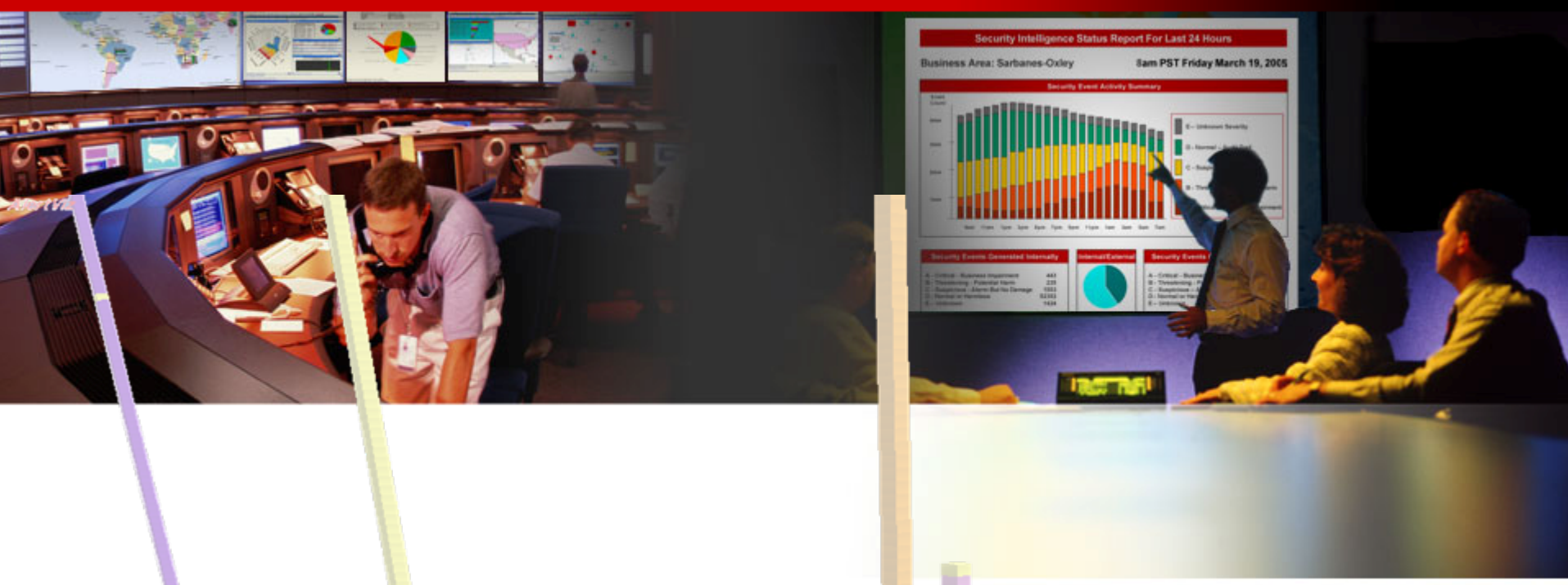


Insider Threat – The Visual Conviction

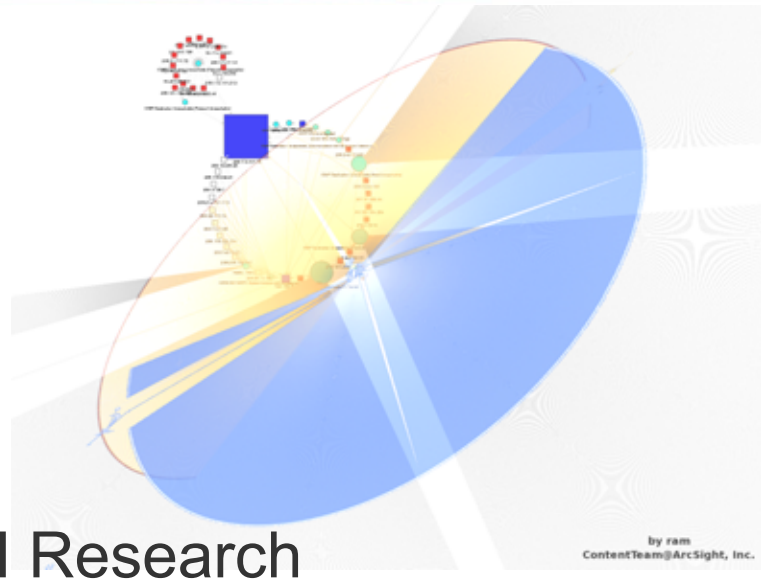
Raffael Marty, GCIA, CISSP
Manager Solutions @ ArcSight, Inc.

FIRST – June 2007 – Seville

Who Am I?

http://raffy.ch/blog

- Raffael Marty, GCIA, CISSP
- Manager Solutions @ ArcSight, Inc.
  - Log management, correlation
  - Regulatory compliance
- Intrusion Detection Research @ IBM Research
  - http://thor.cryptojail.net
- IT Security Consultant @ PriceWaterhouse Coopers
- Open Vulnerability and Assessment Language (OVAL) board member
- Common Event Enumeration (CEE) founding member



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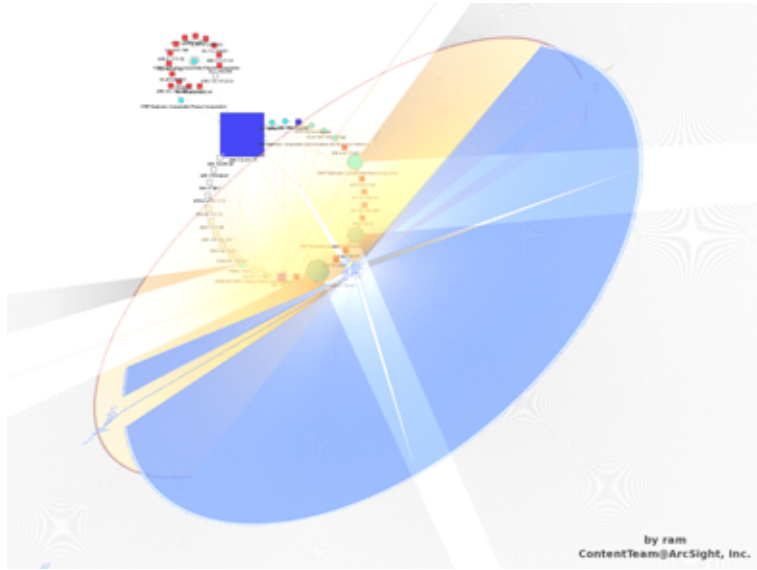
Who Am I?

http://raffy.ch/blog

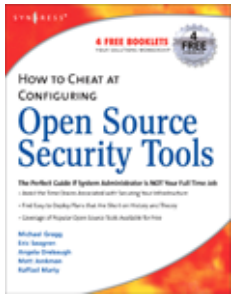
- Passion for Visual Security Event Analysis
  - http://secviz.org
  - http://afterglow.sourceforge.net
  - http://raffy.ch/blog



My Books / Book Contributions

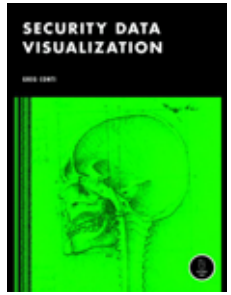
Applied Security Visualization

Paperback: 350 pages
Publisher: Addison Wesley (February, 2008)
ISBN: 0321510100



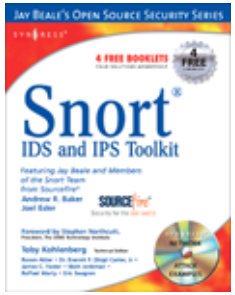
How to Cheat at Configuring Open Source Security Tools

Paperback: 504 pages
Publisher: Syngress Publishing (May 1, 2007)
ISBN: 1597491705



Security Data Visualization

Paperback: 256 pages
Publisher: No Starch Press (August 25, 2007)
ISBN: 1593271433



Snort IDS and IPS Toolkit

Paperback:
Publisher: Syngress Publishing (April 20, 2007)
ISBN: 1-59749-099-7

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Agenda

- Visualization
- Insider Threat Theory
- Log Data Processing
- Open Source Visualization Tools
- ***Visualization Exercise with AfterGlow***
- Simple I-Threat Visualizations
  - DuPont Information Leak
  - SAP Fraud Detection

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Agenda

- Insider Detection Process (IDP)
- ***Applying IDP (Exercise)***
- Insider Threat Solution
- Round Up

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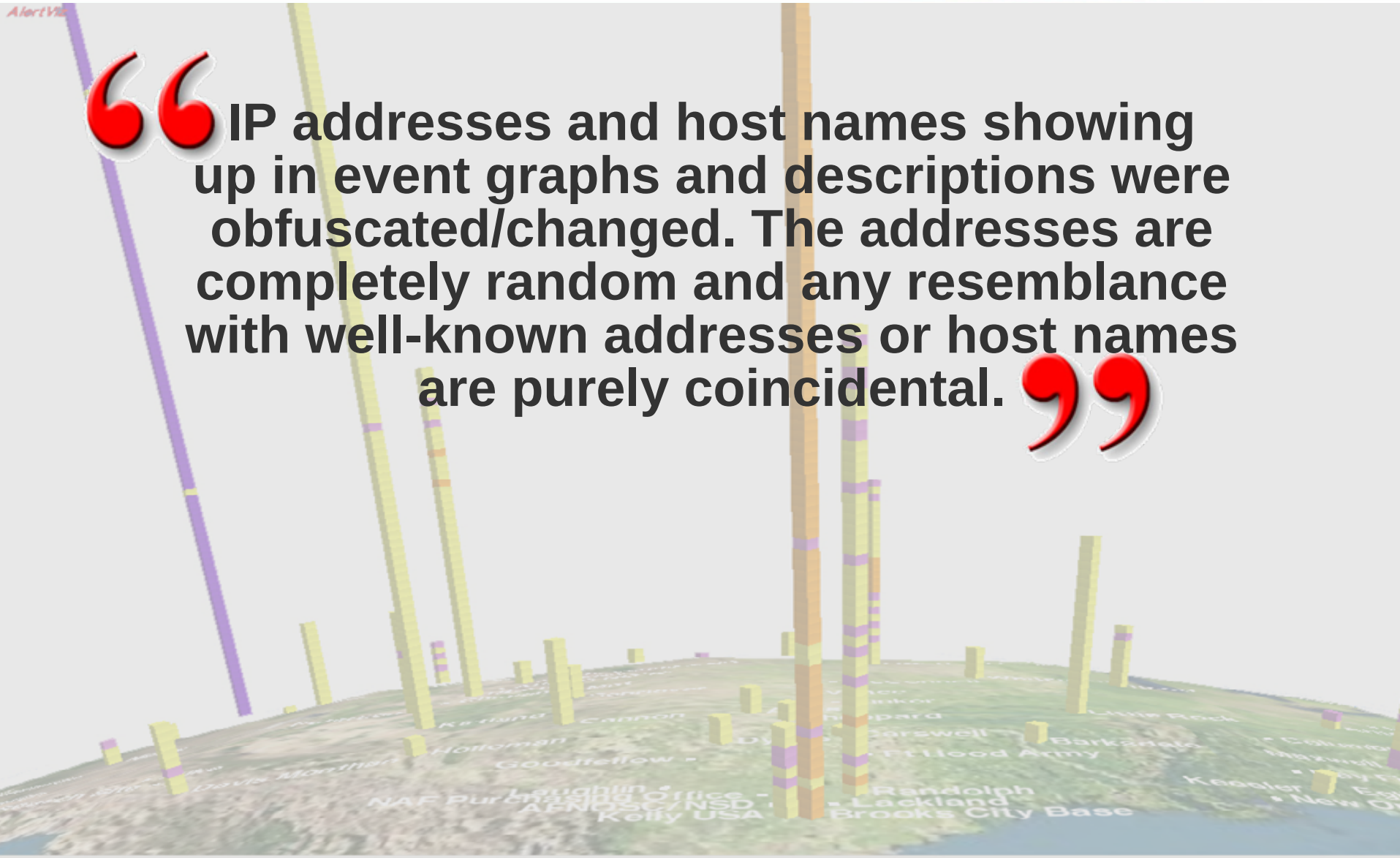
Disclaimer



> IP addresses and host names showing up in event graphs and descriptions were obfuscated/changed. The addresses are completely random and any resemblance with well-known addresses or host names are purely coincidental.

Visualization

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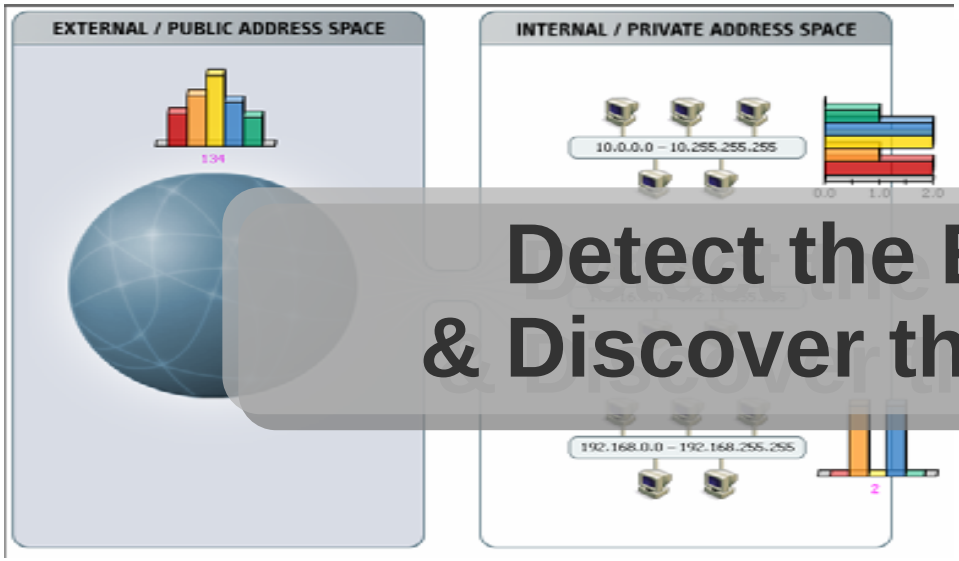
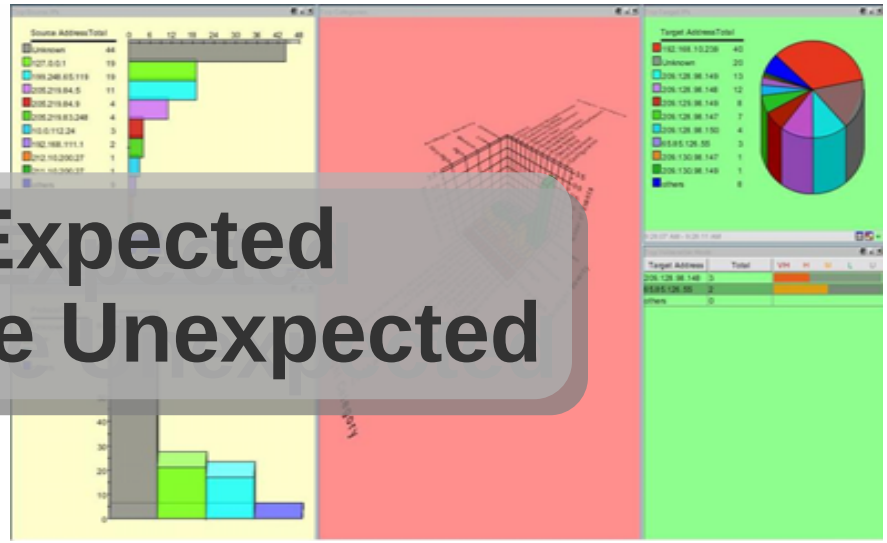
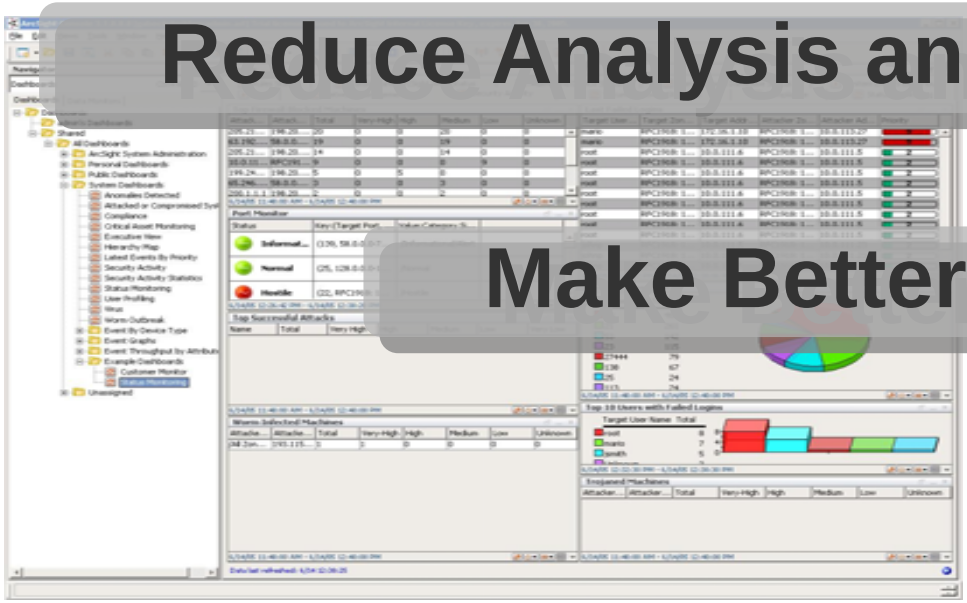
A Picture is Worth a Thousand Log Entries





Detect the Expected
& Discover the Unexpected

Reduce Analysis and Response Times



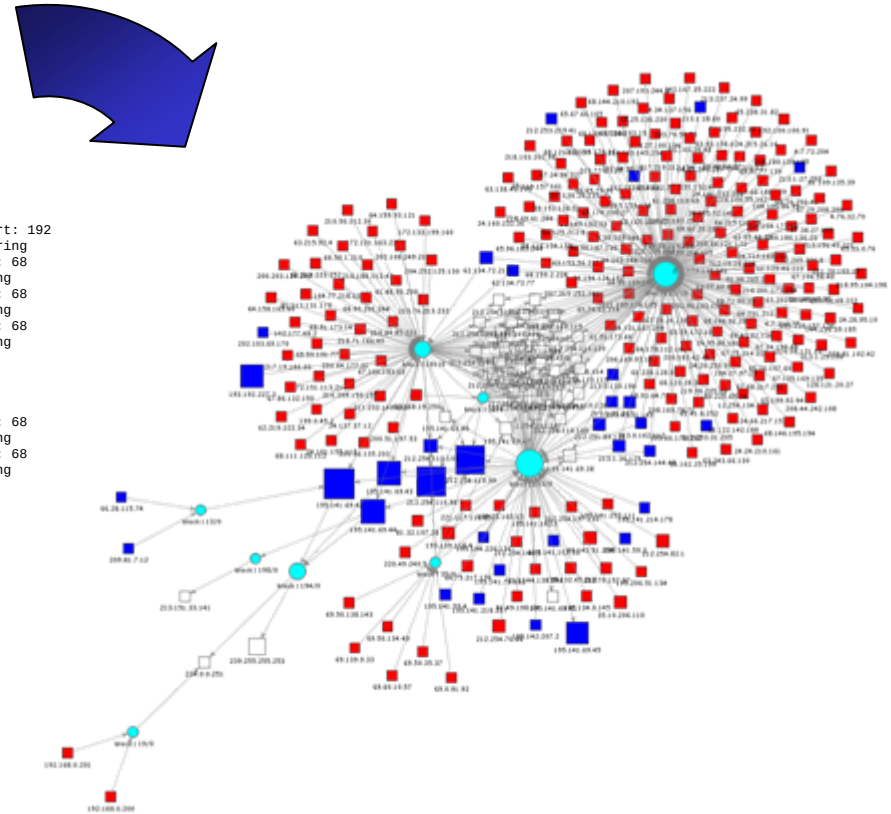
Make Better Decisions

ArcSight

Text or Visuals?

- What would you rather look at?

```
Jun 17 09:42:30 rmarty ifup: Determining IP information for eth0...
Jun 17 09:42:35 rmarty ifup:  failed; no link present.  Check cable?
Jun 17 09:42:35 rmarty network: Bringing up interface eth0:  failed
Jun 17 09:42:38 rmarty sendmail: sendmail shutdown succeeded
Jun 17 09:42:38 rmarty sendmail: sm-client shutdown succeeded
Jun 17 09:42:39 rmarty sendmail: sendmail startup succeeded
Jun 17 09:42:39 rmarty sendmail: sm-client startup succeeded
Jun 17 09:43:39 rmarty vmnet-dhcpd: DHCPINFORM from 172.16.48.128
Jun 17 09:45:42 rmarty last message repeated 2 times
Jun 17 09:45:47 rmarty vmnet-dhcpd: DHCPINFORM from 172.16.48.128
Jun 17 09:56:02 rmarty vmnet-dhcpd: DHCPDISCOVER from 00:0c:29:b7:b2:47 via vmnet8
Jun 17 09:56:03 rmarty vmnet-dhcpd: DHCPOFFER on 172.16.48.128 to 00:0c:29:b7:b2:47 via vmnet8
Jun 17 09:56:03 rmarty vmnet-dhcpd: DHCPREQUEST for 172.16.48.128 from 00:0c:29:b7:b2:47 via vmnet8
Jun 17 09:56:03 rmarty vmnet-dhcpd: DHCPACK on 172.16.48.128 to 00:0c:29:b7:b2:47 via vmnet8
Jun 17 10:00:03 rmarty crond(pam_unix)[30534]: session opened for user root by (uid=0)
Jun 17 10:00:10 rmarty crond(pam_unix)[30534]: session closed for user root
Jun 17 10:01:02 rmarty crond(pam_unix)[30551]: session opened for user root by (uid=0)
Jun 17 10:01:07 rmarty crond(pam_unix)[30551]: session closed for user root
Jun 17 10:05:02 rmarty crond(pam_unix)[30567]: session opened for user idabench by (uid=0)
Jun 17 10:05:05 rmarty crond(pam_unix)[30567]: session closed for user idabench
Jun 17 10:13:05 rmarty portsentry[4797]: attackalert: UDP scan from host: 192.168.80.19/192.168.80.19 to UDP port: 192
Jun 17 10:13:05 rmarty portsentry[4797]: attackalert: Host: 192.168.80.19/192.168.80.19 is already blocked Ignoring
Jun 17 10:14:09 rmarty portsentry[4797]: attackalert: UDP scan from host: 192.168.80.8/192.168.80.8 to UDP port: 68
Jun 17 10:14:09 rmarty portsentry[4797]: attackalert: Host: 192.168.80.8/192.168.80.8 is already blocked Ignoring
Jun 17 10:14:09 rmarty portsentry[4797]: attackalert: UDP scan from host: 192.168.80.8/192.168.80.8 to UDP port: 68
Jun 17 10:14:09 rmarty portsentry[4797]: attackalert: Host: 192.168.80.8/192.168.80.8 is already blocked Ignoring
Jun 17 10:21:30 rmarty portsentry[4797]: attackalert: UDP scan from host: 192.168.80.8/192.168.80.8 to UDP port: 68
Jun 17 10:21:30 rmarty portsentry[4797]: attackalert: Host: 192.168.80.8/192.168.80.8 is already blocked Ignoring
Jun 17 10:28:40 rmarty vmnet-dhcpd: DHCPDISCOVER from 00:0c:29:b7:b2:47 via vmnet8
Jun 17 10:28:41 rmarty vmnet-dhcpd: DHCPOFFER on 172.16.48.128 to 00:0c:29:b7:b2:47 via vmnet8
Jun 17 10:28:41 rmarty vmnet-dhcpd: DHCPREQUEST for 172.16.48.128 from 00:0c:29:b7:b2:47 via vmnet8
Jun 17 10:28:45 rmarty vmnet-dhcpd: DHCPACK on 172.16.48.128 to 00:0c:29:b7:b2:47 via vmnet8
Jun 17 10:30:47 rmarty portsentry[4797]: attackalert: UDP scan from host: 192.168.80.8/192.168.80.8 to UDP port: 68
Jun 17 10:30:47 rmarty portsentry[4797]: attackalert: Host: 192.168.80.8/192.168.80.8 is already blocked Ignoring
Jun 17 10:30:47 rmarty portsentry[4797]: attackalert: UDP scan from host: 192.168.80.8/192.168.80.8 to UDP port: 68
Jun 17 10:30:47 rmarty portsentry[4797]: attackalert: Host: 192.168.80.8/192.168.80.8 is already blocked Ignoring
Jun 17 10:35:28 rmarty vmnet-dhcpd: DHCPINFORM from 172.16.48.128
Jun 17 10:35:31 rmarty vmnet-dhcpd: DHCPINFORM from 172.16.48.128
Jun 17 10:38:51 rmarty vmnet-dhcpd: DHCPREQUEST for 172.16.48.128 from 00:0c:29:b7:b2:47 via vmnet8
Jun 17 10:38:52 rmarty vmnet-dhcpd: DHCPACK on 172.16.48.128 to 00:0c:29:b7:b2:47 via vmnet8
Jun 17 10:42:35 rmarty vmnet-dhcpd: DHCPINFORM from 172.16.48.128
Jun 17 10:42:38 rmarty vmnet-dhcpd: DHCPINFORM from 172.16.48.128
```



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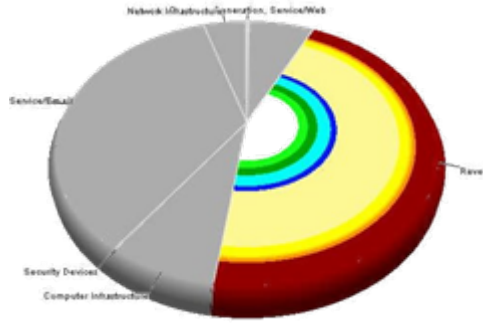
Why a Visual Approach Helps

“A picture tells more than a thousand log lines”

- **Reduce analysis and response times**
  - Quickly visualize thousands of events
- **Make better decisions**
  - Situational awareness
  - Visualize status of business posture
  - Visual display of most important properties
- **Be more efficient**
  - Facilitate communication
  - Use graphs to communicate with other teams
  - Graphs are easier to understand than textual events



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Insider Threat Visualization

- Huge amounts of data
  - More and other data sources than for the traditional security use-cases
  - Insiders often have legitimate access to machines and data. You need to log more than the exceptions.
  - Insider crimes are often executed on the application layer. You need transaction data and chatty application logs.
- The questions are not known in advance!
  - Visualization provokes questions and helps find answers.
- Dynamic nature of fraud
  - Problem for static algorithms.
  - Bandits quickly adapt to fixed threshold-based detection systems.
  - Looking for any unusual patterns

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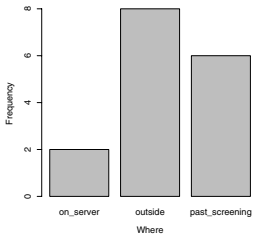
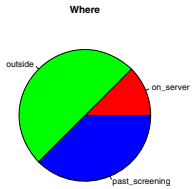
Graph Types
Simple Charts

Bar Charts

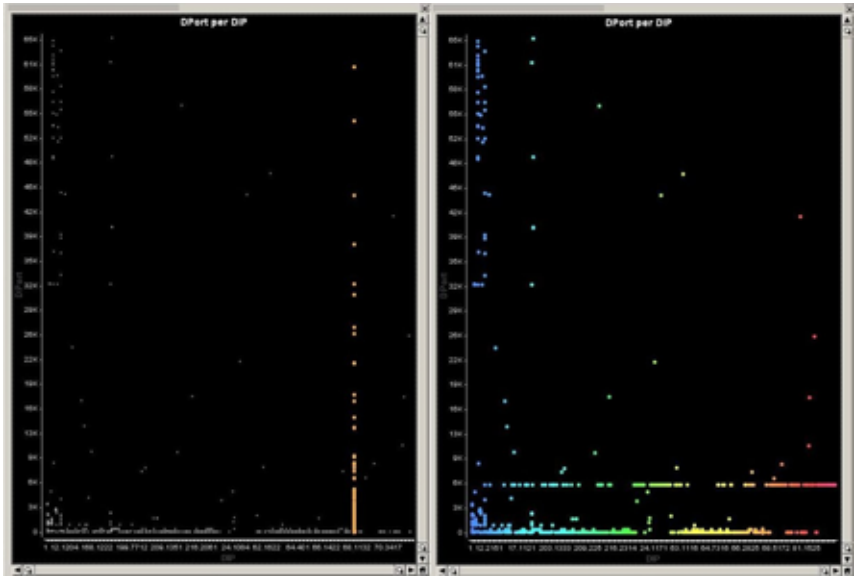


Pie Charts

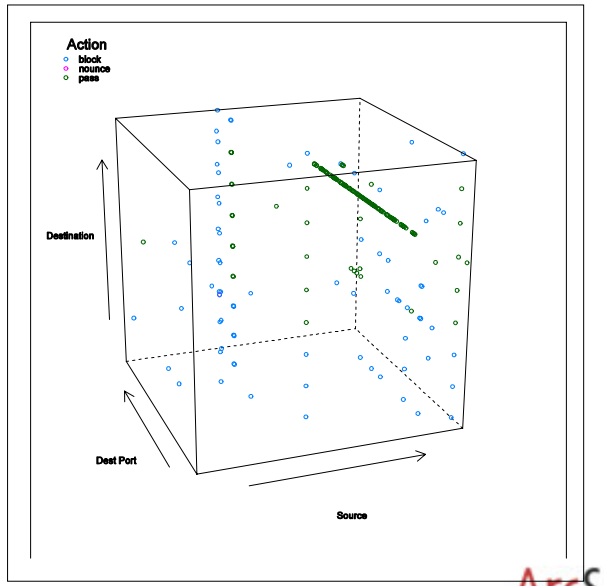


Line Charts

Scatter Plots



3D Scatter Plots



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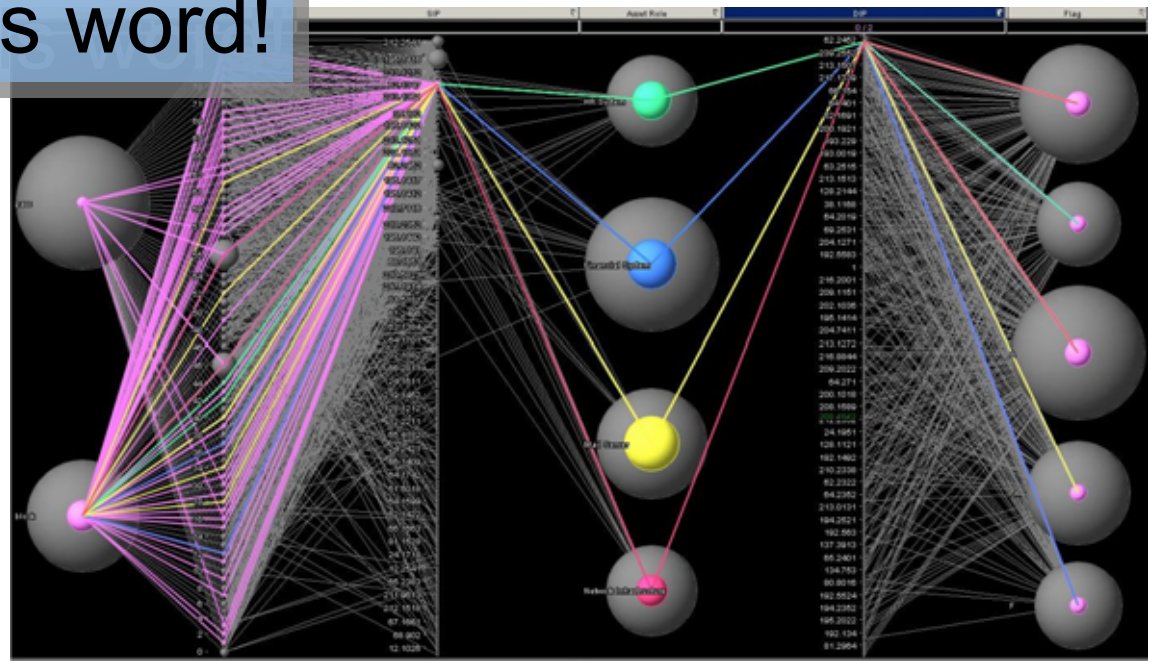
Graph Types
Multivariate Graphs

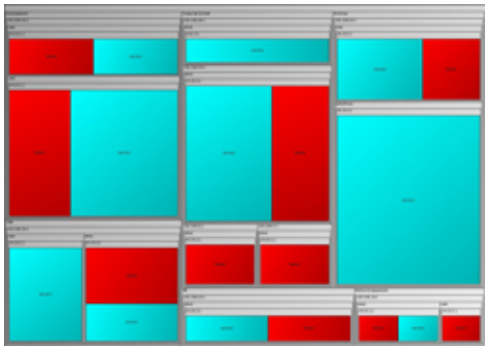
Link Graphs

I like this word!

Parallel Coordinates



TreeMaps



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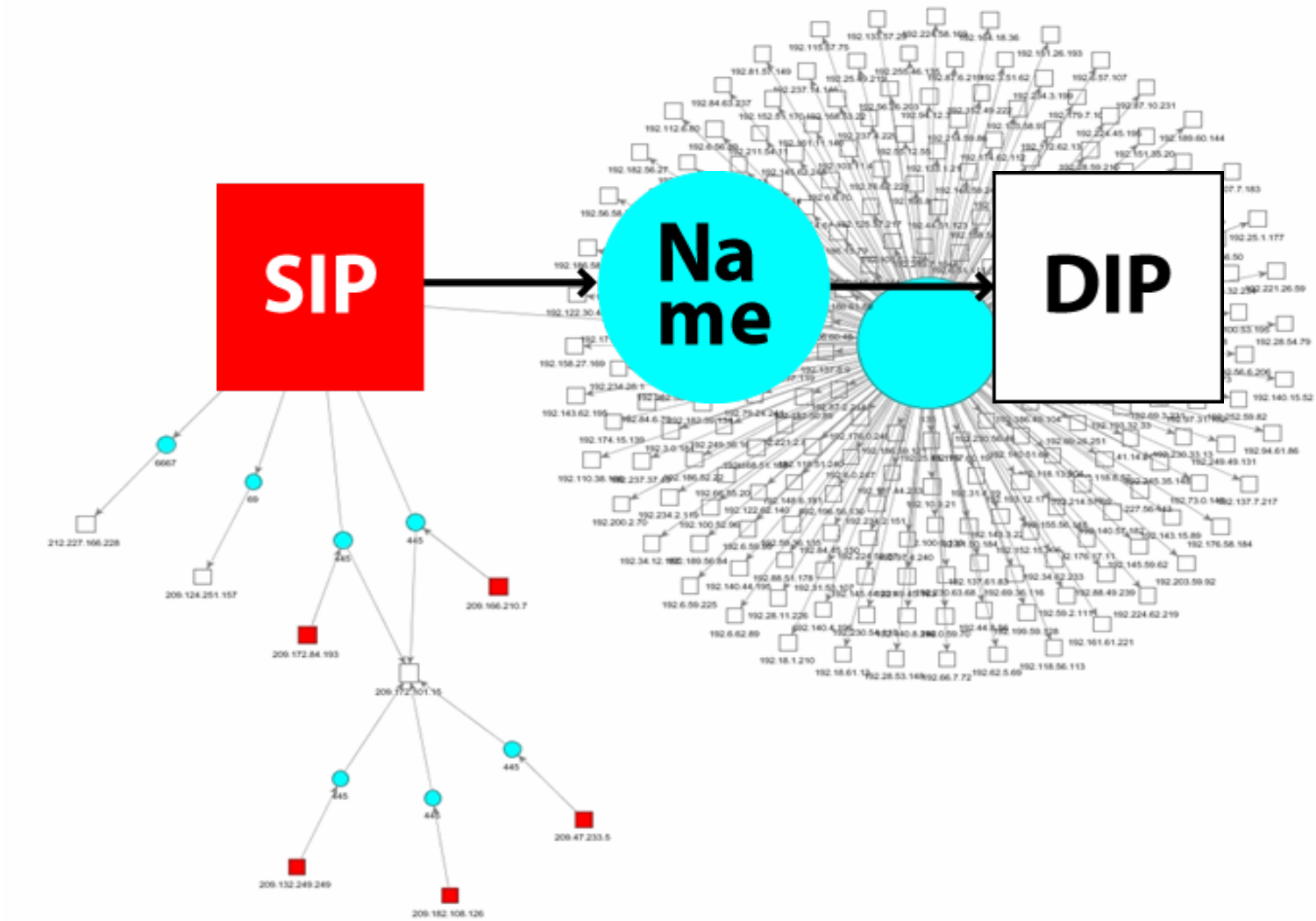
Multivariate Graphs
Link Graphs



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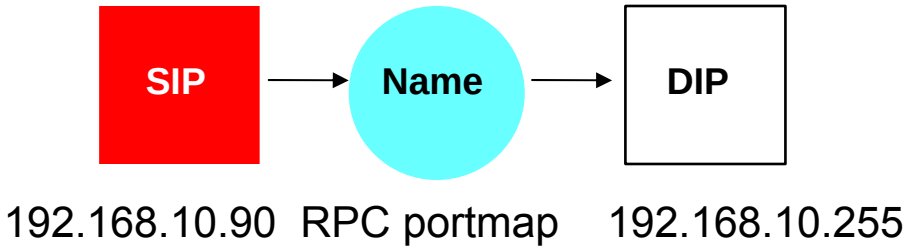
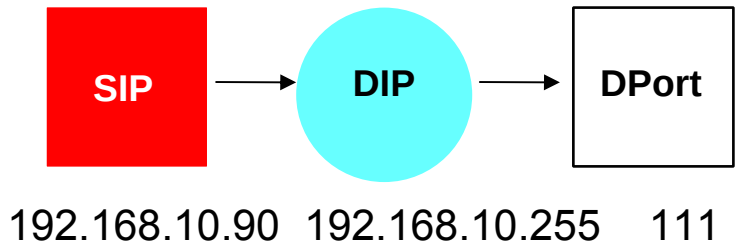
Link Graphs
Data Mapping

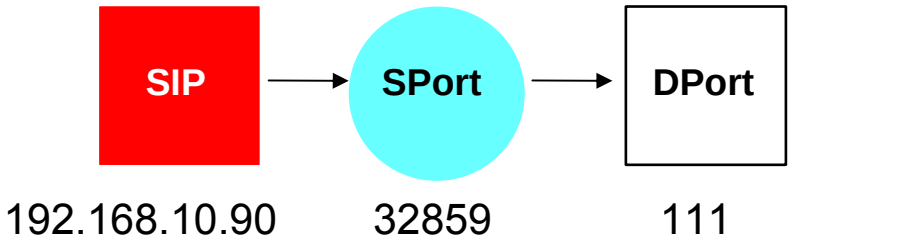
Raw Event:

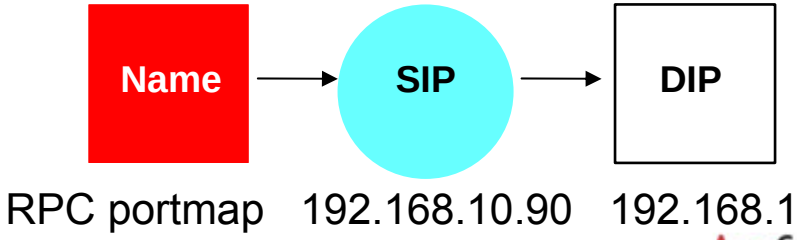
```
[**] [1:1923:2] RPC portmap UDP proxy attempt [**]
[Classification: Decode of an RPC Query] [Priority: 2]
06/04-15:56:28.219753 192.168.10.90:32859 ->
192.168.10.255:111
UDP TTL:64 TOS:0x0 ID:0 IpLen:20 DgmLen:148 DF
Len: 120
```

Different node configurations:









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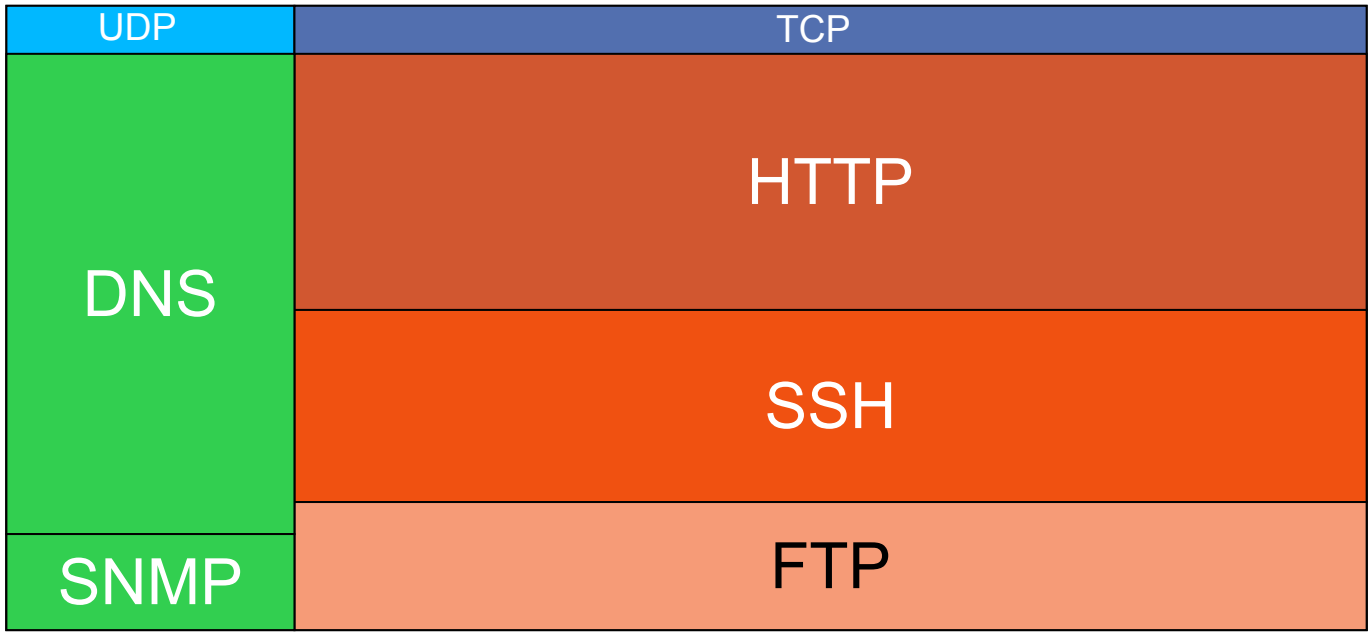
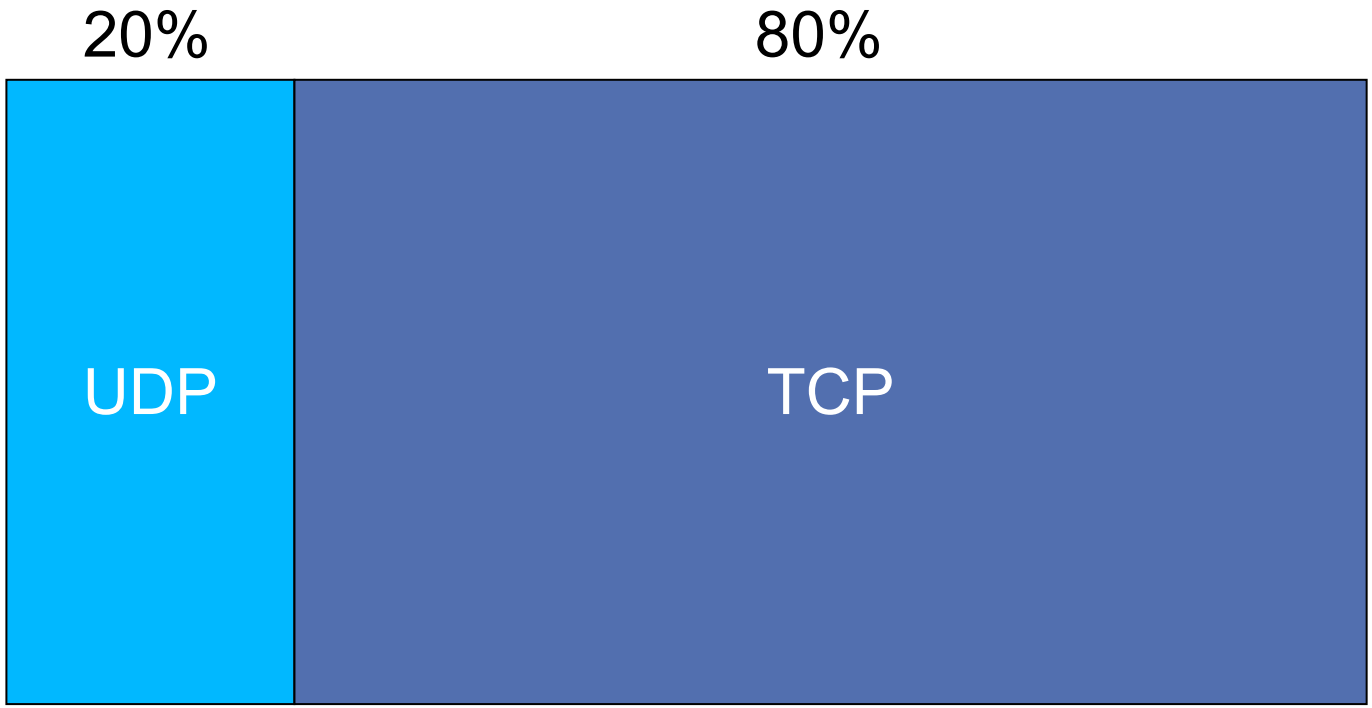
Tree Maps

What is this?



ArcSight

Tree Maps



Configuration (Hierarchy): Protocol

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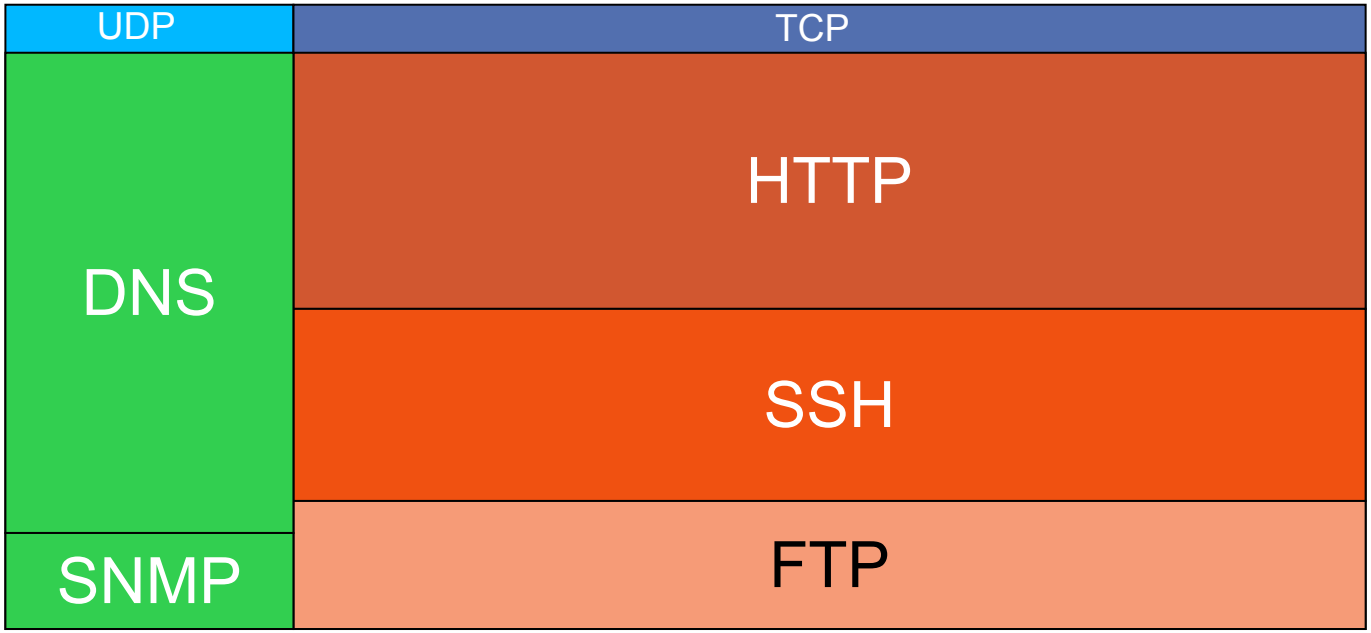
Tree Maps



Configuration (Hierarchy): **Protocol -> Service**
Size: **Count**
Color: **Protocol**

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Tree Maps
Advanced Usage

- More than three dimensions
- Probably less than 5 dimensions
- Color and Size
  - Additional dimensions
  - Not shown in the “main” hierarchy

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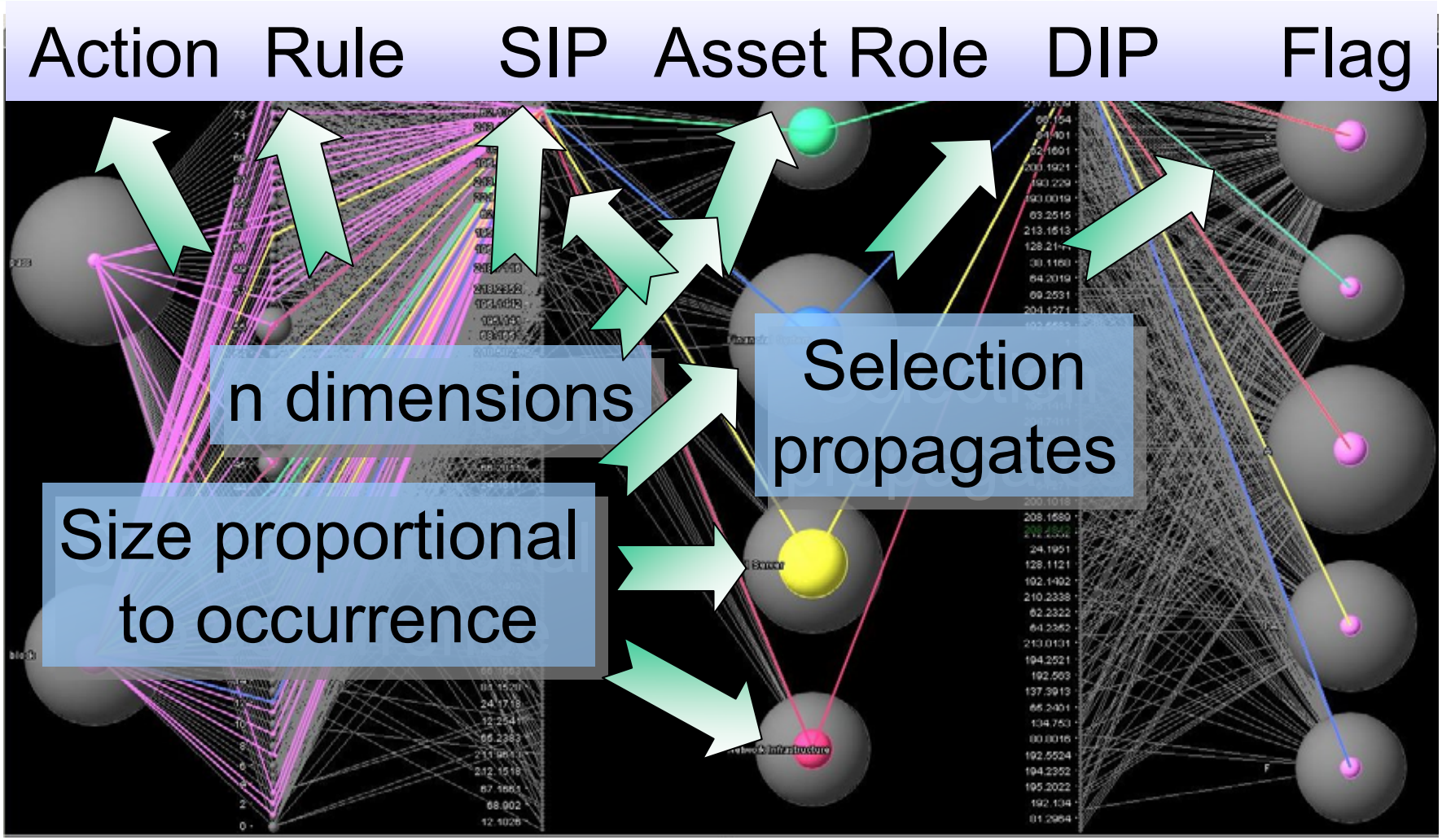
Parallel Coordinates



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Questions and Answers

ArcSight

Thank You

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Security Data Visualization
www.secviz.org

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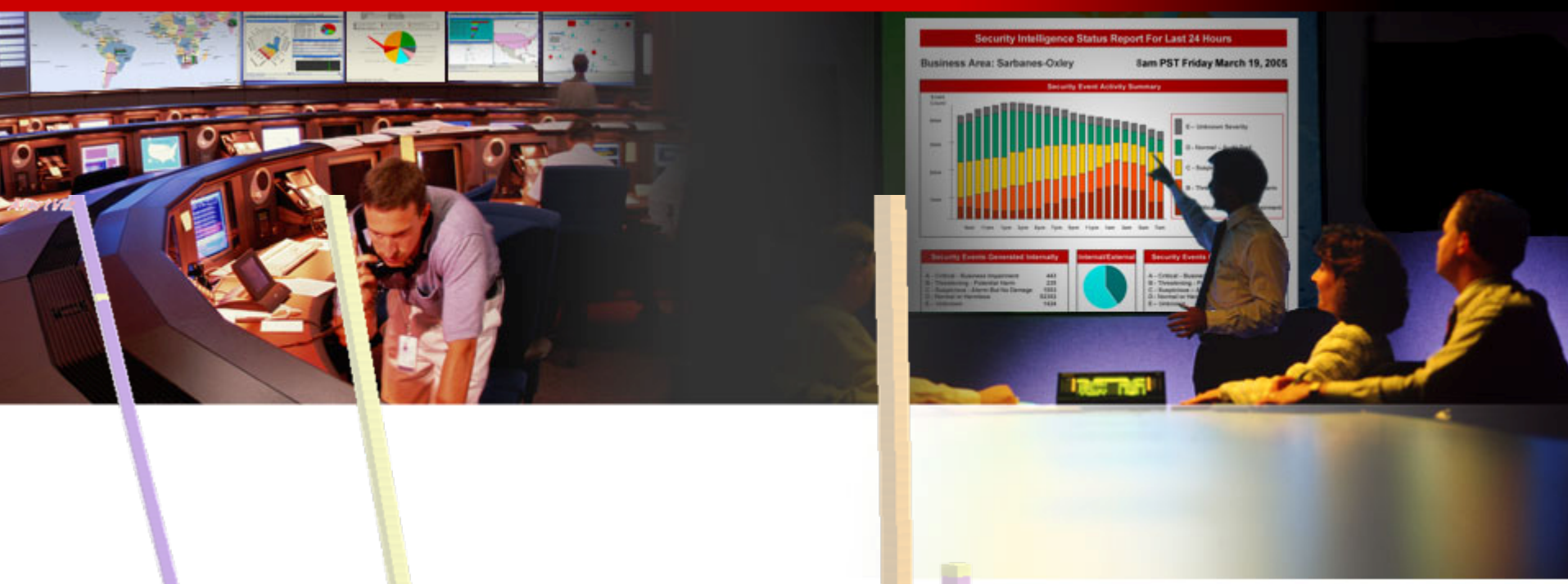


Insider Threat Theory

Raffael Marty, GCIA, CISSP
Manager Solutions @ ArcSight, Inc.

FIRST – June 2007 – Seville

Agenda

- Visualization
- **Insider Threat Theory**
- Log Data Processing
- Open Source Visualization Tools
- ***Visualization Exercise with AfterGlow***
- Simple I-Threat Visualizations
  - DuPont Information Leak
  - SAP Fraud Detection

ArcSight

Insider Threat
Definition

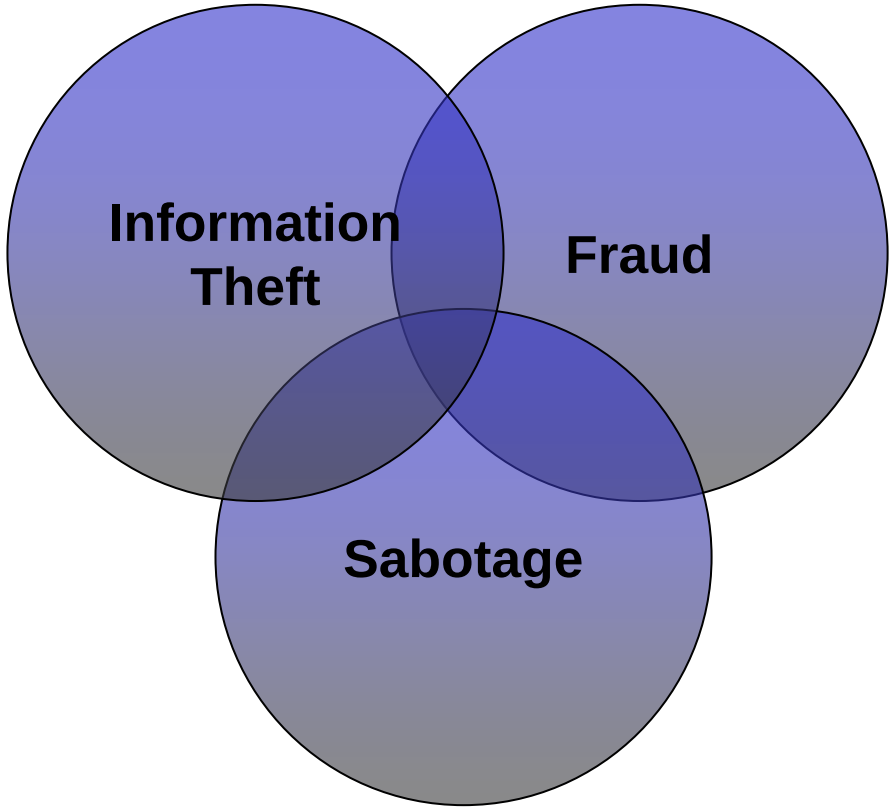
"Current or former employee or contractors who

- intentionally exceeded or misused an authorized level of access to networks, systems or data in a manner that
- targeted a specific individual or affected the security of the organization's data, systems and/or daily business operations"

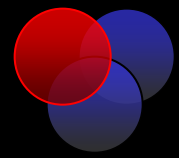
[CERT: http://www.cert.org/insider_threat Definition of an Insider]

Insider Threat

Three Types of Insider Threat

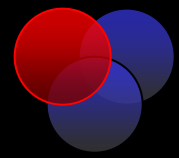


Information Theft



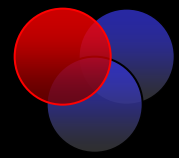
Information Theft is concerned with stealing of confidential or proprietary information. This includes things like financial statements, intellectual property, design plans, source code, trade secrets, etc.

Insider Threat
Information Theft



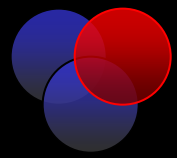
- Hard to stop:
  - Cell Phones / iPods / USB sticks
  - Email
  - Hard copies (printer)
- Information is intangible. How do you protect that?

Insider Threat
Information Protection



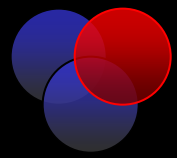
- Extrusion Detection / Prevention
- Document Management
- Policies and Procedures
- Awareness
- Document Classification
- …

Insider Threat
Fraud



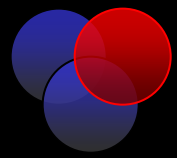
Fraud deals with the misuse of access privileges or the intentional excess of access levels to obtain property or services unjustly through deception or trickery.

Insider Threat
Type of Fraud



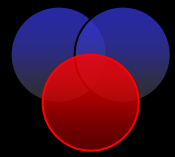
- Real estate
- Insurance
- Tax
- Bank
- Occupational
- Financial Statement

Insider Threat
Fraud Detection



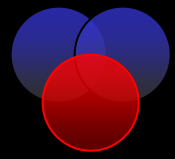
- Various different approaches
  - User Identification
  - Transaction verification / checks and balances
  - Separation of Duties

Insider Threat
Sabotage



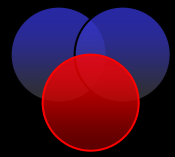
Sabotage has to do with any kind of action to harm individuals, organizations, organizational data, systems, or business operations.

Insider Threat
Sabotage



- Information Destruction
- Denial of Service
- Theft
- Harm to organization of individuals

Insider Threat
Sabotage Detection



- How can you detect this?
- Wouldn't it be too late if you detected sabotage?

Insider Threat Personae
Why are They Important?

- Understand who is behind the crime.
- Know what to look for
- Stop insiders **before** they become a problem

Insider Persona
Information Thieves

- Former employees or employees on their way out
- Three types
  - Financially motivated
  - Employees taking information to new job (starting new company)
  - Embarrass former employee (organization or individual)
- Using their access privileges and in some cases compromised accounts
- Mostly committed crime from within workspace

Insider Persona
Fraudsters

- Current employees
- Using their own account and access privileges
- Generally have system administration or privileged access
- While financially motivated, fraudsters are in general not in financial need
- Generally no sophisticated attack methods (such as exploits)
- Mostly committed crime from within workspace

Insider Persona
Saboteur

- Former employees
- Revenge for negative event (fired, no bonus, new boss, etc.)
- Generally (used to) have system administration or privileged access
- No authorized access when committing crime
- Mostly using compromised accounts, some using backdoor accounts
- Some using technically sophisticated means (scripts as logic bombs, etc.)
- Some took preparatory action

Questions and Answers

ArcSight

Thank You

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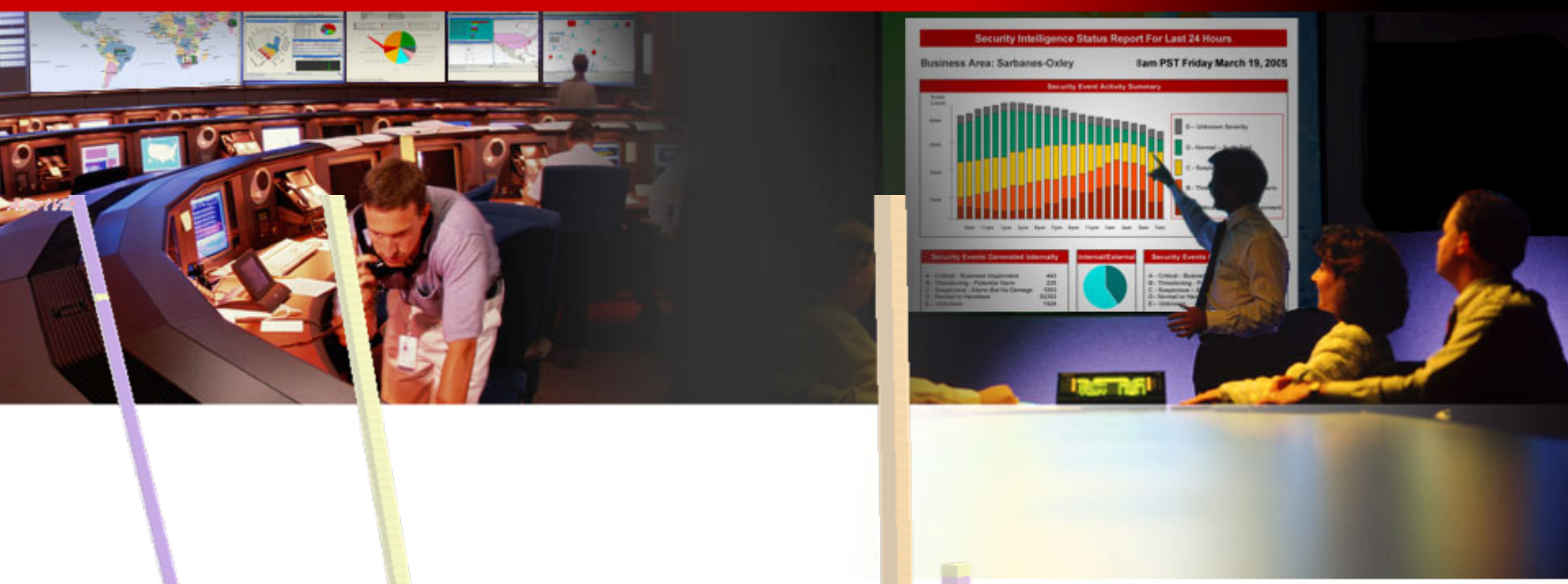


Insider Threat – Log Data Processing

Raffael Marty, GCIA, CISSP
Manager Solutions @ ArcSight, Inc.

FIRST – June 2007 – Seville

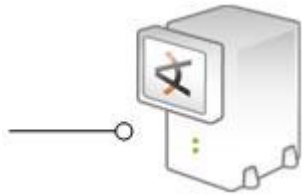
Agenda

- Visualization
- Insider Threat Theory
- **Log Data Processing**
- Open Source Visualization Tools
- ***Visualization Exercise with AfterGlow***
- Simple I-Threat Visualizations
  - DuPont Information Leak
  - SAP Fraud Detection

What Tools Are You Using For Log Processing?

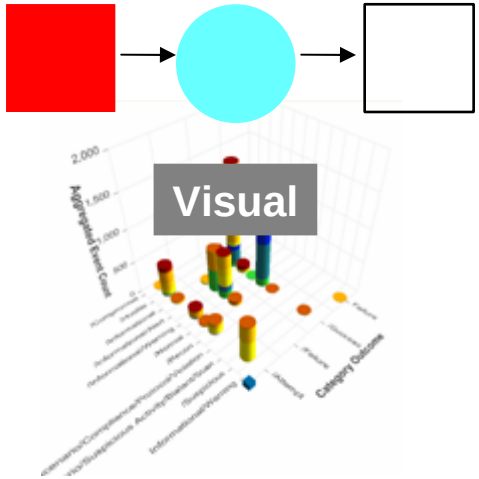
How To Generate A Graph

... | Normalization | ...



Device **Parser** **Event Visualizer**

```
Jun 17 09:42:30 rmarty ifup: Determining IP information for eth0...
Jun 17 09:42:35 rmarty ifup:  failed; no link present.  Check cable?
Jun 17 09:42:35 rmarty network: Bringing up interface eth0:  failed
Jun 17 09:42:38 rmarty sendmail: sendmail shutdown succeeded
Jun 17 09:42:38 rmarty sendmail: sm-client shutdown succeeded
Jun 17 09:42:39 rmarty sendmail: sendmail startup succeeded
Jun 17 09:42:39 rmarty sendmail: sm-client startup succeeded
Jun 17 09:43:39 rmarty vmnet-dhcpd: DHCPINFORM from 172.16.48.128
Jun 17 09:45:42 rmarty last message repeated 2 times
Jun 17 09:45:47 rmarty vmnet-dhcpd: DHCPINFORM from 172.16.48.128
Jun 17 09:56:02 rmarty vmnet-dhcpd: DHCPDISCOVER from 00:0c:29:b7:b2:47 via vmnet8
Jun 17 09:56:03 rmarty vmnet-dhcpd: DHCPOFFER on 172.16.48.128 to 00:0c:29:b7:b2:47 via vmnet8
NH
```



Log File

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UNIX Tools

- awk

```
awk –F, ‘{printf(“%s,%s”,$2,$1);}’
```

- Sed

```
sed 's/fubar/foobar/' filename
```

- Grep

```
cat file | grep –v
```

Regular Expressions
What?

- Text processing
  - Searching
  - Replacing
  - Extracting
- Example

```
Raf{2}a.l Mart[yi]
```

Regular Expressions
Basics

```
^   Beginning of string
$   End of string
.   Any character
[   Start of character list
]   End of character list
(   Start of expression group
)   End of expression group
|   ORs two expressions
\   Escape character
*   Preceding expression occurs zero or more times
?   Preceding expression occurs zero or one times
+   Preceding expression occurs one or more times
```

Regular Expressions
Examples

- Searching
  - `perl -ne 'print if (/^1/)' file.txt`
  - `egrep '^1[0-9]+ +K' file.txt`
- Replacing
  - `perl -pe 's/^ +//' phonelist.txt`
  - `sed 's/^$/d' price.txt`
- Extracting
  - `perl -pe 's/.*(IN=[^ ]*).*/\1/'`

Regular Expressions
Advanced

- Greedy vs. non-greedy

```
Apr 17 08:22:27 rmarty kernel: OutputIN= OUT=vmnet8
SRC=192.168.170.1 DST=192.168.170.255 LEN=258 TOS=0x00
PREC=0x00 TTL=64 ID=0 DF PROTO=UDP SPT=138 DPT=138
LEN=238
```

perl -pe 's/.*(OUT=.*) .*/\1/'

```
OUT=vmnet8 SRC=192.168.170.1 DST=192.168.170.255 LEN=258 TOS=0x00 PREC=0x00 TTL=64
```

perl -pe 's/.*(OUT=.*?) .*/\1/'

```
OUT=vmnet8
```

Regular Expressions
Advanced

- Crazy example: Creates an index of links from a HTML file

```
s/<[     ]*[Aa][  ]*[Hh][Rr][Ee][Ff]/<a href/g
:loop
/<a href *= *"[^#]/{;
  x; s/[^\n]*/&;9876543210 99999000009999000099900099009O;/
  s/\([0-8]\{0,1\}\)\(9*\);[^1]*\(.\)\1[^;]*\2\(0*\)[^;]*;\(.*\)/\3\4\5/
  x;  G;  s
<a href *= *\("\([^"]\+\)"[^>]*>\)\([^\n]*\(\n\)\)\([^\n]*\)\(.*$\)
<||||||=\1[\5] \3\5\4\6\4[\5] \2<br>
  h; s/[^\n]*\n//
  x
  s/\n.*//
  b loop;
}
s/<||||||/<a href/g;
/<\/[Bb][Oo][Dd][Yy]>/{
  G
  s/\(<\/[Bb][Oo][Dd][Yy]>[^\n]*\)\n[^\n]*\n*\(.*\)/<hr>\2\1/;
}
```

PERL

- Simple tools:

(Stolen from: `http://raffy.ch/blog/2007/02/24/geo-lookup-on-the-command-line/`)

```
10/13/2005 20:25:54.032145,195.141.211.178,195.131.61.44,2071,135
```

I want to get the country of the source address (first IP in the log):

```
cat pflog.csv | perl -M'Geo::IPfree' -na -F/,/ -e
'($country,$country_name)=Geo::IPfree::LookUp($F[1]);ch
omp; print "$_,$country_name\n"'
```

And here the output:

```
10/13/2005 20:24:33.494358,62.245.243.139,212.254.111.99,,echo
request,Europe
```

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Data Sources

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Different Data Sources

- PCAP
- Firewall (PF)
  - IP Tables and why its logging is bad
- Argus
- Snort

PCAP

- Packet Captures
- Binary format
- tcpdump –nnlr <file>

PF Firewall

- OpenBSD Firewall

```
Feb 18 13:39:27.977280 rule 71/0(match): pass in on
xl0: 195.27.249.139.63285 > 195.141.69.42.80: S
340743432:340743432(0) win 32768 <mss 1460,nop,wscale
0,nop,nop,timestamp 24078 0> (DF)
```

- Reading the file/interface (which is in pseudo PCAP):

```
tcpdump –nnli pflog
```

- Make sure you are using the OpenBSD tcpdump!!

Argus

```
ram@rmarty$ man 8 argus
```

"Argus is an IP transaction auditing tool that categorizes IP packets which match the boolean expression into a protocol-specific network transaction model. Argus reports on the transactions that it discovers, as they occur."

Argus
Output

```
10 Apr 06 10:55:46   *          tcp  217.118.195.58.22     ?>
   65.219.2.99.37065 1280      1550       309440         23952        RST
```

- Timestamp
- Protocol
- SourceIP . SourcePort
- Directon
- DestiationIP . DestinationPort
- PacketsIn and PacketsOut
- BytesIn and BytesOut
- Status

Parsers

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Parsers

- Parser?

  "To analyze or separate (input, for example) into more easily processed components." (answers.com)

- Interpret Data
- Knows data format
- Re-use don't re-invent!
- The UNIX Paradigm: Work in a pipe!
- Some available on:

http://secviz.org/?q=node/8

Parsers

- tcpdump2csv.pl
  - Takes care of swapping response source and targets

```
tcpdump -vttttnnelr /tmp/log.tcpdump |
./tcpdump2csv.pl "sip dip sport"
```

- sendmail_parser.pl
  - Reassemble email conversations:

```
Jul 24 21:01:16 rmarty sendmail[17072]: j6P41Gqt017072:
from=<root@localhost.localdomain>, size=650, class=0, nrcpts=1,
Jul 24 21:01:16 rmarty sendmail[17073]: j6P41Gqt017072: to=ram,
ctladdr=<root@localhost.localdomain> (0/0), delay=00:00:00,
xdelay=00:00:00, mailer=local, pri=30881, dsn=2.0.0, stat=Sent
```

Parsers

- Argus2csv.pl

```
ragator -r file.argus -nn -A -s +dur -s +sttl -s +dttl |
./argus2csv.pl “src dst pkts”
```

- pf2csv.pl
  - Parsing OpenBSD pf output

```
tcpdump –nnli pflog | ./pflog.pl “src dst rule”
```

- snortalert2csv.pl

```
cat alert | ./snortalert2csv.pl “name src dport”
```

Log Analysis Tools

- These tools are part of AfterGlow 1.5.8

- mergeLogs.pl

```
./merge_logs.pl lookup.csv file.csv
```

lookup.csv

```
Account Sharing,9
AV disabled,10
Backdoor Access,10
Customer Data Access,2
```

file.csv

```
rweiss,AV disabled
wcwu,Account Sharing
bgrosof,Backdoor Access
```

Output:

```
rweiss,AV disabled,10
wcwu,Account Sharing,8
bgrosof,Backdoor Access,10
```

Log Analysis Tools

- anonymize.pl

```
cat file | ./anonymize.pl -c 1 -p user
```

Original:
```
rweiss,AV disabled
wcwu,Internal Recon
bgrosof,Source Code Access
```

Anonymized:
```
user1,AV disabled
user2,Internal Recon
user3,Source Code Access
```

Questions and Answers

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Thank You

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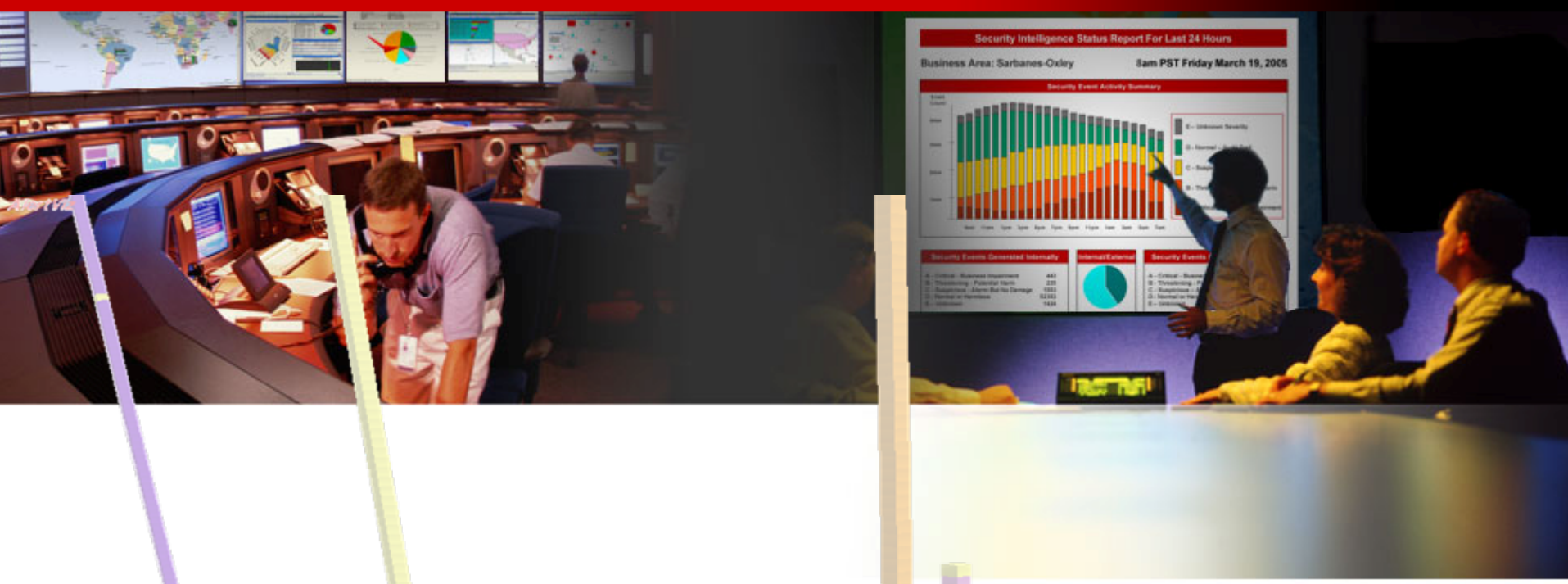

Insider Threat – Open Source Tools

Raffael Marty, GCIA, CISSP
Manager Solutions @ ArcSight, Inc.

FIRST – June 2007 – Seville

Agenda

- Visualization
- Insider Threat Theory
- Log Data Processing
- **Open Source Visualization Tools**
- *Visualization Exercise with AfterGlow*
- Simple I-Threat Visualizations
  - DuPont Information Leak
  - SAP Fraud Detection

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What are some tools?

- AfterGlow 1.5.8

  http://afterglow.sourceforge.net

- Treemap2

  www.cs.umd.edu/hcil/treemap/

- …

AfterGlow 1.x - Perl

- Supported graphing tools:
  - GraphViz from AT&T (dot, neato, circo, twopi)
    http://www.graphviz.org
  - LGL (Large Graph Layout) by Alex Adai
    http://bioinformatics.icmb.utexas.edu/lgl/

AfterGlow 1.x

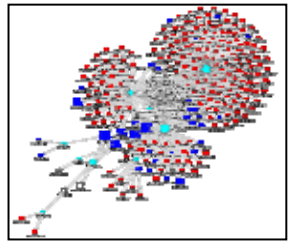
Parser

CSV File

AfterGlow

Graph LanguageFile

Grapher



```
aaelenes,Printing Resume
abbe,Information Encrytion
aanna,Patent Access
aatharuy,Ping
```

```
digraph structs {
  graph [label="AfterGlow 1.5.8",  fontsize=8];
  node [shape=ellipse, style=filled,
    fontsize=10, width=1, height=1,
    fixedsize=true];
  edge [len=1.6];

  "aaelenes" -> "Printing Resume" ;
  "abbe" -> "Information Encryption" ;
  "aanna" -> "Patent Access" ;
  "aatharuv" -> "Ping" ;
}
```

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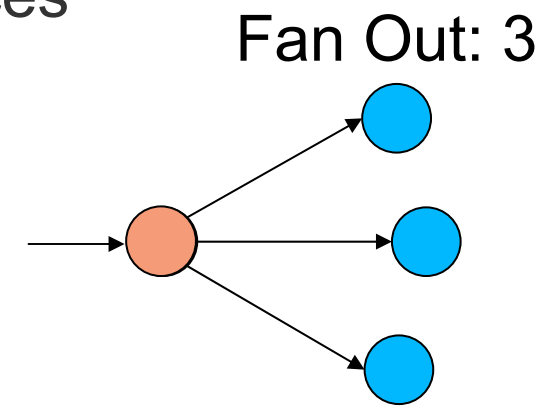
Features

- Generate Link Graphs
- Filtering Nodes
  - Based on name
  - Based on number of occurrences
- Fan Out Filtering
- Coloring
  - Edges
  - Nodes
- Clustering



Features

- Node Sizes
  - Auto adjustment
- Variables

Property File – Color Definition

- Coloring:

```
color.[source|event|target|edge|sourcetarget]=
    <perl expression returning a color name>
```

- Array `@fields` contains input-line, split into tokens:

```
color.event="red" if ($fields[1] =~ /^192\..*)
```

- Filter nodes with "`invisible`" color:

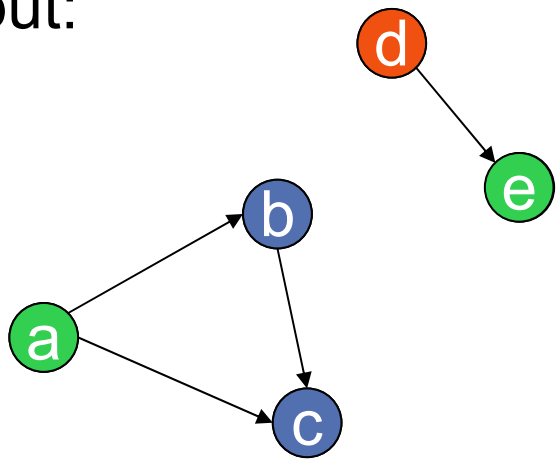
```
color.target="invisible" if ($fields[0] eq
    "IIS Action")
```

Hello World

Input Data:

```
a,b
a,c
b,c
d,e
```

Output:



Command:

```
cat file | ./afterglow -c simple.properties -t \
neato -Tgif -o test.gif
```

simple.properties:

```
color.source="green" if ($fields[0] ne "d")
color.target="blue" if ($fields[1] ne "e")
color.source="red"
color="green"
```

Property File – Threshold

- Threshold:

  `threshold.[source|event|targe]=<value>`

Property File – Clustering and Node Sizes

- Clustering:

```
cluster.[source|event|target]=
    <perl expression returning a cluster
 name>
```

- Node Sizes:

```
size.[source|event|target]=
    <perl expression returning a number>
Maxnodesize=<value>
sum.[source|event|target]=[0|1]
```

Property File – Variables

- Variables
  - Definition:

```
# Watch Lists
variable=@privileged=( "aaerchak" );
```

  - Use:

```
color.target="gold" if (grep(/$fields[0]/,@privileged));
```

- There are no limits on what you do with the “variables” keyword! You can put entire scripts in there!

Running AfterGlow

cat data | ./afterglow.pl –c file.prop | neato -Tgif -otest.gif

```
Usage:   perl afterglow.pl [-adhnstv] …

-a           : turn off labelelling of the output graph with the configuration used
-b lines     : number of lines to skip (e.g., 1 for header line)
-c conffile  : color config file
-d           : print node count
-e length    : edge length
-f threshold : source fan out threshold
-g threshold : event fan out threshold (only in three node mode)
-h           : this (help) message
-l lines     : the maximum number of lines to read
-m           : the maximum size for a node
-n           : don't print node labels
-o threshold : omit threshold (minimum count for nodes to be displayed)
               Non-connected nodes will be filtered too.
-p mode      : split mode for predicate nodes where mode is
                0 = only one unique predicate node (default)
                1 = one predicate node per unique subject node.
                2 = one predicate node per unique target node.
                3 = one predicate node per unique source/target node.
-s           : split subject and object nodes
-t           : two node mode (skip over objects)
-v           : verbose output
-x           : text label color
```

Some Property File Examples

```
# Variable and Color

variable=@violation=("Backdoor Access", "HackerTool Download”);
color.target="orange" if (grep(/$fields[1]/,@violation));
color.target="palegreen"

# Node Size and Threshold

maxnodesize=1;
size.source=$fields[2]
size=0.5
sum.target=0;
threshold.source=14;

# Color and Cluster
color.source="palegreen" if ($fields[0] =~ /^111/)
color.source="red"
color.target="palegreen"
cluster.source=regex_replace("(\\d\+)\\.\\d+")."/8"
```

AfterGlow Demo

Input

TM3 file (I am going to use a simple, but practical form!)

- Tab delimited
- Two special header lines

```
Target System   DIP     Action
STRING  STRING  STRING
Financial System        212.254.109.27  pass
Financial System        212.254.109.27  block
Financial System        212.254.110.102 pass
Mail Server     212.254.110.99  block
Mail Server     212.254.110.97  block
```

Input - Header

- First Header Line: *Column Names*
- Second Header Line: *Data Types*

```
Count Target System   DIP     Action
INTEGER  STRING  STRING  STRING
```

Treemap2

Treemap2 Demo

Agenda

- Visualization
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- ***Visualization Exercise with AfterGlow***
- Simple I-Threat Visualizations
  - DuPont Information Leak
  - SAP Fraud Detection

Questions and Answers

ArcSight

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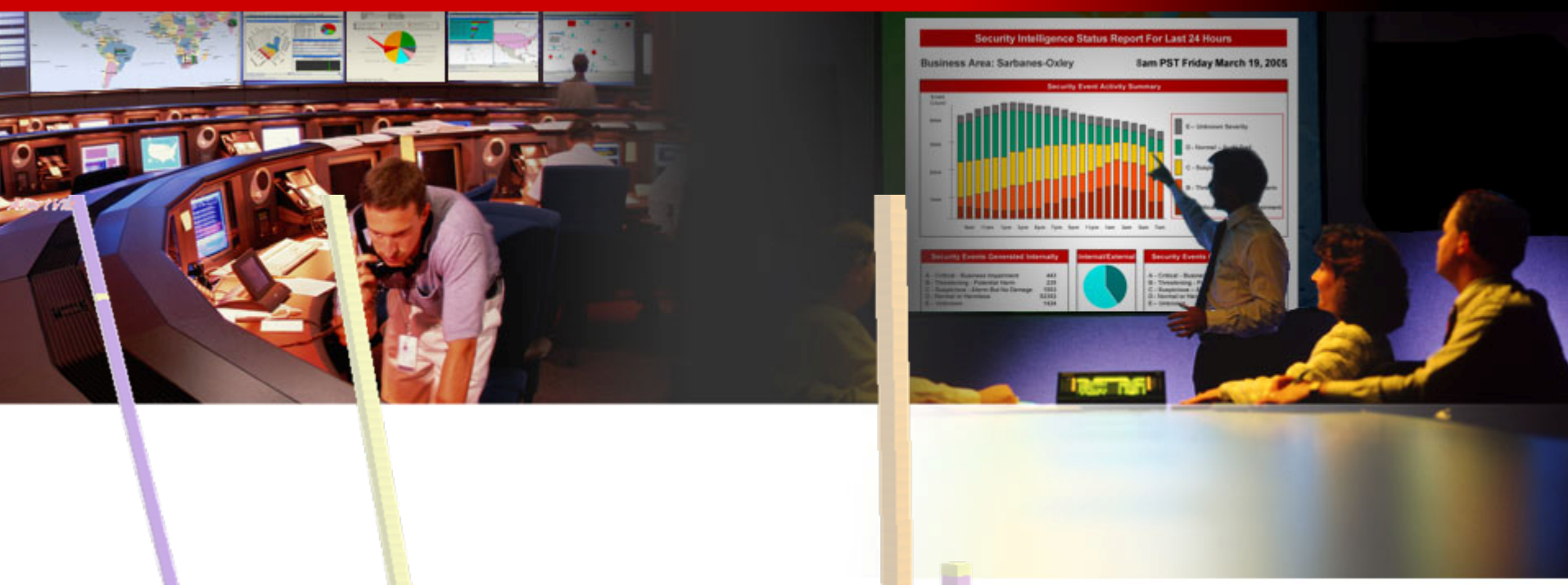

Insider Threat – Simple iThreat Example

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FIRST – June 2007 – Seville

Agenda

- Visualization
- Insider Threat Theory
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DuPont Case

- In February of 2007 a fairly large information leak case made the news. The scientist Gary Min faces up to 10 years in prison for stealing ***16,706*** documents and over ***22,000*** scientific abstracts from his employer DuPont. The intellectual property he was about to leak to a DuPont competitor, Victrex, was assessed to be worth $***400*** million. There is no evidence Gary actually turned the documents over to Victrex.

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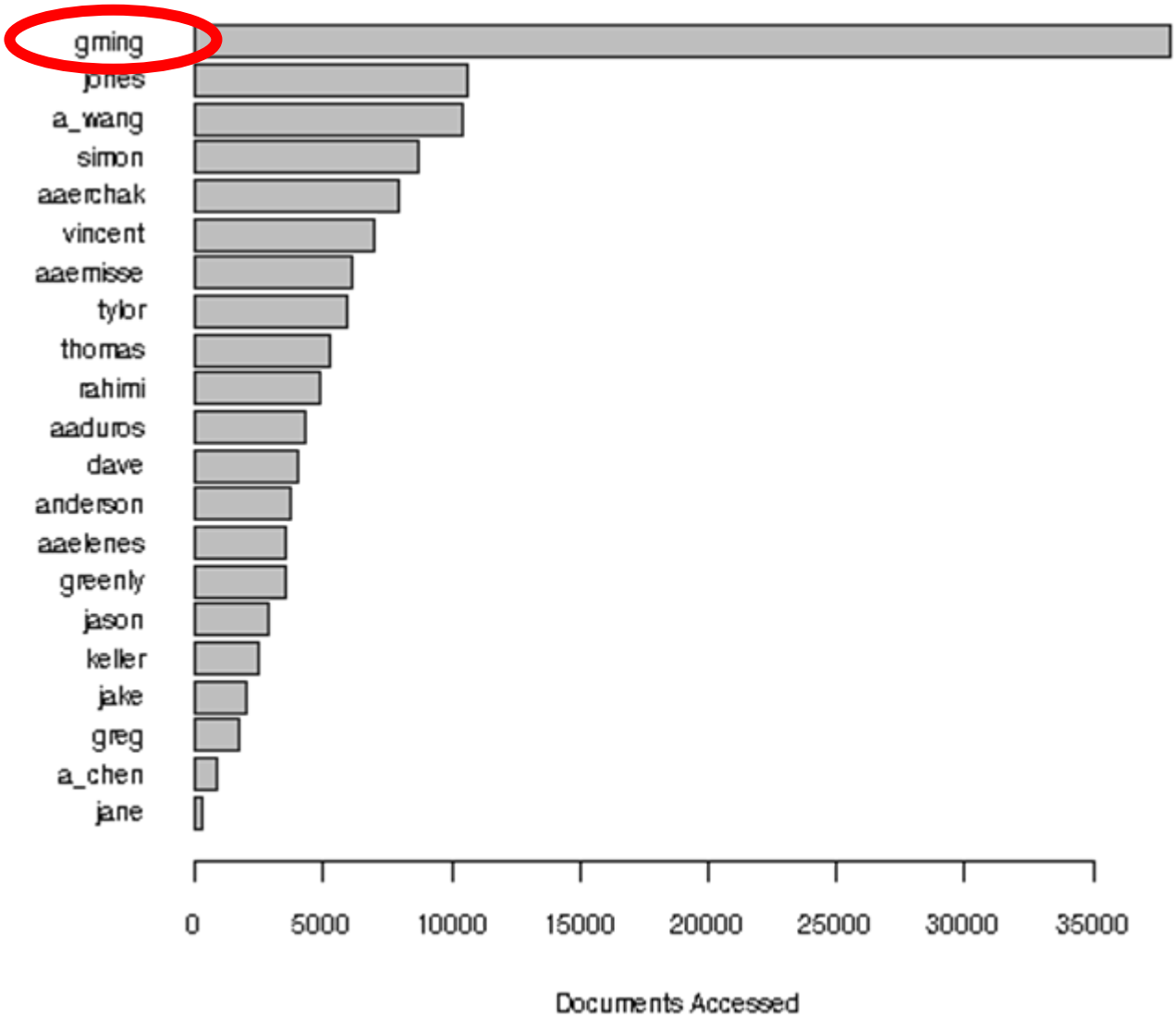
How it Could Have Been Prevented

What's the Answer?

A Simple Solution

DuPont Case
A Simple Solution



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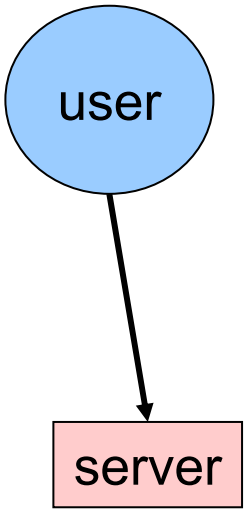
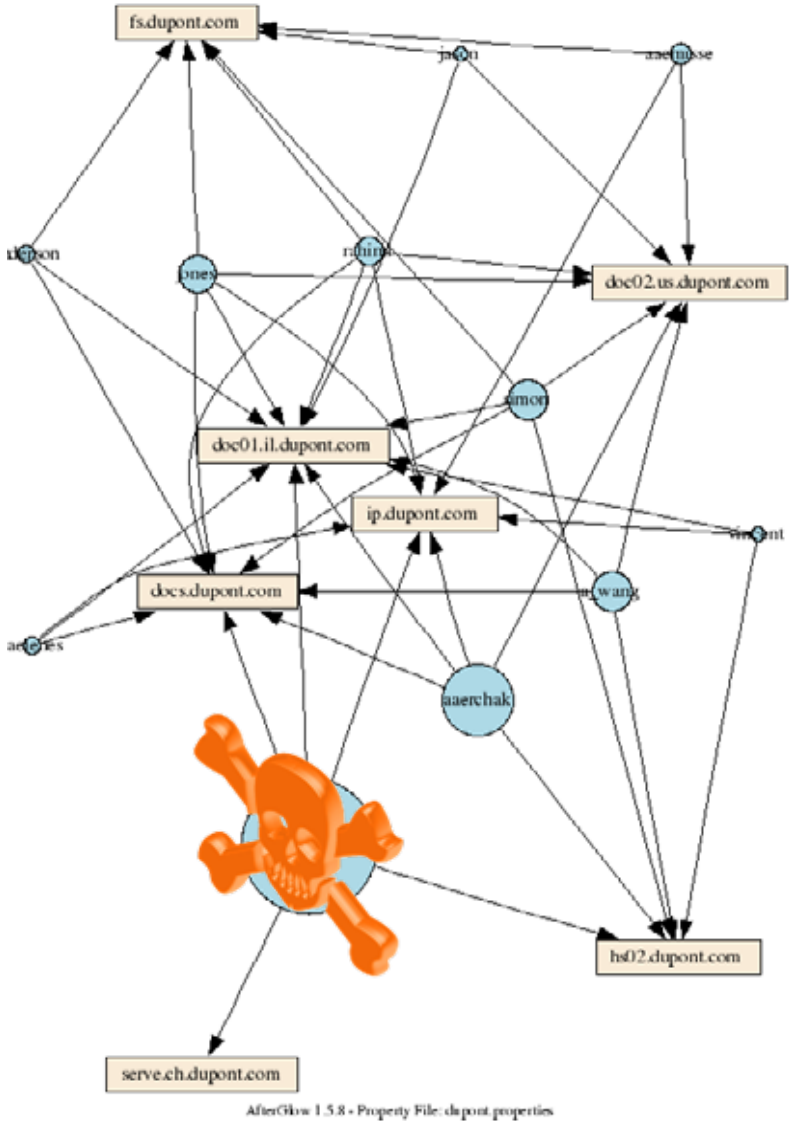
DuPont Case
A Not so Targeted Solution



Size: #accesses



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Questions and Answers

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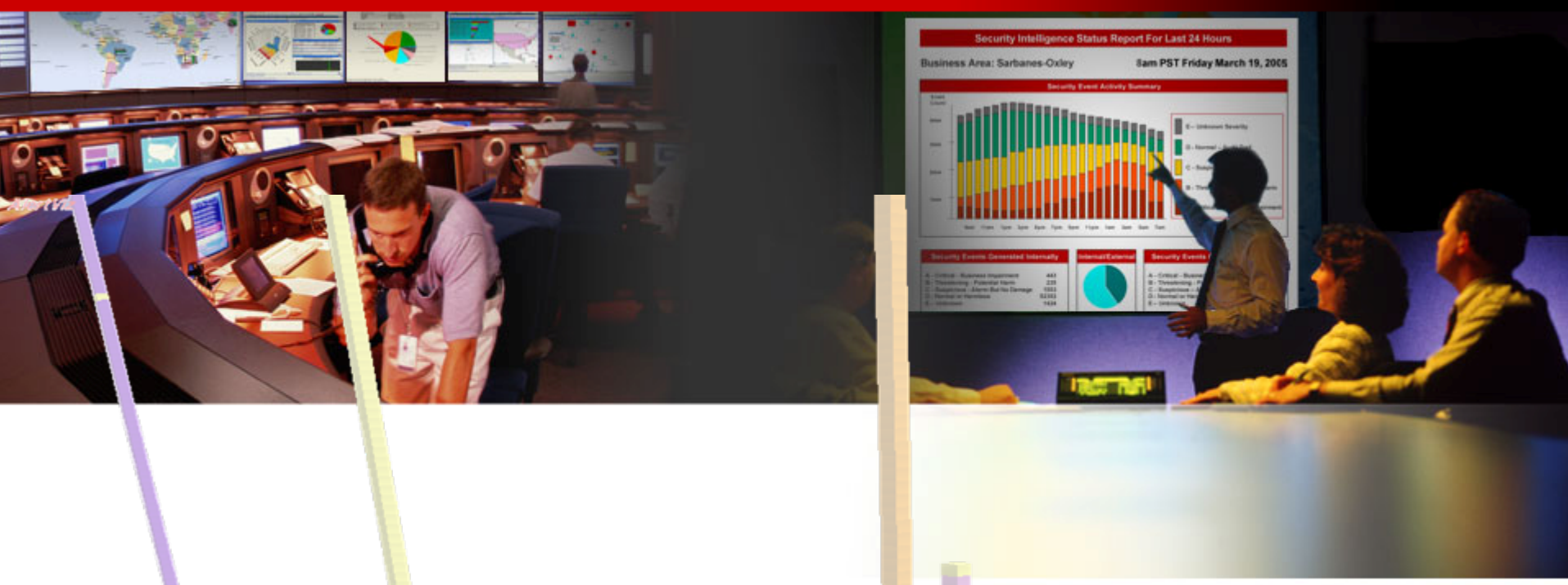

Insider Detection Process

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FIRST – June 2007 – Seville

Agenda

Insider Detection Process (IDP)

- ***Applying IDP (Exercise)***
- Insider Threat Solution
- Round Up

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Insider Threat Detection Process
Overview

- Intro
- Precursors
- Scoring Precursors
- Visualizing
- Watch Lists
- Advanced Scoring

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Insider Threat Detection Process
Intro

- The following *Insider Threat Detection Process* is
  - Ongoing research
  - A proposed approach
  - Not a guarantee for success
  - Probably going to fail in your environment
  - A lot of work to execute
  - Incredibly interesting and generates nice graphs
- Related Work: (no visualization, but uses precursors)
  - "*ELICIT: A System for Detecting Insiders Who Violate Need-to-know*", Mark Maloof and Greg Stephens

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Insider Threat Detection Process
Precursors

- A *precursor* is an *activity* that when observed, flags the associated user as a potential insider.

  Some research calls this “detectors”.

- Examples:
  - Printing off-hours
  - Downloading Hacker Tools
  - Accessing documents outside of user’s role
  - Use of anonymous proxy

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Insider Threat Detection Process
Scoring Precursors

- Each precursor can be assigned a *score* which reflects the extent to which the precursor classifies someone as an insider.
- Factors to consider:
  - Impact of action
  - Rate of False Positives
  - Is this okay for some user roles?

If I actually new some math,
I would use a Bayesian Inference network for this ;-)

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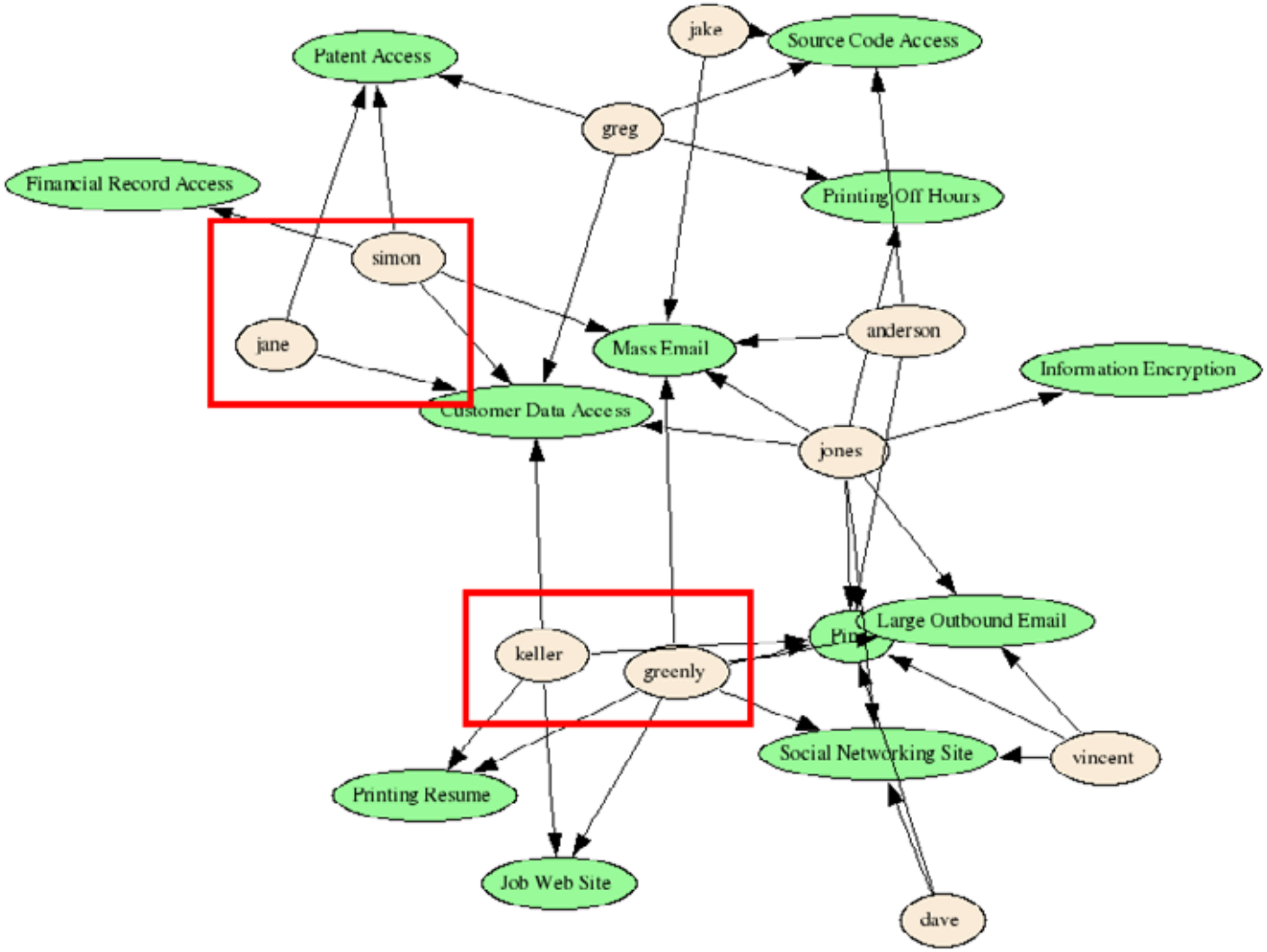
Insider Threat Detection Process
Visualization

- User -> Precursor -> Score
- Find outliers
  - Based on groups of users with similar behavior
  - Based on scores

ArcSight

Insider Threat Detection Process
Visualization – Groups of Users



ArcSight

Insider Threat Detection Process
Visualization – User Scores

ArcSight

Insider Threat Detection Process
Watch Lists

- Keep track of specific users
  - Privileged accounts
  - Contractors
  - Terminated Employees

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Insider Threat Detection Process
Advanced Scoring

- Based on the watch lists, adjust the precursor scores for these users.
- For example, a user name on the terminated employees list: +5!

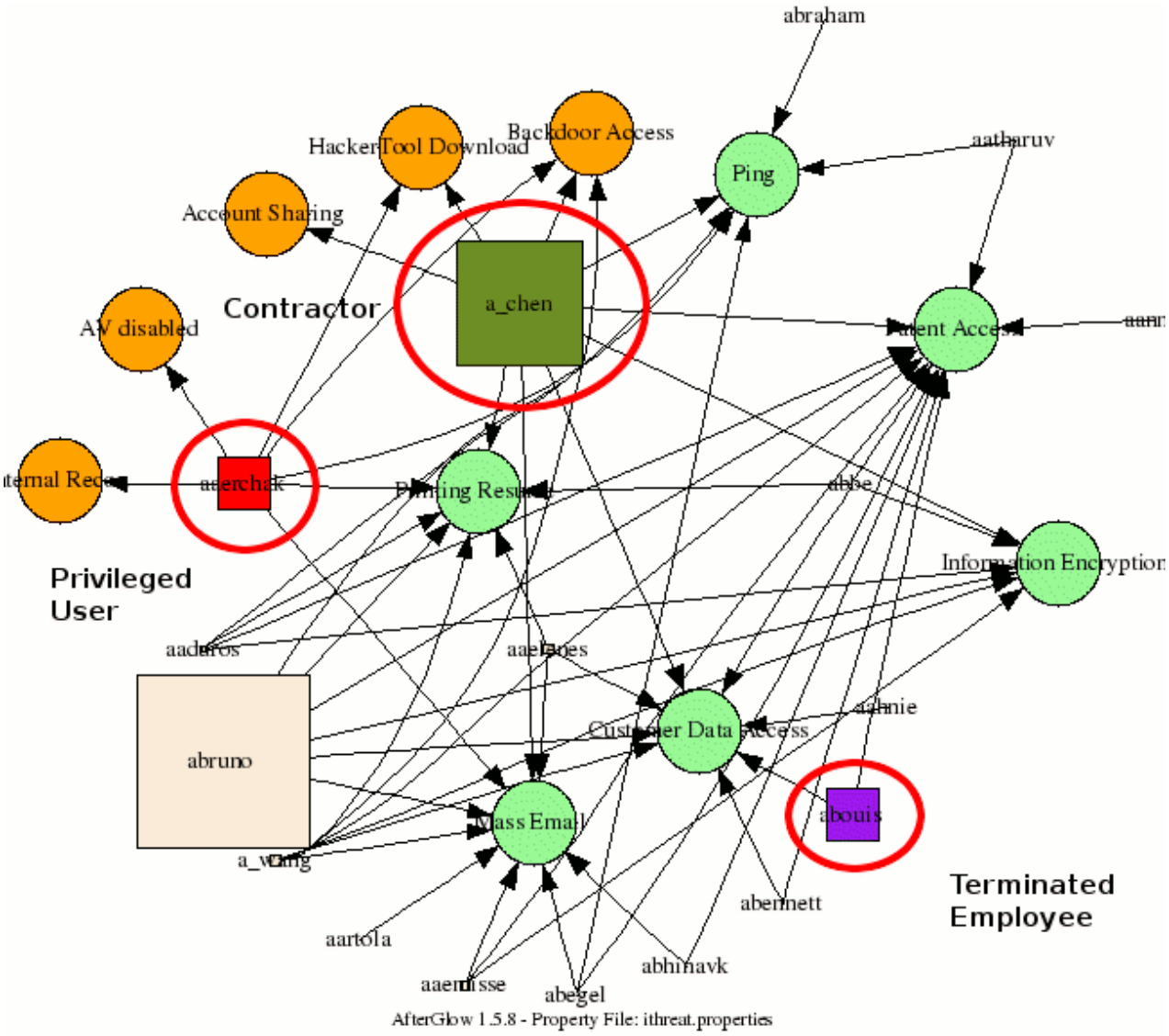
ArcSight

Insider Threat Detection Process
Advanced Watch List Application

- Do role-based behavior assessment based on watch lists
- Color users based on watch list
- Quickly spot groups, outliers, anomalies

ArcSight

Insider Threat Detection Process
Scoring and Coloring based on Watch Lists



Insider Threat Detection Process
Precursor Categories

- Problem of scoring so far:
  - Repetitive “not so bad” behavior escalates a user immediately.
- Group precursors:
  1. Minimal or no impact
  2. Signs of a setup for a malicious act
  3. Malicious behavior, normal for some users
  4. Malicious behavior, this should _never_ happen
  5. The insider crime itself

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Insider Threat Detection Process
User Tiers

- User can accumulate a max of 20 points per category
- Categorize users based on score:

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Questions and Answers

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Thank You

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