European Online Journal of Natural and Social Sciences 2013;
Vol.2, No.3 Special Issue on Accounting and Management.
ISSN 1805-3602

Analyzing the Service Quality in Mobile Ad hoc Networks

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Abstract

Providing the quality of service is one of the complicated issues in mobile ad hoc networks. Providing the service quality in these dynamic networks due to the changes of topology and also using the same media by network nodes is a very difficult task to do. A lot of researches have been done recently in order to provide the quality of service in these networks, such as providing the service quality by routing protocols. The necessity of real applications working with expanded mobile networks makes it necessary to provide quality of service for them. In this research, we study a new approach in providing the quality of service. In current wireless networks, gaining access to mobile wireless networks and communication equipment is limited by the interference elements between the mobile device and immobile station. In this paper we try to analyzing new solution to increase the quality of service.

Keywords: mobile ad hoc network, quality of service, routing

Introduction

A mobile ad hoc network is usually consisted of mobile nodes that communicate with each other by wireless connection without the need of a central control station. The connection between hosts in these networks is not direct and it is done in several steps, so every host should also work as a router. Dynamic topologies, connection with changing capacity, limited bandwidth and energy and low and conditional physical security are the specifications of these networks. In ad hoc networks providing the quality service is harder than other types of networks due to shared bandwidths and changing topology. One of the works done in order to provide the quality service in these networks is routing quality service to bandwidth and delay points of view (Lin and Lui, 1999).

Definition of service quality

The definition of service quality has changed a lot with the explanation of communication networks. In the first days of establishing computer networks, sending the packets from the source to destination and reliable access to the network were the most important and eminent goals in a network. Nowadays with fast development of networks, concepts such as ever increasing need for bandwidths and simultaneous support for different service classes stand at a high priority of importance. So at the end, the quality of service has become a key factor in exploiting modern networks and services.

In general, quality of service is defined as sustaining compatible and predictable service to provide the demands for different applications which means presenting agreeable service and predictable for supporting different application necessity.

Quality of service parameters

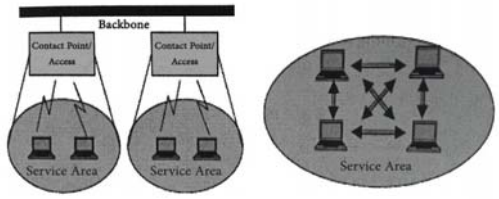
Bandwidths: the number of bits transmitted through a network during in a certain period of time.

Delay: The duration of time needed to transmit a data packet from the source to destination. Delay consists of 3 elements: propagation delay, transmission delay and queuing delay.

Delay Variance: The delay variance which a data packet faces with is equivalent to the difference between the maximum and minimum possible delays for the packet.
*Percent of Lost Packets***:** Is defined as the percentage of lost packets in the networks.
Efficiency: Is the ratio of busy time of a probable channel to the whole time in one period (Yaghmaei Moghadam, 2002).

The mobile ad hoc network and problems

The nodes in mobile ad hoc networks are equipped with wireless senders and receivers which use point to point or multi point antennas. At each moment of time, according to the orientation of nodes and the covered area of their sender and receiver, the power level of transmission and interference among channels, there would be a wireless connection in shape of random and multi-routed graphs among the nodes. This ad hoc topology may change when the nodes move or adjust their sending and receiving parameters.



(a)Structured wireless network (b)Ad-hoc wireless network

Figure 1. **Structured and unstructured wireless networks**

Problems of Ad hoc Networks

Lack of Central Infrastructure and Control

Lack of central structure to develop organization, limitation such as extensity of wireless communication, bandwidth and battery lifetime may cause problems in providing proper services in mobile ad hoc networks which can be listed as follows:

- Causing delay which would become troublesome especially in real time applications
- Bandwidth fluctuations which will increase the delay variance
- Failure in routes that would lead to packet lost
- Increase of traffic in routes which will cause delay and increase in delay variance by itself
- Inaccuracy of routing algorithms

Increasing the quality of service in mobile ad hoc network

Some methods already exist to help increase the quality of service in networks. Some of them are listed as follows including capacity, expanse, buffering, organized traffic, slotted bucket algorithm, bucket algorithm labeled, source book, admission control, and proportional routing (Andro Ten Bam, 2001).

Although there are many routing protocols available, we cannot find a single protocol to become responsible for different transmission scenarios and patterns in various softwares. In the following, we will mention some of the protocols which help increase the quality of services in mobile ad hoc networks.

Ticket-based analysis

The multi-route QOS distribution layout for mobile ad hoc networks is known as ticket-based analysis of the scheme. General information can be analyzed by simultaneous multi routes in order to find the best and most efficient approaches.

These routers follow a general approach which is applicable to mobile ad hoc networks and can control many aspects of quality of service such as bandwidth, delay, packet lost and etc.

A ticket is the permission to find a unique route. When a source is trying to find a route and its goal is reaching the destination, it would lead to initiating some analysis and this analysis would at least need one ticket, but it may also include several tickets. In the middle node, the probe can be divided into several other ones by using more than one ticket. Each probe needs some nodes receivers which decide what kind of information is needed based on their situation. Though a probe should be divided and those neighboring nodes should be pushed forward. Ticket-based analysis is consisted of three mechanisms: Rotational routes and further routing, three leveled difference of the route and route repairing. Further routing needs the source node to be informed about route errors. Then, the source activates the ticket-based algorithm and sets up another acceptable route. The route difference scheme leads to multiple routes in some communications. In this step, source distinction is preserved through the multiple routes. But, only one of them is used as the primary route and others are saved in the support software. At the third level of difference and further difference several routes are selected and used as the primary route but the sources are only preserved and saved in the primary route (Chen and Nahrsteds, 1999).

DSDV Protocols

In DSDV (Charles 1994) protocol, the routing is done using distance vector. In this protocol the routing table and update signals of the route have order number labels which are used to prevent making a loop and confirming the decency of the data and only those route information are used which have higher destination order numbers or equal order numbers with better scale. Using this technique always makes the routing tables information updated and recent.

TBRPF Protocol

In the TBRPF, routing protocol each node reports some of its source tree to adjacent nodes in order to reduce the over load (Ogier and Templin, 2004). This protocol uses Dijkstra algorithm to calculate the source tree and some of the topology information is exploited in the topology table of each node.

AODV Protocol

AODV protocol is one of the most important algorithms that are designed specifically for mobile ad hoc networks (Perkins and Royer, 1998). This protocol increases the speed of routing in detecting new nodes and also reduces the data in routing table, because there is no need to store the routes which do not take part in our communication.

DSR Protocol

According to David and Johnson (2004), DSR protocol is one of the chosen routing protocols in ad hoc mobile networks due to its simplicity and high efficiency and it enables the network to be self-organization and self-configuring completely. In this protocol too, each node contains a routing table that has complete route to some specific destination. While sending data packets, complete rout from the source to destination will be inserted at the header of every packet.

MNH Protocol

In this protocol, which uses the idea of AODV algorithm, this technique is based on the fact that by using the routing table, we will have several route to reach the destination (Ming-Hong et al., 2010). This enables the network to replace a node immediately when a route is lost. In this routing method the source requests to discover a rout by sending a RREQ packet. The difference between this method and AODV is that, in this protocol each middle node saves all the returning routs in its rout table after receiving RREQ packet.

OLSR PROTOCOL

According to acquet et al. (2001), this protocol is an optimization plan for link state routing protocol and uses a multi segmented mechanism to reduce the control traffic over load. Each node selects a subset its symmetric neighbor with one step distance as MPRs which can access to its entire neighbor trough them. This protocol uses MPRs in order to resend the controlling signals and in this way makes the control traffic torrent to its minimum.

CHAMP Protocol

In CHAMP, protocol saving packets and multi-path routing are used in order to reduce the number of lost packets caused by broken route (Valera et al., 2003). In this method, each node has a small buffer to save the transmitted packets and as soon as transmission faces problems, it changes the path to try another route. When the lack of a second rout makes the change in the route for that node impossible, the lower hand nodes are informed so they can transmit the packet to destination by changing the route.

Recommended Solution

In mobile ad hoc networks, for the reasons such as changes in topology, bandwidth limitation, limited lifetime of battery, the nodes in access route to destination are very unstable and it would be probable that the route break at any time and on the other hand usually there are more than one access route to destination. In most methods, multi-path routes are used to create support route between the source and destination so that when the primary route breakers, the support route would replace it immediately. The most important goal is to find an ideal route in worst conditions here, we suggest using AODV routing protocol. AODV protocol increases the speed of routing in detection of the nodes. This protocol also exploits the idea of routing table to help increase the speed of routing. In this protocol each node has a routing table which saves the next steps for reaching the desired destination. So, if a node is not needed in that route, the information related to that node could be omitted from the table which by itself would help reduce the information in routing table and increase speed of routing.

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