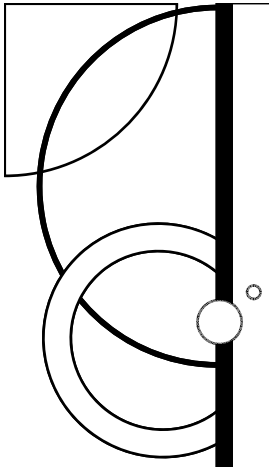


Understanding Routing

Module 6 Fall 2008

Spring Classes

- CIS 380/465 – CCNA
- CIS 420 – Computer Forensics
- CIS 421 – Pen Testing

Router Redux

- Layer 3 Device
- Multihomed Host
- Revises Packet Headers in IP for shipment to other networks
- Required to transition between network segments where the network is different
  - e.g. subnet mask has a change in the network component

CCNA

- Covers CIS 375 + Cisco IOS commands
- CIS 380/ENGR 465 will cover the actual hands on part of CCNA

Basic Router Configuration

- Cisco uses IOS (operating system based on BSD unix).
- Instructions are entered for the router
- This can also be done using Ciscoworks or other tools to configure lots of routers remotely.
- Always remember the ? key in cisco since it will help you figure out commands
- Commands only need enough letters to be "unabmibuous".

So a simple scenario

- A network exists which connects to the internet.
  - Router internal is 10.0.10.1
  - Router external is 198.7.244.50
  - Three hosts behind the switch
  - So the subnet mask can be /24 for this network.

Routing Ideas

- Routers have a table of information (routing table) that contains all the other routers they know about
- Routers may exchange information with other routers
- Routers readdress packet information to allow packets to be forwarded or retained

Two main types of routing

- Static Routing – Routes are set for the given network topology. Any changes mean you need to update all the routers. This is only useful in small specialized networks.
- Dynamic Routing – This means that the routers exchange information and may be able to learn about routes and other network features using some routing protocol.

Key Routing Protocols

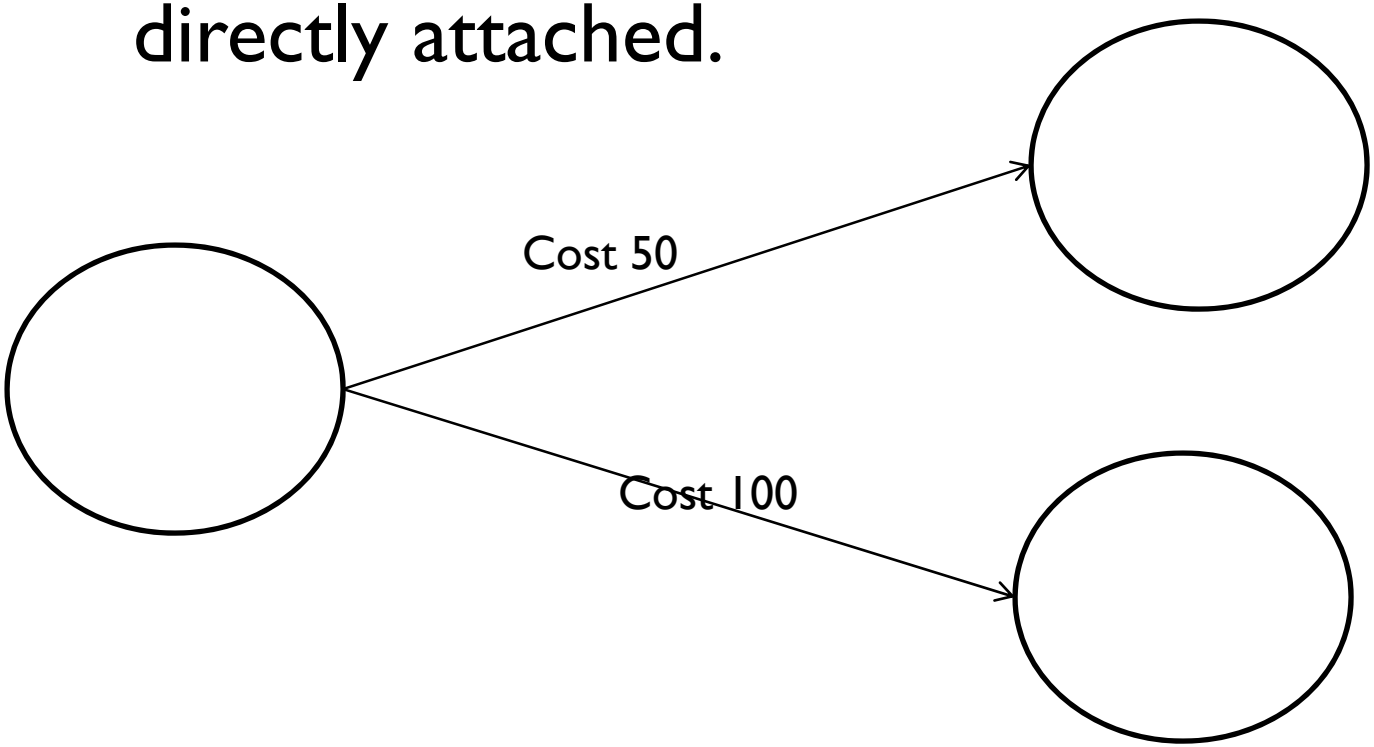
- RIP1 and RIP2
- OSPF
- IGRP (eye grip)
- EIGRP (E Grip) – cisco proprietary

Hierarchical vs. Peer Routing

- Peer routing means all routers are considered equal
- Hierarchical routing means that some routers are peers, some routers are backbone or core, and some routers are ??

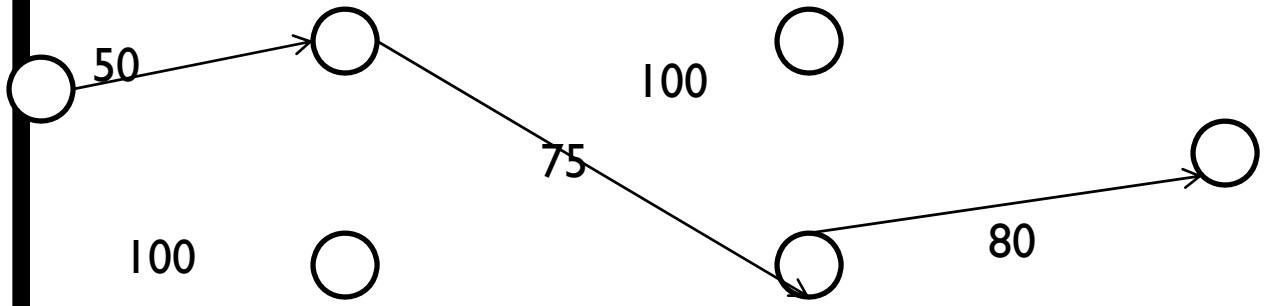
Key Routing Algorithms

- Distance Vector – only initially knows the "cost" of reaching nodes to which it is directly attached.



Key Routing Algorhtims

- Distance Vector – As knowledge is gained, more information about cost can be ascertained for the entire path.



Key Routing Algorithms

- Note Cost is a relative term and can be
  - Time to send
  - MTU – Maximum Transmission Unit
  - Distance
  - Monetary Charges
  - Reliability
  - Bandwidth
  - Load

Cisco

- Uses Administrative Distance
  - Assign a value to a large number of factors to prioritize them.
  - This is used then to determine a path when multiple paths exist.
  - Other routers use different combinations of protocols depending upon algorithms in use.

Key Routing Algorithms

- Link State Algorithms – This is like an AI problem
  - Each node broadcasts everything it knows
  - Each node then computes a shortest path from itself to every other point in the network
  - When a packet arrives, the shortest path from that node to the destination is chosen.
  - If in the next hop this changes, then it changes
  - Should optimize paths

Key Routing Algorithms

- Problems
  - Distance vector becomes difficult if more than a few hops exist in a given network
    - EIGRP now has loop free distance vector management for use in intra-domain networks and is very popular.
  - Link State causes so much information exchange that it will flood large scale networking
  - Thus, neither of these is used for inter-domain routing (just for intra-domain)

Key Routing Algorithms

- Path Vector -- Used for inter-domain routing
  - Each network (say rwu.edu) appoints a speaker node (border router). This router advertises paths to the rest of the network.
  - The core (backbone) only knows of speaker nodes. So packets delivered to rwu.edu can then be handled intra-domain in any way rwu sees fit but inter-domain goes through the border.

Many other approaches

- Adaptive
- Fuzzy
- etc.
- AI is being used
- data mining
- Large dollars involved

Dollars

- 1,698.00 average packets per second rwu
  101,880.00 packets per minute
  6,112,800.00 packets per hour
  146,707,200.00 packets per day
- Ok, so say you can save RWU .00001 per packet with a routing algorithm
- 146.71 per day
- 53,548 per year
- 267,740 per 5 years!