Analyzing Throughput and EED by Varying Item Size

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Abstract

At present , due to its multipurpose applications, ad – hoc networks proves to be the most promising field of research. There are various issues and challenges that need to be considered when an ad-hoc wireless system is to be designed. Many researchers are working in these fields. There are various parameters on which the performance of ad-hoc networks were studied. The need to study item size variation in order to observe the effect on end to end delay and throughput motivates us to explore the field.Three routing protocols are considered : AODV, DSDV, DSR . Reasons for measuring throughput in networks People are often concerned about measuring the maximum data throughput in bits per second of a communications link or network access. A typical method of performing a measurement is to transfer a 'large' file from one system to another system and measure the time required to complete the transfer or copy of the file.

1. Introduction

Mobile ad hoc networks (MANETs) represent complex distributed systems that comprises 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, having been around in various forms for over 20 years. Traditionally, tactical networks have been the only communication networking application that followed the ad hoc 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. This paper attempts to provide a comprehensive overview of this dynamic field.

At present , due to its multipurpose applications, ad – hoc networks proves to be the most promising field of research. There are various issues and challenges that need to be considered when an ad-hoc wireless system is to be designed. Many researchers are working in these fields (like Anders Nilson ,2002; Bijan Paul et al., 2011;Sunil taneja et al.,2011; Tanu Preet singh et al.,2012). However some researchers worked on QOS, some worked on routing protocols and compared various protocols based on various parameters, many of the researchers had also worked on security as it proves to be one of the challenges on top. Some researchers worked on Self organization of ad- hoc networks, reasearchers also explains the application of these networks.

Energy Management and Power management in ad-hoc networks is also one of the major issue to be studied upon. Survivability and Scalability of Mobile ad-hoc networks is also one of the issue of cocern and many researches were had taken place in this area to make the ad-hoc networks more efficient. There are various parameters on which the performance of ad-hoc networks were studied but no one provides the variation with item size. The need to study item size variation in order to observe the effect on end to end delay and throughput motivates us to explore the field.

There are so many problems associated with ad-hoc networks like host is no longer an end system and can also be an acting intermediate system ,Changing the network topology over time ,Potentially frequent network partitions, Every node can be mobile, limited power capacity, limited wireless bandwidth. presence of varying channel quality, no centralized entity, there are so many other problems like,how to support routing, channel access? How to deal with mobility?

How to conserve power? How to use bandwidth efficiently? Many researches are taking place in this area to solve all these problems associated with ad-hoc networks, In the proposed work one of the problem is taken care of. Here we had focused on managing the throughput and end to end delay with item size.

The work shown in this paper is the extension of the work carried out by Princi Chauhan et al. [1] , The result obtained in that work is used here to show the dependency of throughput and end to end delay on item size.

Routing protocols AODV, DSDV, DSR were considered , they were simulated at four different data rates, the aim was to find best of the three routing protocol at one of the four data rates to proceed for the next step.

It was concluded from the simulation that the throughput of routing protocol DSDV is showing the increase when transferring the information from server to client. Average delay of DSDV was highest as compared to the other two. The packets send and received in application layer were more in DSDV as compared to AODV and DSR and it can also be seen that it was high at 1 Mbps of data rate and keep on decreasing when the data rate increases. As far as the hop count was concerned AODV is showing the maximum hop count as compared to the other two. The queue size and queue length was better in DSDV than in AODV and DSR. It was observed that packet drop was less in AODV and it was slightly more in DSDV while it was very high in DSR. Packets from network layer were more in DSDV and least in AODV, Packets from network layer in DSR is in between DSDV and AODV. At last the packets send and received in a channel were more in DSDV as compared to AODV and DSR . So in order to perform next step it was found that DSDV was performing better at 1 Mbps of data rate, though it had larger end- to- end delay than the other two routing protocol but it was observed that it was empowering the other two routing protocol in other parameters.

2. Related Work

Piyush Gupta et al. [2] works to find the capacity of wireless networks, Fundamentally, it is the need for every node all over the domain to share whatever portion of the channel it is utilizing with nodes in its local neighborhood that is the reason for the constriction in capacity. Splitting the channel into several subchannels does not change any of the results. Some implications may be worth considering by designers. Since the throughput furnished to each user diminishes to zero as the number of users is increased, perhaps networks connecting smaller numbers of users, or featuring connections mostly with nearby neighbors, may be more likely to be find acceptance. In 2002 Anders Nilson [3] does the performance analysis of Traffic Load and Node Density in ad- hoc networks, and found that As the transmission power is varied, a tradeoff exists between the number of hops and the overall bandwidth available to individual nodes. Nodes in mobile ad hoc networks are typically battery operated. Because both the battery lifetime and the channel bandwidth are limited resources, it is important to determine the effect different transmission power levels have on the overall performance of the network. There are so many factors that effects the network performance, Dmitri D. Perkins et al. [4] explains all those factors and this study centers on investigating and quantifying the effects of various factors and their two-way interactions on the overall performance of ad hoc networks. This study will contribute to the modeling and development of adaptive ad hoc protocols (routing, medium access control, scheduling and buffer management).Specifically, this paper evaluates the impact of these factors on the following performance metrics: throughput, average routing overhead, and power consumption. Abdul Hadi et al. [5] performs the comaparision of AODV, DSDV, I-DSDV, Three protocols AODV, DSDV and I-DSDV were simulated using NS-2 package and were compared in terms of packet delivery ratio, end to end delay and routing overhead in different environment; varying number of nodes, speed and pause time. Simulation results show that I-DSDV compared with DSDV, it reduces the number of dropped data packets with little increased overhead at higher rates of node mobility but still can't compete with AODV in higher node speed and number of node.

3. Simulation Environment

The simulation platform used for evaluating the proposed approach is GloMoSim , a discrete event detailed simulator for wireless network systems. It is based on C-based parallel simulation language PARSEC. In our experiments all the layers are implemented using default characteristics of IEEE 802.11. The objective of this standard is to provide wireless connectivity to wireless devices nodes that require rapid deployment, which may be portable, or which may be mounted on moving vehicles within local area. The IEEE 802.11 also aids the regulatory bodies in standardising access to one or more radio frequency bands for the purpose of local area communication. The interfaces offered by 802.11 to the higher layers are the same as those offered in other 802.x standards.

3.1 Propogation Model

The models rely on computing the median path loss for a link under a certain probability that the considered conditions will occur. Radio propagation models are empirical in nature, which means, they are developed based on large collections of data collected for the specific scenario. For any model, the collection of data has to be sufficiently large to provide enough likeliness (or enough scope) to all kind of situations that can happen in that specific scenario. Like all empirical models, radio propagation models do not point out the exact behavior of a link, rather they predict the most likely behavior the link may exhibit under the specified conditions. Here Two Ray Loss with threshold cutoff is used as the propogation model . This model uses the Free Space Path Model for near sight and Plane Earth Path Loss for far sight. For a distance R , the free space model attenuates the signal a 1/R2 and the plane earth model as 1/R4 , if the received power level of a packet is below the noise level plus the specified signal to noise ratio (SNR) threshold, a collision is detected.

3.2 Routing Protocol

A routing protocol is to find a path followed by the data packets from a source node to a destination node. A variety of routing protocols for ad-hoc wireless network has been proposed in the recent past. The routing protocol for ad-hoc wireless networks can be broadly classified into four categories:

a) Routing information update mechanism
b) Use of temporal information for routing
c) Routing topology
d) Utilization of specific resources.

The routing protocol used here is DSDV which comes in the first category , as it is proved to be the best routing protocol in [1] at 1 Mbps of data rate.

DSDV [6] is the proactive or table driven routing protocol and is a modification of the conventional Bellman-Ford routing algorithm. It addresses the drawbacks related to the poor looping properties of RIP in the face of broken links. The modification adapted in DSDV makes it a more suitable routing protocol for ad hoc networks.

3.3 Mobility Model

The mobility model is designed to describe the movement pattern of mobile users, and how their location, velocity and acceleration change over time. Since mobility patterns may play a significant role in determining the protocol performance, it is desirable for mobility models to emulate the movement pattern of targeted real life applications in a reasonable way.

The mobility model used for simulation is Random Waypoint model .The Random Waypoint Model was first proposed by Johnson and Maltz. Soon, it became a 'benchmark' mobility model to evaluate the MANET routing protocols, because of its simplicity and wide availability. Each node randomly selects a direction in which to travel , where a direction is measured in degrees. The node then randomly selects a speed and destination along with the direction and travels there. Once it reaches the destination , it remains stationary for some predefined time called as pause time. Two variants, the Random walk model and the Random direction model are variants of the Random waypoint model. Two variants, the Random walk model and the Random direction model are variants of the Random waypoint model.

3.4 Simulation Setup

QualNet is a discrete-event simulator .Whole simulation is carried out on GloMoSim 5.0 version. In the proposed work CBR as traffic generator is used ,For each traffic generator in the simulator change the following properties

- Items to Send
- Item Size (bytes)
- End Time
- Traffic type.

1 Mbps of traffic rate is injected into the network. The simulation simulates for 30 seconds and the network of 100 nodes in a 1000 x 1000 m area is modelled . Number of 512 byte data packets sent per second. The type of traffic injected into the network is 10 short-lived CBR sources spread randomly over the network. When one session ends , a new source-destination pair is randomly selected. Thus the input traffic is constantly maintained. Following is the specifications taken into consideration for the experimental work..

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Area	1000 x 1000 m area
Number of nodes	100
Routing protocol	DSDV
Mobility model	Random Way Point
Simulation time	30 seconds
Data rate	1 Mbps
Start time	1 second
End time	101 seconds
CBR sources	10
Interval	1
Pause time	10 second
Max velocity	10 m/s
Min velocity	0 m/s
Shadowing model	Constant Mode
Item Size	32,128,64,256,512(default),1024,2048,4096,7044,8192.

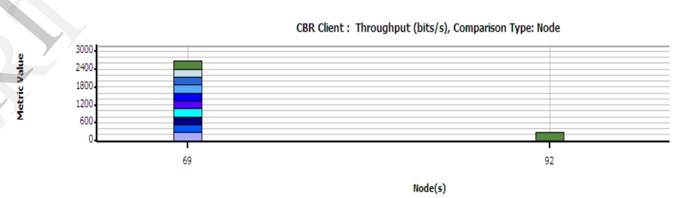
In the proposed work 10 readings are considered to see the variation in throughput and end to end delay. The ten values of item size are 32, 128, 64, 256, 512(default), 1024, 2048, 4096, 7044, 8192 (all the values are in bytes).

4.Results

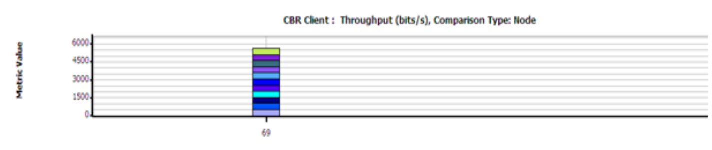
4.1 Throughput

In communication networks, such as Ethernet or packet radio, throughput or network throughput is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot. The system throughput or aggregate throughput is the sum of the data rates that are delivered to all terminals in a network.
Throughput of a network can be measured using various tools available on different platforms. This page explains the theory behind what these tools set out to measure and the issues regarding these measurements. As already being told that a Mobile Ad Hoc NETworks (MANET) is an selforganizing system of mobile routers (and associated hosts) connected by wireless links. The primary objective of this study is to evaluate and quantify the effects of various factors (and their two-way interactions) that may influence network performance. While there have been performance evaluations of ad hoc networks , none have actually quantified the effects of the influential factors. There are so many factors like (1) node speed, (2) node pause time, (3) network size, (4) number of traffic sources and (5) routing protocol (source vs. distributed) , (6) Item size. Here the impact of Item size is seen on one of the performance metrics called Average throughput. Item size is one of the property of CBR traffic generator used.

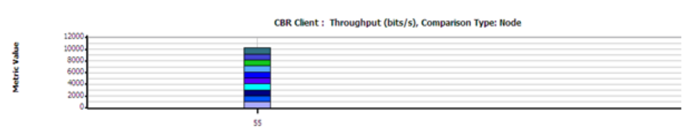
Below are the graphs observed for throughput for different values of item size. The throughput of the CBR client for different item size are observed here to show there variation.



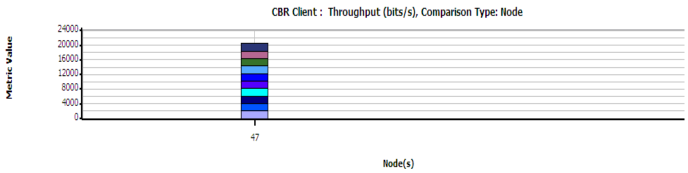
(a) Item Size : 32 bytes



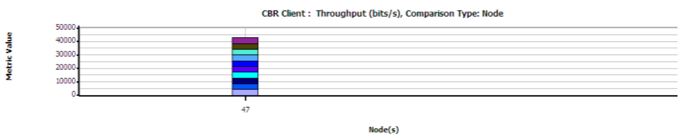
(b) Item Size: 64 bytes



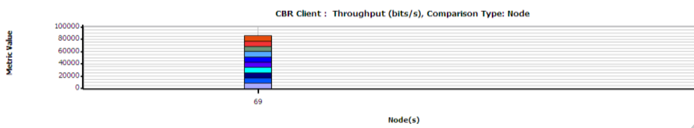
(c) Item Size :128 bytes



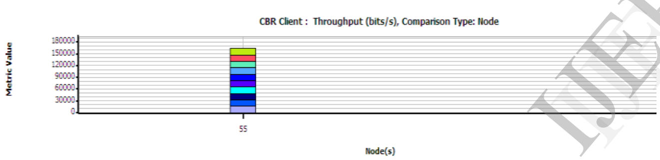
(d) Item Size : 256 bytes



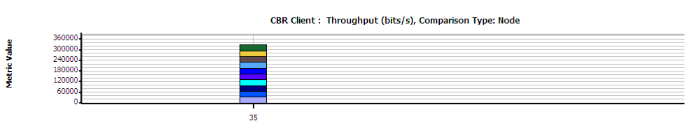
(e) Item Size : 512 bytes



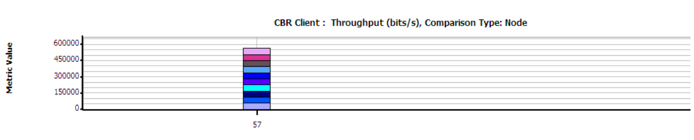
(f): item size 1024 bytes



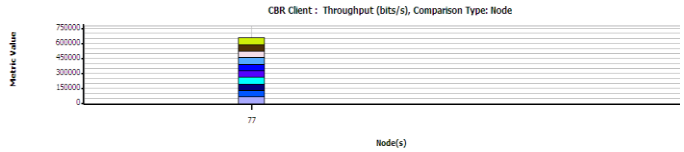
(g): item size 2048 bytes



(h): item size 4096 bytes



(i): item size 7044 bytes



(j): item size 8192 bytes

Fig 1: Throughput Observation by varying item size

CBR is useful for streaming multimedia content on limited capacity channels since it is the maximum bit rate that matters, not the average, so CBR would be used to take advantage of all of the capacity. CBR would not be the optimal choice for storage as it would not allocate enough data for complex sections (resulting in degraded quality) while wasting data on simple sections.

The problem of not allocating enough data for complex sections could be solved by having high throughput to ensure that there will be enough data for the entire encoding process, though the size of the file at the end would be proportionally larger.

The same is observed in our simulation, here also the throughput is increasing with the increasing item size.

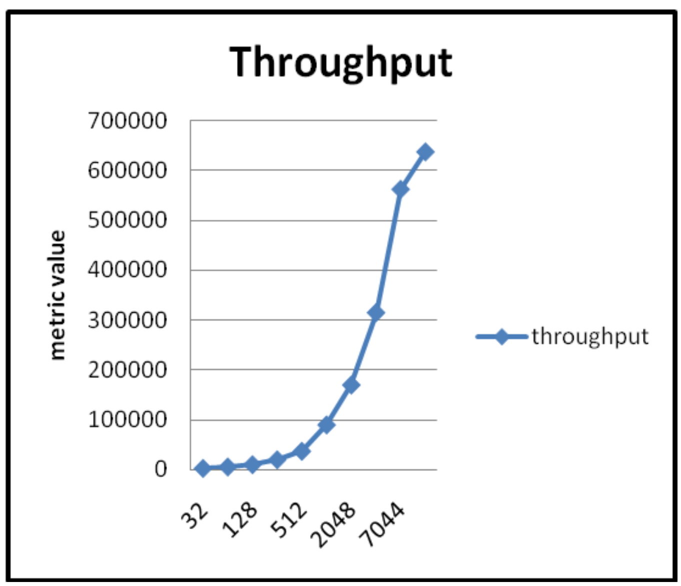


Fig 2: Graph showing the variation of throughput with item size

4.2 Average End to End Delay

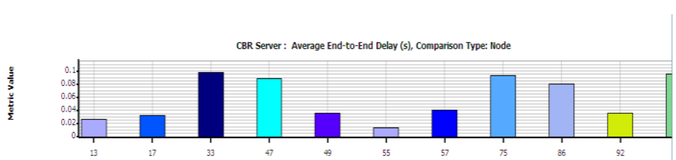
End-to-end delay refers to the time taken for a packet to be transmitted across a network from source to destination.

$d_{end-end}= N[d_{trans}+d_{prop}+d_{proc}]$ where
$d_{end-end}$= end-to-end delay
d_{trans}= transmission delay
d_{prop}= propagation delay
d_{proc}= processing delay
N= number of links (Number of routers + 1)
Note: we have neglected queuing delays.

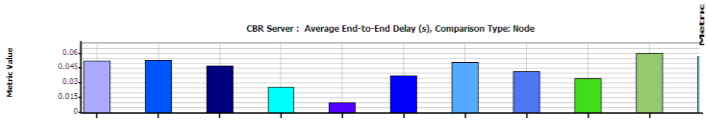
Each router will have its own dtrans, dprop, dproc hence this formula gives a rough estimate.

Most of the Ad hoc routing protocols do not consider MAC delay contention time, which occurs, in the medium reservation. Large contention times can be more critical than hop counts in determining the end-toend delay. Most existing MANET routing protocols such as AODV, DSR and OLSR are designed to search for the shortest path with minimum hop counts. However, the shortest routes do not always provide the best performance, especially when there are congested nodes along these routes.

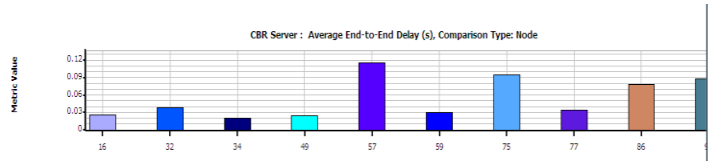
We can show how the average end to end delay of a CBR server is varied by varying item size. For this purpose also ten values of item size are considered as shown:
32,128,64,256,512(default),1024,2048,4096,7044,8192 (all the values are in bytes). . The average end to end delay of the CBR server for different item size are observed here to show there variation.



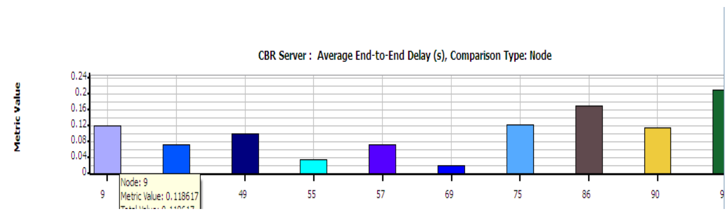
(a) :Item size 32 bytes



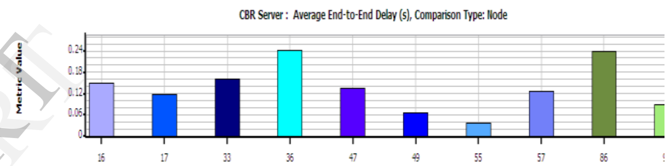
(b):Item size 64 bytes



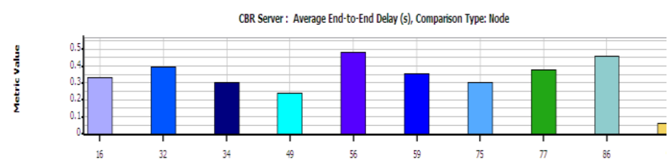
(c):Item size 128 bytes



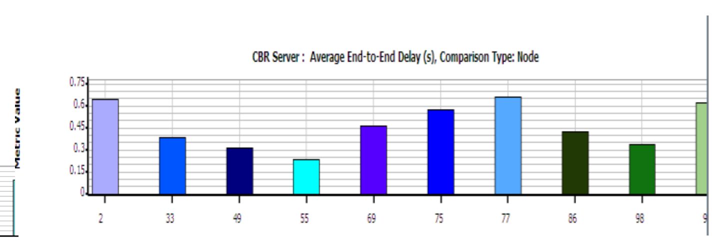
(d):Item size 512 bytes



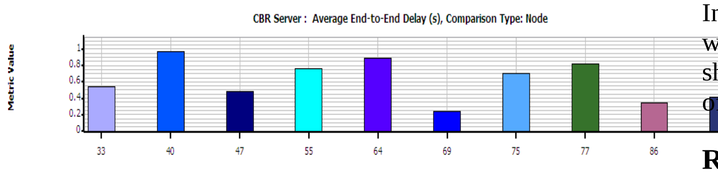
(e):Item size 1024 bytes



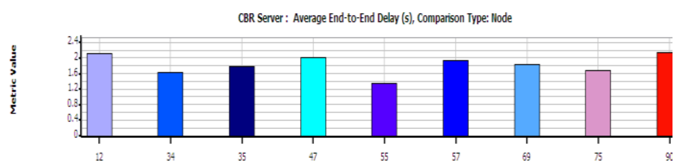
(f):Item size 2048 bytes



(g):Item size 4096 bytes



(h):Item size 7044 bytes



(i):Item size 8192 bytes

Fig 3: EED observation by varying Item size

EED generally accounts for all delays along the path from the source to the destination. This includes the transmission delay, propagation delay, processing delay, and queuing delay experienced at every node in the route. To measure the EED, packets are sent from the source to the destination using the ping utility, over different route lengths and beaconing intervals.

Varying the transmission item size has a direct influence on the EED of ad hoc wireless routes. This is because the larger the item size, the longer the packet transmission, propagation, and processing times.

5.Conclusion

DSDV is performing better at 1 Mbps of data rate, though it is having larger end- to- end delay than the other two routing protocol i.e. AODV, DSR(referring [1])but it is observed that it empowering the other two routing protocol in other parameters.

Further our simulation, shows that throughput is increasing with the increasing item size , Also varying the transmission item size has a direct influence on the EED of ad hoc wireless routes. This is because the larger the item size, the longer the packet transmission, propagation, and processing times.

In our current research, the influences of each factor were tested independently. That means, future work shall be done to present cross-analysis of the influences of these impacts.

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