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*CG*uard: Adaptive Defense Against DNS Cache Poisoning Attacks By Off-path Adversaries

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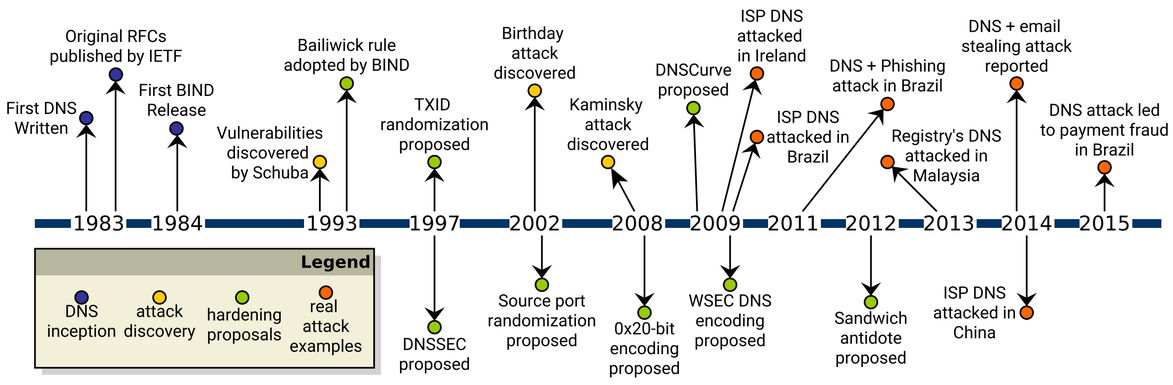
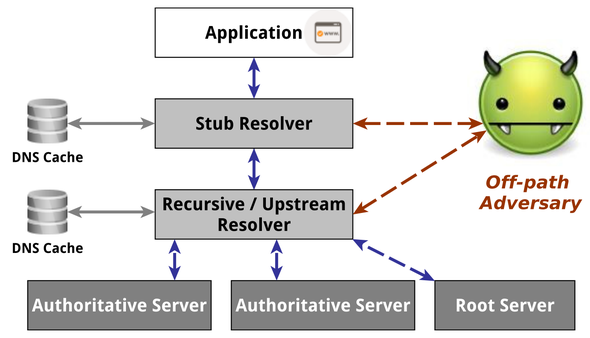
(1) History of DNS Cache Poisoning



(2) Why do we care?

- Cache poisoning is a **real threat**
- Can be used to
  - → Track users and serve Ads
  - → Conduct MITM attacks
  - → Trigger drive-by downloads
- **Serious** potential **damages**
  - → Compromise confidentiality
  - → Mount fraudulent transactions

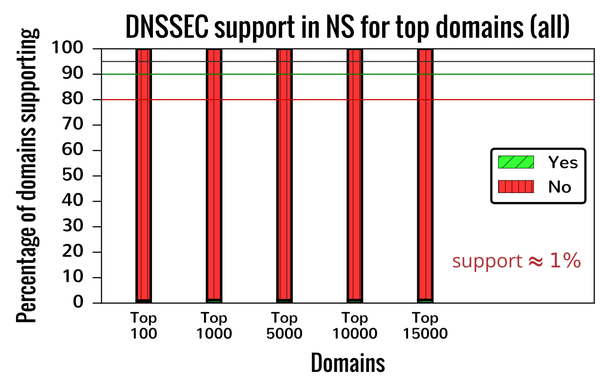


(3) Existing Solutions – Short Term

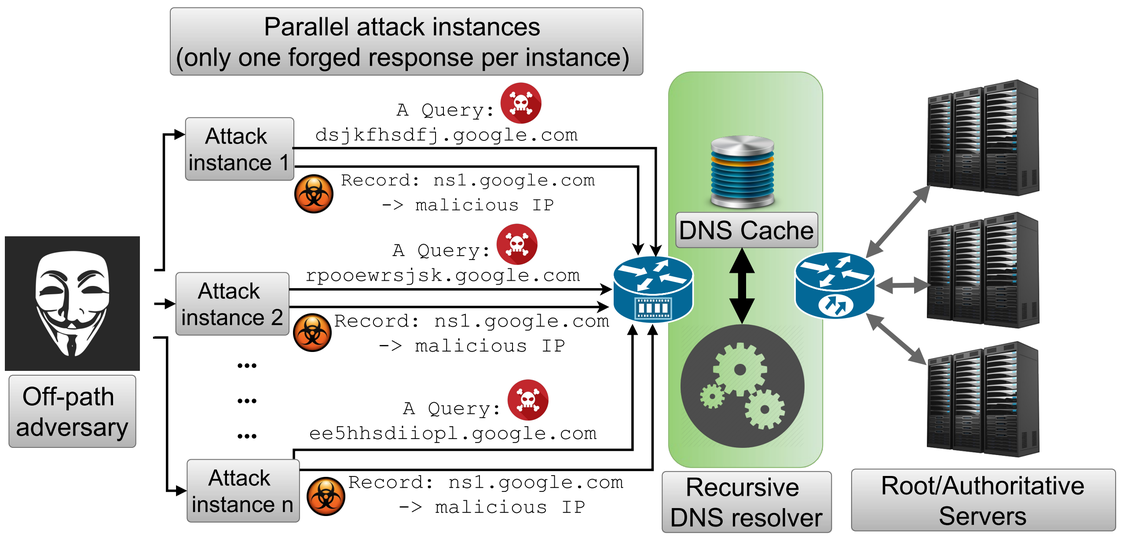
- Entropy increasing mechanisms
  - → Source **port** randomization
  - → IP **address** (destination, source) randomization
  - → **0x20**-bit encoding - rAnDOm caPitALiZaTiOn
  - → **WSEC** DNS - prepend random nounce to queries
- Other mechanisms
  - → Hold-on - wait and use RTT to pick among multiple matching responses
  - → Sandwich Antidote - sends 3 queries, expects 3 in-order valid responses

(4) Existing Solutions – Long Term

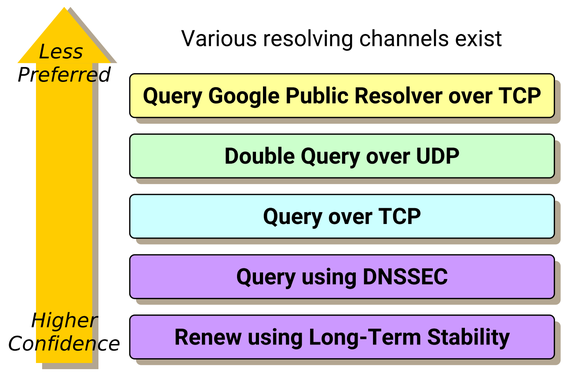
- Using cryptographic means
  - → **DNSCurve** - breaks caching; key distribution problem
  - → **DNSSEC** - adoption is low
- Using P2P cooperative network
  - → **CoDNS** (OSDI '04)
  - → **DoX** (ICC '06)
  - → **CofiDNS** (WORLDS '06)

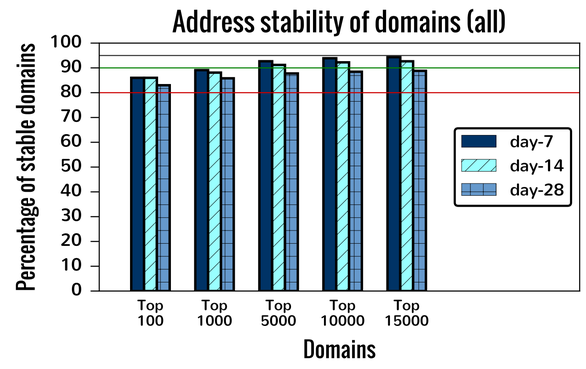


(5) New attack – Parallel Kaminsky



(6) Intuition Behind Our Adaptive Approach





(7) Experiment Results

- We evaluate our defense by implementing in Unbound 1.5.4, and then run instances of Parallel Kaminsky attack against it

	Turn #	1	2	3	4	5	6
Original	Instances	2266	1331	**3072**	1884	2519	1674
	Result	Poisoned	Poisoned	Failed	Poisoned	Poisoned	Poisoned
Modified	Instances	**3072**	**3072**	**3072**	**3072**	**3072**	**3072**
	Result	Failed	Failed	Failed	Failed	Failed	Failed

(8) Take-aways

- DNS cache poisoning is still an **unsolved problem**
  - → Internet was not designed with inbuilt authentication
  - → Long term fixes like DNSSEC are not incentive compatible and hence are not deployed wide enough
- An **adaptive defense mechanism** is desirable
  - → Compatible with the existing **infrastructure**
  - → Compatible with service providers' **incentive**
  - → Deterrence comes almost for free in terms of **performance**
  - → Can benefit from a wide adoption of long term solutions

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