RFP 179 - Compute Management Service

Draft

9 Pages

Abstract

A large variety of ways exist today to create, run and manage computing instances, whether this be in the cloud, on a computing grid or on a container-based environment. While physically highly diverse, managing these on a logical level can be seen as similar. This RFP seeks to define a common service to facilitate managing compute nodes across a wide variety of platforms.

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0.3 Feedback

This document can be downloaded from the OSGi Alliance design repository at https://github.com/osgi/design The public can provide feedback about this document by opening a bug at https://www.osgi.org/bugzilla/.

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0.5 Terminology and Document Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY" and "OPTIONAL" in this document are to be interpreted as described in 1.

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Source code is shown in this typeface.
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0.6 Revision History

The last named individual in this history is currently responsible for this document.

Revision	Date	Comments
Initial	December, 2015	David Bosschaert <*bosschae@adobe.com*> initial version.
0.1	January, 2016	David Bosschaert, feedback from Madrid F2F
0.2	May, 2016	David Bbosschaert, updates following discussion at the Chicago F2F
0.3	May, 2016	David Bosschaert, update to requirement NO0020 following feedback from Todor Boev.

1 Introduction

OSGi RFP 133 (http://osgi.org/bugzilla/show_bug.cgi?id=114) provides the foundation requirements of many cloud-related activities in the OSGi Alliance. It includes requirements around management of nodes in a cloud environment where a node runs an OSGi framework. This RFP seeks to elaborate on the cloud environment management requirements, expanding them to more general container-based environments as well as adding support for nodes that can run any type of application, such as a database or load balancer.

2 Application Domain

The domain of this RFP is Cloud computing, Container-based computing and Grid computing. Effectively any environment where compute nodes or instances can be created programmatically. The RFP seeks to define requirements for a common API specification to manage Compute nodes across these environments.

Existing solutions in this area include, but are not limited to:

- Apache JClouds : http://jclouds.apache.org
- OpenStack: http://www.openstack.org
- Cloud Foundry: https://www.cloudfoundry.org
- TOSCA: http://docs.oasis-open.org/tosca/
- CAMP: https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=camp
- Open Container Initiative: https://www.opencontainers.org/

2.1 Terminology + Abbreviations

Compute Node – an entity that can execute code. Either a physical computer, virtual machine or lightweight container. The entity provides an operating system, such as Microsoft Windows, Linux, other unix or similar. The node is connected to a IP-based network.

3 Problem Description

Many cloud vendors exist today that provide the capability to create compute nodes allowing the user to run applications on these vendor-provided environments. Compute nodes can generally be created using a remote API, web interface or command-line tool.

More recently container-based computing is becoming popular, docker is currently dominant in this space but other solutions such as rkt (Rocket) are also emerging. With container-based computing not an entire Virtual Machine is created, but rather a container to run a single program is created. While containers are isolated, the operating system and baseline functionality such as programming language support is often shared with other containers running on the same physical or virtual underlying platform.

While some standardization is happening on the virtual machine level, e.g. openstack, these standards don't apply to container based solutions. In the Java world some opensource projects exist that try to address this

issue, such as Apache jclouds, however the biggest issue here is that as jclouds provides its own API it also needs to provide all of the bindings to the technologies. This means that jclouds supports an enormous amount of technologies, where not all of these are equally well maintained.

By defining an OSGi service API, implementors can decide to only support one target: the one they care about. Multiple targets can be supported at runtime by combining multiple API implementors, each of which will be represented, for example, by a service in the service registry. Having a specification-defined API supports this federated approach.

4 Use Cases

4.1 Docker cluster on local machine

Bob wants to run an application which is composed of a number of containers using Docker on his local machine. In the future he wants to deploy the same application to a docker-enabled cloud provider, but he does not know yet which one. Bob is looking to develop his application in such a way that he does not need to rewrite the container logic once he has decided what his ultimate target runtime is going to be.

4.2 Private cloud + Azure VM = hybrid

Rosanne needs to create an application that runs in a private cloud. However she needs to cater for scenarios where the capacity of the private cloud is not sufficient. In such cases she needs to be able to add public cloud Vms provided my Microsoft Azure to the application creating a hybrid deployment. She wants to keep the application logic simple and would like a single programming model that works for both the private cloud as well as in Azure.

4.3 Multiple target platforms

Harry needs to run an application that is comprised of a number of docker-based Vms in a cloud container platform such as Amazon ECS. However, for demonstration purposes he would also like to run this application on his local laptop using local docker containers. Harry wants to share his application logic across these two environments, he does not want to create different implementations of his work, one that runs on local docker and the other on Amazon ECS.

4.4 Dynamic Cluster Scaling

William runs his software in a cluster of machines. However, during certain times of the week, the cluster is much heavier loaded than others. William therefore installs a load checker on each machine and if the load goes over a certain limit then the software automatically creates a new node which is then added to the cluster. If the systems go below a certain limit the nodes are deleted again.

4.5 Pets vs Cattle

Zoe needs to run 4 Mongo DB nodes. She therefore creates 4 Elastic Block Storage (EBS) volumes and creates 4 compute nodes that attach these EBS volumes. She then starts the first mongo instance and initializes the support for replica sets. She uses the DNS name that is associated with the volume to mark the initial leader. She repeats this for the other 3 instances. The replica set is therefore made of the DNS names of the volumes.

She then marks the compute nodes to always have one instance running.

5 Requirements

CM0010 – The solution must provide a mechanism to create and destroy compute nodes.

CM0020 – It must be possible to implement the solution for existing compute platforms, including, but not limited to, cloud-based platforms, grid computing-based platforms and/or container-based platforms.

CM0030 – The solution must provide a mechanism to specify the root image to run on the compute node.

CM0040 – The solution must provide a mechanism to specify compute node parameters such as the amount of memory, cpu and exposed network ports.

CM0050 – The solution must provide a means to specify environment variables to be set in the compute node.

CM0060 – The solution must provide a mechanism to run an executable in the compute node once available.

CM0070 – The solution must support listing and querying of compute nodes.

CM0080 – The solution must support specifying that more than one node of a given definition be created.

CM0090 – The solution must allow the number of requested nodes of a given definition to be changed after the initial launch of the associated compute node(s).

CM0100 – The solution must support assigning logical names to nodes that can be used to address them.

CM0110 – The solution must allow integration with security features offered by the compute platform.

CM0120 – The solution must provide support for load balancers across a cluster of nodes.

CM0130 – The solution must provide the external address of a load balancer, if available.

CM0140 – The solution must support addressing a load balancer with a logical name.

CM0150 – The solution must provide runtime management information, for example via DTOs.

CM0160 – The solution must allow the effects of the service to follow a different lifecycle than the runtime of Compute Management Service.

CM0170 – The solution must be able to discover compute nodes created during previous runs of the Compute Management Service.

CM0180 – It must be possible to provide secrets to the computer node in a secure way

CM0190 – It must be possible to specify whether compute nodes have a private or public IP address or both.

CM0200 – It must be possible to create compute nodes which are not directly accessible by the creator, such as nodes that are connected to a different network than the creator.

5.1 Persistent Volumes

PE0010 – The solution must be able to create, list, and delete persistent volumes like Amazon Elastic Storage Blocks or Google's Persistent volumes

PE0020 – It must be possible to attach a persistent volume to a compute node when the node is created

PE0030 – It must be possible to have a unique DNS name for a compute node that is based on the attached persistent volume name.

5.2 Notifications

NO0010 – It must be possible to get notifications when nodes are created, are stopped, or die

NO0020 – It must be possible to receive notifications of the various states that a compute node goes through, including the following states: CREATED, WAITING, PENDING, STARTING, ~~RUNNING~~ACTIVE, ~~TERMINATING~~STOPPING, STOPPED, FAILED. Backing platforms may not support all states. Implementations are not required to provide notifications for states not supported by the backing platform.

6 Document Support

6.1 References

[1]. Bradner, S., Key words for use in RFCs to Indicate Requirement Levels, RFC2119, March 1997.

[2]. Software Requirements & Specifications. Michael Jackson. ISBN 0-201-87712-0

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6.3 End of Document