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Delay Sensitive Packet Scheduling Algorithm for MANETs by Cross Layer

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Abstract --The delay sensitive packet scheduling and routing algorithm to effectively deliver delay sensitive data's over a multi-hop networks. First packet urgency, node urgency, route urgency are calculated on the basis of end-to-end delay requirements. Based on these urgency metrics, the proposed packet scheduling algorithm determines the transmission order of each packet to minimize the node urgency without unnecessary packet drop, and the proposed routing algorithm establishes a route to minimize the derivatives of route urgency in order to maximize the number of packets delivered within the required end-to-end delay. Finally experimental results are presented to evaluate the performance of the proposed joint working algorithms.

Keywords: Packet scheduling algorithm, Routing Algorithm, Mobile Ad-hoc Networks, Delay sensitive data

I. INTRODUCTION

Mobile ad-hoc networks connect a set of mobile nodes by using wireless links. These MANET nodes are self-configuring and don't require a centralized infrastructure to communicate with each other. In recent years, the demand for various multimedia applications such as video conferencing, surveillance system, and video on demand service over Mobile ad-hoc networks has been growing rapidly. However, it is not easy to support the data transmission within the end-to-end delay requirements over MANETs. If interference [1] occurs among the nodes over multi-hop networks, then the data may loss. The topologies of the networks always get changed by the mobility of nodes. The packet scheduling and routing algorithms are the important factors for improving the QoS [10] parameters over the MANETs. Cross-layer protocol interactions, when used appropriately, can lead to increased network efficiency and better QoS support. A Cross-Layer Design (CLD) is particularly important for any network using wireless technologies, since the state of the physical medium can significantly vary over time. Perhaps information exchange between different layers can even optimize the network throughput. Cross layer feedback means interaction of a layer with any other layer in the protocol stack. A layer may interact with layers above or below it.

The routing algorithm establishes a route from the source to destination to efficiently deliver the data. The ad-hoc routing protocols are categorized into three types. They are Table driven, on demand and Hybrid protocol. Table driven protocol is a proactive protocol. Based on the periodically exchanging of routing information between the different nodes, each node builds its own routing table which it can use to find a path to a destination. Examples of the table driven protocols are Destination sequenced distance vector routing protocol (DSDV) [2], Wireless routing protocol (WRP). On demand routing protocol is reactive protocol. This type of protocol finds a route on demand by flooding the network with route request packet. Example of on demand routing protocols are dynamic source routing protocol (DSR), Ad-hoc on demand distance vector routing protocol (AODV) [3] and temporally ordered routing protocol (TORA) [8].

The Dynamic source routing algorithm (DSR) is to routing in a MANET in which nodes communicate along paths stored in source routes carried by the data packets. The temporal ordered routing algorithm is a highly adaptive loop-free distributed routing algorithm based on the concept of link reversal. It is source initiated and provides multiple routes for any desired source/destination pair. To accomplish this, nodes need to maintain routing information about adjacent nodes. AODV provides loop-free routes even while repairing broken links. Because the protocols do not require global periodic routing advertisements, the demand on the overall bandwidth available to the mobile nodes is substantially less than in those protocols that do necessitate such advertisements. Hybrid protocol is both reactive and proactive protocol. Zone routing protocol (ZRP) is the example of hybrid routing protocol.

The packet scheduling algorithm [4] determines the order of transmission packets. An earliest deadline first (EDF) scheduler determines the packet transmission order by considering the arrival time and end-to-end delay [9] requirement of each packet. In a coordinated multi-hop scheduling (CMS) [5], the transmission priority of a packet at each node is recursively expressed using the transmission priority of the same packet at the previous node along the route. The proposed packet scheduling algorithm determines the transmission priority of each packet based on the packet urgency. In this paper we propose a delay sensitive packet scheduling and routing algorithm [7] to deliver the delay sensitive data without any delay.

Packet scheduling algorithm in MAC Layer and Routing algorithm [12] in Network layer are tightly coupled based on the urgency metrics [6] to effectively deliver delay sensitive data over MANETs.

II. PROPOSED PACKET SCHEDULING ALGORITHM

Our objective is to deliver delay-sensitive data packets and to distribute the traffic load across the entire network within the end-to-end delay requirements over multi-hop [11] MANET. To achieve this objective, urgency metrics are defined.

DEFINITION OF PACKET URGENCY

The packet urgency $\left(u_{pt}(t)\right)$ at the j^{th} node along a route $\left(\vec{R}\right)$ at time t is defined as

$$U_{pt}(t) = f_{urg}\left(\frac{d_{res}(t)}{D_{\mathrm{mx}}}\right) \qquad \text{Where } d_{res}(t) = D_{\mathrm{ma}} - d^{j}{}_{acc}(t)$$

D_{mx} Is the maximum tolerable end-end delay, $d^{j}{}_{acc}(t)$ is the cumulative delay from the source node to j_{th} node, and $d_{residual}(t)$ is the residual delay to satisfy the end-to-delay requirement over the remaining hops. A packet with a smaller $d_{res}(t)$ should be transmitted more urgently for delivery to the destination in time.

DEFINITION OF NODE URGENCY

The node urgency $\left(u_{node}(t)\right)$ is defined as the sum of packet urgency of all the packets in the buffer.ie,

$$u_{node}(t) = \sum_{i=1}^{n_{pkt}} u_{pt(i)}(t)$$

Where n_{pt} is the number of packets in the buffer and $u_{pt(i)}(t)$ is the packet urgency of the i^{th} packet in the buffer. Larger node urgency shows that more urgent packets in the buffer.

DEFINITION OF ROUTE URGENCY

The route urgency ($u_{route}(\mathrm{t})$) is the defined as the sum of node urgency of all the nodes along the route $\vec{R}$, i.e.

$$u_{route}(t) = \sum_{j \in \vec{R}} u_{node(j)}(t),$$

Where $\vec{R}$ denotes the route including all intermediate nodes, and $u_{node(j)}(t)$ is the node urgency of the j_{th} node along the route. The route with minimum route urgency is selected as the target route for the data transmission.

DETERMINING THE ORDER OF TRANSMISSION

Each packet's transmission priority is determined using its packet urgency and wireless link [9] condition. To minimize node urgency packets with high transmission priority are transmitted first and then the load transmission priority packets. In this proposed algorithm data packet's transmission priority is calculated according to the variation of node urgency.

III. MODIFIED AODV ROUTING ALGORITHM

The advantage of the proposed routing algorithm is that the route is established to maximize the number of arriving packets at destination in time.

ROUTE CONSTRUCTION

In the proposed routing algorithm, the route construction is similar to AODV but the additional information is included in the RREQ packet header. A source node floods an RREQ packet only when a route is needed. When an intermediate node receives the RREQ packet, it recalculates the derivative of route urgency over the route by adding its node urgency derivative, and then updates the RREQ packet.

The intermediate node rebroadcasts only the updated RREQ packet to its neighbor nodes for an interim route with the minimum derivative of the route urgency in order to reduce the number of RREQ packet. These steps are repeated until the route request RREQ packet receives destination point. When route request packet arrives at the destination node, the route with minimum derivative will be selected, and then a RREP packet for selected route is sent back to the source node. The obtained route is optimal and derivative of route urgency without loss of generality.

EXAMPLE OF ROUTE SELECTION

The figure no.1 shows route selection mechanism. A source node 1 floods an RREQ packet for the route discovery to a destination node 8.when the intermediate node receives the RREQ packet, it rebroadcasts the updated RREQ. when RREQ packets arrive at the destination node through the routes {1,2,3,4,5,8} and {1,5,3,4,8} and {1,6,7,8}, the destination calculates the route urgency of these routes.

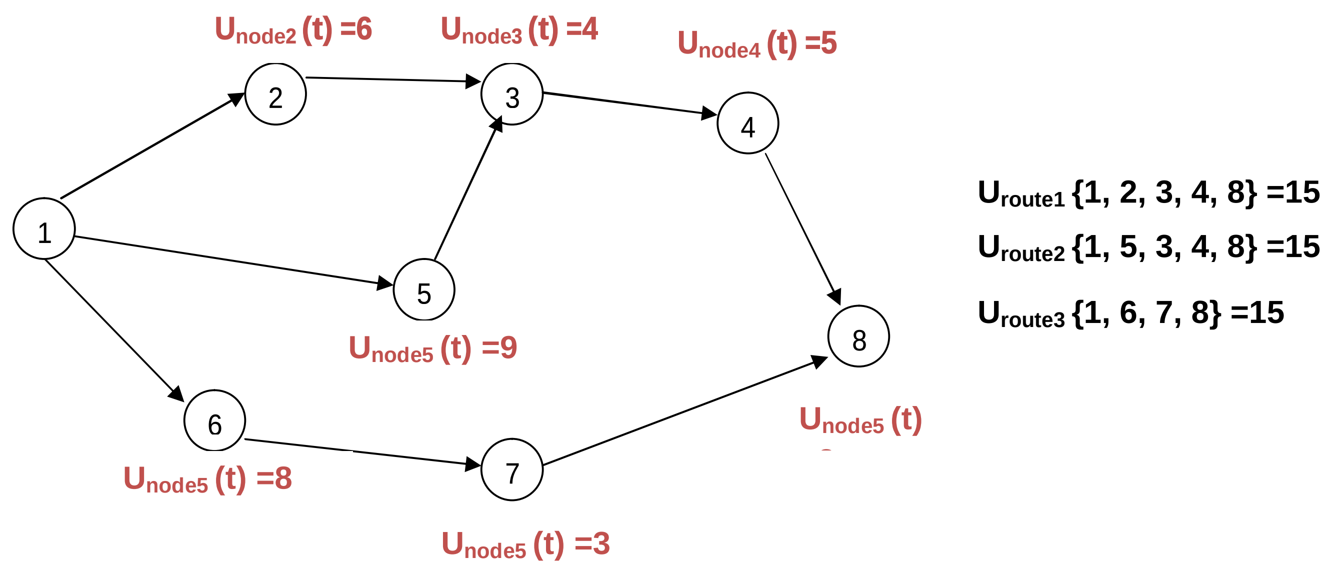

Figure No.1

The route with the minimum route urgency is selected as the appropriate route for the data transmission. Through the selected route, more number of delay sensitive packets is delivered at the destination

IV. ARCHITECTURE OF PROPOSED JOIN WORKING ALGORITHM

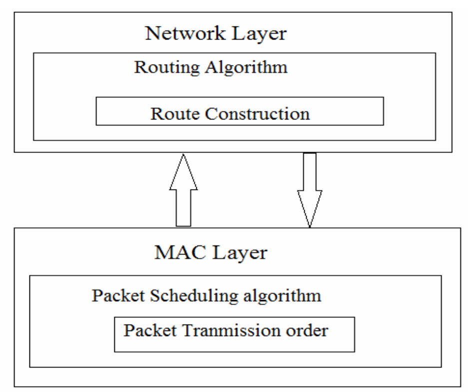

Figure No.2

ROUTE MAINTENANCE

If there are frequent packet drops along a route the dynamic route is maintained for effectively deliver the delay sensitive data. The route is maintained based on the signal strength of each flow and packet drop rate of each flow. If the source node desires a new route after receiving the RERR packet, it can reinitiate the route construction mechanism. If the number of dropped packets for the selected flow is below a Pre-determined threshold, a node realizes that the current routes passing through it are suitable for delay-sensitive data transmission.

V. EXPERIMENTAL RESULTS

The figure given below shows the comparison between the performance of the AODV routing algorithm and Modified AODV routing algorithm. Figure no.3 shows maximum number of packet arrival rate in the proposed algorithm. Figure no.4 shows the minimum end-to-end delay to improve the Qos.

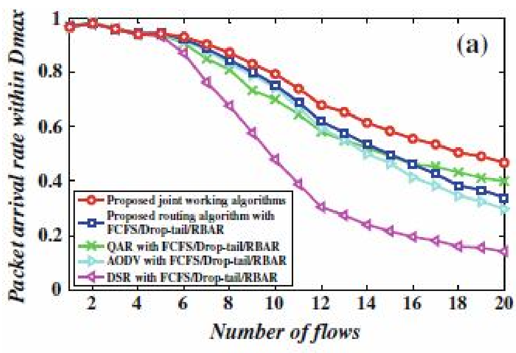

Figure no.3 Packet arrival rate

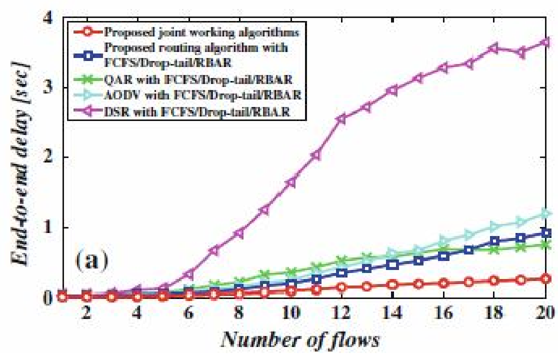

Figure no.4 End-to-End Delay

VI. CONCLUSION

The proposed delay scheduling algorithm is to effectively deliver the delay sensitive data over the MANETs without any delay. These algorithms are developed based on the urgency metrics such as packet urgency, node urgency, and route urgency to improve the QoS parameters. The modified routing algorithm is to deliver the delay sensitive data more urgently for delivery at the destination. The scheduling algorithm in MAC layer and routing algorithm in Network layer is tightly couple on the basis of urgency metrics. The algorithm is to maximize the number of arriving packets at the destination to improve the throughput of the network.

REFERENCES

1. M.S Corson, S. Batsell and J. Macker, "Architectural considerations for mobile mesh networking, working draft", May 1996.
2. D. Johnson and D. Maltz, "Dynamic source routing in ad-hoc wireless networks, T. Imielinski and H. Korth", 1996.
3. Perkins, C., Belding-Royer, E., & Das, S. (2002). "Adhoc on-demand distance vector (AODV) Routing", IETF RFC 3561, July 2002.
4. Kanika Garg, RishiPal Singh, "Scheduling Algorithms in Mobile Ad Hoc Networks", July 2012.
5. Li, C., & Knightly, E. (2002). "Coordinated multihop scheduling: A framework for end-to-end services", IEEE/ACM Transactions on Networking, 10(6), 776–789.
6. Ryu, S., Ryu, B., Seo, H., & Shin, M. (2005). "Urgency and efficiency based packet scheduling algorithm for OFDMA wireless system", IEEE International Conference on Communications (ICC) (pp. 2779–2785), May 2005.
7. Murthy, S., & Garcia-Luna-Aceves, J. J. (1996). "An efficient routing protocol for wireless networks", ACM/ Baltzer Mobile Networks and Applications.
8. Park, V. D. & Corson, M. S. (1997) "A highly adaptive distributed routing algorithm for mobile wireless networks",IEEE International Conference on Computer Communications (INFOCOM), Apr. 1997.
9. Carvalho, M. M., Garcia-Luna-Aceves, J. J. (2003). "Delay analysis IEEE 802.11 in single-hop networks", IEEE International
10. Haseed Zafar, David Harle, "QoS-aware Multipath Routing scheme for Mobile Ad Hoc Networks", April 2012.
11. Liang, B., & Dong, M. (2007). "Packet prioritization in multi-hop latency aware scheduling for delay constrained communication", IEEE Journal on Selected Areas in Communications, 25(4), 819–830.
12. Y. Chen, Y.Tseng, J.Sheu, P.Kuo, "On-Demand, Link- state, Multi-Path QoS Routing in a Wireless Mobile Ad Hoc Networks", February 2002.

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