Development of Efficient Protocol for Residual Energy of a Node in Wireless Adhoc Network using Pareto Distribution

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***Abstract*— one of the major issue in wireless Adhoc network is to enhance the lifespan of wireless Adhoc Network. These networks will be useful for self organizing, self-configuration and for detecting radio connectivity for the dynamic operation. We always require quick & cost effective deployment in applications like battlefield, emergency search and rescue operation & collaborative computing. In this paper we have simulated wireless adhoc networks for various routing protocols, probabilistic approaches, and channel models towards improving the capacity of wireless adhoc network. Also there are many important optimization techniques which helps in reducing energy of a wireless nodes. ACO & PSO techniques plays important role in saving energy of a node at a greater extent. We basically focus on arrival of packets & its distribution to route packet using various approaches i.e. exponential, Pareto, constant and many more & its impact on energy has been studied for improvising the capacity of wireless Adhoc network. These networks are strong enough to set up fixed infrastructure in commercial application among group of soldier in enemy territories as well as it will be useful in coordination of military objects moving at a high speed such as fleets of airplanes or warships.**

Keyword-Pareto, Constant, Hyper exponential, exponential, Packet delivery ratio

I. INTRODUCTION

Performance of a network is affected by various routing approaches. In these Adhoc networks, routing protocols are playing significant role in deciding the network performance. Efficient delivery of data is dependent on the communication channel path, condition, parameters affecting overall transmission. This paper if you look, introduced novel scheme for distributing packets for improving the residual energy of a node in adhoc network.

Throughput of the system depends on the channel quality. Propagation model are designed with the reactive routing protocols [1]. In adhoc network, quality of transmission is always affected by various parameters such as mobility, path breaks, congestion and routing. Mobility affects the transmission of wireless channel & has been very effective in deciding the routing protocol performance. Previous researchers have studied the impact of routing methods in improvising the quality of network.

1.1 Routing Protocol

Routing function is performed by Network Layer. In wireless networks, route failures are more as compared to wired network. The prime cause behind its failure is routing and contention of channel. Pattern of nodes and channel characteristics plays a important role towards route failures.

Significant routing protocols in Ad hoc network are DSR, DSDV, AOMDV, TORA& AODV,.AODV is very important routing protocol. In AODV, unused routing path are not stored and deleted from the table entry. It will not do the maintenance of the route from the originating node to final destination node when they are not communicating. AODV always finds a path for effective communication based on the minimum metric path with the smallest number of hops

1.2 Propagation Model

Propagations models are specified to predict receiver. Small scale and large scale models are elaborated depending on the scenario of networks. The performance of the network degrades by the path loss. It can be defined from various propagation models.

1.3 Two Ray Ground Propagation Model

For calculation of received power, Friss equation is used & given by the following equation

$$Pr(d) = Pt\frac{GtGr\lambda^2}{(4\pi)^2 d\alpha L}$$

Here L specifies the system loss

λ be the wavelength of transmitted signal.

G_t & G_r be the antenna gains

Pt will be the transmitted power.

α will be the path loss exponent

d is the transmitter & receiver distance.

In this, ground reflection spread model is utilized amongst receiver and transmitter additionally to the direct path loss.

In the event that analyzed, model of two beam is more sensible model than the free space show. In this, reflected propagation path from ground is considered between transmitter and receiver**.** The power at the receiver is calculated by

$$\frac{PtGtGrht^2hr^2}{d^4L}$$

This model is considered to be more accurate.

1.4 Probabilistic Model & Shadowing:

This model will have two parts. Path loss model is the first one which determines the received mean power at a specific distance d.

Receiver Power will be calculated with the help of following equation.

$$Pr(d) = Pt - PL(d0) + 10\alpha log\left(\frac{d}{d0}\right) + X\sigma$$

The second section of it shows the variation of the power received at certain distances & this is the log normal random distribution.

1.4.1 Gaussian Channel region using random Multipath for enhancing the capacity

Probabilistic approaches of the communication channel improves the effectiveness of the communication channel. These types of modelling should include fading, multipath and interference. Channels i.e. path loss, shadowing and multipath will have different models & it has a impact on various computational parameters such as routing overheads ,payload, packet delivery, queuing delay, delay, network overheads effect [3].

1.4.2 Indoor Wireless Channel& its Modelling:-

We should look at probabilistic analysis of the indoor wireless channel so that information can be decoded with channel conditions and effectiveness of the channel will be enhanced. Modelling consist of fading and multipath as well as interference during analyzing various performance parameters. Rayleigh distribution is considered as the best model which is accepted for the statistics of signal amplitude [4].This fading distribution done for the signal has affected multipath or refracted signals which are received without any direction[5].The Probability Distribution Function (pdf) for Rayleigh distribution is given by

$$PR(r) = \frac{r}{\sigma^2} e^{-\frac{r^2}{2\sigma^2}v(r)}$$

where mean value E[R]= $\sigma\sqrt{\pi/2}$&variance of it is

V[R]=$\left(2 - \frac{\pi}{2}\right)\sigma^2$

We could have fair accuracy while defining a accurate model. Signal received by one of the user is given by

$$r(t) = \sum \alpha k \ \ \sigma\,(t - \sigma k)$$

Here the attenuation parameter are dependent on the path traversed by the signal l_k and time. The delays depends on l_k.The channel transfer function obtained is

$$h(t) = \sum \alpha k \sigma (t - \sigma k)$$

1.5 Routing Protocol Performance & analysis

MANET has become important because of its size and large capabilities while computing .Routing is considered as significant issue as messages are transferred from originating node to sink node which is remarkable & the packet delivery is not guaranteed .Hence different routing protocols are needed in wireless Adhoc network which are made responsible for this communication. There are various routing algorithms who had impact on network and route resources.

They use various metrics that affects the computational parameters.

DSR: This protocol restricts the bandwidth which is utilized by the control packets in adhoc network. The main point of comparison between dynamic source routing protocol and other routing algorithms that is it will not need periodic transmission of hello packets.

DSR contains two modes 1.Route Discovery mode 2. Route maintenance

Route Discovery: In this mode, source node seek its route cache &find the availability of route from originating node to sink. Because of presence of route in the cache, initialization of the route discovery process starts. Packet carries the sink address as well as address of intermediate node to the destination node.

Maintenance of Route:

Due to changing structure of topology of the network, the route breaks down occur due to breakage of link. Acknowledgement mechanism will be utilized for route maintenance [6].

1.6 Routing Protocol

AODV routing is very efficient method in mobile adhoc networks. In AODV routing process, network stability always depends on the connection. Whenever network wants to establish the connection, broadcasting of message should be taken care of. Messages are being forwarded through the intermediate node and search the nodes from which they heard it and creation of outburst of temporary route takes place. Node receives the message and route gets stored, afterwards it will send a message to the backward node through the provisional node to the requesting node. The node will send data using the route who will have minimum number of hops. Rest of the entries in the routing tables are cycled at regular interval. If the link fails, the routing error is transmitted to the source nodes and process starts repeating [7].

DSDV: It is a distance vector, routing protocol which works on principle of Bellman Ford Routing. Routing node helps to maintain a routing table which has a data of the “next node” for every possible destination, the number of hops attainable to the destination and the sequence number allotted by the sink node. The sequence number will be useful to make the difference between the stale route and the fresh one and it avoids the loop information [8].

1.7: Relay node impact on end to end delays in Multihop Wireless Adhoc Network.

Channel is the main delay source in these systems. Transmission sweep, throughput, density of nodes, likelihood of channel get to are vital parameters in assessing end to end delay. This end to end delay increments with the transmission span, arrange throughput and density of nodes.

Divert access in adhoc system is generally CSMA/CA based conflict. Collision produces extra exponential delays in these system. Delay while accessing the channel can be decreased by aggression & compression in adhoc systems techniques are being utilized for diminishment of channel get to. The CSMA CA Protocol is the best MAC Protocol in the 802.11 standard for better throughput and effectiveness

1.8 Probabilistic Routing impact in Delay Tolerant Networks

There exists many issues of routing in Delays Tolerant Networks. The essential prerequisite in DTN is to discover the correspondence way in the middle of the nodes in Sparse Networks. In such cases, many zones exists in the system & communication in between them will depend on certain nodes

For limiting the routing delays and resources required inside the system, we proposed a routing protocol which utilizes prophet directing convention set up utilizing two routing measurements [5].

In this approach, when a source node tries to send data to a destination node through middle nodes, messages are send to the node which has a high probability of delivery and possibility of remission. At the point when a node associate with other node with the most noteworthy likelihood of packet delivery, it will send the message to that node and message still needs to go to other node in future.

At the point when a node experiences another node of high likelihood of remission and low likelihood of packet delivery, it sends this data to that hub despite the fact that the likelihood of conveyance is low & it evacuates the duplicate of message and arranges for space in its storage unit.

II Motivation towards Probabilistic Approaches:

In Multipath, heading of landing circulation of multipath in the remote channel is determined logically accepting directional radio wire both at both transmitter and recipient. The DOA appropriation depends on the exceptional connection between the beneficiary, transmitter and the diffuses. In remote correspondence, remote sensor organize and ordinary application, difficulties to comprehend the remote channel impact [9].

2.1. Motivation towards Probabilistic Approaches:

In Multipath, direction of arrival distribution of multipath in the wireless channel is derived analytically assuming directional antenna both at both transmitter & receiver. The DOA distribution is based on the special relationship between the receiver, transmitter and the scatters. In wireless communication, wireless sensor network and conventional application, challenges to understand the wireless channel effect [9].

2.2 Traffic Modelling in Spatial Temporal in Mobile Cellular Networks:

The type of traffic data & volume in mobile adhoc network is increasingly rapidly. Data gets affected in several extents such as space and time. For designing efficient future network, traffic modelling is essential. This model shows various user distributions and clusters of hotspot by adopting the parameters: the standard value and mean value. Traffic distribution pattern changes with the evaluation of network architecture.

SPPP and Gaussian appropriation models are utilized for different example to do hypothetical examination, yet there is not really any coordinating of movement information in genuine cell systems. For planning another correspondence framework, a model will be required which mirrors the activity example of genuine current system .Lognormal appropriation is utilized for demonstrating spatial movement dispersion. In this model, the periodicity and irregularity of single base stations movement inconstancy is talked about [10].

2.3 Topologies and irregularities in Wireless Network:

Cellular networks have been evaluated by means of stochastic and deterministic approach. Hexagonal geometries is evaluated in real world for various networks. Hexagonal geometry on real world data is a part of deterministic model [11].

Cellular communication have shown exponentially growth worldwide. Mobile devices will be the finest way to access the internet with the help of Smartphones, Tablets, and Notebook. In such fast evaluation, there are enormous challenges for mobile operators in diversified filed [12]. There is a need for seamless connectivity, global coverage& better quality of service, effective management, operation and optimization. Topology and irregular distribution demands on the performance of the network is now new as evidenced by [13].

Compatibility between service demand distribution and network topology distribution is controlled by radio resource management.

The effect of non-regularity in realistic network deployment is explained in [14]. A comparative analysis between deterministic & stochastic model is done, however the connection with irregular traffic distribution is not extended [15].

III. Discussion

We have simulated various networks using different probabilistic approaches using NS2 up to 40 mobile nodes. It has been observed that there is a impact on energy, packet delivery ratio & throughput if we go on changing distribution of nodes in a specific range inside a network. Table 1 provides the simulation parameters for creating networks. These parameters are useful & effective for analysing computational parameters in wireless Adhoc networks. Figures 1, 2 are the Nam files generated using NS2 which shows various networks created using simulation parameters as mentioned in table. In table 2, it is clear that residual energy of node is better than normal scenario if nodes are placed using Hyper exponential & constant distribution.

Graph 1 & 2 shows that residual energy of a node after active communication is better if placed using Pareto distribution. Best energy models are depicted below

Table 1: Simulation Parameters for Adhoc Wireless Network

No of nodes	20-140
X dimension of topography	1500m
Y dimension of topography	1500m
Propagation	Two ray ground
MAC Type	802_15_4
Antenna	Omni Antenna
Initial energy	5 joule
Tx power	0.9 Joule
Rx power	0.8 Joule
Sense Power	0.0175

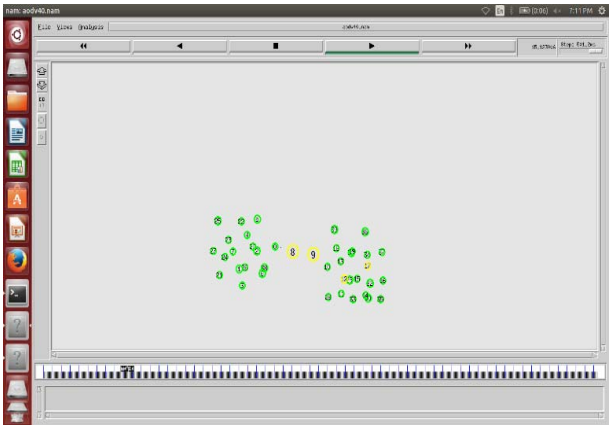


Figure 1: Snapshots of simulation results using NS2 for 40 mobile nodes

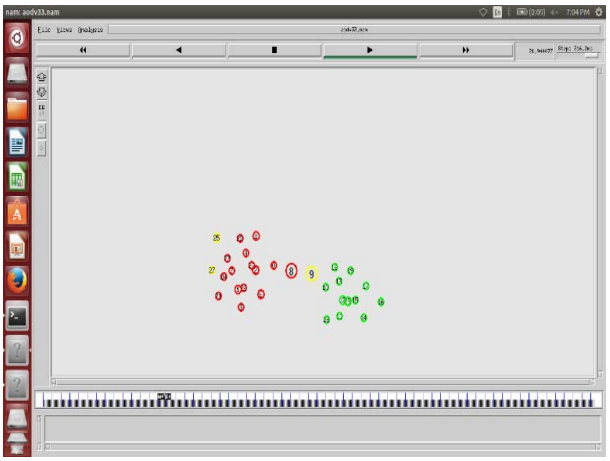
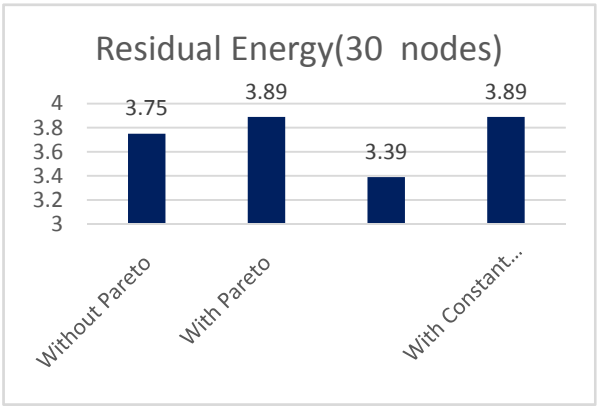
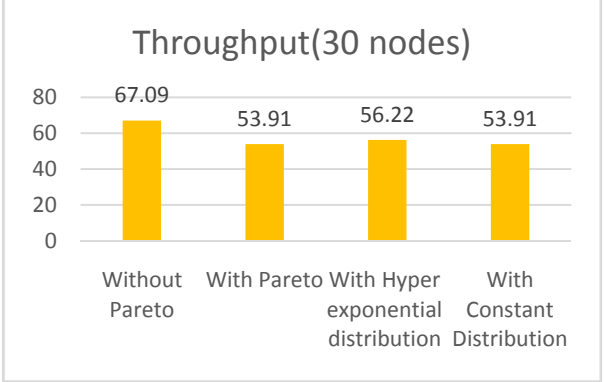
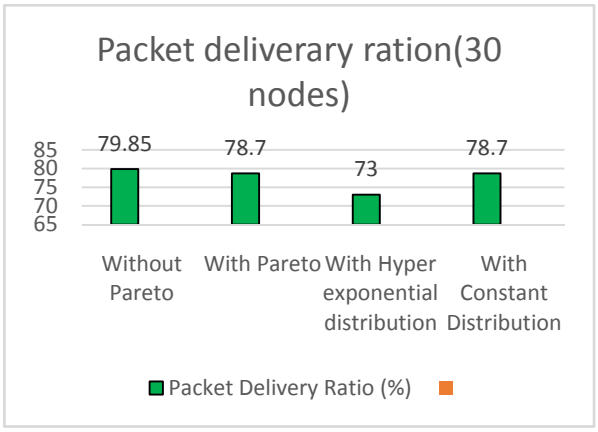


Figure 2: Snapshots of simulation results using NS2 for 30 mobile nodes

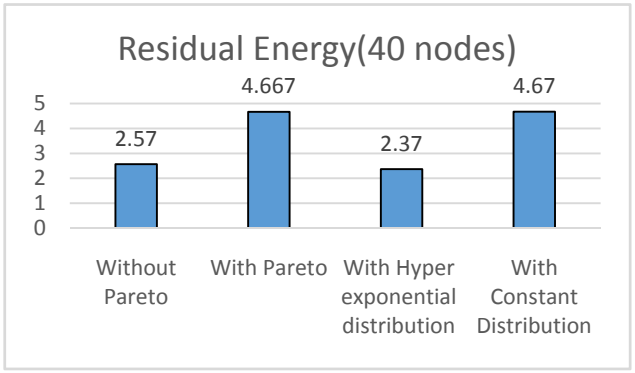
Graph 1: Comparative analysis of Residual energy, Throughput & Packet Delivery Ratio for 30 nodes using Pareto, exponential & hyper exponential distribution.

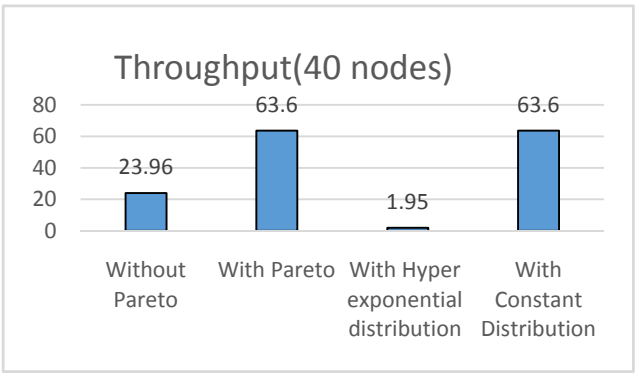


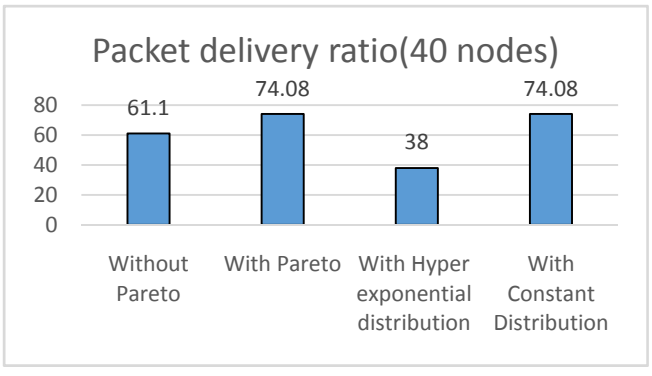




Graph 2: Comparative analysis of Residual energy, Throughput & Packet Delivery Ratio for 40 nodes using Pareto, exponential & hyper exponential distribution







Form the normal probability graph, p value is greater than 0.05 so residuals are normally distributed.

Energy model formulated for residual energy using various distributions

Model for Pareto distribution is

$$Er = 23.8 - 0.0602nn - 0.247PDR + 0.0247Thr$$

Without Pareto distribution network is modelled as

$$Er = -289 + 0.294Thr - 0.88PDR + 5.56nn$$

With Hyperexpontial distribution, model is depicted as

$$Er = 28.7 + 0.174Thr - 0.340PDR - 0.344nn$$

With constant distribution, model for residual energy is

$$Er = 500 - 1.75Thr - 5.06PDR - 0.107nn$$

IV. Conclusion

The main challenge of MANET is finding the best route between source & destination .Many routing algorithms are developed to route the packets using shortest path. In this paper we have investigated the novel approach for distribution of pa packets so that energy can be minimized .Results shows that if packets are distributed using Pareto distribution, 93% of energy of a node is retained after active communication. We get best energy model using AODV routing protocol & using Pareto distribution. These networks will be useful for military applications where soldiers can create their own network for communication & can retain maximum lifetime using these algorithms.

V. References

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