

Hardware Concepts

Bus Definition

- Bus: connections for all of functional units in computer, set of electronic components which handle communications between and among internal and external peripherals
- Speed typically referred to in terms of MegaHertz – MHz – a measure of transfer range

Bus Functions

- Electrical power
- Control signals – coordinate all activities on board
- Memory addresses – passed from one component to another
- Data: number of lines in the bus used to pass data in parallel

Bus Architecture

- Motherboard
 - Contains circuitry for computer systems
 - RAM – Random Access Memory on board
 - Processor chip
 - Intel pentium
 - AMD
 - Motorola – MAC
 - RISC for SUN workstations

CPU Concepts

- Speeds measured in MegaHertz
- 8088 – first Intel based PC, 4.77 MHz clock speed
- 80286 – referred to as AT standard, 8 MHz
- 80386 & 80486 – speeds increased ranging from 16 MHz up to 66+ MHz

More on CPU speeds

- Intel introduced P586 as Pentium class to avoid numbering problems
- P1, PII, PIII and other families within these ranges
- PIII chip set at 1 GigaHertz introduced in 2000
- P4 chip set at 1 – 2 GigaHertz introduced in 2001

Bus Speeds and Design

- ISA bus: first PC bus, 8 bit transfer channel, used on 8088 PC
- AT bus: designed for 286 chip set, used 16 bit transfer channel
- PCI bus: current design, 32 or 64 bit wide data path – size of transfer channel

PCI Design Enhancements

- Bus speeds increased from 66 MHz to 133 MHz on top end systems
- Bus speeds must continue to increase new speeds in 200+ range
- Measures internal CPU transfers – transfers to other devices such as hard drives and floppy drives occur at slower speeds

Enhancements to data exchange

- L1 cache: highest level of memory, special section of processor chip

- L2 cache: next faster memory – may be on chip or external – faster if on chip
- L3 cache: being introduced by Intel in 64 bit server processors – Itanium.
Will connect cache that functions at processor speeds

How Cache Works

- Cache is static memory – when processor executes instruction attempts to retrieve data from areas
 - Registers
 - L1
 - L2
 - RAM
 - Retrieve from disk, etc.

Types of Memory

- RAM: Random Access Memory
- Dynamic, must be refreshed, when power is lost contents are lost as well...
- EDO: Extended Data Output, faster than original, conventional RAM
- SDRAM: Synchronous Dynamic Random Access Memory, faster than EDO, runs at 66 or 100 MHz

More on Memory

- RDRAM: Rambus Dynamic Random Access Memory, runs faster than SDRAM, loads a new stream of data before the previous stream has completed
- Rambus is company name.
- DDR: replacing Rambus as less expensive but provides equivalent speeds

Memory Modules

- First RAM occurred in individual chips which were “rolled” into board
- SIMM: Single Inline Memory Modules, chips on module placed in slot on board
pairs of modules, 32 bit path
- DIMM: Dual Inline Memory Modules, 64 bit path, do not have to match as SIMM

Definitions

- Bit: binary digit; all representations within computer are in binary digits – 0 or 1
- Byte: bits in string or grouping utilizing code to represent a character
100 0001 represents the character A in ASCII

Definitions continued

- ASCII: American Standard Code of Information Interchange
uses bit arrangement of 7 bits to represent a character

CPU Operations

- Components:
 - Control Unit
 - Arithmetic & Logic Unit
 - Registers: Instruction, Program, Accumulator

CPU: Control Unit

■ Functions:

read and interpret program instructions

direct the operation of internal processor components

control flow of programs and data in and out of RAM

CPU: Arithmetic & Logic Unit

■ Performs all computations and logical operations

results are placed in Accumulator Register

Execution of Machine Level Instructions

■ Instruction phase:

Fetch instruction – brings instruction from memory into control unit

Decode instruction – control unit must understand which operations must be performed and where data is located, where next instruction is located, etc.

Execution Phase

■ Execute the instruction – ALC actually performs operations

■ Store results – results from operation places in registers or memory

■ Machine Cycle – complete cycle of instruction phase & execution phase

Multiprocessing

■ Execution two or more instructions at the same time

■ Coprocessor: executes specific types of instructions [in first, second, & third generations of PCs these were add-ons to chip]

■ Parallel Processing: links several processor to operate as coordinated unit; requires dividing processing activities into executable parts

Secondary Storage Devices

■ Sequential access: storage media must be accessed in order in which it is stored [think length of tape]

■ Direct access: retrieval method locates data by address not physical location; think hard drive

Data Storage Concepts

■ RAID: Redundant Array of Inexpensive Disks [some now refer to I as independent]; allows for reduction or risk to loss of data and creates ability to recreate data if one of the series of the disks is lost

[NOTE: hard disks do wear out but usually have life of 5 + years of average usage]

■ Flash Memory: nonvolatile, computer chip, retains memory when power is shut off, may be modified and reprogrammed – has multiple applications including digital cameras, cell phones

Firewire – IEEE 1394

- New standard for data transfer to and from devices– high speed
- Requires firewire compliant card as add-on to mother board
- IEEE: Institute of Electronics and Electrical Engineers
- Hot swap capability: can add or remove device without powering down computer

USB

- Universal Serial Bus – port which connects data devices which transmit in burst of bits/bytes as serial mode; moves SCSI card functionality from add-on card to motherboard
- industry standard supported by Windows 98 2nd edition and Windows 2000, Windows XP versions.
- Digital cameras, scanners, serial zip are examples of USB devices
- Enhanced USB 2.0 devices and ports now on market

Parallel Connections

- Common standard for printers
- May be used for external zip and CD-ROM writers
- Parallel transfer of data to and from device refers to connector pins which transfer data along lines of communication; slower than serial