

NetfFow Overview

Network Monitoring and Management
APRICOT 2011



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

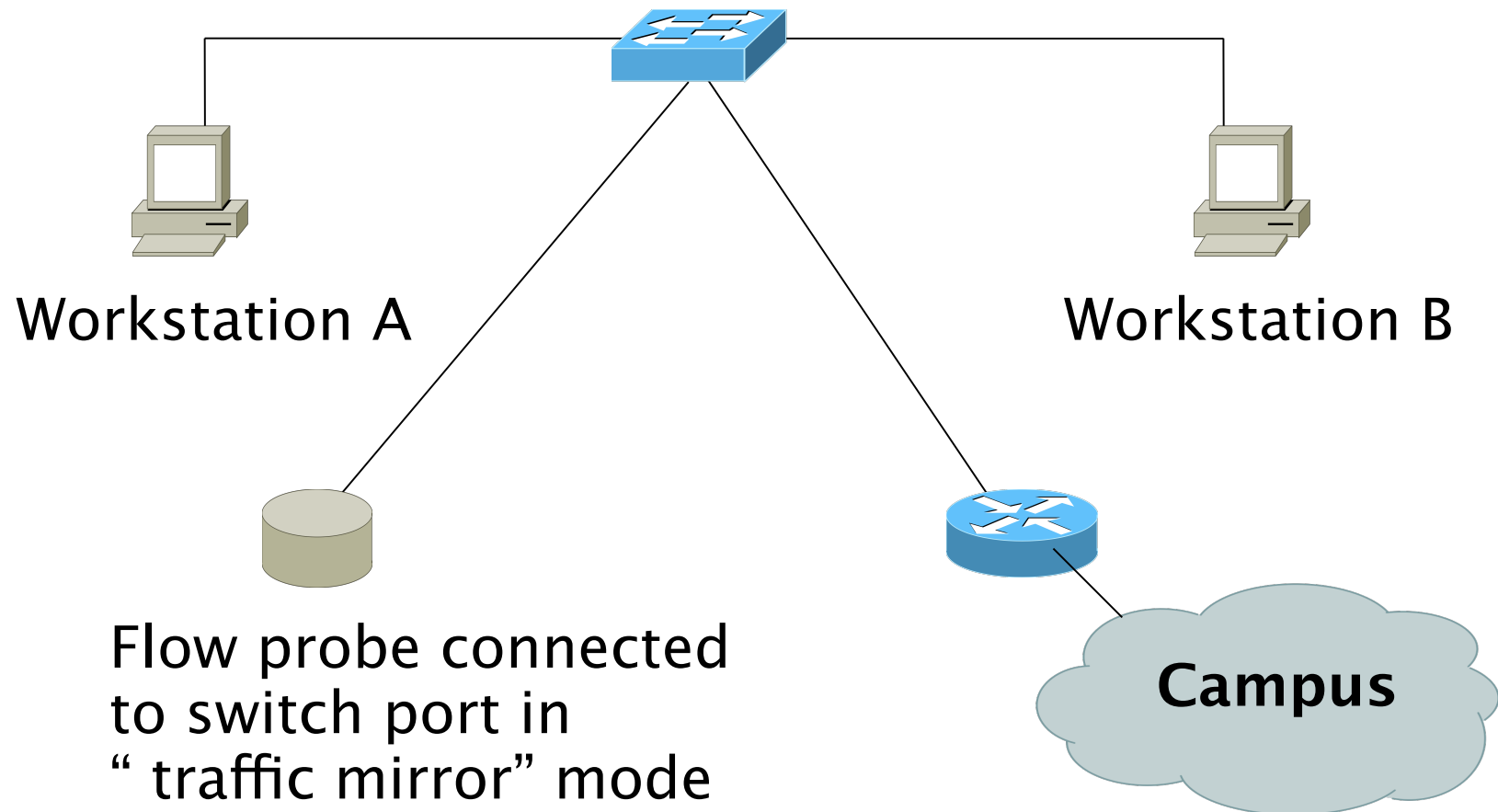
Passive monitor

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

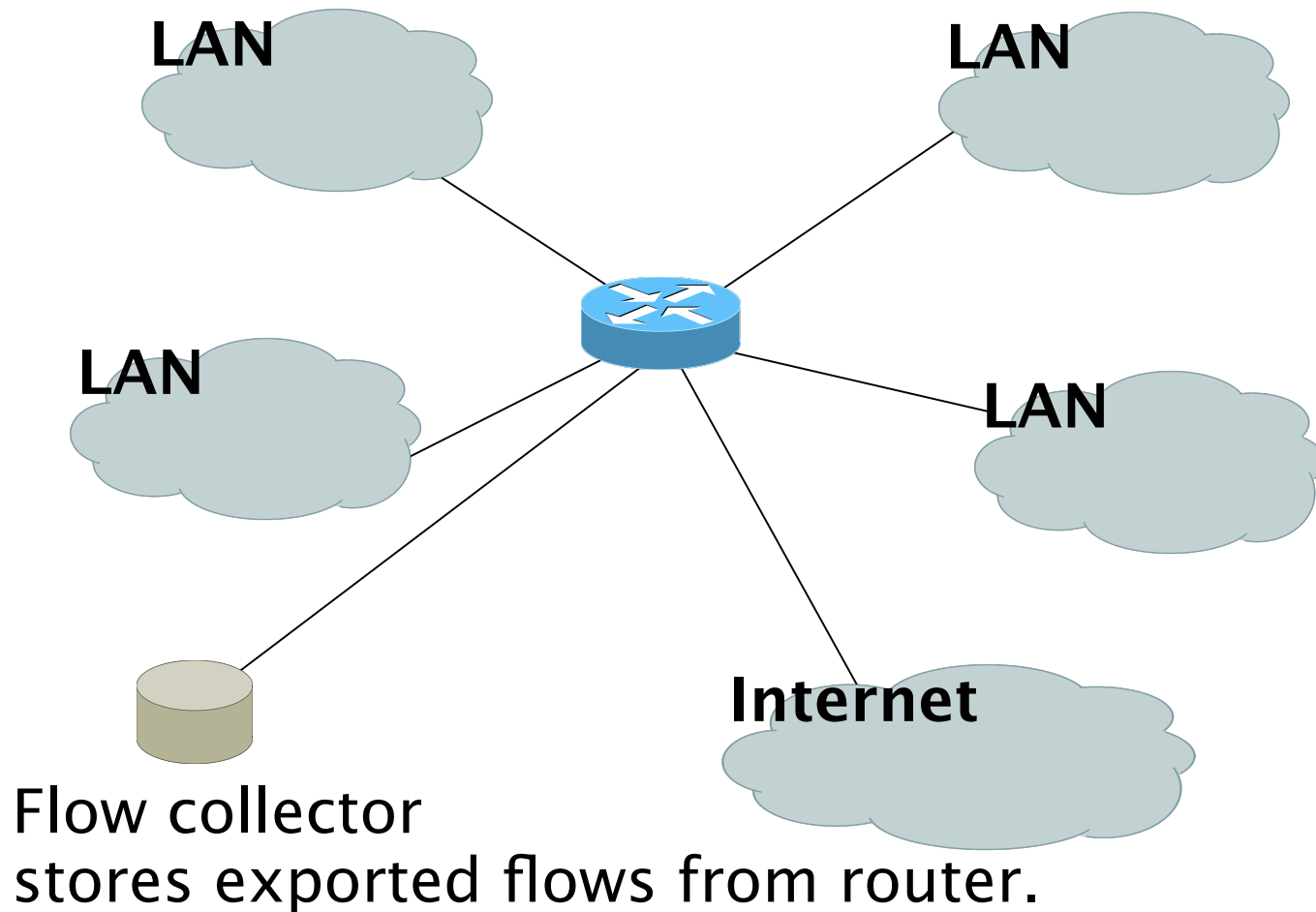
Router or other existing network device

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

Passive Monitor Collection



Router Collection



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

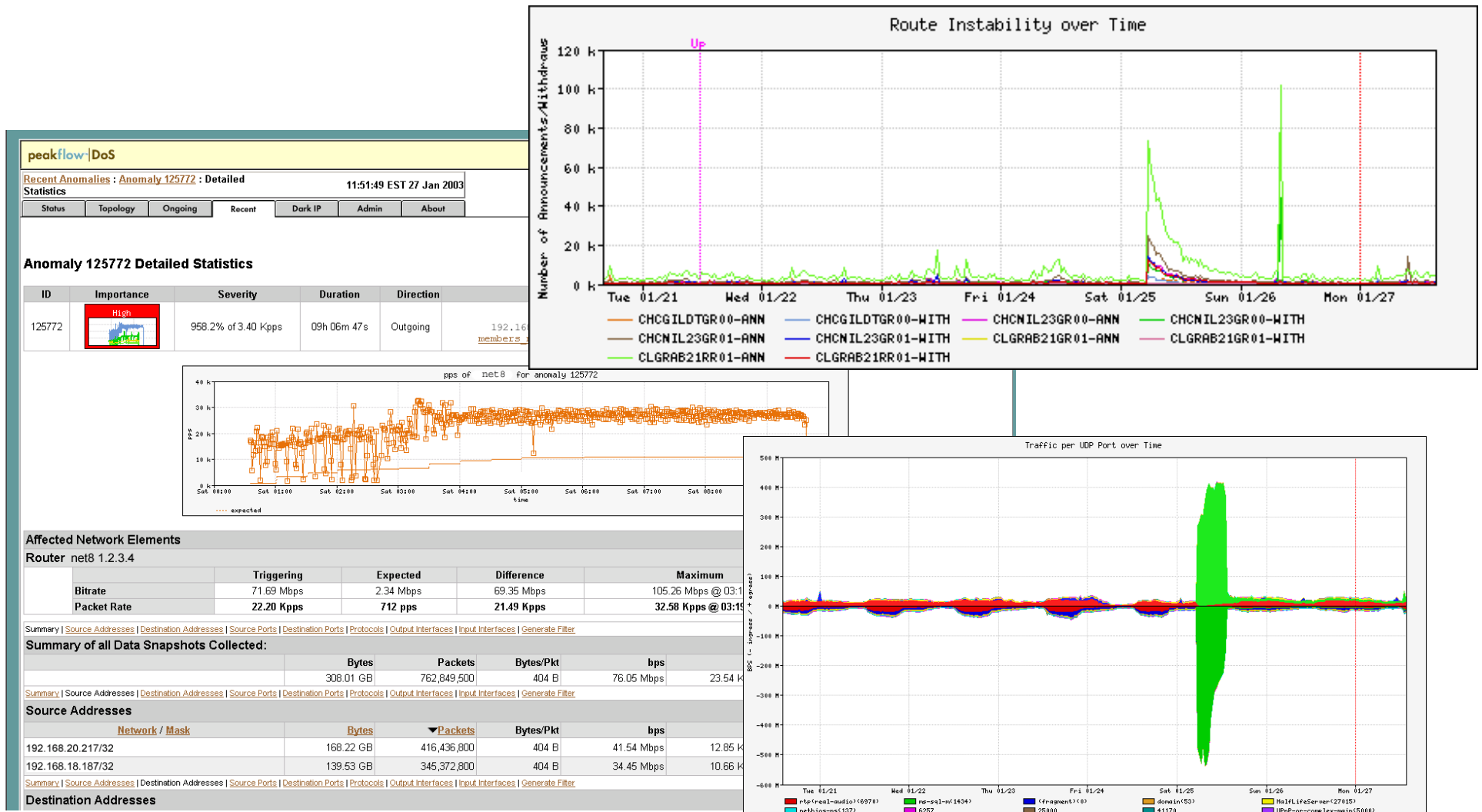
```
ip flow-aggregation cache as|prefix|dest|source|proto  
enabled  
export destination x.x.x.x <udp-port>
```

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*

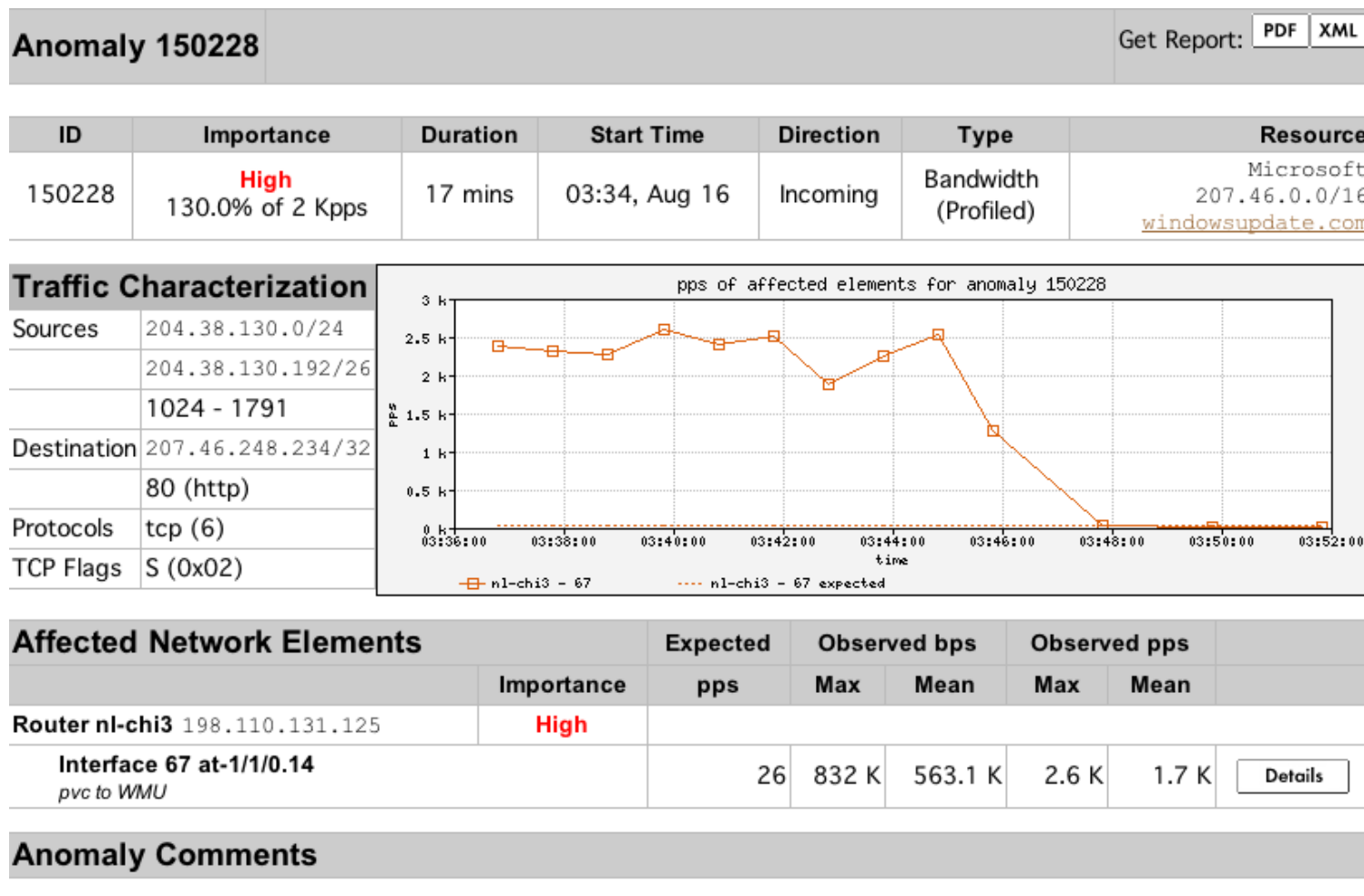


Flow-based Detection (cont)*

Once baselines are built anomalous activity can be detected

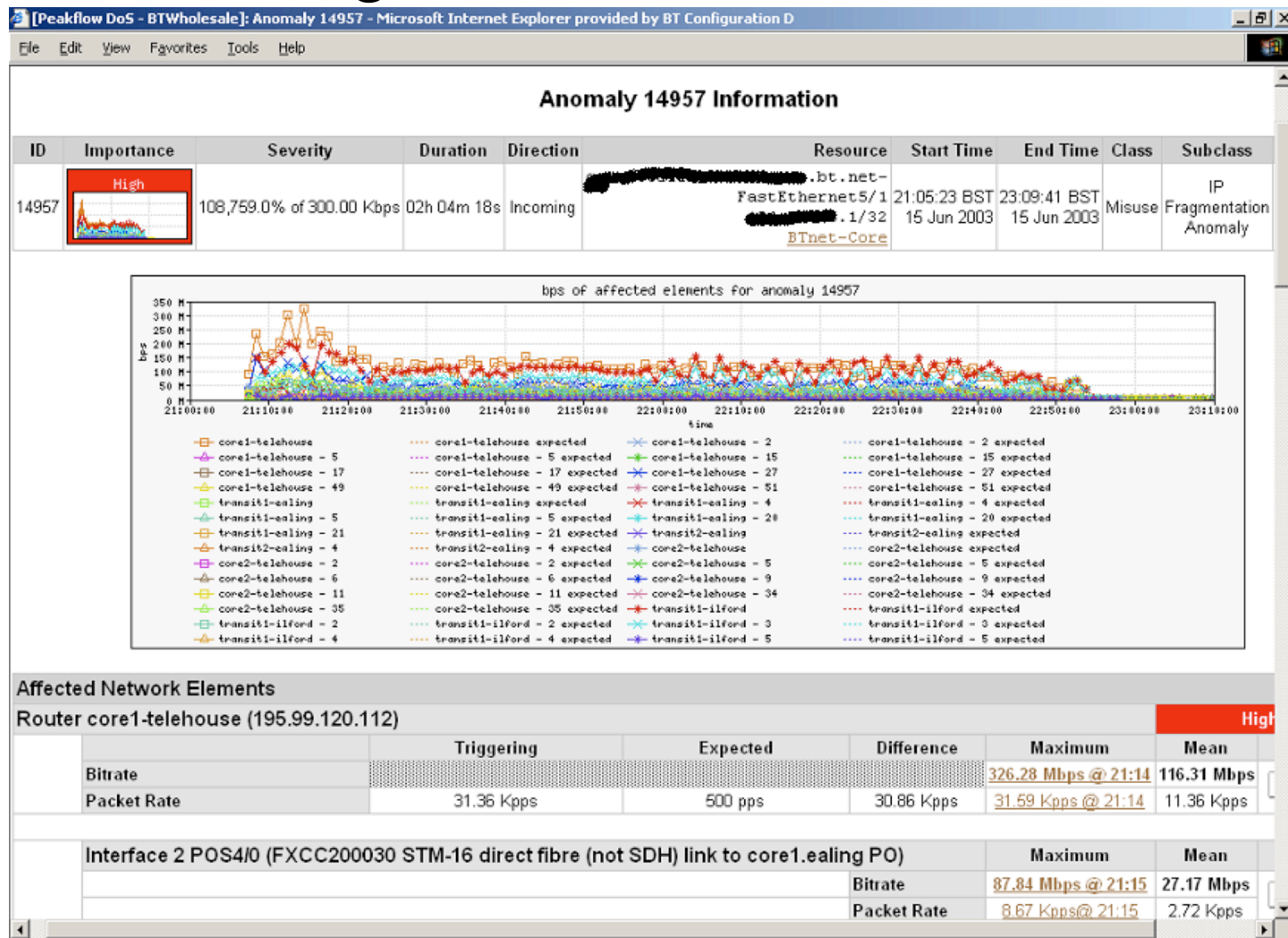
- Pure **rate-based** (pps or bps) anomalies may be legitimate or malicious
- Many **misuse** attacks can be immediately recognized, even **without** baselines (e.g., TCP SYN or RST floods)
- **Signatures** can also be defined to identify “interesting” transactional data (e.g., proto udp and port 1434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

Flow-based Commercial Tools...*



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