



# Stager – A Generic Tool for Presenting Network Statistics

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Arne Øslebø  
[arne.oslebo@uninett.no](mailto:arne.oslebo@uninett.no)

# What is Stager?

- A web based tool for presenting and aggregating most types of network statistics
- Store high level reports in database
- Detailed reports from other sources
- Access control
- Stable version
  - NetFlow
  - Qflow - IPFIX probe with extra QoS attributes
- Development version
  - Qstream, Mping, Asmping, Rude/Crude, SNMP
- <http://software.uninett.no/stager/>
  - GPL license

# Overview report

Protocol   10

All interfaces  In  1

## Protocol

Thursday 15. October 2009, 21:00

All observation points (in)



Pie chart

Other

Plot graph

Octets - percent

Select	Observation Point	Octets - percent							
		<input checked="" type="checkbox"/> TCP	<input type="checkbox"/> UDP	<input type="checkbox"/> GRE	<input type="checkbox"/> ESP	<input type="checkbox"/> IPv6	<input type="checkbox"/> ICMP	<input type="checkbox"/> PIM	<input type="checkbox"/> IPv6-ICMP
<input type="checkbox"/>	elverum-gw.elverum-gw2-1	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
<input type="checkbox"/>	oslo-trd2	0.00%	0.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
<input type="checkbox"/>	trd-tromso2	0.00%	0.00%	0.00%	0.00%	0.00%	75.68%	24.32%	0.00%
<input type="checkbox"/>	elverum-gw.elverum-gw2-2	0.00%	36.36%	0.00%	0.00%	0.00%	63.64%	0.00%	0.00%
<input type="checkbox"/>	hoytek-niva	0.64%	65.75%	0.00%	0.00%	0.00%	33.61%	0.00%	0.00%
<input type="checkbox"/>	trd-niva	3.86%	66.29%	0.00%	0.00%	0.00%	29.84%	0.00%	0.00%
<input type="checkbox"/>	oslo-oslomsh	19.42%	53.90%	0.00%	0.00%	0.00%	26.68%	0.00%	0.00%
<input type="checkbox"/>	teknobyen2-teknobyen	5.89%	3.82%	0.00%	0.00%	0.00%	23.70%	66.59%	0.00%
<input type="checkbox"/>	nhh2-nhh	7.41%	69.95%	0.00%	0.00%	0.00%	22.64%	0.00%	0.00%
<input type="checkbox"/>	nhh-gw2.nhh-gw	7.41%	69.95%	0.00%	0.00%	0.00%	22.64%	0.00%	0.00%

Stager 4.0, 2004-2009 © UNINETT AS

Processing the report took 486.82ms

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# Global report



Source port global Standard 10 Show Add Bookmarks..
All interfaces uninett.uninett-wlan\_ans In none 1

## Source port

Tuesday 12. January 2010, 3:00

All observation points (in)

Select	Port number	Port name	Observation point	Octets		Packets		Flows	
				<input checked="" type="checkbox"/> bit/s	<input type="checkbox"/> Percent	<input type="checkbox"/> Pkts/s	<input type="checkbox"/> Percent	<input type="checkbox"/> flows/s	<input type="checkbox"/> Percent
<input type="checkbox"/>	80	http	uninett-nordunet	159M	20.52%	14.9·10 <sup>3</sup>	9.87%	25.7	9.63%
<input type="checkbox"/>	80	http	uninett-nordunet4	127M	17.12%	12.1·10 <sup>3</sup>	9.93%	22.3	11.04%
<input type="checkbox"/>	80	http	trd-oslo	117M	19.04%	11.2·10 <sup>3</sup>	10.45%	23.7	11.90%
<input type="checkbox"/>	80	http	oslo-dnmi	92.3M	92.03%	8.92·10 <sup>3</sup>	66.50%	13.1	88.40%
<input type="checkbox"/>	33661	33661	uninett.uninett-nett	85.5M	93.45%	7.38·10 <sup>3</sup>	81.17%	5.83·10 <sup>-3</sup>	0.03%
<input type="checkbox"/>	80	http	oslo-gw.stolav-gw1	85.0M	14.92%	8.08·10 <sup>3</sup>	8.93%	19.2	12.24%
<input type="checkbox"/>	49152	49152	nix.nix	78.6M	44.92%	7.31·10 <sup>3</sup>	24.25%	0.188	0.39%
<input type="checkbox"/>	80	http	oslo-trd	73.4M	9.06%	6.61·10 <sup>3</sup>	5.97%	10.6	5.24%
<input type="checkbox"/>	80	http	bergen-oslo	68.6M	19.68%	7.05·10 <sup>3</sup>	12.18%	17.8	21.07%
<input type="checkbox"/>	48959	48959	trofast-gw1	65.3M	54.92%	5.79·10 <sup>3</sup>	54.89%	4.17·10 <sup>-3</sup>	0.05%

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Processing the report took 681.74ms

# Detailed report

Source port table Standard 20 Show Add Bookmarks..

All interfaces uninett-nordunet In none 1

## Source port

Tuesday 12. January 2010, 3:00  
uninett-nordunet (in, 1/100)

Other

Select	Source Port		Octets		Packets		Flows	
	Number	Name	<input checked="" type="checkbox"/> bit/s	<input type="checkbox"/> Percent	<input type="checkbox"/> Pkts/s	<input type="checkbox"/> Percent	<input type="checkbox"/> flows/s	<input type="checkbox"/> Percent
<input type="checkbox"/>	80	http	159M	20.52%	14.9·10 <sup>3</sup>	9.87%	25.7	9.63%
<input type="checkbox"/>	1935	macromedia-fcs	13.9M	1.79%	1.28·10 <sup>3</sup>	0.85%	0.84	0.31%
<input type="checkbox"/>	0	0	4.45M	0.57%	1.52·10 <sup>3</sup>	1.01%	2.94	1.10%
<input type="checkbox"/>	45686	45686	3.03M	0.39%	254	0.17%	0.0267	0.01%
<input type="checkbox"/>	35828	35828	2.95M	0.38%	261	0.17%	0.0122	0.00%
<input type="checkbox"/>	37301	37301	2.86M	0.37%	240	0.16%	1.94·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	50343	50343	2.86M	0.37%	241	0.16%	6.67·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	34950	34950	2.85M	0.37%	251	0.17%	0.0222	0.01%
<input type="checkbox"/>	36267	36267	2.85M	0.37%	239	0.16%	4.17·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	50793	50793	2.84M	0.37%	240	0.16%	6.11·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	57261	57261	2.84M	0.37%	238	0.16%	2.22·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	34915	34915	2.84M	0.37%	238	0.16%	2.50·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	55334	55334	2.84M	0.37%	237	0.16%	3.06·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	48957	48957	2.84M	0.37%	238	0.16%	3.61·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	35775	35775	2.83M	0.36%	236	0.16%	3.89·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	48352	48352	2.82M	0.36%	237	0.16%	2.22·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	44094	44094	2.82M	0.36%	236	0.16%	2.22·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	51701	51701	2.82M	0.36%	237	0.16%	6.11·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	56843	56843	2.82M	0.36%	237	0.16%	8.89·10 <sup>-3</sup>	0.00%
<input type="checkbox"/>	55156	55156	2.82M	0.36%	236	0.16%	5.28·10 <sup>-3</sup>	0.00%

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Processing the report took 599.73ms



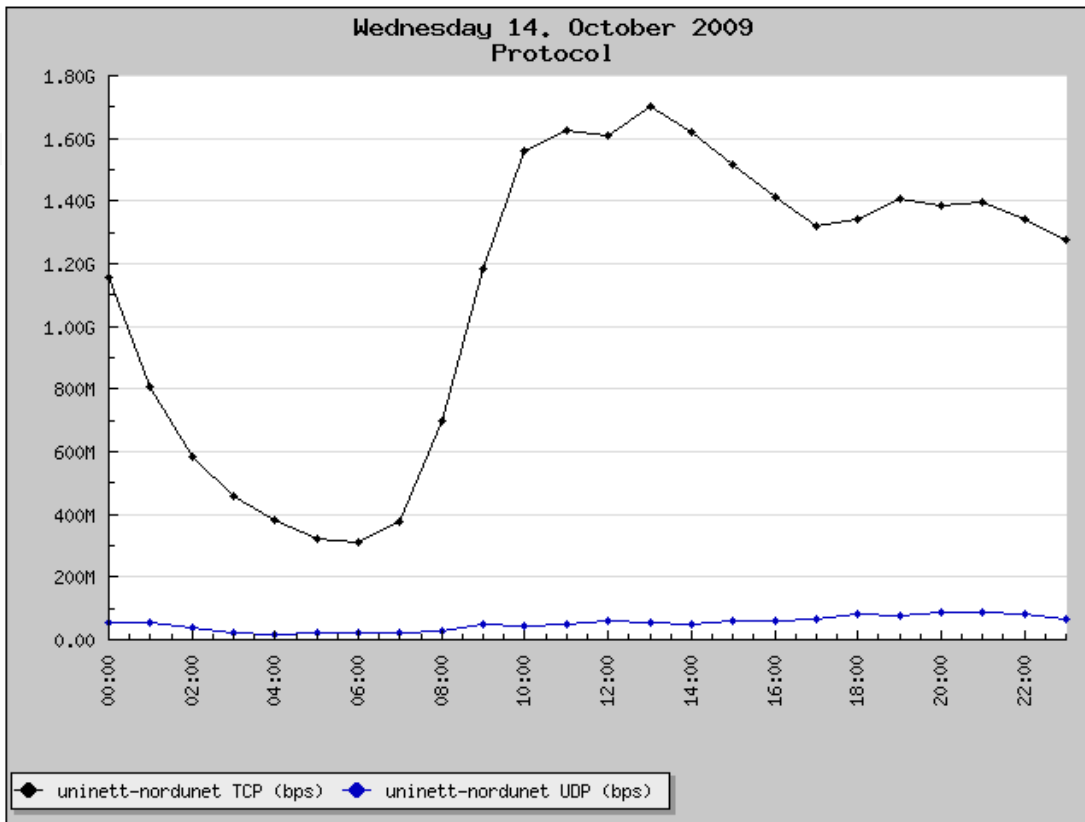
# Graph

Setup Back Protocol table Octet details 20 Show Add hour...  
oslo-gw uninett-nordunet In none 1

## Protocol

Wednesday 14. October 2009

[ Return to table ] Line plot Linear Other Replot



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Processing the report took 168.55ms



# Context menus

Setup Back Multicast TV table Overview 20 Show Add

All UNINETT In none 1

## Multicast TV

Friday 8. January 2010, 11:00  
UNINETT (in, 1/1)

Line plot Other Plot graph

Select	Group				Average statistics				
	Name	IP	Port	# of tests	<input checked="" type="checkbox"/> Setup time	Packets/s	<input type="checkbox"/> Bitrate	<input type="checkbox"/> Gap	
<input type="checkbox"/>	NRK3	239.193.0.3	1234	6	159ms	560	5.90M	1.88ms	
<input type="checkbox"/>	NRK2	239.193.0.2	1234	6	81.5ms	583	6.13M	1.82ms	
<input type="checkbox"/>	NRK1	239.193.0.1	1234	6	79.7ms	589	6.20M	1.72ms	
<input type="checkbox"/>	Stortinget	224.67.1	239.193.0.1	1234	6	0.633ms	536	5.70M	1.90ms

Processing the report took 117.2ms

239.193.0.1  
NetFlow >  
Multicast group

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# Multiple reports



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Protocol  Standard  Show Add
Bookmarks..

All interfaces  In  1

### Protocol Wednesday 14. October 2009

trd-teknobyen (in, 1/100)

Line plot  Other  Plot graph

Select	Number	Protocol Name	Octets		Packets		Flows	
			<input checked="" type="checkbox"/> bit/s	<input type="checkbox"/> Percent	<input type="checkbox"/> Pkts/s	<input type="checkbox"/> Percent	<input type="checkbox"/> flows/s	<input type="checkbox"/> Percent
<input type="checkbox"/>	6	TCP	75.9M	98.70%	7.62·10 <sup>3</sup>	93.33%	4.95	64.15%
<input type="checkbox"/>	17	UDP	915k	1.19%	442	5.41%	2.04	26.42%
<input type="checkbox"/>	1	ICMP	52.0k	0.07%	71.4	0.87%	0.691	8.96%
<input type="checkbox"/>	47	GRE	28.2k	0.04%	26.3	0.32%	0.0178	0.23%
<input type="checkbox"/>	103	PIM	2.46k	0.00%	5.22	0.06%	0.0178	0.23%

### Protocol Tuesday 13. October 2009

trd-teknobyen (in, 1/100)

Line plot  Other  Plot graph

Select	Number	Protocol Name	Octets		Packets		Flows	
			<input checked="" type="checkbox"/> bit/s	<input type="checkbox"/> Percent	<input type="checkbox"/> Pkts/s	<input type="checkbox"/> Percent	<input type="checkbox"/> flows/s	<input type="checkbox"/> Percent
<input type="checkbox"/>	6	TCP	152M	99.10%	14.3·10 <sup>3</sup>	95.46%	5.94	66.18%
<input type="checkbox"/>	17	UDP	1.17M	0.76%	545	3.63%	2.23	24.79%
<input type="checkbox"/>	50	ESP	92.8k	0.06%	14.1	0.09%	3.98·10 <sup>-3</sup>	0.04%
<input type="checkbox"/>	47	GRE	62.4k	0.04%	37.8	0.25%	0.0183	0.20%
<input type="checkbox"/>	1	ICMP	57.3k	0.04%	79.4	0.53%	0.77	8.57%

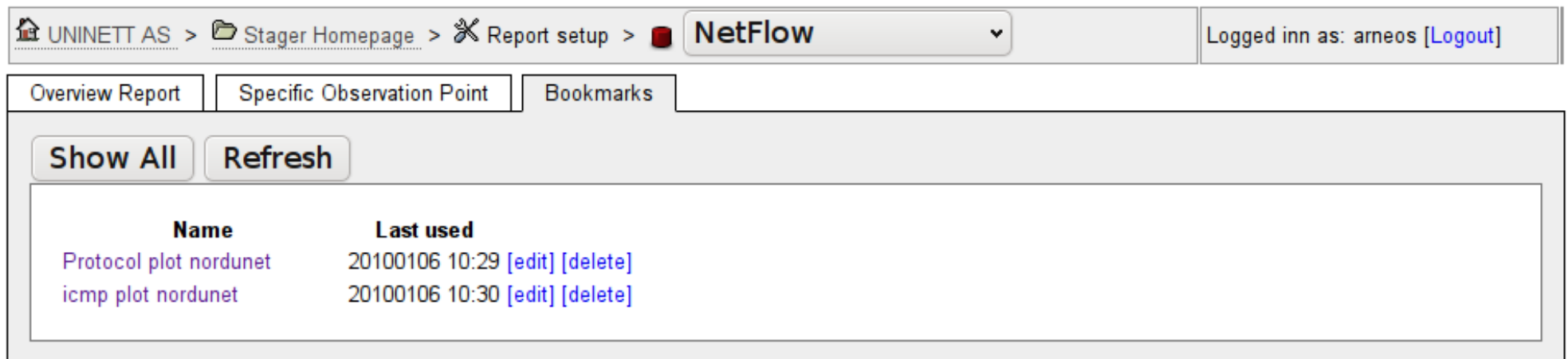
Stager 4.0, 2004-2009 © UNINETT AS Processing the report took 265.77ms



# Bookmarks

- Setting up multiple reports can involve a lot of clicking
- Possible to create bookmarks with relative time
  - Always show last hour, day, week etc.

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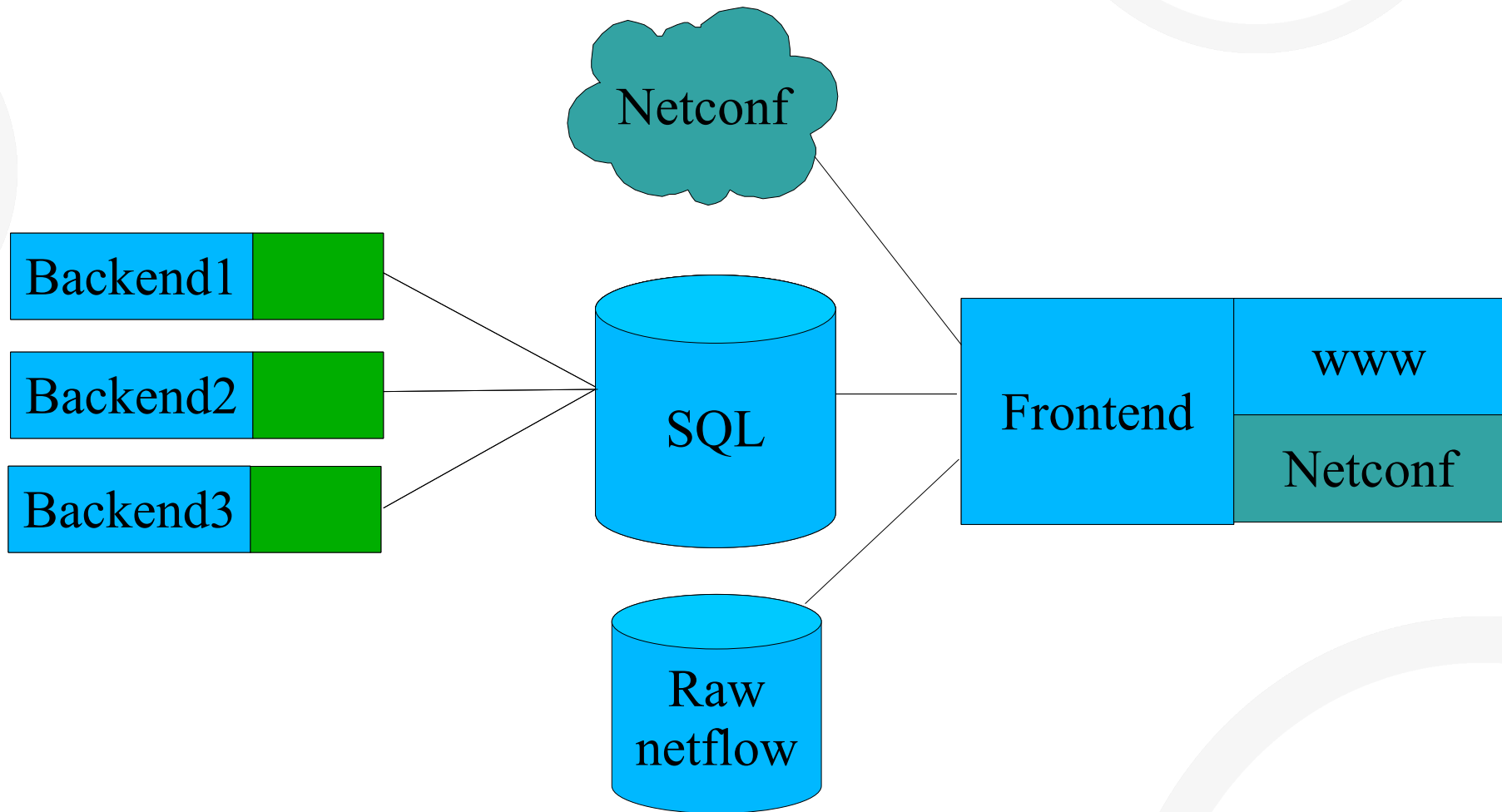


The screenshot shows a web interface for UNINETT AS. The breadcrumb navigation is: UNINETT AS > Stager Homepage > Report setup > NetFlow. The user is logged in as arneos. The interface has three tabs: Overview Report, Specific Observation Point, and Bookmarks. The Bookmarks tab is active, showing a table with two columns: Name and Last used. There are buttons for 'Show All' and 'Refresh' above the table. The table contains two entries:

Name	Last used
Protocol plot nordunet	20100106 10:29 [edit] [delete]
icmp plot nordunet	20100106 10:30 [edit] [delete]

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

# Stager architecture



# Template based

- All data for a report is stored in a database or collected from other sources
- XML based template specifies how the frontend should present the data
  - bps, pps, %, temperature, IP address etc.
- Built in functions
  - divideandmultiply, persec, bitpersec, concat etc.
- Transformations
  - Table, overview, global (and matrix).
- Multiple views for each transformation.
  - Specifies which data types should be visible
- New reports can be added without code changes to the frontend

# Backend robustness

- Graceful handling of database downtime
  - Store reports to files
  - Insert into database when possible
- Avoid multiple instances of the same backend
  - Wait for previous instances that are still processing the raw data
  - Detect dead locks and memory starvations
- Supports anycast for NetFlow
  - Raw NetFlow data automatically processed by active collector

# Anycast support

- All collectors are configured to collect data from all routers
- Script automatically detects which routers a collector actually collects data from
  - Development version: raw NetFlow data automatically copied to one server
- Collectors run Linux
- Loopback interface configured with anycast IP address
- Runs Quagga routing software
  - BGP peering
- Sanity check scripts

 Takes down BGP peering if problems

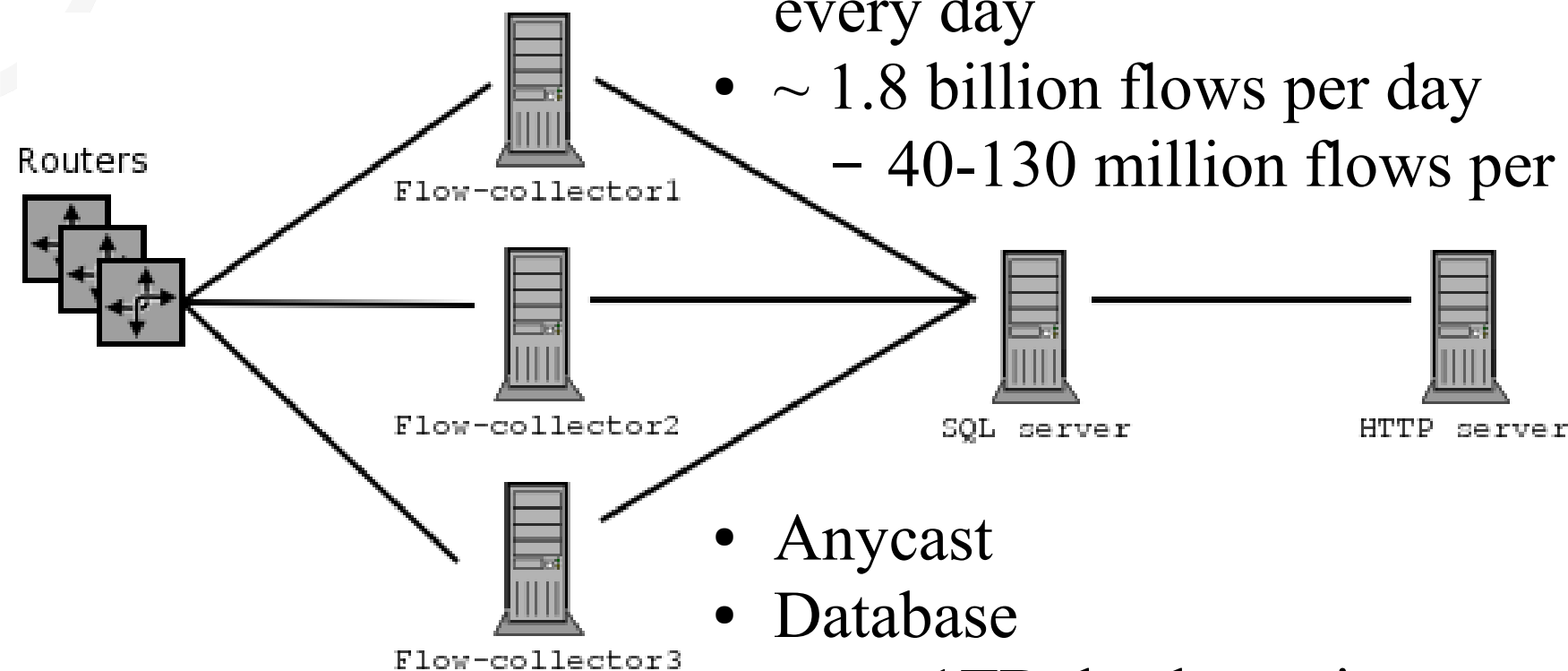
# Netflow in Stager

- Runs nfdump
- Reports generated every hour
- Aggregated to day, week, month and year
- Available reports
  - Summary
  - Interface
  - Src/Dst AS/IP/Port (Top X)
  - Protocol
  - Multicast
    - Src AS
    - Src IP
    - Groups (Dst IP)
- Possible to view raw NetFlow data for more details
- Reports follow links, not interfaces

# Our NetFlow setup

- 34 routers
- 439 interfaces
- 1/100 sampling rate on most routers
- ~25Gb of compressed raw Netflow data every day
- ~ 1.8 billion flows per day
  - 40-130 million flows per hour

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- Anycast
- Database
  - >1TB database size
  - >800 millions entries in a single table

# NetFlow performance

## Backend

Data from January 5 between 12:00-13:00

	<b>Col1</b>	<b>Col2</b>	<b>Col3</b>	<b>Total</b>
<b>Netflow size</b>	470MB	62MB	654MB	1186MB
<b>Sequentially</b>	3min 33s	1min 36s	6min 5s	11min 14s
<b>Simultaneously</b>	3min 36s	1min 38s	6min 17s	11min 31s

## Frontend

### Report

### Time

IP Protocol overview	1540ms
IP Protocol overview (previous timeperiod)	487ms
IP Protocol detailed report	223ms
Top Src Port overview	1068ms
Top Src Port overview (previous timeperiod)	507ms
Top Src Port details	442ms
Top Src IP address from raw NetFlow	3220ms

# Upcoming features

- Improved anycast support
- Improved visualization
  - Today only simple graphs and pie charts are supported
- Better integration between different data sources
  - Shows reports from different sources on the same screen
- Anomaly detection
  - Today we only have simple threshold alerts
- Improved NetFlow reports
  - Top X + specified ports/IP addresses/AS numbers

# Questions?

Arne Oslebo  
arne.oslebo@uninett.no

<http://software.uninett.no/stager>