I J C T A, 9(34) 2016, pp. 217-228

Multicast Routing with Shortest Path and Distance Vector to Analyze Network Classification

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ABSTRACT

The network chore is routing with various nodes that establishes a path between the source and the destination. The intricate networks routing process is a transitional hosts to reach the destination that reduces the complexity of the network to consider as a collection of sub domains where a domain measured as a separate node. The nature of nodes is reallocated in networks which have the intended of multicast routing to preserve the connectivity to locate network analysis. In this work, the routing metrics for network analysis classification with multicast routing is studied. The aim of the work is to incorporate link-quality metrics with a shortest path algorithm and provide flexible, consistent and compatible route to the targets using a multicast routing network. This research work is represented a multicast routing to create the shortest path while various links newly loaded in the network. The shortest path and distance vector routing algorithm methods are provided for better performance using network emulator technique as completing the time decrement and the prearranged nodes which follow the shortest path from source to destination node using python language in multicast network is experimented. The results of this research work, the experimental setups of multicasting network have different nodes to situate the network which has different regions and involvement links to find the path with lowest cost between the vertex. The nodes are apt to secure the connectivity with target nodes to evaluate routing environment is concluded.

Keywords: Wireless network, Shortest path, Distance vector routing, Multicasting Network, and Network Emulator.

1. INTRODUCTION

The wireless network oriented epoch of infrastructure requires efficient communication by recognizing the shortest path and boost the packet throughout to the path. Since, the collapsed survive nodes in the network, opposes the failure by sending information which increases congestion fraction and rerouting of the packets while forwards the packets on the basis of minimum number of transmissions. It transmits with overwhelming less number of costs, and during failure of intermediate links, also having the scope of improvement in the efficiency (i.e. transmission cost, rerouting cost and complexity of the network). The shortest path structure is vital in network routing which is a stagnant routing is used. The dynamic routing is more competent than static routing while several associate nodes in a network have new weights. It reduces redundancy by calculating the affected nodes with the changed links in the network. However, it is not efficient in various situations and increase calculative time to create the shortest path tree and reduce the execution time of shortest path computation.

The multicast routing provides rapid and competent method of routing establishment for the communications of network nodes that improves the throughput of the network system and decrease the speed control overhead is presented by Ahmed Younes (2011) and S.P. Gaikwad and Priyanka Patil (2014). When network load increased, it ensures network performance and improves protocol robustness is presented

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by M. Rajendiran and S.K. Srivatsa (2011). The multicast is a communication between a sender and multiple receivers on a network and transmits a message to a group of recipients presented by Dhanya V. Nair (2016). It is used in streaming video, in which megabytes of data are possible to send over the network. The multicast saves bandwidth and resources that can be delivered to the destination on alternative paths even when the route breaks as advantage.

The users increase and demand of a few narrative technologies can manage the concerns (like mobility or wireless network) is developed by Geetanjali Rathee et al. (2015). The wireless network become a talented concept to solve the challenges in today's scenario in cost effective facet to the service provided by adopting three features are,

(i) Self-structuring,

(ii) Flexibility, and

(iii) Self-management.

Multicast routing is a kind of statement where information is distributing to a set of destination nodes concurrently as shown in Figure 1 where only once messages send at all layer of the network as presented by M. Elizabeth Royer *et al.* (1999).

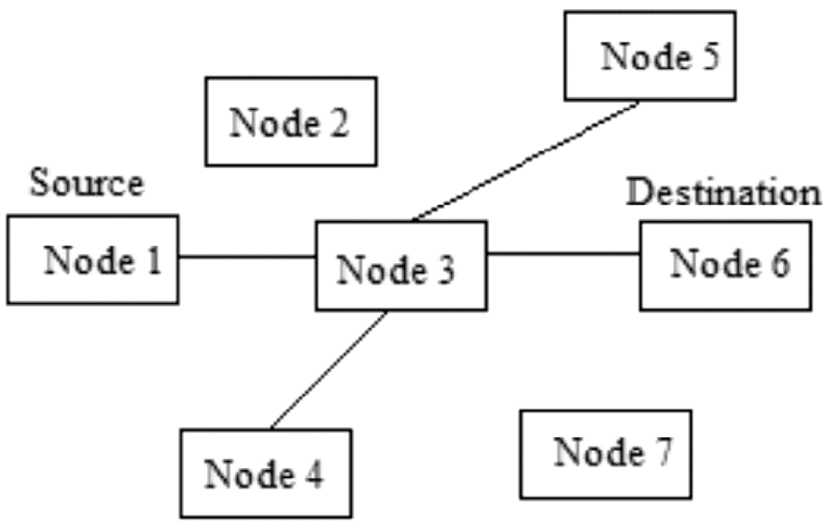

Figure 1: **Multicast routing process in wireless node network**

The replication of information is given at division layer and links have been discriminated to the destination node. The shortest path algorithm is to create a structure that the distance between source and destination should be nominal. The aim of the study includes the node link metrics with the shortest path and distance vector algorithm to represent the dependable and companionable route to the target nodes with a multicasting method.

2. LITERATURE SURVEY

Neeraj Kumar et al. (2012) proposed a minimum delay maximum flow multicast algorithm to solve the problem using CF and associated constraints. Ahmed Younes et al. (2011) proposed a genetic algorithm for solving multicast routing to find the low-cost multicasting tree with bandwidth and delay constraints. Abhishek and Neha (2016) presented the open shortest path first to provide less congestion ratio by allocating traffic and forward multicast datagram from one network to another. Gunasekaran (2016) presented a multipath dynamism proficient algorithm to performance of packet delivery ratio and throughput and end to end delay metrics using the network simulator environment. Rajendiran and Srivatsa (2011) proposed the performance of prominent on-demand routing protocols for a specified network. Arma (2016) presented to assess the applicability of the protocols in different mobile traffic scenarios. Shilpa and Nilesh (2014) proposed to minimize the packet drop problem for minimizing the use of low duty cycle. Sabyasachi Roy et al. (2007) proposed a low-overhead adaptive online algorithm to incorporate link-quality metrics to a representative multicast routing protocol. Elizabeth and Charles (1999) presented an algorithm for the operation of networks to present multicast capabilities from distance vector to formed unicast routes. Dhanya (2016) proposed router based multicast routing method for other routers in the network to construct multicast tree and deliver multicast packet. Geetanjali Rathee et al. (2015) presented the shortest path in a tree and the packet throughout path to recognize the communication. B. Karthikeyan et al. (2016) proposed the multicast routing protocol to reduce the end to end time delay. Saima et al. (2016) presented to analyze and compare routing protocols in terms of throughput, end to end delay and packet delivery fraction. Priyanka et al. (2014) proposed the shortest path algorithm to communicate some nodes on network in shortest, efficient path with efficient throughput mechanism. Neetendra and Anjana (2016) proposed to analyze distance vector routing protocols based performance matrix includes parameters like average end-to-end delay, throughput analysis, number of packet drops and packet delivery ratio etc. S.P. Gaikwad and Priyanka (2014) proposed a methodology to improve the throughput of the network with an adaptive routing algorithm to assign the shortest path from source to destination. Yagvalkya et al. (2010) proposed to calculate the shortest path between source and destination node for static and dynamic routing networks. Taehwan et al. (2013) presented to reduce the total execution time of shortest path tree computation by using the both static and dynamic routing algorithms. Shubhi and Prashant (2015) presented the distance vector protocol and link state protocol is based on Bellman–Ford algorithm and Dijkstra’s algorithm respectively. Rigi et al. (2014) presented to solve the shortest path problem in wireless sensor network which has a significant impact on the network’s performance.

3. MULTICAST NETWORKING WITH SHORTEST PATH ANALYSIS

The multicast drives a segment of node data to frequent specks that are analogous the broadcasts to find the shortest path in the network. The node signal originates from one source that can reach to all the nodes available in the network. The multicasting through various networks are recognized the shortest path amongst the source and the destination hosts to join the multicast networks and recognized convinced data to replace node frequently between routers and hosts.

3.1. Advantages of Multicasting

(i) Uses lesser bandwidth.

(ii) There are smaller contents on the server resources as well as network resources.

(iii) Large size real time transmissions can be sent by means of multicasting.

(iv) Multicasting is suitable for transmission across multiple networks.

3.2. QoS in Multicasting Network

The multicasting is a connectionless and undependable source of communication where packets are vanished during node transmission through the source. It builds a shortest path routing attached to all the senders and receivers of the multicast network. At hand, two essential categories of multicast node network:

(i) Source-based trees, and

(ii) Shared-based trees.

4. INDISTINCT METRIC ALGORITHMS FOR SHORTEST PATH

The standard distance renovation algorithm which is based on shortest path metrics such as neighbor-joining is proposed by N. Saitou and M. Nei (1987) formulate to use of pair-wise distances between nodes and used for computation proficiency presented by Michelle R. and Joseph T. (2006). To understand the consequence, need a conception of node tree "depth" which is an edge $e \in E$, where the depth of 'e' is the length of the shortest path between two nodes on which 'e' lies in,

$$\Delta(e) = \min \{d(u, v) : u, v \in L, e \in P_{uv}\},$$

where'd' is the node distance on T and define the depth of a tree T to be the highest depth in T,

$$\Delta (T) = \max \{\Delta(e) : e \in E\}.$$

It shows that $\Delta(T) \leq \log_2 n$ if the degree of internal nodes is at least 3 (argue by contradiction). The key insight the diameter and the depth of a tree, even though the diameter can be as large as $O(n)$, the depth is always $O(\log n)$. It represents to reconstruct trees with fewer models by ignoring the distances corresponding to paths longer than $O(\log n)$. In particular, a reconstruction algorithm is based on distances which are appropriated in the shortest path networking incident using distances lesser than a threshold to classify $O(\log n)$.

4.1. Pseudo Code of the Shortest Path Sequence

```
distn [p] ← 0
    for all w ∈ W – {p}
          do distn [w] ← ∞
P ← Ø
R ← W
while R ≠ Ø
do z ← mindistance (R, dist)
    P ← P∪ {z}
    for all w ∈ neighbors[z]
          do if distn[w] > distn[z] + y(z, w)
               then d[w] ← d[z] + y(z,w)
    return distn
```

4.2. Multicast Shortest Path Search Algorithm

The multicast shortest path search algorithm is based on the system programming where a multicast path, $s \rightarrow D$, the method begins by searching the possible multicast paths to small subsets of D and larger subsets of D by integration to obtained the multicast paths. It defines the requisites used in the algorithm as specified a directed graph $G = (V, E)$, MS (v, X) is a multicast path $v = X$.

The cost of a multicast path P, cost (P) is the calculation of edge costs in P. CT (v, D) is a multicast path which is the least cost combination of two multicast paths, say $v \rightarrow X$, and, $v \rightarrow (D$ Ð $X)$, which distance multicast vertex v and with their targets (destinations) being the non-empty disjoint subsets of D. The i - vertex set of D is the set of each vertex sets, X such that $|X| = m$ and $X \in D$. For e.g., the vertex set of $\{x, y, z\}$ is $\{\{x, y\}, \{x, z\}, \{y, z\}\}$ and has some component. The multicast path search algorithm for s $\rightarrow D$ is as follows:

for m, n $\in V$, $m \neq n$ do $M, S(m, \{n\})$ = shortest path
from m to n
done
for m, $\in \{2, ..., |D|\}$ do {
for $D_m \in m$ – vertex set of D and $v \in V$ do
find $CT(v, D_m)$ where,
cost $(C, T(v, D_m))$
= min {cost $(M, S(v, X))$
+ cost (M, S(v, Dm Đ X))}
$Ø \in X \in D_m$
done
if (m = |D|) break; // no need $MS(v, D_{|D|}$ where, $v \neq s$.
for $D_m \in m$- vertex set of D and $v \in V$ do
find $MS(v, D_m)$ where,
cost $(MS(v, D_m))$
= min {cost $(MS(v, \{k\}))$
+ cost $(CT(k, D_m))$}
$k \in V$
done }
find $MS(s, D)$ where,
cost $(MS(s, D))$ = min {cost $(MS(s, \{k\}))$+
cost $(CT(k, D))$}

5. DISTANCE VECTOR ROUTING

Distance vector routing uses to calculate paths and inform its neighbors to changes periodically presented by B. Karthikeyan *et al*. (2016) and detected in the network. It has less computational complexity and communication overhead compared to link-state procedure, which require a router to inform the nodes in a network. It signified by next hop to attend and depart interface, uses metrics such as hop count presented by Utpal Barman and Diganto Sahu (2016). The routers using distance vector do not have acquaintance of the path to a destination, it uses two methods are,

(i) Route in which a packet need to be forwarded.

(ii) Distance from its destination.

It executed periodically in a distance-vector where the routing table is sent to the neighbors that are configured to use the same routing network. Once a router has the information is able to amend its possess routing table, and imitates the changes and inform its neighbors. This process is described as routers are relying on the information received from other network and unable to established.

5.1. DSDV Routing Network and Performance Evaluations

The Destination Sequence Distance Vector (DSDV) includes sequence number for each node data transfer (routing table), which is not allowed to send redundant data, and creates sphere in the network presented by Taehwan Cho et al. (2013). Each node of a network preserves a routing table, which have destinations, metric and next hop to each destination and a sequence numeral generated by the destination node. Every node refers table to send packet to other nodes and each node network updates the routing table periodically by sending routing information to preserve the consistency of the routing table is presented by Taehwan Cho et al. (2013). When network changes are detected periodically, each node updates routing information by sending update data to every other node. The update node data starts out with a metric connected nodes and shows that each receiving neighbour is one metric away from the node. After receiving the update packet, the neighbours update their routing table with incrementing the metric by one and retransmit the update packet to the corresponding neighbours of the network. The content of each node changes enthusiastically to maintain steadiness with vigorously changing topology in the routing table. To reach this constancy, the routing in sequence to be frequent to make certain that each node can situate the nodes in the vibrant network.

Consequently, the growing network size and node data delivery within less time are subsequent multicasting scheme. The performance evaluation of DSDV routing protocols pursue measures are;

(i) ***Data throughput***: Data received at the receiver end at which the data packet is received the throughput.

(ii) ***End-to-end delay***: Time taken by the information after transmitted data by the sender to reach the receiving end.

(iii) ***Data delivery ratio***: The fraction of node data are transmitted by the application and received at the end of receiver.

(iv) ***Network routing overhead***: The node packets are transmitted for the innovation and preservation of the multicasting routes as the network overhead.

6. NODE DATA DELIVERY RATIO WITH SHORTEST PATH MULTICASTING NETWORK

It measures the calculation to identify the competence of the path strengthening node system is proposed by Arma Amir Mehdi (2016). The multicast node delivery ratio measurement as,

Multicast Node Delivery Ratio

$$= \frac{No.of\ multicast\ data\ received}{No.of\ multicast\ data\ sent}$$

To evaluate the data delivery ratio against the number of group nodes consist in multicast node data delivery to the receiver nodes as experimented in Figure 2.

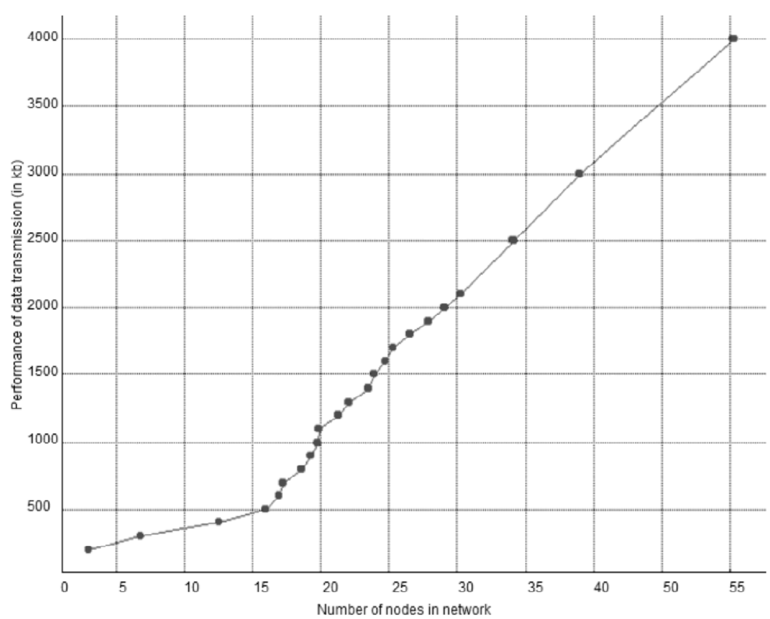

Figure 2: Performance of data transmission analysis with number of nodes in the network

6.1. Multicast node network Algorithm

The multicast node network algorithm uses the request and reply data as depicted only information. It joins the multicast nodes which is composed the cluster of nodes and follow the form of the dynamic nodes which are able to join and leave at any time is proposed by M. Elizabeth Royer (1999). It maintains the multicast cluster sequence number to be arranged with the routers in the multicast shortest path is shown in Figure 3.

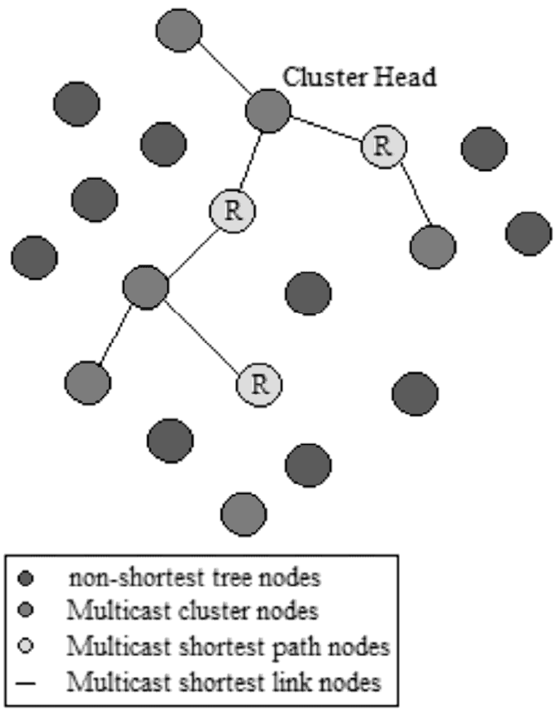

Figure 3: Multicast nodes join operation in wireless network

7. IMPLEMENTATION OF THE WORK

7.1. Shortest Path with User Interface Module

The shortest path is a graph search algorithm that solves the single-source shortest path crisis for a graph with non-negative edge path costs, often used in routing and as a subroutine in additional graph algorithms.

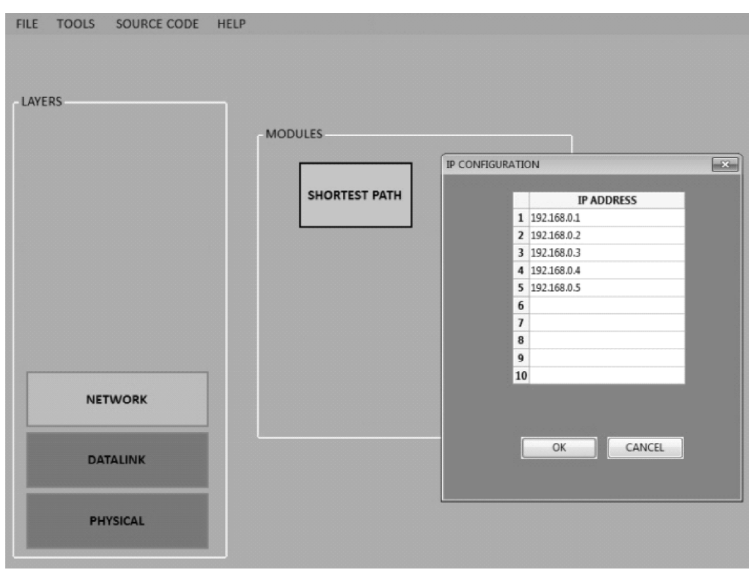

Figure 4: IP Configuration allotted to demonstrate node station in shortest path module (as snapshot)

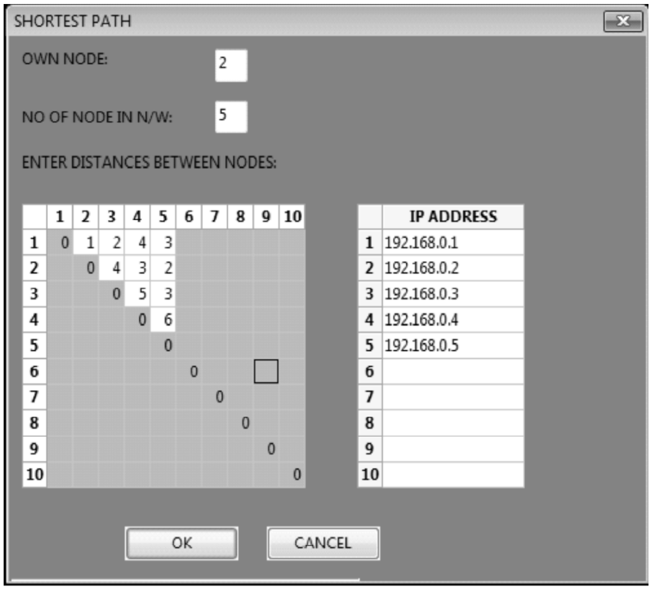

Figure 5: Snapshot of IP configuration and allotted distances between nodes

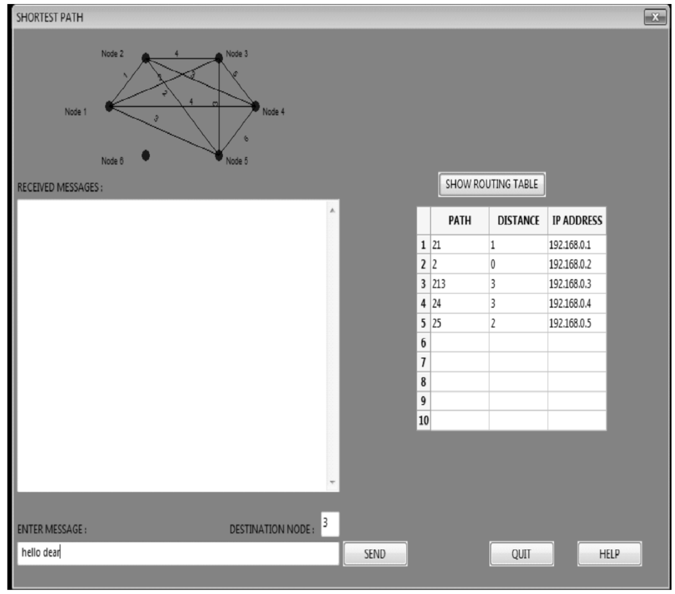

Figure 6: Connected Node network Node diagram with routing table

It shows the distance between one node to another node along with the distance between node to node, and shown the message in message window that allocated the node where destination node occurred.

7.2. Distance Vector with User Interface Module

In this work, the distance vector is analyzed the network path and report to its neighboring nodes which is demonstrated in this section and identified by IP addresses of different nodes. The IP pattern allocation for node location in distance vector is shown in Figure 8.

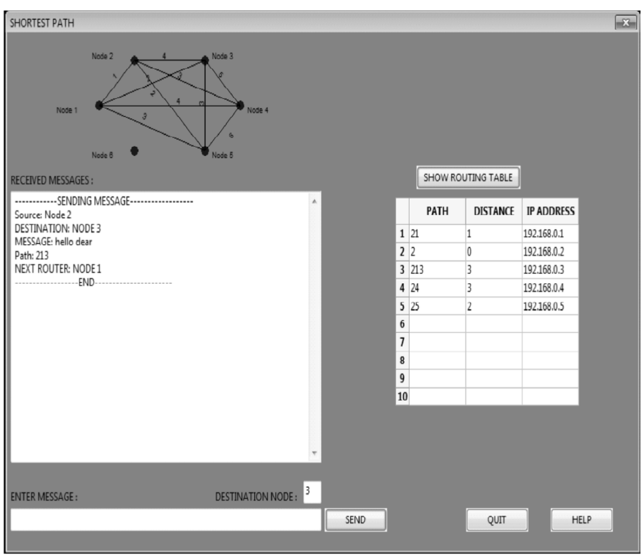

Figure 7: Message Transmitted as receiver in Received message in network emulator

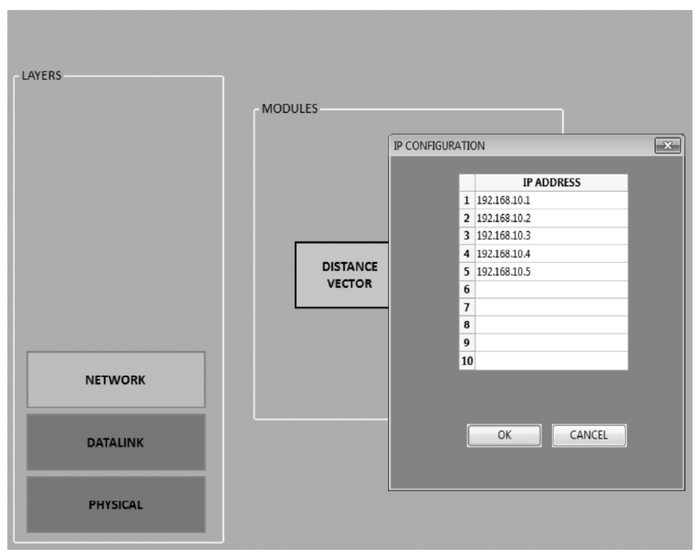

Figure 8: IP Configuration allotted to demonstrate node station in Distance Vector module (as snapshot)

The node configuration and neighboring node allotment from the network is shown in Figure 9.

The transmission of message is communicated with the node in routing table along with the IP address and reached to the receiver is shown in Figure 10.

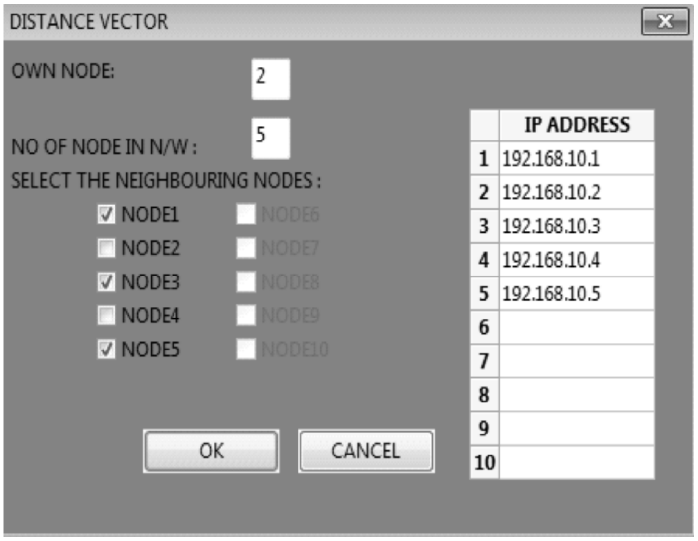

Figure 9: Snapshot of IP configuration and allotted neighboring nodes from the network

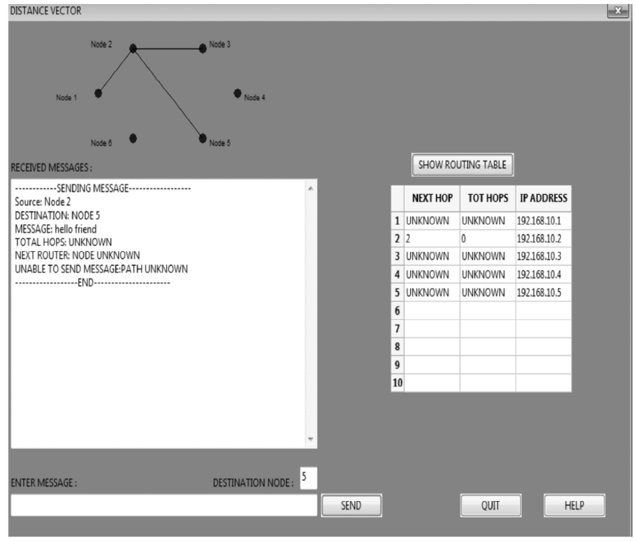

Figure 10: Message transmitted as receiver in received message in distance vector network emulator

8. RESULTS AND DISCUSSION

8.1. Experimented Setup of Multicasting Network Using Shortest Path

In multicast network, total 36 nodes are available, where few nodes are prearranged as an allied network, which has North West (NW) and North East (NE) regions and have different kind of nodes association link is shown in Figure 11, and is given in Table 1 with different regions and node types.

Table 1
Nodes chosen in different regions with node types

Node	*Region*	*Node Type*
1008	NW	Corner Node
1013	NW	Normal Node
1023	NW	Boundary Node
1018	NE	Boundary Node
1028	NE	Boundary Node

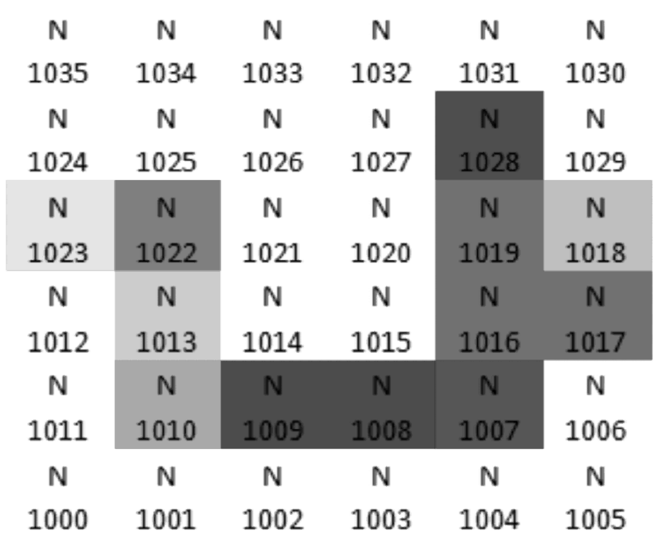

Figure 11: Colored nodes represent as chosen nodes

For a given source vertex (node) in the graph, the algorithm finds the path with lowest cost (i.e. the shortest path) between that vertex and every other vertex. It can also be used for finding costs of shortest paths from a single vertex to a single destination vertex by stopping the algorithm once the shortest path to the destination vertex has been determined.

The source node to destination node regions conveys data packets to the appropriate path are shown in Figure 12, where few nodes are determined for NW region and NE region, and represented a suitable path which is used to transmit data packets.

Figure 12: Source nodes to destination node regions transmitted packet as experimented

9. CONCLUSION

In this work, the nodes are appropriated to defend the connectivity with target nodes to evaluate routing environment. It represents the shortest path and distance vector routing algorithm to make better concert using network emulator is demonstrated and set the nodes to follow the appropriate route in the node link as experimented. The node metric and next hop has a series generates numeral in the network to conserves a consistency routing table is also shown. The network emulator is established the transmission process with the lowest cost between node vertex and every vertex represent the appropriate path to transmit data packets which has different regions and reach to the target is concluded.

ACKNOWLEDGEMENT

I acknowledge the facilitates and amenities offered by my supervisor Dr. B. Justus Rabi and research work cooperated by Dr. Kuldeep Chouhan are to be carry out to do the experimental work and provided the features in Network Emulator.

REFERENCES

[1] Neeraj Kumar, Naveen Chilamkurti, and Jong-Hyouk Lee, "A novel minimum delay maximum flow multicast algorithm to construct a multicast tree in wireless mesh networks", Computers and Mathematics with Applications, Vol. 63, pp. 481–491, 2012.

[2] Ahmed Younes, "Multicast routing with bandwidth and delay constraints based on genetic algorithms", Egyptian Informatics Journal, Vol. 12, pp. 107–114, 2011.

[3] Abhishek Verma, and Neha Bhardwaj, "A Review on Routing Information Protocol (RIP) and Open Shortest Path First Routing Protocol", International Journal of Future Generation Communication and Networking, Vol. 9, No. 4, pp. 161-170, 2016.

[4] Gunasekaran Shanmugam, "Multipath Dynamism Proficient Algorithm for Mobile Ad Hoc Network Environment", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, No. 2, pp. 2215-2223, February 2016.

[5] Rajendiran M., and Srivatsa S.K., "On-Demand Multicasting in Ad-hoc Networks: Performance Evaluation of AODV, ODMRP and FSR", International Journal of Computer Science Issues, Vol. 8, No. 3, pp. 478-482, May 2011.

[6] Arma Amir Mehdi, "Performance Evaluation with Throughput, Packet Delivery on Routing Protocols in MANETs", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 6, No. 2, pp. 424-429, February 2016.

[7] Shilpa Gangele, and Nilesh Bodne, "Adaptive Multicast For Delay Tolerant Network using AOMDV protocol", International Journal of Engineering Research and General Science, Vol. 2, No. 6, pp. 901-906, October 2014.

[8] Sabyasachi Roy, Dimitrios Koutsonikolas, Saumitra Das, and Y. Charlie Hu, "High-throughput multicast routing metrics in wireless mesh networks", Science Direct, Ad-Hoc Networks, pp. 1-22, 2007.

[9] M. Elizabeth Royer, and Charles E. Perkins, "Multicast Operation of the Ad-hoc On-Demand Distance Vector Routing Protocol", IEEE Transactions, pp. 1-12, 1999.

[10] Dhanya V. Nair, "Branching Router Based Multicast Routing Protocol Using MANET", International Journal of Advanced Research in Electronics and Communication Engineering, Vol. 5, No. 5, May 2016.

[11] Geetanjali Rathee, Ninni Singh, and Hemraj Saini, "Efficient Shortest Path Routing (ESPR) Algorithm for Multicasting in Wireless Mesh Network", International Journal in Computer Technology & Applications, Vol. 6. No. 1, pp. 111-115, 2015.

[12] B. Karthikeyan, S. Hari Ganesh, and J.G.R. Sathiaseelan, "Optimal Time Bound Ad-Hoc On-demand Distance Vector Routing Protocol (OpTiB-AODV)", International Journal of Computer Applications, Vol. 140, No. 6, April 2016.

[13] Saima Zafar, Hina Tariq, and Kanza Manzoor, "Throughput and Delay Analysis of AODV, DSDV and DSR Routing Protocols in Mobile Ad-Hoc Networks", International Journal of Computer Networks and Applications, Vol. 3, No. 2, March – April 2016.

[14] Priyanka U. Patil, and S.P. Gaikwad, "Throughput and Packet Error Rate Analysis Using Routing Algorithm", International Journal of Science and Research, Vol. 3, No. 11, pp. 3113-3116, November 2014.

[15] Neetendra Singh Dhakad, and Anjana Goen, "Review on Routing Protocols of Mobile Ad-hoc Network MANET", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 5, No. 4, pp. 2785 – 2790, April 2016.

[16] S.P. Gaikwad, and Priyanka Patil, "Routing Mechanism for the Improvement of Network Throughput", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 4, No. 5, pp. 423-426, May 2014.

[17] H. Saini, "1-2 Skip List Approach for Efficient Security Checks in Wireless Mesh Networks", International Journal of Electronics and Information Engineering, Vol. 1, No. 1, pp. 9-15, 2014.

[18] Yagvalkya Sharma, Subhash Chandra Saini, and Manisha Bhandhari, "Comparison of Dijkstra's Shortest Path Algorithm with Genetic Algorithm for Static and Dynamic Routing Network", International Journal of Electronics and Computer Science Engineering, Vol. 1, No. 2, pp. 416-425, 2010.

[19] Taehwan Cho, Kyeongseob Kim, Wanoh Yoon, and Sangbang Choi, "A Hybrid Routing Algorithm for an Efficient Shortest Path Decision in Network Routing", International Journal of Multimedia and Ubiquitous Engineering, Vol. 8, No. 4, pp. 127-136, July, 2013.

[20] Utpal Barman, and Diganto Sahu, "Performance Analysis of DSDV", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 5, No. 1, January 2016.

[21] Shubhi, and Prashant Shukla, "Comparative Analysis of Distance Vector Routing & Link State Protocols", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 3, No. 10, pp. 9533 – 9539, October 2015.

[22] Rigi C.R, Ancy Antony C., Shalinu Saju, and Sachin Padikkal, "Shortest path routing algorithm in wireless sensor network – A Review", International Journal of Scientific Research and Education, Vol. 2, No. 3, pp. 407-413, 2014.

[23] N. Saitou, and M. Nei, "The neighbor-joining method: A new method for reconstructing phylogenetic trees", Mol. Biol. Evol., Vol. 4, No. 4, pp. 406–425, 1987.

[24] Michelle R. Lacey, and Joseph T. Chang, "A signal-to-noise analysis of phylogeny estimation by neighbor-joining: insufficiency of polynomial length sequences", Math. Bioscience, Vol. 199, No. 2, pp. 188–215, 2006.