INDIAN INSTITUTE OF BOMBAY

Micro Cloud Setup Using OpenShift

Suraj Goel [1] Saurabh Vijay [2] Anzum Bano [3]

[1]CSE,MNNIT Allahabad

[2]CSE,MNNIT Allahabad

[3]IT,MNNIT Allahabad

July 9 2019

Outline

Introduction

Micro-cloud setup using Openshift technology is the project undertaken by Eklavya summer internship program at IIT Bombay.
The project focuses on setting up of OpenShift cluster and deployment of openedX platform on the multi-node cluster.

OpenShift Container Platform adds:

- Source code management, builds, and deployments for developers.
- Autoscaling and Automatic load balancing in an application.
- Managing and promoting images at scale as they flow through your system.

Objective

Setting up Micro-cloud architecture with commodity storage and server nodes using OpenShift(PaaS). OpenShift will provide infrastructure for orchestration of dockerized images of applications like Open edX

- Giving access to developer to create , modify and deploy applications on demand with the click of a button.
- To increase portability of applications by containerizing phenomena .
- To increase scalability of applications.
- To make applications more reliable and secure by containerize code and data separately.
- To make the deployment of dockerised images of applications fast and simple.

Technologies Used

- **Shell Scripting**:A shell script is a text file that contains a sequence of commands for a UNIX-based operating system.
- **Git**:It is a free and open source distributed version control system designed to handle everything from small to very large projects with speed and efficiency.
- **Ansible**:It is an open-source software provisioning, configuration management, and application-deployment tool.
- **Docker**:Docker is an open source software platform to create, deploy and manage virtualized application in containers.
- **Kubernetes**:It is a container orchestration engine.
- **OpenShift**:It is an open source hybrid cloud application Platform as a Service (PaaS) .

OpenedX Platform

OpenedX is an open source online MOOC platform to create and deliver online courses. It is the software that powers edx.org and many other online education sites.
Few Components of openedX platform:

- **Learning Management System (LMS)**:The LMS is the most visible part of the Open edX project.Learners take courses using the LMS.
- **Studio**:Studio is the course authoring environment.Course team use it to create and update courses.
- **Forum**:The LMS uses an API provided by the comments service to integrate discussions into the learners course experience.
- **Elastic Search**:The Open edX project uses Elasticsearch for searching in multiple contexts, including course search and the comments service.

openedX Containers

No.	Container Name	Docker Image
1	edx.devstack.chrome	edxops/chrome:ironwood.master
2	edx.devstack.elasticsearch	edxops/elasticsearch:devstack
3	edx.devstack.firefox	edxops/firefox:ironwood.master
4	edx.devstack.memcached	memcached.devstack.edx
5	edx.devstack.mongo	mongo:3.2.16
6	edx.devstack.mysql	mysql:5.6
7	edx.devstack.credentials	edxops/credentials:ironwood.master
8	edx.devstack.discovery	edxops/discovery:ironwood.master
9	edx.devstack.ecommerce	edxops/ecommerce:ironwood.master
10	edx.devstack.lms	edxops/edxapp:ironwood.master
11	edx.devstack.edx_notes_api	edxops/notes:ironwood.master
12	edx.devstack.studio	edxops/edxapp:ironwood.master
13	edx.devstack.forum	edxops/forum:ironwood.master
14	edx.devstack.devpi	edxops/devpi:ironwood.master

OpenShift Cluster

OpenShift uses the kubernetes master/node architecture as a starting point.
A cluster on 4 machines was setup using openshift. Master node,Infra node and 2 worker nodes were setup.A fully functional cluster was deployed.

Host Name	IP Address	CPUs	RAM
master.cse.iitb.ac.in	10.129.132.111	4	16GB
node1.cse.iitb.ac.in	10.129.132.101	4	8GB
node2.cse.iitb.ac.in	10.129.132.108	4	8GB
node3.cse.iitb.ac.in	10.129.132.112	4	2GB

Table: Nodes

Deployed Cluster Architecture

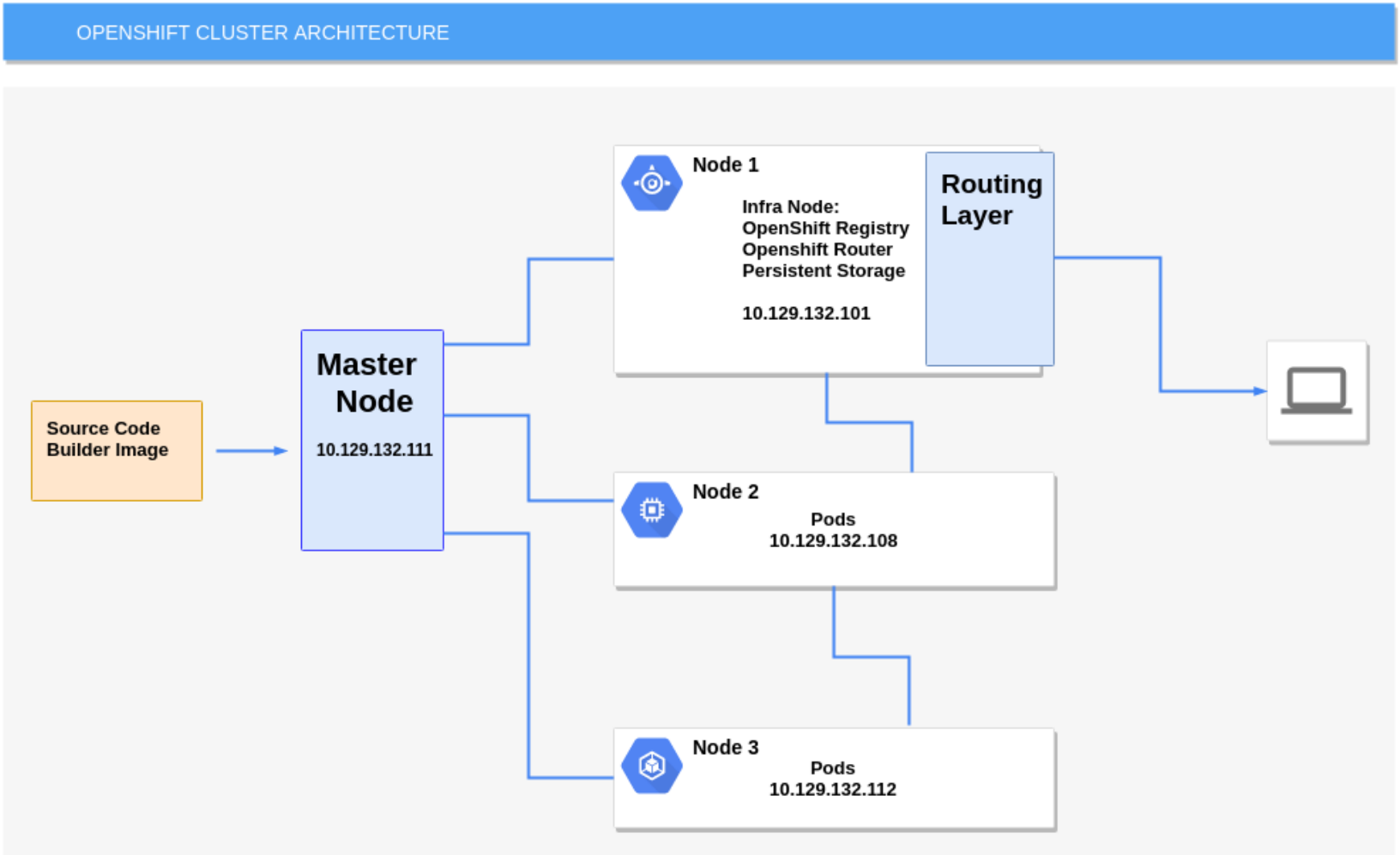

Fig. 1:Openshift cluster

Deployment Of OpenedX Platform On OpenShift Cluster

Deployment of services like LMS and its dependencies such as mySQL,mongodb,devpi was performed on openshift cluster.

- Persistent storage source was setup for the services.
- Persistent volume claims were made for the services.
- Image Stream was setup for each component by pulling docker images from docker-hub and then pushing it to openshift registry present on Infra-Node.
- Openshift services were setup for each openedx service
  A Kubernetes service serves as an internal load balancer. It identifies a set of replicated pods in order to proxy the connections it receives to them.
- openedx services were deployed using deployment configs of each service.

Problems And Errors Faced

- Devstack Installation
  - **./provision.sh: line 21: /usr/local/bin/docker-compose: Permission denied**
  - **TASK [common : Update expired apt keys] ****************
    Fix:keyserver.ubuntu.com to hkp://keyserver.ubuntu.com:80
- OpenShift Installation
  - **wget-1.14-18.el7_6.1.x86_64:No more mirrors to try.**
    Fix:sudo yum install wget
  - **TLS Handshake Error/Connection Timed out**
    Fix: Run the command again.
  - **API Server Error:Get https://127.0.0.1:8443/healthz?timeout=32s:**
    Fix: used 4 dedicated machines for multi-node installation.

- openedX platform on OpenShift
  - **Unable to perform provisioning step**
    Currently the provision step in installation of devstack is done by executing commands in containers.
    Since Containers reside in pods in openshift clusters,Various provisioning steps fails.

Results And Future Goals

- Configured Openshift cluster consisting of 1 master, 1 infra-node , 2 nodes.
- Successfully build and deployed various applications based on Ruby,PHP, NodeJs etc.
- Did Successful Scaling and Descaling of pods.
- Deployed various services of open-edx like mysql,mongodb, chrome,lms,cms etc on openshift.
- Future Goal:Complete deployment of open-edx on openshift by resolving conflicts,being faced in provisioning.
- Future Goal:Installation of open-edx on openshift, using openfun Arnonld tool.

Thank You

References I

- Fig 1 : Diagram drawn using draw.io
- Openshift in Action by Jamie Duncan, John Osborne.