Using NfSen to identify top talkers

Contents

1 Introduction

1.1 Goals

- Use NfSen to find out which hosts are generating the most inbound and outbound traffic on your network

1.2 Assumptions

Your router is sending netflow records to one of your PCs, and that PC is running NfSen to collect this data. If you are working in a pair, then you should both point your web browser to whichever PC is receiving the flows:

http://pcX.ws.nsrc.org/nfsen/nfsen.php

2 Generate some traffic

Firstly, we need to generate some traffic passing through your router. On either of your PCs (it doesn't have to be the one running NfSen), login and type the following commands:

```
$ cd /tmp
$ wget http://noc.ws.nsrc.org/downloads/BigFile
$ rm BigFile
```

It will take around 5 minutes before this shows as a spike in NfSen.

3 Exploring flow records

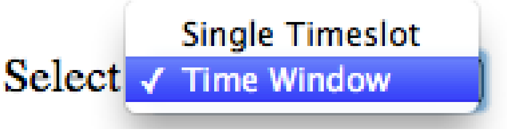
Now let's use NfSen to explore the traffic flows in the network, with the aim of finding out who was been downloading the most data. Look carefully at the output generated at each step - ask an instructor to explain if you don't understand what you see.

3.1 Navigate to Detail page

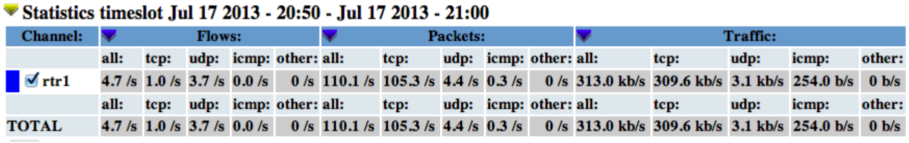
The NfSen home page shows a matrix of graphs: flows per second on the left, packets per second in the middle, bits per second on the right. Click on the top-right graph (bits per second, one day view) to get to the Detail page.

3.2 Select time window

Change from “Single Timeslot” to “Time Window”:



Once you have done this, the vertical selector arrow and line in the graph window can be split. Pull the left half of the arrow to the left and the right half to the right, to select the time period of interest. Then you should see some summary statistics appear in the table below the graph, for the time period you have selected:



Statistics timeslot Jul 17 2013 - 20:50 - Jul 17 2013 - 21:00

Channel:	Flows:					Packets:					Traffic:				
	all:	tcp:	udp:	icmp:	other:	all:	tcp:	udp:	icmp:	other:	all:	tcp:	udp:	icmp:	other:
☑ rtr1	4.7 /s	1.0 /s	3.7 /s	0.0 /s	0 /s	110.1 /s	105.3 /s	4.4 /s	0.3 /s	0 /s	313.0 kb/s	309.6 kb/s	3.1 kb/s	254.0 b/s	0 b/s
	all:	tcp:	udp:	icmp:	other:	all:	tcp:	udp:	icmp:	other:	all:	tcp:	udp:	icmp:	other:
TOTAL	4.7 /s	1.0 /s	3.7 /s	0.0 /s	0 /s	110.1 /s	105.3 /s	4.4 /s	0.3 /s	0 /s	313.0 kb/s	309.6 kb/s	3.1 kb/s	254.0 b/s	0 b/s

Figure 1: Summary statistics

3.3 List individual flows

Select “List Flows”, make sure none of the “Aggregate” boxes are not checked, and then click `process`. This will display some flows at the beginning of the time period.

Increase the limit from 20 flows to 100 flows. Notice that much network traffic consists of large numbers of very small flows - for example a DNS query/response will be two flows, one from client to DNS server, and one back again.

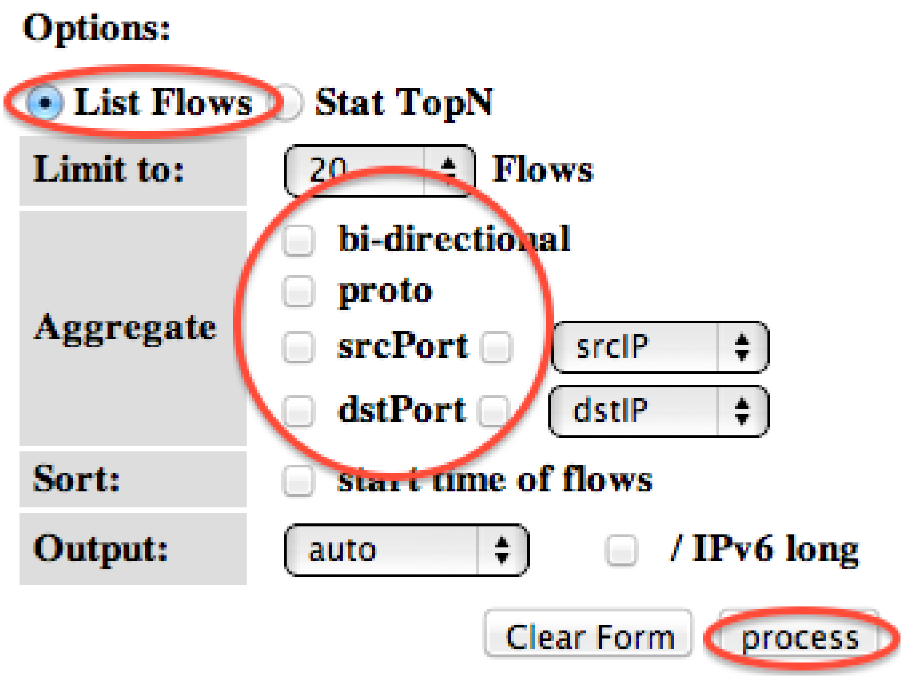
By selecting “bi-directional” you can get NfSen to associate the inbound and outbound flows into a single line:

However it’s still too much work to wade through this looking for interesting traffic. Uncheck the “Bi-directional” box before continuing.

3.4 Flows to/from one host

If we know which host we want to examine, we can apply a filter to show only those flows to and from that host. Do this by entering “host 10.10.X.Y” in the filter box, and then pressing `process` again. (Replace 10.10.X.Y with the address of one of your PCs)

This is a little better, but we would still have to wade through lots of small flows to find anything significant. We need to take a different approach.



Options:

● List Flows ○ Stat TopN

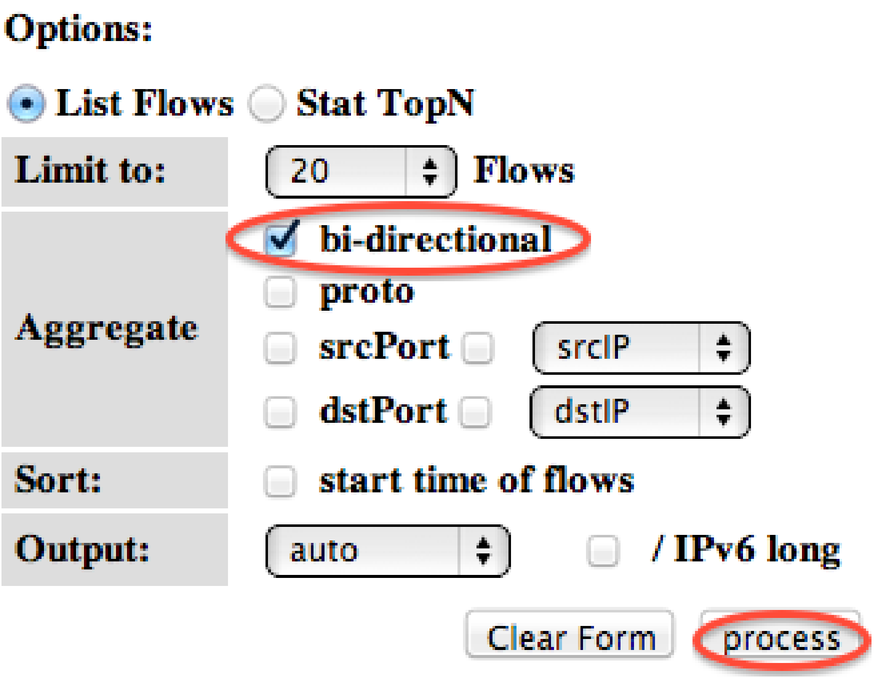
Limit to: 20 Flows

Aggregate: □ bi-directional □ proto □ srcPort □ srcIP □ dstPort □ dstIP

Sort: □ start time of flows

Output: auto □ / IPv6 long

Figure 2: List flows



Options:

● List Flows ○ Stat TopN

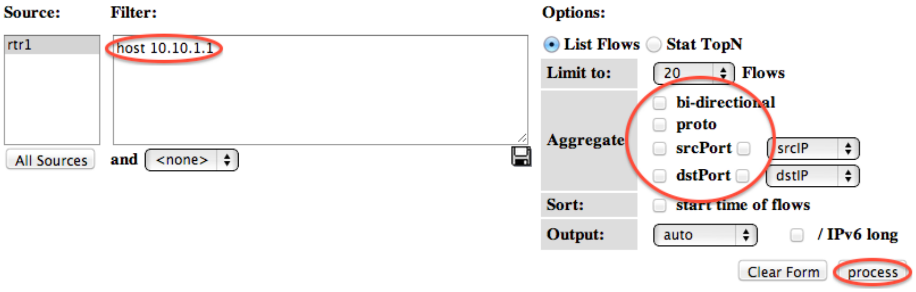
Limit to: 20 Flows

Aggregate
☑ bi-directional
□ proto
□ srcPort □ srcIP
□ dstPort □ dstIP

Sort: □ start time of flows

Output: auto □ / IPv6 long

Figure 3: Bi-directional flows



Source: rtr1

Filter: host 10.10.1.1

and <none>

Options:

● List Flows ○ Stat TopN

Limit to: 20 Flows

Aggregate
□ bi-directional
□ proto
□ srcPort □ srcIP
□ dstPort □ dstIP

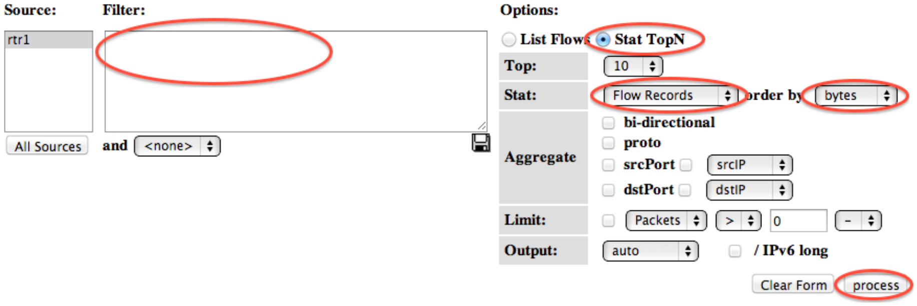
Sort: □ start time of flows

Output: auto □ / IPv6 long

Figure 4: Flows to and from one host

4 Largest flows

The next thing we can do is to get NfSen to sort the flows by number of bytes. Remove any filter from the Filter box; select “Stat TopN”, stat “Flow Records”, order by “Bytes”. Ensure all the aggregate boxes are all unchecked, then press `process`



Source: rtr1 | All Sources

Filter: and <none>

Options: ○ List Flows ● Stat TopN

Top: 10

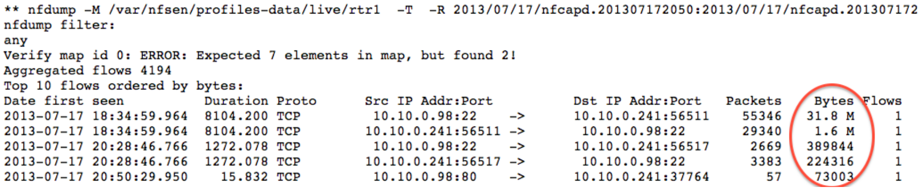
Stat: Flow Records order by bytes

Aggregate □ bi-directional □ proto □ srcPort □ srcIP □ dstPort □ dstIP

Limit: □ Packets > 0 -

Output: auto □ / IPv6 long

Figure 5: Find top flows by bytes



```
** nfdump -M /var/nfsen/profiles-data/live/rtr1  -T  -R 2013/07/17/nfcapd.201307172050:2013/07/17/nfcapd.201307172
nfdump filter:
any
Verify map id 0: ERROR: Expected 7 elements in map, but found 2!
Aggregated flows 4194
Top 10 flows ordered by bytes:
Date first seen          Duration Proto      Src IP Addr:Port          Dst IP Addr:Port   Packets    Bytes Flows
2013-07-17 18:34:59.964  8104.200 TCP         10.10.0.98:22     ->    10.10.0.241:56511    55346   31.8 M     1
2013-07-17 18:34:59.964  8104.200 TCP        10.10.0.241:56511 ->     10.10.0.98:22        29340    1.6 M     1
2013-07-17 20:28:46.766  1272.078 TCP         10.10.0.98:22     ->    10.10.0.241:56517     2669   389844     1
2013-07-17 20:28:46.766  1272.078 TCP        10.10.0.241:56517 ->     10.10.0.98:22         3383   224316     1
2013-07-17 20:50:29.950    15.832 TCP         10.10.0.98:80     ->    10.10.0.241:37764       57    73003     1
```

Figure 6: Output: top flows by bytes

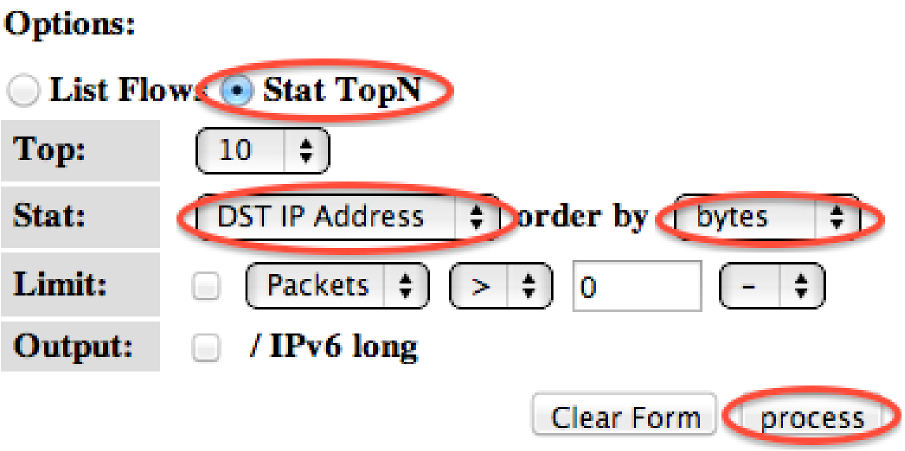
This is a definite improvement, as the flows with the largest number of bytes are shown first. However there’s a problem - we are still looking at individual flows. It’s possible that many small flows to the same host would add up to a large amount of traffic, but we wouldn’t see them at the top of this list.

5 Inbound traffic grouped by receiver IP address

What we want to see is a single line for each host in our network, showing the total amount of traffic delivered to that host.

To do this, Stat “DST IP Address”, order by “bytes”.

This is now much closer to what we want: there is one line for each destination IP address, and they are ordered by total bytes, largest first.



Options:

○ List Flows ● Stat TopN

Top: 10

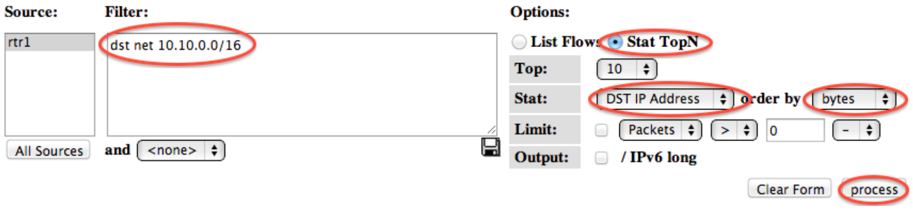
Stat: DST IP Address order by bytes

Limit: □ Packets > 0 -

Output: □ / IPv6 long

Figure 7: Group flows by DST IP Address

But there is still one problem - can you see what it is? We are seeing a mixture of inbound flows (where the destination IP is inside our network) and outbound flows (where the destination IP is on the Internet). We are only interested in the inbound flows, so apply a filter which shows only traffic to your group's network: "dst net 10.10.X.0/24" (replacing X with your group number)



Source: rtr1

Filter: dst net 10.10.0.0/16

and <none>

Options:

○ List Flows ● Stat TopN

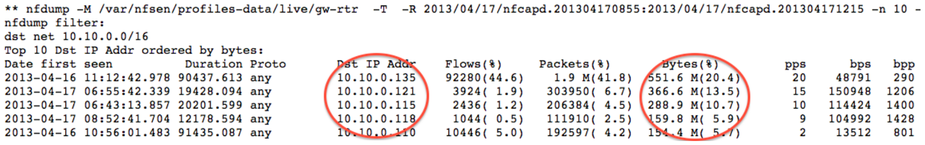
Top: 10

Stat: DST IP Address order by bytes

Limit: □ Packets > 0 -

Output: □ / IPv6 long

Figure 8: Flows to local network, grouped by DST IP Address



```
** nfdump -M /var/nfsen/profiles-data/live/gw-rtr  -T  -R 2013/04/17/nfcapd.201304170855:2013/04/17/nfcapd.201304171215 -n 10 -
nfdump filter:
dst net 10.10.0.0/16
Top 10 Dst IP Addr ordered by bytes:
Date first seen          Duration Proto      Dst IP Addr    Flows(%)     Packets(%)       Bytes(%)         pps     bps   bpp
2013-04-16 11:12:42.978 90437.613 any        10.10.0.135   92280(44.6)    1.9 M(41.8)  551.6 M(20.4)       20   48791   290
2013-04-17 06:55:42.339 19428.094 any        10.10.0.121    3924( 1.9)   303950( 6.7)  366.6 M(13.5)       15  150948  1206
2013-04-17 06:43:13.857 20201.599 any        10.10.0.115    2436( 1.2)   206384( 4.5)  288.9 M(10.7)       10  114424  1400
2013-04-17 08:52:41.704 12178.594 any        10.10.0.118    1044( 0.5)   111910( 2.5)  159.8 M( 5.9)        9  104992  1428
2013-04-16 10:56:01.483 91435.087 any        10.10.0.110   10446( 5.0)   192597( 4.2)  154.4 M( 5.7)        2   13512   801
```

Figure 9: Output: Flows to local network, grouped by DST IP Address

At last we have what we want. The first record you see should tell you the local machine which has downloaded the most data in the period selected.

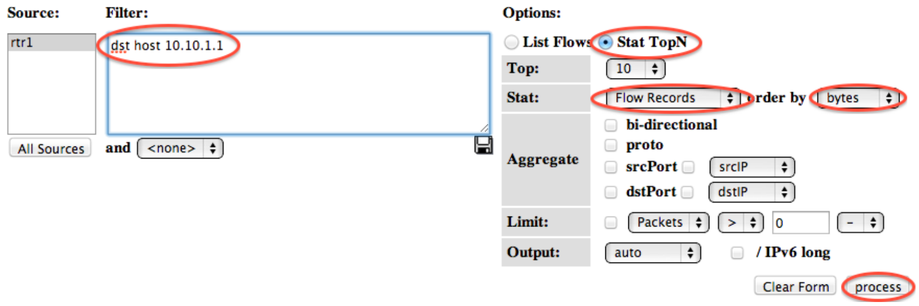
5.1 Outbound traffic grouped by sender IP address

Question: what changes would you have to make to this query to find out which machines in your network are *uploading* the most data to the Internet?

6 Analysing traffic to a single host

Now that we know which host has downloaded the most data, we might want to see where it has been downloading from.

Let's start by looking at the top flows to that host. Change the filter to "dst host 10.10.X.Y" (the IP address you just found). Then select Stat "Flow Records", order by "bytes", and `process`.



Source: rtr1
All Sources

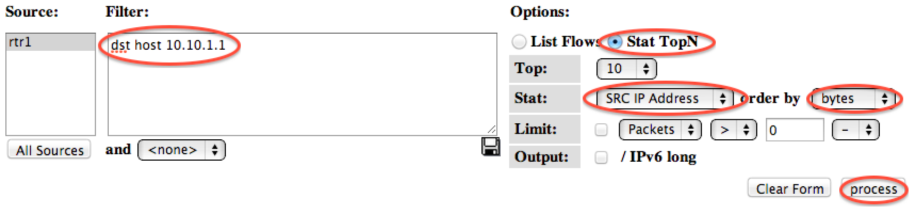
Filter: dst host 10.10.1.1
and <none>

Options:
○ List Flows ● Stat TopN
Top: 10
Stat: Flow Records order by bytes
Aggregate: □ bi-directional
□ proto
□ srcPort □ srcIP
□ dstPort □ dstIP
Limit: □ Packets > 0 -
Output: auto □ / IPv6 long
Clear Form process

Figure 10: Largest flows to one host

You should now see the flows inbound to that host, largest first. But again, we're only seeing large individual flows; a collection of small flows may add together to a large amount of traffic.

Since we are only looking at flow records to one particular destination IP address, we can group these records by source IP address.



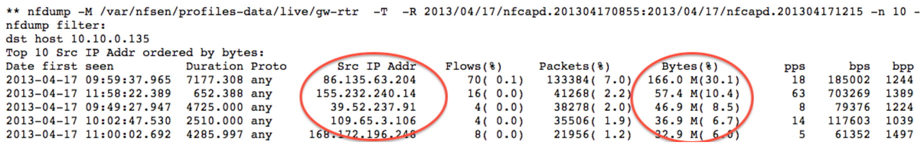
Source: rtr1
All Sources

Filter: dst host 10.10.1.1
and <none>

Options:
○ List Flows ● Stat TopN
Top: 10
Stat: SRC IP Address order by bytes
Limit: □ Packets > 0 -
Output: □ / IPv6 long
Clear Form process

Figure 11: Flows to one host, grouped by SRC IP address

And now we have one row for each IP address this host has been downloading from, with the total number of bytes downloaded from each IP, largest total first.

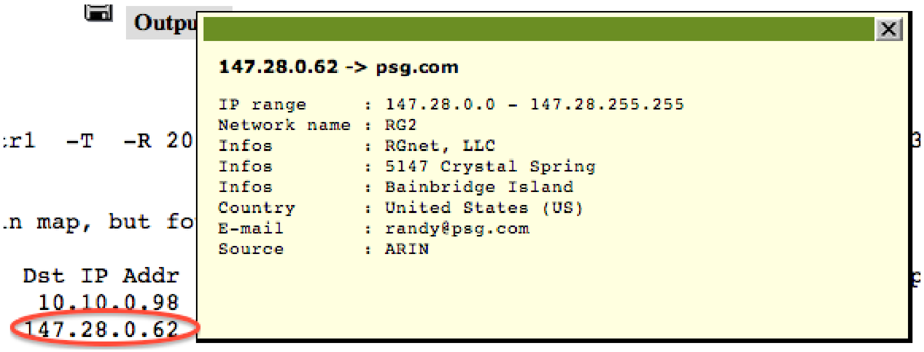


```
** nfdump -M /var/nfsen/profiles-data/live/gw-rtr  -T  -R 2013/04/17/nfcapd.201304170855:2013/04/17/nfcapd.201304171215 -n 10 -
nfdump filter:
dst host 10.10.0.135
Top 10 Src IP Addr ordered by bytes:
Date first seen          Duration Proto      Src IP Addr    Flows(%)     Packets(%)       Bytes(%)         pps      bps   bpp
2013-04-17 09:59:37.965  7177.308 any       86.135.63.204     70( 0.1)   133384( 7.0)  166.0 M(30.1)     18   185002  1244
2013-04-17 11:58:22.389   652.388 any      155.232.240.14     16( 0.0)    41268( 2.2)   57.4 M(10.4)     63   703269  1389
2013-04-17 09:49:27.947  4725.000 any        39.52.237.91      4( 0.0)    38278( 2.0)   46.9 M( 8.5)      8    79376  1224
2013-04-17 10:02:47.530  2510.000 any        109.65.3.106      4( 0.0)    35506( 1.9)   36.9 M( 6.7)     14   117603  1039
2013-04-17 11:00:02.692  4285.997 any     168.172.196.248      8( 0.0)    21956( 1.2)   32.9 M( 6.0)      5    61352  1497
```

Figure 12: Output: Flows to one host, grouped by SRC IP address

6.1 IP address information

By clicking on an IP address, you will get some information from reverse DNS and whois.



```
147.28.0.62 -> psg.com

IP range      : 147.28.0.0 - 147.28.255.255
Network name  : RG2
Infos         : RGnet, LLC
Infos         : 5147 Crystal Spring
Infos         : Bainbridge Island
Country       : United States (US)
E-mail        : randy@psg.com
Source        : ARIN
```

Figure 13: Whois information

7 Additional exercise: aggregating flows

NfSen offers some other ways to summarise the flows, using the Aggregate checkboxes. In this example we'll look again at traffic inbound to your network.

When you click one or more of the Aggregate boxes, NfSen combines all flows that share the same values of the attribute(s) you have selected.

To start this exercise, set the filter to "dst net 10.10.X.0/24" (X = your group). Select "Stat TopN", Stat "Flow Records", order by "bytes". Then try the following aggregates, remembering to click `process` after each one.

- Check "proto". You should get just one row each for TCP, UDP and ICMP, showing the total amount of traffic using each protocol. Sometimes this may show other protocols are active on your network (e.g. protocol 50 = IPSEC ESP; in Linux the file `/etc/protocols` has a list of them)
- Check both "proto" and "srcPort". This tells NfSen to combine together flows which have the same proto *and* the same srcPort. Depending on

what activity has been going on, you may see one line giving the total for TCP port 80, one line for TCP port 443, one line for UDP port 53, and so on.

- Check “srcIP” by itself. This gives one row for each distinct source IP address, and is the same as selecting Stat SRC IP.
- Check both “srcIP” and “dstIP”. You will get one row for each unique pair of srcIP and dstIP seen, with the total traffic between those two endpoints.

How would you change the filter to look at outbound traffic, rather than inbound traffic?

If you have a router with a full BGP table, you can aggregate netflow records by AS number. This is a useful way to find out what networks you are exchanging the most traffic with.