Chapter 10
LAN Wiring, Physical Topology
and Interface Hardware

Introduction

- Interface cards
  - Why a separate card
  - How to connect the interface to the computer
  - What is a “transceiver”?
- LAN wiring schemes
- Logical and physical topology

Speeds of LANs and computers

- LAN data transmission speeds are typically “fast” relative to CPU speeds
- 100MHz CPU could execute only one instruction for each bit on a 100Mhz Ethernet
- LAN speeds are defined independent of any specific processor speeds
  - Allows for mix of attached systems
  - New computers can be attached without affecting LAN speeds
**Network interface hardware**

- CPU can't process data at network speeds
- Computer systems use special purpose hardware for network connection
  - Typically a separate card in the backplane
  - Network adapter card or network interface card (NIC)
- Connector at back of computer then accepts cable to physical network
Network connector

NIC plugged into socket inside computer

connector on NIC exposed on back of computer
NICs and network hardware

- NIC is built for one kind of physical network
  - Ethernet interface can’t be used with token ring
  - ATM interface can’t be used with FDDI
- Some NICs can be used with different, similar hardware
  - Thick, thin and 10Base-T Ethernet
  - 10Mbps and 100Mbps Ethernet
**NIC and CPU processing**

- NIC contains sufficient hardware to process data independent of system CPU
  - Some NICs contain separate microprocessor
    - Includes analog circuitry, interface to system bus, buffering and processing
  - Looks like any other I/O device to system CPU
    - System CPU forms message request
    - Sends instructions to NIC to transmit data
    - Receives interrupt on arrival of incoming data

**Connection between NIC and physical network**

- Two alternatives:
  - NIC contains all circuitry and connects directly to network medium
  - Cable from NIC connects to additional circuitry that then attaches to the network medium
- Thin Ethernet vs. 10Base-T
- Both are Ethernet; network technology not limited to one style of connection
**Thick Ethernet wiring**

- Uses thick coax cable
- AUI cable (or transceiver or drop cable) connects from NIC to transceiver
- AUI cable carries digital signal from NIC to transceiver
- Transceiver generates analog signal on coax
- Wires in AUI cable carry digital signals, power and other control signals
Thick Ethernet also requires termination to avoid signal reflectance.
Connection multiplexing

- In some circumstances, transceivers may be inconvenient; e.g., workstations in a lab
- Connection multiplexor connects multiple computers to a single transceiver
  - Each computer’s AUI cable connects to connection multiplexor
  - One AUI from multiplexor to Ethernet coax
Connection multiplexor completely invisible to attached computers

**Thin Ethernet wiring**

- Uses thin coax that is cheaper and easier to install than thick Ethernet coax
- Transceiver electronics built into NIC; NIC connects directly to network medium
- Coax cable uses BNC connector
Thin Ethernet wiring (continued)

- Coax runs directly to back of each connected computer
- T connector attaches directly to NIC
Thin Ethernet wiring (continued)

- Useful when many computers are located close to each other
- May be unreliable - any disconnection disrupts entire network
- Variously called 10Base-T, twisted pair or TP Ethernet
- Replaces AUI cable with twisted pair cable
- Replaces thick coax with hub
Hubs

- Extension of connection multiplexing concept
- Sometimes called “Ethernet-in-a-box”
- Effectively a very short Ethernet with very long AUI cables
- Can be connected into larger Ethernets
Protocol software and Ethernet wiring

- All wiring technologies use identical Ethernet specification
  - Same frame format
  - Same CSMA/CD algorithms
- Can mix different technologies in one Ethernet
- NICs can provide all three connection technologies
Comparison of wiring schemes

- Separate transceiver allows computer to be powered off or disconnected from network without disrupting other communication
- Transceiver may be located in an inconvenient place
- Finding malfunctioning transceiver can be hard
- Thin coax takes minimum of cable
- Disconnecting one computer (or one loose connection) can disrupt entire network
- Hub wiring centralizes electronics and connections, making management easier
- Bottom line - 10Base-T most popular because of cost
Comparison of wiring schemes (continued)
**Topologies and network technologies**

- 10Base-T network topology is a bus; wiring topology is a star
- Token ring network topology is a ring; wiring topology is a star
- Remember to distinguish between logical and physical topologies