Routing

- Routing
- Process of moving a packet from one network to another network
- Is a Layer 3 operation
- Networks can be of different protocols
- The path a packets takes is defined by a *Routing Table*
Similar to passing a “hot potato”. It is in the best interest of each router to pass the packet as quickly as possible to the next router.

Routers are only aware of its neighbors. All other traffic is passed to one of its neighbors.
Routing Table

- Contains the IP addresses of the router interfaces that are to be used when the packets matches a particular destination.
- If a router interface is not specifically assign for a particular destination a *default route* is used.
- Evaluated from most specific to least specific.
## Routing Table

<table>
<thead>
<tr>
<th>Destination Address</th>
<th>Router</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.2.10.128/25</td>
<td>10.2.0.253</td>
</tr>
<tr>
<td>10.2.10.0/24</td>
<td>10.2.0.252</td>
</tr>
<tr>
<td>10.2.0.0/16</td>
<td>10.2.0.254</td>
</tr>
<tr>
<td>0.0.0.0</td>
<td>10.2.0.254</td>
</tr>
</tbody>
</table>
Types of Routing

- Static – routes are manually added and removed from the routing table
- Dynamic – routers exchange routing information amongst each other
## Settings for Routing Examples

<table>
<thead>
<tr>
<th>Router A</th>
<th>Router B</th>
<th>Router C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eth0 = 10.2.10.1</td>
<td>Eth0 = 10.2.30.1</td>
<td>Eth0 = 10.2.50.1</td>
</tr>
<tr>
<td>Ser0 = 10.2.20.1</td>
<td>Ser0 = 10.2.20.2</td>
<td>Ser0 = 10.2.40.2</td>
</tr>
<tr>
<td>HostA = 10.2.10.1</td>
<td>Ser1 = 10.2.40.1</td>
<td>HostA = 10.2.50.2</td>
</tr>
<tr>
<td></td>
<td>HostB = 10.2.30.2</td>
<td></td>
</tr>
</tbody>
</table>
Static Route Configuration

- For Router A
  - `ip route 10.2.30.0 255.255.255.0 10.2.20.2`
  - `ip route 10.2.50.0 255.255.255.0 10.2.20.2`

- For Router B
  - `ip route 10.2.10.0 255.255.255.0 10.2.20.1`
  - `ip route 10.2.50.0 255.255.255.0 10.2.40.2`

- For Router C
  - `ip route 10.2.10.0 255.255.255.0 10.2.40.1`
  - `ip route 10.2.30.0 255.255.255.0 10.2.40.1`
**Static Route Configuration**

- **Linux**
  - `route add -net 10.2.30.0 netmask 255.255.255.0 gw 10.2.10.2`
  - `route delete -net 10.2.50.0 netmask 255.255.255.0 gw 10.2.10.2`
  - `route -rn`

- **CISCO IOS**
  - `ip route 10.2.30.0 255.255.255.0 10.2.10.2`
  - `no ip route 10.2.30.0 255.255.255.0 10.2.10.2`
  - `Show ip route`
Static Route Configuration

- **MS Windows**
  - `route add 10.2.30.0 mask 255.255.255.0 10.2.10.2`
  - `route delete 10.2.30.0 mask 255.255.255.0 10.2.10.2`
  - `route print`

- **Unix**
  - `route add -net 10.2.30.0/24 10.2.10.2`
  - `route del -net 10.2.30.0/24 10.2.10.2`
  - `netstat -rn`
Static Route Issues

- Cannot possibly add router for ALL known networks. Doing so would consume all the memory your router has and more!
  - Solved using default routes

- Difficult to manage. If routes change the configurations of different routes must also change.
  - Solved using dynamic routing
Using Default Routes

- Default routes allow administrators to configure a route for all networks not specified by a static route.
- Simplifies router configuration allowing each router to focus on its neighboring routes only.
- The only route set in most desktop systems.
For Router A

- ip route 0.0.0.0 0.0.0.0 10.2.10.2

For Router B

- ip route 10.2.10.0 255.255.255.0 10.2.20.1
- ip route 10.2.50.0 255.255.255.0 10.2.40.2
- ip route 0.0.0.0 0.0.0.0 10.2.20.1

For Router C

- ip route 0.0.0.0 0.0.0.0 10.2.40.1
Routing Exercises

- Two branch network with one main branch connected to the Internet.
- Three branch network with two main branches connected to the Internet.
- One Two-tiered network
Questions ?