Secure Node Selection and Data Routing in Delay Tolerant Network

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Abstract— Delay-tolerant networks (DTNs) are partitioned wireless ad hoc networks with intermittent connectivity. Delay-tolerant networks (DTNs) are network environments that are subject to delays and disruptions. The DTN architecture, aims at providing implementations for reliable message delivery in intermittently-connected networks. The DTN architecture also specifies the bundle protocol which controls the exchange of bundles. In this proposed work, an approach has been proposed that will effectively transfer the data with reduced loss of packets. The Proposed approach for routing increases the energy efficiency of the network. The result demonstrated that the improvement in various performance parameters in the network. The simulation result indicates that proposed approach is very efficient as compared to other existing approach.

Keywords— *DTN; Trust Based*

I. INTRODUCTION

Delay-tolerant networks (DTNs) are designed to address networks that exhibit intermittent connectivity. Unlike conventional networks, DTNs do not necessarily provide end-to-end connectivity between two endpoints, and some nodes may experience longer periods of disconnectivity than periods of connectivity. DTN architecture can be defined by one or more of the following characteristics: sparse connectivity, long or variable delay, asymmetric data rate and high error rate (Cerf et al 2007).The DTN architecture executes store and forward message switching by introducing a new layer known as bundle layer on the top of transport layer. The purpose of bundle layer is to store and forward bundles among the nodes. Only bundle layer is utilized in all networks which creates a DTN. The layers which are below the bundle layer i.e. transport layer, network layer, link layer and physical layer are selected for their suitability for communication in every region. All the communication networks should have routing protocol that route the data from source to its destination. Delay tolerant networks are described by their less connectivity. In this demanding situation, regular ad-hoc protocols like DSR and AODV are failing to produce routes. This is because of the protocol which initially tries to set up entire path and only then the route is being generated and forwards the real data. Nevertheless, if direct end to end path are complex to set up, then routing should took store and forward method, where information is stored and moved throughput the network in such manner that it is ultimately reach its destination. General technique is utilized to increase the probability of the data which is being sending to imitate several copies of data in the hope that it will definitely achieve its destination. It is only possible on the network having large amount of local storage with respect to expected traffic.

DTNs has ability to resolve the issue linked with intermittent, long or variable delay, asymmetric data rates and high error rates by using store and forward message switching. In this method, a whole message or fragments of such messages are moved from a storage place on one node to a storage place on another node, along the path that eventually reaches the destination. When communicating nodes are in motion, links can be obstructed by intervening bodies. These events are the reason of intermittent connectivity. When there will no path exist among source and destination, a network division is occurred. Packets that cannot be immediately forwarded are usually discarded and TCP may retransmit the packets with slower retransmission timing. If packet dropping is too heavy, TCP ends the session, which can cause applications to fail. In the delay tolerant networks, DTN executes store and forward message switching by introducing a new layer known as bundle layer on the top of transport layer. The main function of bundle layer is to store and forward bundles among the nodes. The layers which are below the bundle layer i.e. networking layer, transport layer, physical layer and link layer are selected for their suitability for communication in every region. Only bundle layer is utilized in all networks which creates a DTN.

Mobile Ad Hoc Networks (MANETs) With the proliferation of mobile devices (cell phones, personal digital assistants (PDA), laptops, and other handheld digital devices), and the exponential growth in the wireless sector in the past decade, there is a revolutionary change in the way information is being handled. Users carry mobile devices that run applications and provide network services, among which data services are the most demanded by users. Currently most of these connections between mobile devices are infrastructure based. For example, two or more laptops communicate with each other using a wireless access point; cell phones are connected via cell phone towers. Setting up infrastructure for mobile device communication is potentially costly. Users will also face instances where the infrastructure required for desired communication is simply not available. Additionally many of the mobile devices in use like laptops and PDAs have only short range wireless capability. This has prompted the development of an alternative way for mobile device communication in which each mobile device (node)

communicates with each other over wireless without the support of an infrastructure, forming a mobile ad hoc network (MANET).

II. LITERATURE SURVEY

Chen, Ing-Ray, Anh Phan Speer et al. [1] in this work, delay tolerant QOS algorithm has been discussed which is depending on hop-by-hop data delivery that uses path and source redundancy. The main function of proposed algorithm is to satisfy the QOS necessities. The simulation has been done which presents the numerical data with given physical interpretations. The result analysis shows the feasibility of proposed algorithm design.

Goswami, Sudhir et al. [2] in this paper location based energy efficient scheme with AODV protocol has been presented. In this approach, nodes which are relied on energy are enhancing the capability of AODV protocol. Location aided routing protocol decrease the possibility of finding the destination by maintaining the record of position of every node in the network wrt other nodes. The purpose of proposed protocol is to increase the energy developing in the network. In this scheme, the performance of normal AODV, AODV with LAR is described here and showing that the LAR protocol decreases the energy consumption and enhance the network lifetime that fully based on the energy of mobile nodes.

Verma, Ravi Kumar et al. [3] proposed LAR protocol based on Random walk point mobility. The RW is based on the data transmission on nodes. The performance of proposed system has been discussed in this work. On the basis of it performance, it is found that the bit rate transfer is constant on RW model having pause time 0 and proposed protocol performs efficiently in MANET network.

Shen, Haiying et al. [4] presented Location-based Routing protocol. The proposed routing protocol distributes the network in to distinct regions and arbitrarily chose the nodes in region as intermediate relay nodes. As these nodes makes the non traceable path. Moreover, it hides the information between the receiver to make stronger source and destination protection. The result shows that the proposed protocol is very efficient and can secure source, route and destination.

El Defrawy, Karim [5] proposed PRISM protocol that gives support to reactive routing. It is based on the signatures to verify nodes, make sure about the reliability of routing data though avoiding node tracking. The routing overhead has been determined and it indicates that it can outperform anonymous link state based approaches under certain traffic patterns.

Mikki, Mohammad A et al. [6] proposed an location aided routing protocol which is energy efficient and used for mobile ad-hoc network. This proposed approach makes reduction in the enrgy consumption of mobile nodes due to which control packets overhead is minimized. In this EELAR, a base station is used which is generally wireless. This base station is divided into six equal sub-areas. The simulation has been done using NS-2 that indicates the efficiency of proposed protocol. The result demonstrates that the proposed protocol makes an improvement in the control packet overhead and delivery ratio.

El Defrawy, Karim et al. [7] this paper proposed a secure link state based protocol. The proposed protocol gives security and privacy feature. It also provides protection against passive and active attacks. This paper represents the study of link-state MANET routing and various problem growing in suspicious location-based MANET.

Phoummavong, Phonepadith et al. [8] in this paper, an approach has been proposed which is used to minimize the routing overhead and delay and simultaneously used to enhance the reliability of adhoc network that utilizes LAR protocol. LAR is useful in emergency situations. The proposed approach is based on the two-hop neighbor information and forwarding mechanism. Moreover, comparison of proposed approach with existing approach has been presented in this paper and it indicates that the proposed appracoh attains better performance than those of existing methods.

Pandey, Mr Sourabh et al. [9] in this paper, location based approach with AODV protocol has been presented. The purpose of presented method is to improve the energy utilization in network. Simulation has done by using ns-2 simulator and reduces energy consumption. The performance is measure on the basis of performance parameter like Normal Routing Load, Packet Delivery Ratio.

Wei, Li et al. [10] proposed multicast in DTNs. In this work, multicast having unicast and multicast data item and their difference has been discussed. The simulation result indicates that the proposed method have same delivery ratio and delay in routing and it can considerably minimize the data forwarding cost evaluated by the number of relays used.

III. PROPOSED METHODOLOGY

For implementing the proposed algorithm we use Ubuntu platform and install NS2. Figure 1. is an example for a network in which every node is attached to each other directly or in directly.

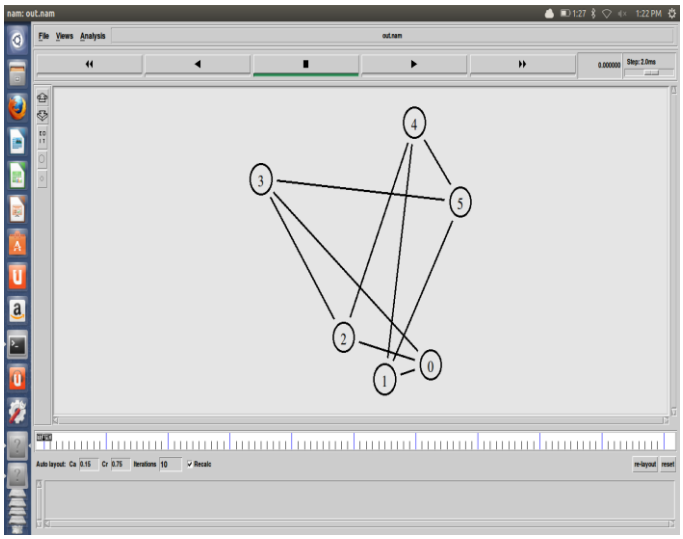

Fig. 1 Example of a network in NS2

Fig. 1 we show the message passing of nodes to each other

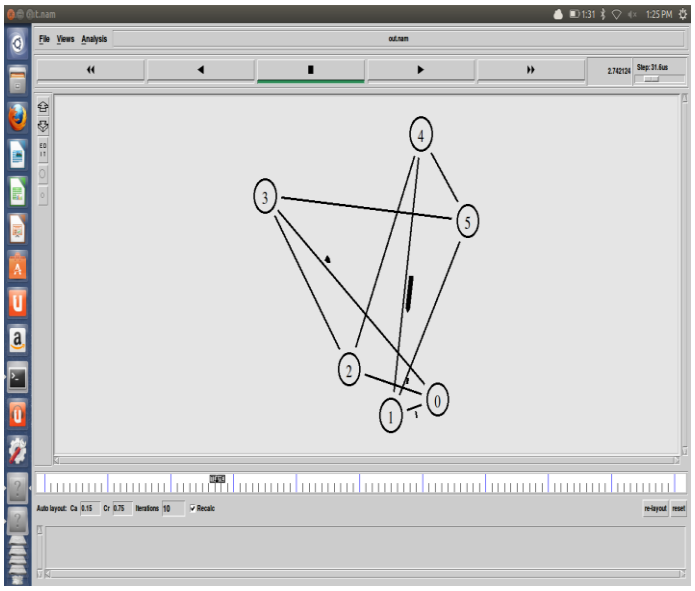

Fig. 2 Example of message passing interface in NS2

A. *PSEUDO-ALGORITHM OF PROPOSED PROTOCOL*

In this section, we have discussed the implementation of proposed algorithm. We also give the detailed description of proposed algorithm.

Pseudo Code for Proposed Algorithm

Algorithm: SITO based Routing in Sparse Delay Tolerant Network

Begin
Initialize opinions for nodes
Allocate current node and neighbor node to opinion1 and opinion2
n: number of nodes in the network
l: number of neighbor nodes
lp: number of loops
np: number of opinions
d: the domain space
f(x):objective function as a function of similarity and betweenness
Define the objective function of f(x), where $x=(x_1,.....,x_d)$
Generate the initial population of opinions or x_i $(i=1,2,...,n)$
While $(i<lp)$
For $j=1$ *to np (all opinions)*
Allocate current node and neighbor nodes
End for
Store best individual to bfn
For $j=1$ *to np (all opinions)*
For $k=1$ *to np (for all opinions)*
If *k not equal to j*
Calculate social influence w_{jk}
End if
End for
Calculate standard deviation
If *j not equal to bfn*
Update opinions using discussed equation
End if
End while
End procedure

IV. RESULTS

Energy Consumption: The total energy consumed in the network while transmitting or receiving the data from source to destination in the network. Figure 4 shows the comparison of Hotspot based approach and our proposed trust based approach. It is clear from the graph that the energy consumed in the proposed approach is less as compared to the basic approach.

Packet Delivery Ratio: It is defined as follows:

$$Packet\ delivery\ ratio = \frac{total\ packets\ received}{total\ packets\ generated}$$

Figure 4- 5 shows the comparison of Hotspot based approach with the proposed approach. The packet delivery ratio for the proposed approach is better compared to the basic approach because the packet lost in the network reduces. In figure 5 the number of nodes are kept constant at 29 and also varies from 14 to 34 randomly in the iHAR with varying nodes parameter.

End to End Delay: It is given by:

$$Delay = (Packet\ received\ by\ receiver\ time - generated\ time)$$

Figure 6 shows the comparison between the Hotspot based approach and the proposed trust approach with respect to time. The delay in the proposed approach reduces because of the reduction in number of retransmissions. In this figure the number of nodes are kept constant at 29 and also varies from 14 to 34 randomly in the iHAR with varying nodes parameter.

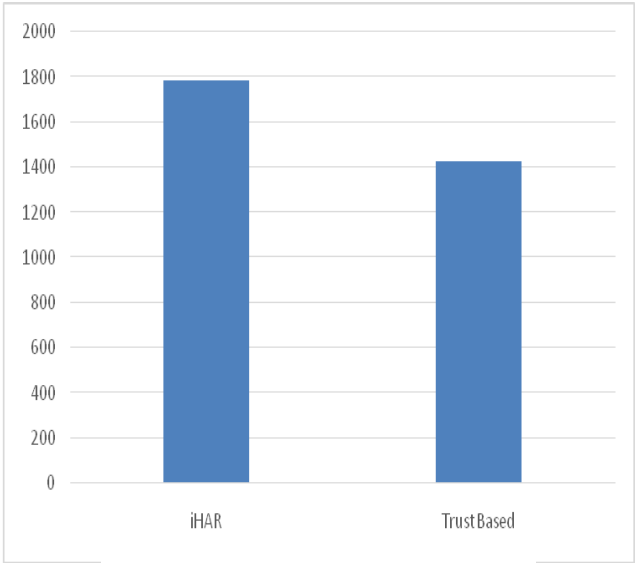

Fig. 3: Energy Consumed in the network

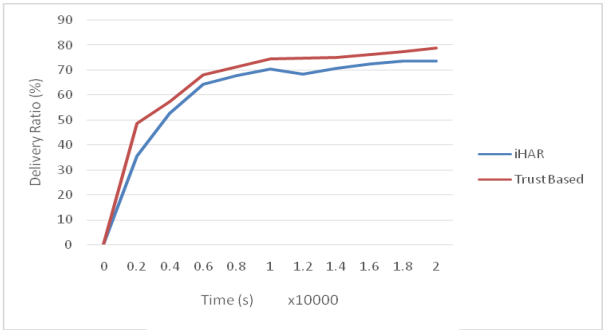

Fig. 4: Packet Delivery Ratio

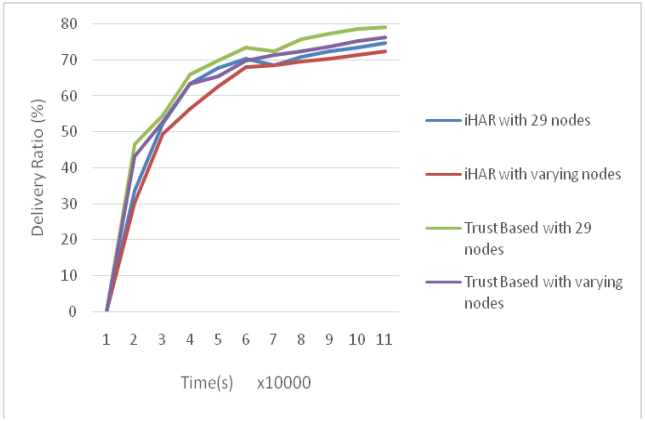

Fig. 5: Packet Delivery Ratio (with different node numbers)

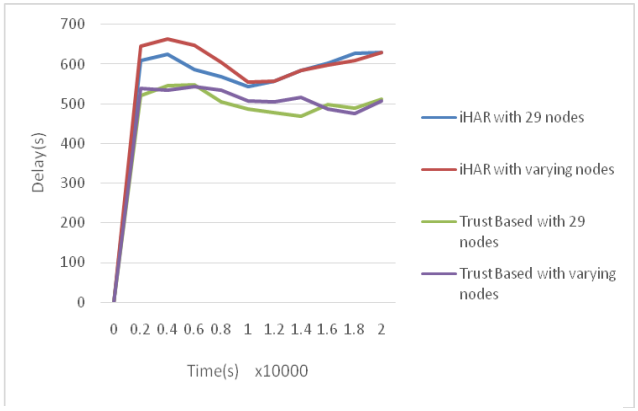

Fig 6: Packet Delivery Delay (with different node numbers)

A. Performance Comparision

In this subsection, we compare our scheme with the IHAR. The simulation results are showed in Table I.

	Energy Consumption (µJ)	Delivery Ratio (%)	Delay (s)
iHAR	1786.0	74.6	619.9
Trust	1428.0	78.9	507.0

V. CONCLUSION

Delay-tolerant networks (DTNs) have attracted lots of attention in the past decades, and many related interesting applications have been experimented and tested, including mobile social networks based on human mobility, sensor networks for wildlife tracking and habitat monitoring, vehicular ad hoc networks for road safety and commercial applications, and deep-space interplanetary networks. A novel opinion based approach is proposed and the trust of each node is computed based on the opinion of the other nodes. The result also validates the proposed technique and it is concluded that presented approach is efficient as compared to other existing approaches. In future other machine learning algorithms must be implemented and their results must be compared with the present work.

VI. REFERENCES

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