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The SPRAWL Distributed Stream Processing System

Many large financial, news, and social media companies stream large quantities of data to customers, either through the public internet or on their own internal networks. These customers often depend on that data being delivered in a timely and efficient manner. In addition, many customers subscribe to the same or similar data products (e.g., particular types of financial feeds, or feeds of specific social media users). A naive implementation of a data dissemination network like this will cause redundant data to be delivered repeatedly, wasting bandwidth, increasing network delays, and driving up costs. In this paper, we present SPRAWL, a stream processing system designed to address the wide-area data processing and dissemination problem. It allows users to pose SQL-like queries over distributed data streams and execute them efficiently. SPRAWL provides two key functions. First, it is able to generate a shared and distributed multi-query plan that transmits records through the network just once, overlapping the computation of streaming operators that operate on the same subset of data. Second, it is able to compute an in-network placement of operators. This placement minimizes the overall plan cost for a class of cost functions that consist of a weighted sum of plan CPU usage, bandwidth consumption and latency. The placement is optimal when resource constrains are not violated, and is near optimal when constraints are reached. Overall, we show that this can increase throughput by up to a factor of 5 and reduce dollar costs by a factor of 6 on a financial data feed processing benchmark.