OpenShift Container Platform 4.4 on AWS with Microsoft Windows Server 2019/1809 Nodes

Developer Preview

Pre-requisites

The document is tested against a Fedora release 31 Linux host for running all the Linux commands.

Please note that a command preceded by > is to be run in a PowerShell window on a Windows instance, and a command preceded by $ is to be run on a Linux console (localhost)

Installation of prerequisite packages

Python3 and pip are required to follow this guide. To check if python3 is installed on the system, run the following command:

```
$ python3 --version
```

To install python3, run the following command:

```
$ sudo dnf install python3
```

To check if pip is installed on the system, run the following command:

```
$ python3 -m pip --version
pip 19.0.3 from /usr/lib/python3.7/site-packages/pip (python 3.7)
```

To install pip refer pip installation

Install jq library to parse json files:

```
$ sudo dnf install jq
```

Install git to clone github repository:

```
$ sudo dnf install git
```

Bring up the OpenShift cluster with ovn-kubernetes

Download the dev-preview 4.4.0-rc.3 OpenShift Installer and Client and pull secret for AWS.
Note: Download both the openshift-install and openshift-client.

Unzip the files with the following commands: (Reference commands given below)

```
$ tar -xzvf openshift-install-linux-<version>.tar.gz
$ tar -xzvf openshift-client-linux-<version>.tar.gz
```

After extracting openshift client, move the oc and kubectl binaries to `/usr/local/bin`

```
$ sudo mv {kubectl,oc} /usr/local/bin
```

Configure AWS CLI

See Configuring the AWS CLI

Create the install-config

```
$ ./openshift-install create install-config --dir=<cluster_directory>
> SSH Public Key <path-to-your-rsa>/id_rsa.pub
> Platform <i.e. aws>
> Region  <region close by i.e. us-east-1>
> Base Domain <Your Domain>
> Cluster Name <cluster_name>
> Pull Secret <content of pull-secrets>
```

Official documentation should be consulted for credentials and other cloud provider related instructions.

The previous step will result in an `install-config.yaml` in your cluster directory. Edit the `install-config.yaml` to switch networkType from OpenShiftSDN to OVNKubernetes inside the cluster directory:

```
$ sed -i 's/OpenShiftSDN/OVNKubernetes/g' install-config.yaml
```

Create manifests

We want to enable hybrid networking on the cluster. For that we need to create the manifests:

```
$ ./openshift-install create manifests --dir=<cluster_directory>
```

Above step will create a `manifests` and `openshift` folder in your `<cluster_directory>`

Configuring OVNKubernetes on a Hybrid cluster

Inside the cluster_directory, create a copy of `manifests/cluster-network-02-config.yml` as `manifests/cluster-network-03-config.yml`.

```
$ cp manifests/cluster-network-02-config.yml
manifests/cluster-network-03-config.yml
```

Edit `manifests/cluster-network-03-config.yml` as shown below:

1. Modify the `api version` to `operator.openshift.io/v1`

```
$ sed -i 's/config.openshift.io\/v1/operator.openshift.io\/v1/g'
manifests/cluster-network-03-config.yml
```

2. Add the following to the `spec:` section of `manifests/cluster-network-03-config.yml`

```
spec:
  defaultNetwork:
    type: OVNKubernetes
    ovnKubernetesConfig:
      hybridOverlayConfig:
        hybridClusterNetwork:
        - cidr: 10.132.0.0/14
          hostPrefix: 23
```

Here is an example of `manifests/cluster-network-03-config.yml`

```
apiVersion: operator.openshift.io/v1
kind: Network
metadata:
  creationTimestamp: null
  name: cluster
spec:
  clusterNetwork:
  - cidr: 10.128.0.0/14
    hostPrefix: 23
  externalIP:
    policy: {}
  networkType: OVNKubernetes
  serviceNetwork:
  - 172.30.0.0/16
  defaultNetwork:
    type: OVNKubernetes
    ovnKubernetesConfig:
      hybridOverlayConfig:
        hybridClusterNetwork:
        - cidr: 10.132.0.0/14
```

```
      hostPrefix: 23
status: {}
```

The highlighted portion above is the required modification for the file.
NOTE: the hybridClusterNetwork CIDR cannot overlap clusterNetwork CIDR

Create the cluster

Execute the following command to create the cluster and wait for it come up:

```
$ ./openshift-install create cluster --dir=<cluster_directory>
```

Export the `kubeconfig` so that oc can communicate with the cluster:

```
$ export KUBECONFIG=$(pwd)/<cluster_directory>/auth/kubeconfig
```

Make sure you can interact with the cluster:

```
$ oc get nodes
```

```
NAME                           STATUS   ROLES    AGE     VERSION
ip-10-0-133-44.ec2.internal    Ready    worker   4h5m    v1.17.1
ip-10-0-142-29.ec2.internal    Ready    master   4h14m   v1.17.1
ip-10-0-152-168.ec2.internal   Ready    master   4h14m   v1.17.1
ip-10-0-153-185.ec2.internal   Ready    worker   4h5m    v1.17.1
ip-10-0-164-237.ec2.internal   Ready    worker   4h5m    v1.17.1
ip-10-0-174-28.ec2.internal    Ready    master   4h13m   v1.17.1
```

Verify Hybrid networking

The network.operator cluster CR spec should look like the example below:

```
$ oc get network.operator cluster -o yaml
```

```
...
spec:

  clusterNetwork:
  - cidr: 10.128.0.0/14
    hostPrefix: 23
  defaultNetwork:
    ovnKubernetesConfig:
      hybridOverlayConfig:
        hybridClusterNetwork:
        - cidr: 10.132.0.0/14
          hostPrefix: 23
    type: OVNKubernetes
  serviceNetwork:
```

```
  - 172.30.0.0/16
status: {}
…
```

Bring up the Windows node

Launch a *Windows 2019 Server Datacenter with Containers* instance and add it to the cluster.

Windows Node Installer

Windows Node Installer (WNI) is an unsupported tool that can automate the process of launching a Windows instance and prepare it for bootstrapping. For more details, please refer to the README.

Download WNI v4.4.3-alpha on your Linux host and ensure you can execute it:

```
$ wget
https://github.com/openshift/windows-machine-config-bootstrapper/releases/downloa
d/v4.4.3-alpha/wni
$ chmod +x wni
```

The following command creates the instance with your AWS account and outputs the credentials. It expects your credentials to be stored on the system and have the aws_access_key_id and aws_secret_access_key.

```
$ ./wni aws create --kubeconfig <path to OpenShift cluster>/auth/kubeconfig
--credentials <path to aws>/credentials --credential-account <credential-account
in the credentials file, ex: default> --instance-type m5a.large --ssh-key <name
of the existing ssh key> --private-key <path to private key> --dir <directory>
```

For eg.

```
$ ./wni aws create --kubeconfig ~/<cluster_dir>/auth/kubeconfig --credentials
~/.aws/credentials --credential-account dev --instance-type m5a.large --ssh-key
aws-key-name --private-key ~/.ssh/key.pem --dir ./windowsnodeinstaller/
```

The output of this command will give the private and public IP required for creating the host file in the Setup Ansible connection step.

You can now setup Ansible before moving on to the next steps.

If the Windows node cannot be brought up due to some reason using the automated Windows Node Installer (WNI) tool, the Windows node can also be brought up manually using the steps outlined in the Appendix section.

Setup Ansible connection

Now we can use Ansible to configure the Windows host. On the Linux host, install ansible and pywinrm, as well as selinux-python bindings:
Note: This step assumes that python3 is installed on the system. Ansible will not work without python.

```
$ sudo dnf install python3-libselinux
$ pip install ansible==2.9 pywinrm selinux --user
```

Create a hosts file with the following information:

```
[win]
<public_ip> ansible_password=<password> private_ip=<private_ip>

[win:vars]
ansible_user=<username>
cluster_address=<cluster_address>
ansible_connection=winrm
ansible_ssh_port=5986
ansible_winrm_server_cert_validation=ignore
```

<cluster_address> is the cluster endpoint. It is the combination of your cluster name and the base domain for your cluster.

```
$ oc cluster-info | head -n1 | sed 's/.*\/\/api.//g'| sed 's/:.*//g'
```

<public_ip> is the IPv4 public ip of the Windows instance from the Amazon console. Do not use the DNS address of the instance here. <private_ip> is the private IP of the node and can be found in the output of the Windows node creation using the automated WNI tool.

<username> and <password> are the login credentials for the Windows instance. Note the username listed here must have administrative privileges. In default case, <username> is 'Administrator'

Here is an example hosts file:

```
[win]
40.69.185.26 ansible_password='mypassword' private_ip=10.0.29.167

[win:vars]
ansible_user=Administrator
cluster_address=winc-cluster.devcluster.openshift.com
ansible_connection=winrm
ansible_ssh_port=5986
ansible_winrm_server_cert_validation=ignore
```

Test if Ansible is able to communicate with the Windows instance with the following command:

```
$ ansible win -i <name_of_the_hosts_file> -m win_ping -v
```

Note: If you do not want to provide the password in the hosts file, you can provide the same as an extra-variable to any ansible command. For example, the above command could be executed as:

```
$ ansible win -i <name_of_the_hosts_file> -m win_ping -v --extra-vars
"ansible_password=<password>"
```

Bootstrap the Windows instance

On a Linux host, run the Ansible Playbook that transfers the necessary files onto the Windows instance and bootstraps it so that it can join the cluster as a worker node.
Note: Playbook assumes you have jq installed. Your active RDP connection might be disrupted during the execution of the playbook. Make sure you have at least 600mb of free space in `/tmp` directory.

Run the ansible playbook to bootstrap the windows worker node. Make sure you have at least 6GB of free space in `/tmp` directory.

```
$ git clone https://github.com/openshift/windows-machine-config-bootstrapper.git
$ git fetch && git checkout release-4.4
$ ansible-playbook -i <path_to_hosts_file>
windows-machine-config-bootstrapper/tools/ansible/tasks/wsu/main.yaml -v
```

```
$ oc get nodes -l kubernetes.io/os=windows
```

You can now see the Windows instance has joined the cluster

```
NAME                           STATUS   ROLES    AGE     VERSION
ip-10-0-71-15.ec2.internal     Ready    worker   3h30m   v1.17.1
```

API rate limit exceeded error when running WSU

WSU playbook uses GitHub API to fetch releases for WMCB. You might encounter an API rate limit exceeded error while running WSU playbook in `TASK [Get release]`. The issue occurs due to GitHub rate-limiting unauthenticated requests at 60 requests per hour. As a workaround, wait for the rate-limit to reset (at most 1 hour) before running the playbook again.

Test Windows workload

We can now create a pod that can be deployed on a Windows instance. We used an example WebServer deployment to create a pod:
Note: Given the size of Windows images, it is recommended to pull the Docker image mcr.microsoft.com/windows/servercore:ltsc2019 on the instance first, before creating the pods.

On Windows instance, run the following command in a powershell window:

```
> docker pull mcr.microsoft.com/windows/servercore:ltsc2019
```

Note: Refer RDP section to set up and RDP into your windows node

On the Linux host, deploy the pods:

```
$ oc create -f
https://gist.githubusercontent.com/suhanime/683ee7b5a2f55c11e3a26a4223170582/raw/
d893db98944bf615fccfe73e6e4fb19549a362a5/WinWebServer.yaml -n default
```

Once the deployment has been created, we can check the status of the pods:

```
$ oc get pods -n default
NAME                              READY   STATUS    RESTARTS   AGE
win-webserver-6f5bdc5b95-x65tq    1/1     Running   0          14m
```

We have created a service of LoadBalancer type:

```
$ oc get service win-webserver -n default
NAME          TYPE         CLUSTER-IP    EXTERNAL-IP   PORT(S)        AGE
win-webserver LoadBalancer 172.30.156.18
a22c5338b80f3431bb6428f8a43a4877-890285700.us-east-2.elb.amazonaws.com
80:30897/TCP   33s
```

```
$ curl a22c5338b80f3431bb6428f8a43a4877-890285700.us-east-2.elb.amazonaws.com
<html><body><H1>Windows Container Web Server</H1><p>IP 10.132.1.2 callerCount 4
</body></html>
```

Deploying in a namespace other than default

In order to deploy into a different namespace SCC must be disabled in that namespace. This should never be used in production, and any namespace that this has been done to should not be used to run Linux pods.

To skip SCC for a namespace the label openshift.io/run-level = 1 should be applied to the namespace. This will apply to both Linux and windows pods, and thus Linux pods should not be deployed into this namespace.

For example, to create a new project and apply the label:

```
$ oc new-project <project_name>
$ oc label namespace <project_name> "openshift.io/run-level=1"
```

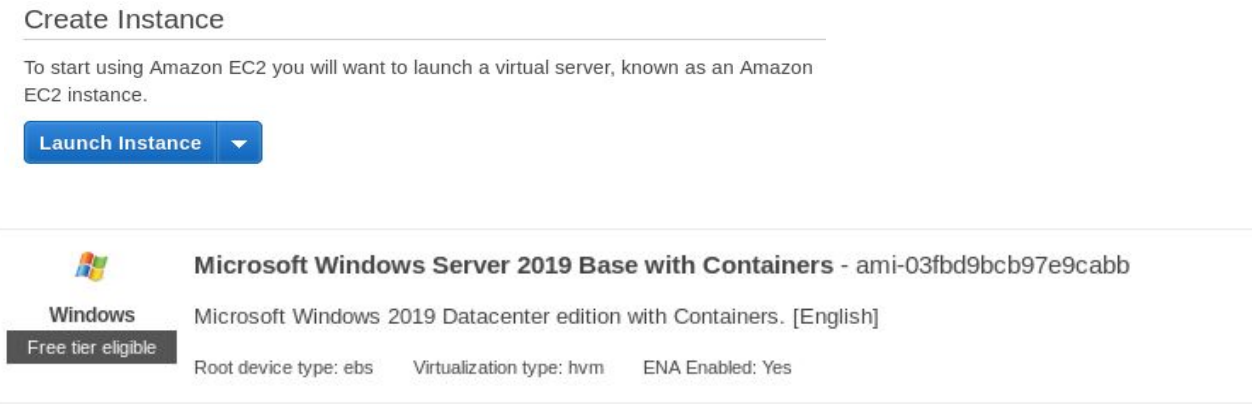
Appendix

Bring up the Windows node using the AWS console

Login into the AWS console. Make sure you are in the same region as your cluster and click on Running Instances

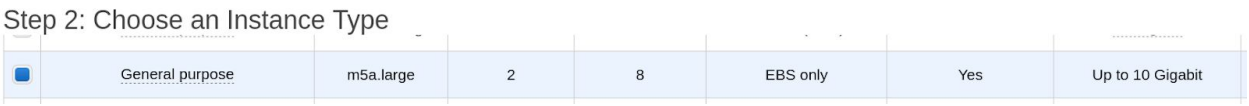
Search for the name of your cluster to see the masters and workers running.

Select Launch instance to create a new instance:



Choose the image for Microsoft Windows Server 2019 Base with Containers

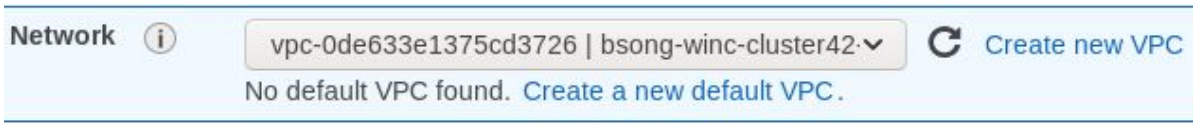
Select m5a.large Instance Type:



Note: We need an AMD based instance

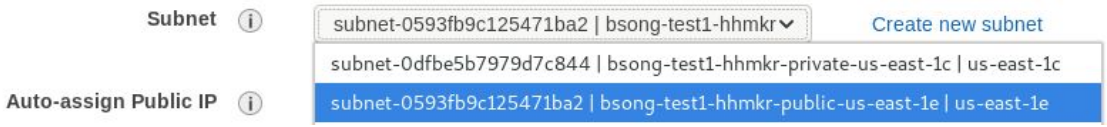
Hit Next: Configure Instance Details button to Configure the details

Select the same vpc as your openshift cluster: (match vpc id or cluster name)



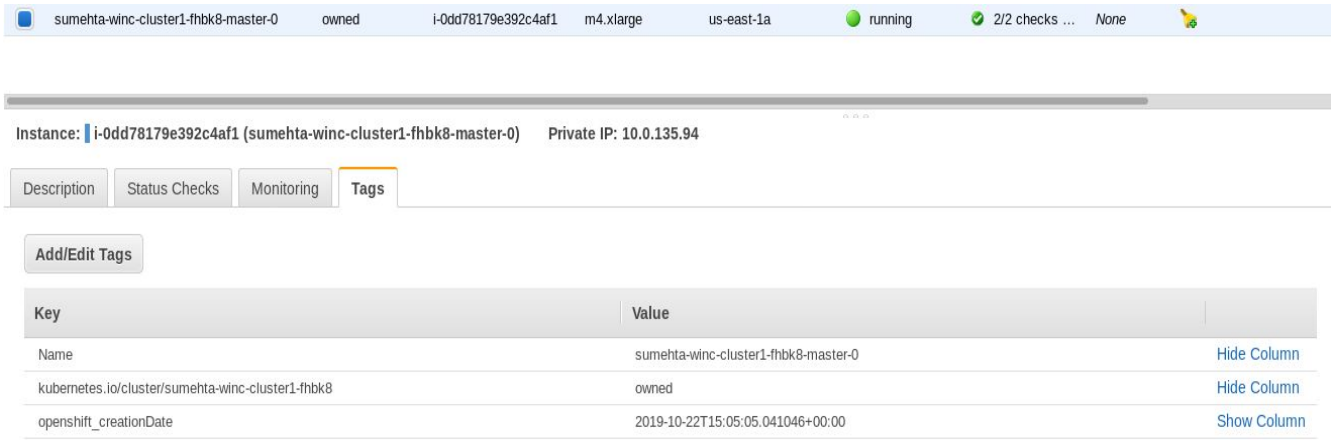
Make sure you have selected a public subnet or you will not be able to RDP to the instance.

Enable auto-assigning of the Public IP

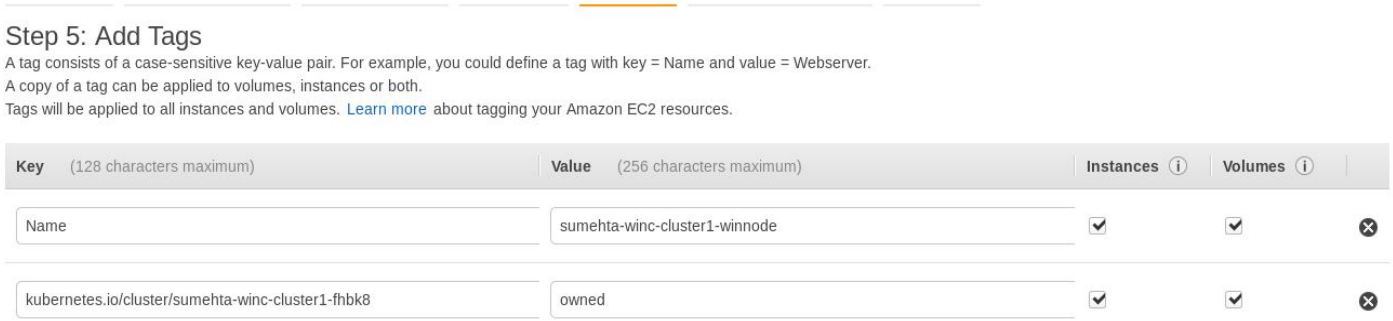


In the Tags section, the cluster tag needs to be added with the value as owned. You can also name your instance by adding the tag for the same.

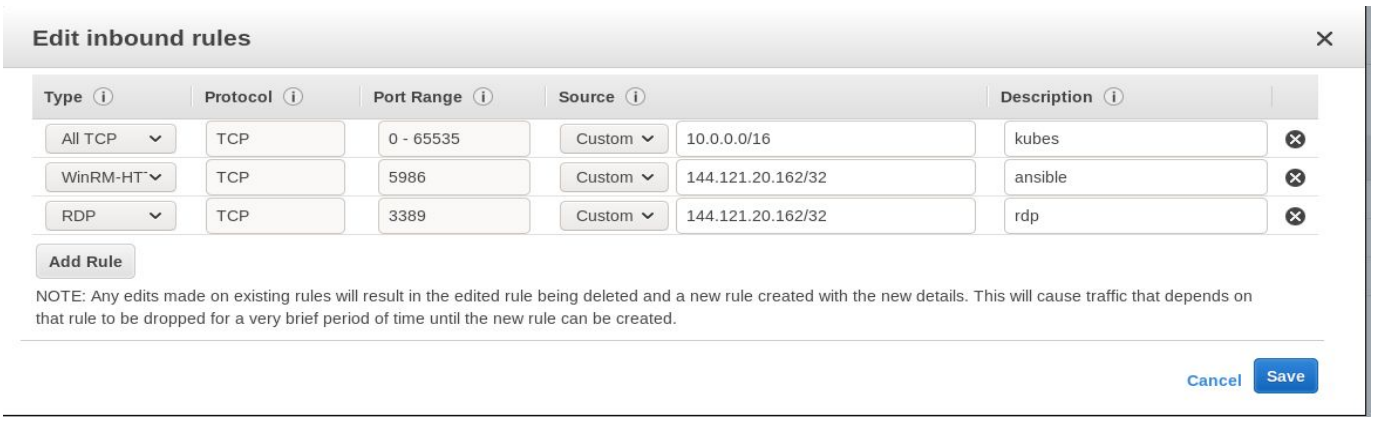
Cluster tag is something like kubernetes.io/cluster/<cluster_name> and can be verified in the Tags section of any node in the cluster



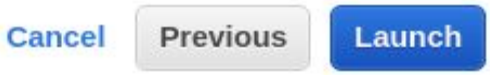
The resultant tags looks like the following:



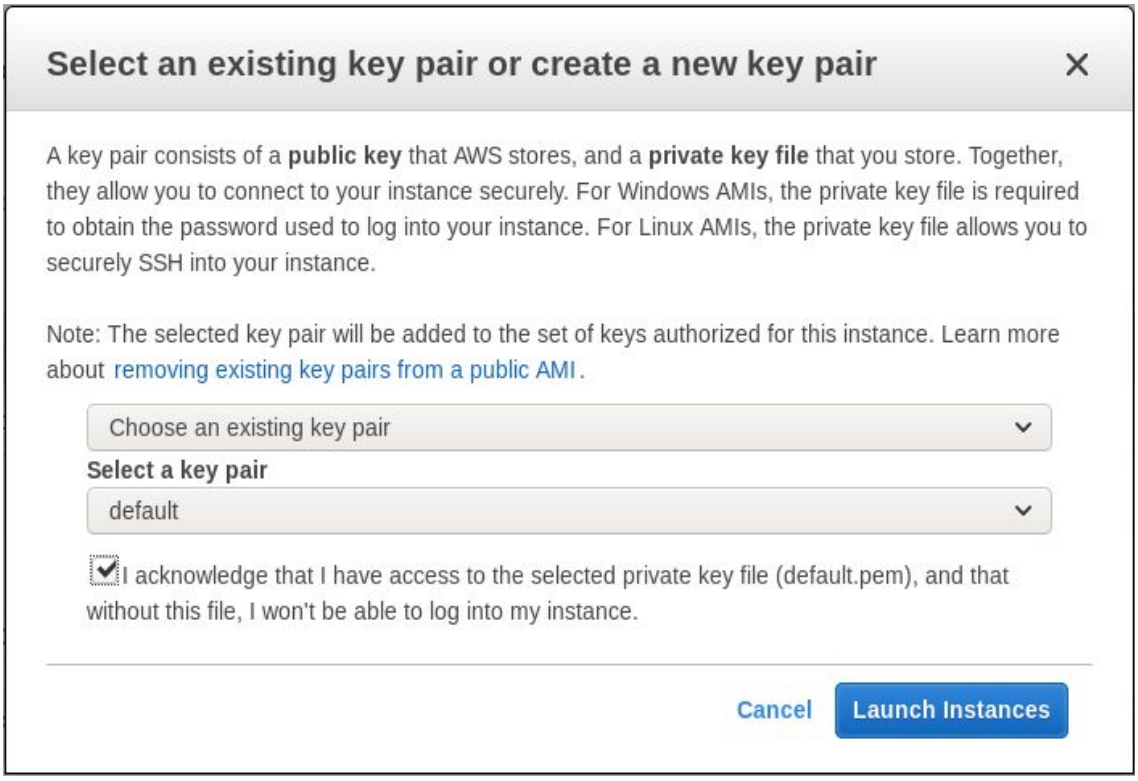
Go to the next step *Configure Security Group*.
Select MyIP under source for RDP Rule and add All traffic rule and change source to Custom 10.0.0.0/16 for allowing cluster communication. Open WinRM-HTTPS port for remote management, enabled for MyIP. The configurations should look like:



Then hit the Launch Button in the review page.



It will then show a prompt window to ask for the key pair.



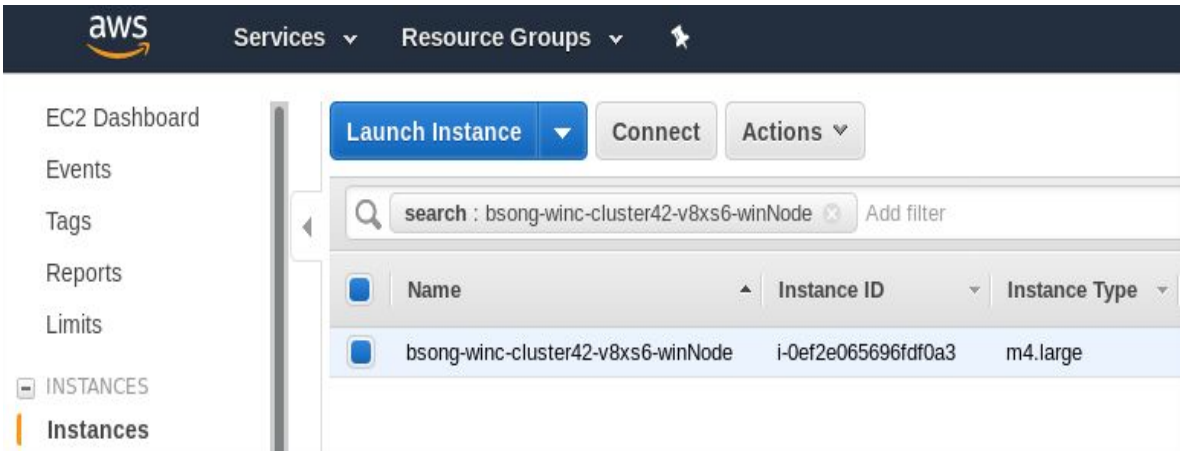
Select the key and launch the instance.
If you already have one key pair on AWS, you can select the one you have. Or you can generate a new key pair by giving it a name and store the *.pem file on your local machine by hitting the Download key Pair button. This is for you to connect to your instance later.

Note: If you are unable to launch an instance due to unavailability of instance type within a zone, simply repeat the process, but choose a different public subnet.

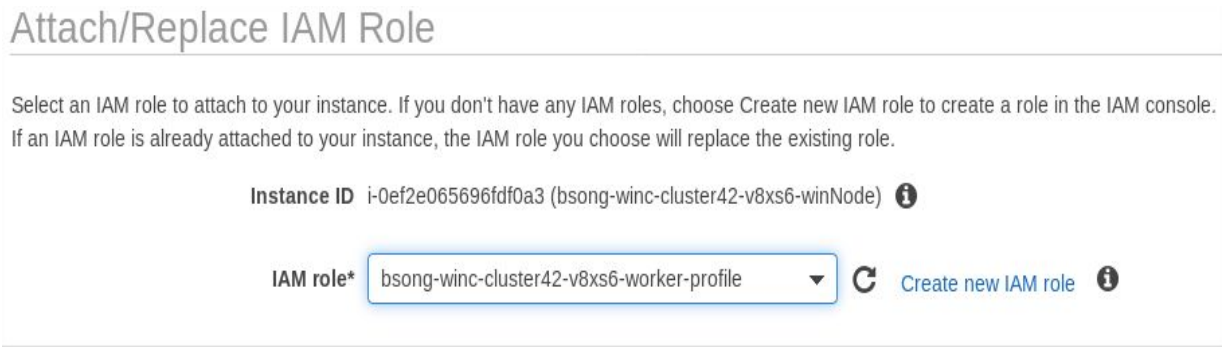
Navigate to your aws **ec2 instance** through web browser and find your **instance**
https://console.aws.amazon.com/ec2/

Attach cluster worker IAM and Security Group to windows node:

1) Select windows node instance, choose **Actions > Instance Settings > Attach/Replace IAM role**.

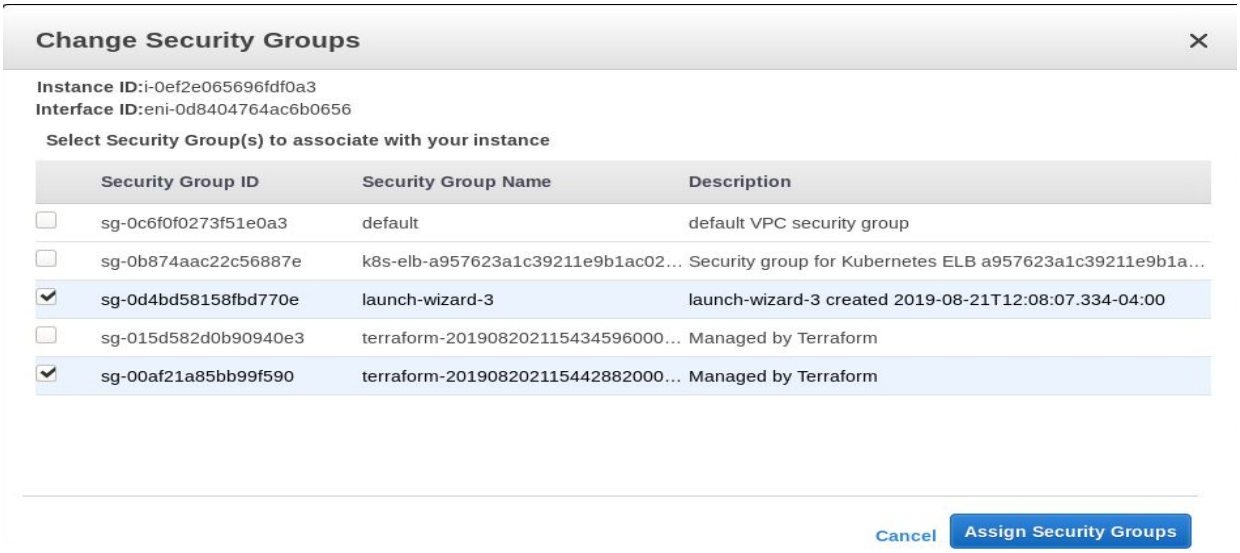


2) Select the IAM role *for your* cluster's worker profile to attach to your instance, and choose **Apply**.

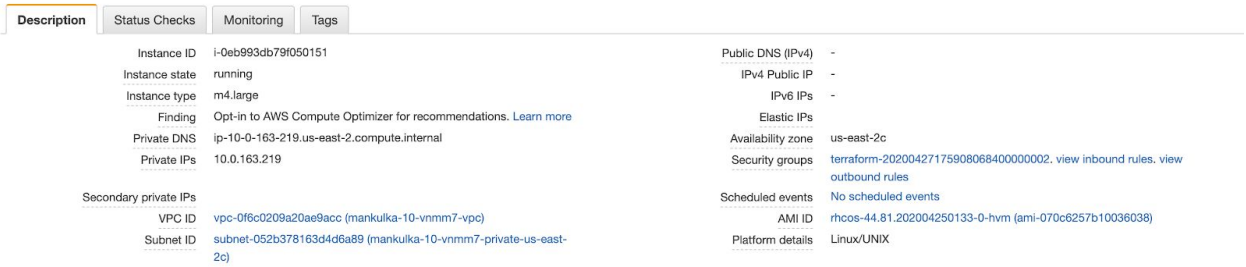


3) Select a openshift cluster **worker node** and check the id of cluster **security group**

4) Again select windows node instance and select **Actions > Networking > Change Security Groups**



5) You can find the private IP of your node under the Description details of your windows node. This is required for creating the host file in the [Setup Ansible Connection] step.



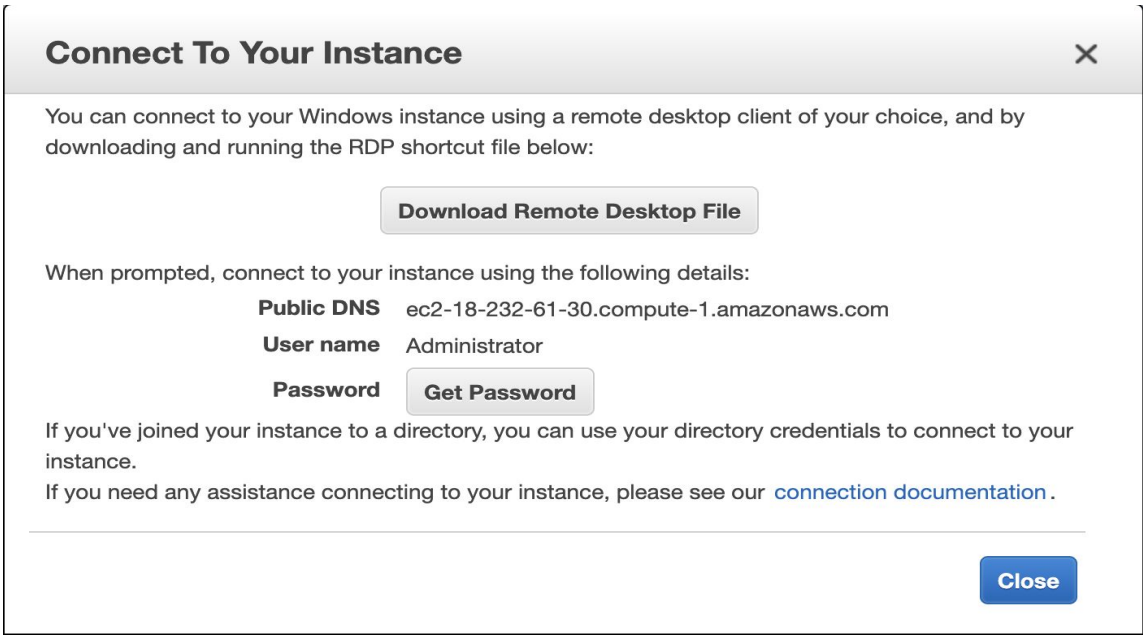
Now you can setup Ansible.

RDP Setup

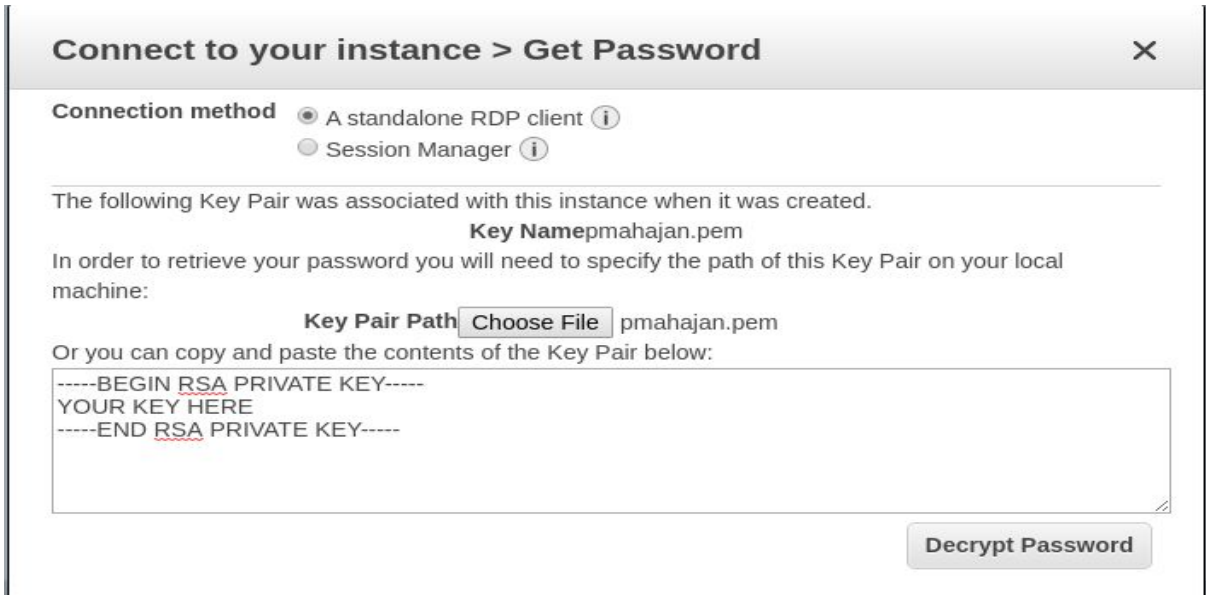
Login into the AWS console. Make sure you are in the same region as your cluster and click on Running Instances

Search for the name of your cluster to see the masters and workers running.

You can now RDP into the instance using the details from the AWS console.
Hit the Connect button.



Click on the Download Remote Desktop File to download the remote desktop application <filename>.rdp:
Then click on the Get Password button and select your secret.pem file (private key of the key-pair you provided to launch the instance) or paste its content to decrypt the password and use it for the next step:



Install a RDP tool:
For Fedora, we use freerdp:

```
$ sudo dnf install freerdp
```

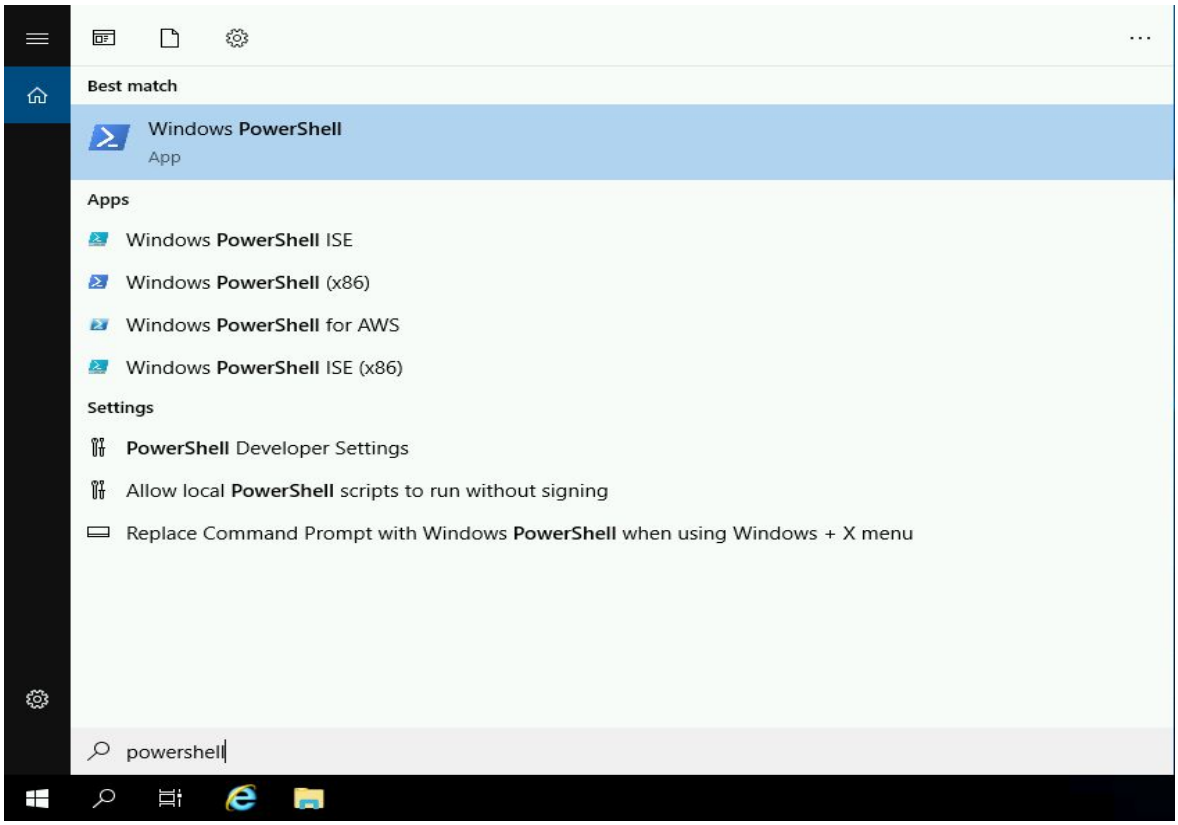
RDP into the windows node:

```
$ xfreerdp <path/to/rdpfile/filename.rdp> /p:'<password>' /f Or
$ xfreerdp /u:Administrator /v:<Public DNS i.e.
ec2-3-80-190-235.compute-1.amazonaws.com> /h:1080 /w:1920 /p:'<password>'
```

You can now see a Windows screen come up.

Setup on Windows instance

Enable WinRM
Bring up powershell and execute the following commands:




```
> $url =
"https://raw.githubusercontent.com/ansible/ansible/devel/examples/scripts/Configu
reRemotingForAnsible.ps1"
$file = "$env:temp\ConfigureRemotingForAnsible.ps1"
(New-Object -TypeName System.Net.WebClient
```

Enable Console logs

Open TCP port 10250 in the Windows Firewall so that logs can be viewed in console and using *oc logs*. On your Windows instance, execute the following in a powershell window:

```
> New-NetFirewallRule -DisplayName "Enable console logs" -Direction Inbound
-Action Allow -Protocol TCP -LocalPort 10250 -EdgeTraversalPolicy Allow
```