SC19 Network Research Exhibition: Demonstration Abstract

Optimized Traffic Engineering Through Bottleneck Structure Identification for High Speed Data Networks

Reservoir Labs

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Abstract

Reservoir Labs has developed GradientGraph (G2), a new network optimization platform to help tune the performance of flows in high speed networks. This framework is based on a new mathematical theory [RG10, RL19] and algorithms that can efficiently (in polynomial time) identify the bottleneck structure of a network, revealing key topological and structural properties of the network towards optimizing its Quality of Service (QoS). Using G2, network operators can (1) identify in real time the bottleneck links in a network, (2) make optimized traffic engineering decisions (e.g., flow re-routing or traffic shaping), (3) create a baseline to identify flow performance issues and (4) perform capacity planning to optimize network upgrade decisions.

We propose to deploy and test our G2 network optimization framework in the Supercomputing/SCinet testbed with the overarching objective of demonstrating and evaluating the performance improvements achieved with the G2 technology.

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Goals

1. Installation of the G2 network optimization software platform into SC/SCinet network. (See also the next section for more details on installation.)
2. Visualization in real time of the network's Bottleneck Precedence Graph and the Flow Gradient Graph. (See [RG10] and [RL19].)
3. Identification of the network's bottlenecks. Ranking of bottlenecks according to their severity.
4. Identification of elephant flows. Ranking of flows according to their performance and QoS impact.
5. Identification of optimal traffic engineering policies: traffic re-routing and traffic shaping.
6. Quantification of flow performance improvements achieved through the optimized policies.

Resources

The G2 network optimization platform provides software plugins to connect to high speed networks requiring three inputs: (1) Network topology (switching and link connectivity graph), (2) routing tables (which can be obtained by querying the routing and/or SDN infrastructure, for instance via BGP-LS, although not limited to it) and (3) IP tuple flow information (which can be obtained from tools such as NetFlow, sFlow or Bro/Zeek logs).

This effort will require us to integrate the G2 network optimization platform into the SC/SCinet network in order to obtain in real time the above three inputs (topology, routing and flow information) and operate the system to achieve the goals stated in the previous section. The G2 optimization platform (libraries, GUIs and CLIs) is a purely software technology that will run on a single computer. That computer will need the necessary network connectivity to obtain the above mentioned inputs.

Involved Parties

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