Comparing EIGRP & OSPF

EIGRP and OSPF are both excellent routing protocols and each provides a unique set of benefits for designing and implementing a scalable network. Both protocols can be used for a wide variety of networks from small regional networks to large global network systems. A question which is frequently asked is, "Which protocol, EIGRP or OSPF, is best?" This is not an easy question, as both protocols have their benefits. This paper compares EIGRP and OSPF and provides criteria to compare the two protocols and determine which is most suitable for your network application. The following criteria have been analyzed so that key differentiating features can be considered when selecting the routing protocol which best fits your network requirements. This paper does not cover the basic operation and features of each protocol; it compares the similar features of each protocol.   Network Architecture - OSPF requires your network topology to be hierarchical, EIGRP does not. It is good design practice to design EIGRP hierarchically as well, but it is not required. Thus, EIGRP is more versatile from a topology standpoint, but still care must be taken to design the network correctly. Sometimes all the versatility of EIGRP allows improper network design, whereas, OSPF forces you to design in a backbone. OSPF also has limitations in number of routers in a OSPF area (guideline - maximum 40-50*) and number of areas per router (guideline - up to 3*). Thus, designing an OSPF network can be more challenging and limiting than designing an EIGRP network.   *Note: Guideline numbers are good general numbers. These numbers can vary widely depending on the topology and number of links in an area - they are not hard and fast rules.   Ease of Use - Because OSPF requires a hierarchical topology, desires a summarized address structure, and requires manually configured summary addresses, it can be seen as harder to implement. In addition, the different rules for the several types of areas and LSA types are conceptually more difficult to understand. However, all these features can be desirable and support a large scalable network, when done properly. EIGRP can also require some difficult advanced configuration when special features are needed. However, many people feel EIGRP is more flexible than OSPF and network designs are easier to implement using EIGRP.   Neighbors - EIGRP forms adjacencies and exchanges routing updates with each neighboring router, whereas, OSPF performs an election process for a DR (Designated Router) and BDR (Backup DR) which act as a "distribution" point for routing information. In OSPF, routers only form a full adjacency to the DR and BDR (there is one DR/BDR per network segment). This means that, all things being equal, OSPF can more efficiently support a full mesh of neighboring routers per interface. This point is especially valid on high speed LAN media. As a rule of thumb, this issue gets to be important at about 20 neighbors per interface, but depends on routing table size, router platform, utilization, media type, etc. However, many network designs do not have a large amount of neighbors per LAN interface, they have a large amount of neighbors per router. In these cases, there are design limitations regarding the number of routers in an OSPF area and the number of areas supported per router (see Network Architecture section of this document for guidelines). It is important to note that both EIGRP and OSPF have design considerations regarding neighbors. These design considerations depend on many factors include routing table size, media type, topology, etc., but a general rule of thumb is that OSPF can have more neighbors per interface, whereas, EIGRP allows more design flexibility for many neighbors per router.   Route Filtering and Aggregation - Filtering routes in OSPF is very difficult. "Distribute-list in" does not work on OSPF routes and "Distribute-list out" works only on the routes being redistributed from other processes into OSPF. Additionally, route aggregation can only be performed at OSPF area or AS boundaries. With EIGRP, information can be filtered and aggregated at any interface and at any bit boundary, theoretically allowing multiple hierarchies based on topology. Therefore, EIGRP is much more versatile and easier to work when performing route filtering and aggregation. Additionally, EIGRP is far superior to OSPF in in-bound and out-bound filtering on a per interface basis.   Route Summarization (Configuration) - EIGRP does an automatic summarization process (by default), whereas, OSPF requires you to define each summary address. As discussed above, EIGRP can thus be easier to implement. However, in many large networks with meshed links and/or redistribution points, not paying careful attention to summarization can cause routing loops and stability problems. You need to carefully understand the topology and addressing design - incorrect auto-summarization is a frequently encountered problem by many customers.   Of course, you can get around these problems in EIGRP (by using interface summary address commands) or OSPF (by using area range commands), but it takes extra steps, good practice, and some knowledge of how the routing protocol works. OSPF requires all manual summary commands and thus requires more thought to this process. With EIGRP, careful consideration should also be given to summarization, even when using the automatic summarization features. Not performing summarization properly with either protocol can cause severe network problems.   Convergence - To recover from a network topology change, EIGRP uses DUAL (Diffusing Update Algorithm) which provides very fast convergence if a "feasible successor" exists. OSPF sends a LSA and recalculates the Diskjtra SPF algorithm. From this perspective, EIGRP can converge faster than OSPF and can require less CPU processing. However, convergence is dependent on many factors including topology, metric, type of failure, etc., so a definitive conclusion can not be made here.   When a feasible successor does not exist, EIGRP will query

neighboring routers for the lost route which then query their neighbors creating an expanding tree of queries until the route is found or determined to be unavailable. In this case, the speed of convergence depends on many factors including the network topology and it is impossible to explicitly state which protocol is faster.   Memory and CPU - EIGRP sends partial updates and only sends updates when a topology change occurs. The existence of a "feasible successor" in EIGRP limits the effect of topology changes to directly affected routers and routes. OSPF multicasts LSAs to all routers in the area upon a topology change and sends periodic database updates. Memory and CPU utilization come into account when considering the routing table size, number of neighbors, and how frequently the routing protocol is actively running it's algorithm. OSPF is generally more CPU intensive on the DR router and this router should have more memory and CPU power to accommodate this function. Also, OSPF may require more CPU and memory resources on other routers in the network.Vendor Interoperability - OSPF is supported by a variety of router vendors and is an industry standard (RFC 1583); EIGRP is not. If a vendor independent routing protocol is required, EIGRP can not meet this criteria. However, care should be take when interoperating with other vendor's OSPF routers because some vendor's OSPF implementations can not handle large routing table sizes (as few as 200 maximum routes with 4 neighbors as been reported). It should also be noted that multiple routing protocols can be supported on a router so it is possible to implement EIGRP and still interoperate with OSPF routers by adding another routing process.   Multi-protocol Support - EIGRP can be used for IP, IPX, and AppleTalk, whereas, OSPF is just for IP. EIGRP for IPX and AppleTalk offers significant improvements over IPX RIP and AppleTalk RTMP by reducing routing information exchanged, improving network convergence, and increasing scalability. Additionally, EIGRP reduces IPX SAP traffic by performing incremental update-only based SAP updates instead of full periodic SAP updates like IPX RIP. EIGRP is therefore superior if one multi-protocol routing protocol is desired for IP, IPX, and AppleTalk support. Keep in mind that although EIGRP is conceptually similar for IP, IPX, and AppleTalk, multi-protocol EIGRP processes are "ships in the night" processes and, therefore, EIGRP is not an integrated multi-protocol routing protocol and should not be treated as such.   Route Selection - OSPF uses the interface cost (inversely proportional to bandwidth) to determine the shortest path. EIGRP builds a topology table and computes shortest paths using link bandwidth and delay as criteria. EIGRP thus offers more versatility and control in selecting the best routing path.   Routing Overhead - OSPF synchronizes router databases every 30 minutes and exchanges Link State Advertisements (LSA) whenever a topology change occurs. EIGRP builds a topology table which does not have to be periodically synchronized and does not send LSAs when the network topology changes. Instead, EIGRP sends out queries only when an acceptable "feasible successor" does not exist to an effort to find a route. Therefore, depending on the network topology, state, and configuration, EIGRP can be more efficient than OSPF by minimizing routing information exchanged.   Link Bandwidth Conservation - OSPF utilizes whatever bandwidth it requires. EIGRP will default to consume only 50% of a link bandwidth, worst case. EIGRP allows you to configure bandwidth utilization parameters, whereas, OSPF does not. Also, EIGRP changes hello timers and hold down timers on NBMA interfaces to minimize the bandwidth used and to increase network convergence reliability. EIGRP further conserves WAN bandwidth by suppressing ACKs and using unicast data packets for this function. Thus, EIGRP is better suited for WAN applications where link bandwidth is precious.   Reliable Delivery of Routing Information - EIGRP provides reliable delivery of query, update, and reply packets to ensure routing information is not lost. OSPF multicasts update information and uses acknowledgments for the packets. Both protocols provide a reliable mechanism to exchange routing information.   Security - OSPF supports password and message digest authentication key security for routing information. EIGRP also supports authentication using an encrypted key. Both protocols have a good degree of security available.