



Solution Brief

MySQL Database as a Service (DBaaS) with Astra Control

Simplified day 2 operations

January 2022

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Introduction

Kubernetes has become the standard IT infrastructure for businesses of all sizes. Production applications are being deployed on or migrated to Kubernetes.

Running a stateful application like MySQL requires lots of planning, understanding the challenges, and identifying the right solutions. Do-it-yourself will result you to take the entire responsibility for building the database, setting up the backup and disaster recovery strategies. More Importantly to identify the way to do entire application portability.

The journey of implementing DBaaS for MySQL requires the following actions on day 1, whether it's

a managed Kubernetes service or vanilla Kubernetes:

1. Identify or build your own registry.
2. Identify the right storage and the Container Storage Interface (CSI) provisioner.
3. Find the performance requirements and define appropriate storage classes.
4. Create your own manifest or identify a helm chart that meets your requirements.

Deploy the MySQL application

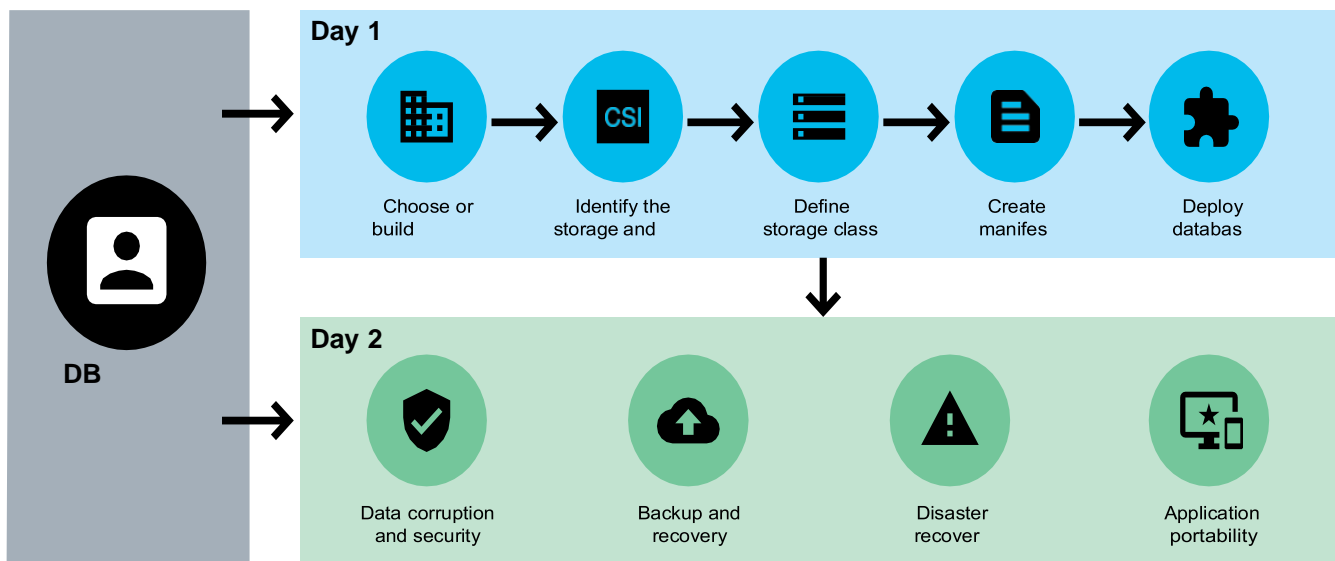


Figure 1) Build your own DBaaS.

Kubernetes offers solutions for all day 1 requirements. When it comes to day 2 operations, you need a strategy and solution for:

1. Data corruption and security
2. Backup and recovery
3. Disaster recovery

4. Application portability

Kubernetes natively doesn't have any solutions to address the day 2 challenges.

Astra Control simplifies and automates the day 1 operations by simply registering the Kubernetes cluster. The day 1 operations are simplified to

1. Identify or build your own registry.
2. Create your own manifest or identify a helm chart that meets your requirements.
3. Register the Kubernetes cluster with Astra.
4. Deploy the MySQL application

Astra Control managing your application addresses the following day 2 challenges

1. Data corruption and security
2. Backup and recovery
3. Disaster recovery
4. Application portability

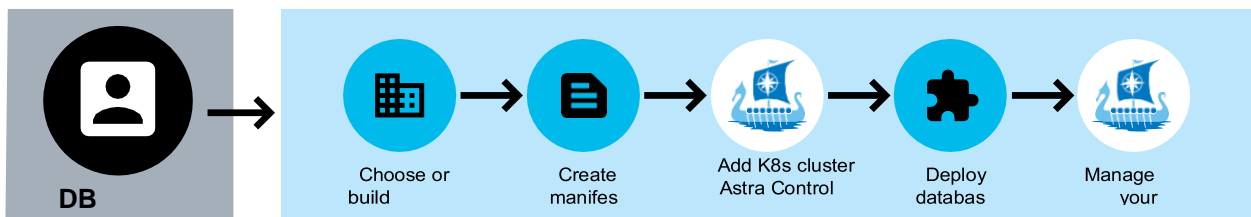


Figure 2) Day 1 operations with Astra.

NetApp Astra Control overview

NetApp Astra Control is an application-aware data management solution that manages, protects, and moves data-rich Kubernetes workloads in both public clouds and on-premises. Astra Control enables data protection, disaster recovery, and migration for your Kubernetes workloads leveraging NetApp's industry-leading data management technology for snapshots, backups, replication, and cloning. NetApp Astra Control is available in two deployment models:

- NetApp Astra Control Service: A NetApp-managed service that provides application-aware data management of Kubernetes clusters in Google Kubernetes Engine (GKE) and Azure Kubernetes Service (AKS).
- NetApp Astra Control Center: Self-managed software that provides application-aware data management of Kubernetes clusters running in your on-premises environment.

Managing MySQL with Astra

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 Kubernetes clusters located on-premises.

Upon adding a cluster, ACS:

- Installs NetApp® Trident, NetApp's open-source Kubernetes storage orchestrator.
- Creates a bucket on the cloud object store for saving application backups.
- Creates a service account on your cluster for itself.

ACC on premises (supported with Redhat OpenShift Container Platform, Rancher and Upstream Kubernetes) uses your current Trident installation, Trident based Storage classes for ONTAP backend and allows you to add your own object storage bucket for backups.

The following example shows two Kubernetes clusters, one AKS (Azure Kubernetes Service) cluster located in Azure East US (Virginia) region and another GKE (Google Kubernetes Engine) cluster located in the GCP europe-west2 region.

Name	Ready	Type	Version	Location	Actions
longboat-cluster-1	✓	Azure Kubernetes Service	v1.21.7	eastus	Running
longboat-cluster-2	✓	Google Kubernetes Engine	v1.21.5-gke.1302	europe-west2-a	Running

Figure 3) Registered kubernetes clusters.

After your Kubernetes cluster is registered, install MySQL on cluster longboat-cluster-2 using the current Bitnami Helm chart or a custom manifest. Trident automatically provisions the Kubernetes Persistent Volume Claims from Cloud Volume Services GCP for MySQL. Astra Control discovers the applications on your registered clusters, and you can easily manage either just the application, all the resources in the entire namespace as one unit or a custom group based on kubernetes labels.

Name	Ready	Cluster	Group	Discovered	Actions
ns-mysql	✓	longboat-cluster-1	ns-mysql	2022/01/20 20:04 UTC	Unmanaged
app-mysql-mysql	✓	longboat-cluster-1	ns-mysql # app.kubernetes.io/name: mysql +1	2022/01/20 20:04 UTC	Manage

Figure 4) Managing the MySQL application.

After managing the application, Astra Control can take snapshots, backups, and clones of that application, its Kubernetes resources, and its associated Persistent Volumes.

Kubernetes Objects

Resource	Type	UUID	Created
kube-root-ca.crt	ConfigMap	b5665ac5-a24d-4e55-b325-1c4d46c1557c	2022/01/20 19:59 UTC
app-mysql # app.kubernetes.io/managed-by: Helm +4	ConfigMap	e14bdae9-1e94-42b7-9f6a-b456dc093758	2022/01/20 19:59 UTC
data-app-mysql-0 # app.kubernetes.io/component: primary +2	PersistentVolumeClaim	6ef76eaf-6fd0-4d53-bbc5-63b2c70a6081	2022/01/20 19:59 UTC
app-mysql-0 # app.kubernetes.io/component: primary +6	Pod	35c97fd0-4675-4dbd-8d66-0aab27486994	2022/01/20 19:59 UTC
default-token-fmcc1	Secret	817a384d-71dd-464a-b77a-77a82c14ed3e	2022/01/20 19:59 UTC
app-mysql # app.kubernetes.io/managed-by: Helm +3	Secret	9aa2b286-0996-4620-81aa-d5ec6c1c79e7	2022/01/20 19:59 UTC
sh.helm.release.v1.app-mysql.v1 # name: app-mysql +4	Secret	b45f4d09-9a21-4b74-9b08-b8129f1d0118	2022/01/20 19:59 UTC

Figure 6) Kubernetes objects of managed MySQL application.

All the data generated by MySQL database clients can be automatically protected by using snapshots and backups. Astra Control snapshots and backups preserve the application state, its Kubernetes resources, and its volumes in one easily manageable unit. MySQL and other stateful applications benefit from application consistent snapshots and backups. In built Pre and Post execution hooks in Astra Control provide the ability to perform application aware backups for MySQL.

NetApp Astra Control supports both on-demand and scheduled snapshots and backups. When using execution hooks, the pre-snapshot script will run first before taking any snapshot or backup. When taking on-demand backups, you have the option to choose any existing snapshot. Otherwise, the backup will be created from the application's current state (from a new snapshot). Astra Control application backups are always saved in an external object store. You can choose a different object store when Astra Control has more than one object store configured.

Astra Control inbuilt execution hooks for MySQL

Hook name	Script name	Container image matches	Source	Type	Created	Script file checksum	Actions
NetApp-MySQL-post-snapshot	NetApp-MariaDB-MySQL.sh	docker.io/bitnami/mysql:8.0.23-debian-10-r57	NetApp	Post-snapshot	2021/12/14 19:34 UTC	4af49523d181f54c862269905c9616ef	Enabled
NetApp-MySQL-pre-snapshot	NetApp-MariaDB-MySQL.sh	docker.io/bitnami/mysql:8.0.23-debian-10-r57	NetApp	Pre-snapshot	2021/12/14 19:34 UTC	4af49523d181f54c862269905c9616ef	Enabled

Figure 7) Astra Control inbuilt pre and post snapshot execution hooks for MySQL

Snapshot application

STEP 1/2: DETAILS

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SNAPSHOT DETAILS

Name

ns-mysql-snapshot-20220120201854

Also provide custom Snapshot Name

CREATING APPLICATION SNAPSHOTS

Astra Control can take a quick snapshot of your application configuration and persistent storage. Enter a snapshot name to get started.

Read more in [Protect apps](#)

Application

ns-mysql

Namespace

ns-mysql

Cluster

longboat-cluster-1

Cancel

Next →

Figure 8) On-demand application snapshot.

Dashboard

MANAGE YOUR APPLICATIONS

Applications

Clusters

MANAGE YOUR STORAGE

Buckets

MANAGE YOUR ACCOUNT

Account

Activity

Support

Activity

Export to CSV

Search

1-25 of 458 entries

All managed applications

All severity

All users

Time range

Activity

Execution hook scripts are executed before and after a snapshot

+	Post-snapshot execution hook 'NetApp-MySQL-post-snapshot' succeeded	Informational	nautilus	Jaimon George	2022/01/20 20:21 UTC
+	Post-snapshot execution hook 'NetApp-MySQL-post-snapshot' started	Informational	nautilus	Jaimon George	2022/01/20 20:21 UTC
+	Pre-snapshot execution hook 'NetApp-MySQL-pre-snapshot' succeeded	Informational	nautilus	Jaimon George	2022/01/20 20:21 UTC
+	Pre-snapshot execution hook 'NetApp-MySQL-pre-snapshot' started	Informational	nautilus	Jaimon George	2022/01/20 20:21 UTC

Figure 9) Running Pre and Post Execution hooks

Backup application STEP 1/2: DETAILS

BACKUP DETAILS

Name: ns-mysql-backup-20220120203001

Backup from an existing snapshot

BACKUP DESTINATION

Bucket: astra-6cb378a8-d3ab-4b9d-a140-a01ee3d9e0a1-backup - astra-6cb378a8-d3ab-4b9d-a140-a01ee3d9e0a1-backup Available Default

CREATING APPLICATION BACKUPS

Astra Control can take a backup of your application configuration and persistent storage. Persistent storage backups are transferred to your object store. Enter a backup name to get started.

Read more in [Application backups](#)

Application: ns-mysql

Namespace: ns-mysql

Cluster: longboat-cluster-1

Cancel Next →

Figure 9) On-demand application backup.

Set up a snapshot and backup schedule and retention policy for the snapshots and backups.

Configure protection policy STEP 1/2: DETAILS

PROTECTION SCHEDULE

Hourly: Every hour on the 30th minute, keep the last 4 snapshots, keep the last backup

Daily: Daily at 04:00 (UTC), keep the last snapshot, keep the last backup

Weekly: Weekly on Mondays at 04:00 (UTC), keep the last snapshot, keep the last backup

Monthly: Every 1st of the month at 04:00 (UTC), keep the last snapshot, keep the last backup

Hourly Daily Weekly Monthly

Time (optional): At 30th minute

Snapshots to keep: 4

Backups to keep: 1

BACKUP DESTINATION

Bucket: astra-6cb378a8-d3ab-4b9d-a140-a01ee3d9e0a1-backup - astra-6cb378a8-d3ab-4b9d-a140-a01ee3d9e0a1-backup Available Default

CONFIGURING PROTECTION POLICIES

Define a policy to continuously protect your application on a schedule and configure a retention count to get started.

For select stateful applications, expect I/O to pause for a short time during a backup or snapshot operation.

Read more in [Protection policies](#)

Application: ns-mysql

Namespace: ns-mysql

Cluster: longboat-cluster-1

Cancel Next →

Figure 10) Configure protection policy.

After reviewing the information, set the protection policy. Astra Control automatically takes snapshots and backups based on the schedule and follows the retention policy defined.

Migrating MySQL application to another cloud provider

After a successful backup, the MySQL application is protected against disasters like losing the Kubernetes cluster or a human error like deleting the namespace. You can use the Clone option to redeploy MySQL to a new namespace within the cluster or to the new cluster. When choosing the option, you can also select an existing snapshot or backup to go back to a point in time copy of the MySQL application.

```
mysql> show databases;
+-----+
| Database |
+-----+
| information_schema |
| my_database |
| mysql |
| performance_schema |
| sys |
+-----+
5 rows in set (0.00 sec)

mysql>
mysql>
mysql>
mysql> show tables;
+-----+
| Tables_in_my_database |
+-----+
| locations |
+-----+
1 row in set (0.00 sec)

mysql>
mysql>
mysql>
mysql> select * from locations;
+-----+
| id | city | attractions | country |
+-----+
| 1 | Amsterdam | Rijkmuseum | Netherlands |
| 2 | paris | Eiffel Tower | France |
| 3 | Munich | Oktoberfest | Germany |
+-----+
3 rows in set (0.00 sec)
```

Figure 11) Test database in MySQL application

Clone MySQL to longboat-cluster-2, in Google Cloud Platform region, Europe-west2 using its current state. You could also clone from an existing backup or snapshot. When cloning from the current state, Astra first creates a backup and then uses that backup for migrating to the destination cluster. This brings up a new instance of MySQL, running at the same state as in the source kubernetes cluster.

For example, suppose that you have a new team in a different location that is going to take over the responsibility of managing the MySQL database. But they are using a GCP (Google Cloud Platform) project to run the application. You want to migrate the MySQL applications to a GKE cluster using the new team. MySQL is currently running on the longboat-cluster-1 (AKS) cluster located in the Azure East US (Virginia) region.

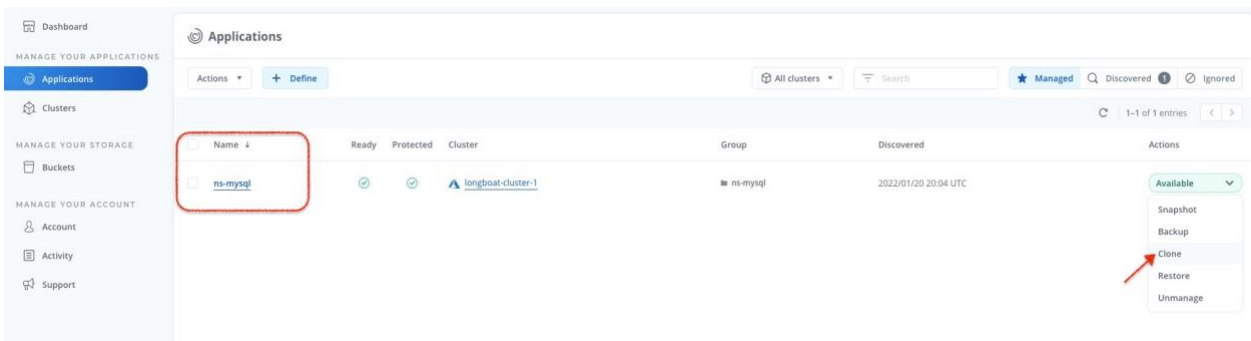


Figure 12a) Migrating MySQL from the current state.

Name	Ready	Protected	Cluster	Group	Discovered	Actions
ns-mysql	✓	✓	longboat-cluster-1	ns-mysql	2022/01/20 20:04 UTC	Available
ns-mysql-remote	✓	⚠	longboat-cluster-2	ns-mysql-remote	2022/01/20 21:26 UTC	Available

Figure 11b) Migrating MySQL from the current state.

A new MySQL clone is provisioned in the destination cluster and the application is automatically managed by Astra Control.

Name	Ready	Protected	Cluster	Group	Discovered	Actions
ns-mysql	✓	✓	longboat-cluster-1	ns-mysql	2022/01/20 20:04 UTC	Available
ns-mysql-remote	✓	⚠	longboat-cluster-2	ns-mysql-remote	2022/01/20 21:26 UTC	Available

Name	Ready	Protected	Cluster	Group	Discovered	Actions
ns-postgres	✓	ⓘ	longboat-cluster-2	ns-postgres	2022/01/20 22:13 UTC	Available
ns-postgres-remote	✓	⚠	longboat-cluster-1	ns-postgres-remote	2022/01/20 23:08 UTC	Available

Figure 13) MySQL migrated to the destination cluster.

After the migration, the MySQL application has the same Kubernetes resources and data as in the source cluster.

Summary

This solution guide provided a step-by-step guide for validating the following key benefits NetApp Astra Control provides to MySQL:

- Automatic storage provisioning and Storage Class setup
- Rich set of application-aware data management functionality (snapshot revert, backup and restore, activity log, and active cloning) for data protection, disaster recovery, data audit, and migration use-cases.
- Consistent data management UI.
- Clear visualization of data protection status.
- Simple data protection management.

- Seamless portability and migration.

Start your free trial of NetApp Astra Control today by registering at <https://cloud.netapp.com/astra-register>.

Where can I learn more?

To learn more, visit the NetApp Astra [website](#) and the [documentation](#).

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