Packet, Frames, ...

Headers and trailers (soh, eoh, …)

Error Control: Parity bits, checksums, ...
ISO OSI Stack
<table>
<thead>
<tr>
<th>Layer</th>
<th>Data Unit</th>
<th>Connection Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Message</td>
<td></td>
</tr>
<tr>
<td>Presentation</td>
<td>Packet</td>
<td>Router</td>
</tr>
<tr>
<td>Session</td>
<td>Frame</td>
<td>Bridge</td>
</tr>
<tr>
<td>Transport</td>
<td>Symbol (bit)</td>
<td>Modem/Repeater</td>
</tr>
<tr>
<td>Network</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data Link</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Addressing

Frames contain physical address of intended recipient (128.114.13.50)

Static

Configurable

Dynamic
Addressing

Broadcasting

Multicasting

Application (user) chooses to accept multicasts

Choose among multicasts
Bridging LANS

Forward frames *if necessary*

learns locations by listening

*(promiscuous mode)*

**Adaptive Bridge**
Bridged Network
Switched LANS

Each computer has (simulated) LAN of its own
Bridges vs. Switches

Switches give greater bandwidth utilization

Switches cost more

Combination of Hubs and Switches

hubs connect to switch ports
computers connect to hubs
Connecting via Teleco Circuits

DSU/CSU: Data Service Unit / Channel Service Unit
ISO OSI Stack

stack on computer 1

Application

Presentation

Session

Transport

Network

Data Link

Physical (network hardware)

stack on computer 2

Application

Presentation

Session

Transport

Network

Data Link
TCP/ IP Protocol

- SMTP: Simple Mail Transfer Protocol
- Telnet: Network Teletype (remote virtual terminal)
- FTP: File Transfer Protocol
- RIP: Routing Information Protocol
- NFS: Network File System
- SNMP: Simple Network Management Protocol
- TCP: Transmission Control Protocol
- UDP: User Datagram Protocol
- IP: Internet Protocol
- ARP: Address Resolution Protocol