

# *Comparative Study of Routing Protocols Convergence using OPNET*

## *Chapter One: Introduction*

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### **1.1General View:-**

On the network layer, achieving routing convergence, the process in which routing tables are updated, is a crucial and complex process. At every topology change, including a link failure or recovery, the routing tables need to be updated at which time the convergence process takes place. The task of updating these tables is accomplished by routers that communicate according to a set of rules set by routing protocols.

EIGRP, OSPF and RIP are dynamic routing protocols used in practical networks to disseminate network topology to the adjacent routers. There are various numbers of static and dynamic routing protocols available but the selection of appropriate routing protocol is most important for routing performance. The right choice of routing protocol is dependent on several parameters. In this thesis, we implement two routing protocols, namely EIGRP, OSPF, and RIP and further do performance evaluation for real-time applications

The main goals of any routing protocol are to achieve fast convergence, while remaining simple, flexible, accurate and robust. In this project, would analyze and compare the convergence times of three protocols: Routing Information Protocol (RIP), Open Shortest Path First (OSPF), and Enhanced Interior Gateway Routing Protocol (EIGRP).

Would be consider different topologies or different sizes, each of which will be simulated on Optimized Network Engineering Tools (OPNET) 14.5. Would be simulate each topology with all three routing protocols and collect statistics such as convergence time and routing traffic sent. Would be also analyze the routing tables of a simple network topology in order to study the metrics of each protocol and gain a better understanding of how routes are chosen. By examining the results (convergence times in particular), would identify the routing protocol with the best performance for a large, realistic network.

Finally, would be discussing the limitations that exist within our project and network implementations of the routing protocols. Furthermore, would provide possible modifications that could be explored for future work [1] [2].

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### **1.2 Problem statement:-**

The main goal of this project is to compare the proposed routing protocols and to evaluate them based on some performance metrics. This evaluation is performed theoretically and by simulation.

RIP is not a Cisco proprietary. RIP is a distance vector protocol. The RIP routing protocol is calculated based on hop count. OSPF is not a Cisco proprietary. OSPF is a link-state interior gateway protocol based on Dijkstra algorithm (Shortest Path First Algorithm). The cost of OSPF routing protocol is calculated based on bandwidth. In contrast EIGRP is a Cisco proprietary distance-vector protocol based on Diffusing Update Algorithm (DUAL). The cost of EIGRP is calculated on the basis of bandwidth and delay [3].

These protocols use different algorithm to route the packets and this may vary the route processing delay. As a consequence, the impact of different algorithm can affect the overall network performance

### **1.3 Objectives:-**

The main aim of the thesis work is to evaluate which protocol, RIP or OSPF or EIGRP is most suitable to route in real-time traffic:

- To design two networks topology models those are configured respectively with RIP, OSPF and EIGRP to evaluate their performance.
- To simulate these network models with failure link and to observe how the performance varies from the RIP network, the OSPF network and the EIGRP network.
- To report the simulated results and to analyze them.

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#### **1.4 Methodology:**

Would be discussed the breakdown of the project implementation from initiating the topologies to setting various protocol and simulation parameters. In the following sections, would be presented the obtained simulation results and compare the performance of the three routing protocols.

In order to compare RIP, OSPF and EIGRP, would use OPNET 14.5 to implement two networks: Ring and Mesh topology. These implementations were realized using Cisco routers connected by PPP\_DS1. The small ring and mesh topologies that would be analyzed and focused on routing protocol behavior and performance.

The purpose of the two simple topologies is for validation of the routing protocols. Would be find routing tables from the ring topology in order to better understand the routing system of each protocol.

Would be chosen collect three sets of statistics. First, for the ring and mesh topologies would export the routing tables of each protocol after the link failure. These tables serve to give us a better understanding of each protocol. Next, for all scenarios would be collected Convergence Activity, Convergence Duration (sec) and Traffic Sent (bits/sec). It should be noted implemented user applications.

#### **1.5 Lay out:-**

This thesis consists of 5 chapters. Chapter 1 describes the introduction of thesis project. Chapter 2 explains computer network, and the basic technique routing, and explains the basic technique of routing protocols (e.g. EIGRP, OSPF and RIP). Chapter 3 exhibits a brief description of simulators and proposed network topologies is presented. Chapter 4 explains the simulation result graph and analysis. Chapter 5 concludes the entire thesis, and recommendation.