SUNBURST Indicators: A Shift in Threat Utility

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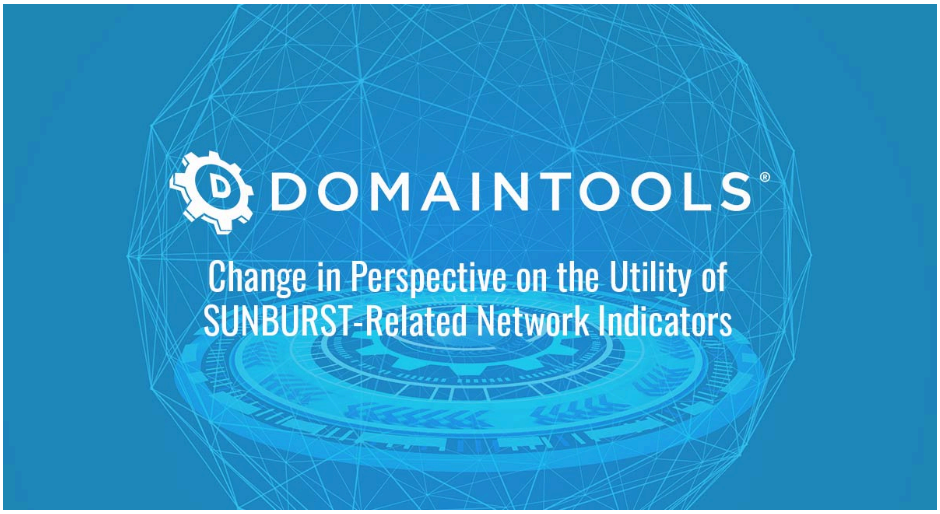
Change in Perspective on the Utility of SUNBURST-Related Network Indicators



If you would prefer to listen to The DomainTools Research team discuss their analysis, it is featured in our recent episode of Breaking Badness, which is included at the bottom of this post.

Background

Since initial disclosure first by FireEye then Microsoft in mid-December 2020, additional entities from Volexity to Symantec to CrowdStrike (among others) have released further details on a campaign variously referred to as “the SolarWinds event,” “SUNBURST,” or “Solorigate.” DomainTools provided an independent analysis of network infrastructure, defensive recommendations, and possible attribution items in this time period as well.

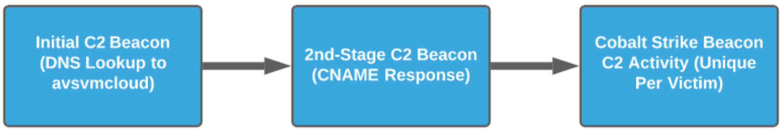
Yet, perhaps the most in-depth analysis of the intrusion at the time of this writing was published by Microsoft on 20 January 2021. Among other interesting observations, Microsoft’s most-recent reporting identified the following items:

- Incredibly high levels of Operational Security (OPSEC) displayed by the attackers to avoid identification or ultimate discovery of the SUNBURST backdoor.
- Narrowly-tailored operations with not only per-victim but even per-host unique Cobalt Strike configurations, file naming conventions, and other artifacts of adversary behaviors.
- Likely use of victim-specific Command and Control (C2) infrastructure, including unique domains and hosting IPs, to further obfuscate operations while limiting the efficacy of indicator-based analysis and alerting.

The above discoveries emphasize that an indicator-centric approach to defending against a SUNBURST-like attack will fail given this adversary’s ability and willingness to avoid indicator reuse. Furthermore, as revealed by CrowdStrike, MalwareBytes, and potentially Mimecast, we also know that the “SolarWinds actor” leverages additional initial infection vectors (most notably abuse of Office365, Azure Active Directory, and related Microsoft-based cloud services). Therefore, multiple entities aside from those using the affected versions of SolarWinds Orion software must be cognizant of and actively defending against this actor’s operations—yet a defense based on indicator alerting and blocking will fail given this actor’s OPSEC capabilities.

SUNBURST-Related Command and Control Overview

Based on reporting from multiple vendors, there was already strong suspicion that SUNBURST and related campaign network infrastructure was likely victim-specific at least during certain stages of the intrusion. As seen in the image below, for the SUNBURST-specific infection vector, C2 behaviors move through three distinct stages: the initial DNS communication to the common first-stage C2 node (avsvmcloud[.]com); the follow-on receipt and communication to a second-stage C2 node passed via a Canonical Name (CNAME) response to the initial DNS request; and finally a third-stage C2 corresponding to the Cobalt Strike Beacon payload installed on victim machines.



In Microsoft's reporting from 20 January 2021, we see confirmation that while first and second stage C2 activity likely feature commonality among victims, third stage Cobalt Strike Beacon-related activity includes not only per-victim uniqueness but potentially per-host uniqueness as well:

> - In addition to the attackers dropping the custom loaders in unique locations on each system during the lateral movement phase, most Beacon and Reflective Loader instances discovered during our investigation were configured with a unique C2 domain name, unique Watermark ID, unique PE compile timestamp, PE Original Name (), DNS Idle IP (e.g., *84[.]200[.]70[.]40* , *208[.]67[.]220[.]220, 208[.]67[.]222[.]222, 9[.]9[.]9[.]9*, and *8[.]8[.]4[.]4*), unique User-Agent and HTTP POST/GET transaction URI, sleep time, and jitter factor. This is notable since no two Beacon instances shared the same C2 domain name, Watermark, or other aforementioned configuration values. Other than certain internal fields, most Beacon configuration fields are customizable via a Malleable C2 profile. If the actor did indeed use custom Malleable C2 profiles, as evidenced in the list above, the profiles varied greatly for Beacon instances used during different lateral movement campaigns within the same network. As mentioned above, each Beacon instance carries a unique Watermark value. Analysis of the Watermark values revealed that all Watermark values start with the number '3', for example:

In this scenario, individual indicators (domains or IP addresses) are effectively useless after the initial SUNBURST stages, and potentially completely impractical for non-SolarWinds infection vectors used by this adversary. Instead of Indicator of Compromise (IOC)-based defense, defenders need to migrate to identifying behavioral and infrastructure patterns to flag infrastructure potentially related to this incident.

Patterns, or the Lack Thereof

At the time of this writing, across multiple vendors, there are 29 domains with associated IP addresses linked to SUNBURST and related activity with high confidence.

Domain	Create Date	IP	Hosting Provider	SSL/TLS Certificate	Registrar
aimsecurity[.]net	2020-01-23	199.241.143.102	VegasNap LLC	6a448007f05bd5069cd222611ccd1e66b4466922	EPIK, INC.,EPIK INC
avsvmcloud[.]com	2018-07-25	Various	Various Azure	N/A	NameSilo, LLC
databasegalore[.]com	2019-12-14	5.252.177.21	MivoCloud SRL	d400021536d712cbe55ceab7680e9868eb70de4a	NAMECHEAP INC
datazr[.]com	2019-09-03	45.150.4.10	Buzoianu Marian	8387c1ca2d3a5a34495f1e335a497f81a8be680d	Epik, Inc.
deftsecurity[.]com	2019-02-11	13.59.205.66	Amazon Technologies Inc.	12d986a7f4a7d2f80aaf0883ec3231db3e368480	NameSilo, LLC
digitalcollege[.]org	2019-03-24	13.57.184.217	Amazon Technologies Inc.	fdb879a2ce7e2cda26bec8b37d2b9ec235fade44	Stichting Registrar of Last Resort Foundation
ervsystem[.]com	2018-02-04	198.12.75.112	ColoCrossing	0548eedb3d1f45f1f9549e09d00683f3a1292ec5	Epik, Inc.
financialmarket[.]org	2001-10-02	23.92.211.15	John George	a9300b3607a11b51a285dcb132e951f03974da27	Namesilo, LLC
freescanonline[.]com	2014-08-14	54.193.127.66	Amazon Technologies Inc.	8296028c0ee55235a2c8be8c65e10bf1ea9ce84f	NAMECHEAP INC

Domain	Create Date	IP	Hosting Provider	SSL/TLS Certificate	Registrar
gallerycenter[.]org	2019-10-10	135.181.10.254	Hetzner Online GmbH	a30c95b105d0c10731c368a40d5f36c778ef96e6	NAMESILO, LLC
globalnetworkissues[.]com	2020-12-16	18.220.219.143	Amazon Technologies Inc.	ff883db5cb023ea6b227bee079e440a1a0c50f2b	Key-Systems Gmbl
highdatabase[.]com	2019-03-18	139.99.115.204	OVH Singapore	35aeff24dfa2f3e9250fc874c4e6c9f27c87c40a	NAMESILO, LLC
incomeupdate[.]com	2016-10-02	5.252.177.25	MivoCloud SRL	4909da6d3c809aee148b9433293a062a31517812	NAMECHEAP, IN
infinitysoftwares[.]com	2019-01-28	107.152.35.77	ServerCheap INC	e70b6be294082188cbe0089dd44dbb86e365f6a2	NameSilo, LLC
kubecloud[.]com	2015-04-20	3.87.182.149	Amazon Data Services NoVa	1123340c94ab0fd1e213f1743f92d571937c5301	NameSilo, LLC
lcomputers[.]com	2002-01-27	162.223.31.184	QuickPacket LLC	7f9ec0c7f7a23e565bf067509fbef0cbf94dfba6	NameSilo, LLC
mobilnweb[.]com	2019-09-28	172.97.71.162	Owned-Networks LLC	2c2ce936dd512b70f6c3de7c0f64f361319e9690	NAMECHEAP INC,NAMECHEAI INC
olapdatabase[.]com	2019-07-01	192.3.31.210	ColoCrossing	05c05e19875c1dc718462cf4afed463dedc3d5fd	NAMESILO, LLC
panhardware[.]com	2019-05-30	204.188.205.176	SharkTech	3418c877b4ff052b6043c39964a0ee7f9d54394d	NameSilo, LLC
seobundlekit[.]com	2019-07-14	3.16.81.254	Amazon Technologies Inc.	e7f2ec0d868d84a331f2805da0d989ad06b825a1	NAMECHEAP IN
solartrackingsystem[.]net	2009-12-05	34.219.234.134	Amazon Technologies Inc.	91b9991c10b1db51ecaa1e097b160880f0169e0c	NameSilo, LLC
swipeservice[.]com	2015-09-03	162.241.124.32	Unified Layer	9aeed2008652c30afa71ff21c619082c5f228454	NAMECHEAP INC,NAMECHEAI INC
techiefly[.]com	2019-09-24	93.119.106.69	Tennet Telecom SRL	ab94a07823d8bb6797af7634ed1466e42ff67bfb	EPIK, INC.,EPIK INC
thedoccloud[.]com	2013-07-07	54.215.192.52	Amazon Technologies Inc.	849296c5f8a28c3da2abe79b82f99a99b40f62ce	NameSilo, LLC
virtualdataserver[.]com	2019-05-30	Various	Various	4359513fe78c5c8c6b02715954cfce2e3c3a20f6	Epik, Inc
virtualwebdata[.]com	2014-03-22	18.217.225.111	Amazon Technologies Inc.	ab93a66c401be78a4098608d8186a13b27db8e8d	NameSilo, LLC
webcodez[.]com	2005-08-12	45.141.152.18	M247 Europe SRL	2667db3592ac3955e409de83f4b88fb2046386eb	NAMECHEAP IN
websitetheme[.]com	2006-07-28	34.203.203.23	Amazon Technologies	66576709a11544229e83b9b4724fad485df143ad	NameSilo, LLC

Domain	Create Date	IP	Hosting Provider	SSL/TLS Certificate	Registrar
			Inc.		
zupertech[.]com	2016-08-16	51.89.125.18	OVH SAS	d33ec5d35d7b0c2389aa3d66f0bde763809a54a8	NameSilo, LLC

Using previous DomainTools research as a guide, we can identify some "weak" patterns, such as clustering around certain registrars, authoritative name servers, and hosting providers when these items were active—note that most of the items on this list are currently sinkholed. Yet the identified patterns are somewhat weak and overlap with a number of other activities, both legitimate and malicious, making pivoting and further infrastructure discovery very difficult, if not outright impossible.

From a Cyber Threat Intelligence (CTI) perspective, pivoting and indicator analysis may seem to be a dead-end. The following items hold, to a greater or lesser extent, for all observed domains in this campaign:

- The use of what appear to be older domains (re-registered, potentially "taken over" by the threat actor, or potentially part of a "stockpile" of infrastructure kept for later use).
- Reliance on cloud hosting providers (such as Amazon Web Services and Microsoft Azure) for domain hosting.
- Use of relatively common (if also typically suspicious) registration patterns to likely "hide" in the noise of domain registration activity.

Combined, these observations make enrichment seem, on its face, somewhat pointless.

However, while these items may be difficult or impossible to use from either a predictive (identifying new infrastructure) or historical (identifying infrastructure used by the adversary, but not previously associated to it in an identified incident) external CTI analysis perspective, there remain options for network defenders. Most significantly, the patterns identified in the items observed to date, though insufficient for external discovery on its own, may be more than sufficient for *internal* defensive response and alerting purposes.

Operationalizing Network Observables for Active Defense

Changing our perspective from *external analysis to internal enrichment* of observables yields interesting and powerful detection scenarios. In the case of SUNBURST and related intrusions, the adversary succeeds in subverting critical trust relationships (with SolarWinds Orion or Microsoft cloud services) to attain initial access to victim environments. But in order to actually take advantage of this subversion, the adversary requires some mechanism of communicating with and controlling the deployed capability. At this stage, defenders can take advantage of this critical attacker dependency to identify that something is amiss.

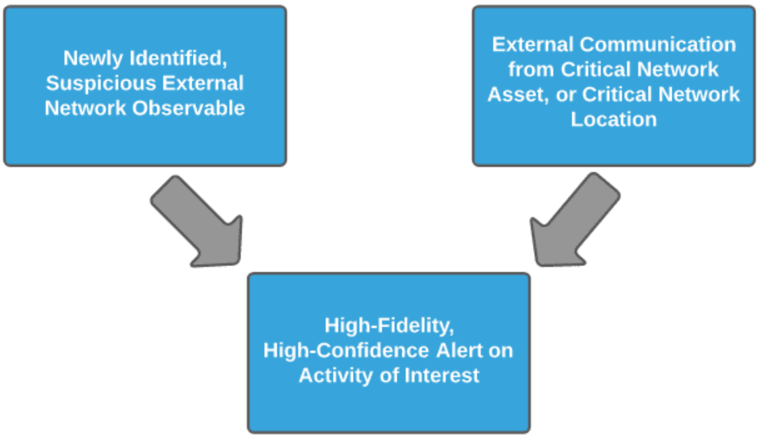
One simple way of approaching the subject would be to flag new, unknown domains referenced in network communications for further scrutiny. This may sound potentially useful at first, but given the vast diversity of domains and the likely noise generated by user activity (or even programmatic actions), such an approach dooms itself rapidly to alert fatigue and failure.

Yet this just represents a barely enriched, minimal context way of observing network infrastructure items referenced in an organization's overall network communication activity. If we, as defenders and responders, can add additional context and nuance to observed items and utilize this for alerting purposes, powerful possibilities emerge. Combining internal network understanding with automated observable or indicator enrichment enables rapid, contextual network defense which can quickly identify suspicious communication patterns.

For example, rather than simply responding to any instance of "new" network items observed, organizations may limit this response to critical services, servers, or network enclaves (e.g., the subnet containing various infrastructure devices). Proper network segmentation, asset identification and asset tagging to identify critical items, such as SolarWinds Orion servers or various items such as email servers or Domain Controllers, can allow for focused response when a significant asset initiates a previously unseen external connection.

From a network observable perspective, just identifying that something is "new" can be replaced with enrichment to identify observable characteristics of interest: hosting provider, hosting location, registrar, authoritative name server, or SSL/TLS certificate characteristics. Identifying and alerting on combinations of these through automated enrichment—such as through DomainTools Iris Enrich or security monitoring plugins such as DomainTools integration with Splunk—can allow for higher fidelity, higher confidence alarms related to observed network communications. In the case of the SUNBURST-related items, even the per-victim unique items associated with follow-on CobaltStrike activity, identifying domains matching certain criteria in terms of name server and registrar associated with historical suspicious activity combined with the new observation can enable security teams to vector resources for follow-on investigation based on the greater level of detail provided.

For a truly game-changing defensive posture that fully amplifies defender advantages in both owning the network and monitoring activity emerging from it, these perspectives can be combined. In this scenario, high-confidence alerting on suspicious external network items post-enrichment is fused with internal asset identification to narrow this communication to a high-value asset or sensitive enclave within the network. The subsequent alert represents a truly critical alarm enriching on both target and adversary infrastructure aspects to focus response and drive an ensuing investigation.



Conclusion

The theoretical alerting scenario described above, where internal and external enrichment are combined to yield high-confidence, high-fidelity alarms, may appear out of reach for many organizations—but given advances in adversary tradecraft, it represents where we as defenders must drive operations. Although initially difficult to create, given both the network engineering and segmentation requirements for an accurate asset or network enclave detection, as well as the establishment of logging and enrichment pipelines for observed network indicators, once in place, an organization will find itself on a much more robust and powerful security footing.

Once attained, even the most complex and stealthy attacks such as the trust-abusing intrusions linked to SolarWinds and Microsoft services can be detected. While subsequent investigation and analysis may remain hard, as highlighted in Microsoft's January 2021 analysis, at the very least defenders now have an opportunity to investigate and search for further signs of malicious activity within the network. Absent the enrichment scenarios described above, defenders yield own-network advantages and investigation initiative to intruders, and place themselves in a position where an adversary mistake or migration away from high-OPSEC activity is necessary to enable detection and response.

By combining own-network understanding and identification with automated indicator enrichment through services such as DomainTools, defenders can take back the initiative from intruders and detect or even cut off initial C2 beacon activity. In this manner, defenders not only adapt to but can disadvantage intruders to shift the landscape of network defense back in the network owner's favor.

The DomainTools Security Research Team Discusses Their Analysis:

Breaking Badness · 73. SUNBURST on the Scene

No items found.
