Proactive Discovery of Phishing Related Domain Names

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Outline

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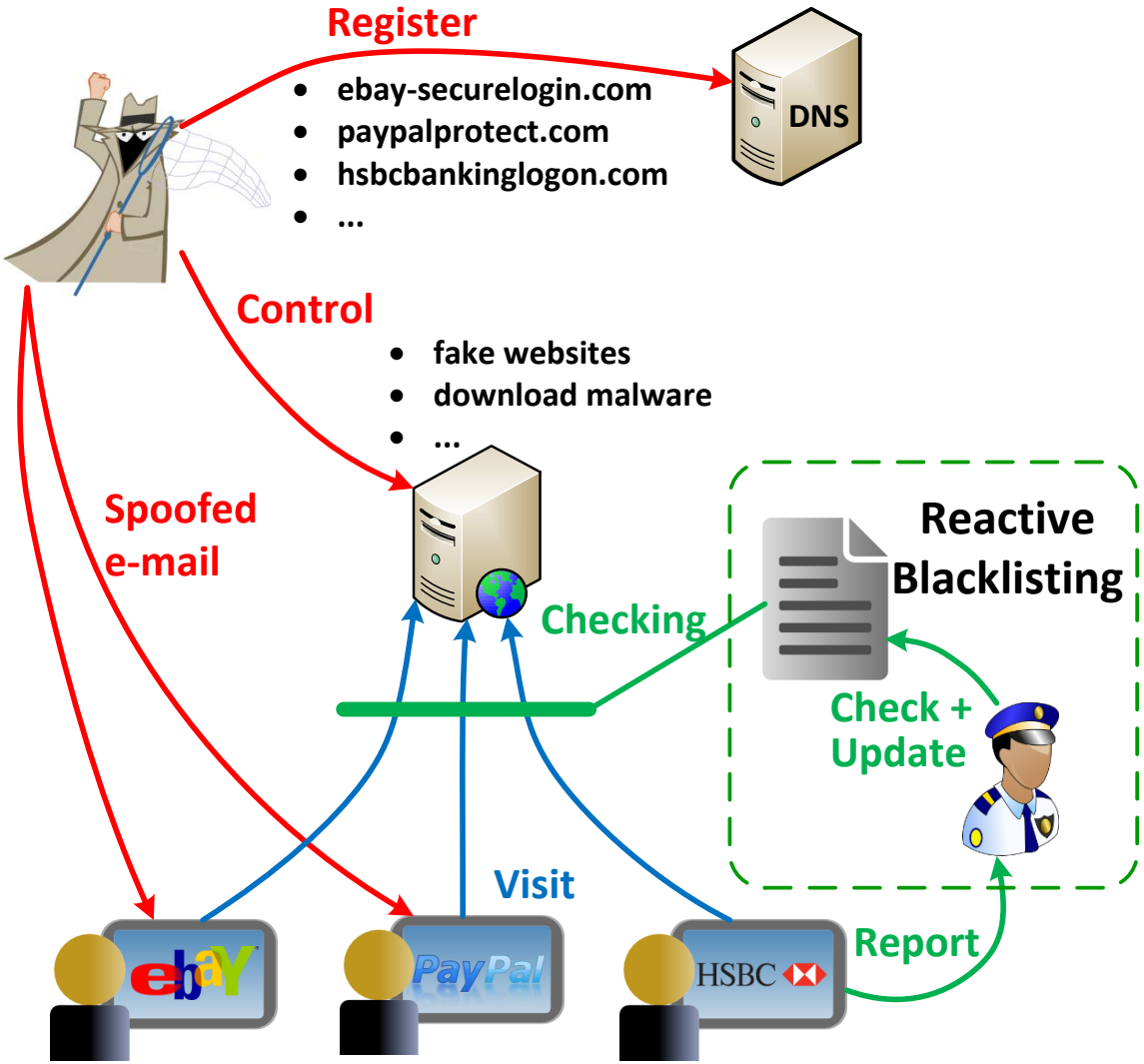
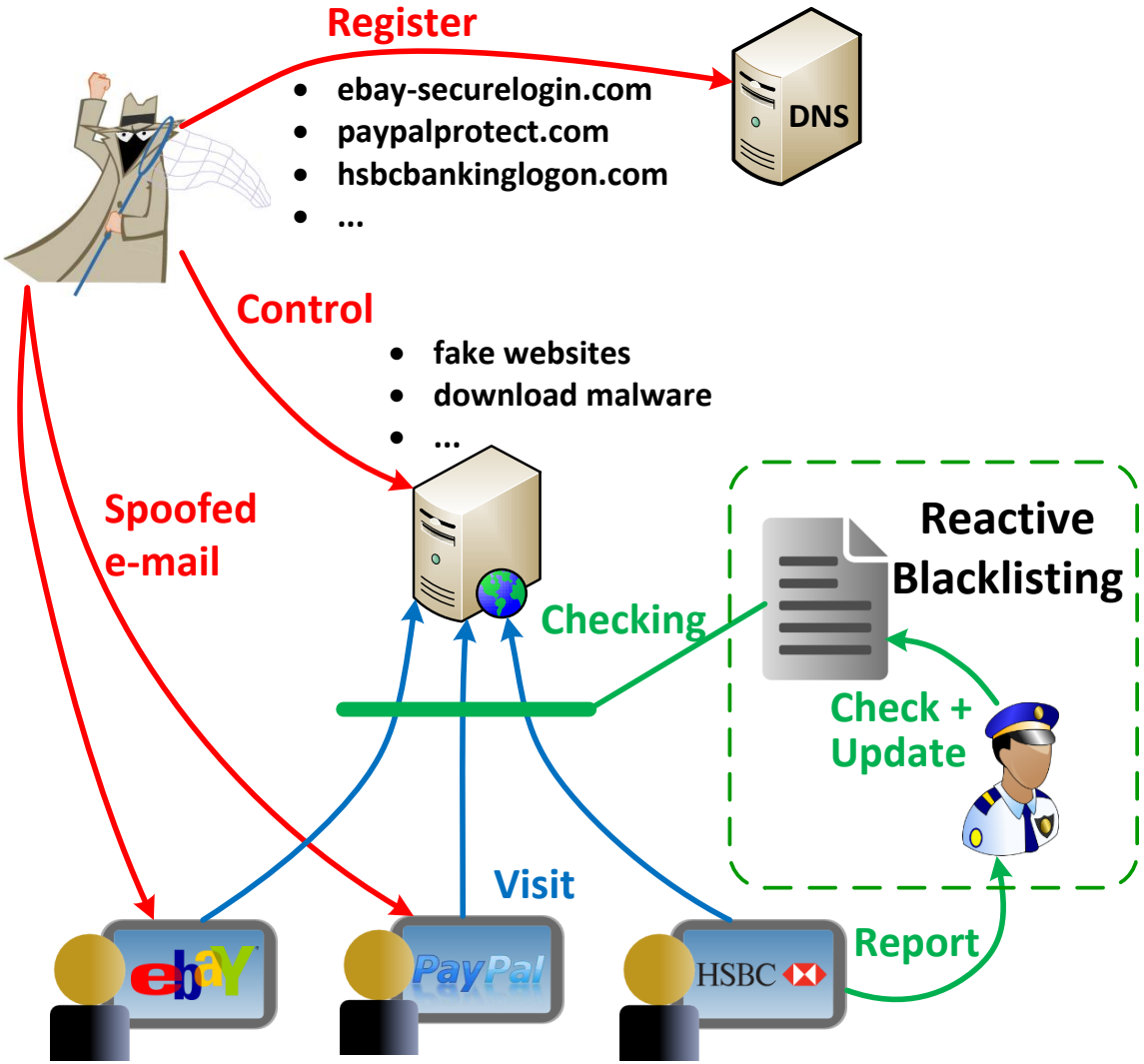
Phishing principles & defenses



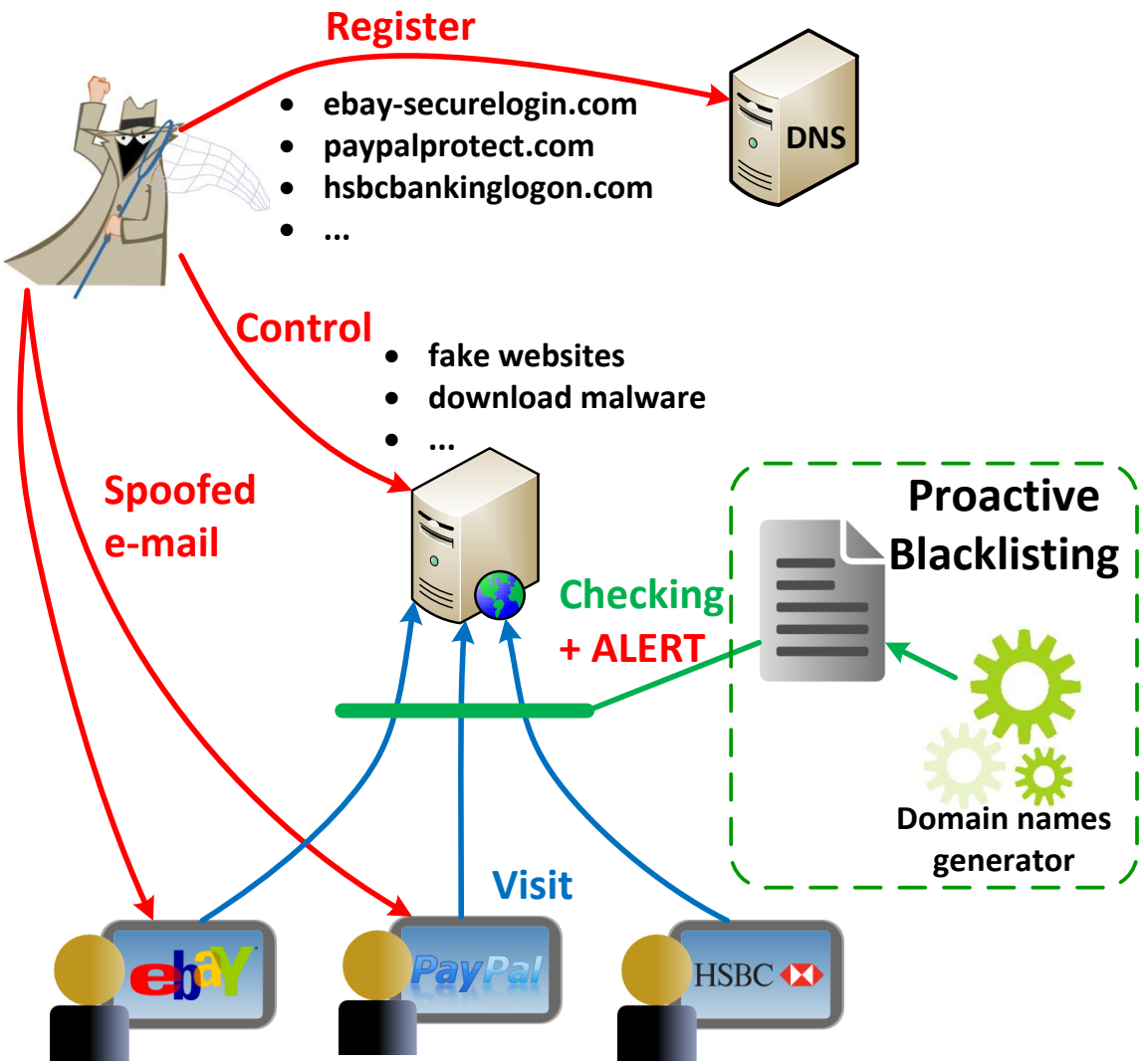
Phishing principles & defenses



Limitations:

- median lifetime: 12 hours
- monetary damage: 90% in 24 hours
- new phishing websites: >50,000/month
- new maliciously registered domain names: >16,000/month

Early blacklisting solution



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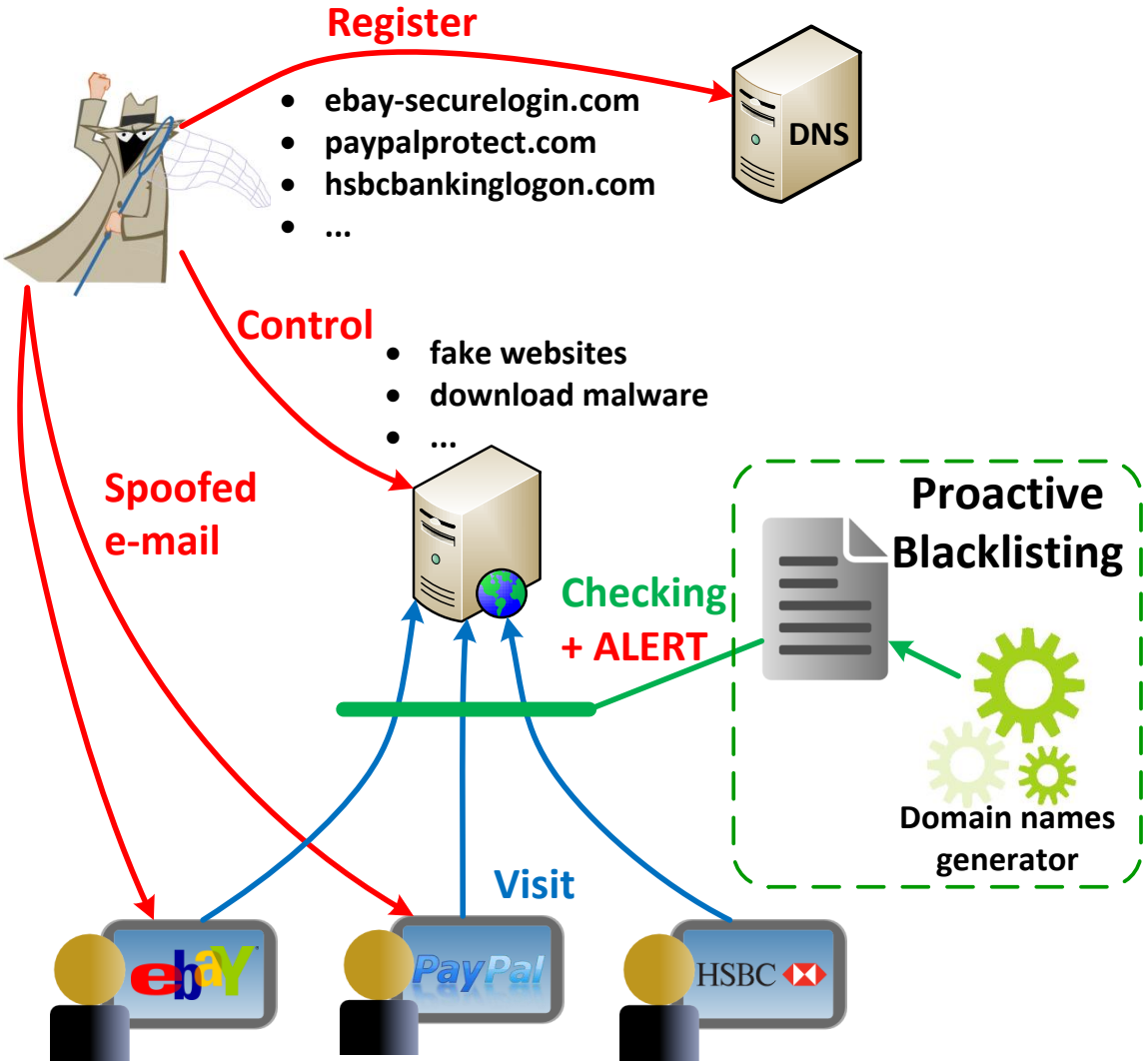
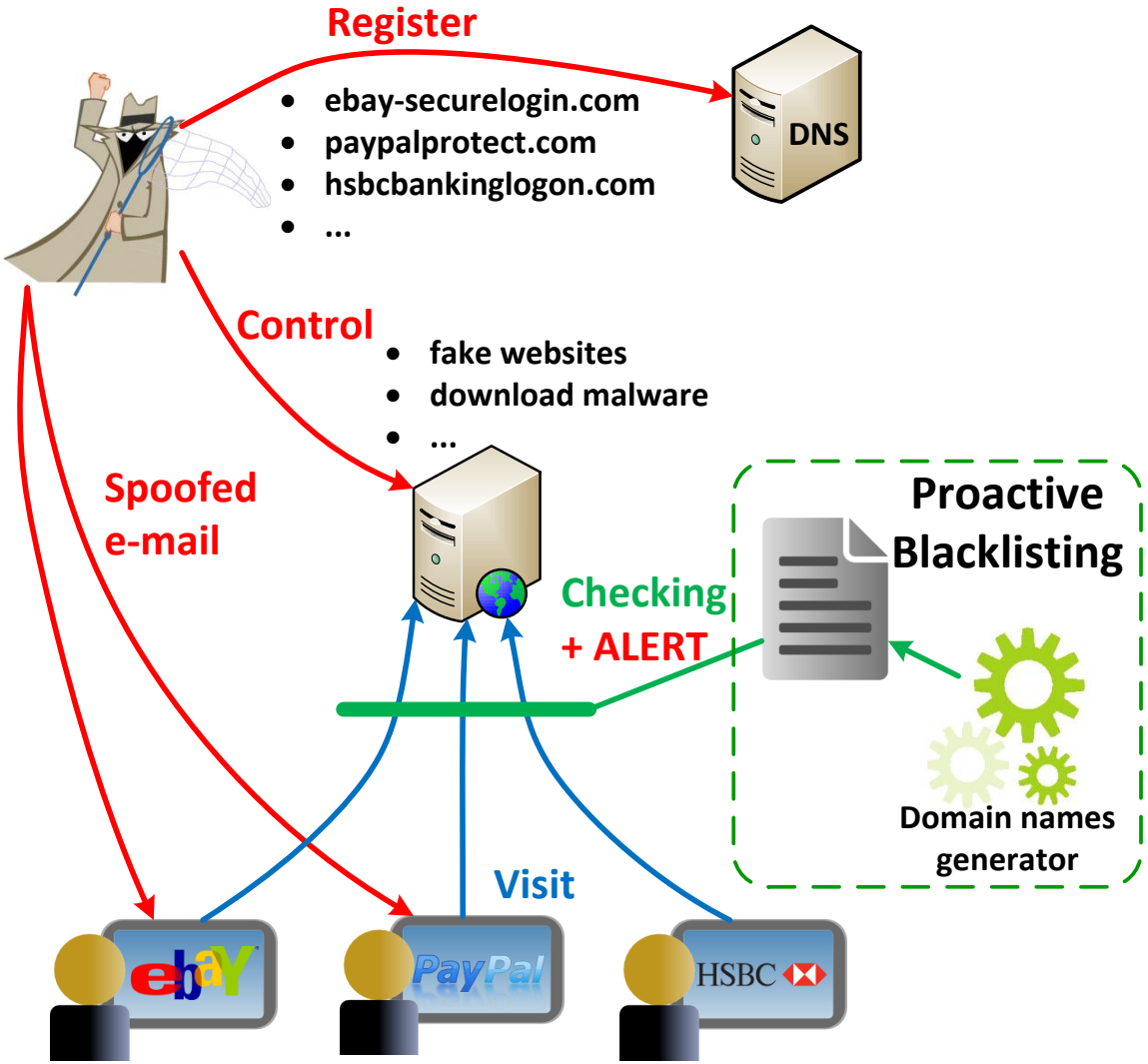


State of the Art:

- analyse early behaviour of domain names
- domains registered at the same time
- reg-exp based blacklisting

Early blacklisting solution



State of the Art:

- analyse early behaviour of domain names
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Limitations $\Longrightarrow$ needs users visit & phishing campaign specific

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Natural language model

Key idea: generate domain names similar to those registered by phishers

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- focus on *main domain* + *TLD*
  ex: www.login.**myphishingdomain.com**/index.php
- extract features from blacklisted phishing domain names
- deduce a generation model for domain names

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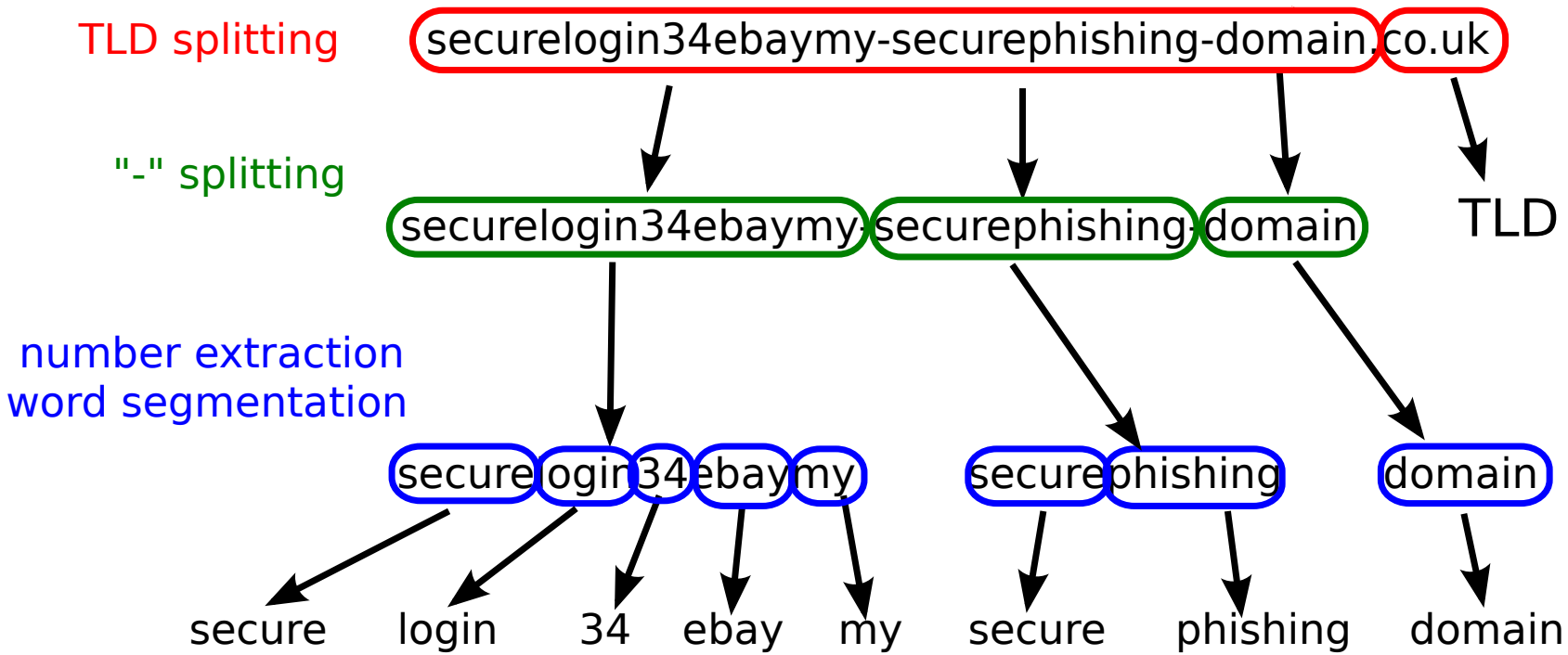
$\Longrightarrow$ Build a blacklist of potential phishing domains even before they are registered

Features extraction



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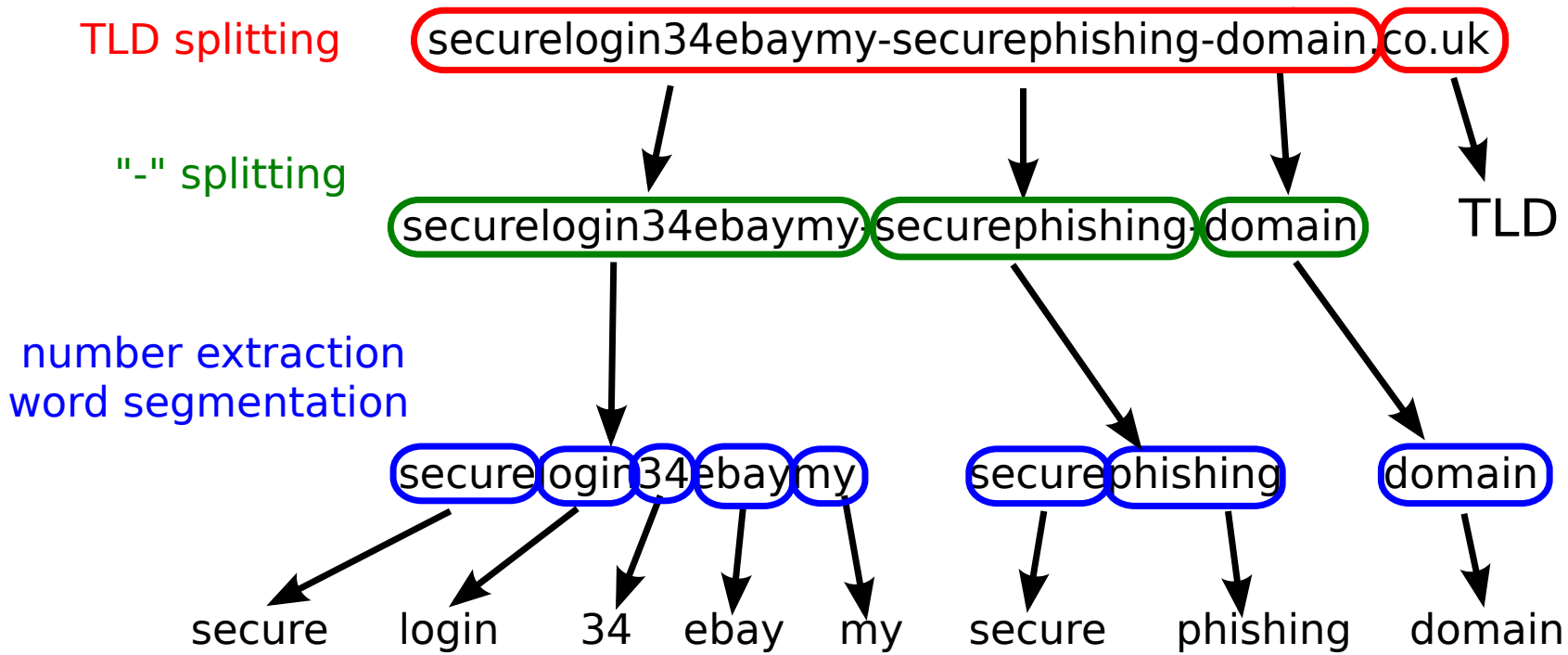
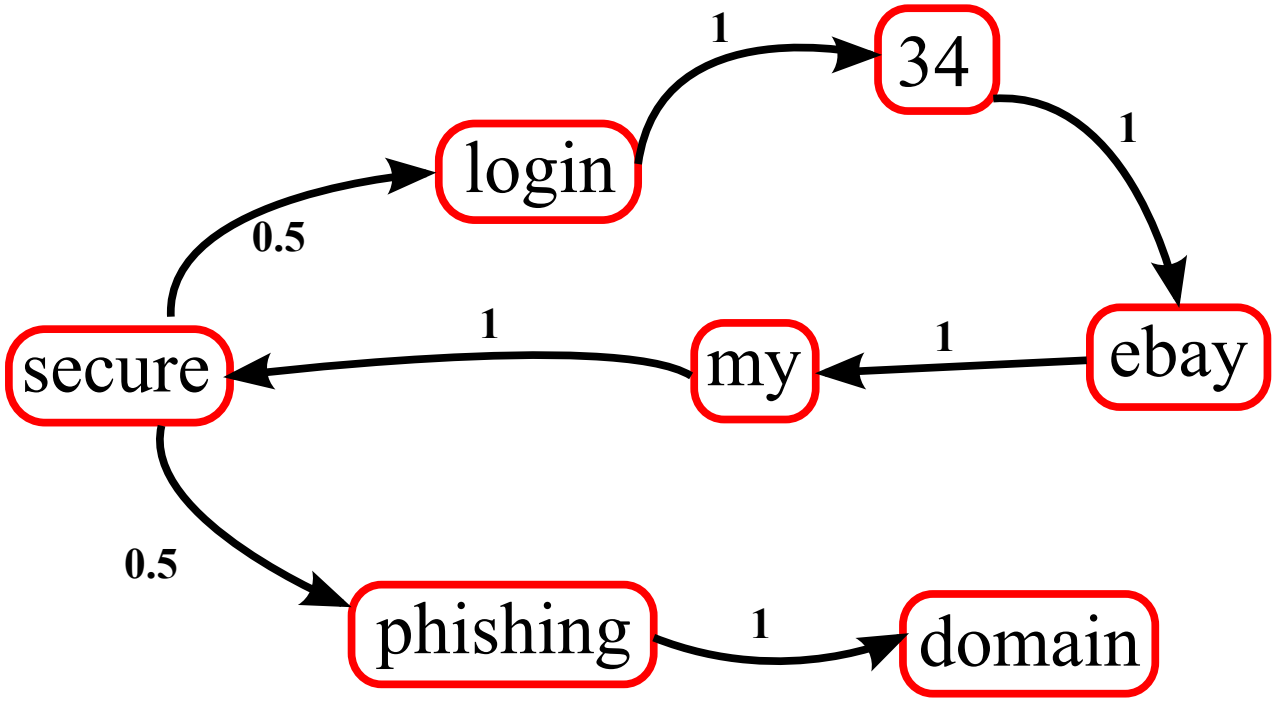


- $distlen = \{(8, 1)\}$
- $distword = \{(secure, 0.25), (login, 0.125), (34, 0.125), (ebay, 0.125), ...\}$
- $distfirstword = \{(secure, 1)\}$
- $distbiwords = \{(secure, \{(login, 0.5), (phishing, 0.5)\}), (login, \{(34, 1)\}), ...\}$

Model generation



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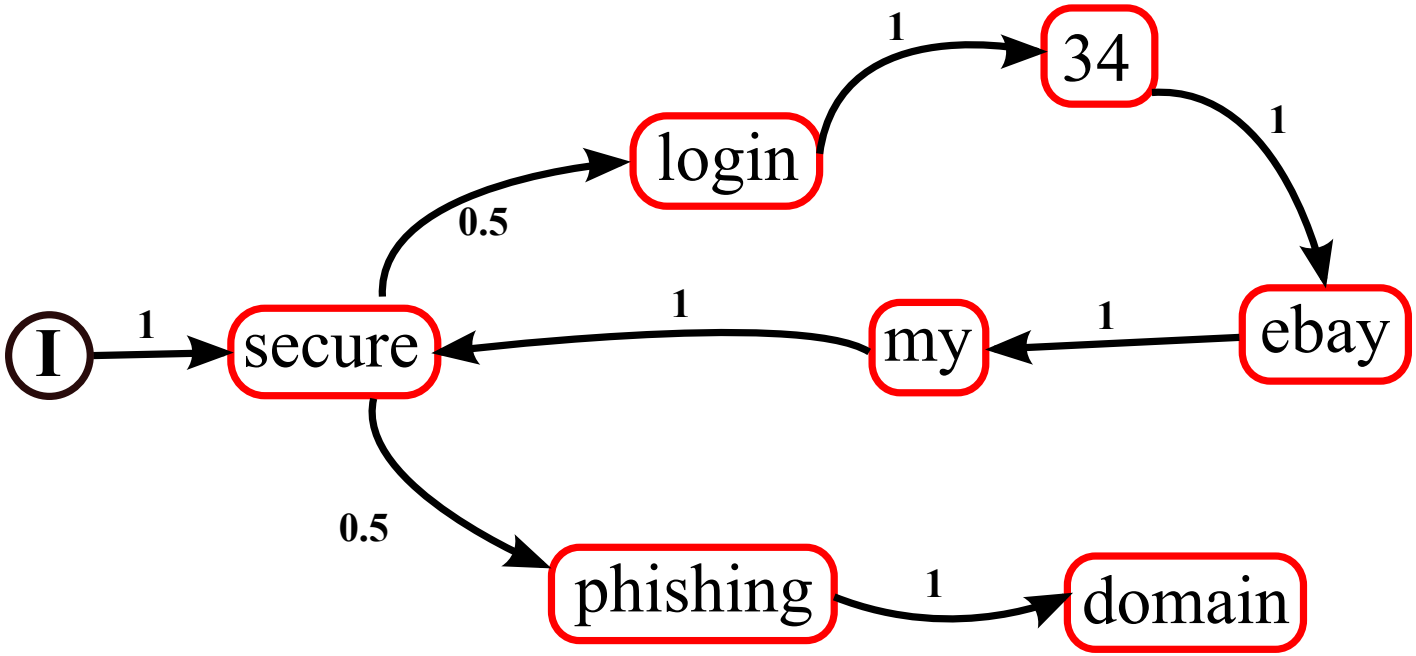

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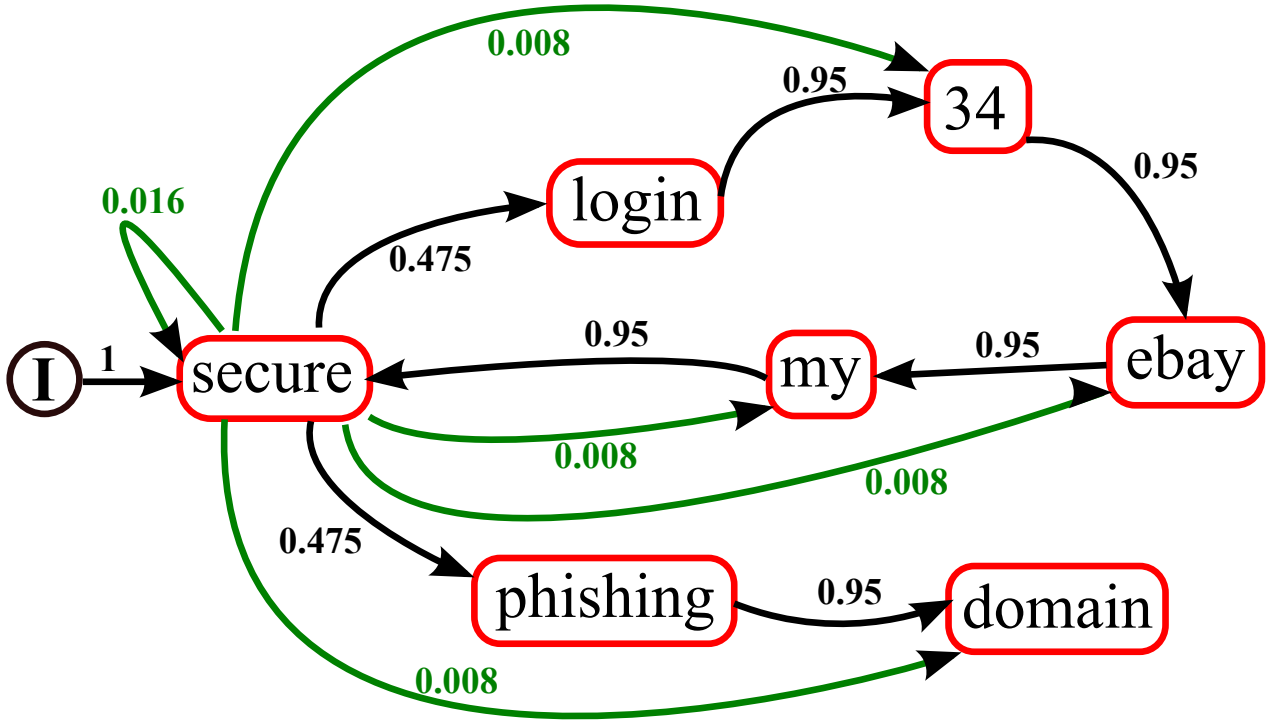

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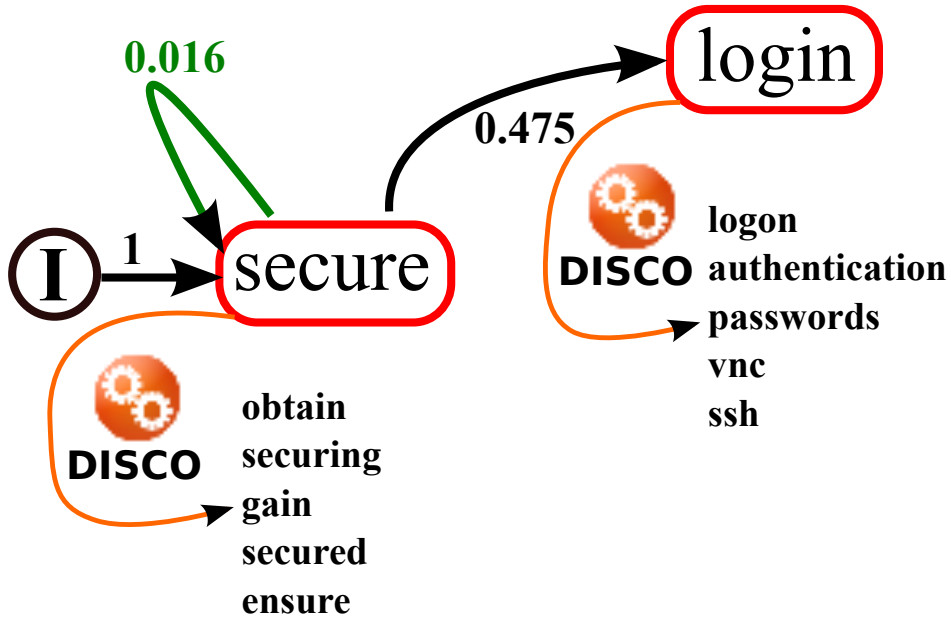
Semantic extension

Disco:

- calculate a similarity score (semantic relatedness) between 2 words
- give the *n* most related words to *w*
- based on dictionary (Wikipedia, BNC, PubMed, etc.)
- applied to each state of the Markov Chain

$\Rightarrow$ expand the discovery

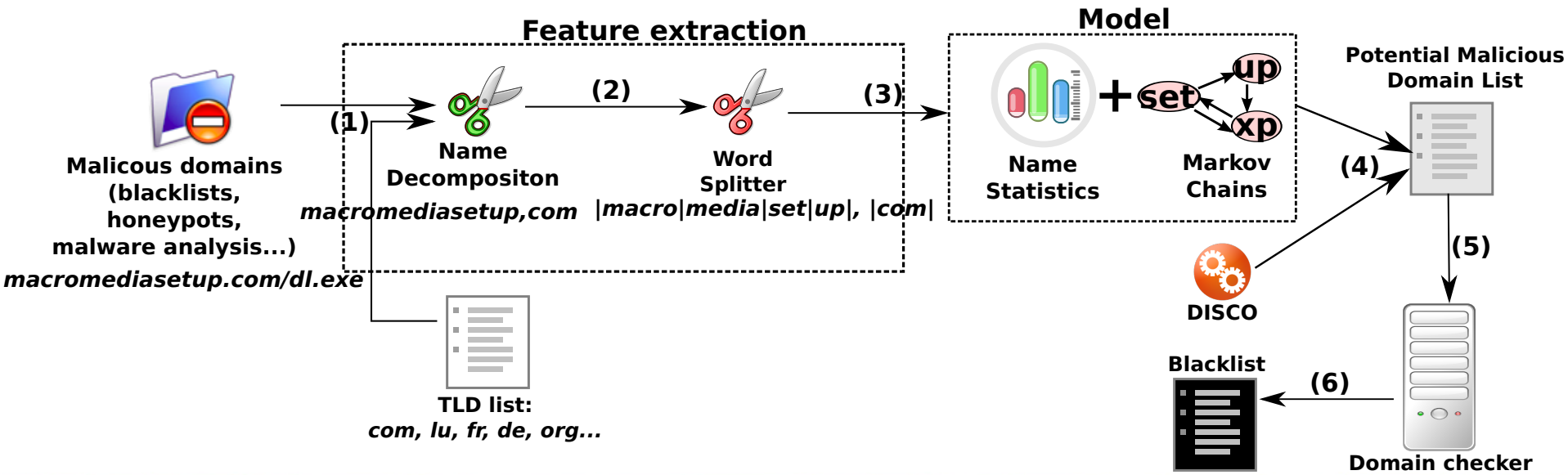
`http://www.linguatools.de/disco`



Generator global overview

- extract features from known phishing domains
- generate domain names ⇒ potentially phishing
- domain names automatically checked further

$\Longrightarrow$ **Blacklist**



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Phishing domain set from blacklists (∼ 50,000):

- Malware Domain List (01/2009 → 03/2012)
- DNS-Black-Hole (01/2009 → 03/2012)
- PhishTank (07/2007 → 03/2012)

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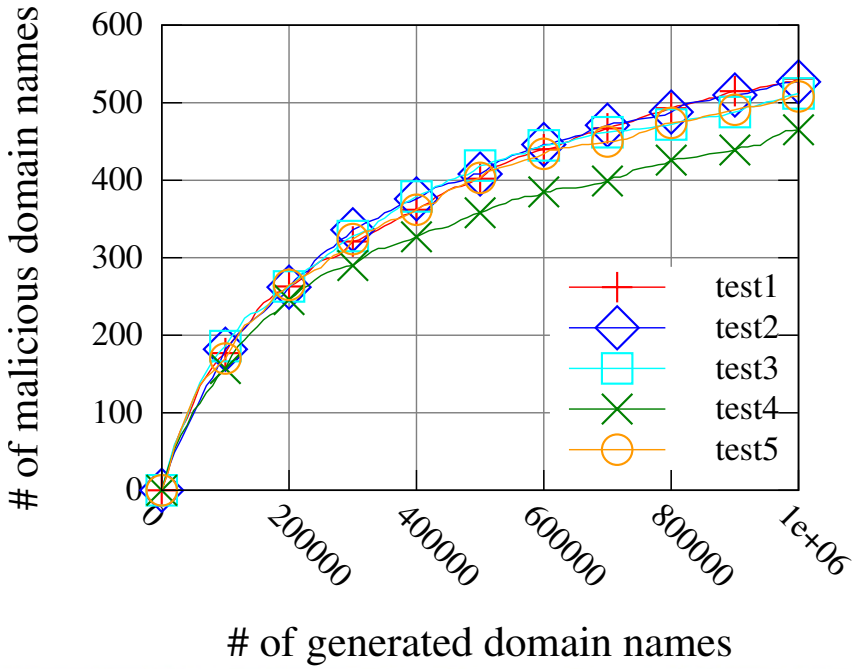
5 tests of 1 million domain generations

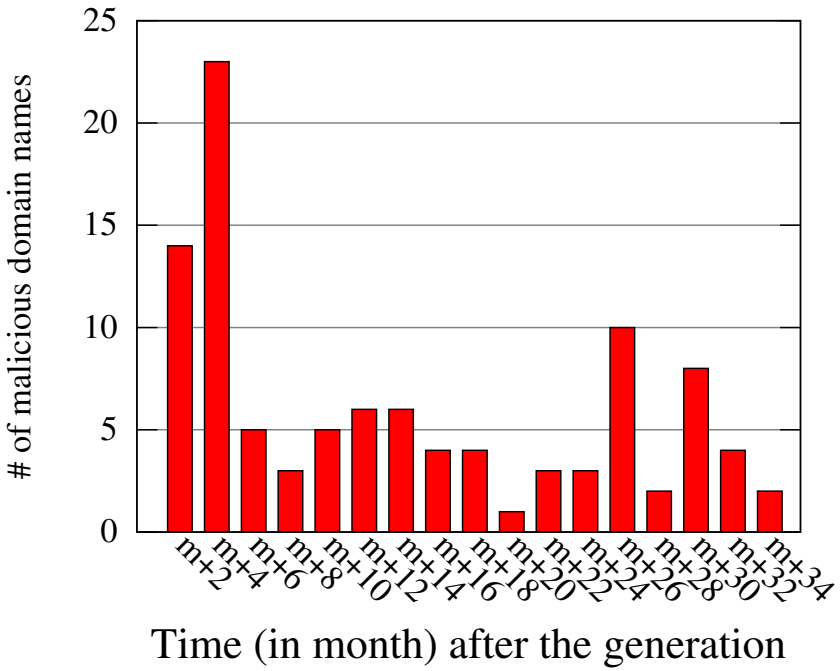
- learning set 30% (15,000 domains)
- testing set 70% (35,000 domains)



Offline testing

Predictability

- learning: the 10% oldest
- testing: 90% remaining



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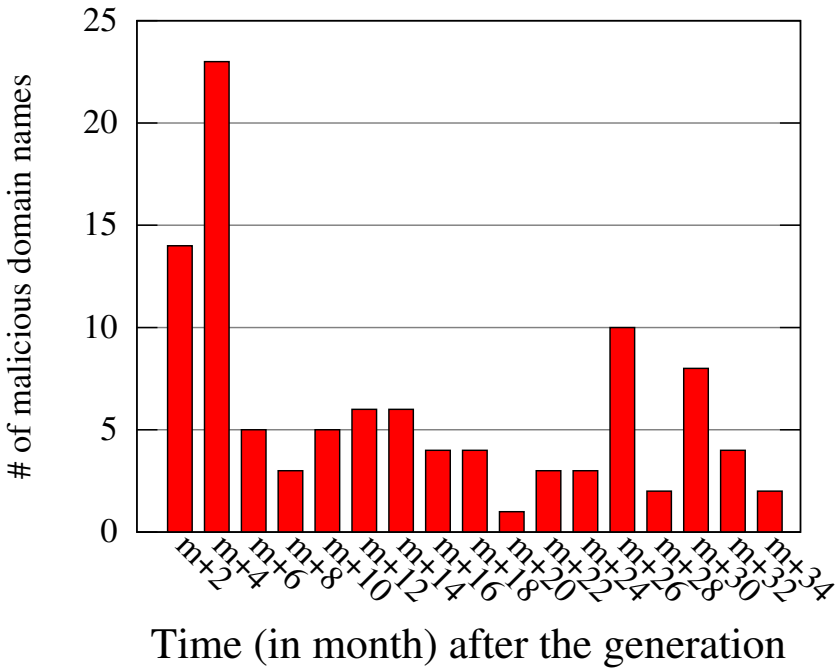

Strategy

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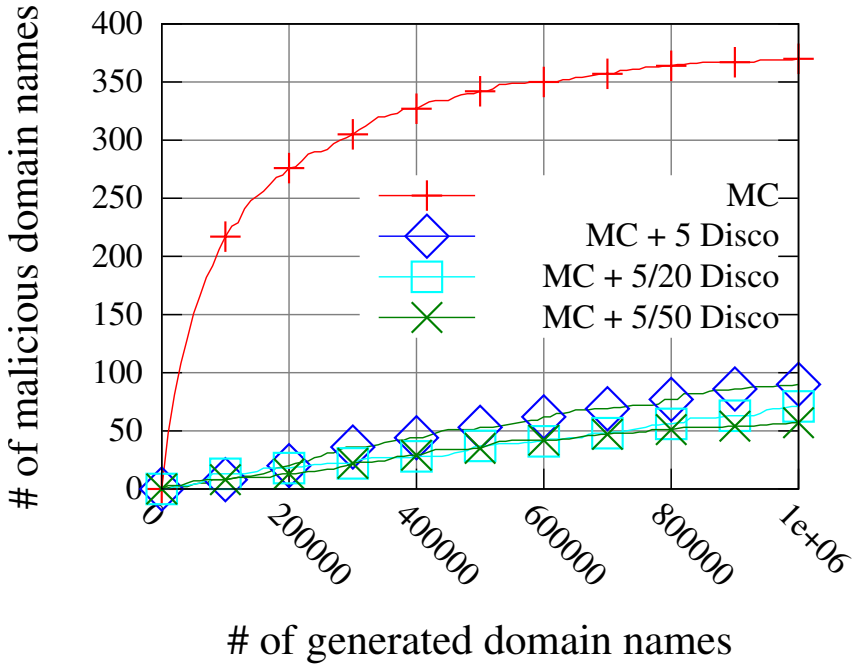

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Online testing

DNS request for 1 million domains generated

$\sim$ 100,000 domains match an @IP:

- $\sim$ 80,000 wildcardings domains
- $\sim$ 5,000 domains for sale
- $\sim$ 15,000 remaining domains:
  - $\sim$ 500 actually malicious and blacklisted
  - $\sim$ 200 legitimate domains

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Discriminate phishing from legitimate generated domains:

MCscore

$\Longrightarrow$ Eliminate 93 % of legitimate domains...

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Discriminate phishing from legitimate generated domains:

MCscore

$\Longrightarrow$ Eliminate 93 % of legitimate domains...

...while keeping 57 % of phishing domains (285)

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Conclusion

Generation of domain names likely to be malicious

- features extracted from existing domain names
- Markov chain model
- semantic relatedness techniques

$\Longrightarrow$ Proactively build a phishing blacklist

Results:

- able to generate phishing domains...
- ... still with false positives

$\Longrightarrow$ Domain scoring based on Markov chain model

Future works:

- remaining part of architecture: domain checker
- reinforcement learning

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