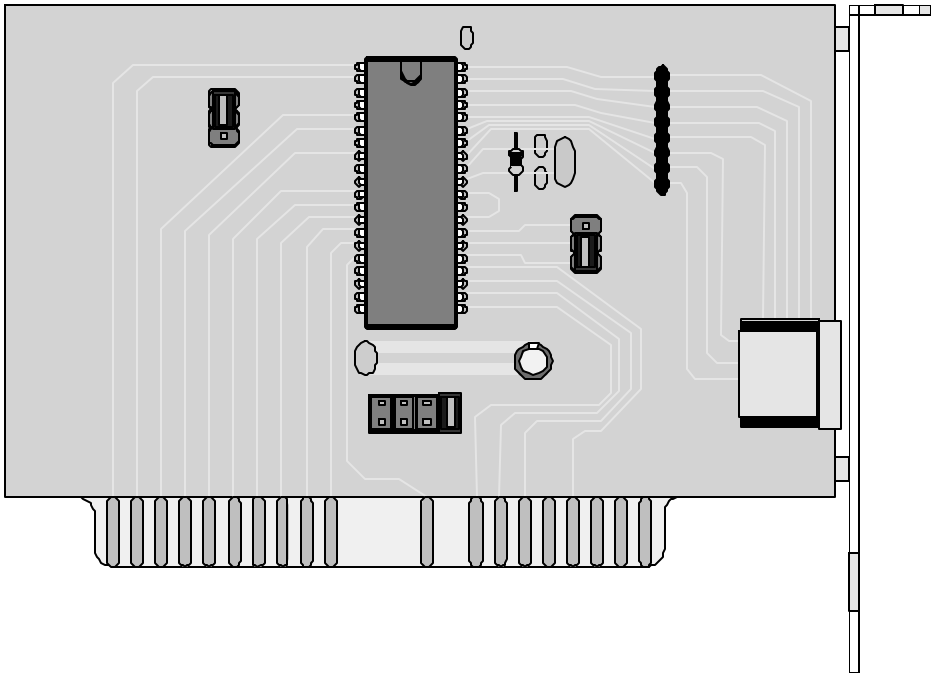
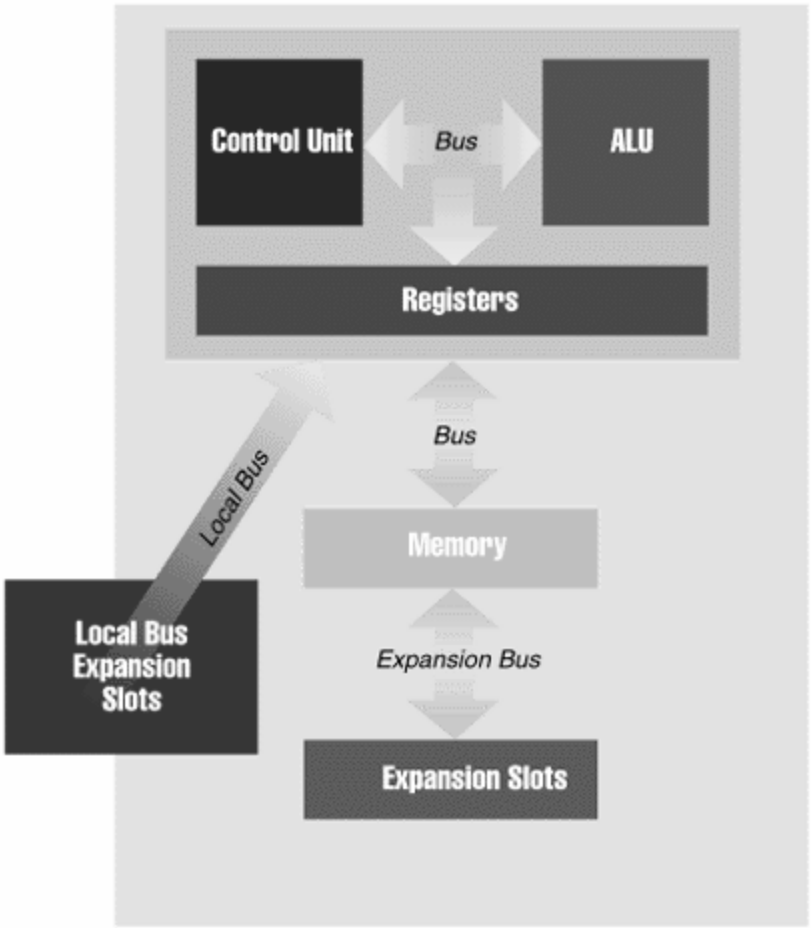
Chapter 5
Busses, Ports and Connecting Peripherals

The Bus

bus - groups of wires on a circuit board that carry information (bits - on’s and off’s) between computer components on a circuit board or within the microchip itself

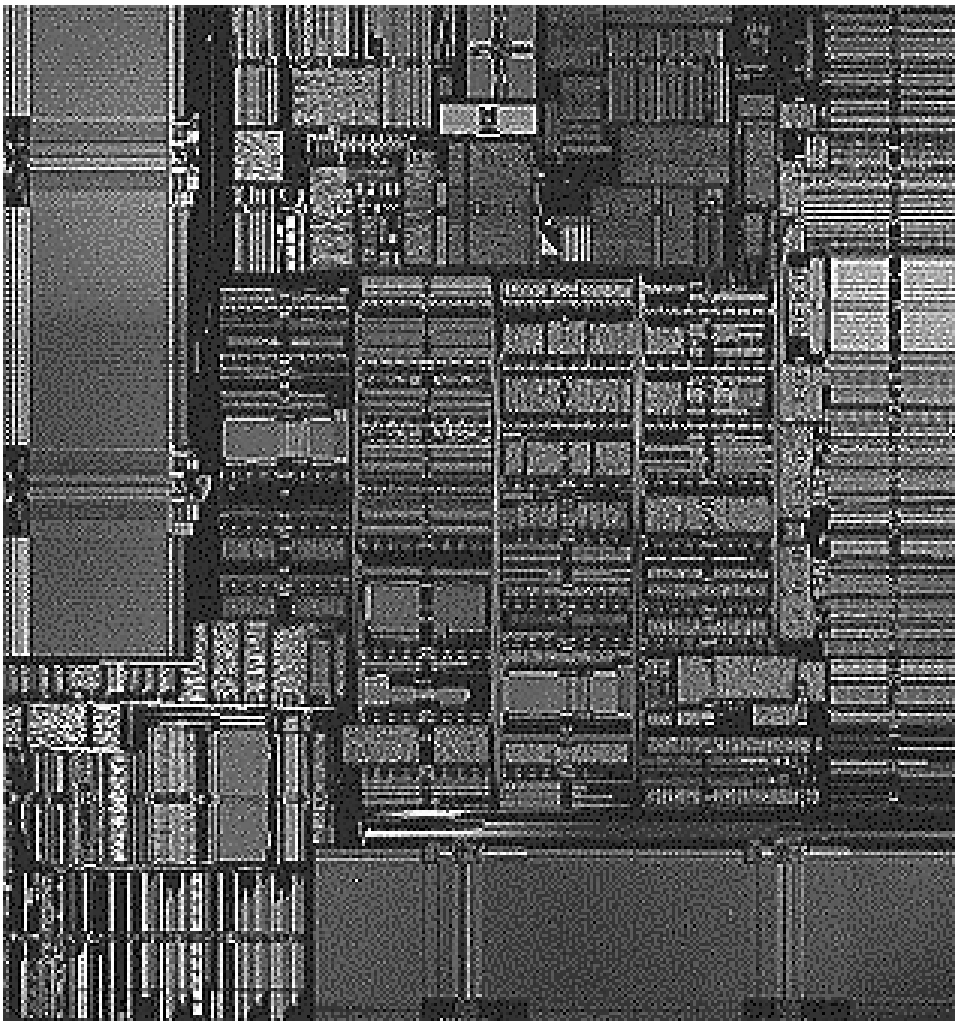


Busses: Circuitry or pathways which carry electrical impulses (bits)



Busses on a Microchip

Motorola's PowerPC™ 620 32/64-Bit
RISC Microprocessor



What travels on the bus?

Information: data and instructions (software)

- bits
- on’s and off’s

Bits travel between microchips

- CPU, RAM, ROM, and others
- to and from expansion slots (coming up next)

Bus Speed

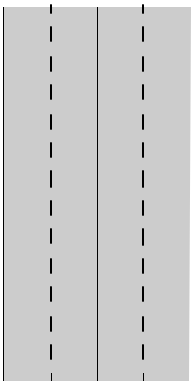
Bus - the speed in which information (bits) travel on a circuit board

Speed is measured in *megahertz*

megahertz (MHz) **-** the number of millions of beats in one second

8 MHz **-** in one second, 8 million bits travel on that bus line (lane)

Bus Size



bus size - the number of wires (lanes) in which information (bits) travel on a circuit board

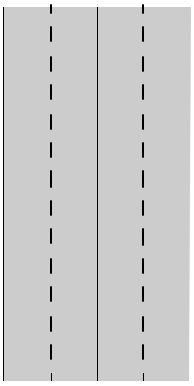
Typical bus sizes:

- 8, 16, 32, 64 wires (lanes)

Example:

- between the Pentium CPU or a PowerPC CPU and RAM are 64 wires or lanes
- known as a **64 bit bus,** data bus

Bus Performance

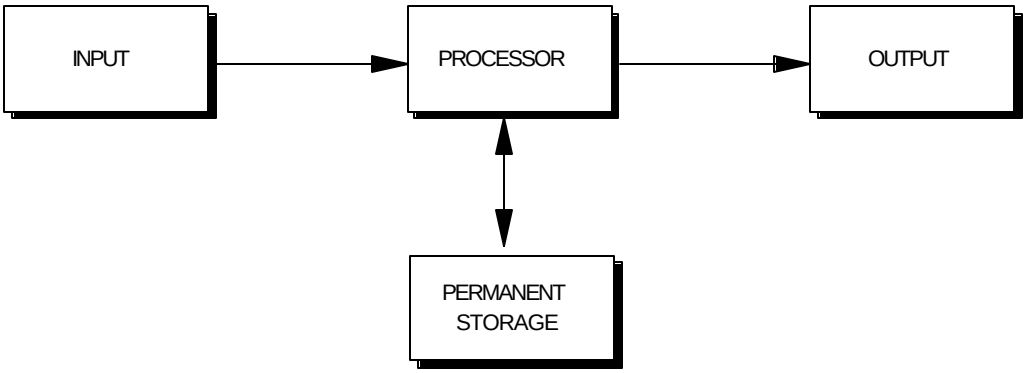


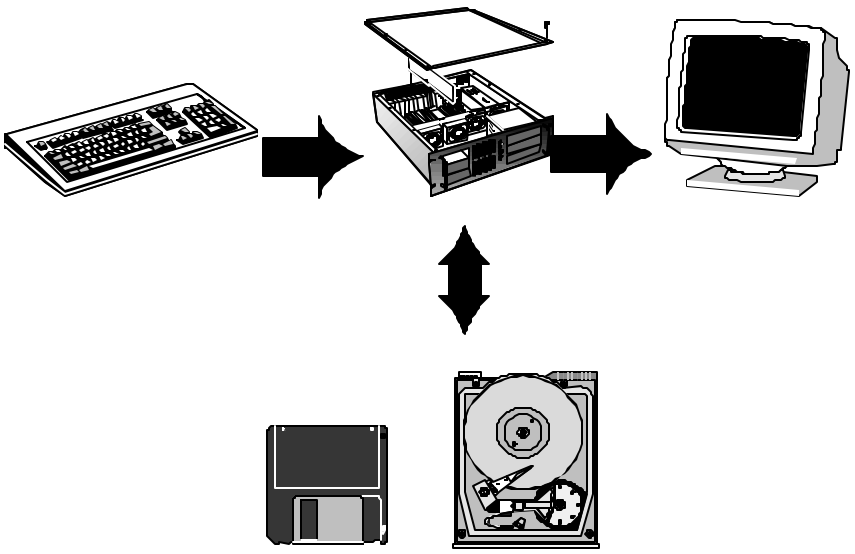
Faster bus performance means faster response for the user

Faster bus performance

- *faster* bus speed
- *larger* bus size

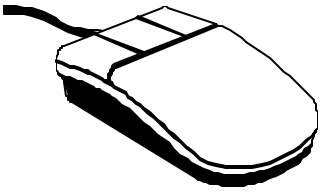
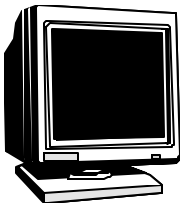
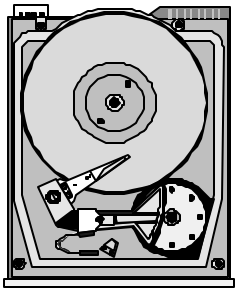
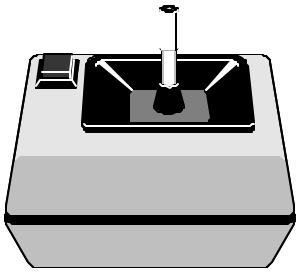
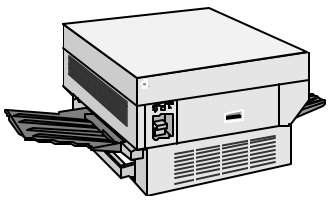
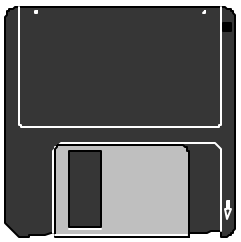
The four hardware components of a computer system





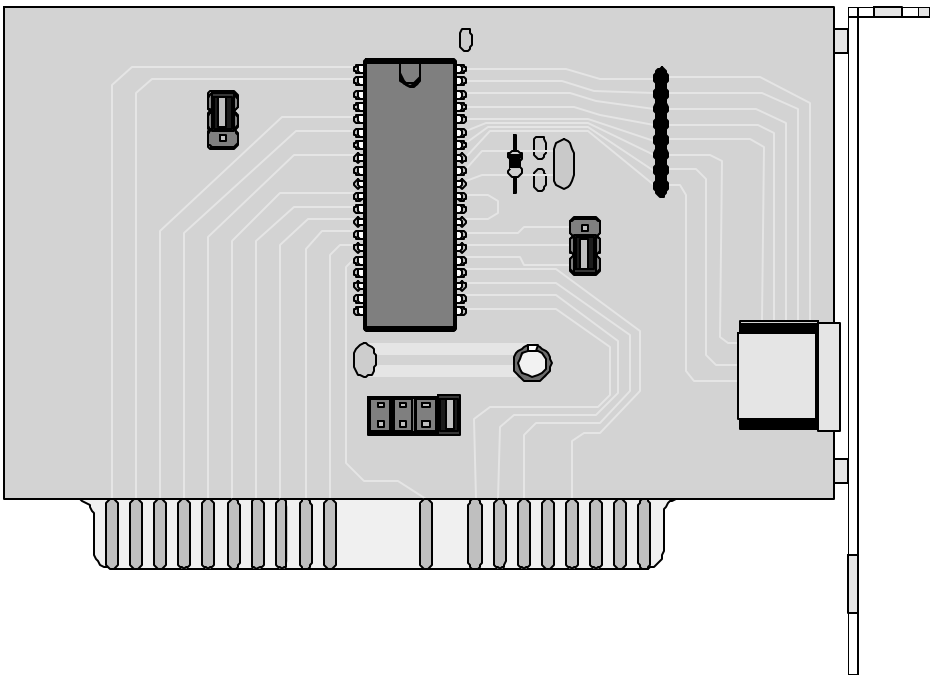
Peripheral Devices -external hardware devices (external to the motherboard) which is used to input, output and store information

Types of peripheral devices:
1. input 2. output 3. storage

interface cards (interface boards or card) - circuit boards which have specific functions, used to connect peripheral devices to the motherboard

• inserted into an expansion slot on motherboard



Expansion Slots (interface slots)

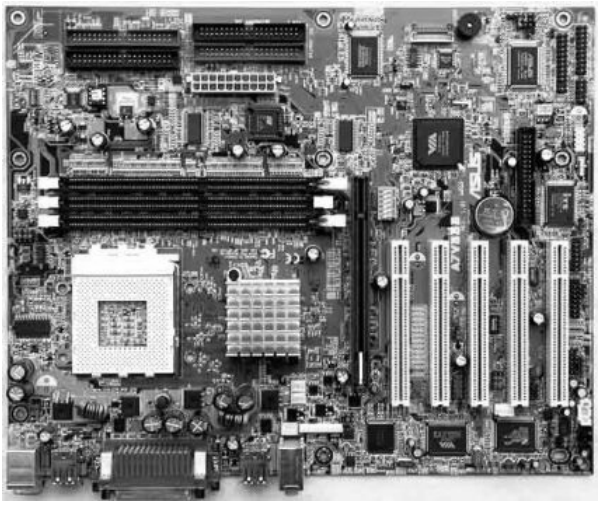
- connections on the motherboard used to insert interface cards, in order to connect external devices (peripheral devices) to the motherboard

- expansion slots are on the motherboard
- an interface card is inserted into an expansion slot
- a peripheral device is connected to the interface card via a special cable

Since circuitry keeps getting smaller…

Modern motherboards have many ports built-in.

For example, a modern motherboard may have the following ports without needing any expansion cards:
1 parallel port
2 serial ports
1 game controller port
1 PS/2 style keyboard port
1 PS/2 style mouse port
audio i/o ports for built-in sound
2 USB ports
internal connectors for disk drives



Serial and Parallel Communications

Data/Information is transmitted in one of two ways:

1. Single lane, one bit at a time:

Serial communications

2. multiple lanes, multiple bits at a time:

Parallel communications

Can be an expansion card, a built-in port, or a type of transmissions

Examples and Devices

Serial

- keyboard
- mouse
- modem
- multi-user operating systems and local area networks (Network Interface Cards)

Parallel

- printer
- disk drives
- CD-ROM
- data bus (between RAM and CPU)
- between interface cards and RAM (PCI)

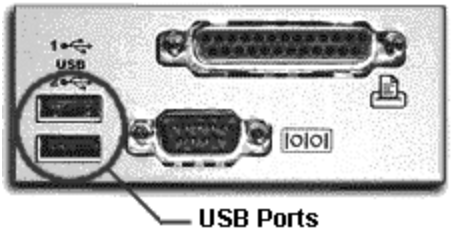
USB
Universal Serial Bus

- Standard developed by Compaq, IBM, DEC, Intel, Microsoft, NEC, and Northern Telecom
- supports a data speed of 12 megabits per second
- (Newer USB 2.0 is 480Mbps)
- accommodate a wide range of devices, including scanners, printers, video devices, data gloves, and digitizers

USB

- **Plug-and-play** is the ability to plug a device into a computer and have the computer recognize that the hardware device is there, without any commands from the user or any special device driver software being installed.

- Can have up to 127 USB devices connected to a single computer



IEEE1394 or Firewire

- A high speed serial bus
- Can transfer data between the computer and peripherals at 100, 200 or 400Mbps or faster
- Can attach up to 63 devices

Expansion Bus (Expansion “slots”) are used to add new interface cards to your computer – they “plug into” the motherboard

Expansion Bus Types

Bus	# of Data Bits	Speed	Notes
Older Technology			
ISA	8 or 16	8 MHz	Old technology (PC)
EISA	16 or 32	8 MHz	Never really accepted(PC)
	ISA and EISA are currently used in conjunction with VESA or PCI.		
MCA	16 or 32	8 MHz	IBM only, never really accepted (PC)
NuBus	32	"High"	Macintosh only
Local Busses			
VESA (VL)	32	33 MHz	Found mostly on 486's PCs
PCI	32 or 64	33 MHz	Found mostly on Pentiums, and Power Macs
AGP	32	66 MHz (8x66)	Found mostly on Pentiums, and Power Macs
Laptops and Notebook computers			
PCMCIA	16	8 MHz	"Credit card size" adapters

What is the oldest and slowest bus in use?

[answer in class]

Caution about performance

Bottleneck - a place that is slowing the computer's performance

Bottleneck problems might not be because of the bus, but might be a result of a slow peripheral device or other problem

Example: The time it takes for data to travel from your hard disk drive to RAM will depend on your bus, type of disk drive, memory and possibly other factors.

Disk Drive Interface (bus)

- ATA (Advanced Technology Attachement) - also known as IDE (Integrated Drive Electronics)
- Popular since the late 80's
- Faster versions are periodically released: ata33, ata66, ata100, ata133
- Supports two disk drives per bus (master and slave)
- Typical pc computer has two ata busses (primary and secondary)

Other Disk Drive Terms…

SCSI

A bus that allows many connections (32) and is found in servers (rarely used in PC's today)

RAID

(Redundant Array of Inexpensive Disks)
invented late 80's – UC Berkeley

Combining multiple drives to increase speed or reliability

What is PCMCIA?

Personal Computer Memory Card International Association (PCMCIA) - A nonprofit standards body chartered with establishing marketing, and maintaining standards for credit-card-sized integrated-circuit PC cards.

Credit-card-sized interface cards for laptop computers.

Inserted into PCMCIA slot in laptop.

PC Card in a laptop computer

In conclusion

Many issues can effect the performance of your system, including:

- bus size
- bus speed

The CPU can get information it needs to process faster with larger data bus, like the Pentium and PowerPC CPUs

- 64 bit data bus (64 lanes)

“typical pc”:

PCI bus for expansion slots

ATA bus for disk drives