I/O Interfaces

Objectives
- Learn about serial, parallel and USB ports
- Learn how UART chips work
- Get the details on the new USB 2.0 standard
- Learn about IEEE-1394 - aka Firewire

Serial Ports
- The asynchronous serial interface was designed as a system-to-system communications port. *Asynchronous* means that no synchronization or clocking signal is present, so characters can be sent with any arbitrary time spacing.
- *Serial* refers to data that is sent over a single wire, with each bit lining up in a series as the bits are sent. This type of communication is used over the phone system because it provides one wire for data in each direction.

Typical Locations for Serial Ports
- Typical systems include one or two serial ports, usually located at the rear of the system. Some recent consumer-oriented computers label a front-mounted serial port the "digital camera port.

UART Chips
- The heart of any serial port is the Universal Asynchronous Receiver/Transmitter (UART) chip.
- This chip completely controls the process of breaking the native parallel data within the PC into serial format and later converting serial data back into the parallel format.
- Device breaks apart each byte into its component bits and then fits them back together.
- Difference between UART chips is how fast they can transfer information.
- 3 UART chips:
  - 8250 (XT: one-byte buffer)
  - 16450 (AT: two-byte buffer)
  - 16550A (adds 16-byte first in, first out buffering to eliminate data overrun)
High-Speed Serial Port Cards
- If you are using external RS-232 devices designed to run at speeds higher than 115Kbps (the maximum speed of the 16550 series UARTs and equivalents), you can't achieve maximum performance unless you replace your existing serial ports with add-on cards using one of the 16650, 16650, or 16750 UARTs.
- You can't really get the full-speed benefit of an external ISDN modem (terminal adapter) unless your serial port can go at least 230Kbps.

Serial (COM) Ports
- Serial ports transfer information one bit at a time, making it slower than parallel ports.
- Serial connectors can be DB9 (9-pin) DB25 (25-pin male) or keyboard or mouse.
- Serial ports can connect to a variety of devices, such as modems, plotters, printers, bar code readers, scales, and other computers.
- Mouse connectors can be either a DB9 (9-pin) or a 6-pin mini-DIN (usually for a PS/2 and LPX motherboards).

Onboard Serial Ports
- Starting with late-model 486-based systems in the mid-1990s, a component on the motherboard called a Super I/O chip began to replace separate UART chips.
- This normally has two serial port UARTs as well as a multimode parallel port, floppy controller, keyboard controller, and sometimes the CMOS memory, all built into a single tiny chip.

Serial Port Configuration
- Each time a character is received by a serial port, it has to get the attention of the computer by raising an Interrupt Request Line (IRQ).
- In a standard configuration, "COM 1 uses IRQ4"
- COM 2 uses IRQ3.
- COM 3 uses IRQ4.
- COM 4 uses IRQ3.

Parallel Ports
- Parallel ports normally are used for connecting printers to a PC.
- Even though that was their sole original intention, parallel ports have become much more useful over the years as a more general-purpose, relatively high-speed interface between devices (when compared to serial ports).
- Parallel ports are so named because they have eight lines for sending all the bits that comprise 1 byte of data simultaneously across eight wires.

Parallel Port
- Transfers information in a sort of a wave, 8 bits at a time with printers usually connected to these ports.
- Parallel Ports use a DB25-pin, female connector.
- Types of parallel ports are Unidirectional, Standard bi-directional, ECP, SPP, and EPP.
- Special parallel cables can be used to connect two computers without the use of a NIC.
Parallel Port Standard

Three different types of IEEE 1284 parallel connectors

Parallel Port Configuration

<table>
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<tr>
<th>Standard LPT</th>
<th>I/O Ports</th>
<th>IRQ</th>
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<td>3BC-3BFh</td>
<td>IRQ7</td>
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<tr>
<td>LPT1</td>
<td>378-37Ah</td>
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<tr>
<td>LPT2</td>
<td>278h-27Ah</td>
<td>IRQ5</td>
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Universal Serial Bus (USB)

USB ports are a peripheral bus specification that provides PnP capabilities from outside the computer case, which eliminates the need to install an expansion card and reconfigure the system.

- Peripherals:
  - modems
  - keyboards
  - floppy drives
  - telephones

Peripheral devices can be plugged into the bus without opening the case or rebooting.

Universal Serial Bus

USB eliminates the need for special-purpose ports, reduces the need to use special-purpose I/O cards, (thus reducing the need to reconfigure the system with each new device added), and saves important system resources such as interrupts (IRQs); regardless of the number of devices attached to a system's USB ports, only one IRQ is required.

USB Connectors

IEEE-1394 (FireWire)

- IEEE 1394 is another choice for fast speed external devices
- 400MBps–3200MBps
- The 1394 bus was derived from the FireWire bus originally developed by Apple and Texas Instruments
- It is part of the new Serial SCSI standard
- Allow up to 63 nodes, with each node a maximum of 16 devices in a chain
FireWire