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Research Article

Performance Comparison of a Reactive and Hierarchical Routing Protocol In 802.16e Using Qualnet 6.1

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Abstract

WiMAX is a technology which provides a mobile access for both fixed and mobile users. Such type of broadband services are coming up quite fast because it provides freedom to be online anywhere, with other significant facilities such as large bandwidth, using a variety of mobile etc. the initial version of WiMAX was IEEE 802.16 for fixed users and nomadic access, later the improved version of WiMAX known as mobile WiMAX, IEEE 802.16e become a popular standard. This paper enlights the fact related to IEEE 802.16e when used with two routing DSR &FSR. Here, the performance of two wireless routing protocols DSR (reactive routing protocol) and fisheye state routing (Hierarchical routing protocol) has been compared for Mobile WiMAX. From simulation it was found that DSR protocol outperforms Fisheye in IEEE 802.16e under different performance parameters.

Keywords: *WiMAX, DSR, FSR Performance parameters and QUALNET 6.1.*

1. Introduction

Today's broadband Internet connections are dependent to wireline using DSL, cable-modem based connection etc. But, these infrastructures are more expensive and with high installation cost than a wireless one. Broadband Wireless Access (BWA) has emerged for last mile access technology and provides high speed connections.
Worldwide Interoperability for Microwave Access (WiMAX) promise to offer high data rate over large areas to a huge number of users where broadband is unavailable. Development of 802.16E standard facilitates low cost equipment, ensure interoperability, and reduce investment for operators. IEEE 802.16 working group has developed a number of standards for WiMAX. The first standard IEEE 802.16 was developed in 2001 with emphasis on the frequency range between 10 and 66 GHz and required line-of-sight (LOS) between the sender and the receiver. This reduces multipath distortion, which increases efficiency of communication. IEEE 802.16 is capable of providing single channel data rates up to 75 Mbps. Providers could use multiple IEEE 802.16 channels for a single transmission to provide bandwidths of up to 350 Mbps. However, because of Line of Sight cost-effective deployment failed. Subsequently, several versions came with new techniques. IEEE 802.16-2004, was developed to expand the scope of bands from 2 to 11 GHz. IEEE 802.16-2004 specifies the air interface, in which Media Access Control (MAC) of wireless access for fixed operation in metropolitan area networks. Support for mobile devices is considered in IEEE802.16e standard, which is published in December2005. WiMAX networks consist of a Base Station (BS) and Subscriber Stations (SSs). In Mobile WiMAX network, BS is connected to public network and can handle multiple mobile SSs. A number of wireless routing protocols are already designed to provide wireless communication; they are AODV, OLSR, DSDV, ZRP, LAR, LANMAR, STAR, DYMO etc. For performing the simulation, we assume that each of the subscriber station maintaining a routing table for its own network, so data can be sent directly to the destination without the help of base station. However, if one subscriber station has to send data to a station located in another network, it must be done through the base station and vice versa

2. Background

In this section we briefly describe an on demand (reactive) routing protocol, DSR (Dynamic Source Routing) and a hierarchical routing protocol fisheye state routing (FSR). A reactive protocol initiates to find route to the destination whenever it needs to forward a packet to other nodes. In other words, we can say that the reactive protocol searches for routes only when needed. On the other hand in a hierarchical routing protocol the choice of proactive and of reactive routing depends on the hierarchic level in which a node resides. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding on the lower levels. The choice for one or the

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other method requires proper attribution for respective levels. A network in which bandwidth is not big issue, proactive protocols would. However, in a wireless ad hoc network, the channel bandwidth is a major concern because of many nodes and energy constraint.

2.1 Dynamic Source Routing Protocol

The key distinguishing feature of DSR is the use of source routing. In which the sender knows the complete hop - by-hop route to the destination. These routes are stored in a route cache. The data packets carry the source route in the packet header. When a node in the ad hoc network attempts to send a data packet to a destination for which it does not already know the route, it uses a route discovery process to dynamically determine such a route. Dynamic Source Routing DSR is a reactive protocol. This protocol is one of the example of an on-demand routing protocol that is based on the concept of source routing. It is designed for use in multi hop ad hoc networks of mobile nodes. It allows the network to be completely self-organizing and self-configuring and does not need any existing network infrastructure or administration. DSR uses no periodic routing messages like AODV, thereby reduces network bandwidth overhead, conserves battery power and avoids large routing updates. However, it needs support from the MAC layer to identify link failure. The DSR routing protocol discovers routes and maintains information regarding the routes from one node to other by using two main mechanisms: (in) Route discovery – Finds the route between a source and destination and (ii) Route maintenance –In case of route failure, it invokes another route to the destination. Route discovery works by flooding the network with route request (RREQ) packets. Each node receiving an RREQ rebroadcasts it, unless it is the destination or it has a route to the destination in its route cache. Such a node replies to the RREQ with a route reply (RREP) packet that is routed back to the original source. RREQ and RREP packets are also source routed. The RREQ builds up the path traversed across the network. The RREP routes itself back to the source by traversing this path backward. The route carried back by the RREP packet is cached at the source for future use.

2.2 FisheyeStateRoutingProtocol

It is a hierarchical routing protocol. It is considered as proactive protocol and a link state based routing protocol that has been adapted to the wireless ad hoc environment. It has the ability to provide route information instantly by maintaining a topology map at each node. Thus it maintains updated information from the neighbor node through a link state table. In each node of the network, a full topology map is stored then utilized (List of ad hoc routing protocols). FSR uses the fisheye technique where the technique was used to reduce the size of information required to represent graphical data. The eye of a fish captures with high detail the pixels near the focal point. The detail decreases as the distance from the focal point increases. The fisheye approach translates to maintaining accurate distance and path quality information about the immediate neighborhood of a node, with progressively less detail as the distance increases. In a wireless environment, a radio link between mobile nodes may experience frequent disconnects and reconnects. When network size grows large, the update message could consume considerable amount of bandwidth, which depends on the update period.

3. Simulation model

The overall purpose of this simulation study is to determine the performance of DSR and FSR in a mobile WiMAX environment. The simulation has been performed using QualNet 6.1 version. To analyze the performance of DSR and FSR routing protocols, both qualitative and quantitative metrics are needed. The main focus of this paper is to achieve maximum quality of service by comparing the routing protocols in three different metrics defining the quality of service of WiMAX which are Throughput, Average End to End delay and Jitter.

Table 1 Simulation Parameters

No. of Nodes	20
Bandwidth(GHz)	2.4
Terrain Dimension(m)	1500 x1500
Start time, End Time	0,0 (infinite)
Number of packets sent	0 (infinite)
Simulation time	500sec
Mobility Model	Random way point.
Application	CBR
MAC	802.16e

4. Results

Simulation were carried out using Qualnet simulator, in which DSR and FSR routing Protocols were compared in the matrices like Throughput, Average End to End Delay and Jitter which characterizes the quality of service. The results of simulation are shown in Figure.1, Figure.2, and Figure.3 respectively.

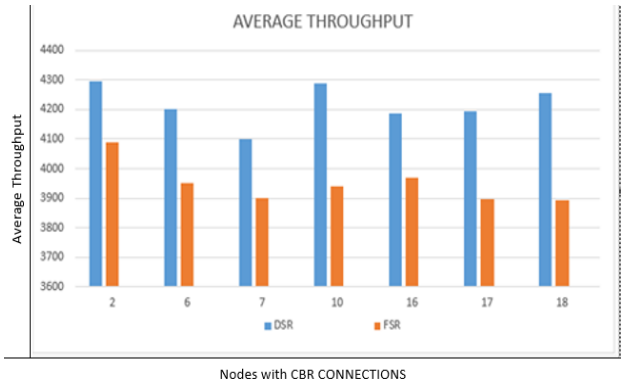

Figure.1 Average throughput Versus Nodes with CBR Connection

The three figures describes a comparison of two different protocols, where the first the figures signifies that the DSR has better values of performance parameters (jitter, end to end delay & throughput) as compared to the FSR routing

protocols because it uses a route discovery process to dynamically determine routes and also allow networks to be completely self-organizing and self-configuring, whereas in FSR uses the fisheye technique which allows considering a fractions of the scope of the eye, leading to reduction in the message size thus routing update overhead is reduced.

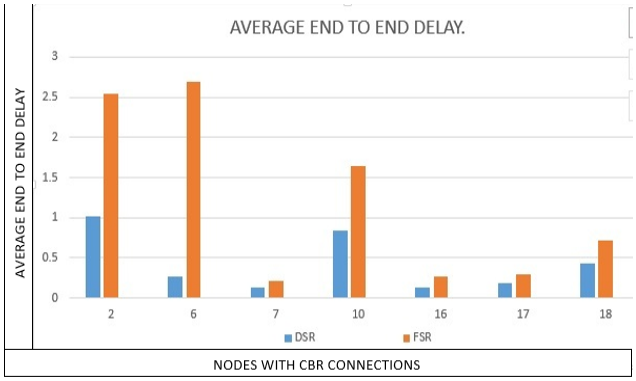

Figure.2 Average end to end delay Versus Nodes with CBR connection**.**

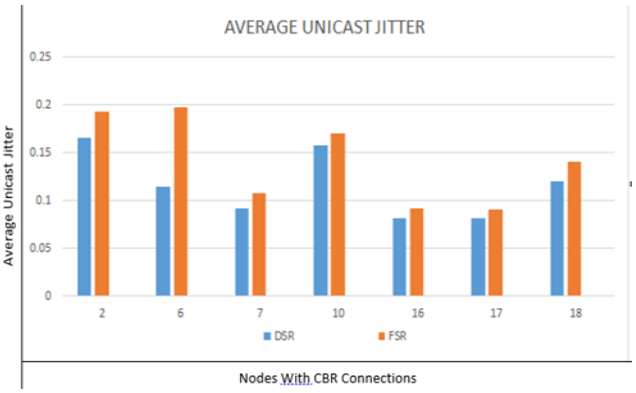

Figure.3. Average uncast jitter Versus Nodes with CBR connection.

4. Conclusion

In this paper we have evaluated the performance of FSR and DSR routing protocols in QualNet 6.1 simulator keeping packet size of 512 Byte. FSR uses the hierarchical table-driven routing strategy whereas DSR uses the reactive on demand routing strategy with different routing mechanisms. It has been observed that the overall performance of DSR routing protocol in the simulation showed that DSR performs better in terms of Throughput, End to End Delay and Jitter in comparison of FSR routing protocols. In our experimental evaluation we have taken up comparison of DSR and FSR protocols with constant bit rate application. We shall consider the comparison of DSR and MSR by random mobility. As a results, DSR is more desirable for large mobile networks where mobility is high .By choosing proper number of scope levels and radius size, DSR proves to be a flexible solution to the challenge of maintaining accurate routes in ad hoc networks.

References

Bharat Raj Pandey, Umesh Barahdiya, Pawan Jain, Manoj Jakhenia, Dr. H. P. Sinha (July 2013), Performance Evolution of MAC Protocols for MANET Networks, International Journal of Emerging Technology and Advanced Engineering, Volume 3, Issue 7

Anil Goyal and Dharmendra Kumar Jhariya (July 2012); Simulation and performance Analysis of Ad-hoc Routing Protocol in Wi-Fi &WiMax networks using QualNet, International Journal of Electronics and Computer Science Engineering, ISSN- 2277-1956, Vol-1, No-3, pp. 1593-1601

C.So-In,R.Jain,andA.-K.Tamimi (Feb.2009),Scheduling in IEEE 802.16e Mobile WiMAX networks: key Issues and survey,IEEE Journal on Selected Areas inCommunications,vol.27,pp.156171,doi:10.1109/JSAC.2009.090207.

DavidB.Johnson,DavidA.Maltz (1996) Dynamic Source routing in wireless Adhoc Networks, computers Science department, Carnegie Mellon University, Pittsburgh Mobile computing conference in ,pages153- 181,volume-353.

D.B. Johnson and D.A. Maltz (1996,), Dynamic SourceRouting in Ad Hoc Wireless Networks, In *MobileComputing*, edited by T. Imielinski and H. Korth, Chapter 5, Kluwer Publishing Company, pp.153-181.

D. Johnson, D. Maltz and J.Jetcheva (2002), The Dynamic Source Routing Protocol for Mobile Ad hoc networks, Internet Draft, draft-ietf-manet-dsr-07.txt.

F.Wang,A.Ghosh,R.Love,K.Stewart,R.Ratasuk,R.Bachuand,Y.Sun(2005),IEEE802.16eSystemAnalysiandSimulations,16thIEEEInternationalSymposiumon Personal Indoor and Mobile Radio Communications(PIMRC).

IEEE802.162004 (October2004.),IEEE Standard for Localand Metropolitan AreaNetworksPart16:Air Interface forFixed Broadband Wireless Access Systems.

I.Khirwar,A.Yadav,andP.Trivedi (Sept. 2010),Comparative assessment of WiMax schedulerinFixed and Mobile WiMax networks for VoI Pusing Qua lNet,International Conference On Computer and Communication Technology (ICCCT2010),,pp.15-21,doi: 10.1109/ICCCT.2010.5640399.

Jadhav, S., Haibo Zhang and Zhiyi Huang (20-22 Oct 2011), Performance Evaluation of Quality of VoIP in WiMax and UMTS, in 12th International Conference on Parallel and Distributed Computing, Applications and Technologies (PDCAT), , pp. 375-380.

J. Broch, D.A. Maltz, D.B. Johnson, Y.-C. Hu, and J. Jetcheva (Oct. 1998), A Performance Comparison of Multi-Hop Wireless Ad Hoc Network Routing Protocols, In Proceedings of ACM/IEEE MOBICOM'98, Dallas, TX, pp. 85-97.

TheQualnetsimulatorwww.Scalable-Networks.com

WiMAX Forum, http://www.WiMaxforum.org

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