Guide: Installing an OKD 4.5 Cluster

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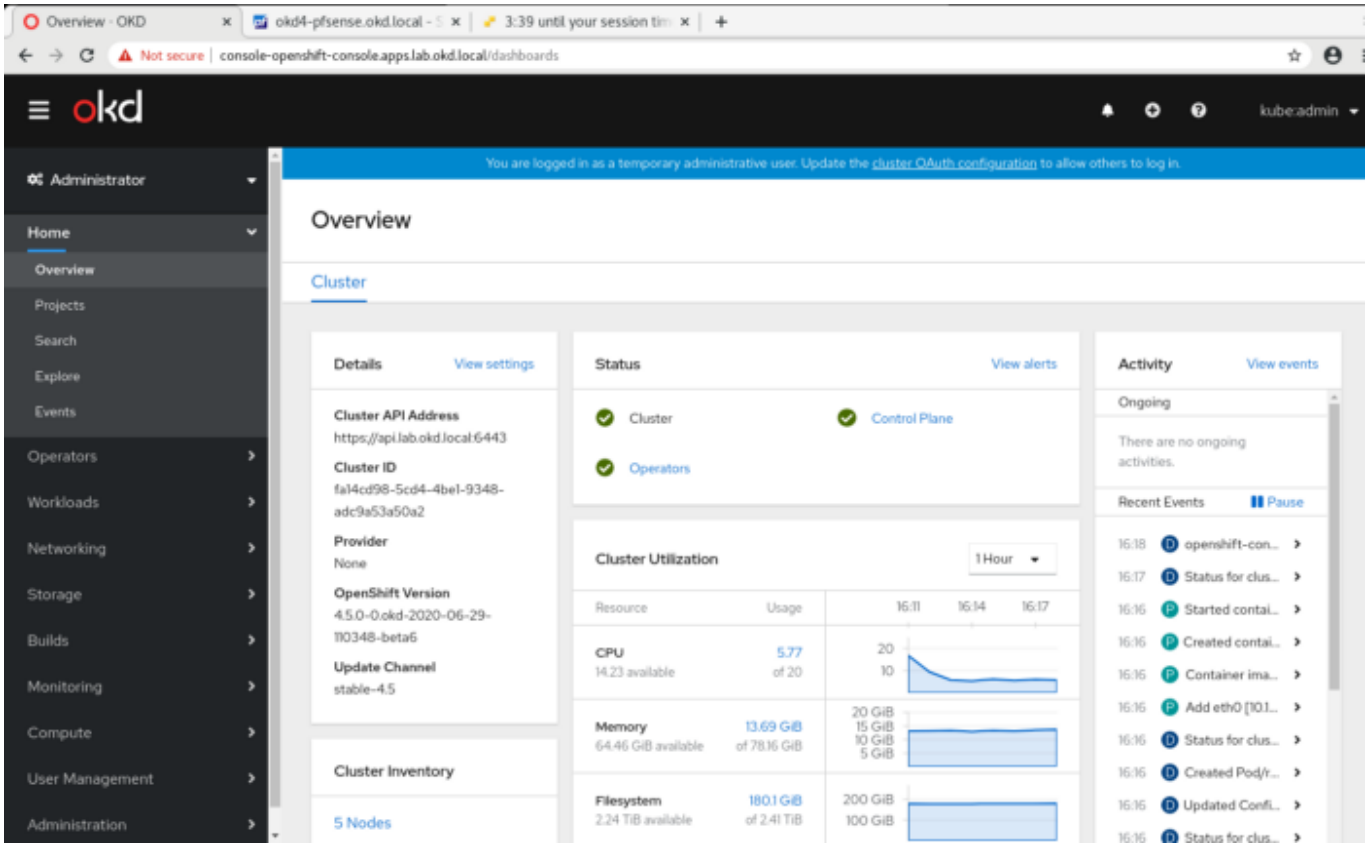
OKD is the upstream and community-supported version of the Red Hat OpenShift Container Platform (OCP). OpenShift expands vanilla Kubernetes into an application platform designed for enterprise use at scale. Starting with the release of OpenShift 4, the default operating system is Red Hat CoreOS, which provides an immutable infrastructure and automated updates. Fedora CoreOS, like OKD, is the upstream version of Red Hat CoreOS.



You can experience OpenShift in your home lab by using the open-source upstream combination of OKD and FCOS (Fedora CoreOS) to build your cluster. Used hardware

for a home lab that can run an OKD cluster is relatively inexpensive these days ($250–$350), especially when compared to a cloud-hosted solution costing over $250 per month.

The purpose of this guide is to help you successfully build an OKD 4.5 cluster so that you can develop and learn to use OpenShift and OKD.

NOTE: In this guide, I use VMWare ESXi as the hypervisor, but you could use Hyper-V, libvirt, Proxmox, VirtualBox, or even bare metal instead.

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VM Overview:

For my installation, I used an ESXi 6.5 host with 96GB of RAM and a separate VLAN configured for OKD. Here is a breakdown of the virtual machines:

Machine	Type	OS	vCPU	RAM	Storage	IP Address
okd4-boostrap	Bootstrap	Fedora CoreOS	4	16	120	192.168.1.200
okd4-control-plane-1	Master	Fedora CoreOS	4	16	120	192.168.1.201
okd4-control-plane-2	Master	Fedora CoreOS	4	16	120	192.168.1.202
okd4-control-plane-3	Master	Fedora CoreOS	4	16	120	192.168.1.203
okd4-compute-1	Worker	Fedora CoreOS	4	16	120	192.168.1.204
okd4-compute-2	Worker	Fedora CoreOS	4	16	120	192.168.1.205
okd4-services	DNS/LB/Web/NFS	CentOS 8	4	4	100	192.168.1.210
okd4-pfsense	Router/DHCP	FreeBSD	1	1	8	192.168.1.1

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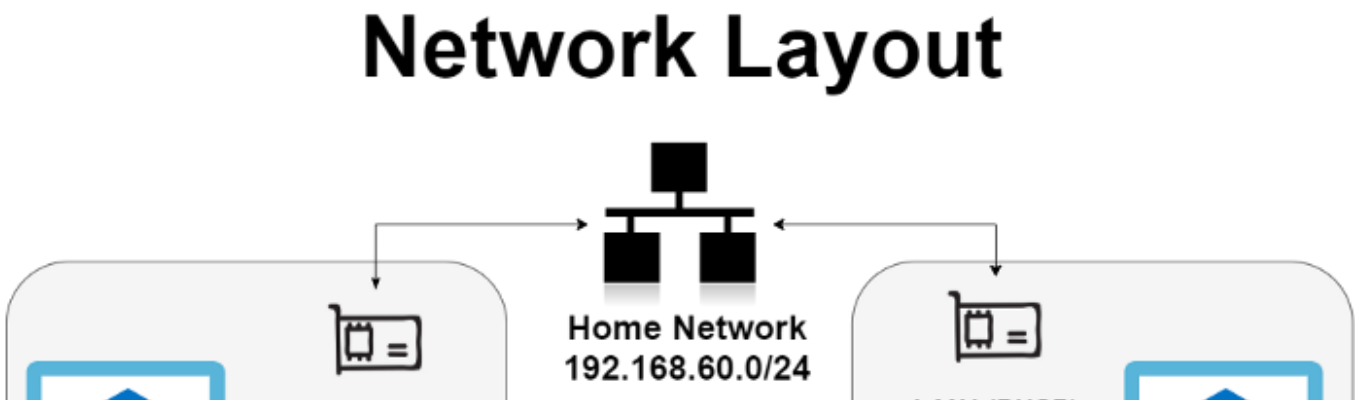

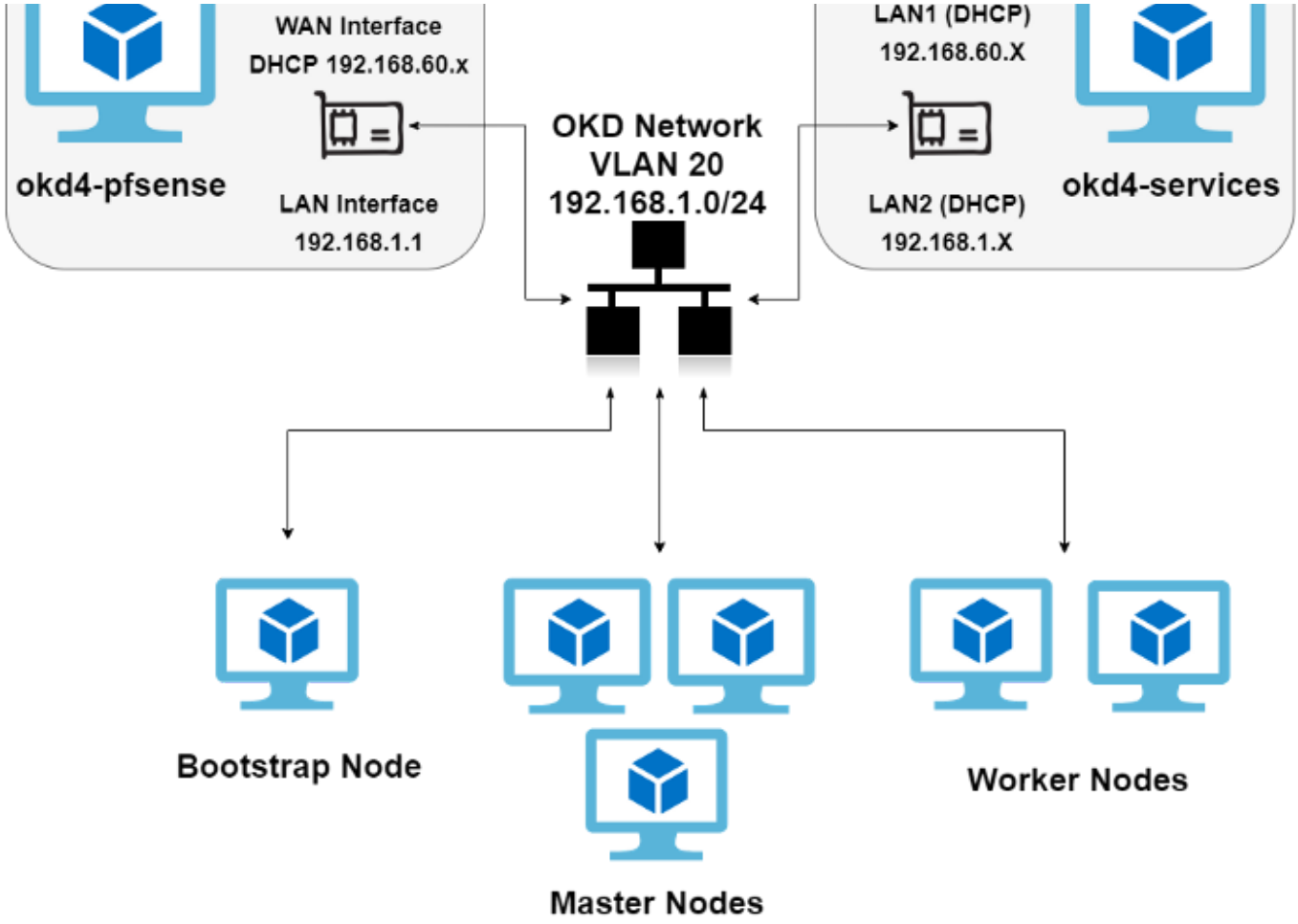

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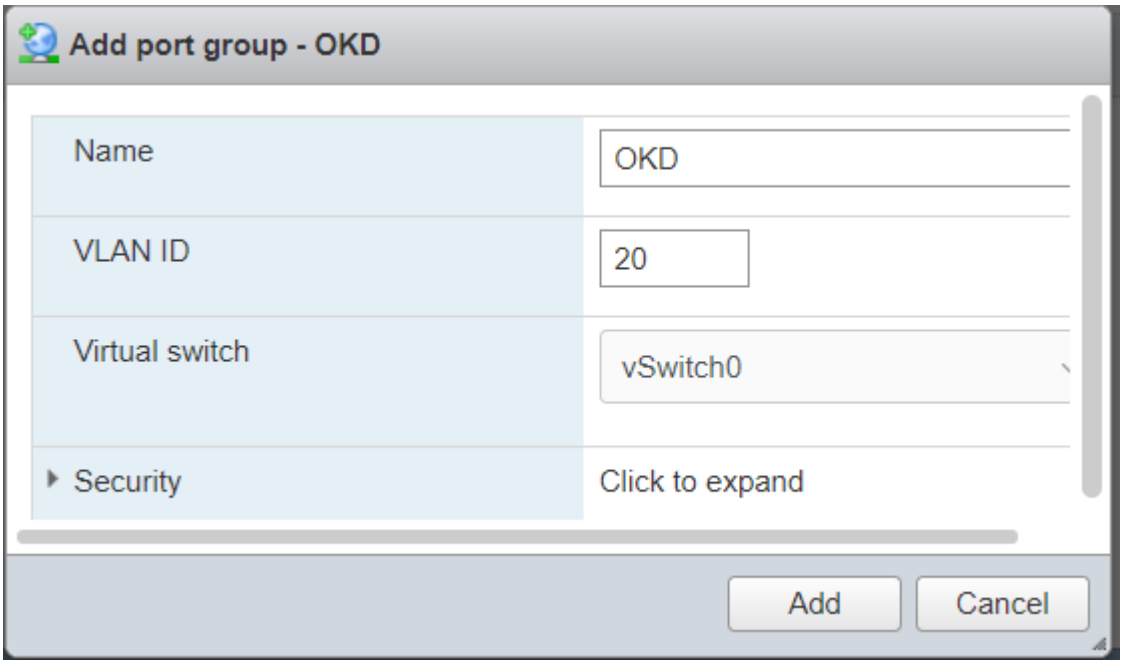
Create a new network in VMWare for OKD:

Login to your VMWare Host. Select Networking → Port Groups → Add port group. Setup an OKD network on an unused VLAN, in my instance, VLAN 20.

Name your Group and set your VLAN ID.



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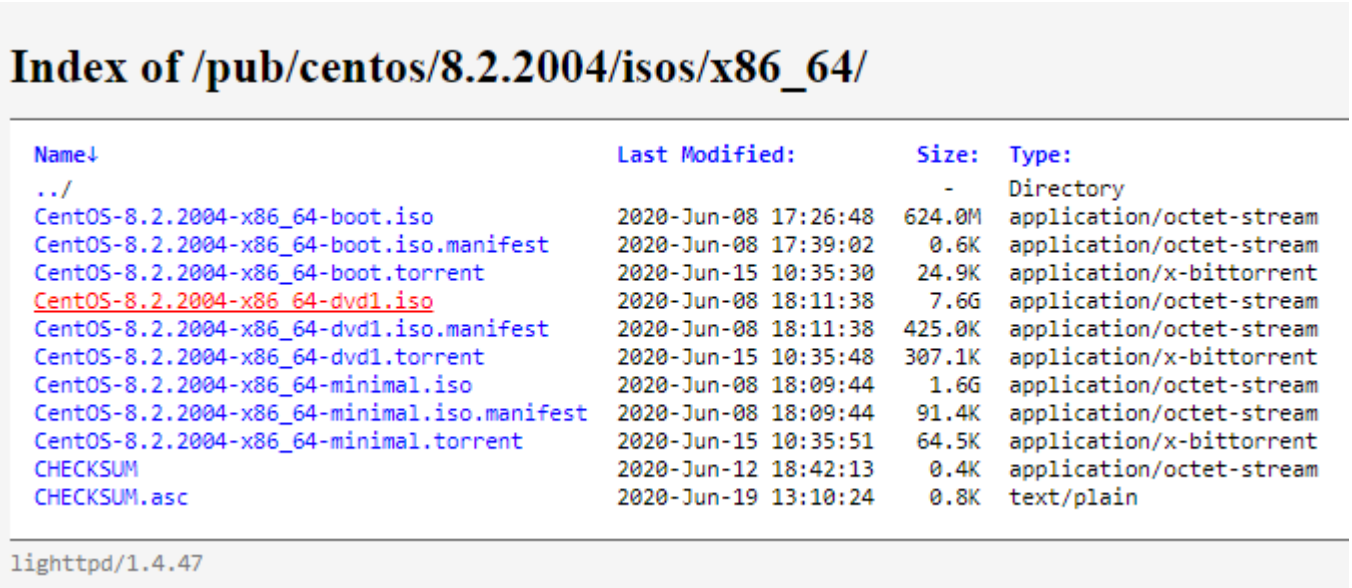
Create the okd4-services VM:

Download the CentOS 8 ISO DVD. Example: CentOS-8.2.2004-x86_64-dvd1.iso and upload it to your ESXi host datastore.

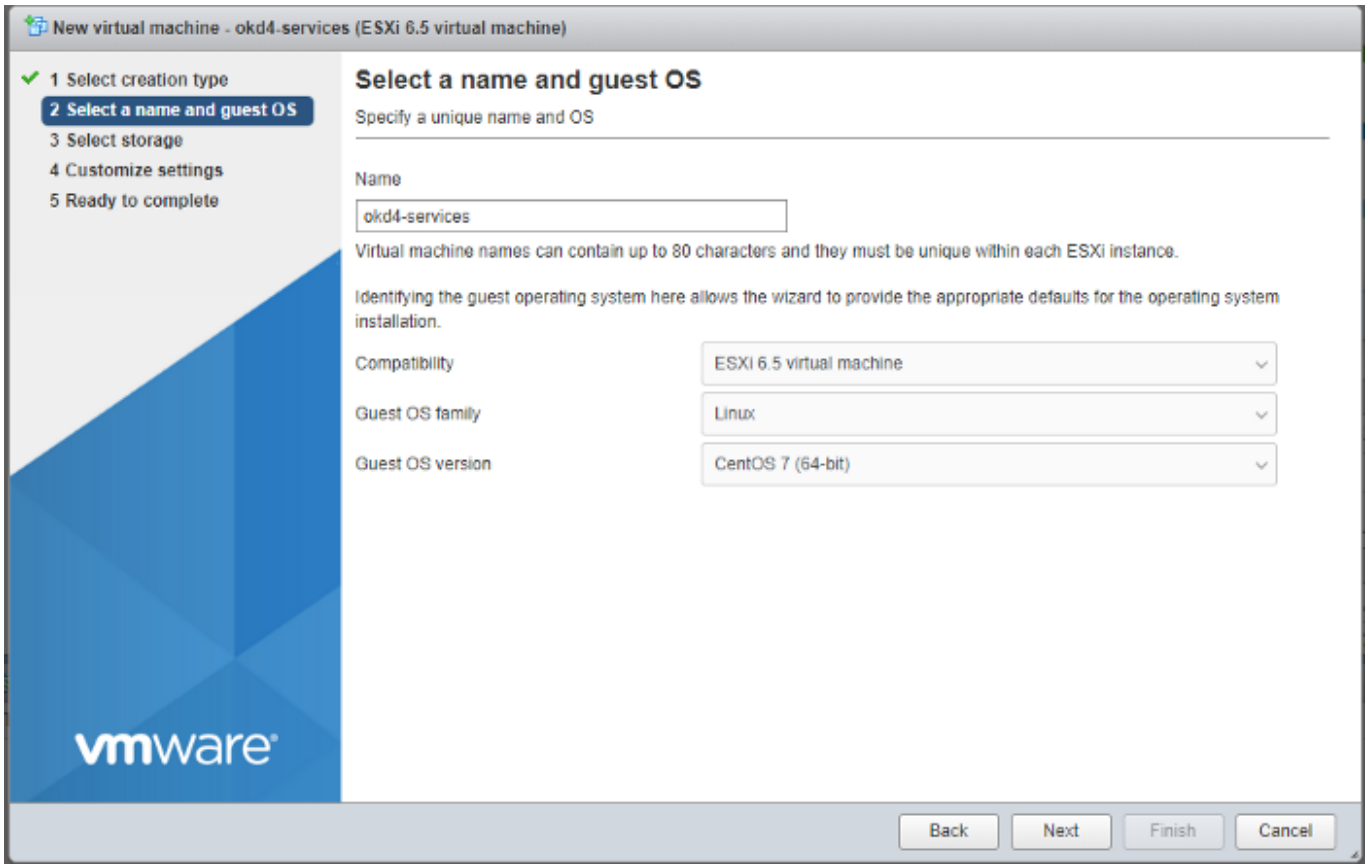


Index of /pub/centos/8.2.2004/isos/x86_64/

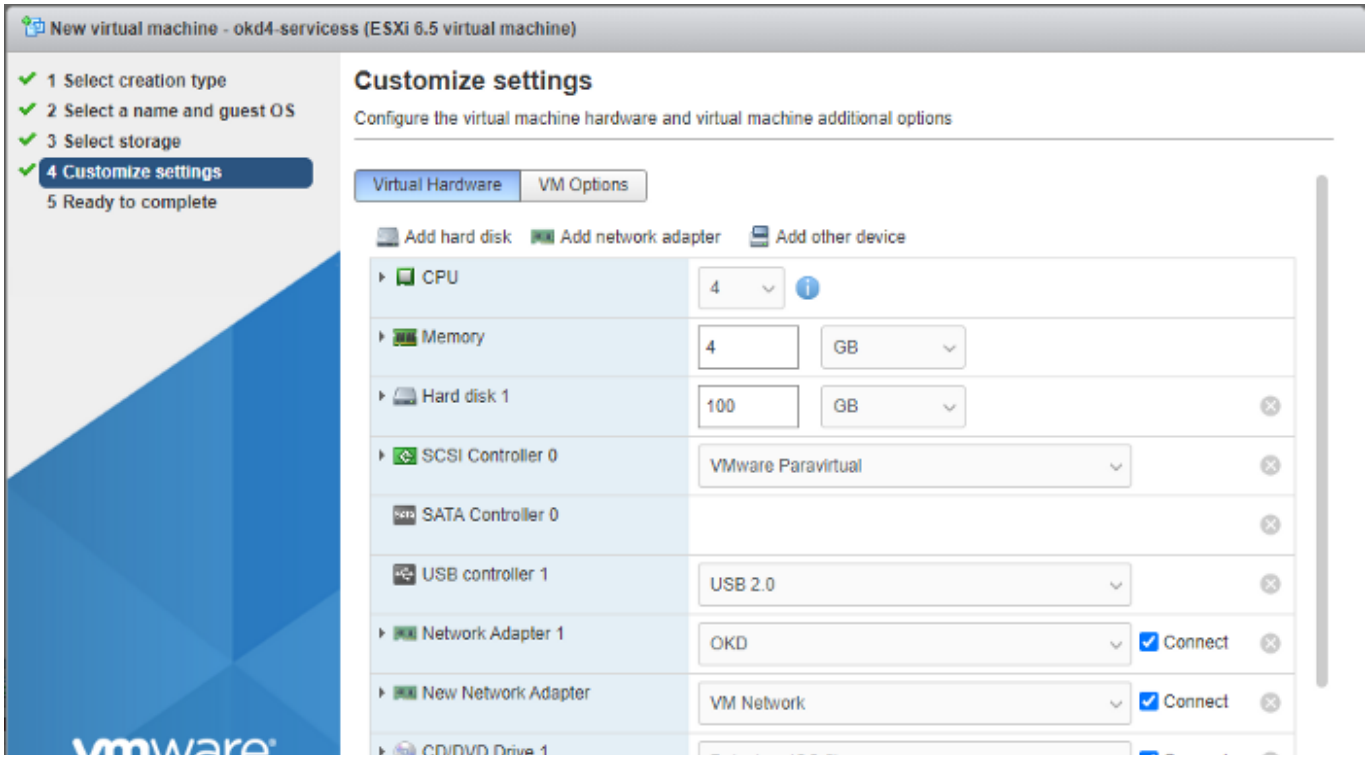
Name↓	Last Modified:	Size:	Type:
../		-	Directory
CentOS-8.2.2004-x86_64-boot.iso	2020-Jun-08 17:26:48	624.0M	application/octet-stream
CentOS-8.2.2004-x86_64-boot.iso.manifest	2020-Jun-08 17:39:02	0.6K	application/octet-stream
CentOS-8.2.2004-x86_64-boot.torrent	2020-Jun-15 10:35:30	24.9K	application/x-bittorrent
CentOS-8.2.2004-x86_64-dvd1.iso	2020-Jun-08 18:11:38	7.6G	application/octet-stream
CentOS-8.2.2004-x86_64-dvd1.iso.manifest	2020-Jun-08 18:11:38	425.0K	application/octet-stream
CentOS-8.2.2004-x86_64-dvd1.torrent	2020-Jun-15 10:35:48	307.1K	application/x-bittorrent
CentOS-8.2.2004-x86_64-minimal.iso	2020-Jun-08 18:09:44	1.6G	application/octet-stream
CentOS-8.2.2004-x86_64-minimal.iso.manifest	2020-Jun-08 18:09:44	91.4K	application/octet-stream
CentOS-8.2.2004-x86_64-minimal.torrent	2020-Jun-15 10:35:51	64.5K	application/x-bittorrent
CHECKSUM	2020-Jun-12 18:42:13	0.4K	application/octet-stream
CHECKSUM.asc	2020-Jun-19 13:10:24	0.8K	text/plain

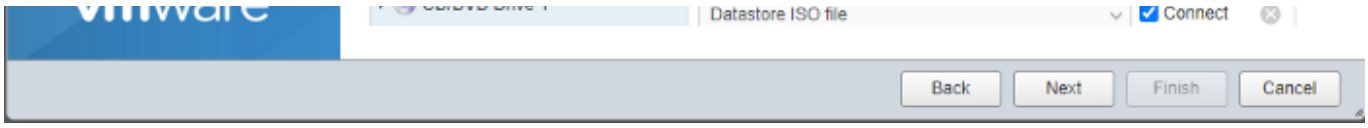
lighttpd/1.4.47

Create a new Virtual Machine. Choose Guest OS as *Linux* and Select CentOS 7 (64-bit).

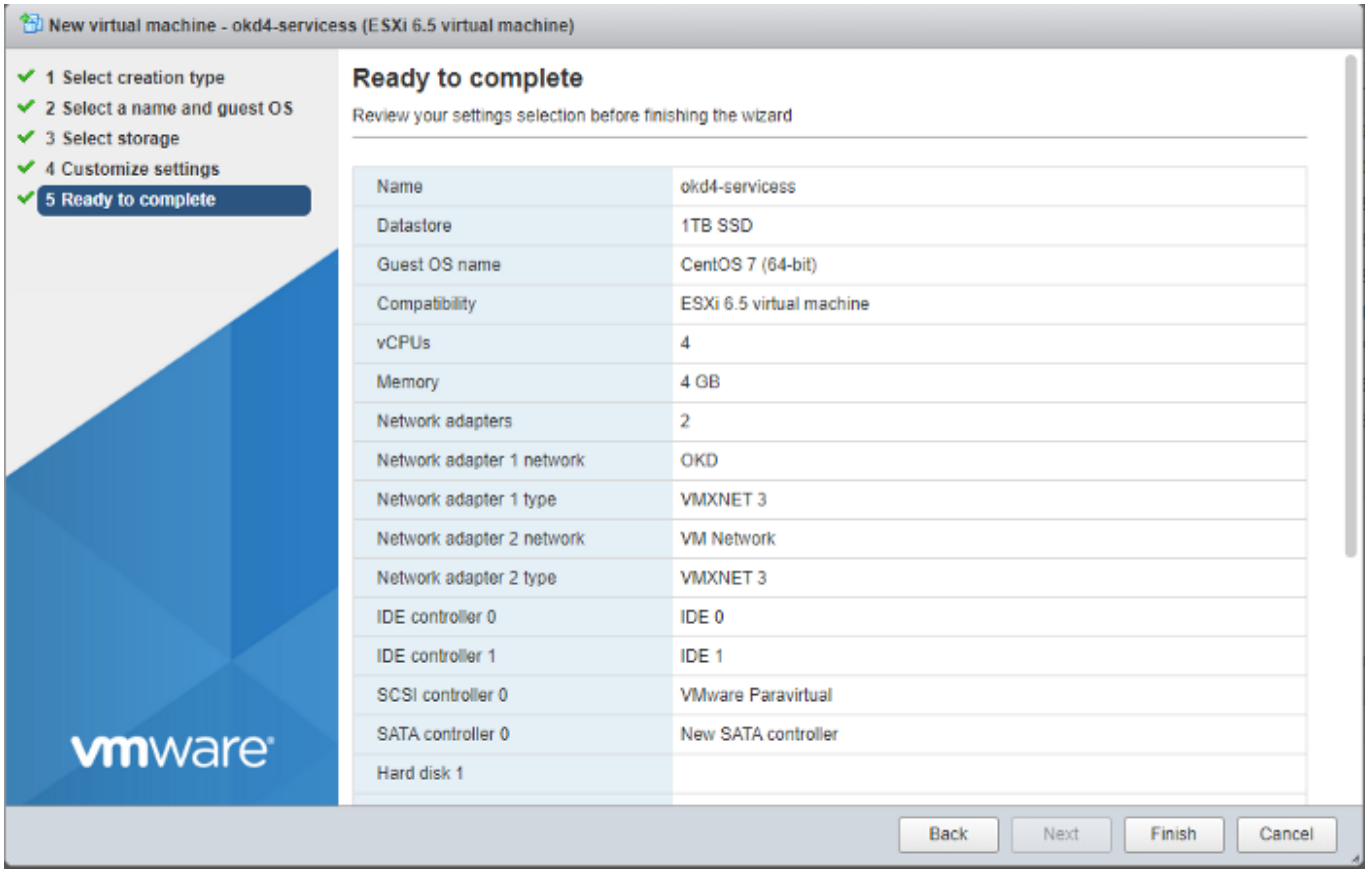


Select the Datastore and customize the settings to 4 vCPU, 4GB RAM, 100GB HD. Add a 2nd network adapter to the OKD network. Attached the CentOS ISO.





Review your settings and click Finish.



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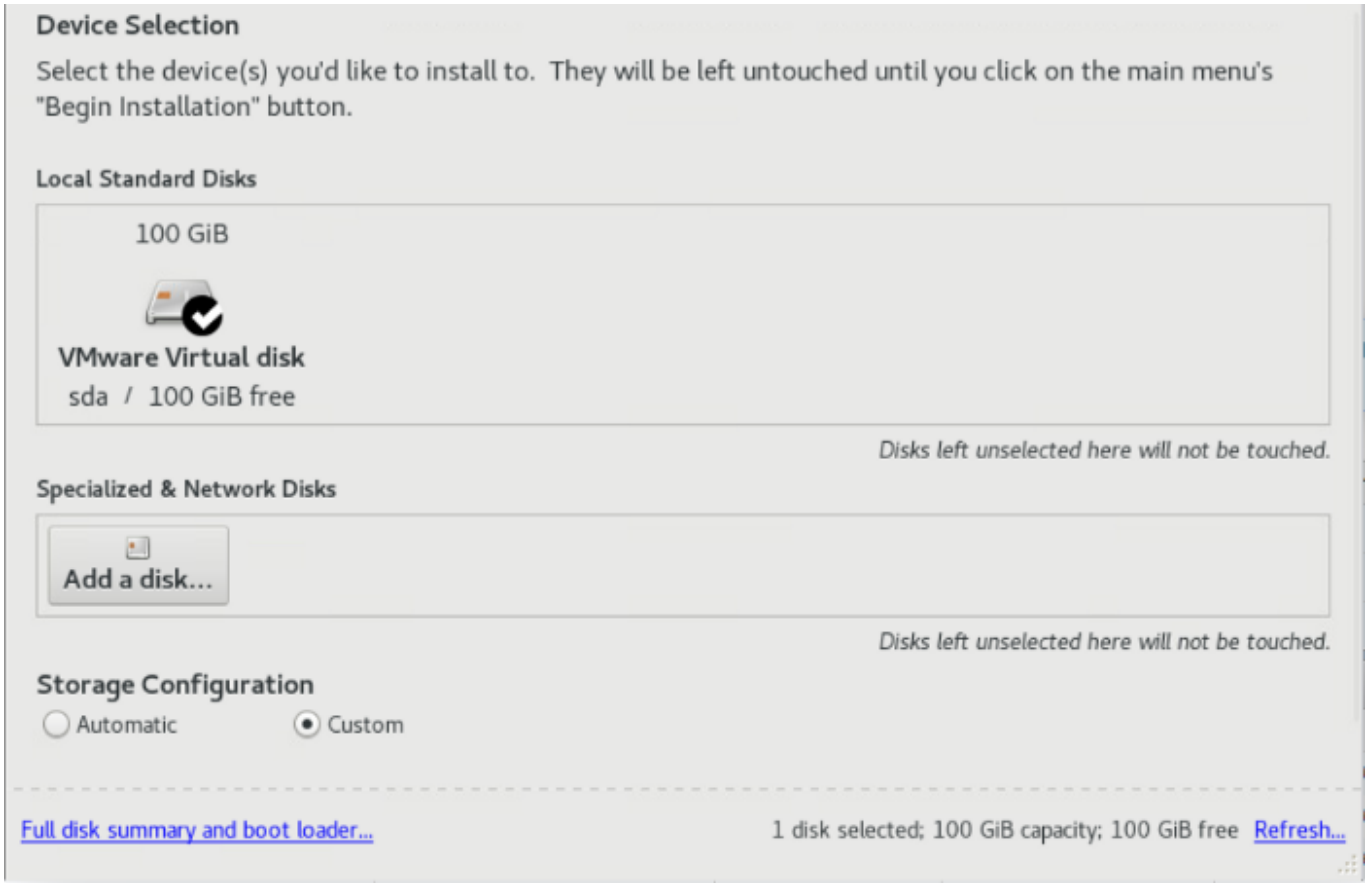
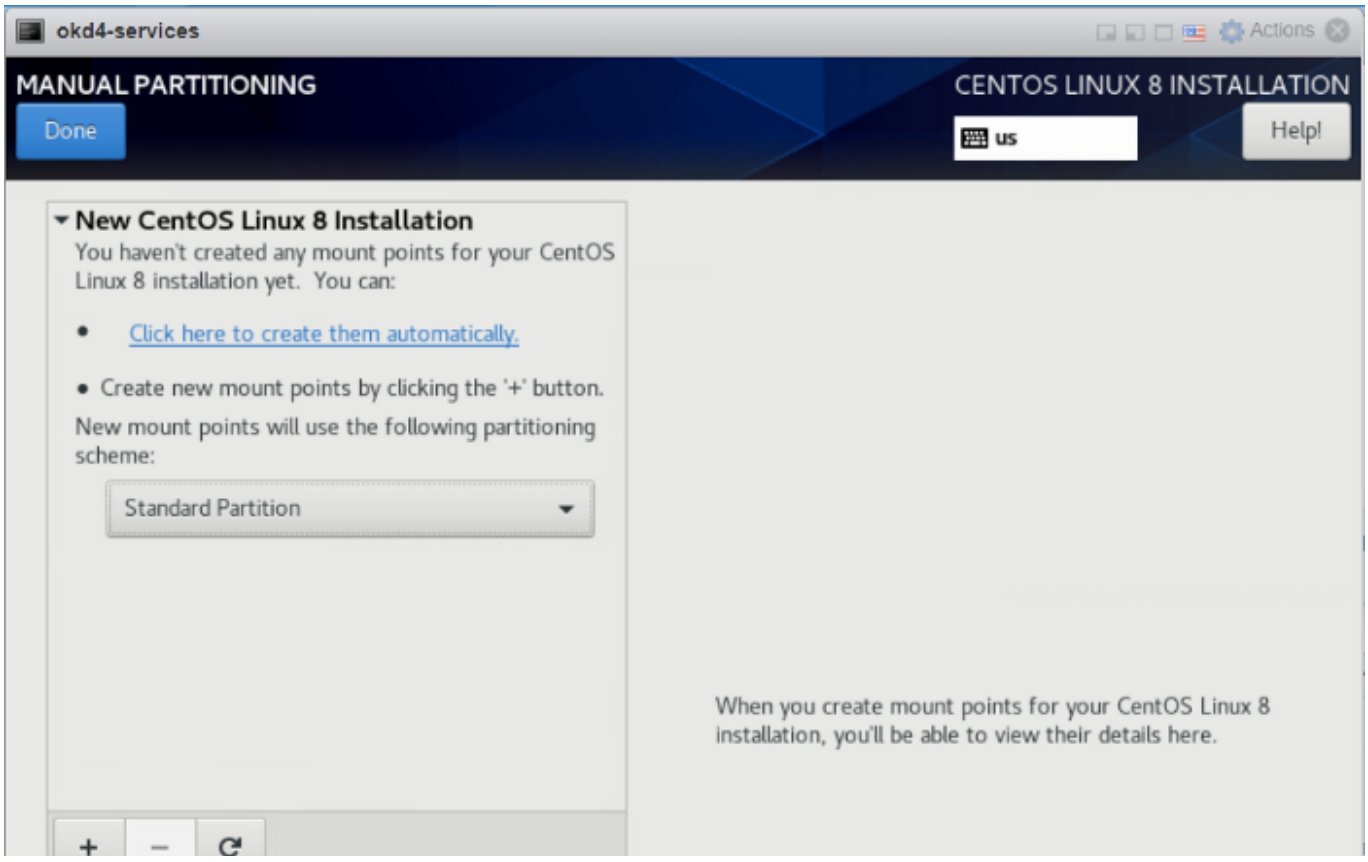
Install CentOS 8 on the okd4-services VM:

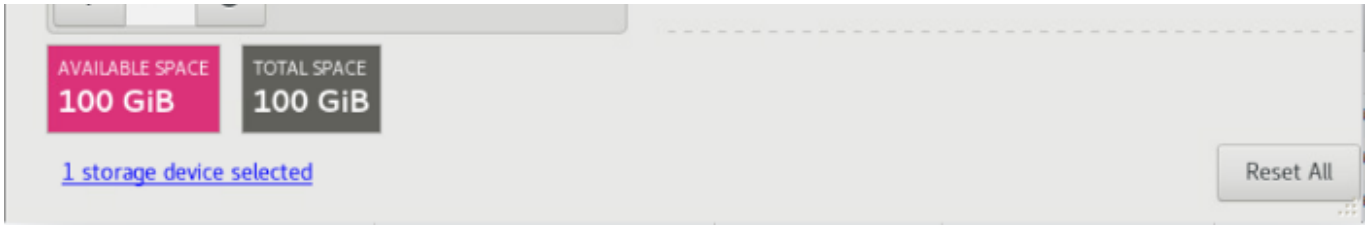
Run through the CentOS 8 installation.

I prefer to use the “Standard Partition” storage configuration without mounting storage for /home. On the “Installation Destination” page, click on Custom under Storage Configuration, then Done.

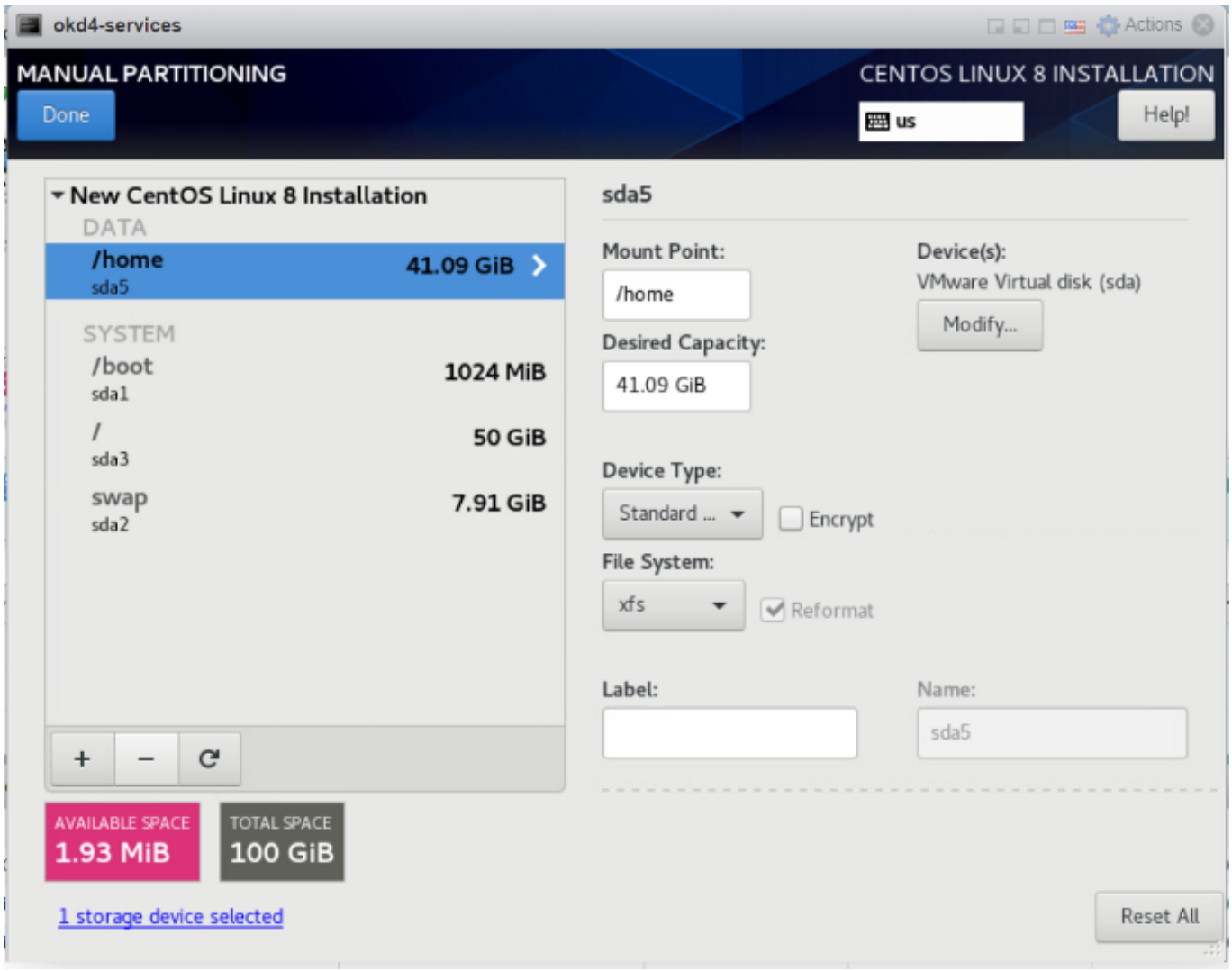


On the Manual Partitioning page, select Standard Partition, then click “Click Here to Create them automatically.”

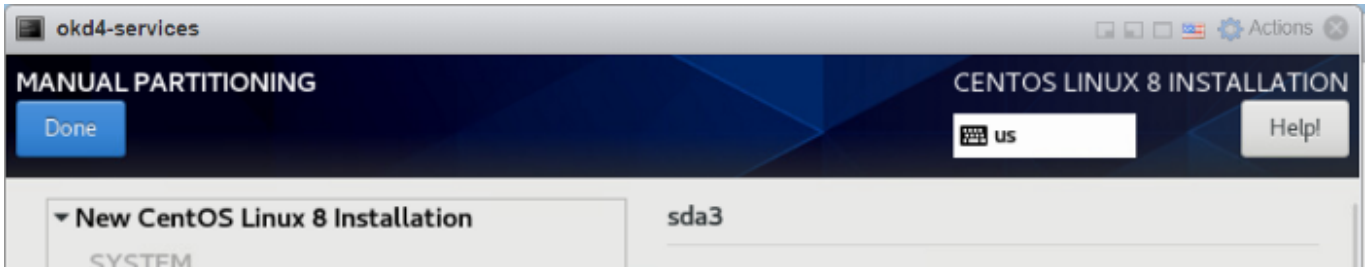


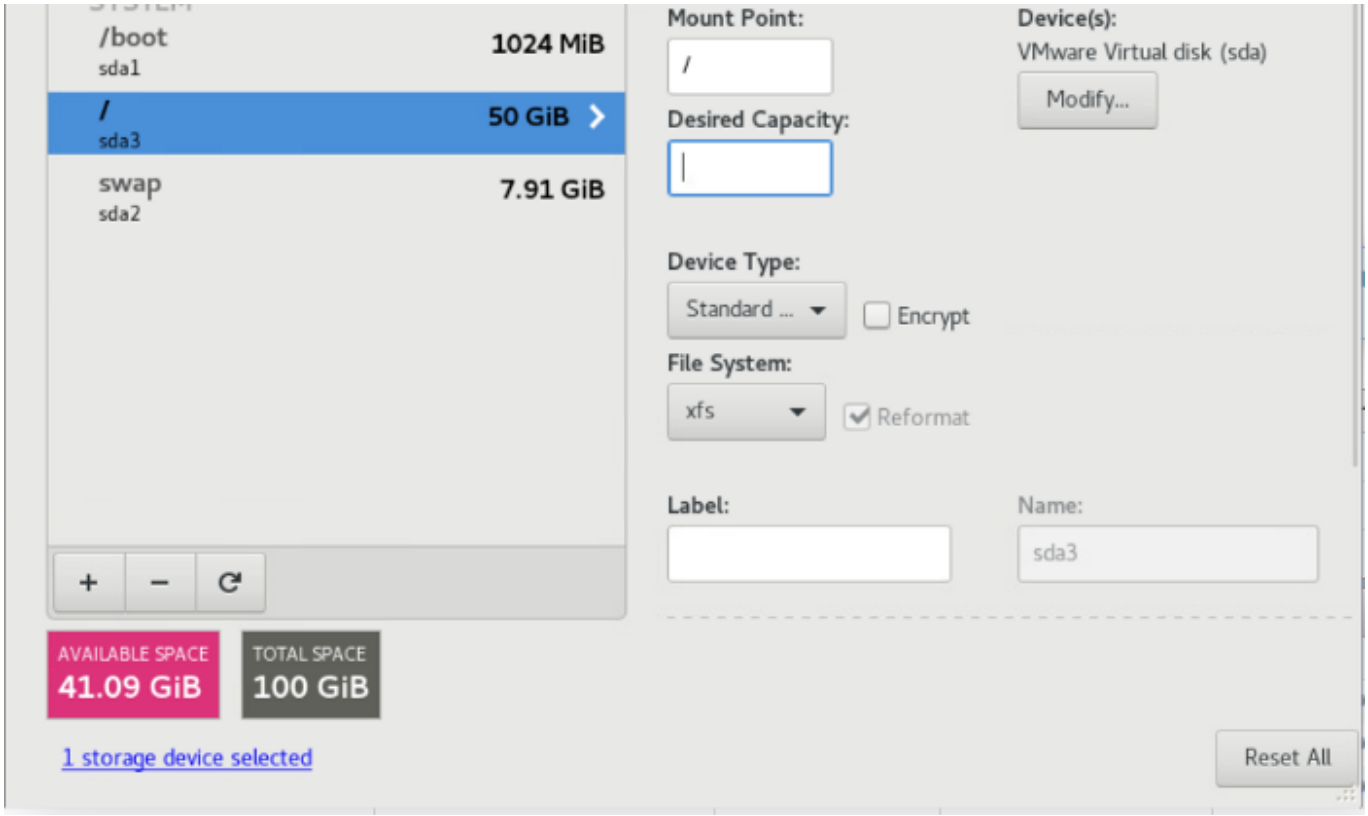


Select the “/home” partition and click the “-” to delete it.

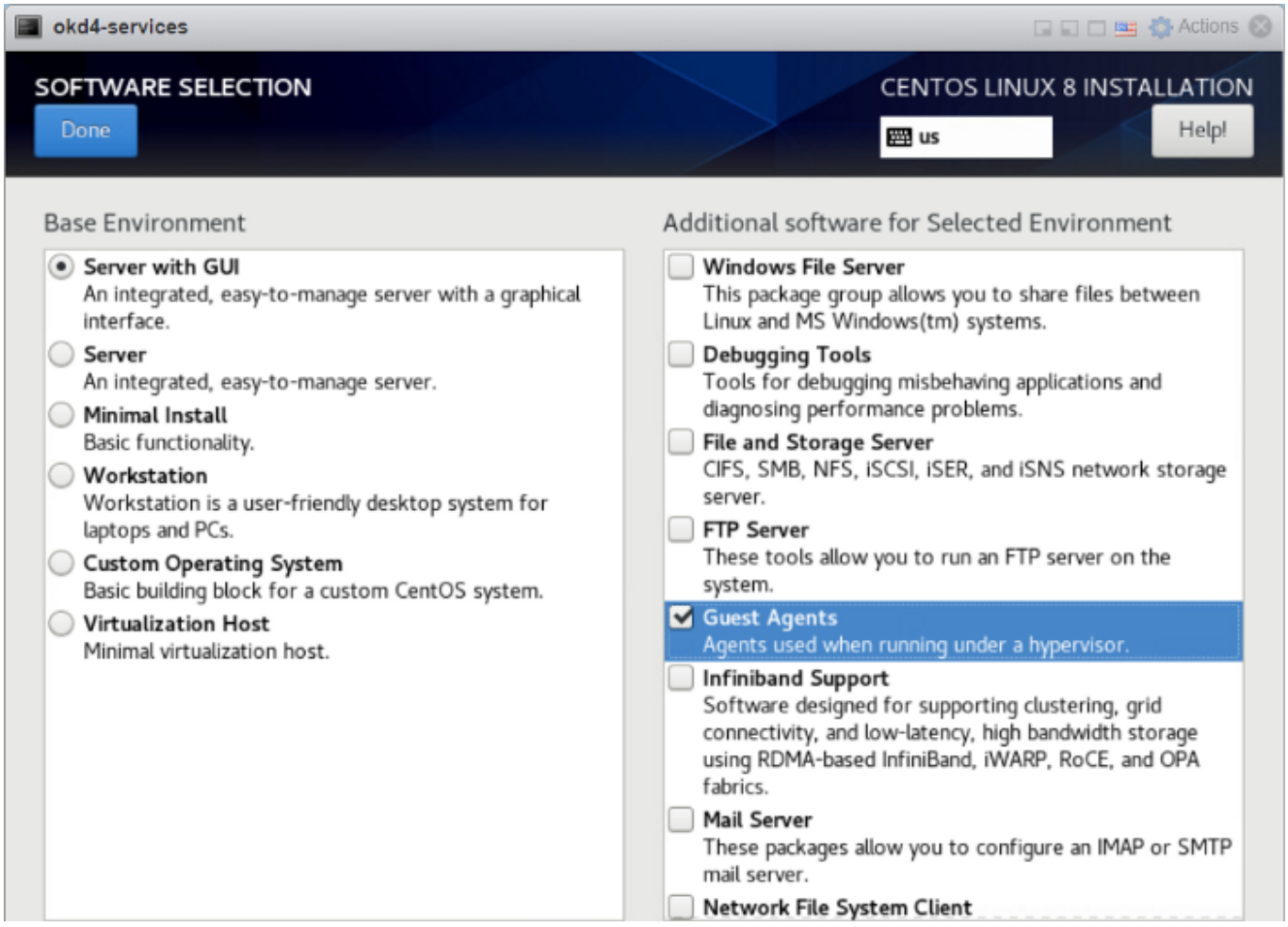


Remove the contents of the “Desired Capacity” field, so it is blank and click Done, then Accept the changes.

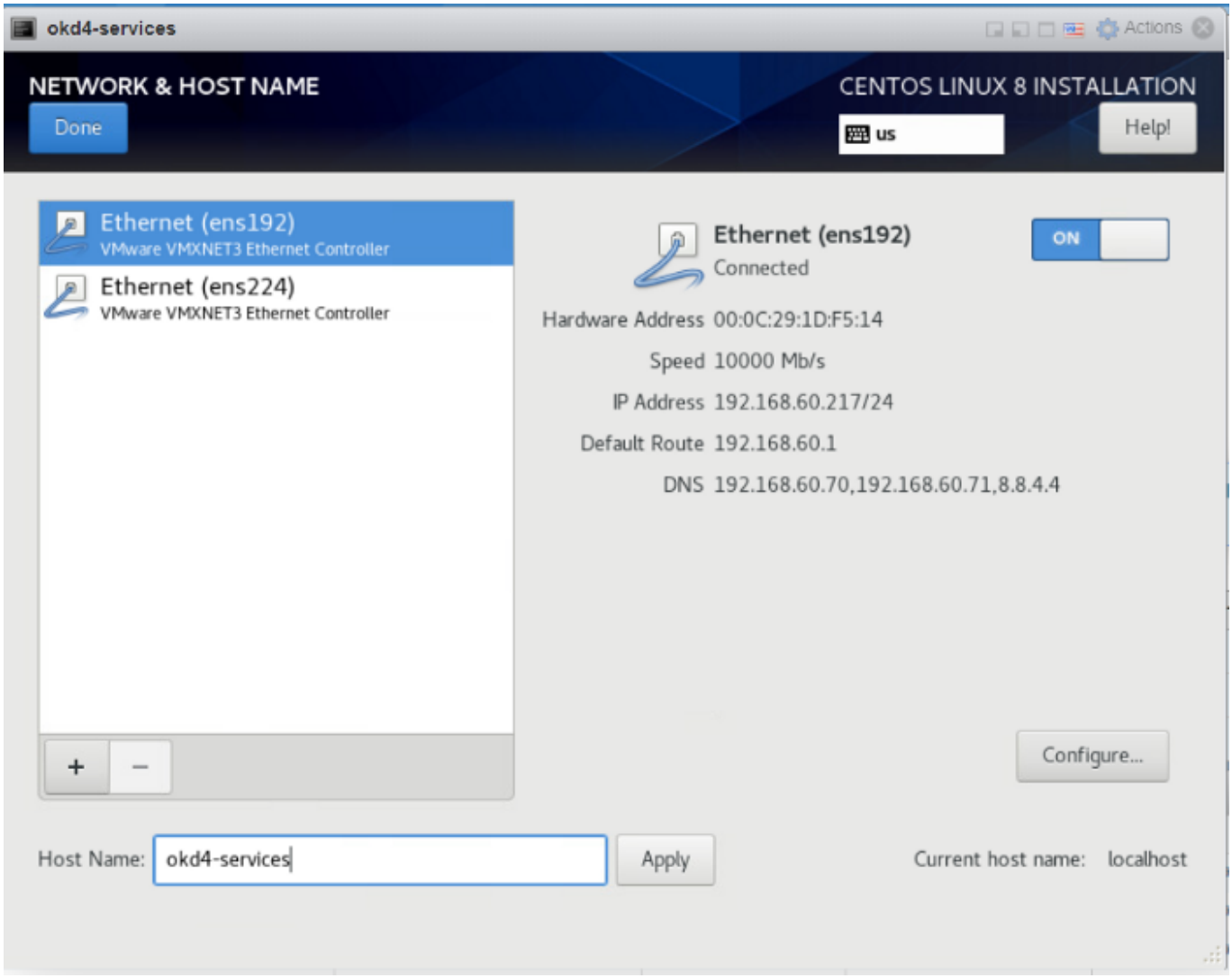




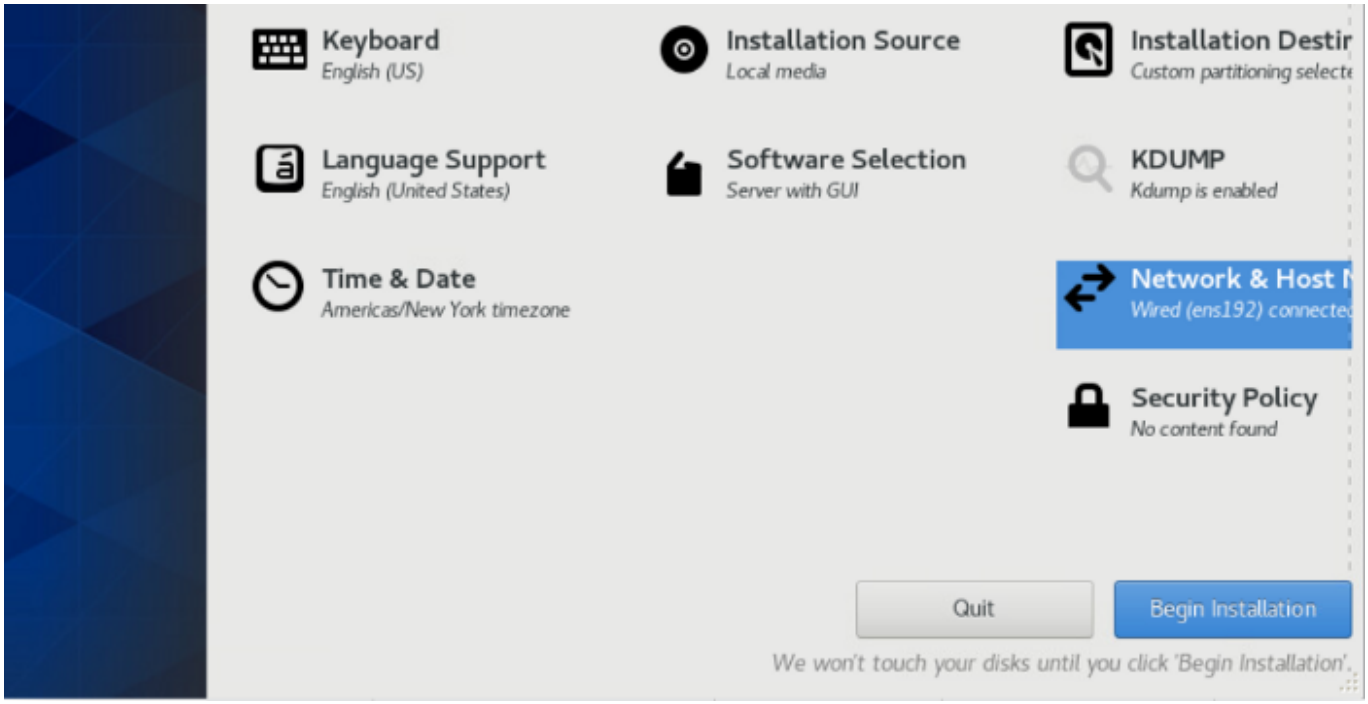
For Software Selection, use Server with GUI and add the Guest Agents.



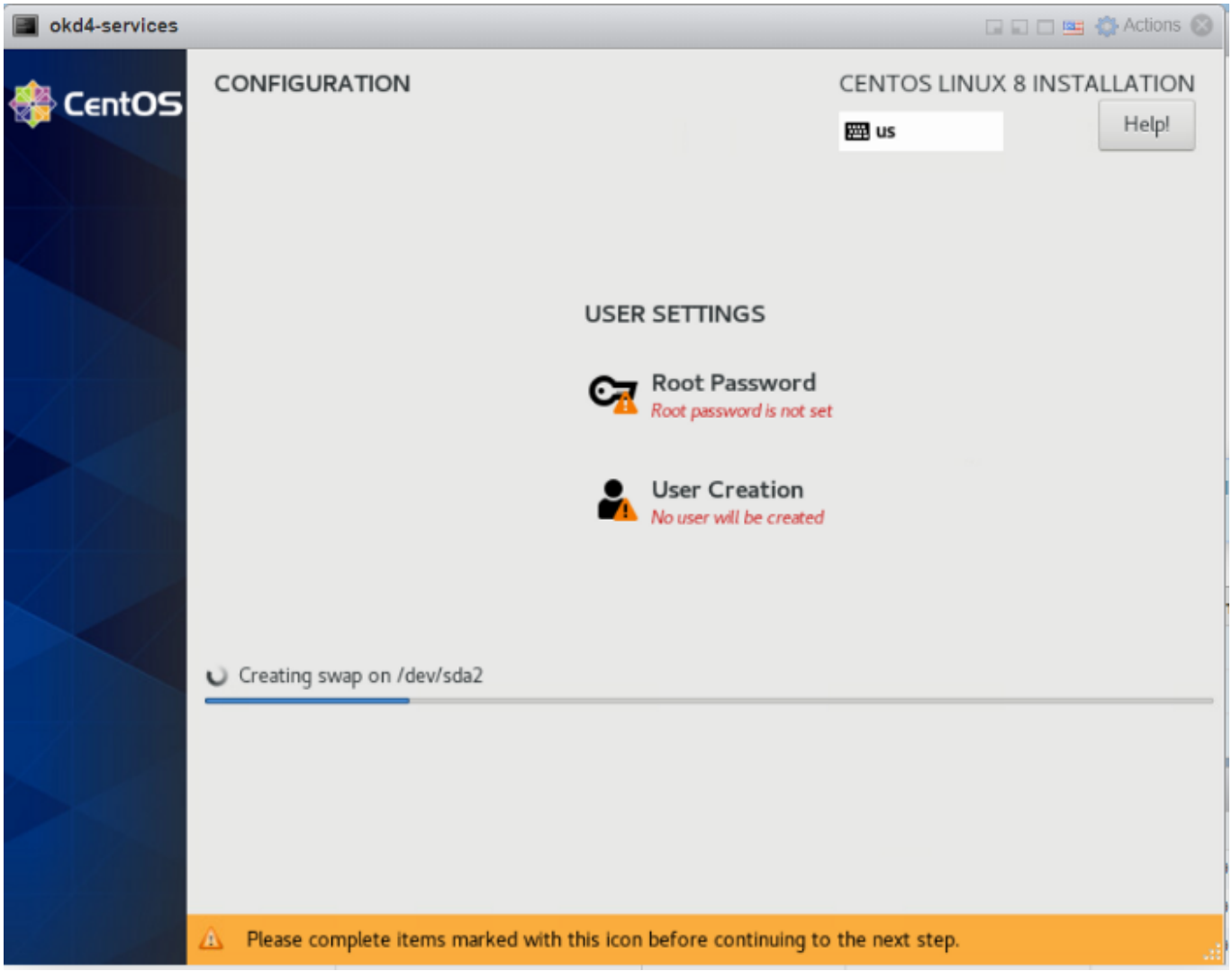
Enable the NIC connected to the VM Network and set the hostname as okd4-services, then click Apply and Done.



Click “Begin Installation” to start the install.



Set the Root password, and create an admin user.



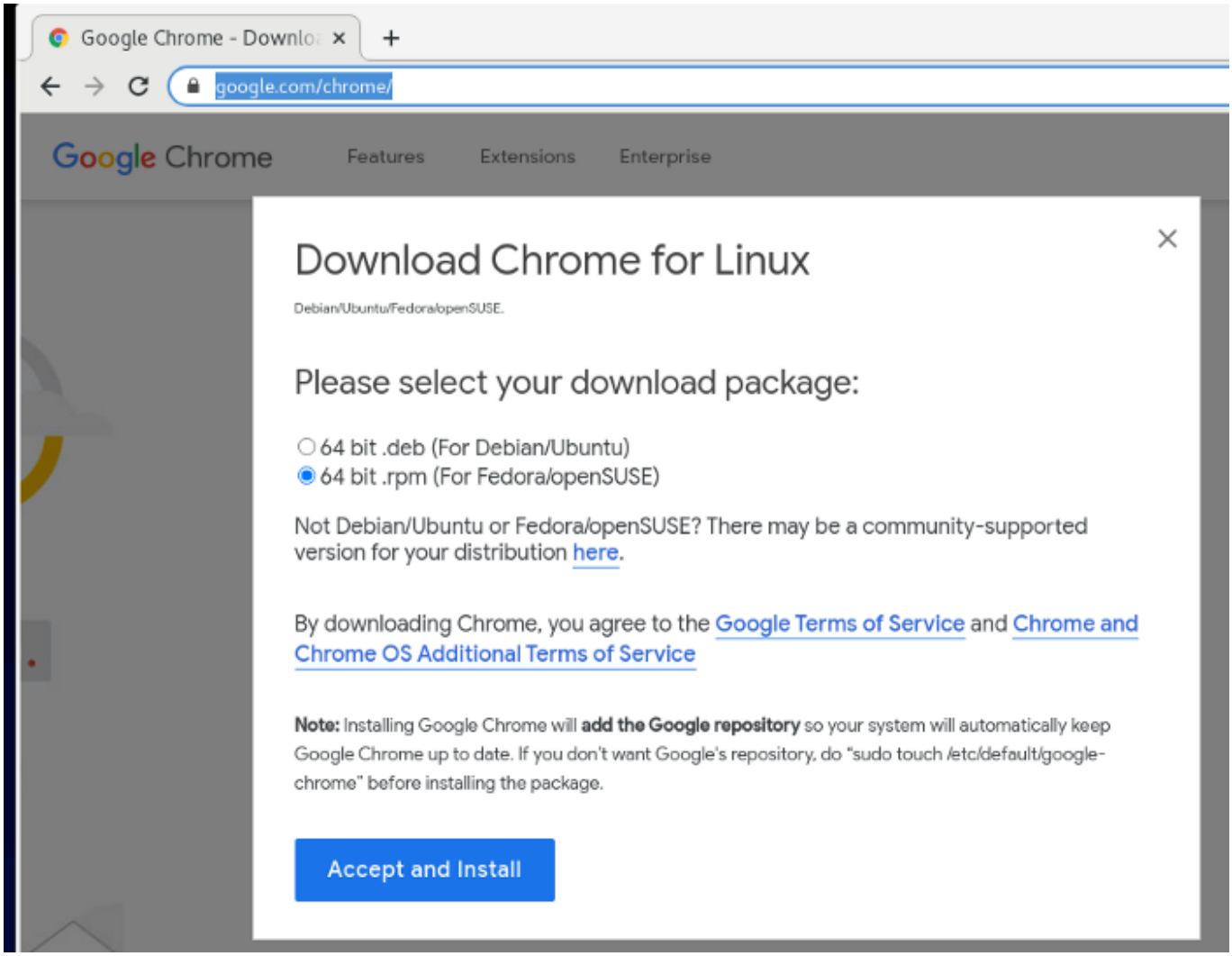
After the installation has completed, login, and update the OS.

```
sudo dnf install -y epel-release
sudo dnf update -y
sudo systemctl restart
```

Setup XRDP for Remote Access from Home Network

```
sudo dnf install -y xrdp tigervnc-server
sudo systemctl enable --now xrxp
sudo firewall-cmd --zone=public --permanent --add-port=3389/tcp
sudo firewall-cmd --reload
```

Download Google Chrome rpm and install along with git



```
sudo dnf install -y ~/Downloads/google-chrome-
stable_current_x86_64.rpm git
```

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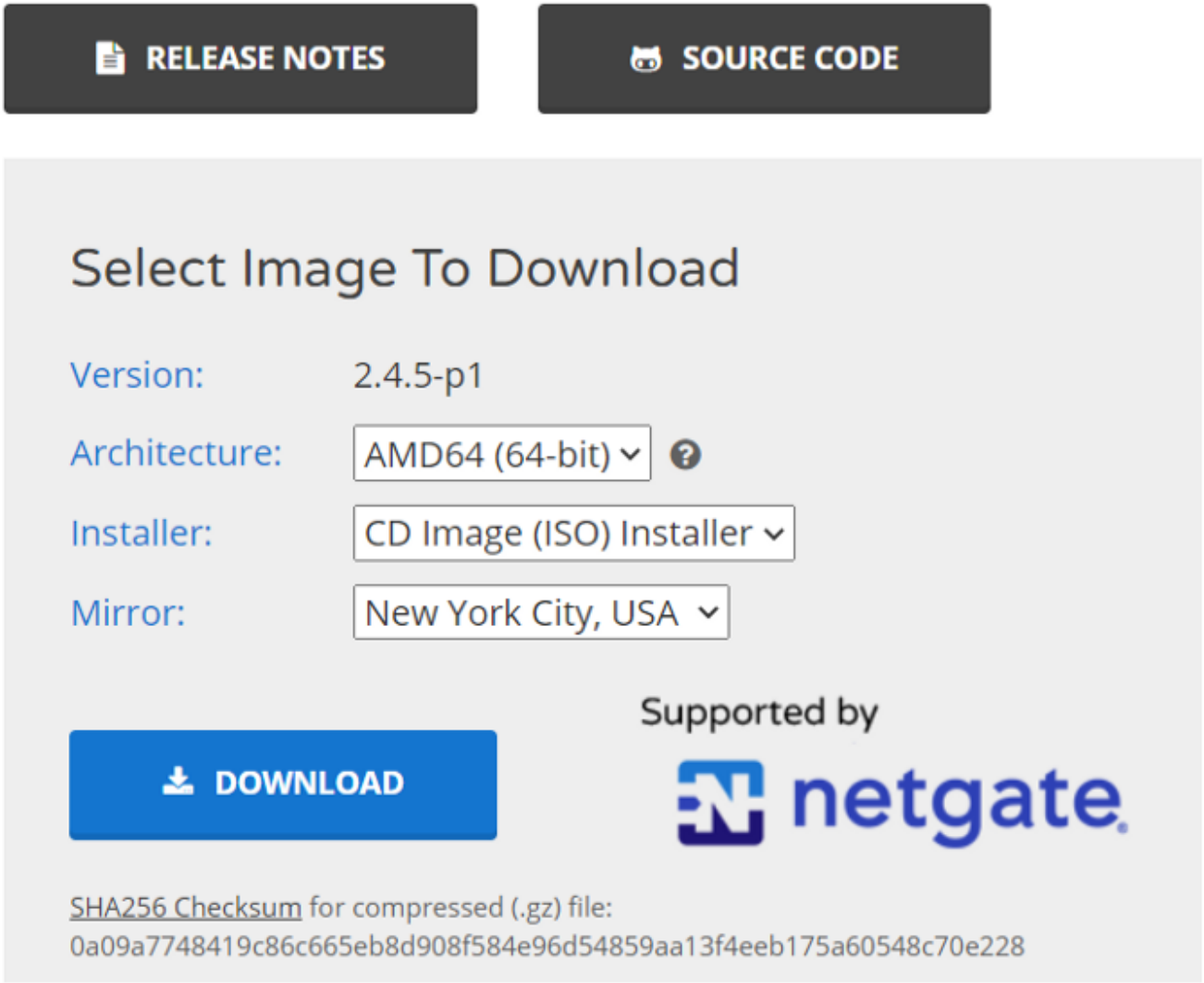
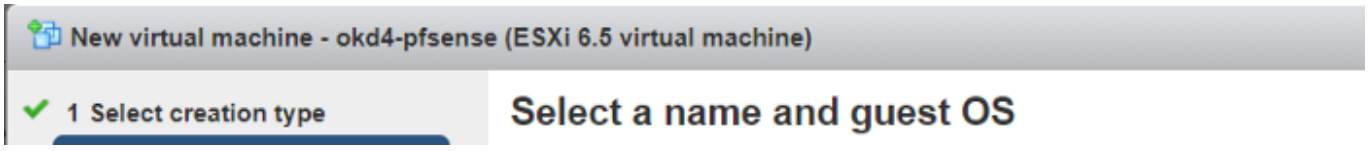
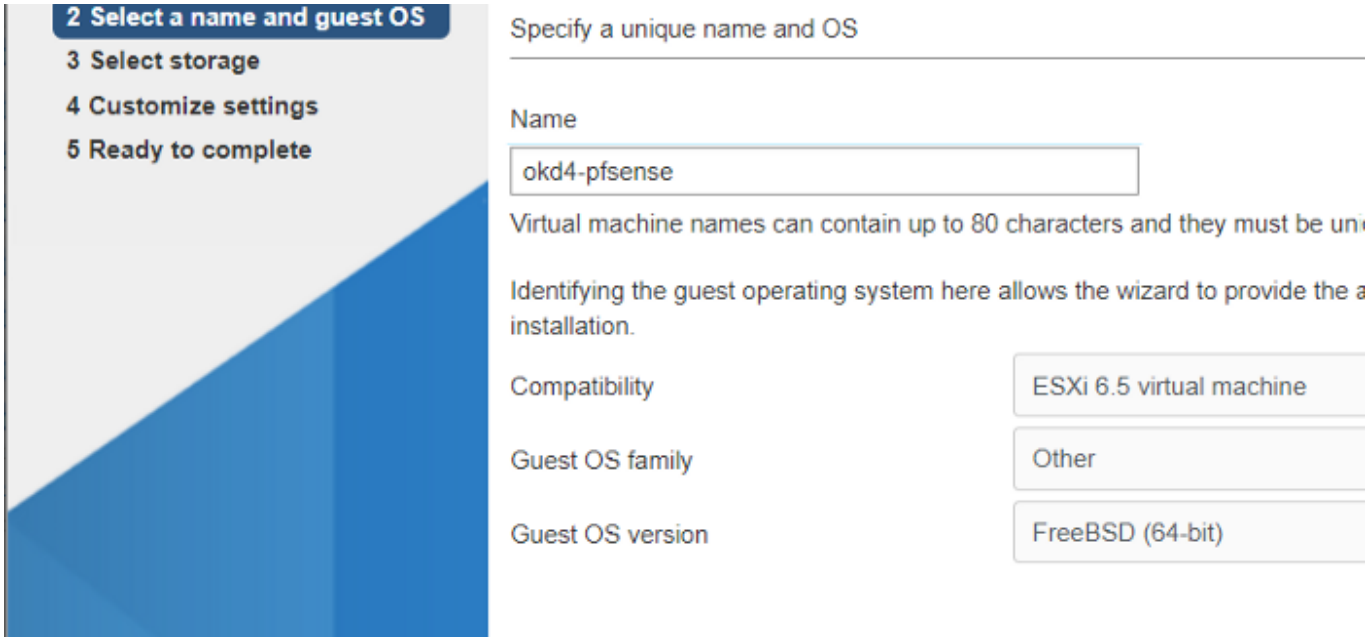
Create the okd4-pfsense VM:

Download the pfSense ISO and upload it to your ESXi host's datastore.



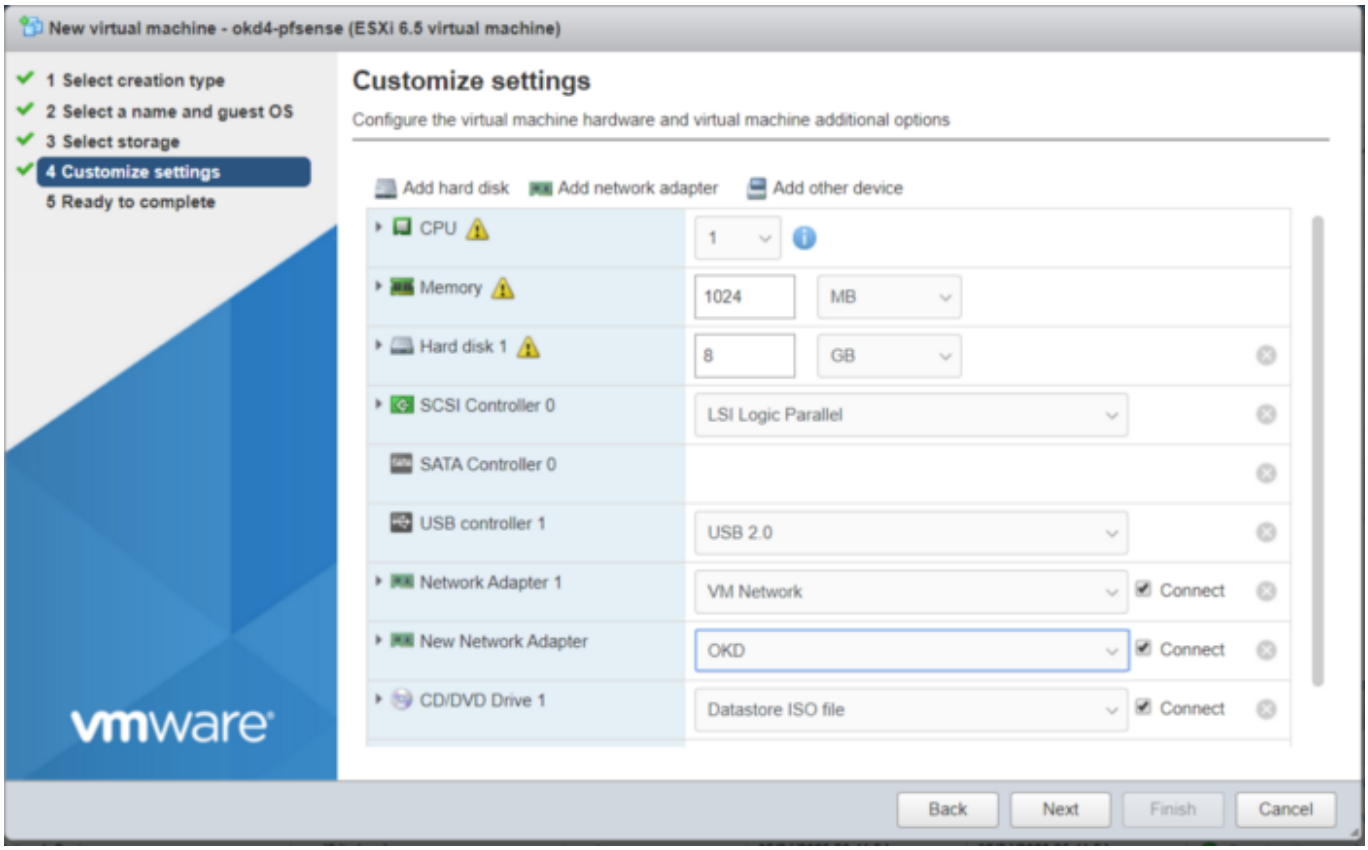
Create a new Virtual Machine. Choose Guest OS as *Other* and Select FreeBSD 64-bit.





Use the default template settings for resources.

Select your home network for Network Adapter 1, and add a new network adapter using the OKD network.



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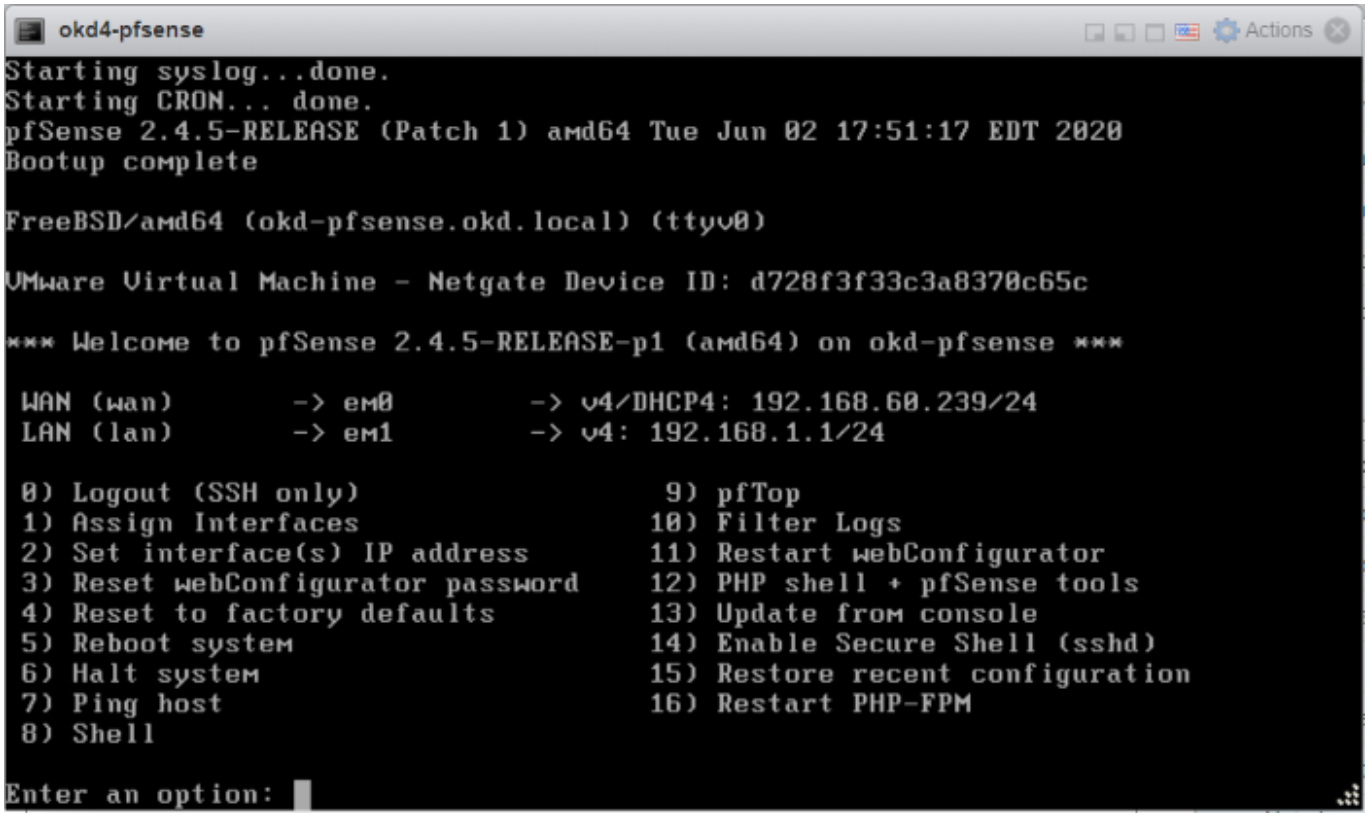
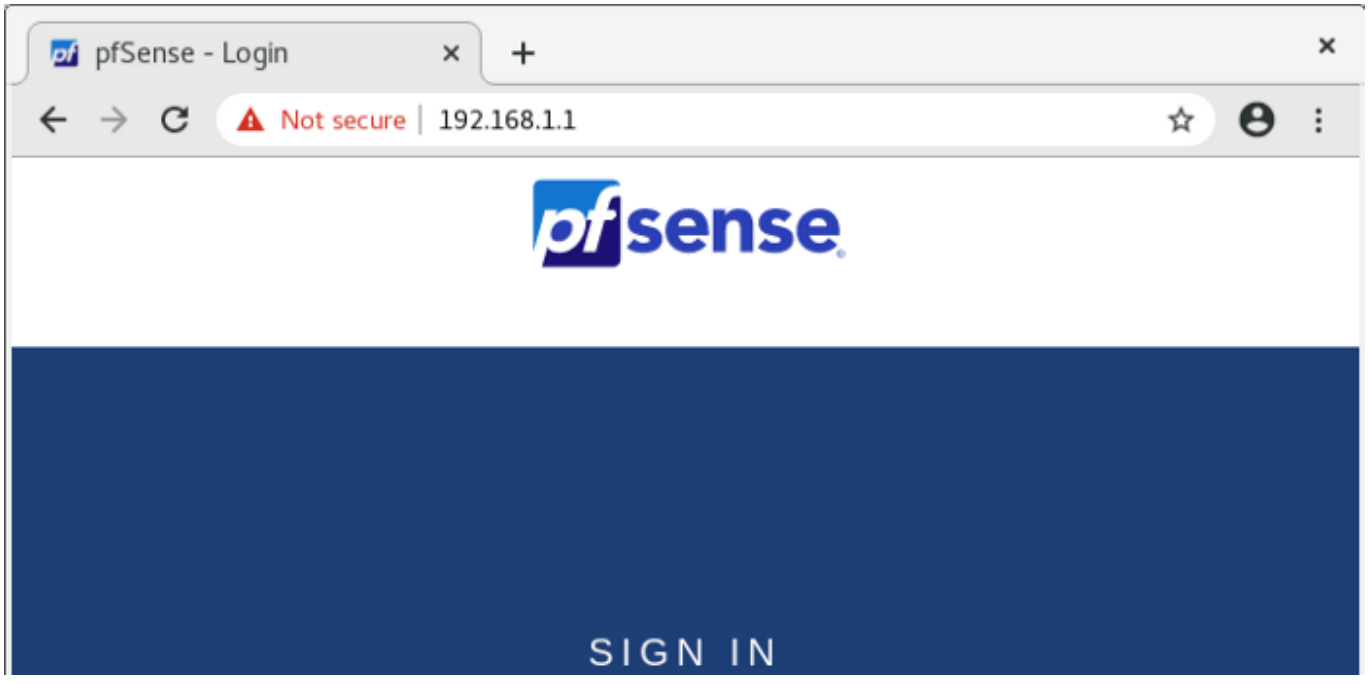
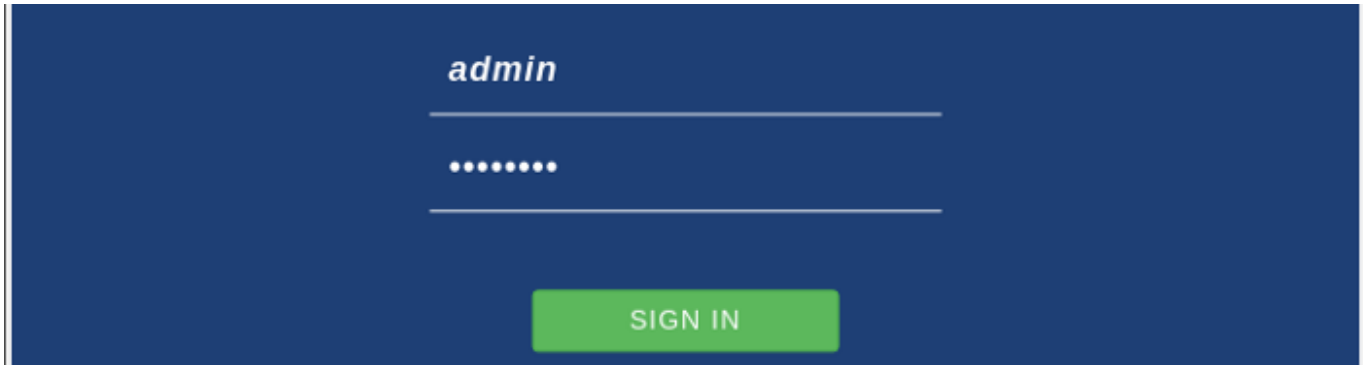
Setup the okd4-pfsense VM:

Power on your pfSense VM and run through the installation using all the default values. After completion your VM console should look like this:

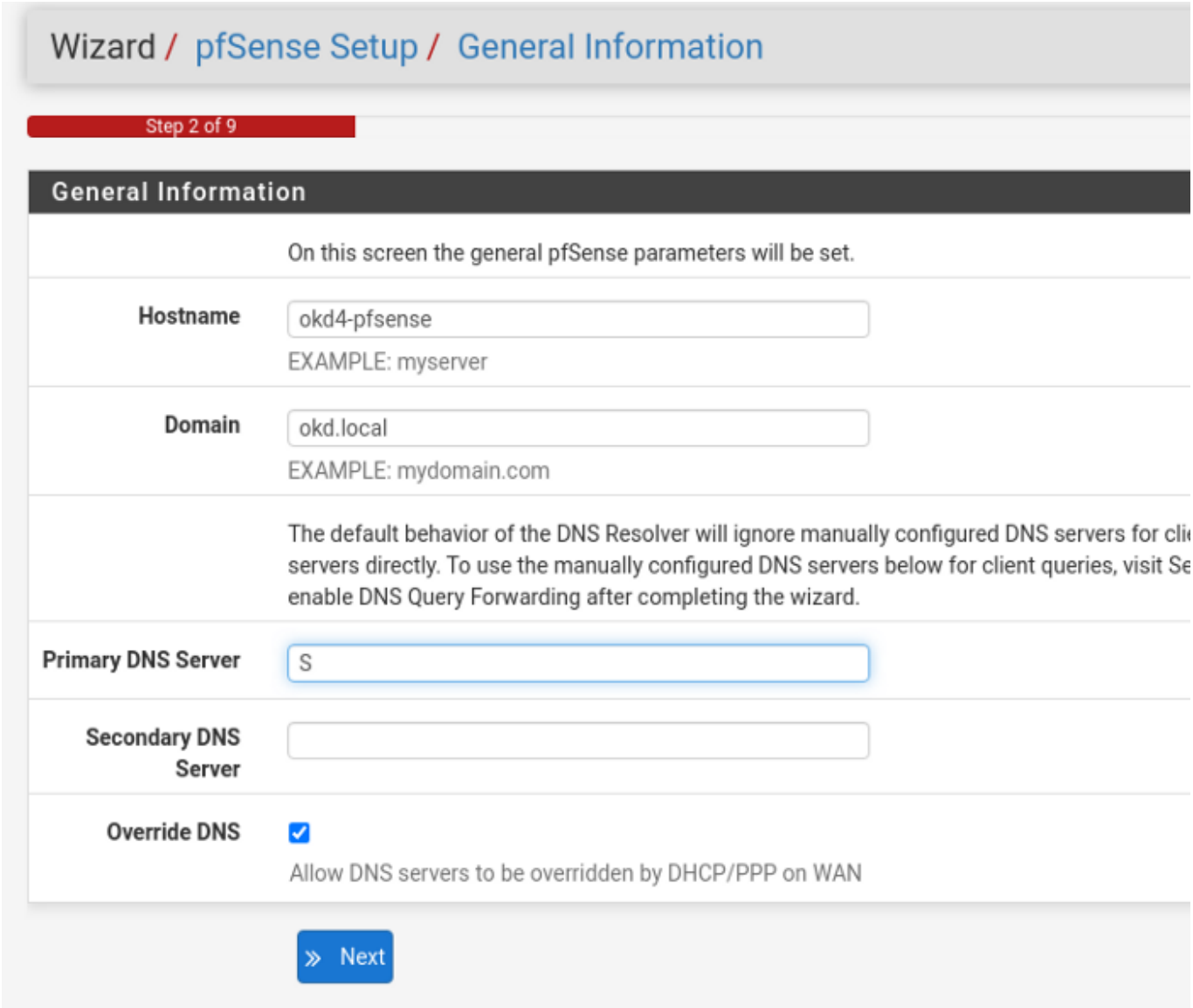


Login to pfSense via your web-browser on the okd4-services VM. The default username is “admin” and the password is “pfsense”.



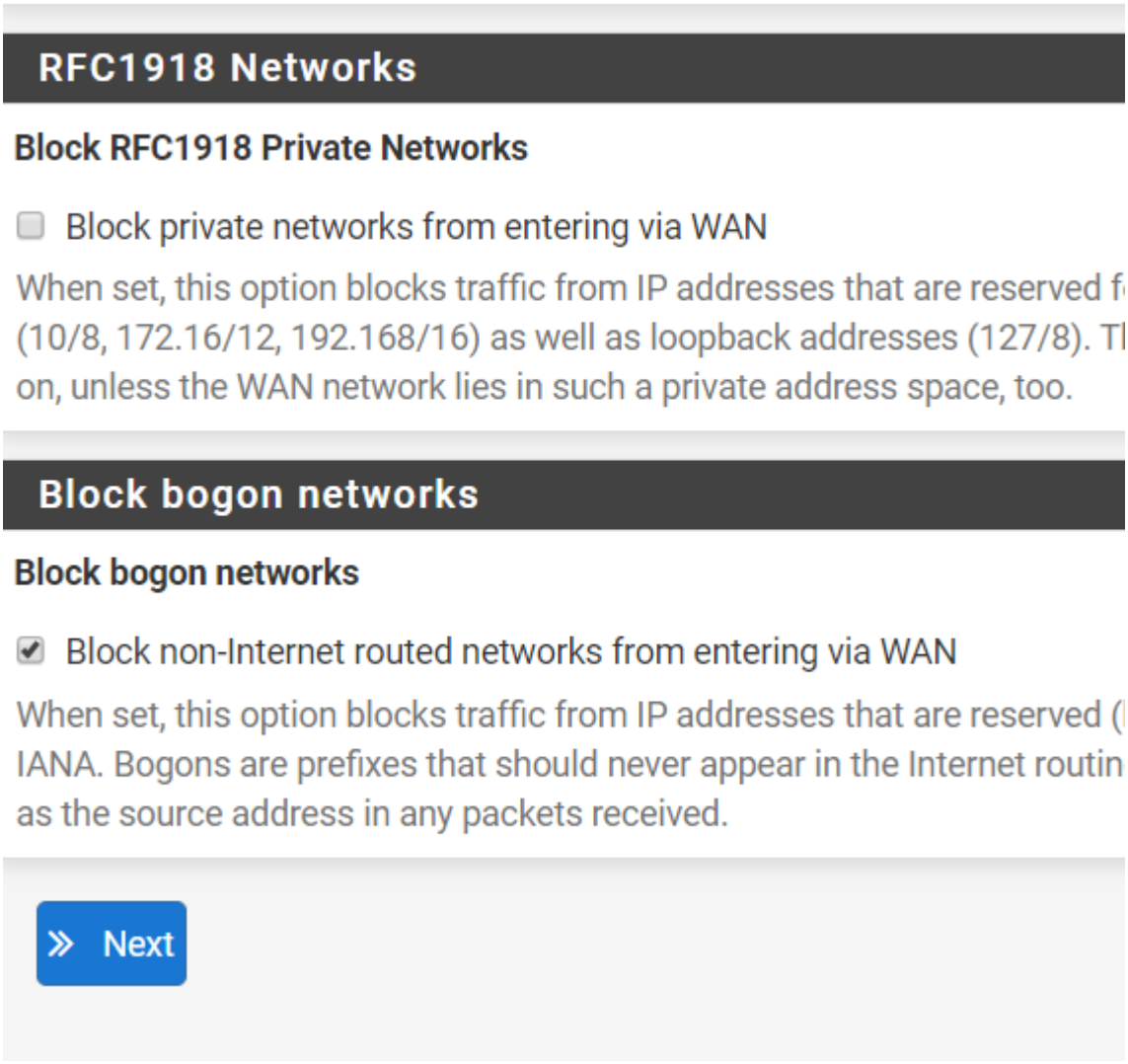


After logging in, click next and use “okd4-pfsense” for hostname and “okd.local” for the domain and add 192.168.1.210 as the Primary DNS server.

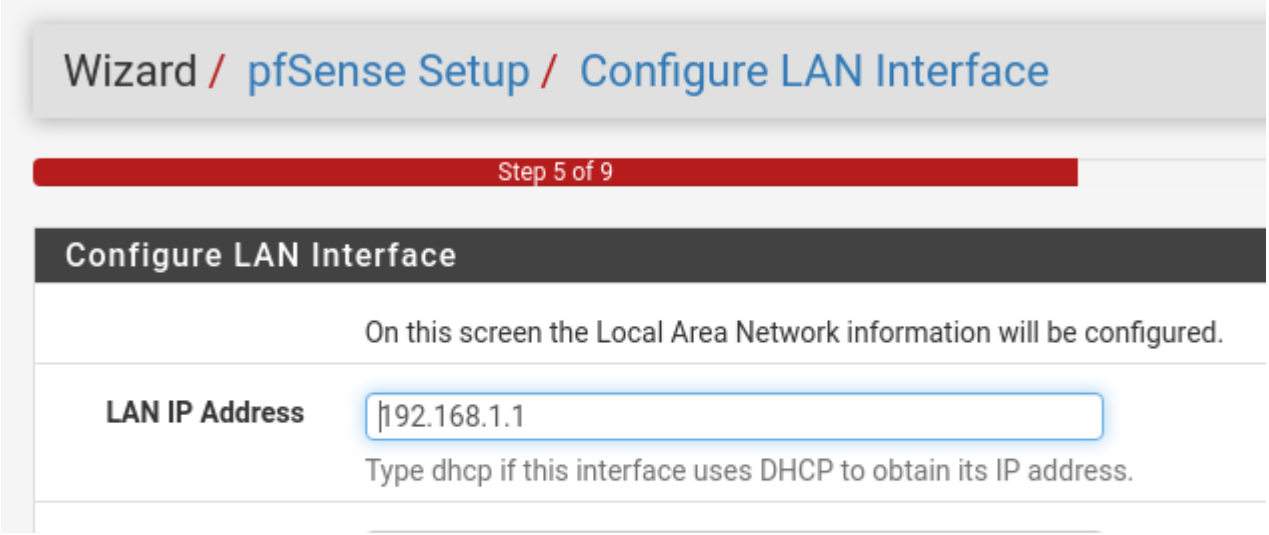


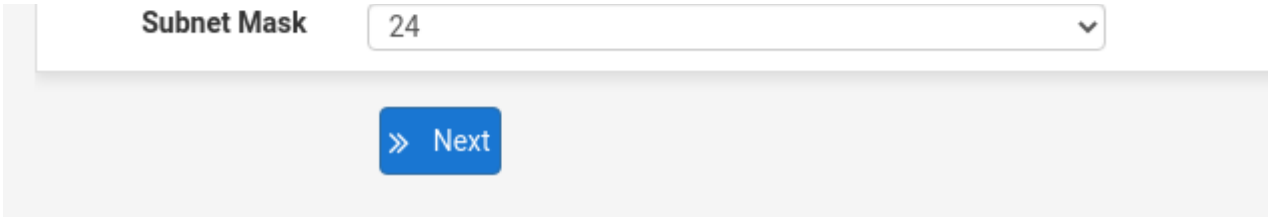
Select your Timezone. Next.

Use Defaults for WAN Configuration. Uncheck “Block RFC1918 Private Networks” since your home network is the “WAN” in this setup. Next.



Use the default LAN IP and subnet mask. Set an admin password on the next screen.





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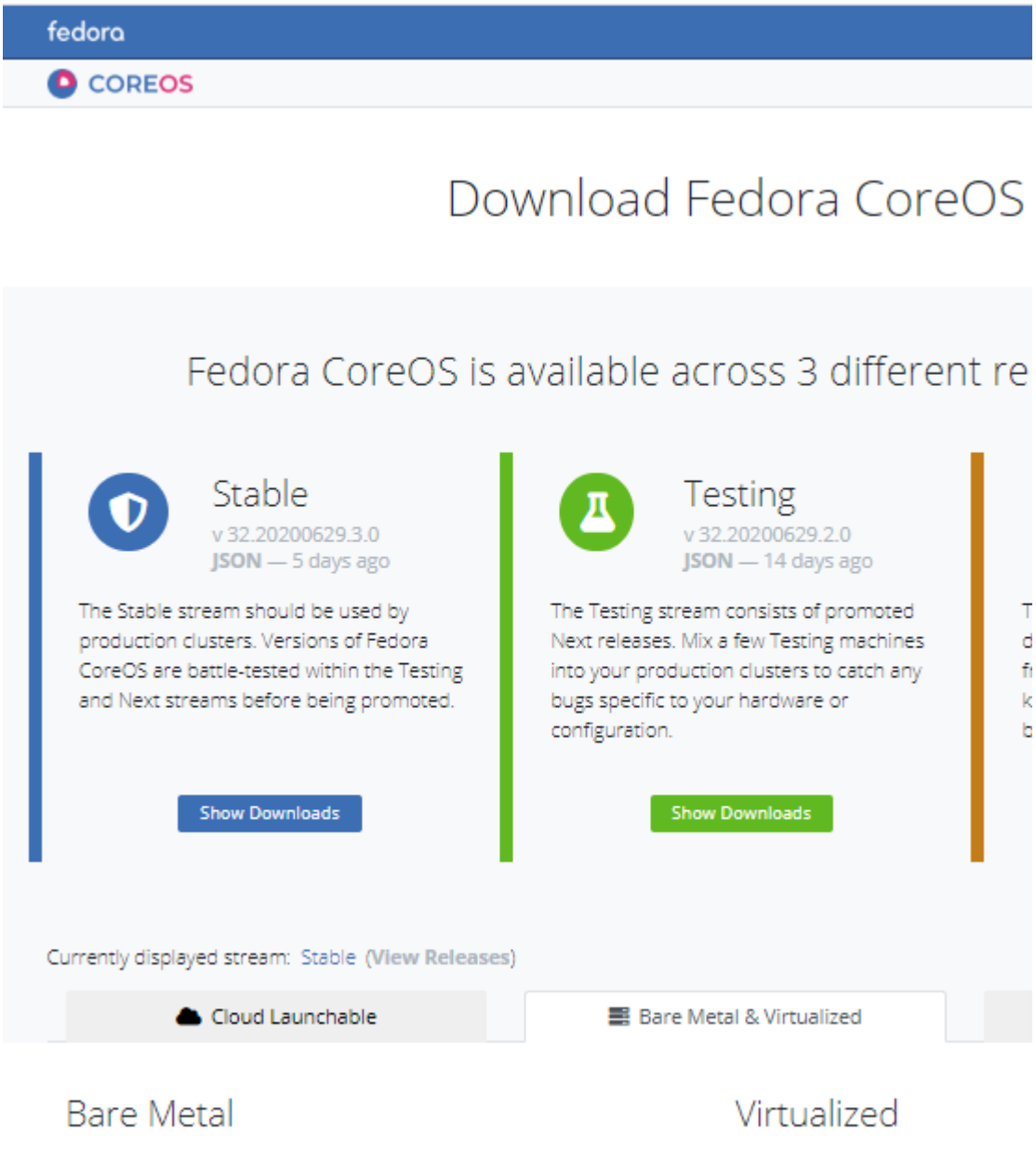
Create bootstrap, master, and worker nodes:

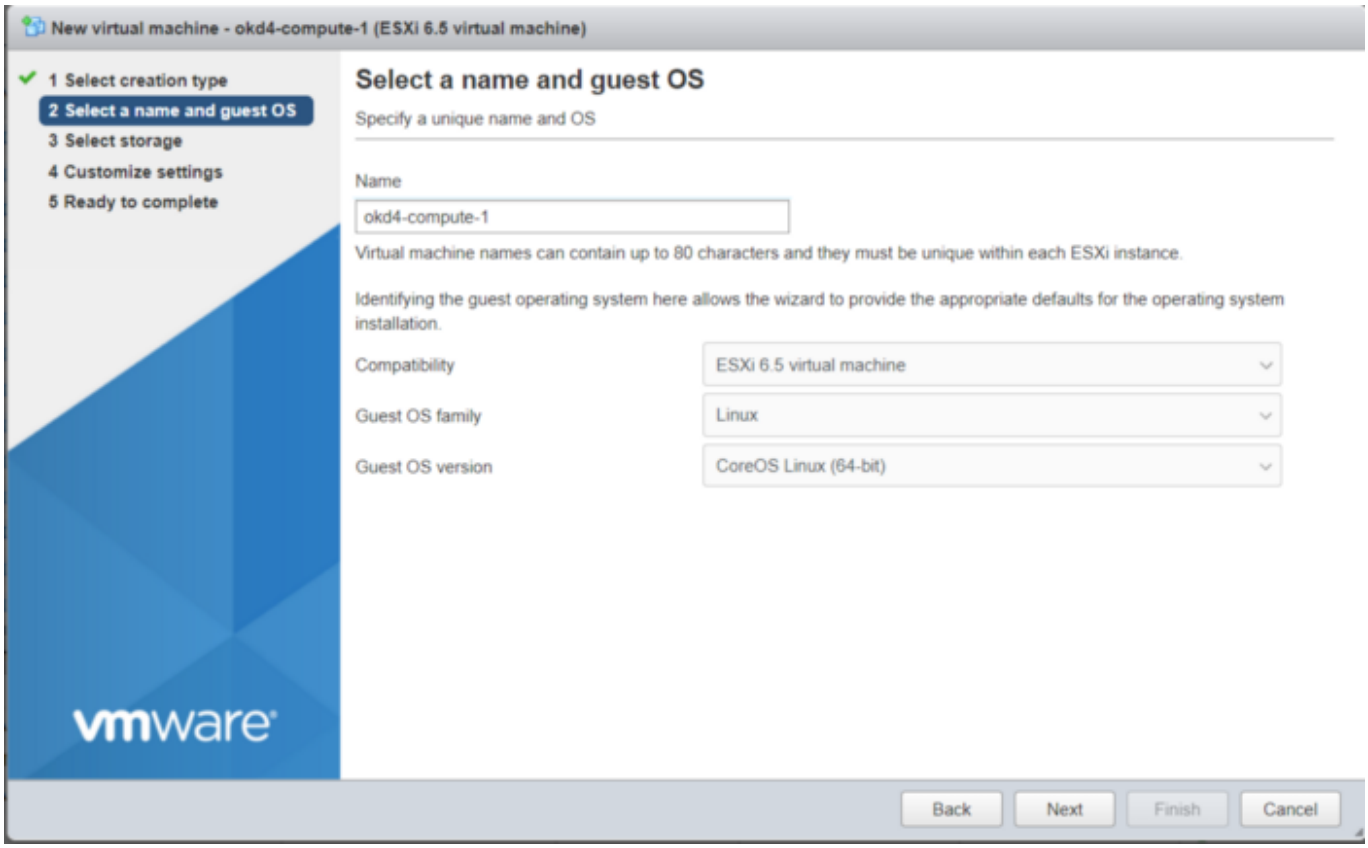
Download the Fedora CoreOS Bare Metal ISO and upload it to your ESXi datastore.

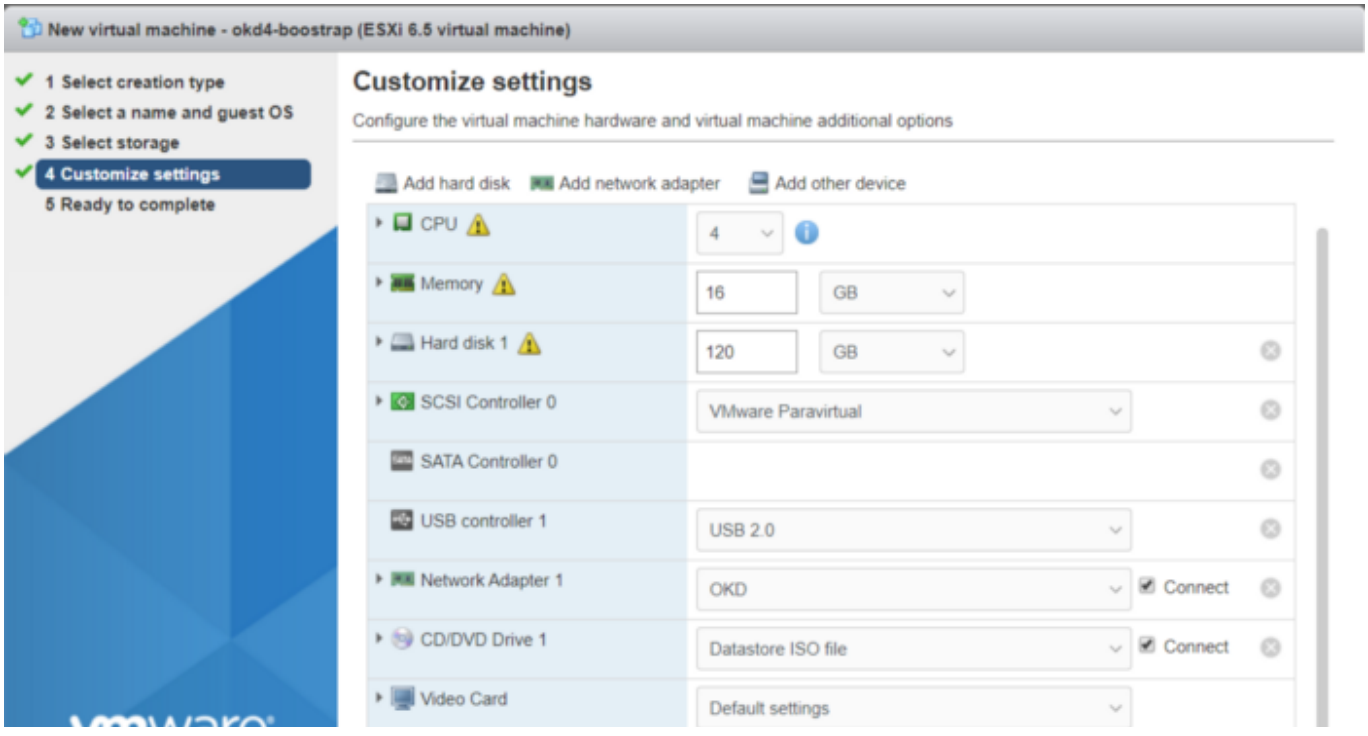
The latest stable version at the time of writing is 32.20200629.3.0



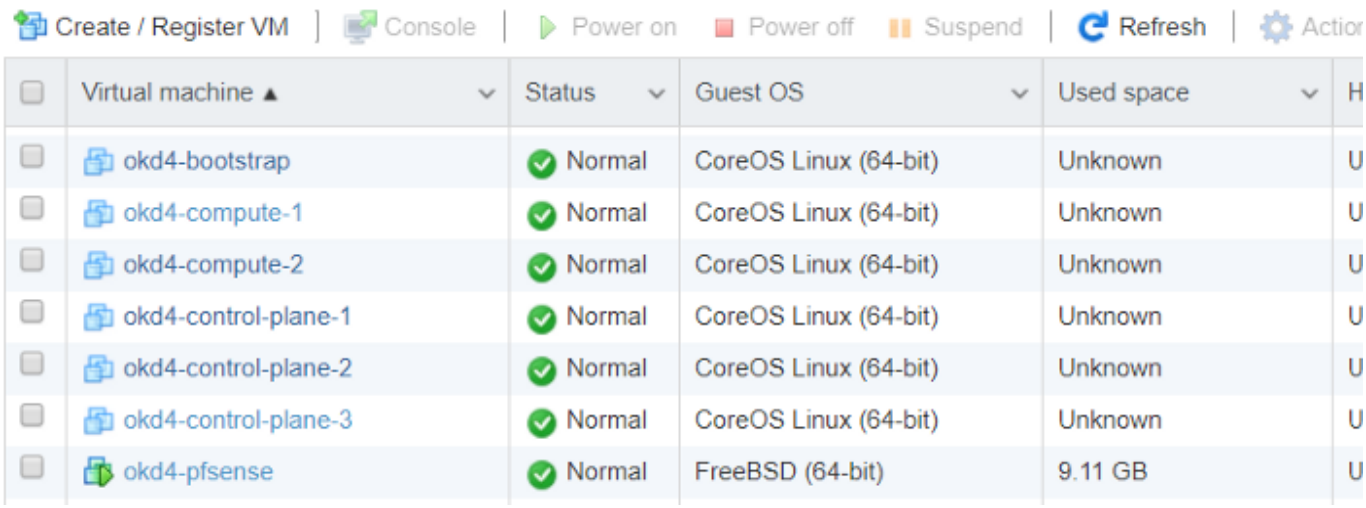
ISO	OpenStack
(iso)	(qcow2.xz)
32.20200629.3.0 stable	32.20200629.3.0 stable

Create the six ODK nodes (bootstrap, master, worker) on your ESXi host using the values in the spreadsheet at the beginning of this post:





You should end up with the following VMs:



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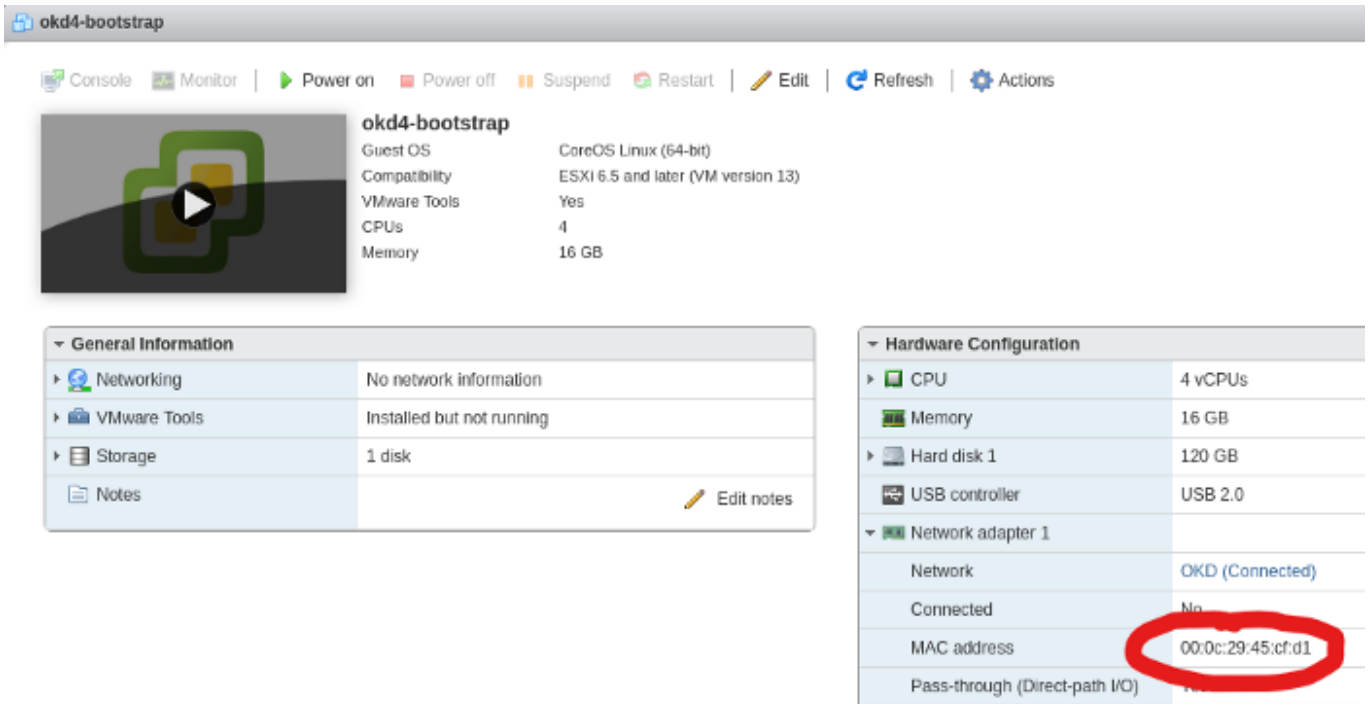
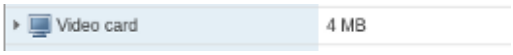
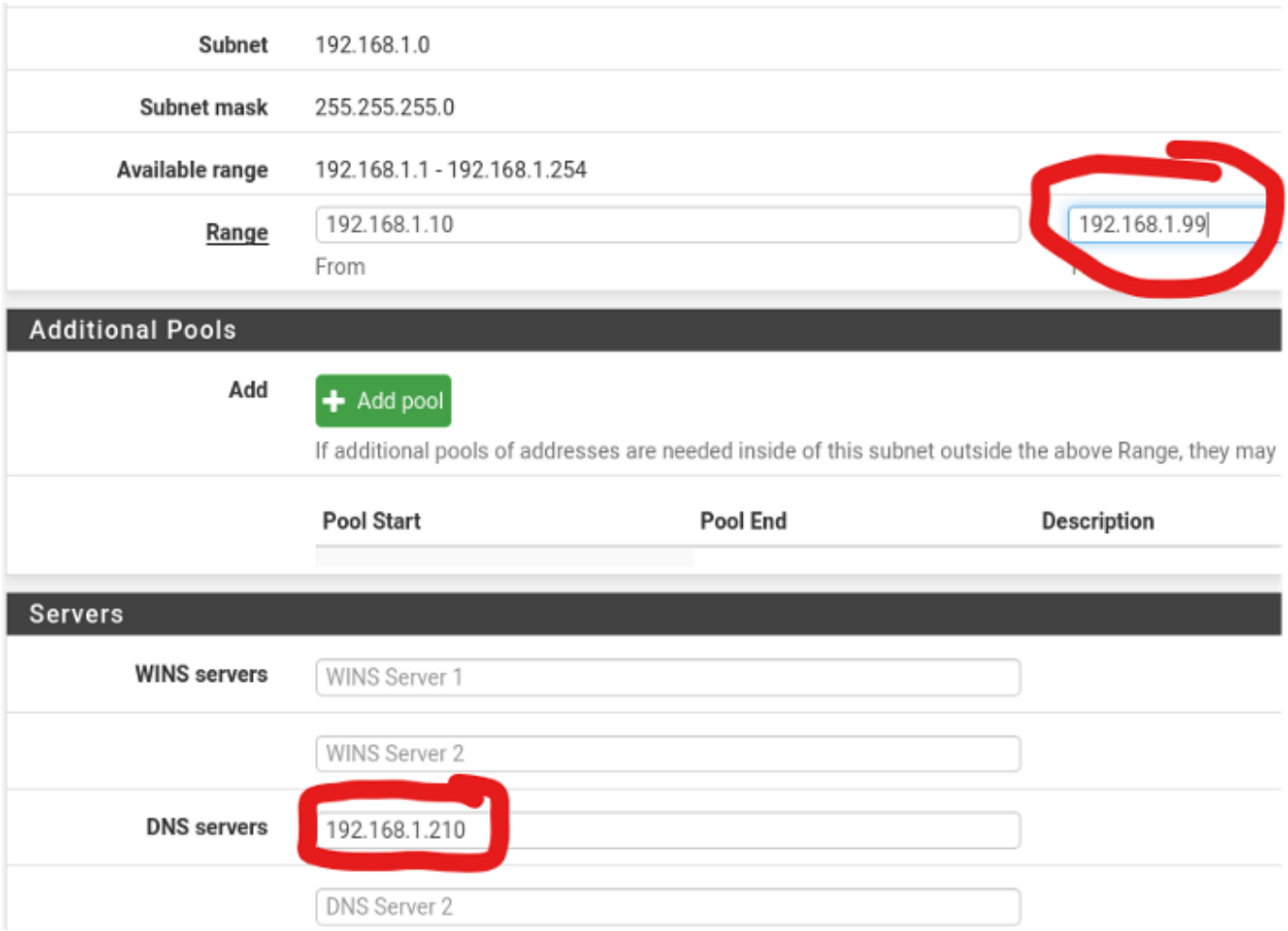
Setup DHCP reservations:

Compile a list of the OKD nodes MAC addresses by viewing the hardware configuration of your VMs.

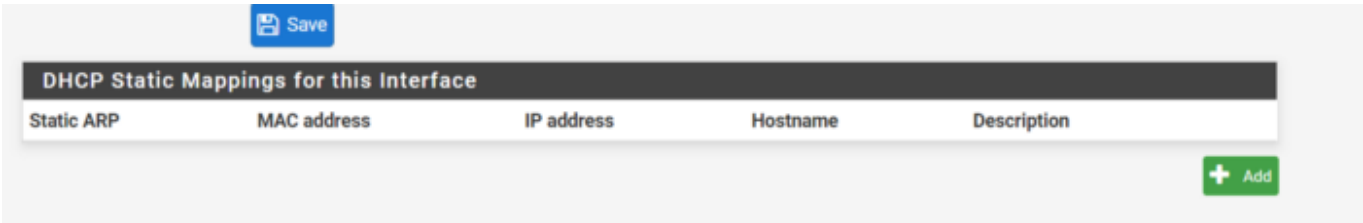




Login into pfSense. Go to Services → DHCP Server and change your ending range IP to 192.168.1.99, and set the primary DNS server as 192.168.1.210, then click Save.



On the DHCP Server, page click Add at the bottom.



Fill in the MAC Address, IP Address, and Hostname, then click save. Do this for each ODK VM. Also, include the okd4-services MAC on the OKD network while you are at it. Click Apply Changes at the top of the page when complete.S

DHCP Static Mappings for this Interface

Static ARP	MAC address	IP address	Hostname	Description
	00:0c:29:45:cf:d1	192.168.1.200	okd4-bootstrap	
	00:0c:29:2f:5b:9d	192.168.1.201	okd4-control-plane-1	
	00:0c:29:be:2f:16	192.168.1.202	okd4-control-plane-2	
	00:0c:29:16:0a:03	192.168.1.203	okd4-control-plane-3	
	00:0c:29:90:2d:76	192.168.1.204	okd4-compute-1	
	00:0c:29:56:be:a9	192.168.1.205	okd4-compute-2	

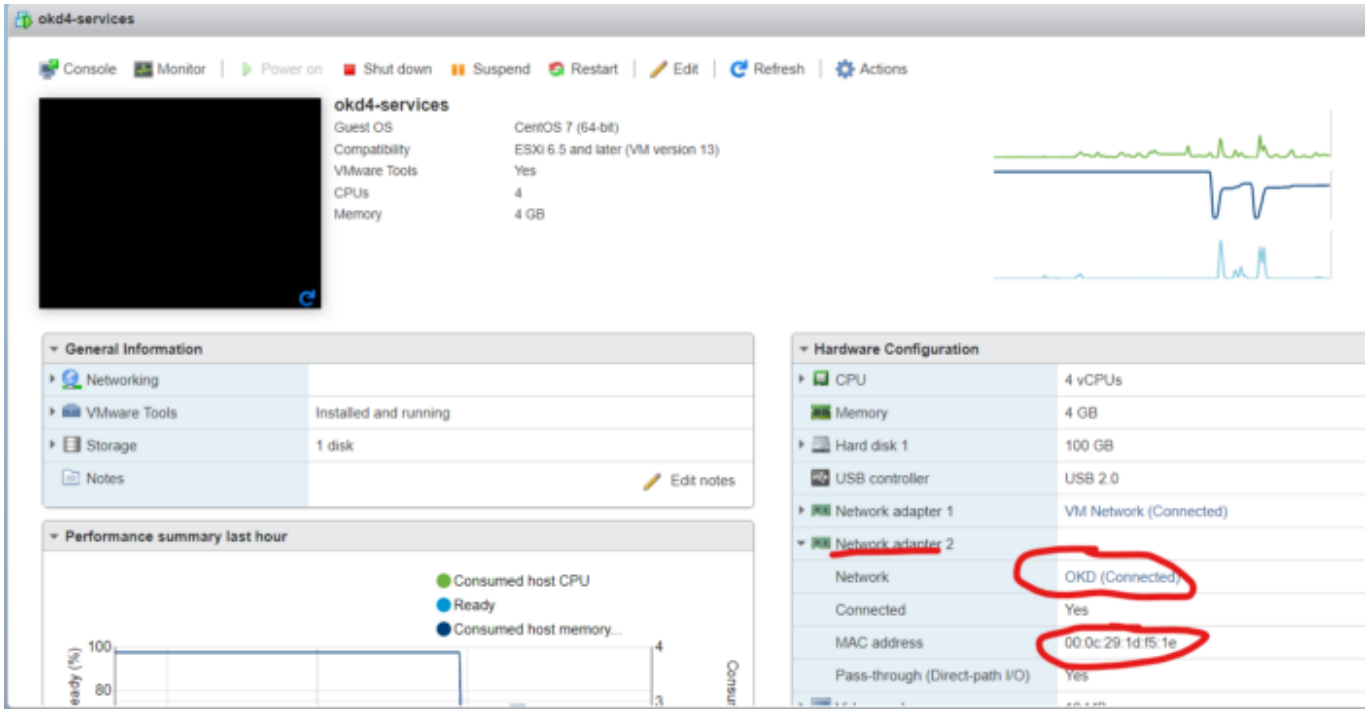
Add

. . .

Configure okd4-services VM to host various services:

The okd4-services VM is used to provide DNS, NFS exports, web server, and load balancing.

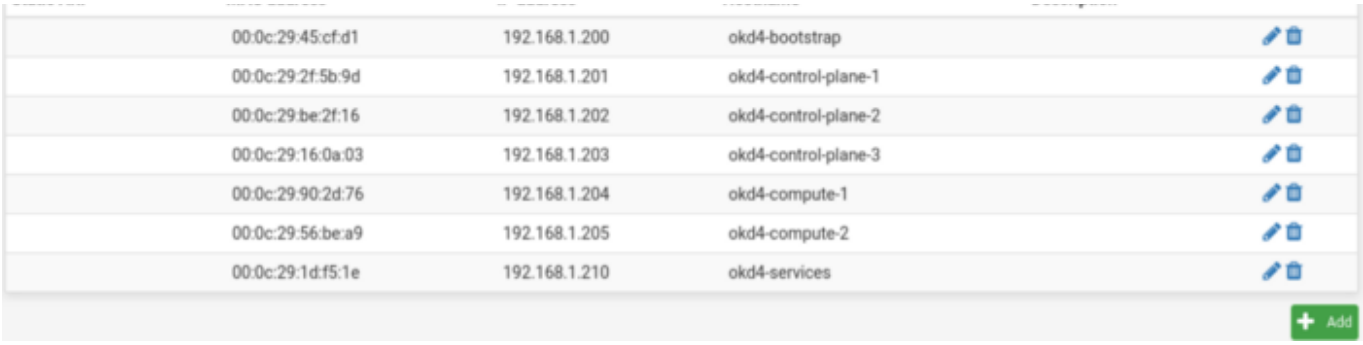
Copy the MAC address on the VM Hardware configuration page for the NIC connected to the OKD network and set up a DHCP Reservation for this VM using the IP address 192.168.1.210.



Hit “Apply Changes” at the top of the DHCP page when completed.

DHCP Static Mappings for this Interface

Static ARP	MAC address	IP address	Hostname	Description



Open a terminal on the okd4-services VM and clone the okd4_files repo that contains the DNS, HAProxy, and install-conf.yaml example files:

```
cd
git clone https://github.com/cragr/okd4_files.git
cd okd4_files
```

. . .

Install bind (DNS)

```
sudo dnf -y install bind bind-utils
```

Copy the named config files and zones:

```
sudo cp named.conf /etc/named.conf
sudo cp named.conf.local /etc/named/
sudo mkdir /etc/named/zones
sudo cp db* /etc/named/zones
```

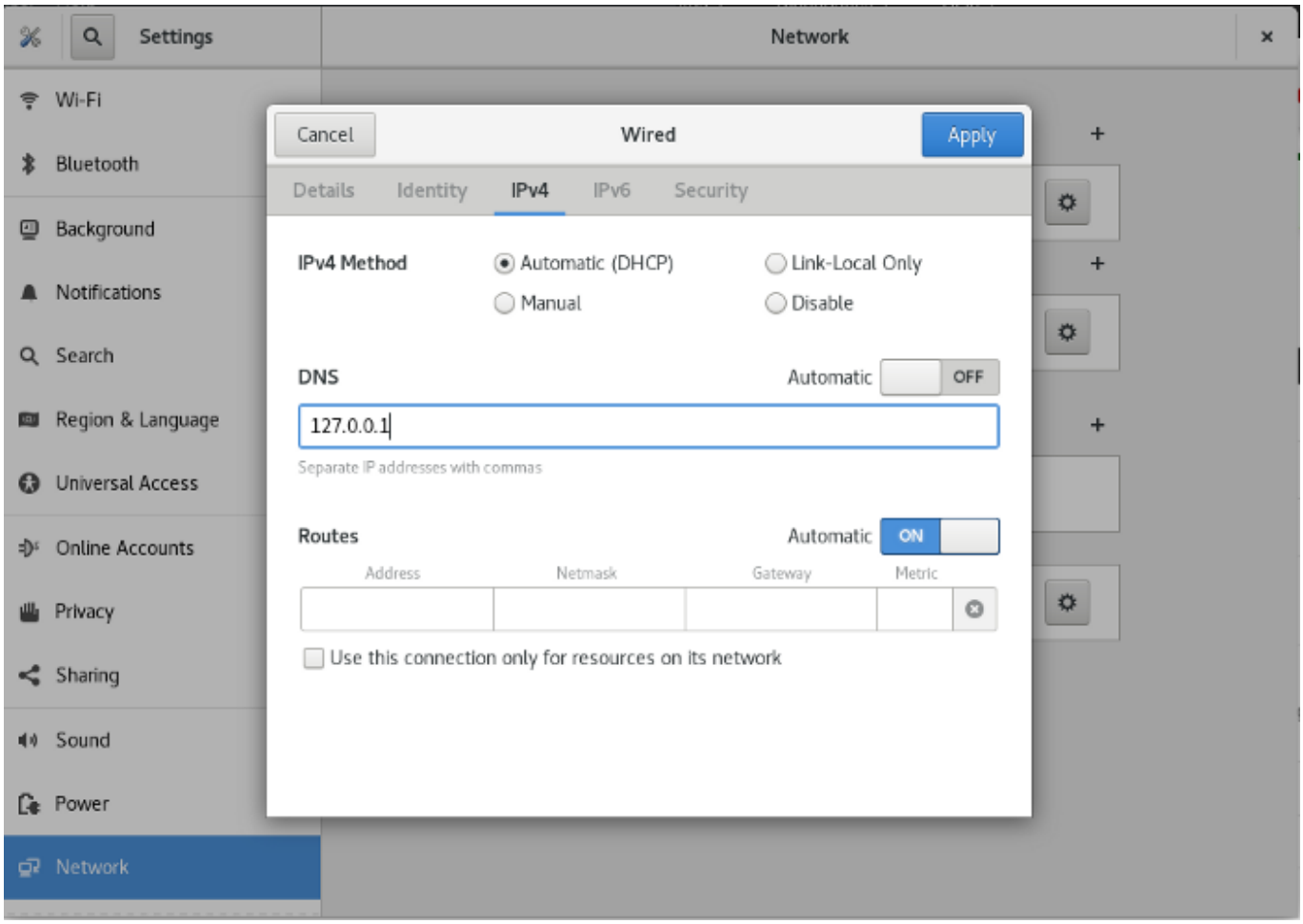
Enable and start named:

```
sudo systemctl enable named
sudo systemctl start named
sudo systemctl status named
```

Create firewall rules:

```
sudo firewall-cmd --permanent --add-port=53/udp
sudo firewall-cmd --reload
```

Change the DNS on the okd4-service NIC that is attached to the VM Network (not OKD) to 127.0.0.1.



Restart the network services on the okd4-services VM:

```
sudo systemctl restart NetworkManager
```

Test DNS on the okd4-services.

```
dig okd.local
dig -x 192.168.1.210
```

With DNS working correctly, you should see the following results:

```
[crobinson@okd4-services okd4_files]$ dig okd.local

; <<>> DiG 9.11.13-RedHat-9.11.13-3.el8 <<>> okd.local
;; global options: +cmd
;; Got answer:
;; WARNING: .local is reserved for Multicast DNS
;; You are currently testing what happens when an mDNS query is leaked to DNS
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 64424
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: 7009863cfd0c3194df61cc045f04c51c67e06b2f24fd0618 (good)
;; QUESTION SECTION:
;okd.local.                     IN      A

;; AUTHORITY SECTION:
okd.local.              604800  IN      SOA     okd4-services.okd.local. admin.o
kd.local. 1 604800 86400 2419200 604800

;; Query time: 0 msec
;; SERVER: 127.0.0.1#53(127.0.0.1)
;; WHEN: Tue Jul 07 14:55:24 EDT 2020
;; MSG SIZE  rcvd: 122
```

```
[crobinson@okd4-services okd4_files]$ dig -x 192.168.1.210

; <<>> DiG 9.11.13-RedHat-9.11.13-3.el8 <<>> -x 192.168.1.210
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 65007
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 1, ADDITIONAL: 2

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: 23bfcaa3f3140ab1261acff65f04c4d921fa9f8011631ba6 (good)
;; QUESTION SECTION:
;210.1.168.192.in-addr.arpa.    IN      PTR

;; ANSWER SECTION:
210.1.168.192.in-addr.arpa. 604800 IN   PTR     api-int.lab.okd.local.
210.1.168.192.in-addr.arpa. 604800 IN   PTR     okd4-services.okd.local.
210.1.168.192.in-addr.arpa. 604800 IN   PTR     api.lab.okd.local.

;; AUTHORITY SECTION:
1.168.192.in-addr.arpa. 604800  IN      NS      okd4-services.okd.local.
```

```
1.168.192.in-addr.arpa. 604800  IN      NS      okd4-services.okd.local.

;; ADDITIONAL SECTION:
okd4-services.okd.local. 604800 IN      A       192.168.1.210

;; Query time: 0 msec
;; SERVER: 127.0.0.1#53(127.0.0.1)
;; WHEN: Tue Jul 07 14:54:17 EDT 2020
;; MSG SIZE  rcvd: 194
```

. . .

Install HAProxy:

```
sudo dnf install haproxy -y
```

Copy haproxy config from the git okd4_files directory :

```
sudo cp haproxy.cfg /etc/haproxy/haproxy.cfg
```

Start, enable, and verify HA Proxy service:

```
sudo setsebool -P haproxy_connect_any 1
sudo systemctl enable haproxy
sudo systemctl start haproxy
sudo systemctl status haproxy
```

Add OKD firewall ports:

```
sudo firewall-cmd --permanent --add-port=6443/tcp
sudo firewall-cmd --permanent --add-port=22623/tcp
sudo firewall-cmd --permanent --add-service=http
sudo firewall-cmd --permanent --add-service=https
sudo firewall-cmd --reload
```

Install Apache/HTTPD

```
sudo dnf install -y httpd
```

Change httpd to listen port to 8080:

```
sudo sed -i 's/Listen 80/Listen 8080/' /etc/httpd/conf/httpd.conf
```

Enable and Start httpd service/Allow port 8080 on the firewall:

```
sudo setsebool -P httpd_read_user_content 1
sudo systemctl enable httpd
sudo systemctl start httpd
sudo firewall-cmd --permanent --add-port=8080/tcp
sudo firewall-cmd --reload
```

Test the webserver:

```
curl localhost:8080
```

A successful curl should look like this:

```
        <h2>推广 Apache 及 CentOS</h2>
        <p>你可在 Apache 及 CentOS Linux 驱动的 HTTP 服务器上随意采用下列图像。多
谢采用 Apache 及 CentOS! </p>
        <p>
          <a href="http://httpd.apache.org/">
            <img src="noindex/common/images/pb-apache.png" alt="[ Powered by Apach
e ]"/>
          </a>
          <a href="http://www.centos.org/">
            <img src="noindex/common/images/pb-centos.png" alt="[ Powered by CentO
S Linux ]"/>
          </a>
        </p>
      </div>
      <div class="col-md-6">
      </div>
      <div class="col-md-6">
```

```
          <h2>CentOS 计划</h2>
          <p>CentOS Linux 发行版本是一个稳定、高预测性、高管理性、高重复性的平台，它
源于 Red Hat 企业级 Linux（RHEL）的源代码。</p>
          <p>除了是寄存网站的热门选择外，CentOS 亦为开源社群提供一个可扩展的丰富平台
。请拜访 <a href="http://www.centos.org/">CentOS 网站</a> 获取更多信息。</p>
        </div>
      </section>
      <hr/>
    </main>
    <footer class="container">
      <p>© 2019 CentOS 计划 | <a href="https://www.centos.org/legal/">法律条文</a> |
 <a href="https://www.centos.org/legal/privacy/">私隐</a></p>
    </footer>
  </body>
</html>
[crobinson@okd4-services okd4_files]$ S
```

. . .

Congratulations, You Are Half Way There!

Congrats! You should now have a separate home lab environment setup and ready for ODK. Now we can start the install.

. . .

Download the openshift-installer and oc client:

SSH to the okd4-services VM

To download the latest oc client and openshift-install binaries, you need to use an existing version of the oc client.

Download the 4.5 version of the oc client and openshift-install from the OKD releases page. Example:

```
wget https://github.com/openshift/okd/releases/download/4.5.0-0.okd-2020-07-14-153706-ga/openshift-client-linux-4.5.0-0.okd-2020-07-14-153706-ga.tar.gz
wget https://github.com/openshift/okd/releases/download/4.5.0-0.okd-2020-07-14-153706-ga/openshift-install-linux-4.5.0-0.okd-2020-07-14-153706-ga.tar.gz
```

Extract the okd version of the oc client and openshift-install:

```
tar -zxvf openshift-client-linux-4.5.0-0.okd-2020-07-14-153706-
ga.tar.gz
tar -zxvf openshift-install-linux-4.5.0-0.okd-2020-07-14-153706-
ga.tar.gz
```

Move the kubectl, oc, and openshift-install to /usr/local/bin and show the version:

```
sudo mv kubectl oc openshift-install /usr/local/bin/
oc version
openshift-install version
```

The latest and recent releases are available at https://origin-release.svc.ci.openshift.org

. . .

Setup the openshift-installer:

In the install-config.yaml, you can either use a pull-secret from RedHat or the default of “{“auths”:{“fake”:{“auth”: “bar”}}}” as the pull-secret.

Generate an SSH key if you do not already have one.

```
ssh-keygen
```

Create an install directory and copy the install-config.yaml file:

```
cd
mkdir install_dir
cp okd4_files/install-config.yaml ./install_dir
```

Edit the install-config.yaml in the install_dir, insert your pull secret and ssh key, and backup the install-config.yaml as it will be deleted in the next step:

```
vim ./install_dir/install-config.yaml
cp ./install_dir/install-config.yaml ./install_dir/install-
config.yaml.bak
```

Generate the Kubernetes manifests for the cluster, ignore the warning:

```
openshift-install create manifests --dir=install_dir/
```

Modify the cluster-scheduler-02-config.yaml manifest file to prevent Pods from being scheduled on the control plane machines:

```
sed -i 's/mastersSchedulable: true/mastersSchedulable: False/'
install_dir/manifests/cluster-scheduler-02-config.yml
```

Now you can create the ignition-configs:

```
openshift-install create ignition-configs --dir=install_dir/
```

Note: If you reuse the install_dir, make sure it is empty. Hidden files are created after generating the configs, and they should be removed before you use the same folder on a 2nd attempt.

. . .

Host ignition and Fedora CoreOS files on the webserver:

Create okd4 directory in /var/www/html:

```
sudo mkdir /var/www/html/okd4
```

Copy the install_dir contents to /var/www/html/okd4 and set permissions:

```
sudo cp -R install_dir/* /var/www/html/okd4/
sudo chown -R apache: /var/www/html/
sudo chmod -R 755 /var/www/html/
```

Test the webserver:

```
curl localhost:8080/okd4/metadata.json
```

Download the Fedora CoreOS bare-metal bios image and sig files and shorten the file names:

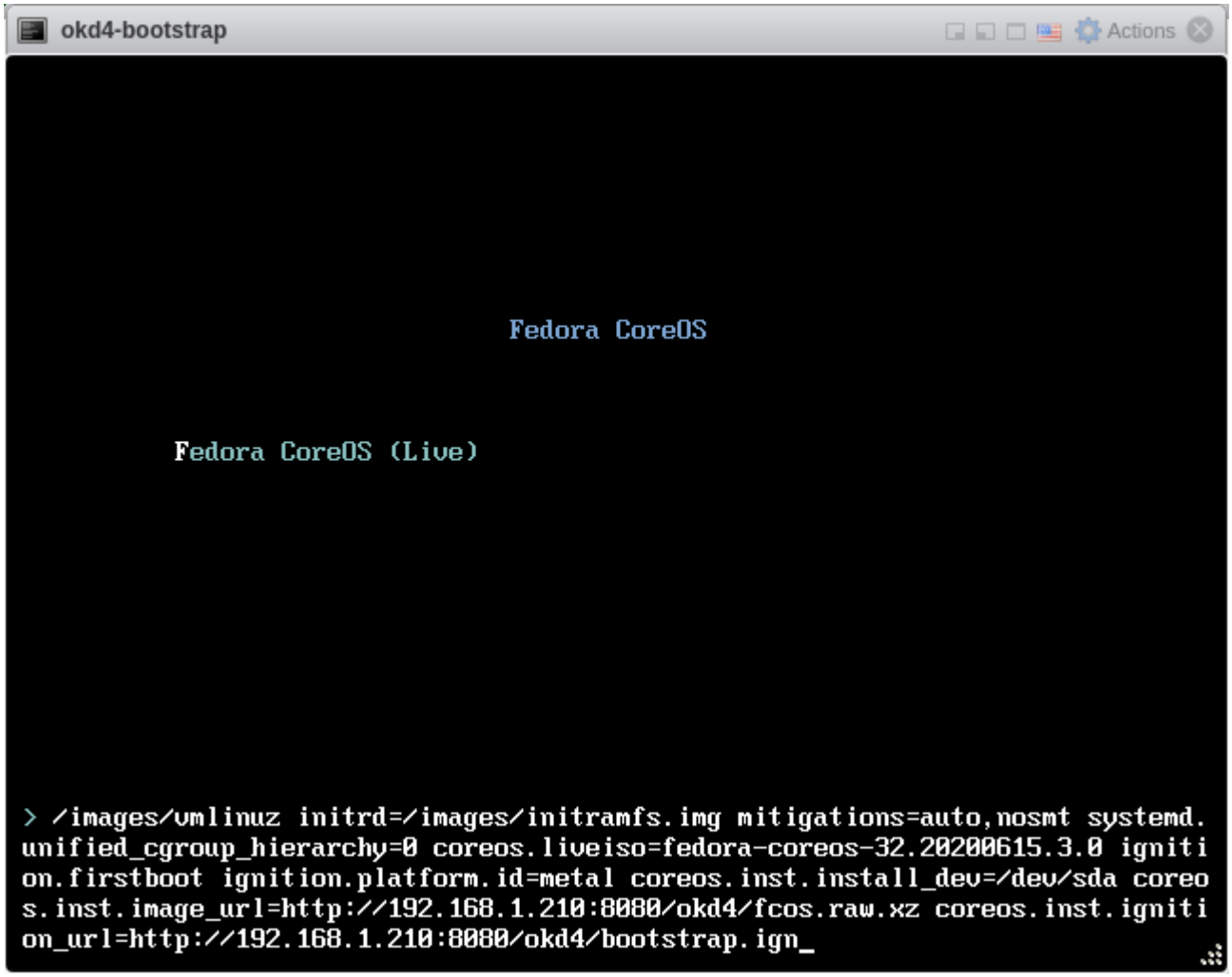
```
cd /var/www/html/okd4/
sudo wget
https://builds.coreos.fedoraproject.org/prod/streams/stable/builds/32
.20200629.3.0/x86_64/fedora-coreos-32.20200629.3.0-
metal.x86_64.raw.xz
sudo wget
https://builds.coreos.fedoraproject.org/prod/streams/stable/builds/32
.20200629.3.0/x86_64/fedora-coreos-32.20200629.3.0-
metal.x86_64.raw.xz.sig
sudo mv fedora-coreos-32.20200629.3.0-metal.x86_64.raw.xz fcos.raw.xz
sudo mv fedora-coreos-32.20200629.3.0-metal.x86_64.raw.xz.sig
fcos.raw.xz.sig
sudo chown -R apache: /var/www/html/
sudo chmod -R 755 /var/www/html/
```

. . .

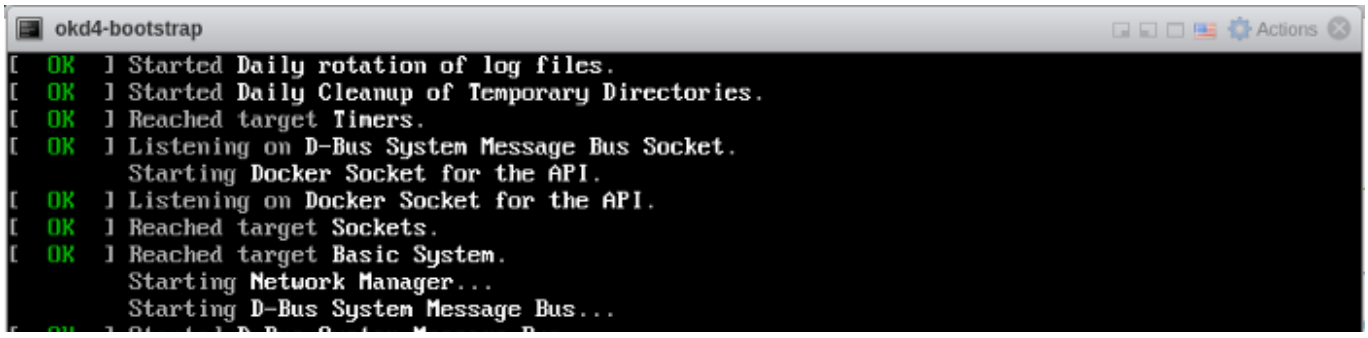
Starting the bootstrap node:

Power on the odk4-bootstrap VM. Press the TAB key to edit the kernel boot options and add the following:

```
coreos.inst.install_dev=/dev/sda
coreos.inst.image_url=http://192.168.1.210:8080/okd4/fcos.raw.xz
coreos.inst.ignition_url=http://192.168.1.210:8080/okd4/bootstrap.ign
```



You should see that the fcos.raw.gz image and signature are downloading:



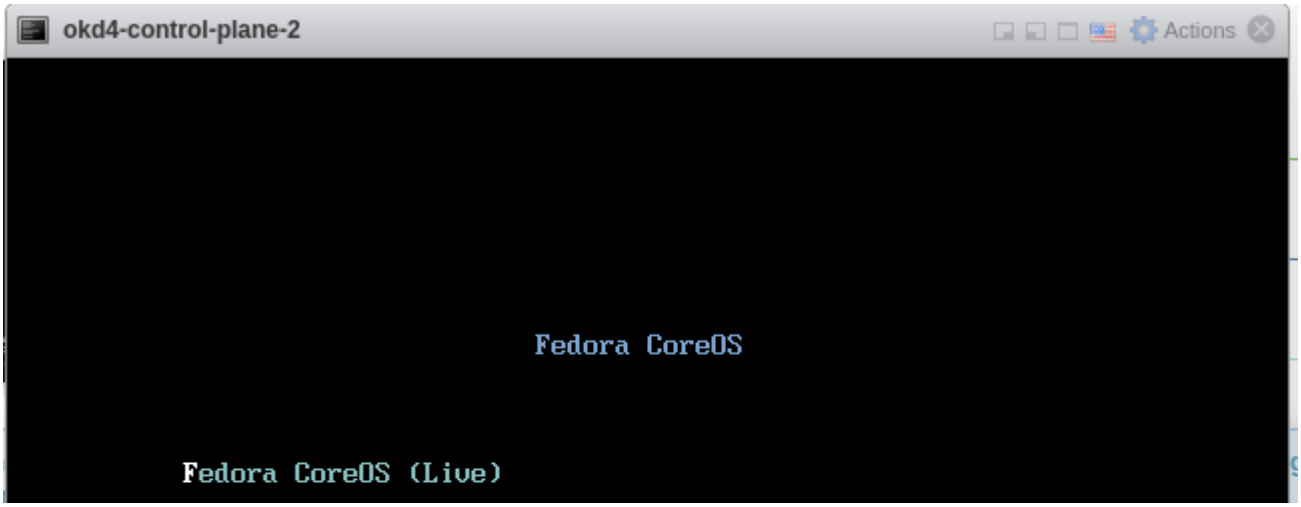
```
[  OK  ] Started D-Bus System Message Bus.
[  OK  ] Started Network Manager.
[  OK  ] Reached target Network.
         Starting Network Manager Wait Online...
         Starting Hostname Service...
[  OK  ] Started Hostname Service.
[  OK  ] Listening on Load/Save RF Kill Switch Status /dev/rfkill Watch.
         Starting Network Manager Script Dispatcher Service...
[  OK  ] Started Network Manager Script Dispatcher Service.
[  OK  ] Finished Network Manager Wait Online.
[  OK  ] Reached target Network is Online.
         Starting CoreOS Installer...
################################################################################ 100.0%
[   12.392624] coreos-installer-service[1073]: coreos-installer install /dev/sda --ignition /tmp/cor
eos-installer-fBbRRu --image-url http://192.168.1.210:8080/okd4/fcos.raw.xz
[   12.423413] coreos-installer-service[1094]: Downloading image from http://192.168.1.210:8080/okd4
/fcos.raw.xz
[   12.424616] coreos-installer-service[1094]: Downloading signature from http://192.168.1.210:8080/
okd4/fcos.raw.xz.sig
[   13.493506] coreos-installer-service[1094]: Read disk 29.6 MiB/481.2 MiB (6%)
[   14.493888] coreos-installer-service[1094]: Read disk 65.3 MiB/481.2 MiB (13%)
[   15.494417] coreos-installer-service[1094]: Read disk 74.4 MiB/481.2 MiB (15%)
[   16.694874] coreos-installer-service[1094]: Read disk 74.5 MiB/481.2 MiB (15%)
[   17.778351] coreos-installer-service[1094]: Read disk 74.7 MiB/481.2 MiB (15%)
[   18.779196] coreos-installer-service[1094]: Read disk 75.1 MiB/481.2 MiB (15%)
[   20.433895] coreos-installer-service[1094]: Read disk 75.6 MiB/481.2 MiB (15%)
```

. . .

Starting the control plane nodes:

Power on the control-plane nodes and press the TAB key to edit the kernel boot options and add the following, then press enter:

```
coreos.inst.install_dev=/dev/sda
coreos.inst.image_url=http://192.168.1.210:8080/okd4/fcos.raw.xz
coreos.inst.ignition_url=http://192.168.1.210:8080/okd4/master.ign
```



```
> /images/vmlinuz initrd=/images/initramfs.img mitigations=auto,nosmt systemd.
unified_cgroup_hierarchy=0 coreos.liveiso=fedora-coreos-32.20200615.3.0 igniti
on.firstboot ignition.platform.id=metal coreos.inst.install_dev=/dev/sda coreo
s.inst.image_url=http://192.168.1.210:8080/okd4/fcos.raw.xz coreos.inst.igniti
on_url=http://192.168.1.210:8080/okd4/master.ign_
```

You should see that the fcos.raw.gz image and signature are downloading:

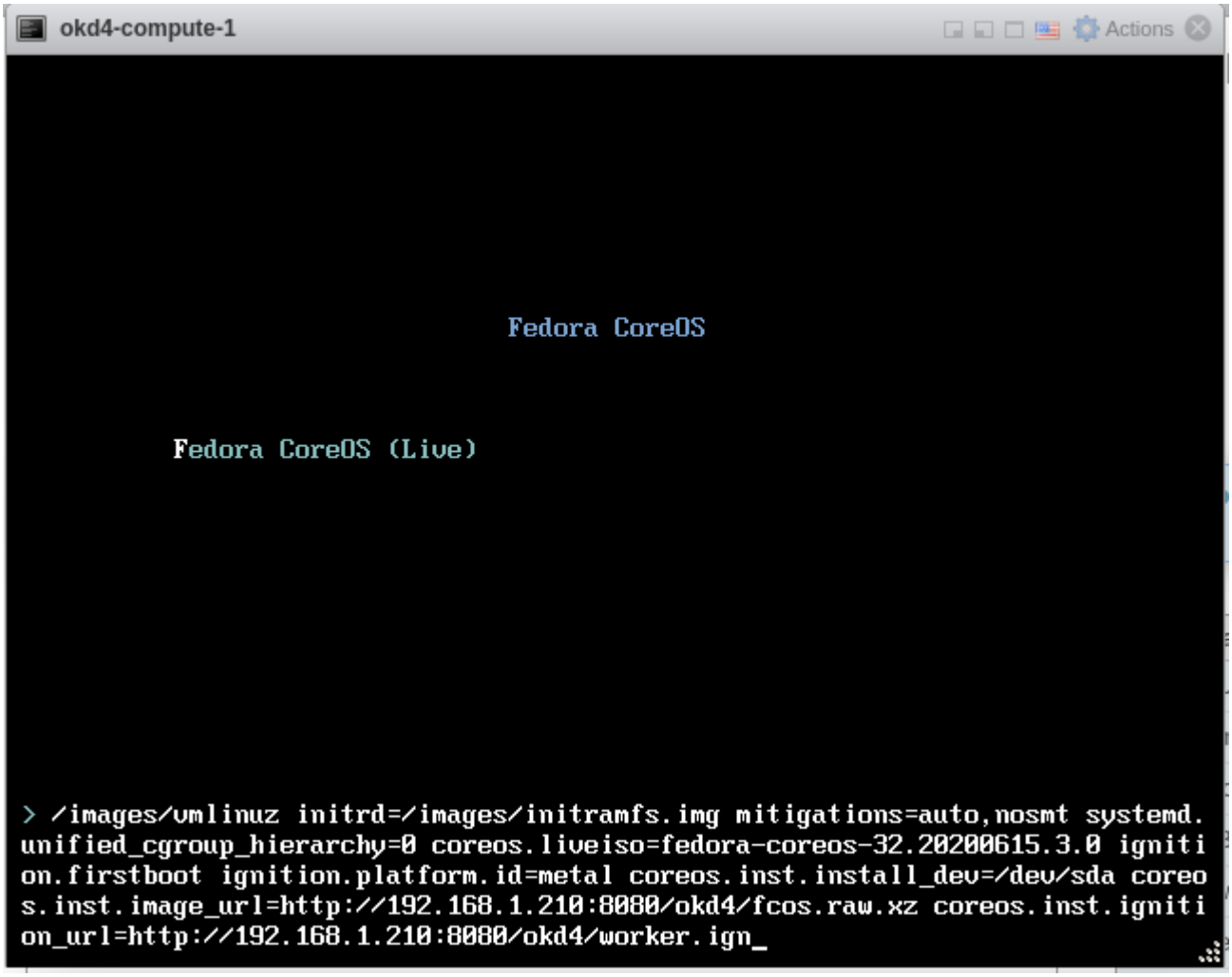
```
okd4-control-plane-2                                                    Actions
[  OK  ] Reached target Timers.
[  OK  ] Listening on D-Bus System Message Bus Socket.
         Starting Docker Socket for the API.
[  OK  ] Listening on Docker Socket for the API.
[  OK  ] Reached target Sockets.
[  OK  ] Reached target Basic System.
         Starting Network Manager...
         Starting D-Bus System Message Bus...
[  OK  ] Started D-Bus System Message Bus.
[  OK  ] Started Network Manager.
[  OK  ] Reached target Network.
         Starting Network Manager Wait Online...
         Starting Hostname Service...
[  OK  ] Started Hostname Service.
[  OK  ] Listening on Load/Save RF Kill Switch Status /dev/rfkill Watch.
         Starting Network Manager Script Dispatcher Service...
[  OK  ] Started Network Manager Script Dispatcher Service.
[  OK  ] Finished Network Manager Wait Online.
[  OK  ] Reached target Network is Online.
         Starting CoreOS Installer...
################################################################################ 100.0%
[   12.678788] coreos-installer-service[1077]: coreos-installer install /dev/sda --ignition /tmp/cor
eos-installer-f1GqNz --image-url http://192.168.1.210:8080/okd4/fcos.raw.xz
[   12.718790] coreos-installer-service[1094]: Downloading image from http://192.168.1.210:8080/okd4
/fcos.raw.xz
[   12.720319] coreos-installer-service[1094]: Downloading signature from http://192.168.1.210:8080/
okd4/fcos.raw.xz.sig
[   13.804845] coreos-installer-service[1094]: Read disk 28.0 MiB/481.2 MiB (5%)
[   14.805276] coreos-installer-service[1094]: Read disk 61.8 MiB/481.2 MiB (12%)
[   15.893925] coreos-installer-service[1094]: Read disk 74.3 MiB/481.2 MiB (15%)
[   17.352149] coreos-installer-service[1094]: Read disk 74.5 MiB/481.2 MiB (15%)
[   18.722067] coreos-installer-service[1094]: Read disk 74.7 MiB/481.2 MiB (15%)
[   19.881882] coreos-installer-service[1094]: Read disk 74.7 MiB/481.2 MiB (15%)
[   20.908220] coreos-installer-service[1094]: Read disk 75.5 MiB/481.2 MiB (15%)
[   21.916272] coreos-installer-service[1094]: Read disk 75.6 MiB/481.2 MiB (15%)
[   23.173243] coreos-installer-service[1094]: Read disk 87.2 MiB/481.2 MiB (18%)
```

. . .

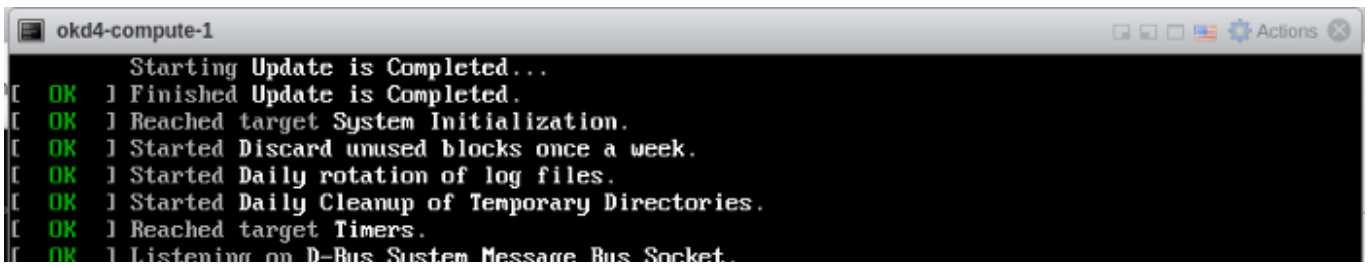
Starting the compute nodes:

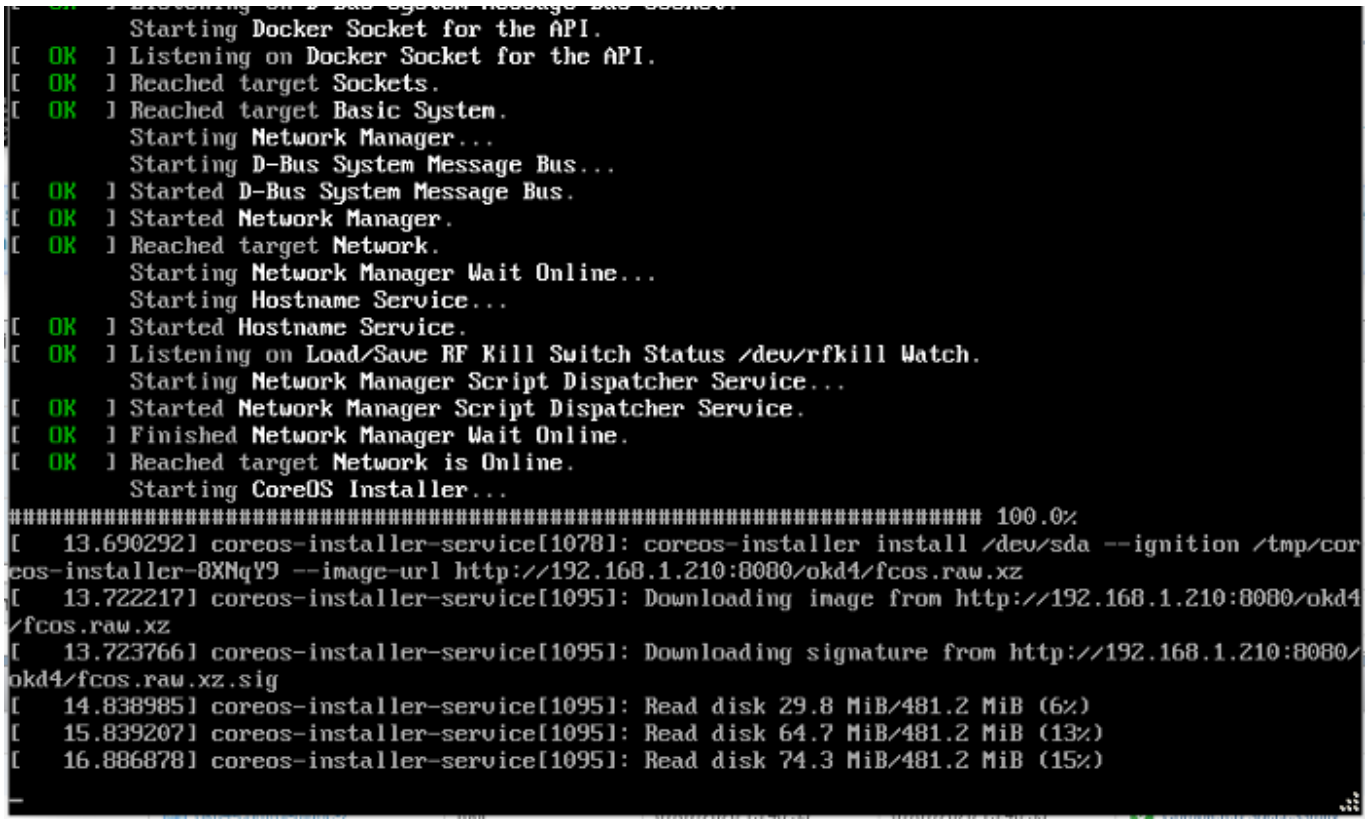
Power on the control-plane nodes and press the TAB key to edit the kernel boot options and add the following, then press enter:

```
coreos.inst.install_dev=/dev/sda
coreos.inst.image_url=http://192.168.1.210:8080/okd4/fcos.raw.xz
coreos.inst.ignition_url=http://192.168.1.210:8080/okd4/worker.ign
```

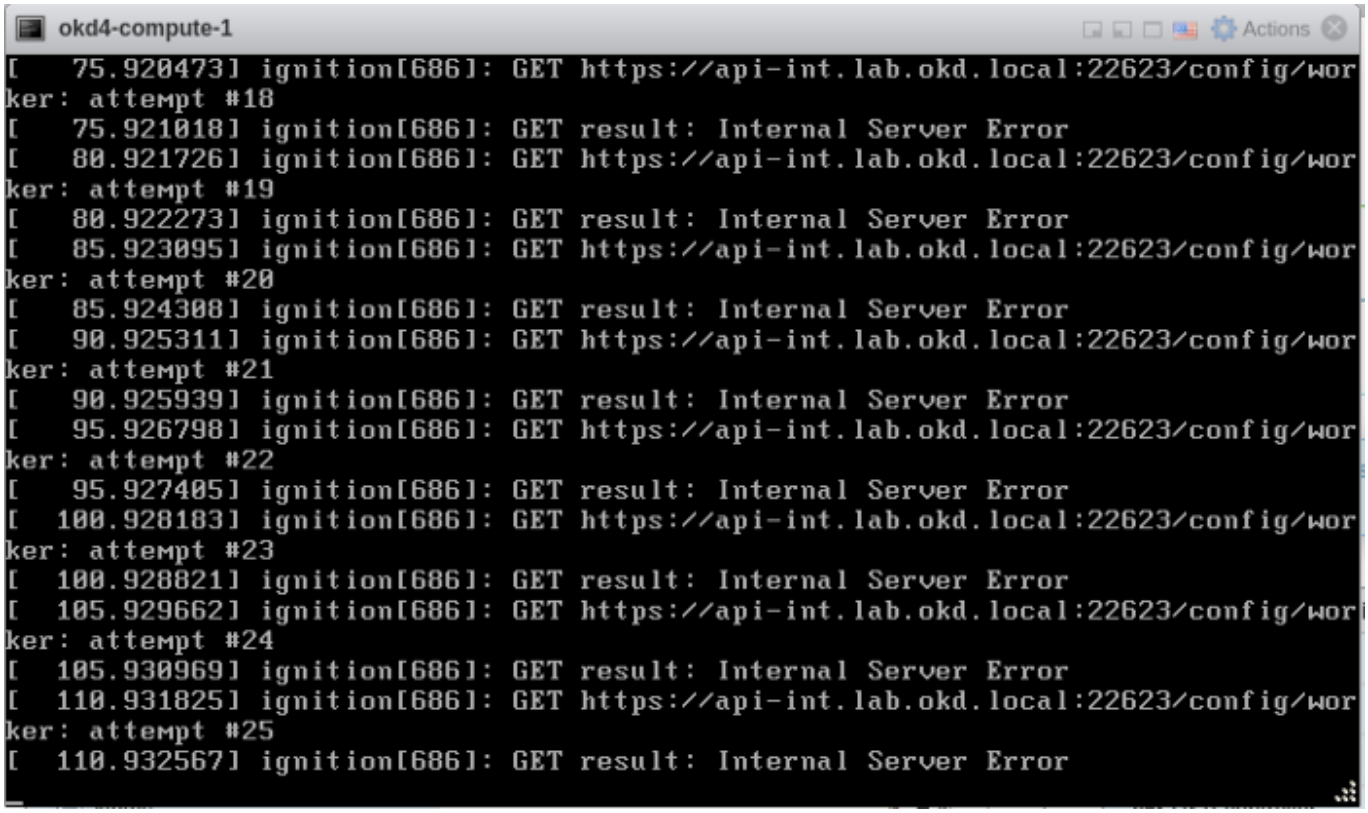


You should see that the fcos.raw.gz image and signature are downloading:





It is usual for the worker nodes to display the following until the bootstrap process complete:



. . .

Monitor the bootstrap installation:

You can monitor the bootstrap process from the okd4-services node:

```
openshift-install --dir=install_dir/ wait-for bootstrap-complete --
log-level=info
```

```
[crobinson@okd4-services ~]$ openshift-install --dir=install_dir/ wait-for boots
trap-complete --log-level=info
INFO Waiting up to 20m0s for the Kubernetes API at https://api.lab.okd.local:644
3...
INFO API v1.18.3 up
INFO Waiting up to 40m0s for bootstrapping to complete...
INFO It is now safe to remove the bootstrap resources
```

Once the bootstrap process is complete, which can take upwards of 30 minutes, you can shutdown your bootstrap node. Now is a good time to edit the /etc/haproxy/haproxy.cfg, comment out the bootstrap node, and reload the haproxy service.

```
sudo sed '/ okd4-bootstrap /s/^/#/' /etc/haproxy/haproxy.cfg
sudo systemctl reload haproxy
```

. . .

Login to the cluster and approve CSRs:

Now that the masters are online, you should be able to login with the oc client. Use the following commands to log in and check the status of your cluster:

```
export KUBECONFIG=~/install_dir/auth/kubeconfig
oc whoami
oc get nodes
oc get csr
```

```
[crobinson@okd4-services ~]$ export KUBECONFIG=~/install_dir/auth/kubeconfig
[crobinson@okd4-services ~]$ oc whoami
system:admin
[crobinson@okd4-services ~]$ oc get nodes
NAME                 STATUS   ROLES    AGE     VERSION
okd4-control-plane-1   Ready    master   17m     v1.18.3
okd4-control-plane-2   Ready    master   12m     v1.18.3
okd4-control-plane-3   Ready    master   9m54s   v1.18.3
[crobinson@okd4-services ~]$ oc get csr
NAME        AGE     SIGNERNAME                                    REQUESTOR
                                CONDITION
csr-2ggcf   10m     kubernetes.io/kube-apiserver-client-kubelet   system:serviceaccount:openshift-machine-confi
g-operator:node-bootstrapper   Approved,Issued
csr-2wjcp   17m     kubernetes.io/kube-apiserver-client-kubelet   system:serviceaccount:openshift-machine-confi
g-operator:node-bootstrapper   Approved,Issued
csr-4lqrm   4m52s   kubernetes.io/kube-apiserver-client-kubelet   system:serviceaccount:openshift-machine-confi
g-operator:node-bootstrapper   Pending
csr-bxjqn   12m     kubernetes.io/kubelet-serving                 system:node:okd4-control-plane-2
                                Approved,Issued
csr-c5mcj   3m33s   kubernetes.io/kube-apiserver-client-kubelet   system:serviceaccount:openshift-machine-confi
g-operator:node-bootstrapper   Pending
csr-pf92t   17m     kubernetes.io/kubelet-serving                 system:node:okd4-control-plane-1
                                Approved,Issued
csr-rf4vx   12m     kubernetes.io/kube-apiserver-client-kubelet   system:serviceaccount:openshift-machine-confi
g-operator:node-bootstrapper   Approved,Issued
csr-tgfvr   9m56s   kubernetes.io/kubelet-serving                 system:node:okd4-control-plane-3
                                Approved,Issued
```

You should only see the master nodes and several CSR's waiting for approval. Install the jq package to assist with approving multiple CSR's at once time.

```
wget -O jq https://github.com/stedolan/jq/releases/download/jq-
1.6/jq-linux64
chmod +x jq
sudo mv jq /usr/local/bin/
jq --version
```

```
[crobinson@okd4-services ~]$ wget -O jq https://github.com/stedolan/jq/releases/download/jq-
1.6/jq-linux64
--2020-07-07 16:05:41--  https://github.com/stedolan/jq/releases/download/jq-1.6/jq-linux64
Resolving github.com (github.com)... 140.82.114.4
Connecting to github.com (github.com)|140.82.114.4|:443... connected.
HTTP request sent, awaiting response... 302 Found
Location: https://github-production-release-asset-2e65be.s3.amazonaws.com/5101141/6387d980-d
e1f-11e8-8d3e-4455415aa408?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAIWNJYAX4CSV
EH53A%2F20200707%2Fus-east-1%2Fs3%2Faws4_request&X-Amz-Date=20200707T200358Z&X-Amz-Expires=3
00&X-Amz-Signature=5812bef9169856b24b2525bebcba78fe74e755c78319aa542265fdf8a85dcef9&X-Amz-Si
gnedHeaders=host&actor_id=0&repo_id=5101141&response-content-disposition=attachment%3B%20fil
ename%3Djq-linux64&response-content-type=application%2Foctet-stream [following]
--2020-07-07 16:05:41--  https://github-production-release-asset-2e65be.s3.amazonaws.com/510
1141/6387d980-de1f-11e8-8d3e-4455415aa408?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=
AKIAIWNJYAX4CSVEH53A%2F20200707%2Fus-east-1%2Fs3%2Faws4_request&X-Amz-Date=20200707T200358Z&
X-Amz-Expires=300&X-Amz-Signature=5812bef9169856b24b2525bebcba78fe74e755c78319aa542265fdf8a8
5dcef9&X-Amz-SignedHeaders=host&actor_id=0&repo_id=5101141&response-content-disposition=atta
chment%3B%20filename%3Djq-linux64&response-content-type=application%2Foctet-stream
Resolving github-production-release-asset-2e65be.s3.amazonaws.com (github-production-release
-asset-2e65be.s3.amazonaws.com)... 52.216.138.43
Connecting to github-production-release-asset-2e65be.s3.amazonaws.com (github-production-rel
```

```
ease-asset-2e65be.s3.amazonaws.com)|52.216.138.43|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 3953824 (3.8M) [application/octet-stream]
Saving to: 'jq'

jq                  100%[=========================>]   3.77M  6.81MB/s    in 0.6s

2020-07-07 16:05:42 (6.81 MB/s) - 'jq' saved [3953824/3953824]

[crobinson@okd4-services ~]$ chmod +x jq
[crobinson@okd4-services ~]$ sudo mv jq /usr/local/bin/
[crobinson@okd4-services ~]$ jq --version
jq-1.6
[crobinson@okd4-services ~]$
```

Approve all the pending certs and check your nodes:

```
oc get csr -ojson | jq -r '.items[] | select(.status == {} ) |
.metadata.name' | xargs oc adm certificate approve
```

```
[crobinson@okd4-services ~]$ oc get csr -ojson | jq -r '.items[] | select(.status == {} ) |
.metadata.name' | xargs oc adm certificate approve
certificatesigningrequest.certificates.k8s.io/csr-4lqrm approved
certificatesigningrequest.certificates.k8s.io/csr-c5mcj approved
[crobinson@okd4-services ~]$ oc get nodes
NAME                   STATUS     ROLES    AGE   VERSION
okd4-compute-1         NotReady   worker   2s    v1.18.3
okd4-control-plane-1   Ready      master   20m   v1.18.3
okd4-control-plane-2   Ready      master   15m   v1.18.3
okd4-control-plane-3   Ready      master   13m   v1.18.3
[crobinson@okd4-services ~]$ oc get nodes
NAME                   STATUS     ROLES    AGE   VERSION
okd4-compute-1         NotReady   worker   10s   v1.18.3
okd4-compute-2         NotReady   worker   8s    v1.18.3
okd4-control-plane-1   Ready      master   20m   v1.18.3
okd4-control-plane-2   Ready      master   16m   v1.18.3
okd4-control-plane-3   Ready      master   13m   v1.18.3
[crobinson@okd4-services ~]$
```

Check the status of the cluster operators.

```
oc get clusteroperators
```

```
[crobinson@okd4-services ~]$ oc get clusteroperators
NAME                                       VERSION                              AVAILABLE   PROGRESSING   DEGRADED   SINCE
authentication                                                                  False       True          False      2m28s
cloud-credential                           4.5.0-0.okd-2020-06-29-110348-beta6  True        False         False      29m
cluster-autoscaler                         4.5.0-0.okd-2020-06-29-110348-beta6  True        False         False      9m58s
config-operator                            4.5.0-0.okd-2020-06-29-110348-beta6  True        False         False      10m
console                                    4.5.0-0.okd-2020-06-29-110348-beta6  True        False         False      10s
csi-snapshot-controller                    4.5.0-0.okd-2020-06-29-110348-beta6  True        False         False      2m32s
dns                                        4.5.0-0.okd-2020-06-29-110348-beta6  True        False         False      20m
etcd                                       4.5.0-0.okd-2020-06-29-110348-beta6  True        False         False      18m
image-registry                             4.5.0-0.okd-2020-06-29-110348-beta6  True        False         False      11m
```

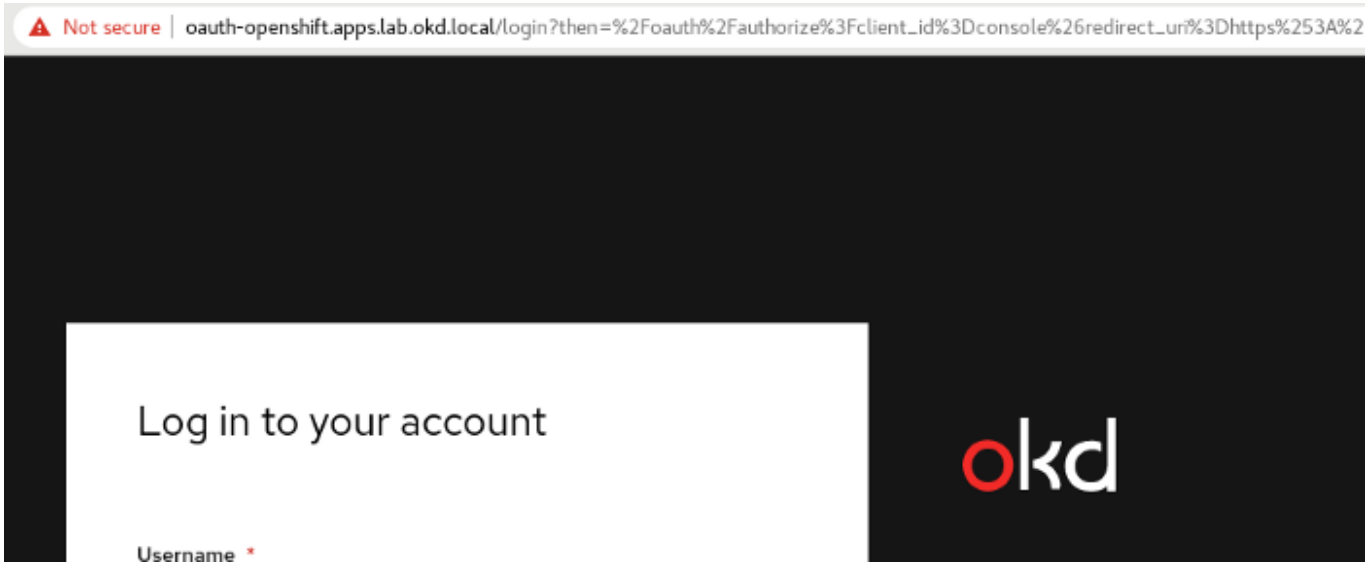
```
ingress                                    4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      2m51s
insights                                   4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      11m
kube-apiserver                             4.5.0-0.okd-2020-06-29-110348-beta6   True        True        False      14m
kube-controller-manager                    4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      20m
kube-scheduler                             4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      20m
kube-storage-version-migrator              4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      3m
machine-api                                4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      11m
machine-approver                           4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      16m
machine-config                             4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      19m
marketplace                                4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      10m
monitoring                                 4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      118s
network                                    4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      24m
node-tuning                                4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      23m
openshift-apiserver                        4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      12m
openshift-controller-manager               4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      11m
openshift-samples                          4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      8m44s
operator-lifecycle-manager                 4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      21m
operator-lifecycle-manager-catalog         4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      21m
operator-lifecycle-manager-packageserver   4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      15m
service-ca                                 4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      23m
storage                                    4.5.0-0.okd-2020-06-29-110348-beta6   True        False       False      11m
[crobinson@okd4-services ~]$
```

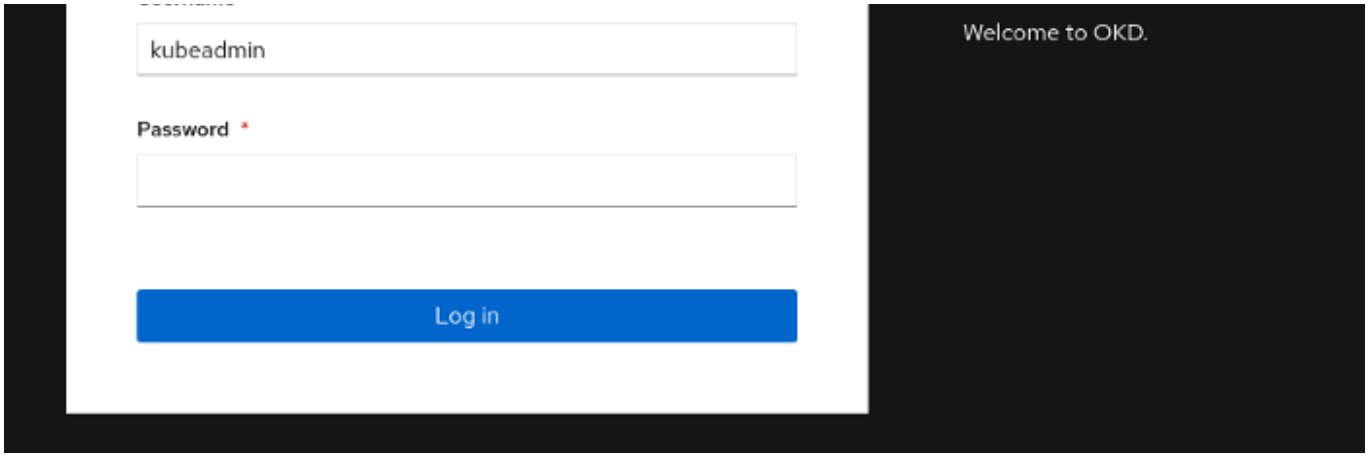
The console has just become available in my picture above. Get your kubeadmin password from the install_dir/auth folder and login to the web console:

```
cat install_dir/auth/kubeadmin-password
```

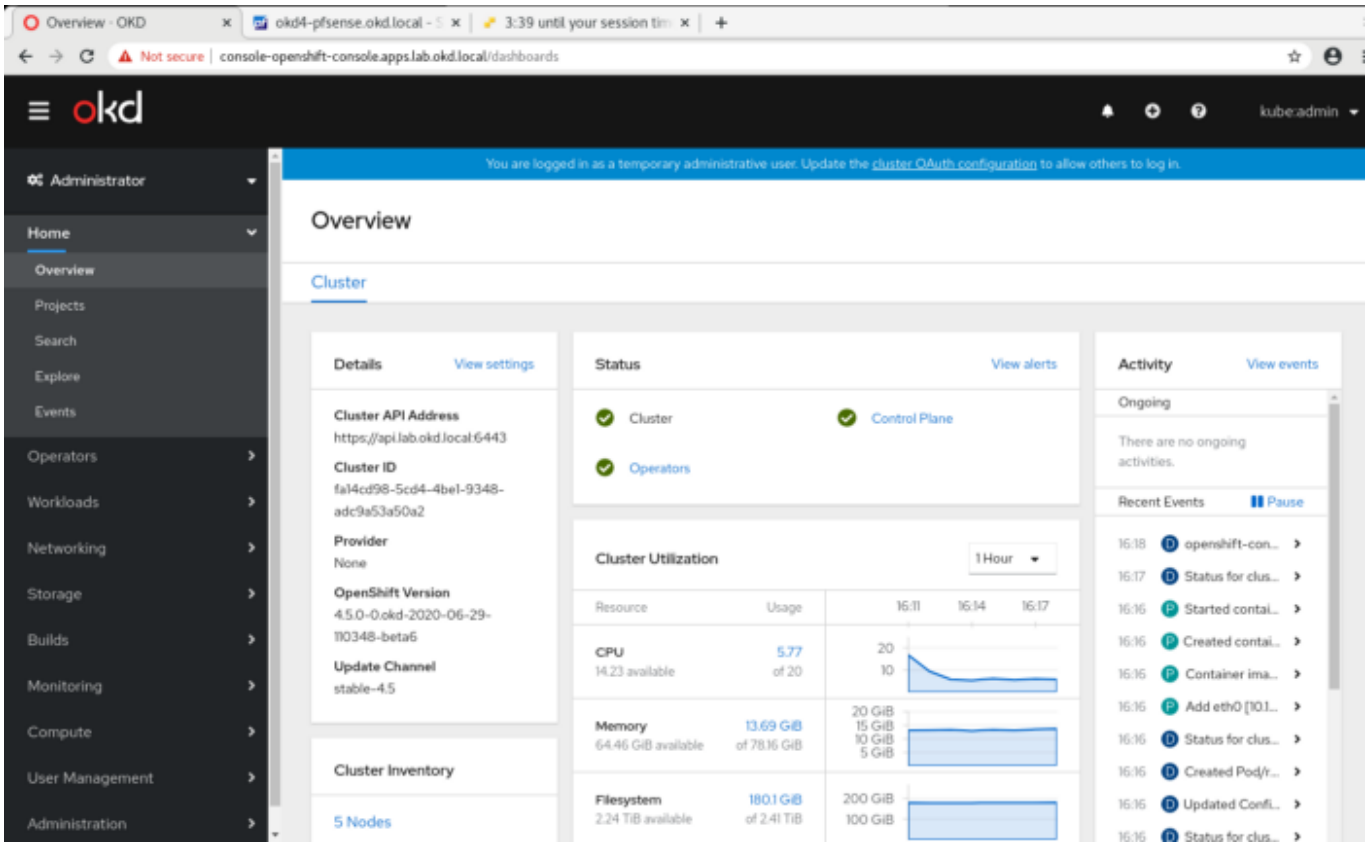
```
crobinson@okd4-services:~
File  Edit  View  Search  Terminal  Help
[crobinson@okd4-services ~]$ cat install_dir/auth/kubeadmin-password
xmLBi-xUC26-n3EU5-Mrtxb[crobinson@okd4-services ~]$
```

Open your web browser to https://console-openshift-console.apps.lab.okd.local/ and login as kubeadmin with the password from above:





The cluster status may still say upgrading, and it continues to finish the installation.



. . .

Persistent Storage:

We need to create some persistent storage for our registry before we can complete this project. Let's configure our okd4-services VM as an NFS server and use it for persistent storage.

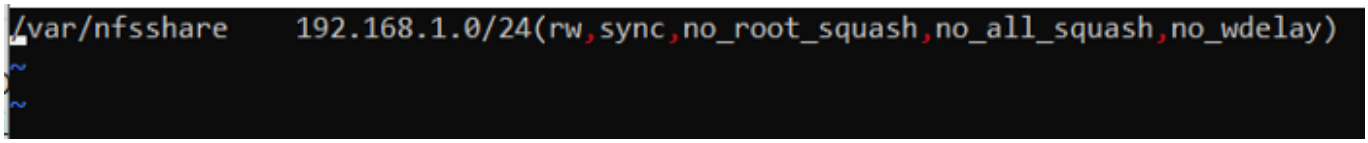
Login to your okd4-services VM and begin to set up an NFS server. The following commands install the necessary packages, enable services, and configure file and folder permissions.

```
sudo dnf install -y nfs-utils
sudo systemctl enable nfs-server rpcbind
sudo systemctl start nfs-server rpcbind
sudo mkdir -p /var/nfsshare/registry
sudo chmod -R 777 /var/nfsshare
sudo chown -R nobody:nobody /var/nfsshare
```

Create an NFS Export

Add this line in the new /etc/exports file "/var/nfsshare 192.168.1.0/24(rw,sync,no_root_squash,no_all_squash,no_wdelay)"

```
echo '/var/nfsshare
192.168.1.0/24(rw,sync,no_root_squash,no_all_squash,no_wdelay)' |
sudo tee /etc/exports
```



Restart the nfs-server service and add firewall rules:

```
sudo setsebool -P nfs_export_all_rw 1
sudo systemctl restart nfs-server
sudo firewall-cmd --permanent --zone=public --add-service mountd
sudo firewall-cmd --permanent --zone=public --add-service rpc-bind
sudo firewall-cmd --permanent --zone=public --add-service nfs
sudo firewall-cmd --reload
```

. . .

Registry configuration:

Create a persistent volume on the NFS share. Use the registry_py.yaml in okd4_files folder from the git repo:

```
oc create -f okd4_files/registry_pv.yaml
oc get pv
```

```
[crobinson@okd4-services ~]$ oc get pv
No resources found
[crobinson@okd4-services ~]$ oc create -f okd4_files/registry_pv.yaml
persistentvolume/registry-pv created
[crobinson@okd4-services ~]$ oc get pv
NAME          CAPACITY   ACCESS MODES   RECLAIM POLICY   STATUS      CLAIM   STORAGECLASS   REASON   AGE
registry-pv   100Gi      RWX            Retain           Available                                   1s
[crobinson@okd4-services ~]$
```

Edit the image-registry operator:

```
oc edit configs.imageregistry.operator.openshift.io
```

Change the managementState: from Removed to Managed. Under storage: add the pvc: and claim: blank to attach the PV and save your changes automatically:

```
managementState: Managed

storage:
    pvc:
      claim:
```

```
File  Edit  View  Search  Terminal  Help
        f:storage: {}
        f:storageManaged: {}
    manager: cluster-image-registry-operator
    operation: Update
    time: "2020-07-07T20:29:00Z"
  name: cluster
  resourceVersion: "28815"
  selfLink: /apis/imageregistry.operator.openshift.io/v1/configs/clu
  uid: d04a80b4-dfd4-4f6b-82db-07cf5c7cc136
spec:
```

```
  httpSecret: 6dad3c822fe59312785dafa707f3192d30de946cf21b3ac3da9359
  logging: 2
  managementState: Managed
  proxy: {}
  replicas: 1
  requests:
    read:
      maxWaitInQueue: 0s
    write:
      maxWaitInQueue: 0s
  rolloutStrategy: RollingUpdate
  storage:
    pvc:
      claim:
status:
  conditions:
```

Check your persistent volume, and it should now be claimed:

```
oc get pv
```

```
[crobinson@okd4-services ~]$ oc get pv
NAME          CAPACITY   ACCESS MODES   RECLAIM POLICY   STATUS   CLAIM
                        STORAGECLASS   REASON   AGE
registry-pv   100Gi      RWX            Retain           Bound    openshift-image-registry/i
mage-registry-storage                            5m19s
[crobinson@okd4-services ~]$
```

Check the export size, and it should be zero. In the next section, we will push to the registry, and the file size should not be zero.

```
du -sh /var/nfsshare/registry
```

```
[crobinson@okd4-services ~]$ du -sh /var/nfsshare/registry/
0       /var/nfsshare/registry/
[crobinson@okd4-services ~]$
```

In the next section, we will create a WordPress project and push it to the registry. After the push, the NFS export should show 200+ MB.

. . .

Create WordPress Project:

Create a new OKD project.

```
oc new-project wordpress-test
```

```
[crobinson@okd4-services ~]$ oc new-project wordpress-test
Now using project "wordpress-test" on server "https://api.lab.okd.local:6443".

You can add applications to this project with the 'new-app' command. For example, try:

    oc new-app ruby~https://github.com/sclorg/ruby-ex.git

to build a new example application in Ruby. Or use kubectl to deploy a simple Kubernetes app
lication:

    kubectl create deployment hello-node --image=gcr.io/hello-minikube-zero-install/hello-no
de

[crobinson@okd4-services ~]$
```

Create a new app using the centos php73 s2i image from docker hub and use the WordPress GitHub repo for the source. Expose the service to create a route.

```
oc new-app centos/php-73-
centos7~https://github.com/WordPress/WordPress.git
oc expose svc/wordpress
```

```
[crobinson@okd4-services ~]$ oc new-app centos/php-73-centos7~https://github.com/WordPress/W
ordPress.git

--> Found container image 83d5957 (2 weeks old) from Docker Hub for "centos/php-73-centos7"

    Apache 2.4 with PHP 7.3
    -----------------------
    PHP 7.3 available as container is a base platform for building and running various PHP 7
.3 applications and frameworks. PHP is an HTML-embedded scripting language. PHP attempts to
make it easy for developers to write dynamically generated web pages. PHP also offers built-
in database integration for several commercial and non-commercial database management system
s, so writing a database-enabled webpage with PHP is fairly simple. The most common use of P
HP coding is probably as a replacement for CGI scripts.

    Tags: builder, php, php73, rh-php73

    * An image stream tag will be created as "php-73-centos7:latest" that will track the sou
rce image
```

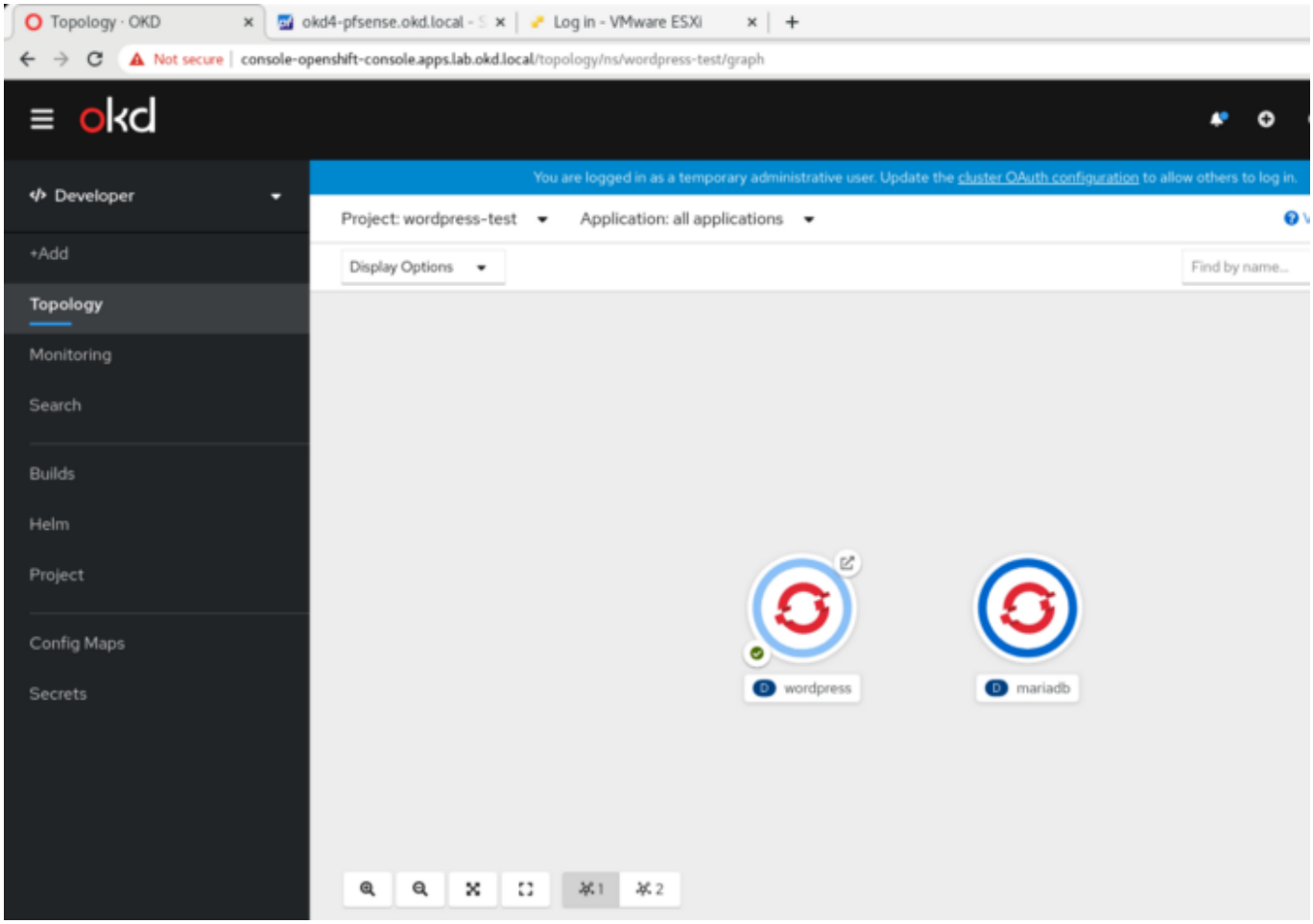
```
    * A source build using source code from https://github.com/WordPress/WordPress.git will
be created
      * The resulting image will be pushed to image stream tag "wordpress:latest"
      * Every time "php-73-centos7:latest" changes a new build will be triggered

--> Creating resources ...
    imagestream.image.openshift.io "php-73-centos7" created
    imagestream.image.openshift.io "wordpress" created
    buildconfig.build.openshift.io "wordpress" created
    deployment.apps "wordpress" created
    service "wordpress" created
--> Success
    Build scheduled, use 'oc logs -f bc/wordpress' to track its progress.
    Application is not exposed. You can expose services to the outside world by executing on
e or more of the commands below:
     'oc expose svc/wordpress'
    Run 'oc status' to view your app.
[crobinson@okd4-services ~]$ oc expose svc/wordpress
route.route.openshift.io/wordpress exposed
[crobinson@okd4-services ~]$
```

Create a new app using the centos7 MariaDB image with some environment variables:

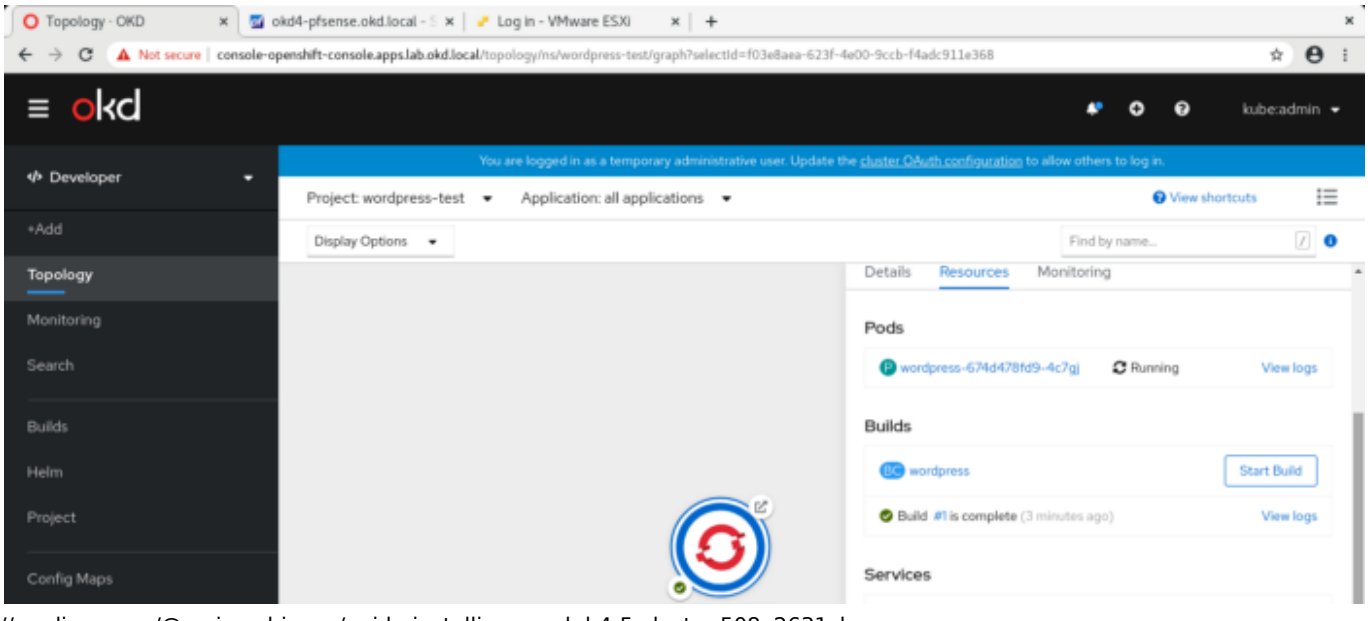
```
oc new-app centos/mariadb-103-centos7 --name mariadb --env
MYSQL_DATABASE=wordpress --env MYSQL_USER=wordpress --env
MYSQL_PASSWORD=wordpress
```

```
[crobinson@okd4-services ~]$ oc new-app centos/mariadb-103-centos7 --name mariadb --env MYSQ
L_DATABASE=wordpress --env MYSQL_USER=wordpress --env MYSQL_PASSWORD=wordpress
--> Found container image 000778a (4 days old) from Docker Hub for "centos/mariadb-103-cento
s7"

    MariaDB 10.3
    ------------
    MariaDB is a multi-user, multi-threaded SQL database server. The container image provide
s a containerized packaging of the MariaDB mysqld daemon and client application. The mysqld
server daemon accepts connections from clients and provides access to content from MariaDB d
atabases on behalf of the clients.

    Tags: database, mysql, mariadb, mariadb103, rh-mariadb103, galera

    * An image stream tag will be created as "mariadb:latest" that will track this image

--> Creating resources ...
    imagestream.image.openshift.io "mariadb" created
    deployment.apps "mariadb" created
    service "mariadb" created
--> Success
    Application is not exposed. You can expose services to the outside world by executing on
e or more of the commands below:
     'oc expose svc/mariadb'
    Run 'oc status' to view your app.
[crobinson@okd4-services ~]$
```

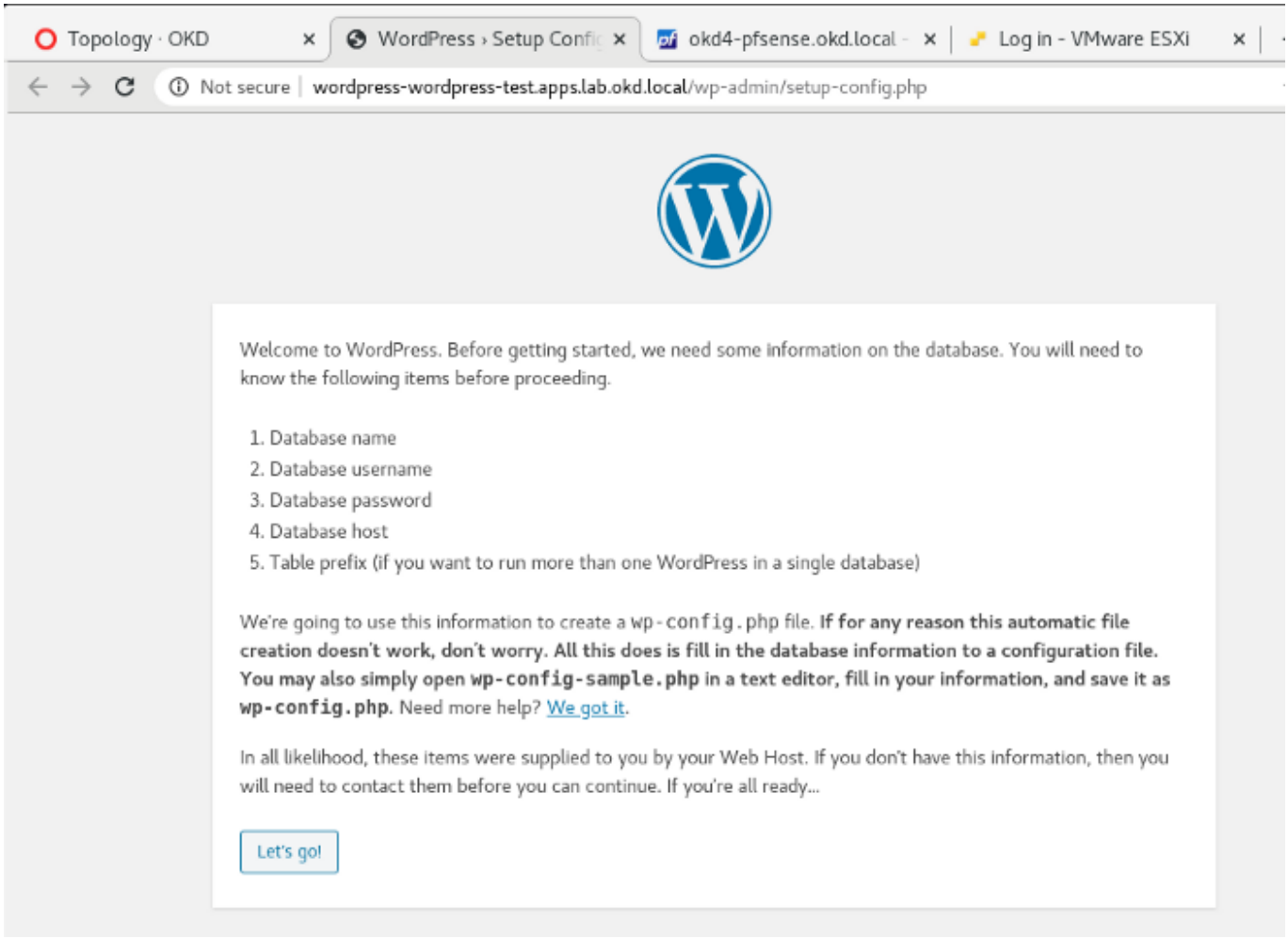
Open the OpenShift console and browse to the WordPress-test project. Once the WordPress image is built and ready, it will be dark blue like the MariaDB instance show here:



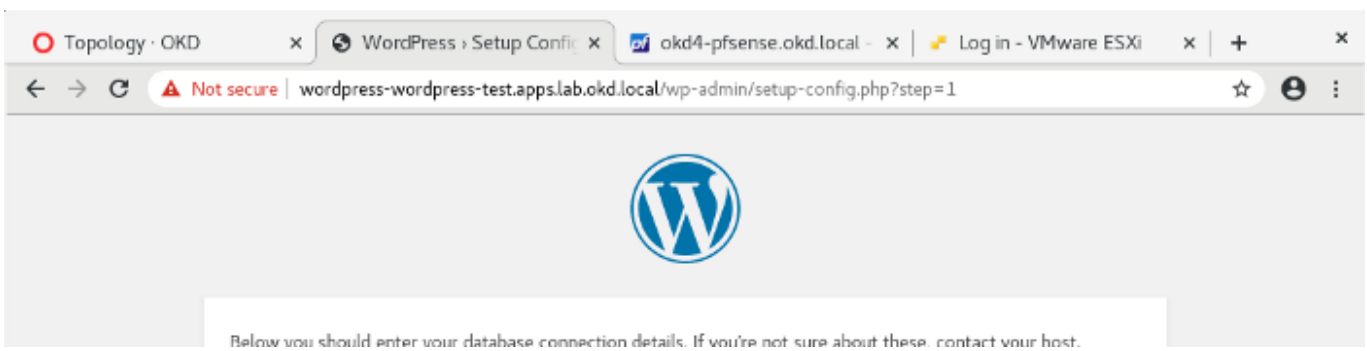
Click on the WordPress object and click on the route to open it in your web browser:

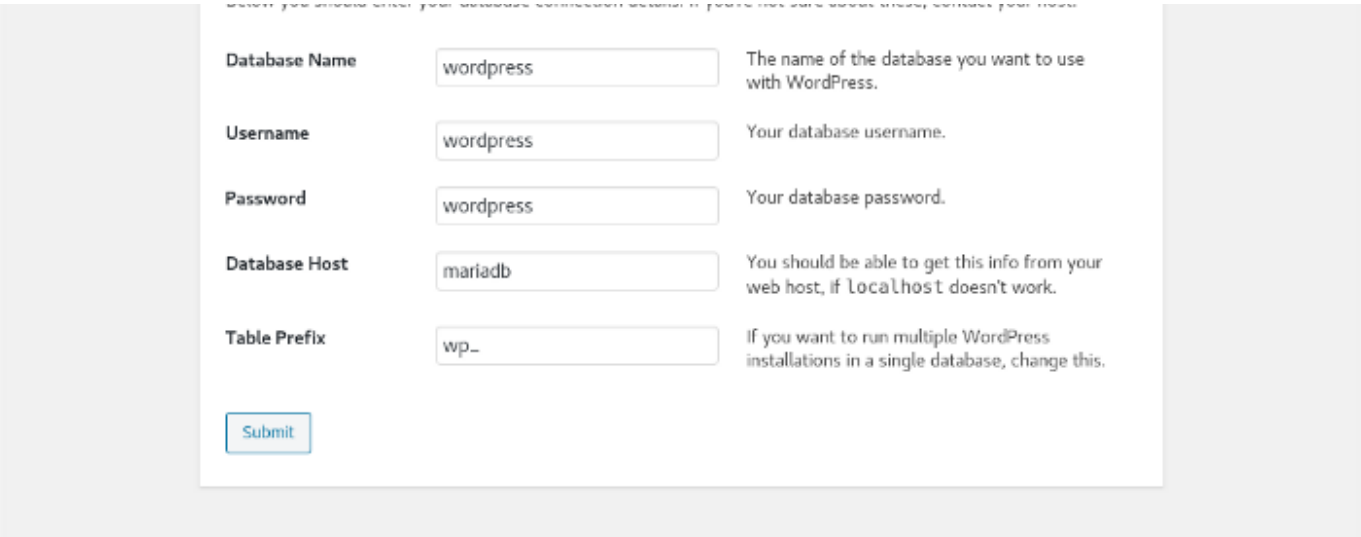


You should see the WordPress setup config, click Let's Go.

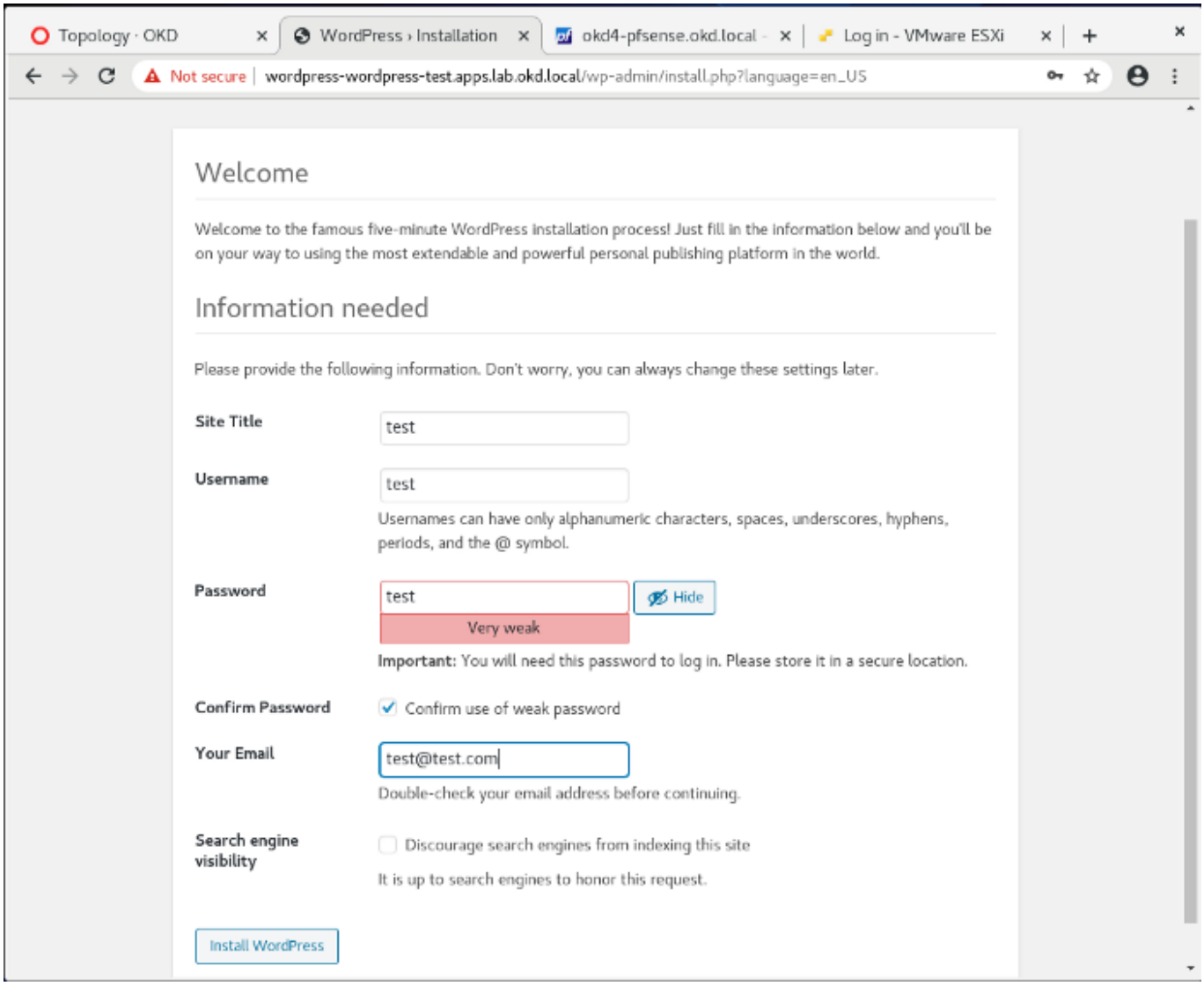


Fill in the database, username, password, and database host as pictured and run the installation:

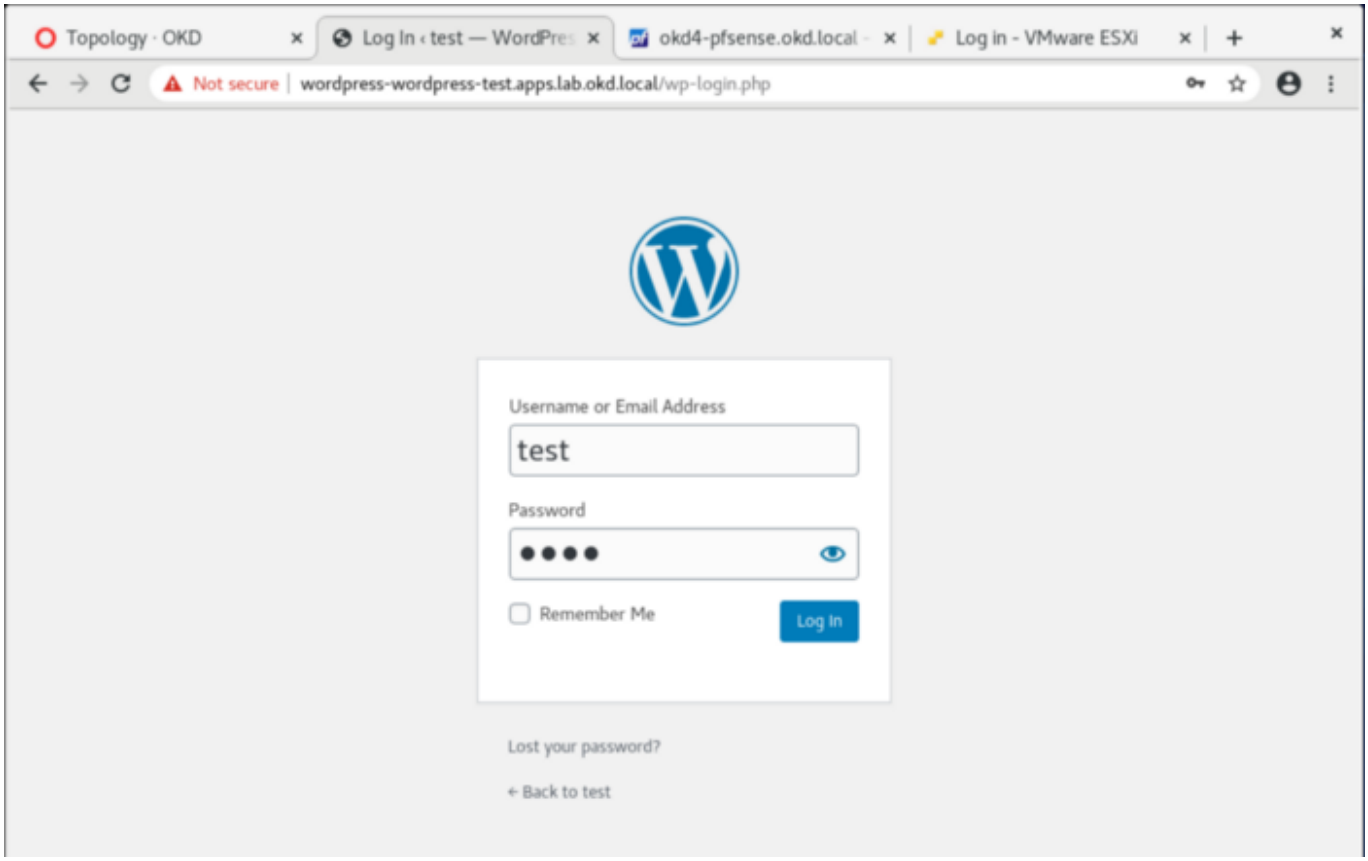


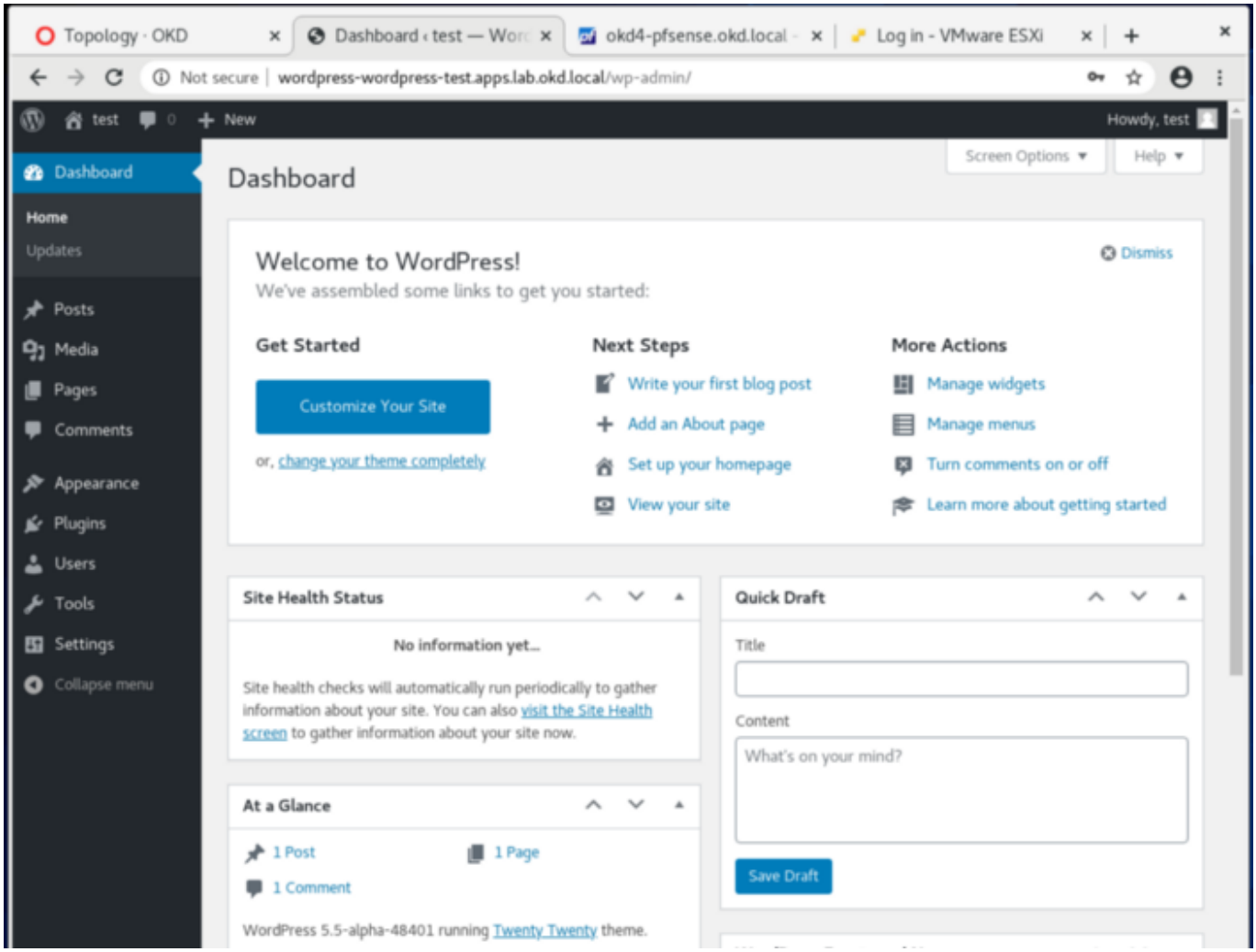


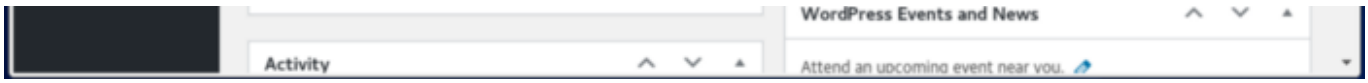
Fill out the welcome information and click Install WordPress.

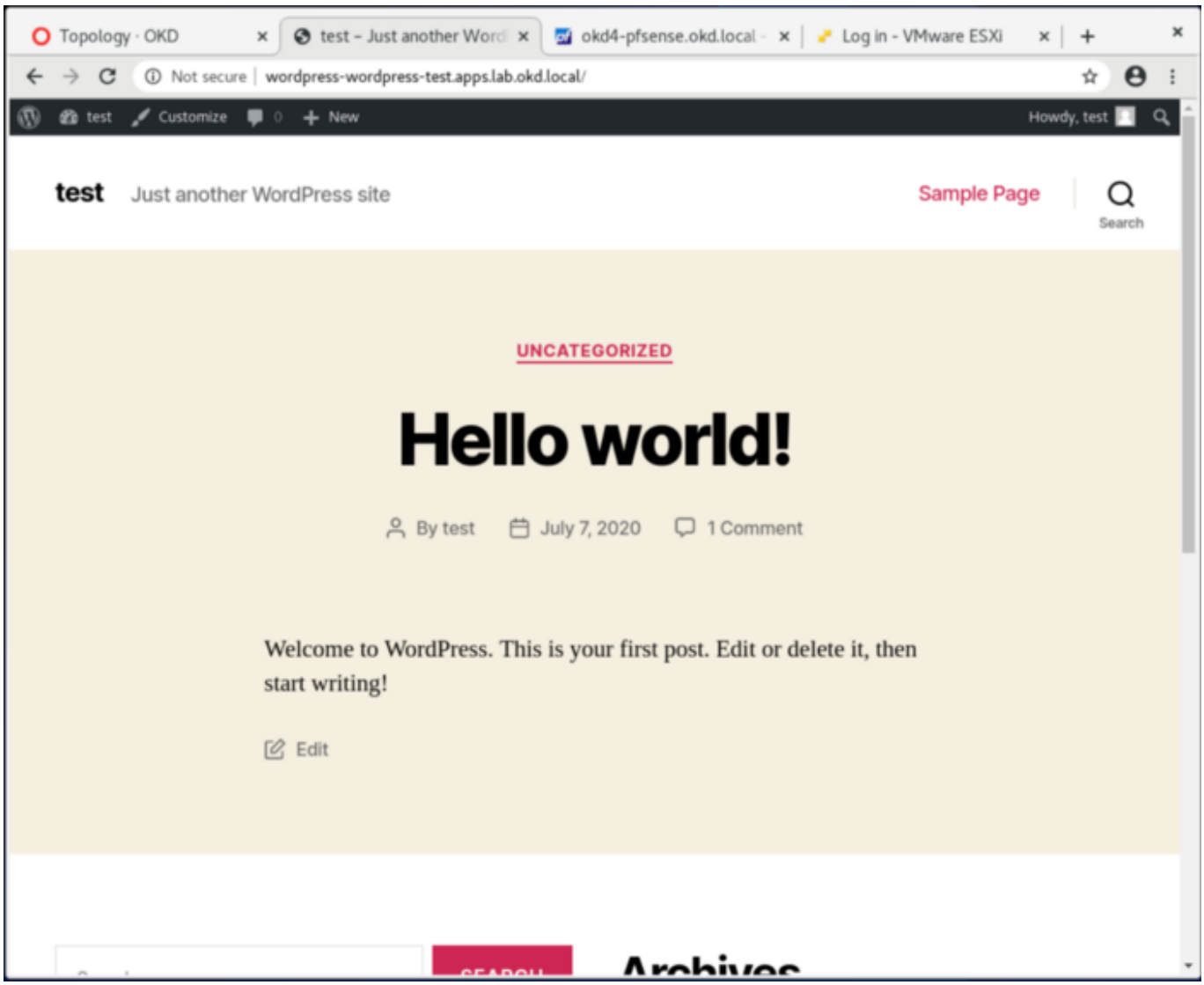


Log in, and you should have a working WordPress installation:


Topology · OKD
Log In ‹ test — WordPress
okd4-pfsense.okd.local
Log in - VMware ESXi
Not secure
wordpress-wordpress-test.apps.lab.okd.local/wp-login.php
Username or Email Address
test
Password
Remember Me
Log In
Lost your password?
← Back to test


Topology · OKD
Dashboard ‹ test — WordPress
okd4-pfsense.okd.local
Log in - VMware ESXi
Not secure
wordpress-wordpress-test.apps.lab.okd.local/wp-admin/
test
New
Howdy, test
Dashboard
Home
Updates
Posts
Media
Pages
Comments
Appearance
Plugins
Users
Tools
Settings
Collapse menu
Screen Options
Help
Welcome to WordPress!
We've assembled some links to get you started:
Dismiss
Get Started
Customize Your Site
or, change your theme completely
Next Steps
Write your first blog post
Add an About page
Set up your homepage
View your site
More Actions
Manage widgets
Manage menus
Turn comments on or off
Learn more about getting started
Site Health Status
No information yet...
Site health checks will automatically run periodically to gather information about your site. You can also visit the Site Health screen to gather information about your site now.
Quick Draft
Title
Content
What's on your mind?
Save Draft
At a Glance
1 Post
1 Page
1 Comment
WordPress 5.5-alpha-48401 running Twenty Twenty theme.





Check the size of your NFS export on the okd4-services VM. It should be around 300MB in size.

```
du -sh /var/nfsshare/registry/
```

```
[crobinson@okd4-services ~]$ du -sh /var/nfsshare/registry/
272M    /var/nfsshare/registry/
[crobinson@okd4-services ~]$
```

You have just verified your persistent volume is working.

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HTPasswd Setup:

The kubeadmin is a temporary user. The easiest way to set up a local user is with htpasswd.

```
cd
cd okd4_files
htpasswd -c -B -b users.htpasswd testuser testpassword
```

```
[crobinson@okd4-services okd4_files]$ cd
[crobinson@okd4-services ~]$ cd okd4_files/
[crobinson@okd4-services okd4_files]$ htpasswd -c -B -b users.htpasswd testuser testpassword
Adding password for user testuser
[crobinson@okd4-services okd4_files]$
```

Create a secret in the openshift-config project using the users.htpasswd file you generated:

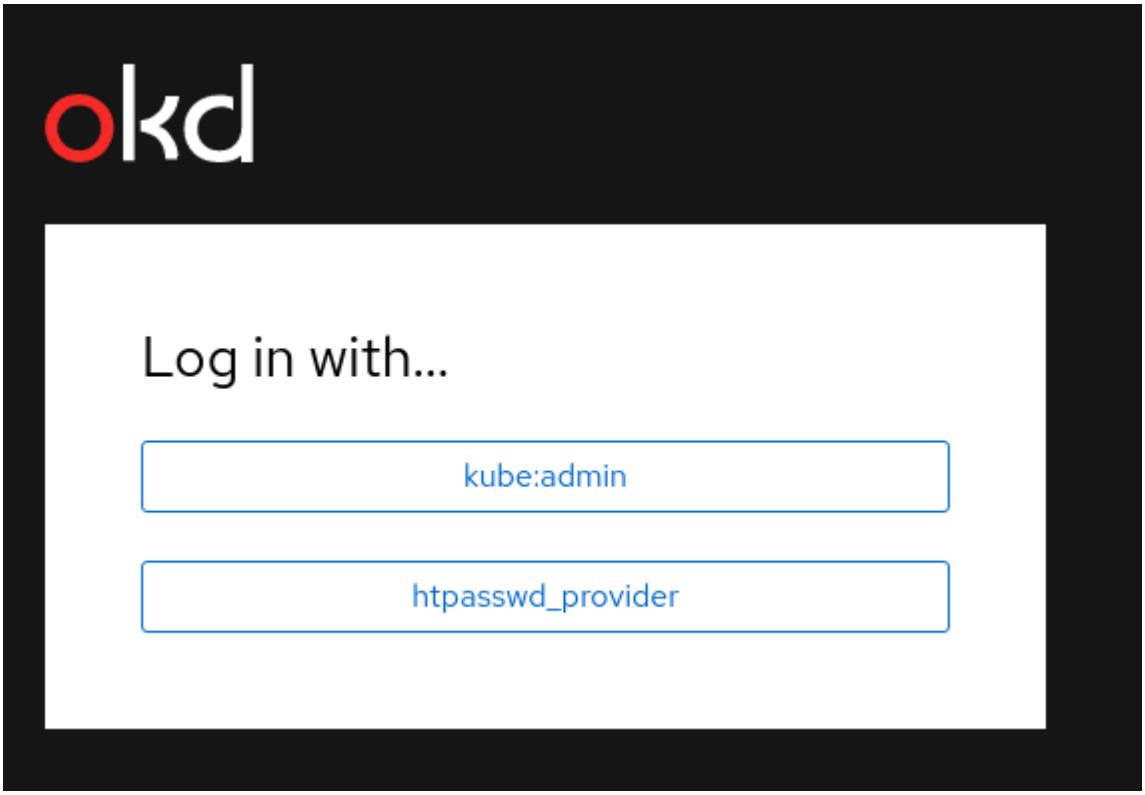
```
oc create secret generic htpass-secret --from-
file=htpasswd=users.htpasswd -n openshift-config
```

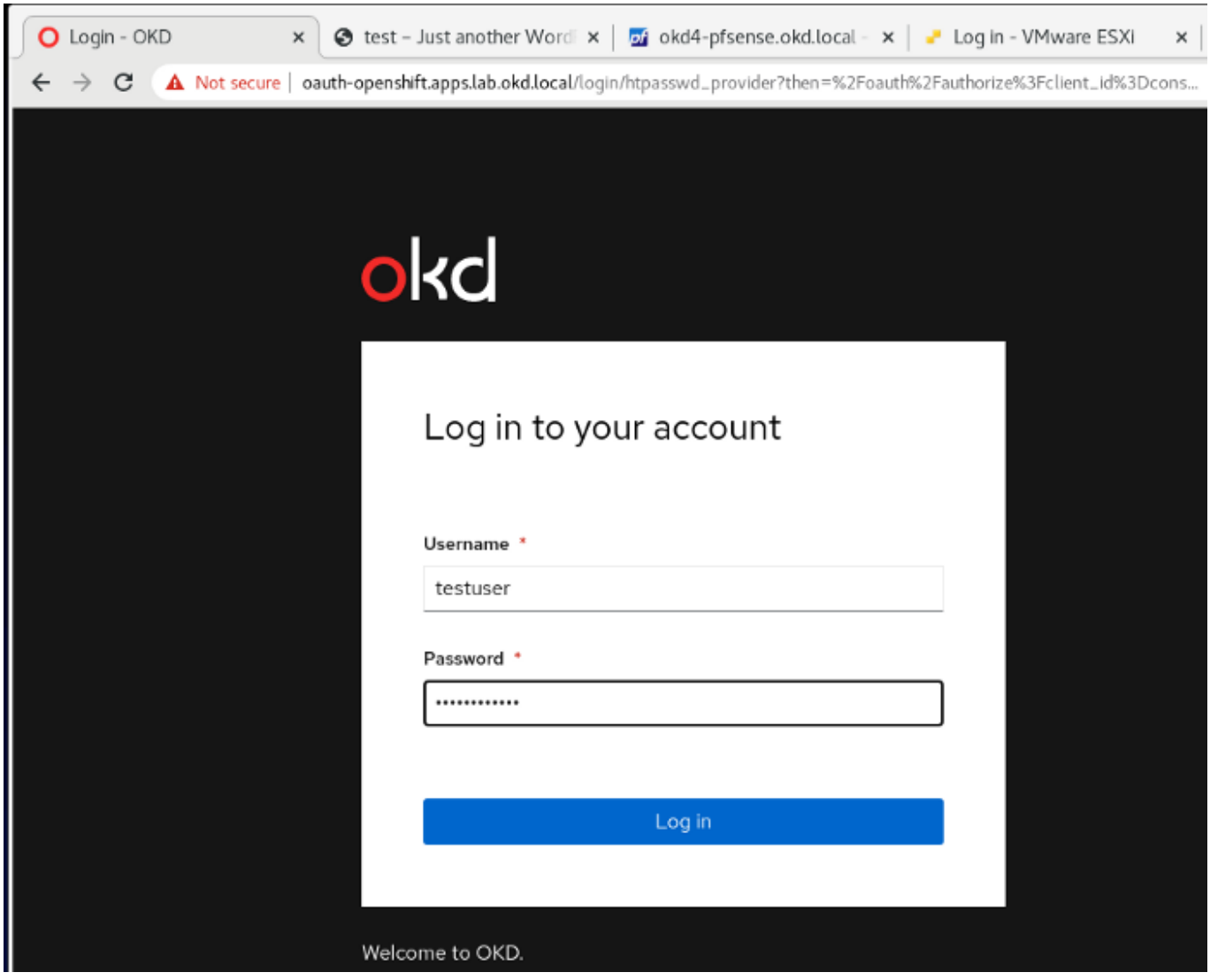
Add the identity provider.

```
oc apply -f htpasswd_provider.yaml
```

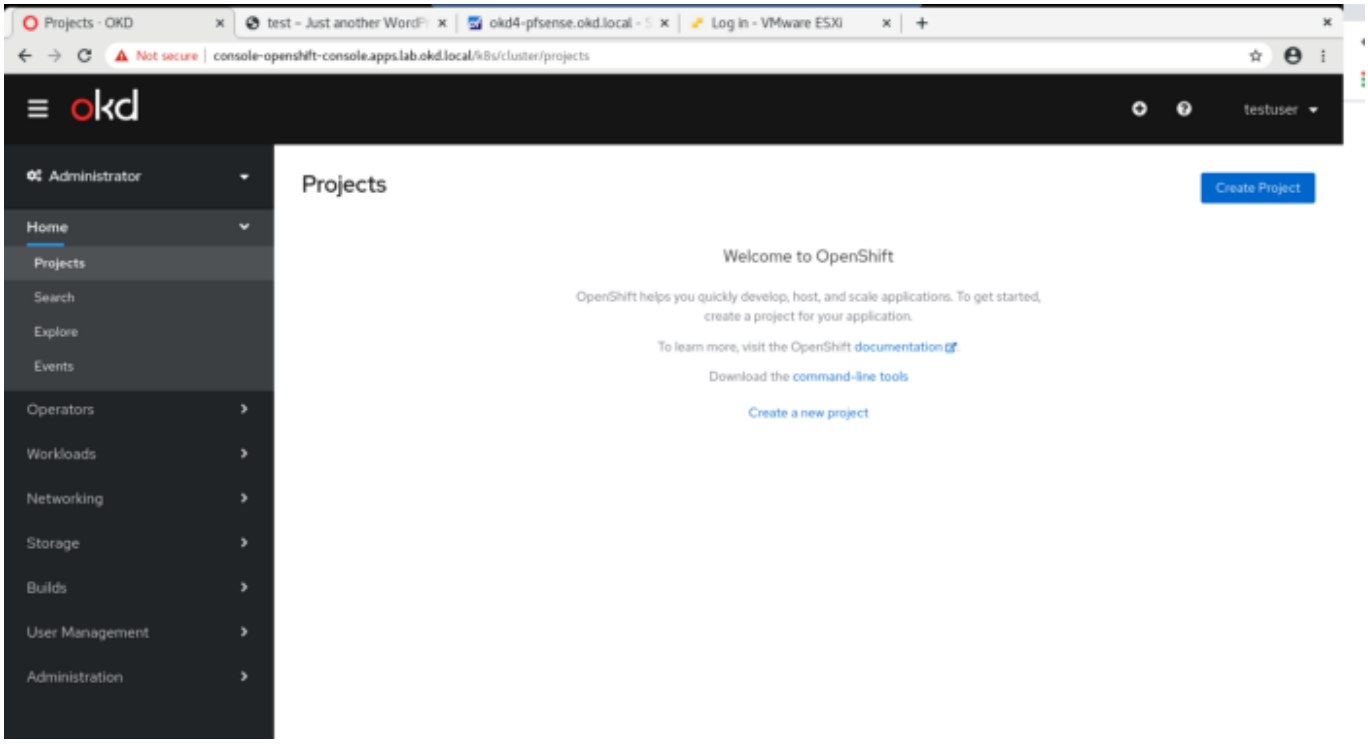
```
[crobinson@okd4-services okd4_files]$ oc apply -f htpasswd_provider.yaml
Warning: oc apply should be used on resource created by either oc create --save-config or oc
 apply
oauth.config.openshift.io/cluster configured
[crobinson@okd4-services okd4_files]$
```

Logout of the OpenShift Console. Then select htpasswd_provider and login with testuser and testpassword credentials.


okd
Log in with...
kube:admin
htpasswd_provider


Login - OKD
test – Just another Word
okd4-pfsense.okd.local
Log in - VMware ESXI
Not secure
oauth-openshift.apps.lab.okd.local/login/htpasswd_provider?then=%2Foauth%2Fauthorize%3Fclient_id%3Dcons...
okd
Log in to your account
Username *
testuser
Password *
Log in
Welcome to OKD.

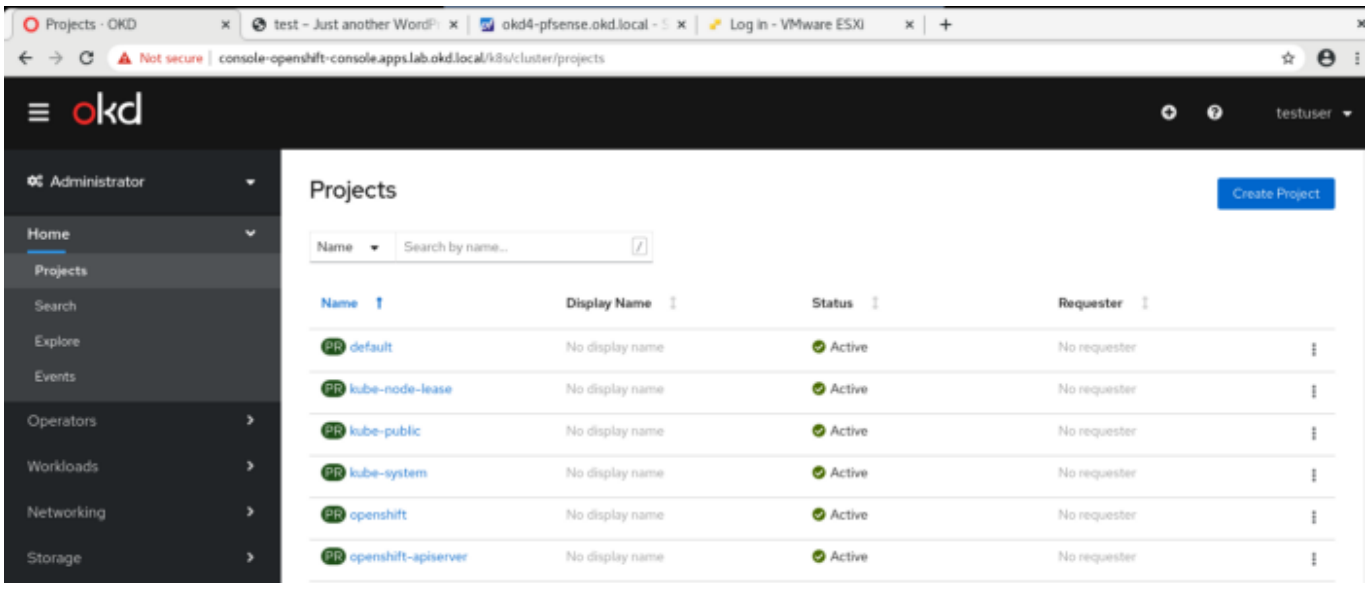
If you visit the Administrator page you should see no projects:



Give yourself cluster-admin access, and the projects should immediately populate:

```
oc adm policy add-cluster-role-to-user cluster-admin testuser
```

Your user should now have cluster-admin level access:



. . .

Congrats! You have created an OKD Cluster!

Hopefully, you have created an OKD cluster and learned a few things along the way. At this point, you should have a decent basis to tinker with OpenShift continue to learn.

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Here are some resources available to help you along your journey:

To report issues, use the OKD Github Repo: https://github.com/openshift/okd

For support check out the #openshift-users channel on k8s Slack

The OKD Working Group meets bi-weekly to discuss the development and next steps. The meeting schedule and location are tracked in the openshift/community repo.

Google group for okd-wg: https://groups.google.com/forum/#!forum/okd-wg

Openshift Kubernetes Homelab Okd Coreos