Must Have SOC Analysts customized cookbook

Leverage automation and threat intel data analysis for prioritizing detection

Report customized for manufacturing sector

This report aims at providing statical analysis of TTPs (Tactics, Techniques and Procedures) used by threat actors targetting manufacturing sector in order to help SOC in operationalizing their mission.

While contextualising, gathering and analysing available data for a given sector, the overall objective is to introduce a different threat perspective for SOC teams - a perspective based on all known (and shared) threat actor behaviours. The main idea is to provide to SOC team a dedicated baseline to operationalize their efficiency in their daily job from collections to remediations.

The 1st chapter enumerates the threat actors based on MITRE data sources.
The 2nd chapter gives statistics about TTPs and data sources to collect in order to maximise detection capability (beware of bias).
The 3rd and last chapter gives detailed information on how to detect the most used techniques.
This report is AUTOMATICALLY generated based on MITRE ATT&CK and OSSEM data.

MITRE ATT&CK (https://attack.mitre.org) is a globally-accessible knowledge base of adversary tactics and techniques based on real-world observations. The ATT&CK knowledge base is used as a foundation for the development of specific threat models and methodologies in the private sector, in government, and in the cybersecurity product and service community.
With the creation of ATT&CK, MITRE is fulfilling its mission to solve problems for a safer world - by bringing communities together to develop more effective cybersecurity. ATT&CK is open and available to any person or organization for use at no charge.

The OSSEM (Open Source Security Events Metadata / https://github.com/OTRF/OSSEM) is a community-led project that focuses primarily on the documentation and standardization of security event logs from diverse data sources and operating systems. Security events are documented in a dictionary format and can be used as a reference while mapping data sources to data analytics used to validate the detection of adversarial techniques. In addition, the project provides a common data model (CDM) that can be used for data engineers during data normalization procedures to allow security analysts to query and analyze data across diverse data sources. Finally, the project also provides documentation about the structure and relationships identified in specific data sources to facilitate the development of data analytics.

This is a beta version (work still in progress).
Good enough for now.
May this work be of help for you.

Feedbacks, contributions and enrichments are welcome :)
Thomas Billaut <thomas.billaut@protonmail.com>
https://github.com/tbillaut

1. Threat Groups

This chapter aims at giving the list of threat groups targetting the manufacturing sector.
Data are extracted from MITRE ATT&CK.
Information and citation links can be retrieved from MITRE ATTACK website (https://attack.mitre.org/groups).

1.1 Fox Kitten

Alias : Fox Kitten, UNC757, PIONEER KITTEN, Parisite

Fox Kitten (https://attack.mitre.org/groups/G0117) is threat actor with a suspected nexus to the Iranian government that has been active since at least 2017 against entities in the Middle East, North Africa, Europe, Australia, and North America. Fox Kitten (https://attack.mitre.org/groups/G0117) has targeted multiple industrial verticals including oil and gas, technology, government, defense, healthcare, manufacturing, and engineering.
Citation: ClearkSky Fox Kitten February 2020
Citation: CrowdStrike PIONEER KITTEN August 2020
Citation: Dragos PARISITE
Citation: ClearSky Pay2Kitten December 2020

1.2 APT-C-36

Alias : APT-C-36, Blind Eagle

[APT-C-36](https://attack.mitre.org/groups/G0099) is a suspected South America espionage group that has been active since at least 2018. The group mainly targets Colombian government institutions as well as important corporations in the financial sector, petroleum industry, and professional manufacturing.
Citation: QiAnXin APT-C-36 Feb2019

1.3 SilverTerrier

Alias : SilverTerrier

SilverTerrier (https://attack.mitre.org/groups/G0083) is a Nigerian threat group that has been seen active since 2014. SilverTerrier (https://attack.mitre.org/groups/G0083) mainly targets organizations in high technology, higher education, and manufacturing.
Citation: Unit42 SilverTerrier 2018
Citation: Unit42 SilverTerrier 2016

1.4 APT19

Alias : APT19, Codoso, C0d0so0, Codoso Team, Sunshop Group

APT19 (https://attack.mitre.org/groups/G0073) is a Chinese-based threat group that has targeted a variety of industries, including defense, finance, energy, pharmaceutical, telecommunications, high tech, education, manufacturing, and legal services. In 2017, a phishing campaign was used to target seven law and investment firms.
Citation: FireEye APT19

Some analysts track APT19 (https://attack.mitre.org/groups/G0073) and Deep Panda (https://attack.mitre.org/groups/G0009) as the same group, but it is unclear from open source information if the groups are the same.
Citation: ICIT China's Espionage Jul 2016
Citation: FireEye APT Groups
Citation: Unit 42 C0d0so0 Jan 2016

1.5 Leviathan

Alias : Leviathan, MUDCARP, Kryptonite Panda, Gadolinium, BRONZE MOHAWK, TEMP.Jumper, APT40, TEMP.Periscope

Leviathan (https://attack.mitre.org/groups/G0065) is a Chinese state-sponsored cyber espionage group that has been attributed to the Ministry of State Security's (MSS) Hainan State Security Department and an affiliated front company.
Citation: CISA AA21-200A APT40 July 2021

Active since at least 2009, Leviathan (https://attack.mitre.org/groups/G0065) has targeted the following sectors: academia, aerospace/aviation, biomedical, defense industrial base, government, healthcare, manufacturing, maritime, and transportation across the US, Canada, Europe, the Middle East, and Southeast Asia.
Citation: CISA AA21-200A APT40 July 2021
Citation: Proofpoint Leviathan Oct 2017
Citation: FireEye Periscope March 2018

1.6 BRONZE BUTLER

Alias : BRONZE BUTLER, REDBALDKNIGHT, Tick

BRONZE BUTLER (https://attack.mitre.org/groups/G0060) is a cyber espionage group with likely Chinese origins that has been active since at least 2008. The group primarily targets Japanese organizations, particularly those in government, biotechnology, electronics manufacturing, and industrial chemistry.
Citation: Trend Micro Daserf Nov 2017
Citation: Secureworks BRONZE BUTLER Oct 2017
Citation: Trend Micro Tick November 2019

1.7 menuPass

Alias : menuPass, Cicada, POTASSIUM, Stone Panda, APT10, Red Apollo, CVNX, HOGFISH

menuPass (https://attack.mitre.org/groups/G0045) is a threat group that has been active since at least 2006. Individual members of menuPass (https://attack.mitre.org/groups/G0045) are known to have acted in association with the Chinese Ministry of State Security's (MSS) Tianjin State Security Bureau and worked for the Huaying Haitai Science and Technology Development Company.
Citation: DOJ APT10 Dec 2018
Citation: District Court of NY APT10 Indictment December 2018

menuPass (https://attack.mitre.org/groups/G0045) has targeted healthcare, defense, aerospace, finance, maritime, biotechnology, energy, and government sectors globally, with an emphasis on Japanese organizations. In 2016 and 2017, the group is known to have targeted managed IT service providers (MSPs), manufacturing and mining companies, and a university.
Citation: Palo Alto menuPass Feb 2017
Citation: Crowdstrike CrowdCast Oct 2013
Citation: FireEye Poison Ivy
Citation: PWC Cloud Hopper April 2017
Citation: FireEye APT10 April 2017
Citation: DOJ APT10 Dec 2018
Citation: District Court of NY APT10 Indictment December 2018

1.8 Threat Group-3390

Alias : Threat Group-3390, Earth Smilodon, TG-3390, Emissary Panda, BRONZE UNION, APT27, Iron Tiger, LuckyMouse

[Threat Group-3390](https://attack.mitre.org/groups/G0027) is a Chinese threat group that has extensively used strategic Web

compromises to target victims.
Citation: Dell TG-3390

The group has been active since at least 2010 and has targeted organizations in the aerospace, government, defense, technology, energy, manufacturing and gambling/betting sectors.
Citation: SecureWorks BRONZE UNION June 2017
Citation: Securelist LuckyMouse June 2018
Citation: Trend Micro DRBControl February 2020

1.9 APT18

Alias : APT18, TG-0416, Dynamite Panda, Threat Group-0416

APT18 (https://attack.mitre.org/groups/G0026) is a threat group that has operated since at least 2009 and has targeted a range of industries, including technology, manufacturing, human rights groups, government, and medical.
Citation: Dell Lateral Movement

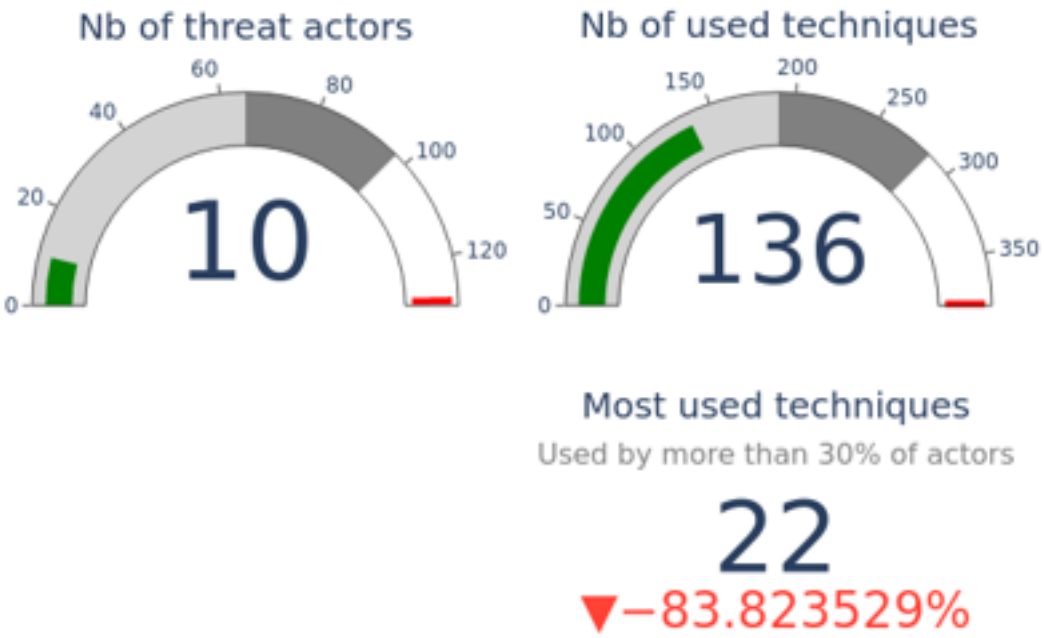
1.10 Axiom

Alias : Axiom, Group 72

Axiom (https://attack.mitre.org/groups/G0001) is a suspected Chinese cyber espionage group that has targeted the aerospace, defense, government, manufacturing, and media sectors since at least 2008. Some reporting suggests a degree of overlap between Axiom (https://attack.mitre.org/groups/G0001) and Winnti Group (https://attack.mitre.org/groups/G0044) but the two groups appear to be distinct based on differences in reporting on TTPs and targeting.
Citation: Kaspersky Winnti April 2013
Citation: Kaspersky Winnti June 2015
Citation: Novetta Winnti April 2015

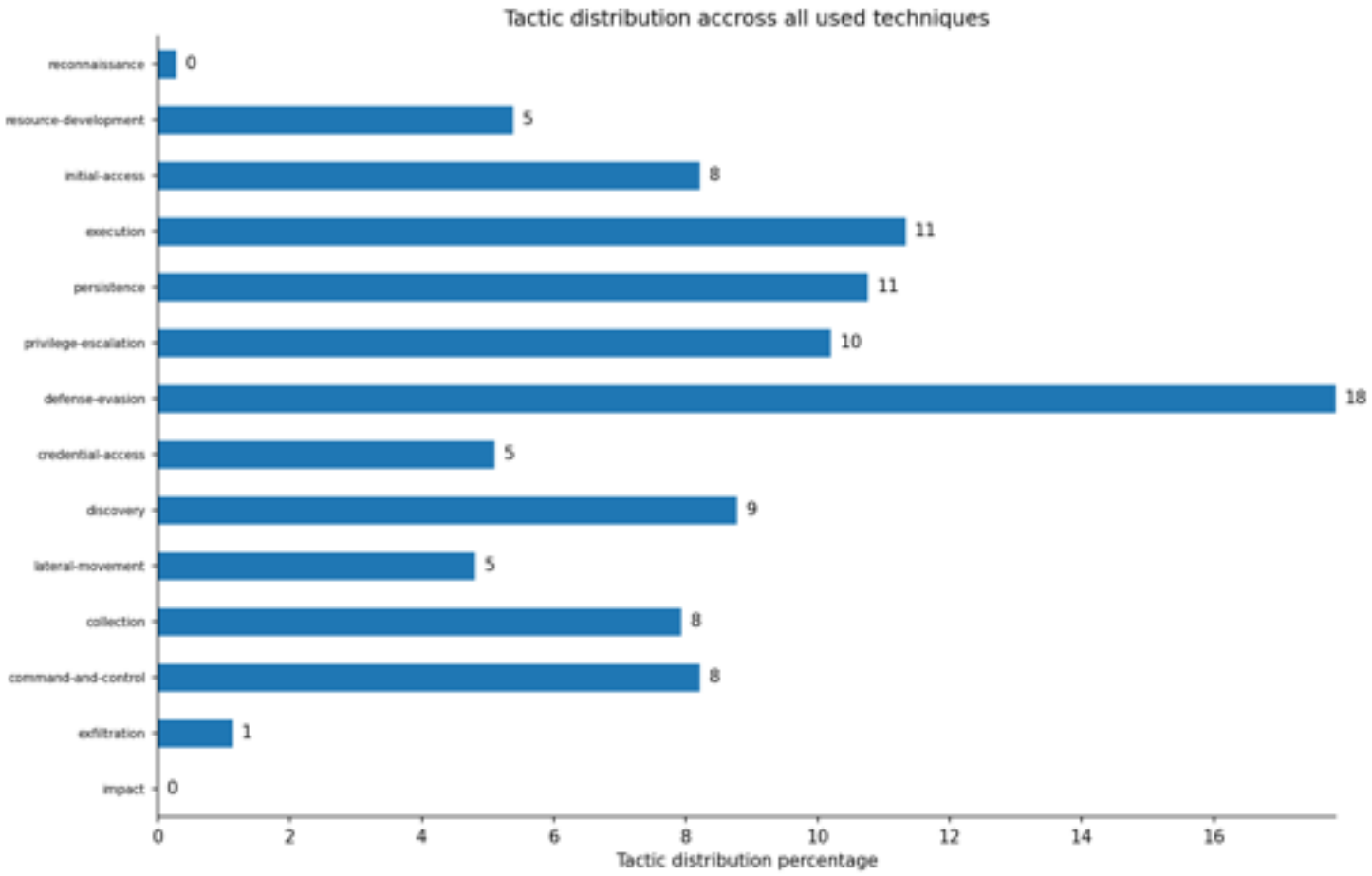
2. What TTPs to prioritize for detection ?

This chapter aims at providing some statistics about tactics and techniques used by the previous threat actors. While understanding most used and share techniques, SOC analysts should be able to focus on most used tactics and techniques. And possibly adopt a new perspective of the priority.



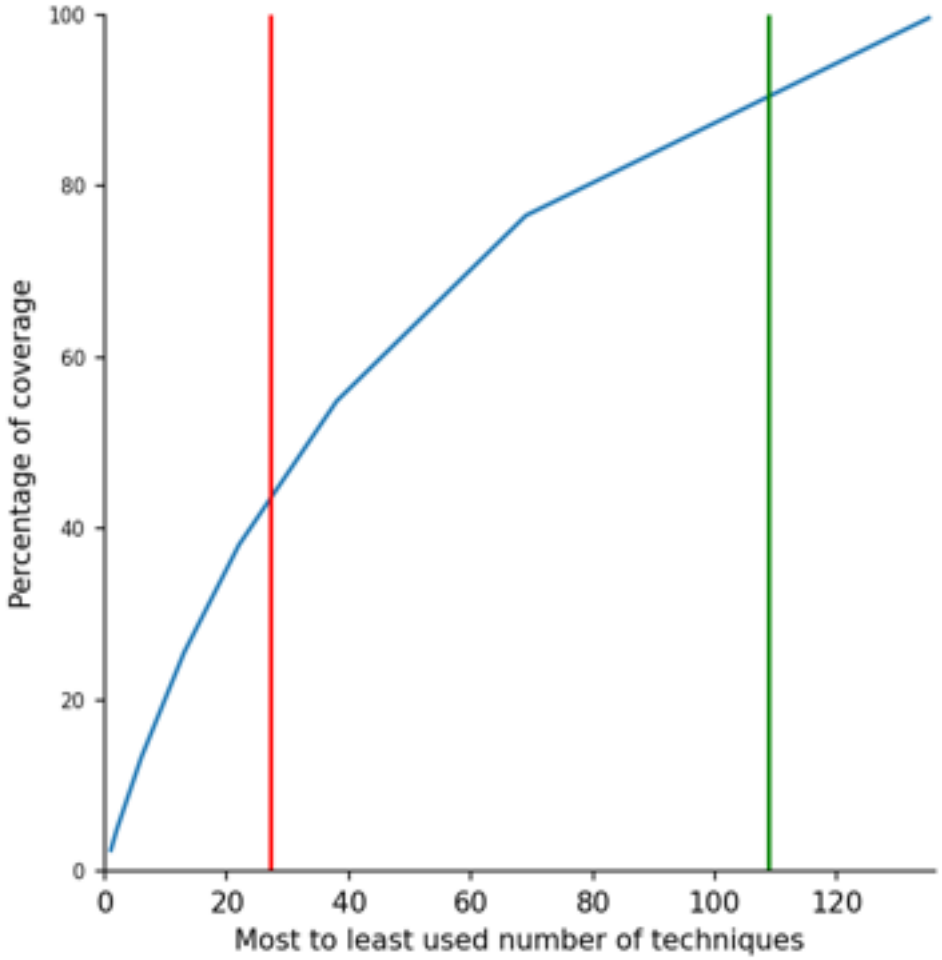
2.1 Tactics distribution

The following chart gives the tactics distribution of all used techniques used by the threat actors.
This representation may offer a new perpective for SOC teams concerning detection capabilities.



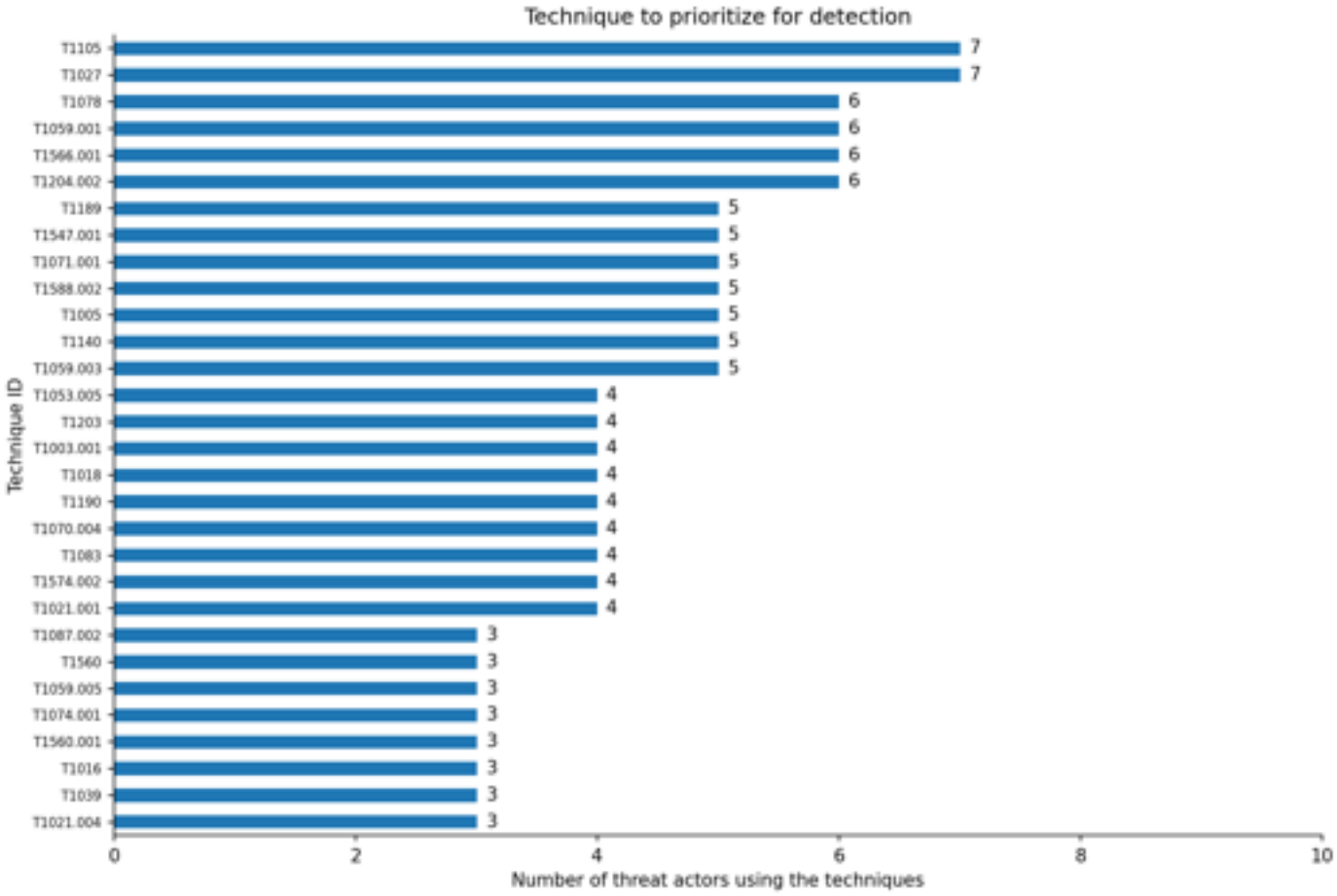
2.2 Technique distribution

The following graph gives the techniques distribution accross all of those threat actors.
It aims at understanding how many techniques need to be covered in order to have the suitable level of detection.
The profile can be compared to the pareto model where covering 20% of the most used techniques would covered 80% of the total of techniques used.
The red line gives the number of techniques corresponding to 20% of total techniques used.
The green line gives the number of techniques corresponding to 80% of total techniques used.



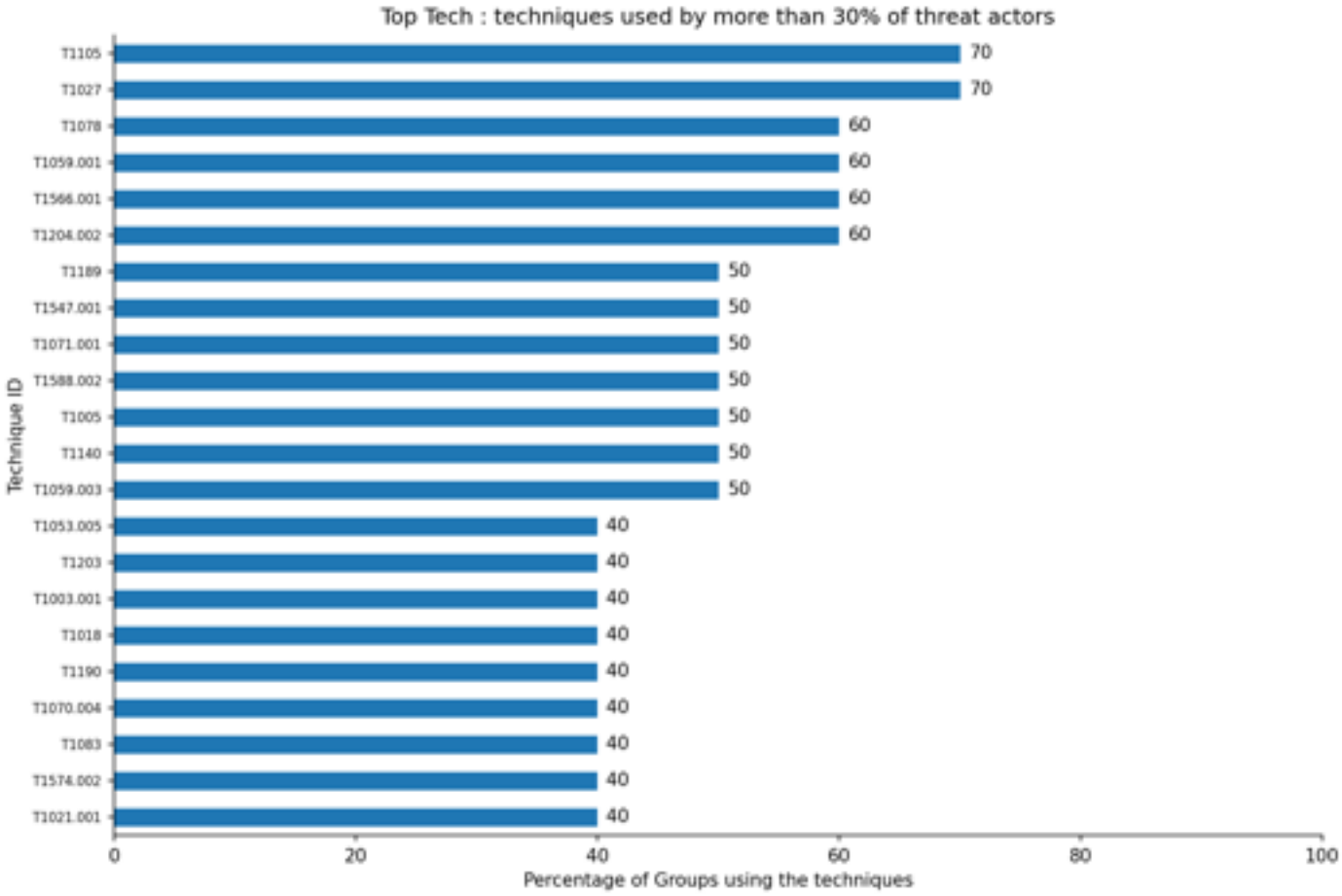
2.3 Top 30 most used techniques

The following graph gives the top 30 techniques that are most used by all of those threat actors.
For each most used technique, the number of group using this technique is given.



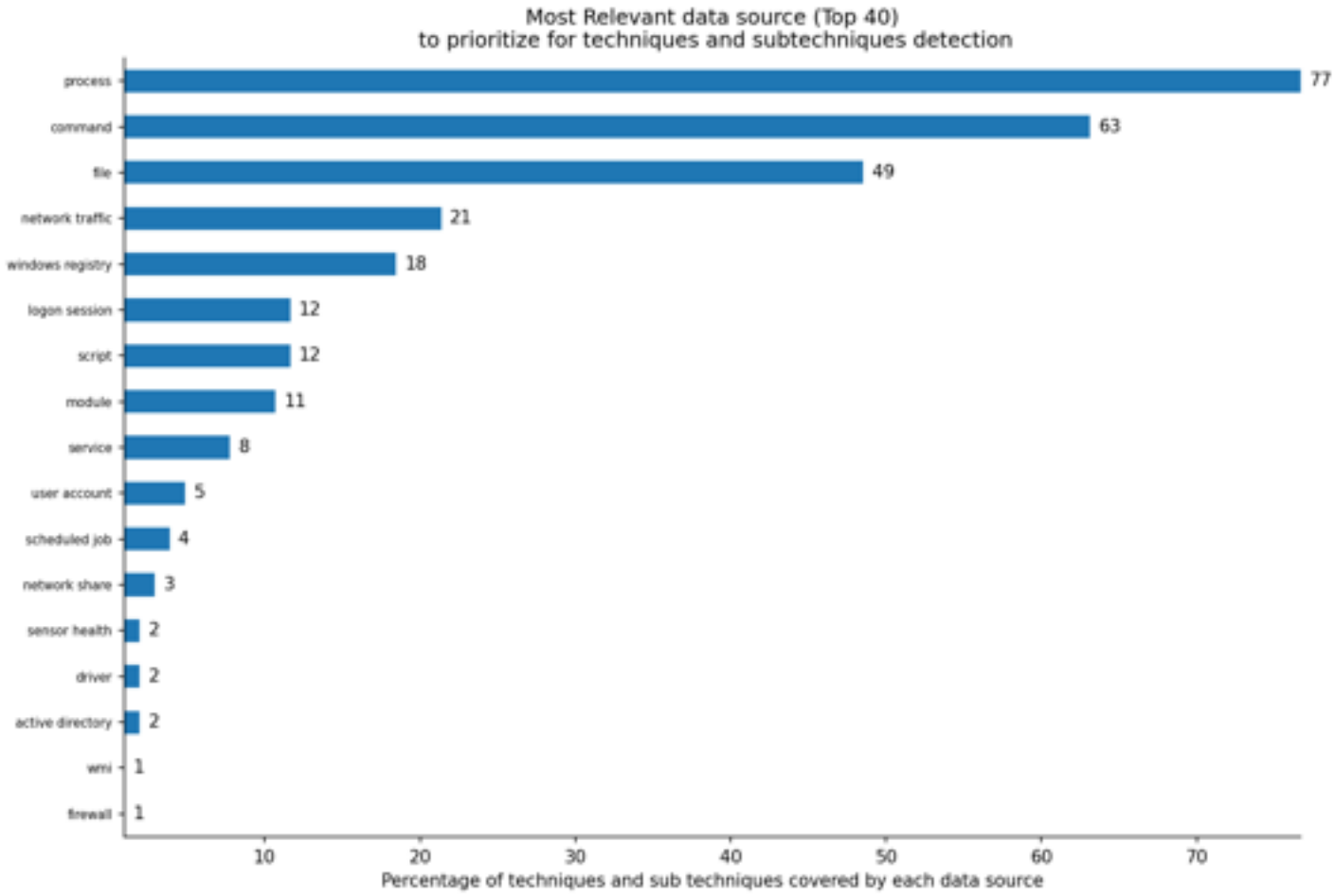
2.4 The Must be covered techniques

The following graph is just a focus of the previous one by giving the techniques that are used by almsot 30% of the threat actors. For each technique, the percentage of threat actors using this technique is given.



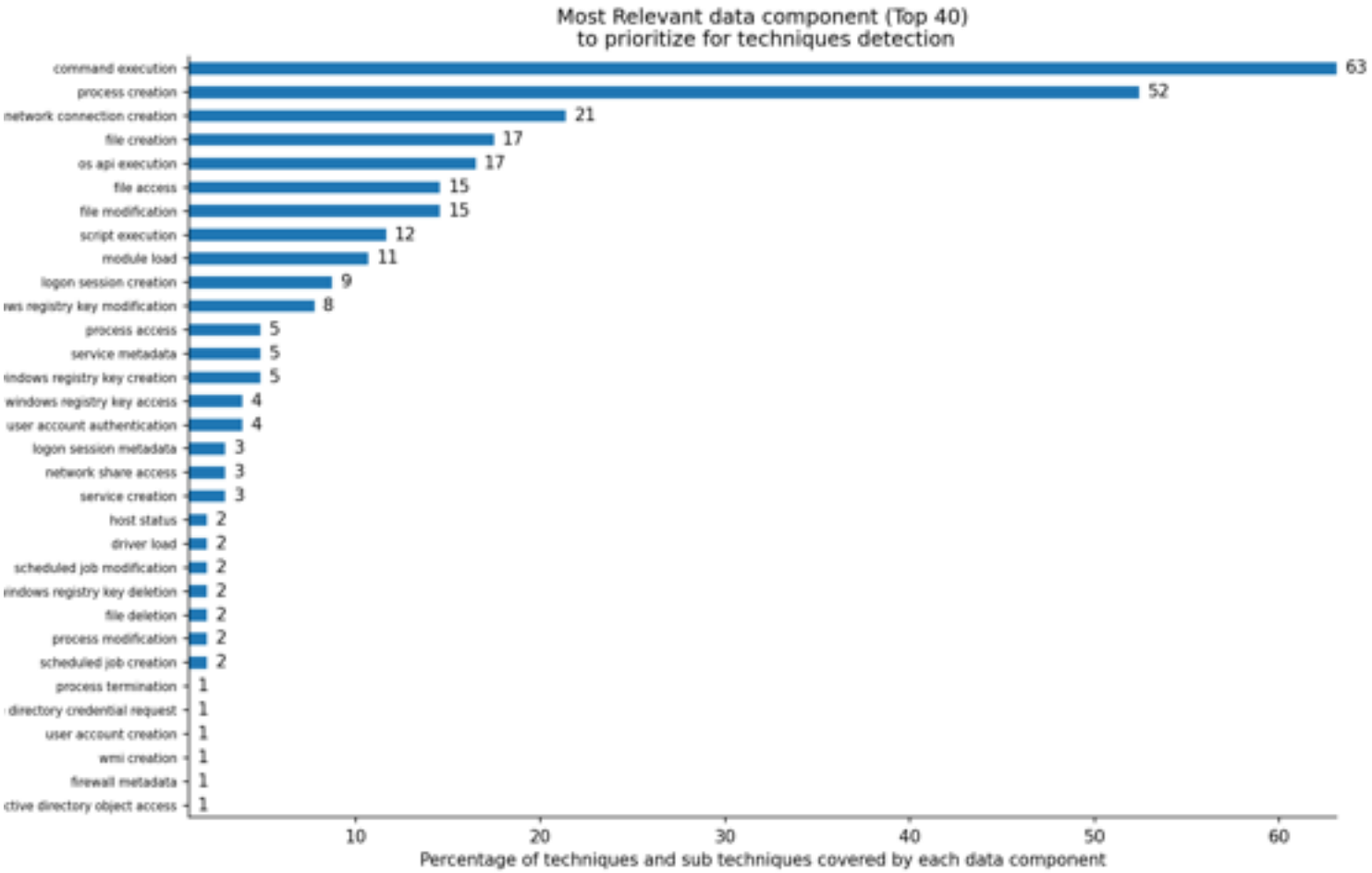
2.5 Top data source to collect for detections

The following graph gives the top 40 data source to collect in order to be able to detect the techniques used by threat actors. Please see annexes for reference.



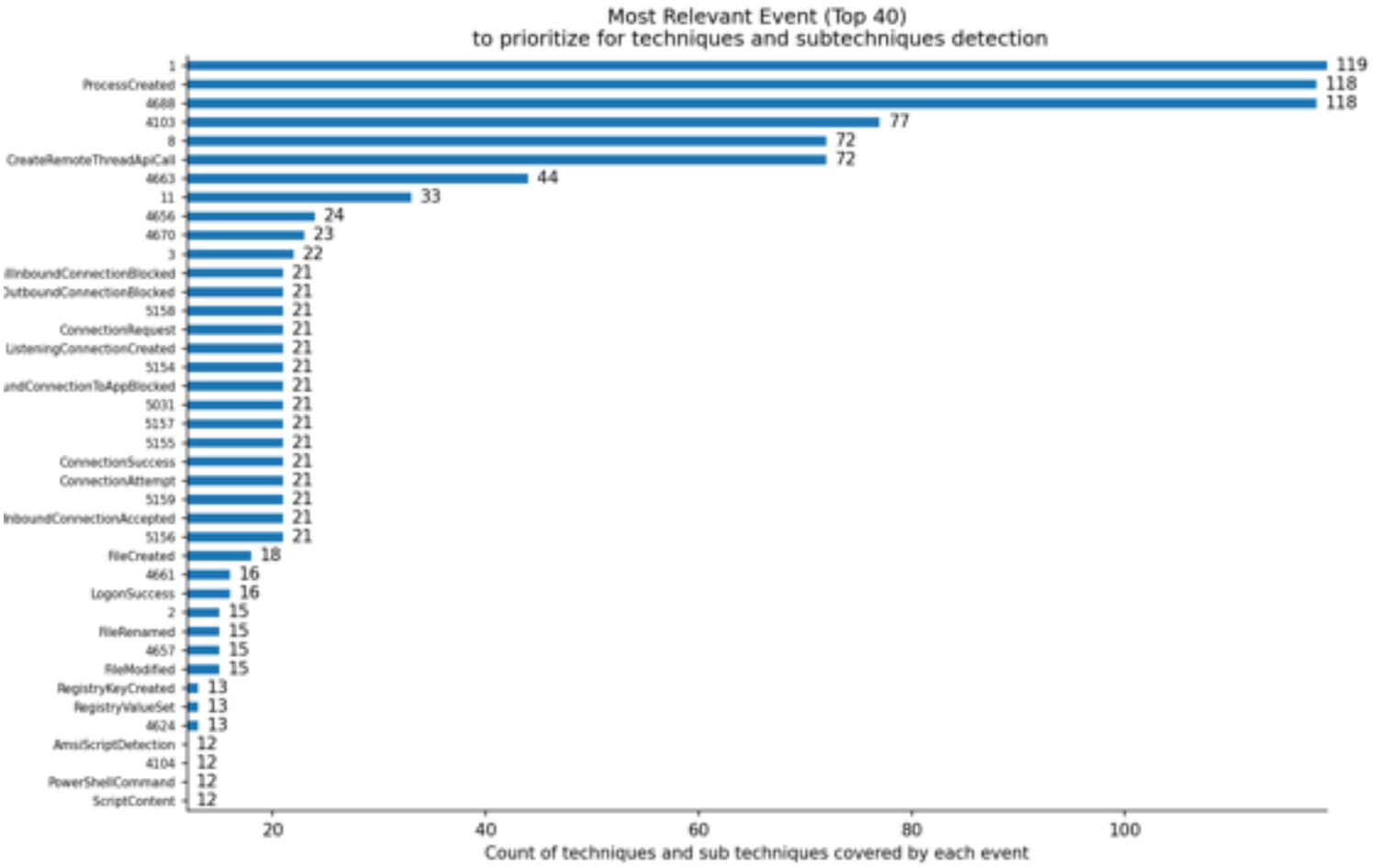
2.6 Top data component to collect for detections

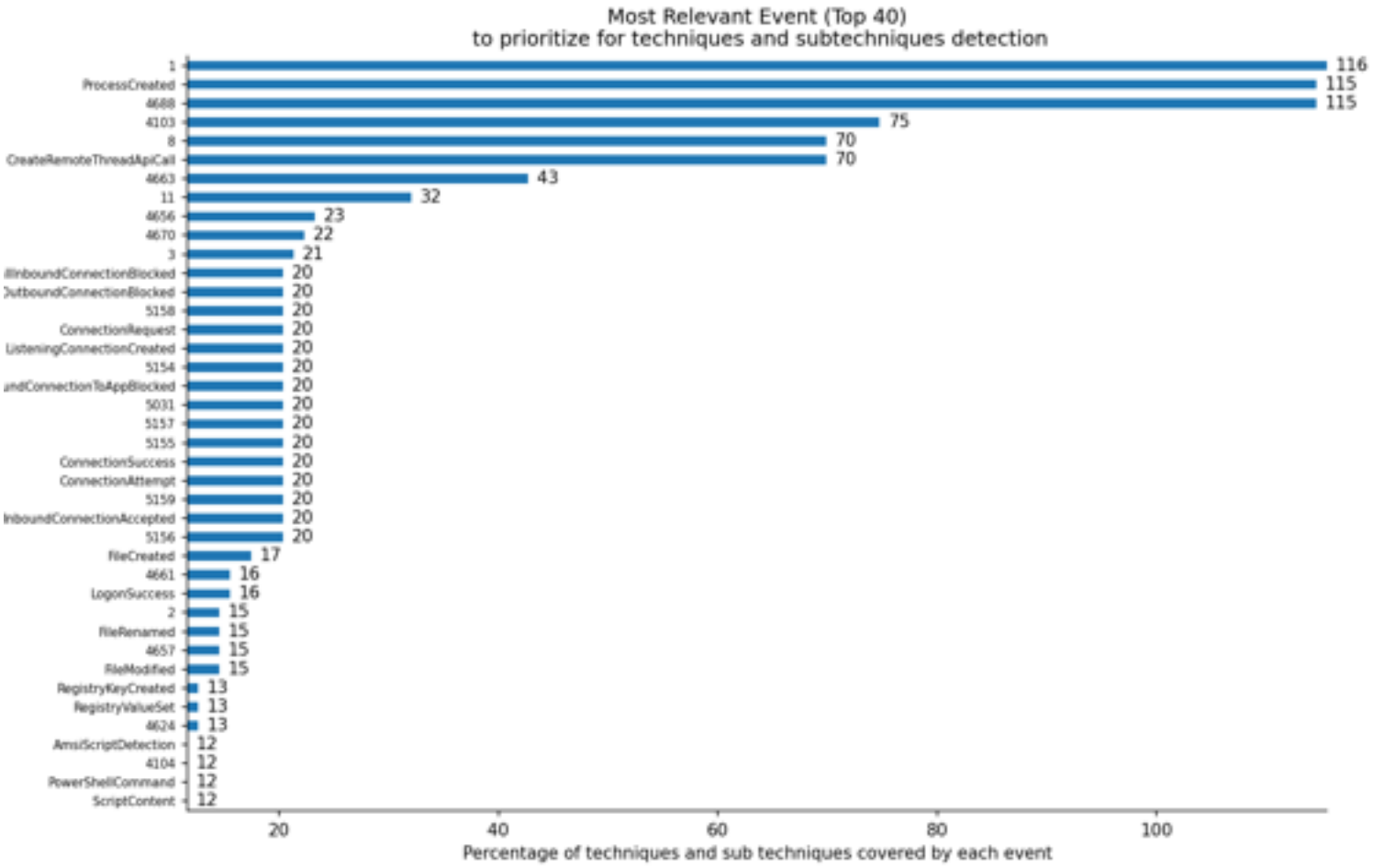
The following graph gives the top 40 data source to collect in order to be able to detect the techniques used by threat actors.
Please see annexes for reference.



2.7 Top event to collect for detections

The following graph gives the top 40 event to collect in order to be able to detect the techniques used by threat actors.
Please see annexes for reference.


Most Relevant Event (Top 40)
to prioritize for techniques and subtechniques detection
1
ProcessCreated
4688
4103
8
CreateRemoteThreadApiCall
4663
11
4656
4670
3
llInboundConnectionBlocked
)utboundConnectionBlocked
5158
ConnectionRequest
ListeningConnectionCreated
5154
andConnectionToAppBlocked
5031
5157
5155
ConnectionSuccess
ConnectionAttempt
5159
InboundConnectionAccepted
5156
FileCreated
4661
LogonSuccess
2
FileRenamed
4657
FileModified
RegistryKeyCreated
RegistryValueSet
4624
AmsiScriptDetection
4104
PowerShellCommand
ScriptContent
119
118
118
77
72
72
44
33
24
23
22
21
21
21
21
21
21
21
21
21
21
21
21
21
18
16
16
15
15
15
15
13
13
13
12
12
12
12
20
40
60
80
100
Count of techniques and sub techniques covered by each event


Most Relevant Event (Top 40)
to prioritize for techniques and subtechniques detection
1
ProcessCreated
4688
4103
8
CreateRemoteThreadApiCall
4663
11
4656
4670
3
llInboundConnectionBlocked
)utboundConnectionBlocked
5158
ConnectionRequest
ListeningConnectionCreated
5154
andConnectionToAppBlocked
5031
5157
5155
ConnectionSuccess
ConnectionAttempt
5159
InboundConnectionAccepted
5156
FileCreated
4661
LogonSuccess
2
FileRenamed
4657
FileModified
RegistryKeyCreated
RegistryValueSet
4624
AmsiScriptDetection
4104
PowerShellCommand
ScriptContent
116
115
115
75
70
70
43
32
23
22
21
20
20
20
20
20
20
20
20
20
20
20
20
17
16
16
15
15
15
15
13
13
13
12
12
12
12
20
40
60
80
100
Percentage of techniques and sub techniques covered by each event

3. How to detect most used techniques ?

This chapter aims at reviewing the most used techniques from most used to least used while providing more detailed information on the technique, the collection data required for detection and how to detect the technique.

3.1 T1105

Used by group : Fox Kitten, APT-C-36, Leviathan, BRONZE BUTLER, menuPass, Threat Group-3390, APT18

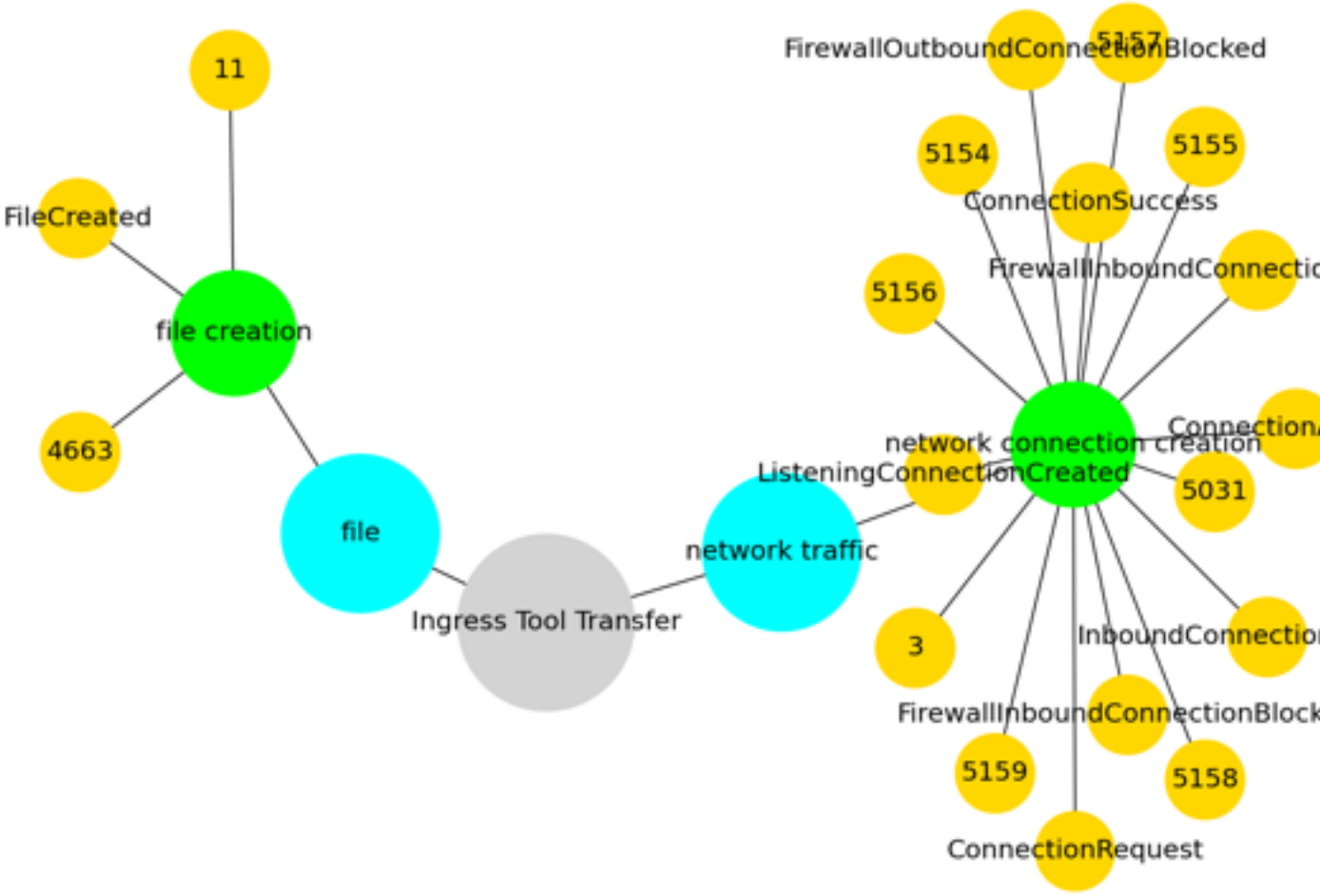
Tactic : command-and-control

Technique : Ingress Tool Transfer

Adversaries may transfer tools or other files from an external system into a compromised environment. Tools or files may be copied from an external adversary-controlled system to the victim network through the command and control channel or through alternate protocols such as [ftp](https://attack.mitre.org/software/S0095). Once present, adversaries may also transfer/spread tools between victim devices within a compromised environment (i.e. [Lateral Tool Transfer](https://attack.mitre.org/techniques/T1570)).

Files can also be transferred using various [Web Service](https://attack.mitre.org/techniques/T1102)s as well as native or otherwise present tools on the victim system.(Citation: PTSecurity Cobalt Dec 2016)

On Windows, adversaries may use various utilities to download tools, such as `copy`, `finger`, and [PowerShell](https://attack.mitre.org/techniques/T1059/001) commands such as <code>IEX(New-Object Net.WebClient).downloadString()</code> and <code>Invoke-WebRequest</code>. On Linux and macOS systems, a variety of utilities also exist, such as `curl`, `scp`, `sftp`, `tftp`, `rsync`, `finger`, and `wget`.(Citation: t1105_lolbas)



3.2 T1027

Used by group : Fox Kitten, APT-C-36, APT19, Leviathan, menuPass, Threat Group-3390, APT18

Tactic : defense-evasion

Technique : Obfuscated Files or Information

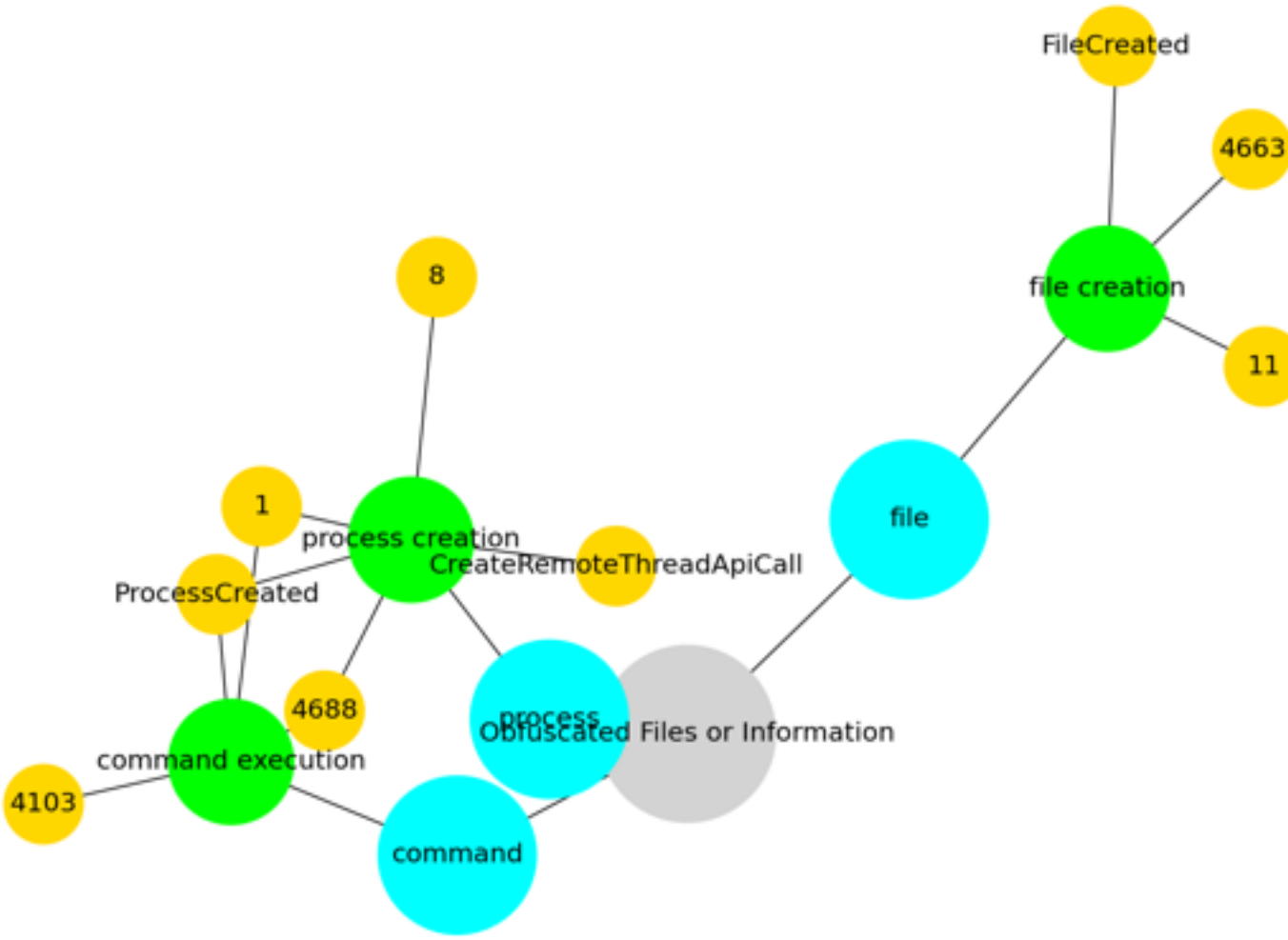
Adversaries may attempt to make an executable or file difficult to discover or analyze by encrypting, encoding, or otherwise obfuscating its contents on the system or in transit. This is common behavior that can be used across different platforms and the network to evade defenses.

Payloads may be compressed, archived, or encrypted in order to avoid detection. These payloads may be used during Initial Access or later to mitigate detection. Sometimes a user's action may be required to open and [Deobfuscate/Decode Files or Information](https://attack.mitre.org/techniques/T1140) for [User Execution](https://attack.mitre.org/techniques/T1204). The user may also be required to input a password to open a password protected compressed/encrypted file that was provided by the adversary.

(Citation: Volexity PowerDuke November 2016) Adversaries may also used compressed or archived scripts, such as JavaScript.

Portions of files can also be encoded to hide the plain-text strings that would otherwise help defenders with discovery. (Citation: Linux/Cdorked.A We Live Security Analysis) Payloads may also be split into separate, seemingly benign files that only reveal malicious functionality when reassembled. (Citation: Carbon Black Obfuscation Sept 2016)

Adversaries may also obfuscate commands executed from payloads or directly via a [Command and Scripting Interpreter](https://attack.mitre.org/techniques/T1059). Environment variables, aliases, characters, and other platform/language specific semantics can be used to evade signature based detections and application control mechanisms. (Citation: FireEye Obfuscation June 2017) (Citation: FireEye Revoke-Obfuscation July 2017)(Citation: PaloAlto EncodedCommand March 2017)



3.3 T1078

Used by group : Fox Kitten, Leviathan, menuPass, Threat Group-3390, APT18, Axiom

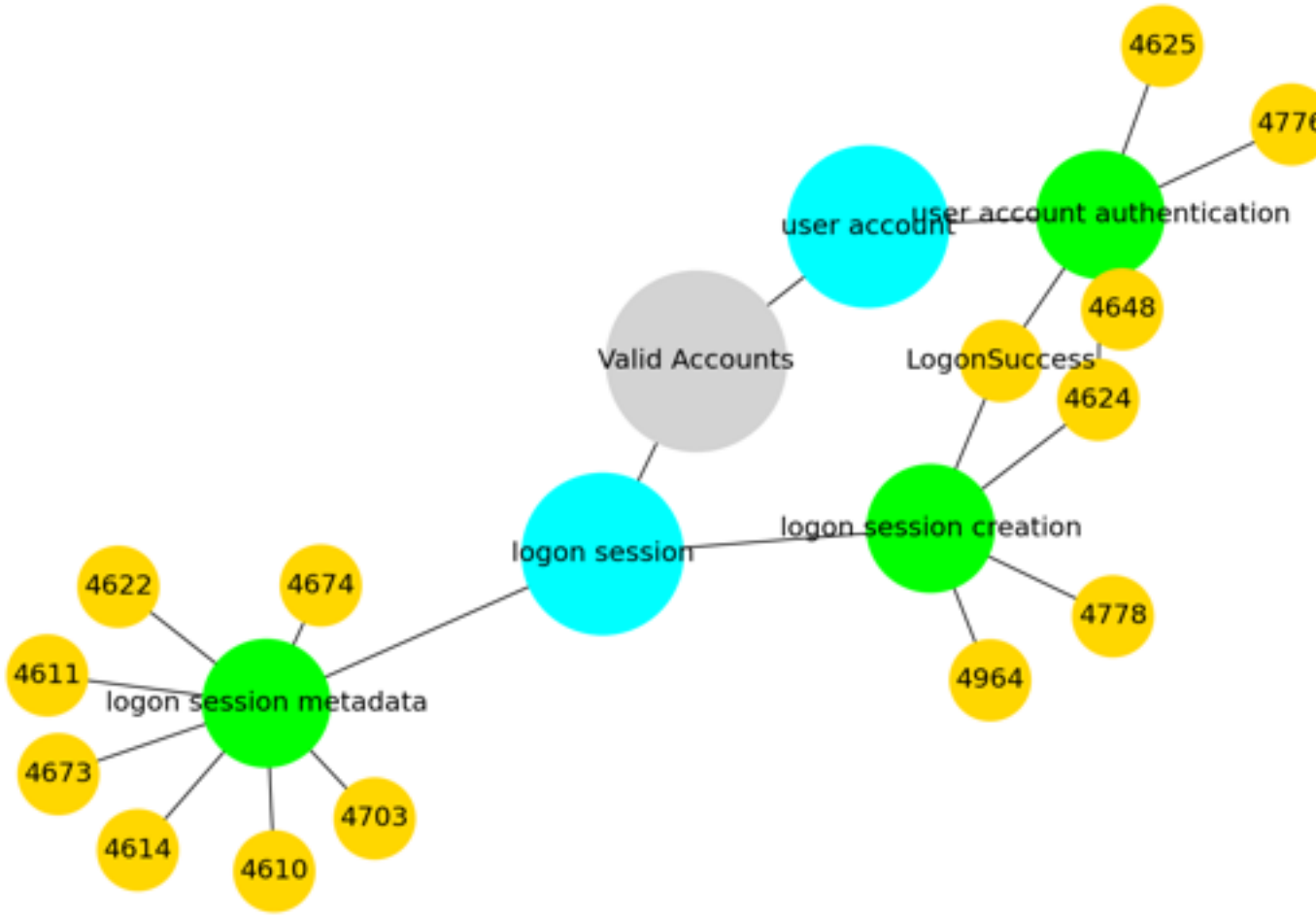
Tactic : defense-evasion, persistence, privilege-escalation, initial-access

Technique : Valid Accounts

Adversaries may obtain and abuse credentials of existing accounts as a means of gaining Initial Access, Persistence, Privilege Escalation, or Defense Evasion. Compromised credentials may be used to bypass access controls placed on various resources on systems within the network and may even be used for persistent access to remote systems and externally available services, such as VPNs, Outlook Web Access and remote desktop. Compromised credentials may also grant an adversary increased privilege to specific systems or access to restricted areas of the network. Adversaries may choose not to use malware or tools in conjunction with the legitimate access those credentials provide to make it harder to detect their presence.

In some cases, adversaries may abuse inactive accounts: for example, those belonging to individuals who are no longer part of an organization. Using these accounts may allow the adversary to evade detection, as the original account user will not be present to identify any anomalous activity taking place on their account.(Citation: CISA MFA PrintNightmare)

The overlap of permissions for local, domain, and cloud accounts across a network of systems is of concern because the adversary may be able to pivot across accounts and systems to reach a high level of access (i.e., domain or enterprise administrator) to bypass access controls set within the enterprise.(Citation: TechNet Credential Theft)



3.4 T1059.001

Used by group : Fox Kitten, APT19, Leviathan, BRONZE BUTLER, menuPass, Threat Group-3390

Tactic : execution

Technique : PowerShell

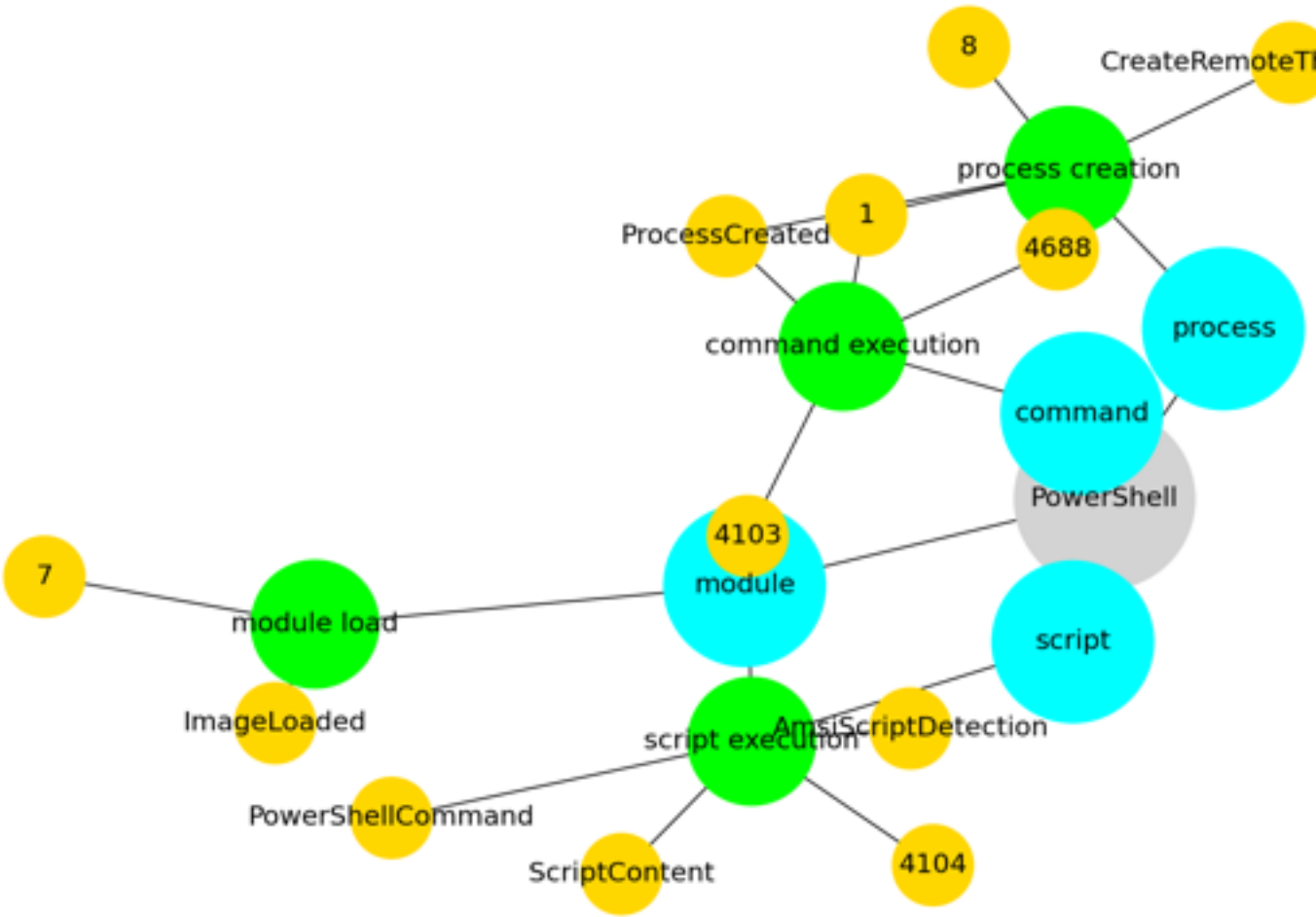
Adversaries may abuse PowerShell commands and scripts for execution. PowerShell is a powerful interactive command-line interface and scripting environment included in the Windows operating system.(Citation: TechNet PowerShell) Adversaries can use PowerShell to perform a number of actions, including discovery of information and execution of code. Examples include the <code>Start-Process</code> cmdlet which can be used to run an executable and the <code>Invoke-Command</code> cmdlet which runs a command locally or on a remote computer (though administrator permissions are required to use PowerShell to connect to remote systems).

PowerShell may also be used to download and run executables from the Internet, which can be executed from disk or in memory

without touching disk.

A number of PowerShell-based offensive testing tools are available, including [Empire](https://attack.mitre.org/software/S0363), [PowerSploit](https://attack.mitre.org/software/S0194), [PoshC2](https://attack.mitre.org/software/S0378), and PSAttack.(Citation: Github PSAttack)

PowerShell commands/scripts can also be executed without directly invoking the <code>powershell.exe</code> binary through interfaces to PowerShell's underlying <code>System.Management.Automation</code> assembly DLL exposed through the .NET framework and Windows Common Language Interface (CLI).(Citation: Sixdub PowerPick Jan 2016)(Citation: SilentBreak Offensive PS Dec 2015)(Citation: Microsoft PSfromCsharp APR 2014)



3.5 T1566.001

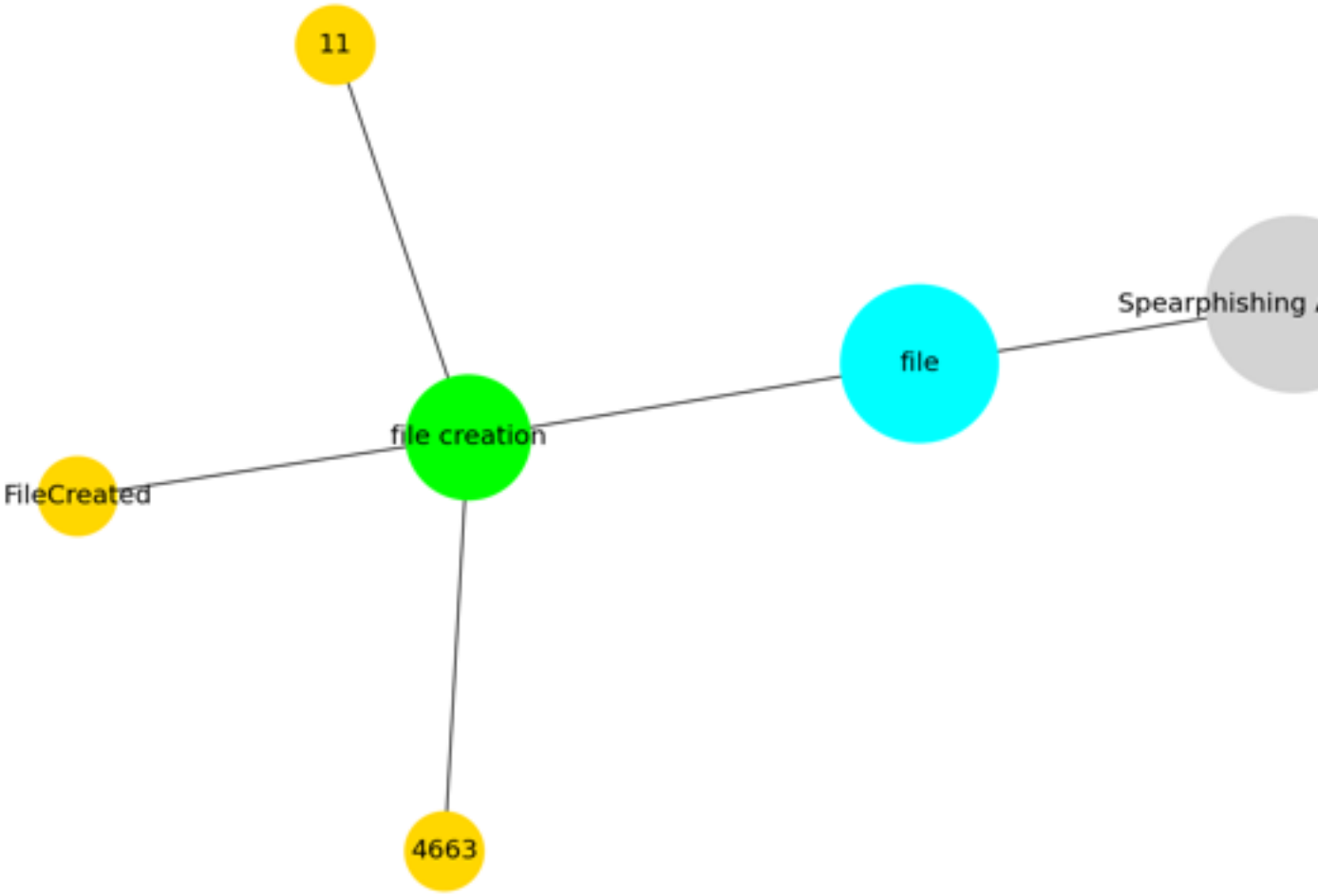
Used by group : APT-C-36, APT19, Leviathan, BRONZE BUTLER, menuPass, Threat Group-3390

Tactic : initial-access

Technique : Spearphishing Attachment

Adversaries may send spearphishing emails with a malicious attachment in an attempt to gain access to victim systems. Spearphishing attachment is a specific variant of spearphishing. Spearphishing attachment is different from other forms of spearphishing in that it employs the use of malware attached to an email. All forms of spearphishing are electronically delivered social engineering targeted at a specific individual, company, or industry. In this scenario, adversaries attach a file to the spearphishing email and usually rely upon [User Execution](https://attack.mitre.org/techniques/T1204) to gain execution. Spearphishing may also involve social engineering techniques, such as posing as a trusted source.

There are many options for the attachment such as Microsoft Office documents, executables, PDFs, or archived files. Upon opening the attachment (and potentially clicking past protections), the adversary's payload exploits a vulnerability or directly executes on the user's system. The text of the spearphishing email usually tries to give a plausible reason why the file should be opened, and may explain how to bypass system protections in order to do so. The email may also contain instructions on how to decrypt an attachment, such as a zip file password, in order to evade email boundary defenses. Adversaries frequently manipulate file extensions and icons in order to make attached executables appear to be document files, or files exploiting one application appear to be a file for a different one.



3.6 T1204.002

Used by group : APT-C-36, APT19, Leviathan, BRONZE BUTLER, menuPass, Threat Group-3390

Tactic : execution

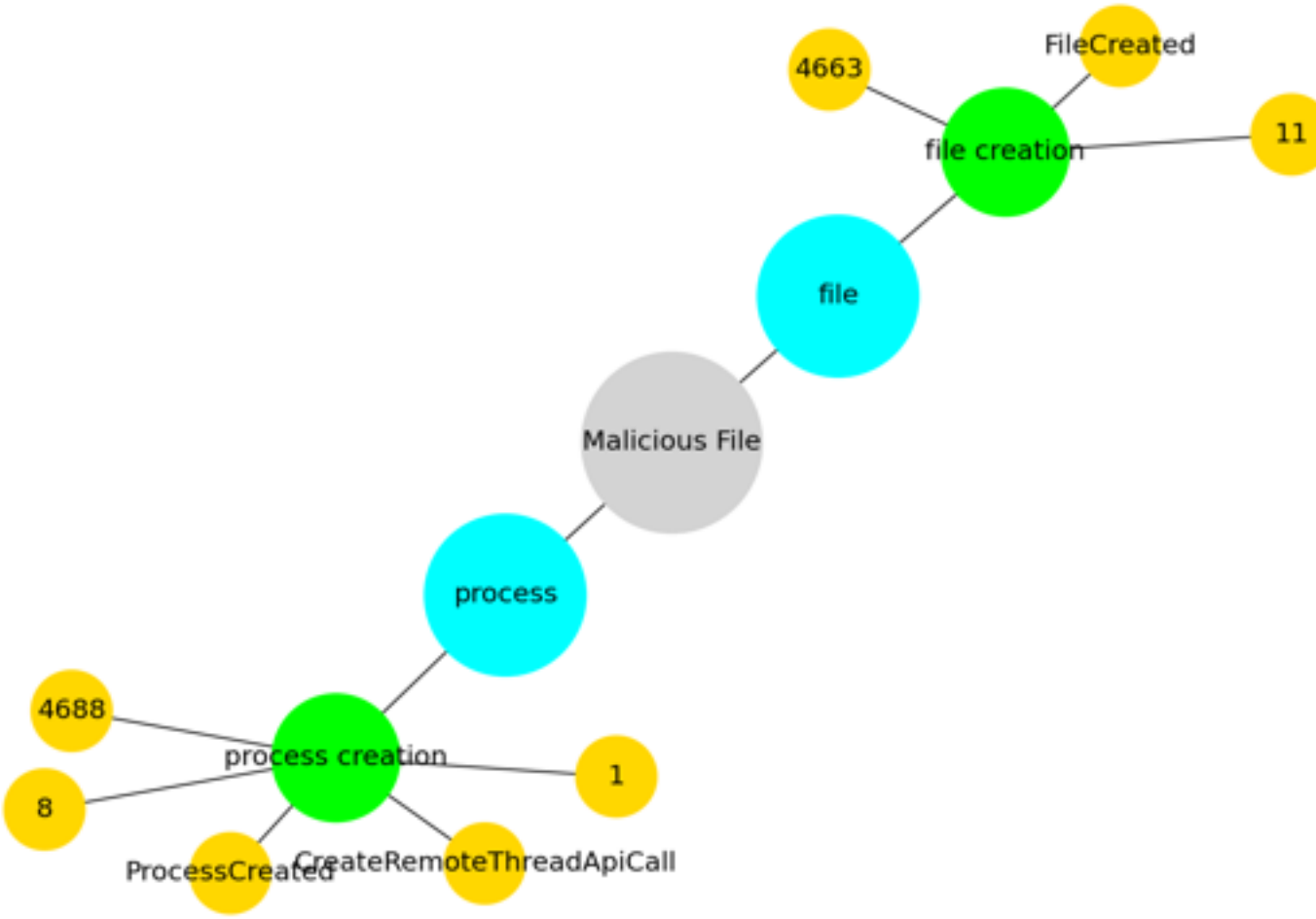
Technique : Malicious File

An adversary may rely upon a user opening a malicious file in order to gain execution. Users may be subjected to social engineering to get them to open a file that will lead to code execution. This user action will typically be observed as follow-on behavior from [Spearphishing Attachment](https://attack.mitre.org/techniques/T1566/001). Adversaries may use several types of files that require a user to execute them, including .doc, .pdf, .xls, .rtf, .scr, .exe, .lnk, .pif, and .cpl.

Adversaries may employ various forms of [Masquerading](https://attack.mitre.org/techniques/T1036) and [Obfuscated Files or Information](https://attack.mitre.org/techniques/T1027) to increase the likelihood that a user will open and successfully execute a malicious file. These methods may include using a familiar naming convention and/or password protecting the file and supplying

instructions to a user on how to open it.(Citation: Password Protected Word Docs)

While [Malicious File](https://attack.mitre.org/techniques/T1204/002) frequently occurs shortly after Initial Access it may occur at other phases of an intrusion, such as when an adversary places a file in a shared directory or on a user's desktop hoping that a user will click on it. This activity may also be seen shortly after [Internal Spearphishing](https://attack.mitre.org/techniques/T1534).



3.7 T1189

Used by group : APT19, Leviathan, BRONZE BUTLER, Threat Group-3390, Axiom

Tactic : initial-access

Technique : Drive-by Compromise

Adversaries may gain access to a system through a user visiting a website over the normal course of browsing. With this technique, the user's web browser is typically targeted for exploitation, but adversaries may also use compromised websites for non-exploitation

behavior such as acquiring [Application Access Token](https://attack.mitre.org/techniques/T1550/001).

Multiple ways of delivering exploit code to a browser exist, including:

* A legitimate website is compromised where adversaries have injected some form of malicious code such as JavaScript, iFrames, and cross-site scripting.
* Malicious ads are paid for and served through legitimate ad providers.
* Built-in web application interfaces are leveraged for the insertion of any other kind of object that can be used to display web content or contain a script that executes on the visiting client (e.g. forum posts, comments, and other user controllable web content).

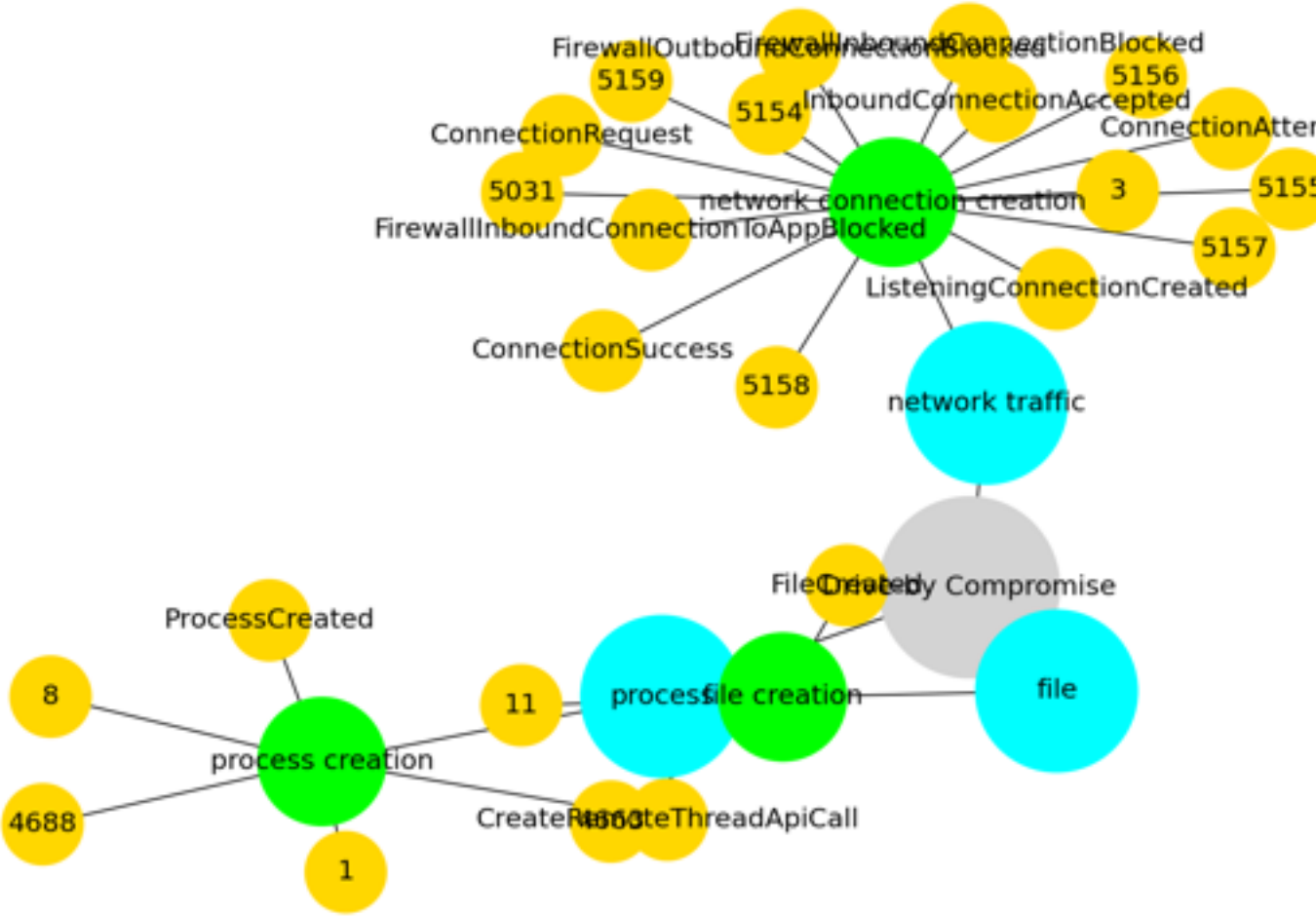
Often the website used by an adversary is one visited by a specific community, such as government, a particular industry, or region, where the goal is to compromise a specific user or set of users based on a shared interest. This kind of targeted campaign is often referred to a strategic web compromise or watering hole attack. There are several known examples of this occurring.(Citation: Shadowserver Strategic Web Compromise)

Typical drive-by compromise process:

1. A user visits a website that is used to host the adversary controlled content.
2. Scripts automatically execute, typically searching versions of the browser and plugins for a potentially vulnerable version.
    * The user may be required to assist in this process by enabling scripting or active website components and ignoring warning dialog boxes.
3. Upon finding a vulnerable version, exploit code is delivered to the browser.
4. If exploitation is successful, then it will give the adversary code execution on the user's system unless other protections are in place.
    * In some cases a second visit to the website after the initial scan is required before exploit code is delivered.

Unlike [Exploit Public-Facing Application](https://attack.mitre.org/techniques/T1190), the focus of this technique is to exploit software on a client endpoint upon visiting a website. This will commonly give an adversary access to systems on the internal network instead of external systems that may be in a DMZ.

Adversaries may also use compromised websites to deliver a user to a malicious application designed to [Steal Application Access Token](https://attack.mitre.org/techniques/T1528)s, like OAuth tokens, to gain access to protected applications and information. These malicious applications have been delivered through popups on legitimate websites.(Citation: Volexity OceanLotus Nov 2017)



3.8 T1547.001

Used by group : APT19, Leviathan, BRONZE BUTLER, Threat Group-3390, APT18

Tactic : persistence, privilege-escalation

Technique : Registry Run Keys / Startup Folder

Adversaries may achieve persistence by adding a program to a startup folder or referencing it with a Registry run key. Adding an entry to the "run keys" in the Registry or startup folder will cause the program referenced to be executed when a user logs in.(Citation: Microsoft Run Key) These programs will be executed under the context of the user and will have the account's associated permissions level.

Placing a program within a startup folder will also cause that program to execute when a user logs in. There is a startup folder location for individual user accounts as well as a system-wide startup folder that will be checked regardless of which user account logs in. The startup folder path for the current user is <code>C:\Users\\[Username]\AppData\Roaming\Microsoft\Windows\Start

Menu\Programs\Startup</code>. The startup folder path for all users is <code>C:\ProgramData\Microsoft\Windows\Start Menu\Programs\StartUp</code>.

The following run keys are created by default on Windows systems:

* <code>HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Run</code>
* <code>HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\RunOnce</code>
* <code>HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\Run</code>
* <code>HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\RunOnce</code>

Run keys may exist under multiple hives.(Citation: Microsoft Wow6432Node 2018)(Citation: Malwarebytes Wow6432Node 2016) The <code>HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\RunOnceEx</code> is also available but is not created by default on Windows Vista and newer. Registry run key entries can reference programs directly or list them as a dependency.(Citation: Microsoft Run Key) For example, it is possible to load a DLL at logon using a "Depend" key with RunOnceEx: <code>reg add HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\RunOnceEx\0001\Depend /v 1 /d "C:\temp\evil[.]dll"</code> (Citation: Oddvar Moe RunOnceEx Mar 2018)

The following Registry keys can be used to set startup folder items for persistence:

* <code>HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Explorer\User Shell Folders</code>
* <code>HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Explorer\Shell Folders</code>
* <code>HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Explorer\Shell Folders</code>
* <code>HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Explorer\User Shell Folders</code>

The following Registry keys can control automatic startup of services during boot:

* <code>HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\RunServicesOnce</code>
* <code>HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\RunServicesOnce</code>
* <code>HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\RunServices</code>
* <code>HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\RunServices</code>

Using policy settings to specify startup programs creates corresponding values in either of two Registry keys:

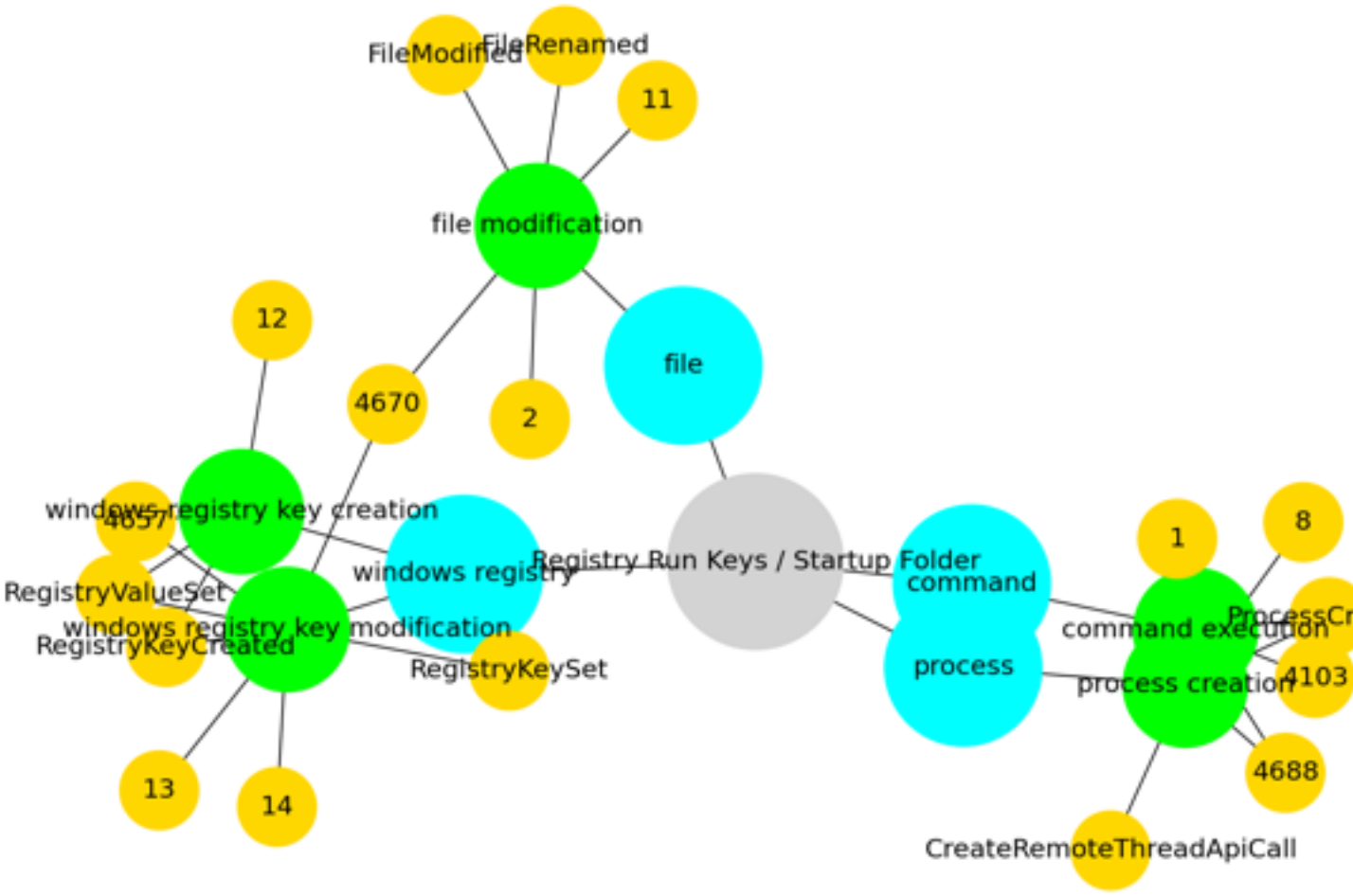
* <code>HKEY_LOCAL_MACHINE\Software\Microsoft\Windows\CurrentVersion\Policies\Explorer\Run</code>
* <code>HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Policies\Explorer\Run</code>

The Winlogon key controls actions that occur when a user logs on to a computer running Windows 7. Most of these actions are under the control of the operating system, but you can also add custom actions here. The <code>HKEY_LOCAL_MACHINE\Software\Microsoft\Windows NT\CurrentVersion\Winlogon\Userinit</code> and <code>HKEY_LOCAL_MACHINE\Software\Microsoft\Windows NT\CurrentVersion\Winlogon\Shell</code> subkeys can automatically launch programs.

Programs listed in the load value of the registry key <code>HKEY_CURRENT_USER\Software\Microsoft\Windows NT\CurrentVersion\Windows</code> run when any user logs on.

By default, the multistring <code>BootExecute</code> value of the registry key <code>HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\Session Manager</code> is set to <code>autocheck autochk *</code>. This value causes Windows, at startup, to check the file-system integrity of the hard disks if the system has been shut down abnormally. Adversaries can add other programs or processes to this registry value which will automatically launch at boot.

Adversaries can use these configuration locations to execute malware, such as remote access tools, to maintain persistence through system reboots. Adversaries may also use [Masquerading](https://attack.mitre.org/techniques/T1036) to make the Registry entries look as if they are associated with legitimate programs.



3.9 T1071.001

Used by group : SilverTerrier, APT19, BRONZE BUTLER, Threat Group-3390, APT18

Tactic : command-and-control

Technique : Web Protocols

Adversaries may communicate using application layer protocols associated with web traffic to avoid detection/network filtering by blending in with existing traffic. Commands to the remote system, and often the results of those commands, will be embedded within the protocol traffic between the client and server.

Protocols such as HTTP and HTTPS that carry web traffic may be very common in environments. HTTP/S packets have many fields and headers in which data can be concealed. An adversary may abuse these protocols to communicate with systems under their control within a victim network while also mimicking normal, expected traffic.

3.10 T1588.002

Used by group : APT-C-36, APT19, BRONZE BUTLER, menuPass, Threat Group-3390

Tactic : resource-development

Technique : Tool

Adversaries may buy, steal, or download software tools that can be used during targeting. Tools can be open or closed source, free or commercial. A tool can be used for malicious purposes by an adversary, but (unlike malware) were not intended to be used for those purposes (ex: [PsExec](https://attack.mitre.org/software/S0029)). Tool acquisition can involve the procurement of commercial software licenses, including for red teaming tools such as [Cobalt Strike](https://attack.mitre.org/software/S0154). Commercial

software may be obtained through purchase, stealing licenses (or licensed copies of the software), or cracking trial versions.(Citation: Recorded Future Beacon 2019)

Adversaries may obtain tools to support their operations, including to support execution of post-compromise behaviors. In addition to freely downloading or purchasing software, adversaries may steal software and/or software licenses from third-party entities (including other adversaries).

3.11 T1005

Used by group : Fox Kitten, BRONZE BUTLER, menuPass, Threat Group-3390, Axiom

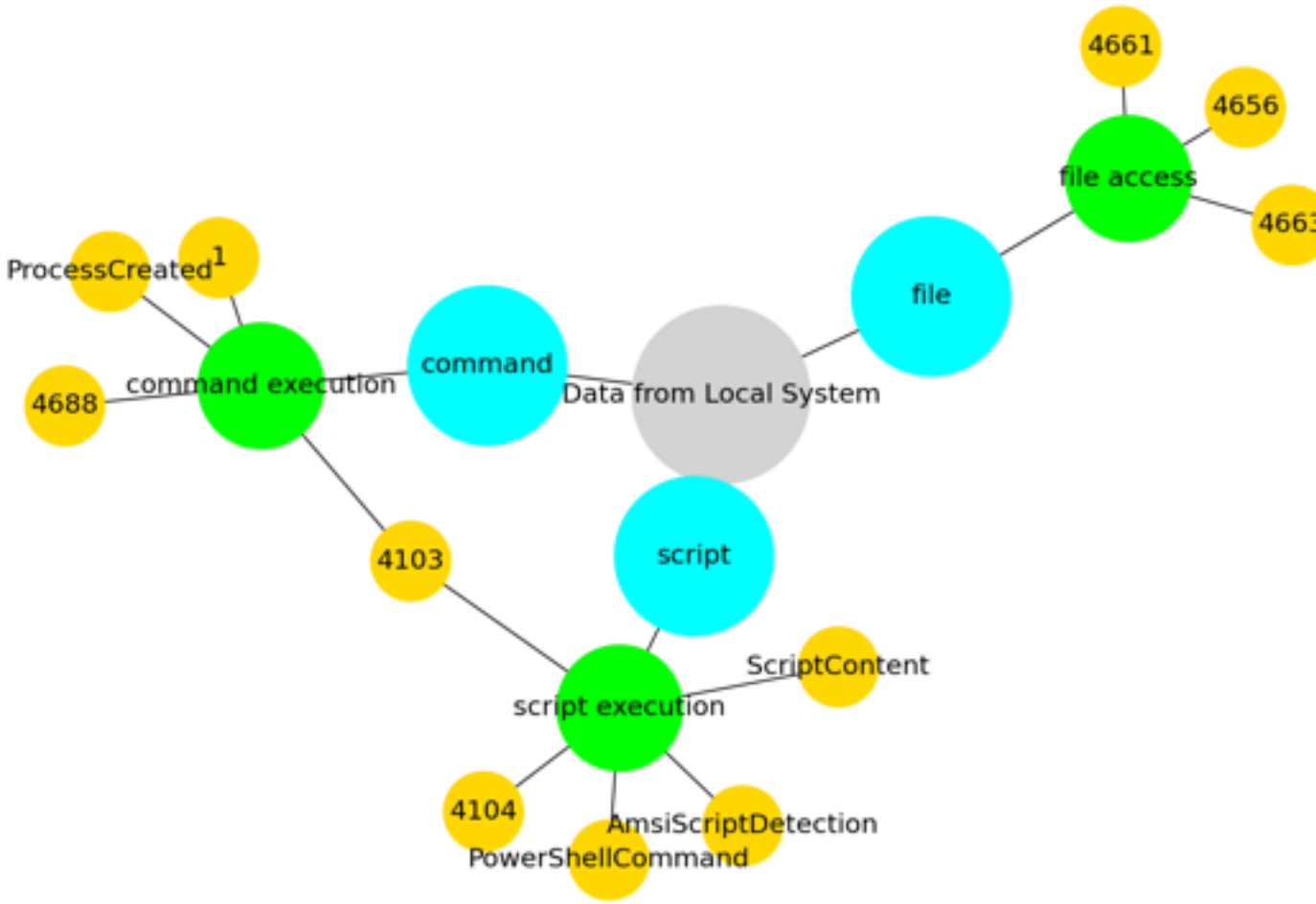
Tactic : collection

Technique : Data from Local System

Adversaries may search local system sources, such as file systems and configuration files or local databases, to find files of interest

and sensitive data prior to Exfiltration.

Adversaries may do this using a [Command and Scripting Interpreter](https://attack.mitre.org/techniques/T1059), such as [cmd](https://attack.mitre.org/software/S0106) as well as a [Network Device CLI](https://attack.mitre.org/techniques/T1059/008), which have functionality to interact with the file system to gather information. Adversaries may also use [Automated Collection](https://attack.mitre.org/techniques/T1119) on the local system.



3.12 T1140

Used by group : APT19, Leviathan, BRONZE BUTLER, menuPass, Threat Group-3390

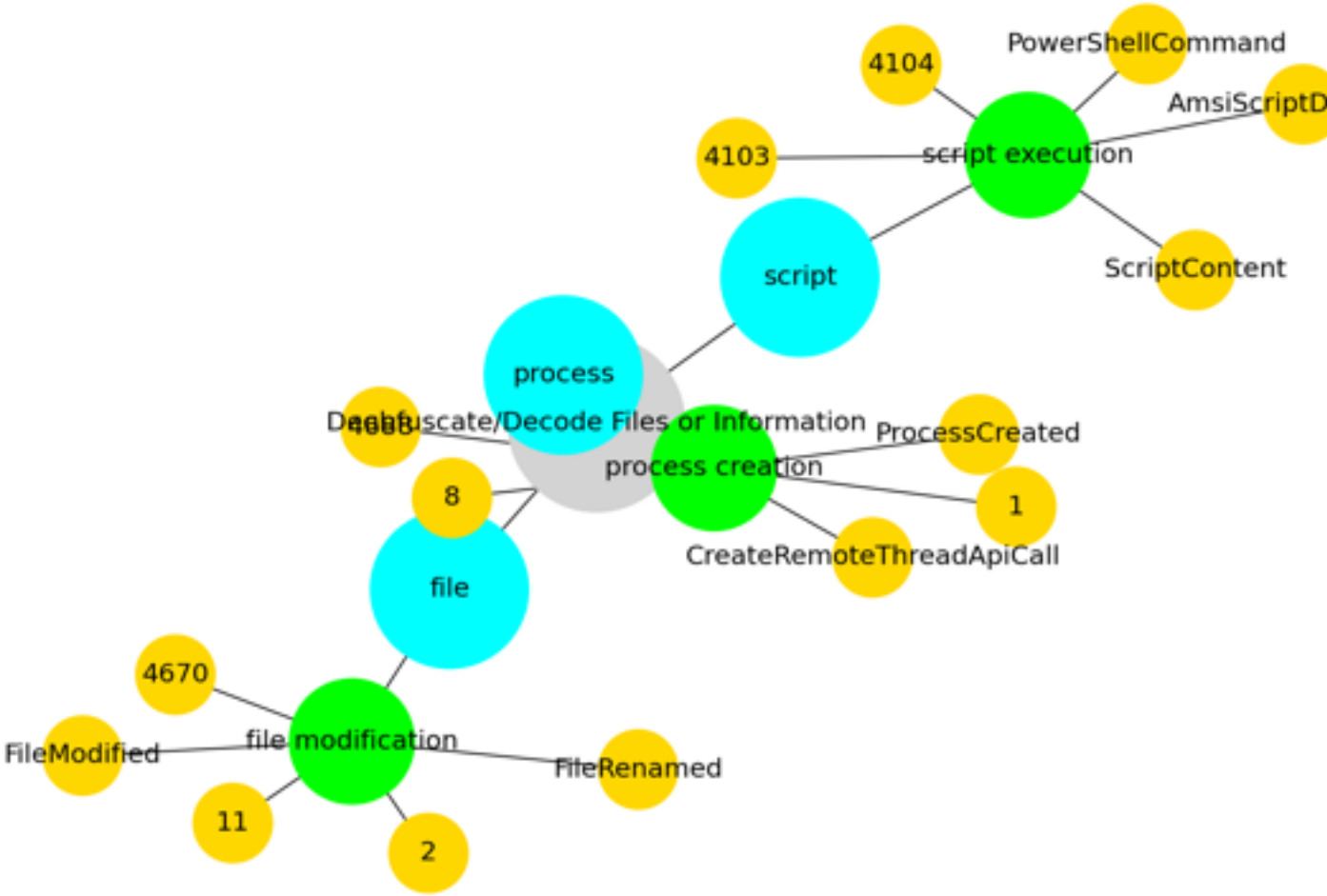
Tactic : defense-evasion

Technique : Deobfuscate/Decode Files or Information

Adversaries may use [Obfuscated Files or Information](https://attack.mitre.org/techniques/T1027) to hide artifacts of an intrusion from analysis. They may require separate mechanisms to decode or deobfuscate that information depending on how they intend to use it. Methods for doing that include built-in functionality of malware or by using utilities present on the system.

One such example is use of [certutil](https://attack.mitre.org/software/S0160) to decode a remote access tool portable executable file that has been hidden inside a certificate file. (Citation: Malwarebytes Targeted Attack against Saudi Arabia) Another example is using the Windows <code>copy /b</code> command to reassemble binary fragments into a malicious payload. (Citation: Carbon Black Obfuscation Sept 2016)

Sometimes a user's action may be required to open it for deobfuscation or decryption as part of [User Execution](https://attack.mitre.org/techniques/T1204). The user may also be required to input a password to open a password protected compressed/encrypted file that was provided by the adversary. (Citation: Volexity PowerDuke November 2016)



3.13 T1059.003

Used by group : Fox Kitten, BRONZE BUTLER, menuPass, Threat Group-3390, APT18

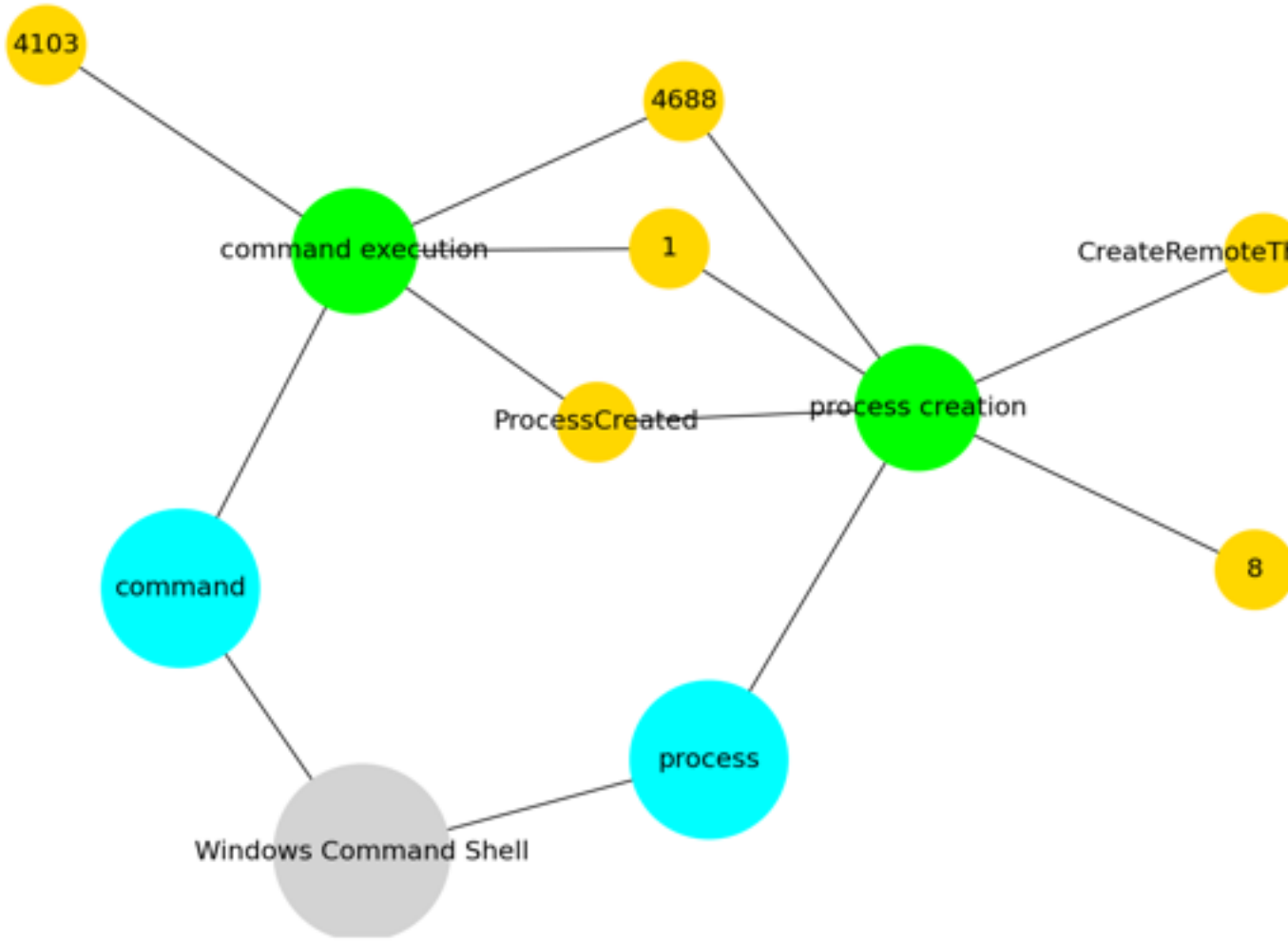
Tactic : execution

Technique : Windows Command Shell

Adversaries may abuse the Windows command shell for execution. The Windows command shell ([cmd](https://attack.mitre.org/software/S0106)) is the primary command prompt on Windows systems. The Windows command prompt can be used to control almost any aspect of a system, with various permission levels required for different subsets of commands. The command prompt can be invoked remotely via [Remote Services](https://attack.mitre.org/techniques/T1021) such as [SSH](https://attack.mitre.org/techniques/T1021/004).(Citation: SSH in Windows)

Batch files (ex: .bat or .cmd) also provide the shell with a list of sequential commands to run, as well as normal scripting operations such as conditionals and loops. Common uses of batch files include long or repetitive tasks, or the need to run the same set of commands on multiple systems.

Adversaries may leverage [cmd](https://attack.mitre.org/software/S0106) to execute various commands and payloads. Common uses include [cmd](https://attack.mitre.org/software/S0106) to execute a single command, or abusing [cmd](https://attack.mitre.org/software/S0106) interactively with input and output forwarded over a command and control channel.



3.14 T1053.005

Used by group : Fox Kitten, APT-C-36, BRONZE BUTLER, menuPass

Tactic : execution, persistence, privilege-escalation

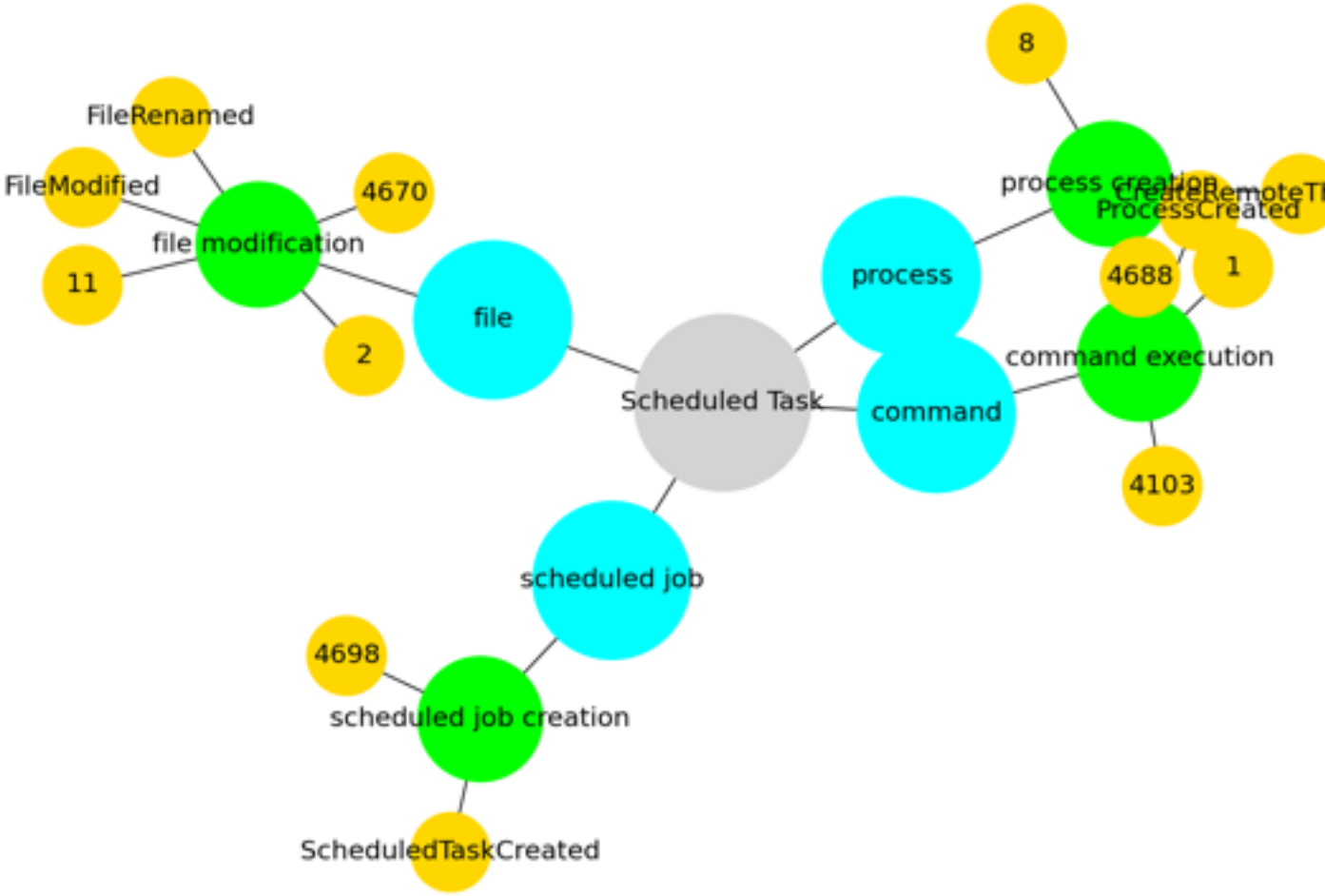
Technique : Scheduled Task

Adversaries may abuse the Windows Task Scheduler to perform task scheduling for initial or recurring execution of malicious code. There are multiple ways to access the Task Scheduler in Windows. The [schtasks](https://attack.mitre.org/software/S0111) utility can be run directly on the command line, or the Task Scheduler can be opened through the GUI within the Administrator Tools section of the Control Panel. In some cases, adversaries have used a .NET wrapper for the Windows Task Scheduler, and alternatively, adversaries have used the Windows netapi32 library to create a scheduled task.

The deprecated [at](https://attack.mitre.org/software/S0110) utility could also be abused by adversaries (ex: [At](https://attack.mitre.org/techniques/T1053/002)), though <code>at.exe</code> can not access tasks created with

<code>schtasks</code> or the Control Panel.

An adversary may use Windows Task Scheduler to execute programs at system startup or on a scheduled basis for persistence. The Windows Task Scheduler can also be abused to conduct remote Execution as part of Lateral Movement and/or to run a process under the context of a specified account (such as SYSTEM). Similar to [System Binary Proxy Execution](https://attack.mitre.org/techniques/T1218), adversaries have also abused the Windows Task Scheduler to potentially mask one-time execution under signed/trusted system processes.(Citation: ProofPoint Serpent)



3.15 T1203

Used by group : Leviathan, BRONZE BUTLER, Threat Group-3390, Axiom

Tactic : execution

Technique : Exploitation for Client Execution

Adversaries may exploit software vulnerabilities in client applications to execute code. Vulnerabilities can exist in software due to unsecure coding practices that can lead to unanticipated behavior. Adversaries can take advantage of certain vulnerabilities through targeted exploitation for the purpose of arbitrary code execution. Oftentimes the most valuable exploits to an offensive toolkit are those that can be used to obtain code execution on a remote system because they can be used to gain access to that system. Users will expect to see files related to the applications they commonly used to do work, so they are a useful target for exploit research and development because of their high utility.

Several types exist:

Browser-based Exploitation

Web browsers are a common target through [Drive-by Compromise](https://attack.mitre.org/techniques/T1189) and [Spearphishing Link](https://attack.mitre.org/techniques/T1566/002). Endpoint systems may be compromised through normal web browsing or from certain users being targeted by links in spearphishing emails to adversary controlled sites used to exploit the web browser. These often do not require an action by the user for the exploit to be executed.

Office Applications

Common office and productivity applications such as Microsoft Office are also targeted through [Phishing](https://attack.mitre.org/techniques/T1566). Malicious files will be transmitted directly as attachments or through links to download them. These require the user to open the document or file for the exploit to run.

Common Third-party Applications

Other applications that are commonly seen or are part of the software deployed in a target network may also be used for exploitation. Applications such as Adobe Reader and Flash, which are common in enterprise environments, have been routinely targeted by adversaries attempting to gain access to systems. Depending on the software and nature of the vulnerability, some may be exploited in the browser or require the user to open a file. For instance, some Flash exploits have been delivered as objects within Microsoft Office documents.

3.16 T1003.001

Used by group : Fox Kitten, Leviathan, BRONZE BUTLER, Threat Group-3390

Tactic : credential-access

Technique : LSASS Memory

Adversaries may attempt to access credential material stored in the process memory of the Local Security Authority Subsystem Service (LSASS). After a user logs on, the system generates and stores a variety of credential materials in LSASS process memory. These credential materials can be harvested by an administrative user or SYSTEM and used to conduct [Lateral Movement](https://attack.mitre.org/tactics/TA0008) using [Use Alternate Authentication Material](https://attack.mitre.org/techniques/T1550).

As well as in-memory techniques, the LSASS process memory can be dumped from the target host and analyzed on a local system.

For example, on the target host use procdump:

* <code>procdump -ma lsass.exe lsass_dump</code>

Locally, mimikatz can be run using:

* <code>sekurlsa::Minidump lsassdump.dmp</code>
* <code>sekurlsa::logonPasswords</code>

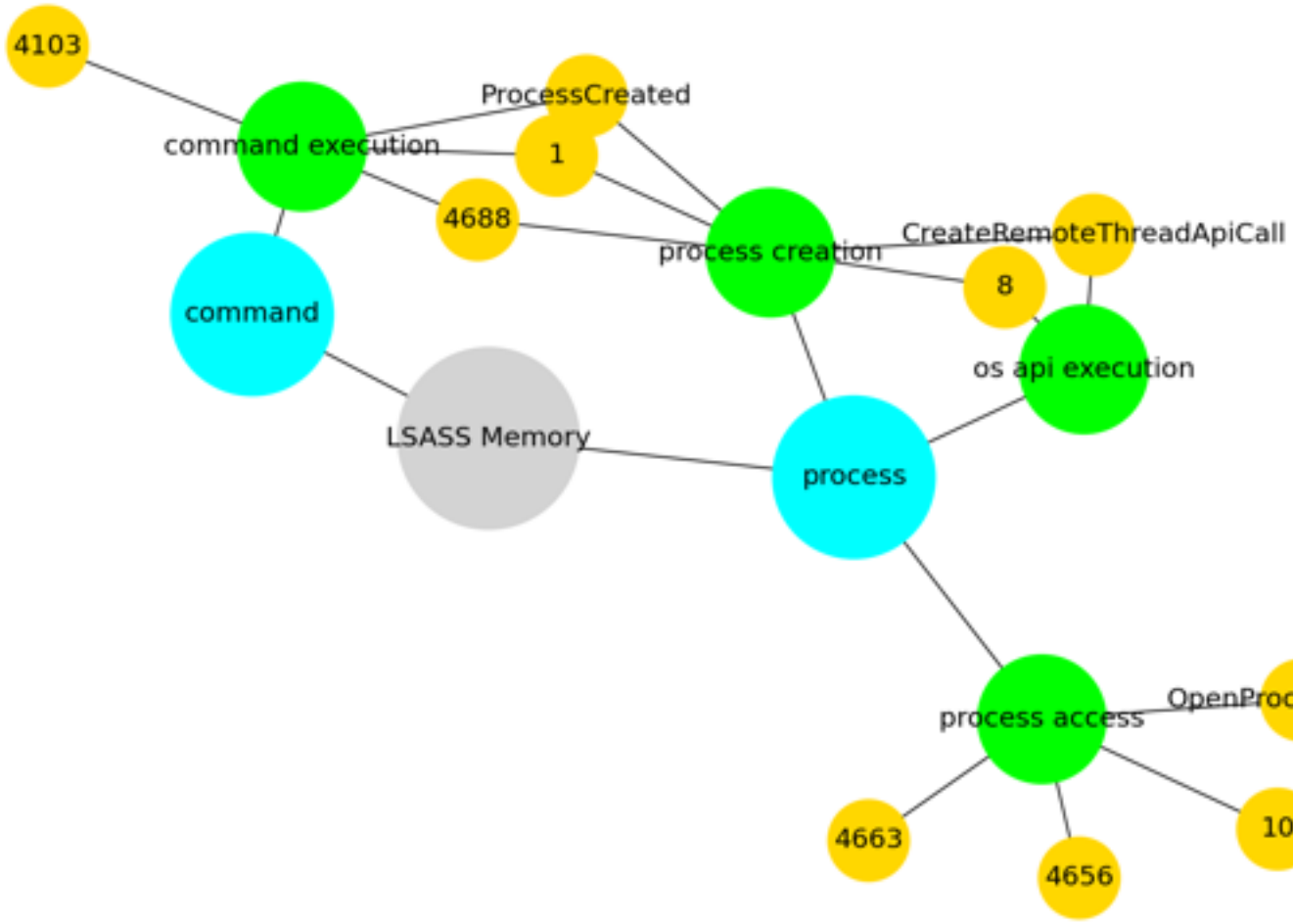
Built-in Windows tools such as comsvcs.dll can also be used:

* <code>rundll32.exe C:\Windows\System32\comsvcs.dll MiniDump PID lsass.dmp full</code>(Citation: Volexity Exchange Marauder March 2021)(Citation: Symantec Attacks Against Government Sector)

Windows Security Support Provider (SSP) DLLs are loaded into LSSAS process at system start. Once loaded into the LSA, SSP DLLs have access to encrypted and plaintext passwords that are stored in Windows, such as any logged-on user's Domain password or smart card PINs. The SSP configuration is stored in two Registry keys: <code>HKLM\SYSTEM\CurrentControlSet\Control\Lsa\Security Packages</code> and <code>HKLM\SYSTEM\CurrentControlSet\Control\Lsa\OSConfig\Security Packages</code>. An adversary may modify these Registry keys to add new SSPs, which will be loaded the next time the system boots, or when the AddSecurityPackage Windows API function is called.(Citation: Graeber 2014)

The following SSPs can be used to access credentials:

* Msv: Interactive logons, batch logons, and service logons are done through the MSV authentication package.
* Wdigest: The Digest Authentication protocol is designed for use with Hypertext Transfer Protocol (HTTP) and Simple Authentication Security Layer (SASL) exchanges.(Citation: TechNet Blogs Credential Protection)
* Kerberos: Preferred for mutual client-server domain authentication in Windows 2000 and later.
* CredSSP: Provides SSO and Network Level Authentication for Remote Desktop Services.(Citation: TechNet Blogs Credential Protection)



3.17 T1018

Used by group : Fox Kitten, BRONZE BUTLER, menuPass, Threat Group-3390

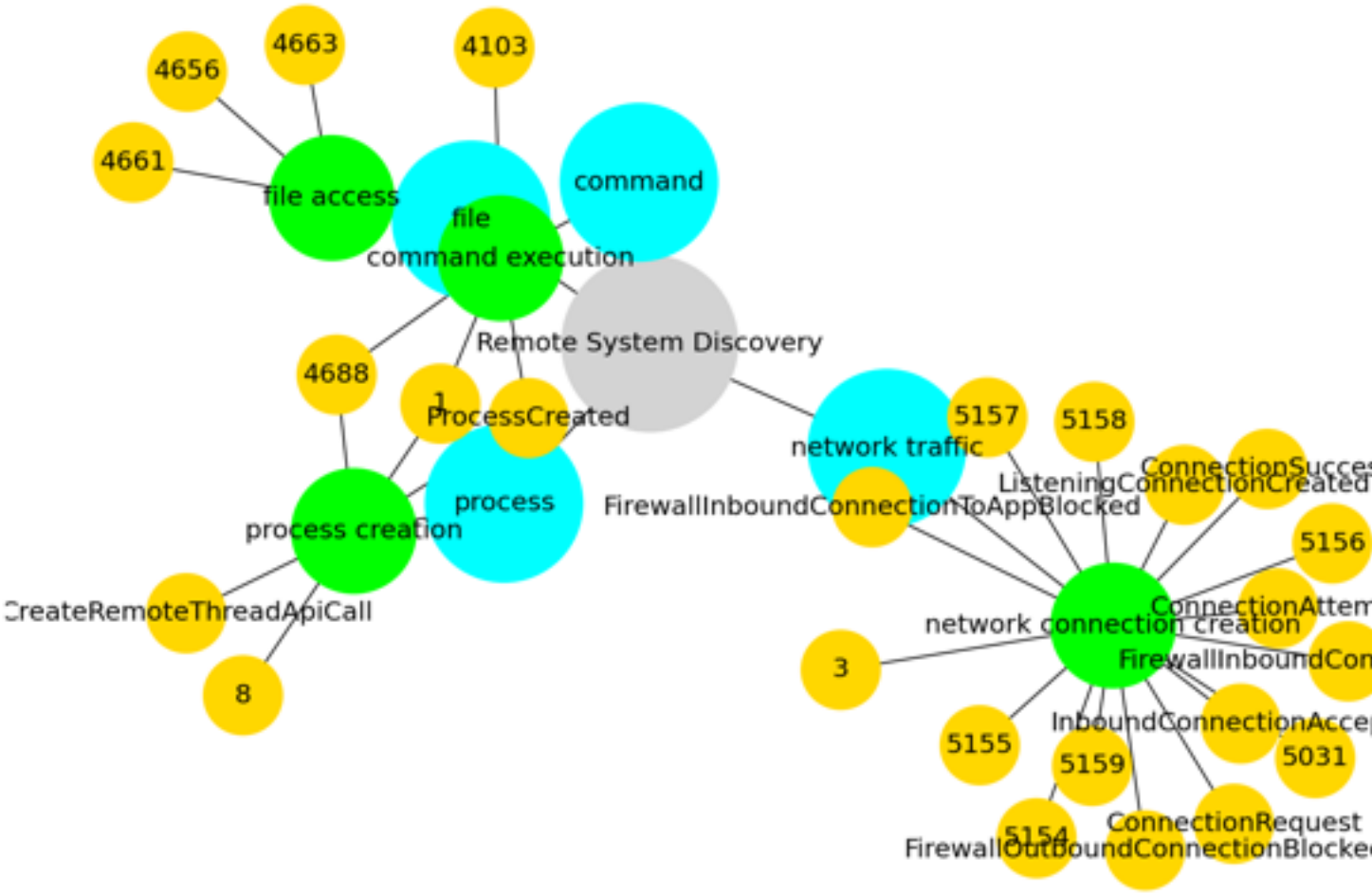
Tactic : discovery

Technique : Remote System Discovery

Adversaries may attempt to get a listing of other systems by IP address, hostname, or other logical identifier on a network that may be used for Lateral Movement from the current system. Functionality could exist within remote access tools to enable this, but utilities available on the operating system could also be used such as [Ping](https://attack.mitre.org/software/S0097) or <code>net view</code> using [Net](https://attack.mitre.org/software/S0039).

Adversaries may also analyze data from local host files (ex: <code>C:\Windows\System32\Drivers\etc\hosts</code> or <code>/etc/hosts</code>) or other passive means (such as local [Arp](https://attack.mitre.org/software/S0099) cache entries) in order to discover the presence of remote systems in an environment.

Adversaries may also target discovery of network infrastructure as well as leverage [Network Device CLI](https://attack.mitre.org/techniques/T1059/008) commands on network devices to gather detailed information about systems within a network.(Citation: US-CERT-TA18-106A)(Citation: CISA AR21-126A FIVEHANDS May 2021)



3.18 T1190

Used by group : Fox Kitten, menuPass, Threat Group-3390, Axiom

Tactic : initial-access

Technique : Exploit Public-Facing Application

Adversaries may attempt to take advantage of a weakness in an Internet-facing computer or program using software, data, or commands in order to cause unintended or unanticipated behavior. The weakness in the system can be a bug, a glitch, or a design

vulnerability. These applications are often websites, but can include databases (like SQL), standard services (like SMB or SSH), network device administration and management protocols (like SNMP and Smart Install), and any other applications with Internet accessible open sockets, such as web servers and related services.(Citation: NVD CVE-2016-6662)(Citation: CIS Multiple SMB Vulnerabilities)(Citation: US-CERT TA18-106A Network Infrastructure Devices 2018)(Citation: Cisco Blog Legacy Device Attacks)(Citation: NVD CVE-2014-7169) Depending on the flaw being exploited this may include [Exploitation for Defense Evasion](https://attack.mitre.org/techniques/T1211).

If an application is hosted on cloud-based infrastructure and/or is containerized, then exploiting it may lead to compromise of the underlying instance or container. This can allow an adversary a path to access the cloud or container APIs, exploit container host access via [Escape to Host](https://attack.mitre.org/techniques/T1611), or take advantage of weak identity and access management policies.

For websites and databases, the OWASP top 10 and CWE top 25 highlight the most common web-based vulnerabilities.(Citation: OWASP Top 10)(Citation: CWE top 25)

3.19 T1070.004

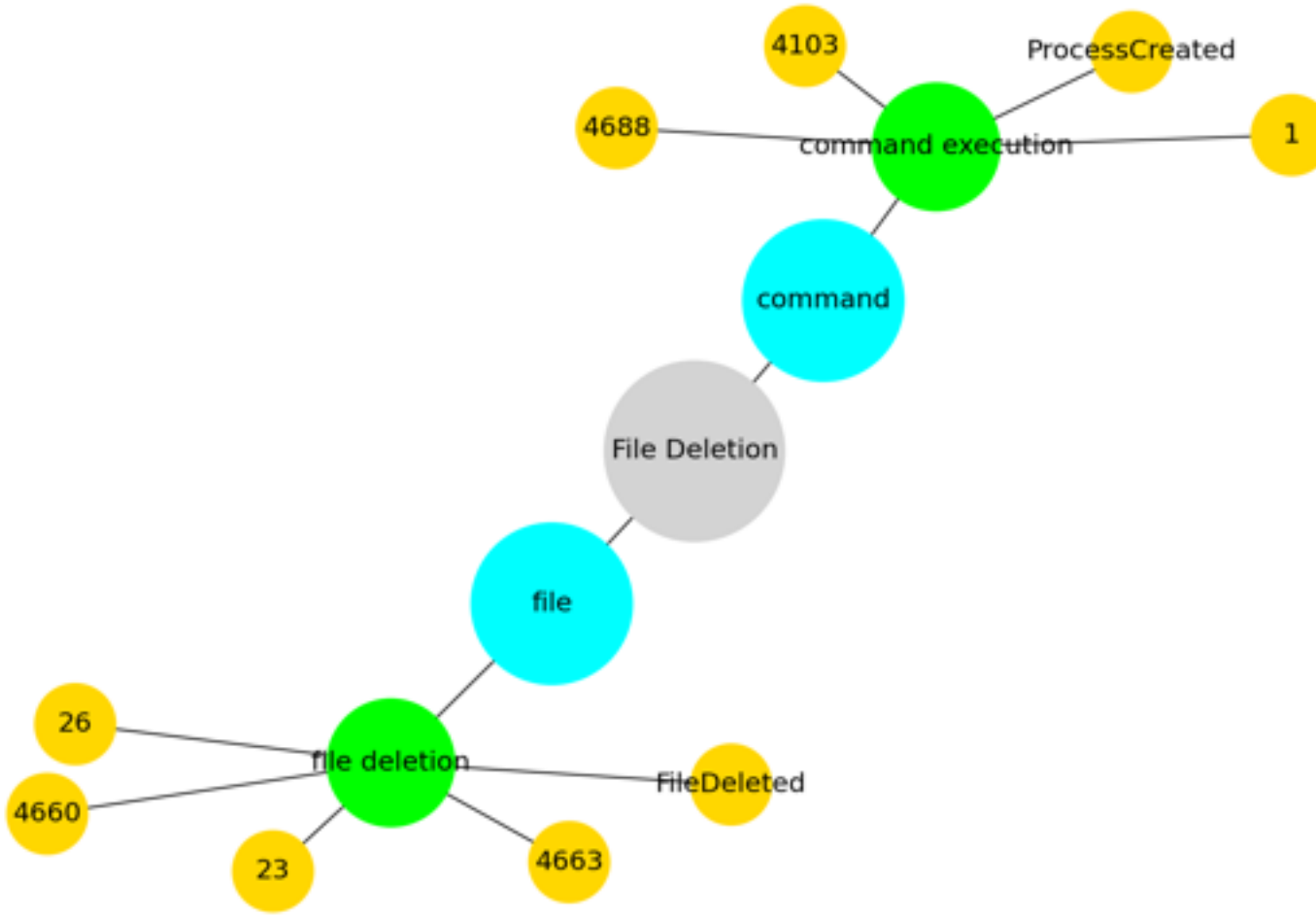
Used by group : BRONZE BUTLER, menuPass, Threat Group-3390, APT18

Tactic : defense-evasion

Technique : File Deletion

Adversaries may delete files left behind by the actions of their intrusion activity. Malware, tools, or other non-native files dropped or created on a system by an adversary (ex: [Ingress Tool Transfer](https://attack.mitre.org/techniques/T1105)) may leave traces to indicate to what was done within a network and how. Removal of these files can occur during an intrusion, or as part of a post-intrusion process to minimize the adversary's footprint.

There are tools available from the host operating system to perform cleanup, but adversaries may use other tools as well.(Citation: Microsoft SDelete July 2016) Examples of built-in [Command and Scripting Interpreter](https://attack.mitre.org/techniques/T1059) functions include <code>del</code> on Windows and <code>rm</code> or <code>unlink</code> on Linux and macOS.



3.20 T1083

Used by group : Fox Kitten, BRONZE BUTLER, menuPass, APT18

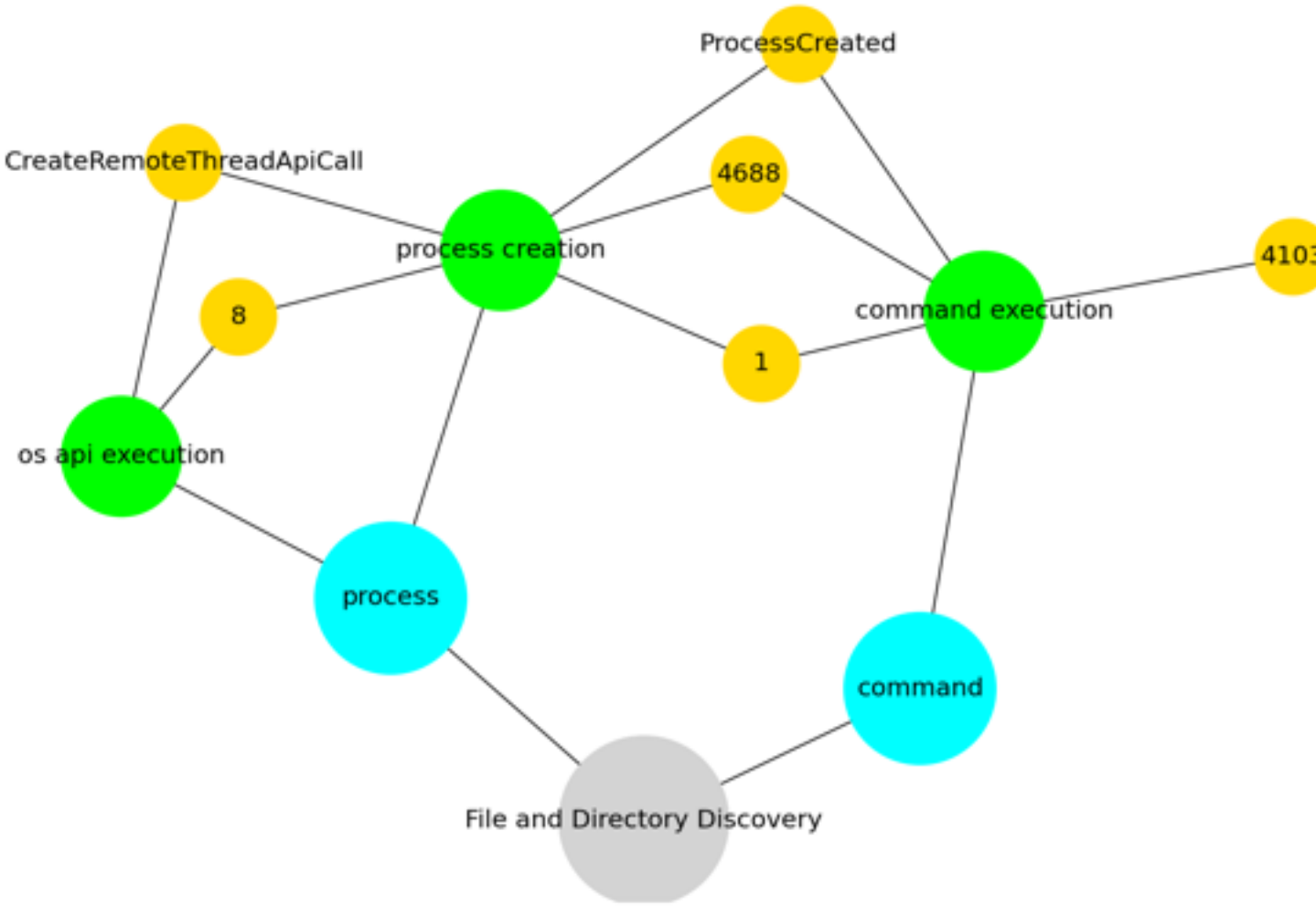
Tactic : discovery

Technique : File and Directory Discovery

Adversaries may enumerate files and directories or may search in specific locations of a host or network share for certain information within a file system. Adversaries may use the information from [File and Directory Discovery](https://attack.mitre.org/techniques/T1083) during automated discovery to shape follow-on behaviors, including whether or not the adversary fully infects the target and/or attempts specific actions.

Many command shell utilities can be used to obtain this information. Examples include <code>dir</code>, <code>tree</code>, <code>ls</code>, <code>find</code>, and <code>locate</code>.(Citation: Windows Commands JPCERT) Custom tools may also be used to gather file and directory information and interact with the [Native API](https://attack.mitre.org/techniques/T1106). Adversaries

may also leverage a [Network Device CLI](https://attack.mitre.org/techniques/T1059/008) on network devices to gather file and directory information.(Citation: US-CERT-TA18-106A)



3.21 T1574.002

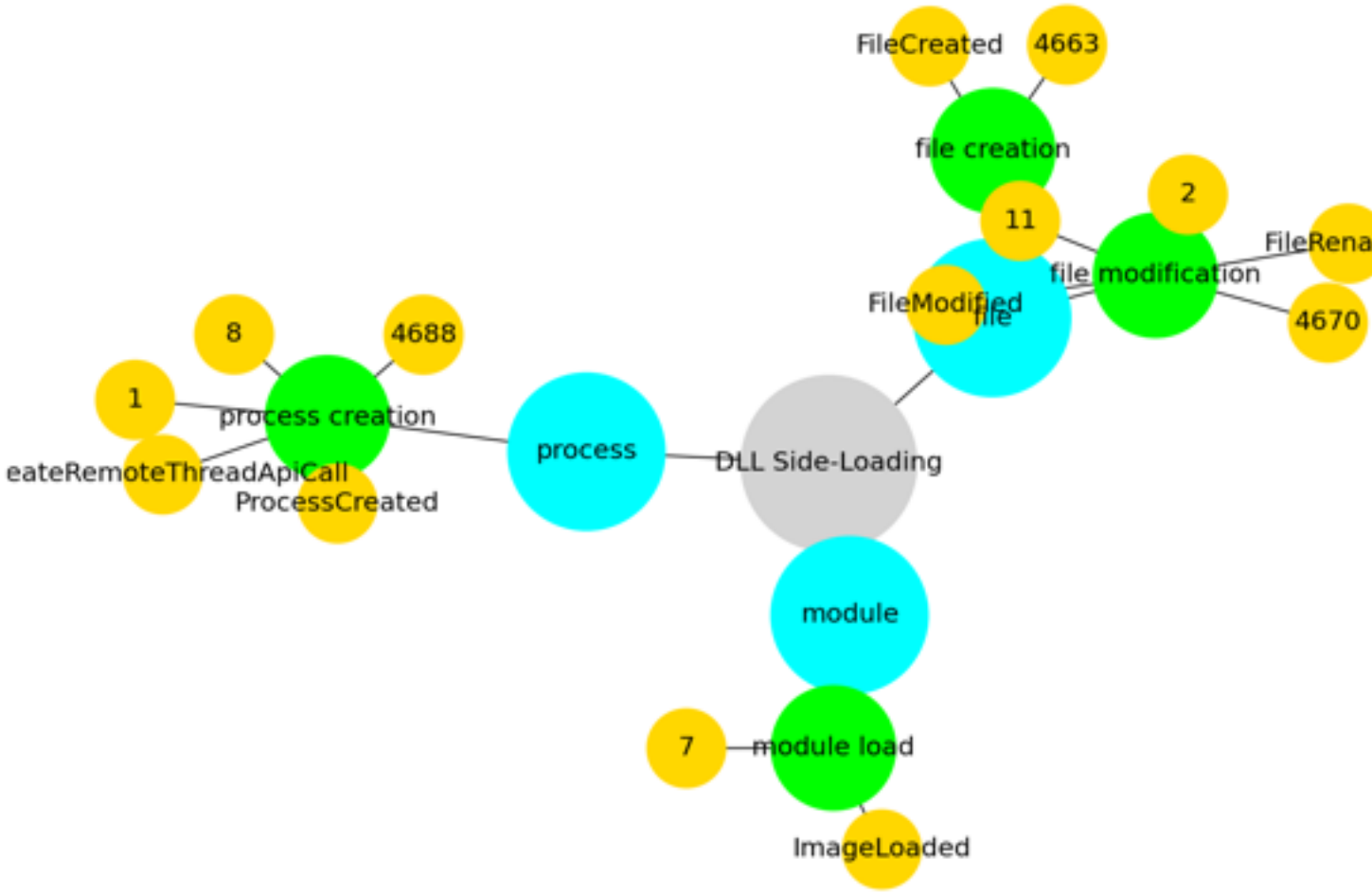
Used by group : APT19, BRONZE BUTLER, menuPass, Threat Group-3390

Tactic : persistence, privilege-escalation, defense-evasion

Technique : DLL Side-Loading

Adversaries may execute their own malicious payloads by side-loading DLLs. Similar to [DLL Search Order Hijacking](https://attack.mitre.org/techniques/T1574/001), side-loading involves hijacking which DLL a program loads. But rather than just planting the DLL within the search order of a program then waiting for the victim application to be invoked, adversaries may directly side-load their payloads by planting then invoking a legitimate application that executes their payload(s).

Side-loading takes advantage of the DLL search order used by the loader by positioning both the victim application and malicious payload(s) alongside each other. Adversaries likely use side-loading as a means of masking actions they perform under a legitimate, trusted, and potentially elevated system or software process. Benign executables used to side-load payloads may not be flagged during delivery and/or execution. Adversary payloads may also be encrypted/packed or otherwise obfuscated until loaded into the memory of the trusted process.(Citation: FireEye DLL Side-Loading)



3.22 T1021.001

Used by group : Fox Kitten, Leviathan, menuPass, Axiom

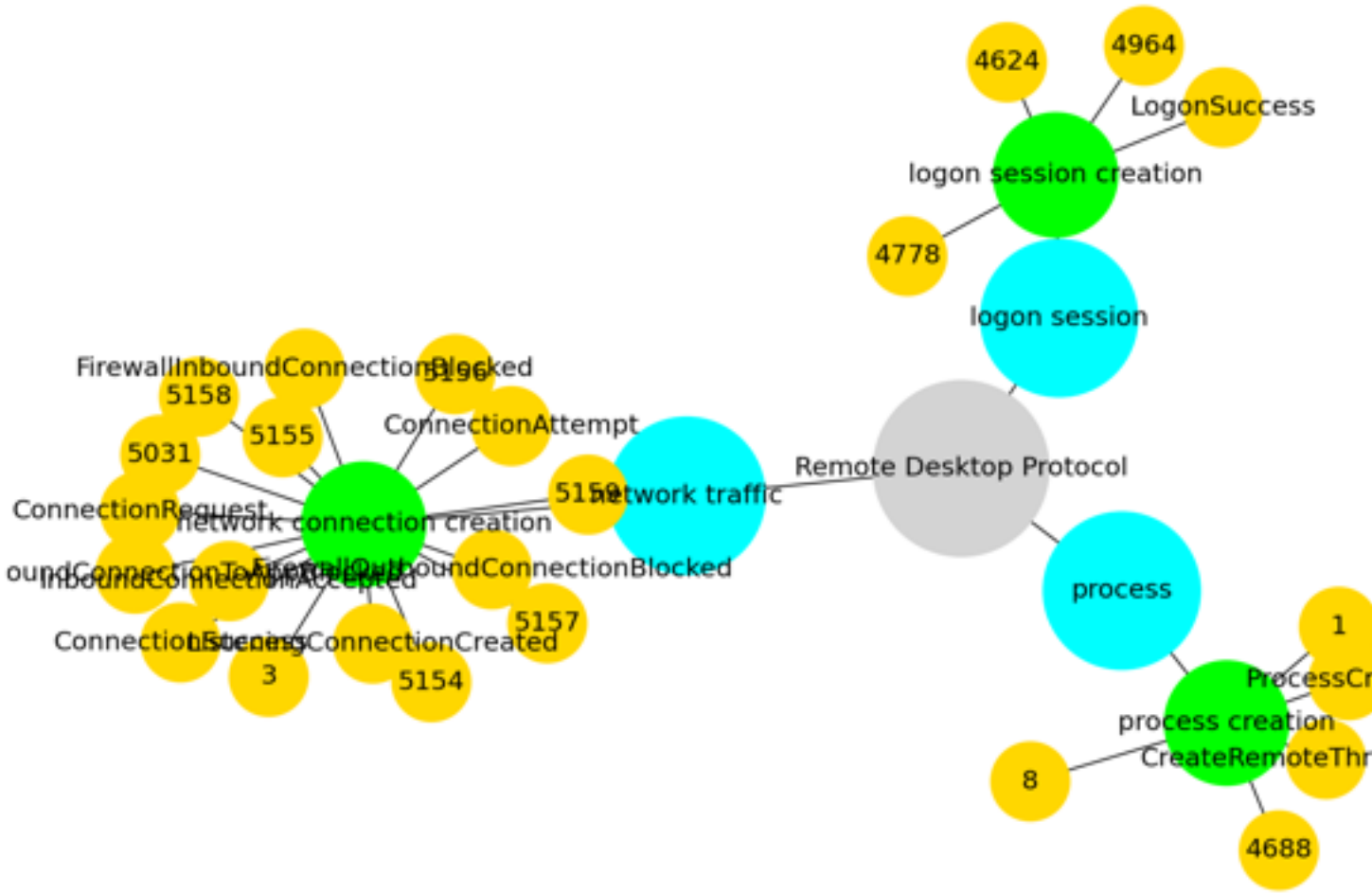
Tactic : lateral-movement

Technique : Remote Desktop Protocol

Adversaries may use [Valid Accounts](https://attack.mitre.org/techniques/T1078) to log into a computer using the Remote Desktop Protocol (RDP). The adversary may then perform actions as the logged-on user.

Remote desktop is a common feature in operating systems. It allows a user to log into an interactive session with a system desktop graphical user interface on a remote system. Microsoft refers to its implementation of the Remote Desktop Protocol (RDP) as Remote Desktop Services (RDS).(Citation: TechNet Remote Desktop Services)

Adversaries may connect to a remote system over RDP/RDS to expand access if the service is enabled and allows access to accounts with known credentials. Adversaries will likely use Credential Access techniques to acquire credentials to use with RDP. Adversaries may also use RDP in conjunction with the [Accessibility Features](https://attack.mitre.org/techniques/T1546/008) or [Terminal Services DLL](https://attack.mitre.org/techniques/T1505/005) for Persistence.(Citation: Alperovitch Malware)



3.23 T1087.002

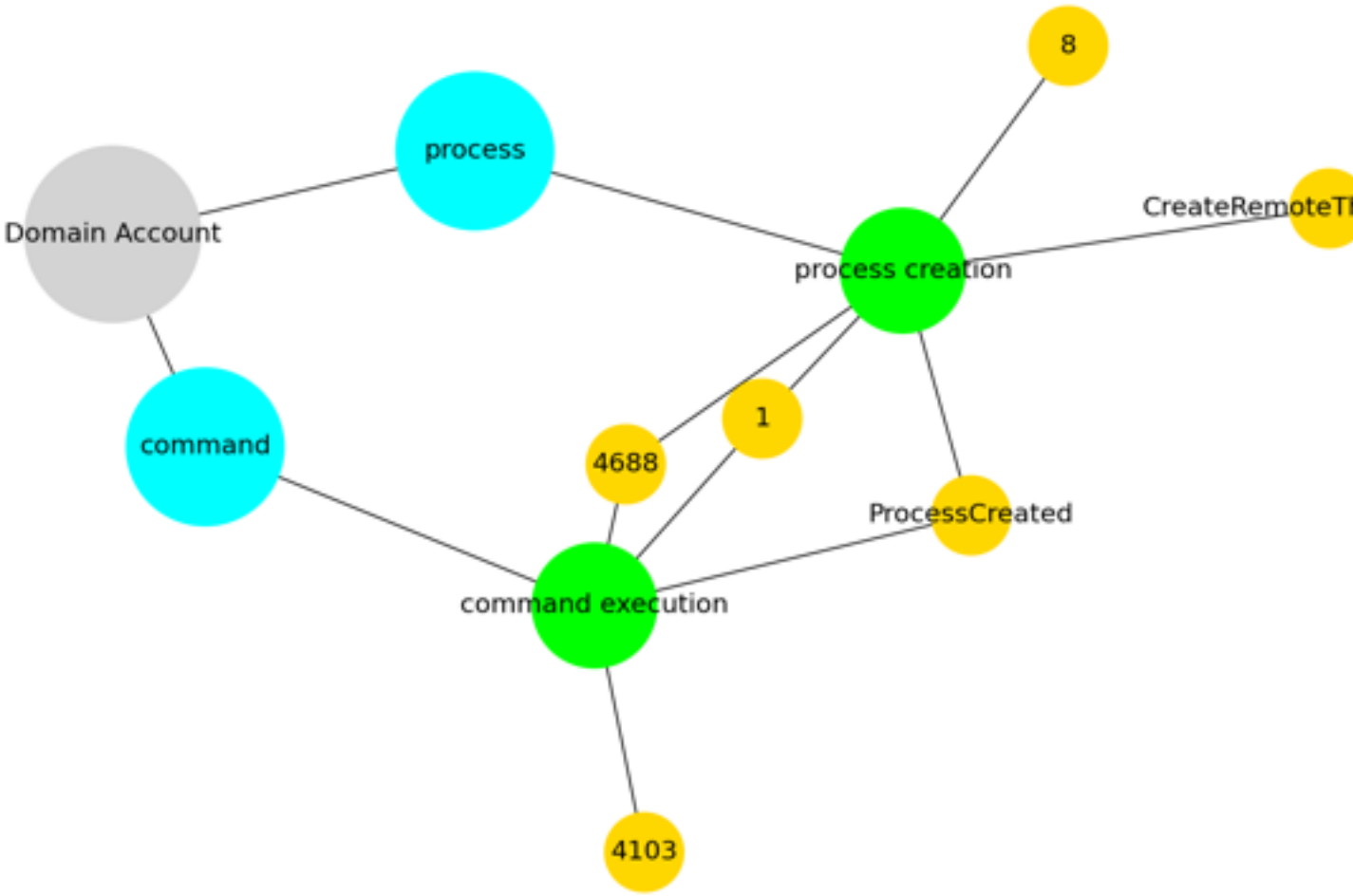
Used by group : Fox Kitten, BRONZE BUTLER, menuPass

Tactic : discovery

Technique : Domain Account

Adversaries may attempt to get a listing of domain accounts. This information can help adversaries determine which domain accounts exist to aid in follow-on behavior.

Commands such as <code>net user /domain</code> and <code>net group /domain</code> of the [Net](https://attack.mitre.org/software/S0039) utility, <code>dscacheutil -q group</code>on macOS, and <code>ldapsearch</code> on Linux can list domain users and groups.



3.24 T1560

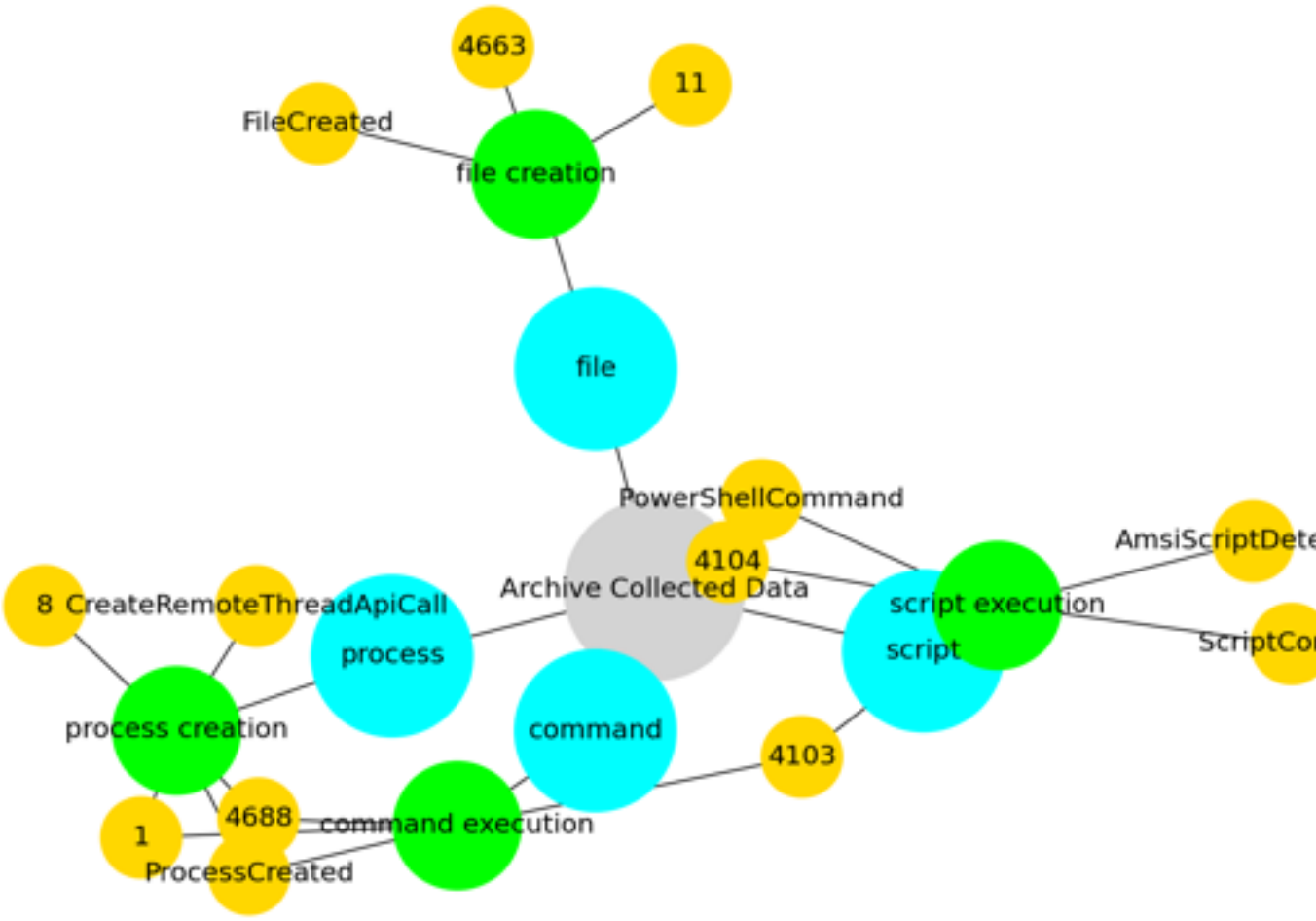
Used by group : Leviathan, menuPass, Axiom

Tactic : collection

Technique : Archive Collected Data

An adversary may compress and/or encrypt data that is collected prior to exfiltration. Compressing the data can help to obfuscate the collected data and minimize the amount of data sent over the network. Encryption can be used to hide information that is being exfiltrated from detection or make exfiltration less conspicuous upon inspection by a defender.

Both compression and encryption are done prior to exfiltration, and can be performed using a utility, 3rd party library, or custom method.



3.25 T1059.005

Used by group : APT-C-36, Leviathan, BRONZE BUTLER

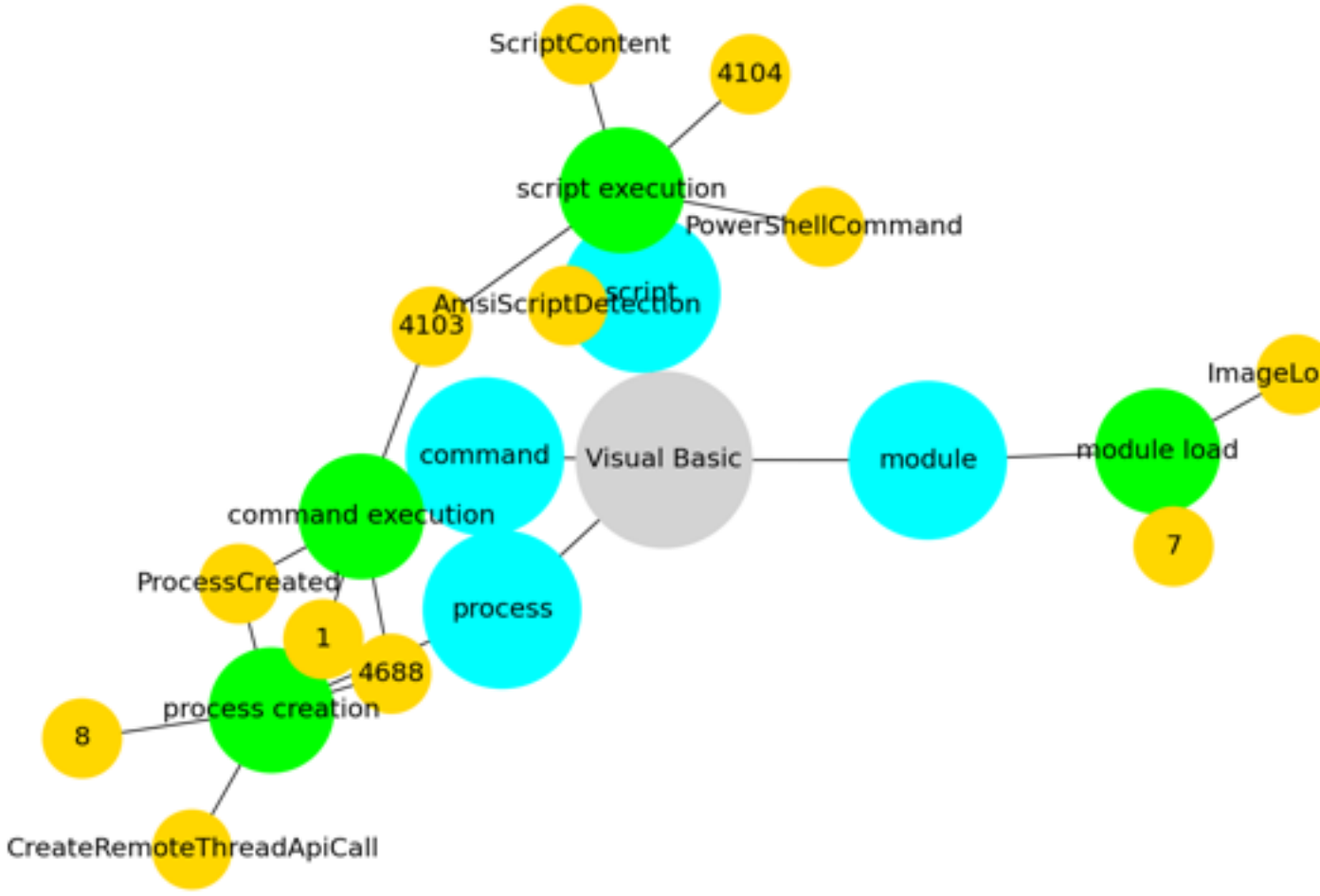
Tactic : execution

Technique : Visual Basic

Adversaries may abuse Visual Basic (VB) for execution. VB is a programming language created by Microsoft with interoperability with many Windows technologies such as [Component Object Model](https://attack.mitre.org/techniques/T1559/001) and the [Native API](https://attack.mitre.org/techniques/T1106) through the Windows API. Although tagged as legacy with no planned future evolutions, VB is integrated and supported in the .NET Framework and cross-platform .NET Core.(Citation: VB .NET Mar 2020)(Citation: VB Microsoft)

Derivative languages based on VB have also been created, such as Visual Basic for Applications (VBA) and VBScript. VBA is an event-driven programming language built into Microsoft Office, as well as several third-party applications.(Citation: Microsoft VBA)(Citation: Wikipedia VBA) VBA enables documents to contain macros used to automate the execution of tasks and other functionality on the host. VBScript is a default scripting language on Windows hosts and can also be used in place of [JavaScript](https://attack.mitre.org/techniques/T1059/007) on HTML Application (HTA) webpages served to Internet Explorer (though most modern browsers do not come with VBScript support).(Citation: Microsoft VBScript)

Adversaries may use VB payloads to execute malicious commands. Common malicious usage includes automating execution of behaviors with VBScript or embedding VBA content into [Spearphishing Attachment](https://attack.mitre.org/techniques/T1566/001) payloads (which may also involve [Mark-of-the-Web Bypass](https://attack.mitre.org/techniques/T1553/005) to enable execution).(Citation: Default VBS macros Blocking)



3.26 T1074.001

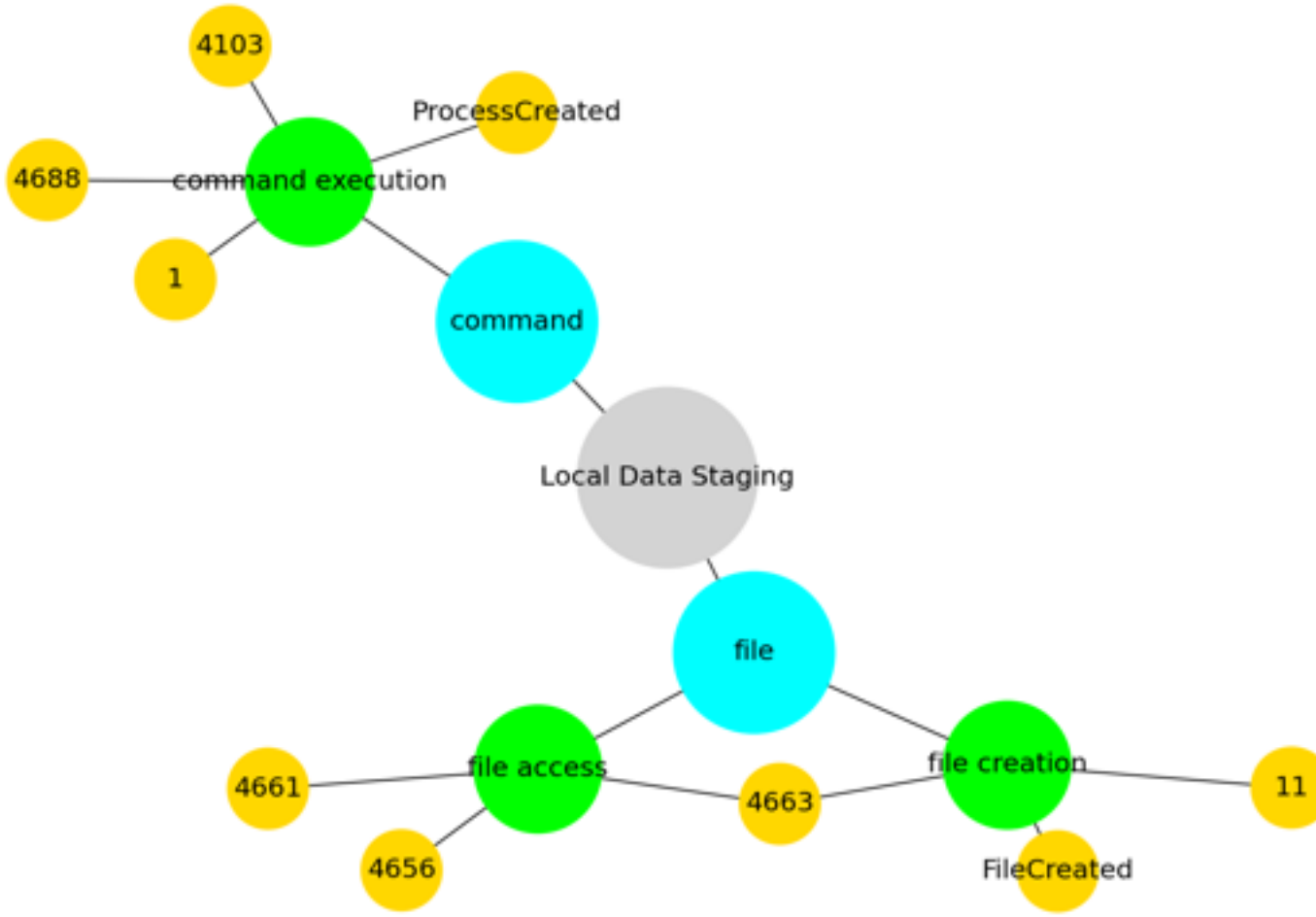
Used by group : Leviathan, menuPass, Threat Group-3390

Tactic : collection

Technique : Local Data Staging

Adversaries may stage collected data in a central location or directory on the local system prior to Exfiltration. Data may be kept in separate files or combined into one file through techniques such as [Archive Collected Data](https://attack.mitre.org/techniques/T1560). Interactive command shells may be used, and common functionality within [cmd](https://attack.mitre.org/software/S0106) and bash may be used to copy data into a staging location.

Adversaries may also stage collected data in various available formats/locations of a system, including local storage databases/repositories or the Windows Registry.(Citation: Prevailion DarkWatchman 2021)



3.27 T1560.001

Used by group : Fox Kitten, BRONZE BUTLER, menuPass

Tactic : collection

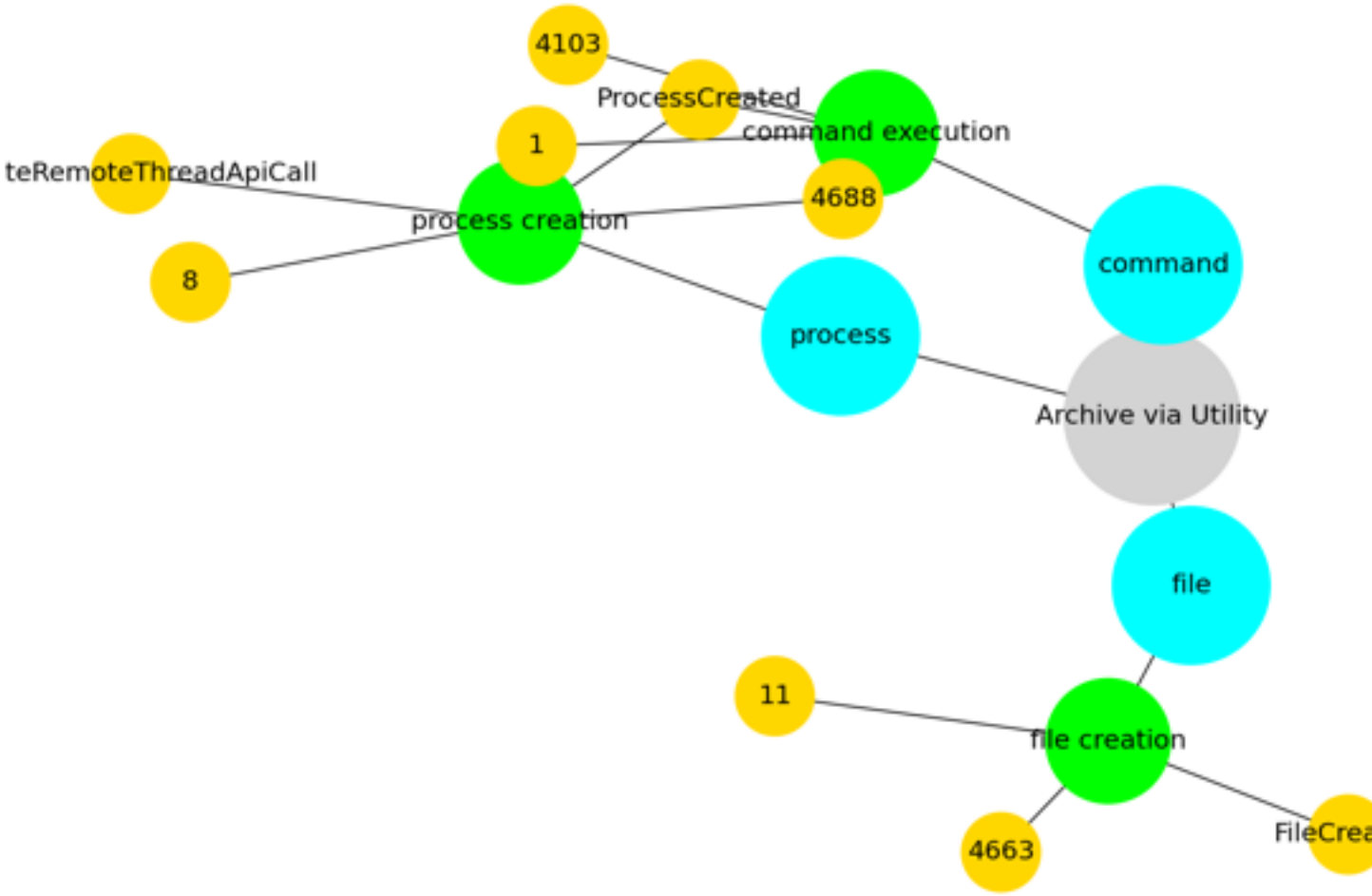
Technique : Archive via Utility

Adversaries may use utilities to compress and/or encrypt collected data prior to exfiltration. Many utilities include functionalities to compress, encrypt, or otherwise package data into a format that is easier/more secure to transport.

Adversaries may abuse various utilities to compress or encrypt data before exfiltration. Some third party utilities may be preinstalled, such as <code>tar</code> on Linux and macOS or <code>zip</code> on Windows systems. On Windows, <code>diantz</code> or <code> makecab</code> may be used to package collected files into a cabinet (.cab) file. <code>diantz</code> may also be used to download and compress files from remote locations (i.e. [Remote Data Staging](https://attack.mitre.org/techniques/T1074/002)).(Citation: diantz.exe_lolbas) Additionally, <code>xcopy</code> on Windows

can copy files and directories with a variety of options.

Adversaries may use also third party utilities, such as 7-Zip, WinRAR, and WinZip, to perform similar activities.(Citation: 7zip Homepage)(Citation: WinRAR Homepage)(Citation: WinZip Homepage)



3.28 T1016

Used by group : APT19, menuPass, Threat Group-3390

Tactic : discovery

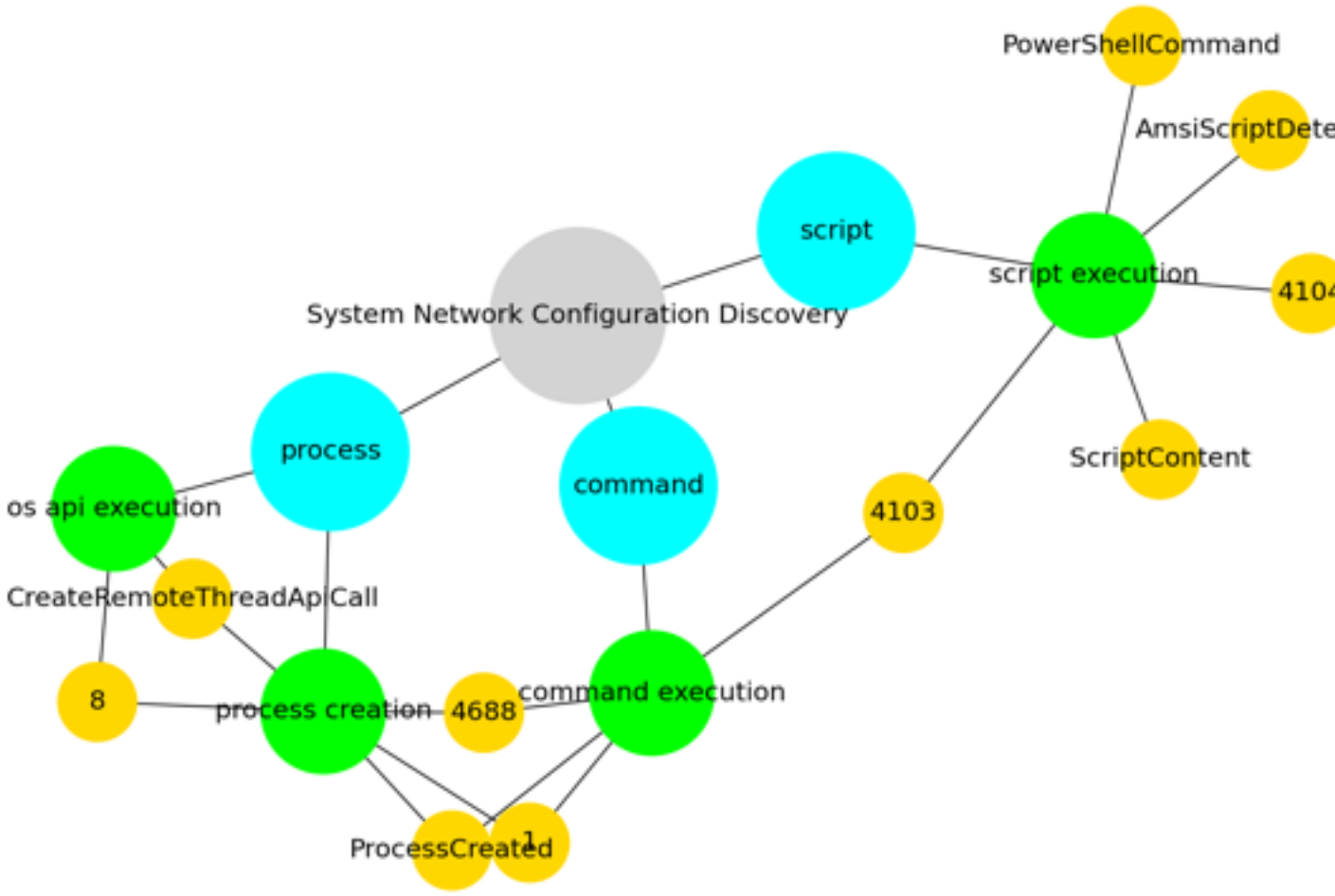
Technique : System Network Configuration Discovery

Adversaries may look for details about the network configuration and settings, such as IP and/or MAC addresses, of systems they access or through information discovery of remote systems. Several operating system administration utilities exist that can be used to gather this information. Examples include [Arp](https://attack.mitre.org/software/S0099),

[ipconfig](https://attack.mitre.org/software/S0100)/[ifconfig](https://attack.mitre.org/software/S0101), [nbtstat](https://attack.mitre.org/software/S0102), and [route](https://attack.mitre.org/software/S0103).

Adversaries may also leverage a [Network Device CLI](https://attack.mitre.org/techniques/T1059/008) on network devices to gather information about configurations and settings, such as IP addresses of configured interfaces and static/dynamic routes.(Citation: US-CERT-TA18-106A)(Citation: Mandiant APT41 Global Intrusion)

Adversaries may use the information from [System Network Configuration Discovery](https://attack.mitre.org/techniques/T1016) during automated discovery to shape follow-on behaviors, including determining certain access within the target network and what actions to do next.



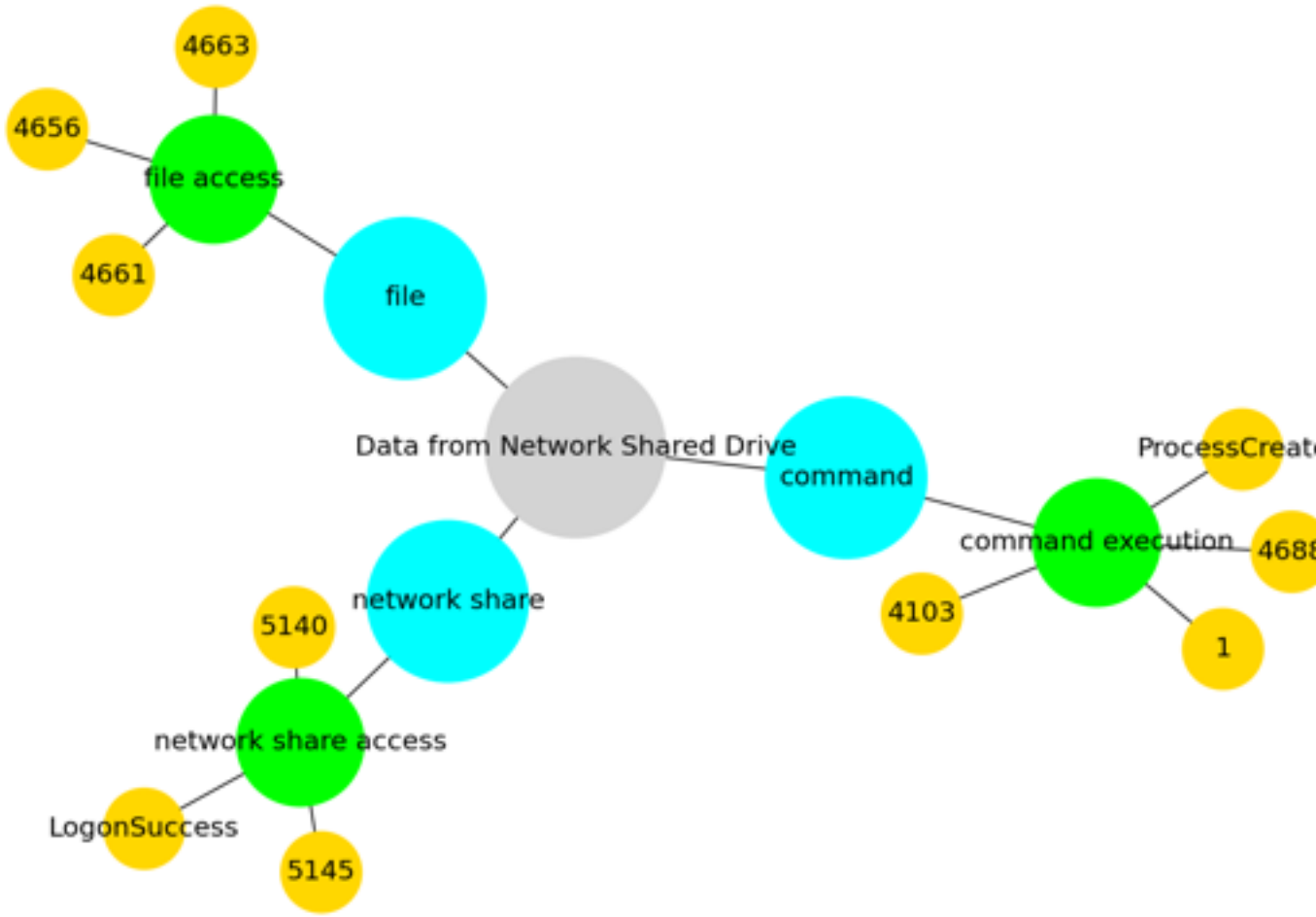
3.29 T1039

Used by group : Fox Kitten, BRONZE BUTLER, menuPass

Tactic : collection

Technique : Data from Network Shared Drive

Adversaries may search network shares on computers they have compromised to find files of interest. Sensitive data can be collected from remote systems via shared network drives (host shared directory, network file server, etc.) that are accessible from the current system prior to Exfiltration. Interactive command shells may be in use, and common functionality within [cmd](https://attack.mitre.org/software/S0106) may be used to gather information.



3.30 T1021.004

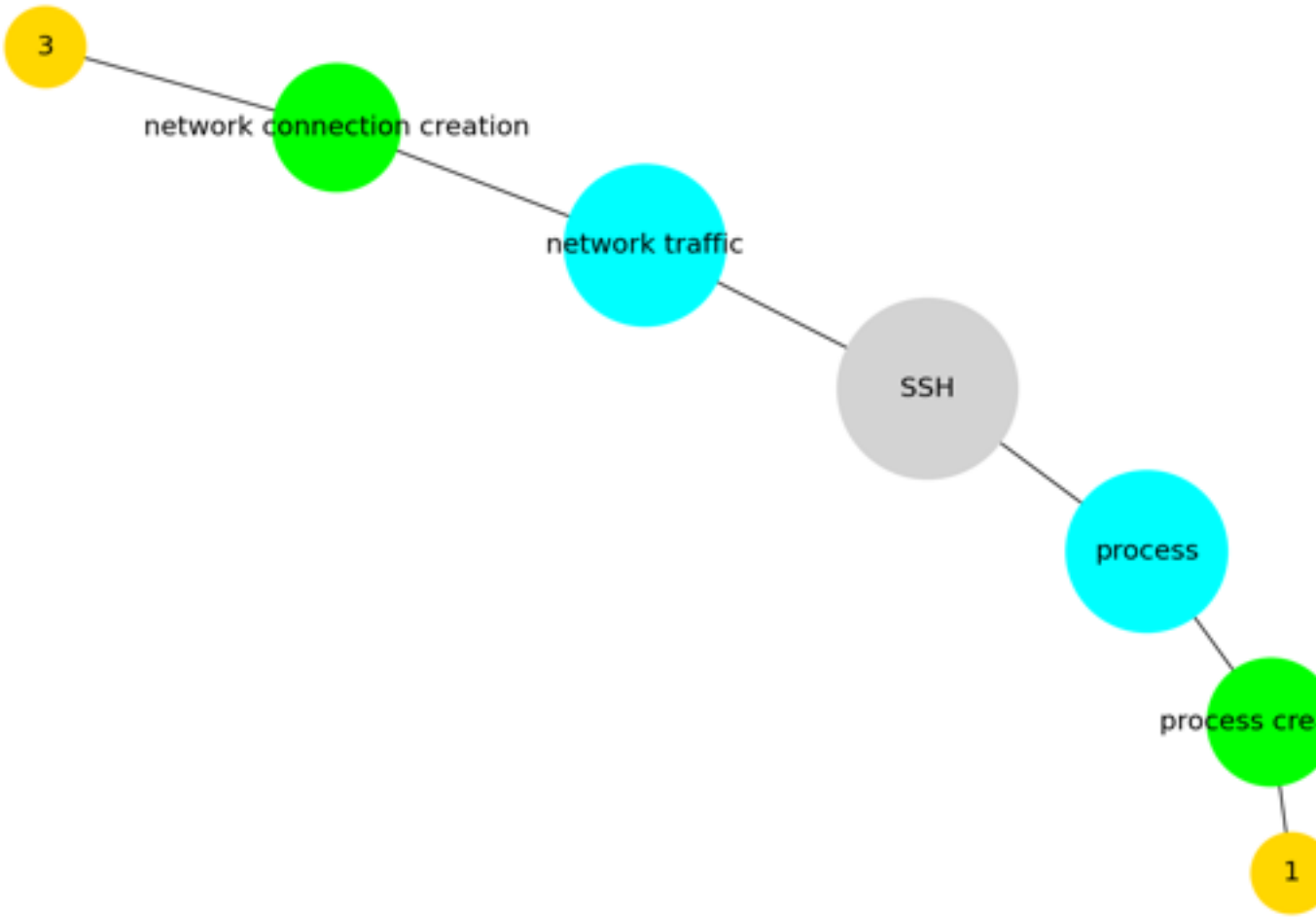
Used by group : Fox Kitten, Leviathan, menuPass

Tactic : lateral-movement

Technique : SSH

Adversaries may use [Valid Accounts](https://attack.mitre.org/techniques/T1078) to log into remote machines using Secure Shell (SSH). The adversary may then perform actions as the logged-on user.

SSH is a protocol that allows authorized users to open remote shells on other computers. Many Linux and macOS versions come with SSH installed by default, although typically disabled until the user enables it. The SSH server can be configured to use standard password authentication or public-private keypairs in lieu of or in addition to a password. In this authentication scenario, the user's public key must be in a special file on the computer running the server that lists which keypairs are allowed to login as that user.



4. Annexes

< To be corrected or added in future releases >

4.1 List of all techniques used

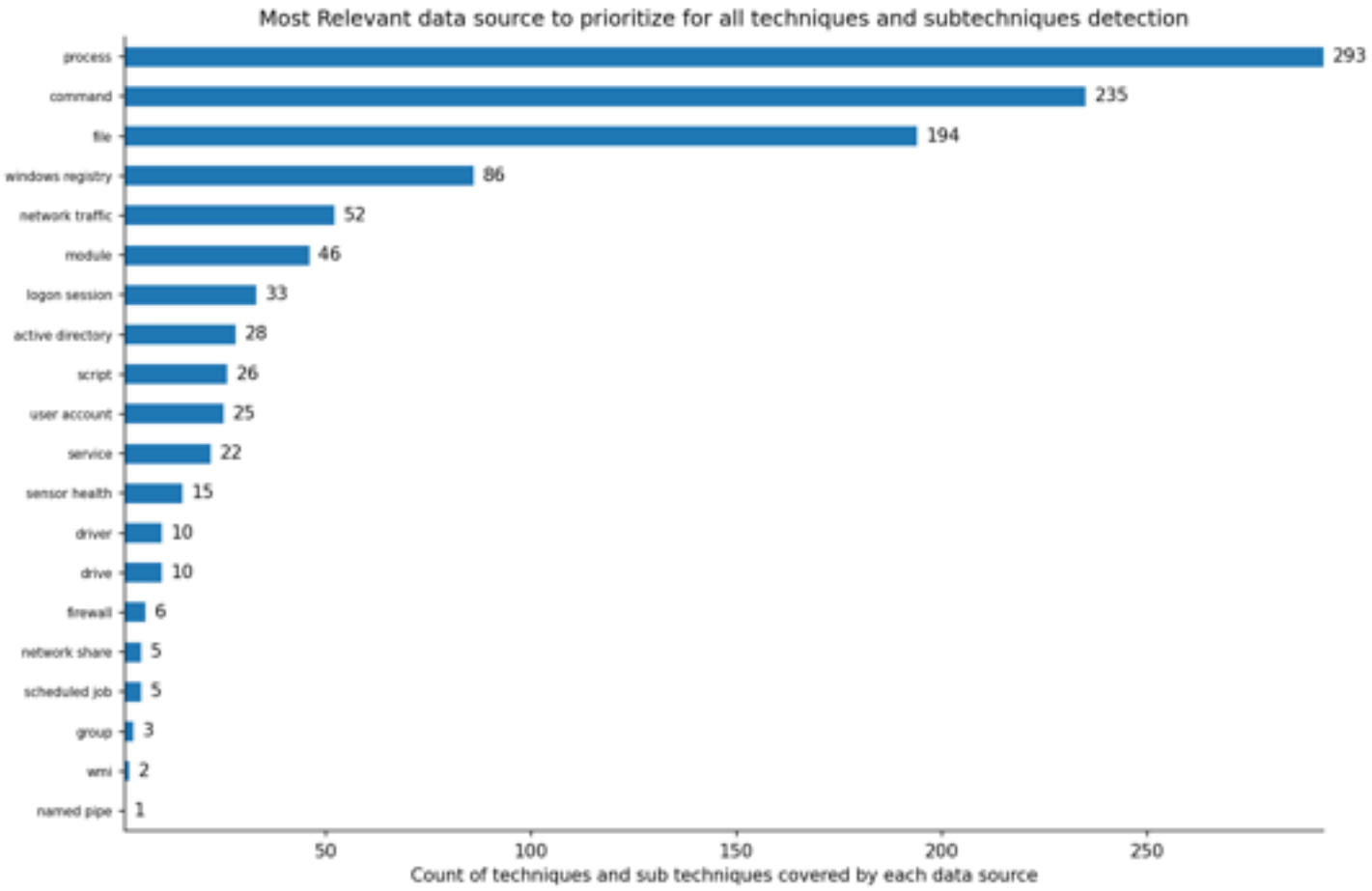
technique_id	tactic	technique	group
T1105	command-and-control	Ingress Tool Transfer	Fox Kitten, APT-C-36, Leviathan, BRONZE BUTLER, menuPass, Threat Group-3390, APT18
T1027	defense-evasion	Obfuscated Files or Information	Fox Kitten, APT-C-36, APT19, Leviathan, menuPass, Threat Group-3390, APT18
T1078	defense-evasion, persistence, privilege-escalation, initial-access	Valid Accounts	Fox Kitten, Leviathan, menuPass, Threat Group-3390, APT18, Axiom
T1059.001	execution	PowerShell	Fox Kitten, APT19, Leviathan, BRONZE BUTLER, menuPass, Threat Group-3390
T1566.001	initial-access	Spearphishing Attachment	APT-C-36, APT19, Leviathan, BRONZE BUTLER, menuPass, Threat Group-3390
T1204.002	execution	Malicious File	APT-C-36, APT19, Leviathan, BRONZE BUTLER, menuPass, Threat Group-3390
T1189	initial-access	Drive-by Compromise	APT19, Leviathan, BRONZE BUTLER, Threat Group-3390, Axiom
T1547.001	persistence, privilege-escalation	Registry Run Keys / Startup Folder	APT19, Leviathan, BRONZE BUTLER, Threat Group-3390, APT18
T1071.001	command-and-control	Web Protocols	SilverTerrier, APT19, BRONZE BUTLER, Threat Group-3390, APT18
T1588.002	resource-development	Tool	APT-C-36, APT19, BRONZE BUTLER, menuPass, Threat Group-3390
T1005	collection	Data from Local System	Fox Kitten, BRONZE BUTLER, menuPass, Threat Group-3390, Axiom
T1140	defense-evasion	Deobfuscate/Decode Files or Information	APT19, Leviathan, BRONZE BUTLER, menuPass, Threat Group-3390
T1059.003	execution	Windows Command Shell	Fox Kitten, BRONZE BUTLER, menuPass, Threat Group-3390, APT18
T1053.005	execution, persistence, privilege-escalation	Scheduled Task	Fox Kitten, APT-C-36, BRONZE BUTLER, menuPass
T1203	execution	Exploitation for Client Execution	Leviathan, BRONZE BUTLER, Threat Group-3390, Axiom
T1003.001	credential-access	LSASS Memory	Fox Kitten, Leviathan, BRONZE BUTLER, Threat Group-3390
T1018	discovery	Remote System Discovery	Fox Kitten, BRONZE BUTLER, menuPass, Threat Group-3390
T1190	initial-access	Exploit Public-Facing Application	Fox Kitten, menuPass, Threat Group-3390, Axiom
T1070.004	defense-evasion	File Deletion	BRONZE BUTLER, menuPass, Threat Group-3390, APT18
T1083	discovery	File and Directory Discovery	Fox Kitten, BRONZE BUTLER, menuPass, APT18
T1574.002	persistence, privilege-escalation, defense-evasion	DLL Side-Loading	APT19, BRONZE BUTLER, menuPass, Threat Group-3390
T1021.001	lateral-movement	Remote Desktop Protocol	Fox Kitten, Leviathan, menuPass, Axiom
T1087.002	discovery	Domain Account	Fox Kitten, BRONZE BUTLER, menuPass
T1560	collection	Archive Collected Data	Leviathan, menuPass, Axiom
T1059.005	execution	Visual Basic	APT-C-36, Leviathan, BRONZE BUTLER
T1074.001	collection	Local Data Staging	Leviathan, menuPass, Threat Group-3390
T1560.001	collection	Archive via Utility	Fox Kitten, BRONZE BUTLER, menuPass
T1016	discovery	System Network Configuration Discovery	APT19, menuPass, Threat Group-3390
T1039	collection	Data from Network Shared Drive	Fox Kitten, BRONZE BUTLER, menuPass
T1021.004	lateral-movement	SSH	Fox Kitten, Leviathan, menuPass
T1046	discovery	Network Service Discovery	Fox Kitten, menuPass, Threat Group-3390
T1133	persistence, initial-access	External Remote Services	Leviathan, Threat Group-3390, APT18
T1047	execution	Windows Management Instrumentation	Leviathan, menuPass, Threat Group-3390
T1036.005	defense-evasion	Match Legitimate Name or Location	Fox Kitten, BRONZE BUTLER, menuPass
T1053.002	execution, persistence, privilege-escalation	At	BRONZE BUTLER, Threat Group-3390, APT18
T1210	lateral-movement	Exploitation of Remote Services	Fox Kitten, menuPass, Threat Group-3390
T1505.003	persistence	Web Shell	Fox Kitten, Leviathan, Threat Group-3390
T1074.002	collection	Remote Data Staging	Leviathan, menuPass, Threat Group-3390
T1027.003	defense-evasion	Steganography	Leviathan, BRONZE BUTLER
T1049	discovery	System Network Connections Discovery	menuPass, Threat Group-3390
T1033	discovery	System Owner/User Discovery	APT19, Threat Group-3390
T1027.001	defense-evasion	Binary Padding	Leviathan, BRONZE BUTLER

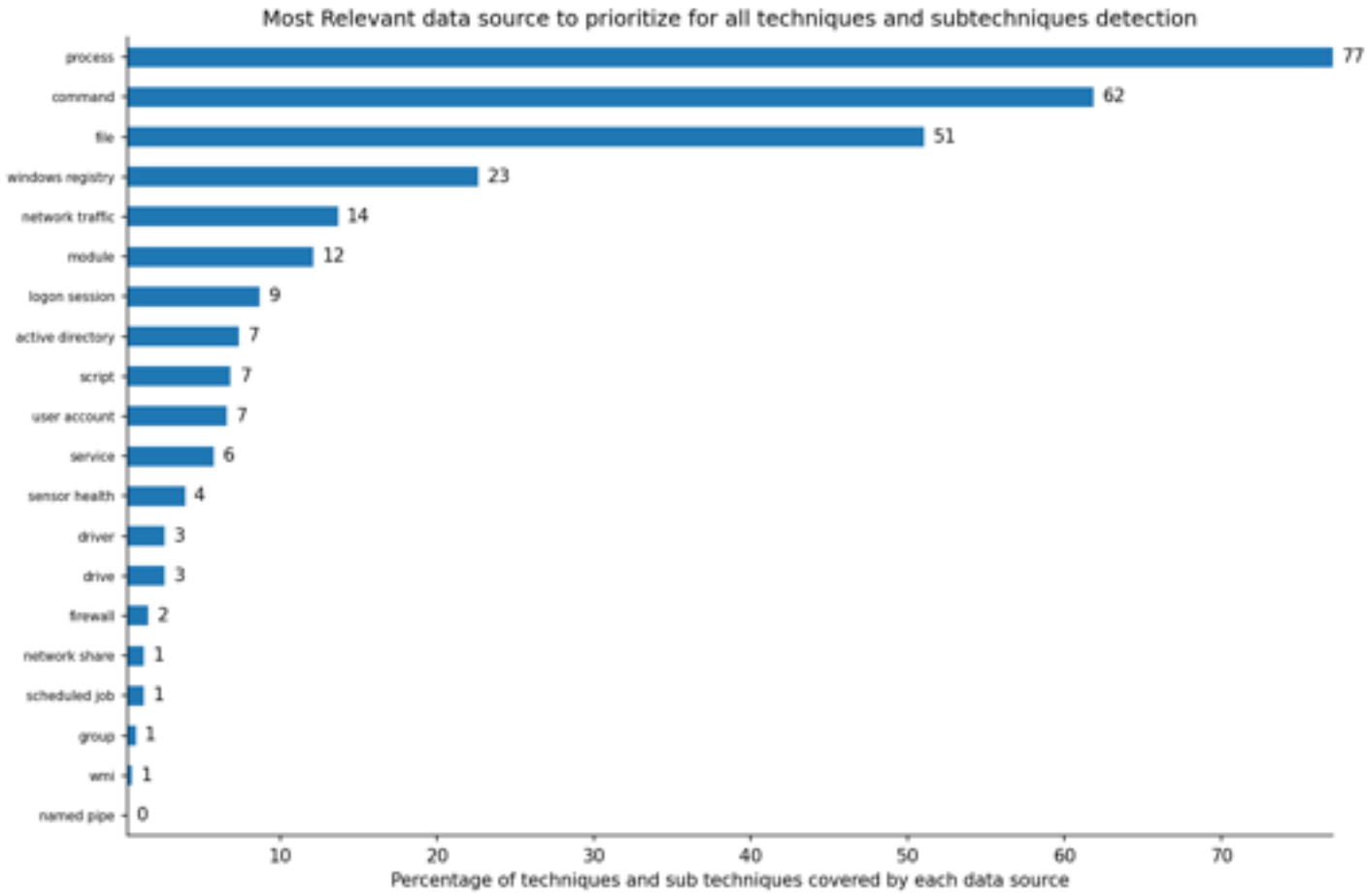
T1583.001	resource-development	Domains	Leviathan, menuPass
T1119	collection	Automated Collection	menuPass, Threat Group-3390
T1003.004	credential-access	LSA Secrets	menuPass, Threat Group-3390
T1585.001	resource-development	Social Media Accounts	Fox Kitten, Leviathan
T1574.001	persistence, privilege-escalation, defense-evasion	DLL Search Order Hijacking	menuPass, Threat Group-3390
T1082	discovery	System Information Discovery	APT19, APT18
T1567.002	exfiltration	Exfiltration to Cloud Storage	Leviathan, Threat Group-3390
T1056.001	collection, credential-access	Keylogging	menuPass, Threat Group-3390
T1003.002	credential-access	Security Account Manager	menuPass, Threat Group-3390
T1548.002	privilege-escalation, defense-evasion	Bypass User Account Control	BRONZE BUTLER, Threat Group-3390
T1199	initial-access	Trusted Relationship	menuPass, Threat Group-3390
T1553.002	defense-evasion	Code Signing	Leviathan, menuPass
T1003	credential-access	OS Credential Dumping	Leviathan, Axiom
T1055.012	defense-evasion, privilege-escalation	Process Hollowing	menuPass, Threat Group-3390
T1036	defense-evasion	Masquerading	BRONZE BUTLER, menuPass
T1555.005	credential-access	Password Managers	Fox Kitten, Threat Group-3390
T1112	defense-evasion	Modify Registry	APT19, Threat Group-3390
T1036.004	defense-evasion	Masquerade Task or Service	Fox Kitten, APT-C-36
T1572	command-and-control	Protocol Tunneling	Fox Kitten, Leviathan
T1059	execution	Command and Scripting Interpreter	Fox Kitten, APT19
T1012	discovery	Query Registry	Fox Kitten, Threat Group-3390
T1087.001	discovery	Local Account	Fox Kitten, Threat Group-3390
T1003.003	credential-access	NTDS	Fox Kitten, menuPass
T1132.001	command-and-control	Standard Encoding	APT19, BRONZE BUTLER
T1218.010	defense-evasion	Regsvr32	APT19, Leviathan
T1546.008	privilege-escalation, persistence	Accessibility Features	Fox Kitten, Axiom
T1543.003	persistence, privilege-escalation	Windows Service	APT19, Threat Group-3390
T1568.001	command-and-control	Fast Flux DNS	menuPass
T1021.002	lateral-movement	SMB/Windows Admin Shares	Fox Kitten
T1608.004	resource-development	Drive-by Target	Threat Group-3390
T1021.005	lateral-movement	VNC	Fox Kitten
T1036.003	defense-evasion	Rename System Utilities	menuPass
T1070.003	defense-evasion	Clear Command History	menuPass
T1218.004	defense-evasion	InstallUtil	menuPass
T1552.001	credential-access	Credentials In Files	Fox Kitten
T1090.002	command-and-control	External Proxy	menuPass
T1007	discovery	System Service Discovery	BRONZE BUTLER
T1106	execution	Native API	menuPass
T1585	resource-development	Establish Accounts	Fox Kitten
T1608.001	resource-development	Upload Malware	Threat Group-3390
T1608.002	resource-development	Upload Tool	Threat Group-3390
T1080	lateral-movement	Taint Shared Content	BRONZE BUTLER
T1563.002	lateral-movement	RDP Hijacking	Axiom
T1566	initial-access	Phishing	Axiom
T1001.002	command-and-control	Steganography	Axiom
T1583.002	resource-development	DNS Server	Axiom
T1583.003	resource-development	Virtual Private Server	Axiom
T1584.005	resource-development	Botnet	Axiom
T1071.004	command-and-control	DNS	APT18
T1030	exfiltration	Data Transfer Size Limits	Threat Group-3390

T1068	privilege-escalation	Exploitation for Privilege Escalation	Threat Group-3390
T1070.005	defense-evasion	Network Share Connection Removal	Threat Group-3390
T1027.002	defense-evasion	Software Packing	Threat Group-3390
T1021.006	lateral-movement	Windows Remote Management	Threat Group-3390
T1560.002	collection	Archive via Library	Threat Group-3390
T1562.002	defense-evasion	Disable Windows Event Logging	Threat Group-3390
T1195.002	initial-access	Compromise Software Supply Chain	Threat Group-3390
T1136.001	persistence	Local Account	Fox Kitten
T1518	discovery	Software Discovery	BRONZE BUTLER
T1113	collection	Screen Capture	BRONZE BUTLER
T1564.003	defense-evasion	Hidden Window	APT19
T1571	command-and-control	Non-Standard Port	APT-C-36
T1559.002	execution	Dynamic Data Exchange	Leviathan
T1071.003	command-and-control	Mail Protocols	SilverTerrier
T1566.002	initial-access	Spearphishing Link	Leviathan
T1071.002	command-and-control	File Transfer Protocols	SilverTerrier
T1204.001	execution	Malicious Link	Leviathan
T1102.003	command-and-control	One-Way Communication	Leviathan
T1546.003	privilege-escalation, persistence	Windows Management Instrumentation Event Subscription	Leviathan
T1090.003	command-and-control	Multi-hop Proxy	Leviathan
T1585.002	resource-development	Email Accounts	Leviathan
T1586.001	resource-development	Social Media Accounts	Leviathan
T1586.002	resource-development	Email Accounts	Leviathan
T1589.001	reconnaissance	Credentials	Leviathan
T1218.011	defense-evasion	Rundll32	APT19
T1547.009	persistence, privilege-escalation	Shortcut Modification	Leviathan
T1055.001	defense-evasion, privilege-escalation	Dynamic-link Library Injection	Leviathan
T1124	discovery	System Time Discovery	BRONZE BUTLER
T1102.001	command-and-control	Dead Drop Resolver	BRONZE BUTLER
T1530	collection	Data from Cloud Storage Object	Fox Kitten
T1550.003	defense-evasion, lateral-movement	Pass the Ticket	BRONZE BUTLER
T1213	collection	Data from Information Repositories	Fox Kitten
T1036.002	defense-evasion	Right-to-Left Override	BRONZE BUTLER
T1562.001	defense-evasion	Disable or Modify Tools	BRONZE BUTLER
T1059.006	execution	Python	BRONZE BUTLER
T1573.001	command-and-control	Symmetric Cryptography	BRONZE BUTLER
T1534	lateral-movement	Internal Spearphishing	Leviathan
T1217	discovery	Browser Bookmark Discovery	Fox Kitten
T1041	exfiltration	Exfiltration Over C2 Channel	Leviathan
T1110	credential-access	Brute Force	Fox Kitten
T1102	command-and-control	Web Service	Fox Kitten
T1197	defense-evasion, persistence	BITS Jobs	Leviathan
T1090	command-and-control	Proxy	Fox Kitten
T1553	defense-evasion	Subvert Trust Controls	Axiom

4.2 Data sources reference for covering all mitre technique

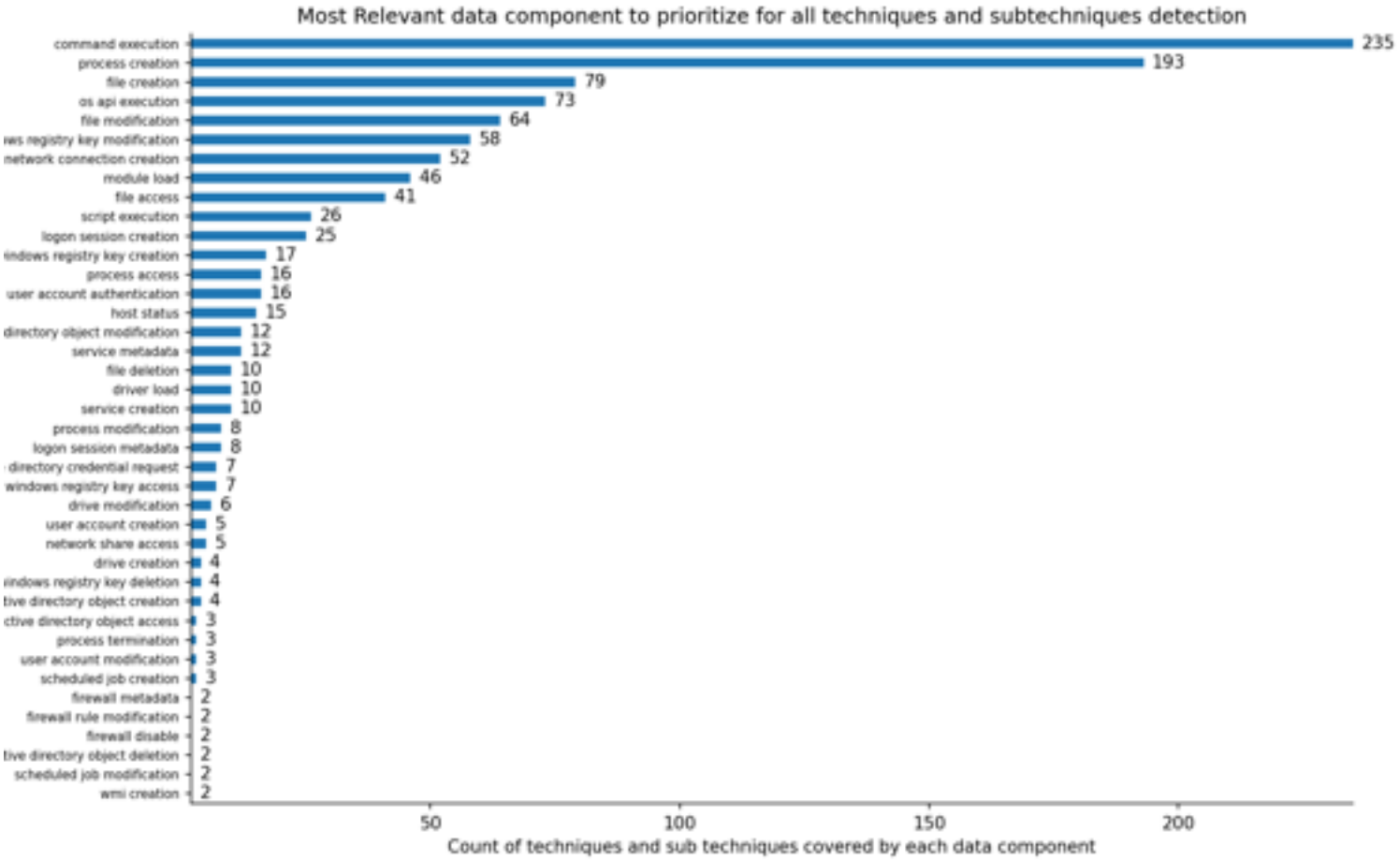
< To be corrected or added in future releases >

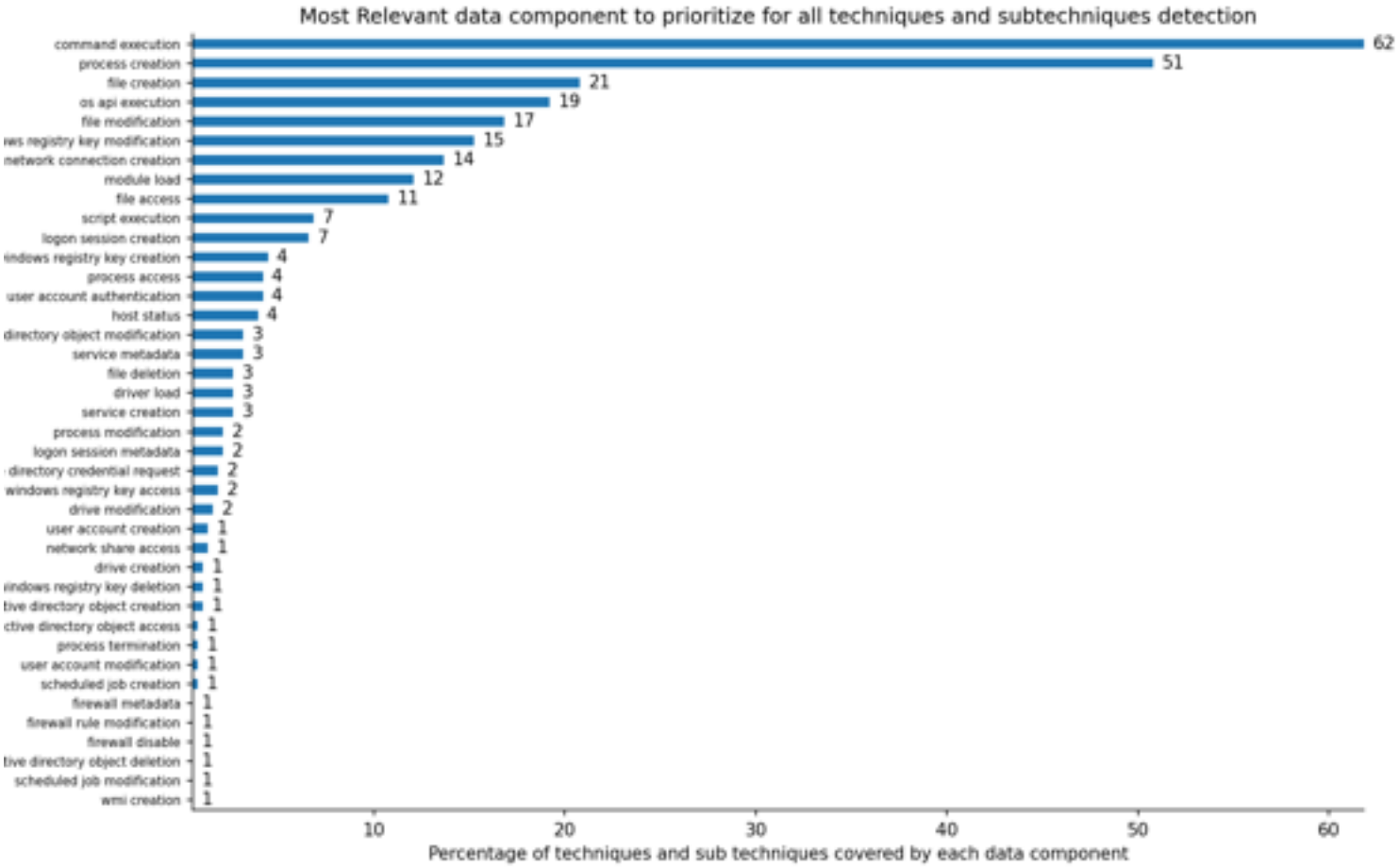

Most Relevant data source to prioritize for all techniques and subtechniques detection
process
command
file
windows registry
network traffic
module
logon session
active directory
script
user account
service
sensor health
driver
drive
firewall
network share
scheduled job
group
wmi
named pipe
293
235
194
86
52
46
33
28
26
25
22
15
10
10
6
5
5
3
2
1
50
100
150
200
250
Count of techniques and sub techniques covered by each data source



4.3 Data component reference for covering all mitre technique

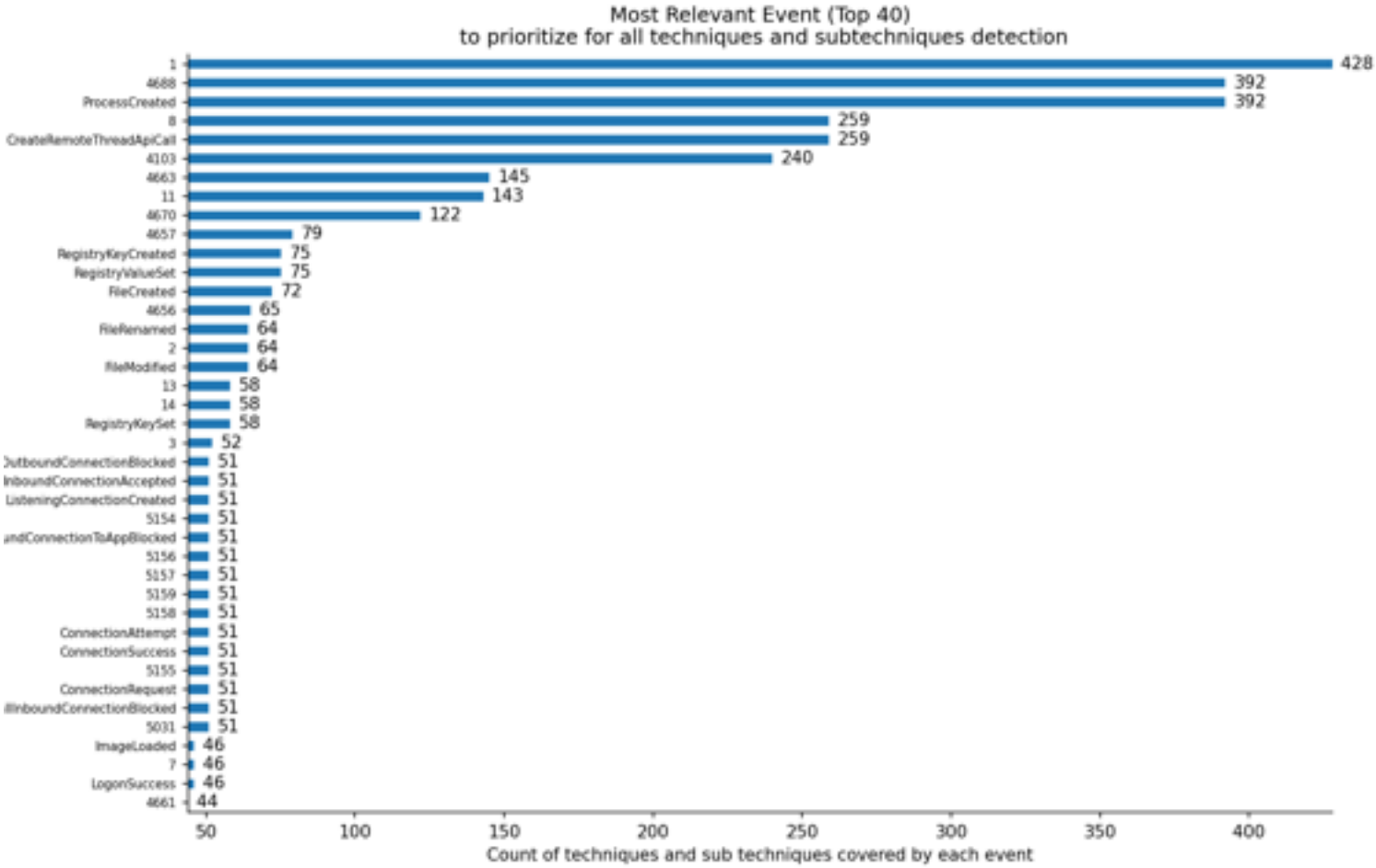
< To be corrected or added in future releases >

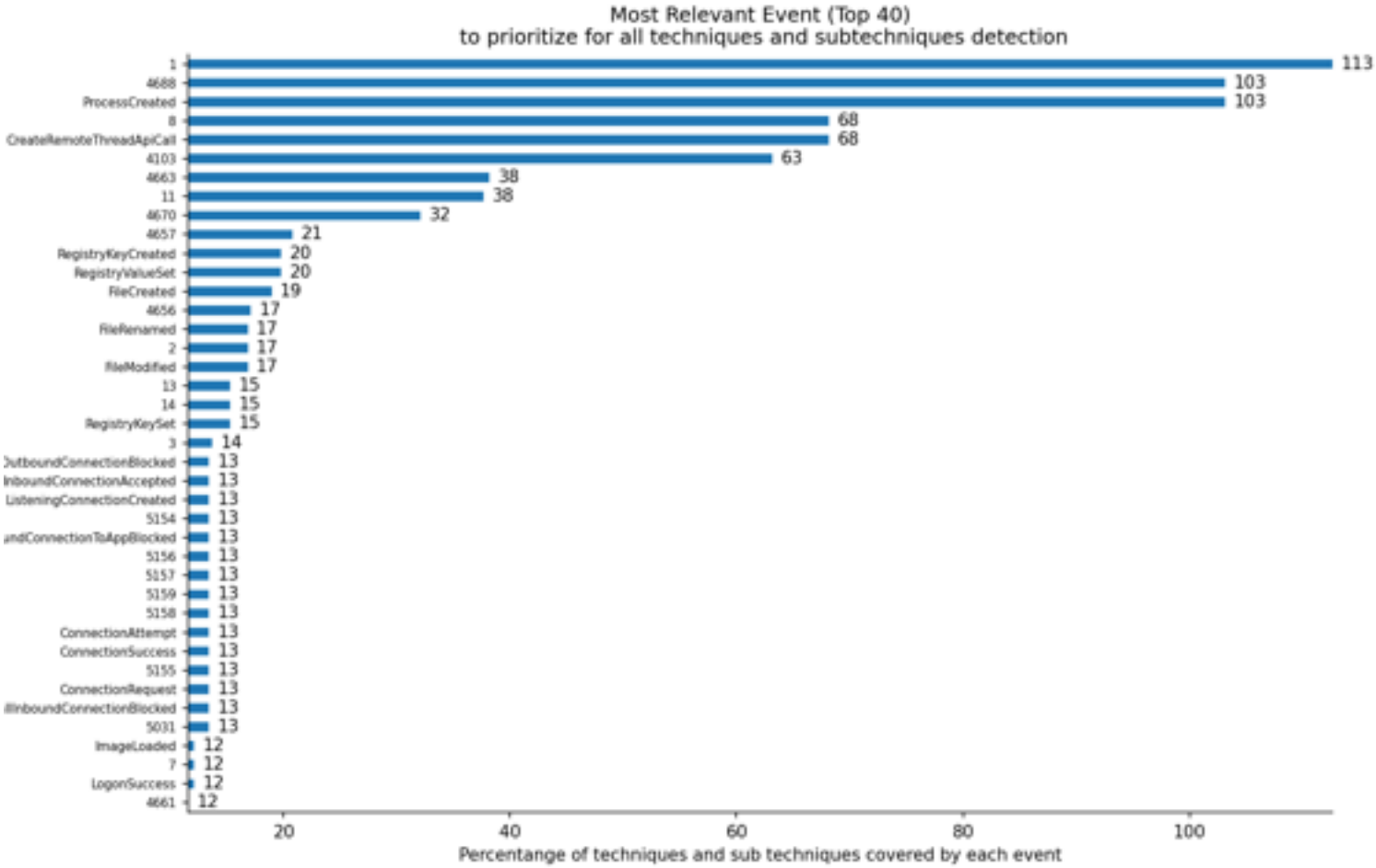

Most Relevant data component to prioritize for all techniques and subtechniques detection
command execution 235
process creation 193
file creation 79
os api execution 73
file modification 64
ws registry key modification 58
network connection creation 52
module load 46
file access 41
script execution 26
logon session creation 25
indows registry key creation 17
process access 16
user account authentication 16
host status 15
directory object modification 12
service metadata 12
file deletion 10
driver load 10
service creation 10
process modification 8
logon session metadata 8
directory credential request 7
windows registry key access 7
drive modification 6
user account creation 5
network share access 5
drive creation 4
indows registry key deletion 4
tive directory object creation 4
ctive directory object access 3
process termination 3
user account modification 3
scheduled job creation 3
firewall metadata 2
firewall rule modification 2
firewall disable 2
tive directory object deletion 2
scheduled job modification 2
wmi creation 2
50
100
150
200
Count of techniques and sub techniques covered by each data component



4.4 Event reference for covering all mitre technique

< To be corrected or added in future releases >


Most Relevant Event (Top 40)
to prioritize for all techniques and subtechniques detection
1
4688
ProcessCreated
8
CreateRemoteThreadApiCall
4103
4663
11
4670
4657
RegistryKeyCreated
RegistryValueSet
FileCreated
4656
FileRenamed
2
fileModified
13
14
RegistryKeySet
3
OutboundConnectionBlocked
InboundConnectionAccepted
ListeningConnectionCreated
5154
andConnectionToAppBlocked
5156
5157
5159
5158
ConnectionAttempt
ConnectionSuccess
5155
ConnectionRequest
llInboundConnectionBlocked
5031
ImageLoaded
7
LogonSuccess
4661
428
392
392
259
259
240
145
143
122
79
75
75
72
65
64
64
64
58
58
58
52
51
51
51
51
51
51
51
51
51
51
51
51
51
51
51
46
46
46
44
50
100
150
200
250
300
350
400
Count of techniques and sub techniques covered by each event


Most Relevant Event (Top 40)
to prioritize for all techniques and subtechniques detection
1
4688
ProcessCreated
8
CreateRemoteThreadApiCall
4103
4663
11
4670
4657
RegistryKeyCreated
RegistryValueSet
FileCreated
4656
FileRenamed
2
fileModified
13
14
RegistryKeySet
3
utboundConnectionBlocked
nboundConnectionAccepted
ListeningConnectionCreated
5154
ndConnectionToAppBlocked
5156
5157
5159
5158
ConnectionAttempt
ConnectionSuccess
5155
ConnectionRequest
llInboundConnectionBlocked
5031
ImageLoaded
7
LogonSuccess
4661
113
103
103
68
68
63
38
38
32
21
20
20
19
17
17
17
17
15
15
15
14
13
13
13
13
13
13
13
13
13
13
13
13
13
13
13
12
12
12
12
20
40
60
80
100
Percentange of techniques and sub techniques covered by each event