MEMORY SAFETY
ATTACKS & DEFENSES

CMSC 414

FEB 06 2018

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void safe()
{
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    fgets(buf, 80, stdin);
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FORMAT STRING VULNERABILITIES

PRINTF FORMAT STRINGS

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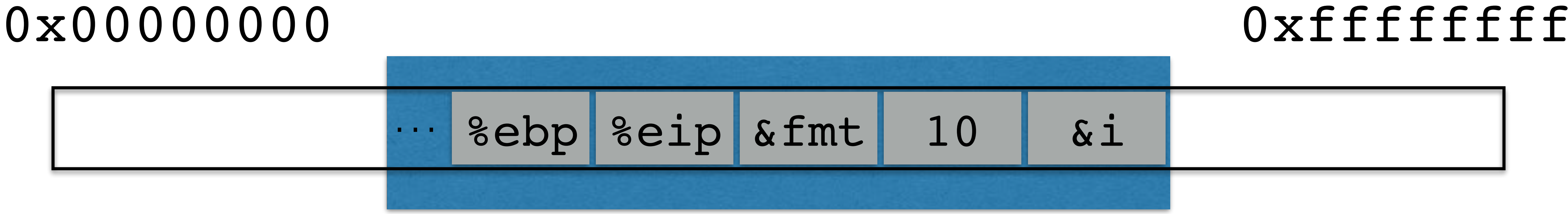

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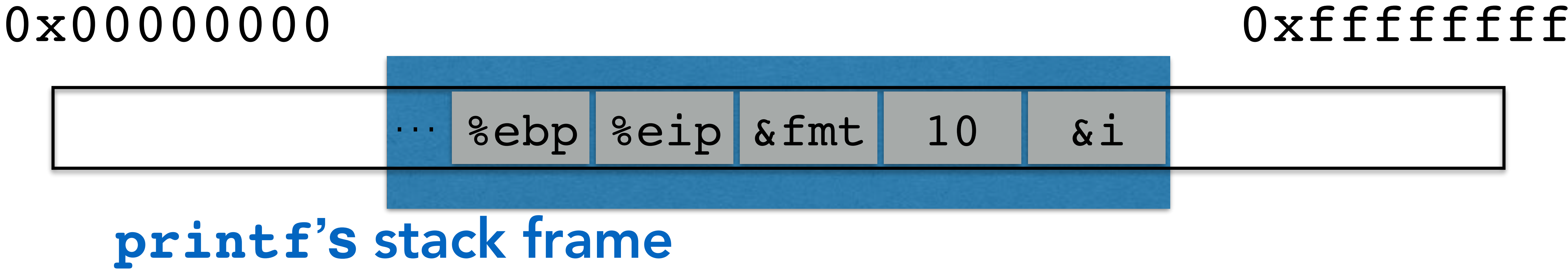

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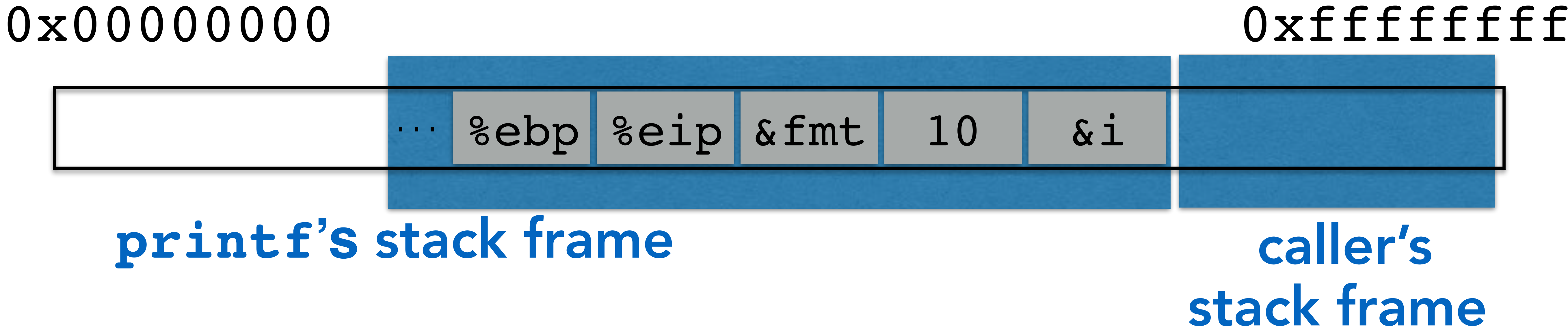

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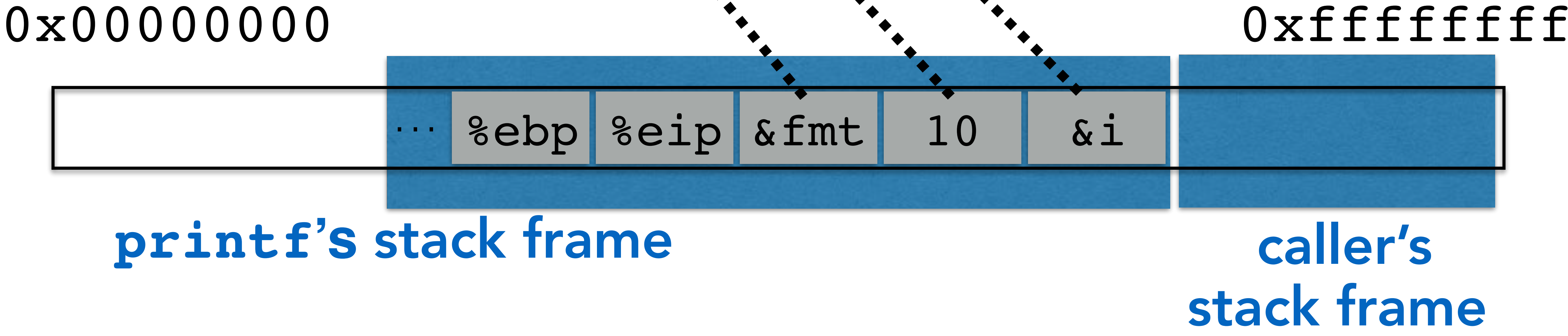

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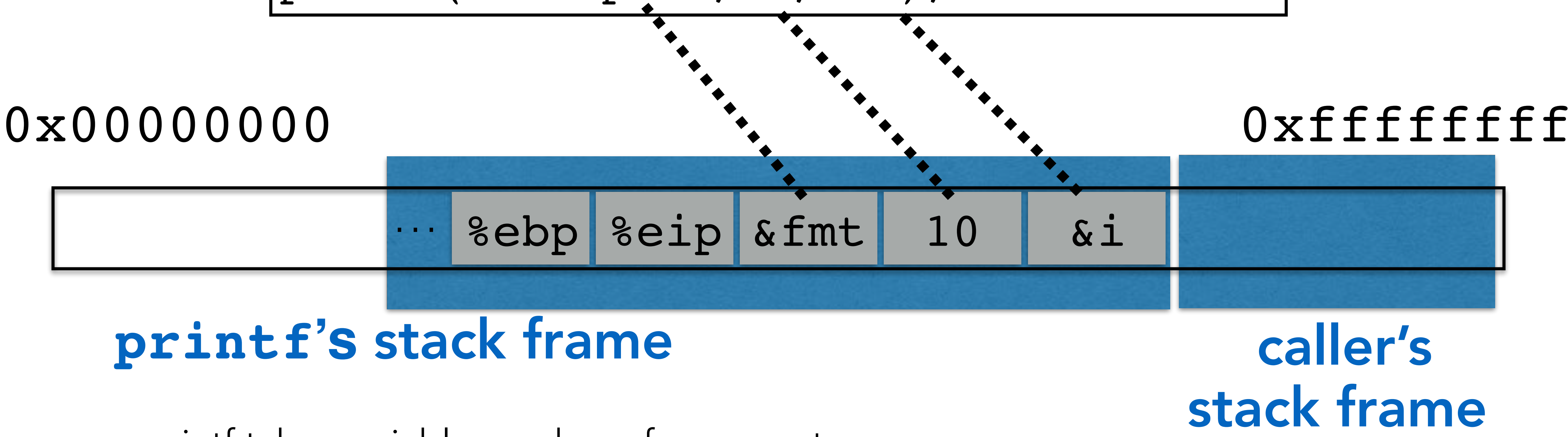

- printf takes variable number of arguments
- printf pays no mind to where the stack frame "ends"
- It presumes that you called it with (at least) as many arguments as specified in the format string

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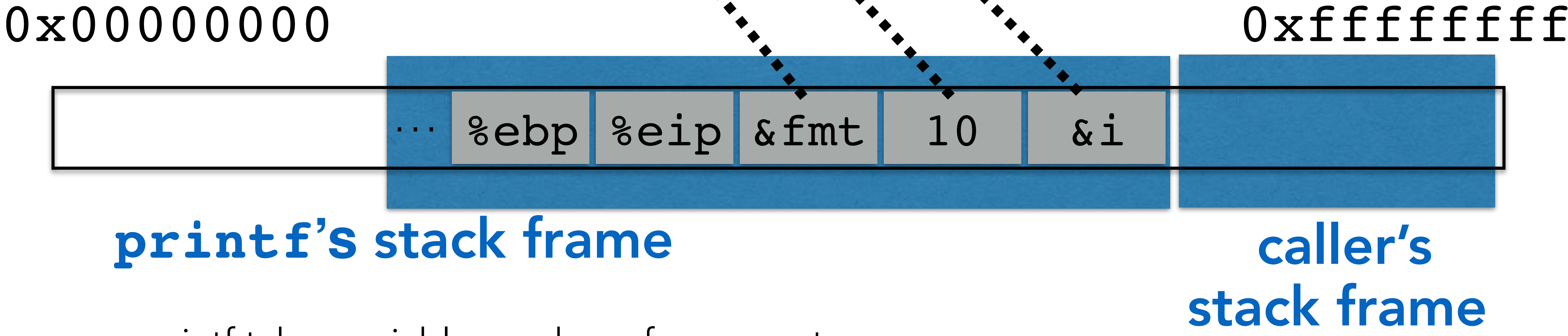

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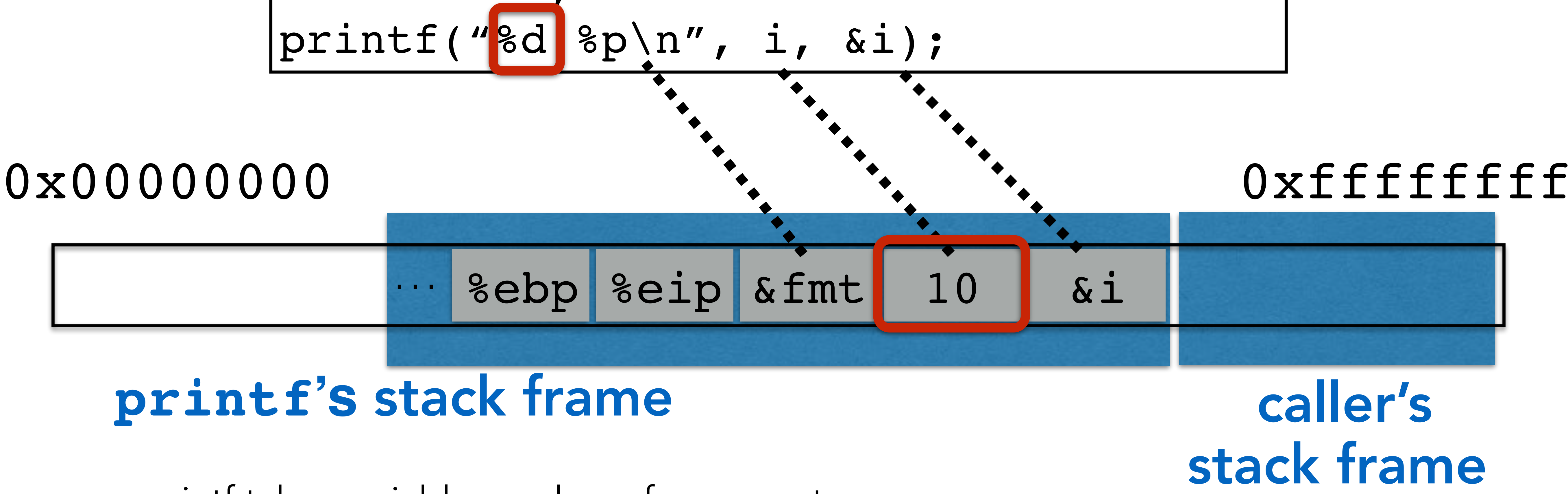

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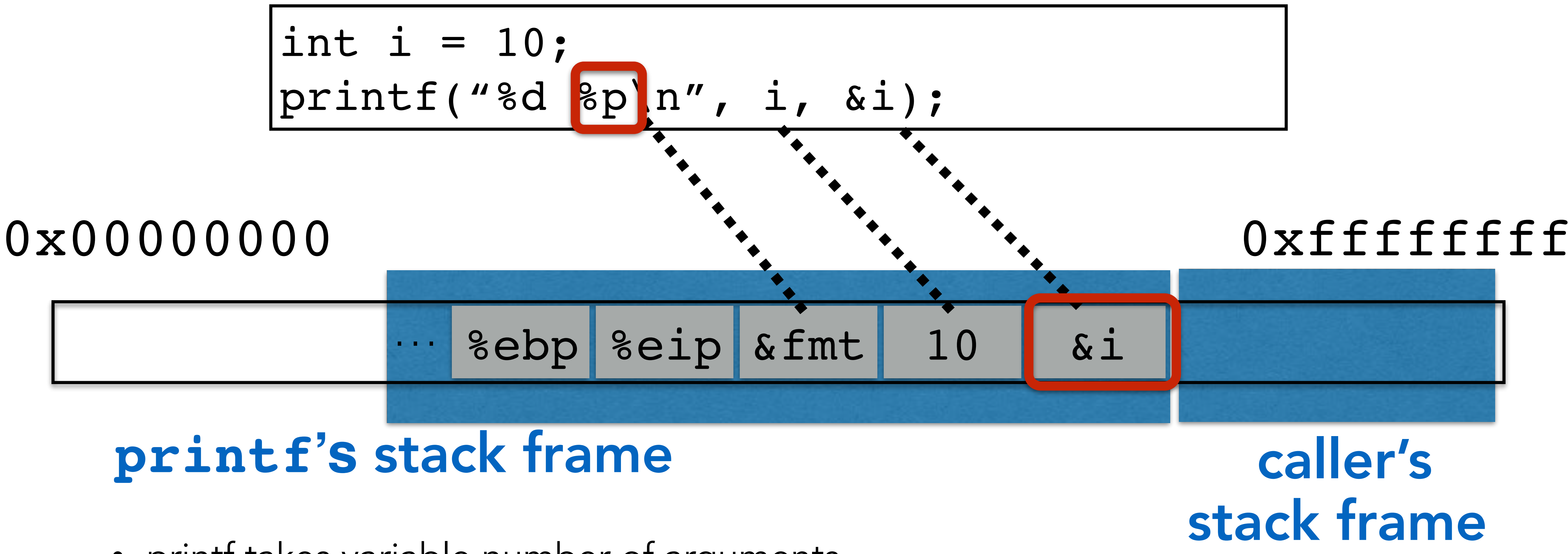

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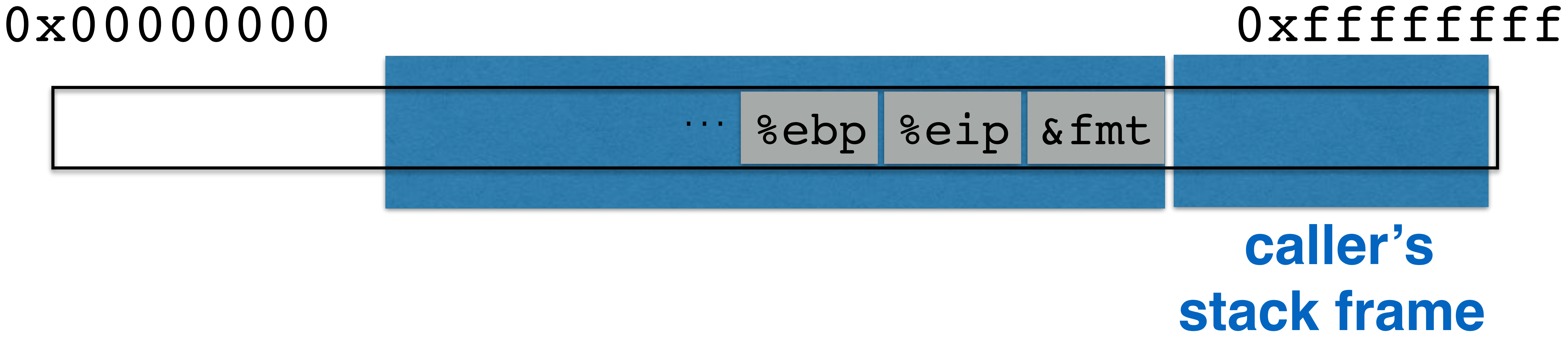

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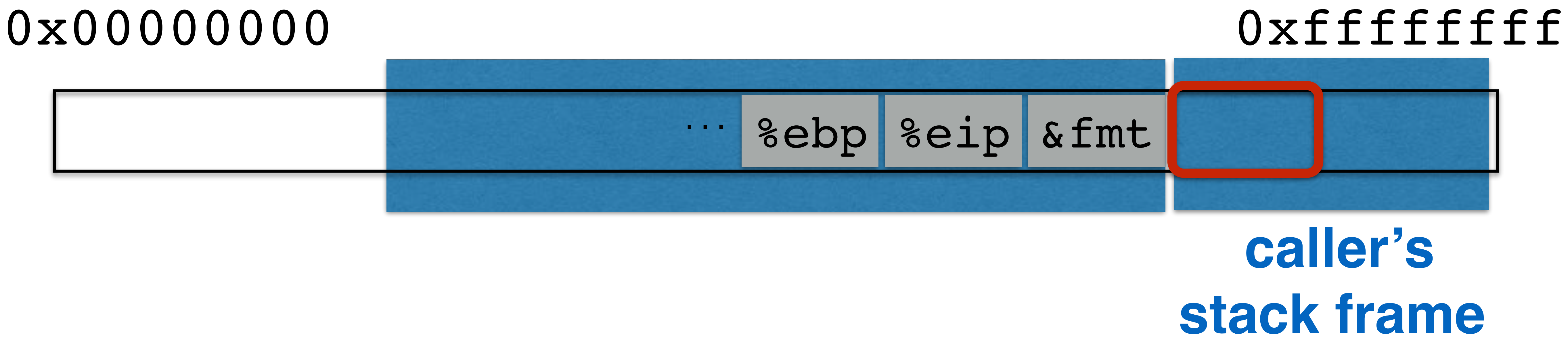

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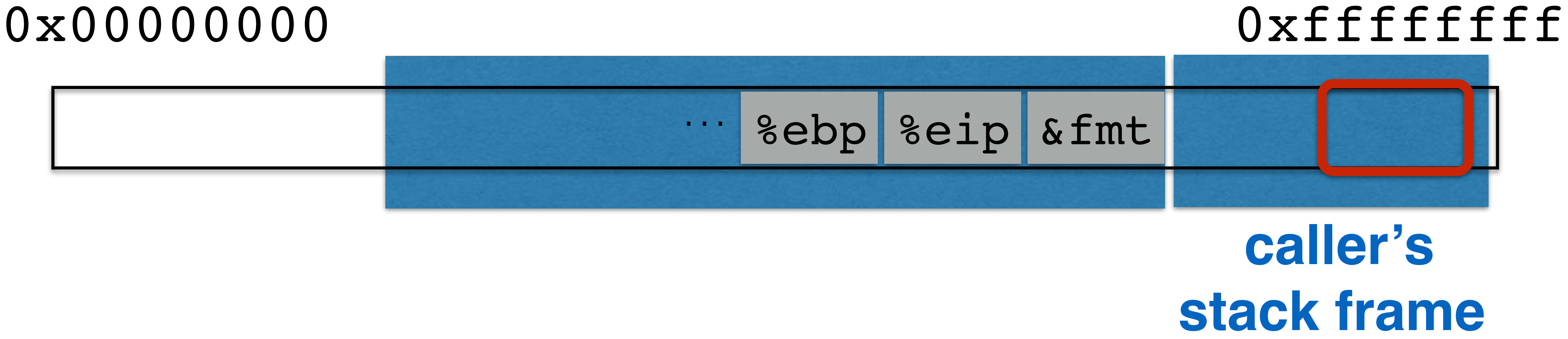

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  - Prints stack entry 4 byes above saved %eip
- `printf(“%s”);`
  - Prints bytes *pointed to* by that stack entry
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  - Prints a series of stack entries as integers

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- `printf(“%08x %08x %08x %08x …”);`
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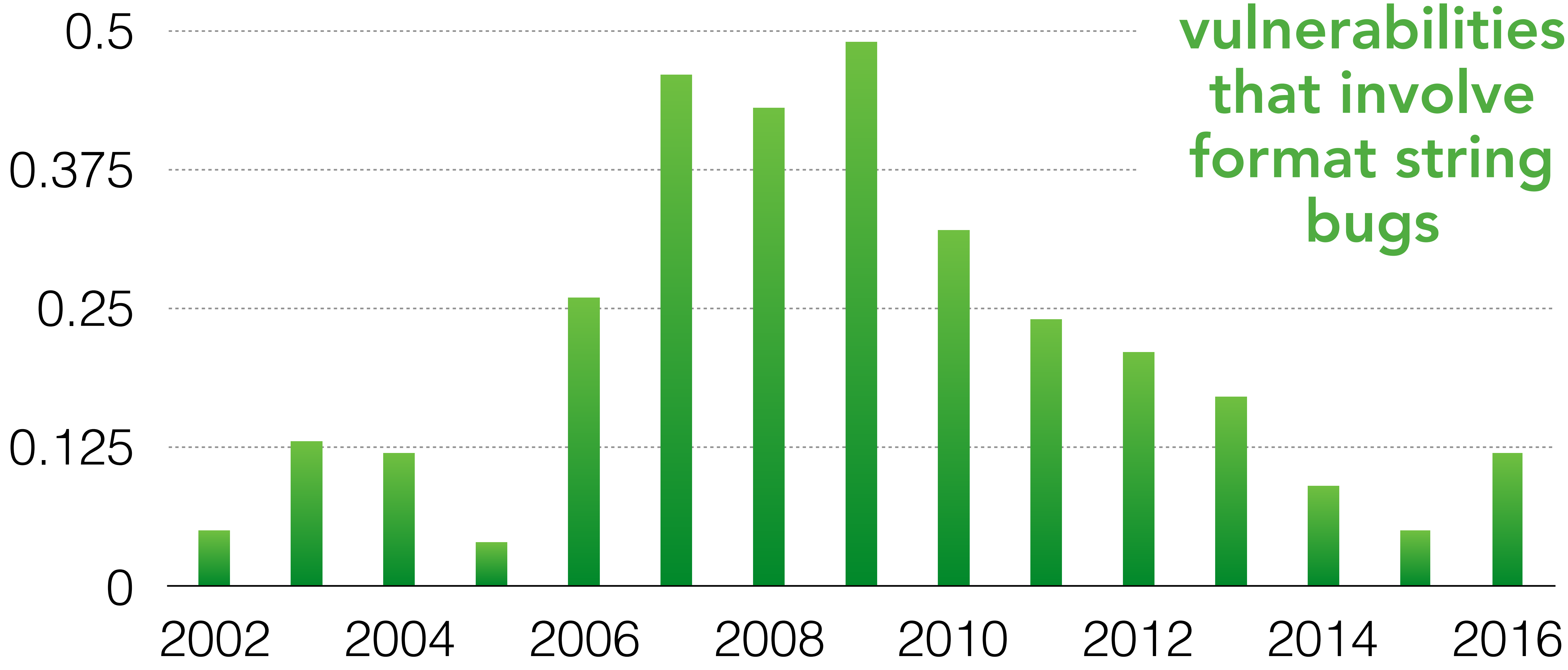
- `printf(“100% no way!”)`
  - ***WRITES*** the number 3 to address pointed to by stack entry

FORMAT STRING PREVALENCE



% of vulnerabilities that involve format string bugs

http://web.nvd.nist.gov/view/vuln/statistics

WHAT'S WRONG WITH THIS CODE?

```
#define BUF_SIZE 16
char buf[BUF_SIZE];
void vulnerable()
{
    int len = read_int_from_network();
    char *p = read_string_from_network();
    if(len > BUF_SIZE) {
        printf("Too large\n");
        return;
    }
    memcpy(buf, p, len);
}
```

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void *memcpy(void *dest, const void *src, size_t n);
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```
void *memcpy(void *dest, const void *src, size_t n);
typedef unsigned int size_t;
```

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#define BUF_SIZE 16
char buf[BUF_SIZE];
void vulnerable()
{   Negative
    int len = read_int_from_network();
    char *p = read_string_from_network();
    if(len > BUF_SIZE) {
        printf("Too large\n");
        return;
    }
    memcpy(buf, p, len);
}
```

```
void *memcpy(void *dest, const void *src, size_t n);
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#define BUF_SIZE 16
char buf[BUF_SIZE];
void vulnerable()
{   Negative
    int len = read_int_from_network();
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 Ok if(len > BUF_SIZE) {
        printf("Too large\n");
        return;
    }
    memcpy(buf, p, len);
}
```

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    int len = read_int_from_network();
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 Ok if(len > BUF_SIZE) {
        printf("Too large\n");
        return;
    }
    memcpy(buf, p, len);
}                Implicit cast to unsigned
```

```
void *memcpy(void *dest, const void *src, size_t n);
typedef unsigned int size_t;
```

INTEGER OVERFLOW
VULNERABILITIES

WHAT'S WRONG WITH THIS CODE?

```
void vulnerable()
{
    size_t len;
    char *buf;

    len = read_int_from_network();
    buf = malloc(len + 5);
    read(fd, buf, len);
    ...
}
```

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void vulnerable()
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    size_t len;
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  HUGE
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Wrap-around

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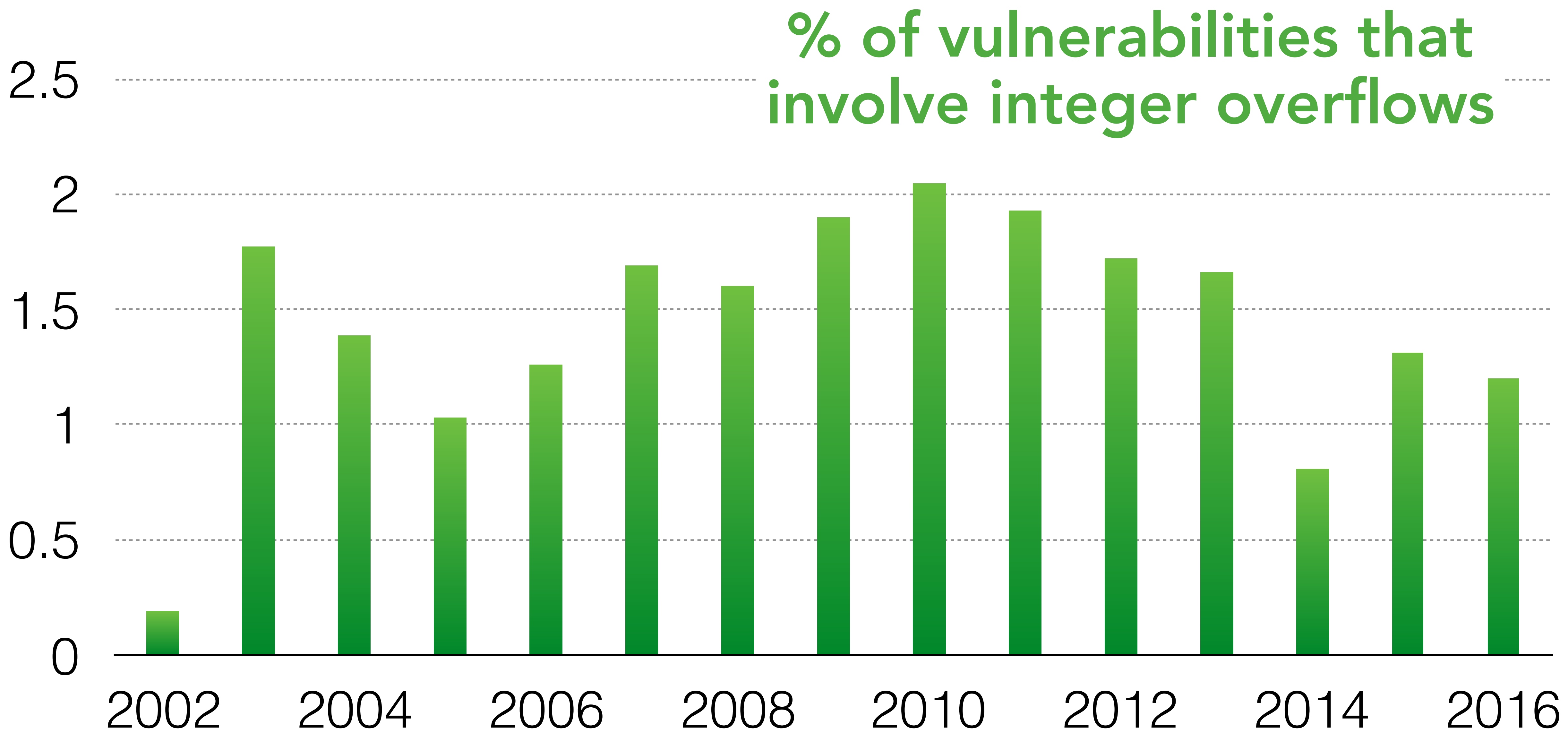
Takeaway: You have to know the semantics of your programming language to avoid these errors

INTEGER OVERFLOW PREVALENCE



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