

# Aloe: An Elastic Auto-Scaled and Self-stabilized Orchestration Framework for IoT Applications

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**Abstract—** Management of networked Internet of Things (IoT) infrastructure with in-network processing capabilities is becoming increasingly difficult due to the volatility of the system with low-cost resource-constraint devices. Traditional software-defined networking (SDN) based management systems are not suitable to handle the plug and play nature of such systems. Therefore, in this paper, we propose Aloe, an elastically auto-scalable SDN orchestration framework. Instead of using service grade SDN controller applications, Aloe uses multiple lightweight controller instances to exploit the capabilities of in-network processing infrastructure. The proposed framework ensures the availability and significant reduction in flow-setup delay by deploying instances near the resource constraint IoT devices dynamically. Aloe supports fault-tolerance and can recover from network partitioning by employing self-stabilizing placement of migration capable controller instances. The performance of the proposed system is measured by using an in-house testbed along with a large scale deployment in Amazon web services (AWS) cloud platform. The experimental results from these two testbed show significant improvement in response time for standard IoT based services. This improvement of performance is due to the reduction in flow-setup time. We found that Aloe can improve flow-setup time by around 10%–30% in comparison to one of the state of the art orchestration framework.

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