Configuration

NetApp Solutions

NetApp
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Configuration

For any multitenant solution, no user can have access to more cluster resources than is required. So, the entire set of resources that are to be configured as part of the multitenancy configuration is divided between cluster-admin, storage-admin, and developers working on each project.

The following table outlines the different tasks to be performed by different users:

Role	Tasks
Cluster-admin	Create projects for different applications or workloads
	Create ClusterRoles and RoleBindings for storage-admin
	Create Roles and RoleBindings for developers assigning access to specific projects
	[Optional] Configure projects to schedule pods on specific nodes
Storage-admin	Create SVMs on NetApp ONTAP
	Create Trident backends
	Create StorageClasses
	Create storage ResourceQuotas
Developers	Validate access to create or patch PVCs or pods in assigned project
	Validate access to create or patch PVCs or pods in another project
	Validate access to view or edit Projects, ResourceQuotas, and StorageClasses

Next: Prerequisites.

Configuration

Prerequisites

- NetApp ONTAP cluster
- Red Hat OpenShift cluster
- Trident installed on the cluster
- Admin workstation with tridentctl and oc tools installed and added to $PATH
- Admin access to ONTAP
- Cluster-admin access to OpenShift cluster
- Cluster is integrated with Identity Provider
- Identity provider is configured to efficiently distinguish between users in different teams

Next: Cluster Administrator Tasks.

Configuration: cluster-admin tasks

The following tasks are performed by the Red Hat OpenShift cluster-admin:

1. Log into Red Hat OpenShift cluster as the cluster-admin.
2. Create two projects corresponding to different projects.

```
oc create namespace project-1
oc create namespace project-2
```

3. Create the developer role for project-1.

```
cat << EOF | oc create -f -
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  namespace: project-1
  name: developer-project-1
rules:
  - verbs:
      - '*'
    apiGroups:
      - apps
      - batch
      - autoscaling
      - extensions
      - networking.k8s.io
      - policy
      - apps.openshift.io
      - build.openshift.io
      - image.openshift.io
      - ingress.operator.openshift.io
      - route.openshift.io
      - snapshot.storage.k8s.io
      - template.openshift.io
    resources:
      - '*'
  - verbs:
      - '*'
    apiGroups:
      - ''
    resources:
      - bindings
      - configmaps
      - endpoints
```

```
      - events
      - persistentvolumeclaims
      - pods
      - pods/log
      - pods/attach
      - podtemplates
      - replicationcontrollers
      - services
      - limitranges
      - namespaces
      - componentstatuses
      - nodes
  - verbs:
      - '*'
    apiGroups:
      - trident.netapp.io
    resources:
      - tridentsnapshots
EOF
```

The role definition provided in this section is just an example. Developer roles must be defined based on end-user requirements.

4. Similarly, create developer roles for project-2.
5. All OpenShift and NetApp storage resources are usually managed by a storage admin. Access for storage administrators is controlled by the trident operator role that is created when Trident is installed. In addition to this, the storage admin also requires access to ResourceQuotas to control how storage is consumed.
6. Create a role for managing ResourceQuotas in all projects in the cluster to attach it to storage admin.

```
cat << EOF | oc create -f -
kind: ClusterRole
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: resource-quotas-role
rules:
  - verbs:
      - '*'
    apiGroups:
      - ''
    resources:
      - resourcequotas
  - verbs:
      - '*'
    apiGroups:
      - quota.openshift.io
    resources:
      - '*'
EOF
```

7. Make sure that the cluster is integrated with the organization's identity provider and that user groups are synchronized with cluster groups. The following example shows that the identity provider has been integrated with the cluster and synchronized with the user groups.

```
$ oc get groups
NAME                          USERS
ocp-netapp-storage-admins     ocp-netapp-storage-admin
ocp-project-1                 ocp-project-1-user
ocp-project-2                 ocp-project-2-user
```

8. Configure ClusterRoleBindings for storage admins.

```
cat << EOF | oc create -f -
kind: ClusterRoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: netapp-storage-admin-trident-operator
subjects:
  - kind: Group
    apiGroup: rbac.authorization.k8s.io
    name: ocp-netapp-storage-admins
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: trident-operator
---
kind: ClusterRoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: netapp-storage-admin-resource-quotas-cr
subjects:
  - kind: Group
    apiGroup: rbac.authorization.k8s.io
    name: ocp-netapp-storage-admins
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: resource-quotas-role
EOF
```

For storage admins, two roles must be bound: trident-operator and resource-quotas.

9. Create RoleBindings for developers binding the developer-project-1 role to the corresponding group (ocp-project-1) in project-1.

```
cat << EOF | oc create -f -
kind: RoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: project-1-developer
  namespace: project-1
subjects:
  - kind: Group
    apiGroup: rbac.authorization.k8s.io
    name: ocp-project-1
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: Role
  name: developer-project-1
EOF
```

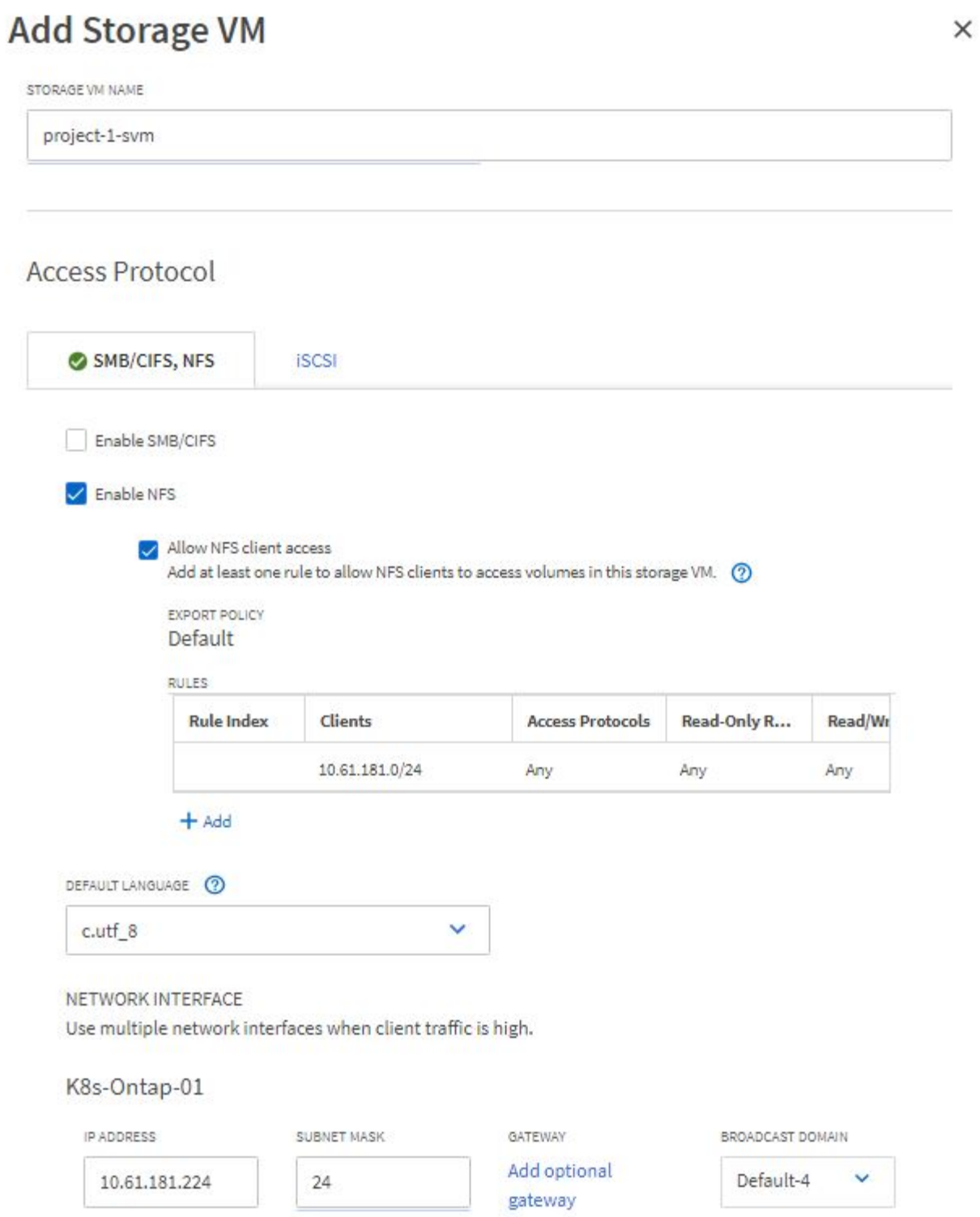
10. Similarly, create RoleBindings for developers binding the developer roles to the corresponding user group in project-2.

Next: Storage Administrator Tasks.

Configuration: Storage-admin tasks

The following resources must be configured by a storage administrator:

1. Log into the NetApp ONTAP cluster as admin.
2. Navigate to Storage > Storage VMs and click Add. Create two SVMs, one for project-1 and the other for project-2, by providing the required details. Also create a vsadmin account to manage the SVM and its resources.



3. Log into the Red Hat OpenShift cluster as the storage administrator.
4. Create the backend for project-1 and map it to the SVM dedicated to the project. NetApp recommends using the SVM's vsadmin account to connect the backend to SVM instead of using the ONTAP cluster administrator.

```
cat << EOF | tridentctl -n trident create backend -f
{
    "version": 1,
    "storageDriverName": "ontap-nas",
    "backendName": "nfs_project_1",
    "managementLIF": "172.21.224.210",
    "dataLIF": "10.61.181.224",
    "svm": "project-1-svm",
    "username": "vsadmin",
    "password": "NetApp123"
}
EOF
```

We are using the ontap-nas driver for this example. Use the appropriate driver when creating the backend based on the use case.

We assume that Trident is installed in the trident project.

5. Similarly create the Trident backend for project-2 and map it to the SVM dedicated to project-2.
6. Next, create the storage classes. Create the storage class for project-1 and configure it to use the storage pools from backend dedicated to project-1 by setting the storagePools parameter.

```
cat << EOF | oc create -f -
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: project-1-sc
provisioner: csi.trident.netapp.io
parameters:
  backendType: ontap-nas
  storagePools: "nfs_project_1:.*"
EOF
```

7. Likewise, create a storage class for project-2 and configure it to use the storage pools from backend dedicated to project-2.
8. Create a ResourceQuota to restrict resources in project-1 requesting storage from storageclasses dedicated to other projects.

```
cat << EOF | oc create -f -
kind: ResourceQuota
apiVersion: v1
metadata:
  name: project-1-sc-rq
  namespace: project-1
spec:
  hard:
    project-2-sc.storageclass.storage.k8s.io/persistentvolumeclaims: 0
EOF
```

9. Similarly, create a ResourceQuota to restrict resources in project-2 requesting storage from storageclasses dedicated to other projects.

Next: Validation.

Validation

To validate the multitenant architecture that was configured in the previous steps, complete the following steps:

Validate access to create PVCs or pods in assigned project

1. Log in as ocp-project-1-user, developer in project-1.
2. Check access to create a new project.

```
oc create ns sub-project-1
```

3. Create a PVC in project-1 using the storageclass that is assigned to project-1.

```
cat << EOF | oc create -f -
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: test-pvc-project-1
  namespace: project-1
  annotations:
    trident.netapp.io/reclaimPolicy: Retain
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 1Gi
  storageClassName: project-1-sc
EOF
```

4. Check the PV associated with the PVC.

```
oc get pv
```

5. Validate that the PV and its volume is created in an SVM dedicated to project-1 on NetApp ONTAP.

```
volume show -vserver project-1-svm
```

6. Create a pod in project-1 and mount the PVC created in previous step.

```
cat << EOF | oc create -f -
kind: Pod
apiVersion: v1
metadata:
  name: test-pvc-pod
  namespace: project-1
spec:
  volumes:
    - name: test-pvc-project-1
      persistentVolumeClaim:
       claimName: test-pvc-project-1
  containers:
    - name: test-container
      image: nginx
      ports:
        - containerPort: 80
          name: "http-server"
      volumeMounts:
        - mountPath: "/usr/share/nginx/html"
          name: test-pvc-project-1
EOF
```

7. Check if the pod is running and whether it mounted the volume.

```
oc describe pods test-pvc-pod -n project-1
```

Validate access to create PVCs or pods in another project or use resources dedicated to another project

1. Log in as ocp-project-1-user, developer in project-1.
2. Create a PVC in project-1 using the storageclass that is assigned to project-2.

```
cat << EOF | oc create -f -
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: test-pvc-project-1-sc-2
  namespace: project-1
  annotations:
    trident.netapp.io/reclaimPolicy: Retain
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 1Gi
  storageClassName: project-2-sc
EOF
```

3. Create a PVC in project-2.

```
cat << EOF | oc create -f -
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: test-pvc-project-2-sc-1
  namespace: project-2
  annotations:
    trident.netapp.io/reclaimPolicy: Retain
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 1Gi
  storageClassName: project-1-sc
EOF
```

4. Make sure that PVCs `test-pvc-project-1-sc-2` and `test-pvc-project-2-sc-1` were not created.

```
oc get pvc -n project-1
oc get pvc -n project-2
```

5. Create a pod in project-2.

```
cat << EOF | oc create -f -
kind: Pod
apiVersion: v1
metadata:
  name: test-pvc-pod
  namespace: project-1
spec:
  containers:
    - name: test-container
      image: nginx
      ports:
        - containerPort: 80
          name: "http-server"
EOF
```

Validate access to view and edit Projects, ResourceQuotas, and StorageClasses

1. Log in as ocp-project-1-user, developer in project-1.
2. Check access to create new projects.

```
oc create ns sub-project-1
```

3. Validate access to view projects.

```
oc get ns
```

4. Check if the user can view or edit ResourceQuotas in project-1.

```
oc get resourcequotas -n project-1
oc edit resourcequotas project-1-sc-rq -n project-1
```

5. Validate that the user has access to view the storageclasses.

```
oc get sc
```

6. Check access to describe the storageclasses.
7. Validate the user’s access to edit the storageclasses.

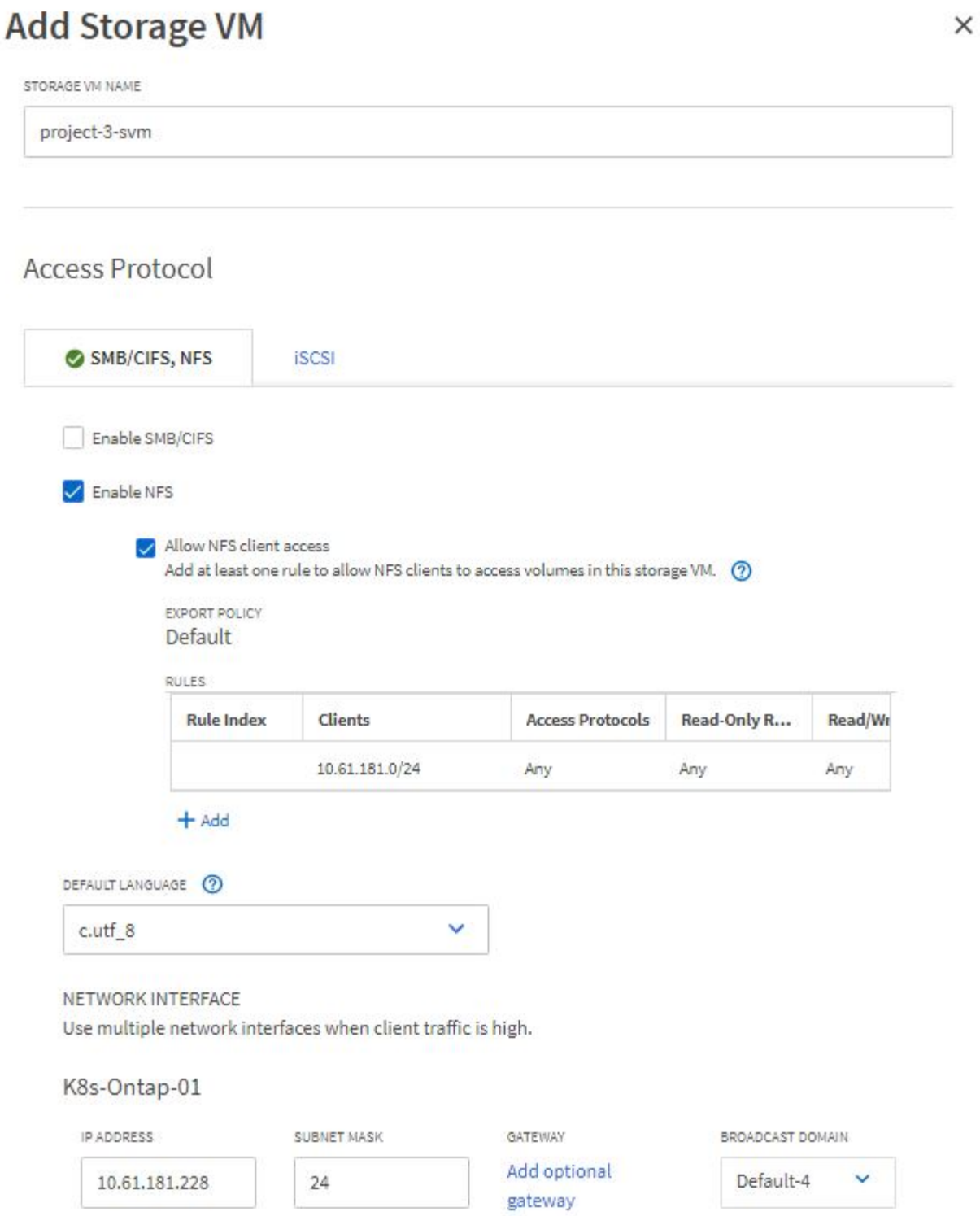
```
oc edit sc project-1-sc
```

Next: Scaling.

Scaling: Adding more projects

In a multitenant configuration, adding new projects with storage resources requires additional configuration to make sure that multitenancy is not violated. For adding more projects in a multitenant cluster, complete the following steps:

1. Log into the NetApp ONTAP cluster as a storage admin.
2. Navigate to `Storage → Storage VMs` and click `Add`. Create a new SVM dedicated to project-3. Also create a vsadmin account to manage the SVM and its resources.



3. Log into the Red Hat OpenShift cluster as cluster admin.
4. Create a new project.

```
oc create ns project-3
```

5. Make sure that the user group for project-3 is created on IdP and synchronized with the OpenShift cluster.

```
oc get groups
```

6. Create the developer role for project-3.

```
cat << EOF | oc create -f -
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  namespace: project-3
  name: developer-project-3
rules:
  - verbs:
      - '*'
    apiGroups:
      - apps
      - batch
      - autoscaling
      - extensions
      - networking.k8s.io
      - policy
      - apps.openshift.io
      - build.openshift.io
      - image.openshift.io
      - ingress.operator.openshift.io
      - route.openshift.io
      - snapshot.storage.k8s.io
      - template.openshift.io
    resources:
      - '*'
  - verbs:
      - '*'
    apiGroups:
      - ''
    resources:
      - bindings
      - configmaps
      - endpoints
      - events
      - persistentvolumeclaims
      - pods
      - pods/log
      - pods/attach
      - podtemplates
      - replicationcontrollers
      - services
```

```
      - limitranges
      - namespaces
      - componentstatuses
      - nodes
  - verbs:
      - '*'
    apiGroups:
      - trident.netapp.io
    resources:
      - tridentsnapshots
EOF
```

The role definition provided in this section is just an example. The developer role must be defined based on the end-user requirements.

7. Create RoleBinding for developers in project-3 binding the developer-project-3 role to the corresponding group (ocp-project-3) in project-3.

```
cat << EOF | oc create -f -
kind: RoleBinding
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  name: project-3-developer
  namespace: project-3
subjects:
  - kind: Group
    apiGroup: rbac.authorization.k8s.io
    name: ocp-project-3
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: Role
  name: developer-project-3
EOF
```

8. Login to the Red Hat OpenShift cluster as storage admin
9. Create a Trident backend and map it to the SVM dedicated to project-3. NetApp recommends using the SVM's vsadmin account to connect the backend to the SVM instead of using the ONTAP cluster administrator.

```
cat << EOF | tridentctl -n trident create backend -f
{
    "version": 1,
    "storageDriverName": "ontap-nas",
    "backendName": "nfs_project_3",
    "managementLIF": "172.21.224.210",
    "dataLIF": "10.61.181.228",
    "svm": "project-3-svm",
    "username": "vsadmin",
    "password": "NetApp!23"
}
EOF
```

We are using the ontap-nas driver for this example. Use the appropriate driver for creating the backend based on the use-case.

We assume that Trident is installed in the trident project.

10. Create the storage class for project-3 and configure it to use the storage pools from backend dedicated to project-3.

```
cat << EOF | oc create -f -
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: project-3-sc
provisioner: csi.trident.netapp.io
parameters:
  backendType: ontap-nas
  storagePools: "nfs_project_3:.*"
EOF
```

11. Create a ResourceQuota to restrict resources in project-3 requesting storage from storageclasses dedicated to other projects.

```
cat << EOF | oc create -f -
kind: ResourceQuota
apiVersion: v1
metadata:
  name: project-3-sc-rq
  namespace: project-3
spec:
  hard:
    project-1-sc.storageclass.storage.k8s.io/persistentvolumeclaims: 0
    project-2-sc.storageclass.storage.k8s.io/persistentvolumeclaims: 0
EOF
```

12. Patch the ResourceQuotas in other projects to restrict resources in those projects from accessing storage from the storageclass dedicated to project-3.

```
oc patch resourcequotas project-1-sc-rq -n project-1 --patch
'{"spec":{"hard":{ "project-3-
sc.storageclass.storage.k8s.io/persistentvolumeclaims": 0}}}'
oc patch resourcequotas project-2-sc-rq -n project-2 --patch
'{"spec":{"hard":{ "project-3-
sc.storageclass.storage.k8s.io/persistentvolumeclaims": 0}}}'
```

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