



Raft for Cloud Continuum

An Open Call Success Story





The cloud continuum, ranging from centralized cloud data centers through fog and edge nodes to IoT devices, is on a growth trajectory to play a crucial role in the implementation of advanced data-driven applications, including emerging AI and machine-learning-based applications, beyond the 5G era. With its distributed and federated model, the cloud continuum will help address the pressing challenges of exploiting data generated at the network edge and by IoT devices. The efficient operation of this distributed model requires a consensus protocol, such as Raft, to coordinate the geo-distributed sites.

Despite the high efficiency of Raft in the absence of long delays in the network, the geo-distributed nature of the cloud continuum requires its redesign and adaptation to this environment. Raft is a state-of-the-art algorithm for reaching consensus in distributed systems, such as the etcd cluster of Kubernetes (K8s), the various clusters of SDN controllers (ODL and ONOS), or the ordering service of HyperLedger Fabric (HF). We should mention that ONOS is a main component of the Aether architecture, and HF most probably will be integrated into the beyond 5G networks for trusted information sharing between the network providers. In all the aforementioned examples of distributed systems, there are multiple nodes (etcd nodes/SDN controllers/orderer peers of HF) with identical states across all of them, thanks to Raft.

Every time one of the nodes has a state change, the other nodes repeat that change. This serves as load balancing across the nodes as well as resilience against network failures.

Raft is thoroughly researched, however, there is a large gap in the literature on how it performs in geo-distributed networks. The effective selection of the best node to serve as the leader among the distributed nodes is a critical factor in Raft performance since all operations and state changes are handled by the leader.

Currently, Raft includes a mechanism that elects a new leader among the nodes when there is no one, without considering critical parameters for the system operability, such as the location of these nodes. This was one of the main objectives of Raft4CC, which is the efficient election of the Raft leader for maximum system availability. Apart from the Raft election mechanism improvements, scalability is required so that Raft-operated distributed systems can include even 2-digit numbers of nodes. Raft supports strong consistency between node states, requiring a quadratically increased volume of control traffic between the nodes and raising scalability issues.

Meet the Team



PANGAEASA is an innovative start-up enterprise established in Volos, Greece in 2017. The start-up despite its small size, is utilizing academic labs and industrial partners either in Greece or abroad, therefore is capable of coping with the most modern challenges to satisfy its customers' needs, while maintaining the "state of the art" both in developing technologies and the provision of services. During the last 3 years, **PANGAEASA** has been involved in the experimental development and application of innovative tools and systems in the food industry and precision agriculture technologies (drones, IoT sensors/ Cloud etc).

In this respect, the following are utilized:

- Development and deployment of autonomous IoT sensing devices. Technological research, applications on Autonomous Aerial Vehicles (UAVs).
- Translational research, applications and support on autonomous prototype vehicles with applications in "Precision Agriculture"

The leading team involves highly skilled people having extensive experience in the field of research and experimental development in computer science but also in the production fields.

Ms Georgia Panagopoulou, founder, specialises in planning/scheduling systems automation, participating in a series of research and industrial projects.

Dr Theodosiadis - Thomaidis Thomas has long experience (1995 to date) in research and development, as he has led several industrial projects and set up start-up companies and organisations, acting either as an entrepreneur or innovation manager.

