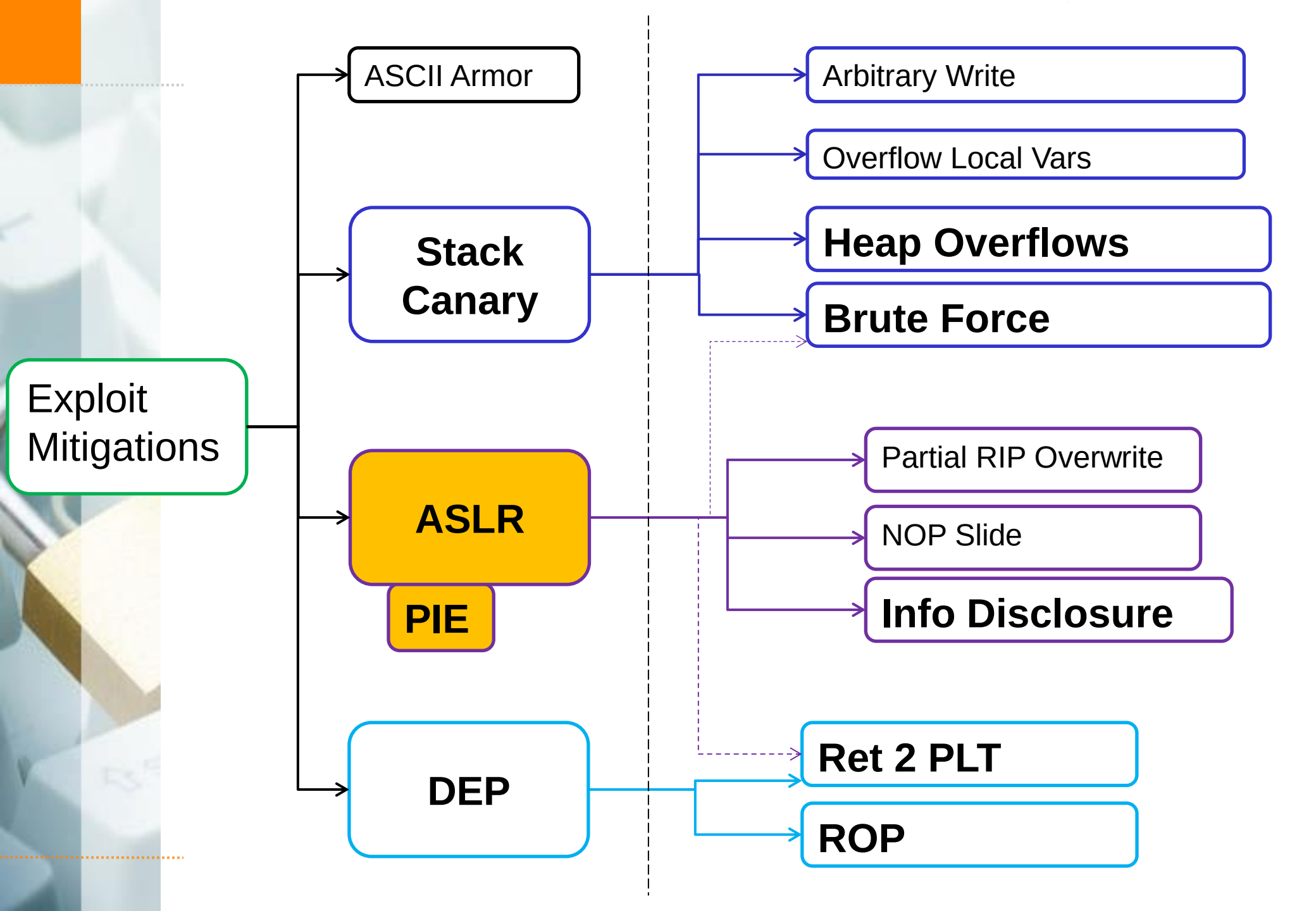
Exploit Mitigation - PIE

Compass Security Schweiz AG
Werkstrasse 20
Postfach 2038
CH-8645 Jona

Tel +41 55 214 41 60
Fax +41 55 214 41 61
team@csnc.ch
www.csnc.ch


Exploit Mitigations
ASCII Armor
Stack Canary
ASLR
PIE
DEP
Arbitrary Write
Overflow Local Vars
Heap Overflows
Brute Force
Partial RIP Overwrite
NOP Slide
Info Disclosure
Ret 2 PLT
ROP

All three exploit mitigations can be defeated by black magic

Easily

Is there a solution?

Exploit Mitigation - PIE

Compass Security Schweiz AG
Werkstrasse 20
Postfach 2038
CH-8645 Jona

Tel +41 55 214 41 60
Fax +41 55 214 41 61
team@csnc.ch
www.csnc.ch

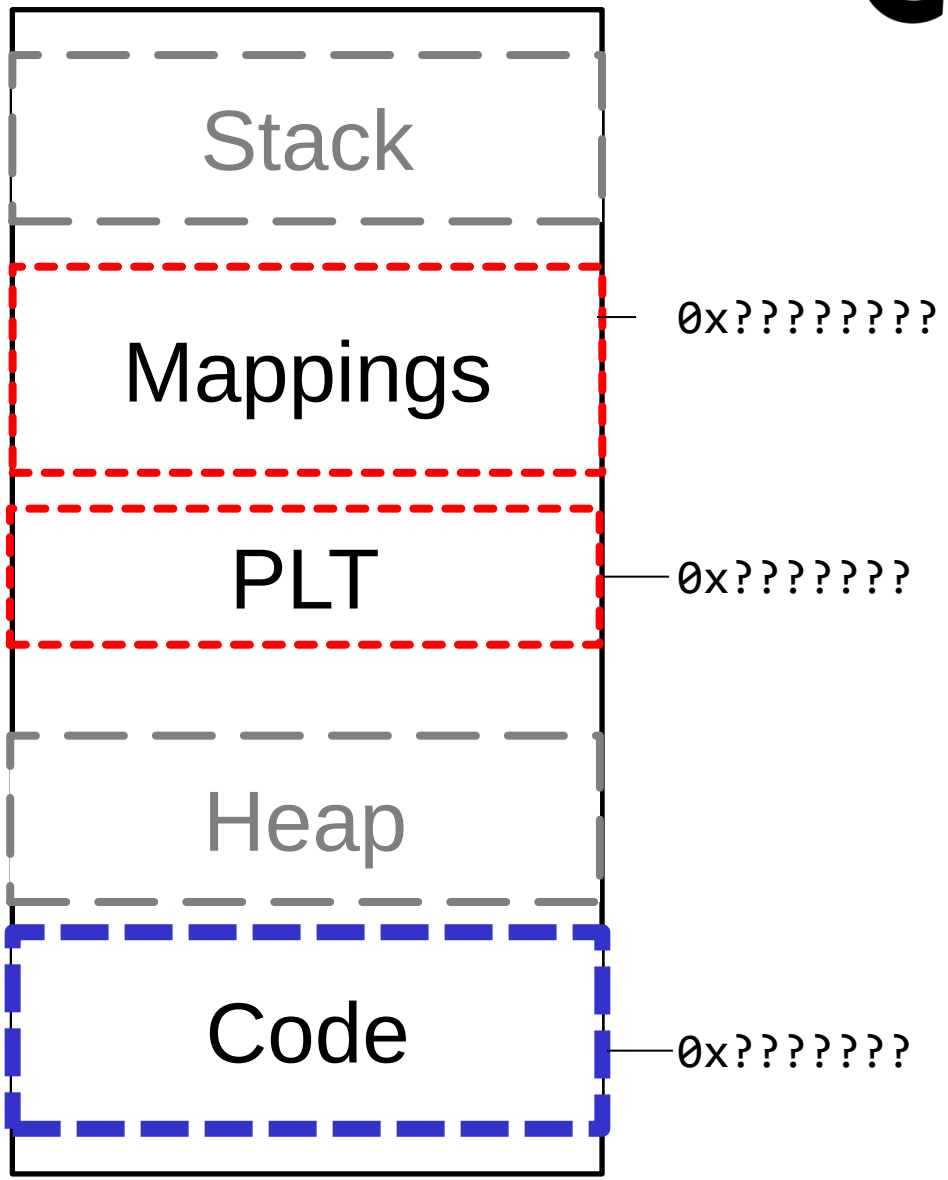
The solution to all problems… PIE

Exploit Mitigation++

- Fix:
  - Compile as **PIE**
  - **PIE: P**osition **I**ndependent **E**xecutable
  - Will randomize Code and PLT, too

- Note:
  - Shared libraries are PIC
    - (Position Independent Code)
  - Because they don't know where they are being loaded
  - Always randomized, even without PIE

Exploiting: ASLR for code: PIE



Exploiting: ASLR for code: PIE

PIE randomizes Code segment base address

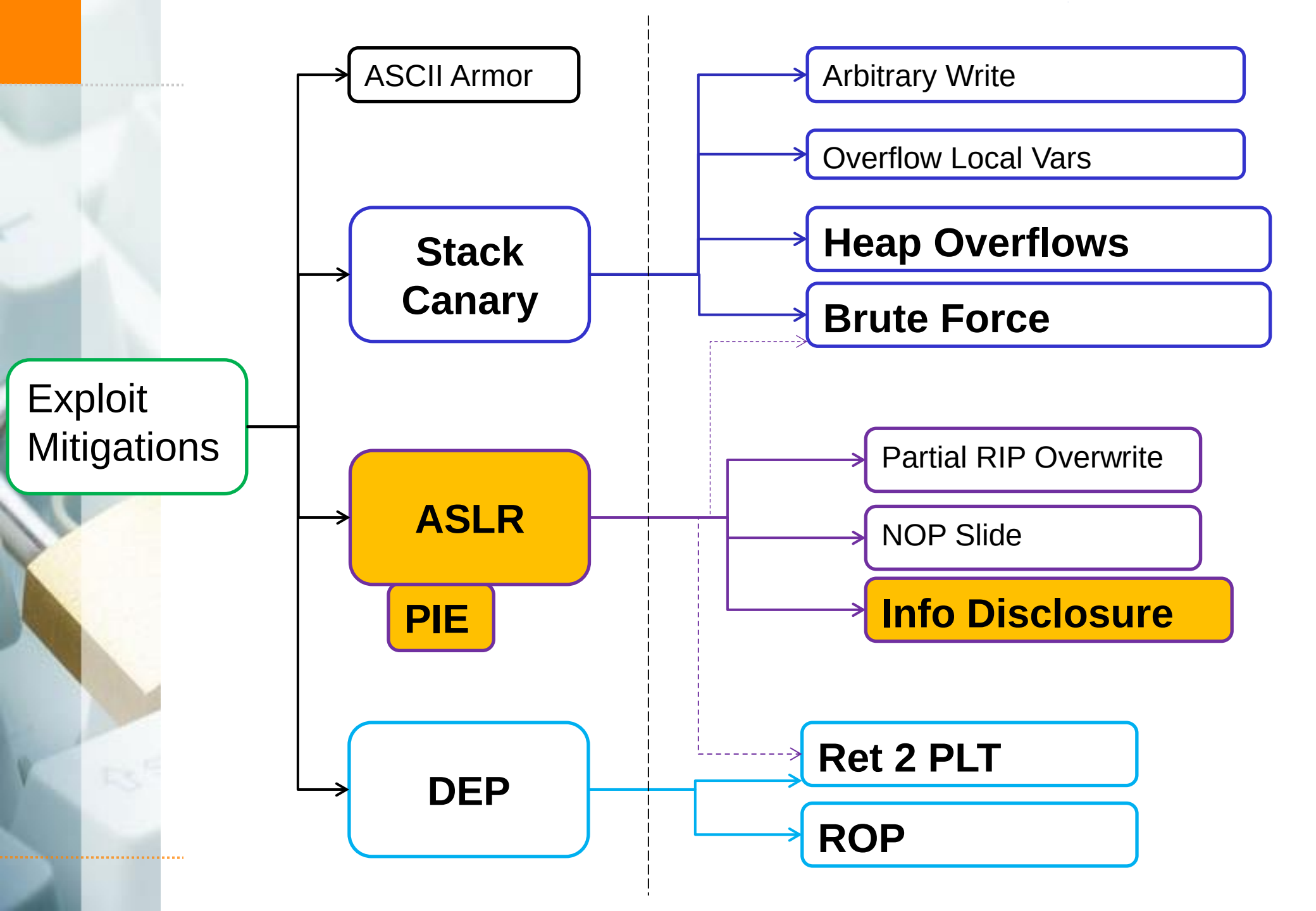
PIE randomizes GOT/PLT base address too

No more static locations!

Defeat Exploit Mitigation: PIE

Compass Security Schweiz AG
Werkstrasse 20
Postfach 2038
CH-8645 Jona

Tel +41 55 214 41 60
Fax +41 55 214 41 61
team@csnc.ch
www.csnc.ch


Exploit Mitigations
ASCII Armor
Stack Canary
ASLR
PIE
DEP
Arbitrary Write
Overflow Local Vars
Heap Overflows
Brute Force
Partial RIP Overwrite
NOP Slide
Info Disclosure
Ret 2 PLT
ROP


[the cake is a lie]

ASLR vs Information Leak

ASLR assumes attacker can't get information

What if they can?

Meet: Memory Leak

Memory Leak / Information Disclosure

Compass Security Schweiz AG
Werkstrasse 20
Postfach 2038
CH-8645 Jona

Tel +41 55 214 41 60
Fax +41 55 214 41 61
team@csnc.ch
www.csnc.ch

Memory Leak

Memory leak or information disclosure:

- Return more data to the attacker than the intended object size
- The data usually includes meta-data, like:
  - Stack pointers
  - Return addresses
  - Heap-management data
  - Etc.

ASLR vs Memory Leak

char **buf1**[**16**]	*ptr	SFP	EIP

Server:

```
send(socket, buf1, sizeof(int) * 16, NULL);
```

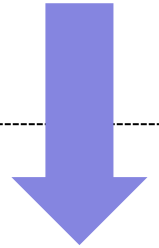
Oups, attacker got 64 bytes back

- Pointer to stack, code, heap
- Can deduce base address

ASLR vs Memory Leak

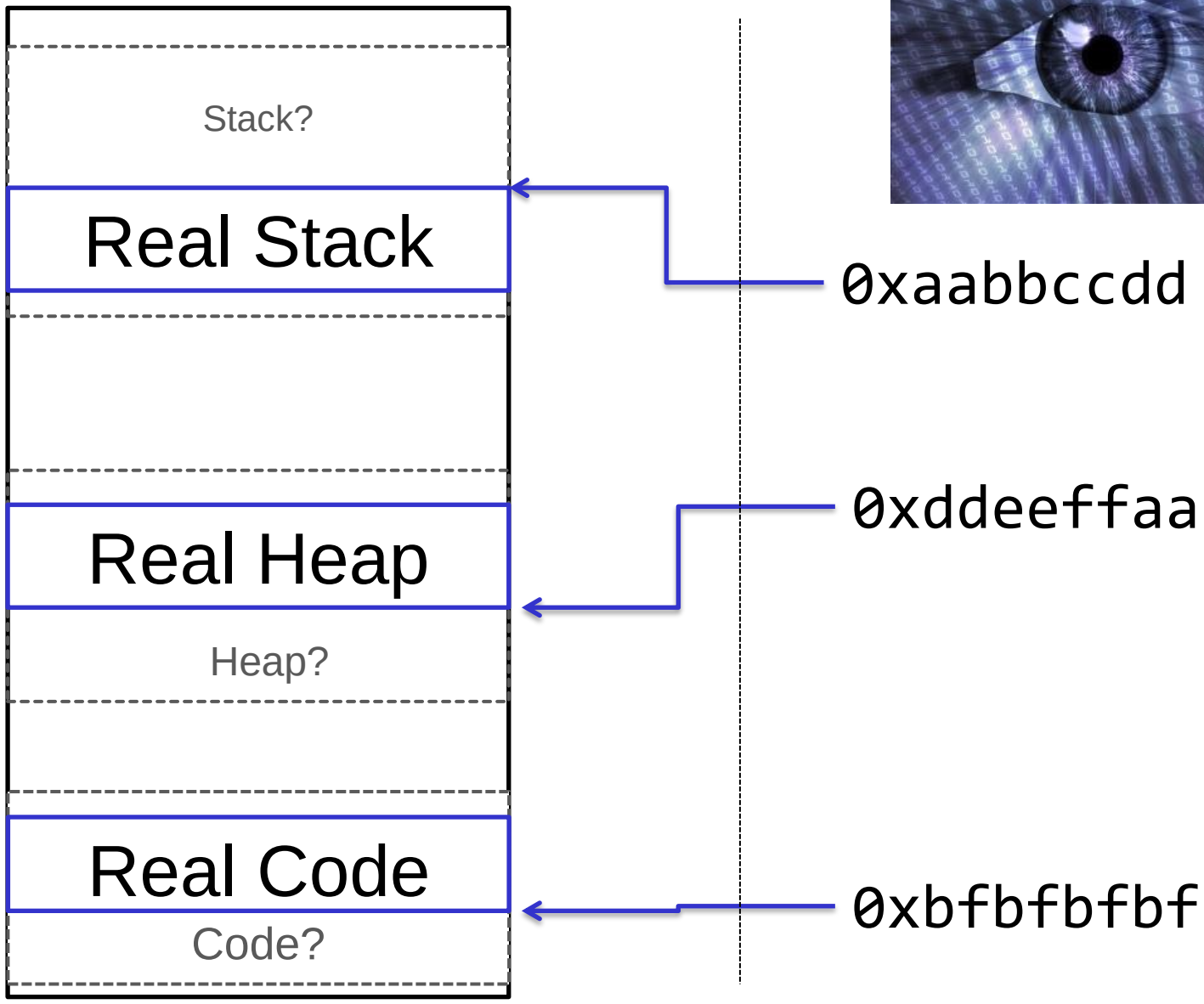
char **buf1**[16]	*ptr	SFP	EIP

send(socket, **buf1**, sizeof(int) * 16, NULL);



char **buf1**[16]	*ptr	SFP	EIP

Exploiting: ASLR for code: PIE



Exploiting: ASLR for code: PIE

Exploiting: ASLR for code: PIE

Attacker:

- Information disclosure / memory leak
- Gains a pointer (Address of memory location)
- From pointer: Deduct base address of segment
- From base address: Can deduct all other addresses

~~A note on code -> libraries:~~

- ~~Distance between code segment and mapped libraries is usually constant~~
- ~~Got SIP? Can use LIBC gadgets…~~

Exploiting: ASLR for code: PIE

Example: Windows memory disclosure (unpatched, 21.2.17, CVE-2017-0038)

> As a consequence, the 16x16/24bpp bitmap is now described by just 4 bytes, which is good for only a single pixel. **The remaining 255 pixels are drawn based on junk heap data, which may include sensitive information, such as private user data or information about the virtual address space.**

Windows gdi32.dll heap-based out-of-bounds reads / memory disclosure in EMR_SETDIBITSTODEVICE and possibly other records

‹ Prev 2 of 4 Next ›

Back to list

Project Member Reported by mjurczyk@google.com, Nov 16

In ~~issue #757~~, I described multiple bugs related to the handling of DIBs (Device Independent Bitmaps) embedded in EMF records, as implemented in the user-mode Windows GDI library (gdi32.dll). As a quick reminder, the DIB-embedding records follow a common scheme: they include four fields, denoting the offsets and lengths of the DIB header and DIB data (named offBmiSrc, cbBmiSrc, offBitsSrc, cbBitsSrc). A correct implementation should verify that:


GIT THE PRINCESS!
HOW TO SAVE THE PRINCESS USING 8 PROGRAMMING LANGUAGES
BY toggl
Goon Squad
YOU HAVE JAVASCRIPT
YOU SPEND HOURS PICKING LIBRARIES, SETTING UP NODE & BUILDING A FRAMEWORK FOR THE CASTLE.
BY THE TIME YOU'RE FINISHED WITH THE FRAMEWORK, THE FORT HAS BEEN ABANDONED AND THE PRINCESS HAS MOVED TO ANOTHER CASTLE
YOU HAVE C
YOU HAVE A LIBRARY FOR A CASTLE & A LIBRARY FOR THE PRINCESS- CHARGE!
YOU RESCUE THE PRINCESS HER DOG, HER ENTIRE WARDROBE & EVERYTHING SHE HAS EVER EATEN... FUCK - DID I FORGET A NULL-TERMINATOR?

Exploit Mitigation Conclusion

Compass Security Schweiz AG
Werkstrasse 20
Postfach 2038
CH-8645 Jona

Tel +41 55 214 41 60
Fax +41 55 214 41 61
team@csnc.ch
www.csnc.ch

Defeat Exploit Mitigations: TL;DR

Enable ALL the mitigations (DEP, ASLR w/PIE, Stack Protector)

Defeat ALL the mitigations:

- **ROP** shellcode as stager to defeat **DEP**
- **Information leak** to defeat **ASLR**
- **Non stack**-based-stack-overflow vulnerability

Recap

Information disclosure can eliminiate ASLR protection

Which enables ROP to eliminate DEP