Lawrence Livermore National Laboratory

Mining Proxy Logs: Finding Needles In Haystacks

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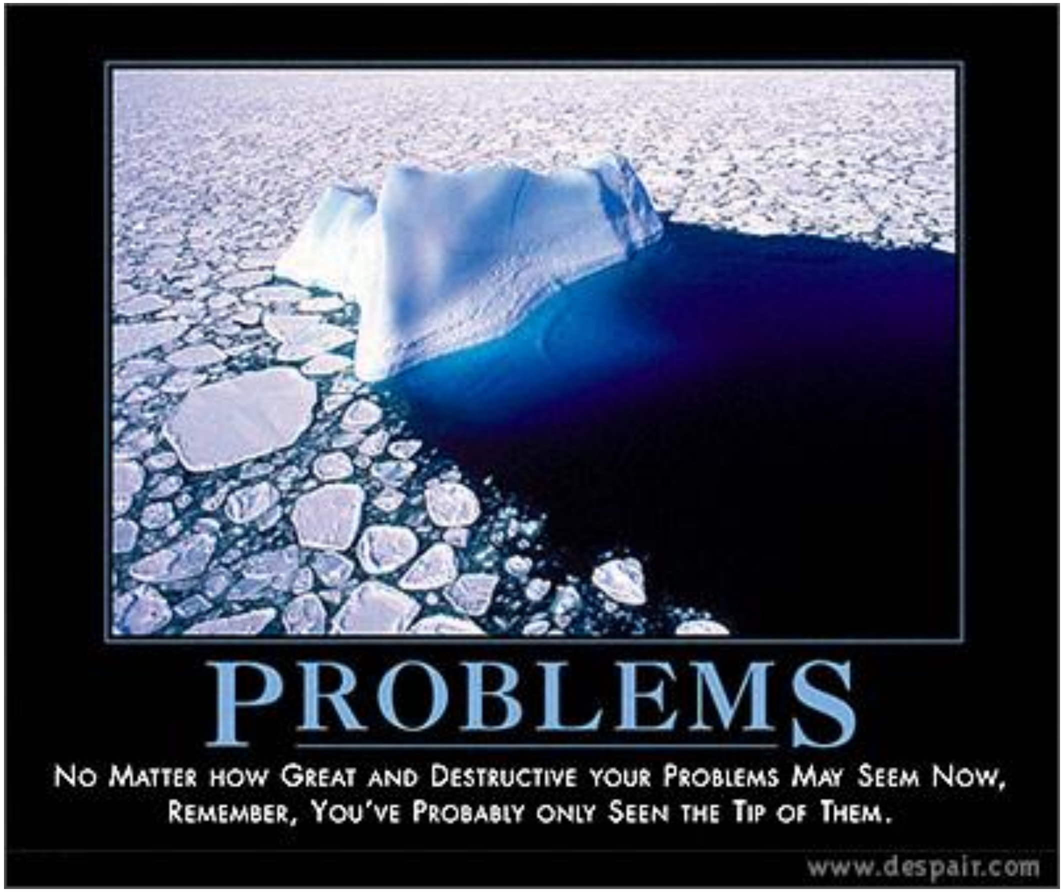
Disclaimer

- Our security infrastructure is a work in progress
  - This presentation is for educational purposes
  - This discussion pertains to our “Unclassified” environment ONLY
  - Hopefully we can make things better by learning from each other
    - If you see problems please say something

Have Fun!

Overview

- Introduction
- Problems
- Landscape
- Solutions
- Future
- Conclusion


PROBLEMS
No Matter how Great and Destructive your Problems May Seem Now, Remember, You've Probably only Seen the Tip of Them.
www.despair.com

Introduction – About LLNL/My Team/Me

- LLNL – Livermore, CA (1 sq mile and 13 sq miles)
  - ~7000 Employees (including contractors)
  - ~20,000 computers
    - ~10,000 Access Internet
- My Team
  - Network Security Team (NST) - 8 people
    - Incident Management Team (IMT) - 4 people
  - IDS, IPS, Proxys, Firewalls, IR, Log Aggregation/Correlation, Pen Testing, Malware Analysis, Forensics, etc.
- Me
  - B.S./M.S. in Computer Science from CSU, Chico
  - Over 13 years w/ LLNL ~6 years full time
  - Currently hold a CISSP, BCCPA, GCIH, GPEN

Problems – What Are We Trying To Solve?

- How do we find “bad guys” on our networks???
  - There are a lot of users
  - There are a lot of computers
  - There is a lot of data
  - There is no consistency and centralized governance is lacking
- What do the “bad guys” look like???
  - I’ve never spoken to a “bad guy”
  - I’ve never met a “bad guy” in person
  - “Bad guys” means something different to different people
- Most of us now have a web proxy…now what???
  - It never works perfectly
  - Somebody is always blaming me for breaking their app ☹

Landscape - LLNL Proxy Deployment

Cyber Security Program

- Blue Coat Proxy SG's
  - Transparent forwarding deployment using WCCP
  - We proxy ALL egress traffic (4 ports)
    - Excluding mail, dns and things explicitly exempted
  - Protocols or enforced on their respective ports
  - Content filtering (BCWF)
  - A/V scanning (McAfee)
  - Internet authentication (ldaps)
  - By and large most data flows through our proxy!

Landscape - Log Format Details

- Blue Coat uses a format called ELFF (WC3 Extended)
  - Extend Log File Format (http://www.w3.org/TR/WD-logfile.html)
- date time time-taken c-ip cs-username cs-auth-group x-exception-id sc-filter-result cs-categories cs(Referer) sc-status s-action cs-method rs(Content-Type) cs-uri-scheme cs-host cs-uri-port cs-uri-path cs-uri-query cs-uri-extension cs(User-Agent) s-ip sc-bytes cs-bytes x-virus-id

Landscape - Log Format Details

- prefix (header) Describes a header data field. The valid prefixes are:
- c = Client
- s = Server
- r = Remote
- cs = Client to Server
- sc = Server to Client

http://www.bluecoat.com/http:/%252Fwww.bluecoat.com/support/self-service/6/ELFF_Format_Descriptions.html

Landscape - Log Format Details continued…

- LLNL format
- date time time-taken c-ip sc-status s-action sc-bytes cs-bytes cs-method cs-uri-scheme cs-host cs-ip cs-uri-port cs-uri-path cs-uri-query cs(Referer) cs-username cs-auth-group s-hierarchy s-supplier-name rs(Content-Type) cs(User-Agent) sc-filter-result cs-category x-virus-id s-ip s-sitename
- Customize your log format to best suite your needs

Landscape - Log Format Example

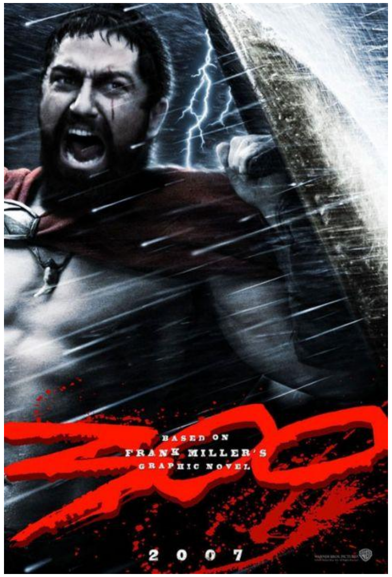
```
2010-04-20 07:00:40 225 1XX.115.109.XX 200 TCP_NC_MISS 332 533 GET http 116vistadrive.greatluxuryestate.com 65.18.172.67 80 /mlsmax/layout05/images/menu_div.gif - http://116vistadrive.greatluxuryestate.com/mlsmax/home.htm?mls=&vkey=&vid= linney1 - DIRECT 116vistadrive.greatluxuryestate.com image/gif "Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9.2.3) Gecko/20100401 Firefox/3.6.3" OBSERVED "Real Estate" – 1XX.115.27.XX SG-HTTP-Service
```

Solutions – How can we solve our problems?

- Most of us now have a web proxy…now what???
  - Centralize your logs
  - Modify your log format to suite your needs
- What do the “bad guys” look like???
  - Different types of bad guys, overlap, difficult to tell apart
    - Users
    - Criminals / Entrepreneurs
    - APT (Advanced Persistent Threat)
- How do we find “bad guys” on our networks???
  - Depends on which “bad guys” we’re looking for
    - Digest
    - Analyze
    - Scrutinize

Solutions – Overview

- Parse your logs with whatever makes you happy
  - My Proof of Concept codes are in Perl
    - Need a code reference I’ll share
  - You can use grep, awk, sed, cut, PHP, C, etc.
- Practical tips
  - Pay attention to http redirects
    - 301, 302, 3XX
  - Pay attention to referrer
    - Could contain search terms
    - Multi staged attacks are commonplace
  - Looking at logs after 5pm can be detrimental! -Monzy



Solutions – Overview Continued

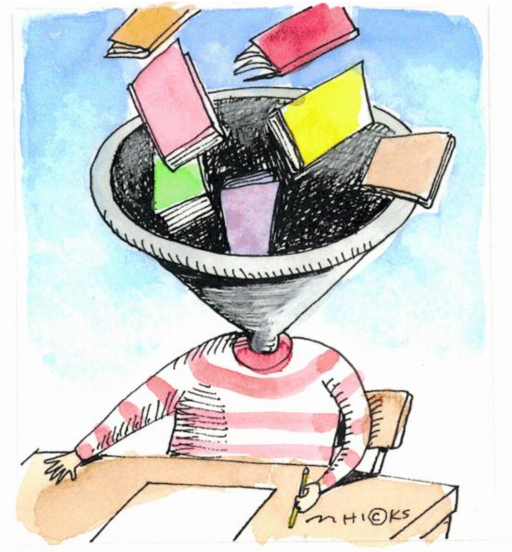
- Getting comfortable with the data
  - Machine learning algorithms are not mandatory
    - get www.010h45m.com/FreeAV2010.exe
- Our solutions will focus on the following
  - Simple statistics
    - summarization, mean, std. dev, etc.
  - User agents
  - Content Types
  - Compound Searches
  - Consult the oracle
    - a.k.a. google

Solution - Summarization

- 2010-04-20 07:00:40 225 1XX.115.109.XX 200 TCP_NC_MISS 332 533 GET http 116vistadrive.greatluxuryestate.com 65.18.172.67 80 /mlsmax/layout05/images/menu_div.gif - http://116vistadrive.greatluxuryestate.com/mlsmax/home.htm?mls=&vkey=&vid= linney1 - DIRECT 116vistadrive.greatluxuryestate.com image/gif "Mozilla/5.0 (Windows; U; Windows NT 5.1; en-US; rv:1.9.2.3) Gecko/20100401 Firefox/3.6.3" OBSERVED "Real Estate" – 1XX.115.27.XX SG-HTTP-Service

Solution - Summarize logs

- Daily summary
  - Total HTTP users, Total FTP users, Top Sources, Top Destinations, Top Categories, Top Denied Sources, Top Spyware/Malware Sources, Top Spyware Effects, Top User Agents, Top IP getting images, Top IP performing POST’s
  - Top 15 Spyware/Malware Sources:
  - 1xx.115.226.xx : 48
  - 1xx.115.105.xxx : 47
  - 1xx.9.139.xx : 14
  - 1xx.9.139.xx : 12
  - 1xx.9.93.xx : 8
  - 1xx.115.105.xxx : 5
  - 1xx.115.105.xxx : 5
  - 1xx.9.135.xx : 2
  - 1xx.9.135.xx : 2
  - 1xx.115.62.xxx : 2
  - 1xx.9.135.xx : 1



- PoC bcsummary.pl
  - Daily summary of most of the above

Solution - Summarize all requests by TLD

- Top Level Domain (TLD)
  - I need to jump through hoops to travel physically
    - Virtually users are all over the map!
  - Summary of daily TLD's:
  - com : 15889009
  - net : 1883675
  - org : 679329
  - gov : 265059
  - edu : 125093
  - uk : 116674
  - us : 38544
  - de : 29788
  - it : 26079
  - tv : 24495
  - fr : 11703
  - ca : 11016
  - ru : 7621

  - PoC tldsummary.pl
  - summary by Top Level Domain
- Maybe you should block entire TLD's?

Solution – User Agents

-
  ```
  2010-04-20 07:00:40 225 1XX.115.109.XX 200 TCP_NC_MISS
  332 533 GET http 116vistadrive.greatluxuryestate.com
  65.18.172.67 80 /mlsmax/layout05/images/menu_div.gif -
  http://116vistadrive.greatluxuryestate.com/mlsmax/home.htm?mls=
  &vkey=&vid= linney1 - DIRECT
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  ```

- Most things identify themselves
  - Or at least try to mimic common agents
    - Even malware or unwanted software

Solution - User Agents

- Recent interesting user agents
  - Possible trojan
    - "QI.exe"
    - "TwcToolbarIe7"
    - "weather2004"
  - Possible piracy/MPAA issues
    - "AnyDVD" (DVD cloning software)
  - Possible PII issues
    - TurboTax2009.r07.005 VFNetwork/438.14 Darwin/9.8.0 (i386) (MacBook5%2C1)
  - Possible Data Loss Prevention
    - dotmacsyncclient259 CFNetwork/438.14 Darwin/9.8.0 (i386) (MacBook3%2C1)
  - Possible malware or IT issue
    - "Immunet Updater"
    - "MSDW" //Thank you Monzy,Danny Quist, Kevin Hall
      - Microsoft Dr. Watson (sqm.microsoft.com, sqm.msn.com, watson.microsoft.com)

Solution - User Agents Continued

- Possible Waste Fraud and Abuse (WFA)
  - “BattlefieldBadCompany2Updater”
  - “Solitaire III Build 33”
  - “AppleTV/1.1”
- Possible attack victims
  - “honeyd/1.5b”
  - “Winamp/5.551” //Integer overflow exploit
    - Integer overflow (www.milw0rm.com/exploits/8783)
  - WordPress/2.7; http://localhost
- Possibly anything
  - “ie8ish“
  - “blah”

- Handy lookup tool (user-agents.org)
- PoC uasummary.pl
  - Summarizes user agents and list in descending order by number of occurrences

Solution – Content Types

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Solution - Content-Type (a.k.a. MIME)

- HTTP Protocol (originally designed for SMTP)
  - Used to identify the type of information that a file contains.
    - Specified by web server using “Content-type:” header
- Common examples

text/html	.html	Web Page
image/png	.png	PNG-format image
image/jpeg	.jpeg	JPEG-format image
audio/mpeg	.mp3	MPEG Audio File
application	.exe	Executable content

Content-Type continued…

- Focus on executable content
  - "application/octet-stream“
    - Beware of .ico (i.e. favicon.ico)
  - "application/x-msdownload”
  - application/x-msdos-program

Or

- Ends in
  - .exe
  - .msi
  - .pif
  - .scr
  - etc.

Content-Type continued…

- PoC executables.pl
  - Look for everything that ends in .exe
    - Exempt items from trusted domains
      - Less than 100 domains for my enterprise
  - Interesting examples
  - www.hotfile.com/free-games-download/Treasure_Puzzle.exe
  - www.inovikov.net/srs/rgaSetup_Release_3.205.007.exe
  - download.uniblue.com/aff/rb/fdm/registrybooster.exe
  - koti.mbnet.fi/vaultec/files/miscellaneous/MinGWStudioSetup-2.05r2.exe
- The possibilities are endless

Solution – Compound Searches

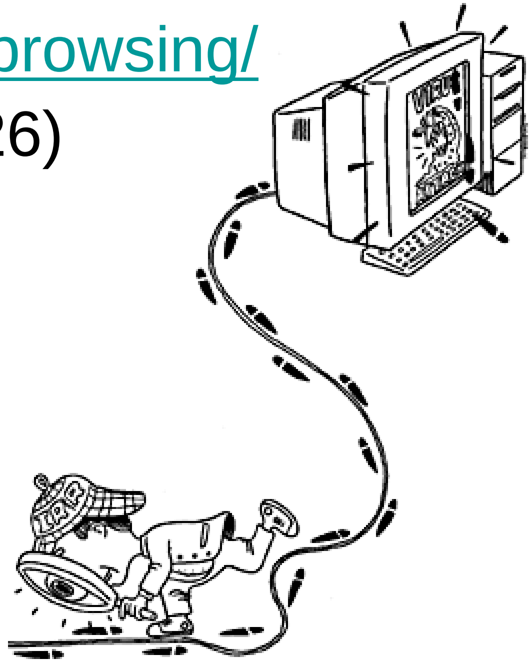
- Mix and match all of the tools previous tools
  - This where scripting languages come in handy!
- Pay close attention to some TLDs, specifically .ca!
  - If the destination ends in .ca
    - If the mime type is "application/octet-stream"
      - Print the log line
- Check out executables coming from category of “none”
  - If content type is "application/octet-stream” or "application/x-msdownload”
    - If category is “none”
      - If the file doesn’t end in .ico
        - » Print the log line

Solution – Compound Searches

- Examine requests to IP’s categorized as “none”
- If the destination host is the same as the destination IP
  - If the category is “none”
    - If this isn’t FTP
      - Print the log line
- PoC quickie.pl (does this + more)
  - Simple canned compound queries of interest
  - Useful for looking for things quickly
    - Great for APT indicators

Solution - Google Safe Browsing API

- “API that enables client applications to check URLs against Google's constantly updated blacklists of suspected phishing and malware pages. Isolates machine from Internet”
  - http://code.google.com/apis/safebrowsing/
    - ~300,227 domains (2010-04-26)
  - Built into Firefox
  - FREE
- Reactive
  - Checks nightly
  - PoC safebrows-canonical.pl
    - Monzy Merza & Adam Sealey



Future

- Continue automation/scripting
  - Proxy Log IDS (P.L.I.D.S.)
    - Share indicators/ideas that work!
- Other Antivirus Scanners
  - Experimenting with Avira/Kaspersky
    - Add to current ICAP group
- Other Content filters
  - Procuring McAfee Smartfilter
- Do More with HTTPS
  - Deny (Category=NONE && Untrusted issuer)
  - Intercept everything
  - Archive HTTPS files

Conclusion

- Further Reading
  - Dr Anton Chuvakin (chuvakin.blogspot.com)
  - Joe Griffin (http://www.sans.org/reading_room/whitepapers/malicious/mining_for_malware_theres_gold_in_them_thar_proxy_logs_32959)
- Any Questions???

- My Contact Information
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  - Office: 925.422.0361
- Thank you for your time ☺