

All about OpenShift Windows Containers

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OpenShift Container Platform

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- Actively works on install-upgrade and windows containers issues.
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What we'll discuss today

- ❖ Why Windows Containers?
- ❖ Mixed Workloads
- ❖ Use cases
- ❖ WMCO Design
- ❖ WMCO Workflow
- ❖ Prerequisites
- ❖ Configuring Hybrid Networking
- ❖ Operator Installation
- ❖ Windows MachineSet Object
- ❖ Troubleshooting
- ❖ Collecting Logs
- ❖ Accessing Windows Node
- ❖ Windows OS Updates
- ❖ Limitations
- ❖ Case Workflow

Why

Windows

Containers?

To avoid rebuilding these Windows-based applications and get them to the cloud, some container orchestration platforms can support Windows containers while delivering the benefits of Kubernetes.



Windows presence

Windows Server still enjoys significant presence amongst server operating systems in the datacenter



.NET app development

.NET has been and continues to be used widely for application development



Commingle in Linux ecosystem

Work side by side with Linux® containers



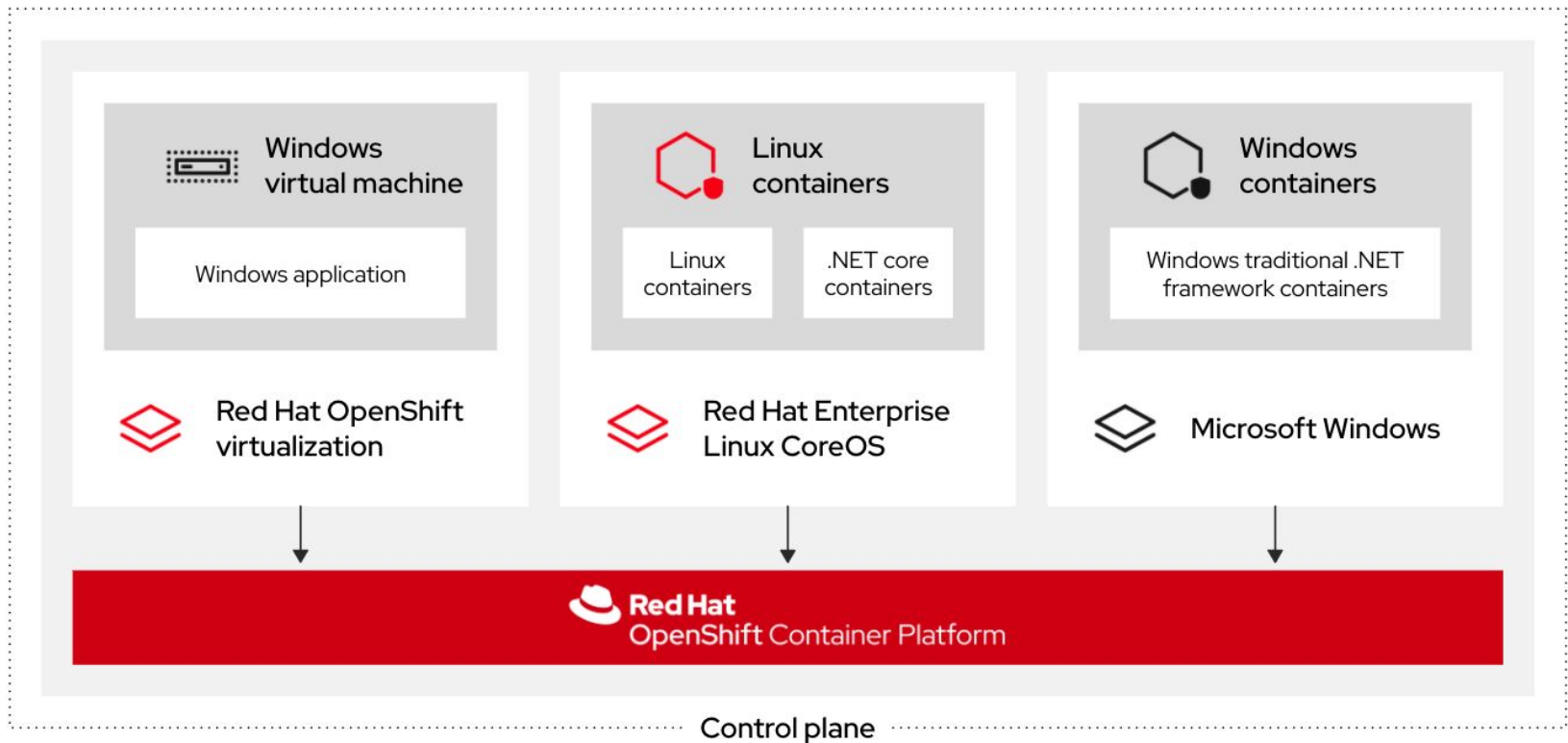
Embrace microservices

Help Windows application developers adopt microservices by running Windows containers

Windows Servers have a long history (*but*)

- ❖ Application development shifts to cloud-native deployments
- ❖ Traditional Windows applications have transitioned
- ❖ From data centers, to the cloud with the support of container technology

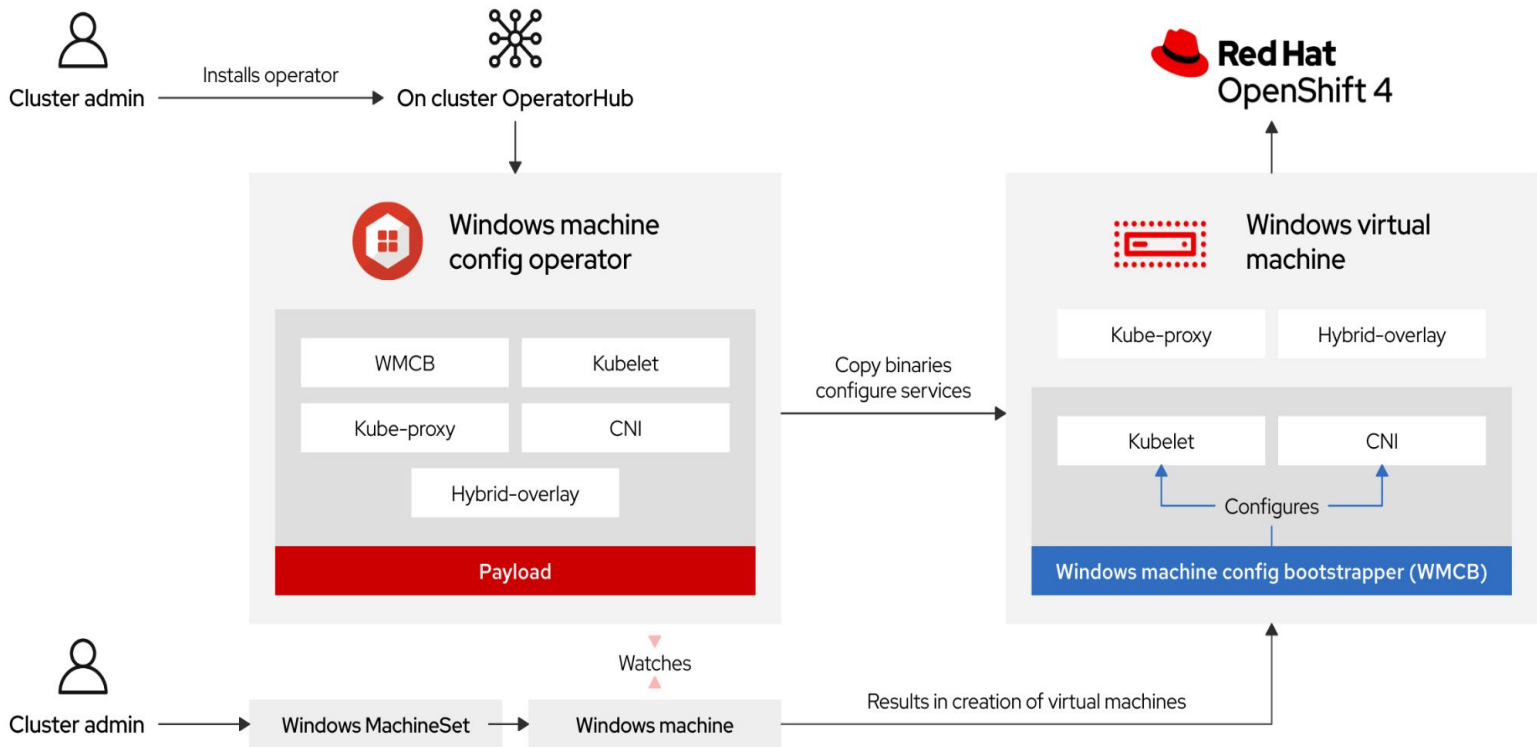
Mixed Windows and Linux workloads



Windows Container workloads use cases

| Step | Red Hat OpenShift feature | Use case | Advantages | Trade offs |
|---------------------|---|--|--|---|
| Rehost | OpenShift Virtualization | Lift and shift Windows virtual machines to OpenShift | Easy and low friction | Few benefits of containerization |
| Refactor | Red Hat OpenShift support for Windows Containers | Containerize and run traditional .NET framework apps on Windows Server containers and deploy to Windows worker nodes on Red Hat OpenShift Container Platform | Benefits of containerization and OpenShift | Evolving Windows container ecosystem, supported only for newer version of Windows including Windows Server 2019 |
| Re-architect | Red Hat Enterprise Linux Red Hat Enterprise Linux CoreOS | Migrate traditional .NET frameworks apps to .NET Core and deploy to Red Hat Enterprise Linux containers in OpenShift. | Full benefit of containerization and OpenShift, highly evolved community | Migration effort involved, time consuming |
| Rebuild | Red Hat Enterprise Linux Red Hat Enterprise Linux CoreOS | Build cloud native apps using Linux containers and deploy to Red Hat Enterprise Linux/Red Hat Enterprise Linux CoreOS containers on OpenShift. | Full benefit of containerization and OpenShift highly evolved community | Net new development may not be an option for customers running in maintenance mode |

Windows Machine Config Operator Design



Workflow

- ❖ The WMCO expects a predetermined secret in its namespace containing a private key that is used to interact with the Windows instance. WMCO checks for this secret during boot up time and creates a user data secret which you must reference in the Windows MachineSet object that you created. Then the WMCO populates the user data secret with a public key that corresponds to the private key.
- ❖ Copies the following files Windows Machine Config Bootstrapper (WMCB), kubelet, hybrid-overlay, kube-proxy, CNI package.
- ❖ Remotely executes the following.
 - WMCB to configure the kubelet.
 - Hybrid-overlay to create the OpenShift HNS networks.
 - WMCB to configure the kubelet for CNI plugin.
 - Kube-proxy
- ❖ CSRs are approved.

Prerequisites

Supported cloud providers based on OpenShift Container Platform and WMCO versions

| Cloud provider | Supported OpenShift Container Platform version | Supported WMCO version |
|---------------------------|--|------------------------|
| Amazon Web Services (AWS) | 4.6+ | WMCO 1.0+ |
| Microsoft Azure | 4.6+ | WMCO 1.0+ |
| VMware vSphere | 4.7+ | WMCO 2.0+ |

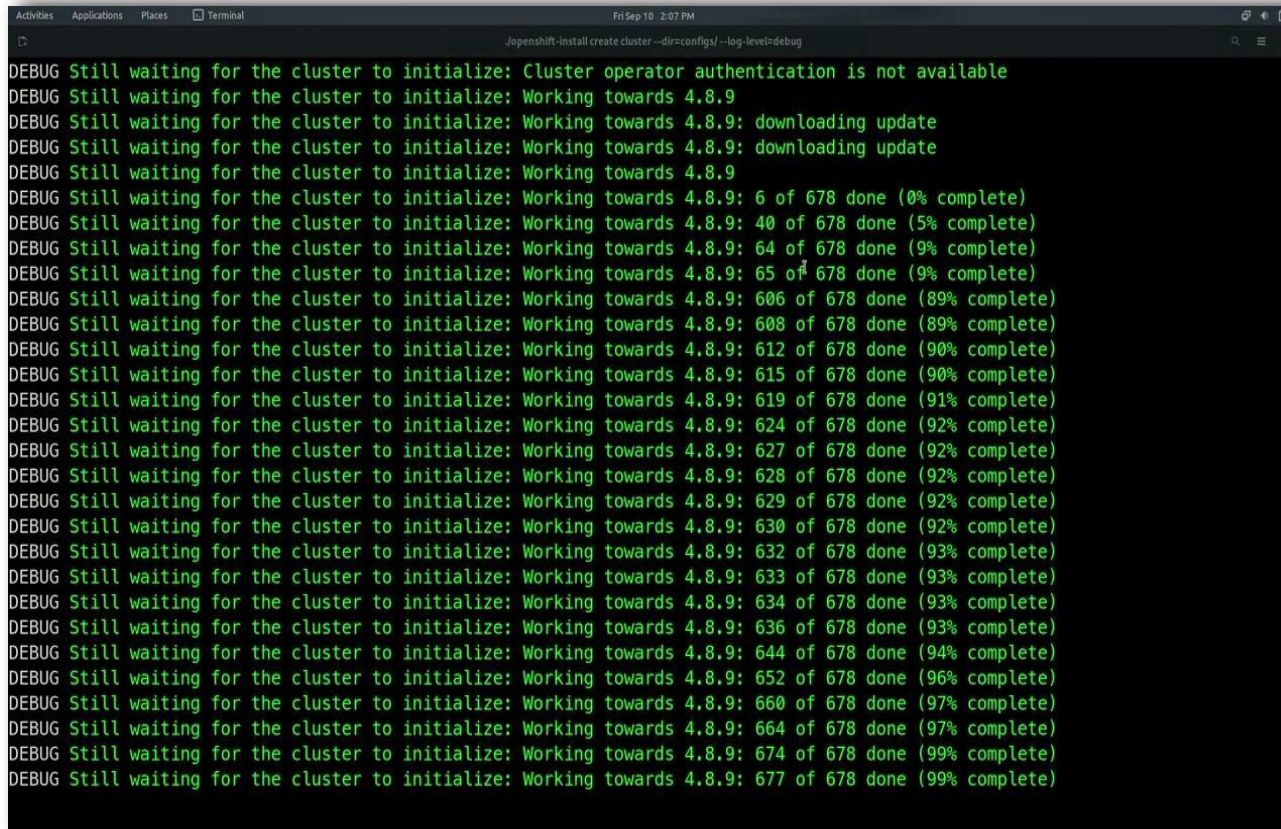
Supported Windows Server versions

| Cloud provider | Supported Windows Server version |
|---------------------------|--|
| Amazon Web Services (AWS) | Windows Server Long-Term Servicing Channel (LTSC); Windows Server 1809 |
| Microsoft Azure | Windows Server Long-Term Servicing Channel (LTSC); Windows Server 1809 |
| VMware vSphere | Windows Server Semi-Annual Channel (SAC); Windows Server 2004 |

Supported networking

| Cloud provider | Supported networking |
|---------------------------|--|
| Amazon Web Services (AWS) | Hybrid networking with OVN-Kubernetes |
| Microsoft Azure | Hybrid networking with OVN-Kubernetes |
| VMware vSphere | Hybrid networking with OVN-Kubernetes with a custom VXLAN port |

Hybrid networking with OVN-Kubernetes



```
Activities Applications Places Terminal
Fri Sep 10 2:07 PM
./openshift-install create cluster --dir=configs/ --log-level=debug

DEBUG Still waiting for the cluster to initialize: Cluster operator authentication is not available
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: downloading update
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: downloading update
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 6 of 678 done (0% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 40 of 678 done (5% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 64 of 678 done (9% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 65 of 678 done (9% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 606 of 678 done (89% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 608 of 678 done (89% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 612 of 678 done (90% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 615 of 678 done (90% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 619 of 678 done (91% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 624 of 678 done (92% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 627 of 678 done (92% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 628 of 678 done (92% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 629 of 678 done (92% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 630 of 678 done (92% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 632 of 678 done (93% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 633 of 678 done (93% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 634 of 678 done (93% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 636 of 678 done (93% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 644 of 678 done (94% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 652 of 678 done (96% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 660 of 678 done (97% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 664 of 678 done (97% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 674 of 678 done (99% complete)
DEBUG Still waiting for the cluster to initialize: Working towards 4.8.9: 677 of 678 done (99% complete)
```

WMCO Installation

CONFIDENTIAL designer

The screenshot shows the Red Hat OpenShift Container Platform console. On the left is a navigation sidebar with sections like Administrator, Home, Operators, Workloads, Networking, Storage, and Builds. The 'Operators' section is expanded, showing 'OperatorHub' and 'Installed Operators'. The main content area displays the 'Windows Machine Config Operator' page, which is version 3.0.0 and provided by Red Hat. A prominent blue 'Install' button is visible. Below the button, the page lists the latest version (3.0.0), capability level (Basic Install, Seamless Upgrades), source (Red Hat), provider (Red Hat), repository (https://github.com/openshift/windows-machine-config-operator), and pre-requisites (Red Hat OpenShift subscription, OCP 4.8 cluster, WMCO pre-requisites). The introduction text explains that the operator configures Windows Machines into nodes and enables Windows container workloads on OCP clusters.

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https://docs.openshift.com/container-platform/4.8/windows_containers/enabling-windows-container-workloads.html

V0000000



Windows MachineSet object on AWS

```

Activities Applications Places Terminal
Fri Sep 10 2:54 PM
aygarg@ayush-garg:~/OCP-4.8

conciler group":"","reconciler kind":"ConfigMap","worker count":1}
{"level":"info","ts":1631263745.1562474,"logger":"controller-runtime.manager.controller.machine","msg":"Starting workers","reconciler group":"machine.openshift.io","reconciler kind":"Machine","worker count":1}
{"level":"info","ts":1631263745.1615798,"logger":"controller-runtime.manager.controller.secret","msg":"Starting workers","reconciler group":"","reconciler kind":"Secret","worker count":1}
{"level":"info","ts":1631263823.5541542,"logger":"controller.secret","msg":"secret not found, creating the secret","secret":"openshift-windows-machine-config-operator/cloud-private-key","name":"windows-user-data"}
{"level":"info","ts":1631265070.6506917,"logger":"metrics","msg":"Prometheus configured","endpoints":"windows-exporter","port":9182,"name":"metrics"}
{"level":"info","ts":1631265098.4877064,"logger":"metrics","msg":"Prometheus configured","endpoints":"windows-exporter","port":9182,"name":"metrics"}
{"level":"info","ts":1631265098.507971,"logger":"metrics","msg":"Prometheus configured","endpoints":"windows-exporter","port":9182,"name":"metrics"}
{"level":"info","ts":1631265098.5081754,"logger":"controller.windowasmachine","msg":"processing","windowasmachine":"openshift-machine-api/windows-machineset-mljqc"}
{"level":"info","ts":1631265501.5203578,"logger":"VM 10.0.151.239","msg":"configuring"}
{"level":"info","ts":1631265501.8367238,"logger":"VM 10.0.151.239","msg":"transferring files"}
{"level":"info","ts":1631265578.28219,"logger":"VM 10.0.151.239","msg":"configured kubelet","cmd":"C:\\k\\wmcb.exe initialize-kubelet --ignition-file C:\\Windows\\Temp\\worker.ign --kubelet-path C:\\k\\kubelet.exe","output":"Bootstrapping completed successfully"}
{"level":"info","ts":1631265608.316799,"logger":"VM 10.0.151.239","msg":"configure","service":"hybrid-overlay-node","args":"--node ip-10-0-151-239.ec2.internal --k8s-kubeconfig c:\\k\\kubeconfig --windows-service --logfile C:\\var\\log\\hybrid-overlay\\hybrid-overlay.log\\ depend= kubelet"}
{"level":"info","ts":1631265732.986924,"logger":"VM 10.0.151.239","msg":"configured","service":"hybrid-overlay-node","args":"--node ip-10-0-151-239.ec2.internal --k8s-kubeconfig c:\\k\\kubeconfig --windows-service --logfile C:\\var\\log\\hybrid-overlay\\hybrid-overlay.log\\ depend= kubelet"}
{"level":"info","ts":1631265784.4867184,"logger":"VM 10.0.151.239","msg":"configured kubelet for CNI","cmd":"C:\\k\\wmcb.exe configure-cni --cni-dir=C:\\k\\cni\\ --cni-config=C:\\k\\cni\\config\\cni.conf","output":"CNI configuration completed successfully"}
{"level":"info","ts":1631265803.944961,"logger":"VM 10.0.151.239","msg":"configured","service":"kube-proxy","args":"--windows-service --v=4 --proxy-mode=kernel-space --feature-gates=WinOverlay=true --hostname-override=ip-10-0-151-239.ec2.internal --kubelet

```

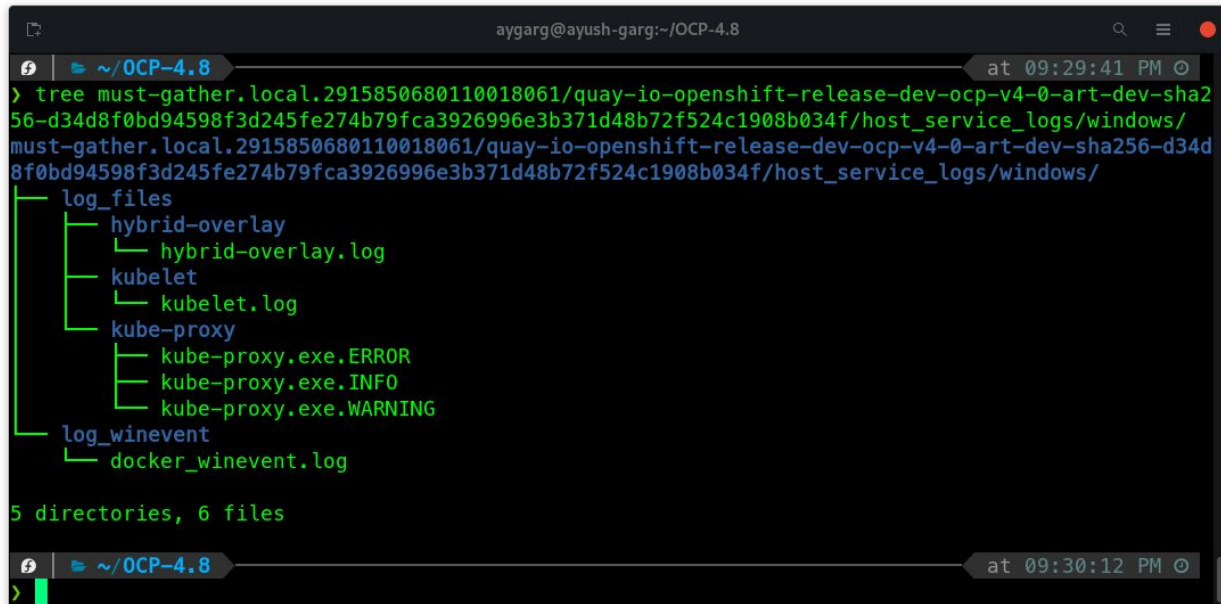
Troubleshooting

The following two namespaces only need to be checked for troubleshooting issues related to Windows Containers.

- ❖ openshift-machine-api for Windows Machine provisioning issue.
 - `$ oc get events`
 - `$ oc get machines`
 - `$ oc describe machine <windows-machine>`
 - `$ oc logs machine-api-controllers-<id> -c machineset-controller`
 - `$ oc logs machine-api-controllers-<id> -c machine-controller`
 - `$ oc get machineset <windows-machineset-name> -o yaml`
- ❖ openshift-windows-machine-config-operator for WMCO pod logs and if windows node doesn't join cluster.
 - `$ oc get network.operator cluster -o yaml`
 - `$ oc get events`
 - `$ oc logs windows-machine-config-operator-<id>`

Collecting Logs

- ❖ \$ oc adm must-gather [+]
- ❖ \$ oc adm inspect ns/openshift-windows-machine-config-operator



```
aygarg@ayush-garg:~/OCP-4.8
~ /OCP-4.8 at 09:29:41 PM
> tree must-gather.local.2915850680110018061/quay-io-openshift-release-dev-ocp-v4-0-art-dev-sha256-d34d8f0bd94598f3d245fe274b79fca3926996e3b371d48b72f524c1908b034f/host_service_logs/windows/
must-gather.local.2915850680110018061/quay-io-openshift-release-dev-ocp-v4-0-art-dev-sha256-d34d8f0bd94598f3d245fe274b79fca3926996e3b371d48b72f524c1908b034f/host_service_logs/windows/
├── log_files
│   ├── hybrid-overlay
│   │   └── hybrid-overlay.log
│   ├── kubelet
│   │   └── kubelet.log
│   ├── kube-proxy
│   │   ├── kube-proxy.exe.ERROR
│   │   ├── kube-proxy.exe.INFO
│   │   └── kube-proxy.exe.WARNING
│   └── log_winevent
│       └── docker_winevent.log
5 directories, 6 files
~ /OCP-4.8 at 09:30:12 PM
>
```

Accessing a Windows Node

Windows nodes can't be accessed using the oc debug command, as it requires a privileged pod on the node, which is not yet supported for Windows. Instead, a Windows node can be accessed using SSH or RDP.

- ❖ \$ ssh -i
 \\ For Amazon Web Services (AWS)
- ❖ \$ ssh -i
 \\ For Microsoft Azure

The must-gather won't be in
when Windows Node is in
"oc adm node-logs" command

```

Administrator: c:\windows\system32\cmd.exe - powershell
aygarg@ayush-garg: ~/OCP-4.8 Administrator: c:\windows\system32\cmd.exe - ...
Microsoft Windows [Version 10.0.17763.2114]
(c) 2018 Microsoft Corporation. All rights reserved.

administrator@EC2AMAZ-S94RVUB C:\Users\Administrator> powershell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\Administrator> cd C:\var\log\
PS C:\var\log> ls

Directory: C:\var\log

Mode                LastWriteTime         Length Name
----                -
d-----          9/12/2021   3:10 PM          containers
d-----          9/12/2021   3:10 PM        hybrid-overlay
d-----          9/12/2021   3:13 PM        kube-proxy
d-----          9/12/2021   3:10 PM        kubelet
d-----          9/12/2021   4:17 PM          pods

PS C:\var\log> ls kubelet

Directory: C:\var\log\kubelet

Mode                LastWriteTime         Length Name
----                -
-a-----          9/12/2021   4:32 PM    691711 kubelet.log

PS C:\var\log>
  
```

The WMCO is not responsible for the Windows operating system updates.

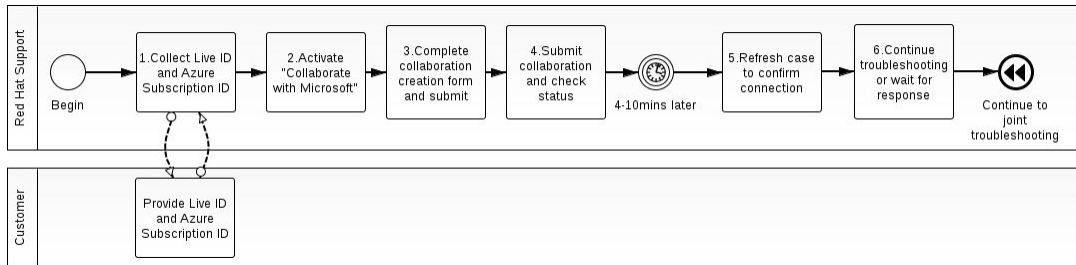
The Cluster Administrator provides the Windows image while creating the VMs and hence, the Cluster Administrator is responsible for providing an updated image. The Cluster Administrator can provide an updated image by changing the image in the MachineSet spec.

Limitations

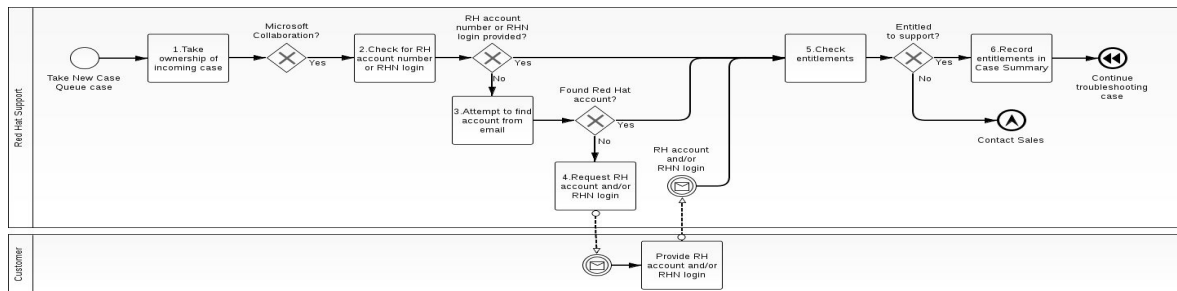
- ❖ **Serverless**
- ❖ **Service Mesh**
- ❖ **OpenShift Pipelines**
- ❖ **Cost Management**
- ❖ **CodeReady**
- ❖ **Thanos User Workload Monitoring**
- ❖ **Builds V2 or BuildConfig or s2i**
- ❖ **No built in Windows OS**
(bring your own Windows license)

Red Hat / Microsoft collaboration support workflow

❖ Open a collaboration with Microsoft



❖ Receiving a new collaboration from Microsoft



Available Resources

- ❖ [Windows Containers Landing Page](#)
- ❖ [Troubleshooting Windows container workload issues](#)
- ❖ [Hybrid cloud blog](#)
- ❖ [Scheduling Windows container workloads](#)

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