Previously

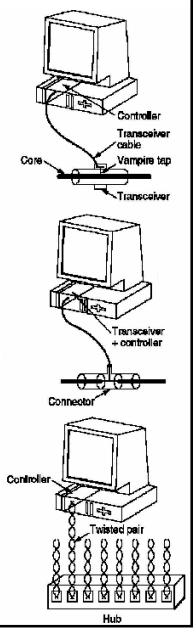
- Protocol Design issues
- Framing
- Error Control
- Flow Control

Ethernet

- IEEE standard 802.3
  - CSMA / CD

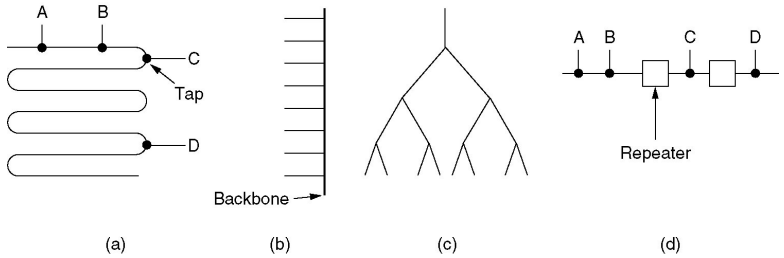
Ethernet Cabling

- 10Base-5: _____
  _____
  - Connected using _____
  - Up to 100 _____
- 10Base-2: _____
  - Uses a _____
  - Connected using _____
  - Up to 30 _____
- 10Base-T: _____
  - Runs to a _____
  - Up to 1024 stations allowed within 200m
- 10Base-F
  - Typically a hub/star topology
  - Max segment 2km, Up to 1024 stations per segment



Cable Topologies

- Linear: _____
- Spine: _____
- Tree: _____
- Repeaters: _____

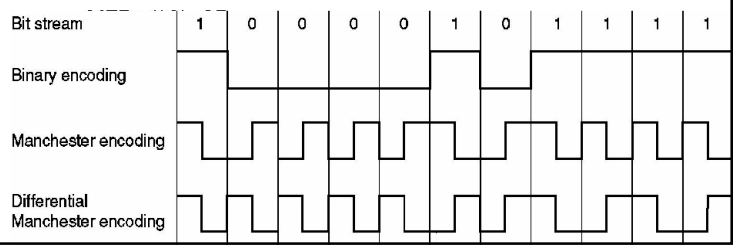


Encoding

- Considering a stream of bits to be transmitted and received we must address a number of issues:
  - How to distinguish idle from 0?
    - Solution: _____
  - How can we avoid having an average D.C. voltage?
    - Solution: _____
  - How can we be sure that we sample the signal correctly?
    - Solution: _____

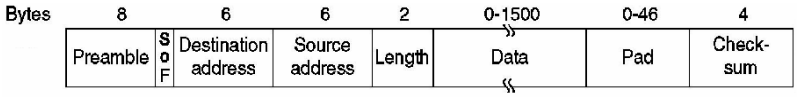
Manchester Encoding

- Manchester
  - 1 represented as _____
  - 0 represented as _____
- Differential Manchester
  - 1 represented as _____
  - 0 represented as _____



MAC Sublayer protocol

- A preamble is sent in order to _____
  _____
  - This consists of _____
  - This is followed by a SOF byte: _____
- Destination & Source Addresses are
  - Either _____
  - High order bit (Destination Bit 47) is
    - 0 _____
    - 1 _____
    - 111…111 _____
  - Destination Bit 46 indicates _____

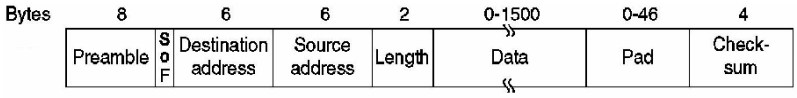


Medium Access Control Sublayer, Topic 6.2&7.1, Ethernet

Classic Ethernet
Improvements

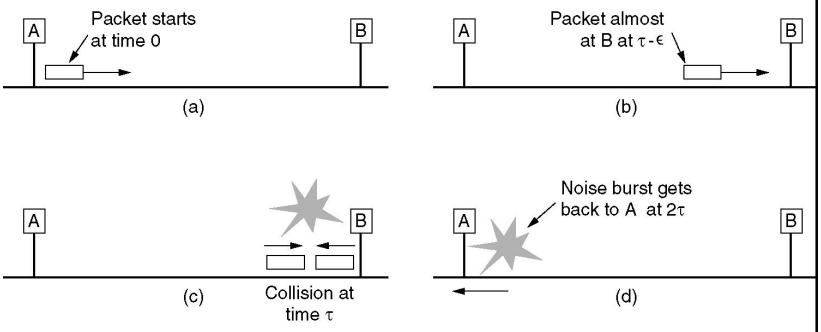
MAC Sublayer protocol

- Length / Type is interpreted differently…
  - <= 1500 _____
  - > 1500 _____
- Data & PAD
  - Data + PAD >= 46 bytes as _____
    _____
- Checksum is _____



Detecting Collision

- Assume stations A and B are at extremes of the LAN



- Time Simultaneous transmission _____
- Time Collision Detection _____
- Worst Case _____

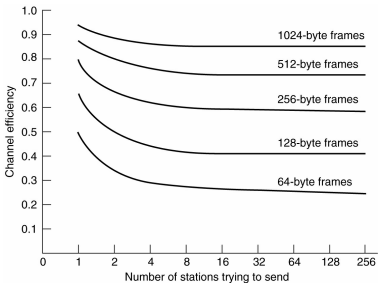
Binary Exponential Backoff

- After a collision time is divided into discrete time slots
  - Length of time slot: _____
- After collisions 1-9: _____
- After collisions 10-15: _____
- After collision 16: _____

- Performance:
  - Small number of stations colliding: _____
  - Large number colliding _____

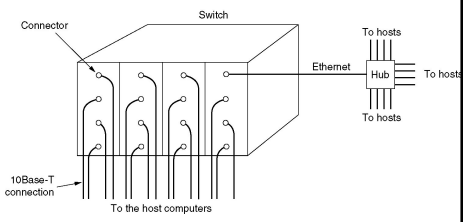
Performance

- Under high load to increase efficiency:
  - Decrease B _____
  - Decrease L_____
  - Increase F _____
  - Note: Channel efficiency = 1 / (1 + 2.B.L.e/c.F)
  - (See text for more detailed mathematics).



Switched Ethernet

- Eventually Ethernet will become saturated with traffic
- One approach to soling this is use _____. This contains …
  - Cards _____
  - Connectors _____
  - High speed backbone _____
- Card operation:
  - On-card LAN so that _____
  - Buffering can be used _____



Fast Ethernet

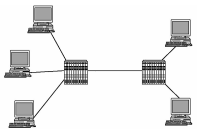
- 802.3u _____.
  Selected by IEE because
  - Compatibility _____
  - Fear: _____
  - Speed: _____
- No changes _____
- Changes were made…
  - 10Base-T _____
  - Wiring: _____

Fast Ethernet Wiring

- 100Base-T4 _____
  - Cabling & Speed: _____
  - Cable organisation: _____
  - Encoding
    - 8B/6T _____
- 100Base-TX _____
  - Cabling & Speed: _____
  - Cable organisation: _____
  - Encoding
    - 4B/5B _____
- 100Base-FX _____
  - Cabling & Speed: _____

Gigabit Ethernet

- 802.3z: _____
  - Compatibility: _____
  - Protocol: _____
- Point-to-point connections only
- Two modes of operation supported:
  - Full duplex – where only _____
    - No possibility _____
    - Max cable length now determined by _____
  - Half duplex – where _____
    - Standard CSMA/CD used
    - Max length maintained by:
      - Carrier Extension: _____
      - Frame bursting: _____

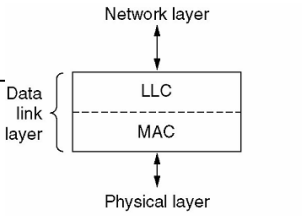


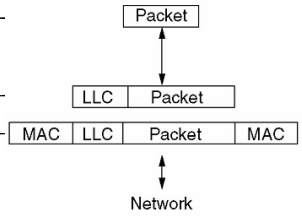
Gigabit Ethernet Wiring

- Wiring Options:
  - 1000Base-SX _____
  - 1000Base-LX _____
  - 1000Base-CX _____
  - 1000Base-T _____
- Encoding (fiber)
  - 8B/10B _____
  - 4 identical bits: _____
  - Six 0s or six 1s: _____
- Encoding (1000Base-T) _____
- Flow control _____
- 802.3ae _____

Logical Link Control

- Data Link Layer is in theory capable of supporting reliable communication on an unreliabled line…
- LLC _____
  - Service Options
    1. _____
    2. _____
    3. _____
  - Header _____
    It contains:
    - Access points _____
    - Control field _____





Why Ethernet?

- Competition: _____
- Reliability: _____
- Simple: _____
- Maintenance: _____
- TCP/IP: _____
- Stability: _____