Today

- Learning Outcomes
  - Identify the properties that we would like the process abstraction to provide.
- How we'll get there
  - What exactly is a process? What is process isolation?
  - What are the system calls that manipulate processes?
  - How does the operating system create the process abstraction?
    - Protected control transfer
    - Virtual Memory
- Reading:
  - Chapter 8: intro and 8.1

All code is in the course code repository.

Trivial Programs

```
mseltzer@lulu:nov23$ cat hello.c
#include <stdio.h>


int main(int argc, char *argv[]) {
    printf("Hello, world!\n");
}
mseltzer@lulu:nov23$ ./hello
Hello, world!
mseltzer@lulu:nov23$
```

```
mseltzer@lulu:nov23$ cat goodbye.c
#include <stdio.h>


int main(int argc, char *argv[]) {
    printf("Goodbye, world!\n");
}
mseltzer@lulu:nov23$ ./goodbye
Goodbye, world!
mseltzer@lulu:nov23$
```

Strange Phenomena

```
Reading symbols from hello...
(gdb) b main
Breakpoint 1 at 0x400430: file
hello.c, line 3.
(gdb) run
Starting program:
/home/m/mseltzer/313/cs313-
coderepo/mar30/hello
Missing separate debuginfos, use:
zypper install glibc-debuginfo-2.26-
lp151.18.7.x86_64


Breakpoint 1, main (argc=1,
argv=0x7fffffffe248) at hello.c:3
3 int main(int argc, char *argv[]) {
(gdb)
```

```
Reading symbols from goodbye...
(gdb) b main
Breakpoint 1 at 0x400430: file
goodbye.c, line 3.
(gdb) run
Starting program:
/home/m/mseltzer/313/cs313-
coderepo/mar30/goodbye
Missing separate debuginfos, use:
zypper install glibc-debuginfo-2.26-
lp151.18.7.x86_64


Breakpoint 1, main (argc=1,
argv=0x7fffffffe248) at goodbye.c:3
3 int main(int argc, char *argv[]) {
```

Why don’t these programs affect each other?

Why don't these programs affect each other?

- Programs run in different processes.
- Each process has its own address space.
- Address spaces provide process isolation.
- Process Isolation:
  - Anything one process does should not affect what another process does, unless the processes agree (e.g., set up a communication channel).
  - Each process behaves as if it controls the entire machine's resources.

Where we are going:

- What exactly is an operating system?
- How does control transfer back and forth between user processes and the operating system?
- How exactly does the OS provide process isolation?
- What is the role of virtual memory in providing process isolation.