Solution Brief

Manage Percona XtraDB Cluster Application and Data Using Astra Control

Multi-cloud data protection, restoration, and portability for XtraDB in the public cloud or on-premises.

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>3</td>
</tr>
<tr>
<td>Astra Control Overview</td>
<td>3</td>
</tr>
<tr>
<td>Managing Percona XtraDB Cluster, Percona Kubernetes Operator, and Its Front End With Astra Control</td>
<td>4</td>
</tr>
<tr>
<td>About NetApp</td>
<td>14</td>
</tr>
<tr>
<td>Legal Notice</td>
<td>14</td>
</tr>
</tbody>
</table>
Introduction

**Percona's XtraDB Cluster** provides a clustered robust MySQL database solution supporting critical business applications. Within Kubernetes, Percona XtraDB Cluster is deployed as a Custom Resource (CR) by Percona's Kubernetes Operator using Percona's Custom Resource Definitions (CRDs) in the same namespace as the MySQL cluster. It also offers load balancing between the MySQL cluster instances. Percona XtraDB Cluster may be deployed either in the public cloud or on-premises.

Astra Control provides data protection, portability, and restoration to your entire Percona XtraDB Cluster along with its front-end application, managed as one entity. It also clones and restores the relationship with the Percona Kubernetes Operator. Protect your most valuable asset, your data, and its application together using automated snapshots and backups. Restore those backups, or do a direct clone that includes the Percona Kubernetes Operator with its CR on the same or a different cluster in the same or different public cloud. You can also snapshot, backup, restore, and clone to the same or different RedHat OpenShift Container Platform (OCP) cluster on-premises. Percona's Kubernetes Operator, CR and CRDs are all included! All of this can be done with just a few clicks.

Use Astra Control to:

- Backup and snapshot your front-end application, Percona XtraDB Cluster and Percona Kubernetes Operator with their data.
- Clone your Percona XtraDB Cluster along with Percona Kubernetes Operator to a new cluster in the same or different cloud.
- Manage your front-end application along with the backend Percona XtraDB Cluster as one unit.
- Ensure your Percona XtraDB Cluster clones automatically register with Percona Performance Monitoring and Management.

**Astra Control Overview**

Astra Control is a fully managed service or customer managed on-premises application that makes it easier for our customers to manage, protect, and move their data-rich containerized workloads running on Kubernetes within and across public clouds and on-premises. Astra Control provides persistent container storage that leverages NetApp's proven and expansive storage portfolio in the public cloud and on-premises. It also offers a rich set of advanced application-aware data management functionality (like snapshot, revert, backup and restore, activity log, and active cloning) for data protection, disaster recovery, data audit, and migration use cases for your modern apps.
Managing Percona XtraDB Cluster, Percona Kubernetes Operator, and Its Front End With Astra Control

Astra Control Service (ACS) provides management, protection, and cloning for Google Kubernetes Engine (GKE) or Azure Kubernetes Service (AKS) clusters located in the public cloud. Astra Control Center (ACC) provides the same experience and functionality for RedHat Openshift Container Platform (OCP) clusters located on-premises.

In this example using ACS, a WordPress application using a Percona XtraDB Cluster as the backend database is installed on a GKE cluster, but any front-end application compatible with Percona XtraDB Cluster may be used. Percona's Kubernetes Operator was used to install and manage the Percona XtraDB Cluster. A few changes were made to Percona's default CR.yaml file to support this configuration. Both WordPress and Percona XtraDB Cluster are deployed in the same Kubernetes namespace.

Percona Monitoring and Management server is installed as a Docker container on a Virtual Machine in Google Cloud and is monitoring the database instances. The namespace, called `wordpress`, is being managed by Astra Control Service. If the Kubernetes cluster is on-premises, Astra Control Center may be used.

```bash
$ kubectl get pxc -n wordpress
NAME            ENDPOINT                          STATUS   PXC   PROXYSQL
HAPROXY   AGE
astracluster1   astracluster1-haproxy.wordpress   ready    3                3
47h

$ kubectl get pods -n wordpress
NAME                                              READY   STATUS    RESTARTS
AGE
astracluster1-haproxy-0                           2/2     Running   0
47h
astracluster1-haproxy-1                           2/2     Running   0
47h
astracluster1-haproxy-2                           2/2     Running   0
47h
astracluster1-pxc-0                               4/4     Running   0
47h
astracluster1-pxc-1                               4/4     Running   0
47h
astracluster1-pxc-2                               4/4     Running   0
47h
percona-xtradb-cluster-operator-d65896bcb-8754n   1/1     Running   0
4d10h
wordpress-644449bc48-j8pkh                          1/1     Running   0
47h
```
Trident has created persistent volumes (PVs) for each of these database instances and the WordPress application that is using the MySQL databases for its blog content.

```bash
$ kubectl get pv
NAME                  CAPACITY   ACCESS MODES   RECLAIM POLICY   STATUS   CLAIM                          STORAGECLASS
pvc-12b84b73-a7eb-463e-8733-ff3686437d89 100Gi        RWO           Delete Bound   wordpress/datadir-astracluster1-pxc-0 netapp-cvs-perf-premium
pvc-6619a039-af6c-406d-9758-7b31b960515f 100Gi        RWO           Delete Bound   wordpress/datadir-astracluster1-pxc-1 netapp-cvs-perf-premium
pvc-b9ba8e44-7037-4786-ad60-2914dfcc4d9f 100Gi        RWO           Delete Bound   wordpress/datadir-astracluster1-pxc-2 netapp-cvs-perf-premium
pvc-f3b0399b-08d8-4203-8df5-703fde3c5025 100Gi        RWO           Delete Bound   wordpress/wp-pv-claim netapp-cvs-perf-premium
```

The Percona Monitoring and Management (PMM) server is displaying statistics in the `wordpress` namespace on the three MySQL instances on `cluster-1-patd`. Figure 1 shows the MySQL instances within PMM.

Figure 1) PMM Server
Figure 2 depicts the posted blog on **cluster-1-patd**.

**Figure 2) WordPress blog**

Astra – World’s first fully managed application-aware data management service built for Kubernetes

Kubernetes, our customers, and us

At NetApp, we don’t have a bit of doubt that containers and Kubernetes are the future of computing for modern cloud-native applications. We also believe that’s true for many of the traditional lights-on applications that our customers run on virtual machines or bare metal platforms today. We view Kubernetes as the next-generation cluster operating system that will run all workloads, both modern and traditional, over time. Our customers are at different phases in the journey of adopting containers and Kubernetes to address their data-driven digital transformation and application modernization initiatives. Such initiatives almost always use one or more of the following methodologies:

- **Containerize existing applications as-is** (lift and shift, blanket containerization).
- **Refactor existing applications** as microservices deployed in containers.
Since the entire `wordpress` namespace is being managed by Astra as one entity, all the images, PVs and resources get grouped together, so you can back them up, snapshot, or clone/restore them together. You can either group the entire namespace as one cohesive unit, you can make custom groups via labels.

Figure 3 outlines all the images and all the resources within that namespace that are being managed together as one application or unit.

**Figure 3) Managing WordPress in Astra Control**
You can take on-demand or pre-specified scheduled snapshots and backups of that one unit, keeping the database together with its front end application.

Figure 4 depicts a scenario where two hourly backups and one on-demand backup were taken and stored. You can restore from any of these backups. If you lose the cluster, the backups remain.
You need to restore a backup (WordPress and Percona XtraDB Cluster) to another GKE cluster in the cloud, keeping the operator managing the Percona XtraDB Cluster CR. You could clone directly from the running application, or restore directly from a backup. In this case, you will restore the application, database, and its data along with the Percona Kubernetes Operator, CRDs and CR from a recently taken backup to a different cluster within GKE. The new operator will manage the new cluster directly.

**Figure 5) Restore an application from a backup**
You choose to restore the application to `cluster-2-patd`, located in a different zone within GKE as shown in Figure 6.

**Figure 6) Restore to a different cluster**

<table>
<thead>
<tr>
<th>Step 1/2: Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>APP DETAILS</strong></td>
</tr>
<tr>
<td>Backup (optional)</td>
</tr>
<tr>
<td>hourly-update-dirdc04</td>
</tr>
<tr>
<td><strong>RESTORE DETAILS</strong></td>
</tr>
<tr>
<td>Application restoring</td>
</tr>
<tr>
<td>Astra Control can restore your application configuration and persistent storage backups are transferred from your object store, so restoring from an existing backup will complete the fastest. Enter a name for your restored app to get started.</td>
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</table>

![Image of application restore interface](image-url)
After the restore completes, you see the CR and the new cluster, along with WordPress on the new namespace on the new cluster. The Percona Kubernetes Operator is still managing the CR, as it was in the original cluster. You also see the PVs have been copied over.

```bash
$ kubectl get pxc astracluster1 -n wordpress-cec50
NAME            ENDPOINT                                STATUS   PXC
PROXYSQL       HAPROXY   AGE
astracluster1   astracluster1-haproxy.wordpress-cec50 ready 3
3               6m22s

$ kubectl get pods -n wordpress-cec50
NAME                                              READY   STATUS    RESTARTS
AGE
astracluster1-haproxy-0                           2/2     Running   1
6m19s
astracluster1-haproxy-1                           2/2     Running   0
2m28s
astracluster1-haproxy-2                           2/2     Running   0
2m7s
astracluster1-pxc-0                               4/4     Running   0
6m19s
astracluster1-pxc-1                               4/4     Running   1
5m19s
astracluster1-pxc-2                               4/4     Running   1
4m28s
percona-xtradb-cluster-operator-7854ccdb8-bjdq7  1/1     Running   0
6m30s
wordpress-5c85884cb-gfn6w                         1/1     Running   4
6m32s

$ kubectl get pv -n wordpress-cec50
NAME                                       CAPACITY   ACCESS MODES   RECLAIM     STORAGECLASS
POLICY STATUS CLAIM                        REASON   AGE
REASON AGE
pvc-180ecad6-3509-483c-af42-d1ac186136da   100Gi      RWO            Delete  netapp-cvs-perf-premium 15m
Bound  wordpress-cec50/datadir-astracluster1-pxc-2
pvc-5cb92c7d-9265-4ec5-9053-3e6fc459b0da   100Gi      RWO            Delete  netapp-cvs-perf-premium 15m
Bound  wordpress-cec50/wp-pv-claim
pvc-a2095fb3-2051-4c8b-8d24-ed59e4be2bad   100Gi      RWO            Delete  netapp-cvs-perf-premium 15m
Bound  wordpress-cec50/datadir-astracluster1-pxc-1
pvc-cc02a912-ccba-426f-81c2-4212cb4f5986   100Gi      RWO            Delete  netapp-cvs-perf-premium 15m
Bound  wordpress-cec50/datadir-astracluster1-pxc-0
```
Astra is now managing your new application on the new cluster. However, it is not protected since you haven’t yet set up a protection policy for that application.

Figure 7 shows the new **wordpress-cec50 namespace on cluster-2-padt**.

The PMM Server now is informed of the new cluster, so both are being monitored, as depicted in Figure 8.
You now have access to the blog on the new cluster, exactly as it is on the old cluster. Figure 9 shows the new blog.

**Figure 9**

![App and Data Management with Kubernetes](image)

**Posts**

**July 29, 2021**

**Astra – World’s first fully managed application-aware data management service built for Kubernetes**

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- Refactor existing applications as microservices deployed in containers.
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As a cloud-led, data-centric software company, only NetApp can help build your unique data fabric, simplify and connect your cloud, and securely deliver the right data, services and applications to the right people—anytime, anywhere.

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