Internetworking

• How Networks Differ
• How Networks Can Be Connected
• Concatenated Virtual Circuits
• Connectionless Internetworking
• Tunneling
• Internetwork Routing
• Fragmentation

A collection of interconnected networks
**How Networks Differ**

- Connection-oriented vs. Connectionless
- Flat addressing vs. Hierarchical
- Frame/Packet size (max)
- Error handling and Flow control
- Congestion control
- Quality of Service
- Security
- Multicast/Broadcast
- Etc.

**How Networks Can Be Connected**

- Physical layer – hubs and repeaters
  - signal amplification
- Data link layer – bridges and switches
  - protocol conversion, switching
- **Network layer – multiprotocol routers**
  - wide area routing, network protocol conversion.
- Transport layer – transport gateways
  - transport protocol conversion (TCP to SNA)
- Application layer – application gateways
  - document translation (Word – StarOffice)

**Concatenated Virtual Circuits**

- Series of Virtual Circuits,
- joined by Multiprotocol Routers
- to make a long Virtual Circuit…..
**Connectionless Internetworking**

- Series of datagram networks
- joined together at the network layer
- by *Multiprotocol Routers*
- to make larger datagram network.

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**Connectionless verses Connection-oriented Internets**

- Connection-oriented internetworks have much the same problems as connection oriented subnets (what are they?). But they also have the same disadvantages (which are?).
- Connection-oriented internetworks are difficult, if not impossible to run across datagram subnets.
- Connectionless internetworks have much the same characteristics as connectionless subnets (which are?)
- Connectionless internets can run across both datagram and virtual circuit subnets.

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**Tunneling**

- Put IP packets into Ethernet frames.
- Multiprotocol router puts IP packets into WAN packets and sends.
- Multiprotocol router takes IP packets out of WAN packets and puts in into Ethernet frames.
Internetwork routing

- An internetwork and its graph, used for internetwork routing

Fragmentation

- Transparent fragmentation
- Non-transparent fragmentation