

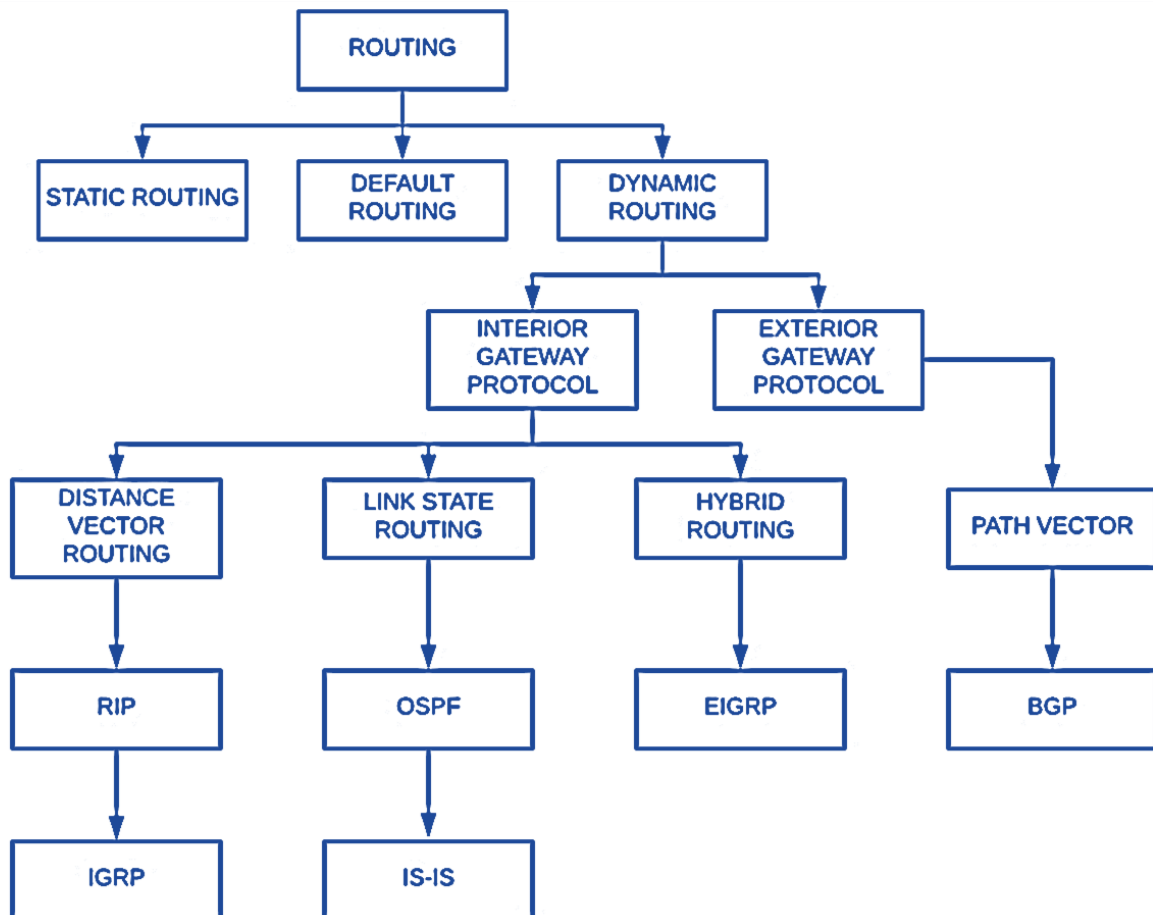
Routed Protocols:

- o Routed protocols are the actual data that is transferred from router to router.
- o Examples of routed protocols are Internet Protocol (IP) such as IPV4 and IPV6.
- o Routed Protocol is used to send user data from one network to another network.
- o Routed Protocol carries user traffic such as e-mails, file transfers, web traffic etc.
- o Used between routers to direct user traffic, it is also called network protocols.
- o That are signs at intersections that point to nearby cities, giving mileage to each.

Routing Protocols:

- o Routing protocols are used by routers to exchange information about known networks.
- o Routers will initially only know the existence of directly connected or attached networks.
- o With the use of routing protocols routers communicate with & learn from other routers.
- o Routing protocols are used to distribute routing information across routers on a network.
- o Routing protocol is Google Maps: It tells you the best way to get where you want to go.

| Routed Protocol | Routing Protocols |
|-----------------|-------------------------------------|
| IP, IPV4, IPV6 | RIPV1, RIPV2, OSPF, EIGRP, BGP,ISIS |



Static Routing:

- o Static Routing administrator manually inputs all routing table information.
- o A static route is a route that is created manually by a network administrator.
- o Router's routing table entries are populated manually by network administrator.
- o Static route tells the network devices about exact location for the routes.
- o Static routes are typically and can only be used in the smaller networks.
- o Configure static routes between routers to allow data transfer between routers.
- o The command used in static is IP route network, mask address/interface [distance].
- o Example: IP route 2.0.0.1 255.0.0.0 1.0.0.2. Here, 2.0.0.0 is destination network.
- o In example, 255.0.0.0 is subnet mask and 1.0.0.2 is the default gateway ip address.
- o Major advantages of static routing are reduced routing protocol router overhead.
- o Another advantage of static routing it reduced routing protocol network traffic.
- o Disadvantages of static routing are network changes require manual reconfiguration.
- o Easy to Configure, High Secure, Use Low Resources, Bandwidth & Use in Small Network.
- o Static Routing doesn't not require Advanced Knowledge to configure them.
- o Static Routing not able to support VLSM It is only support class full Network.
- o Not Scalable also Administrator should know the destination IP-address to configure.
- o When changes occur in the network Configured by the administrator manually only.

Default Routing:

- o A Default Route also known as the gateway of last resort is a special type of static route.
- o This method where all routers are configured to send all packets towards single router.
- o Default Route is Network Route used by router when there is no other known route exists.
- o All the IP datagrams with unknown destination address are sent to the default route.

Dynamic Routing:

- o Dynamic routing protocols can dynamically respond to changes in the network.
- o Routing protocol is configured on each router & router learn about both each other.
- o Dynamic routing table is created, maintained and updates by the routing protocol.
- o Examples of routing protocols includes RIPv1, RIPv2, ISIS, EIGRP, and OSPF and BGP.
- o Dynamic routing protocols share routing updates with neighbors and find best path.
- o Dynamically choose a different route if a link goes also Updates are dynamically.
- o Also, Dynamic Protocols has the ability to load balance between multiple links.
- o Dynamic Routing protocols put additional load on the Router CPU and RAM.
- o The choice of the best route is on the hands of the dynamic routing protocol.

Exterior Gateway Protocol (EGP):

- o A routing protocol operating between different Autonomous System (AS).
- o Exterior Gateway Protocol is usually used on Internet, between different AS.
- o EGP is used to exchange routing info between different autonomous systems.
- o Border Gateway Protocol (BGP) is the only EGP used nowadays.
- o Commonly used for ISP to exchange routing with other ISPs or Upstream.
- o EGP is commonly used between hosts on Internet to exchange routing table info.

IGP (Interior Gateway Protocol):

- o Usually routers running IGP are under the same administration of a company.
- o IGPs are used to exchange routing information within same Autonomous system.
- o IGP are basically routing protocols used internally into company to exchange info.
- o Commonly used in LAN/Private networks where private IP addresses are used.
- o Corporation or individual, or ISP. Example RIPV1, RIPV2, OSPF, EIGRP, and ISIS.

Distance Vector:

- o Distance vector routing protocol uses distance (metric value) and direction (vector).
- o Distance Vector use distance and vector to find the best path to destination network.
- o In Distance Vector routing router receives routing update from neighboring router.
- o In distance vector neighboring routers receive updates from their neighboring routers.
- o In this way, distance vector routing protocol work until the destination network.
- o In Distance Vector routing, every router in the way of destination network called hop.
- o Each time a packet goes through a router, it adds one in hop count value or number.
- o Route with least hop count value chosen as best path & will be placed in routing table.
- o RIP version 1 and RIP version 2 is the example of distance vector routing protocol.
- o These protocol shares entire routing table to the directly connected neighbors.
- o Distance Vector Routing Protocols are slow and have a chances for loops.
- o Distance means (How far Away) and Vector means (Which Direction).

Link State:

- o As compare to distance routing Link State Routing Protocols operate differently.
- o Routers send information about the state of their links to the entire network or area.
- o In this way, in Link State Routing each router understands the entire network topology.
- o Run algorithm every time network change is announced to recalculate best routes.
- o As compare to other Link State Routing Protocols much more processor intensive.
- o Link State Routing Protocols only send triggered updates not periodic updates.
- o Link State Protocols maintain three separate tables Neighbor, Topology & Routing Table.

Hybrid Routing Protocol:

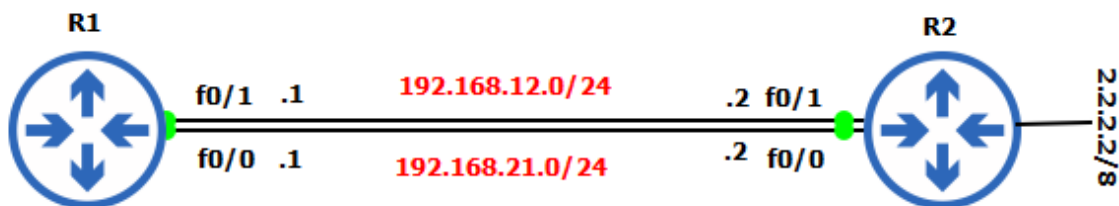
- o Hybrid Routing protocol has advantages of both Distance Vector & Link State Routing.
- o Hybrid Routing protocols merges both distance & link state protocol into new protocol.
- o Typically, the hybrid routing protocols are based on a Distance Vector protocol.
- o But contain many of the features and advantages of Link State Routing protocols.
- o Example of Hybrid Protocol is EIGRP (Enhanced Interior Gateway Routing Protocol).

Path Vector Protocol:

- o Path Vector Protocol relies on number of autonomous systems it must go through.
- o It chooses path with least number of autonomous systems to reach the destination.
- o BGP is a Path Vector Protocol, it does not rely on the bandwidth of the links like OSPF.
- o BGP does not rely on hop count like RIPv1, RIPv2 or a group of parameters like EIGRP.

Floating Static Routes:

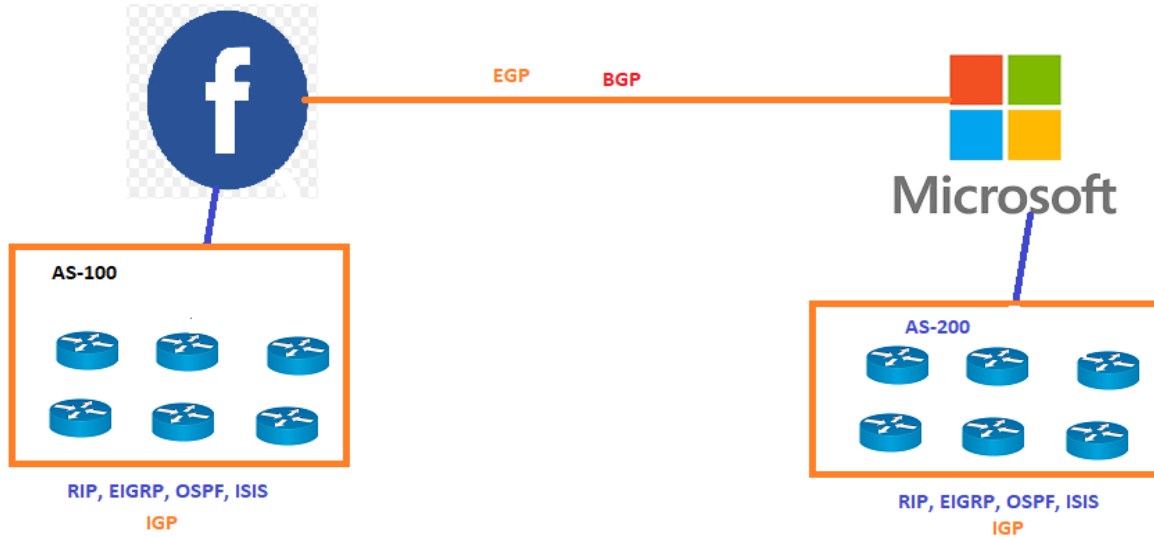
- o If want to use a static route as a backup route, we have to change its AD.
- o To make static route as a backup route, this is called a floating static route.
- o Floating static routes are used for redundancy in-case an interface fails or down.
- o Floating static route is route that has higher AD then current route in routing table.
- o AD is configured on static so that static route is less desirable than dynamic route.
- o In this manner, the static route is not used when the dynamic route is available.



| Protocols | Metric |
|-----------|-----------------------|
| Static | Administrator decides |
| OSPF | Cost |
| RIP | Hop Counts |
| EIGRP | Bandwidth and Delay |
| BGP | Path Counts |

Autonomous System (AS):

- o Autonomous system is one network or sets of networks under a single administrative.
- o AS is a set of routers and devices, or even a set of networks, controlled by a single entity.
- o Autonomous System (AS) example such as Pepsi, Apple, Microsoft, Facebook etc.



Administrative Distance:

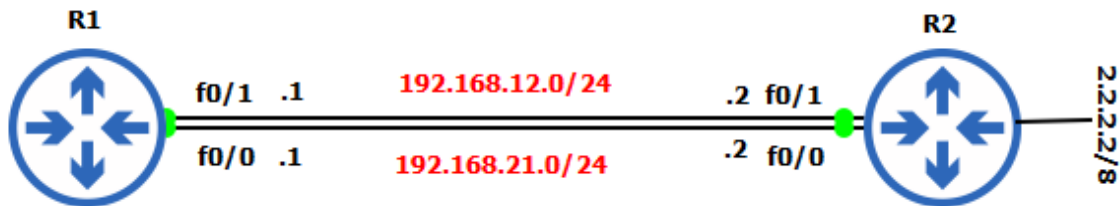
- o Administrative distance is the feature that routers use to select best path.
- o Administrative Distance (AD) defines the reliability of a routing protocol.
- o The administrative Distance (AD) number is start from 0 and end on 255.
- o AD has only local significance and is not advertised in the routing updates.
- o The smaller the administrative distance value, the more reliable the protocol.
- o Router is running multiple routing protocols; AD is to determine trustable protocol.
- o Routing Protocol with lowest Administrative Distance (AD) wins put in routing table.

| Route Source | Default Administrative Distance |
|----------------------|---------------------------------|
| Connected Interfaces | 0 |
| Static Route | 1 |
| EIGRP Summary | 5 |
| External BGP | 20 |
| EIGRP | 90 |
| OSPF | 110 |
| IS-IS | 115 |
| RIP | 120 |
| External EIGRP | 170 |
| Internal BGP | 200 |
| Unknown | 255 |

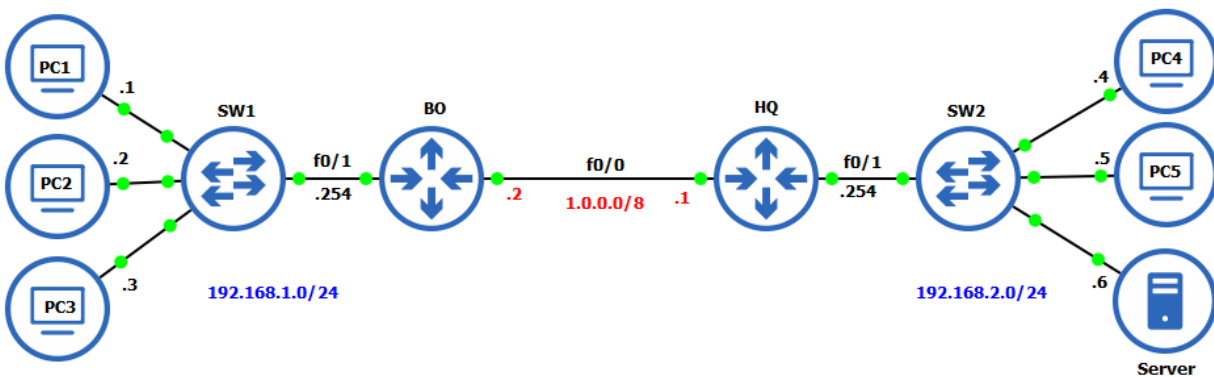
LAB TIME:

Default Route, Static Route, Network Route, Host Route and Floating Route.

Static Floating Routing Topology:



Static, default, Network, Host Routing Topology:



```
BO(config)#ip route 0.0.0.0 0.0.0.0 1.1.1.1 ?
<1-255> Distance metric for this route —Change AD
multicast multicast route —As Multicast
name Specify name of the next hop —Give Name
permanent permanent route —Permanent
tag Set tag for this route
track Install route depending on tracked item
<cr>
```

Permanent:

When a route goes down router will remove that from routing table. Permanent parameter will keep this route in routing table even if it goes down. use this parameter for security reason if you never want packets to take another path.