CRACK.ME UP!

AN INTRODUCTION TO

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Reverse Engineering

- Uncovering the hidden behaviour of a given technology, system, program, protocol or device, by analysing the structure and operation of its components

- Extracting knowledge about any unknown engineering invention

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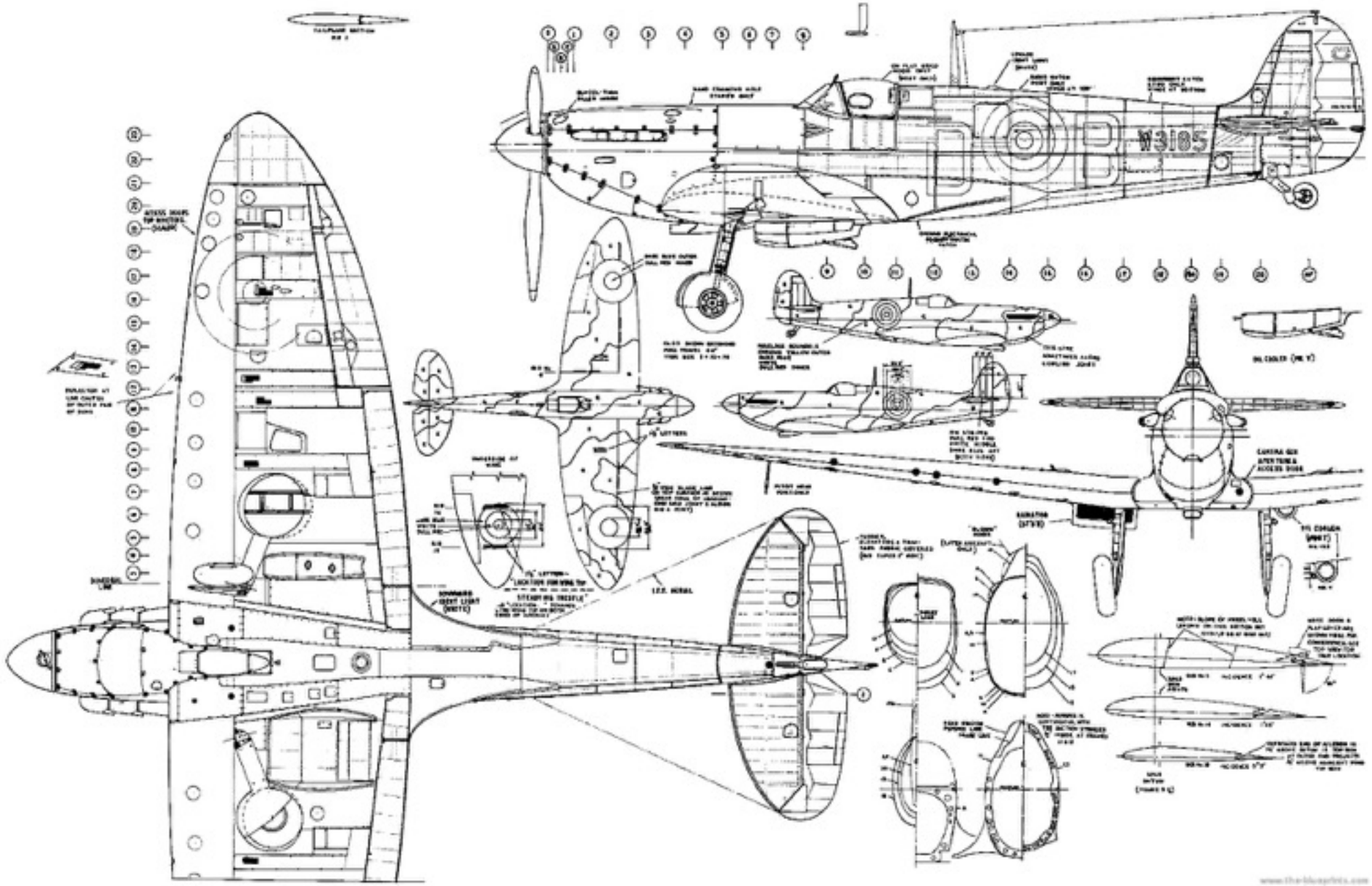
History



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Reverse Engineering

History

- RE was used to copy inventions made by other countries or business competitors
- Frequently used in the WW2 and Cold War:
  - *Jerry can*
  - *Panzerschreck*

Binary Reverse Engineering

- It’s the process of getting knowledge about compiled software, in order to understand how it works and how it was originally implemented.

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Binary Reverse Engineering

- It's the process of getting knowledge about compiled software in order to understand how it was originally implemented.

WITHOUT THE SOURCE CODE

Binary Reverse Engineering

Motivation

- Software and hardware cracking
- Malware analysis - botnet clients, spyware, ransomware
- Finding bugs in compiled software
- Creating or improving docs
- Interpreting unknown protocols
- Academic purposes
- Industrial or military espionage
- Software interoperability

Who knows how to do this stuff?

- Hackers in general
- Some intelligence agencies
- Antivirus companies
- Students and curious people

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Wanna Cry?

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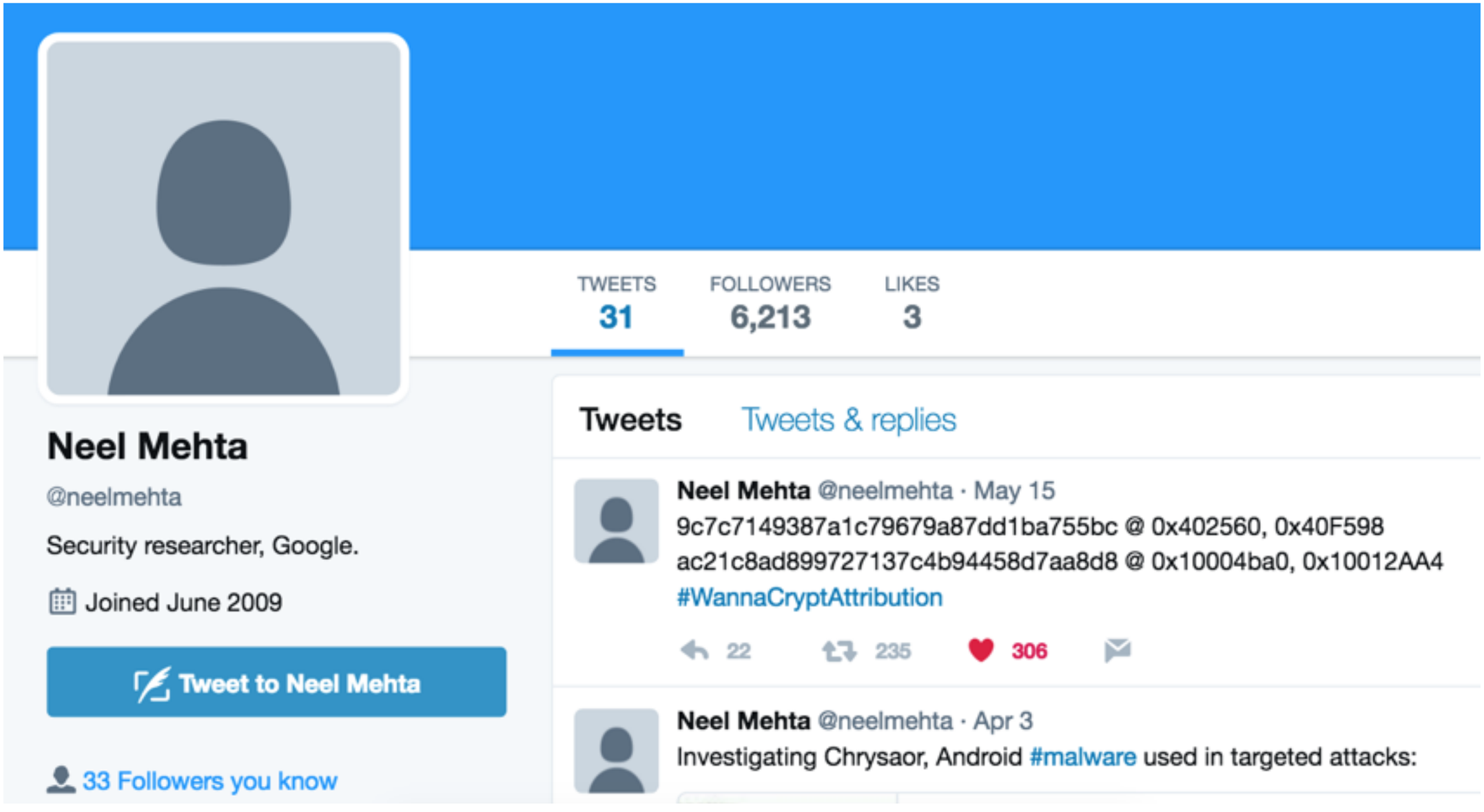
The kill switch

iuqerfsodp9ifjaposdfjhgosurijfaewrwergwea[dot]com

```
qmemcpy(&szUrl, sinkholeddomain, 0x39u);      // previously unregistered domain, now sinkholed
v8 = 0;
v9 = 0;
v10 = 0;
v11 = 0;
v12 = 0;
v13 = 0;
v14 = 0;
v4 = InternetOpenA(0, 1u, 0, 0, 0);
v5 = InternetOpenUrlA(v4, &szUrl, 0, 0, 0x84000000, 0);// do HTTP request to previously unregistered domain
if ( v5 )                                     // if request successful quit
{
  InternetCloseHandle(v4);
  InternetCloseHandle(v5);
  result = 0;
}
else                                          // if request fails, execute payload
{
  InternetCloseHandle(v4);
  InternetCloseHandle(0);
  detonate();
  result = 0;
}
return result;
}
```

https://www.malwaretech.com/2017/05/how-to-accidentally-stop-a-global-cyber-attacks.html

Then...


TWEETS
31
FOLLOWERS
6,213
LIKES
3
Neel Mehta
@neelmehta
Security researcher, Google.
Joined June 2009
Tweet to Neel Mehta
33 Followers you know
Tweets
Tweets & replies
Neel Mehta @neelmehta · May 15
9c7c7149387a1c79679a87dd1ba755bc @ 0x402560, 0x40F598
ac21c8ad899727137c4b94458d7aa8d8 @ 0x10004ba0, 0x10012AA4
#WannaCryptAttribution
22
235
306
Neel Mehta @neelmehta · Apr 3
Investigating Chrysaor, Android #malware used in targeted attacks:

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IDA View-A | Pseudocode-A | Hex View-1 | Structures | Enums | Imports | Exports

```
16  u_short *v15; // [sp+18h] [bp+4h]@2
17
18  v1 = (int *)a1;
19  v2 = *(_DWORD *)a1;
20  LOBYTE(v2) = 1;
21  v3 = (_BYTE *)(a1 + 5);
22  *(_DWORD *)a1 = v2;
23  *(v3 - 1) = 3;
24  *v3 = 1;
25  sub_408130(a1 + 6, 32);
26  v4 = time(0);
27  *(_DWORD *)(a1 + 6) = htonl(v4);
28  *(_BYTE *)(a1 + 38) = 0;
29  v5 = (u_short *)(a1 + 39);
30  v6 = 0;
31  v7 = 6 * (rand() % 5 + 2);
32  if ( v7 > 0 )
33  {
34    v15 = (u_short *)(a1 + 41);
35    while ( 1 )
36    {
37      v8 = rand() % 0x4Bu;
38      v9 = 0;
39      v14 = v8;
40      if ( v6 > 0 )
41        break;
42LABEL_8:
43      if ( v8 == -1 )
44        goto LABEL_10;
45      *v15 = htons(*(&table_03_00_04_00 + v8));
46LABEL_11:
47      ++v6;
48      ++v15;
49      if ( v6 >= v7 )
50        goto LABEL_12;
51    }
52    v10 = *(&table_03_00_04_00 + v8);
53    v11 = v5 + 1;
54    while ( *v11 != v10 )
```

000025C1 sub_402560:34

3e6de9e2baacf930949647c399818e7a2caea2626df6a468407854aaa515eed9

```
RD __stdcall sub_402A40(_DWORD, char);
RD __cdecl sub_408130(_DWORD, _DWORD);
```

Wanna Cry

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Symantec.Contopee / Lazarus Group

```
16  _WORD *v15; // [sp+18h] [bp+4h]@2
17
18  v1 = (int *)a1;
19  v2 = *(_DWORD *)a1;
20  LOBYTE(v2) = 1;
21  v3 = (_BYTE *)(a1 + 5)
22  *(_DWORD *)a1 = v2;
23  *(v3 - 1) = 3;
24  *v3 = 1;
25  sub_100016B0(a1 + 6, 32);
26  v4 = time(0);
27  *(_DWORD *)(a1 + 6) = htonl(v4, (unsigned __int64)v4 >> 32, 4);
28  *(_BYTE *)(a1 + 38) = 0;
29  v5 = (_WORD *)(a1 + 39);
30  v6 = 0;
31  v7 = 6 * (rand() % 5 + 2);
32  if ( v7 > 0 )
33  {
34    v15 = (_WORD *)(a1 + 41);
35    while ( 1 )
36    {
37      v8 = rand() % 0x4Bu;
38      v9 = 0;
39      v14 = v8;
40      if ( v6 > 0 )
41        break;
42LABEL_8:
43      if ( v8 == -1 )
44        goto LABEL_10;
45      LOWORD(v8) = table_03_00_04_00[v8];
46      *v15 = htons(v8);
47LABEL_11:
48      ++v6;
49      ++v15;
50      if ( v6 >= v7 )
51        goto LABEL_12;
52    }
53    v10 = table_03_00_04_00[v8];
54    v11 = v5 + 1;
```

00004BF7 sub_10004BA0:30

766d7d591b9ec1204518723a1e5940fd6ac777f606ed64e731fd91b0b4c3d9fc

```
WORD __cdecl sub_10004A30(_DWORD, _DWORD, char);
WORD __cdecl sub_10004D00(_DWORD);
```

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North Korea?

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Binary Reverse Engineering

Formats of compiled software

- **ELF** (Linux & UNIX like)
- **Mach-O** (OSX)
- **PE** (Windows)
- **Class** (Java bytecode)
- **DEX** (Android - Dalvik bytecode)
- **PYC** (Python bytecode)
- …


REQUIRED SKILLS

Skills

- **Debugging** (GDB, WinDbg, OllyDbg)
- **Assembly** (x86, x64, ARM, MIPS and many others)
- **Programming** (C, C++, Java, Python, Ruby, etc)
- **Software architecture**
- **Logic, math, crypto, protocols, networks**
- **Don’t giving up**

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Awesome tools

- **Disassemblers**
- **Debuggers**
- **Decompilers**
- **Patchers**

Disassemblers

These programs translate machine code to assembly.

```
            main:
080483e4        push    ebp                                     ; XREF=_start+23
080483e5        mov     ebp, esp
080483e7        sub     esp, 0x18
080483ea        and     esp, 0xfffffff0
080483ed        mov     eax, 0x0
080483f2        add     eax, 0xf
080483f5        add     eax, 0xf
080483f8        shr     eax, 0x4
080483fb        shl     eax, 0x4
080483fe        sub     esp, eax
08048400        mov     dword [ss:esp+0x18+var_18], 0x8048528   ; argument "format" for method j_printf
08048407        call    j_printf
0804840c        mov     dword [ss:esp+0x18+var_18], 0x8048541   ; argument "format" for method j_printf
08048413        call    j_printf
08048418        lea     eax, dword [ss:ebp+var_4]
0804841b        mov     dword [ss:esp+0x18+var_14], eax
0804841f        mov     dword [ss:esp+0x18+var_18], 0x804854c   ; argument "format" for method j_scanf
08048426        call    j_scanf
0804842b        cmp     dword [ss:ebp+var_4], 0x149a
08048432        je      0x8048442
--------------------------------------------------------------------------------------------------
08048434        mov     dword [ss:esp+0x18+var_18], 0x804854f   ; argument "format" for method j_printf
0804843b        call    j_printf
08048440        jmp     0x804844e
--------------------------------------------------------------------------------------------------
08048442        mov     dword [ss:esp+0x18+var_18], 0x8048562   ; "Password OK :)\\n", argument "format"
08048449        call    j_printf
--------------------------------------------------------------------------------------------------
0804844e        mov     eax, 0x0                                ; XREF=main+92
08048453        leave
08048454        ret
                ; endp
08048455        nop
```

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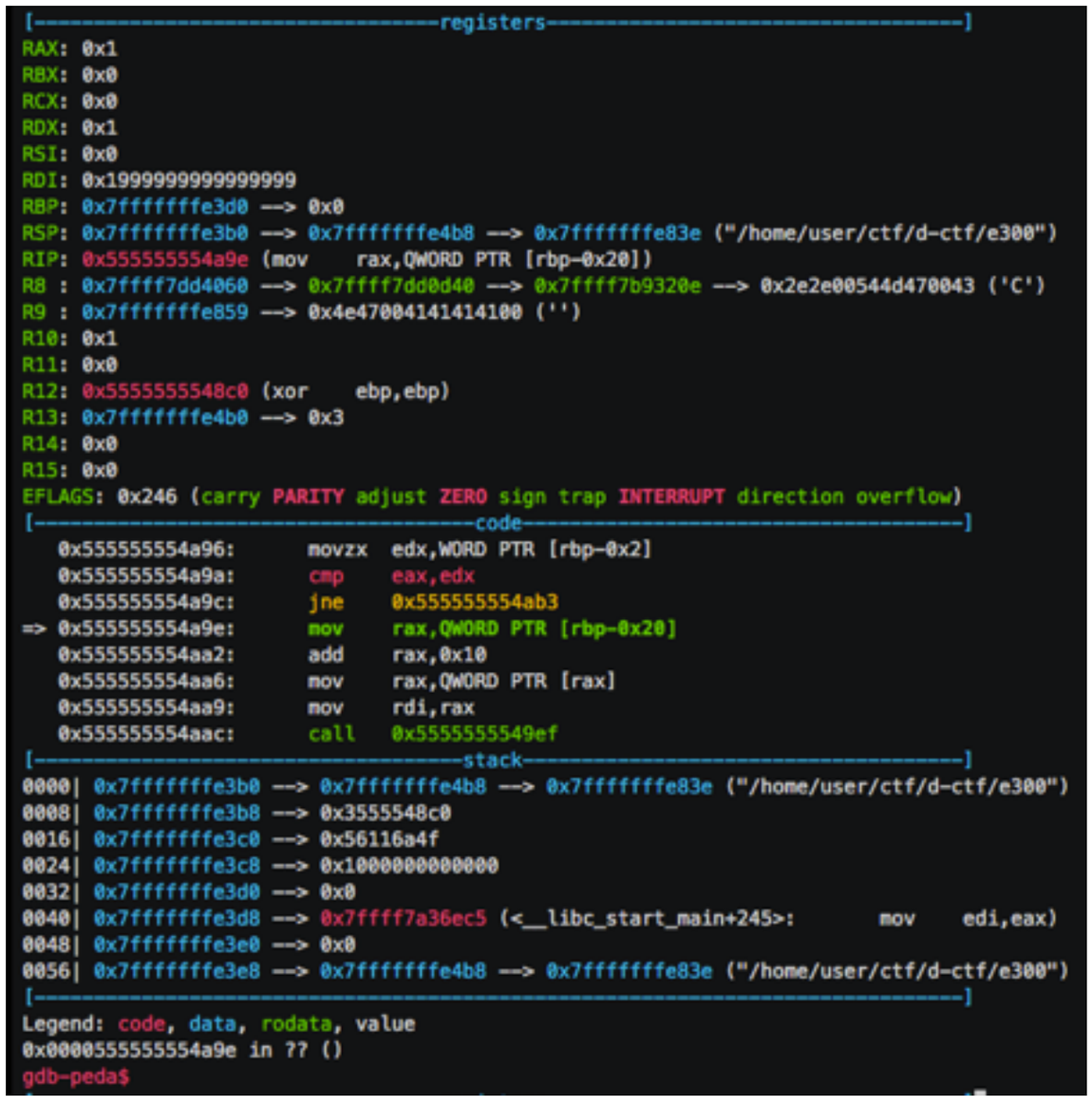
Debuggers

These programs are used to test other programs.

Debuggers allow us to inspect memory and CPU registers, modify of variables in runtime, set breakpoints and call functions outside the program flow.

In reverse engineering they are widely used for *dynamic analysis.*



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Decompilers

These programs try to achieve the *near-impossible* task of translating compiled software to the original source code.

Sometimes, the generated code is enough to perform reversing tasks.

Hex-rays

```
signed __int64 __fastcall sub_400962(__int64 a1)
{
 signed int v2; // [sp+14h] [bp-Ch]@6
 int v3; // [sp+18h] [bp-8h]@1
 int i; // [sp+1Ch] [bp-4h]@1

 *(_BYTE *)(strlen((const char *)a1) - 1 + a1) = 0;
 v3 = 1;
 for ( i = 0; i <= dword_600F30; ++i )
 {
  if ( !*(_BYTE *)(i + a1) )
  {
   v3 = i;
   break;
  }
 }
 v2 = 0;
 if ( dword_600F30 - 1 < v3 )
 {
  while ( 1 )
  {
   i *= v3 + 1 / dword_600F30;
   if ( i * i * v3 < i )
    break;
   v2 ^= v3 * i;
  }
 }
 return sub_400616(a1, v3, v2);
}
```

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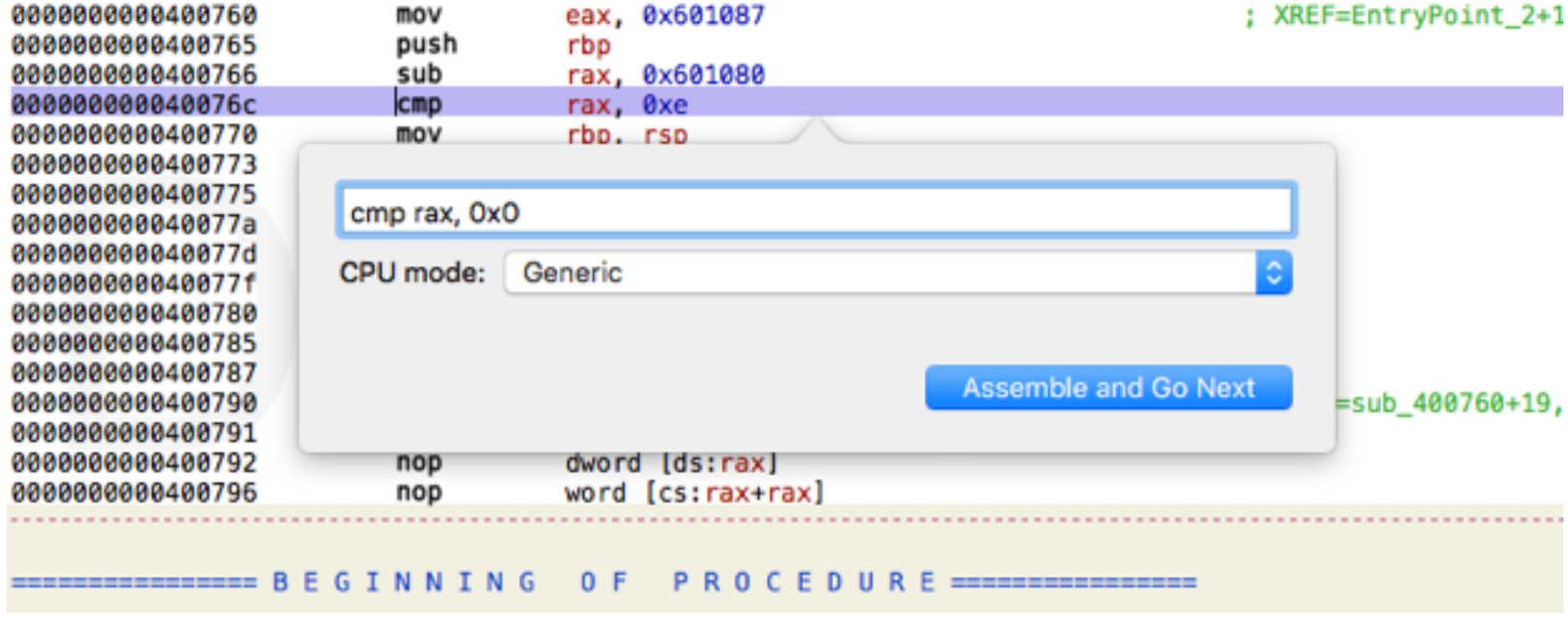
Patchers

Patchers can change machine code in order to modify the software behaviour. Hex editors can also be used for patching but there are better tools for patching assembly instructions.



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Badass tools

- IDA Pro - https://www.hex-rays.com/products/ida
- Radare 2 - http://rada.re
- Hopper Disassembler - http://www.hopperapp.com
- binary.ninja - https://binary.ninja
- ODA - http://www.onlinedisassembler.com
- OllyDbg - http://www.ollydbg.de
- Linux tools: objdump, ltrace, strace, readelf, gdb
- GDB with steroids: PwnDBG, GEF, PEDA, GDB Init
- Apktool - https://ibotpeaches.github.io/Apktool
- Packer inspector (PE) - https://www.packerinspector.com

Decompilers

- IDA Pro - https://www.hex-rays.com/products/ida (x86, x64, ARM, MIPS, etc)
- Hopper Disassembler - http://www.hopperapp.com (x86, x64, ARM)
- Retargetable Decompiler (AVG) - https://retdec.com (x86, ARM, MIPS, Power PC)
- JADX - https://github.com/skylot/jadx (DEX2Java)
- JetBrains dotPeek - https://www.jetbrains.com/decompiler (.NET)
- ILSpy - http://ilspy.net (.NET)
- uncompyle2/6 - https://github.com/wibiti/uncompyle2 | https://github.com/rocky/python-uncompyle6 (Python bytecode)

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Static Analysis

- **Do not** execute the program
- Read the spooky assembly/decompiled code
- Inspect flow charts
- Take notes… Lots of them. Use a whiteboard if possible!
- Translate procedures into the programming language of your choice
- It’s a pain in the ass to reverse obfuscated or very complex programs

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Dynamic Analysis

- **Execute** the program
- Inspect the program behaviour
  - Use a debugger to inspect specific states of execution, understand the values of the CPU registers, memory segments (*stack*, *heap*, *libs*), returned values and function call arguments
- It's difficult to achieve if any anti-debugging protections exist (Some even deliberately crash common RE tools)

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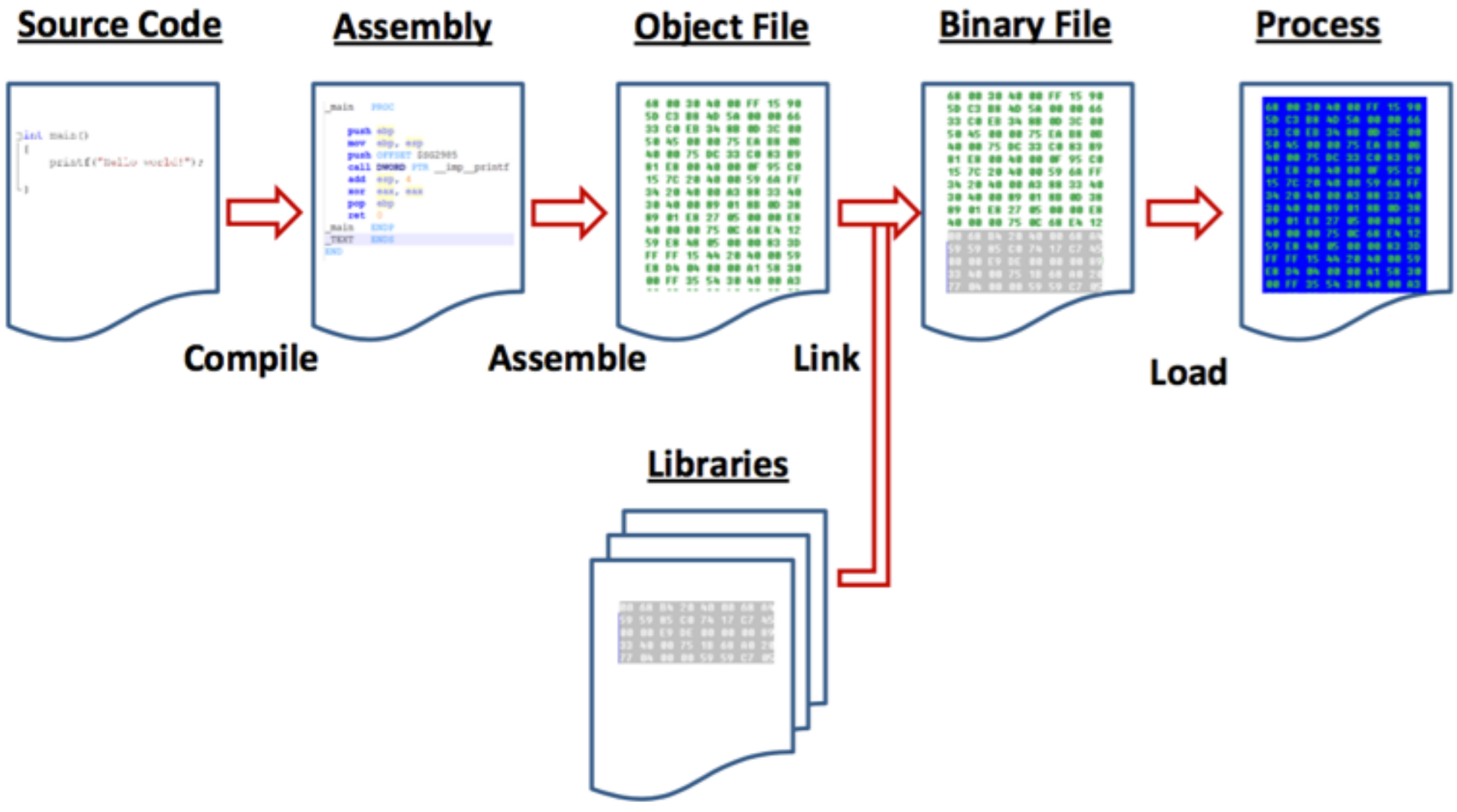
Binary RE



https://github.com/RPISEC/MBE

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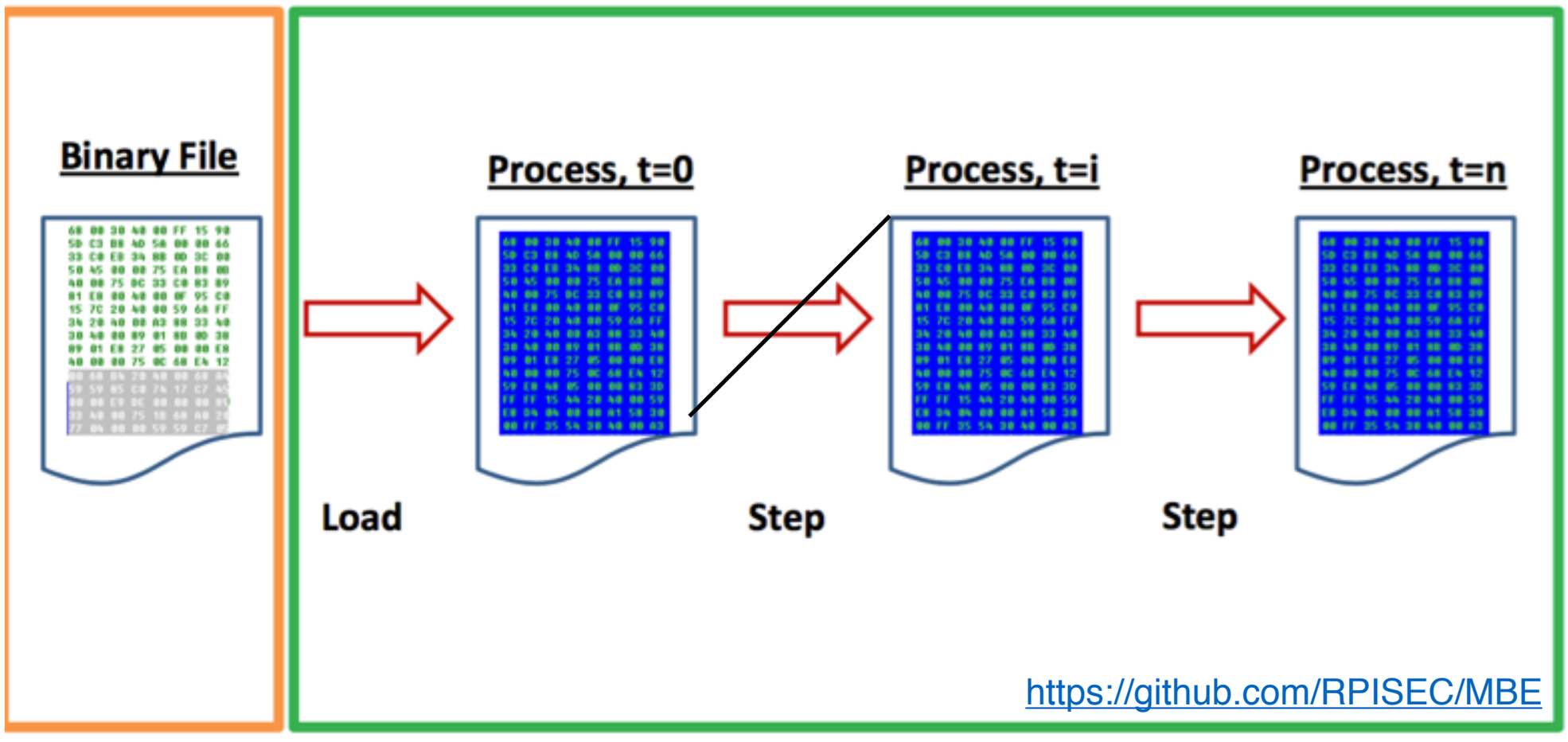
Binary RE

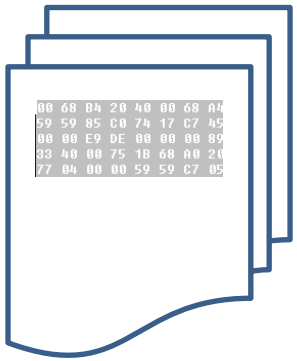


Static

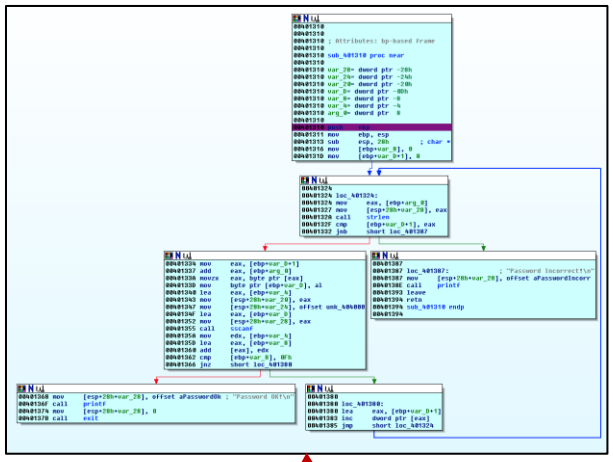
Dynamic

RE Domain

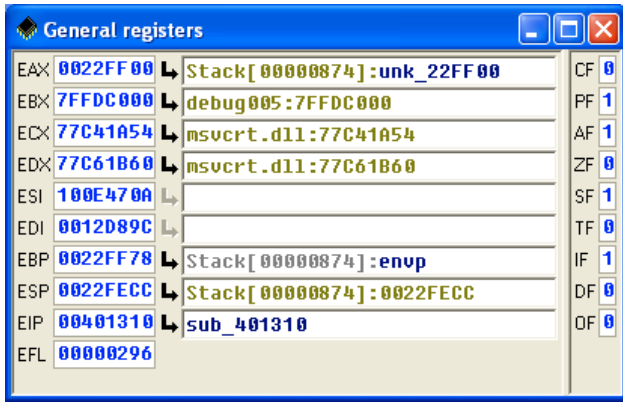
Libraries



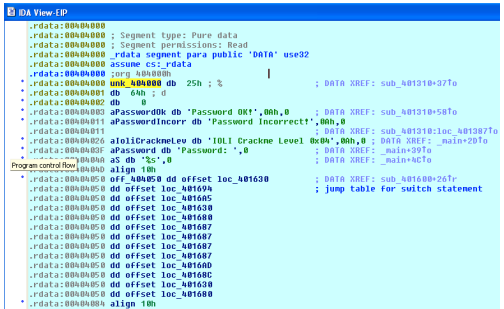
Code



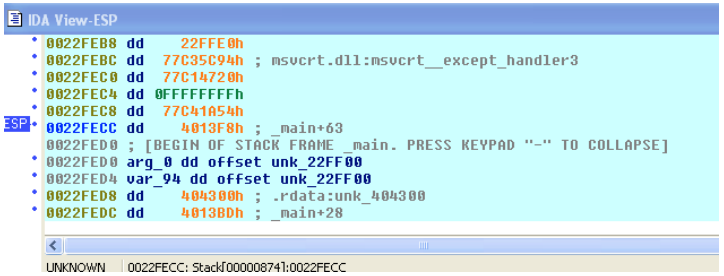
Registers



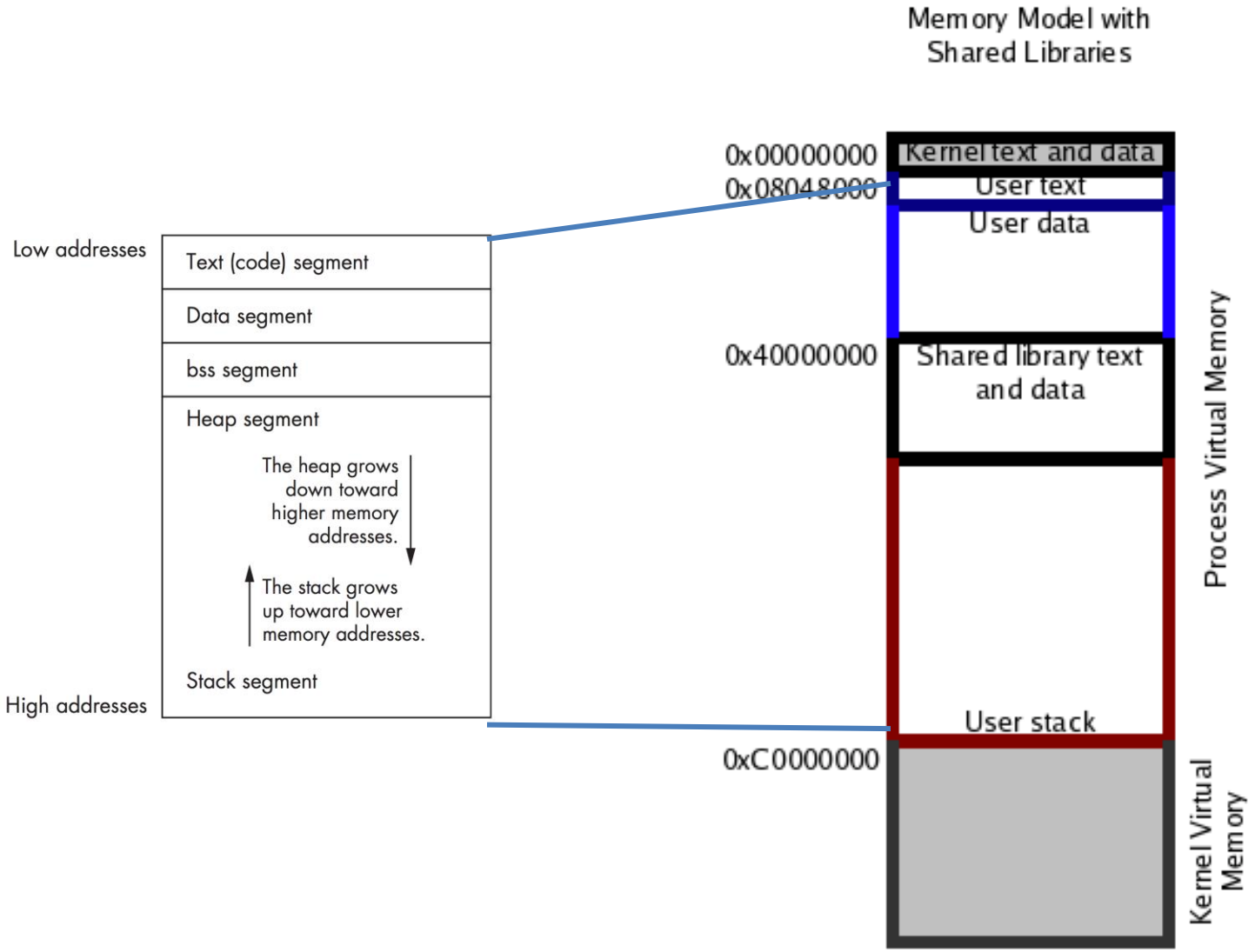
Other Memory



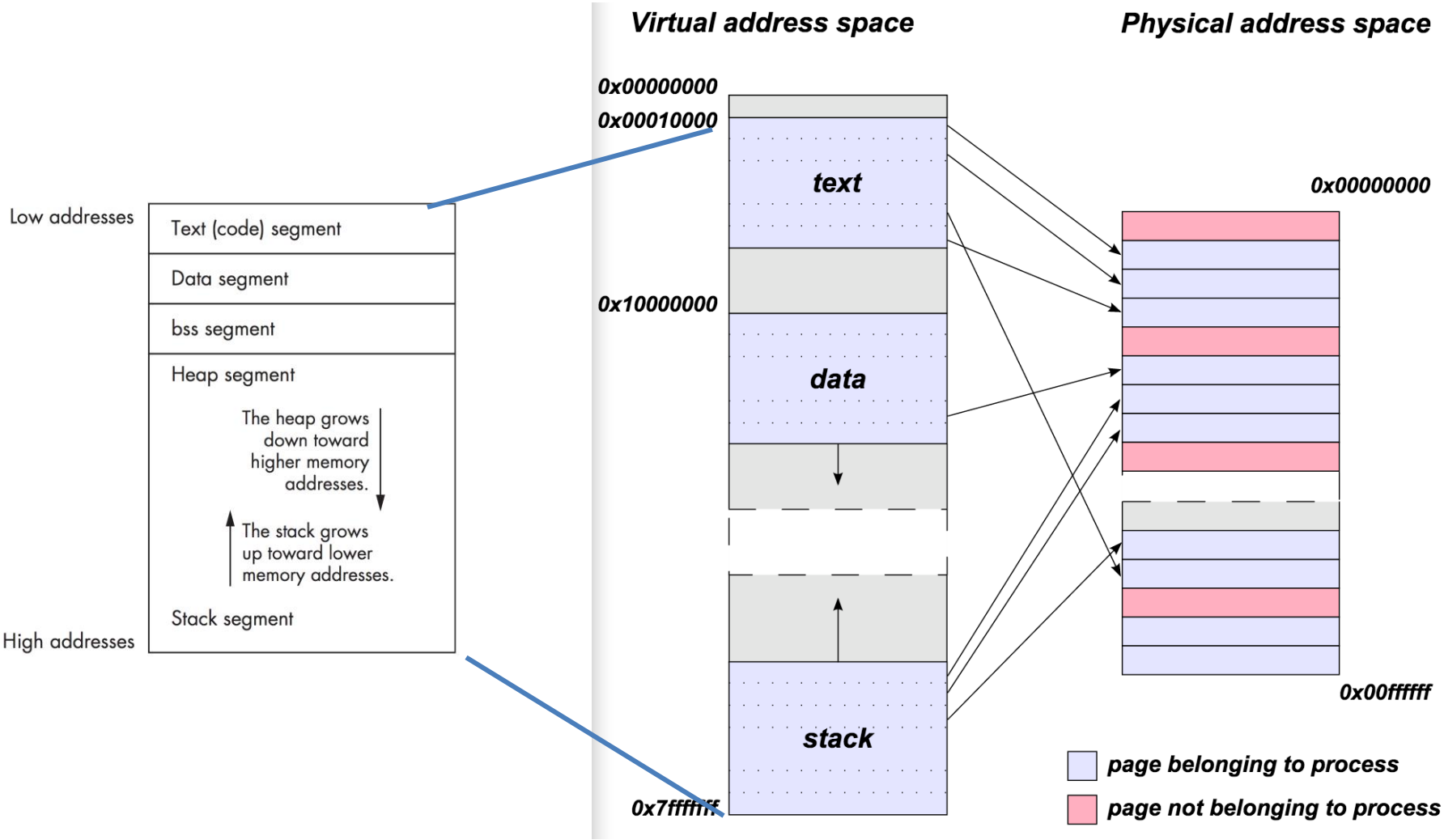
Stack



Virtual Memory Layout

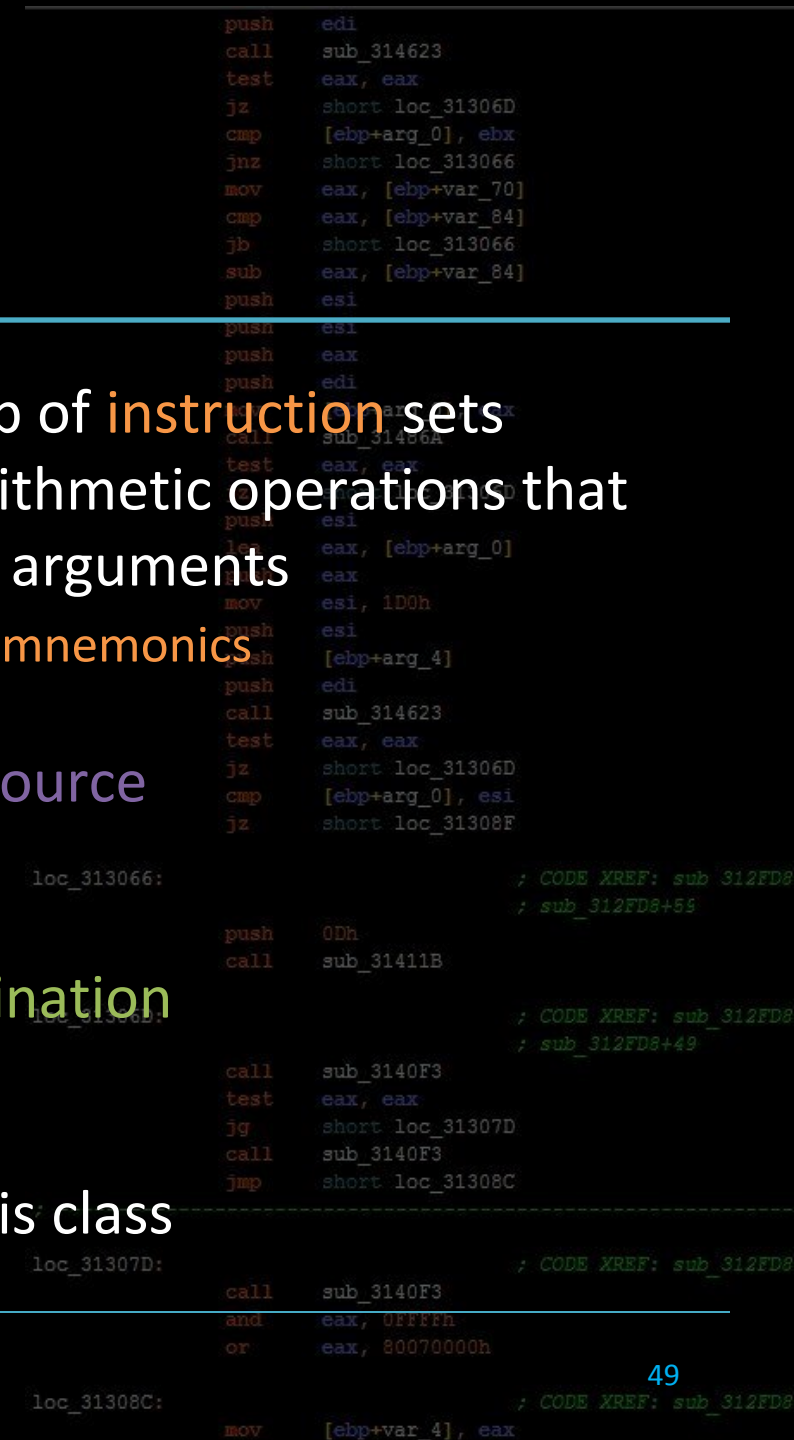


Physical Memory Layout

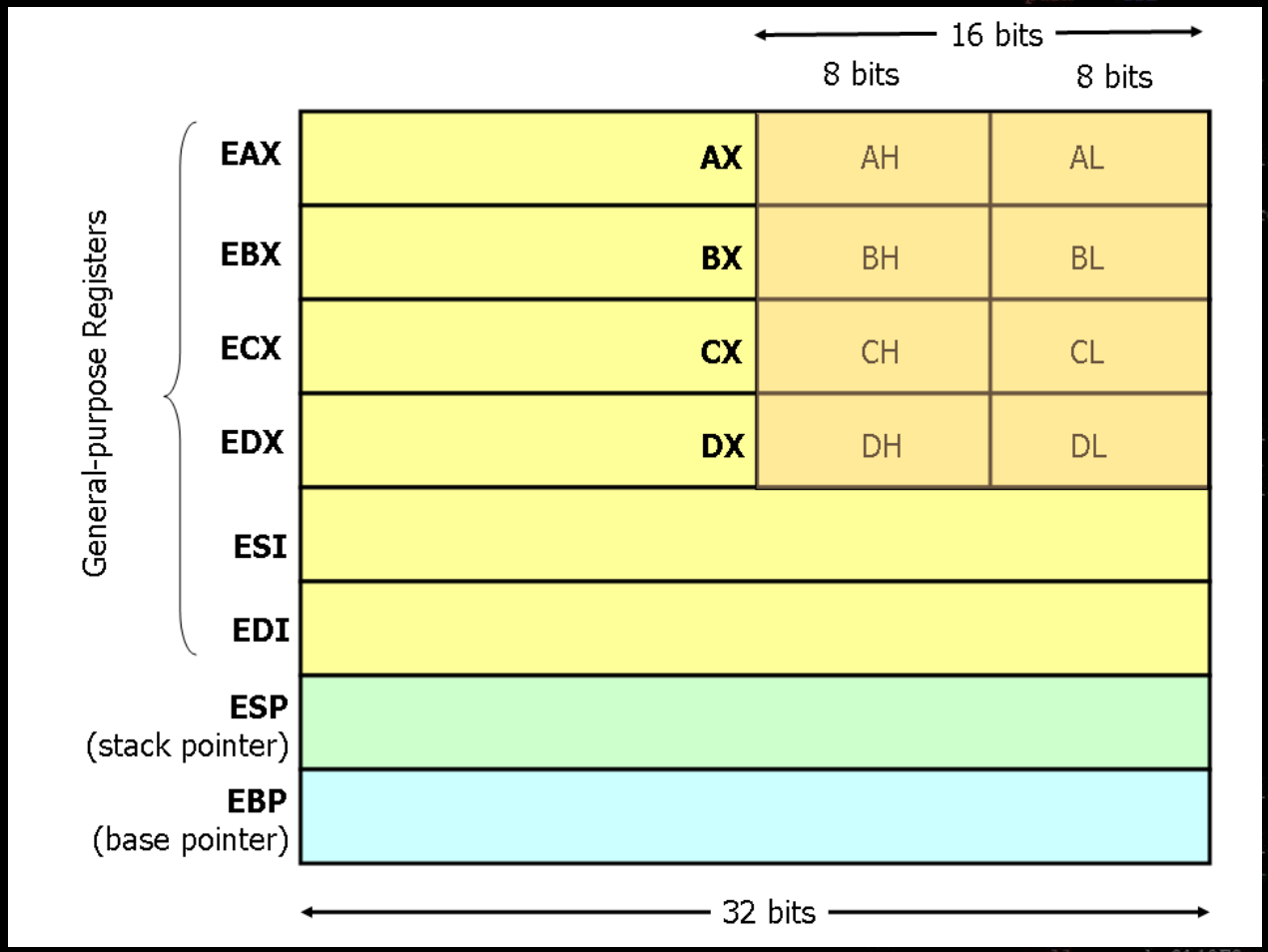


x86 Assembly Syntax

- All assembly languages are made up of instruction sets
- Instructions are generally simple arithmetic operations that take registers or constant values as arguments
  - Also called Operands, OpCode, Op(s), mnemonics
- Intel syntax: operand destination, source
  - `mov eax, 5`
- AT&T syntax: operand source, destination
  - `mov $5, eax`
- We'll be using the Intel syntax in this class



x86 Register Diagram



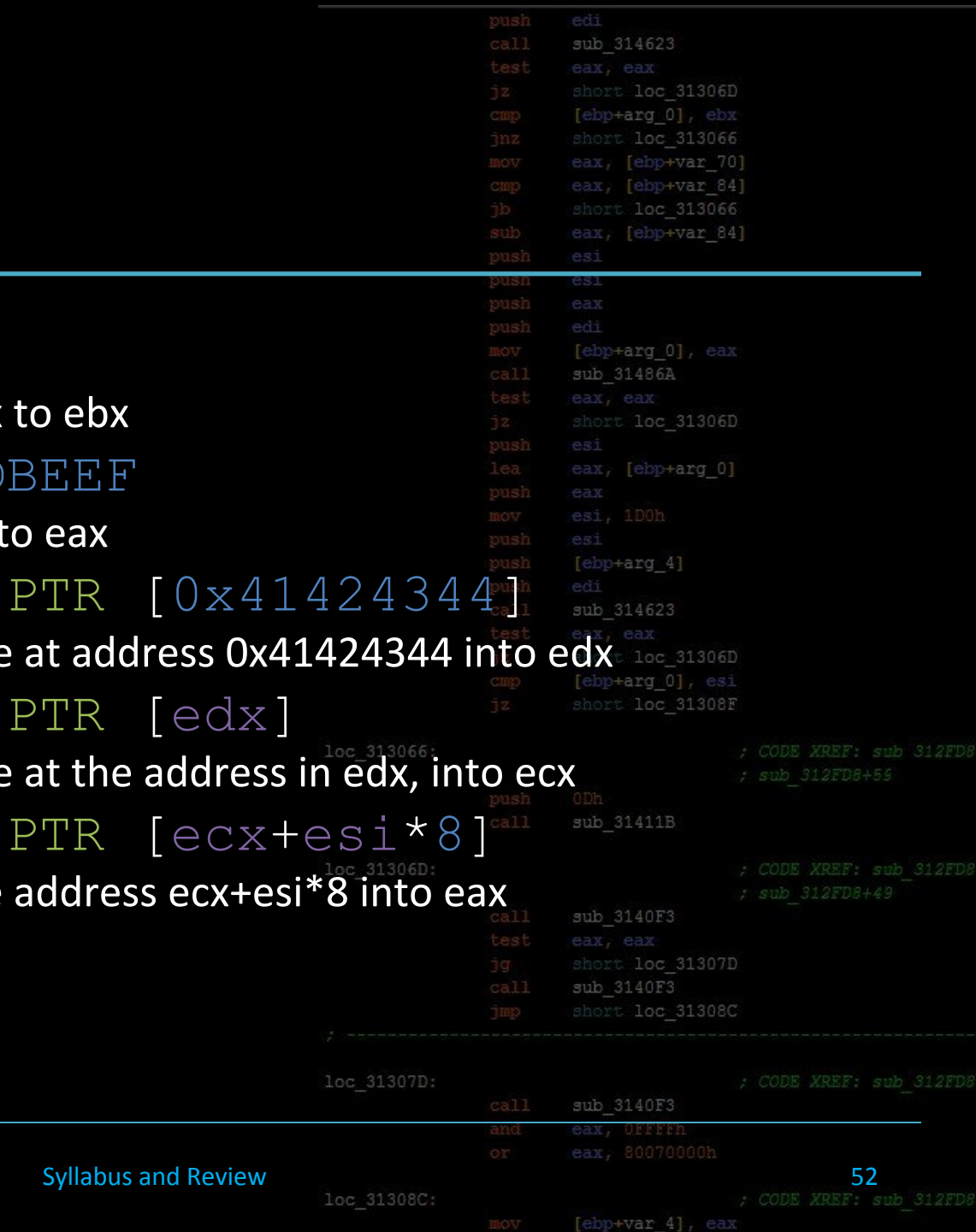
Important Registers

- EAX EBX ECX EDX - General purpose registers
- ESP - Stack pointer, “top” of the current stack frame (lower memory)
- EBP - Base pointer, “bottom” of the current stack frame (higher memory)
- EIP - Instruction pointer, pointer to the *next* instruction to be executed by the CPU

- EFLAGS - stores flag bits
  - ZF - zero flag, set when result of an operation equals zero
  - CF - carry flag, set when the result of an operation is too large/small
  - SF - sign flag, set when the result of an operation is negative

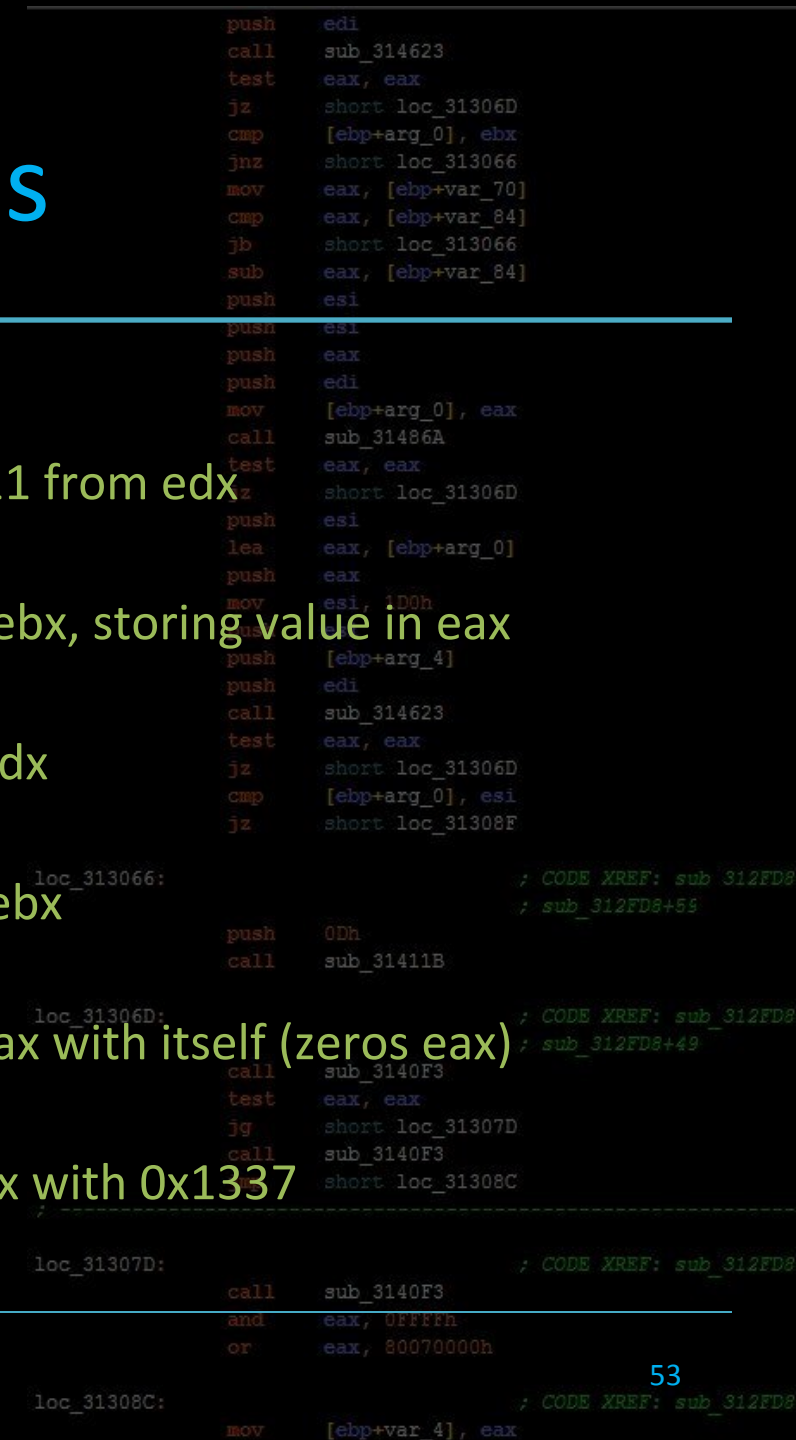
Moving Data

- `mov ebx, eax`
  - Move the value in eax to ebx
- `mov eax, 0xDEADBEEF`
  - Move 0xDEADBEEF into eax
- `mov edx, DWORD PTR [0x41424344]`
  - Move the 4-byte value at address 0x41424344 into edx
- `mov ecx, DWORD PTR [edx]`
  - Move the 4-byte value at the address in edx, into ecx
- `mov eax, DWORD PTR [ecx+esi*8]`
  - Move the value at the address ecx+esi*8 into eax



Arithmetic Operations

- `sub edx, 0x11`
  - edx = edx - 0x11; // subtracts 0x11 from edx
- `add eax, ebx`
  - eax = eax + ebx; // add eax and ebx, storing value in eax
- `inc edx`
  - edx++; // increments edx
- `dec ebx`
  - ebx--; // decrements ebx
- `xor eax, eax`
  - eax = eax ^ eax; // bitwise xor eax with itself (zeros eax)
- `or edx, 0x1337`
  - edx = edx | 0x1337; // bitwise or edx with 0x1337



Some Conditional Jumps

- `jz $LOC`
  - Jump to $LOC if ZF = 1
- `jnz $LOC`
  - Jump to $LOC if ZF = 0
- `jg $LOC`
  - Jump to $LOC if the result of a comparison is the destination is greater than the source

Stack Manipulation

- `push ebx`
  - Subtract 4 from the stack pointer to move it towards lower memory (zero,) and copy the value in EBX on top of the stack

```
sub esp, 4
mov DWORD PTR [esp], ebx
```

- `pop ebx`
  - Copy the value off the top of the stack and into EBX, the add 4 to the stack pointer to move it towards higher memory (0xFFFFFFFF)

```
mov ebx, DWORD PTR [esp]
add esp, 4
```

Calling / Returning

- `call some_function`
  - Calls the code at some_function. We need to push the return address onto the stack, then branch to some_function

```
push eip
mov  eip, some_function  ; not actually valid
```

- `ret`
  - Used to return from a function call. Pops the top of the stack to eip

```
pop eip      ; not actually valid
```

- `nop`
  - 'no operation' - does nothing

Basic x86

```
0x08048624: "YOLOSWAG\0"
    mov ebx, 0x08048624
    mov eax, 0
LOOPY:
    mov cl, BYTE PTR [ebx]
    cmp cl, 0
    jz  end
    inc eax
    inc ebx
    jmp LOOPY
end:
    ret
```

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F

loc_313066:                             ; CODE XREF: sub_312FD8
                                        ; sub_312FD8+55
push    0Dh
call    sub_31411B

loc_31306D:                             ; CODE XREF: sub_312FD8
                                        ; sub_312FD8+49
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C
; ---------------------------------------------------------------------------

loc_31307D:                             ; CODE XREF: sub_312FD8
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h

loc_31308C:                             ; CODE XREF: sub_312FD8
mov     [ebp+var_4], eax
```

Basic x86

```
0x08048624: "YOLOSWAG\0"   ; 9 bytes of string data
    mov ebx, 0x08048624    ; char * ebx = "YOLOSWAG\0";
    mov eax, 0             ; set eax to 0
LOOPY:                     ; label, top of loop
    mov cl, BYTE PTR [ebx] ; char cl = *ebx;
    cmp cl, 0              ; is cl 0? (eg "\0")
    jz  end                ; if cl was 0, go to end
    inc eax                ; eax++; (counter for length)
    inc ebx                ; ebx++; ([ebx] = "Y", "O"... "\0")
    jmp LOOPY              ; go to LOOPY
end:                       ; label, end of loop/function
    ret                    ; return (len of str in eax)
```

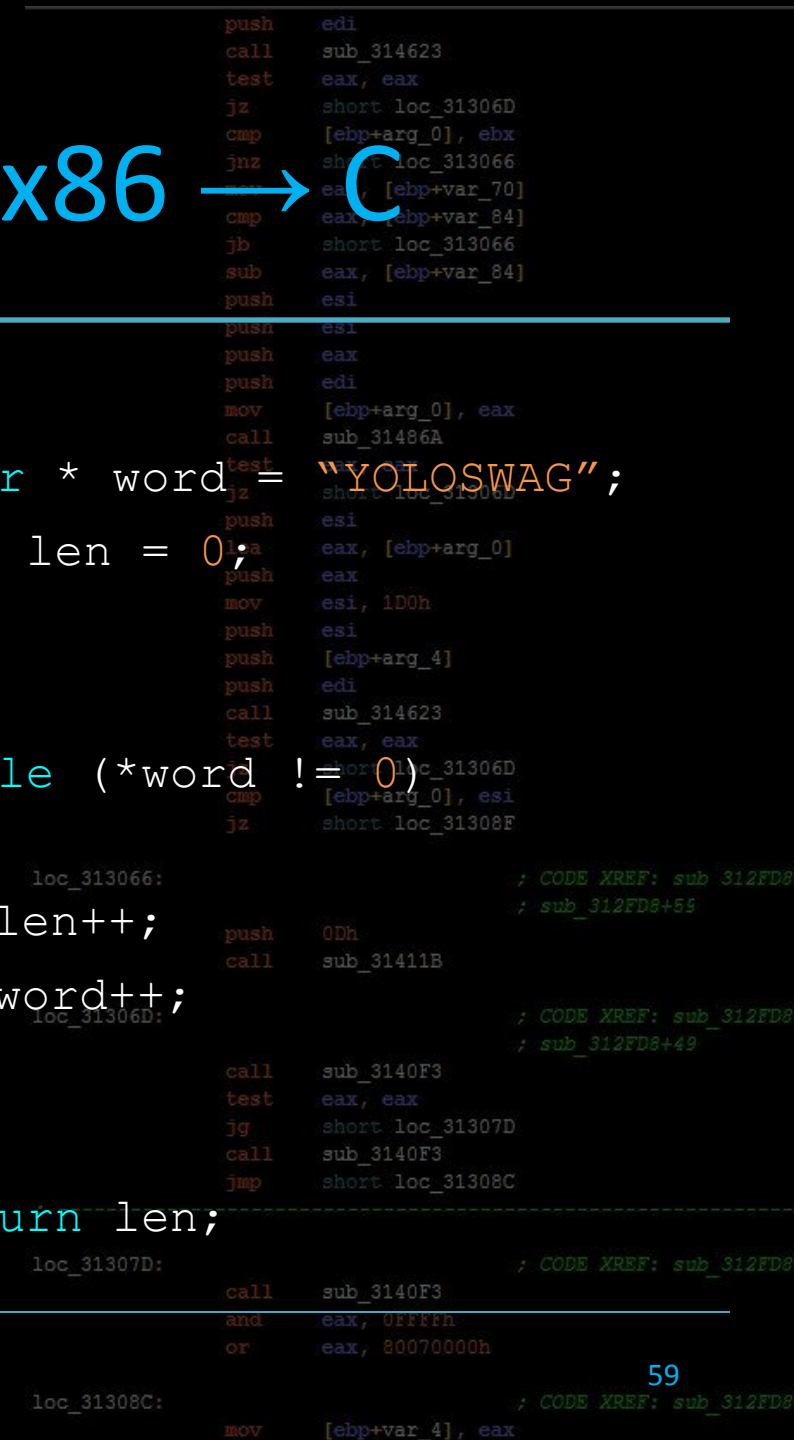
Human Decompiler - x86 → C

```
0x08048624: "YOLOSWAG\0"
    mov ebx, 0x08048624
    mov eax, 0
LOOPY:
    mov cl, BYTE PTR [ebx]
    cmp cl, 0
    jz  end
    inc eax
    inc ebx
    jmp LOOPY
end:
    ret
```

```
...
char * word = "YOLOSWAG";
int len = 0;


while (*word != 0)
{
    len++;
    word++;
}

return len;
```



GNU Debugger - Basics

- crackme0x00a
- gdb
  - disassemble main (disas main)
  - set disassembly-flavor intel
  - break main (b main)
  - run
  - stepi (s), step into
  - nexti (n), step over

GNU Debugger – Examine Memory

- gdb
  - Examine memory: x/NFU address
  - N = number
  - F = format
  - U = unit
- Examples
  - x/10xb 0xdeadbeef, examine 10 bytes in hex
  - x/xw 0xdeadbeef, examine 1 word in hex
  - x/s 0xdeadbeef, examine null terminated string

Tracing

- ltrace, library calls
- strace, system calls

Demo 1

Static vs Dynamic analysis

https://goo.gl/XXoPCV

Cracking

- This demo was a very simple cracking example
- The real stuff involves much more complex tasks (static analysis, dynamic analysis, concolic analysis, taint analysis)
- E.g. If you want to create a keygen you need to fully understand the serial number validation algorithm
- You need to be a patching ninja to remove anti-debugging protections (usually triggered in runtime)

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Cracking Games

How they do it?

- In the good old days: to crack a game you just needed to patch code to bypass PC-CDROM identification checks
- Then, virtual drive tools became a thing. But games started to be compiled with additional protections: Anti-debugging, obfuscation and virtual emulators detection (DAEMON Tools/ Generic SafeDisc Emulator).

Demo 2

Let’s crack a game for fun and pr…

…**for educational purposes**

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Capture The Flag

- Reverse engineering is one of the main categories in Security CTFs
- Contestants are typically challenged to solve cracking problems
- The simplest case is just like the first demo. Find the correct input!

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Cracking

Advanced techniques

```
for (i=0;i<10;i++) {
  if (input[i] != password[i]) {
    puts("Wrong!");
    return;
  }
}
puts("Correct!");
```

What's possibly wrong? 🤔

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Cracking

Advanced techniques

- **Timing attacks**
  - When a char is correct: one more cycle is executed, i.e. more instructions
  - It's possible to launch a timing attack, char by char
  - The attack complexity is reduced from 256^{length} to $256 \times length$
  - **How can we prevent this kind of attacks? Constant time algorithms** (very nice research area)
  - Tools for local binary timing attacks: Pin tool, GDB scripting

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Cracking

Advanced techniques

- **Solvers**

  - Serial number validation algorithms are usually composed by complex verifications, whose components are for e.g. the values of certain indexes of the serial number.

    E.g. $sn[17] == sn[21] \oplus sn[34] - sn[5] \bmod (sn[14] * sn[43]^2)$

  - These verifications can be translated to systems of equations, that can be easily solved by powerful magic: Z3 Theorem Prover, Sage, Maple, Matlab

  - Z3 supports both arithmetic and bitwise operators, and custom functions as well.

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Cracking

Advanced techniques - Z3

```python
from z3 import *

s = Solver()

x = BitVec("x", 32)
y = BitVec("y", 32)
z = BitVec("z", 32)
a = BitVec("a", 32)
b = BitVec("b", 32)
c = BitVec("c", 32)

def shiftRight(y, c):
    return y >> c

s.add(x != 0)
s.add(x == a ^ b * z * shiftRight(y, c))

while (s.check() == sat):
    print(s.model())
    s.add(x != s.model()[x], y != s.model()[y])
```

Python script

```
[z = 0,
 b = 1,
 a = 33587201,
 y = 173155,
 x = 33587201,
 c = 17]
[z = 0,
 b = 1,
 a = 34635777,
 y = 173159,
 x = 34635777,
 c = 17]
[z = 0,
 b = 1,
 a = 34766849,
 y = 173158,
 x = 34766849,
 c = 17]
[z = 0,
 b = 1,
 a = 33718273,
 y = 238694,
 x = 33718273,
 c = 17]
```

Solutions

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What about the future?

Predicting the RE future using **Naive Mayes**


CYBER
HEARTBLEED
CYBER
DARPA
DARPA
splunk

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DARPA CGC

- A very important mark in the history of infosec
- It was the “first-ever all-machine hacking tournament”
- These machines were able to automatically find and patch vulnerabilities in binaries
- The Mechanical Phish project, from the Shellphish CTF team, was able to identify vulnerabilities using both **fuzzing** and **symbolic execution** techniques. It’s open source 😎

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DARPA CGC

Mechanical Phish - Driller

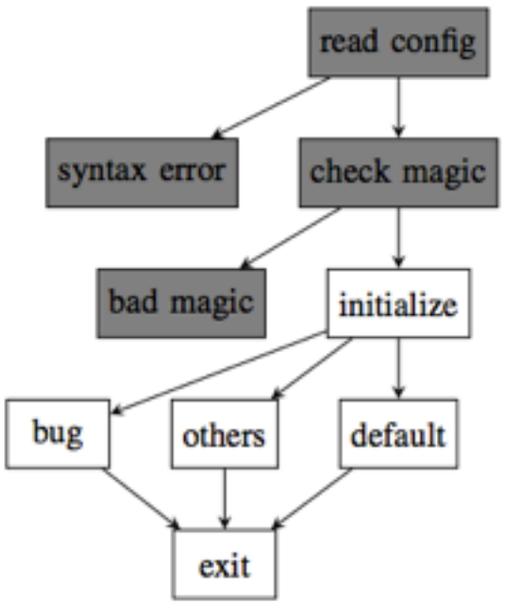

Fig. 1. The nodes initially found by the fuzzer.

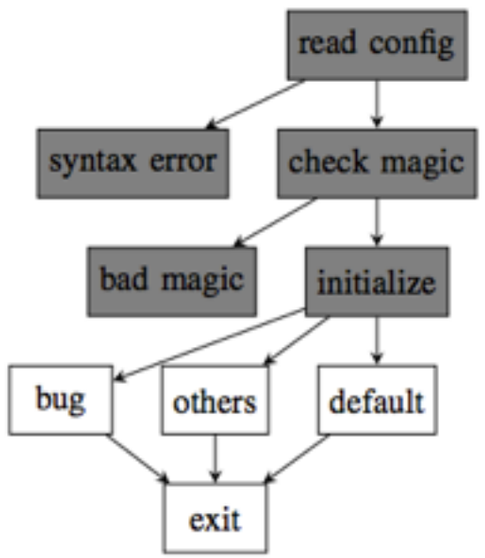

Fig. 2. The nodes found by the first invocation of concolic execution.

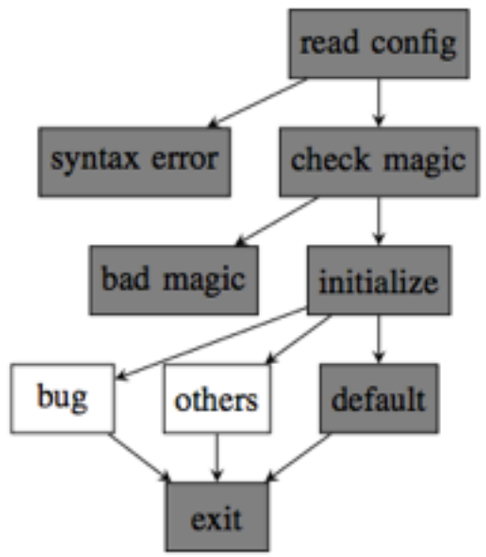

Fig. 3. The nodes found by the fuzzer, supplemented with the result of the first Driller run.

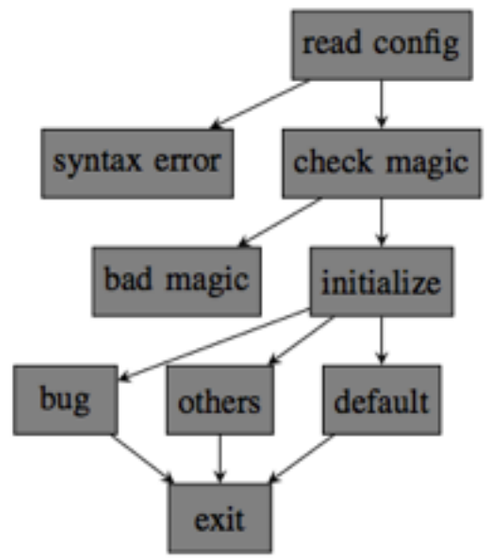

Fig. 4. The nodes found by the second invocation of concolic execution.

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DARPA CGC

Mechanical Phish - ANGR

- ANGR is a very powerful binary analysis framework. It was implemented mostly by the Shellphish team and is one of the main components of Driller

- It's one of the most powerful open source software solutions to perform reversing/cracking tasks

- We can easily accomplish *control-flow* analysis, i.e., realize the damn conditions that make the program reach a specific state of execution

- First, it translates the binary in VEX Intermediate Representation. Then, simulates instructions in a simulation engine -> symbolic execution: SimuVEX

- Finally, they use a custom Z3 wrapper. It is called claripy: *"a abstracted constraint-solving wrapper"*

Demo 3 - Angr

https://goo.gl/42T4mi

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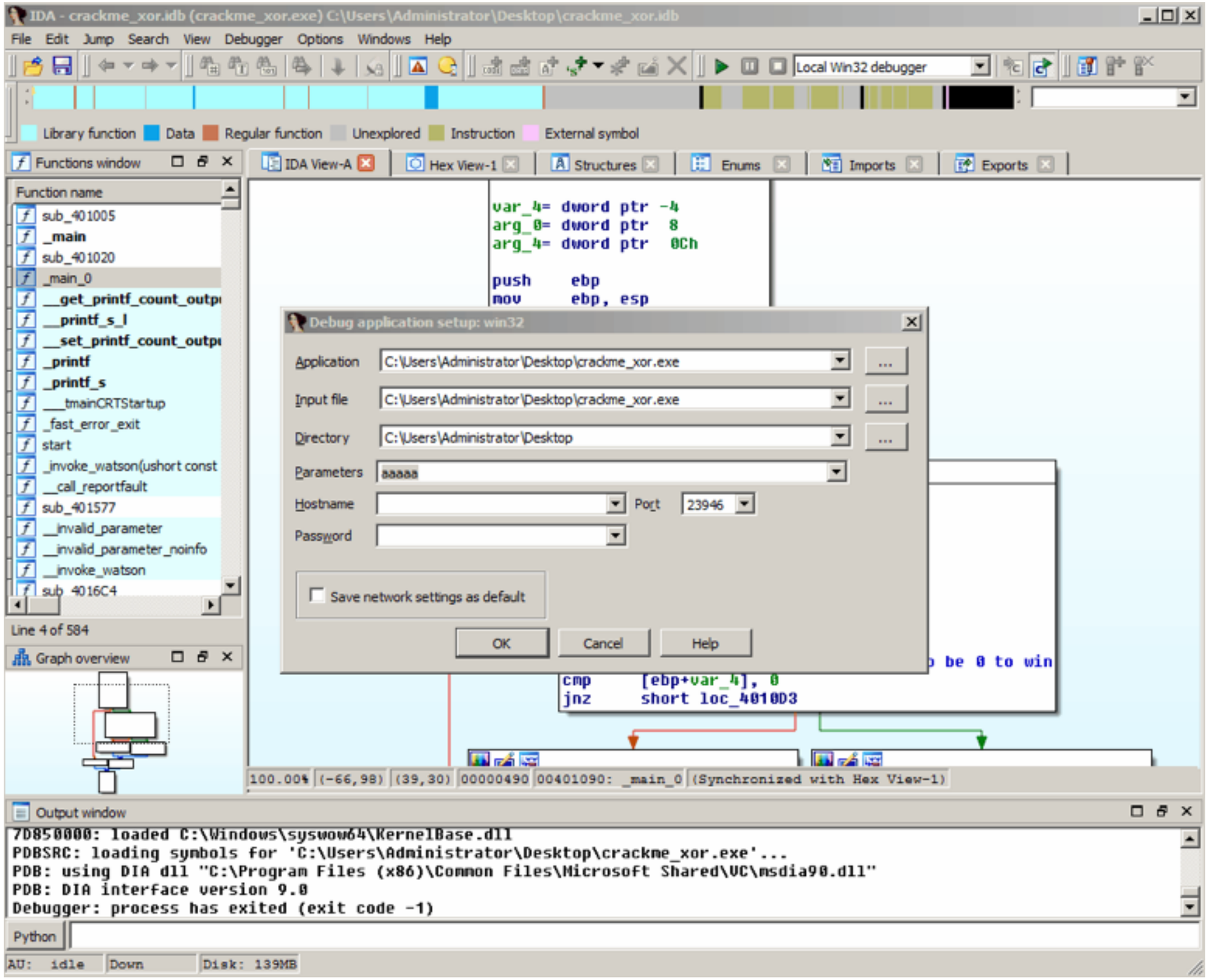
Ponce

IDA plugin contest - 2016

- **Taint analysis:** this mode is used to easily track “where” a user input occurs inside a program and observe all the propagations related with the given input

- **Symbolic analysis:** in this mode, the plugin maintains a symbolic state of registers and memory at each step in a binary’s execution path, allowing the user to solve user-controlled conditions to do manually guided execution


IDA - crackme_xor.idb (crackme_xor.exe) C:\Users\Administrator\Desktop\crackme_xor.idb
File Edit Jump Search View Debugger Options Windows Help
Local Win32 debugger
Library function Data Regular function Unexplored Instruction External symbol
Functions window
Function name
sub_401005
_main
sub_401020
_main_0
__get_printf_count_outp
__printf_s_l
__set_printf_count_outp
_printf
_printf_s
___tmainCRTStartup
_fast_error_exit
start
_invoke_watson(ushort const
__call_reportfault
sub_401577
__invalid_parameter
__invalid_parameter_noinfo
__invoke_watson
sub_4016C4
Line 4 of 584
Graph overview
IDA View-A
Hex View-1
Structures
Enums
Imports
Exports
var_4= dword ptr -4
arg_0= dword ptr 8
arg_4= dword ptr 0Ch
push ebp
mov ebp, esp
Debug application setup: win32
Application C:\Users\Administrator\Desktop\crackme_xor.exe
Input file C:\Users\Administrator\Desktop\crackme_xor.exe
Directory C:\Users\Administrator\Desktop
Parameters aaaaa
Hostname
Port 23946
Password
Save network settings as default
OK
Cancel
Help
be 0 to win
cmp [ebp+var_4], 0
jnz short loc_4010D3
100.00% (-66,98) (39,30) 00000490 00401090: _main_0 (Synchronized with Hex View-1)
Output window
7D850000: loaded C:\Windows\syswow64\KernelBase.dll
PDBSRC: loading symbols for 'C:\Users\Administrator\Desktop\crackme_xor.exe'...
PDB: using DIA dll "C:\Program Files (x86)\Common Files\Microsoft Shared\VC\msdia90.dll"
PDB: DIA interface version 9.0
Debugger: process has exited (exit code -1)
Python
AU: idle Down Disk: 139MB

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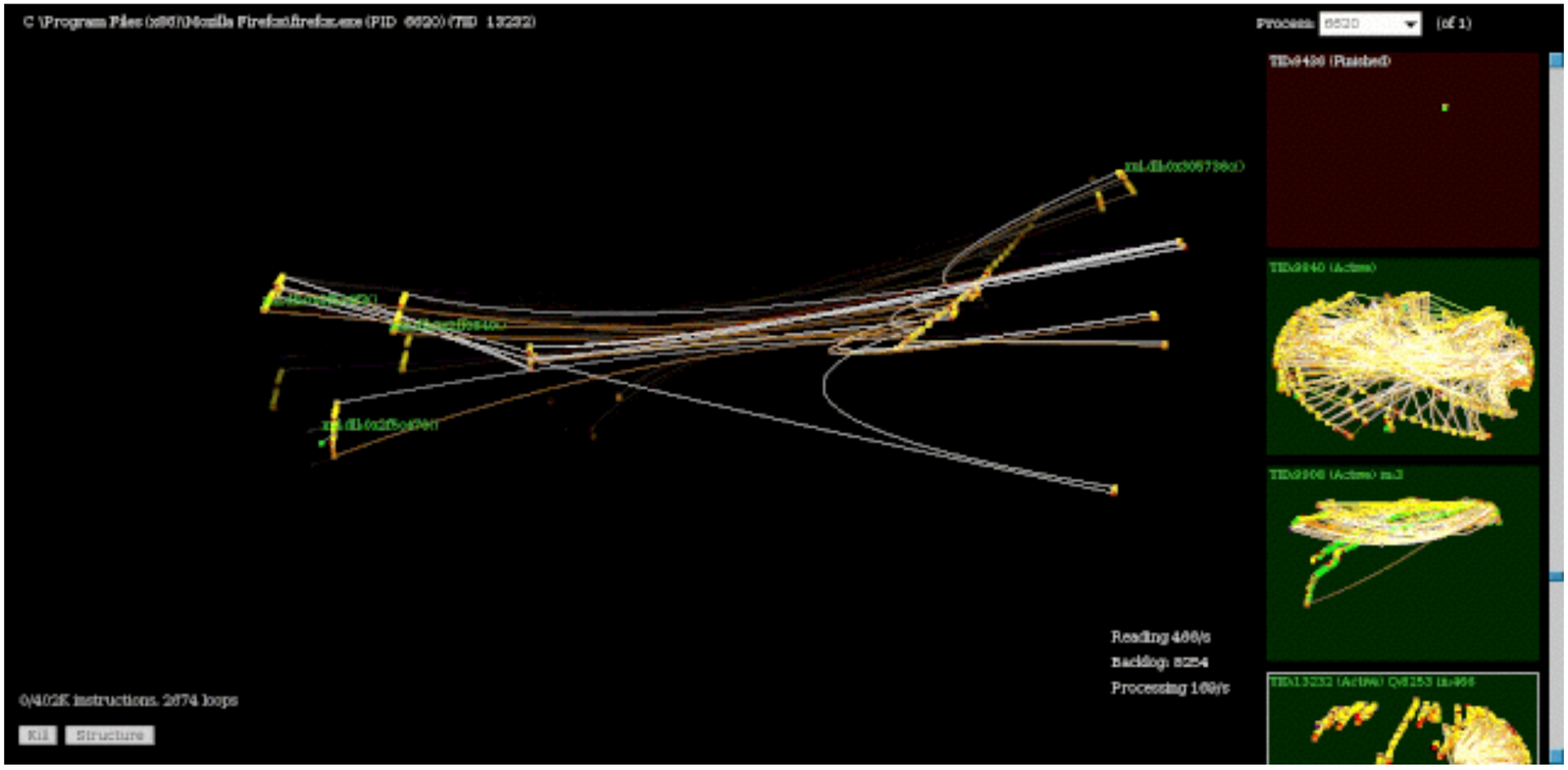
RGAT

An instruction trace visualisation tool



Useful links to fry your brain

(Over 1337 °C)

- **Chill**
  - https://github.com/RPISEC/MBE (lectures 2 and 3)
  - Reddit
    - https://reddit.com/r/reverseengineering
    - https://reddit.com/r/netsec
- **Practice**
  - http://reversing.kr
  - https://ringzer0team.com
  - http://crackmes.de
  - https://ctftime.org (Read CTF writeups and try to solve available challenges)
  - **Play CTFs**: alone or create/join a team

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THE END

Security Through Obscurity

André Baptista

@0xACB