



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

Diane Patton, NetApp  
January 2022

## TABLE OF CONTENTS

<b>Introduction .....</b>	<b>3</b>
<b>Astra Control Overview .....</b>	<b>3</b>
<b>Managing Percona XtraDB Cluster, Percona Kubernetes Operator, and Its Front End With Astra Control.....</b>	<b>4</b>
<b>About NetApp.....</b>	<b>14</b>
<b>Legal Notice .....</b>	<b>14</b>

## 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), Rancher, or Upstream 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 entity.
- 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), Rancher or Upstream 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, ACC may be used instead.

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

$ kubectl get pods -n wordpress
NAME                               READY   STATUS    RESTARTS
AGE
astracluster1-haproxy-0            2/2    Running   1
47m
astracluster1-haproxy-1            2/2    Running   1
44m
astracluster1-haproxy-2            2/2    Running   0
43m
astracluster1-pxc-0                4/4    Running   0
47m
astracluster1-pxc-1                4/4    Running   1
46m
astracluster1-pxc-2                4/4    Running   1
45m
percona-xtradb-cluster-operator-c5cbd4547-fcwcw  1/1    Running   0
64m
wordpress-644449bc48-w7sk1        1/1    Running   0
37m
```

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.

```
patd-mac-1:~ patd$ kubectl get pv
NAME                                     CAPACITY  ACCESS MODES  RECLAIM
POLICY  STATUS  CLAIM                                     STORAGECLASS
REASON  AGE
pvc-207fb2fc-7d91-42ae-9441-42d16e105172  100Gi     RWO           Delete
Bound   wordpress/datadir-astracluster1-pxc-0  netapp-cvs-perf-premium
60m
pvc-b825a730-8347-4cfc-a252-7bb8d4f0a473  100Gi     RWO           Delete
Bound   wordpress/wp-pv-claim                  netapp-cvs-perf-premium
40m
pvc-cae51800-fbf3-4754-9645-d8d468990557  100Gi     RWO           Delete
Bound   wordpress/datadir-astracluster1-pxc-1  netapp-cvs-perf-premium
58m
pvc-feeb0593-16f3-4a97-bdd8-3e1cf77ba46e  100Gi     RWO           Delete
Bound   wordpress/datadir-astracluster1-pxc-2  netapp-cvs-perf-premium
55m
```

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

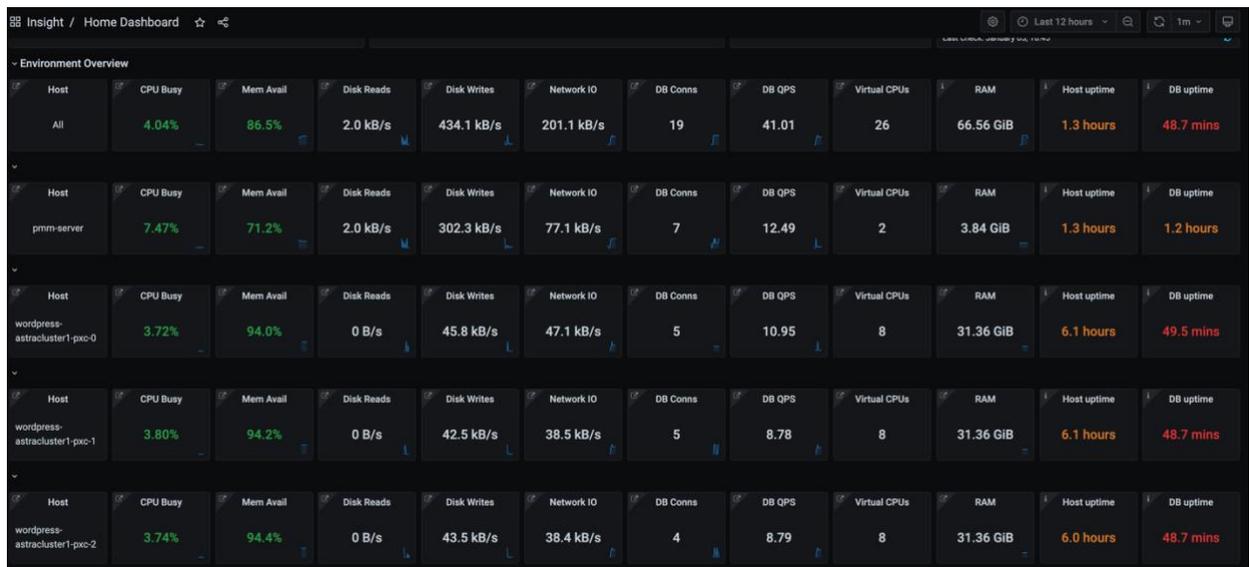
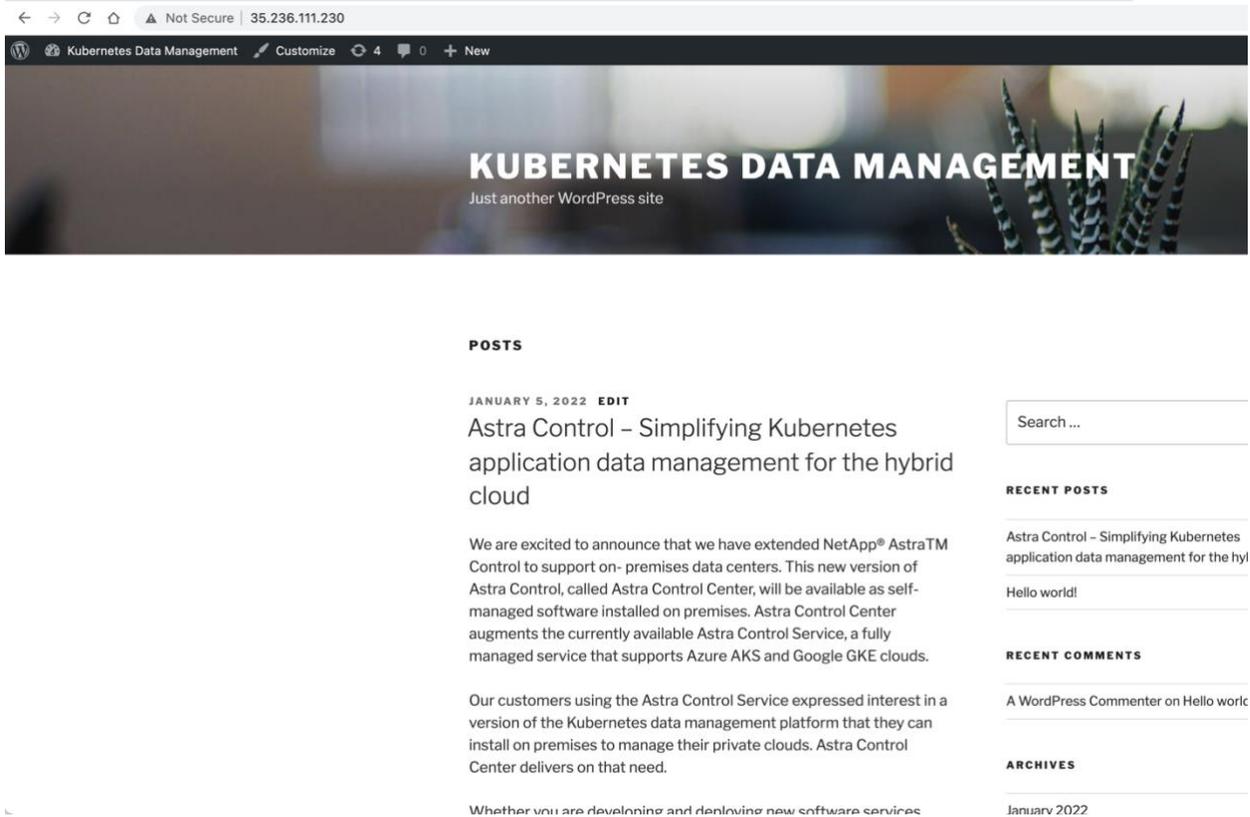


Figure 2 depicts the posted blog on cluster-1-patd.

Figure 2) WordPress blog



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 or 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 entity.

**Figure 3) Managing WordPress in Astra Control**

The screenshot displays the Astra Control interface for the 'wordpress' application. At the top, the application status is 'Running' and 'Healthy'. The 'APPLICATION PROTECTION STATUS' is 'Fully protected'. A red box highlights the 'Images' section, listing several container images managed together. Below this, the 'Resources' tab is active, showing a table of Kubernetes resources managed together, also highlighted with a red box.

**Images being grouped/managed together:**

- percona/percona-xtradb-cluster-operator:1.7.0
- percona/percona-xtradb-cluster-operator:1.7.0-haproxy
- percona/percona-xtradb-cluster-operator:1.7.0-logcollector
- percona/percona-xtradb-cluster:8.0.21-12.1
- percona/pmm-client:2.12.0
- wordpress:4.8-apache

**Kubernetes resources/objects being managed together (scrolls down):**

Resource	Type	UUID	Created
kube-root-ca.crt	ConfigMap	3e696779-eb8b-4d37-99c2-2a607686e42c	2022/01/05 21:38 UTC
astracluster1-pxc	ConfigMap	541cd0c2-cc92-429e-b154-7bfe1988c212	2022/01/05 21:55 UTC
auto-astracluster1-pxc	ConfigMap	6a6b4f52-daa5-4f47-8ce5-a5b386067344	2022/01/05 21:55 UTC
percona-xtradb-cluster-operator-lock	ConfigMap	f000ce4-0b78-4c9c-b594-82c7448a8510	2022/01/05 21:39 UTC
astracluster1 app: cluster	CustomResource	d38ee69e-131f-46af-a382-33306e08c62f	2022/01/05 21:55 UTC

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. You can even add your own execution hooks if needed to provide application consistent snapshots.

Figure 4 depicts a scenario where one scheduled hourly backup 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.

**Figure 4) Backups, on-schedule and on-demand**

The screenshot displays the NetApp Astra Control interface for a WordPress application. At the top, the application status is 'Healthy' and the protection status is 'Fully protected'. Below this, a list of images is shown, including 'percona/percona-xtradb-cluster-operator:1.7.0' and 'wordpress:4.8-apache'. The protection schedule is 'Every hour on the hour'. The group is 'wordpress' and the cluster is 'cluster-1-patid'. The 'Data protection' tab is active, showing a table of backups. Two backups are listed: 'hourly-00isj-hgf8h' (On-Schedule) and 'wordpress-backup-20220105225145' (On-Demand). Both are ready and available for restoration.

Name	Ready	On-Schedule / On-Demand	Bucket	Created ↑	Actions
hourly-00isj-hgf8h	✓	🕒 On-Schedule	astra-4289f351-72b0-48f7-9e14-b682d18a6887-backup	2022/01/05 23:00 UTC	Available
wordpress-backup-20220105225145	✓	🕒 On-Demand	astra-4289f351-72b0-48f7-9e14-b682d18a6887-backup	2022/01/05 22:51 UTC	Available

You need to clone the application along with all its content (WordPress and Percona XtraDB Cluster) to another GKE cluster in the cloud for another team, keeping the operator managing the Percona XtraDB Cluster CR. You could clone directly from the running application, or clone from a backup or snapshot. It can be done in a new namespace, or the same namespace in a different cluster. In this case, you will clone 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) Clone an application**

The screenshot shows the Astra Control console interface for a WordPress application. At the top, the application status is 'Healthy' and the protection status is 'Fully protected'. A dropdown menu is open, showing options: Running, Snapshot, Backup, Clone (highlighted with a red box), Restore, and Unmanage. Below this, the 'Data protection' tab is active, displaying a table of backups.

Name	Ready	On-Schedule / On-Demand	Bucket	Created ↑	Actions
hourly-00isj-hgf8h	✓	🕒 On-Schedule	astra-4289f351-72b0-48f7-9e14-b682d18a6887-backup	2022/01/05 23:00 UTC	Available
wordpress-backup-20220105225145	✓	🕒 On-Demand	astra-4289f351-72b0-48f7-9e14-b682d18a6887-backup	2022/01/05 22:51 UTC	Available

You choose to clone the application to `cluster-2-patd`, located in a different zone within GKE as shown in Figure 6 from the most recent backup. Alternatively, you could also choose to clone to the Azure cluster if needed. The destination cluster is a drop down.

**Figure 6) Clone from backup to a different cluster**

**Clone application** STEP 1/2: DETAILS ✕

**CLONE DETAILS**

Clone name:

Clone namespace:

Destination cluster:  drop down

Clone from an existing snapshot or backup

Snapshots Backups

Ready	On-Schedule/On-Demand	Created ↑
<input checked="" type="checkbox"/>	On-Schedule	2022/01/05 23:00 UTC
<input type="checkbox"/>	On-Demand	2022/01/05 22:51 UTC

select backup

**CLONING APPLICATIONS**

Astra Control can create a clone of your application configuration and persistent storage. Persistent storage backups are transferred from your object store, so choosing a clone from an existing backup will complete the fastest. Enter a clone name to get started.

Read more in [Clone applications](#)

- Application: wordpress
- Namespace: wordpress
- Cluster: cluster-1-patd

After the restore completes, you see the CR and the new cluster, along with WordPress on the new namespace on the new cluster. The new Percona Kubernetes Operator is managing the new CR, as it was in the original cluster. You also see the PVs have been copied over.

```

$ kubectl get pxc astracluster1 -n wordpress-clone
NAME                               ENDPOINT                               STATUS   PXC
PROXYSQL   HAPROXY   AGE
astracluster1  astracluster1-haproxy.wordpress-clone  ready    3
3          26m

$ kubectl get pods -n wordpress-clone
NAME                               READY   STATUS   RESTARTS
AGE
astracluster1-haproxy-0           2/2     Running  2
26m
astracluster1-haproxy-1           2/2     Running  1
19m
astracluster1-haproxy-2           2/2     Running  0
19m
astracluster1-pxc-0               4/4     Running  0
26m
astracluster1-pxc-1               4/4     Running  1
24m
astracluster1-pxc-2               4/4     Running  1
23m
percona-xtradb-cluster-operator-546c6759cf-16dpp  1/1     Running  0
26m
wordpress-5c85884cb-tm7xs         1/1     Running  5
26m

$ kubectl get pv -n wordpress-clone
NAME                               CAPACITY   ACCESS MODES   RECLAIM
POLICY   STATUS   CLAIM                               STORAGECLASS
REASON   AGE
pvc-1776955d-a272-4708-a3f0-6384a7385e81  100Gi      RWO             Delete
Bound    wordpress-clone/datadir-astracluster1-pxc-0  netapp-cvs-perf-
premium  28m
pvc-6e875709-4886-4c4a-b878-a3fec328407  100Gi      RWO             Delete
Bound    wordpress-clone/datadir-astracluster1-pxc-1  netapp-cvs-perf-
premium  28m
pvc-af490ded-82cf-4a44-8513-40291ea67e9c  100Gi      RWO             Delete
Bound    wordpress-clone/wp-pv-claim                 netapp-cvs-perf-
premium  28m
pvc-e75ed87b-399e-4989-bbf4-10db2287dcb6  100Gi      RWO             Delete
Bound    wordpress-clone/datadir-astracluster1-pxc-2  netapp-cvs-perf-
premium  28m

```

Astra is now managing your new application on `cluster-2-patd`. However, it is not protected since you haven't yet set up a protection policy for that application. You can set up a protection policy for that new cloned application.

Figure 7 shows the new `wordpress-clone` namespace on `cluster-2-patd`.

**Figure 7) Restored WordPress application**

Name	Ready	Protected	Cluster	Group	Discovered	Actions
wordpress	✔	✔	cluster-1-patd	wordpress	2022/01/05 22:40 UTC	Available
wordpress-clone	✔	⚠	cluster-2-patd	wordpress-clone	2022/01/05 23:25 UTC	Available

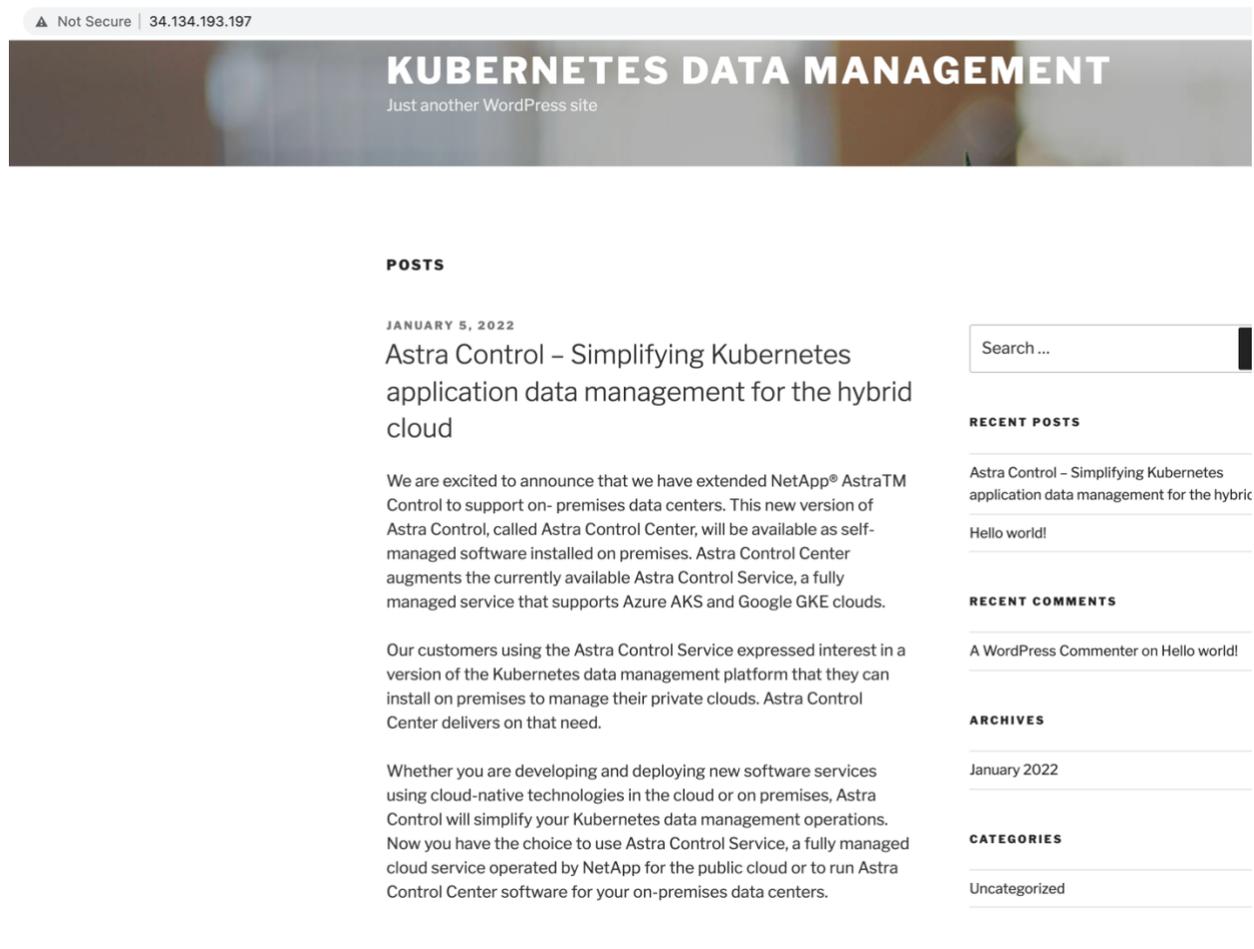
The PMM Server now is informed of the new cluster, so both are being monitored, as depicted in Figure 8.

**Figure 8) PMM with two Percona XtraDB C clusters**

Host	CPU Busy	Mem Avail	Disk Reads	Disk Writes	Network IO	DB Conns	DB QPS	Virtual CPUs	RAM	Host uptime	DB uptime
wordpress- astracuster1-pxc-0	3.90%	94.0%	0 B/s	39.7 kB/s	47.0 kB/s	5	10.85	8	31.36 GiB	7.4 hours	2.0 hours
wordpress- astracuster1-pxc-1	3.94%	94.2%	0 B/s	38.6 kB/s	38.6 kB/s	5	8.77	8	31.36 GiB	7.4 hours	2.0 hours
wordpress- astracuster1-pxc-2	3.51%	94.4%	0 B/s	38.1 kB/s	38.5 kB/s	5	8.77	8	31.36 GiB	7.3 hours	2.0 hours
wordpress-clone- astracuster1-pxc-0	3.00%	94.6%	0 B/s	48.1 kB/s	42.9 kB/s	5	10.87	8	31.36 GiB	7.0 hours	26.6 mins
wordpress-clone- astracuster1-pxc-1	3.67%	94.0%	0 B/s	42.0 kB/s	36.7 kB/s	5	8.74	8	31.36 GiB	7.0 hours	25.1 mins
wordpress-clone- astracuster1-pxc-2	3.20%	94.6%	0 B/s	44.3 kB/s	37.1 kB/s	5	8.78	8	31.36 GiB	7.1 hours	25.0 mins

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**



If you would like, you can then delete the application on the first cluster to free up resources for additional applications.

## About NetApp

In a world full of generalists, NetApp is a specialist. We're focused on one thing, helping your business get the most out of your data. NetApp brings the enterprise-grade data services you rely on into the cloud, and the simple flexibility of cloud into the data center. Our industry-leading solutions work across diverse customer environments and the world's biggest public clouds.

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.

## Legal Notice

Refer to the [Interoperability Matrix Tool \(IMT\)](#) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

### Copyright Information

Copyright © 2022 NetApp, Inc. All Rights Reserved. Printed in the U.S. No part of this document covered by copyright may be reproduced in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system—without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP "AS IS" AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

Data contained herein pertains to a commercial item (as defined in FAR 2.101) and is proprietary to NetApp, Inc. The U.S. Government has a non-exclusive, non-transferrable, non-sublicensable, worldwide, limited irrevocable license to use the Data only in connection with and in support of the U.S. Government contract under which the Data was delivered. Except as provided herein, the Data may not be used, disclosed, reproduced, modified, performed, or displayed without the prior written approval of NetApp, Inc. United States Government license rights for the Department of Defense are limited to those rights identified in DFARS clause 252.227-7015(b).

### Trademark Information

NETAPP, the NETAPP logo, and the marks listed at <http://www.netapp.com/TM> are trademarks of NetApp, Inc. Other company and product names may be trademarks of their respective owners.