Introduction to Computing (SE-101)

Ali Ameer Gondal
Assistant Professor
Software Engineering Department
University of Engineering & Technology
Taxila, Pakistan
ali.ameer@uettaxila.edu.pk

Questions from previous lecture?

Processor & Memory

Lecture # 5*

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* Note that there are no slides for Lecture# 4.

CPU

- The CPU is the computer’s “brain” that manipulates data

CPU’s Two Basic Parts

- Control unit
- Arithmetic logic unit

Control Unit

- Manages all the computer's resources
- CPU's instructions are built in it

Arithmetic Logic Unit

- Performs the CPU's arithmetic and logical operations

Machine Cycle

- The complete series of steps the CPU takes to execute an instruction

Machine Cycle's Two Cycles

- Instruction cycle
- Execution cycle

Instruction Cycle

- Fetching
- Decoding

Execution Cycle

- Executing
- Storing

CPU performance measurement

- Millions of Instructions Per Second (MIPS)
- BIPS

Pipelining

- Also called pipeline processing
- The control unit begins a new machine cycle before the current cycle is completed
- Multitasking
- Threading
- Hyperthreading

Memory

- Allows the CPU to store and retrieve data quickly

Two Kinds of Memory

- Read-only memory (ROM): nonvolatile
- Random-access memory (RAM): volatile

ROM

- ROM holds the data permanently
- For example the computer's start-up instructions, BIOS
- POST routine

RAM

- RAM's job is to hold programs and data while they are in use
- RAM can change instantly
- Random implies accessing any portion
- Memory address
  - Number indicating location on memory chip

Other Kinds of RAM

- Dynamic RAM (DRAM)
- DRAM Variations
- Static RAM (SRAM)
- Difference btw DRAM & SRAM

Difference btw DRAM & SRAM

- SRAM is static while DRAM is dynamic
- SRAM is faster compared to DRAM
- SRAM consumes less power than DRAM
- SRAM uses more transistors per bit of memory compared to DRAM
- SRAM is more expensive than DRAM
- DRAM is used in main memory while SRAM is commonly used in cache

Flash Memory

- Special type of non-volatile memory
- Switches store binary data

Factors Affecting Processing Speed

- Registers
- Memory and computing power
- System clock
- The bus
- Cache memory

Registers

- High speed memory locations built inside CPU
- Hold current data
- Word size
- Bigger word size means quicker processing
- 32-bit/64-bit processors

Memory and computing power

- More memory means computer runs faster
- Swapping
- Virtual memory: swapping unused RAM to HD

System clock

- Used to time processing operations
- clock speed proportional to operating speed of the computer
- Measured in Hertz (Hz): cycles per sec
- Clock cycle : single tick
- MHz, GHz

The Bus

- Path between computer components
- Group of wires
- Internal bus (system)
- External bus (expansion)
- Internal:
  - Data bus
  - Address bus
- Speed in MHz

Data Transfer Rate

- The amount of data buses can transfer in a second
- Measured in megabits per second (Mbps) or megabytes per second (MBps)

Cache memory

- Speeds processing by storing frequently used data or instructions in its high-speed memory
- Similar to RAM but extremely faster
- Level-1: built inside CPU, recently run instr.
- Level-2: additional built onto motherboards, potential upcoming instr.
- Level-3: also being used in high-speed computers now, hold many of possible instr.

Bus Standards

- Industry standard architecture (ISA) bus
- Local bus
- Peripheral component interconnect (PCI) bus
- Accelerated Graphics Port (AGP) bus
- Universal Serial Bus (USB)
- IEEE 1394 (FireWire)
- PC Card

Bus Standards

- Industry standard architecture (ISA) bus
  - 16 bit
  - Became standards in 80’s
  - Connects slower devices to the CPU
- Local bus
  - Connects faster devices to the CPU
  - Internal bus

Bus Standards

- Peripheral component interconnect (PCI) bus
  - Local bus by Intel
  - For integrating new data types
- Accelerated Graphics Port (AGP) bus
  - Special architecture to increase graphics perform.
  - Allows video card to access RAM directly
- Universal Serial Bus (USB)
  - Relatively new
  - Hot swappable

Bus Standards

- IEEE 1394 (FireWire)
  - Used to connect video devices
  - Earlier used to be in Macs only
  - Now in PCs & TVs
- PC Card
  - Exclusive to laptops
  - Hot swappable
  - WiFi cards, network cards, external modems etc

Questions?

If you have any query please feel free to ask

Phone: +92-51-9047-590

Email: ali.ameer@uettaxila.edu.pk

University of Engineering & Technology, Taxila Pakistan

Reference

- The slides were taken from the book:
  - “Introduction to computing” by Peter Norton