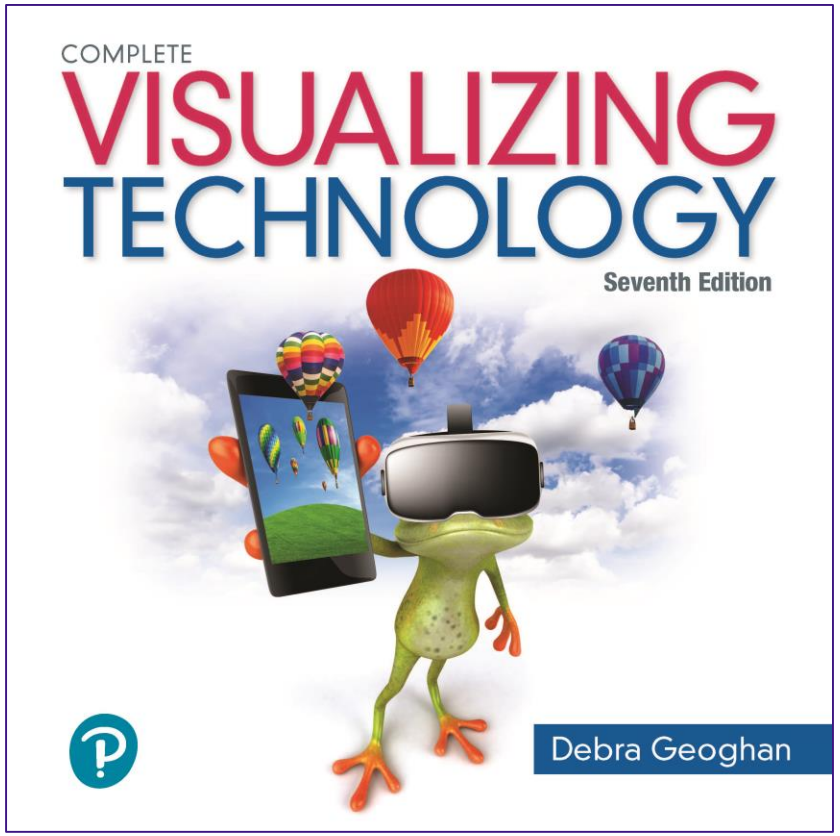
Introductory Visualizing Technology

Seventh Edition



Chapter 1

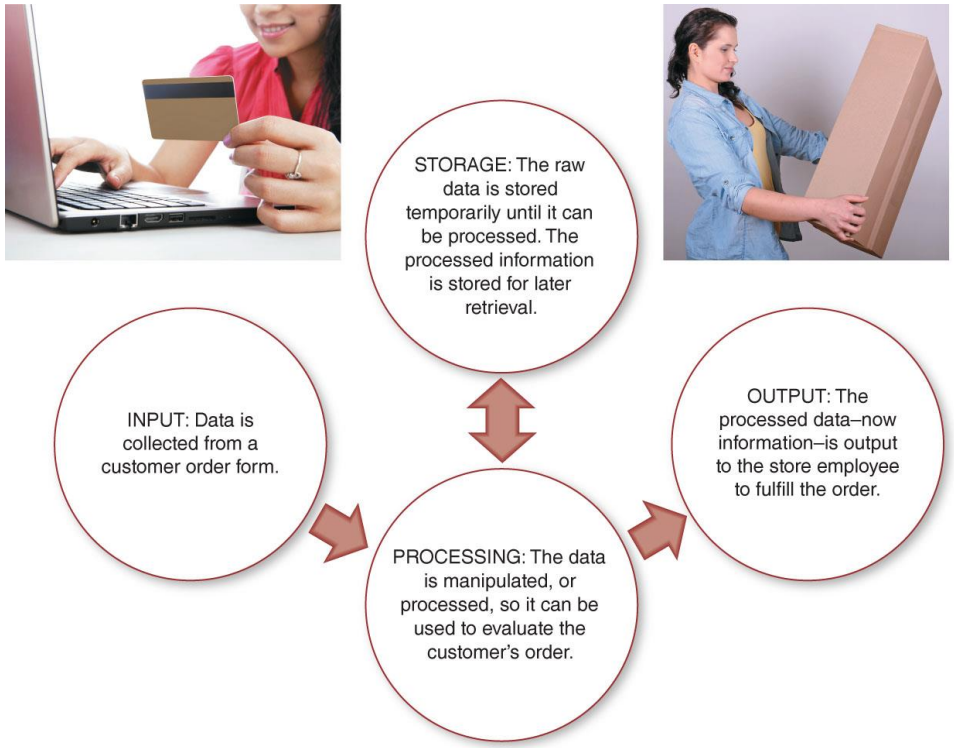
What Is a Computer?

Explain the Functions of a Computer

Computers are programmable machines that convert raw data into useful information

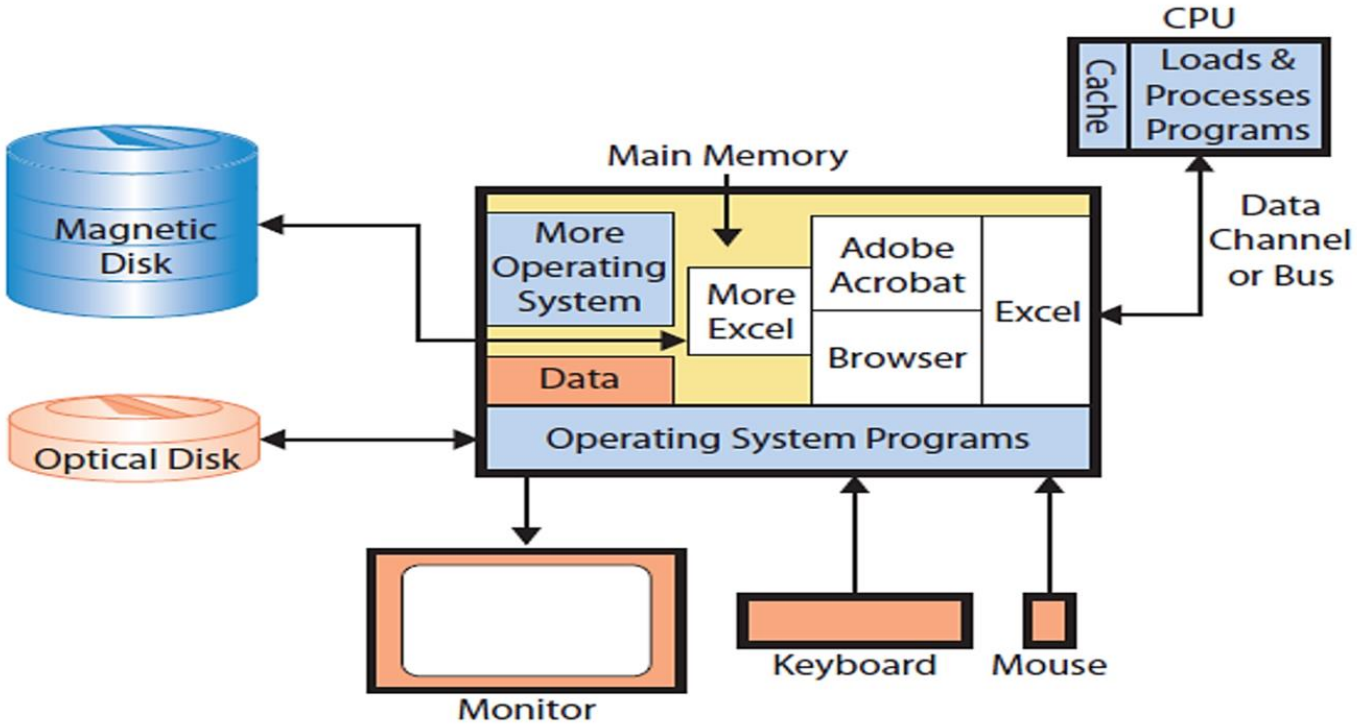
The Information Processing Cycle

- The information processing cycle converts data collected from a customer order form into information used to fulfill the order.



Describe the Evolution of Computer Hardware

How Does a Computer Work?



Functions of the CPU

- **Central Processing Unit** (CPU or **processor**):
  - Brain of the computer
  - Housed on the motherboard (main circuit board of a computer)
  - Contains two parts
    - ✓**Arithmetic Logic Unit** (ALU):
      - Performs arithmetic and logic (AND, OR, and NOT) calculations
    - ✓**Control Unit:** Manages data movement through the CPU
  - Together these two units:
    - ✓Execute instructions (control unit)
    - ✓Perform calculations (ALU)
    - ✓Make decisions (control unit)

First-Generation Computers

- Used vacuum tubes
  - Resembled incandescent light bulbs
  - Emitted a lot of heat
  - Unreliable
- Massive in size
- Used manual switches to process data

First-Generation Computers (2 of 3)

Table 1.1 Important First-Generation Computers

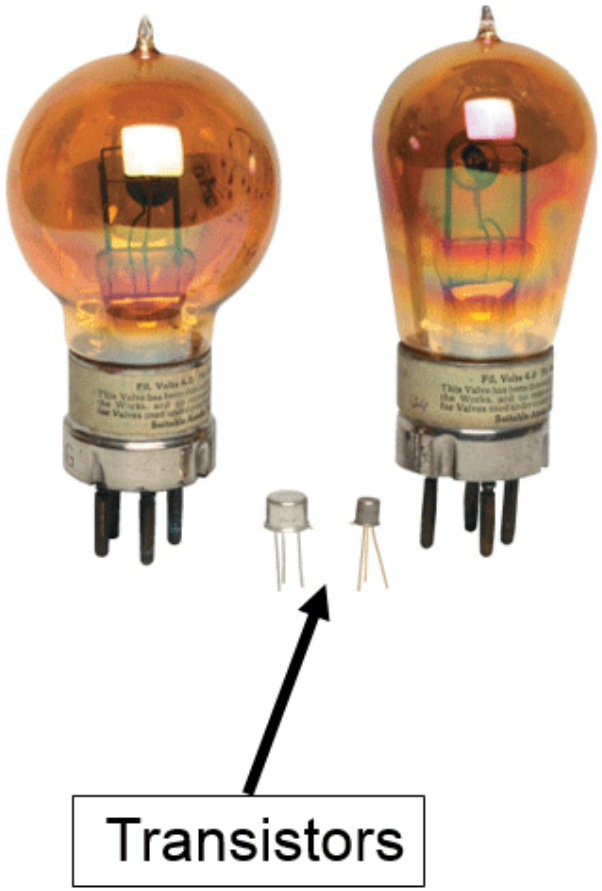
Date	Computer	Origin	Creator	Description
1936–1941	Z1–Z3	Germany	Konrad Zuse	The Z1 through Z3 were mechanical, programmable computers. Working in isolation in Germany, Konrad Zuse didn't receive the support of the Nazi government, and his computers were destroyed during the war.
1942	Atanasoff–Berry Computer (ABC)	United States	Professor John Atanasoff and graduate student Clifford Berry at Iowa StateCollege	The ABC was never fully functional, but Atanasoff won a patent dispute against John Mauchly (ENIAC), and Atanasoff was declared the inventor of the electronic digital computer.

First-Generation Computers (3 of 3)

Date	Computer	Origin	Creator	Description
1944	Colossus	United Kingdom	Tommy Flowers	Used by code-breakers to translate encrypted German messages, these computers were destroyed after the war and kept secret until the 1970s.
1944	Harvard Mark 1	United States	Designed by Howard Aiken and programmed by Grace Hopper at Harvard University	The Mark 1 was used by the U.S. Navy for gunnery and ballistic calculations until 1959.
1946	ENIAC	United States	Presper Eckert and John Mauchly at the University of Pennsylvania	ENIAC was the first working, digital, general-purpose computer.
1951	UNIVAC	United States	Eckert/Mauchly	The world's first commercially available computer, UNIVAC was famous for predicting the outcome of the 1952 presidential election.

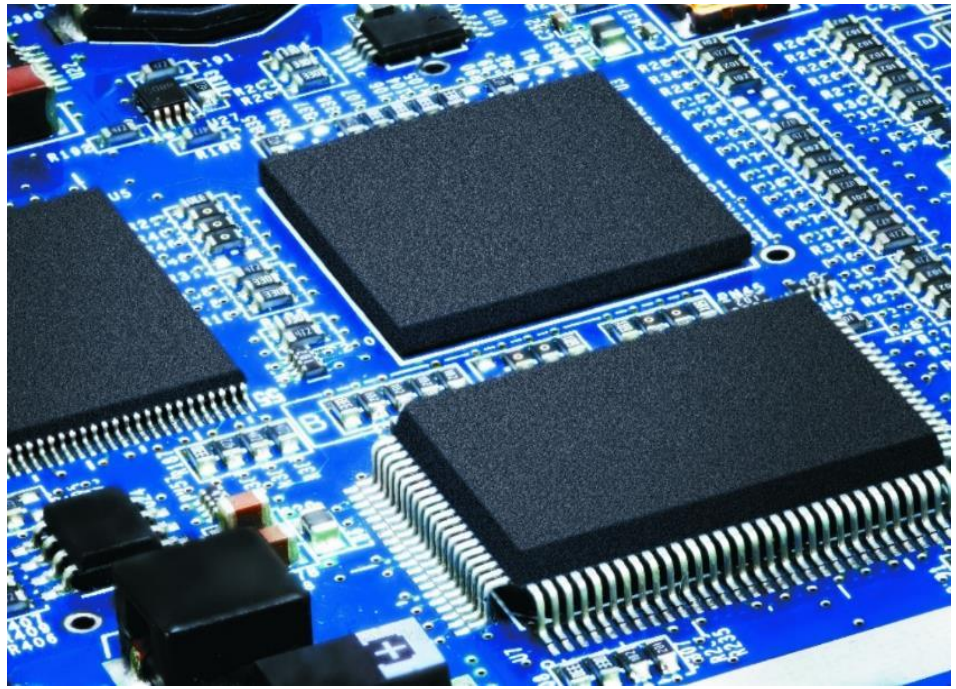
Second-Generation Computers

- Transistors replaced vacuum tubes in 1947
  - Revolutionized the electronics industry
- More powerful
- Smaller
- More reliable
- Reprogrammed in less time



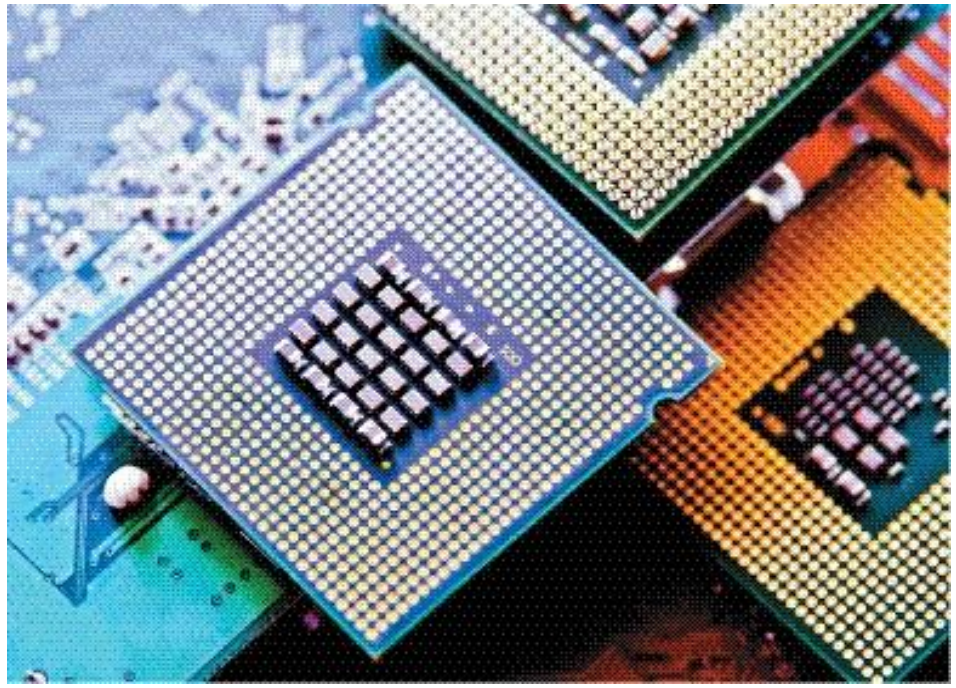
Third-Generation Computers

- Integrated circuits
  - Developed in the 1960s
  - Contained many tiny transistors on semiconducting material (silicon)
- Faster, smaller, and more reliable



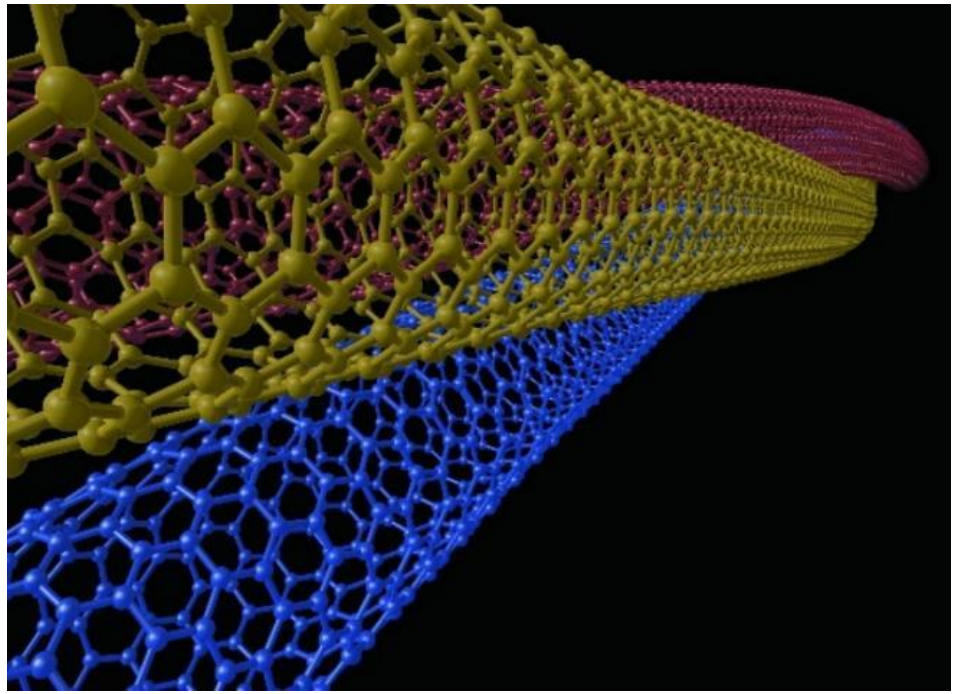
Fourth-Generation Computers

- Microprocessors
  - Emerged in 1970s
  - Complex integrated circuits that contain the central processing unit (CPU), the brain of a computer
  - First microprocessor was as powerful as the ENIAC

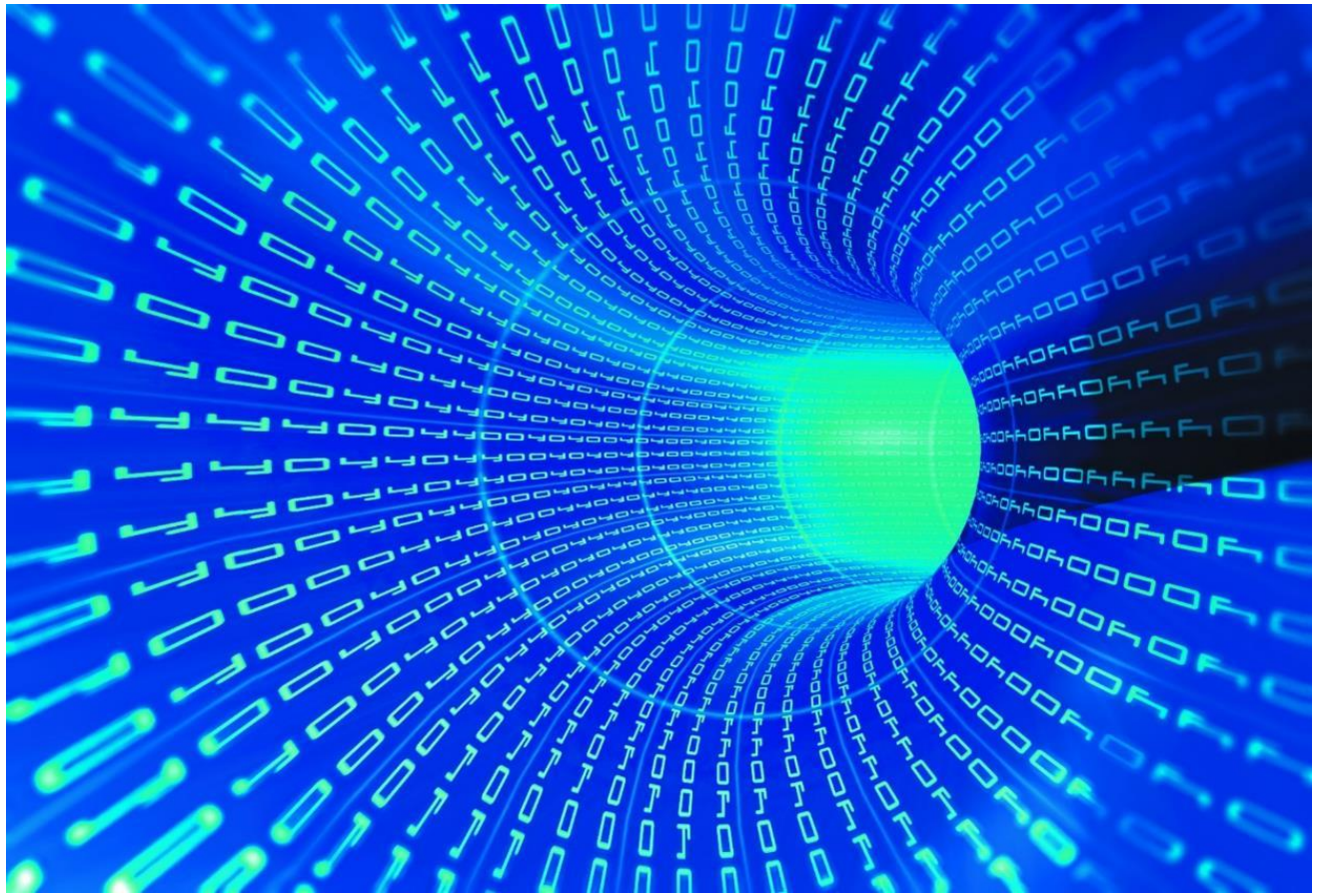


Moore's Law

- Gordon Moore
  - Made prediction in1965
  - Number of transistors on an integrated circuit doubled every 2 years
  - Prediction of continued exponential growth
  - Current trend is closer to 18 months
  - Affects processing speeds and storage capacity of modern electronic devices



How Computers Represent Data Using Binary Code



Binary Number System: 1s & 0s

- Binary code has two possible states: on/off, 1/0, yes/no
- Bit—the smallest unit of digital information 8 bits = 1 byte
- With two bits, there are four possible combinations of states (10, 01, 11, 00)

Binary Code

- ASCII—uses 7 bits and represents 128 characters
  - With 8 bits, there are 256 different possible combinations $2^8 = 256$
- Unicode—extended ACSII; represents more than 100,000 characters

Bits and Bit Patterns

- **Bit:** Binary digit (0 or 1)
- Bit Patterns are used to represent information.
  - Numbers
  - Text characters
  - Images
  - Sound
  - And others

The Binary System

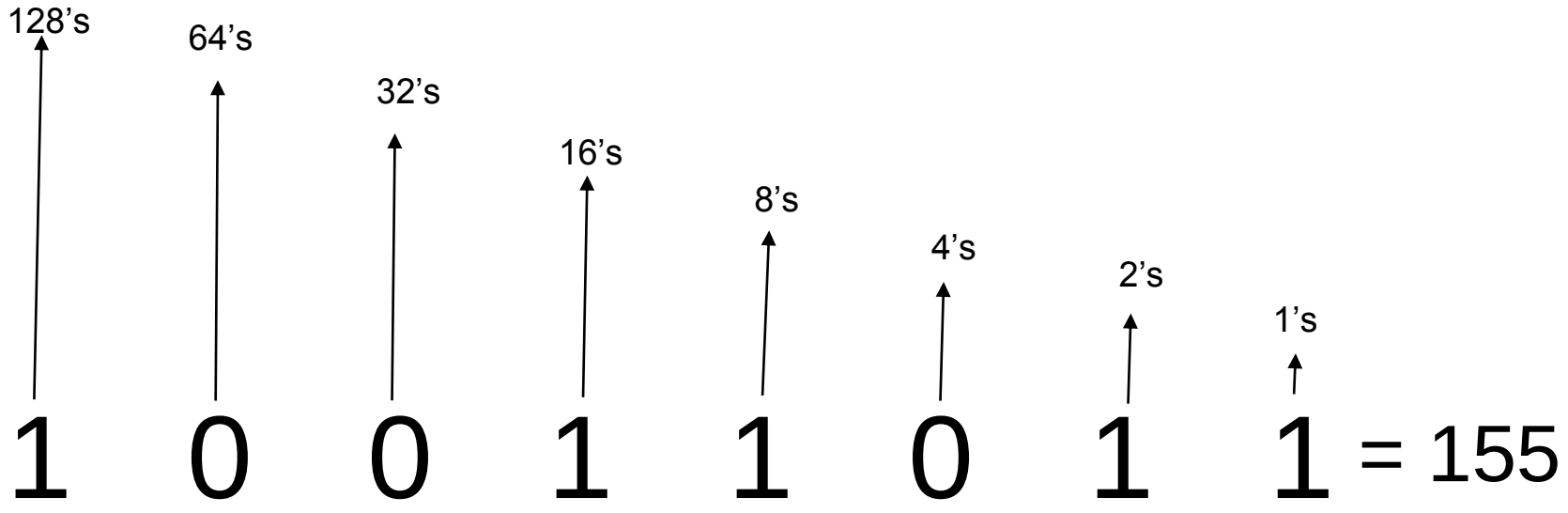
The traditional decimal system is based on powers of ten.

The Binary system is based on powers of two.

Binary Numbers

1 0 0 1 1 0 1 1

Binary Numbers



This is an 8 bit system (Yours is probably 64!)

Representing Text

- **Each character (letter, punctuation, etc.) is assigned a unique bit pattern.**
  - ASCII: Uses patterns of 7-bits to represent most symbols used in written English text
  - ISO developed a number of 8 bit extensions to ASCII, each designed to accommodate a major language group
  - Unicode: Uses patterns of 16-bits to represent the major symbols used in languages world wide

Dec	Hx	Oct	Char	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL (null)	32	20	040		Space	64	40	100	@	@	96	60	140	`	`
1	1	001	SOH (start of heading)	33	21	041	!	!	65	41	101	A	A	97	61	141	a	a
2	2	002	STX (start of text)	34	22	042	"	"	66	42	102	B	B	98	62	142	b	b
3	3	003	ETX (end of text)	35	23	043	#	#	67	43	103	C	C	99	63	143	c	c
4	4	004	EOT (end of transmission)	36	24	044	$	$	68	44	104	D	D	100	64	144	d	d
5	5	005	ENQ (enquiry)	37	25	045	%	%	69	45	105	E	E	101	65	145	e	e
6	6	006	ACK (acknowledge)	38	26	046	&	&	70	46	106	F	F	102	66	146	f	f
7	7	007	BEL (bell)	39	27	047	'	'	71	47	107	G	G	103	67	147	g	g
8	8	010	BS (backspace)	40	28	050	(	(	72	48	110	H	H	104	68	150	h	h
9	9	011	TAB (horizontal tab)	41	29	051	)	)	73	49	111	I	I	105	69	151	i	i
10	A	012	LF (NL line feed, new line)	42	2A	052	*	*	74	4A	112	J	J	106	6A	152	j	j
11	B	013	VT (vertical tab)	43	2B	053	+	+	75	4B	113	K	K	107	6B	153	k	k
12	C	014	FF (NP form feed, new page)	44	2C	054	,	,	76	4C	114	L	L	108	6C	154	l	l
13	D	015	CR (carriage return)	45	2D	055	-	-	77	4D	115	M	M	109	6D	155	m	m
14	E	016	SO (shift out)	46	2E	056	.	.	78	4E	116	N	N	110	6E	156	n	n
15	F	017	SI (shift in)	47	2F	057	/	/	79	4F	117	O	O	111	6F	157	o	o
16	10	020	DLE (data link escape)	48	30	060	0	0	80	50	120	P	P	112	70	160	p	p
17	11	021	DC1 (device control 1)	49	31	061	1	1	81	51	121	Q	Q	113	71	161	q	q
18	12	022	DC2 (device control 2)	50	32	062	2	2	82	52	122	R	R	114	72	162	r	r
19	13	023	DC3 (device control 3)	51	33	063	3	3	83	53	123	S	S	115	73	163	s	s
20	14	024	DC4 (device control 4)	52	34	064	4	4	84	54	124	T	T	116	74	164	t	t
21	15	025	NAK (negative acknowledge)	53	35	065	5	5	85	55	125	U	U	117	75	165	u	u
22	16	026	SYN (synchronous idle)	54	36	066	6	6	86	56	126	V	V	118	76	166	v	v
23	17	027	ETB (end of trans. block)	55	37	067	7	7	87	57	127	W	W	119	77	167	w	w
24	18	030	CAN (cancel)	56	38	070	8	8	88	58	130	X	X	120	78	170	x	x
25	19	031	EM (end of medium)	57	39	071	9	9	89	59	131	Y	Y	121	79	171	y	y
26	1A	032	SUB (substitute)	58	3A	072	:	:	90	5A	132	Z	Z	122	7A	172	z	z
27	1B	033	ESC (escape)	59	3B	073	;	;	91	5B	133	[	[	123	7B	173	{	{
28	1C	034	FS (file separator)	60	3C	074	<	<	92	5C	134	\	\	124	7C	174			|
29	1D	035	GS (group separator)	61	3D	075	=	=	93	5D	135	]	]	125	7D	175	}	}
30	1E	036	RS (record separator)	62	3E	076	>	>	94	5E	136	^	^	126	7E	176	~	~
31	1F	037	US (unit separator)	63	3F	077	?	?	95	5F	137	_	_	127	7F	177	&#127;	DEL

Source: www.LookupTables.com

The message “Hello.” in ASCII

01001000 H	01100101 e	01101100 l	01101100 l	01101111 o	00101110 .

Representing Numeric Values

- Binary notation: Uses bits to represent a number in base two
- Limitations of computer representations of numeric values
  - Overflow: occurs when a value is too big to be represented
  - Truncation: occurs when a value cannot be represented accurately

Why Does a Business Professional Care How a Computer Works?

- Simple tasks do not need fast CPU.
- 64-bit dual processor, 8+GB RAM for large, complicated spreadsheets, large database files, large picture, sound, movie files.
- Cache and main memory are **volatile**, so system or you need to save frequently.

Measuring Data

- Bits measure data transfer rates
- Bytes measure file size and storage capacity

Important Storage Capacity Terminology

Term	Definition	Abbreviation
Byte	Number of bits to represent one character	
Kilobyte	1,024 bytes	K
Megabyte	1,024 K = 1,048,576 bytes	MB
Gigabyte	1,024 MB = 1,073,741,824 bytes	GB
Terabyte	1,024 GB = 1,099,511,627,776 bytes	TB
Petabyte	1,024 TB = 1,125,899,906,842,624 bytes	PB
Exabyte	1,024 PB = 1,152,921,504,606,846,976 bytes	EB
Zetabyte	1,024 EB = 1,180,591,620,717,411,303,424 bytes	ZB

List the Various Types and Characteristics of Personal Computers

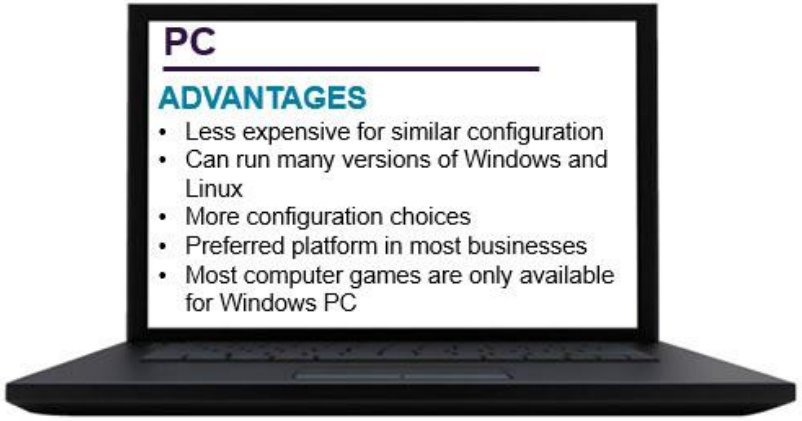
Desktop Computers

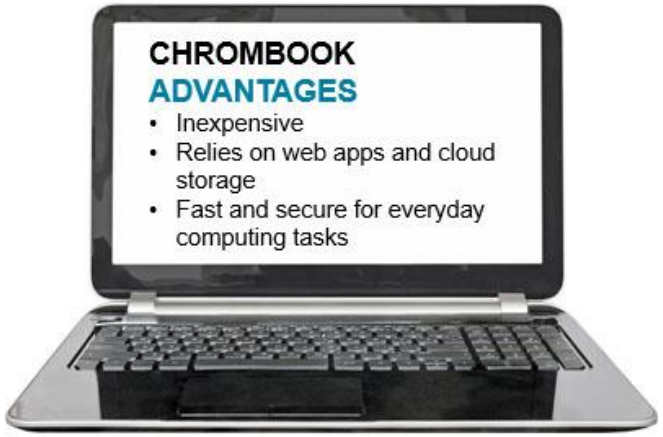
- Desktop computer
- Workstation
- All-in-one computer

Notebook Computers

- Portable personal computers
  - May use a stylus (a digital pen)
- Convertible notebook
  - Has swivel screen
- Tablet
  - Preinstalled mobile apps

Mac, PC, or Something Else?





Ergonomics

- Ergonomic (proper) workspace
  - Proper posture
  - Use a foot rest
  - Elbows on arm rest bent at 90 degrees
  - Monitor below eye level
  - Frequent breaks

Ergonomics

- Improper workspace
  - Can affect health, comfort, and productivity
  - Leads to discomfort and can result in musculoskeletal disorders

Give Examples of Other Personal Computing Devices

Mobile Devices

- Smartphones and tablets
  - Internet access
  - Email access
  - Digital cameras
  - GPS
  - Mapping tools
  - Document editing
  - Mobile apps

Wearables and GPS

- GPS (Global Positioning System)
  - Satellite-based navigation system
  - Used for
    - Location and navigation
    - Tracking and mapping
    - Timing
    - Geocaching

Wearables and GPS

- Wearables
  - Devices worn on the body
  - Used for
    - Health monitoring
    - Communication
    - Military operations
    - Entertainment

Video Game Systems and Simulations

- Game consoles—Microsoft Xbox Scorpio and Sony PlayStation 5
  - High-end processors
  - High-end graphics capabilities
  - Play movies and music
  - Online game play
  - Browse the Internet
  - Use a game controller

Video Game Systems and Simulations

- Handheld games
  - Portable
  - Listen to music and view photos and movies
  - Chat and access the Internet over cellular or wireless networks
  - 3D photo and graphic capability

List the Various Types and Characteristics of Multiuser Computers

Servers

- Servers
  - Provide services such as Internet access and email to a client system
- Small and midrange computers
  - Perform complex calculations
  - Store customer information and transactions
  - Host an email system

Servers

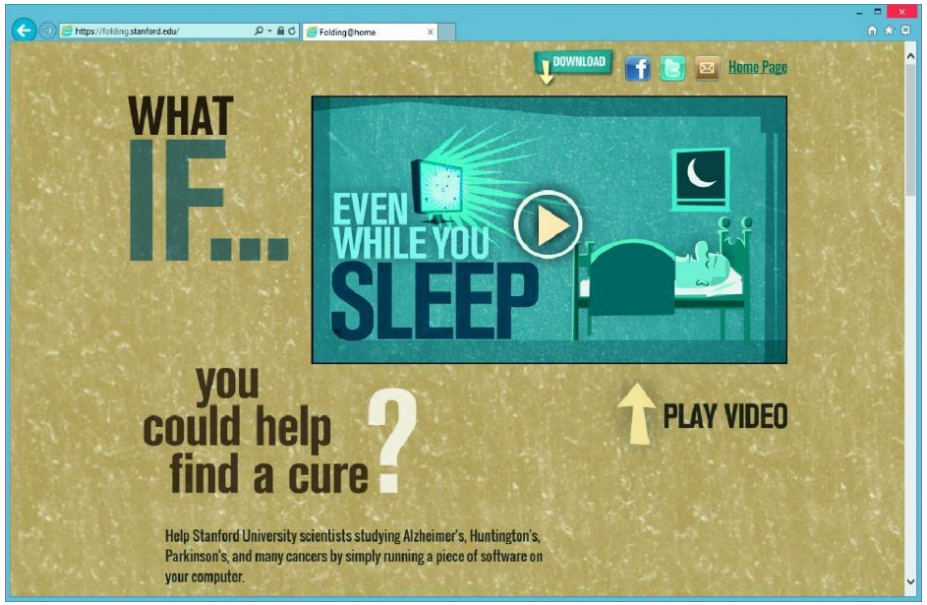
- Mainframes
  - Process millions of transactions a day
  - Have largely been replaced by enterprise servers
- Enterprise servers
  - Allow thousands of users to use the system concurrently

Supercomputers

- Very expensive
- Designed to perform limited number of tasks as quickly as possible
- Perform complex mathematical calculations
  - Weather forecasting
  - Medical research
- Can be a single computer with multiple processors or a group of computers working together

Distributed and Grid Computing

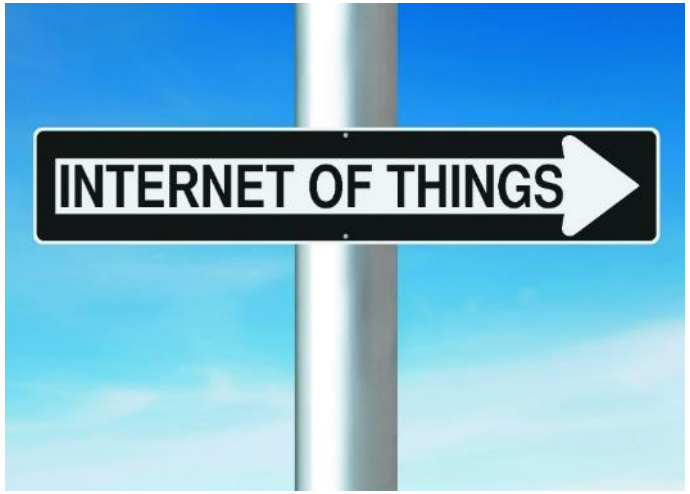
- Distributed computing
  - Spreading processing tasks across multiple computers
- Grid computing
  - Form of distributed computing uses computers in one location
- Volunteer computing
  - Large-scale form of distributed computing
  - Harnesses the power of hundreds or thousands of computers



Explain Ubiquitous Computing and Convergence

Embedded Computers

- Specialized computers
- Internet of Things (IoT)
  - Connection of the physical world to the Internet



Convergence

- Convergence—integration of technology on multifunction devices
  - Smartphones
  - Cell phones
  - Personal information management tools
  - Email
  - Web browsing

Convergence

- Convergence—integration of technology on multifunction devices
  - Document editing
  - MP3 players
  - Cameras
  - GPS
  - Games

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