



The Survey on Fuzzy based Routing Techniques in DTN

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Abstract- Delay Tolerant network is very large and sparse network compared to simple MANET. When two mobile node comes to each other within a range and exchange the information these scenario is called “contact” in DTN. Here in DTN end to end connectivity is not possible because of varying of contact time and very large network area. So the ordinary routing protocol of MANET like OSR, DSDV are not usable for DTN. Due to different nature of network DTN require some new protocols which can provide store and forward mechanism. Today DTN has large set of protocols like Epidemic, Spray and wit, PropHet and other more. In this paper we surveyed different papers based on fuzzy logic decision mechanism technique in DTN.

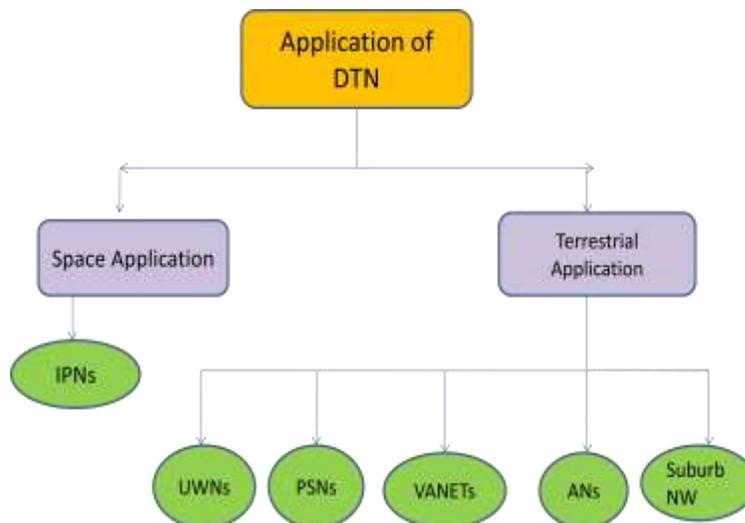
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I. INTRODUCTION

Now a days the use of network technology is increased. In every field of life the networking technology is used and that’s why the new types of network and protocols are available. DTN is a subpart of Mobile ad hock network. The main difference is that DTN contain very less number of communicating node in very large area like only 2 or 3 nodes are present in hundreds of kilometer area. So routing in DTN is not same as in MANET. IT’s require some extra mechanism for avoidance of message dropping problem in DTN. These mechanism called “**store and forward mechanism**” which store the message in buffer space until the other node comes in contact with the source node. In DTN the extra layer called Bundle layer is implemented between transport layer and application layer.

II. APPLICATIONS OF DTN

Here we describe the applications of DTN in pictorial form.



III. CHALLENGES OF DTN

DTN faced numbers of challenges that are not present in traditional network. Many stem from the need to deal with disconnections, which directly impacts routing and forwarding. However, because these networks enable communication between a wide range of devices, there are secondary problems that routing strategies may need to be aware of, such as dealing with limited resources. The main challenges of DTN is given bellow

- Contact Schedules
- Contact Capacity
- Buffer Space
- Processing Power
- Energy

Evaluation Criteria

Delivery Ratio:

Delivery ratio is defined as the fraction of generated messages that are correctly delivered to the final destination within a given time period.

Latency:

The important matrices latency is defined as the time between when a message is generated and when it is received.

Transmissions:

It is also an approximate measure of the computational resources required, as there is some processing required for each message. The number of transmissions is a measure of the amount of contact capacity consumed by a protocol, each transmission consumes energy, so it is also an approximate measure of power consumption.

IV. BACK GROUND THEORY AND RELATED WORK

A large number of routing protocols have been proposed to make efficient routing in DTN. Routing protocols of DTN is different than MANET because end-to-end connectivity of nodes is not possible in DTN. Second thing is that the density of node is very less and transmission range covers only small part of network. Because of these reasons DTN require special types of protocols or routing techniques. Direct transmission is a simple technique to transfer a message from source to destination. In this method the source node wait until the destination node comes in direct contact range. When it find the destination node then directly send the message.

Epidemic[18] is routing protocol in which it is assumed that each node has infinite buffer space and bandwidth. each node maintain the summary vector and it will be exchanged when two node comes in contact and transfer the message which is not present in buffer. Epidemic strategy is useful when the message size is small and network is very sparse. PropHet uses history of previous encounters with neighbor nodes to estimate probability which is called "delivery predictability". Pair of nodes that encountered often in the past has high delivery predictability. When two nodes encounter, they exchange delivery predictability vector. This vector contains list of delivery predictability, which is updated after each "contact". Based on this information, each node can select the messages that have high possibility to reach the intended destinations, and transfer them to its "contact" node. However, this approach does not work well in DTN networks where node movements are not predictable.

Spray and wait[8] is another approach of routing. In first phase the message is flooded up to L copies to L different node. If the final destination is encounter then the massager is directly transfer. If not then wait phase is started. In this phase node can delivered the message only when the destination comes in contact. To decide the optimum value of L is a major issue. The value of L is depended on node density and their mobility profile.

Prophet[7] is another protocol of DTN. The history of previous encounters with neighbor to estimate probability called "Delivery Predictability". when two node comes in contact with each other they exchange their "PD vector". As per this information each node can select the message which has high possibility to reach the destination. when node movement is not predictable then this approach is not work well.

The routing protocol in DTN deals with knowledge and phenomena in many fields, which clearly cannot be said true or false. Using fuzzy knowledge to process can improve the describing ability.

V. SURVEY ON FUZZY BASED TECHNIQUES

5.1 “Fuzzy-Spray: Efficient Routing in Delay Tolerant Ad-hoc Network Based on Fuzzy Decision Mechanism”[6]

Fuzzy Spray uses the Fuzzy technique to prioritize message that are stored in the buffer and then transfer the message to next node during contact time. Replication strategies are used to increase the delivery rate. Because bandwidth is limited node can't transmit all messages it has in its buffer within a short contact time. It uses simple store and forward and replication mechanism. Two local parameters named forward transmission count and Message size is used to take fuzzy decision. FTC is initiated as 1. It will increased by 1 both sender and receiver side after successful delivery of message. FTC gives good result compared to hop count and MTC.

Here FTC and Message Size is taken as an input to priorities the message in buffer. The message with Low FTC and small size has High priority and Message with High FTC and Large Size has Low priority in buffer. Here two inputs each has 3 categories, and the buffer is divided into 9 buffer session (BS) and set up the rules as follows.

FTC \in { low, medium, high }

MS \in { small, medium, large }

BS \in { BS₀, BS₁, BS₂, BS₃, BS₄, BS₅, BS₆, BS₇, BS₈ }

BS₀ is at top of message queue and has high priority and BS₈ is at tail of queue and has low priority.

Fuzzy Spray is best performing protocol in terms of both speed of success rate and latency.

5.2 “Adaptive Fuzzy Routing in Opportunistic Network (AFRON)”[17]

In these paper the use three parameters as input which is listed below

1. Message Transmission count (MTC)

This parameter increase when the node exchanges their messages. So approximately its shows the number of message transmission in network.

2. Message Size (MS)

This an important parameter for DTN node because the each node has limited buffer space.

3. Time To Live (TTL)

TTL is considered in order to increase the ratio of message delivery.

Output variable (Buffer sections)

This protocol divide the buffer in 19 sections and according to input. This partition will be used to prioritize the message in order to exchange it in next contact. The priority of message will be calculated as below:

Priority_of_Message = 1 - BS_of_Message.

5.3 “Adaptive Fuzzy Spray and Wait: Efficient Routing for Opportunistic Networks.”[10]

Adaptive Fuzzy Spray and Wait (AFSnW) is a spray based routing mechanism that overcomes the spray based approaches. Fuzzy set technique allows partial membership to sets.

Here main two parameters are used to calculate the Fuzzy decision.

1. FTC (Forward Transmission Count)

FTC is the indicator of number of duplicate copies of message in network. The FTC is incremented by 1 at both side when the message is transmitted.

2. Message Size (MS)

Message size is very simple parameter to calculate. The message which has low FTC and small message size is has high priority. The fuzzy decision table is as same as paper 10.

Dropping Policy:

Dropping Policy is an important buffer management policy. Here the dropping is chosen is randomize with respect to priority. The message which has low priority means that it is present in many numbers of node is dropped first when new message is arrived and buffer is full.

Comparing with the simple Fuzzy mechanism the AFSnW gives the optimal solutions in terms of latency, probability of delivery and low overhead.

Improve the probability of latency and delivery. The limitation of this protocol is performance of the routing in realistic scenario is not evaluated.

5.4 “ Proposed Fuzzy based Routing for DTN.”[13]

Fuzzy based Routing protocol(FBRP) is designed to maximize successful data delivery and minimize the transmission delay. It uses only two parameters namely

1. Probability of Delivery(PD)

Here PD function is divided into three sections

- P_encounter_max - 0.7
- P_encounter_first - 0.5
- P_first_thresold - 0.1

2. Energy value (EV)

If the node has full capacity(100%) then it is called high level EV. If the energy is bellow then 50% then the node is not good to forward the message.

In this paper the Delivery Predictability is evaluated by nine Fuzzy rules. The first and last law is given here

If PD is low and EV is low then DP is very low

If PD is high and EV is high then DP is very very high.

FBRP described here is very good performing protocol compared to Prophet and Epidemic protocol. This protocol gives good performance in terms of delivery rate and overhead ratio. Fuzzy decision mechanism is simple.

5.5 “ A Fuzzy based Routing Protocol for Delay Tolerant Network”[16]

In this paper the author uses main four parameters as input of fuzzy logic .First Fuzzy Logic Controller (FLC1) uses two input named Residual Energy(RE) and Buffer Availability .Second Fuzzy Logic Controller(FLC2) uses Message Transmission Count(MTC) and Fast moving node as input parameter. Both FLC take their fuzzy decision based on input and gives appropriate output of it .The output of FLC1 and FLC2 is taken as the input of FLC and the output of FLC gives the final decision.

VI. OPEN RESEARCH ISSUES

Research in routing in DTN is still not sufficient. There are many issue regarding to connection delivery ratio, speed, transition range . Bandwidth and Buffer size is also affected parameters in routing of DTN.

In the direction of security in DTN more efforts are required. Because DTN has to face so many security threats .So security is most effective and important parameter in DTN.

There is many social issues which can be solved by DTN. So one has to develop the social network using DTN. Fuzzy is also a new evolving technique to take routing decision. The new researcher can experiment to applying fuzzy logic with different parameters and can get good results out of them.

VII. CONCLUSION

DTN has a numbers of good routing protocols and day by day an evolution of many new is going on. Here in this paper we summarized some basic protocol an focused on different methods of fuzzy spray protocol.

Here we analyzed various fuzzy techniques with its parameters and also with merits and limitations. we hope that our try give the directions to new researchers to understand the new Fuzzy techniques and gives the best output to world.

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