Streaming Solutions for Fine-Grained Network Traffic Measurements and Analysis

Abstract:

Online network traffic measurements and analysis is critical for detecting and preventing any real-time anomalies in the network. We propose, implement, and evaluate an online, adaptive measurement platform, which utilizes real-time traffic analysis results to refine subsequent traffic measurements. Central to our solution is the concept of Multi-Resolution Tiling (MRT), a heuristic approach that performs sequential analysis of traffic data to zoom into traffic subregions of interest. However, MRT is sensitive to transient traffic spikes. In this paper, we propose three novel traffic streaming algorithms that overcome the limitations of MRT and can cater to varying degrees of computational and storage budgets, detection latency, and accuracy of query response. We evaluate our streaming algorithms on a highly parallel and programmable hardware as well as a traditional software-based platforms. The algorithms demonstrate significant accuracy improvement over MRT in detecting anomalies consisting of synthetic hard-to-track elephant flows and global icebergs. Our proposed algorithms maintain the worst-case complexities of the MRT while incurring only a moderate increase in average resource utilization.