RESEARCH PAPER | Engineering | Volume - 5 | Issue - 1 | Jan Special Issue - 2015 | ISSN - 2249-555X

Contingency Based Spray and Wait Routing in Delay Tolerant Network

KEYWORDS: Delay tolerant network; spray and wait; disconnection issues; contact time

Trupesh S Patel	Viren G. Patel
PG Student, Department Of Computer Science & Engineering, S. P. B. Patel Engineering College	Assistant Professor,Department Of Computer Science & Engineering, S. P. B. Patel Engineering College

ABSTRACT Delay Tolerant Networks are provision of message transmission mechanism where link lost, message drop and disconnection frequently happens. To upgrade Spray and wait routing protocol which is pre-eminent protocol in Delay Tolerant Network, we have introduced Contingency Based approach in Spray and wait Routing. This approach purely concentrates on contact time of two nodes. Based on the value of contact time , spray of message copies into network is decided. Contingency based approach improves disconnection issues successfully.

I. INTRODUCTION

Delay Tolerant Networks (DTNs) is a disruption tolerant network where source to destination connection does not be present. They have frequent disconnection issues and very small contact time. In many real scenarios like interplanetary internet, Deep Space Networks, Military Networks, Inhabitant or Wildlife Tracking System, Terrestrial Wireless Networks, Satellite Networks, Underwater Acoustic Networks, Nomadic Communities Networks , the concept of DTN is applied[1].

The purpose of a DTN is to deliver reliable communication in situation where frequent disconnection and long delay [2] in transmission occurs. The researchers worked in different issues like increasing the delivery ratio [3], optimizing resource usage, providing scalability.

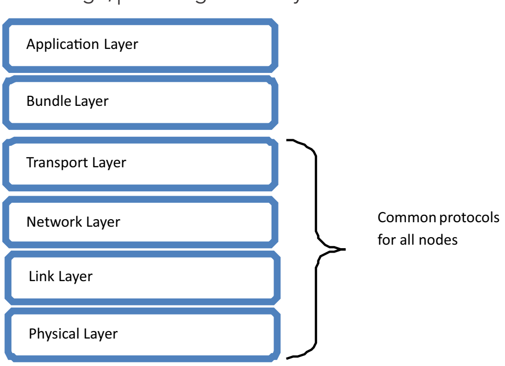

Fig. 1. Bundle Layer

A Delay Tolerant Network is overlying on the existing provincial networks. This overlie is known as bundle layer [4]. The bundle layer works above provincial protocols and its purpose is to provide entrance when two nodes encounter each other. Bundle layer protocol is very flexible in nature. We can join more than one network together with the help of Bundle layer. Bundle layer can be explained well according to fig 1.

As shown in fig 1, there are four basic layers below Bundle layer. This four layer namely Physical layer, Link layer, Network layer, Transport layer are always present in any type of network so Bundle layer can be easily embedded in any type of networks.

Bundles are also known as collection of packet data. We can achieve reliability by transmitting data from one node to another by store carry and forward mechanism. The Bundles contains a bundle header, control data and source node's user data.

DTN implements store-carry and forward mechanism in which intermittent nodes contain data packets and store it. When link to destination or next intermittent node is established then it sends that stored packets. This store carry and forward mechanism is exactly same as postal services in real life. Every document must have to pass through all the post offices which come into route. We can overcome common issues like message lost, link lost, low delivery ratio, interrupted connectivity etc. store carry and forward mechanism is explain well in fig 2.

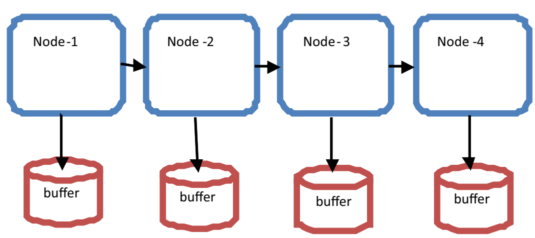

Fig. 2. Store carry and forward Mechanism

Many DTN routing protocols have been proposed. Three main different categories of DTN routing protocols are: message-ferry-based, opportunity-based, and prediction-based [4].

In this paper, we propose contingency based spray and wait. Our proposed method will improve disconnection issues and successful delivery rate of message can be increased. Rest of the chapter is scheduled as follows. Section II describes related works. Our proposed approach is discussed in section III. Section IV includes conclusion of the paper.

I. RELATED WORKS

DTN is suitable for data transmission where source to destination connection does not be present. Epidemic, prophet and spray & wait are flooding based routing protocol of DTNs.

A. Epidemic

In Epidemic, each node spreads a copy of own data to every neighbor node. Due to spreading of copies of message to every neighbor node [6], network traffic increases and some

Volume - 5 | Issue - 1 | Jan Special Issue - 2015 | ISSN - 2249-555X

problems arise related to efficiency of buffer resource management. Each node keeps and updates details of summary vector which contains information regarding each bundle's length, destination and hop count. When two nodes meet with each other they compare their bundle summary vector to finding out the missing bundles. They will exchange missing bundle of each other if they have it. Such node stops comparison when they find same bundle summary vector.

B. PRoPHET

The PRoPHET (Probabilistic Routing Protocol using History of Encounters and Transitivity) establishes delivery predictability, $P(a,b) \in [0,1]$, at every node a for known destination b.

Some fundamentals equations regarding to delivery predictability in PRoPHET are as follows.

$$P(a,b) = P(a,b)_{old} + (1 - P(a,b)_{old}) \times P_{ini} \quad (1)$$

Where Pini is an initialization constant. According to equation 1, the metric is updated whenever a node is encountered [7].

If two nodes does not encounter within time fraction then they are consider as a poor forwarder. So the value of delivery predictability can be calculated by following equation.

$$P(a,b) = P(a,b)_{old} \times \Gamma^k \quad (2)$$

Where $\Gamma \in [0,1]$

In PRoPHET, delivery predictability contains nature of transitivity. If node A frequently meets node B, node B frequently meet node C then C can be promising node to destined for node A. transitivity[8] can be explained by following equation.

$$P(A,C)=P(A,C)_{old}+(1-P(A,C)_{old})*P(A,B)*P(B,C)*\beta \quad (3)$$

Where β is a constant that predicts the effect of transitivity on delivery probability.

C. Spray and wait

To reduce network traffic due to vast number of message copies in Epidemic, Spray and wait limits it by mechanism in which L copies of messages are spray into network. Such copy counts are much smaller than the total node count in the network (L<<M). This protocol consists of spray and wait phase. In spray phase the source node spray L copies of message to relay nodes. After receiving copies of message, L relay nodes move into wait phase [9] and wait until direct delivery to destination. There are two types of spray and wait protocols. Source spray and wait(SsW) and Binary Spray and wait(BsW). In source spray and wait protocol source node assign L copies [9] of the message to first L node it encounters. In Binary spray and wait, any node (source or relay) having more than one (L>1) message copies deliver half of the copy (L/2) to first node encounter with no copies and keeps rest of the (L/2) copies with it. This policy continue for all intermittent nodes until they have L=1. When node has only single copy then it switch into wait phase [9] and assign the message only to the destination. Under low load, spray and wait delivers less transmissions and smaller delays than flooding based routing. Under high load, it has better delays and less transmission than flooding based routing. Spray and wait is highly scalable that handles above performance behavior though the size of network is frequently changing.

D. MaxProp

The motivation to develop Maxprop is taken from pedestrian mobility and busses. It is protocol based on forwarding strategy. It uses probability mechanism of meeting with all nodes in the network. Based on different probability value, destination path cost is calculated. Node assigns message to those node who has lowest cost [8] path value. In data transfer phase, it transmit packet data intended for neighbor node, transmit routing information, acknowledgement of delivered data. It also uses prearranged queue which is already divided into two different parts based on adaptive threshold. It allocates high priority to new messages and forwards it first. MaxProp assumes unlimited buffer sizes for own messages per node. It assumes fix sized buffer for messages of intermittent node. It does not require any knowledge of topology of network. It performs poor when node has small buffer sizes. It performs best when node has large buffer size.

III. proposed contingency based spray and wait

While we are upgrading protocol in DTN then we have to increase successful delivery rate with minimum utilization of resources.

A. Frequent disconnection issues

As we know in DTN, there isn't end to end connectivity between source and destination. Nodes must have to deliver message when they meet with each other. Such meeting time is very small so sometimes nodes move away before completion of message transmission. So we can improve this issue by just considering those nodes that has sufficient contact time. Speed of nodes is also considerable factor. If speed of nodes into the network is higher than both node will have small contact time which is less suitable for transmission. Transmission Range is also major factor in disconnection issues. If node assigns copies of message to such a node whose range is smaller than other nodes in the network, then that node will meet few numbers of nodes due to its small range and ultimately probability of meeting and delivering to destination reduced.

B. Forwarding strategy specification

B.1 spray phase

In contingency based spray and wait, every source node calculates the contact time of the node it encounters then only allocates copies of message. We have formulated an equation to calculate contact time of two nodes as shown in equation (1).

$$Ct_{12} = 2(R_1+R_2)/(s_1+s_2) \quad (1)$$

In above equation (1) Ct12, R1, R2, s1, s2 represent contact time, range of node 1, range of node 2, speed of node 1, speed of node 2 respectively. From equation (1), it is clear that node believes only those relay nodes as a promising one who have enough contact time. This calculation of contact time reduces disconnection issue because it only selects those intermittent nodes who are looking most promising as per equation (1). Due to such contingency based spraying, only selected node will get the copies of the message so total number of copies into the network reduces and thus network overhead can be effectively reduced which was one of the major challenges in DTN.

When source node S encounters node A, both will update their SSV(spray summary vector) and then exchange the SSV. SSV contains different information like speed, transmission capacity, range. If node S contains N copies of the message and Ct12 is higher than other then, Number of copies S will forward to A is:

Volume - 5 | Issue - 1 | Jan Special Issue - 2015 | ISSN - 2249-555X

$$n=(R2)/(R1+R2) \times N/2 \quad (2)$$

Here n is number of copies S will allocate to node A, R1 is range of source node; R2 is range of node A.

Due to equation 2, number of copies in the network reduced which reduce network overhead.

B.2 wait phase

When nodes have only one copy of the message then it moves into wait phase. In wait phase, TTL becomes 200 then node assign copy of the message to such node that has low message drop ratio. Message drop ratio is the ratio which is number of messages node should have to drop due to buffer overflow and aborted messages which is number of messages lost due to losing of range area of node during transmission.

IV. Conclusion

Spray and wait is advanced routing protocol in DTN, but its forwarding of L copies of the messages is so random so successful delivery ratio of the message copies are low. Large number of messages increases the network overhead. In contingency based spray and wait, only most promising nodes are selected depending on their contact time so small number of transmission occurs but they are most guaranteed transmission of the message so it gives result oriented efforts. Contingency based routing reduces network overhead and decrease message loss.

REFERENCE

[1] Shahid Md. Asif Iqbal, Alok Kumar Chowdhury,"Adaptation of Spray Phase to Improve the Binary Spray and Wait Routing in Delay Tolerant Networks" | [2] Kenta Henmi, Akio Koyama,"A DTN Routing Protocol Based on Mobility and Maximum Number of Replications " in 2013 7th International Conference on Complex , Intelligent , and software Intensive System,IEEE 2013 | [3] Md.Nazmus Sadat, Muhammad Tasnim Mohiuddin,"A Neghbourhood Contact History Based Spraying Hueristic for Delay Tolerant Networks" in 3rd International conference on INFORMATICS, ELECTRONICS & VISION 2014 , IEEE 2014 | [4] SuvarnaPatil, Geetha R. Chillerge,"Delay Tolerant Networks – Survey Paper ", In Journal of Engineering Research and Applications, Issue 2, February 2014, pp.21 - 25 | [5] Ying Zhu, Bin Xu, Xinghua Shi, and Yu Wang,"A Survey Of Social Based Routing in Delay Tolerant Networks: Positive and Negative Social Effects"in IEEE communications surveys & tutorials ,vol 15,no. 1, first quarter 2013,pp.387-401 | [6] Kyungrak Lee, Yong Li, Inwhee Joe, Yeonyi Choi,"Selective 2-phase Spray and Wait Routing for Overhead Reduction in Delay Tolerant Networks" in IEEE,2014 | [7] Eung-Hyup Kim, Jae-Choong Nam, Jae-In Choi, You-Ze Cho,"Probability-based Spray and wait protocol in Delay Tolerant Networks " in IEEE, 2014 | [8] Anjula Mehto, Meenu Chawla,"comparing delay tolerant network routing protocols for optimizing L – copies in spray and wait routing for minimum delay " in Conference on Advances in Communication and Control Systems 2013 | [9] Rémi DIANA, Emmanuel LOCHIN, "Modeling the Delay Distribution of Binary Spray and Wait Routing Protocol" in arXiv 13 Apr 2012