



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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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			
astracuster1	astracuster1-haproxy.wordpress	ready	3	3
47m				

```
$ kubectl get pods -n wordpress
```

NAME	READY	STATUS	RESTARTS
AGE			
astracuster1-haproxy-0	2/2	Running	1
47m			
astracuster1-haproxy-1	2/2	Running	1
44m			
astracuster1-haproxy-2	2/2	Running	0
43m			
astracuster1-pxc-0	4/4	Running	0
47m			
astracuster1-pxc-1	4/4	Running	1
46m			
astracuster1-pxc-2	4/4	Running	1
45m			
percona-xtradb-cluster-operator-c5cbd4547-fcwcw	1/1	Running	0
64m			
wordpress-644449bc48-w7skl	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	POLICY	STATUS	CLAIM	CAPACITY	ACCESS MODES	RECLAIM
		REASON	AGE		STORAGECLASS	
pvc-207fb2fc-7d91-42ae-9441-42d16e105172		Bound	60m	100Gi	RWO	Delete
					netapp-cvs-perf-premium	
pvc-b825a730-8347-4cfc-a252-7bb8d4f0a473		Bound	40m	100Gi	RWO	Delete
					netapp-cvs-perf-premium	
pvc-cae51800-fbf3-4754-9645-d8d468990557		Bound	58m	100Gi	RWO	Delete
					netapp-cvs-perf-premium	
pvc-feeb0593-16f3-4a97-bdd8-3e1cf77ba46e		Bound	55m	100Gi	RWO	Delete
					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

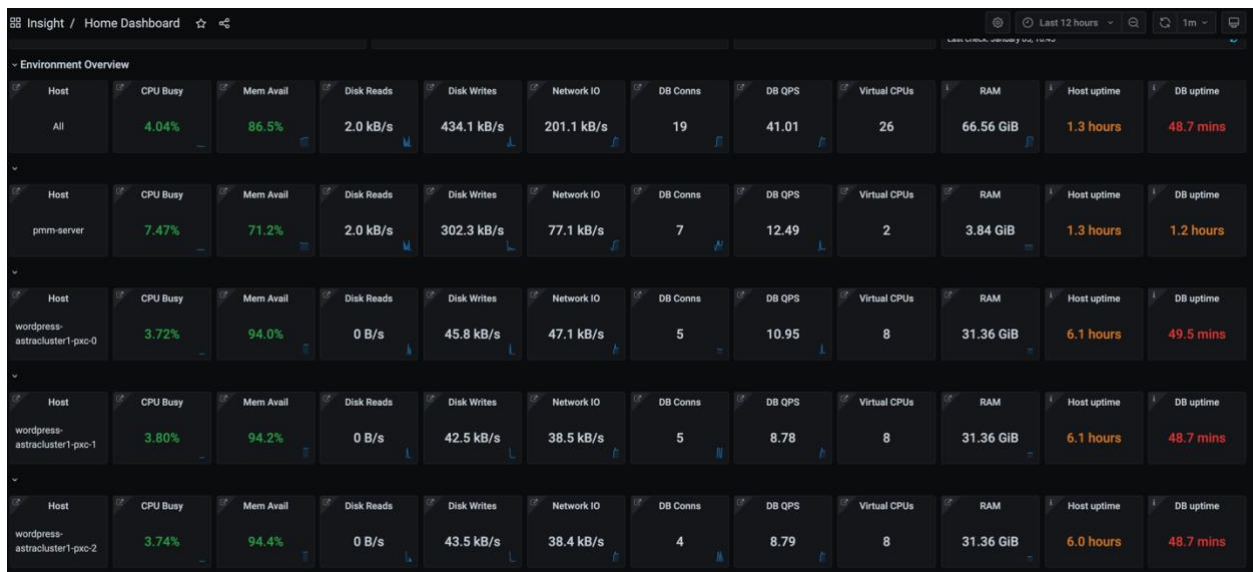
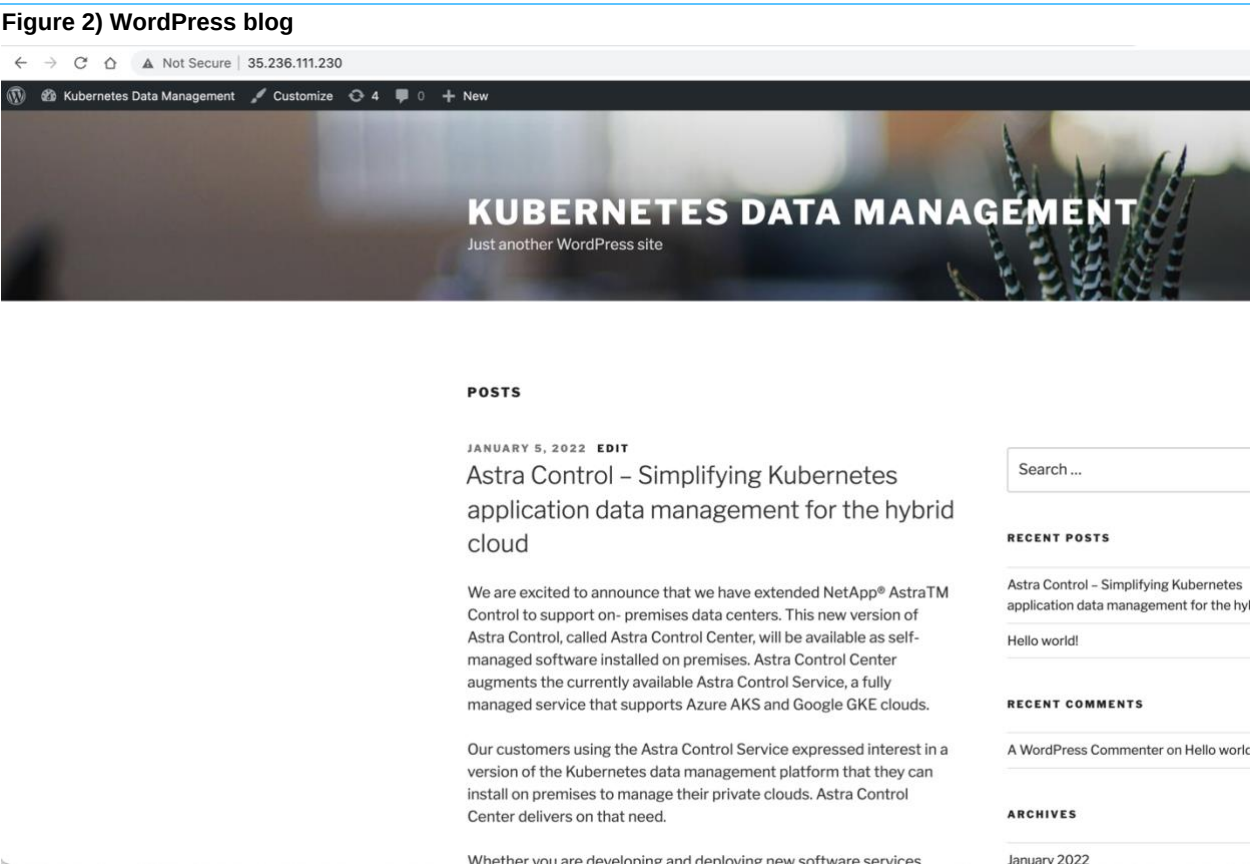


Figure 2 depicts the posted blog on `cluster-1-patd`.



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

wordpress

Running

APPLICATION STATUS

Healthy

APPLICATION PROTECTION STATUS

Fully protected

Images

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

Protection schedule
Every hour on the hour

Group
wordpress

Cluster
cluster-1-pand

Overview

Data protection

Storage

Resources

Execution hooks

Activity

All types

kubernetes resources/objects being managed together (scrolls down)

1-25 of 44 entries

Resource	Type	UUID	Created
kube-root-ca.crt	ConfigMap	3e696779-eb8b-4d37-99c2-2a607686e42c	2022/01/05 21:38 UTC
astracuster1-pxc	ConfigMap	541cd0c2-cc92-429e-b154-7bfe1988c212	2022/01/05 21:55 UTC
auto-astracuster1-pxc	ConfigMap	6a6b4f52-daa5-4f47-8ce5-a5b386067344	2022/01/05 21:55 UTC
percona-xtradb-cluster-operator-lock	ConfigMap	f000c0e4-0b78-4c9c-b594-82c7448a8510	2022/01/05 21:39 UTC
astracuster1 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

Running

APPLICATION STATUS

Healthy

APPLICATION PROTECTION STATUS

Fully protected

Images

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

Protection schedule

Every hour on the hour

Group

wordpress

Cluster

cluster-1-pa0td

Overview

Data protection

Storage

Resources

Execution hooks

Activity

Actions

Configure protection policy

Search

Snapshots

Backups

1-2 of 2 entries

☐	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

Running

Snapshot

Backup

Clone

Restore

Unmanage

APPLICATION STATUS

Healthy

APPLICATION PROTECTION STATUS

Fully protected

Images

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

Protection schedule

Every hour on the hour

Group

wordpress

Cluster

cluster-1-paid

Overview

Data protection

Storage

Resources

Execution hooks

Activity

Actions

Configure protection policy

Search

Snapshots

Backups

1-2 of 2 entries

<

>

☐	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

Figure 6) Clone from backup to a different cluster

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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-l6dpp	1/1	Running	0
26m			
wordpress-5c85884cb-tm7xs	1/1	Running	5
26m			


```
$ kubectl get pv -n wordpress-clone
```

NAME	CAPACITY	ACCESS MODES	RECLAIM STORAGECLASS
POLICY	STATUS	CLAIM	
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

The screenshot shows the 'Applications' page in the Astra control plane. It features a table with columns for Name, Ready, Protected, Cluster, Group, Discovered, and Actions. Two applications are listed: 'wordpress' and 'wordpress-clone'. The 'wordpress-clone' application is highlighted with a red box around its 'Cluster' value, 'cluster-2-patd'.

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.

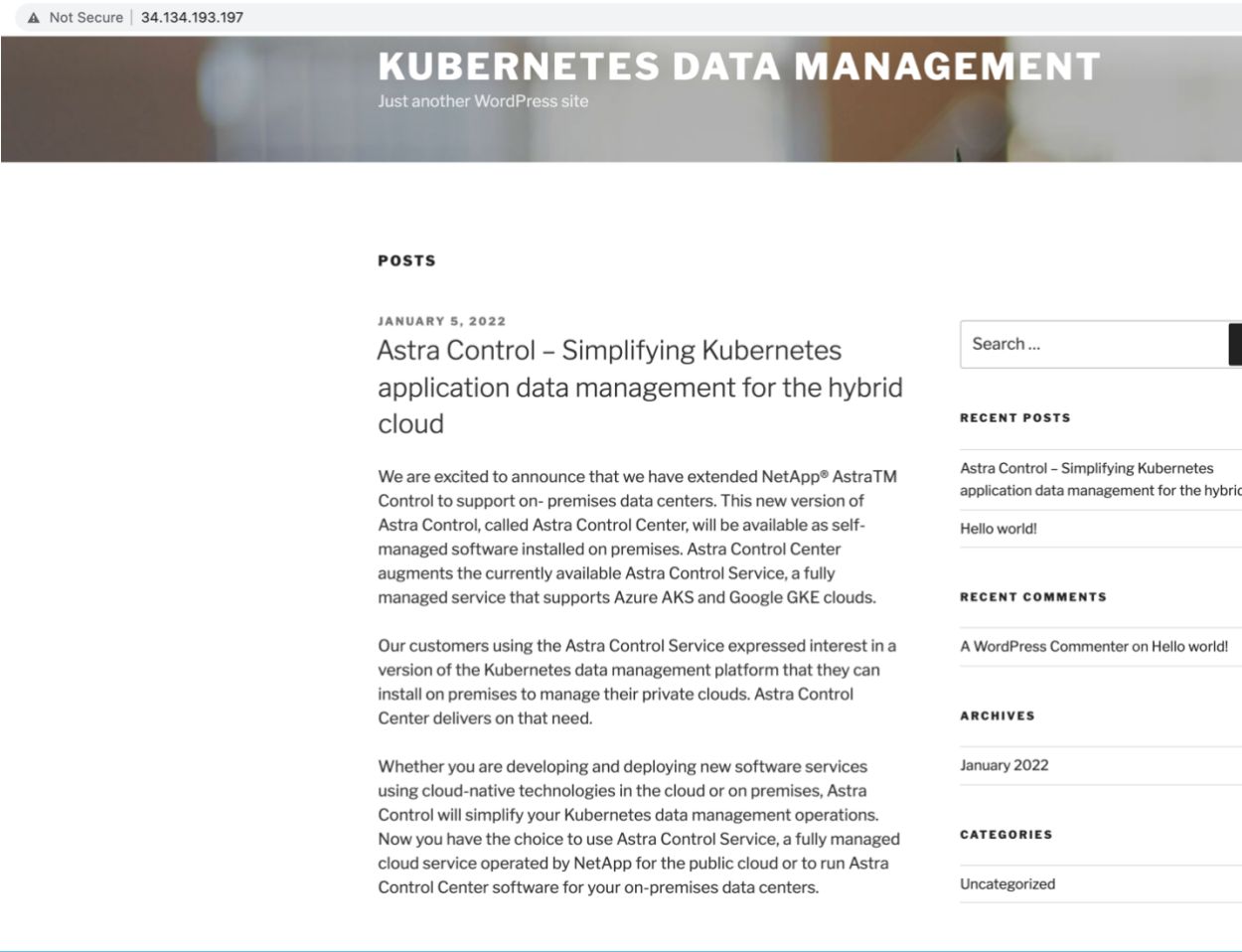
Figure 8) PMM with two Percona XtraDB C clusters

The screenshot displays the PMM dashboard with a grid of performance metrics for six hosts. The metrics include CPU Busy, Mem Avail, Disk Reads, Disk Writes, Network IO, DB Conns, DB QPS, Virtual CPUs, RAM, Host uptime, and DB uptime. The hosts are 'wordpress-astralcluster1-pxc-0' through 'wordpress-clone-astralcluster1-pxc-2'.

Host	CPU Busy	Mem Avail	Disk Reads	Disk Writes	Network IO	DB Conns	DB QPS	Virtual CPUs	RAM	Host uptime	DB uptime
wordpress-astralcluster1-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-astralcluster1-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-astralcluster1-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-astralcluster1-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-astralcluster1-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-astralcluster1-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.

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