在笔者上一篇文章`《驱动开发：内核特征码搜索函数封装》`中为了定位特征的方便我们封装实现了一个可以传入数组实现的`SearchSpecialCode`定位函数，该定位函数其实还不能算的上简单，本章`LyShark`将对特征码定位进行简化，让定位变得更简单，并运用定位代码实现扫描内核PE的`.text`代码段，并从代码段中得到某个特征所在内存位置。

老样子为了后续教程能够继续，先来定义一个`lyshark.h`头文件，该头文件中包含了我们本篇文章所必须要使用到的结构体定义，这些定义的函数如果不懂请去看`LyShark`以前的文章，这里就不罗嗦了。

```
#include <ntifs.h>
#include <ntimage.h>

typedef struct _KLDR_DATA_TABLE_ENTRY
{
    LIST_ENTRY64 InLoadOrderLinks;
    ULONG64 __Undefined1;
    ULONG64 __Undefined2;
    ULONG64 __Undefined3;
    ULONG64 NonPagedDebugInfo;
    ULONG64 DllBase;
    ULONG64 EntryPoint;
    ULONG SizeOfImage;
    UNICODE_STRING FullDllName;
    UNICODE_STRING BaseDllName;
    ULONG   Flags;
    USHORT  LoadCount;
    USHORT  __Undefined5;
    ULONG64 __Undefined6;
    ULONG   CheckSum;
    ULONG   __padding1;
    ULONG   TimeDateStamp;
    ULONG   __padding2;
}KLDR_DATA_TABLE_ENTRY, *PKLDR_DATA_TABLE_ENTRY;

typedef struct _RTL_PROCESS_MODULE_INFORMATION
{
    HANDLE Section;
    PVOID MappedBase;
    PVOID ImageBase;
    ULONG ImageSize;
    ULONG Flags;
    USHORT LoadOrderIndex;
    USHORT InitOrderIndex;
    USHORT LoadCount;
    USHORT OffsetToFileName;
    UCHAR  FullPathName[256];
} RTL_PROCESS_MODULE_INFORMATION, *PRTL_PROCESS_MODULE_INFORMATION;

typedef struct _RTL_PROCESS_MODULES
{
    ULONG NumberOfModules;
    RTL_PROCESS_MODULE_INFORMATION Modules[1];
} RTL_PROCESS_MODULES, *PRTL_PROCESS_MODULES;

typedef enum _SYSTEM_INFORMATION_CLASS
{
    SystemBasicInformation = 0x0,
    SystemProcessorInformation = 0x1,
    SystemPerformanceInformation = 0x2,
    SystemTimeOfDayInformation = 0x3,
    SystemPathInformation = 0x4,
    SystemProcessInformation = 0x5,
    SystemCallCountInformation = 0x6,
    SystemDeviceInformation = 0x7,
    SystemProcessorPerformanceInformation = 0x8,
    SystemFlagsInformation = 0x9,
    SystemCallTimeInformation = 0xa,
    SystemModuleInformation = 0xb,
    SystemLocksInformation = 0xc,
    SystemStackTraceInformation = 0xd,
    SystemPagedPoolInformation = 0xe,
    SystemNonPagedPoolInformation = 0xf,
    SystemHandleInformation = 0x10,
    SystemObjectInformation = 0x11,
    SystemPageFileInformation = 0x12,
    SystemVdmInstemulInformation = 0x13,
    SystemVdmBopInformation = 0x14,
    SystemFileCacheInformation = 0x15,
    SystemPoolTagInformation = 0x16,
    SystemInterruptInformation = 0x17,
    SystemDpcBehaviorInformation = 0x18,
    SystemFullMemoryInformation = 0x19,
    SystemLoadGdiDriverInformation = 0x1a,
    SystemUnloadGdiDriverInformation = 0x1b,
    SystemTimeAdjustmentInformation = 0x1c,
    SystemSummaryMemoryInformation = 0x1d,
    SystemMirrorMemoryInformation = 0x1e,
    SystemPerformanceTraceInformation = 0x1f,
    SystemObsolete0 = 0x20,
    SystemExceptionInformation = 0x21,
    SystemCrashDumpStateInformation = 0x22,
    SystemKernelDebuggerInformation = 0x23,
    SystemContextSwitchInformation = 0x24,
    SystemRegistryQuotaInformation = 0x25,
    SystemExtendServiceTableInformation = 0x26,
    SystemPrioritySeperation = 0x27,
    SystemVerifierAddDriverInformation = 0x28,
    SystemVerifierRemoveDriverInformation = 0x29,
    SystemProcessorIdleInformation = 0x2a,
    SystemLegacyDriverInformation = 0x2b,
    SystemCurrentTimeZoneInformation = 0x2c,
    SystemLookasideInformation = 0x2d,
    SystemTimeSlipNotification = 0x2e,
    SystemSessionCreate = 0x2f,
    SystemSessionDetach = 0x30,
    SystemSessionInformation = 0x31,
    SystemRangeStartInformation = 0x32,
    SystemVerifierInformation = 0x33,
    SystemVerifierThunkExtend = 0x34,
    SystemSessionProcessInformation = 0x35,
    SystemLoadGdiDriverInSystemSpace = 0x36,
    SystemNumaProcessorMap = 0x37,
    SystemPrefetcherInformation = 0x38,
    SystemExtendedProcessInformation = 0x39,
    SystemRecommendedSharedDataAlignment = 0x3a,
    SystemComPlusPackage = 0x3b,
    SystemNumaAvailableMemory = 0x3c,
    SystemProcessorPowerInformation = 0x3d,
    SystemEmulationBasicInformation = 0x3e,
    SystemEmulationProcessorInformation = 0x3f,
    SystemExtendedHandleInformation = 0x40,
    SystemLostDelayedWriteInformation = 0x41,
    SystemBigPoolInformation = 0x42,
    SystemSessionPoolTagInformation = 0x43,
    SystemSessionMappedViewInformation = 0x44,
    SystemHotpatchInformation = 0x45,
    SystemObjectSecurityMode = 0x46,
    SystemWatchdogTimerHandler = 0x47,
    SystemWatchdogTimerInformation = 0x48,
    SystemLogicalProcessorInformation = 0x49,
    SystemWow64SharedInformationObsolete = 0x4a,
    SystemRegisterFirmwareTableInformationHandler = 0x4b,
    SystemFirmwareTableInformation = 0x4c,
    SystemModuleInformationEx = 0x4d,
    SystemVerifierTriageInformation = 0x4e,
    SystemSuperfetchInformation = 0x4f,
    SystemMemoryListInformation = 0x50,
    SystemFileCacheInformationEx = 0x51,
    SystemThreadPriorityClientIdInformation = 0x52,
    SystemProcessorIdleCycleTimeInformation = 0x53,
    SystemVerifierCancellationInformation = 0x54,
    SystemProcessorPowerInformationEx = 0x55,
    SystemRefTraceInformation = 0x56,
    SystemSpecialPoolInformation = 0x57,
    SystemProcessIdInformation = 0x58,
    SystemErrorPortInformation = 0x59,
    SystemBootEnvironmentInformation = 0x5a,
    SystemHypervisorInformation = 0x5b,
    SystemVerifierInformationEx = 0x5c,
    SystemTimeZoneInformation = 0x5d,
    SystemImageFileExecutionOptionsInformation = 0x5e,
    SystemCoverageInformation = 0x5f,
    SystemPrefetchPatchInformation = 0x60,
    SystemVerifierFaultsInformation = 0x61,
    SystemSystemPartitionInformation = 0x62,
    SystemSystemDiskInformation = 0x63,
    SystemProcessorPerformanceDistribution = 0x64,
    SystemNumaProximityNodeInformation = 0x65,
    SystemDynamicTimeZoneInformation = 0x66,
    SystemCodeIntegrityInformation = 0x67,
    SystemProcessorMicrocodeUpdateInformation = 0x68,
    SystemProcessorBrandString = 0x69,
    SystemVirtualAddressInformation = 0x6a,
    SystemLogicalProcessorAndGroupInformation = 0x6b,
    SystemProcessorCycleTimeInformation = 0x6c,
    SystemStoreInformation = 0x6d,
    SystemRegistryAppendString = 0x6e,
    SystemAitSamplingValue = 0x6f,
    SystemVhdBootInformation = 0x70,
    SystemCpuQuotaInformation = 0x71,
    SystemNativeBasicInformation = 0x72,
    SystemErrorPortTimeouts = 0x73,
    SystemLowPriorityIoInformation = 0x74,
    SystemBootEntropyInformation = 0x75,
    SystemVerifierCountersInformation = 0x76,
    SystemPagedPoolInformationEx = 0x77,
    SystemSystemPtesInformationEx = 0x78,
    SystemNodeDistanceInformation = 0x79,
    SystemAcpiAuditInformation = 0x7a,
    SystemBasicPerformanceInformation = 0x7b,
    SystemQueryPerformanceCounterInformation = 0x7c,
    SystemSessionBigPoolInformation = 0x7d,
    SystemBootGraphicsInformation = 0x7e,
    SystemScrubPhysicalMemoryInformation = 0x7f,
    SystemBadPageInformation = 0x80,
    SystemProcessorProfileControlArea = 0x81,
    SystemCombinePhysicalMemoryInformation = 0x82,
    SystemEntropyInterruptTimingInformation = 0x83,
    SystemConsoleInformation = 0x84,
    SystemPlatformBinaryInformation = 0x85,
    SystemThrottleNotificationInformation = 0x86,
    SystemHypervisorProcessorCountInformation = 0x87,
    SystemDeviceDataInformation = 0x88,
    SystemDeviceDataEnumerationInformation = 0x89,
    SystemMemoryTopologyInformation = 0x8a,
    SystemMemoryChannelInformation = 0x8b,
    SystemBootLogoInformation = 0x8c,
    SystemProcessorPerformanceInformationEx = 0x8d,
    SystemSpare0 = 0x8e,
    SystemSecureBootPolicyInformation = 0x8f,
    SystemPageFileInformationEx = 0x90,
    SystemSecureBootInformation = 0x91,
    SystemEntropyInterruptTimingRawInformation = 0x92,
    SystemPortableWorkspaceEfiLauncherInformation = 0x93,
    SystemFullProcessInformation = 0x94,
    SystemKernelDebuggerInformationEx = 0x95,
    SystemBootMetadataInformation = 0x96,
    SystemSoftRebootInformation = 0x97,
    SystemElamCertificateInformation = 0x98,
    SystemOfflineDumpConfigInformation = 0x99,
    SystemProcessorFeaturesInformation = 0x9a,
    SystemRegistryReconciliationInformation = 0x9b,
    MaxSystemInfoClass = 0x9c,
} SYSTEM_INFORMATION_CLASS;

// 声明函数
// By: Lyshark.com
NTSYSAPI PIMAGE_NT_HEADERS NTAPI RtlImageNtHeader(_In_ PVOID Base);
NTSTATUS NTAPI ZwQuerySystemInformation(SYSTEM_INFORMATION_CLASS
SystemInformationClass, PVOID SystemInformation, ULONG SystemInformationLength,
PULONG ReturnLength);

typedef VOID(__cdecl *PMiProcessLoaderEntry)(PKLDR_DATA_TABLE_ENTRY section, IN
LOGICAL Insert);
```

```
typedef NTSTATUS(*NTQUERYSYSTEMINFORMATION)(IN ULONG SystemInformationClass, OUT
PVOID SystemInformation, IN ULONG_PTR SystemInformationLength, OUT PULONG_PTR
ReturnLength OPTIONAL);
```

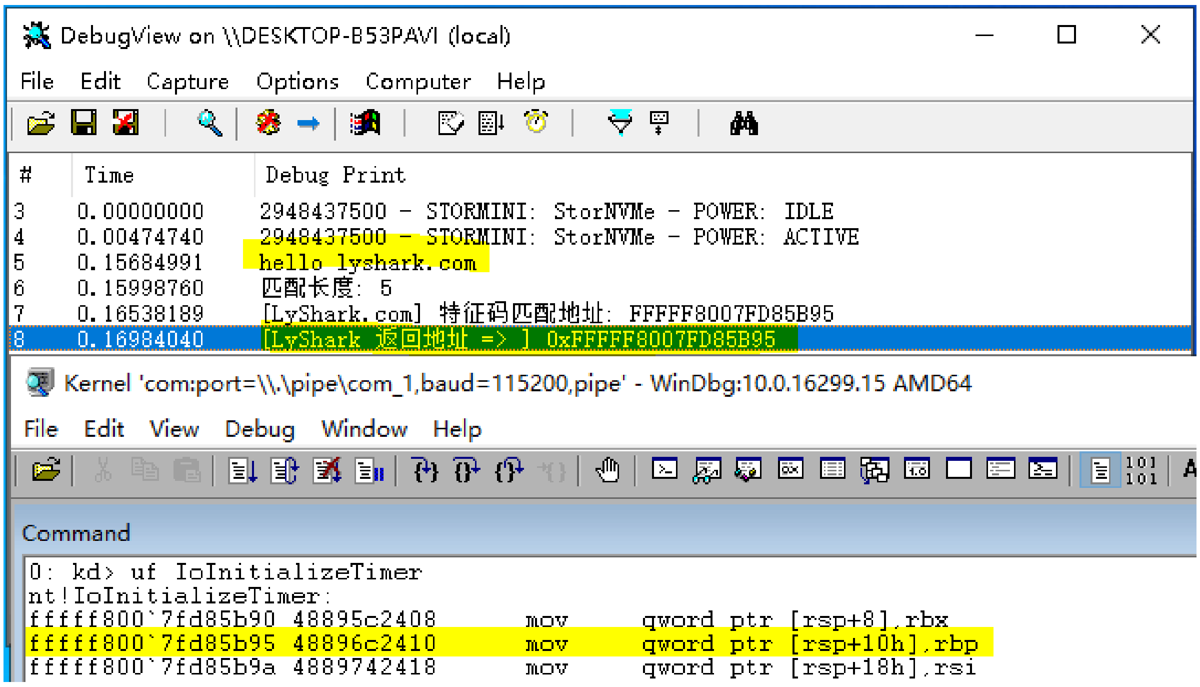
我们继续，首先实现特征码字符串的解析与扫描实现此处`UtilLySharkSearchPattern`函数就是`LyShark`封装过的，这里依次介绍一下参数传递的含义。

- pattern 用于传入一段字符串特征值`(以\x开头)`
- len 代表输入特征码长度`(除去\x后的长度)`
- base 代表扫描内存的基地址
- size 代表需要向下扫描的长度
- ppFound 代表扫描到首地址以后返回的内存地址

这段代码该如何使用，如下我们以定位`IoInitializeTimer`为例，演示`UtilLySharkSearchPattern`如何定位特征的，如下代码`pattern`变量中就是我们需要定位的特征值，`pattern_size`则是需要定位的特征码长度，在`address`地址位置向下扫描`128`字节，找到则返回到`find_address`变量内。

```
// 署名权
// right to sign one's name on a piece of work
// PowerBy: LyShark
// Email: me@lyshark.com
#include "lyshark.h"

PVOID GetIoInitializeTimerAddress()
{
    PVOID VariableAddress = 0;
    UNICODE_STRING uioiTime = { 0 };

    RtlInitUnicodeString(&uioiTime, L"IoInitializeTimer");
    VariableAddress = (PVOID)MmGetSystemRoutineAddress(&uioiTime);
    if (VariableAddress != 0)
    {
        return VariableAddress;
    }
    return 0;
}

// 对指定内存执行特征码扫描
NTSTATUS UtilLySharkSearchPattern(IN PUCHAR pattern, IN ULONG_PTR len, IN const
VOID* base, IN ULONG_PTR size, OUT PVOID* ppFound)
{
    // 计算匹配长度
    // LyShark.com 特征码扫描
    NT_ASSERT(ppFound != 0 && pattern != 0 && base != 0);
    if (ppFound == 0 || pattern == 0 || base == 0)
    {
        return STATUS_INVALID_PARAMETER;
    }

    __try
    {
        for (ULONG_PTR i = 0; i < size - len; i++)
        {
            BOOLEAN found = TRUE;
            for (ULONG_PTR j = 0; j < len; j++)
            {
                if (pattern[j] != ((PUCHAR)base)[i + j])
                {
                    found = FALSE;
                    break;
                }
            }

            if (found != FALSE)
            {
                *ppFound = (PUCHAR)base + i;
                DbgPrint("[LyShark.com] 特征码匹配地址: %p \n", (PUCHAR)base + i);
                return STATUS_SUCCESS;
            }
        }
    }
    __except (EXCEPTION_EXECUTE_HANDLER)
    {
        return STATUS_UNHANDLED_EXCEPTION;
    }

    return STATUS_NOT_FOUND;
}

VOID UnDriver(PDRIVER_OBJECT driver)
{
    DbgPrint(("Uninstall Driver Is OK \n"));
}

NTSTATUS DriverEntry(IN PDRIVER_OBJECT Driver, PUNICODE_STRING RegistryPath)
{
    DbgPrint(("hello lyshark.com \n"));

    // 返回匹配长度5
    CHAR pattern[] = "\x48\x89\x6c\x24\x10";
    PVOID *find_address = NULL;

    int pattern_size = sizeof(pattern) - 1;
    DbgPrint("匹配长度: %d \n", pattern_size);

    // 得到基地址
    PVOID address = GetIoInitializeTimerAddress();

    // 扫描特征
    NTSTATUS nt = UtilLySharkSearchPattern((PUCHAR)pattern, pattern_size,
address, 128, &find_address);

    DbgPrint("[LyShark 返回地址 => ] 0x%p \n", (ULONG64)find_address);

    Driver->DriverUnload = UnDriver;
    return STATUS_SUCCESS;
}
```

运行驱动程序完成特征定位，并对比定位效果。


DebugView on \\DESKTOP-B53PAVI (local)
File Edit Capture Options Computer Help

```
#   Time        Debug Print
3   0.00000000  2948437500 - STORMINI: StorNVMe - POWER: IDLE
4   0.00474740  2948437500 - STORMINI: StorNVMe - POWER: ACTIVE
5   0.15684991  hello lyshark.com
6   0.15998760  匹配长度: 5
7   0.16538189  [LyShark.com] 特征码匹配地址: FFFFF8007FD85B95
8   0.16984040  [LyShark 返回地址 => ] 0xFFFFF8007FD85B95
```

Kernel 'com:port=\\.\pipe\com_1,baud=115200,pipe' - WinDbg:10.0.16299.15 AMD64
File Edit View Debug Window Help
Command

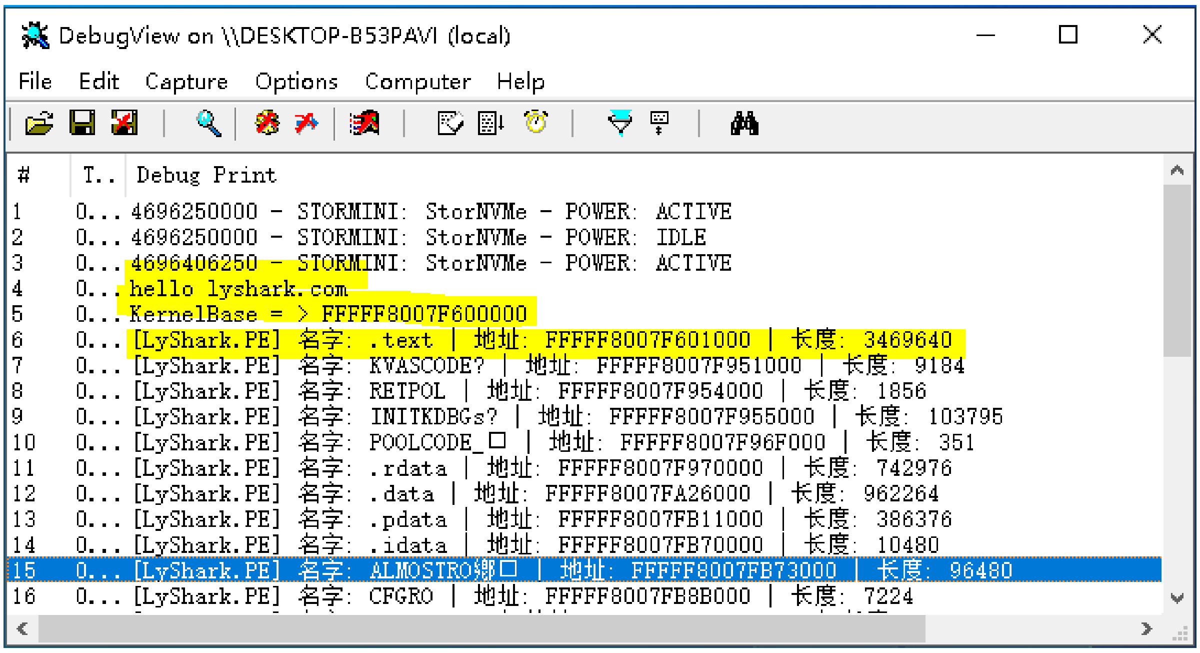
```
0: kd> uf IoInitializeTimer
nt!IoInitializeTimer:
fffff800`7fd85b90 48895c2408      mov     qword ptr [rsp+8],rbx
fffff800`7fd85b95 48896c2410      mov     qword ptr [rsp+10h],rbp
fffff800`7fd85b9a 4889742418      mov     qword ptr [rsp+18h],rsi
```

如上述所示定位函数我们已经封装好了，相信你也能感受到这种方式要比使用数组更方便，为了能定位到内核PE结构我们需要使用`RtlImageNtHeader`来解析，这个内核函数专门用来得到内核程序的PE头部结构的，在下方案例中首先我们使用封装过的`LySharkToolsUtilKernelBase`函数拿到内核基址，如果你不懂函数实现细节请阅读《驱动开发：内核取ntoskrnl模块基地址》这篇文章，拿到基址以后可以直接使用`RtlImageNtHeader`对其PE头部进行解析，如下所示。

```
// 署名权
// right to sign one's name on a piece of work
// PowerBy: LyShark
// Email: me@lyshark.com
#include "lyshark.h"

// 定义全局变量
static PVOID g_KernelBase = 0;
static ULONG g_KernelSize = 0;

// 得到KernelBase基地址
// lyshark.com
PVOID LySharkToolsUtilKernelBase(OUT PULONG pSize)
{
    NTSTATUS status = STATUS_SUCCESS;
    ULONG bytes = 0;
    PRTL_PROCESS_MODULES pMods = 0;
    PVOID checkPtr = 0;
    UNICODE_STRING routineName;

    if (g_KernelBase != 0)
    {
        if (pSize)
        {
            *pSize = g_KernelSize;
        }
        return g_KernelBase;
    }
    RtlInitUnicodeString(&routineName, L"NtOpenFile");

    checkPtr = MmGetSystemRoutineAddress(&routineName);
    if (checkPtr == 0)
        return 0;

    __try
    {
        status = ZwQuerySystemInformation(SystemModuleInformation, 0, bytes,
&bytes);
        if (bytes == 0)
        {
            return 0;
        }

        pMods = (PRTL_PROCESS_MODULES)ExAllocatePoolWithTag(NonPagedPoolNx,
bytes, L"LyShark");
        RtlZeroMemory(pMods, bytes);

        status = ZwQuerySystemInformation(SystemModuleInformation, pMods, bytes,
&bytes);

        if (NT_SUCCESS(status))
        {
            PRTL_PROCESS_MODULE_INFORMATION pMod = pMods->Modules;

            for (ULONG i = 0; i < pMods->NumberOfModules; i++)
            {
                if (checkPtr >= pMod[i].ImageBase && checkPtr < (PVOID)
((PUCHAR)pMod[i].ImageBase + pMod[i].ImageSize))
                {
                    g_KernelBase = pMod[i].ImageBase;
                    g_KernelSize = pMod[i].ImageSize;
                    if (pSize)
                    {
                        *pSize = g_KernelSize;
                    }
                    break;
                }
            }
        }
    }
    __except (EXCEPTION_EXECUTE_HANDLER)
    {
        return 0;
    }

    if (pMods)
    {
        ExFreePoolWithTag(pMods, L"LyShark");
    }

    DbgPrint("KernelBase = > %p \n", g_KernelBase);
    return g_KernelBase;
}
```

```
VOID UnDriver(PDRIVER_OBJECT driver)
{
    DbgPrint(("Uninstall Driver Is OK \n"));
}

NTSTATUS DriverEntry(IN PDRIVER_OBJECT Driver, PUNICODE_STRING RegistryPath)
{
    DbgPrint(("hello lyshark.com \n"));

    // 获取内核第一个模块的基地址
    PVOID base = LySharkToolsUtilKernelBase(0);
    if (!base)
        return STATUS_NOT_FOUND;

    // 得到NT头部PE32+结构
    // lyshark.com
    PIMAGE_NT_HEADERS64 pHdr = RtlImageNtHeader(base);
    if (!pHdr)
        return STATUS_INVALID_IMAGE_FORMAT;

    // 首先寻找代码段
    PIMAGE_SECTION_HEADER pFirstSection = (PIMAGE_SECTION_HEADER)(pHdr + 1);
    for (PIMAGE_SECTION_HEADER pSection = pFirstSection; pSection < pFirstSection
+ pHdr->FileHeader.NumberOfSections; pSection++)
    {
        ANSI_STRING LySharkSection, LySharkName;
        RtlInitAnsiString(&LySharkSection, ".text");
        RtlInitAnsiString(&LySharkName, (PCCHAR)pSection->Name);

        DbgPrint("[LyShark.PE] 名字: %Z | 地址: %p | 长度: %d \n", LySharkName,
(PUCHAR)base + pSection->VirtualAddress, pSection->Misc.VirtualSize);
    }

    Driver->DriverUnload = UnDriver;
    return STATUS_SUCCESS;
}
```

运行这段驱动程序，你会得到`当前内核`的`所有PE节`信息，枚举效果如下所示。

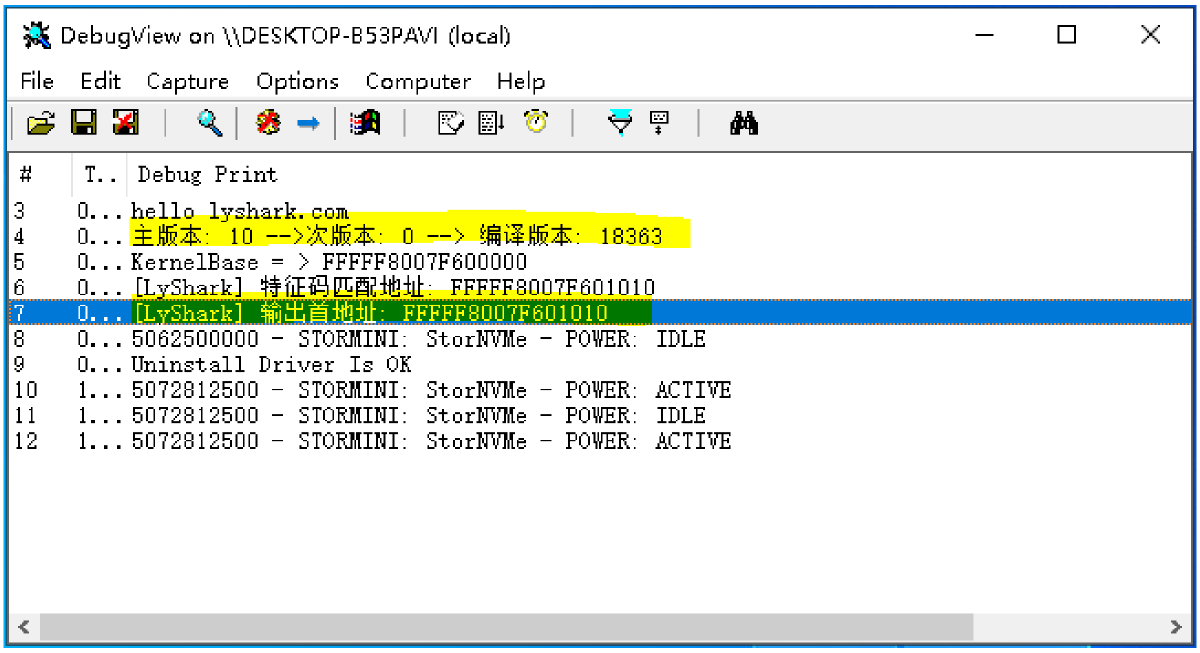

DebugView on \\DESKTOP-B53PAVI (local)
File Edit Capture Options Computer Help

```
#    T..  Debug Print
1    0... 4696250000 - STORMINI: StorNVMe - POWER: ACTIVE
2    0... 4696250000 - STORMINI: StorNVMe - POWER: IDLE
3    0... 4696406250 - STORMINI: StorNVMe - POWER: ACTIVE
4    0... hello lyshark.com
5    0... KernelBase = > FFFFF8007F600000
6    0... [LyShark.PE] 名字: .text | 地址: FFFFF8007F601000 | 长度: 3469640
7    0... [LyShark.PE] 名字: KVASCODE? | 地址: FFFFF8007F951000 | 长度: 9184
8    0... [LyShark.PE] 名字: RETPOL | 地址: FFFFF8007F954000 | 长度: 1856
9    0... [LyShark.PE] 名字: INITKDBGs? | 地址: FFFFF8007F955000 | 长度: 103795
10   0... [LyShark.PE] 名字: POOLCODE_□ | 地址: FFFFF8007F96F000 | 长度: 351
11   0... [LyShark.PE] 名字: .rdata | 地址: FFFFF8007F970000 | 长度: 742976
12   0... [LyShark.PE] 名字: .data | 地址: FFFFF8007FA26000 | 长度: 962264
13   0... [LyShark.PE] 名字: .pdata | 地址: FFFFF8007FB11000 | 长度: 386376
14   0... [LyShark.PE] 名字: .idata | 地址: FFFFF8007FB70000 | 长度: 10480
15   0... [LyShark.PE] 名字: ALMOSTRO鄉□ | 地址: FFFFF8007FB73000 | 长度: 96480
16   0... [LyShark.PE] 名字: CFGRO | 地址: FFFFF8007FB8B000 | 长度: 7224
```

既然能够得到PE头部数据了，那么我们只需要扫描这段空间并得到匹配到的数据即可，其实很容易实现，如下代码所示。

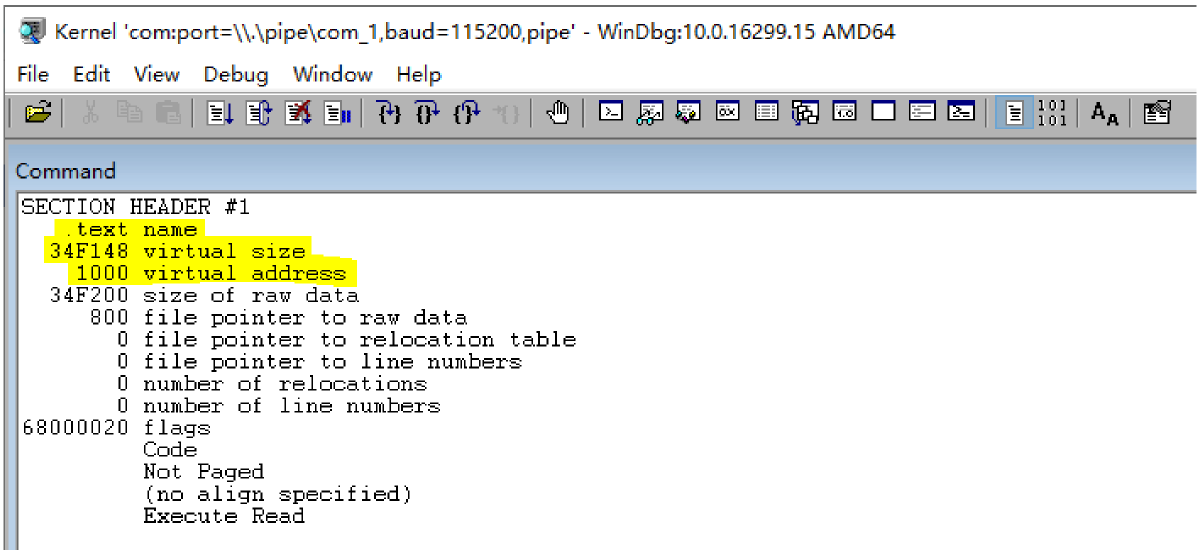
```c
// 署名权
// right to sign one's name on a piece of work
// PowerBy: LyShark
// Email: me@lyshark.com
#include "lyshark.h"

// 定义全局变量
static PVOID g_KernelBase = 0;
static ULONG g_KernelSize = 0;

// 得到KernelBase基地址
// lyshark.com
PVOID LySharkToolsUtilKernelBase(OUT PULONG pSize)
{
    NTSTATUS status = STATUS_SUCCESS;
    ULONG bytes = 0;
    PRTL_PROCESS_MODULES pMods = 0;
    PVOID checkPtr = 0;
    UNICODE_STRING routineName;

    if (g_KernelBase != 0)
    {
        if (pSize)
        {
            *pSize = g_KernelSize;
        }
        return g_KernelBase;
    }

    RtlInitUnicodeString(&routineName, L"NtOpenFile");

    checkPtr = MmGetSystemRoutineAddress(&routineName);
    if (checkPtr == 0)
        return 0;
    __try
    {
        status = ZwQuerySystemInformation(SystemModuleInformation, 0, bytes,
&bytes);
        if (bytes == 0)
        {
            return 0;
        }

        pMods = (PRTL_PROCESS_MODULES)ExAllocatePoolWithTag(NonPagedPoolNx,
bytes, L"LyShark");
        RtlZeroMemory(pMods, bytes);

        status = ZwQuerySystemInformation(SystemModuleInformation, pMods, bytes,
&bytes);

        if (NT_SUCCESS(status))
        {
            PRTL_PROCESS_MODULE_INFORMATION pMod = pMods->Modules;

            for (ULONG i = 0; i < pMods->NumberOfModules; i++)
            {
                if (checkPtr >= pMod[i].ImageBase && checkPtr < (PVOID)
((PUCHAR)pMod[i].ImageBase + pMod[i].ImageSize))
                {
                    g_KernelBase = pMod[i].ImageBase;
                    g_KernelSize = pMod[i].ImageSize;
                    if (pSize)
                    {
                        *pSize = g_KernelSize;
                    }
                    break;
                }
            }
        }
    }
    __except (EXCEPTION_EXECUTE_HANDLER)
    {
        return 0;
    }

    if (pMods)
    {
        ExFreePoolWithTag(pMods, L"LyShark");
    }

    DbgPrint("KernelBase = > %p \n", g_KernelBase);
    return g_KernelBase;
}

// 对指定内存执行特征码扫描
NTSTATUS UtilLySharkSearchPattern(IN PUCHAR pattern, IN UCHAR wildcard, IN
ULONG_PTR len, IN const VOID* base, IN ULONG_PTR size, OUT PVOID* ppFound)
{
    NT_ASSERT(ppFound != 0 && pattern != 0 && base != 0);
    if (ppFound == 0 || pattern == 0 || base == 0)
    {
        return STATUS_INVALID_PARAMETER;
    }

    __try
    {
        for (ULONG_PTR i = 0; i < size - len; i++)
        {
            BOOLEAN found = TRUE;
            for (ULONG_PTR j = 0; j < len; j++)
            {
                if (pattern[j] != wildcard && pattern[j] != ((PUCHAR)base)[i +
j])
                {
                    found = FALSE;
                    break;
                }
            }

            if (found != FALSE)
            {
                *ppFound = (PUCHAR)base + i;
                DbgPrint("[LyShark] 特征码匹配地址: %p \n", (PUCHAR)base + i);
                return STATUS_SUCCESS;
            }
        }
    }
    __except (EXCEPTION_EXECUTE_HANDLER)
    {
        return STATUS_UNHANDLED_EXCEPTION;
    }

    return STATUS_NOT_FOUND;
}

// 扫描代码段中的指令片段
NTSTATUS ByLySharkComUtilScanSection(IN PCCHAR section, IN PUCHAR pattern, IN
UCHAR wildcard, IN ULONG_PTR len, OUT PVOID* ppFound)
{
    NT_ASSERT(ppFound != 0);
    if (ppFound == 0)
        return STATUS_INVALID_PARAMETER;

    // 获取内核第一个模块的基地址
    PVOID base = LySharkToolsUtilKernelBase(0);
    if (!base)
        return STATUS_NOT_FOUND;

    // 得到NT头部PE32+结构
    PIMAGE_NT_HEADERS64 pHdr = RtlImageNtHeader(base);
    if (!pHdr)
        return STATUS_INVALID_IMAGE_FORMAT;

    // 首先寻找代码段
    PIMAGE_SECTION_HEADER pFirstSection = (PIMAGE_SECTION_HEADER)(pHdr + 1);
    for (PIMAGE_SECTION_HEADER pSection = pFirstSection; pSection < pFirstSection
+ pHdr->FileHeader.NumberOfSections; pSection++)
    {
        ANSI_STRING LySharkSection, LySharkText;
        RtlInitAnsiString(&LySharkSection, section);
        RtlInitAnsiString(&LySharkText, (PCCHAR)pSection->Name);

        // 判断是不是我们要找的.text节
        if (RtlCompareString(&LySharkSection, &LySharkText, TRUE) == 0)
        {
            // 如果是则开始匹配特征码
            return UtilLySharkSearchPattern(pattern, wildcard, len, (PUCHAR)base
+ pSection->VirtualAddress, pSection->Misc.VirtualSize, ppFound);
        }
    }

    return STATUS_NOT_FOUND;
}

VOID UnDriver(PDRIVER_OBJECT driver)
{
    DbgPrint(("Uninstall Driver Is OK \n"));
}

NTSTATUS DriverEntry(IN PDRIVER_OBJECT Driver, PUNICODE_STRING RegistryPath)
{
    DbgPrint("hello lyshark.com \n");

    PMiProcessLoaderEntry m_MiProcessLoaderEntry = NULL;
    RTL_OSVERSIONINFOW Version = { 0 };

    Version.dwOSVersionInfoSize = sizeof(Version);
    RtlGetVersion(&Version);

    //获取内核版本号
    DbgPrint("主版本: %d -->次版本: %d --> 编译版本: %d", Version.dwMajorVersion,
Version.dwMinorVersion, Version.dwBuildNumber);

    if (Version.dwMajorVersion == 10)
    {
        // 如果是 win10 18363 则匹配特征
        if (Version.dwBuildNumber == 18363)
        {
            CHAR pattern[] = "\x48\x89\x5c\x24\x08";
            int pattern_size = sizeof(pattern) - 1;

            ByLySharkComUtilScanSection(".text", (PUCHAR)pattern, 0xCC,
pattern_size, (PVOID *)&m_MiProcessLoaderEntry);
            DbgPrint("[LyShark] 输出首地址: %p", m_MiProcessLoaderEntry);
        }
    }

    Driver->DriverUnload = UnDriver;
    return STATUS_SUCCESS;
}
```

代码中首先判断系统主版本`windows 10 18363`如果是则执行匹配，只匹配`.text`也就是代码段中的数据，当遇到`0xcc`时则取消继续，否则继续执行枚举，程序输出效果如下所示。


DebugView on \\DESKTOP-B53PAVI (local)
File Edit Capture Options Computer Help

```
#    T..  Debug Print
3    0... hello lyshark.com
4    0... 主版本: 10 -->次版本: 0 --> 编译版本: 18363
5    0... KernelBase = > FFFFF8007F600000
6    0... [LyShark] 特征码匹配地址: FFFFF8007F601010
7    0... [LyShark] 输出首地址: FFFFF8007F601010
8    0... 5062500000 - STORMINI: StorNVMe - POWER: IDLE
9    0... Uninstall Driver Is OK
10   1... 5072812500 - STORMINI: StorNVMe - POWER: ACTIVE
11   1... 5072812500 - STORMINI: StorNVMe - POWER: IDLE
12   1... 5072812500 - STORMINI: StorNVMe - POWER: ACTIVE
```

在WinDBG中输入命令`!dh 0xfffff8007f600000`解析出内核PE头数据，可以看到如下所示，对比无误。


Kernel 'com:port=\\.\pipe\com_1,baud=115200,pipe' - WinDbg:10.0.16299.15 AMD64
File Edit View Debug Window Help
Command

```
SECTION HEADER #1
   .text name
  34F148 virtual size
    1000 virtual address
  34F200 size of raw data
     800 file pointer to raw data
       0 file pointer to relocation table
       0 file pointer to line numbers
       0 number of relocations
       0 number of line numbers
68000020 flags
         Code
         Not Paged
         (no align specified)
         Execute Read
```