第一次二进制培训

Vidar-Team

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为什么要学二进制?

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二进制有哪些方向

- 逆向工程
- PWN

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什么是逆向工程？

一种探究应用程序内部组成结构及工作原理的技术

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- 轻松窥探程序内部结构、掌握工作原理
- 在程序的开发与测试阶段发现BUG和漏洞
- 并直接修改程序文件或内存解决这些隐含的问题
- 为程序添加新功能，使程序更强大

这就像是一种魔法，魅力无限

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什么是PWN?

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控制一个程序的流程，触发攻击

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1. 反汇编

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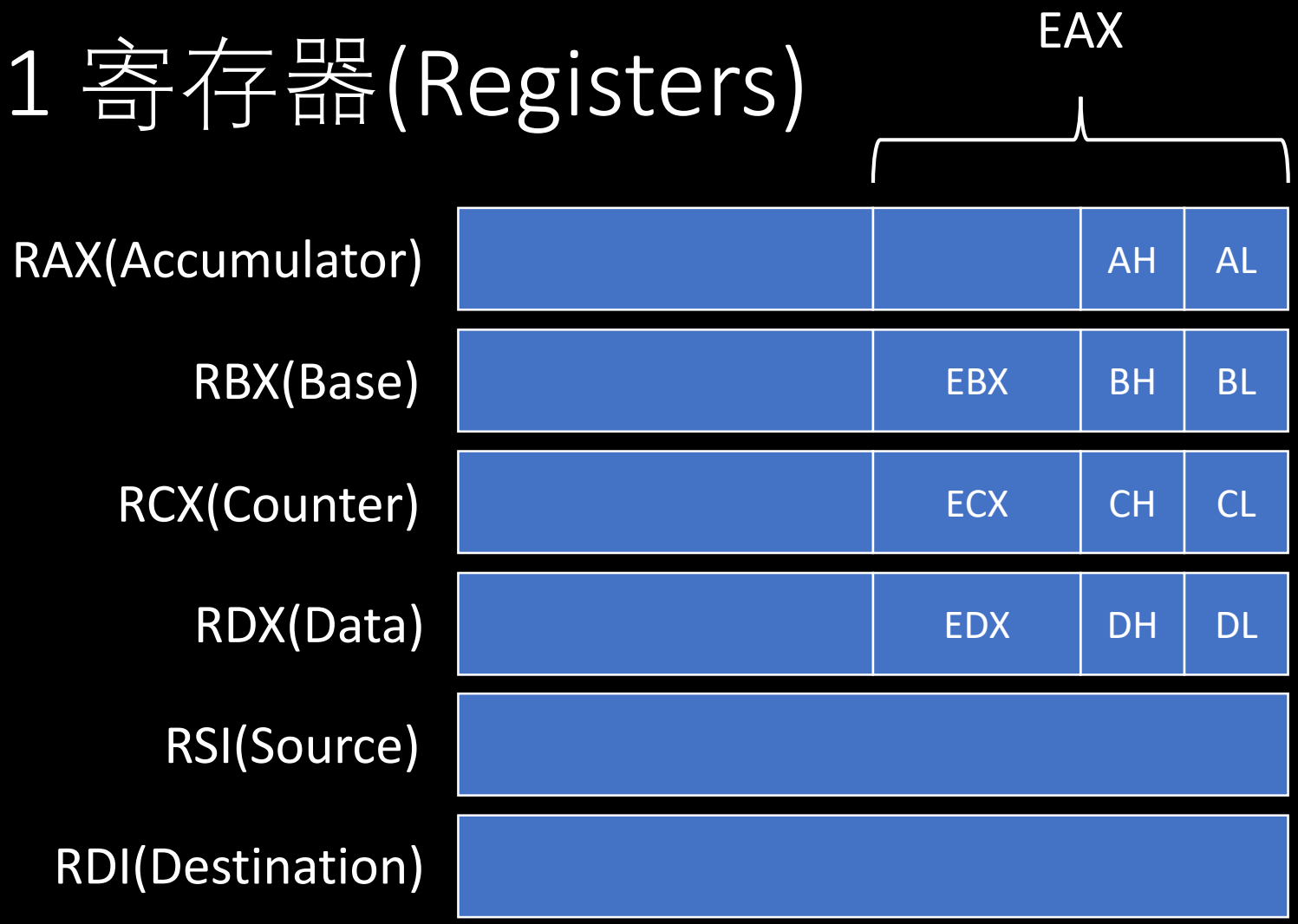
1.1 寄存器(Registers)



== 8 bit

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1.1 寄存器(Registers)

RSP(Stack Pointer)

RBP(Stack Base Pointer)

RIP(Instruction Pointer)

 == 8 bit

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1.1 汇编语言

Add a, b: a += b
Sub a, b: a -= b
Jmp a: 跳转到a地址
Call a: 调用a函数
Cmp a, b: a与b进行比较
Mov a, b: 把b的值赋值给a
Ret: 返回到栈顶指向的地址
Nop: no operation
Push a: 将a入栈
Pop a: 出栈并存入a中

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1.1 汇编语言 来看一个demo

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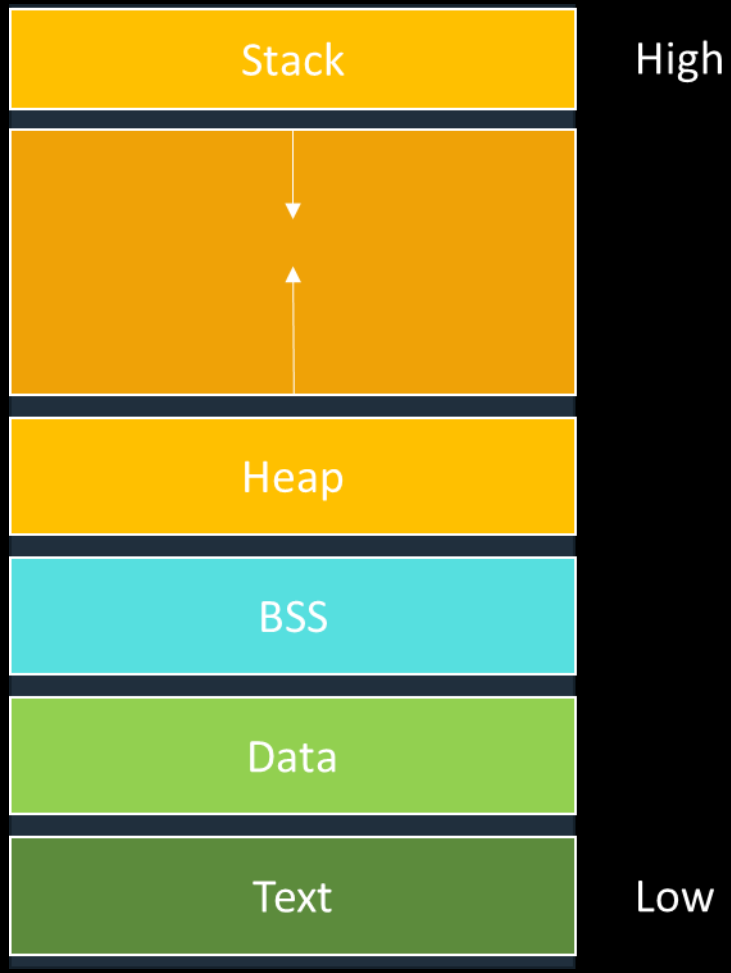
2. Program Structure

2.1



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2.1

```c
#include <stdio.h>

int c = 0x1234;
int d;

void myFunc()
{
    int a = 0x2333;
    int b = 0x6666;
    printf("%d, %d", a, b);
}

int main()
{
    c = 0x4321;
    d = 0x1551;
    myFunc();
}
```

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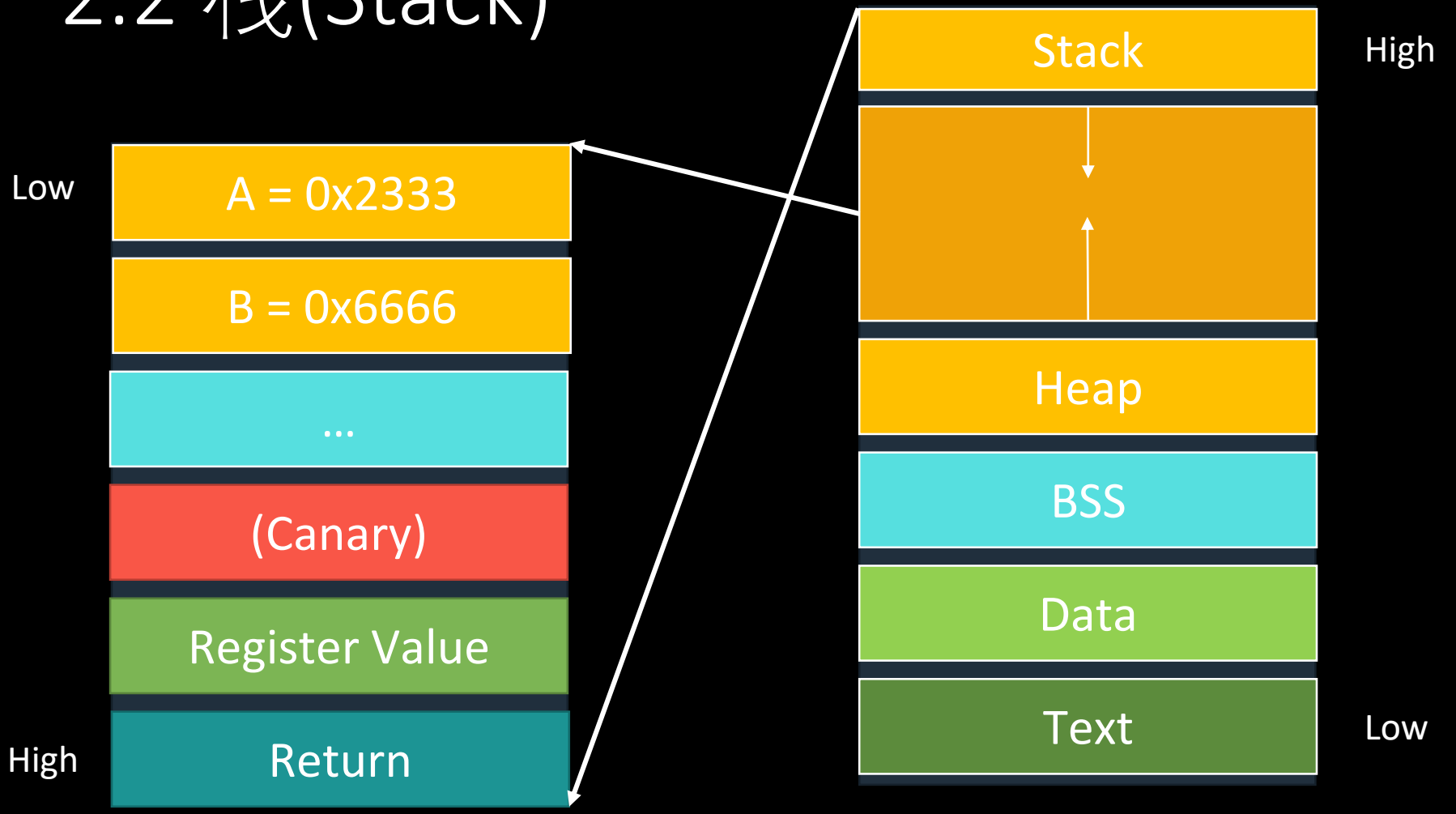
2.1 我们可以用IDA看一看

2.2 栈(Stack)



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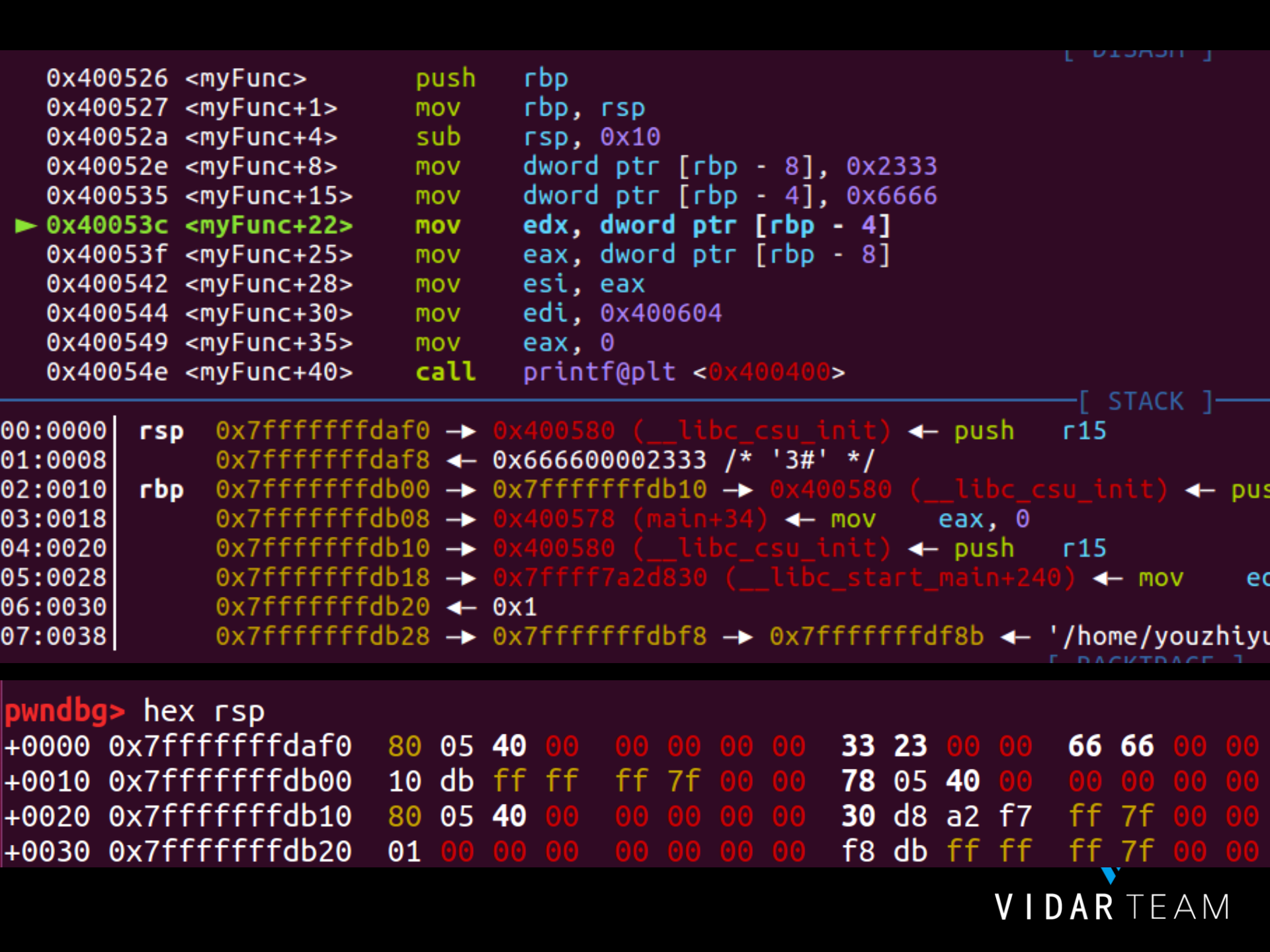
0x400526 <myFunc> push rbp
0x400527 <myFunc+1> mov rbp, rsp
0x40052a <myFunc+4> sub rsp, 0x10
0x40052e <myFunc+8> mov dword ptr [rbp - 8], 0x2333
0x400535 <myFunc+15> mov dword ptr [rbp - 4], 0x6666
0x40053c <myFunc+22> mov edx, dword ptr [rbp - 4]
0x40053f <myFunc+25> mov eax, dword ptr [rbp - 8]
0x400542 <myFunc+28> mov esi, eax
0x400544 <myFunc+30> mov edi, 0x400604
0x400549 <myFunc+35> mov eax, 0
0x40054e <myFunc+40> call printf@plt <0x400400>
[STACK]
00:0000 rsp 0x7fffffffdaf0 → 0x400580 (__libc_csu_init) ← push r15
01:0008 0x7fffffffdaf8 ← 0x666600002333 /* '3#' */
02:0010 rbp 0x7fffffffdb00 → 0x7fffffffdb10 → 0x400580 (__libc_csu_init) ← push
03:0018 0x7fffffffdb08 → 0x400578 (main+34) ← mov eax, 0
04:0020 0x7fffffffdb10 → 0x400580 (__libc_csu_init) ← push r15
05:0028 0x7fffffffdb18 → 0x7ffff7a2d830 (__libc_start_main+240) ← mov
06:0030 0x7fffffffdb20 ← 0x1
07:0038 0x7fffffffdb28 → 0x7fffffffdbf8 → 0x7fffffffdf8b ← '/home/youzhiyu
pwndbg> hex rsp
+0000 0x7fffffffdaf0 80 05 40 00 00 00 00 00 33 23 00 00 66 66 00 00
+0010 0x7fffffffdb00 10 db ff ff ff 7f 00 00 78 05 40 00 00 00 00 00
+0020 0x7fffffffdb10 80 05 40 00 00 00 00 00 30 d8 a2 f7 ff 7f 00 00
+0030 0x7fffffffdb20 01 00 00 00 00 00 00 00 f8 db ff ff ff 7f 00 00

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2.2 Stack – Return address

- Call function前，将 return address 存进 stack
- Return时，回到 stack 中所存的地址

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2.2 栈溢出

```
1   #include <stdio.h>
2
3   int main()
4   {
5       char a[16];
6       char b[16] = "hello\n";
7       gets(a);
8       printf("%s", b);
9   }
```

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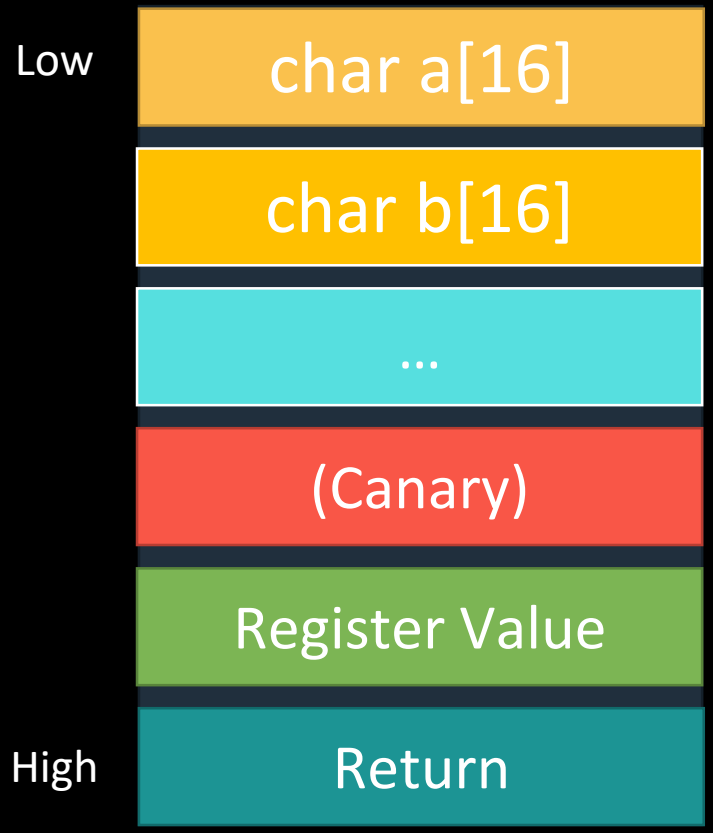
2.2 栈溢出



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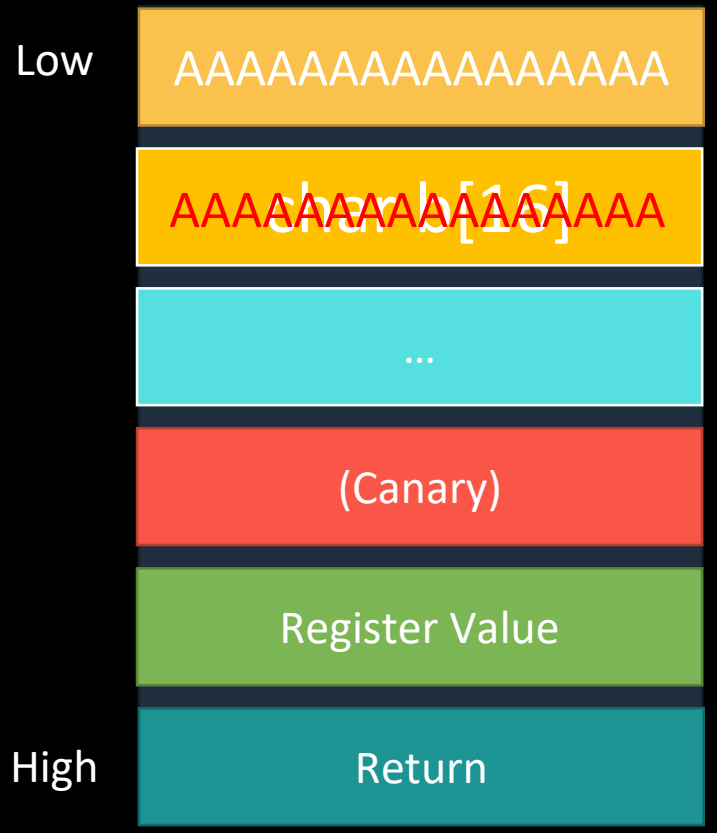
2.2 栈溢出



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2.2 我们可以来动手调试一下

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2.3 Security Options

```
root@kali:~/ctf/PWN# checksec test
[*] '/root/ctf/PWN/test'
    Arch:     amd64-64-little
    RELRO:    Partial RELRO
    Stack:    Canary found
    NX:       NX enabled
    PIE:      PIE enabled
root@kali:~/ctf/PWN#
```

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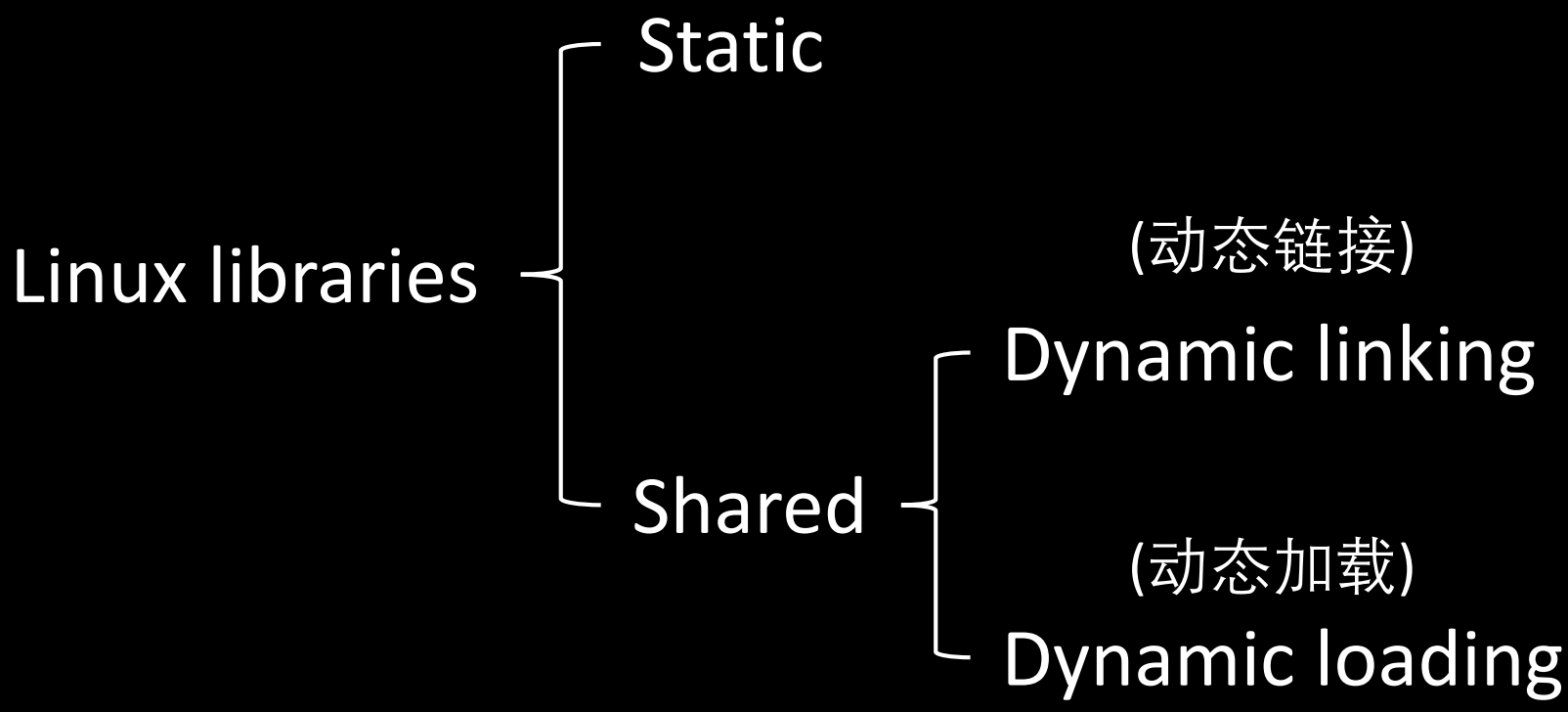
2.4 Linux libraries



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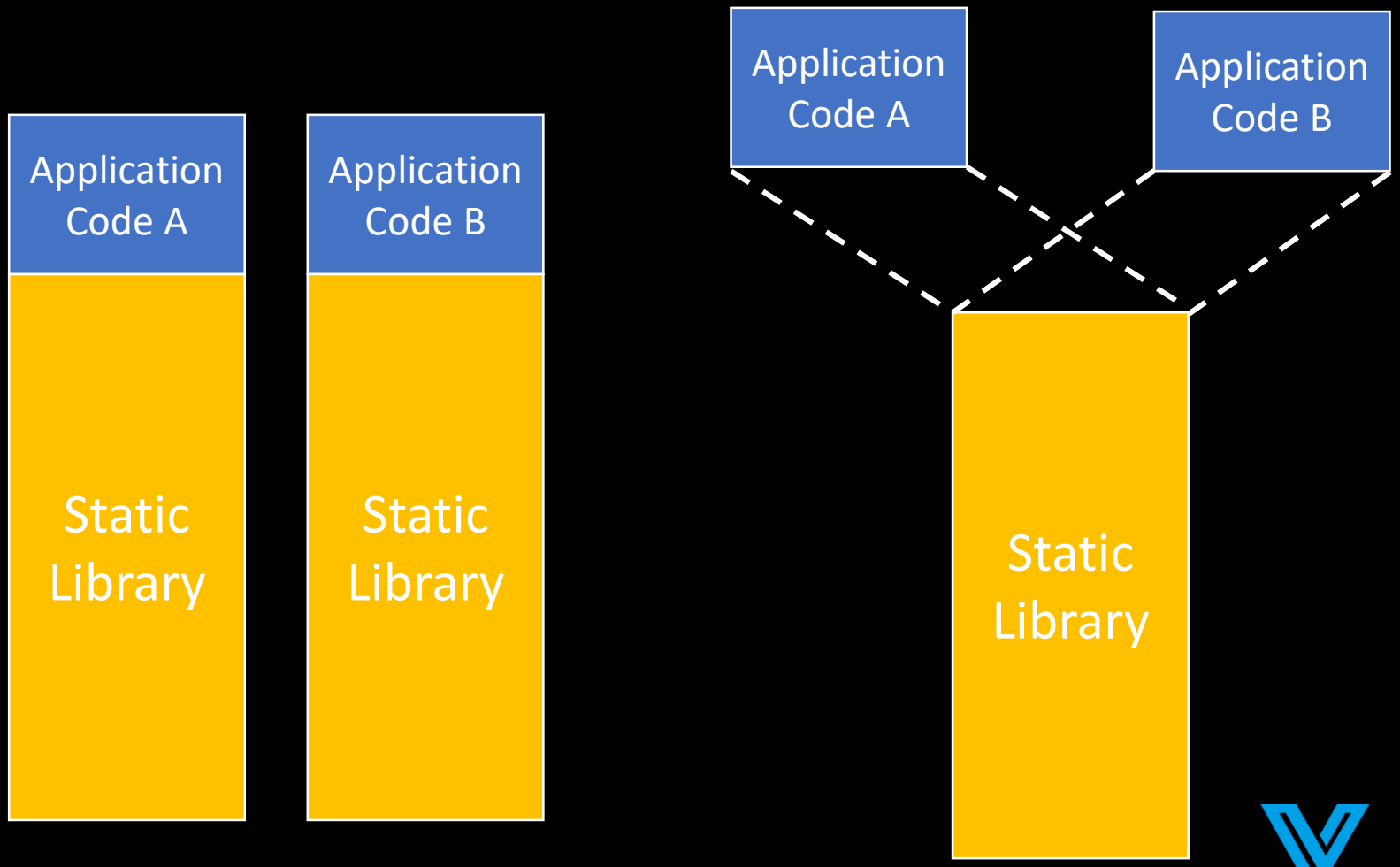
2.4 Dynamic linking



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2.4 Libc – C standard library

Ubuntu 16.04 -- Libc 2.23
Ubuntu 18.04 -- Libc 2.27+

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2.5 Lazy Binding

在第一次 call library 函数时，才会去寻找函数真正的位置进行binding

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2.6 GOT & PLT

- GOT (Global Offset Table, 全局偏移表)
- PLT (Procedure Linkage Table, 过程连接表)

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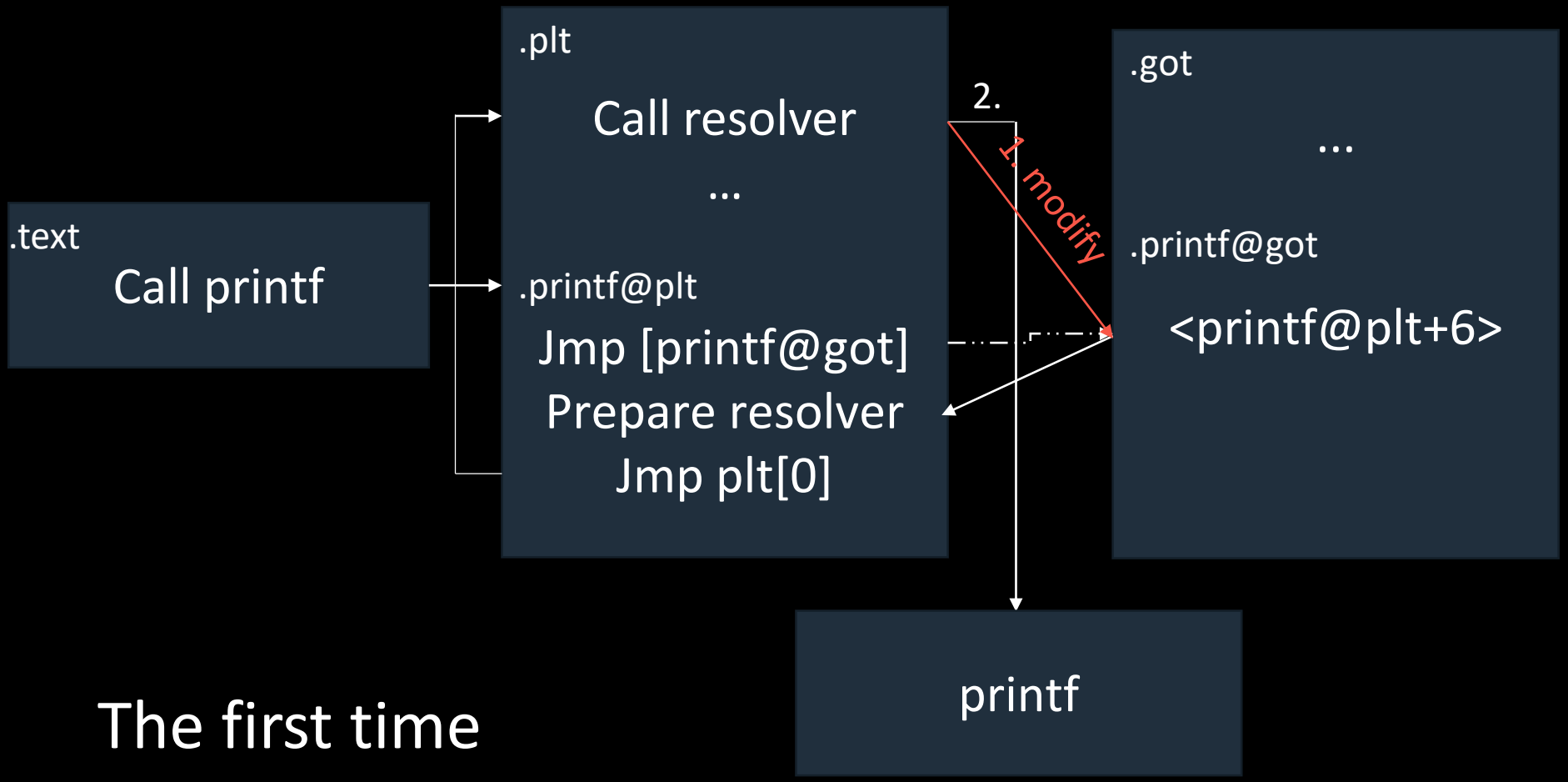
2.6 GOT & PLT



The first time

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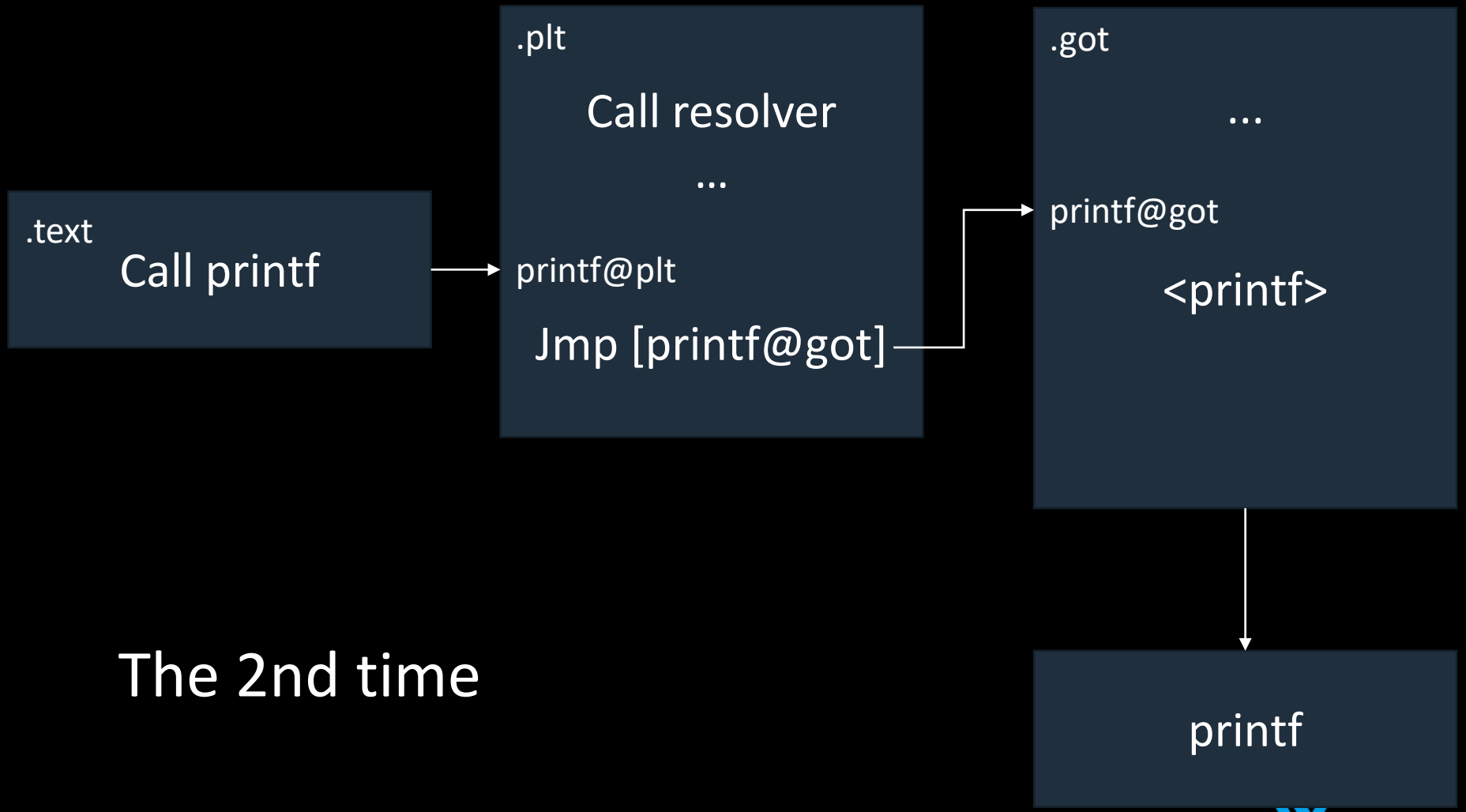
2.6 GOT & PLT



The 2nd time

2.7 CALL

```
.text
                                ...
   0x000011d3 e868feffff     call printf
0x000011d8 b800000000      mov eax, 0
                                ...
```

==

Push
0x000011d8

+

Jmp printf

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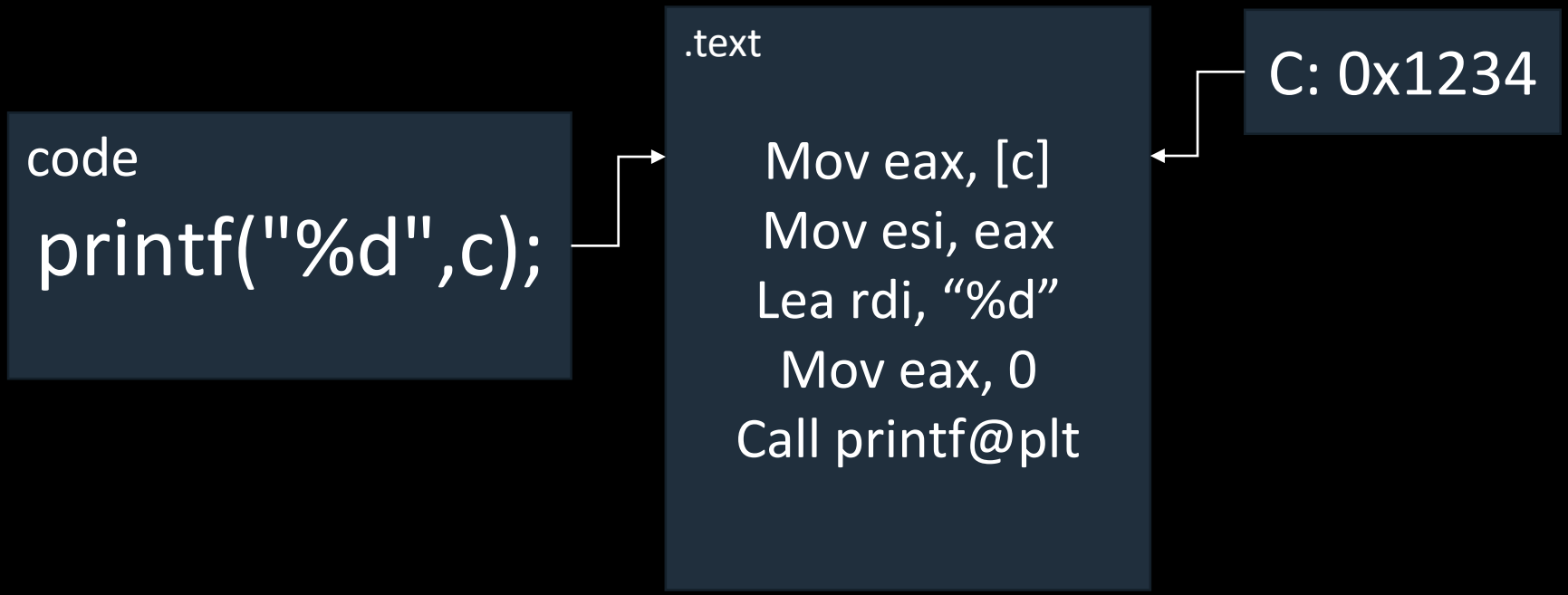
2.7 CALL FUNC (x64)

rdi	rsi	rdx	rcx	r8	r9	stack



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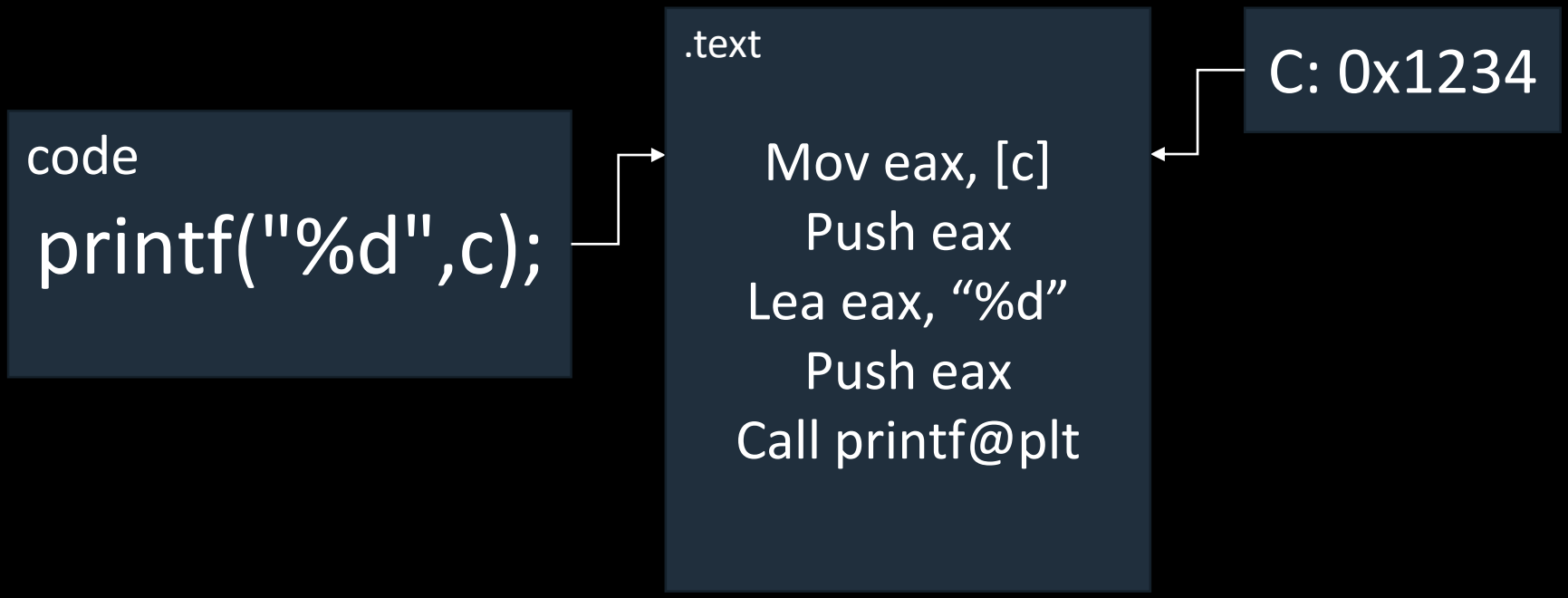
2.8 CALL FUNC (x86)

stack



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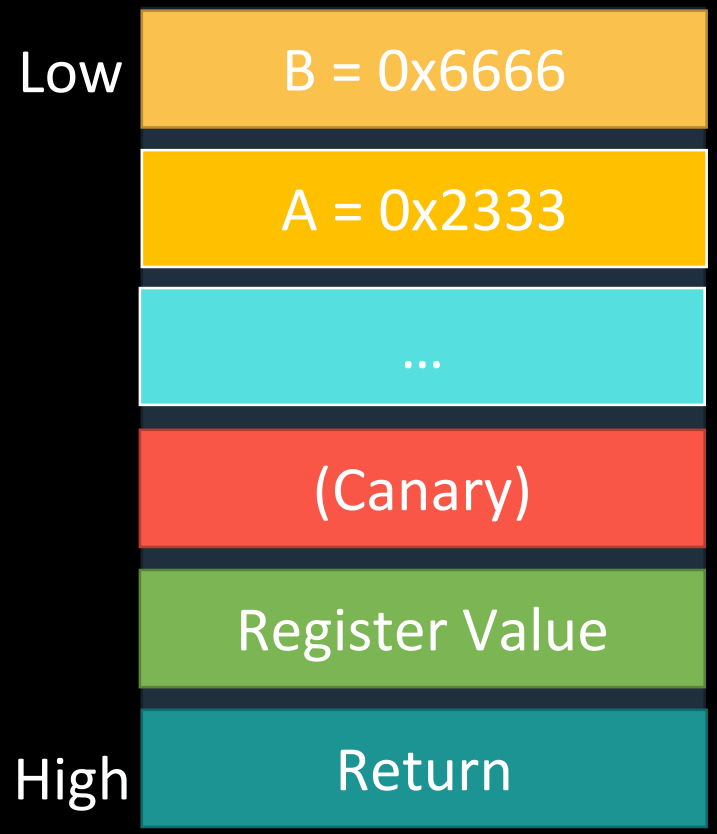
3.1 ROP (Return Oriented Programming)

栈缓冲区溢出的基础上，利用程序中已有的小片段 (gadgets) 来改变某些寄存器或者变量的值，从而控制程序的执行流程



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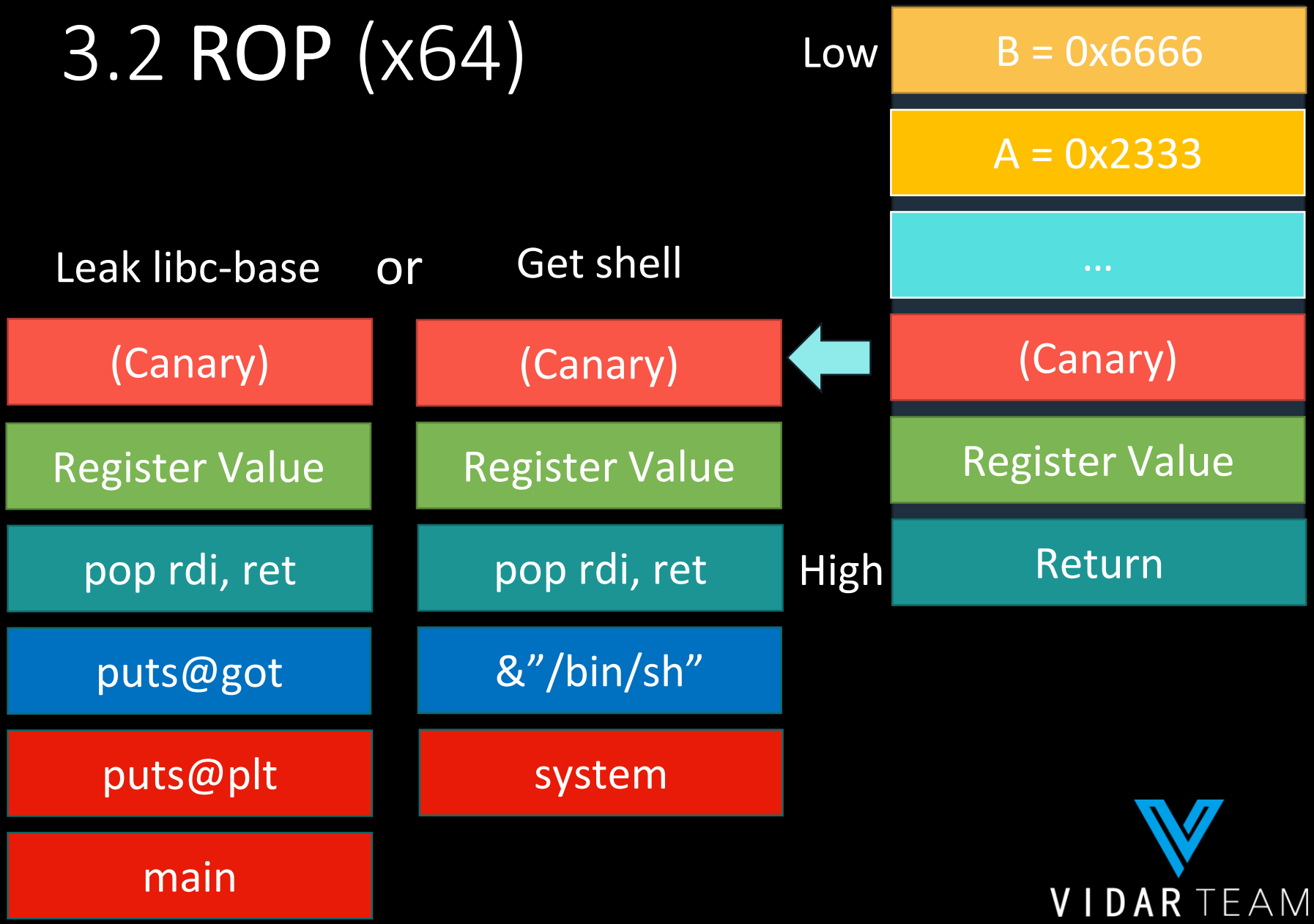
3.2 ROP (x64)



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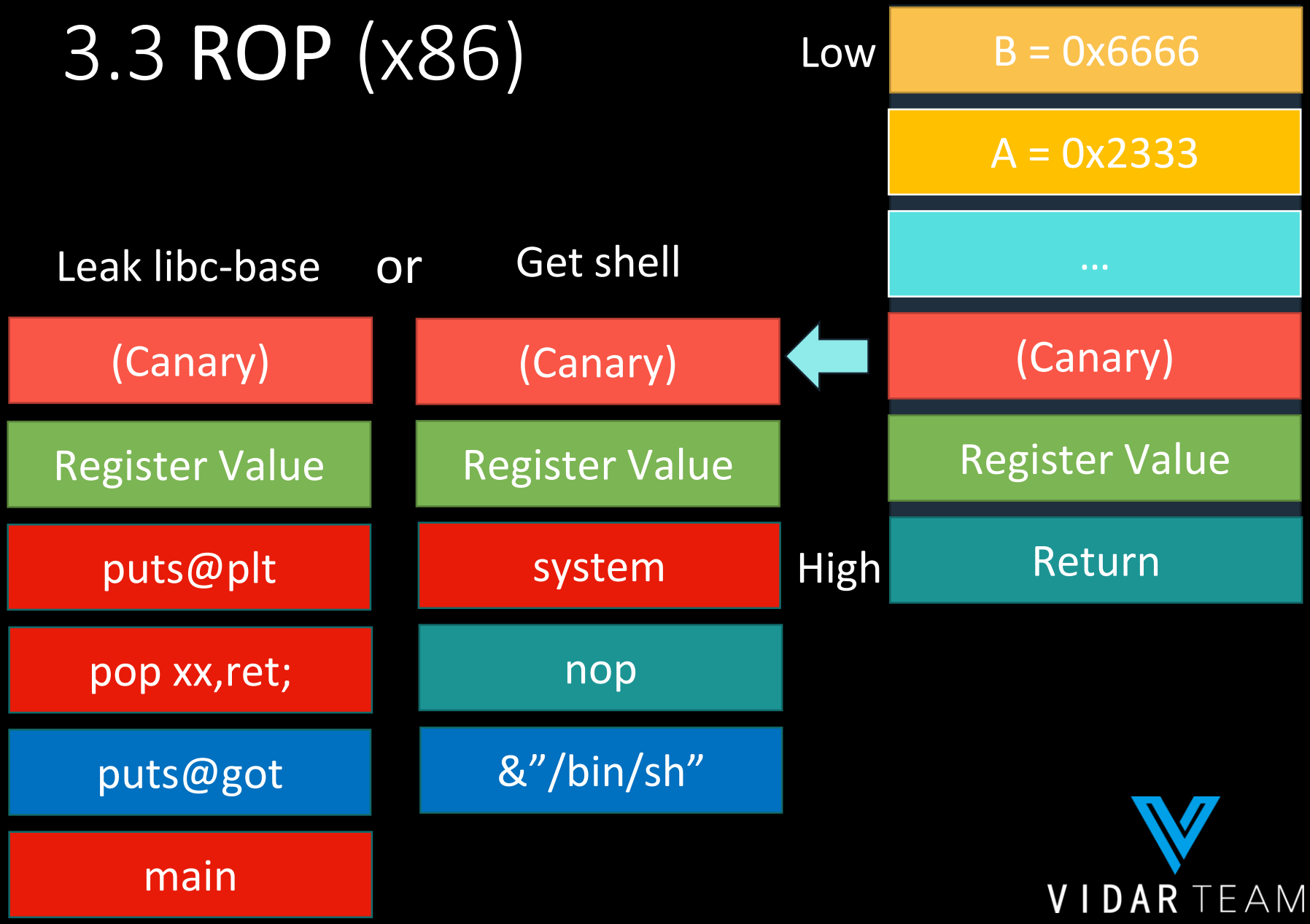
3.3 ROP (x86)



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4.1 TOOLS

- IDA Pro -- 反编译工具
- Gdb -- Linux中必要的调试工具
- Pwndbg -- Gdb插件（便于调试）
- Pwntools -- 写exp和poc的利器

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4.1 TOOLS

- Checksec——可以很方便的知道elf程序的安全性和程序的运行平台
- ROPgadget——rop利用工具

……

5.0 PWN!

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5.0 Books!

- 《汇编语言》（王爽）
- 《程序员的自我修养》
- 《加密与解密》

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