Fault Tolerance with Clustering Approach in Ad-Hoc on Demand Protocol

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ABSTRACT
Mobile Ad-hoc networks are the networks which work independently for doing task and limited with energy carrying capacity. Generally, there are many protocols to save resources which can be used in routing process. Some of them are on demand and some of them are proactive. In this research, focus is on On demand distance vector protocols. In general, on demand routing doesn't remember the previous path encountered for routing process as it finds the path every time it requires new routing and only current routing path is saved in routing table. This process sometimes becomes an issue due to the availability of paths. Moreover every time, it searches new path with more resources on wasting side. For saving more resources in the routing process while faulty nodes exist in network, this research is focused on providing fault tolerance mechanism for the TAODV. In this process, Nodes with less energy worked normally and perform only essential task as compared to normal routine tasks, requirement of the task is based on the cluster with more energy level nodes and routing process carried with selected cluster nodes.

Keywords
Mobile Ad-Hoc Networks, AODV protocol, Simulation Analysis, clustering Approach, Fault Tolerance, TAODV

1. INTRODUCTION
MANET stands for Mobile Ad hoc Network. It is a decentralized autonomous wireless system which consists of free nodes. MANET sometimes called mobile mesh network, is a self configurable wireless network. Mobile ad hoc networks (MANETs) represent complex distributed systems that comprise wireless mobile nodes that can freely and dynamically self-organize into arbitrary and temporary, ''ad-hoc'' network topologies, allowing people and devices to seamlessly internetwork in areas with no pre-existing communication infrastructure, e.g., disaster recovery environments. Ad hoc networking concept is not a new one, have been around in various forms for over 20 years. Traditionally, tactical networks have been the only communication networking application that followed the Adhoc paradigm. Recently, the introduction of new technologies such as the Bluetooth, IEEE 802.11 and Hyperlan are helping enable eventual commercial MANET deployments outside the military domain. These recent evolutions have been generating a renewed and growing interest in the research and development of MANET. After huge research work on MANET, still it does not have a complete form of Internet based standards. The identification of experimental Request for Comments (RFCs) since 2003 is used. In these RFCs the questions are unanswered concerning of implementation or deployment of these routing protocols.

AODV protocol is a reactive routing protocol which finds route to destination when required. AODV consists of routing table which helps to differentiate between expiry and fresh routes. The routing table at node contains the sequence number and next hop information. The working of protocol is consists of two phases:

1. Route discovery
2. Route maintenance.

In route discovery process, the source node generate RREQ packet, if the path to destination is not stored in the routing table, and pass it to the neighboring nodes. The neighboring nodes will pass it to their neighbor and so on. When the packet reached to the destination node, then destination node generates RREP (Route Reply) packet and send it back to the source node. Thus the path is established between source and destination node.

Taking clustering approach in consideration, it allow to form the clusters of nodes having some specific battery power and only those nodes are allowed to participate in the network which have sufficient battery power to transmit the data over a network.

2. RELATED WORK

Tripti Nema et al in [1] explained about Energy based Ad-Hoc on-Demand Routing algorithm that balances energy among nodes so that a minimum energy level is maintained among nodes and the lifetime of network is increased. This paper, focused on increasing the prolonged existence of node in the network. In this proposed work, one set the minimum energy threshold limit of a mobile node, when a node reach the minimum threshold limit the node goes to sleep mode, save energy and participate in the event as long as possible.

Rajkumar et al in [4] explained that the performance of ad hoc routing protocols will significantly degrade when there are faulty nodes in the network. In this study, it is proposed to design a fault tolerant congestion aware multi path routing protocol to reduce the route breakages and congestion losses. The AOMDV protocol is used as a base for the multipath routing. This proposed scheme enables more nodes to salvage a dropped packet.

Mueller et al in [3] explained that Mobile ad hoc networks (MANETs) consist of a collection of wireless mobile nodes which dynamically exchange data among themselves without the reliance on a fixed base station or a wired backbone network. Due to the limited transmission range of wireless network nodes, multiple hops are usually needed for a node to exchange information with any other node in the network. Thus routing is a crucial issue to the design of a MANET. In this paper, author specifically examines the issues of multipath routing in MANETs. Multipath routing allows the establishment of multiple paths between a single source and single destination node. It is typically proposed in order to increase the reliability of data transmission (i.e., fault tolerance).

Llewellyn et al [2] proposed a fault tolerance mechanism through clustering techniques. They elaborated that MANET communications represent a diversification in communication technology necessary to solve the stringent end-to-end requirements of QoS-based communication networks. Of the many challenges in this complex distributed system, the problem of routing based on a predefined set of customer preferences, critical to guaranteeing quality-of-service, is the focus of this research. They modifies a cluster-based QoS routing algorithm for mobile ad hoc networks with the aim of providing fault tolerance, which is a critical feature in providing QoS in the link failure-prone environment of mobile networks.

3. PROPOSED WORK

In our study for various literatures, we found that ad-hoc networks have on demand and proactive protocol which provide communication according to the nature of the protocol. Normally proactive protocols have many options for path selection and many alternative paths to various destinations. In case of on demand protocols, for at particular time, there is only single path to the destination which make on demand protocols somewhere limited. Choice of the communication through proactive or on demand protocols depends on application.

This work has been carried out with an aim to develop a more effective mechanism for energy saving for MANET by applying the time constraints and battery checking scheme for avoiding the faulty conditions in network.

4. SIMULATION MODEL

To simulate the result we used Opnet 14.5. This research has focused on providing solution for said problem by preventing the faults from ad-hoc network to make it better in term of energy saving. This research proposed a better solution for energy saving process by improving quality in selection of nodes which are best fitted for routing in between wireless nodes. Moreover research worked on Time on demand distance vector protocol for further experimentation.

Research has started with building a MANET network in opnet simulator with FTP as application for measurement with AODV as routing protocol in first scenario as described in figure 4.1 below. The parameters for Application profile and Topology parameters have been shown in figure 4.2 and table 4.1 respectively.

Figure 4.1 Overall simulation with AODV routing protocol

Basic parameters like energy carrying capacity, buffer size, speed of nodes, mobility rate and average error rate for AODV have been monitored to have changes for desired results.

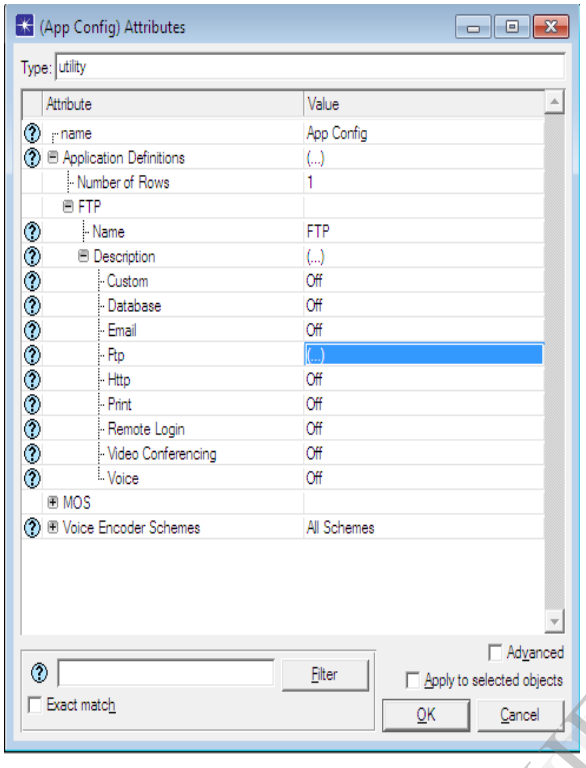

Figure 4.2 Application profile for FTP traffic

Research starts with basic parameters which are explained below in table 3.1.

Attributes	Values
Inter Request time(sec)	Constant (20 sec)
Application	File Transfer Protocol
Type of Service	Excellent Effort(DSCP=0111100)
RSVP Parameters	None
Traffic Mix	50 %
File Size (bytes)	Constant (1000)
Number of Nodes	50
No of Servers	One

Table 4.1 Basic parameter for simulation

5. MODEL FOR FAULT TOLERANCE

Each route table of a node has an entry for its power status (which is measured in terms of Critical, Danger and Active state). Whenever need for a new route arises, active nodes status is checked and a route is established within time constraints. If Node takes more time then assumed time for finding route then node will not be used for route discovery

Selection of nodes

Battery status is divided into 3 categories:
1) If (Battery Status < 30%) It is called Danger state.
2) If (30% > Battery Status < 50%) it is Critical State
3) If (Battery Status > 50%) It is Active mode
Step1: Those nodes who are not participating in route, goes to sleep mode from the start.
Step 2: Source node S broadcasts an active request to the destination D. [This request is same as RREQ, as used in AODV]
Step 3: Check Reply phase and set active path [only nodes with status greater than Critical level are selected.]
Step 4: In case of link failure, Check Backbone nodes (one hop) for the link failure path. This is carried out using Local repair scheme. In the route table, Energy factor is added. After designing the model it will be simulated and compared for betterment in terms of QoS like throughput, delay and network load.

6. RESULT DISCUSSIONS

In this work, Quality of service of AODV and fault tolerance with clustered network, performance analysis is evaluated for Adhoc Time Ad-hoc On Demand Distance Vector Protocol (AODV). The network topologies used for experimentation are Normal AODV, Sleep mode scenario, proposed scheme with Clustered approach and failure of nodes network scenario. To choose best solution for fault tolerance and energy saving, clustered network has been considered which will distribute the nodes according to the energy level of the wireless nodes. Selecting the correct metrics in the evaluation of the performance of network is very important to the results and validity of evaluation. The metrics which have been considered are throughput, delay and network load. In this section, all the simulation results obtained are discussed and results are shown in form of graph.
Results obtained for normal performance of AODV, Performance of Sleep mode concept, Performance of Clustered approach in sleep mode concept and performance behavior of Faulty network in term of throughput, delay and Network load is discussed in the following sections.

6.1 Performance of AODV and Sleep mode with Throughput of four scenarios

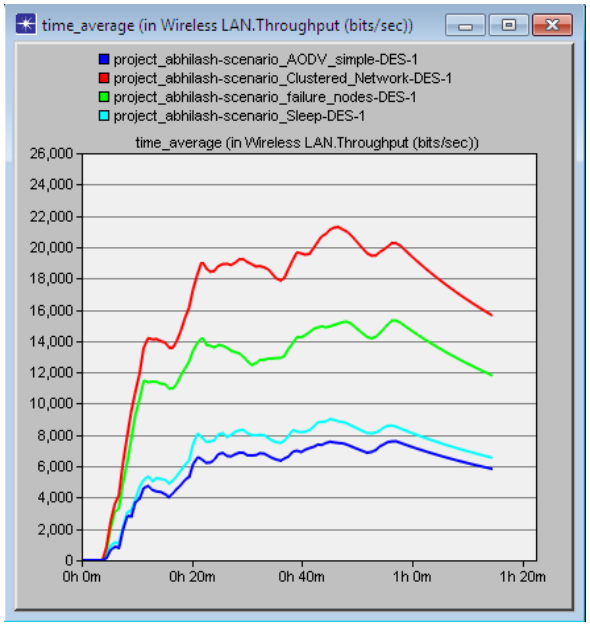

Figure 6.1 Throughput (bits/sec) comparisons of all four scenarios

6.2 Performance of AODV and Sleep mode with Network Load of four scenarios

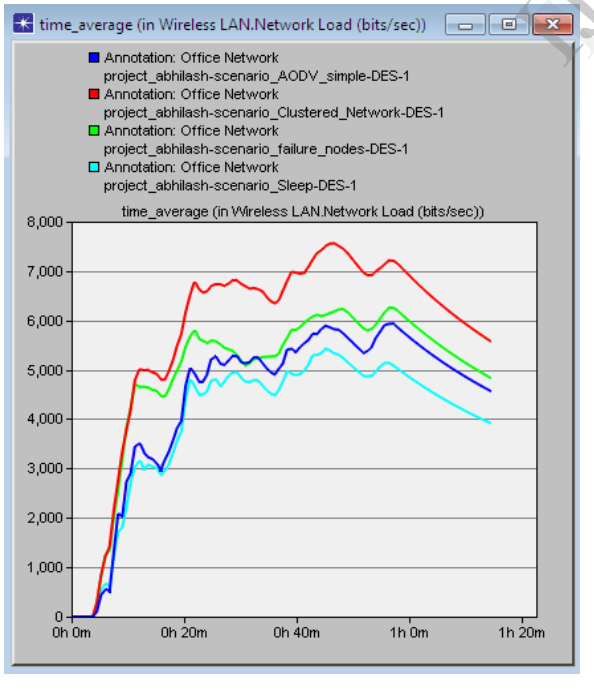

Figure 6.2 Network Load (bits/sec) comparisons of all four scenarios

6.3 Performance of AODV and Sleep mode with Delay of four scenarios

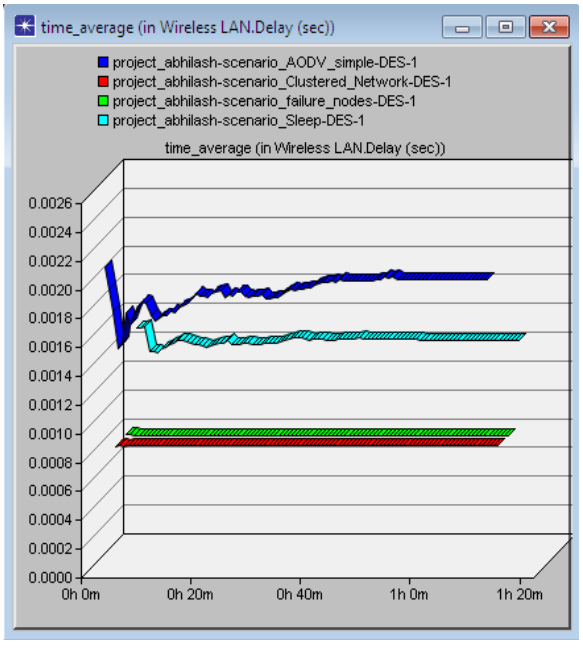

Figure 6.3 Delay (sec) comparisons of all four scenarios

The overall simulation performance is presented in nutshell in the following table, which indicates that the clustered network provides the better results as fault tolerance value is directly proportional to the throughput value of the network. In this simulation is done for 74 (min) approximately after the completion of simulation the result of various parameters are stored inform of throughput, network load and delay. The results shown in Table 6.1 illustrates that the proposed scenario provides better result in form of throughput, delay and network load.

7. CONCLUSIONS & FUTURE SCOPE

In this work, the performance of the Ad-hoc on demand distance vector routing protocol and time Ad-hoc on demand distance vector protocol have been summarized. The main focus was to show the performance of sleep mode concept under normal environment, under clustered environment and performance after fault occurrences in term of throughput, delay and network load. In doing so, a sleep mode scenario has been created and performance found to be better than normal AODV.

Attributes	Simulation Time	AODV	Sleep Mode	Clustered Scenario (Proposed Scenario)	Faulty Scenario
Throughput (bits/sec)	4500	7800	9000	21500	15500
Delay (sec)	4500	0.0021	0.0016	0.0009	0.0010
Network load (bits/sec)	4500	6000	5400	7500	6300

Table 6.1 Result Summary

This network further extends to create cluster head and cluster formation according to the energy check level. Clustered network of sleep mode concept provides better result in form of throughput. It has an important issue for the further study to implement the proposed scheme on the distributed environment of wireless ad-hoc devices with congested networks.

8. REFERENCES

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