



March 14-16, 2012

NH Grand Krasnapolsky Hotel
Amsterdam, Netherlands



Finding Needles in Haystacks (the size of Countries)

michael@packetloop.com
@cloudjunky

david@packetloop.com
@dsturnbull

gerald@packetloop.com
@gakman

2011



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We all know the story



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The CEO thinks the network is...



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VAULT DOOR
WEIGHT: 22 1/2 Tons
THICKNESS: 22 Inches
STEEL: 11 Layers of Special
Cutting and Drill Resistant
LOOKS: 4 Hamilton Watch
Movements for Time Locks

The Blackhats are...



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www.rabittooth.com


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Or is it?



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This is you



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I burnt the roof of my mouth



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Some Consultants are..



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And guaranteed you are
going to be asked to...



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Enhance!


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Why is this funny?



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Prevention Fails.



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Detection is the key.



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NSM - “Analysis and escalation of indications and warnings to detect and respond to intrusions”

- Richard Bejtlich

NSM - “focused on providing an intrusion analyst with the best possible information in the shortest amount of time” - NSMWiki

Network Security Monitoring

- Advocates focus on detection and that prevention will fail.
- Believes in inventoried and defensible networks.
- Build entropy from alert (attack) information.
- Provide analysts with the accurate information and context as fast as possible.
- Products provide collection, People the analysis



Network Security Monitoring

- Examples of NSM Tools
 - Sguil
 - Argus
 - Flowgrep
 - Snort
 - Bro
 - Network Miner
- Tools -> Collection, Humans -> Analysis



It's all about context.



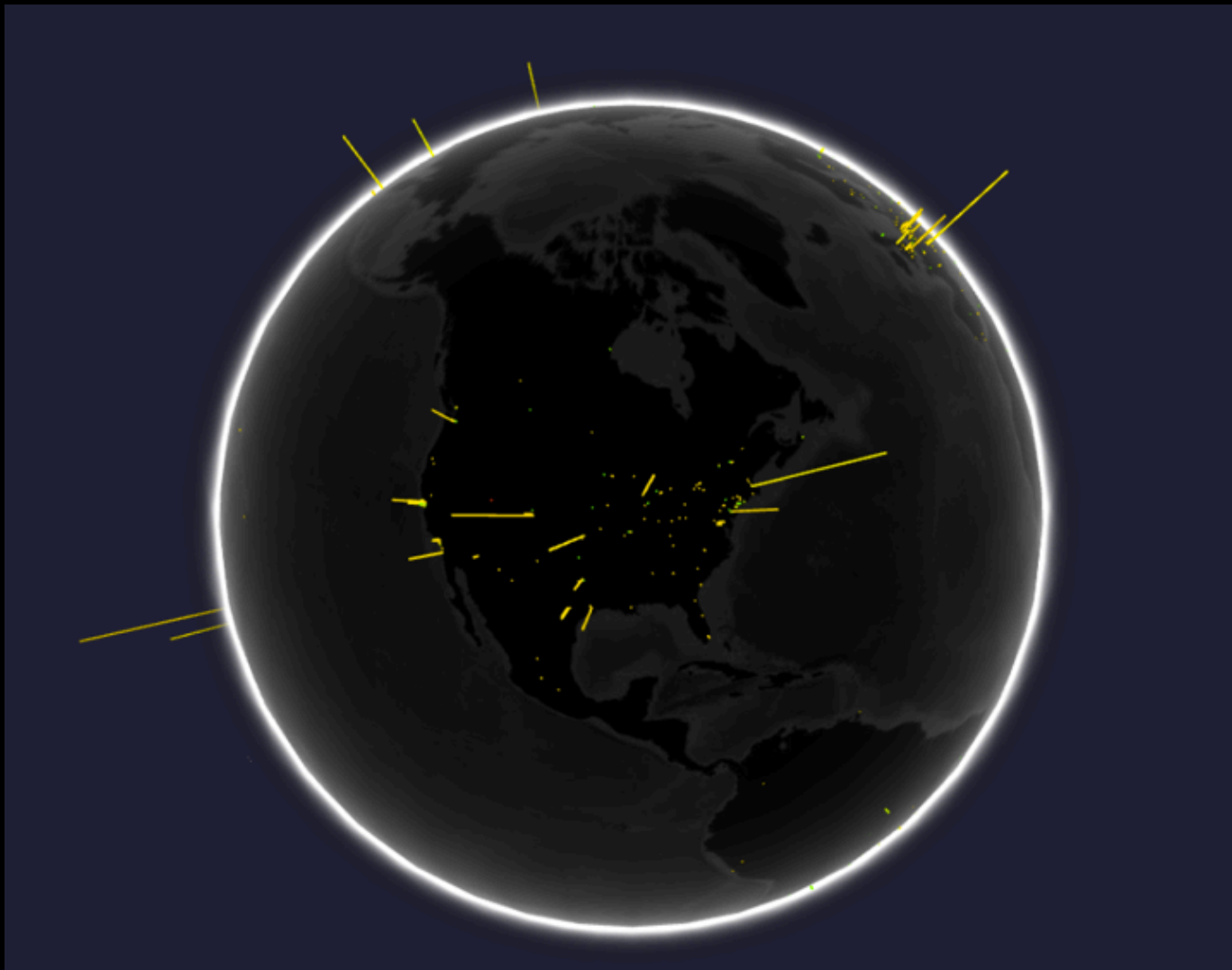
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Context

- Going back to the well.
- Providing as much context as possible in relation to attacks and attackers.
- Security analysis is detective work.
- Able to ask What if? Branch our analysis. React to new information.
- Providing full fidelity and full context quickly.





That's no moon.

- Pretty WebGL globe by Google.
- Each line represents a source IP address of an attacker.
- Height is frequency and Colour is Severity
- The destination (victim) is located in Sydney Australia.
- Approximately 60K Snort alerts in a 10 day period.

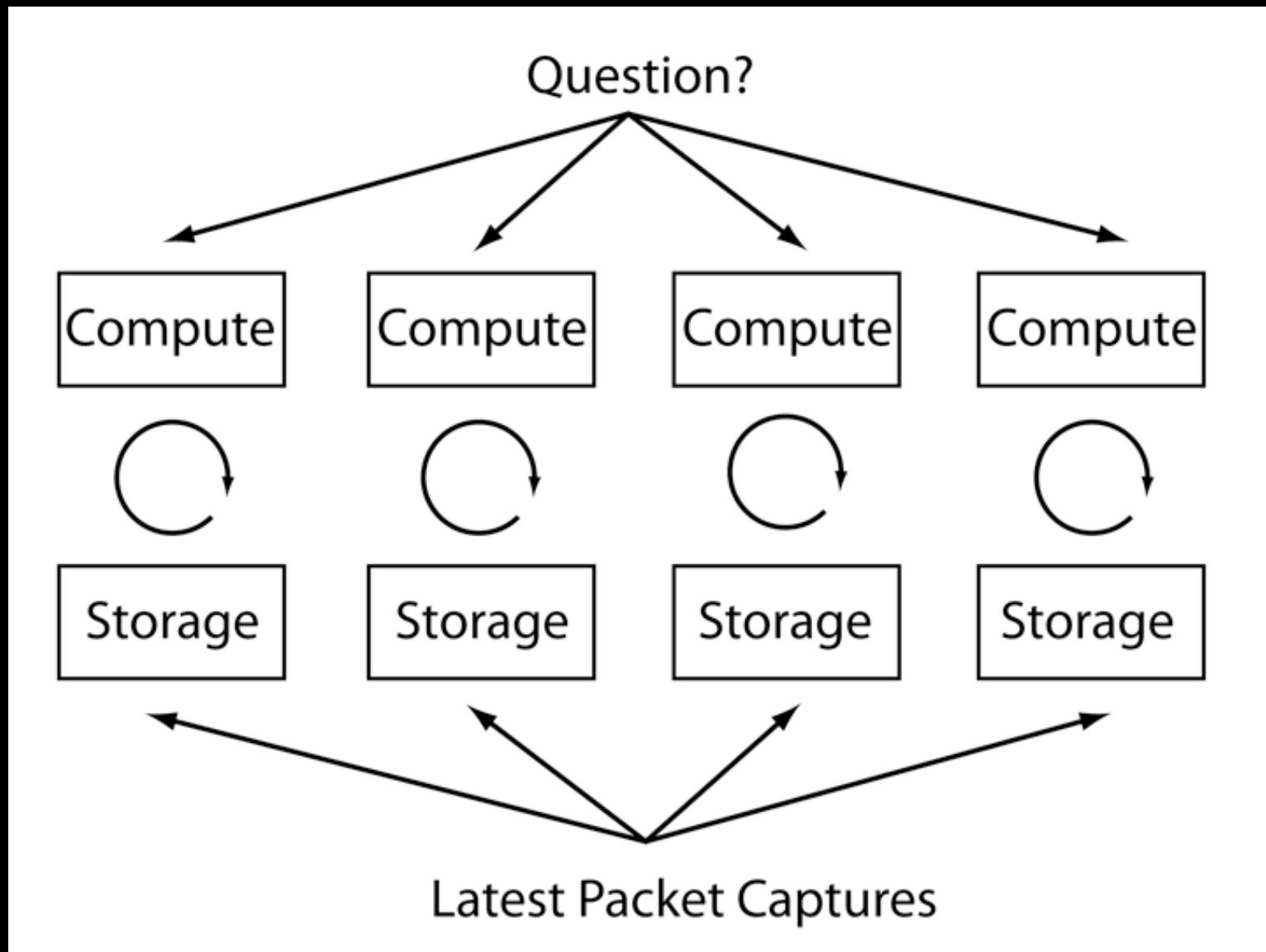
Full Packet Capture

- Complete record of all network transactions.
- If the attack takes place across a network it is in the packet captures.
- Provides the highest fidelity to analysts.
- Only way to really understand subtle and targeted attacks.
- Played, Paused, Stop, Rewind using NSM tools.
- No need to have specific logging setup.

NSM + FPC =
> % OPTIONS

“The difficulty shifts from traffic collection to traffic analysis. If you can store hundreds of gigabytes of traffic per day, how do you make sense of it?”

– Richard Bejtlich

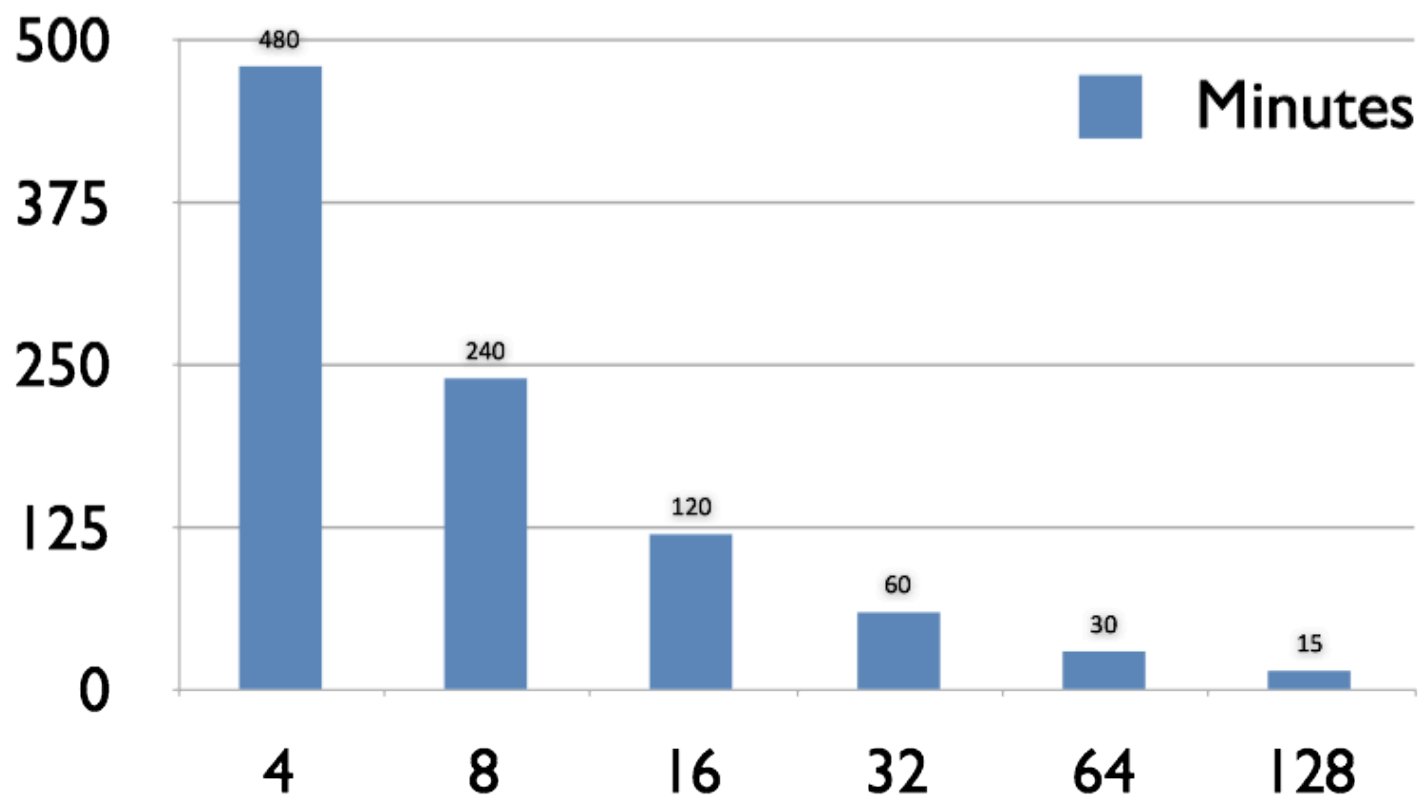


Big Data Scale

- I want to ask a 2.5TB question
 - Process 2.5TB, 8 hours, 4 Compute units.
 - Process 2.5TB, 4 hours , 8 Compute units.
 - Process 2.5TB, 2 hours, 16 Compute units.
 - Process 2.5TB, 1 hour, 32 Compute units.
 - Process 2.5 TB, 30 minutes, 64 Compute units.
 - Process 2.5 TB , 15 minutes, 128 Compute units.
- Scale my compute to answer my question.

Big Data Scale

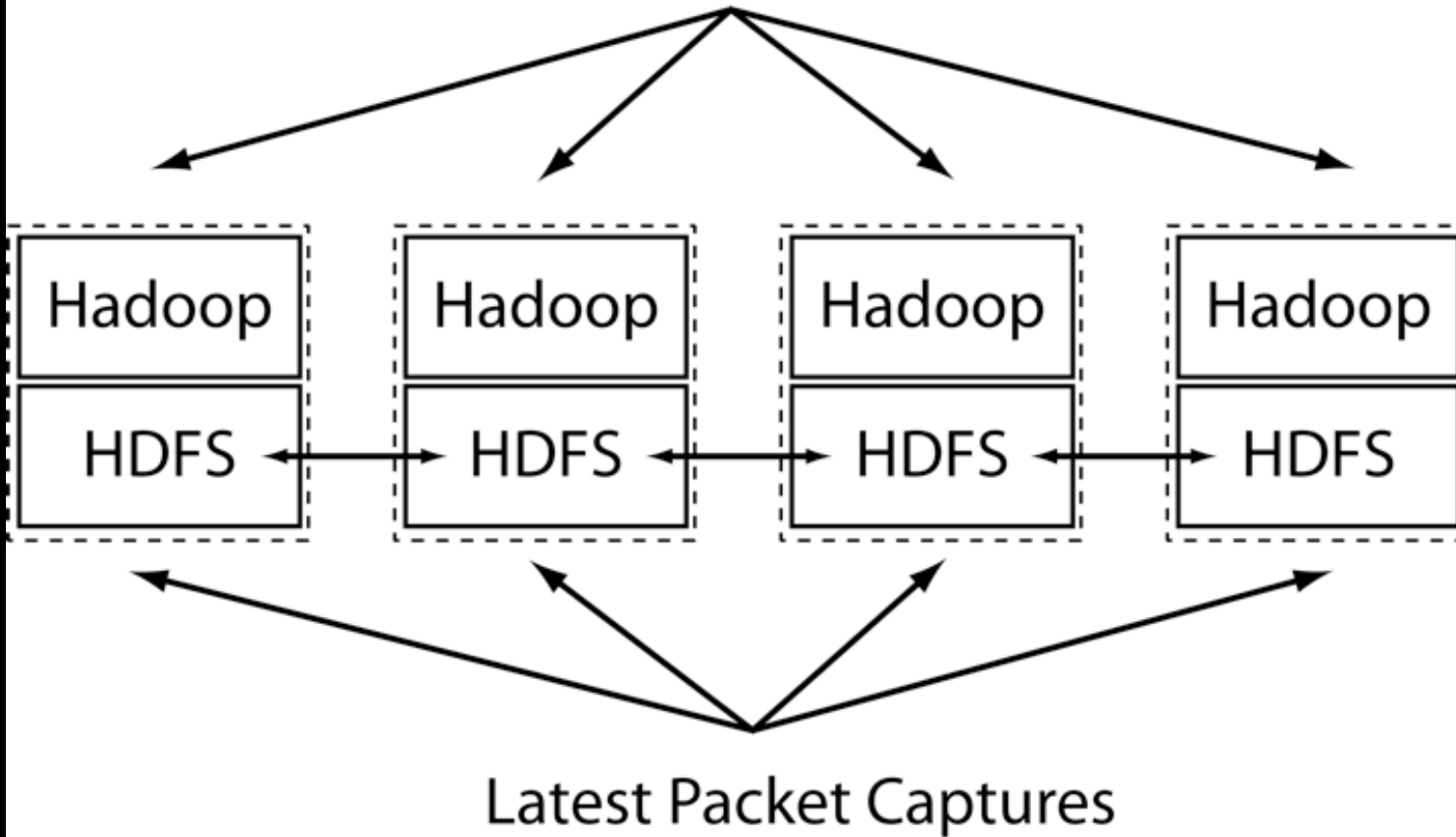
Complex Job (Approx 2.5TB)



Distributed Processing

- Google Map Reduce Whitepaper (2004)
- Google File System Whitepaper (2003)
- Hadoop is an Apache Project for M/R (2007)
- Hadoop File System is a distributed file system for Hadoop nodes (2007)
- Pig is a data analysis language to ease the creation of Map / Reduce jobs that run on Hadoop Clusters (2008)

Question?



Pig

- A acyclic data flow language.
- Transforms data rather than queries data.
- Builds map reduce jobs that are distributed across a Hadoop Cluster.
- Write and debug on your laptop and run on the cluster.
- Relatively easy to learn and brute force.

Pig

- Loaders
- Types
- UDFs
- Java
- Scripts (Python) and
- Binaries (p0f and Snort)



Piglatin

- The data analysis language for Pig scripts
- Group on keys and iterate values
- Iterate using FOREACH
- Filter, Distinct, Sort, Count, Avg, Sum
- Join (LEFT, OUTER)
- Piggybank community tools.
- Illustrate, Explain, Dump or Store.

@packetpig

- Packetloop + Pig = Packetpig
- <https://github.com/packetloop/packetpig>
- Open Source, Big Data, Security Analytics
- One stop shop for Network Security Monitoring for large data sets.
- Capable of integrating other NSM tools and LOGS!
- Visualisations

@packetpig - Features

- Wireshark the Internet!!
- Bin Time
- Threat Analysis
- Traffic Analysis
- Conversations and Flows
- Geo-Location
- Operating System Fingerprinting
- File Dissection



Wireshark the Internet!

- Access to raw packet captures
- Query, filter, group, sort, count or average anything in the IP, TCP and UDP Headers.
- PacketLoader() acts as a base class for most Loaders.
- Used for bandwidth, packets per second, breakdown by protocol and global queries.
- Search for strange combination of TCP flags



Demo



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Binning Time

- Packetpig can process billions and billions of data points.
- Most other software can't handle loading datasets that big.
- Bin on 5m, 30m, 1h, 4h, 8h, 12h, 24h etc.
- Convert your bin time to seconds and pass as parameter to Packetpig scripts.
- Anything with a timestamp can be binned.

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Threat Analysis

- SnortLoader() is a wrapper for Snort.
- Runs Snort distributed across Hadoop nodes.
- Pass different snort.conf at run time.
- Snort output is returned to the script.
- Loader returns the following schema.
 - Timestamp, Sig ID, Priority, Message, Protocol,
 - Source IP, SPort, Destination IP, DPort



Geo Location

- GeoIP User Defined Function (UDF)
- Wraps the Maxmind Geoip Java library.
- Returns
 - Country
 - ASNum
 - Lat/Long
- Can be used in any script with any loader.

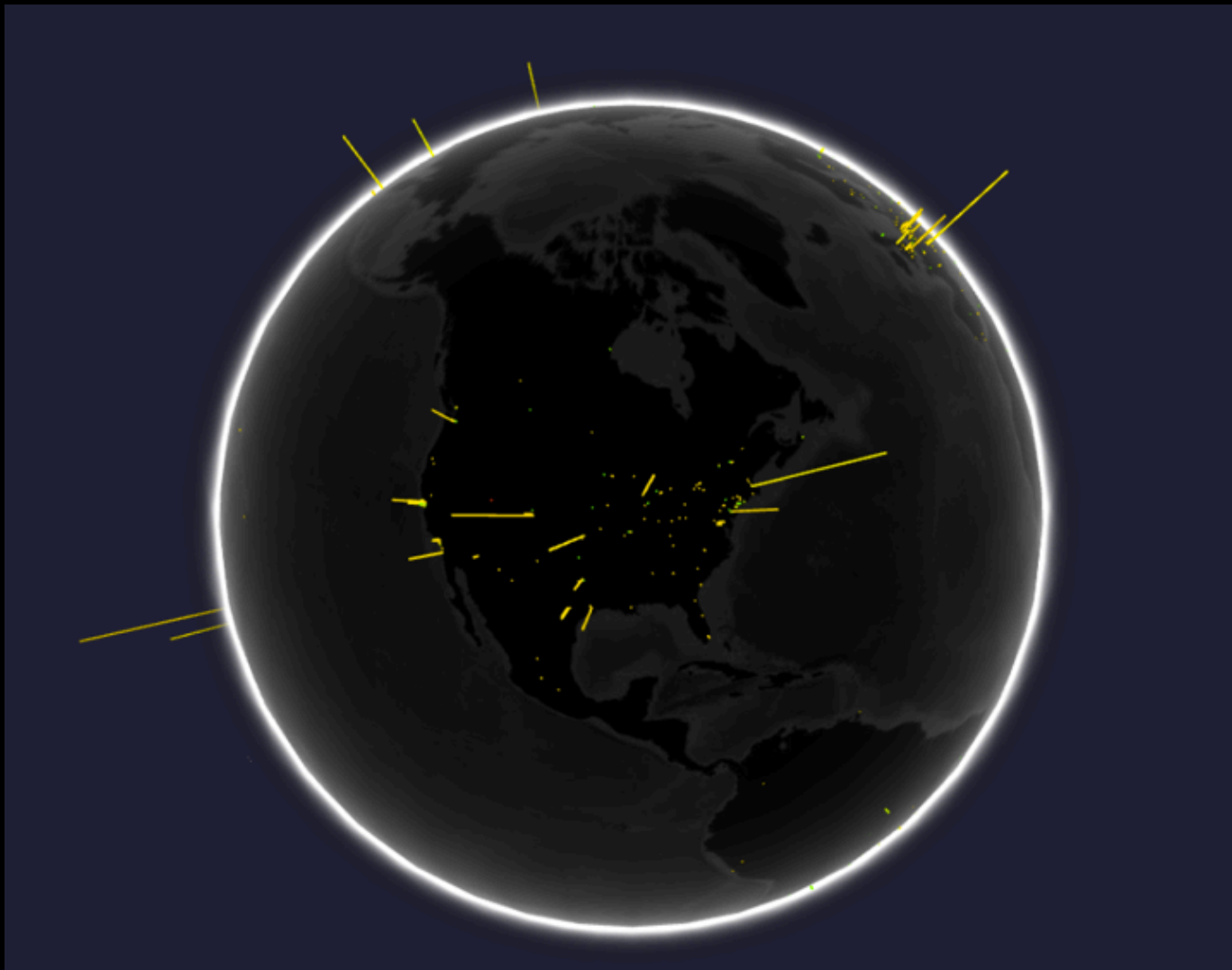


Demo

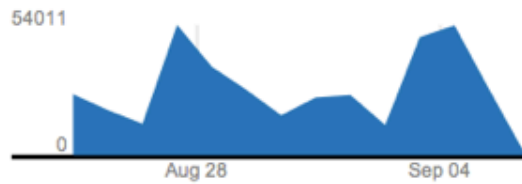


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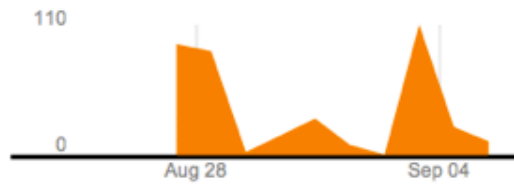




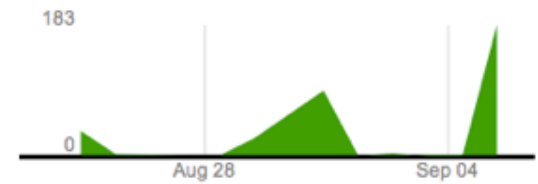
Australia (AU)



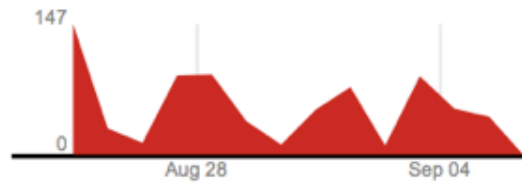
China (CN)



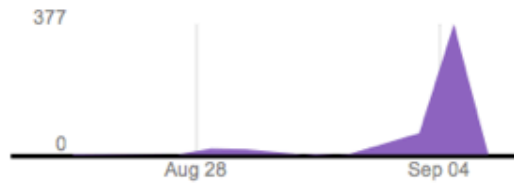
Germany (DE)



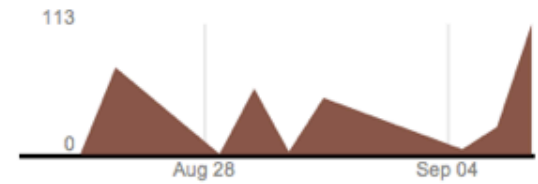
Japan (JP)



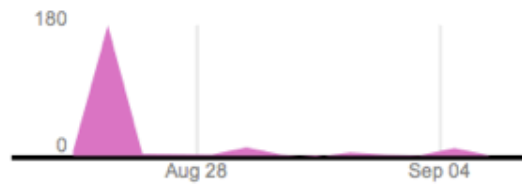
Korea, Republic of (KR)



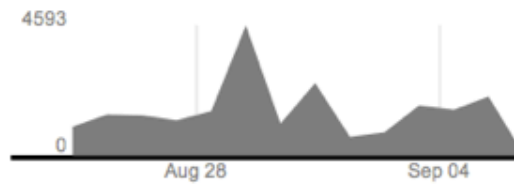
Netherlands (NL)

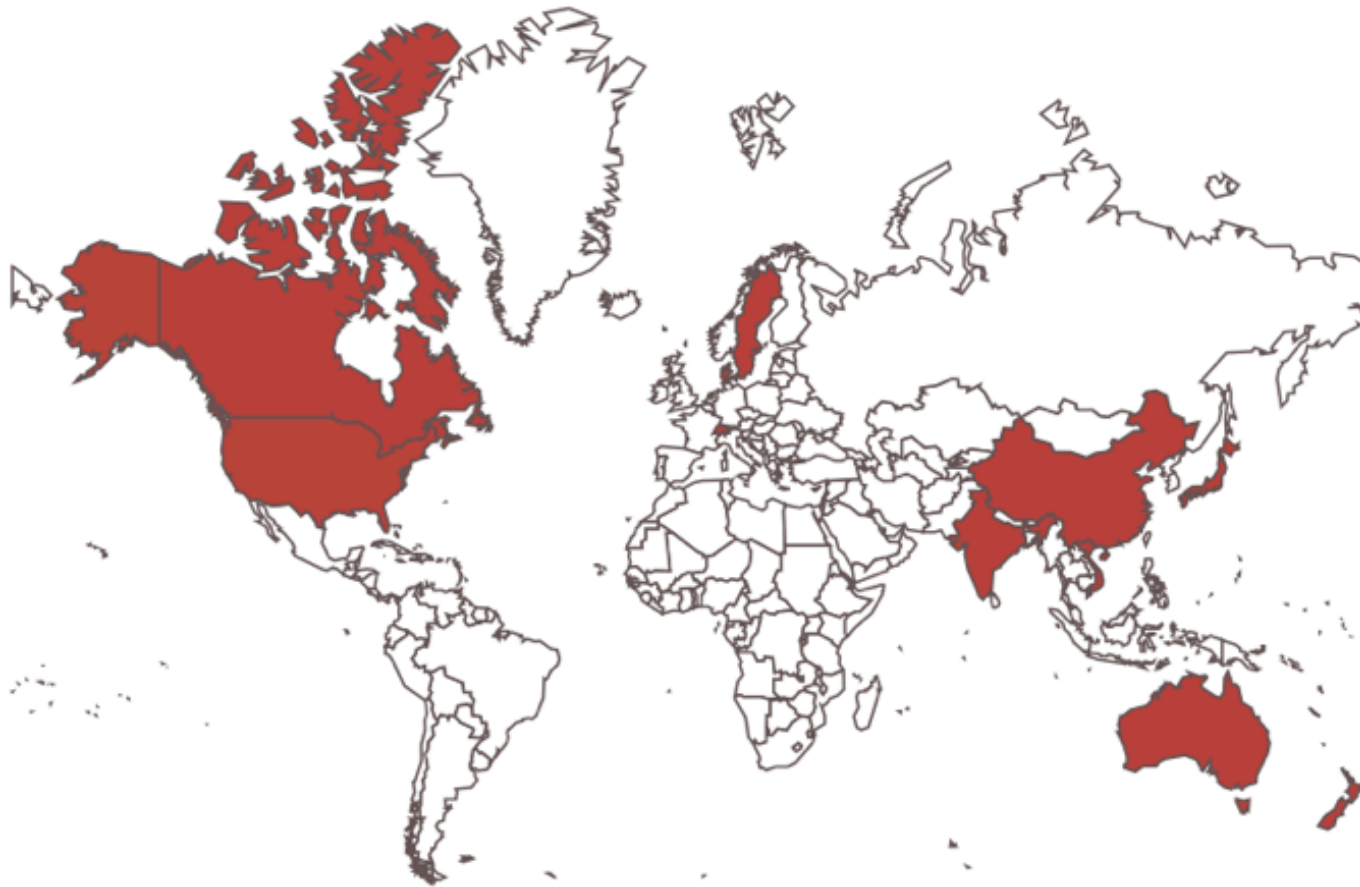


New Zealand (NZ)



United States (US)



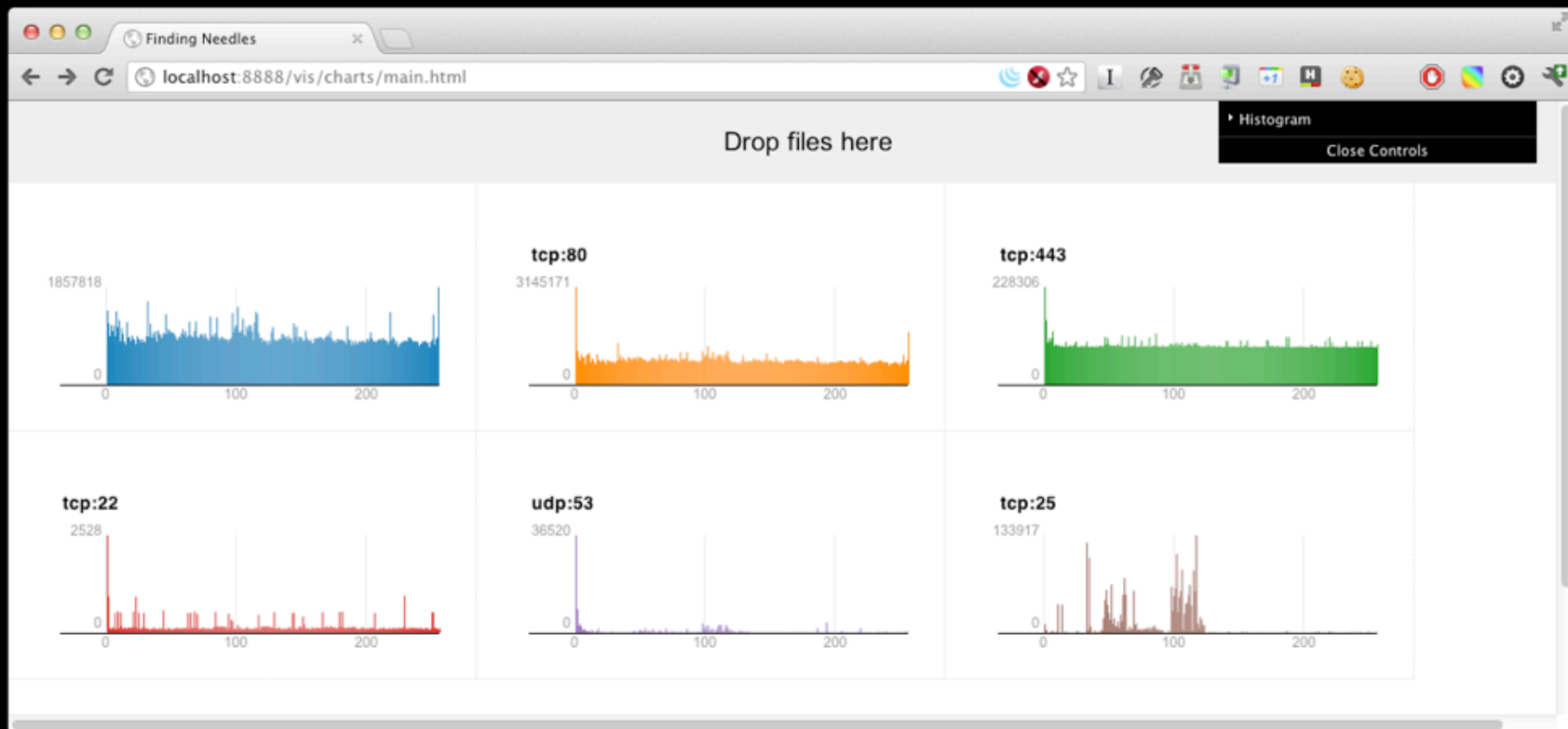


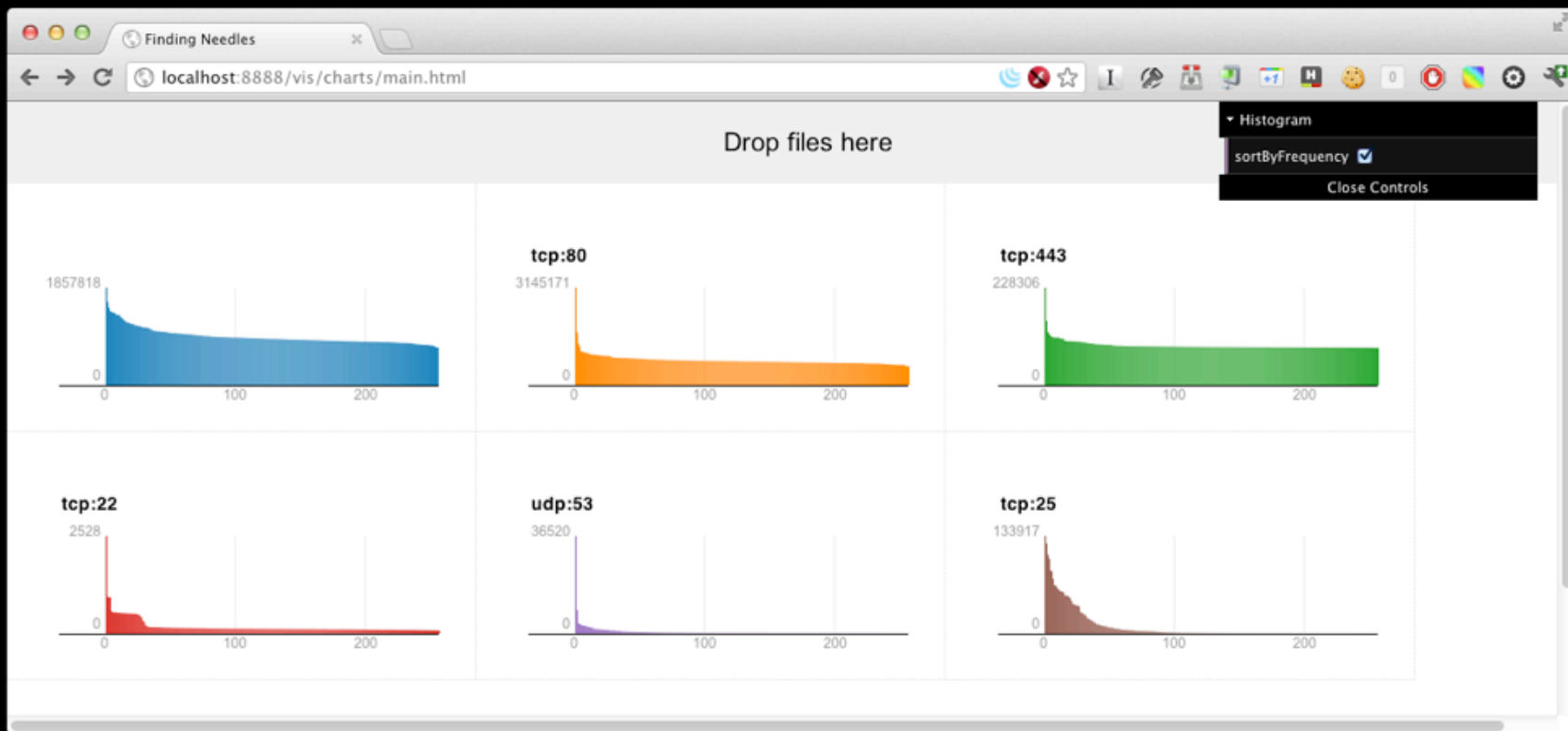
Traffic Analysis

- Detecting covert and encrypted channels
- Packet Size
 - “Traffic analysis of SSL Encrypted Web Browsing” - Heyning Cheng and Ron Avnur
- Packet Size / Inter-packet delay
 - “Datamining for Hackers” - Stefan Burschka at the Chaos Communications Conference.
- Packet Size and Ngram analysis
 - “Anomalous Payload-based Network Intrusion Detection” - Ke Wang and Salvatore J Stolfo.

Ngram Analysis

- Analyse packet payloads for what ASCII codes are used between 0-255.
- Perform unigram, bigram and trigram analysis.
- Analyse the number of characters uses in a frequency of byte ordered plot.
- Packetpig supports N number of grams.





Deep Packet Inspection

- DNSConversationLoader()
 - Access DNS queries and responses
 - Timestamp, Query ID, Mode, Name, IP Address and TTL
- HTTPConversationLoader()
 - Access to HTTP fields (e.g. user-agent, set-cookie, etag)
 - Access to requests and responses.

Demo

Basic DNS, HTTP



Malware Domain Analysis

- Track increases and decreases in the number of queries per domain.
- Track the TTL for domains and see how they change over time.
- Track the number of IP's returned for each domain and how many distinct countries those IP's reside in.





Conversations / Flows

- Track conversation establishment and termination
- Return all packets related to a conversation
- Return inter-packet delay
- Return the size of packets in the conversation.
- Return the end state of the conversation

OS Fingerprinting

- FingerprintLoader() is a wrapper for @lcamtuf's p0f
- FingerprintLoader() returns the information from p0f to the Pig script.
- Perform passive operating system detection across terabytes of data.

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File Extraction

- Analyse every conversation on the network.
- Extraction or just output information
 - Choose whether to extract files or not.
 - Extract based on mime type or file extension.
 - Extract or search for particular hashes.
- Additional file information through libmagic.
- Output file name, file type, name, extension, MD5, SHA1, SHA256 hashes.



Demo



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Is Big Data - Big Surveillance?

- Packet capture is analogous to wire tapping.
- Distributed processing of full network data starts to worry you.
- Potential for mis-use, surveillance, data warehouses.
- Reputation services that sell dossiers on hashed IP addresses.
- Data mining 'networks' for long periods.





A Simple Experiment



[Home](#)
[Authors](#)
[Scare your friends](#)
[Statistics](#)
[Contact Us](#)






40k

6,937

Netherlands (NL)

Hi Pirate IP 84. We got you! (In our database). You like torrents, don't you? At least someone in your house does. It looks like you are from Netherlands. We are not sure about which part though. According to our records, you have downloaded a couple of files. Below is a table with examples. You can click on any filename to get more details. Of course, we are sure that you didn't violate any laws of Netherlands and downloaded only legal stuff, right?

Downloaded files

Name	Date
Blue.Gold.World.Water.Warx264.AC3.MVGroup.org.mkv (1.08 GB)	Dec, 2011
Modern.Family.S03E09.HDTV.XviD-LOL.avi (175.01 MB)	Dec, 2011
The.Hangover.Part.II.2011.HDRip.1400MB.avi (1.37 GB)	Nov, 2011
The.Walking.Dead.S02E05.Dual.lagoM-Junio_Tk2 (390.42 MB)	Nov, 2011
[www.TorrentDay.com] - ... ead.S02E06.HDTV.XviD-ASAP (349.99 MB)	Nov, 2011
Adobe.Acrobat.X.Pro.v10.0 ... MacOSX.Incl.Keymaker-CORE (474.96 MB)	Nov, 2011
Men's Health - Novemb ... Muscle PT+ 2011- Mantesh (220.54 MB)	Nov, 2011
The Walking Dead S02 E04 HD-Xvid (352.71 MB)	Nov, 2011
the.good.wife.306.hdtv-lol.avi (349.53 MB)	Nov, 2011

Removal request

We only aggregate publicly available information. Thus, we don't have to accommodate requests for removal. But we are nice people.

[Remove Me!](#)



735 comments ▼
Add a comment



Eric-Sebastien Lachance - ★ Top Commenter - Technical Writer at Objectif Lune

Are you taking dynamic IPs into account? Because if you're not, this system is absolutely useless.

Reply ·  453 · Like · December 10, 2011 at 9:38am



Suren Ter-Saakov - ★ Top Commenter

Torrents

- Connect to the top torrent trackers like the PirateBay 100, dump Seeders and Leechers.
- Record the BitTorrent Client type (entropy).
- Look at all attacks on a particular dataset
- Join Torrent Data and Snort data on Source IP
- What files are downloaded by the people that trigger IDS alerts?
- Does Torrent data allow me to triangulate?

Torrent Results



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Attackers and Torrents

- 17 IP addresses matched attacks and torrents.
- 5 Countries - Australia, China, South Africa, Phillipines, Singapore.
- Mainly protocol anomalies and Spyware upload detection.
- Two cases are worth looking into further.
- Use Packetpig to gather Snort, Torrent, p0f and User-Agent data.

Torrent Files

- Justice.League.Doom.2012.BRRip.XviD.Ac3.Feel-Free
- Tower Heist (2011) DVDRip XviD-MAXSPEED
- Friends with Benefits 2011 R5 LiNE READNFO XViD-IMAGiNE
- The.Adventures.of.Tintin.2011.1080p.BluRay.x264-MaxHD
- 7 Weeks to 100 Push-Ups: Strengthen and Sculpt Your Arms, Abs, C
- The Walking Dead S02E04 HDTV XviD-ASAP[ettv]
- Footloose.2011.DVDRip.XviD- PADD0
- Thor (2011) DVDRip XviD-MAX
- Daredevil - Soundtrack:-:Thar
- Rise of the Planet of the Apes (2011) DVDRip XviD-MAX
- Revenge S01E15 HDTV XviD-LOL [VTV]
- 1000 Photoshop Tips and Tricks (Dec 2010)-Mantesh
- CSI.S12E14.HDTV.XviD-LOL.avi



The Suspects

- Two attackers analysed due to Snort Alert severity.
- The South African.
 - Snort triggering on Spyware 'PUT' to a web site.
- The Australian.
 - Protocol anomalies that are worth investigating.



The South African

- 9 IP addresses from AS5713 SAIX-NET
- Reverse DNS links them to SAIX Proxies.
 - e.g. wblv-ip-pcache-4-vif0.telkom-ipnet.co.za.
- Attacks
 - (http_inspect) LONG HEADER
 - SPYWARE-PUT Trackware funwebproducts
mywebsearchtoolbar-funtools runtime detection

Let's Enhance!



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The South African

- Packetpig UDF provided two lat/longs but they were worthless.
- Linked to 7 Torrent files.
 - “7 Weeks to 100 Push-Ups: Strengthen and Sculpt Your Arms, Abs, C” linked two IP addresses to the one user.
 - “The.Adventures.of.Tintin.2011.DVDRip.XviD-TARGET” linked another two IP addresses to another user.
 - User-agents for these individual users confirmed this.
- Using torrents as a way to triangulate works.

Spreading malware and forum post abuse

The South African

- Google the IP addresses.
- Linked to a botnet traffic
 - Spreading malware and forum spam.
- Likely some home machine that's torrents and is also infected with Malware.


Advanced Search

Donate
help keep
us online

[Home](#) [FAQ](#) [Add Spam Data](#) [Search](#) [Forum](#) [Statistics »](#) [Resources »](#) [User Panel »](#) [Contact »](#)

196 [redacted] appears in our database 7 times

Current country of origin: [South Africa](#)

IP Tools: [whois](#) | [domain tools](#) | [spamhaus](#) | [spamcop](#) | [senderbase](#) | [google](#)



No activity seen from this IP in approximately 5 weeks

[Details](#)

[Nearby IP addresses](#)

Nearby IPs found

- 196 [redacted]
- 196 [redacted]
- 196 [redacted]
- 196 [redacted]
- 196 [redacted]
- 196 [redacted]
- 196 [redacted]

[Privacy](#)
[License](#)
[Legal & AuP](#)
US title code 47230



Details

Nearby IP addresses

Date	IP Address	Username	Email		
7-Mar-12 09:40	196	ho	ail.com		
7-Mar-12 06:21	196	bla	.com		
5-Mar-12 12:54	196	br			
28-Feb-12 11:20	196	wo	.com		
27-Feb-12 09:52	196	ha			
27-Feb-12 06:52	196	lev			
24-Feb-12 17:05	196	wil	om		
21-Feb-12 15:09	196	pr	m		
14-Feb-12 09:06	196	ma	m		
10-Feb-12 10:52	196	wo			
9-Feb-12 19:03	196	bu	.com		
27-Jan-12 08:51	196	mi	pl		
12-Jan-12 19:32	196	XL			
8-Jan-12 12:48	196	Ni			
8-Jan-12 12:34	196	Ni			
8-Jan-12 12:18	196	Ni			
29-Dec-11 16:54	196	me			
29-Dec-11 16:48	196	me			
22-Dec-11 07:51	196	lec			
22-Dec-11 07:50	196	lec			
12-Dec-11 09:30	196	De			
3-Oct-11 04:58	196	Ke			
6-Aug-11 14:39	196	ro			

Legend

 Toxic IP address or "bad" email domain

Highlighted Hot IP or disposable email address

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Privacy
License
Legal & AuP
US title code 47230

How to whitelist a single IP that is listed in SFS?

Moderators: [diabolic.bg](#), [Spudzz](#), [macmathan](#), [tobias](#), [trparky](#), [Katana](#)

New Topic

Post Reply

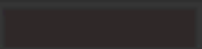
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AdChoices

How to whitelist a single IP that is listed in SFS?

Author	Message
 Joined: Fri Mar 05, 2010 5:43 pm Posts: 7	☺ How to whitelist a single IP that is listed in SFS? I have a legit user with an IP: 196. [REDACTED] Indeed this IP is in the SFS database (what's more. there are records from last month, too): http://www.stopforumspam.com/ipcheck/196.[REDACTED] yet I would still like to know how I can get around this. I tried to whitelist the IP in the customsigs file this way: <pre>Code: \$ax = \$ax - (lmatch(\$address,"196.[REDACTED]","In SFS database. ")); //Andrew McK...</pre> but it does not seem to have any effect. Is there a way to whi belong to a legit use ISP's. His host is (not http://wblv-ip-pcaci but shown as proxy server here (which does not necessarily mean bad though admittedly suspicious  March 14-16, 2012 NH Grand Krashapolsky Hotel Amsterdam, Netherlands  It was recorded in SFS, it may now I seem to have several issues with

Packetpig Query

- Packetpig
 - SnortLoader()
 - FingerPrintLoader()
 - HTTPConversationLoader()
 - GeoIP UDF to determine Country, ASNum, Lat/Long
 - Torrent output as a CSV text file.



Packetpig Query

- All 9 IP addresses are OpenBSD 3.X
- A number of distinct user-agents making requests of different web sites.
- User-agents triggering alerts include the Trident/4.0 or Trident/5.0 and FunWebProducts user-agent strings.
- Host,Connection=[keep-alive],Accept=[*/*],?Referer,Accept-Language=[en-ZA],User-Agent,Accept-Encoding=[gzip, deflate],?X-Forwarded-For,?Via:Accept-Charset,Keep-Alive:Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; WOW64; Trident/4.0; FunWebProducts; GTB7.1; SLCC2; .NET CLR 2.0.50727; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; HPNTDF; InfoPath.)



Conclusion

- Just some infected Windows machines sitting behind OpenBSD proxies that were browsing a website.
- When analysing the HTTP queries there were no PUTs.
- Snort signature is matching on the user-agent.
- No reason to run more detailed jobs to dump all conversations, protocols or files.



The Australian

- Single IP address from AS18291 Vodafone Australia.
- Attacks (read: Crimes!)
 - TCP Timestamp is outside of PAWS window
 - Bad segment, adjusted size ≤ 0
- Packetpig geoip provides a Lat/Long.

Packetpig Query

- Packetpig
 - SnortLoader()
 - FingerPrintLoader()
 - HTTPConversationLoader()
 - GeoIP UDF to determine Country, ASNum, Lat/Long
 - Torrent output as a CSV text file.

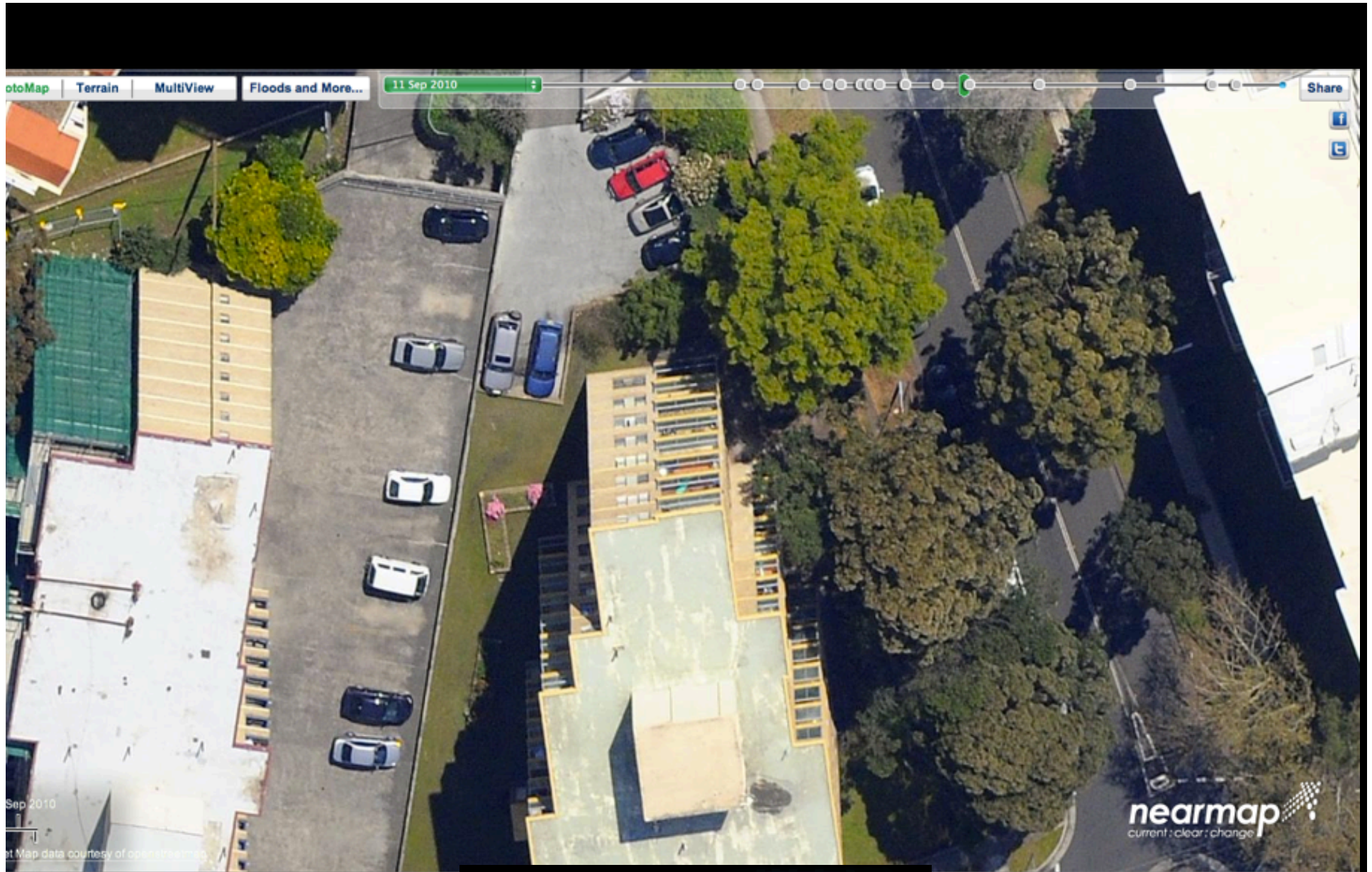


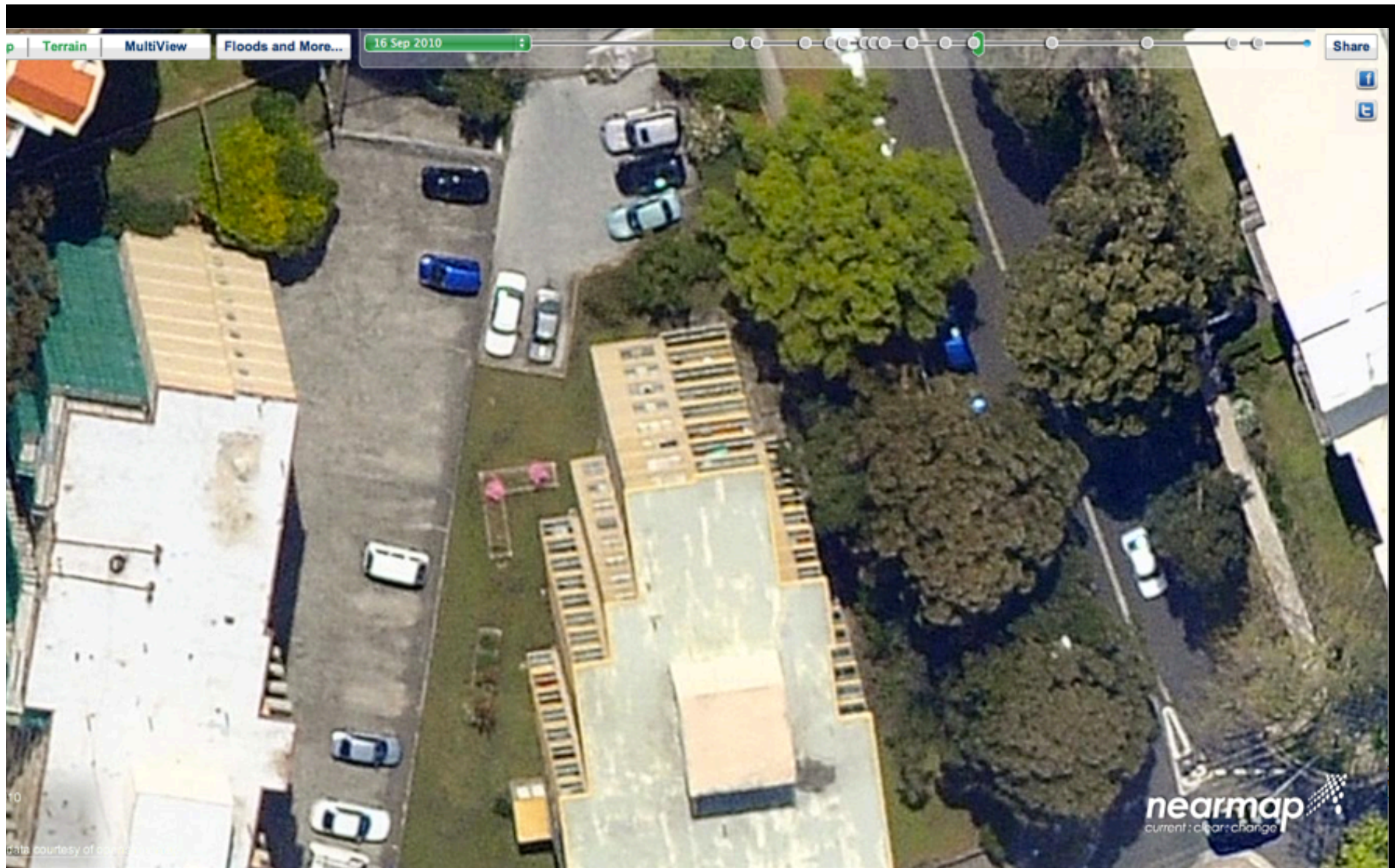
Let's Enhance!

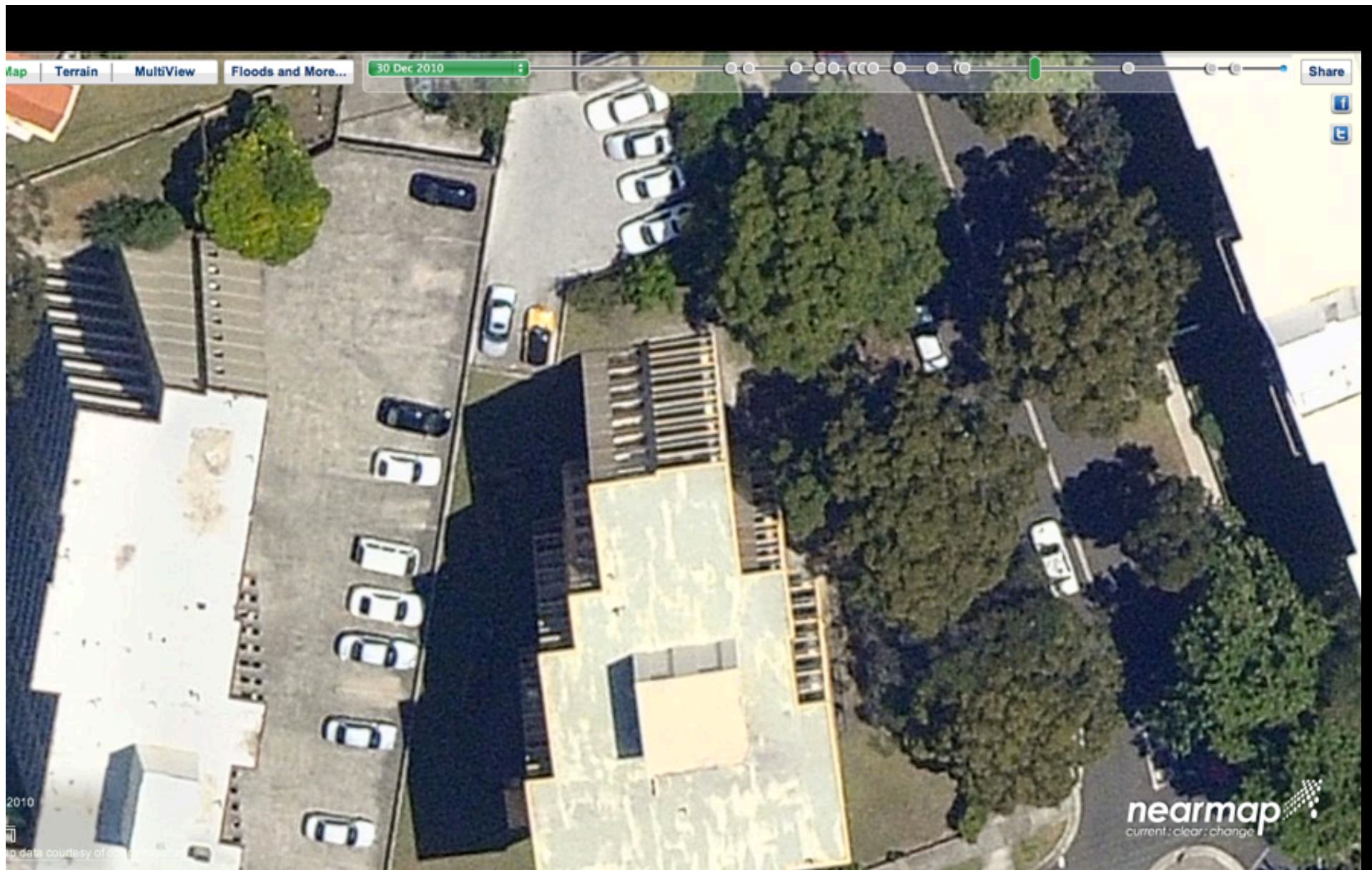


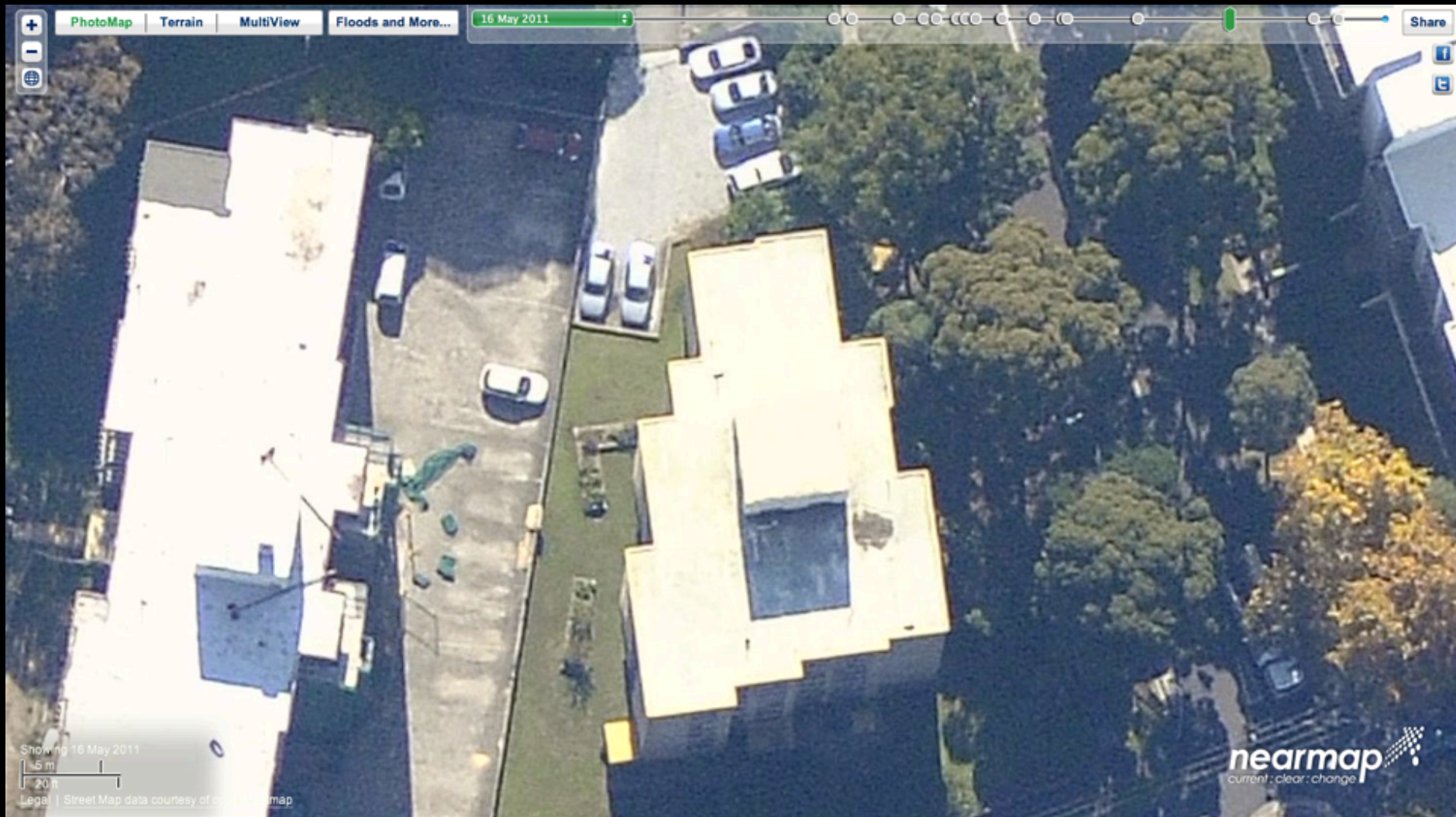
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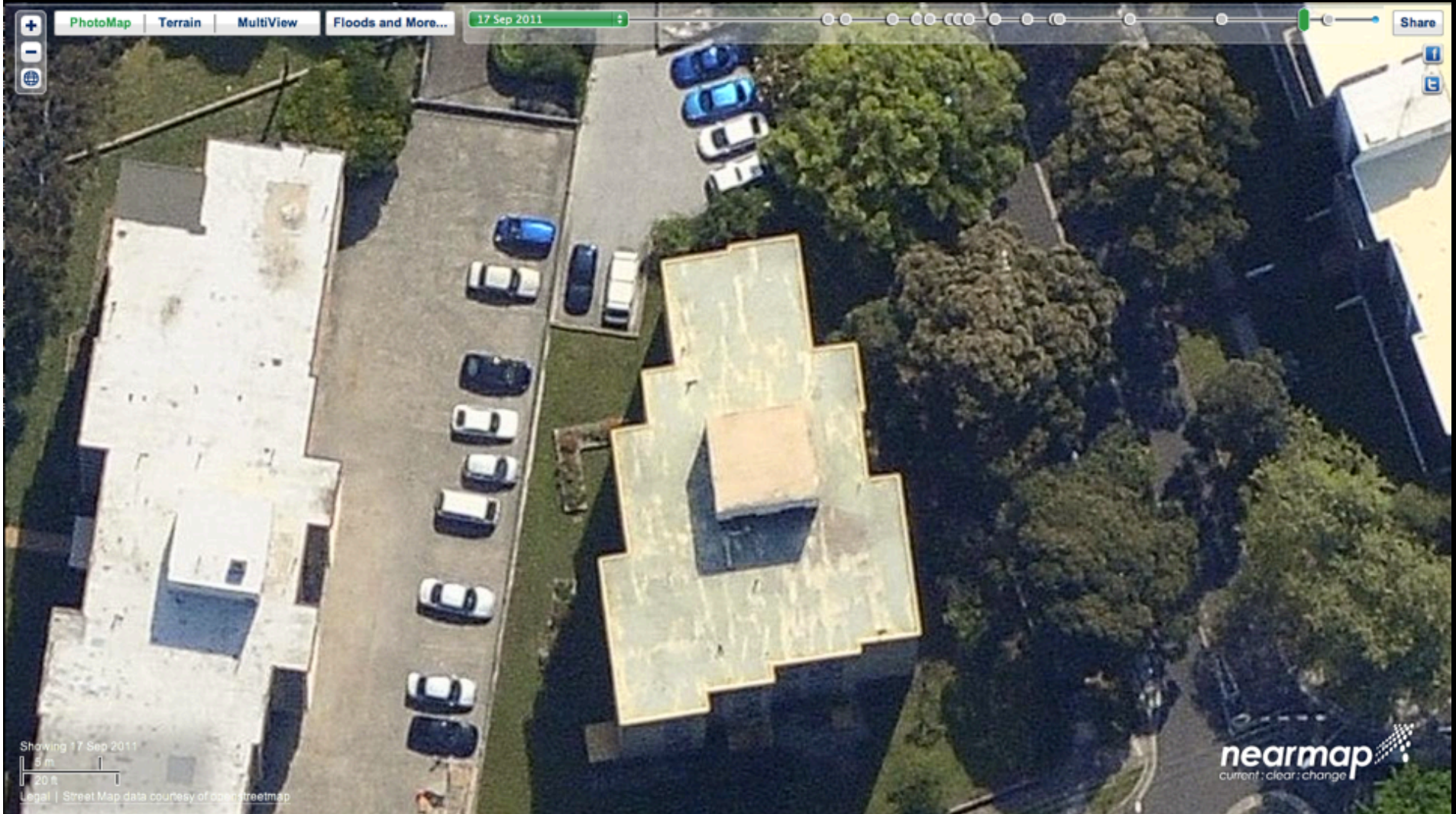


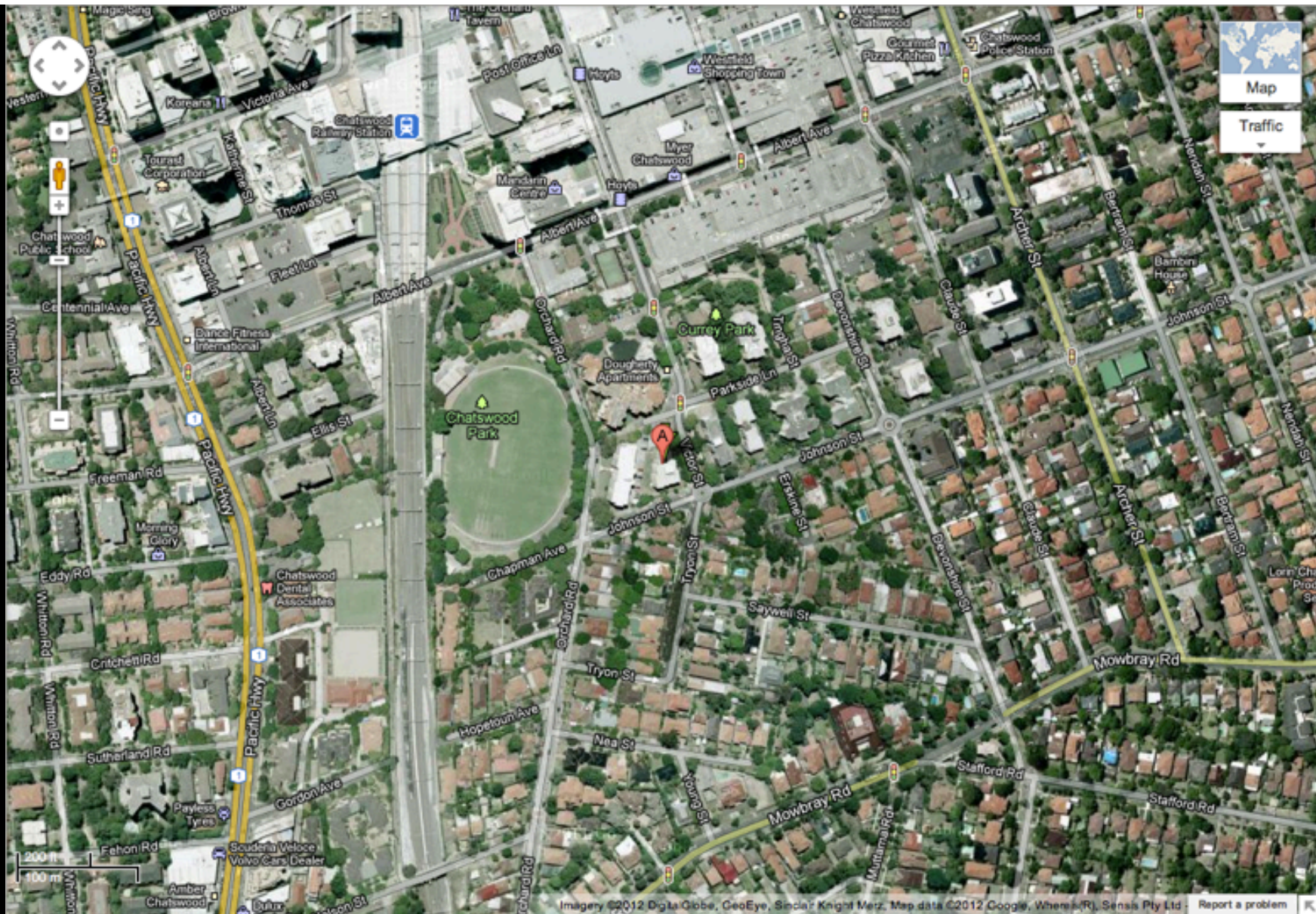


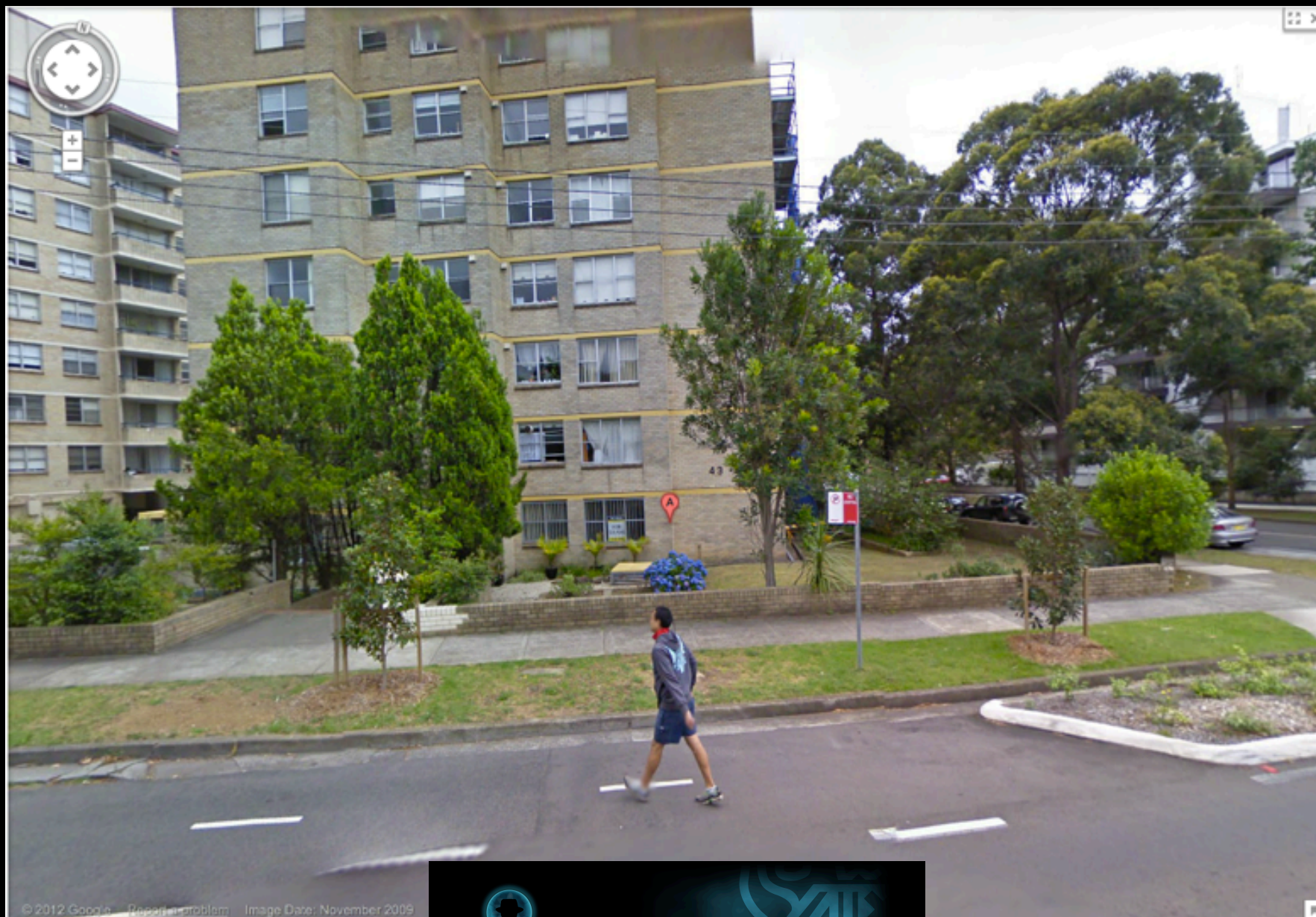












© 2012 Google - Report a problem - Image Date: November 2009

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Just before calling the police...



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AWSTATS



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[AWSTATS DATA FILE 6.95 \(build 1.943\) # If you remove this file, all ...](#)

www.sanctuaryspringbrook.com.au/.../awstats/awstats092011.info....

AWSTATS DATA FILE 6.95 (build 1.943) # If you remove this file, all statistics for 0
9 271017 196.219.172.179 1 1 4598 20110908141058 **123.███** 4 25 ...

[AWSTATS DATA FILE 6.8 \(build 1.910\) # If you remove this file, all ...](#)

www.steelrod.com.au/awstats/data/awstats122011.steelrod.com.au.txt

AWSTATS DATA FILE 6.8 (build 1.910) # If you remove this file, all statistics 8 93
1653201 20111206193345 **123.███** 3 10 180650 20111212234001 ...

[AWSTATS DATA FILE 6.8 \(build 1.910\) # If you remove this file, all ...](#)

www.steelrod.com.au/awstats/data/awstats102011.steelrod.com.au.txt

AWSTATS DATA FILE 6.8 (build 1.910) # If you remove this file, all statistics 0 ...
20111014031149 208.80.194.63 1 1 12978 20111019052515 **123.███** 0 ...

[AWSTATS DATA FILE 6.8 \(build 1.910\) # If you remove this file, all ...](#)

www.steelrod.com.au/awstats/data/awstats112011.steelrod.com.au.txt

AWSTATS DATA FILE 6.8 (build 1.910) # If you remove this file, all statistics for 1
2 12908 20111110015106 **123.███** 1 6 178243 20111117032811 ...

[AWSTATS DATA FILE 6.8 \(build 1.910\) # If you remove this file, all ...](#)

www.swanplastics.com.au/awstats/.../awstats102011.swanplastics.com...

AWSTATS DATA FILE 6.8 (build 1.910) # If you remove this file, all statistics for 1
1 13187 20111009165853 **123.███** 2 40 264038 20111026050205 ...

[AWSTATS DATA FILE 6.9 \(build 1.925\) # If you remove this file, all ...](#)

tabten.org/awstats/awstats022012.dtc.txt

AWSTATS DATA FILE 6.9 (build 1.925) # If you remove this file, all statistics for 8
8 955956 20120220171600 **123.███** 6 6 1054976 20120220154031 ...

[AWSTATS DATA](#)

www.hi.net.au/awstat

AWSTATS DATA FILE

94804 201203021813

[AWSTATS DATA](#)

www.sandhouse.com/awstat/.../awstats472011.sandhouse.com


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VPN

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Votes

This table lists all the recorded votes for this poll. If anonymous users are allowed to vote, they will be identified by the IP address of the computer they used when they voted.

Visitor	Vote	Timestamp
80	Australia	Wed, 09/14/2011 - 12:15
60	Australia	Wed, 09/14/2011 - 15:48
10	Australia	Wed, 09/14/2011 - 16:14
21	Australia	Wed, 09/14/2011 - 19:58
87	Australia	Wed, 09/14/2011 - 21:06
20	Australia	Wed, 09/14/2011 - 22:40
83	Australia	Wed, 09/14/2011 - 23:02
2.8	Australia	Wed, 09/14/2011 - 23:48
41	Australia	Thu, 09/15/2011 - 01:23
20	Australia	Thu, 09/15/2011 - 03:29
13	Australia	Thu, 09/15/2011 - 03:41
66	Australia	Thu, 09/15/2011 - 06:06
11	Australia	Thu, 09/15/2011 - 11:18
11	Australia	Thu, 09/15/2011 - 11:29
12	Australia	Thu, 09/15/2011 - 12:09

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114

115

116

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Moral of the story...



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Moral of the Story

- In both cases IDS alerts can be investigated quickly through a joined query.
- Joining Snort Source IP with p0f, http and torrent data provides additional context.
- Torrent data provides triangulation when matched to user-agent information.
- Didn't justify a query of all connections, sessions, protocols and files for these sources.

What about TOR?



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TOR

- Track TOR Exit Gateways every hour.
- Record every IP address with Geo information
- Correlate TOR Gateway addresses with sources of attack on the network.



TOR Results



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Future Features

- Statistical Analysis
- Machine Learning.
- Loaders for more NSM tools.
- Sentiment Analysis
- Build Lucene search indexes.



Questions?



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Feedback Forms



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Information

- Packetpig
 - <https://github.com/packetloop/packetpig>
 - @packetpig on twitter.
- Packetloop
 - www.packetloop.com
 - @packetloop on twitter.
 - blog.packetloop.com