Lab: Run Applications as Containers and Pods

Run a web server as a pod and insert a debug page that displays diagnostic information.

Outcomes

- Deploy a pod from a container image.
- Retrieve the status and events of a pod.
- Troubleshoot a failed pod.
- Edit pod resources.
- Copy files to a running pod for diagnostic purposes.
- Use port forwarding to connect to a running pod.

As the `student` user on the `workstation` machine, use the `lab` command to prepare your system for this exercise.

This command ensures that exercise resources are available.

```
[student@workstation ~]$ lab start pods-review
```

Instructions

The API URL of your OpenShift cluster is https://api.ocp4.example.com:6443, and the `oc` command is already installed on your `workstation` machine.

Log in to the OpenShift cluster as the `developer` user with `developer` as the password.

Use the `pods-review` project for your work.

1. Log in to the OpenShift cluster and change to the `pods-review` project.

   Log in to the OpenShift cluster.

   ```
   [student@workstation ~]$ oc login -u developer -p developer \
   https://api.ocp4.example.com:6443
   ...output omitted...
   ```

   Select the `pods-review` project.

   ```
   [student@workstation ~]$ oc project pods-review
   Already on project "pods-review" on server "https://api.ocp4.example.com:6443".
   ```

2. Deploy a pod named `webphp` that uses the `registry.ocp4.example.com:8443/redhattraining/webphp:v1` container image. Determine why the pod fails to start.

Deploy a pod named `webphp` that uses the `registry.ocp4.example.com:8443/redhattra`

```
[student@workstation ~]$ oc run webphp \
  --image=registry.ocp4.example.com:8443/redhattraining/webphp:v1
pod/webphp created
```

After a few moments, observe the status of the `webphp` pod.

```
[student@workstation ~]$ oc get pods
NAME     READY   STATUS             RESTARTS     AGE
webphp   0/1     CrashLoopBackOff   1 (4s ago)   7s
[student@workstation ~]$ oc get pods
NAME     READY   STATUS    RESTARTS     AGE
webphp   0/1     Error     2 (24s ago)   7s
```

The pod failed to start.

Retrieve the cluster events.

```
[student@workstation ~]$ oc get events
LAST SEEN   TYPE      REASON           OBJECT       MESSAGE
3m25s       Normal    Scheduled        pod/webphp   Successfully assigned pods-rev
3m23s       Normal    AddedInterface   pod/webphp   Add eth0 [10.8.0.73/23] from o
3m23s       Normal    Pulling          pod/webphp   Pulling image "registry.ocp4.e
p:v1"
3m15s       Normal    Pulled           pod/webphp   Successfully pulled image "reg
aining/webphp:v1" in 9.432s (9.432s including waiting). Image size: 292899537 byte
104s        Normal    Created          pod/webphp   Created container webphp
104s        Normal    Started          pod/webphp   Started container webphp
104s        Normal    Pulled           pod/webphp   Container image "registry.ocp4
php:v1" already present on machine
103s        Warning   BackOff          pod/webphp   Back-off restarting failed con
iew(1a1d3055-5250-4a80-9600-9008a5a4b601)
```

Retrieve the logs for the `webphp` pod.

```
[student@workstation ~]$ oc logs webphp
[15-Aug-2025 18:46:56] NOTICE: [pool www] 'user' directive is ignored when FPM is
[15-Aug-2025 18:46:56] NOTICE: [pool www] 'group' directive is ignored when FPM is
[15-Aug-2025 18:46:56] ERROR: unable to bind listening socket for address '/run/ph
(13)
[15-Aug-2025 18:46:56] ERROR: FPM initialization failed
AH00558: httpd: Could not reliably determine the server's fully qualified domain n
rName' directive globally to suppress this message
(13)Permission denied: AH00058: Error retrieving pid file run/httpd.pid
AH00059: Remove it before continuing if it is corrupted.
```

The logs indicate permission issues with the `/run` directory within the pod.

3. Troubleshoot the failed `webphp` pod by creating a debug pod.

Create a debug pod to troubleshoot the failed `webphp` pod.

```
[student@workstation ~]$ oc debug pod/webphp
Starting pod/webphp-debug-mfbxx ...
Pod IP: 10.8.0.87
If you don't see a command prompt, try pressing enter.
sh-4.4$
```

List the contents of the `/run` directory to retrieve the permissions, owners, and groups.

```
sh-4.4$ ls -la /run
total 0
drwxr-xr-x. 1 root root   42 Aug 15 18:47 .
dr-xr-xr-x. 1 root root   17 Aug 15 18:47 ..
-rw-r--r--. 1 root root    0 Aug 15 18:47 .containerenv
drwx--x---. 3 root apache 26 Dec 20 18:42 httpd
drwxr-xr-x. 2 root root    6 Nov 3 11:10  lock
drwxr-xr-x. 2 root root    6 Dec 20 18:42 php-fpm
drwxr-xr-x. 4 root root   80 Aug 15 18:47 secrets
```

The `/run/httpd` directory grants read, write, and execute permissions to the `root` user, b
the `root` group.

Retrieve the UID and GID of the user in the container. Determine whether the user is a p
the `root` group.

```
sh-4.4$ id
uid=1000770000(1000680000) gid=0(root) groups=0(root),1000770000
```

Your UID and GID values might differ from the previous output.

The user is an unprivileged, `non-root` user and belongs to the `root` group, which does n
Therefore, the user in the container cannot access the files and directories that the cont
for arbitrarily assigned UIDs.

Exit the debug pod.

```
sh-4.4$ exit
exit

Removing debug pod ...
```

4. The application developer resolved the identified issue in the `registry.ocp4.example.com:8443/redhattraining/webphp:v2` container image. In a terminal window, edit the `webphp` pod resource to use the `v2` image tag. Retrieve the status of the `webphp` pod. Then, confirm that the user in the container is an unprivileged user and belongs to the `root` group. Confirm that the `root` group permissions are correct for the `/run/httpd` directory.

Use the terminal to edit the `webphp` pod resource.

```
[student@workstation ~]$ oc edit pod/webphp
```

Update the `.spec.containers.image` object value to use the `:v2` image tag.

```
...output omitted...
spec:
  containers:
  - image: registry.ocp4.example.com:8443/redhattraining/webphp:v2
    imagePullPolicy: IfNotPresent
...output omitted...
```

Verify the status of the `webphp` pod.

```
[student@workstation ~]$ oc get pods
NAME          READY   STATUS    RESTARTS       AGE
webphp        1/1     Running   9 (2m9s ago)   18m
```

Retrieve the UID and GID of the user in the container to confirm that the user is an unpr

```
[student@workstation ~]$ oc exec -it webphp -- id
uid=1000680000(1000680000) gid=0(root) groups=0(root),1000680000
```

Your UID and GID values might differ from the previous output.

Confirm that the permissions for the `/run/httpd` directory are correct.

```
[student@workstation ~]$ oc exec -it webphp -- ls -la /run/
total 0
drwxr-xr-x. 1 root root 70 Dec 20 19:01 .
dr-xr-xr-x. 1 root root 39 Dec 20 19:01 ..
-rw-r--r--. 1 root root  0 Dec 20 18:45 .containerenv
drwxrwx---. 1 root root 41 Dec 20 19:01 httpd
drwxr-xr-x. 2 root root  6 Oct 26 11:10 lock
drwxrwxr-x. 1 root root 41 Dec 20 19:01 php-fpm
drwxr-xr-x. 4 root root 80 Dec 20 19:01 secrets
```

5. Connect port `8080` on the `Workstation` machine to port `8080` on the `webphp` pod. In a new terminal window, retrieve the content of the pod's `127.0.0.1:8080/index.php` web page to confirm that the pod is operational.

> **NOTE**
>
> The terminal window that you connect to the `webphp` pod must remain open for the remainder of the lab. This connection is necessary for the final lab step and for the `lab grade` command.

Connect to port `8080` on the `webphp` pod.

```
[student@workstation ~]$ oc port-forward pod/webphp 8080:8080
Forwarding from 127.0.0.1:8080 -> 8080
Forwarding from [::1]:8080 -> 8080
```

Open a second terminal window and then retrieve the `127.0.0.1:8080/index.php` web p

```
[student@workstation ~]$ curl 127.0.0.1:8080/index.php
<html>
<body>
Hello, World!
</body>
</html>
```

6. An issue occurs with the PHP application that is running on the `webphp` pod. To debug the issue, the application developer requires diagnostic and configuration information for the PHP instance that is running on the `webphp` pod.

   The `~/DO180/labs/pods-review` directory contains a `phpinfo.php` file to generate debugging information for a PHP instance. Copy the `phpinfo.php` file to the `/var/www/html/` directory on the `webphp` pod.

Then, confirm that the PHP debugging information is displayed when accessing the `127.0.0.1:8080/phpinfo.php` from a web browser.

NOTE

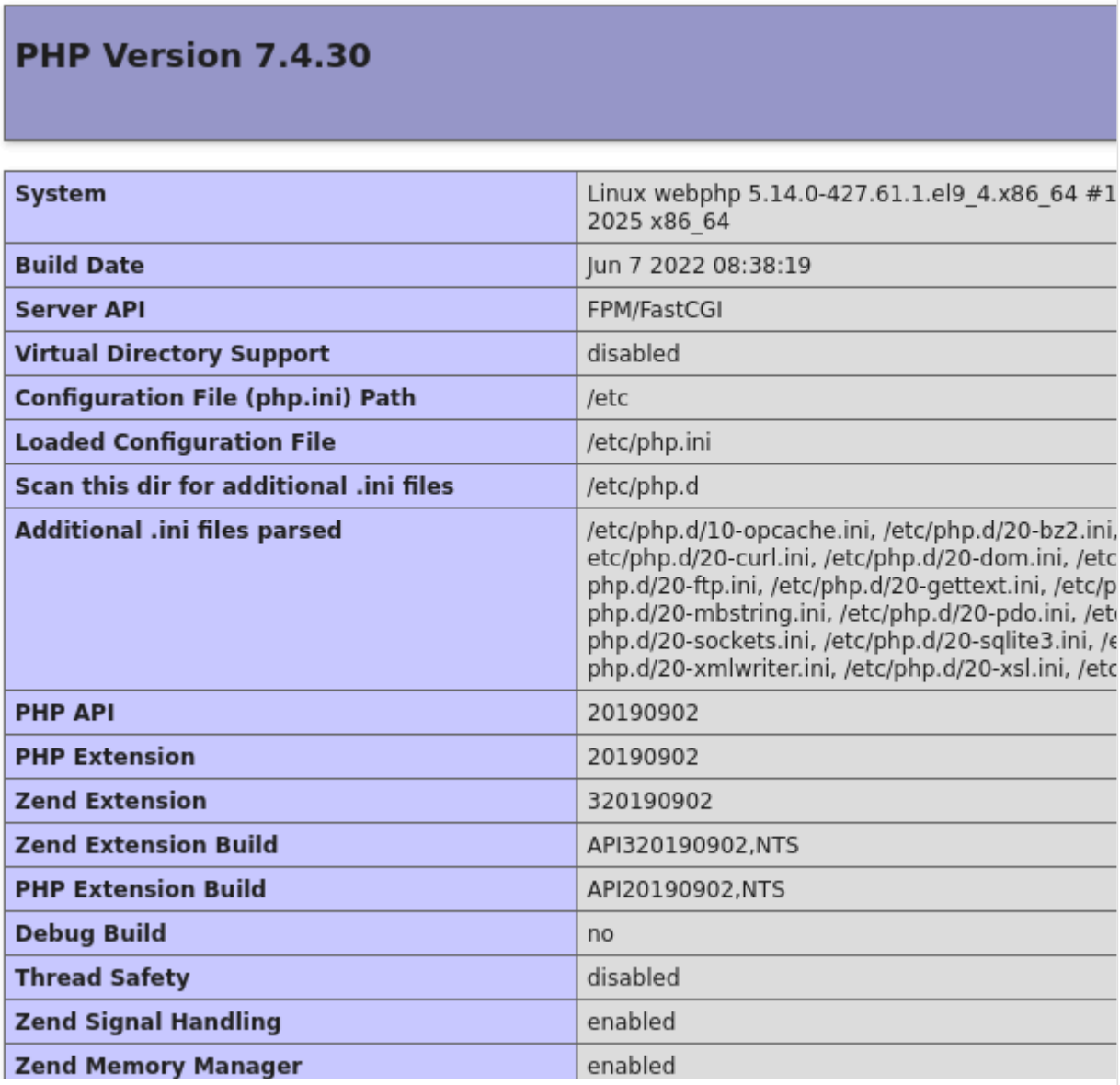
After running the `lab grade` command in the second terminal, return to the terminal that is executing the `oc port-forward` command, and press **Ctrl**+**C** to end the connection.

```
[student@workstation ~]$ oc port-forward pod/webphp 8080:8080
Forwarding from 127.0.0.1:8080 -> 8080
Forwarding from [::1]:8080 -> 8080
Handling connection for 8080
^C[student@workstation ~]$
```

In the second terminal, copy the `~/DO180/labs/pods-review/phpinfo.php` file to the `webp` the `/var/www/html/phpinfo.php` file.

```
[student@workstation ~]$ oc cp ~/DO180/labs/pods-review/phpinfo.php \
  webphp:/var/www/html/phpinfo.php
```

Open a web browser and access the `127.0.0.1:8080/phpinfo.php` web page. Confirm th displayed.



PHP Version 7.4.30

System	Linux webphp 5.14.0-427.61.1.el9_4.x86_64 #1 2025 x86_64
Build Date	Jun 7 2022 08:38:19
Server API	FPM/FastCGI
Virtual Directory Support	disabled
Configuration File (php.ini) Path	/etc
Loaded Configuration File	/etc/php.ini
Scan this dir for additional .ini files	/etc/php.d
Additional .ini files parsed	/etc/php.d/10-opcache.ini, /etc/php.d/20-bz2.ini, etc/php.d/20-curl.ini, /etc/php.d/20-dom.ini, /etc php.d/20-ftp.ini, /etc/php.d/20-gettext.ini, /etc/p php.d/20-mbstring.ini, /etc/php.d/20-pdo.ini, /et php.d/20-sockets.ini, /etc/php.d/20-sqlite3.ini, /e php.d/20-xmlwriter.ini, /etc/php.d/20-xsl.ini, /etc
PHP API	20190902
PHP Extension	20190902
Zend Extension	320190902
Zend Extension Build	API320190902,NTS
PHP Extension Build	API20190902,NTS
Debug Build	no
Thread Safety	disabled
Zend Signal Handling	enabled
Zend Memory Manager	enabled

PHP debugging information

Evaluation

As the `student` user on the `workstation` machine, use the `lab` command to grade your work. Correct any reported failures and rerun the command until successful.

```
[student@workstation ~]$ lab grade pods-review
```

Finish

As the `student` user on the `workstation` machine, use the `lab` command to complete this exercise. This step is important to ensure that resources from previous exercises do not impact upcoming exercises.

```
[student@workstation ~]$ lab finish pods-review
```