Chapter-4

Device- Management

Introduction

- Devices usually refer to physical/hardware devices such as computers, laptops, servers, mobile phones and more.
- Device management is the process of controlling the Input/Output devices like disk, microphone, keyboard, printer, magnetic tape, USB ports, camcorder, scanner, other accessories, and supporting units.
- The operating system handles communication with the devices via their drivers.
- Device drivers are software modules that can be plugged into an OS to handle a particular device.
- Operating System takes help from device drivers to handle all I/O devices.

Introduction Con't…

- The system has multiple devices, and in order to handle these physical or virtual devices, the OS requires a separate program known as a device controller.
- The Device Controller works like an interface between a device and a device driver to convert serial bit stream to block of bytes, perform error correction as necessary.
- The fundamentals of I/O devices may be divided into three categories:

- **Block Device:** It stores data in fixed-size blocks, each with its unique address. For example- Disks.
- **Character Device:** It transmits or accepts a stream of characters, none of which can be addressed individually. For example, keyboards, printers, etc.
- **Network Device:** It is used for transmitting the data packets.

Functions of the device management in the operating system

- An Operating System does the following activities in device management:
  - Keeps tracks of all devices by using a Program responsible for this task which is called **I/O controller**.
  - It decides which process gets the device when and for how much time.
  - It connects devices to various programs in efficient way without error.
  - Allocates the device in the efficient way.
  - De-allocates devices when they are no longer in use.

Types of devices

- There are three types of Operating system peripheral devices: **dedicated, shared, and virtual.**
- Dedicated Device: some devices are allocated or assigned to process only one job at a time until that job releases them.
  - Devices such as plotters, printers, tape drives, floppy disks and other similar devices require such an allocation mechanism because it will be inconvenient if multiple people share them simultaneously.
- Shared Devices : are assigned to multiple processes by interleaving their requests. For example, hard disk it is shared, but interleaving between different processes requests.

Types of devices Con’t…

- Virtual Devices : a hybrid of the two devices, and they are dedicated devices that have been transformed into shared devices.

- For example, a printer can be transformed into a shareable device by using a spooling program that redirects all print requests to a disk.

Characteristics of serial and parallel devices

Serial Transmission	Parallel Transmission
The data is transmitted one bit at a time over a single wire or channel.	Various data bits are simultaneously transmitted together.
Requires a single line to communicate and transfer data.	Requires multiple lines
Serial transmission is not time-sensitive	Parallel transmission is time-sensitive
Serial transmission is reliable for transferring data to longer distance.	Parallel transmission is used for a limited distance, provides higher speed.
Slow	Fast

Serial Transmission vs Parallel Transmission

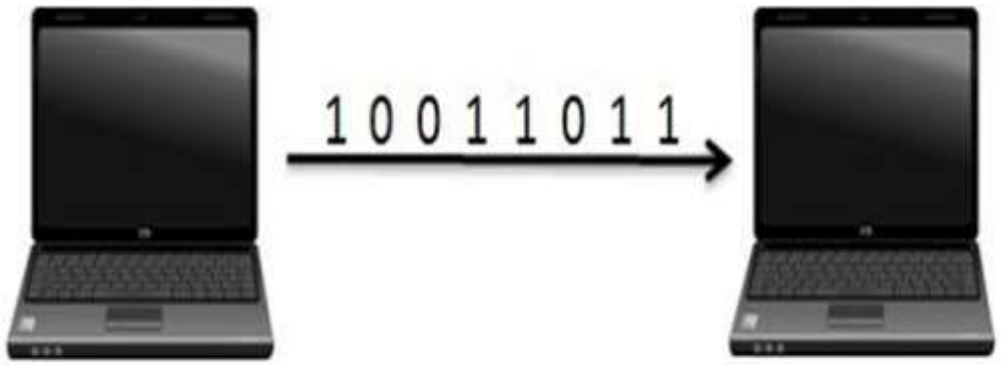


Figure 4.1: Serial Transmission

Example: Data transfer between computer to a modem

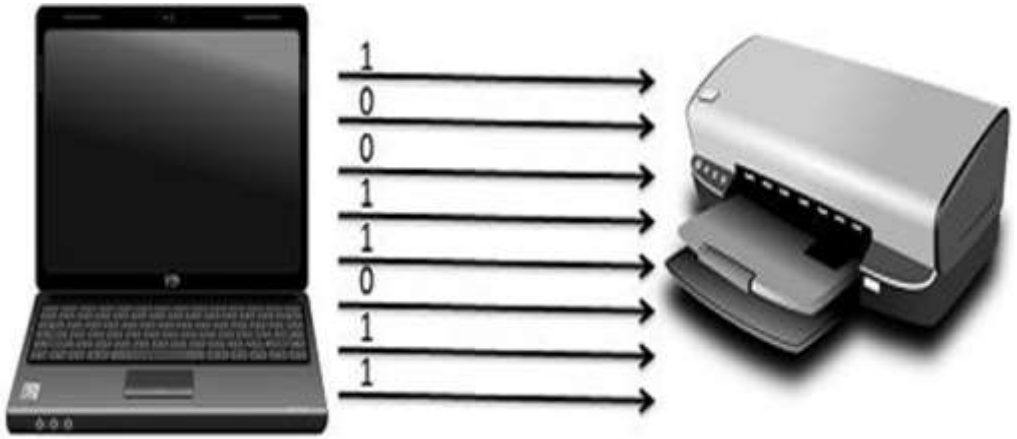


Figure 4.2: Parallel Transmission

Data transfer between a computer to a printer

Buffering strategies

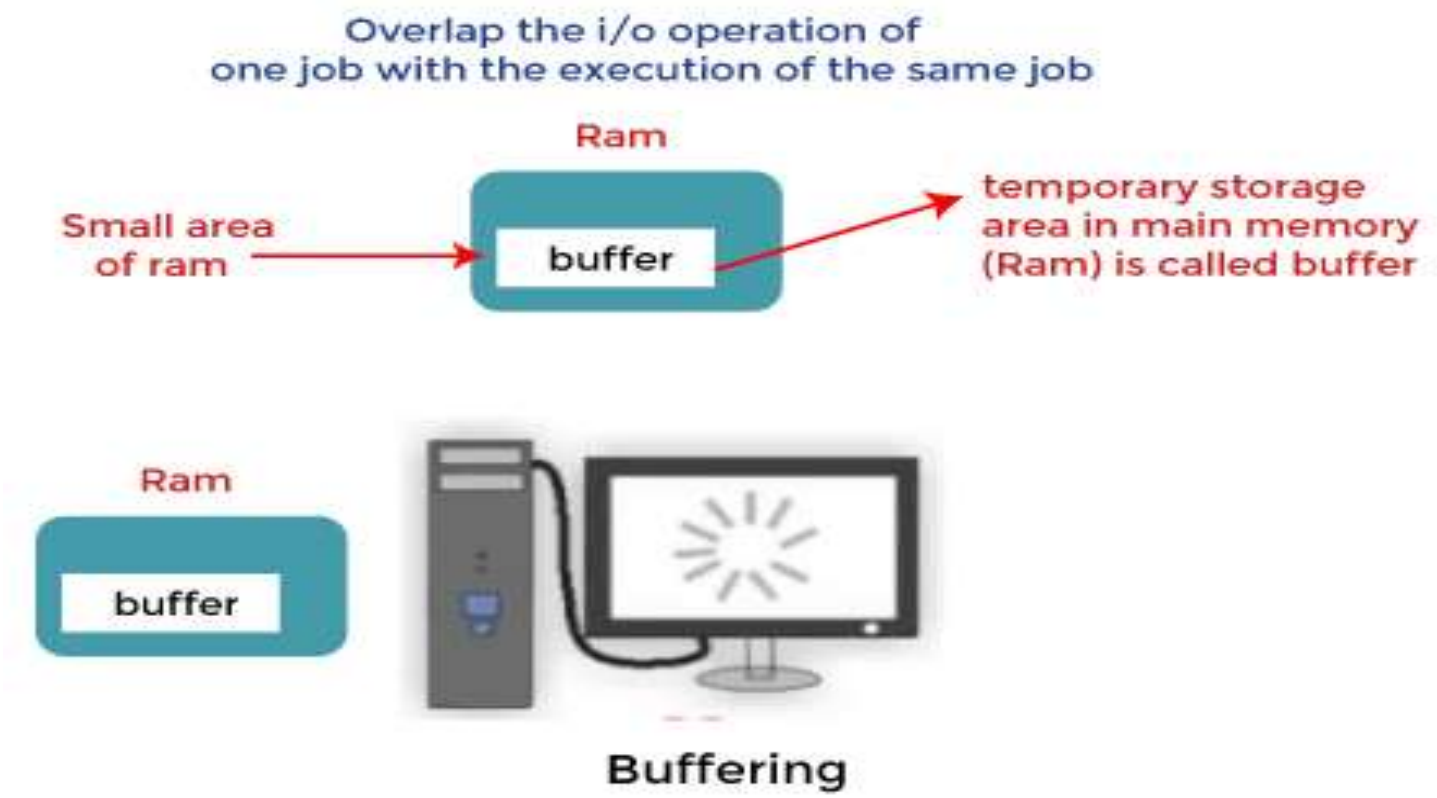
- The **buffer** is an area in the main memory used to store or hold data temporarily.
- The act of storing data temporarily in the buffer while it is being transferred between two devices or between a device and an application known as **buffering.**
- **I/O buffering** is the process of temporarily storing data that is passing between a processor and a peripheral devices.

Why Buffering is required?

- Buffering is done for three reasons:
  - To manage with a speed mismatch between the sender and receiver of a data stream.
  - Data Transfer Size Mismatch: To adapt between different data transfer sizes. For example, a network packet might be of one size, and the disk block another. Buffers can hold data until enough is accumulated for the desired operation.
  - Synchronization: To allow for synchronization between devices or processes that produce and consume data at different rates.

How Buffering Works?

- In an operating system, buffer works in the following way :

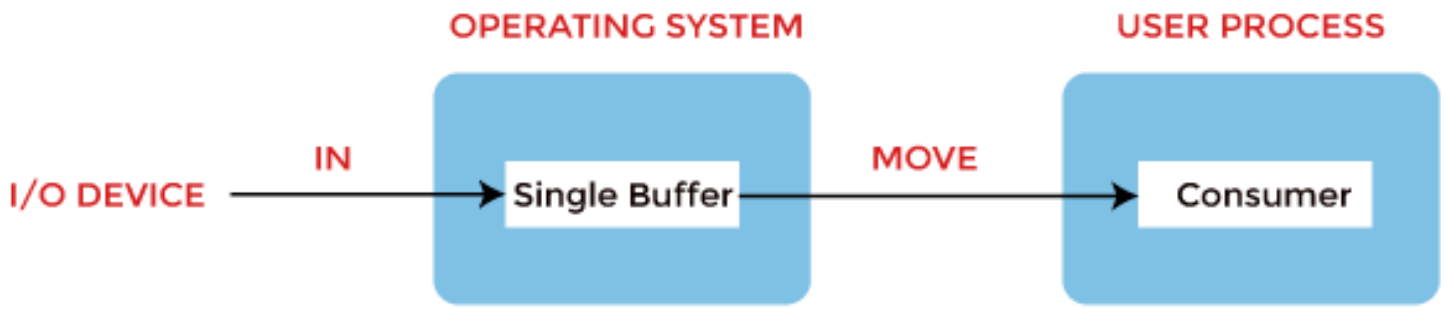


Types of Buffering

- There are three main types of buffering in the operating system:

1. Single buffering:

- Only one buffer is used to transfer the data between two devices.
- The sender produces one block of data into the buffer. After that, the receiver receives the buffer.

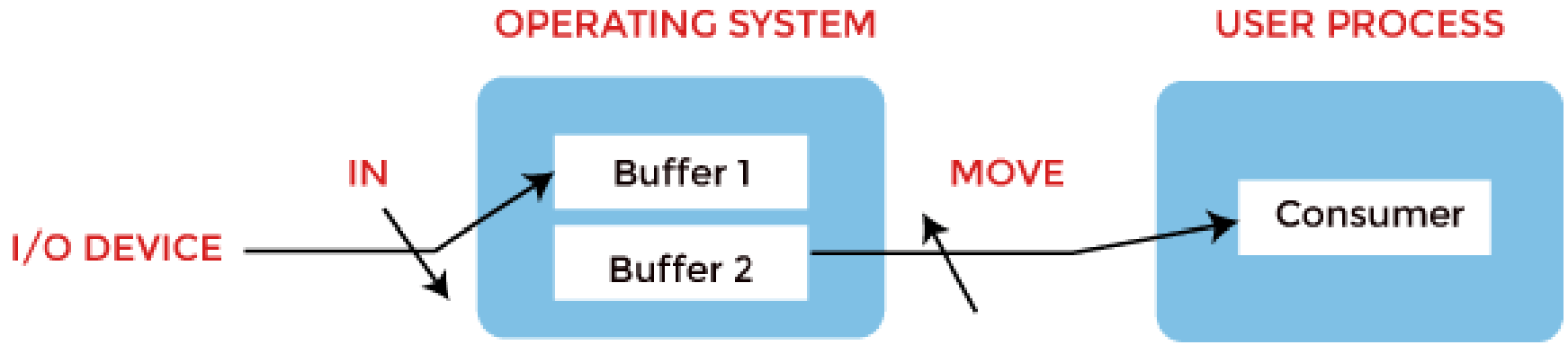


SINGLE I/O BUFFERING

Types of Buffering Con't…

2. Double buffering:

- Two buffers are used in the place of one.
- The sender produces one buffer while the receiver consumes another buffer simultaneously. So, the sender not needs to wait for filling the buffer.
- It is also known as buffer swapping.

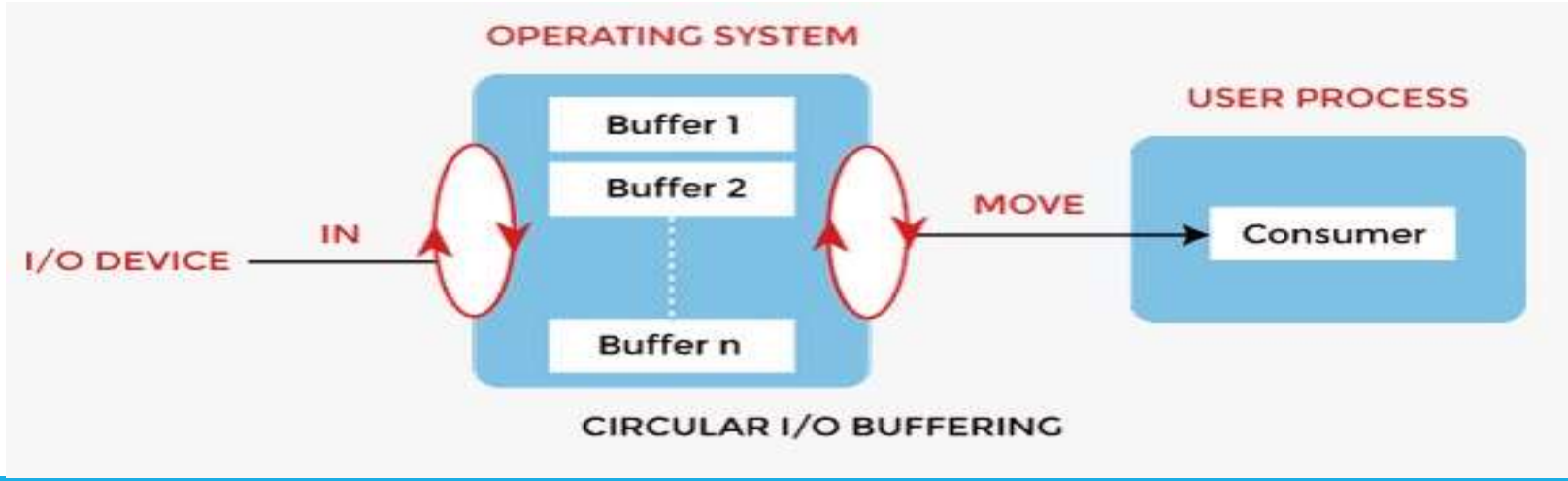


DOUBLE I/O BUFFERING

Types of Buffering Con't…

3. Circular buffering:

- When more than two buffers are used, the buffers collection is called a **circular buffer**.
- Each buffer is being one unit in the circular buffer.
- The data transfer rate will increase using the circular buffer rather than the double buffering.



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