Passive SSL

Passive Detection and Reconnaissance Techniques, to Find, Track, and Attribute Vulnerable "Devices"

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TLP:WHITE

June 17, 2015

Datasets used

- Eireann used Shodan stream of certificates (350k certificates in counting Bloomfilter).
    - Thanks to John (Shodan) Matherly.
- Alex used the CIRCL Passive SSL datasets (around 100 millions certificates).
    - Thanks to GCHQ (for the idea).

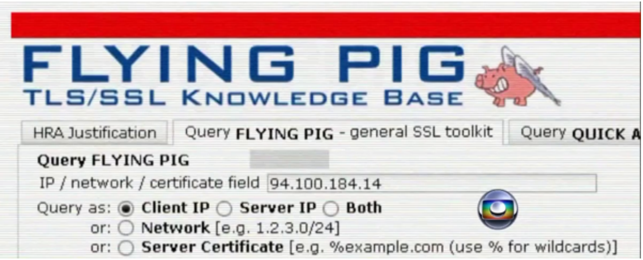
Problem statement

CSIRT or LIRT or security analysts have recurring issues to:

- Find owners of IP addresses.
- Detect usage of CIDR blocks.
- Find vulnerable systems passively (and avoid intrusive scanning).
  - Scale of potential impact.
- Detect compromised services.

Acknowlegement

- Thanks to GCHQ and the FLYING PIG program
- and Edward Snowden for releasing the document.



FLYING PIG
TLS/SSL KNOWLEDGE BASE

HRA Justification | Query **FLYING PIG** - general SSL toolkit | Query **QUICK A**

Query FLYING PIG

IP / network / certificate field: 94.100.184.14

Query as: ● **Client IP** ○ **Server IP** ○ **Both**
or: ○ **Network** [e.g. 1.2.3.0/24]
or: ○ **Server Certificate** [e.g. %example.com (use % for wildcards)]

- Double edge techniques that can be used for good or bad reasons.
- Another opportunity to improve your threat modeling and your weak TLS knowledge.

Passive SSL

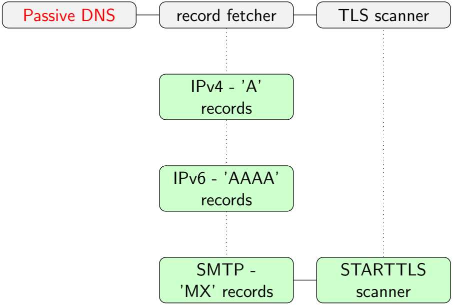
- Replicating Passive DNS concepts into SSL/TLS.
- Keeping a history of X.509 certificates seen per IP address.
  - Usage over time of the X.509 certificates.
- Providing a search ReST interface per IP address, CIDR block.
- Tracing the use of CA and CRL/OCSP.

Collecting X.509 Certificates - Internet Scanning

- Scan the Internet yourself (e.g. In a single scan of the IPv4 space, close to 50 millions certificates).
- Which port to scan? protocol or service? pps?
- How often? (e.g. weekly scan helps to determine the stability of an IP,Certificate tuple)
- Cannot scan, you can reuse existing scanning data (e.g. `scans.io`).

Collecting X.509 Certificates - Passive DNS - SNI

- On a single IPv4 address, you can have more than one certificate.
  - Alternate SSL ports, multihomed systems
  - Other services: SSL-VPN, ESMTP, DTLS, IMAP, ...
- How to scan IPv6 address space for X.509 Certificates.
- Passive DNS used as a source for SNI (Server Name Indication) value or IPv6 addresses.



Collecting X.509 Certificates - Network Interception

- Tapping a network interface where SSL/TLS handshakes are performed.
- TCP reassembly is still hard and finding SSL/TLS handshakes is a complementary problem.
- ssldump[1], Suricata, Moloch,...
- If you collect SSL/TLS handshakes in your internal network, don't forget the impact of intercepting proxies.

[1] `http://www.github.com/adulau/ssldump`

Collecting X.509 Certificates from Tor exit nodes

- Tor exit nodes traffic is an interesting source of alternative X.509 certificates (e.g. Tor circuits, XMPP sessions, TLS on non-standard ports).
- A huge proportion of flows uses TLS which provides a good overview of the most active X.509 certificates (e.g. Google, .vk.com...).
- Don't forget, not all the security researchers have good intention (e.g. FLYING PIG).

Security Perspective of X.509 Certificates

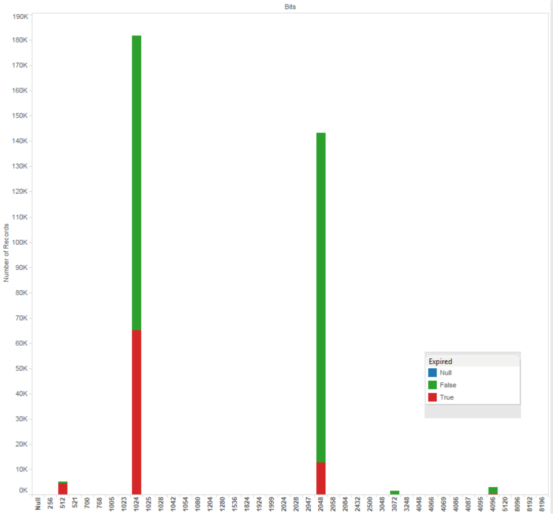
- Subject Name and Issuer Name can provide a lot of details about the devices, issuers or the overall security practices.
  - A lot of X.509 certificates are automatically generated without the users knowledge.
  - Detailed or sensitive information can leak in the X.509 certificate fields.

```
4fd64e325ec7a14ac2e34bb5cfed28fef24c3ffb,C=DE, ST=Bavaria, L=Ingolstadt, O=Kaspersky Lab GmbH, OU=Pre-Sales, CN=rdg.klab.it.cx/emailAddress=consulting@kaspersky.de
dc4a127eae8a47a8041a4ce7f1a214c3e6957cd6,C=RU, ST=Moscow, L=Moscow, O=Kaspersky Lab ZAO, OU=IT, CN=nordnetsync.anti-theft.kaspersky.com
8a9c839f2ff275c79a985ea84b89bc9fa404d010,C=RU, ST=Moscow, L=Moscow, O=Kaspersky Lab, OU=IT, CN=owa.kaspersky.com
```

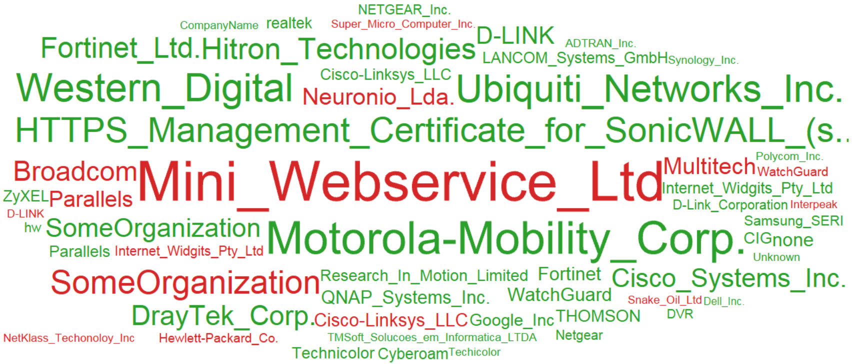
Key-size distribution

Occurences	Key-size
181899	1024
143532	2048
4997	512
2845	4096
1467	3072
36	1023
33	256
30	2432
26	768
13	8192
11	2047
10	1536

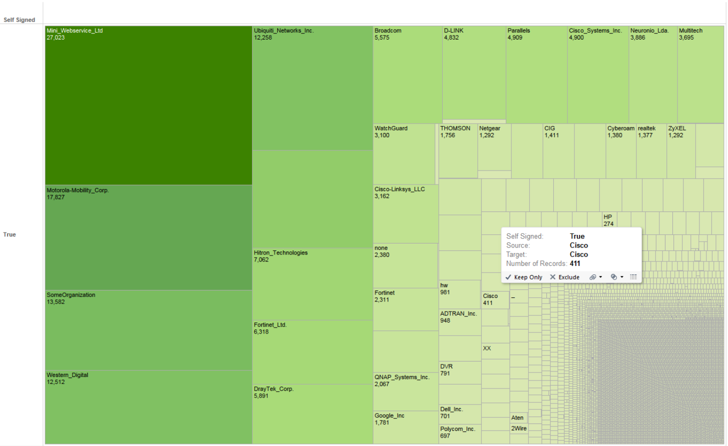
Key-size and Revocation



An Overview of Most Common Self-signed Certificates



Most Common Subject and Org Names in X.509



Self Signed: True
Source: Cisco
Target: Cisco
Number of Records: 411

Dyre malware and SSL fingerprint

- Dyre malware contains a list of static IP addresses to reach as C&C. What kind of C&C?

```
{"5.44.15.70": ["C=US, ST=CA, L=San Jose, O=Ubiquiti Networks Inc., OU=Technical Support, CN=UBNT/emailAddress=support@ubnt.com"]}
{"93.184.71.88": ["C=US, ST=CA, L=San Jose, O=Ubiquiti Networks Inc., OU=Technical Support, CN=UBNT/emailAddress=support@ubnt.com"]}
```

- The compromised Ubiquiti routers (with default password) were compromised to proxy SSL connections.

How to find user of a specific software?

- Who use MobileIron Mobile Device Management? More than 11000 certificates on a two-year period.

```
c2ef4df6c7be287f78ae9178d65e8078f253cfb1,C=US, ST=California, L=Sunnyvale, O=MobileIron, OU=Support, CN=ActiveSyncProxyCA/emailAddress=support@mobileiron.com
5c10590f0e977c15805124ddc00f470383768b10,C=US, ST=California, L=Sunnyvale, O=MobileIron, OU=Support, CN=usslmmdmsecapp004.net.plm.eds.com/emailAddress=support@mobileiron.com
9ce9edf68ecbf59c746e0d3bbe6d98d72b65fed3,C=US, ST=California, L=Sunnyvale, O=MobileIron, OU=Support, CN=mbx-desat-otn.defdh.astrium.eads.net/emailAddress=support@mobileiron.com
b47ec8382624035448eebcf15a1cd402425ca661,C=US, ST=California, L=Sunnyvale, O=MobileIron, OU=Support, CN=ActiveSyncProxyCA/emailAddress=support@mobileiron.com
5190314e4590420e75a2e7b21c74b34255da0806,C=US, ST=California, L=Sunnyvale, O=MobileIron, OU=Support, CN=ats.patrizia.ag/emailAddress=support@mobileiron.com
```

Detecting dynamic IP ranges?

- SSL/TLS services are often running on dynamic IP ranges. Users use dynamic DNS. Dynamic ranges managed by ISP can be detected and associated users too.

```
d53cc7380ed06c8b8ef0163952c9c534afad7ab8,CN=pino007.ath.cx
92bfef7362de7b381c723a2a352d54d82d49712a,CN=profinance.ath.cx
2cd0f2033c756222c976b631dba1a95a87aeadf9,CN=kschaub.ath.cx
c0de4fe83452046c0529b74f6081a39f82907746,CN=fferemote.ath.cx
b0d04a23ff6da2191d7b78f72352f1196802f61f,CN=hm01-server.Filmhotel.local, CN=
    localhost, CN=hm01-server, CN=companyweb, CN=filmhotel.ath.cx
a4b54adb780a5c9ea737399f9492f9f4dafc721d,CN=praxis-drciftci.ath.cx
77b89a57304256562ebfa42024fa9adeb304ad5a,CN=remote.mandk.ath.cx
```

Popcorn time

```
e4bd71c2e365b61b39d775ba43ef936a4fe9175c,C=Unknown, ST=Unknown, L=Unknown, O=Unknown, OU=Unknown, CN=*.*
1fc3a857a14ca15d3c37fdb2c8b7e0de01e4f0fd,C=IL, ST=Tel Aviv, O=Visonic Ltd., CN=*.*
397b25c864131bc78aff25622296171d60843318,C=IE, ST=Dublin, O=Fuck SSL Cartels, CN=*.nosmo.me/emailAddress=nosmo@nosmo.me
```

- We can laugh at everything? Especially with this certificate proposed by 94.242.58.131

```
06892001be0854570546b1e609d33a5510290e3b,C=US, ST=California, L=Mountain View, O=GeoTrust Inc., OU=GeoTrust Global CA, CN=*.*

Issuer: C=US, ST=California, L=Mountain View, O=GeoTrust Inc., OU=GeoTrust Global CA, CN=*.*
Validity
    Not Before: May 19 09:54:04 2015 GMT
    Not After : May 16 09:54:04 2025 GMT
Subject: C=US, ST=California, L=Mountain View, O=GeoTrust Inc., OU=GeoTrust Global CA, CN=*.*
```

Conclusion

- Passive SSL helped us to get in contact with owners of vulnerable or abused systems.
- Passive SSL is an ongoing project and you can request access if do incident handling or security research[2].
- Weird occurences in dataset lead to additional insights.
- Analysing the same dataset with different eyes improved analysis.
- Comparing different datasets can be independant verification of facts or proportion.
- Information visualisation can be used as a navigation strategy before deep diving.

[2] `https://www.circl.lu/services/passive-ssl/`

Q&A

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