Securing MapReduce Computations Using Accumulating Automata

Goals

MapReduce is a programming model that was introduced by Google in 2004 for large-scale data processing. MapReduce also has extensive applications for cloud computing. The use of public, private, hybrid, and multi-clouds gives rise to several challenges regarding security and data management. Companies and countries each have their own regulations for using the clouds.

Description

Various challenges in the hybrid clouds, e.g., malicious mappers, malicious reducers, non-secure communications between the map and the reduce phases, are still not being considered. These challenges could reveal data or computations in the clouds. We explore a secure model for MapReduce computations that will provide a solution to the aforementioned problems.

State-transition systems are accumulating automata, $A = (V, \sum, T)$, where $V \sum$ is a set of nodes, is an input data split, and T is a transition function. Each node has a value, and these values are shared among several mappers using secret sharing.

A secure version of MapReduce computations using accumulating automata solves multiple real-world problems, where users do not want to reveal data and computations in the cloud. A few examples include: accessing the patients' database to enhance the drugs and diseases relation without revealing the patients' information; shopping a website's database to enhance advertisement policies without revealing customers' information; and computations on a bank database without revealing individuals' information and illustrating the need for secure MapReduce using accumulating automata.

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