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An overlap Architecture for throughput Optimal Multipath Routing

Mrs L.N.B Jyotsna[1], V.Roopa[2], K.Sri Niyathi[3], A.Venkata Sai[4], D.Surya Sai[5]
[1]Assistant Professor, DEPT OF CSE, Dhanekula Institute of Engineering and Technology, A.P., India.
[2,3,4,5] B.Tech (CSE), Dhanekula Institute of Engineering and Technology, A.P., India.

Abstract: *Legacy networks are often designed to operate with simple single-path routing, like the shortest path, which is known to be throughput suboptimal. On the other hand, previously proposed throughput optimal policies (i.e., backpressure) require every device in the network to make dynamic routing decisions. In this paper, we study an overlay architecture for dynamic routing, such that only a subset of devices (overlay nodes) need to make the dynamic routing decisions. We determine the essential collection of nodes that must bifurcate traffic for achieving the maximum multi-commodity network throughput. We apply our optimal node placement algorithm to several graphs and the results show that a small fraction of overlay nodes is sufficient for achieving maximum throughput. Finally, we propose a threshold-based policy (BP-T) and a heuristic policy (OBP), which dynamically control traffic bifurcations at overlay nodes. Policy BP-T is proved to maximize throughput for the case when underlay paths do no overlap. In all studied simulation scenarios, OBP not only achieves full throughput but also reduces delay in comparison to the throughput optimal backpressure routing.*

INTRODUCTION

Optimal Routing Design provides the tools and techniques, learned through years of experience with network design and deployment, to build a large-scale or scalable IProuted network. Optimal routing in networks where some legacy nodes are replaced with overlay nodes. While the legacy nodes perform only forwarding on pre-specified paths, the overlay nodes are able to dynamically route packets. Dynamic backpressure is known to be an optimal routing policy. Backpressure routing is an algorithm for dynamically routing traffic over a multi-hop network by using congestion gradients but it typically requires a homogeneous network, where all nodes participate in control decisions. Instead, let us consider only a subset of the nodes are controllable, these nodes form a network overlay within the legacy network. Backpressure routing is designed to make decisions that (roughly) minimize the sum of squares of queue backlogs in the network from one time slot to the next. It is important to note that the backpressure algorithm does not use any pre-specified paths. Paths are learned dynamically, and may be different for different packets. Delay can be very large, particularly when the system is lightly loaded so that there is not enough pressure to push data towards the destination. As an example, suppose one packet enters the network, and nothing else ever enters. This packet may take a loopy walk through the network and never arrive at its destination because no pressure gradients build up. This does not

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contradict the throughput optimality or stability properties of backpressure because the network has at most one packet at any time and hence is trivially stable.

RELATED WORK

The exploitation of path diversity has attracted much attention recently, and [9] provides a broad overview of the general area. We note that existence of multiple disjoint paths can result in many benefits including: (1) increased bandwidth, and (2) improved loss characteristics. There are a number of approaches [7–9] to accomplishing multipath data delivery, the path diversity-based approach is considered in this paper.

Multipath routing [10–12], especially for wireless ad hoc networks, focuses on how to leverage multiple complete paths through a network. In [10], Disjoint Pathset Selection Protocol (DPSP) is proposed for selecting a set of paths to achieve the best reliability. Mao et al. [11] further propose a meta-heuristic approach based on Genetic Algorithms to solve the routing selection problem. Wei and Zakhor [12] propose a different method for selection of two node-disjoint paths that takes into account the interference caused by the neighboring links.

Selecting optimal paths in overlay networks has also been an active research area recently [13–15]. Begen et al. study how to select multiple paths that maximize the video quality at clients on Internet overlay networks [13]. Given information about the underlying network graph, [14] proposes multipath routing heuristics for unicast and multicast scenarios along with a data scheduling algorithm. In [15], the authors propose to select two paths with minimal correlation for streaming over Internet overlay networks.

There are other similar works in interface [16], access network [17] and IP address [4,7] selection for multihomed wireless device. Historically, this was good, as the first link was usually the bottleneck which had the least bandwidth. Often now, however, it is a ‘‘backhaul’’ rather than the access link that has the most constrained bandwidth – an example of this could be a satellite or 3G link which connects a train WLAN to the internet. Therefore, the target should be how to select end-to-end complete paths instead of merely part of them. Another work in [18] aims at selecting the best path among several available end-toend paths through the use of bandwidth estimation techniques, which is more suited to the single path selection.

Multipath selection needs to take advantage of the benefits of path diversity, so discovering the correlation characteristics of multiple paths is the key problem. It can be done either by internal nodes or by end systems.

EXISTING SYSTEM

In Existing System, Backpressure (BP) routing is used in the Existing System; this is a throughput optimal routing policy that has been studied for decades. Its strength lies in discovering multipath routes and utilizing them optimally without

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knowledge of the network parameters, such as arrival rates, link capacities, mobility, fading, etc. Nevertheless, the adoption of this routing policy has not been embraced for general use on the Internet. This is due, in part, to an inability of backpressure routing to coexist with legacy routing protocols. With few exceptions, backpressure routing has been studied in homogeneous networks, where all nodes are dynamically controllable and implement the backpressure policy across all nodes uniformly. In Existing System there are two problem areas for control of heterogeneous networks. First, we develop algorithms for choosing the placement of controllable nodes, where our goal here is to allocate the minimum number of controllable nodes such that the full network stability region is available. Second, given any subset of nodes that are controllable, we also wish to develop an optimal routing policy that operates solely on these nodes.

DIS ADVANTAGES

• The minimum number of controllable nodes required to enable the full throughput region.

• Network overlays are frequently used to deploy new communication architectures in legacy networks.

PROPOSED SYSTEM

In Proposed System, we study overlay architecture for dynamic routing, such that only a subset of devices (overlay nodes) need to make the dynamic routing decisions. We determine the essential collection of nodes that must bifurcate traffic for achieving the maximum multi commodity network throughput. We apply our optimal node placement algorithm to several graphs and the results show that a small fraction of overlay nodes is sufficient for achieving maximum throughput. Finally, we propose a threshold-based policy (BP-T) and a heuristic policy (OBP), which dynamically control traffic bifurcations at overlay nodes. Policy BP-T isproved to maximize throughput for the case when underlay paths do no overlap. In all studied simulation scenarios, OBP not only achieves full throughput but also reduces delay in comparison to the throughput optimal backpressure routing.

ADVANTAGES

• Homogeneous networks, where all nodes are dynamically controllable and implement the backpressure policy across all nodes uniformly.

• Overlay nodes is sufficient for achieving maximum throughput.

Results:

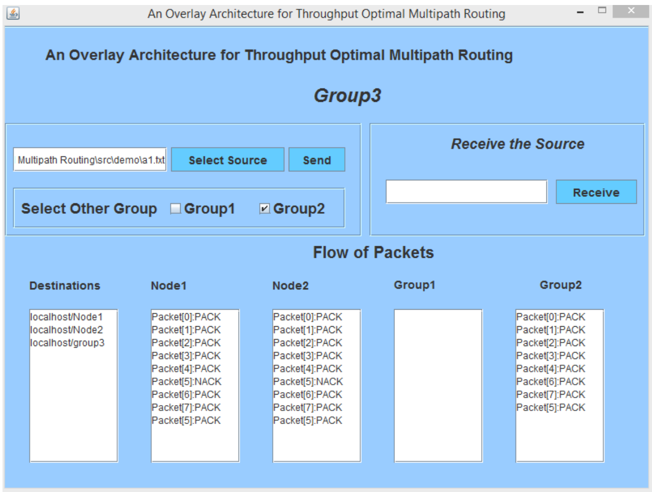

Fig: 1 Shows the Results for proposed system

CONCLUSION

This model captures evolving heterogeneous networks where intelligence is introduced at a fraction of nodes. Finally, proposed dynamic routing policies to be implemented in a network overlay. The threshold based policy that is optimal for overlays with non-overlapping tunnels, and provides alternate policy for general networks that demonstrates superior performance in terms of both throughput and delay.

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