International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

COPY RIGHT

ELSEVIER
SSRN

IJIEMR Transactions, online available on 8th Dec 2020. Link
:http://www.ijiemr.org/downloads.php?vol=Volume-09&issue=ISSUE-12

DOI: 10.48047/IJIEMR/V09/I12/164

Title **A Layered Architecture for Delay Tolerant Networks and Routing Mechanism**
Volume 09, Issue 12, Pages: 959-963.
Paper Authors

Dr.Mohammad Imran

USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

To Secure Your Paper As Per UGC Guidelines We Are Providing A Electronic Bar Code

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

A Layered Architecture for Delay Tolerant Networks and Routing Mechanism

Dr.Mohammad Imran

Associate Professor, Department of CSE, Neil Gogte Institute of Technology(NGIT),Kachavanisingaram(V),Peerzadiguda,Uppal,Hyderabad

imran.quba@gmail.com

Abstract: A Delay tolerant network is a collection of networks that communicate with each other when ever a path is established. To predict establishment of path, it is critical because the communication among the networks is not predetermined whenever they have the availability they will communicate with each other. It will be critical to establish a path when all the sub networks of delay tolerant network are combined as one large network, which makes the network movement critical. To avoid that in this paper we are suggesting an approach called layered architecture of delay tolerant network.

KeywordsTolerant Network, Border Gateways, Layered Architecture, Forwardtime, hoptime.

1. Introduction

Delay-tolerant networking isarchitecture of computer that seeks to address the technical issues in non-homogeneous networks that may lack continuous network connectivity [2]. Examples of such networks are those operating in mobile or extreme terrestrial environments, or planned networks in space. The term tolerant in networking, is the time need to wait until the node get connected with the waiting one. Disruption may occur because of the limits of wireless [10] radio range, sparsest of mobile nodes, energy resources, attack, and noise.

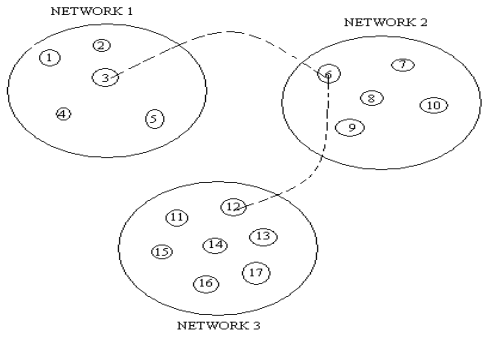

Figure 1: node arrangement of delay tolerant network

I. A DELAY TOLERANT MESSAGE BASED OVERLAY ARCHITECTURE

The architecture of delay tolerant network is based on an abstraction of message switching. Message advancements are forwarded in the network [2]. The routers that handle them are known as gateways of Delay tolerant network. As in normal architecture, DTN attempts to work different organization structures and give a store-and-forward door work between them when a hub speaks with at least two non-homogeneous organizations. For instance, inside the Internet the overlay may work over TCP/IP, for profound space joins it might give an entryway administration to CFDP [5], and in postpone lenient sensor/actuator networks it might give interconnection a few yet-to-be-normalized sensor transport convention. Every one of which contains their own of these systems administration conditions sorted convention stacks and naming semantics created for their proposed application territory. By extraordinary DTN entryways situated at their correspondence hubs it is conceivable to accomplish interoperability.

A. Regions and Border gateways

The DTN architecture includes the concepts of regions and DTN gateways, as illustrated in Figure 1. In this example, three regions are shown (network 1, network 2, and network 3). All regions include a DTN gateways resident on each system. Network-1 includes a low-earth- orbiting satellite link that also provides periodic connectivity. Dissimilar network protocols use interconnection points for communication among irregular networks, where those points are produced from region boundaries. If the nodes are able to communicate with each other without using gateways those are present in same network. DTN uses a few types of dissimilar networks if

it maintains single layered architecture [3]. The gateway suggests a point, by which data need to use in order to gain entry to a network. This gateway serves as a basis for transmission and control.

B. Path selection and Scheduling

The DTN architecture it is assumed that there may be non availability of end-to-end route [4]. Rather, routes are used to move messages from their starting point toward their destinations based on time divisions or time slot manner. Communications are parameterized by their start and end times, capacity, latency, endpoints, and direction. To send the message it's required to measure the predictability of a communication point that can be used as a hop point. The predictability depends on the availability. The measure of a communication point's predictability is depends on its direction. A wireless[11] connection may be absolute predictable from the source's point of view while being completely unpredicted from the destination's point of view. The particular attributes of path selection and message scheduling are expected to be depends on routing algorithms[6]. In this single layered architecture[12] a few complex issues have been recognized: assurance of the presence and consistency of contacts, acquiring information on the condition of forthcoming messages given suspicions of high postponement, and the issue of proficiently allotting messages to contacts and deciding their transmission request. While basic heuristics for these issues can be executed without inordinate issues, each issue speaks to a noteworthy test and stays as future work. A straight programming definition of the (romanticized) directing/planning issue with contacts has been portrayed as of late in.

II. ARCHITECTURE OF DELAY TOLERANT NETWORKS

In layered architecture of delay tolerant network as shown in figure 2, it contains hierarchies of layers, where each layer is composed of several nodes. Each layer is known as network. The nodes of the network are composed of nodes with nearest possibility for communication. The communication channels of the layer are composed by using number of successful attempts of nearby node using non gateway mechanism [5][13]. Here gateway indicate the border nodes that are used for communication, gateway node contains a table that represents possible nearest other node information. A combination of gateway information is maintained at every layer of the network. A network need to maintain at least one gateway node because to maintain connectivity among other networks. To detect the border gateways, the following algorithm will be effective.

Algorithm to detect border gateways:

Function total_network (1 to n)

For network 1 to n

Count nodes

Count degree for each node

Hoptime:=estimated packet return time

If Forwardtime:=0

Not a bordernode

else

Node[i]=forwardtime+hoptime

Node_detect(1 to m)

Foreverybordernode

Find the network

Connect networks

The above algorithm defines number of border nodes and the network they belong to. First number of nodes is passed. Then by using the hoptime and the forwardtime a node is decide as the border gateway or normal node. To find out hoptime the following is used

Algorithm to find border gateways:

Function node (1 to m)

Send the empty packet with return address

Calculate the time to return

To find out the forward time the following

algorithm is used

Function node (1 to m)

Calculate the total nodes nearby

Send packet to each node

If node in same network

Count the neighbors

Else

Count as non neighbor

If total count nodes equals to sum of the

neighbor nodes

Than not a border

Else count the border node gives the number

A. Layer Communication

Layer is a logical separation of nodes. The set of nodes whose communication is direct are grouped under a name called layer. Layered mechanism is done by using above mentioned algorithms. To make the layer communication borders gateways are used. Border gateways have the property called any node communication. It is designed in a way that all nodes are reachable nodes for the border node. It can able to communicate with any node present in the layer. It maintains all sort of information regarding every node present in the layer and also maintains shortest path to communicate with every node. Each layer may contain more than one border gateway. The calculated amount border gateways are maintained in layer table, which contains information about nearest nodes and the nearest layered border nodes, which are calculated as shown in the algorithm. To communicate with the other layer node, first the source node sends the address value to the layer it belongs to where the layer searches for the destination is it available in current layer or not. If not then layer communicates the table to find out the border nodes, from those nodes it calculate the nearest possible node value that is present at another layer. The border node which is forwarding the message must able to follow store and forward mechanism strictly. Without this mechanism it is not possible to achieve communication among different layers. The mentioned DTN in figure 2 represents layered mechanism.

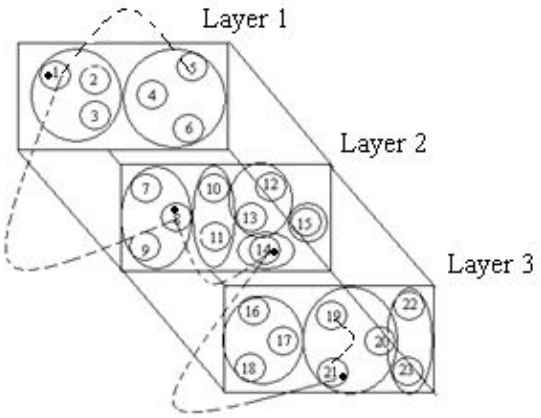

Figure 2: Layered Architecture of Delay Tolerant Network.

It is assumed that by calculating the hoptime and forwardtime nodes are separated to form the layers. In that example the node5 want to communicate with node19, first node5 approaches border node present in the layer where node1 is the border gateway. Border gateway collects the information from source node and reads the destination address, if the destination is one of the nodes of current layer it communicates the destination directly and passes the information. If it is present in other layers than first border node communicates with the nearby layer through layer's border gateway. It passes the request to the border gateway of the layer. Where the layer searches for destination address provided by the request layer, if it found in the layer then forwards the message otherwise nearest border gateway is calculated. If current border gateway is the nearest border gateway then it will communicate with border gateway present in other layer, otherwise the message is forwarded to nearest neighbour of the current layer. In this way a message is passed from source to destination of various layers. The communication mechanism is shown in below.

B. Internal Arrangement of Border Gateways

The internal architecture of the border gateway contains the following: A routing table of nodes, layer information table, border gateway management table. Routing table consists of nodes of the layer and their communication paths most of them are shortest paths. Layer information table maintains information about the other border gateway nodes of the layers and internal routing tables[7]. Border management table contains information regarding overall border gateways, by

using which it is possible to pass the information through layers.

1) Routing table:Routing table for this layered architecture is entirely different from the normal routing table of the network. This routing table consists of various calculated measures that specify nodal detection and their interconnection. Routing table in the layers is useful for that layer only and not used by the other layers.

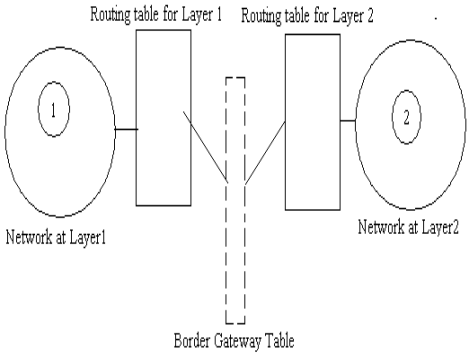

Figure 3: Communication Establishment through different tables in network

This routing table [8] is used to find out the shortest paths in current network only.The below diagram indicating a network that consists of four nodes, it is assumed that each node of the network is connected to every other node present in the network.The route path depends on the nodes which are indicated by using route table present in the network. In the first measure of the route table it maintains information regarding the current network nodes that are active. It is unpredictable to mention in a route table that at what time the nodes of a network are active but by using the range approach it can be predictable at what time network nodes will be active. Delay tolerant network does not give guarantee of the live nodes rather it suggests a mechanism that makes comfort to send the messages. The example given below shows a network of four nodes and their connected paths.

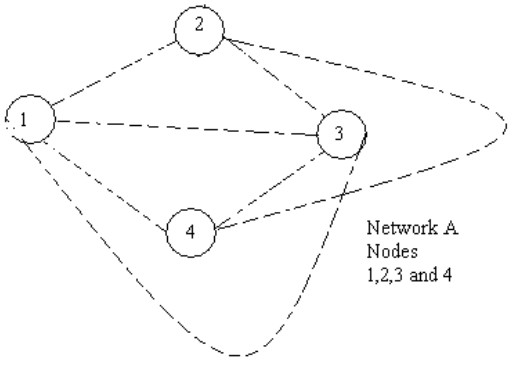

Figure 4: Example Network for Route Table

The below mentioned table format shows the route establishment by different nodes present in the network at Figure 4.Node has the possibility to communicate with every node in the network so hop path of the table contains all the live node values. This is assumed for all the nodes present in the network.

Nodes of the system	Hop path
1	2,3,4
2	1,3,4
3	1,2,4
4	1,2,3

Figure 5: Route Table for Network at Figure 4

The hop path suggests possible nodes by which routing may be done [9]. This routing may not be able to produce shortest path but possible to detect and generate path through live nodes.

2) Layer Information Table:This table contains the information regarding the layers. All the information like border gateways, number of nodes in the layer, shortest path among the nodes present in the layer, conversion factors and other sort of information. Layer information table is formed from the network that forms the layer division. Layer division is done by using always path establish able nodes. This nodes in the network are found by using sending a blank packet to adjacent node present in the network if the packet returns to the source one, which node that send the packet, then the node in counted as a local node and considered as a node of layer. The formation of all kinds of these nodes forms a layer. The below is the process by that a layer is formed.

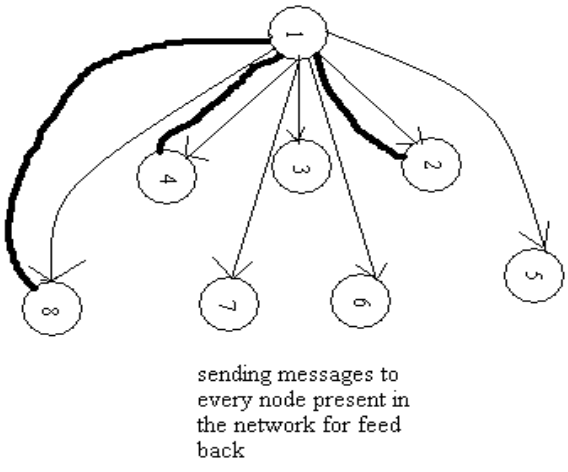

Figure 6: Node message forwarding for layer formation

The above structure shows that a blank message is sent to all the nodes present in the network where some nodes after getting the messages sends acknowledge are treated as nearby nodes and are used to construct a layer.

3) Gateway management table: This table consists of information regarding all the border gateways that are present in network according to their layer number. The use of this layer is to find out the number of nodes that acting as a border gateways and how to establish communication with other layers of the network.

Border Node	Layer	Comm. Possibility
1	2,3,4	2,3,4
2	1,2	1,2,3
3	1,5	1,2,3,4,5

Figure 7: Example Layer Table for Network at Figure 4

III. CONCLUSION

With the advent of Delay Tolerant Network it is possible to establish communication over networks that non homogeneous and irregular. The single layered architecture provides good communication. With the help of distinguish of nodes into different layers, it is effective to establish communication in a quick and reliable manner.

IV. *FUTURE WORK*

It may be useful if it is possible to establish intercommunication channels in between or among the layers, by which it is possible to add more amount of nodes and more number of networks to the existing one.

References

[1] Geva, A. (1998). ScaleNet—Multiscale Neural-Network Architecture for Time Series Prediction. IEEE Transactions on Neural Networks, 9(5), 1471-1482.

[2] Rajesh Vemulakonda and Nageswararao Kapu (2012).Probability Based Path Detection Routing in Delay Tolerant Networks, IJARCSEE.

[3] Md. Ali Hussain,RajeshVemulakonda,Md. Abdul Ahad,Satya Rajesh K,Syed Umar(2013). Through Estimated Probability, Path Detection Routing in Delay Tolerant Networks; Advances in Engineering and Technology Series.DOI:03.AETS.2013.2.24.

[4] SrinivasaRao Y., Ali Hussain M. (2019), 'Adaptive quality of service medium access control protocol for IEEE 802.11 based mobile Ad hoc network', International Journal of Innovative Technology and Exploring Engineering, 8(4), PP.430-433.

[5] Ganesan T., Rajarajeswari P. (2019), 'Genetic algorithm approach improved by 2D lifting scheme for sensor node placement in optimal position', Proceedings of the International Conference on Intelligent Sustainable Systems, ICISS 2019, (), PP.104-109.

[6] Bhandari R.R., Raja Sekhar K. (2019), 'Mobility aware clustering routing algorithm (MACRON) to improve lifetime of wireless sensor network', International Journal of Recent Technology and Engineering, 8(2), PP.76-85.

[7] Satyanarayana K.V.V., Vijay Kumar S. (2019), 'Adaptive framework combining sensors for data monitoring', International Journal of Innovative Technology and Exploring Engineering, 8(7), PP.1290-1293

[8] Dhage M.R., Vemuru S. (2018),'A effective cross layer multi-hop routing protocol for heterogeneous wireless sensor network',Indonesian Journal of Electrical Engineering and Computer Science,10 (2),PP. 664-671

[9] Venkateswararaorao M., Srinivas M. (2018),'A multi factorization approach in wireless sensor network for efficient communication',Journal of Advanced Research in Dynamical and Control Systems,10 (0),PP. 593-598

[10] Gummadi A., RaghavaRao K. (2018),'EECLA: Clustering and localization techniques to improve energy efficient routing in vehicle tracking using wireless sensor networks',International Journal of Engineering and Technology(UAE),7 (),PP. 926-929

[11] Radhouene M., Chhipa M.K., Najjar M., Robinson S., Suthar B. (2017),'Novel design of ring resonator based temperature sensor using photonics technology',Photonic Sensors,7(4),PP.311-316.

[12] Krishna M.N.V., Harsha N.S., Kasula V.D.K., Swain G. (2017),'Optimization of energy aware path routing protocol in wireless sensor networks', International Journal of Electrical and Computer Engineering,7 (3),PP.1268-1277.

[13] Dr. Mohammed Ali Hussain and Dr. Balaganesh Duraisamy Minimizing the Packets Drop by System Fault in Wireless Infrastructure less Network Due to Buffer Overflow and Constrained Energy, International Journal of Advanced Science and Technology Vol. 29, No. 5, 2020.