

Multi-Service Networks Workshop – Coseners 2016

NorNet

—

The Internet Testbed for Multi-Homed Systems

Thomas Dreibholz

托马斯 博士

توماس ترايبهولس

dreibh@simula.no

Simula Research Laboratory

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- Motivation
- The NorNet Testbed
 - NorNet Core
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- Users and Research
- Conclusion

Overview:

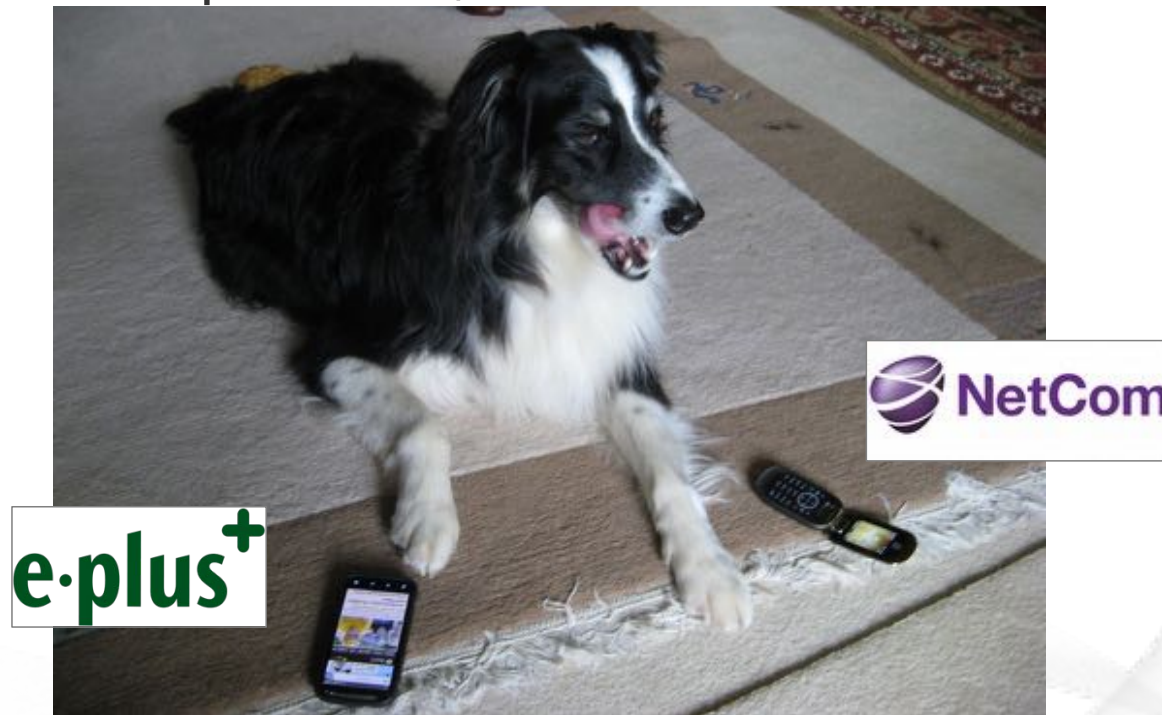
Motivation

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Resilience by Redundancy

Multi-Homing

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



Is resilience really improved? What about multi-path transport?

Goals of the NorNet Project

- Building up a **realistic** multi-homing testbed
- Wired and wireless
 - Wired → “NorNet Core”
 - Wireless → “NorNet Edge”
- **Perform research with the testbed!**



How is the current testbed status?

Overview:

NorNet Core

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NorNet Core Site Deployment Status (July 2016)

No.	Site	ISP 1	ISP 2	ISP 3	ISP 4
1	Simula Research Laboratory	Uninett	Kvantel	Telenor	PowerTech
2	Universitetet i Oslo	Uninett	Broadnet	PowerTech	
3	Høgskolen i Gjøvik	Uninett	PowerTech		
4	Universitetet i Tromsø	Uninett	Telenor	PowerTech	
5	Universitetet i Stavanger	Uninett	Altibox	PowerTech	
6	Universitetet i Bergen	Uninett	BKK		
7	Universitetet i Agder	Uninett	PowerTech		
8	Universitetet på Svalbard	Uninett	Telenor		
9	Universitetet i Trondheim	Uninett	PowerTech		
10	Høgskolen i Narvik	Uninett	Broadnet	PowerTech	
11	Høgskolen i Oslo og Akershus	Uninett	–		
12	Karlstads Universitet	SUNET			
13	Universität Kaiserslautern	DFN			
14	Universität Duisburg-Essen	DFN	Versatel		
15	Hainan University 海南大学	CERNET	China Unicom		
16	The University of Kansas	KanREN			
17	Korea University 고려대학교	KREONET			
18	National ICT Australia (NICTA)	AARNet			
19	HAW Hamburg	DFN			
20	Technische Universität Darmstadt	DFN			
21	Haikou Cg. of Econ. 海口经济学院	China Telecom	CERNET		

- IPv4 and IPv6
- IPv4 only (ISP without IPv6 support ☹)
- IPv4 only (site's network without IPv6 support)
- ISP negotiation in progress

<https://www.nntb.no/pub/nornet-configuration/NorNetCore-Sites.html>

Remote Systems

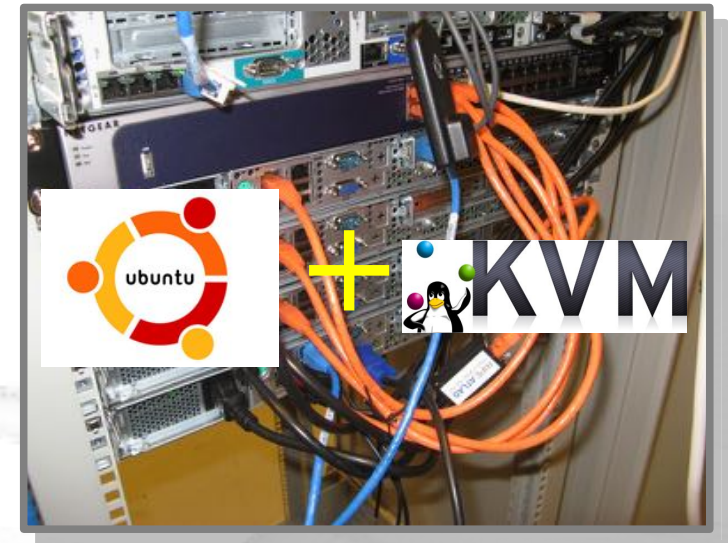
Our servers may be really remote!

The “road” to Longyearbyen på Svalbard, 78.2°N

Virtualisation

"Anything that can go wrong, will go wrong."
[Murphy's law]

- Experimentation software is experimental
- How to avoid software issues making a remote machine unusable?
- Idea: virtualisation
 - Lightweight, stable software setup:
Ubuntu Server 14.04 LTS
 - KVM (Kernel-based Virtual Machine)
 - Other software runs in VMs:
 - Tunnelbox (router) VM on server #1
 - 2 LXC-based research node VMs on physical servers #2 to #4
 - In case of problem: manual/automatic restart or reinstall of VM



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NorNet Edge – Wireless Network Conditions at Heterogeneous Locations



Locations

Configuration
by provider

Utilisation
of cells

NorNet Edge needs to cover many locations!

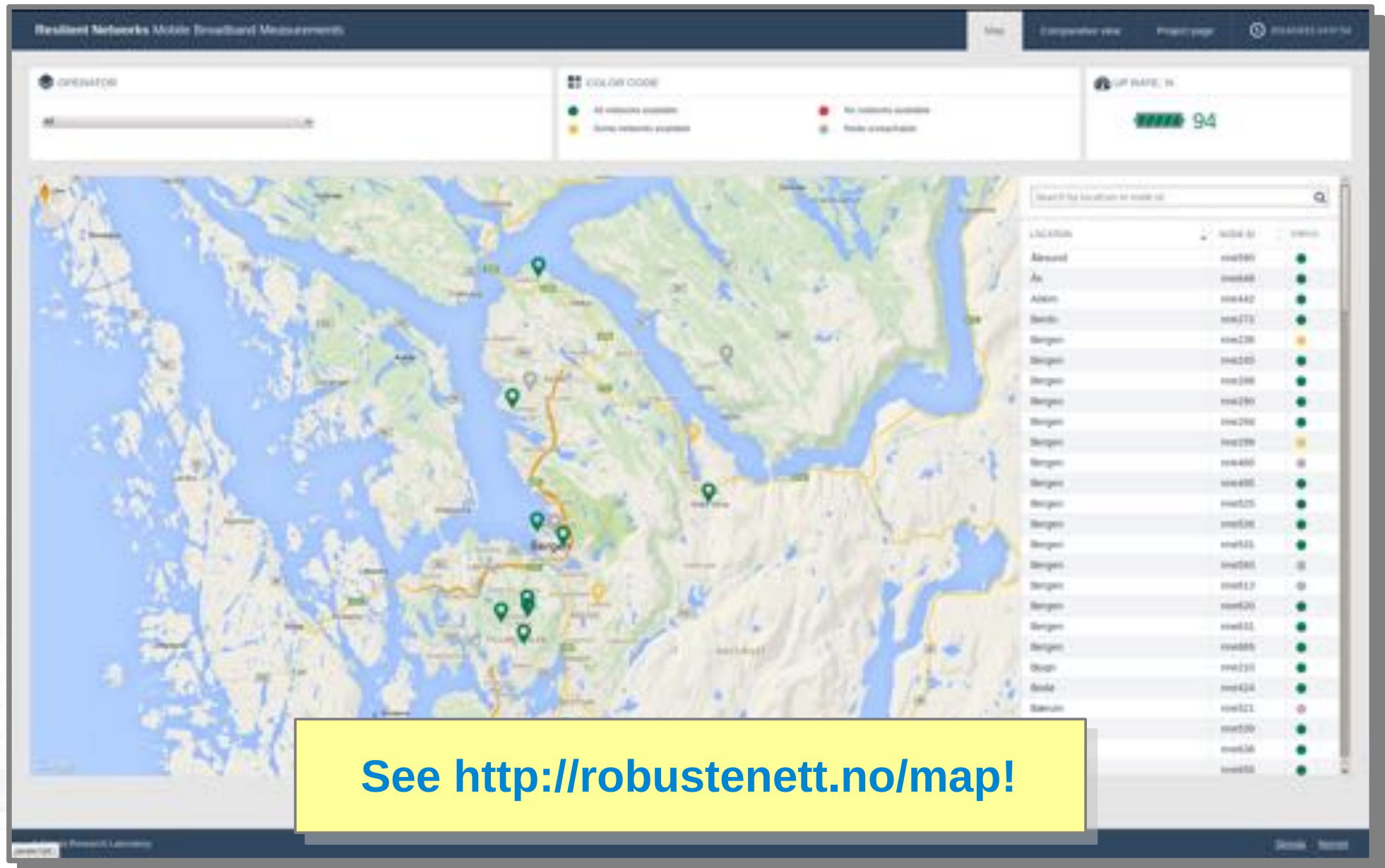
The NorNet Edge Box: Ready for Deployment

Box contents:

- Ufoboard
- Up to 4x USB UMTS or LTE:
 - Telenor, Telia,
 - Network Norway, Tele2
- 1x ICE CDMA mobile broadband
- 1x Ethernet
- 1x WLAN (optional)
- Power supplies
- Handbook



Live Visualisation of NorNet Edge



See <http://robustennett.no/map!>

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Users and Research

"The road to hell is paved with unused testbeds."
[James P. G. Sterbenz]

- We already have some users!
- Examples:
 - Shared Bottleneck Detection (UiO+Simula)
 - VoIP Misuse Detection (UDE)
 - Multi-Path Transport (Simula, UDE, UiO, HU, etc.)
 - Balia Congestion Control (Bell Labs in South Korea)
 - IPv4/IPv6 Performance Comparison (Simula)
 - ...

List to be extended!

See <https://www.nntb.no/projects/> for further projects using NorNet!

Interested in using NorNet? Just ask!

“NorNet wants to be a building block of the railroad to heaven” ...



<https://www.nntb.no>

... and not be another unused testbed that paves the road to hell!