

From MEM to Next-Gen MySQL Monitoring

A practical roadmap for observability & automation in hybrid environments



several9s

Housekeeping items

- Standard presentation format
 - Speaker intro
 - Topic
 - Demo
 - Q&A
 - 2 Polls
- Recording will be sent to attendees

Your expert presenter

Who: Ashraf Sharif

What: Support Engineering
Team Lead

Where: Severalnines

Why: 15+ YoE as DBA for MySQL,
MariaDB, Galera, MongoDB, Redis



```

```

- **MySQL Enterprise Monitor (MEM)**
- **Enterprise Manager for MySQL (EM4MySQL)**
- **ClusterControl (CC)**
- **Migration Paths**
- **Decision framework, costs, and next steps**

MySQL Enterprise Monitor (MEM) Overview

MySQL Server Community vs Enterprise

| Area | Community | Enterprise |
|-------------------------|--|---|
| License & support | GPLv2, community support only | Commercial + Oracle Premier Support |
| Backup | mysqldump, mysqlpump, snapshot | + MySQL Enterprise Backup |
| Security & compliance | SSL/TLS, user/roles, password policies | + Enterprise Audit, Enterprise Firewall, Enterprise Encryption, Transparent Data Encryption, Data Masking & De-identification |
| Authentication | Native MySQL auth, community plugins | + Enterprise Authentication plugins: PAM/LDAP/AD/Kerberos/Windows external auth. |
| Scalability | One-thread-per-connection | + Enterprise Thread Pool plugin |
| Monitoring & management | Open-source stacks (Prometheus/Zabbix/PMM,etc) | - MySQL Enterprise Monitor (EOL Jan 1, 2025) + Oracle Enterprise Manager or OCI Database Management |

MySQL Community Server

MySQL Enterprise
Server + MEB +
MEM

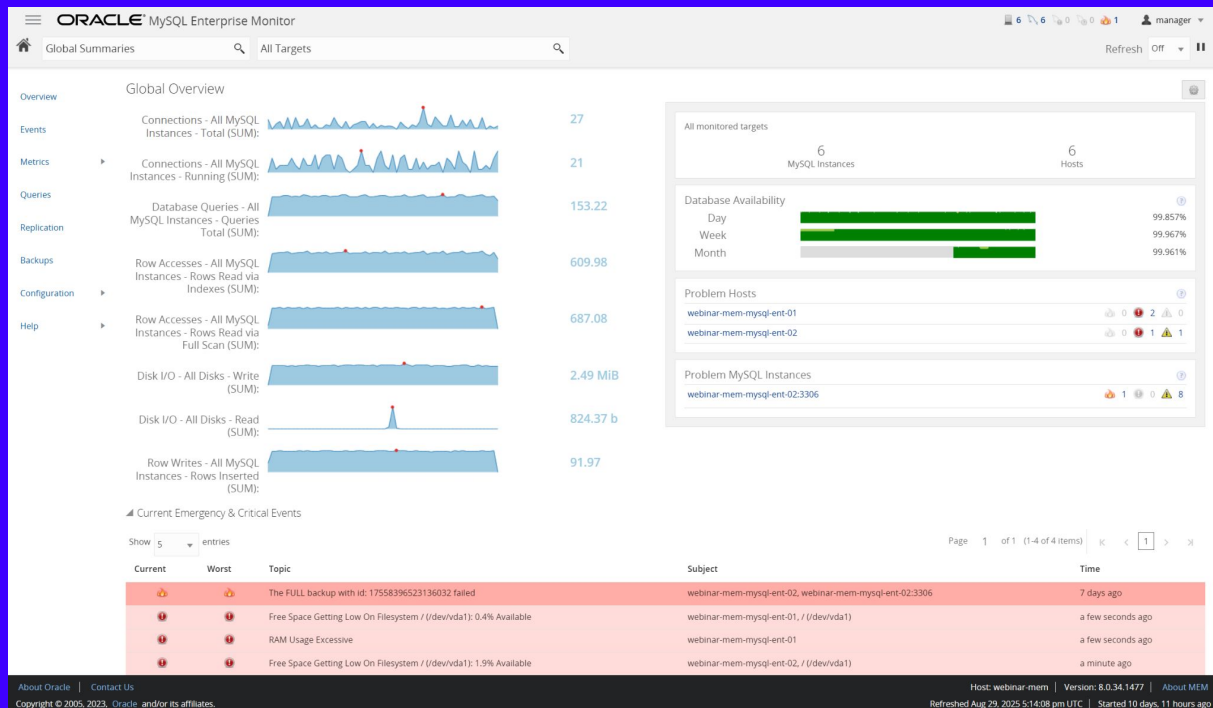
several9s

Database ops, your way

MySQL Enterprise Monitor

- On-premises monitoring solution for MySQL servers
- Available as part of the MySQL Enterprise subscription
- First release - v1 - 2006
- EOL - v8 - Jan 1st, 2025 (18+ years)
- Major features:
 - Monitoring
 - Alerting
 - Compliance

ORACLE® MySQL Enterprise Monitor





Why MEM is EOled?

- To consolidate MySQL monitoring into Oracle's newer platforms:
 - Oracle Enterprise Manager for MySQL (plug-in), or
 - The cloud-hosted OCI Database Management for MySQL.
- Limited integrations with modern tools
- Resource focus on newer platforms and analytics

Impact on Your Operations

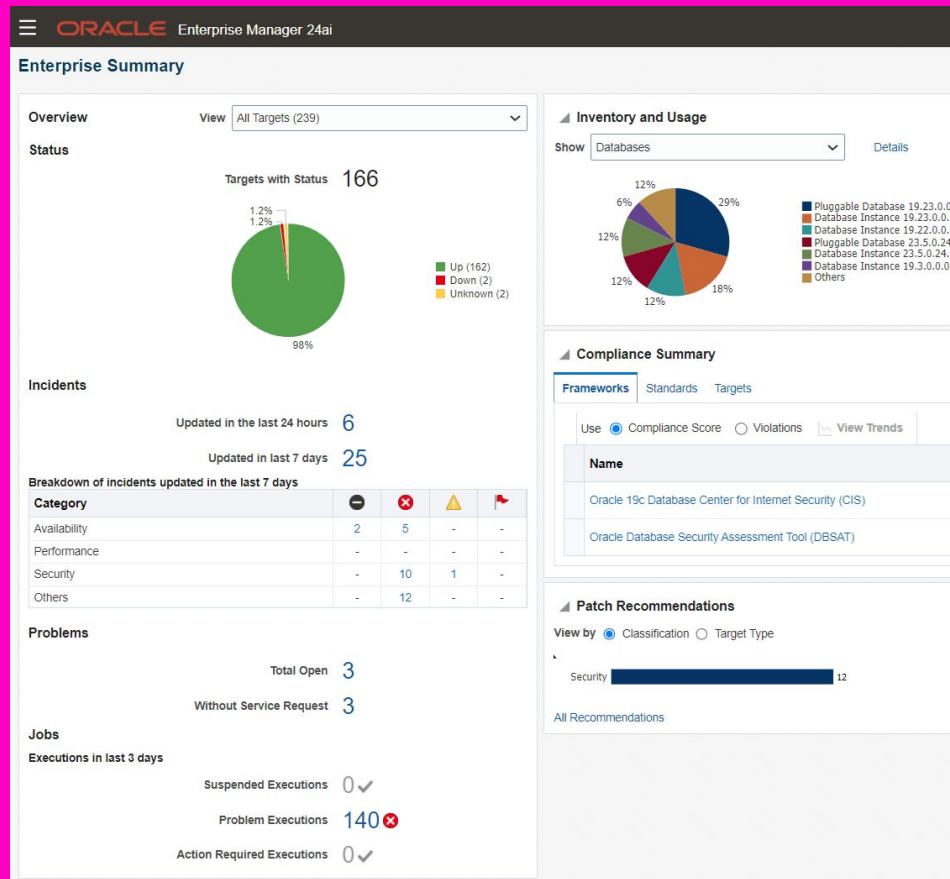
- **Monitoring & Alerting**
 - Assess coverage gaps as updates cease
 - Validate alert rules and channels
- **Security & Compliance**
 - No new fixes → plan risk mitigation
 - Map responsibilities for patching stack
- **Supportability**
 - Vendor support transitions
 - Community vs. enterprise support trade-offs



Oracle Enterprise Manager for MySQL (EM4MySQL) Overview

Oracle Enterprise Manager (EM)

- Latest release: 24ai (2025)
- On-premises management platform for monitoring, configuring, patching, and automating Oracle infrastructure
- Scalable architecture (agents + plugins + centralized services)
- Higher infrastructure footprint than MEM
- No separate license need for base functionality (EM is paired with a properly licensed Oracle product)



EM Plugins

Applications

- Oracle E-Business Suite
- Oracle Instant Messaging Server
- Oracle Jdedwards EnterpriseOne
- Oracle PeopleSoft
- Oracle Primavera P6 EPPM
- Oracle Primavera Prima
- Oracle Siebel
- Oracle Utilities Application
- Oracle Utilities Network Management System
- Oracle VCP

Cloud

- Oracle Cloud Application
- Oracle Cloud Framework

Databases

- IBM DB2
- Microsoft SQL Server
- MySQL
- Oracle Database
- Oracle TimesTen In-Memory
- Sybase ASE

Server, Storage, Network

- Oracle Axiom
- Oracle Flash Storage System
- Oracle Key Manager
- Oracle Secure Global Desktop
- Oracle ZFS Storage Appliances
- Oracle Storage Management Framework
- Oracle Virtual Infrastructure
- Sun Ray Software
- System Infrastructure

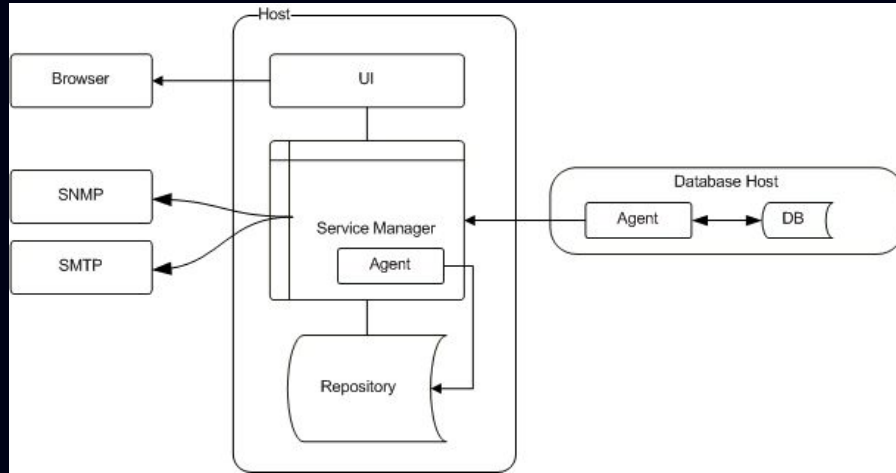
Middleware

- Apache Tomcat
- IBM WebSphere
- JBoss Enterprise Application Platform
- Microsoft IIS
- Oracle Fusion Middleware
- Oracle GoldenGate
- Oracle Tuxedo
- Oracle Unified Directory

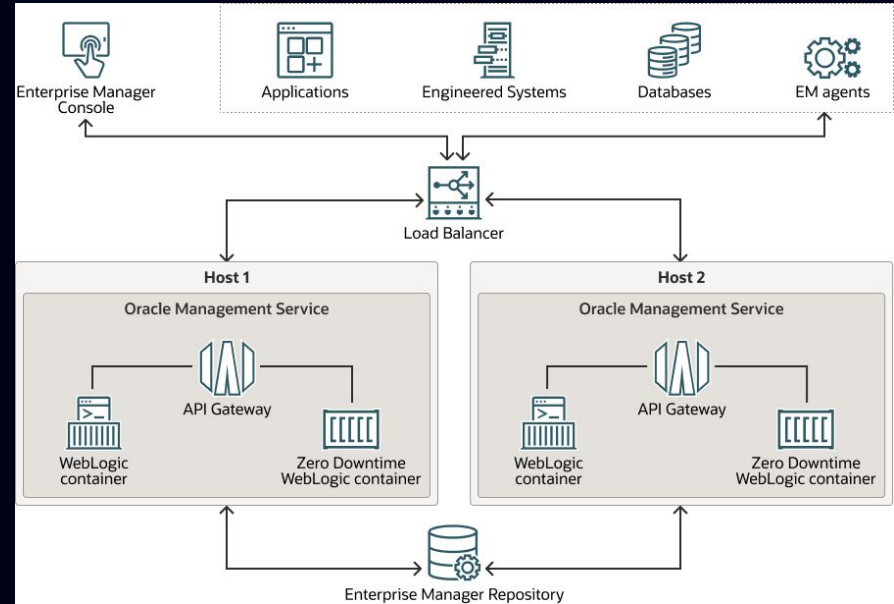
Engineered System

- Oracle Exadata
- Oracle Database Appliance
- Zero Data Loss Recovery Appliance

Architecture



MEM v8



EM v24ai

EM Requirements

For the latest 24ai:

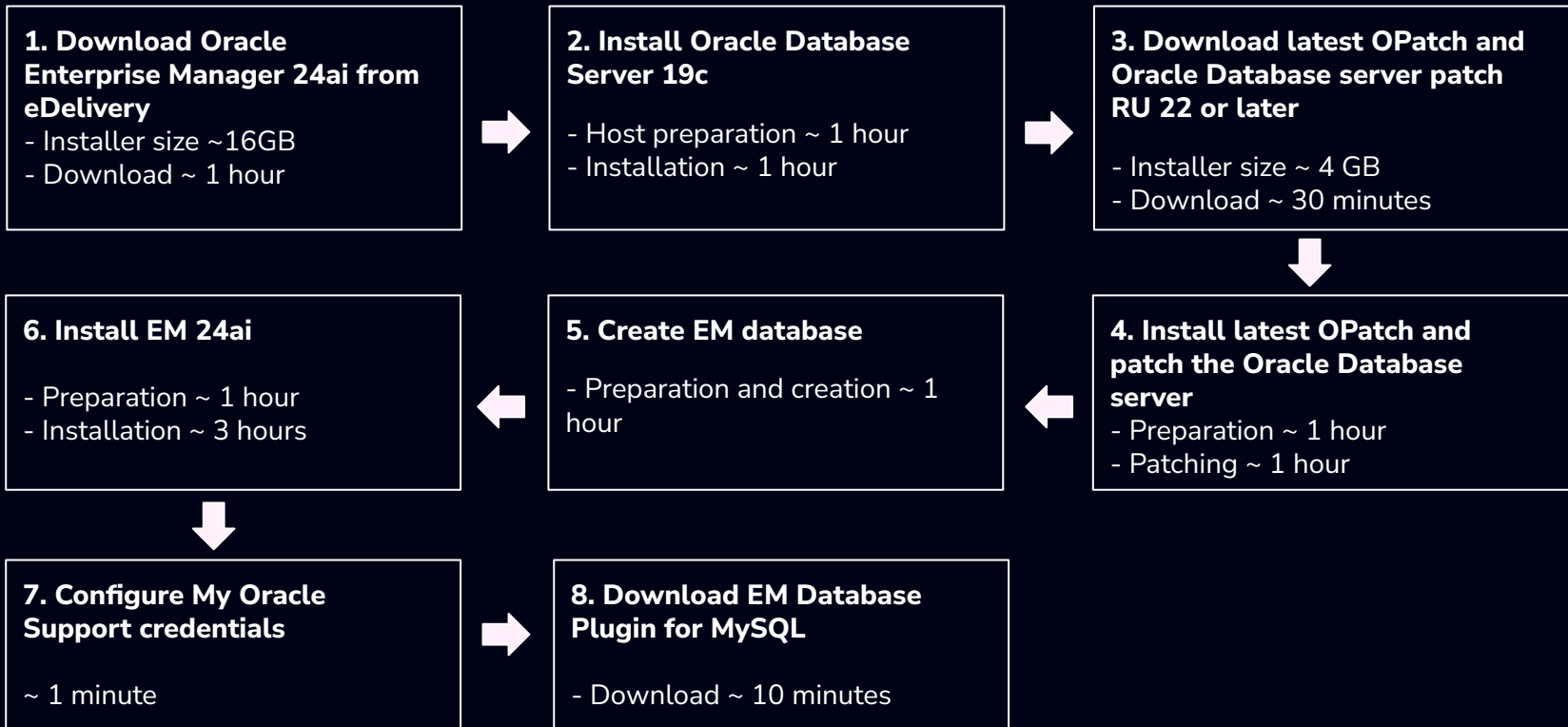
- Management repository:
 - Oracle Database 19c with RU \geq 19.22
- Hardware (production- small<1000 targets):
 - CPU cores: 4 cores
 - RAM: 16+ GB RAM
 - Disk: 100+ GB
- Operating system:
 - OL7/RHEL7+
 - SUSE Enterprise Linux 12+
 - Solaris SPARC
 - IBM AIX 7.2
 - Microsoft Windows
- An active My Oracle Support (MOS) account
- Network and ports:
 - Agent host: 3872/TCP
 - OMS console (UI): defaults picked from ranges during install - HTTP 7788-7798, HTTPS 7799-7809.
 - Upload (agent→OMS): HTTPS 1159 or 4899-4908
- Privilege delegation:
 - `sudo - grant NOPASSWD`
- Packages (OS dependant):
 - `make/binutils/gcc/libstdc++/libaio/sysstat/libXtst`

Oracle Jargons

- EM - Oracle Enterprise Manager
- OMS - Oracle Management Server
- OMA - Oracle Management Agent
- RU - Release Update
- OL - Oracle Linux
- MOS - My Oracle Support
- OCI - Oracle Cloud Infrastructure
- Targets - Instance to be monitored by an OMA
- Remote Targets - Remote instances to be monitored by an OMA
- Oracle Management Repository - Oracle database server that hosts EM's data.

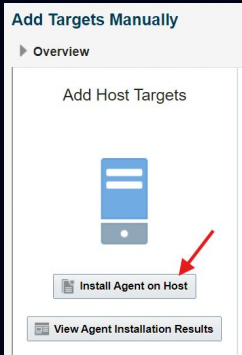
The Oracle logo is displayed in a bold, red, sans-serif font. The word "ORACLE" is followed by a registered trademark symbol (®). The logo is positioned on the right side of the slide, against a dark blue background.

Installing Oracle Enterprise Manager for MySQL (standalone)

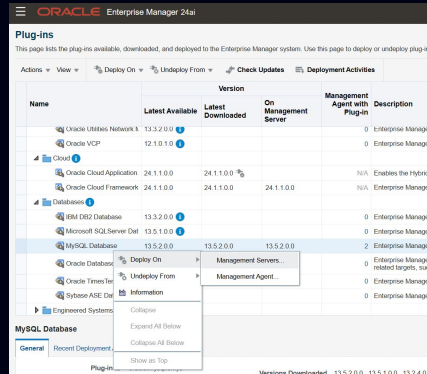


Adding MySQL Instances

Install the agent (OMA) on the database hosts.



Deploy MySQL plugin to OMS and OMA(s)



Create monitoring user

```
# On the DB server

mysql> CREATE USER
'monitoring'@'localhost'
IDENTIFIED BY
'Super^Str0ngPass769';

mysql> GRANT SELECT,
REPLICATION CLIENT, SHOW
DATABASES, PROCESS,
EXECUTE
ON *.* TO
'monitoring'@'localhost';
```

Add the database instance into EM

Add: MySQL Database

Add a target to be monitored by Enterprise Manager by specifying target monitoring details.

Target

* Target Name: MySQL_db1

Target Type: MySQL Database

Host: 192.168.73.51

Agent: https://192.168.73.51:3872/emd/main/

MySQL Database Monitoring Credentials

Credential type: OracleMySQLCredType

* MySQL User: monitoring

* MySQL Password:

* Confirm MySQL Password:

Properties

Host (default - localhost):

Port (default - 3306):

Socket: /var/lib/mysql/mysql.sock

Features Gap

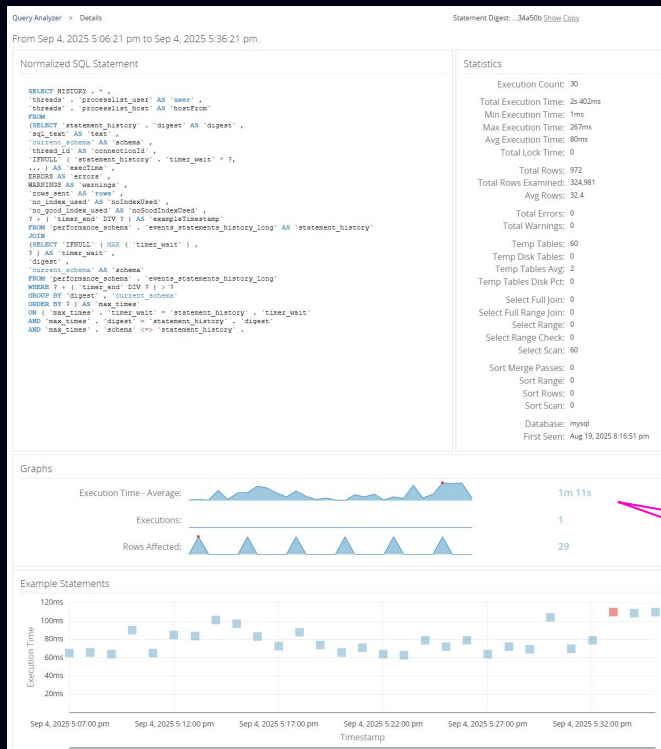
MySQL Enterprise Monitor (MEM)

- Topology viewer
- In-depth query analyzer
- Automatic grouping for replication, InnoDB Cluster and NDB Cluster
- MySQL Enterprise Backup (MEB) monitoring

Oracle Enterprise Manager (EM) for MySQL

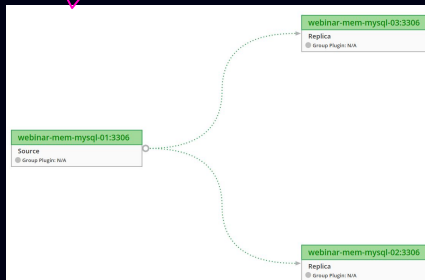
- Monitor other systems and databases
- Runbooks
- Compliance management
- Configuration drift
- Notification integration (mobile apps, webhooks, Slack)
- Incident management
- EMCLI

Features Gap - What you will miss

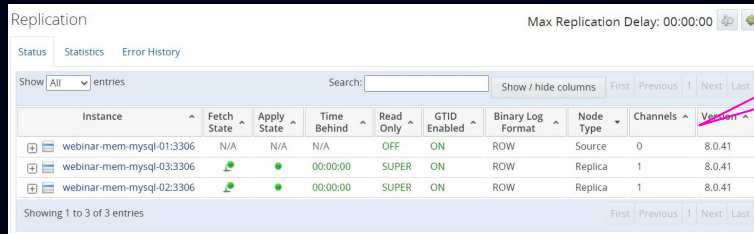
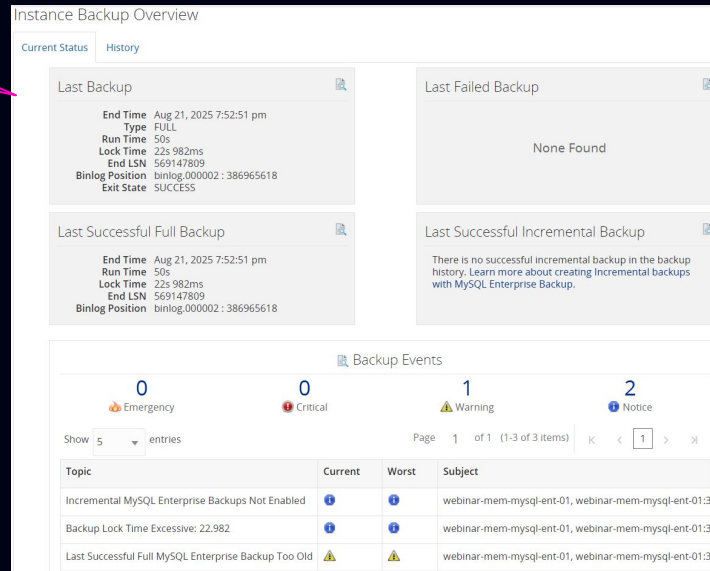


Backup monitoring

Topology viewer



In-depth query monitoring



Instances auto grouping

Features Gap - What you will get

Add Notification Method

Applies to Incidents

Select a type.

Webhook Slack

Notification integration

Apply Monitoring Template MySQL_Replication: General

Source Template MySQL_Replication Owner SYSMAN

Target Type MySQL Database Advanced Settings Not Present

Apply Options Static Thresholds

Template will completely replace all metric settings in the target.

Template will only override metrics that are common to both template and target.

Monitoring templates

Metrics with Key Value Settings

Apply Options Advanced Thresholds

Destination Targets

The table below shows the list of MySQL Database targets to which this monitoring template will be applied.

Target Name mysql84_com_db1 mysql84_com_db2

Target Type MySQL Database MySQL Database

Compliance Results

Compliance Frameworks Compliance Standards Target Compliance

Evaluation Results Errors

Search

View Show Details Manage Violations

| Compliance Standards | Applicable To | Compliance Standard State | Target Evaluations | Violations | Average Score (%) |
|-------------------------------|----------------|---------------------------|--------------------|------------|-------------------|
| MySQL Replication Standard | MySQL Database | Production | 0 0 1 0 0 0 | 0 | 100 |
| MySQL Administration Standard | MySQL Database | Production | 0 0 1 0 0 1 | 1 | 99 |
| MySQL Security Standard | MySQL Database | Production | 0 0 1 0 0 0 | 0 | 100 |
| MySQL Schema Standard | MySQL Database | Production | 0 0 1 0 0 0 | 0 | 100 |
| MySQL Performance Standard | MySQL Database | Production | 0 0 1 0 0 0 | 0 | 100 |

Compliance reports

Turn on the Slow Query Log (if it is not already turned on) and monitor what goes into it. S

Unassigned, Not acknowledged

General Events Notifications My Oracle Support Knowledge All Updates Related Events Related Metrics

Incident Details

ID 214

Metric indexes_not_being_used_efficiently

Metric Group MySQLServerHandlerActivity

Target mysql84_com_db1 (MySQL Database)

Incident Created Sep 2, 2025 8:18:58 PM GMT

Last Updated Sep 4, 2025 12:23:57 AM GMT

Summary

Turn on the Slow Query Log (if it is not already turned on) and monitor what goes into it. Statements that are logged there are candidates for tuning. Note, however, that statements will only be logged there if they take longer than long_query_time seconds to run, so statements triggering full scans of small tables that execute very quickly may not show up. Once you have found tuning candidates, use the EXPLAIN statement on the queries to see which tables should have indexes added to them. If you are using MySQL 4.1 or later you can use the -log-queries-not-using-indexes option to log all statements that do a full table scan, even if they would not otherwise qualify for the slow query log. Note that full table scans are not necessarily bad, as long as they are confined to very small tables, so be sure to take table size into account as you review your queries and their EXPLAIN plans.

Internal Event Name MySQLServerHandlerActivity indexes_not_being_used_efficiently

Event Type Metric Alert

Category Load

Show internal values for attributes...

Tracking

Escalated No

Priority None

Status New

Last Incident created by rule (Name = Incident management rule set for all targets, Create incident for Comment: critical metric alerts [System generated rule]) on Sep 2, 2025 8:18:58 PM GMT

This incident will be automatically cleared when the underlying issue is resolved.

Runbook Sessions

Start Runbook Session

No runbooks apply for this incident

Current Sessions

No sessions for this incident

Guided Resolution

Diagnosis Problem Analysis

Actions Reevaluate Alert Edit Thresholds

Corrective Actions No corrective action defined. Add or Google Play Store

Create Runbook

Enterprise Manager Mobile

Available on the App Store and Google Play

Mobile apps

Remote command execution

Command ps -ef | grep -i mysql

Enter the full command, including parameters.

TIP Target properties can be specified along with the command. Property names are case-sensitive. See the online help for a list of valid target properties. If you intend to use % as a literal, escape it as %.

Load OS Script OS Script

Run

Succeeded 2 Executed Sep 4, 2025 6:03:27 PM GMT+00:00

Failed 0

Select Host Credentials

Select credential from one of the following options.

Credential Preferred Named New

ORACLE-ONLY

Attribute Value

Username oracle

Password *****

More Details

Optional, enter a script for use with the command above.

Details Host

Hide 192.168.73.51

| Host | OS | Username | Command | Exit Code | Output |
|----------|---------|----------|---------|-----------|---|
| mysql | 6421 | 1 | 0 | Aug30 ? | 06:26:16 /usr/sbin/mysqld |
| prometh+ | 8522 | 1 | 0 | Aug30 ? | 00:40:08 /usr/local/bin/mysqld_exporter --mysqld.address=localhost:3306 --mysqld.username=cmonexp |
| oracle | 3129442 | 3129440 | 0 | 18:03 ? | 00:00:00 /bin/sh -c ps -ef grep -i mysql |
| oracle | 3129447 | 3129442 | 0 | 18:03 ? | 00:00:00 grep -i mysql |

Hide 192.168.73.52

| Host | OS | Username | Command | Exit Code | Output |
|----------|---------|----------|---------|-----------|---|
| mysql | 6492 | 1 | 0 | Aug30 ? | 04:09:14 /usr/sbin/mysqld |
| prometh+ | 8591 | 1 | 0 | Aug30 ? | 00:40:48 /usr/local/bin/mysqld_exporter --mysqld.address=localhost:3306 --mysqld.username=cmonexp |
| oracle | 3486159 | 3486157 | 0 | 18:03 ? | 00:00:00 /bin/sh -c ps -ef grep -i mysql |
| oracle | 3486164 | 3486159 | 0 | 18:03 ? | 00:00:00 grep -i mysql |

Some Tips..

- Don't underestimate the EM requirements and installation procedures. It can take days to weeks.
- MySQL 5.7+ supported. For MySQL 8.0 support requires plug-in 13.2.4.0.0+
- The current plug-in does not support TLS for the monitored connection, so the monitoring user must not be defined with REQUIRE SSL.
- Enable sys schema and performance_schema instrumentations:

```
# On every DB server
CALL sys.ps_setup_enable_instrument('wait');
CALL sys.ps_setup_enable_instrument('stage');
CALL sys.ps_setup_enable_instrument('statement');
CALL sys.ps_setup_enable_consumer('current');
CALL sys.ps_setup_enable_consumer('history_long');
```



Oracle Cloud Infrastructure (OCI) Database Management

- A managed, cloud-hosted monitor with lighter local footprint
- Subscription-based model - *Database Management for MySQL External Nonmetered* - ~USD\$15/month/host CPU core
- Notable MySQL features on OCI:
 - MySQL Database Service (MDS)
 - HeatWave MySQL
- Quicker piloting and onboarding

The screenshot displays the Oracle Cloud Database Management console. The left sidebar contains navigation links: Overview, Diagnostics & Management (selected), Vulnerability Detection, Patch Management, SQL Performance Watch, and Administration. Under Diagnostics & Management, there are links for Oracle Database, HeatWave & MySQL (selected), Exadata Infrastructure, High Availability, and Dashboards. The main content area is titled 'HeatWave & External MySQL fleet' and includes tabs for 'MySQL databases' and 'HeatWave clusters'. The 'MySQL databases' tab is active, showing an 'Inventory' section with a donut chart indicating 9 databases: 5 External (dark grey) and 4 HeatWave (teal). Below the chart is a search bar and a table with columns 'DB system name', 'Monitoring status', and 'Deployment status'. The table lists three databases: 'products-catalog-db', 'demodb', and 'sourcedb', all with a status of 'Up' and deployment type 'External'.

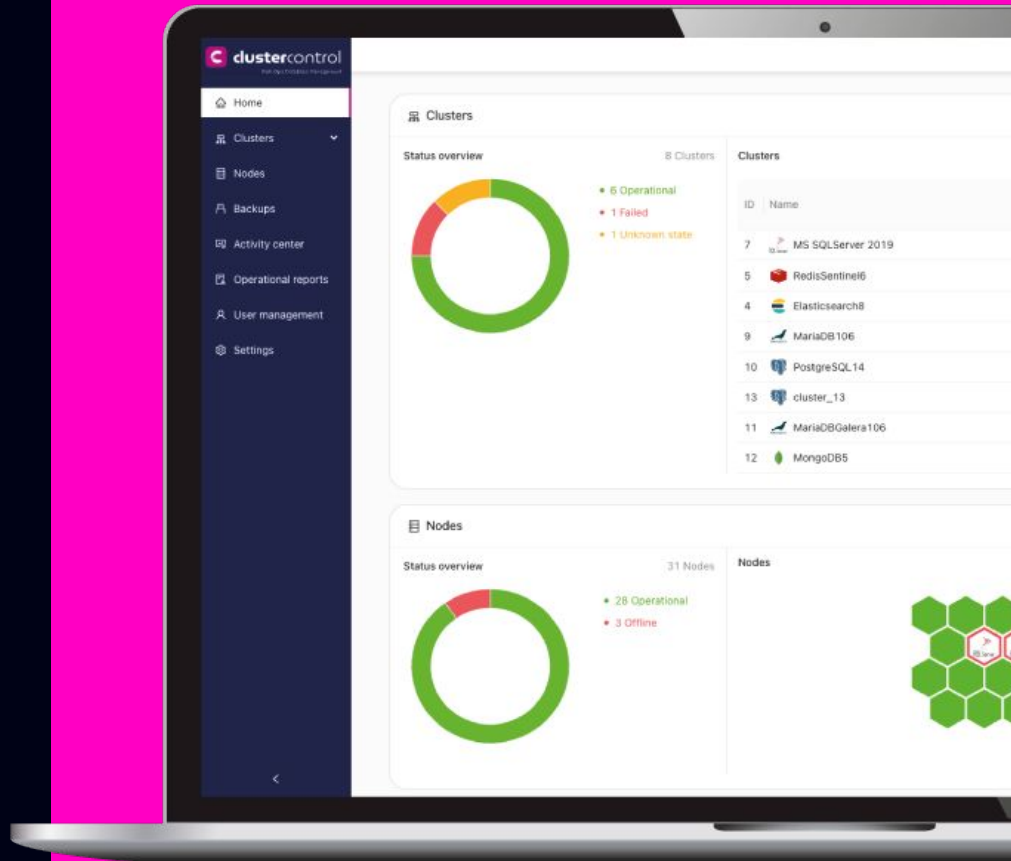
| DB system name | Monitoring status | Deployment status |
|-------------------------------------|-------------------|-------------------|
| products-catalog-db | Up | External |
| demodb | Up | HeatWave |
| sourcedb | Up | HeatWave |

ClusterControl Overview

Introducing ClusterControl

Database ops orchestration platform to deploy, monitor, manage, and scale database ops in any environment:

- Self-hosted in on-prem and hybrid environments
- Centralized management and monitoring from a single pane of glass
- Supports open-source and source-available databases
- Integrates with popular tooling - Terraform, Ansible, Puppet, etc



ClusterControl is holistic

Deploy

Scale

Failover

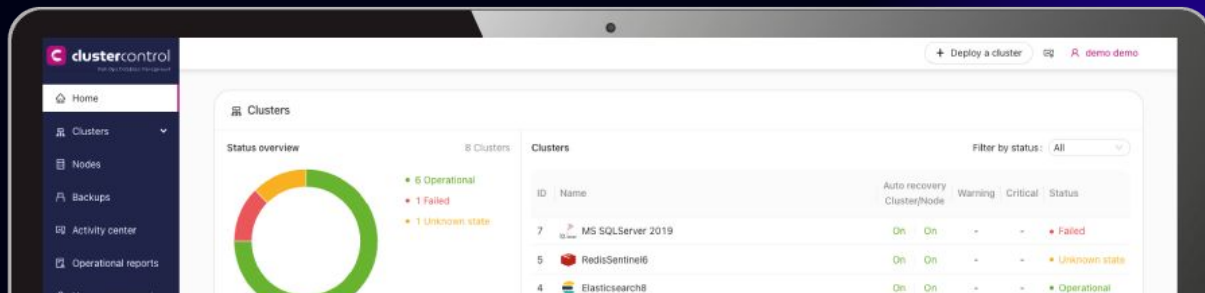
Backup and
restore

Monitor

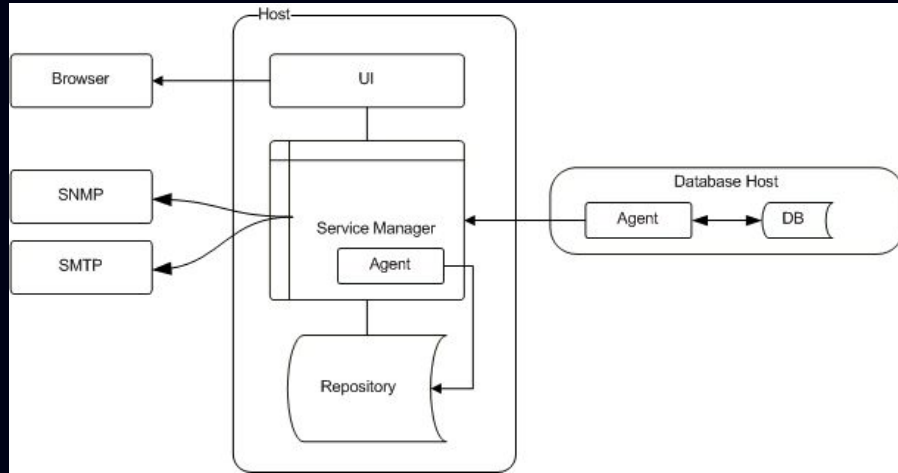
Integrate

Management

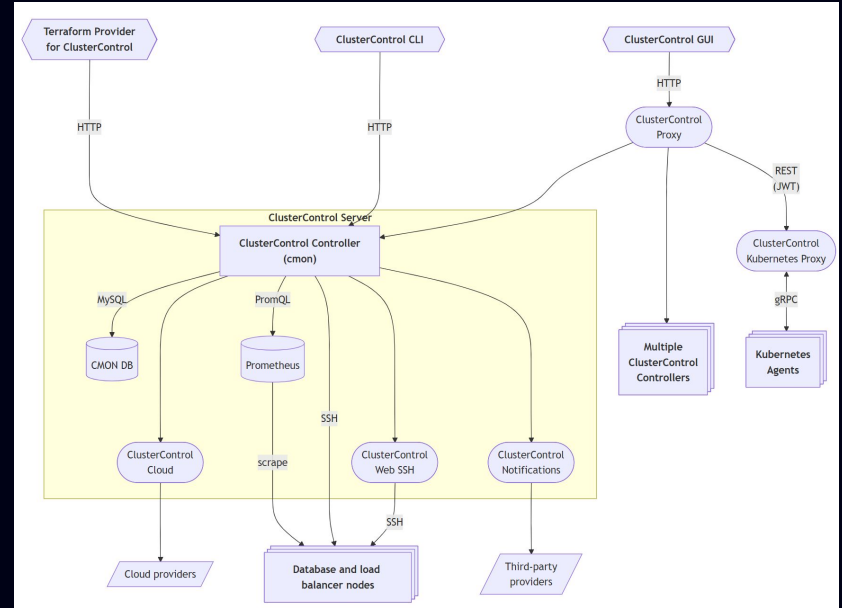
Administration



Architecture



MEM v8



ClusterControl v2.3.3

Supported Database Technology

MySQL/MariaDB

- Standalone & replication:
 - MySQL Community Server
 - Percona Server for MySQL
 - Percona Server for MySQL Pro
 - MariaDB Community Server
- Galera Cluster:
 - Percona XtraDB Cluster
 - Percona XtraDB Cluster Pro
 - MariaDB Cluster
- Group Replication (*coming soon!*)

PostgreSQL

- Standalone & streaming replication:
 - PostgreSQL
 - EDB
 - TimescaleDB
- Logical replication:
 - PostgreSQL

MongoDB

- Standalone, replica set and sharded cluster:
 - MongoDB Community
 - MongoDB Enterprise
 - Percona Server for MongoDB

Elasticsearch

- Single-node cluster
- Multi-node cluster

Redis

- Standalone, replication with Sentinel & cluster:
 - Redis Community Server
 - Valkey

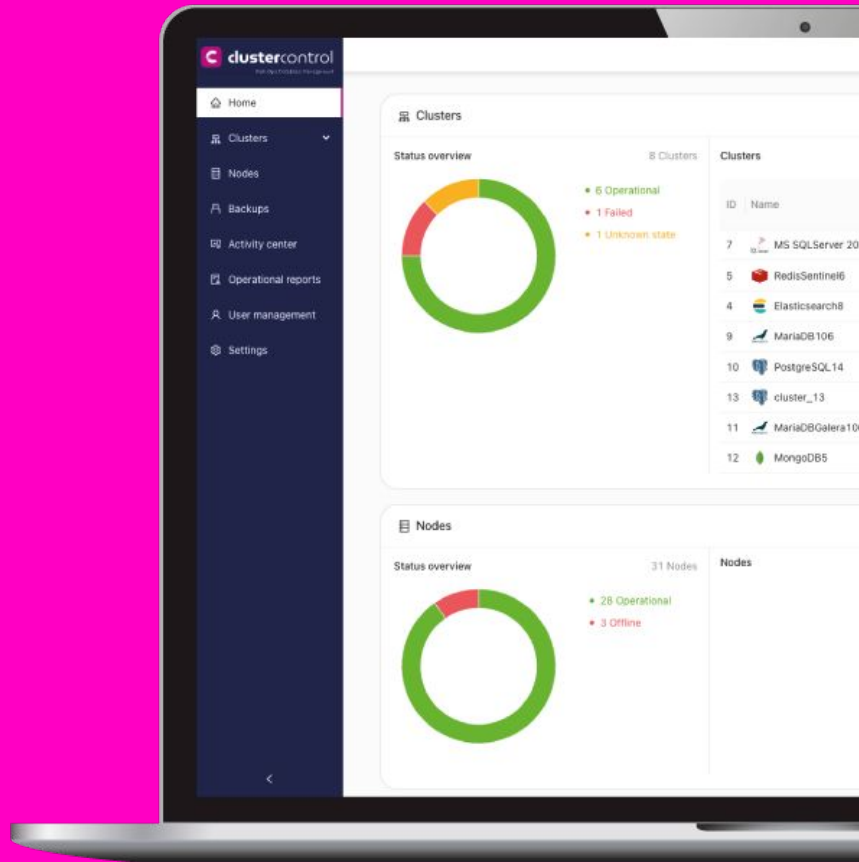
Microsoft SQL Server

- Standalone
- Always On availability group

Overview

- First release: 2011 (14+ years) - started with MySQL Cluster (NDB)
- Edition:
 - Community (free forever - monitoring & deployment)
 - Advanced (+management,+scaling)
 - Enterprise (+security,+24/7/365)
- Latest version: 2.3.3 (Jul 2025)
- Free 30-day Enterprise trial license (turns to Community after expiry)
- Linux x86_64 only
- Installation:

```
# On ClusterControl server, as root
$ wget https://severalnines.com/downloads/cmon/install-cc
$ bash install-cc
```



Support for MySQL Enterprise

1. ClusterControl does not officially support full lifecycle management of MySQL Enterprise Server, however it supports :

- MySQL replication (single-primary, multi-primary, chain-replication)
- MySQL standalone
- MySQL Group Replication (InnoDB cluster, but without Router + Shell)
- *coming soon in the next release*

2. Supported operating systems:

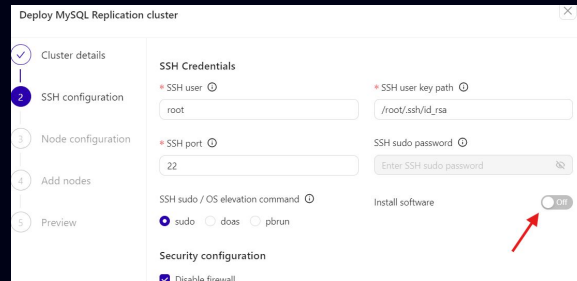
- RHEL/AlmaLinux/Oracle Linux/Rocky Linux 8/9
- Debian 11/12
- Ubuntu 22.04/24.04

3. ClusterControl understands MySQL topology & ecosystem - MySQL/MariaDB/Percona/Galera/NDB Cluster/Xtrabackup/ProxySQL

4. Install the MySQL Enterprise packages manually and toggle OFF "Install software".

Fun fact!

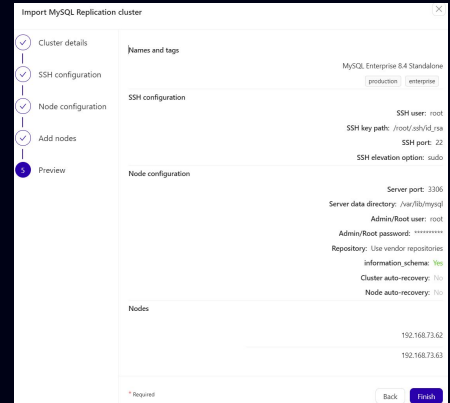
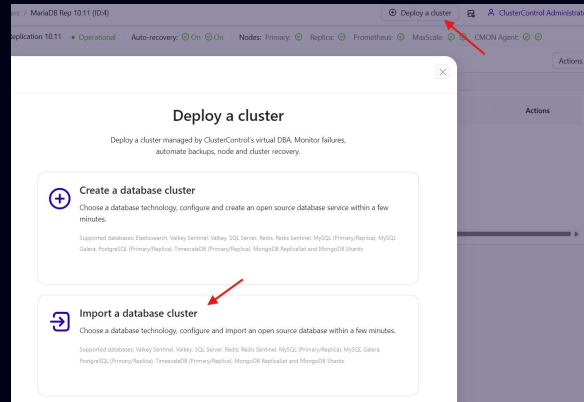
ClusterControl also supports proprietary databases; Percona Pro, MongoDB Enterprise, EDB and Microsoft SQL Server for Linux.



Importing MySQL Enterprise Servers

1. Configure SSH key-based authentication from ClusterControl server to all database nodes.
2. Go to *ClusterControl GUI* -> *Deploy a Cluster* -> *Import a database cluster*.
3. Fill up all required information.
4. Click *Finish* and monitor the job progress.

```
# On ClusterControl server
$ ssh-copy-id root@192.168.73.62
$ ssh-copy-id root@192.168.73.63
```



Adapting MySQL Enterprise into CC

1. Install Percona Xtrabackup for physical backup.
2. Configure a dummy backup user secret file.
3. Host must be configured with `report_host=<ip_address>` inside `my.cnf` for an accurate Topology visualization.
4. ClusterControl will manage the `read_only` flag. If you want to manage yourself, set `auto_manage_readonly=0` inside `cmon_X.cnf` (where X is the cluster ID).
5. Install MySQL Enterprise packages manually and set `install_software = false` when scaling up the database node via ClusterControl.

```
# Install Xtrabackup
$ dnf install percona-release
$ dnf install percona-xtrabackup-84
$ apt install percona-release
$ apt install percona-xtrabackup-84

# Create a dummy backup credential file
$ cat > /etc/mysql/mysql.conf.d/secrets-backup.cnf <<EOF
[mysqldump]
user=backupuser
password=whateverpassworditsjustadummy

[xtrabackup]
user=backupuser
password=whateverpassworditsjustadummy
EOF

# Secure it
$ chmod 640 /etc/mysql/mysql.conf.d/secrets-backup.cnf

# Go to ClusterControl and create a new database backup.
ClusterControl will reconfigure the backupuser accordingly.
```

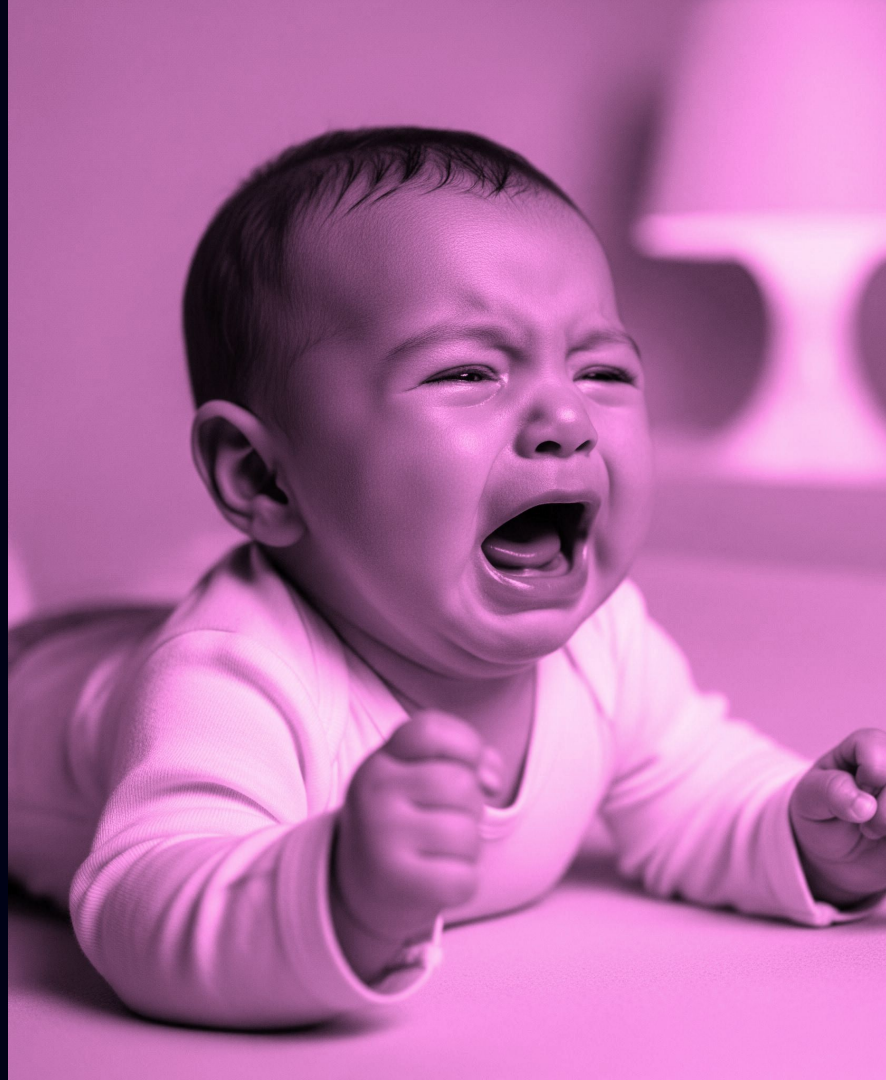

What you will get

- ✓ Monitoring (Host/DB/DB status/DB variables/logs/topology and query)
- ✓ Management - Backup (mysqldump/PXB), restore, backup verification, backup to cloud, PITR, configuration, DB users, SSL/TLS, restart, reboot, maintenance mode.
- ✓ Cluster recovery - Primary/replica failover, switchover, replica promotion, read-only
- ✓ Scaling - Add/remove new replica, create cluster from backup
- ✓ Load balancer integration (HAProxy/ProxySQL/Keepalived)
- ✓ Reporting - Operational reports, availability report, backup report, DB growth, schema analyzer, schema change report
- ✓ Alert & notifications - Email, Slack, Telegram, Webhook, PagerDuty, ServiceNow, OpsGenie, VictorOps, ilert

| 192.168.73.51:3306 (Primary) | 192.168.73.52:3306 (Intermediate) | 192.168.73.53:3306 (Replica) |
|--|--|---|
| Server ID: 5001 Executed Gtid Set: 3a270605-8...1-3323650 Binlog file: binlog.000065 Binlog position: 50428730 Show more | Server ID: 5002 Retrieved Gtid Set: 3a270605-8...1-3323650 Executed Gtid Set: 3a270605-8...1-3323650 Master Log File: binlog.000065 Read Master Log Pos: 50428730 Show more | Server ID: 5003 Lag: - Retrieved Gtid Set: 3a270605-8...45-3323650 Executed Gtid Set: 3a270605-8...1-3323650 Master Log File: binlog.000066 Read Master Log Pos: 2227 Show more |

What you will not get

1. MySQL Enterprise plugins management (so does MEM/EM)
2. MySQL Enterprise Backup (MEB) management. (so does MEM/EM - MEM supports backup monitoring only). You can still use mysqldump/Percona Xtrabackup.
3. No Enterprise software repository configured:
 - Cannot deploy a new MySQL Enterprise cluster/server via ClusterControl. Only import existing.
 - For scaling, the database software must be pre-installed manually on the new node.
4. SNMP monitoring.



Migration Paths and Decision Frameworks

Decision Framework: Which Road to Take?

- If you are all-in on Oracle stack
 - EM4MySQL likely the smoother fit
- If you want unified DB ops + hybrid flexibility
 - ClusterControl offers broader automation
- Budget & Ops Model
 - Account for licensing, infrastructure, and run costs
- Time to Value
 - Pilot both on a subset; compare alert fidelity & TCO

Costs, Risks, and Mitigations

- Costs: Licensing & Infrastructure
 - Budget both software and host sizing
 - Right-size retention and scraping intervals
- Risks: Operational Risk
 - Run in parallel; back out plan; keep MEM read-only during cutover
- Mitigations: Skills & Training
 - Short enablement for SRE/DBA teams
 - Docs and runbooks updated early

Path A: MEM → EM

1. Inventory current MEM targets, alerts, custom rules
2. Map feature parity & gaps; define target Service Level Objective (SLO)
3. Pilot a subset of hosts; install OMA and add target; validate dashboards & alarms
4. Phased rollout: per environment/tier; run in parallel until parity
5. Decommission MEM after sign-off and docs handover

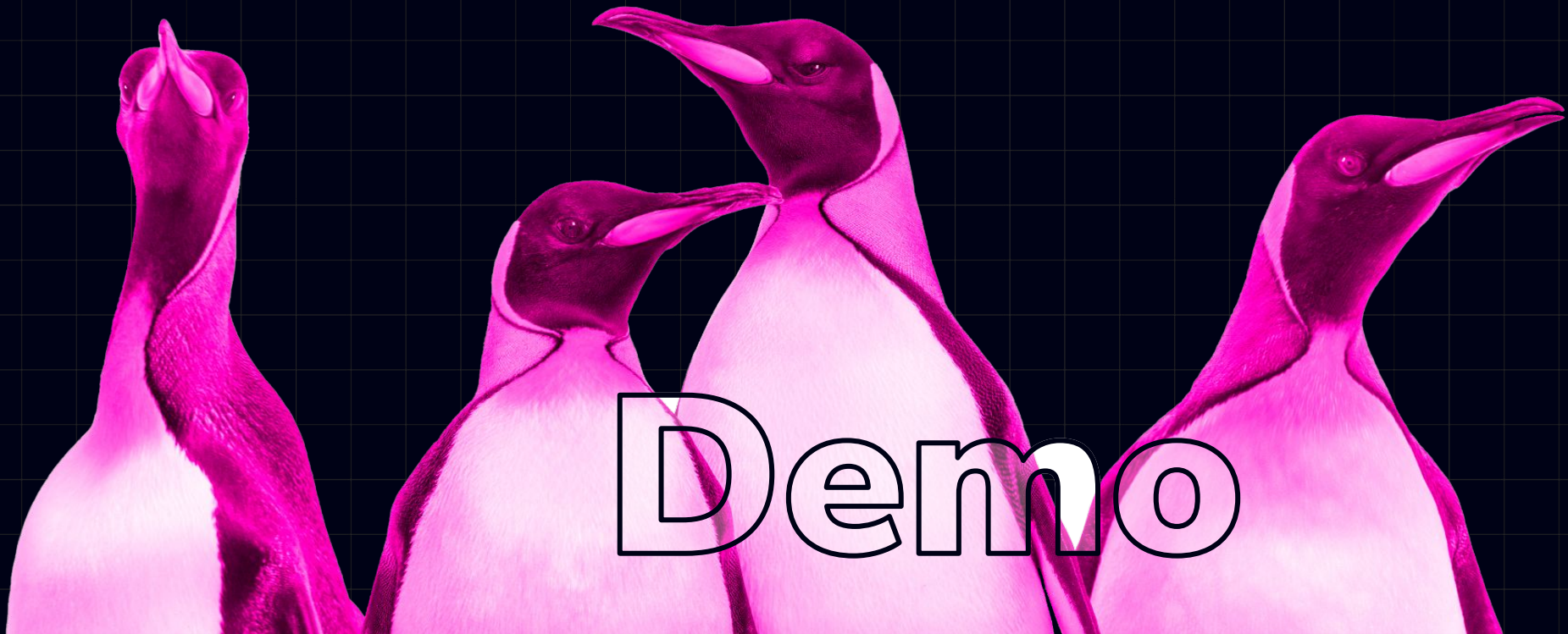
Path B: MEM → ClusterControl

1. Stand up a ClusterControl server.
2. Configure SSH key-based authentication from ClusterControl server to all target nodes.
3. Import a subset of existing MySQL nodes into ClusterControl.
4. Enable monitoring, configure backup tools (Percona XtraBackup) and disable automatic recovery. Configure notification channels, SMTP settings and schedule operational reports.
5. Test ClusterControl management & scaling features via GUI and CLI - automatic recovery, promote replica, backup/restore/PITR, add nodes, etc.
6. Cutover plan: Remove the target/instance from MEM, stop the MEM agent, decommission MEM.

Action Plan (Next 30–60 Days)

- Week 1: Inventory MEM coverage, alert rules, dashboards
- Week 2: Stand up EM4MySQL and/or ClusterControl pilots
- Week 3-4: Validate parity, tune alerts, test failure & recovery
- Week 5-6: Expand rollout, finalize training, decommission MEM

Short



Demo

Q&A

Thank you!

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