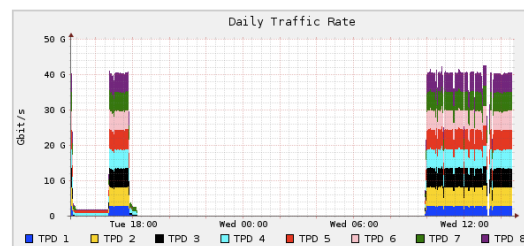
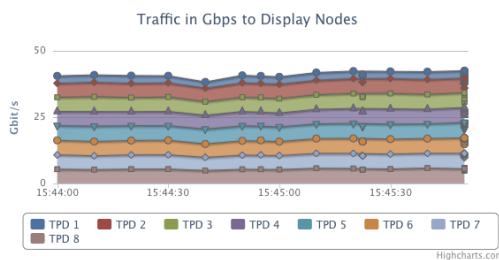
# SC10 Demo



Single Server 2x 40GE Disk to Network Streaming

Live Monitoring

Network Throughput



Sending Server

6x 10GE

Extreme X650

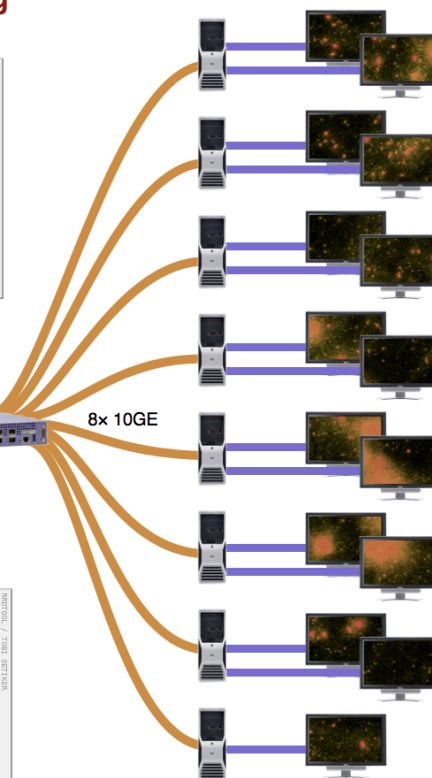
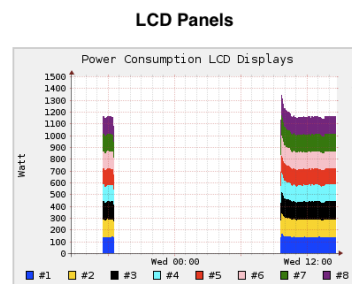
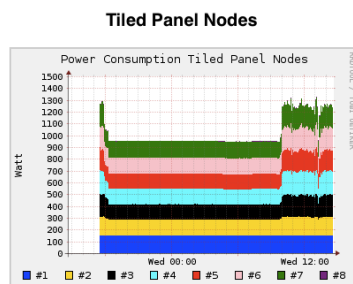
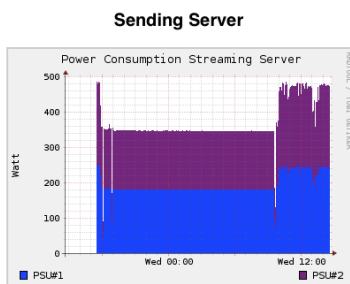
2x 40GE

Extreme X650

8x 10GE

Current traffic rate: 40.7 Gbit/s

Power Consumption



Sponsored by:



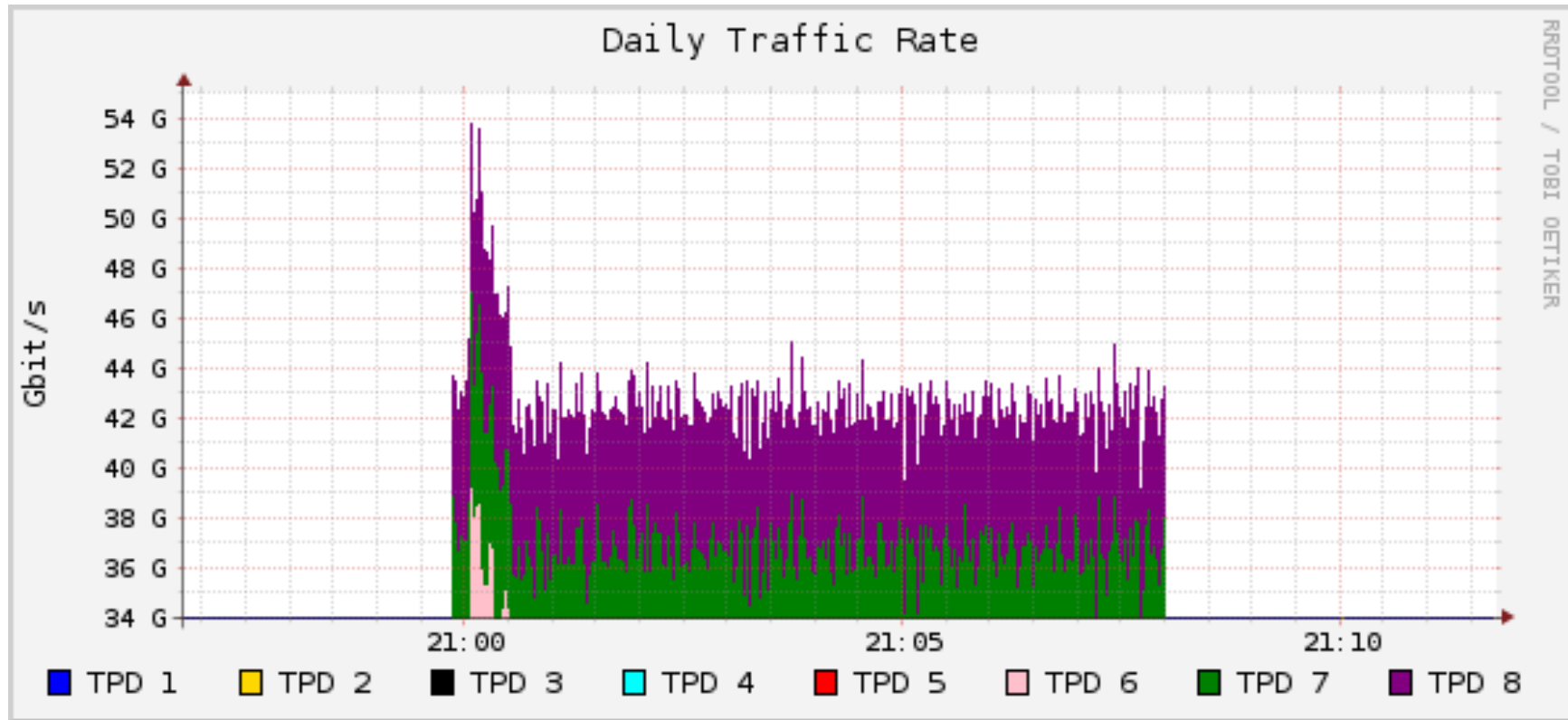
In Collaboration with:



CineGrid Workshop, 12-15 dec, La Jolla, USA



# Results







# Server & Extreme X650s



CineGrid Workshop, 12-15 dec, La Jolla, USA





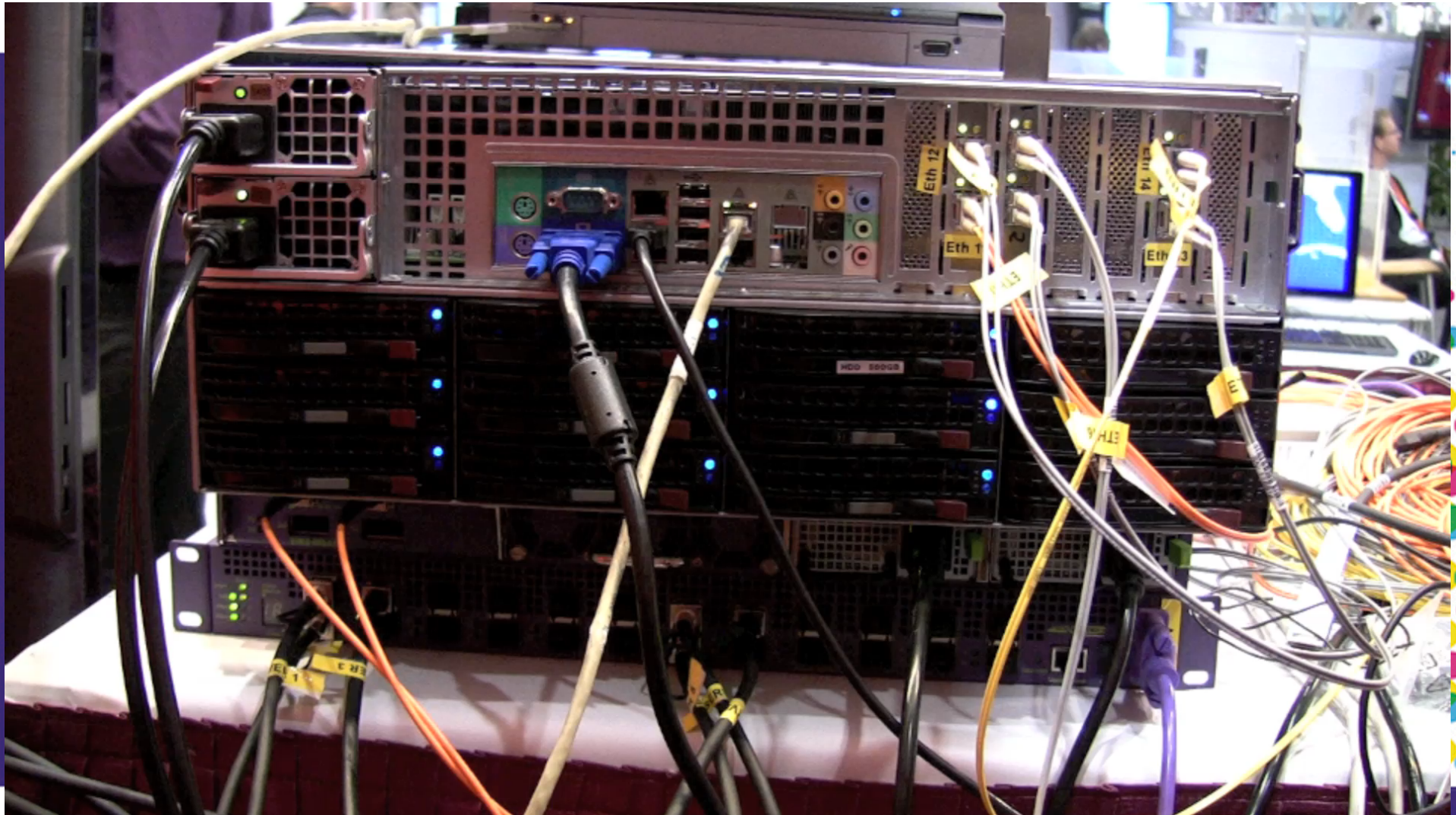
# 2x 40GE Disk to Network

CineGrid Workshop, 12-15 dec, La Jolla, USA





# SC10 6x 10GE Demo



CineGrid Workshop, 12-15 dec, La Jolla, USA

# Conclusions

- Modern off the shelf server can transmit 42 Gbit/s from disk to network
- 54 Gbit/s memory to network
- 40 Gigabit Ethernet not production quality yet
  - Most equipment still in beta or development
  - More interoperability testing needed
- Testing with real applications useful to find problems





# Additional Information

- ▀ <http://nrg.sara.nl/>
- ▀ <http://nrg.sara.nl/publications/RoN2010-D1.1.pdf>
- ▀ <http://nrg.sara.nl/publications/40G-Applications.pdf>
- ▀ Email: [nrg@sara.nl](mailto:nrg@sara.nl)



# Acknowledgements

- **SARA:** *Pieter de Boer, Freek Dijkstra, Igor Idziejczak, Tijs de Kler, Paul Melis, Hanno Pet, Peter Tavenier, Paul Wielinga*
- **SURFnet:** *Gerben van Malenstein, Erik-Jan Bos*
- **Extreme Networks:** *Rene Huntelerslag, Gihad Ghaibeh, Ramon Semmekrot, Trung Tran, Renuke Mendis*
- **Mellanox:** *Bill Lee, Yossi Avni, Glenn Church*
- **Ciena:** *Martin Bluethner, Jan Willem Elion, Kevin Mckernan, Harry Peng, David Yeung*
- **CERN:** *Edoardo Martelli*
- **Leiden Observatory:** *Simon Portegies Zwart*
  
- **Partly funded by GigaPort3 and CineGrid.nl (EFRO, Pieken in de Delta, Provincie Noord-Holland, Gemeente Amsterdam)**



# Thank you

Ronald van der Pol  
rvdp@sara.nl