Approach and outcome of “AOKI” - DNS sinkhole by JPCERT/CC.

Sho AOKI

Japan Computer Emergency Response Team Coordination Center (JPCERT/CC)

Agenda

- Background
  - About JPCERT Coordination Center
  - Sinkhole mechanism & purpose
- The flow of research & coordination
  - Collect and Investigate
  - Architecture of Sinkhole System "AOKI“
  - Investigate access log and Coordination
- Tracing Targeted Attack Cases
  - Case Study
- Future of this project

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Self introduction

Sho Aoki

Information Analyst at
Watch & Warning Group,
JPCERT/CC since 2015.

Collect:
Collect Information
(Public and Private Disclosure, Incident Reports)

Analyze:
Analyze the collected information from various viewpoints

Transmit:
Provide or transmit information to appropriate parties
- Public Notification (Website or Mailing List)
- Critical Infrastructure
- Domestic CSIRTs

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Background

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About JPCERT Coordination Center

- Foundation - October, 1996
- Organization Status & Constituency
  - An independent, non-profit organization
  - Internet users in Japan, for enterprises
  - Mainly providing service through technical staffs with high degree of professionalism in enterprise
  - International and Regional Activities

20th Anniversary

Prevent

-Vulnerability Information Handling

- Coordinate with developers on unknown vulnerability information
- Secure coding

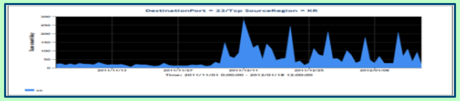
JVN Japan Vulnerability Notes

Watch

- Information gathering / analysis / sharing

- Internet Traffic Monitoring

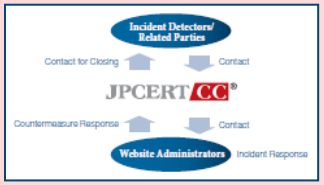
- Alert / Advisories



Respond

- Incident handling

- Mitigating the damage through efficient incident handling
- Information sharing to prevent similar incidents



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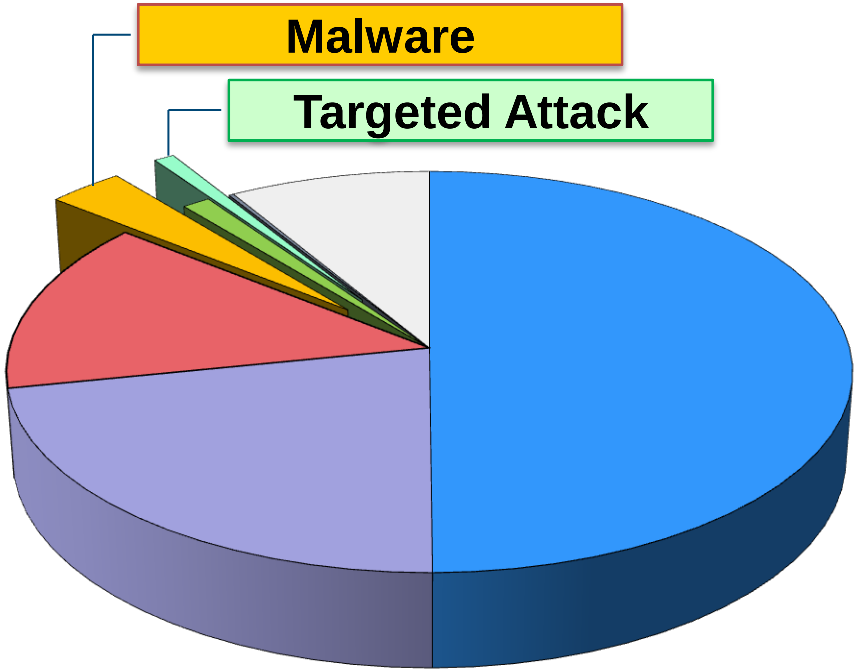
Breakdown of coordinated incidents

- Abuse Statistics of FY2015

Category	%
Scan	49.9%
Website defacement	21.9%
Phishing	14%
Malware	**3.3%**
DDoS	1.2%
Targeted Attack	**0.9%**
ICS	0.2%
Other	8.6%

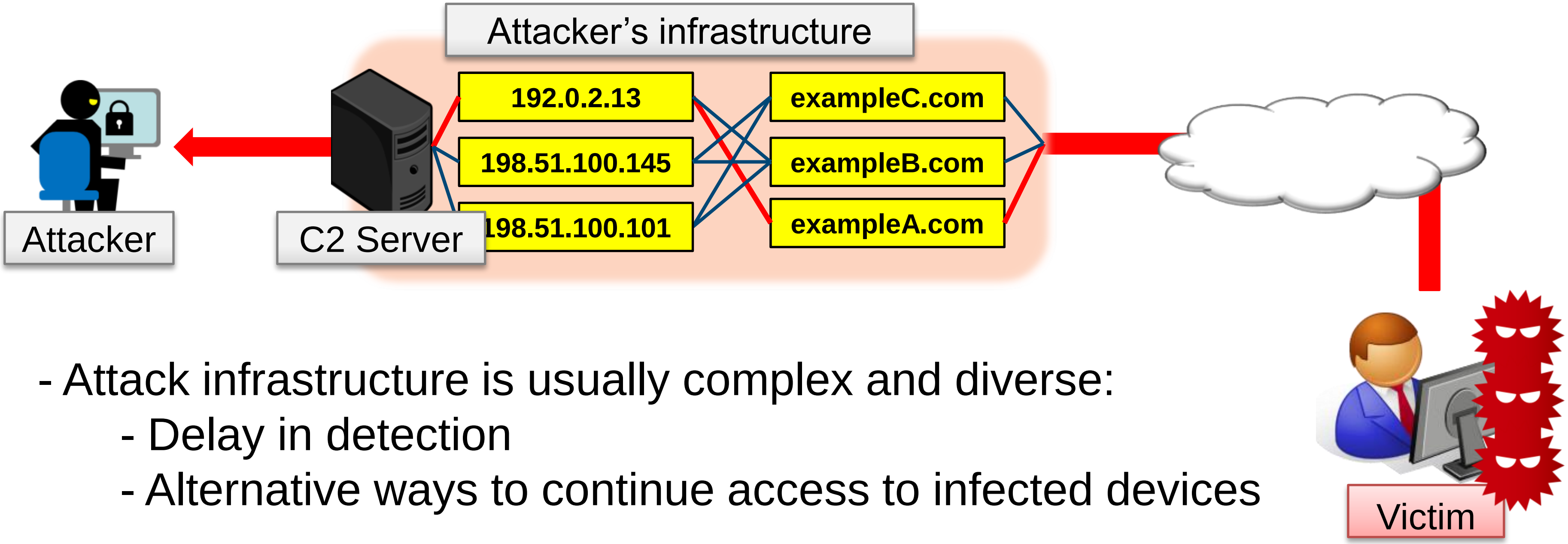


- “Targeted attack” has became a prominent topic through news media in Japan

  Communication with C2 servers sometimes continued even after completing a series of attacks

Sinkhole mechanism and purpose

- Why we started the sinkhole project
  - To identify victim organizations through gathering information from the traces left by the attackers.
- Sinkhole mechanism
  - Attackers infect the devices with malware and remotely control it using domains and IP addresses



- Attack infrastructure is usually complex and diverse:
  - Delay in detection
  - Alternative ways to continue access to infected devices

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Sinkhole mechanism and purpose

- Why we started the sinkhole project

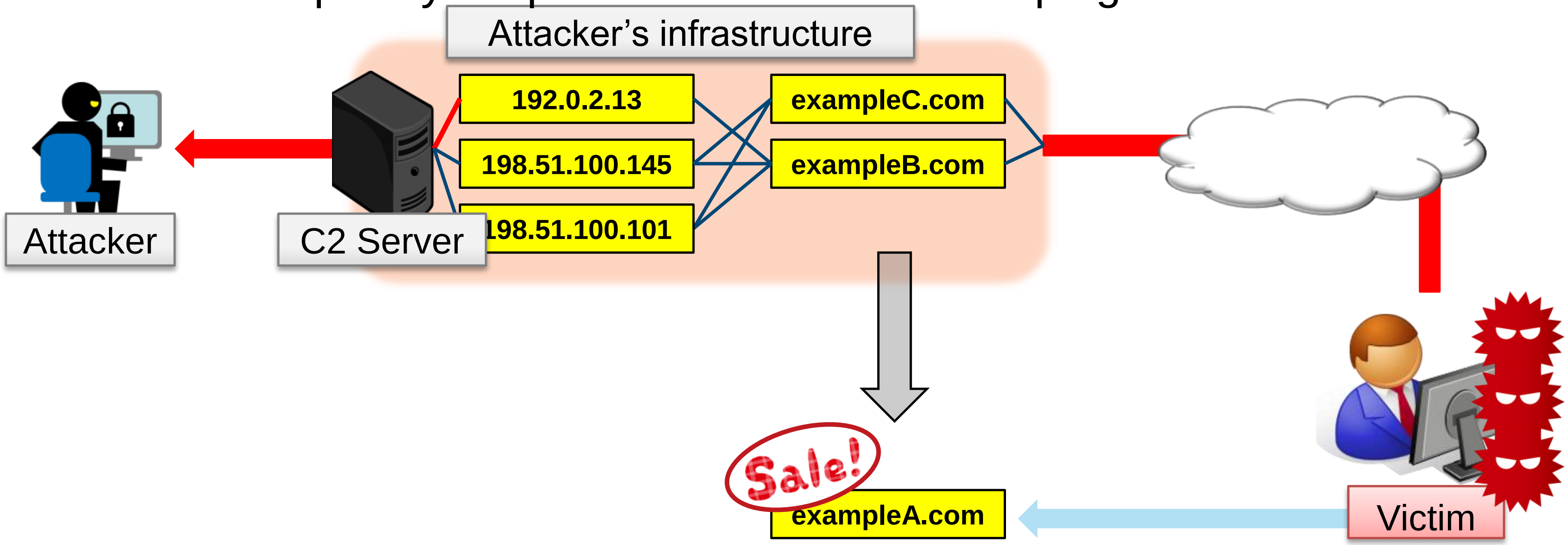
  - To identify victim organizations through gathering information from the traces left by the attackers.

- Sinkhole mechanism

  - Some domains are on sale while the communication is still alive:

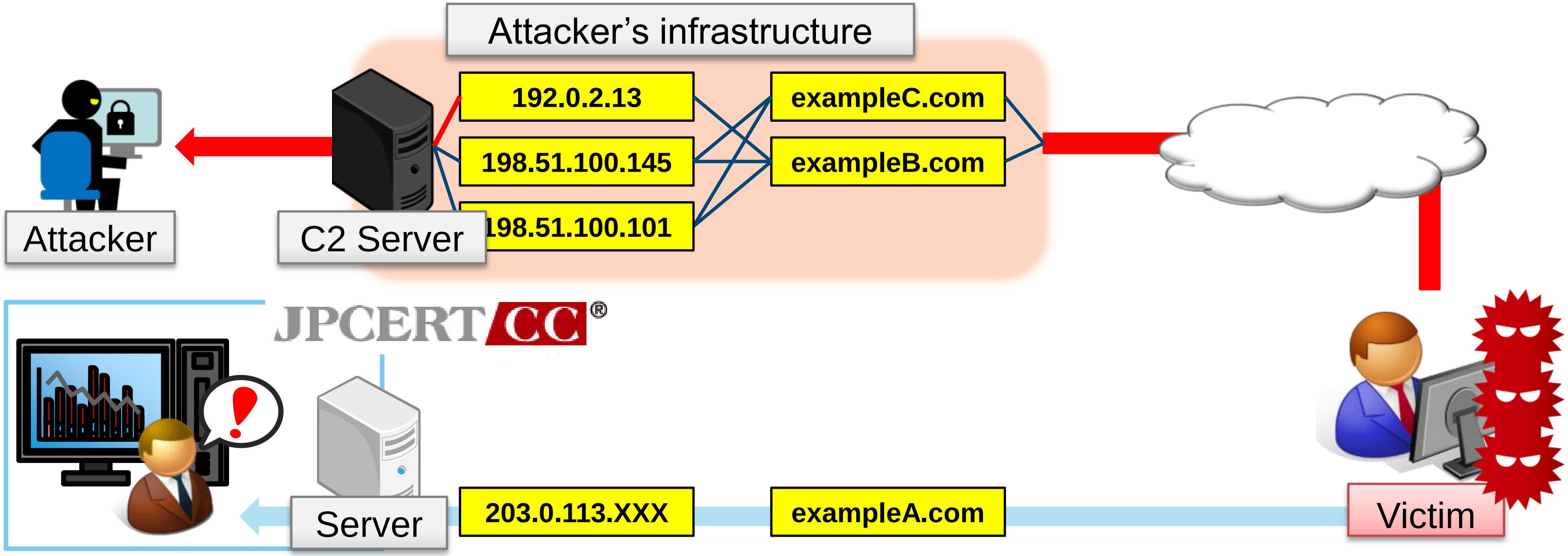
    -Fund issue

    -Temporary suspension of an attack campaign



Sinkhole mechanism and purpose

- Why we started the sinkhole project
  - To identify victim organizations through gathering information from the traces left by the attackers.
- Sinkhole mechanism
  - Communication from infected devices can be seen by obtaining the associated domains



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Sinkhole mechanism and purpose

- Purpose of Sinkhole

[Mission as a National CSIRT]

- To grasp the range of cyber attack damage
- To notify the victim of the attack and promote countermeasures

[Our expectations]

- To research attacker behavior in the victim’s PC
- To research the reliabilities of the attacker’s infrastructure information.

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The flow of investigation and coordination

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Collect and Investigate

- Research the domain to obtain

①Collect information on attack activities

- Data gained through actual incident coordination
- Reports published by vendors/researchers
- Malware database updates

②Investigate relations and similarities with other attack activities

- Domain information
- IP addresses change history
- Similarity in malware and its function
- Targeted attack method and information on attackers

③Obtain the domain (if expired and available)

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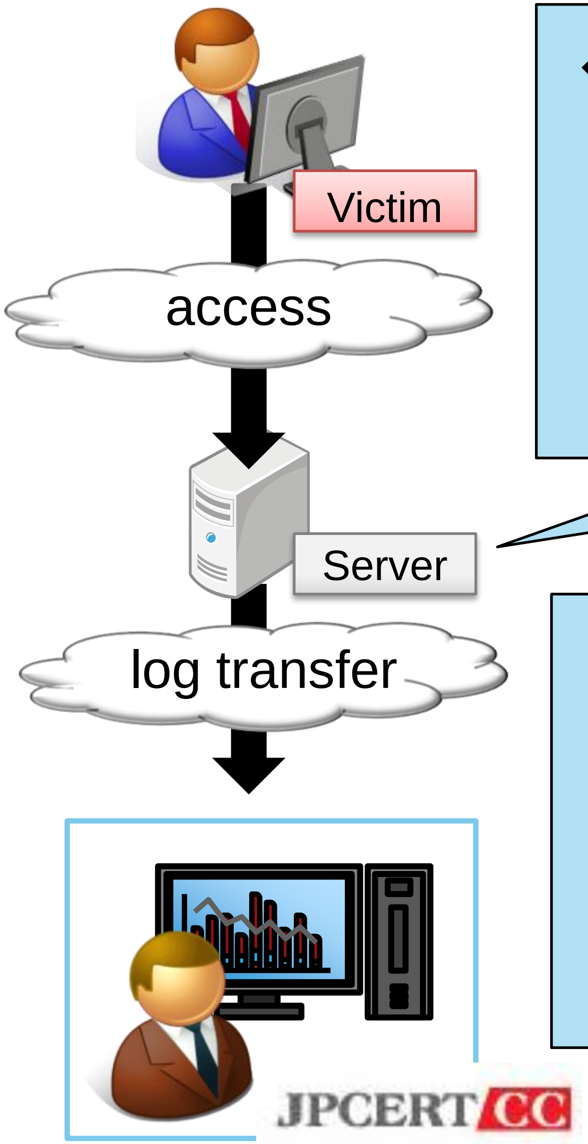
Architecture of Sinkhole System "AOKI"



◆Web Server

- Located in the cloud
- 80(HTTP) / 443(HTTPS) is open
- Output access log
- When the domains are accessed, a webpage is displayed to notify that it is a sinkhole

◆Application

- Forwards the access log
- Collects the logs and researches access by day/week/month
- Manage logs by IPs and domains
- Manage the obtained domains

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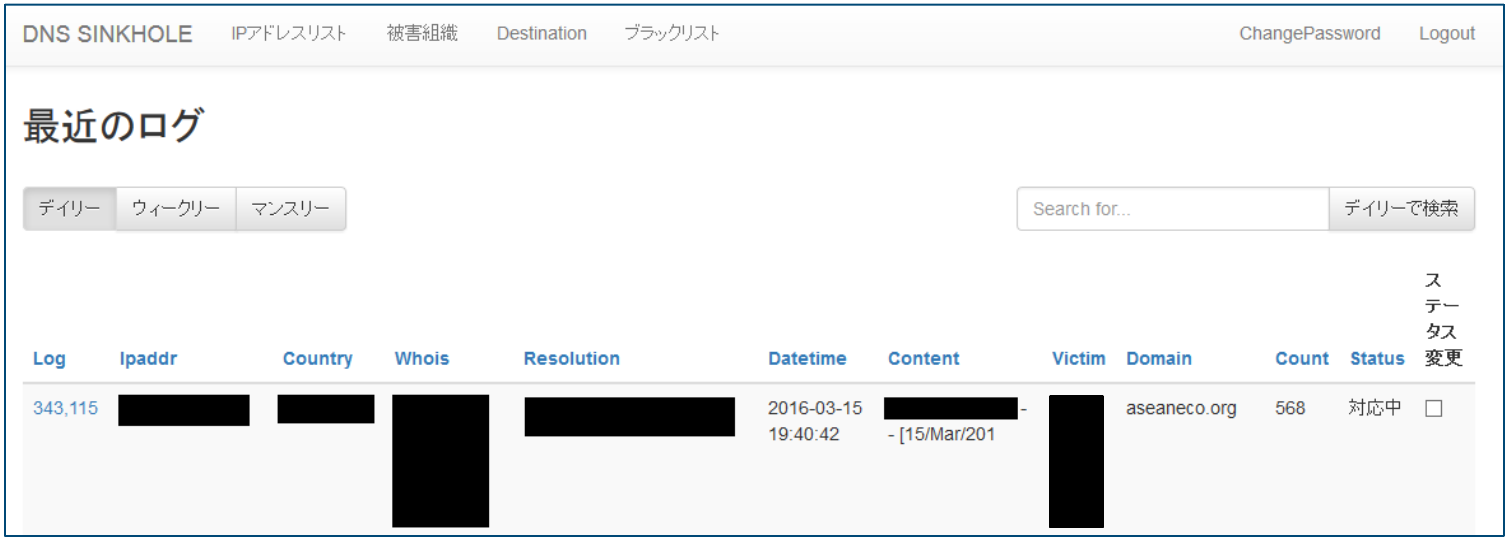
Investigate access log and Coordination

- Identify victim organization from public information
  - We basically refer to public information.
    - WHOIS information (organization name, domain name)
    - NS information (domain name)

- Our original application and its featured functions
  - Associate organization names and IP addresses
  - Manage coordination status

    Done / In process / To be assigned / Blacklist



最近のログ

Log	Ipaddr	Country	Whois	Resolution	Datetime	Content	Victim	Domain	Count	Status	ステータス変更
343,115	[redacted]	[redacted]	[redacted]	[redacted]	2016-03-15 19:40:42	[redacted]- - [15/Mar/201	[redacted]	aseaneco.org	568	対応中	□

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Investigate access log and Coordination

Coordination from JPCERT

From JPCERT	Coordination
To Japanese organizations	Coordinate individually in case there is a report on suspicious communication with external servers
To Foreign organizations	Share information gained through sinkhole with the National CSIRT of the economy

- Cases coordinated (Sep. 2015 – Mar. 2016)

9 Economies

24 Organizations

33 IP addresses

- Military organizations,
  Government organizations
- Communication Authority
- Academic organizations

⇒ Issues have been addressed in **25 IP** addresses.

about **70 %** of the total.

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Investigate access log and Coordination

Coordination using a questionnaire

- Questions for victims (voluntary)

- What is the purpose of the infected device(s)?

  For operation / For personal use / Others

- Who is the user of the infected device(s)?

  Position / Assigned duties

- Did you manage to identify the malware and the source of infection?

  Yes / No

  (If yes) Is it possible to share the data with us?

  Yes / No

- Is there any information stolen?

  (Comments)

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Tracing Targeted Attack Cases

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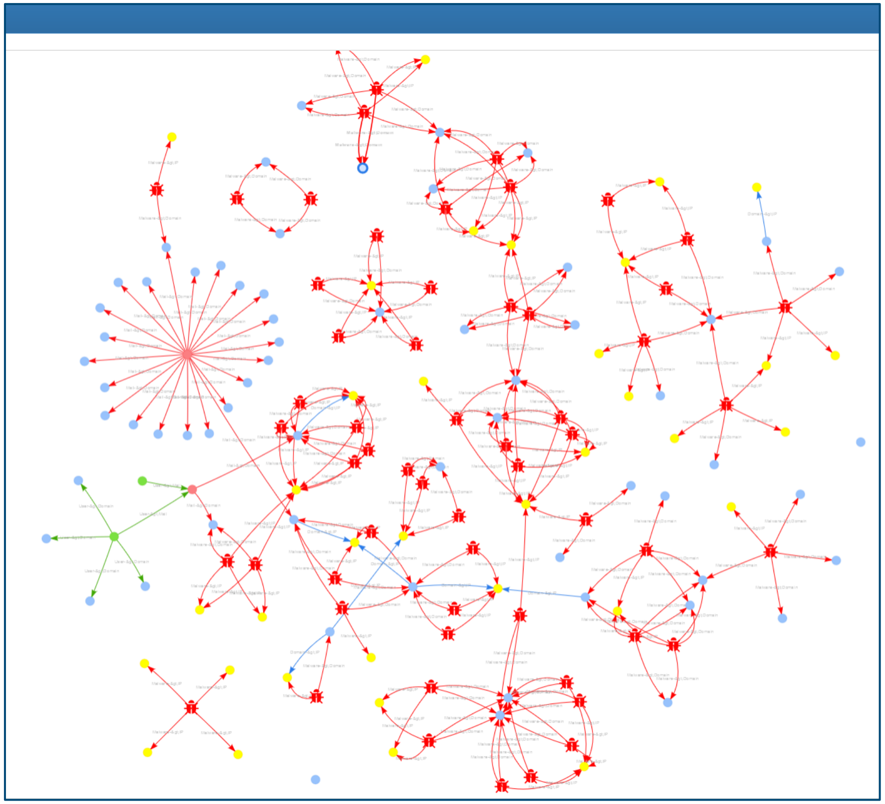
Case Study

- Tracing attack activities based on published reports
  - We investigated malware “Elise/Esile”, reported in 2015
  - The attackers seem to be targeting Eastern Asian economies.
    (VN / PH / TW / HK / ID)



original tool : Hiryu
https://github.com/S03D4-164/Hiryu

- Motivation
  - We were able to obtain some of the domains used for the attacks
  - We wanted to see the link with the attacks targeting Japan

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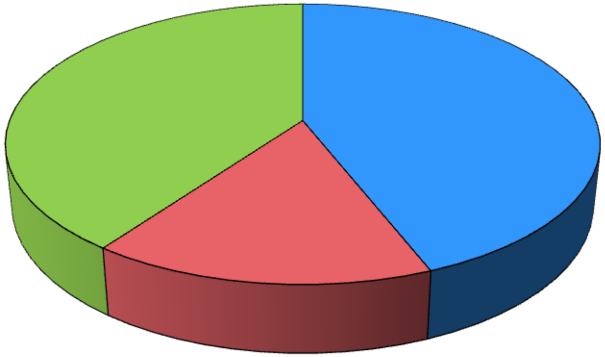
Case Study

- Investigation results after sinkholing

  - Information on domains related to the attacks on reports

  (about 50 domains)



Category	%
Domains that work as a sinkhole and that JPCERT/CC observes logs	44%
Domains that attackers own	16%
Unknown owners / others	40%

- Criteria for the categorization

  ・Judged that attackers own the domain if the WHOIS detail available and the ownership has not changed, or the IP remains as the time of attack campaign

  ・Judged “unknown owner” when the registrant information is hidden using WHOIS privacy service etc.

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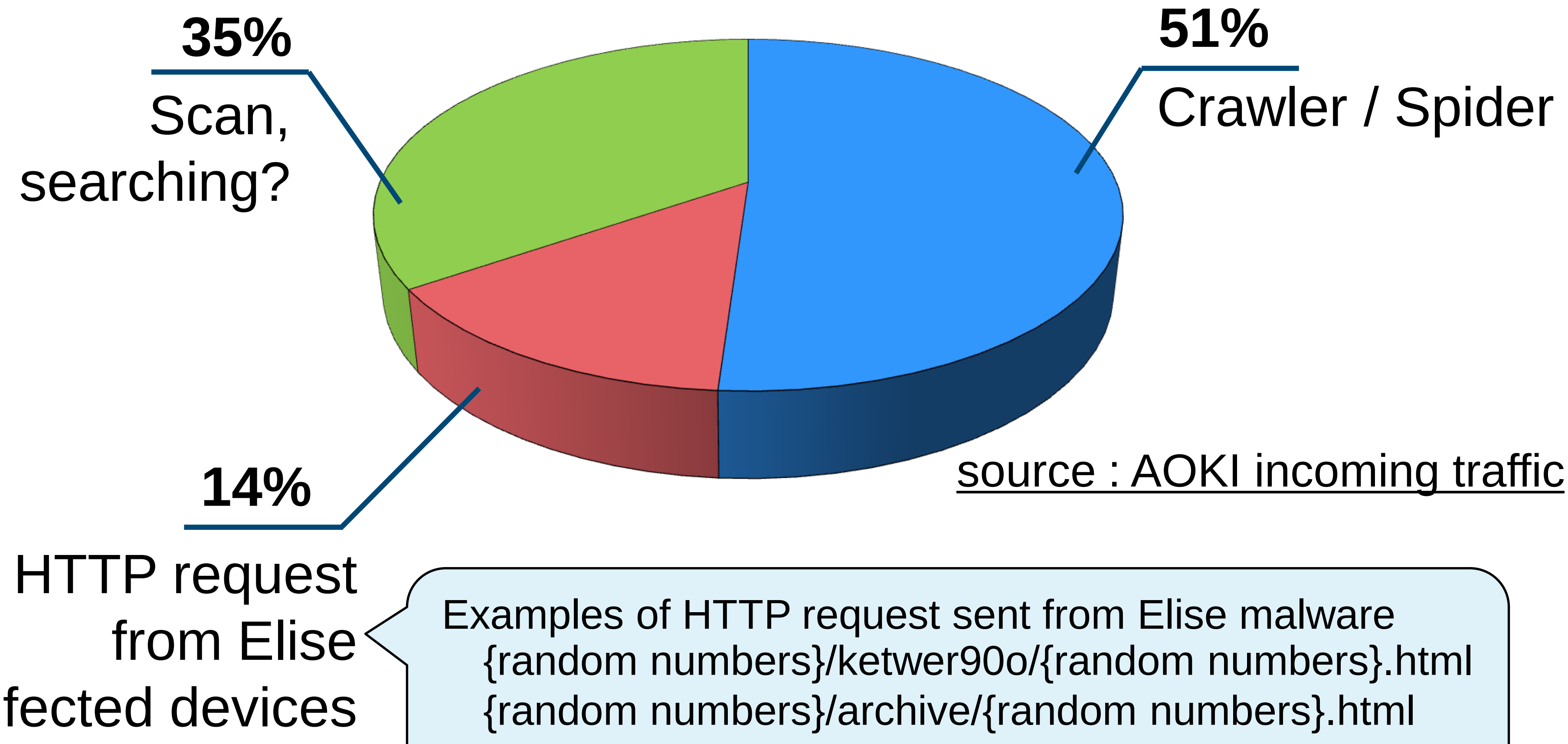
Case Study

- Communication to sinkhole domains (Apr, 2016)
  Analyzed the communication purpose for each unique IP address



source : AOKI incoming traffic

Examples of HTTP request sent from Elise malware
{random numbers}/ketwer90o/{random numbers}.html
{random numbers}/archive/{random numbers}.html
{random characters}/page_{random numbers}.html

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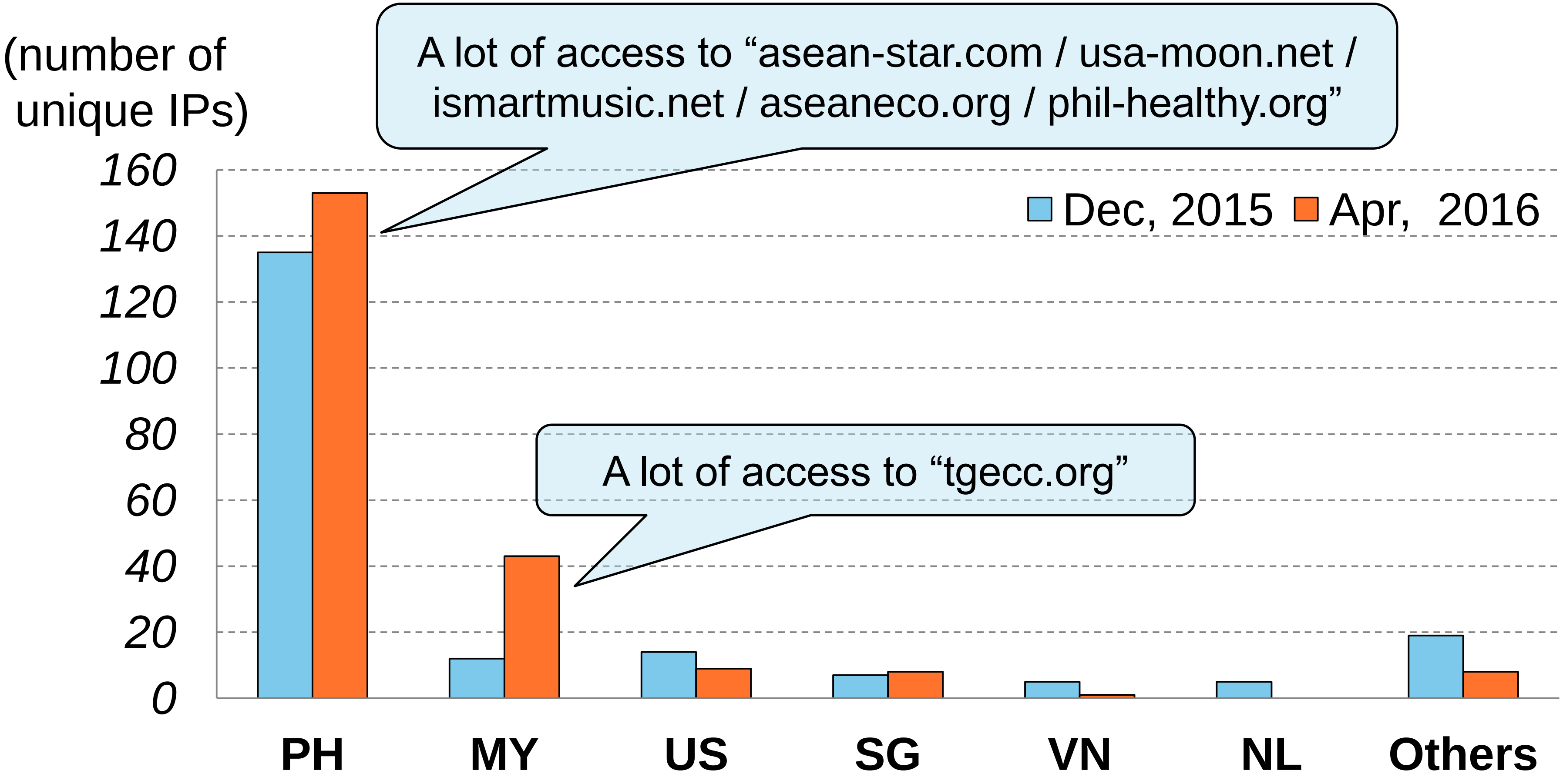
Case Study

- Transition of the number of IP addresses which Elise malware sent a HTTP request to



A lot of access to “asean-star.com / usa-moon.net / ismartmusic.net / aseaneco.org / phil-healthy.org”

A lot of access to “tgecc.org”

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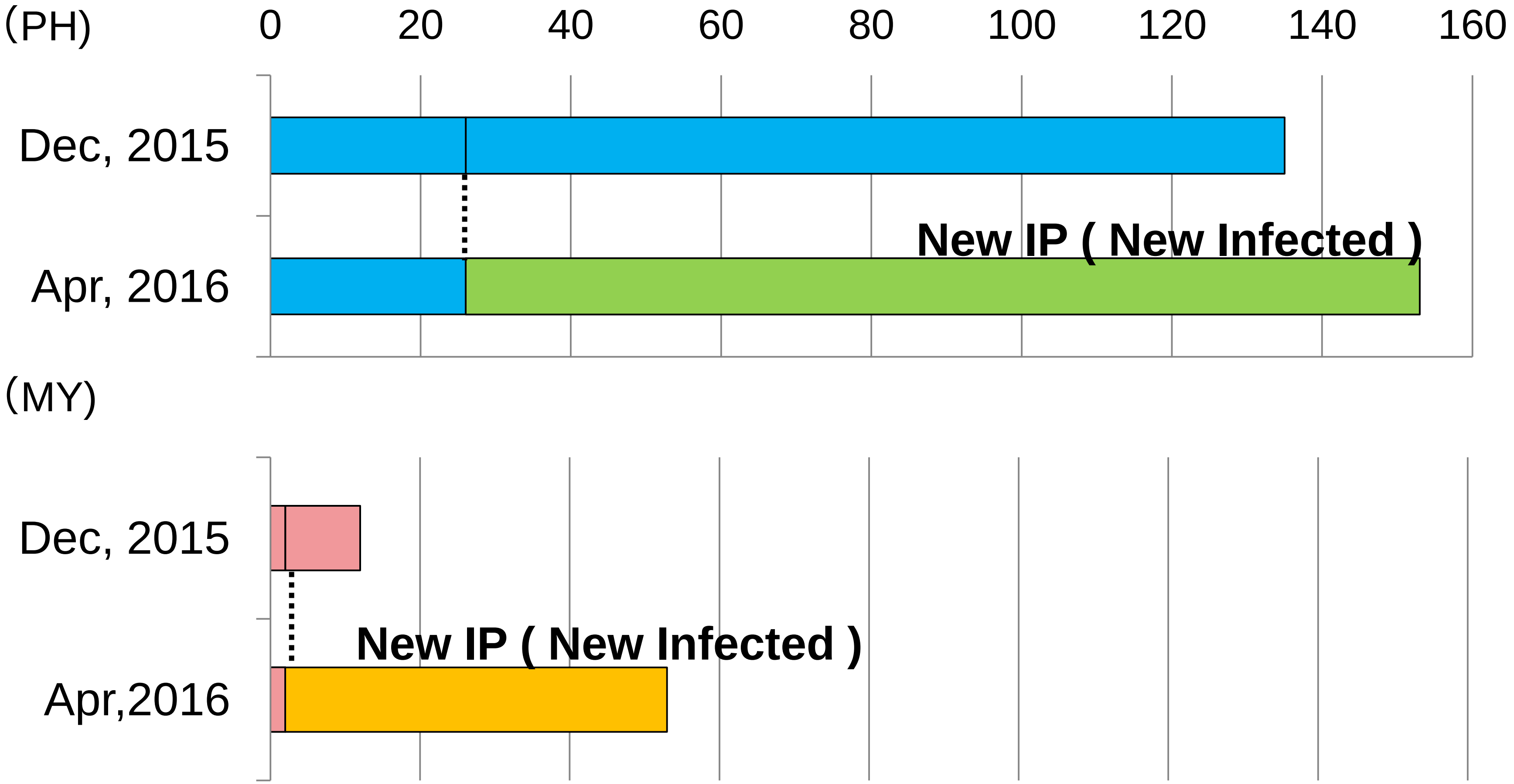
Case Study

- Comparison of IP addresses that communicate with expired domains



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Conclusion and plan for future

■ The expectations were fulfilled

- Similar attack situation have been observed as mentioned in the report
- Obtained certain degree of expertise on the investigation

■ Taking over IP addresses

- Malware communicates not only with domains but also with IPs
- Seeking for assistance from Japanese partners

■ Working towards global information sharing

- Like SinkDB ? and join other information sharing community.

Thank you for listening !! ☺

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