High-performance Scientific Computing
Final Project Report

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Project Overview:

Apache OpenWhisk is one of the top-level projects by Apache Foundation. It's an open source serverless platform that follows event driven programming model, events drive the Serverless execution of functional code called Actions. Events can come from any Event Source or Feed service including such as Datastores, Message Queues, Mobile and Web Applications, Sensors, Chatbots, etc. The diagram below shows the control workflow logic inside OpenWhisk.

Problem Statement:

Most serverless platforms offer large-scale offerings but the default configuration of OpenWhisk is very small scale which could be used for exploration stages but for production workloads. The aim of this project was to perform a large-scale deployment of OpenWhisk.

Setup details:

During the lifetime of the project, two different deployment options were deployed and tested.

1- Docker-Compose

Docker-compose is a tool for defining and running multi-container docker applications.

Hardware specifications:

Single node bare-metal server
CPU: Two Intel E5-2660 v2 10-core CPUs at 2.20 GHz
RAM: 256GB Memory (16x 16 GB DDR4 1600MT/s dual rank RDIMMs)

Deployment official link:

https://github.com/apache/openwhisk-devtools/tree/master/docker-compose

2- Kubernetes

Kubernetes is an open-source container-orchestration system for automating application deployment, scaling, and management.

Hardware specifications:

9 – node Kubernetes cluster
Kube version: v1.16.3
Single node hardware specifications
CPU: Ten-core Intel E5-2640v4 at 2.4 GHz
RAM: 64GB ECC Memory (4x 16 GB DDR4-2400 DIMMs)

Deployment official link:

https://github.com/apache/openwhisk-deploy-kube

Conclusion:

The project required continuous interactions with the OpenWhisk developers which was done through official Slack channel. By the end of the project, I have done a successful Kubernetes deployment of OpenWhisk, large enough to support a concurrency limit of 800 function invocations down from a concurrency limit of 8 in default settings.

Final submissions:

The official repositories did not include any details for scaling-up the local OpenWhisk deployments. After successfully finishing the project, I offered to improve the documentation for scale-up. I opened a git issue, submitted a pull request which has also been merged. In order to replicate the results, one can follow the contribution link to configure the local deployment.

Contribution link:

https://github.com/apache/openwhisk-deploy-kube/issues/551