



# CUSTOMER

Red Hat OpenShift Virtualization  
QuickStart  
SOW (this "SOW")

Version 2.1

May 7, 2024

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## CUSTOMER Contacts

Name	Customer1
Email	

Name	Customer 2
Email	

Name	Customer 3
Email	

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This Statement of Work (this “**SOW**”) is entered into and effective on \_\_\_\_\_, 2024 (the “**SOW Effective Date**”) by and between **CUSTOMER** (hereinafter referred to as “**CUSTOMER**”) and **Li9 Technology Solutions, Inc.** (hereinafter referred to as “**Li9**”). This project will be governed by the terms of the Master Services Agreement between **CUSTOMER** and Li9 dated \_\_\_\_\_, 2024 (the “**Agreement**”). Unless otherwise defined in this SOW, all capitalized terms shall have the meanings set forth in the Agreement. In the event of a conflict between the terms of this SOW and the Agreement, the terms of this SOW shall control but only as to the conflicting terms.

## Project Overview

**CUSTOMER** has decided to engage **Li9** to assist with Red Hat OpenShift Virtualization implementation. **Li9** will provide Professional Services to **CUSTOMER** at a fixed price basis.

This Statement of Work (SOW) outlines the implementation of a Red Hat OpenShift Virtualization environment, adhering to industry best practices, specifically designed for deployment on Bare Metal infrastructure.

This SOW focuses on the following:

- Rapidly deploy a baseline Red Hat OpenShift environment following industry best practices.
- Implement Red Hat OpenShift Virtualization.

## SOW Fees

The SOW fees are **\$33,870**. The start date for this SOW shall be \_\_\_\_\_, 2024 or such other date as determined by **CUSTOMER** (the “**Start Date**”), and the solution shall be delivered in **3** weeks from the Start Date (the “**Completion Date**”) using multiple Li9’s resources (subject to any extensions to the Completion Date as agreed to in writing by Customer).

## Current state

Parameter	Value
Virtual Machines	<ul style="list-style-type: none"> <li>● 125 VMs</li> </ul>

	<ul style="list-style-type: none"> <li>● 95% Windows</li> <li>● Windows 2016 or newer</li> <li>● 16 Linux VMs (Debian-based)</li> </ul>
Server Hardware	<ul style="list-style-type: none"> <li>● 3xR750 Power Edges</li> <li>● 1TB each</li> </ul>
Network	<ul style="list-style-type: none"> <li>● 2x10G</li> <li>● looking to upgrade to 25G between hosts into the switch, so the domain would still be 10G</li> </ul>
PKI	<ul style="list-style-type: none"> <li>● Microsoft CA</li> </ul>
DHCP	<ul style="list-style-type: none"> <li>● Microsoft DHCP</li> </ul>
DNS	<ul style="list-style-type: none"> <li>● Microsoft DNS</li> </ul>
Automation	<ul style="list-style-type: none"> <li>● AWX</li> <li>● Powershell</li> <li>● Not looking to implement Ansible</li> </ul>
Backup and recovery	<ul style="list-style-type: none"> <li>● VEEAM</li> </ul>

## CUSTOMER requirements

- CUSTOMER needs to implement a Red Hat OpenShift Virtualization Environment
- CUSTOMER wants to see the migration process
- CUSTOMER will perform the migration activities

# OpenShift Solution

## The Platform

This SOW focuses on a container management platform based on the Red Hat OpenShift Container Platform Plus (OPP). The platform design is aligned with industry best practices and helps to simplify application delivery processes. The platform is designed to deploy applications using container technologies and virtual machines using Red Hat OpenShift Virtualization.

## Platform Features

The platform is designed as the primary application hosting platform that should standardize containerized application delivery processes and virtual machine management.

Here is the list of main features platform features:

- CUSTOMER bare metal platform as the underlying infrastructure
- Application containers support
- Centralized authentication
- OpenShift Virtualization
- Migration Toolkit for Virtualization
- Centralized role-based access control

## Platform Components

The platform contains multiple components working together.

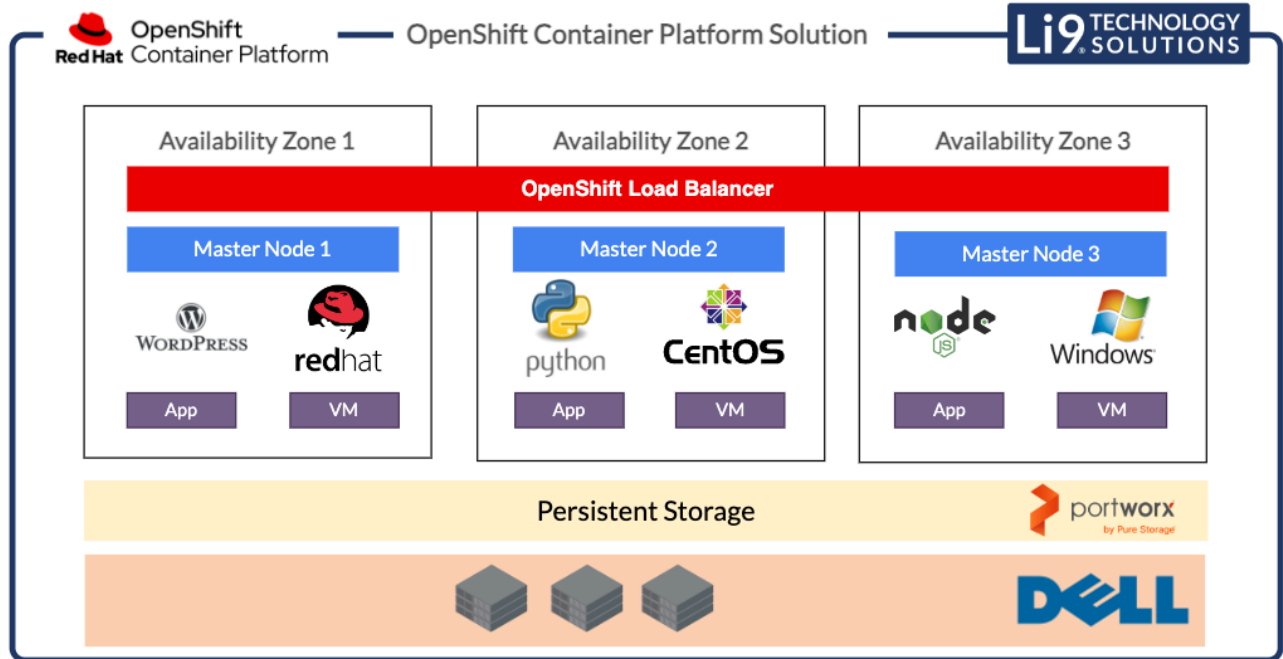
Component	Description
Red Hat OpenShift	Red Hat OpenShift, the industry's leading hybrid cloud application platform powered by Kubernetes, brings together tested and trusted services to reduce the friction of developing, modernizing, deploying, running, and managing applications. OpenShift delivers a consistent experience across public cloud, on-premise, hybrid cloud, or edge architecture.

Local Storage Operator	Operator that configures local storage volumes for use in Kubernetes and OpenShift. For non HA storage workloads.
Red Hat OpenShift Virtualization	<p>Red Hat® OpenShift® Virtualization, a feature of Red Hat OpenShift, allows IT teams to run virtual machines (VM) alongside containers on the same platform, simplifying management and improving time to production.</p> <p>OpenShift Virtualization lets VM administrators bring VMs into containerized workflows by running a VM within a container, where they can deploy and manage VMs side-by-side with containers, all on a single platform. This allows organizations to benefit from their existing investments in virtualization, while taking advantage of the simplicity and speed of a modern application platform.</p> <p>OpenShift gives organizations a path to a cloud-native future, while letting them keep existing workloads running in VMs on a single platform.</p>
Migration Toolkit for Virtualization	The Migration Toolkit for Virtualization (MTV) enables you to migrate virtual machines from VMware vSphere to OpenShift Virtualization, an add-on to OpenShift Container Platform. With OpenShift Virtualization, you can run and manage virtual machine workloads alongside container workloads.
Version control	All platform features rely on Git, which helps keeping all automation code, application code, application delivery processes, and infrastructure under version control. Additionally, Git is used as the single source of truth.

## OpenShift Cluster

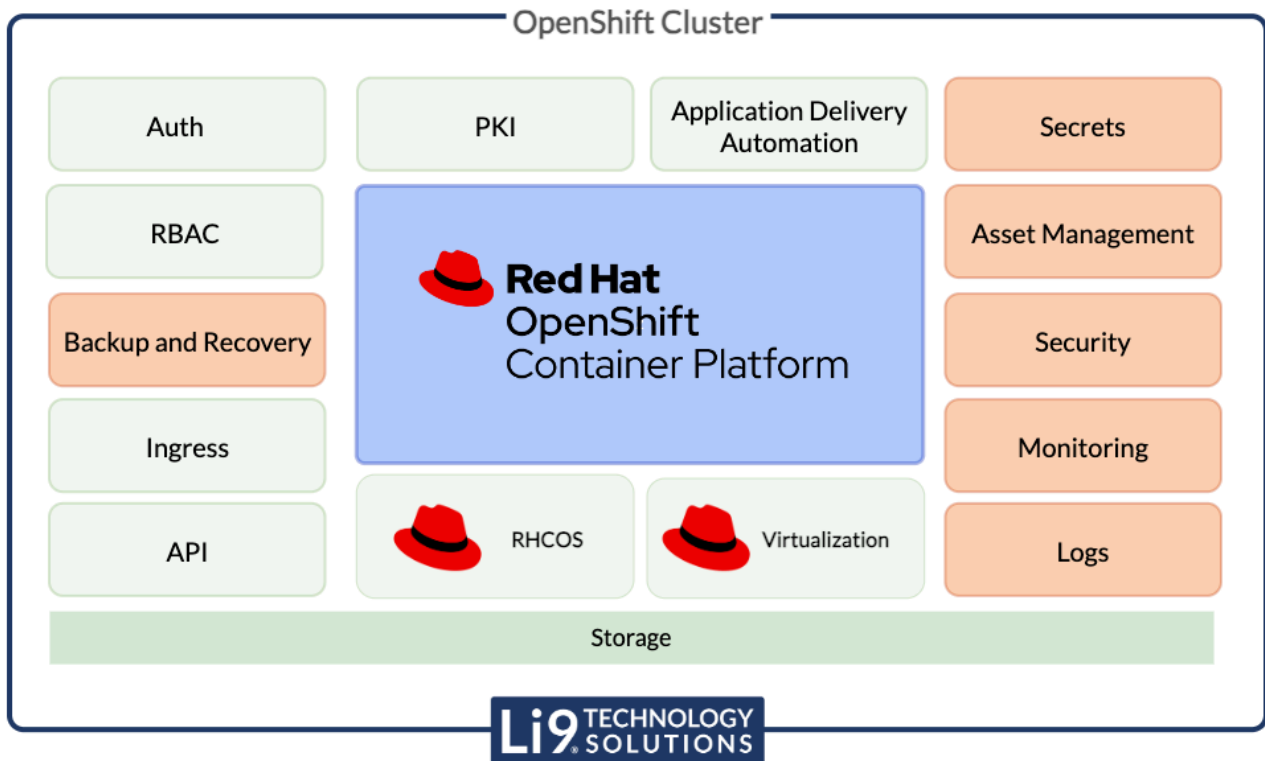
The solution is based on Red Hat OpenShift, which is a core component of the platform. The OpenShift environment is deployed on three nodes.





## Cluster integrations

The OpenShift cluster is integrated with CUSTOMER identity management, as shown in the following diagram:



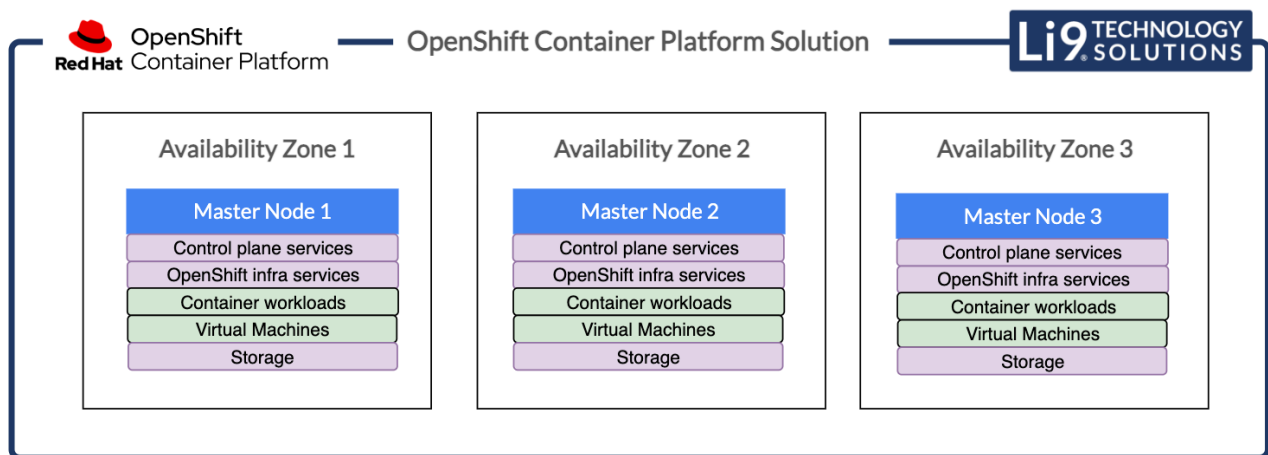
This SOW does not include all possible cluster integrations. For a comprehensive list of available integrations, please contact Li9.

## OpenShift nodes

The solution deploys a few node types:

- Master nodes
- Infra nodes
- Worker nodes

The following diagram shows the node setup:



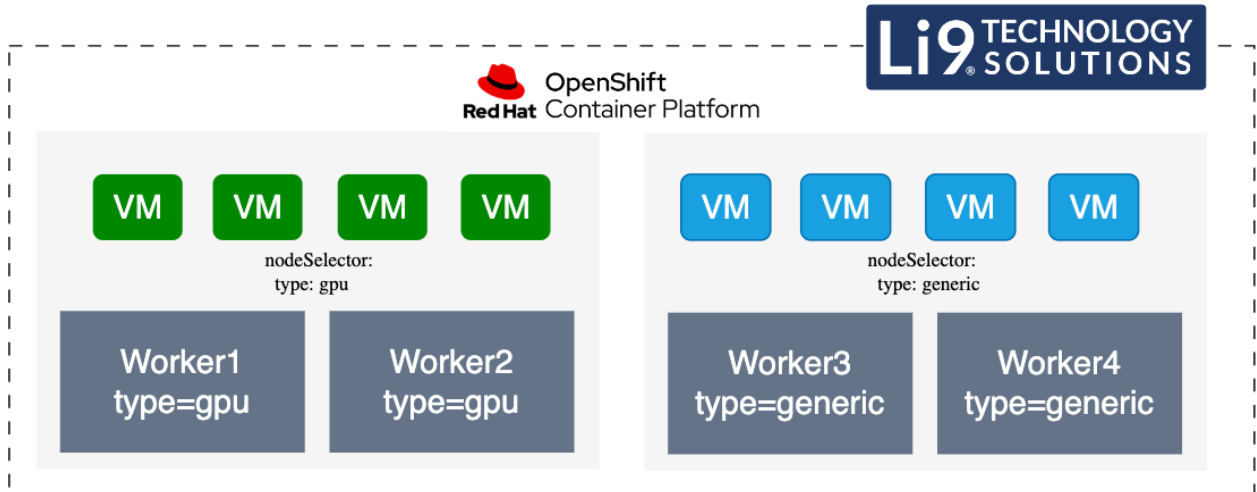
Note! The exact setup can be different.

## OpenShift Virtualization

OpenShift Virtualization (deployed on top of Red Hat OpenShift Container Platform) manages virtual machine types of workloads. This SOW brings a fully functional Red Hat OpenShift Virtualization environment designed to deploy CUSTOMER's virtual machines or migrate them from other platforms (VMware, OpenStack, etc).

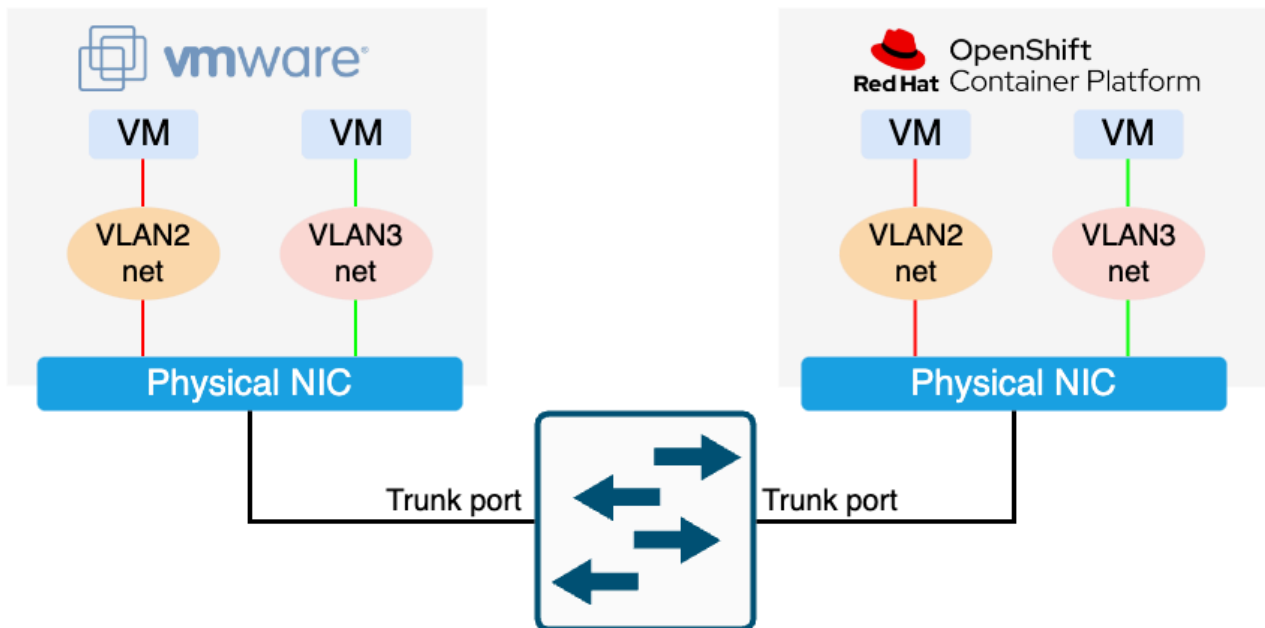
### VM Affinity Rules

The solution comes with a configuration of the VM Affinity rules.



### Networking

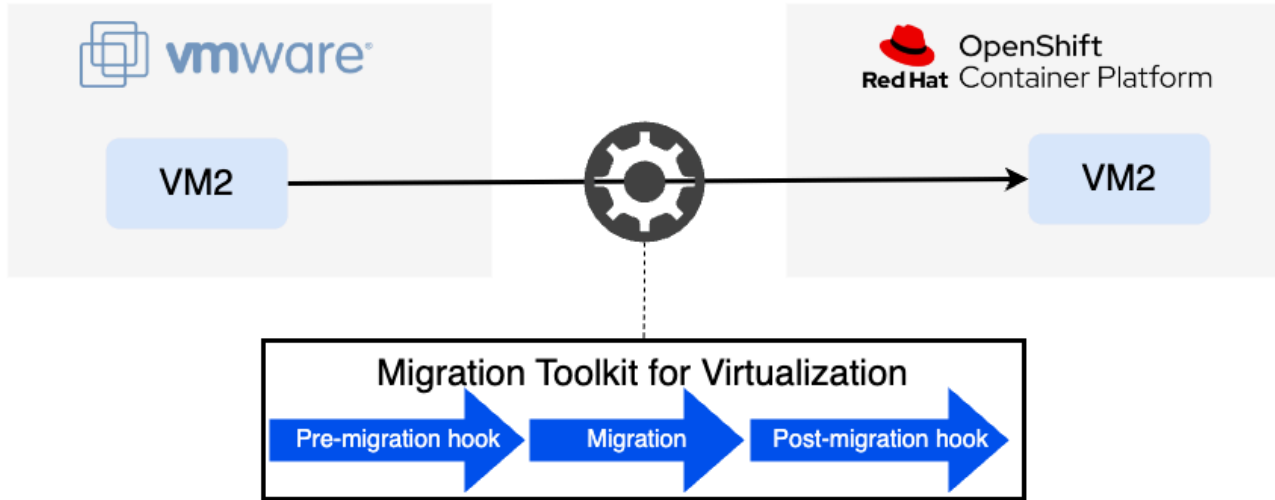
The solution implements an advanced VM network that helps to deploy Virtual Machines in different guest networks.



Note! The exact network setup can be different.

## Migration Toolkit for Virtualization

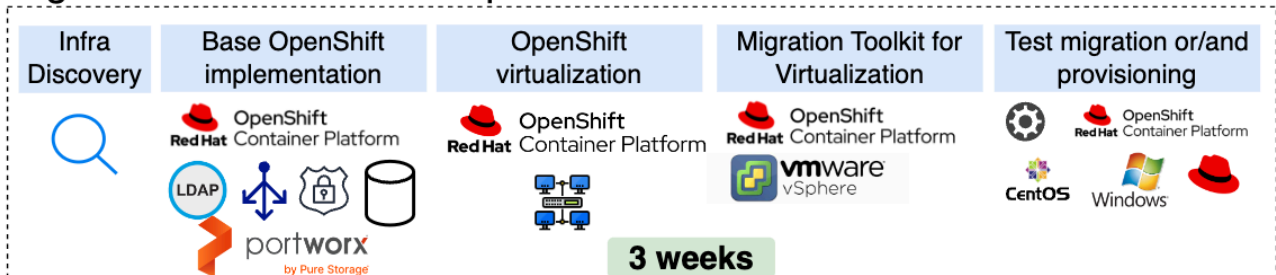
The platform is designed to migrate Virtual Machines from other platforms. This SOW creates a migration foundation based on the Migration Toolkit for Virtualization.



## Project Scope

The project includes activities to build a Red Hat OpenShift Container Platform cluster and Red Hat OpenShift Virtualization on Bare Metall. The steps can be delivered in parallel. This chapter describes the project scope and Li9’s approach to project delivery.

### Migration Phase 1 - Base OpenShift Virtualization environment



## Kick-off call

Li9 will schedule at least a 1-hour call to initiate the project delivery. The agenda for the call should include the following items:

- Introduction of the delivery team
- Customer Participants
- Proposed solution overview
- Schedule daily meetings with key CUSTOMER stakeholders
- Granting/requesting the delivery team all required accesses and permissions.

## Discovery

Li9 will review the existing infrastructure. This is a collaborative workshop with CUSTOMER's stakeholders to gather requirements, assess existing infrastructure, and define the deployment scope.

At least the following components are subject to the review process (if applicable):

- Underlying compute infrastructure
  - Datacenters
  - Server specification
- Networking
  - Subnet(s)
  - DHCP configuration
  - Internet access
- DNS
- Load Balancers
- Identity and Access Management
  - Authentication
  - Role-Based Access Control
- Storage
- PKI
- Internal registries (if applicable)

**Li9** may request additional information from **CUSTOMER** at this stage. **Li9** expects network, storage, and security engineers to be on the call. As a result of this call, **Li9** will send the full list of service delivery prerequisites that **CUSTOMER** will need to work on to continue project delivery.

## Resolve Infrastructure dependencies

**CUSTOMER** will focus on resolving OpenShift provisioning prerequisites. This may include but is not limited to the following infrastructure components:

- Compute resources (servers)
- Networking
  - Subnets
  - Routing
  - DNS
  - DHCP
  - Load Balancers
- PKI
- Container registry
- Storage
  - Architecture/Configuration
  - Capacity
  - Types
- Bastion/Jump host

## OpenShift Design

**Li9** will work on the platform and cluster designs using the information gathered during the early stages.

## OpenShift provisioning

**Li9** will provision a Red Hat OpenShift cluster on Bare Metal using Assisted Installer.

## Install and configure Local Storage Operator

**Li9** will install and configure the Local Storage Operator for VM primary storage.

## Configure OpenShift integrations

Li9 will perform post-provisioning configuration for the cluster provisioned in an early stage. This includes the following activities:

- Configure API and ingress SSL certificates
- Configure dedicated infrastructure nodes to optimize Openshift subscription usage (if it applies)
- Configure enterprise authentication
- Configure Role-Based Access Control (RBAC)

## Install OpenShift Virtualization

Li9 will install the following components on top of the OpenShift cluster:

- Red Hat OpenShift Virtualization
- Migration Toolkit for Virtualization

## Configure Virtualization

Li9 will configure the OpenShift Virtualization and the Migration Toolkit for Virtualization. The following is included:

- Networking and network mappings
- Storage

## Migration toolkit for Virtualization implementation

Li9 will install and configure the Migration Toolkit for Virtualization to demonstrate the V2V migration process.

## Server deploy acceptance testing

Li9 will provision a test Linux server on top of OpenShift Virtualization to demonstrate its capabilities.

## Server migration acceptance testing

Li9 will demonstrate the platform's V2V migration capabilities.

## Knowledge sharing

Li9 will work with a few CUSTOMER employees who will try to:

- Deploy a test server on Red Hat OpenShift Virtualization
- Migrate a test server from VMware vSphere

## Deliverables

- **Red Hat OpenShift Cluster:** A functional Red Hat OpenShift cluster.
- **Enterprise authentication and RBAC:** A secure, scalable integration of OpenShift's enterprise authentication mechanisms with CUSTOMER's existing identity management system. This integration aims to ensure seamless access control, leveraging your current user identities and authentication protocols.
- **Trusted certificates:** API and ingress certificates.
- **Red Hat OpenShift Virtualization:** A functional virtualization platform.
- **Migration Toolkit for Virtualization:** A tool that simplifies migration from VMware vSphere to Red Hat OpenShift Virtualization.
- **Knowledge transfer:** Sessions to empower customer teams and ensure effective OpenShift management post-engagement.

## Limitations

- This SOW is limited to the following integrations:
  - Enterprise authentication, such as Active Directory
  - Role-Based Access Control (RBAC)
  - Trusted API and ingress certificates
- This SOW

## Out of Scope

- Pre and post-migration hook implementation
- VMware and VirtIO driver installation
- Automation development for the migration process
- Anything not listed in this document



## Dependencies

- **Red Hat OpenShift Platform Subscription:** The solution depends on the availability of Red Hat OpenShift Container Platform subscriptions.
- **Compute Platform Access:** The solution assumes enough compute and storage resources to deploy an OpenShift cluster.
- **Remote access:** For time-saving, the Li9 Team assumes remote access to infrastructure(network) where the deployment of Openshift clusters is planned.

## Prerequisites

This service relies on a number of activities performed by CUSTOMER before the project starts.

## Servers

This solution requires at least 3 servers:

Type	Num	Min Capacity	Description
master	3	<ul style="list-style-type: none"> <li>● 256G RAM</li> <li>● 16 cores</li> </ul>	Master nodes implement the OpenShift control plane. These servers do not consume any Red Hat Subscriptions

## Cluster URL

Every OpenShift cluster has a URL to access it and its services. CUSTOMER has to choose the following parameters

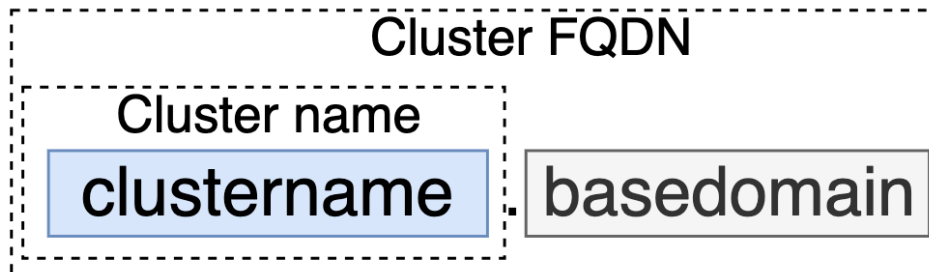
Parameter	Description	Examples
Base domain	A base domain is where the cluster will be provisioned. This is usually a DNS zone to which the CUSTOMER has access.	<ul style="list-style-type: none"> <li>● example.com</li> <li>● ocp4.example.com</li> <li>● ocp.example.com</li> </ul>

Cluster name	Name of the cluster. We strongly recommend developing an appropriate cluster naming standard. For example, the cluster name may include the following information. <ul style="list-style-type: none"> <li>● Datacenter</li> <li>● Location</li> <li>● Environment</li> <li>● Sequential number</li> </ul>	<ul style="list-style-type: none"> <li>● ocp4-dc1-dev</li> <li>● prod</li> <li>● ocp-dallas1-prod</li> <li>● ocpdl1uat</li> </ul>
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The final cluster URL is a combination of the cluster name and the base domain:

CLUSTERFQDN=CLUSTERNAME.BASEDOMAIN. Examples:

- ocp4-dc1-dev.example.com
- ocp4-dc1-dev.local
- ocpdl1uat.CUSTOMER.com
- prodocp.local
- ocp-dc1-prod.example.com



## Networking

### Subnet(s)

Every OpenShift node will reside in a network. We strongly recommend hosting OpenShift on a dedicated network. The OpenShift network should be accessible from CUSTOMER networks. We recommend allocating a dedicated /24 network for the OpenShift cluster.

## Virtual IP addresses

The installation engine needs two Virtual IP addresses allocated from the same network where the OpenShift cluster will reside.

IP address alias	Description
vip-api	API endpoint used by the provisioning process
vip-ingress	Ingress endpoint used by the provisioning process

## DHCP

DHCP service must be enabled for the network. This is the prerequisite for the OpenShift Installer Provisioning Infrastructure (IPI).

We recommend configuring DHCP service on the first 50% of the networks. For example, if a /24 network is allocated, the first /25 block of IP addresses should be part of the DHCP range.

## Internet access

This design does not require direct internet access. However, internet registry access is required.

## Load Balancers

Note! You may skip this if OpenShift is deployed on a public cloud.

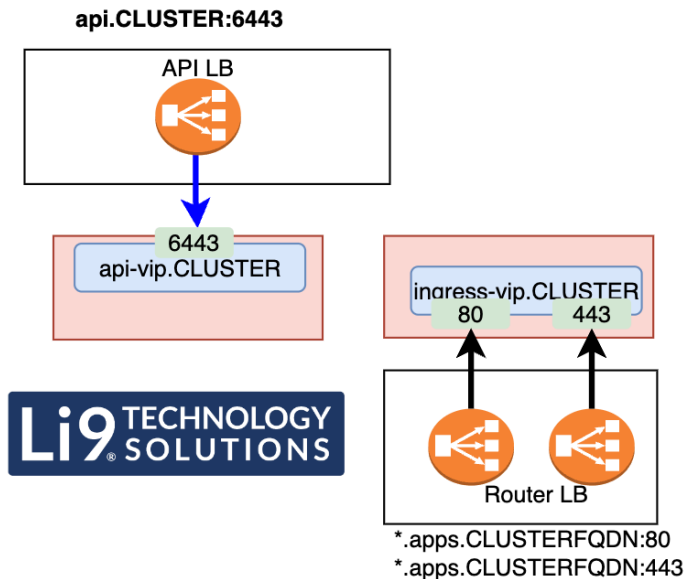
Although an OpenShift cluster can be deployed without an enterprise-grade load balancer, production installation requires a dedicated OpenShift load balancer (F5, A10, etc.).

We expect the following load balancers to be created:

IP address alias	Ports	Description
------------------	-------	-------------

api	6443	<p>API load balancer</p> <p>Layer 4 load balancing only. This can be referred to as Raw TCP, SSL Passthrough, or SSL Bridge mode. If you use SSL Bridge mode, you must enable Server Name Indication (SNI) for the API routes. A stateless load-balancing algorithm.</p>
ingress	80,443	<p>Application Ingress load balancer</p> <p>Provides an Ingress point for application traffic flowing in from outside the cluster. Configure the following conditions:</p> <ul style="list-style-type: none"> <li>• Layer 4 load balancing only. This can be referred to as Raw TCP, SSL Passthrough, or SSL Bridge mode. If you use SSL Bridge mode, you must enable Server Name Indication (SNI) for the Ingress routes.</li> <li>• A connection-based or session-based persistence is recommended, based on the options available</li> </ul>

The configuration above can be illustrated by the following diagram



## DNS records

The following DNS records should be created

IP address alias	DNS record
api	api.CLUSTERFQDN
ingress	*.apps.CLUSTERFQDN
vip-api	vip-api.CLUSTERFQDN
vip-ingress	vip-ingress.CLUSTERFQDN

## PKI

OpenShift requires the following CUSTOMER-trusted CA certificates:

Certificate alias	Hostname
api	api.CLUSTERFQDN
ingress	*.apps.CLUSTERFQDN

## Container Image Registry

OpenShift nodes should be able to pull container images from Red Hat registries.

## Identity management

To access the identity management system, we need a service account, such as an AD or LDAP user.

## Assumptions

- **CUSTOMER's** resources will be available for project deliverables and activities as required
- **Li9** will have appropriate access permissions to all necessary environments and hardware the parties agree are necessary for Li9 to perform the Services.

- The engagement sponsor will act as an escalation point and assist in resolving project-related issues.
- **CUSTOMER** remains responsible for the Services that the **Li9's** resources contribute to. The Services will be under the control of **CUSTOMER**.
- **By default, Li9** will provide the Services remotely using offshore engineers. However, Li9 may deliver services on-site at a higher price.

## Project delivery

Li9 will use its best efforts to ensure personnel continuity by not removing or replacing any of its core team members prior to the completion of the Services.

The following table represents the escalation process governing the management of the Services described in this SOW. Names are listed in the order in which escalation occurs.

Title	Name	Contact Information
VP of Engineering and Principal Architect	Artemii Kropachev	<a href="mailto:artemii.kropachev@li9.com">artemii.kropachev@li9.com</a> 480.410.4339
President	Armando Arias	<a href="mailto:armando.arias@li9.com">armando.arias@li9.com</a> 480.712.1812

## Pricing

### Services

Title	Price
Red Hat OpenShift Virtualization implementation	\$31,910
<b>TOTAL</b>	<b>\$31,910</b>

The pricing demonstrated in the table above is valid until this document is fully executed or 60 days from 05/06/2024 , whichever comes first. Upon becoming fully executed, the pricing shall be honored for the duration of this SOW.

Delivery Team	Hours
US Architect	91
European Engineer	138
Project Manager	33
<b>TOTAL</b>	<b>\$31,910</b>

## Subscriptions

SKU	Price
Red Hat OpenShift Container Platform Plus (3 servers)	\$13,785

## Invoicing and Payment Terms

- Li9 will invoice CUSTOMER as soon as this SOW is signed
- Payment terms are Net 30 from invoice receipt.

## Additional Services

Li9 can provide additional services to expand this solution into a full production OpenShift environment, including:

1. **Advanced Security:** Hardening of the OpenShift environment with role-based access control (RBAC), network policies, and integration with security information and event management (SIEM) solutions.
2. **Monitoring and Logging:** Implementation of centralized monitoring and logging solutions for OpenShift and containerized applications.
3. **CI/CD Pipelines:** Design and configure continuous integration/continuous delivery pipelines for automated application deployment and updates.
4. **Disaster Recovery:** Development of disaster recovery strategies and

procedures to ensure business continuity.

5. **Application Migration:** Assistance with the migration of existing applications to the OpenShift platform.
6. **Performance Tuning:** Optimization of OpenShift and container workloads for resource efficiency and scalability.
7. **Managed Services:** Ongoing support and management of the OpenShift environment.
8. **DevOps Transformation:** Advisory services for cultural and process shifts towards DevOps methodologies.
9. **Cloud-Native Development:** Guidance and support for building new cloud-native applications leveraging OpenShift.
10. **VMware to OpenShift migration:** End-to-end V2V/V2C migration assistance.

## Authority to Act

Each individual who executes this SOW hereto represents that they have the authority, on behalf of their respective Party, to do so.

## Counterparts

This SOW may be executed in one or more counterparts, each of which shall be deemed an original, but all of which shall constitute the same instrument. Executed copies of this SOW sent by facsimile or otherwise transmitted electronically shall be treated as originals, fully binding, and with full legal force and effect.

**IN WITNESS WHEREOF**, Li9 and CUSTOMER have entered into this SOW effective as of the date this Agreement is signed by both Parties.



# Signatures

	CUSTOMER	Li9, Inc.
Name		Armando Arias
Title		President
Date		
Signature		