



lobster

An IST Project



Information Society
Technologies

<http://www.ist-lobster.org>

Stager

LOBSTER tutorial

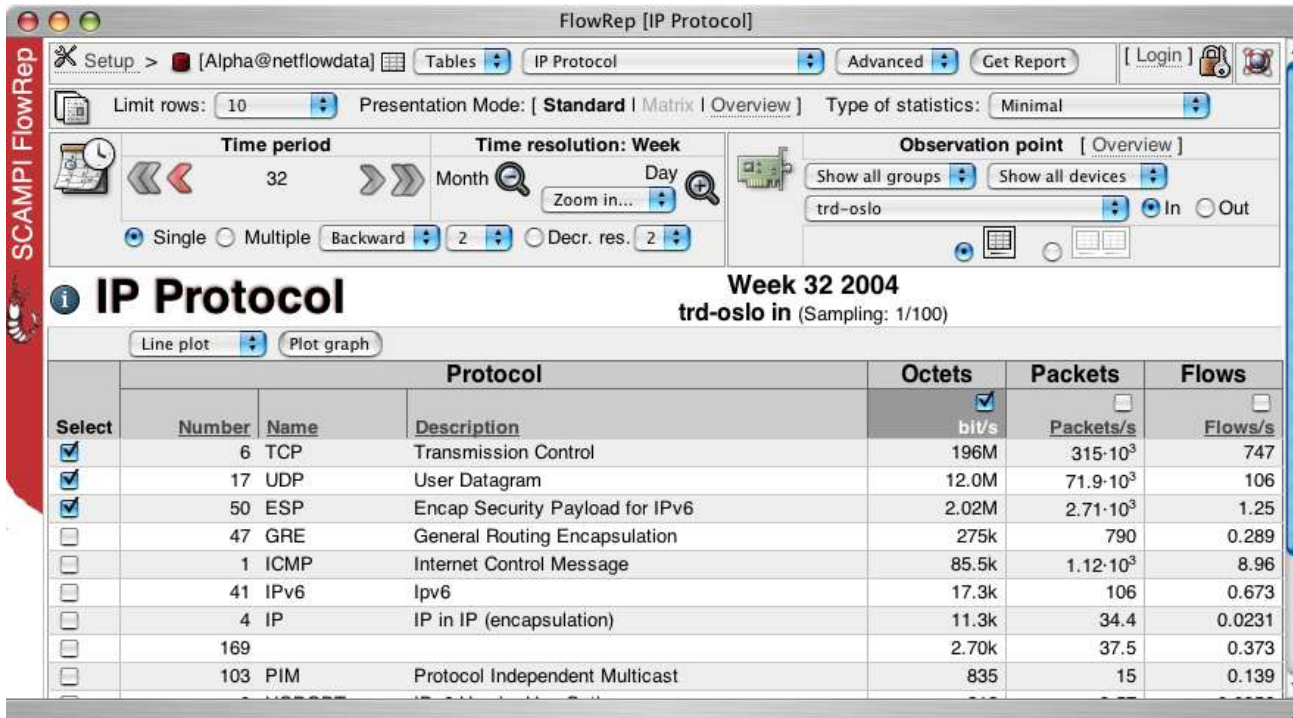
6 May 2005

Arne Øslebø

UNINETT

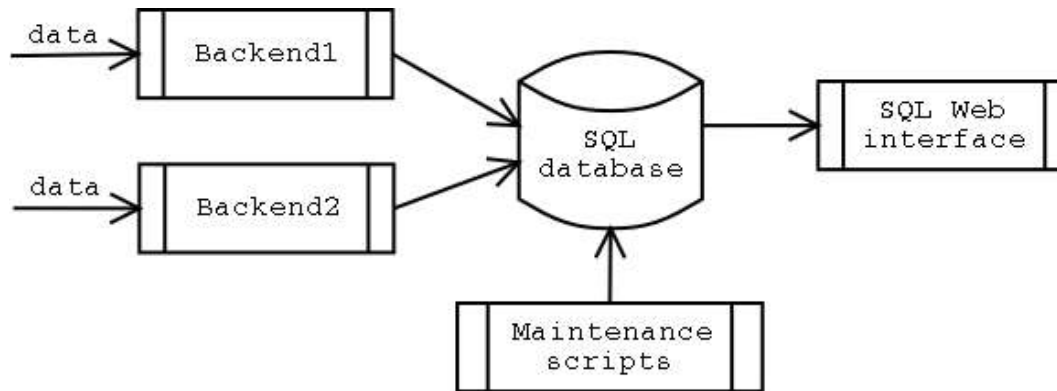
arneos@uninett.no

- A web-based tool for aggregating and presenting most types of network statistics



Stager design

- One or more backends for collecting data
- Database for storing and aggregating data
- Web frontend





- Robustness
 - Detects deadlocks
 - Inserts missing data automatically after DB problems
- Generic aggregation
- Collect data from:
 - Netflow
 - flow-tools
 - SNMP data
 - Mping



Time periods

- Frontend completely generic
- timeperiodinfo
 - describes available time resolutions
 - hour, day, week etc.
- plotinfo
 - Specifies which resolution to use in plots



Report templates



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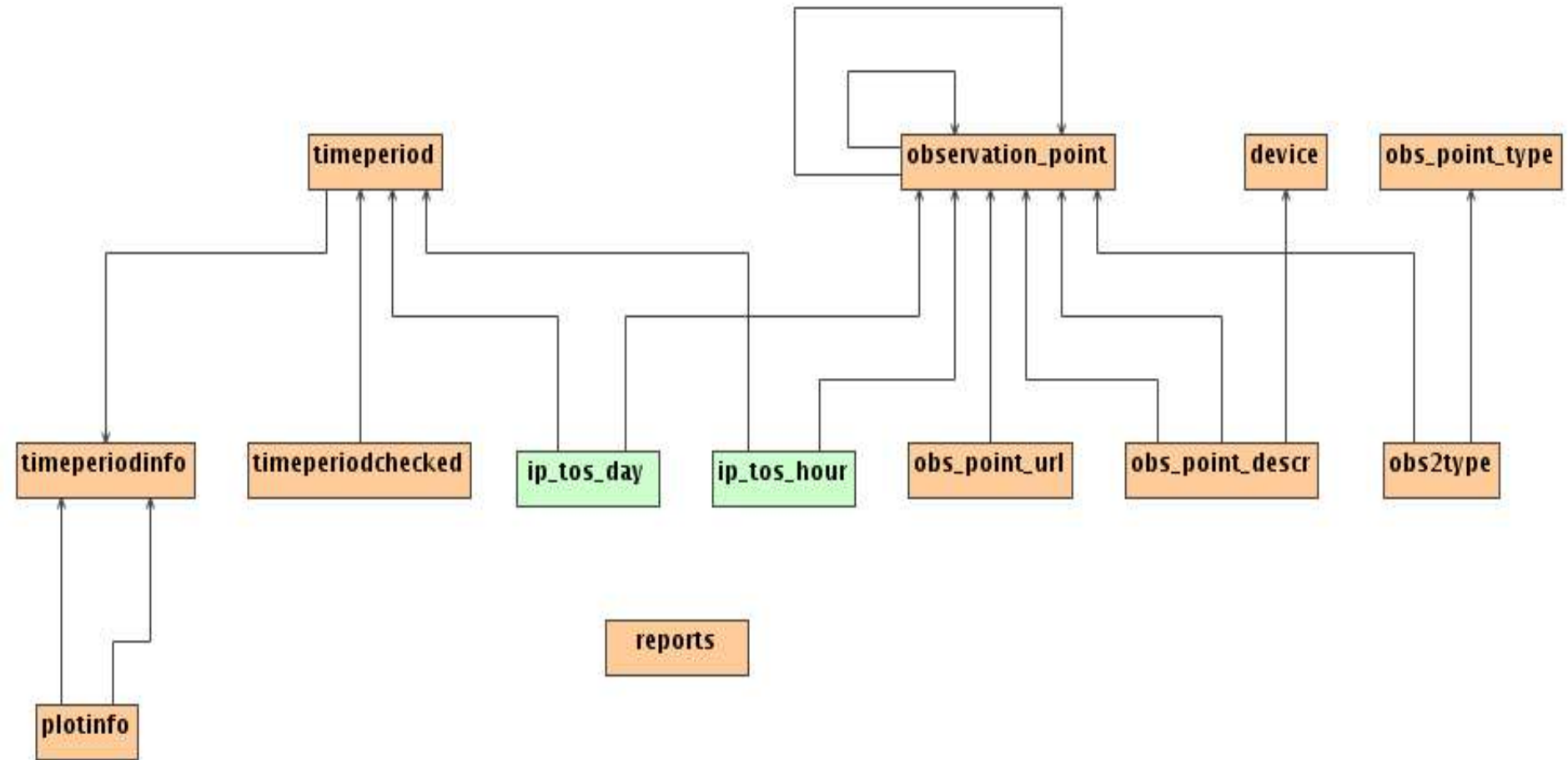
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<http://www.ist-lobster.org>

- Specifies how to present a report in the frontend.
 - bps, pps, % etc.
- Multiple views for the same report type.
 - Overview, packet details, flows details etc



Database schema





What do you need to run Stager?



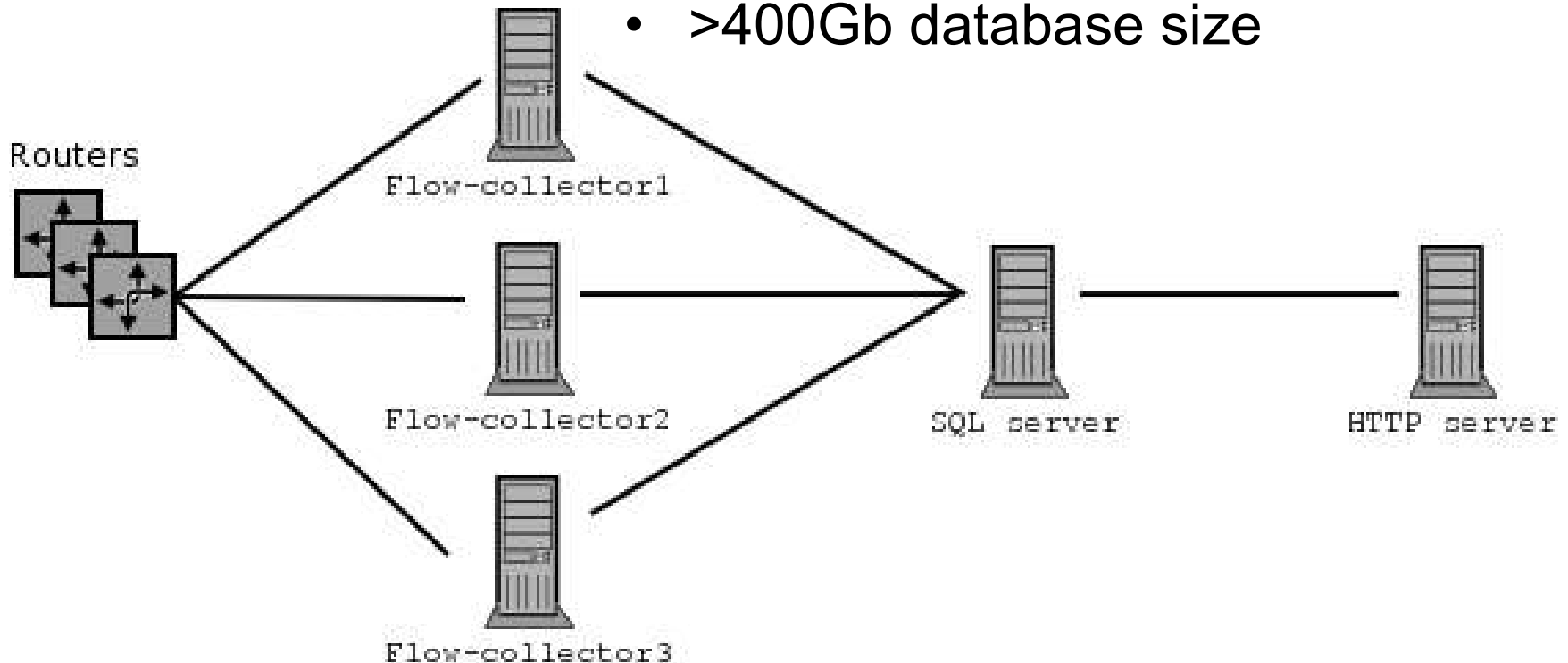
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<http://www.ist-lobster.org>

- Linux or BSD
- Perl
 - DBI – database interface module
- PostgreSQL
- HTTP server
 - PHP
 - Smarty – template engine
 - JpGraph – graph creating library
- Stager
 - <http://software.uninett.no/>

Our setup

- 24 routers
- 215 interfaces
- peak hours: 100 inserts per second
- >250 millions entries in a single table
- >400Gb database size





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Live demo



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<http://www.ist-lobster.org>

<https://stager.uninett.no>



Start page



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http://www.ist-lobster.org

File Edit View Go Bookmarks Tools Help

https://stager.uninett.no/setup.php?ss_db=stager&ss_tablelimit=20&ss_reportstyle=graphsetup&ss_obspoint

UNINETT AS > Network statistics > Stager > Report setup

arneos [Logout]

Overview Report | **Specific Observation Point** | Multiple Observation Points

Report type: IP Protocol

Time period: IP Protocol

Custom date (optional):

Limit rows:

Select overview columns:

- IP Type Of Service
- IP Source Address
- IP Destination Address
- Source AS
- Destination AS
- Transport Layer Source Port
- Transport Layer Destination Port
- Runtime data

example: 21-23,00,110

Create report

Reset all selections stored in your session object: [Reset all](#)

Stager 1.11, 2004 © UNINETT AS



Overview report



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http://www.ist-lobster.org

File Edit View Go Bookmarks Tools Help

https://stager.uninett.no/index.php?s_time_timestamp=20050428_000000&ss_db=stager&ss_tablelimit=20&ss

Setup > Tables IP Protocol Simple Get Report arneos [Logout]

Time: Thursday 28. April 2005 Time resolution: Day Week Hour Zoom in... Overview [Single observation point]

Fields with highest values is automatically selected. [Refresh selection] Manual Auto

IP Protocol Thursday 28. April 2005

All observation points

Line plot Plot graph

Select	Observation Point	Octets				
		<input checked="" type="checkbox"/> Protocol TCP Percent	<input type="checkbox"/> Protocol UDP Percent	<input type="checkbox"/> Protocol ESP Percent	<input type="checkbox"/> Protocol GRE Percent	<input type="checkbox"/> Protocol ICMP Percent
<input checked="" type="checkbox"/>	oslo-bo	99.75%	0.23%	0.00%	0.00%	0.02%
<input type="checkbox"/>	trd-hovedbygget	99.49%	0.46%	0.04%	0.00%	0.01%
<input type="checkbox"/>	hovedbygget-alesund	99.48%	0.46%	0.05%	0.00%	0.01%
<input type="checkbox"/>	oslo-ulo	98.31%	1.33%	0.12%	0.09%	0.15%
<input type="checkbox"/>	uninett-nordunet	97.66%	2.22%	0.00%	0.01%	0.10%
<input type="checkbox"/>	oslo-gw1.oslo-gw2	97.61%	1.91%	0.25%	0.22%	0.01%
<input type="checkbox"/>	oslo-bergen	97.47%	2.23%	0.14%	0.14%	0.01%
<input type="checkbox"/>	hovedbygget-trd	97.29%	2.55%	0.15%	0.00%	0.01%
<input type="checkbox"/>	trd-tromso	97.21%	2.19%	0.31%	0.01%	0.27%
<input type="checkbox"/>	tromso-uito	97.13%	2.51%	0.00%	0.00%	0.36%
<input type="checkbox"/>	bergen.uib-ether-1	96.36%	2.28%	1.20%	0.14%	0.01%
<input type="checkbox"/>	oslo-stolav	95.60%	4.18%	0.14%	0.06%	0.02%
<input type="checkbox"/>	oslo-gw1.oslo-gw4	95.59%	0.27%	4.08%	0.00%	0.06%
<input type="checkbox"/>	oslo-gw2.oslo-gw1	95.49%	3.99%	0.42%	0.08%	0.02%
<input type="checkbox"/>	bergen-oslo	94.86%	4.65%	0.40%	0.06%	0.02%
<input type="checkbox"/>	oslo-trd	94.82%	4.45%	0.60%	0.06%	0.07%
<input type="checkbox"/>	trd-oslo	93.05%	5.91%	0.81%	0.14%	0.08%
<input type="checkbox"/>	tromso-trd	92.27%	6.57%	0.73%	0.01%	0.40%
<input type="checkbox"/>	trd-ntnu	91.92%	7.83%	0.15%	0.08%	0.01%
<input type="checkbox"/>	nix.nix	90.01%	9.28%	0.30%	0.36%	0.02%

The page is not cached

Stager 1.11, 2004 © UNINETT AS

The page took 1431ms to load
[Create report alias]

Done

stager.uninett.no Adblock



Overview – sorted on UDP

File Edit View Go Bookmarks Tools Help

https://stager.uninett.no/index.php?s_sortby=p_octets__17&ss_db=stager&ss_tablelimit=20&ss_reportstyle=...

Setup > Tables IP Protocol Simple Get Report [Login]

Time: Thursday 28. April 2005 Time resolution: Day Overview [Single observation point]

Thursday Week Hour Zoom in... Fields with highest values is automatically selected. [Refresh selection] Manual Auto

IP Protocol

Thursday 28. April 2005 All observation points

Line plot Plot graph

Select	Observation Point	Octets				
		<input checked="" type="checkbox"/> Protocol TCP Percent	<input type="checkbox"/> Protocol UDP Percent	<input type="checkbox"/> Protocol ESP Percent	<input type="checkbox"/> Protocol GRE Percent	<input type="checkbox"/> Protocol ICMP Percent
<input checked="" type="checkbox"/>	kristiansand-kristiansand2	89.39%	10.55%	0.04%	0.00%	0.02%
<input type="checkbox"/>	uninett.nix2	89.05%	10.38%	0.47%	0.06%	0.03%
<input type="checkbox"/>	teknobyen-trd	90.27%	9.56%	0.00%	0.11%	0.06%
<input type="checkbox"/>	nix.nix	90.01%	9.28%	0.30%	0.36%	0.02%
<input type="checkbox"/>	trd-ntnu	91.92%	7.83%	0.15%	0.08%	0.01%
<input type="checkbox"/>	kristiansand-gimlemoen	93.11%	6.87%	0.00%	0.00%	0.01%
<input type="checkbox"/>	tromso-trd	92.27%	6.57%	0.73%	0.01%	0.40%
<input type="checkbox"/>	trd-oslo	93.05%	5.91%	0.81%	0.14%	0.08%
<input type="checkbox"/>	bergen-oslo	94.86%	4.65%	0.40%	0.06%	0.02%
<input type="checkbox"/>	oslo-trd	94.82%	4.45%	0.60%	0.06%	0.07%
<input type="checkbox"/>	oslo-stolav	95.60%	4.18%	0.14%	0.06%	0.02%
<input type="checkbox"/>	oslo-halden	95.70%	4.13%	0.02%	0.15%	0.01%
<input type="checkbox"/>	oslo-gw2.oslo-gw1	95.49%	3.99%	0.42%	0.08%	0.02%
<input type="checkbox"/>	tromso-uito	97.13%	2.51%	0.00%	0.00%	0.36%
<input type="checkbox"/>	bergen.uib-ether-1	96.36%	2.28%	1.20%	0.14%	0.01%
<input type="checkbox"/>	oslo-bergen	97.47%	2.23%	0.14%	0.14%	0.01%
<input type="checkbox"/>	uninett-nordunet	97.66%	2.22%	0.00%	0.01%	0.10%
<input type="checkbox"/>	trd-tromso	97.21%	2.19%	0.31%	0.01%	0.27%
<input type="checkbox"/>	oslo-gw1.oslo-gw2	97.61%	1.91%	0.25%	0.22%	0.01%
<input type="checkbox"/>	oslo-uiu	98.31%	1.33%	0.12%	0.09%	0.15%

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The page took 1780ms to load
[Create report alias]



Details



File Edit View Go Bookmarks Tools Help

https://stager.uninett.no/index.php?s_obspoints_type=single&s_transform=None&obsnav_points=569j0&obsr

Setup > Tables IP Protocol Simple Get Report [Login]

Time: Thursday 28. April 2005 Time resolution: Day Observation point [Overview]

Thursday Week Hour Zoom in... Show all groups Show all devices

kristiansand-kristiansand2 In Out

IP Protocol Thursday 28. April 2005 kristiansand-kristiansand2 in

Line statistics: Traffic in percent Go Router statistics for kristiansand-gw: Memory usage Go

Line plot Plot graph

Select	Protocol			Octets		Packets		Flows		Packetsize
	Number	Name	Description	bit/s	Percent	Packets/s	Percent	Flows/s	Percent	Octets
<input checked="" type="checkbox"/>	6	TCP	Transmission Control	22.7M	89.39%	3.80·10 ³	65.05%	9.51	92.23%	745
<input checked="" type="checkbox"/>	17	UDP	User Datagram	2.68M	10.55%	2.03·10 ³	34.74%	0.708	6.86%	165
<input type="checkbox"/>	50	ESP	Encap Security Payload for IPv6	10.2k	0.04%	2.79	0.05%	6.83·10 ⁻³	0.07%	458
<input type="checkbox"/>	1	ICMP	Internet Control Message	5.58k	0.02%	8.81	0.15%	0.0847	0.82%	79
<input type="checkbox"/>	103	PIM	Protocol Independent Multicast	94	0.00%	0.0926	0.00%	926·10 ⁻⁶	0.01%	127
<input type="checkbox"/>	47	GRE	General Routing Encapsulation	58	0.00%	0.0718	0.00%	590·10 ⁻⁶	0.01%	101
<input type="checkbox"/>	41	IPv6	Ipv6	0	0.00%	1.16·10 ⁻³	0.00%	11.6·10 ⁻⁶	0.00%	68

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The page took 853ms to load

[Create report alias]



Detailed statistics

File Edit View Go Bookmarks Tools Help

https://stager.uninett.no/index.php?ss_db=stager&ss_tablelimit=20&ss_reportstyle=graphsetup&ss_obspoint:

Setup > Tables | IP Protocol | Advanced | Get Report | [Login]

Limit rows: 20 Presentation Mode: [Standard | Matrix | Overview] Type of statistics: Octets Details

Time: Thursday 28. April 2005 Time resolution: Day Observation point [Overview]

Thursday Week Hour Zoom in... Show all groups Show all devices

kristiansand-kristiansand2

Single Multiple Backward 2 Decr. res. 2

IP Protocol

Thursday 28. April 2005
kristiansand-kristiansand2 in (Sampling: 1/100)

Line statistics: Traffic in percent Go Router statistics for kristiansand-gw: Memory usage Go

Line plot Plot graph

Select	Protocol			Octets						
	Number	Name	Description	<input checked="" type="checkbox"/> bit/s	<input type="checkbox"/> Total	<input checked="" type="checkbox"/> Percent	Minimum bit/s	Maximum bit/s	Std.Dev.	Variance Coeff.
<input checked="" type="checkbox"/>	6	TCP	Transmission Control	22.7M	244G	89.39%	8.81M	39.6M	3.99·10 ⁹	0.392
<input checked="" type="checkbox"/>	17	UDP	User Datagram	2.68M	28.9G	10.55%	2.55M	2.85M	39.4·10 ⁶	0.0327
<input type="checkbox"/>	50	ESP	Encap Security Payload for IPv6	10.2k	110M	0.04%	1.64k	70.1k	6.44·10 ⁶	1.4
<input type="checkbox"/>	1	ICMP	Internet Control Message	5.58k	60.2M	0.02%	3.29k	8.47k	668·10 ³	0.266
<input type="checkbox"/>	103	PIM	Protocol Independent Multicast	94	1.02M	0.00%	6	241	30.1·10 ³	0.681
<input type="checkbox"/>	47	GRE	General Routing Encapsulation	58	627k	0.00%	118	882	174·10 ³	0.832
<input type="checkbox"/>	41	IPv6	Ipv6	0	6.80k	0.00%	15	15	0	0

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The page took 816ms to load
[\[Create report alias \]](#)



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Piechart



http://www.ist-lobster.org

File Edit View Go Bookmarks Tools Help

https://stager.uninett.no/index.php?ss_db=stager&ss_tablelimit=20&ss_reportstyle=graphsetup&ss_obspoint:

Setup > Graph Transport Layer Source Port Advanced Get Report arneos [Logout]

Time: Thursday 28. April 2005 Time resolution: Day

Thursday Week Hour Zoom in... Single Multiple Backward 2 Decr. res. 2

Observation point Show all groups Show all devices oslo-trd In Out

Replot Plot type: Piechart Y-scale: Linear Omit other Plot image size: 800x400 Plot colors: Standard 16-color Antialias

Transport Layer Source Port Thursday 28. April 2005

Thursday 28. April 2005
Transport Layer Source Port Octets (bit/s) for oslo-trd in

Category	Percentage
Other	77.8%
www-http	17.9%
ssh	2.9%
ftp-data	1.4%

The page is not cached Stager 1.11, 2004 © UNINETT AS The page took 1025ms to load

Done stager.uninett.no Adblock

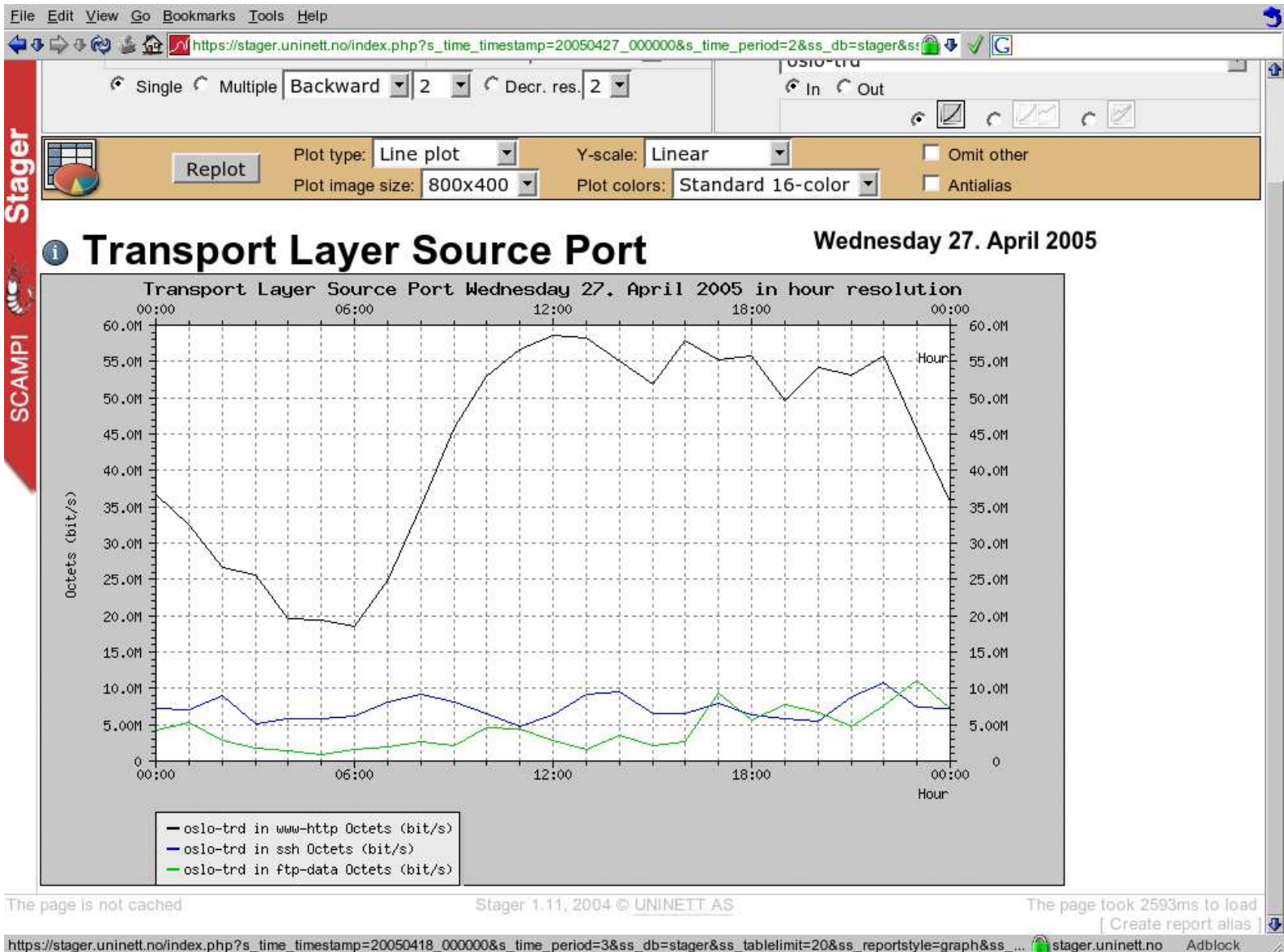


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Line plot



<http://www.ist-lobster.org>



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The page took 2693ms to load

[Create report alias]



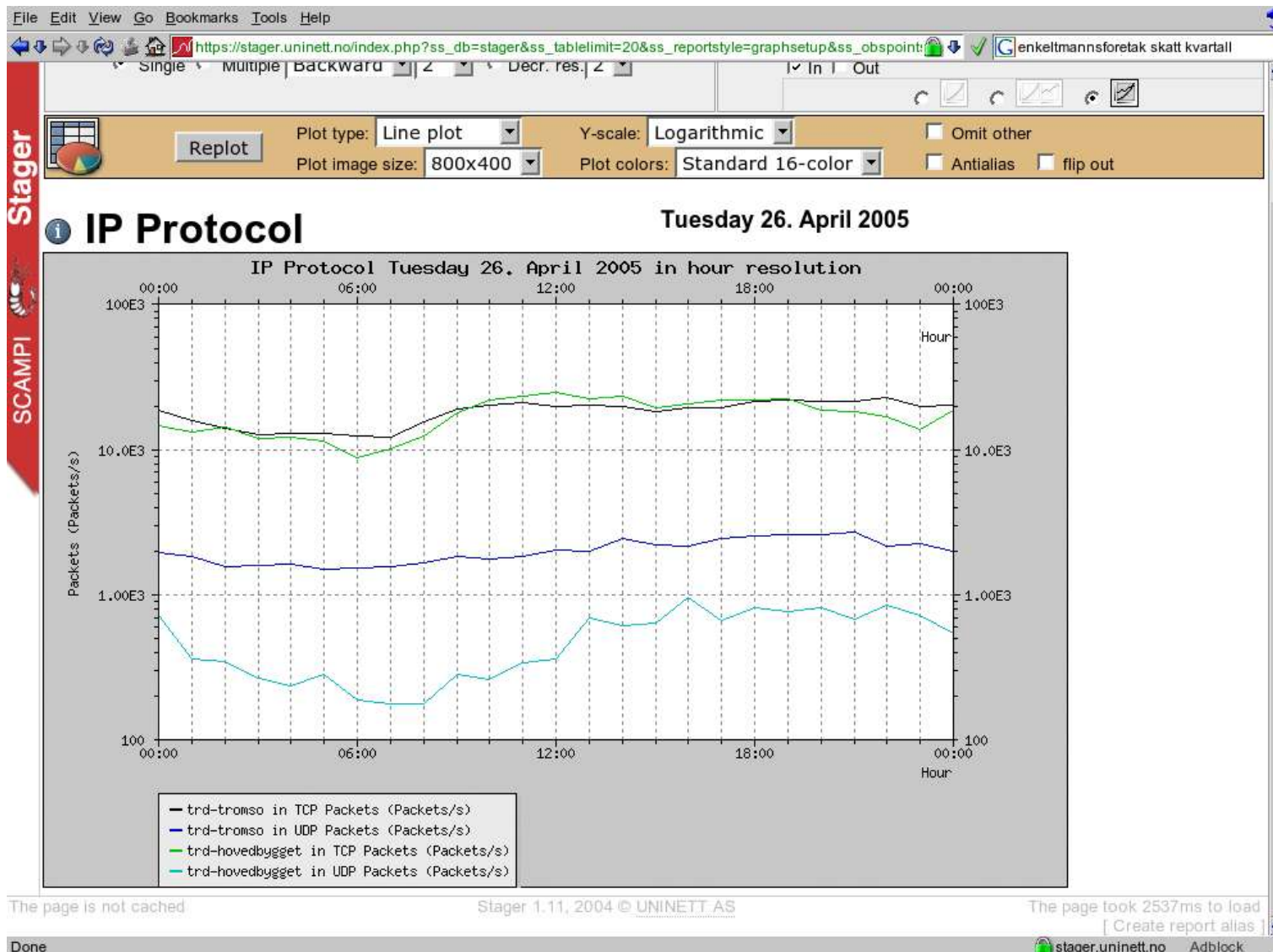
Multiple observation points



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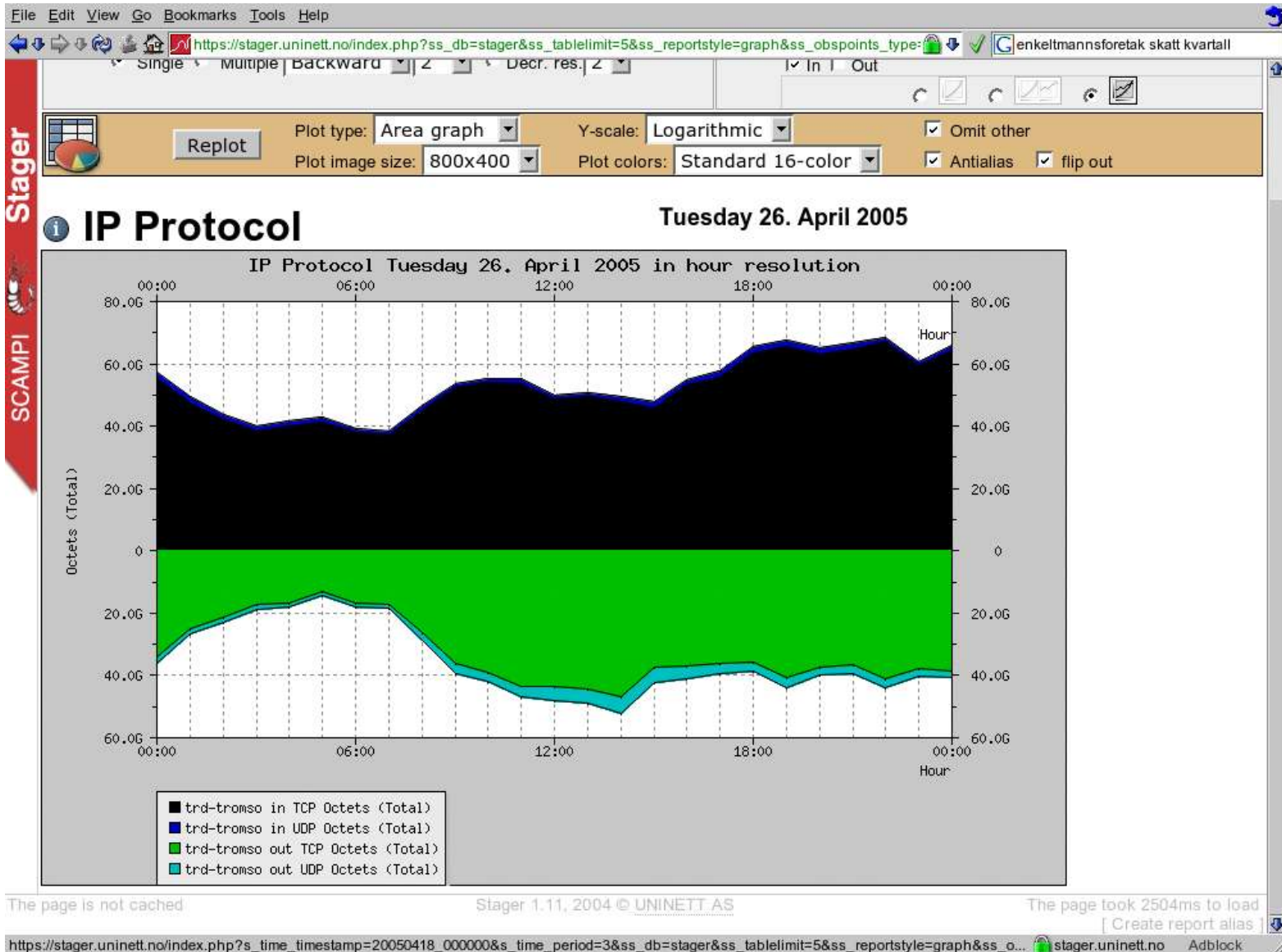
An IST Project

<http://www.ist-lobster.org>





Area graph





Multiple time periods

File Edit View Go Bookmarks Tools Help

https://stager.uninett.no/index.php?s_indexstyle=toolbox&ss_db=stager&ss_tablelimit=5&ss_reportstyle=grap enkeltmannsforetak skatt kvartal

Single Multiple Backward 2 Decr. res. 2 In Out

IP Protocol

Tuesday 29. March 2005
trd-tromso in (Sampling: 1/100)

Line statistics: Traffic in percent Router statistics for trd-gw: Memory usage

Piechart Plot graph

Select	Protocol			Octets		Packets		Flows		Packetsize
	Number	Name	Description	bit/s	Percent	Packets/s	Percent	Flows/s	Percent	Octets
<input checked="" type="checkbox"/>	6	TCP	Transmission Control	98.0M	97.83%	16.1·10 ³	91.71%	40.9	82.85%	762
<input checked="" type="checkbox"/>	17	UDP	User Datagram	1.71M	1.70%	1.25·10 ³	7.14%	7.43	15.05%	170
<input type="checkbox"/>	50	ESP	Encap Security Payload for IPv6	388k	0.39%	93.4	0.53%	0.185	0.38%	520
<input type="checkbox"/>	1	ICMP	Internet Control Message	57.9k	0.06%	87.2	0.50%	0.746	1.51%	83
<input type="checkbox"/>	47	GRE	General Routing Encapsulation	11.3k	0.01%	5.94	0.03%	0.0181	0.04%	237

IP Protocol

Week 13 2005
trd-tromso in (Sampling: 1/100)

Line statistics: Traffic in percent Router statistics for trd-gw: Memory usage

Piechart Plot graph

Select	Protocol			Octets		Packets		Flows		Packetsize
	Number	Name	Description	bit/s	Percent	Packets/s	Percent	Flows/s	Percent	Octets
<input checked="" type="checkbox"/>	6	TCP	Transmission Control	96.9M	97.84%	15.1·10 ³	91.19%	40.8	84.84%	800
<input checked="" type="checkbox"/>	17	UDP	User Datagram	1.75M	1.77%	1.28·10 ³	7.71%	6.3	13.12%	171
<input type="checkbox"/>	50	ESP	Encap Security Payload for IPv6	304k	0.31%	78.6	0.47%	0.154	0.32%	484
<input type="checkbox"/>	1	ICMP	Internet Control Message	55.5k	0.06%	84.7	0.51%	0.729	1.52%	82
<input type="checkbox"/>	47	GRE	General Routing Encapsulation	13.6k	0.01%	5.35	0.03%	0.0163	0.03%	317

The page is not cached Stager 1.11, 2004 © UNINETT AS The page took 959ms to load [Create report alias]

List Goto report section trd-tromso in

Done stager.uninett.no Adblock



Matrix



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http://www.ist-lobster.org

File Edit View Go Bookmarks Tools Help

https://stager.uninett.no/index.php?ss_db=stager&ss_tablelimit=10&ss_reportstyle=graphsetup&ss_obspoint: enkeltmannsforetak skatt kvartall

Setup > Tables Source - Destination AS Advanced Get Report arneos [Logout]

Limit rows: 10 Presentation Mode: [Standard | **Matrix** | Overview] Type of statistics: Octets

Time: Friday 29. April 2005 Time resolution: Day

Observation point: Show all groups Show all devices bergensS.bix In Out

Source - Destination AS

Friday 29. April 2005 bergensS.bix in (Sampling: 1/1)

Line statistics: Traffic in percent Go Router statistics for bergensS-gw: Memory usage Go

Octets From / To [Rotate]	0	Universitetet i Bergen	NTNU	Universitetet i Oslo	Universitetet i Tromsø
BKK Bredbaand Autonomous System, Formerly EITele Autonomous System, Norway	1.42M	551k	319k	306k	76.5k
Webhuset Datasenter AS	204k	57.0k	85.1k	51.7k	0
Bergen Nett og Media AS, Norway	69.7k	0	0	0	0

The page is not cached

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The page took 766ms to load

[Create report alias]



Next version preview Mping



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http://www.ist-lobster.org

Stager [Ping data] - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

https://beta-stager.uninett.no/index.php?ss_db=stager-mping&ss_tablelimit=75&ss_obspoints_limit_group=un

Setup > MPing Ping data Simple Get Report [Login] [Help]

Time: 2. May 2005 Time resolution: Day Observation point [Single observation point]

Monday Week Hour Zoom in... Show all groups

Ping data

Monday 2. May 2005 All observation points

Line plot Plot graph

Select	Observation Point	Packets		Response time	
		Packet loss	Minimum	Average	Maximum
<input checked="" type="checkbox"/>	samson.ldh.no (samson.ldh.no) (in)	0.05%	17.3 ms	125 ms	4.60 s
<input checked="" type="checkbox"/>	lovise-gw.uninett.no (158.38.164.14) (in)	0.00%	16.9 ms	118 ms	4.71 s
<input checked="" type="checkbox"/>	kautokeino-gw.uninett.no (128.39.0.90) (in)	0.03%	23.5 ms	38.1 ms	179 ms
<input checked="" type="checkbox"/>	samson.samiskhs.no (samson.samiskhs.no) (in)	0.00%	22.1 ms	37.5 ms	246 ms
<input type="checkbox"/>	naringsbygget-sw.uninett.no (158.39.0.2) (in)	0.00%	34.1 ms	35.1 ms	53.8 ms
<input type="checkbox"/>	svalbard-gw.uninett.no (158.39.0.14) (in)	0.00%	32.9 ms	33.8 ms	47.0 ms
<input type="checkbox"/>	arkmuseum-gw.uninett.no (128.39.3.43) (in)	0.09%	23.7 ms	26.5 ms	472 ms
<input type="checkbox"/>	samson.rlvphs.no (samson.rlvphs.no) (in)	2.97%	23.1 ms	26.4 ms	65.7 ms
<input type="checkbox"/>	sandane-gw.uninett.no (158.37.1.19) (in)	0.03%	22.6 ms	24.5 ms	55.0 ms
<input type="checkbox"/>	forde-gw.uninett.no (158.37.1.138) (in)	0.00%	20.9 ms	24.2 ms	216 ms
<input type="checkbox"/>	stokmarknes-gw.uninett.no (158.39.0.48) (in)	0.00%	19.0 ms	21.9 ms	128 ms
<input type="checkbox"/>	narbo-gw.uninett.no (158.37.1.143) (in)	2.13%	20.0 ms	21.6 ms	121 ms
<input type="checkbox"/>	sandnes-gw.uninett.no (128.39.0.95) (in)	1.59%	19.6 ms	21.1 ms	206 ms
<input type="checkbox"/>	rauland-gw.uninett.no (128.39.3.18) (in)	0.00%	16.5 ms	20.7 ms	544 ms
<input type="checkbox"/>	samson.nupi.no (samson.nupi.no) (in)	0.13%	10.4 ms	20.6 ms	293 ms
<input type="checkbox"/>	haugesund-gw.uninett.no (128.39.0.27) (in)	0.00%	17.9 ms	20.4 ms	226 ms
<input type="checkbox"/>	afs-gw.uninett.no (158.38.164.6) (in)	0.00%	17.5 ms	20.3 ms	207 ms
<input type="checkbox"/>	nupi-gw.uninett.no (128.39.3.49) (in)	0.00%	10.7 ms	20.2 ms	434 ms
<input type="checkbox"/>	158.39.12.2 (158.39.12.2) (in)	0.00%	17.0 ms	20.2 ms	49.3 ms
<input type="checkbox"/>	harstad-gw2.uninett.no (158.39.0.23) (in)	0.00%	18.8 ms	19.7 ms	41.3 ms
<input type="checkbox"/>	arendal-gw.uninett.no (128.39.0.3) (in)	0.00%	16.7 ms	19.5 ms	278 ms
<input type="checkbox"/>	harstad-gw.uninett.no (158.39.0.29) (in)	0.00%	18.0 ms	19.2 ms	173 ms

Done beta-stager.uninett.no Adblock



Next version preview

Mping traceroute



Information Society
Technologies

An IST Project

http://www.ist-lobster.org

Stager (Traceroute) - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

https://beta-stager.uninett.no/index.php?ss_db=stager-mping&ss_tablelimit=75&ss_transform=None&ss_obs...

Setup > MPing Traceroute Simple Get Report [Login] [Help]

Time: 1. May 2005 Sunday Time resolution: Day Week Hour Observation point: uninett Show all devices artifact.hsh.no (artifact.hsh.no)

Traceroute

Sunday 1. May 2005 rauland-gw.uninett.no (128.39.3.18) in

Line statistics: Traffic in percent Router statistics for uninett: Memory usage

Line plot Plot graph

Select	Host		Response time				Jitter
	Hop	Hostname	Minimum	Average	Maximum	Median	Std dev
<input checked="" type="checkbox"/>	3	trd-gw.uninett.no (128.39.46.173)	0.177 ms	0.869 ms	11.9 ms	0.874 ms	0.267 ms
<input checked="" type="checkbox"/>	2	teknobyen-gw.uninett.no (128.39.47.89)	0.208 ms	0.917 ms	198 ms	0.753 ms	3.59 ms
<input checked="" type="checkbox"/>	1	uninett-gw.uninett.no (158.38.152.1)	0.668 ms	1.59 ms	193 ms	0.799 ms	3.38 ms
<input checked="" type="checkbox"/>	4	oslo-gw1.uninett.no (128.39.46.1)	7.89 ms	8.59 ms	19.2 ms	8.60 ms	0.278 ms
<input type="checkbox"/>	6	bo-gw2.uninett.no (128.39.3.58)	10.4 ms	11.5 ms	159 ms	11.3 ms	2.23 ms
<input type="checkbox"/>	5	bo-gw.uninett.no (128.39.46.114)	9.89 ms	11.7 ms	411 ms	10.9 ms	11.0 ms
<input type="checkbox"/>	7	rauland-gw.uninett.no (193.156.92.102)	16.4 ms	92.7 ms	618 ms	95.1 ms	171 ms

Caching is disabled. Stager 1.20 trunk, 2004 © UNINETT AS The page took 6591ms to load

Traceroute, Unnamed Create bookmark

Done beta-stager.uninett.no Adblock



Future plans

- New release in 1-2 weeks
 - Two new backends
 - Mping (round trip time)
 - Spoller (SNMP)
- Present data from other sources
 - Raw netflow data
- More report types and statistics
- Alarms
- Hierarchical observation points
- Integration with GEANT2 JRA1
- NERD as backend



An IST Project

Questions?



Information Society
Technologies

<http://www.ist-lobster.org>

<http://software.uninett.no>

<https://stager.uninett.no>