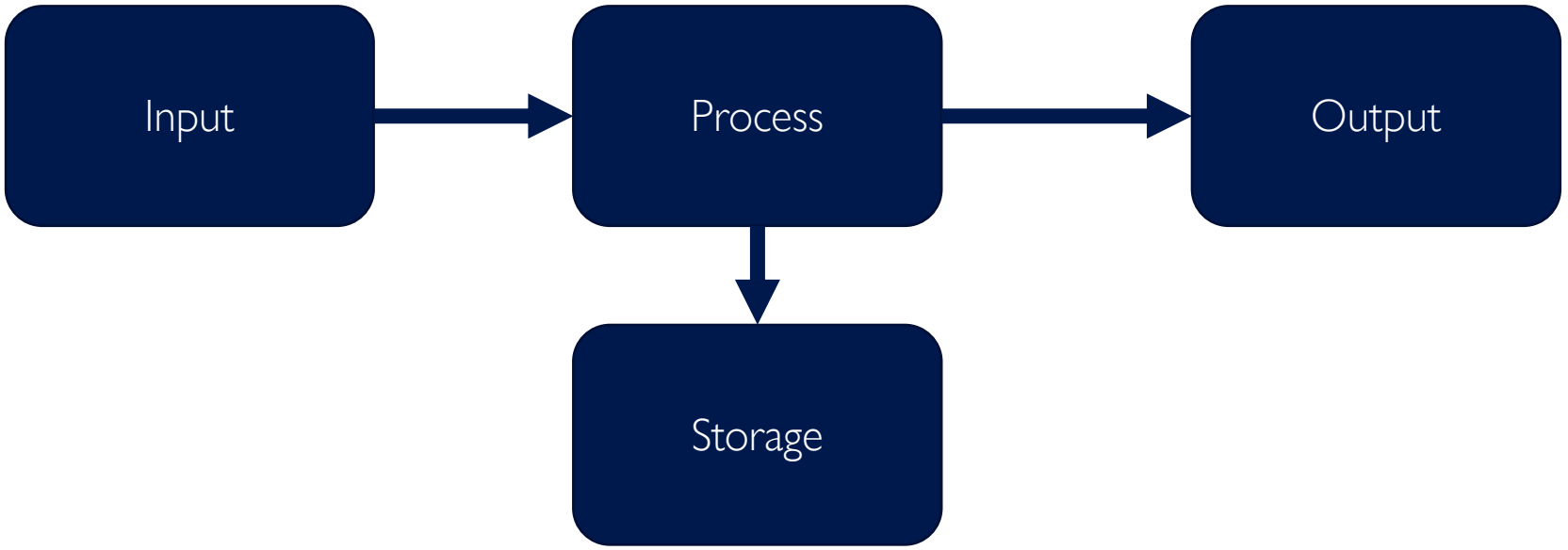
Computers and Applications

WHAT IS A 'COMPUTER'?

- A computer is a data processing device that performs four major functions:



- To Access the jamboard :
  - S15: https://tinyurl.com/ccicomps15
  - S11b : https://tinyurl.com/ccicomps11b

DATA VS INFORMATION

- Data is a representation of a fact, a figure, or an idea
  - Can be a number, a word, a picture, or even a recording of sound.
  - Means little on its own
- Information is data that has been organized or presented in a meaningful fashion.
  - Useful to humans

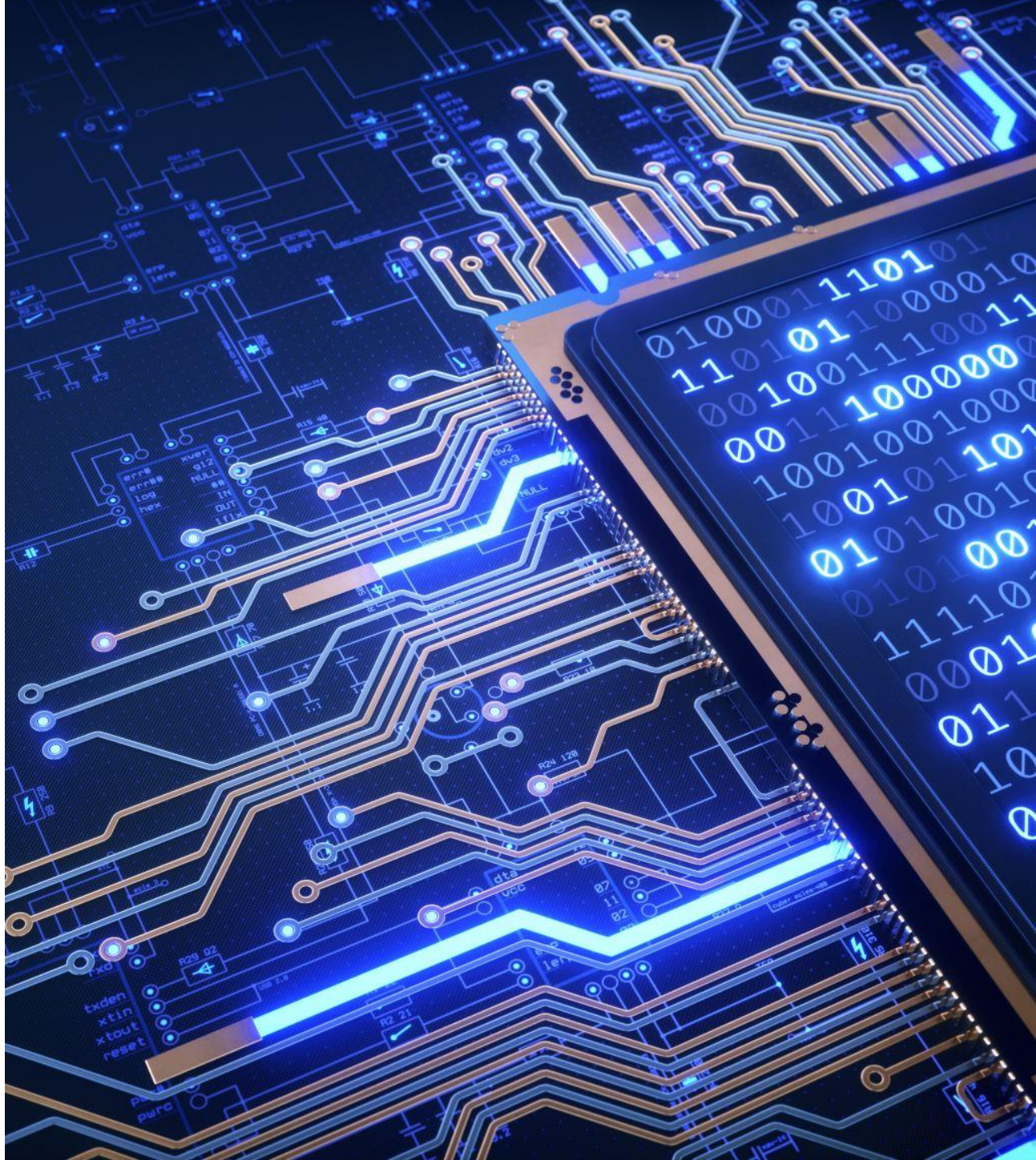
What are other forms of data?

Brain

- Made up of neurons and connected by synapses
- Fire or not Fire

Computers

- Computers represent data electrically
- Process it with electrical switches with 2 states (on / off)
- Non-numeric data (e.g. strings, images, video) are internally still represented by a set of numeric values



BINARY

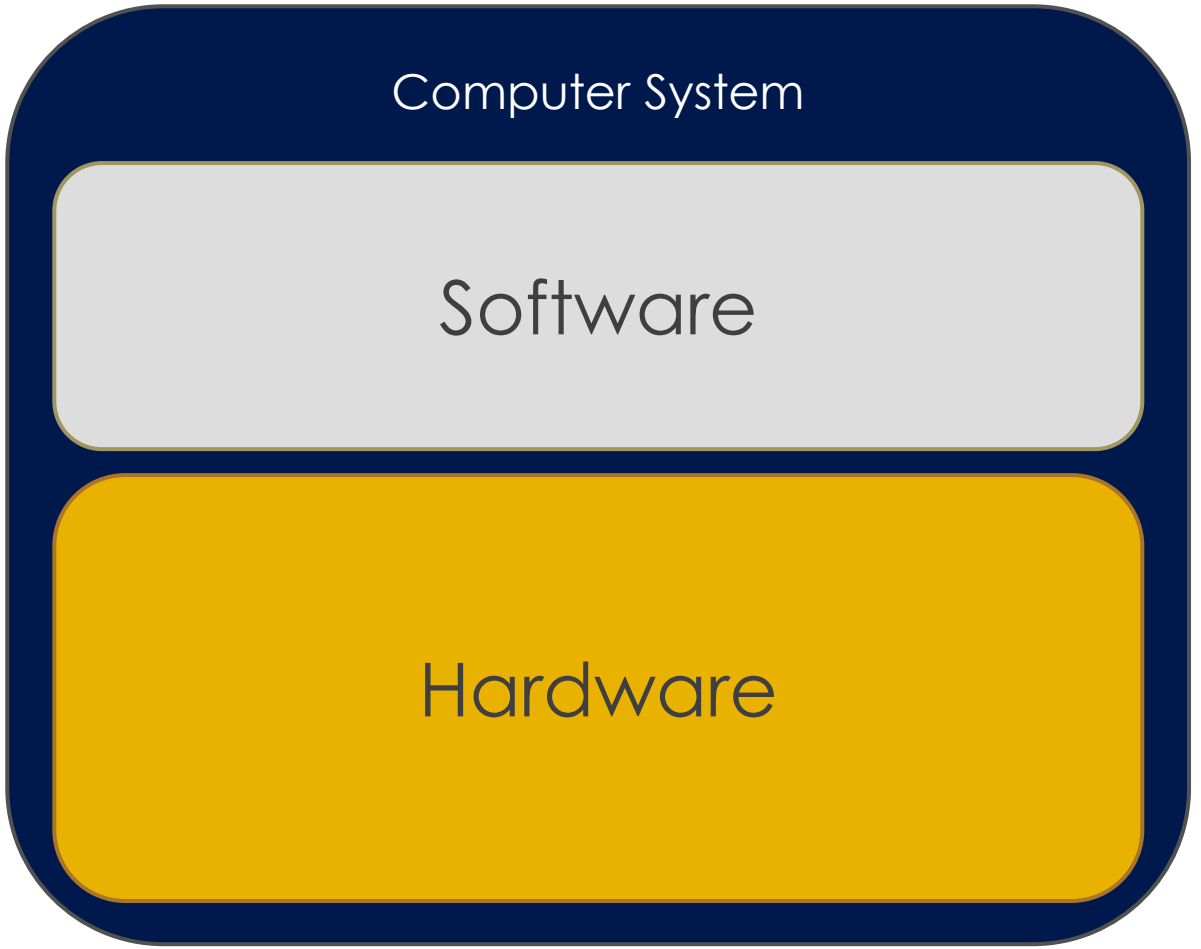
- The 'language' that computers work with to represent and process data is called binary
  - All data is represented using a series of 0s and 1s.
  - Each 0 and 1 is a binary digit, or 'bit'
  - Four binary digits (or bits) combine to create one 'nibble' – e.g. 1010
  - Two nibbles or eight bits combine to create one 'byte'. – e.g. 10011100

Terminology	Number of Bytes	Relative Size
Kilobyte	1024 bytes	1 page of plain text
Megabyte	1,048,576 bytes	1 photo taken with a 12 MP phone camera
Gigabyte	1,073,741,824 bytes	A 2-hr movie in high-definition
Terabyte	1,099,511,627,776 bytes	4.6 million books

COMPUTER COMPONENTS

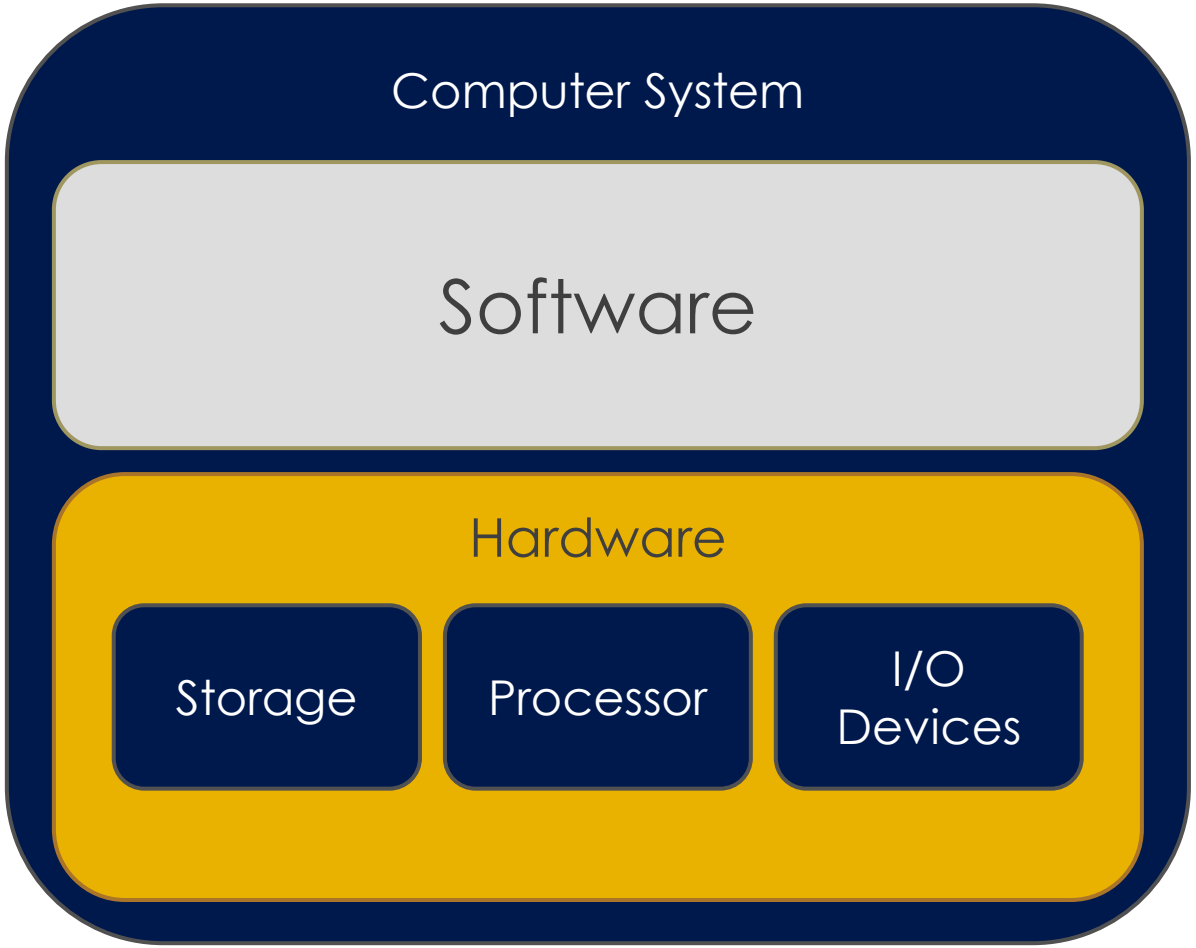
PROCESSING BITS AND BYTES

- A computer uses hardware and software to process data into information
- Hardware is any tangible part of the computer you can physically touch
- Software is the set of procedures (programs) that enables the hardware to perform different tasks.



COMPUTER HARDWARE

- A computer system's hardware is composed of
  - Processor
  - Storage
  - Input devices
  - Output devices



PROCESSOR

- A processor is the device that performs data manipulation and transformation functions:

  Computation (addition, subtraction, sion)

  Comparison (less than, greater than, equal to, and not equal to)

  Data movement between storage, and input/output devices

PROCESSOR

- A processor is the device that performs data manipulation and transformation functions:

Examples:

Central Processing Unit (CPU)
General Purpose Computers (GPU)
Raspberry PI

RaspberryPi

STORAGE

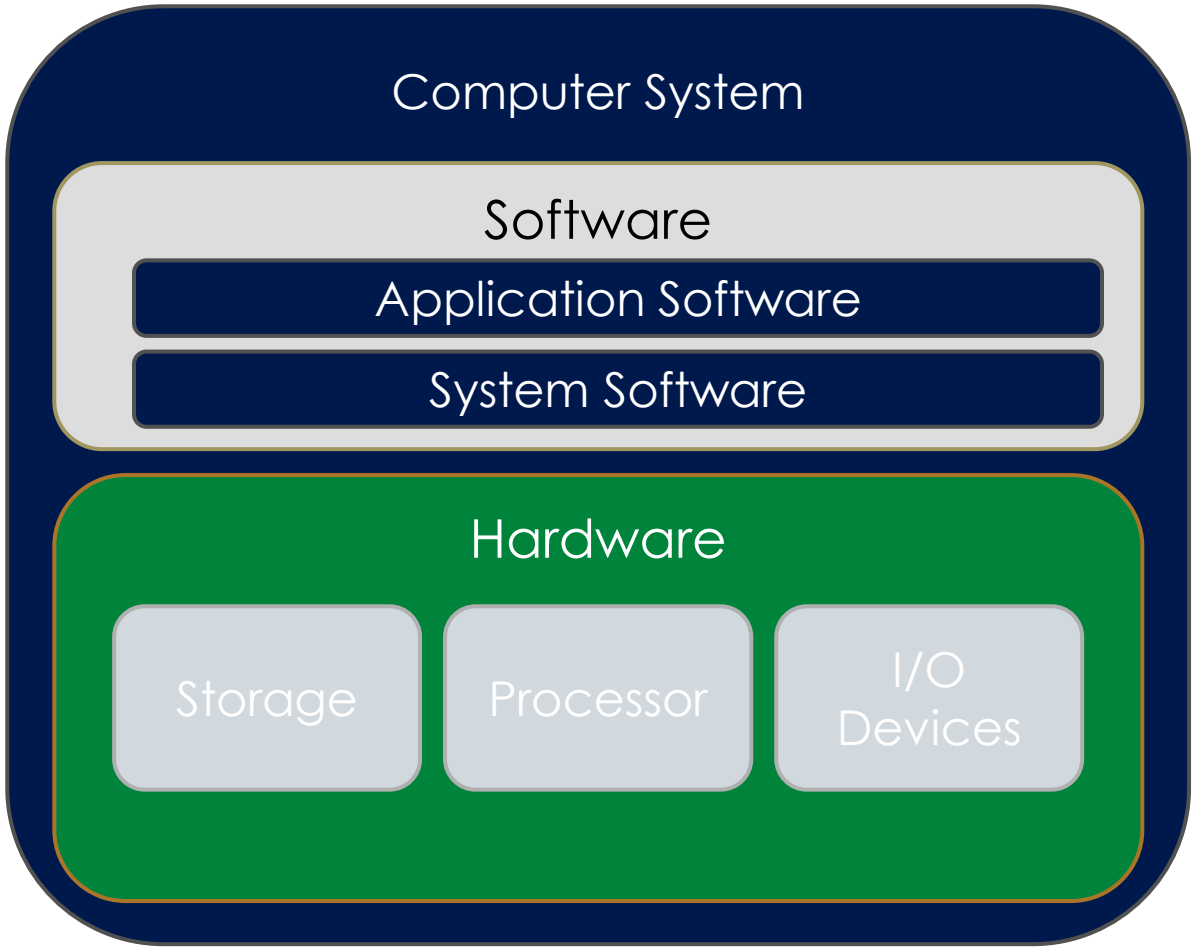
- A computer hold a variety of information:
  - Intermediate processing results of complex processing tasks
  - Data and programs for current or future use
- In general, components used to hold these results, data and programs is called storage
  - Primary storage holds currently running programs and data needed immediately. They do not hold their contents when the computer is turned off
  - Secondary storage hold programs and data that are kept for the long term. They retain their contents even when the computer is off

INPUT / OUTPUT DEVICES

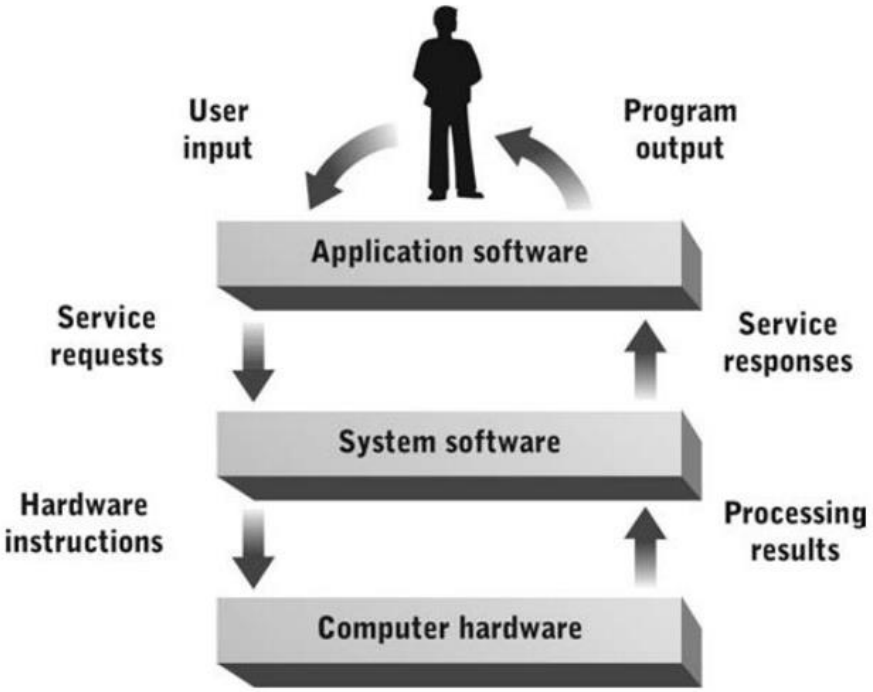
- I/O devices or Peripherals provide computers with the capability of communicating using sound, text, and graphics for humans and electronic or optical communication for other computers
  - Input devices accept input from a person, the environment or another computer and convert it into something the computer can understand
  - Output devices send information to another computer or convert electrical signals into a format that a person can understand

COMPUTER SOFTWARE

- Software performs a complex translation process that bridges two gaps:
  - Human native language conversion to binary computer language –
  - Convert a high-level task request from a human to low-level detailed set of instructions for the CPU to produce a result
- Computer software include:
  - Application software
  - System software



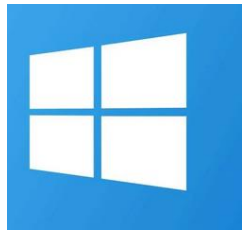
SOFTWARE CLASSIFICATIONS



- Application software are programs that perform user- or business-specific tasks




- System software enable users to control computer hardware and application software



COMPUTER TYPES AND CLASSES

GENERAL PURPOSE COMPUTERS

- Designed to perform a wide variety of functions and operations
- Personal computers
  - Are tailored to satisfy the computing needs of one user at a time
  - May be mobile or stationary

Laptops

Desktops / Workstations

Tablets

Mobile Phones

GENERAL PURPOSE COMPUTERS

- **Servers**
  - Are computers or groups of computers that manages shared resources such as and are meant to be used by multiple users at the same time
  - **Mainframes**
    - used in businesses
    - manage large amounts of data
    - execute many computer programs at the same time.
  - **Supercomputers**
    - specially designed computers
    - perform complex mathematical calculations

Mainframes

Supercomputers

GENERAL PURPOSE COMPUTERS

- A **cluster**
  - group of similar or identical computers connected together that cooperate to provide services or run a single application
- A **grid**
  - a group of connected dissimilar computers that cooperate to provide services or run a shared application

Embedded Systems

- Computers designed to be task-specific; job is to solve one particular problem
- Dedicated to perform a single task over and over again
- An **embedded computer** is a specially designed computer chip that resides in another device or object to provide them data processing and communication capability

Car Navigation Systems

Gaming consoles

Network Routers

Smart appliances

Computer Classes

Feature	Personal mobile device (PMD)	Desktop	Server	Clusters/warehouse-scale computer	Internet of things/ embedded
Price of system	$100–$1000	$300–$2500	$5000–$10,000,000	$100,000–$200,000,000	$10–$100,000
Price of microprocessor	$10–$100	$50–$500	$200–$2000	$50–$250	$0.01–$100
Critical system design issues	Cost, energy, media performance, responsiveness	Price-performance, energy, graphics performance	Throughput, availability, scalability, energy	Price-performance, throughput, energy proportionality	Price, energy, application-specific performance

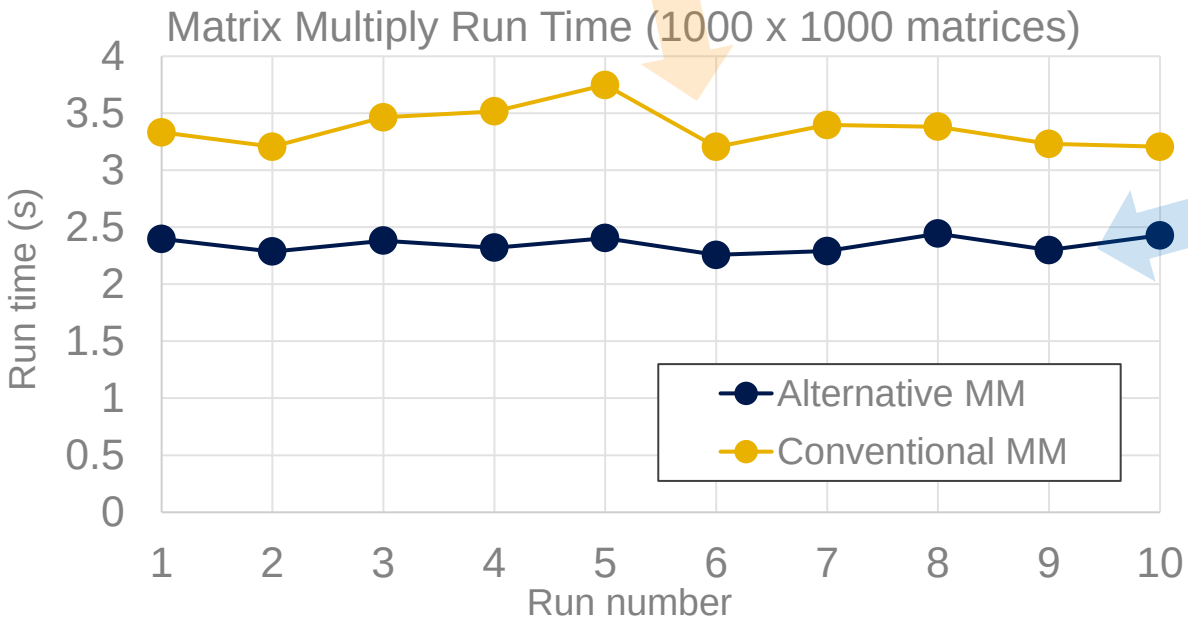
SUMMARY

- A computer is an automated device for performing computational tasks. It accepts input data from the external world, performs one or more computations on the data, and then returns results to the external world.
- Computers process data into meaningful information
- The language of computers is called binary, which represents any data as a combination of 1's and 0's. Each binary digit is called a bit.
- Computer hardware consists of a processor, storage, and I/O devices
- The role of software is to translate user requests into machine instructions. The two primary types of software are application software and system software.
- Computers may be classified as general purpose, which are designed to perform various types of data processing; and special purpose, which are designed to perform a single specialized task

Why study the hardware?

Coding techniques impact performance

```
for(i=0; i<XSIZE; i=i+1) {
    for(j=0; j<YSIZE; j=j+1) {
      r = 0;
      for(k=0; k<XSIZE; k=k+1) {
        r = r + y[i][k] * z[k][j];
      }
      x[i][j] = r;
    }
}
```




```
for(jj=0; jj<XSIZE; jj=jj+B) {
   for(kk=0; kk<YSIZE; kk=kk+B) {
      for(i=0; i<XSIZE; i=i+1) {
         if((jj+B) < YSIZE) {
            p = jj+B;
         }
         else {
            p = YSIZE;
         }
         for(j=jj; j<p; j=j+1) {
            r=0;
            if((kk+B) < XSIZE) {
               q = kk + B;
            }
            else {
               q = XSIZE;
            }
            for(k=kk; k<q; k=k+1) {
               r = r + y[i][k]*z[k][j];
            }
            x[i][j] = x[i][j] + r;
         }
      }
   }
}
```

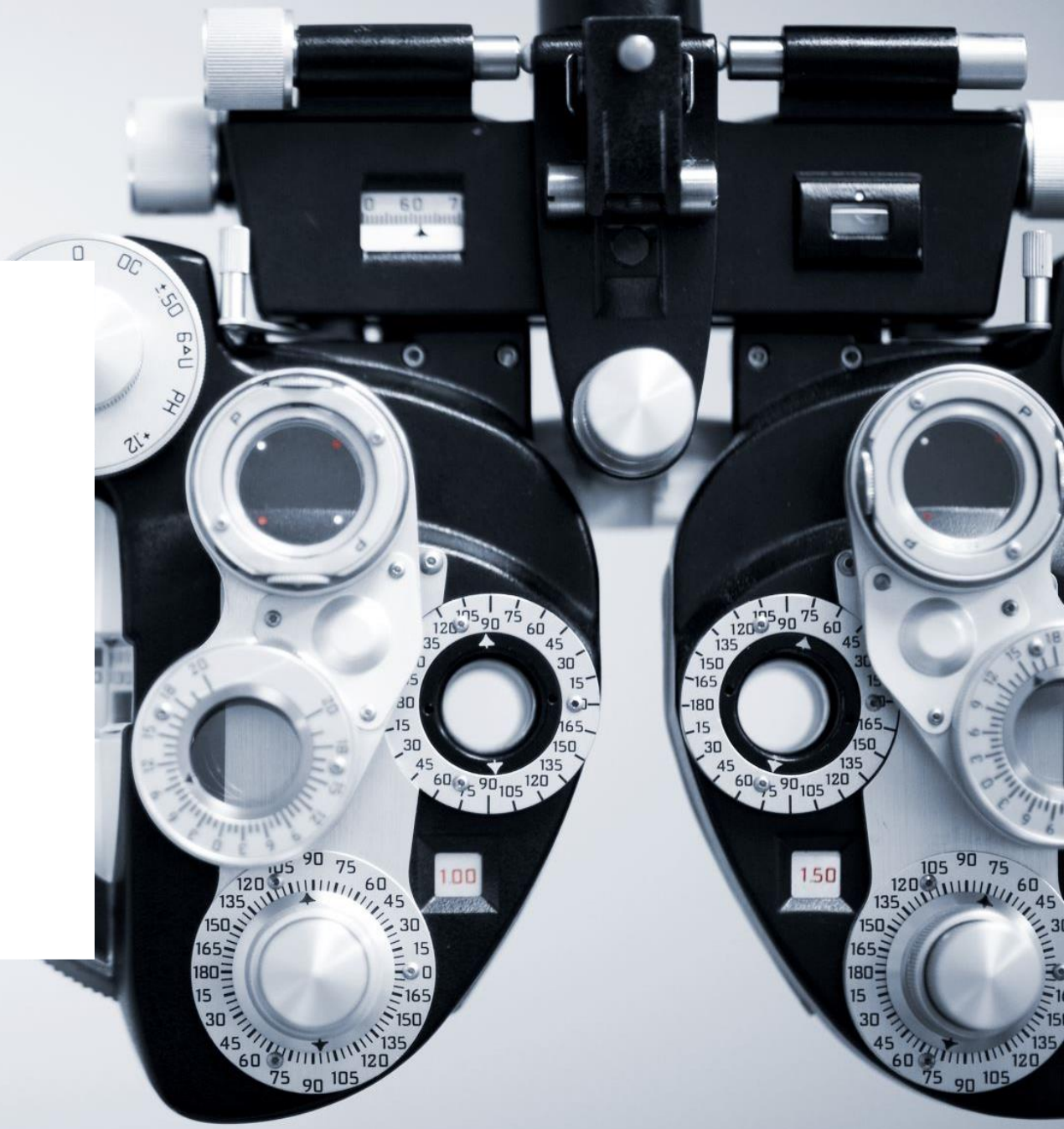
This code is faster

Applications

Why do we use Apps?

- Productivity
- Business
- Games
- Media and Entertainment
- Social Media / Communications
- Education
- Content Creation

A case for computer vision



Deep Fake


Reference
Our Result

ChatGPT


BBC NEWS