How to be a malware analyst/research

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About me

- Ex-Malware Analyst/Researcher
- Coder and Reverser
- Wannabe entrepreneur
- Programming languages enthusiast

Who is malware analyst

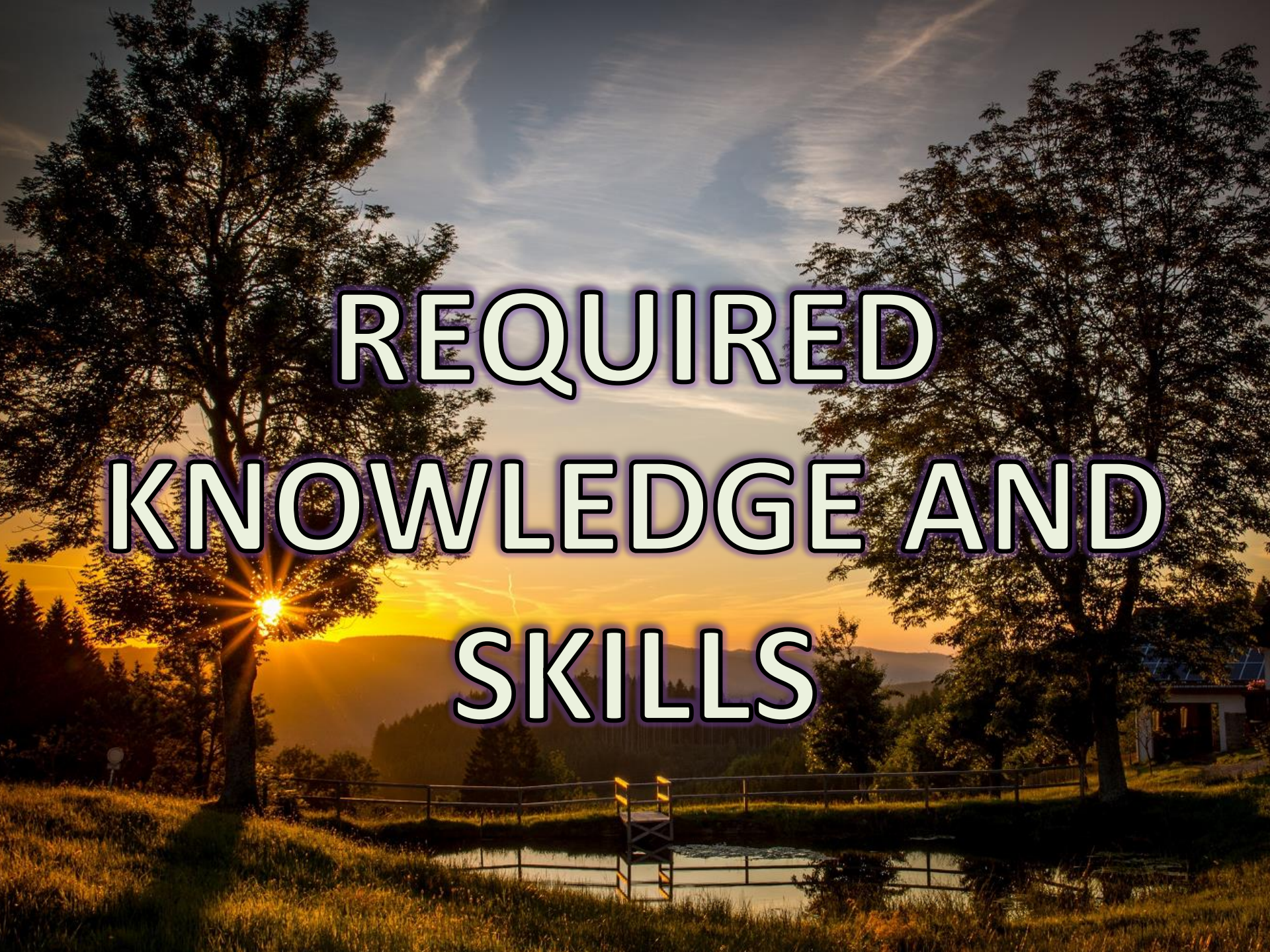
- Somebody who analyzes and studies malware by using some techniques and tools

What kind of analyst

- Two categories of malware analyst
- First:
  - Only do dynamic analysis
  - Using dynamic analysis tools such Sysinternals Suite, sandboxes, etc
- Second:
  - All of above
  - Analyze deeper, static analysis and debugging

How to be malware analyst

- Required knowledge and skills
- Learning paths


REQUIRED
KNOWLEDGE AND
SKILLS

Quiz 1

```
void function1(void *a, void *b, size_t n)
{
    char *x = (char *)b;
    char *y = (char *)a;

    for (int i=0; i<n; i++) {
        y[i] = x[i];
    }
}
```

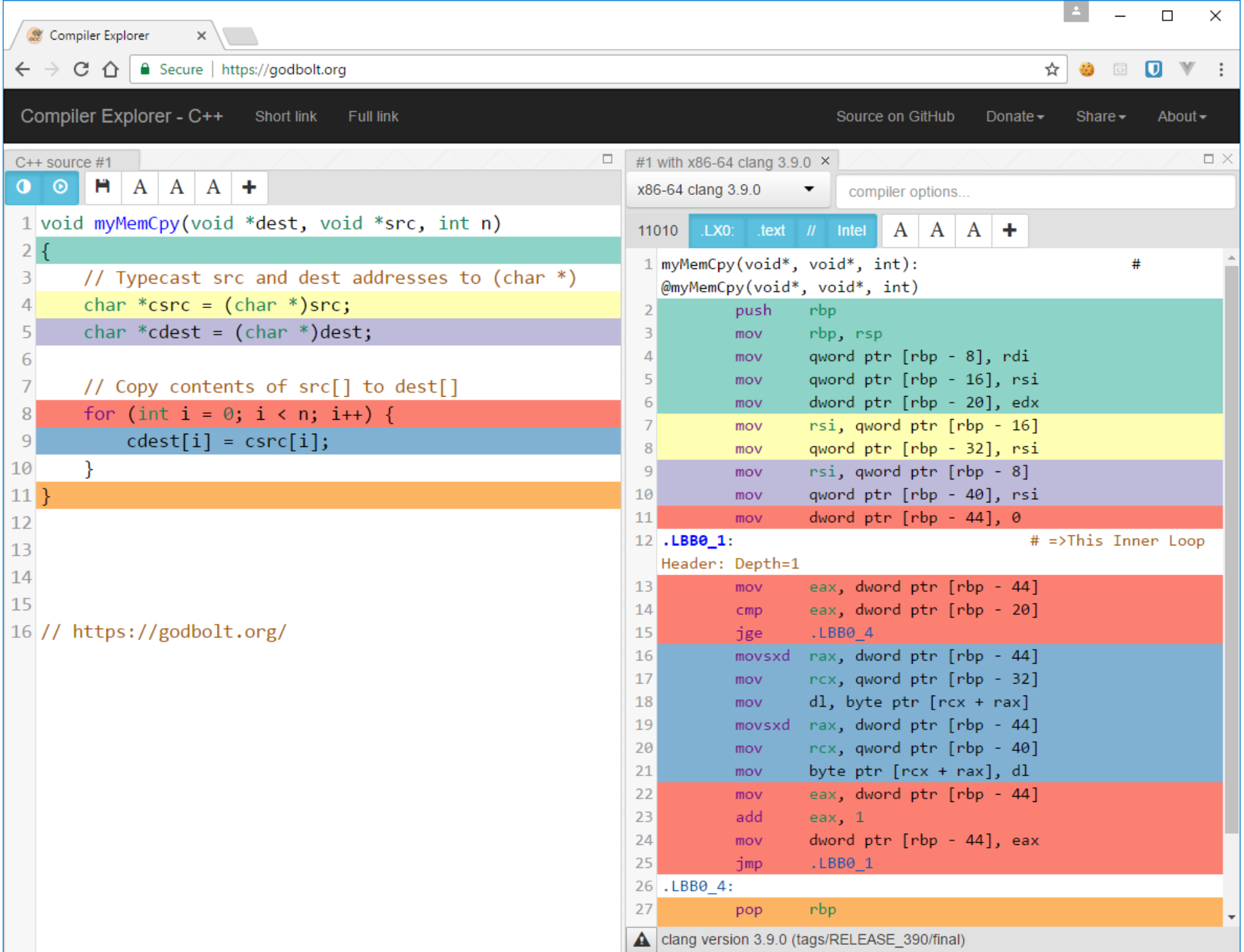
Quiz 2

```
01061020  PUSH EBP
01061021  MOV EBP,ESP
01061023  PUSH ECX
01061024  MOV DWORD PTR SS:[EBP-4],0
0106102B  JMP SHORT 01061036
0106102D  MOV EAX,DWORD PTR SS:[EBP-4]
01061030  ADD EAX,1
01061033  MOV DWORD PTR SS:[EBP-4],EAX
01061036  MOV ECX,DWORD PTR SS:[EBP-4]
01061039  CMP ECX,DWORD PTR SS:[EBP+10]
0106103C  JAE SHORT 01061050
0106103E  MOV EDX,DWORD PTR SS:[EBP+8]
01061041  ADD EDX,DWORD PTR SS:[EBP-4]
01061044  MOV EAX,DWORD PTR SS:[EBP+0C]
01061047  ADD EAX,DWORD PTR SS:[EBP-4]
0106104A  MOV CL,BYTE PTR DS:[EAX]
0106104C  MOV BYTE PTR DS:[EDX],CL
0106104E  JMP SHORT 0106102D
01061050  MOV ESP,EBP
01061052  POP EBP
01061053  RETN
```

Answer

```
void myMemCpy(void *dest, void *src, size_t n)
{
    // Typecast src and dest addresses to (char *)
    char *csrc = (char *)src;
    char *cdest = (char *)dest;

    // Copy contents of src[] to dest[]
    for (int i=0; i<n; i++) {
        cdest[i] = csrc[i];
    }
}
```

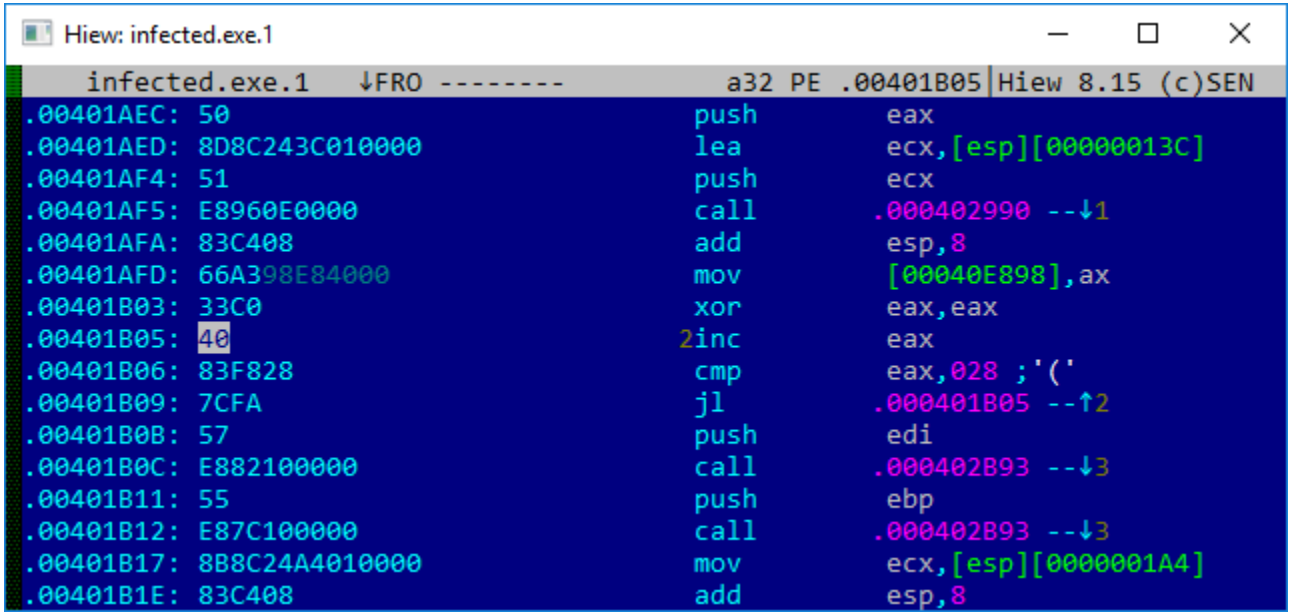

Compiler Explorer
Secure | https://godbolt.org
Compiler Explorer - C++
Short link
Full link
Source on GitHub
Donate
Share
About
C++ source #1
#1 with x86-64 clang 3.9.0
x86-64 clang 3.9.0
compiler options...
11010
.LX0:
.text
//
Intel
1 void myMemCpy(void *dest, void *src, int n)
2 {
3 // Typecast src and dest addresses to (char *)
4 char *csrc = (char *)src;
5 char *cdest = (char *)dest;
6
7 // Copy contents of src[] to dest[]
8 for (int i = 0; i < n; i++) {
9 cdest[i] = csrc[i];
10 }
11 }
16 // https://godbolt.org/
1 myMemCpy(void*, void*, int): #
@myMemCpy(void*, void*, int)
2 push rbp
3 mov rbp, rsp
4 mov qword ptr [rbp - 8], rdi
5 mov qword ptr [rbp - 16], rsi
6 mov dword ptr [rbp - 20], edx
7 mov rsi, qword ptr [rbp - 16]
8 mov qword ptr [rbp - 32], rsi
9 mov rsi, qword ptr [rbp - 8]
10 mov qword ptr [rbp - 40], rsi
11 mov dword ptr [rbp - 44], 0
12 .LBB0_1: # =>This Inner Loop
Header: Depth=1
13 mov eax, dword ptr [rbp - 44]
14 cmp eax, dword ptr [rbp - 20]
15 jge .LBB0_4
16 movsxd rax, dword ptr [rbp - 44]
17 mov rcx, qword ptr [rbp - 32]
18 mov dl, byte ptr [rcx + rax]
19 movsxd rax, dword ptr [rbp - 44]
20 mov rcx, qword ptr [rbp - 40]
21 mov byte ptr [rcx + rax], dl
22 mov eax, dword ptr [rbp - 44]
23 add eax, 1
24 mov dword ptr [rbp - 44], eax
25 jmp .LBB0_1
26 .LBB0_4:
27 pop rbp
clang version 3.9.0 (tags/RELEASE_390/final)

Required knowledge

- Basic computer architecture
- Operating System
- Native OS API
- C/C++ programming
- Assembly language programming
- Executable file format
- Scripting (Python, Javascript, VB Script)

Required knowledge – cont.

- Reverse engineering
  - **[Program] reading comprehension**
  - Disassembling, decompiling, and debugging techniques



Pressing F8 in OllyDBG


Learning Paths

How to start

- Start with C programming
  - C programming language
  - Learn how to use debugger to debug your C program
- Assembly language for the platform architecture
  - x86 or ARM
- Scripting (Python, Javascript)

Operating System Internal

- Process
- Virtual memory
- Executable file format

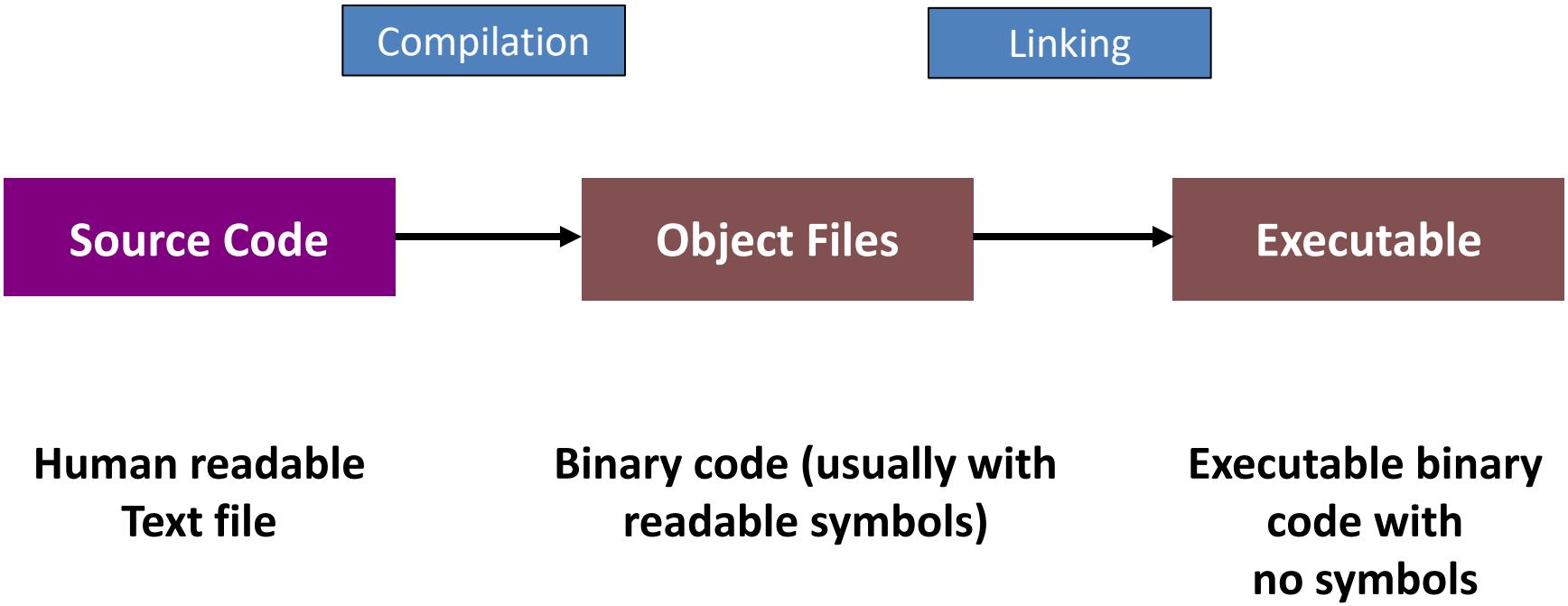
Reverse engineering

- Reverse Engineering is also known as RE or RCE
  - RE: Reverse Engineering
  - RCE: Reverse Code Engineering
- RE is the process of understanding an existing product. In our case, malicious software.
- Malware analysis and security research often involves RE

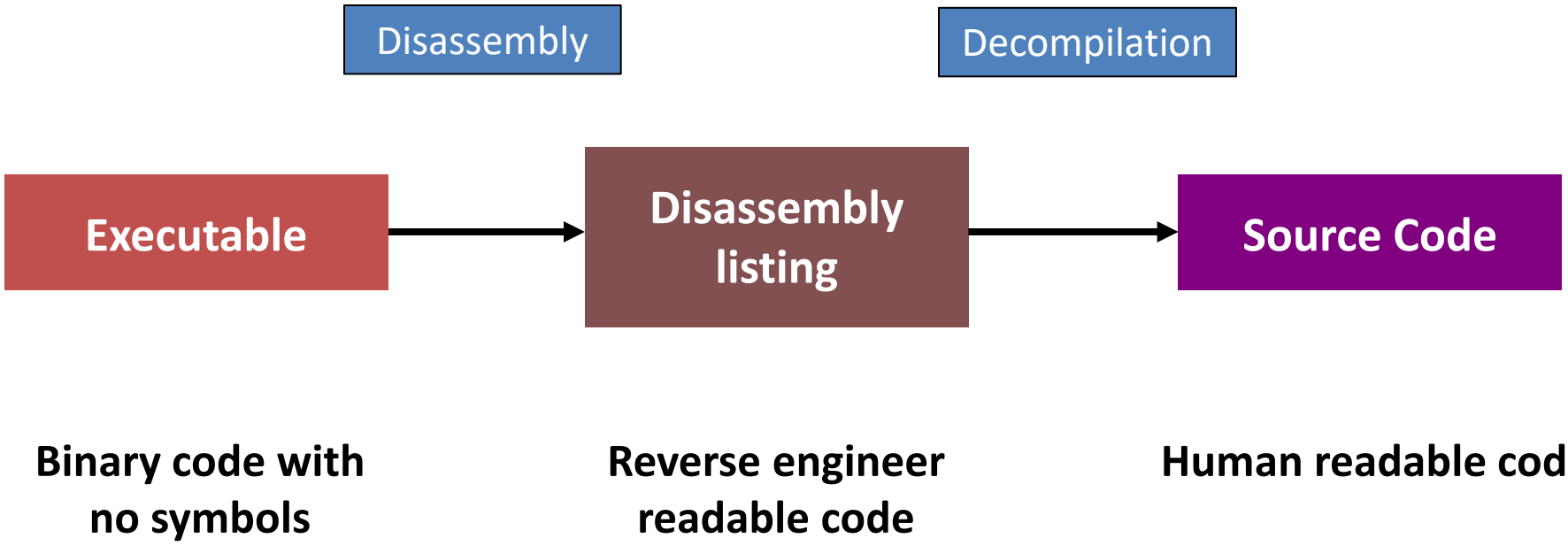
Use cases for RE

- Malware analysis
- Security / Vulnerability Research
- Driver development
- Compatibility fixes
- Legacy application support

Compilation process



Decompilation process



Tools of the Trade

- Hex Editor / Viewer
  - HIEW / BIEW
- Disassembler
  - IDA Pro
- Debugger
  - WinDBG
  - OllyDbg
- **Your own tools**

Learn the right way of reversing

- **Learn how to read code for program comprehension**
- Use static analysis tools
  - IDA Pro
- Smart debugging
  - No need waste time analyze wrong codes
- Get a good mentor

The challenges of Malware Reversing

- Obfuscation
- Packed and obfuscated malware
- The anti
  - Anti-debug
  - Anti-dump
  - Anti-disassembly
- Other clever techniques to prevent reversing

OS Native API

```
FILE *fp;
fp = fopen(const char *filename, const char *mode);
```

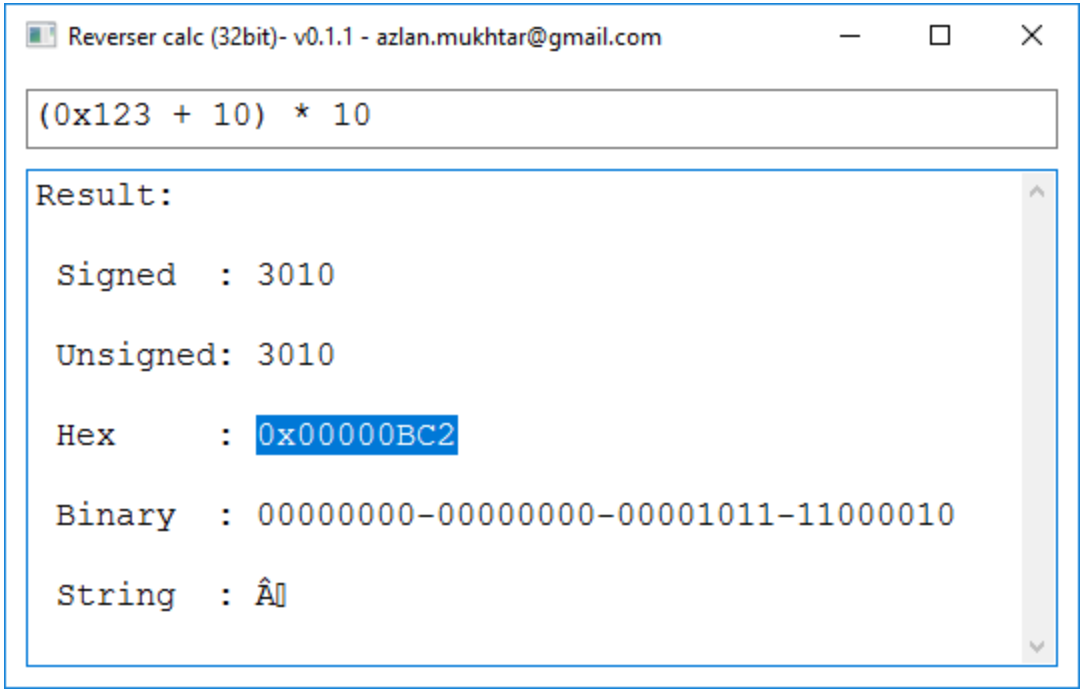
VS

```
HANDLE hFile;
hFile = CreateFile("filename",GENERIC_READ/WRITE,…, NULL);
```

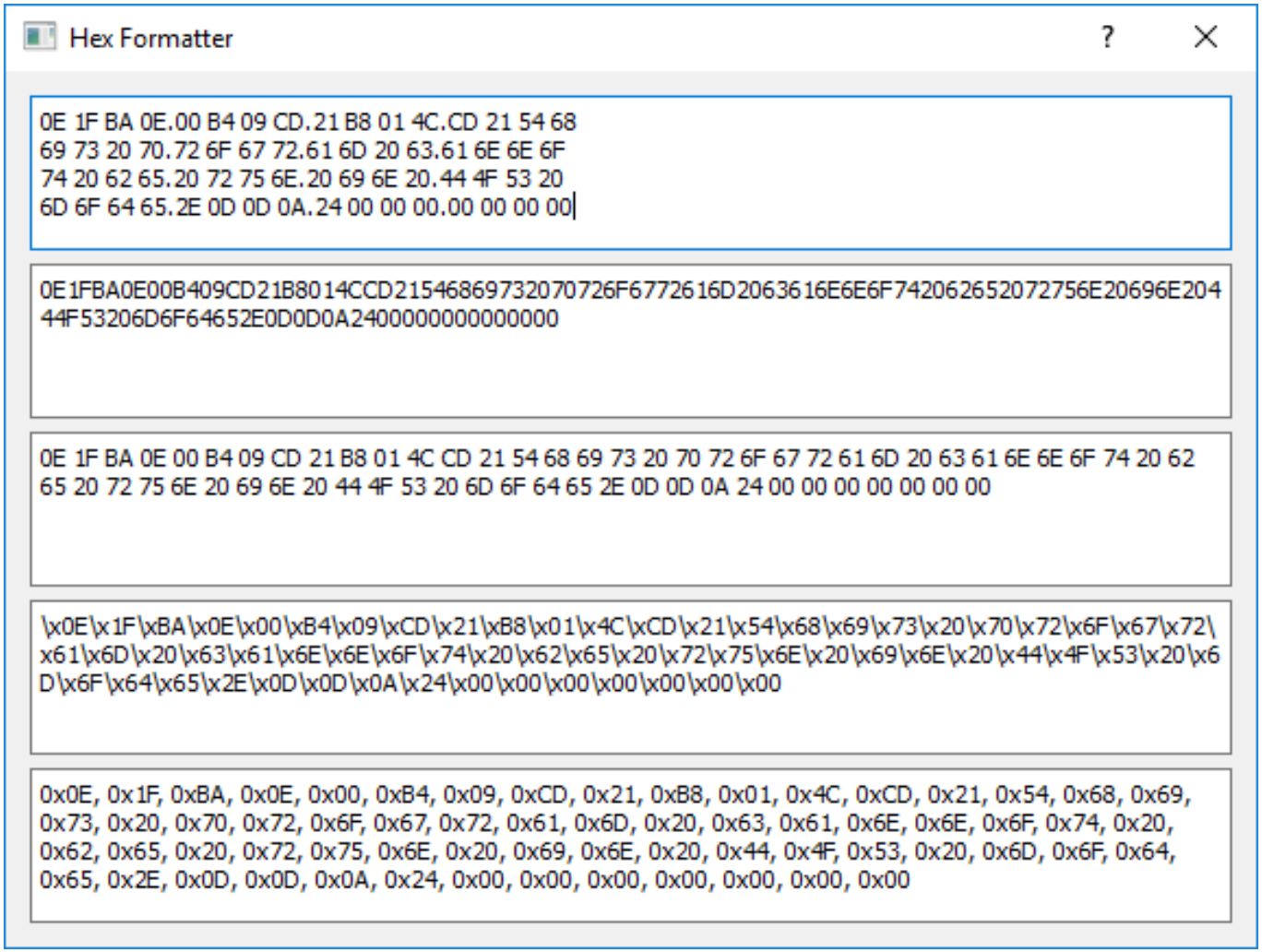
VS

```
int fd = open(const char *pathname, int flags, mode_t mode);
```

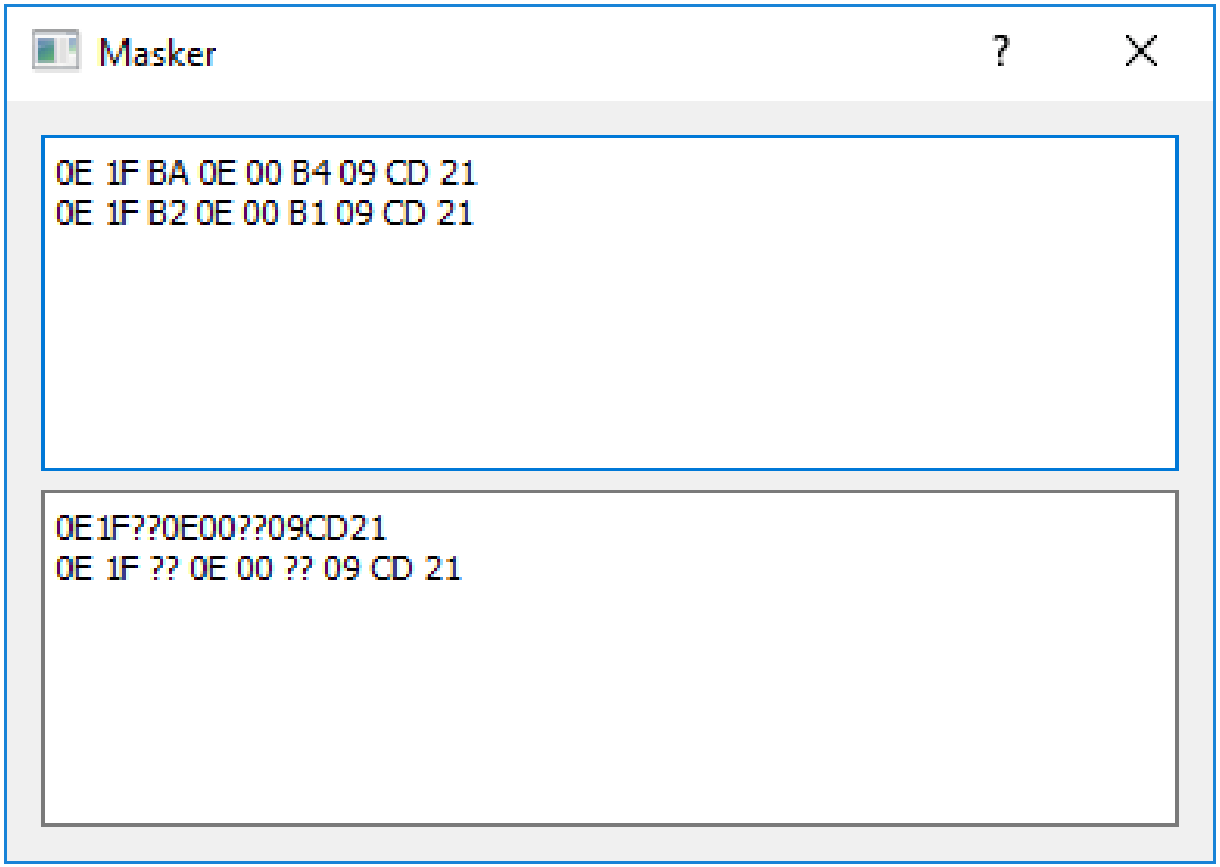
Code your own tools



Code your own tools – cont.



Code your own tools – cont.



What else

- Develop algorithmic thinking
  - Project Euler - https://projecteuler.net/
- Always be coding and reversing
- Mastery take years, don't take shortcuts
- Do a lot of practices
- Participate reverse engineering challenges (CTF)

References

- Books
  - The C Programming Language, 2nd Edition
  - Windows via C/C++, 5th Edition
  - Guide to Assembly Language: A Concise Introduction
  - Windows Internals, 6th Edition
  - IDA Pro Book, 2nd Edition
  - Practical Malware Analysis

Q & A

Thank you

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