SOPHOS

simple + secure

Strategies for Monitoring Fake AV Distribution Networks

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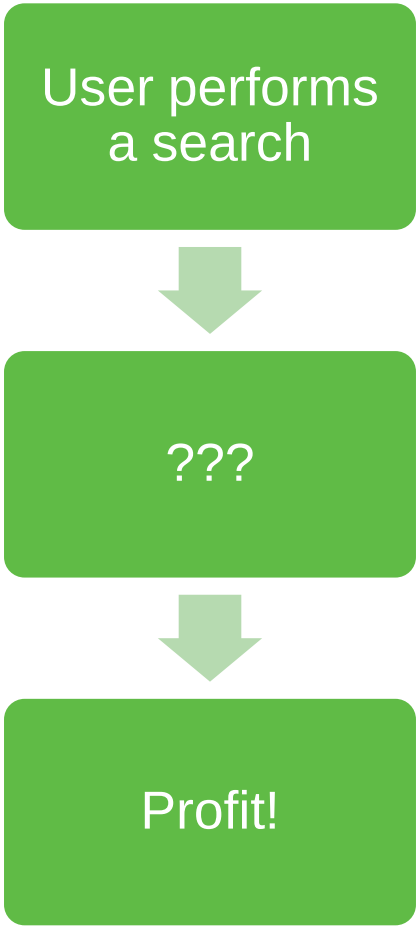
Introduction

- Security researchers study MDNs to counter malware
  - Block and take down network components
  - Detect malware binaries
  - Understand intent of malware
- MDNs are designed to evade the scrutiny of security researchers
  - Rapidly updating MDN structure and MDN content
  - Obfuscating content across various components
  - Identifying and blacklisting researchers through various methods

Introduction

- These behaviours introduce two problems for researchers:
  - **Unbounded growth in working set:** There are too many URLs to (re)evaluate
  - **Accuracy of content:** URL evaluation can be tainted by blacklisting
- **Our goal:** Optimize re-evaluation algorithm to reduce the number of evaluations per URL

Typical FakeAV Attack



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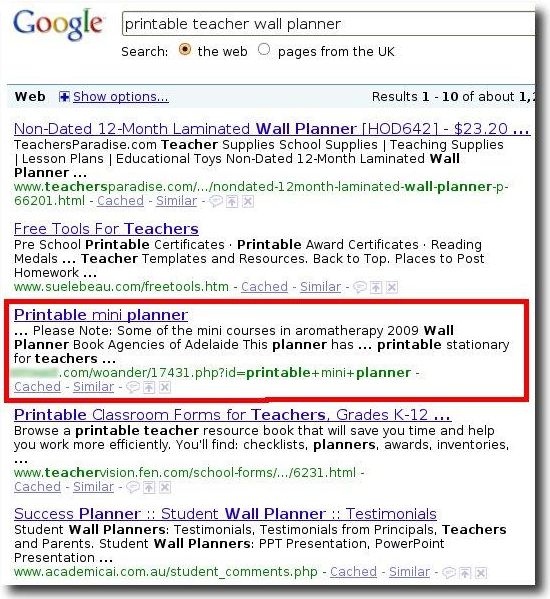
Doorways

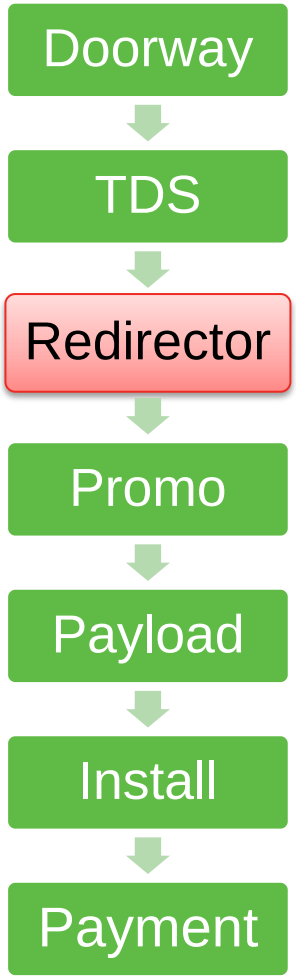
- Often on legitimate but compromised sites
- Serves keyword stuffed content to crawlers
- Google Trends or Auto Complete abuse
- Redirects user to next hop in redirect chain
- We focus on social engineering, not drive-by



Traffic Direction System (TDS)

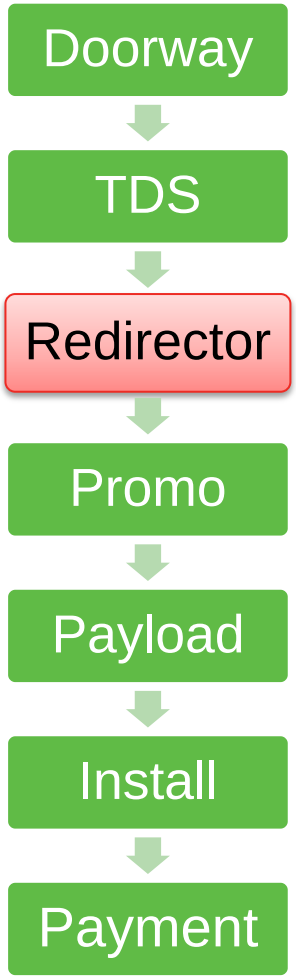
- Not always present
- SutraTDS, SimpleTDS, …
- Redirect traffic to malicious content based on
  - Country
  - Browser
  - OS
  - Keywords searched
  - etc…

Redirector



- Again, not always present
- Adds to the level of complexity
- Could have multiple redirectors
- Often hosted on bulk subdomain service sites

Bulk Subdomain Service

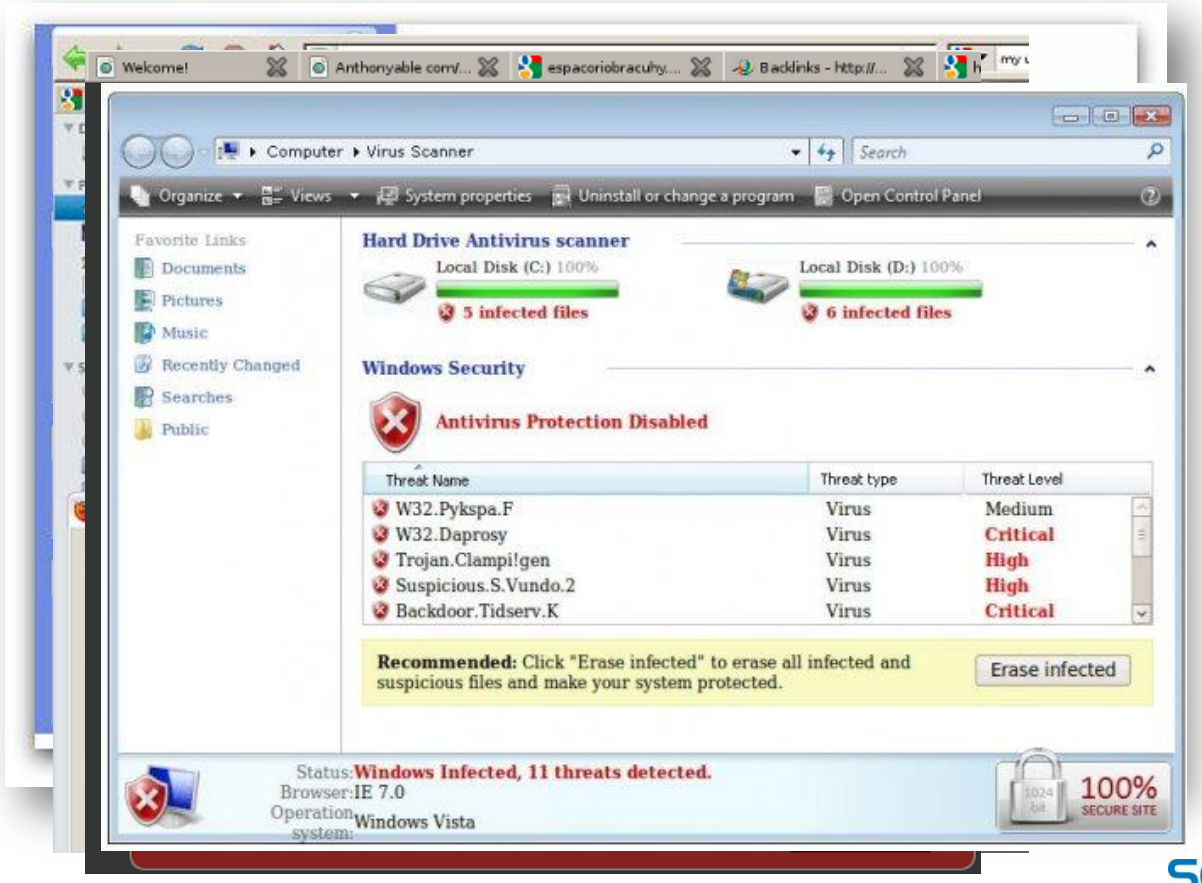


- Popular sites: co.cc, cx.cz, co.be, rr.nu, cz.cc, etc...
- Offer low-cost subdomains - as low as $0.07-$0.10 each
- Some AV vendors reluctant to block these services due to FP risk
- In June, Google began flagging many of the popular domains on their Google Safebrowsing list

Promotional Page

- Doorway
- TDS
- Redirector
- **Promo**
- Payload
- Install
- Payment

- Fake “My Computer” (or Finder) scanner page



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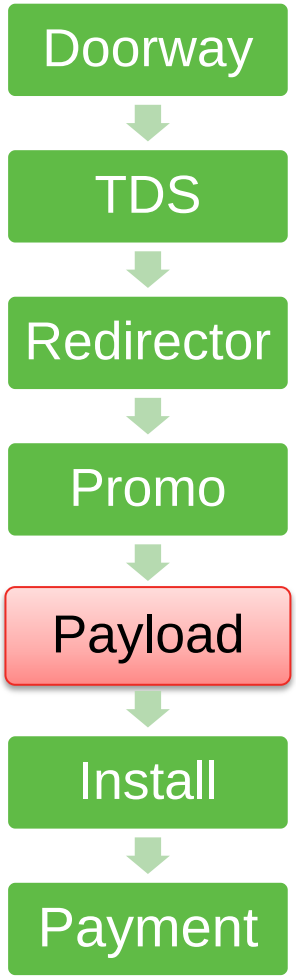
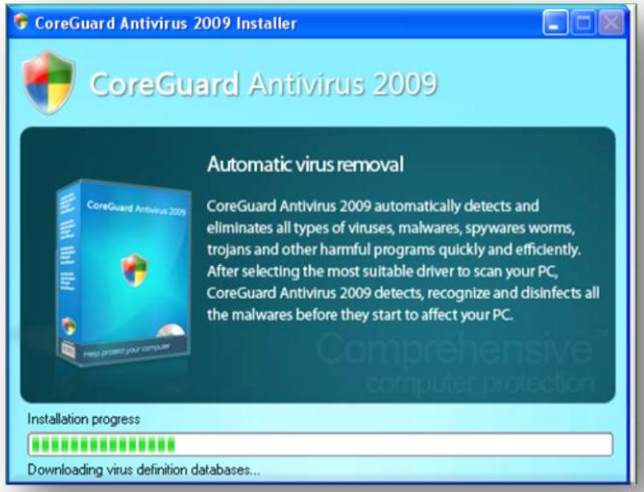
Payload



- Often hosted on the same location as the promo page
- Fully or partially polymorphic



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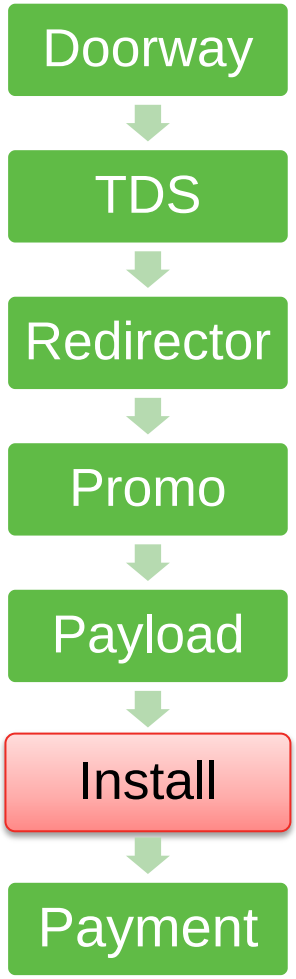
Install



- Not concerned with anything past the binary for this research

Payment

As an aside, a few points worth mentioning on the payment front:

- FakeAV is extremely profitable
- “The Underground Economy of Fake Antivirus Software” by Stone-Gross et al.
- Targeting them at the payment level has proven to be an effective method of reducing the amount of FakeAV seen in the wild

Why is Re-evaluation a problem?

- Daily volume of new potentially malicious URLs needing analysis is in the 100,000's
  - A subset provide additional value upon subsequent evaluation
  - Which URLs yield value, and for how long the URLs yield value is not well understood
- Every re-evaluation exposes the research IP pools to adversary
  - Assumption: More re-evaluation increases probability of blacklisting

Approach

- Systematically study malicious web sites over time to identify the distribution and prevalence of malware update behaviours
- Develop and evaluate optimizations to the re-evaluation logic based on update behaviours observed
- Identify the prevalence of IP blacklisting by MDNs and propose strategies to avoid blacklisting

Tachyon Detection Grid

- In house research tool developed to fetch and reschedule monitoring of URLs fed into the system
- Used to detect cloaking behaviour used by MDNs
- Uses a high interaction fetcher also developed in house
  - Virtual Box
  - Windows XP
  - Firefox + various addons
  - Sikuli
  - Number of custom scripts
- Generated PCAP files for post-analysis

Identifying MDNs

Three characteristics used to identify specific MDNs:

1) Each MDN identified had only one repository active at a given time

2) The repository URLs contain distinct patterns

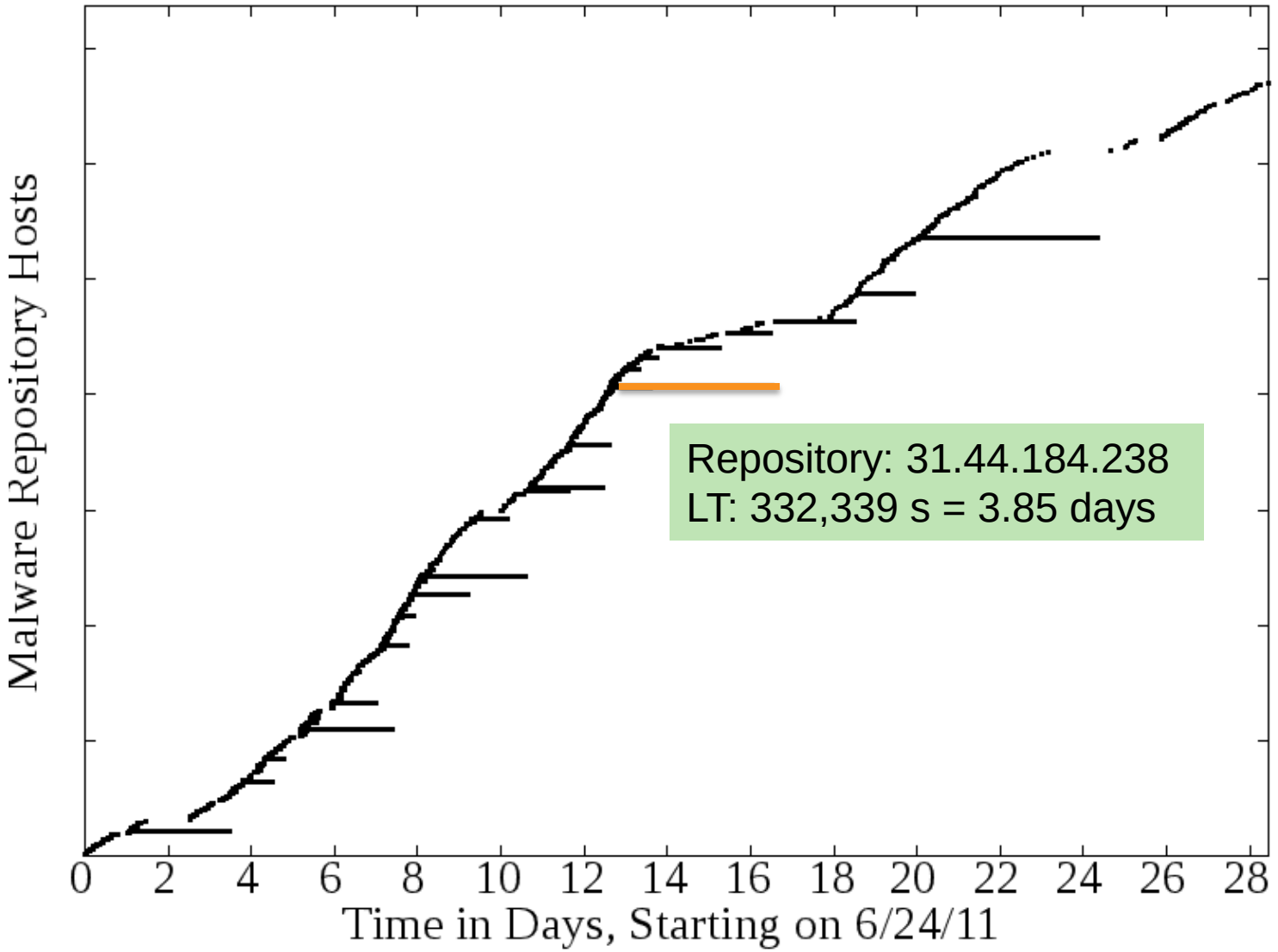
- e.g., /^http:\/\/www[0-9]\.[a-z]+\.rr\.nu\//

3) The injected code at the doorway is distinct for each MDN

Side Note…

- Early days of black SEO, scripts used server side 302 redirects
- Lately they tend to use Javascript/Meta instead
- Why the change?
- Easy for researchers to fetch with a low interaction fetcher by spoofing referrer checks, need a “real” browser for Javascript handling

Ungrouped Repository Lifetimes



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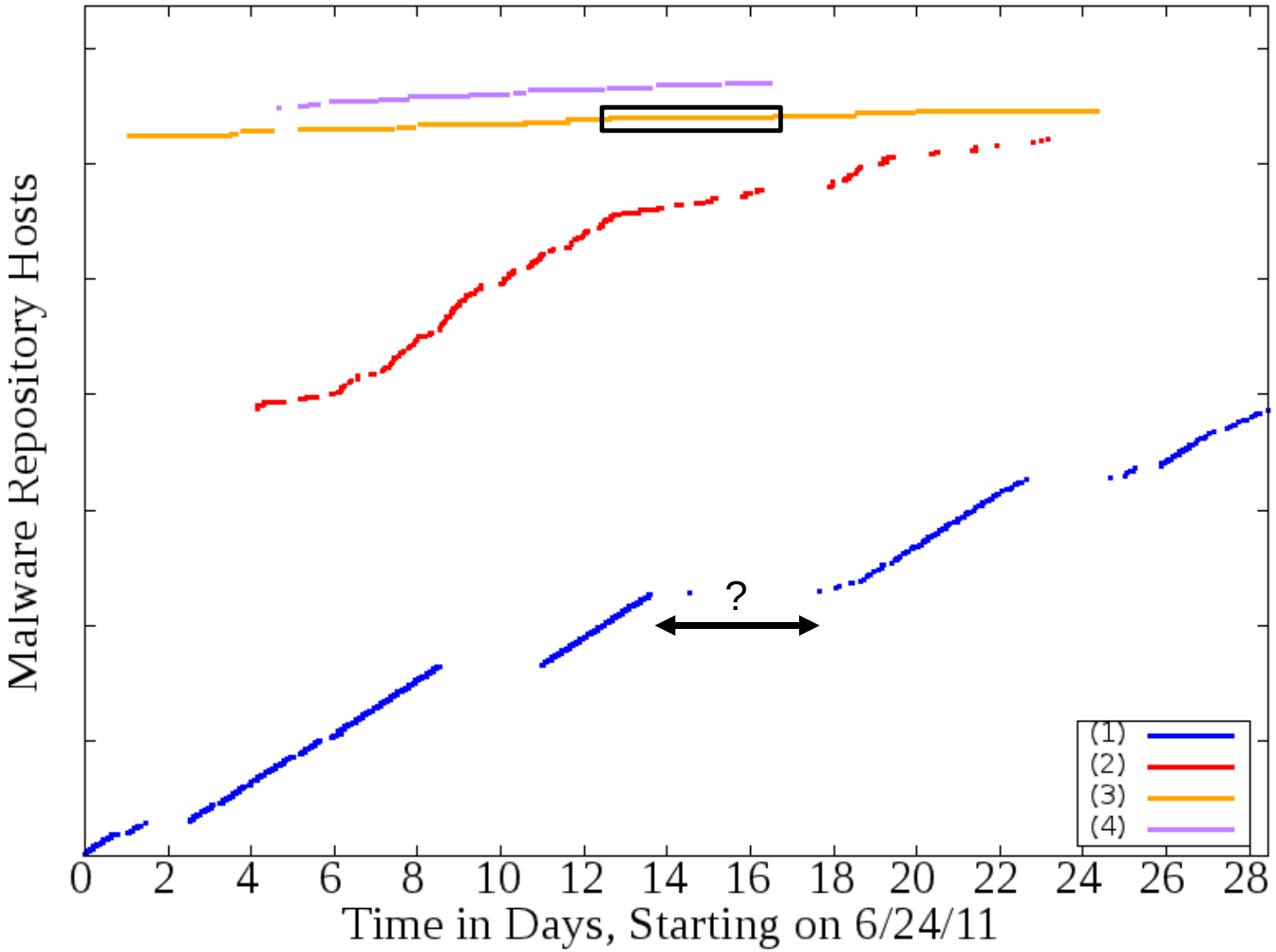
Grouped Repository Lifetimes



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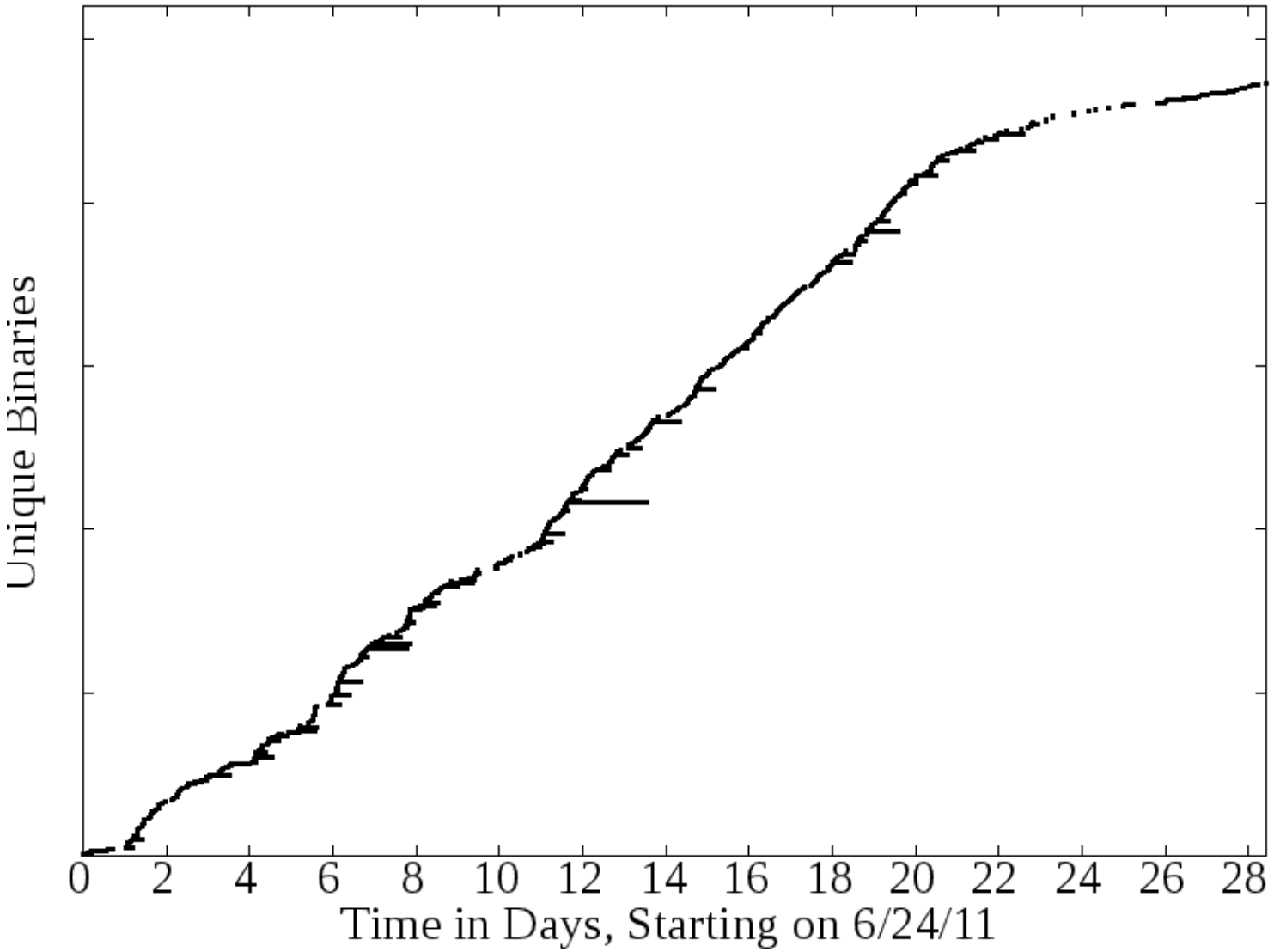
Ungrouped Binary Lifetimes



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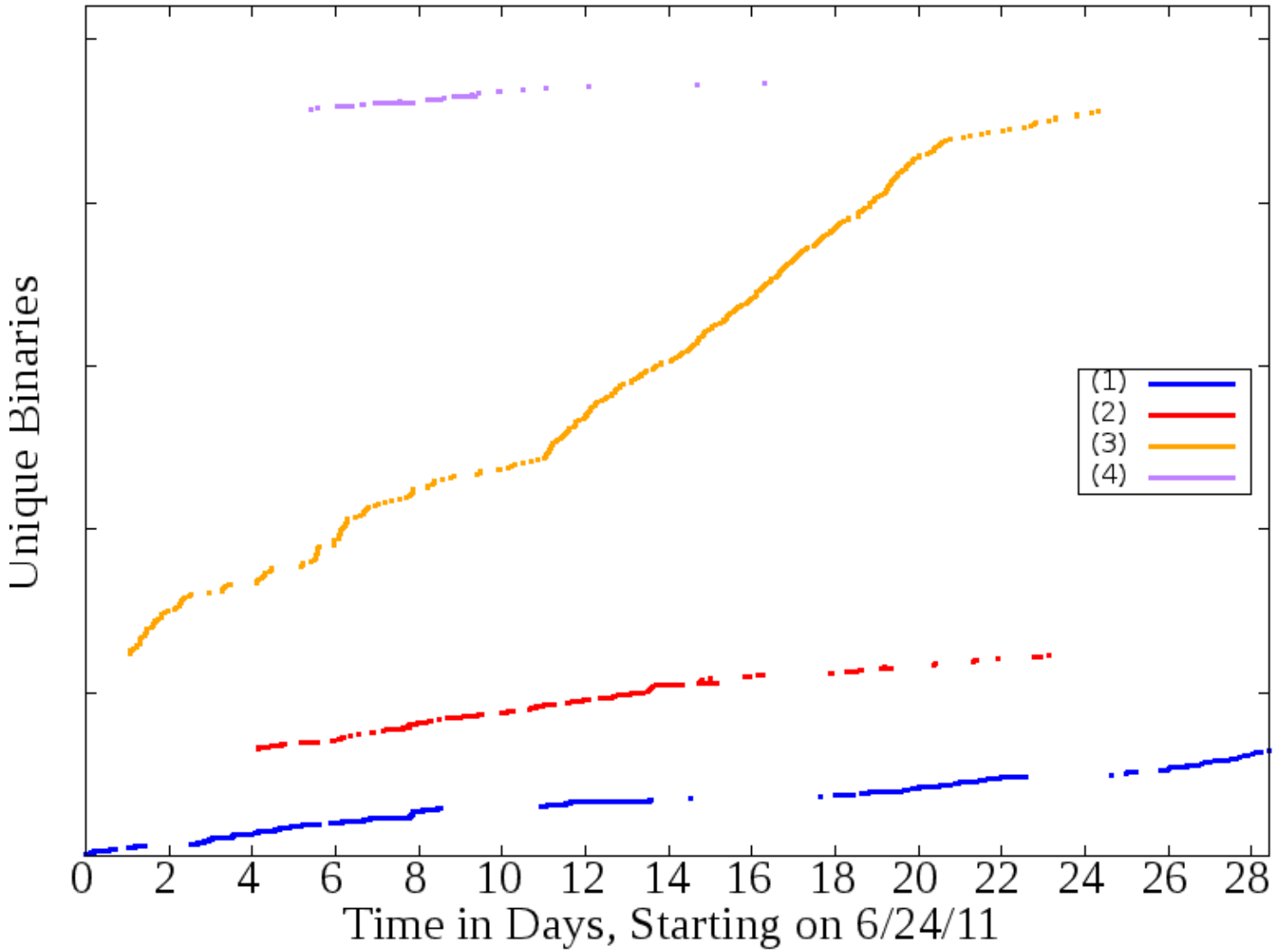
Grouped Binary Lifetimes



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MDNs

MDN #	Mal Repo Details	Binary Update Behaviour	Blacklisting?
1	Randomly generated strings of .info TLD	Periodic updates	IP Blacklisting, redirection to non-malicious sites
2	Hosted on findhere.org, rr.nu	Periodic updates	None observed
3	Snowshoeing through multiple ranges of Ips	Fully polymorphic	Possible
4	Static base string incremented numbers appended, .info TLD	Periodic updates	None observed

Blacklisting

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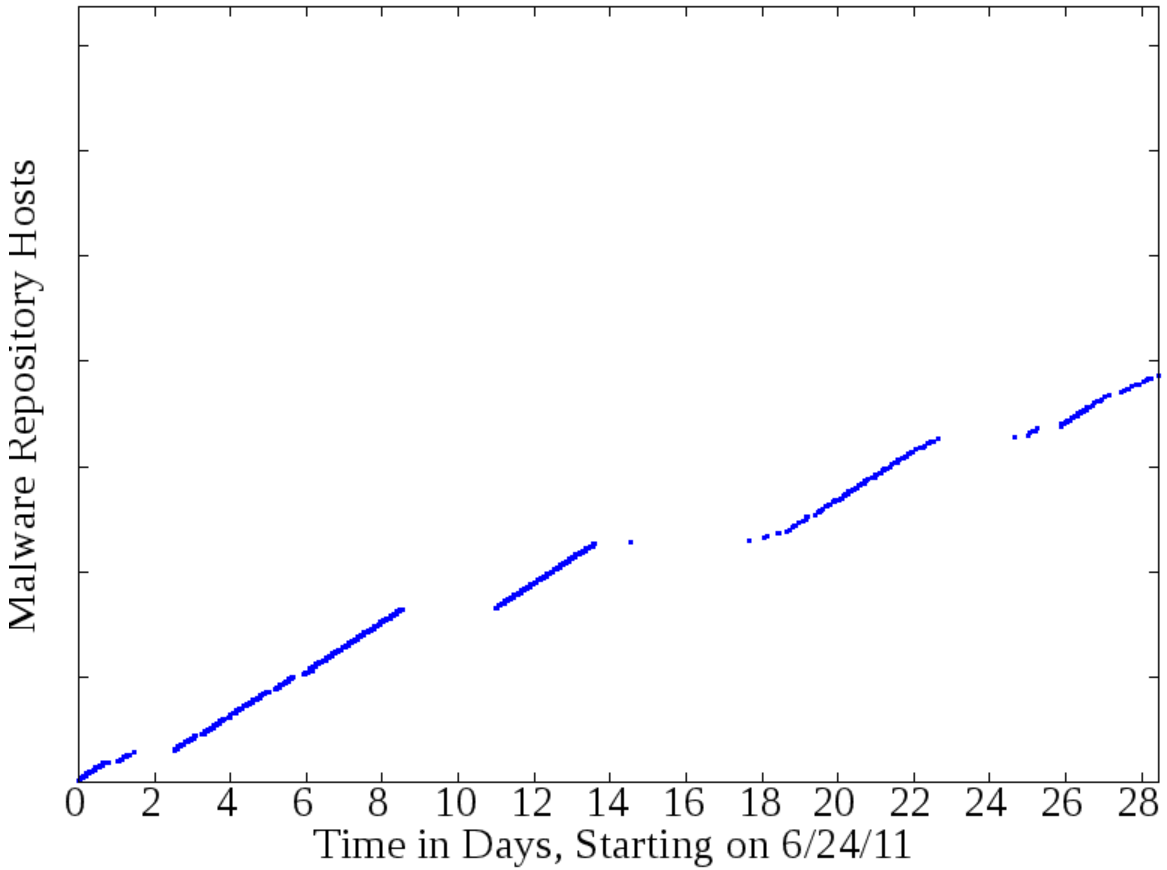
IP Blacklisting



Gaps indicate no successful fetches of binaries were made during that time

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Some Kind Words

Fetch ID	755667
Fetch Time	2011-07-05 18:09
Experiment	high_interaction_best_protection_july5
Downloader	high_interaction_best_protection_july5-rotating_proxies
Client	pink
Get JSON	get raw json
Back to URL Summary	url summary

Structured Pages

200 - meltemdaysal.com/teaching/econ305/abnormal-qrs-complex&page=6
stream OC f780189342e607451591fbdd86a2597c3b8cbce8, detection:Mal/SEORed-A, filetype:ASCII text
Link via jsvar

200 - iozbireddest.info/fast-scan/
stream OC d5efd6bf836ae815bcb02066c6edc0cd0128055b, detection:Undetected, filetype:HTML
Link via img

200 - iozbireddest.info/fast-scan/img4/loading.gif
stream OC b3feb85f8b3587a591538c87a1596716f331e8e6, detection:Undetected, filetype:GIF

Link via iframe

302 - iozbireddest.info/fast-scan/download.php?q=av-sucks
stream OC adc83b19e793491b1c6ea[redacted]2fc, detection:Undetected, filetype:very short file (no magic)
Link via server_redirect

iozbireddest.info/fastantivirus2011.exe

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Not Quite Blacklisting

- On July 20th, domains from the same MDN started resolving to an IP belonging to Denis Sinegubko's unmaskparasites.com
- Site was not hacked, just trying to confuse us
- From July 8-19, 3.9 million requests were made to his server, have full server logs
- At one point people were being redirected to: *http://blog.unmaskbullshits.com/penis-sinegubko-was-found-shit-in-the-park-even-worst-than-previous-one-part-3213.html*





Possible Blacklisting

document.write("<img src='http://counter.yadro.ru/hit;JohnDeer?t52.6;r"+escape(document.referrer)+((typeof(screen)=="undefined")?"":";s"+screen.width+""+screen.height+"*"+(screen.colorDepth?screen.colorDepth:screen.pixelDepth))+";u"+escape(document.URL)+";"+Math.random()+"'"+"border='0' width='88' height='31'>");*

- JohnDeer perhaps a reference to John Deere Tractors used in harvesting fields
- Screen width and height when run in headless mode had values of 0

Optimizations

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Fake AV MDN Structure and Optimizations

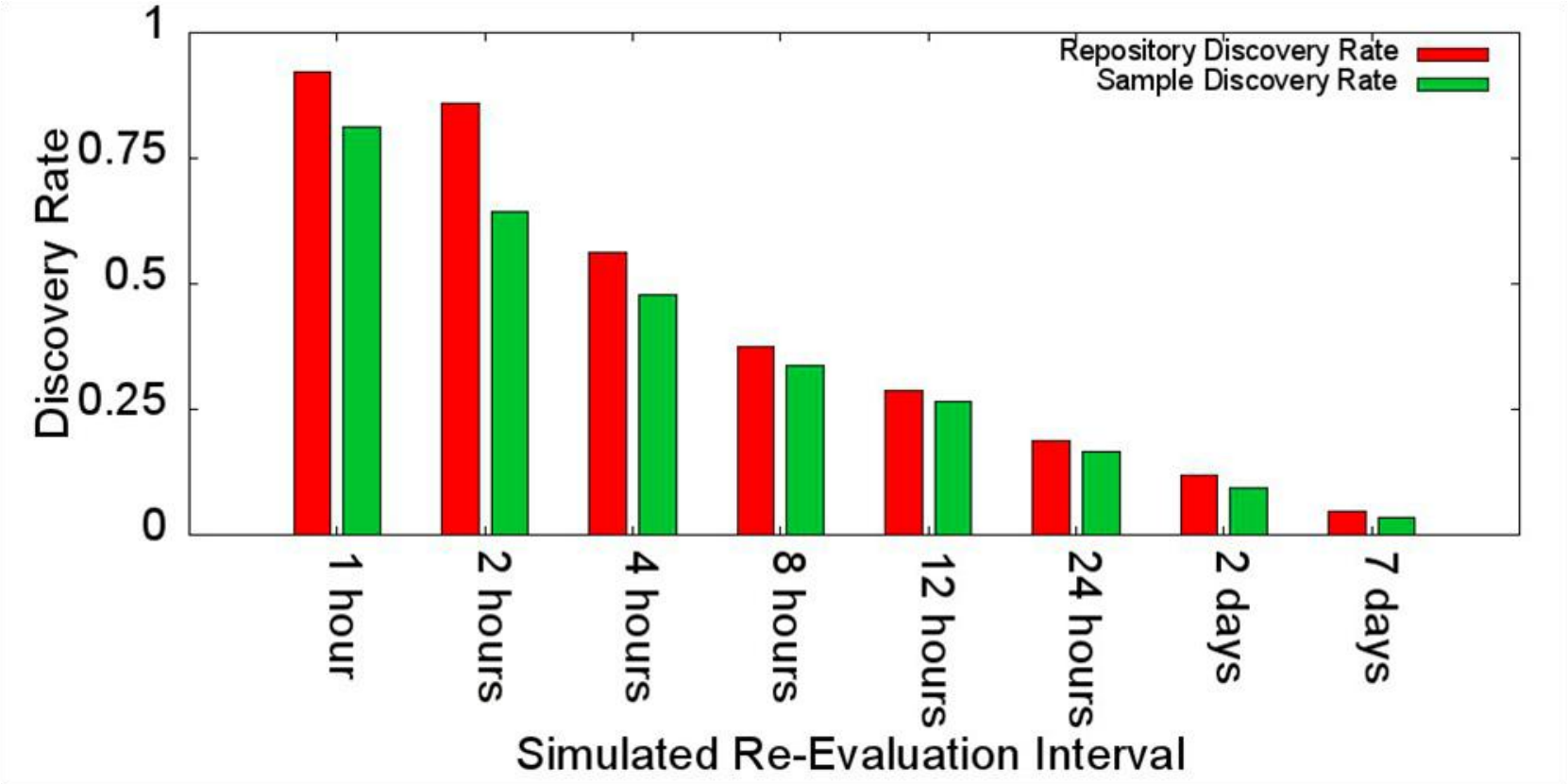
Two proposed optimizations:

1) Exploit high ’Fan In Factor’ between Landing Pages and Repositories in an MDN

2) Reduce exposures to repositories if we suspect the binary has not updated

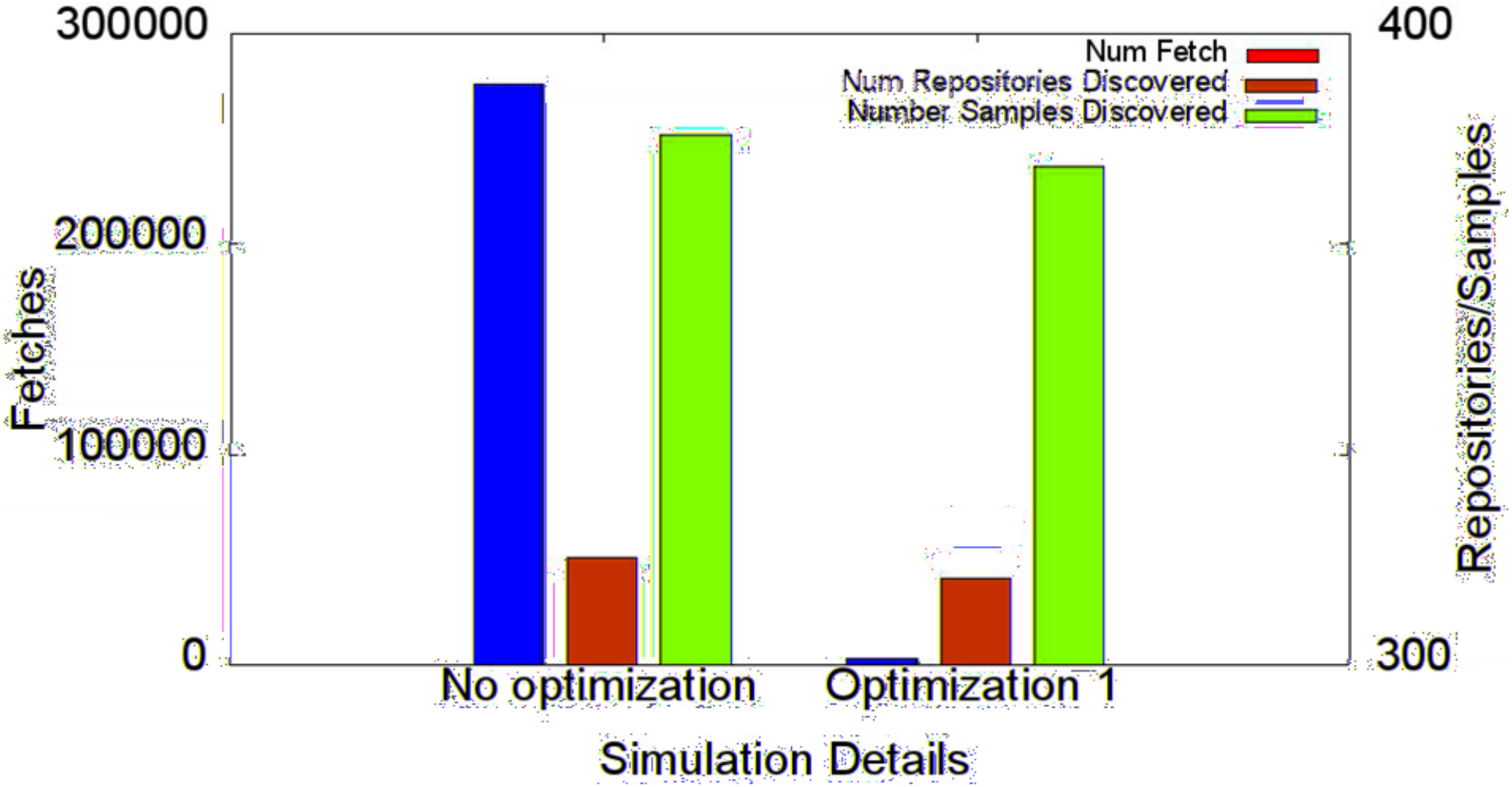
We performed a number of simulations to evaluate their effectiveness.

Re-Evaluation Interval vs Sample/Network Discovery



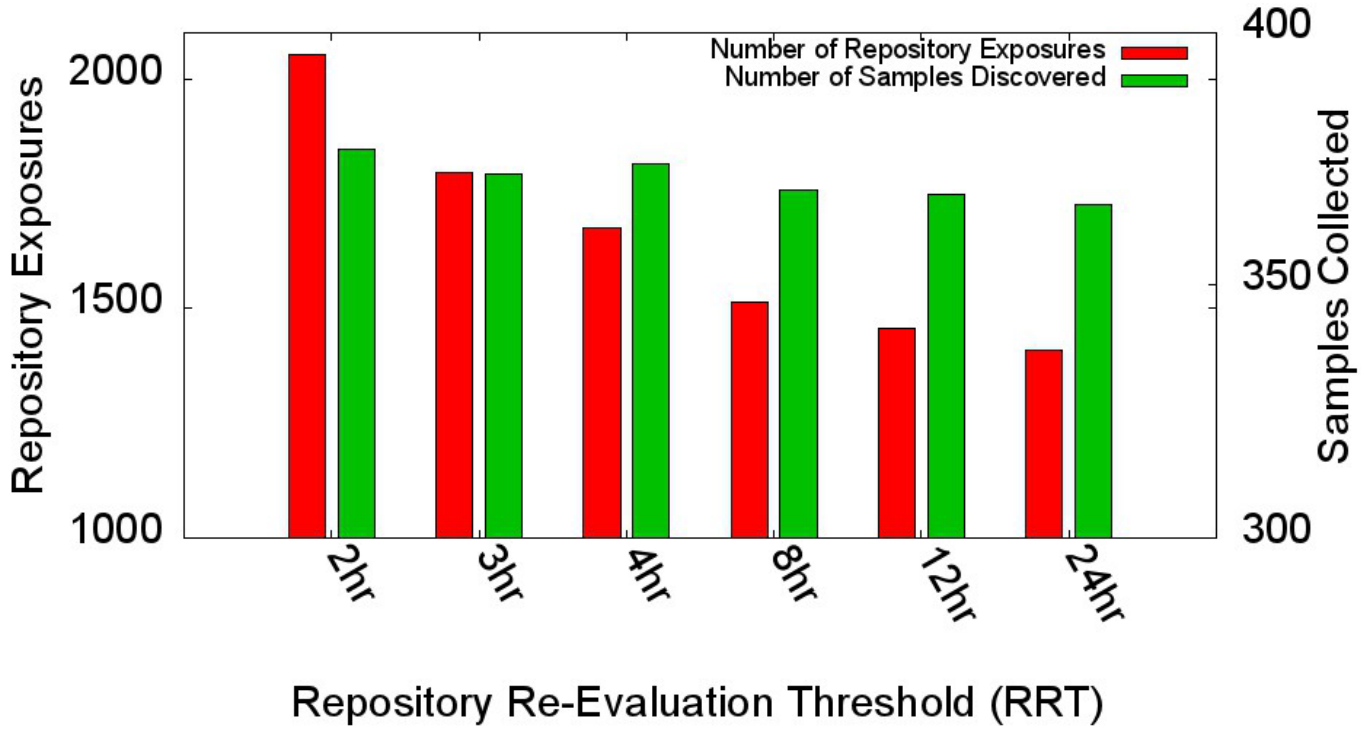
Sample and network discovery rates quickly decline as the re-evaluation interval increases

Impact of First Optimization



Drastic reduction in fetch volume at small discovery cost

Impact of Second Optimization



- RRT = Do not revisit repository more frequently than X
- Further reduction in fetch volume, with minor cost to sample discovery rate
- This optimization does not work well with fully polymorphic MDNs

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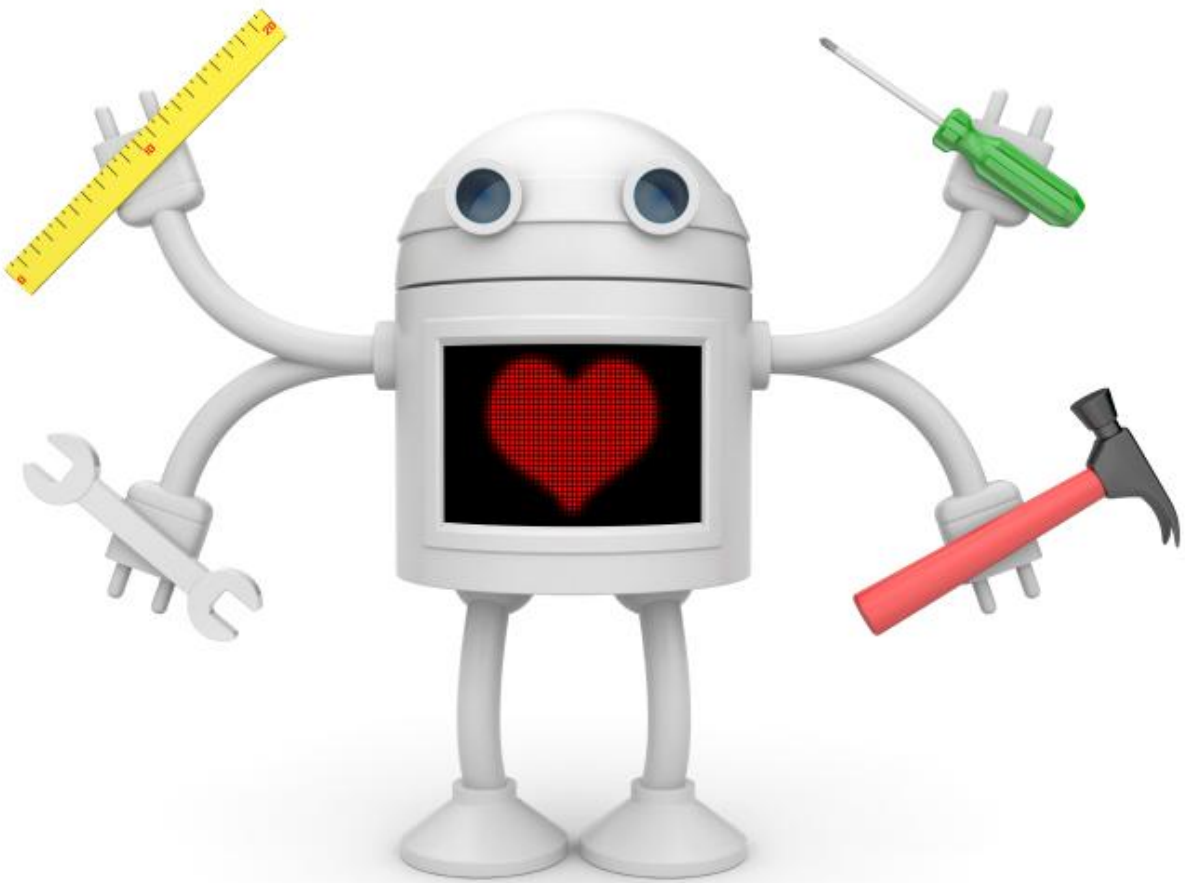
Conclusions

- Blacklisting is a valid concern when developing automated systems to monitor MDNs
- URLs should be grouped into MDNs and a re-evaluation strategy should be applied wherever possible to reduce resource requirements and chance of blacklisting
- Grouping binary samples by MDN is also an effective strategy when writing detection
- Using knowledge of MDNs and their lifetimes allows you to prioritize which samples require immediate attention versus which can potentially use a quick checksum detection



Thank you!