# STUDY OF TCP PERFORMANCE IN MULTI-HOP WIRELESS AD HOC NETWORKS

This thesis is presented in partial fulfillment for the award of the Bachelor of Electrical Engineering (Hons.) Universiti Teknologi MARA.



IRMAN SHAH BIN IDRIS Faculty of Electrical Engineering UNIVERSITI TEKNOLOGI MARA 40450 SHAH ALAM, SELANGOR

#### ACKNOWLEDGEMENT

In the name of Allah, The Most Gracious, The Most Merciful and The Most Beneficent. Praise in only Allah S.W.T for his bounty and blessing upon us. It is with deepest sense of gratitude to Allah who has given the strength and ability to complete this project as it is today.

I would like to express my countless appreciations and gratitude to my project supervisor, Prof. Madya Ruhani Abdul Rahman for her continued guidance and for her invaluable ideas as well as a lot of advices which helped me tremendously in completing this project. I am also greatly to Pn Yusnani Mohd Yussoff for her guidance, valuable knowledge and suggestion in completing this thesis successful. I am thankful to my panels, Puan Nur Emileen Abdul Rashid and Puan Aziati Husna Awang for their valuable comments and criticism in proofing this thesis.

I would like to express my deepest thanks to my friends, as my course mates in UiTM who had shared with me their valuable ideas in J-Sim software toward the completion of this project.

My thanks also to all lectures in Faculty of Electrical Engineering, UiTM and to those who have devoted their time either directly or indirectly, for their ideas, support and a lot of contribution towards the success of this project. Last but not least, to both of my parent and family for their understanding and support throughout the years. You all are the source of my strength and inspiration.

Irman Shah Idris

Universiti Teknologi MARA

#### ABSTRCT

This paper studies TCP performance in multi-hop wireless network using IEEE 802.11 for channel access control. The multi-hop wireless network was setup on "chain" network topology that contains on 3 hops as intermediate nodes. The purpose is to examine and understand the concept of TCP performance environment that is being used in multi-hop wireless Ad Hoc networks and its implementation in the Wireless Local Area Network (WLAN). The network simulates on J-Sim to perform the TCP performances on throughput, sequence number and smoothed round trip time. The explanation of each TCP performance is due to observations and analysis of the packet loss in multi-hop wireless network.

### TABLE OF CONTENTS

### CHAPTER

	ACKNOWLEDGEMENT		iv v vi ix x		
	ABSTRACT TABLE OF CONTENTS LIST OF FIGURES LIST OF TABLES				
	LIST	OF AB	BREVIATIONS	xi	
1	INTI	RODUC	ΓΙΟΝ		
	1.1	Introdu	action	1	
	1.2	Object	ives of the Project	2	
	1.3	Scope	of Project	3	
	1.4	Organi	ization of the project	3	
2	WIRELESS AD HOC NETWORKS				
	2,1	Introduction to Ad Hoc Networks		5	
	2,2	Overview		6	
	2.3	Wirele	ess networks	10	
		2.3.1	Multi-hop Wireless Ad Hoc Networks	11	
		2.3.2	IEEE 802.11	12	
	2.4	Ad Ho	c Routing	15	
		2.4.1	AODV Overview	15	
		2.4.2	Route Discovery	16	
		2.4.3	Route Maintenance	17	
		2.4.4	Properties	17	

2.5	Transport Protocols		19
	2.5.1	ТСР	19
	2.5.2	TCP Performance	19
	2.5.3	TCP Operations	20
	2.5.4	Throughput	24
	2.5.2	Smoothed Round Trip Time	25
	2.5.3	Sequence number	27

## 3 METHODOLOGY

3.0	Introduction	28
3.1	Literature on Multi-hop	29
3.2	J-Sim Software	29
	3.2.1 Theory operation	30
	3.2.2 Run J-Sim	31
	3.2.3 Modify Program	32
3.3	Simulation	33
3.4	Result	33

#### 4

## **RESULT and DISCUSSION**

4.0	Result and Discussion	34
4.1	Throughput Measurements	34
4.2	Sequence number	37
4.3	End to End Delay	39
4.4	Variable nodes	41
4.5	Variable Distances	46
	4.5.1 Explanation of Variable distance	51