4.1 Routing Tables:-

Would obtain the routing tables for each routing protocol in order to compare their outputs at 350 seconds, when the link between Router 1 and Router 2 is still in a failed state. The routing table for Router 1 using RIP is shown in table (4.1). The metric used for RIP is the hop count shown in the third column. The first row shows the metric of IF17 link from Router 1 to Router 2 as 16, which is the maximum hop value in RIP, because the link has failed.

Table (4.1) RIP Routing Table

	Destination	Metric	Next Hop Address	Next Hop Node	
1	192.0.1.0/24	16	192.0.1.2	Router1	IF17
2	192.0.2.0/24	3	192.0.4.2	Router5	IF18
3	192.0.3.0/24	2	192.0.4.2	Router5	IF18
4	192.0.5.0/24	1	192.0.4.2	Router5	IF18
5	192.0.4.0/24	0	192.0.4.1	Router1	IF18

Would use OSPF's interface cost parameters to change the cost of each interface in order to investigate the effects on the routing table. Table (4.2) is Router 1's routing table at 350 seconds using OSPF. The metric displayed in the thin is the interface cost we implemented. As expected, when the link from Router 1 to Router 2 fails, packets are all routed to their destination through Router 5. Specify the cost of an interface by editing the value the desired cost setting. When set Auto calculate, the formula used to calculate the cost is based on interface speed and another configurable attribute called **Reference bandwidth**;

Table (4.2) OSPF Routing Table

	Destination	Metric	Next_Hop_Address	Next_Hop_Node	Interface
1	192.0.2.0/24	2588	192.0.4.2	Router5	IF18
2	192.0.3.0/24	1941	192.0.4.2	Router5	IF18
3	192.0.4.0/24	647	192.0.4.0	Router1	IF18
4	192.0.5.0/24	1294	192.0.4.2	Router5	IF18
5	192.0.6.0/24	1	192.0.6.1	Router1	LB0
6	192.0.7.0/24	2589	192.0.4.2	Router5	IF18
7	192.0.8.0/24	1942	192.0.4.2	Router5	IF18
8	192.0.9.0/24	1295	192.0.4.2	Router5	IF18
9	192.0.10.0/24	648	192.0.4.2	Router5	IF18

Table (4.3) is the equivalent EIGRP routing table. The metric in the third column is calculated by the protocol. It is calculated using the equation (2) in chapter 2.

Table (4.3) EIGRP Routing Table

	Destination	**Metric /Successor's Metric**	**Next Hop Address**	**Next Hop Node**	**Interface**	**Delay (msec)**	**Bandwidth (Mbps)**
1	192.0.2.0/24	3705856/3193856	192.0.4.1	Router5	IF18	80.00	1.544
2	192.0.3.0/24	3193856/2681856	192.0.4.1	Router5	IF18	60.00	1.544
3	192.0.4.0/24	2169856/0	192.0.4.1	Router1	IF18	20.00	1.544
4	192.0.5.0/24	2681856/2169856	192.0.4.1	Router5	IF18	40.00	1.544

4.2 Performance Results:-

Performance results used ring and mesh topologies network

4.2.1 Ring Topology:

Figure (4.1) shows the router traffic sent in bits/sec of the three protocols in a small ring network. From the graph of routing traffic sent we observe that EIGRP has the highest bandwidth efficiency while RIP has the lowest. It should be noted that OSPF has better bandwidth efficiency than EIGRP when there are no new routers added. OSPF has the highest initial peak because the routers must first map out the network before choosing a path. This requires routers to distribute a significant amount of information initially.

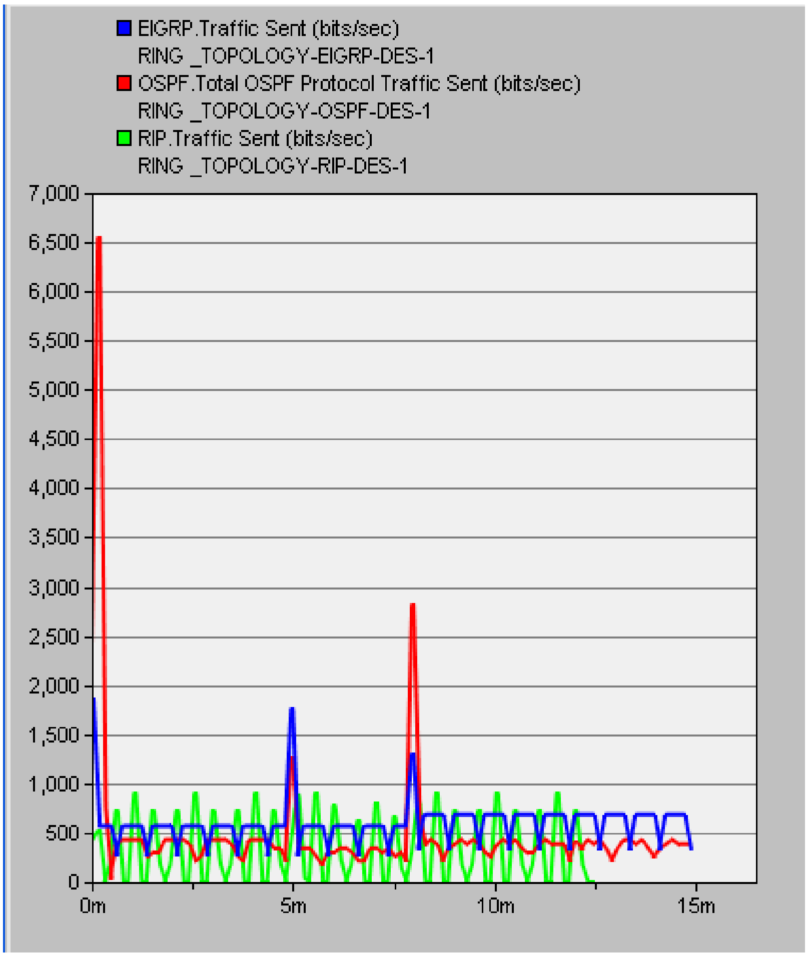

Figure (4.1) Routing Traffic Sent in bits/sec for Small Ring

The figure (4.2) shows the convergence activity of each protocol. The first, second, and third peaks represents the initial setup, the link failure at 300 seconds, and link recovery at 480 seconds. The width of each peak represents the convergence duration. The longer a protocol takes to converge, the wider the peak will be. From these results we observe that EIGRP has the fastest convergence in all the stages while OSPF has a faster convergence time than RIP during a link-failure.

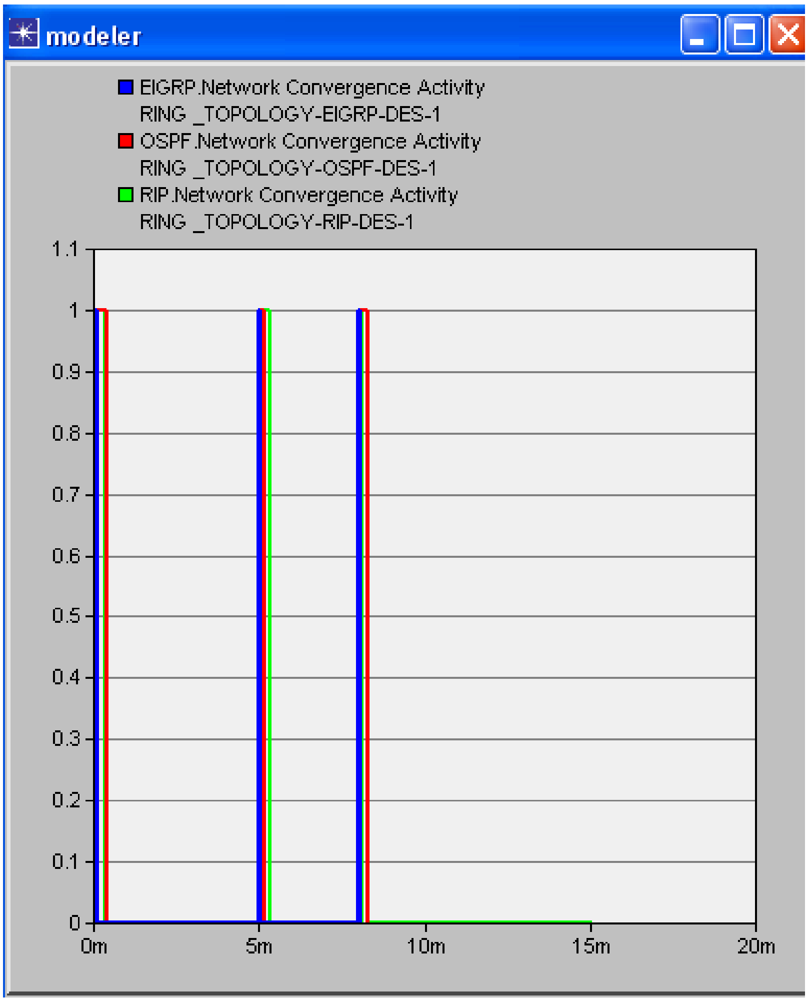

Figure (4.2) Convergence Activity for Small Ring

The figure (4.3) displays the approximate convergence durations, including initial convergence, convergence after link failure and convergence after link recovery. From this table it is clear that OSPF is much quicker at detecting and recovering from a link failure than it is at realizing convergence initially and after link recovery.

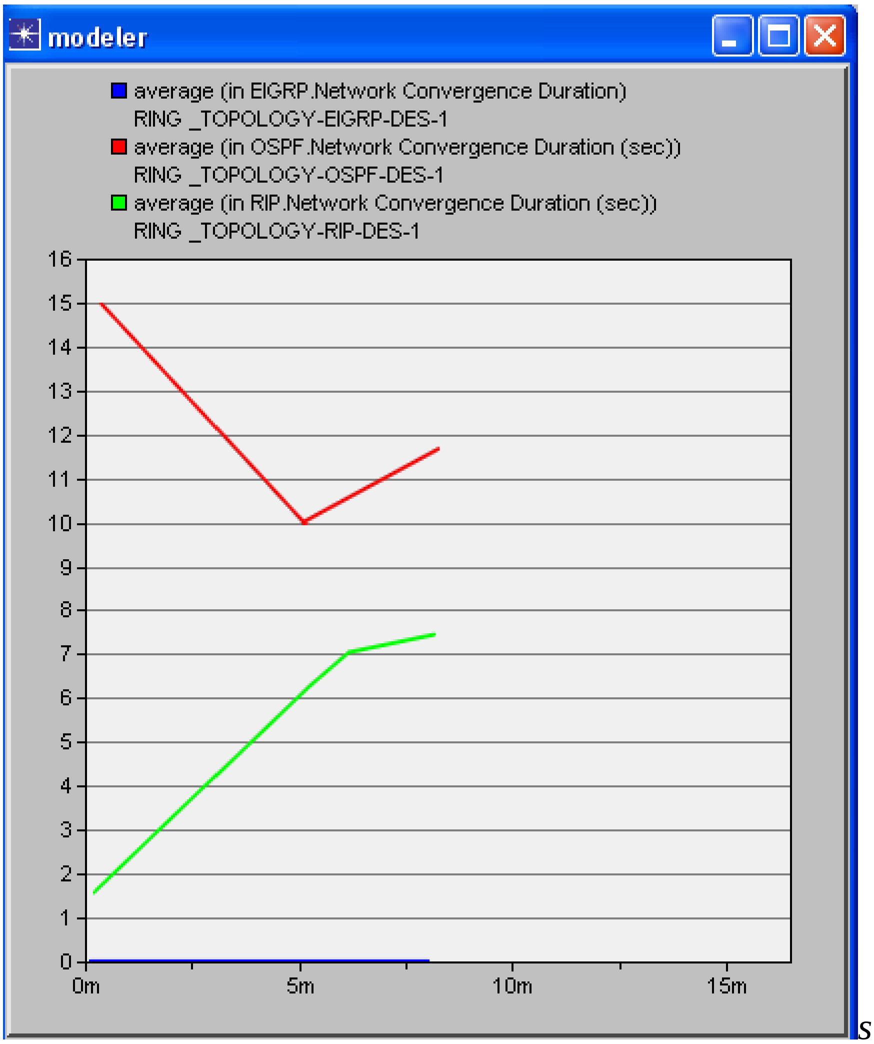

Figure (4.3) average Convergence duration for Small Ring

4.2.2 Small Mesh Topology:

The traffic sent and convergence results of the small mesh are shown in figure (4.4) and respectively. Similarly to the results in the small ring topology, the first, second, and third peak represents the initial setup, link-failure, and link recovery in the network. Looking at the traffic sent results we can see the throughput has increased for each protocol due to the increase of neighbor routers, but in comparison to the small ring the bandwidth efficiency (the amount of routing traffic sent within the network topology) has not changed.

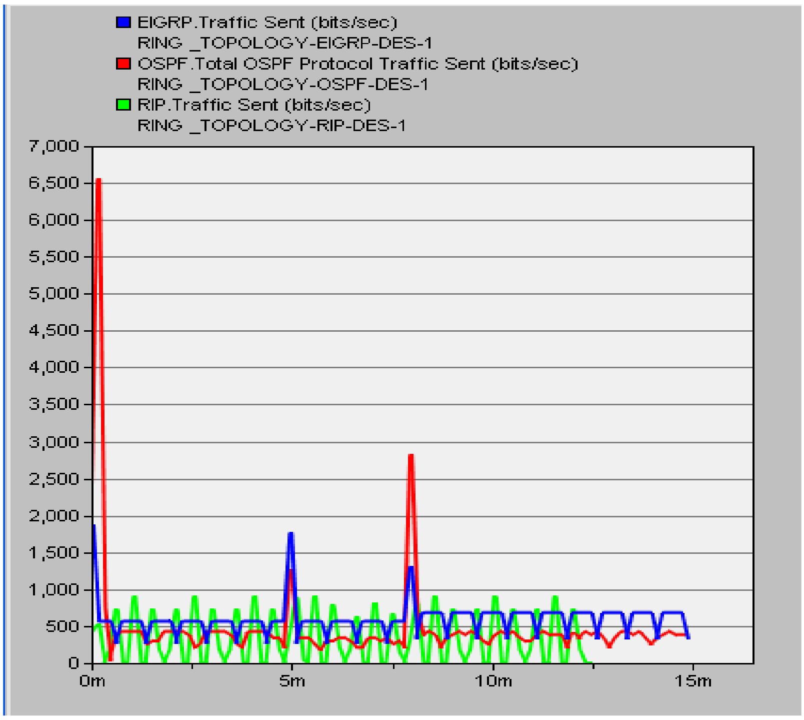

Figure (4.4) Routing Traffic Sent in bits/sec for Small Mesh

However, the convergence results shown figure (4.5) are different; while EIGRP is still the fastest, RIP now has faster convergence times than OSPF at all three peaks. RIP is unseen in this graph as it overlaps with EIGRP during the first and third peak and OSPF during the second peak.

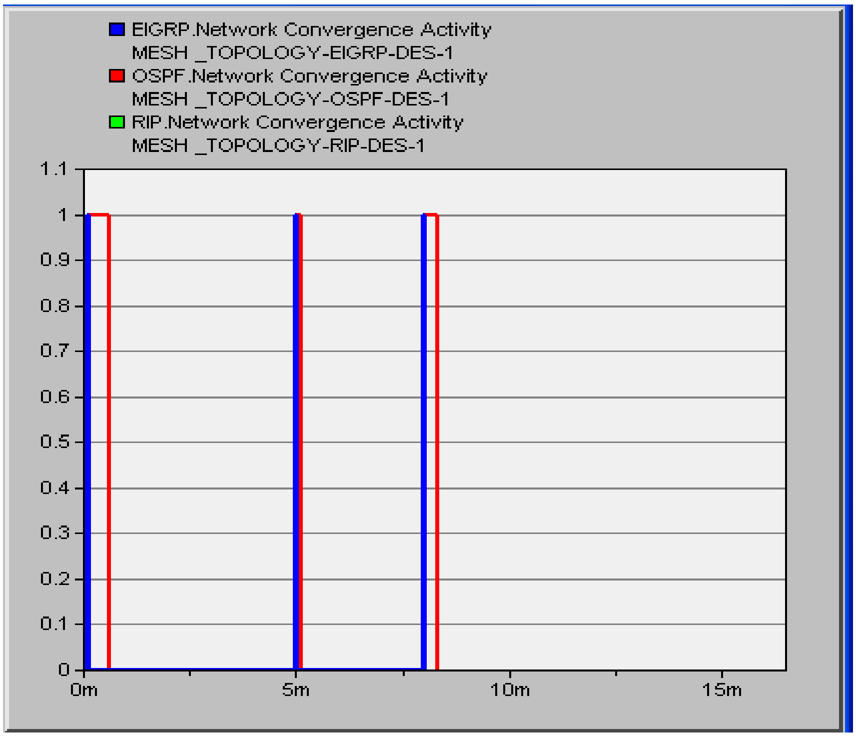

Figure (4.5) Convergence Activity for Small Mesh

The figure (4.6) confirms that RIP has surprisingly fast convergence times. This behavior is contradictory to that we expected, as OSPF should be significantly faster than RIP. Would attribute this discrepancy to the unrealistic network topology, and that the OSPF parameters have not been set to optimal for the protocol to perform at its "best". Because each destination in this topology is only one hop away, RIP is able to easily find its destination. In contrast, OSPF must first map out the entire network even though for this topology, it suffices to only having knowledge of neighbor routers.

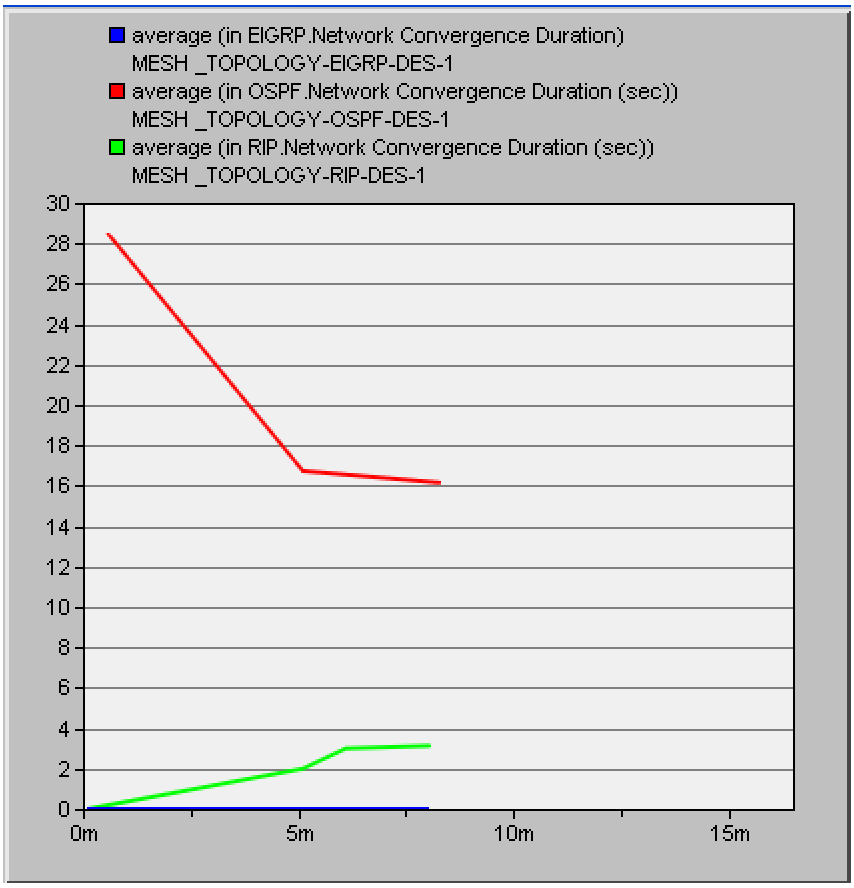

Figure (4.6) average Convergence Duration for Small Mesh

4.3 Discuses

Based on my results, EIGRP had the best convergence time and bandwidth efficiency for all scenarios. As for RIP, its initial convergence performance was better than OSPF for small topologies, but its bandwidth efficiency was the lowest for all scenarios. I expected RIP to have the lowest bandwidth efficiency, as it requires full periodic updates while OSPF and EIGRP do not. It should also be noted that OSPF had a better convergence time for small ring topologies after a link failure. This result makes sense, because like EIGRP, OSPF has an early detection mechanism for changes in the network. OSPF's overall convergence time and bandwidth efficiency, they stayed constant for both topologies.