

CLASSIFICATION OF COMPUTERS

Understanding Different Types of Computing Devices

Classification by Physical Size

1. Super Computers

The highest computing power is used for scientific simulations, weather forecasting, and complex modelling. Very large and expensive.

2. Mainframe Computers

Designed for multiple users and large-scale businesses. They excel at transaction processing and reliability rather than raw speed.

3. Mini Computers

Medium-scale, common-purpose systems. Though today they've largely been replaced by servers.

4. Micro Computers

Personal computers (desktops, laptops, tablets, smartphones). Smallest in size, designed for individual use

Supercomputers



Fugaku (Japan)

The Most Powerful Computing Systems

Key Characteristics:

- Perform trillions of calculations per second
- Cost millions to billions of dollars
- Occupy entire rooms or buildings
- Require specialised cooling systems

Common Applications:

- Weather forecasting and climate modelling
- Nuclear weapons simulation
- Drug discovery and molecular modelling
- Space research and astrophysics
- Oil and gas exploration
- AI and machine learning

Examples: Fugaku (Japan), Summit (USA)

Size and Power Comparison

Type	Size	Power	Cost	Primary Use
Supercomputer	Room-sized	Extreme	\$\$\$\$\$	Research
Mainframe	Cabinet-sized	Very High	\$\$\$\$	Enterprise
Server	Rack/Tower	High	\$\$\$	Networks
Workstation	Desktop	High	\$\$\$	Professional
Desktop PC	Desktop	Medium	\$\$	General
Laptop	Portable	Medium	\$\$	Mobile Work
Tablet	Handheld	Low-Medium	\$	Media
Smartphone	Pocket	Low-Medium	\$\$-\$	Communication
Embedded	Tiny	Very Low	\$	Specific Task
Wearable	Wrist-sized	Very Low	\$	Health/Fitness

Classification by Technology



Analog Computers

Process continuous
physical quantities

01

Digital Computers

Process discrete
binary data
(0s and 1s)

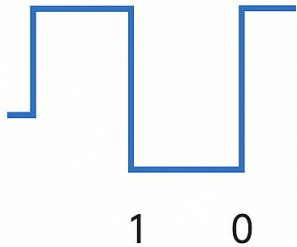


Hybrid Computers

Combine analog
and digital
technologies

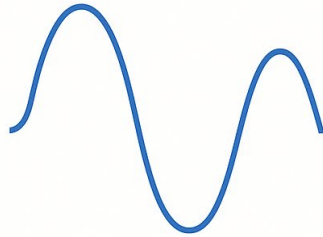
Analog & Digital Signals

DISCRETE SIGNAL



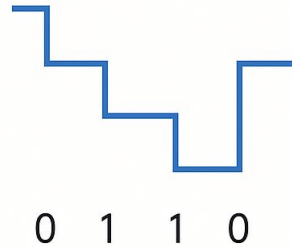
Binary (0 or 1)

ANALOG SIGNAL

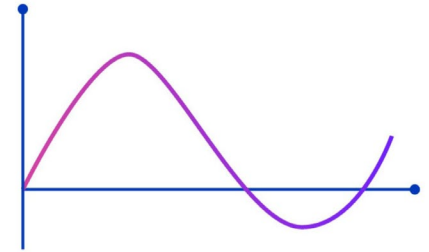


Continuously variable

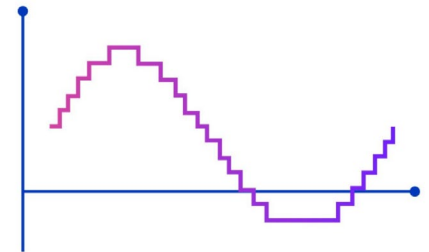
DIGITAL SIGNAL



Multiple discrete values



Analog Signal



Digital Signals

Analog-to-Digital Converters

Analog Computers

Definition:

Computers that operate on continuously varying physical quantities such as voltage, current, temperature, or pressure. They represent data as continuous signals rather than discrete numbers.

Key Characteristics:

- Work with continuous data (analog signals)
- Perform calculations using physical phenomena
- Very fast for specific calculations
- Limited accuracy compared to digital
- Difficult to store and retrieve data
- Prone to environmental interference

Historical Applications:

- Weather forecasting systems
- Flight simulators
- Tide predictors
- Artillery firing tables
- Process control systems

Modern Use:

- Mostly replaced by digital computers
- Still used in some specialised applications
- Legacy systems in older equipment

Digital Computers

Definition:

Computers that process information in discrete form using binary digits (bits) - 0s and 1s. All data is converted to digital format for processing.

Types of Digital Computers:

- Personal computers (desktops, laptops)
- Smartphones and tablets
- Servers and mainframes
- Embedded systems
- Supercomputers

Today's Standard:

Nearly all modern computers are digital computers.

Key Characteristics:

- Work with discrete data (digital signals)
- Use the binary number system (0 and 1)
- High accuracy and precision
- Easy to store and retrieve data
- Programmable and versatile
- Less affected by noise and interference
- Accurate and reliable results
- Can perform complex calculations
- Data can be easily stored
- Programmable for various tasks
- Can be networked and connected

Hybrid Computers

Definition:

Computers that combine features of both analog and digital computers. They accept analog signals, convert them to digital for processing, and can output in either format.

How They Work:

- Analog-to-Digital Converters (ADC):
Convert continuous signals to digital
- Digital Processing: Perform calculations using binary logic
- Digital-to-Analog Converters (DAC):
Convert back to analog if needed

Perfect for applications requiring real-time processing of analog data with digital accuracy.

Key Characteristics:

- Best of both worlds
- Fast like analog, accurate like digital
- Real-time processing capability
- Can interface with analog sensors
- More complex and expensive

Common Applications:

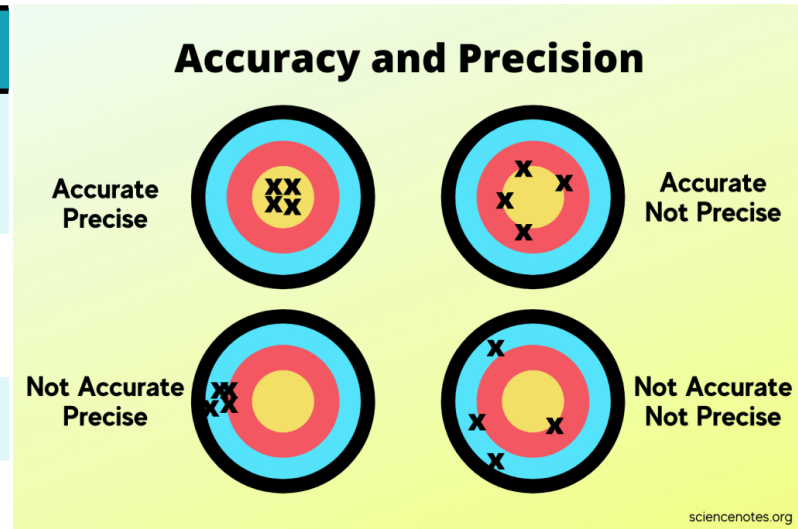
- Medical equipment (ECG, ultrasound machines)
- Scientific instruments and sensors
- Industrial process control systems
- Aerospace and defense systems
- Radar systems
- Seismology equipment
- Automotive systems (engine control units)

Technology Comparison

Feature	Analog	Digital	Hybrid
Data Type	Continuous	Discrete (0s & 1s)	Both
Accuracy	Limited	Very High	High
Speed	Very Fast	Fast	Very Fast
Storage	Difficult	Easy	Easy
Noise Resistance	Low	High	High
Complexity	Simple	Moderate	Complex
Cost	Low	Moderate	High
Current Use	Rare	Dominant	Specialized

Accuracy vs Precision

Aspect	Accuracy	Precision
Definition	Closeness to the true value	Closeness of repeated measurements
Example	Hitting the bullseye	All darts clustered together
Affected by	Systematic error	Random error
Fixed by	Calibration or correction	Better technique/tools
Key in	Reporting correct results	Ensuring reproducibility



Key Takeaways

- Computers are classified by SIZE: from supercomputers to wearables
- Each size category serves specific purposes and use cases
- Computers are classified by TECHNOLOGY: Analog, Digital, and Hybrid
- Analog computers process continuous data (mostly historical)
- Digital computers process binary data (today's standard)
- Hybrid computers combine analog input with digital processing
- Most modern computers are digital, regardless of their size
- Understanding classification helps in selecting the right computer