Application of Information & Communication Technologies

Lecture-6

Recap of Lecture 5

- Inside System Unit
  - Ports & Cables
  - Expansion Cards and Slots

Overview of Lecture 6

- Buses
- Memory
- ROM
- RAM
- Flash

What is a Bus?

- Bus = electronic pathway inside computer.
- Used to transfer data, addresses, control signals.

What is a Bus?

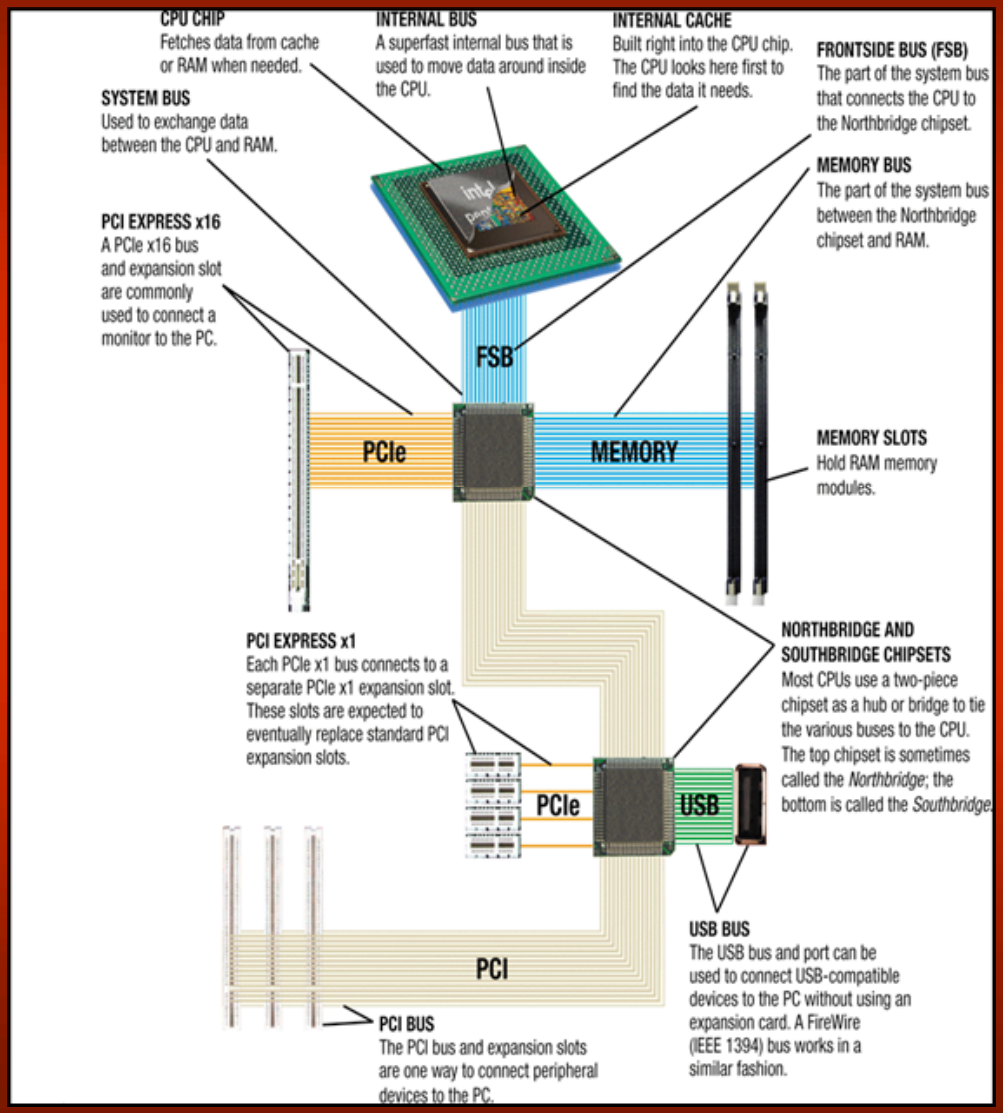

FIGURE 2-16
Buses and expansion slots. Buses transport bits and bytes from one component to another, including the CPU, cache, RAM, and peripheral devices.

Type of Buses

- **Data Bus** → moves actual data
- **Address Bus** → tells where data goes
- **Control Bus** → manages signals

Buses Width

- **Width** = number of wires/lines.
- **Wider bus** → more data per cycle
  - (E.g., 8-bit, 16-bit, 32-bit, 64-bit)

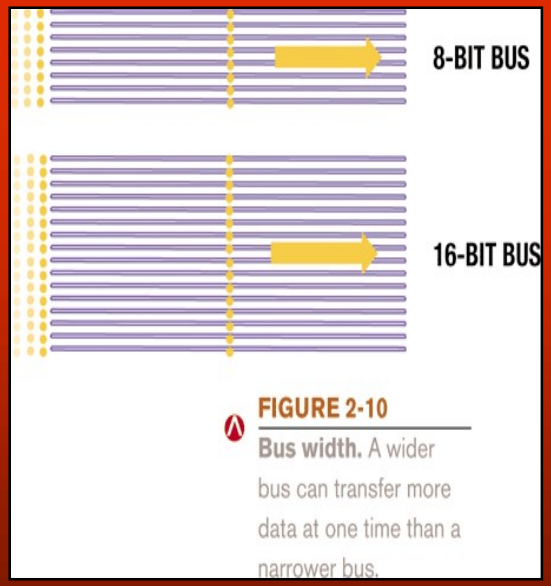

FIGURE 2-10
Bus width. A wider bus can transfer more data at one time than a narrower bus.

Buses speed

- **Speed** = how fast data travels.
- Measured in MHz or GHz.

Bandwidth

- **Bandwidth** = Bus Width × Bus Speed.
- Bus width and speed determine the throughput
- Example:
  - 32-bit bus × 100 MHz = 400 MB/s.

System vs Expansion Bus

- System Bus → between CPU & Memory.
- Expansion Bus → connects to peripherals (USB, PCI, etc.).

Memory and Registers

- Stores data and instructions.
  - Types: ROM, RAM, Cache, Flash.
- Registers: Very small and high speed memory inside CPU.
  - Stores data being used right now.

ROM

- Read Only Memory.
- Permanent → cannot be changed easily.
- Used to store startup instructions.
- Retrieved by the computer when needed
- BIOS stored in ROM

- Types of ROM:
  - PROM → Programmable ROM
  - EPROM → Erasable ROM
  - EEPROM → Electrically Erasable ROM

RAM

- Random Access Memory.
- Temporary storage for active programs.
- Volatile → erased when power off.

- Why RAM is Important?
  - More RAM = faster performance.
  - Needed to run modern apps.

Types of RAM

- DRAM (Dynamic RAM)
- SRAM (Static RAM, faster)
- SDRAM, DDR, DDR2, DDR3, DDR4

- RAM Modules
- DIMM, SIMM, RIMM (physical sticks).

FIGURE 2-12
MRAM is a type of nonvolatile RAM.

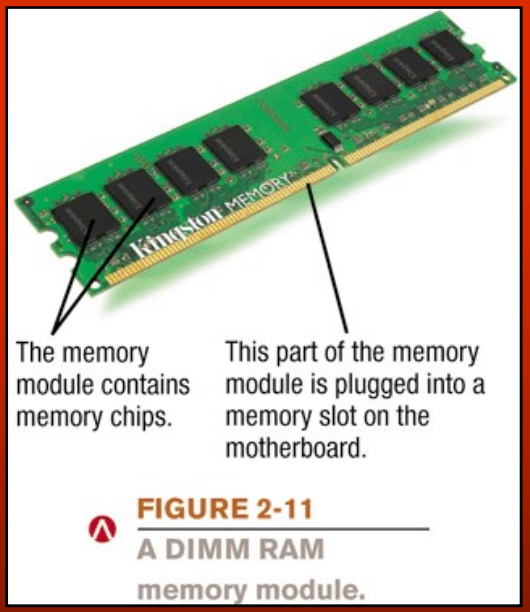

FIGURE 2-11
A DIMM RAM memory module.

Flash Memory

- Non-volatile
- can be erased and reprogrammed or rewritable
- Used in USB drives, SSDs, memory cards.

What is Cache Memory?

- Small, very fast memory close to CPU.
- Stores frequently used instructions/data.

- Levels of Cache
  - L1 Cache → inside CPU (fastest, smallest).
  - L2 Cache → near CPU (bigger, slower than L1).
  - L3 Cache → shared by cores.

RAM vs ROM vs Cache

Feature	RAM	ROM	Cache
Volatility	Temporary	Permanent	Temporary (like RAM)
Speed	Fast	Slower	Very Fast (closer to CPU)
Location	On motherboard	On motherboard (chip)	Inside/near CPU
Function	Run programs	Store startup code	Stores frequently used instructions/data

Summary

- Buses
- Memory
- ROM
- RAM
- Flash

Suggested Reading

- Ch-02, The System Unit: Processing and Memory , “Understanding Computers: Today and Tomorrow, Comprehensive”, 15th Edition by Deborah Morley & Charles S. Parker
- Ch-04, Discovering Computers Fundamentals- Your Interactive Guide -- Gary B Shelly; Misty E Vermaat; Jeffrey J Q