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
I/O interfaces
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 example

- 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
**10Base-T**

- 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
• Transciever 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