Investigating APT1

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Introduction

- We wanted to validate what Mandiant proposed in its APT1 report
- We wanted to utilize the Internet Census 2012 data
  - We wanted to understand how public sources can tell a story about a specific threat group
- We came to many similar conclusions as Mandiant with significantly less man power
- We were able to show that important information can be gathered, combined, and reported by not using private or otherwise sensitive data

Data Sources

Mandiant: APT1: Exposing One of China's Cyber Espionage Units

Joint Indicator Bulletins: INC260425, INC260425-2

Internet Census Data 2012

Security Information Exchange at the Internet System Consortium (SIE@ISC): passive DNS Data

Open Resolvers Data Set

Neustar GeoPoint Data for geo-location and routing data

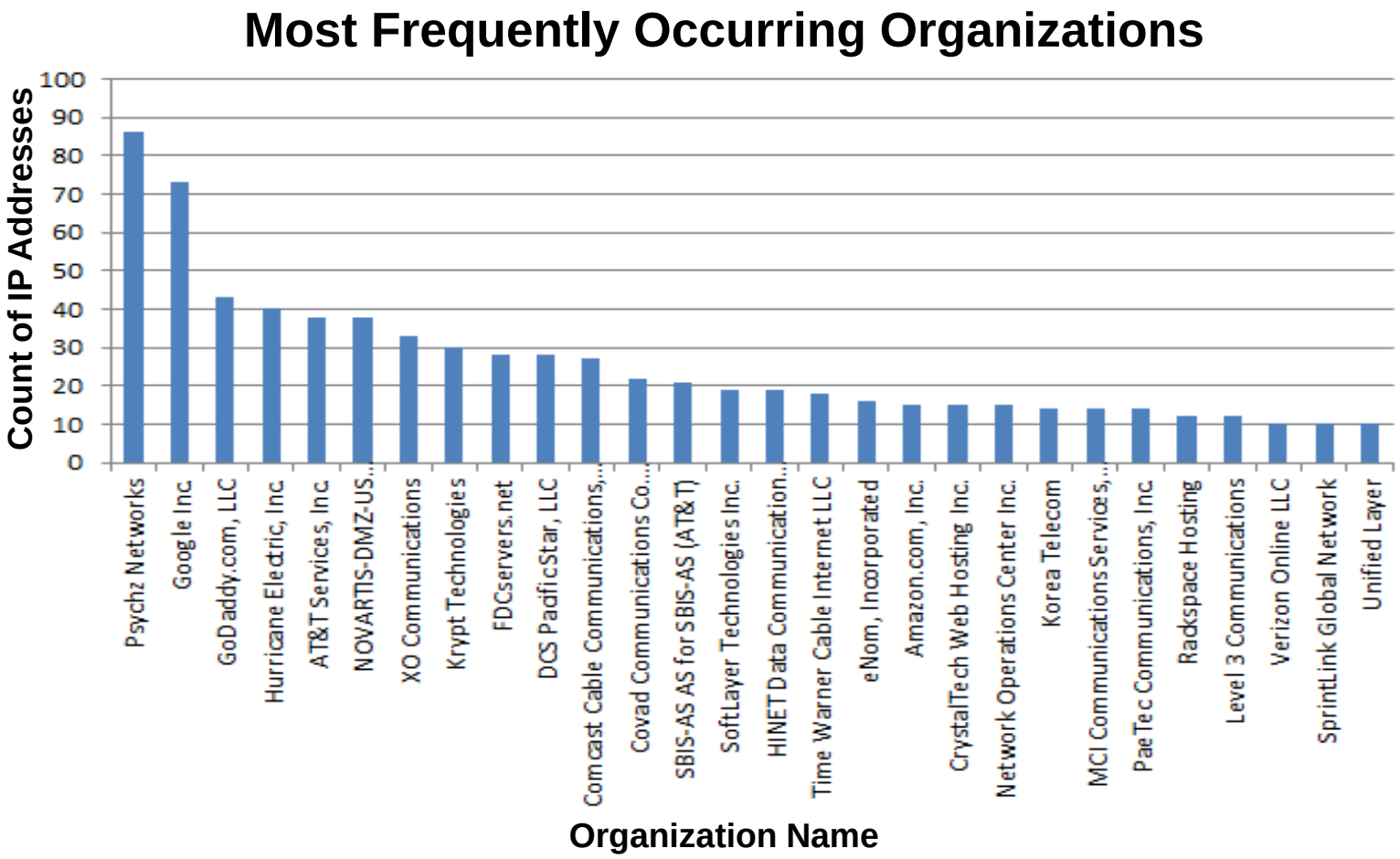
Internet Storm Center Data: Dshield

Indicator Expansion

- Address sets
  - **I_j**: IP addresses found in both JIBs
  - **DI_m**: IP addresses resolved from Mandiant FQDNs
  - **I_j+I_m**: Combined I_j and DI_m
- Network Attribution
  - **I_j+I_mA**: ASN information
  - **I_j+I_mR**: Routing type
  - **I_j+I_mC**: Country code, city and state (or province)
  - **I_j+I_mO**: Open resolvers
  - **I_jD:** Domain Names
  - **I_jDM:** Malicious Code
- Device Architecture
  - **I_j+$I_m$$F_{p75}$**: Fingerprints with minimum 75% match
  - **P**: Set of IP addresses having open ports
  - **I_j+I_mP** : Open ports
- IPv4 Random Sample
  - **SF_{p75}:** Fingerprints with minimum 75% match
  - **SP:** Open Ports

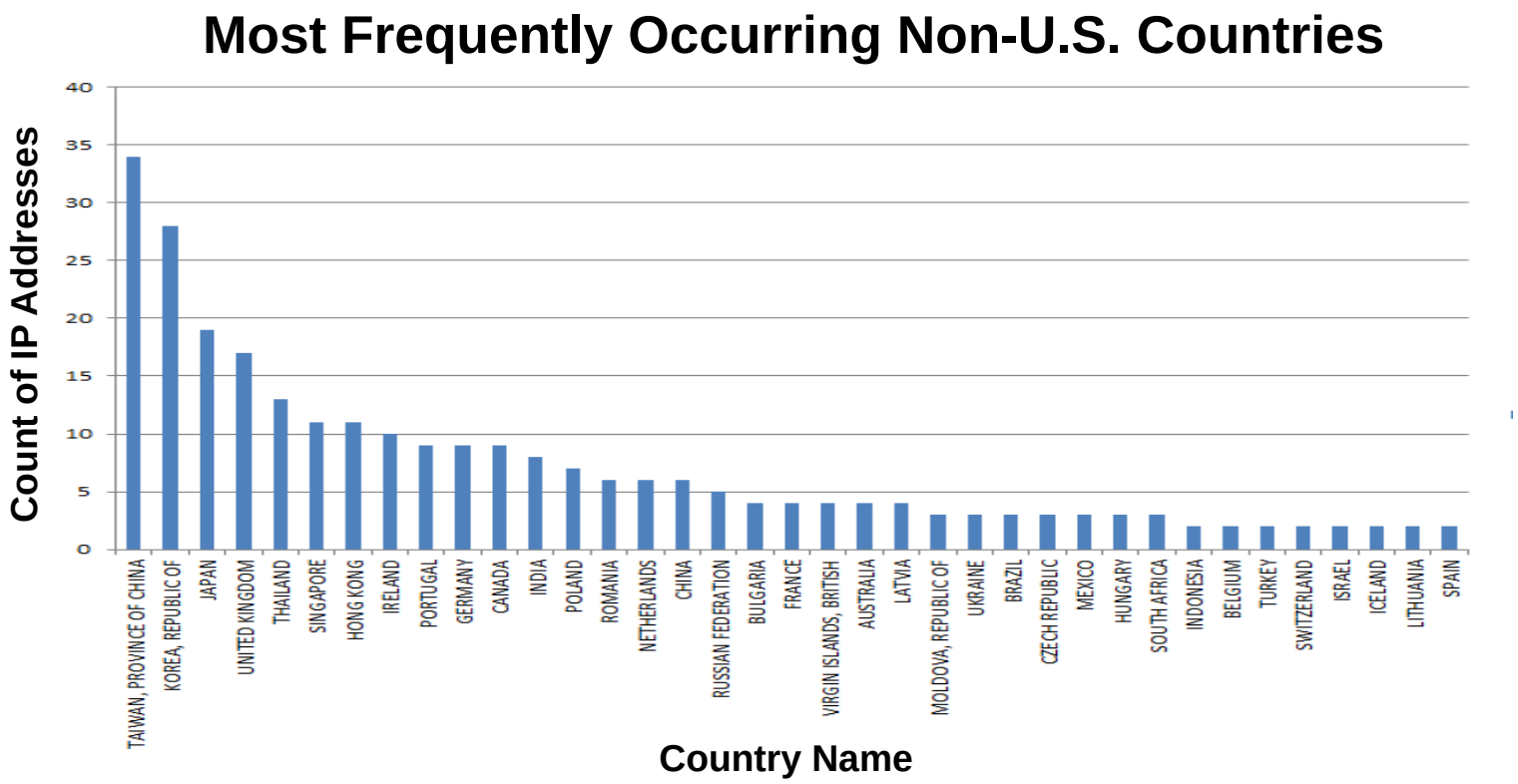
I_j+I_mA: Autonomous System Numbers

There are 28 organizations with 10 or more IP addresses which comprise 51.9% of the data.



I_j+I_mC: Location of IP Addresses

- 79% of I_j+I_m IPs are located in the United States
  - 45 U.S states and the District of Columbia are represented
  - 28% of IPs resolve to California
- 54 different countries are represented

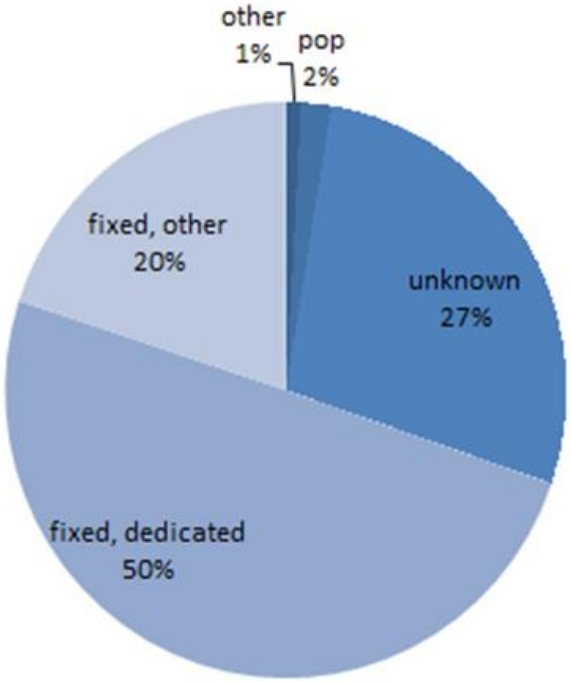


I_j+I_mR: Routing Data

- 1,000 I_j+I_m IPs have a routing type

- 984 IP addresses having connection types, which classifies if the routing type is fiber, leased line, DSL, cable or dialup.

Routing Types



I_jD : Domain Names

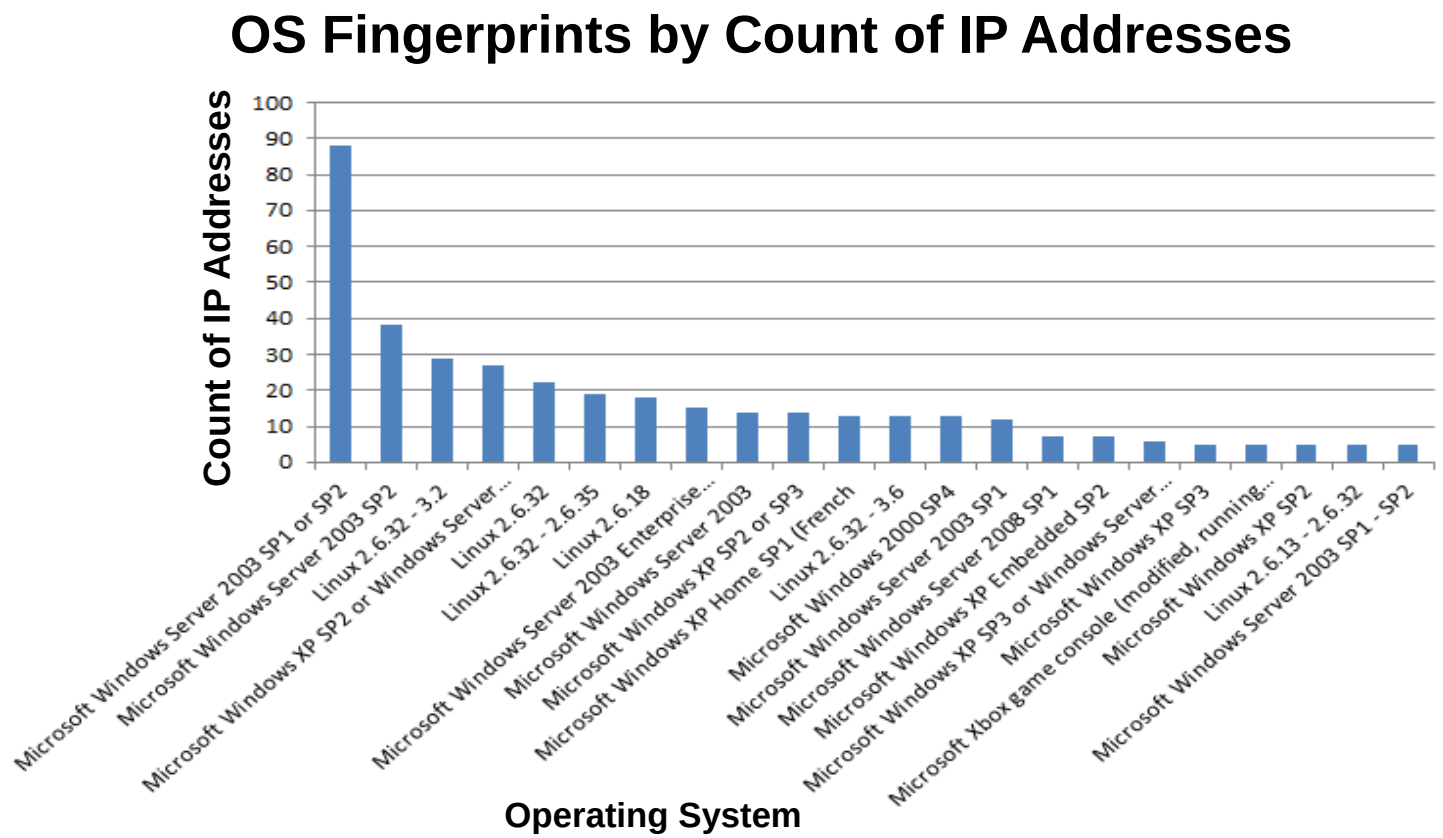
- Deceptive Domains; “off by 1”
- Pseudo-random Alphanumeric Strings
- Malicious Domains

I_jDM: Malicious Code

- 266 unique malicious code hashes found in CERT's Malicious Runtime Analysis efforts
- 7 of 266 appeared in the Mandiant report in 8 different domain names
- Only 3 of these 8 domain names were listed by Mandiant
- 15 hashes occurred more than once, all others occurred only once

$(I_j+I_mF_{p75})_5$: Top TCP/IP Fingerprints

- 32.5% of I_j+I_m was fingerprinted
  - Linux made up 27.9 % of the fingerprinted machines.
  - Microsoft Windows accounted for 65.4% of the fingerprinted machines.



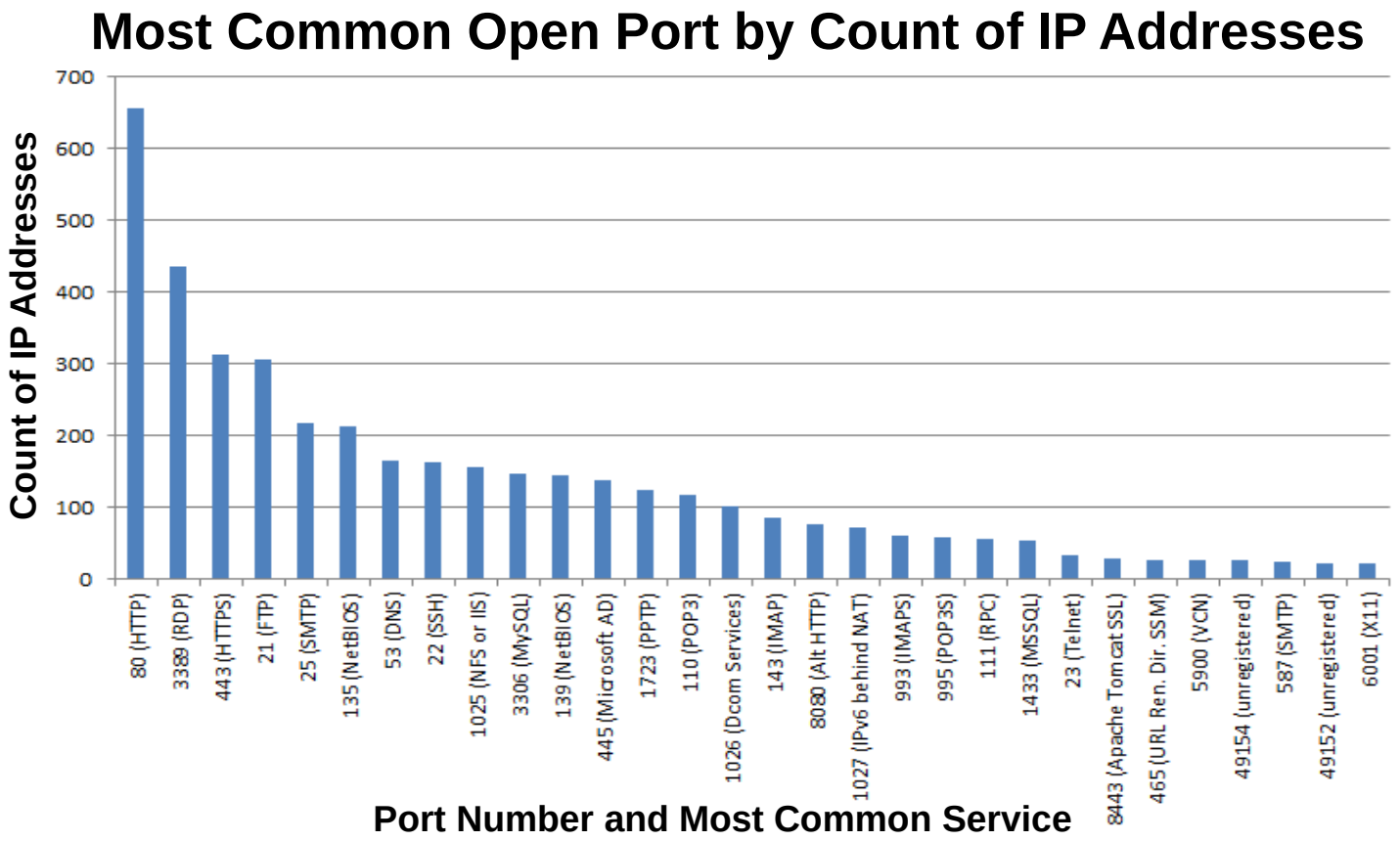
SF_{p75}:TCP/IP Fingerprints of S given a 75% Match

- 11.13% of the sample set was fingerprinted
  - Linux made up 35.2% of the fingerprinted machines.
  - Windows made up 12.9% of the fingerprinted machines.
  - 51.9% were other device types

Fingerprint	% Total IPs I_j+I_m	%Total IPs S
Microsoft Windows Sever 2003 Service Pack 1 or 2	21.5%	0.6%
Microsoft Windows Server 2003 SP2	9.3%	3.0%
Linux 2.6.32 - 3.2	7.5%	1.8%
Windows XP SP2 or Windows Server 2003 SP1 or SP2	6.2%	0.2%
Linux 2.6.32	5.3%	6.6%
VxWorks	-	6.2%
Linux 2.6.18	4.2%	4.2%
Linksys WRT610Nv3 WAP	0.2%	4.1%
AVM FRITZ!Box FON WLAN 7170 WAP (Linux 2.6.13	-	3.8%

I_j+I_mP: Port Analysis

- 51.1% of the I_j+I_m had open ports
  - 609 unique open ports
  - Four IP addresses had more than 100 ports open



SP: Open Ports

- There are 33,573 IP addresses found in the S having open ports.
  - This constitutes 33.6% of the sample data.
- There are 14,024 unique open ports represented in the data.

Port	% Total of IPs I_j+I_m	% Total IPs S
3389 (RDP)	**54.9%**	**4.3%**
443 (HTTPS)	**39.4%**	**17.6%**
21 (FTP)	**38.6%**	**16.6%**
25 (SMTP)	27.4%	9.8%
135 (NetBIOS)	**26.8%**	**3.2%**
53 (DNS)	20.9%	8.2%
22 (SSH)	20.5%	11.3%
1025 (NFS or IIS)	19.7%	1.4%
3306 (MySQL)	18.5%	4.2%
139 (NetBIOS)	**18.3%**	**1.4%**
445 (Microsoft AD)	**17.3%**	**1.0%**
1723 (PPTP)	**15.5%**	**3.4%**
110 (POP3)	14.8%	5.2%
1026 (DCom Services)	12.8%	1.5%
143 (IMAP)	10.9%	4.8%
8080 (Alt HTTP)	9.6%	2.6%
23 (Telnet)	4.2%	5.2%

I_j+I_mO: Open Resolvers

- There are 43 open resolvers total in the I_j+I_m .
  - This constitutes 3.1% of the I_j+I_m.
  - These belong to 30 different organizations

- Companies associated with more than 1 open resolver

Company Name	Number of Open Resolvers
Comcast Cable Communications, Inc.	6
CrystalTech Web Hosting Inc.	5
MegaPath Networks Inc.	3
Charlotte Colocation Center, LLc	2
NOVARTIS-DMZ-US (Qwest/CenturyLink)	2

Overall Findings

- Our available unclassified data gives a snapshot in time of what APT1 was using

- APT1 uses stable, well connected infrastructure, mostly in the US
  - Windows 2003 or XP, Linux ~ 2.6.32
  - Mostly ISPs or hosting providers
  - Especially from California

- The APT1 infrastructure may be evolving
  - Time frame of Windows vs. Linux versions
  - Open port differences (including absences) across IP addresses even within same ASN

- Malware hashes indicate there is a much bigger network for APT1 than what was released

Conclusion

- We were able to validate at a high level some of what Mandiant proposed
  - Command and control servers communicate over port 443
  - Malware communicated using RDP or similar protocols
  - APT1 used compromised mail servers in its operations
- In some cases we found more data then it provided
  - Exploited devices are predominately in the U.S. and in particular California
  - Found 259 previously unattributed pieces of malware
- In other cases what we were able to investigate did not directly corroborate Mandiant's findings
  - Exploited devices are hosting providers
- We were able to find important information by not using private or otherwise sensitive data