


Welcome to

4. SIEM Visualization and Dashboards

KEA Kompetence SIEM and Log Analysis

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Slides are available as PDF, [kramse@Github](#) 
4-visualization-siem.tex in the repo security-courses

Goals for today



Today's goals:

- Visualizations see a lot of examples, knowing possibilities makes it possible to choose
- Kibana features like importing/exporting dashboards
- Look at alerting

Photo by Thomas Galler on Unsplash

Plan for today

Subjects

- Visualizations examples
- Tool examples
- Kibana features like importing/exporting dashboards

Exercise theme: Make it easy and pretty

- Importing dashboards

DDS 6. Visualizing Security Data 22

DDS 10. Designing Effective Security Dashboards

Skim: DDS 11. Building Interactive Security Visualizations

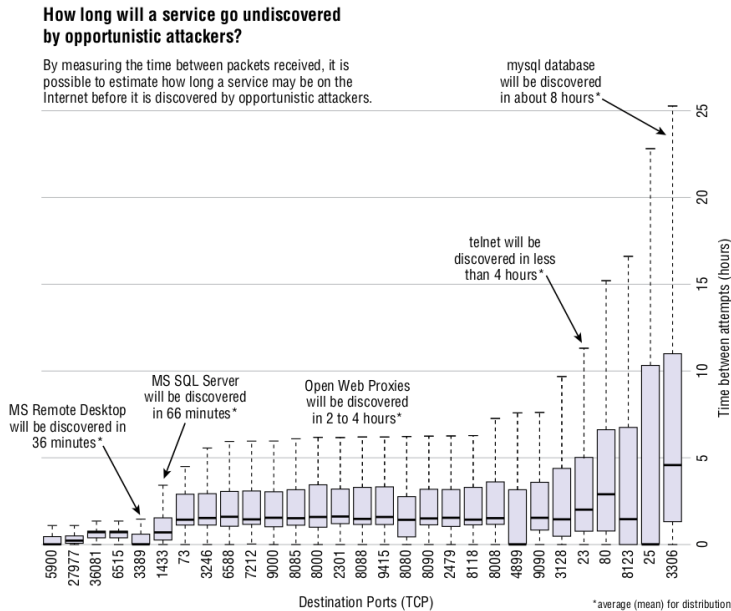
Reading Summary, continued

- **Data visualizations communicate complexity quickly.** Descriptive statistics (mean, median, variance, and so on) exist to describe and simplify data but tend to remove subtleties that exist. It's possible to communicate millions of data points in seconds while minimizing the loss of detail and resolution through visualization.
- **Data visualizations enable recognition of latent patterns.** Patterns that would never be apparent using statistical methods or scanning the data may be revealed through visualization. When data is visually presented, patterns in a single variable or relationships across many variables may leap off the screen.
- **Data visualizations enable quality control on the data.** Mistakes and errors in data collection or preparation can often be revealed through visualization. Data visualizations can serve as a good and quick sanity check on your work.
- **Data visualizations can serve as a muse.** It's been said that most breakthroughs in science didn't start with a "Eureka!" but instead with a "Huh, that's odd." Laying out the data visually can give you a new perspective and help facilitate your thinking and discovery processes.

Source: DDS 6. Visualizing Security Data

- A light reading chapter, color, eye movements etc.

Example plot 6-17



Source: DDS 6. Visualizing Security Data

- Interesting graph, and interesting results Changing away from standard ports delay attackers!

Reading Summary, continued

- **A Dashboard Is Not a Report** ... However, the top-level view should be designed solely to give the viewer situational awareness of the desired task.
- **A Dashboard Is Not an Art Show**
- **Take Care with Colors** - talks about printing, but color blindness is a real problem
- **Use Fonts Wisely** - be sure to select one that scales consistently, supports variable width text, and has fixed-width numbers.
- **No One Dashboard to Rule Them All** - An iterative process

Source: DDS 10. Designing Effective Security Dashboards

Going through dashboards must be part of a procedure

Reading Summary, continued

Getting started with D3 requires only three things—a text editor, the D3 JavaScript library, and a web server. To prove this, read through this annotated, basic example of a static bar chart (Figure 11-11) to see what it's like to code in D3.

Source: DDS 11. Building Interactive Security Visualizations

- Skim read chapter!
- D3.js is fantastic and also fantastically complex, beautiful examples <https://d3js.org/>
- I learned similar things from the NoStarch book, Data Visualization with JavaScript by Stephen A. Thomas March 2015, 384 pp. ISBN-13: 978-1-59327-605-8 <https://nostarch.com/datavisualization>
- Today you can easily start out with Kibana, and defaults
- Finding recipes for running a full screen Dashboard with a rPi are easy to find

- Multiple sites and resources are available in this area
- FloCon, the international conference on “Using Data to Defend,” <https://resources.sei.cmu.edu/news-events/events/flocon/>
- Zeek (BroCon) events <https://zeek.org/past-events/>
- IEEE Symposium on Visualization for Cyber Security, <https://vizsec.org/>
- Secviz older web site I have browsed from time to time, seeing examples, tools, data <https://secviz.org/>
- Greg Conti <http://rumint.org/>
- List a couple of tools you should know by name at least
- graphviz <https://graphviz.org/>
- afterglow <http://afterglow.sourceforge.net/>, examples Raffael Marty <https://raffy.ch/blog/2012/03/24/advanced-network>

Take names, make a list - note the tools and people working with this

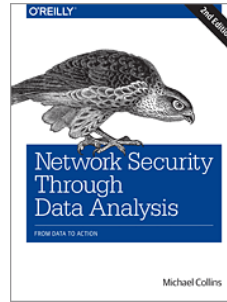
Newer tools

- <https://www.brimsecurity.com/> Brim now renamed Zui is packaged as a desktop app, built with Electron just like Slack. Once installed, you can open a pcap with Zui and it will transform the pcap into Zeek logs in the ZNG format.
- <https://seaborn.pydata.org/> Seaborn is a Python data visualization library based on matplotlib. It provides a high-level interface for drawing attractive and informative statistical graphics.
- <https://www.scikit-yb.org/en/latest/> Yellowbrick extends the Scikit-Learn API to make model selection and hyper-parameter tuning easier. Under the hood, it's using Matplotlib.
- <https://altair-viz.github.io/> Altair is a declarative statistical visualization library for Python, based on Vega and Vega-Lite, and the source is available on GitHub.
- <https://github.com/gtkcyber/griffon-vm> Griffon is a environment for data science. Griffon is based on Ubuntu MATE and includes numerous data science tools, all installed and configured for immediate use.

Recommended by Charles Givre in the article:

<https://www.oreilly.com/content/improving-security-through-data-analysis-and-visualizations/>

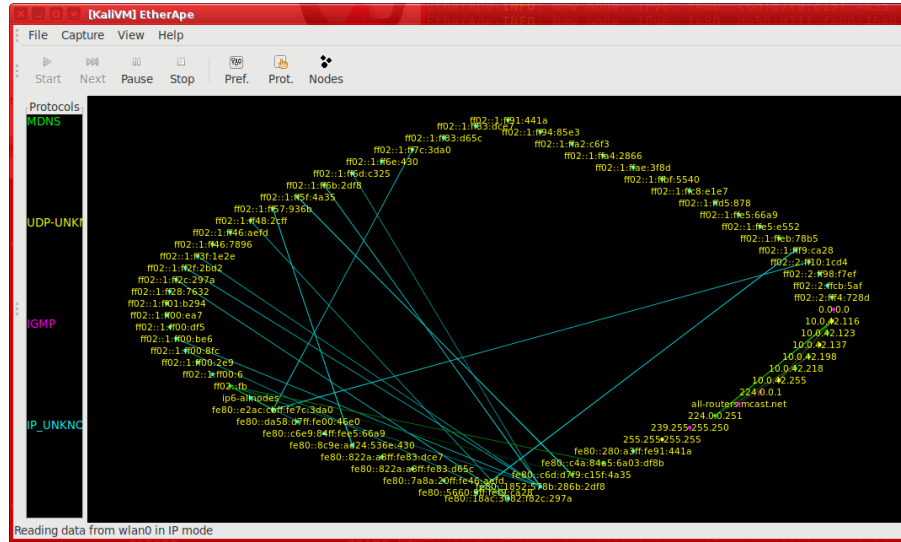
Books: Network Security Through Data Analysis



Network Security through Data Analysis, 2nd Edition By Michael S Collins Publisher: O'Reilly Media 2015-05-01: Second release, 348 Pages

- *Applied security visualization*, Rafael Marty, 2009
- *Security Data Visualization: Graphical Techniques for Network Analysis*, Greg Conti 2007
- *Visualize This: The FlowingData Guide to Design, Visualization, and Statistics*, Nathan Yau ISBN: 978-0-470-94488-2 July 2011 384 Pages

Example tools and graphs



- Graph types not in the book
- Etherape shown, see <https://etherape.sourceforge.io/>

Parallel coordinate plots

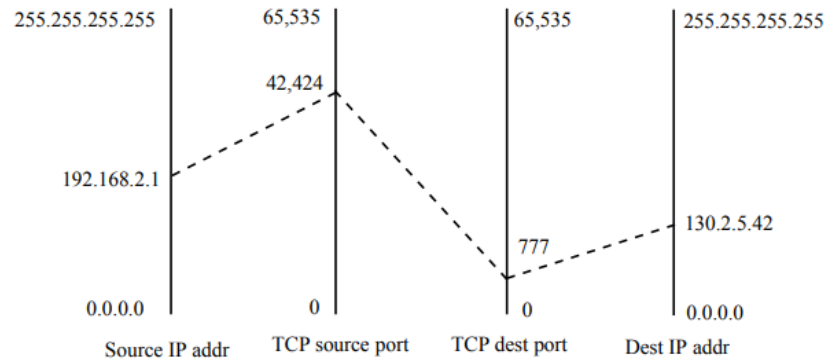


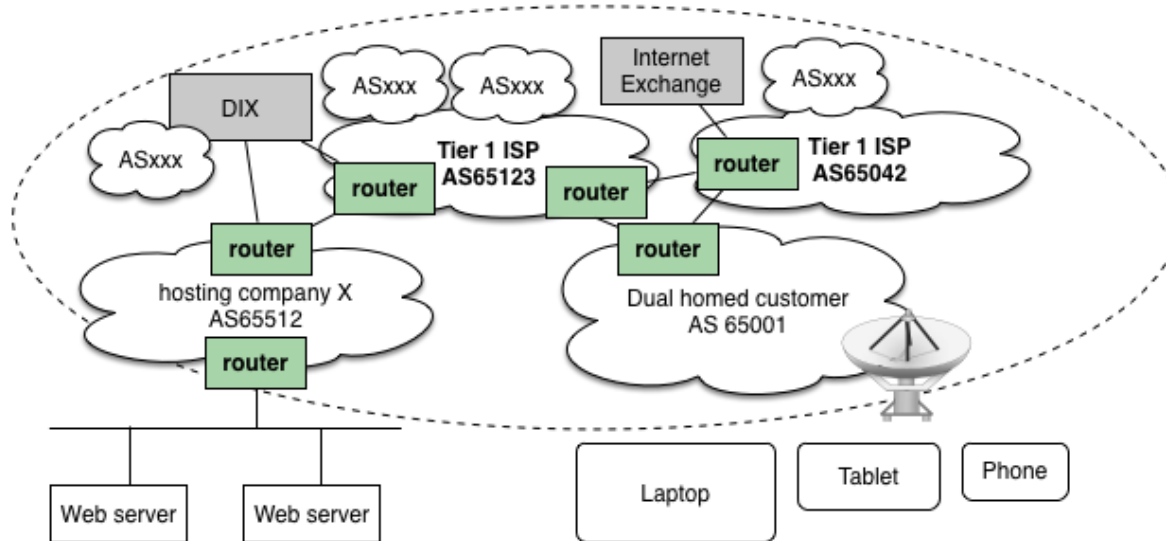
Figure 7: Parallel coordinate plot for a TCP packet from 192.168.1.1:42424 to 130.2.5.42:777.

Source: image from Network Security Visualization Keith Fligg and Genevieve Max

<https://www2.cs.arizona.edu/~collberg/Teaching/466-566/2013/Resources/presentations/2012/topic13-final/report.pdf>

- https://en.wikipedia.org/wiki/Parallel_coordinates
- Nice for explaining connections, but not used much in real life systems

Hosting and internet providers



- BGP networks are used for all of the Internet
- New standards like Resource Public Key Infrastructure (RPKI) are underway
- Try RIPE BGPlay https://stat.ripe.net/special/bgplay#bgplay_fetch.resource=185.129.60.1

Monitor your network

MRTG The Multi Router Traffic Grapher - simple, great, fast

<http://oss.oetiker.ch/mrtg/>

Smokeping Network Latency measurements - network quality

<http://oss.oetiker.ch/smokeping/>

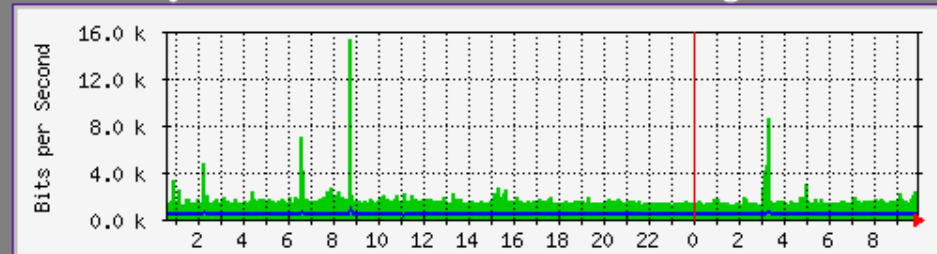
NFsen Netflow monitoring - turn on at selected routers/switches

LibreNMS <https://www.librenms.org/>

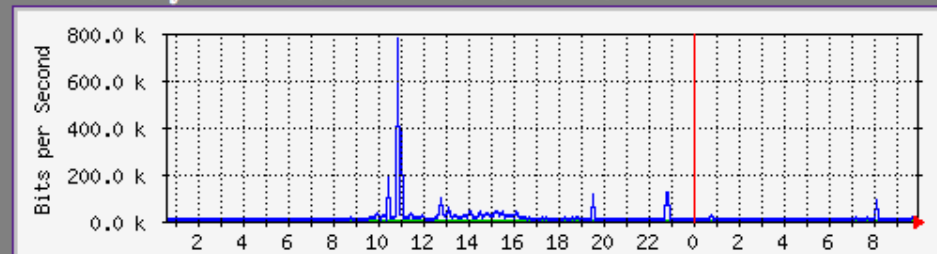
Manual tools, My Traceroute, Nping

Routers in Luxembourg

Traffic Analysis for xe-0/0/3 -- mx-lux-01 Global Crossing

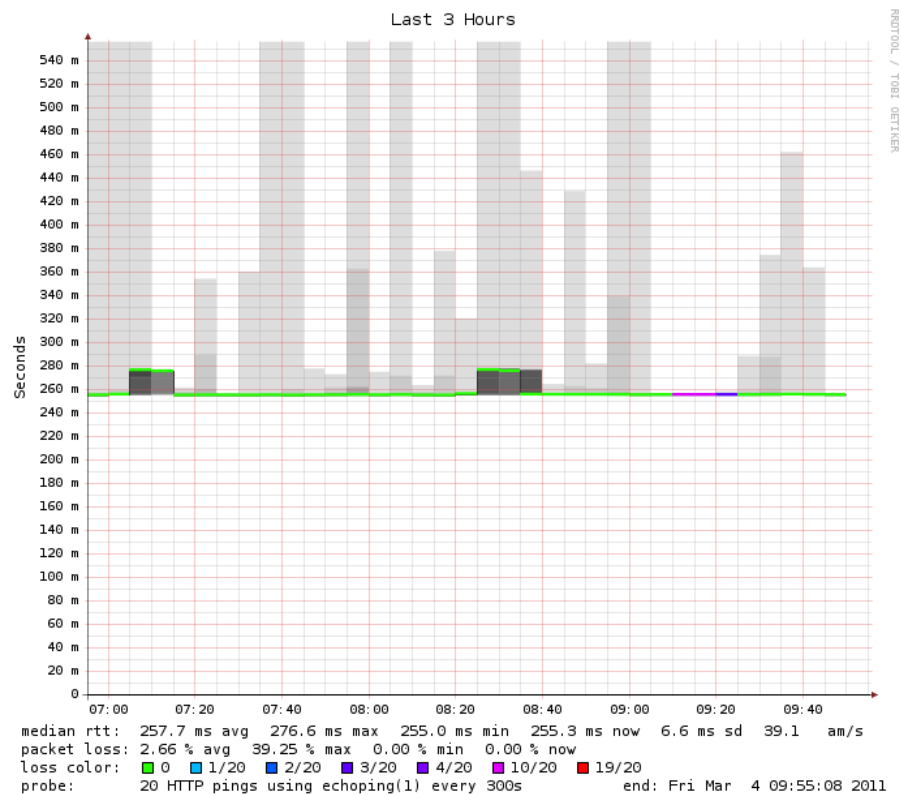


Traffic Analysis for xe-0/0/1 -- mx-lux-01 link to MX2



Run configmaker, indexmaker - almost done

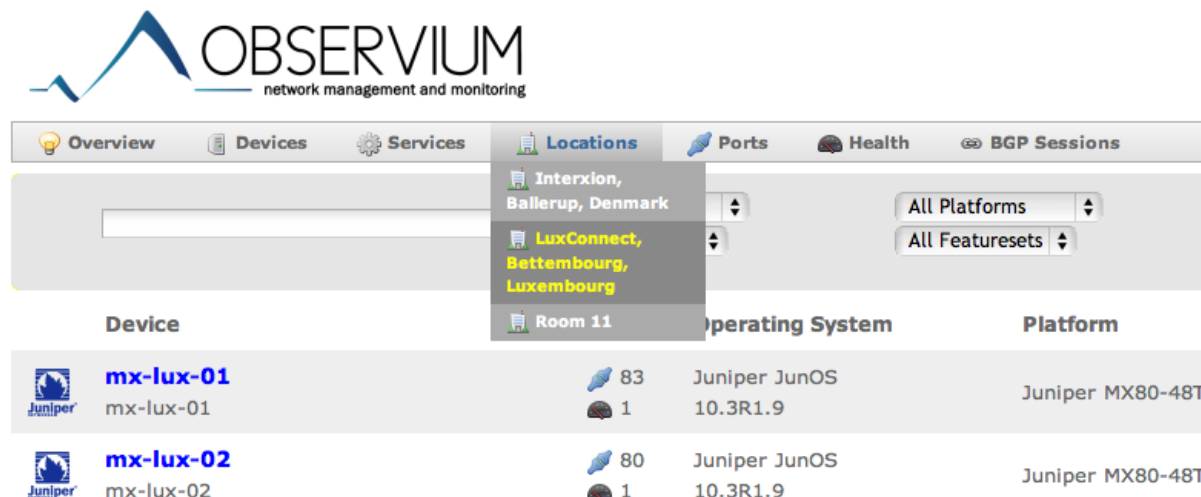
Smokeping packet loss



Smokeping latency changed



Autoconfiguration: location









OBSERVIVM
network management and monitoring

Overview Devices Services **Locations** Ports Health BGP Sessions

Interxion, Ballerup, Denmark
LuxConnect, Bettembourg, Luxembourg
Room 11

All Platforms
All Featuresets

| Device | Operating System | Platform |
|---|---|------------------|
|  mx-lux-01 mx-lux-01 |  83  1 Juniper JunOS 10.3R1.9 | Juniper MX80-48T |
|  mx-lux-02 mx-lux-02 |  80  1 Juniper JunOS 10.3R1.9 | Juniper MX80-48T |

Observium picks up the location from SNMP :-)

Config example: LLDP

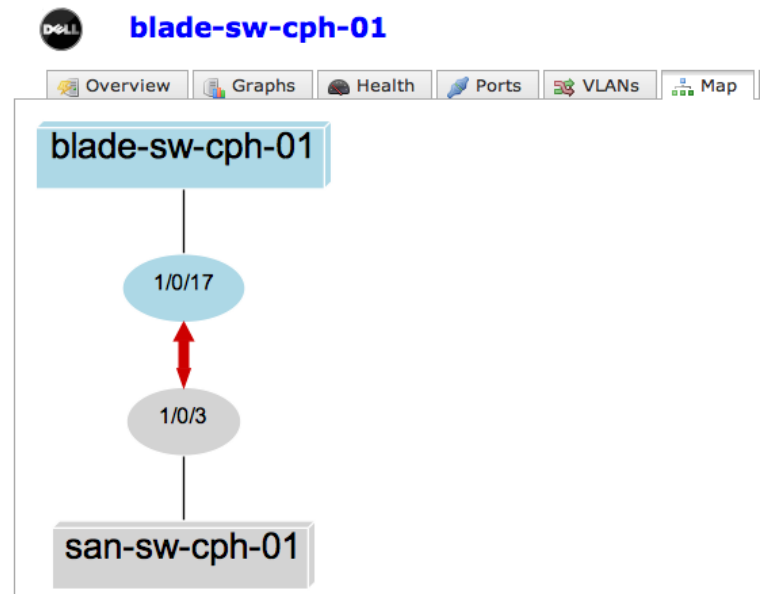
Dell

8024F

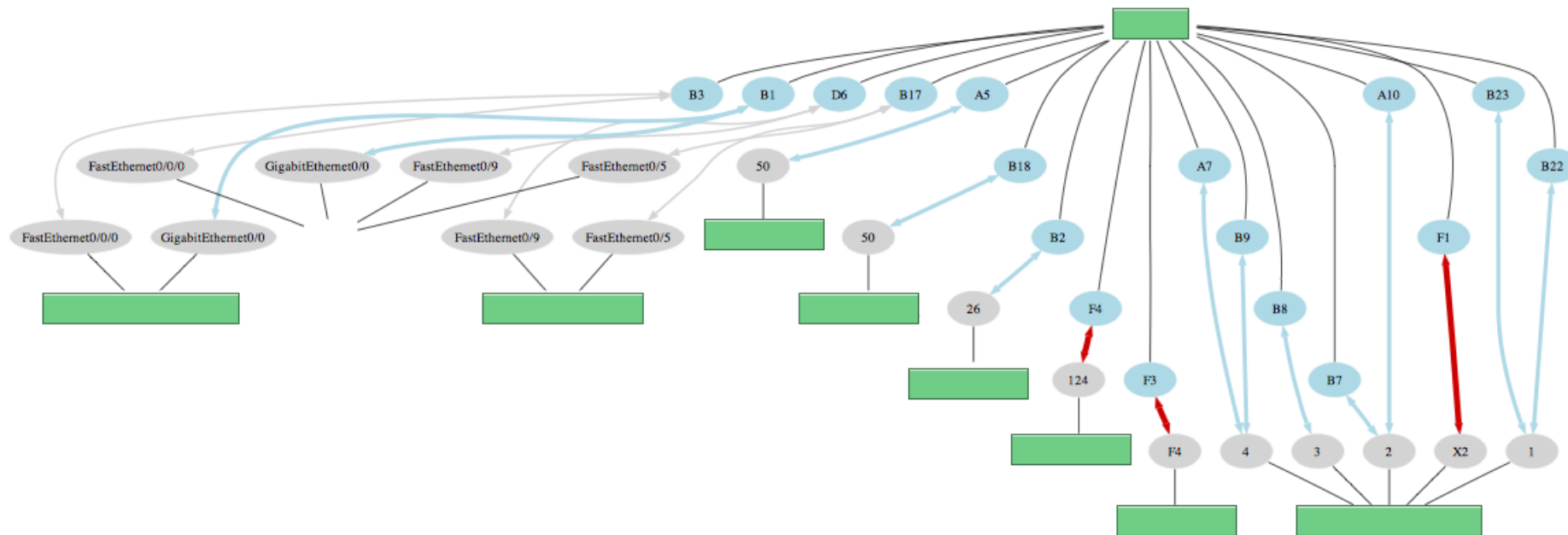
```
interface ethernet 1/xg17
mtu 9216
lldp transmit-tlv port-desc sys-name sys-desc sys-cap
lldp transmit-mgmt
exit
```

switch

LLDP



Autoconfigured maps from LLDP



LLDP is needed!

Netflow processing from the web interface

The screenshot shows the 'Netflow Processing' web interface. At the top, there's a summary table with columns for various network metrics. Below this, the 'Netflow Processing' section includes a 'Source' dropdown menu with options like 'peer1', 'peer2', 'gateway', 'site', and 'upstream'. The 'Filter' field is empty. To the right, there are 'Options' for 'List Flows' and 'Stat TopN', with 'Top' set to 10. The 'Stat' section shows 'Flow Records' and 'order by' set to 'flows'. The 'Aggregate' section has checkboxes for 'proto', 'srcPort', and 'dstPort', with 'srcIP' and 'dstIP' dropdowns. The 'Limit' section has a 'Packets' dropdown and a value of 0. The 'Output' section has a 'line' dropdown and a checkbox for 'IPV6 long'. Below these options, there's a 'Clear Form' button and a 'process' button. The main content area displays a command line: `** nfdump -M /netflow0/nfsen-demo/profile-data/live/peer1:peer2:gateway:site:upstream -T -r 2007/05/31/04/nfcapd.200705310440`. Below the command, it shows 'nfdump filter: any' and 'Aggregated flows 2797250'. The 'Top 10 flows ordered by flows:' section lists 10 flows with columns for Date, flow start, Duration, Proto, Src IP Addr:Port, Dst IP Addr:Port, Packets, Bytes, and Flows. The summary at the bottom shows: 'Summary: total flows: 4616424, total bytes: 156.6 G, total packets: 172.6 M, avg bps: 644.8 M, avg pps: 90946, avg bpp: 929'. The time window is '2007-05-31 04:11:49 - 2007-05-31 04:44:58'. The total flows processed is 4616424, skipped is 0, and bytes read is 240064932. The system is processing 6.184s flows/second and wall time is 6.185s flows/second: 746361.3.

| peer2 | 3.3 k/s | 76.2 k/s | 66.9 k/s | 7.0 k/s | 621.0 /s | 1.7 k/s | 484.6 Mb/s | 459.9 Mb/s | 12.5 Mb/s | 437.3 kb/s | 11.7 Mb/s |
|----------|----------|----------|----------|---------|----------|----------|------------|------------|-----------|------------|-----------|
| gateway | 1.0 /s | 651.0 /s | 600.8 /s | 46.6 /s | 0 /s | 3.7 /s | 6.2 Mb/s | 6.1 Mb/s | 36.4 kb/s | 0 b/s | 4.4 kb/s |
| site | 467.1 /s | 8.9 k/s | 6.1 k/s | 2.0 k/s | 181.7 /s | 613.3 /s | 38.8 Mb/s | 28.3 Mb/s | 7.4 Mb/s | 104.0 kb/s | 2.9 Mb/s |
| upstream | 6.4 k/s | 94.2 k/s | 84.3 k/s | 8.2 k/s | 896.4 /s | 766.7 /s | 588.4 Mb/s | 568.2 Mb/s | 16.7 Mb/s | 685.1 kb/s | 2.8 Mb/s |

Netflow Processing

Source: peer1, peer2, gateway, site, upstream

Filter: All Sources and <none>

Options: List Flows, Stat TopN

Top: 10

Stat: Flow Records, order by flows

Aggregate: proto, srcPort, dstPort, srcIP, dstIP

Limit: Packets, > 0

Output: line, / IPV6 long

```
** nfdump -M /netflow0/nfsen-demo/profile-data/live/peer1:peer2:gateway:site:upstream -T -r 2007/05/31/04/nfcapd.200705310440
nfdump filter: any
Aggregated flows 2797250
Top 10 flows ordered by flows:
Date flow start      Duration Proto      Src IP Addr:Port    Dst IP Addr:Port    Packets  Bytes  Flows
2007-05-31 04:39:54.045 299.034 UDP      116.147.95.88:1110  188.142.64.162:27014 68      5508   68
2007-05-31 04:39:56.282 298.174 UDP      116.147.249.27:1478 188.142.64.163:27014 67      5427   67
2007-05-31 04:39:57.530 298.206 UDP      117.196.44.62:1031  188.142.64.166:27014 67      5427   67
2007-05-31 04:39:57.819 298.112 UDP      117.196.75.134:1146 188.142.64.167:27014 67      5427   67
2007-05-31 04:39:53.787 297.216 UDP      61.191.235.132:4121 60.9.138.37:4121    62      3720   62
2007-05-31 04:39:55.354 300.833 UDP      60.9.138.37:2121   118.25.93.95:2121   61      3660   61
2007-05-31 04:39:58.936 298.977 UDP      60.9.138.36:2121   119.182.123.166:2121 61      3660   61
2007-05-31 04:39:54.329 303.585 UDP      120.150.194.76:2121 60.9.138.37:2121    61      3660   61
2007-05-31 04:39:53.916 300.734 UDP      60.9.138.37:2121   125.167.25.128:2121 61      3660   61
2007-05-31 04:39:57.946 300.353 UDP      60.9.138.36:2121   121.135.4.186:2121  61      3660   61

IP addresses anonymized
Summary: total flows: 4616424, total bytes: 156.6 G, total packets: 172.6 M, avg bps: 644.8 M, avg pps: 90946, avg bpp: 929
Time window: 2007-05-31 04:11:49 - 2007-05-31 04:44:58
Total flows processed: 4616424, skipped: 0, Bytes read: 240064932
Sys: 6.184s flows/second: 746464.4 Wall: 6.185s flows/second: 746361.3
```

Bringing the power of the command line forward

LibreNMS Automatic discovery



LibreNMS

[Overview](#)[Devices](#)[Ports](#)[Health](#)[Wireless](#)[Alerts](#)

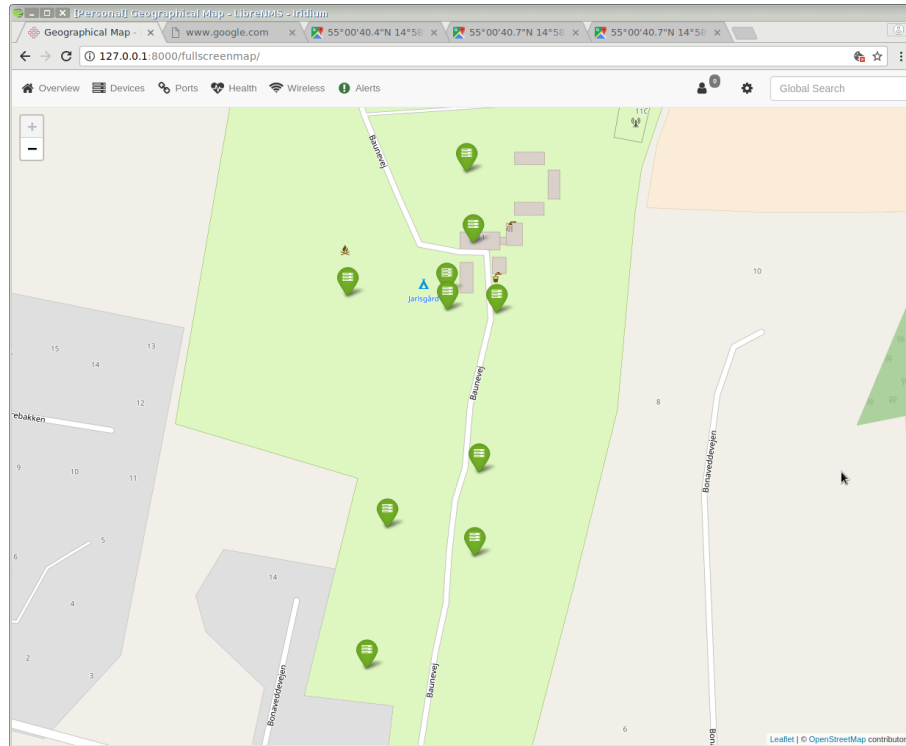
Lists: [Basic](#) | [Detail](#)

Graphs: [Bits](#) | [CPU](#) | [Load](#) | [Memory](#) | [Uptime](#) | [Storage](#) | [Disk I/O](#) | [Poller](#) | [Ping](#) | [Temperature](#)

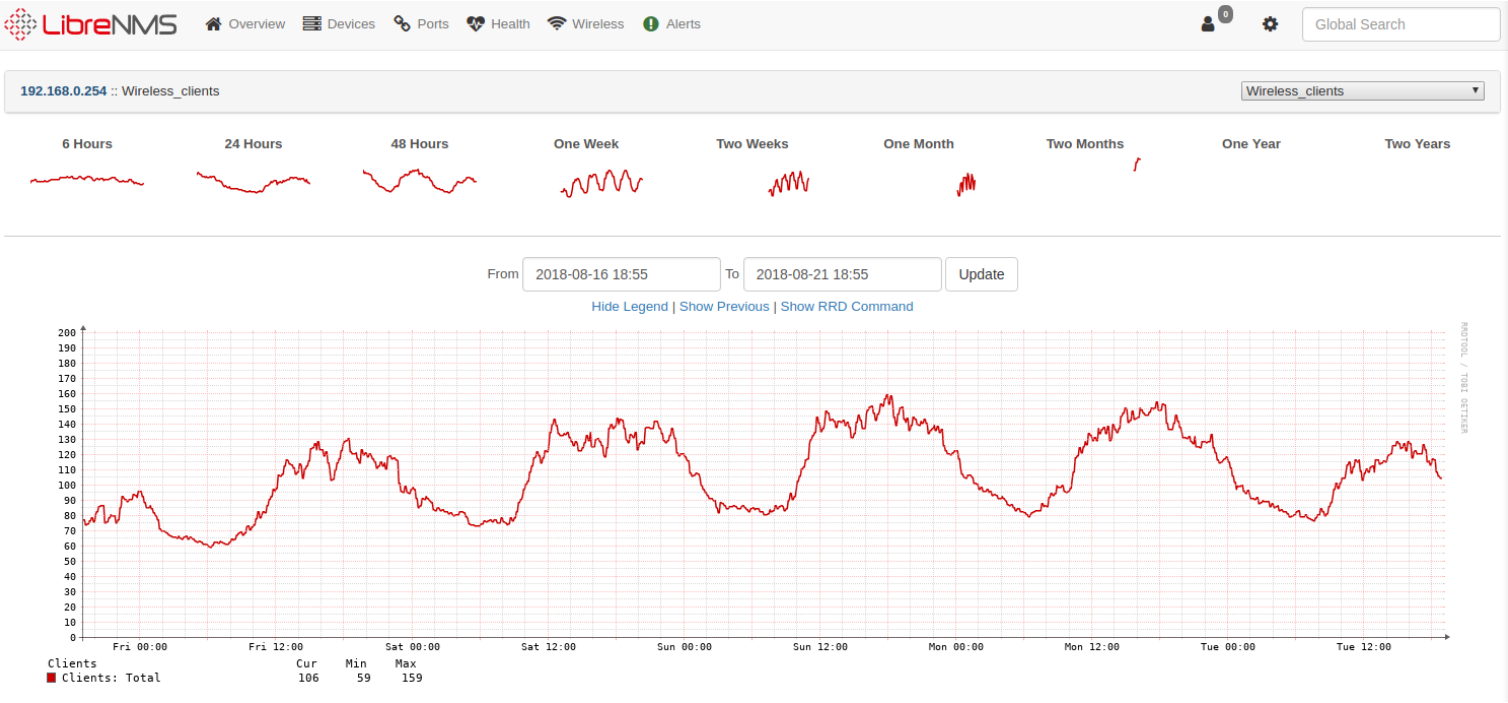
| Search | All OSes | All Versions | All Platforms | All Featuresets |
|--------|------------------------------|--------------|---------------------------------|---|
| Vendor | Device | Metrics | Platform | Operating System |
| | 192.168.0.254 zw-zd3k-001 | 7 2 | zd3025 | Ruckus Wireless 10.1.1.0 build 42 (DK) |
| | born-core-01 | 102 13 | Juniper EX3300 | Juniper JunOS 15.1R2.9 |
| | nocent1 noc-tent | 29 3 | Brocade ICX 6430 24-port Switch | Brocade IronWare |
| | north1 north1 | 25 | | Foundry Networking |
| | south1 south1 | 25 4 | snFWS624GSwitch | Brocade IronWare |
| | south2 south2 | 29 3 | Brocade ICX 6430 24-port Switch | Brocade IronWare |
| | south3 south3 | 49 | | Foundry Networking |
| | southwest1 southwest1 | 49 | | Foundry Networking |
| | west1 west1 | 25 4 | snFWS624GSwitch | Brocade IronWare |
| | west2 west2 | 25 | | Foundry Networking |

Automatically discover your entire network using CDP, FDP, LLDP, OSPF, BGP, SNMP and ARP.

LibreNMS Geo Location

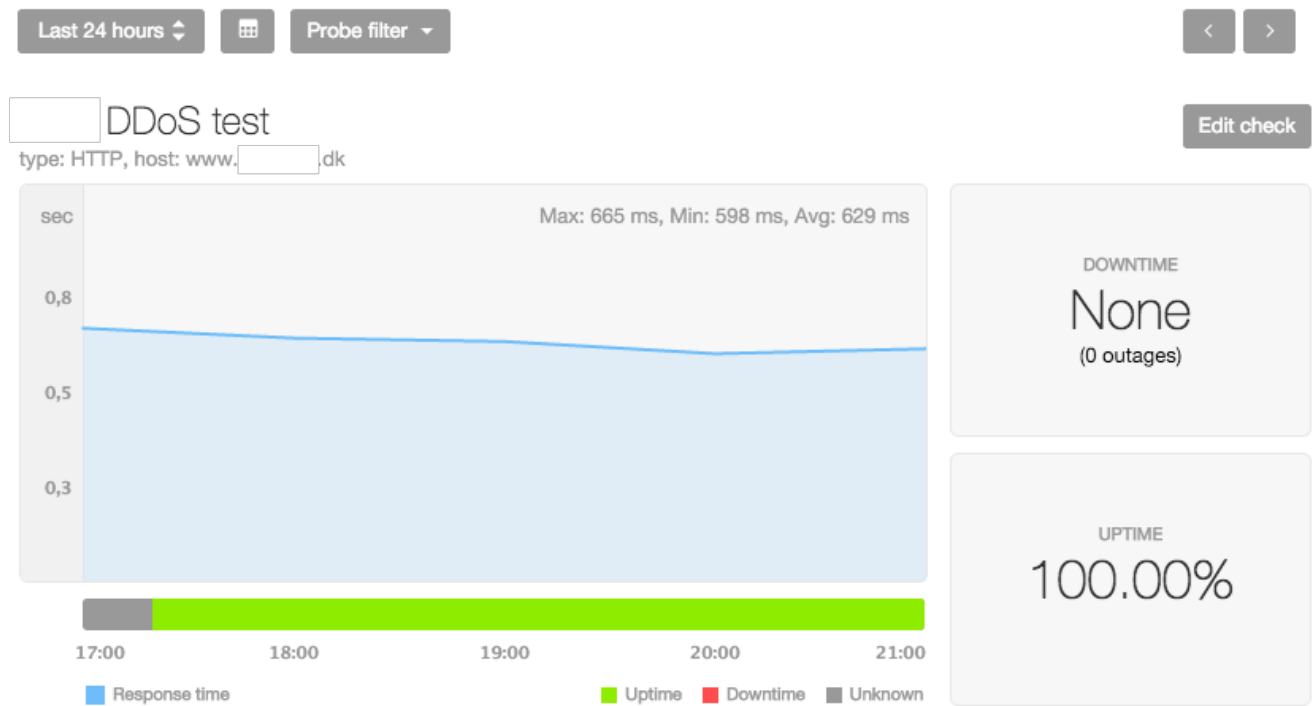


LibreNMS wireless clients

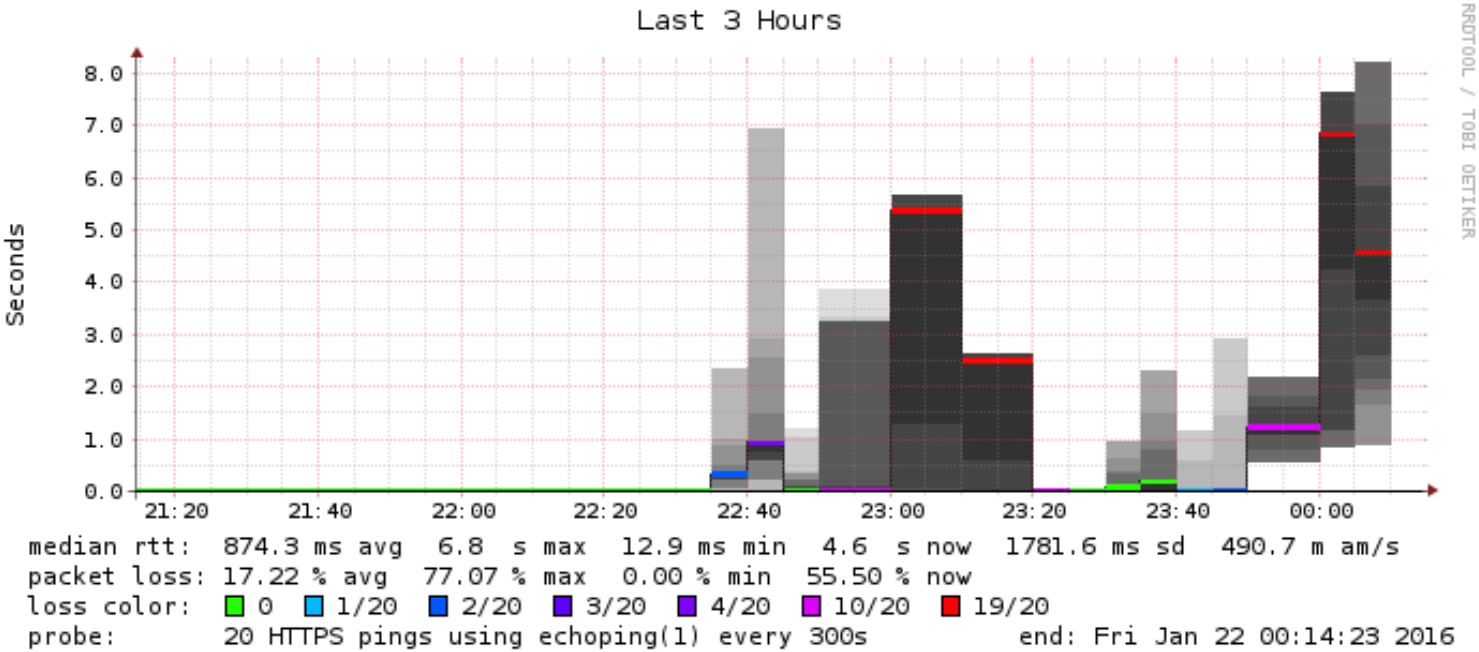


- Demo: Unifi dashboard
- Demo: LibreNMS and Smokeping

Before testing: Pingdom



Another external monitoring from Pingdom.com



Oh no DDoS attack?

What to put into the Dashboard

Chapter 11. Anomaly-Based Detection with Statistical Data

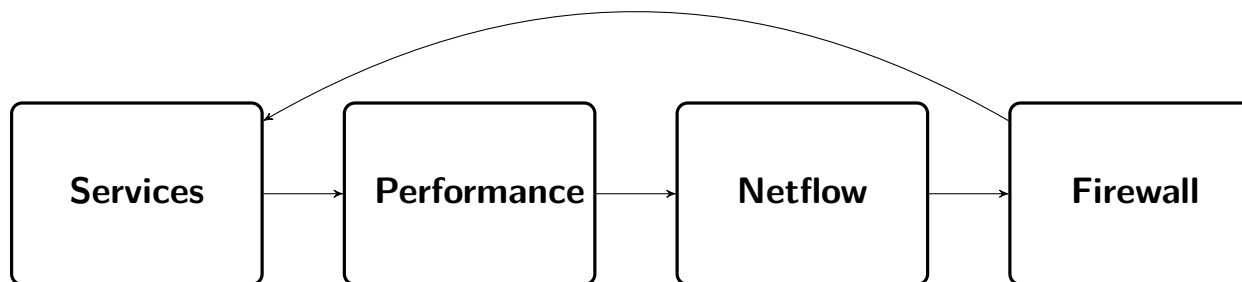
Good advice found in the book:

- Top Talkers with SiLK
- Service Discovery with SiLK
- Furthering Detection with Statistics
- Visualizing Statistics with Gnuplot
- Visualizing Statistics with Google Charts
- Visualizing Statistics with Afterglow

Newer and other tools exist, but the process is the same.

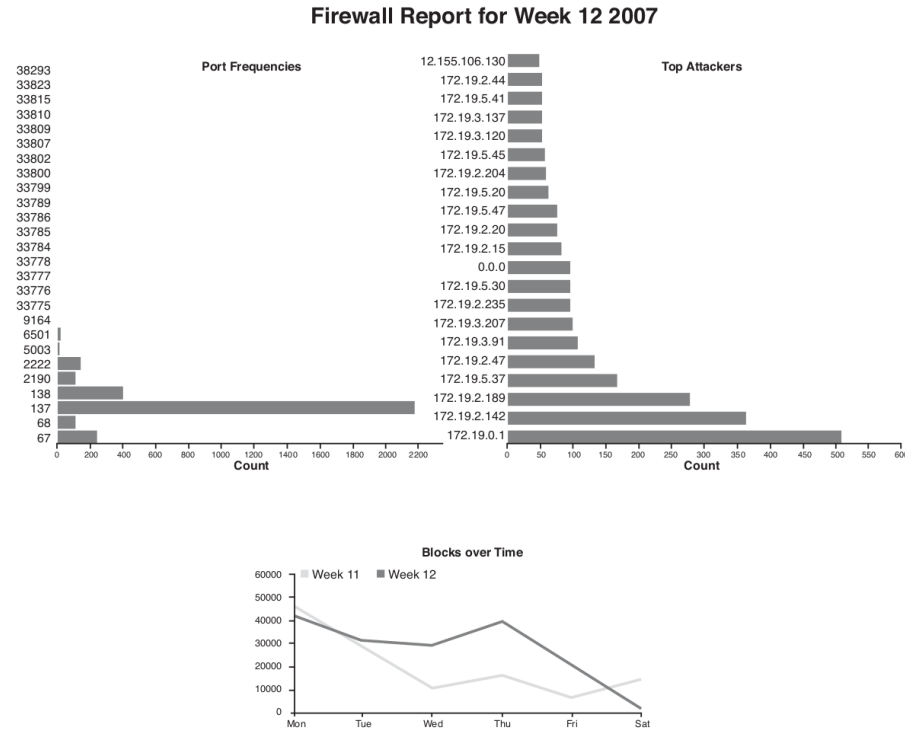
Source: Applied Network Security Monitoring Collection, Detection, and Analysis, 2014 Chris Sanders ISBN: 9780124172081

Map sources to dashboards!



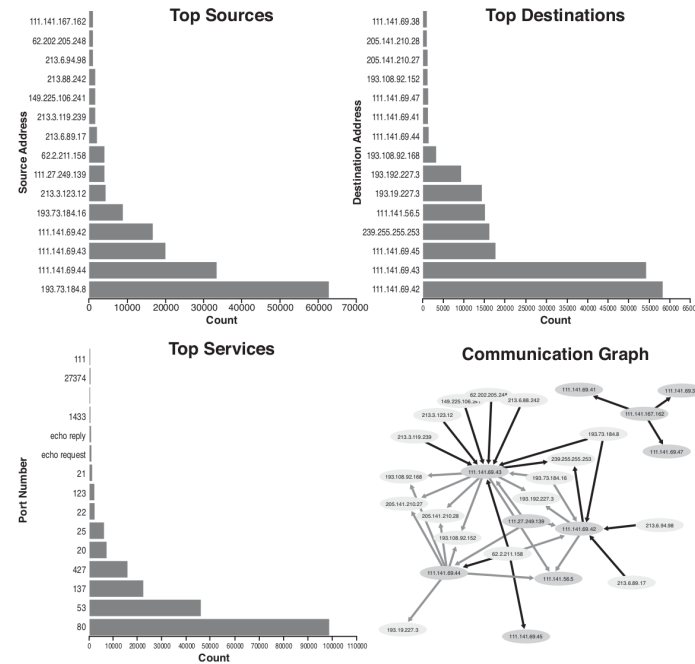
- There are many input sources available
- Dont put them all in ONE DASHBOARD
- I had luck in creating multiple dashboards, and then having a display cycle through them
- Maybe use Elastic Spaces for this? <https://www.elastic.co/guide/en/kibana/master/xpack-spaces.html>

Applied Security Visualization examples



Source: Firewall Report in *Applied security visualization*, Rafael Marty, 2009

Applied Security Visualization examples



Source: Network Flow Data in *Applied security visualization*, Rafael Marty, 2009

Drill down process

1. Get an overview
2. Research top talkers,
3. When identified and handled, remove with filter `not host 10.1.2.3`
4. Look at the next ones

Look into details, lookup hostnames – hopefully your tool allows some help

We're excited to announce a new alerting framework that delivers a first-class alerting experience natively within the SIEM, Uptime, APM, and Metrics applications as part of the Kibana 7.7 release.

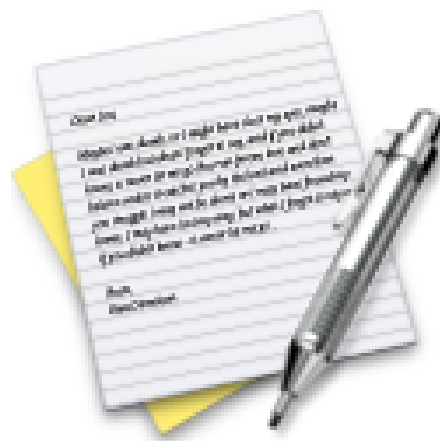
Alerting is a fundamental use case across the Elastic Stack, which is why we're making it part of the core experience within Kibana. Whether you are monitoring application transactions or tracking brute force login attempts, our goal is to provide a tailored experience that allows you to build powerful alerts in the normal flow of your task. The new alerting framework is built from the ground up and designed to offer more than just convenient interfaces. We understand the need to go beyond just notifying people which is why we've also incorporated the ability to trigger predefined actions that can do anything from sending an email to using brand new third-party integrations with platforms like Slack and PagerDuty.

The new alerting framework is being introduced as a beta in the 7.7 release of Kibana and is available immediately on the Elasticsearch Service on Elastic Cloud, or for download.

- <https://www.elastic.co/blog/introducing-the-new-alerting-framework-for-observability-security-and-the-elastic-stack>
- <https://www.elastic.co/what-is/kibana-alerting>
- <https://www.elastic.co/blog/alerting-in-the-elastic-stack>
- <https://www.elastic.co/blog/elastic-stack-alerting-now-generally-available>

Alerting everywhere: Kibana 7.7 introduces ubiquitous alerting for Elastic Observability, Elastic Security, and the Elastic Stack. Users can now create alerts directly from within the SIEM, APM, Metrics, and Uptime applications as well as for any index.

- Seems a lot has happened with alerting in the new version!
- Lets try to work with the alerting framework, note: sending email can sometimes be tricky without some configuration.



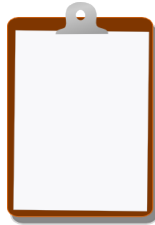
Now lets do the exercise

⚠ Working with dashboards – 15-60min

which is number **29** in the exercise PDF.

Moving to next time, with baseline your data

Discussion! Writing and presenting are two very different things, so are dashboards and reports!



Think about the subjects from this time, write down questions

Check the plan for chapters to read in the books

Visit web sites and download papers if needed

Retry the exercises to get more confident using the tools