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Performance Analysis of Ad Hoc on-Demand Distance Vector Routing Protocol under the Real World Implementation and Simulation Environment

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ABSTRACT

Ad Hoc networks have become increasingly important in view of their promise of ubiquitous connectivity beyond traditional wired infrastructure networks. Such networks, consisting of potentially highly mobile nodes, have provided new challenges by introducing special considerations stemming from the unique characteristics of the wireless medium and the dynamic nature of the network topology.

This research was conducted with the objective of studying the performance of Ad Hoc wireless networks; the area of which currently falls under emerging technologies in the Wireless Communication. The study involved two major works; real world implementation and simulation of the Ad Hoc network. Both works used Ad Hoc On-Demand Distance Vector (AODV) as the routing protocol. The real world implementation was carried out in the Wireless Laboratory at Faculty of Electrical Engineering, Universiti Teknologi MARA, Shah Alam where a test bed of Ad Hoc network consists of four static nodes was set up. All tests and data collection on the real world implementation were done using various traffic monitoring and measurement software. Performance parameters used in both studies are throughput, Round Trip Time (RTT) and packet loss rate. The performance was studied by varying the number of hops in the Ad Hoc communication while distance between nodes and node mobility were kept constant.

A simulation study on the same network topology was subsequently carried out using J-Sim network simulation software. J-Sim is an open source and component based simulation software and was entirely developed in Java. J-Sim components are autonomous and are realization of software ICs. To ensure valid and comparable data between simulation and real world implementation, the network topology, components and model used in the simulation was modified to be as close as possible to the real world implementation specification. The Free Space Model available in J-sim was used to model the radio propagation wave in the laboratory environment. This model assumes that no obstacle that can degrade the signal strength of the wireless cards on the Ad Hoc nodes as all the nodes in the laboratory were located in the same room.

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CHAPTER 1

INTRODUCTION

The demand on wireless communication devices has increased tremendously over the last few years. Modern users insist on communicating with each other anywhere and anytime without relying on any existing infrastructure or centralized access point. Users nowadays are getting more and more comfortable with constantly being able to have access to different on-line services. It may be e-mail or on line dictionary services, e-ticket booking, or traveling information such as road maps and driving directions or even subject registration for university students. Those applications used in wireless communication are still dependent on base stations to connect to. These base stations are in turn connected to an infrastructure. To be able to expand the wireless services, they depend on this infrastructure. Problem arises when such infrastructure is not available. It can be costly to build new links for which there is little profit for the service provider. This has lead to the development of a wireless technology called Ad Hoc wireless network. This thesis presents a performance evaluation of a real-world implementation and a simulation study of the Ad Hoc network test bed. Both implementations used AODV as the routing protocol.

1.1   Research Background

In computer networking, Ad Hoc is a network connection method which is most often associated with wireless devices. The connection is established for the duration of one session and requires no base station. Instead, devices discover others within range to form a network for those computers. Devices may search for target nodes that are out of range by flooding the network with broadcasts that are forwarded by each node. Connections are possible over multiple nodes (multi-hop Ad Hoc network) [1].