Inside the Perimeter

6 Steps to Improve Your Security Monitoring

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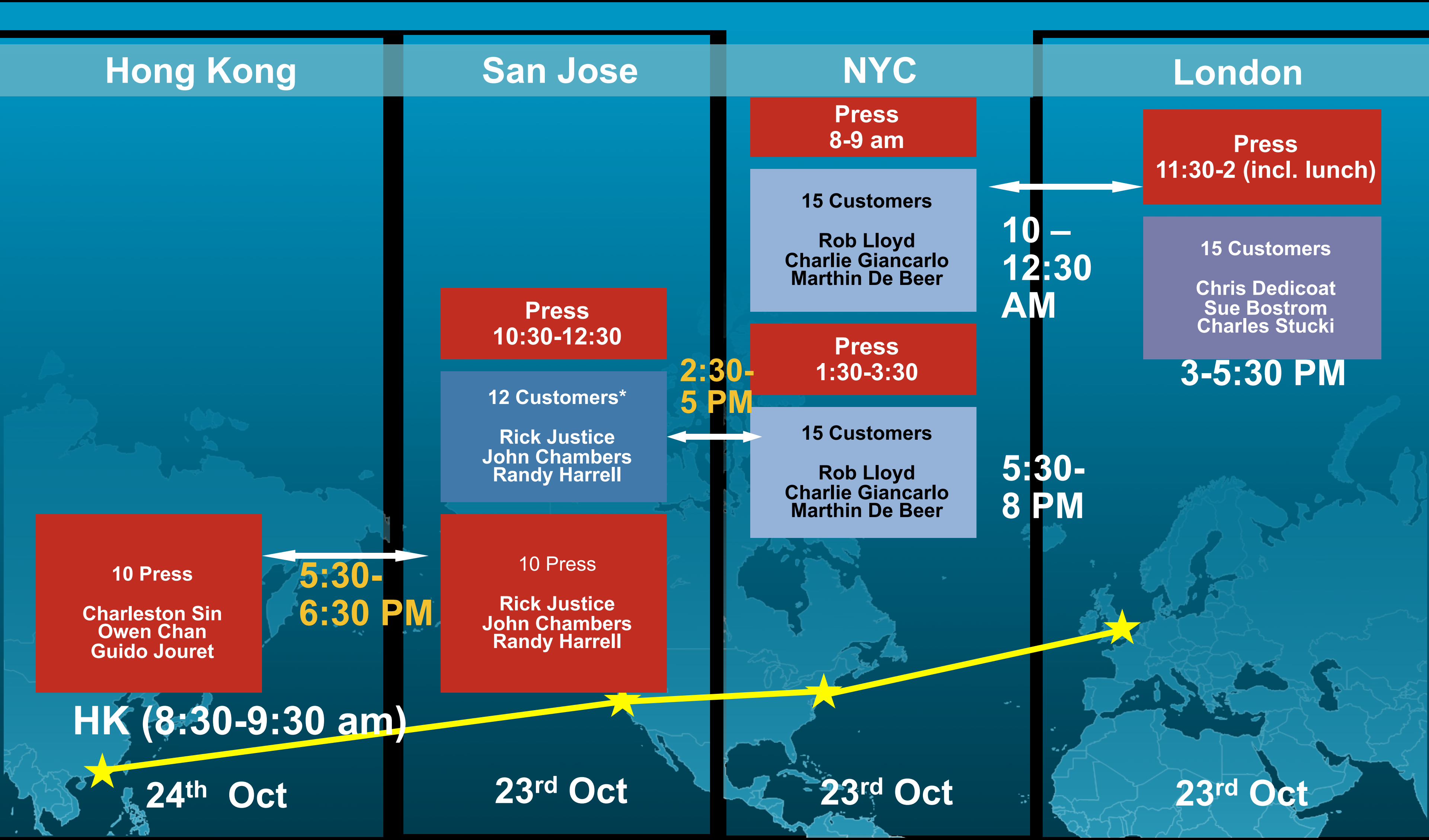
Cisco CSIRT

Cisco TelePresence
Next-generation IP video conferencing

TelePresence Public Launch Across Theatres



Hong Kong

10 Press

Charleston Sin
Owen Chan
Guido Jouret

5:30-
6:30 PM

HK (8:30-9:30 am)

24th Oct

San Jose

Press
10:30-12:30

12 Customers*

Rick Justice
John Chambers
Randy Harrell

10 Press

Rick Justice
John Chambers
Randy Harrell

2:30-
5 PM

23rd Oct

NYC

Press
8-9 am

15 Customers

Rob Lloyd
Charlie Giancarlo
Marthin De Beer

Press
1:30-3:30

15 Customers

Rob Lloyd
Charlie Giancarlo
Marthin De Beer

10 –
12:30
AM

5:30-
8 PM

23rd Oct

London

Press
11:30-2 (incl. lunch)

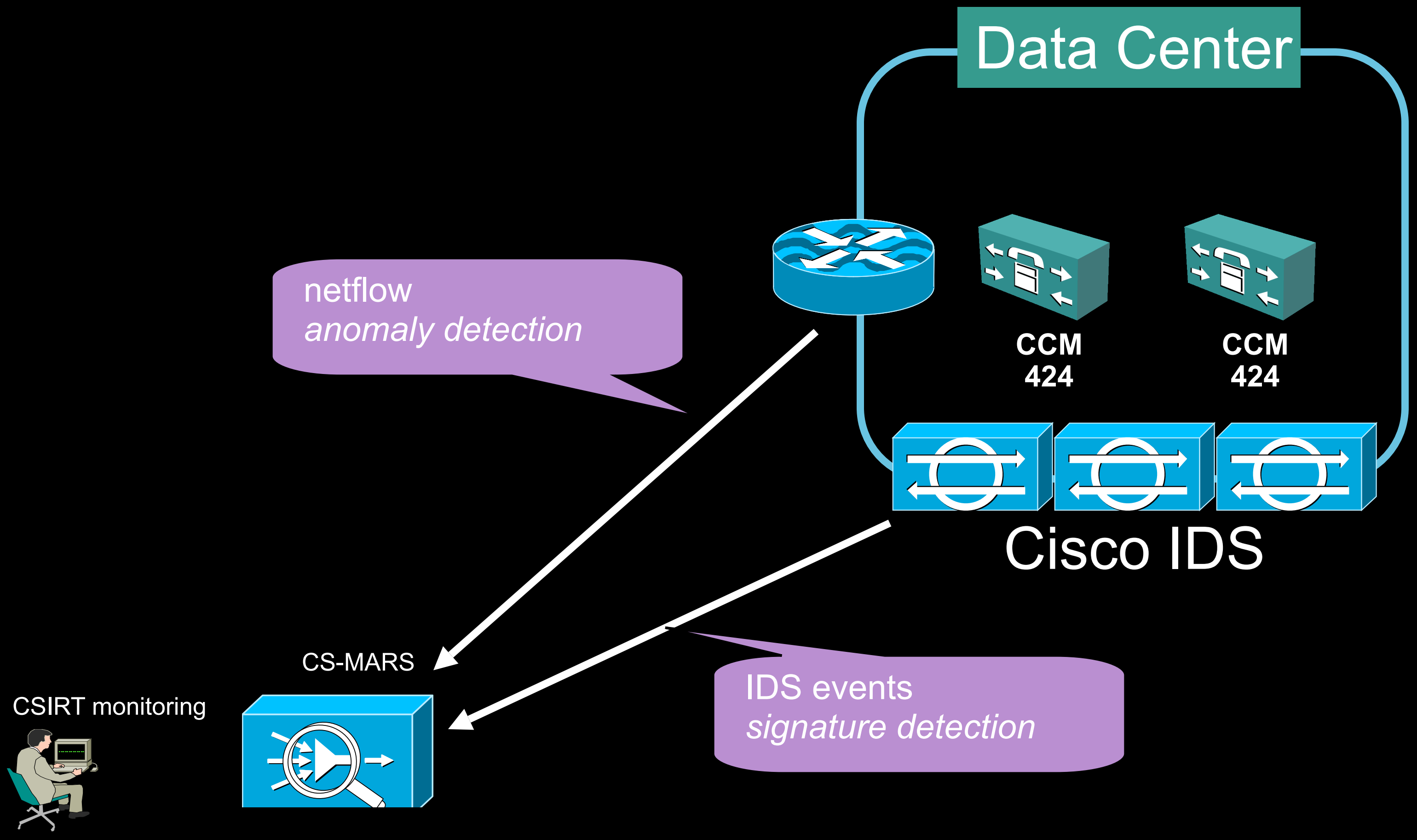
15 Customers

Chris Dedicoat
Sue Bostrom
Charles Stucki

3-5:30 PM

23rd Oct

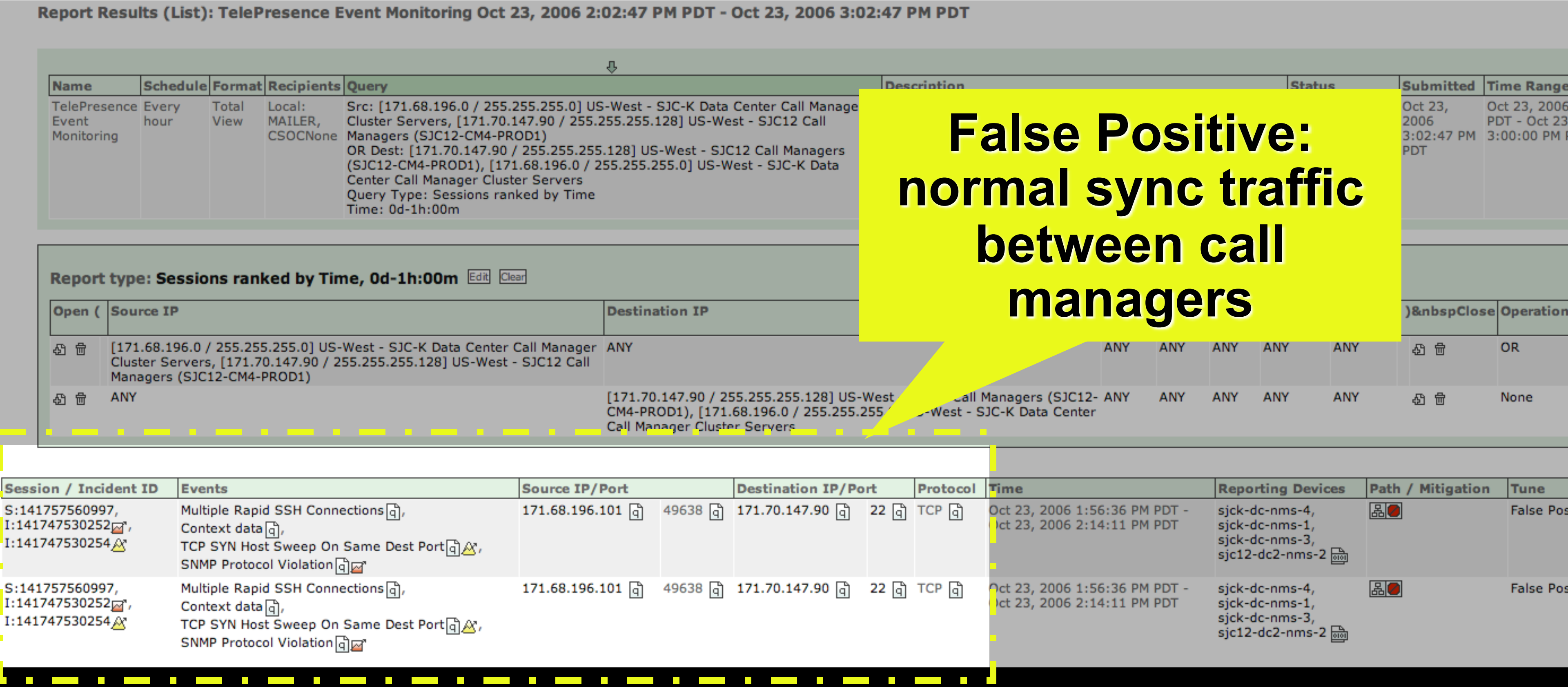
Monitoring Architecture
Cisco IDS, Netflow, and CS-MARS



netflow
anomaly detection

IDS events
signature detection

False Positive Traffic Example:
SSH sync between CM's



Report Results (List): TelePresence Event Monitoring Oct 23, 2006 2:02:47 PM PDT - Oct 23, 2006 3:02:47 PM PDT

Name	Schedule	Format	Recipients	Query	Description	Status	Submitted	Time Range
TelePresence Event Monitoring	Every hour	Total View	Local: MAILER, CSOCNone	Src: [171.68.196.0 / 255.255.255.0] US-West - SJC-K Data Center Call Manage Cluster Servers, [171.70.147.90 / 255.255.255.128] US-West - SJC12 Call Managers (SJC12-CM4-PROD1) OR Dest: [171.70.147.90 / 255.255.255.128] US-West - SJC12 Call Managers (SJC12-CM4-PROD1), [171.68.196.0 / 255.255.255.0] US-West - SJC-K Data Center Call Manager Cluster Servers Query Type: Sessions ranked by Time Time: 0d-1h:00m			Oct 23, 2006 3:02:47 PM PDT	Oct 23, 2006 PDT - Oct 23 3:00:00 PM

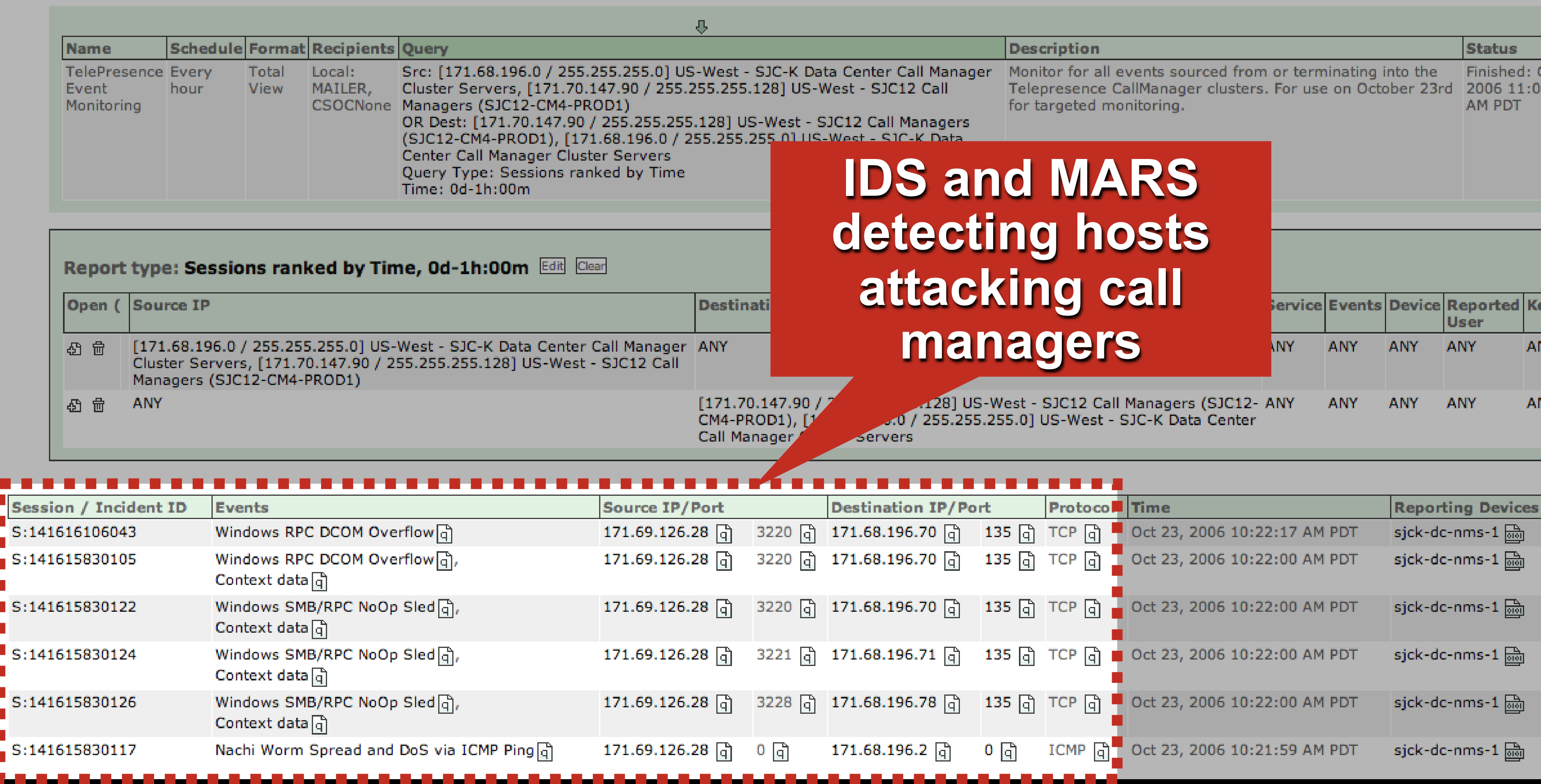
Report type: Sessions ranked by Time, 0d-1h:00m Edit Clear

Open (	Source IP	Destination IP						) Close	Operation
	[171.68.196.0 / 255.255.255.0] US-West - SJC-K Data Center Call Manager Cluster Servers, [171.70.147.90 / 255.255.255.128] US-West - SJC12 Call Managers (SJC12-CM4-PROD1)	ANY	ANY	ANY	ANY	ANY	ANY		OR
	ANY	[171.70.147.90 / 255.255.255.128] US-West Call Managers (SJC12-CM4-PROD1), [171.68.196.0 / 255.255.255 -West - SJC-K Data Center Call Manager Cluster Servers	ANY	ANY	ANY	ANY	ANY		None

Session / Incident ID	Events	Source IP/Port		Destination IP/Port		Protocol	Time	Reporting Devices	Path / Mitigation	Tune
S:141757560997, I:141747530252, I:141747530254	Multiple Rapid SSH Connections, Context data, TCP SYN Host Sweep On Same Dest Port, SNMP Protocol Violation	171.68.196.101	49638	171.70.147.90	22	TCP	Oct 23, 2006 1:56:36 PM PDT - Oct 23, 2006 2:14:11 PM PDT	sjck-dc-nms-4, sjck-dc-nms-1, sjck-dc-nms-3, sjc12-dc2-nms-2		False Pos
S:141757560997, I:141747530252, I:141747530254	Multiple Rapid SSH Connections, Context data, TCP SYN Host Sweep On Same Dest Port, SNMP Protocol Violation	171.68.196.101	49638	171.70.147.90	22	TCP	Oct 23, 2006 1:56:36 PM PDT - Oct 23, 2006 2:14:11 PM PDT	sjck-dc-nms-4, sjck-dc-nms-1, sjck-dc-nms-3, sjc12-dc2-nms-2		False Pos

False Positive: normal sync traffic between call managers

Security Event Example:
Infected host attacking call managers



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Report type: **Sessions ranked by Time, 0d-1h:00m** Edit Clear

Open (	Source IP	Destinati	ervice	Events	Device	Reported User	Ke
	[171.68.196.0 / 255.255.255.0] US-West - SJC-K Data Center Call Manager Cluster Servers, [171.70.147.90 / 255.255.255.128] US-West - SJC12 Call Managers (SJC12-CM4-PROD1)	ANY	NY	ANY	ANY	ANY	AI
	ANY	[171.70.147.90 / 2 128] US-West - SJC12 Call Managers (SJC12-CM4-PROD1), [1 .0 / 255.255.255.0] US-West - SJC-K Data Center Call Manager Servers	ANY	ANY	ANY	ANY	AI

Session / Incident ID	Events	Source IP/Port		Destination IP/Port		Protoco	Time	Reporting Devices
S:141616106043	Windows RPC DCOM Overflow	171.69.126.28	3220	171.68.196.70	135	TCP	Oct 23, 2006 10:22:17 AM PDT	sjck-dc-nms-1
S:141615830105	Windows RPC DCOM Overflow, Context data	171.69.126.28	3220	171.68.196.70	135	TCP	Oct 23, 2006 10:22:00 AM PDT	sjck-dc-nms-1
S:141615830122	Windows SMB/RPC NoOp Sled, Context data	171.69.126.28	3220	171.68.196.70	135	TCP	Oct 23, 2006 10:22:00 AM PDT	sjck-dc-nms-1
S:141615830124	Windows SMB/RPC NoOp Sled, Context data	171.69.126.28	3221	171.68.196.71	135	TCP	Oct 23, 2006 10:22:00 AM PDT	sjck-dc-nms-1
S:141615830126	Windows SMB/RPC NoOp Sled, Context data	171.69.126.28	3228	171.68.196.78	135	TCP	Oct 23, 2006 10:22:00 AM PDT	sjck-dc-nms-1
S:141615830117	Nachi Worm Spread and DoS via ICMP Ping	171.69.126.28	0	171.68.196.2	0	ICMP	Oct 23, 2006 10:21:59 AM PDT	sjck-dc-nms-1

IDS and MARS detecting hosts attacking call managers

Attacking host was blackholed and submitted for remediation

6 steps to improve your security monitoring

6. Troubleshoot

5. Feed and tune

4. Choose event sources

3. Select targets

2. Know the network

1. Know your policy

What We Assume About Our Audience

- You’ve got an incident response team
- You have experience deploying tools and monitoring
- Focus on discussing *deploying* monitoring solutions

Step 1. Build and understand your policy

Monitor Against Defined Policies

- Which policies to monitor?
  - Be concrete, precise
  - Which will management enforce?
- Types of policies
  - Compliance with regulations or standards
    - SOX – monitor financial apps and databases
    - HIPAA – monitor healthcare apps and databases
    - ISO 17799 - best practices for information security
  - Employee policies
    - Rogue devices – laptops, wireless, DC devices, honeypots, etc.
    - Employees using shared accounts
    - Hardened DMZ devices – services running that should not be?
    - Direct login with privileged accounts (root, DBA, etc.)
    - Tunneled traffic – P2P, etc.

Policy Monitoring Examples

- Policy: COBIT DS9.4: Configuration Control

  Monitor changes to network devices, reconcile against approved change lists

- Policy: No direct privileged logins

  Monitor IDS, SSH logs for successful *root* logins

- Policy: Use strong passwords

  Vulnerability scan for routers with with *cisco/cisco* credentials

- Policy: No internet access from production servers

  Monitor for accepted connections to Internet initiated from servers

- Policy: No protocol tunneling

  Monitor IDS alerts for protocols tunneled over DNS to/from non-DNS servers

Example: FTP Root Login

```
evIdsAlert:  eventId="1173129985693574851"  severity="low"  vendor="Cisco"
    originator:
        hostId:  rcdn4-dmz-nms-1
        appName:  sensorApp
        appInstanceId:  421
    time:  Mar 22 2007 18:14:39 EDT (117                              '0"  timeZone="UTC"
    signature:  version="S31"  description                             "  id="3171"
        subsigId:  1
        sigDetails:  USER administrator
        marsCategory:  Info/SuccessfulLogin/FTP
    interfaceGroup:  vs0
    vlan:  0
    participants:
        attacker:
            addr:  163.180.17.91  locality="OUT"
            port:  1387
        target:
            addr:  12.19.88.226  locality="IN"
            port:  21
            os:  idSource="unknown"  relevance="unknown"  type="unknown"
    summary:  2  final="true"  initialAlert="1173129985693574773"  summaryType="Regular"
    alertDetails:  Regular Summary: 2 events this interval ;
    riskRatingValue:  37  targetValueRating="medium"
    threatRatingValue:  37
    interface:  ge0_0
    protocol:  tcp
```

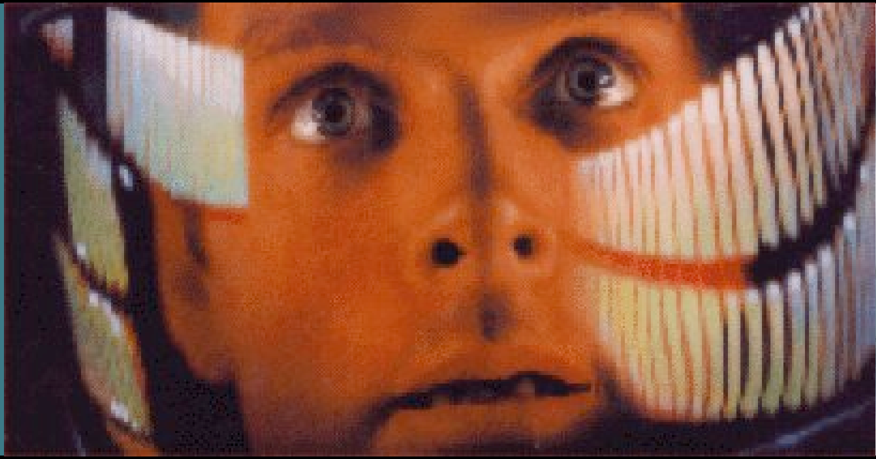
Caught successful FTP Administrator login via IDS

Example: SSH root login message

```
Mar 28 16:19:01 xianshield ssh                98]:
session opened for user root by (uid=0)
```

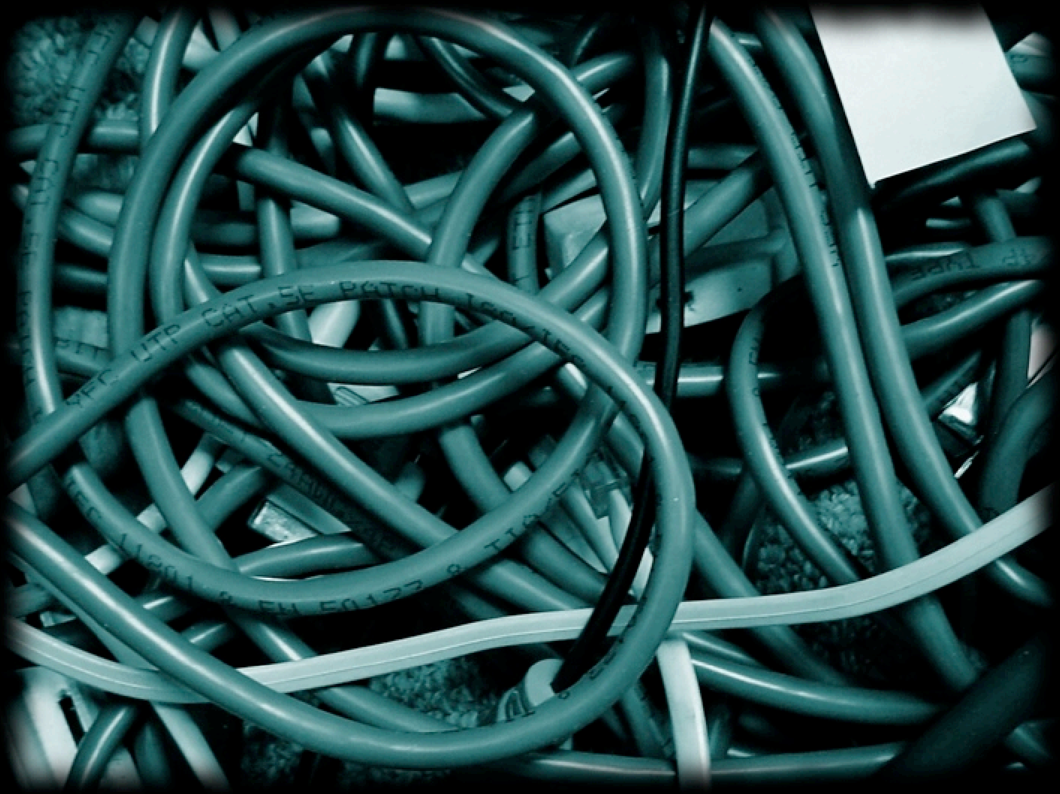
Caught direct root login via syslog

Step 2: Know Your Network



Do You Have a Self Defeating Network?

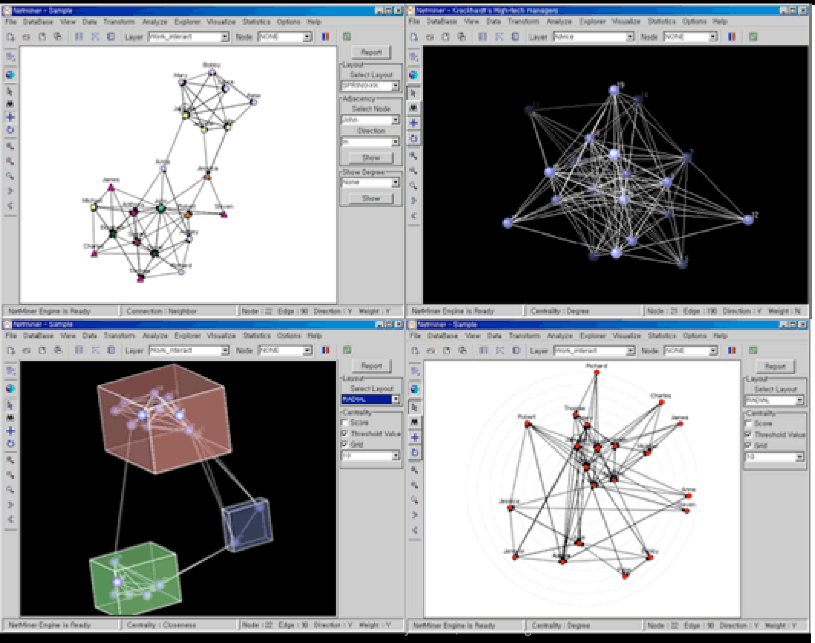
- Unknown
- Unmonitored
- Uncontrolled
- Unmanned
- Trusted

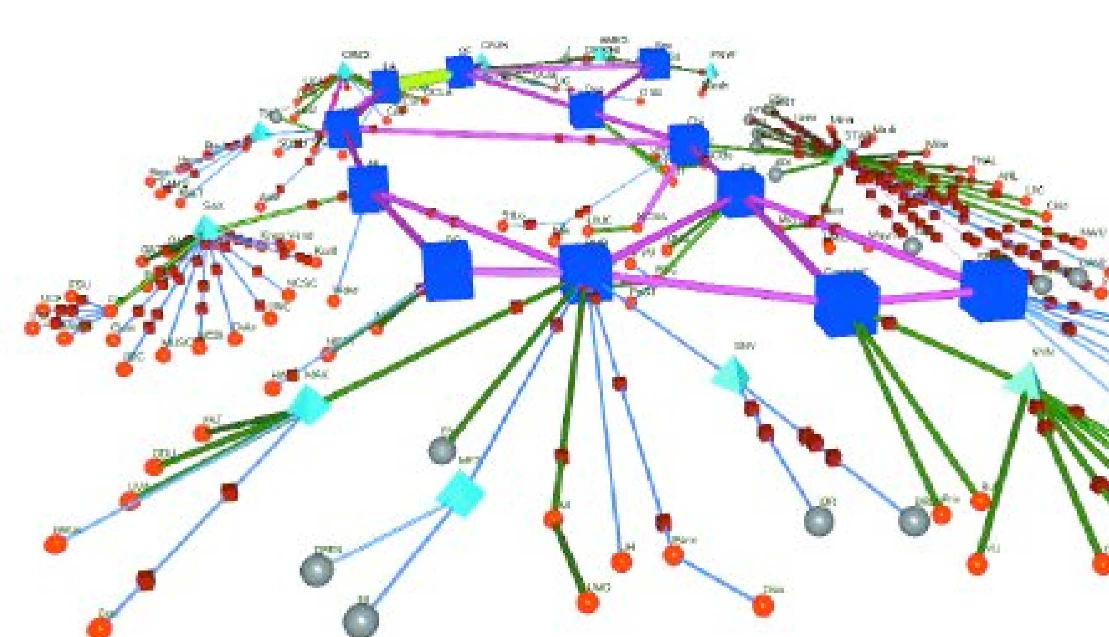


Source: Richard Beijtlich

What Is Meant by ‘Telemetry’?

Te·lem·e·try— a technology that allows the remote measurement and reporting of information of interest to the system designer or operator. The word is derived from Greek roots *tele* = remote, and *metron* = measure





Network Telemetry - What's it Do For Me?

- Historically used for capacity planning
- Detects attacks
  - With analysis tools, can detect anomalies
- Supports investigations
  - Tools can collect, trend, and correlate activity
- Well supported
  - Arbor PeakFlow
  - CS-MARS
  - NetQoS
  - OSU FlowTools
- Simple to understand

Network Telemetry — Time Synchronization

- Without it, can’t correlate different sources
- Enable Network Time Protocol (NTP) everywhere

  supported by routers, switches, firewalls, hosts, and other network-attached devices
- Use UTC for time zones

What is NetFlow?

- NetFlow is a form of *telemetry* pushed from the network devices.
- Netflow is best used in combination with other technologies: IPS, vulnerability scanners, and full traffic capture.

  Traffic capture is like a *wiretap*

  NetFlow is like a *phone bill*
- We can learn a lot from studying the network phone bill!

  Who's talking to whom? And when?

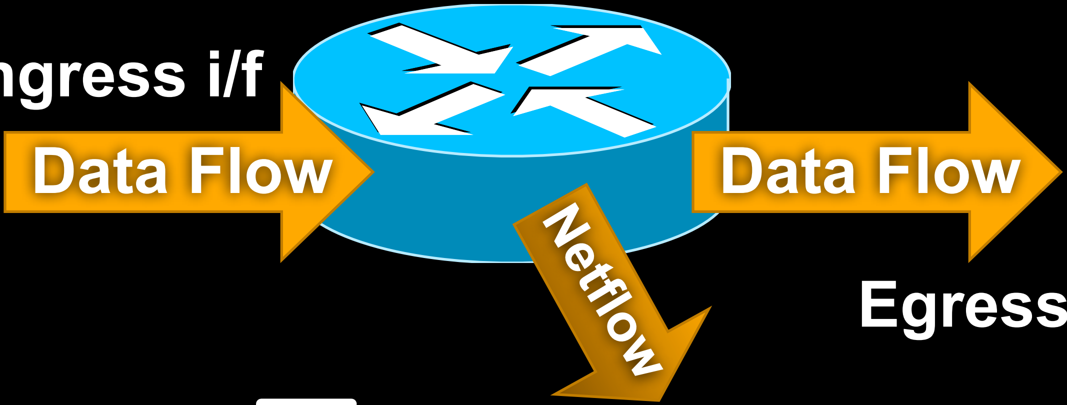
  Over what protocols & ports?

  How much data was transferred?

  At what speed?

  For what duration?

Netflow



Ingress i/f

Netflow is our #1 tool

Egress i/f

Usage

- Packet Count
- Byte Count

Time of Day

- Start sysUpTime
- End sysUpTime

Port Utilization

- Input ifIndex
- Output ifIndex

QoS

- Type of Service
- TCP Flags
- Protocol

From/To

- Source IP Address
- Destination IP Address

Application

- Source TCP/UDP Port
- Destination TCP/UDP Port

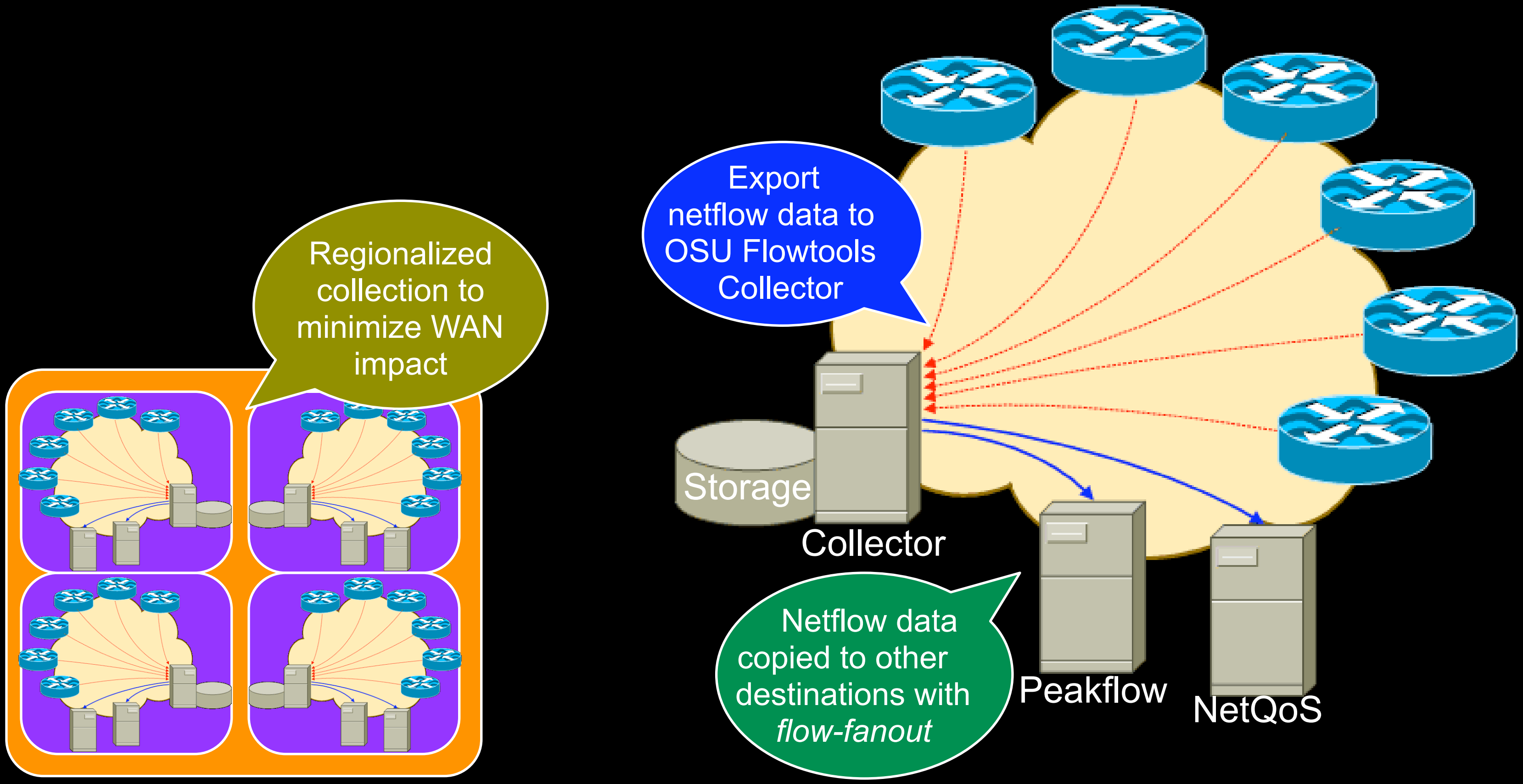
Routing and Peering

- Next Hop Address
- Source AS Number
- Dest. AS Number
- Source Prefix Mask
- Dest. Prefix Mask

Netflow Setup

- Don't have a copy of netflow data b/c IT won't share?

  Many products have the ability to copy flow data off to other destinations



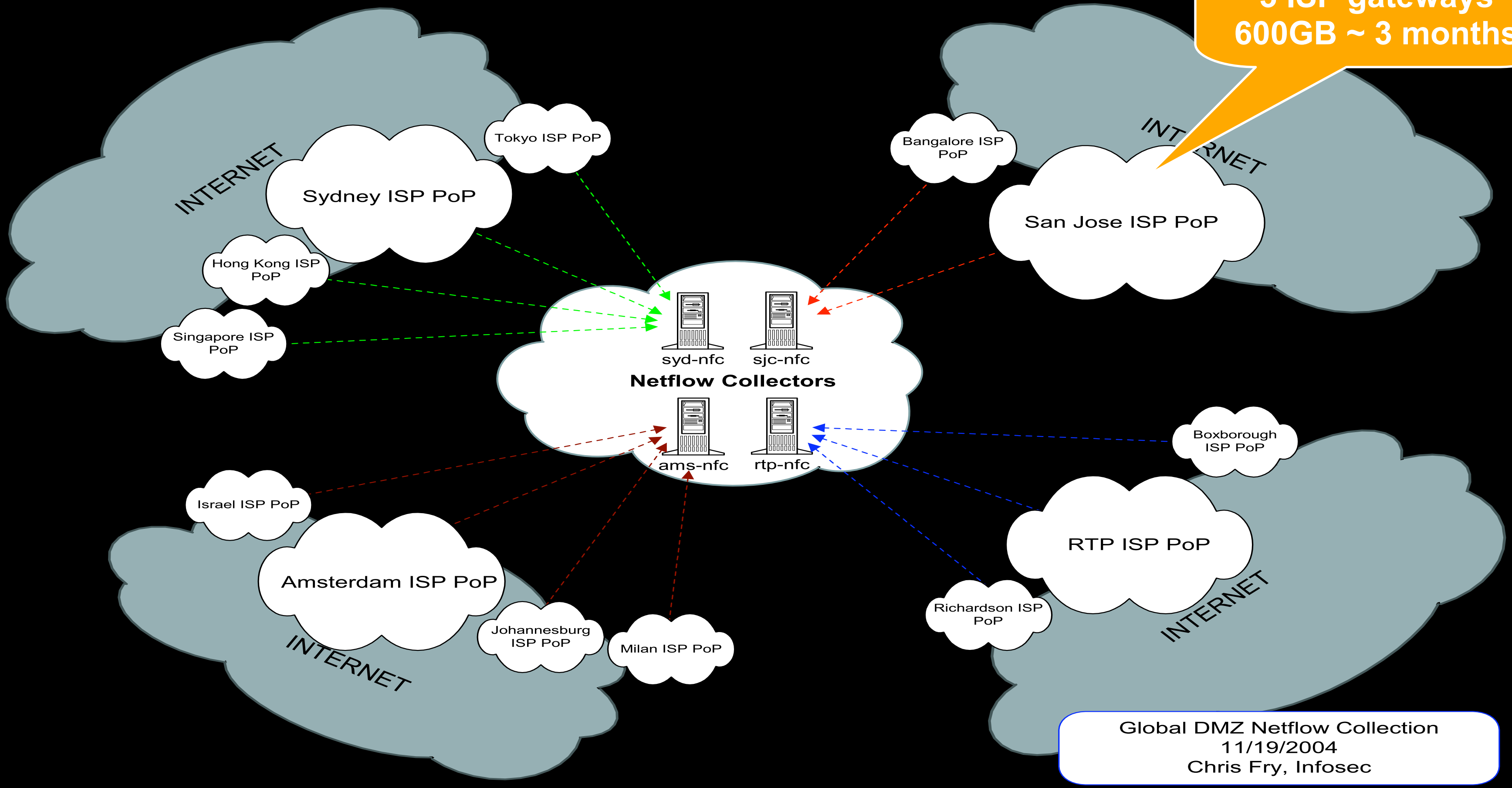
Regionalized collection to minimize WAN impact

Export netflow data to OSU Flowtools Collector

Netflow data copied to other destinations with *flow-fanout*

NetFlow Collection at Cisco

- DMZ Netflow Collection (4 servers)
- Data Center Netflow Collection (20+ servers)
- Query/Reporting tools (OSU Flowtools, DFlow, Netflow Report Generator)



200K pps
3 ISP gateways
600GB ~ 3 months

Global DMZ Netflow Collection
11/19/2004
Chris Fry, Infosec

OSU Flowtools - Netflow Collector Setup

- Tool: OSU FlowTools

  Free

  Developed by Ohio State University

- Examples of capabilities

  - Did 192.168.15.40 talk to 216.213.22.14?
  - What hosts and ports did 192.168.15.40 talk to?
  - Who’s connecting to port TCP/6667?
  - Did anyone transfer data > 500MB to an external host?

OSU Flowtools Example - Who’s Talking?

- Scenario - New botnet, variant undetected

  Goal: identify all systems that ‘talked’ to the botnet C&C

  Be glad: you have netflow collection at all your PoPs

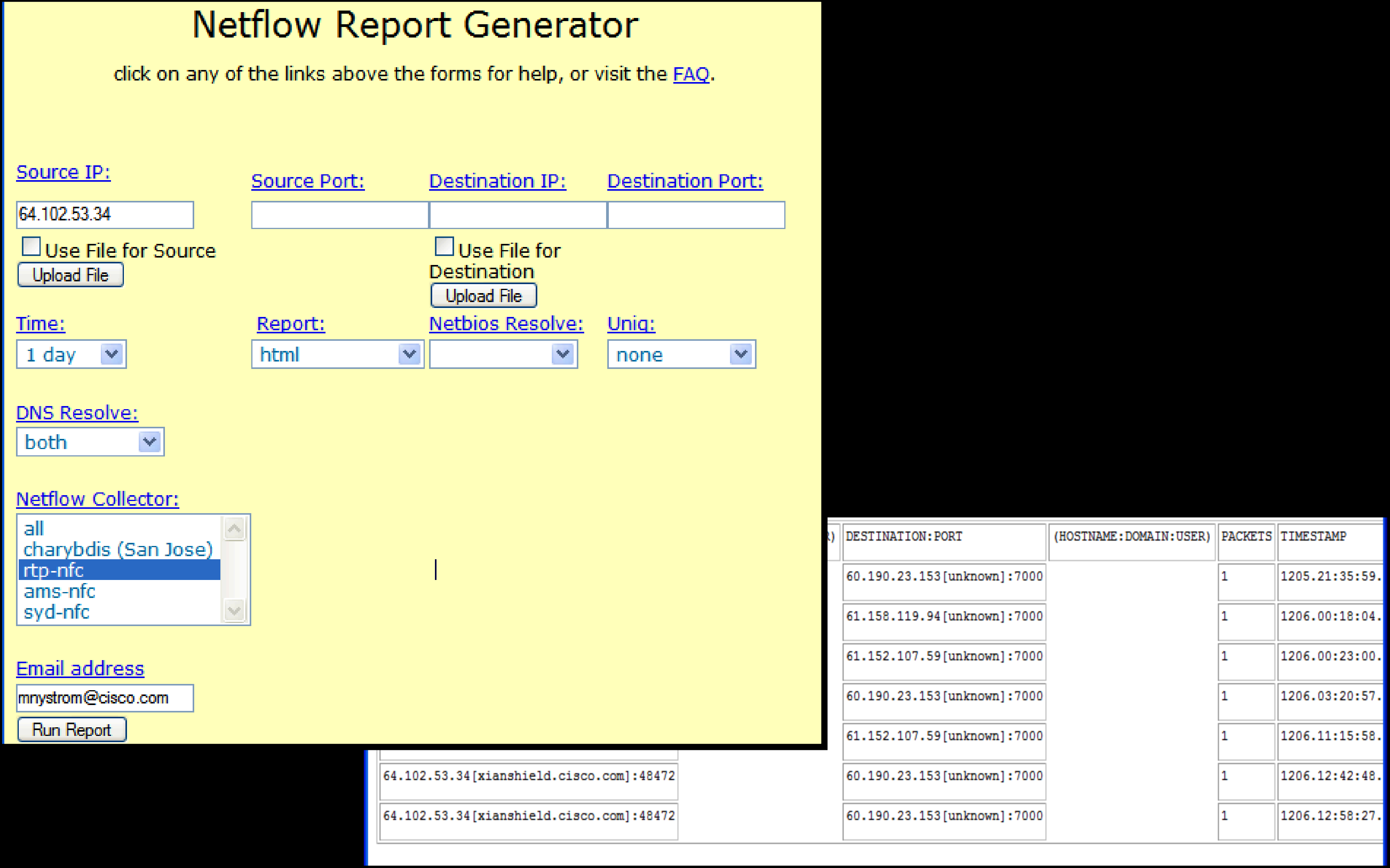
flow.acl file uses familiar ACL syntax. create a list named ‘bot’

concatenate all files from Feb 12, 2007 then filter for src or dest of ‘bot’ acl

host in the botnet!

```
[mynfchost]$ head flow.acl
ip access-list standard bot permit host 69.50.18
ip access-list standard bot permit host 66.182.15

[mynfchost]$ flow-cat /var/local/flows/data/2007-02-12/ft* | flow-filter -Sbot -o -Dbot |
flow-print -f5

Start             End               Sif   SrcIPaddress    SrcP  DIf   DstIPa
DstP

0213.08:39:49.911 0213.08:40:34.519 58    10.10.71.100    8343  98    69.50.        7

0213.08:40:33.590 0213.08:40:42.294 98    69.50.180.3     31337 58    10.10.71.100    83
```

NetFlow Report Generator – Query by IP



Netflow Report Generator

click on any of the links above the forms for help, or visit the FAQ.

Source IP: 64.102.53.34

□ Use File for Source

Source Port:

Destination IP:

Destination Port:

□ Use File for Destination

Time: 1 day

Report: html

Netbios Resolve:

Uniq: none

DNS Resolve: both

Netflow Collector:

Email address: mnystrom@cisco.com

	R)	DESTINATION:PORT	(HOSTNAME:DOMAIN:USER)	PACKETS	TIMESTAMP
		60.190.23.153[unknown]:7000		1	1205.21:35:59.
		61.158.119.94[unknown]:7000		1	1206.00:18:04.
		61.152.107.59[unknown]:7000		1	1206.00:23:00.
		60.190.23.153[unknown]:7000		1	1206.03:20:57.
		61.152.107.59[unknown]:7000		1	1206.11:15:58.
64.102.53.34[xianshield.cisco.com]:48472		60.190.23.153[unknown]:7000		1	1206.12:42:48.
64.102.53.34[xianshield.cisco.com]:48472		60.190.23.153[unknown]:7000		1	1206.12:58:27.

IP Address Data

- Critical to understanding a given incident involving 10.2.3.5

  Is 10.2.3.5 in your DMZ? lab? remote access? desktop? data center?

- Make the data queryable

  Commercial & open source products available

- Build the data into your security devices

  SIMS - netForensics asset groups

  SIMS - CS-MARS network groups

  IDS - Cisco network locale variables

```
variables DC_NETWORKS address 10.2.121.0-10.2.121.255,10.3.120.0-10.3.127.
255,10.4.8.0-10.4.15.255
variables DMZ_PROD_NETWORKS address 198.133.219.0-198.133.219.255
variables DMZ_LAB_NETWORKS 172.16.10.0-172.16.11.255
```

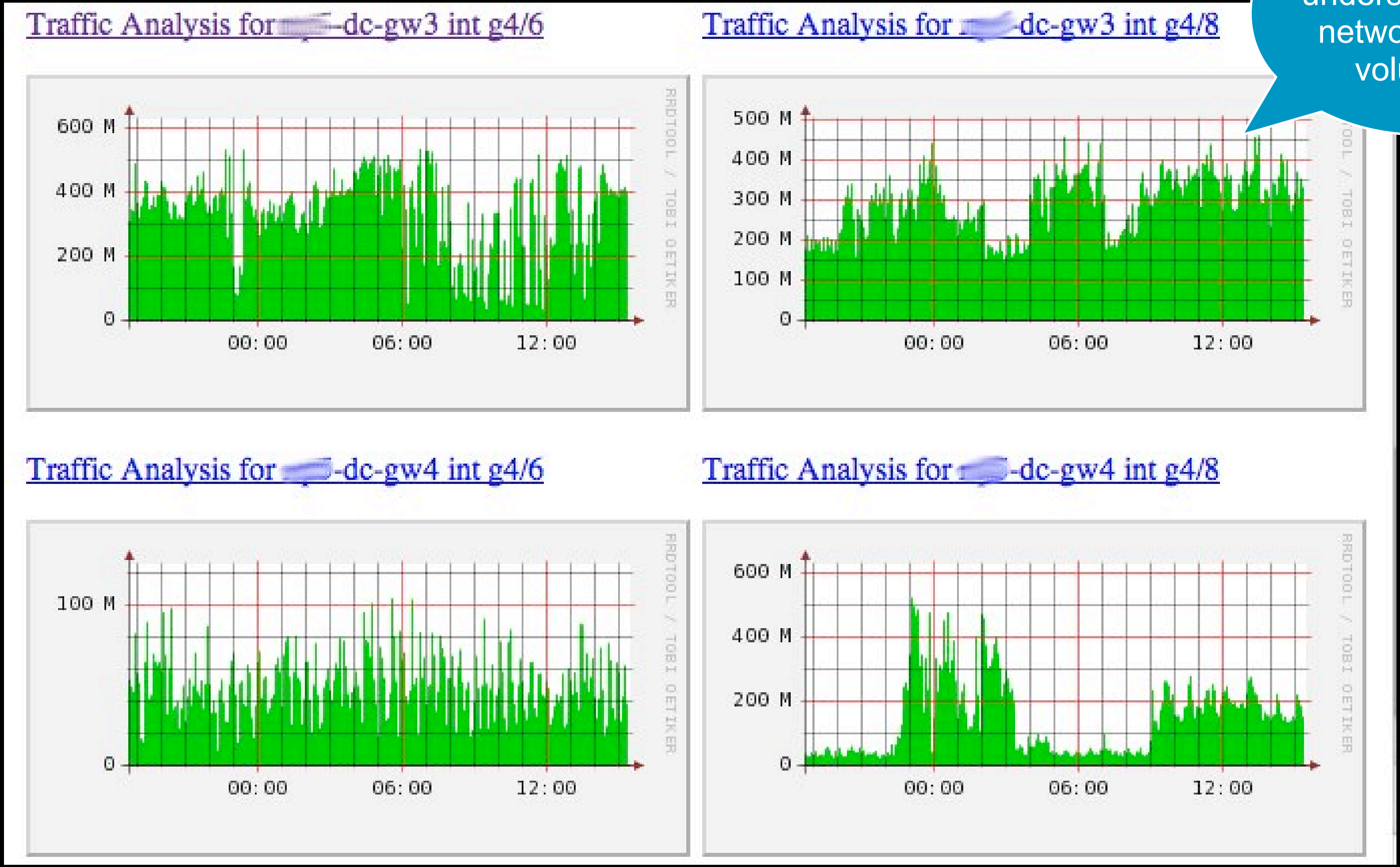
```
 eventId=1168468372254753459 eventType=evIdsAlert hostId=xxx-dc-nms-4appName=sensor
appInstanceId=6718 tmTime=1178426525155 severity=1 vLan=700 Interface=ge2_1 Protoc
riskRatingValue=26 sigId=11245 sigDetails=NICK...USER" src=10.2.121.10 srcDir=DC_NETWORKS
srcport=40266 dst=208.71.169.36 dstDir=OUT
 dstport=6665
```

Data center host!

Network Telemetry - MRTG/RRDTool

- Not just netflow, can also use SNMP to grab telemetry
- Shows data volumes between endpoints

You must understand your network traffic volume!



Traffic Analysis for [redacted]-dc-gw3 int g4/6

Traffic Analysis for [redacted]-dc-gw3 int g4/8

Traffic Analysis for [redacted]-dc-gw4 int g4/6

Traffic Analysis for [redacted]-dc-gw4 int g4/8

Step 3. Select Your Targets

1. Determine Which Assets to Monitor

- Face it: you can't monitor everything equally
- How to prioritize?
    - Revenue impact?
    - Regulatory compliance/legal obligation?
    - Expense reduction?
    - At risk?
        - Systems that can't be patched
        - Most attractive targets to hackers?
    - Sensitive data?
    - Visibility to upper management?
    - Manageable event rates?

- Hopefully, someone else figured this out for you
    - Disaster planning teams
- Which incidents can be mitigated?

Recommendation: Best Targets

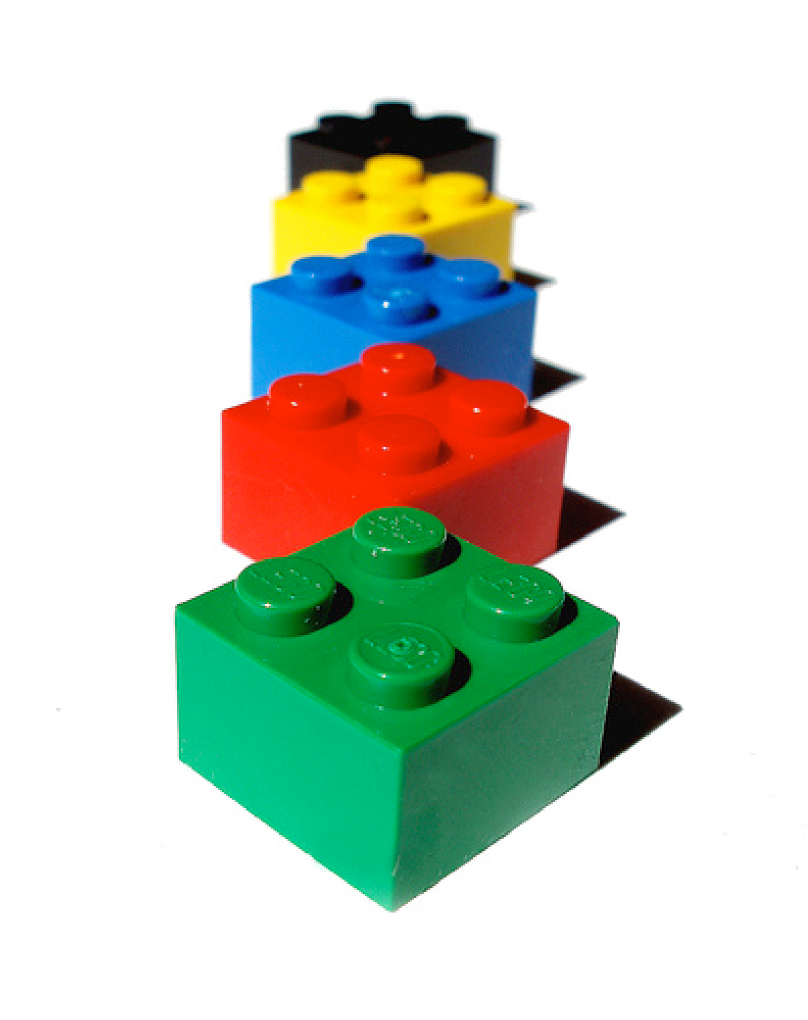
1. Accesses sensitive data
   - Legal compliance
   - Intellectual property
   - Customer sensitive data
2. Risky

   Fewer controls (ACL’s, poor configs, etc.)

   Hard to patch (limited patch windows, high uptime requirements, custom vendor code, etc.)
3. Generates revenue
4. Produces actionable events
   - Why monitor if you can’t mitigate?

2. Determine Components to Monitor

- What assets are associated with the target?
  - host names
  - databases
  - applications
  - network devices
- Example: Monitor ERP system
  - List assets associated with system
    - 10 clustered Linux servers
    - 5 clustered database servers
    - 4 “logical” application names
    - 1 LDAP server
  - Policy: Database should only be accessed from app server
  - Monitor for:
    - Outbound connections from db
    - Access to DB on non SQL ports (SSH, terminal services, etc.)



Step 4. Choose Event Sources

Choosing Event Sources: What to Consider

- How will you use it?
  - For monitoring
  - For incident response
  - For investigations
- How will you collect it?
  - Pushed from device (syslog, netflow, etc.)
  - Pulled from device (SDEE, SNMP, Windows logs, etc.)
  - Detected with special equipment (IDS, etc.)
- Performance: what will it do to the sending device?
  - Can you get sufficient detail?
  - Will the support staff give it to you?

Choosing Event Sources: What to Consider (cont.)

- How much storage do you have?
- What tools will you use to read it?

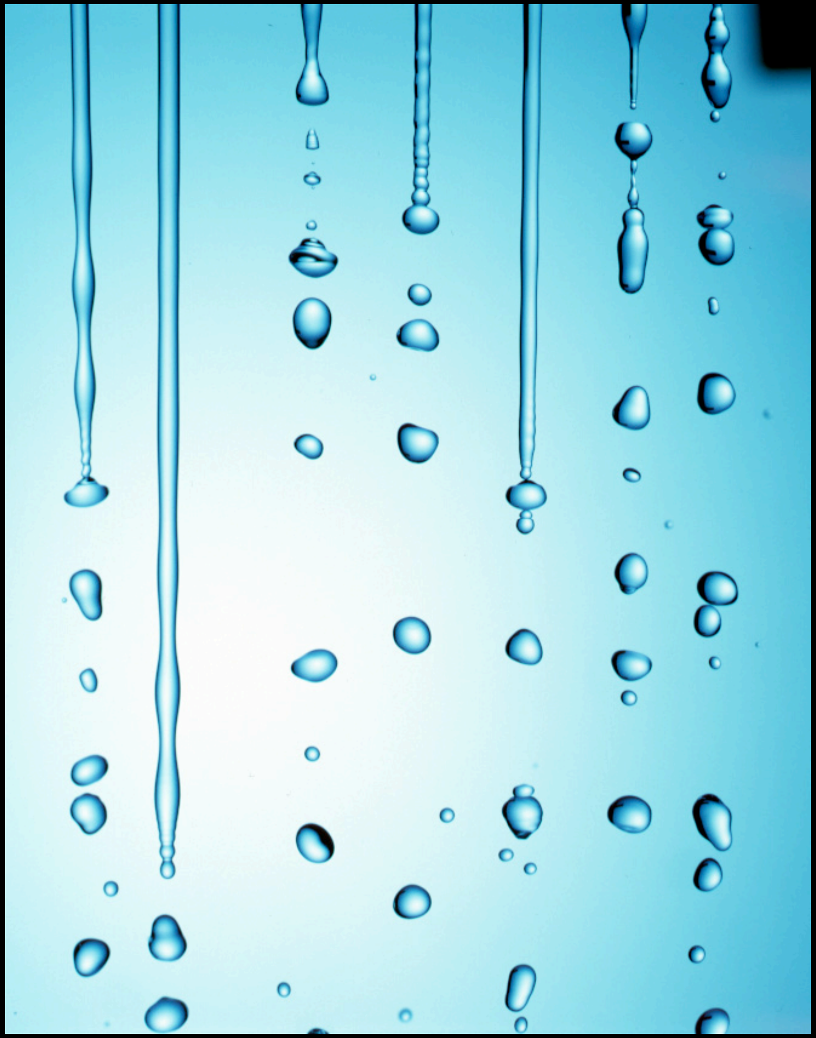
  SIM, log analyzer, etc.
- Application specific

  Can you recognize “false positive” patterns and tune them out?

  Will you get enough information to act on it without a full packet-capture?

  Can you identify specific incidents and how you’d see it with your event source?

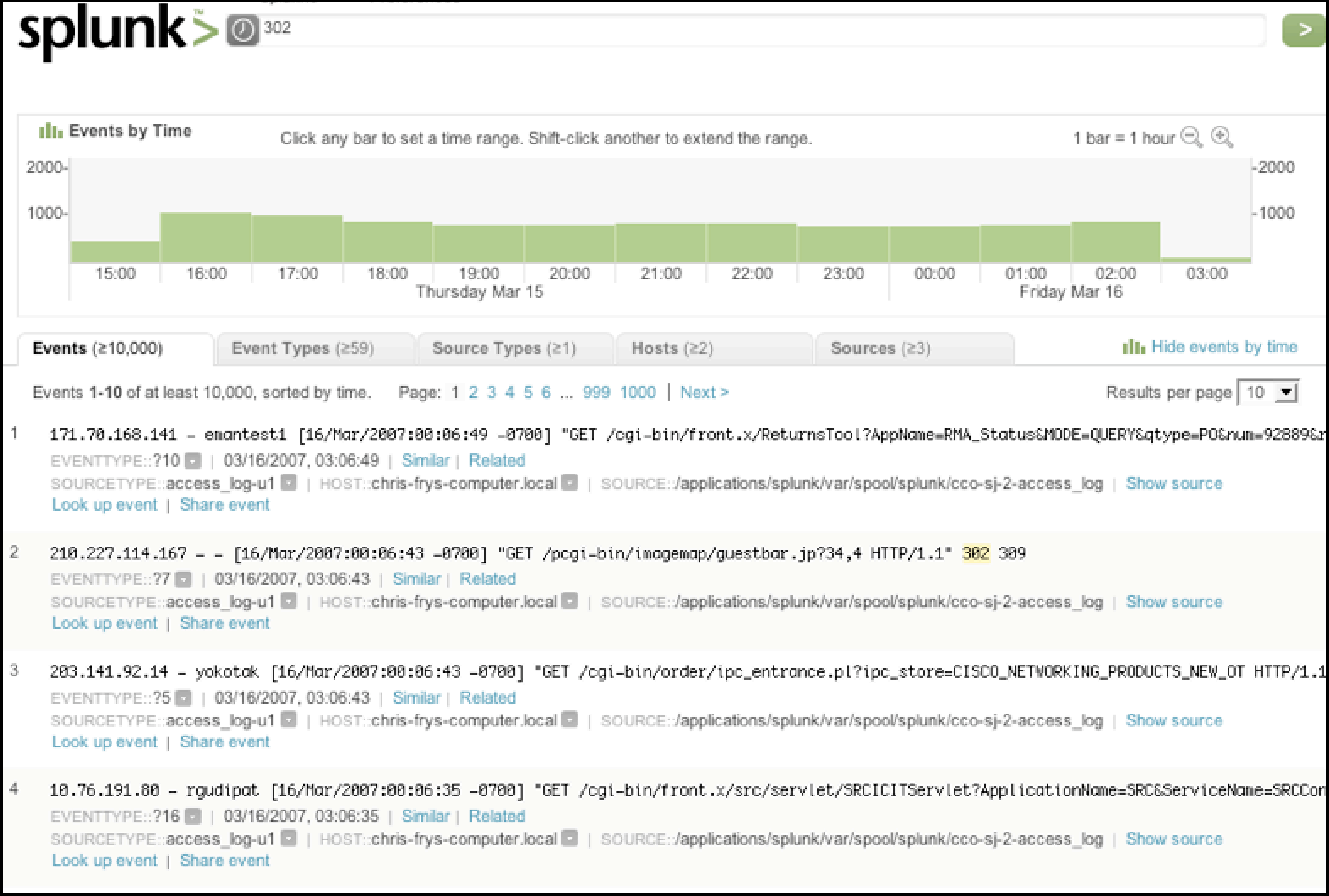
  Do you know what you’d do with it if there’s really an incident?



Three Best Event Sources

- Netflow
  - Collect at chokepoints (data center gateways)
  - Cheap to collect: SJC stores 3 ISP gateways, 200k pps, 600GB storage, can query back 3 months
  - Free tools to collect, relay, query
    - OSU FlowTools, nfdump/nfsen, etc.
- Network IDS
  - Collect at chokepoints (data center gateways)
  - No agents or feeds taxing end systems
- Host logs
  - Unix: syslog
  - Collect common services via syslog (web servers, mail servers, etc.)
  - Collect with syslog relay/collector
    - syslog-ng, splunk, etc.
  - Collect Windows logs into same infra with Snare agents

Searching Through Logs w/Splunk



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Events by Time

Click any bar to set a time range. Shift-click another to extend the range.

1 bar = 1 hour

Events (≥10,000) | Event Types (≥59) | Source Types (≥1) | Hosts (≥2) | Sources (≥3)

Hide events by time

Events **1-10** of at least 10,000, sorted by time. Page: 1 2 3 4 5 6 ... 999 1000 | Next >

Results per page 10

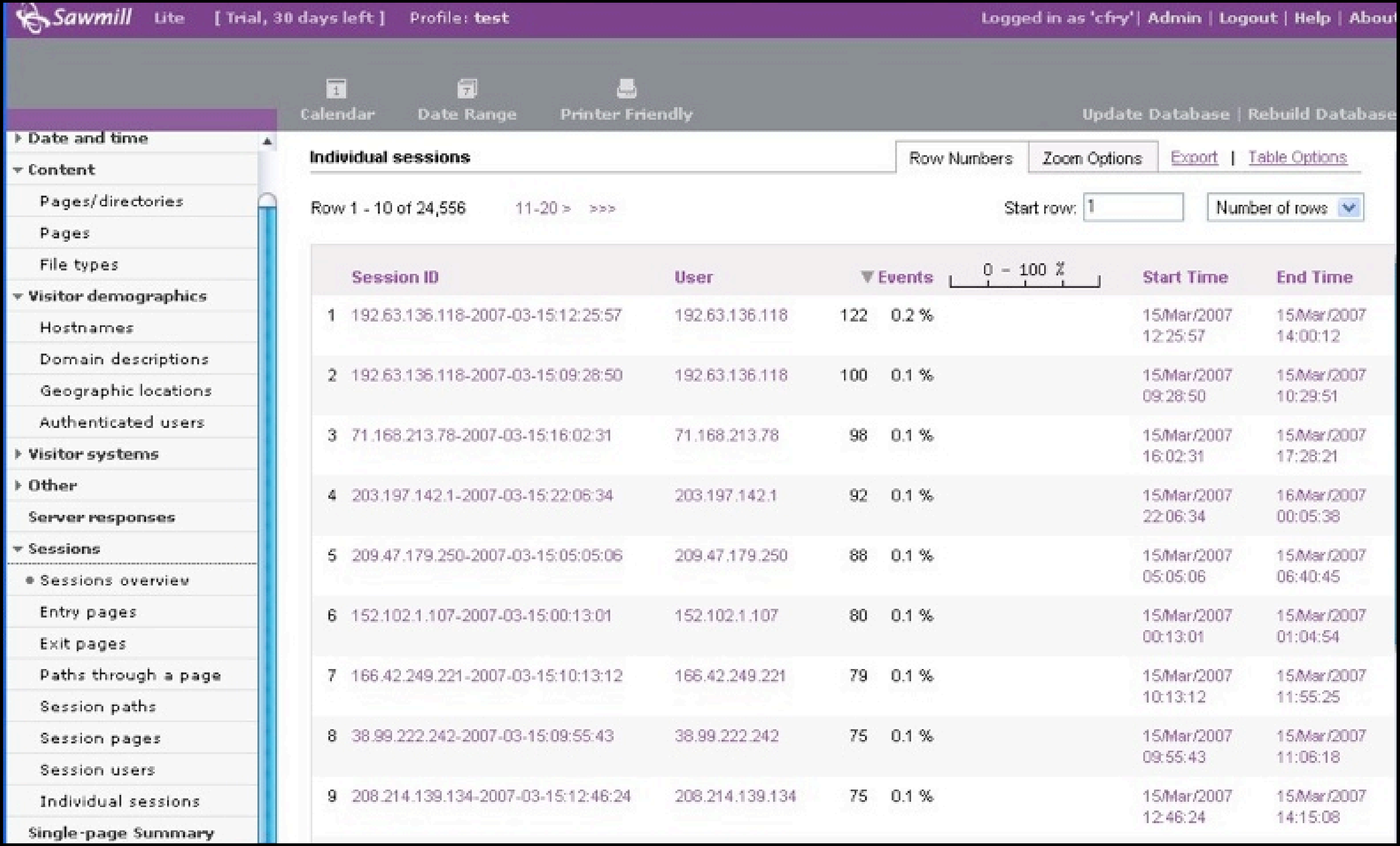
```
1  171.70.168.141 - emantest1 [16/Mar/2007:00:06:49 -0700] "GET /cgi-bin/front.x/ReturnsTool?AppName=RMA_Status&MODE=QUERY&qtype=PO&num=92889&r
   EVENTTYPE::?10 | 03/16/2007, 03:06:49 | Similar | Related
   SOURCETYPE::access_log-u1 | HOST::chris-frys-computer.local | SOURCE::/applications/splunk/var/spool/splunk/cco-sj-2-access_log | Show source
   Look up event | Share event

2  210.227.114.167 - - [16/Mar/2007:00:06:43 -0700] "GET /pcgi-bin/imagemap/guestbar.jp?34,4 HTTP/1.1" 302 309
   EVENTTYPE::?7 | 03/16/2007, 03:06:43 | Similar | Related
   SOURCETYPE::access_log-u1 | HOST::chris-frys-computer.local | SOURCE::/applications/splunk/var/spool/splunk/cco-sj-2-access_log | Show source
   Look up event | Share event

3  203.141.92.14 - yokotak [16/Mar/2007:00:06:43 -0700] "GET /cgi-bin/order/ipc_entrance.pl?ipc_store=CISCO_NETWORKING_PRODUCTS_NEW_OT HTTP/1.1
   EVENTTYPE::?5 | 03/16/2007, 03:06:43 | Similar | Related
   SOURCETYPE::access_log-u1 | HOST::chris-frys-computer.local | SOURCE::/applications/splunk/var/spool/splunk/cco-sj-2-access_log | Show source
   Look up event | Share event

4  10.76.191.80 - rgudipat [16/Mar/2007:00:06:35 -0700] "GET /cgi-bin/front.x/src/servlet/SRCICITServlet?ApplicationName=SRC&ServiceName=SRCCon
   EVENTTYPE::?16 | 03/16/2007, 03:06:35 | Similar | Related
   SOURCETYPE::access_log-u1 | HOST::chris-frys-computer.local | SOURCE::/applications/splunk/var/spool/splunk/cco-sj-2-access_log | Show source
   Look up event | Share event
```

Searching Through Logs w/Sawmill



Individual sessions

Row 1 - 10 of 24,556 11-20 > >>>

	Session ID	User	▼Events		0 - 100 %	Start Time	End Time
1	192.63.136.118-2007-03-15:12:25:57	192.63.136.118	122	0.2 %		15/Mar/2007 12:25:57	15/Mar/2007 14:00:12
2	192.63.136.118-2007-03-15:09:28:50	192.63.136.118	100	0.1 %		15/Mar/2007 09:28:50	15/Mar/2007 10:29:51
3	71.168.213.78-2007-03-15:16:02:31	71.168.213.78	98	0.1 %		15/Mar/2007 16:02:31	15/Mar/2007 17:28:21
4	203.197.142.1-2007-03-15:22:06:34	203.197.142.1	92	0.1 %		15/Mar/2007 22:06:34	16/Mar/2007 00:05:38
5	209.47.179.250-2007-03-15:05:05:06	209.47.179.250	88	0.1 %		15/Mar/2007 05:05:06	15/Mar/2007 06:40:45
6	152.102.1.107-2007-03-15:00:13:01	152.102.1.107	80	0.1 %		15/Mar/2007 00:13:01	15/Mar/2007 01:04:54
7	166.42.249.221-2007-03-15:10:13:12	166.42.249.221	79	0.1 %		15/Mar/2007 10:13:12	15/Mar/2007 11:55:25
8	38.99.222.242-2007-03-15:09:55:43	38.99.222.242	75	0.1 %		15/Mar/2007 09:55:43	15/Mar/2007 11:06:18
9	208.214.139.134-2007-03-15:12:46:24	208.214.139.134	75	0.1 %		15/Mar/2007 12:46:24	15/Mar/2007 14:15:08

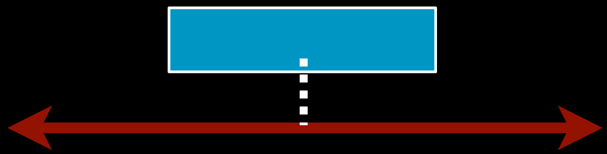
Step 5. Feed and Tune

IDS/IPS Refresher

- IDS - Intrusion Detection System

  passive network traffic monitoring

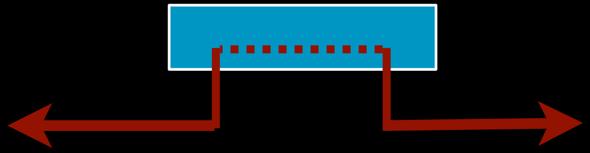
  limited actions, mostly for alerting

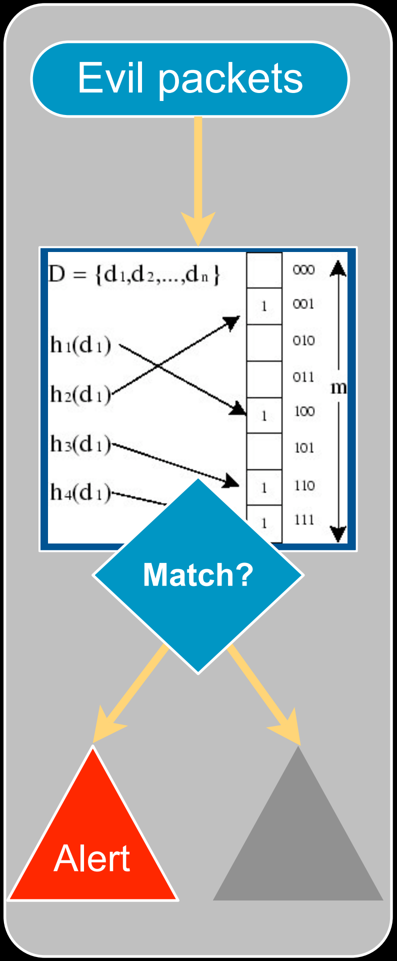


- IPS - Intrusion Prevention System

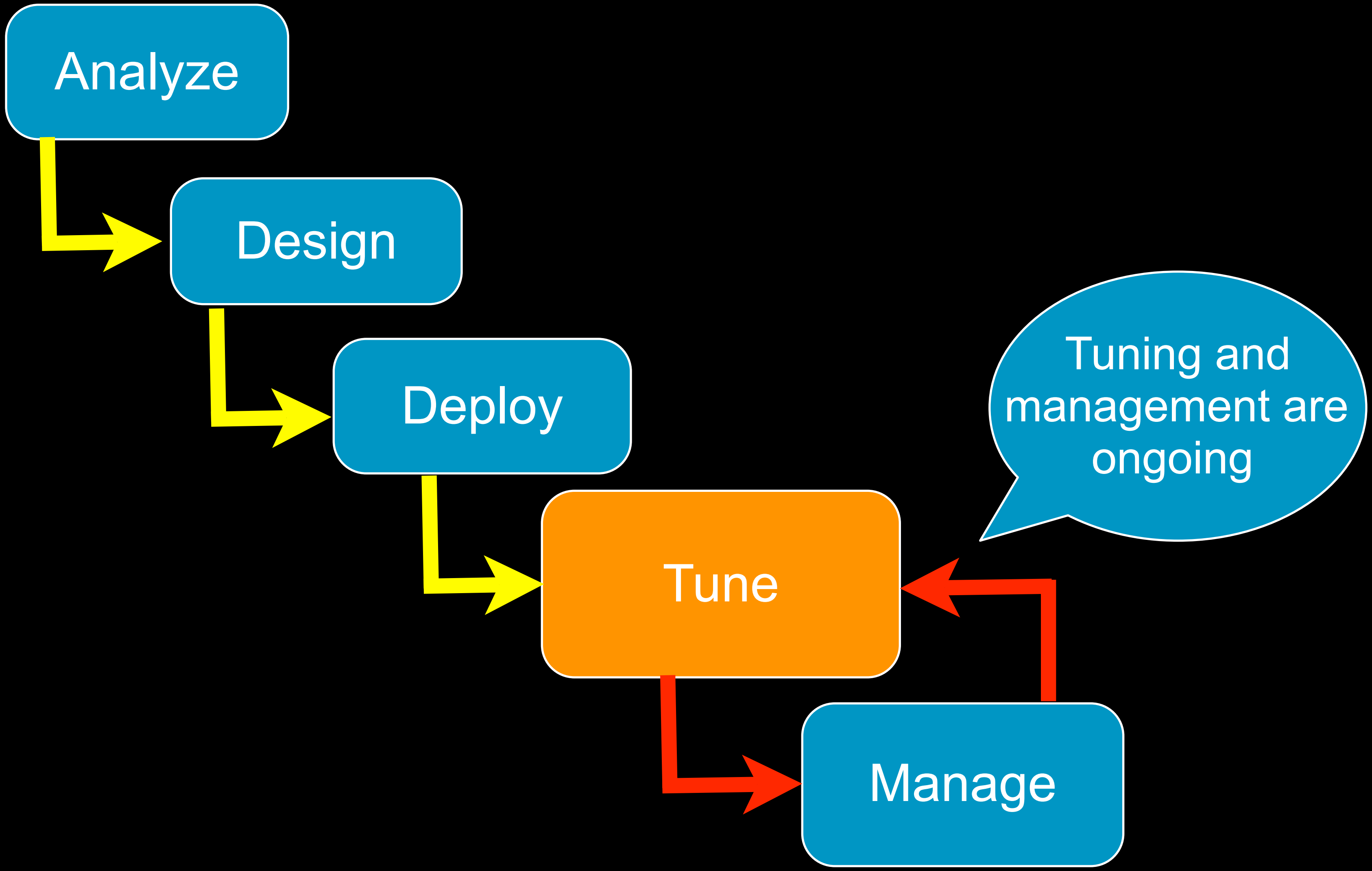
  inline network traffic monitoring

  alerting + ability to drop packets



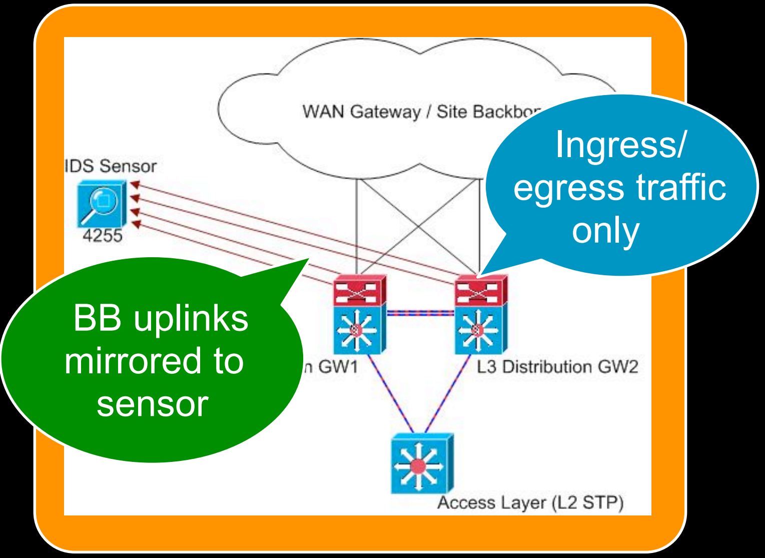


IDS - basic deployment steps



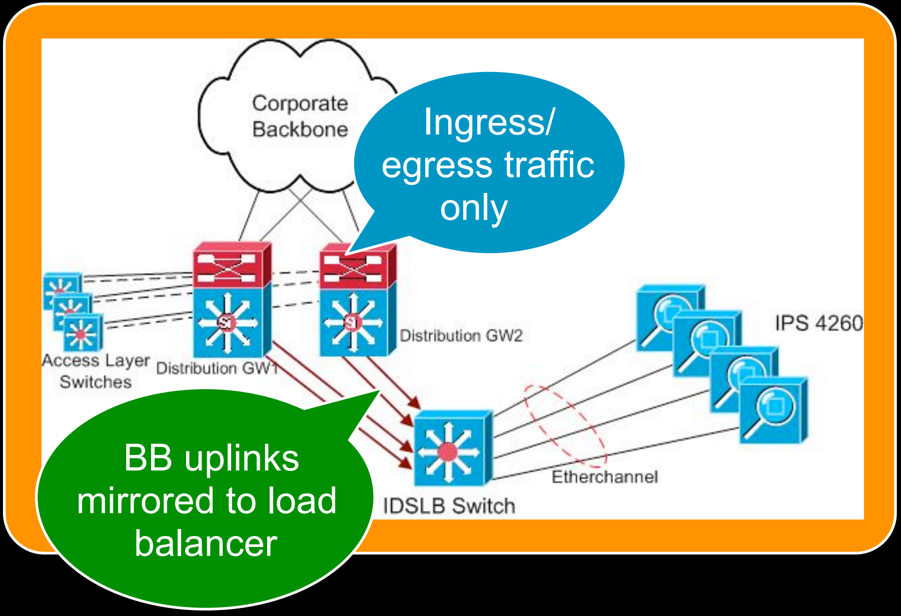
Setup IDS

- Avoid asymmetry in your *traffic view!*
- Minimize the number of platforms and designs
  - Two different designs: small vs. large data centers
  - Distribution layer router uplink traffic ideal



Ingress/ egress traffic only

BB uplinks mirrored to sensor



Ingress/ egress traffic only

BB uplinks mirrored to load balancer

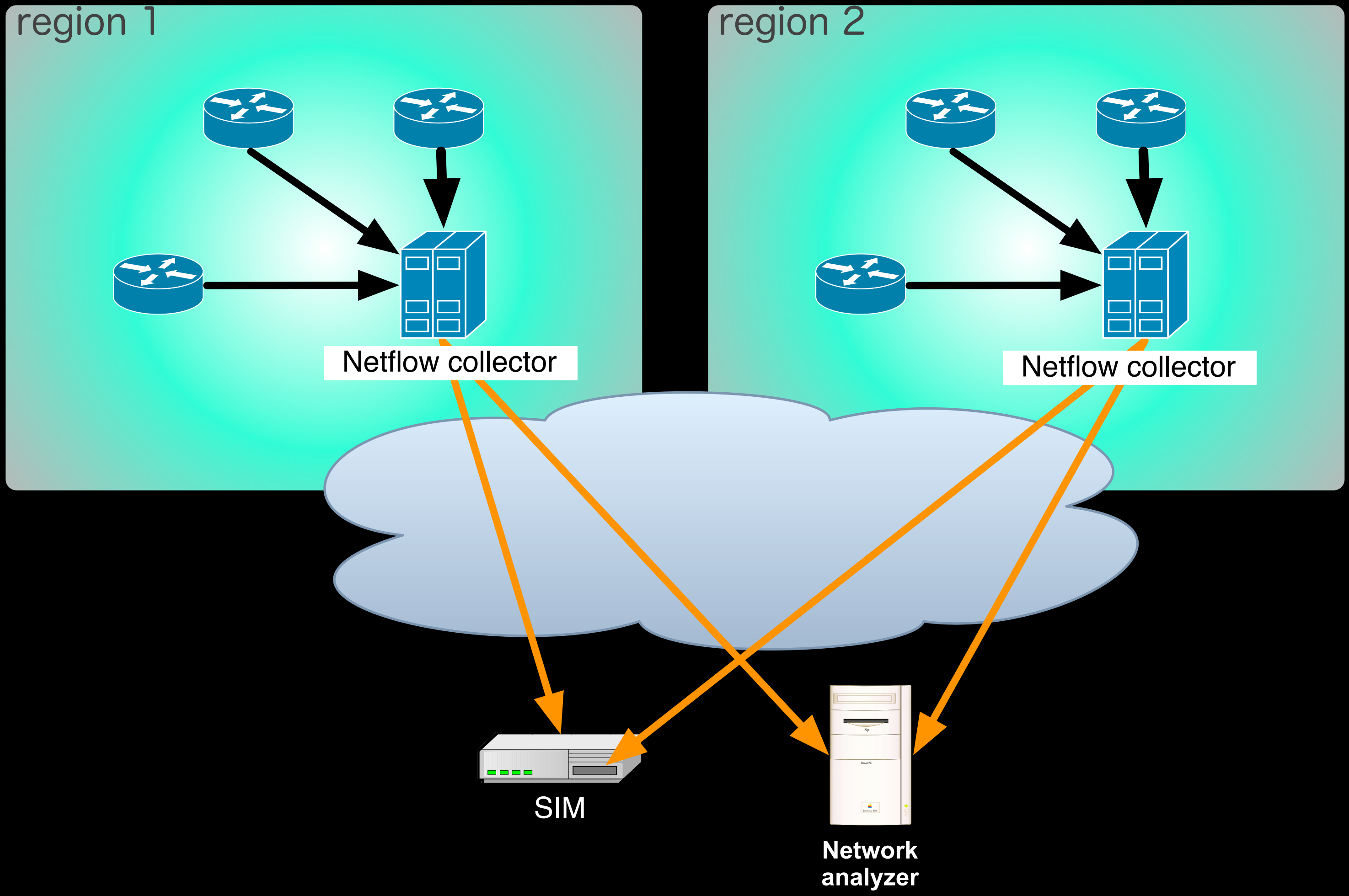
Feed Netflow to SIMs and Other Tools

- Feed Netflow to every tool that will use it

  MARS, PeakFlow, etc.

- Regionalize deployment

  minimize sending over network



Host Syslog

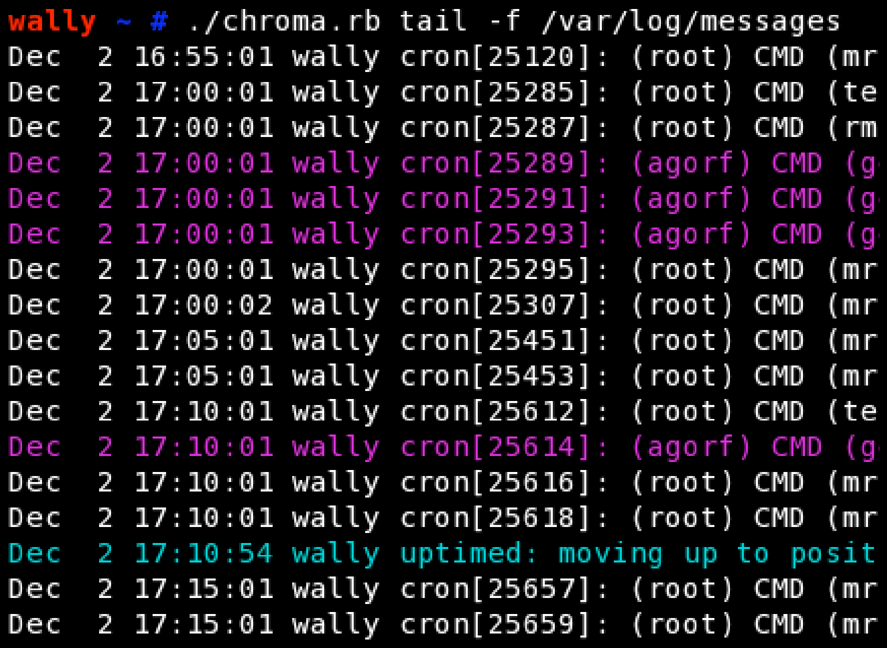
- Capture, store, and relay with syslog-ng
- For monitoring, be sure your SIM can parse events
- Deploy standard template (syslog.conf)
- Key events to log

  authentication logs

  authorization logs (sudo, su, etc.)

  daemon status logs (know when they stop/ start)

  security application logs (tcpwrappers, portsentry, etc.)



```
wally ~ # ./chroma.rb tail -f /var/log/messages
Dec  2 16:55:01 wally cron[25120]: (root) CMD (mr
Dec  2 17:00:01 wally cron[25285]: (root) CMD (te
Dec  2 17:00:01 wally cron[25287]: (root) CMD (rm
Dec  2 17:00:01 wally cron[25289]: (agorf) CMD (g
Dec  2 17:00:01 wally cron[25291]: (agorf) CMD (g
Dec  2 17:00:01 wally cron[25293]: (agorf) CMD (g
Dec  2 17:00:01 wally cron[25295]: (root) CMD (mr
Dec  2 17:00:02 wally cron[25307]: (root) CMD (mr
Dec  2 17:05:01 wally cron[25451]: (root) CMD (mr
Dec  2 17:05:01 wally cron[25453]: (root) CMD (mr
Dec  2 17:10:01 wally cron[25612]: (root) CMD (te
Dec  2 17:10:01 wally cron[25614]: (agorf) CMD (g
Dec  2 17:10:01 wally cron[25616]: (root) CMD (mr
Dec  2 17:10:01 wally cron[25618]: (root) CMD (mr
Dec  2 17:10:54 wally uptimed: moving up to posit
Dec  2 17:15:01 wally cron[25657]: (root) CMD (mr
Dec  2 17:15:01 wally cron[25659]: (root) CMD (mr
```

- Windows logging

  Agents can relay events via syslog

  Very noisy, grab only important events

EventID	Title
528	User Logon
529 - 537	Logon Failure
538	User Logoff
612	Audit Policy Change
517	Audit Log Cleared

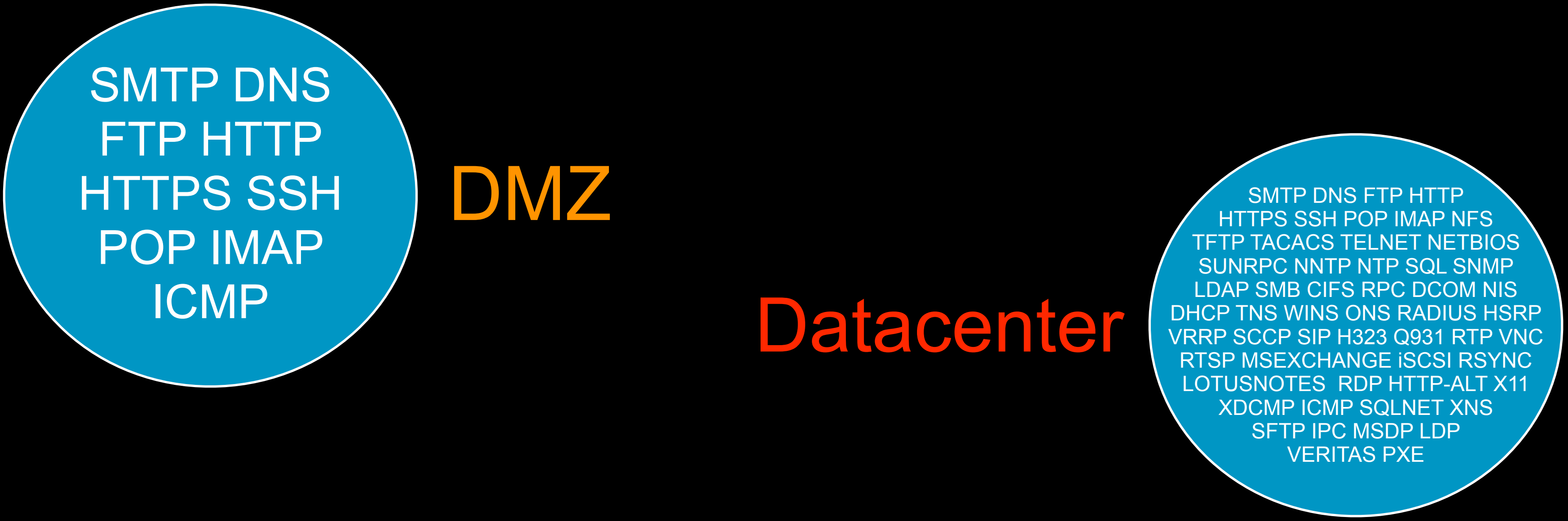
Other Logs

- Web server logs
  - Can verify and elaborate attacks
    - Use HTTP status codes to determine if IDS alert really worked
    - Can provide URL details during attack
  - Apache
    - Send as syslog via httpd.conf setting
  - IIS
    - Send as syslog via MonitorWare Agent
- App server logs
  - Find way to relay as syslog
  - Send via SNMP events
  - Pull via SQL queries
- Oracle logs
  - Pull logs from AUD$ table via SQL

Internal vs. Perimeter (DMZ) Monitoring

What’s the difference?

Number of Services/Protocols



SMTP DNS
FTP HTTP
HTTPS SSH
POP IMAP
ICMP

DMZ

Datacenter

SMTP DNS FTP HTTP
HTTPS SSH POP IMAP NFS
TFTP TACACS TELNET NETBIOS
SUNRPC NNTP NTP SQL SNMP
LDAP SMB CIFS RPC DCOM NIS
DHCP TNS WINS ONS RADIUS HSRP
VRRP SCCP SIP H323 Q931 RTP VNC
RTSP MSEXCHANGE iSCSI RSYNC
LOTUSNOTES RDP HTTP-ALT X11
XDCMP ICMP SQLNET XNS
SFTP IPC MSDP LDP
VERITAS PXE

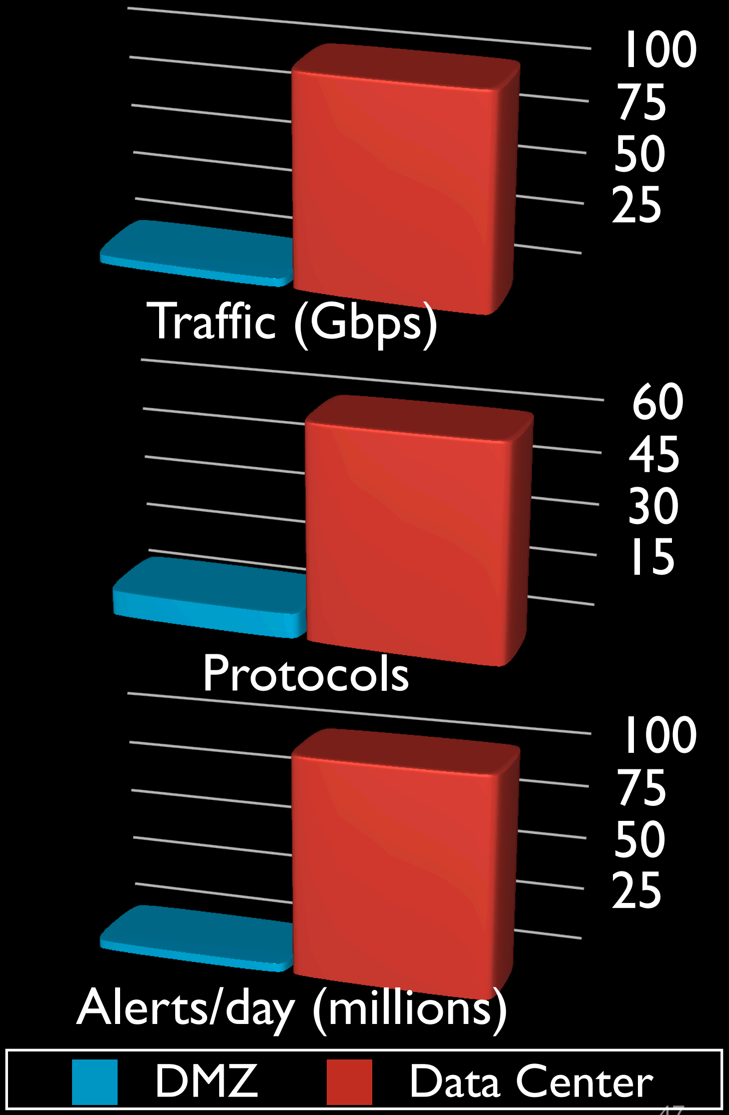
- Many more false positives sources
- Tuning more complex

A good relationship with IT application and service owners is key

Enterprise Datacenter Monitoring

Complications / Difficulties

- Traffic: 100+ Gbps globally vs. 4 Gbps outside
- Protocols: Higher number of services/protocols increases variety and complexity of tuning
- Alerts: Untuned sensor in large datacenter generates > 100 million alerts/day



Enterprise Datacenter Monitoring

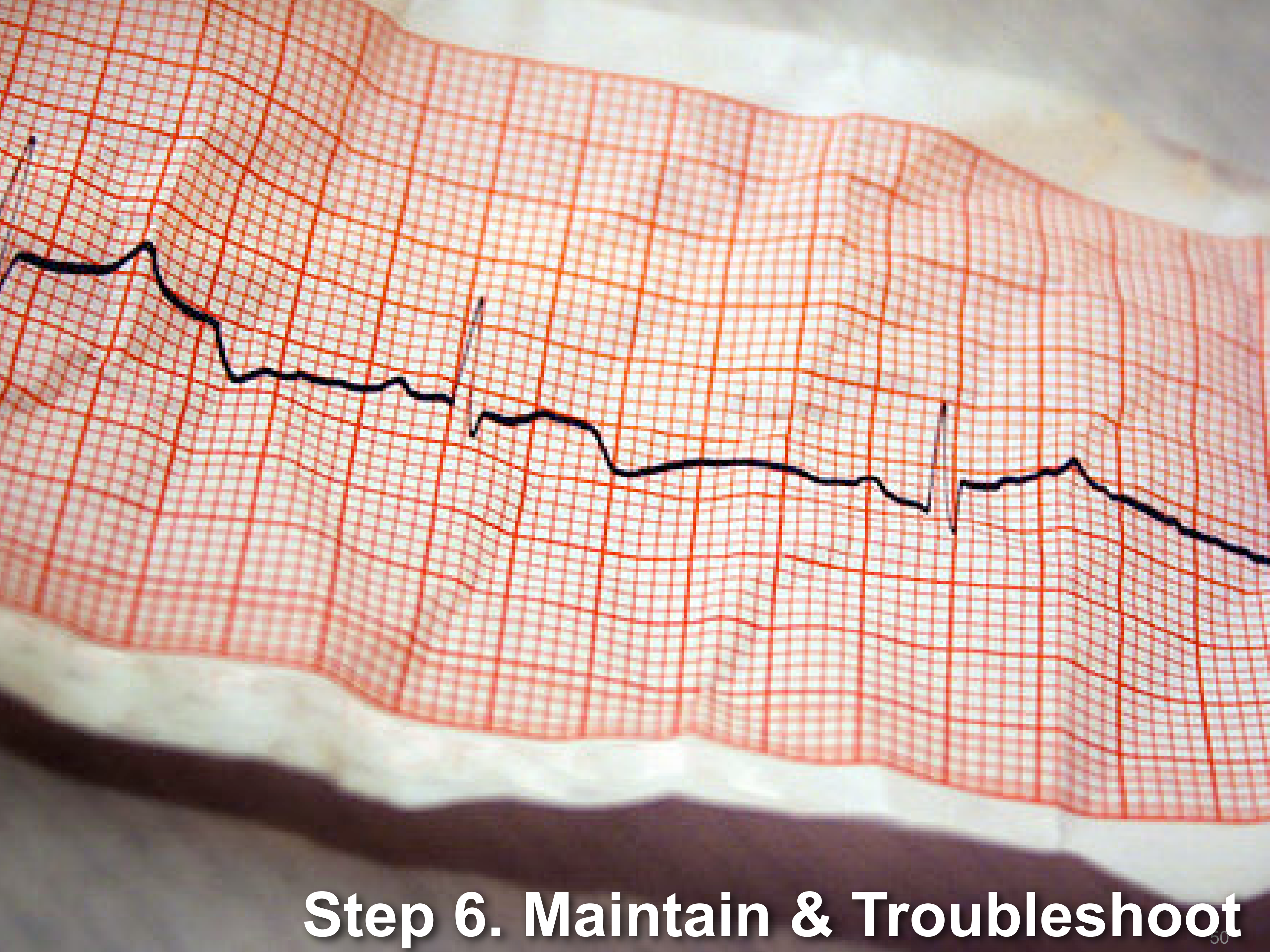
Complications / Difficulties (continued)

- **Higher availability expectations**
    - Enterprise data centers have very high availability requirements
    - Inline “IPS” a hard sell, most hardware not properly redundant
        - We don’t use inline IPS
- **False positives**
    - Difficult and time consuming to identify
    - Key: good relationship with IT application and service owners
- **Relatively new technology**
    - Not well understood by IDS & SIMs yet
    - Limited signature base
    - Most signatures based on Internet attacks

False Positives - Examples

- SigID 3320 - ADMIN$ access
- SigID 3337 - Windows RPC Race Condition
- SigID 5722 Google Appliance ProxyStyleSheet Cmd Exec
- SigID 3653 Multiple Rapid SSH Connections

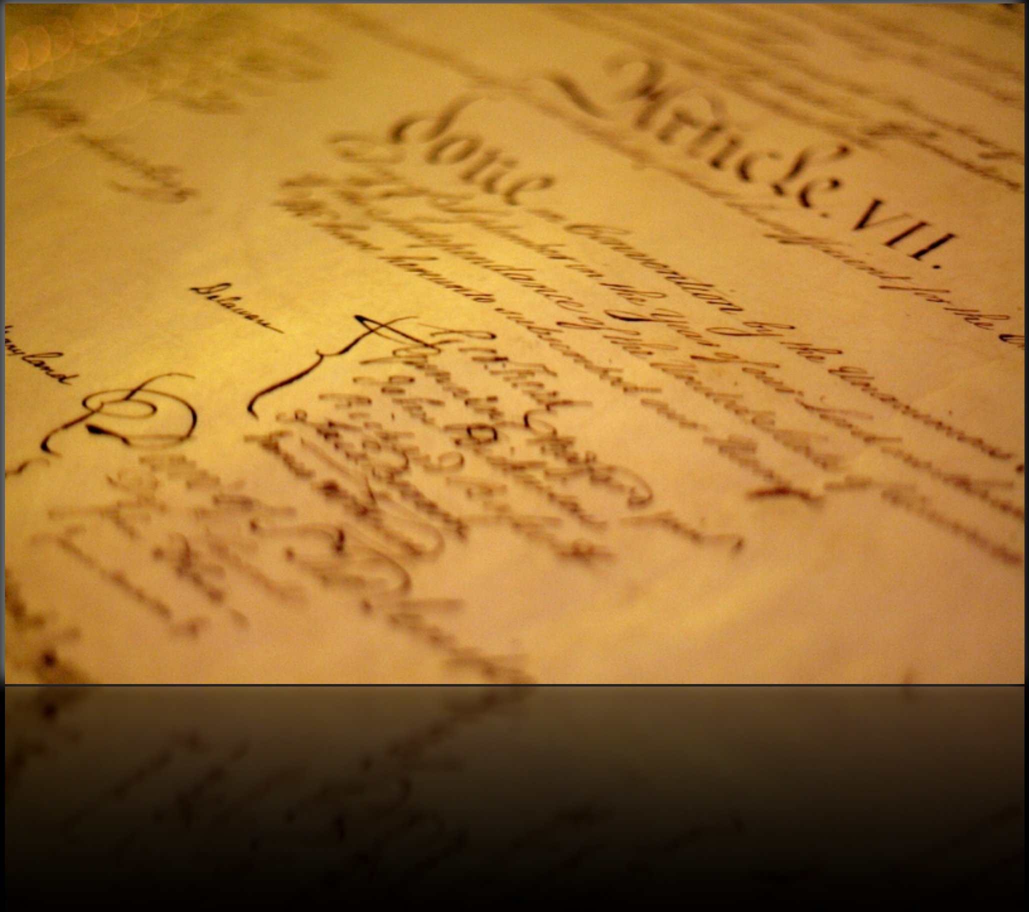
Each of these required that we contact the IT application or system owners to verify false positive.



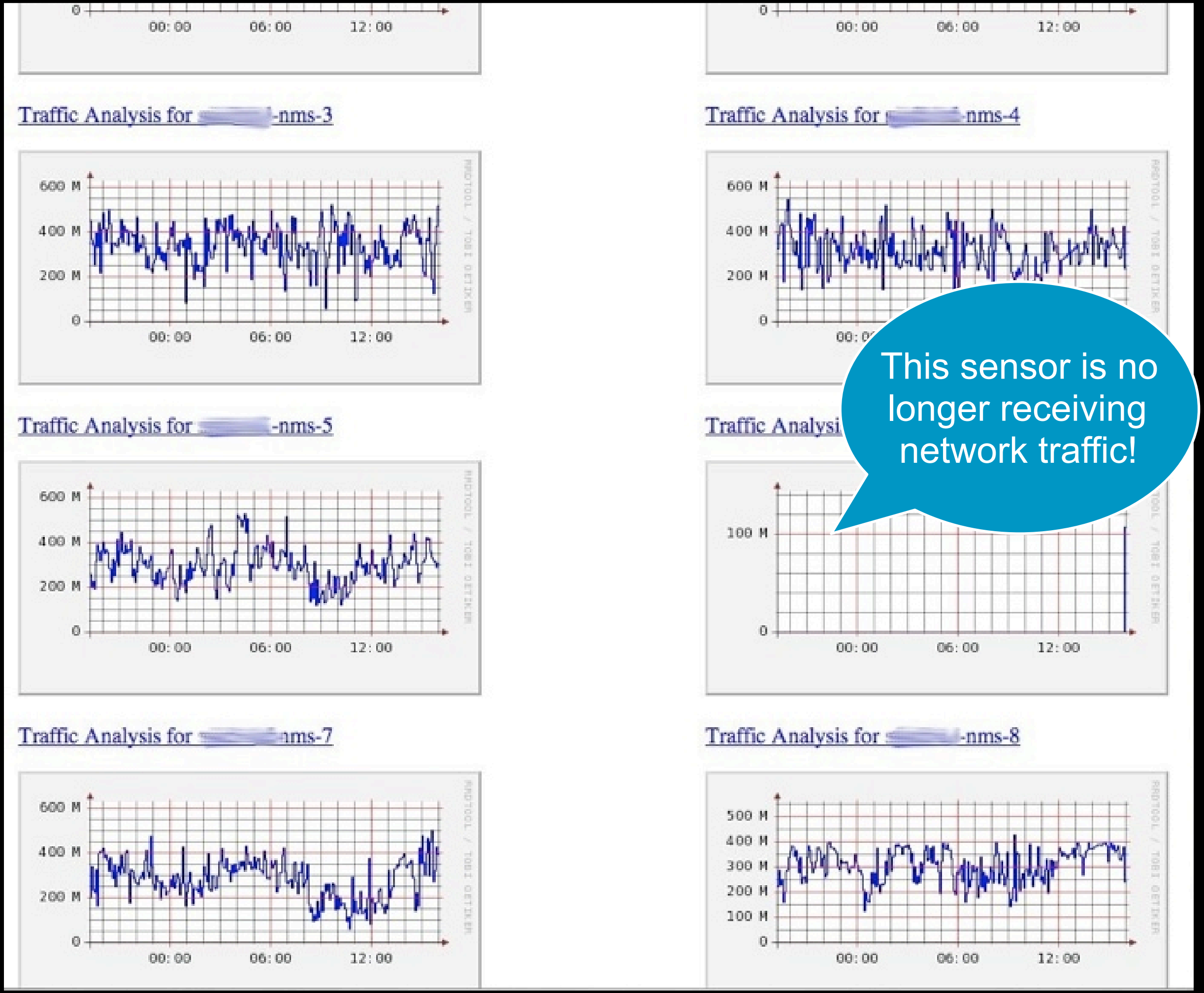
Step 6. Maintain & Troubleshoot

Maintain Documented Commitments

- Document agreements with IT
  - Fixed timelines
  - Expectations (SLAs, OS patching, etc)
  - Refresh commitments every year
- Review assets regularly
  - Look for new assets, new feeds, replaced hosts, etc.
  - Check for feeds/hosts that may have changed/ disappeared
  - Check for ownership changes due to re-orgs



Maintain IDS Feeds



Traffic Analysis for [redacted]-nms-3

Traffic Analysis for [redacted]-nms-4

Traffic Analysis for [redacted]-nms-5

Traffic Analysi

Traffic Analysis for [redacted]nms-7

Traffic Analysis for [redacted]-nms-8

This sensor is no longer receiving network traffic!

- Monitor your IDS

  sensor uplinks

  sensor processes

- Watch for spikes/ drops in sensor alert volume
- Have monitoring staff monitor feeds

Verify Feeds

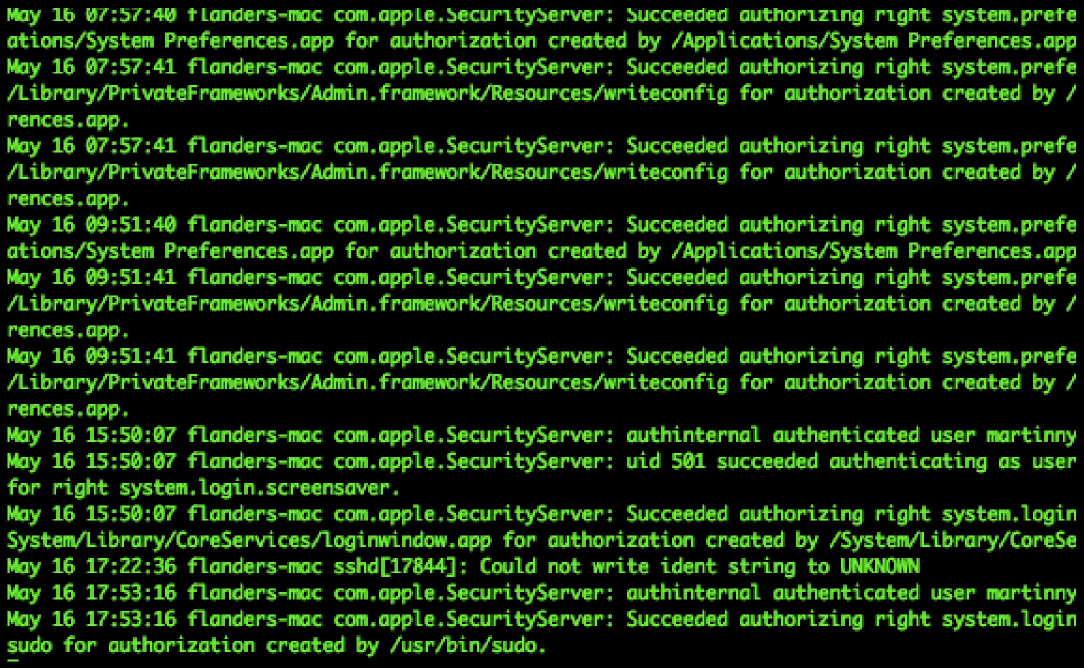
- Syslog feed verification

  Script awk to grab hostnames of systems that syslog daily and do a diff

  Ask IT to use a daily cron to re-set syslog.conf on servers

- Netflow feed verification

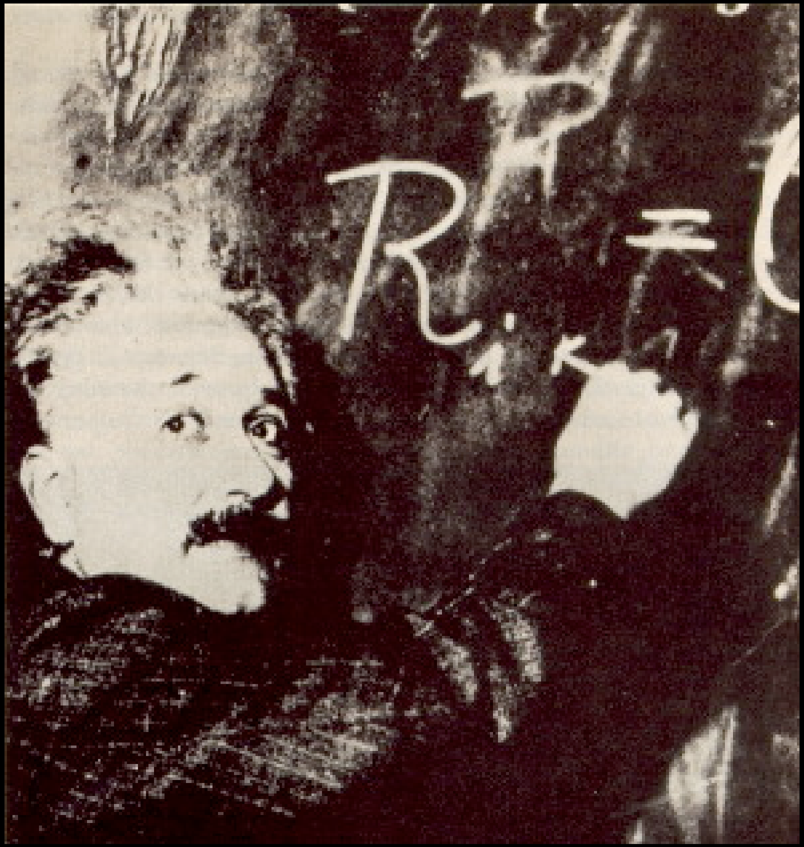
  tcpdump -i eth0 port 2060 -c 1000 | grep gw | awk '{print $2}' | sort | uniq



```
May 16 07:57:40 flanders-mac com.apple.SecurityServer: Succeeded authorizing right system.prefe
ations/System Preferences.app for authorization created by /Applications/System Preferences.app
May 16 07:57:41 flanders-mac com.apple.SecurityServer: Succeeded authorizing right system.prefe
/Library/PrivateFrameworks/Admin.framework/Resources/writeconfig for authorization created by /
rences.app.
May 16 07:57:41 flanders-mac com.apple.SecurityServer: Succeeded authorizing right system.prefe
/Library/PrivateFrameworks/Admin.framework/Resources/writeconfig for authorization created by /
rences.app.
May 16 09:51:40 flanders-mac com.apple.SecurityServer: Succeeded authorizing right system.prefe
ations/System Preferences.app for authorization created by /Applications/System Preferences.app
May 16 09:51:41 flanders-mac com.apple.SecurityServer: Succeeded authorizing right system.prefe
/Library/PrivateFrameworks/Admin.framework/Resources/writeconfig for authorization created by /
rences.app.
May 16 09:51:41 flanders-mac com.apple.SecurityServer: Succeeded authorizing right system.prefe
/Library/PrivateFrameworks/Admin.framework/Resources/writeconfig for authorization created by /
rences.app.
May 16 15:50:07 flanders-mac com.apple.SecurityServer: authinternal authenticated user martinny
May 16 15:50:07 flanders-mac com.apple.SecurityServer: uid 501 succeeded authenticating as user
for right system.login.screensaver.
May 16 15:50:07 flanders-mac com.apple.SecurityServer: Succeeded authorizing right system.login
System/Library/CoreServices/loginwindow.app for authorization created by /System/Library/CoreSe
May 16 17:22:36 flanders-mac sshd[17844]: Could not write ident string to UNKNOWN
May 16 17:53:16 flanders-mac com.apple.SecurityServer: authinternal authenticated user martinny
May 16 17:53:16 flanders-mac com.apple.SecurityServer: Succeeded authorizing right system.login
sudo for authorization created by /usr/bin/sudo.
_
```

Lessons Learned

- Start small
  - Too many events at once is overwhelming
  - Understand/tune each source before adding more
  - Understand “normal” traffic thoroughly before moving on
    - Avoid alerting on false-positives
- Use a SIM
  - Event correlation, false positive reduction
- Choose carefully what you want to monitor
  - …or you’ll waste your time chasing false positives
- Use defined playbooks, escalation procedures
- Have allies in the IT support teams
  - Network support, DBA’s, webmasters, etc.
  - They can explain/remediate issues you find



6 steps to improve your security monitoring

6. Troubleshoot

5. Feed and tune

4. Choose event sources

3. Select targets

2. Know the network

1. Know your policy