Evil Searching: Compromise and Recompromise of Internet Hosts for Phishing

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Data collection methodology

- We empirically examine phishing website 'take-down'
  - Widely-used countermeasure in fight against phishing
  - Banks, or 3rd party take-down companies, collect 'feeds' of phishing URLs
  - Feeds obtained from banks, third parties and using proprietary spam traps
  - Verify URLs in feed, then issue take-down notices to relevant ISPs and/or registrars
- Amalgamate several phishing 'feeds'
  - One large brand owner
  - PhishTank
  - APWG
  - Two take-down companies (each a combination of outside feeds and proprietary collection)

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Phishing-website demographics (Oct '07–Mar '08)

Type of phishing attack	Count	%
Compromised web servers	88 102	75.8
Free web hosting	20 164	17.4
Rock-phish domains	4 680	4.0
Fast-flux domains	1 672	1.4
'Ark' domains	1 575	1.4
Total	116 193	100

- Questions we seek to answer
  - What % of web servers used to host phishing are later recompromised?
  - How are vulnerable web servers found?
  - Does the way vulnerable web servers are found influence the likelihood of later recompromise?

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Phishing website recompromise

- What constitutes recompromise?
  - If one attacker loads two phishing websites on the same server a few hours apart, we classify it as one compromise
  - If the phishing pages are placed into different directories, it is more likely two distinct compromises
- For simplicity, we define website recompromise as distinct attacks on the same host occurring ≥ 7 days apart
- 83% of phishing websites with recompromises ≥ 7 days apart are placed in different directories on the server

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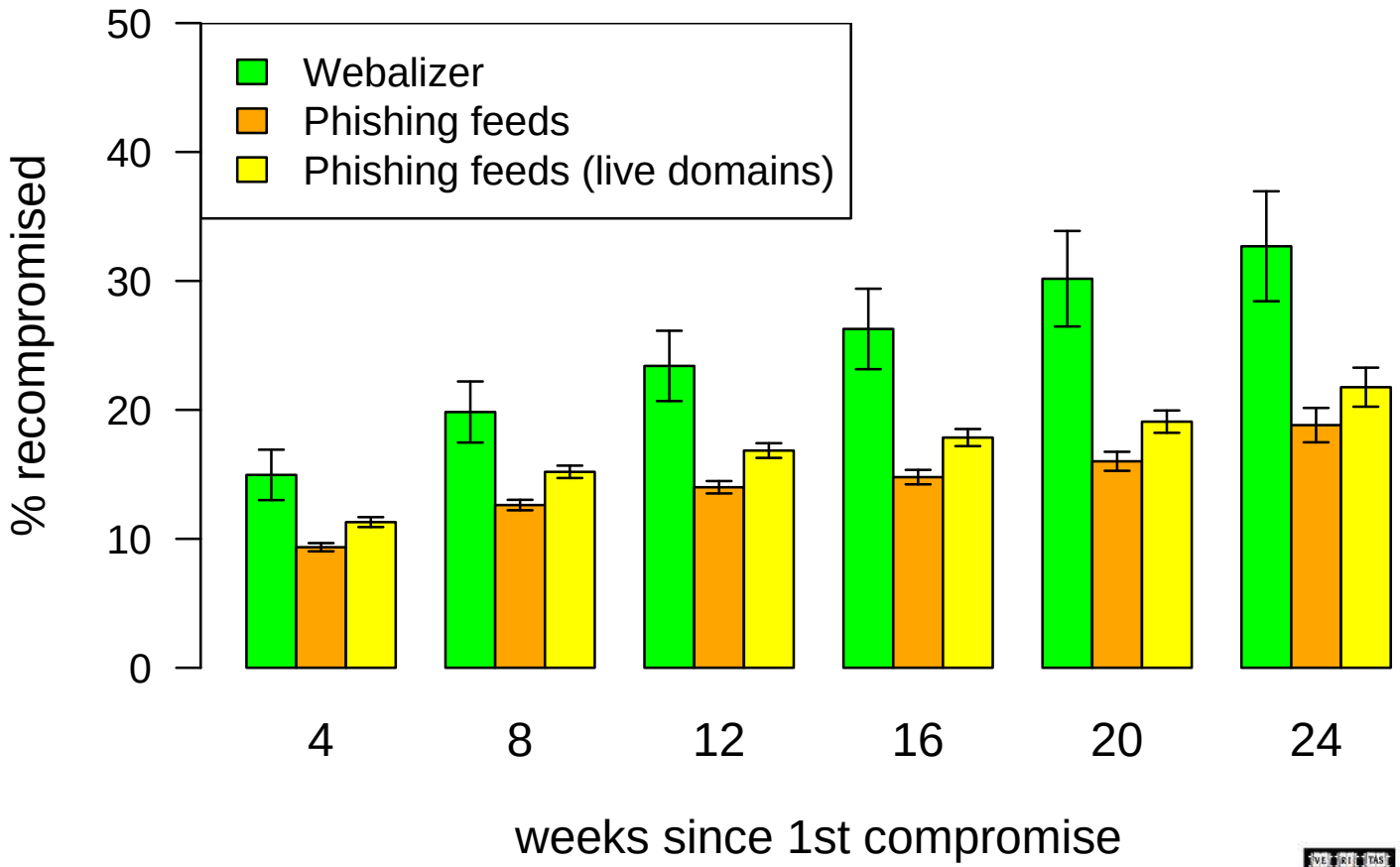
Phishing website recompromise



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The Webalizer

- Webalizer data
  - Web page usage statistics are sometimes set up by default in a world-readable state
  - We automatically checked all sites reported to our feeds for the Webalizer package, revealing over 2 486 sites from June 2007–March 2008
  - 1 320 (53%) recorded search terms obtained from '`Referrer`' header in the HTTP request
- Using these logs, we can determine whether a host used for phishing had been discovered using targeted search

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Types of evil search

- Vulnerability searches: `phpizabi v0.848b c1 hfp1` (unrestricted file upload vuln.), `inurl: com_juser` (arbitrary PHP execution vuln.)
- Compromise searches: `allintitle: welcome paypal`
- Shell searches: `intitle: ''index of'' r57.php`, `c99shell drwxrwx`

Search type	Websites	Phrases	Visits
Any evil search	204	456	1 207
Vulnerability search	126	206	582
Compromise search	56	99	265
Shell search	47	151	360

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One phishing website compromised using evil search

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One phishing website compromised using evil search

1: 2007-11-30 10:31:33 phishing URL reported: http://chat2me247.com/stat/q-mono/pro/www.lloydstsb.co.uk/lloyds_tsb/logon.ibc.html
2: 2007-11-30 no evil search term 0 hits
3: 2007-12-01 no evil search term 0 hits
4: 2007-12-02 phpizabi v0.415b r3 1 hit
5: 2007-12-03 phpizabi v0.415b r3 1 hit
6: 2007-12-04 21:14:06 phishing URL reported: http://chat2me247.com/seasalter/www.usbank.com/online_banking/index.html
7: 2007-12-04 phpizabi v0.415b r3 1 hit

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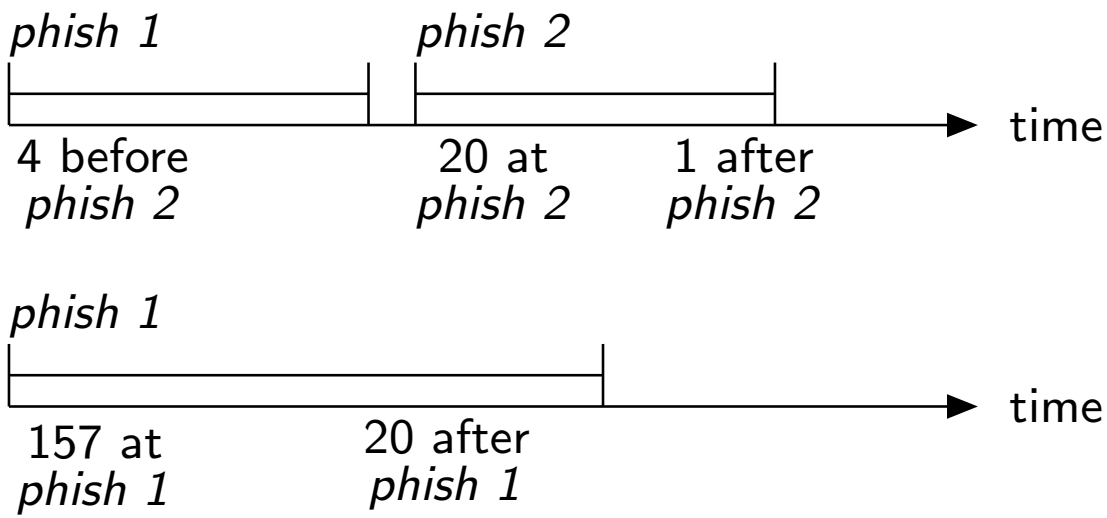
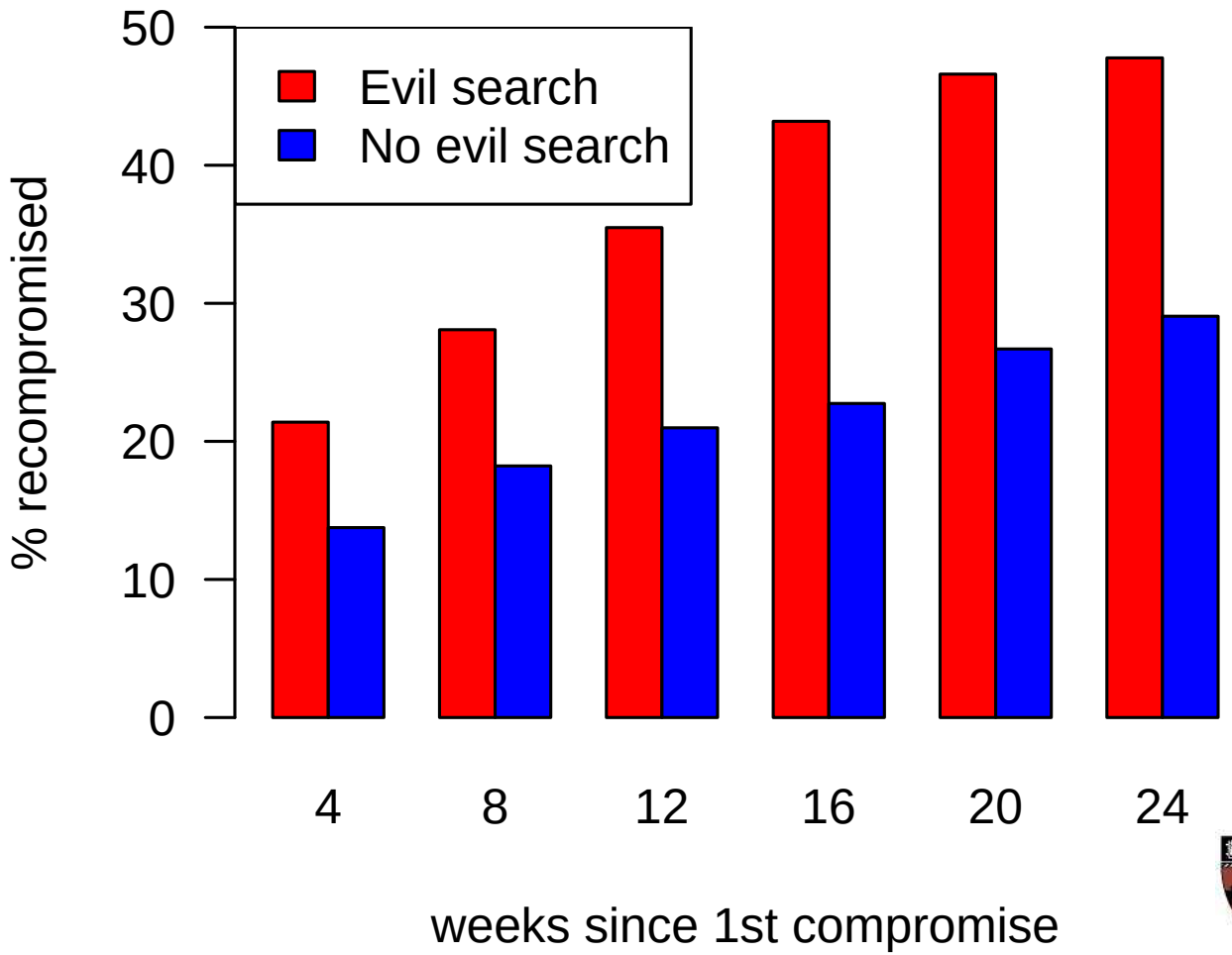
Timeline of evil web search terms appearing in Webalizer logs



Evil searching makes recompromise more likely



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Public versus private blacklists

- Is it better to hide or publish blacklists of vulnerable hosts?
  - Many fear publishing could help attackers find hosts to recompromise
  - Google's Safe Browsing API only allows verification of known URLs; APWG only shares with trusted parties
  - But might the good from public dissemination (e.g., greater awareness to defenders) outweigh the bad?
  - PhishTank and CastleCops publish lists of phishing URLs
- Fortunately, the data can give us an answer
  - Our test: do websites appearing in PhishTank get recompromised more or less frequently than websites not appearing in PhishTank
  - Caveat: we only compare recompromise rates of new hosts following their first compromise

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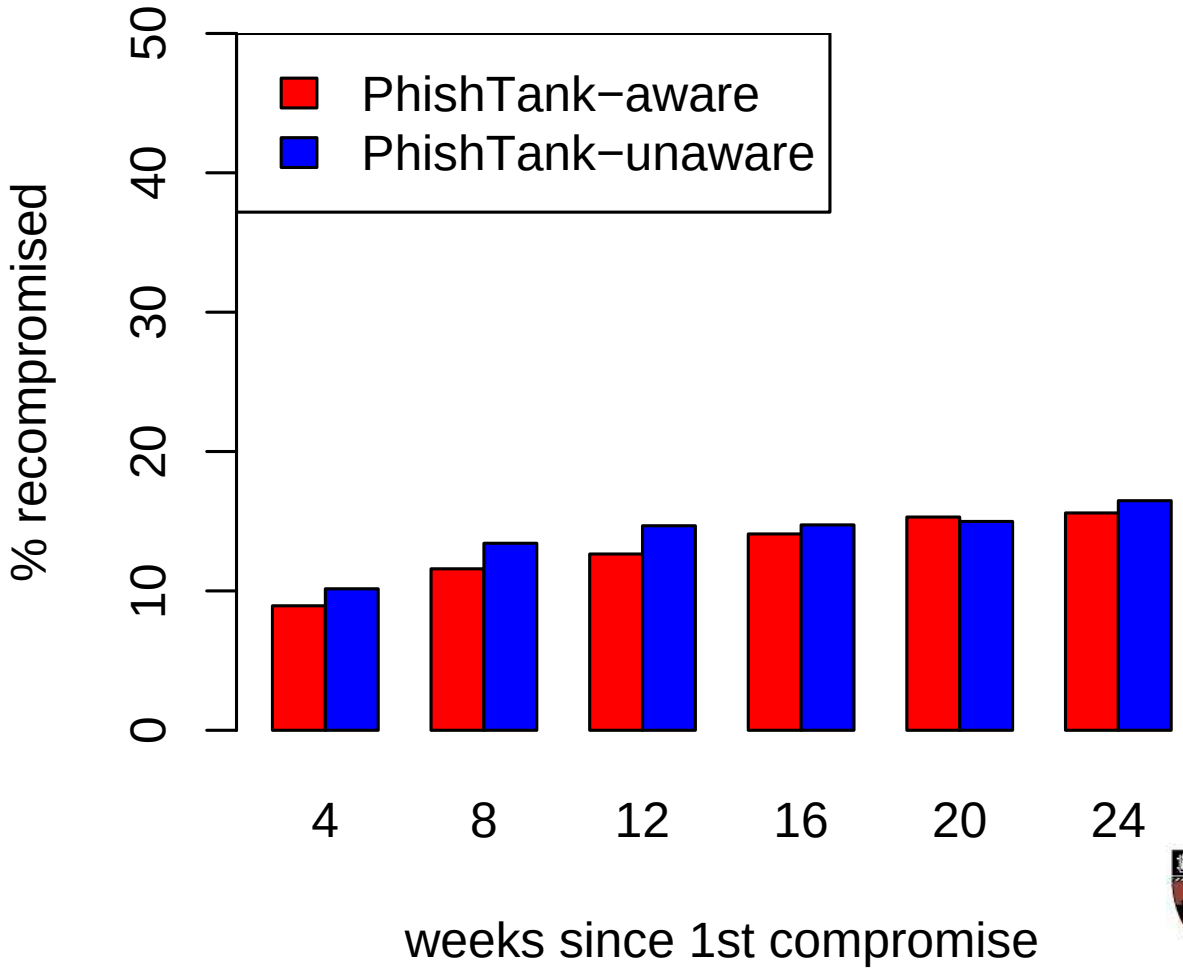
Recompromise rates similar for public and private blacklists



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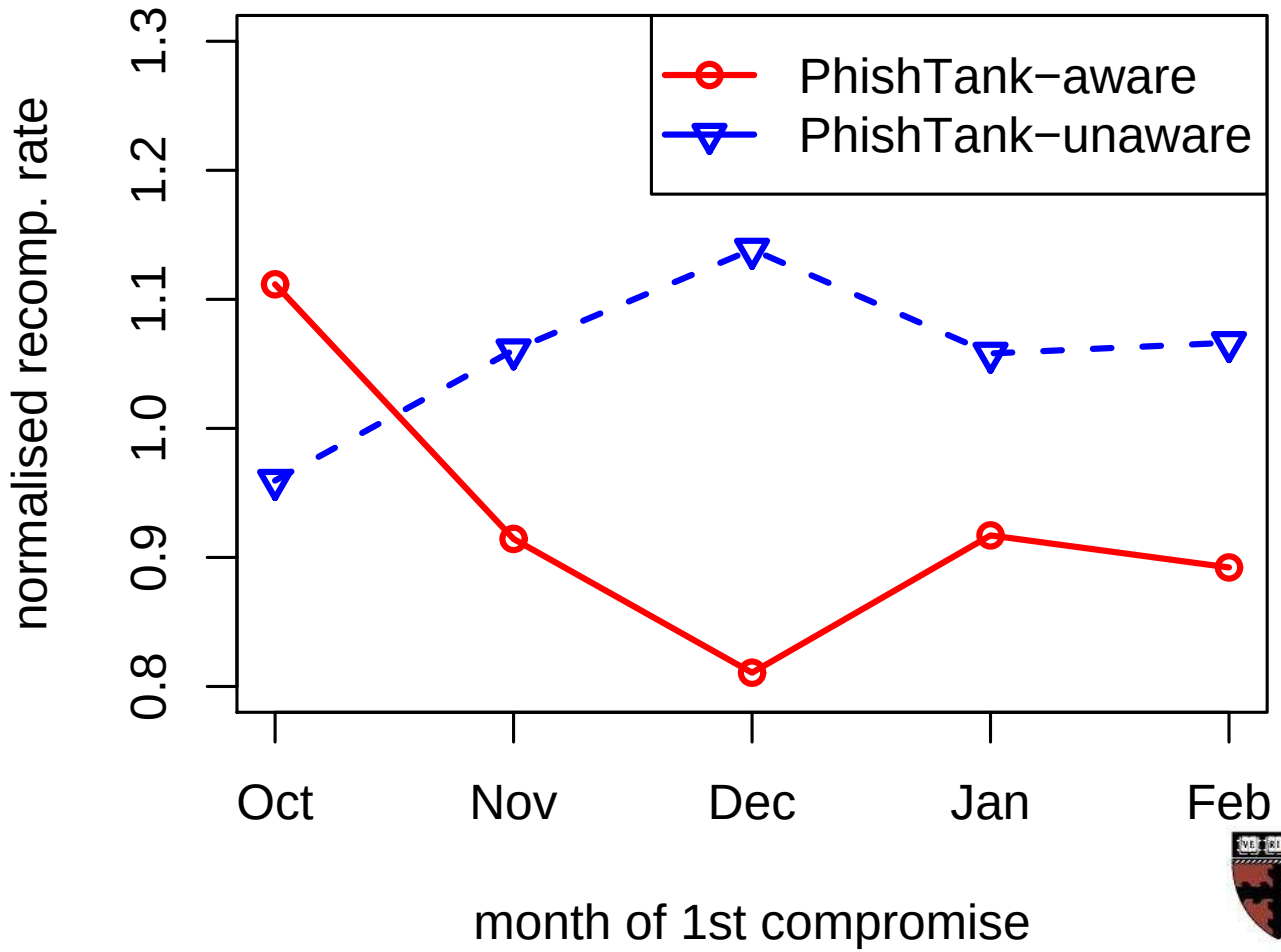
Recompromise rates slightly lower for public blacklists



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Mitigating the impact of evil searches

1. Obfuscating target details
   - Strip out version numbers, etc.
   - But: most searches contained no version numbers; defenders also use searches
2. Evil search penetration testing
   - Run evil search terms and warn affected sites
   - But: searches are only hints; confirming suspicions often illegal
3. Blocking evil search queries
   - But: constructing up-to-date blacklist hard; no incentive for search engines to block
4. Lower reputation of previously phished hosts discoverable by evil search terms
   - SiteAdvisor warns about websites consistently hosting malicious content; why not warn about hosts findable by evil search terms?

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Concluding remarks

- We have provided clear evidence that criminals who compromise web servers to host phishing websites use search engines to find them ($\geq 18\%$ of hosts found by evil search)
- 19% of all phishing websites recompromised within 24 weeks, rising to 48% when evil search terms found in the logs
- Phishing hosts disclosed on a public blacklist are slightly less likely to be recompromised than hosts kept hidden