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Enhancing Network Resilience with Dynamic Routing Protocol.

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ABSTRACT:

This research presents a network topology comprising four distinct OSPF areas and three EIGRP instances, integrated through route redistribution mechanisms. Area 43 is designated as a failover destination, offering redundancy and fault tolerance. The study explores the design and implications of this network configuration, highlighting its potential for improving network reliability and performance in complex environments.

Introduction:-

Routers facilitate data packet routing through static and dynamic methods. Static routing involves manual path definition, while dynamic routing employs algorithms to find efficient routes. In network routing, two vital protocol types are routed and routing protocols. Routed protocols like IP enable device communication. Routing protocols, including EIGRP and OSPF, determine routes between devices. These protocols often require redistribution to share routing information. Routed protocols rely on routing protocols to transport data, optimizing paths based on factors like hop count, cost, bandwidth, MTU, and delay.

Ospf Routes:-

In OSPF networks, routing is managed through three key route types:

1. **Intra-Area Routes**: These routes connect devices within the same OSPF area, generated by OSPF routers in that area.

2. **Inter-Area Routes**: They link devices in different OSPF areas within the same AS, also internal to OSPF.

3. **External Routes**: These connect OSPF areas to EIGRP routers, categorized as E1 (considering both internal and external costs) and E2 (considering external cost only).

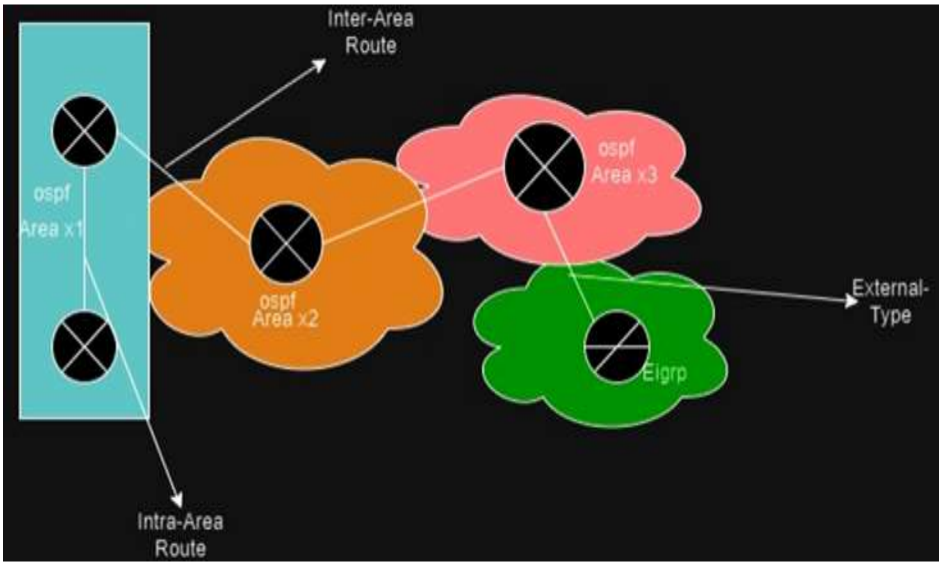

Fig-1:ospf Route Types

Ospf Routers:-

In OSPF (Open Shortest Path First) networks, routers serve different roles to facilitate efficient routing within and between OSPF areas. These roles include:

1. **Internal Routers (IR)**: These routers belong to the same OSPF area and are responsible for maintaining a single, up-to-date database. This database is crucial for determining the shortest path to reach destinations within their connected area.

2. **Backbone Router (BR)**: Backbone routers have interfaces connected to the OSPF backbone area. They play a central role in the network by providing connectivity to the backbone, which serves as the core infrastructure for OSPF routing.

3. **Area Border Router (ABR):** ABRs have interfaces that connect multiple OSPF areas to the backbone area. Their primary responsibility is to summarize routing information from each connected area and present it to the backbone area. This summarization helps in reducing the size of routing tables and simplifying routing within and between areas.

4. **Autonomous System Border Router (ASBR)**: ASBRs are routers that perform the task of redistributing routing information between OSPF areas and areas running non-OSPF routing protocols. They act as gateways between OSPF domains and external networks, ensuring seamless communication and route distribution between them.

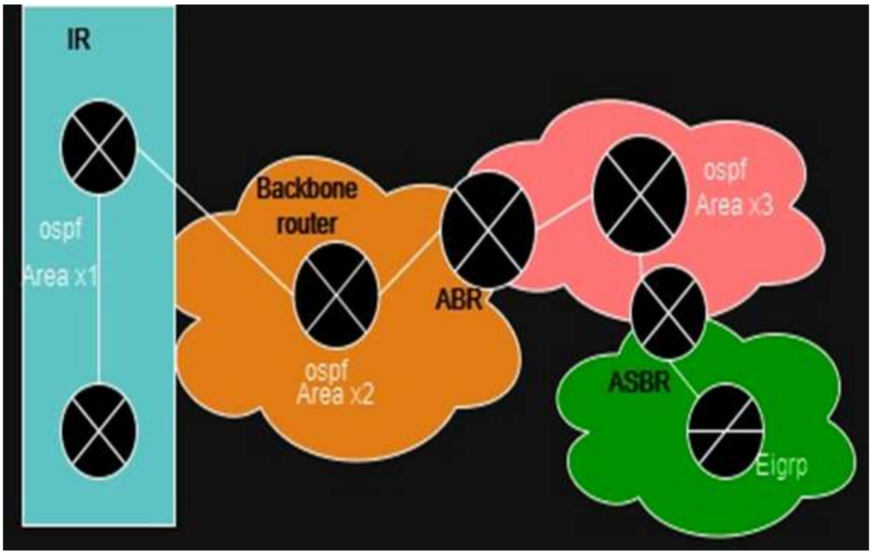

Fig-2:-Ospf Router types

Ospf Areas:-

OSPF areas come in different types, each serving specific purposes:

1. **Stub Area:**

- Stub Areas do not accept external routes, except for a default route.
- They contain internal OSPF routes and are ideal for simplifying routing and reducing the routing table size.
- Stub Areas are suitable for isolated areas within the OSPF network.

2. **Not-So-Stubby Area (NSSA):**

- NSSAs are similar to Stub Areas but allow for limited introduction of external routes.
- They receive external routes as Type 7 LSAs, which are converted into Type 5 LSAs at the NSSA ABR (Area Border Router).
- NSSAs are useful when you need to connect an OSPF area to an external network while maintaining some level of control.

3. **Totally Stubby Area:**

- In Totally Stubby Areas, only a single default route is allowed in addition to internal OSPF routes.
- They are more restrictive than regular Stub Areas and help further reduce routing table size.
- Totally Stubby Areas are suitable for scenarios where extreme routing simplicity is required.

These OSPF area types offer flexibility in managing routing and controlling the flow of external routes within an OSPF network, catering to various network design and security needs.

Ospf Virtual-link:-

An OSPF Virtual Link is a vital tool for connecting OSPF areas when a direct physical link to the OSPF backbone (Area 0) isn't feasible. It enables routers in non-backbone areas to maintain essential connectivity with the backbone. This involves choosing a transit area through which OSPF routing updates flow between the non-backbone and backbone areas. Configuration includes setting up two routers—one in the non-backbone area and the other in the transit area—with a shared OSPF area. Virtual Links are crucial for network integrity in scenarios where physical connections are impractical, but they should be implemented thoughtfully due to added complexity.

Ospf Redistribution:-

OSPF redistribution is a crucial routing technique used to facilitate communication between OSPF networks and routers operating different routing protocols. Its primary function is to allow routers in an OSPF domain to share and receive routing information with routers using alternative routing protocols such as RIP, EIGRP, or BGP. This capability ensures interoperability within diverse network environments.

Key aspects of OSPF redistribution include control and filtering, which empower network administrators to manage the flow of routes into and out of OSPF. This control allows for fine-tuning of routing decisions and enhances security by permitting the selection of specific routes for redistribution. Additionally, OSPF routers can convert route metrics during redistribution to align with OSPF's metric standards, ensuring accurate path selection.

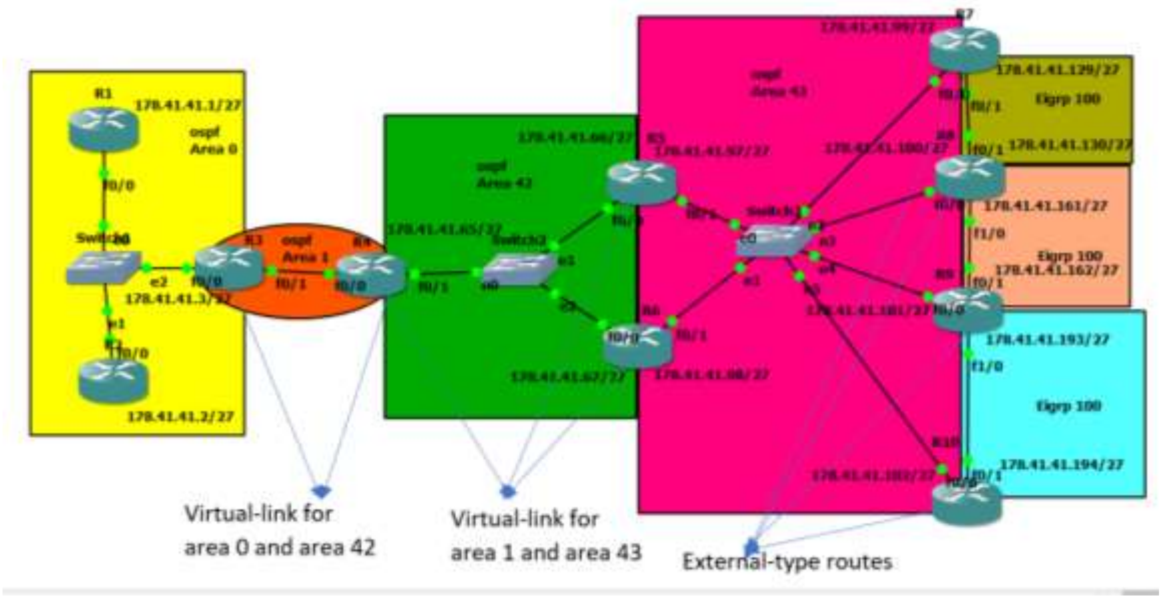

Fig-3:- Redistribution of ospf and Eigrp

Calculation Formula cost:

The reference bandwidth is a configurable value in Mbps, with a default setting of 100Mbps on Cisco IOS routers. In contrast, the interface bandwidth is a value that can be looked up.

$$\text{Cost} = \frac{\text{Reference Bandwidth}}{\text{Interface Bandwidth}}$$

$$= \frac{100 * 10^6 \text{ bps}}{10000 \text{ kbps}}$$

$$= \frac{100 * 10^6 \text{ bps}}{10000 * 10^3 \text{ bps}}$$

$$\text{Cost} = 10$$

Configuring routing Ospf and Eigrp

Router R1:

interface FastEthernet0/0

ip address 178.41.41.1 255.255.255.224

router ospf 100

network 178.41.41.0 0.0.0.31 area 0

Router R2:

interface FastEthernet0/0

ip address 178.41.41.2 255.255.255.224

router ospf 100

network 178.41.41.0 0.0.0.31 area 0

Router R3:

interface Loopback0

ip address 3.3.3.3 255.255.255.255

interface FastEthernet0/0

ip address 178.41.41.3 255.255.255.224

interface FastEthernet0/1

ip address 178.41.41.33 255.255.255.224

router ospf 100

router-id 3.3.3.3

log-adjacency-changes

area 1 virtual-link 4.4.4.4

network 178.41.41.0 0.0.0.31 area 0

network 178.41.41.32 0.0.0.31 area 1

Router R4:

interface Loopback0

ip address 4.4.4.4 255.255.255.255

interface FastEthernet0/0

ip address 178.41.41.34 255.255.255.224

interface FastEthernet0/1

ip address 178.41.41.65 255.255.255.224

router ospf 100

router-id 4.4.4.4

area 1 virtual-link 3.3.3.3

area 42 virtual-link 5.5.5.5

network 178.41.41.32 0.0.0.31 area 1

network 178.41.41.64 0.0.0.31 area 42

Router R5:

interface Loopback0

ip address 5.5.5.5 255.255.255.255

interface FastEthernet0/0

ip address 178.41.41.66 255.255.255.224

interface FastEthernet0/1

ip address 178.41.41.97 255.255.255.224

router ospf 100

router-id 5.5.5.5

area 42 virtual-link 4.4.4.4

network 178.41.41.64 0.0.0.31 area 42

network 178.41.41.96 0.0.0.31 area 43

Router R6:

interface FastEthernet0/0

ip address 178.41.41.67 255.255.255.224

interface FastEthernet0/1

ip address 178.41.41.98 255.255.255.224

router ospf 100

network 178.41.41.64 0.0.0.31 area 42

network 178.41.41.96 0.0.0.31 area 43

Router R7:

interface FastEthernet0/0

ip address 178.41.41.99 255.255.255.224

interface FastEthernet0/1

ip address 178.41.41.129 255.255.255.224

router eigrp 100

redistribute ospf 100

network 178.41.0.0

no auto-summary

router ospf 100

log-adjacency-changes

redistribute eigrp 100 subnets

network 178.41.41.96 0.0.0.31 area 43

Router 8:

interface FastEthernet0/0

ip address 178.41.41.100 255.255.255.224

interface FastEthernet0/1

```
 ip address 178.41.41.130 255.255.255.224
interface FastEthernet1/0
 ip address 178.41.41.161 255.255.255.224
router eigrp 100
 redistribute ospf 100
 network 178.41.0.0
 no auto-summary
router ospf 100
 log-adjacency-changes
 redistribute eigrp 100 subnets
 network 178.41.41.96 0.0.0.31 area 43
```

Router R9:

```
interface FastEthernet0/0
 ip address 178.41.41.101 255.255.255.224
interface FastEthernet0/1
 ip address 178.41.41.162 255.255.255.224
interface FastEthernet1/0
 ip address 178.41.41.193 255.255.255.224
router eigrp 100
 redistribute ospf 100
 network 178.41.0.0
 no auto-summary
router ospf 100
redistribute eigrp 100 subnets
 network 178.41.41.96 0.0.0.31 area 43
```

Router R10:

```
interface FastEthernet0/0
 ip address 178.41.41.102 255.255.255.224
interface FastEthernet0/1
 ip address 178.41.41.194 255.255.255.224
router eigrp 100
 redistribute ospf 100
 network 178.41.0.0
 no auto-summary
router ospf 100
 redistribute eigrp 100 subnets
 network 178.41.41.96 0.0.0.31 area 43
```

Result

Conducting experiments involves utilizing the Command Prompt to execute the PING IP Address command, which serves to assess network connectivity. The experimentation process, aimed at calculating packet loss, yields variable results influenced by factors such as router distance, delivery queue, and device readiness.

$$\frac{\text{(Packet data send – Packet data receive)}}{\text{Packet data send}} \quad \text{X } 100\%$$

Category	**Range value**	**Received**
Very good	0%-2%	4
Good	3%-14%	3
Average	15%-24%	2
Poor	>25%	1

Conclusion

Furthermore, the project seamlessly integrated OSPF and EIGRP redistribution, enhancing the network's adaptability. Simultaneously, a strategic initiative involved the establishment of a virtual link, specifically tailored for sharing routing tables within the parameters of both stub and NSSA configurations. These purposeful implementations not only fortify the network's robustness but also underscore the project's steadfast commitment to optimizing routing efficiency and overall adaptability.

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