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# Enhancing OLSR Routing Protocol to Assure QoS in MANET.

KEYWORDS: MANET, Proactive protocol, Reactive protocol, OLSR protocol, Quality of service, MPR, NS2 simulator.

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**ABSTRACT** In this paper we propose an approach to improve the quality of service (QoS) routing in the optimized link state routing (OLSR) protocol. The protocol is based on the link state algorithm and it is proactive in nature. The OLSR protocol generally operates in a best effort mode by finding the shortest path between a source and destination without any quality of service consideration.

We debate that an optimal path is not always the shortest path, and based on the network configuration and routing load, end to end delay, other alternatives such as a longer path with a high bandwidth may be a good consideration. To provide such alternatives and improve the communication quality among end users, our approach propose to perform at each 1-hop neighbour selected with maximum bandwidth and 2-hop neighbour selected with maximum number of degrees. Results from our proposed mechanism achieve a higher performance than the standard OLSR used in mobile ad hoc wireless network.

## I. INTRODUCTION

The wireless network is the one of the main research area currently carried out widely because of its ubiquitous features and provision of the pervasive computing by including standards, services, tools and protocols. There are two kinds of approaches: infrastructure and infrastructure less approaches, to enable wireless mobile unit to communicate to each other .In infrastructure network base station are the bridges, a mobile host will communicate with the nearest base station and also handoff is taken when a host roams from one base to another. When in infrastructure less network no fixed base station and it will quickly and unpredictably changing topology. [1]

A Mobile Ad hoc Network (MANET) consist of multiple mobile nodes which share an open transmission medium and the same available bandwidth. Nodes in MANET are autonomous, self-organized and self-configured with no need for any pre-existing infrastructure or any centralized control system and have the ability to be immediately deployed when required. Each node in MANET acts as both an end system and a router by forwarding data packets through the network.

Routing is one of the most important aspects of all network activity including discovering the topology and delivering messages needs to be carried out by the nodes themselves. There are two main approaches to this: proactive routing and reactive routing. Proactive or table-driven routing maintains an up to date list of destination and routes by distributing routing tables periodically throughout the network, resulting major overhead due to the amount of data being transmitted throughout the network and the time taken for changes in the network to be realised. Reactive or on-demand routing on other hand finds routes on demand by flooding the network with request packets known as RouteRequests, resulting in longer latency due to the time taken for routes to be found and the potential for routing overhead when frequent route discoveries are required. [2]

The unpredictability of the environment, unreliability of the wireless device, resources constraints on the nodes, transmission errors, node failures, link failures, route breakages, and congested nodes or links are major challenges in MANET. Most of the nodes that are part of a MANET often rely on batteries or other exhaustible means for their energy. For nodes like this, the most important criteria when designing a fully optimised system may be energy conservation. As nodes in a MANET are distributed to an area that is greater than the radio scope of an individual node, routing protocols are required to facilitate the connectivity between nodes. [2]

In extreme circumstances like forest fires, earth quakes, floods and terrorist attacks, the ability to construct a network topology immediately has a significant effect on how well the rescue terms are able to co-ordinate with each other. An emergency MANET is ideal for such scenarios because it is based on protocols that behave in a distributed way, allowing a quick response to rapid changes in network topology such as nodes joining or leaving the network. MANET technology is also utilised commercially through electronic payment systems and vehicle-to-vehicle communication.

## II. BACK GROUND THEORY OF OLSR

The IETF MANET Working Group introduces the Optimized Link State Routing (OLSR) protocol for mobile ad-hoc networks. The protocol is an optimization of the pure link state algorithm and proactive (table-driven) in nature. It employs periodic exchange of messages to maintain topology information of the network at each node. OLSR is an optimization over a pure link state protocol as it compacts size of information sent in the messages, and furthermore, reduces the number of retransmission to flood these messages in entire network. The key concept used in the protocol is that of multipoint relays (MPRs). The MPR set is selected such that it covers all nodes that are two hops away. [3]

MPR selection is key point in OLSR. The smaller the MPR set is the less overhead the protocol introduces. The MPR selection is to iteratively select a 1-hop neighbor which reaches the maximum number of uncovered 2-hop neighbors as MPR. If there is a tie, the one with higher degree(more neighbors) is chosen. [3]

Table 1 shows how node X selects MPR(s), based on the network depicted in Figure 1:

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**Table 1: MPR selection in OLSR**

| Node | 1 Hop Neighbors | 2 Hop Neighbors | MPR(s) |
|---|---|---|---|
| B | A,C,F,G | D,E | C |

From the position of node B, both C and F cover all of node B's 2-hop neighbors. However, C is selected as B's MPR as it 5 neighbors while F only has 4 (C's degree is higher than F).

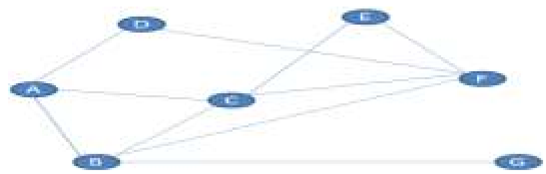

**Figure 1: Network example for MPR selection [3]**

In OLSR the optimization is done in two ways: first by reducing the size of control packets and second is by reducing the number of links that used for forwarding link state packets. First, it reduces the size of control packets instead of all links, it declares only a subset of links with its neighbors who are its MPR selectors. Secondly it minimizes flooding of this control traffic by using only the selected nodes called MPR. Only the MPR of a node retransmit its broadcast messages, this technique significantly reduces the number of retransmission in a flooding or broadcast procedure. OLSR protocol perform hop by hop routing each node uses its most recent information to route a packet, so when node is moving its packets can be successfully delivered to it.

### A. Types of Flooding

**Classical flooding** **MPR flooding**

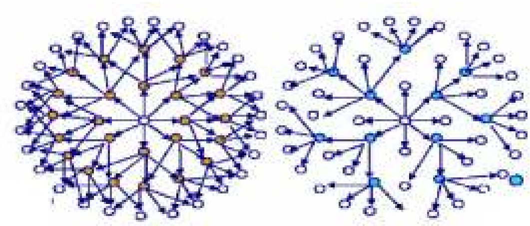

**Figure 2: Flooding in OLSR protocol**

In OLSR there are mainly two types of flooding process first one is classical flooding and second one is MPR flooding.
In classical flooding there is each node selects a subset of nodes in its neighborhood which retransmit its message, and in MPR flooding there is each node retransmits only messages received from the nodes inside its MPR selector set.

### A. MPR selection

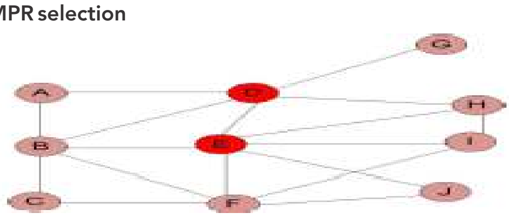


**Figure 3: MPR selection process. [4]**

In MPR flooding messages using MPR nodes reduces significantly the induced overhead, compared to classical flooding mechanism, due to following rule: an MPR node relays a message if and only if: 1) it hasn't already received it, 2) it just received it from a node which belongs to its MPR selectors set. Above figure shows illustrating the MPR set selection mechanism. The node for which want to compute the MPR set is B, the set of B's 1-hop neighbors is A, C, E, D, F. The set of B's 2-hop neighbours is G, H, I, J. Then, to reach this set we can pass through the nodes belonging to one of the following subsets: {D,E}, {D,F} or {D,E,F}.Since we have minimum sub set which are {D,F} and {D,E}, then the chosen MPR set of B is {D,E} because E is higher connectivity than F. [4]

### I. CHALLENGES IN OLSR PROTOCOL

The main challenge in OLSR is its lack of mechanisms that allow it to provide QoS guarantees, which makes it unable to find the optimal route that satisfies the QoS requirements of a given traffic flow. Moreover, we cannot apply this heuristic in QoS routing for MPR selection in OLSR due to their selection criteria which is the number of hops. This criterion may hide the good quality links to other nodes. [4]

In link state routing requires the topology database to be synchronized across the network, open shortest path finding perform topology flooding using a reliable algorithm.

### II. PROPOSED MECHANISM

In this section, we present our approach that aim to find best route that guarantees the QoS requirement from the source to destination node using bandwidth fair-share estimation between adjacent nodes and also choosing instead of shortest path, we try to find the path with highest bandwidth for all 1-hop neighbors and find the 2-hop neighbors with maximum connectivity degree.

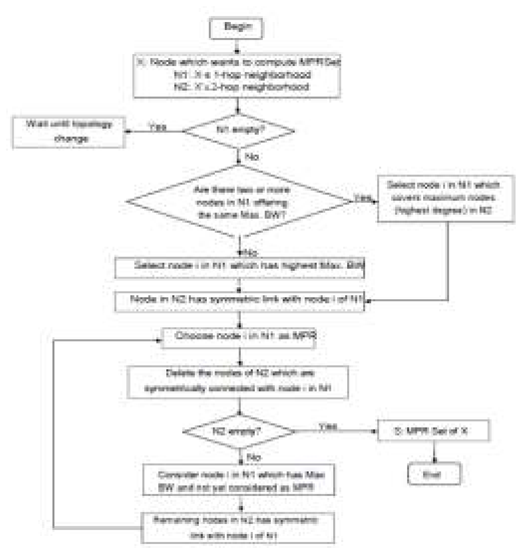


**Figure 4: Flowchart of MPR selection with bandwidth and connectivity degree constraints**

In our proposed algorithm flowchart shows that, let us assume that X is a node which wants to compute MPR set N1 is a set of X's 1-hop neighbourhood and N2 is a set of X's 2-hop neighbourhood, there are two conditions if set of N1 neighbourhood is empty then its waits until topology

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changes then its compute with X and else N1 is not empty then its clarify that if there are two node offering same bandwidth then it select node i N1 which covers maximum nodes(highest connectivity degree) in N2 neighbourhood, otherwise it select node i which has highest bandwidth. Now node in N2 has symmetric link with node i of N1 then choose node i in N1 as MPR nodes and delete the nodes of N2 which are symmetrically connected with node i in N1.If set node N2 is empty then it set to MPR x else consider node i in N1 which has maximum bandwidth and not yet considered as MPR, remaining nodes in N2 has symmetric link with node i of N1, otherwise choose node i in N1 as MPR.

OLSR protocol has its own timeout period for rebroadcasting message to check N1 neighbours. As we have through of MANET where mobile nodes moves, I consider that no node would remain idle without performing communication. In case of long time waiting it is presumed that other node does not move.

Mac protocols in data link layer e.g. MACA, IEEE 802.11 are having bandwidth estimation capability & using NS2 we can get estimated bandwidth value by MAC protocols.

QoS depends on bandwidth, so if proposed mechanism selects higher bandwidth paths, then automatically quality of data improves. QoS depends on high bandwidth paths rather than shorter paths.

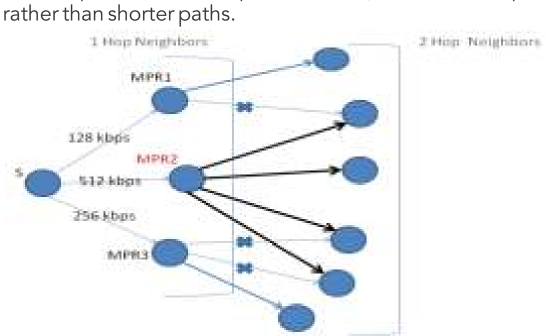


**Figure 5: Proposed algorithm figure with MPR selection based on bandwidth and degree**

In figure shows that MPR selection based on our proposed mechanism, with 1-hop neighbours selected maximum bandwidth and 2-hop neighbours selected with maximum number of connectivity degrees. 1-hop neighbours are stronger in terms of band width.

Let, assume node S as source node and its 1-hop neighbours are selected as MPRs 1, 2, 3. With bandwidth, MPR1 has 128kbps, MPR2 has 512kbps and MPR3 has 256kbps. Then MPR1 is select 2-hop neighbours with bandwidth sharing, also MPR2 and MPR3 selects its 2-hop neighbours on their bandwidth. In our proposed algorithm that MPR2 has highest bandwidth so it covers more 2-hop neighbours (connectivity degree) then other two MPRs. In figure shows that MPR2 has cover 4 four 2-hop neighbours so it is select as MPR selector and other two MPR connected with 2-hop neighbours which is overlapping with MPR2, delete that nodes of MPR1 and MPR3 which are symmetrically connected with MPR2.

## V.SIMULATOR ENVIRONMENT OR PLATFORM

We introduce some popular Network Simulators, such as NS2, SWANS, OPNET, etc. All the networking simulators described here support performing simulations with mobile wireless nodes. Generally a mobility simulator is used to produce node movement traces that are then fed to the network simulator.

NS2 is open-source discrete event network simulator that supports both wired and wireless networks, including most MANET routing protocols and an implementation of the IEEE 802.11 MAC layer. As mentioned earlier, NS2 has an implementation of the random trip mobility model. NS2 simulates the physical layer and the important parameters that influence its behavior. NS2 is most widely-used simulator for networking research. [5]

Usually, NS2 takes one input file written in the scripting language TCL. In this input file, researcher normally has to specify the following: an instance of NS simulation, initiating global variables, setting topology, configuring simulation nodes, assign scenes, defining connection and movement, point the simulation end time. [5]

## VI.CONCLUSION

In OLSR, the MPRs are usually chosen based on their degree of connectivity to adjacent nodes, so this MPR selection scheme doesn't provide any guarantee of QoS requirements especially for real time and multimedia applications. To overcome this drawback, we proposed novel MPR selection scheme that combine both of the connectivity degree and offered bandwidth ensure higher QoS guarantees. If two MPRs offer same bandwidth then the connectivity degree is used to select one of them as MPR node.

In future we will try to simulate the our proposed algorithm in NS2 and find the best bandwidth share estimation and also decreasing the routing load, end-to-end delay, also improving throughput and number of packet sent, received and routed.

**REFERENCE**

[1] Sanguankotchakorn.T, Wijayasekara. S. K, Sugino. N, "A Cross-layer design approach in OLSR MANET using BER and Weighted Connectivity Index", 19th IEEE International Conference on Networks, 2013 (ICON 2013), pp. 1-6. | [2] Al-Rokabi. A, Politis.C, "SOAP: A Congnitive Hybrid Routing Protocol for Mobile Ad-hoc Networks", 9th IEEE International conference on Cognitive Radio Oriented Wireless Networks and Communications (CROWNCOM 2014), pp. 353-359. | [3] Ying Ge, Kunz. T, Lamont. L, "Quality of Service Routing in Ad-Hoc Networks Using OLSR", Proceeding of 36th Annual Hawaii international conference on System Sciences, 2003, Paper (31), Patents (2) | [4] Moad. D, Djahel. S, Nait-Abdesselam. F, "Improving the quality of service routing in OSLR protocol", International Conference on Communication and Information Technology (ICCIT 2012), 2012, pp.314-319 | [5] Goungjun Yan, Khaled Ibrahim, "Basic simulators for wireless ad-hoc networks", computer science department, Norfolk, VA 23529. | [6] C. Siva Ram Murthy, B. S. Manoj, " Ad Hoc Wireless Networks: Architectures and Protocol", Prentice Hall PTR Upper SaddleRiver, NJ, USA©2004. | [7] Pompeo Silva Mineiro. E, Muchaluat-Saade. D. C, "Admission Control for QoS Provision in Wireless Mesh Networks", Latin America Transactions, IEEE (Revista IEEE America Latina) , vol.10, no.1, pp.1135-1142, Jan. 2012 | [8] Cervera. G, Barbeau. J, Gracia-Alfaro. J, Krankis. E, "A Multipath Routing Strategy to Prevent Flooding Disruption Attacks in Link State Routing Protocol for MANETs", ELSEVIER, Vol. 36, no. 2, pp. 744-755, March 2013 | [9]Anand. D, Faizul Islam. A. M, Heydari. S. S, Rahman. M. M, "OLSR-Based Topology Discovery for Mobile Situational Awareness Systems", ELSEVIER,, Vol. 5, pp. 418-425, May 2011