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Authentication of Secure Data Transmission In Wireless Routing

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ABSTRACT
The major objective of our work is to explore a security enhanced dynamic routing algorithm based on distributed routing information widely supported in existing wired and wireless networks. The message authentication is the main area to be considered in WSN's. Most of the wireless networks are attacked for detecting the data's that are transmitted in between the users. We aim at the randomization of delivery paths for data transmission to provide considerably small path similarity (i.e., the number of common links between two delivery paths) of two consecutive transmitted packets. The proposed algorithm should be easy to implement and compatible with popular routing protocols, such as the Routing Information Protocol (RIP) for wired networks and Destination-Sequenced Distance Vector (DSDV) protocol for wireless networks over existing infrastructures. These protocols shall not increase the number of control messages if the proposed algorithm is adopted. An analytic study will be presented for the proposed routing algorithm, and a series of simulation study will be conducted to verify the analytic results and to show the capability of the proposed algorithm.
Keywords - Hop By Hop, Random Path, Routing, Wireless Networks

I. INTRODUCTION

Hop-by-hop and shortest-path routing are twin quintessences of Internet routing protocols. Hop-by-hop routing means that forwarding decisions are made independently at each node based only on the destination addresses of incoming packets, and on path computations performed locally at the node. In shortest-path routing, the path computations performed locally at each node are such as to make packets travel over paths that minimize an additive weight function, often with delay-related semantics. Hop-by-hop and shortest-path routing are also key components in minimum delay routing. Metrics other than delay-related are of fundamental importance in the Internet, both for conventional datagram operation routing best-effort traffic, and for virtual circuit operation routing flows with strict Quality-of-Service (QoS) requirements. For datagram operation, link utilization is proposed in [4] as an adequate metric to deal with congestion, and, in [5], link utilization is used with advantage to route traffic belonging to classes with different QoS requirements. The popular Open Shortest Path First (OSPF) protocol also has provisions to route packets along different types of paths, including maximum throughput paths [6]. Although the semantics of link utilization and throughput would seem to call for a bottleneck weight function, where the weight of a path equals the weight of its bottleneck link, an additive weight function is used instead in the previous examples. As a matter of fact, our investigations show that routing loops may arise if the path computation algorithms used for additive weight functions are blindly transposed to bottleneck weight functions.

Most recent studies of QoS routing in the Internet [7], [8] presuppose a virtual circuit mode of operation, whereby flows can be pinned to paths using, for example, label-switching techniques [9]. In this framework, the relevance and performance of a variety of paths for routing flows have been addressed, including widest paths [10], [11], widest-shortest paths [12], [13], [14] and shortest-widest paths [10], [13], among others. A widest path is one of maximum available bandwidth, with bandwidth predicating a bottleneck weight function; a widest-shortest path is a widest path among the set of shortest paths between two nodes; and, conversely, a shortest-widest path is a shortest path among the set of widest paths between two nodes. In virtual circuit operation, hop-by-hop routing plays a role in setting-up paths for new flows [15]. For example, hop-by-hop routing allows for an expedient exploration of several paths at flow set-up time without crankback to the source every time resources cannot be reserved along the initial chosen path.

This focuses on the problem of identifying the maximum available bandwidth path from a source to a destination, which is also called the Maximum Bandwidth Problem (MBP). MBP is a sub problem of the Bandwidth-Constrained Routing Problem (BCRP), the problem of identifying a path with at least a given amount of available bandwidth. We consider whether packets can be routed on the computed widest path when the routing tables are stable. How to avoid loops when routing tables change is an important but difficult problem, and is outside the scope of this paper. We refer readers to for the techniques to reduce route update inconsistencies in the distance-vector protocol which can be applied in our mechanism as well.

We study the problem of identifying the maximum available bandwidth path, a fundamental issue in supporting quality-of-service in WMNs. Due to interference among links, bandwidth, a well-known bottleneck metric in wired networks, is neither concave nor additive in wireless networks. We propose a new path weight which captures the available path bandwidth information. We formally prove that our hop-by-hop routing protocol based on the new path weight satisfies the consistency and loop-freeness requirements. The work gives how to estimate the available bandwidth (residual channel resources) of each link. It means that if the link has to carry another 1-hop flow without violating the bandwidth guarantees of existing flows, the rate of this flow can be at most the available bandwidth of the link. On the other hand, intra flow interference refers to the scenario where when a data packet is being transmitted on a link along a path, some link along the path has to remain idle to avoid conflict.

II. RELATED WORKS

2.1 Routing Protocols and Their Requirements

To understand how the design of routing metrics affects routing protocols, in this section, we introduce the necessary concepts for describing the proper operations of different routing protocols. We first briefly review the different types of routing protocols in wireless networks. Then, we establish a mathematical model of wireless networks. Finally, using this mathematical model, we formally define three requirements that a properly operated routing protocol must satisfy.

2.1.1 Types of Routing Protocols

A routing protocol consists of two components: a path calculation algorithm and a packet forwarding scheme. In this section, we review the most commonly used path calculation algorithms and packet forwarding schemes in wireless networks. By classifying routing protocols based on their path calculation algorithms and packet forwarding schemes, we can examine the design guidelines for routing metrics of different types of routing protocols.

2.2 Path Calculation Algorithms:

Different path calculation algorithms are appropriate for different networks. In this paper, we exam three path calculation algorithms: flooding-based route discovery, Dijkstra's algorithm and the Bellman-Ford algorithm, all of which are widely used in wireless routing. In flooding-based route discovery, to search for a path to a destination node, a source node floods a route request message through the entire network to explore multiple paths simultaneously and the destination node selects a single path among all the searched paths as the path between the source node and the destination node. In Dijkstra's algorithm or the Bellman-Ford algorithm, a source node collects network topology information through periodic message exchanges among neighboring nodes. Based on the collected information, the source node calculates its paths to the other nodes.

2.3 Packet Forwarding Schemes:

In wireless networks, two packet forwarding schemes, source routing and hop-by-hop routing, are often used in different routing protocols. In source routing, a source node puts the entire path of a flow in its packet headers and intermediate nodes forward the packets accordingly. In hop-by-hop routing, a source node only puts the destination addresses in its packet headers. Intermediate node forwards packets based on its routing table, which stores the next hops for reaching each destination address.

III. QOS ROUTING PROTOCOL

In this section, we first present our path selection mechanism. It is based on the distance-vector mechanism. We give the necessary and sufficient condition to determine whether a path is not worthwhile to be advertised. We then describe our new isotonic path weight. We show that the routing protocol based on this new path weight satisfies the optimality requirement [7], [8]. Afterward, we present our hop-by-hop packet forwarding mechanism which satisfies the consistency requirement. We apply (3) to estimate the available bandwidth of a path. To simplify our discussion, in the rest of our paper, we use "available bandwidth" instead of "estimated available bandwidth" when the context is clear. On the other hand, "widest path" refers to the path that has the maximum estimated available bandwidth.

3.1 Path Selection

We would like to develop a distance-vector based mechanism. In the traditional distance-vector mechanism, a node only has to advertise the information of its own best path to its neighbors. Each neighbor can then identify its own best path. In Section 1, we mentioned that if a node only advertises the widest path from its own perspective, its neighbors may not be able to find the widest path. To illustrate, consider the network in Fig. 1 where the number of each link is the available bandwidth on the link.

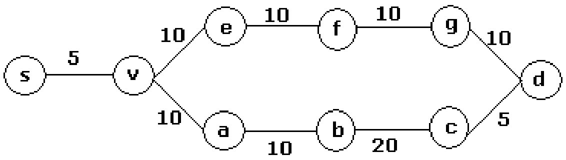

Fig. 1. An Example of Network Topology

IV. Our Work

Flooding-based route discovery is a widely used path calculation algorithm in reactive routing protocols. In an ideal network without packet loss, it works as follows. To find a path to a destination, a source node broadcasts a route request message to its neighboring nodes. Its neighboring nodes rebroadcast this message to their neighbors, eventually flooding the entire network. During the flooding process, the route request message carries the status information of its traveled path, such as bottleneck capacity, hop count and delay. When an intermediate node receives multiple route request messages, it rebroadcasts the one that travels the lightest path calculated based on the path status, and drops the rest. If there is a tie in lightest path, the intermediate node either rebroadcasts all route request messages in the tie or enforces a tie breaking scheme that assigns additional weights to paths to ensure the uniqueness of the lightest path. The tie breaking scheme is essentially part of the weight function w(·) in the path weight structure. Eventually, the destination node selects the lightest path among all paths carried by its received route request messages. If hop-by-hop forwarding scheme is used, the routing table entries at the nodes along the selected path are set accordingly. If source routing is used, the entire path information is sent back to the source node.

Some existing QoS routing protocols operate with the knowledge of the available bandwidth of each link. These works study how to compute the available bandwidth of a path based on the available bandwidth of each link on this path. Liu give a new link metric which is the available bandwidth of the link divided by the number of interference links of this link. The path bandwidth is thus defined as the minimum value of the new metrics of all the links on this path. In the mechanism described, the available bandwidth of a path is the minimum bandwidth among the links on the path divided by 2, 3, or 4, depended on the number of hops on the path. Such formula cannot reflect the exact path bandwidth. The path selection processes in [4] assume the bandwidth requirement of a connection request is known. The metric proposed in [4] is based on the bandwidth requirement of a certain request. The protocol checks the local available bandwidth of each node to determine whether it can satisfy the bandwidth requirement. Some works consider the TDMA-based MAC model and discuss how to assign the available time slots on each link for a new flow in order to satisfy the bandwidth requirement of the new flow.

By Applying **random selection algorithm** we choose a path from routing table.

- For find a new route here we use hop-by-hop packet forwarding mechanism.

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V. Conclusion

The main contribution of our work is a new left-isotonic path weight which captures the available path bandwidth information. The left-isotonicity property of our proposed path weight facilitates us to develop a proactive hop-by-hop routing protocol, and we formally proved that our protocol satisfies the optimality and consistency requirements. Based on the available path bandwidth information, a source can immediately determine some infeasible connection requests with the high bandwidth requirement. We tested the performance of our protocol under different scenarios. Network links and paths are characterized by generic weights, themselves a function of one or more metrics. A binary operation and an order relation are defined on the set of weights, and they are intertwined by the isotones property. We have shown that, within this framework, a generalized Dijkstra's algorithm correctly computes lightest paths. On the other hand, without isotonicity, the generalized Dijkstra's algorithm does not determine lightest paths in general.

In the future, we would like to extend our analysis to more types of routing protocols, such as geographic routing, zone based routing, etc. We will also focus on designing new routing protocols that has less strict requirements on path weight structure than existing protocols.

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