

Scale-SMR: Design and Implementation of Support Mechanisms for Dynamic Scaling for State Machine Replication Systems

Context:

State machine replication (SMR) is a generic method for implementing fault-tolerant services. Traditionally, SMR is used in static configurations, and only few research publications (and even fewer real systems) consider dynamic reconfigurations at runtime. On the other hand, cloud computing has highly popularized the concept of dynamic scaling. It is desirable for SMR application used on cloud infrastructure to adequately support dynamic scaling.

Topic:

This project aims at analyzing and improving the performance of the combination of SMR with dynamic scaling. Auto-scaling of resources in a SMR system without considering the specifics of SMR will possibly result in a very poor performance. It shall be investigated how SMR systems can be prepared for scaling operations and how auto-scaling decisions can take into account specifics of SMR.

In the project, as a first step the impact of both horizontal scaling (i.e., adding and removing replicas) and vertical scaling (i.e., changing the CPU or network resources of replicas) when applied to SMR replicas shall be studied on the basis of existing SMR implementations such as JPaxos and BFTsmart. In a second step, mechanisms for optimization the combination of scaling and SMR shall be designed, implemented, and analyzed.

Keywords: State Machine Replication (SMR), Dynamic Scaling, Intrusion Tolerance (INTOL), Paxos, BFTsmart

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