IP Dossier

Paul N. Krystosek, Ph.D.
CERT/NetSA
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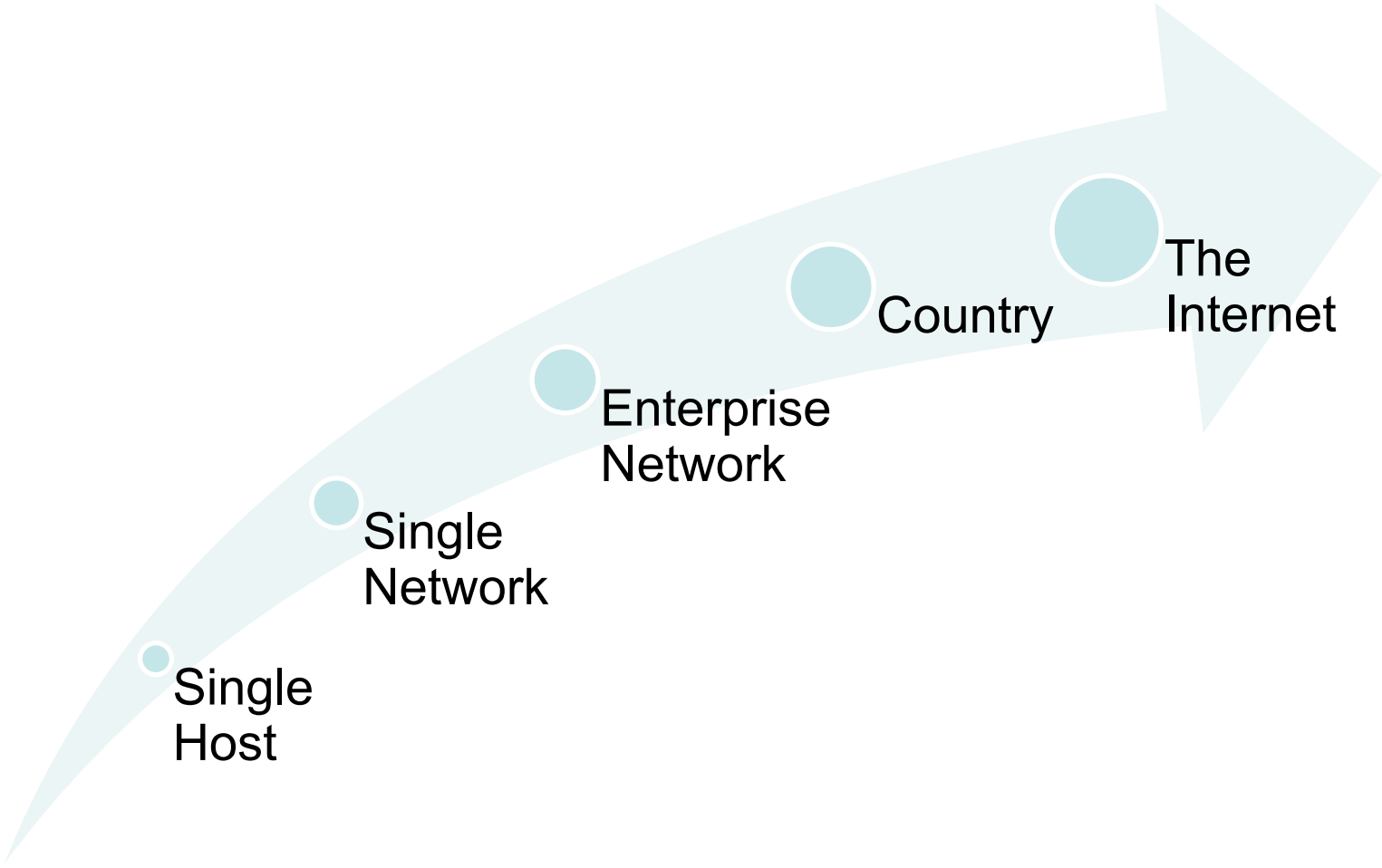
SEI CERT NetSA

Mission

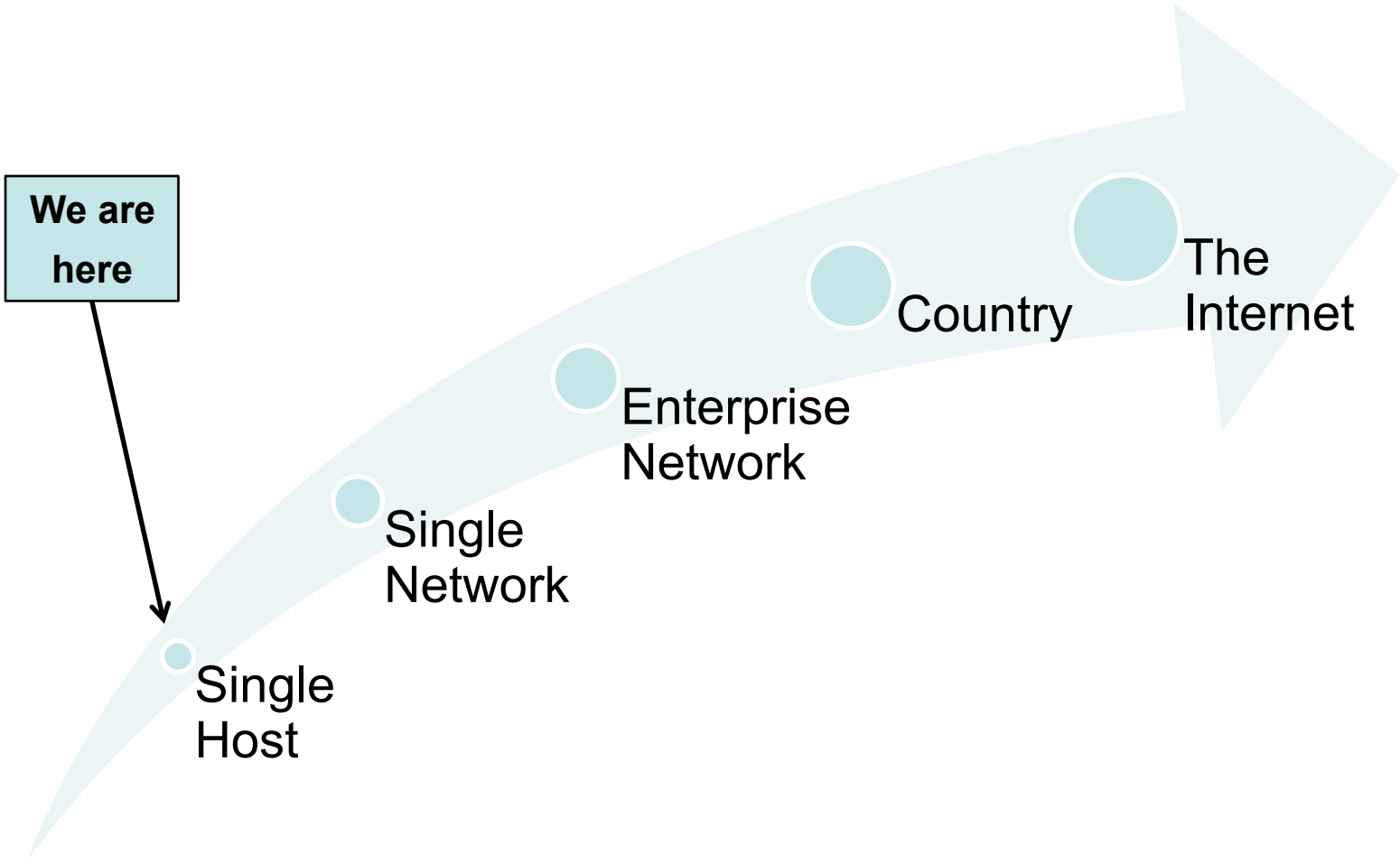
The mission of the Network Situational Awareness (NetSA) team is to enable and provide situational awareness to a broad constituency through applied research and engineering approaches. Situational Awareness (SA) attempts to quantitatively characterize threats and intruder activity in order to provide network operators tractable views and actionable insight into their network; improve and confirm best-practices; and inform technology design and implementation.

As an auxilary goal, the NetSA team explicitly tries to foster a community of analysts spanning organizations.

The Range of Network Situational Awareness



The Range of Network Situational Awareness



Outline

Introduction

Motivation

The Task

Method

Examples

Redesign

Conclusion

Introduction

This is a work in progress

It does not exist as a cohesive product

It is not done

It needs input from your expertise

Motivation

Why are we doing this?

- Automate a complex task
- Transition from “one off” to “everyday” operation
- Establish “organizational memory”
- Refine the subtasks that make up the whole

The Task

Find everything about the activity of a host given an IP address (and perhaps a time range)

Primarily from NetFlow data

Present it in an understandable fashion

To at least two levels of personnel

- Manager
- Analyst

Why is *The Task* Important?

A common task in computer security incident response it to fulfill a request such as:

- Tell us everything there is know about host with IP address a.b.c.d
- Host w.x.y.z compromised a system at agency blah look for it at your agency and report back… now
- This host at your agency just scanned our agency, what are you going to do about it?

How to Organize it?

Administrative information

External information

Top level or Volumetric information

Connection oriented

Service and protocol oriented

Applications

Functional

Behavioral

OS or IP stack specific

Administrative & External Information

Administrative Information

- Nslookup
- Whois

External information (not flow based)

- Watchlists
- UV

Top Level and Connection Oriented

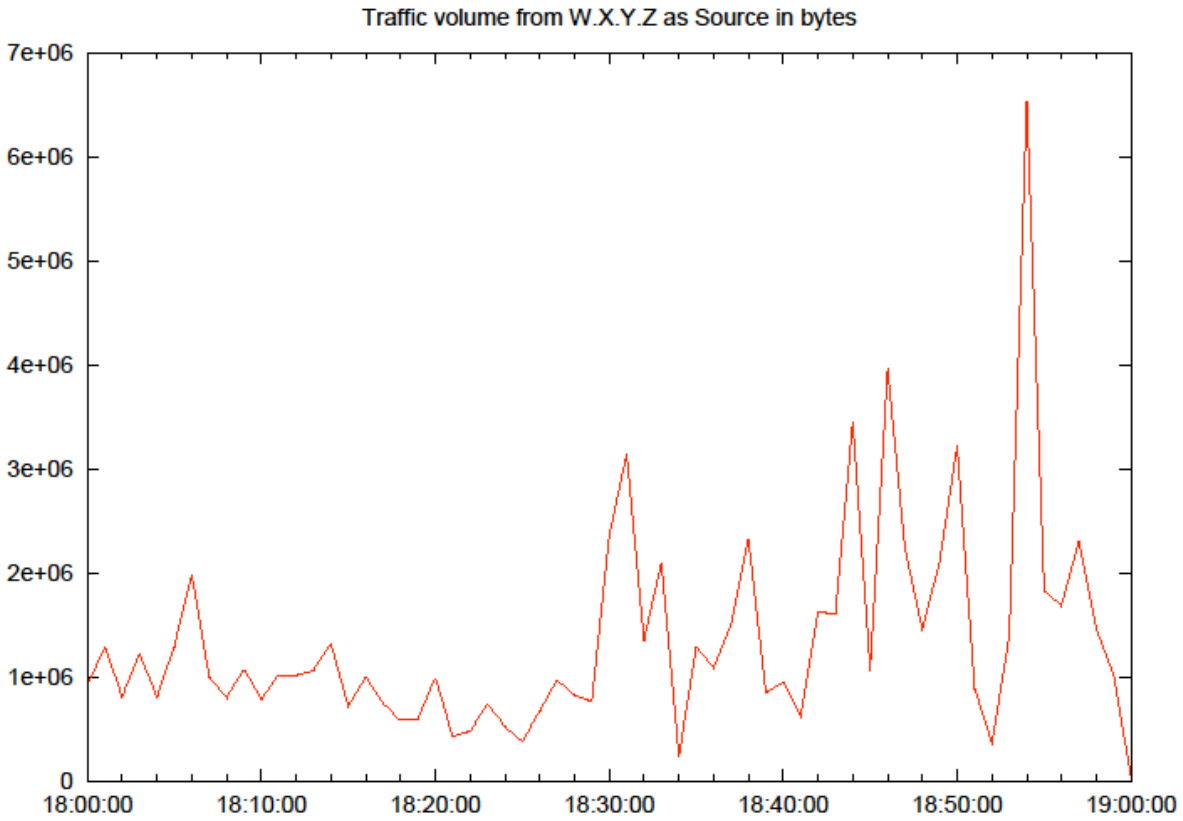
Top Level

- Look at volume and direction of traffic
- Diurnal cycle
- Continuous operation

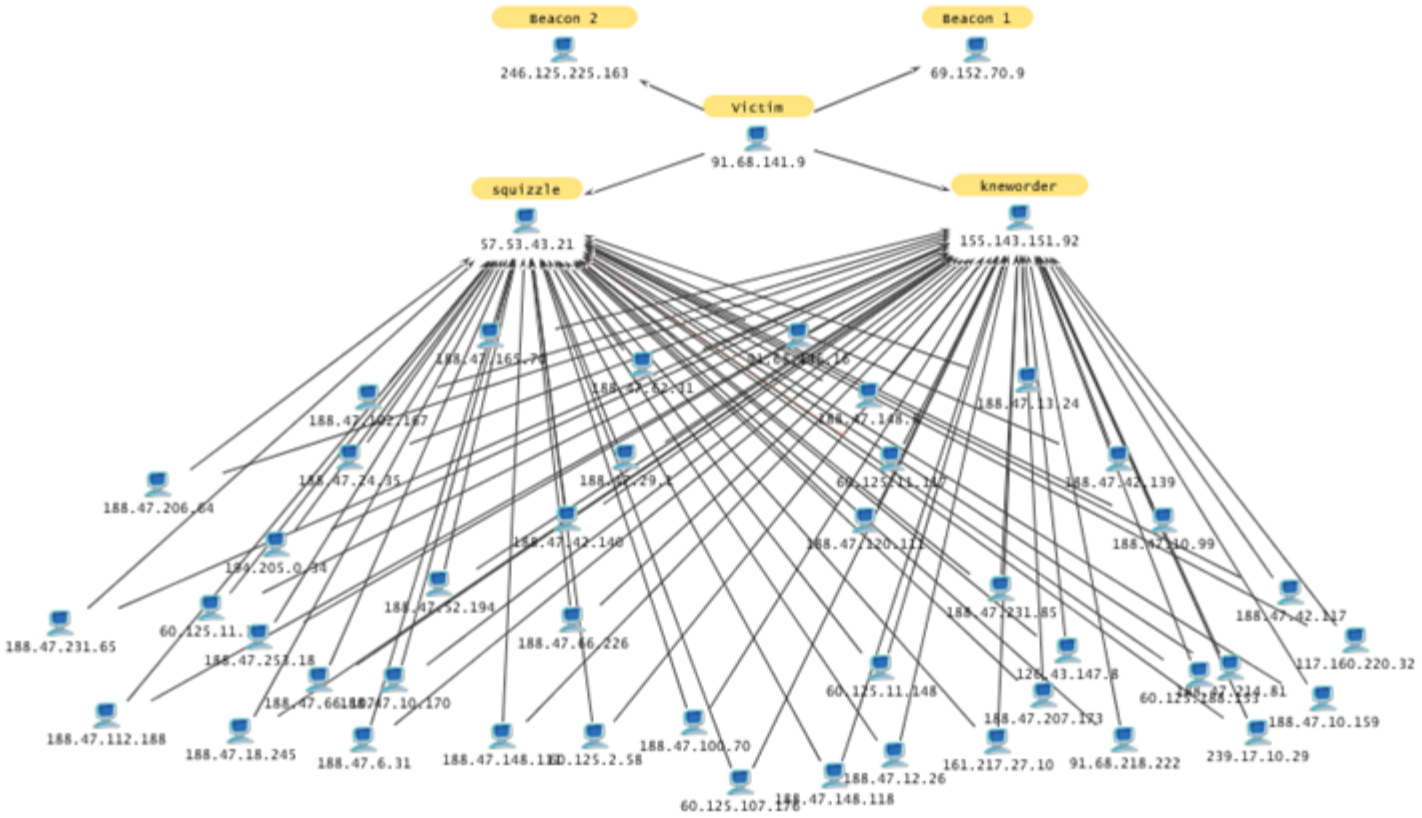
Connection Oriented

- Who did it talk to?

Example Volume Plot



Example connection diagram



IP addresses have been anonymized

Service and Protocol Oriented

By looking at ports and protocols

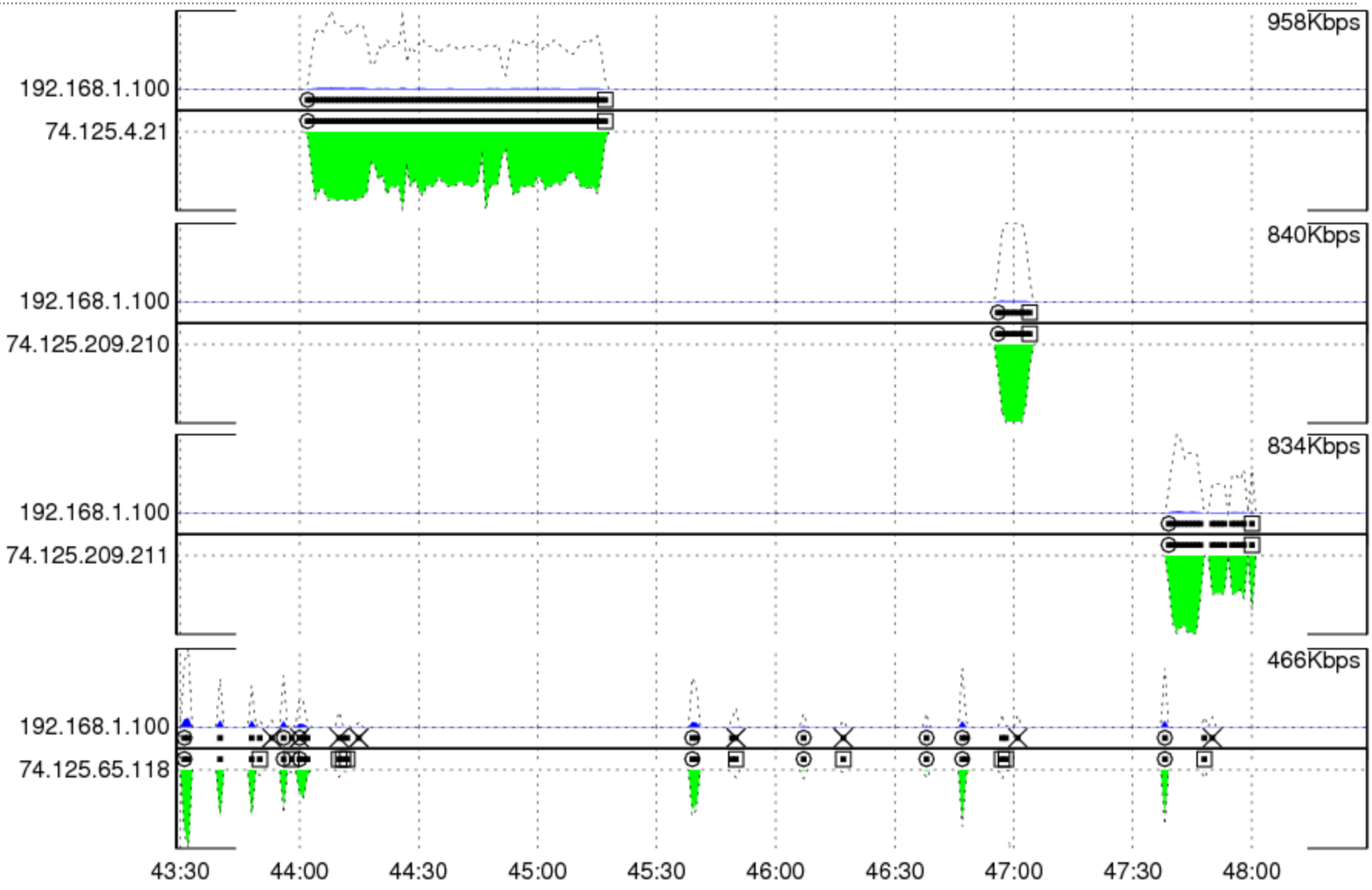
- Is it a client, server or both
- Do we see its DNS queries
  - If so, is it a client or server?
- Same for mail, web …

Applications

Sid Faber showed us how to find

- Web
- Video
- Audio
- News feed
- FTP

Watch Three YouTube Videos



Functional

Is it a

- Client
- Server
- Proxy
- Network device

FloViz looks like it will help out here

Functional continued

John Gerth from Stanford has a useful and simple technique to categorize hosts he calls **Local Role**

- Servers are given a positive number
- Clients are given a negative number
- 1 and -1 indicate packets in one direction only
- 2 and -2 indicate packets in both directions
- 3 and -3 indicate data in both directions
- 0 indicates backscatter

Behavioral

What is it doing?

- Scanning
- Beaconing
- Ordinary user/server

OS or IP Stack specific

- OS by ephemeral port behavior

Format

The example I'll show is in Word

But a LaTex template producing a PDF would be a better choice

I was able to ~~fake it~~ prototype it in Word by hand fairly easily, but it won't scale well

Small stuff as tables

Large stuff as plots

Connection diagram useful in some instances

What Might the Result Look Like?

Dossier for IP Address: 1.2.3.4	
Report Date	Date/time range analyzed
nslookup information	whois information
Watchlist	UV Status
Inbound byte volume plot	Outbound byte volume plot
Protocol Information	Connection Partners
Ephemeral Port plot	Service Port Information
“As client”	“As server”
Out bound scan info	In bound scan info
Out bound flag usage	In bound flag usage
Analyst commentary	

Dossier of a Server

Dossier for IP Address A.B.C.D

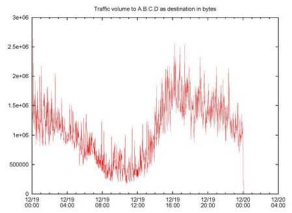
Report produced: 12/23/2008	Report period: 12/19/2008 0000-2359 UTC
Nslookup Information removed	Whois Information removed

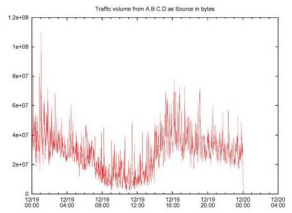
Protocol as destination IP

protocol	Name	Records
1	ICMP	232
6	TCP	504443
17	UDP	1250
46	RSVP	3

Protocol as source IP

protocol	Name	Records
1	ICMP	129
6	TCP	307501





Destination Ports for Target as Destination

dPort	Records
22	2
25	499
80	503542
135	5
443	271
445	100
524	5
1433	6
2967	3
3128	2
8080	1
20480	6
52452	1

Source Ports for Target as Source

sPort	Records
80	307239
443	262

Initial Flags for Flows with Target as Destination

Initial Flags	Records
S	393322
	98259
F A	9077
A	4569
F PA	418
PA	282
FS	1

Initial Flags for Flows with Target as Source

InitialFlags	Records
F A	212
F PA	478
S A	294961
PA	597
A	4280
	7102

Server Dossier continued

Session Flags for flows with target as destination

Session Flags	Records
F PA	184289
RPA	164578
R	88626
F RPA	21363
PA	13913
	12888
R A	11390
F A	4098
FS PA	1650
S	975
SRPA	727
F R A	517
A	318
FSRPA	235
S PA	232
SR	48
FS A	45
SR A	18
Other	18

Session Flags for flows with target as source

sessionFlags	Records
FS PA	1826
F A	1647
SRPA	4
F PA	251181
S A	1433
PA	36398
SR A	5
A	1474
F RPA	9
R	7284
R A	22
FS A	51
S PA	575
RPA	176
	5545

Analyst Commentary

This would seem to be a Web server with clients in North America that access it during business hours. It is not scanned excessively. And does not provide other services to the Internet. It uses internal DNS services.

Client Dossier

Dossier for IP Address W.X.Y.Z

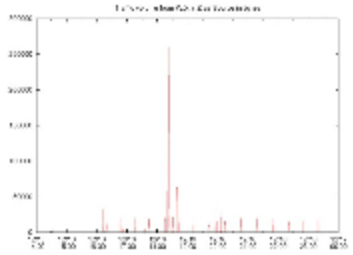
Report produced: 12/23/2008	Report period: 12/19/2008 0000-2359 UTC
Nslookup Information removed	Whois Information removed
Target does not appear on any watchlists	

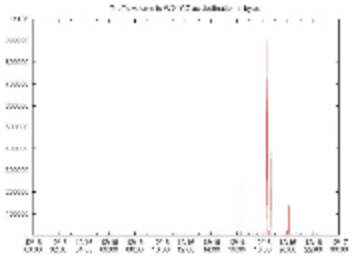
Protocol as destination IP

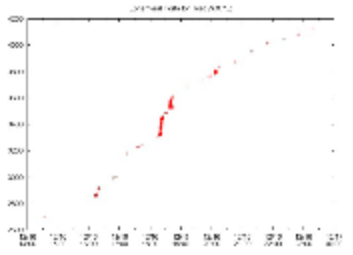
protocol	Name	Records
1	ICMP	10
6	TCP	389
17	UDP	11

Protocol as source IP

protocol	Name	Records
6	TCP	416







Destination Ports for Target as Source

sPort	Records
80	408
443	8

No apparent outbound scans	21 apparent inbound SYN scans from 13 IP addresses

Client Dossier, continued

Initial Flags for Flows with Target as Source	
initialFlags	Records
S A	322
	60
S	21
F A	4
A	3

Initial Flags for Flows with Target as Source	
initialFlags	Records
S	321
	74
A	17
F A	3
PA	1

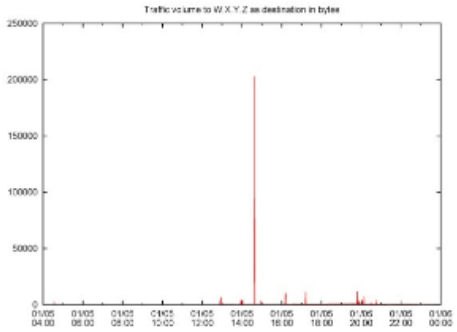
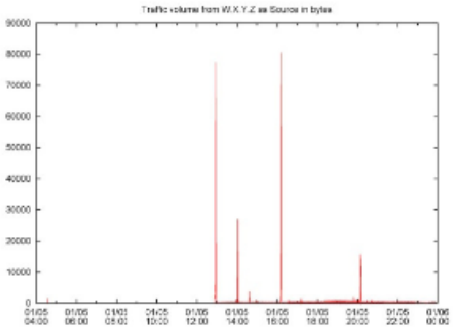
Session Flags for Flows with Target as Destination	
Session Flags	Records
F PA	250
R	83
RPA	21
PA	20
F RPA	20
F A	17
A	2
	1
SRPA	1
F R A	1

Session Flags for Flows with Target as Destionation	
sessionFlags	Records
F PA	262
	51
R	30
PA	23
R A	20
A	10
RPA	6
S	3
F A	3
F RPA	1
S PA	1

Analyst Commentary

This would seem to be a client in North America active during business hours in the Central or Eastern Time Zone. It is not scanned excessively. The regular activity that occurs every 80 minutes or so is with Google.

Malware Dossier

<table>
<tr><th colspan="2">Dossier for Target IP Address A.B.C.D</th></tr>
<tr><td>Report produced:
1/09/2008</td><td>Report period:
1/05/2008 0000-2359 UTC</td></tr>
<tr><td>Nslookup Information removed</td><td>Whois Information removed</td></tr>
<tr><td>Target appears on malware watchlist</td><td></td></tr>
<tr><td>
<table>
<tr><th colspan="3">Protocol as destination IP</th></tr>
<tr><td>protocol</td><td>Name</td><td>Records</td></tr>
<tr><td>6</td><td>TCP</td><td>363</td></tr>
</table>
</td><td>
<table>
<tr><th colspan="3">Protocol as source IP</th></tr>
<tr><td>protocol</td><td>Name</td><td>Records</td></tr>
<tr><td>6</td><td>TCP</td><td>360</td></tr>
</table>
</td></tr>
<tr><td>  </td><td>  </td></tr>
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<tr><td>sPort</td><td>Records</td></tr>
<tr><td>80</td><td>363</td></tr>
</table>
</td></tr>
<tr><td>No apparent outbound scans</td><td>No apparent inbound scans</td></tr>
</table>

Malware Dossier, continued

Session Flags for Flows with Target as Destination	
Session Flags	Records
FS PA	363

Session Flags for Flows with Target as Destionation	
sessionFlags	Records
FS PA	360

Analyst Commentary

This address is known to host malware. It is the target of beacons after an internal system has been infected. The beacon interval is approximately 5 minutes (295-310 seconds). Beacons typically continue for several hours. It is not known what data is transferred during the flows with larger numbers of bytes.

Things to Consider

We have a “dossier” on an IP address, now

- How long is it good for?
- When it “expires” and we run another, do we keep the old one?
- Who can we show it to?
- Have we drawn the correct conclusions?
- Is there a better way to store it than PDF?

Future Work

Better report format

TCP and UDP Work Weight

Uncleanliness Vector values

Entropy

Better volume plots

More comprehensive scan data

Think about how other disciplines coax surprising amounts of information out of raw data

Conclusion(s)

Flow data can provide a lot of information about a single host

It's useful to present all it in one place

How clever can we be to entice more information out of it?

Now let's automate the process

Still need analyst commentary

Remember the audience

Help Me Redesign It, Please

What should it look like?

What should it include?

How might you use it?

Thanks for sticking around

Paul Krystosek
CERT Software Engineering Institute
pnk@cert.org
http://www.sei.cmu.edu/
http://www.cert.org/netsa/