High Availability with VMware Cloud Director Container Service Extension
# Table of Contents

- Introduction ................................................................. 3
- High Availability Architecture of Container Service Extension Workloads .......... 3
- Configuration steps for the Service Provider ........................................... 5
  - VM/Host rule configuration in vCenter .............................................. 5
  - Placement Policy configuration in Cloud Director ............................... 7
- Creating Highly Available Kubernetes Clusters as Tenant User ......................... 11
- Note for stretched ESXi clusters .................................................. 13
  - Conclusion .................................................................................. 13
Introduction
This document describes how to create high available Kubernetes clusters with VMware Cloud Director and Container Service Extension.

VMware Cloud Director is a cloud service delivery platform that enables service providers to offer secure, efficient, and scalable cloud services to their customers. It provides a multi-tenant architecture that allows service providers to manage multiple customers and their resources in a vSphere environment. VMware Cloud Director also offers a self-service portal for customers to manage their own resources, including virtual machines, networks, and storage.

Container Service Extension (CSE) is an add-on for VMware Cloud Director that enables service providers to offer Kubernetes as a Service to their customers. CSE allows customers to deploy and manage Kubernetes clusters on VMware Cloud Director through the web portal or APIs.

Any vSphere infrastructure consists of a set of components such as CPU/Memory/Storage components within a bare-metal ESXi host, a rack of hosts, networking components within the racks, switches connecting multiple racks and so on.

A failure domain is a set of components whose failure will cause failure of application workloads. Hence application workloads will need to be aware of the topology of the failure domains, and replicate workloads across failure domains in order to achieve reliability across failure domains of interest. To ensure availability with good performance on failure, the placement of application workloads across failure domains must be balanced.

High Availability Architecture of Container Service Extension Workloads
To increase the availability of Kubernetes Clusters that are created and managed by Container Service Extension, you can use Placement Policies in VCD to spread the Kubernetes Master and Worker nodes across failure domains in vCenter.

This can be done by grouping ESXi hosts based on their failure domain location in the DRS settings in vCenter. These Host Groups then can be used in the Provider VDC (PVDC) configuration in VMware Cloud Director, to define Placement Policies. When creating a Kubernetes Cluster using Container Service Extension, a tenant user then can create groups of master and worker nodes, and select these Placement Policies.

The Kubernetes nodes then will be distributed across the different ESXi hosts, spanning multiple failure domains in vCenter.

The diagram below shows the architecture:
High Availability with VMware Cloud Director Container Service Extension

Fault Domain
Applications
Capacity
Aggregation
Virtualization
Hardware
Configuration steps for the Service Provider
As Service Provider, following steps are needed:

VM/Host rule configuration in vCenter
In Cluster Configuration, VM/Host Group setting, create Host Groups that reflect the physical failure domains. Add the ESXi hosts to the representing Host Group.
Then create VMs groups for each failure domain.

Now create VM/Host rules, and specify that the VM group must run on the corresponding Host Group.
Placement Policy configuration in Cloud Director
In Cloud Director’s Provider Portal, under Resources / Cloud Resources, VM Placement Policies, create Placement Policies that reflect these different Host / VM Groups. Make sure to label them properly, so that tenant users can understand that they represent different failure domains.
High Availability with VMware Cloud Director Container Service Extension

Create VM Placement Policy

1. What is VM Placement Policy?
2. General
3. VM Groups
4. Ready to Complete

VM Groups

A VM group is a collection of virtual machines with similar host requirements. Create an inline Logical VM Group by selecting one VM Group per cluster.

- legacy-cloud (0 selected)
- vmware-cloud-vcf (1 selected)
- VMware-Cloud
  - Site B VMs
  - Site A VMs

CANCEL  PREVIOUS  NEXT
In the Settings of Organization VDCs that are entitled to use Container Service Extension, add the VM Placement Policies
High Availability with VMware Cloud Director Container Service Extension
Creating Highly Available Kubernetes Clusters as Tenant User

As Tenant User, when creating the Kubernetes Cluster in the Container Service Extension UI, create additional Groups for and Worker Nodes, and select a different Placement Policy for each group.
Create New VMware Tanzu Kubernetes Grid Cluster

5. Worker Pools

Worker Pools

- worker-node-pool-1
  - Name: worker-node-pool-1
  - Number of Nodes: 2
  - Disk Size: 20
  - Sizing Policy: TKG small
  - Placement Policy: Site A
  - Storage Profile: lab-shared-storage

- worker-node-pool-2
  - Name: worker-node-pool-2
  - Number of Nodes: 2
  - Disk Size: 20
  - Sizing Policy: TKG small

CANCEL  BACK  NEXT
Note for stretched ESXi clusters
In case of using stretched ESXi clusters, where the hosts groups are located in different data centers with a higher probability of network connectivity loss between the data centers it is recommended to keep the Kubernetes Master nodes within the same data center to avoid inconsistencies in the etcd database.

Conclusion
In this paper we have described a model to achieve high availability for Container Service Extension workloads in VCD with the failure domain being at the level of a ESXi host group.