Goals of Routing

- Minimize delay
- Minimize hop count
- Maximize throughput
- Balance load
- Minimize jitter
- Respond quickly to change
- Minimize administrative cost
- Conform to political policies

Internet Routing

- Internet routing is based on the NetID.
- Once a packet is delivered to the proper subnet, the Internet routing protocols are no longer needed.

Static and Dynamic Routing

- Most hosts on the Internet use static routing. Frequently there is only one way out of your local network.
- Routers use dynamic routing that can recover from errors and change based on system load.

Internet Routing Protocols

- Internet routing is a two layer hierarchical system.
- Interior Gateway Protocols (IGP) route within an Autonomous System (AS).
- Exterior Gateway Protocols (EGP) route between Autonomous Systems.

A&T Autonomous System

- The NCAT domain represents an AS.
- There are many subnets within the ncat.edu domain connected by routers.
- Routing at A&T between subnets uses an Interior Gateway Protocol
- The OSPF routing system is the currently used Interior Gateway Protocol.
IGP and EGP example

Routing Information Protocol (RIP)
- An older Interior Gateway Protocol
- Provides routing within an AS.
- Uses hop count as routing metric
- Uses UDP for routing communications

Open Shortest Path First Protocol
- OSPF is a newer Interior Gateway Protocol.
- Provides routing within an AS.
- Uses Authenticated Message Exchange
- May balance load over multiple lines
- Uses the link state routing algorithm
- Supports a hierarchy within the AS

Count to Infinity Problem

Network between A and B breaks

After 1st Exchange of Routing Table data
Responsiveness

- Algorithms that exchange destination times may suffer from the count to infinity problem.
- Problems are slow to propagate.
- Good news travels fast.
Border Gateway Protocol
- A popular Exterior Gateway Protocol
- Routes among Autonomous Systems.
- AS can be either transit systems (providing transmission of packets through the system) or stub systems that only route packets for that AS.
- Uses TCP for inter-AS communications.

Border Gateway Protocol
- Exchanges paths of autonomous systems.
- Each router scores the paths
  - Paths using this router are discarded
  - Paths violating rules are discarded
  - Remaining paths are scored by time

Multicast Routing
- Hosts send and receive data from a single multicast address.
- The routers:
  - Make sure members of the group get the data
  - Accept new members
  - Drop members leaving the group.
- Multicasting is not well supported over the Internet.