

Introduction to Operating Systems

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Introduction

An **operating system**(OS) is a piece of software that lies between the hardware and software layer inside a computer. The OS helps the machine allocate resources to processes that require them.

The OS allocates resources to different processes on a computer.

Computer System Organization

When we have an I/O request, the device controller will receive a signal to load and move the data to the CPU or main memory. When this process is done, the controller will send a signal to the CPU informing of a successful completion of the transfer.

There are wother ways of triggering a system interrupt. Sometimes the program might create an interrupt, known as a **software interrupt**. Other times, the hardware itself might create an interrupt. When this happens, there is a wire connected to the CPU which is directly activated.

There are a couple useful distinctions:

- Random Access: This type of memory allows any part of its data to be accessed without having to first access the other parts. This memory is *volatile*, which means it will be wiped clean next time the computers boot.
- Solid State: A solid state drive(SSD) uses solid state technology and removes any moving components from the drive. This allows for faster read speeds since we don't have to wait for the platter to spin in the correct decision under the read/write head.

Computer System Architecture

In days past, the comptuer was able to run on a single **core**, which executed a general instruciton set needed by application programs. There could also be some smaller and different processors such as **controllers**.¹

However, recently there are multicore systems, which have more than one physical core. This means that they can execute more than one instruction at at a time. However, it depends on whether there

¹ A **controller** is a type of device which handles taking information from I/O devices and getting it to the CPU. A controller usually has its own buffer, where it stores the data it is responsible for fetching before sending it to memory or CPU.

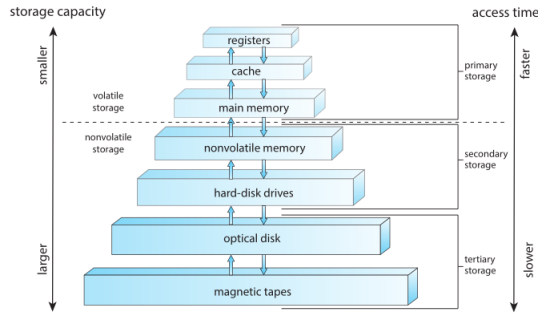


Figure 1: Memory hierarchy. As the speed of the memory increases, so does its cost. So we can only include a limited amount of very quick memory. Cache and registers usually are very limited and are located directly in the CPU.

are any resources to allocate available. These systems will usually share L2 cache, but L1 is local for each core. Since there will be N individual CPUs according to the computer, application programmers should effectively use all the cores.

Why does continually adding more CPU cores not work *ad infinitum*? There is an overhead performance penalty when trying to coordinate their loading. Also, once we add too many CPUs, the competition for the system bus might bottleneck performance.

Blade servers usually have multiple machines on the same chassis. **Clustered systems** are usually independent computers that share mostly storage. They might be individual multicore systems that are interconnected to share storage. Clustered systems are usually used in systems where we need the maximum reliability. The advantage of having clustered systems is that we can monitor the performance of the other nodes. We can assign one node in the cluster to monitor another one of the nodes. If the observed node fails, we can set the monitoring node to take over the failed node's operation, and report the error.

Some other types of networks might run on wide-area-networks and thus require to be connected over many miles. Software such as Oracle's database system might run on every node in the network, as well as have a layer of software controlling other aspects of resource allocation.