

## 5) Broadband Router

provides high speed Internet access to computer.

### Benefits of Router

- 1) Security
- 2) Performance Enhancement
- 3) Reliability
- 4) Networking Range.

### Routing Protocols

- 1) **OSPF** Open shortest path first.
- 2) **BGP** Border gateway protocol
- 3) **IGRP** Interior gateway Protocol.
- 4) **EIGRP** Enhanced Interior Gateway Protocol.
- 5) **EGP** Exterior Gateway Protocol.
- 6) **RIP** Routing Information Protocol.

## Features

- 1) works on 3rd layer.
- 2) provides high speed connectivity
- 3) allows user to configure the port.
- 4) provides redundancy.

## Types of Routers

### 1) Wireless Router.

offers wifi connectivity. Ex- ~~laptop~~ Laptop, Smartphone.

### 2) Brouter

Combination of bridge & router. called bridging router. can work on data link layer and network layer both.

### 3) Core Router

can route data within n/w but not between n/w.

### 4) Edge Router

also called access router.

connects internal n/w to external n/w.

Types → Subscriber ER, Label ER.



## # RIPV1 VS RIPV2

### RIPV1

- Classful Routing protocol
- does not send info of subnet mask.
- Routing updates are broadcasted.
- No authentication
- does not support VLSM
- Less secure
- Does not provide triggered updates
- does not support CIDR Classless Interdomain Routing

### RIPV2

- Classless Routing protocol
- It does send info of subnet mask.
- multicasted.
- Has Authentication.
- Supports.
- More secure.
- provides
- Supports.

Advantages, Disadvantages.

## # Routing Table

- determines the path of a given packet with the help of an IP address of device.
- The routers have internal memory known as RAM (Random Access Memory)
- All information of routing table is stored in RAM.

Destination	Subnet Mask	Interface
2001.2.0.0	255.255.255.0	Eth 0
200.1.2.0/24	255.255.255.255	Eth 1, 0
200.1.2.128	255.255.255.255	Eth 2,

## Ways of maintaining Routing Table

- 1) Static Routing
- 2) Dynamic Routing

## # RIP

→ Routing Information protocol.

→ dynamic routing protocol which uses hop count as routing metric to find the best path b/w source & destination n/w.

→ 3 versions: RIPv1, RIPv2, RIPv3.

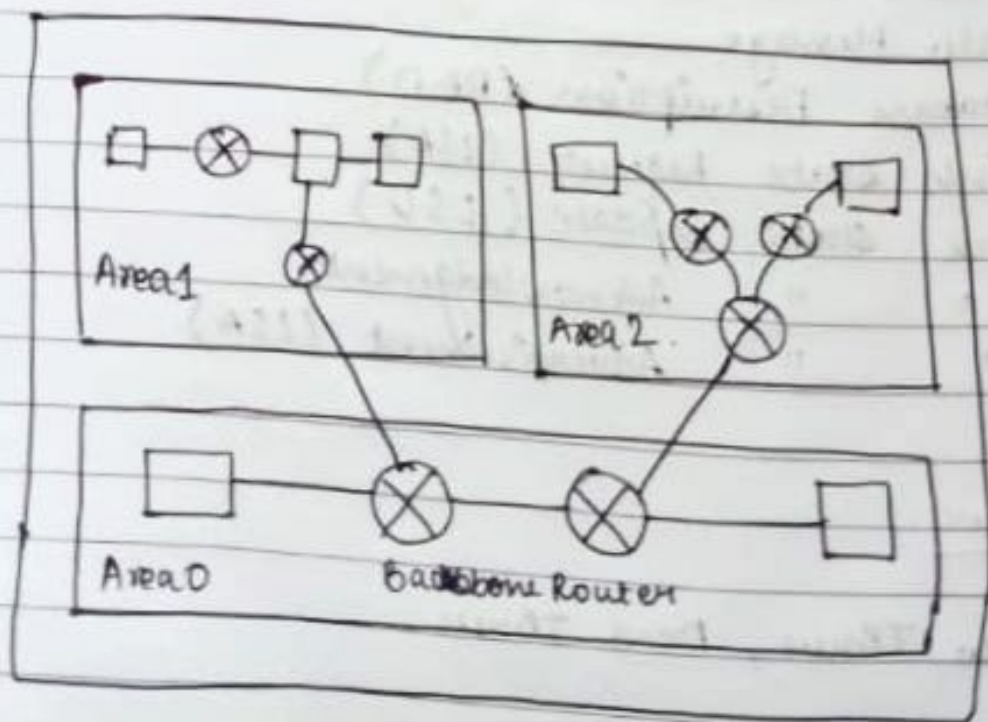


EIGRP Routes	AD Value.
Summary Routes	5
Internal Routes	90
External Routes	170

## # OSPF

- Open Shortest Path First.
- It is an Intradomain protocol.
- It is used within an area or a network.
- It is an Interior gateway protocol that has been designed within a single autonomous system.
- It is based on Link State Routing algorithm.

### Areas



## # IGRP v/b EIGRP

IGRP:	EIGRP:
→ Interior Gateway Routing protocol.	→ Enhanced Interior Gateway Routing protocol.
→ classful routing technique.	→ classless routing technique.
→ slow convergence.	→ fast convergence.
→ Bellman ford Algo is used.	→ Dual algorithm.
→ Needs high bandwidth.	→ Low.
→ least hop count is 255.	→ least hop count is 256.
→ provides 24 bits for delay.	→ 32 bits.

## # EIGRP Messages & Timers

- 1) Hello Message
- 2) Null update
- 3) Full update
- 4) Partial update
- 5) Query Message
- 6) Reply Message
- 7) Acknowledgment Message.

- 1) Hello Timer
- 2) Dead Timer.



## Features

- 1) Wide Scope - multiple network stages
- 2) Fast Convergence
- 3) Loop Free - avoid routing loops.
- 4) Area based n/w partition.
- 5) ECMP Routing - multiple equal cost routes.
- 6) Routing Hierarchy
- 7) Authentication
- 8) Supports multicasting

## Messages / Packet Format

- 1) Hello Message
- 2) Database Description (DD)
- 3) Link State Request (LSR)
- 4) Link state update (LSU)
- 5) " " Acknowledgment
- 6) " " Advertisement (LSA)

## Timer

Hello Timer, Dead Timer.

## Advantages

- 1) Supports both IPv4 & IPv6
- 2) Load Balancing with equal cost
- 3) VLSM & route summarization
- 4) Unlimited Hop counts.
- 5) Classless protocols.

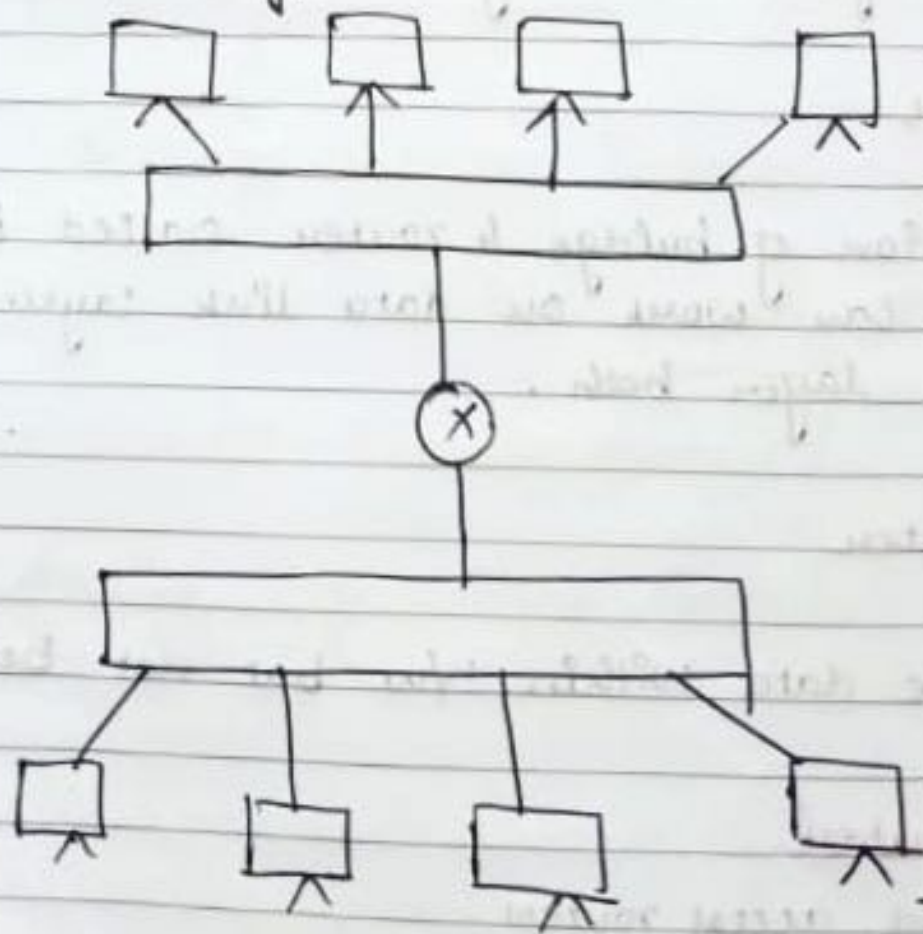
## OSPF Packet

Version (8)	Type (8)	Message (16)
Source IP Address		
Area Identification		
Check sum	Authentication Type	
Authentication (32)		



## # Routers

- connects with different n/w together and sends data packets among them.
- It maintains routing table and decides the optimal path route through and then sends the data.
- used in LAN and WAN.
- connects several smaller networks into 'large' networks.
- connects two different network architecture.



- works on 3rd layer (network layer) of OSI

## # Similarities b/w IS-IS and OSPF

- 1) Both are link state protocols
- 2) Both are used to create hierarchical structure
- 3) Both support unlimited no. of hop count
- 4) Both are classless routing protocols
- 5) Both support authentication protocols
- 6) Both are IGP (Interior gateway protocols).

## # Difference b/w IS-IS &amp; OSPF

OSPF	IS-IS
→ Supports point to multipoint link.	→ does not.
→ runs on data link layer	→ Network layer
→ Supports virtual links	→ does not
→ uses Router ID	→ System ID
→ can belong to multiple area	→ single area
→ elects DR & BDR	→ single DR called DIS.

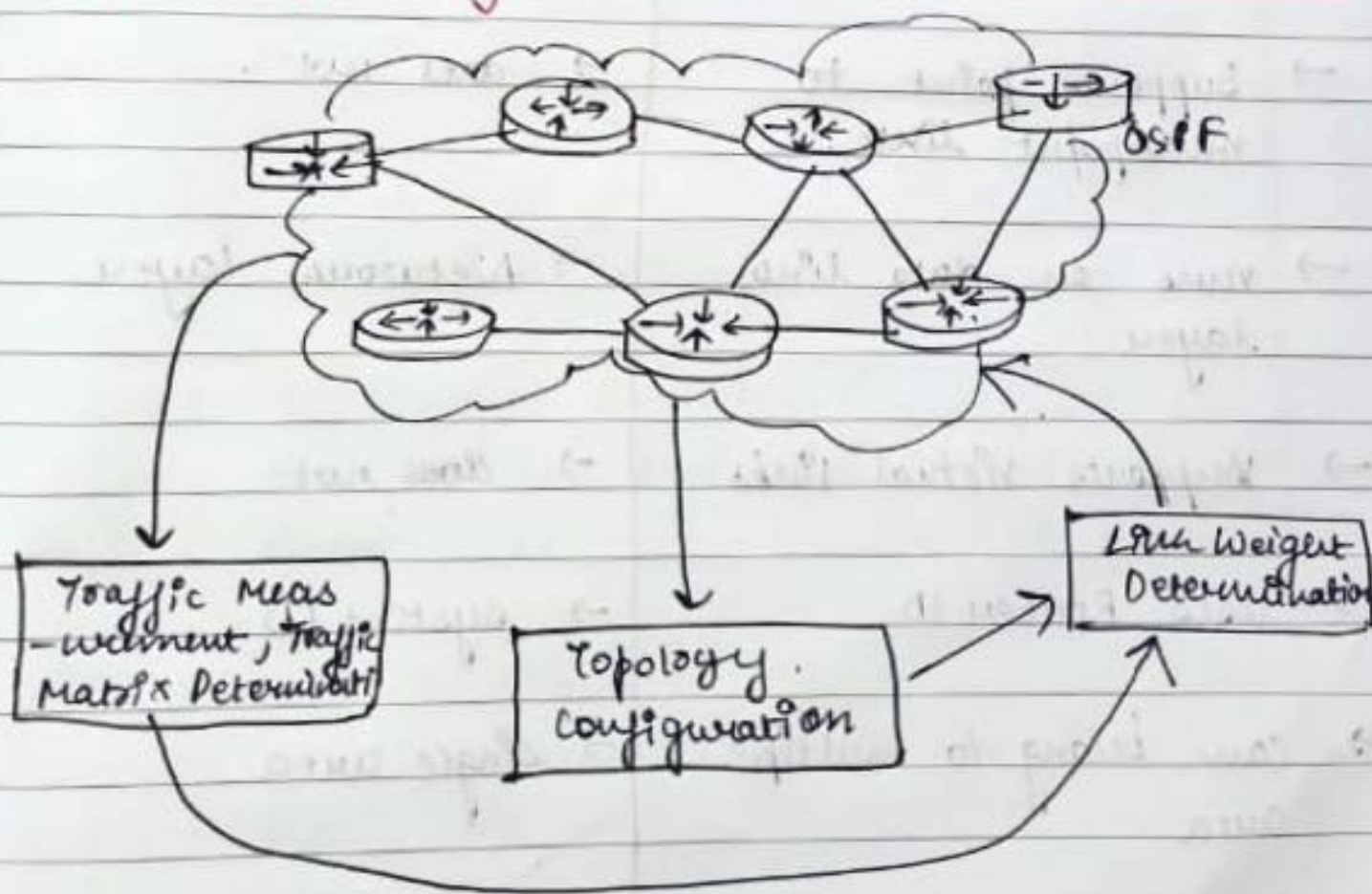


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- Traffic engineering occurs outside the actual network.
  - From the actual network, traffic measurements are collected to estimate traffic matrix.
  - Topology and configuration are also obtained from the network.
  - The computed link weight is injected into the network.
  - Each router receives metrics for its outgoing links.
  - Once the router receives these links, it then disseminates through flooding to other routers through OSPF.
  - This means if no new link weights are obtained from the traffic engineering system, the router will generate a new LSA.

## IP Network Traffic

- An IP network provide many services such as web & email.
- There are also interactive services such as Telnet, ssh for terminal services.
- Traffic is due to applications that use TCP for transport layer.

## Traffic Engineering: An architectural Framework





## Integrated IS-IS (Intermediate System).

- It runs directly over layer-2 protocols.
- Similar to OSPF, IS-IS has also been extended to provide traffic engineering capabilities.
- An address to identify IS is called NSAP (Network Service Access Point).
- The name intermediate system to intermediate system means router to router.

### Features

- Open Standard (OS)
- Link State Routing Protocol
- Classless
- VLSM & Manual Summary
- Works on Dijkstra Algorithm.
- Protocol Independent.

IS-IS defines 4 protocol packets:

Hello Packet

Link State PDU

Complete sequence number PDU

Partial sequence number PDU.