CSC369 Notes

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1 Operating Systems

Definition 1 **operating system** : An *operating system* (OS) is a system software that manages a computer's resources for its users and their applications. The operating system provides an interface that that abstracts the details of accessing and managing hardware. This interface typically comes as a collection of *system calls*, and is often referred to as the *standard library*.

Applications run in *user mode* by default, within which hardware will restrict the set of possible actions. When a system call is made (typically via the *trap* hardware instruction), the hardware transfers control to a *trap handler* and simultaneously raises the hardware privilege level to *kernel mode*, within which the OS has full access to the hardware of the system and thus may initiate I/O requests or make more memory available to a process. When the OS is done servicing the request, it returns control to the user via a *return-from-trap* instruction, which reverts to user mode while simultaneously passing control back to where the application left off.

Operating systems use *virtualization* to produce an illusion of nearly unlimited resources. Resources refer to physical or virtual components that a computer system uses to perform tasks, such as CPU, memory, storage, and other devices. Hence, we often refer to the OS as a *resource manager*. The virtualization of memory, for instance, involves introducing an address space.

Definition 2 **address space** : A *(virtual) address space* is the range of memory addresses that an operating system allocates to a process, enabling it to access memory independently of the underlying physical memory layout. This abstraction allows each process to operate as though it has its own private memory space, typically beginning at address `0x0000`.[1]

The objective of a good operating system is to act as a resource manager while isolating processes and providing a high degree of reliability.

[1] This means we may have a collection of processes allocating memory at the same address without interference!