**Basic EIGRP**

This lab scenario covers basic EIGRP; you will configure the EIGRP routing process over 5 routers using Ethernet and Serial links. You will also use various commands to verify the configuration and check connectivity. In addition you will configure one server and 6 PC workstations to demonstrate the operation and connectivity of the EIGRP routing process.

This lab scenario has been created as a Cisco Packet Tracer activity but I have also included the GNS3 topology and a network draying to allow those that may be practicing this lab on real hardware.

**Enhanced Interior Gateway Routing Protocol** - (**EIGRP**) is a Cisco proprietary routing protocol loosely based on their original IGRP. EIGRP is an advanced distance-vector routing protocol, with optimizations to minimize both the routing instability incurred after topology changes, as well as the use of bandwidth and processing power in the router. Routers that support EIGRP will automatically redistribute route information to IGRP neighbors by converting the 32 bit EIGRP metric to the 24 bit IGRP metric. Most of the routing optimizations are based on the Diffusing Update Algorithm (DUAL) work from SRI, which guarantees loop-free operation and provides a mechanism for fast convergence.

**Basic operation**

The data EIGRP collects is stored in three tables:

* Neighbor Table: Stores data about the neighboring routers, i.e. those directly accessible through directly connected interfaces.
* Topology Table: Confusingly named, this table does not store an overview of the complete network topology; rather, it effectively contains only the aggregation of the routing tables gathered from all directly connected neighbors. This table contains a list of destination networks in the EIGRP-routed network together with their respective metrics. Also for every destination, a successor and a feasible successor are identified and stored in the table if they exist. Every destination in the topology table can be marked either as "Passive", which is the state when the routing has stabilized and the router knows the route to the destination, or "Active" when the topology has changed and the router is in the process of (actively) updating its route to that destination.
* Routing table: Stores the actual routes to all destinations; the routing table is populated from the topology table with every destination network that has its successor and optionally feasible successor identified (if unequal-cost load-balancing is enabled using the variance command). The successors and feasible successors serve as the next hop routers for these destinations.

Unlike most other distance vector protocols, EIGRP does not rely on periodic route dumps in order to maintain its topology table. Routing information is exchanged only upon the establishment of new neighbor adjacencies, after which only changes are sent. Also, it uses route tagging.

**Successor**

A successor for a particular destination is a next hop router that satisfies these two conditions:

* it provides the least distance to that destination
* it is guaranteed not to be a part of some routing loop

The first condition can be satisfied by comparing metrics from all neighboring routers that advertise that particular destination, increasing the metrics by the cost of the link to that respective neighbor, and selecting the neighbor that yields the least total distance. The second condition can be satisfied by testing a so-called Feasibility Condition for every neighbor advertising that destination. There can be multiple successors for a destination, depending on the actual topology.

The successors for a destination are recorded in the topology table and afterwards they are used to populate the routing table as next-hops for that destination.

**Feasible Successor**

A feasible successor for a particular destination is a next hop router that satisfies this condition:

* it is guaranteed not to be a part of some routing loop

This condition is also verified by testing the Feasibility Condition.

Thus, every successor is also a feasible successor. However, in most references about EIGRP the term "feasible successor" is used to denote only those routers which provide a loop-free path but which are not successors (i.e. they do not provide the least distance). From this point of view, for a reachable destination there is always at least one successor, however, there might not be any feasible successors.

A feasible successor provides a working route to the same destination, although with a higher distance. At any time, a router can send a packet to a destination marked "Passive" through any of its successors or feasible successors without alerting them in the first place and this packet will be delivered properly. Feasible successors are also recorded in the topology table.

The feasible successor effectively provides a backup route in the case that existing successors die. Also, when performing unequal-cost load-balancing (balancing the network traffic in inverse proportion to the cost of the routes), the feasible successors are used as next hops in the routing table for the load-balanced destination.

By default, the total count of successors and feasible successors for a destination stored in the routing table is limited to four. This limit can be changed in the range from 1 to 6. In more recent versions of Cisco IOS (e.g. 12.4), this range is between 1 and 16.