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Research Paper

Multi-Path Source Routing Using Portfolio Selection For Traffic Allocation in Lossy Network

Engineering

KEYWORDS : Jamming, multiple-path routing, network utility maximization (NUM), optimization, portfolio selection theory.

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ABSTRACT

Multiple-path source routing protocols allow a data source node to distribute the total traffic among available paths. The problem of jamming-aware source routing in which the source node performs traffic allocation based on empirical jamming statistics at individual network nodes. The traffic allocation as a lossy network flow optimization problem using portfolio selection theory from financial statistics. In multi source networks, this centralized optimization problem can be solved using a distributed algorithm based on decomposition in network utility maximization (NUM). The network's ability to estimate the impact of jamming and incorporate these estimates into the traffic allocation problem. The achievable throughput using our proposed traffic allocation method in several scenarios.

I. INTRODUCTION

JAMMING point-to-point transmissions in a wireless mesh network [4] or underwater acoustic network [9] can have debilitating effects on data transport through the network. The effects of jamming at the physical layer resonate through the protocol stack, providing an effective denial-of-service (DoS) attack on end-to-end data communication. The simplest methods to defend a network against jamming attacks comprise physical layer solutions such as spread-spectrum or beam forming, forcing the jammers to expend a greater resource to reach the same goal.

However, recent work has demonstrated that intelligent jammers can incorporate cross-layer protocol information into jamming attacks, reducing resource expenditure by several orders of magnitude by targeting certain link layer and MAC implementations as well as link layer error detection and correction protocols. Hence, more sophisticated anti-jamming methods and defensive measures must be incorporated into higher layer protocols, for example channel surfing or routing around jammed regions of the network.

In order to characterize the effect of jamming on throughput, each source must collect information on the impact of the jamming attack in various parts of the network. However, the extent of jamming at each network node depends on a number of unknown parameters, including the strategy used by the individual jammers and the relative location of the jammers with respect to each transmitter–receiver pair.

Since the effect of jamming at each node is probabilistic, the end-to-end throughput achieved by each source–destination pair will also assume that the network does not rely on a jamming detection, localization, or tracking infrastructure. This factor other than jamming that similarly impact throughput can be included as well. This work as it is likely the prominent source of packet loss be nondeterministic and hence, must be studied using a stochastic framework.

The ability of network nodes to characterize the jamming impact and the ability of multiple source nodes to compensate for jamming in the allocation of traffic across multiple routing paths.

Problem Description

Allocating traffic across multiple routing paths in the presence of jamming as a lossy network flow optimization problem. To map the optimization problem to that of asset allocation using portfolio selection theory.

The centralized traffic allocation problem for multiple source nodes as a convex optimization problem. The multisource multiple-path optimal traffic allocation can be computed at the source nodes using a distributed algorithm based on decomposition in network utility maximization (NUM).

Portfolio Theory

Portfolio Theory is concerned with risk and return. The investor is concerned only with the expected values of securities and the interested in the expected value of the portfolio. To maximize the expected value of a portfolio, one need only invest in one security (the security with maximum expected return).

Thus action based on expected return only must be rejected as descriptive of actual or rational investment behavior. Is seemed obvious that investors are concerned with risk and return, and these should be measured for the portfolio as a whole. Therefore, the portfolio theory is about maximizing the benefits of investments considering risk and return.

Traffic Allocation Using Portfolio Selection Theory

In order to determine the optimal allocation of traffic to the paths in each source chooses a utility function that evaluates the total data rate, or throughput, successfully delivered to the destination node. In defining our utility function, present an analogy between traffic allocation to routing paths and allocation of fund to correlated assets in finance.

Optimal Distributed Traffic Allocation Using NUM

In the distributed formulation of the algorithm, each source determines its own traffic allocation, ideally with minimal message passing between sources. By inspection, the optimal jamming-aware flow allocation problem is similar to the NUM formulation of the basic maximum network flow problem. To develop a distributed traffic allocation algorithm using lagrangian dual decomposition techniques for NUM.

Since updating the link prices depends only on the expected link usage, sources must only exchange the link usage vectors to ensure that the link prices are consistently updated across all sources. The iterative optimization step can be repeated until the allocation vector coverage for all sources.

End-to-End Delay

The end to end was calculated for both Standard and Important Nodes and the results are compared. The graph proves that the delay for the improved node is less than that of the standard node. The time taken for transmitting the time critical data using the temporary route recovery scheme is less than that of the standard method of transmitting normal data.

II. PROPOSED SYSTEM

The anti-jamming diversity based on the use of multiple routing paths. Using multiple-path variants of source routing protocols such as Dynamic Source Routing (DSR) or Ad Hoc on-Demand Distance Vector (AODV), for example the MP-DSR protocol, each

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source node can request several routing paths to the destination node for concurrent use. To make effective use of this routing diversity, however, each source node must be able to make an intelligent allocation of traffic across the available paths while considering the potential effect of jamming on the resulting data throughput.

However, the extent of jamming at each network node depends on a number of unknown parameters, including the strategy used by the individual jammers and the relative location of the jammers with respect to each transmitter–receiver pair. Hence, the impact of jamming is probabilistic from the perspective of the network, 1 and the characterization of the jamming impact is further complicated by the fact that the jammers' strategies may be dynamic and the jammers themselves may be mobile. The ability of the network nodes to characterize the jamming impact and the ability of multiple source nodes to compensate for jamming in the allocation of traffic across multiple routing paths. Our contributions to this problem are as follows. The problem of allocating traffic across multiple routing paths in the presence of jamming as a lossy network flow optimization problem. Mapping the optimization problem to that of asset allocation using portfolio selection theory. The centralized traffic allocation problem for multiple source nodes as a convex optimization problem. The multisource multiple-path optimal traffic allocation can be computed at the source nodes using a distributed algorithm based on decomposition in network utility maximization (NUM) to propose methods that allow individual network nodes to locally characterize the jamming impact and aggregate this information for the source nodes. Finally to demonstrate that the use of portfolio selection theory allows the data sources to balance the expected data throughput with the uncertainty in achievable traffic rates.

Advantages

- The throughput time is reduced as the data traffic jamming in the path is reduced.
- The impact of jamming in the path is reduced.
- Dynamic data allocation to the path is based on the portfolio of the path.

III. TECHNIQUE USED FOR IMPLEMENTATION

Anti Jamming Technique Using DSR Routing Protocol

'Dynamic Source Routing' (DSR) is a routing protocol for wireless mesh networks. It is similar to AODV in that it forms a route on-demand when a transmitting computer requests one. However, it uses source routing instead of relying on the routing table at each intermediate device.

Determining source routes requires accumulating the address of each device between the source and destination during route discovery. The accumulated path information is cached by nodes processing the route discovery packets. The learned paths are used to route packets. To accomplish source routing, the routed packets contain the address of each device the packet will traverse. This may result in high overhead for long paths or large addresses, like IPv6. To avoid using source routing, DSR optionally defines a flow id option that allows packets to be forwarded on a hop-by-hop basis.

To return the Route Reply, the destination node must have a route to the source node. If the route is in the Destination Node's route cache, the route would be used. Otherwise, the node will reverse the route based on the route record in the Route Reply message header (this requires that all links are symmetric).

In the event of fatal transmission, the Route Maintenance Phase is initiated whereby the Route Error packets are generated at a node. The erroneous hop will be removed from the node's route cache; all routes containing the hop are truncated at that point. Again, the Route Discovery Phase is initiated to determine the most viable route.

Dynamic source routing protocol (DSR) is an on-demand protocol designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks by eliminating the periodic table-update messages required in the table-driven approach. The major difference between this and the other on-demand routing protocols is that it is beacon-less and hence does not require periodic hello packet (beacon) transmissions, which are used by a node to inform its neighbors of its presence.

Consider a source node that does not have a route to the destination. When it has data packets to be sent to that destination, it initiates a Route Request packet. This Route Request is flooded throughout the network. Each node, upon receiving a Route Request packet, rebroadcasts the packet to its neighbors if it has not forwarded it already, provided that the node is not the destination node and that the packet's time to live (TTL) counter has not been exceeded. Each Route Request carries a sequence number generated by the source node and the path it has traversed.

Thus, all nodes except the destination forward a Route Request packet during the route construction phase. A destination node, after receiving the first Route Request packet, replies to the source node through the reverse path the Route Request packet had traversed. Nodes can also learn about the neighboring routes traversed by data packets if operated in the promiscuous mode (the mode of operation in which a node can receive the packets that are neither broadcast nor addressed to itself). This route cache is also used during the route construction phase.

IV. ARCHITECTURE FOR PACKET TRANSFER FROM SOURCE TO DESTINATION NODE

These techniques for the network nodes to estimate and characterize the impact of jamming and for a source node to incorporate these estimates into its traffic allocation. In order for a source node to incorporate the jamming impact in the traffic allocation problem, the effect of jamming on transmissions over each link must be estimated and relayed to.

However, to capture the jammer mobility and the dynamic effects of the jamming attack, the local estimates need to be continually updated. The possible effects of jammer mobility on the traffic allocation problem and motivate the use of continually updated local estimates.

Fig. 1. illustrates a single-source network with three routing paths p1 = { (A , E), (E , C), (C , D) }, p2 = { (A , B), (B , C), (C , D) }, p3 = { (A , F), (F , C), (C , D) }. The label on each edge (i , j) is the link capacity c of i , j indicating the maximum number of packets per second that can be transported over the wireless link.

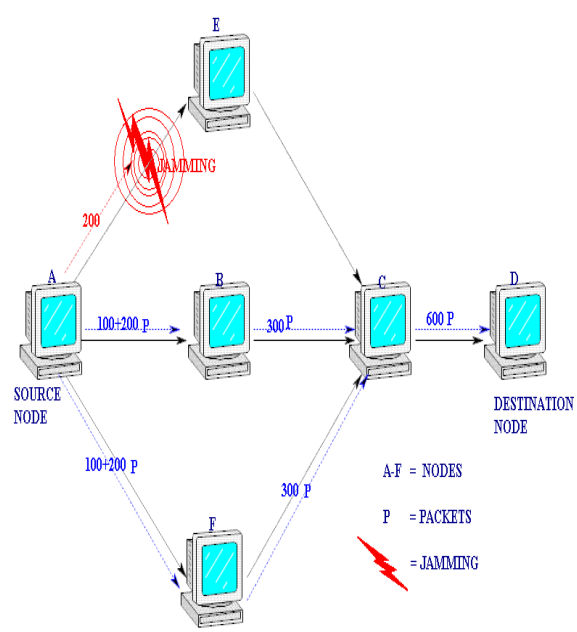

Fig. 1. Architecture Diagram

Let us assume that the source is generating data at a rate of 300pkts/s. In the absence of jamming, the source can continuously send 100pkts/s over each of the three paths, yielding a throughput rate equal to the source generation rate of 300pkts/s. If a jammer near node x is transmitting at high power, the probability of successful packet exception, referred to as the packet success rate, over the link (A, E) drops to nearly, and the traffic flow to node reduces to 200pkts/s.

If the source node becomes ware of this effect, the allocation of traffic can be changed to 150pkts/s on each of paths p2 and p3, thus recovering from the jamming attack at node E. However, this one-time reallocation by the source node A does not adapt to the potential mobility of the jammer. If the jammer moves to node B , the packet success rate over (A , E) returns to 1, and that over (A , B) drops to zero, reducing the throughput to node D to 150pkts/s, which is less than the 200pkts/s that would be achieved using the original allocation of 100pkts/s over each of the three paths.

Next, suppose the jammer continually changes position between nodes E and B, causing the packet success rates over links (A, E) and (A, B) to oscillate between zero and one. This behavior introduces a high degree of variability into the observed packet success rates, leading to a less certain estimate of the future success rates over the links (A, E) and (A, B).

However, since the Packet success rate over link (A, F) has historically been steadier, it may be a more reliable option. Hence, the source A can choose to fill p3 to its capacity and partition the remaining 100pkts/s equally over p1 and p3.

V. PROPOSED MODULES

A. Node Registration

Enter the node details such as the port address, ip address and name of user using the present system. The ip address can be given in an ip 4 byte format or ip 6 byte configuration. And the port number is the common address port for connecting to two systems. The registered node details are stored in the database. Each node has distinct port address. Each node is executed from different port number.

B. Topology Construction

The node constructed can be added to form a structured topology or an unstructured topology. The topology is constructed to transfer data through different path of the network. Each node is connected to each other and the source and the destination is connected with each other and the topology is constructed it may be a structured network or may be an instructed network.

C. Jammer Detection in the Network

The jammer in the network is identified based on the number of request and the jammer is removed from the network. Dynamic detection of the jammer is detected automatically even though the jammer changes the path frequently. The jammer in the network path may be change the location frequently. But the dynamic location in the path is identified by the number of request.

D. Dynamic Allocation of Data Packet

The data content of the file is splitter according to the number of the available path and then the data is transferred so that the traffic jamming is avoided and the impact of the jamming is reduced between the source and the destination.

VI. CONCLUSION AND FUTUREWORK

The problem for traffic allocation in multiple-path routing algorithms in the presence of jammers whose effect can only be characterized statistically. These methods presented for each network node to probabilistically characterize the local impact of a dynamic jamming attack and for data sources to incorporate this information into the routing algorithm. To formulate multiple-path traffic allocation in multisource networks as a lossy network flow optimization problem using an objective function based on portfolio selection theory from finance. The centralized optimization problem can be solved using a distributed algorithm based on decomposition in network utility maximization (NUM). The simulation results to illustrate the impact of jamming dynamics and mobility on network throughput and to demonstrate the efficacy of our traffic allocation algorithm. The multiple-path source routing algorithms can optimize the throughput performance by effectively incorporating the empirical jamming impact into the allocation of traffic to the set of paths.

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