UNC2452: Highly Evasive Attacker Leverages Supply Chain to Compromise Targets

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Innovation Cycle

TARGET

In the Wild

FireEye Products
Managed Defense
Mandiant IRs
3rd Party

ATTACKER

Malware
Infrastructure
Artifacts
Tradecraft
Motivation

Observables
UNC2452 & FireEye Customers

- Detections
- Hunting
- Notifications
- Webinar & Blog
Threat Attribution Methodology

Cluster
Cluster
Cluster
Cluster

Group

Motivation

Crimes

Criminal
Threat Attribution Methodology

We are currently analyzing multiple events.
UNC2452 & Associated Clusters

- Low Malware Footprint
- Prioritizes Stealth
- High OPSEC
- Targeted & Resourced
TTPs of UNC2452

...and associated Clusters
Supply Chain Compromise

MITRE TECHNIQUE: T1195.002

Summary: UNC2452 has compromised the SolarWinds supply chain. They distribute backdoored updates to unsuspecting customers.

Supply Chain: SolarWinds

*avsvmcloud[.]com
command and control coordinator

**defsecurity.com**
command and control

**freescanonline.com**
command and control

**thedoccloud.com**
command and control

*netsetupsrv.dll*
TEARDROP dropper

**memory-only**
CobaltStrike BEACON

legitimate SolarWinds update server

**SolarWinds.BusinessLayerHost.exe**
**SolarWinds.BusinessLayerHostx64.exe**
legitimate host process

**SolarWinds.Orion.Core.BusinessLayer.dll**
legitimate code and **SUNBURST backdoor**
Supply Chain Compromise


Digitally-signed plug-in for SolarWinds Orion

Large amount of legitimate code
- 400+ classes
- 3,000+ methods
- ~45,000 lines of source code

One namespace implements the SUNBURST backdoor
A second region of code invokes backdoor

Signature Dates:
- March, 2020
- April, 2020
- May, 2020

Hides in plain sight:
- OrionImprovementBusinessLayer appId
- ReportWatcherPostpone

Summary: UNC2452 has compromised the SolarWinds supply chain. They distribute backdoored updates to unsuspecting customers.
Malware: SUNBURST

Summary: SolarWinds.Orion.Core.BusinessLayer.dll (b91ce2fa41029f6955bhf20079468448) is a SolarWinds-signed plugin component of the Orion software framework. This plugin contains a malicious class named that communicates via HTTP to a command-and-control (C2) server to retrieve commands, called “Jobs”, that are executed on the system. No binary similarity or code reuse was identified in malware repositories.

Characteristics

Capabilities

- Blocklist of analysis tools and services including: FireEye HX, floss, AV
- System survey and reconnaissance
- Full control of system
  - Registry
  - Processes
  - Files

Network Protocol

- DGA + DNS-based C2 coordinator
- Outbound traffic masquerades as Orion Improvement Program
- Commands returned in fake .NET config (steganography)
Steganography
MITRE TECHNIQUE: T1027.003

Hidden C2 Protocol

Commands extracted from fake .NET assembly configs

Regular expressions select:
• GUIDs
• Hexadecimal strings

Decrypt, decode, and dispatch
Malware: SUNBURST

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No binary similarity or code reuse was identified in malware repositories.

Technologies

- FireEye NX
- FireEye HX

Indicators

Domain: avsvmcloud[.]com
URL: /swip/Events
String: OrionImprovementBusinessLayer
Named Pipe: 583da945-62af-10e8-4902-a8f205c72b2e

Countermeasures

- 4x Yara rules [code patterns]
- 16x Snort rules [C2 protocol]
- 4x HX IOCs [behavior]
Malware: TEARDROP

Memory-Only Dropper

No binary similarity or code reuse with the dropper was identified in malware repositories.

Summary: The malware runs as a service, spawns a thread, and reads from the file "gracious_truth.jpg" which has a fake JPEG header. Next, it decodes an embedded payload using custom rolling XOR algorithm, and manually loads into memory embedded payload using custom PE-like file format.

Data Source
- Endpoint Agent
- AV Logs

Technologies
- FireEye HX: MalwareGuard
- Windows Defender

Countermeasures
- MalwareGuard
- 2x Yara

Artifacts

HX file_operation_closed
actor-process: SolarWinds.BusinessLayerHost.exe
file-path: C:\Windows\SysWOW64\NetSetupSvc.dll

Windows Defender Exploit Guard log entries
Process '...\svchost.exe' (PID ...) would have been blocked from loading the non-Microsoft-signed binary '\Windows\SysWOW64\NetSetupSvc.dll'.

Payload
Layers of loaders unpack a BEACON backdoor in-memory.
Attacker Hostname Masquerades

MITRE TECHNIQUE: NOT FOUND

Summary: The Attackers use legitimate victim hostnames as the hostname on their C2 servers for masquerades during remote access sessions.

Data Source

- Internet Scan Data
- Remote Access Logs

Impact

Results in enumerated attacker infrastructure and timelines of use, which can be used to trace attacker access through a compromised environment.

Analyst Methodology

1. Identify Attacker Infrastructure:
   - Query internet-wide scan data sources for infrastructure serving SSL certs on tcp/3389 with your environment’s hostnames in the Common Name (CN).
     - NOTE: IP Scan history often showed IPs switching between default (WIN-* ) hostnames and victim’s hostnames

2. Identify Malicious Remote Access:
   - Cross Reference identified infrastructure with IP records from your Remote Access Logs
     - NOTE: Attacker has a high level of OPSEC, they’ll most likely use a single account per IP Address
Domestic Infrastructure Hosting

Summary: The Attackers use infrastructure originating from the country where their victims are located. However, their remote authentications often were from impossible locations when analyzed against that user’s legitimate logins.

Identify Suspicious Logons
- Analyze logons sourced from different regions within windows of time in which a human being cannot feasibly travel

Identify Logins From Attacker ASNs
- After identifying malicious IP addresses, monitoring for remote access from the same ASN may yield further attacker infrastructure
- Baselining and normalizing ASNs used for legitimate remote access may identify attacker infrastructure

Data Source
- Remote Access Logs

Technologies
- SIEM
  - https://github.com/fireeye/GeoLogonalyzer
  - (Integrated into FireEye Helix)

Impact
Identify patterns of not only attacker behavior but of common legitimate-use behavior which can be excluded from intrusion analysis.
Remote Access
From VPS

Summary: The Attackers primarily use DCH (distributed cloud hosting) infrastructure to authenticate to environments

MITRE TECHNIQUE: T1583.003 or T1584.003

Data Source
- ip2location
- Remote Access Logs

Technologies
- SIEM

Impact
Identify additional attacker infrastructure

Analyst Methodology

Identify Suspicious Logons
- Monitoring remote access authentications from DCH IP addresses may identify malicious access

- Available Tool:
  - https://github.com/fireeye/GeoLogonalyzer (integrated into FireEye Helix)
Lateral Movement

MITRE TECHNIQUE: T1021 (REMOTE SERVICES)

Summary: The Attackers move laterally with multiple credentials from one host, once authenticated to Remote Access

Data Source
- Windows Event Logs with EIDs: 4624, 4625, 4628, 21, 22

Technologies
- SIEM
- HX LogonTracker module

Impact
This analysis quickly identifies systems used by an attacker to move laterally through the environment and can help prioritize those systems for deeper forensic analysis

Analyst Methodology

Identify One:Many relationships for Logons
- Use HX’s LogonTracker module, to graph all logon activity and analyze for systems displaying a 1:many relationship between source systems and accounts.
  - One system authenticating to multiple systems, with multiple credentials
  - Never with the credentials used for remote access
Summary: The Attackers remotely execute utilities by identifying a legitimate file, supplanting it with their own utility for use and then replacing the original file.

Analyst Methodology

Identify Attackers Supplanting Utilities

- Look for SMB sessions that show access to legitimate directories and follow a delete-create-execute-delete-create pattern in a short amount of time.

Impact

This analysis allows analysts to identify attackers staging, obfuscating, and executing malware on hosts.

Data Source

- SMB Logs

Technologies

- NSM Sensors

MITRE TECHNIQUE: NOT FOUND
Temporary Task Modification

MITRE TECHNIQUE: T1053.005 (SCHEDULED TASK/JOB: SCHEDULED TASK)
MITRE SUB-TECHNIQUE: NOT FOUND

Summary: The Attackers temporarily **UPDATE** existing, legitimate Scheduled Tasks to execute their tools before returning the Scheduled Task to its original state

Data Source

- Microsoft-Windows-TaskScheduler/Operational event log -- EID 140, task updated
- Security event log -- EID 4702

Impact

This technique is likely used for OPSEC purposes, specific detections for this technique will increase likelihood of discovering an intrusion

### Analyst Methodology

**Monitor Existing Scheduled Tasks for Temporary Updates**

- Use frequency analysis of task updates to identify anomalous modifications to tasks
  - Look for suspicious modifications to legitimate Windows tasks
- Monitor for legitimate Windows tasks executing new/unknown binaries
UNC2452 & FireEye Customers

- We’ve deployed detections across our Products
- Hunted across appliance telemetry and notified impacted customers
- We will continue to hunt across product telemetry
- Coordination across Incident Response engagements
- Managed Defense is actively hunting and providing compromise reports to their impacted customers
- Releasing a blog that includes
  - Overview Activity
  - Attacker techniques
  - In-depth Malware on SUNBURST
Recommended Actions

- Following recommendations are for immediate mitigation techniques:
  - Ensure the SolarWinds servers are isolated / contained until a further review
    - This should include blocking all Internet egress from SolarWinds servers.
  - If SolarWinds infrastructure is not isolated, consider taking the following steps:
    - Restrict scope of connectivity to endpoints from SolarWinds servers - especially those that would be considered Tier 0 / crown jewel assets
    - Restrict the scope of accounts that have local administrator privileged on SolarWinds servers.
    - Block Internet egress from servers or other endpoints with SolarWinds software.
Recommendation Actions (con’t)

- Consider (at a minimum) changing passwords for accounts that have access to SolarWinds servers / infrastructure.

- If SolarWinds is used to managed networking infrastructure, consider conducting a review of network device configurations for unexpected / unauthorized modifications.
  - Note, this is a proactive measure due to the scope of SolarWinds functionality, not based on investigative findings.
  - SolarWinds should be releasing a blog post shortly which will include their specific mitigation actions and recommendations
Summary

- Best Operational Security we’ve seen across our investigations
- Attacker is highly skilled and motivated
- Leverages inherent Trust through Supply Chain
- Highly Evasive and Resourced

- FireEye’s signatures to detect this threat actor and supply chain attack in the wild are available here: https://github.com/fireeye/sunburst_countermeasures