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Simulation of PSO using ONE Simulator in DTN

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Abstract*: - Delay Tolerance Networks (DTNs) are infrastructure less wireless networks. DTNs are wireless networks where disconnections and delays occur frequently due to phenomena such as node mobility, power outages etc. In order to achieve data delivery, a Store –Carry –Forward approach is used. In store carry and forward approach node stores the message in its buffer and forward the message to next intermediate node when that node in the range of network. In this paper we first describe delay tolerance network and its different routing schemes. Then we discuss Particle Swam Optimization (PSO) in Delay Tolerance Network with PSO basic algorithm. Here In this paper an attempt has been made to propose new DTNPSO scheme to increase throughput of particles routing.*
Keywords: *Delay Tolerance Network (DTN), Particle Swam Optimization (PSO) Routing Schemes.ONE(Opportunistic Network Environment).*

I. Introduction

Delay-tolerant networking (DTN) is a kind of computer network architecture that addresses the technical issues in heterogeneous networks lacking continuous end to end network connectivity. Examples of such networks are that operate in mobile or extreme terrestrial environments or interplanetary networks [1,2]. A delay-tolerant network (DTN) is a network of regional networks. It is an over-lay on top of regional networks, including the Internet. DTNs accommodate long delays between and within regional networks, and support interoperability of regional networks by translating between regional network communications characteristics. Communication between nodes in DTNs could be either scheduled or opportunistic, depending on the knowledge that we have about the initial status and the time evolution of the network.

1.1 Characteristics

a) Asymmetric data rates: The Internet does support some forms of asymmetric bi-directional data, as in cable TV or asymmetric DSL access. But if asymmetries increase then it will hinder traditional interactive protocols such as TCP.

b) High error rates: If bit errors occur on links, then they either require correction, hence, consuming more bandwidth, or even retransmitting the entire packet, resulting in more network traffic.

c) Ambiguous mobility patterns: Unlike the case with public bus services that maintain fixed routes or planetary trajectories, future behavior of a node is not fully known for many DTN applications. It is widely assumed, however, that node mobility patterns (while random) are generally recurrent.

d) Data Loss: In DTN each node has its own buffer with limited size. So due to limited size of buffer data may lose.

1.2 Architecture

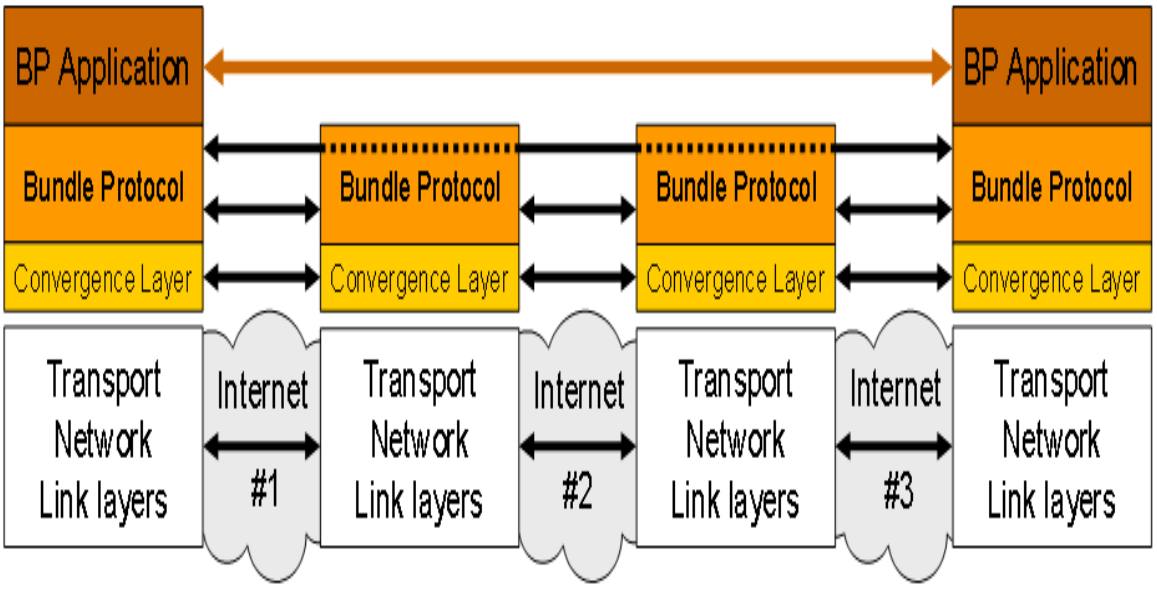

Fig.1. DTN Architecture

In this architecture mainly three types of layers are present:
Link Layers: In link layers same lower level Layers are present which are present in TCP/IP i.e. Data link layer, Internet Layer, Transport Layer. The function of these layers is same as in TCP/IP protocol suite.
Bundle Layer: Bundle Layer provides link between lower level link Layers and Application layer. Data is transmitted in network in form of bundles and is transmitted by Bundle Layer.
Application Layer: Application Layer provides interface to the end users. End users can communicate to other Layers through Application Layer. In application Layer various protocols are present like FTP, Telnet, and DNS etc.

II. Related Work

Routing Data is delivered in a DTN using a store-carry-forward model. The main categories of routing schemes for delay tolerant networks are given below:

i) Epidemic routing

The epidemic routing is one of the simplest and earliest routing schemes for DTN [8]. In this routing strategy, whenever two nodes come in contact with each other, they exchange all the messages they currently carry at that point of time. In other words, the packets are spread like a viral epidemic. So this routing strategy is fastest possible routing scheme. In epidemic routing, the data delivery results in inefficient use of the network resources such as power, bandwidth, and buffer at each node[4,5].

ii) Location Based Routing

In some cases, the location of the nodes may be known, that can be used in case of opportunistic forwarding of messages in DTN. The location information of the nodes may be known in either a physical (for example, from GPS devices attached to nodes or through a location service) or a virtual coordinate space (designed to represent network topology taking obstacles into account). When an encounter occurs, the node forwards data to another node only if it is closer to the destination [4,5].

iii) Spray and Wait Routing

In spray and wait routing there are two phases.
First phase is Spray phase in which it limits the generation of duplicity of messages to minimize the use of network resources.

Second phase is Wait phase in which sender wait for the response of sent messages which are sent in

spray phase if there is no response of delivery of message then sender again send the messages to destination. Spray and Wait routing overcomes the problem occurred in epidemic based routing.
In Spray and Wait routing, duplicity of message is less as compared to epidemic based routing. Also bandwidth consumption is less in Spray and Wait routing as compared to epidemic [4,5].

iv) First Contact Routing
In this node send a message randomly using any available contact .If none of the path is available then the message wait for that particular path until become available and is assigned to first available contact.

2.1 Movement model used
Shortest path map based movement model: here node uses the concept of shortest path as shortest available path is chosen among various available paths in map based environment. heredijkastra algorithm is used to calculate shortest part from all the available paths and different nodes in nodes move on the basis of shortest path.

2.2 Particle Swarm Optimization
PSO is a strong optimization technique based on the movement and intelligence of swarms In DTN we consider swarms as nodes. PSO uses the concept of social interaction to solve a problem. It was developed in 1995 by James Kennedy (social-psychologist) and Russell Eberhart (electrical engineer). It uses a number of particles that constitute a swarm moving around in the network search space looking for the best solution. Each particle is treated as a node at in an N-dimensional network space where each node adjusts their routing according to its own history experience as well as the history of other particles. Each particle keeps track of its coordinates in the solution space which are associated with the best solution (fitness) that has achieved so far by
that particle. This value is called personal best, ***pbest***. Another best value that is tracked by the PSO is the best value obtained so far by any particle in the neighborhood of that particle. This value is called ***gbest***. The particle swarm optimization concept consists of, at each time step, changing the velocity of (accelerating) each particle toward its p*best*and *lbest*locations (local version of PSO). The basic concept of PSO lies in accelerating each particle toward its pbest and the gbest locations, with a random weighted acceleration at each time step [9,10]. Each particle tries to modify its position.

III. Results and analysis

ONE Simulator: In this paper, ONE (Opportunistic Network Environment) Simulator is used to perform simulation of our work. ONE is a java based simulator specially designed for the simulation of DTN protocols. ONE can be run on Linux and Windows operating system.

Table 1: Simulation Parameters

Parameter Description	**Value**
Simulation Area	4500mX3400m
Simulation Time	43200s
Mobility Model	Shortest Path Map Based
Routing	Epidemic
No. of Groups	6
Transmission Range	10m
Node Speed	2m/s
Warm-up Period	1000seconds
Time To Live	300m
Buffer Size	5MB
Operating System	Windows 7

The following performance metrics are considered for Simulation: (a) Delivery Ratio*:* It is defined as the total number of messages delivered per second, (b) Avg_msg_Delay: It is defined as the average message delay from creation to message delivery, (c) Average buffer time: It is the average time for which messages stayed in the buffer at each node, (d) Dropped Packets: It defines total number of dropped packets, and (e) Delivered Packets: It defines total number of delivered packets.

IV. Simulation Results

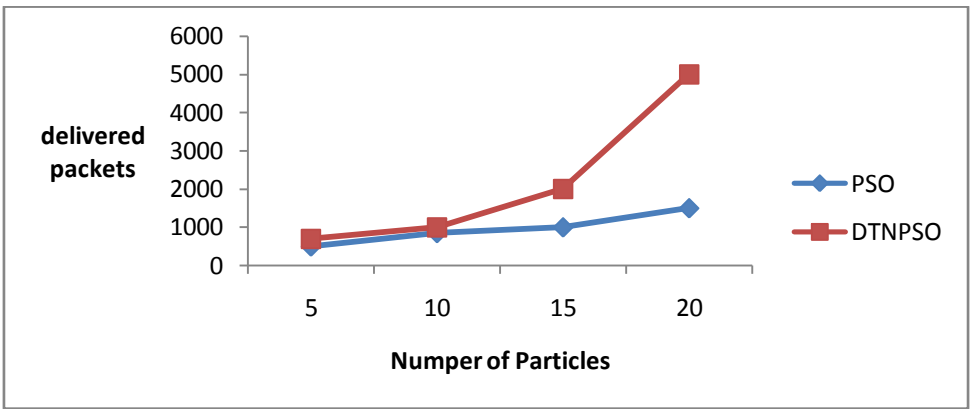

Fig.2. Number of Particles v/s Delivered Packets

Figure 2 describes that as number of particles increases the delivered packets are also increases. In DTNPSO delivered rate is high.

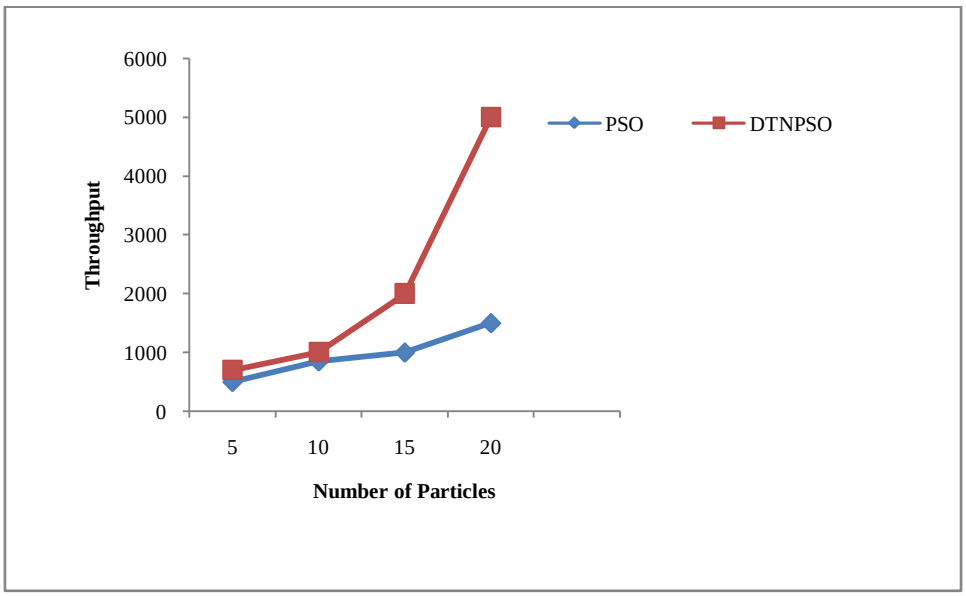

Fig.3. Number of Particles v/s Throughput

Figure 3 describes that throughput is increases as number of particles increases constantly.

V. Conclusion and Future Scope

In this paper, various routing schemes like Epidemic, Prophet, Spray and wait etc. and various Movement models with brief introduction of PSO with basic algorithm that describes the working principle of PSO are discussed. This paper provides a DTNPSO scheme to increase throughput as well as delivered packets.

In future, it is intended to continue working on it and propose an enhanced DTNPSO scheme to reduce average message delay.

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