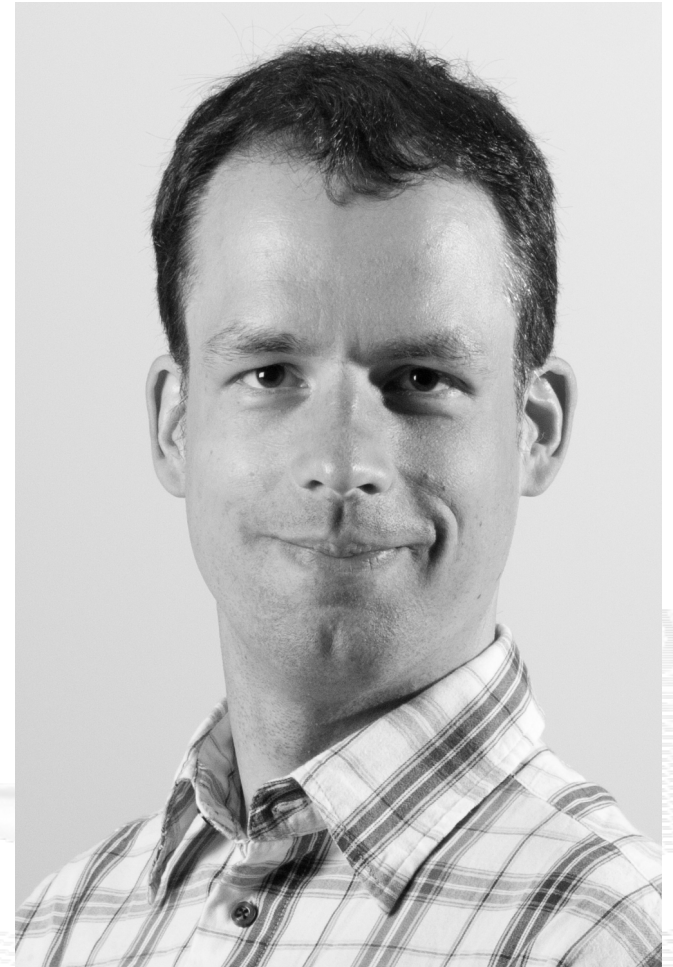


The NorNet Project

An Overview of NorNet Core

Simula Research Laboratory AS

6 March 2013



Contents

- Motivation
- NorNet Core
- Deployment and Users
- Conclusion

Overview: Motivation

- Motivation
- NorNet Core
- Deployment and Users
- Conclusion

Motivation: Robust Networks

- More and more applications rely on ubiquitous Internet access!
- However, our current networks are not as robust as they should be ...



How to make networks more robust?

Resilience by Redundancy

Multi-Homing

- Connections to multiple Internet Service Providers (ISP)
- Idea: if one ISP has problems, another connection still works



Do multiple ISP connections really improve robustness?

NorNet: A Testbed Distributed over Norway

- **Challenging topology:**
 - Large distances
 - A few “big” cities, many large rural areas
 - Longyearbyen (Svalbard):
 - Interesting location
 - Many polar research institutions
- **NorNet Core:**
 - Ca. 10 sites planned
- **NorNet Edge:**
 - Ca. 500 nodes planned



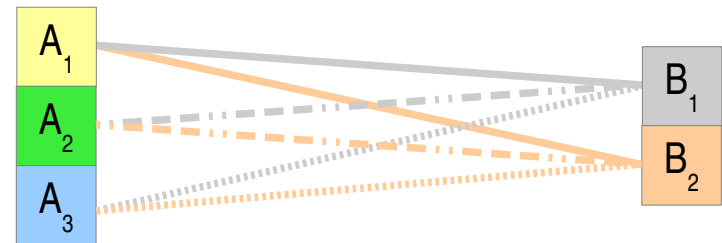
Overview:

NorNet Core

- Motivation
- NorNet Core
- Deployment and Users
- Conclusion

Tunnelling

- Researchers require control over used ISP interfaces
 - Which outgoing (local site) interface
 - Which incoming (remote site) interface
- Idea: Tunnels among sites
 - Router at site A: IPs A_1, A_2, A_3
 - Router at site B: IPs B_1, B_2
 - IP tunnel for each combination:
 $A_1 \leftrightarrow B_1, A_1 \leftrightarrow B_2, A_2 \leftrightarrow B_1, A_2 \leftrightarrow B_2, A_3 \leftrightarrow B_1, A_3 \leftrightarrow B_2$
 - Fully-connected tunnel mesh among NorNet Core sites (ca. 10)
 - Each site's router (called **tunnelbox**) maintains the tunnels
 - Static tunnels
 - NorNet-internal addressing and routing over tunnels



Address Assignment

- NorNet-internal address spaces:
 - Private NorNet-internal IPv4 “/8” address space (NAT to outside)
 - Public NorNet-internal IPv6 “/48” address space
- Systematic address assignment:
 - IPv4: 10.<Provider ID>.<Site ID>.<Node ID>/24 per site
 - Similar for IPv6, with “/64” network per site


Make it as easy as possible to keep the overview!

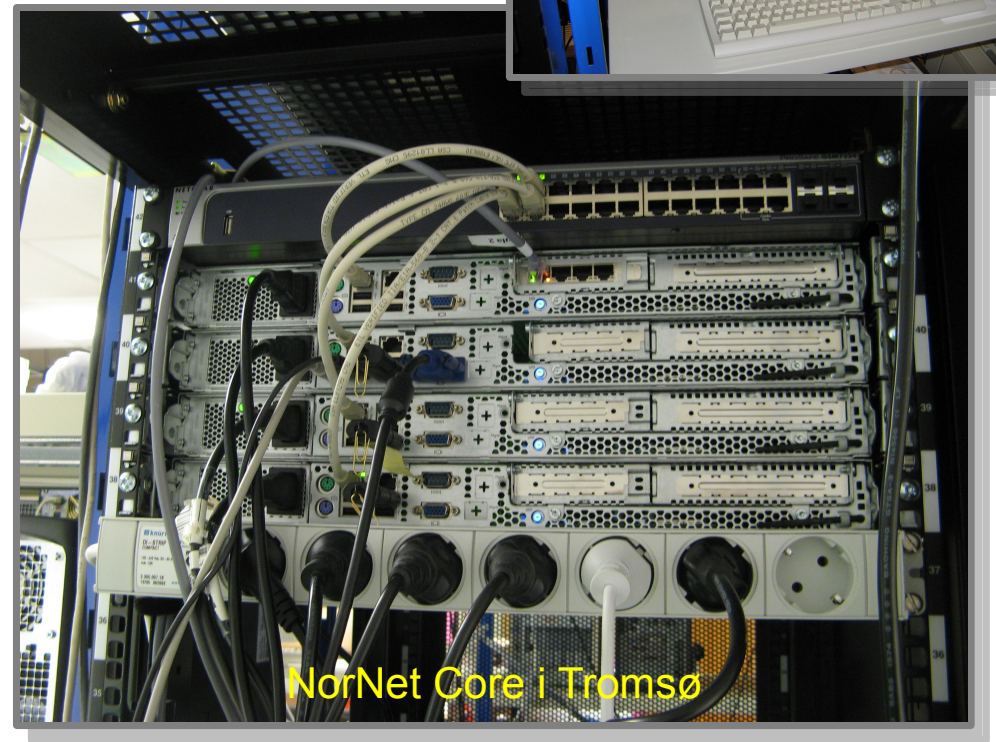
PlanetLab-based Software for Experiments

- Key idea:
 - Researchers should get virtual machines for their experiments
 - Like **PlanetLab** ...
 - ... but with multi-homing, of course
- PlanetLab software:
 - Different “stable” distributions: PlanetLab, OneLab, etc.
 - Current implementation: based on Linux VServers
 - Not in mainline kernel
 - Patched kernel, makes upgrades difficult
 - The future: **Linux Containers** (LXC)
 - Active development by PlanetLab/OneLab
 - We are involved in testing experimental LXC software

NorNet Core Site Deployment

A NorNet Core site:

- 1x switch
- 4x server
 - 1x tunnelbox
 - 3x research systems
- At least two ISP connections
 - Uninett 
 - Other providers
- NorNet Edge node



Monitoring

- PlanetLab:
 - 367 nodes of 1035 nodes alive (June 28, 2012)
⇒ availability < 36% ☹
 - NorNet should do much better!
- Direct contact to technical staff/researchers at sites
- Monitoring using Nagios
 - Flexible
 - Extensible by service-specific plug-ins

The Nagios logo, featuring the word "Nagios" in a bold, black, sans-serif font. The letter "N" is stylized with a horizontal bar extending to the left. A registered trademark symbol (®) is located at the top right of the word.

How to visualise NorNet?

“Kontrollsenteret”



Overview:

Deployment and Users

- Motivation
- NorNet Core
- Deployment and Users
- Conclusion

Deployment Status

- Deployed sites:
 - Simula Research Laboratory (IPv4/IPv6, Uninett+Hafslund)
 - Universitetet i Oslo (temporarily offline)
 - Høgskolen i Gjøvik (IPv4 only, Uninett)
 - Universitetet i Tromsø (IPv4 only, Uninett)
 - Universitetet i Agder (temporarily offline)
 - Universitetet i Stavanger (IPv4 only, Uninett)
 - Universitetet i Bergen (IPv4 only, Uninett)
- Future sites:
 - Høgskolen i Narvik (March 2013)
 - Universitetet på Svalbard (March 2013)
 - Universität Duisburg-Essen (April 2013; IPv4/IPv6, DFN+Versatel)
 - NTNU Trondheim (until summer 2013)
- Additional ISP connections still to be negotiated



Users

“The road to hell is paved with unused testbeds.”

[James P. G. Sterbenz]

- Of course, NorNet does **not** intend to be another unused testbed!
- NorNet will be open for all interested users!
 - Interest by multiple research groups
 - Multi-path transport
 - Security
 - Simula is going to organise a workshop for potential users

More details to be announced soon!

Overview:

Conclusion

- Motivation
- NorNet Core
- Deployment and Users
- Conclusion

Conclusion and Future Work

- NorNet is progressing!
 - Management software under development
 - First site deployments have been made
- Future work:
 - Finish the initial deployment
 - Make sites multi-homed
 - Improve/refine management software

And, of course, do some research!

Any Questions?

N  RNET

Visit <http://www.nntb.no> for further information!