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Architecture and routing protocols for wireless area networks. Comparative analysis and evaluation of the effectiveness

MASTER'S THESIS

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INTRODUCTION

With the widespread rapid development of computers and the wireless communication, the mobile computing has already become the field of computer communications in high-profile link. Mobile Ad Hoc Network (MANET) is a completely wireless connectivity through the nodes constructed by the actions of the network, which usually has a dynamic shape and a limited bandwidth and other features, network members may be inside the laptop, Personal Digital Assistant (PDA), mobile phones, MP3 players, and digital cameras and so on. On the Internet, the original Mobility (mobility) is the term used to denote actions hosts roaming in a different domain; they can retain their own fixed IP address, without the need to constantly changing, which is Mobile IP technology. Mobile IP nodes in the main action is to deal with IP address management, by Home Agent and Foreign Agent to the Mobile Node to packet Tunneling, the Routing and fixed networks are no different from the original; however, Ad Hoc Network to be provided by Mobility is a fully wireless, can be any mobile network infrastructure, without a base station, all the nodes can be any link, each node at the same time take Router work with the Mobile IP completely different levels of Mobility. Early use of the military on the Mobile Packet Radio Networked in fact can be considered the predecessor of MANET, with the IC technology advances, when the high-tech communication equipment, the size, weight continuously decreases, power consumption is getting low, Personal Communication System (Personal Communication System, PCS) concept evolved, from the past few years the rapid popularization of mobile phones can be seen to communicate with others anytime, anywhere, get the latest information, or exchange the required information is no longer a dream, And we have gradually become an integral part of life. Military purposes, as is often considerable danger in field environment, some of the major basic communication facilities, such as base stations, may not be available, in this case, different units, or if you want to communicate between the forces, we must rely on This cannot MANET network infrastructure limitations. In emergency relief, the mountain search and rescue operations at sea, or even have any infrastructure can not be expected to comply with the topographical constraints and the pressure of time under the pressure, Ad Hoc Network completely wireless and can be any mobile feature is especially suited to disaster relief operations. When personal communication devices and more powerful, some assembly occasions, if you need to exchange large amounts of data, whether the transmission of computer files or applications that display. If we can link into a temporary network structure, then the data transmission will be more efficient without the need for large-scale

projection equipment would not have point to point link equipment (such as network line or transmission line). The current wireless LAN technology, Bluetooth is has attracted considerable attention as a development plan. Bluetooth's goal is to enable wireless devices to contact with each other, if the adding the design of Ad Hoc Network (MANET).

GENERAL DESCRIPTION OF THE WORK

Architecture, routing, Comparative analysis protocols for MANET.

The network architecture is grouped into main three categories: Enabling technologies; Networking; Middleware and applications. Routing is the process of selecting paths in a network along which to send data packets. An ad hoc routing protocol is a convention, or standard, that controls how nodes decide which way to route packets between computing devices in a mobile ad-hoc network. we examined simulation studies and also compared the On-Demand (DSR and AODV) and Table Driven (DSDV) routing protocols [1,2,4] by varying the pause time and measured the metrics like end-end delay, dropped packets, routing overhead, power efficiency etc. The results indicate that the performance of the two on demand protocols namely DSR and AODV is superior to the DSDV.

The purpose.

The Goal of the manet working group is to standardize one (or more) intra-domain unicast routing protocol(s), and related network-layer support technology which:

* provides for effective operation over a wide range of mobile networking "contexts" (a context is a set of characteristics describing a mobile network and its environment);

* supports traditional, connectionless IP service;

* reacts efficiently to topological changes and traffic demands while maintaining effective routing in a mobile networking context.

THE BASIC CONTENT OF WORK

In **Introduction,** description of an image segmentation.

Chapter 1 The field of wireless and mobile communications has experienced an unprecedented growth during the past decade. Current second-generation (3G) cellular systems have reached a high penetration rate, enabling worldwide mobile connectivity. Mobile users can use their cellular phone to check their email and browse the Internet. Recently, an increasing number of wireless local area network (LAN) hot spots is emerging, allowing travelers with portable computers to surf the Internet from airports, railways, hotels and other public locations. Broadband Internet access is driving wireless LAN solutions in the home for sharing access between computers. In the meantime, 3G cellular networks are evolving to 4G and even 5G, offering higher data rates, infotainment and location-based or personalized services. As already stated, the specific characteristics of MANETs impose many challenges to network protocol designs on all layers of the protocol stack. The physical layer must deal with rapid changes in link characteristics. The media access control (MAC) layer needs to allow fair channel access, minimize packet collisions and deal with hidden and exposed terminals. At the network layer, nodes need to cooperate to calculate paths.

The transport layer must be capable of handling packet loss and delay characteristics that are very different from wired networks. Applications should be able to handle possible disconnections and reconnections. Further- more, all network protocol developments need to integrate smoothly with traditional networks and take into account possible security problems. In the following sections, technological challenges and possible solutions related to unicast routing, resource and service discovery, addressing and Internet connectivity, security and node cooperation are covered in more detail. MANET is a collection of two or more devices or nodes or terminals with wireless communications and networking capability that communicate with each other without the aid of any centralized administrator also the wireless nodes that can dynamically form a network to exchange information without using any existing fixed network infrastructure. And it’s an autonomous system in which mobile hosts connected by wireless links are free to be dynamically and some time act as routers at the same time. All nodes in a wireless ad hoc network act as a router and host as well as the network topology is in dynamically, because the connectivity between the nodes may vary with time due to some of the node departures and new node arrivals. In this architecture that allow the wireless station to make a communication between each other, and this

type relies on the third fixed party and we call it a Base Station, as shows in this figure 1.7, and that will handover the offered traffic from the Station to another, the same entity will regulate or organize the allocation of radio resources. When a source node likes to communicate with a destination node, the former notifies the base station. At this point, the communicating nodes do not need to know anything about the route from one to another. All that matters is that the both the source and the destination nodes are within the transmission range for the Base Station and then if there's any one loses this condition, the communication will frustration or abort.

Chapter 2 The main aspects of designing the physical transmission system are dependent on the characteristics of the radio propagation channel such as path loss, interference (co-channel), and fading. In addition, since mobile terminals usually have limited power resources, the transceiver must be power efficient. These aspects are taken into account while designing the modulation, coding, and power control features in the radio equipment. In principle, the radio equipment in the nodes forming a mobile ad hoc network can use any technology as long as it provides reliable links between neighboring mobile terminals on a common channel. Candidate physical layers that have gained prominence are infrared and spread spectrum radio. The 802.11 MAC is designed to provide mandatory asynchronous data service along with an optional time-bounded service that is only usable in an infrastructured wireless networks with access points. The asynchronous data service is usable by both ad hoc networks and infrastructured wireless networks and supports "best effort" packet exchange without delay bounds.

The mandatory basic asynchronous service is provided by a method known as *carrier sense multiple access with collision avoidance (CSMA/CA)* and an optional channel reservation scheme based on a four-way handshake between the sender and receiver nodes. These two methods provide the mechanism for achieving distributed coordination amongst uncoordinated wireless terminals that do not use a fixed access point, and are known as the **distributed coordination function (DCF)**. A third method, known as the **point coordination function (PCF)**, offers both asynchronous and time-bounded service, but needs an access point to control medium access to avoid contention. Movements of nodes in a mobile ad hoc network cause the nodes to move in and out of range from one another. As the result, there is a continuous making and breaking of links in the

network, making the network connectivity (topology) to vary dynamically with time. Since the network relies on multi-hop transmissions for communication, this imposes major challenges for the network layer to determine the multi-hop route over which data packets can be transmitted between a given pair of source and destination nodes. Figure 2.8 demonstrates how the movement of a single node (**C**) changes the network topology rendering the existing route between **A** and **E** (i.e. **A**–**C**–**E**) unusable. The network needs to evaluate the changes in the topology caused by this movement and establish a new route from **A** to **E** (such as **A**–**D**–**C**–**E**).

Chapter 3 ROUTING TECHNIQUE FOR PROTOCOLS OF MANET.

Flooding.

Flooding is the simplest routing technique which has been designed for multi-hop networks. In flooding, whenever a node receives a packet, it sends out the received packet to all of its neighbors. This process continues until all the nodes within the network receive the packet or a maximum number of hops for that packet are achieved . In other words we can say that in flooding, the received packets are flooded through the whole network. The main advantage of flooding is that all the nodes that are participating in this routing technique don't have a need for neighborhood information[1].

Gossiping.

Gossiping protocol was proposed to overcome the implosion problem faced by flooding nodes. In gossiping, whenever a node receives data, it doesn't broadcast the data through the whole network but select a random node among its neighbors and then send the data to that randomly selected node. Once the selected neighbor node receives the data then it again selects a random node among its neighbor and sends the data to that node. Note that, at a particular time interval only a single node is informed about the data. Hence, the information is distributed slowly and long time propagation is required to forward the data to all sensor nodes . On the other hand, the energy consumption of gossiping protocol is less than that of flooding as it avoids the replicated copies of packet. Although, gossiping can avoid the implosion problem but it cannot solve the overlapping problem[1].

Direct Diffusion.

It can be classified under both data centric and flat routing protocols. A node appeals for data by forwarding interests for naming data. A sensing work is propagated within the whole network. The nodes which show interest, arranged

their own gradients throughout the network to which the data transmission is carried out [8]. During the delivery of data, reinforcement and negative reinforcement techniques are used for systematic distribution[2]. As shown in the figure 3.1.

Chapter 4 Modeling can be considered as substitution of the object under study (the original) in a conditional way, a description or another object called a model and providing a close to the original in the framework of a number of assumptions and acceptable errors. Simulation is usually performed to understand the properties of the original by examining its model, rather than the object itself. Of course, modeling is justified in that case when it is easier to create the original itself or when the latter, for whatever reason, is better not to be created at all.

NS-2 [Network Simulator version 2] is a discrete event simulator which provides support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks. It is the most popular network simulator used by researchers. The Network Simulator began as a variant of the REAL network simulator in 1989 and has evolved over the past years. REAL is a simulator for studying the dynamic behavior of flow and congestion control schemes in packet switch data networks.

NS-2 is written in C++ and is based on two languages: C++ which is used to extend the simulator (i.e. to define protocol behaviors), and OTcl [9], an object-oriented extension of Tcl developed at Massachusetts Institute of Technology, which is used for scenario configuration, manipulation of existing C++ objects, periodic or triggered actions, etc.

In NS-2, to create the topology of the network for simulation some of topology generators may use they are Inet Topology Generator, GT-ITM (Georgia Tech Internetwork Topology Models) topology generator or Tiers Topology Generator and convert their outputs to NS-2 format.

Generation of topologies by hand is another option. The simulation event scheduler of the simulator, contained in OTcl script interpreter, is either a non real-time scheduler or a real time scheduler which is mainly used for real-time synchronization of an emulated network. The user indicates in the event scheduler when network elements should start or stop transmitting packets. In order to visualize a network simulation in NS-2, traffic and movement patterns should be generated and references as inputs into the OTcl code configuring the simulation

scenario. The simulation can then be visualized by NAM (Network Animator) [10] which is shown in figure 4.1.

CONCLUSION

I preferred to simulate AODV,DSDV and DSR routing protocols by NS-2 with tcl script with doing comparison between performance metrics and I observed that DSR outperforms AODV in less stressful situations, i.e. smaller number of nodes. AODV outperforms DSR in more stressful situations. The poor delay and packet delivery ratio of DSR is mainly due to caching and lack of mechanisms to expire stale routes. The routing overhead is consistently low for DSR and AODV than in comparison with DSDV especially for large number of nodes. This is due to the fact that in DSDV the routing table exchanges would increase with larger number of nodes. The results indicate that as the number of nodes in the network increases DSDV would be better with regard to the packet delivery ratio, but it may have considerable routing overhead. As far as packet delay and dropped packets ratio are concerned, DSR/AODV performs better than DSDV with large number of nodes. Hence for real time traffic AODV is preferred over DSR and DSDV. For less number of nodes and less mobility, DSDV performance is superior.

LIST OF PUBLICATIONS

1-A. Nouri Zaid AD HOC ROUTING PROTOCOLS FOR MOBILE LOCAL AREA NETWORKS ,2017/ 2-A. MOBILITY MODELS in MOBILE Ad Hoc NETWORKS,2018 / Nouri Zaid // Materials of 54 scientific conference postgraduate students, master student and student of BSUIR, Minsk, 26 April 2018.