Amirkabir University of Technology
(Tehran Polytechnic)

Operating Systems

Processes-Part2

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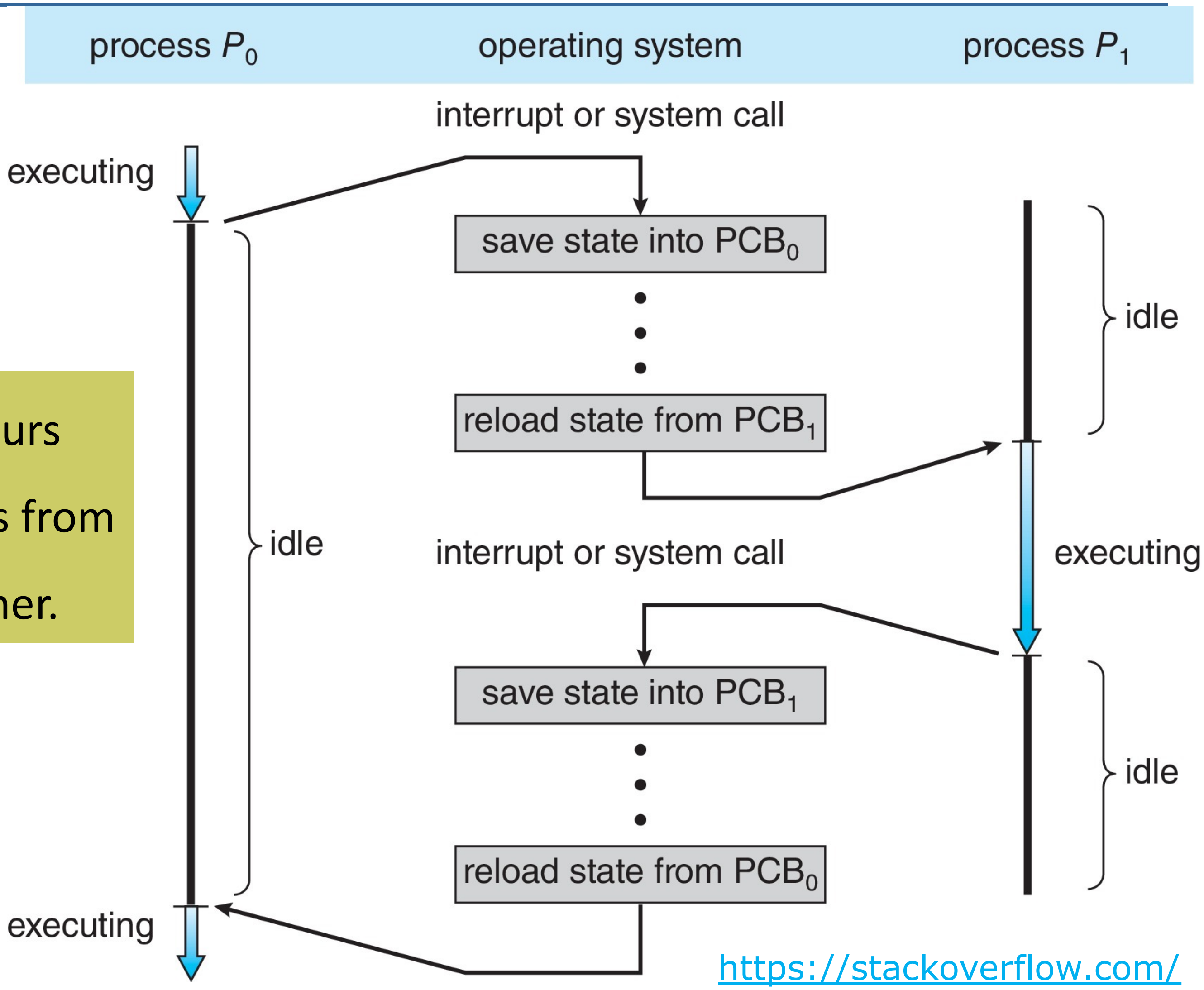
CPU Switch From Process to Process

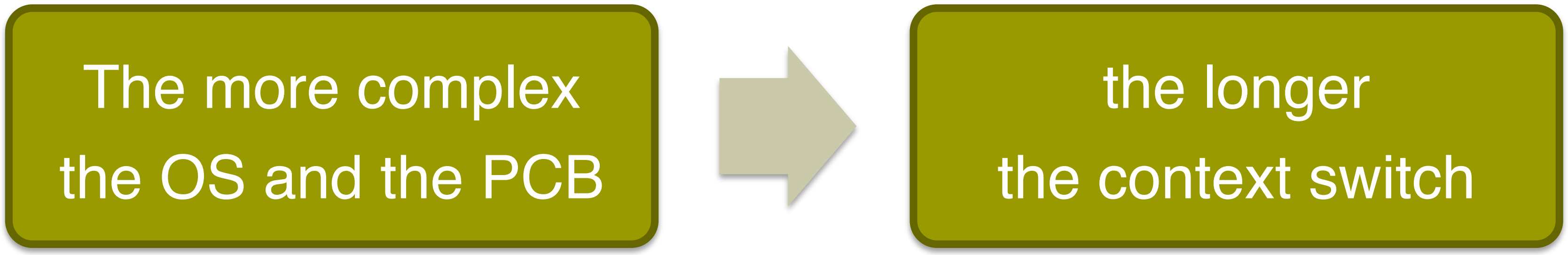


A **context switch** occurs when the CPU switches from one process to another.

https://stackoverflow.com/questions/9238326/system-call-and-context-switch

Context Switch

- The system must ***save the state*** of the old process and load the ***saved state*** for the new process via a ***context switch***.
- ***Context*** of a process represented in the ***PCB***.
- Context-switch time is ***pure overhead***
  - The system does no useful work while switching.


The more complex the OS and the PCB
the longer the context switch

Context Switch (cont.)

- Time dependent on hardware support

Some hardware provides multiple sets of registers per CPU (e.g., the Sun UltraSPARC processor)

→ ***multiple*** contexts loaded at once

https://en.wikipedia.org/wiki/UltraSPARC_IV

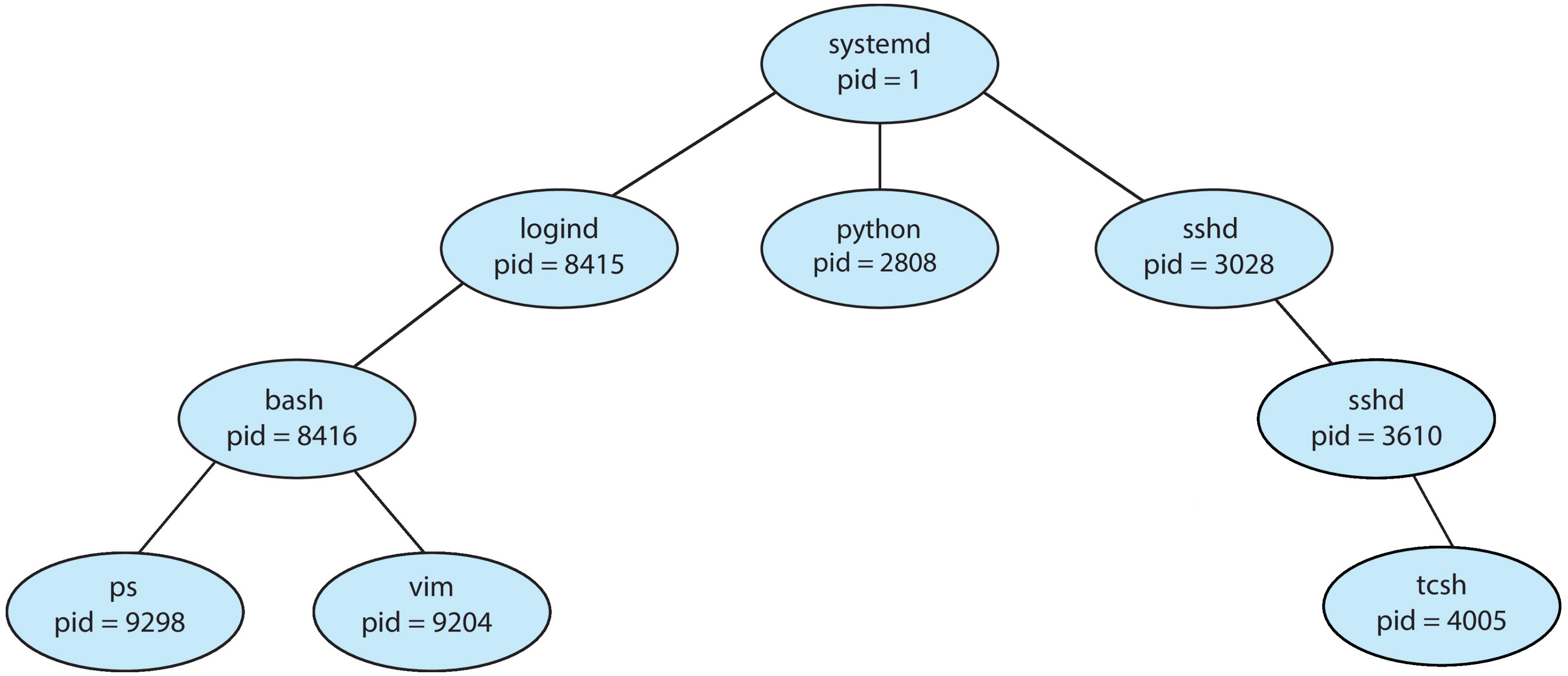
Operations on Processes

- System must provide mechanisms for:
  - Process creation
  - Process termination

https://dextutor.com/operations-on-process-in-os/

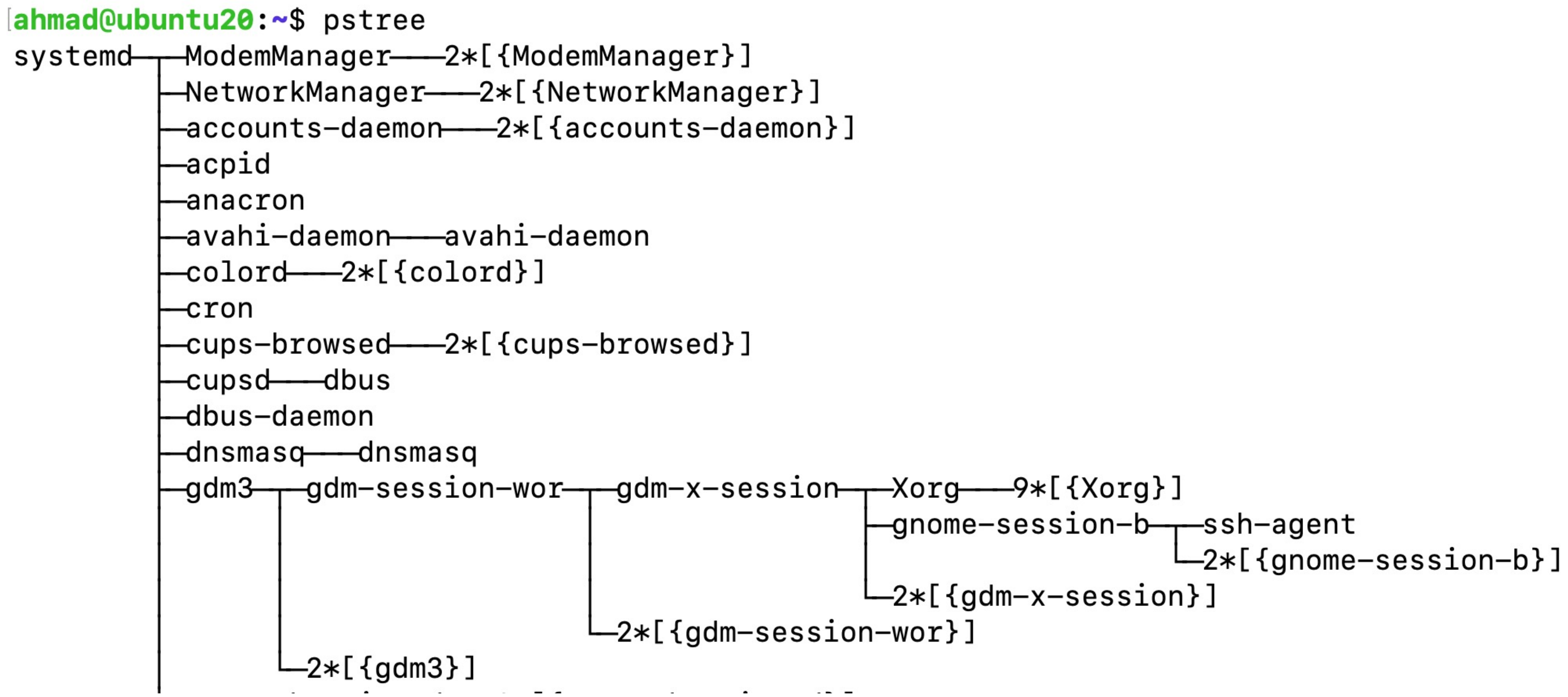
Process Creation

- **Parent** process create **children** processes, which, in turn create other processes, forming a ***tree*** of processes.
- Process identified and managed via a ***process identifier*** (pid).



Let’s See It in Practice

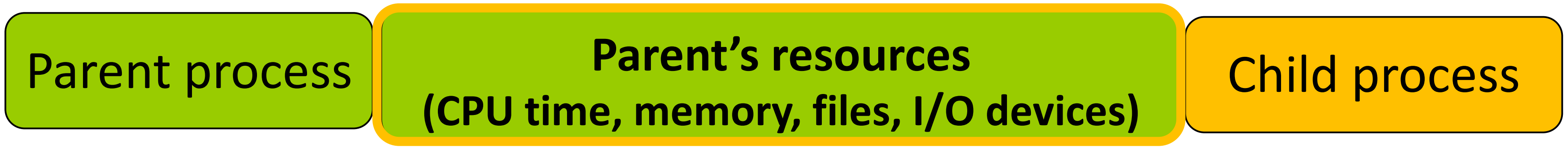
- https://www.simplified.guide/linux/process-view-tree
- http://manpages.ubuntu.com/manpages/bionic/man1/pstree.1.html



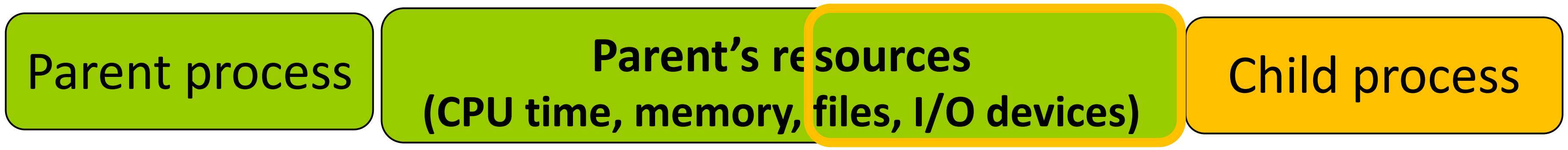
```
ahmad@ubuntu20:~$ pstree
systemd─┬─ModemManager───2*[{ModemManager}]
        ├─NetworkManager───2*[{NetworkManager}]
        ├─accounts-daemon───2*[{accounts-daemon}]
        ├─acpid
        ├─anacron
        ├─avahi-daemon───avahi-daemon
        ├─colord───2*[{colord}]
        ├─cron
        ├─cups-browsed───2*[{cups-browsed}]
        ├─cupsd───dbus
        ├─dbus-daemon
        ├─dnsmasq───dnsmasq
        ├─gdm3─┬─gdm-session-wor─┬─gdm-x-session─┬─Xorg───9*[{Xorg}]
        │      │                 │               ├─gnome-session-b─┬─ssh-agent
        │      │                 │               │                 └─2*[{gnome-session-b}]
        │      │                 │               └─2*[{gdm-x-session}]
        │      │                 └─2*[{gdm-session-wor}]
        │      └─2*[{gdm3}]
        │
```

Process Creation-Resource Sharing Options

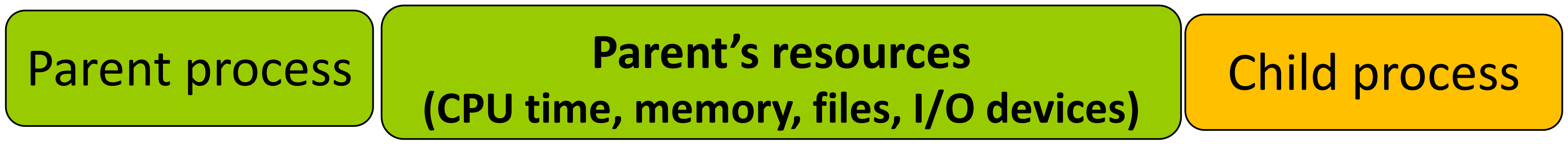
- Parent and children share all resources



- Children share subset of parent's resources

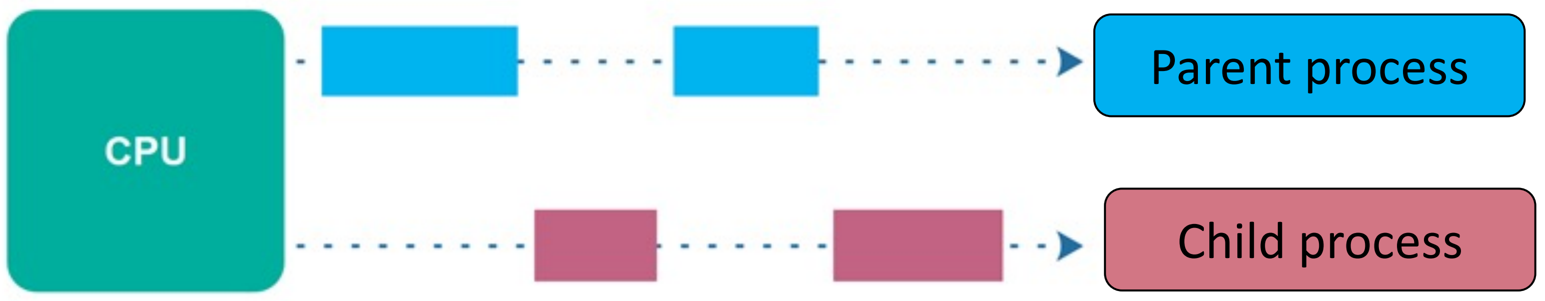


- Parent and child share no resources

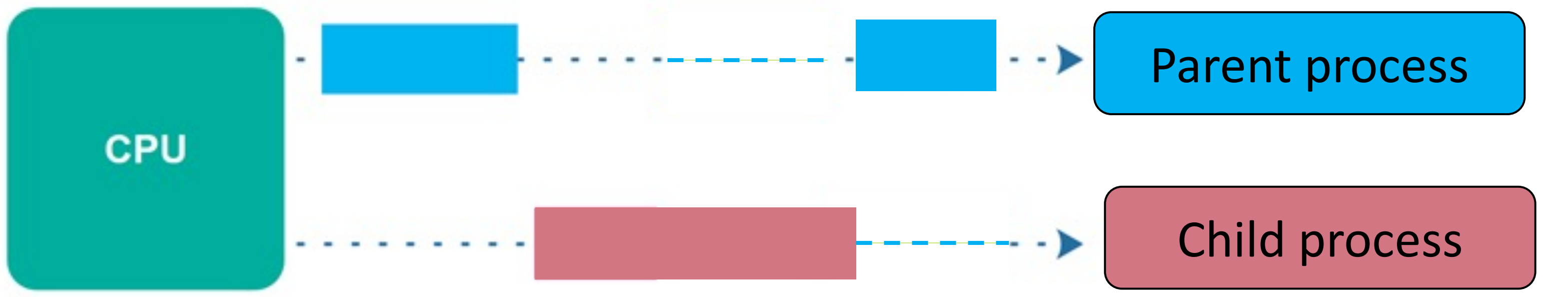


Process Creation-Execution Options

- Parent and children execute ***concurrently***

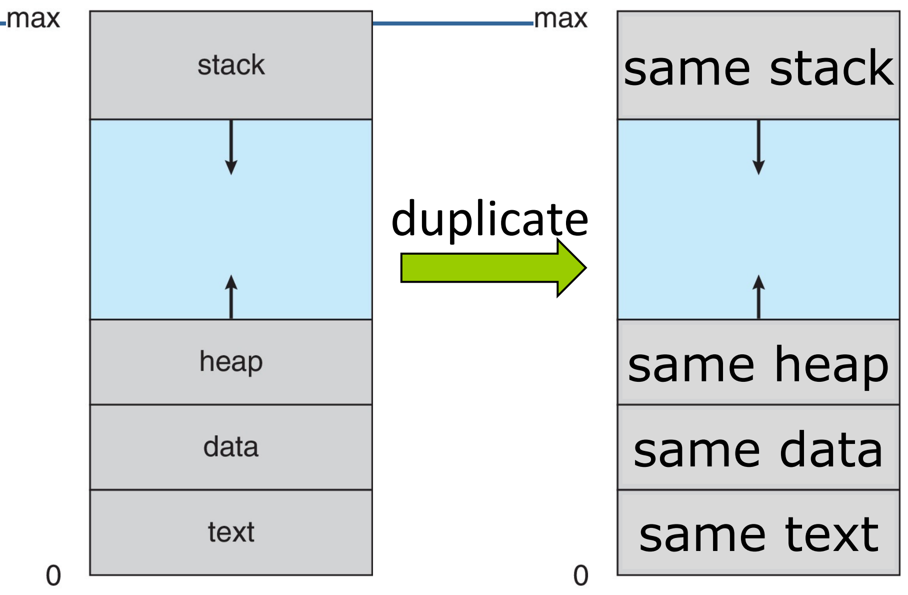


- Parent ***waits*** until children terminate

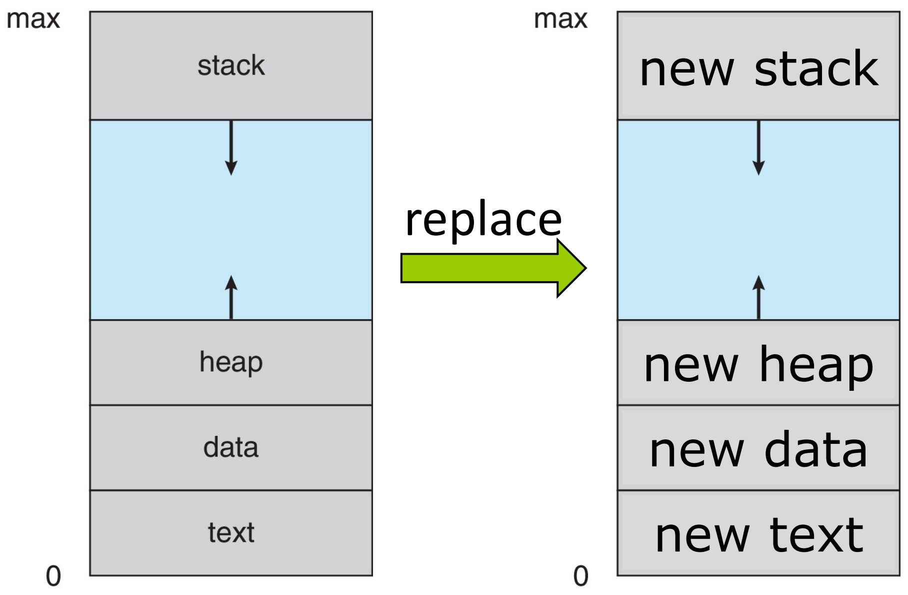


Process Creation-Address Space

- Child ***duplicate*** of parent



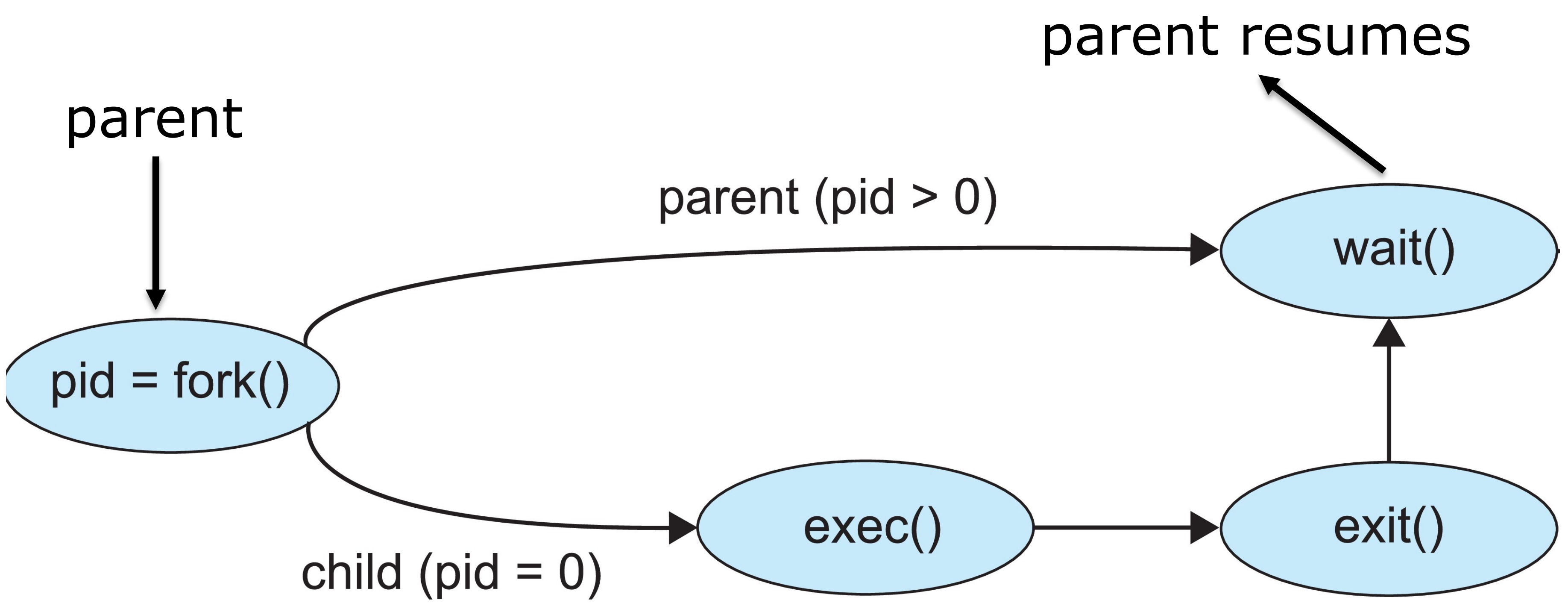
- Child has a program loaded into it



Process Creation-UNIX examples

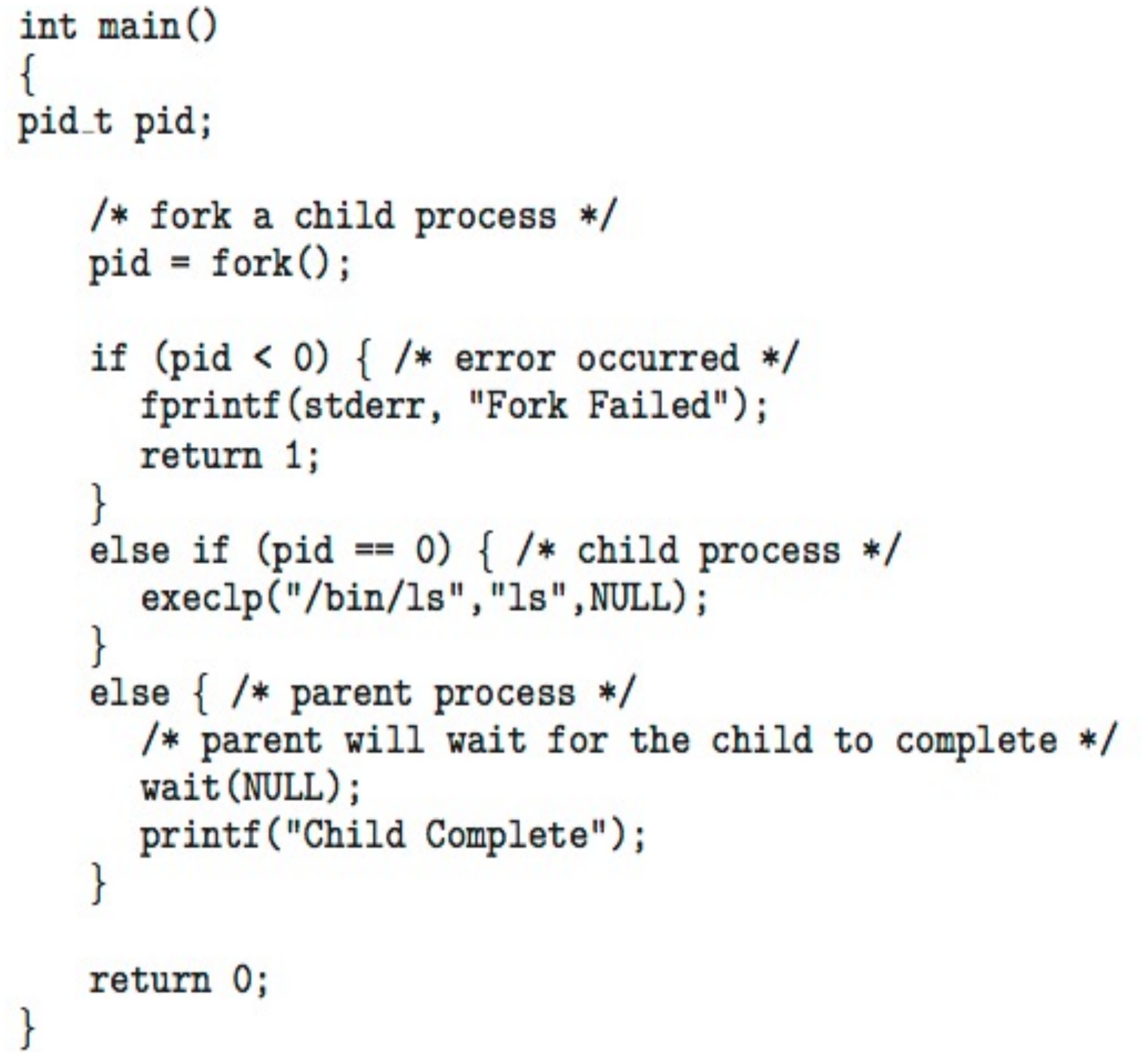
- **fork()** system call creates new process.
- **exec()** system call used after a **fork()** to ***replace*** the process' memory space with a new program.
- Parent process calls **wait()** waiting for the child to terminate.

Process Creation (Cont.)



C Program Forking Separate Process

#include <sys/types.h> <stdio.h> <***unistd***.h>



```
int main()
{
pid_t pid;

    /* fork a child process */
    pid = fork();

    if (pid < 0) { /* error occurred */
       fprintf(stderr, "Fork Failed");
       return 1;
    }
    else if (pid == 0) { /* child process */
       execlp("/bin/ls","ls",NULL);
    }
    else { /* parent process */
       /* parent will wait for the child to complete */
       wait(NULL);
       printf("Child Complete");
    }

    return 0;
}
```