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Effect of Velocity and Number of Hubs on AOMDV Protocol in MANET

[1] Bhawna Mathur, [2]Anuj Jain, [3]V.K. Sharma
[1][3] ECE, Bhagwant university, Ajmer, India
[2] ECE, Lovely Professional University, Punjab, India
Email: [1] bhawnamathurmth@gmail.com, [2] anuj.22631@lpu.co.in, [3] viren_krec@yahoo.com

Abstract— Reproduction is the most basic instrument that may be employed in the confirmation, test, and implementation of mobile ad-hoc network (MANET) conditions. Any specified climate can be displayed and run as a virtual apparatus using these computational methods. MANET is defined as "A collection of mobile hubs that roam freely and communicate with one another without the need for a foundation." Simulation is a useful and accurate method for evaluating the display of a present or forecast MANET climate in various arrangements throughout time. In this paper, the AOMDV Routing Protocol was used to recreate and test a MANET environment. The effects of the number of hubs, their velocities, and their interruption times are displayed and investigated. The organization test system ns-2 was used to investigate and break down the effects of these components. A variety of hubs, speeds, and delay lengths were used to create the recreation environment.

Index Terms— AOMDV Protocol, MANET, Routing, Routing Protocols

I. INTRODUCTION

Mobile ad-hoc network (MANET) (Portable Ad Hoc Network) is a collection of remote versatile hubs that may be set up anywhere, at any time, and connected by remote connection without the need for any kind of infrastructure. An autonomous configuration of portable hubs powerfully frames the MANET. It deals with a mobile network of remote devices that can travel in any direction. MANET capabilities and applications are rapidly becoming an indisputable component of current and future remote organization utility. The nodes in a MANET are free to move around at random while communicating, and they can link to other and organize themselves arbitrarily [1].

The topology of such a network can change quickly and without warning. At least one organization interface, each coupled with a channel, may be found in every flexible hub. A channel is a transporter that transmits bundles between portable hubs. When a portable hub sends a package to a channel, the channel duplicates the package and transmits it to each of the channel's organization interfaces. After that, these connection points employ a radio proliferation model to see if they can actually obtain the package [2].

Each node includes a wireless interface that allows them to connect with one another over a radio transmission range [3]. A MANET could be made up of various home computing devices, such as mobile phones, PDAs, laptops, mp3 players, notebooks, and handheld PCs. cars, ships, planes, and other small personal electronic gadgets can all contain these nodes. Every hub will naturally seek to communicate with other hubs within its transmission range. The hub should use moderate hubs to replay messages bounce by a bounce in order to communicate with hubs beyond this range [4].

II. CHARACTERISTICS OF MANET

MANET, on the whole, has the traits of a remote organization, and there are some extra viewpoints Ad Hoc networking has its own set of characteristics:

- Infrastructure-Free: MANET is a self-coordinating network. It is well-organized and lacks any pre-existing framework. Each hub functions as a switch and operates in unison.
- Multi-Hop Routing: Because there isn't a dedicated switch, each hub acts as a switch and assists in the delivery of parcels to the destination hub. This is how data sharing between flexible hubs is now a reality.
- Dynamic Network Topology: As MANET nodes move throughout the network at random, the topology of the network changes often, resulting in frequent route changes, network partitions, and sometimes packet losses.
- Variation On Link And Node Capabilities: Each node in an ad hoc network is made up of different types of radio devices with different transmission and reception capabilities. They all use many frequency bands to operate. Asymmetric links may form as a result of this heterogeneity in radio capabilities.
- Energy-Constrained Working: It is restricted to process power of node due to the limited power supply of the batteries carried by portable mobile devices.
- Scalable Network: Various network management algorithms have been created to deal with fixed or small wireless networks. Bulky networks with a large number of nodes, such as those seen in strategic networks, may be used in a variety of MANET applications. The advantageous operation of MANET requires adaptability.

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III. INTRODUCTION TO ROUTING PROTOCOLS IN MANETS

In a network, routing is the process of exchanging information from one program to the next.

• Proactive Routing Protocols:

This protocol is also known as a table-driven protocol because each node keeps a routing table that contains routing information for each node in the network. Because the nodes are mobile, their location is always changing. It maintained the Routing Tables, which are updated regularly or whenever a change occurs, and provided a variety of proactive routing protocols.

• Reactive Routing Protocol:

This protocol is also known as the On-Demand Routing Protocol since it does not keep track of routing information or activity at network nodes and there is no communication between them [10].

• Hybrid Routing Protocol:

This is the combination of the Proactive and Reactive protocols which work well for the networks with a small number of nodes. While the Hybrid Reactive/Proactive Protocols are used to achieve the high performance as the number of nodes increases [10]. It is a key of idea to use a Reactive Routing at the global network level while the employing a Proactive in a node in the immediate vicinity ZRP (Zone Routing Protocol) and ZHLS (Zone-Based Hierarchical Link State) are two examples of cross breed routing protocols.

IV. MODELING

Modeling is the process of creating a model to solve a problem. A problem describes a real-world system using simplified assumptions. This procedure assists designers or users in experimenting with, testing, and changing system parameters in order to determine their impacts and relationships. As a cost-effective virtual scientific method, such a process can be carried out without causing any harm to the real system. In this study, the demonstrating approach was utilized to construct and display many feasible MANET configuration situations.

V. SIMULATION

"Imitating or estimating how events could occur in a real setting" is what simulation is all about. It is frequently used in the field of networks and communications to evaluate, design, and test various topologies, novel protocols, and architectures. This method provides a useful lab for simulating and specifying the behavior of correspondence channels and network hubs The Reenactment method is commonly used to examine scientific models, make a list, and so on. Measurement findings, and test and assess the performance of recommended new protocols in comparison to existing protocols. The study of network performance is one of the main goals of network simulation [5], [6].

Because of its complexity, failure to investigate actual organizations, and expensive prices, the reproduction strategy has become the most popular procedure in pc and media transmission network inventive job. It's commonly used to validate logical models, summarize estimation results, assess the presentation of fresh protocols in development, and examine the display of current protocols [5]. It can be used to evaluate, test, and analyze a wide range of engineering, science, and other systems in an effective manner.

One of the most widely used academic discrete event-based simulators is a tool (ns-2) for assessing network topology and protocols, and it is one of the accessible network simulators. Ns-2 may be easily extended and because of its open-source nature, it has been revitalized. The Ns-2 programming suite was created with the goal of simulating networks. [7].

VI. METHODOLOGY FOR SIMULATION

The Reenactment strategy is the most appropriate method for obtaining precise data on manet activities. It aids in the study of a framework under significant repeatability situations to understand the framework's similar exercises and events [8]. The required significant large correspondence network boundaries and measurements can be displayed and measured using a network simulator Ns-2. To evaluate the display of a specific existing or proposed correspondence frame work [9].

A. Evaluation of performance

Analytical modeling, simulation, and measurement are three methodologies that can be used to assess network performance. Experimentation, testing, and operation of complicated and expensive problems (such as communication networks) are extremely challenging in real systems. A simple technique is required called "the simulation technique" can be used [10].

The major intrinsic characteristics of MANETs include remote channels, multi-jump routing, and appropriate control and the executives were compelled by dynamic geography, time-changing, and transfer speed. The AOMDV routing protocol was investigated and assessed in this work. A variety of performances to compare and evaluate the performance of the available or suggested MANET measures can be used [11].

There are many essential factors that may be used to evaluate the performance of a real network. It refers to the availability, dependability, reaction time, usage, throughput, bandwidth capacity, and packet loss ratio of a network [7].

To test and analyze the performance of MANET networks, a variety of performance metrics were created and accepted. To estimate the values of these parameters, statistical modeling is used in all of the performance measurement processes [12]. Six evaluation measurements were chosen

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and used in this investigation to investigate and break down the effects and behaviors of MANET settings and parameters related to hub speed and gesture halt times. The following are important markers for the exhibition:

Throughput, Which Is Measured As [13]:

Throughput = Receive Packets / Simulation Time

Dropped Packets [15],

Dropped Packets = Sent Packets(I) – Received Packets(I)

Average End-To-End Delay (Average E2e Delay) [3][16],

E2e Delay [Packet_Id] = Received Time [Packet_Id] – Sent Time [Packet_Id]

Normalize Routing Load (NRL) [10][17],

NRL = Number Of Routing Packets/ Number Of Received Packets

Packet Delivery Fraction (PDF) [8],

PDF = (Number Of Received Packets / Number Of Sent Packets) * 100

Average Jitter [18],

Jitter = | (End-To-End Delay (K+1)) – (End-To-End Delay (K))|

B. Environment For Simulation

This study was designed and recreated by the suggested reproduction climate. In this article, the Network Simulator (Ns-2) was used as a reproduction tool.

The purpose of this study is to look into and survey how the number of hubs and their average speeds affect MANET's overall behavior. This impact should be visible in the re-created advantages of a variety of outcome execution indicators (Bundles Misfortune, Throughput, Delay, NRL, PDF, and Jitter). For all recreation runs in this recommended MANET's condition, a few factors or (boundaries) were designed to be fixed. Random numbers were assigned to the Reenactment District, type of traffic, reproduction period, halt time, and the most extreme number of associations. In all of the examples, the AOMDV routing protocol was used as the primary routing protocol. The proposed MANET's boundaries and their locations are shown in Table I to compare values.

Table I: The proposed MANET's parameters and their values.

Parameter	Value
Nodes no.	5, 10, 15, 20
Nodes speed	5, 10, 15, 20, 25
Area	500m * 500m
Traffic type	CBR
Simulation Time	80 s
Routing Protocol	AOMDV
Speed Type	Uniform
Pause Time	5 s
Pause Type	Uniform
Max Connection	5

VII. RESULT

To achieve near-reliable stable outcomes every recreation atmosphere has been created and re-created numerous times. It was discovered that changing the number and speed of hubs affects their number and speed. Bundle conveyance part, routing load, dropped parcels, normal jitter, normal start to finish deferral, furthermore, the AOMDV routing protocol was used to calculate throughput. The results are graphed below; each point in the diagrams represents the average of 50 circumstance runs. This climate was re-created to show how the number of hubs and their velocities affect MANET's behavior. The typical incentive for each measurement was evaluated after each run was repeated several times. Fig. 1 depicts the lost bundles in terms of hub speed and hub count (5, 10, 15, and 20). As the number of hubs with low speed increased, the number of lost parcels decreased. It will increase the speed of the hub increments. The optimum circumstance is for the hubs to travel at a speed of less than 17 m/sec, with 15 hubs being the optimal number for such a location.

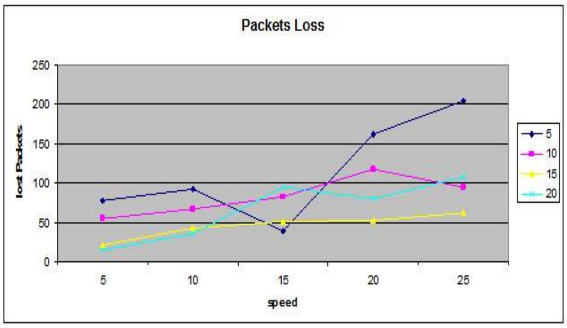

Fig. 1: lost packets in different nodes speed and different number of nodes.

In Fig. 2 we attempted to demonstrate the throughput values for varied node speeds and numbers of nodes.

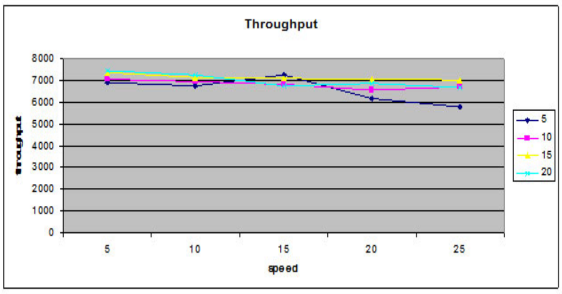

Fig. 2; throughput values in different nodes speed and different number of nodes

Fig. 3 The average End-To-End Delay values are displayed for various node speeds and numbers of nodes

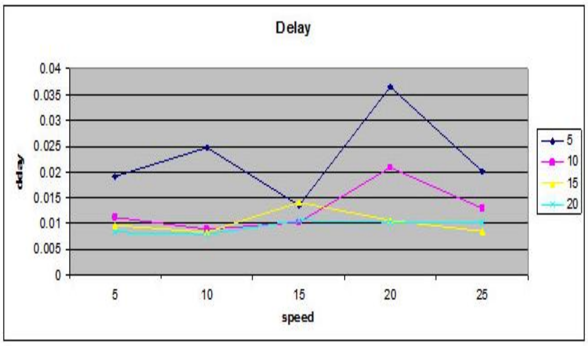

Fig. 3: average end to end delay values in different nodes speed and numbers.

As seen in this graph, the start-to-finish defer will be critical while there are few hubs and will lessen as the number of hubs increases (sub 15 m/sec). The start-to-end delay values were expanded as the velocities increased. A regular speed of 15 m/sec is the ideal incentive for this action, regardless of the number of hubs surrounding here.

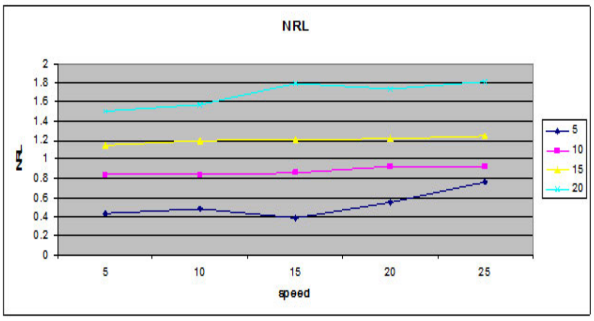

Fig 4: the average NRL values in different nodes speed and numbers.

In Fig. 4 at each speed, the NRL values will appear to decrease with a small number of hubs and grow with a larger number of hubs NRL values increased somewhat as interest rates increased. A speed of less than 15 m/sec appears to be the appropriate motivation for this boundary for quite a few hubs around here.

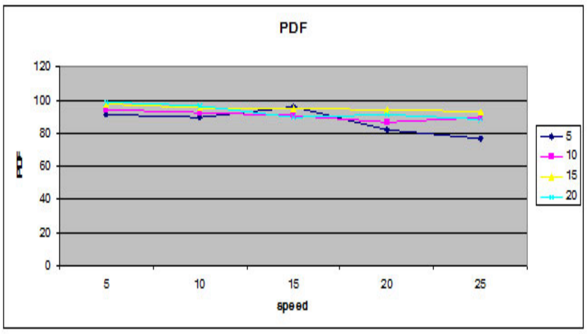

Fig 5: the PDF values in different nodes speed and different number of nodes.

In Fig. 5 with any number of nodes speeds less than 15 m/sec, there are no significant changes in PDF values. As the speed of the nodes increases, the PDF values will decrease.

Figure 6 depicts the jitter values for various node speeds and numbers of nodes.

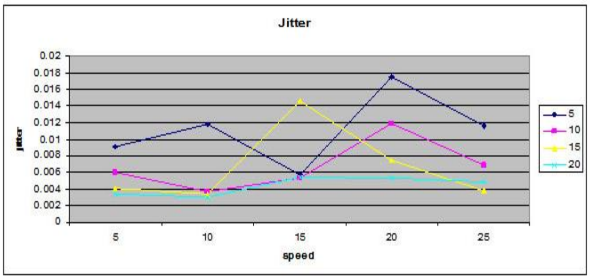

Fig 6: the Jitter values in different nodes speed and different number of nodes.

The Jitter values appeared to decrease as the number of nodes increased in this graph. The speed level of 15 m/sec is also a critical amount at which a change will occur.

VIII. CONCLUSION AND FUTURE SCOPE

This paper's main purpose is to address the most important issues MANET challenges from an application standpoint. These applications are dependent on a variety of conditions. With the AOMDV routing protocol, the number of nodes, node speed, and node pause lengths was chosen as criteria. The effects of node number must be considered in order to anticipate the best number of nodes and the fastest possible performance for any newly built MANET and node speed was examined and assessed in numerous scenarios.

The purpose of this study was to explore the limits that the MANET must meet, as well as the various aspects that must be considered while constructing a new MANET.

As the number of hubs with low speed increased, the number of lost bundles decreased. It will increase the speed of the hub increments. The optimum circumstance is for the hubs to travel at a speed of less than 17 m/sec, with 15 hubs being the optimal number for such a location. The best organization throughput illustrated by this chart for a large number of hubs sent is to keep the hubs' velocities around 17 m/sec. There are no major improvements in network throughput at these speeds. The Start-To-Finish Delay will be large when there are few hubs, but it will decrease as the number of hubs increases (under 15 m/sec). Its characteristics were discovered to improve as the vehicle's speed increased.

A regular speed of 15 m/sec is the ideal incentive for this action, regardless of the number of hubs surrounding here. When the number of hubs is small, the NRL appears to be shrinking, and when the number of hubs is increased at each speed, the NRL appears to be expanding. NRL values increased somewhat as interest rates increased. A speed of less than 15 m/sec appears to be the appropriate motivation for this boundary for quite a few hubs around here. There are no significant changes in PDF readings for several hubs with speeds less than 15 m/sec. The PDF readings will decrease as the hubs' speed increases. As the number of hubs increased, the jitter values appeared to decrease. The 15 m/sec speed figure is also a significant value at which a change will occur.

This work does not consider the security of the network, therefore the proposed protocol can be analyzed under different attacks that happen in MANETs, and then a security scheme can be incorporated in this protocol to make it more secure.

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[Note- I request for colour printing of figures.]