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PART 1

Overview

- Understanding Contrail Cloud on page 3
CHAPTER 1

Understanding Contrail Cloud

• Contrail Cloud Overview on page 3

Contrail Cloud Overview

Juniper Networks Contrail Cloud is an integrated Telco cloud platform built to run high-performance NFV with always-on reliability, allowing service providers to deliver innovative services with greater agility. Contrail Cloud Release 10.0 features Red Hat OpenStack combined with Juniper Contrail Networking, thereby bridging dynamic cloud orchestration with highly scalable connectivity. Furthermore, Contrail Cloud leverages AppFormix which has a built-in automation capability powered by machine learning to run the cloud infrastructure and VNFs in the most optimal manner, and remediating any potential failures to ensure adherence to SLAs.

This guide describes a platform architecture for Contrail Cloud Release 10.0. This guide can be used as a reference for building small and medium size OpenStack clusters comprising of < 100 computes.

For larger clusters, depending on the number of workloads that need to be supported in the cluster, the storage and compute requirements (CPU, Memory) on the servers hosting the controller components must be configured accordingly.
PART 2

Network Design

• Cluster Design on page 7
• Underlay Network Design on page 13
• Contrail Cloud and OpenStack on page 15
CHAPTER 2

Cluster Design

- Cluster Design Overview on page 7
- Controller VMs Requirements and Physical Server Specifications on page 10

Cluster Design Overview

A typical layout of the control plane infrastructure needed to support a small or medium OpenStack cluster is displayed in Figure 1 on page 7. Red Hat OpenStack (RHOS) Platform 10 which is the Newton release of OpenStack is typically deployed using OSP Director, the deployment tool for Red Hat OpenStack. RHOS Platform 10 is based on the OpenStack Triple-O project which has two primary components – an undercloud and an overcloud.

Figure 1: Basic Layout of an Undercloud and an Overcloud

The undercloud deploys and configures the overcloud. The undercloud is responsible for specifying the environment and roles for the different controller, compute, and storage components, provision the bare metal system and orchestrate the provisioning on the overcloud. In order to achieve these functions, the undercloud uses the following OpenStack services:

- Ceilometer
- Glance
- Heat
- Ironic
- Keystone
- Nova
- Neutron
- Swift

The overcloud is the resulting Red Hat OpenStack platform which is created using the undercloud where the actual OpenStack services run. The overcloud hosts the virtualized workloads running the cloud applications. The overcloud controller runs the following OpenStack services:

The undercloud host runs the OSP Director VM which is responsible for deploying the overcloud on the four other overcloud controller hosts, as displayed in Figure 2 on page 8. Each overcloud controller host has a few VMs that host the controller services related to Contrail and OpenStack.

In Figure 2 on page 8:

- CC refers to the contrail controller which constitutes the contrail configuration and control node
- CA refers to Contrail Analytics
- CADB refers to Contrail Analytics DB
- OS refers to the Red Hat OpenStack controller
- AFX refers to AppFormix which is an operations and monitoring tool that helps to manage the day 2 operations of the cluster

*Figure 2: Undercloud and Overcloud Controllers*

In order to establish communication between the various OpenStack services, the following six fundamental networks are essential in this deployment:

- Internal API network used for the actual VM data traffic
- Provisioning network used to provision the overcloud controller hosts base OS using the undercloud host’s ironic service
• Storage network used to carry Ceph-related storage traffic
• Storage management used for Ceph control and management traffic
• Management network used for OpenStack API traffic
• External network leading to the internet which is used to pull packages from external repos

While for some enterprise workloads, hyperconverged computes could work well, Juniper recommends separating computes from storage nodes in order to guarantee storage SLAs. Juniper suggests the deployment architecture model displayed in Figure 3 on page 9 with the specifications listed in Table 1 on page 9.

**Figure 3: Deployment Architecture**

![Deployment Architecture Diagram](image)

**Table 1: Deployment Architecture Specifications**

<table>
<thead>
<tr>
<th>Role</th>
<th>Model</th>
<th>Quantity (1 Rack)</th>
<th>Quantity (Additional Rack)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf TOR Switches</td>
<td>Basic Network Fabric</td>
<td>QFX5100-48S</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Advanced Network Fabric</td>
<td>QFX5100-48S</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>SmartNIC</td>
<td>QFX5200-32C</td>
<td>2</td>
</tr>
<tr>
<td>Spine Switches</td>
<td>Basic Network Fabric</td>
<td>QFX10002-72Q</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Advanced Network Fabric</td>
<td>QFX10002-72Q</td>
<td>4</td>
</tr>
<tr>
<td>Gateway Router</td>
<td>MX480</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>
Table 1: Deployment Architecture Specifications (continued)

Controller VMs Requirements and Physical Server Specifications

Table 2 on page 10 lists the minimum CPU, memory and disk requirements for the various controller VMs that constitute the control plane for the cluster.

Table 2: Controller VMs Requirements

<table>
<thead>
<tr>
<th>Role</th>
<th>vCPU</th>
<th>Memory (GB)</th>
<th>Disk (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSP Director VM</td>
<td>8</td>
<td>32</td>
<td>1000</td>
</tr>
<tr>
<td>OpenStack VM</td>
<td>8</td>
<td>64</td>
<td>500</td>
</tr>
<tr>
<td>Contrail Analytics DB VM</td>
<td>8</td>
<td>64</td>
<td>1000</td>
</tr>
<tr>
<td>Contrail Analytics VM</td>
<td>8</td>
<td>32</td>
<td>80</td>
</tr>
<tr>
<td>Contrail Controller VM</td>
<td>8</td>
<td>32</td>
<td>80</td>
</tr>
<tr>
<td>Appformix VM</td>
<td>8</td>
<td>16</td>
<td>100</td>
</tr>
</tbody>
</table>

In order to address the controller VM requirements listed in Table 2 on page 10 and design architecture described in “Cluster Design Overview” on page 7, the typical physical server specifications are listed in Table 3 on page 10. Depending on the actual workloads and the data plane traffic requirements, the network interfaces could be 25G/40G versus 10G.

NOTE: Blade Server platforms are not supported on Contrail Cloud.

Table 3: Physical Server Specifications

<table>
<thead>
<tr>
<th>Role</th>
<th>Undercloud Host</th>
<th>Controller Host</th>
<th>Compute Host</th>
<th>Storage Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU</td>
<td>Intel Xeon 2600v4 Series</td>
<td>Intel Xeon Platinum 8100 Series</td>
<td>Intel Xeon Platinum 8100 Series</td>
<td>Intel Xeon 6100 Series</td>
</tr>
<tr>
<td>Memory</td>
<td>128G</td>
<td>256G</td>
<td>256G</td>
<td>64G</td>
</tr>
</tbody>
</table>
Table 3: Physical Server Specifications (continued)

<table>
<thead>
<tr>
<th>Role</th>
<th>Undercloud Host</th>
<th>Controller Host</th>
<th>Compute Host</th>
<th>Storage Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk</td>
<td>1 x 480 GB SSD (Cassandra Journaling)</td>
<td>1 x 480 GB SSD (Cassandra Journaling)</td>
<td>2 x 1 TB HDD (SW RAID) — Host OS</td>
<td>2 x 1 TB HDD (SW RAID) — Host OS</td>
</tr>
<tr>
<td></td>
<td>2 x 1 TB HDD (SW RAID) — Host OS</td>
<td>2 x 1 TB HDD (SW RAID) — Host OS</td>
<td>4 x 240 GB SSDs — Ceph Journaling (1:5)</td>
<td>20 x 1 TB HDDs — Ceph OSDs</td>
</tr>
<tr>
<td></td>
<td>3 x 1 TB HDD — Data</td>
<td>3 x 1 TB HDD — Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network</td>
<td>2 x 10G — VM Traffic</td>
<td>2 x 10G — VM Traffic</td>
<td>2 x 10G — VM Traffic</td>
<td>2 x 10G — VM Traffic</td>
</tr>
<tr>
<td></td>
<td>2 x 10G — Storage Traffic</td>
<td>2 x 10G — Storage Traffic</td>
<td>2 x 10G — Storage Traffic</td>
<td>2 x 10G — Storage Traffic</td>
</tr>
<tr>
<td></td>
<td>2 x 1G — IPMI and Management</td>
<td>2 x 1G — IPMI and Management</td>
<td>2 x 25G — SmartNIC (optional)</td>
<td>2 x 1G — IPMI and Management</td>
</tr>
<tr>
<td>Quantity (1 Rack)</td>
<td>1</td>
<td>3</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>Additional Rack</td>
<td>-</td>
<td>-</td>
<td>18</td>
<td>16</td>
</tr>
</tbody>
</table>
Underlay Network Design

- Underlay Network Design with Contrail Cloud on page 13
- Advanced Network Fabric Design Overview on page 14

Underlay Network Design with Contrail Cloud

Figure 4 on page 14 provides a general guidance of what the underlay network fabric design looks like in a spine-and-leaf topology in order to cater to the cluster build-out as described in “Cluster Design Overview” on page 7.

As a requirement for RHOS, the RHOS Platform controller hosts must be on the same subnet, and thereby all controller hosts must be on the same rack in an Layer 3 Clos fabric underlay design.

Juniper recommends running the spine-and-leaf topology in a simple Open Shortest Path First (OSPF) area 0 Layer 3 Clos fabric design. The MX480 SDN gateways are connected separately to an additional top-of-rack (ToRs) leaf. This is similar to the Contrail Cloud Reference Architecture (CCRA) 1.0 underlay design.

NOTE: Due to limitations with Red Hat OpenStack Director (RHOSP 10) provisioning constructs, the Layer 3 Clos fabric underlay design is not supported. The multi-rack design is available only on Layer 2 fabric architecture.
Advanced Network Fabric Design Overview

If you want to provide separate underlay paths for storage and VM data plane traffic, a separate set of storage TORs and spine switches can constitute an advanced network fabric design as shown in Figure 5 on page 14.
CHAPTER 4

Contrail Cloud and OpenStack

Contrail Cloud Integration with OpenStack Overview

Figure 6 on page 15 illustrates the API-level interaction between OpenStack and Contrail configuration. The Contrail Neutron plug-in enables the OpenStack Neutron service to make the necessary API calls into the Contrail configuration node to create, delete, and update network resources as defined in OpenStack. Contrail configuration node has a northbound interface which exposes REST APIs to orchestration systems such as OpenStack and Contrail Web UI that can be used to make the network configurations.

Figure 6: Contrail Configuration and OpenStack—API Interaction

Figure 7 on page 16 illustrates a more detailed step-by-step interaction between components of OpenStack services, specifically Nova, Neutron, and Contrail services. At the control plane the Contrail plug-in for Neutron translates the configuration commands received from the northbound orchestration engines into corresponding Contrail-related configuration. On the data plane or forwarding plane, the Nova-agent running on each compute hypervisor interacts with the distributed forwarding engine in Contrail, called the vRouter, to set up a virtual-interface and tap interfaces for VMs to obtain connectivity.
Figure 7: OpenStack Services Interaction

User Logs in, Create Tenant (Projects), Create iPAM, Create Virtual Network, Launch VMs

Authentication, etc.

WEB UI (Horizon)

CONTRAIL WEB UI

Launch VM

Network-related Interaction

IDENTITY / ACCESS MANAGEMENT (Keystone)

NEUTRON PLUGIN

CONTRAIL CONFIG

CONTRAIL CONTROL

Bidirectional Message Bus (XMPP interaction)

VM

VM Spawned

vROUTER

NOVA AGENT

HYPERSERVER

Compute Node

Info to Spawn VM

Get Virtual Network Info

Select Compute Node to Spawn VM

Get VM image to Spawn

IMAGE SERVER (Glance)

OBJECT STORAGE (Swift)

BLOCK STORAGE (Cinder)

Storage

Contrail Cloud Platform Architecture
PART 3

Contrail Cloud Management

• Lifecycle Management on page 19


Lifecycle Management

- Lifecycle Management of Contrail Cloud on page 19

Lifecycle Management of Contrail Cloud

Perform the steps in the following illustrations for Red Hat OpenStack and Contrail upgrades:

Figure 8: Red Hat OpenStack Minor Upgrades

RedHat OpenStack Minor Upgrades

1. Minor Upgrades are in-place and follow the steps illustrated
2. Controllers are upgraded one at a time, so services keep running
3. Computes are upgraded one-at a time while workloads running on them are migrated to other computes
Figure 9: Red Hat OpenStack Major Upgrades

RedHat OpenStack Major Upgrades

1. Major upgrades are service impacting for the duration of controller upgrades when all controllers are upgraded at the same time.

2. Computes are upgraded one-at-a-time while workloads running on them are migrated to other computes.

Figure 10: Contrail Minor Upgrades

Contrail Minor Upgrades

1. Minor Upgrades are in-place and follow the steps illustrated.

2. Controllers are upgraded one at a time, so services keep running.

3. vRouters are upgraded one-at-a-time while workloads running on them are migrated to other computes.
1. Contrail Major upgrades follow ISSU where new set of controllers are spawned. 
   - ISSU daemon listens to config changes on old controllers and replays config onto the new controllers
2. The vRouters are upgraded one at a time and workloads are migrated during this upgrade.
3. Once all the vRouters are upgraded the old controllers are decommissioned and new controllers are brought into service