AN EFFICIENT ROUTING SCHEME FOR WIRELESS SENSOR NETWORKS WITH OPTIMIZATION IN FAULT TOLERANCE[1]

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ABSTRACT

The main objective of the study is to identify the best optimal routing scheme in highly dynamic environments where high level scalability is achieved with a large number of nodes deployed. In this study mobility models are implemented in different routing protocols and their performance was scrutinized under various scenarios. Mobility Model defines the movement patterns of nodes atspecific instants. The Mobility Model implemented is Random Way Point Model that enables the node to choose a destination in Random and move towards it in a constant velocity with a constant pause time (the time period that the node stops after reaching a Way Point). The velocity can range from 0to Vmax that can be set. The pause time is another parameter according to this model that enables thenode to wait at a waypoint for a certain period of time. In this proposition, we intend to compare Destination Sequenced Distance Vector (DSDV) which is a proactive protocol (Table-driven) alongside the reactive protocols namely Ad hoc On-demand Distance Vector (AODV) and Dynamic Source Routing (DSR) which happen to be the most outstanding protocols in Wireless Sensor Networks. The performance metrics that we tend to analyse are Throughput, End-to-End delay, Packet delivery ratio, Jitter. The problem identified was that there were several routing schemes for wireless sensor networks which showed varied results in their individual performance analysis under different scenarios. The parameters that were mainly concentrated are throughput, end-to-end delay, packet delivery ratio and jitter. Since sensor nodes are battery powered and operate at critical energylevels there is a need for most optimal routing scheme by which the communication between the nodescould be established.

INTRODUCTION

Wireless sensor network (WSN) is considered as one of the important technologies for the past century. In the recent years it has got humungous attention in both academics as well as the industrial sectors. A WSN largely consists of a many number of cost efficient, energy efficient, and diversified wireless sensor nodes, with sensing all types of wireless communications and computational capabilities. These wireless sensor nodes communicate within a short distance through a wireless channel and work together to achieve a mundane task, for instance, military surveillance, and also industrial task control. The basic

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phenomenon behind WSNs is that the capability of each independent node is bounded and the aggregate power of the whole network is enough for the required mission.

In many applications of wireless sensor networks, the sensor nodes are being deployed in an ad hoc manner with very less planning & engineering. On deploying, the sensor nodes automatically organize themselves into a wireless communication network. Since they are battery powered they should operate without monitoring for a comparatively more period of time. Typically it's very complicated and also not possible to vary or even refresh battery packs for your sensor nodes. WSNs are generally characterized along with denser amounts of sensor node deployment, better unreliability associated with sensor nodes, as well as intense power, calculation, as well as ram difficulties. Thus, the initial traits along with the demands pose numerous completely new challenges to the advancement along with program involving WSNs. Because of the extreme power restrictions involving large numbers of densely used sensor nodes, it needs a new suite of protocols involving low energy, implementing functions for node localization, synchronization and network security. Based on our study, the standard routing protocols have several problems and disadvantages when implemented in a highly dynamic wireless environment which are primarily because of the energy constraints.

MATERIALS AND METHODS

Random Movement Generation Algorithm:

Generation of node movement can be easily done with the help of the setdest utility that can be found in the directory ns/indep-utils/cmu-scen-gen/setdest. This consists of setdest.cc and setdest.h and a makefile. The random numbers are generated using the initstate() module which makes use of the random class present in the linux kernel. Now this version is obsolete and the RNG class is used to generate the random numbers now.

The RNG class makes use of a combined multiple recursive generator which was proposed by L'Ecuyer.

$$x_n = a_{11}x_{n-1} + a_{12}x_{n-2} + a_{13}x_{n-3} (\bmod m_1)$$

$$y_n = a_{21}y_{n-1} + a_{22}y_{n-2} + a_{23}y_{n-3} (\bmod m_2)$$

$$z_n = x_n - y_n (\bmod m_1)$$

$$u_n = z_n / m_1$$

$$a_{11} = 0,\ a_{12} = 1403580,\ a_{13} = -810728,\ m_1 = 2^{32} - 209$$

$$a_{21} = 527612,\ a_{22} = 0,\ a_{23} = -1370589,\ m_2 = 2^{32} - 22853$$

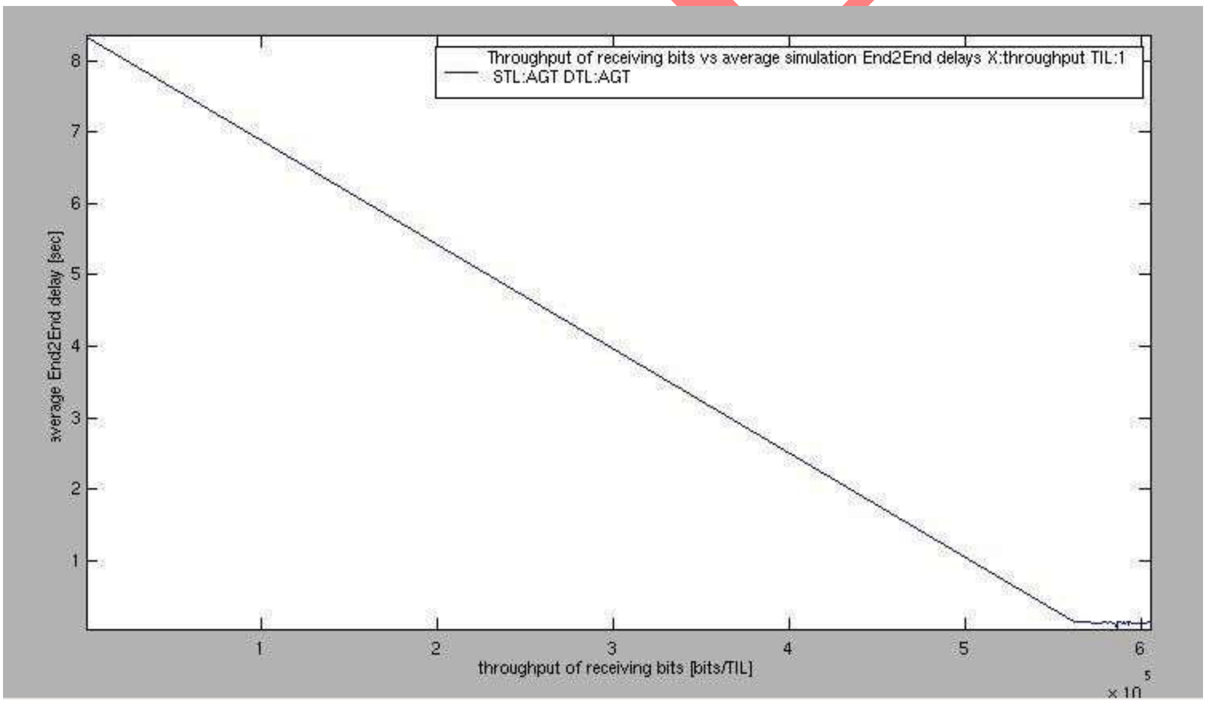
This provides x streams of independent random numbers, which consists of 2.3x10^{16} sub streams each.

RESULT

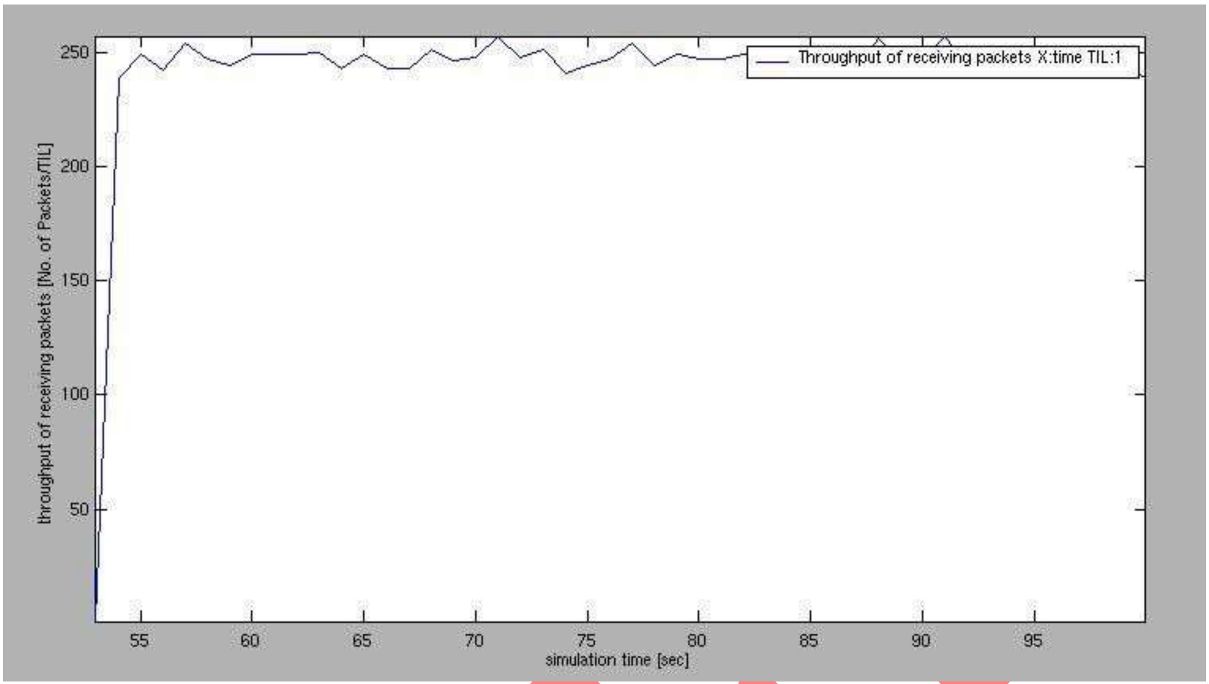
The performance analysis is done using various performance metrics like throughput, end-to-end delay, jitter, packet delivery ratio, etc. It is found to be that the DSR and AODV protocols are highly efficient as the DSDV protocol is table driven and hence when amobility model is implemented where nodes are specified to move, the DSDV protocol fails to achieve a good throughput whereas the AODV and DSR stand a good chance against DSDV. The AODV and DSR themselves are different from each other in different respects. For instance, the packet delivery ratio of DSR and AODV are equally good and the differenceis negligible for a scenario of 15 nodes. But when the same is scaled to larger number of nodes, then the ratio makes a huge difference affecting throughput. As the network is scaled, DSR catches up easily with AODV though AODV is better for 15 nodes. Similarly, various performance metrics were used to compare the scenarios where AODV and DSR are found tobe equally good where AODV surpasses DSR in average throughput but DSR surpasses AODV in end-to-end delay. The other metrics are similar in both cases.

TABLES AND GRAPHS

AODV:

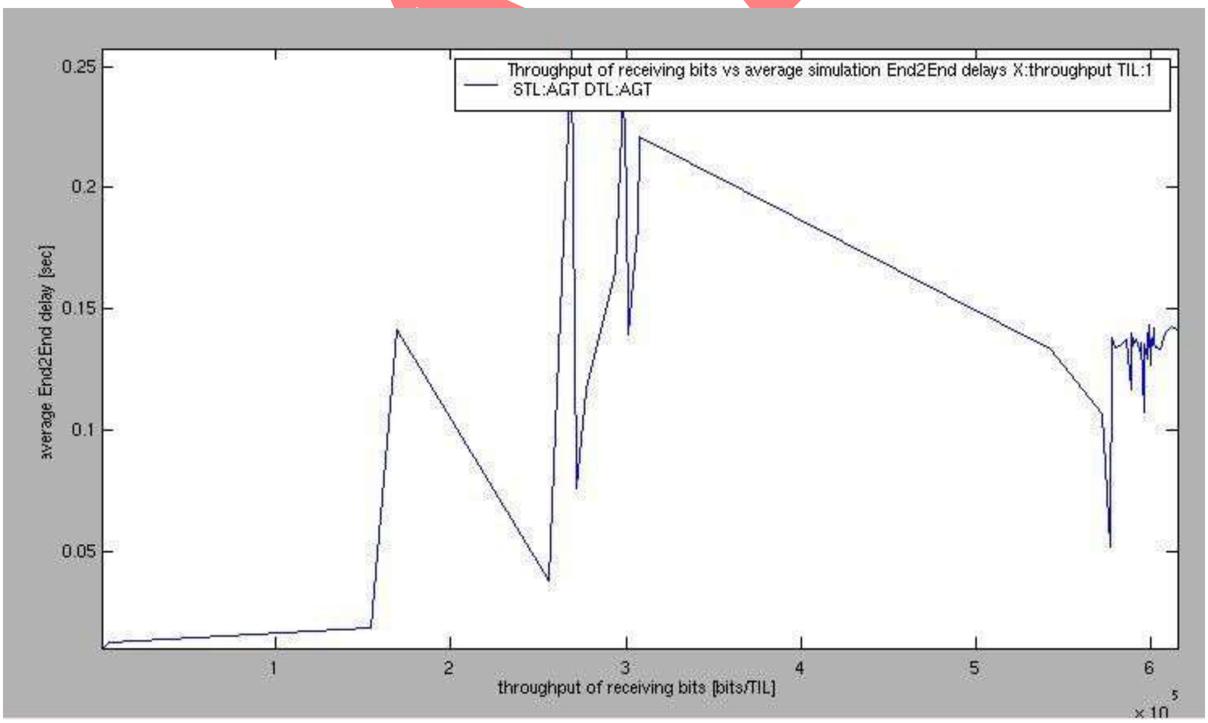


Graph- End-to-End Delay vs Throughput

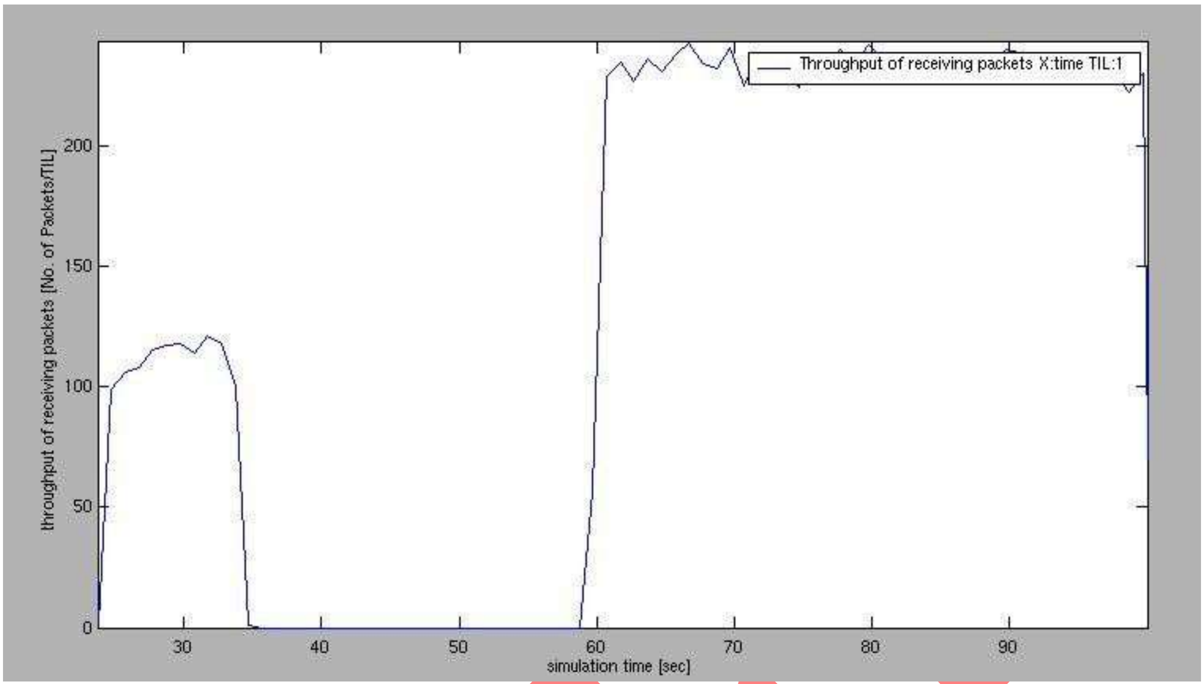


Graph- Throughput of recv. Packets at start vs Time

DSDV

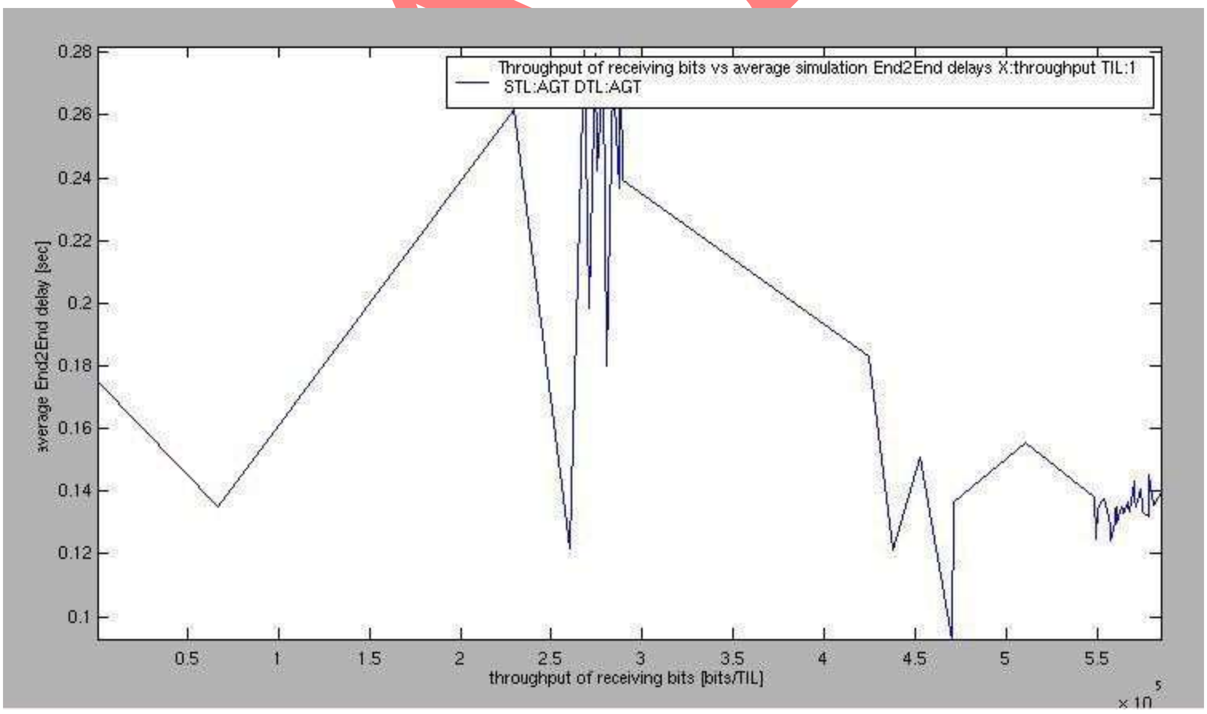


Graph-Throughput vs Avg. End-to-End Delay

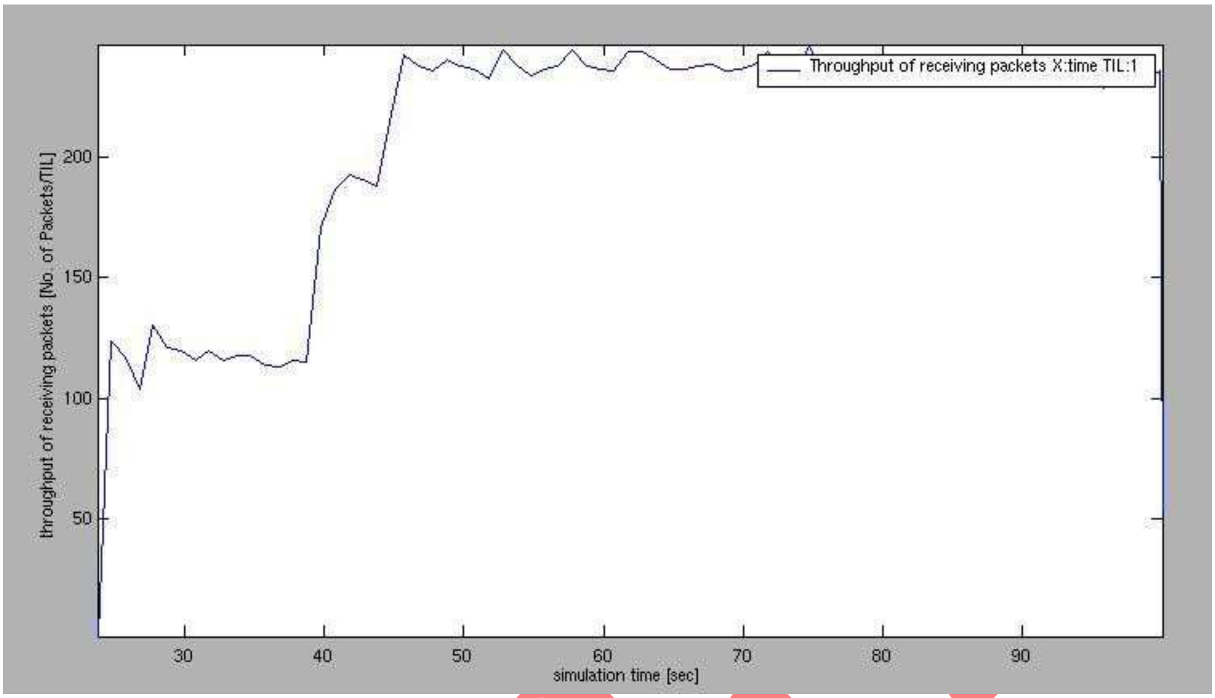


Graph- Throughput of recv. Packets at start vs Time

DSR



Graph- End-to-End Delay vs Throughput



Throughput of recv. Packets at start vs Time

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