Lab-6: Objective:

Part A: Configure Enhanced Interior Gateway Routing Protocol (EIGRP).
Part B: Configure EIGRP on physical router.

Lab-6
Enhanced Interior Gateway Routing Protocol (EIGRP)

Part A: Configure Enhanced Interior Gateway Routing Protocol (EIGRP).Refer figure 15 for this purpose.

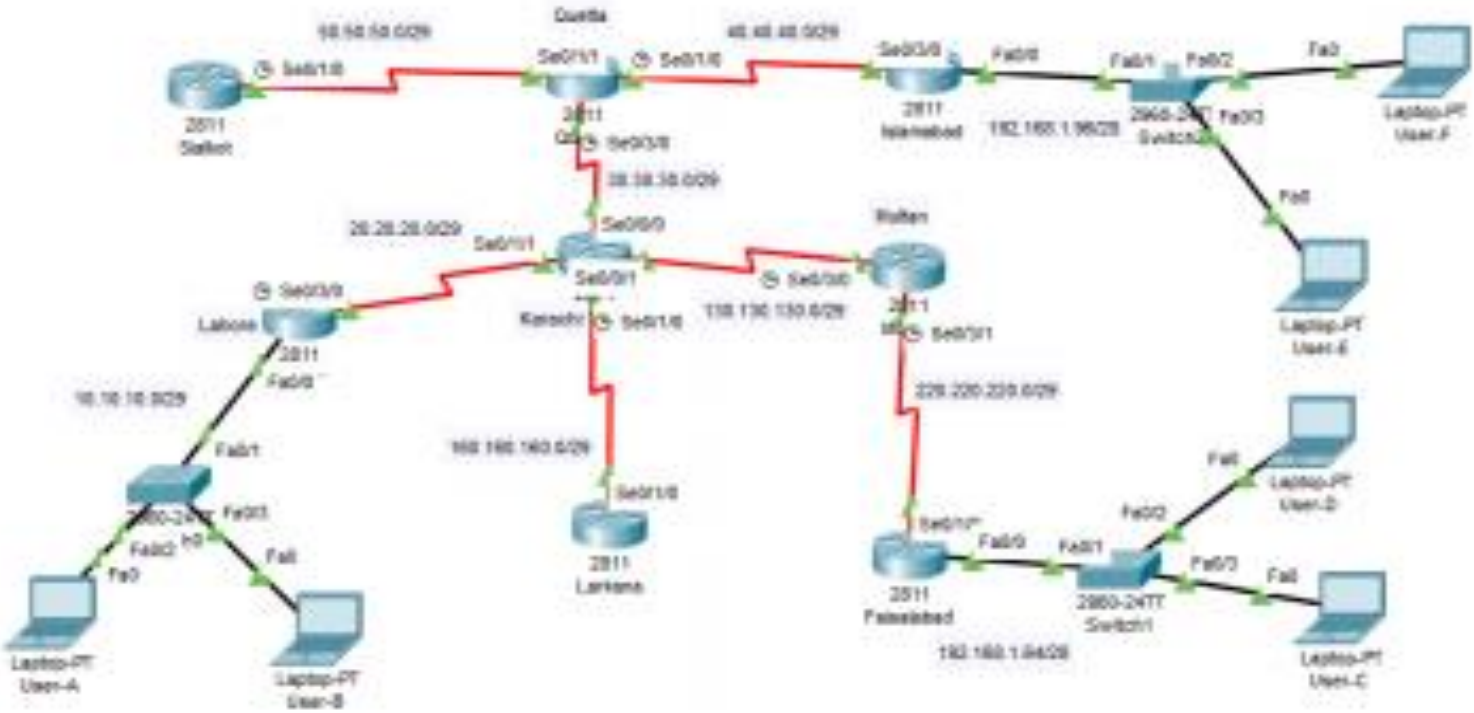

Figure 15

EIGRP Theory of Operation

Some of the many advantages of EIGRP are:

- very low usage of network resources during normal operation; only hello packets are transmitted on a stable network
- when a change occurs, only routing table changes are propagated, not the entire routing table; this reduces the load the routing protocol itself places on the network
- rapid convergence times for changes in the network topology (in some situations convergence can be almost instantaneous)

EIGRP is an enhanced distance vector protocol, relying on the Diffused Update Algorithm (DUAL) to calculate the shortest path to a destination within a network.

Enhanced Interior Gateway Routing Protocol (EIGRP) is a dynamic routing Protocol which is used to find the best path between any two layers 3 device to deliver the packet. EIGRP works on network layer Protocol of OSI model and uses the protocol number 88.It uses metric to find out best path between two layer 3 device (router or layer 3 switch) operating EIGRP.

It uses some messages to communicate with the neighbordevices that operate EIGRP. These are:-

1. **Hello message**-These messages are keep alive messages which are exchanged between two devices operating EIGRP. These messages are used for neighbor discovery/recovery, if there is any device operating EIGRP or if any device (operating EIGRP) coming up again. These messages are used for neighbor discovery if multicast at 224.0.0.10. It contains values like AS number, k values etc.
   These messages are used as acknowledgment when unicast. A hello with no data is used as the acknowledgment.
2. NULL update-It is used to calculate SRTT (Smooth Round Trip Timer) and RTO (Retransmission Time Out).
   SRTT:The time is taken by a packet to reach neighboring router and the acknowledgment of the packet to reach to the local router.

   RTO: If a multicast fails then unicast are being sent to that router. RTO is the time for which the local router waits for an acknowledgment of the packet.
3. **Full Update** – After exchanging hello messages or after the neighbourship is formed, these messages are exchanged. This message contains all the best routes.
4. **Partial update**-These messages are exchanged when there is a topology change and new links are added. It contains only the new routes, not all the routes. These messages are multicast.
5. **Query message**-These messages are multicast when the device is declared dead and it has no routes to it in its topology table.

6. **Reply message** – These messages are the acknowledgment of the query message sent to the originator of the query message stating the route to the network which has been asked in the query message.
7. **Acknowledgement message**
   It is used to acknowledge EIGRP update, queries, and replies. ACKs are hello packets that contain no data.
   Note: Hello and acknowledgment packets do not require any acknowledgment. Reply, query, update messages are reliable messages i.e. requires acknowledgement.
   Composite matrix-The EIGRP composite metric calculation can use up to 5 variables, but only 2 are used by default (K1 and K3). The composite metric values are:
   K1 (bandwidth), K2 (load), K3 (delay), K4 (reliability) and K5 (MTU)
   The lowest bandwidth, load, delay, reliability, MTU along the path between the source and the destination is considered in the composite matrix in order to calculate the cost.

EIGRP uses these scaled values to determine the total metric to the network:

Metric = [[K1 * bandwidth + (K2 * bandwidth) / (256 - load) + K3 * delay] * [K5 / (reliability + K4)]] * 256

Timers:-
Hello timer- The interval in which EIGRP sends a hello message on an interface. It is 5 seconds by default.
Dead timer- The interval in which the neighbor will be declared dead if it is not able to send the hello packet. It is 15 seconds by default.

Task 1, Assign the IP address on each Router

Router Lahore:

```
Lahore >enable

Lahore #configure terminal

Enter configuration commands, one per line.  End with CNTL/Z.

Lahore (config)#interface serial 0/3/0

Lahore (config-if)#ip address 20.20.20.1 255.255.255.248

Lahore (config)#clock rate 64000

Lahore (config-if)#no shutdown

Lahore (config-if)#exit

Lahore (config)#interface fa 0/0
```

Lahore (config-if)#ip address 10.10.10.1 255.255.255.248

Lahore (config-if)#no shutdown

Lahore (config-if)#exit

Router Karachi:

Karachi >enable

Karachi #configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Karachi (config)#interface serial 0/1/0

Karachi (config-if)#ip address 160.160.160.1 255.255.255.248

Karachi (config)#clock rate 64000

Karachi (config-if)#no shutdown

Karachi (config-if)#exit

Karachi (config)#interface serial 0/1/1

Karachi (config-if)#ip address 20.20.20.1 255.255.255.248

Karachi (config-if)#no shutdown

Karachi (config-if)#exit

Karachi (config)#interface serial 0/0/0

Karachi (config-if)#ip address 30.30.30.2 255.255.255.248

Karachi (config-if)#no shutdown

Karachi (config-if)#exit

Karachi (config)#interface serial 0/0/1

Karachi (config-if)#ip address 130.130.130.1 255.255.255.248

Karachi (config-if)#no shutdown

Karachi (config-if)#exit

Router Quetta:

```
Quetta >enable

Quetta #configure terminal

Enter configuration commands, one per line.  End with CNTL/Z.

Quetta (config)#interface serial 0/1/0

Quetta (config-if)#ip address 40.40.40.1 255.255.255.248

Quetta (config)#clock rate 64000

Quetta (config-if)#no shutdown

Quetta (config-if)#exit

Quetta (config)#interface serial 0/3/0

Quetta (config-if)#ip address 30.30.30.1 255.255.255.248

Quetta (config)#clock rate 64000

Quetta (config-if)#no shutdown

Quetta (config-if)#exit

Quetta (config)#interface serial 0/1/1

Quetta (config-if)#ip address 50.50.50.2 255.255.255.248

Quetta (config-if)#no shutdown

Quetta (config-if)#exit
```

Router Islamabad:

```
Islamabad >enable

Islamabad #configure terminal

Enter configuration commands, one per line.  End with CNTL/Z.

Islamabad (config)#interface serial 0/3/0

Islamabad (config-if)#ip address 40.40.40.2 255.255.255.248
```

Islamabad (config-if)#no shutdown

Islamabad (config-if)#exit

Islamabad (config)#interface fa 0/0

Islamabad (config-if)#ip address 192.16.1.97 255.255.255.240

Islamabad (config-if)#no shutdown

Islamabad (config-if)#exit

Router Multan:

Multan >enable

Multan #configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Multan(config)#interface serial 0/3/0

Multan (config-if)#ip address 130.130.130.2 255.255.255.248

Multan (config-if)#clock rate 64000

Multan (config-if)#no shutdown

Multan (config-if)#exit

Multan(config)#interface serial 0/3/1

Multan (config-if)#ip address 220.220.220.1 255.255.255.248

Multan (config-if)#clock rate 64000

Multan (config-if)#no shutdown

Multan (config-if)#exit

Router Faisalabad:

Faisalabad >enable

Faisalabad #configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Faisalabad (config)#interface serial 0/1/0

Faisalabad (config-if)#ip address 220.220.220.2 255.255.255.248

Faisalabad (config-if)#no shutdown

Faisalabad (config-if)#exit

Faisalabad (config)#interface fa 0/0

Faisalabad (config-if)#ip address 192.168.1.65 255.255.255.240

Faisalabad (config-if)#no shutdown

Faisalabad (config-if)#exit

Router Larkana:

Larkana >enable

Larkana #configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Larkana (config)#interface serial 0/1/0

Larkana (config-if)#ip address 160.160.160.2 255.255.255.248

Larkana (config-if)#no shutdown

Larkana (config-if)#exit

RouterSialkot:

Sialkot >enable

Sialkot #configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Sialkot (config)#interface serial 0/1/0

Sialkot (config-if)#ip address 50.50.50.1 255.255.255.248

Sialkot (config-if)#clock rate 64000

Sialkot (config-if)#no shutdown

Sialkot (config-if)#exit

Task 2, Configure EIGRP on each Router

Router Lahore:

Lahore (config)#router eigrp 999

Lahore (config-router)#network 10.10.10.0 0.0.0.7

Lahore (config-router)#network 20.20.20.0 0.0.0.7

Lahore (config-router)#no auto-summary

Lahore (config-router)#exit

Router Karachi:

Karachi (config)#router eigrp 999

Karachi(config-router)#network 20.20.20.0 0.0.0.7

Karachi(config-router)#network 30.30.30.0 0.0.0.7

Karachi(config-router)#network 130.130.130.0 0.0.0.7

Karachi(config-router)#network 160.160.160.0 0.0.0.7

Karachi(config-router)#no auto-summary

Karachi(config-router)#exit

Router Quetta:

Quetta (config)#router eigrp 999

Quetta(config-router)#network 40.40.40.0 0.0.0.7

Quetta (config-router)#network 30.30.30.0 0.0.0.7

Quetta (config-router)#no auto-summary

Quetta(config-router)#exit

Router Islamabad:

Islamabad (config)#router eigrp 999

Islamabad(config-router)#network 40.40.40.0 0.0.0.7

Islamabad(config-router)#network 192.168.1.96 0.0.0.15

Islamabad(config-router)#no auto-summary

Islamabad(config-router)#exit

Router Multan:

Multan(config)#router eigrp 999

Multan(config-router)#network 130.130.130.0 0.0.0.7

Multan(config-router)#network 220.220.220.0 0.0.0.7

Multan(config-router)#no auto-summary

Multan(config-router)#exit

Router Faisalabad:

Faisalabad (config)#router eigrp 999

Faisalabad(config-router)#network 220.220.220.0 0.0.0.7

Faisalabad(config-router)#network 192.168.1.64   0.0.0.15

Faisalabad(config-router)#no auto-summary

Faisalabad(config-router)#exit

Router Larkana:

Larkana (config)#router eigrp 999

Larkana(config-router)#network 160.160.160.0 0.0.0.7

Larkana(config-router)#no auto-summary

Larkana(config-router)#exit

RouterSialkot:

Sialkot(config)#router eigrp 999

Sialkot(config-router)#network 50.50.50.0 0.0.0.7

```
Sialkot(config-router)# no auto-summary

Sialkot(config-router)#exit
```

Lab-6 Exercise:

Design a ring network which consists of 5 routers. Attach 3 PC's with each router. Configure EIGRP on this environment so that all the devices can send data packets to each other. What do you understand when you use the command "Show IP route" on each router? Each student will use the Student ID as EIGRP process ID.