BCSE101E Computer Programming Python

Kavya Alluru

Vellore Institute of Technology, Chennai.

1. Introduction to Computers

2. How Computers store Data

3. Evolution of Computers and Programming Languages-A brief history

Computers in every day life

Think over...

Difference between a computer user, computer programmer, computer designer or manufacturer.

Difference between a calculator and computer

Manual vs Automation

What is problem solving using computers

Whether all problems can be solved by computers?
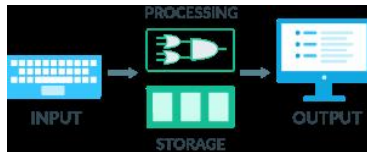
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What is a computer and how it works?

Let's see what Bill Gates say on "How Computer works?"
https://youtu.be/_bVqU4D_MVw
Every computer takes input data, stores and processes it, and outputs results.

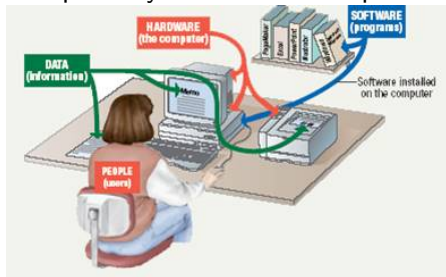Inventor and designer May-Li Khoe and virtual reality designer Nat Brown introduce the four features of a computer.
https://youtu.be/xfKn5OjHLqQ
Src: What is a Computer, Khan Academy.

Parts of Computer System

Computer systems have four parts

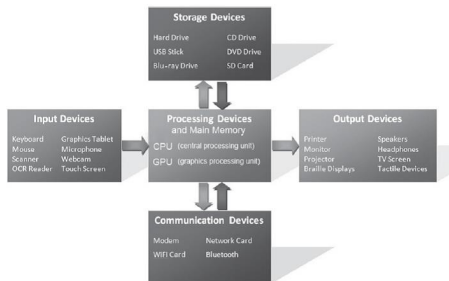
- Hardware
  - Mechanical devices in the computer
- Software
  - Tell the computer what to do. Also called as program.
- Data
  - Pieces of information. Computers organize and present data.
- User
  - People operating the computer. Tell the computer what to do.

Computer Hardware

Figure: Fundamental Hardware Components

Src: Introduction to Computer Science using python, Charles Dierbach.

Computer Hardware

The System Unit houses the central processing unit, memory modules, expansion slots, and electronic circuitry as well as expansion cards that are all attached to the motherboard; along with disk drives, a fan or fans to keep it cool, and the power supply.

Motherboard
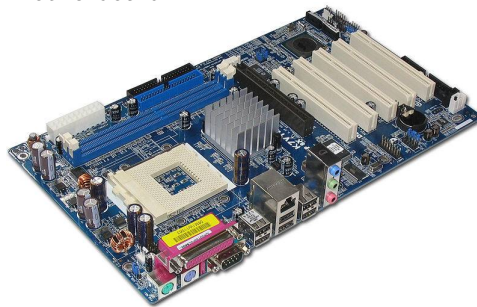
All other devices (monitor, keyboard, mouse, etc., are linked either directly or indirectly into the system unit.

Input Devices

Keyboard

Mouse

Joystick

Digital Tablet

Earphones

Web camera

Wearable input gloves

3-D scanner

Fingerprint scanner

Output Devices

Speakers

Printer

Projector

Monitor

Plotter

Memory

Memory (RAM)

- Random Access Memory (RAM)
  - Stores current data and programs
  - Keep the information for a shorter period of time (usually volatile)
  - Faster, More expensive
- Read Only Memory (ROM)
  - Permanent storage of programs
  - Holds the computer boot directions

Storage Devices

Flash Memory card

Floppy Drive

Tape Drive

Hard Disk

non-volatile
Slower ,Cheaper
Higher storage capacity

Layers of Software

Application software:

- We use a lot of applications in the computer like Microsoft word, excel, browsers, media players, games etc., these are application software's.

Operating System:

- is the manager which manages and controls the functioning of entire computer system. Acts as an intermediary between a user and the computer hardware.

For example, you want to print a word document, operating system is the one which makes the communication happen.

src: https://windsongtraining.ca/
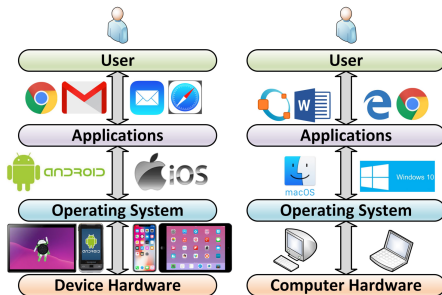
Types of Operating Systems

Real-time operating system

- Very fast small OS
- Built into a device
- Respond quickly to user input
- MP3 players, Medical devices

Single user/Single tasking OS

- One user works on the system
- Performs one task at a time
- MS-DOS and Palm OS
- Take up little space on disk
- Run on computers

Single user/Multitasking OS

- User performs many tasks at once
- Most common form of OS
- Windows XP and OS X
- Require expensive computers

Multi user/Multitasking OS

- Many users connect to one computer
- Each user has a unique session
- UNIX, Linux, and VMS
- Maintenance can be easy VIT
- Requires a powerful computer

PC Operating systems

DOS
- Disk Operating System
- Single user single-tasking OS
- Command line interface
- 16-bit OS, supports legacy applications

Windows 9x
- 95, 98, and Millennium Edition (Me)
- 32-bit OS
- Supported 16-bit programs well
- Very pretty not stable OS
- Still found in large corporations
- 95 introduced the Start button
- 98 introduced active desktop

How is data stored in a computer

- Only language a computer can understand is binary i.e, 0's and 1's.
- Generally, a wire is used to represent either 0 or 1, based on the amount of electricity flowing through it.
- a "bit" is atomic: the smallest unit of storage. A bit stores just a 0 or 1.
- One byte = collection of 8 bits
- Kilobyte, KB, about 1 thousand bytes
- Megabyte, MB, about 1 million bytes
- Gigabyte, GB, about 1 billion bytes
- Terabyte, TB, about 1 trillion bytes

ASCII Code

Have a look at your keyboard : consists of characters, numbers(0-9), special symbols - input to computer. Other inputs are images, video, speech. Ultimately, all these are stored as 0's and 1's in a computer. Let's see how these characters, special symbols are converted to 0's and 1's.

ASCII is an encoding where each character is represented by a number.

DEC	ASCII	DEC	ASCII	DEC	ASCII	DEC	ASCII	DEC	ASCII	DEC	ASCII	DEC	ASCII	DEC	ASCII
1	☺	32	space	64	@	96	`	128	Ç	160	á	192	└	224	α
2	☻	33	!	65	A	97	a	129	ü	161	í	193	┴	225	ß
3	♥	34	"	66	B	98	b	130	é	162	ó	194	┬	226	Γ
4	♦	35	#	67	C	99	c	131	â	163	ú	195	├	227	π
5	♣	36	$	68	D	100	d	132	ä	164	ñ	196	─	228	Σ
6	♠	37	%	69	E	101	e	133	à	165	Ñ	197	┼	229	σ
7	•	38	&	70	F	102	f	134	å	166	ª	198	╞	230	µ
8	◘	39	'	71	G	103	g	135	ç	167	º	199	╟	231	τ
9	○	40	(	72	H	104	h	136	ê	168	¿	200	╚	232	Φ
10	◙	41	)	73	I	105	i	137	ë	169	⌐	201	╔	233	Θ
11	♂	42	*	74	J	106	j	138	è	170	¬	202	╩	234	Ω
12	♀	43	+	75	K	107	k	139	ï	171	½	203	╦	235	δ
13	♪	44	,	76	L	108	l	140	î	172	¼	204	╠	236	∞
14	♫	45	-	77	M	109	m	141	ì	173	¡	205	═	237	φ
15	☼	46	.	78	N	110	n	142	Ä	174	«	206	╬	238	ε
16	►	47	/	79	O	111	o	143	Å	175	»	207	╧	239	∩
17	◄	48	0	80	P	112	p	144	É	176	░	208	╨	240	≡
18	↕	49	1	81	Q	113	q	145	æ	177	▒	209	╤	241	±
19	‼	50	2	82	R	114	r	146	Æ	178	▓	210	╥	242	≥
20	¶	51	3	83	S	115	s	147	ô	179	│	211	╙	243	≤
21	§	52	4	84	T	116	t	148	ö	180	┤	212	╘	244	⌠
22	▬	53	5	85	U	117	u	149	ò	181	╡	213	╒	245	⌡
23	↨	54	6	86	V	118	v	150	û	182	╢	214	╓	246	÷
24	↑	55	7	87	W	119	w	151	ù	183	╖	215	╫	247	≈
25	↓	56	8	88	X	120	x	152	ÿ	184	╕	216	╪	248	°
26	→	57	9	89	Y	121	y	153	Ö	185	╣	217	┘	249	∙
27	←	58	:	90	Z	122	z	154	Ü	186	║	218	┌	250	·
28	∟	59	;	91	[	123	{	155	¢	187	╗	219	█	251	√
29	↔	60	<	92	\	124			156	£	188	╝	220	▄	252	ⁿ
30	▲	61	=	93	]	125	}	157	¥	189	╜	221	▌	253	²
31	▼	62	>	94	^	126	~	158	₧	190	╛	222	▐	254	■
		63	?	95	_	127	⌂	159	ƒ	191	┐	223	▀	255	space

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Decimal to Binary Number System

Characters and special symbols are converted to decimals using ASCII encoding.

Decimal numbers are converted to binary numbers.

Decimal number : 17

| 2	17	1
2	8	0
2	4	0
2	2	0
	1	

Binary number: 10001

- Divide the number by 2.
- Get the integer quotient for the next iteration.
- Get the remainder for the binary digit.
- Repeat the steps until the quotient is equal to 0.

Bits and Bytes

- One byte = collection of 8 bits
- 1 bit = 2 patters (0 or 1)
- 2 bits = 4 patters (00 ,01,10,11)
- 3 bits = 8 patters (000,001,010,011,100,101,110,111)
- 8 bits = 256 patters
- i.e., One byte can hold a number between 0 and 255
- Each letter is stored in a byte

V   I   T

86   73   84   (decimal equivalent)
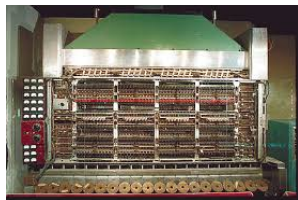
1010110   1001001   1010100
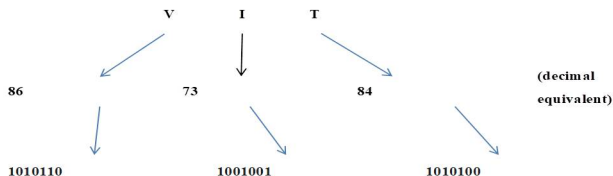
ENIAC

- ENIAC (Electronic Numerical Integrator and Computer) was the first electronic digital computer developed.
- Developed at University of Pennsylvania in 1940's.
- Programming was a complex task, done by manipulating switches and cables.

IAS Computer

- IAS machine was built at Institute of Advanced Study (IAS), Princeton University in early 1950's.
- Developed by John VonNeumann.
- First computer with stored program concept(used even today).
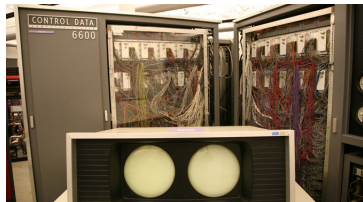- Programmed using assembly language.

IBM 704

- IBM 704 was introduced by IBM in 1950's.
- First computer with floating point arithmetic.
- The programming languages FORTRAN] and LISP were first developed for the 704.

First Super computer

- CDC 6600 was one of the first supercomputer to be developed in 1960's.
- Followed by CRAY 1 and ILLIAC IV.
- FORTRAN] was used to program these machines.

First Personal Computer

- Intel produces the world's first single-chip CPU, the 4004 microprocessor (1971).
- The first IBM personal computer was introduced in 1981. With Microsoft's MS-DOS operating system and Intel chip.
- Apple's Lisa is the first personal computer with a GUI.
- Microsoft introduced Windows in 1985.

- High level programming languages like FORTRAN,C,JAVA were developed to program the computer hardware.
- Compilers enable the programmer to develop large scale software by hiding the architecture details of the hardware.
- C programming is a general-purpose procedural programming language developed in 1972 by Dennis M. Ritchie to develop the UNIX operating system.
- JAVA, an object oriented programming language, was developed by James Gosling at Sun Microsystems and released in 1995.