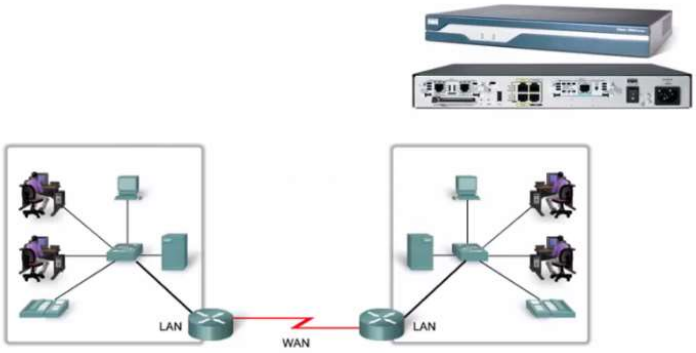
Router : Router is a Interconnecting device used to connect two or more different networks . Within the same location or two different geographical locations .



Which Routers to buy ?

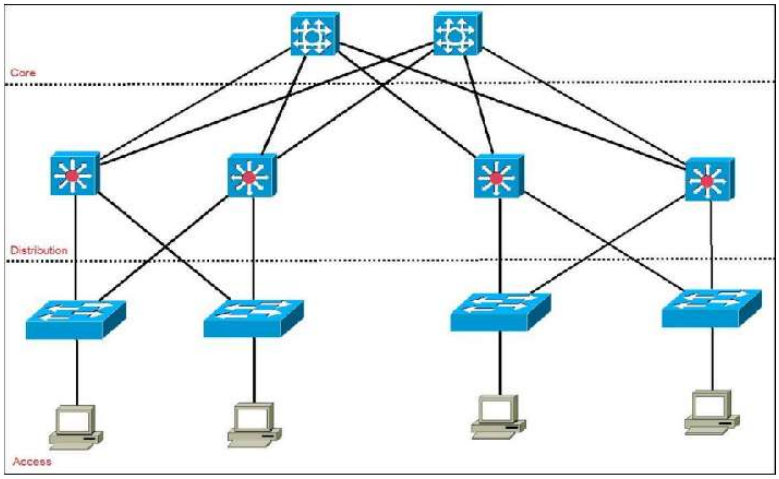
Many companies are manufacturing Router :

- Cisco
- Nortel
- Multicom
- Cyclades
- Juniper
- Dlink
- Linksys
- 3Com

All company routers - Implementation , Features and functionality all will be exactly same , other than the way you configure it , Only CLI configuration will be different.

Cisco develops routers in 3 layer hierarchy .

Cisco three layer Hierarchy.



1.Access layer - They are typically low end routers , Low in terms of cost , Processing , and also number of ports .
2.Distribution Layer
3.Core layer– high speed routers

intel celeron processors – P4 - MS office and internet
i3 i5 i7 processors – Java and programming languages
intel xeon itanium processors – High speed processors – Server based applications

Communication between networks connected to edge routers will have less traffic ,
communication between two different networks' between two core layer routers will have more traffic .

Switches

NOTE : Access Layers	Distribution layer	Nexus – Only in DATA centers .
3850	4500x vss	5k
3650	9500 virtual stack	7k
		9k

Access Layer Router

- Routers which are used by the Small Organization and are also known as Desktop or Company Layer Routers.

Router Series : 800, 1000, 1600, 1700, 1800,2500

Dist Routers :
2600 , 2800 , 3700 , 3800 .

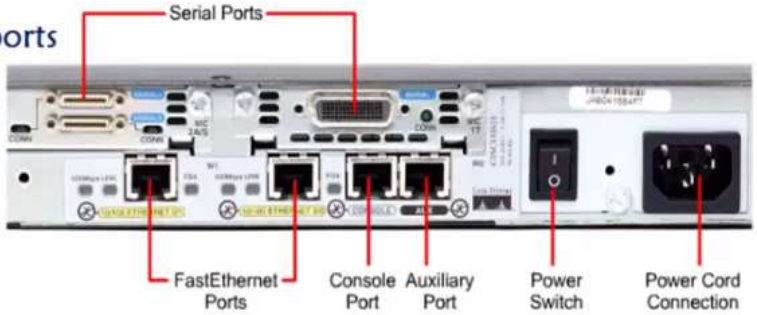
Core layer routers :
6400 , 7200 , 8000 , 9000 .

Router Classification .

FIXED ROUTER	MODULAR ROUTER
• All ports are integrated on motherboard (no Slots) • Non Upgradable cannot add and remove the interfaces • 2500, 800 series routers	• Have Slots where you can add or remove cards • Distribution and Core Layer Routers example of Modular Router • 1600,1700,1800, 2600,2800,3600,3700

External Ports of Router

LAN , WAN , admin ports



LAN Ports: (RJ45)

- Ethernet 10 Mbps
- Fast Ethernet 100 Mpbs
- Gig Ethernet 1000 Mbps

WAN ports

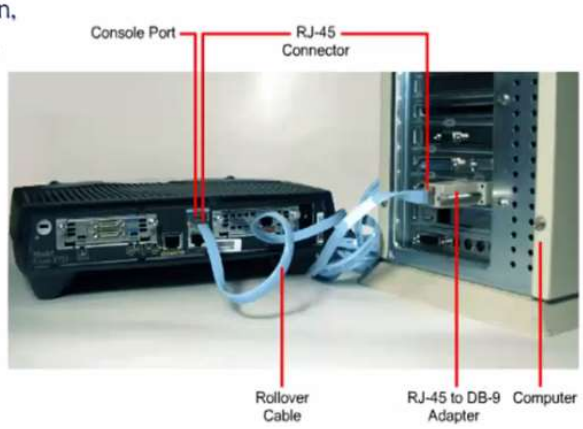
- Serial ports
- 60 pin or 26 pin smart serial

26 Pin serial ports are called <u>smart serial ports</u>

Admin ports carry commands , Not traffic .

Console Port

- Used for local administration ,
  Initial Configuration,
  Password Recovery
- It is RJ45 Port

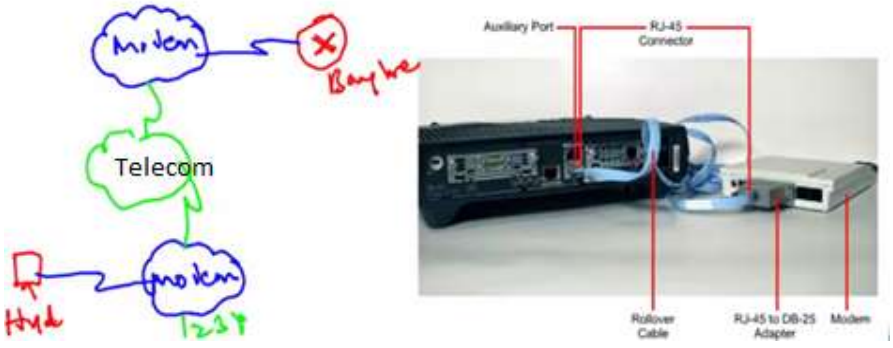


Putty terminal software . / HyperTerminal .

Auxiliary Port

- Used for remote administration.
- Its an RJ-45 port
- A console or a rollover cable is to be used.

Remotely



AUX port is used to access the device remotely through dail – Up modem . But disadvantages are

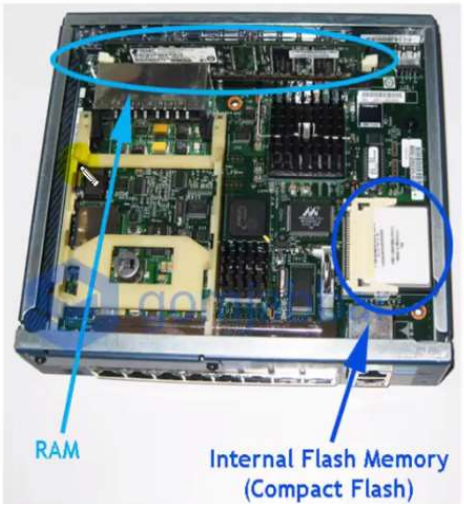
Auxiliary port disadvantages .

1.No reliable

2. Does not support high speed

There is one more way to access the device remotely – telnet / SSH

Internal Components



Internal Components

POST
power on self test Checks the hardware

ROM
loads the bootstrap programs and searches for the IOS (Flash/ TFTP/ROM)

FLASH
Stores IOS

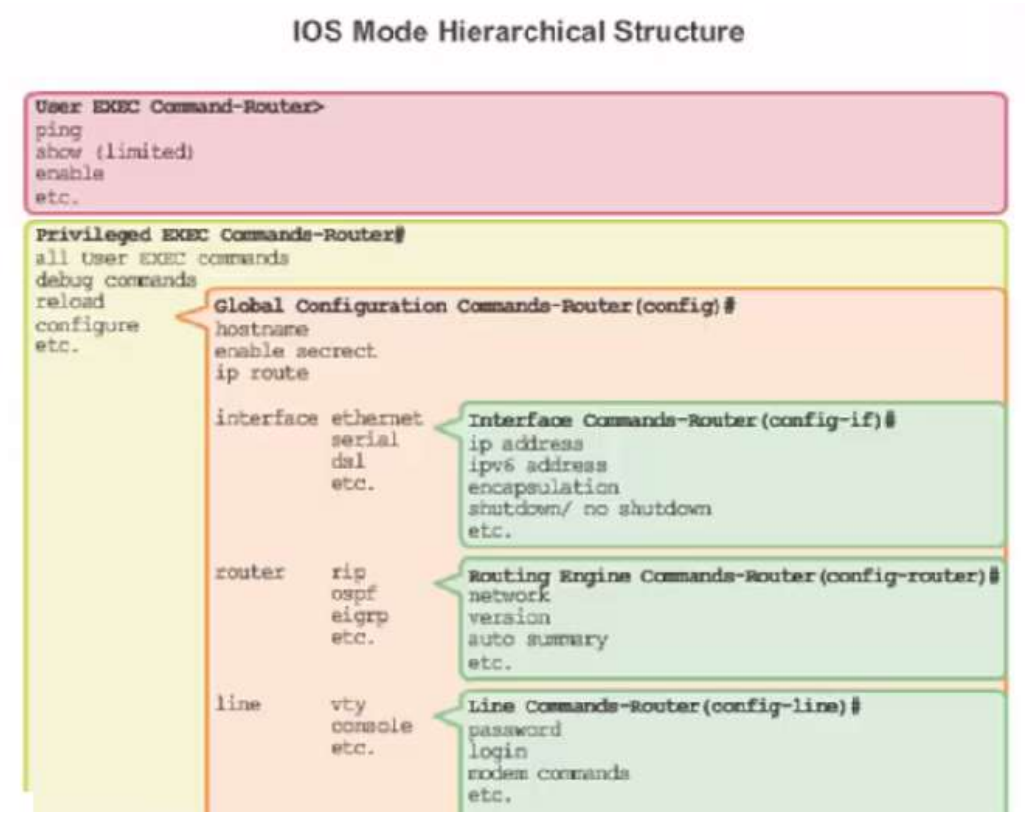
NVRAM
Stores configurations (permanent)
Startup-config

RAM
Stores Configurations (temporary)
Running-config

Booting Process .

POST , ROM , Flash , NVRAM , RAM – Setup mode ,

Cisco Router Modes .



Setup Mode :-

- If NVRAM is Blank

User Mode:-

- Only some basic monitoring

Privileged Mode:-

- monitoring and some troubl Ctrl poting

Global Configuration mode:-

- All Configurations that effect the router globally

Interface mode:-

- Configurations done on the specific interface

Rommon Mode:-

- Reverting Password

User mode : Basic Ping , Basic Trace , Basic show commands .
If you want to do complete monitoring , Complete show commands then PM .
100 per commands only show . Any changes then Global config mode .

1. Basic configuration 2. Router CLI modes 3. Configure Password(Secret,Telnet, Console) 4. Configure hostname & login banner 5. Encrypt password,CDP,

Setting up passwords .

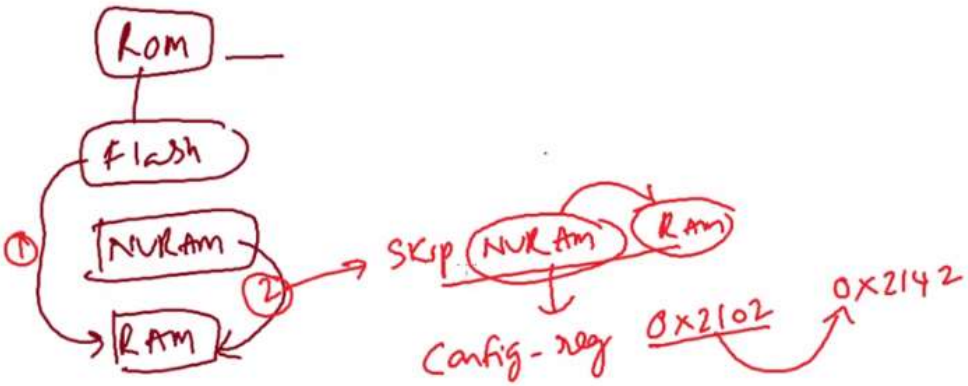
Enable password / Enable secret
Console password .
Telnet Password .

Save and remove all configurations .

Router#**erase startup-config**
Router#**reload**

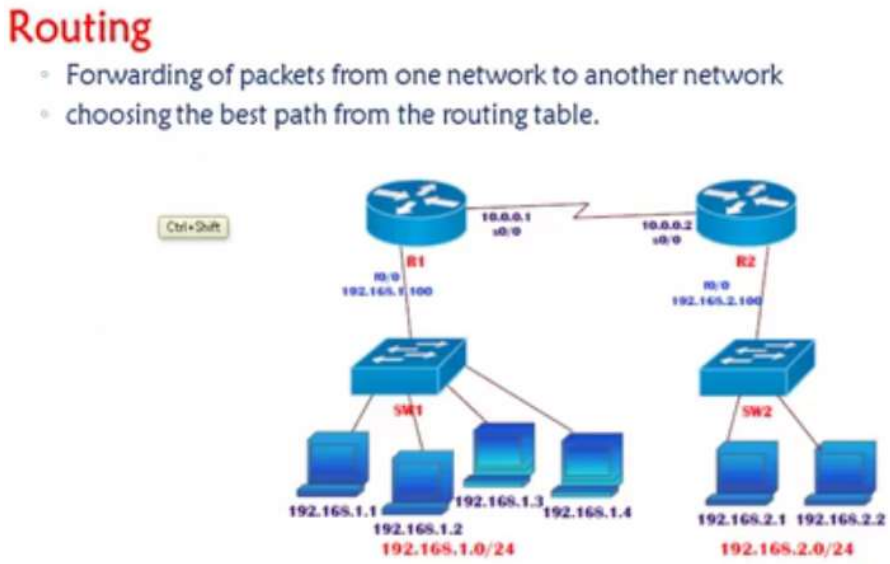
Password recovery .

This is done when routers kept on store are taken for new implementation , or old admin didn't save the password correctly or incorrect password . Then we will not be able to access the router so we need to make some password recovery mechanisms .



Show version – default is 2102 .
Ctr + PauseBreak / Ctr + shift + Pausebreak
ROMMON> Confreg 2142
ROMMON> Reset

Routing



Even though all the devices are connected , Lins are UP and IP address are given still we cannot communicate between 192.168.1. network to 2. Network , Hence we need routing .
Three Types of routing .
Static ,
Default ,
Dynamic .

Difference between Static and Dynamic is , In static administrator will be deciding the best route in dynamic routing protocols will automatically decide the best route .
Default routing generally used in internet connections .

Static Routing

- It is configured by Administrator manually.
- Mandatory need of Destination Network ID
- It is Secure & fast
- Used for Small organizations with a network of 10-15 Routers.
- Administrative distance for Static Route is 0 and 1.
  - It is the "trustworthiness" of the routing information. Lesser the Administrative distance, higher the preference.

Disadvantages :-

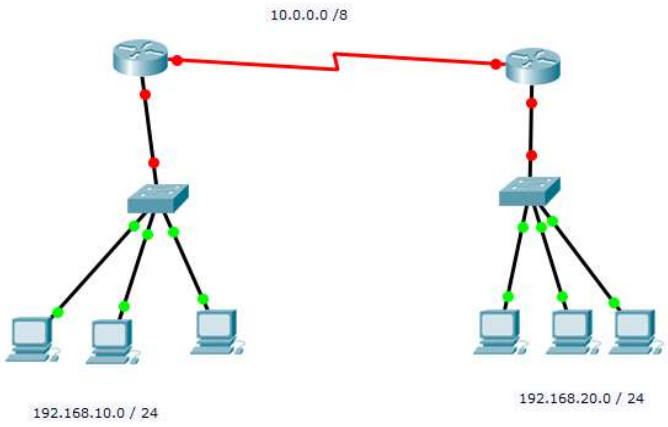
- Used for small network.
- Everything to manually
- Network change effect complete n/W

Configuring Static Route

Router(config)#

ip route <Destination Network ID> <Destination Subnet Mask> <Next-hop IP address >

Lab :



Show IP Route , Ping , Traceroute .
Lab Task : 3 Routers .

<u>Default Routing</u>

Default route which is also known as the gateway of last resort, is used in forwarding packets whose destination address does not match any route in the routing table .

Dynamic Routing

Advantages of Dynamic over static :

- Works with advertisements (of directly connected networks)
- No need to know the destination networks.
- Updates the topology changes dynamically.
- Administrative work is reduced
- Used for large organizations.
- Neighbor routers exchange routing information and build the routing table automatically.

Types of Dynamic Routing Protocols

- Distance Vector Protocol
- Link State Protocol
- Hybrid Protocol

Distance Vector	Link State	Hybrid (Advance Distance vector Protocol)
Works with Bellman Ford algorithm	Works with Dijkstra algorithm	Works with DUAL algorithm
Periodic updates	Incremental updates Link state updates	Incremental updates
Full Routing tables are exchanged	Missing routes are exchanged	Missing routes are exchanged
Classful routing protocol	Classless routing protocol	Classless routing protocol
Updates are through broadcast	Updates are through multicast	Updates are through multicast
Example: RIP v1, RIPv2, IGRP	Example : OSPF, IS-IS	Example : EIGRP
Less overhead	More overhead	Less overhead
Easy to configure	Difficult to configure	Easy to configure

Classful Protocols:

- Classful routing protocol do not carry the subnet mask information along with updates
- which means that all devices in the network must use the same subnet mask (FLSM or default)
  - Ex : RIPv1 , IGRP

Classless Protocols:

- Classless routing protocol carry the subnet mask information along with updates
- That's why they support sub networks(VLSM and FLSM) and default networks also
  - Ex : RIPv2 , EIGRP , OSPF, IS-IS

Routing Information Protocol

- Open Standard Protocol
- Classful routing protocol
- Updates are broadcasted via 255.255.255.255
- Metric : Hop count
- Load Balancing of 4 equal paths
- Max Hop counts : 15 Max routers : 16
- Used for small organizations
- Exchange entire routing table for every 30 second
- Administrative distance is 120

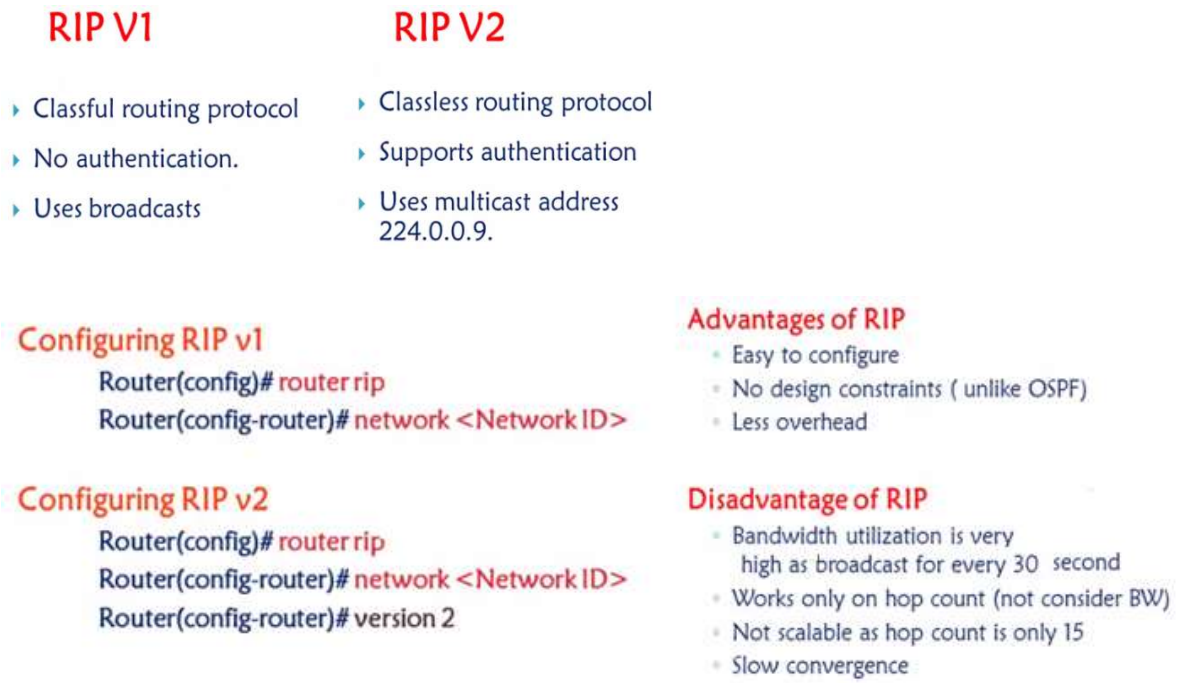
RIP TIMERS

UPDATE timer = 30Sec. Every router will share its complete routing table with its neighbors once in 30 sec .
INVALID timer = 180 [30+150] , 31st sec – If any link goes down none of the Update will be shared to any of its neighbors as they will wait till 180 sec hoping it will come up again .
FLUSH timer = 60sec more 240 sec , [180+60] – Removal of entry from Routing table .
HOLDDOWN timer = 180sec – In general whenever there is a new update , It will wait for 180 sec for the best route calculation .

In RIP Convergence time is 240sec .
EIGRP = 15sec
OSPF = 40sec

Rip Timers

- Update timer : 30 sec
  - Time between consecutive updates
- Invalid timer : 180 sec
  - Time a router waits to hear updates
  - The route is marked unreachable if there is no update during this interval.
- Flush timer : 240 sec
  - Time before the invalid route is purged from the routing table
- Hold Down timer : 180 Sec
  - Stabilizes routing information and helps preventing routing loops during periods when the topology is converging on new information.



Problem with RIP (Slow Coverage time, Routing loop, Count to Infinity and DV Algorithm)
Loops : Loops are something where a Circle start and end point both are same.

Routing Loops : Occur when the router forward packets such that the same single packet ends up back at the same routers repeatedly.
A routing loop is a serious network problem which happens when a data packet is continually routed through the same routers over and over. The data packets continue to be routed within the network in an endless circle

Counting to infinity problem: Because of this issue loop prevention methods were found in RIP.

Route poisoning: The practice of advertising a route with a special metric value of 16 called infinity.

Split Horizon: In computer networking, ***split-horizon*** route advertisement is a method of preventing routing loops in distance-vector routing protocols by prohibiting a router from advertising a route back onto the interface from which it was learned

Poison reverse: In a computer network that uses the Routing Information Protocol (**RIP**) or other distance vector routing protocols, a **poison reverse** is a way in which a gateway node tells its neighbor gateways that one of the gateways is no longer connected.

Routing Loops and Prevention methods

Routing loops : A **routing loop** is a serious network problem which happens when a data packet is continually routed through the same **routers** over and over. The data packets continue to be routed within the network in an endless circle

In RIP there are 4 loop prevention methods .

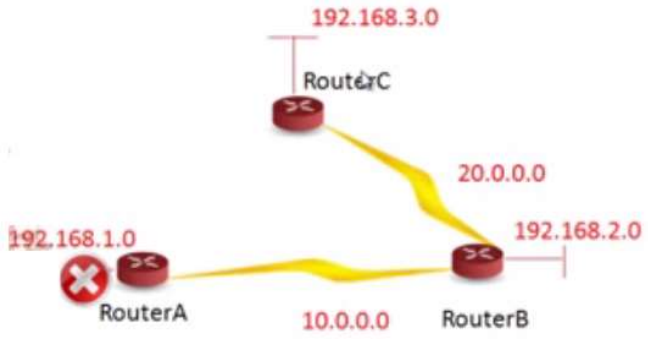
RIP Loop Prevention

- Route Poisoning
- Split Horizon
- Poison Reverse and Triggered Updates

And Hold down timer.

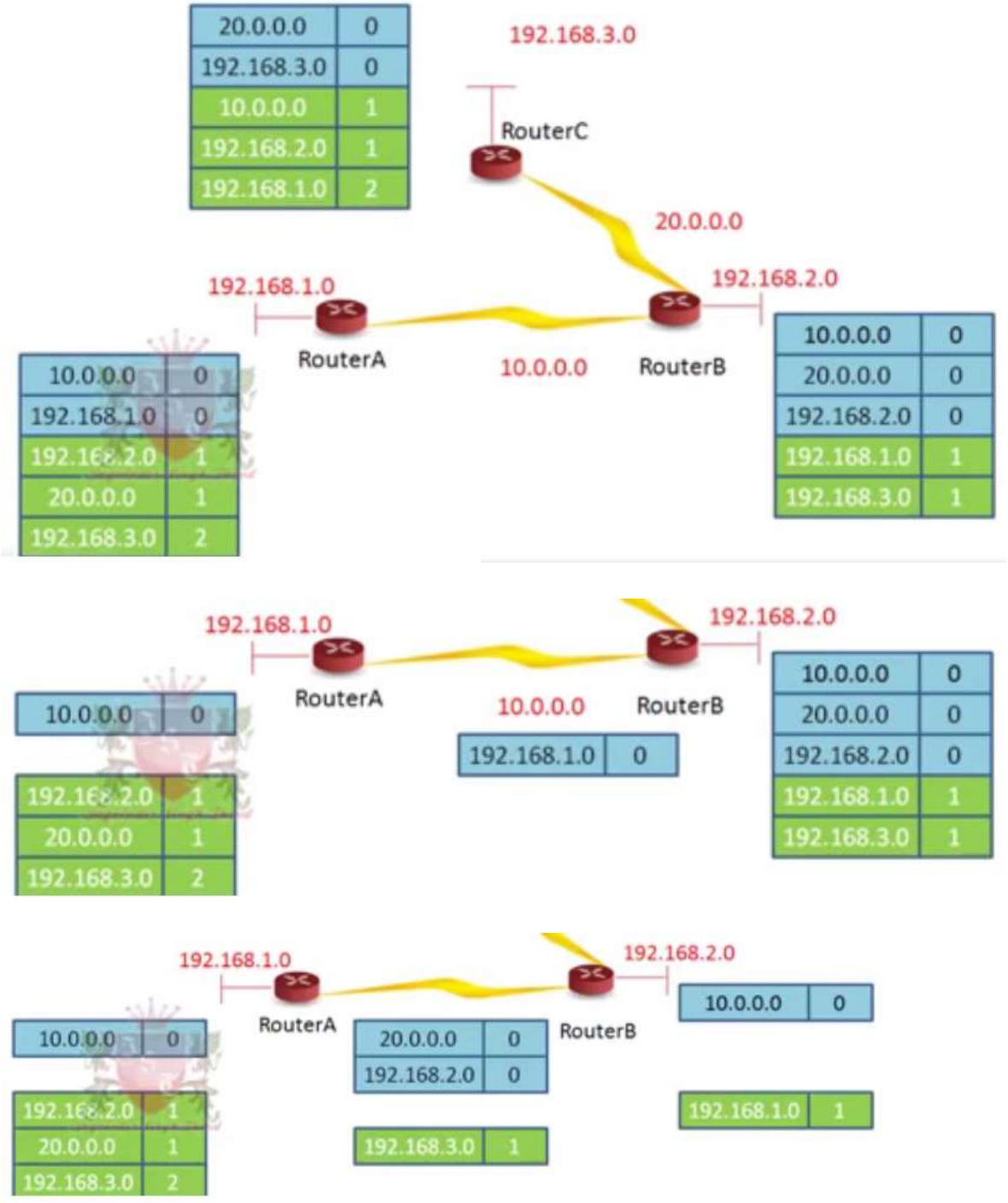
1.**Route poisoning**

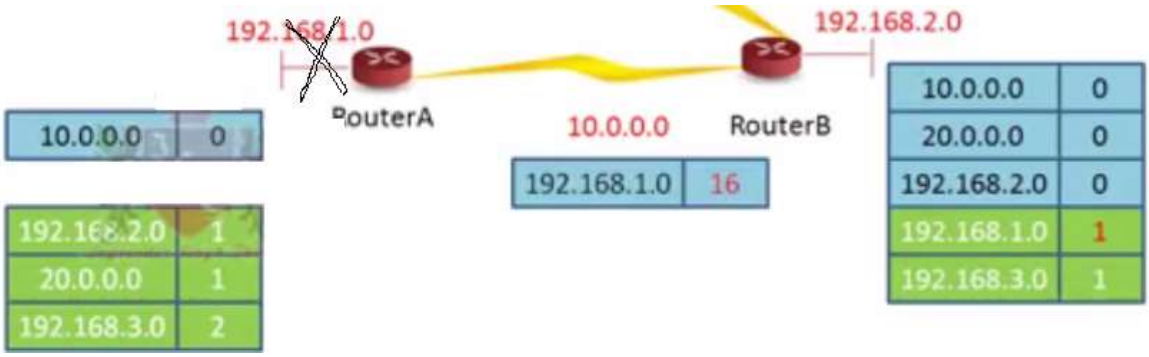
- The practice of advertising a route, but with a special metric value called infinity



Spit horizon and poison reverse – for LTI

- A method of preventing routing loops in distance-vector routing protocols
- Prohibiting a router from advertising a route back onto the interface from which it was learned

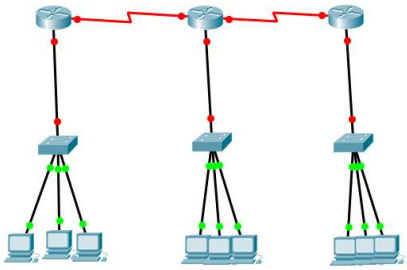




Poison Reverse

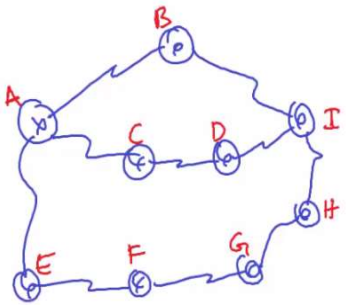
When a router knows about a failed network , it will send triggered updates to all the neighbors breaking even the split horizon rule .

LAB :



Administrative Distance

- Trust worthiness of the information received by the router.
- The Number is between 0 and 255
- Less value is more trusted.
- Default administrative distances
  - Directly Connected = 0
  - Static Route = 1
  - IGRP = 100
  - EIGRP = 90
  - OSPF = 110
  - RIP = 120



A ⇒ I hops

ABI - 2

ACDI - 3

AEFGHI - 5

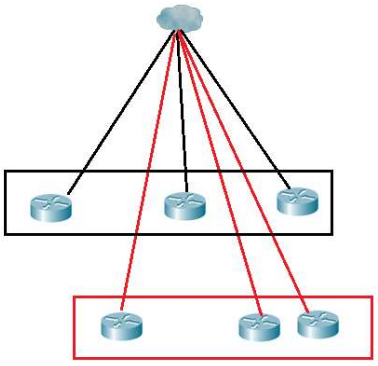
ABI – 100Mbps – EIGRP , ACDI – 80Mbps – RIP , AEFGHI – 10Mbps - Static.

Autonomous System Number

- A unique number identifying the Routing domain of the routers.
- An autonomous system is a collection of networks under a common administrative domain

Ranges from 1- 65535

Public AS (in between muliple SP)	1 – 64512
Private AS (same SP)	64513 – 65535



How the SP will differentiate the traffic coming from ABC company and XYZ company – Through Autonomous System number . NOTE : Circuit ID is different .

Private AS system number , Airtel and TATA both can use same AS numbers, no issue as it is used within the SP so no issues . Public AS are used to connect between two different SP .

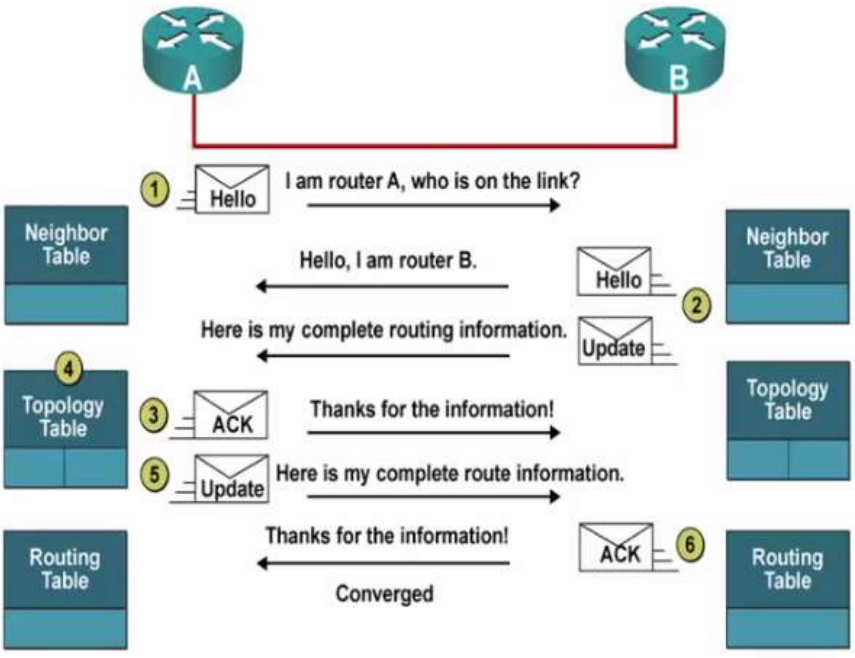
Similar to public and Private IP address .

Once we now what is Autonomous system number – there are two protocol categories – IBGP and EBGP .

Enhanced Interior Gateway Routing Protocol

- Advanced distance vector
- Standard protocol (initially was cisco proprietary)
- Classless routing protocol
- Includes all features of IGRP
- Max Hop count is 255 (100 by default)
- Administrative distance is 90
- Flexible network design
- Multicast and unicast instead of broadcast address
- 100% loop-free classless routing
- Easy configuration for WANs and LANs

- Updates are through Multicast (224.0.0.10)
- Hello packets are sent every 5 seconds
- Convergence rate is fast
- Supports IP, IPX and Apple Talk protocols
- It uses DUAL (diffusion update algorithm)
- Supports equal cost an unequal cost load balancing



Hello all I am running EIGRP is there anyone else who is running the same and it will send multicast 224.0.0.10 , All EIGRP listen at this address . If any router is not running EIGRP they will not get these hello msgs neither they will understand .

Topology table will have a list of all best routes , This is when it will run DUAL algorithm and find out the best routes .

EIGRP Tables

1. Neighbor table
   - Contains list of directly connected routers
   - **# show ip eigrp neighbor**

2. Topology table
   - List of all the best routes learned from each neighbor
   - **# Show ip eigrp topology**

3. Routing table
   - The best route to the destination
   - **# show ip route**

Packet Type	Description
Hello	Used to discover other EIGRP routers in the network.
Acknowledgement	Used to acknowledge the receipt of any EIGRP packet.
Update	Convey routing information to known destinations.
Query	Used to request specific information from a neighbor router.
Reply	Used to respond to a query.

EIGRP Metric

- EIGRP uses BW + Delay + load + MTU + reliability
- By default uses BW and Delay in the metric calculation
- Formula with default K values **(K1 = 1, K2 = 0, K3 = 1, K4 = 0, K5 = 0):**

  Metric = [K1 * BW + ((K2 * BW) / (256 – load)) + K3 * delay]

K1 , Bandwidth : Serial link - 1544bps If required we can change these bandwidths.
Ethernet – 10Mbps
Fast E – 100
GiG E – 1000

EIGRP calculates interface bandwidth .

NOTE: While selecting the BW its gonna take the least bandwidth , But not the addition of all bandwidth .

Changing the bandwidth – show interface serial 2/0 , interface serial 2/0 , bandwidth 1000 done.

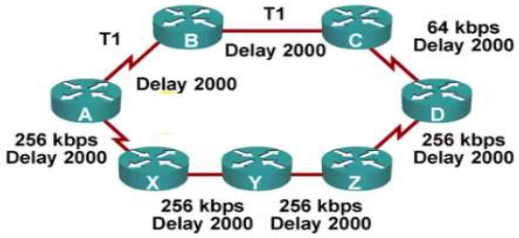
K3 , Delay : Default delay on Serial link :20000 micro sec , Eth – 200micro sec , FE – 100ms , GE-10ms , show interface serial 2/0 , interface serial 2/0 , delay ?

NOTE : While calculating delay – It is the sum of all delays .

K2 , Load – Amount of traffic moving in the link . 1- 255 , If its 1 less traffic – 255 Highest traffic

K4 , MTU – When we send traffic it will be divided into segments and each segment becomes packet and this is called MTU default 1500 bytes

K5 , Reliability – Status of the link , The amount of packets dropped , 1-255 .



A → B → C → D	Least bandwidth 64 kbps	Total delay 6,000
A → X → Y → Z → D	Least bandwidth 256 kbps	Total delay 8,000

- **Delay** is the sum of all the delays of the links along the paths:
  Delay = [delay in tens of microseconds] x 256
- **Bandwidth** is the lowest bandwidth of the links along the paths:
  Bandwidth = [10,000,000 / (bandwidth in kbps)] x 256

Configuring EIGRP

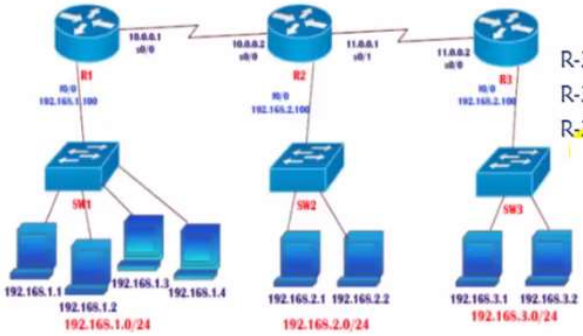
Router(config)# **router eigrp** <AS NO>
Router(config-router)# **network** <Network ID>

AS No : 1 - 65535

LAB : Routing using EIGRP

R-1(config)# **router eigrp 100**
R-1(config-router)# **network 192.168.1.0**
R-1(config-router)# **network 10.0.0.0**

R-2(config)#**router eigrp 100**
R-2(config-router)# **network 192.168.2.0**
R-2(config-router)# **network 11.0.0.0**
R-2(config-router)# **network 10.0.0.0**



R-3(config)# **router eigrp 100**
R-3(config-router)# **network 192.168.3.0**
R-3(config-router)# **network 11.0.0.0**

No Auto summary Lab .

Dual Terminology

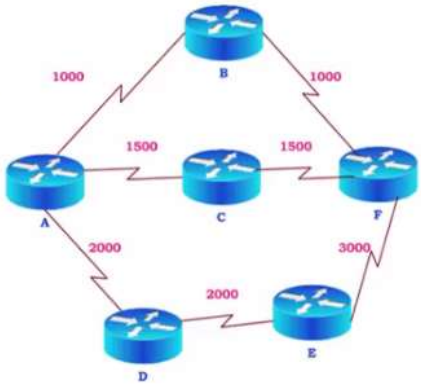
Feasible Distance

Total cost from local router to destination

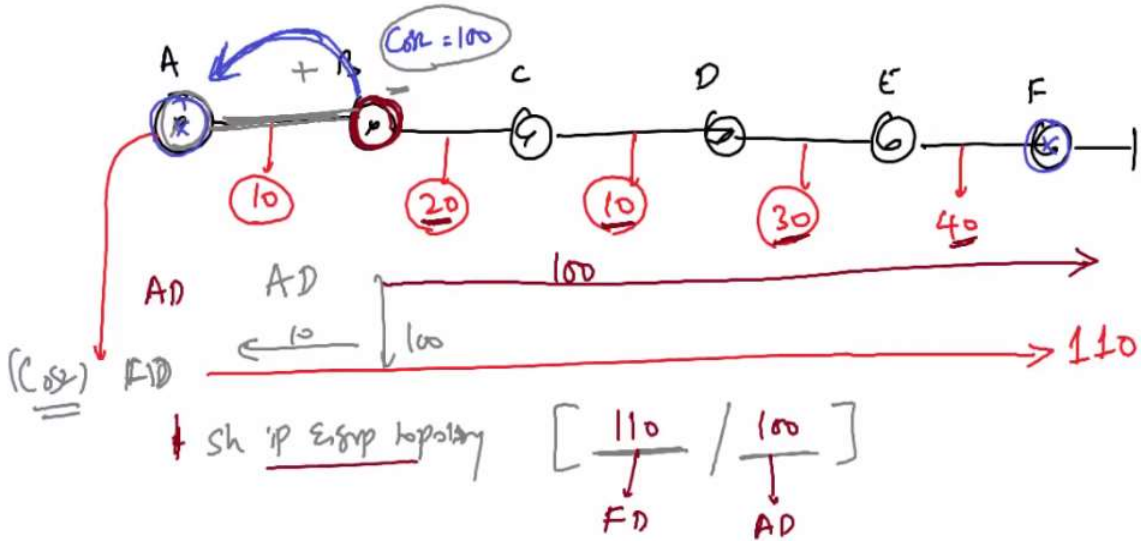
cost from local router = AD of next-hop router + cost between the local router and the next-hop router

Advertise Distance

Cost from the next-hop router to the destination



S.NO	A TO F	FEASIBLE DISTANCE	ADVERTISE DISTANCE
1	ABF	**2000**	1000
2	ACF	3000	**1500**
3	ADEF	7000	5000



EIGRP also pre-calculates the second best route if satisfy the feasibility condition	
Successor :	*best route to the destination*
Feasible successor :	*backup path*

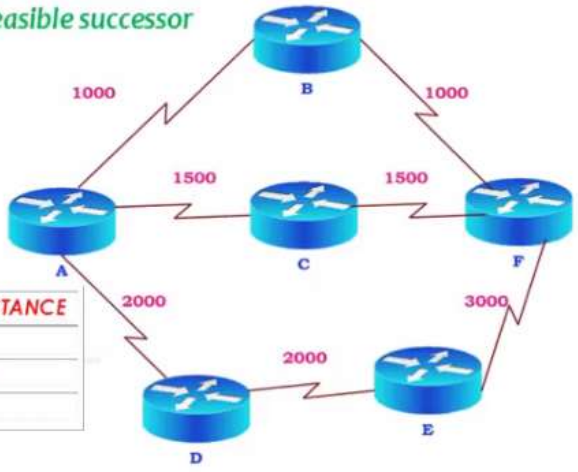
Feasibility Condition:

FD of current successor route > AD of feasible successor

EIGRP with feasible successor(second best path)

Feasibility Condition:

FD of current successor route > AD of feasible successor

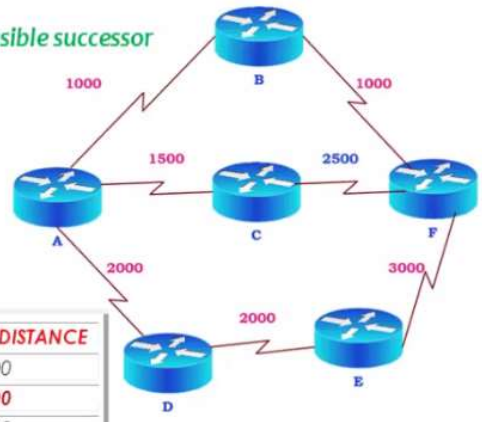


S.NO	A TO F	FEASIBLE DISTANCE	ADVERTISE DISTANCE
1	ABF	**2000**	1000
2	ACF	3000	**1500**
3	ADEF	7000	5000

EIGRP without feasible successor

Feasibility Condition:

FD of current successor route > AD of feasible successor



S.NO	A TO F	FEASIBLE DISTANCE	ADVERTISE DISTANCE
1	ABF	2000	1000
2	ACF	4000	2500
3	ADEF	7000	5000

IN this scenario QUERY and REPLY messages will be sent .

When a router looses its best route (successor) for a network and there is no backup route (feasible successor) for it, the router sends an **EIGRP query message** to locate any alternate routes for that network. When a **QUERY** is sent the router expects a **REPLY message** containing the whereabouts of the route

If the router that sends out a Query does **not receive** a **response** from any of its neighbors, it resends the Query as a Unicast packet to the non-responsive neighbor(s). If no **response** is **received** in 16 attempts, the **EIGRP** neighbor relationship is reset

Passive-interface command is used in all routing protocols to disable sending updates out from a specific interface. However the command behavior varies from one protocol to another.

In RIP this command will disable sending multicast updates via a specific interface but will allow listening to incoming updates from other RIP speaking neighbors.

This simply means that the router will still be able to receive updates on that passive interface and use them in the routing table.
In EIGRP the passive-interface command stops sending outgoing hello packets, hence the router can not form any neighbor relationship via the passive interface. This behavior stops both outgoing and incoming routing updates.

In OSPF the passive-interface has a similar behavior to EIGRP. The command suppresses hello packets and hence neighbor relationships.

OPSF

OSPF

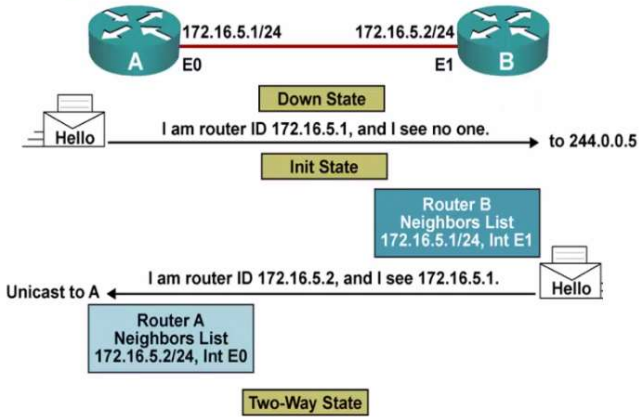
- OSPF stand for Open Shortest path first
- Standard protocol
- It's a link state protocol
- It uses SPF (shortest path first) or dijkistra algorithm
- Unlimited hop count
- Metric is cost (cost=10 ^8/B.W.)
- Administrative distance is 110
- It is a classless routing protocol
- It supports VLSM and CIDR
- It supports only equal cost load balancing
- Introduces the concept of Area's to ease management and control traffic
- Updates are sent through multicast address 224.0.0.5
- Faster convergence.
- Sends Hello packet every 10 seconds & Dead = 40 sec
- Incremental updates

The OSPF timers on a Cisco router depend on what time of interface they are used on.

By default the timers on a broadcast network which include Ethernet, point-to-point and point-to-multipoint are 10 seconds hello and 40 seconds dead. The timers on a non-broadcast network are 30 seconds hello 120 seconds dead.

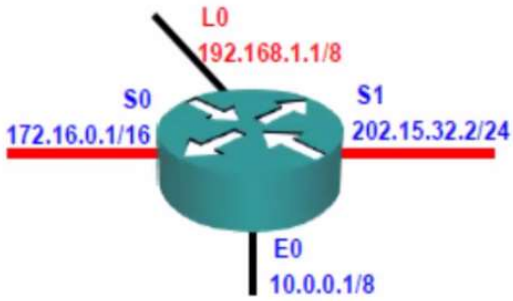
Incremental updates meaning - Updates will be sent only if there is a change

Establishing Bidirectional Communication

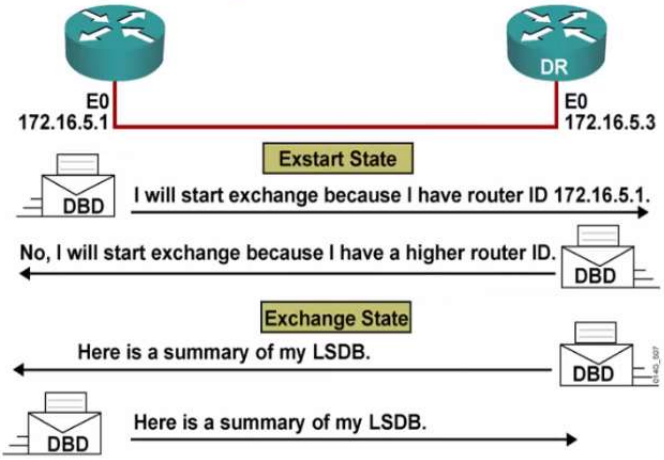


Router ID

- The highest IP address of the active physical interface of the router is Router ID.
- If logical interface is configured, the highest IP address of the logical interface is Router ID



Discovering the Network Routes



OSPF Tables

Neighbor Table

- Also known as the adjacency database
- Contains list of directly connected routers (neighbors)
- **# Show ip ospf neighbor**

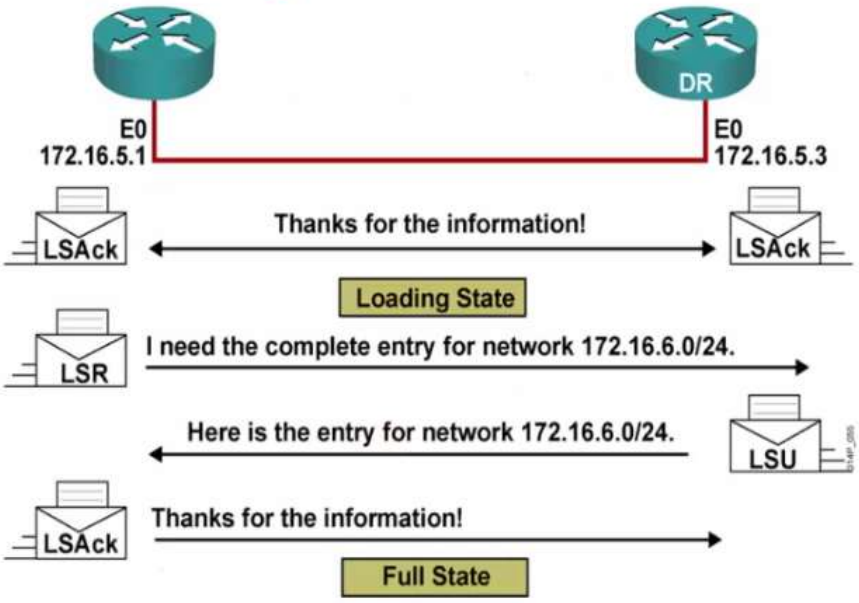
Database Table

- Typically referred to as LSDB (link state database)
- Contains information about all the possible routes to the networks with in the area
- **# show ip ospf database**

Routing Table

- Contains list of best paths to each destination
- **# show ip route**

Adding the Link-State Entries



Link-state update (LSU) packets contain different types of link-state advertisements (LSAs). The LSUs are used to reply to link-state requests (LSRs) and to announce new information.

When an OSPF network is converged and no network topology change has been detected by a router, how often will LSU packets be sent to neighboring routers – 30 min

After all LSRs have been satisfied for a given router, the adjacent routers are considered synchronized and in a full state. Updates (LSUs) are sent to neighbors only under the following conditions:

when a network topology change is detected (incremental updates)

OSPF loop avoidance

There is no loop avoidance in OSPF,like those you would see in distance-vector routing protocols.The loop avoidance is inherent in the SPF algorithm,which OSPF (as a link-state routing protocol) uses to calculate routes.This way, a tree is built for each router with itself as the root.Trees by definition do not have loops.Extensions to this tree exist only for load-balancing reason

In EIGRP

"To be considered a feasible successor, the Advertise distance must be less than the feasible distance of the successor".

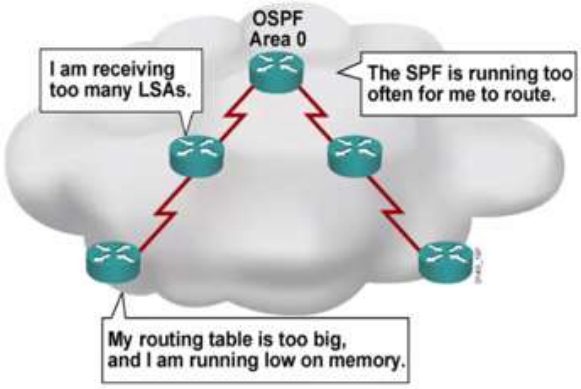
Let's say you call your neighbor and tell him you have the best route to get to the grocery store. It's only 5 blocks away. One of your neighbors tells you he can get there in 7 blocks. You still have the better path. Your other neighbor calls and says they can get there in 4 blocks. Well, your neighbor has a better distance. The neighbor that is 4 blocks away isn't going to drive to your house first to get to the store. The idea here is that if you hear an advertisement to a destination that is better than your own, then obviously they can't be routing THROUGH you, so there can't possibly be a loop.

- The hello packet
- The Database Description **Packet** : ...
- The Link State Request **packet** : ...
- The Link State Update **packets**: ...
- The Link State Acknowledge **packets**

OSPF Areas

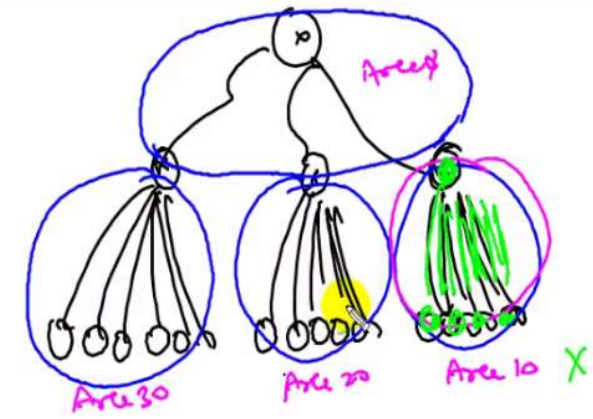
- All the routers maintain same database.
- Any change impact all the routers.
- Area is logical grouping of Routers.

Issues with Maintaining a Large OSPF Network



OSPF Area Design **Advantages**

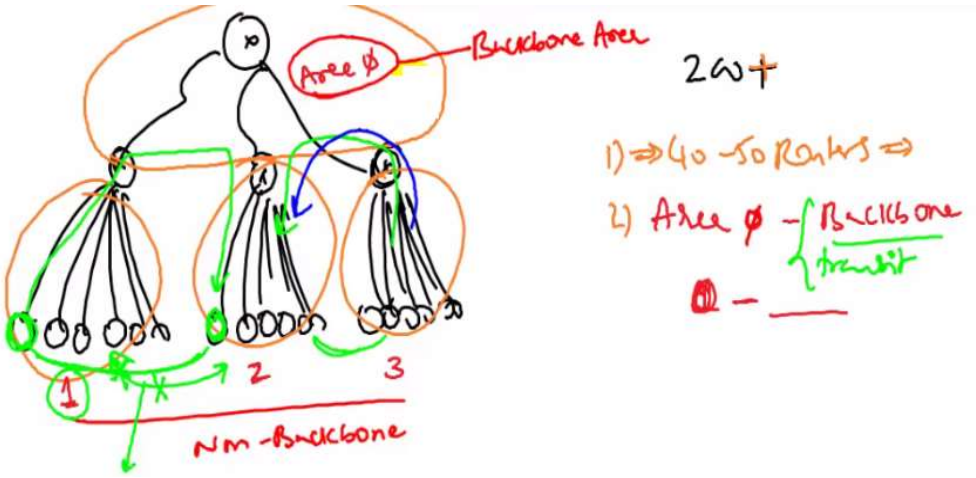
Using **areas** improves **OSPF** operations in many ways, particularly in larger internetworks: * The smaller per-**area** LSDB requires less memory. * The router requires fewer CPU cycles to process the smaller per-**area** LSDB with the SPF algorithm, reducing CPU overhead and improving convergence time.



2w+

OSPF AREAS

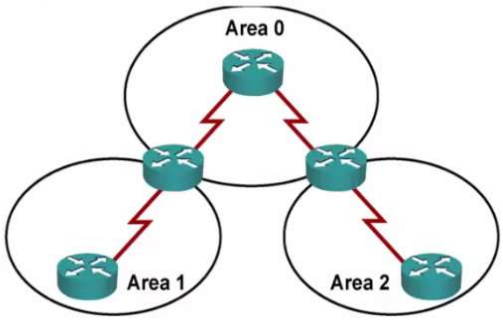
{all Routers — Same Database within Area



OSPF Router Types

- Internal **Router**. —A **router** with that has **OSPF** neighbor relationships only with devices in the same area.
- Area Border **Router** (ABR) —A **router** that has **OSPF** neighbor relationships with devices in multiple **OSPF** areas. ...
- Backbone **Router**. ...
- Autonomous System Boundary **Router** (ASBR)

The Solution: OSPF Hierarchical Routing



- Minimizes size of database
- Restrict any changes with in that area.(not flood outside area)
- Routers with in the same area participate in Algorithm

OSPF Areas

- Area is logical grouping of Routers .
- OSPF Provides hierarchical network design with multiple different areas
- All the routers maintain same database with in the same Area.
- Any change impact all the routers with the same area.

Rules:

1. Must have one area called as area 0 (its backbone area)
2. All the areas must connect to area 0.
3. At least one Area Border Router.
4. Interfaces of both routers facing must be in the same Area.

Advantages of OSPF

- Open standard
- No hop count limitations
- Loop free
- Faster convergence

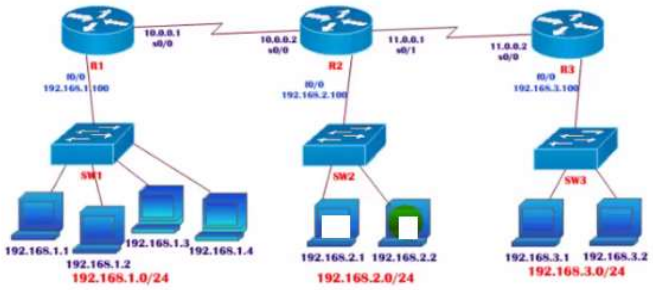
Disadvantages of OSPF

- Consume more CPU resources.
- Complex design
- Support only equal cost balancing
- Support only IP protocol don't work on IPX and APPLE Talk.

Configuring OSPF

(config)# router ospf <process ID>

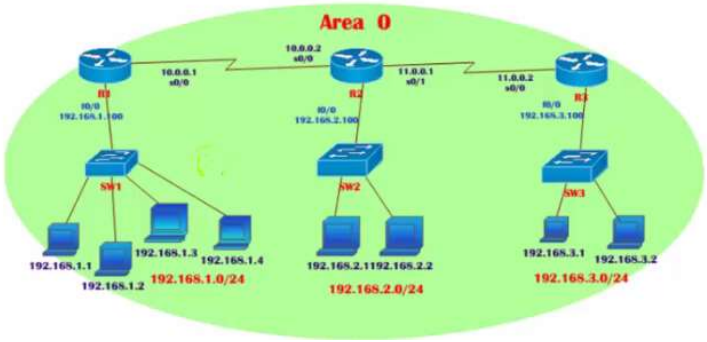
(config-router)# network <Network ID> <wildcard mask> area <area id>



[1-65535] Process ID Defines the OSPF Process running on a router .
WCM – Opp of subnet mask .

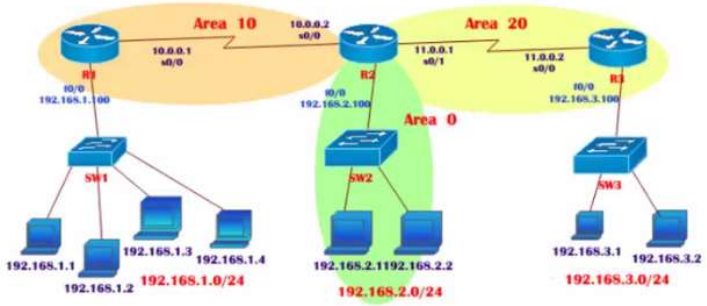
LAB: OSPF Single Area

```
R-1(config)#router ospf 1
R-1(config-router)#network 192.168.1.0 0.0.0.255 area 0
R-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
```



LAB: OSPF using Multiple Areas

```
R-1(config)#router ospf 1
R-1(config-router)#network 192.168.1.0 0.0.0.255 area 10
R-1(config-router)#network 10.0.0.0 0.255.255.255 area 10
```



Show ip Protocols .
Show ip OSPF neighbours . Repeat .
Show ip route

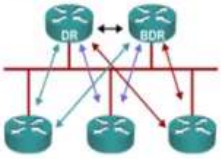
OSPF Multi Areas . – Show ip route [IA - Routes]

DR and BDR

OSPF NETWORK TYPES

- Point-to-Point

- Broadcast Multi Access networks

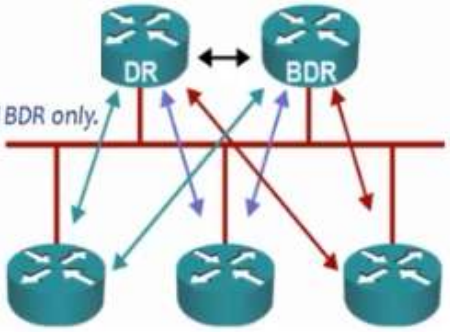


- NBMA (non Broadcast multi Access)

BCMA – Accessing multiple devices where there is a possibility of Broadcast – This type of Bcma is seen Metro Ethernet connections very common

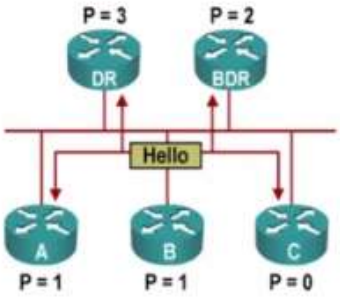
Broadcast Multi Access networks

- LAN technologies like Ethernet and Token Ring.
- DR and BDR selection are required.
- OSPF detects this type of link automatically.
- All neighbor routers form full adjacencies with the DR and BDR only.



DR & BDR

- The router having highest priority is DR
- The router with second-highest priority is BDR
- The default priority value is 1
- In the case of a tie, router with highest router ID is DR second highest router ID becomes the BDR
- If router priority is 0 it cannot become the DR or BDR
- Router which is not a DR or BDR is called as DROTHER
- DR & BDR election is not preemptive



Router(config)#**interface** <type> <no>
Router(config-if)#**ip ospf priority** <0-255>

NON – Preemptive , if we want to reset then clear IP OSPF process .

DR/BDR Elections Neighbors

DR/BDR →DROTHER → Full

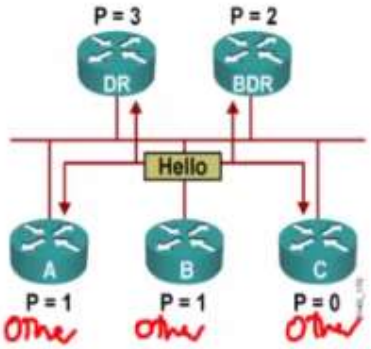
DROTHER → DR/BDR → Full

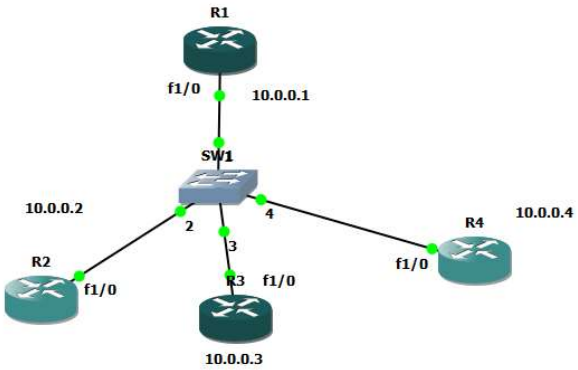
DROTHER → DROTHER → 2 Way

Updates

DROTHER → DR/BDR → 224.0.0.6

DR → DROTHER → 224.0.0.5

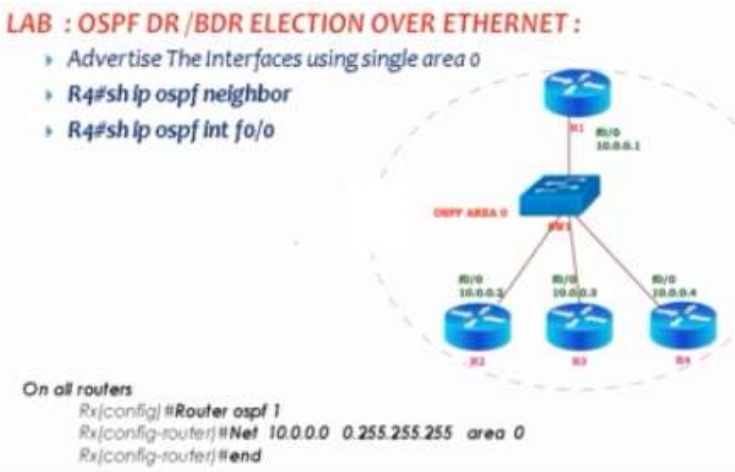




show ip ospf neighbor

show ip ospf interface fastEthernet 1/0

change Priority values – IP OSPF priority number



LSA Advertisements

LSA Type	Description
1	Router LSAs
2	Network LSAs
3 or 4	Summary LSAs
5	Autonomous system external LSAs
6	Multicast OSPF LSA
7	Defined for not-so-stubby areas
8	External attributes LSA for Border Gateway Protocol (BGP)
9, 10, 11	Opaque LSAs

Re: OSPF LSA Types

- **LSA Type** 1: Router **LSA**.
- **LSA Type** 2: Network **LSA**.
- **LSA Type** 3: Summary **LSA**.
- **LSA Type** 4: Summary ASBR **LSA**.
- **LSA Type** 5: Autonomous system external **LSA**.
- **LSA Type** 6: Multicast OSPF **LSA**.
- **LSA Type** 7: Not-so-stubby area **LSA**.
- **LSA Type** 8: External attribute **LSA** for BGP.

1-5 Main LSA s
9,10,11 - Used in MPLS traffic
8 – 11 Advanced LSA s used in BGP

LSA1 – Update sent by one router to another router within a same area . O routes – Same area

- *generated by the internal router*
- *Floods within its area only; does not cross the ABR*
- *"O" routes in the routing table*

LSA2 - Update sent by DR router to other router within a same area – O routes – Same area

LSA3 – Generated by ABR , Updates sent by ABR from one area to another area –OIA routes – Diff Area

LSA4 - Generated by ABR , ABR will tell who is the ASBR and who is doing the redistribution of EIGRP to all the internal routers

LSA5 – Generated by ASBR , Updates / Information from another autonomous system advertised to OSPF routes – OE1 / OE2 routes – xternal routes

LSA-6 Multicast OSPF LSA

- *used in multicast routing (MOSPF routing protocol)*
- *Multicast LSA (Cisco routers don't support)*

Parse mode , dense mode protocols which is not available in cisco routes .