

### Data Transmission

#### Parallel Transmission

This is **multiple wires** sending a number of bits at the same time.

This is used in buses in the CPU but can only be used for **short distances** due to interference.

This is much **faster** than serial transmission, but may have **synchronization problems**.

#### Serial Transmission

Bits are sent **serially** across a single wire.

This is used for **longer distances** and is frequently used in computer cables.

There are three types of serial transmission:

1. **Simplex** - Transmission in one direction only.
2. **Half-Duplex** - Transmission in both directions, but only one at a time.
3. **Full-Duplex** - Transmission in both directions simultaneously.

### Bandwidth

Bandwidth is the amount of data that can be transmitted at a time along a **single communication channel**.

This is related to the **range of frequencies** available on the carrier wave.

### Multiplexing

**Multiplexing** involves combining more than one signal through a single communications channel.

When the signal reaches its destination, it has to be **demultiplexed** or **demuxed**. This involves decoding the multiplexed signal to extract the original data.

**Inverse multiplexing** breaks one data stream into several data streams to be sent separately over multiple channels, where it can be re-assembled at the destination.

### Bit Rate

The **speed** at which a transmission is taking place. This is proportional to **bandwidth**, since bandwidth can determine how many bits can be transmitted at a time.

This is measured in **bits per second** or **bps**.

### Baud Rate

One **baud** represents one electronic state change per second.

In a system where one bit is sent per each state change, **one baud** would equate to **one bit per second**.

However, it is possible to store multiple voltages as representing **combinations of bits**.

For example, **1Hz** might represent "**1010**", **2Hz** might represent "**1111**", etc.

This way the number of state changes can remain constant while bits per second increases.

### Types of Switching

#### Circuit Switching

This is when a specific route of switches is determined and data is sent only down that specific path. This path is maintained for the duration of the transmission.

#### Packet Switching

Data is split into **packets**. Each packet contains **data**, the **source address**, the **destination address**, and a **checksum**.

Each packet may take a different route around the network.

This means that if one computer fails, the message can still be sent. Also, it is more difficult to intercept.



By **AlexHoratio** (Horatio)  
[cheatography.com/horatio/](https://cheatography.com/horatio/)

[alexhoratiogamedev.blogspot.com](https://alexhoratiogamedev.blogspot.com)

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