NetfFow Overview

Network Monitoring and Management
SANOG 18
Pokhara, Nepal

Agenda

- Netflow
  - What it is and how it works
  - Uses and Applications
- Vendor Configurations/ Implementation
  - Cisco and Juniper
- Flow-tools
  - Architectural issues
  - Software, tools etc
- More Discussion / Lab Demonstration

Network Flows

- Packets or frames that have a common attribute.
- Creation and expiration policy – what conditions start and stop a flow.
- Counters – packets, bytes, time.
- Routing information – AS, network mask, interfaces.

Network Flows

- Unidirectional or bidirectional.
- Bidirectional flows can contain other information such as round trip time, TCP behavior.
- Application flows look past the headers to classify packets by their contents.
- Aggregated flows – flows of flows.

Working with Flows

- Generating and Viewing Flows
- Exporting Flows from devices
  - Types of flows
  - Sampling rates
- Collecting it
  - Tools to Collect Flows - Flow-tools
- Analyzing it
  - More tools available, can write your own

Flow Descriptors

- A Key with more elements will generate more flows.
- Greater number of flows equals:
  - More post processing time to generate reports
  - more memory and CPU requirements for device generating flows
- Depends on application. Traffic engineering vs. intrusion detection.

Flow Accounting

- Accounting information accumulated with flows.
- Packets, Bytes, Start Time, End Time.
- Network routing information – masks and autonomous system number.

Flow Generation/Collection

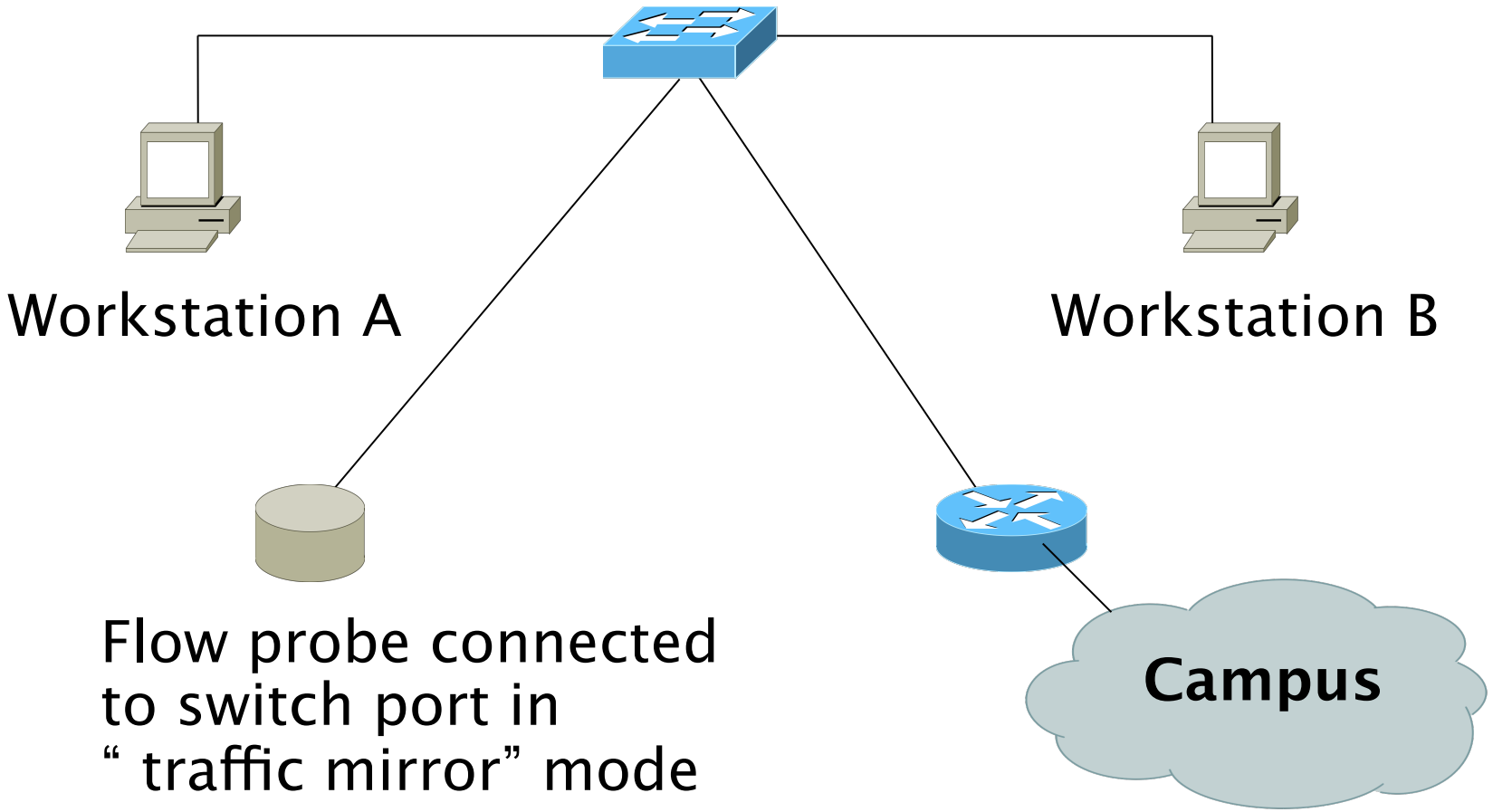
Passive monitor

- A passive monitor (usually a Unix host) receives all data and generates flows.
- Resource intensive

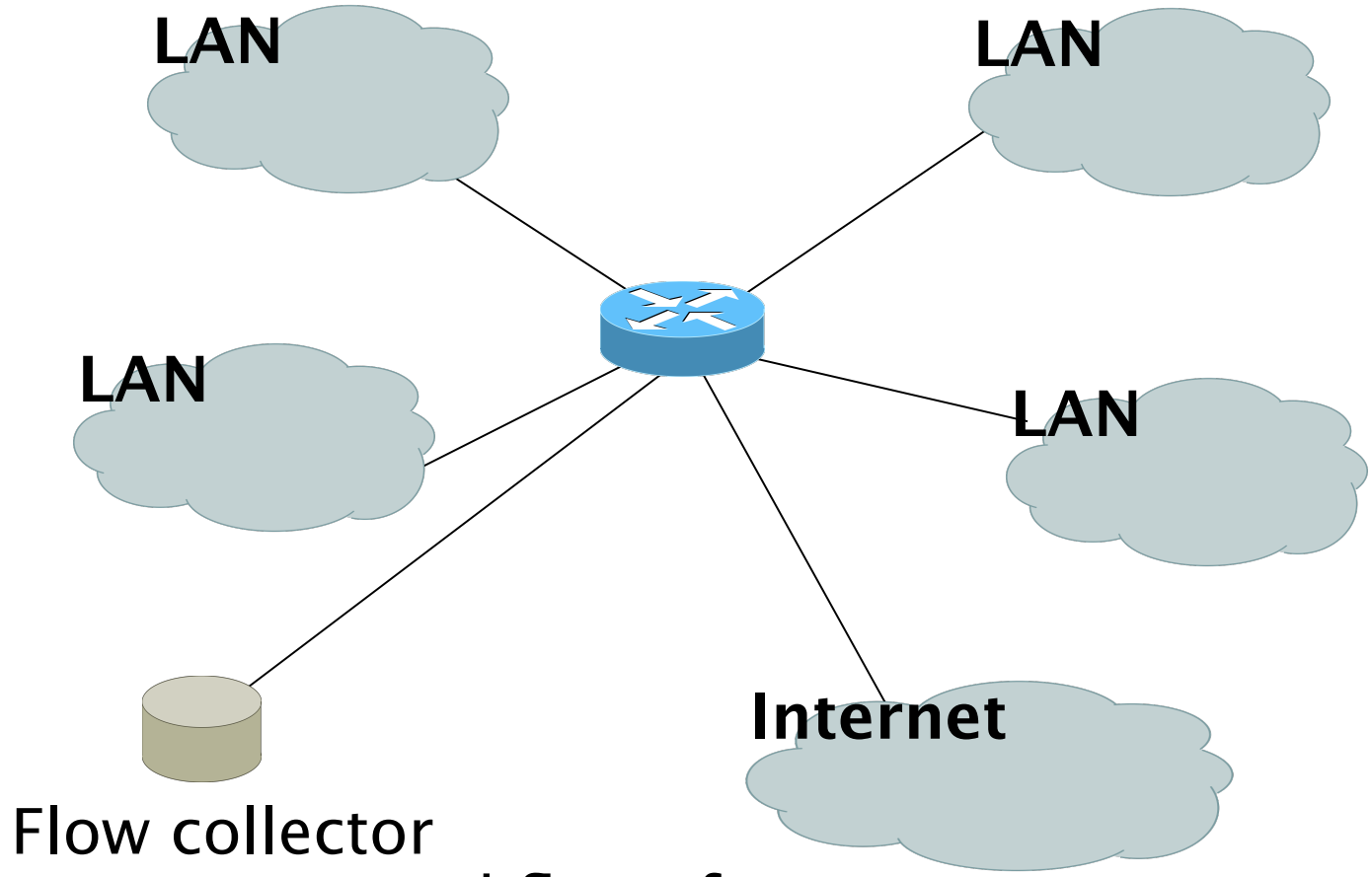
Router or other existing network device

- Router or other existing devices like switch, generate flows.
- Sampling is possible
- Nothing new needed

Passive Monitor Collection



Router Collection



Flow collector
stores exported flows from router.

Vendor implementations

Cisco NetFlow

- Unidirectional flows.
- IPv4 unicast and multicast.
- Aggregated and unaggregated.
- Flows exported via UDP.
- Supported on IOS and CatOS platforms.
- Catalyst NetFlow is different implementation.

Cisco NetFlow Versions

- 4 Unaggregated types (1,5,6,7).
- 14 Aggregated types (8.x, 9).
- Each version has its own packet format.
- Version 1 does not have sequence numbers – no way to detect lost flows.
- The “version” defines what type of data is in the flow.
- Some versions specific to Catalyst platform.

NetFlow v1

- Key fields: Source/Destination IP, Source/Destination Port, IP Protocol, ToS, Input interface.
- Accounting: Packets, Octets, Start/End time, Output interface
- Other: Bitwise OR of TCP flags.

NetFlow v5

- Key fields: Source/Destination IP, Source/Destination Port, IP Protocol, ToS, Input interface.
- Accounting: Packets, Octets, Start/End time, Output interface.
- Other: Bitwise OR of TCP flags, Source/Destination AS and IP Mask.
- Packet format adds sequence numbers for detecting lost exports.

NetFlow v8

- Aggregated v5 flows.
- Not all flow types available on all equipments
- Much less data to post process, but loses fine granularity of v5 – no IP addresses.

Cisco IOS Configuration

- Configured on each input interface.
- Define the version.
- Define the IP address of the collector (where to send the flows).
- Optionally enable aggregation tables.
- Optionally configure flow timeout and main (v5) flow table size.
- Optionally configure sample rate.

Cisco IOS Configuration

```
ip flow-top-talkers
 top 10
 sort-by bytes


gw-169-223-2-0#sh ip flow top-talkers

SrcIf         SrcIPaddress    DstIf         DstIPaddress    Pr SrcP DstP Bytes
Fa0/1         169.223.2.2     Fa0/0         169.223.11.33   06 0050 0B64  3444K
Fa0/1         169.223.2.2     Fa0/0         169.223.11.33   06 0050 0B12  3181K
Fa0/0         169.223.11.33   Fa0/1         169.223.2.2     06 0B12 0050    56K
Fa0/0         169.223.11.33   Fa0/1         169.223.2.2     06 0B64 0050    55K
Fa0/1         169.223.2.2     Local         169.223.2.1     01 0000 0303    18K
Fa0/1         169.223.2.130   Fa0/0         64.18.197.134   06 9C45 0050    15K
Fa0/1         169.223.2.130   Fa0/0         64.18.197.134   06 9C44 0050    12K
Fa0/0         213.144.138.195 Fa0/1         169.223.2.130   06 01BB DC31  7167
Fa0/0         169.223.15.102  Fa0/1         169.223.2.2     06 C917 0016  2736
Fa0/1         169.223.2.2     Local         169.223.2.1     06 DB27 0016  2304
10 of 10 top talkers shown. 49 flows processed.
```

Cisco command summary

- Enable CEF (done by default)
  - **`ip cef`**
- Enable flow on each interface

  `ip route cache flow OR`

  `ip flow ingress`

  `ip flow egress`

- View flows
  - **`show ip cache flow`**
  - **`show ip flow top-talkers`**

Cisco Command Summary

- Exporting Flows to a collector

```
ip flow-export version 5 [origin-as|peer-as]
ip flow-export destination x.x.x.x <udp-port>
```

- Exporting aggregated flows

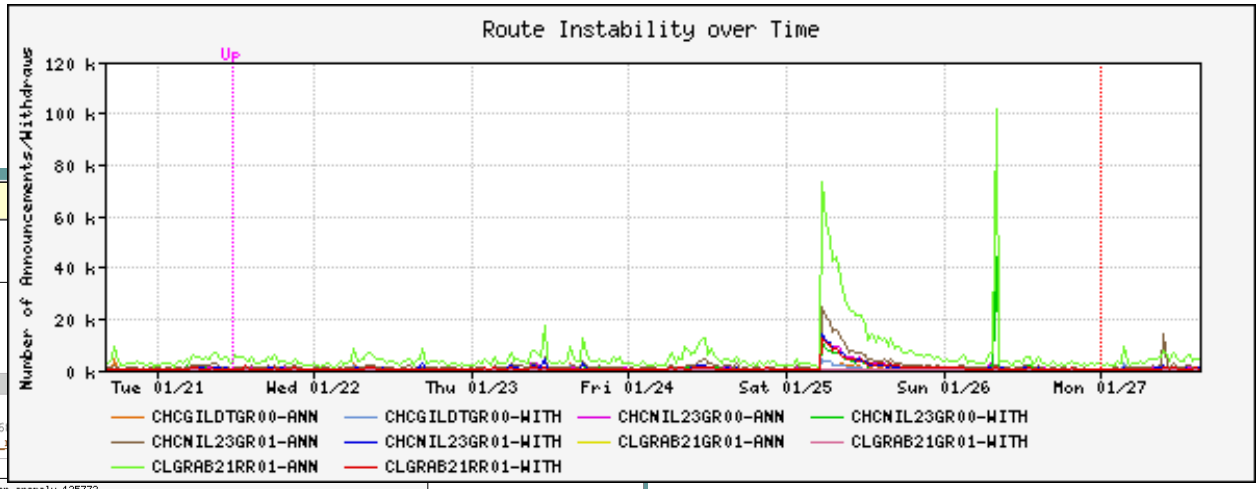
```
ip flow-aggregation cache as|prefix|dest|source|proto
  enabled
  export destination x.x.x.x <udp-port>
```

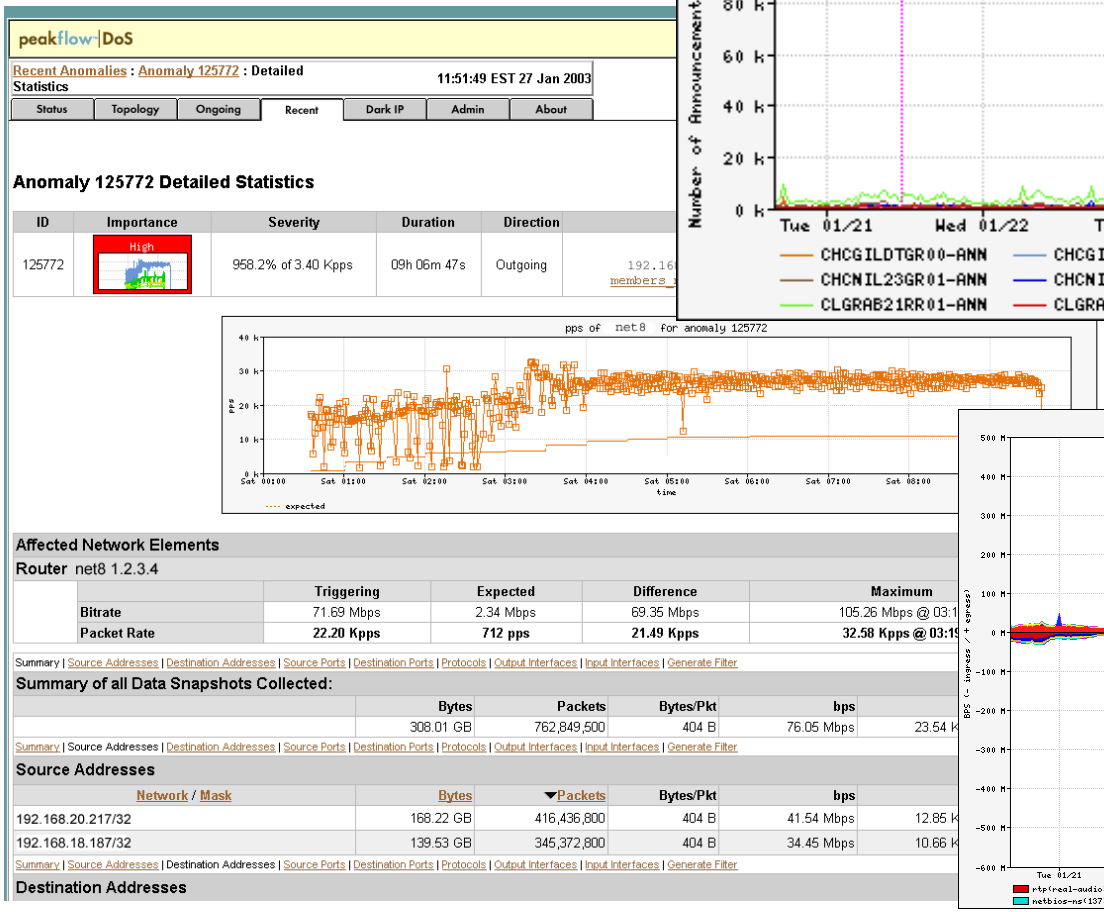
Flows and Applications

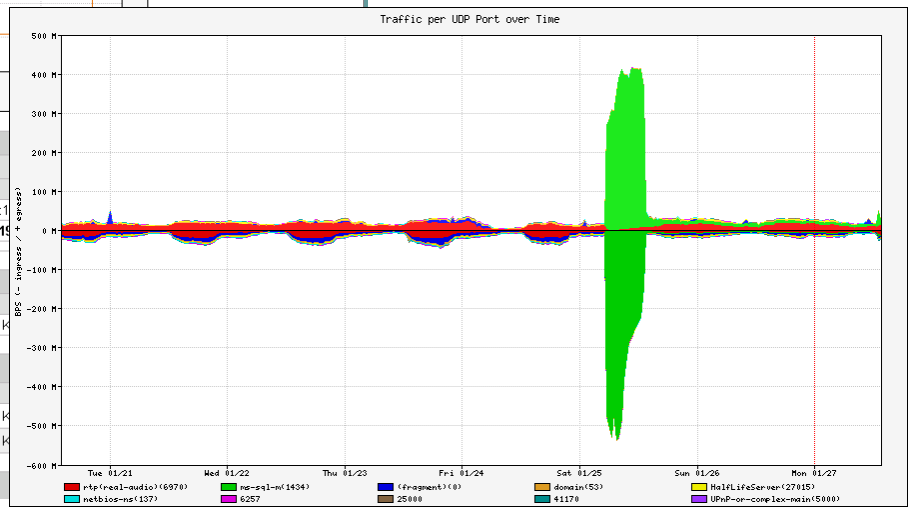
Uses for Flow

- Problem identification / solving
  - Traffic classification
  - DoS Traceback (some slides by Danny McPherson)
- Traffic Analysis
  - Inter-AS traffic analysis
  - Reporting on application proxies
- Accounting
  - Cross verification from other sources
  - Can cross-check with SNMP data

Detect Anomalous Events: SQL “Slammer” Worm*







Flow-based Detection (cont)*

Once baselines are built anomalous activity can be detected

- Pure **rate-based** (pps or bps) anomalies may be legitimate or malicious
- Many **misuse** attacks can be immediately recognized, even **without** baselines (e.g., TCP SYN or RST floods)
- **Signatures** can also be defined to identify “interesting” transactional data (e.g., proto udp and port 1434 and 404 octets(376 payload) == slammer!)
- Temporal compound signatures can be defined to detect with higher precision

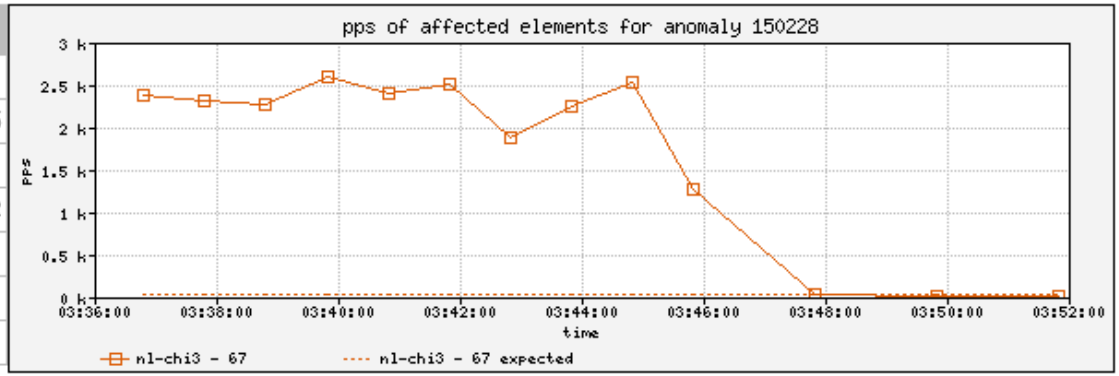
Flow-based Commercial Tools…*

Anomaly 150228 Get Report: PDF XML

ID	Importance	Duration	Start Time	Direction	Type	Resource
150228	High 130.0% of 2 Kpps	17 mins	03:34, Aug 16	Incoming	Bandwidth (Profiled)	Microsoft 207.46.0.0/16 windowsupdate.com

Traffic Characterization

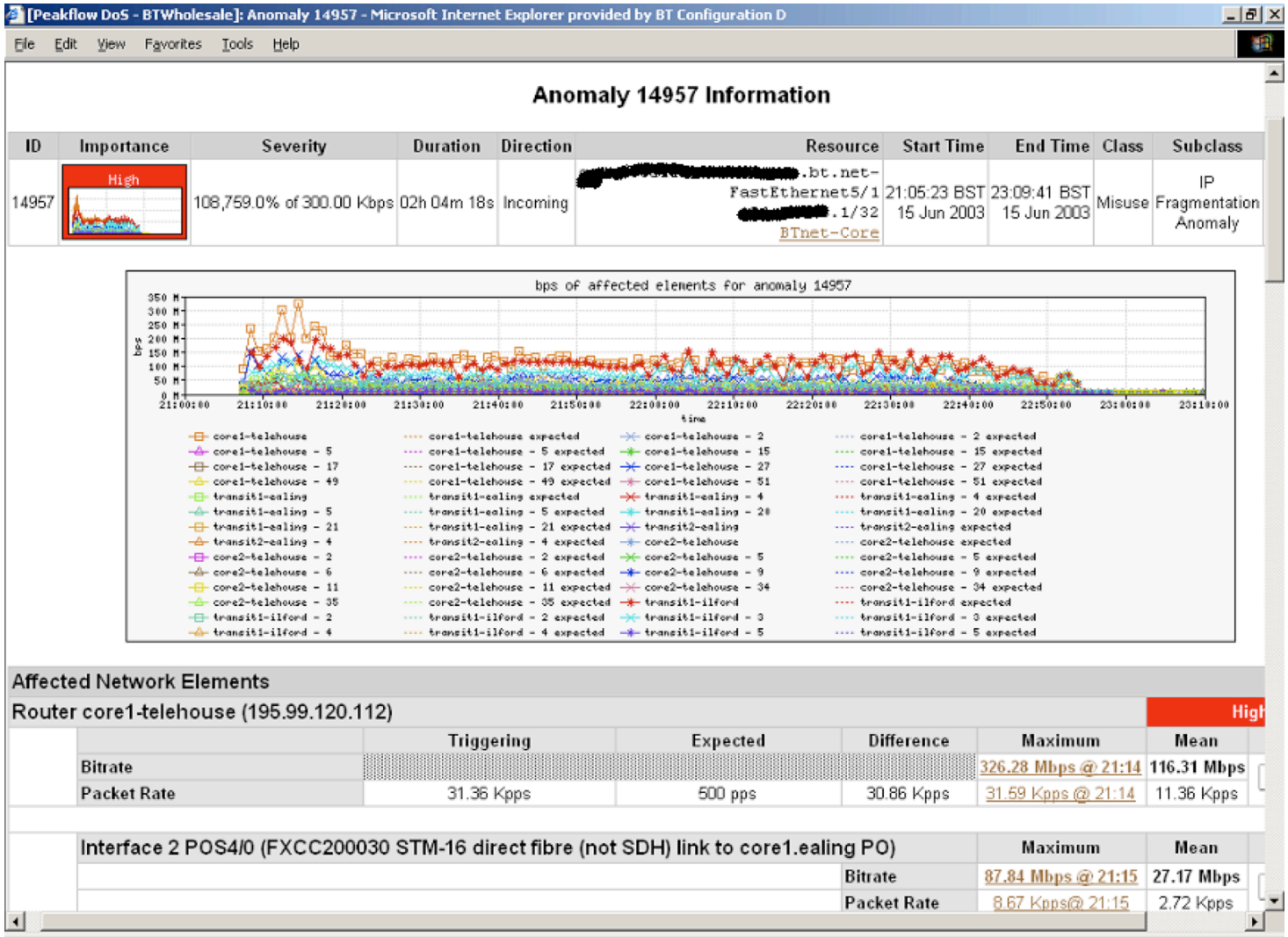
Sources	204.38.130.0/24
	204.38.130.192/26
	1024 - 1791
Destination	207.46.248.234/32
	80 (http)
Protocols	tcp (6)
TCP Flags	S (0x02)



Affected Network Elements	Importance	Expected pps	Observed bps Max	Observed bps Mean	Observed pps Max	Observed pps Mean	
Router nl-chi3 198.110.131.125	High						
Interface 67 at-1/1/0.14 *pvc to WMU*		26	832 K	563.1 K	2.6 K	1.7 K	Details

Anomaly Comments

Commercial Detection
A Large Scale DOS attack*



Accounting

Flow based accounting can be a good supplement to SNMP based accounting.

References

- flow-tools:
  http://www.splintered.net/sw/flow-tools
- NetFlow Applications

  http://www.inmon.com/technology/netflowapps.php
- Netflow HOW-TO
  http://www.linuxgeek.org/netflow-howto.php
- IETF standards effort:
  http://www.ietf.org/html.charters/ipfix-charter.html

References

- Abilene NetFlow page
  http://abilene-netflow.itec.oar.net/
- Flow-tools mailing list:
  flow-tools@splintered.net
- Cisco Centric Open Source Community
  http://cosi-nms.sourceforge.net/related.html
- Cisco NetFlow Collector User Guide
  http://www.cisco.com/en/US/docs/net_mgmt/netflow_collection_engine/6.0/tier_one/user/guide/user.html