An Overlay Construction for Throughput Optimal Multipath Routing using optimal node placement

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ABSTRACT_ Inheritance networks are frequently intended to work with basic single-way steering, similar to the most brief way, which is known to be throughput problematic. Then again, recently proposed throughput ideal arrangements (i.e., backpressure) require each gadget in the system to settle on unique directing choices. In this paper, we ponder an overlay design for dynamic steering, with the end goal that just a subset of gadgets (overlay hubs) need to settle on the dynamic directing choices. We decide the basic accumulation of hubs that must bifurcate movement for accomplishing the most extreme multi-item arrange throughput. We apply our ideal hub position calculation to a few charts and the outcomes demonstrate that a little part of overlay hubs is adequate for accomplishing greatest throughput. At long last, we propose a limit based arrangement (BP-T) and a heuristic strategy (OBP), which progressively control movement bifurcations at overlay hubs. Approach BP-T is demonstrated to boost throughput for the situation when underlay ways do no cover. In all contemplated reproduction situations, OBP accomplishes full throughput as well as diminishes delay in contrast with the throughput ideal backpressure steering.

I. INTRODUCTION

We study best possible routing in networks where some bequest nodes are replaced with overlay nodes. While the bequest nodes execute only forwarding on pre-specified paths, the overlay nodes are capable to animatedly route packets. *Dynamic backpressure* is known to be an optimal routing policy, but it usually requires a uniform network, where all nodes contribute in organize decisions. As an alternative, we guess that only a division of the nodes are convenient; these nodes form a network overlay inside the bequest network. The option of the overlay nodes is shown to conclude the throughput area of the network.

We estimate our algorithm on numerous classes of usual and random graphs. In the case of random networks with a power-law degree distribution, which is a general model for the Internet. We find that smaller number than 80 out of 1000 nodes are necessary to be convenient to allow the complete throughput area.

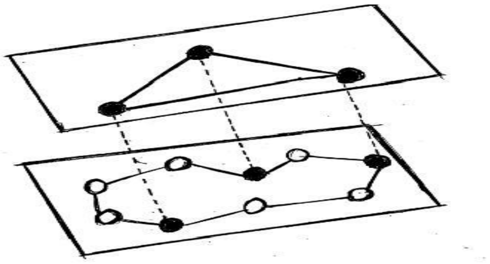

Fig. 1. Pattern of a network overlay.

The bottom plane shows the whole network graph, whereas the top plane shows a subset of network nodes and their theoretical overlay connectivity. In this we study network throughput under the statement that overlay nodes apply dynamic routing schemes and underlay nodes forward packets by means of pre-specified paths.

Our first finding is that ring networks need accurately three convenient (overlay) nodes to allow the similar throughput area as when all nodes are convenient, free of the whole number of nodes in the network, Provoked by this, we build up an algorithm for choosing the smallest amount number of convenient nodes necessary to allow the complete throughput region..

Since usual backpressure routing cannot be explicitly realistic to the overlay situation, we build longer extensions to back-pressure routing that conclude how to route packets among overlay nodes. We confirm that highest throughput can be attained with our policies in numerous scenarios, when only a portion of legacy nodes are replaced by convenient nodes. Moreover, we monitor summary delay relative to the case where all nodes are convenient and operate under backpressure routing.

II. EASE OF USE

A. Motivation and related work

Backpressure(BP)routing, first projected is a throughput optimal routing rule that has been considered for decades. Its potency lies in discovering multipath routes and utilizing them optimally with no information of the network parameters, such as entrance rates, link capacities, mobility, desertion, etc. however, the acceptance of this routing strategy has not been embraced for common use on the Internet. This is due, in part, to an incapability of backpressure routing to coexist with bequest routing protocols. With not many exceptions, back-pressure routing has been considered in uniform networks, where all nodes are animatedly convenient and execute the backpressure strategy crosswise all nodes consistently. Techniques to offer throughput-optimal multipath routing have been explored in a variety of contexts. The effort considers the difficulty of situation link weights provided to the Open Shortest Path First (OSPF) routing protocol such that, when joined with bifurcating traffic evenly along with shortest paths, the network achieves throughput equivalent to the optimal multi commodity flow. The authors make use of an entropy maximization framework to extend a new throughput optimal link state routing protocol where each router wisely bifurcates traffic for each target among its leaving links. These techniques all need centralized control, universal acceptance by all network nodes, or both; thus none of these techniques could give incremental use of throughput optimal routing to wireless networks. Moreover these techniques cannot be used in mixture with throughput optimal dynamic control schemes. BWe would akin to allow new network control policies to be deployed in accessible networks, beside bequest nodes that are unconscious of the new control policies. There are many reasons to add convenient nodes into mixed networks in a slow manner, not the smallest amount of which is the financial price of replacing all nodes at one time. Other reasons hold a necessitate to uphold compatibility with present applications and particular reason hardware, a need of control to decommission bequest equipment, and a need of administrative freedom to transform accessible software. Theoretically, we sculpt controllable nodes as working in a network overlay on peak of a bequest network. Network overlays are often used to organize new communication architectures in bequest networks. To achieve this, messages from the fresh technology are encapsulated in the bequest format, allowing the two methods to coexist in the bequest network. Nodes making utilize of the new communication methods are then associated in a conceptual network overlay that operates on peak of the bequest network, as shown in Fig. 1. Numerous works have well thought-out the use of network overlays to get better routing in the Internet. The work proposes resilient overlay networks (RON) to find paths in the region of network outages on a quicker timescale than BGP. Similarly, [5] projected a method for choosing placement of overlay nodes to get better path diversity in overlay routes. Whereas both of the foregoing works show that their strategies decide high excellence single-path routes, we go advance and spot multipath routes that present maximum throughput. Setback decrease for BP routing has been measured in a diversity of scenarios. whereas multipath routes are necessary to hold up the complete throughput area, the examining segment of BP can show the way to large queues when the obtainable weight is low and single-path routes would suffice. In [9], a crossbreed procedure combining BP with shortest-path routing is proposed, where flows are biased towards shortest-path routes, however still hold the full throughput area. This crossbreed policy is extended in [8] to also contain digital fountain codes, and revealed to attain good end-to-end delay performance in the existence of accidental link failures. The work in [18] develops strategy that achieves a similar shortest-path result by minimizing the average hop count used by flows. In a scenario with multiple clusters that are intermittently connected, [15] combines BP with source routing in a network overlay model to separate the queue dynamics of intra-cluster traffic from longer inter-cluster delays. The work in [2] applies shadow queues to allow the use of per-neighbor FIFO queues instead of per-commodity queues, as is typical with differential backlog routing, and finds that this can improve network delay. A loop-free backpressure policy is developed in [14] that dynamically finds acyclic graphs for reducing delay while maintaining throughput optimality. These prior works assume a homogeneous scenario where all nodes use the same control policy and thus differ fundamentally from our approach. Our proposed algorithms for applying backpressure in overlay networks can help reduce delay by reducing the number of nodes between which differential backpressure is formed. While our original motivation for studying backpressure in overlay networks was not to reduce delay, we believe that our scheme can be used as part of a delay-reducing solution.

B. Problem Statement and Contributions

We consider 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.

In the second problem area, we consider the design of dynamic network control policies that operate only at controllable nodes V. These controllable nodes are connected by "tunnels" or paths through uncontrollable sections of the network, where the control policy can choose when to inject packets into a tunnel but the tunnel itself is uncontrollable. We develop an overlay control policy that stabilizes all arrival rate vectors in $\Lambda G(V)$ for the case when tunnels do not overlap. We also develop a heuristic overlay control policy for use on general topologies, and show through simulation that stability is achieved for all arrival rates considered.

Our solutions for the first and second problem areas are complementary, in the sense that they can be used together to solve the joint problem of providing maximum throughput when only a subset of nodes are controllable. However, our solutions can also be used in isolation; our node placement algorithm can be used with other control policies, and our BP extensions can yield maximal stability with any overlay node placement and legacy single-path routing.

C. Our Contributions are Summarized Below.

1) formulate the problem of placing the minimum number of overlay (controllable) nodes in a legacy network in order to achieve the full multi commodity throughput region and provide an efficient placement algorithm.
2) We apply our placement algorithm to numerous scenarios of interest including regular and random graphs, showing that in some cases only a small fraction of overlay nodes is sufficient for maximum throughput
3) We propose a threshold-based control policy — BP-T — as a modification of BP for use at overlay nodes, and prove this policy to stabilize all arrival rates in $\Lambda G(V)$ when tunnels do not overlap
4) We propose a heuristic overlay BP policy — OBP — for use at overlay nodes on general topologies. We show via simulation that OBP can outperform BP when limited to control at overlay nodes, and that OBP also has better delay performance compared to BP with control at all nodes.

III.OVERLAY NODES IN WIRELESS NETWORKS

The goal of this section is to motivate the need for additional study into the placement of overlay nodes for networks with wireless interference.

The all-paths condition C.1 is sufficient to achieve $\Lambda_G(V) = \Lambda_G$ in all networks, but this condition is not always a necessary condition in wireless networks. In other words, satisfying the all-paths condition may over allocate controllable nodes under certain wireless interference models. To see this, consider a clique where all edges have unit-capacity and all transmissions mutually interfere. Due to interference, the maximum network sum throughput in this scenario is one, and this maximum throughput can only be achieved when each source a sends to destination b directly over edge (a, b). Thus no multi-hop paths are required, and the all-paths condition is sufficient but not necessary for this scenario.

To illustrate an overlay network in a wireless scenario, we study the performance of the overlay node placement algorithm on random geometric graphs, which is a simple model for wireless networks with omnidirectional antennas. The geometric model has parameters N and r, where N is the number of nodes and r is the edge range. Random graphs are then generated by randomly placing N nodes in a unit square, and creating all edges (a, b) for which the Euclidean distance

IV. CONCLUSION

We study optimal routing in legacy networks where only a subset of nodes can make dynamic routing decisions, while the legacy nodes can forward packets only on pre-specified shortest-paths. This model captures evolving heterogeneous networks where intelligence is introduced at a fraction of Bnodes. We propose a necessary and sufficient condition for the overlay node placement to enable the full multi commodity throughput region. Based on this condition, we devise an algorithm for optimal controllable node placement. We run the algorithm on large random graphs to show that very often a small number of intelligent nodes suffices for full throughput. Finally, we propose dynamic routing policies to be implemented in a network overlay. We provide a threshold based policy that is optimal for overlays with non-overlapping tunnels, and provide and alternate policy for general networks that demonstrates superior performance in terms of both throughput and delay.

REFERENCES

[1] D. Andersen, H. Balakrishnan, F. Kaashoek, and R.Morris, “Resilient overlay networks,” in Proc. ACM SOSP, Oct. 2001, pp. 131–145. [Online]. Available:http://doi.acm.org/10.1145/502034.50208

[2] L. Bui, R. Srikant, and A. Stolyar, “Novel architectures and algorithms for delay reduction in back-pressure scheduling and routing,” in Proc. IEEE INFOCOM, Apr. 2009, pp. 2936–2940.

[3] B. Fortz and M. Thorup, “Internet traffic engineering by optimizing OSPF weights,” in Proc. IEEE INFOCOM, Mar. 2000,pp. 519–528.

[4] L. Georgiadis, M. J. Neely, and L. Tassiulas, “Resource allocation and cross-layer control in wireless networks,” Found. Trends Netw.,vol. 1, no. 1, pp. 1–144, 2006. [Online]. Available: http://dx.doi.org/10.1561/1300000001

[5] J. Han, D. Watson, and F. Jahanian, “Topology aware overlay networks,”in Proc. IEEE INFOCOM, Mar. 2005, pp. 2554–2565.[Online].Available:http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=1498540

[6] N. M. Jones, “Practical algorithms for distributed network control,”Ph.D. dissertation, Dept. Aeronautics Astronautics Massachusetts Inst.Technol., Cambridge, MA, USA, 2013.

[7] N. M. Jones, G. S. Paschos, B. Shrader, and E. Modiano, “An overlay architecture for throughput optimal multipath routing,” in Proc. ACM MobiHoc, Aug. 2014, pp. 73–82.

[8] W. Khan, L. B. Le, and E. Modiano, "Autonomous routing algorithms for networks with wide-spread failures," in Proc. IEEE MILCOM,Oct. 2009, pp. 1–6. [Online]. Available: http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=5379792

[9] M. J. Neely, E. Modiano, and C. E. Rohrs, "Dynamic power allocation and routing for time-varying wireless networks," IEEE J. Sel. Areas Commun., vol. 23, no. 1, pp. 89–103, Jan. 2005.

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