Research Journal of Applied Sciences, Engineering and Technology 8(8): 1036-1040, 2014
DOI:10.19026/rjaset.8.1066
ISSN: 2040-7459; e-ISSN: 2040-7467

Submitted: May 26, 2014 Accepted: June 20, 2014 Published: August 25, 2014

Research Article

A Novel Highly Dynamic Choice Routing Scheme for Mobile Adhoc Network

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Abstract: This study aims to improve the performance of the traditional routing protocol for MANET such as DSR and AODV in terms of delay and overhead. The proposed routing scheme is called as Highly Dynamic Choice Routing (HDCR) which adopts with the highly dynamic environment of MANET. The link residual life is estimated to reduce the link failure before forwarding data through a node. The velocity of the moving mode is considered while choosing the next forwarder node. This enables the HDCR to decrease the delay in the network. The proposed routing scheme reduces routing overhead and reduces the delay. This scheme reduces the link failure too. The performance is evaluated by using the simulation results obtained by using NS2 simulator.

Keywords: Delay, link failure, link residual life, overhead, velocity

INTRODUCTION

MANET is used to exchange the information between the nodes in moving mode. The mobile nodes are connected by wireless links is called as mobile adhoc network. The nodes in MANET are autonomous or independent node. The mobile nodes are transferring the information without the help of any external devices such as routers. Each and every node in MANET is autonomous nodes. They are act as relay nodes to support the transmission of other nodes. The nodes itself act as transmitter, receiver and routers. So, the nodes in MANET called as autonomous nodes. As the topology of the MANET changes dynamically, the MANET is called as infrastructure less network. The link between the nodes also changes dynamically. So, it is hard to transmit the data to the node in a highly dynamic environment. Traditionally, there are several routing protocols developed specifically for MANET such as DSR, AODV and DSDV.

In that the Dynamic Source Routing (DSR) is outperforms than the Adhoc on Demand distance Vector (AODV) routing protocol in terms of throughput. But it is not suitable for the highly dynamic environment. In Thakare and Joshi (2010), the author compared and evaluated the performance of DSR and AODV by using the random way mobility model as a mobility model. In that analysis, they have found that the DSR provides better performance than the AODV in terms of throughput and delay with low mobility speed and less load. But the AODV outperforms than DSR when the nodes are moved with high speed and with more load. The delay is occurred in the DSR due to hostile use of caches and stale routes.

The behavior of the AODV and DSR has studied in Khattak *et al*. (2008). In this study, the author analyses the performance over TCP (Transmission Control Protocol) communication protocol and Constant Bit Rate (CBR) traffic model. The obtained results showed that, the Packet delivery ratio is higher when using TCP and CBR while the delay is high for TCP and low for CBR. With high speed the PDR of AODV is lower than the PDR of DSR. The authors have concluded that the AODV and DSR is outperforms than each other with different traffic patterns.

The performance of AODV and DSR is analyzed in the highly dynamic environment like VANET in Som and Singh (2012). The authors detected that, the AODV provides better throughput than the DSR but the packet loss is high for ADOV. But they have found that they are mostly control packets. The authors concluded that, the AODV provides better performance than DSR in a highly dynamic environment.

In Sapna and Desmukh (2009), the author analyses the performance of AODV and DSR by using Network simulator NS2 with Random way point mobility model. The AODV provides higher throughput than DSR. But the ADOV is suffered by packet loss, delay and overhead as it maintains only route per destination. The AODV, DSR and DSDV routing protocols are analyzed and different parameters are compared in Taksande and Kulat (2011). In that, the author said that, all the routing protocols are performed well under TCP connection rather than UDP because of retransmission is not

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available in UDP. They have concluded that, the DSDV is performed poorly in the mobility environment due to the low coverage time.

From the survey, the DSR is performed well than AODV in the less dynamic environment. But it is not suitable for the highly dynamic environment. So, in this study, the newly proposed routing is used to improve the performance of DSR and make it to adopt with the highly dynamic environment. The proposed routing scheme HDCR is well suited for the highly dynamic environment as it constructs the route dynamically. And reduces the overhead and delay occurred in the network.

PROPOSED METHODOLOGY

The MANET consists of autonomous mobile nodes connected by wireless link to exchange the information. As the topology of the network changes dynamically, the link between the nodes also changes frequently. The node transmits the information to the indented destination directly if the destination is in the transmission range of the source node. If the destination is present out of the transmission range in the sense the source node transmit via intermediate relay nodes. The mobile node itself acts as relay node. There are many routing protocols are available for MANET. All the traditional routing protocols are built the route before transmitting the data to the destination. So, there is a chance to occur a link failure in MANET. Due to link failure in the network, the data never reaches the destination. After that, the source node reconstructs the route to transmit the data. It causes delay and routing overhead in MANET. To overcome this, this study proposes a novel routing scheme is called as Highly Dynamic Choice Routing scheme (HDCR). The HDCR scheme additionally uses the link residual life to construct the route.

The HDCR select the next forwarder node based on the link residual life and the velocity of the node. In HDCR, the source node finds the list of neighbor node. And then chooses the next forwarder node based on the link residual life and the distance to the destination. The source node itself does not know the entire rout to reach the destination. In the proposed scheme, the intermediate relay node is also responsible to reconstruct the route failure. Moreover, there is no chance of link failure in the proposed scheme why because the link residual life is also considered while constructing the route. The delay is reduced in the routing scheme by considering the distance between the current node and the destination node. The proposed routing scheme provides the choice of next forwarder node. The reliability is ensured by reducing the link failure in the network. The following block diagram explains the proposed scheme very well.

Figure 1 explains the concept of proposed routing scheme that is the intermediate process between the source node and destination node to transmit the data. In Fig. 1, the source node intends to transmit the data to the destination node. So, initially, the source node finds out the nodes which are in their transmission range to

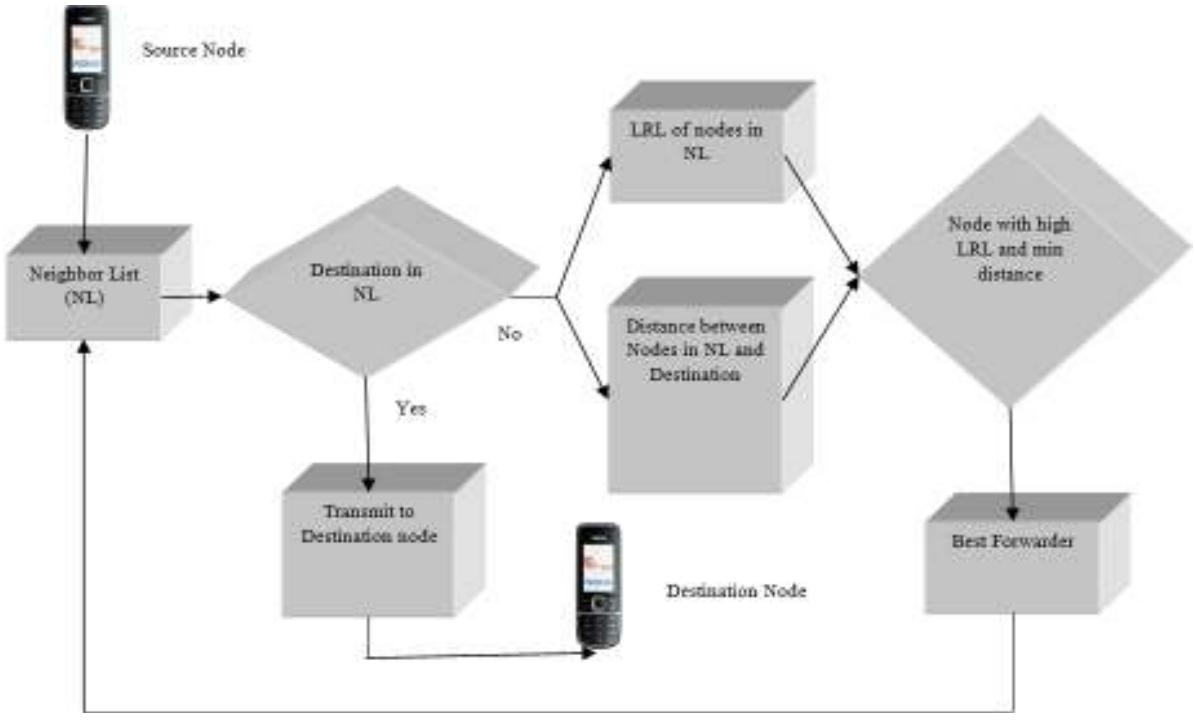

Fig. 1: Block diagram of the proposed scheme HDCR

form the neighbor list. First, it checks that, whether the destination node is present in the neighbor list or not. If it is present in the sense, it will forward the data to the destination directly. Otherwise, it searches for the best forwarder node in the neighbor list by using the following way:

Step 1: Find out the link residual life of the link exists between the source node and the nodes in the neighbor list.
Step 2: Calculate the distance between the nodes in the neighbor list and the destination.
Step 3: Choose the node with high Link Residual Life (LRL) and the min distance as a next forwarder node.
Step 4: Forward the data to the next best forwarder node.
Step 5: Repeat from step 1 until the data packet reaches the destination.

The link residual life is defined as the duration at which the link exists between the nodes. The LRL is calculated by using the following formula:

$$LRL = \frac{Distance}{Relative\ Velocity} \quad (1)$$

Distance indicates that the neighbor (relay) node needs to move to get out of range of the source node. The relative velocity is used to find the direction of the moving node. The relative velocity is calculated by:

$$Relative\ Velocity = {Displacement}/{Time} \quad (2)$$

The distance between the node and the destination should be in the decreasing manner to become a next forwarder node. The proposed routing scheme reduces the routing overhead by reducing link failure. The routing delay also reduced in the network. This have been analyzed by using the simulation results obtained by the network simulator NS2.

SIMULATION RESULTS

The simulation is done by using the simulator NS2. Network simulator is a discrete event time driven simulator. NS2 is open source software which uses C++ and Tool Command Language (TCL) for simulation. C++ is used for packet processing and fast to run. TCL is used for simulation description and used to manipulate existing C++ objects. It is faster to run and change. NS2 is widely used to simulate the networking concepts. The simulation parameter used in the simulation is tabulated in Table 1.

Table 1 describes that, 21 numbers of nodes are distributed in the simulation area 1070×746 m. The mobiles are moving within the simulation area by using the random way mobility model with the speed 5 m/sec. Each and every node has the direct link with the nodes within the range 250 m. The Constant Bit Rate (CBR) traffic model is used to control the traffic flow in the network. The performance or the proposed scheme is analyzed by the parameters throughput, Link duration and delay. And the performance is evaluated by changing the mobility model such as Random way point and city section mobility model.

Table 1: Simulation parameters of RS-OR

Parameter	Value
Simulator	NS2 (Ver. 2.28)
Simulation time	10 msec
Number of nodes	20
Routing scheme	HDCR
Traffic model	CBR
Mobility model	Random way mobility model and city section mobility model
Mobility speed	5 m/sec
Simulation area	800×800
Transmission range	250 m

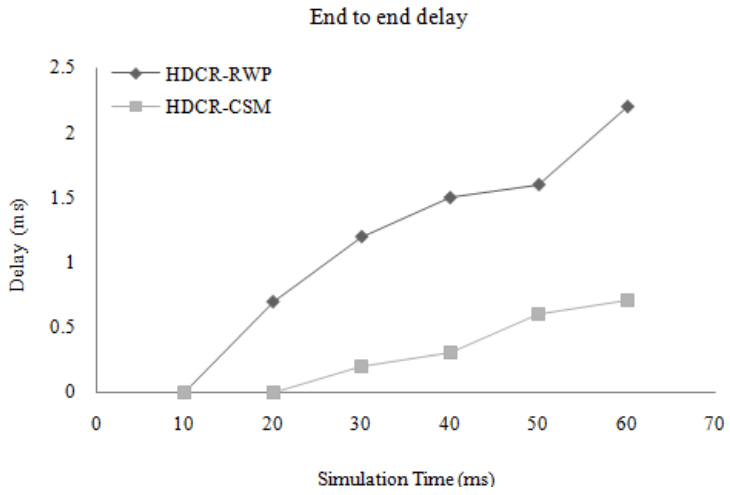

Fig. 2: Delay analysis of HDCR

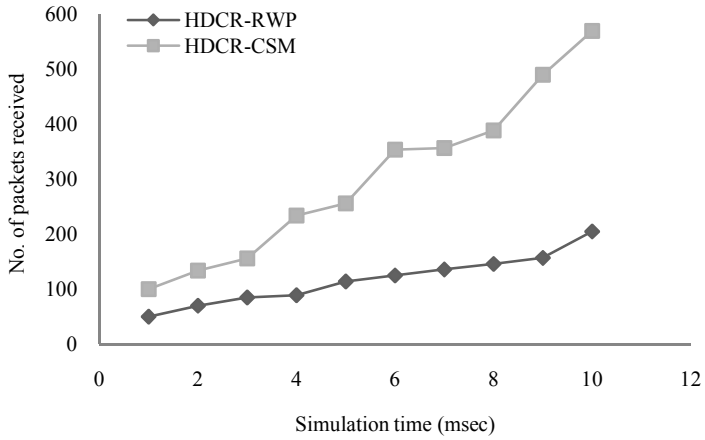

Fig. 3: Throughput analysis of HDCR

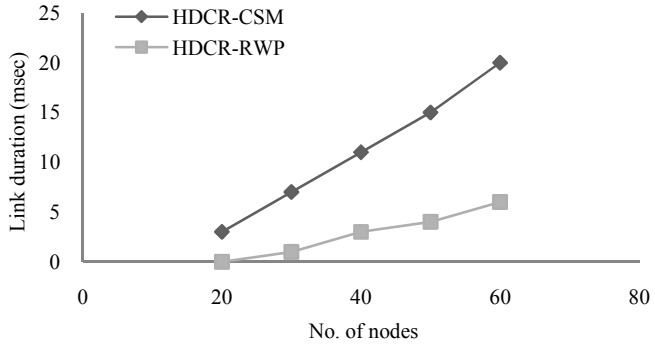

Fig. 4: Link duration analysis of HDCR

The End to End delay is the average time taken by the data packet to reach the destination. The delay is calculated by using the formula (Fig. 2):

$$Delay = Packet\ arrival\ time - Packet\ send\ time \quad (3)$$

Figure 3 shows the graph plotted between the delays occur in the destination verses simulation time. Lower the delay indicates that the high performance of the proposed scheme.

The throughput indicates that the amount of work done per unit time. In the proposed scheme, the throughput indicates that, the amount of data delivered per unit time. The throughput is calculated by using the following formula:

$$Throughput = \frac{Number\ of\ packets\ received}{Time} \quad (4)$$

Figure 3 explains that the proposed scheme HDCR provides better performance while using City section mobility model.

Figure 4 shows that, as the number of node increases the link between the nodes exists for long duration. The proposed scheme outperforms in the city section mobility model than Random way point mobility model.

CONCLUSION

In this study, a novel routing scheme is proposed to adopt the routing protocol for the highly dynamic MANET. The link residual life and velocity of the moving node plays a very important role while constructing the path to reach the destination. The proposed scheme outperforms than the existing scheme in terms of routing overhead, delay, reliability and link failure.

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