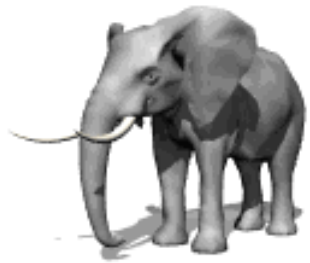
Ethernet Fundamentals

What are we doing?

How to sculpture an elephant

Get a large block of stone and chip away all of those parts that do not look like an elephant.

We will continue on toward TCP/IP

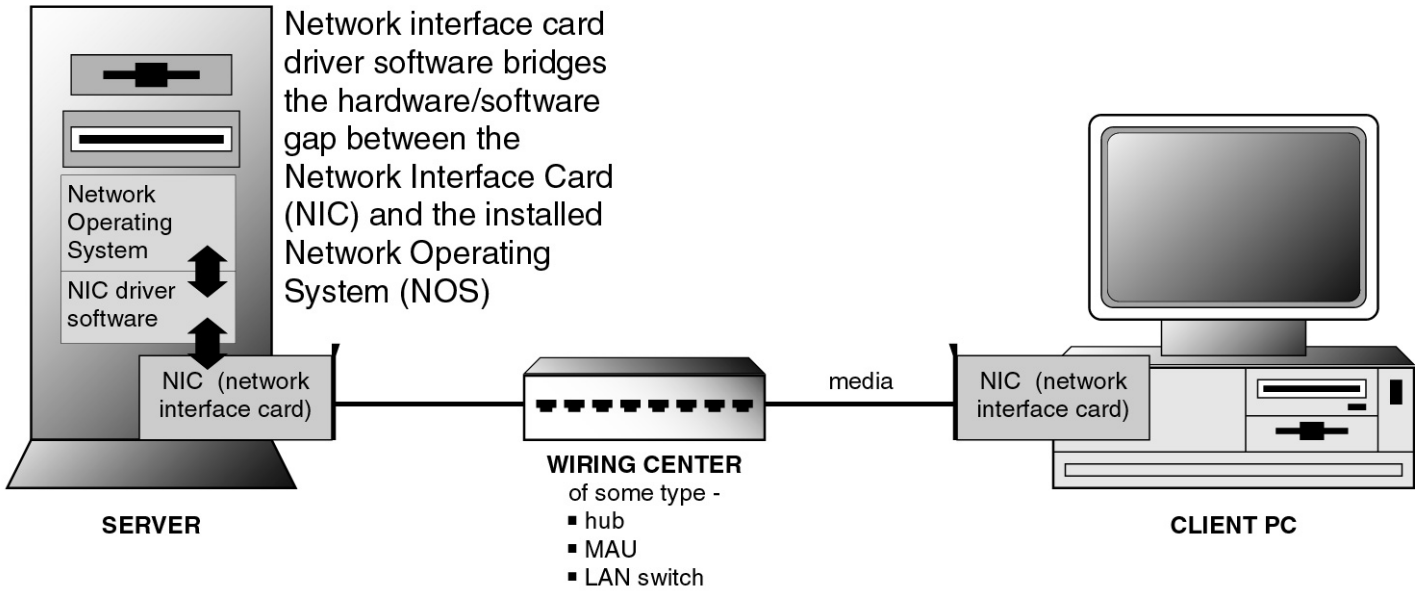


LAN Components

- Local LANs are composed of the following components:
  - Wiring concentrator
  - Media (cable)
  - NIC card
  - Software

LAN Components

Logical Diagram



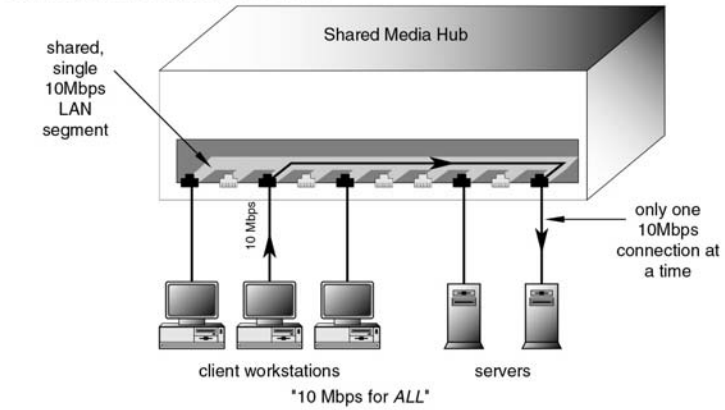
GOLDMAN & RAWLES: LAN 2e
FIG: 03-01

LAN Architectures

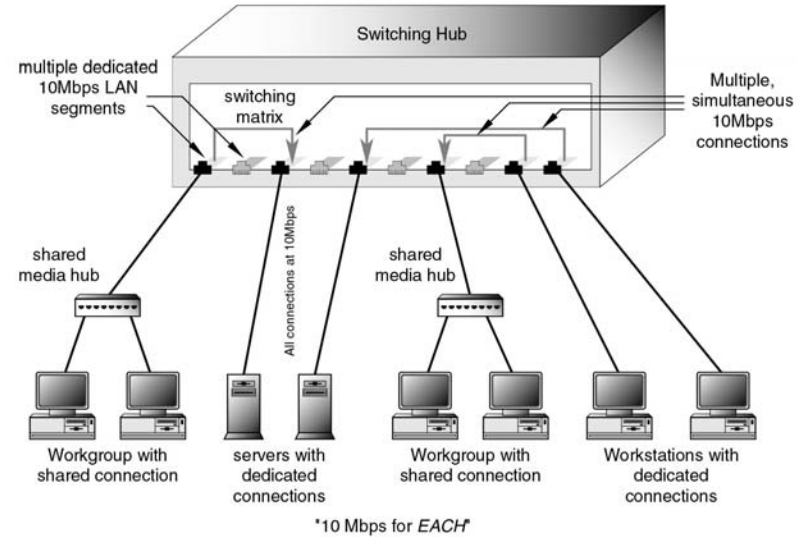
- Shared-media Networks
  - Hubs
  - Cable based links (I.e. Ethernet coax)
- Switched LANs
  - Each port on the switch is a dedicated LAN segment

Hubs versus Switches

Shared Media LAN Architecture

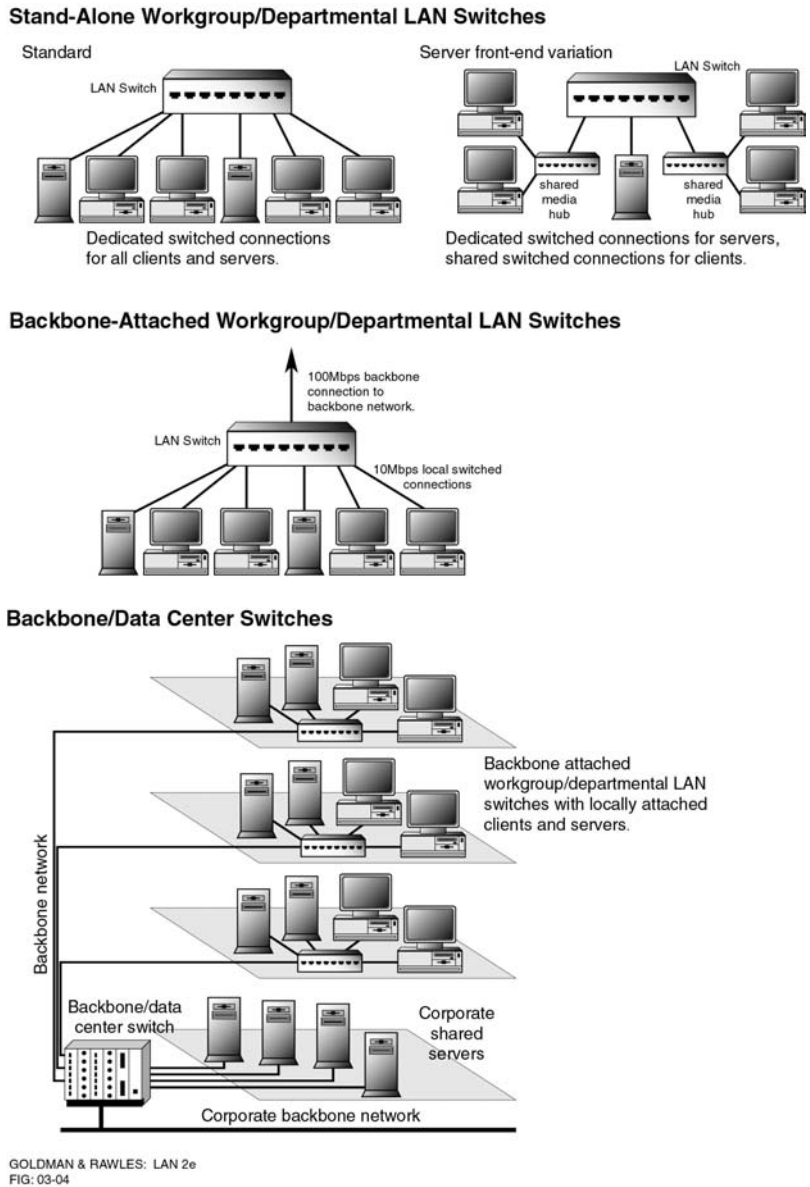


Switch-Based LAN Architecture



GOLDMAN & RAWLES: LAN 2e
FIG: 03-03

Switched LAN Architectures



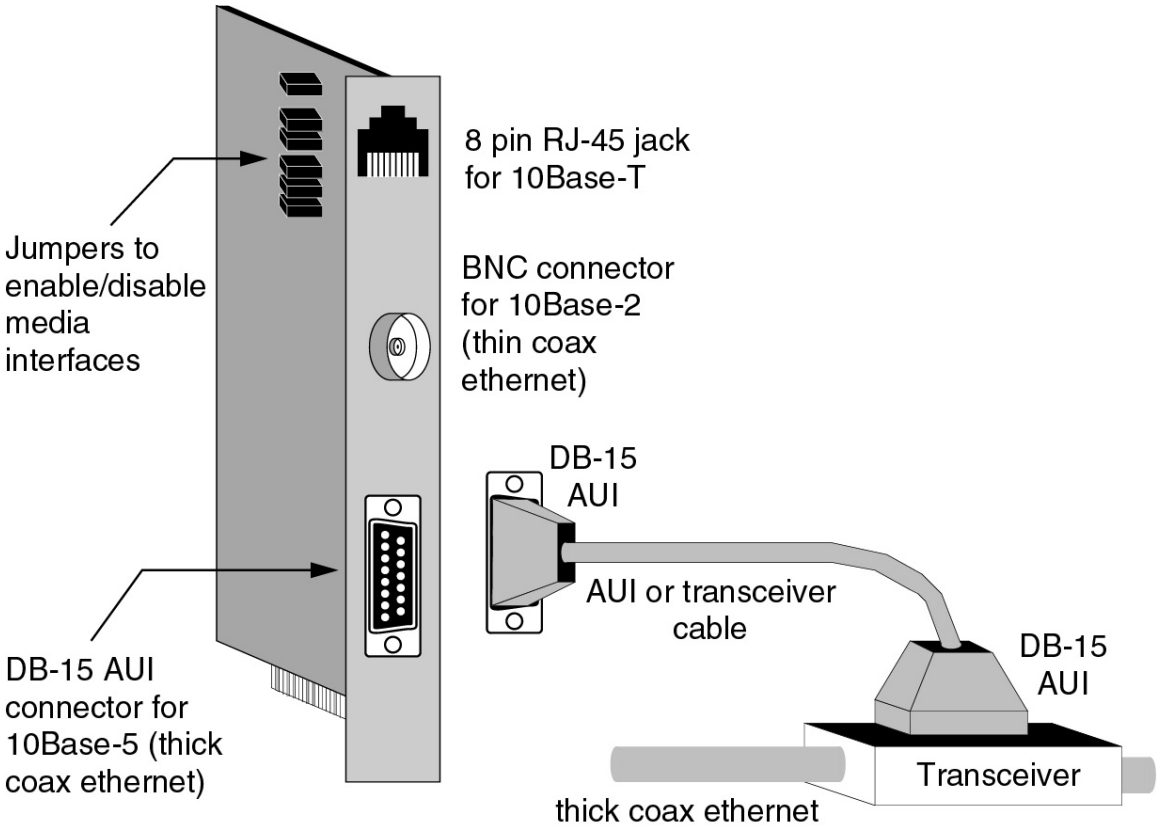
NIC Cards

- The interface between the PC and the network.
- Provides LAN connection and MAC layer
  - OSI level 1 and lower part of 2
- LAN standard on one side, PC bus on the other side

Media Interfaces

- RJ45 (most common)
  - 10BaseT
  - 100Base-T
  - UTP based media
- BNC (obsolete)
  - 10Base2 Coax Media
- AUI (obsolete)
  - 10Base5 Coax Media

Ethernet Media Interfaces



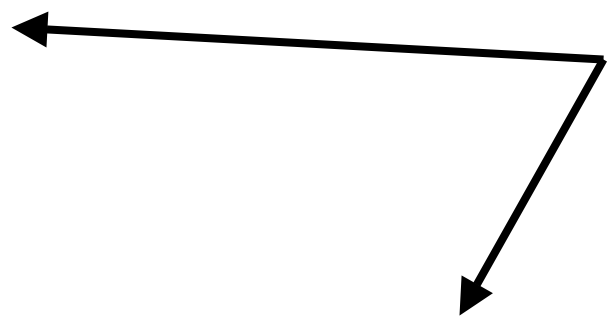
GOLDMAN & RAWLES: LAN 2e
FIG: 03-08

NIC Card Trends

- Dual speed cards, 10/100 Mbps
- On the PC motherboard
- Full Duplex
- Multi-port NICs for servers
- Performance Enhanced
  - Packet overlapping

Cable Medias

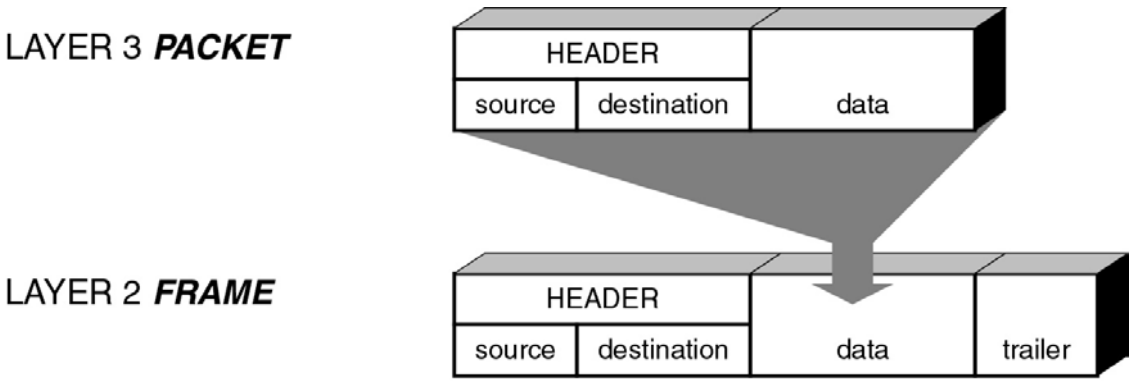
- The link between active network components
- Copper based cable
  - UTP
  - STP
  - Coax
- Various flavors of fiber optic cable



Two most common medias

Packets and Frames

- Layer 2 uses Frames
- Layer 3 uses Packets
- Packets are encapsulated in Frames

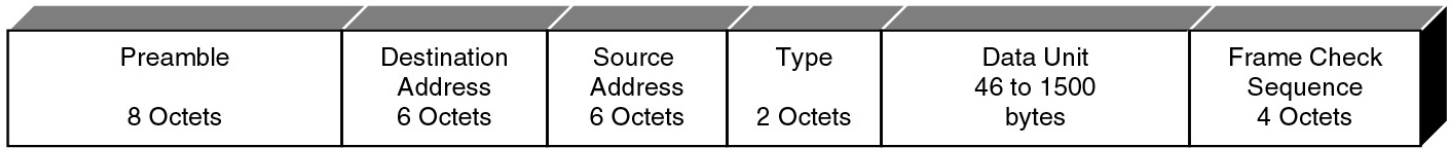


GOLDMAN & RAWLES: LAN 2e
FIG: 04-04

Ethernet Frames

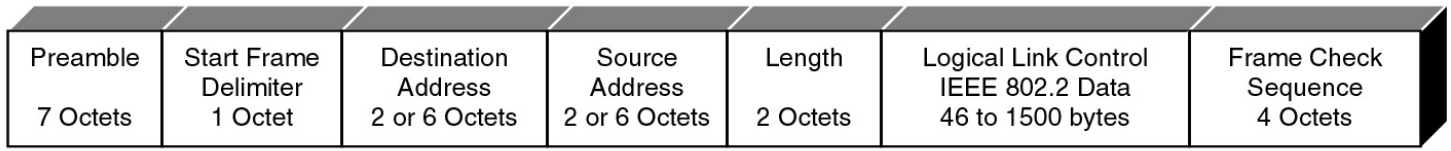
Format used by IP

Ethernet II Frame Layout



The overall frame length varies from 64 to 1518 Octets

IEEE 802.3 Frame Layout



The overall frame length varies from 64 to 1518 Octets

NOTE: 1 Octet = 8 bits

GOLDMAN & RAWLES: LAN 2e
FIG: 02-05

Ethernet Frames

- Ethernet II Frame
  - Used a type field to identify the higher level protocol that is encapsulated in the Data area.
    - 8137 SPX/IPX
    - 0800 TCP/IP
  - Uses CRC32 in the Frame Check Sequence
    - Used by almost all LANs for error checking
  - Max 1518, Min 64

Access Methodology

- Required to control access to the network by multiple users on media sharing LANs
- Specific to the the type of LAN
  - Token passing for token ring and FDDI
  - CSMA/CD for Ethernet
- Part of the physical layer

Ethernet CSMA/CD

- Carrier sense multiple access/collision detection.
  - Listen for traffic
  - Access the network sending a frame
  - Check for collision (two stations talk)
  - Backoff and retry
- Collisions caused by propagation delay