Data Storage

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UDINUS

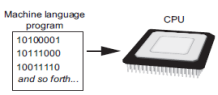
Data Storage

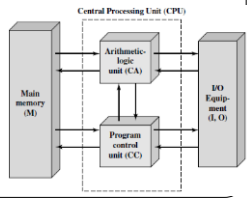
- Main Memory/Primary Storage :
- Secondary Storage
- Representasi informasi dalam bit
- Sistem Bilangan

Konsep Sistem Komputer

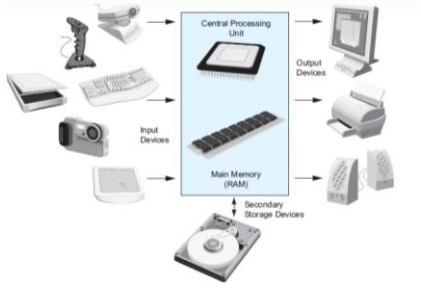
Von Neumann Architecture

- Main memory menyimpan program and data
- ALU mengoperasikan data biner
- Control Unit menerjemahkan instruksi dari memory dan melakukan eksekusi.
- Perangkat I/O dioperasikan oleh Control Unit.





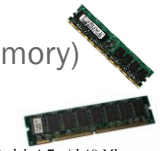
Sistem Komputer Lengkap



Data Storage

- Primary Storage/main memory
  - RAM
  - ROM
- Secondary Storage
  - Hardisk
  - Floppy Disk
  - Magnetic Tape
  - Optical Disc
  - Smart Card
  - Flash Memory
  - Online-secondary storage

RAM (Random Access Memory)



- Menyimpan data dan instruksi program
- Umumnya bersifat volatile
- Jenis-jenis chip RAM
  - DRAM(dynamic RAM) : isinya harus selalu diperbarui oleh 4,7 s/d 40 Mhz
  - SDRAM(synchronous dynamic RAM): SDRAM disinkronisasi oleh sistem clock , 100 - 133 Mhz.
  - SRAM(static RAM) isinya bisa tetap ada tanpa harus diperbarui oleh CPU. 500 MHz.
  - DDR-SDRAM(double-data rate SDRAM),DDR2:400MHz s/d 1,066GHz, DDR-3: 2,133 GHz, DDR-4:2,133 s/d 4,266GHz.
- Modul memory RAM
  - SIMM (single inline memory module): FPM(Fast page Mode),EDO(Extended Data Output)
  - DIMM(dual inline memory module)

ROM (read only memory)

- Menyimpan instruksi start-up (operasi dasar komputer,misl:menghidupkan komputer BIOS,menampilkan informasi ke layar monitor)
- Bersifat non-volatile
- Varian ROM:

  PROM (programmable ROM)

CMOS (complementary metal-oxyde semiconductor)

- Memperoleh sinyal listrik dari battery
- Berisi instruksi-instruksi startup yang bersifat flexible spt-jam,tanggal,kalender.
- Dapat diprogram ulang.

Chace

- Menyimpan instruksi dan data yang sering digunakan cpu secara temporer
- Akibat kerja CPU yg lebih cepat dari RAM sehingga CPU sering bersikap menunggu.
- Meningkatkan kapasitas RAM.
- Chip SRAM sering digunakan sebagai chace
- Jenis chace:
  - L1 (chace internal) : bagian chip microprocessor
  - L2 (chace external/advanced Transfer Chace) : terletak di luar microprocessor
  - L3: terletak di luar microprocessor/ berada pada motherboard
- Selain menggunakan chace dalam meningkatkan kapasitas RAM sistem operasi juga menggunakan Virtual Memory(ruang kosong pada hardisk).

Secondary Storage

- Disket & Zip Disk
- Hardisk
- Disk Optik
- Pita Magnetic
- smartcard
- Memory flash
- Penyimpanan Sekunder Online

Disket/Zipdisk

- Piringan plastik terdiri dari track,sector,cluster
- Disket :kapasitas 1.44 Mbyte
- Zipdisk :kapasitas 100,250,750MByte

Hardsik

- 1889:

  a machine that that could record and store information using punch cards

- 1953:

  RAMAC 305, weighed over a ton and required the space of an entire room. $10,000 per MB

hardisk

- 1980 : IBM HDD 1GB $44,000 , **226.8** kg
- 1980 :Seagate HDD ST506 5,25",

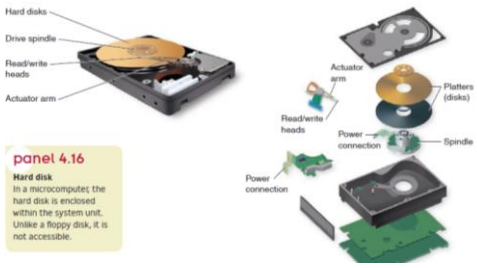
- Saat ini, sebagian besar komputer deskt HDD 3,5 inci, sementara laptop menggunakan ukuran 2,5 inci yang lebih kecil.
- Seagate & Western Digital membuatHDD 12TB berharga $400 - $500

Hardisk

- 1963:The IBM 1311, 6 disks yang masing2 dapat menyimpan data 2.6MB

Hardisk

- Bahan dari piringan kaca,keramik ,zat (berbahan magnetik).
- Data disimpan pada lokasi track,sector,cluster



Hardisk

- Kontroler hardisk: adalah komponen untuk memposisikan piringan dan head serta mengatur aliran data dan instruksi ke hardisk.
  - EIDE (enhanced integrated drive electronics) atau (SATA/seria advanced technology attachment): Fast ATA,Fast IDE,ATA-2,ATA/100, Serial ATA(SATA).
  - SCSI (small component system interface)
  - Fibre Cannel (untuk high-end servers)
- Teknologi hardisk utk sistem besar : RAID (redundant array of independent for inexpensive disk) menghubungkan sejumlah hardisk dalam sebuah tempat sehingga data dpt dikirim ke komputer melalaui beberapa jalur paralel secara simultan.

Hardisk IDE

Solid-State Drive (SSD)

- HDD menggunakan piringan cakram untuk menyimpan data dan lengan mekanik untuk membaca dan menulis.
  - waktu akses :8 ms
  - 400 operasi i/o per detik
- SSD menggunakan memori flash, Memori flash berarti data disimpan dalam microchip.
  - Waktu akses :0,1 ms
  - 6.000 operasi i/o per detik
- SSD 250GB Samsung 850 Evo berharga $ 100 (HDD 4TB)

Disk Optik

- CD 650 – 700 MB
- DVD 4.7 – 9.4 GB
- BD:Blue-ray Disc 25GB

Pita Magnetic

- 200GB

Smartcard

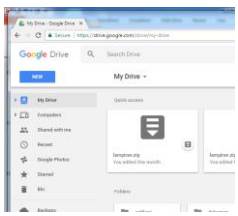
- Memiliki microprocessor dan chip memory
- 8 – 10 MB
  - Ultracard: 2GB dg informasi biometric misl: sidik jari
  - Smartcard contact: harus dimasukkan ke cardreader (atm card)
  - Smartcard non-contact: dibaca dengan meletakkannya di depan alat laser berkekuatan rendah (e-tol card)

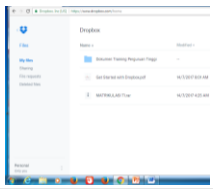
Flash Memory

- Non volatile
- Berupa chip
- Contoh:
  - Kartu memory flash: compactflash,miniSD,xD.
  - Stik Memory flash;
  - Drive Memory flash:USB flash

Penyimpanan Sekunder Online

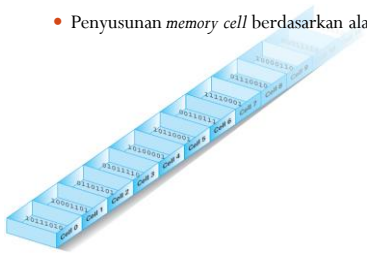
- Google Drive
- DropBox
- 4shared

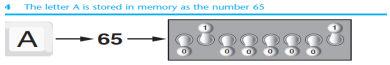




Representasi informasi dalam bit

- Penyusunan *memory cell* berdasarkan alamat

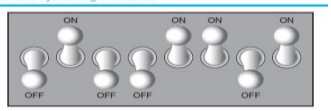




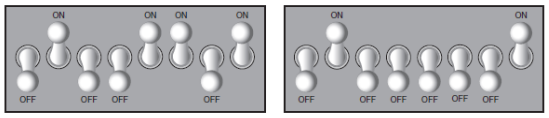
How Computers Store Data

- Sebuah data disimpan dalam byte,komputer menentukan 8 bit berupa pola on/off yang mewakili data.

Think of a byte as eight switches

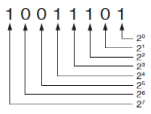


1-8 Bit patterns for the number 77 and the letter A

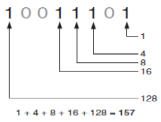


The number 77 stored in a byte. The letter A stored in a byte.

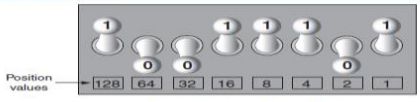
The values of binary digits as powers of 2



Determining the value of 10011101



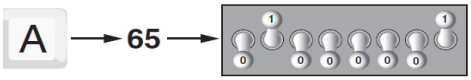
The bit pattern for 157



ASCII (*American Standard Code for Information Interchange.*)

- ASCII is a set of 128 numeric codes that represent the English letters, various punctuation marks, and other characters.

4 The letter A is stored in memory as the number 65



Sistem Bilangan

- Decimal
- Binary
- Hexadecimal
- Octal
- Converting Binary, Hexadecimal, Octal and Decimal

Decimal

- Have a base, or radix of 10
- Ex :
  - 83
  - 4728
  - 10009

Decimal

- 83 = (**8** x 10^1) + (**3** x 10^0)
- 4728 = (**4**x10^3) + (**7**x10^2) + (**2**x10^1) + (**8** x 10^0)
- 10009 = (**1**x10^4) + (**0**x10^3) + (**0**x10^2) +
  = (**0** x 10^1) + (**9** x 10^0)

Binary

- Only 2 digits, 1 and 0
- Numbers in the binary system are represented to the base 2
- Ex :
  - $0_{(2)}$
  - $1_{(2)}$
  - $0101_{(2)}$
  - $1010_{(2)}$

Decimal to Binary

- $3_{(10)} = \ldots_{(2)}$

128	64	32	16	8	4	2	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Decimal to Binary

- $3_{(10)} = \ldots_{(2)}$

128	64	32	16	8	4	2	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	0	0	0	0	0	1	1

$3_{(10)} = 11_{(2)}$

Decimal to Binary

- $24_{(10)} = \ldots_{(2)}$

128	64	32	16	8	4	2	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	0	0	1	1	0	0	0

$24_{(10)} = 11000_{(2)}$

Decimal to Binary

- $255_{(10)} = \ldots_{(2)}$

128	64	32	16	8	4	2	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	1	1	1	1	1	1	1

$255_{(10)} = 11111111_{(2)}$

Binary to Decimal

- $101_{(2)}$ = ……$_{(10)}$
- $1001_{(2)}$ = ……$_{(10)}$
- $1111_{(2)}$ = ……$_{(10)}$

Binary to Decimal

- $101_{(2)}$ = …$_{(10)}$

1	0	1

Binary to Decimal

- $101_{(2)}$ = …$_{(10)}$

1	0	1
2^2	2^1	2^0

Binary to Decimal

- $101_{(2)}$ = …$_{(10)}$

1	0	1
2^2	2^1	2^0
4	0	1

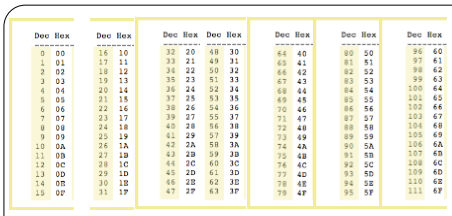
$101_{(2)} = (1x2^2) + (0x2^1) + (1x2^0)$
$= 4 + 0 + 1 = 5_{(10)}$

Hexadecimal

- Binary digits are grouped into sets of four
- Base 16

Ex :

- $2C_{(16)}$
- $DE2_{(16)}$
- $A_{(16)}$
- $AA_{(16)}$
- $69F_{(16)}$



Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex
0	00	16	10	32	20	48	30	64	40	80	50	96	60
1	01	17	11	33	21	49	31	65	41	81	51	97	61
2	02	18	12	34	22	50	32	66	42	82	52	98	62
3	03	19	13	35	23	51	33	67	43	83	53	99	63
4	04	20	14	36	24	52	34	68	44	84	54	100	64
5	05	21	15	37	25	53	35	69	45	85	55	101	65
6	06	22	16	38	26	54	36	70	46	86	56	102	66
7	07	23	17	39	27	55	37	71	47	87	57	103	67
8	08	24	18	40	28	56	38	72	48	88	58	104	68
9	09	25	19	41	29	57	39	73	49	89	59	105	69
10	0A	26	1A	42	2A	58	3A	74	4A	90	5A	106	6A
11	0B	27	1B	43	2B	59	3B	75	4B	91	5B	107	6B
12	0C	28	1C	44	2C	60	3C	76	4C	92	5C	108	6C
13	0D	29	1D	45	2D	61	3D	77	4D	93	5D	109	6D
14	0E	30	1E	46	2E	62	3E	78	4E	94	5E	110	6E
15	0F	31	1F	47	2F	63	3F	79	4F	95	5F	111	6F

Hexadecimal to Decimal

$2C_{(16)} = \cdots_{(10)}$

$2C_{(16)} = (2 \times 16^1) + (12 \times 16^0)$

$= 32 + 12$

$= 44_{(10)}$

Decimal to Hexadecimal

$44_{(10)} = \cdots_{(16)}$

$\frac{44}{16} = 2,$ 12

$\frac{2}{16} = 0,$ 2

12 = C

$44_{(10)} = 2C_{(16)}$

Hexadecimal to Binary

$2C_{(16)} = \ldots_{(2)}$

2	C (12)
0010	1100

$2C_{(16)} = 00101100_{(2)}$

Binary to Hexadecimal

$00101100_{(2)} = \ldots_{(16)}$

00101100

Binary to Hexadecimal

$00101100_{(2)} = \ldots_{(16)}$

00101100	
0010	1100

Binary to Hexadecimal

$00101100_{(2)} = \ldots_{(16)}$

00101100	
0010	1100
2	12 / (C)

$00101100_{(2)} = 2C_{(16)}$

Octal

- Binary digits are grouped into sets of three
- Base 8

Ex :

- $545_{(8)}$
- $5545_{(8)}$
- $55_{(8)}$

Octal to Decimal

- $545_{(8)} = \ldots_{(10)}$

5	4	5

Octal to Decimal

- $545_{(8)} = \ldots_{(10)}$

5	4	5
8^2	8^1	8^0

Octal to Decimal

- $545_{(8)} = \ldots_{(10)}$

5	4	5
8^2	8^1	8^0
320	32	5

$545_{(8)} = (5 \times 8^2) + (4 \times 8^1) + (5 \times 8^0)$

$= 320 + 32 + 5 = 357_{(10)}$

Decimal to Octal

$357_{(10)} = \ldots_{(8)}$

$$\frac{357}{8} = 44, \quad 5$$
$$\frac{44}{8} = 5, \quad 4$$
$$\frac{5}{8} = 0, \quad 5$$

↑

$357_{(10)} = 545_{(8)}$

Octal to Binary

$545_{(8)} = \ldots_{(2)}$

5	4	5

Octal to Binary

$545_{(8)} = \ldots_{(2)}$

5	4	5
101	100	101

$545_{(8)} = 101100101_{(2)}$

Binary to Octal

$101100101_{(2)} = \ldots_{(8)}$

101100101

Binary to Octal

$101100101_{(2)} = \ldots_{(8)}$

101100101		
101	100	101

Binary to Octal

$101100101_{(2)} = \ldots_{(8)}$

101100101		
101	100	101
5	4	5

$101100101_{(2)} = \mathbf{545}_{(8)}$

Octal to Hexadecimal

$545_{(8)} = \ldots_{(16)}$

5	4	5
101	100	101

0001	0110	0101
1	6	5

$545_{(8)} = \mathbf{165}_{(16)}$

Hexadecimal to Octal

$165_{(16)} = \ldots_{(8)}$

1	6	5
0001	0110	0101

000101100101		
5	4	5

$165_{(16)} = \mathbf{545}_{(8)}$