Dynamic Routing Protocols Assessment for Varying Packets Using OPNET

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Abstract

Paper provides the detailed investigation of three well-known Routing protocols namely IS-IS, IGRP and RIP for fifty workstations which have increasing number of packets from 100 to 1000 in steps working on three dissimilar applications i.e. Ftp, Remote login and Videoconferencing respectively. Simulation is carried out with the help of Optimized Network Engineering Tool (OPNET) which gives the better edge over the other network simulation tools available. Videoconferencing Packet delay variation (PDV) and Packet end to end delay are the parameters used to measure the routing performance of the network and the results illustrated that IGRP performs well for PDV which gives minimum variation where IS-IS attains good results for Videoconferencing packet end-to-end delay for increasing number of packets.

Keywords: IS-IS, IGRP, RIP, OPNET, LAN, Videoconferencing Packet delay variation and Videoconferencing Packet end-to-end delay.

I. INTRODUCTION

Efficient and scalable routing is one of the key challenges in design and performance of a large scale intra-domain network [1]. An effective intra-domain network routing may make distributed applications more efficient. With the growing need to distribute applications across multiple networks and the availability of high- capacity, high performance intermediate switching nodes and networks, an efficient routing mechanism has become the core requirement. In this paper, we present an analysis for distance vector and link state routing protocols like RIP, IGRP and IS-IS, that can impact the efficiency of any large scale network. RIP(Routing Information Protocol) and IGRP(Interior Gateway Routing Protocol) based on Bellman-Ford algorithm[2], both are distance vector protocols[3]. In contrast IS-IS(Intermediate System to Intermediate System) is a link state routing protocol based on Dijkstra's algorithm[4]. We evaluate the parameters of Videoconferencing Packet delay variation and Packet end to end delay. RIP[5],IGRP[6] and IS-IS[7] are dynamic routing protocols used in practical networks to disseminate network topology to the adjacent routers.

II. LITERATURE REVIEW

There are a number of studies which looked at the evaluation of a number of Routing protocols. However, they focused on certain aspects of the simulation. Ahmad Karim *et al* [8] showed the behavior of routing protocols for medium to large scale networks. He evaluated these protocols on the basis of quantitative metrics such as CPU processing power ,point to point throughput, point to point queuing delay. Results show that IS-IS protocol uses only 0.0004% of the CPU processing capability, whereas RIP produces greater point to point throughput and also has the highest point to point queuing delay. Jagdeep Singh *et al* [9] showed the comparative study of RIP,OSPF,EIGRP and found that RIP performs well for Email download and upload response time and DB querry response time. Ikram Ud Din *et al* [10] presented the analysis of routing protocols in real time transmissions. It has been shown that IGRP performs well in packets dropping, traffic received and end to end delay while in case of jitter RIP performs a bit well than IGRP. The paper compares the two protocols on the basis of Videoconferencing Packet delay variation and packet end to end delay for different number of packets.

III. SIMULATION MODEL

First of all a 500 Km × 400 Km enterprise network consisting of three interconnected subnets: subnet_0, subnet_1, subnet_2 is created. Each subnet is consisting of two switches, dissimilar number of routers, three servers and three Workstations or LANs working on three different applications i.e. Ftp, Remote Login and Videoconferencing. The scenario is shown in figure 1. Figure 2 shows internal topology of subnet_0. Main characteristics of the scenarios maintained are depicted in the Table 1. Optimized Network Engineering Tool (OPNET)[11] is preferred network simulation environment for network modeling. It is a powerful network simulator. It simulates the network graphically[12] and its graphical editors mirror the structure of actual networks and network components. OPNET[13] provides a variety of toolboxes to design, simulate and analyze a network parameters. Network

with several hundreds of nodes can be managed. OPNET modeler version 14.5[14] is used for simulations.

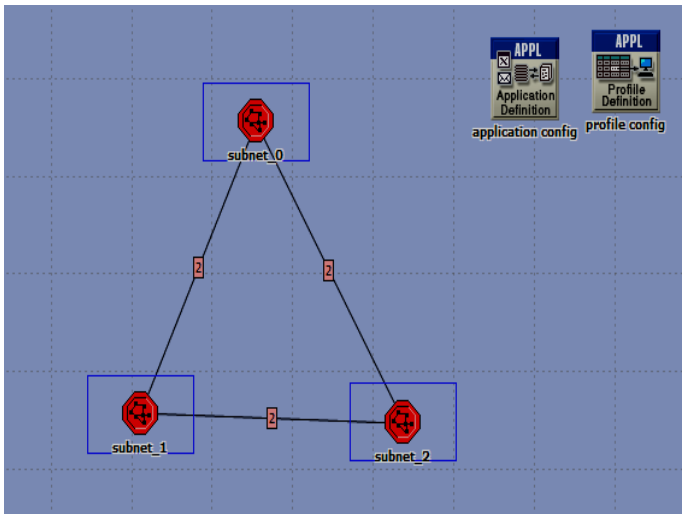

Figure 1 : Network Scenario

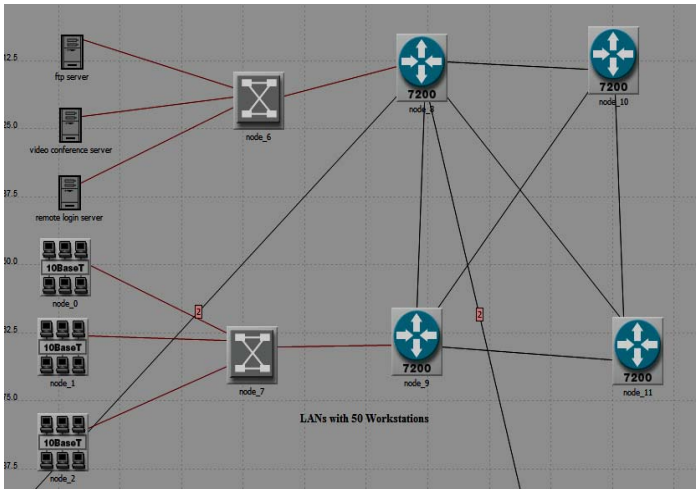

Figure 2: LANs with 50 workstations for subnet _0 Topology

TABLE 1: MAIN CHARACTERISTICS OF SCENARIO

Parameters	**Values**
Simulator	OPNET Modeler version 14.5
Protocols Studied	RIP,IGRP,IS-IS
Scenario Size	500 Km × 400 Km
Number of Subnets	3
Number of Workstations	50
Links	100BaseT, PPP_DS3
Applications	Ftp, Remote Login, Videoconferencing
Simulation Duration	5 min
Simulation Kernel	Optimized
Number of Routers in:	
Subnet_0	4
Subnet_1	3
Subnet_2	5

IV. SIMULATION RESULTS AND ANALYSIS

TABLE 2: VIDEOCONFERENCING PACKET DELAY VARIATION FOR DIFFERENT NUMBER OF PACKETS

Videoconferencing Packet delay variation			
Number of Packets per sec	***Protocols***		
	IS-IS	***IGRP***	***RIP***
100	148.01	287.98	244
200	354.185	73.76	239.54
500	148.01	106.61	94.35
800	191.818	129.35	158.06
1000	192.61	180	95.02

A. VIDEOCONFERENCING PACKET DELAY VARIATION

Packet delay variation (PDV)[15] is the difference in end-to-end one-way delay between selected packets in a flow with any lost packets being ignored. The effect is sometimes referred to as jitter. Low PDV is especially important for applications requiring timely delivery of packets. Table 2 shows Videoconferencing PDV for different number of packets. Observing the characteristics in figures 3 to 7, it is evident that IGRP gives the lowest packet delay variation of

73.76 out of three protocols for 200 packets followed by RIP whose value is 94.35 for 500 packets. Also RIP performs well for 1000 packets whose PDV is 95.02. IS-IS attains the higher value of delay variation of 354.185 for 200 packets throughout the period of simulation. It is shown that for IS-IS PDV increases for increasing number of packets whereas for IGRP and RIP its value decreases for increasing packets.

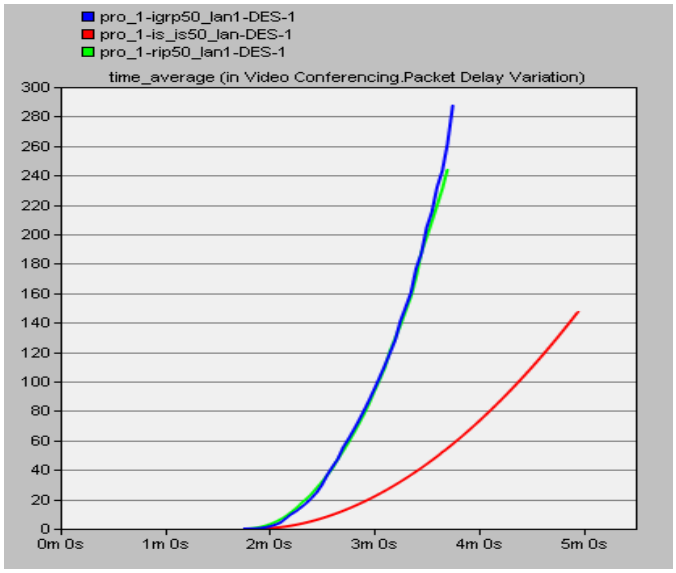

Figure 3: Videoconferencing Packet delay variation for 100 packets.

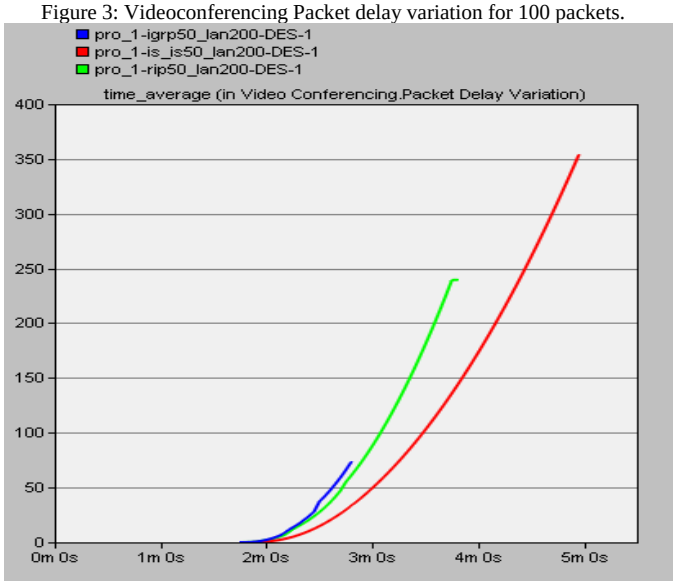

Figure 4: Videoconferencing Packet delay variation for 200 packets.

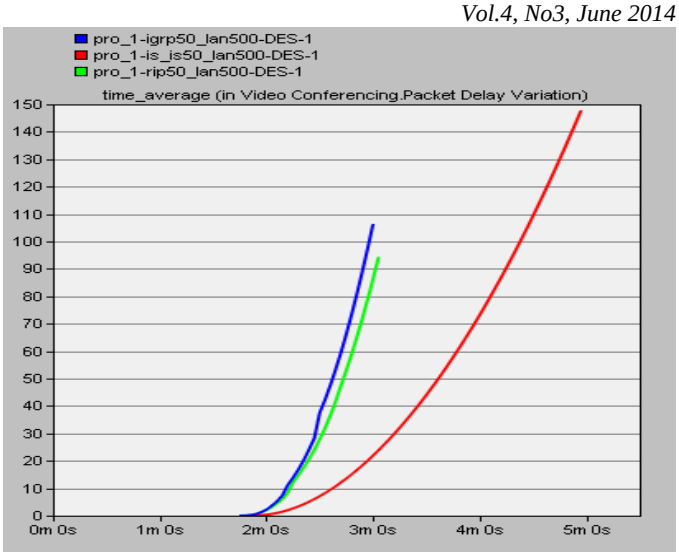

Figure 5: Videoconferencing Packet delay variation for 500 packets.

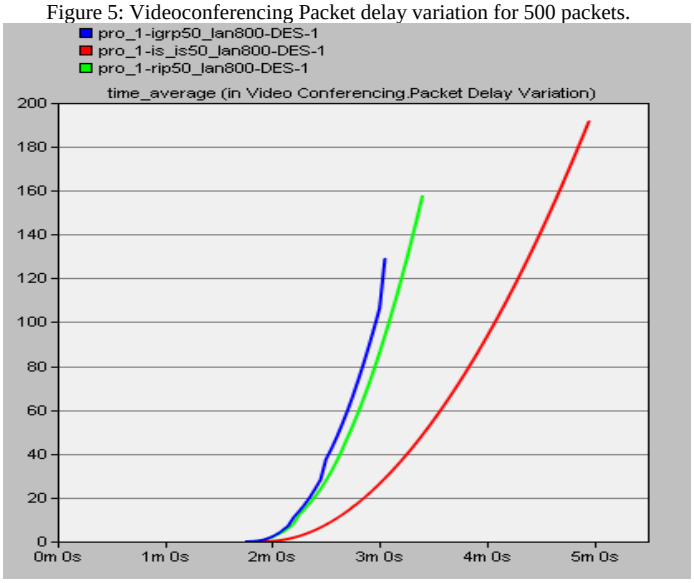

Figure 6: Videoconferencing Packet delay variation for 800 packets.

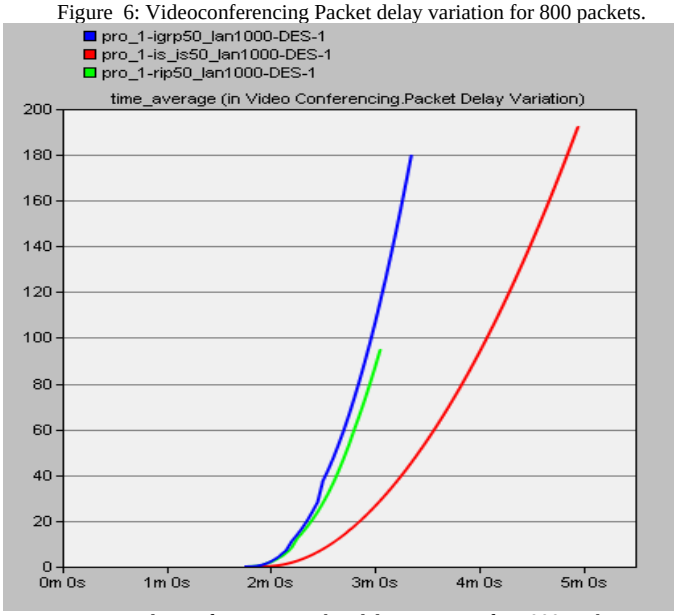

Figure 7: Videoconferencing Packet delay variation for 1000 packets

TABLE 3: VIDEOCONFERENCING PACKET END TO END DELAY FOR DIFFERENT NUMBER OF PACKETS

Videoconferencing Packet end-to- end delay(sec)			
Number of Packets per sec	***Protocols***		
	IS-IS	***IGRP***	***RIP***
100	2.867	3.39	3.681
200	2.314	2.159	2.610
500	2.867	2.6	2.05
800	1.452	2.69	2.302
1000	1.44	3.11	2.041

B. VIDEOCONFERENCING PACKET END- TO- END DELAY

The packet end-to-end delay is the average time that packets take to traverse the network. This is the time from the generation of the packet by the sender up to their reception at the destination application layer and is expressed in seconds[16]. Figure 8 to 12 shows the characteristics obtained by different protocols for different packets. Table 3 represents the Videoconferencing end-to-end delay for different number of packets. It is shown that lowest delay out of three protocols is obtained by IS-IS protocol of 1.44 sec for 1000 packets. Also 1.452 sec of delay is produced by IS-IS for 800 packets which is slightly differing. Higher value of delay is attained by RIP of 3.681 sec for 100 packets but decreasing for increasing number of packets to 2.041 for 1000 packets. Also for IGRP and IS-IS the value of delay decreases for increasing number of packets. IGRP neither attains higher nor lower value of delay.

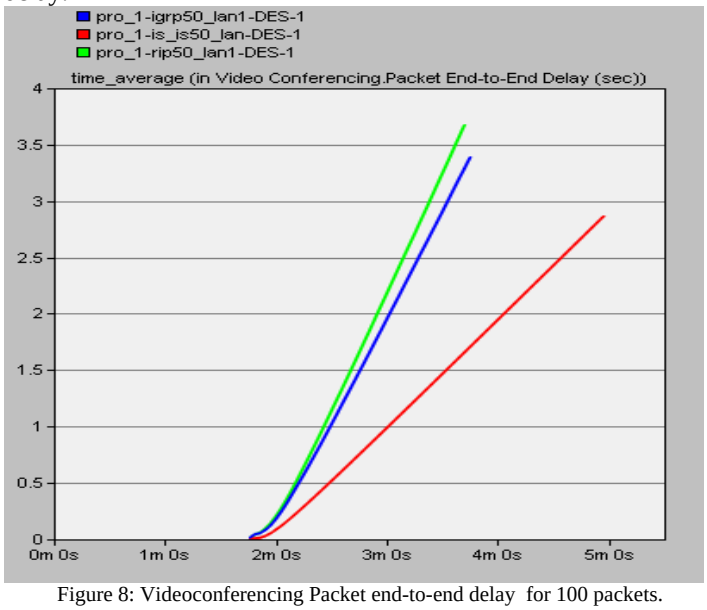

Figure 8: Videoconferencing Packet end-to-end delay for 100 packets.

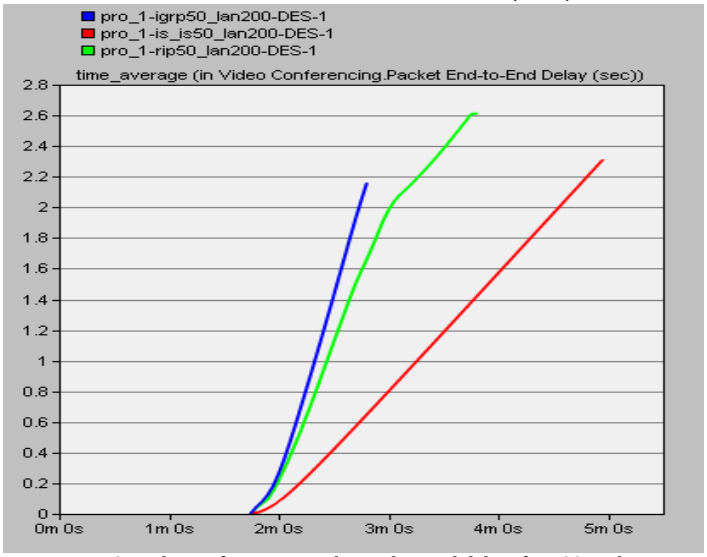

Figure 9: Videoconferencing Packet end-to-end delay for 200 packets.

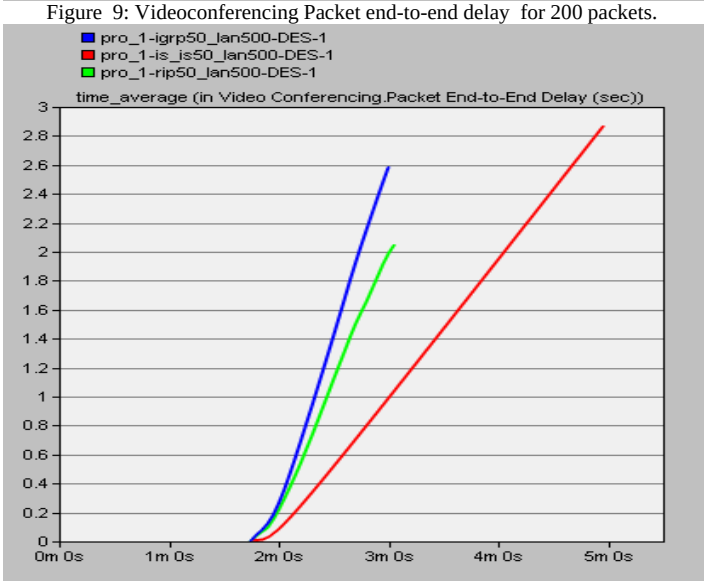

Figure 10: Videoconferencing Packet end- to-end delay for 500 packets.

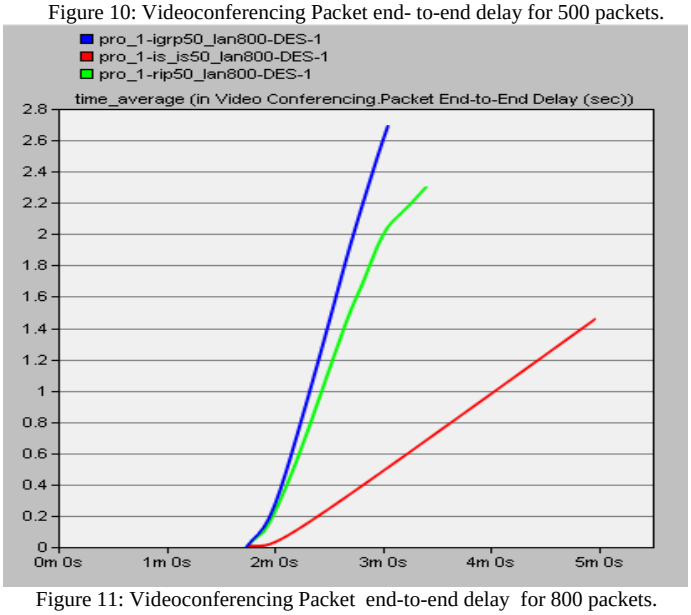

Figure 11: Videoconferencing Packet end-to-end delay for 800 packets.

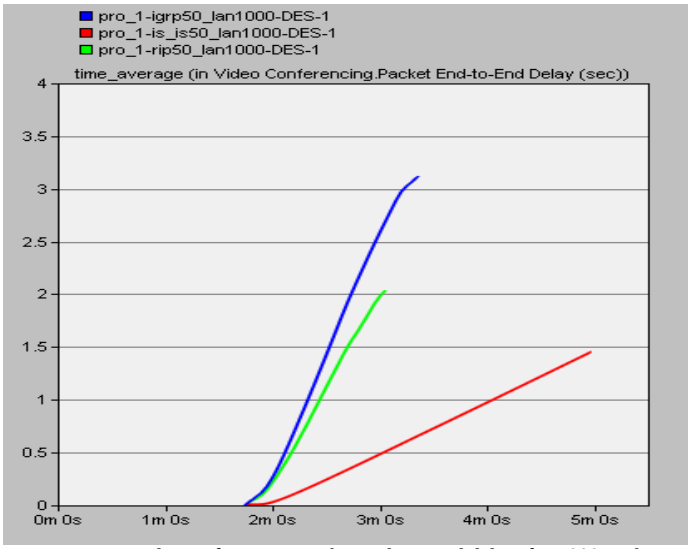

Figure 12: Videoconferencing Packet end- to- end delay for 1000 packets.

V. CONCLUSION

The analysis shows that to have minimum Videoconferencing packet delay variation IGRP protocol should be preferred which has the variation of 73.76 for 200 packets. Maximum packet delay variation is given by IS-IS protocol of 354.185 for 200 packets. RIP also performs well giving variation of 94.35 for 500 packets. For IGRP and RIP packet delay variation is minimum for increasing number of packets compared to 100 packets. IS-IS protocol behaves in reverse manner where PDV increases for increasing packets compared to 100 packets. Minimum Packet end-to-end delay is given by IS-IS protocol for 1000 and 800 number of packets. RIP protocol has maximum delay for 100 packets which decreases for increasing packets. IGRP and IS-IS also behaves in same manner for which delay continues on decreasing for increasing number of packets.

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AUTHOR'S PROFILE

Sonam is a student pursuing M.Tech in Communication System from Guru Nanak Dev University, Amritsar. She has completed her graduation in Electronics and Communication in Guru Nanak Dev University Regional Campus Gurdaspur. She has keen interest in the field of Network Communication specifically in routing protocols deployment and their performance assessment in small to large scale networks. She has worked on LDAP(LightWeight Directory Access Protocol) to maintain and distribute directory information services over an Internet Protocol(IP) in Linux Operating System.

Er. Rajan Vohra has been working as Asstt. Professor in the Department of Electronics Technology, Guru Nanak Dev

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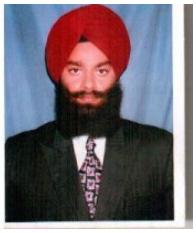

Prof. Ravinder Singh Sawhney has been working as faculty with the Department of Electronics Technology, Guru Nanak Dev University, Amritsar. He has teaching experience of more than 15 years to both post-graduate and under graduate engineering students. He has more than 30 publications to his credit in various International journals as well as International and National conferences. He has membership of many International and National Engineering Societies. His key areas of interest in the field of Data Communication are routing through WLANs, MANETS, Mesh Networks, MPLS, Ant Colony Optimization, Particle Swarm Optimization and Different Encryption Techniques. He has been on the board of many journals as reviewer. Currently, he is working in the field of modelling and simulation of charge transport through various molecules and designing of various molecular junctions for future Nanoelectronic Devices.