

# Ethernet Fundamentals

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## 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

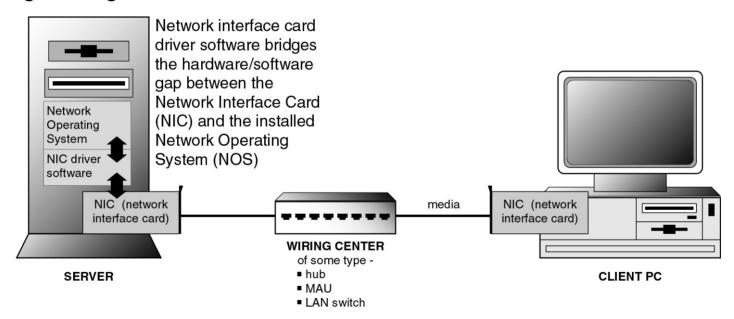


- Local LANs are composed of the following components:
  - Wiring concentrator
  - Media (cable)
  - NIC card
  - Software

## LAN Components



#### **Logical Diagram**



GOLDMAN & RAWLES: LAN 2e

FIG: 03-01

#### LAN Architectures

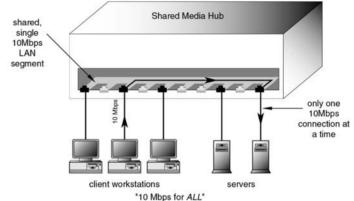


- Shared-media Networks
  - Hubs
  - Cable based links (I.e. Ethernet coax)
- Switched LANs
  - Each port on the switch is a dedicated LAN segment

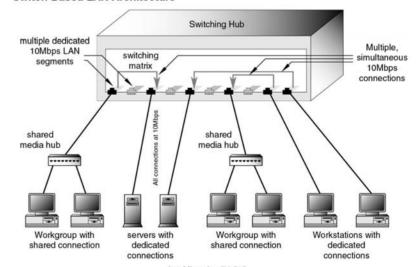


# Hubs versus Switches

#### **Shared Media LAN Architecture**



Switch-Based LAN Architecture

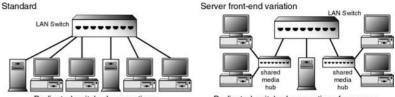


"10 Mbps for EACH"

GOLDMAN & RAWLES: LAN 2e

# Switched LAN Architectures

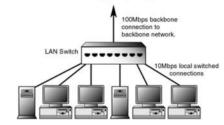
#### Stand-Alone Workgroup/Departmental LAN Switches



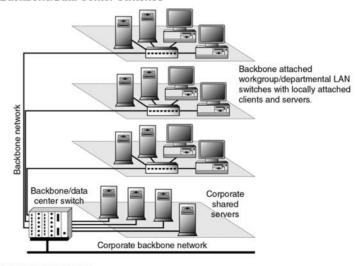
Dedicated switched connections for servers, for all clients and servers.

Dedicated switched connections for servers, shared switched connections for clients.

#### Backbone-Attached Workgroup/Departmental LAN Switches



#### **Backbone/Data Center Switches**



GOLDMAN & RAWLES: LAN 2e FIG: 03-04

#### 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

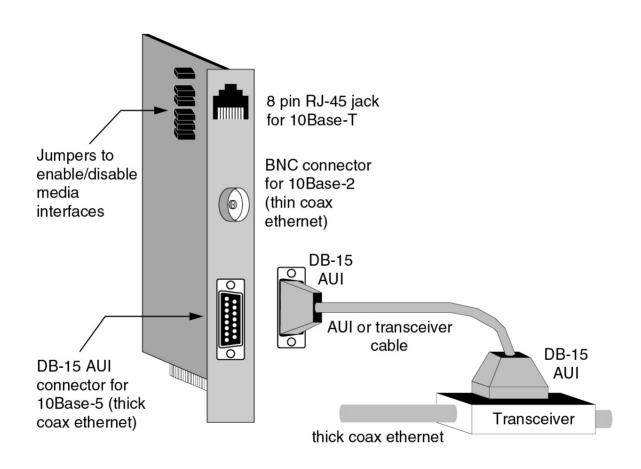
#### Media Interfaces



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

#### Ethernet Media Interfaces





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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 ← Two most common medias
    STP
    Coax
- Various flavors of fiber optic cable

#### Packets and Frames



- Layer 2 uses <u>Frames</u>
- Layer 3 uses Packets
- Packets are encapsulated in Frames

**HEADER** 

source

destination

LAYER 3 PACKET

source destination data

HEADER

data

trailer

LAYER 2 FRAME

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

#### Ethernet Frames



Format used by IP

#### **Ethernet II Frame Layout**

Preamble	Destination	Source	Туре	Data Unit	Frame Check
8 Octets	Address 6 Octets	Address 6 Octets	2 Octets	46 to 1500 bytes	Sequence 4 Octets

The overall frame length varies from 64 to 1518 Octets

#### **IEEE 802.3 Frame Layout**

_				/			
	Preamble	Start Frame Delimiter	Destination Address	Source Address	Length	Logical Link Control IEEE 802.2 Data	Frame Check Sequence
	7 Octets	1 Octet	2 or 6 Octets	2 or 6 Octets	2 Octets	46 to 1500 bytes	4 Octets

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