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MuleSoft Anypoint Platform Private Cloud Edition on vSphere Kubernetes Service on VMware Cloud Foundation

vmware by Broadcom

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Executive Summary

MuleSoft Anypoint Platform Private Cloud Edition (PCE) on VMware vSphere Kubernetes Service (VKS) with VMware Cloud Foundation delivers enterprise-grade integration capabilities that operate entirely within your private cloud infrastructure. Unlike cloud-hosted Anypoint Platform, PCE on VKS requires no external system interactions or internet connectivity, making it the optimal solution for air-gapped environments and organizations with stringent data sovereignty or compliance requirements. This solution provides a fully self-contained integration platform where all data, APIs, and management functions remain within the customer's data center, addressing regulatory mandates in financial services, healthcare, government, and other highly regulated industries.

Built on Kubernetes for inherent high availability, scalability, and resilience, this architecture enables customers to achieve cloud-native capabilities without the operational complexity typically associated with container orchestration platforms. By leveraging existing vSphere administrative skill sets and familiar VMware management tools, organizations can readily adopt MuleSoft Anypoint Platform without requiring specialized Kubernetes expertise. This approach reduces time-to-value, minimizes training requirements, and allows infrastructure teams to manage integration workloads using the same proven processes and tools they use for traditional virtualized environments, while benefiting from modern container-based deployment patterns and automated lifecycle management.

Benefits of using VKS with modern applications:

Lower TCO: With VKS, organizations have the ability to reduce silos, leverage existing tools and skill sets without having to retrain staff and/or change existing processes. Utilizing unified lifecycle management across infrastructure components to stay up-to-date with the most recent patches and minimizing security risks.

Operational Simplicity: VKS is engineered for unparalleled operational simplicity, leveraging the familiarity of existing vSphere tools, skills, and workflows. This design philosophy significantly reduces the learning curve for IT teams and streamlines management processes. With VKS, organizations benefit from automated cluster provisioning, which accelerates deployment times and minimizes manual configuration errors. Furthermore, its robust capabilities extend to automated upgrades and comprehensive lifecycle management. This integrated approach ensures consistent operations, reduces overhead, and frees up valuable resources to focus on innovation rather than infrastructure maintenance.

Run and Manage Kubernetes at Scale: Customers can effortlessly deploy and manage Kubernetes clusters at scale, leveraging a built-in, Cloud Native Computing Foundation (CNCF) certified Kubernetes distribution. VKS provides fully automated lifecycle management, streamlining operations from initial setup to ongoing maintenance and upgrades. This comprehensive approach ensures that organizations can harness the power of Kubernetes for their containerized applications with unparalleled efficiency and reliability, without the complexities typically associated with large-scale Kubernetes deployments.

Secure & Compliant by Design: Organizations can confidently run sensitive and regulated workloads with built-in compliance, data residency and sovereignty controls, and the ability to deploy isolated Kubernetes environments with flexible security postures at the cluster level.

vSphere Kubernetes Service

vSphere Kubernetes Service (VKS) is the Kubernetes runtime built directly into VMware Cloud Foundation (VCF). With CNCF certified Kubernetes, VKS enables platform engineers to deploy and manage Kubernetes clusters while leveraging a comprehensive set of cloud services in VCF. Cloud admins benefit from the support for N-2 Kubernetes versions, enterprise grade security, and simplified lifecycle management for modern apps adoption.

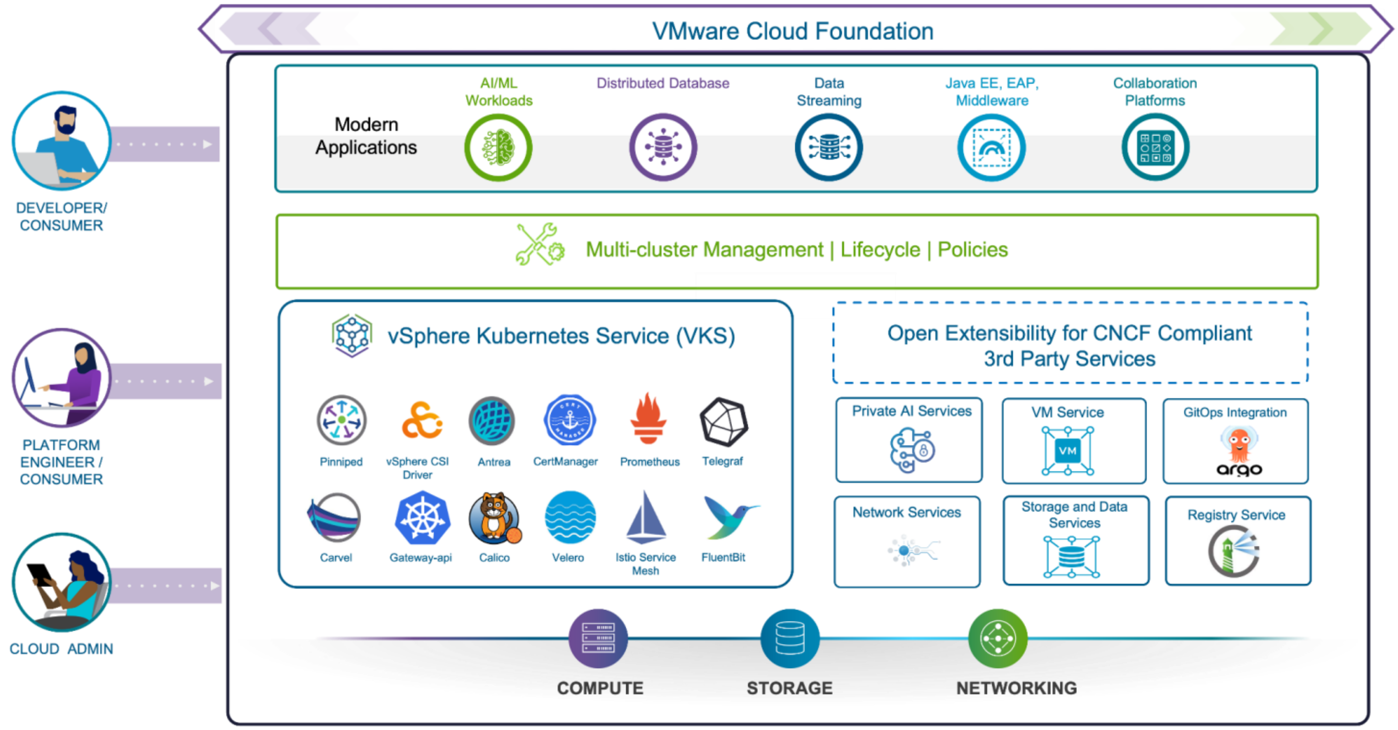


Figure 1: VKS on VCF Ecosystem

MuleSoft Anypoint Platform Private Cloud Edition

Anypoint Platform Private Cloud Edition (PCE) is an on-premises deployment of Mulesoft's Anypoint Platform that enables organizations to run and manage Mule applications on their own infrastructure while maintaining complete control over data storage, processing, and transmission. MuleSoft provides an integration platform that enables organizations to connect disparate systems, applications, and data sources, facilitating seamless data exchange, API management, and business process automation across on-premises and cloud environments.

The platform follows a two-plane architecture: the Control Plane, which consists of Anypoint services deployed as Kubernetes pods providing web-based management, application lifecycle management, API management, runtime management, monitoring, and security services; and the Runtime Plane, where Mule applications actually execute. Mule Runtimes are Java-based application servers that execute Mule applications, handling message processing, data transformation, connector execution for various protocols and systems, error handling, transaction management, and security enforcement.

Each runtime includes a Runtime Agent that registers with the control plane, receives deployment commands, manages application deployments and updates, sends health and metrics data, and handles certificate renewal and authentication. In the Hybrid Runtime Plane deployment model used with PCE, Mule runtimes are deployed as standalone processes (on physical servers, VMs, or containers) that register with the PCE control plane over the network, allowing the control plane to manage runtimes remotely while runtimes can be distributed across different locations or data centers. This architecture provides organizations with a fully self-contained integration platform that maintains all data on-premises while benefiting from MuleSoft’s powerful integration capabilities, with the flexibility to optimize infrastructure based on specific requirements, security policies, and operational constraints.

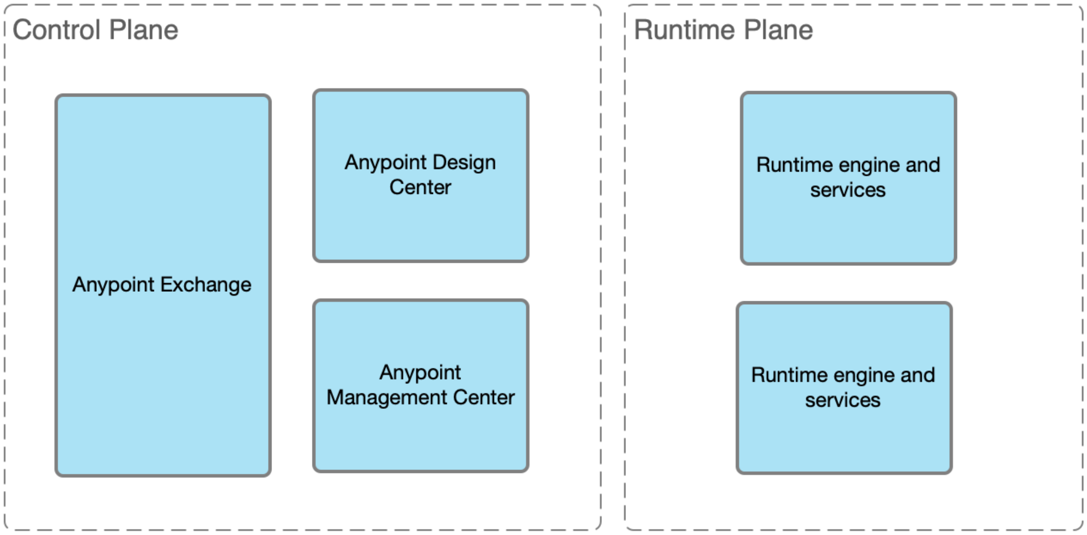

Control Plane
Anypoint Exchange
Anypoint Design Center
Anypoint Management Center
Runtime Plane
Runtime engine and services
Runtime engine and services

Figure 2: MuleSoft Workflow

Anypoint Platform PCE 4.1 Architecture

Anypoint Platform PCE is deployed to a VMware VKS cluster.

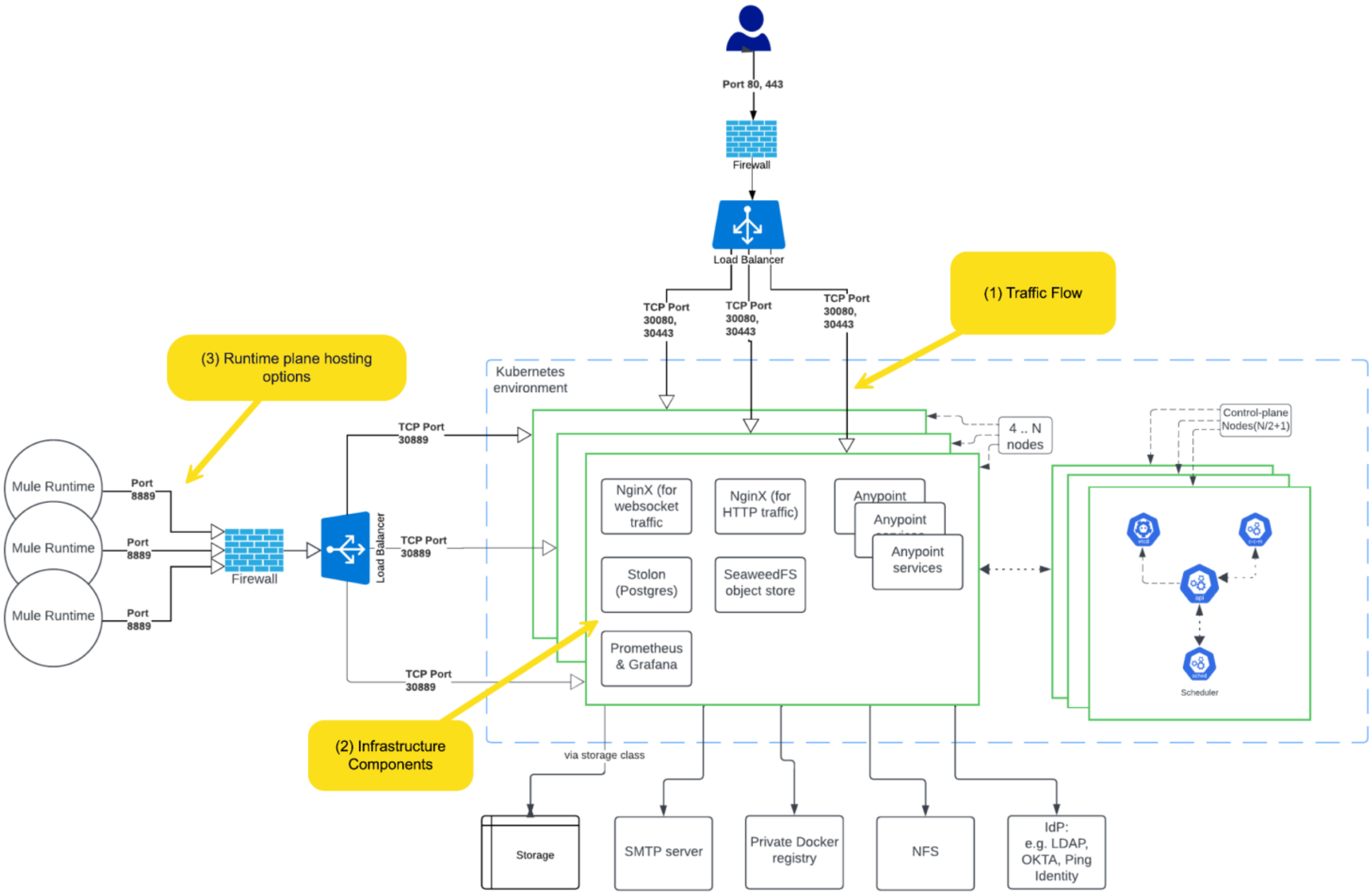


Figure 3: MuleSoft Architecture

1- Traffic Flow:

Traffic is forwarded from the external load balancer to two Kubernetes NginX services for HTTP/HTTPs and websocket traffic. For shared Docker registries, a subpath can be specified to isolate PCE container images within the registry.

2- Infrastructure components:

Stolon is an open-source PostgreSQL high-availability manager that provides reliable database services for PCE's stateful applications. It implements a master-standby replication model with automatic failover capabilities.
SeaweedFS is a distributed file system that provides scalable object storage for PCE.

3- Runtime plane hosting options:

MuleSoft offers various runtime planes. For Anypoint Platform PCE, the Hybrid Standalone hosting option is used to deploy and manage Mule runtimes via the MuleSoft control plane. https://docs.mulesoft.com/hybrid-standalone/

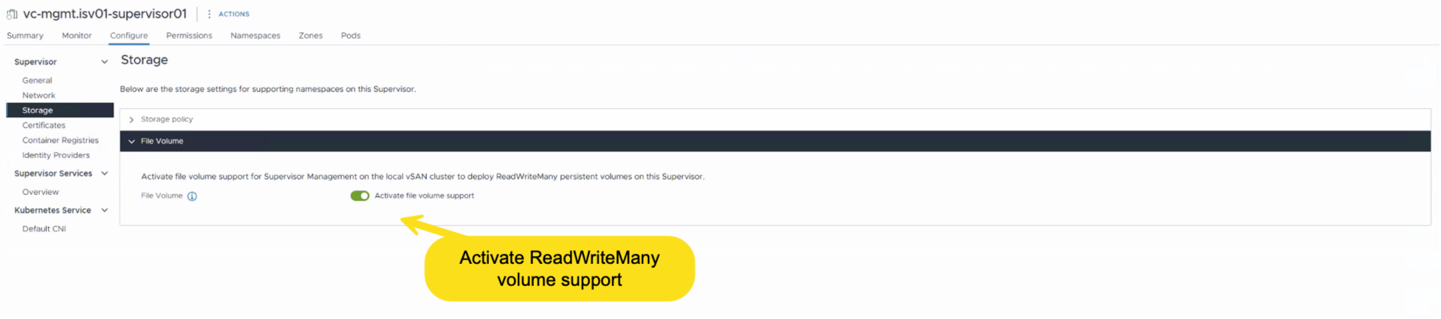
The hardware configuration depends on the expected workload; minimum requirements are documented at: https://docs.mulesoft.com/private-cloud/latest/install-checklist#hardware-requirements

MuleSoft Anypoint Platform on VKS Preinstallation Checklist:

Prior to deploying MuleSoft Anypoint Platform, this is the list of VCF and VKS prerequisites.

1. vSphere Supervisor has been enabled https://techdocs.broadcom.com/us/en/vmware-cis/vcf/vcf-9-0-and-later/9-0/vsphere-supervisor-installation-and-configuration.html
2. vSAN File Services has been enabled. vSAN File Services will be used for the NFS Mounts required by MuleSoft Anypoint Platform and for VKS to provision ReadWriteMany persistent volumes.

   https://techdocs.broadcom.com/us/en/vmware-cis/vcf/vcf-9-0-and-later/9-0/vsan-deployment-administration-and-monitoring/administering-vmware-vsan/expanding-and-managing-a-vsan-cluster/vsan-file-service/enable-vsan-file-service.html
3. Activate ReadWriteMany persistent volumes on the supervisor.



Storage

Below are the storage settings for supporting namespaces on this Supervisor.

> Storage policy

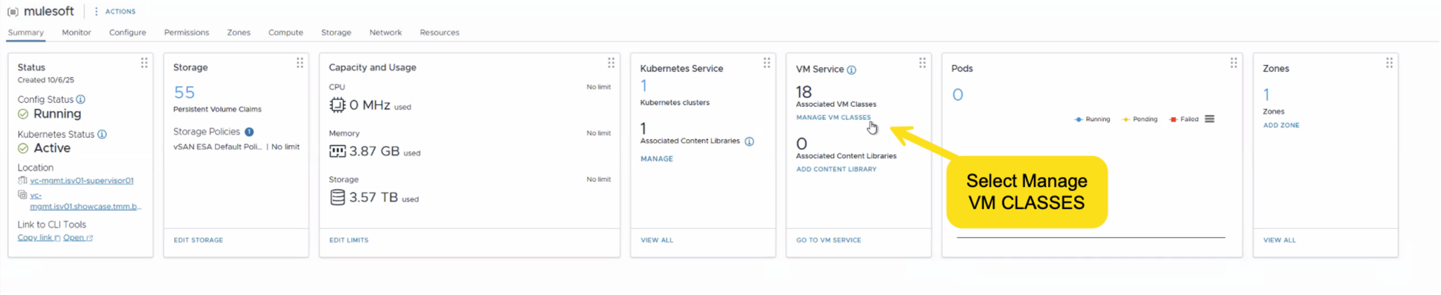
File Volume

Activate file volume support for Supervisor Management on the local vSAN cluster to deploy ReadWriteMany persistent volumes on this Supervisor.

File Volume ● Activate file volume support

Activate ReadWriteMany volume support

4. Create a vSphere namespace named *mulesoft*
5. Create a custom vmClass named mulesoft-8-32 to signify 8vCPUS and 32GB of RAM.
6. Assign the vmClasses to the *mulesoft* namespace



Status
Created 10/6/25
Config Status: Running
Kubernetes Status: Active
Location: vc-mgmt.isv01-supervisor01, vc-mgmt.isv01.showcase.tmm.b...
Link to CLI Tools: Copy link Open

Storage: 55 Persistent Volume Claims
Storage Policies 1: vSAN ESA Default Poli... | No limit

Capacity and Usage
CPU: 0 MHz used (No limit)
Memory: 3.87 GB used (No limit)
Storage: 3.57 TB used (No limit)

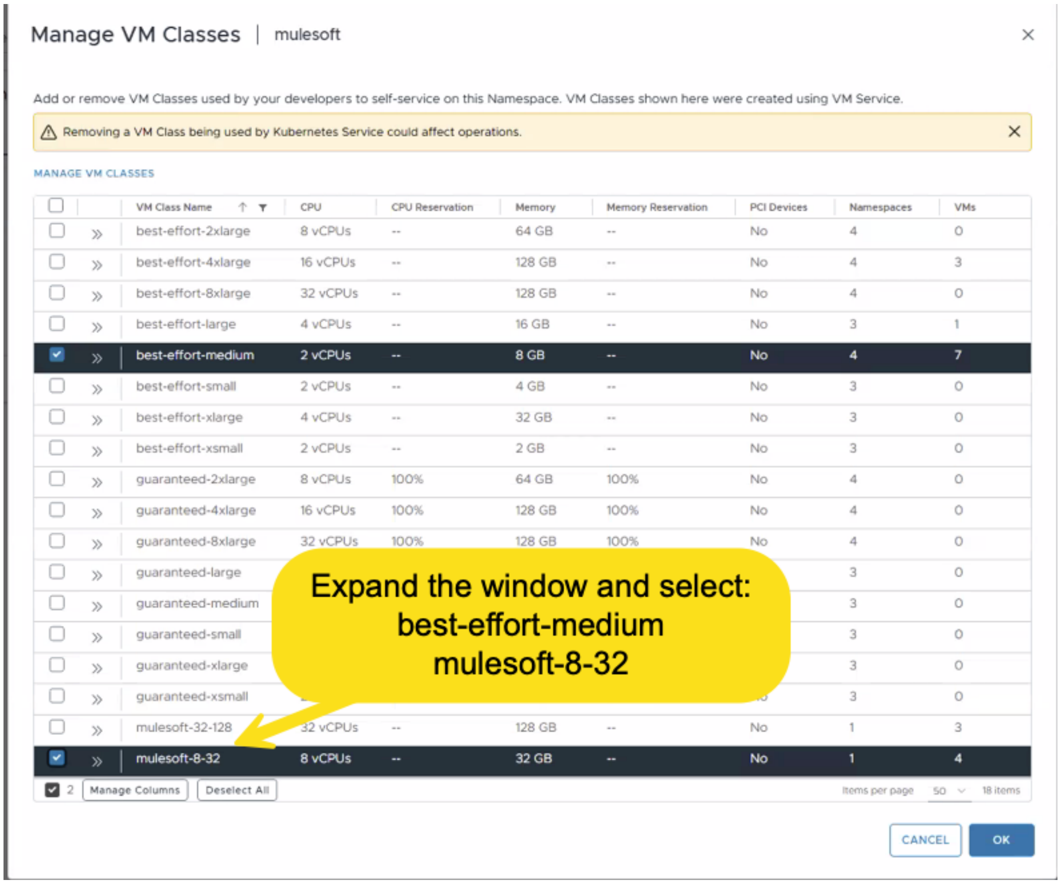
Kubernetes Service: 1 Kubernetes clusters; 1 Associated Content Libraries

VM Service: 18 Associated VM Classes; 0 Associated Content Libraries

Pods: 0

Zones: 1 Zones

Select Manage VM CLASSES



Manage VM Classes | mulesoft

Add or remove VM Classes used by your developers to self-service on this Namespace. VM Classes shown here were created using VM Service.

⚠ Removing a VM Class being used by Kubernetes Service could affect operations.

MANAGE VM CLASSES

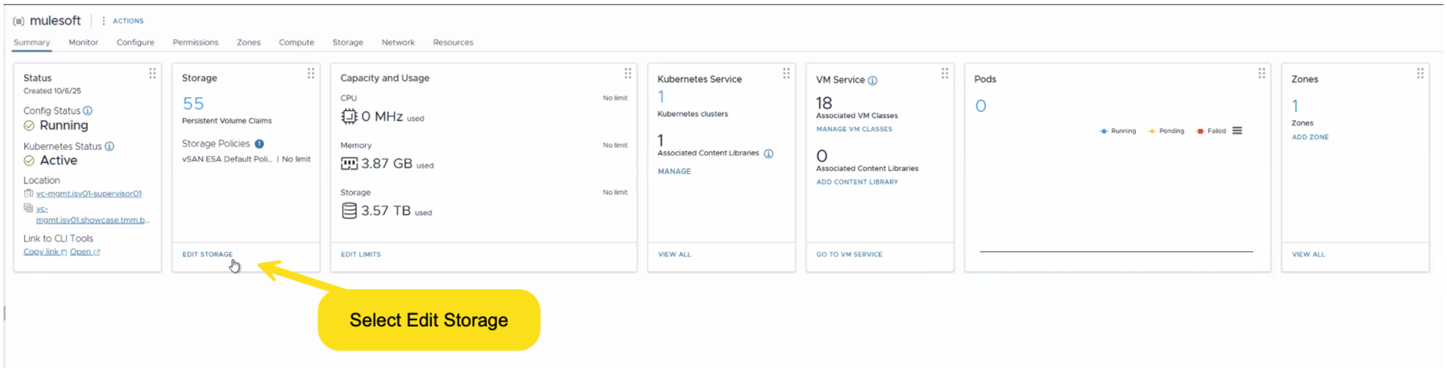
☐		VM Class Name	CPU	CPU Reservation	Memory	Memory Reservation	PCI Devices	Namespaces	VMs
☐	»	best-effort-2xlarge	8 vCPUs	--	64 GB	--	No	4	0
☐	»	best-effort-4xlarge	16 vCPUs	--	128 GB	--	No	4	3
☐	»	best-effort-8xlarge	32 vCPUs	--	128 GB	--	No	4	0
☐	»	best-effort-large	4 vCPUs	--	16 GB	--	No	3	1
☑	»	best-effort-medium	2 vCPUs	--	8 GB	--	No	4	7
☐	»	best-effort-small	2 vCPUs	--	4 GB	--	No	3	0
☐	»	best-effort-xlarge	4 vCPUs	--	32 GB	--	No	3	0
☐	»	best-effort-xsmall	2 vCPUs	--	2 GB	--	No	3	0
☐	»	guaranteed-2xlarge	8 vCPUs	100%	64 GB	100%	No	4	0
☐	»	guaranteed-4xlarge	16 vCPUs	100%	128 GB	100%	No	4	0
☐	»	guaranteed-8xlarge	32 vCPUs	100%	128 GB	100%	No	4	0
☐	»	guaranteed-large						3	0
☐	»	guaranteed-medium						3	0
☐	»	guaranteed-small						3	0
☐	»	guaranteed-xlarge						3	0
☐	»	guaranteed-xsmall						3	0
☐	»	mulesoft-32-128	32 vCPUs	--	128 GB	--	No	1	3
☑	»	mulesoft-8-32	8 vCPUs	--	32 GB	--	No	1	4

☑ 2 Manage Columns Deselect All Items per page 50 18 items

CANCEL OK

Expand the window and select:
best-effort-medium
mulesoft-8-32

7. Assign the storage policy to the namespace vsan-esa-default-policy-raid5



mulesoft | ⋮ ACTIONS

Summary Monitor Configure Permissions Zones Compute Storage Network Resources

Status
Created 10/6/25
Config Status ⓘ
✓ Running
Kubernetes Status ⓘ
✓ Active
Location
vc-mgmt.isv01-supervisor01
vc-mgmt.isv01.showcase.tmm.b...
Link to CLI Tools
Copy link Open

Storage
55
Persistent Volume Claims
Storage Policies 1
vSAN ESA Default Poli... | No limit
EDIT STORAGE

Capacity and Usage
CPU No limit
0 MHz used
Memory No limit
3.87 GB used
Storage No limit
3.57 TB used
EDIT LIMITS

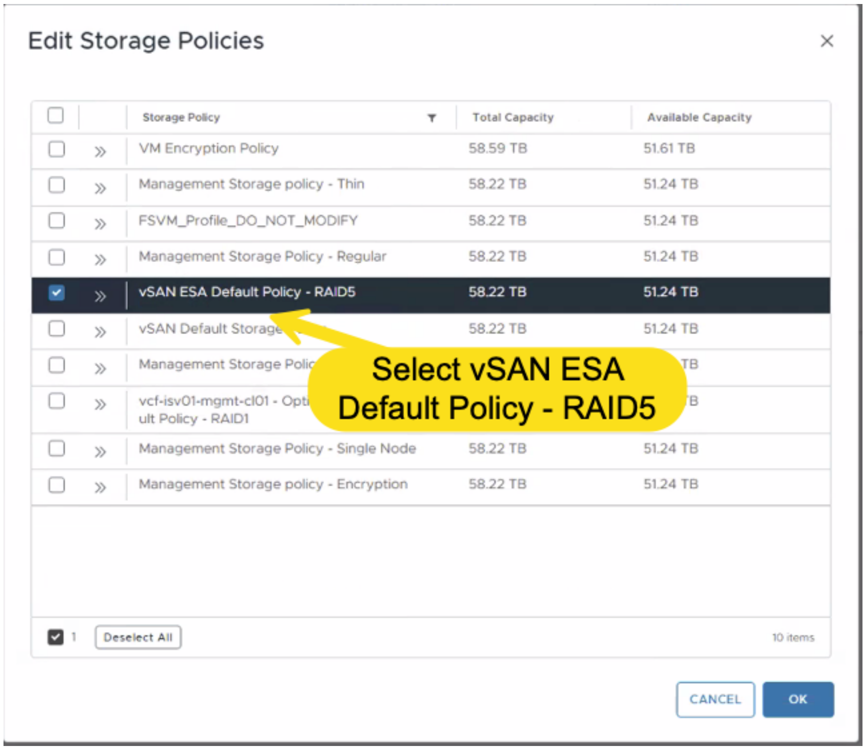
Kubernetes Service
1
Kubernetes clusters
1
Associated Content Libraries ⓘ
MANAGE
VIEW ALL

VM Service ⓘ
18
Associated VM Classes
MANAGE VM CLASSES
0
Associated Content Libraries
ADD CONTENT LIBRARY
GO TO VM SERVICE

Pods
0
Running Pending Failed

Zones
1
Zones
ADD ZONE
VIEW ALL

Select Edit Storage



Edit Storage Policies

☐		Storage Policy	Total Capacity	Available Capacity
☐	»	VM Encryption Policy	58.59 TB	51.61 TB
☐	»	Management Storage policy - Thin	58.22 TB	51.24 TB
☐	»	FSVM_Profile_DO_NOT_MODIFY	58.22 TB	51.24 TB
☐	»	Management Storage Policy - Regular	58.22 TB	51.24 TB
☑	»	vSAN ESA Default Policy - RAID5	58.22 TB	51.24 TB
☐	»	vSAN Default Storage	58.22 TB	51.24 TB
☐	»	Management Storage Polic		TB
☐	»	vcf-isv01-mgmt-cl01 - Opti ult Policy - RAID1		B
☐	»	Management Storage Policy - Single Node	58.22 TB	51.24 TB
☐	»	Management Storage policy - Encryption	58.22 TB	51.24 TB

8. Using the vcf cli command, login to the supervisor and change the current context to the mulesoft namespace. Please refer to the installation instructions: https://techdocs.broadcom.com/us/en/vmware-cis/vcf/vcf-9-0-and-later/9-0/building-your-cloud-applications/getting-started-with-the-tools-for-building-applications/installing-and-using-vcf-cli-v9.html?wcmmode=disabled

   Here's an example of the vcf cli context commands:

```
vcf context create <context-name> --endpoint <supervisor-ip> --insecure-skip-tls-verify -u <user>
vcf context use <context-name>:<namespace>
```

9. Deploy a VKS cluster using the example yaml file below.

```
kubectl apply -f mulesoft-vks.yaml
```

A few highlights in our yaml file

- We have (1) worker node pool using the custom vmClass mulesoft-8-32
- We set the default pod security to baseline
- For the default path /var/lib/containerd we set the size to 200GB from 20GB. We increase the size of the disk to download the MuleSoft application for install.

```
aapiVersion: cluster.x-k8s.io/v1beta1
kind: Cluster
metadata:
  name: mulesoftcluster01
  namespace: mulesoft
```

```
spec:
  clusterNetwork:
    services:
      cidrBlocks: ["10.96.0.0/12"]
    pods:
      cidrBlocks: ["192.168.0.0/16"]
    serviceDomain: "cluster.local"
  topology:
    class: builtin-generic-v3.4.0
    version: v1.33.3---vmware.1-fips-vkr.1
    controlPlane:
      replicas: 3
      metadata:
        annotations:
          run.tanzu.vmware.com/resolve-os-image: os-name=ubuntu,os-version=24.04
    workers:
      machineDeployments:
        - class: node-pool
          name: node-pool-1
          replicas: 4
          variables:
            overrides:
            - name: vmClass
              value: mulesoft-8-32
            - name: volumes
              value:
                - name: containerd
                  mountPath: /var/lib/containerd
                  storageClass: vsan-esa-default-policy-raid5
                  capacity: 200Gi
          metadata:
            annotations:
              run.tanzu.vmware.com/resolve-os-image: os-name=ubuntu,os-version=24.04
    variables:
      - name: vmClass
        value: best-effort-medium
      - name: storageClass
        value: vsan-esa-default-policy-raid5
      - name: vsphereOptions
        value:
          persistentVolumes:
            defaultStorageClass: vsan-esa-default-policy-raid5
      - name: kubernetes
        value:
          security:
            podSecurityStandard:
              enforce: baseline
```

10. Monitor the deployment of the VKS cluster

```
kubectl get cluster mulesoftcluster01 -o yaml | tail -12
    controlPlane:
      availableReplicas: 3
      desiredReplicas: 3
      readyReplicas: 3
      replicas: 3
      upToDateReplicas: 3
    workers:
      availableReplicas: 4
      desiredReplicas: 4
      readyReplicas: 4
      replicas: 4
      upToDateReplicas: 4
```

11. Validate the VKS cluster by connecting to the VKS context and list all of the nodes in the cluster.

```
vcf context create vks --insecure-skip-tls-verify --endpoint <supervisor-ip> -u <user> --workload-cluster-namespace
mulesoft --workload-cluster-name mulesoftcluster01

vcf context use vks:mulesoftcluster01

kubectl get node

NAME                                        STATUS   ROLES           AGE     VERSION
mulesoftcluster01-node-pool-1-z25mg-cw2kl-b575w   Ready    <none>          92s     v1.33.3+vmware.1-fips
mulesoftcluster01-node-pool-1-kwpj4-nztsr-kb2zm   Ready    <none>          94s     v1.33.3+vmware.1-fips
mulesoftcluster01-node-pool-1-bjkpp-8rs24-sjxkp   Ready    <none>          94s     v1.33.3+vmware.1-fips
mulesoftcluster01-node-pool-1-kx4mk-btmfv-dwghk   Ready    <none>          87s     v1.33.3+vmware.1-fips
mulesoftcluster01-vmft2-485f7                     Ready    control-plane   3m12s   v1.33.3+vmware.1-fips
```

MuleSoft Anypoint Platform Dependency Checklist

In addition to the Kubernetes cluster, the following external components are required for MuleSoft Anypoint Platform PCE:

- External Layer 4 TCP load balancer: Forwards HTTP/HTTPS and WebSocket traffic to all nodes in the cluster. The load balancer must support forwarding traffic on ports 80, 443, 8083 (for Mule runtime authentication and certificate renewal) and 8889 (for WebSocket connections).
- DNS A-record: Points to the external load balancer IP address
- Private Docker registry: Stores PCE container images.
- SMTP server: Required for email notifications.
- NFS file system: Provides shared storage for platform components.
- Identity provider: Required for user authentication after initial installation. Supports SAML, OAuth, and other standard protocols.
- Virtual machines or servers for Mule runtimes: Separate infrastructure for deploying Mule runtimes using the Hybrid Standalone hosting option. These can be physical servers, VMs, or containers, and must have network connectivity to the PCE control plane. For VCF it's best to use the VM Service to deploy, manage, and consolidate VMs and containers into the same namespace.

Install Anypoint Platform PCE on VKS

For details see https://docs.mulesoft.com/private-cloud/latest/install-workflow

At a high level the installer is bundled as a tarball with a command line tool to:

- Perform a Pre-installation Verification
- Upload the Docker images embedded in the installer tarball to the private Docker registry
- Run the actual installation of PCE

Component	Version
MuleSoft Anypoint Platform PCE	4.1.2
vSphere Kubernetes Service	3.4
vSphere Cloud Foundation	9.0
Kubernetes	1.33.3

Table 1: Solution Components

Conclusion

Deploying MuleSoft Anypoint Platform PCE on VKS offers organizations a straightforward path to powerful integration capabilities while maintaining control over critical business requirements. The simplicity of deploying within existing VMware VCF environments eliminates complex cloud migrations and allows teams to leverage familiar tools and processes they already know. By running integration workloads on-premises, organizations maintain complete data sovereignty, ensuring sensitive information never leaves their controlled infrastructure—a crucial consideration for regulated industries and companies with strict compliance requirements.

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