Performing enterprise-wide DFIR and Threat Hunting with Yamato Security OSS Tools

Zach Mathis, Akira Nishikawa, Fukusuke Takahashi

2024/08/23

MIND MELD HACKER SPIRIT FROM HUMAN TO AI

Congratulations on 20 years!!!

20周年、おめでとうございます！

Zach Mathis

- Yamato Security founder and project leader
- 2006~ Kobe Digital Labo (KDL)
- 2016~ SANS 504 Instructor

Akira Nishikawa

- First core developer
- Kaminashi
- 2007~ Freelance engineer
- 2021~ SaaS product security
- AWS Community Builder

Fukusuke Takahashi

- Latest core developer
- NTTDATA-CERT
- DFIR, OSINT, SOAR
- Fixes OSS tool bugs and does bug hunting in free time

Agenda

- About Yamato Security and tools/resources
- Scalable DFIR built with Velociraptor & Hayabusa
- Easy analysis with Takajo
- Open-source tool management
- Future plans

About Yamato Security tools and resources

About Yamato Security

HITCON

- A Japanese security group that provides free/cheap training since 2012.
- Develops various open-source security tools and resources since 2021:

Project Leader
Zach Mathis (@yamatosecurity)
Developers
Akira Nishikawa (@nishikawaakira)
DustInDark / hitenkoku
James Takai / hachiyone(@hach1yon)
ItiB (@itiB_S144)
Kazuminn (@k47_um1n)
Garigariganzy (@garigariganzy31)
Fukusuke Takahashi / fukuseket
Yusuke Matsui (@apt773)(AD Hacking Group Leader)

Project Leader
Zach Mathis (@yamatosecurity)
Developers
Akira Nishikawa (@nishikawaakira)
DustInDark / Hitenkoku
Fukusuke Takahashi / fukusuket

Follow:
@SecurityYamato

Who has used Yamato Security tools (Hayabusa, Takajo, RustyBlue, WELA, etc…) before?
(Please raise your hand)

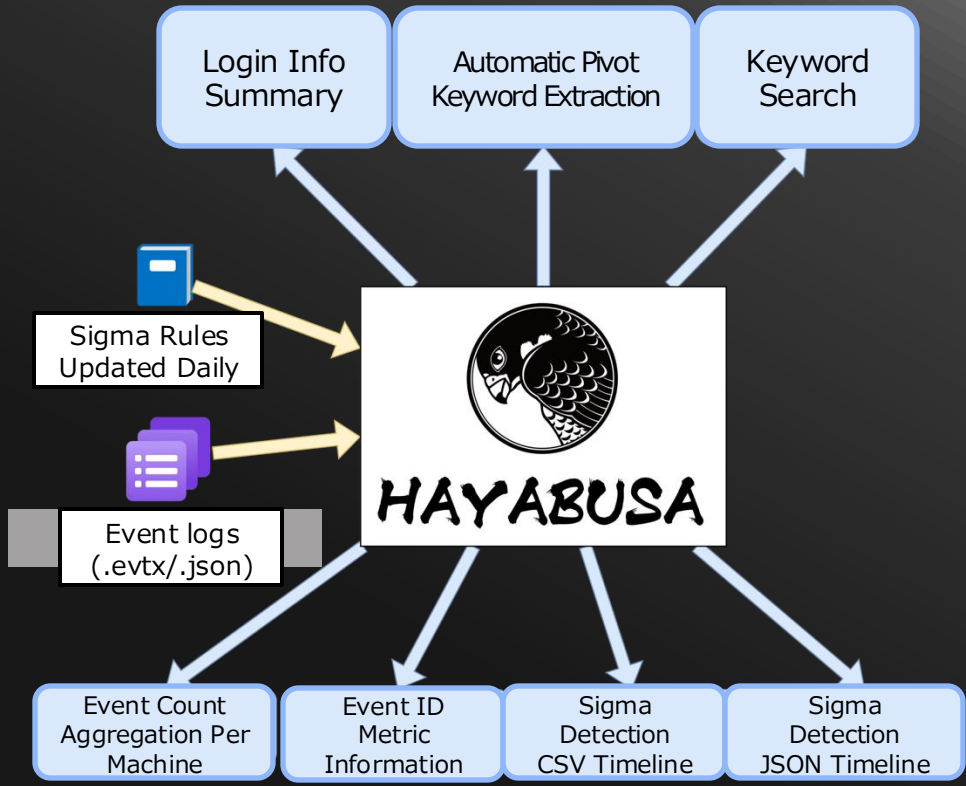
Yamato Security tools and resources

- Hayabusa: DFIR timeline generator using native Sigma rules for Windows event logs
- Takajo: Hayabusa results analyzer
- Yamato Security's Windows Event Log Configuration Guide For DFIR And Threat Hunting
- Curation of Sigma Rules for Windows Event Logs
- Deprecated: WELA

Hayabusa

https://github.com/Yamato-Security/hayabusa

- Fast forensics and Threat Hunting tool
- Quickly analyzes large amounts of Windows event logs.
- Written in Rust so it is very fast and cross-platform and safe from anti-forensics memory corruption exploits
- Has various commands specialized for Windows event log analysis
- Synchronize with Sigma repository with one command. Over 4000 Sigma and built-in detection rules to output a CSV or JSON timeline!

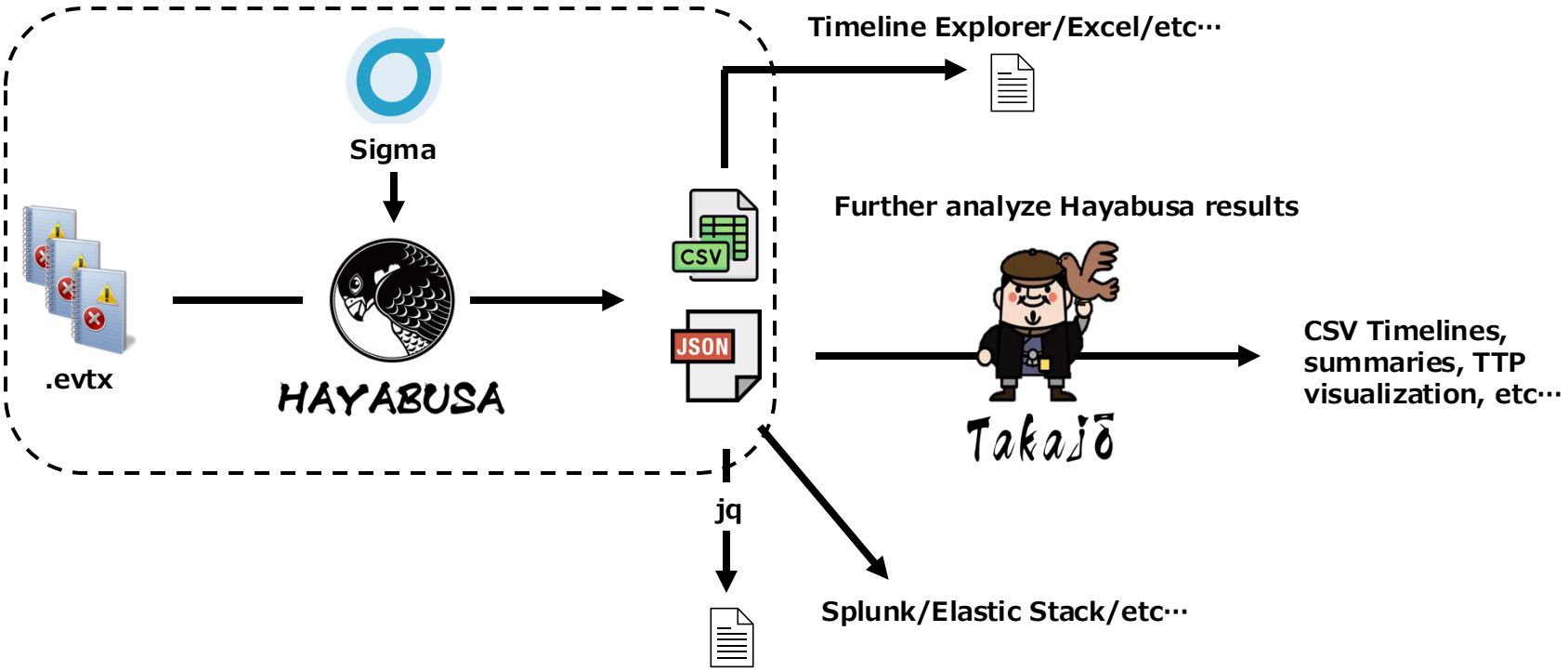


Sigma

https://github.com/SigmaHQ/sigma

- Free open source detection rules for various platforms (Windows event logs, cloud, linux, etc…)
- 4000+ rules for Windows event logs
- Advantages:
  - Easy to write/read YAML files
  - Many free, high-quality and up-to-date rules
  - Can convert to any backend out there (Splunk, Elastic Stack, Qradar, KQL, etc…)

Hayabusa overview



Hayabusa

https://github.com/Yamato-Security/hayabusa

- Best native support for Sigma rules! Hayabusa supports all major field modifiers including the Sigma correlation rules that are still in development.
- Contributors: 14
- Releases / Major updates: 45!
- Major updates almost monthly for almost 3 years!
- Commits: 4200+!
- Issues closed: 500+
- Pull Requests Merged: ~800
- Downloads: 113,000+!
- Hayabusa detection rules: ~200
- Sigma detection rules: 4000+
- Talks: Black Hat, CODE BLUE, SANS DFIR Summit, Bsides Tokyo, Hack Fes, FIRSTCON, etc…
- Used world-wide by many CERTs and DFIR specialists!

Hayabusa 2.17.0 Release!

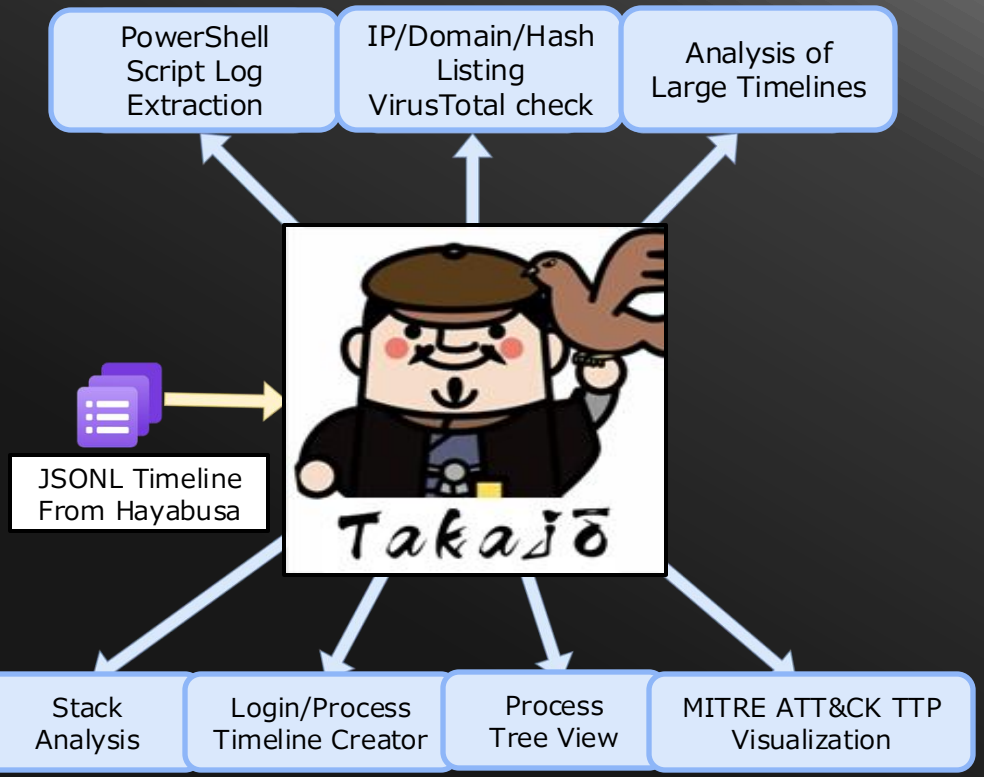
https://github.com/Yamato-Security/hayabusa

- We are releasing the latest version 2.17.0 “HITCON Community Release” today!
- Low memory mode is enabled by default so you can scan 100GB+ of event logs with less than 4GB of memory!
- Better support for Sigma correlation rules
- Aggregation rules show more information like Event ID and Channel
- The “windash” modifier has been updated to detect special dash characters used to bypass signatures
- Various bug fixes
- Download here: https://github.com/Yamato-Security/hayabusa/releases
- Contributors: Fukusuke Takahashi and DustInDark (hitenkoku)

Takajo

https://github.com/Yamato-Security/takajo

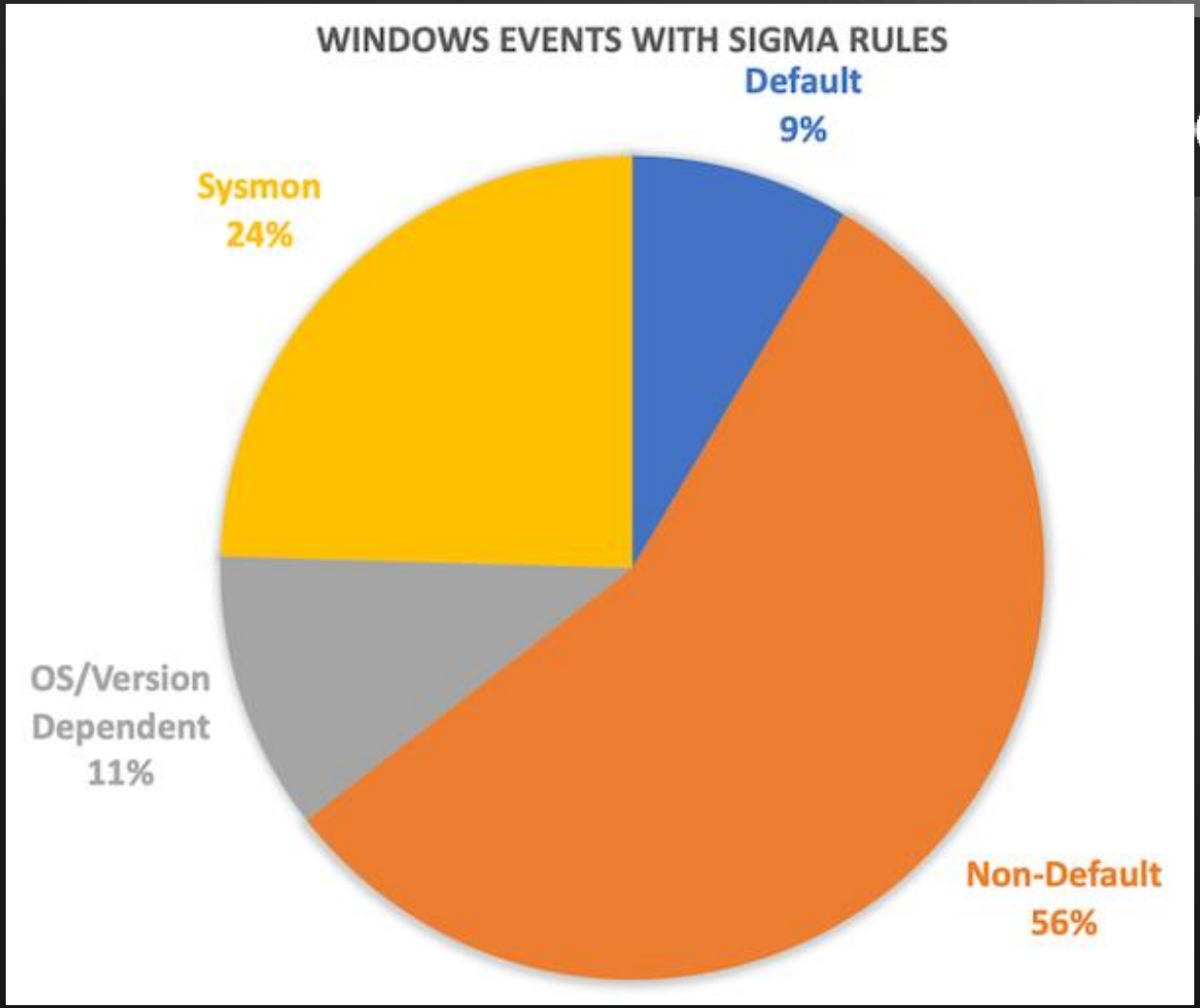
- Written in Nim so is easy to program as python but is as fast as C !
- Main developers: DustInDark, Zach Mathis, Fukusuke Takahashi
- New version 2.6.0 “HITCON Community Release” today!
- New “html-report” web report command thanks to Akira Nishikawa!
- We will explain more in detail later in this presentation



Yamato Security's Windows Event Log Configuration Guide For DFIR And Threat Hunting

https://github.com/Yamato-Security/EnableWindowsLogSettings

- Yet another guide for properly configuring Windows event log audit settings
- Very practical because it is based on real world Sigma detection rules
- Tells you what attacks you are able to detect if you enable certain settings
- Visualization of the most important Windows audit settings
- Includes a batch script to automatically configure your Windows audit settings correctly!
- Documentation: Zach Mathis and Fukusuke Takahashi


WINDOWS EVENTS WITH SIGMA RULES
Default
9%
Sysmon
24%
OS/Version
Dependent
11%
Non-Default
56%

Sigma Log Source	Channel and EID	Default Settings	Rules	Percent
process_creation	Microsoft-Windows-Sysmon/Operational 1 or Security 4688	non-default	804	49.36%
security	Security	partial	139	8.53%
ps_script	Microsoft-Windows-PowerShell/Operational 4104	partial	125	7.67%
registry_set	Microsoft-Windows-Sysmon/Operational 13	sysmon	109	6.69%
file_event	Microsoft-Windows-Sysmon/Operational 11	sysmon	96	5.89%
system	System	default	50	3.07%
image_load	Microsoft-Windows-Sysmon/Operational 7	sysmon	39	2.39%
registry_event	Microsoft-Windows-Sysmon/Operational 12/13/14	sysmon	37	2.27%
ps_module	Microsoft-Windows-PowerShell/Operational 4103	non-default	30	1.84%
network_connection	Microsoft-Windows-Sysmon/Operational 3	sysmon	29	1.78%
process_access	Microsoft-Windows-Sysmon/Operational 10	sysmon	25	1.53%
pipe_created	Microsoft-Windows-Sysmon/Operational 17/18	sysmon	14	0.86%
application	Application	default	13	0.80%
dns_query	Microsoft-Windows-Sysmon/Operational 22	sysmon	12	0.74%
ps_classic_start	Windows PowerShell 400	default	10	0.61%
create_remote_thread	Microsoft-Windows-Sysmon/Operational 8	sysmon	10	0.61%

Curation of Sigma Rules for Windows Event Logs and Hayabusa Rules Repo

https://github.com/Yamato-Security/sigma-to-hayabusa-converter
https://github.com/Yamato-Security/hayabusa-rules

- Documentation, research, conversion design: Zach Mathis
- Initial Python implementation: James Takai and Itib
- Research, current implementation: Fukusuke Takahashi
- Sigma rule “logsource” field is de-abstracted to concrete field names in new rules so it is easier to understand the rule and we can now support many built-in event logs in case Sysmon cannot be installed:
- Process Creation (Sysmon 1 => Security 4688)
- Registry Events (Sysmon 12, 13, 14) => Security 4657)
- Network Events (Sysmon 3 => Security 5156)
- New rules are curated and saved to the hayabusa-rules repository

Original Sigma Rule

```
logsource:
    category: process_creation
    product: windows
detection:
    selection:
        - Image|endswith: '.exe'
    condition: selection
```

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Sysmon Rule

```
logsource:
    category: process_creation
    product: windows
detection:
    process_creation:
        Channel: Microsoft-Windows-Sysmon/Operational
        EventID: 1
    selection:
        - Image|endswith: '.exe'
    condition: process_creation and selection
```

Built-In Event Rule

```
logsource:
    category: process_creation
    product: windows
detection:
    process_creation:
        Channel: Security
        EventID: 4688
    selection:
        - NewProcessName endswith: '.exe'
    condition: process_creation and selection
```

Sysmon 1	Sysmon 1 Example
User	DOMAIN\User
LogonId	0x1864E
ProcessId	2468
Image	C:\Windows\System32\PING.EXE
ParentProcessId	7772
CommandLine	C:\WINDOWS\system32\PING.EXE 8.8.8.8
ParentImage	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe
IntegrityLevel	High
RuleName	
UtcTime	2019-06-15 07:13:42.278
ProcessGuid	{365ABB72-9AA6-5D04-0000-00109C850F00}
FileVersion	10.0.19041.1 (WinBuild.160101.0800)
Description	TCP/IP Ping Command
Product	Microsoft® Windows® Operating System
Company	Microsoft Corporation
OriginalFileName	ping.exe
CurrentDirectory	C:\tools\Sysmon-15\
LogonGuid	{365ABB72-98E4-5D04-0000-0020A4350100}
TerminalSessionId	1
Hashes	SHA1=D4F0397F83083E…
ParentProcessGuid	{365ABB72-9972-5D04-0000-0010F0490C00}
ParentCommandLine	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe
ParentUser	DOMAIN\User

Security 4688	Security 4688 Example
SubjectUserName	User
SubjectDomainName	DOMAIN
SubjectLogonId	0x1864e
NewProcessId	0x9a4
NewProcessName	C:\Windows\System32\PING.EXE
ProcessId	0x1e5c
CommandLine	"C:\WINDOWS\system32\PING.EXE" 8.8.8.8
ParentProcessName	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe
MandatoryLabel	S-1-16-12288
TargetUserSid	S-1-0-0
TargetUserName	-
TargetDomainName	-
TargetLogonId	0x0
SubjectUserSid	S-1-5-21-2977773840-2930198165-1551093962-1000
TokenElevationType	%%1937

Author: Zach Mathis (@yamatosecurity)

Legend
Exists in both events
Needs field name conversion
Needs field name and value conversion
Only exists in one event

Sysmon 3	Sysmon 3 Example
ProcessId	3080
Image	C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe
Protocol	tcp
Initiated	true
SourceIp	10.0.0.4
SourcePort	49775
DestinationIp	93.184.215.14
DestinationPort	443
RuleName	-
UtcTime	45501.34839
ProcessGuid	{09e2f3ec-ff78-66a5-d700-000000000500}
DestinationHostname	-
DestinationPortName	https
SourceIsIpv6	false
SourceHostname	samurai.g514.mx.internal.cloudapp.net
SourcePortName	-
DestinationIsIpv6	false
User	samurai\samurai

Security 5156	Security 5156 Example
ProcessID	3080
Application	\device\harddiskvolume4\windows\system32\windowspowershell\v1.0\powershell.exe
Protocol	6
Direction	%%14593
SourceAddress	10.0.0.4
SourcePort	49775
DestAddress	93.184.215.14
DestPort	443
FilterRTID	68840
LayerName	%%14611
LayerRTID	48
RemoteUserID	S-1-0-0
RemoteMachineID	S-1-0-0

Author: Fukusuke Takahashi (@fukusuket)

Legend
Exists in both events
Needs field name conversion
Needs field name and value conversion
Only exists in one event

Curation of Sigma Rules for Windows Event Logs and Hayabusa Rules Repo

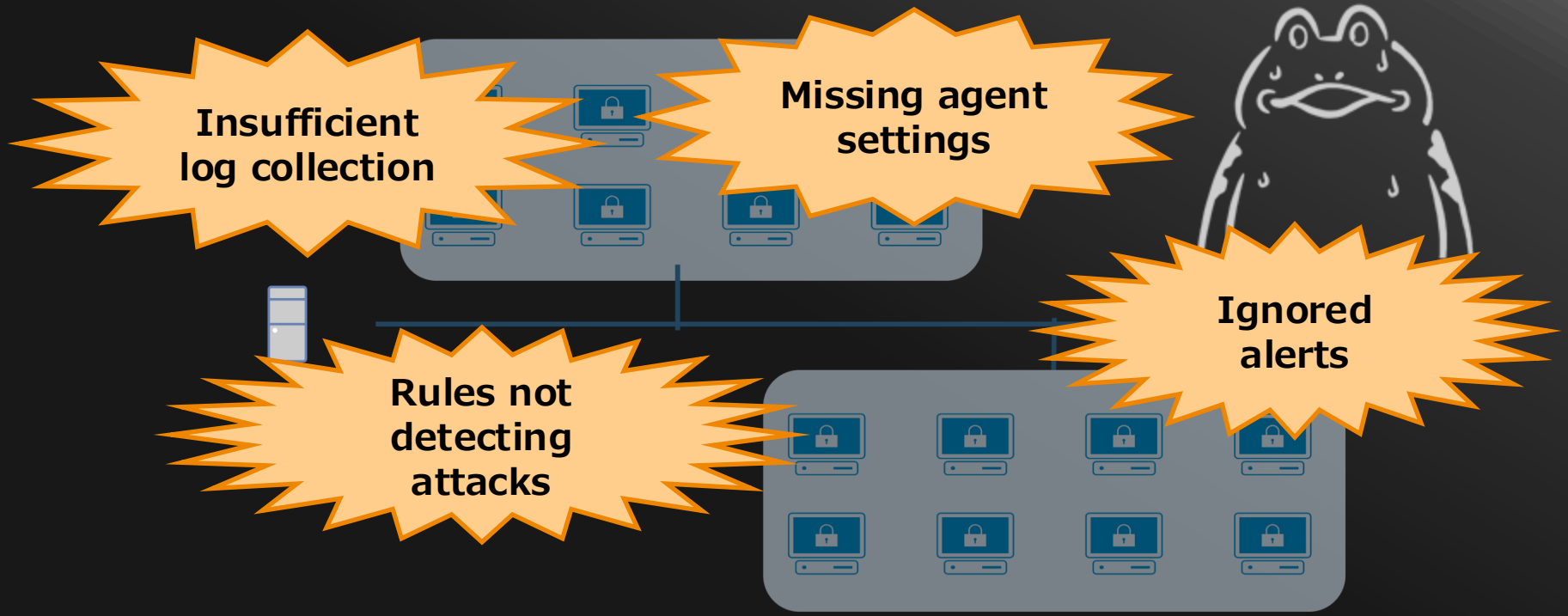
https://github.com/Yamato-Security/sigma-to-hayabusa-converter
https://github.com/Yamato-Security/hayabusa-rules

- Benefits of de-abstracting “logsource” field:
  - Can detect attacks in built-in Windows events
  - Easier to read and understand the rule
  - Easier for native Sigma-parsers to use
- For these reasons, the curated rules in the hayabusa-rules repository are used for Hayabusa and Velociraptor.
- Please read the (long) documentation for all of the details!

Scalable DFIR built with Velociraptor & Hayabusa

Environments where EDR and SIEM operations are insufficient

Environments where EDR and SIEM operations are insufficient



Scalable DFIR with Velociraptor, Hayabusa and Takajo!

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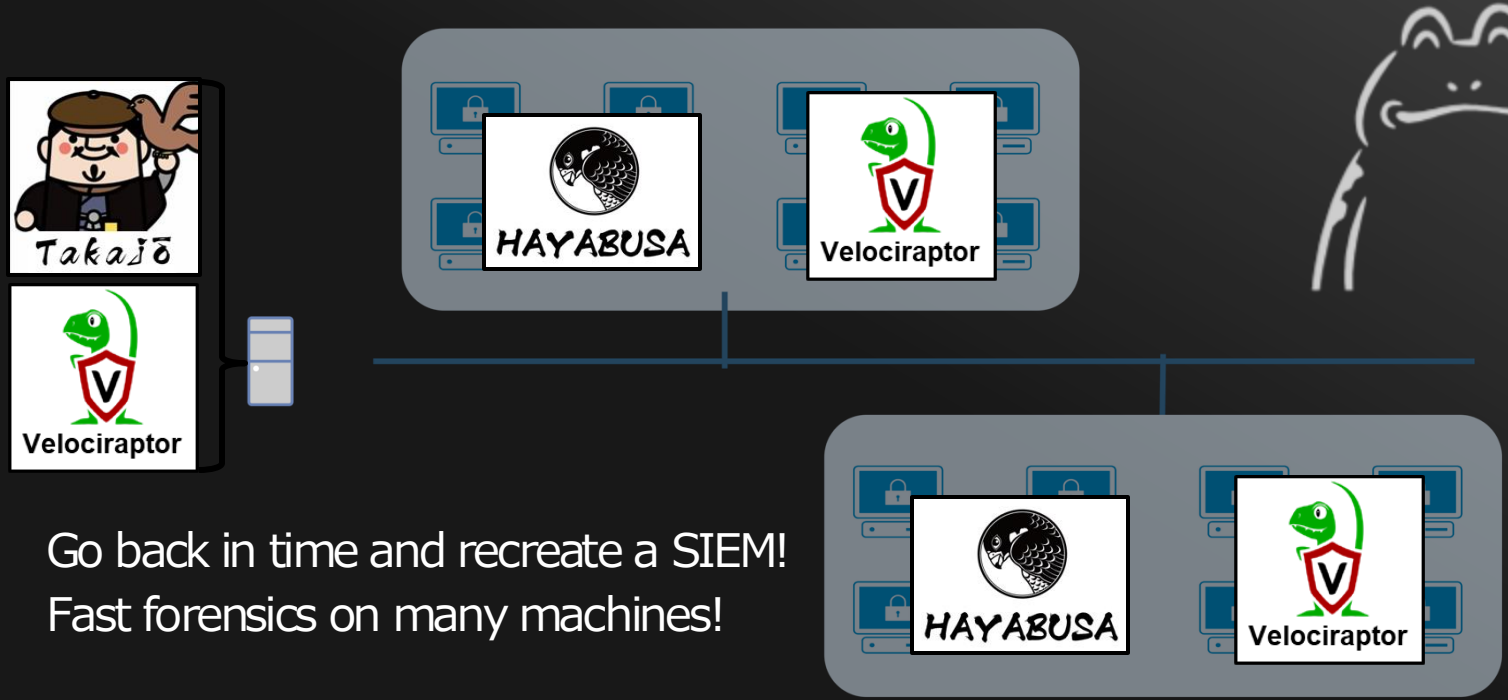
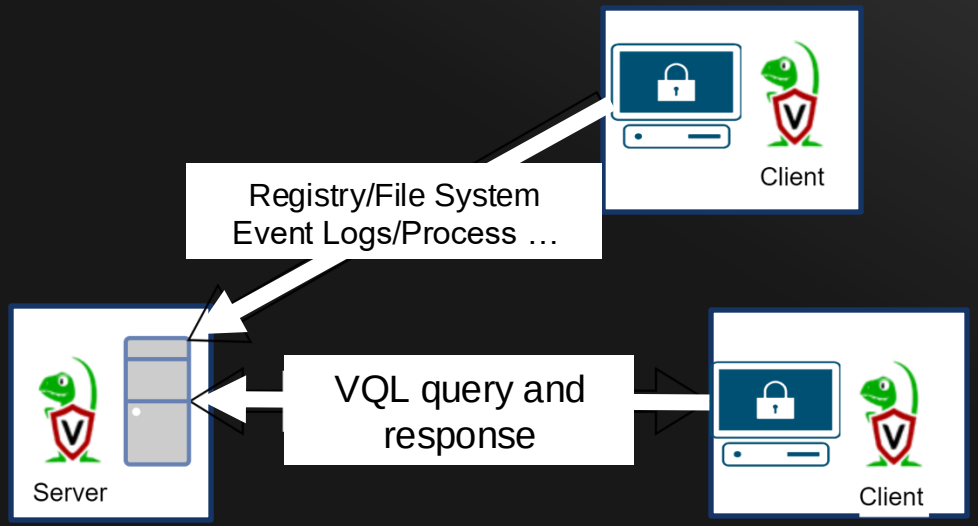


- Go back in time and recreate a SIEM!
- Fast forensics on many machines!

About Velociraptor

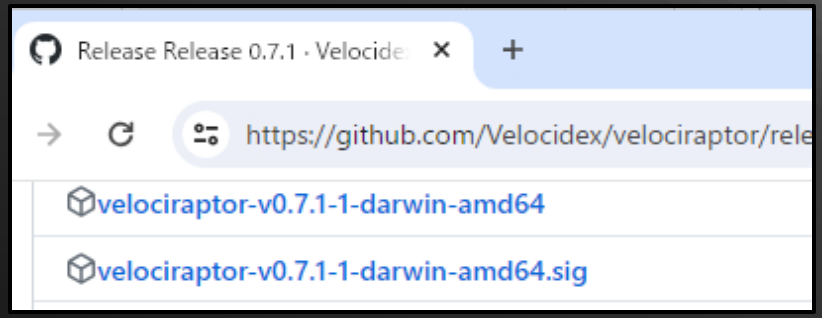
https://docs.velociraptor.app

- An OSS EDR-like DFIR tool developed by Mike Cohen and Rapid 7.
- Very good at collecting and analyzing forensic artifacts.
- Each artifact is gathered by executing “VQL” queries from serve to client.
- Leverage knowledge by importing queries (VQL) shared by the community.



Velociraptor environment setup

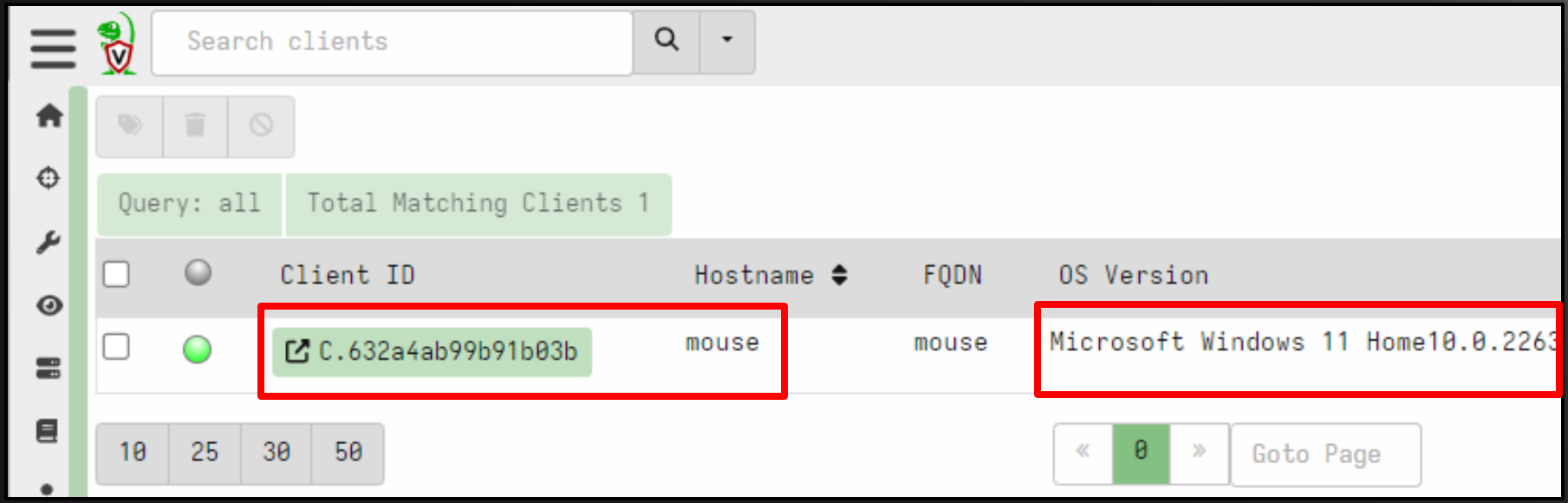
Set up in 3 easy steps:



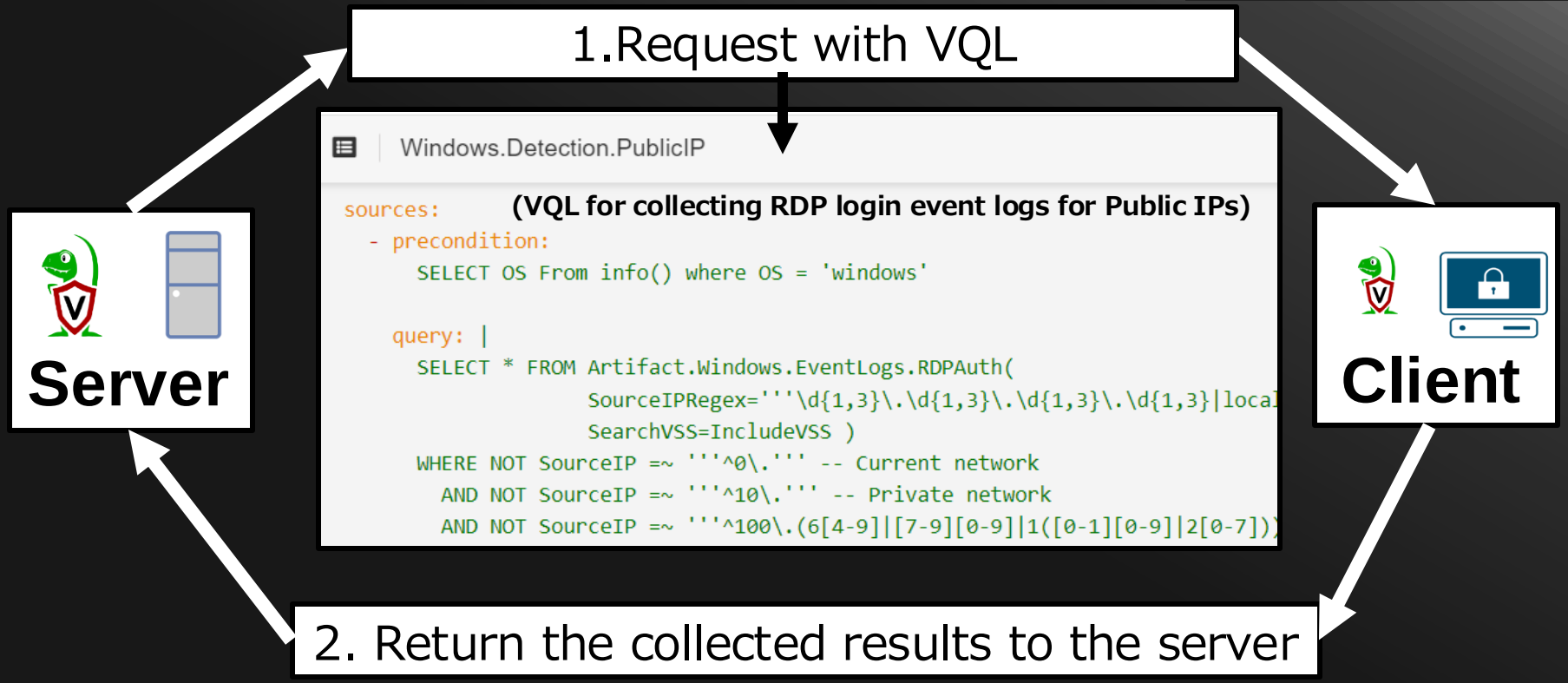
1. Server module startup
   - velociraptor gui
2. Create MSI package for distribution
   - Run Server.Utils.CreateMSI artifact
3. Distribute to client terminal
   - Distribute the MSI package created in <Step 2> using AD Group Policy, Intune, EDR, etc.

… And the setup is now complete!

Velociraptor Server Web GUI



Velociraptor Basics



Distribution, execution, and collection of Hayabusa using VQL

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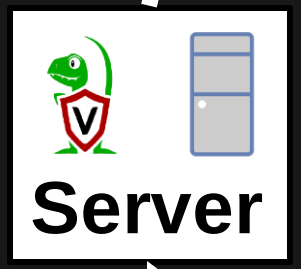
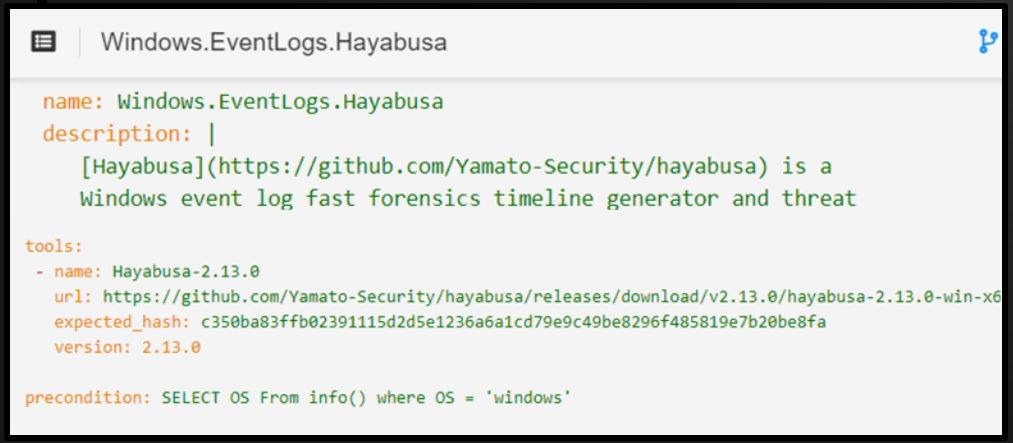
1.Request Hayabusa distribution + execution with VQL

https://docs.velociraptor.app/exchange/artifacts/pages/windows.eventlogs.hayabusa/



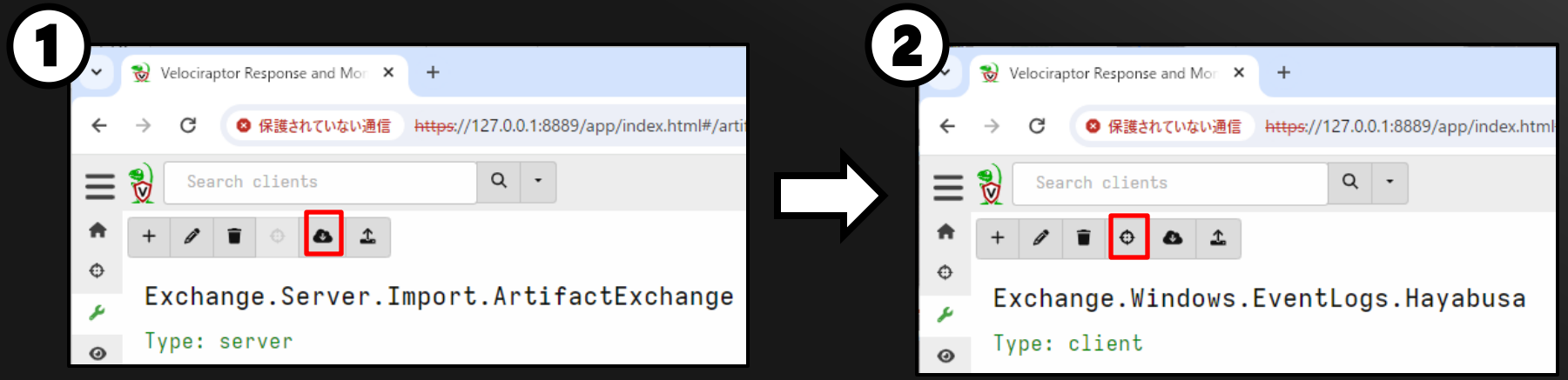


2. Return the collected results to the server

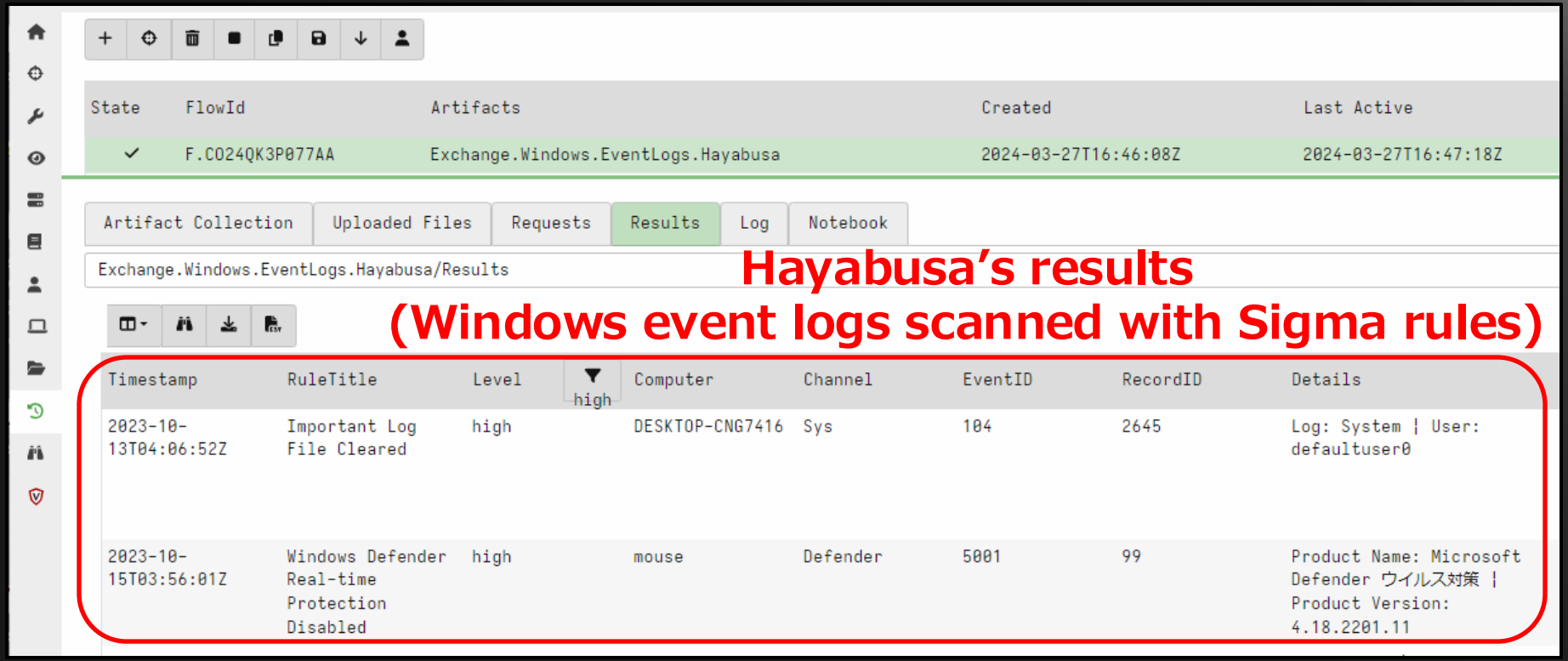
Distribution, execution, and collection of Hayabusa using VQL

Can be started in 2 easy steps!

1. Run Server.Import.ArtifactExchange to import the community VQL
2. Run Exchange.Windows.EventLogs.Hayabusa !



Collecting Windows event log timeline with Hayabusa



State	FlowId	Artifacts	Created	Last Active
✓	F.CO24QK3P077AA	Exchange.Windows.EventLogs.Hayabusa	2024-03-27T16:46:08Z	2024-03-27T16:47:18Z

Artifact Collection | Uploaded Files | Requests | Results | Log | Notebook

Exchange.Windows.EventLogs.Hayabusa/Results

Hayabusa's results
(Windows event logs scanned with Sigma rules)

Timestamp	RuleTitle	Level (high)	Computer	Channel	EventID	RecordID	Details
2023-10-13T04:06:52Z	Important Log File Cleared	high	DESKTOP-CNG7416	Sys	104	2645	Log: System ¦ User: defaultuser0
2023-10-15T03:56:01Z	Windows Defender Real-time Protection Disabled	high	mouse	Defender	5001	99	Product Name: Microsoft Defender ウイルス対策 ¦ Product Version: 4.18.2201.11

The next step...

We collected **event log analysis results** from multiple clients at once using **Velociraptor** and **Hayabusa**!

The next step is to **analyze** this all at once🤔

Easy analysis with Takajo

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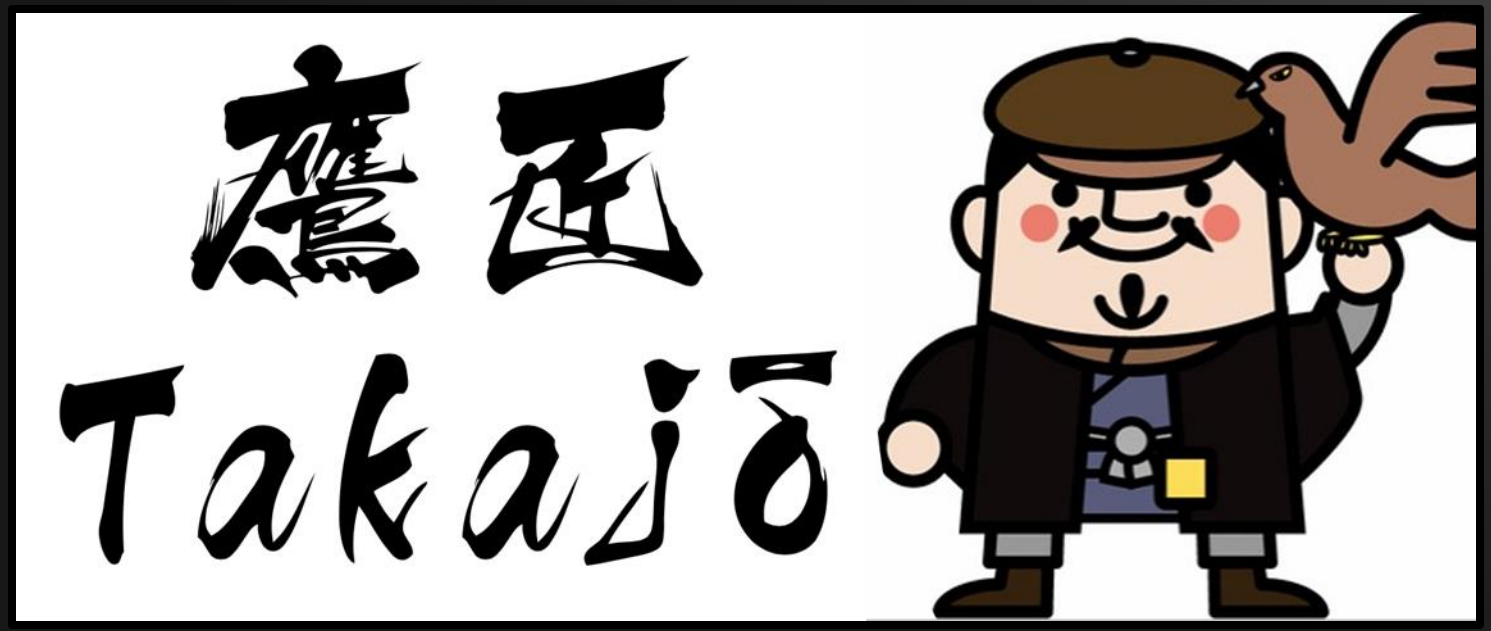
Yamato Security's automatic analysis



Collect Hayabusa timelines from multiple client at once

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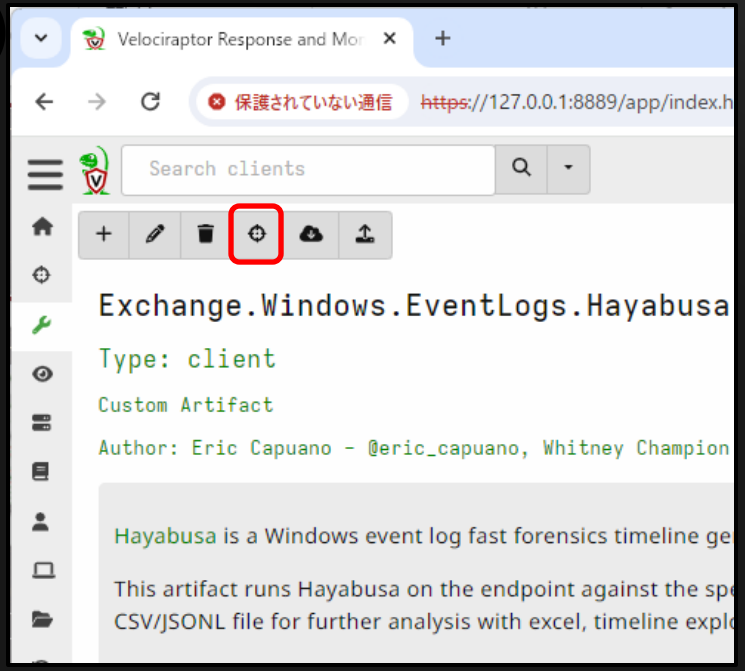
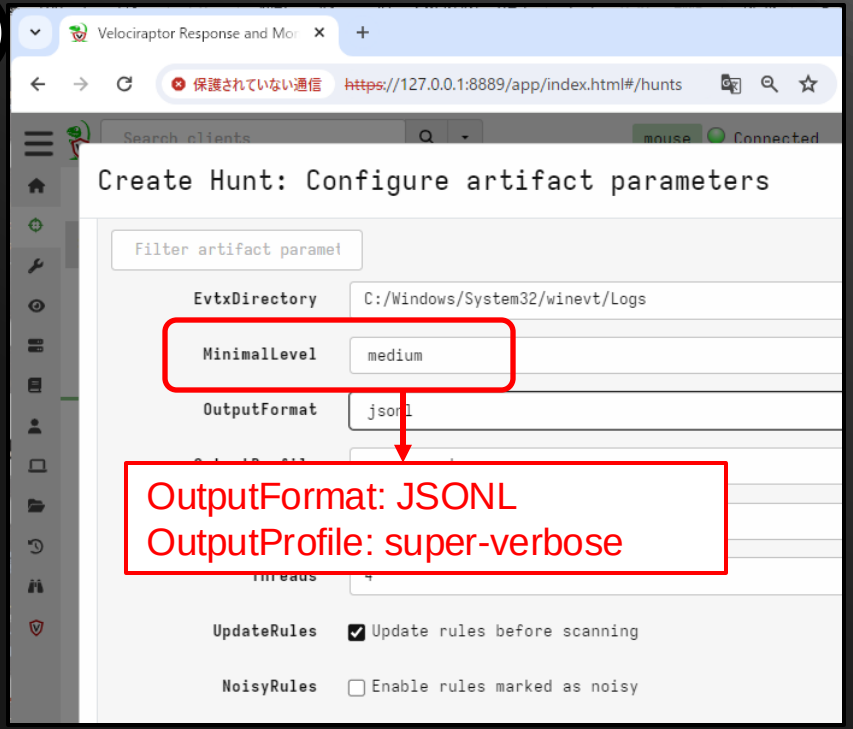
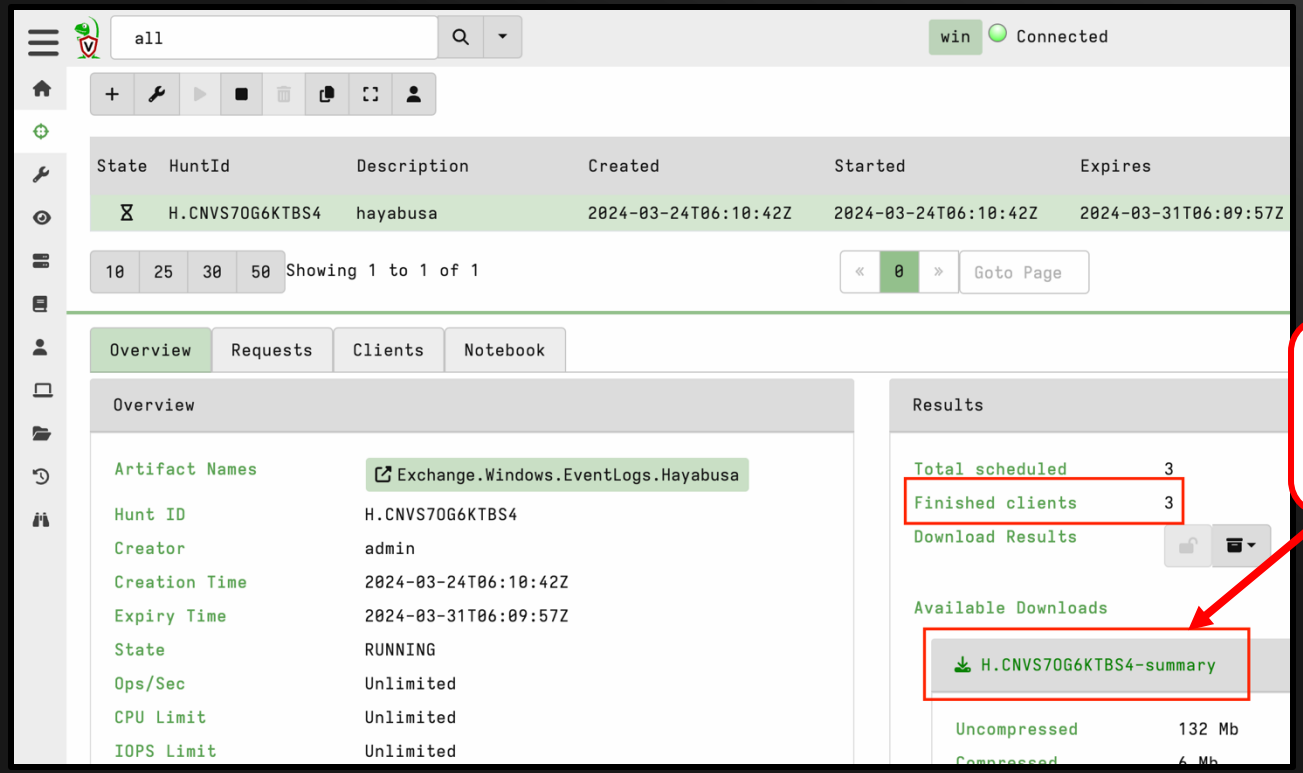
1



2



Collect Hayabusa timelines from multiple client at once



Hayabusa results for multiple clients can be downloaded in one file!

Takajo automagic command!

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‘automagic’ command !

= Batch analysis of multiple files !

Takajo's various analysis commands and
Analyze multiple files in one go!

All analyzed by Takajo automagic!

Batch analysis only requires the following two steps!

1. **Download hunt JSONL results from Velociraptor GUI**
2. takajo.exe automagic –t results.jsonl

All analyzed by Takajo automagic!

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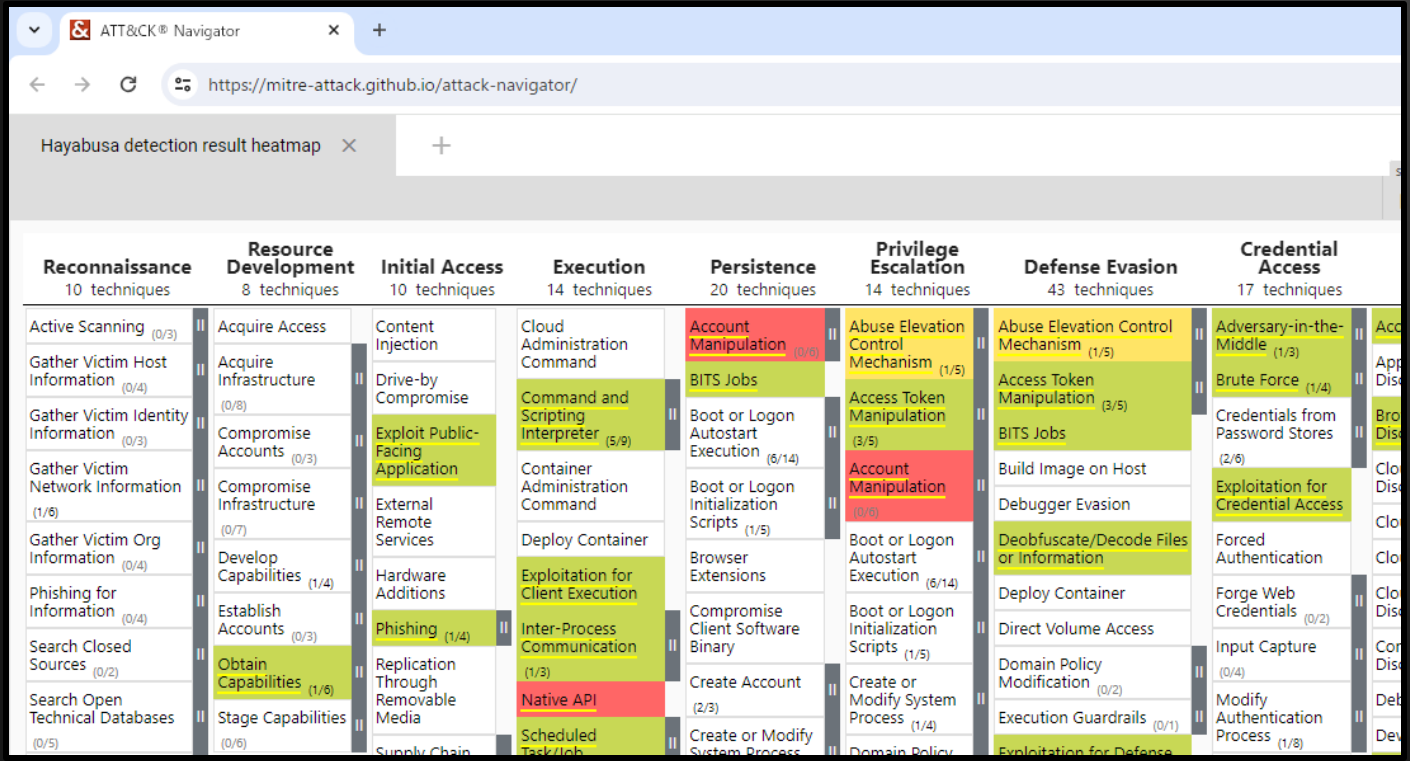
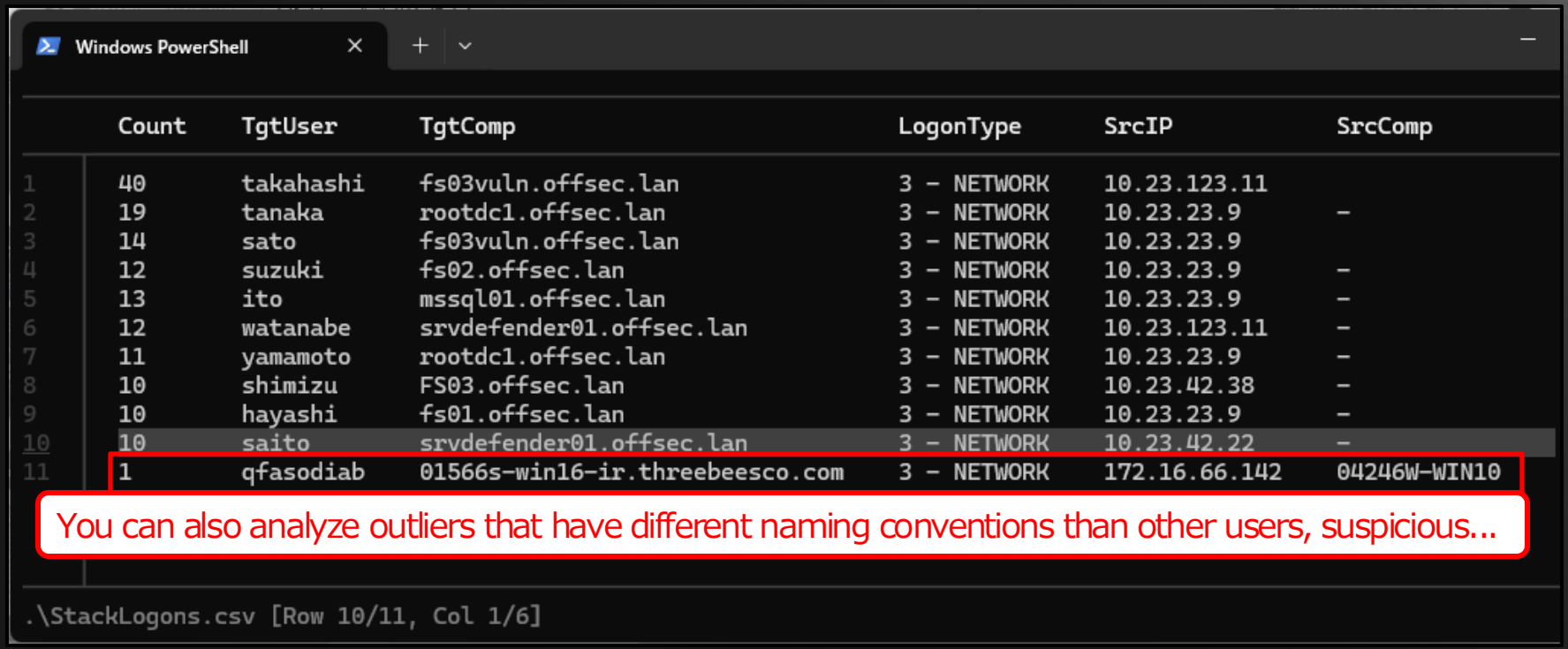
```
PS C:\tmp\takajo-2.4.0-win> .\takajo automagic -t .\timeline.jsonl -q
Started the automagic command

Automatically executes as many commands as possible and output results to a new folder.

File: .\timeline.jsonl (45.27 MB)
Counting total lines. Please wait.
Total lines: 34,940

Scanning the Hayabusa timeline. Please wait.

100%|████████████████████| 34940/34940 [ 3.0s< 0.0s,  61.55k/sec]
```

Command	Results	Saved Files
extract-scriptblocks	PowerShell logs: 108	case-1/scriptblock-logs/Summary.csv (19.92 case-1/scriptblock-logs/*.txt
list-domains	Domains: 0	case-1/ListDomains.txt (0 Bytes)
list-domains(detailed)	Domains: 2	case-1/ListDomainsDetailed.txt (16 Bytes)
list-hashes	MD5: 1,038 SHA1: 976 SHA256: 978 Import: 1,038	case-1/ListHashes-MD5.txt (4.88 KB) case-1/ListHashes-SHA1.txt (5.66 KB) case-1/ListHashes-SHA256.txt (9.02 KB) case-1/ListHashes-ImportHashes.txt (4.28 KB
list-ip-addresses	IP adddresses: 0	case-1/ListIP-Addresses.txt (0 Bytes)
stack-cmdlines	Unique cmdlines: 1,411	case-1/StackCmdlines.csv (814.13 KB)
stack-computers	Unique computers: 54	case-1/StackTargetComputers.csv (49.51 KB)
stack-computers	Unique computers: 3,571	case-1/StackSourceComputers.csv (383.32 KB)

Visualization of MITRE ATT&CK TTPs with automagic results



Stack analysis with automagic results



All analyzed by Takajo automagic!

Many other analysis results can be output with a single run of automagic:

- List Domain/IP/Hash
- Stacking Scheduled Tasks
- Stacking Users
- Stacking Service names
- Task scheduler timeline
- Logon timeline
- Process timeline
- PowerShell execution history
- MITRE ATT&CK TTPs
- and more!

New command: html-report

- 2.6.0 “HITCON Community Release” new command!
- Graphical triage with HTML Report
- Raw data generated in SQLite file
- Timeline visualization for easy detection!

```
./takajo html-report -t ../hayabusa/timeline.jsonl -o html-report -r ../hayabusa/rules
```

```
Database file created.
Creating HTML report. Please wait.

HTML report completed.

Please open "./html-report/index.html"
```

Takajo

Summary

- critical alerts (357)
- high alerts (200)
- med alerts (784)
- low alerts (26894)

Summary

Total detections

SEVERITY	NUMBER OF DETECTIONS	DETECTION RATE
critical	357	1.16%
high	200	0.65%
med	784	2.54%
low	26894	87.07%
info	2653	8.59%

Unique detections

SEVERITY	NUMBER OF DETECTIONS	DETECTION RATE
critical	3	3.85%
high	9	11.54%
med	23	29.49%
low	15	19.23%
info	28	35.90%

Dates with most total detections

SEVERITY	NUMBER OF DETECTIONS	DETECTION RATE
critical	2023-10-21	352

Takajo

Summary

- critical alerts (357)
  - ■Antivirus Exploitation Framework Detection (1)
    - mouse (1) (2023-11-04 ~ 2023-11-04)
  - ■Antivirus Password Dumper Detection (4)
    - mouse (4) (2024-01-28 ~ 2024-08-02)
  - ■Defender Alert (Severe) (352)
    - mouse (352) (2023-10-21 ~ 2024-08-04)
- high alerts (200)
  - ■Antivirus Hacktool Detection (5)
    - mouse (5) (2023-11-04 ~ 2024-08-02)
  - ■Antivirus Relevant File Paths Alerts (149)
    - mouse (149) (2023-10-22 ~ 2024-06-29)
  - ■Defender Alert (High) (3)
    - mouse (3) (2024-01-28 ~ 2024-08-02)
  - ■Important Log File Cleared (1)
    - DESKTOP-CNG7416 (1)

Summary

Total detections

SEVERITY	NUMBER OF DETECTIONS	DETECTION RATE
critical	357	1.16%
high	200	0.65%
med	784	2.54%
low	26894	87.07%
info	2653	8.59%

Unique detections

SEVERITY	NUMBER OF DETECTIONS	DETECTION RATE
critical	3	3.85%
high	9	11.54%
med	23	29.49%
low	15	19.23%
info	28	35.90%

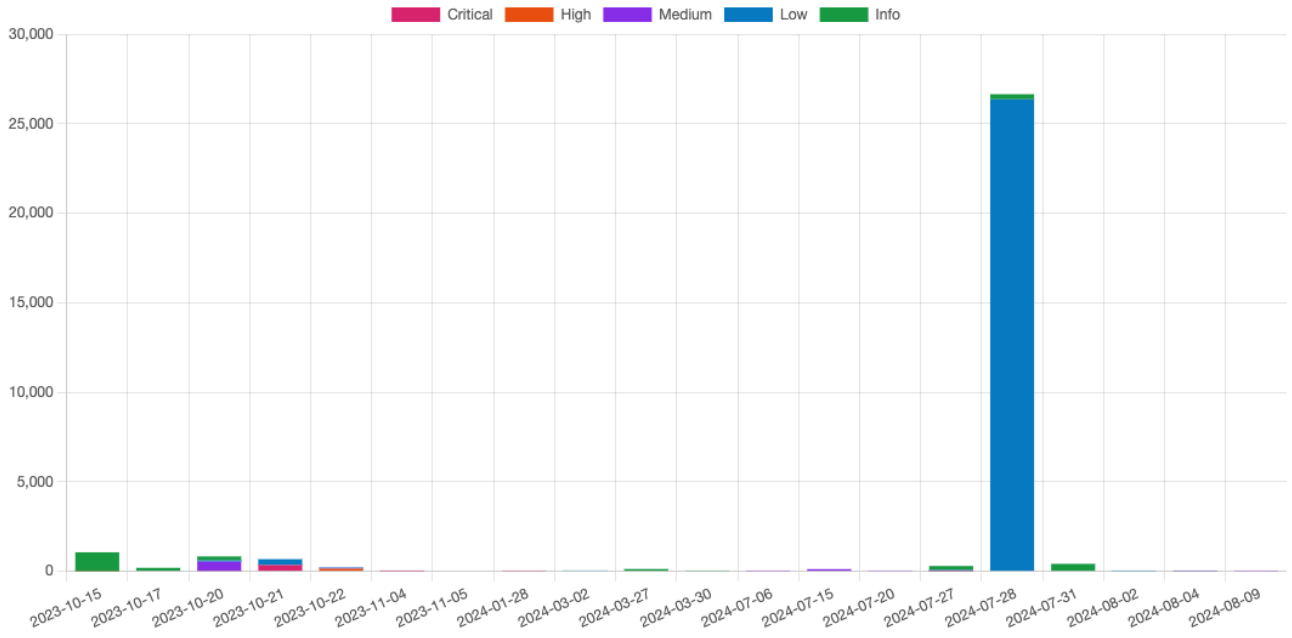
Takajo

Summary

- critical alerts (357)
- high alerts (200)
- med alerts (784)
- low alerts (26894)

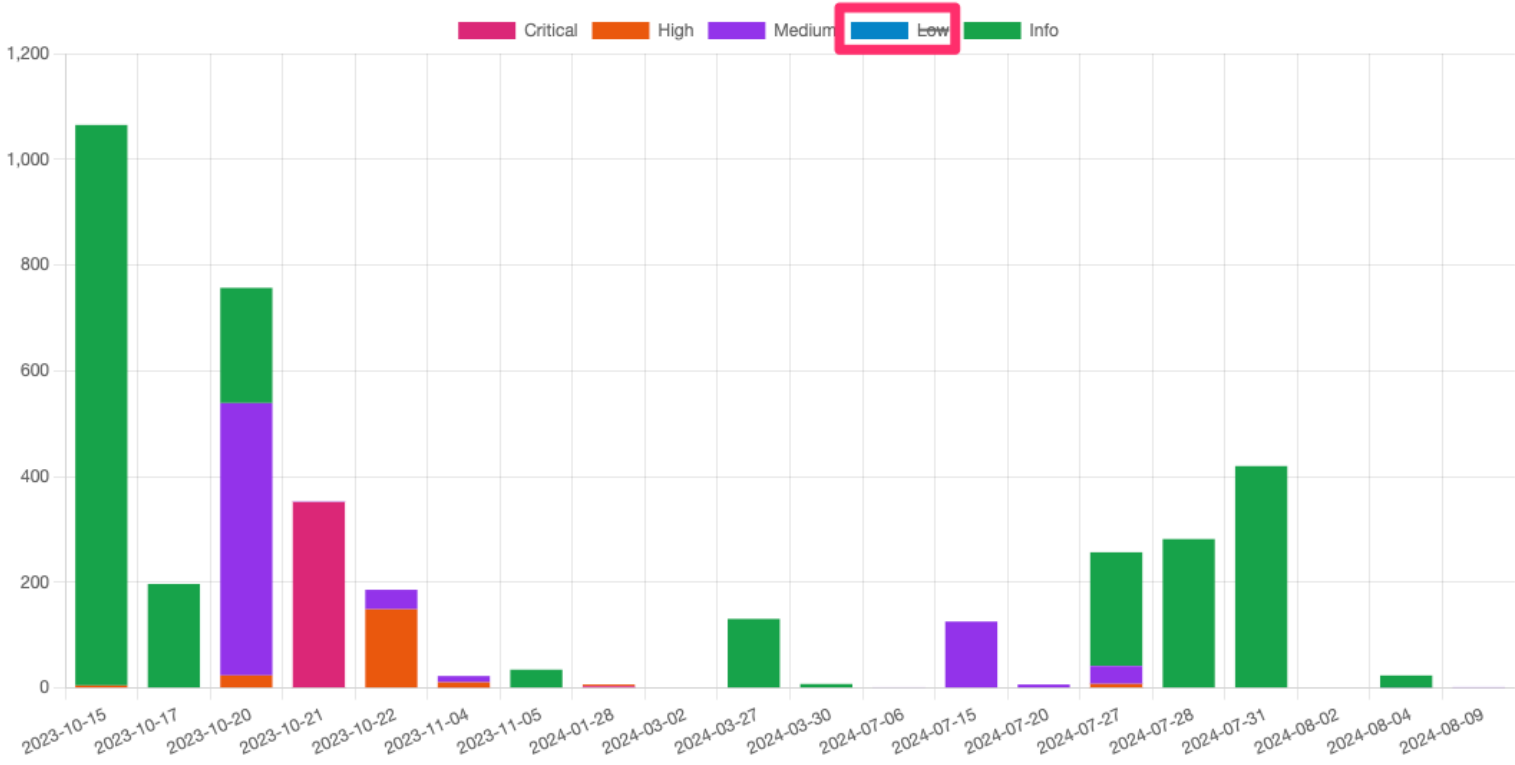
mouse

357	199	736	26893	2589
Critical	High	Medium	Low	Information



mouse

357	199	736	26893	2589
Critical	High	Medium	Low	Information



Detection Rule List

ALERT TITLE	RULE PATH	SEVERITY
Antivirus Exploitation Framework Detection	av_exploiting.yml	critical
Antivirus Password Dumper Detection	av_password_dumper.yml	critical
Defender Alert (Severe)	Defender_1116_Crit_Alert.yml	critical
Antivirus Hacktool Detection	av_hacktool.yml	high
Antivirus Relevant File Paths Alerts	av_relevant_files.yml	high
Defender Alert (High)	Defender_1116_High_Alert.yml	high
Microsoft Defender Blocked from Loading Unsigned DLL	win_security_mitigations_defender_load_unsigned_dll.yml	high
Microsoft Defender Tamper Protection Trigger	win_defender_tamper_protection_trigger.yml	high
Powershell Token Obfuscation - Powershell	posh_ps_token_obfuscation.yml	high

HTML Report Future Plans

- Create a dynamic web server
  - **SQLite access will be done dynamically through an API**
  - **This will allow better scalability for large data**

- We will still support HTML report output though
  - **Just in case it is hard to share data through a web server**

Open-source contribution and management advice

Open-source contribution advice

- If you are thinking of creating an open-source free tool or resource (guide, training, etc…), please do! Especially if you are blue team!
- There are too many offensive tools and guides and not enough blue team defensive resources
- Create something that will solve a problem you currently have for work.
  - Even if your tool or guide does not become very popular, you will still have helped yourself!
- If you don’t know what to make, start off by contributing to other open-source projects. (Fixing bugs, adding features, etc…)
  - Learn how to use GitHub, create issues/pull requests
- It does not have to be a tool, it can be just documentation, but I recommend to manage on GitHub!
- It is hard work, but very well worth it!

Open-source management advice

- Make sure there is a leader you can trust or be that leader.
- Make your project and goals clear.
- Example: “I want to create a Windows event log analyzer that is flexible and supports Sigma rules. Let’s try to present at a conference!”
- Have a diversity of members with different strengths and weaknesses.
- One person usually isn’t a master at everything. You need people with good documentation skills, presentation skills, design skills, not just programming skills.
- Doing a project with 3-5 people is probably the best number.
- Have good documentation!!!
- As this is volunteer work, don’t force anyone to do anything, but keep people motivated and make sure there are no problems. If they need to focus on work or personal things, no problem. Let them do that and maybe one day they will come back to help out again. If not, no problem either.

Open-source management advice

- Never give up! Success does not usually come right way unless you are very lucky (or have good marketing!). Consistent improvement is key. It will take time for people to notice but if you have a good tool or resource then people will promote it for you and that is the best promotion! (Aim for “being so good that people cannot ignore you.”)
- Have periodic meetings over Zoom. (Once a week in the beginning. Once every 2-3 weeks later on.) Make the meetings fun too! Not just serious talk…
- Meet up in-person some day if you have never met offline before.
- If someone contributes to your project, be sure to thank them and offer them more issues to work on if they are interested.
- Always welcome more members to help out.
- Keep maintaining it! It is always sad to see good open-source projects get abandoned and become unusable…

Future plans

Future plans

- Analysis with AI
  - ”Analyze the Hayabusa and Takajo results and write a 10-page forensics report” => “OK! No problem”
  - Challenges:
    - Needs to keep all of the data local
    - Needs to be accurate
    - Current AI does not produce long reports so we would first have to script things to ask many questions
- Analysis with machine learning (UEBA-type detection)
  - Example: Find any abnormal logins
- Suzaku: A Sigma-based event log analyzer for cloud logs (AWS, Azure, GCP)
- Please let us know if you want to help out with any of these!

Thank you so much for listening!

If you like our tools, please consider supporting us with a GitHub star!

Please give us feedback on what we can do better. Please also contact us if you want to help out.

Check out the latest release information on X-Twitter!

Follow:
@SecurityYamato

Thank you for your attention!