redhat.

OpenShift - Access Denied 2018

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Linux

Docker

File permissions

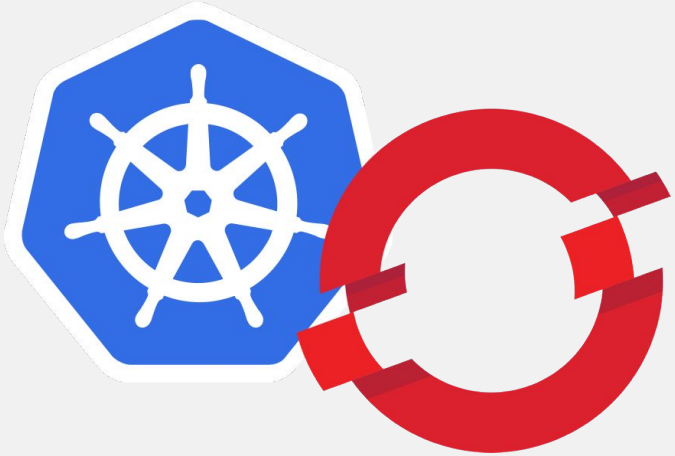
SELinux

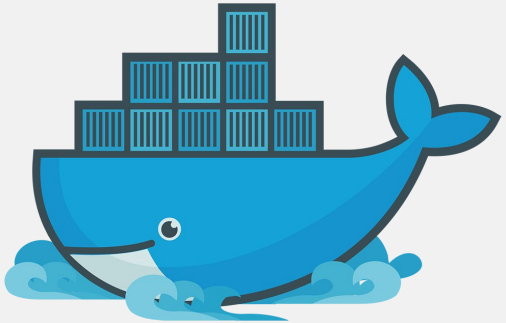
Kubernetes

Security Context Constraints

OpenShift

Persistent Volumes





Docker, Kubernetes and OpenShift

Docker

- Encapsulated app with its dependencies
- Easy to run (container) and build / share (image)

Kubernetes

- Orchestration, span containers across multiple machines

OpenShift

- RedHat flavored Kubernetes with additional features (multitenancy, security ...)

Linux - Users & File Permissions

Host filesystem

```
# id
uid=1009(tst1) gid=100(users) groups=100(users)
# ls -l
dr-xr-x---.   9 root  root   280 Jan 17 13:14 root
lrwxrwxrwx.   1 tst1 users    8 Dec 19 03:25 fldr1 -> xyz/fldr
-rwxr-xr-x.  30 tst2 wheel 1020 Jan 18 18:30 awesome file
```

Container filesystem

```
$ id
uid=1000160000 gid=0(root) groups=0(root)
$ ls -l
dr-xr-x---.   9 root  root   280 Jan 17 13:14 root
lrwxrwxrwx.   1 tst1 users    8 Dec 19 03:25 fldr1 -> xyz/fldr
-rwxr-xr-x.  30 tst2 wheel 1020 Jan 18 18:30 awesome file
```

Security Enhanced Linux

- fine grained control over objects in Linux
- set of rules defining who can access what

```
# ls -lFnZa
-rw-r--r--. usr1 users  system_u:object_r:svirt_sandbox_file_t:s0:c0,c12 f
```

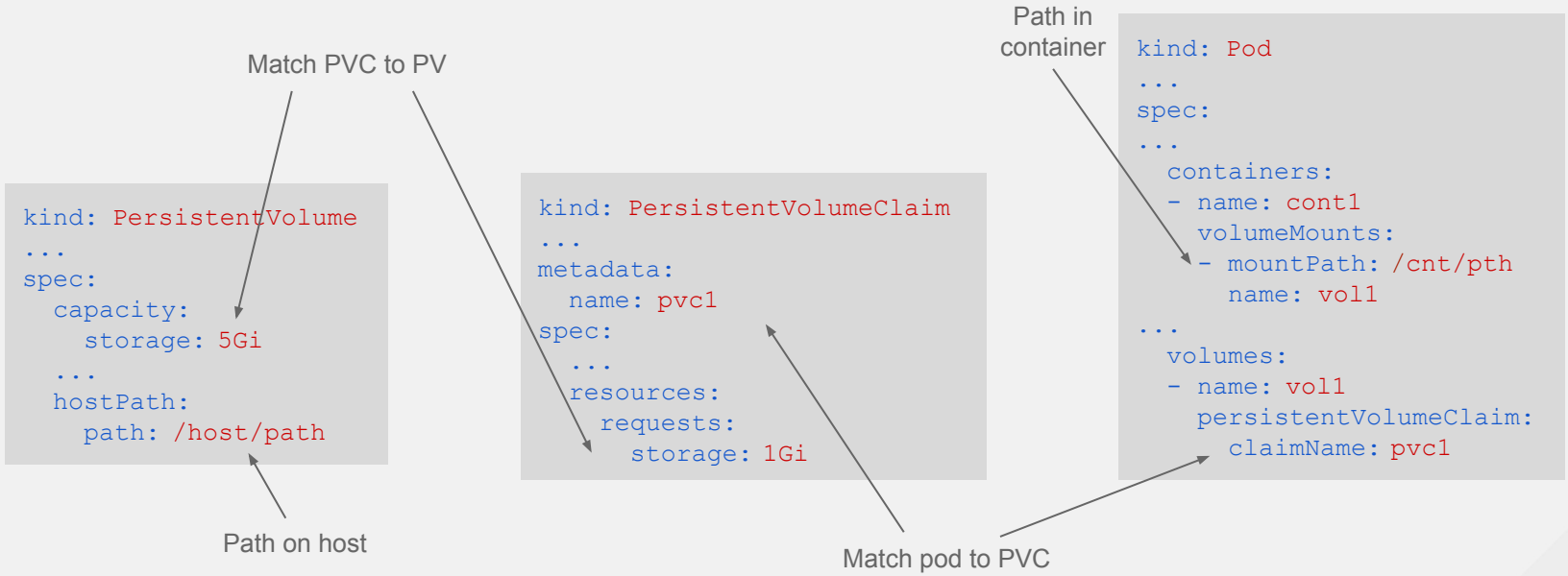
Security Context

1. **User:** Typically available `user_u (logged user)`, `system_u (system process)`, `root`
2. **Role:** Placeholder for files, grouping of policies for processes (RBAC)
3. **Type:** Finer grained control over what processes have access to which objects
4. **Level:** Optional field, higher level dominates lower
5. **Categories**: Optional field, addition for containers. Isolation of objects host shares with specific container

```
# oc get deployment [d] -o yaml
   container:
     securityContext:
       seLinuxOptions:
         level: " s0:c0,c12"
```

Storage

Pods are stateless -> Storage maintains state
Persistent Volume vs. “bare hostPath”



User Control and Management

User vs. Service Account
- pod vs. deployment

```
# oc whoami
# system:serviceaccount: [project]:[name]     # remember 'default' name
```

Security Context Constraints
- additional control to RBAC over actions pod can perform
- "SCCs are also very useful for managing access to persistent storage" - OpenShift documentation

```
# oc get scc
NAME                    SELINUX     RUNASUSER          VOLUMES
hostaccess              MustRunAs    MustRunAsRange     [..., hostPath, ...]
hostmount-anyuid        MustRunAs    RunAsAny           [..., hostPath, ...]
privileged              RunAsAny     RunAsAny           [..., hostPath, ...]
# oc adm policy add-scc-to-user [scc] system:serviceaccount: [pr]:default
```

Useful Commands & Information

```
$ oc get pod
$ oc get pod [pod] -o yaml
$ oc describe pod [pod]
$ oc edit pod [pod]

$ oc get deployment
$ oc get rs/replicaset
$ oc get pv/persistentvolume
$ oc get pvc/persistentvolumeclaim

$ oc logs [pod]
$ oc rsh [pod]
$ oc replace --force -f [file.yaml]

$ oc adm policy add-scc-to-user [scc] [user]
```

```
$ ssh [user]@[host]
$ id

$ check_results
$ retry [task]

$ ls -lFnZa
$ chmod [mod] [file]
$ sudo chcon -u [user] -r [role] -t [type] [file]
$ sudo chcat -- [+/-][cat] [file]

SCC: hostaccess, hostmount-anyuid, privileged
SELinux: system_u:object_r:svirt_sandbox_file_t

SA: system:serviceaccount:[project]:default
```

Task 1 - hint

```
# oc logs task1
/bin/sh: /pv/file: Permission denied
# oc rsh task1
$ id
uid=10000X0000 gid=0(root) groups=0(root),10000X0000
$ ls -la /pv/
drwxr-xr-x.    2 root   root    18 Jan 24 13:14 .
-rw-r--r--.   30 100Y   root     0 Jan 24 13:14 file
```

Task 1 - solution

```
# oc logs task1
/bin/sh: /pv/file: Permission denied
# oc rsh task1
$ id
uid=10000X0000 gid=0(root) groups=0(root),10000X0000
$ ls -la /pv/
drwxr-xr-x.    2 root   root    18 Jan 24 13:14 .
-rw-r--r--.   30 100Y   root     0 Jan 24 13:14 file
```

```
# chmod 664 ~/pv/1/file
# retry task1
# check_results
```

Task 2 - hint

```
# oc describe replicaset task2-*
...
unable to validate against any security context constraint:
...
"hostPath": hostPath volumes are not allowed to be used
# oc get scc
NAME            ...           VOLUMES
...
hostaccess      ...           [... hostPath ...]
```

Task 2 - solution

```
# oc describe replicaset task2-*
...
unable to validate against any security context constraint:
...
"hostPath": hostPath volumes are not allowed to be used
# oc get scc
NAME              ...             VOLUMES
...
hostaccess        ...             [... hostPath ...]
```

```
# oc adm policy add-scc-to-user hostmount-anyuid \
    system:serviceaccount:${user}-project:default
# retry task2
# check_results
```

Task 3 - hint

```
# retry task3
# oc logs task3-*
# ls -lFnZa ~/pv/3/
-rw-rw-r--. system_u:object_r:svirt_sandbox_file_t:s0 file
drwxr-xr-x. system_u:object_r:svirt_sandbox_file_t:s0:c0,c5 ./
# oc get deployment -o yaml
...
securityContext: {}
```

Task 3 - solution

```
# retry task3
# oc logs task3-*
# ls -lFnZa ~/pv/3/
-rw-rw-r--. system_u:object_r:svirt_sandbox_file_t:s0 file
drwxr-xr-x. system_u:object_r:svirt_sandbox_file_t:s0:c0,c5 ./
# oc get deployment -o yaml
...
securityContext: {}
```

```
# oc edit deployment task3
   securityContext:
     seLinuxOptions:
       level: "s0:c0,c5"
# oc adm policy add-scc-to-user privileged \
    system:serviceaccount:${user}-project:default
```

Task 4 - hint

```
# ls -ltrFnZa ~/pv/4/
-rw-rw-r--. 1002 0 unconfined_u:object_r:user_home_t:s0 file
drwxr-xr-x.    0 0 unconfined_u:object_r:user_home_t:s0 ./
```

Task 4 - solution

```
# ls -ltrFnZa ~/pv/4/
-rw-rw-r--. 1002 0 unconfined_u:object_r:user_home_t:s0 file
drwxr-xr-x.    0 0 unconfined_u:object_r:user_home_t:s0 ./
```

```
sudo chcon -u system_u -t svirt_sandbox_file_t ~/pv/4
sudo chcon -u system_u -t svirt_sandbox_file_t ~/pv/4/file
```

Task 5 - hint

```
# oc describe pod task5
...
Unable to mount volumes for pod … timeout expired … list of
unattached/unmounted volumes=[v1]
# oc get pod -o yaml
...
volumes:
  persistentVolumeClaim:
# oc get pv pv-${user}
NAME      CAPACITY   ...
px-ux     1Mi        ...
# oc get pvc -o yaml
    resources:
      requests:
        storage: 1Gi
```

Task 5 - solution

```
# oc get pv pv-${user}
NAME      CAPACITY   ...
px-ux     1Mi        ...
# oc get pvc -o yaml
    resources:
      requests:
        storage: 1Gi
```

```
# oc get pvc -o yaml > pvc.yaml
# vim pvc.yaml
    resources:
      requests:
        storage: 1Mi
# oc replace --force -f pvc.yaml
```