Routing Optimization with Efficient Second Order Distributed Approach Using Congestion Control Rules

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Abstract: Distributed joint congestion control and routing optimization has received a significant amount of attention recently. To date, however, most of the existing schemes follow a key idea called the back-pressure algorithm. Despite having many salient features, the first-order sub gradient nature of the back-pressure based schemes results in slow convergence and poor delay performance. To overcome these limitations, the present study was made as first attempt at developing a second-order joint congestion control and routing optimization framework that offers utility-optimality, queue-stability, fast convergence, and low delay. Contributions in this project are three-fold. The present study propose a new second-order joint congestion control and routing framework based on a primal-dual interior-point approach and established utility-optimality and queue-stability of the proposed second-order method. The results of present study showed that how to implement the proposed second-order method in a distributed fashion.

Keywords: Second-order distributed algorithm, multi-hop routing, and congestion control.

I. INTRODUCTION

The rapid integration of new applications and technologies, recent years have witnessed a growing challenge in making communication networks work more efficiently. To date, while there exists a large body of work on optimization based Dynamic joint congestion control and routing policy for both wire line and wireless networks i) a provable throughput optimality, ii) elegant cross-layer extensions, and iii) a distributed queue-length differential based routing that stabilizes all queues in the network. Most of these schemes follow a key idea called the “back-pressure algorithm,” which traces its roots to the celebrated paper.

The enduring popularity of the back-pressure algorithm is primarily due to: i) approvable throughput optimality, ii) elegant cross-layer extensions, and iii) a distributed dynamic queue-length differential based routing policy that stabilizes all queues in the network. Researchers have also uncovered a fundamental connection between the back-pressure based congestion control and the Lagrangian dual decomposition framework plus the sub gradient method in classical nonlinear optimization theory where (scaled) queue-lengths play the role of Lagrangian dual variables and the queue-length updates correspond to sub gradient directions. However, despite all the salient features, the sub gradient nature of the back-pressure based congestion control and routing schemes turns out to be a factor that plagues their performance in practice. Being a first-order method (sub gradients can be viewed as a first-order support of the dual function), back-pressure based joint congestion control and routing schemes neglect the curvature of the objective function contour, which is characterized by the Eigen value condition number of the Hessian matrix that usually becomes increasingly ill-conditioned as the iterates approach an optimal solution. As a result, it necessitates a small update in each iteration which subsequently slows down convergence and undermines the performance of optimization. This limitation motivates us to pursue a second-order design approach for joint congestion control and routing.

II. EXISTING SYSTEM

The stability works all use backlog-based transmission rules, which treat joint stability and utility optimization. However some scheduling algorithms available in past to make the weight decision in a queuing network. This approach naturally provides tighter control of the actual queuing delays. Consider a simple distributed scheduling strategy, scheduling and prove that it attains a guaranteed fraction of the maximum throughput region in random wireless networks. The guaranteed fraction depends on “interference degree” of the network which is the maximum number of sessions that interfere with any given session in the network and do not interfere with each other. The outcome of throughput utilization is also suffered with those kinds of dependencies. Depending on the nature of communication, the transmission powers and the transmission models, the guaranteed division can be lower bounded by the maximum link degrees dependencies beyond the bandwidth, or even by constant delivery of packets without the knowledge of server life. The guarantees also hold in networks with network communication and an arbitrary number of frequencies. Hence the guarantees are tight in that they cannot be improved any further with maximal scheduling.

III. PROPOSED SYSTEM

The proposed system considers the problem of scheduling for maximum throughput utility and congestion control in a queuing network with random packet arrivals and time varying channel reliability. The system considers on hop technique, where each packet requires transmission over a single link. At every slot the network controller assesses
the condition of its channels and selects a set of links for transmission. The current system derives average delay bounds for one-hop wireless networks that use maximal scheduling subject to a general set of interference constraints. In particular, when arrival processes are modulated by independent Markov processes, we show that average delay grows at most logarithmically in the number of nodes in the network. Existing work provides explicitly computable and order-optimal delay bounds for time-correlated arrivals. Our work addresses the issues of general interference constraints and time-correlated “busty” traffic simultaneously. We treat the general interference model use the concept of queue grouping to derive the order-optimal delay results. Queue grouping techniques have been used in to reduce scheduling complexity in switches and wireless networks.

IV. MODULE DESCRIPTION

4.1 Node Status Identification
In this node status identification we identify the Node is weather live or not. In this process we easily identify the status of the node and also easily identify the path failure

4.2 Message Transmission
In this message transmission we just transfer the message to the destination or intermediate nodes. The intermediate node just forwards the message to destination. The receiver receives the message and sends the Acknowledge.

4.3 Update Status
In this paper we update the status of the node. Then only we can identify whether the node is live or not.

4.4 Change Status
In this module we can change the status of the node that the server is ready to receive.

V. ALGORITHM AND TECHNIQUES

5.1 Network Routing Algorithm:
Client-server computing or networking is a distributed application architecture that partitions tasks or workloads between service providers (servers) and service requesters, called clients. Often clients and servers operate over a computer network on separate hardware. A server machine is a high-performance host that is running one or more server programs which share its resources with clients. A client also shares any of its resources; Clients therefore initiate communication sessions with servers which await (listen to) incoming requests.

5.1.1 system architecture

![System Architecture Diagram]

Figure 5.1 System Architecture
5.1.2 Utility optimality and Queue stability

The utility-optimality and queue-stability is established of the proposed second-order framework. Our theoretical analysis unveils the fundamental reason behind the fast convergence in the proposed second-order framework. Interestingly, our analytical results naturally lead to a utility-optimality and queue-length tradeoff relationship governed by the barrier parameter of the interior-point method. We compare this tradeoff relationship to those in first-order methods and contrast their similarities and differences, thus further advancing our understanding of both first- and second-order methods in network optimization theory. We suggest several approaches to implement the proposed second-order method in a distributed fashion. In particular, for the distributed dual Newton direction computation (the most challenging part in our second-order method), we propose a new Sherman-Morrison-Woodbury (SMW) based iterative approach. We show that, on a -link network, the SMW-based approach obtains the precise solution in iterations, rather than asymptotically.

VI. DATA FLOW DIAGRAM

Data flow diagrams can also be used to provide a clear representation of any business function. The technique starts with an overall picture of the business and continues by analyzing each of the functional areas of interest. This analysis can be carried to precisely the level of detail required. The technique exploits a method called top-expansion to conduct the analysis in a targeted way.

The result is a series of diagrams that represent the business activities in a way that is clear and easy to communicate. A business model comprises one or more data flow diagrams (also known as business process diagrams)

Level 0

Figure 6.1 Level 0 Data Flow Diagram

Level 1

Figure 6.2 Level 1 Data Flow Diagram

Level 2

Figure 6.3 Level 2 Data Flow Diagram
Having a fundamentally different algorithmic meaning, the barrier parameter $\lambda$ in our second order method plays a similar role in characterizing the tradeoff compared to the sub gradient step-size scaling factor of the first-order methods. Thus, we summarize the performance scaling of first and second-order methods in Table I (all parameters in firs to order methods are standardized.

Therefore, the “change of queue-length” in our second-order method compared to the “queue-length value itself” in first-order backpressure methods can be viewed as one-order higher in the queue length variation sense, hence providing another perspective to interpret the name “second-order.” Lastly, the step-size control in (7) and (8) is used to ensure the utility-optimality result and will be the parameter $M > 0$ could be set to some upper bound of the average source session rate to reduce the bushiness.

VIII. CONCLUSION

In my paper have developed a new second-order algorithmic framework used joint congestion control and routing optimizations. Unlike most joint congestion control and routing methods in the literature, our proposed algorithmic framework fundamentally deviates from the classical back-pressure idea to offer not only utility-optimality and queue-stability, but also fast convergence and low delay. Collectively, these results serve as an exciting first step toward an analytical foundation for a second-order joint congestion control and optimization theory that offers fast convergence performance. Second-order cross-layer optimization for network systems is an important and yet under-explored area. Future research topics may include extending and generalizing our proposed second-order algorithmic framework to applications in other network systems, such as wireless networks with stochastic channel models, cloud computing resource allocations, and energy production scheduling in the smart electric power grid.

REFERENCES


