INTERNETWORKING PROTOCOL
CATENET

• An interconnected set of networks is called a catenet.

Example: the Internet
A CATENET

S = Station / G = Gateway / B = Bridge
REQUIREMENTS FOR AN INTERNETWORKING FACILITY

• Connection

• Routing and delivery

• Accounting

• Network independence
DIFFERENCES AMONG NETWORKS

Addressing schemes
Maximum packet size
Network access protocol
Timing
Error recovery
Status reporting
User access control
Connection, connectionless
Routing techniques
INTERNETWORKING TECHNOLOGIES

- Repeater
- Bridge
- Router
- Brouter
- Gateway
INTERNETWORKING TECHNOLOGIES

REPEATER:

• A network device used to regenerated or replicate a signal is called a repeater.
• Repeaters are used in transmission systems to regenerate analog or digital signals distorted by transmission loss.
• A repeater can not do the intelligent routing performed by bridges and routers.
INTERNETWORKING TECHNOLOGIES

REPEATER:

• Operates at the physical layer
  – Coax
  – Twisted pair
  – Baseband ring or star
  – Broadband

• Link networks using different media
• Network must share same access protocol
• Same protocol, same speed
BRIDGE:

• A simplified gateway that connects homogeneous networks is called a bridge.
• Useful in connecting homogenous LANs.
INTERNETWORKING TECHNOLOGIES

BRIDGE:

• Smarter than repeater
• Operate at the data link layer, OSI Layer 2
• Filter out unnecessary traffic between networks
• Transparent bridge
• Source routing bridge
• Store and forward frames between LANS
INTERNETWORKING TECHNOLOGIES

BRIDGE:

• Historically homogenous
• Transparent
• Makes no modifications to the data it sees
• Unlike routers, bridges are protocol-independent
• Higher performance than routers
• Less versatile than routers
• Low cost
X.75 PROTOCOL

A standard for a protocol that provides virtual circuit service across multiple X.25 networks.
INTERNETWORKING TECHNOLOGIES

ROUTER:

• Similar to bridges but provide additional functionality
  – ability to filter messages and forward them to different
    places based on various criteria
• Operate at the network layer, OSI layer 3
• Protocol dependent (TCP/IP, XNS, etc.)
• Extract network identification to pinpoint destination
• Store and forward packets between dissimilar
  networks
• Needs lots of processing power
Cisco Routers *

The Cisco 700 Series of ISDN Access routers provide home offices, telecommuters, and small professional offices the next generation of affordable, high-speed, easy-to-manage, and multiprotocol remote access solutions. The Cisco 700 Series Product Family comprises the Cisco 760 and 770 Series.

* Source: http://www.cisco.com
Cisco Routers

Cisco 12000 Series Gigabit Switch Router, Rear View

* Source: http://www.cisco.com
Cisco Routers

12000 Series:

- The 12000 series is the newest addition to Cisco’s next generation of Internet routing products
- Includes three models: 12004, 12008, 12012
- Targeted at scaling Internet and enterprise backbones to speeds of 2.4 Gbps and beyond
- Provides high-density and high-speed packet-over-SONET connections
- Provides multi-gigabit bandwidth switching of IP datagrams at rates ranging from 5 to 60 Gbps

* Source: http://www.cisco.com
INTERNETWORKING TECHNOLOGIES

BROUTER:

• Short for *bridge router* and pronounced *brau-ter*

• A device that can provide the functions of a bridge, router, or both concurrently

• A brouter can route certain types of protocols -- such as TCP/IP, IPX, and/or XNS -- and bridge other protocols, thereby combining the functions of routers and bridges
GATEWAY:

• A device that connects networks is called a gateway.

• Gateways provide a communication path so that data can be exchanged between networks.
INTERNETWORKING TECHNOLOGIES

GATEWAY:

• Operate at the transport layer and higher

• Protocol converter

• Much more complex than a router

Example:

• OSI transport → TCP transport

• More expensive than router
INTERNETWORKING TECHNOLOGIES

GATEWAY:

• May provide protocol conversion
• For connecting internetworks
• Keeps sophisticated routing tables
• Operates well in a heterogeneous environment
• Large buffer space
• Can control traffic flow
Two key issues in designing a gateway deal with:

1. The nature of the internetwork interface
   - Interface at node (network, DCE) level or
   - Interface at station (attached device, DTE) level

2. The nature of the transmission service
   - End-to-End
   - Network-by-Network
# ALTERNATIVE INTERNETWORKING APPROACHES

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