

NS2024

POWER OF PARTNERSHIP

Containers Versus Virtual Machines

*Curtis McKerlie – Tridium
Europe*

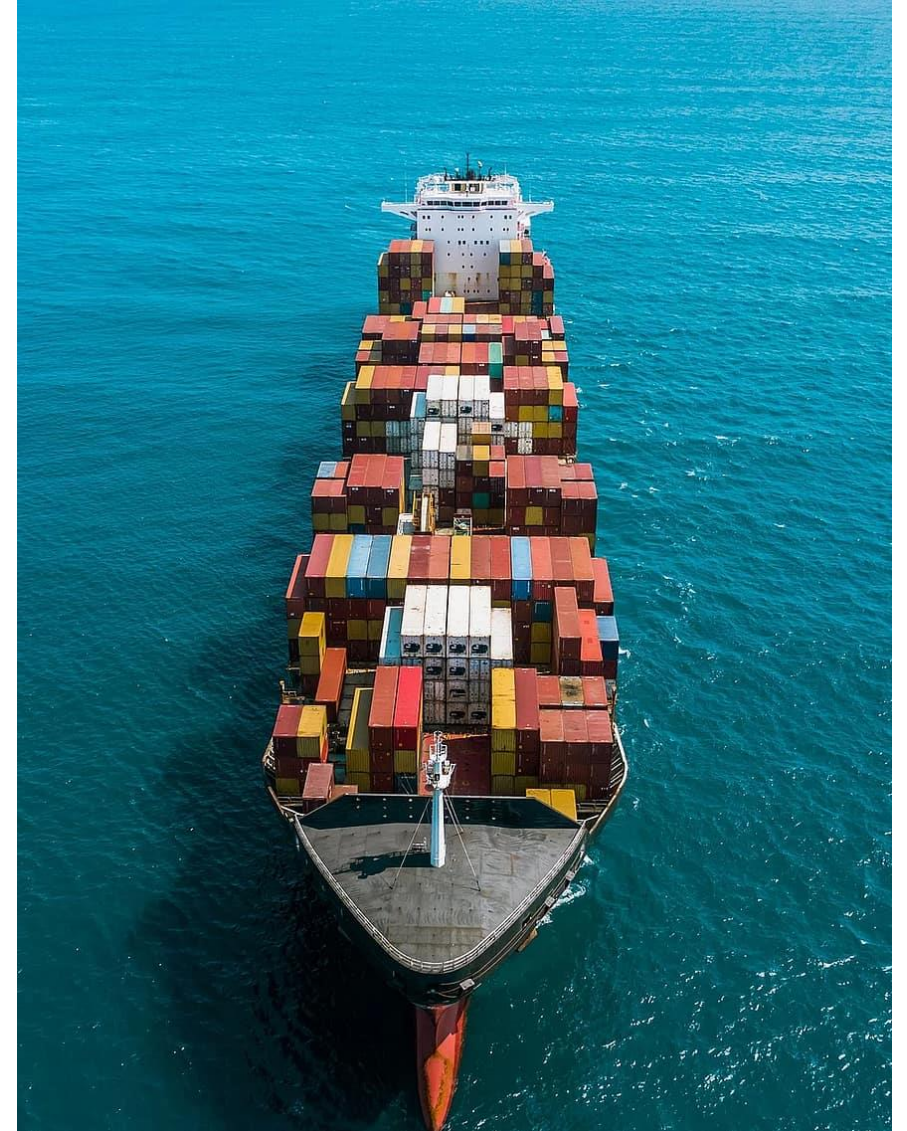
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What is a container?

Containers are technologies that allow the packaging and isolation of applications with their entire runtime environment and all of the files necessary to run.

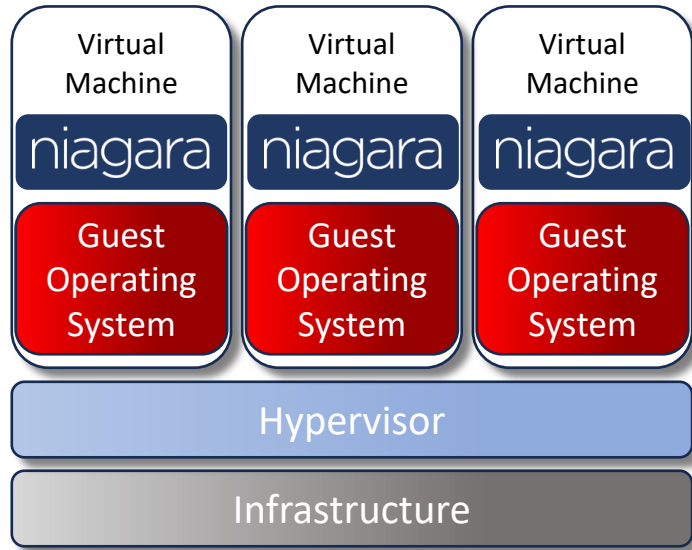
This makes it easy to move the contained application between environments (dev, test, production, etc.) while retaining full functionality.*

*Source [redhat.com](https://www.redhat.com)



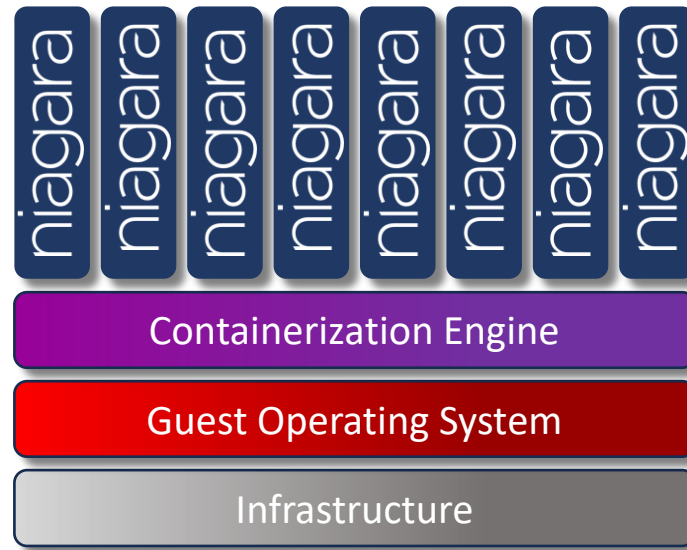
What are the benefits of containers over VMs?

Virtual Machines



Formerly Popular for Virtualization

Containers



Now Popular for Virtualization

Lightweight:

Shares the host's OS system kernel
Does not require an OS per application

Driving higher server efficiencies
Reduces server and licensing costs

Secure:

Applications are safer in containers
and provides the strongest default
isolation capabilities in the industry

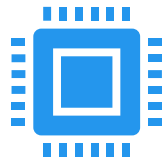
What about containerized Niagara?

Supported Architectures

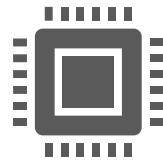
ARM favors simplicity and fast execution of single instructions.

Uses less power and produces less heat.

Ideal for embedded devices.



ARM 64



AMD x86

The x86 processors allow you to perform several activities at the same time from a single instruction.

Used predominately in servers and PCs.

What about containerized Niagara?

The File Domain Authentication (FDA) based version is similar to how a JACE is managed today

Connect with a Workbench client using default platform credentials

Use the wizard to change the default platform credentials and passphrase similar to how a JACE is provisioned out of the box.

The Workbench client can be used to manage the passphrase and platform credentials using the platform administration

Authorization Models



File Domain



Native Domain

The Native Domain Authentication (NDA) based version requires configuring the passphrase and platform credentials using either environment variables passed into the container runtime or using `platform_password` and `system_passphrase` files which are located under a volume which the container has access to

This uses tools such as Kubernetes Secrets to manage all credentials

Ideal for large scale deployments of Niagara

What about containerized Niagara?

Where can Containerized Niagara be utilised?

CLOUD

Supervisor deployment in a cloud service

ON PREMISE

Supervisor deployment on a server device housed locally

HARDWARE EMBEDDED

Embedded deployment whereby a Niagara development partner deploys Niagara containers on its own proprietary or a third-party commercial device



Subscription Based Licensing



More purchasing flexibility

Purchased using OPex rather than CAPex

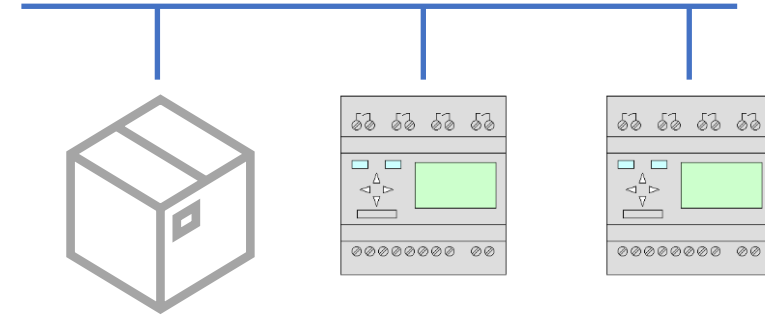
Models available for Hardware and Supervisors

Each instance must be connected to the internet to allow call back to the license server to check validity

Type	Part #
Supervisor	NCC-SUP-0
	NCC-SUP-1
	NCC-SUP-10
	NCC-SUP-100
	NCC-SUP-500
Supervisor Upgrade	NCC-SUP-UP-1
	NCC-SUP-UP-10
	NCC-SUP-UP-100
Supervisor Device Pack	NCC-SUP-DEV-10
	NCC-SUP-DEV-50
	NCC-SUP-DEV-100
	NCC-SUP-DEV-500
	NCC-SUP-DEV-1000

Worth noting

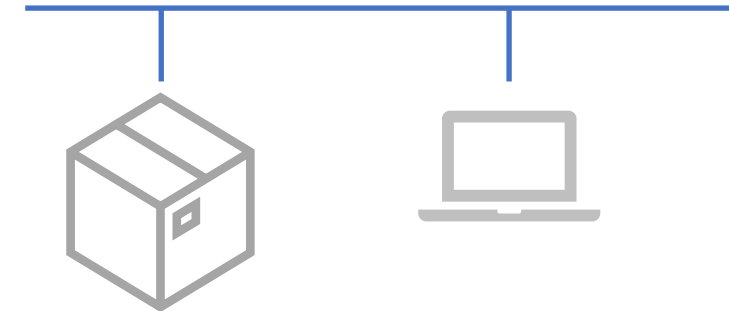
Supervisor Container Models only support IP drivers



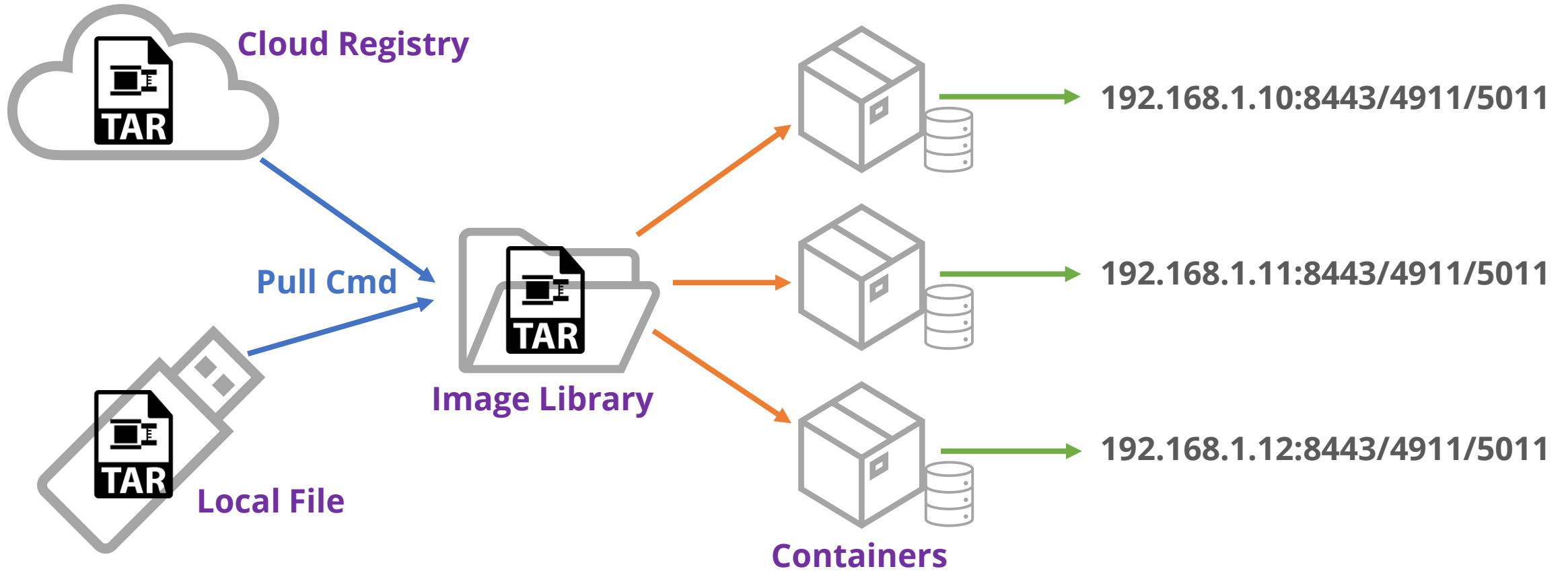
Containers provide headless JAVA runtime

Remote Workbench environment required to commission

Browser support for station viewing and configuration



Container Workflow



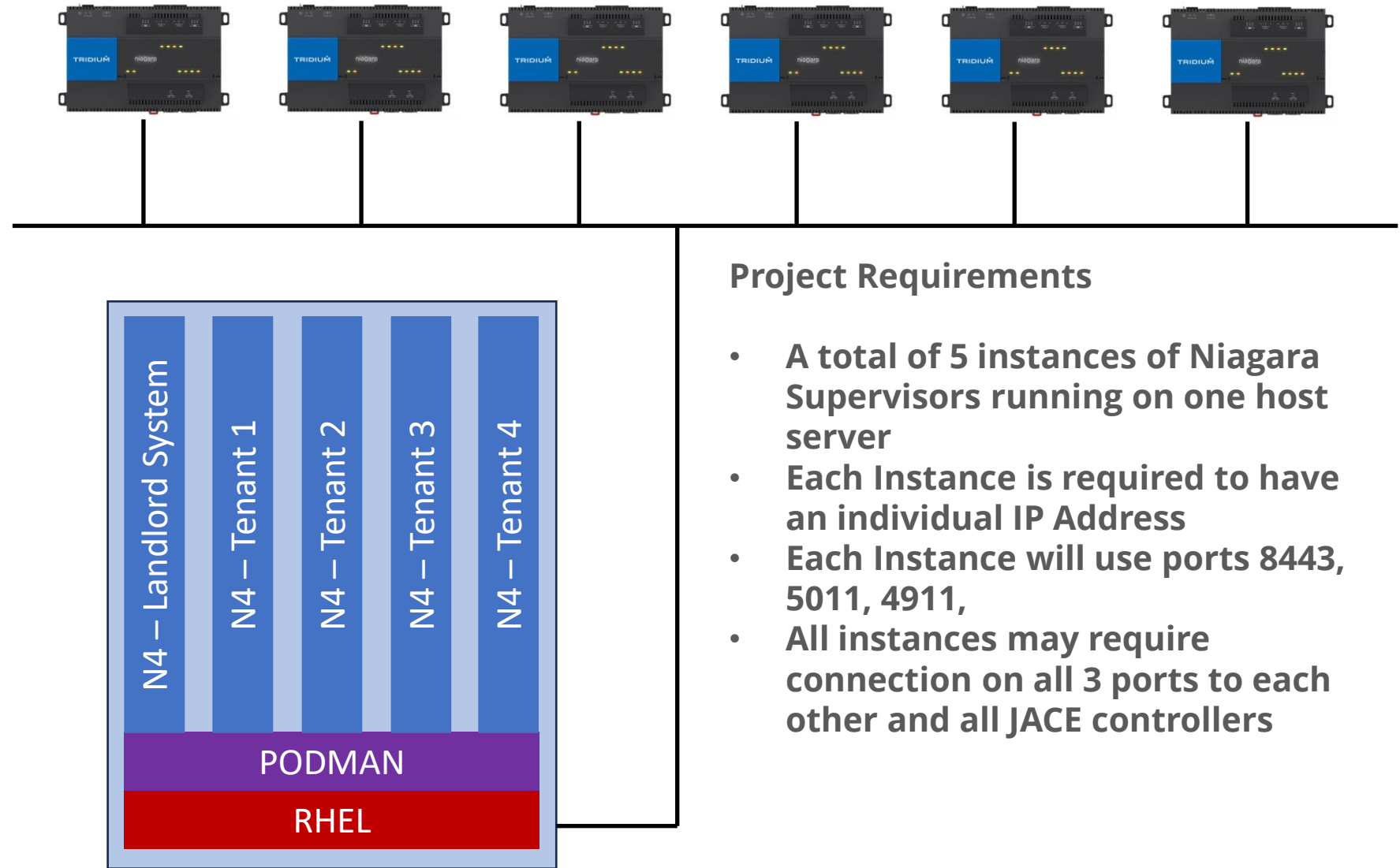
Use Cases

Use Case 1 - Multi-Tenant Building

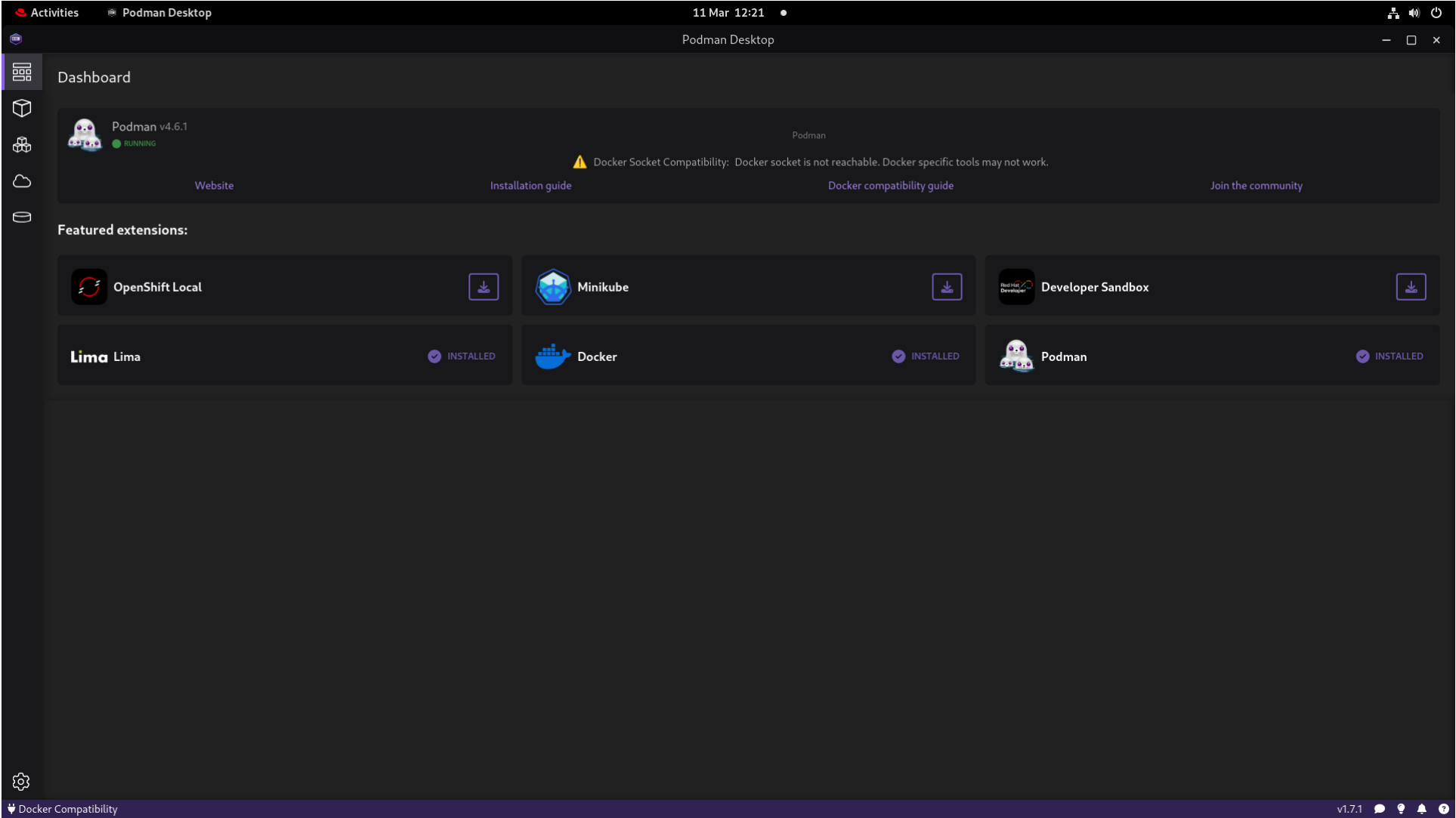
*Use Case 2 - High Availability
Supervisor*

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Use Case 1 – Multi-Tenant Building



Use Case 1 – Multi-Tenant Building



Use Case 1 – Multi-Tenant Building

Activities

Settings

11 Mar 12:26

Podman Desktop

Dashboard

Network

Bluetooth

Background

Notifications

Search

Multitasking

Applications

Privacy

Online Accounts

Sharing

Sound

Power

Displays

Mouse & Touchpad

Network

Wired

Cancel

Apply

Details

Identity

IPv4

IPv6

Security

IPv4 Method

Automatic (DHCP)

Manual

Shared to other computers

Link-Local Only

Disable

Addresses

Address	Netmask	Gateway
10.10.20.11	255.255.255.0	10.10.20.1
10.10.20.111	255.255.255.0	
10.10.20.112	255.255.255.0	
10.10.20.113	255.255.255.0	
10.10.20.114	255.255.255.0	
10.10.20.115	255.255.255.0	

not reachable. Docker specific tools may not work.

Docker compatibility guide

Join the community

Developer Sandbox

Podman

INSTALLED

INSTALLED

Podman Desktop

v1.7.1

Add an IP Address for each instance of Niagara

Use Case 1 – Multi-Tenant Building

ActivitiesPodman Desktop11 Mar 12:46Podman Desktop

Volumes

Search volumes....

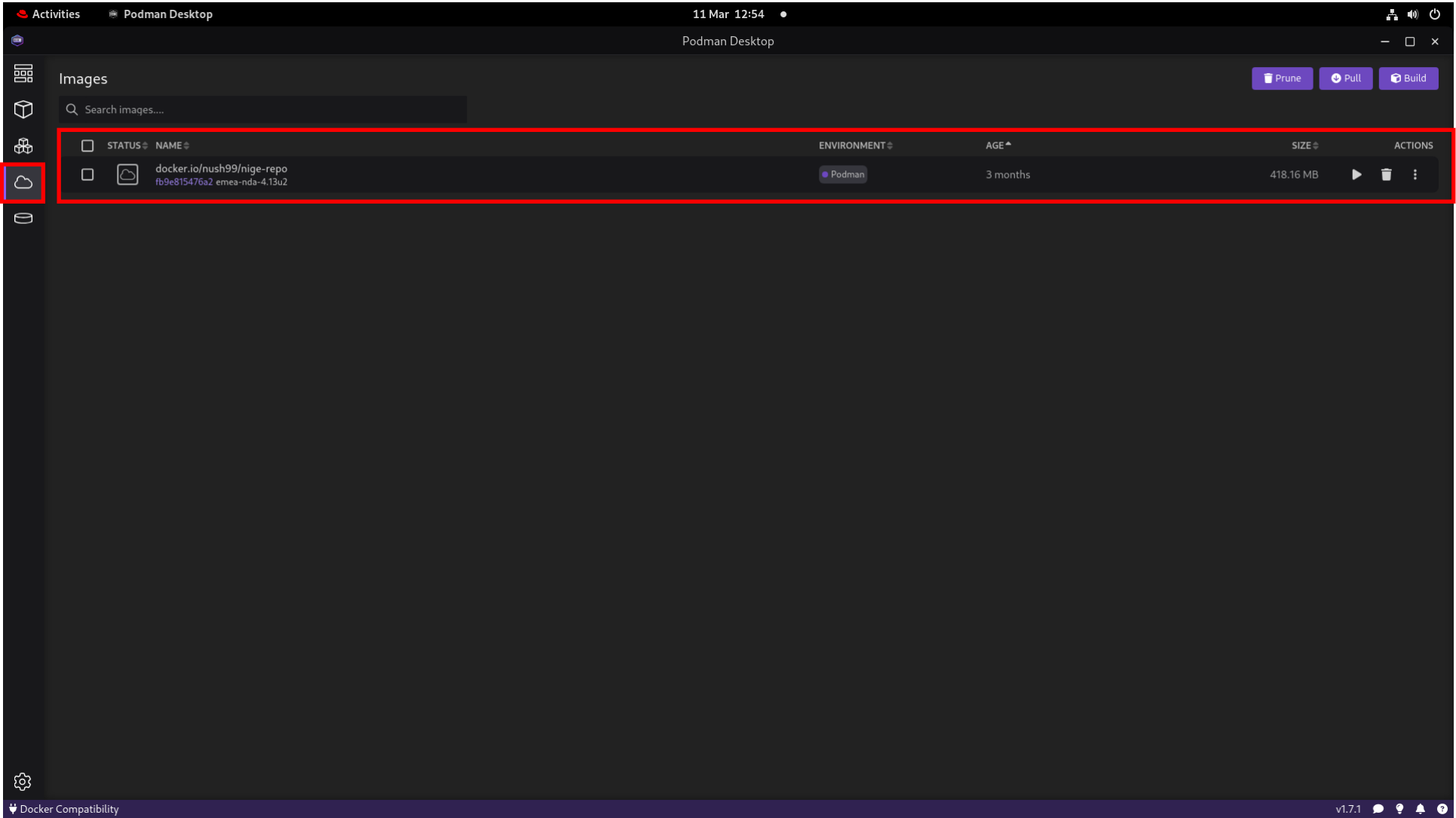
CreatePruneCollect usage data

STATUS	NAME	ENVIRONMENT	AGE	SIZE	ACTIONS
<input type="checkbox"/>	niagara-user-home1	Podman	4 hours	N/A	
<input type="checkbox"/>	niagara-user-home2	Podman	4 hours	N/A	
<input type="checkbox"/>	niagara-user-home3	Podman	2 hours	N/A	
<input type="checkbox"/>	niagara-user-home4	Podman	2 hours	N/A	
<input type="checkbox"/>	niagara-user-home5	Podman	2 hours	N/A	

Create a volume for each instance of Niagara

Docker Compatibilityv1.7.1

Use Case 1 – Multi-Tenant Building



Use Case 1 – Multi-Tenant Building

ActivitiesPodman Desktop

Containers

Search containers....

AllRunningStopped

STATUS	NAME
Landlord (pod) 2 containers	
3f217c4268b4-infra RUNNING PORTS 4911,5011,8443	
Landlord-niagara RUNNING PORTS 4911,5011,8443	
Tenant01 (pod) 2 containers	
ba348a024f9b-infra RUNNING PORTS 4911,5011,8443	
Tenant01-niagara RUNNING PORTS 4911,5011,8443	
Tenant02 (pod) 2 containers	
2626cb8140f1-infra RUNNING PORTS 4911,5011,8443	
Tenant02-niagara RUNNING PORTS 4911,5011,8443	
Tenant03 (pod) 2 containers	
983e13d72a3c-infra RUNNING PORTS 4911,5011,8443	
Tenant03-niagara RUNNING PORTS 4911,5011,8443	
Tenant04 (pod) 2 containers	
8b2f2eb4bf65-infra RUNNING PORTS 4911,5011,8443	
Tenant04-niagara RUNNING PORTS 4911,5011,8443	

Docker Compatibility

Kube-FDA-AMD-LandlordSystem.yml
~/Documents/yamlFiles

Save

```
1 ---
2
3 apiVersion: v1
4 kind: Pod
5 metadata:
6   app: Landlord
7   name: Landlord
8   annotations:
9     io.podman.annotations.autoremove/Landlord: "FALSE"
10    io.podman.annotations.init/Landlord: "FALSE"
11    io.podman.annotations.privileged/Landlord: "FALSE"
12    io.podman.annotations.publish-all/Landlord: "FALSE"
13 spec:
14   containers:
15     - name: niagara
16       image: nush99/nige-repo:emea-nda-4.13u2
17       ports:
18         - containerPort: 8443
19           hostIp: 10.10.20.111
20           hostPort: 8443
21         - containerPort: 4911
22           hostIp: 10.10.20.111
23           hostPort: 4911
24         - containerPort: 5011
25           hostIp: 10.10.20.111
26           hostPort: 5011
27       volumeMounts:
28         - mountPath: /home/niagara1
29           name: niagara-user-home1
30       env:
31         - name: NIAGARA_TZ
32           value: Europe/London
33         - name: LOG_LEVEL
34           value: INFO
35         - name: NIAGARA_STATION_STARTING_HEAP
36           value: 512M
37         - name: NIAGARA_STATION_MAX_HEAP
38           value: 1024M
39       capabilities:
40         add:
41           - NET_BIND_SERVICE
42       volumes:
43         - name: niagara-user-home1
44           hostPath:
45             path: /home/tridium
46             type: Directory
```

YAML Tab Width: 8 Ln 1, Col 1 INS

Prune Create Play Kubernetes YAML

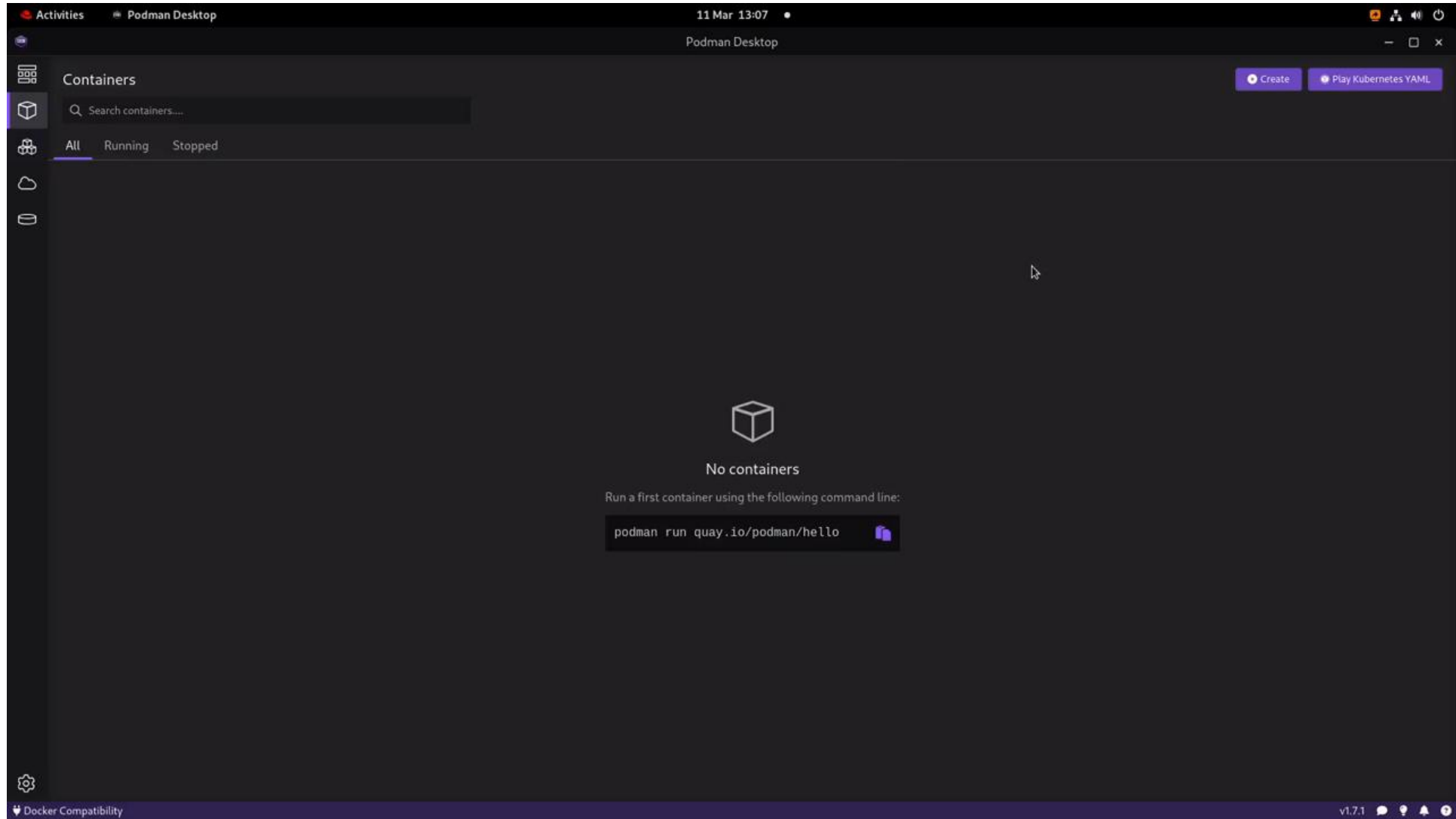
ACTIONS

v1.7.1

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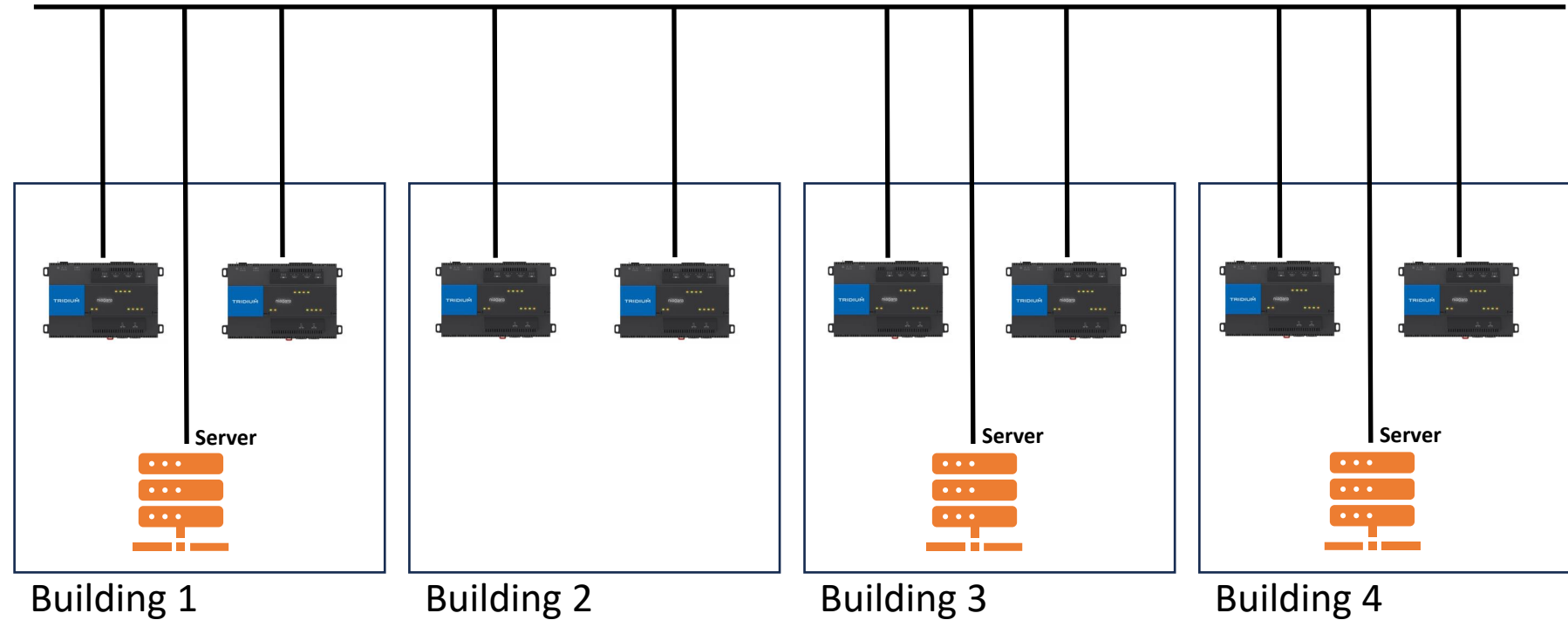
Use Case 1 – Multi-Tenant Building



Use Case 2 - High Availability Niagara

Project Requirements

- 4 separate buildings across a campus with multiple JACE controllers in each building
- 3 physical servers used as a single Supervisors
- Each server and all controllers are connected to a common network
- Upon failure of hardware or power to the running server, the running Niagara instance is to “hot swap” from duty server to the available server
- IP address of server “follows” the running version of Niagara



Use Case 2 - High Availability Niagara

Activities

Firefox

27 Mar 14:35

tridium - Project - Overview

Grafana

Login

https://console-openshift-console.apps.niagara-summit.2024.redhat-workshops.com/k8s/cluster/projects/tridium

Red Hat

OpenShift

Administrator

Home

Overview

Projects

Search

API Explorer

Events

Operators

Workloads

Networking

Storage

Builds

Observe

Compute

User Management

Administration

You are logged in as a temporary administrative user. Update the [cluster OAuth configuration](#) to allow others to log in.

Projects > Project details

PR tridium

Active

Actions

Overview

Details

YAML

Workloads

RoleBindings

Details

View all

Name

tridium

Requester

No requester

Labels

kubernetes.io/metadata.name=tridium

name=tridium

pod-security.kubernetes.io/audit=privileged

View all

Description

No description

Inventory

4 Deployments

0 DeploymentConfigs

0 StatefulSets

27 Pods

2 PersistentVolumeClaims

7 Services

6 Routes

Status

Active

AlertmanagerReceiversNotConfigured

27 Mar 2024, 13:28

Alerts are not configured to be sent to a notification system, meaning that you may not be notified in a timely fashion when important failures occur. Check the OpenShift documentation to learn how to configure notifications with Alertmanager.

Configure

Utilization

1 hour

Resource	Usage
CPU	5.12m
Memory	752 MiB
Filesystem	3.27 MiB
Network transfer	1.85 KBps in 2.43 KBps out

Activity

View events

Ongoing

There are no ongoing activities.

Recent events

Pause

14:36

Job completed

14:36

Created container track-pods

14:36

Successfully pulled image "quay.io...

14:36

Started container track-pods

14:36

Pulling image "quay.io/jswanson/tr...

14:36

Started container track-pods

14:36

Successfully assigned tridium/trac...

14:36

Add eth0 [10.131.140/23] from ov...

14:36

Created pod: track-pods-cronjob-...

14:36

Successfully assigned tridium/trac...

14:36

Created pod: track-pods-cronjob-...

14:36

Container image "quay.io/jswanso...

14:36

Created container track-pods

14:36

Started container track-pods

14:36

Successfully assigned tridium/trac...

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TRIDIUM

Use Case 2 - High Availability Niagara

Activities

Firefox

27 Mar 14:38

Deployments - Red Hat

Grafana

Login

https://console-openshift-console.apps.niagara-summit.2024.redhat-workshops.com/k8s/ns/tridium/apps~v1~Deployment

Red Hat OpenShift

1

?

kube:admin

Administrator

Home

Overview

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Search

API Explorer

Events

Operators

Workloads

Pods

Deployments

DeploymentConfigs

StatefulSets

Secrets

ConfigMaps

CronJobs

Jobs

DaemonSets

ReplicaSets

ReplicationControllers

HorizontalPodAutoscalers

Project: tridium

Deployments

Create Deployment

Name

Search by name...

Name	Status	Labels	Pod selector
grafana-deployment	1 of 1 pods	<div>app.kubernetes.io/managed-by=Helm</div> <div>app.kubernetes.io/name=grafana</div> <div>app.kubernetes.io/part-of=dashboard</div> <div>application=grafana</div>	<div>application=grafana</div>
landlord	1 of 1 pods	<div>app.kubernetes.io/managed-by=Helm</div> <div>app.kubernetes.io/name=landlord</div> <div>app.kubernetes.io/part-of=niagara4</div> <div>application=landlord</div>	<div>application=landlord</div>
prometheus-deployment	1 of 1 pods	<div>app.kubernetes.io/managed-by=Helm</div> <div>app.kubernetes.io/name=prometheus</div> <div>app.kubernetes.io/part-of=dashboard</div> <div>application=prometheus</div>	<div>application=prometheus</div>
pushgateway-deployment	1 of 1 pods	<div>app.kubernetes.io/managed-by=Helm</div> <div>app.kubernetes.io/name=pushgateway</div> <div>app.kubernetes.io/part-of=dashboard</div> <div>application=pushgateway</div>	<div>application=pushgateway</div>

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TRIDIUM

Use Case 2 - High Availability Niagara

Activities

Firefox

27 Mar 14:09

Topology · Red Hat OpenShift

Grafana

Login

Downloads | Red Hat OpenShift

Getting started with the OpenShift console

https://console-openshift-console.apps.niagara-summit.2024.redhat-workshops.com/topology/ns/tridium?view=graph&selectId=05c6b93e-13f3-48d0-93e7-e11b1d69d4a0

Red Hat OpenShift

kube:admin

Developer

+Add

Topology

Observe

Search

Builds

Environments

Helm

Project

ConfigMaps

Secrets

You are logged in as a temporary administrative user. Update the [cluster OAuth configuration](#) to allow others to log in.

Project: tridium Application: All applications

Display options Filter by resource Name Find by name...

1 Pod

landlord

niagara4

landlord

Details Resources Observe

1 Pod

Name

landlord

Namespace

tridium

Labels

app.kubernetes.io/managed-by=Helm

app.kubernetes.io/name=landlord

app.kubernetes.io/part-of=niagara4

application=landlord

Pod selector

application=landlord

Node selector

No selector

Update strategy

RollingUpdate

Max unavailable

25% of 1 pod

Max surge

25% greater than 1 pod

Progress deadline seconds

600 seconds

Min ready seconds

Not configured

PodDisruptionBudget

No PodDisruptionBudget

VerticalPodAutoscalers

Use Case 2 - High Availability Niagara

Activities

Firefox

27 Mar 14:32

Topology · Red Hat OpenShift

Grafana

Login

https://console-openshift-console.apps.niagara-summit.2024.redhat-workshops.com/topology/ns/tridium?selectId=05c6b93e-13f3-48d0-93e7-e11b1d69d4a0&view=graph

Red Hat OpenShift

Developer

+Add

Topology

Observe

Search

Builds

Environments

Helm

Project

ConfigMaps

Secrets

You are logged in as a temporary administrative user. Update the [cluster OAuth configuration](#) to allow others to log in.

Project: tridium Application: All applications

Display options Filter by resource Name Find by name...

1 Pod

landlord

niagara4

landlord

Details Resources Observe

Pods

landlord-64557f75cd-x4xt8 Running View logs

Services

niagara4-allports

Service port: port4911 → Pod port: 4911

Service port: port5011 → Pod port: 5011

Service port: port8443 → Pod port: 8443

niagara4-landlord-4911

Service port: TCP/4911 → Pod port: 4911

niagara4-landlord-5011

Service port: TCP/5011 → Pod port: 5011

niagara4-landlord-8443

Service port: TCP/8443 → Pod port: 8443

Routes

niagara4-landlord-4911-route

Location: https://niagara4-landlord-4911-route-tridium.apps.niagara-summit.2024.redhat-workshops.com

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Use Case 2 - High Availability Niagara

Activities

Firefox

27 Mar 14:32

landlord - Deployment - Y x

Grafana

Login

https://console-openshift-console.apps.niagara-summit.2024.redhat-workshops.com/k8s/ns/tridium/deployments/landlord/yaml

Red Hat OpenShift

Administrator

Home

Operators

OperatorHub

Installed Operators

Workloads

Pods

Deployments

DeploymentConfigs

StatefulSets

Secrets

ConfigMaps

CronJobs

Jobs

DaemonSets

ReplicaSets

ReplicationControllers

HorizontalPodAutoscalers

PodDisruptionBudgets

Networking

You are logged in as a temporary administrative user. Update the [cluster OAuth configuration](#) to allow others to log in.

Project: tridium

Deployments > Deployment details

landlord

Actions

Details Metrics **YAML** ReplicaSets Pods Environment Events

Alt + F1 Accessibility help

View shortcuts

Show tooltips

View sidebar

188

189

190

191

192

193

194

195

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198

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200

201

202

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211

212

213

214

215

216

env:

- name: NIAGARA_TZ

value: Europe/London

- name: LOG_LEVEL

value: INFO

- name: NIAGARA_STATION_STARTING_HEAP

value: 512M

- name: NIAGARA_STATION_MAX_HEAP

value: 1024M

securityContext:

privileged: true

ports:

- name: port-8443

containerPort: 8443

protocol: TCP

- name: port-4911

containerPort: 4911

protocol: TCP

- name: port-5011

containerPort: 5011

protocol: TCP

imagePullPolicy: IfNotPresent

volumeMounts:

- name: niagara-data

mountPath: /home/niagara

terminationMessagePolicy: File

image: 'docker.io/nush99/nige-repo:emea-nda-4.13u2'

serviceAccount: niagara4-sa

Save

Reload

Cancel

Download

Use Case 2 - High Availability Niagara

The screenshot displays a Grafana dashboard for 'Workload Locator' and a terminal window. The dashboard shows the status of three nodes: node0 (FALSE), node1 (TRUE), and node2 (FALSE). The terminal window shows the execution of Kubernetes commands to drain and uncordon a node.

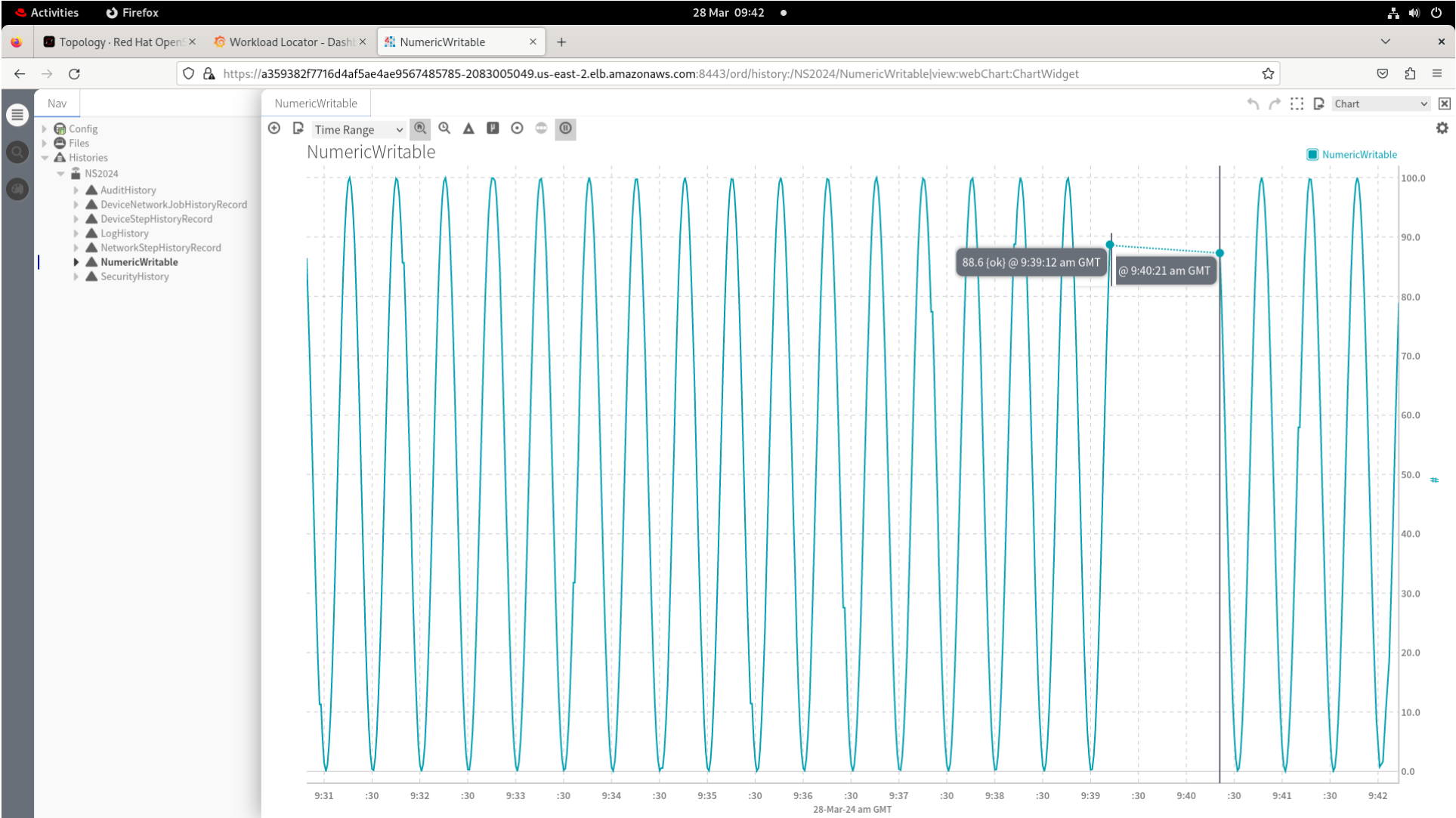
Grafana Dashboard:

- URL: <https://grafana-route-josh-testing.apps.niagara-summit.2024.redhat-workshops.com/d/cdgd0mp>
- Navigation: Home > Dashboards > Workload Locator
- Nodes: node0 + node1 + node2
- node0: Landlord, FALSE
- node1: Landlord, TRUE
- node2: Landlord, FALSE

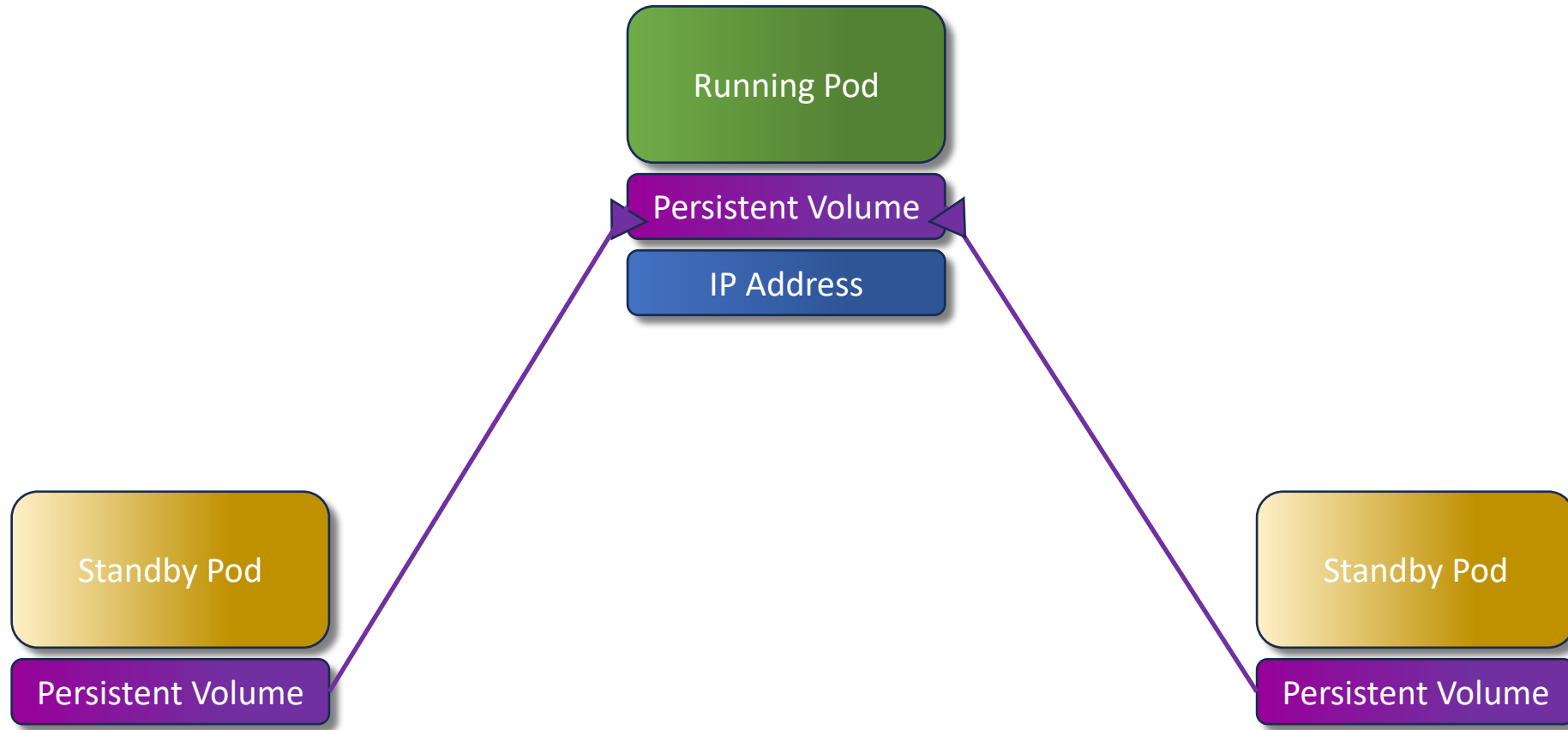
Terminal Window:

```
tridium@podman-machine:~$  
[tridium@podman-machine ~]$  
*Drain Commands.txt  
1 oc get nodes -l topology.kubernetes.io/zone=us-east-2a | grep worker  
2  
3 oc adm drain ip-10-0-5-240.us-east-2.compute.internal --ignore-daemonsets --delete-emptydir-data  
4  
5 oc adm uncordon ip-10-0-5-240.us-east-2.compute.internal
```

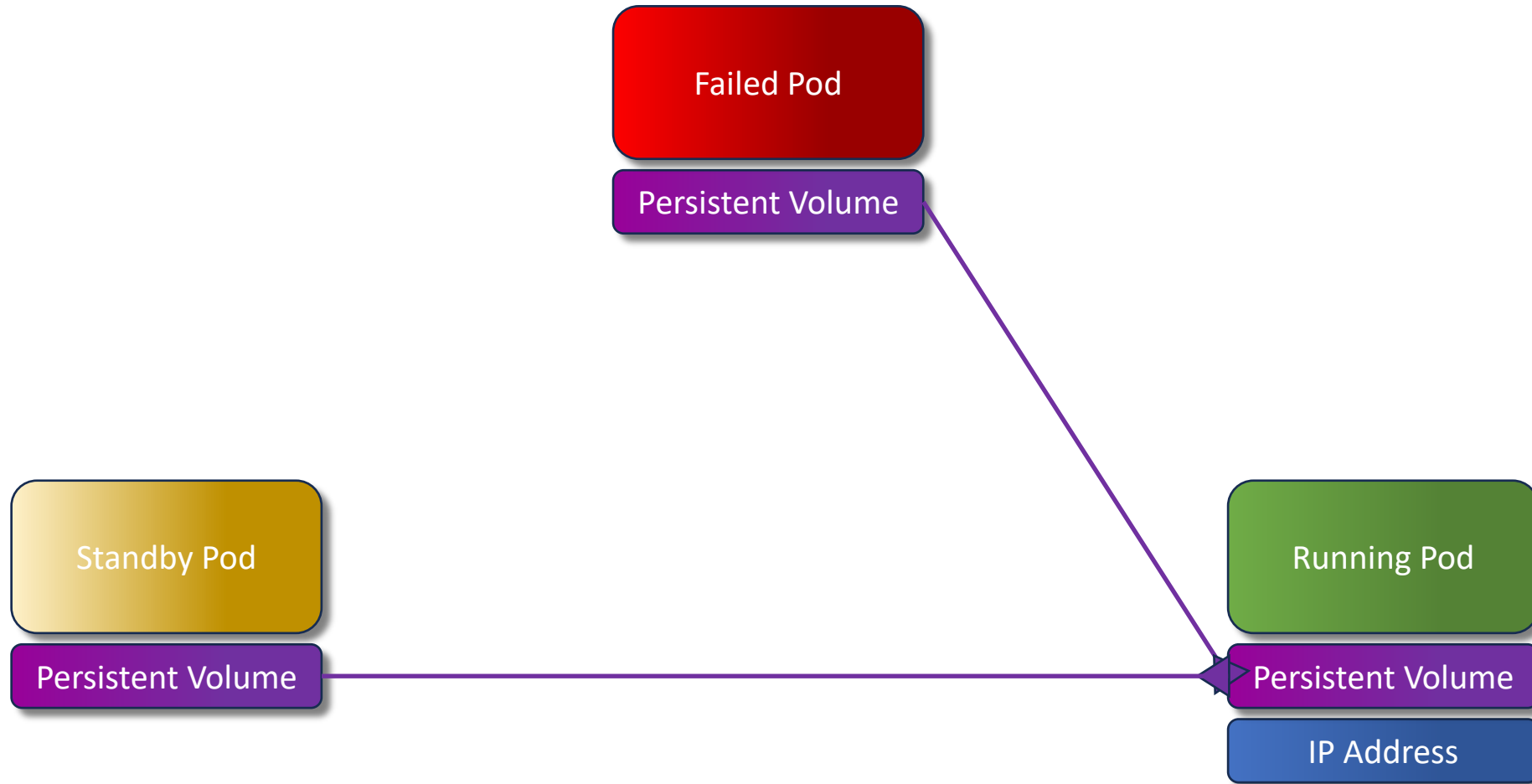
Use Case 2 - High Availability Niagara



Use Case 2 - High Availability Niagara



Use Case 2 - High Availability Niagara



In Summary

Containers are more resource efficient, quicker to deploy, there are many tools available to deploy at scale

Seamless upgrades to Niagara devices

Typical Niagara uses are supervisors in the cloud and on-prem - as well as embedded devices

New subscription business offer - you are only paying for the time it's running

Opens the door to new application such high availability

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<https://docs.niagara-community.com/bundle/ContainerizedNiagara/page/index.html>

<https://www.tridium.com/us/en/services-support/events/2023/06/2023-06-08-containerized-niagara-subscription-licensing>

<https://www.tridium.com/us/en/services-support/events/2024/03/2024-03-21-niagara-containerization>

Any Question?

curtis.mckerlie@tridium.com



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**Thank you for your
time 😊**