Do you analyze your DNS traffic? You should!

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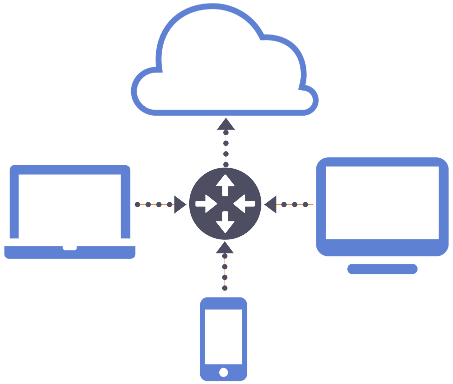
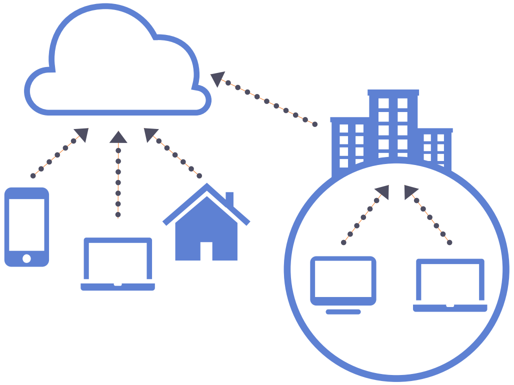
Can we predict attacks?

DNS is *Used by Every Device* on Your Network



ANY OWNER

network's DHCP tells
every connected device
where to point DNS



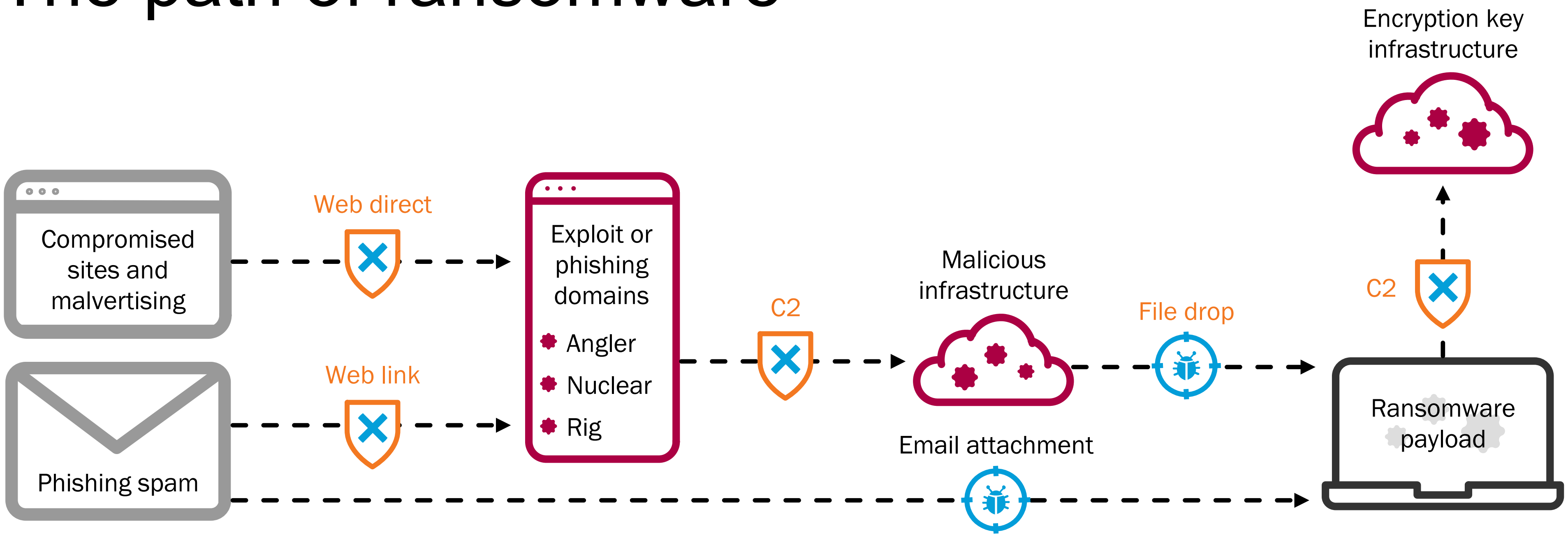
ANY TOPOLOGY

no matter how your
LAN or WAN is set up,
it simply works

ANY OPERATING SYS

Win, Mac, iOS, Android,
Linux, custom app servers,
and even IoT

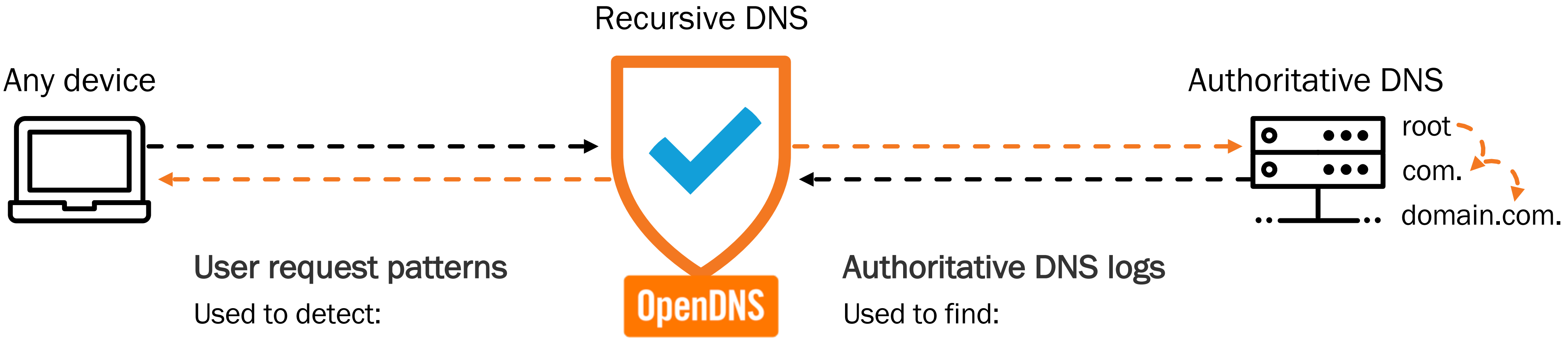
The path of ransomware



☒ Blocked by Cisco Umbrella

Blocked by Cisco AMP for Endpoints

Gather intelligence and enforce security at the DNS layer



User request patterns

Used to detect:

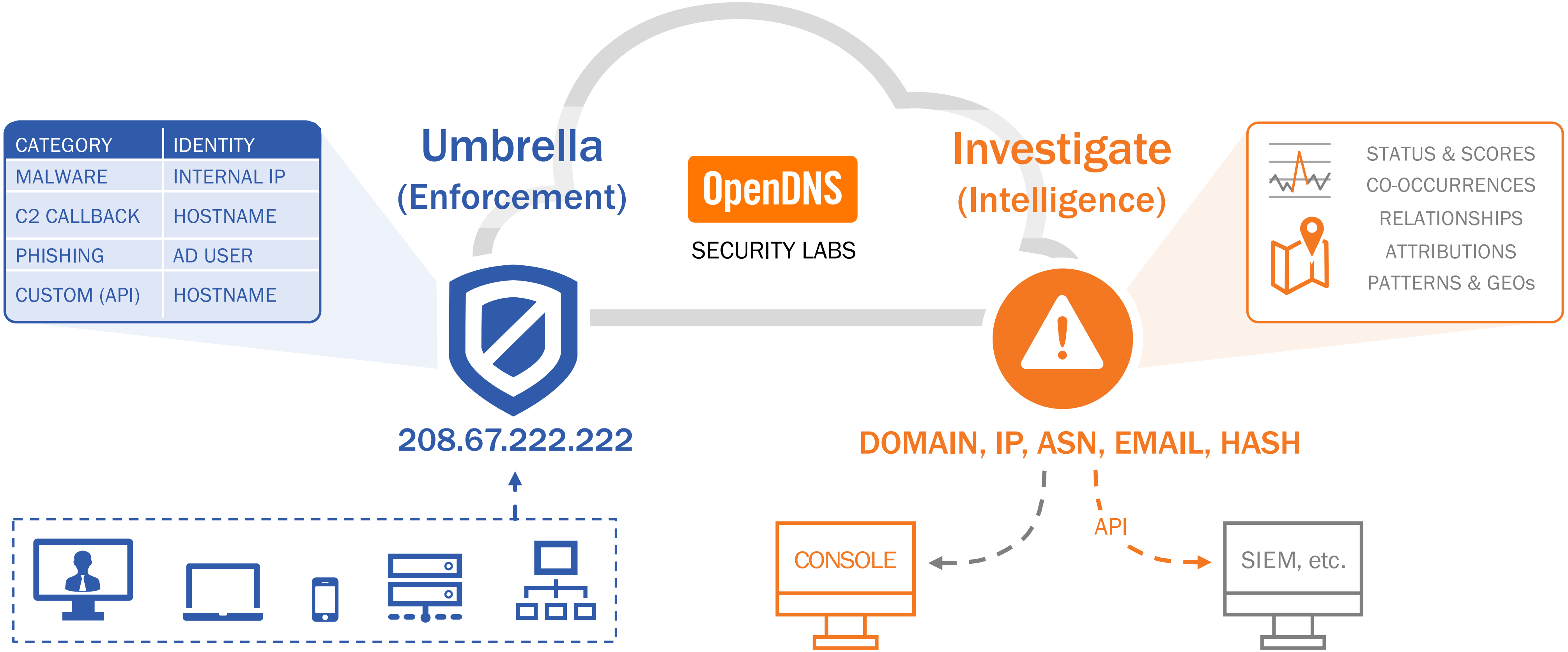
- Compromised systems
- Command and control callbacks
- Malware and phishing attempts
- Algorithm-generated domains
- Domain co-occurrences
- Newly registered domains

Authoritative DNS logs

Used to find:

- Newly staged infrastructures
- Malicious domains, IPs, ASNs
- DNS hijacking
- Fast flux domains
- Related domains

What does OpenDNS Provide



CATEGORY	IDENTITY
MALWARE	INTERNAL IP
C2 CALLBACK	HOSTNAME
PHISHING	AD USER
CUSTOM (API)	HOSTNAME

Umbrella (Enforcement)

OpenDNS SECURITY LABS

Investigate (Intelligence)

STATUS & SCORES
CO-OCCURRENCES
RELATIONSHIPS
ATTRIBUTIONS
PATTERNS & GEOs

208.67.222.222

DOMAIN, IP, ASN, EMAIL, HASH

Our efficacy

Discover

3M+

daily new domain names

Identify

60K+

daily malicious destinations

Enforce

7M+

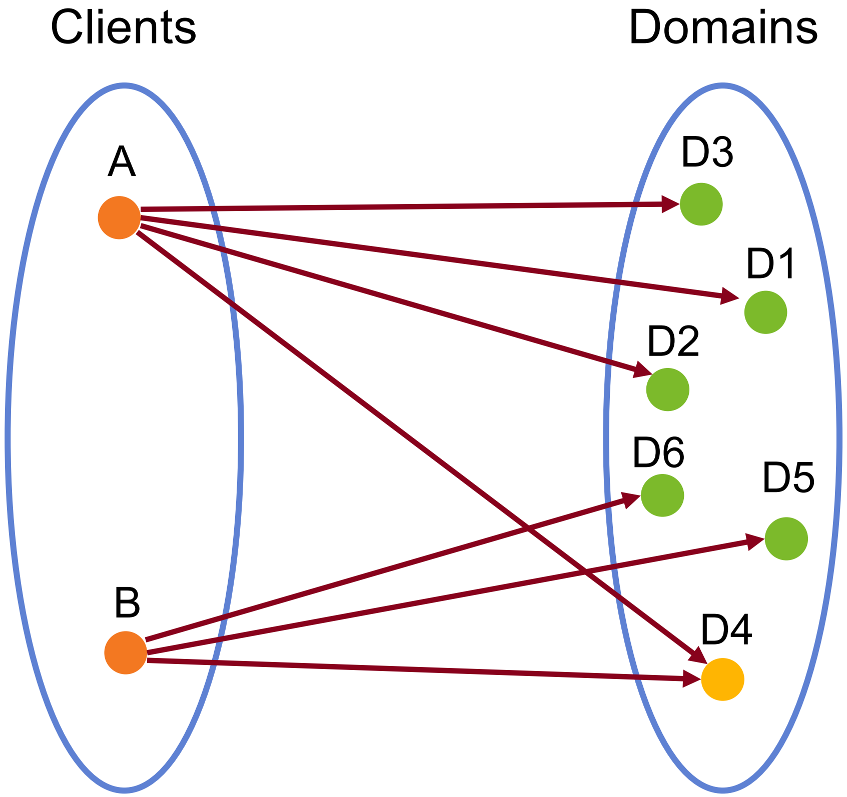
malicious destinations while resolving DNS

Predictive Detectors Used by OpenDNS

- SecureRank
- Co-Occurrences
- NLPRank
- DGA Detectors
- Spike Detectors
- Predictive IP Space Monitoring

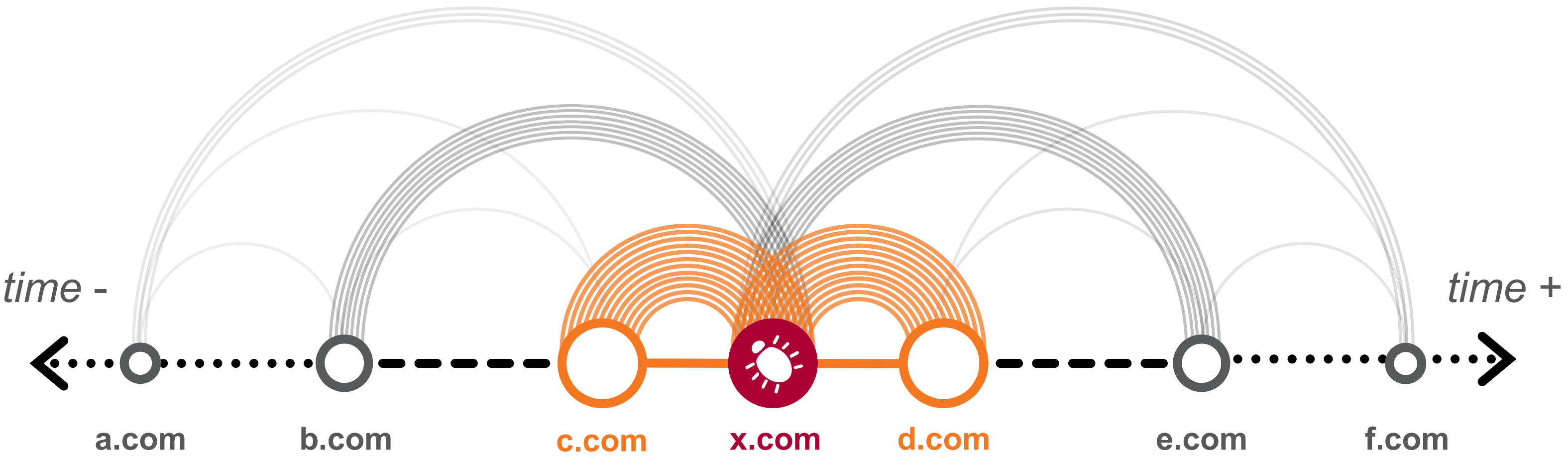
SecureRank

- Abstract DNS traffic in a bipartite graph
- **Domains requested by known infected clients but never requested by clean ones are most likely to be bad.**
- **The less visited by good clients, the higher chance a domain is bad**
- SecureRank2 is designed to identify these domains
- Negative ranks to known blacklisted domains and positive ranks to known whitelisted domains.
- Nodes are either visited or being visited, but never both



Co-Occurrence Rank

Domains Guilty by Inference



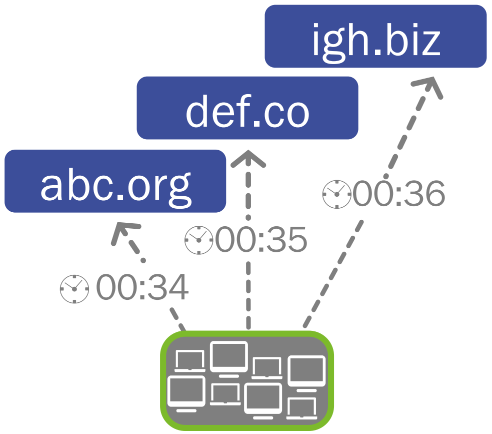
Possible Malicious Domain

Known Malicious Domain

Possible Malicious Domain

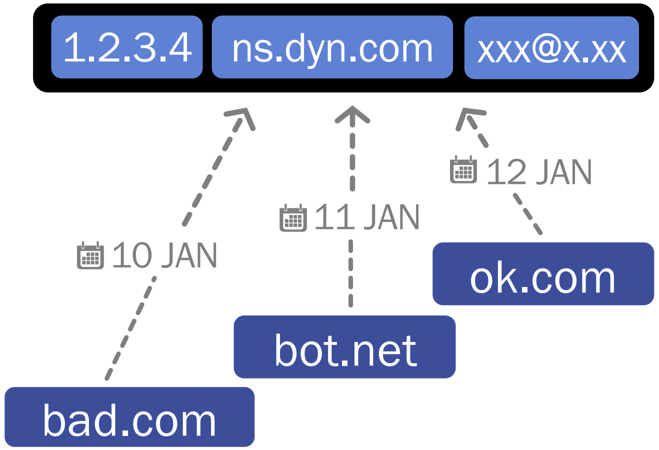
Co-occurrence of domains means that a statistically significant number of identities have requested both domains consecutively in a short timeframe

Co Occurrences can be correlated with more “traditional” Techniques



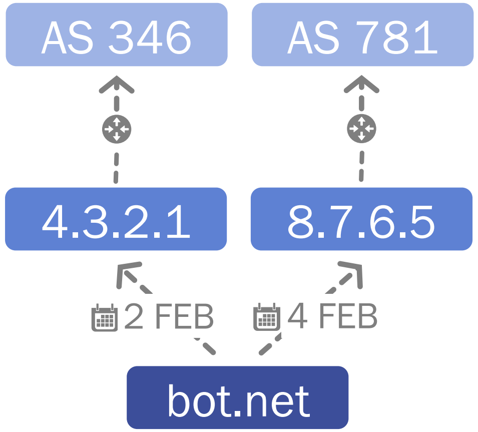
CO-OCCURRENCES

domain-to-domain request sequences via recursive DNS



PASSIVE DNS & WHOIS

present & past relationships for domains-to-IP/nameserver/email via authoritative DNS & DNS registrars

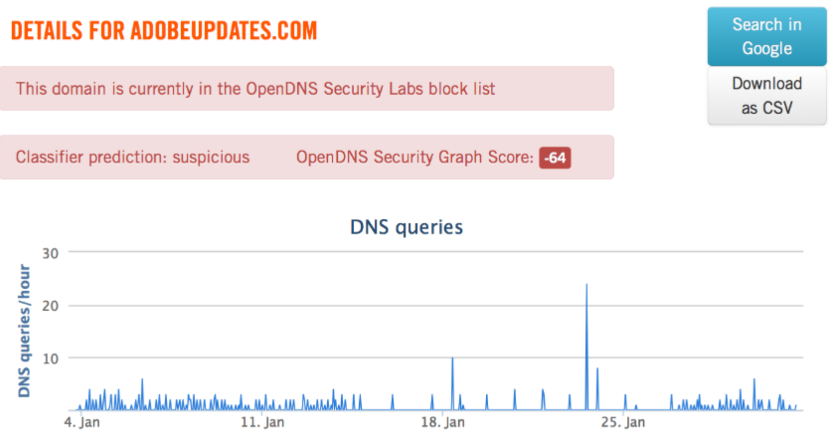


INFRASTRUCTURES

domain-to-IP-to-AS relationships via graphing BGP routing data

NLPRank Detections: DarkHotel

- adobeupdates[.]com

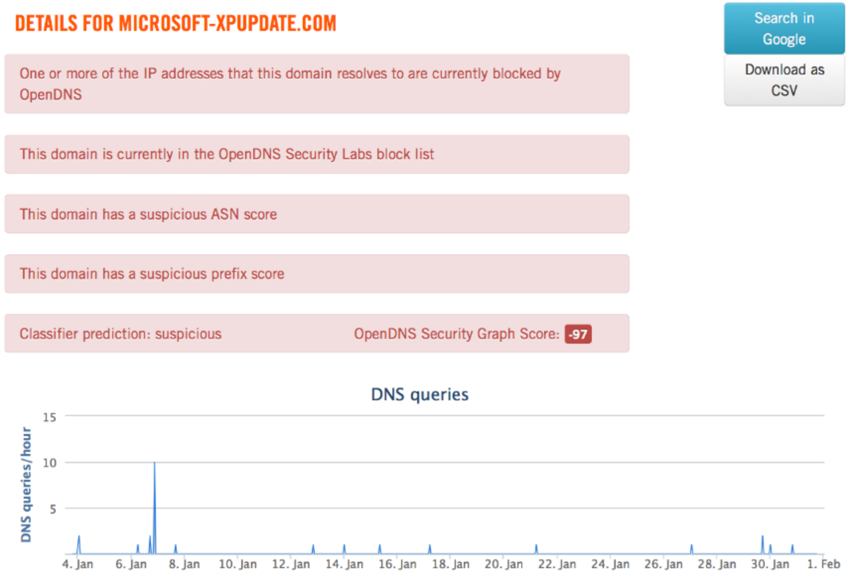


DETAILS FOR ADOBEUPDATES.COM

This domain is currently in the OpenDNS Security Labs block list

Classifier prediction: suspicious OpenDNS Security Graph Score: -64

- microsoft-xpupdate[.]com



DETAILS FOR MICROSOFT-XPUPDATE.COM

One or more of the IP addresses that this domain resolves to are currently blocked by OpenDNS

This domain is currently in the OpenDNS Security Labs block list

This domain has a suspicious ASN score

This domain has a suspicious prefix score

Classifier prediction: suspicious OpenDNS Security Graph Score: -97

Anomaly Detection: Live DGA Detection

Domain Generation Algorithms: technique to generate malware domains on-the-fly & avoid hardcoding domains in payload

N-gram" analysis

Do letter pairings match normal language patterns?

yfrscsddkkdl.com

qgmcgoqeasgommee.org

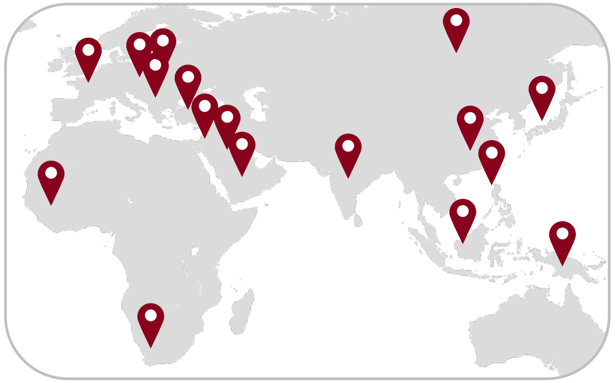
iyyxtyxdeypk.com

diiqngijkpop.ru

Does the probability distribution of letters appear random?

IP Geo-Location Analysis

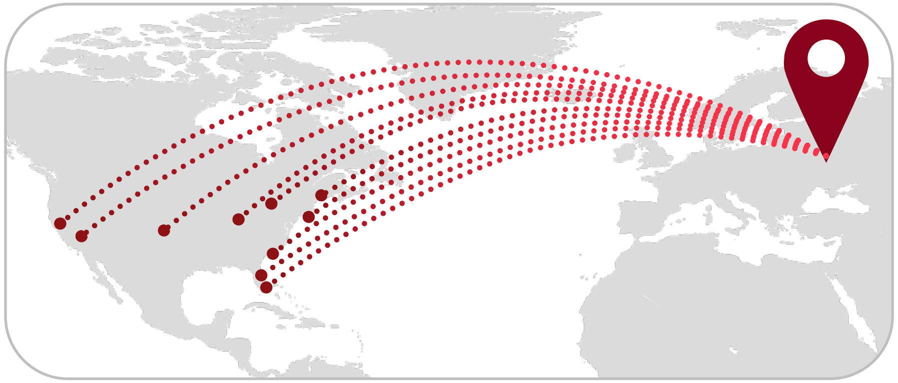
hosted across 28+ geo-locations



HOST INFRASTRUCTURE

location of the server
IP addresses mapped to domain

only US-located users requesting a .RU TLD



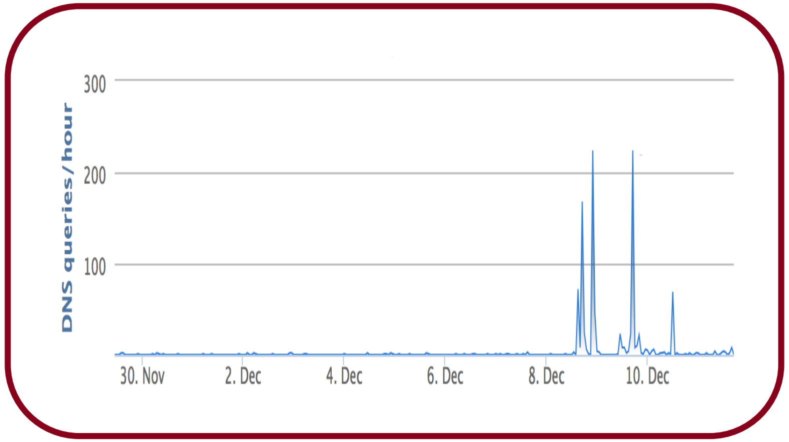
DNS REQUESTERS

location of the network & off-network device
IP addresses requesting the domain

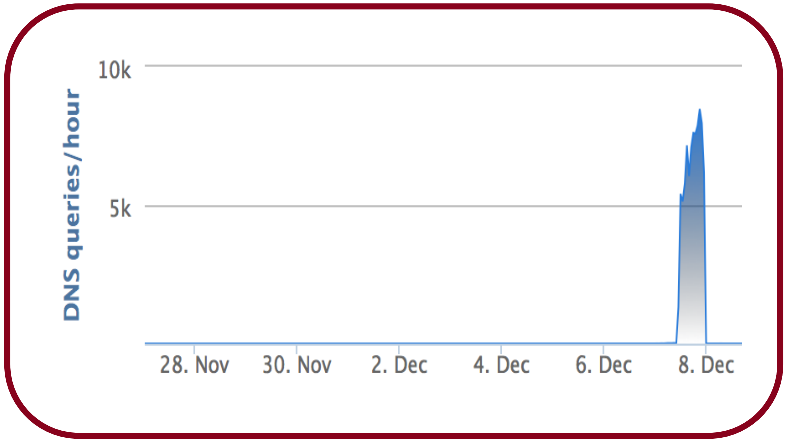
What Does a Malicious Connection Sounds Like?

Spike detector

What if we could model the traffic spikes as sound waves and identifies “spike behavior” typical of domains used for malware campaigns such as exploit kits, DGAs, fake software, phishing, etc…



Example of An Exploit Kit



Example of a DGA

Predictive IP Space Monitoring

Predictive IP Space Monitoring is used to further drill into associated indicators by analyzing 8 different recorded hosting patterns:

- Compromised domains, i.e. “domain shadowing”
- Domain shadowing on multiple hosting IPs
- Sibling peripheral ASNs and bulk malware IP setup
- Leaf ASNs
- Offshore registration and diversification of IP space
- Rogue ASN and affiliated hosters
- Abuse of large hosting providers
- Shady hosts within larger hosting providers

For

1

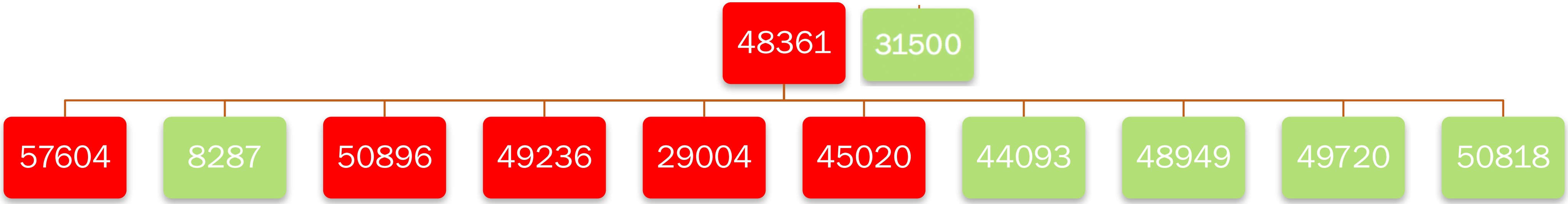
malicious domain identified by SPRank, Predictive IP Space Monitoring predicted

340

Additional domains

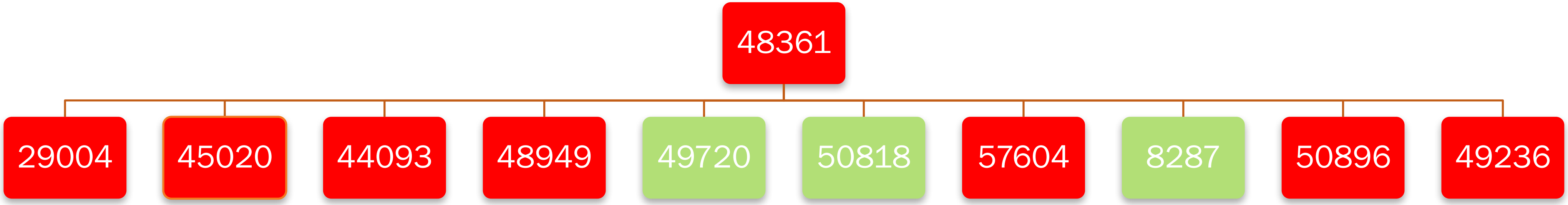
Malicious ASN subgraph

Whitepaper: Defcon 22 - openDNS



🟥 48361 🟩 31500

🟥 57604 🟩 8287 🟥 50896 🟥 49236 🟥 29004 🟥 45020 🟩 44093 🟩 48949 🟩 49720 🟩 50818



🟥 48361

🟥 29004 🟥 45020 🟥 44093 🟥 48949 🟩 49720 🟩 50818 🟥 57604 🟩 8287 🟥 50896 🟥 49236

6 weeks later

3100+ malware domains on 1020+ IPs

- nmap fingerprint (50 IPs)

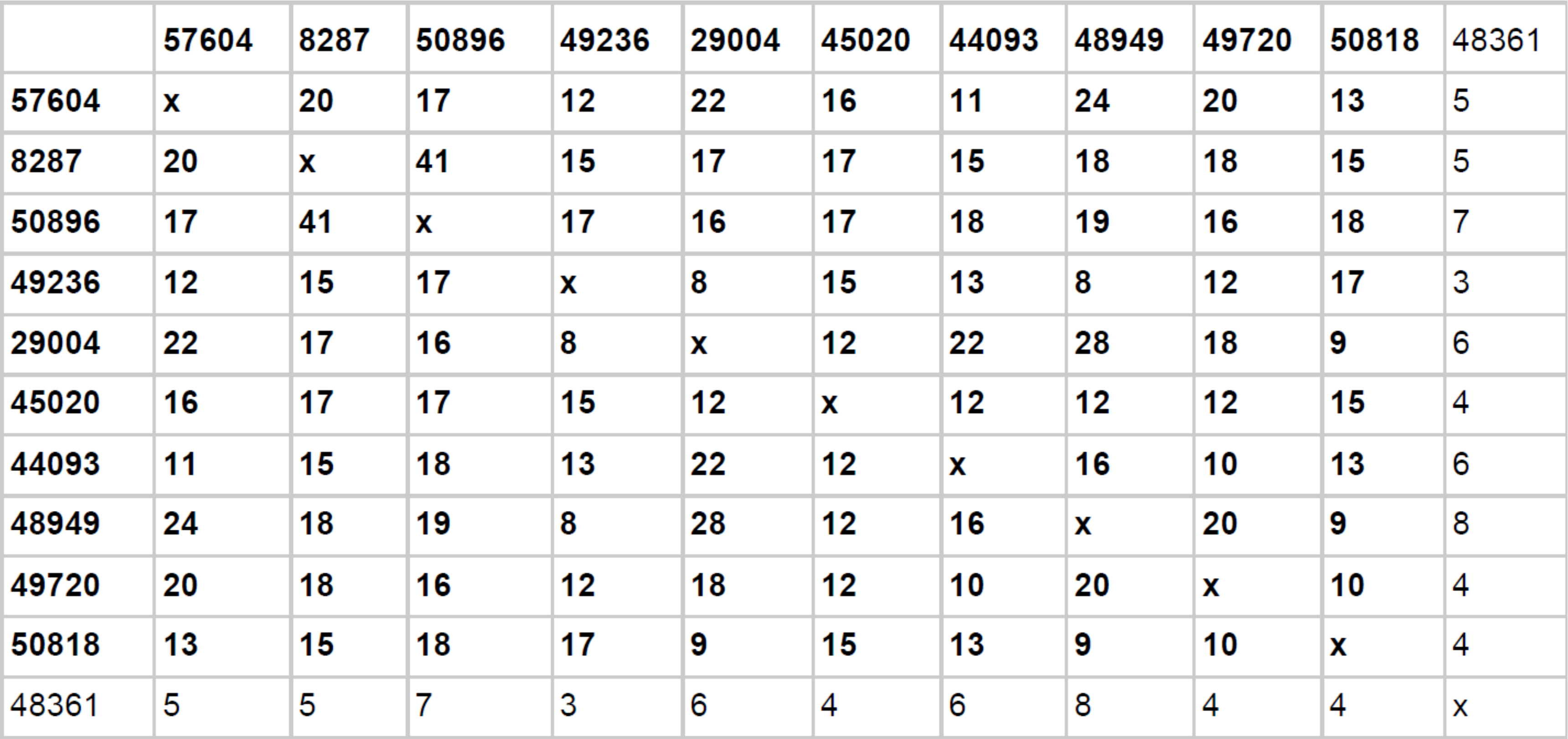
```
22/tcp open ssh  OpenSSH 6.2_hpn13v11 (FreeBSD 20130515; protocol 2.0)
8080/tcp open http-proxy 3Proxy http proxy
Service Info: OS: FreeBSD
```

- nmap fingerprint (108 IPs)

and 108 IPs shared the following fingerprint:

```
22/tcp open ssh OpenSSH 5.3 (protocol 1.99)
80/tcp open http?
```

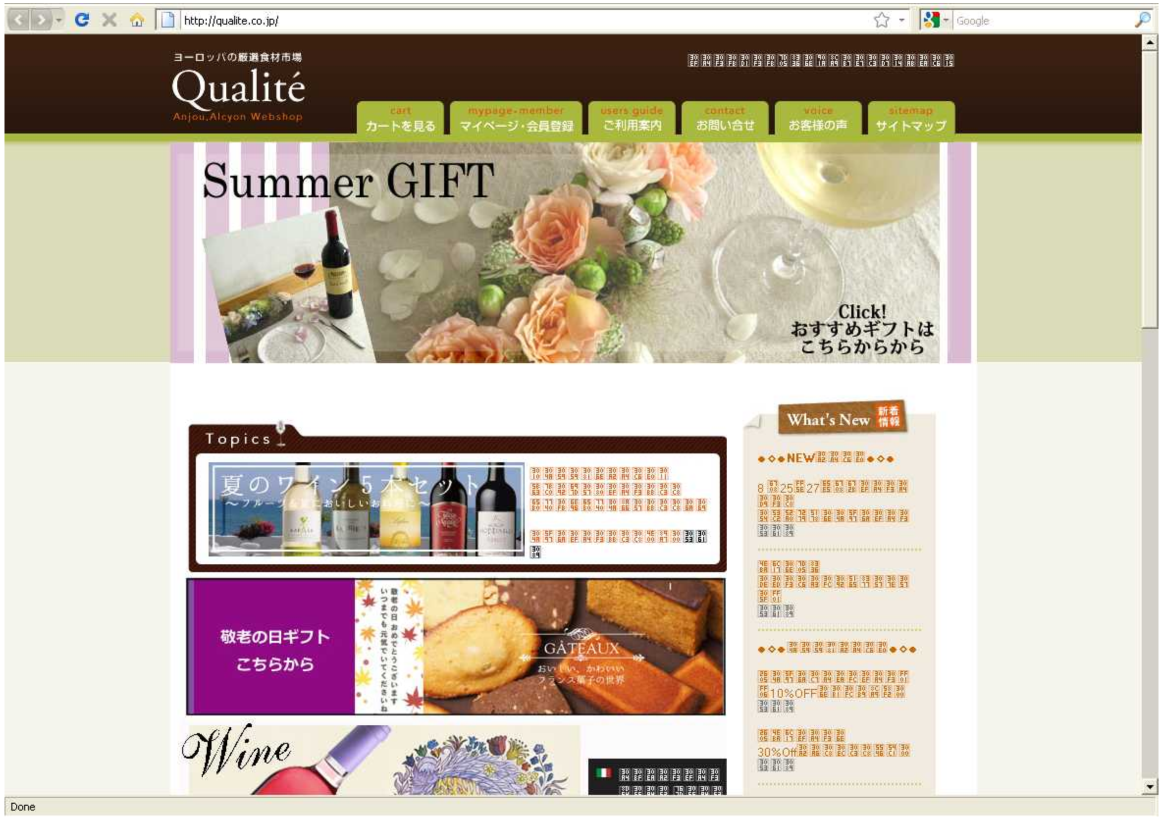
Overlapping outages between sibling ASNs



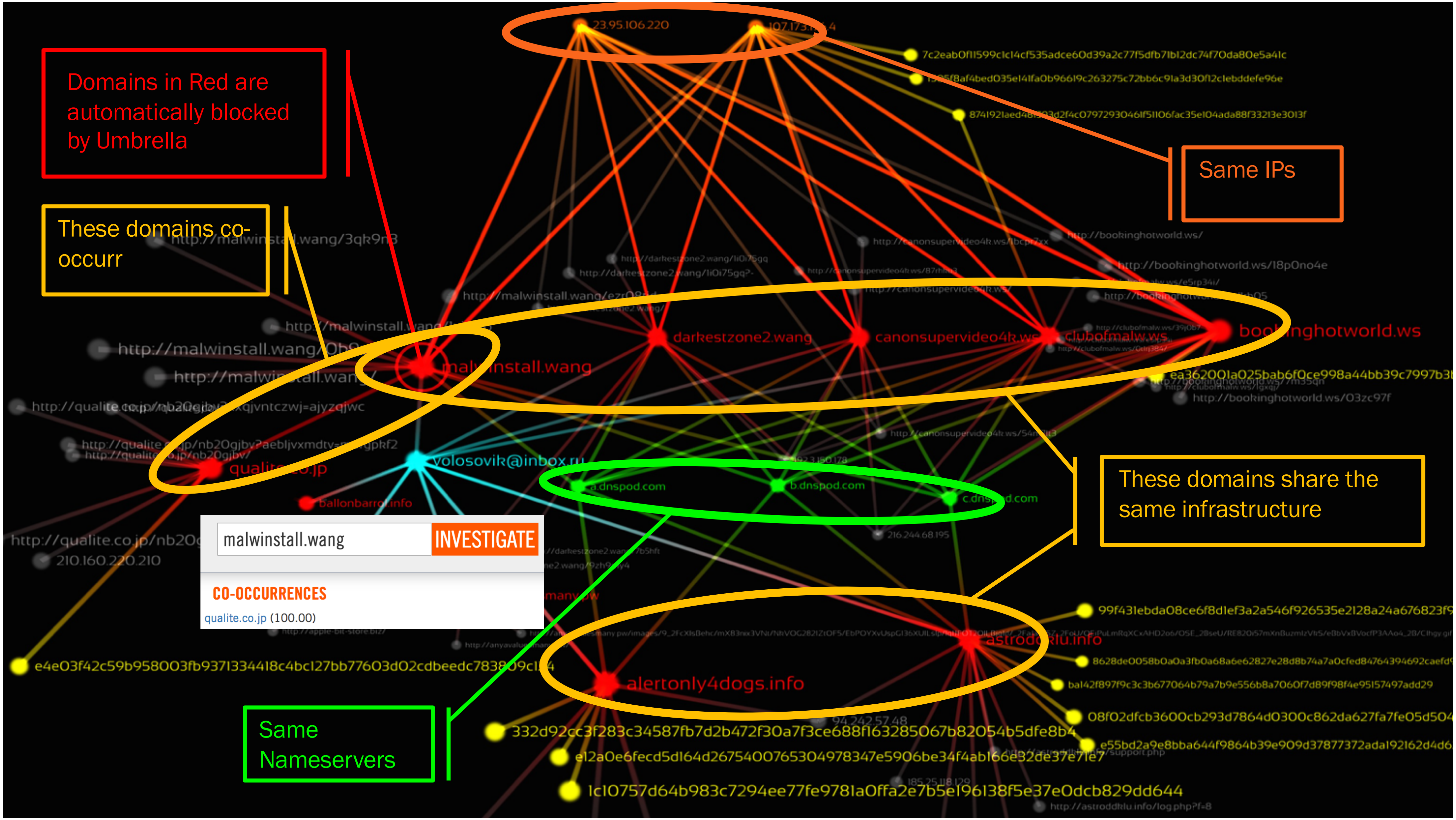
	57604	8287	50896	49236	29004	45020	44093	48949	49720	50818	48361
57604	x	20	17	12	22	16	11	24	20	13	5
8287	20	x	41	15	17	17	15	18	18	15	5
50896	17	41	x	17	16	17	18	19	16	18	7
49236	12	15	17	x	8	15	13	8	12	17	3
29004	22	17	16	8	x	12	22	28	18	9	6
45020	16	17	17	15	12	x	12	12	12	15	4
44093	11	15	18	13	22	12	x	16	10	13	6
48949	24	18	19	8	28	12	16	x	20	9	8
49720	20	18	16	12	18	12	10	20	x	10	4
50818	13	15	18	17	9	15	13	9	10	x	4
48361	5	5	7	3	6	4	6	8	4	4	x

Do You Fancy a Glass of Wine?

Well… This could be particularly bitter…



qualite.co.jp: Screenshot @ 2016-09-06 12:18:41



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107.173.
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http://bookinghotworld.ws/
http://canonsupervideo4k.ws/lbcpr7xx
http://darkestzone2.wang/1i0i75gq
http://darkestzone2.wang/1i0i75gq?-
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http://astroddrlu.info/log.php?f=8

Domains in Red are automatically blocked by Umbrella

These domains co-occurr

Same IPs

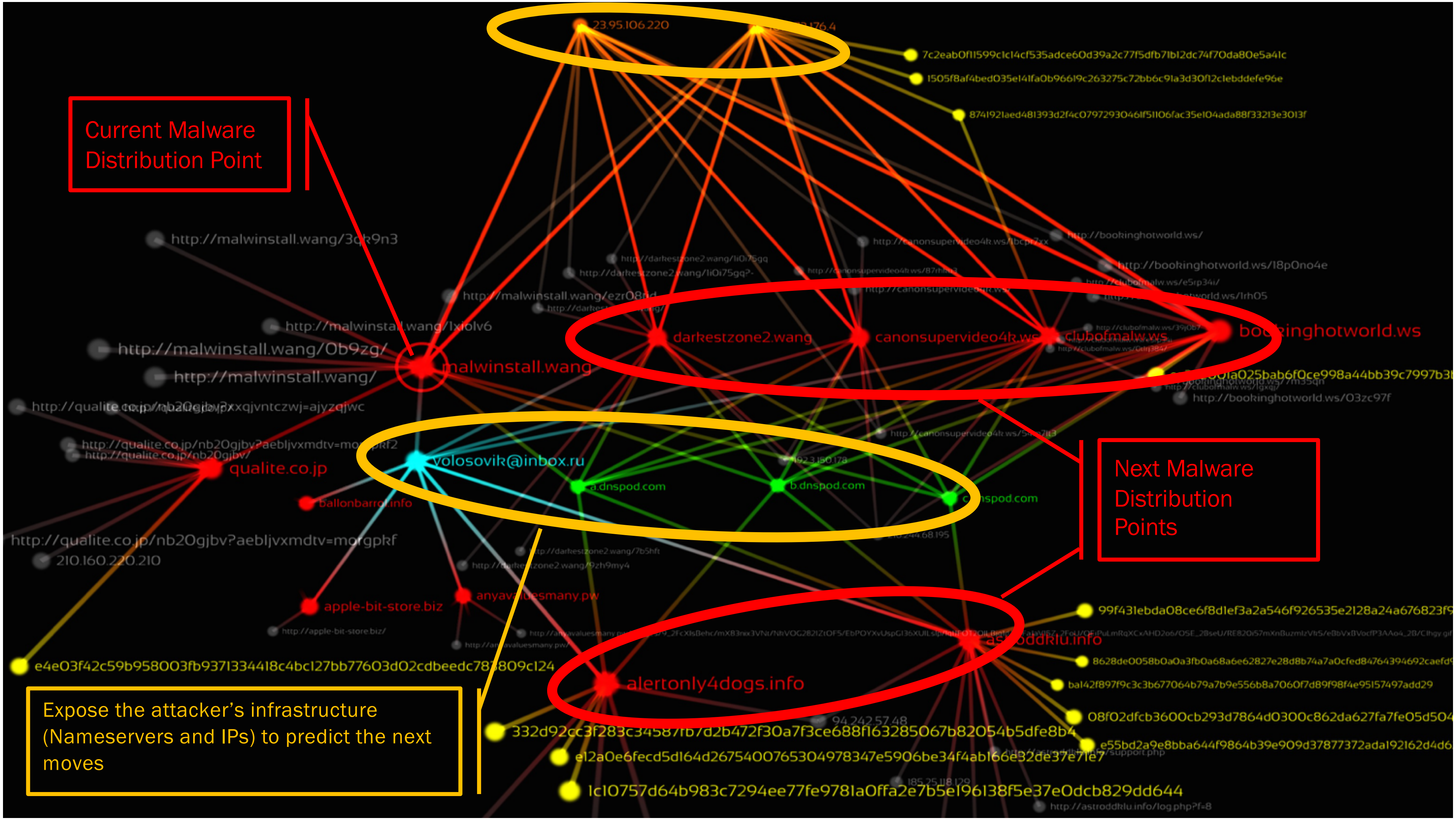
These domains share the same infrastructure

Same Nameservers

malwinstall.wang INVESTIGATE

CO-OCCURRENCES

qualite.co.jp (100.00)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http://astroddklu.info/support.php
http://astroddklu.info/log.php?f=8

Current Malware Distribution Point

Next Malware Distribution Points

Expose the attacker's infrastructure (Nameservers and IPs) to predict the next moves

Thank you

cisco

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