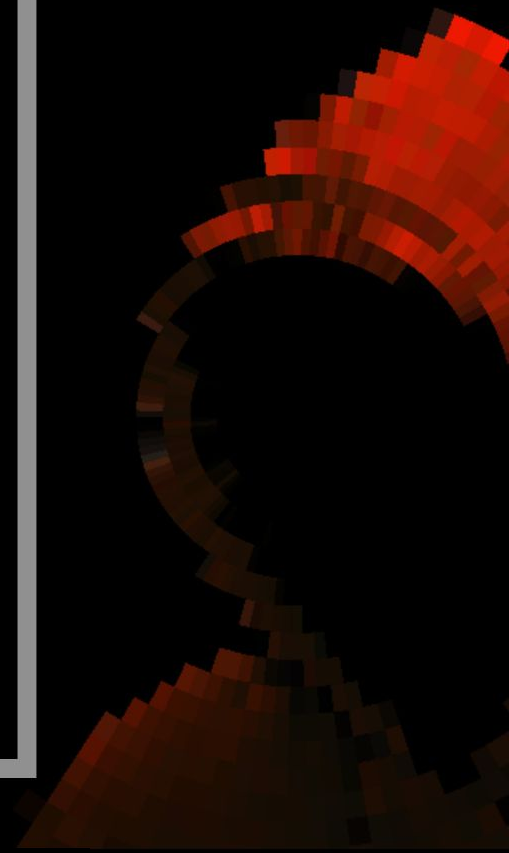
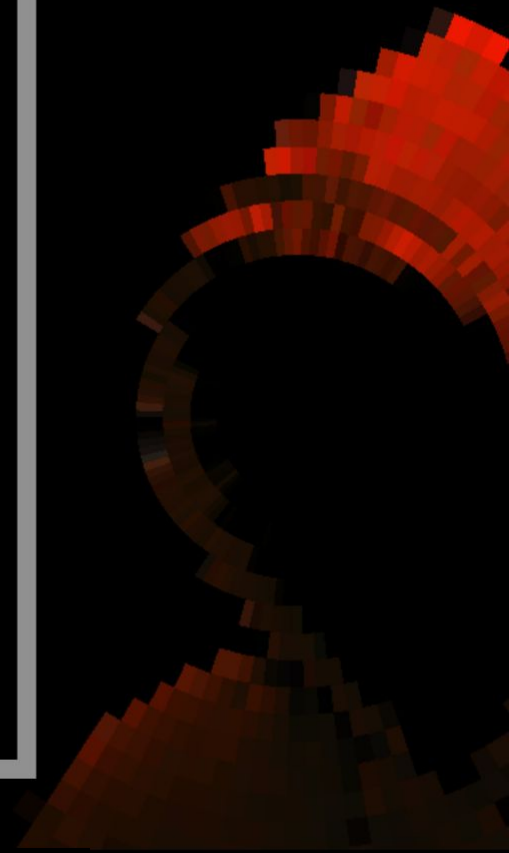
Introduction to Malware Reverse Engineering



Introduction to Malware Reverse Engineering

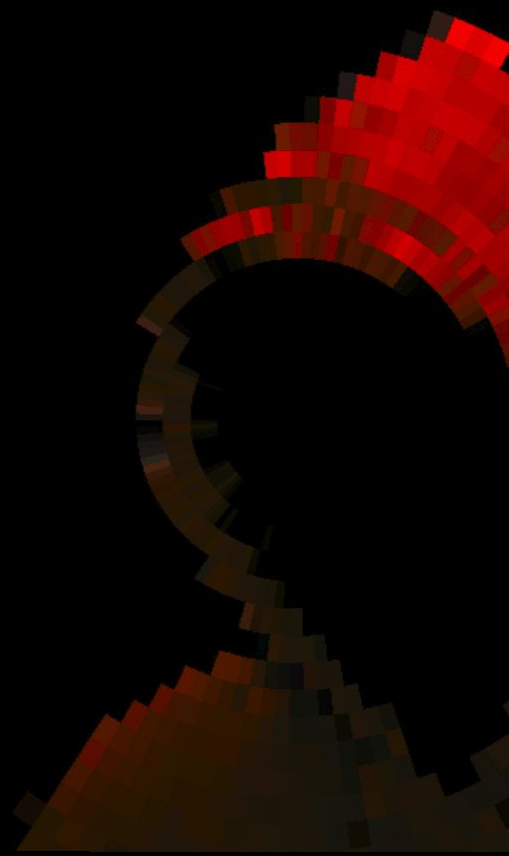
CONTINUE



Contents

CONTINUE

Contents



What is Malware ?

Malware is code that is used to perform malicious actions.

Types of Malwares

Virus

Worm

Trojan

Spyware

Ransomware

Adware

Rootkit

...

Types of Malwares

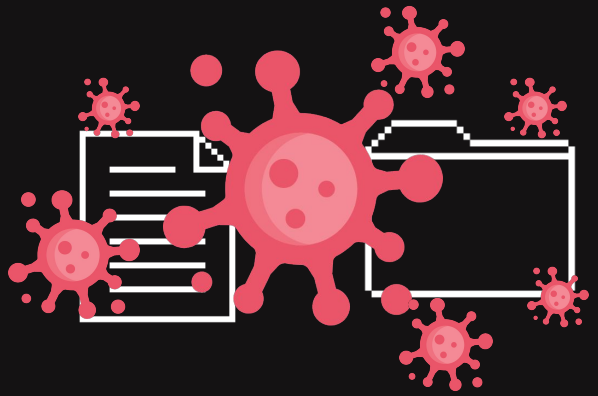
Virus

Types of Malwares

Virus: Replicating ability.

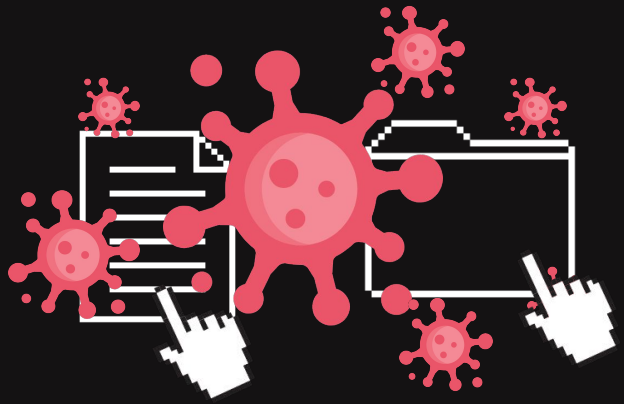
Types of Malwares

Virus - Replicating ability.

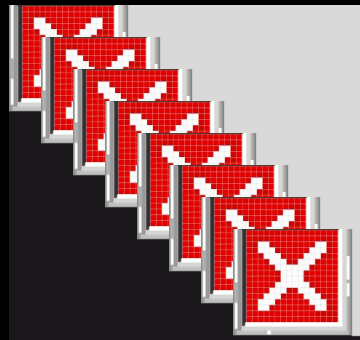


Types of Malwares

Virus - Replicating ability.

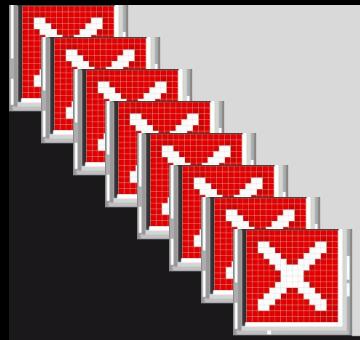


- ❑ Delete
- ❑ Encrypt Files
- ❑ Modify Applications
- ❑ Disable functions



Virus Detected

Your Virus detector has detected dead32.exe virus



Key points:

- Attached to files to corrupt them.
- Multiply
- Requires an existing file to infect
- Needs a person to initiate itself that is, not self propagating

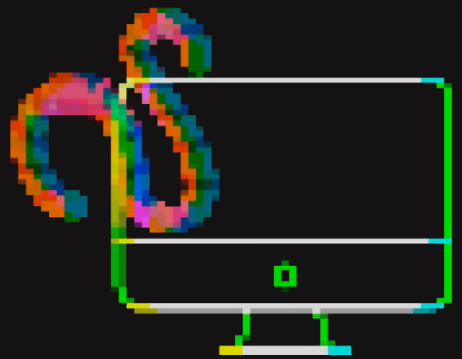
Types of Malwares

Worm

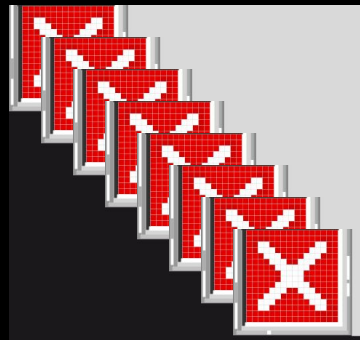
Types of Malwares

Worm: Self-replicate and propagate independently.

Stand-alone malicious programs.



- Enters via the network or downloaded file
- Multiply and spread



Key points:

- Replicate themselves.
- No need for activation.
- Multiple and send it self without user intervention.
- Fast propagation.

Types of Malwares

Trojan

Types of Malwares

Trojan: Type of malicious code or software that looks legitimate but can take control of your computer.

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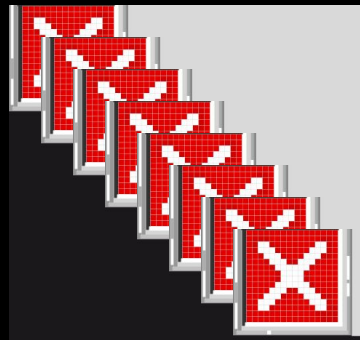


Key points:

- ❑ Pretends to be legitimate.
- ❑ Deceive user and get into system.
- ❑ Cannot replicate.

Types of Malwares

Spyware

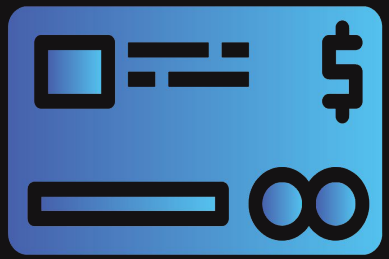
Types of Malwares

Spyware: Software that infiltrates your computing device, stealing your sensitive information.

Types of Malwares

Spyware

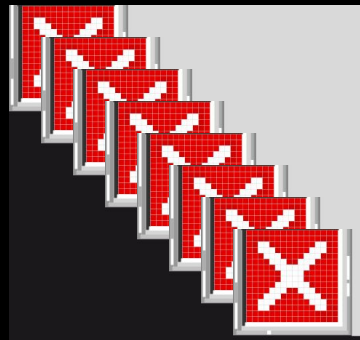
- ❑ Bank account information



Types of Malwares

Spyware

- Steal your personal identity.



Key points:

- ❑ Installed without the user's knowledge
- ❑ Gathers information about the user
- ❑ Thus spys on the user and his activities
- ❑ Keylogging

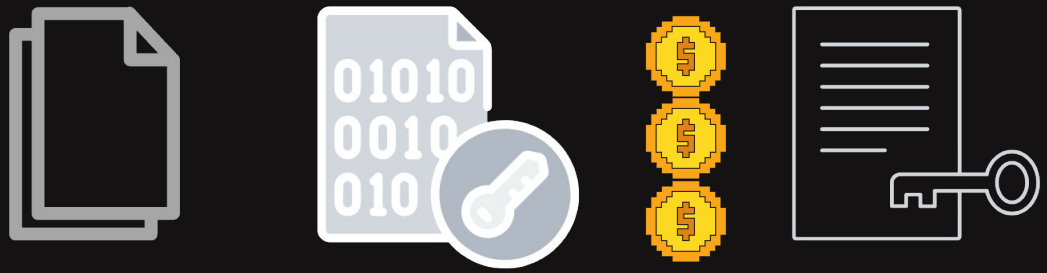
Ransomware

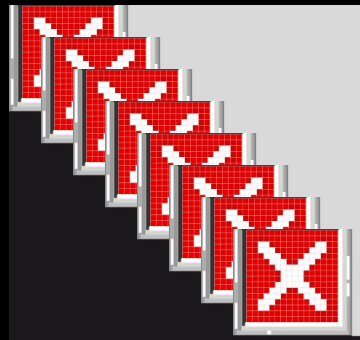
Types of Malwares

Ransomware: A form of malware that encrypts victim's files and data.

Types of Malwares

Ransomware: A form of malware that encrypts victim's files on the system.



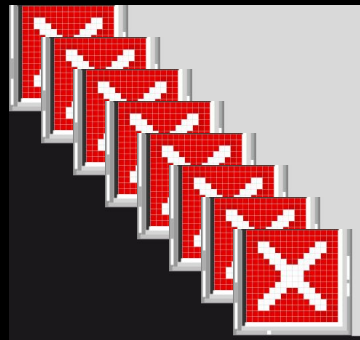


Key points:

- Encrypts your files and in return demands for money for the decryption key.

Types of Malwares

Rootkit: Malicious software that allows an unauthorized user to have privileged access.



Key points:

- Hide themselves within another application and uses operating system file to hide itself such as registry key, running processes etc.
- Hard to find and to clean-out.


Check Examples
RUN

Samples

WANNACRY

ILOVEYOU

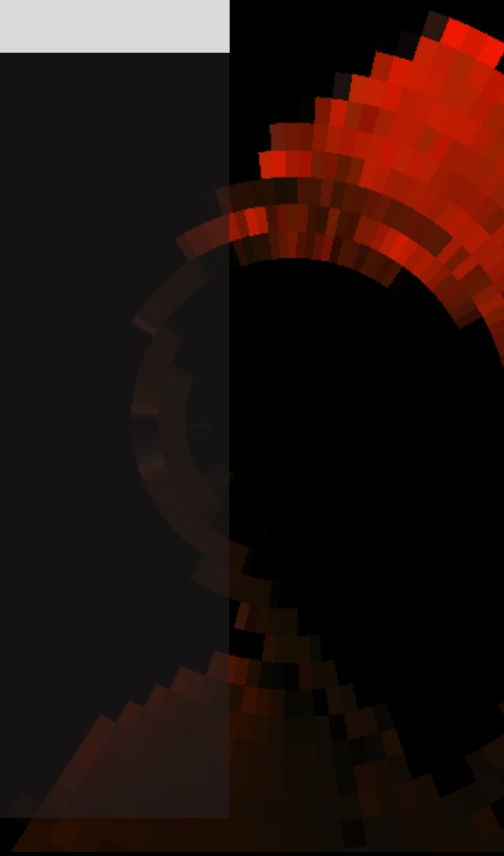
STUXNET

Cryptolocker

Petya

Zeus

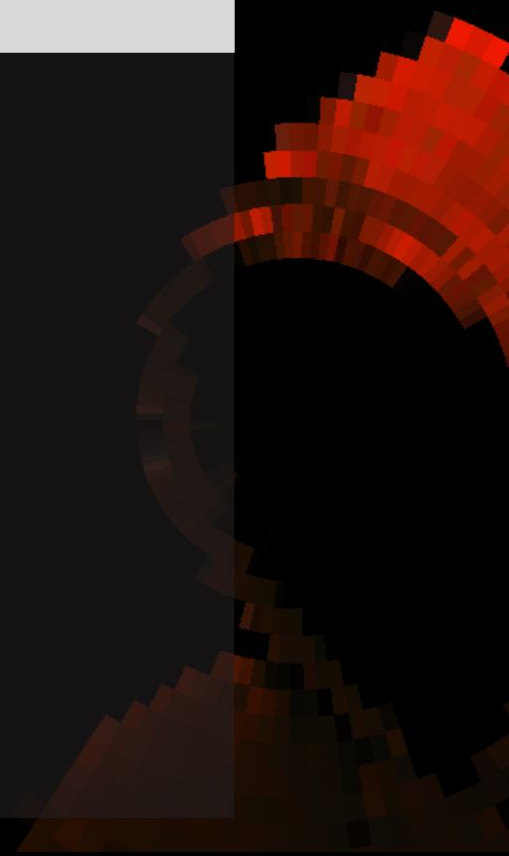
...



Sample - 0

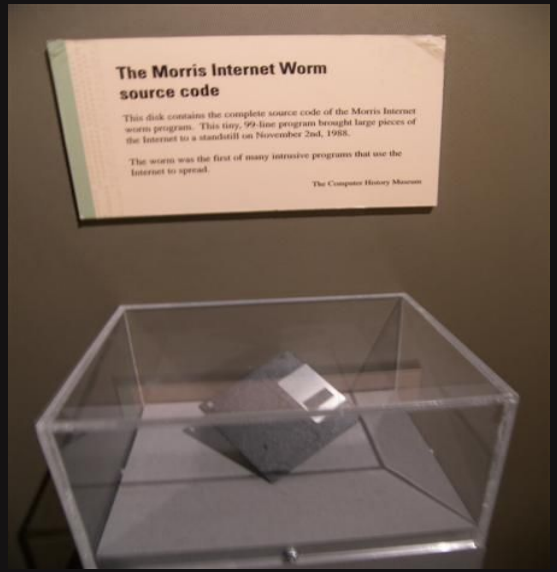
Morris worm

- November 1988
- How big the internet was?
- Worked well
  - Copying
  - Send signals
- First DDos attack



One of the oldest samples:

Morris worm
“99 line program”



https://en.wikipedia.org/wiki/Morris_worm

Sample - 1

ILOVEYOU

Sample - 1

ILOVEYOU

- WORM
- 2000
- 10 MILLION Windows PCs

Sample - 2

Wannacry

Sample - 2

Wannacry

- Ransomware
- May 2017
- 200,000 devices

https://en.wikipedia.org/wiki/WannaCry_ransomware_attack

Sample - 2

Zeus

Sample - 3

Zeus

- Trojan-horse
- July 2007
- By 2009, it compromised many accounts present on the companies:  

https://en.wikipedia.org/wiki/Zeus_(malware)

Sample - 3

Sample - 3

Zeus

- Trojan-horse
- July 2007
- By 2009, it compromised many accounts present on the companies: 
- Also came to be known as zbot.

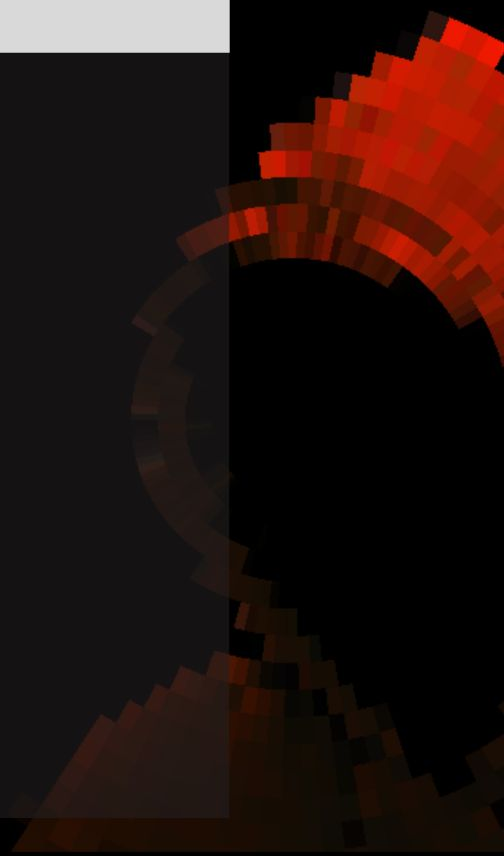
https://en.wikipedia.org/wiki/Zeus_(malware)

Types of Malwares

Zeus:

Creates a botnet.

Hence also known as Zbot.

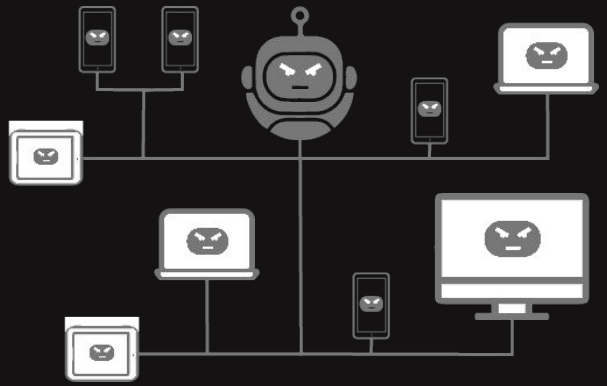


Key point

Botnet

Botnet

Botnet: Networks of computers infected by malware (such as viruses, keyloggers and other malicious software) and controlled remotely by attackers.



Contents

Senario

- Suppose that a system is infected with a malware...

Senario

- ❑ Collect the evidences:
  - ❑ File
  - ❑ Network traffic analysis
  - ❑ Changes in the system
  - ...

Why is reverse engineering necessary ?

- Backtrack from the current information.
  - Reverse the logic.
  - Backtrack from the current information.
  - Search the sources.

Sample - 4

Jigsaw

https://en.wikipedia.org/wiki/Jigsaw_(ransomware)

Sample - 4

Jigsaw

- Ransomware
- 2016
- Written in .NET Framework

https://en.wikipedia.org/wiki/Jigsaw_(ransomware)

Sample - 4

Jigsaw

It can be reverse engineered to remove the encryption without paying the ransom.

https://en.wikipedia.org/wiki/Jigsaw_(ransomware)

Precaution

- ❑ Install Anti-Virus/Malware Software.
- ❑ Keep Your Anti-Virus Software up to Date.
- ❑ Keep your softwares/applications updated.
- ❑ Back-up your data.

Precaution and cure for an infected system

- Never download attachments from unknown sources.
- Limit personal information you give online.

Contents

PE File Structure

Microsoft Windows

DOS -> NE -> LX -> PE

DISK OPERATING SYSTEM | New Executable | Linear Executable | Portable Executable

PE File Structure

PE: Portable executable

- ❑ Executables
- ❑ DLL
- ❑ .NET

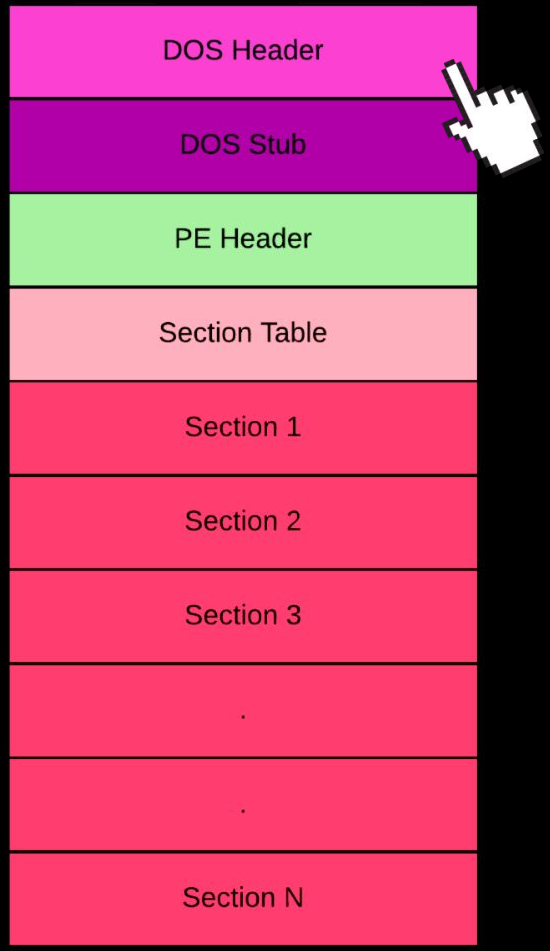
...

PE File Structure

CFF explorer

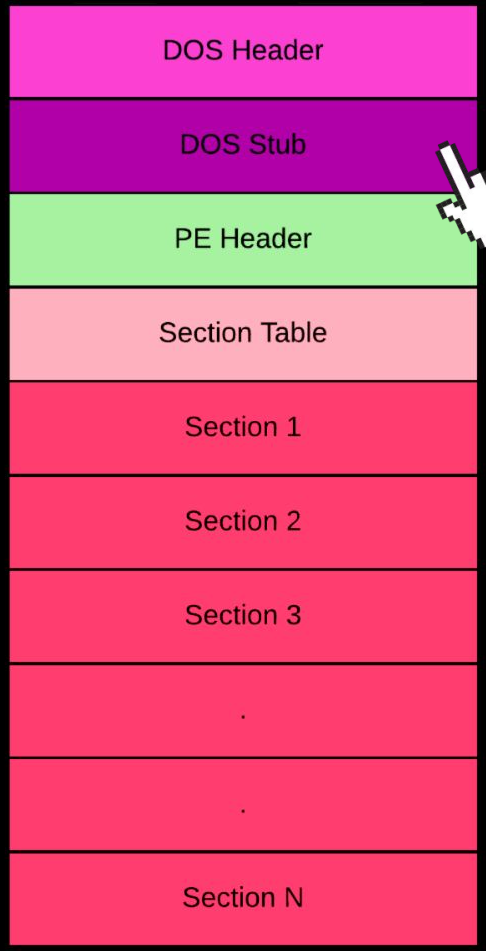
PE bear


DOS Header
DOS Stub
PE Header
Section Table
Section 1
Section 2
Section 3
.
.
Section N



DOS headers

- Backward compatibility to MS-DOS, to run and exit without any errors.

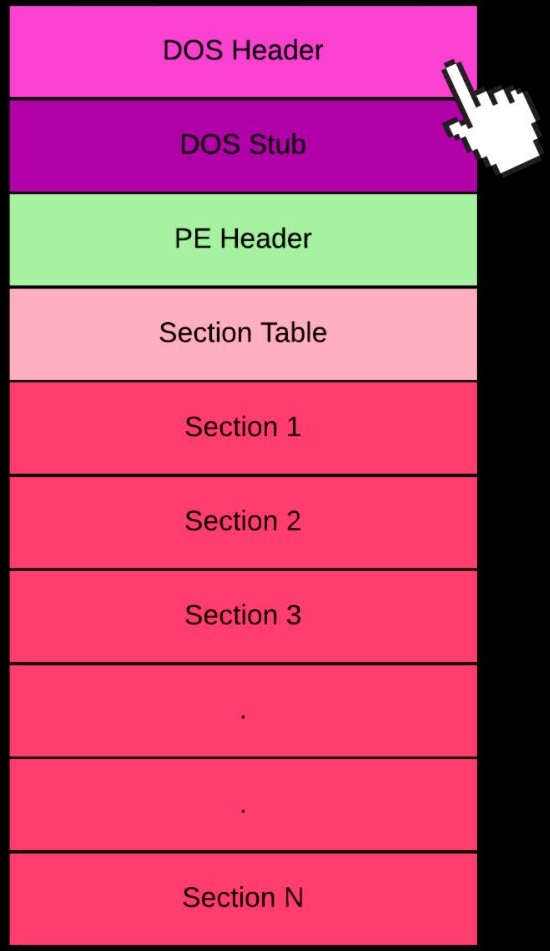


DOS headers

- Backward compatibility to MS-DOS, to run and exit without any errors.
- If the program runs under MS-DOS then it will run and print the message "This program cannot be run in DOS mode" and exit without any errors

DOS headers

- Backward compatibility to MS-DOS, to run and exit without any errors.
- If the program runs under MS-DOS then it will run and print the message "This program cannot be run in DOS mode" and exit without any errors.
- This is the first 64 BYTES of the file.

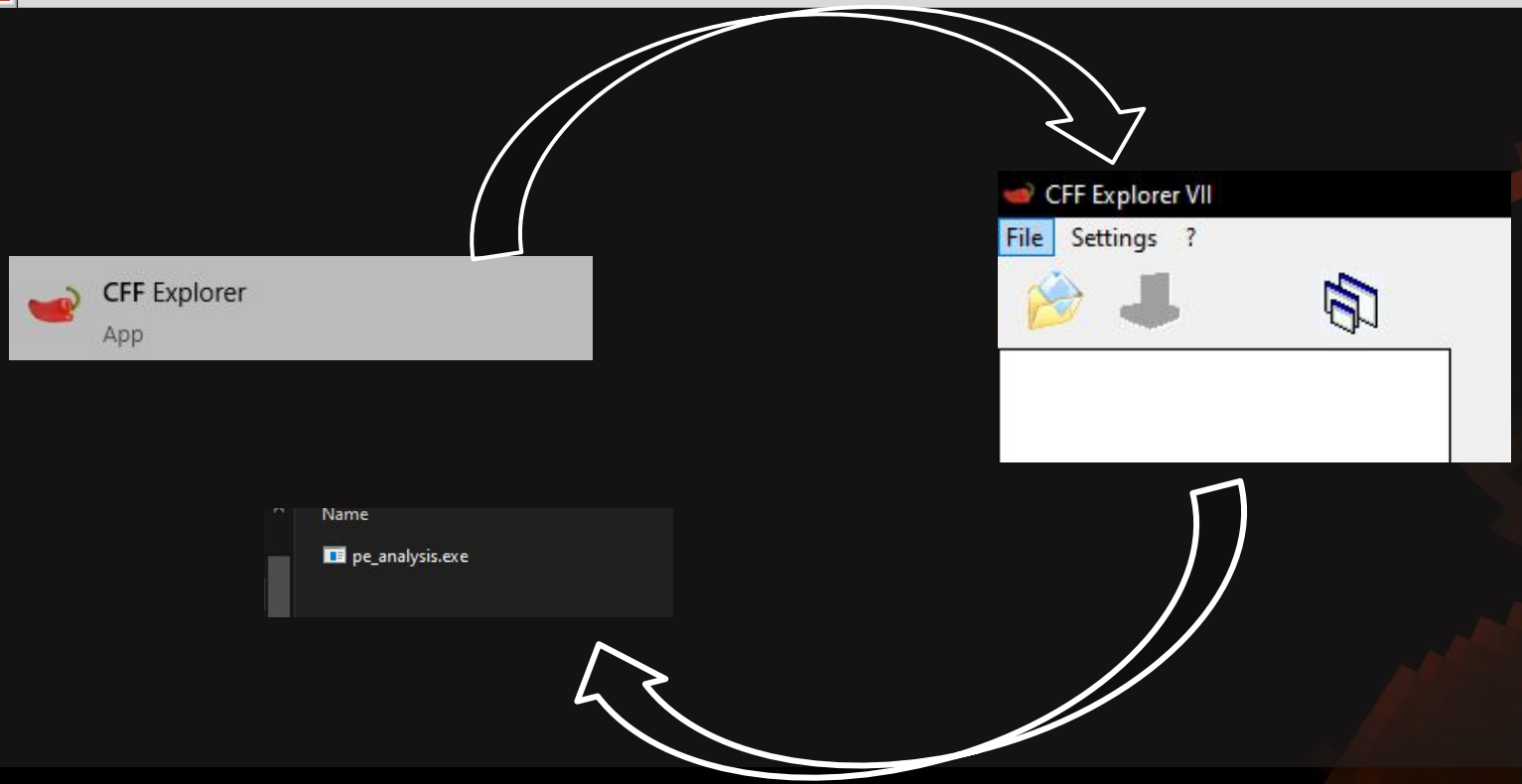


DOS headers

DOS header members:

```
e_magic
e_cblp
e_cp
e_crlc
e_cparhdr
e_minalloc
e_maxalloc
e_ss
e_sp
e_csum
e_ip
e_ip
e_ifarlc
e_ovna
e_res
e_oemid
e_oeminfo
e_res2
e_lfanew
```

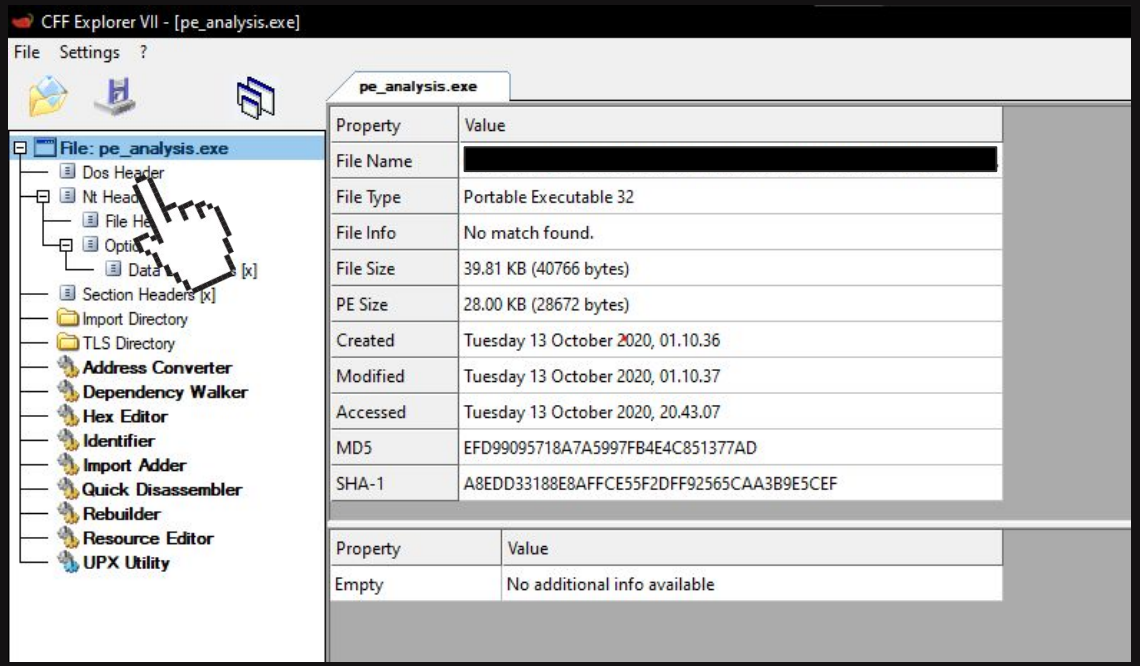
DOS headers


CFF Explorer
App
CFF Explorer VII
File
Settings
?
Name
pe_analysis.exe

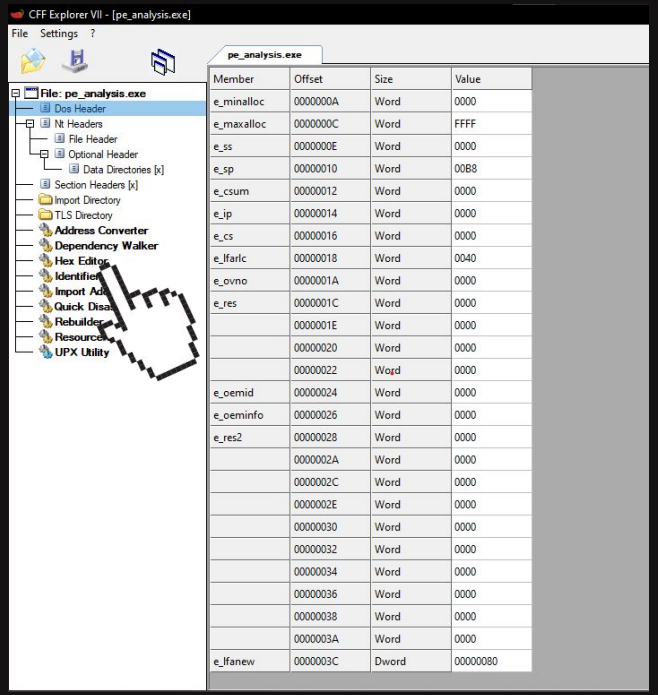
DOS headers

```
C:\Users\hp\Desktop\workshoptemp>pe_analysis.exe
Welcome to this workshop!!
C:\Users\hp\Desktop\workshoptemp>_
```

DOS headers

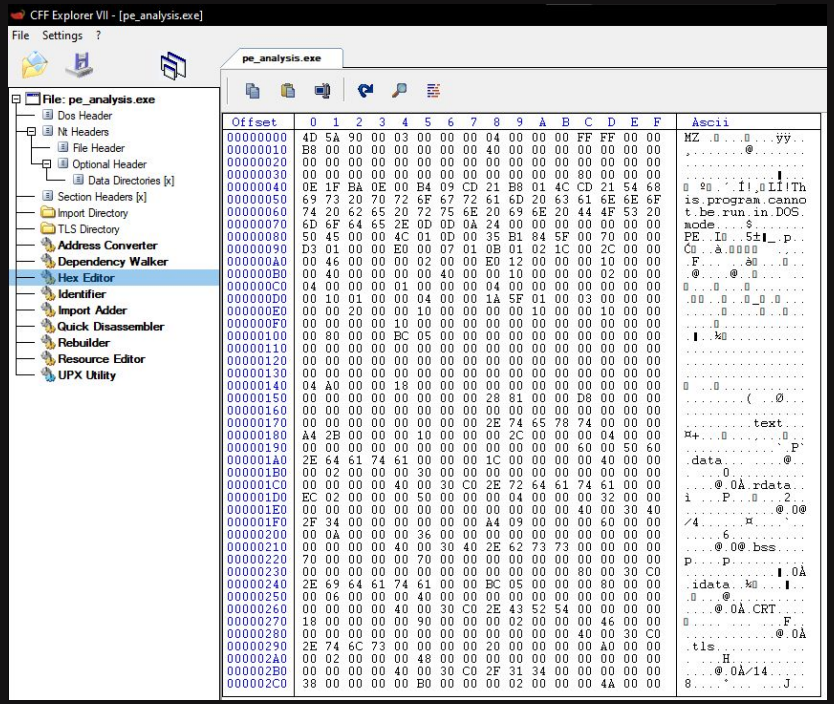

CFF Explorer VII - [pe_analysis.exe]
File Settings ?
pe_analysis.exe
File: pe_analysis.exe
Dos Header
Nt Head
File He
Optio
Data
[x]
Section Headers [x]
Import Directory
TLS Directory
Address Converter
Dependency Walker
Hex Editor
Identifier
Import Adder
Quick Disassembler
Rebuilder
Resource Editor
UPX Utility
Property
Value
File Name
File Type
Portable Executable 32
File Info
No match found.
File Size
39.81 KB (40766 bytes)
PE Size
28.00 KB (28672 bytes)
Created
Tuesday 13 October 2020, 01.10.36
Modified
Tuesday 13 October 2020, 01.10.37
Accessed
Tuesday 13 October 2020, 20.43.07
MD5
EFD99095718A7A5997FB4E4C851377AD
SHA-1
A8EDD33188E8AFFCE55F2DFF92565CAA3B9E5CEF
Property
Value
Empty
No additional info available

DOS headers



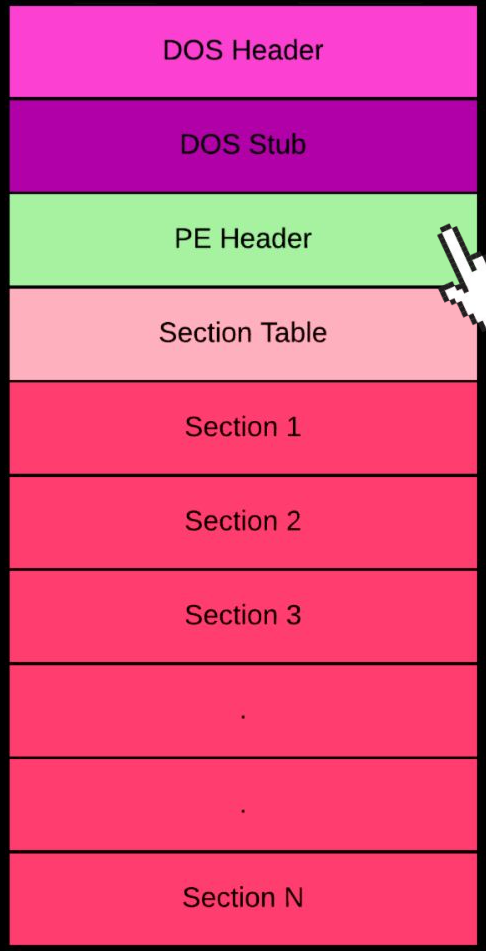
Member	Offset	Size	Value
e_minalloc	0000000A	Word	0000
e_maxalloc	0000000C	Word	FFFF
e_ss	0000000E	Word	0000
e_sp	00000010	Word	00B8
e_csum	00000012	Word	0000
e_ip	00000014	Word	0000
e_cs	00000016	Word	0000
e_lfarlc	00000018	Word	0040
e_ovno	0000001A	Word	0000
e_res	0000001C	Word	0000
	0000001E	Word	0000
	00000020	Word	0000
	00000022	Word	0000
e_oemid	00000024	Word	0000
e_oeminfo	00000026	Word	0000
e_res2	00000028	Word	0000
	0000002A	Word	0000
	0000002C	Word	0000
	0000002E	Word	0000
	00000030	Word	0000
	00000032	Word	0000
	00000034	Word	0000
	00000036	Word	0000
	00000038	Word	0000
	0000003A	Word	0000
e_lfanew	0000003C	Dword	00000080

DOS headers


CFF Explorer VII - [pe_analysis.exe]
File Settings ?
pe_analysis.exe
File: pe_analysis.exe
Dos Header
Nt Headers
File Header
Optional Header
Data Directories [x]
Section Headers [x]
Import Directory
TLS Directory
Address Converter
Dependency Walker
Hex Editor
Identifier
Import Adder
Quick Disassembler
Rebuilder
Resource Editor
UPX Utility
Offset 0 1 2 3 4 5 6 7 8 9 A B C D E F Ascii
00000000 4D 5A 90 00 03 00 00 00 04 00 00 00 FF FF 00 00 MZ
00000010 B8 00 00 00 00 00 00 00 40 00 00 00 00 00 00 00
00000020 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00000030 00 00 00 00 00 00 00 00 00 00 00 00 80 00 00 00
00000040 0E 1F BA 0E 00 B4 09 CD 21 B8 01 4C CD 21 54 68 !..L.!Th
00000050 69 73 20 70 72 6F 67 72 61 6D 20 63 61 6E 6E 6F is program canno
00000060 74 20 62 65 20 72 75 6E 20 69 6E 20 44 4F 53 20 t be run in DOS
00000070 6D 6F 64 65 2E 0D 0D 0A 24 00 00 00 00 00 00 00 mode....$.......
00000080 50 45 00 00 4C 01 0D 00 35 B1 84 5F 00 70 00 00 PE..L...5..._.p..
00000090 D3 01 00 00 E0 00 07 01 0B 01 02 1C 00 2C 00 00
000000A0 00 46 00 00 00 02 00 00 E0 12 00 00 00 10 00 00 .F..........
000000B0 00 40 00 00 00 00 40 00 00 10 00 00 00 02 00 00 .@....@.....
000000C0 04 00 00 00 01 00 00 00 04 00 00 00 00 00 00 00
000000D0 00 10 01 00 00 04 00 00 1A 5F 01 00 03 00 00 00 ....._......
000000E0 00 00 20 00 00 10 00 00 00 00 10 00 00 10 00 00
000000F0 00 00 00 00 10 00 00 00 00 00 00 00 00 00 00 00
00000100 00 80 00 00 BC 05 00 00 00 00 00 00 00 00 00 00
00000110 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00000120 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00000130 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00000140 04 A0 00 00 18 00 00 00 00 00 00 00 00 00 00 00
00000150 00 00 00 00 00 00 00 00 28 81 00 00 D8 00 00 00 ....(...
00000160 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00000170 00 00 00 00 00 00 00 00 2E 74 65 78 74 00 00 00 ....text...
00000180 A4 2B 00 00 00 10 00 00 00 2C 00 00 00 04 00 00 .+.......,......
00000190 00 00 00 00 00 00 00 00 00 00 00 00 60 00 50 60 ....`.P`
000001A0 2E 64 61 74 61 00 00 00 1C 00 00 00 00 40 00 00 .data........@..
000001B0 00 02 00 00 00 30 00 00 00 00 00 00 00 00 00 00 .....0..........
000001C0 00 00 00 00 40 00 30 C0 2E 72 64 61 74 61 00 00 ....@.0..rdata..
000001D0 EC 02 00 00 00 50 00 00 00 04 00 00 00 32 00 00 .....P.......2..
000001E0 00 00 00 00 00 00 00 00 00 00 00 00 40 00 30 40 ....@.0@
000001F0 2F 34 00 00 00 00 00 00 A4 09 00 00 00 60 00 00 /4.......`..
00000200 00 0A 00 00 00 36 00 00 00 00 00 00 00 00 00 00 .....6..........
00000210 00 00 00 00 40 00 30 40 2E 62 73 73 00 00 00 00 ....@.0@.bss....
00000220 70 00 00 00 00 70 00 00 00 00 00 00 00 00 00 00 p....p..........
00000230 00 00 00 00 00 00 00 00 00 00 00 00 80 00 30 C0 ....0.
00000240 2E 69 64 61 74 61 00 00 BC 05 00 00 00 80 00 00 .idata..........
00000250 00 06 00 00 00 40 00 00 00 00 00 00 00 00 00 00 .....@..........
00000260 00 00 00 00 40 00 30 C0 2E 43 52 54 00 00 00 00 ....@.0..CRT....
00000270 18 00 00 00 00 90 00 00 00 02 00 00 00 46 00 00 ....F..
00000280 00 00 00 00 00 00 00 00 00 00 00 00 40 00 30 C0 ....@.0.
00000290 2E 74 6C 73 00 00 00 00 00 20 00 00 00 00 00 00 .tls..... ......
000002A0 00 02 00 00 00 48 00 00 00 00 00 00 00 00 00 00 .....H..........
000002B0 00 00 00 00 40 00 30 C0 2F 31 34 00 00 00 00 00 ....@.0./14.....
000002C0 38 00 00 00 00 B0 00 00 00 02 00 00 00 4A 00 00 8.............J..

DOS headers

Offset	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	Ascii
00000000	4D	5A	90	00	03	00	00	00	04	00	00	00	FF	FF	00	00	MZ .▯...▯...ÿÿ..
00000010	B8	00	00	00	00	00	00	00	40	00	00	00	00	00	00	00	¸.......@.......
00000020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
00000030	00	00	00	00	00	00	00	00	00	00	00	00	80	00	00	00	............▌...
00000040	0E	1F	BA	0E	00	B4	09	CD	21	B8	01	4C	CD	21	54	68	▯ º▯.´.Í!¸▯LÍ!Th
00000050	69	73	20	70	72	6F	67	72	61	6D	20	63	61	6E	6E	6F	is.program.canno
00000060	74	20	62	65	20	72	75	6E	20	69	6E	20	44	4F	53	20	t.be.run.in.DOS.
00000070	6D	6F	64	65	2E	0D	0D	0A	24	00	00	00	00	00	00	00	mode....$.......

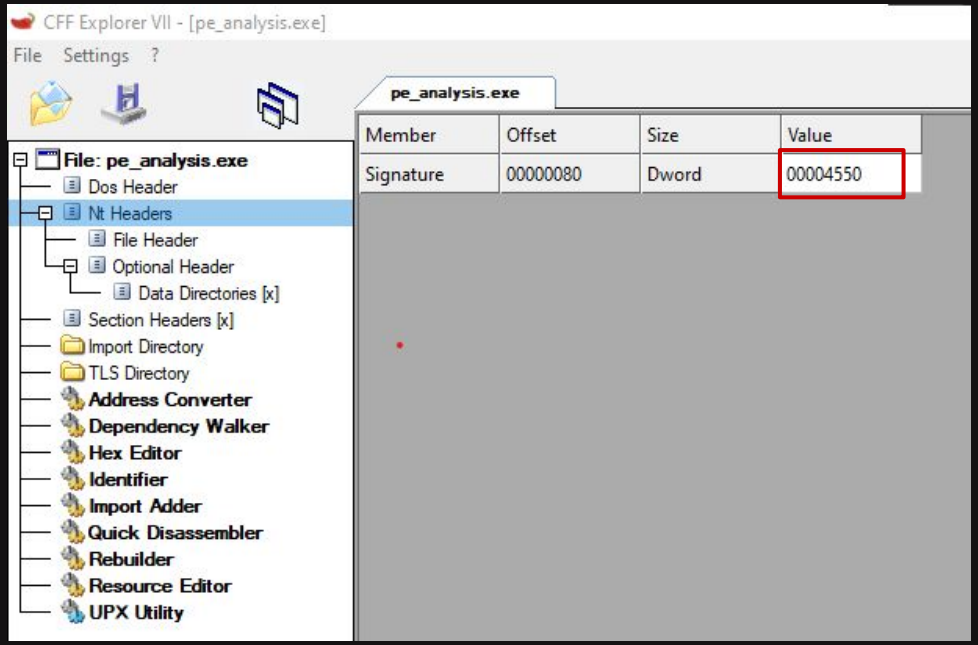


PE headers

- Starts with the value 50h, 45h, 00h, 00h ("PE" followed by two terminating zeroes).
- It is a struct with the following members:

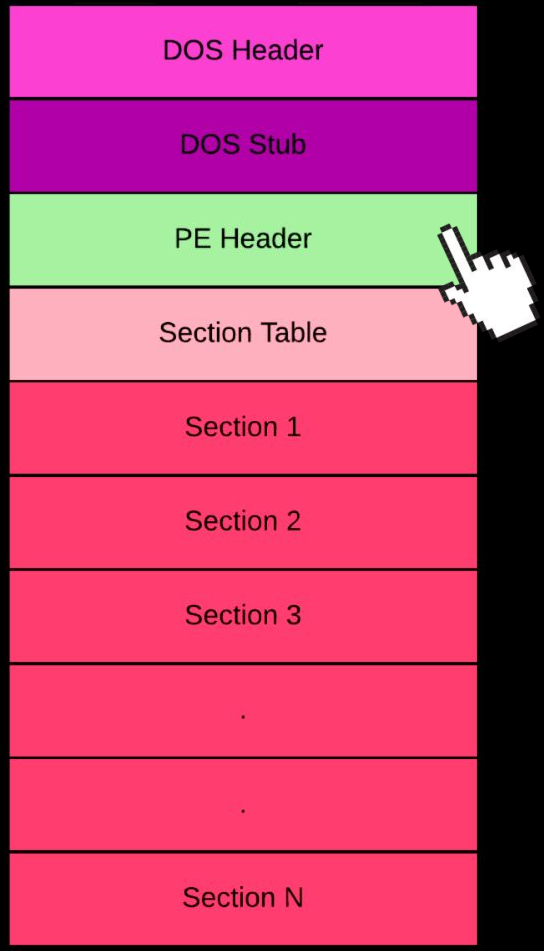
```
IMAGE_NT_HEADERS STRUCT {
      Signature
      FileHeader
      OptionalHeader
}
```

PE headers


CFF Explorer VII - [pe_analysis.exe]
File Settings ?
pe_analysis.exe
File: pe_analysis.exe
Dos Header
Nt Headers
File Header
Optional Header
Data Directories [x]
Section Headers [x]
Import Directory
TLS Directory
Address Converter
Dependency Walker
Hex Editor
Identifier
Import Adder
Quick Disassembler
Rebuilder
Resource Editor
UPX Utility
Member
Offset
Size
Value
Signature
00000080
Dword
00004550

PE headers

Offset	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	Ascii
00000000	4D	5A	90	00	03	00	00	00	04	00	00	00	FF	FF	00	00	MZ .▯ . . .▯ . . .ÿÿ . .
00000010	B8	00	00	00	00	00	00	00	40	00	00	00	00	00	00	00	¸ . . . . . @ . . . . .
00000020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	. . . . .
00000030	00	00	00	00	00	00	00	00	00	00	00	00	80	00	00	00	. . . . . ▌ . . .
00000040	0E	1F	BA	0E	00	B4	09	CD	21	B8	01	4C	CD	21	54	68	▯ º▯ . ´ . Í ! ¸▯ LÍ ! Th
00000050	69	73	20	70	72	6F	67	72	61	6D	20	63	61	6E	6E	6F	is . program . canno
00000060	74	20	62	65	20	72	75	6E	20	69	6E	20	44	4F	53	20	t . be . run . in . DOS .
00000070	6D	6F	64	65	2E	0D	0D	0A	24	00	00	00	00	00	00	00	mode . . . $ . . . . .
00000080	50	45	00	00	4C	01	0D	00	35	B1	84	5F	00	70	00	00	PE . . L▯ . . 5± ▌ _ . p . .
00000090	D3	01	00	00	E0	00	07	01	0B	01	02	1C	00	2C	00	00	Ó▯ . . à . ▯ ▯ ▯ . . . , . .
000000A0	00	46	00	00	00	02	00	00	E0	12	00	00	00	10	00	00	. F . . . . . à▯ . . . ▯ . .
000000B0	00	40	00	00	00	00	40	00	00	10	00	00	00	02	00	00	. @ . . . . @ . . ▯ . . . .
000000C0	04	00	00	00	01	00	00	00	04	00	00	00	00	00	00	00	▯ . . . ▯ . . . ▯ . . . . .
000000D0	00	10	01	00	00	04	00	00	1A	5F	01	00	03	00	00	00	. ▯▯ . . ▯ . . ▯ _ ▯ . ▯ . . .
000000E0	00	00	20	00	00	10	00	00	00	00	10	00	00	10	00	00	. . . . . ▯ . . . ▯ . . ▯ . .
000000F0	00	00	00	00	10	00	00	00	00	00	00	00	00	00	00	00	. . . . ▯ . . . . .
00000100	00	80	00	00	BC	05	00	00	00	00	00	00	00	00	00	00	. ▌ . . ¼▯ . . . . .
00000110	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	. . . . .
00000120	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	. . . . .
00000130	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	. . . . .
00000140	04	A0	00	00	18	00	00	00	00	00	00	00	00	00	00	00	▯ . . ▯ . . . . .
00000150	00	00	00	00	00	00	00	00	28	81	00	00	D8	00	00	00	(Ø

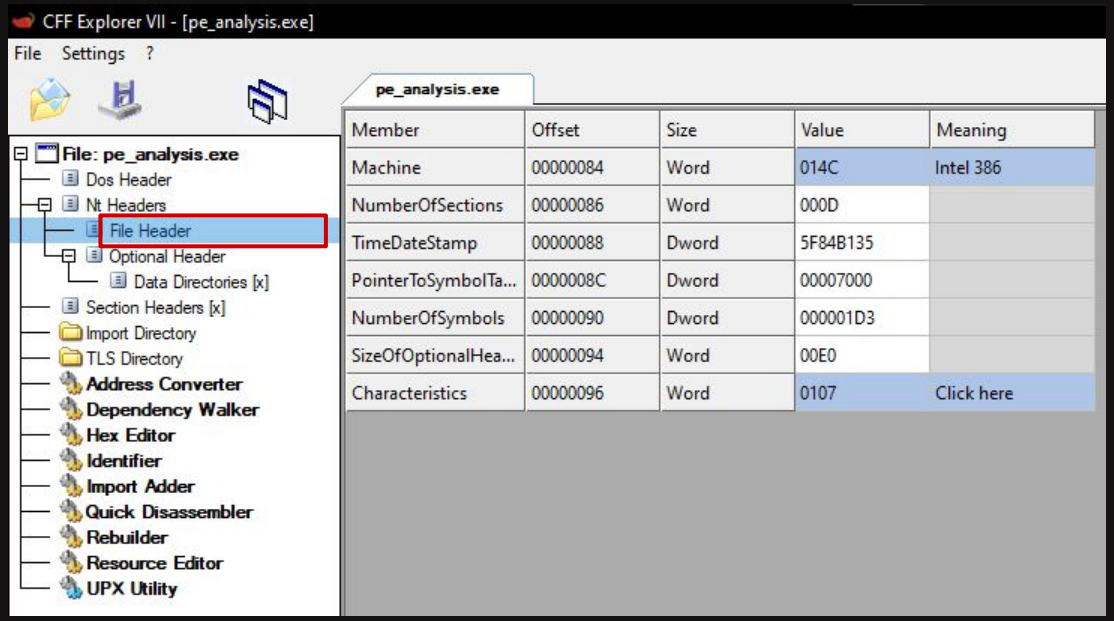


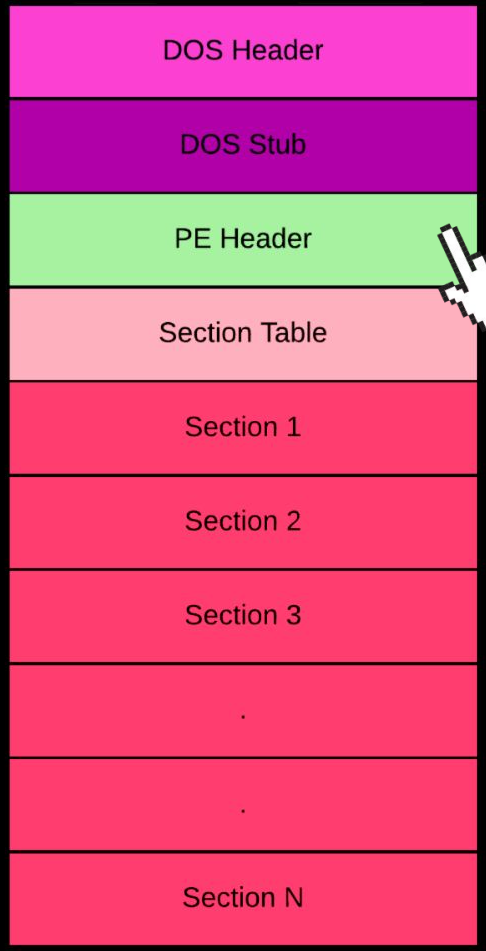
PE headers

❑ File headers

```
IMAGE_FILE_HEADER_STRUCT{
Machine
NumberOfSections
TimeDateStamp
PointerToSymbolTable
NumberOfSymbols
SizeOfOptionalHeader
Characteristics
}
```

PE headers


CFF Explorer VII - [pe_analysis.exe]
File Settings ?
pe_analysis.exe
File: pe_analysis.exe
Dos Header
Nt Headers
File Header
Optional Header
Data Directories [x]
Section Headers [x]
Import Directory
TLS Directory
Address Converter
Dependency Walker
Hex Editor
Identifier
Import Adder
Quick Disassembler
Rebuilder
Resource Editor
UPX Utility
Member | Offset | Size | Value | Meaning
Machine | 00000084 | Word | 014C | Intel 386
NumberOfSections | 00000086 | Word | 000D
TimeDateStamp | 00000088 | Dword | 5F84B135
PointerToSymbolTa... | 0000008C | Dword | 00007000
NumberOfSymbols | 00000090 | Dword | 000001D3
SizeOfOptionalHea... | 00000094 | Word | 00E0
Characteristics | 00000096 | Word | 0107 | Click here

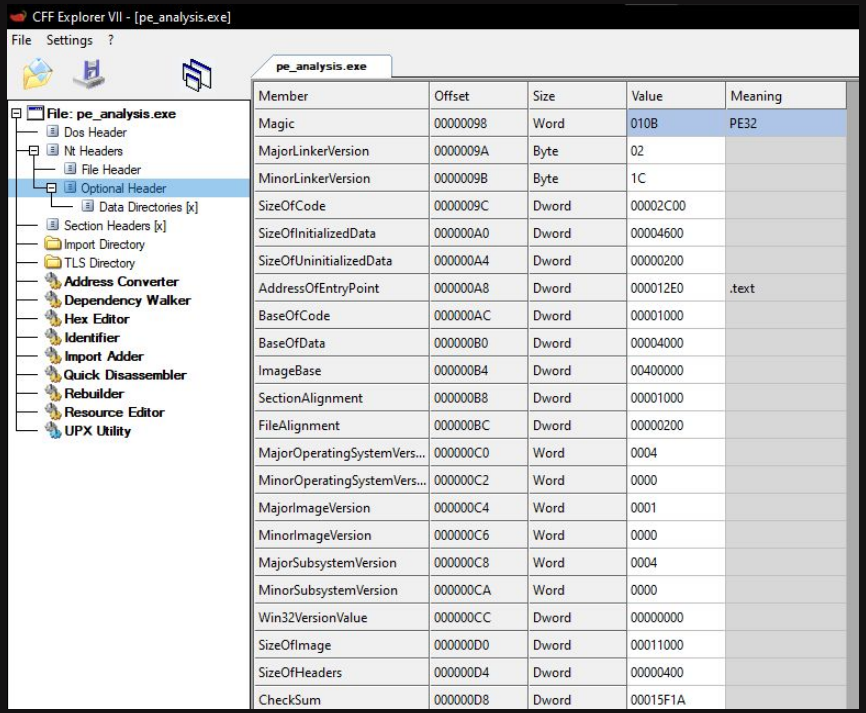


PE headers

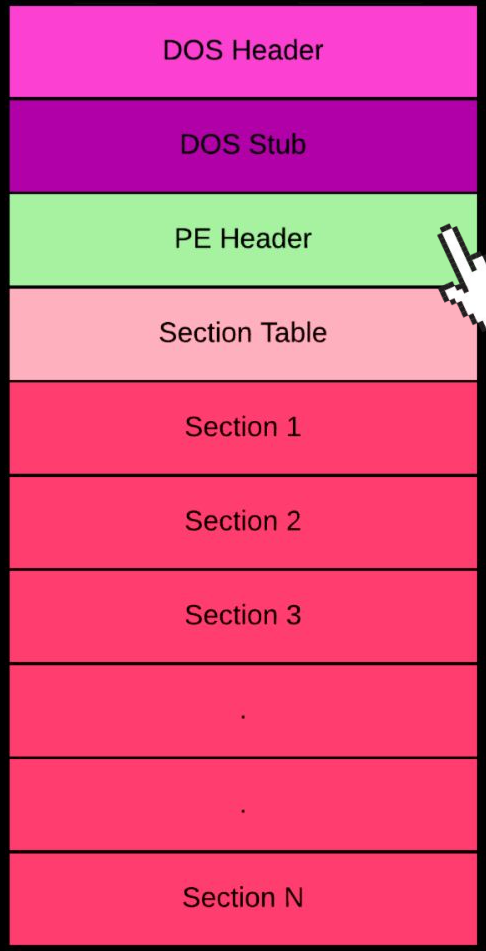
❑ Optional headers

```
IMAGE_OPTIONAL_HEADER_STRUCT {
  Magic
  MajorLinkerVersion
  MinorLinkerVersion
  SizeOfCode
  SizeOfInitializedData
  SizeOfUninitializedData
  AddressOfEntryPoint
  BaseOfCode
  BaseOfData
  ImageBase
  SectionAlignment
  FileAlignment
  MajorOperatingSystemVersion
  MinorOperatingSystemVersion
  MajorImageVersion
  MinorImageVersion
  MajorSubsystemVersion
  MinorSubsystemVersion
  Win32VersionValue
  SizeOfImage
  SizeOfHeaders
  CheckSum
  Subsystem
  DllCharacteristics
  SizeOfStackReserve
  SizeOfStackCommit
  SizeOfHeapReserve
  SizeOfHeapCommit
  LoaderFlags
  NumberOfRvaAndSizes
  DataDirectory
}
```

DOS headers



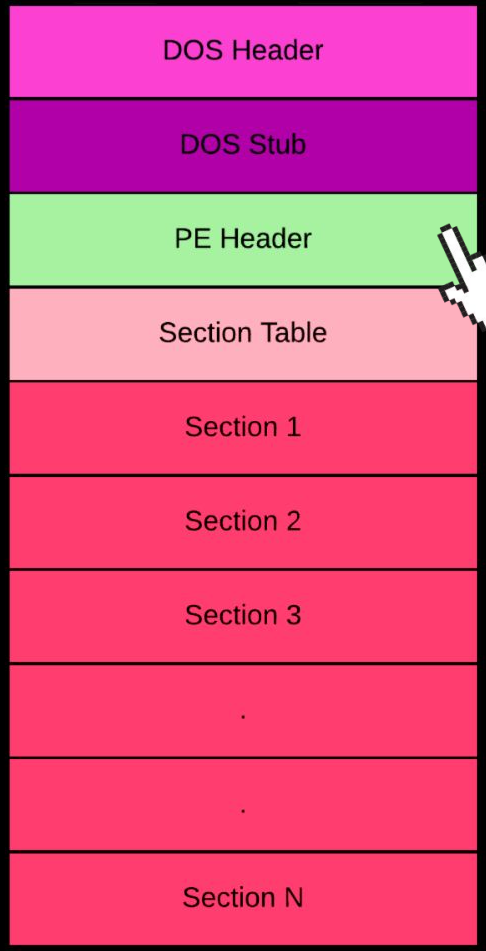
Member	Offset	Size	Value	Meaning
Magic	00000098	Word	010B	PE32
MajorLinkerVersion	0000009A	Byte	02	
MinorLinkerVersion	0000009B	Byte	1C	
SizeOfCode	0000009C	Dword	00002C00	
SizeOfInitializedData	000000A0	Dword	00004600	
SizeOfUninitializedData	000000A4	Dword	00000200	
AddressOfEntryPoint	000000A8	Dword	000012E0	.text
BaseOfCode	000000AC	Dword	00001000	
BaseOfData	000000B0	Dword	00004000	
ImageBase	000000B4	Dword	00400000	
SectionAlignment	000000B8	Dword	00001000	
FileAlignment	000000BC	Dword	00000200	
MajorOperatingSystemVers...	000000C0	Word	0004	
MinorOperatingSystemVers...	000000C2	Word	0000	
MajorImageVersion	000000C4	Word	0001	
MinorImageVersion	000000C6	Word	0000	
MajorSubsystemVersion	000000C8	Word	0004	
MinorSubsystemVersion	000000CA	Word	0000	
Win32VersionValue	000000CC	Dword	00000000	
SizeOfImage	000000D0	Dword	00011000	
SizeOfHeaders	000000D4	Dword	00000400	
CheckSum	000000D8	Dword	00015F1A	



Optional headers

- DataDirectory
  - 128 bytes
  - Array of IMAGE_DATA_DIRECTORY structure

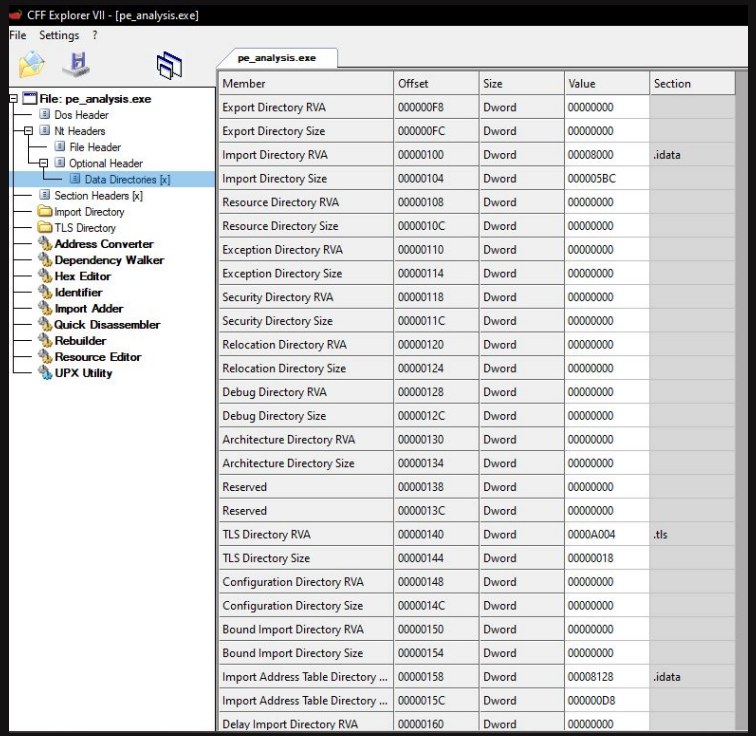
```
IMAGE_DATA_DIRECTORY_STRUCT {
    DWORD VirtualAddress
    DWORD Size
}
```



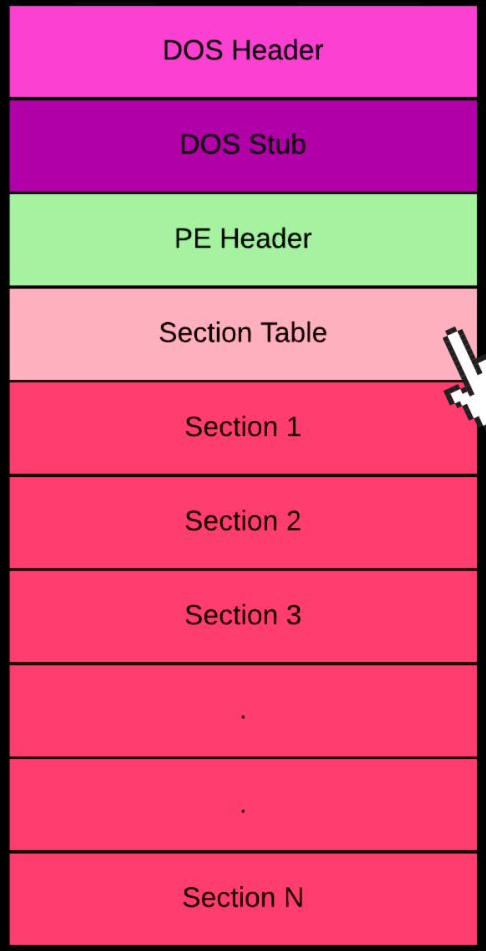
Optional headers

IMAGE_DIRECTORY_ENTRY_EXPORT
IMAGE_DIRECTORY_ENTRY_IMPORT
IMAGE_DIRECTORY_ENTRY_RESOURCE
IMAGE_DIRECTORY_ENTRY_EXCEPTION
IMAGE_DIRECTORY_ENTRY_SECURITY
IMAGE_DIRECTORY_ENTRY_BASERELOC
IMAGE_DIRECTORY_ENTRY_DEBUG
IMAGE_DIRECTORY_ENTRY_COPYRIGHT
IMAGE_DIRECTORY_ENTRY_GLOBALPTR
IMAGE_DIRECTORY_ENTRY_TLS
IMAGE_DIRECTORY_ENTRY_LOAD_CONFIG
IMAGE_DIRECTORY_ENTRY_BOUND_IMPORT
IMAGE_DIRECTORY_ENTRY_IAT
IMAGE_DIRECTORY_ENTRY_DELAY_IMPORT
IMAGE_DIRECTORY_ENTRY_COM_DESCRIPTOR
IMAGE_NUMBEROF_DIRECTORY_ENTRIES

Optional headers

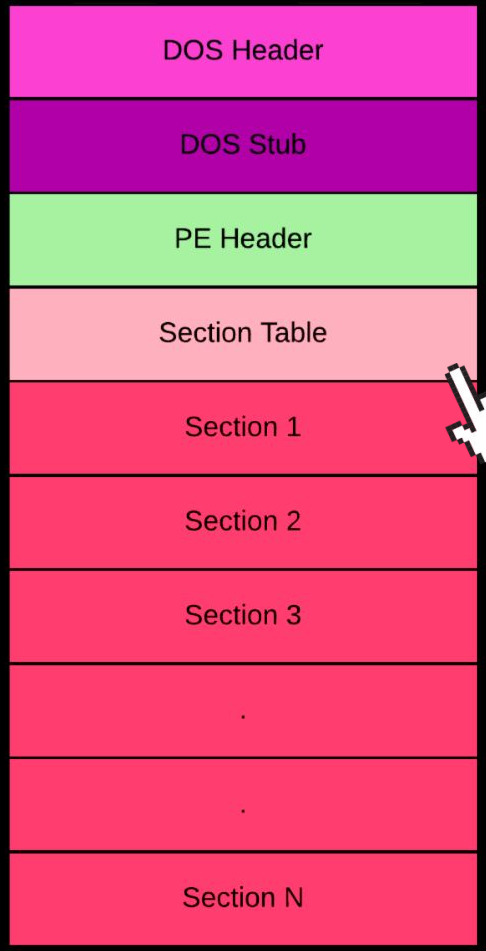


Member	Offset	Size	Value	Section
Export Directory RVA	000000F8	Dword	00000000	
Export Directory Size	000000FC	Dword	00000000	
Import Directory RVA	00000100	Dword	00008000	.idata
Import Directory Size	00000104	Dword	000005BC	
Resource Directory RVA	00000108	Dword	00000000	
Resource Directory Size	0000010C	Dword	00000000	
Exception Directory RVA	00000110	Dword	00000000	
Exception Directory Size	00000114	Dword	00000000	
Security Directory RVA	00000118	Dword	00000000	
Security Directory Size	0000011C	Dword	00000000	
Relocation Directory RVA	00000120	Dword	00000000	
Relocation Directory Size	00000124	Dword	00000000	
Debug Directory RVA	00000128	Dword	00000000	
Debug Directory Size	0000012C	Dword	00000000	
Architecture Directory RVA	00000130	Dword	00000000	
Architecture Directory Size	00000134	Dword	00000000	
Reserved	00000138	Dword	00000000	
Reserved	0000013C	Dword	00000000	
TLS Directory RVA	00000140	Dword	0000A004	.tls
TLS Directory Size	00000144	Dword	00000018	
Configuration Directory RVA	00000148	Dword	00000000	
Configuration Directory Size	0000014C	Dword	00000000	
Bound Import Directory RVA	00000150	Dword	00000000	
Bound Import Directory Size	00000154	Dword	00000000	
Import Address Table Directory ...	00000158	Dword	00008128	.idata
Import Address Table Directory ...	0000015C	Dword	000000D8	
Delay Import Directory RVA	00000160	Dword	00000000	



Section Table

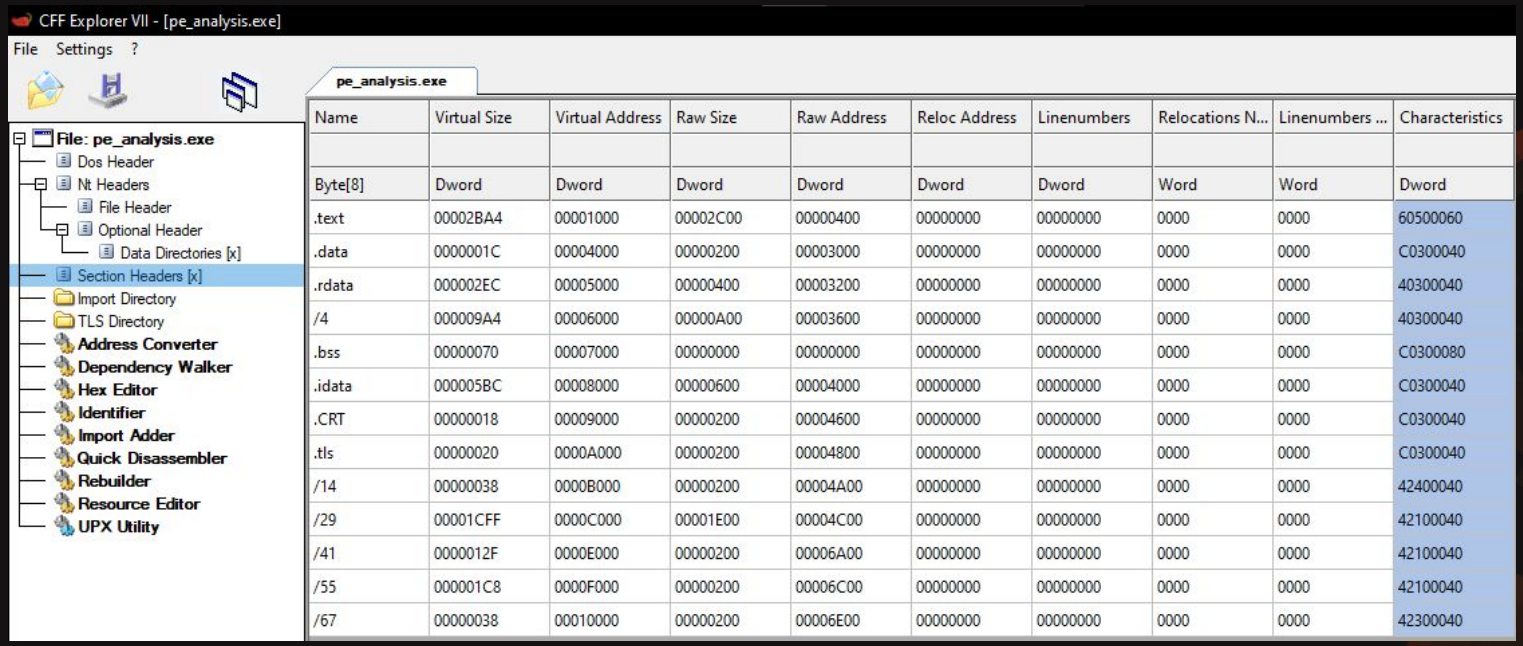
- The number of the array members is determined by NumberOfSections field in the file header struct or IMAGE_FILE_HEADER



Each Section header

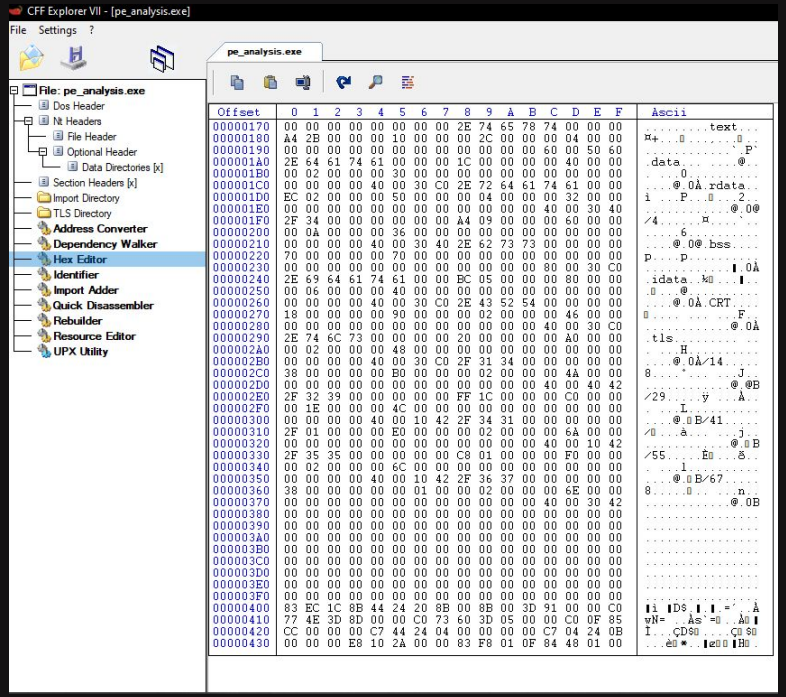
- ❑ Size is at least 40 bytes.
- ❑ Contains the following informations:
  - ❑ Name
  - ❑ PhysicalAddress
  - ❑ VirtualAddress
  - ❑ SizeOfRawData
  - ❑ PointerToRawData
  - ❑ Characteristics

Section headers



Name	Virtual Size	Virtual Address	Raw Size	Raw Address	Reloc Address	Linenumbers	Relocations N...	Linenumbers ...	Characteristics
Byte[8]	Dword	Dword	Dword	Dword	Dword	Dword	Word	Word	Dword
.text	00002BA4	00001000	00002C00	00000400	00000000	00000000	0000	0000	60500060
.data	0000001C	00004000	00000200	00003000	00000000	00000000	0000	0000	C0300040
.rdata	000002EC	00005000	00000400	00003200	00000000	00000000	0000	0000	40300040
/4	000009A4	00006000	00000A00	00003600	00000000	00000000	0000	0000	40300040
.bss	00000070	00007000	00000000	00000000	00000000	00000000	0000	0000	C0300080
.idata	000005BC	00008000	00000600	00004000	00000000	00000000	0000	0000	C0300040
.CRT	00000018	00009000	00000200	00004600	00000000	00000000	0000	0000	C0300040
.tls	00000020	0000A000	00000200	00004800	00000000	00000000	0000	0000	C0300040
/14	00000038	0000B000	00000200	00004A00	00000000	00000000	0000	0000	42400040
/29	00001CFF	0000C000	00001E00	00004C00	00000000	00000000	0000	0000	42100040
/41	0000012F	0000E000	00000200	00006A00	00000000	00000000	0000	0000	42100040
/55	000001C8	0000F000	00000200	00006C00	00000000	00000000	0000	0000	42100040
/67	00000038	00010000	00000200	00006E00	00000000	00000000	0000	0000	42300040

Section headers



Practice Time

CHAL1.EXE

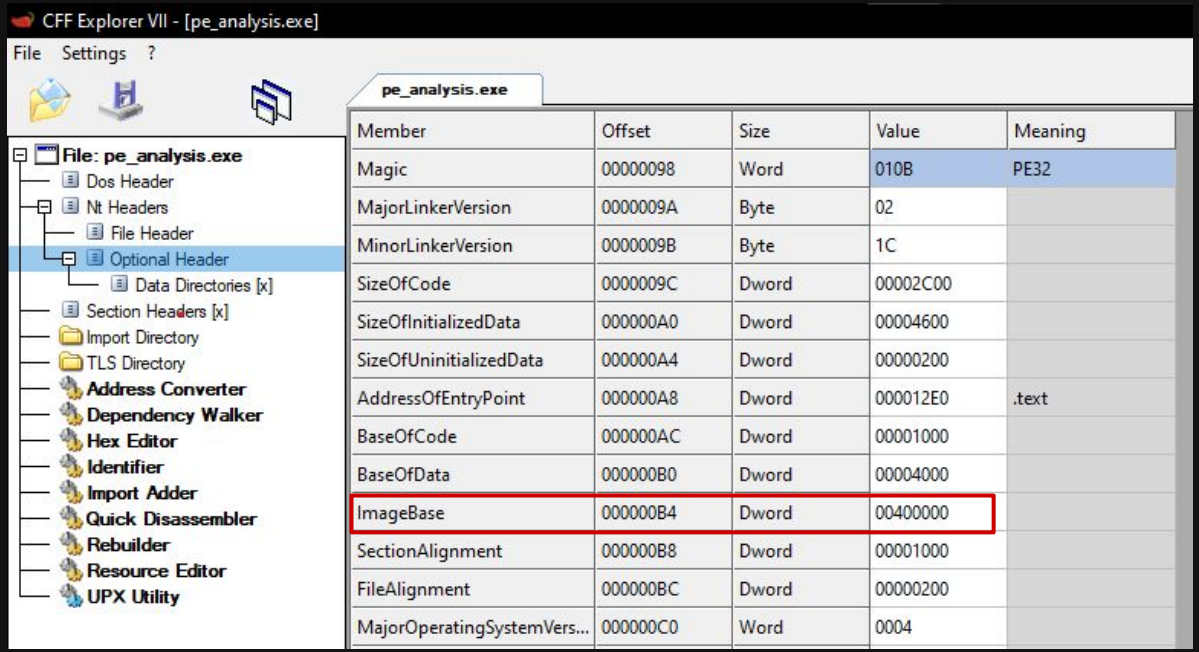
RUN

Walkthrouh

RUN

Answers

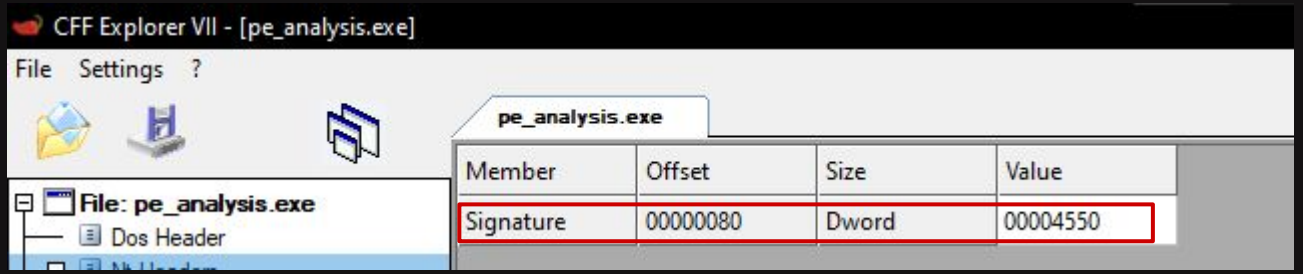
What is the value of ImageBase of this executable?



Member	Offset	Size	Value	Meaning
Magic	00000098	Word	010B	PE32
MajorLinkerVersion	0000009A	Byte	02	
MinorLinkerVersion	0000009B	Byte	1C	
SizeOfCode	0000009C	Dword	00002C00	
SizeOfInitializedData	000000A0	Dword	00004600	
SizeOfUninitializedData	000000A4	Dword	00000200	
AddressOfEntryPoint	000000A8	Dword	000012E0	.text
BaseOfCode	000000AC	Dword	00001000	
BaseOfData	000000B0	Dword	00004000	
ImageBase	000000B4	Dword	00400000	
SectionAlignment	000000B8	Dword	00001000	
FileAlignment	000000BC	Dword	00000200	
MajorOperatingSystemVers...	000000C0	Word	0004	

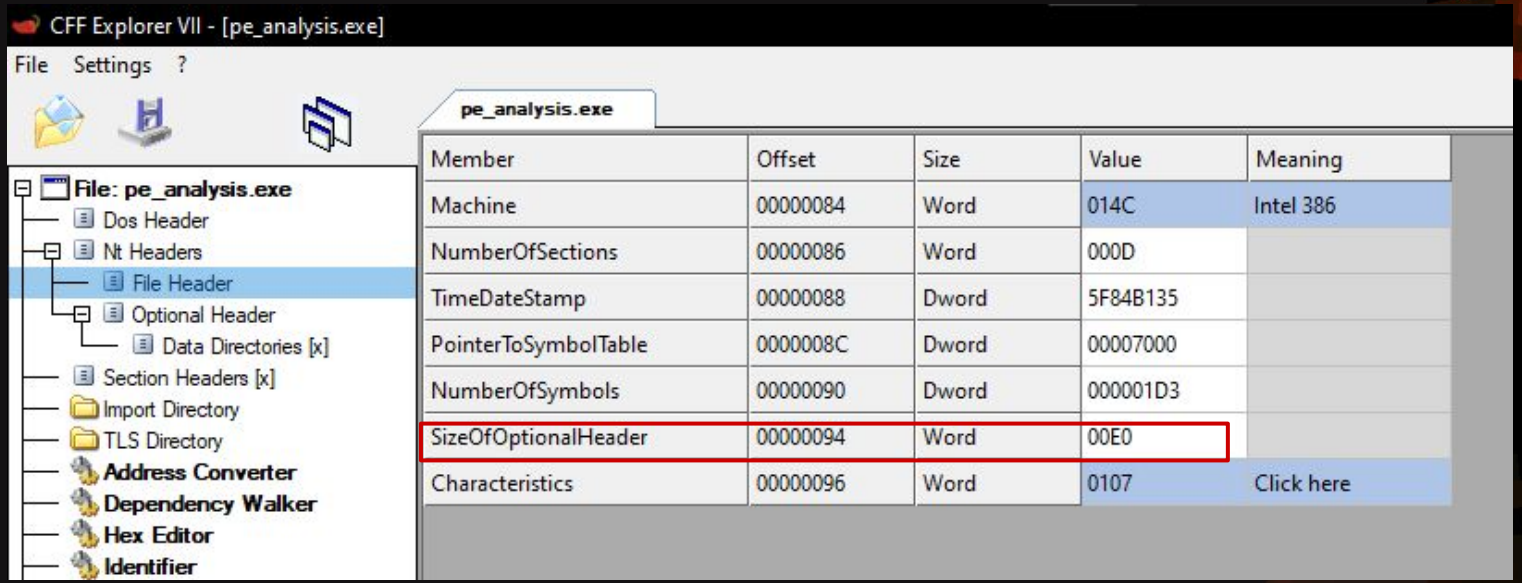
Answers

What is value in the signature field of PE header?



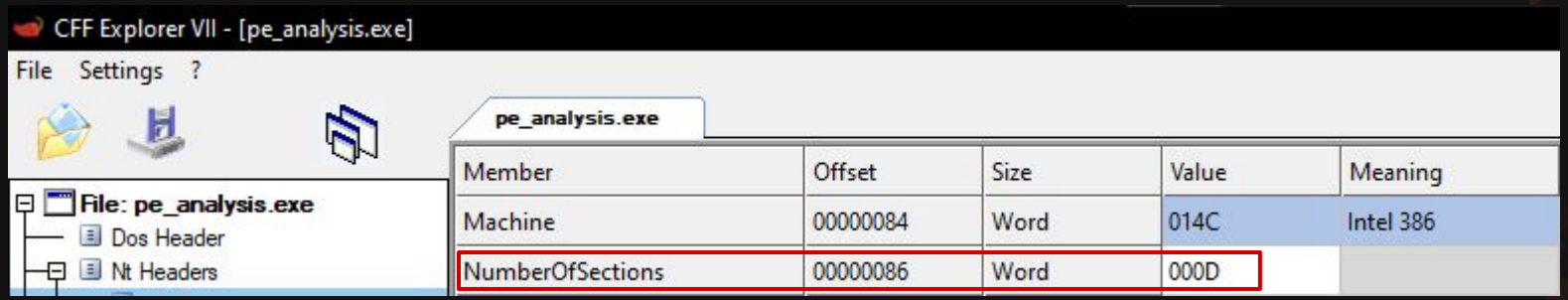
Answers

What is the value of SizeOfOptionalHeader field?



Answers

Number of sections:



Why is it necessary to know ?

- Fixing distorted headers
- For unpacking the executable
- Retrieving other important information related to the executable

Why is it necessary to know ?

- Research purpose
  - For classifying an application as Malicious or Benign.
  - Extracting specific details and using this in the development of tools.

Why is it necessary to know ?

Index	Key Features	Malware (5598)	Normal (1237)	Difference
1	Size Of Initialized Data == 0	1626 (29%)	0 (0%)	29%
2	Unknown Section Name	2709 (48.4%)	16 (1.3%)	47.1%
3	DLL Characteristics == 0	5335 (95.3%)	401 (32.4%)	62.9%
4	Major Image Version == 0	5305 (94.8%)	486 (39.3%)	55.5%
5	Checksum == 0	5084 (90.8%)	474 (38.3%)	52.5%

http://cobweb.cs.uga.edu/~liao/PE_Final_Report.pdf

Contents

Environment Isolation

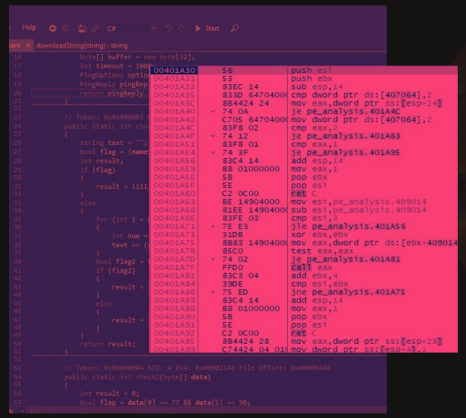
- Virtual Machines

Basic Analysis:

- ❑ Fingerprint
- ❑ Virus Scanning
- ❑ Strings
- ❑ Checking for packers and obfuscation

Static Analysis

- Analysing the disassembly.
- Use tools for decompilation.
  - Eg IDA pro



Contents

Dynamic Analysis

Contents

Dynamic Analysis

- ❑ Executing the sample
- ❑ Analysis using debuggers

Dynamic Analysis

Be careful!!

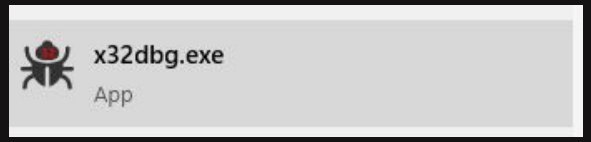
Contents

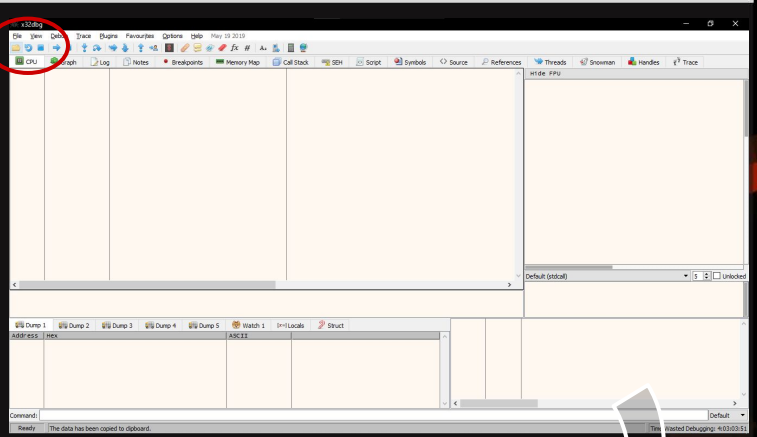
Challenge - 1

On executing

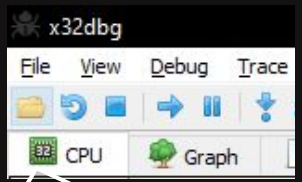
```
C:\Users\hp\Desktop\workshoptemp\challenge_file\Challenge-1>
C:\Users\hp\Desktop\workshoptemp\challenge_file\Challenge-1>challenge1.exe
Hello there!
Here is your flag:
Not so simple!!
```

Open x32dbg

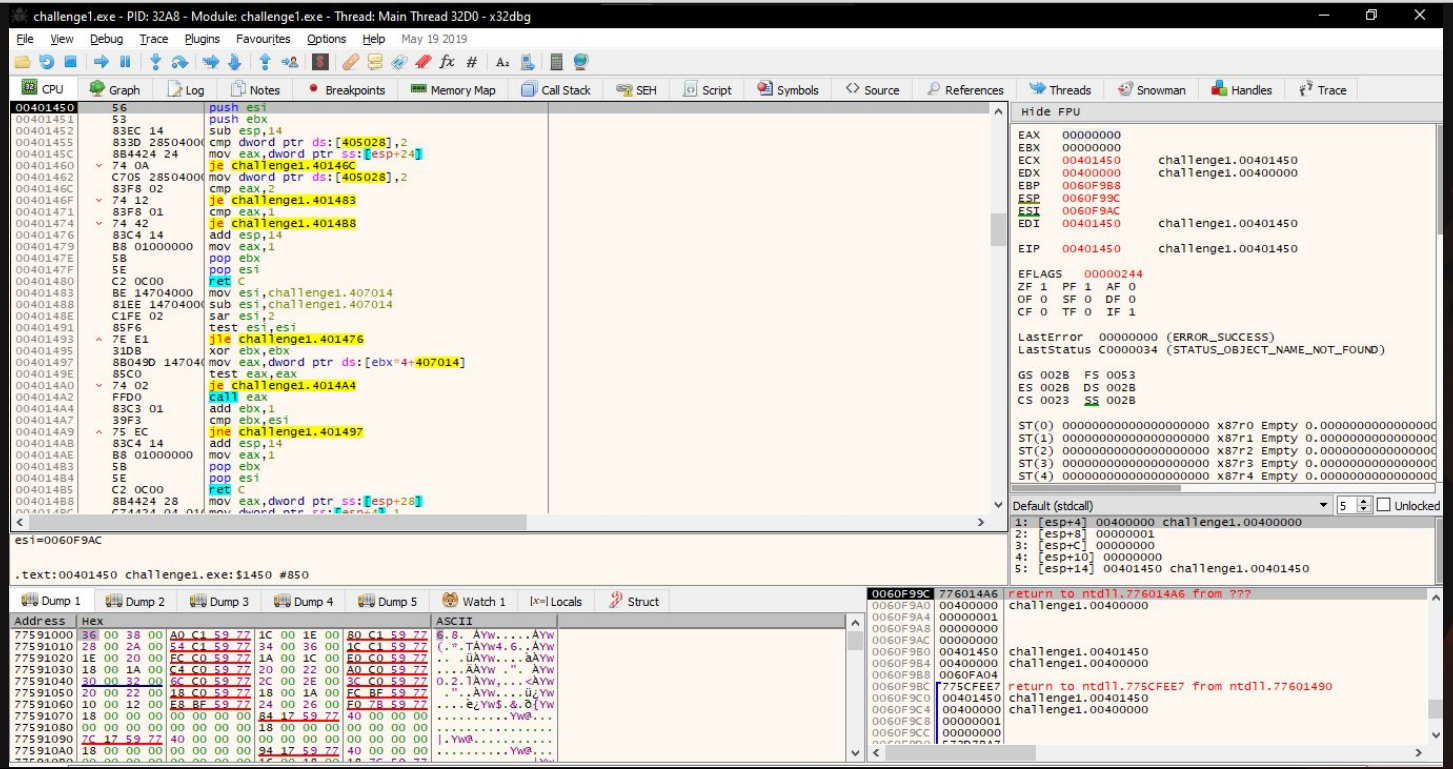

x32dbg.exe
App




challenge1.exe


x32dbg
File
View
Debug
Trace
CPU
Graph

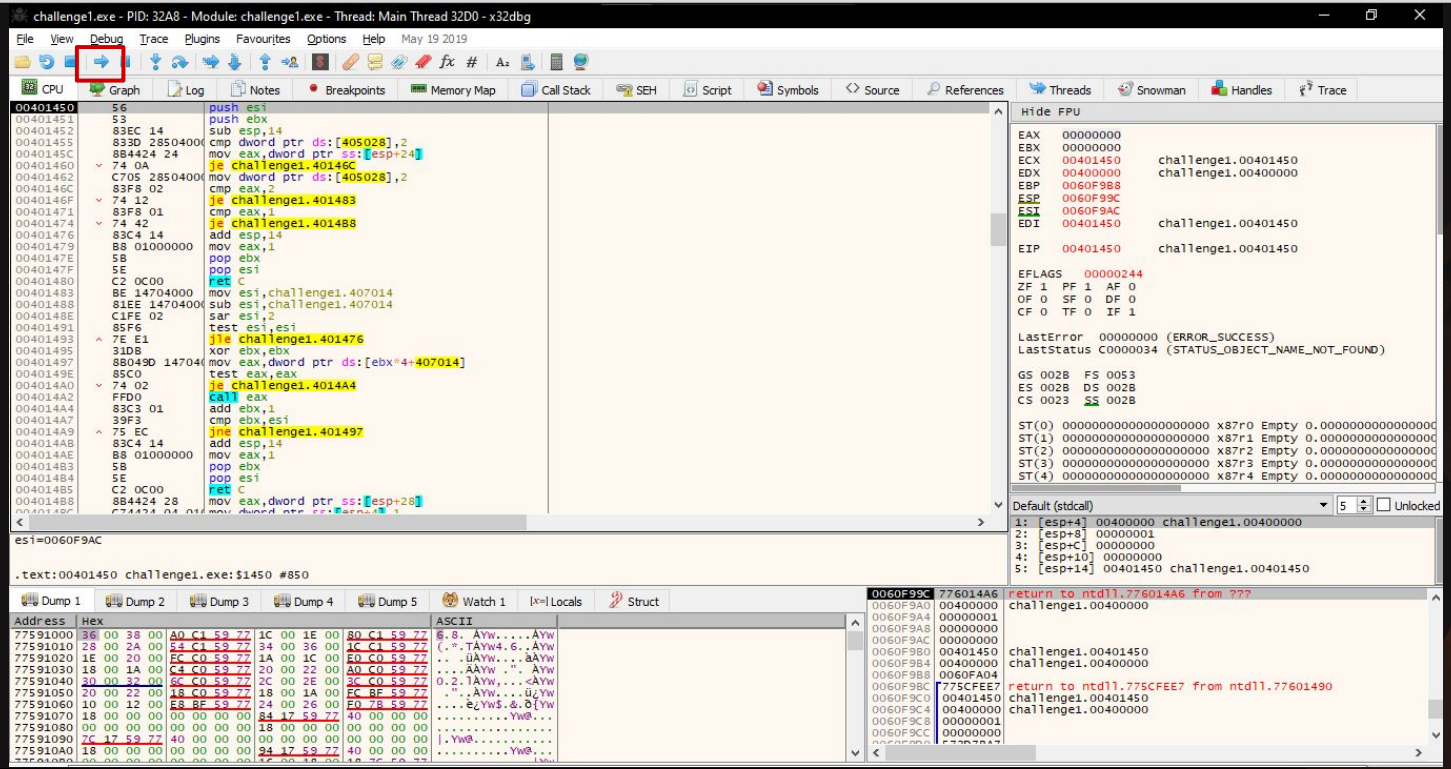
Open x32dbg



b10s

Team hakti 104

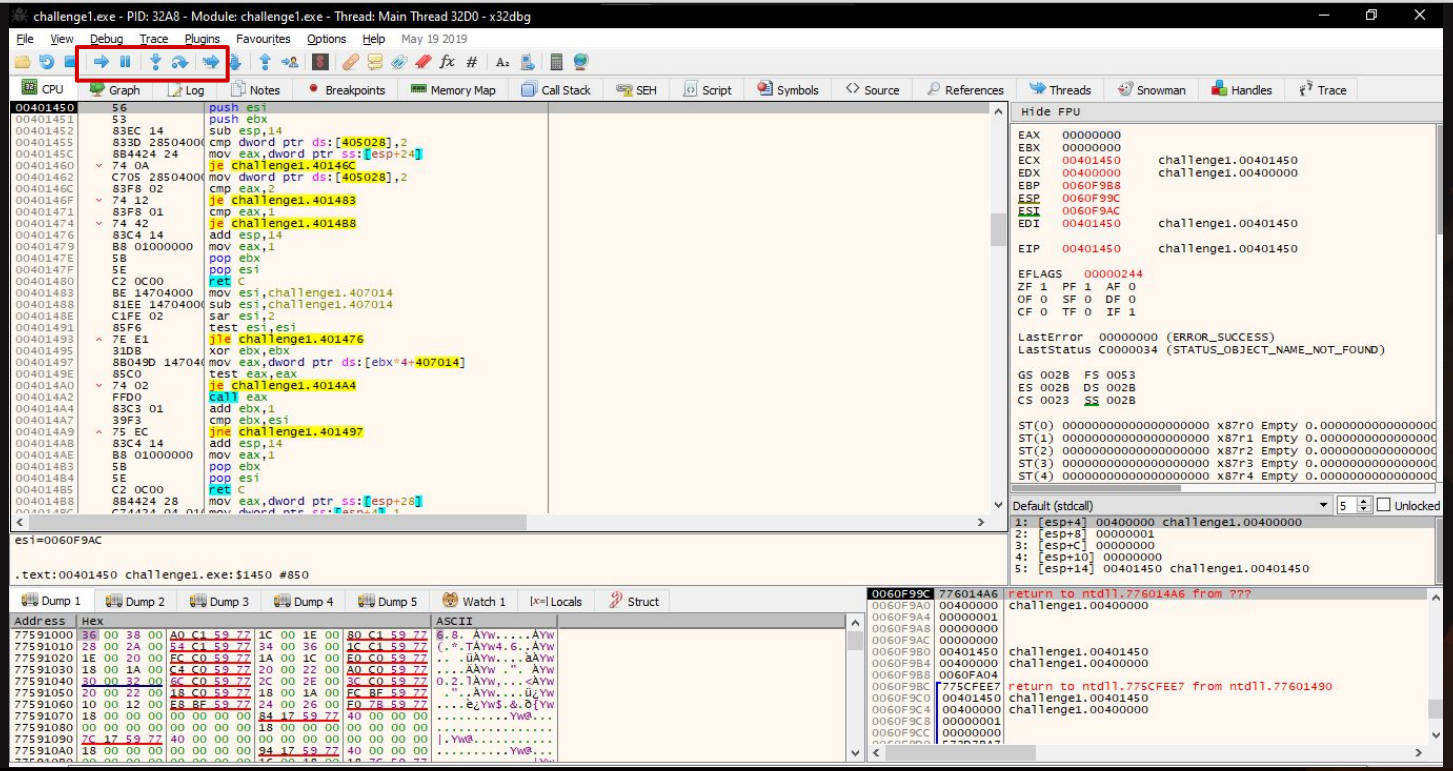
Open x32dbg



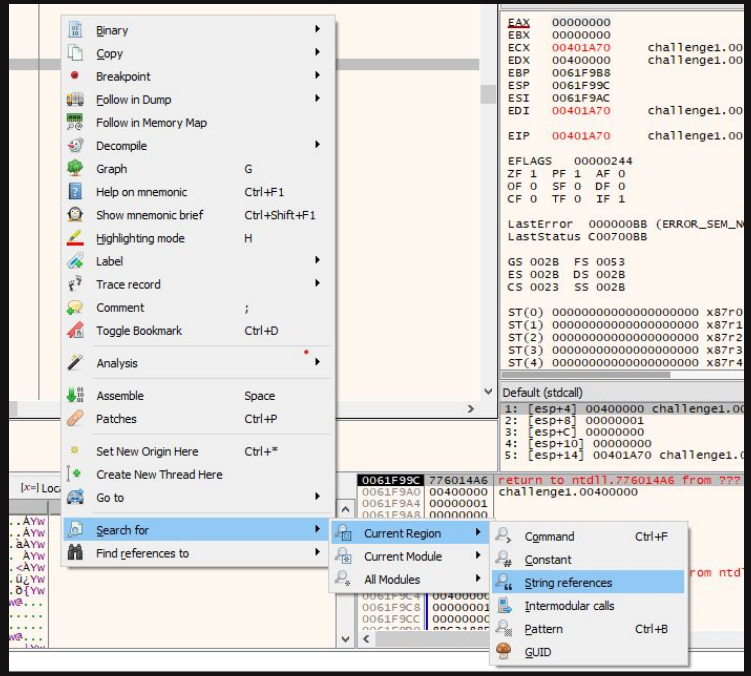
b10s

Team hakti 105

Open x32dbg


challenge1.exe - PID: 32A8 - Module: challenge1.exe - Thread: Main Thread 32D0 - x32dbg
File View Debug Trace Plugins Favourites Options Help May 19 2019
CPU Graph Log Notes Breakpoints Memory Map Call Stack SEH Script Symbols Source References Threads Snowman Handles Trace
00401450 56 push esi
00401451 53 push ebx
00401452 83EC 14 sub esp,14
00401455 833D 2850400(cmp dword ptr ds:[405028],2
0040145C 8B4424 24 mov eax,dword ptr ss:[esp+24]
00401460 74 0A je challenge1.40146C
00401462 C705 2850400(mov dword ptr ds:[405028],2
0040146C 83F8 02 cmp eax,2
0040146F 74 12 je challenge1.401483
00401471 83F8 01 cmp eax,1
00401474 74 42 je challenge1.4014B8
00401476 83C4 14 add esp,14
00401479 B8 01000000 mov eax,1
0040147E 5B pop ebx
0040147F 5E pop esi
00401480 C2 0C00 ret C
00401483 BE 14704000 mov esi,challenge1.407014
00401488 81EE 1470400(sub esi,challenge1.407014
0040148E C1FE 02 sar esi,2
00401491 85F6 test esi,esi
00401493 7E E1 jle challenge1.401476
00401495 31DB xor ebx,ebx
00401497 8B049D 14704(mov eax,dword ptr ds:[ebx*4+407014]
0040149E 85C0 test eax,eax
004014A0 74 02 je challenge1.4014A4
004014A2 FFD0 call eax
004014A4 83C3 01 add ebx,1
004014A7 39F3 cmp ebx,esi
004014A9 75 EC jne challenge1.401497
004014AB 83C4 14 add esp,14
004014AE B8 01000000 mov eax,1
004014B3 5B pop ebx
004014B4 5E pop esi
004014B5 C2 0C00 ret C
004014B8 8B4424 28 mov eax,dword ptr ss:[esp+28]
Hide FPU
EAX 00000000
EBX 00000000
ECX 00401450 challenge1.00401450
EDX 00400000 challenge1.00400000
EBP 0060F9B8
ESP 0060F99C
ESI 0060F9AC
EDI 00401450 challenge1.00401450
EIP 00401450 challenge1.00401450
EFLAGS 00000244
ZF 1 PF 1 AF 0
OF 0 SF 0 DF 0
CF 0 TF 0 IF 1
LastError 00000000 (ERROR_SUCCESS)
LastStatus C0000034 (STATUS_OBJECT_NAME_NOT_FOUND)
GS 002B FS 0053
ES 002B DS 002B
CS 0023 SS 002B
ST(0) 00000000000000000000 x87r0 Empty 0.0000000000000000
ST(1) 00000000000000000000 x87r1 Empty 0.0000000000000000
ST(2) 00000000000000000000 x87r2 Empty 0.0000000000000000
ST(3) 00000000000000000000 x87r3 Empty 0.0000000000000000
ST(4) 00000000000000000000 x87r4 Empty 0.0000000000000000
Default (stdcall) 5 Unlocked
1: [esp+4] 00400000 challenge1.00400000
2: [esp+8] 00000001
3: [esp+C] 00000000
4: [esp+10] 00000000
5: [esp+14] 00401450 challenge1.00401450
esi=0060F9AC
.text:00401450 challenge1.exe:$1450 #850
Dump 1 Dump 2 Dump 3 Dump 4 Dump 5 Watch 1 [x=] Locals Struct
Address Hex ASCII
77591000 36 00 38 00 A0 C1 59 77 1C 00 1E 00 80 C1 59 77 6.8. ÁYw.....ÁYw
77591010 28 00 2A 00 54 C1 59 77 34 00 36 00 1C C1 59 77 (.*.TÁYw4.6..ÁYw
77591020 1E 00 20 00 FC C0 59 77 1A 00 1C 00 F0 C0 59 77 .. .üÀYw....ðÀYw
77591030 18 00 1A 00 C4 C0 59 77 20 00 22 00 A0 C0 59 77 ....ÄÀYw .". ÀYw
77591040 30 00 32 00 6C C0 59 77 2C 00 2E 00 3C C0 59 77 0.2.lÀYw,...<ÀYw
77591050 20 00 22 00 18 C0 59 77 18 00 1A 00 FC BF 59 77 .".. ÀYw....ü¿Yw
77591060 10 00 12 00 E8 BF 59 77 24 00 26 00 F0 78 59 77 ....è¿Yw$.&.ðxYw
77591070 18 00 00 00 00 00 00 00 84 17 59 77 40 00 00 00 ....Yw@...
77591080 00 00 00 00 00 00 00 00 18 00 00 00 00 00 00 00 ....
77591090 7C 17 59 77 40 00 00 00 00 00 00 00 00 00 00 00 |.Yw@...........
775910A0 18 00 00 00 94 17 59 77 40 00 00 00 ....Yw@...
0060F99C 776014A6 return to ntdll.776014A6 from ???
0060F9A0 00400000 challenge1.00400000
0060F9A4 00000001
0060F9A8 00000000
0060F9AC 00000000
0060F9B0 00401450 challenge1.00401450
0060F9B4 00400000 challenge1.00400000
0060F9B8 0060FA04
0060F9BC 775CFEE7 return to ntdll.775CFEE7 from ntdll.77601490
0060F9C0 00401450 challenge1.00401450
0060F9C4 00400000 challenge1.00400000
0060F9C8 00000001
0060F9CC 00000000

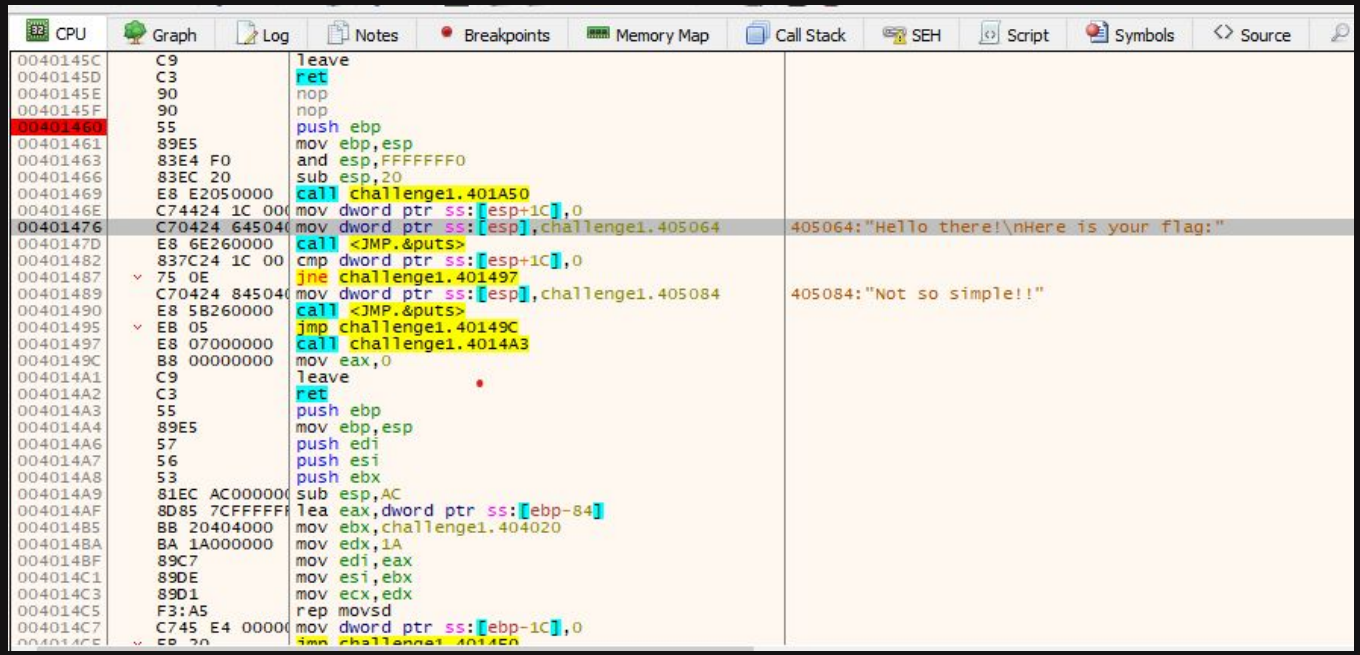
Check for strings



Check for strings

Address	Disassembly	String
00401348	mov dword ptr ss:[esp],challenge1.405000	"libgcc_s_dw2-1.dll"
0040135F	mov dword ptr ss:[esp],challenge1.405000	"libgcc_s_dw2-1.dll"
00401375	mov dword ptr ss:[esp+4],challenge1.405013	"__register_frame_info"
0040138A	mov dword ptr ss:[esp+4],challenge1.405029	"__deregister_frame_info"
004013C0	mov dword ptr ss:[esp],challenge1.405041	"libgcj-16.dll"
004013D8	mov dword ptr ss:[esp+4],challenge1.40504F	"_Jv_RegisterClasses"
00401476	mov dword ptr ss:[esp],challenge1.405064	"Hello there!\nHere is your flag:"
00401489	mov dword ptr ss:[esp],challenge1.405084	"Not so simple!!"
004019DC	test edx,800000	"A."
004019D0	mov eax,dword ptr ds:[4040AC]	"O<@"
004019E2	mov eax,dword ptr ds:[4040AC]	"O<@"
004019ED	mov dword ptr ds:[4040AC],edx	"O<@"
00401DAE	mov dword ptr ss:[esp],challenge1.405098	"Mingw runtime failure:\n"
00401EC4	mov dword ptr ss:[esp],challenge1.4050B0	" VirtualQuery failed for %d bytes at address %p"
00401F91	mov dword ptr ss:[esp],challenge1.405118	" Unknown pseudo relocation bit size %d.\n"
0040208F	mov dword ptr ss:[esp],challenge1.4050E4	" Unknown pseudo relocation protocol version %d.\n"
0040308E	cmp dword ptr ds:[esi],challenge1.405146	"glob-1.0-mingw32"
0040309D	mov dword ptr ds:[esi],challenge1.405146	"glob-1.0-mingw32"
0040316A	cmp dword ptr ds:[esi],challenge1.405146	"glob-1.0-mingw32"

Function


CPU
Graph
Log
Notes
Breakpoints
Memory Map
Call Stack
SEH
Script
Symbols
Source
0040145C C9 leave
0040145D C3 ret
0040145E 90 nop
0040145F 90 nop
00401460 55 push ebp
00401461 89E5 mov ebp,esp
00401463 83E4 F0 and esp,FFFFFFF0
00401466 83EC 20 sub esp,20
00401469 E8 E2050000 call challenge1.401A50
0040146E C74424 1C 00(mov dword ptr ss:[esp+1C],0
00401476 C70424 645040 mov dword ptr ss:[esp],challenge1.405064 405064:"Hello there!\nHere is your flag:"
0040147D E8 6E260000 call <JMP.&puts>
00401482 837C24 1C 00 cmp dword ptr ss:[esp+1C],0
00401487 75 0E jne challenge1.401497
00401489 C70424 845040 mov dword ptr ss:[esp],challenge1.405084 405084:"Not so simple!!"
00401490 E8 5B260000 call <JMP.&puts>
00401495 EB 05 jmp challenge1.40149C
00401497 E8 07000000 call challenge1.4014A3
0040149C B8 00000000 mov eax,0
004014A1 C9 leave
004014A2 C3 ret
004014A3 55 push ebp
004014A4 89E5 mov ebp,esp
004014A6 57 push edi
004014A7 56 push esi
004014A8 53 push ebx
004014A9 81EC AC000000 sub esp,AC
004014AF 8D85 7CFFFFFF lea eax,dword ptr ss:[ebp-84]
004014B5 BB 20404000 mov ebx,challenge1.404020
004014BA BA 1A000000 mov edx,1A
004014BF 89C7 mov edi,eax
004014C1 89DE mov esi,ebx
004014C3 89D1 mov ecx,edx
004014C5 F3:A5 rep movsd
004014C7 C745 E4 0000(mov dword ptr ss:[ebp-1C],0

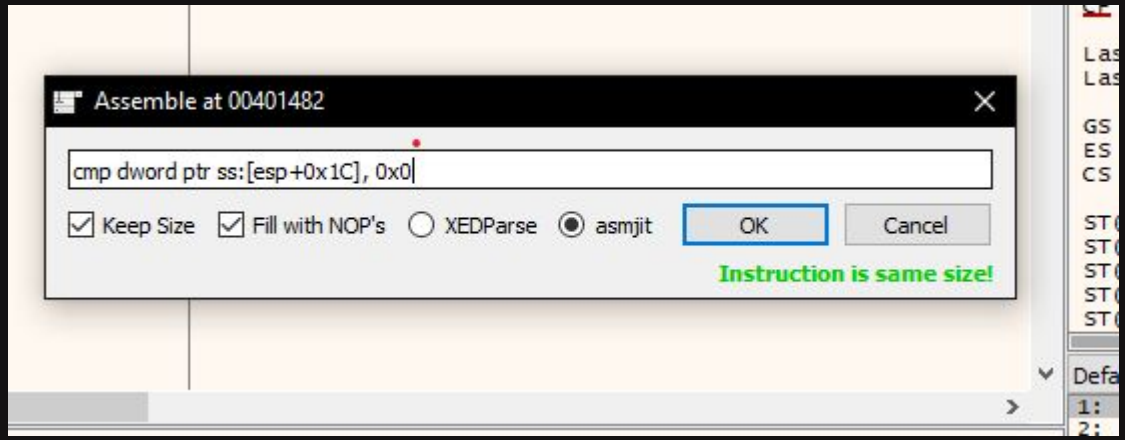
What to patch?

What to patch?

Figure it out

```
00401476    C70424 645040  mov dword ptr ss:[esp],challenge1.405064
0040147D    E8 6E260000    call <JMP.&puts>
00401482    837C24 1C 00   cmp dword ptr ss:[esp+1C],0
00401487    75 0E          jne challenge1.401497
00401489    C70424 845040  mov dword ptr ss:[esp],challenge1.405084
```

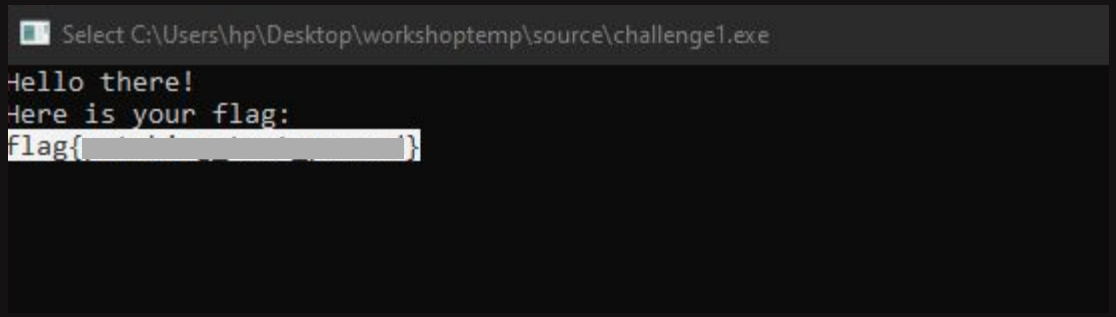
Figure it out



Patch it to:

```
00401476    C70424 64504(  mov dword ptr ss:[esp],challenge1.405064
0040147D    E8 6E260000    call <JMP.&puts>
00401482    837C24 1C 01   cmp dword ptr ss:[esp+1C],1
00401487    75 0E          jne challenge1.401497
00401489    C70424 845040  mov dword ptr ss:[esp],challenge1.405084
00401490    E8 5B260000    call <JMP.&puts>
00401495    EB 05          jmp challenge1.40149C
```

Run the executable after the patch



Practice Time

CHAL2.EXE

RUN

Walkthrouh

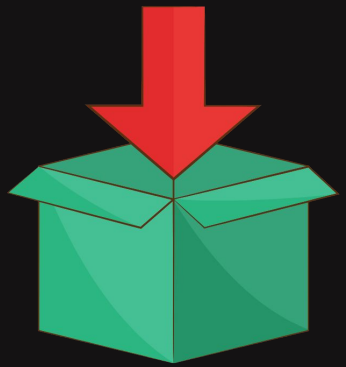
RUN

Contents

Packing

Packing

What is packing ?



Packer

A packer is software that will compress your executable files, similar to the way zip files work.

When you run the executable it will run the uncompressed code which unpacks the rest of the code and runs it.

Packing

Why to pack any application?

- ❑ To decrease the size of the file.
- ❑ To obfuscate it.
- ❑ Difficult to reverse engineer.

Packing

How packing is done?

How is Packing done?

- The the original code goes through the packing process, where it is compressed or encrypted.

How is Packing done?

- The original executable is compressed along with all its headers and placed in the new executable.
- This new executable contains:
  - New headers
  - Decompression stub
  - Packed data
- The original entry point is changed.

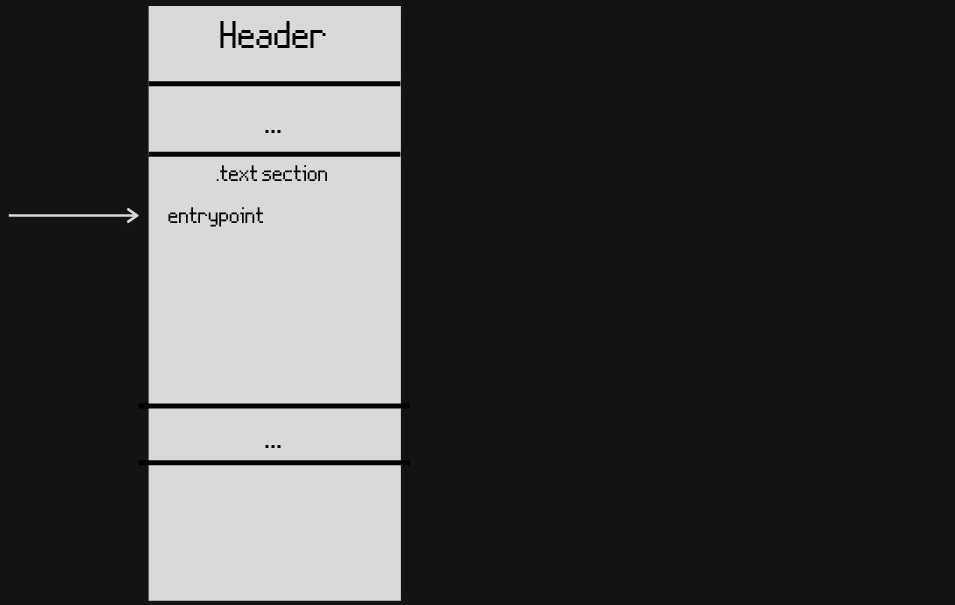
Key points

The packer will:

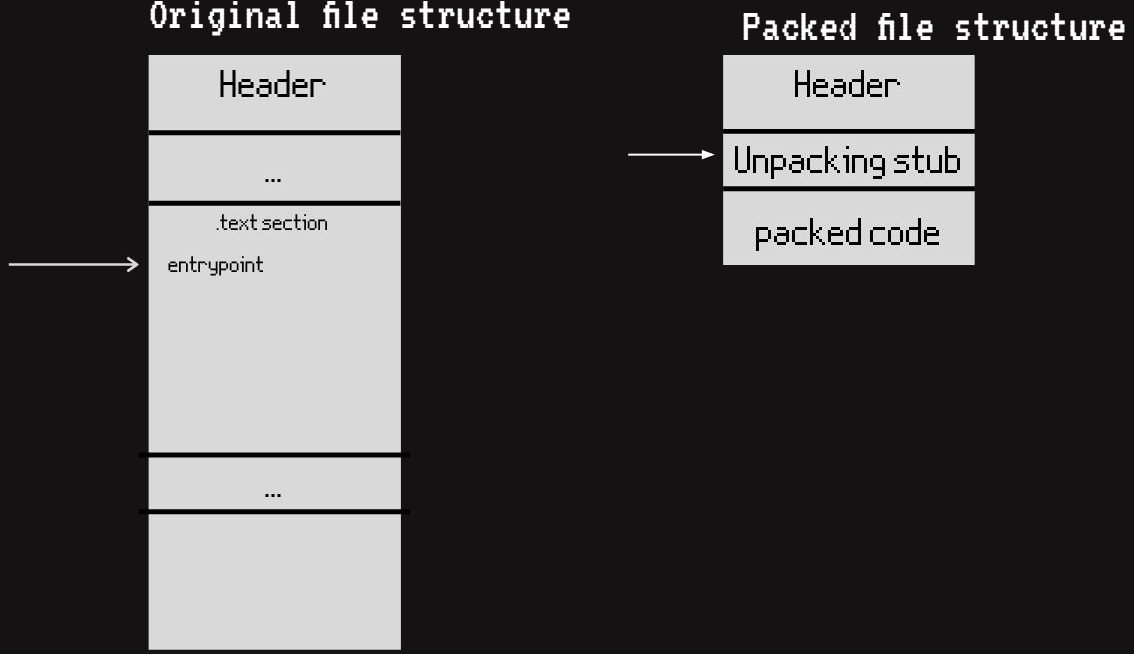
- ❑ Determine Size of original
- ❑ Setup new section(s)
- ❑ Create and add stub outside this region
- ❑ Preserve few informations
- ❑ Compress and store original data
- ❑ Write out the results

How is Packing done?

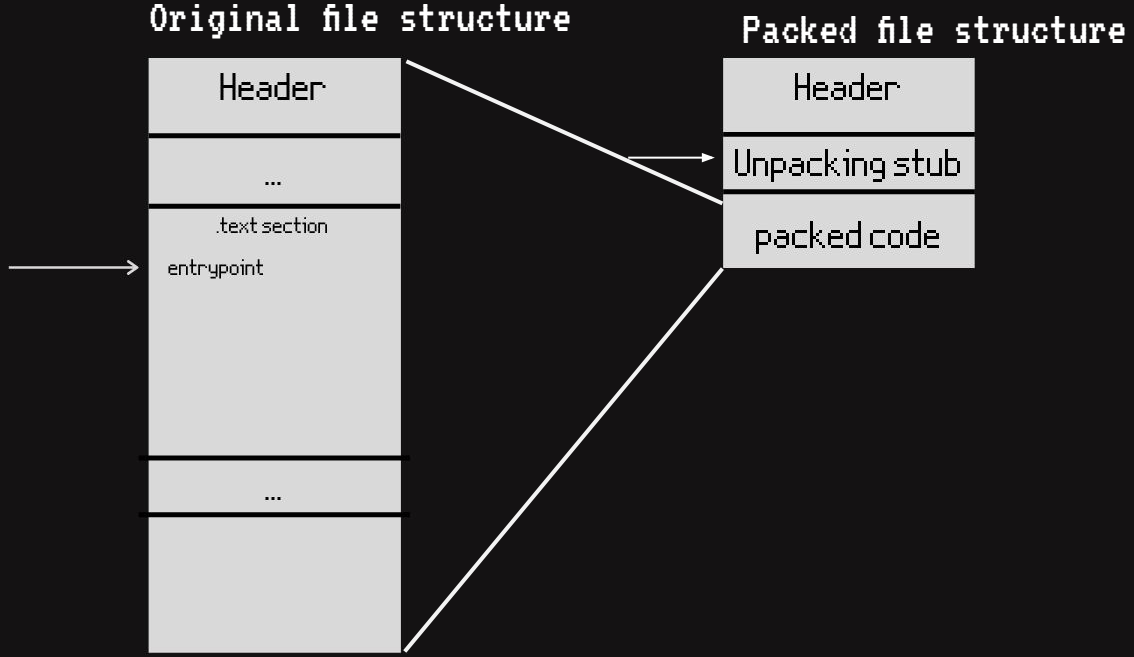
Original file structure



How is Packing done?



How is Packing done?

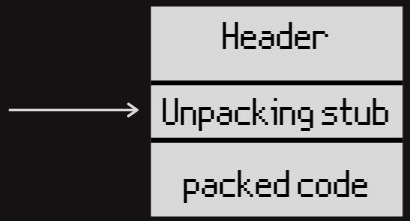


Packing

How to unpack?

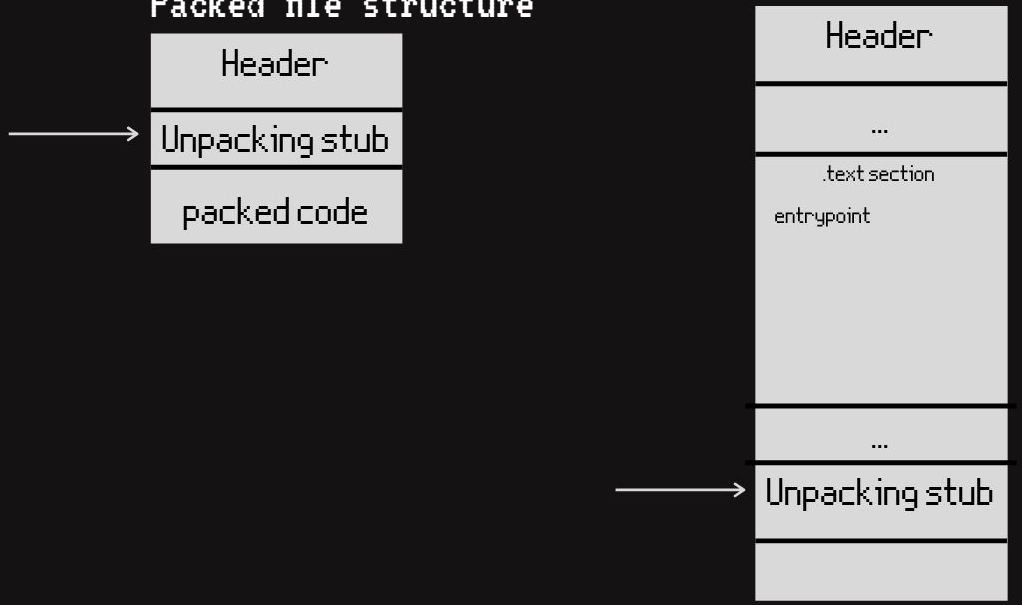
How to unpack?

Packed file structure



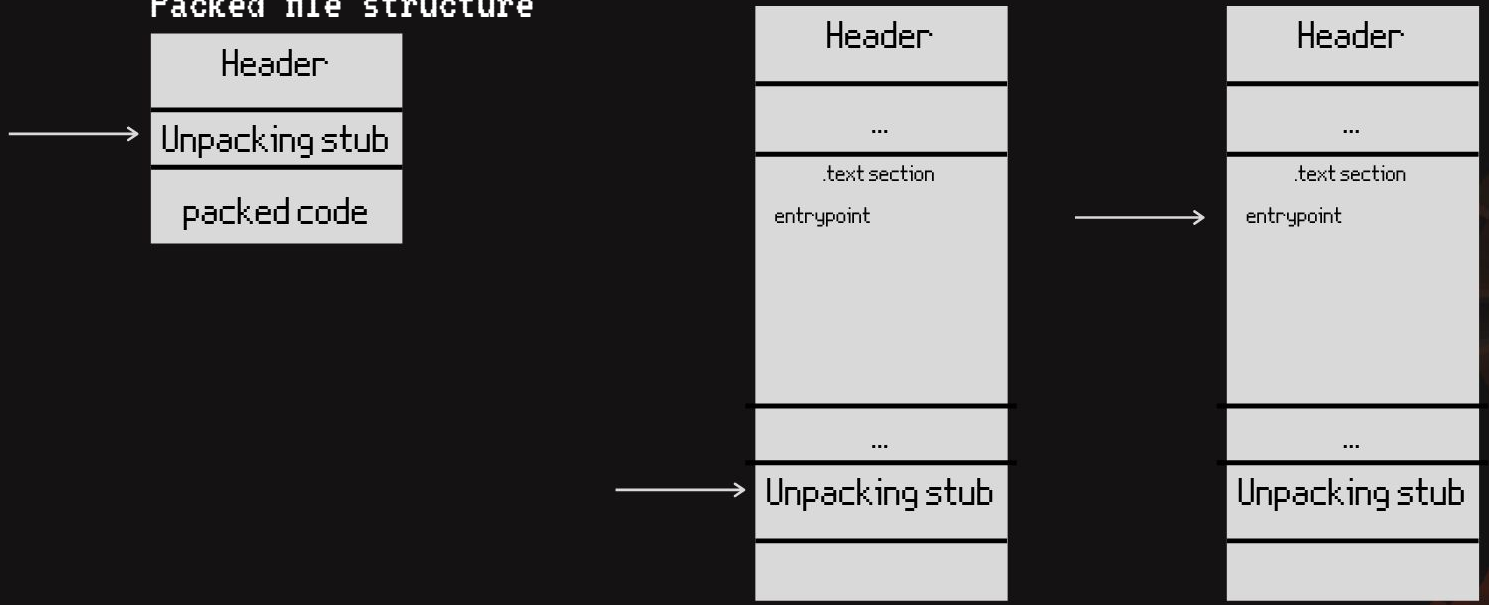
How to unpack?

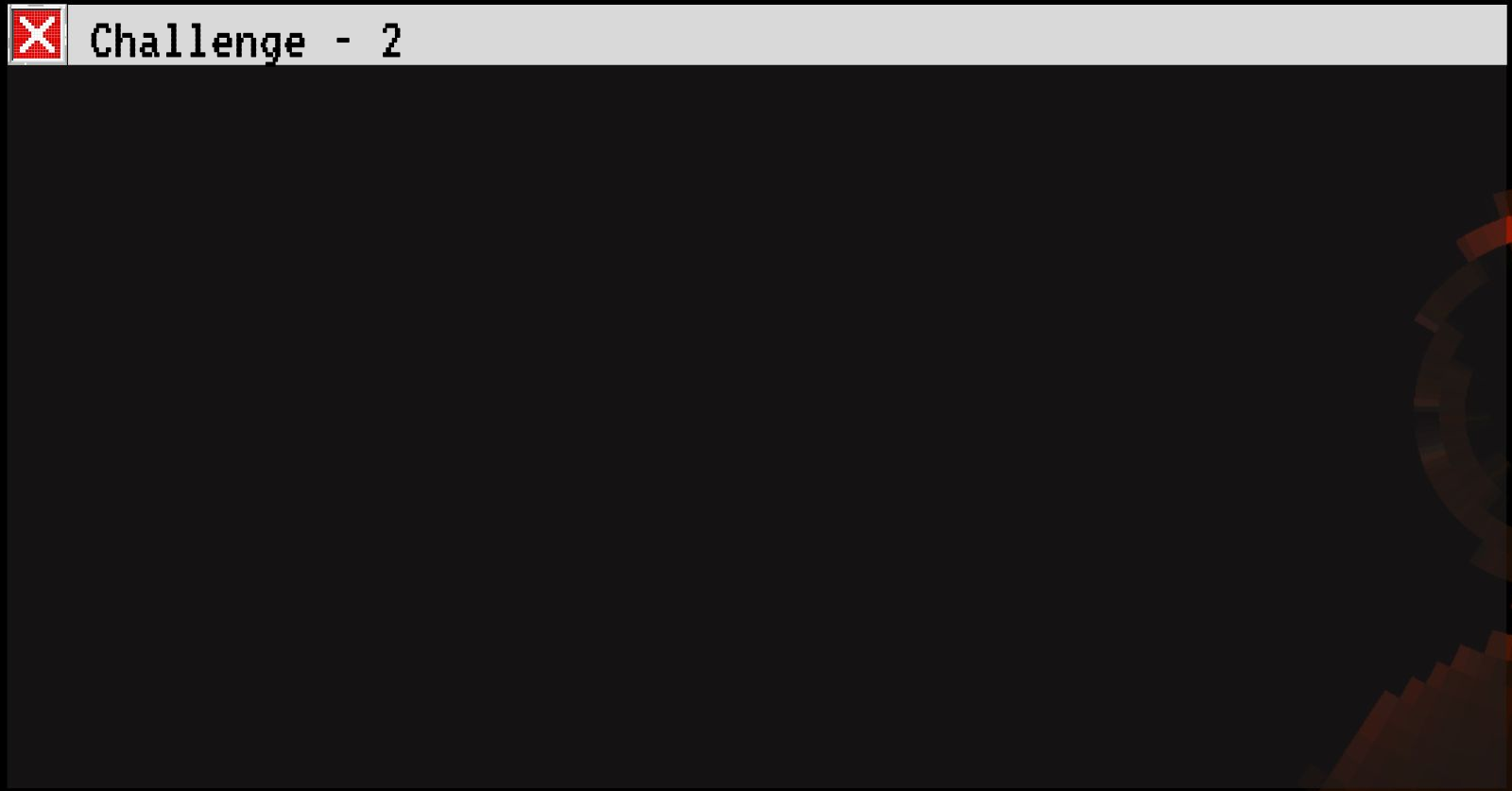
Packed file structure



How to unpack?

Packed file structure

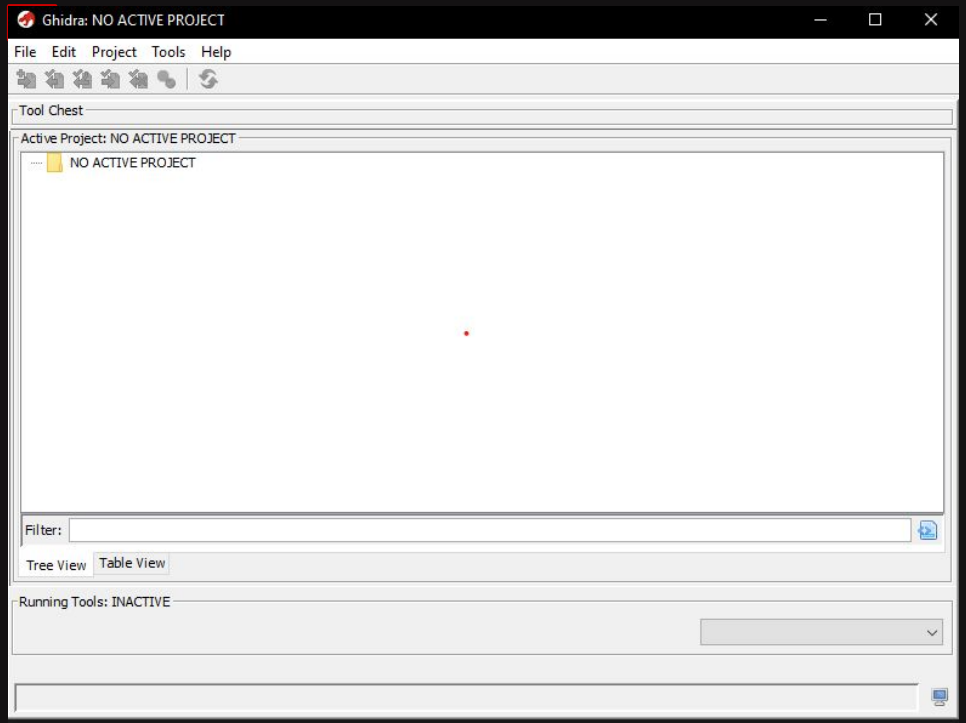



Challenge - 2

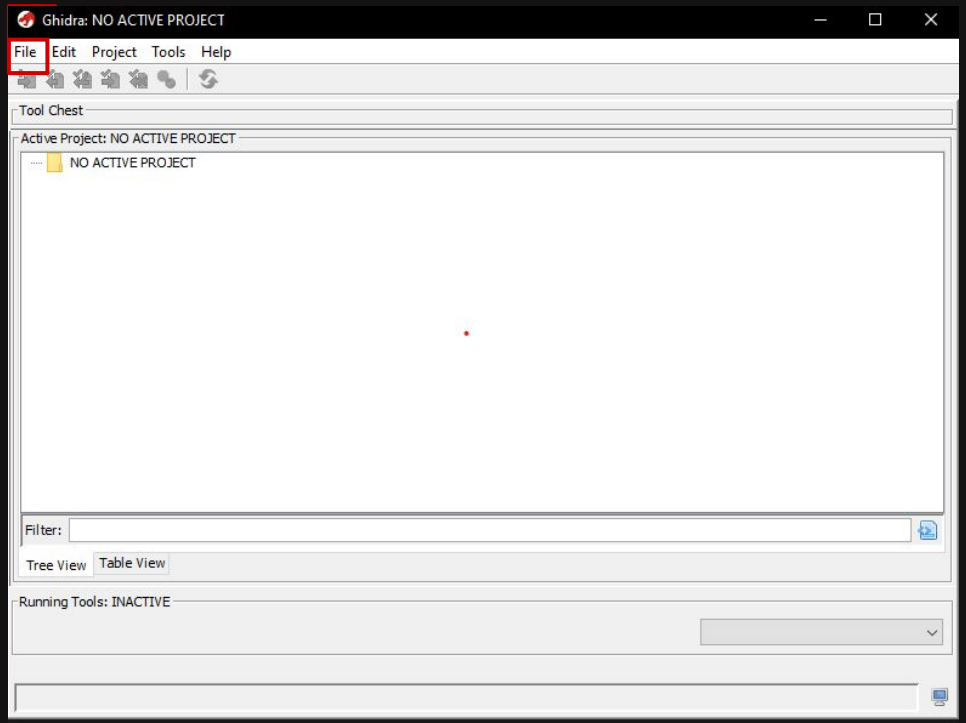
Challenge - 2

```
C:\Users\hp\Desktop\workshoptemp\challenge_file\Challenge-2>challenge2.exe
Hello there!
Enter the password:
```

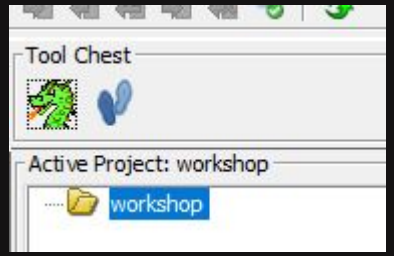
Open Ghidra


Ghidra: NO ACTIVE PROJECT
File Edit Project Tools Help
Tool Chest
Active Project: NO ACTIVE PROJECT
NO ACTIVE PROJECT
Filter:
Tree View
Table View
Running Tools: INACTIVE

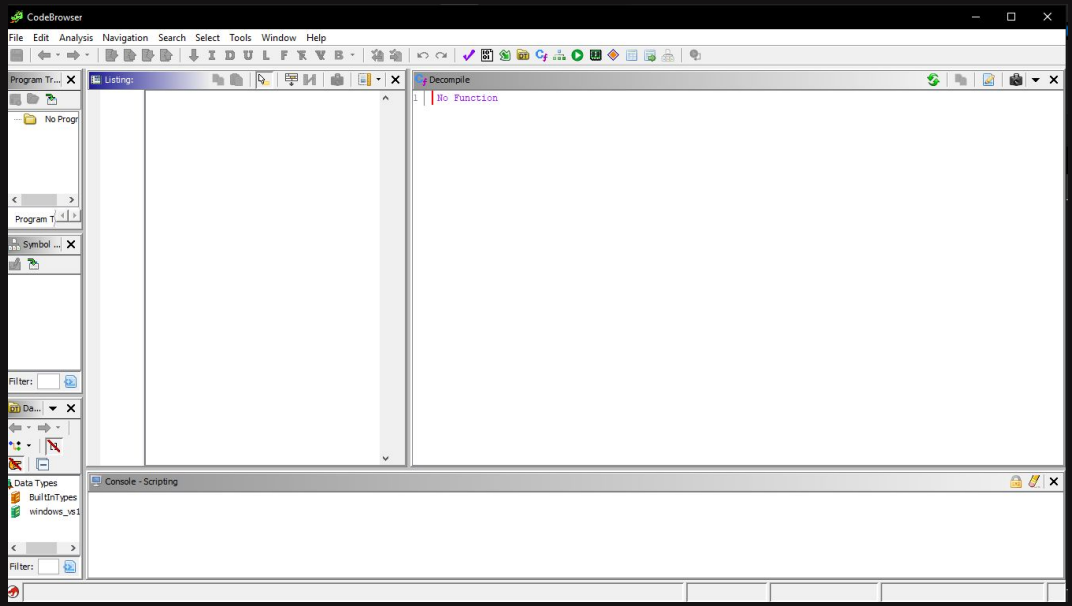
Open Ghidra


Ghidra: NO ACTIVE PROJECT
File
Edit
Project
Tools
Help
Tool Chest
Active Project: NO ACTIVE PROJECT
NO ACTIVE PROJECT
Filter:
Tree View
Table View
Running Tools: INACTIVE

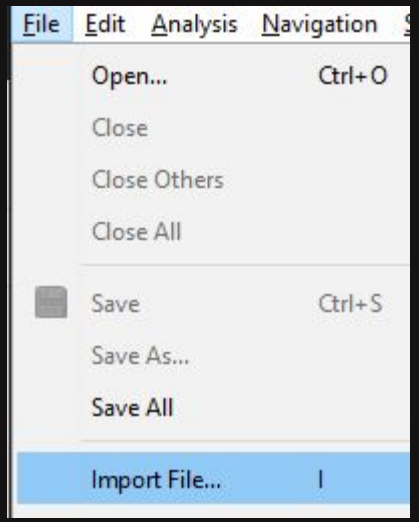
Open Ghidra



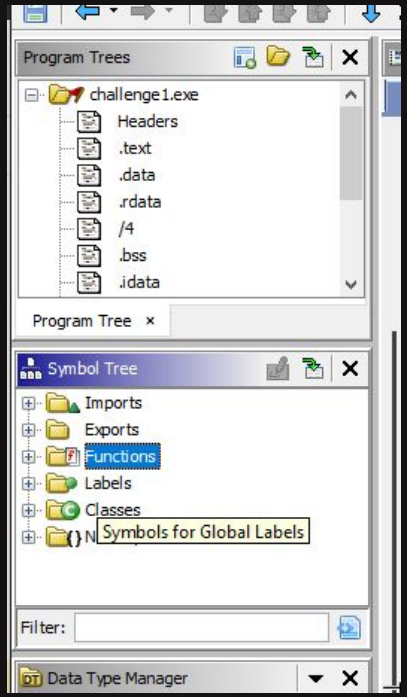
Open Ghidra


CodeBrowser
File Edit Analysis Navigation Search Select Tools Window Help
Listing:
Decompile
1 No Function
Console - Scripting
Data Types
BuiltInTypes
windows_vs1

Open Ghidra


File
Edit
Analysis
Navigation
Open... Ctrl+O
Close
Close Others
Close All
Save Ctrl+S
Save As...
Save All
Import File... I

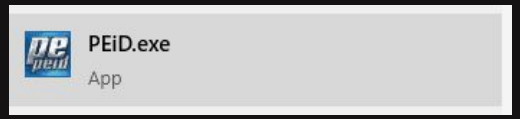
Open Ghidra

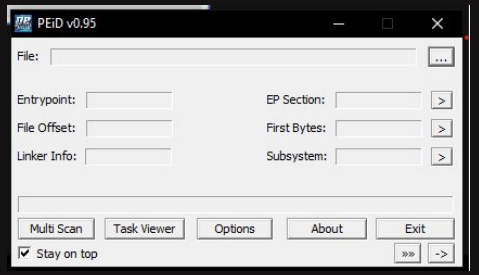

Program Trees
challenge1.exe
Headers
.text
.data
.rdata
/4
.bss
.idata
Program Tree
Symbol Tree
Imports
Exports
Functions
Labels
Classes
Symbols for Global Labels
Filter:
Data Type Manager

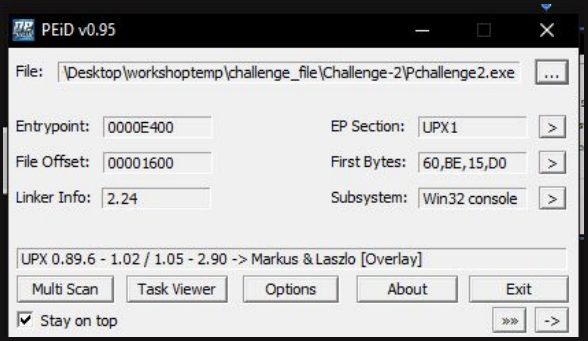
Open Ghidra


Symbol Tree
Imports
Exports
Functions
entry
Labels
Classes
Namespaces
Filter:

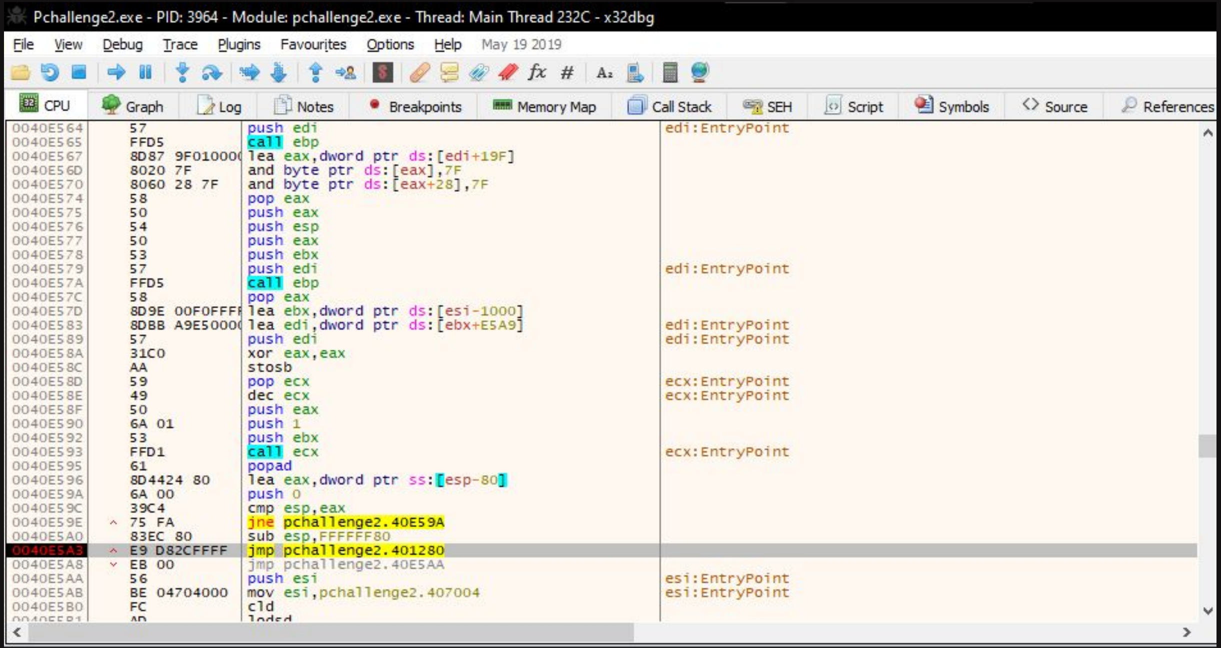
PEiD


PEiD.exe
App


PEiD v0.95
File:
...
Entrypoint:
EP Section:
>
File Offset:
First Bytes:
>
Linker Info:
Subsystem:
>
Multi Scan
Task Viewer
Options
About
Exit
Stay on top
»»
->

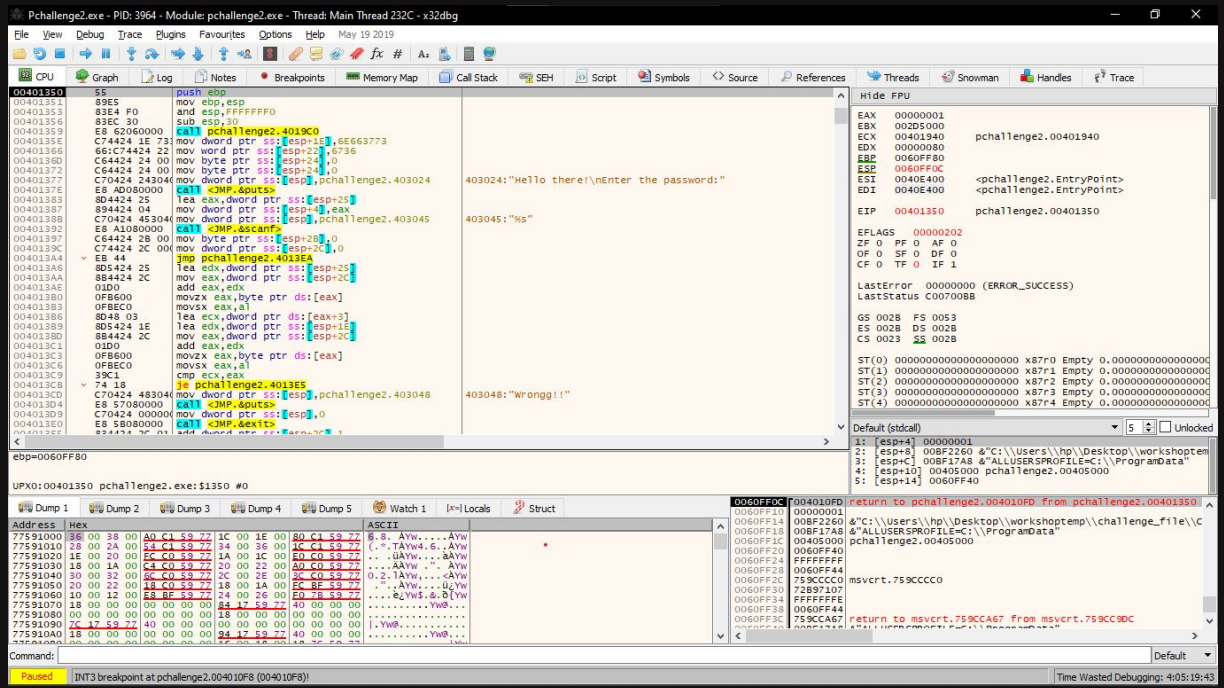

PEiD v0.95
File:
\Desktop\workshoptemp\challenge_file\Challenge-2\Pchallenge2.exe
...
Entrypoint:
0000E400
EP Section:
UPX1
>
File Offset:
00001600
First Bytes:
60,BE,15,D0
>
Linker Info:
2.24
Subsystem:
Win32 console
>
UPX 0.89.6 - 1.02 / 1.05 - 2.90 -> Markus & Laszlo [Overlay]
Multi Scan
Task Viewer
Options
About
Exit
Stay on top
»»
->

Demo



Pchallenge2.exe - PID: 3964 - Module: pchallenge2.exe - Thread: Main Thread 232C - x32dbg
File View Debug Trace Plugins Favourites Options Help May 19 2019
CPU Graph Log Notes Breakpoints Memory Map Call Stack SEH Script Symbols Source References
0040E564 57 push edi edi:EntryPoint
0040E565 FFD5 call ebp
0040E567 8D87 9F010000 lea eax,dword ptr ds:[edi+19F]
0040E56D 8020 7F and byte ptr ds:[eax],7F
0040E570 8060 28 7F and byte ptr ds:[eax+28],7F
0040E574 58 pop eax
0040E575 50 push eax
0040E576 54 push esp
0040E577 50 push eax
0040E578 53 push ebx
0040E579 57 push edi edi:EntryPoint
0040E57A FFD5 call ebp
0040E57C 58 pop eax
0040E57D 8D9E 00F0FFFF lea ebx,dword ptr ds:[esi-1000]
0040E583 8DBB A9E50000 lea edi,dword ptr ds:[ebx+E5A9] edi:EntryPoint
0040E589 57 push edi edi:EntryPoint
0040E58A 31C0 xor eax,eax
0040E58C AA stosb
0040E58D 59 pop ecx ecx:EntryPoint
0040E58E 49 dec ecx ecx:EntryPoint
0040E58F 50 push eax
0040E590 6A 01 push 1
0040E592 53 push ebx
0040E593 FFD1 call ecx ecx:EntryPoint
0040E595 61 popad
0040E596 8D4424 80 lea eax,dword ptr ss:[esp-80]
0040E59A 6A 00 push 0
0040E59C 39C4 cmp esp,eax
0040E59E 75 FA jne pchallenge2.40E59A
0040E5A0 83EC 80 sub esp,FFFFFF80
0040E5A3 E9 D82CFFFF jmp pchallenge2.401280
0040E5A8 EB 00 jmp pchallenge2.40E5AA
0040E5AA 56 push esi esi:EntryPoint
0040E5AB BE 04704000 mov esi,pchallenge2.407004 esi:EntryPoint
0040E5B0 FC cld

Demo



b10s

Team hakti143

Demo

```
00401387    894424 04       mov dword ptr ss:[esp+4],eax
0040138B    C70424 453040   mov dword ptr ss:[esp],pchallenge2.403045
00401392    E8 A1080000     call <JMP.&scanf>
00401397    C64424 2B 00    mov byte ptr ss:[esp+2B],0
0040139C    C74424 2C 000   mov dword ptr ss:[esp+2C],0
004013A4    EB 44           jmp pchallenge2.4013EA
004013A6    8D5424 25       lea edx,dword ptr ss:[esp+25]
004013AA    8B4424 2C       mov eax,dword ptr ss:[esp+2C]
004013AE    01D0            add eax,edx
004013B0    0FB600          movzx eax,byte ptr ds:[eax]
004013B3    0FBEC0          movsx eax,al
004013B6    8D48 03         lea ecx,dword ptr ds:[eax+3]
004013B9    8D5424 1E       lea edx,dword ptr ss:[esp+1E]
004013BD    8B4424 2C       mov eax,dword ptr ss:[esp+2C]
004013C1    01D0            add eax,edx
004013C3    0FB600          movzx eax,byte ptr ds:[eax]
004013C6    0FBEC0          movsx eax,al
004013C9    39C1            cmp ecx,eax
004013CB    74 18           je pchallenge2.4013E5
```

Challenge - 2

```
C:\Users\hp\Desktop\workshoptemp\challenge_file\Challenge-2>challenge2.exe
Hello there!
Enter the password:

correct!!!
```

Practice Time

CHAL2.EXE

RUN

Walkthrouh

RUN

Some statistics

Packed Malwares

Packed Malwares

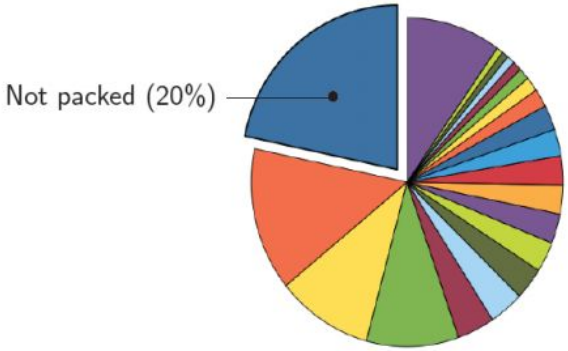


Fig. 1. Malware and packing, 80% of new malware are packed with various packers, 50% of new malware samples are simply repacked versions of existing malware [8].

https://www.researchgate.net/publication/307843262_Generic_Packing_Detection_Using_Several_Complexity_Analysis_for_Accurate_Malware_Detection

What is a DLL?

Dynamic link library

- It is a library that contains code and data which can be used by more than one program at the same time.

What is a DLL?

Dynamic link library

- It is a library that contains code and data which can be used by more than one program at the same time.
- Shared library concept

What is a DLL?

Dynamic link library

Dynamic link library

- It is a library that contains code and data which can be used by more than one program at the same time.
- Shared library concept
- Same file format as PE.
- Cannot execute on their own.

DLL

Advantages:

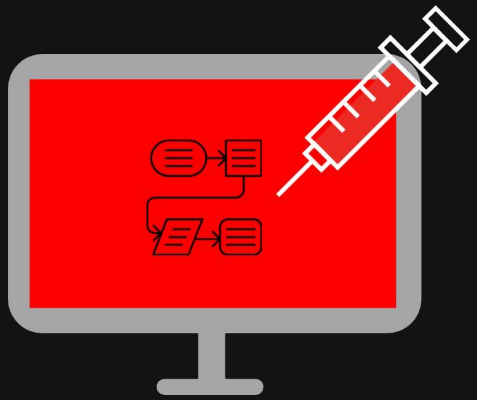
- ❑ Modularisation of code.
- ❑ Low resource consumption.
- ❑ Eases the process of development/modification

DLL injection

- DLL injection is a technique used for executing code within the program, by forcing it to load and run a dynamic library that was not actually meant by its original design.

DLL injection

- Injector process
- Target process

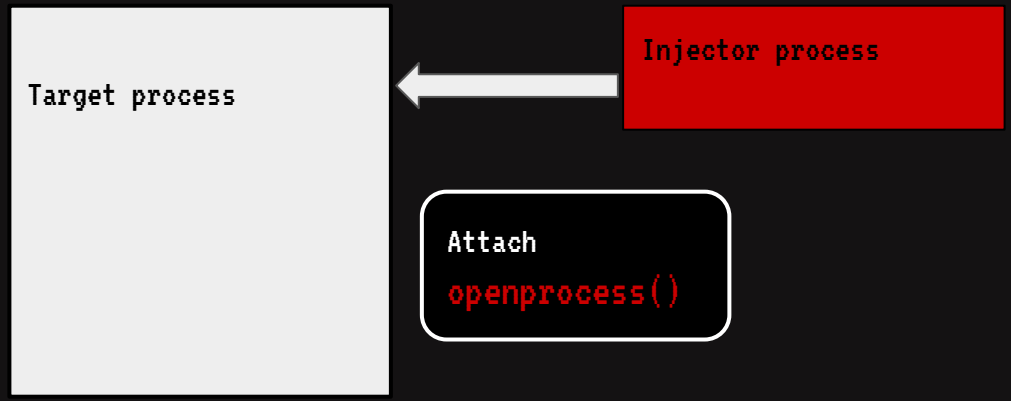


DLL injection

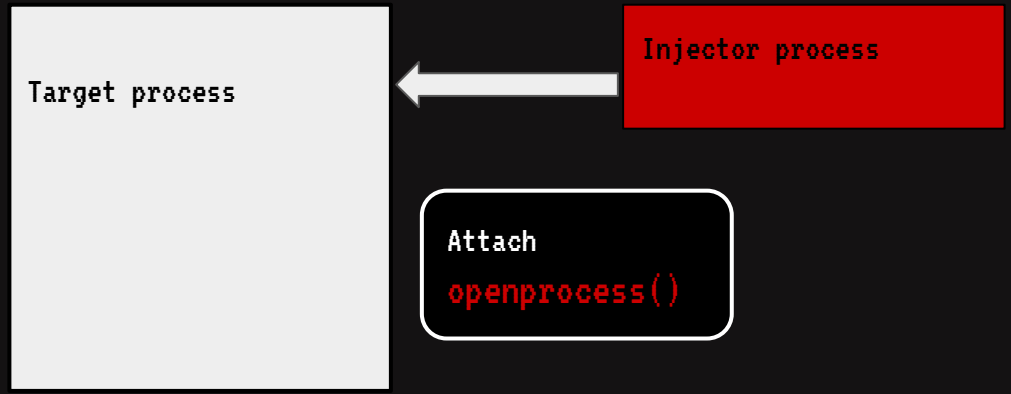
Target process

Injector process

DLL injection

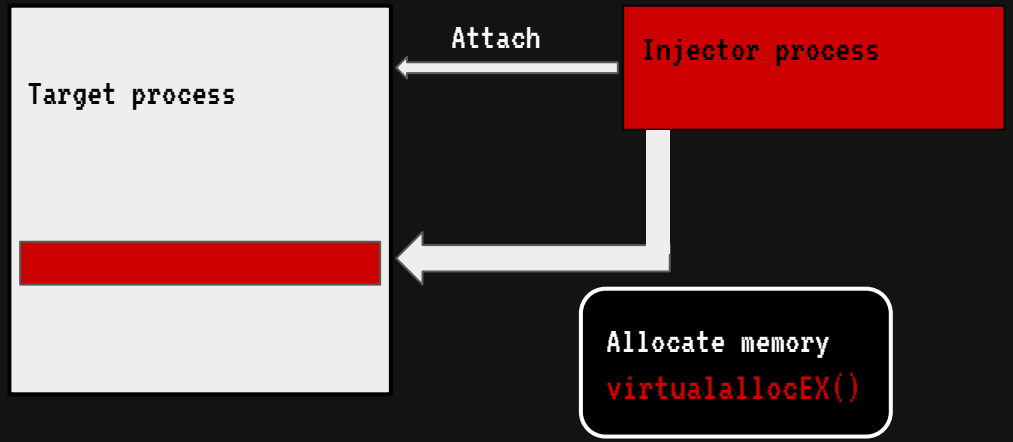


DLL injection

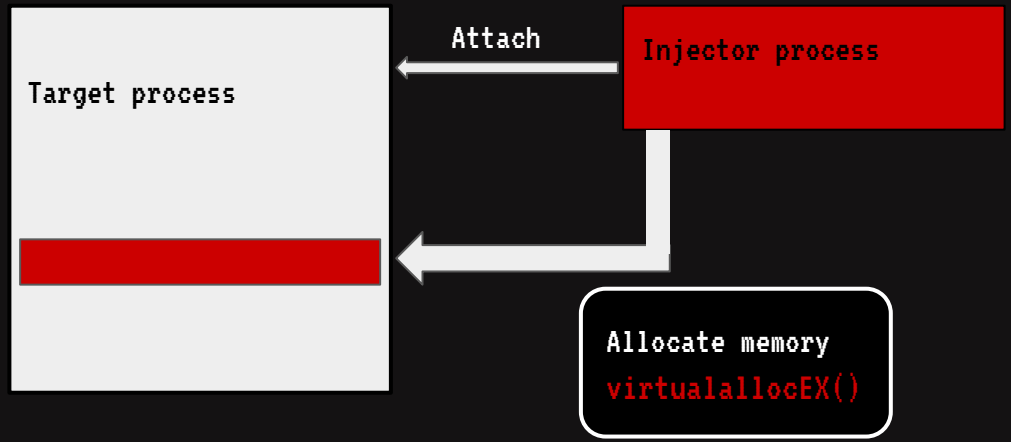



```
HANDLE process = OpenProcess(PROCESS_ALL_ACCESS, 0, process_id);
```

DLL injection

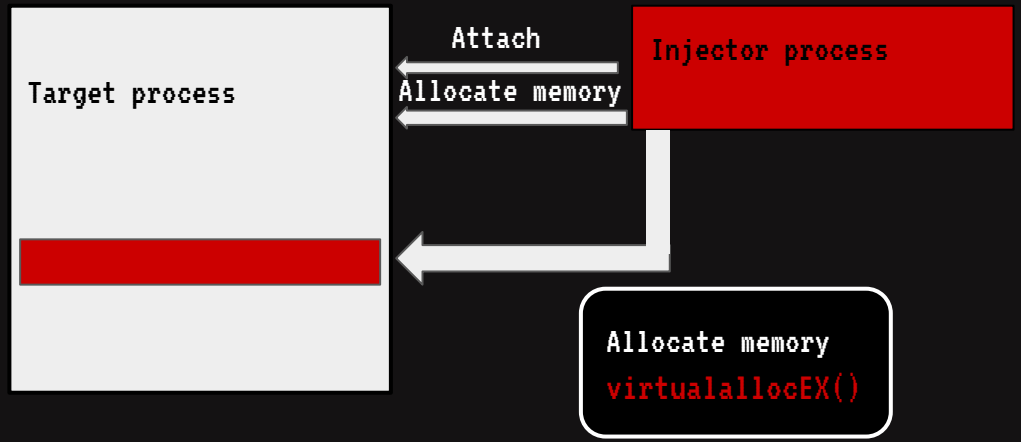


DLL injection



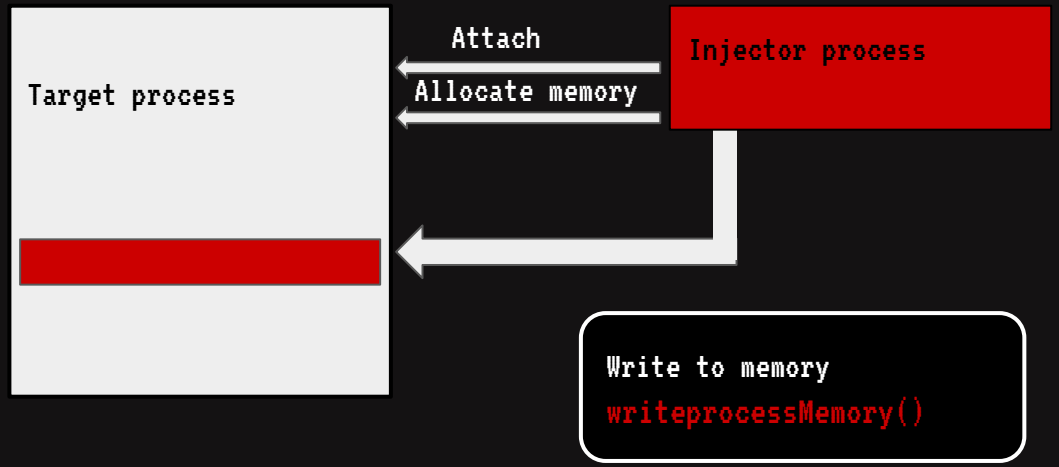

```
base_address = VirtualAllocEx(process, NULL, sizeof(pathDLL), MEM_COMMIT | MEM_RESERVE, PAGE_EXECUTE_READWRITE);
```

DLL injection

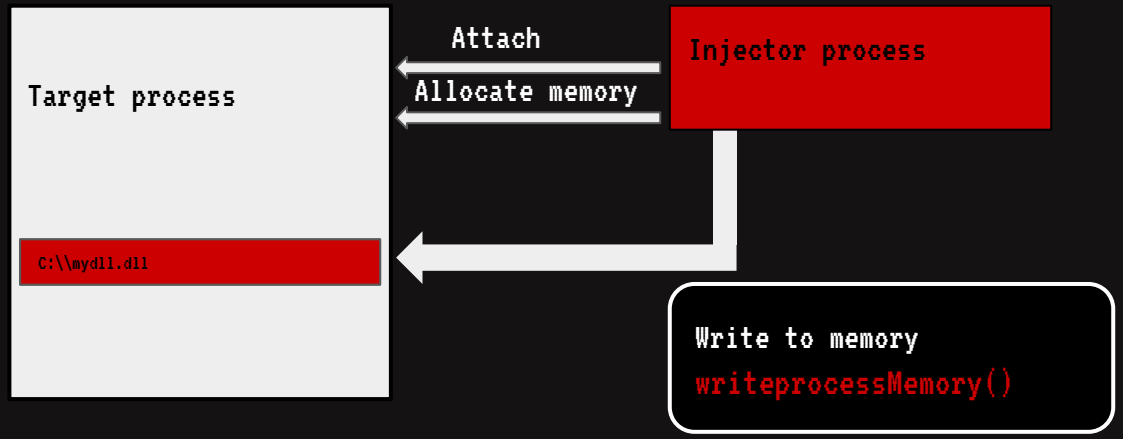



```
base_address = VirtualAllocEx(process, NULL, sizeof(pathDLL), MEM_COMMIT | MEM_RESERVE, PAGE_EXECUTE_READWRITE);
```

DLL injection

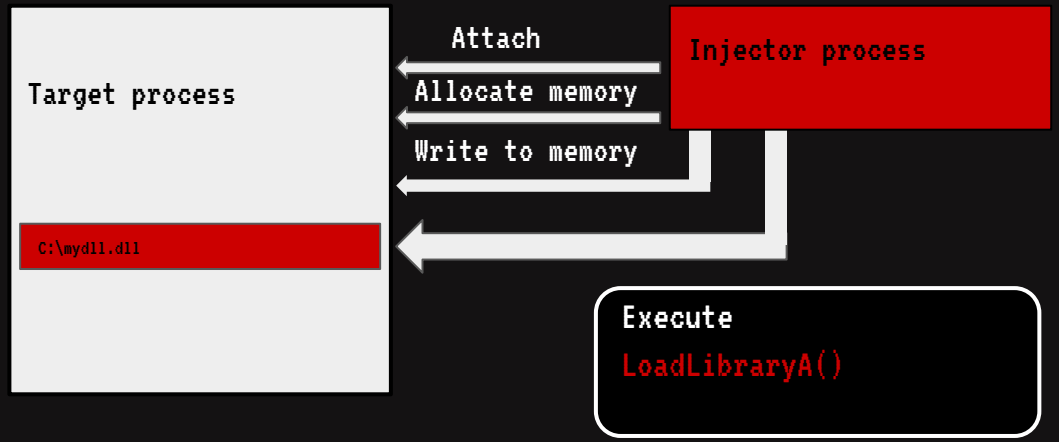


DLL injection

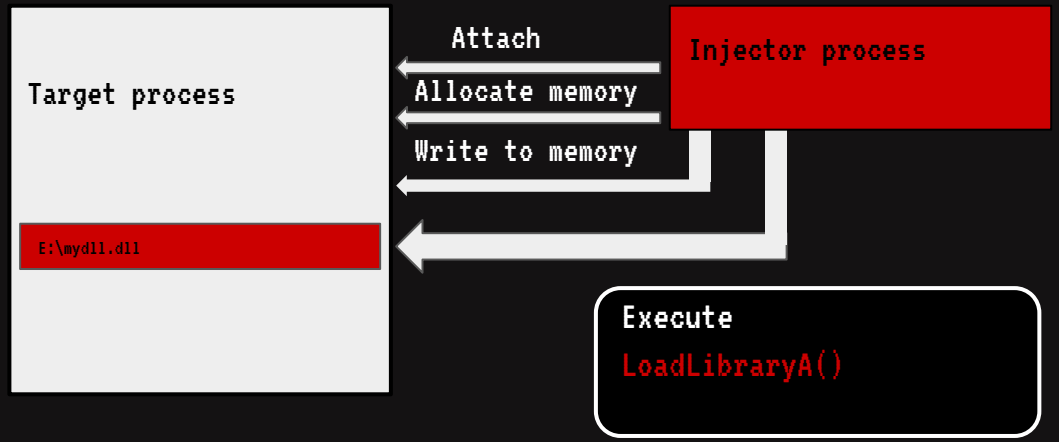



```
WriteProcessMemory(process, base_address, pathDLL, strlen(pathDLL), NULL)
```

DLL injection

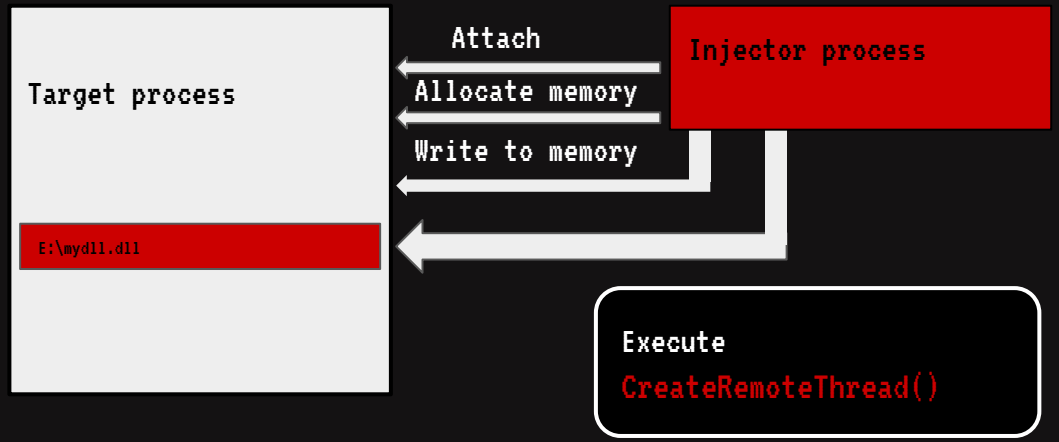


DLL injection

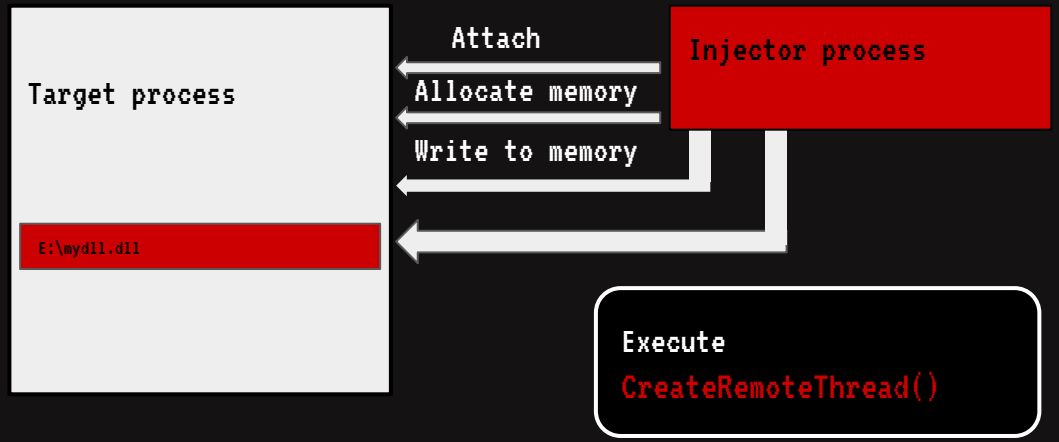



```
LPVOID addr = (LPVOID)GetProcAddress(GetModuleHandle("kernel32.dll"), "LoadLibraryA");
```

DLL injection



DLL injection




```
HANDLE threadID = CreateRemoteThread(process, NULL,0,(LPTHREAD_START_ROUTINE)addr,base_address, 0, NULL);
```

Tada

Success !!

Practice Time

challenge4.exe

RUN

Challenge - 3

Inject.exe

Victim.exe

Mydll.dll

Challenge - 3

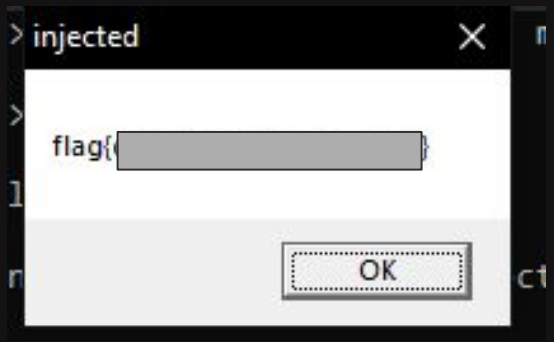
> Run Victim.exe

> open procexp.exe

> take the PID of victim.exe

> use inject.exe to inject mydll.dll

Challenge - 3



Walkthrouh

Contents

- Malware use these concepts to attack.
- Embed it into existing processes so that they can remain undetected and launch and execute additional successful attacks.
- Not all the Malwares are the same so be prepared for a new one.

Anything can happen at any moment

Contents

- ❑ Danger is not just for a Personal Computer
- ❑ Weaponized malwares can affect:
  - ❑ Personal systems
  - ❑ Public infrastructures
  - ❑ Power grids
  - ❑ Nuclear plants
  - ...

References

https://www.forcepoint.com/cyber-edu/malware

https://blog.kowalczyk.info/articles/pefileformat.html#:~:text=Each%20data%20directory%20indicates%20how,sections%20for%20code%20and%20data.

https://en.wikipedia.org/wiki/DLL_injection#:~:text=In%20computer%20programming%2C%20DLL%20injection,did%20not%20anticipate%20or%20intend.

Any Questions ?

Thank You

STAY SAFE