NATION-STATE MONEYMULE’S HUNTING SEASON
APT ATTACKS TARGETING FINANCIAL INSTITUTIONS

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• BACKGROUND

• THE MALWARES AND ATTACK CASES FROM LAZARUS, BLUENOROFF AND ANDARIEL

• ANOTHER ATTACK TARGETING FINANCIAL INSTITUTES FROM UNKNOWN GROUP

• TTP & KEY FINDING

• CONCLUSION & BLACK HAT SOUND BYTES
BACKGROUND

Some backgrounds and related works
Our observation shows that some nation-state actors are shifting their focus to join the battle field of moneymule in the past few years.
<table>
<thead>
<tr>
<th>Targeted Industry</th>
<th>Lazarus</th>
<th>Bluenoroff</th>
<th>Andariel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic government, finance, broadcasting</td>
<td>Domestic financial institutes</td>
<td>Global and domestic financial institutes</td>
<td>Domestic financial institutes, IT companies and large corporations. Defense industry</td>
</tr>
<tr>
<td>Purpose</td>
<td>Social chaos</td>
<td>Financial profit motivation</td>
<td>Information gathering</td>
</tr>
<tr>
<td><strong>Historical major incidents</strong></td>
<td>• 2009 7.7 DDoS attack on US and South Korea</td>
<td>• 2015-2016 SWIFT banking attack</td>
<td>• 2015 Attack Defense industry</td>
</tr>
<tr>
<td></td>
<td>• 2011 DDoS attack in South Korea</td>
<td>• 2017 Polish financial supervisory authority</td>
<td>• 2016 Attack on cyber command center</td>
</tr>
<tr>
<td></td>
<td>• 2013 320 DarkSeoul</td>
<td>• 2017 South Korea Bitcoin companies</td>
<td>• 2017 South Korea ATM breach</td>
</tr>
<tr>
<td></td>
<td>• 2014 Sony Picture Entertainment breach</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
BACKGROUND – Activity Timeline

2016/02
- Bangladesh Bank Heist
- South Korea Conglomerates Hacked

2016/08
- South Korea Ministry of National Defense Hacked

2017/02
- Watering hole on Polish Financial Supervision Authority website to target 100+ banks in Europe

2017/03
- South Korea ATM company hacked

2017/05
- WannaCry Ransomware attack
- South Korea Labour Unions Websites Hacked
- South Korea Bithumb Bitcoin Exchange Hacked

2017/07
- South Korea Korbit Bitcoin Exchange Hacked

2017/09
- South Korea Largest Travel Agency Hanatour Hacked

2017/10
- Taiwan Far Eastern International Bank Heist
THE MALWARES AND ATTACK CASES
from Lazarus, Bluenoroff and Andariel
• KOREA MAJOR BANK ATTACK BY BLUENOROFF

• ATM OPERATOR COMPANY BREACH a.k.a VANXATM

• BITCOIN EXCHANGES HACKED
KOREA MAJOR BANK ATTACK BY BLUENOROFF - Background

• Time:
  • In March, 2017

• Target:
  • One of Top 5 Banks in South Korea
  • Employees of the bank (in charge of SWIFT system)

• Vulnerability:
  • File sharing function in VDI program (it was a 0 day during that time)

• Damage:
  • No severe damage due to the rapid detection
  • 2 PCs infected
• The vulnerability – The Named Pipe file sharing feature in VDI

<Architectural overview of Host-Guest Communication Channel with named pipe >
KOREA MAJOR BANK ATTACK BY BLUENOROFF – Attack Vector

Network Environment

Employee’s PC
for internal network use only
Computer Name Start with “pb”

Vlan A
(with critical data)
(not connect to WAN)

Vlan B
(Connect to WAN)

Named Pipe

Employee’s PC
For accessing the internet
(Virtual Machine)

Spear-phishing Emails

Critical Data stolen

attacker

C2 server
Evidence in the malware

VDI Software manufacturer insisted that File Sharing functionality via NamedPipe was disabled.

However, it was just hidden.

So
Attackers were able to use this functionality.
KOREA MAJOR BANK ATTACK BY BLUENOROFF - Malware

• Malwares
  • Family:
    • Manuscrypt (file name: corems.dll, amanuv.dll)

• Features:
  1. Searching in the internal network for some specific hosts related to SWIFT network.
  2. Activate NamedPipe of specific process (vmsal.exe)
     ➢ vmsal.exe : management process of virtual machine’s segregation program
     ➢ Stealing data from internal segregated network by using hidden NamedPipe file sharing feature
  3. Look for desired data and send them to C&C Server
KOREA MAJOR BANK ATTACK BY BLUENOROFF - Malware

- Malwares (corems.dll, amanuv.dll)

```
if (!SetNamedPipeHandle_10006460(0)) { return 0; }
if (!ConnectNamedPipe(PipeHandle, 0) && GetLastError() != 0x217 )
{
    return 0;
}
while (1)
{
    v1 = ReadNamedPipe_10006620() - 0x835;
    if (!v1)
    {
        result = WriteFileToPipe_10008A80();
        goto LABEL_9;
    }
}
```

NamedPipe Set -> Connect -> Read -> Write
Malwares (corems.dll, amanuv.dll)

Get NamedPipe Handle

<table>
<thead>
<tr>
<th>Mode</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIPE_READMODE_BYTE 0x0</td>
<td>Data is read from the pipe as a stream of bytes. specified.</td>
</tr>
</tbody>
</table>

Set NamedPipe Handle State with Mode 0x0
• Malwares (corems.dll, amanuv.dll)

Search specific files and write the result with following the special structure
KOREA MAJOR BANK ATTACK BY BLUENOROFF - Malware

- Malwares (corems.dll, amanuv.dll)

Flag
If (IsDirectory) :
    flag = "GY:"
Else:
    flag = "FZ:"

EOF (End of File) Flag
If (EOF) :
    eof_flag = ",**,"

0  4  8  12  16  20  24

Flag  Unknown Integer  Unknown Integer
File time  Length of Filename  Filename
KOREA MAJOR BANK ATTACK BY BLUENOROFF - Malware

- Malwares (corems.dll, amanuv.dll)

C&C Configuration

C&C IPs hidden inside Registry Value
KOREA MAJOR BANK ATTACK BY BLUENOROFF - Malware

- Data send to C2 server

Encoded String

Decoding Function

Decoded String

```c
signed int sub_10002A40()
{
    ...
    if (v6)
        do
            v3 = +v2;
            if (*v2 < 'I' || v3 > 'p')
                goto LABEL_12;
            if (v3 < 'I' || v3 > 'p')
                goto LABEL_14;
            goto LABEL_13;
        ...
    while (*v2);
    print(s1, "%s", x6);
}
```

Accept: */*;
Content-Type: multipart/form-data; boundary=
Accept-Encoding: gzip, deflate, sdch
Accept-Language: ko-KR
Content-Disposition: form-data; name="board_id"
Content-Disposition: form-data; name="user_id"
Content-Disposition: form-data; name="file1"; filename="img01_29.jpg"
Content-Disposition: form-data; name="file1"; filename="my.doc"
Content-Disposition: form-data; name="file1"; filename="pratice.pdf"
Content-Disposition: form-data; name="file1"; filename="king.jpg"
Content-Disposition: form-data; name="file1"; filename="dream.avi"

......
• KOREA MAJOR BANK ATTACK BY BLUENOROFF
• ATM OPERATOR COMPANY BREACH a.k.a VANXATM
• BITCOIN EXCHANGES HACKED
• Operation started from Feb. 2015 (Actual information leakage in March 2017)
• Target : ATM Operator Company (provide and manage 2000 ATM SK)
• Used vulnerability
  • 0 day in antivirus program
  • Misconfiguration and management between ATM machines and ATM update server

• Attribution
  • Andareil Group

• Damage
  • the number of leaked card information (Sept, 2016 ~ Feb, 2017)
  => Total 1.9m (After deduplication 230k)
VANXATM - ATM OPERATOR COMPANY BREACH
VANXATM - ATM OPERATOR COMPANY BREACH

• Process flow of VANXATM

Inside ATM company

- Unencrypted FTP
- Account & password
- Stored on ATM machine
- No authentication to update files
- Update malware

Remote File Transfer & Remote command exec

60+ ATM Infected

Unencrypted FTP
Account & password
Stored on ATM machine

Card Information Leakage

C&C #1
C&C #2
C&C #3
C&C #4

ATTACKER

Internet

Av Server

ATM Update Server With FTP server

No authentication to update files

Update malware
VANXATM - ATM OPERATOR COMPANY BREACH

- Exploit tool (fs.exe)
  - Scan antivirus server’s service port
  - Connect to the server
  - Send file
  - Run file
**VANXATM - ATM OPERATOR COMPANY BREACH**

- **VAN_XATM.exe (Dropper Type A)**

```c
v4 = fopen("c:\\windows\\temp\\javaupdate.exe", "wb");
Sleep(0x3E8u);
if (v4)
  fwrite(&unk_40DE80, 0x1D8A00u, 1u, v4),
    fclose(v4),
    memset(&StartupInfo.lpReserved, 0, 0x40u),
    ProcessInformation.hProcess = 0,
    ProcessInformation.hThread = 0,
    ProcessInformation.dwProcessId = 0,
    ProcessInformation.dwThreadId = 0,
    StartupInfo.cb = 68,
    sprintf(&CommandLine, "%s %s", "c:\\windows\\temp\\javaupdate.exe", &Filename),
    v6 = fopen("c:\\windows\\temp\\java.exe", "wb"),
    Sleep(0x64u),
    v6);

{  fwrite(&unk_5E6880, 0x10800u, 1u, v6);
  fclose(v6);
  Sleep(0x64u);
  CreateProcessA(0, "c:\\windows\\temp\\java.exe", 0, 0, 1, 0, 0, &StartupInfo, &ProcessInformation);
  Sleep(0x64u);
  result = CreateProcessA(0, &CommandLine, 0, 0, 1, 0, 0, &StartupInfo, &ProcessInformation);
}
```

Dropping `java.exe` (RAT) & `javaupdate.exe` (legit ATM program)

- **PDB Path**
  ```
  00000040BA04 0 c:\windows\temp\java.exe
  00000040BA80 0 F:\Work\card\Van_XATM\Release\Van_XATM.pdb
  00000040BF4A 0 GetModuleFileNameA
  ```
VANXATM - ATM OPERATOR COMPANY BREACH

- msupdate.exe, u.tmp, 1.exe, up.tmp (Data Exfiltration)

```
MSNBFileHandle_dword_417F94 = CreateMSNB_sub_405FF0();

v3 = 0;
memset(&v3, 0, 0x1FFu);

printf("%02d%02dCHVA", SystemTime.wMonth, SystemTime.wDay - 1);
FindCHVAFile_sub_406110(&v3);
Sleep(0x64u);
Sleep(0x64u);

FindJNLFile_sub_401780();

v0 = MSNBFileHandle_dword_417F94;
if ( MSNBFileHandle_dword_417F94 )
{
if ( *(DWORD *)MSNBFileHandle_dword_417F94 == 2 )
{
    v1 = (void *)(*(DWORD *)MSNBFileHandle_dword_417F94 + 1);
    dword_4181E8 = CreateZipArchive_sub_4055E0(*(DWORD *)MSNBFileHandle_dword_417F94);
    if ( v1 )
        operator delete(v1);
    operator delete(v0);
}
else
{
    dword_4181E8 = 0x80000;
}
}
else
{
    dword_4181E8 = 0x10000;
}

SendFileToFTP_sub_4016F0();
Sleep(0x64u);
return remove("c:\windows\temp\""1msnb.tmp");
```

Search \{mmdd\}CHVA files

Send Files to C2

Transaction Date
Transaction Time
Account Number
Issuer
Request Amount
Balance
Suspicious files discovered from VANXATM C&C Server

<table>
<thead>
<tr>
<th>이름</th>
<th>생성일</th>
<th>수정일</th>
<th>크기</th>
</tr>
</thead>
<tbody>
<tr>
<td>0904CHVA.100</td>
<td>2016년 9월 4일 오전 11:39</td>
<td>2016년 9월 4일 오전 11:39</td>
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</tr>
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<td>0904CHVA.000</td>
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<tr>
<td>0905.100</td>
<td>2016년 9월 5일 오전 3:58</td>
<td>2016년 9월 5일 오전 3:58</td>
<td>72바이트</td>
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<tr>
<td>0905CHVA.100</td>
<td>2016년 9월 5일 오후 10:35</td>
<td>2016년 9월 5일 오후 10:35</td>
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</tr>
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<td>0905CHVA.000</td>
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<tr>
<td>0906CHVA.000</td>
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<tr>
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<td>2016년 9월 7일 오전 12:00</td>
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<td>0907.100</td>
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<td>2016년 9월 7일 오전 3:58</td>
<td>72바이트</td>
</tr>
<tr>
<td>0907CHVA.100</td>
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<td>0907CHVA.000</td>
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<td>192KB</td>
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<tr>
<td>0908CHVA.100</td>
<td>2016년 9월 8일 오후 11:45</td>
<td>2016년 9월 8일 오후 11:45</td>
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<td>0908CHVA.000</td>
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<td>2016년 9월 8일 오후 11:45</td>
<td>136KB</td>
</tr>
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<td>0909.100</td>
<td>2016년 9월 9일 오전 3:53</td>
<td>2016년 9월 9일 오전 3:53</td>
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<tr>
<td>0909CHVA.000</td>
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<td>0909CHVA.100</td>
<td>2016년 9월 10일 오전 12:00</td>
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<td>0910CHVA.000</td>
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<td>2016년 9월 10일 오후 11:59</td>
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<td>0910CHVA.100</td>
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<tr>
<td>0911.100</td>
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<td>2016년 9월 11일 오전 3:53</td>
<td>72바이트</td>
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<tr>
<td>0911CHVA.100</td>
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<td>2016년 9월 11일 오후 11:23</td>
<td>182KB</td>
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</tbody>
</table>
• KOREA MAJOR BANK ATTACK BY BLUENOROFF
• ATM OPERATOR COMPANY BREACH a.k.a VANXATM
• BITCOIN EXCHANGES HACKED
**BITCOIN EXCHANGES HACKING CAMPAIGN**

- Trading volume of major Bitcoin Exchanges in South Korea
  - ‘C’ is the first char of Bitcoin Exchanges that is used for many company names

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>C#1</th>
<th>C#2</th>
<th>C#3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorporation</td>
<td>2014 Jan</td>
<td>2014 Aug</td>
<td>2013 July</td>
<td>2017 Apr</td>
</tr>
<tr>
<td>Number of employee</td>
<td>Around 150</td>
<td>Around 80</td>
<td>Around 60</td>
<td>Around 20</td>
</tr>
<tr>
<td>Number of coin type</td>
<td>10</td>
<td>7</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Transaction Amount per day(17.11.21. USD)</td>
<td>735 million</td>
<td>84 million</td>
<td>120 million</td>
<td>29 million</td>
</tr>
</tbody>
</table>
**BITCOIN EXCHANGES HACKING CAMPAIGN**

- Four Bitcoin Exchanges were attacked
- Attacker impersonates the public institutes for phishing
  - Public Prosecutors' Office, National Police Agency, Financial Security Institute, Major Bank, etc.
- They used nine email accounts for attack
  - 4 out of 9 were stolen email accounts, and 5 were confirmed created by the attacker
- Mobile malware was deployed to bypass SMS authentication.
  - Palo Alto - Operation Blockbuster Goes Mobile
  - McAfee - Lazarus Cybercrime Group Moves to Mobile Platform
    - [https://securingtomorrow.mcafee.com/mcafee-labs/lazarus-cybercrime-group-moves-to-mobile/](https://securingtomorrow.mcafee.com/mcafee-labs/lazarus-cybercrime-group-moves-to-mobile/)
- Sample Hash: (sha256)
  22a279c5685d7c3e24c04580204a8a932b2909a77a549bdd7bcf7ead285efde9
25 people received phishing emails attached with malicious HWP files during the campaign
  • In Korea, HWP (Hangul Word Processor) is the most popular word processor as MS OFFICE

They used a vulnerability of Ghostscript
  • Ghostscript is interpreter for postscript language
  • Ghostscript is included in HWP
    • removed in a current version by vulnerability issue
  • Its vulnerability could allow the arbitrary code execution
  • Ghostscript can create files without vulnerability
BITCOIN EXCHANGES HACKED - Phishing Email Attack Vector

1. **Attack Scenario**
   - **Attacker**
   - **Infected Mobile Phone**
   - **Passthru Server**
   - **Control C2 Server**
   - **C2 Server**
   - **Information Gathering**

2. **Phishing Email Attack Vector**
   - Several times sent phishing emails (07.05. ~ 08.08.)
   - Four Bitcoin exchanges (25 people targeted)

3. **Key Steps**
   - **Receive SMS verification**
   - **Create email account**
   - **Connect email services**
BITCOIN EXCHANGES HACKED – Attack Timeline

[FSI] Financial Security Standardization...

nondisclosure

04.Aug.2017
Check Bcoin wallet addresses in attached file

03.Aug.2017
Sent a transaction log

07.Aug.2017
nondisclosure

National Tax Service...

nondisclosure

10.Jul.2017
[**bank] establishment of a pledge right...

<-Target changed->
TARGETING BITCOIN EXCHANGES USERS – Before July, 2017

• A phishing email impersonated the National Tax Service
  • Targeted users of Bitcoin Exchanges

2017.5.22. 04:54 PM

Hello,

This is special tax investigation team at National Tax Service.
I attached a file that you need to prepare for tax investigation.
You have to complete preparing until 10 am, 25 May.

Thanks

[Attached a malicious hwp file]
BITCOIN EXCHANGES HACKED – Before July, 2017

• Compares with Korean Major Bank Sample

```
if ( !strcmp(String, (const char *)&word_10) )
{
    if ( v40 & 0x10 )
        lstrcpy((LPSTR)MARKER_v2, "FZ:" );
    else
        lstrcpy((LPSTR)MARKER_v2, "GY:" );

    *(DWORD *)(MARKER_v2 + 4) = *(DWORD *)&v3 + v4;
    *(DWORD *)(MARKER_v2 + 8) = *(DWORD *)&v3 + 6;
    FileTimeToLocalFileTime((const FILETIME *)&v6 = LocalFileTime.dwHighDateTime;
    *(DWORD *)(MARKER_v2 + 18) = *(DWORD *)&v3 + v4;
    *(DWORD *)(MARKER_v2 + 22) = *(DWORD *)&v3 + 6;
}
else
{
    *(WORD *)(v4 + v3) = ' ';  
    *(WORD *)(v18 + v4) = 'F'; 
    *(WORD *)(v3 + v4 + 4) = '2'; 
    *(WORD *)(v4 + v3 + 6) = ' ': 
}
```

Major Bank Sample

Users of Bitcoin Exchanges Sample
BITCOIN EXCHANGES HACKED – CASE 1: IMPERSONATED as FSI

• After 2 months we found another sample related to Bitcoin Exchanges
• A phishing email impersonated the Financial Security Institute

Hello,
We (FSI) are going to survey regarding the financial security standardization.
I expect your active participation, so I attached a file related to the survey.
news link: http://....
If you have any questions, please feel free to contact me.

Thanks,
FSI survey manager

[Attached a malicious hwp file (2017 the financial ...)]
CASE 1: IMPERSONATED as FSI – Malicious scripts in HWP file

- We could find ps (postscript) files in BinData of malicious HWP file
- They were compressed by zlib
CASE 1: IMPERSONATED as FSI – Files

Attached

HWP malicious document

Embedded

BIN0001.ps

Create/Drop

HncCheck.lnk

Execute

HncBB80.bin
Trojan Downloader

Create/Drop

BIN0002.ps

Run shellcode
& Decode downloader &
inject into memory

Create/Drop

BIN0003.ps
CASE 1: IMPERSONATED as FSI—Postscript

- BIN0001.ps
  - It makes a shortcut at the path below

```
"%temp%\..\.\.\Roaming\Microsoft\Windows\Start Menu\Programs\Startup\HncCheck.lnk"
```

  - HncCheck.lnk has included
    “C:\Windows\System32\rundll32.exe %temp%\.\HncBB80.bin,MainCallBack”
  - It is a trigger to execute “HncBB80.bin” when victims reboot their PCs

- BIN0002.ps will drop a binary file HncBB80.bin ➔ trojan downloader
CASE 1: IMPERSONATED as FSI – Files

Attached

HWP malicious document

Embedded

BIN0001.ps

BIN0002.ps

BIN0003.ps

Create/Drop

HncCheck.lnk

HncBB80.bin

Run shellcode & Decode downloader & inject into memory

Execute
CASE 1: IMPERSONATED as FSI – Postscript

- BIN0003.ps
  - If victim system has vulnerability in gs32dll.dll, it will be executed
  - It has a xor key of 4-byte-length (0x77, 0x5D, 0x11, 0x72)
  - Decoded the hex strings using xor key, then we got another postscript with shellcode
CASE 1: IMPERSONATED as FSI – Postscript vulnerability

- BIN0003.ps – (similar to CVE 2017-0261)
  - gs32dll.dll is a necessary library for handling postscript
  - postscript is processed as flow “read -> execute -> close”
  - There is a vulnerability in "close" part of the flow
  - Loads embedded PE and inject to a system process when shellcode was executed

```
100684D2 68 24612710 100684D7 56 50 FFD2
100684D8

PUSH gsdll32.10276124
PUSH ESI
PUSH EAX
CALL EDX

ASCII "s_std_close"

gsdll32.10017082
```

CALL ROP Chain

ROP Chain start

Shellcode will get a execution permission

```
75582886 8BEC
75582888 FF75 14
75582888 FF75 10
7558288E FF75 0C
75582891 FF75 08
75582894 6A FF
75582896 E8 09000000
75582898 5D

MOV EBP,ESP
PUSH DWORD PTR SS:[EBP+14]
PUSH DWORD PTR SS:[EBP+10]
PUSH DWORD PTR SS:[EBP+C]
PUSH DWORD PTR SS:[EBP+8]
pOldProtect .. NULL
NewProtect .. PAGE_READWRITE|PAGE_EXECUTE|PAGE_NOACCESS
Size .. 0x40
Address .. 0x00001F94
hProcess .. 0xFFFFFFFF
```
CASE 1: IMPERSONATED as FSI – Agent Dropper

- When HncBB80.bin (downloader) and shellcode were executed
  - Infected system information gathering and send them to C2
  - Receives data from C2 (additional file download & execution)
  - But we did not get any additional files from C2
  - C2 is https://www.kbautosys.com
  - 115.92.103.37

![Network Request Example](image)
CASE 2: IMPERSONATED as A NATIONAL POLICE OFFICER

• Phishing Email Impersonated a National Police Officer

2017.8.4. 10:08 AM

Hello.
This is a detective OOO at **** police station. Please check bitcoin addresses from attached excel file. If you have any question, feel free to contact me by the following number.

Thank you.

[Attached a pdf file(Copy of identification card)]
[Attached a malicious xls file(bitcoin transaction log)]
CASE 2: IMPERSONATED as A NATIONAL POLICE OFFICER – Files

Attached
PDF
scanned ID card (benign decoy)

Macro/Drop
XLS
malicious document

dschtost.exe
(include another custom encoded PE downloader)
CASE 2: IMPERSONATED as A NATIONAL POLICE OFFICER – It’s not a hwp

• In this case, they used a excel file not a hwp file
• And they attached a pdf file (scanned a identification card)
  • Unknown how they got a scanned ID card image
  • Tried to increase credibility by scanned ID card
MALWARE FUNCTIONALITY IS SAME AS CASE1 BUT C2 IS NOT

- Infected system information gathering and send them to C2
- Receives data from C2 (additional file download & execution)
- But we did not get any additional file from C2
- C2 is https://www.[.]unsunozo[.]org
- 49[.]239[.]189[.]45

CASE 2: IMPERSONATED AS A NATIONAL POLICE OFFICER

- Malware functionality is same as case1 but C2 is not
  - Infected system information gathering and send them to C2
  - Receives data from C2 (additional file download & execution)
  - But we did not get any additional file from C2
  - C2 is https://www.[.]unsunozo[.]org
  - 49[.]239[.]189[.]45
Another Attack Targeting Financial Institutes

From unidentifiable nation-state actors
Campaign targeted Egypt bank and SK banks – Background

• O bank is run by O group, which is based in Egypt and has branch in North Korea
• O group also runs K telecom, in charge of telecommunication in NK
• Target has connection with O bank in NK and K Telecom and locate in Egypt.
• O Group has shut down branch in NK in 2016 because of sanction.
• Target was targeted by attacker in 2017.
We observed 2 interesting samples from target in May, 2017
Both are exploits CVE 2017-0199 DOCX documents
Upon opening the document, it connects to C&C server to download HTA file containing malicious script
Campaign targeted Egypt bank and SK banks – Delivery Method

Exploit CVE 2017-0199 download HTA Powershell script

Powershell script to download Trojan downloader, loader and script

http://foodforu.heliohost.org/blog/apache.jpg
(http://old.jrchina.com/btob_asiana/appach01.jpg) save as alitmp0131.jpg

http://foodforu.heliohost.org/blog/apache_backup.jpg
(http://old.jrchina.com/btob_asiana/appach02.jpg) save as alitmp0132.jpg

http://foodforu.heliohost.org/blog/apache.ipp
(http://old.jrchina.com/btob_asiana/udel_ok.ipp) save as alitmp0133.js

C2 server
Campaign targeted Egypt bank and SK banks – Powershell Script

Base64 decode
**Campaign targeted Egypt bank and SK banks – Javascript**

- The IPP file contains encoded VBScript to extract payload from fake JPG files and save as:
  - Windows-KB275122-x86.exe (trojan downloader)
  - Windows-KB271854-x86.exe (Milk loader)
Campaign targeted Egypt bank and SK banks – Trojan downloader

- Named Freenki Downloader by PaloAlto
- Need specific arguments to execute. Supporting 3 commands (script pass “help” command to execute):

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help</td>
<td>Perform main function. Collects system information and beacon to C&amp;C server.</td>
</tr>
<tr>
<td>console</td>
<td>Setting up persistence in the registry</td>
</tr>
<tr>
<td>sample</td>
<td>Perform console command function and later perform help command function when successes.</td>
</tr>
</tbody>
</table>

```c
u4 = wcscmp(command, L"help");
if ( u4 )
  u4 = -(u4 < 0) | 1;
if ( !u4 )
  help_command_f();
 u5 = wcscmp(command, L"console");
if ( u5 )
  u5 = -(u5 < 0) | 1;
if ( u5 )
  {
    result = wcscmp(command, L"sample");
    if ( result )
      result = -(result < 0) | 1;
    if ( !result )
      {
        result = console_command_f();
        if ( result )
          help_command_f();
      }
  }
else
  {
    result = console_command_f();
  }
return result;
```
Campaign targeted Egypt bank and SK banks – Trojan downloader

- Convert MAC address to hex string and use as victim ID
- Collects system information and beacon to C&C server
  - Username>Computer Name>File version of kernel32.dll>IsWow64Process() > Ethernet MAC addresses>running processes

Report status | MAC Address | Encoded Victim Data
---|---|---

<table>
<thead>
<tr>
<th>MAC Address</th>
<th>Encoded Victim Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:0C:99:85:57:28</td>
<td>OK</td>
</tr>
<tr>
<td>00:0C:99:85:57:28</td>
<td>Date: Wed, 14 Jun 2017 06:20:37 GMT</td>
</tr>
<tr>
<td>00:0C:99:85:57:28</td>
<td>Server: Apache</td>
</tr>
<tr>
<td>00:0C:99:85:57:28</td>
<td>Content-Length: 0</td>
</tr>
<tr>
<td>00:0C:99:85:57:28</td>
<td>Content-Type: text/html; charset=UTF-8</td>
</tr>
</tbody>
</table>

Decoded Victim Data

<table>
<thead>
<tr>
<th>Computer Name</th>
<th>OS version</th>
<th>MAC address</th>
<th>Process list</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Campaign targeted Egypt bank and SK banks – Trojan downloader

- Download payload from another C&C and save in %Temp%
- The downloaded payload need argument “abai” to execute (abai means father in Korean dialect)

```c
format_string((int)&downloaded_file, (const char *)L"%s\%s.exe", &Temp_Path, v4);
v6 = sub_122B2C7();
v7 = v6;
if ( v6 )
{
    sub_122B1AE(v9, 1, v2, v6);
    sub_12283C7(v7);
    sub_1228496(v7);
    v14 = 0;
    _mm_storel_epi64((__m128i *)Parameters, _mm_loadl_epi64((const __m128i *)&abai));
    ShellExecuteW(0, L"open", &downloaded_file, Parameters, 0, 0);
    result = 1;
}
else
{
```
Campaign targeted Egypt bank and SK banks – Milk loader

- Named Milk loader because of the pdb string found in the binary
  - E:\\BIG_POOH\\Project\\milk\\Release\\milk.pdb (a.k.a Poohmilk by PaloAlto)
  - Sleep for 6 mins upon execute
  - Look for file “wsatra.tmp” in the %Temp% folder. (however not existed in this case)
    - If found: read the file and get a path from the file. Scanning .lnk file and ZIP in the path. Extract file from ZIP and execute

```
setTempPath(0x104u, &FileName);
strcpyW(&FileName, L"\wsatra.tmp"); // %temp\\wsatra.tmp
v1 = CreateFileW(&FileName, 0x80000000, 1u, 0, 3u, 0x80u, 0);
result = lstrncpyW(a1, &::String2);
if ( v1 == -1 )
  return result;
wsatr_file = operator new(0x400u);
memset(wsatr_file, 0, 0x400u);
ReadFile(v1, wsatr_file, 0x400u, &NumberOfBytesRead, 0);
```
Campaign targeted Egypt bank and SK banks – Milk loader

- Launch the downloader. Create registry “Windows Update” to set persistent of the downloader. Default command is “help”
TTP & KEY FINDINGS

Some interesting facts
TTP & Key-finding

• Delivery
  • Deliver payload with spear-phishing emails.

• Infrastructure
  • Frequently use compromised C&C server.

• Tools
  • Many shared code between proprietary malwares.
  • Open source tools in arsenal (i.e. Aryan, Xtreme RAT, Ghost RAT, FBI RAT)
  • Destroy evidence and tracks with ransomware. (i.e. Taiwan Far Eastern with Hermes Ransomware)

• Target
  • Targeting SWIFT system when attack on banks.
  • Launching SWIFT transaction during holiday/weekends.

• Persistent
  • Penetrating target’s network and control for a long time before doing transaction.
Getting new C&C server with (stolen? ransomed?) bitcoin

• Our observation shows that there are lesser compromised server been used in the recent attacks.

• In a case we investigated, we tried to inquiry the registrant information of an Andariel group’s C&C server from the hosting server provider.

• The hosting server provider reveals that since the server was pay with bitcoin, they don’t have any information about the identity.

• It is a far more effective way than hacking legitimate servers and also keeping anonymity.
Sample Timestamp Analysis of Andariel Group

Watching Time?

12:00~13:00 Delicious Lunch?

17:00~19:00 Delicious Dinner?

Good Night!
BLACK HAT SOUND BYTES (CONCLUSION)

• We’ve seen an increasing trend of nation-state actors using their cyber espionage capabilities for financial gain.

• Lazarus, Bluenoroff and Andariel groups targeted not only banks, but also bitcoin users/exchanges and ATM machines.

• In many cases, the attackers shows strong knowledge to the compromised system, network environment and their targets. They tailored their tools and develop 0 days for the targets. (They study hard about you!!)

• It is difficult to track these threat groups only with C&C infrastructure. Therefore, be familiar with their tools and tactic is one of the key to defend against them. (You should study hard about them too!!)
Q&A

Any Questions?

- ashley@hitcon.org
- null@fsec.or.kr
- kjkwak@fsec.or.kr
Reference
Disclosed in Feb 2017, but the initial attack was taken in as early as **October 2016**

**Target**: Polish Financial Supervision Authority and **more than 100 banks in Europe** and many other countries (including South Korea)

**Attack Vector**: Watering Hole attack & IP whitelist

**Malware Family**: Ratankba, Destover

**Threat Actor**: Bluenoroff

**Infected Webpage URL**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Poland</td>
<td>19</td>
</tr>
<tr>
<td>2</td>
<td>United States</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Mexico</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>United Kingdom</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Chile</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Brazil</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Peru</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Colombia</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Denmark</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>India</td>
<td>3</td>
</tr>
</tbody>
</table>

(from BAE SYSTEMS THREAT RESEARCH BLOG)
• Reference
  • “Lazarus Under The Hood”, Kaspersky
    • https://securelist.com/files/2017/04/Lazarus_Under_The_Hood_PDF_final.pdf
  • Attackers target dozens of global banks with new malware
  • Jak to było z tym atakiem na KNF i polskie banki oraz kto jeszcze był na celowniku atakujących? (Polish title)
  • Watering hole attacks on Polish Banks Linked to Lazarus Group
    • http://securityaffairs.co/wordpress/56235/apt/lazarus-group-polish-bank.html
  • Several Polish banks hacked, information stolen by unknown attackers
    • https://badcyber.com/several-polish-banks-hacked-information-stolen-by-unknown-attackers/

LAZARUS & WATERING-HOLE ATTACKS

On 3rd February 2017, researchers at badcyber.com released an article that detailed a series of attacks directed at Polish financial institutions. The article is brief, but states that “This is – by far – the most serious information security incident we have seen in Poland” followed by a claim that over 20 commercial banks had been confirmed as victims.

This report provides an outline of the attacks based on what was shared in the article, and our own additional findings.

ANALYSIS

As stated in the blog, the attacks are suspected of originating from the website of the Polish Financial Supervision Authority (knf.gov.pl), shown below: