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Fisheye state Protocol in Correlation with Power Consumption in Ad-hoc Networks

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Abstract

Ad-hoc networks are self-organizing networks and hence the challenges are also larger. Active research is going on in the field of ad-hoc networks for the same reason. The challenges are numerous like routing, MAC, mobility, scalability, reliability, security, power consumption, bandwidth etc., Depending upon the application of ad-hoc networks the specific challenges can be dealt.

In this paper routing protocols has been studied thoroughly and proactive routing protocols have been chosen for a particular challenge, power consumption. FSR is compared with other proactive protocols like DSDV and OLSR. It is found from simulation results that Fisheye state routing protocol has been proved to be best for many parameters like throughput, packet delivery ratio and energy consumption. FSR, OLSR, DSDV has been implemented and FSR is chosen to be best for power consumption. The simulation is executed using discrete event simulator NS-2.

Category: Smart and intelligent computing

Keywords: Ad-hoc Networks, DSDV, Fisheye state, OLSR.

INTRODUCTION

Wireless communication is the quickly expanding & most vital technological areas in the communication field. Our lives are unimaginable without Wireless communication like TV, Radio, Mobile, Radar, GPS, Wi fi, Bluetooth, RFID etc. [18]. In latin adhoc means "for this purpose" . Ad-hoc networks are collection of autonomous nodes or terminals that communicate with each other by forming a multi-hop radio network and maintaining connectivity in a suburbanized manner in an infrastructure less environment. [16] Several classifications of Ad-hoc networks are MANET, VANET, FANET, WSN etc. Ad-hoc network often refers to a mode of operation of IEEE 802-11 wireless networks. Initially these networks were designed for battlefield networks & disaster recovery applications, due to their quick deployment feature without the existence of any infrastructure .But with rapid growth of mobile communication, MANETs are considered as major contemplate in the next generation network technologies.

Various power optimization techniques are existent in Ad-hoc networks. Optimization of power is of great importance in Ad-hoc networks as their organizational composition & lack of central co-ordination. The power control requirements vary depends on various layers like the physical, network & MAC layer implementations of Ad-hoc network [5].Generally power conservative protocols are divided into two main categories transmitter power control protocols & power management algorithms. Second classification can be further divided into MAC layer and network layer protocols.

It has been seen that in Ad-hoc network, power consumption does not always demonstrate active communication in the network. In a transmitting or receiving state power consumption of wireless devices is only moderately smaller than sleep state. It is better to turn radio off when it is not in use. Most of the power conservation schemes consider the nodes can adapt this transmission power, some of them consider position awareness of the nodes using GPS & capability of energy replenishment etc.

The rest of this paper is organized as follows we briefly discuss routing protocols in section 2. In section 3 in particular Fish eye state protocol is discussed. Section 4 is simulation results & analysis. Section 5 is conclusion & future work.

ROUTING PROTOCOLS

In mobile Ad-hoc networks nodes are mobile and can be connected actively in a random style. All nodes here are routers and involve in route discovery & conserving of routes to another nodes in the network. [4]. There are many classifications of protocols depending upon the diversity of application areas. The basic aim of the protocols are the maximize throughput and packet delivery ratio while minimizing packet loss, control overhead & energy usage. Nevertheless the comparative preferences of these criteria vary among different application areas. There are certain situations where ad-hoc networks are really the only possible solution, while in some other application ad-hoc network participate with other technologies. [11]. The routing protocols can be classified as flat routing, hierarchical & graphic position assisted routing [10]

Discovering & conserving routes in an Ad-hoc network is a challenge as topology of the network changes very frequently & requires more efficient & flexible mechanisms. Apart from handling the topology changes these protocols must deal with other restrictions such as low BW, limited power consumption, high error rates.

Proactive methods maintain router to all nodes, irrespective of whether those routes are needed or not. The main advantage of this category of protocols is that hosts can quickly obtain route information & establish a session.

FISHEYE STATE ROUTING PROTOCOL

FSR is an inferred proactive routing protocol. It uses the "fisheye" technique proposed by Klein rock & Stevens (where the technique was used to reduce the size of information required to represented graphical data) fishes do have 3600 vision. Eye of the fish captures with high details as the distance near focal point grows. Based on this concept a table driven proactive protocol is proposed. Fish eye routing generates accurate routing decisions by taking advantage of the global networks information. It takes the shorter routes, class sensitive to traffic load, less sensitive to topology. It is easier to debug and account for routes since the entire network topology & route tables are stored at each node. For the above stated reasons table driven scheme is chosen for routing. Reactive protocols are distance vector based where as proactive protocol like FSR is link state based and have faster speed of convergence and lesser routing loops. In link state topology information is disseminated in special link state packages where each nodes receives a global view of the network rather than the view seen by nodes neighbor. Fisheye routing takes advantages of this feature by implementing a novel updating mechanism to reduce control overhead traffic.

FSR is chosen to be the appropriate protocol for the present study; FSR is a link state proactive protocol. Why fish eye protocol is the best?

1) Fish eye is a proactive routing protocol which maintains routes to all destinations, instead of whether or not these routes are needed. The main advantage of this category of protocols is that hosts establish a session.

2) Through updating link state information with different frequencies depending on the scope distance, FSR scales well to large network size & keeps overhead low without comprising route computation accuracy when the destination is near.

3) As mobility increases, routes to remote destinations become less accurate. However, when a package approaches its destination, it finds increasingly accurate routing instructions as it enters sectors with a higher refresh rate.

4) The control overhead is greatly reduced in FSR. Average no of neighboring nodes is independent from network size since node density is kept constant. The reason why FSR reduces O/H is that only a fraction of the entries are updated each time. In a two level fisheye hierarchy, the smaller radius, the smaller fraction of entries updated in the "fast" interval and the lower the control O/H.

5) FSR is more desirable for large mobile network where mobility is high & the BW is low. By choosing proper no of scope levels & radius size, FSR proves to be a flexible solution to the challenge of maintaining accurate routes in ad-hoc network.

6) In a wireless environment, a radio link between mobile nodes may experience frequent disconnects & reconnects. The Link state protocol release a link state update for each such change, which floods the network & causes excessive overhead. FSR avoids this problem by using periodic, instead of event driven, exchange of the topology map greatly reducing the control message overhead.

7) FSR scales well to large network size & keep overhead low without compromising route computation accuracy when the destination is near. By retaining a routing entry for each destination, FSR avoids the extra work of finding the destination & thus maintains low single package transformer latency. (As mobility increases, routes to remote destinations become less accurate. However, when a package approaches its destination, it finds increasingly accurate routing instructions as it enters sectors with a higher refresh rate)

8) Throughput of FSR also increases as it uses multilevel fish eye scope. This technique results in lower overhead & less consumption of BW which is a major plus point for throughput. FSR is highly scalable as it uses different frequencies for different scope that is at different time intervals.

Another characteristic of FSR is it uses different frequency in exchanging link state information. (One hop neighbors are classified as scopes) scope is defined in terms of the nodes that can be reached in a certain no of hopes.

The center nodes has most accurate information about all nodes in the circle & because less accurate with each outer circle

Even though a node does not have accurate information about distance nodes, the package are routed correctly because the route information becomes more & more accurate as the package moves closer to destination The reduction of routing messages is achieved by updating the network information for nearby nodes at a higher frequency and remote nodes at lower frequency. As a results considerable amount of LSPs are suppressed.

FSR reduces significantly the consumed BW as the link state updating packets are exchange only among neighboring nodes. The routing overhead is also reduced due to different frequencies of updates among nodes of different scopes.

FSR manages to reduce the message size of the topology information due to removal of topology information concerned far away nodes.

SIMULATION AND RESULT ANALYSIS

Simulation Software

Simulation is the emulation of the performance of actuality over time[20]. The act of simulating something first requires that a model be developed. Many network simulators are available which portray as same as possible to real time implementation. In our work we have used the discrete-event simulator NS2(Version 2..35) [21] and the performance analysis is conducted by AWK script. Graphs are plotted using GNU plot. There are several models available in NS2 simulator, from which we have considered the few models

like Energy model, Randomwaypoint, Two ray ground model, Wirelessphy.etc

Result Analysis

1. Throughput v/s Speed

   Fig1 shows the throughput with respect to Speed of movement of nodes for all three protocols. Speed indicates how quickly topology changes are happening in the network.so with different speeds starting from 0-30m/s .FSR protocol has best throughput compared to other two protocols.

2. Throughput v/s Pausetime

   Fig2 shows the throughput with respect to pause time. Mobility is the key parameter when pause time is considered. Pause time is used to describe the interval between the movement .If pause time is infinitude, then mobile node is fixed while pause time equals to 0,that means this mobile node is always on move. Our results show that routing protocol reduces energy consumption when compared to FSR with other protocols.

3. Throughput v/s no of nodes

   Scalability is the parameter with increase in no of nodes. Our results show that with different number of nodes throughput increases as shown in fig3.

4. Energy Consumption vs no of nodes

   Energy consumption is very critical in many important applications. With increase in number of nodes

Table 1. Simulation parameter Table.

PARAMETER	VALUE
Simulator	NS-2.35
Topology	Random
Number of nodes	20,40,60,80,100
Wifi Data Rate	1 Mbps
Propagation Model	Two ray ground
Physical Model	Wirelessphy
Antenna model	OmniAntenna
Queue Size	50
Traffic type	CBR,UDP
Mobility Model	Random Way Point
Routing Algorithm	DSDV,FSR,OLSR
Packet size	512
Mac protocol	802.11 standard
Speed Varying	0,5,10,15,20,25,30 m/s --by keeping 50 nodes as constant
Pause time varying	1,5,10,20,30,40,50 --by keeping 50 nodes as constant

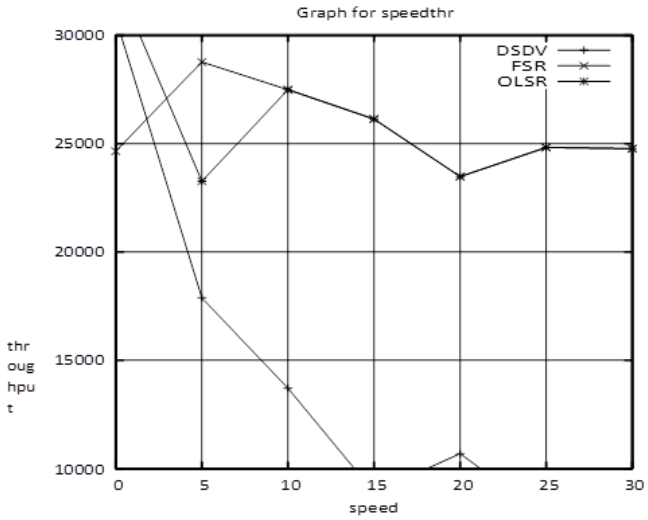

Figure 1. Throughput vs Speed

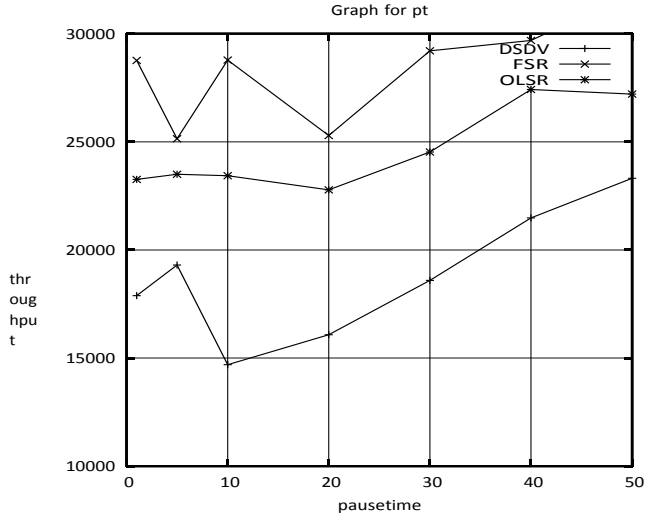

Fig 2. Throughput vs Pausetime

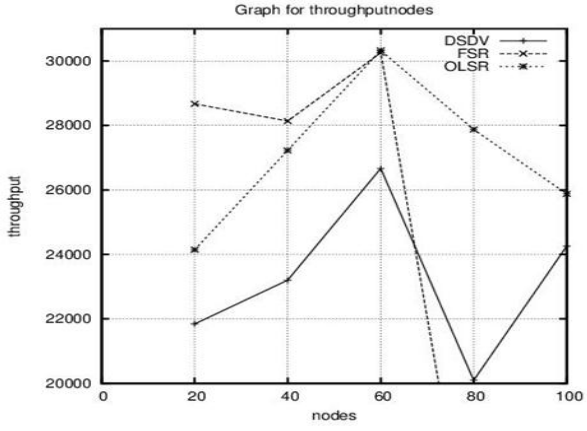

Fig 3. Throughput vs no of nodes

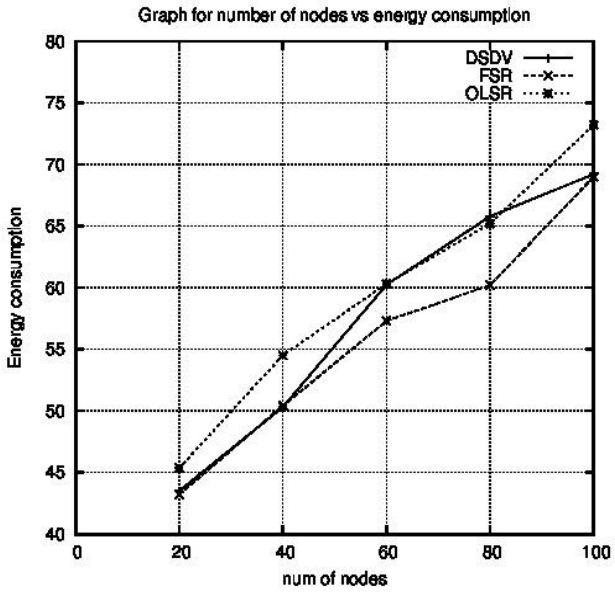

Fig 4. Energy consumption vs no of nodes.

CONCLUSION AND FUTURE WORK

In this paper a FSR protocol has been compared with other protocols for considering various conditions for optimizing power in ad-hoc networks. A protocol which can be used in applications where power consumption is critical. As we know wireless devices in ad-hoc networks expend more power .FSR protocol can reduce power consumption greatly and gives extended network lifetime.

In future the power reduction process can be used in applications where power consumption is critical.

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