

A study on increasing Wireless Mesh Network performance by routing in advance using cross layer design

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Abstract: Wireless Mesh Networks routing standard has not been yet finalized which brought numerous proposals for routing protocols. Regardless the different protocols, the routing process occur at a specific layer called internet layer in TCP/IP, where every packet has to route for its path to destination, therefore an estimated time of milliseconds is to be consumed on every routing process. This paper applies cross layer design to route in advance and prepare a ready path for the packets on the time of its arrival for routing, so the packet saves the time needed on finding its path. The idea is to send a copy of the destination IP address from application layer to the internet layer a head of its time to be delivered for path routing, in order to conduct a routing path for the packet while the original packet along with the original IP address passes the rest of the layers and complete the TCP/IP layering procedure. The work proposes that when a packet reaches the internet layer a routing path should be available and no time is wasted for path routing.

Keywords: WMNs, Cross Layer, Routing Protocols, TCP/IP, Path Routing.

I. INTRODUCTION

Wireless Mesh Network is a desirable wireless technology to use in various environments such as organizations, companies, traffic signals etc. The flexibility of its topology makes it a great wireless network, the possibility of expanding the network at low cost increases the chances of having WMN adapted by several users, governments, and internet providers. Wireless Mesh Networks have received number of routing proposals and routing protocols during the last few years, some of these protocols goals were to increase the performance of the data rate transfer but other protocols proposed to reduce the delay of route discovery. Routing in wireless mesh networks has been a hot research area in recent years, with the objective to achieve as high throughput as possible over the network. The main methodology adopted by most of the existing work is selecting path based on interference-aware or load-balancing routing metrics to reduce network-wide channel contentions [1]. In this work different method is proposed, the method is to use the existing protocols in finding the path for the packets, at the same time cross layer design shall be applied in order to pass some layers and reach from one nonadjacent layer to another layer in a direct communication process, eventually by applying cross layer design we can route with any selected protocol that may be suitable to the design but the main advantage is that we route in advance and get the path ready for the packet when it reaches the routing process stage at internet layer. Cross-layer design is one of the emerging themes in recent studies that researchers are exploring to optimize the performance in wireless networks [2]. Cross layer design defines new rolls for the OSI model and TCP/IP these rolls can be distributed in multiple manners based on certain

researches and hypotheses in order to overall the limitation of data exchange among layers. Wireless Mesh Network can have a great optimization process but different scenarios must be obtained to evaluate the expected results and apply effective methods.

II. RELATED WORK

Routing protocols aim to provide good quality paths that may be used to transport traffic from a source node to a destination node [3]. To provide strict quality of service (QoS) requirements of the applications and to create application protocols for managing distributed information sharing in WMNs, the protocols in the lower layers need to work interactively with the application layer. This requires a cross-layer approach through information sharing among application, transport, routing, medium access control and physical layers. In this way, the deployed WMN can be self-adaptive to network dynamics and meet end-to-end real-time deadlines of the applications [4]. Routing protocols in wireless mesh networks can be divided into two categories: proactive and reactive [5], each category maintains various routing protocols.

Proactive protocols involve a situation where network nodes continuously maintain one, or a number, of routing tables that store routes to each of the nodes of a network and, at the same time, recurrently send them along the network to exchange and update information in neighbouring nodes. Reactive protocols, in turn, receive information on the route to the destination (node) of a packet only at the moment when data transmission is to be

effected (on demand) [6]. Eventually routing in WMNs is one of the primary functions, which achieve network functions at any point of time. Routing enables connections between nodes those are not within each other [7].

III. SELECTED ROUTING PROTOCOLS IN WMN

Comparison of all protocols in WMNs is not preferable due to many reasons, but some of the protocols can be discussed according to their characteristics, features and methods used to apply these protocols, understanding different types of routing protocols bring knowledge on how each protocol can operate and up to which level the improvement could be limited. Therefore we discuss three different protocols for WMNs.

- 1) DSR: dynamic source routing algorithm is a widely famous and used protocol, it works by sending the packets which contain the destination address, the source address and its unique ID to each of its neighbours, any node receives the packet and it is not a destination node, it sends the packet to the address found in the packet also it add its own address to the packet. So the packet that reaches its destination would have information on the end to end path which obviously can be used to find the path for other packets. Also intermediate nodes gather information on each destination.
- 2) LQSR: link quality secure routing protocol is a protocol based on the DSR protocol which was proposed by Microsoft group. In this protocol congestion control is maintained to increase the throughput and perform a load balancing. The LQSR does not use end to end parameters but instead it uses single link parameters, a quality matrix is used to determine individual links. This protocol assures a links quality services but developers thought it needs to be far improved as it does not provide scalability also WMNs topology should be more under consideration. As a result another routing protocol was proposed called ML (LQSR).
- 3) RMR: the ring mesh routing protocol is based on a Token ring protocol that secure the WMNs services with huge number of hops, in fact these rings are emerged to maintain unharmed and assured services. The ring which passes packets directly to the gateway acts as root ring where other rings are considered as child to the gateway ring.

Protocol Name	Protocol Type	Routing protocol
DSR	Reactive	Hope count based
LQSR	Reactive	Link level based
RMR	Proactive	End to end QoS

Table 1: shows the characteristics of the selected protocols

IV. PROPOSED WORK

This work presents an optimization process for Wireless Mesh Network by taking advantage of the cross layer design, the design states that the payload travels the layers one by one in its normal architecture without any changes, but a copy of the destination IP address is required to perform the procedure of information exchange at early stage. In the normal way of information exchange, a packet is suppose to reach the internet layer of the TCP/IP then starts routing (finding its path to destination). Nevertheless, path routing possesses various protocols initiated to mount the path. This design intends to use the help of cross layer design to optimize the speed of data movements in the stack. A routing process is meant to be executed first by assigning the path using the IP address which was forwarded from the application layer to the internet layer at the time of dispatching the data transfer order (email, videos etc), when payload reaches the internet layer the path shall be ready for the packet, so it fetches the routing path (Map) and continue to complete data transfer in next layer. The buffer or the forwarding table shall hold the ready path instead of making a queue in the buffer for the packets to start their routing process.

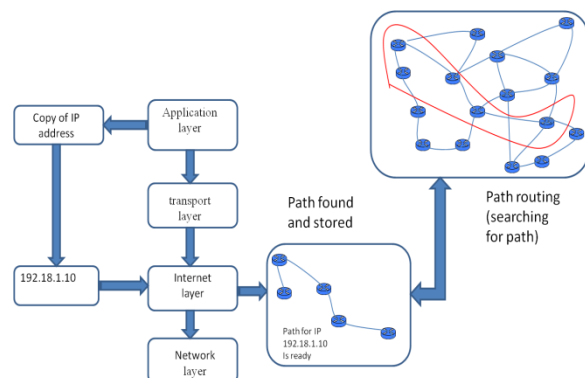


Figure1: shows the process of finding and storing the path before packets reach internet layer.

V. CONCLUSION

This work presents a design to increase the performance of wireless mesh network by applying the cross layer. At the time of executing the order for data to be transferred from source to destination, an IP address of the destination is obtained by application layer along with the data packet, this work establishes a new method which is to use the IP address by capturing a copy of it and transfer it to internet layer. A process of path routing takes place before the data packet (segment) arrives to internet layer.

When the segment reaches a path is found ready and no need to wait for path routing. Therefore the Wireless Mesh Network utilizes the time spared out of the path routing process and increases its performance. Furthermore this work discussed three different types of routing protocol to gain more understanding on how protocols vary from each other and how the proposed design can possibility operate on different scenarios.

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BIOGRAPHIES

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