Far East Journal of Electronics and Communications
Proceedings of SHANNON 100 - 3*rd Int. Conf. Comp. Sci.*, 2016

http://dx.doi.org/10.17654/ECSV3PII16295
Special Volume 3, Part II, 2016, Pages 295-305 **ISSN: 0973-7006**

LOCAL REPAIR USING DATA BROADCASTING

Gagandeep Singh, Ashok Kumar Sharma and Onkar Singh Bawa

Department of Computer Science Engineering
Lovely Professional University
Phagwara, India

Abstract

In wireless communication, path between the nodes can be settled up by using a fixed infrastructure or an infrastructure less network. The mobile ad hoc network uses infrastructure less architecture. In the paper, a new local route repair scheme for ad hoc on demand distance vector routing protocol is given which helps in increasing the performance of existing ad hoc on demand distance vector routing protocol. We have simulated the performance of the improved local repair using Ns2 (2.35) simulator.

1. Introduction

Wireless technology has become a very emerging era in the past years. The wireless communication provides us with the ability to move from one place to another while sending the information. The mobile ad hoc networks are good in providing connectivity in remote areas but they are also having few disadvantages. Few of the disadvantages are because of the mobile nature of the mobile ad hoc network. The mobile nature of node creates problems while transferring the data from source to destination. The infrastructure less network is the network which does not require any fixed infrastructure for providing communication services. Mobile ad hoc

Conference held during April 8-9, 2016 at Lovely Professional University, Punjab, India.
Guest Editor: G. Geetha; Division of Research and Development, Lovely Professional University, Punjab, India.

networks are temporary networks that can provide communication between the nodes in the area where it is not possible to construct an infrastructure network. Mobile ad hoc networks are adaptive to the environment and can change its topology according to the requirements. The mobile ad hoc networks are very different from the wired networks because of the different architectures. The mobile ad hoc network supporting devices have their own restrictions such as limited battery power, low processing power. Due to the limitations of the mobile devices, it can become very difficult to handle such kind of devices efficiently.

Reactive protocols are widely used protocols of mobile ad hoc networks. In reactive protocols, a node wants to find a path to the destination, it needs to start the route discovery process. The route discovery process starts finding a path by broadcasting the route request messages and when the path is discovered, then a node can start the data transfer to the destination. The reactive protocols produce less number of control packets than proactive protocols. When a topology change occurs in the network, the number of the generated control packets is less. The less number of control packets improves the performance of the network. The reactive protocols need to wait for the path to be discovered. This waiting time increases the delay of the network. In AODV protocol, there is a mechanism which can handle the link breaks of the route due to the mobility or other failures. This mechanism is known as local repair. In this paper, we have modified the way of local repair of the path breakage.

2. Related Work

AODV protocol is a reactive protocol. The protocol has wide application areas. The basic functionality of the protocol is defined in the document. It has defined the main constituents of the protocol. A mechanism of the route discovery, path maintenance is described in the document. Fields of the headers are also explained in it. Various timers used by the protocol are explained in the documentation [1].

The node which is in the exposure to the other node’s transmission can hear the transmission of control messages such as route reply. Whenever a node hears a route reply from its neighbors that node enters the path to destination into its backup routing table. Whenever a duplicate path to the destination is received, the node discards the message. When there is a link layer feedback error, the node which detects the error broadcasts the data to its neighbors. After receiving the data neighbor, lookup its backup routing table and route the packets to the destination. This approach had improved the performance of the AODV protocol by decreasing the number of the rediscovery requests [2].

Every node has a backup path to its 1 hop neighbors. When there is a link breakage or the path currently used becomes unprofitable, then backup node can be used to transfer the data towards the destination. This setup helps to maintain the seamless connectivity between the nodes. Important considerations are that total number of backup paths should be less than the total number of the active connections. The connection will be considered as active connection when it has its flag bit is set otherwise the path remains as the backup path. There is only one backup path at a one time. Otherwise, huge control traffic could be generated by the nodes [3].

The path break can be classified into three main types, i.e., Type 1, Type 2 and Type 3. In Type 1, error happens when a link failure occurs due to the mobility of the communicating nodes. Type 2 error occurs when some sort of software error occurs in the node. Type 3 error occurs when a node has depleted energy. A modification was done in the ROUTE REQUEST packets. These packets carry a new field of destination node. This helps to find a path to destination if the downstream node fails. The error message was modified to contain a field of low battery power [4].

There is a tradeoff between the various timers used in the AODV protocols. The timers used in the protocol can affect the performance of the protocol. The transmission failures are also known as link layer feedback errors. The timeout errors occur due to the active route timeout. A simulation was carried out to find a balance between the various timers. The main focus was concentrated on the active route timer and the link layer feedback errors. The simulation studies showed a tradeoff between the various timers and corresponding errors [5].

The data and control packets can be collectively used to prepare a backup path for a broken link. Mesh architecture is created along the active path. When a link between source and destination node breaks, the upstream node of the broken link gets the LLF error. The node starts the route repair process by sending the request packets and waits for the timer to expire. If it receives the reply, then it selects the path with less number of hops else it will send error message to the source node [6].

Data overhearing can be used to repair a link. When a link failure occurs on the active path, neighboring nodes can detect the error by hearing the data retransmissions by the upstream node of the broken link. After detecting error, the neighbor node waits for random back off time. In mean time, if the acknowledgement of data delivery is not overheard by the neighbor node, then it will send a route change message to the retransmitting node [7].

3. Proposed Approach

In the proposed approach, an upstream node detects the link breakage on the active route. It will broadcast the data and will also initiate a timer for repair. The nodes which are in the one hop vicinity of the error detecting node will only receive the broadcasted message. After receiving the data, broadcast node checks its routing table to find the path for destination, if routing table contain entry for the destination. It will send the data to destination and send a reply to the broadcasting node. If there is no entry for the destination, then receiving node will send the local route discovery to the neighboring 1 hop nodes. If local request initiator receives the reply successfully, then it will send data to the destination and will reply back to the source node after the local repair is successful. If the node which had sent the local route request does not get a reply back, then it will intimate the data broadcasting node with an error message which will be sent to the source node. The illustration of the scenario is shown in Figure 1. *S* node is the first source and *K* is the second source node, *Z* is the destination node for both the sources. Link between the nodes *D* and *F* is broken. Node *D* will broadcast the data to the node *M*. Node *M* will check for the path to the destination *Z*. There is a path available for the destination *Z*. The data will be forwarded to the destination node *Z* and message will be sent to the data broadcasting node to intimate the local repair is successful. As the number of users will increase and the local repairs will be performed by using the same mechanism of data broadcasting wherever the data path is available for the destination, the local route repair will be performed and if the path is not available, then the local repair will fail and the message will be sent to the source node for the route error. As the number of users increases, the possibility of the repair increases as the density of users is more and probability of finding the repair path for the route becomes high.

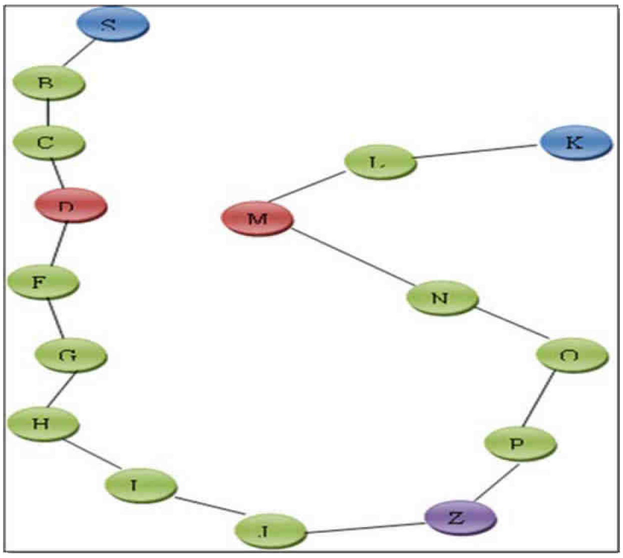

Figure 1. Scenario illustration.

4. Implementation

Algorithm for purposed approach

1. If Data Forward successful

   {Forward data until DATA==NULL}

2. Else If (NODE==SOURCE)

   {Perform re route discovery}

   Else If (NODE==INTERMEDIATE)

   {Broadcast to 1 hop and imitate a timer}

   Wait for timeout

   If (REPAIR ==SUCESSFULL)

   {Forward buffered data}

   Else

   {Send Route error to source}

3. If (NODE receives DATA with IP_BROADCAST)

   {Check route for destination in route table

   If (ROUTE==UP)

   {Forward DATA}

   Else

   {Start Local request and start timer}

   }

4. EXIT

5. Simulation Result

All results of the simulation are obtained by using the Ns2 simulator. Results were well tested by repeating the experiments several times by using the different parameters. The results shown in the paper are by taking the node parameters as given below:

Table 1. Parameters defined

Serial number	Defined parameters	Parameter's value
1	Propagation model	Propagation/TwoRayGround
2	Channel	Channel/WirelessChannel
3	Interface	Phy/WirelessPhy
4	Media access	Mac/802_11
5	Antennea type	Antenna/OmniAntenna
6	Maximum queue length	50
7	Number of nodes	35
8	Routing protocol used	AODV
9	Topography	1800 *1800
10	Dropping mechanism	Queue/DropTail/PriQueue

In the graph, the green color shows the end to end delay in the basic AODV protocol and the red line shows the AODV modified. The end to end delay is the total amount of time taken for a packet to travel from one end of the network to the other end.

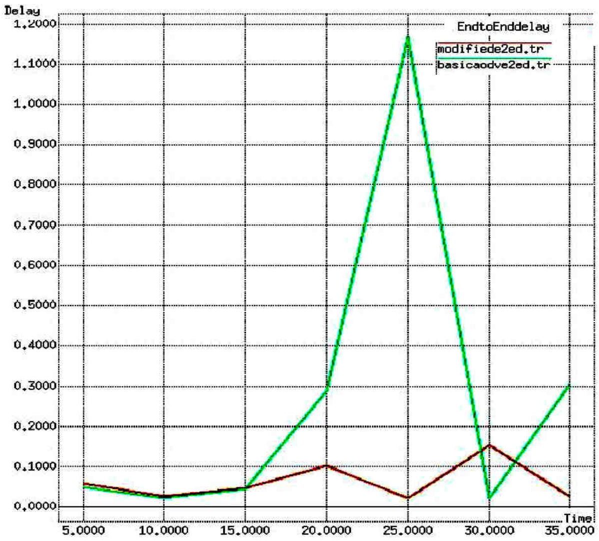

Figure 2. End to end delay.

In the graph, the improved method of local repair performs better as compared to the basic AODV protocol. In the basic AODV, the packets which are buffered during the repair are delivered late. But in the improved mechanism, the data packets are broadcasted as a node detects the link break. We can define the throughput as the number of packets received at the destination. The throughput can be a very important parameter to measure the performance of network.

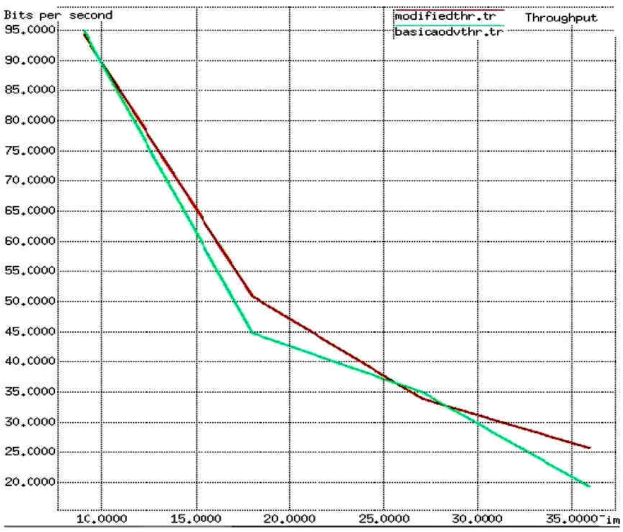

Figure 3. Throughput.

As we can see in the graph, the overall performance of the AODV protocol has been improved. The red line of modified approach remains higher than the green line of basic protocol. There is one small intersection between the lines of basic and modified AODV protocol.

The packets are dropped by the nodes when they become unable to handle the packets. The buffer can get full due to many reasons which result in dropping of packets.

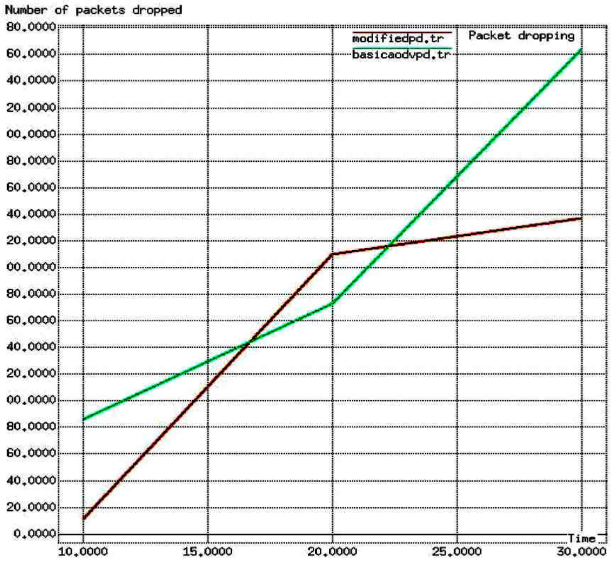

Figure 4. Packets dropped.

The red line of modified protocol remains lower than the green line of basic protocol. The packet dropping because of the unavailability of route becomes less in new repair mechanism.

Overhead of the network is the number of control packets required to deliver one data packet to the destination. Large overhead can decrease the performance of the network. Overhead of the network can degrade the performance of the network.

As shown in Figure 5, overhead of the modified protocol is less than the basic AODV protocol. The overhead of the control packets is reduced because of which graph of overhead is lower than basic protocol.

Overhead is due to the large number of control messages when node does not find an entry for the destination.

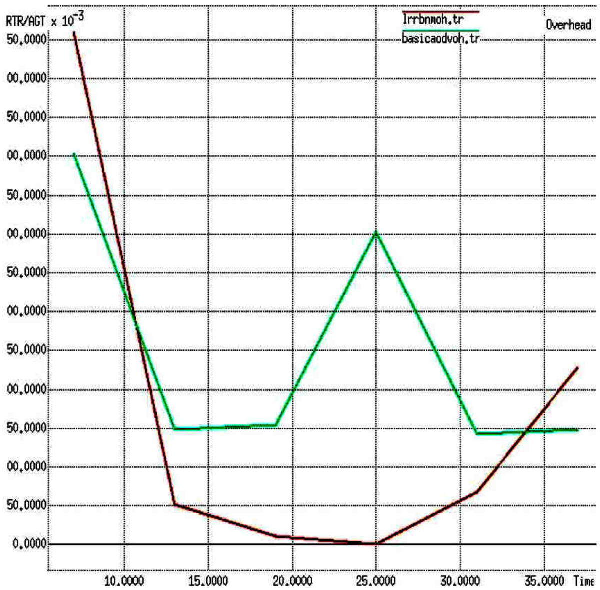

Figure 5. Overhead.

References

[1] C. Perkins and E. Belding-Royer, Ad hoc On-Demand Distance Vector (AODV) Routing, Nokia Research Centre and University of Cincinnati, 2003.

[2] S. J. Lee and M. Gerla, AODV-BR: backup routing in ad hoc networks, Wireless Communications and Networking Conference, Vol. 3, 2000, pp. 1311-1316.

[3] T. Suhua and Z. Bing, A robust AODV protocol with local update, The 2004 Joint Conference of the 10th Asia-Pacific Conference on Communications, 2004 and the 5th International Symposium on Multi-dimensional Mobile Communications Proceedings, Vol. 1, 2004, pp. 418-422.

[4] J. Zhao, Q. Hua and Z. Peng, A new local repair scheme for mobile ad hoc networks, The 12th International Conference on Advanced Communication Technology (ICACT), Vol. 2, 2010, pp. 1316-1320.

[5] C. Richard, C. Perkins and C. Westphal, Defining an optimal active route timeout for the AODV routing protocol, Second Annual IEEE Communications Society Conference on Sensor and Ad-hoc Communications and Networks, IEEE SECON, 2005, pp. 26-29.

[6] W. K. Lai, H. Sheng-Yu and L. Yuh-Chung, AODV-ABR adaptive backup routing for ad-hoc networks, Computer Communications 30 (2007), 453-464.

[7] J. Jeon, K. Lee and C. Kim, Fast route recovery scheme for mobile ad hoc networks, International Conference on Information Networking (ICOIN), 2011, pp. 419-423.