



Operating Systems

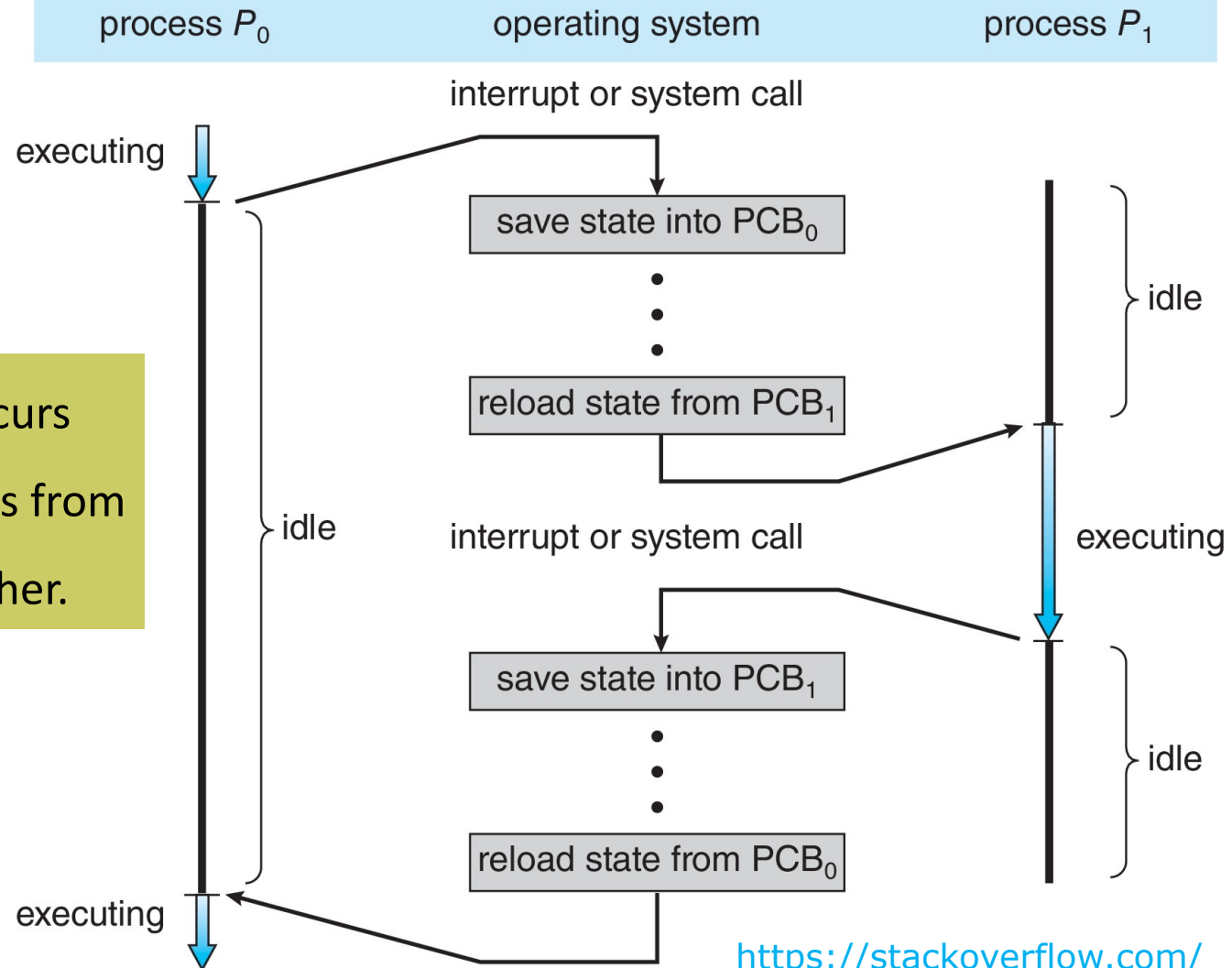
Processes-Part2

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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.



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



Process Creation

`fork()`

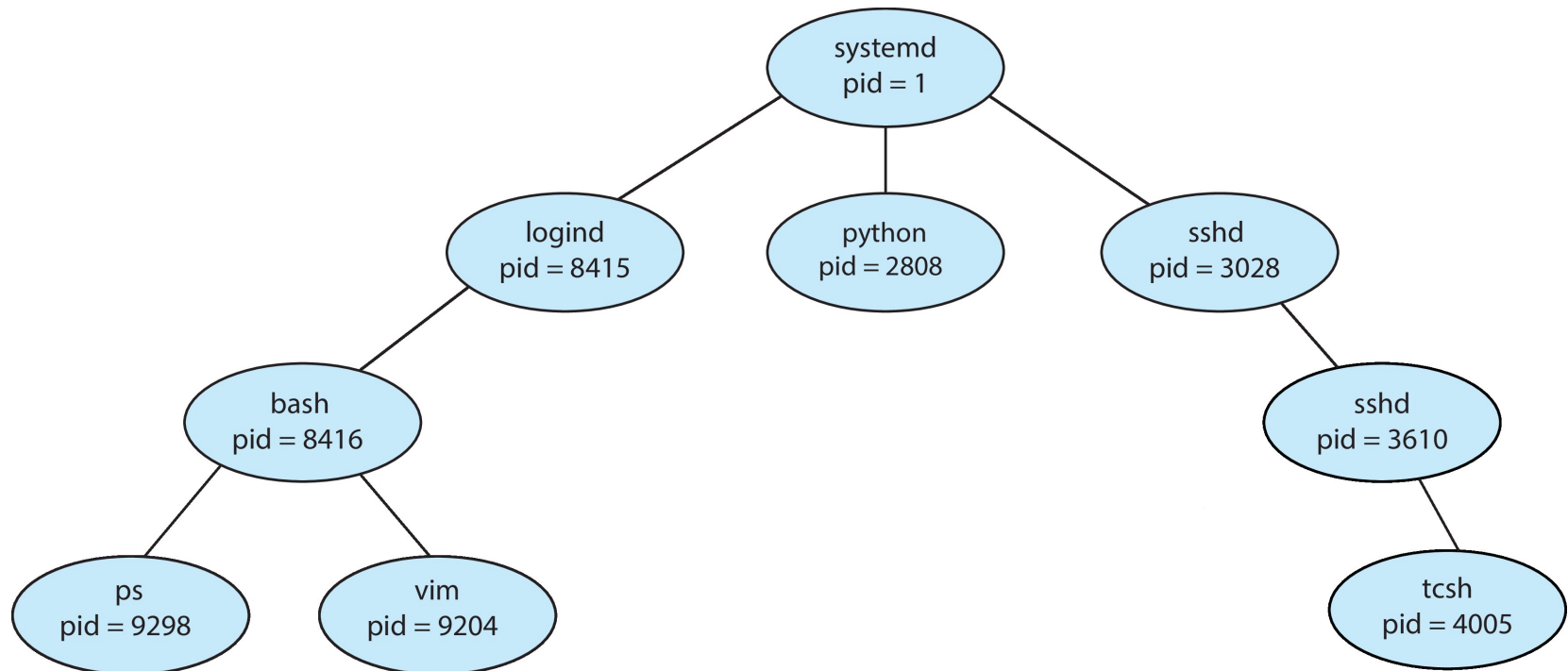


Process Termination

<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}]
—2*[{gdm3}] —2*[{gdm-session-wor}] —2*[{gdm-x-session}]
—gnome-session-b—ssh-agent
—2*[{gnome-session-b}]

```

Process Creation-Resource Sharing Options

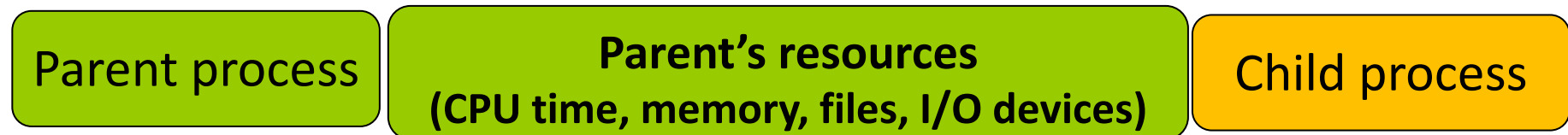
- Parent and children share all resources



- Children share subset of parent's resources

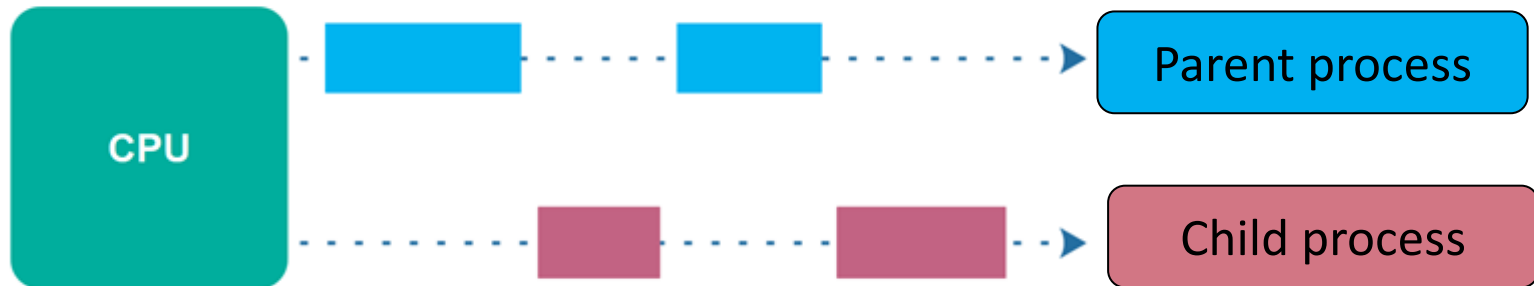


- Parent and child share no resources

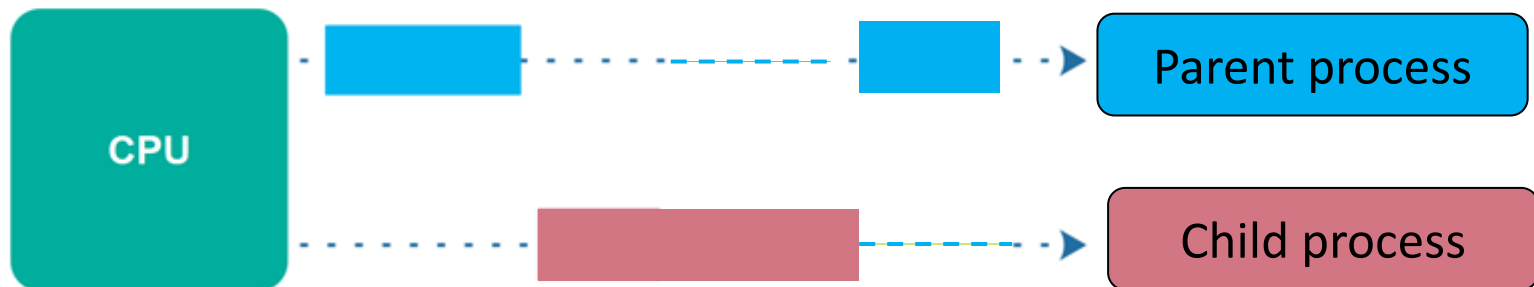


Process Creation-Execution Options

- Parent and children execute **concurrently**

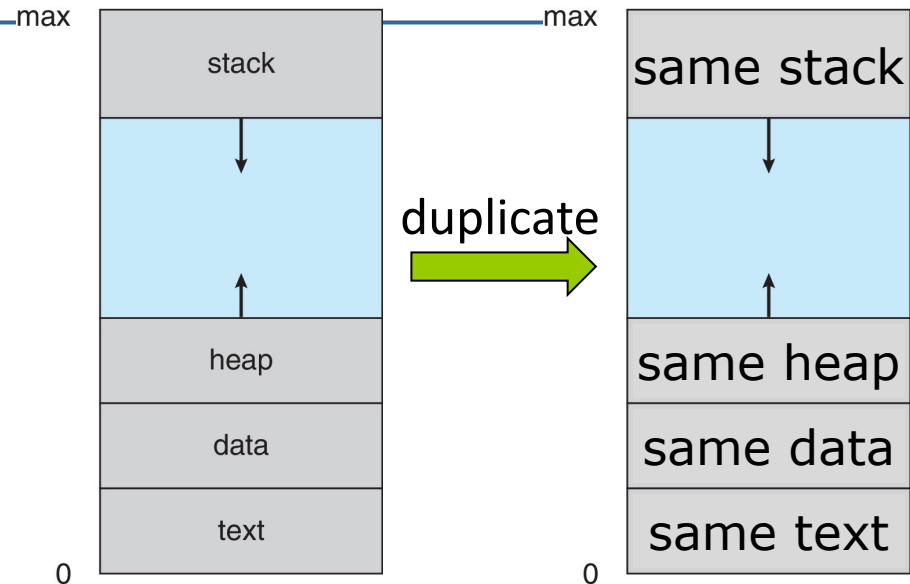


- Parent **waits** until children terminate

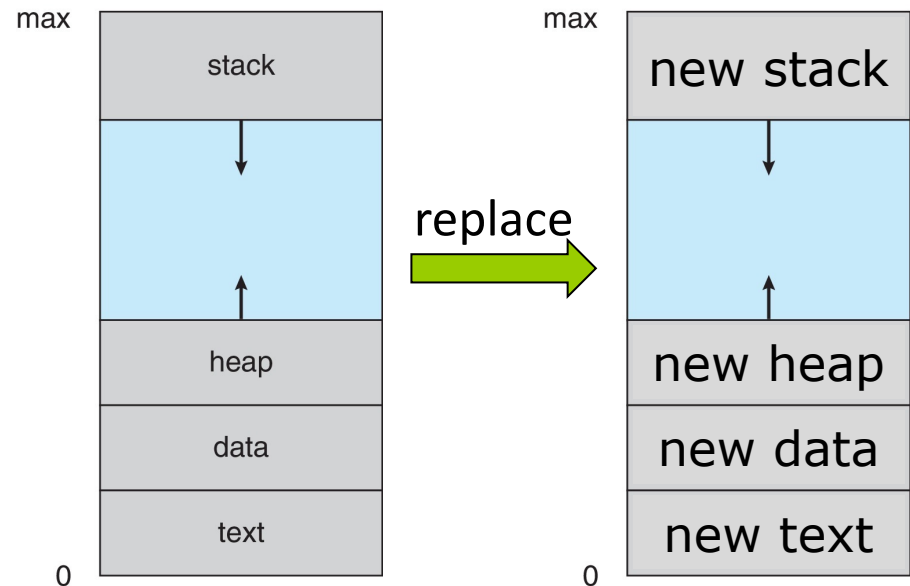


Process Creation-Address Space

- Child ***duplicate*** of parent



- Child has a program loaded into it

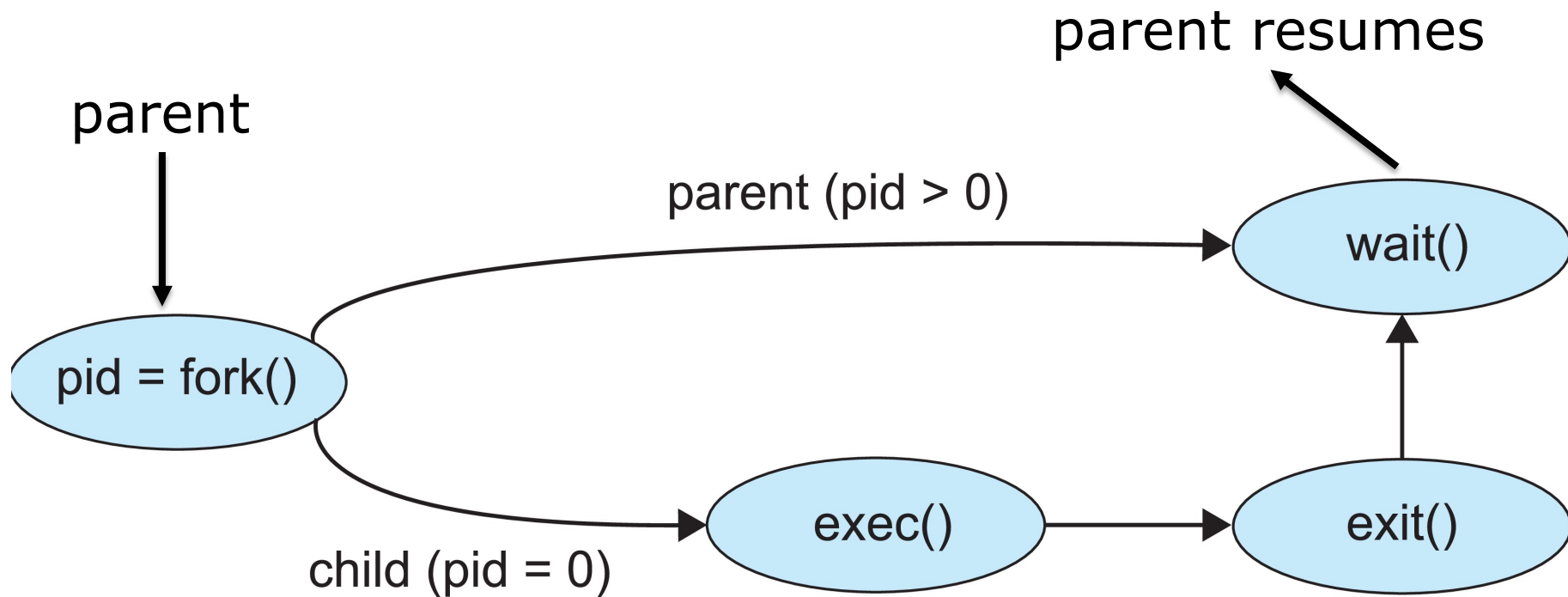


Process Creation-UNIX examples

- **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;
    }
}
```

