Scaling network management tools

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16th October 2003
Abstract

UNINETT, The norwegian research network, is actively collecting information on it’s network in order to assess and maintain the quality of the offered service. We are developing tools to do management and measurements on our own and our customers infrastructure. This talk describes some of the management and measurement activities and the tools.
UNINETT

- The norwegian research network since 1987 with 280 customers in higher education and research
  - 55 people in 4 companies doing internet service, no names, administrative systems, schools networking advice

- 2.5 Gbps backbone, access to wavelengths/fibre through cooperation with telecom provider
  - local cooperative fibre projects
Why homegrown

- PSI/Nysernet SNMP from 1990-1998
  - nice but a bit static cumbersome configuration
- Major NM platforms - solved wrong problems
  - centralized operations and intranet-oriented
  - poor history functions
- Resources: Hackers and students and open software => develop tailored tools
Scaling principles

Accessability - UNINETT is distributed in organisation: users, customers, external projects, operations, engineering, services, research, managers, Board of Directors ...

Trends - Proactive better than reactive - see trends in traffic, error rates over days, weeks and years
Numbers - can’t do 100’s of customers, devices and links one by one
=> summaries, thresholds, tables and sorting

Dynamic - config change (SNMP ifIndex)

Usability - easy access to the most important related statistics

Visuality - graphs, maps and animation

Openness - open software: perl, TCL, sh, postgresql, PHP, python, net-snmp, flow-tools, scotty, ...
Network maps

3 network load map systems being made in Trondheim

**Netmap** autozoomed geographical maps (UNINETT)
- menus with URLs
- animation of any point or link load

**Zino** schematic load maps - tgif (UNINETT/NORDUnet)

**Nav** autodetected campus topology (NTNU)
Network Map System (netmap)

- make information and network maps
- generates suitable clickable WWW-maps from a topology database
- breaks the topology down to suitable maps
- use geographical maps - UTM coordinates
- generate URLs for the maps based on database info
- navigation and menus with a Java-client
- animate - link and cpu load, delays, protocols,..
Why measurements

- Problem detection and solving!
- To assess the quality of our service!
- Capacity planning and traffic engineering
- To inform help customers and users on their own via the web
- To assist research that will find interesting phenomena for us...
Partners - arenas

- Work with researchers - offer access to data, being a lab
  - Q2S - Center for Quantifiable Quality of Service (NTNU)

- Actively support student work - projects, thesis
  - Student employees to do programming
International participation in European fora like
- Terena - TF-NGN - network level experiments and studies(perfmon)
- EU-projects like Scampi
- cooperation with measurement activities like CAIDA(AMS)
- IETF - net management - ipfix, ippm,
Passive activities..

**Scampi** - a EU-project with about 10 participants to develop a free and low cost

- high speed passive measurement platform (10Gbps)
- API with adapted “standard” open software (tcpdump, flow-tools)
SNMP tools 1

Zino SNMP link statistics

- tables, graphs, aggregation and error analysis
- scales by config just by pointing to the router
- map IP-address and link name from description field/ifAlias
SNMP tools 2

**Genplot** General SNMP statistics package

- collect, aggregate SNMP or other data and present in tables and graphs with zoomed context

**JustSNMP** - console tool to extract data like links with name and BGP (Scotty)

**other tools** hw and software version inventory, sw version control
## CPU and Memory Usage - busyPer

**week 30 in 2003**

CPU busy percentage in the last 5 second period. Not the last 5 realtime seconds but the last 5 second period in the scheduler.

You may check each line to generate a plot for this variable.

"Raw" plots the raw data. "Other" allows you to plot other variables for the selected line.

<table>
<thead>
<tr>
<th>Filename</th>
<th>Busy value</th>
<th>Peak at sample</th>
<th>Period avg</th>
<th>Plot</th>
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<tbody>
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<td>telefoncentral-sw1</td>
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<td>Tue</td>
<td>39</td>
<td>Tue</td>
</tr>
<tr>
<td>158_39_12_2</td>
<td>37</td>
<td>Fri</td>
<td>39</td>
<td>Fri</td>
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<td>osalle-gw</td>
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<td>Sun</td>
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<tr>
<td>bo-gw</td>
<td>35</td>
<td>Thu</td>
<td>92</td>
<td>Sat</td>
</tr>
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<td>lillehammer-gw</td>
<td>49</td>
<td>Wed</td>
<td>100</td>
<td>Wed</td>
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<td>halden-gw</td>
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<td>Sun</td>
<td>63</td>
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</tr>
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<td>breivika-gw</td>
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<td>Wed</td>
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<td>sogndal-gw</td>
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<td>Wed</td>
<td>68</td>
<td>Wed</td>
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<tr>
<td>borre-gw</td>
<td>26</td>
<td>Wed</td>
<td>44</td>
<td>Wed</td>
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<tr>
<td>supergw</td>
<td>22</td>
<td>Sat</td>
<td>100</td>
<td>Sat</td>
</tr>
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<td>stavanger-gw</td>
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<td>Wed</td>
</tr>
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<td>narvik-gw</td>
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<td>Sun</td>
<td>69</td>
<td>Tue</td>
</tr>
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<td>alta-gw</td>
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<td>51</td>
<td>Sun</td>
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<td>kautokeino-gw</td>
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<td>cadeler30-gw</td>
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<td>Fri</td>
<td>27</td>
<td>Mon</td>
</tr>
</tbody>
</table>
CPU and Memory Usage

The above image "clickable" for zooming etc. A brief explanation is available.

You may view other plots or browse the data for this period.

July, 2003

2003-07-24
Zino status monitor

- Polls and handles SNMP events (traps)
- Simple Trouble Ticketing - User authentication
- Fin grained downtime registration (IfLastChange)
- Link identification by Cisco description/ifAlias
- Availability statistics from the logs
● Remote Interface To Zino
Active measurements - mping

**Mping** - scaling ping measurements IPv4/IPv6

- polls targets in parallel at controlled rate
- repeated at Poisson based intervals
- statistical analysis - percentiles, distribution
- aggregation with plots, tables, traceroute view
- animate reponse time distribution
## Mping table report

### Round-trip time for 6Group

Data from Tuesday 23 September 2003

<table>
<thead>
<tr>
<th>Machine name (Route)</th>
<th>Round-trip time (ms)</th>
<th>Round-trip time distribution (%)</th>
<th>Packet loss (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
<td>Std dev</td>
<td>&lt;25 ms</td>
</tr>
<tr>
<td>skye.ki.ilf.hu</td>
<td>56.81</td>
<td>114.36</td>
<td>36.2</td>
</tr>
<tr>
<td>ping.at.6net.org</td>
<td>59.04</td>
<td>100.52</td>
<td>30.5</td>
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<td>ping.de.6net.org</td>
<td>44.11</td>
<td>75.40</td>
<td>30.5</td>
</tr>
<tr>
<td>ping.nl.6net.org</td>
<td>40.21</td>
<td>965.97</td>
<td>30.5</td>
</tr>
<tr>
<td>ping.gr.6net.org</td>
<td>100.71</td>
<td>156.92</td>
<td>30.5</td>
</tr>
<tr>
<td>ping.ch.6net.org</td>
<td>47.06</td>
<td>122.34</td>
<td>30.5</td>
</tr>
<tr>
<td>ping.uk.6net.org</td>
<td>35.58</td>
<td>117.40</td>
<td>30.5</td>
</tr>
<tr>
<td>ping6host.uninett.no</td>
<td>0.19</td>
<td>13.46</td>
<td>100.0</td>
</tr>
</tbody>
</table>

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**22. sep 2003**
Round-trip times and packet loss

For freebsd.ki.iif.hu (skye.ki.iif.hu) on August 2003

Round-trips for skye.ki.iif.hu, Aug 2003

Loss % per 10 for skye.ki.iif.hu, Aug 2003
Mping round-trip distribution

Round-trip time distribution

For '6Group', Tuesday 23 September 2003

Distribution of round-trip times for 6Group, Tuesday 23 Sep 2003

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micro measurements

micro measurements - what is the short term sub-second load condition on a link

- traditional SNMP statistics poll frequency is in order of minutes

- poll SNMP-agents at sub-second time resolution with interleaving short and long intervals.

- Graph in real time to do immediate diagnostics
Problem: routers have varying SNMP MIB update interval (1-15sec)  
- puts low priority on answering SNMP

Extended SNMP-agent for DAG-cards  
- should give at least ms accuracy

Analysis of DAG-card packet dumps for bursts  
( talk at NORDUNET 2003)
As short as it makes sense to go

![Graph showing network load with sampling intervals of 1 ms and 100 μs](image)

1 ms

100 μs
Flow reporting

- Develops IETF ipfix flow generation with passive monitoring cards (DAG, Scampi, Ethernet)

- Flow collection and reporting with “scaling” properties
  - based on flow-tools and will be contributed
  - Postgresql with aggregation and statistics
  - multiuser interface with tables and graphs
Source Port
Week 30 2003
Software availability

**Zino** status monitor and link statistics with load map - available high quality

**mping** multi-destination parallel ping with statistics aggregation IPv4/v6 - available

**scampi tools** flowrep - flow-tools extension - available late this autumn
- other passive monitoring tools - next year

**micro-poll** available
**genplot** general SNMP statistics aggregation, reporting av plotting - available

**netmap** geographic map and menu system - not sufficiently documented

**nemo** java based netmap client for animation - not documented yet

**justnetstat** available
Software license

The software is freely available but there is a redistribution clause:

**Corollary 1.** # Copyright (c) 1996, 1997 # UNINETT and NORDUnet. All rights reserved. # Redistribution and use in source and binary forms, with or without # modification, are permitted provided that the following conditions ... more details follow the software
Thank you!

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