Ethernet Fundamentals
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
• Local LANs are composed of the following components:
  – Wiring concentrator
  – Media (cable)
  – NIC card
  – Software
LAN Components

Logical Diagram

Network interface card driver software bridges the hardware/software gap between the Network Interface Card (NIC) and the installed Network Operating System (NOS).

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
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

8 pin RJ-45 jack for 10Base-T

BNC connector for 10Base-2 (thin coax ethernet)

DB-15 AUI connector for 10Base-5 (thick coax ethernet)

Jumpers to enable/disable media interfaces

DB-15 AUI

AUI or transceiver cable

Transceiver

thick coax ethernet

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

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FIG: 04-04
Ethernet Frames

Format used by IP

**Ethernet II Frame Layout**

<table>
<thead>
<tr>
<th>Preamble</th>
<th>Destination Address</th>
<th>Source Address</th>
<th>Type</th>
<th>Data Unit</th>
<th>Frame Check Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Octets</td>
<td>6 Octets</td>
<td>6 Octets</td>
<td>2 Octets</td>
<td>46 to 1500 bytes</td>
<td>4 Octets</td>
</tr>
</tbody>
</table>

The overall frame length varies from 64 to 1518 Octets

**IEEE 802.3 Frame Layout**

<table>
<thead>
<tr>
<th>Preamble</th>
<th>Start Frame Delimiter</th>
<th>Destination Address</th>
<th>Source Address</th>
<th>Length</th>
<th>Logical Link Control</th>
<th>Frame Check Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Octets</td>
<td>1 Octet</td>
<td>2 or 6 Octets</td>
<td>2 or 6 Octets</td>
<td>2 Octets</td>
<td>IEEE 802.2 Data</td>
<td>4 Octets</td>
</tr>
</tbody>
</table>

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 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