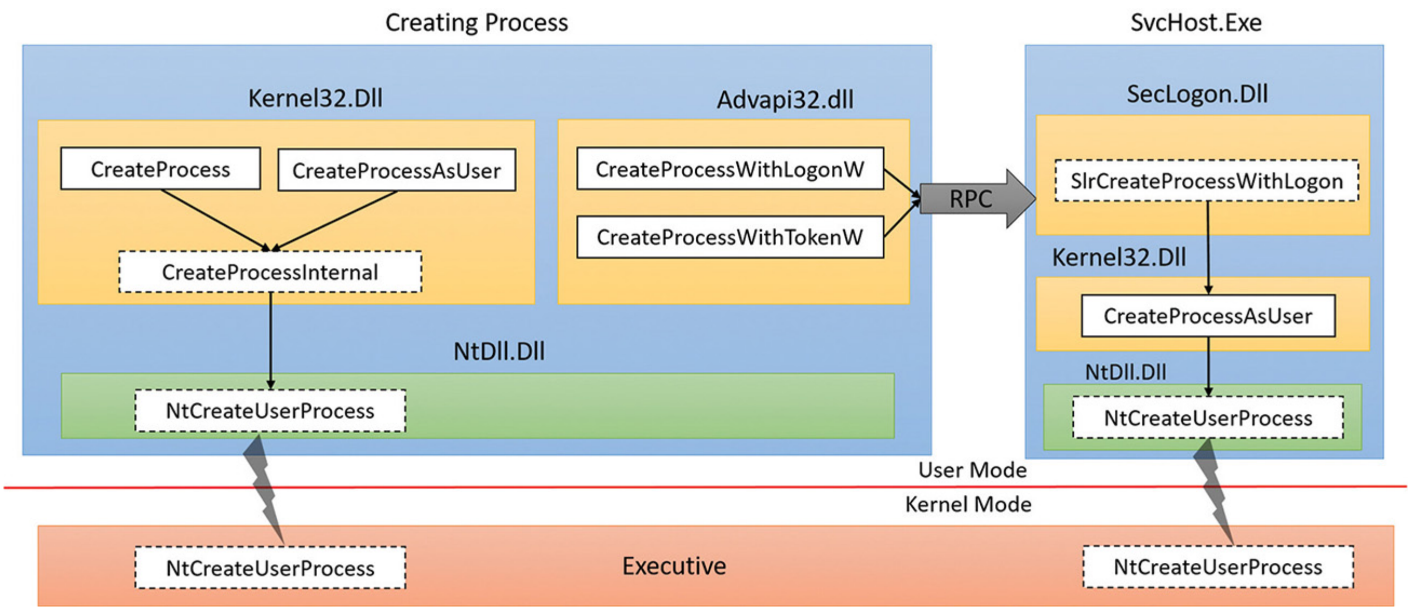
Diving Into NtCreateUserProcess

Introduction

Up to this point in the course, the `CreateProcess` WinAPI has been utilized for the creation of new processes. Nevertheless, it is worth noting that the `CreateProcess` function ultimately invokes NtCreateUserProcess after executing several internal functions, which may be hooked by security vendors. Thus, given the possibility of calling a hooked NtCreateUserProcess through `CreateProcess`, it becomes obligatory for us to invoke it directly via direct or indirect syscalls as a means of bypassing the potential hook installed.

The following is an image from the Windows Internals 7th edition - Part 1 book, which shows `CreateProcess`'s execution flow. Note that functions marked with dotted boxes are internal functions.



`NtCreateUserProcess` is the final user-mode accessible function and represents the lowest level `CreateProcess` can reach before the kernel mode.

NtCreateUserProcess Parameters

The `NtCreateUserProcess` function is a highly customizable function that has multiple parameters and performs complex operations.

```
NTSTATUS NTAPI NtCreateUserProcess(
    OUT          PHANDLE ProcessHandle,
    OUT          PHANDLE ThreadHandle,
    IN           ACCESS_MASK ProcessDesiredAccess,
    IN           ACCESS_MASK ThreadDesiredAccess,
    IN OPTIONAL  POBJECT_ATTRIBUTES ProcessObjectAttributes,
    IN OPTIONAL  POBJECT_ATTRIBUTES ThreadObjectAttributes,
    IN ULONG     ProcessFlags,                                    //
PROCESS_CREATE_FLAGS_*
    IN ULONG     ThreadFlags,                                     //
THREAD_CREATE_FLAGS_*
    IN OPTIONAL PRTL_USER_PROCESS_PARAMETERS ProcessParameters,
    IN OUT      PPS_CREATE_INFO CreateInfo,
    IN          PPS_ATTRIBUTE_LIST AttributeList
);
```

- `ProcessHandle` - A pointer to a `HANDLE` variable that receives the handle of the newly created process.
- `ThreadHandle` - A pointer to a `HANDLE` variable that receives the handle to the main thread of the newly created process.
- `ProcessDesiredAccess` - Determines the granted access to the process handle and is of type `ACCESS_MASK`. This module will use `PROCESS_ALL_ACCESS` to grant full access rights to the object.
- `ThreadDesiredAccess` - Determines the granted access to the thread handle and is of type `ACCESS_MASK`. This module will use `THREAD_ALL_ACCESS` to grant full access rights to the object.
- `ProcessObjectAttributes` - This parameter specifies the attributes that can be applied to the process. The attributes are defined using the `OBJECT_ATTRIBUTES` structure and are typically initialized using the InitializeObjectAttributes macro. For this module, this parameter will be set to `NULL`.
- `ThreadObjectAttributes` - This parameter specifies the attributes that can be applied to the thread. The attributes are defined using the `OBJECT_ATTRIBUTES` structure and are typically initialized using the InitializeObjectAttributes macro. For this module, this parameter will be set to `NULL`.
- `ProcessFlags` - This is the flag that determines the initial state of the created process. For example, the process could be created in a suspended state or could inherit from its parent process. In this module, this flag will be set to `NULL` to indicate that the process should be created in a normal state.
- `ThreadFlags` - This is the flag that determines the initial state of the main thread. In this module, this flag will be set to `NULL` to indicate that the thread should be created in a normal state.
- `ProcessParameters` - An optional parameter, that points to an RTL_USER_PROCESS_PARAMETERS structure. This parameter describes the process's initial arguments.
- `CreateInfo` - This is a pointer to a PS_CREATE_INFO structure that will hold returned information about the created process when the function succeeds.
- `AttributeList` - This is a pointer to a PS_ATTRIBUTE_LIST structure. The purpose of this parameter is to set up the attributes of the created process and thread. Recall that these are the same attributes that allow PPID spoofing and block DLL policy.

Note that the process name to be created is passed as an attribute using the `AttributeList` parameter.

PS_ATTRIBUTE_LIST AttributeList

As mentioned above, `NtCreateUserProcess`'s last parameter is a pointer to a `PS_ATTRIBUTE_LIST` structure.

```
typedef struct _PS_ATTRIBUTE_LIST
{
        SIZE_T TotalLength;
        PS_ATTRIBUTE Attributes[1];

} PS_ATTRIBUTE_LIST, * PPS_ATTRIBUTE_LIST;
```

- `TotalLength` - This is always set to the size of the `PS_ATTRIBUTE_LIST` structure.
- `Attributes` - An array of PS_ATTRIBUTE structure.

PS_ATTRIBUTE Attributes

```
typedef struct _PS_ATTRIBUTE
{
        ULONG_PTR Attribute;
        SIZE_T Size;
        union
        {
                ULONG_PTR Value;
                PVOID ValuePtr;
        };
        PSIZE_T ReturnLength;

} PS_ATTRIBUTE, * PPS_ATTRIBUTE;
```

The following elements should be initialized for every attribute added to the process:

- `Attribute` - Set to the type of attribute.
- `Value` - The attribute value.
- `Size`: The size of the attribute value (size of `Value`).

The parameters are similar to those used in the `UpdateProcThreadAttribute` WinAPI function. The main difference is the `Attribute` member must use one of the values that are specific to the `NtCreateUserProcess` function. These values are shown below.

```
// Specifies the parent process of the new process
#define PS_ATTRIBUTE_PARENT_PROCESS \
    PsAttributeValue(PsAttributeParentProcess, FALSE, TRUE, TRUE)

// Specifies the debug port to use
#define PS_ATTRIBUTE_DEBUG_PORT \
    PsAttributeValue(PsAttributeDebugPort, FALSE, TRUE, TRUE)

// Specifies the token to assign to the new process
#define PS_ATTRIBUTE_TOKEN \
    PsAttributeValue(PsAttributeToken, FALSE, TRUE, TRUE)

// Specifies the client ID to assign to the new process
#define PS_ATTRIBUTE_CLIENT_ID \
    PsAttributeValue(PsAttributeClientId, TRUE, FALSE, FALSE)
```

```
// Specifies the TEB address to use for the new process
#define PS_ATTRIBUTE_TEB_ADDRESS \
    PsAttributeValue(PsAttributeTebAddress, TRUE, FALSE, FALSE)

// Specifies the image name of the new process
#define PS_ATTRIBUTE_IMAGE_NAME \
    PsAttributeValue(PsAttributeImageName, FALSE, TRUE, FALSE)

// Specifies the image information of the new process
#define PS_ATTRIBUTE_IMAGE_INFO \
    PsAttributeValue(PsAttributeImageInfo, FALSE, FALSE, FALSE)

// Specifies the amount of memory to reserve for the new process
#define PS_ATTRIBUTE_MEMORY_RESERVE \
    PsAttributeValue(PsAttributeMemoryReserve, FALSE, TRUE, FALSE)

// Specifies the priority class to use for the new process
#define PS_ATTRIBUTE_PRIORITY_CLASS \
    PsAttributeValue(PsAttributePriorityClass, FALSE, TRUE, FALSE)

// Specifies the error mode to use for the new process
#define PS_ATTRIBUTE_ERROR_MODE \
    PsAttributeValue(PsAttributeErrorMode, FALSE, TRUE, FALSE)

// Specifies the standard handle information to use for the new process
#define PS_ATTRIBUTE_STD_HANDLE_INFO \
    PsAttributeValue(PsAttributeStdHandleInfo, FALSE, TRUE, FALSE)

// Specifies the handle list to use for the new process
#define PS_ATTRIBUTE_HANDLE_LIST \
    PsAttributeValue(PsAttributeHandleList, FALSE, TRUE, FALSE)

// Specifies the group affinity to use for the new process
#define PS_ATTRIBUTE_GROUP_AFFINITY \
    PsAttributeValue(PsAttributeGroupAffinity, TRUE, TRUE, FALSE)

// Specifies the preferred NUMA node to use for the new process
#define PS_ATTRIBUTE_PREFERRED_NODE \
    PsAttributeValue(PsAttributePreferredNode, FALSE, TRUE, FALSE)

// Specifies the ideal processor to use for the new process
#define PS_ATTRIBUTE_IDEAL_PROCESSOR \
    PsAttributeValue(PsAttributeIdealProcessor, TRUE, TRUE, FALSE)

// Specifies the process mitigation options to use for the new process
#define PS_ATTRIBUTE_MITIGATION_OPTIONS \
    PsAttributeValue(PsAttributeMitigationOptions, FALSE, TRUE, FALSE)
```

```
// Specifies the protection level to use for the new process
#define PS_ATTRIBUTE_PROTECTION_LEVEL \
    PsAttributeValue(PsAttributeProtectionLevel, FALSE, TRUE, FALSE)

// Specifies the UMS thread to associate with the new process
#define PS_ATTRIBUTE_UMS_THREAD \
    PsAttributeValue(PsAttributeUmsThread, TRUE, TRUE, FALSE)

// Specifies whether the new process is a secure process
#define PS_ATTRIBUTE_SECURE_PROCESS \
    PsAttributeValue(PsAttributeSecureProcess, FALSE, TRUE, FALSE)

// Specifies the job list to associate with the new process
#define PS_ATTRIBUTE_JOB_LIST \
    PsAttributeValue(PsAttributeJobList, FALSE, TRUE, FALSE)

// Specifies the child process policy to use for the new process
#define PS_ATTRIBUTE_CHILD_PROCESS_POLICY \
    PsAttributeValue(PsAttributeChildProcessPolicy, FALSE, TRUE, FALSE)

// Specifies the all application packages policy to use for the new process
#define PS_ATTRIBUTE_ALL_APPLICATION_PACKAGES_POLICY \
    PsAttributeValue(PsAttributeAllApplicationPackagesPolicy, FALSE, TRUE, FALSE)

// Specifies the child process should have access to the Win32k subsystem.
#define PS_ATTRIBUTE_WIN32K_FILTER      \
    PsAttributeValue(PsAttributeWin32kFilter, FALSE, TRUE, FALSE)

// Specifies the child process is allowed to claim a specific origin when making a
safe file open prompt
#define PS_ATTRIBUTE_SAFE_OPEN_PROMPT_ORIGIN_CLAIM      \
    PsAttributeValue(PsAttributeSafeOpenPromptOriginClaim, FALSE, TRUE, FALSE)

// Specifies the child process is isolated using the BNO framework
#define PS_ATTRIBUTE_BNO_ISOLATION      \
    PsAttributeValue(PsAttributeBnoIsolation, FALSE, TRUE, FALSE)

// Specifies that the child's process desktop application policy
#define PS_ATTRIBUTE_DESKTOP_APP_POLICY \
    PsAttributeValue(PsAttributeDesktopAppPolicy, FALSE, TRUE, FALSE)
```

Initializing PS_ATTRIBUTE_LIST

In the code snippet below, the `PS_ATTRIBUTE_IMAGE_NAME` flag is used as the first attribute in the `PS_ATTRIBUTE_LIST` structure, `pAttributeList`. This flag represents the attribute that will hold the name of the process. By setting this attribute, the `NtCreateUserProcess` function is informed about which image to execute, which in this case is specified with the `szProcessName` variable.

```
PPS_ATTRIBUTE_LIST  pAttributeList          =
(PPS_ATTRIBUTE_LIST)HeapAlloc(GetProcessHeap(), HEAP_ZERO_MEMORY,
sizeof(PS_ATTRIBUTE_LIST));
if (!pAttributeList)
    return FALSE;

// this is always set to the size of the 'PS_ATTRIBUTE_LIST' structure
pAttributeList->TotalLength                 = sizeof(PS_ATTRIBUTE_LIST);

// the type of the attribute
pAttributeList->Attributes[0].Attribute     = PS_ATTRIBUTE_IMAGE_NAME;
// the size of the attribute value
pAttributeList->Attributes[0].Size          = dwProcessNameLength;
// the attribute value
pAttributeList->Attributes[0].Value         = szProcessName;
```

Initializing Additional Attributes

To initialize additional attributes, update the number of elements in the `Attributes` array.

```
typedef struct _PS_ATTRIBUTE_LIST
{
    SIZE_T TotalLength;
    PS_ATTRIBUTE Attributes[2];       // updated to fit an additional attribute
    // PS_ATTRIBUTE Attributes[3];    // updated to fit 3 attributes

} PS_ATTRIBUTE_LIST, * PPS_ATTRIBUTE_LIST;
```

PS_CREATE_INFO CreateInfo

`NtCreateUserProcess`'s 10th parameter, `CreateInfo`, is an input and output parameter and a pointer to the `PS_CREATE_INFO` structure.

```
typedef struct _PS_CREATE_INFO
{
        SIZE_T Size;
        PS_CREATE_STATE State;
        union
        {
                struct
                {
                        union
                        {
                                ULONG InitFlags;
                                struct
                                {
                                        UCHAR WriteOutputOnExit : 1;
                                        UCHAR DetectManifest : 1;
                                        UCHAR IFEOSkipDebugger : 1;
                                        UCHAR IFEODoNotPropagateKeyState : 1;
                                        UCHAR SpareBits1 : 4;
                                        UCHAR SpareBits2 : 8;
                                        USHORT ProhibitedImageCharacteristics :
16;
                                } s1;
                        } u1;
                        ACCESS_MASK AdditionalFileAccess;
                } InitState;

                struct
                {
                        HANDLE FileHandle;
                } FailSection;

                struct
                {
                        USHORT DllCharacteristics;
                } ExeFormat;

                struct
                {
                        HANDLE IFEOKey;
                } ExeName;

                struct
                {
                        union
                        {
                                ULONG OutputFlags;
                                struct
                                {
                                        UCHAR ProtectedProcess : 1;
                                        UCHAR AddressSpaceOverride : 1;
                                        UCHAR DevOverrideEnabled : 1;
                                        UCHAR ManifestDetected : 1;
                                        UCHAR ProtectedProcessLight : 1;
                                        UCHAR SpareBits1 : 3;
                                        UCHAR SpareBits2 : 8;
                                        USHORT SpareBits3 : 16;
                                } s2;
                        } u2;
                        HANDLE FileHandle;
                        HANDLE SectionHandle;
                        ULONGLONG UserProcessParametersNative;
```

```
                         ULONG UserProcessParametersWow64;
                         ULONG CurrentParameterFlags;
                         ULONGLONG PebAddressNative;
                         ULONG PebAddressWow64;
                         ULONGLONG ManifestAddress;
                         ULONG ManifestSize;
                 } SuccessState;
         };

} PS_CREATE_INFO, * PPS_CREATE_INFO;
```

Initializing PS_CREATE_INFO

While the `PS_CREATE_INFO` structure is large, most of its elements are set by `NtCreateUserProcess` when it's executed successfully. The only elements that should be initialized before passing the structure to `NtCreateUserProcess` are the `Size` and `State` elements as shown below.

```
PS_CREATE_INFO CreateInfo = { 0 };

CreateInfo.Size  = sizeof(PS_CREATE_INFO);
CreateInfo.State = PsCreateInitialState;
```

The value of the `State` element is derived from the enumeration below. However, in almost all cases, it is set to `PsCreateInitialState`.

```
typedef enum _PS_CREATE_STATE
{
        PsCreateInitialState,
        PsCreateFailOnFileOpen,
        PsCreateFailOnSectionCreate,
        PsCreateFailExeFormat,
        PsCreateFailMachineMismatch,
        PsCreateFailExeName,
        PsCreateSuccess,
        PsCreateMaximumStates

} PS_CREATE_STATE;
```

RTL_USER_PROCESS_PARAMETERS ProcessParameters

Although the `ProcessParameters` parameter is designated as an optional parameter, setting it to `NULL` will result in `NtCreateUserProcess` failing with `0xC0000005` or `STATUS_ACCESS_VIOLATION`. The `RTL_USER_PROCESS_PARAMETERS` structure is poorly documented by Microsoft and therefore the structure was retrieved from the Process Hacker repository.

```
typedef struct _RTL_USER_PROCESS_PARAMETERS
{
        ULONG MaximumLength;
        ULONG Length;
        ULONG Flags;
        ULONG DebugFlags;

        HANDLE ConsoleHandle;
        ULONG ConsoleFlags;
        HANDLE StandardInput;
        HANDLE StandardOutput;
        HANDLE StandardError;

        CURDIR CurrentDirectory;
        UNICODE_STRING DllPath;
        UNICODE_STRING ImagePathName;
        UNICODE_STRING CommandLine;
        PWCHAR Environment;

        ULONG StartingX;
        ULONG StartingY;
        ULONG CountX;
        ULONG CountY;
        ULONG CountCharsX;
        ULONG CountCharsY;
        ULONG FillAttribute;

        ULONG WindowFlags;
        ULONG ShowWindowFlags;
        UNICODE_STRING WindowTitle;
        UNICODE_STRING DesktopInfo;
        UNICODE_STRING ShellInfo;
        UNICODE_STRING RuntimeData;
        RTL_DRIVE_LETTER_CURDIR CurrentDirectories[RTL_MAX_DRIVE_LETTERS];

        ULONG_PTR EnvironmentSize;
        ULONG_PTR EnvironmentVersion;
        PVOID PackageDependencyData;
        ULONG ProcessGroupId;
        ULONG LoaderThreads;

} RTL_USER_PROCESS_PARAMETERS, * PRTL_USER_PROCESS_PARAMETERS;
```

Initilizaing RTL_USER_PROCESS_PARAMETERS

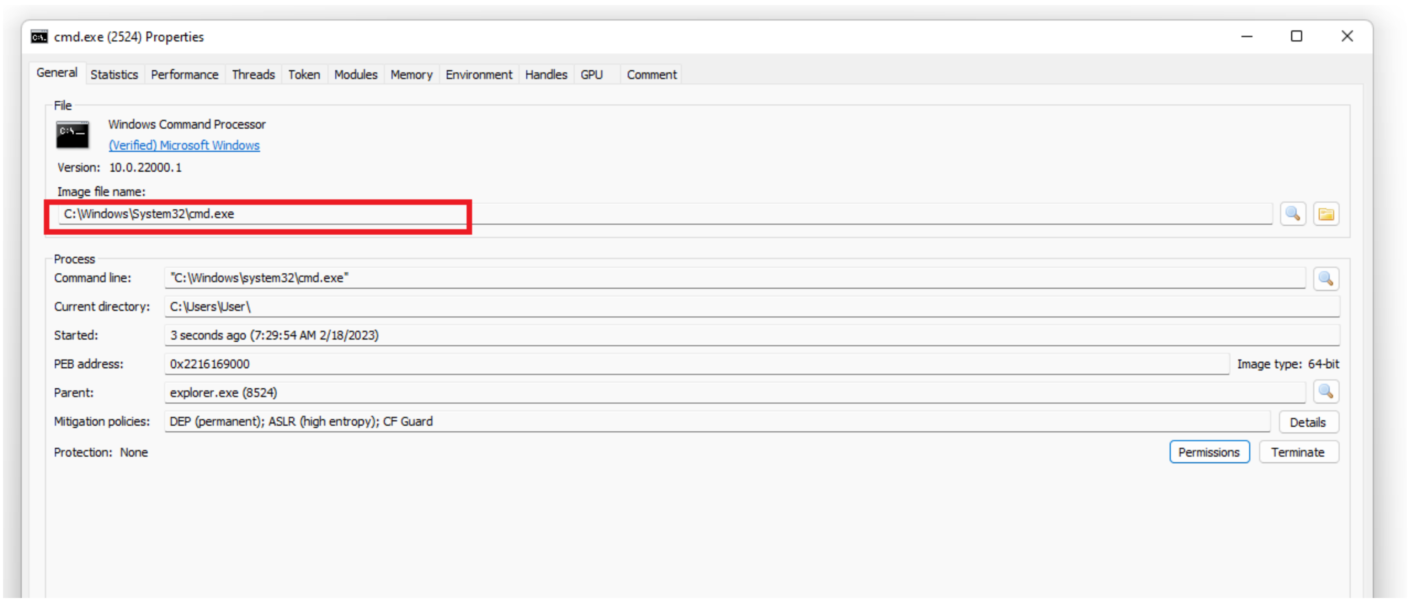
To initialize the `RTL_USER_PROCESS_PARAMETERS` structure, the RtlCreateProcessParametersEx native function is used.

```
RtlCreateProcessParametersEx(
    OUT         PRTL_USER_PROCESS_PARAMETERS *pProcessParameters,
    IN          PUNICODE_STRING ImagePathName,
    IN OPTIONAL PUNICODE_STRING DllPath,          // set to NULL
    IN OPTIONAL PUNICODE_STRING CurrentDirectory,
    IN OPTIONAL PUNICODE_STRING CommandLine,
    IN OPTIONAL PVOID Environment,              // set to NULL
    IN OPTIONAL PUNICODE_STRING WindowTitle,    // set to NULL
    IN OPTIONAL PUNICODE_STRING DesktopInfo,    // set to NULL
    IN OPTIONAL PUNICODE_STRING ShellInfo,      // set to NULL
    IN OPTIONAL PUNICODE_STRING RuntimeData,    // set to NULL
    IN ULONG Flags
);
```

The majority of the parameters are optional and can be set to `NULL`. The important parameters are explained below.

- `pProcessParameters` - A pointer to the `PRTL_USER_PROCESS_PARAMETERS` structure. This is the output of `RtlCreateProcessParametersEx`.

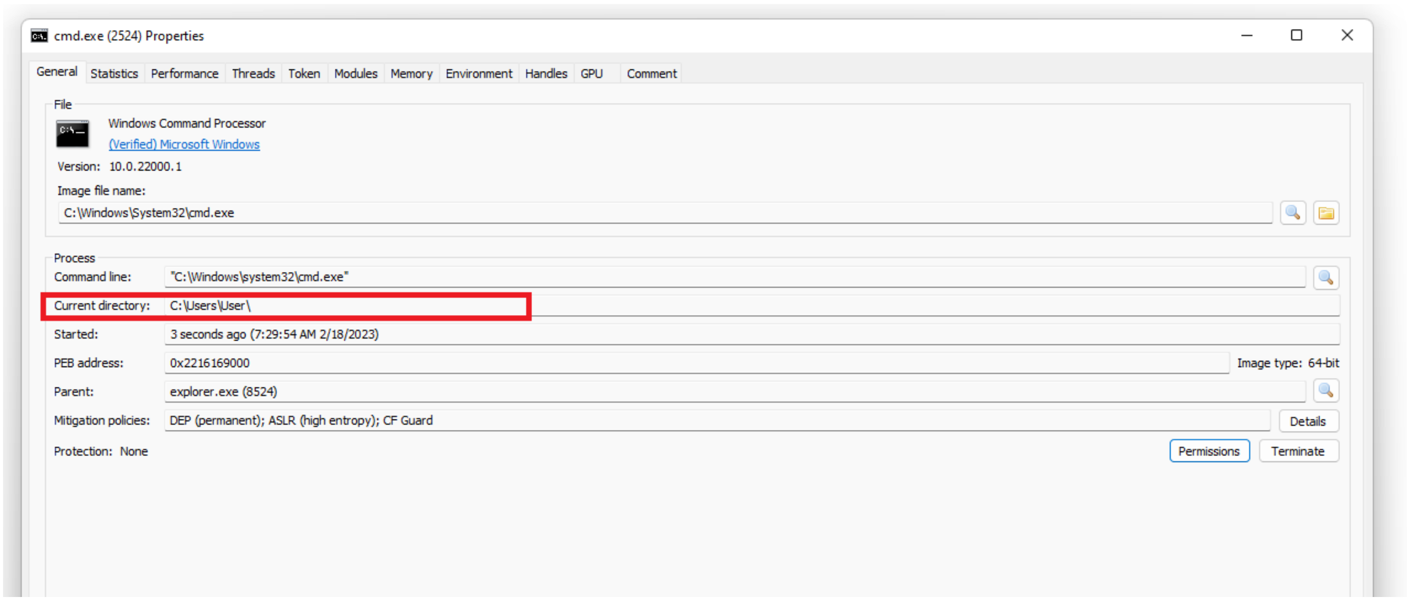
- `ImagePathName` - A pointer to a `UNICODE_STRING` structure that holds the complete path of the image file used to create the process. The provided image path must be in NT path format. For example, to create `C:\\Windows\\System32\\cmd.exe`, the path should be prefixed with `\\??\\` making it `\\??\\C:\\Windows\\System32\\cmd.exe`. This parameter is shown using Process Hacker in the image below.


cmd.exe (2524) Properties

File
Windows Command Processor
(Verified) Microsoft Windows
Version: 10.0.22000.1
Image file name:
C:\Windows\System32\cmd.exe

Process
Command line: "C:\Windows\system32\cmd.exe"
Current directory: C:\Users\User\
Started: 3 seconds ago (7:29:54 AM 2/18/2023)
PEB address: 0x2216169000 Image type: 64-bit
Parent: explorer.exe (8524)
Mitigation policies: DEP (permanent); ASLR (high entropy); CF Guard
Protection: None

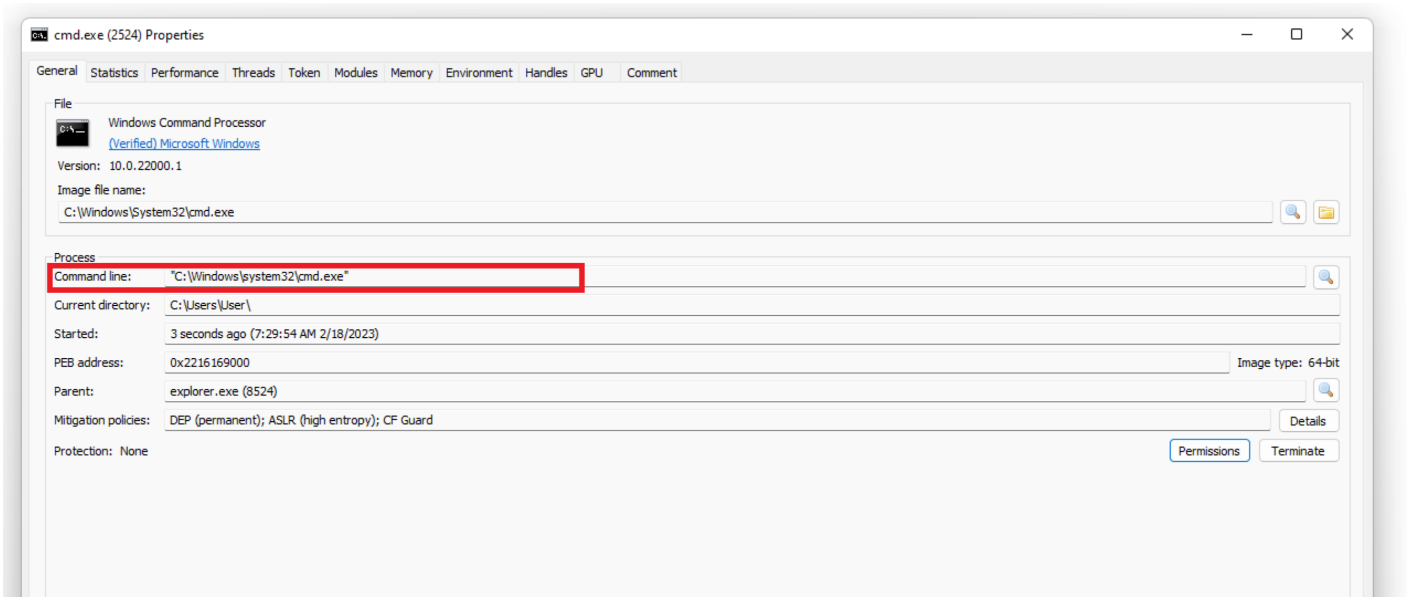
- `CurrentDirectory` - A pointer to a `UNICODE_STRING` structure that holds the current directory path of the created process. This parameter is shown using Process Hacker in the image below.


cmd.exe (2524) Properties

File
Windows Command Processor
(Verified) Microsoft Windows
Version: 10.0.22000.1
Image file name:
C:\Windows\System32\cmd.exe

Process
Command line: "C:\Windows\system32\cmd.exe"
Current directory: C:\Users\User\
Started: 3 seconds ago (7:29:54 AM 2/18/2023)
PEB address: 0x2216169000 Image type: 64-bit
Parent: explorer.exe (8524)
Mitigation policies: DEP (permanent); ASLR (high entropy); CF Guard
Protection: None

- `CommandLine` - A pointer to a `UNICODE_STRING` structure that holds the arguments for the created process. This parameter is shown using Process Hacker in the image below.


cmd.exe (2524) Properties

File
Windows Command Processor
(Verified) Microsoft Windows
Version: 10.0.22000.1
Image file name:
C:\Windows\System32\cmd.exe

Process
Command line: "C:\Windows\system32\cmd.exe"
Current directory: C:\Users\User\
Started: 3 seconds ago (7:29:54 AM 2/18/2023)
PEB address: 0x2216169000 Image type: 64-bit
Parent: explorer.exe (8524)
Mitigation policies: DEP (permanent); ASLR (high entropy); CF Guard
Protection: None

- `Flags` - This is set to `RTL_USER_PROC_PARAMS_NORMALIZED` to keep parameters normalized as per Process Hacker's note. With that being said, `Flags` can be set to any of the values below.

```
#define RTL_USER_PROC_PARAMS_NORMALIZED 0x00000001      // indicates that the
parameters passed to the process are already in a normalized form
#define RTL_USER_PROC_PROFILE_USER 0x00000002           // enables user-mode
profiling for the process
#define RTL_USER_PROC_PROFILE_KERNEL 0x00000004         // enables kernel-mode
profiling for the process
#define RTL_USER_PROC_PROFILE_SERVER 0x00000008         // enables server-mode
profiling for the process
#define RTL_USER_PROC_RESERVE_1MB 0x00000020            // reserves 1 megabyte
(MB) of virtual address space for the process
#define RTL_USER_PROC_RESERVE_16MB 0x00000040           // reserves 16 MB of
virtual address space for the process
#define RTL_USER_PROC_CASE_SENSITIVE 0x00000080         // sets the process to be
```

```
case-sensitive
#define RTL_USER_PROC_DISABLE_HEAP_DECOMMIT 0x00000100  // disables heap
decommitting for the process
#define RTL_USER_PROC_DLL_REDIRECTION_LOCAL 0x00001000  // enables local DLL
redirection for the process
#define RTL_USER_PROC_APP_MANIFEST_PRESENT 0x00002000   // indicates that an
application manifest is present for the process
#define RTL_USER_PROC_IMAGE_KEY_MISSING 0x00004000      // indicates that the
image key is missing for the process
#define RTL_USER_PROC_OPTIN_PROCESS 0x00020000          // indicates that the
process has opted in to some specific behavior or feature
```

Creating a Process Using NtCreateUserProcess

Now that `NtCreateUserProcess` has been thoroughly explained, this section will demonstrate the usage of the function to create a process via the custom function `NtCreateUserProcessMinimalPoC`. Note that `PS_ATTRIBUTE_LIST` only requires one attribute as shown below.

```
typedef struct _PS_ATTRIBUTE_LIST
{
        SIZE_T TotalLength;
        PS_ATTRIBUTE Attributes[1]; // 1 attribute

} PS_ATTRIBUTE_LIST, * PPS_ATTRIBUTE_LIST;
```

```
BOOL NtCreateUserProcessMinimalPoC(
        IN      PWSTR   szTargetProcess,
        IN      PWSTR   szTargetProcessParameters,
        IN      PWSTR   szTargetProcessPath,
        OUT     PHANDLE hProcess,
        OUT     PHANDLE hThread
) {

        // getting the address of 'RtlCreateProcessParametersEx' and
'NtCreateUserProcess' from ntdll.dll
        fnRtlCreateProcessParametersEx  RtlCreateProcessParametersEx    =
(fnRtlCreateProcessParametersEx)GetProcAddress(GetModuleHandle(L"NTDLL"),
"RtlCreateProcessParametersEx");
        fnNtCreateUserProcess           NtCreateUserProcess             =
(fnNtCreateUserProcess)GetProcAddress(GetModuleHandle(L"NTDLL"),
"NtCreateUserProcess");

        if (NtCreateUserProcess == NULL || RtlCreateProcessParametersEx == NULL)
                return FALSE;

        NTSTATUS                        STATUS                      = NULL;
        UNICODE_STRING                  UsNtImagePath               = { 0 },
                                    UsCommandLine               = { 0 },
                                UsCurrentDirectory          = { 0 };
        PRTL_USER_PROCESS_PARAMETERS    UppProcessParameters        = NULL;
        // allocating a buffer to hold the value of the attribute lists
        PPS_ATTRIBUTE_LIST              pAttributeList              =
(PPS_ATTRIBUTE_LIST)HeapAlloc(GetProcessHeap(), HEAP_ZERO_MEMORY,
sizeof(PS_ATTRIBUTE_LIST));
        if (!pAttributeList)
                return FALSE;

        // initializing the 'UNICODE_STRING' structures with the inputted paths
        _RtlInitUnicodeString(&UsNtImagePath, szTargetProcess);
        _RtlInitUnicodeString(&UsCommandLine, szTargetProcessParameters);
        _RtlInitUnicodeString(&UsCurrentDirectory, szTargetProcessPath);

        // calling 'RtlCreateProcessParametersEx' to intialize a
'PRTL_USER_PROCESS_PARAMETERS' structure for 'NtCreateUserProcess'
        STATUS = RtlCreateProcessParametersEx(&UppProcessParameters,
&UsNtImagePath, NULL, &UsCurrentDirectory, &UsCommandLine, NULL, NULL, NULL, NULL,
NULL, RTL_USER_PROC_PARAMS_NORMALIZED);
        if (STATUS != STATUS_SUCCESS) {
                printf("[!] RtlCreateProcessParametersEx Failed With Error :
0x%0.8X \n", STATUS);
                goto _EndOfFunc;
        }

        // setting the length of the attribute list
        pAttributeList->TotalLength                         =
sizeof(PS_ATTRIBUTE_LIST);

        // intializing an attribute list of type 'PS_ATTRIBUTE_IMAGE_NAME' that
specifies the image's path
        pAttributeList->Attributes[0].Attribute        = PS_ATTRIBUTE_IMAGE_NAME;
        pAttributeList->Attributes[0].Size             = UsNtImagePath.Length;
        pAttributeList->Attributes[0].Value            =
(ULONG_PTR)UsNtImagePath.Buffer;

        // creating the 'PS_CREATE_INFO' structure, that will almost always look
like this
        PS_CREATE_INFO                          psCreateInfo = {
                                        .Size  = sizeof(PS_CREATE_INFO),
                                        .State = PsCreateInitialState
        };

        // creating the process
        // hProcess and hThread are already pointers
        STATUS = NtCreateUserProcess(hProcess, hThread, PROCESS_ALL_ACCESS,
THREAD_ALL_ACCESS, NULL, NULL, NULL, NULL, UppProcessParameters, &psCreateInfo,
pAttributeList);
```

```
        if (STATUS != STATUS_SUCCESS) {
                printf("[!] NtCreateUserProcess Failed With Error : 0x%0.8X \n",
STATUS);
                goto _EndOfFunc;
        }

_EndOfFunc:
        HeapFree(GetProcessHeap(), 0, pAttributeList);
        if (*hProcess == NULL || *hThread == NULL)
                return FALSE;
        else
                return TRUE;
}
```

Custom RtlInitUnicodeString

The `_RtlInitUnicodeString` function initializes a `UNICODE_STRING` structure with the provided wide string. Note that `_RtlInitUnicodeString` is a custom replacement function of the real one, that is RtlInitUnicodeString.

```
VOID _RtlInitUnicodeString(OUT PUNICODE_STRING UsStruct, IN OPTIONAL PCWSTR
Buffer) {

        if ((UsStruct->Buffer = (PWSTR)Buffer)) {

                unsigned int Length = wcslen(Buffer) * sizeof(WCHAR);
                if (Length > 0xfffc)
                        Length = 0xfffc;

                UsStruct->Length = Length;
                UsStruct->MaximumLength = UsStruct->Length + sizeof(WCHAR);
        }

        else UsStruct->Length = UsStruct->MaximumLength = 0;
}
```

The second if-statement in the above function is to check if the calculated length (in bytes) is greater than the maximum size allowed for a `UNICODE_STRING` structure (`0xfffc`). If that's the case, the length is capped at the maximum size. Besides that, the function initializes the inputted `UNICODE_STRING`'s elements with the correct values.

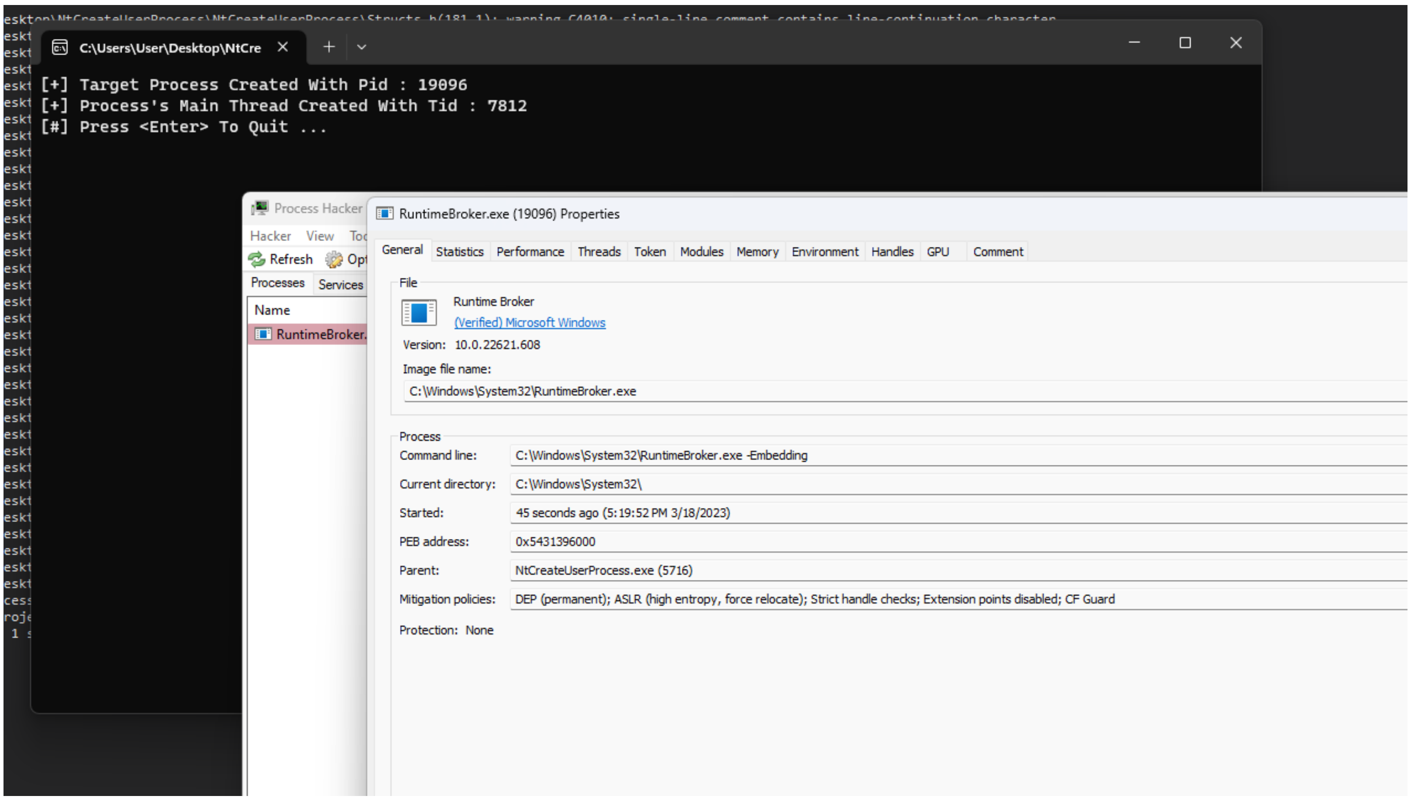
Main Function

Use the main function below to call the `NtCreateUserProcessMinimalPoC`.

```

#define TARGET_PROCESS          L"\\??\\C:\\Windows\\System32\\RuntimeBroker.exe"
#define PROCESS_PARMS           L"C:\\Windows\\System32\\RuntimeBroker.exe -
Embedding"
```

```
#define PROCESS_PATH            L"C:\\Windows\\System32"


int main() {

  HANDLE       hProcess         = NULL,
                 hThread              = NULL;

  if (!NtCreateUserProcessMinimalPoC(TARGET_PROCESS, PROCESS_PARMS, PROCESS_PATH,
&hProcess, &hThread))
        return -1;

  printf("[+] Target Process Created With Pid : %d \n", GetProcessId(hProcess));
  printf("[+] Process's Main Thread Created With Tid : %d \n",
GetThreadId(hThread));
  return 0;
}
```

Results



```
esktop\NtCreateUserProcess\NtCreateUserProcess\Structs.h(181,1): warning C4010: single-line comment contains line-continuation character
```

```
C:\Users\User\Desktop\NtCre
[+] Target Process Created With Pid : 19096
[+] Process's Main Thread Created With Tid : 7812
[#] Press <Enter> To Quit ...
```

RuntimeBroker.exe (19096) Properties

General | Statistics | Performance | Threads | Token | Modules | Memory | Environment | Handles | GPU | Comment

File

Runtime Broker
(Verified) Microsoft Windows

Version: 10.0.22621.608

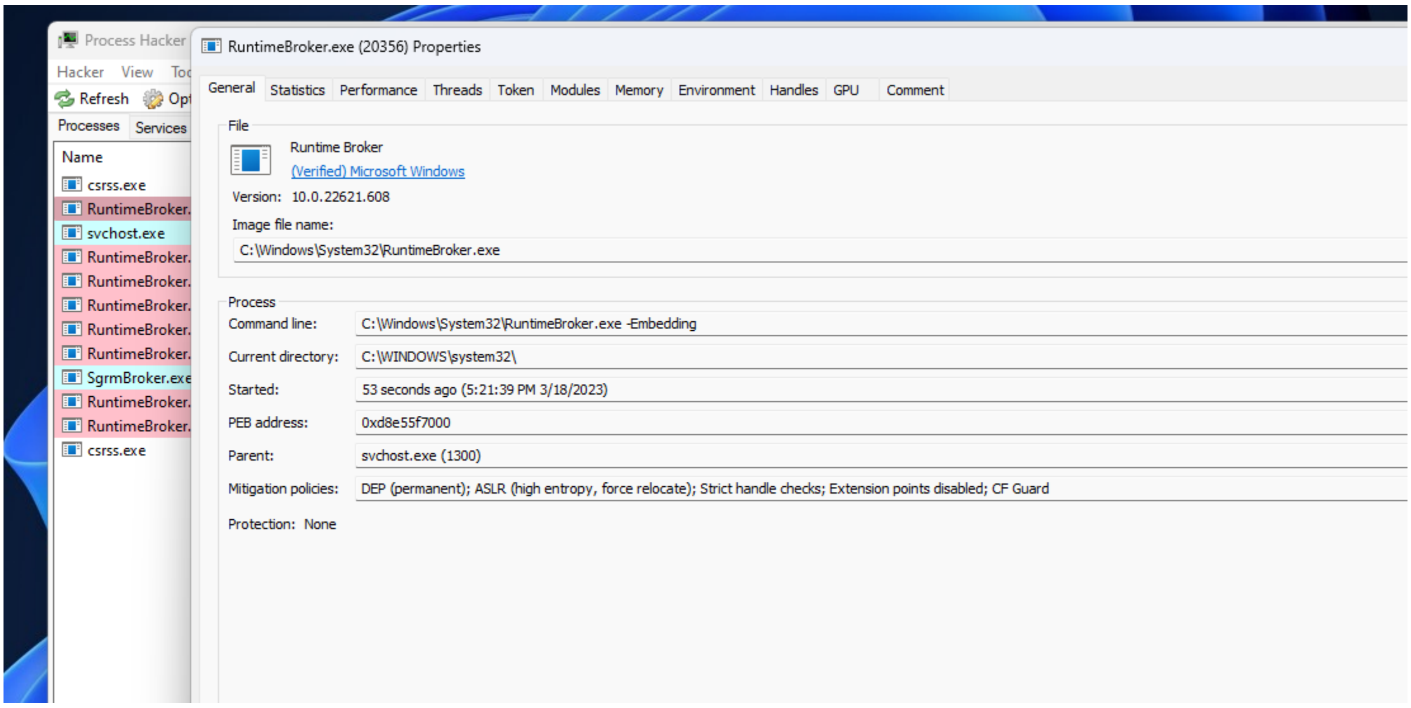
Image file name:
C:\Windows\System32\RuntimeBroker.exe

Process

Command line:	C:\Windows\System32\RuntimeBroker.exe -Embedding
Current directory:	C:\Windows\System32\
Started:	45 seconds ago (5:19:52 PM 3/18/2023)
PEB address:	0x5431396000
Parent:	NtCreateUserProcess.exe (5716)
Mitigation policies:	DEP (permanent); ASLR (high entropy, force relocate); Strict handle checks; Extension points disabled; CF Guard

Protection: None

Which looks similar to that of a legit RuntimeBroker (except for the parent Process).



File
Runtime Broker
(Verified) Microsoft Windows
Version: 10.0.22621.608
Image file name:
C:\Windows\System32\RuntimeBroker.exe

Process
Command line: C:\Windows\System32\RuntimeBroker.exe -Embedding
Current directory: C:\WINDOWS\system32\
Started: 53 seconds ago (5:21:39 PM 3/18/2023)
PEB address: 0xd8e55f7000
Parent: svchost.exe (1300)
Mitigation policies: DEP (permanent); ASLR (high entropy, force relocate); Strict handle checks; Extension points disabled; CF Guard
Protection: None

PPID Spoofing Using NtCreateUserProcess

The next usage of `NtCreateUserProcess` will be for performing PPID spoofing. Note that `PS_ATTRIBUTE_LIST` needs to be modified to allow an additional attribute as shown below.

```
typedef struct _PS_ATTRIBUTE_LIST
{
        SIZE_T TotalLength;
        PS_ATTRIBUTE Attributes[2]; // Increment to 2 for an additional attribute

} PS_ATTRIBUTE_LIST, * PPS_ATTRIBUTE_LIST;
```

`NtCreateUserProcessForPPidSpoofing` is a custom function that performs PPID spoofing. The function is similar to `NtCreateUserProcessMinimalPoC`, with the main difference being that the additional attribute uses the `PS_ATTRIBUTE_PARENT_PROCESS` flag to specify the spoofed parent process.

```
BOOL NtCreateUserProcessForPPidSpoofing(
        IN      PWSTR   szTargetProcess,
        IN      PWSTR   szTargetProcessParameters,
        IN      PWSTR   szTargetProcessPath,
        IN      HANDLE  hParentProcess,
        OUT     PHANDLE hProcess,
        OUT     PHANDLE hThread
) {

        // getting the address of 'RtlCreateProcessParametersEx' and
'NtCreateUserProcess' from ntdll.dll
        fnRtlCreateProcessParametersEx  RtlCreateProcessParametersEx    =
(fnRtlCreateProcessParametersEx)GetProcAddress(GetModuleHandle(L"NTDLL"),
"RtlCreateProcessParametersEx");
        fnNtCreateUserProcess           NtCreateUserProcess             =
(fnNtCreateUserProcess)GetProcAddress(GetModuleHandle(L"NTDLL"),
"NtCreateUserProcess");

        if (NtCreateUserProcess == NULL || RtlCreateProcessParametersEx == NULL)
                return FALSE;

        NTSTATUS                        STATUS                      = NULL;
        UNICODE_STRING                  UsNtImagePath               = { 0 },
                                    UsCommandLine               = { 0 },
                                    UsCurrentDirectory          = { 0 };
        PRTL_USER_PROCESS_PARAMETERS    UppProcessParameters        = NULL;
        // allocating a buffer to hold the value of the attribute lists
        PPS_ATTRIBUTE_LIST              pAttributeList              =
(PPS_ATTRIBUTE_LIST)HeapAlloc(GetProcessHeap(), HEAP_ZERO_MEMORY,
sizeof(PS_ATTRIBUTE_LIST));
        if (!pAttributeList)
                return FALSE;

        // initializing the 'UNICODE_STRING' structures with the inputted paths
        _RtlInitUnicodeString(&UsNtImagePath, szTargetProcess);
        _RtlInitUnicodeString(&UsCommandLine, szTargetProcessParameters);
        _RtlInitUnicodeString(&UsCurrentDirectory, szTargetProcessPath);

        // calling 'RtlCreateProcessParametersEx' to intialize a
'PRTL_USER_PROCESS_PARAMETERS' structure for 'NtCreateUserProcess'
        STATUS = RtlCreateProcessParametersEx(&UppProcessParameters,
&UsNtImagePath, NULL, &UsCurrentDirectory, &UsCommandLine, NULL, NULL, NULL, NULL,
NULL, RTL_USER_PROC_PARAMS_NORMALIZED);
        if (STATUS != STATUS_SUCCESS) {
                printf("[!] RtlCreateProcessParametersEx Failed With Error :
0x%0.8X \n", STATUS);
                goto _EndOfFunc;
        }

        // setting the length of the attribute list
        pAttributeList->TotalLength                     =
sizeof(PS_ATTRIBUTE_LIST);

        // intializing an attribute list of type 'PS_ATTRIBUTE_IMAGE_NAME' that
specifies the image's path
        pAttributeList->Attributes[0].Attribute         = PS_ATTRIBUTE_IMAGE_NAME;
        pAttributeList->Attributes[0].Size              = UsNtImagePath.Length;
        pAttributeList->Attributes[0].Value             =
(ULONG_PTR)UsNtImagePath.Buffer;

        // intializing an attribute list of type 'PS_ATTRIBUTE_PARENT_PROCESS'
that specifies the process's parent
        pAttributeList->Attributes[1].Attribute         =
PS_ATTRIBUTE_PARENT_PROCESS;
        pAttributeList->Attributes[1].Size              = sizeof(HANDLE);
        pAttributeList->Attributes[1].Value             = hParentProcess;

        // creating the 'PS_CREATE_INFO' structure, that will almost always look
like this
        PS_CREATE_INFO                          psCreateInfo = {
                                        .Size   = sizeof(PS_CREATE_INFO),
                                        .State  = PsCreateInitialState
        };

        // creating the process
        // hProcess and hThread are already pointers
        STATUS = NtCreateUserProcess(hProcess, hThread, PROCESS_ALL_ACCESS,
THREAD_ALL_ACCESS, NULL, NULL, NULL, NULL, UppProcessParameters, &psCreateInfo,
pAttributeList);
        if (STATUS != STATUS_SUCCESS) {
                printf("[!] NtCreateUserProcess Failed With Error : 0x%0.8X \n",
STATUS);
                goto _EndOfFunc;
        }



_EndOfFunc:
        HeapFree(GetProcessHeap(), 0, pAttributeList);
        if (*hProcess == NULL || *hThread == NULL)
                return FALSE;
        else
                return TRUE;
}
```

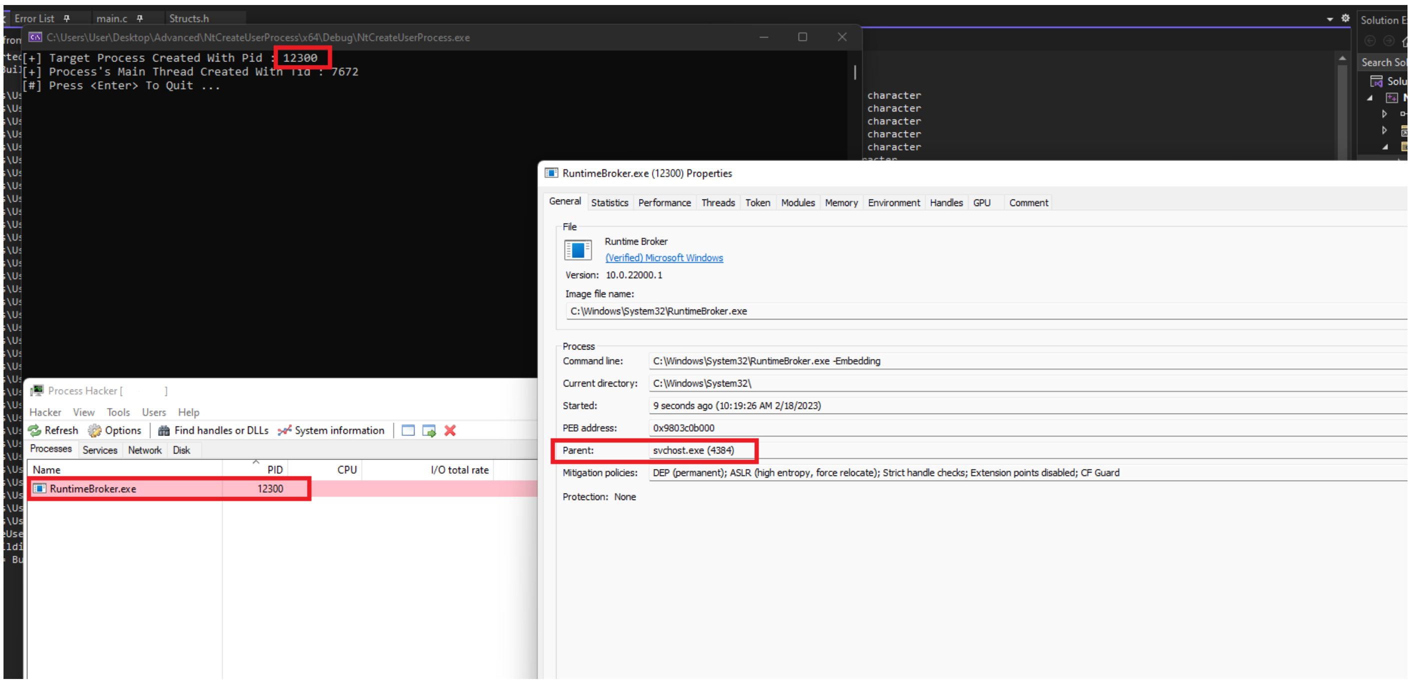
Main Function

The main function below invokes `NtCreateUserProcessForPPidSpoofing` to perform PPID spoofing.

```
#define TARGET_PROCESS          L"\\??\\C:\\Windows\\System32\\RuntimeBroker.exe"
#define PROCESS_PARMS           L"C:\\Windows\\System32\\RuntimeBroker.exe -
Embedding"
#define PROCESS_PATH            L"C:\\Windows\\System32"

#define PARENT_PID              4384

int main() {

  HANDLE        hProcess        = NULL,
                    hThread             = NULL;

  hParentProcess = OpenProcess(PROCESS_ALL_ACCESS, FALSE, PARENT_PID);

  if (!NtCreateUserProcessForPPidSpoofing(TARGET_PROCESS, PROCESS_PARMS,
PROCESS_PATH, hParentProcess, &hProcess, &hThread))
        return -1;

  printf("[+] Target Process Created With Pid : %d \n", GetProcessId(hProcess));
  printf("[+] Process's Main Thread Created With Tid : %d \n",
GetThreadId(hThread));
  return 0;
}
```

Results

The image below shows a process with a successfully spoofed parent process.



```
C:\Users\User\Desktop\Advanced\NtCreateUserProcess\x64\Debug\NtCreateUserProcess.exe
[+] Target Process Created With Pid : 12300
[+] Process's Main Thread Created With Tid : 7672
[#] Press <Enter> To Quit ...
```

```
RuntimeBroker.exe (12300) Properties
File
Runtime Broker
(Verified) Microsoft Windows
Version:  10.0.22000.1
Image file name:
C:\Windows\System32\RuntimeBroker.exe
Process
Command line:        C:\Windows\System32\RuntimeBroker.exe -Embedding
Current directory:   C:\Windows\System32\
Started:             9 seconds ago (10:19:26 AM 2/18/2023)
PEB address:         0x9803c0b000
Parent:              svchost.exe (4384)
Mitigation policies: DEP (permanent); ASLR (high entropy, force relocate); Strict handle checks; Extension points disabled; CF Guard
Protection:  None
```

Name	PID	CPU	I/O total rate
RuntimeBroker.exe	12300		

Error List
main.c
Structs.h
Process Hacker [ ]
Hacker View Tools Users Help
Refresh Options Find handles or DLLs System information
Processes Services Network Disk
General Statistics Performance Threads Token Modules Memory Environment Handles GPU Comment

Block DLL Policy Using NtCreateUserProcess

`NtCreateUserProcess` can also be used to enable the block DLL policy, which was introduced in the previous module. The `PS_ATTRIBUTE_LIST` structure will require two attributes. The additional attribute is set to `PS_ATTRIBUTE_MITIGATION_OPTIONS` which specifies the process mitigation options to use for the new process.

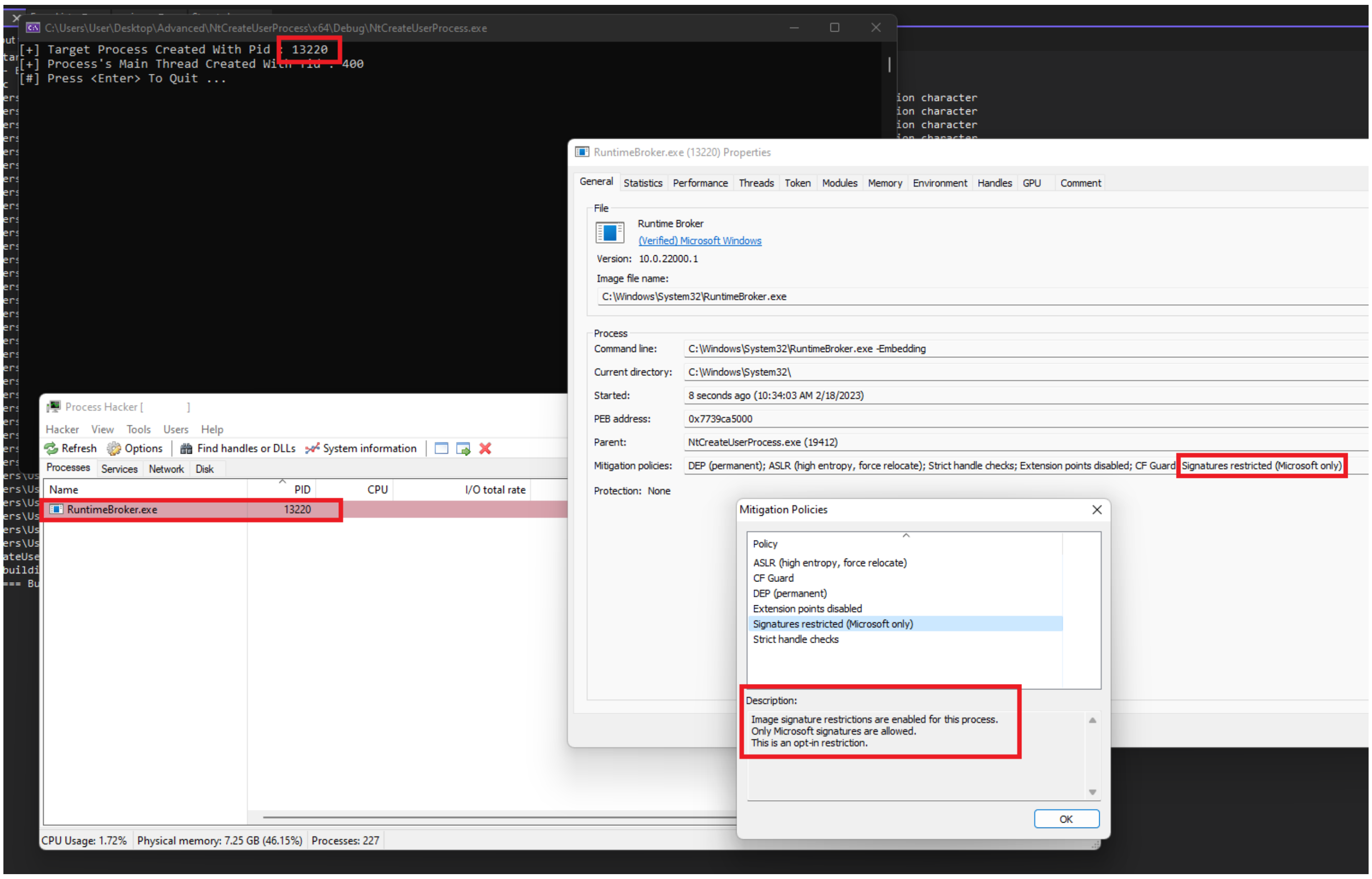
`NtCreateUserProcessForBlockDllPolicy` is a custom function that enables the mitigation policy to block non-Microsoft signed DLLs.

```
BOOL NtCreateUserProcessForBlockDllPolicy(
        IN      PWSTR   szTargetProcess,
        IN      PWSTR   szTargetProcessParameters,
        IN      PWSTR   szTargetProcessPath,
        OUT     PHANDLE hProcess,
        OUT     PHANDLE hThread
) {
        // getting the address of 'RtlCreateProcessParametersEx' and
'NtCreateUserProcess' from ntdll.dll
        fnRtlCreateProcessParametersEx  RtlCreateProcessParametersEx    =
(fnRtlCreateProcessParametersEx)GetProcAddress(GetModuleHandle(L"NTDLL"),
"RtlCreateProcessParametersEx");
        fnNtCreateUserProcess           NtCreateUserProcess             =
(fnNtCreateUserProcess)GetProcAddress(GetModuleHandle(L"NTDLL"),
"NtCreateUserProcess");

        if (NtCreateUserProcess == NULL || RtlCreateProcessParametersEx == NULL)
                return FALSE;

        NTSTATUS                        STATUS                      = NULL;
        UNICODE_STRING                  UsNtImagePath               = { 0 },
                                    UsCommandLine               = { 0 },
                                    UsCurrentDirectory          = { 0 };
        PRTL_USER_PROCESS_PARAMETERS    UppProcessParameters        = NULL;
        // the mitigation policy flag (attribute value)
        DWORD64                         dwBlockDllPolicy            =
PROCESS_CREATION_MITIGATION_POLICY_BLOCK_NON_MICROSOFT_BINARIES_ALWAYS_ON;
        // allocating a buffer to hold the value of the attribute lists
        PPS_ATTRIBUTE_LIST              pAttributeList              =
(PPS_ATTRIBUTE_LIST)HeapAlloc(GetProcessHeap(), HEAP_ZERO_MEMORY,
sizeof(PS_ATTRIBUTE_LIST));
        if (!pAttributeList)
                return FALSE;

        // initializing the 'UNICODE_STRING' structures with the inputted paths
        _RtlInitUnicodeString(&UsNtImagePath, szTargetProcess);
        _RtlInitUnicodeString(&UsCommandLine, szTargetProcessParameters);
        _RtlInitUnicodeString(&UsCurrentDirectory, szTargetProcessPath);

        // calling 'RtlCreateProcessParametersEx' to intialize a
'PRTL_USER_PROCESS_PARAMETERS' structure for 'NtCreateUserProcess'
        STATUS = RtlCreateProcessParametersEx(&UppProcessParameters,
&UsNtImagePath, NULL, &UsCurrentDirectory, &UsCommandLine, NULL, NULL, NULL, NULL,
NULL, RTL_USER_PROC_PARAMS_NORMALIZED);
        if (STATUS != STATUS_SUCCESS) {
                printf("[!] RtlCreateProcessParametersEx Failed With Error :
0x%0.8X \n", STATUS);
                goto _EndOfFunc;
        }

        // setting the length of the attribute list
        pAttributeList->TotalLength                     =
sizeof(PS_ATTRIBUTE_LIST);
```

```
        // intializing an attribute list of type 'PS_ATTRIBUTE_IMAGE_NAME' that
specifies the image's path
        pAttributeList->Attributes[0].Attribute         = PS_ATTRIBUTE_IMAGE_NAME;
        pAttributeList->Attributes[0].Size              = UsNtImagePath.Length;
        pAttributeList->Attributes[0].Value             =
(ULONG_PTR)UsNtImagePath.Buffer;

        // intializing an attribute list of type 'PS_ATTRIBUTE_MITIGATION_OPTIONS'
that specifies the use of process's mitigation policies
        pAttributeList->Attributes[1].Attribute         =
PS_ATTRIBUTE_MITIGATION_OPTIONS;
        pAttributeList->Attributes[1].Size              = sizeof(DWORD64);
        pAttributeList->Attributes[1].Value             = &dwBlockDllPolicy;

        // creating the 'PS_CREATE_INFO' structure, that will almost always look
like this
        PS_CREATE_INFO                                  psCreateInfo = {
                                                .Size = sizeof(PS_CREATE_INFO),
                                                .State = PsCreateInitialState
        };



        // creating the process
        // hProcess and hThread are already pointers
        STATUS = NtCreateUserProcess(hProcess, hThread, PROCESS_ALL_ACCESS,
THREAD_ALL_ACCESS, NULL, NULL, NULL, NULL, UppProcessParameters, &psCreateInfo,
pAttributeList);
        if (STATUS != STATUS_SUCCESS) {
                printf("[!] NtCreateUserProcess Failed With Error : 0x%0.8X \n",
STATUS);
                goto _EndOfFunc;
        }



_EndOfFunc:
        HeapFree(GetProcessHeap(), 0, pAttributeList);
        if (*hProcess == NULL || *hThread == NULL)
                return FALSE;
        else
                return TRUE;
}
```

Results

Invoking `NtCreateUserProcessForBlockDllPolicy` will result in the output below.



C:\Users\User\Desktop\Advanced\NtCreateUserProcess\x64\Debug\NtCreateUserProcess.exe

```
[+] Target Process Created With Pid : 13220
[+] Process's Main Thread Created With Tid : 400
[#] Press <Enter> To Quit ...
```

RuntimeBroker.exe (13220) Properties

File

Runtime Broker
(Verified) Microsoft Windows
Version: 10.0.22000.1
Image file name: C:\Windows\System32\RuntimeBroker.exe

Process

Command line: C:\Windows\System32\RuntimeBroker.exe -Embedding
Current directory: C:\Windows\System32\
Started: 8 seconds ago (10:34:03 AM 2/18/2023)
PEB address: 0x7739ca5000
Parent: NtCreateUserProcess.exe (19412)
Mitigation policies: DEP (permanent); ASLR (high entropy, force relocate); Strict handle checks; Extension points disabled; CF Guard; Signatures restricted (Microsoft only)
Protection: None

Mitigation Policies

Policy
ASLR (high entropy, force relocate)
CF Guard
DEP (permanent)
Extension points disabled
Signatures restricted (Microsoft only)
Strict handle checks

Description:
Image signature restrictions are enabled for this process.
Only Microsoft signatures are allowed.
This is an opt-in restriction.

Name	PID
RuntimeBroker.exe	13220

CPU Usage: 1.72% Physical memory: 7.25 GB (46.15%) Processes: 227

Process Hacker
Hacker View Tools Users Help
Refresh Options Find handles or DLLs System information
Processes Services Network Disk
CPU I/O total rate
General Statistics Performance Threads Token Modules Memory Environment Handles GPU Comment
OK

PPID Spoofing And Block DLL Policy

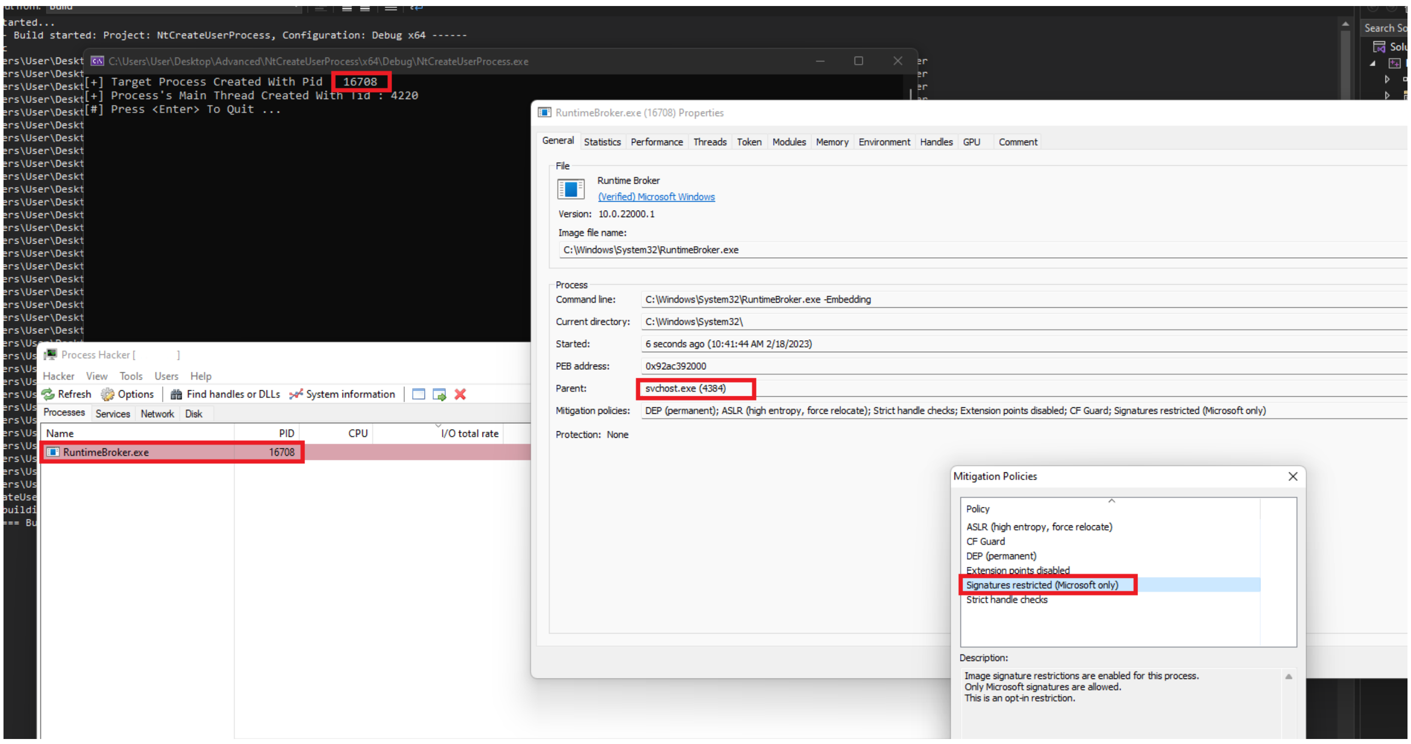
Finally, this section merges the two previous implementations into a single one by modifying the `PS_ATTRIBUTE_LIST` structure to accommodate an extra attribute and subsequently invoking the `NtCreateUserProcessForBoth` function as shown below. The `PS_ATTRIBUTE_LIST` structure will require three attributes.

```
BOOL NtCreateUserProcessForBoth(
        IN      PWSTR   szTargetProcess,
        IN      PWSTR   szTargetProcessParameters,
        IN      PWSTR   szTargetProcessPath,
        IN      HANDLE  hParentProcess,
        OUT     PHANDLE hProcess,
        OUT     PHANDLE hThread
) {

        // getting the address of 'RtlCreateProcessParametersEx' and
'NtCreateUserProcess' from ntdll.dll
        fnRtlCreateProcessParametersEx  RtlCreateProcessParametersEx    =
(fnRtlCreateProcessParametersEx)GetProcAddress(GetModuleHandle(L"NTDLL"),
"RtlCreateProcessParametersEx");
        fnNtCreateUserProcess           NtCreateUserProcess             =
(fnNtCreateUserProcess)GetProcAddress(GetModuleHandle(L"NTDLL"),
"NtCreateUserProcess");

        if (NtCreateUserProcess == NULL || RtlCreateProcessParametersEx == NULL)
```

```
                return FALSE;

        NTSTATUS                        STATUS                      = NULL;
        UNICODE_STRING                  UsNtImagePath               = { 0 },
                                    UsCommandLine               = { 0 },
                                    UsCurrentDirectory          = { 0 };
        PRTL_USER_PROCESS_PARAMETERS    UppProcessParameters        = NULL;
        // the mitigation policy flag (attribute value)
        DWORD64                         dwBlockDllPolicy            =
PROCESS_CREATION_MITIGATION_POLICY_BLOCK_NON_MICROSOFT_BINARIES_ALWAYS_ON;
        // allocating a buffer to hold the value of the attribute lists
        PPS_ATTRIBUTE_LIST              pAttributeList              =
(PPS_ATTRIBUTE_LIST)HeapAlloc(GetProcessHeap(), HEAP_ZERO_MEMORY,
sizeof(PS_ATTRIBUTE_LIST));
        if (!pAttributeList)
                return FALSE;

        // initializing the 'UNICODE_STRING' structures with the inputted paths
        _RtlInitUnicodeString(&UsNtImagePath, szTargetProcess);
        _RtlInitUnicodeString(&UsCommandLine, szTargetProcessParameters);
        _RtlInitUnicodeString(&UsCurrentDirectory, szTargetProcessPath);

        // calling 'RtlCreateProcessParametersEx' to intialize a
'PRTL_USER_PROCESS_PARAMETERS' structure for 'NtCreateUserProcess'
        STATUS = RtlCreateProcessParametersEx(&UppProcessParameters,
&UsNtImagePath, NULL, &UsCurrentDirectory, &UsCommandLine, NULL, NULL, NULL, NULL,
NULL, RTL_USER_PROC_PARAMS_NORMALIZED);
        if (STATUS != STATUS_SUCCESS) {
                printf("[!] RtlCreateProcessParametersEx Failed With Error :
0x%0.8X \n", STATUS);
                goto _EndOfFunc;
        }



        // setting the length of the attribute list
        pAttributeList->TotalLength                     =
sizeof(PS_ATTRIBUTE_LIST);

        // intializing an attribute list of type 'PS_ATTRIBUTE_IMAGE_NAME' that
specifies the image's path
        pAttributeList->Attributes[0].Attribute         = PS_ATTRIBUTE_IMAGE_NAME;
        pAttributeList->Attributes[0].Size              = UsNtImagePath.Length;
        pAttributeList->Attributes[0].Value             =
(ULONG_PTR)UsNtImagePath.Buffer;

        // intializing an attribute list of type 'PS_ATTRIBUTE_MITIGATION_OPTIONS'
that specifies the use of process's mitigation policies
        pAttributeList->Attributes[1].Attribute         =
PS_ATTRIBUTE_MITIGATION_OPTIONS;
        pAttributeList->Attributes[1].Size              = sizeof(DWORD64);
        pAttributeList->Attributes[1].Value             = &dwBlockDllPolicy;

        // intializing an attribute list of type 'PS_ATTRIBUTE_PARENT_PROCESS'
that specifies the process's parent
        pAttributeList->Attributes[2].Attribute         =
PS_ATTRIBUTE_PARENT_PROCESS;
        pAttributeList->Attributes[2].Size              = sizeof(HANDLE);
        pAttributeList->Attributes[2].Value             = hParentProcess;

        // creating the 'PS_CREATE_INFO' structure, that will almost always look
like this
        PS_CREATE_INFO                          psCreateInfo    = {
                                        .Size = sizeof(PS_CREATE_INFO),
                                        .State = PsCreateInitialState
        };

        // creating the process
        // hProcess and hThread are already pointers
        STATUS = NtCreateUserProcess(hProcess, hThread, PROCESS_ALL_ACCESS,
THREAD_ALL_ACCESS, NULL, NULL, NULL, NULL, UppProcessParameters, &psCreateInfo,
pAttributeList);
        if (STATUS != STATUS_SUCCESS) {
                printf("[!] NtCreateUserProcess Failed With Error : 0x%0.8X \n",
STATUS);
                goto _EndOfFunc;
        }


_EndOfFunc:
        HeapFree(GetProcessHeap(), 0, pAttributeList);
        if (*hProcess == NULL || *hThread == NULL)
                return FALSE;
        else
                return TRUE;
}
```

Results

Executing `NtCreateUserProcessForBoth` with the right parameter will result in the following



```
- Build started: Project: NtCreateUserProcess, Configuration: Debug x64 ------
```

C:\Users\User\Desktop\Advanced\NtCreateUserProcess\x64\Debug\NtCreateUserProcess.exe

```
[+] Target Process Created With Pid  16708
[+] Process's Main Thread Created With Tid : 4220
[#] Press <Enter> To Quit ...
```

Name	PID
RuntimeBroker.exe	16708

RuntimeBroker.exe (16708) Properties

File
Runtime Broker
(Verified) Microsoft Windows
Version: 10.0.22000.1
Image file name: C:\Windows\System32\RuntimeBroker.exe

Process

Command line:	C:\Windows\System32\RuntimeBroker.exe -Embedding
Current directory:	C:\Windows\System32\
Started:	6 seconds ago (10:41:44 AM 2/18/2023)
PEB address:	0x92ac392000
Parent:	svchost.exe (4384)
Mitigation policies:	DEP (permanent); ASLR (high entropy, force relocate); Strict handle checks; Extension points disabled; CF Guard; Signatures restricted (Microsoft only)
Protection:	None

Mitigation Policies

Policy
ASLR (high entropy, force relocate)
CF Guard
DEP (permanent)
Extension points disabled
Signatures restricted (Microsoft only)
Strict handle checks

Description:
Image signature restrictions are enabled for this process.
Only Microsoft signatures are allowed.
This is an opt-in restriction.

Process Hacker
Hacker View Tools Users Help
Refresh Options Find handles or DLLs System information
Processes Services Network Disk
CPU I/O total rate
General Statistics Performance Threads Token Modules Memory Environment Handles GPU Comment

Improving The Implementation

The `NtCreateUserProcess` function was retrieved using `GetProcAddress` and `GetModuleHandle` for the sake of simplicity. However, in a real-world scenario, it is recommended to use direct or indirect syscalls in case `NtCreateUserProcess` is hooked.