The 1st International NorNet Users Meeting (NNUW-1)

The NorNet Core Testbed

An Experiment Tutorial

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Preparations

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Tutorial Accounts

- Please see the backside of your name tag!
  - Username
  - Password
- Valid for:
  - SSH login server
  - PLC server

Accounts are just temporary for this tutorial!
Initial Tasks

- **Account for our SSH login server:** gatekeeper.nntb.no
  - Server is gateway into NorNet Core network
  - `ssh <username>@gatekeeper.nntb.no`
- **Use port forwarding to access PLC and Monitor servers:**
  - Forwards TCP port 2000 to PLC server's HTTPS port
  - Forwards TCP port 2001 to Monitor server's HTTP port
- **Account for the PLC server:** plc.simula.nornet (inside NorNet Core only)
  - Login: `<username>@simula.nornet`
- **VPN into NorNet Core coming soon**

Try to directly connect to your NorNet Core switch
Access to PLC and Monitor

- Via port forwarding:
  - PLC: https://localhost:2000/

- Inside NorNet Core network:
  - Monitor: http://monitor.simula.nornet
  - PLC: https://plc.simula.nornet

Is everybody able to log in?
Overview:
Getting an Overview of the Testbed

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“Kontrollsenteret”

Velkommen til NorNet-Kontrollsenter på Simula Research Laboratory, Fornebu

See http://monitor.simula.nornet within NorNet Core!
PLC User Interface: Sites View

See https://plc.simula.nornet within NorNet Core!
PLC User Interface: Nodes View

Node state: should be “boot”
- Your temporary SSH keys are on the login server!
- Public key is already provided to PLC for authentication to nodes
Overview: Using a Slice

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The Tutorial Slice *srl_tutorial*

- A test slice has already been created:
  - Name: *srl_tutorial*
  - Special NorNet Core properties:
    - Own IP addresses on each node
    - IPv4 and IPv6
    - Multiple ISPs (at sites with several ISPs)
  - The slice is instantiated on all nodes
  - Your account is mapped as user to *srl_tutorial*
Logging In

• From the login server:
  - `ssh -i <your private key> <slice name>@<node name>`

• Examples (private key is in `~/.ssh/id_rsa`, slice is `srl_tutorial`):
  - `ssh -i ~/.ssh/id_rsa srl_tutorial@nordberg.simula.nornet`
  - `ssh -i ~/.ssh/id_rsa srl_tutorial@amundsen.uit.nornet`
  - `ssh -i ~/.ssh/id_rsa srl_tutorial@altenessen.ude.nornet`

Use PLC to find other nodes. We have 70 VMs!
Inside a Sliver

- Each sliver contains a Fedora Core 18 environment

- Obtain root access:
  - `su`
  - `sudo bash`

- Install custom software:
  - `yum install <package> ...
  - **Example:** `yum install yum-plugin-fastestmirror bind-utils`

- Show IP addresses and routes:
  - `ip -4 addr show ; ip -4 route show`
  - `ip -6 addr show ; ip -6 route show`

**Important:** slivers have their own addresses!
Slivers and Addresses

- **Node:**
  - The node itself, e.g. altenessen.ude.nornet
  - Used for SSH login

- **How to find sliver addresses of a node?**
  - Look inside the sliver itself (login to sliver → ip addr show)
  - Ask the DNS server:
    - Use “dig” (part of bind-utils package for Fedora Core)
    - `dig <slice name>.<node name>.<site name>.nornet`
    - But replace “_” by “–” in slice name!
  - Examples for srl_tutorial slice:
    - `dig srl-tutorial.altenessen.ude.nornet any` to obtain primary provider's addresses
    - `dig srl-tutorial.altenessen.all.ude.nornet any` to obtain all providers' addresses
    - `dig srl-tutorial.solvang.all.simula.nornet` without “any” → gets only A RRs (i.e. IPv4 addresses)
A Dig Example

```bash
olal@nordberg:~$ dig srl-tutorial.solvang.all.simula.nornet any
; <<>> DiG 9.9.2-P1 <<>> srl-tutorial.solvang.all.simula.nornet any
;
;; ANSWER SECTION:
srl-tutorial.solvang.all.simula.nornet. 86400 IN A 10.2.1.169
srl-tutorial.solvang.all.simula.nornet. 86400 IN A 10.1.1.169
srl-tutorial.solvang.all.simula.nornet. 86400 IN AAAA 2001:700:4100:101::a9:69
srl-tutorial.solvang.all.simula.nornet. 86400 IN AAAA 2001:700:4100:201::a9:69
srl-tutorial.solvang.all.simula.nornet. 86400 IN HINFO "Amiga 5000" "Slice srl_tutorial"
srl-tutorial.solvang.all.simula.nornet. 86400 IN LOC 59 53 45.240 N 10 37 39.360 E 15.00m

;; AUTHORITY SECTION:
simula.nornet. 86400 IN NS ns.ntnu.nornet.
```
Overview:
A Practical Example

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A Multi-Path Routing Test

- Select 2 nodes at different sites
  - Two ISPs are available at Simula (here) and UDE (Essen) sites
  - Login to srl_tutorial sliver: `ssh srl_tutorial@<node name>`
  - Check IP addresses: `ip -4 addr show dev eth0`
  - Example:
    - `srl-tutorial.kettwig.ude.nornet: 10.30.42.125 10.31.42.125`
      - ISPs: 30=DFN, 31=Versatel (a ADSL connection)
    - `srl-tutorial.frogner.simula.nornet: 10.1.1.176 10.2.1.176`
      - ISPs: 1=UNINETT, 2=Hafslund
- Try ping/traceroute:
  - `ping [-f] [-s <size>] [-c <count>] <dest IP> -s <src IP>`
  - `traceroute <dest IP> -s <src IP>`
  - Look at the second and third hop (and their reverse DNS lookups)!
  - What do you see?
Some Flood Ping Results

DFN → UNINETT

DFN → Hafslund

Versatel → UNINETT

Versatel → Hafslund

RTT differences among provider combinations; higher ADSL delay (Versatel)
Some Traceroute Results

traceroute to 10.1.1.176 (10.1.1.176), 30 hops max, 60 byte packets
1  essen.dfn.ude.nornet (10.30.42.1) 2.104 ms 2.849 ms 2.831 ms
2  dfn.ude.uninett.simula.nornet (192.168.178.10) 95.059 ms 95.024 ms 94.961 ms
3  srl-tutorial.frogner.uninett.simula.nornet (10.1.1.176) 105.432 ms 105.281 ms 105.220 ms

traceroute to 10.2.1.176 (10.2.1.176), 30 hops max, 60 byte packets
1  essen.dfn.ude.nornet (10.30.42.1) 1.190 ms 1.739 ms 1.031 ms
2  dfn.ude.uninett.simula.nornet (192.168.178.10) 56.972 ms 56.722 ms 56.853 ms
3  srl-tutorial.frogner.hafslund.simula.nornet (10.2.1.176) 100.773 ms 99.513 ms 99.337 ms

traceroute to 10.1.1.176 (10.1.1.176), 30 hops max, 60 byte packets
1  essen.versatel.ude.nornet (10.31.42.1) 1.830 ms 2.633 ms 2.609 ms
2  versatel.ude.uninett.simula.nornet (192.168.133.222) 127.768 ms 127.954 ms 127.507 ms
3  srl-tutorial.frogner.uninett.simula.nornet (10.1.1.176) 182.544 ms 182.564 ms 182.269 ms

traceroute to 10.2.1.176 (10.2.1.176), 30 hops max, 60 byte packets
1  essen.versatel.ude.nornet (10.31.42.1) 1.178 ms 1.805 ms 1.769 ms
2  versatel.ude.uninett.simula.nornet (192.168.133.222) 88.834 ms 91.932 ms 96.620 ms
3  srl-tutorial.frogner.hafslund.simula.nornet (10.2.1.176) 79.603 ms 75.599 ms 69.910 ms

Hop 2: Router's ICMP TTL Exceeded is sent back via Simula's primary ISP!
What Else To Do?

- Try the same with IPv6!
  - ping6 [-f] [-s <size>] [-c <count>] <dest IP> -s <src IP>
  - traceroute6 <dest IP> -s <src IP>

- Install custom software
  - But note: do not assume the slivers to be permanent storages
  - Write scripts to automatise installation
  - In case of problems, nodes may just be wiped and reinstalled

And, of course, try your own experiments in NorNet!
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Conclusion and Future Work

- **NorNet Core is ready for your ideas!**
  - Think about your experiments
  - Let them run in NorNet Core

- How to get permanent access?
  - **Talk to us!**
  - Provide some information on your project
    Let us **discuss the details** about running your experiment in NorNet Core!

**In case of questions, ask us!**
Any Questions?

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