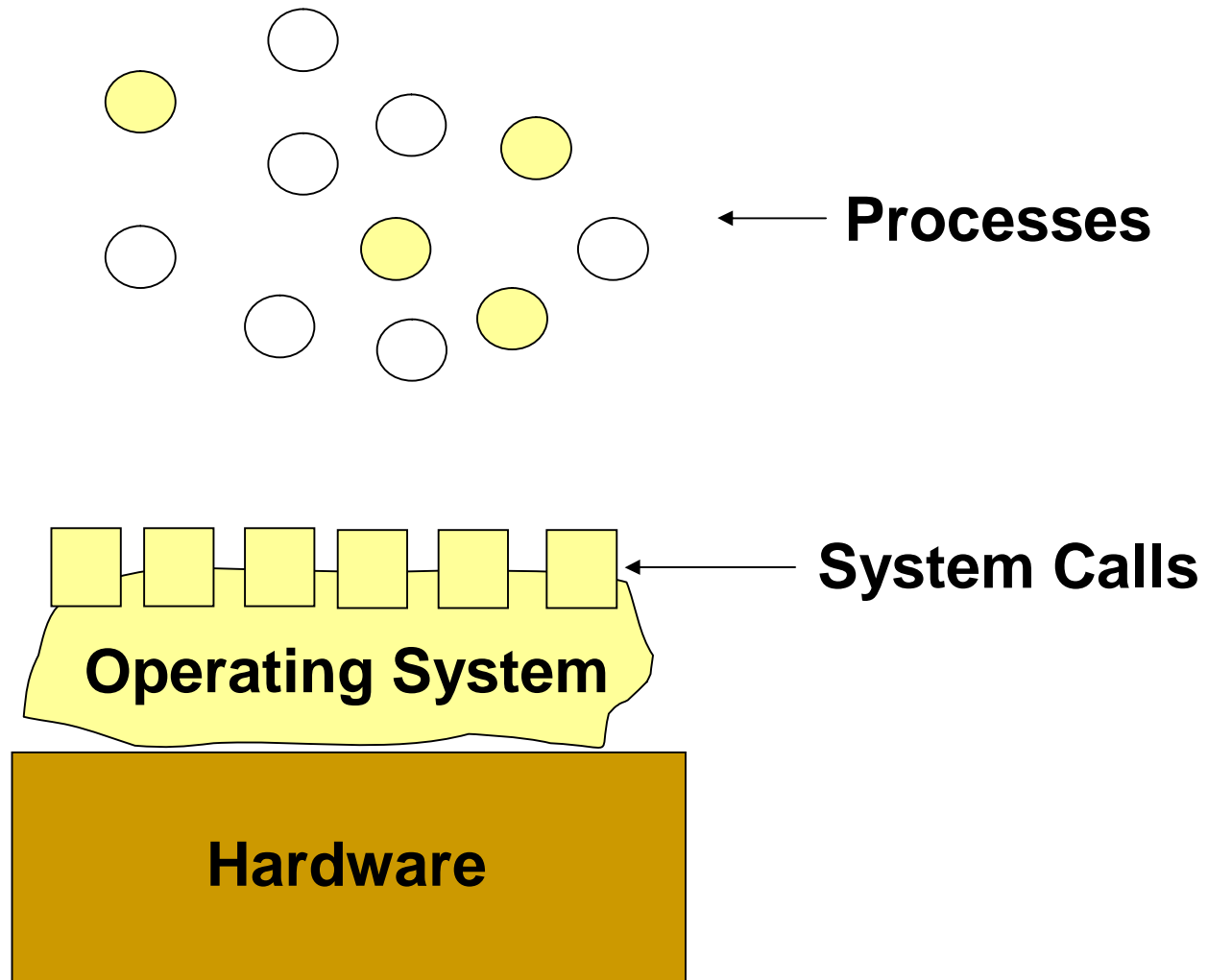

High Performance Computing

Lecture 12

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Operating System, Processes, Hardware



OS Code Must Have Special Privileges

- A process must be allowed to do sensitive operations while it is executing in a system call
- Special instructions will have been included in the Instruction Set Architecture for such purposes
 - They are called **privileged instructions**
 - Meant for use only by special programs like the OS

Mechanics of System Calls

- Processor hardware is designed to operate in at least 2 modes of execution
 - Ordinary or user mode
 - Privileged or system mode
- A system call is entered using a special machine instruction (e.g. MIPS 1 **syscall**) that switches processor mode from user to system before transferring control

Process Lifetime

- At any given point in time, a running process is executing either in user mode or in system mode
- Can find out the total CPU time used by a process, as well as CPU time in user mode, CPU time in system mode
- Two programs we have talked about
 - Operating system
 - Shell

What does a Shell do?

```
while (true){
```

- Prompt the user to type in a command `write`
- Read in the command `read`
- Understand what the command is asking for
- Get the command executed `fork, exec`
- }

Q: What system calls are involved?

Operating System

Software that manages the resources of a computer system

- ❑ CPU time
- ❑ Main memory
- ❑ I/O devices
- ❑ Software resources

Main Memory Management

- Example: [Paged Virtual Memory](#)
- Recall: Need for Address Translation
- To translate a virtual address to the corresponding physical address, a table of translation information is needed
- The size of the address translation table ..

Address Translation Table Size

- Mapping from virtual address to physical address
- If there is an entry for each byte address, then for 32b addresses size of the table is
 - $2^{32} \times 32\text{b}$, i.e., 16GB
 - Entry per each word address: 4GB
 - Entry for each 256B unit address: 64MB

Physical Address

Virtual Address →

