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SMACK MY SIMULATOR UP - HOW BIGDATA TOOLS CAN BE USED TO IMPROVE SYSTEM  
SIMULATION SCALABILITY

**Abstract**

Space systems and systems-of-systems are becoming more and more complex while at the same time development cost has to come down due to increasing competition. This lead to the adoption of system-simulation in the system-engineering domain. As these simulation tools are becoming more and more complex themselves, the question of scalability arises. Traditionally system-simulators are scaling well vertically. This means that the performance scales with the power of the computer the simulator is run on. Horizontal scalability over multiple computers and/or data centers remains a problem though. In this paper we propose a simulator technology and data processing pipeline that scales well horizontally. This is achieved through the use of tools from the "BigData" domain which are built to be horizontally scalable. The tools described in this paper are forming the so called "SMACK Stack" which stands for: Scala, Mesos, Akka, Cassandra and Kafka. Scala and Akka are used for the programming of the scalable simulator architecture while Kafka is a messaging framework that is used to send the simulated data to Cassandra, a database. This architecture allows arbitrarily large simulations to be run, depending on the amount of available computing resources. The storage of the results in Cassandra additionally allows to do "BigData" analytics on the results of simulations in order to find anomalies and to derive knowledge about the simulated system. In this paper we show the refactoring of the existing "ThirdEye" system simulation kernel to the new architecture and show how this new architecture can be used to simulate large scale systems.