



# Enterprise Open Source Databases

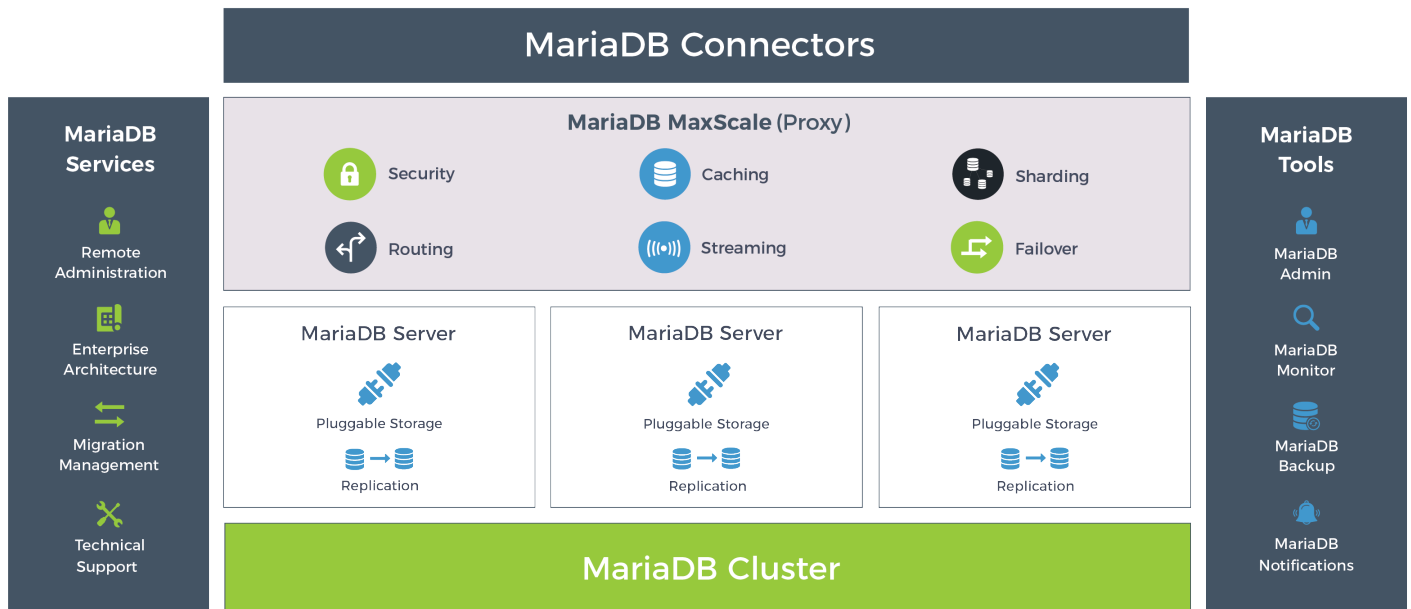
MariaDB vs. Oracle MySQL vs. EnterpriseDB

MAY 2018



# MariaDB TX – Born of the community. Raised in the enterprise.

MariaDB TX, with a history of proven enterprise reliability and community-led innovation, is a complete database solution for any and every enterprise. MariaDB TX, when deployed, is comprised of MariaDB connectors (e.g., JDBC/ODBC), MariaDB MaxScale (a database proxy and firewall), MariaDB Server, MariaDB Cluster (multi-master replication), MariaDB tools and access to MariaDB services – and is available via an enterprise open source subscription.



## Enterprise reliability

### High availability

Ensure uptime for mission-critical applications with replication and automatic failover.

### Disaster recovery

Recover from unexpected failure with backup and restore or point-in-time rollback.

### Security

Protect customer data with roles, encryption, data obfuscation/masking and query blocking.

### Scalability

Sustain business growth by scaling on demand with distributed, multi-master storage.

### Performance

Meet user expectations with multi-core processors and a multi-threaded architecture.

## Community innovation

### Open development

Participate in a 100% open and transparent development process – tests and all.

### Extensible architecture

Extend everything from storage to routing to implement features as needed.

### Community contribution

Benefit from an active community with contributions from industry leaders.

### Streaming integration

Stream database changes as Avro or JSON objects to external systems, including Kafka.

### Schema flexibility

Create hybrid data models with built-in JSON functions and instant add column.



# Table of Contents

Introduction .....	1
Vendor Comparison .....	2
Product Comparison .....	3
- Disaster Recovery .....	3
- High Availability .....	3
- Security .....	4
- Firewall .....	5
- Performance and Scalability .....	6
- Development .....	7
- Oracle Compatibility .....	8
Conclusion .....	9

# Introduction

The role of open source software in modern infrastructure is expanding – the operating system, the middleware, and now, the database. In fact, many organizations are implementing open source mandates and/or strategic initiatives to evaluate open source software and limit the use of proprietary software. It reduces costs, supports the shift from capital expenses to operating expenses and enables enterprises to benefit from community collaboration and innovation.

The leading enterprise open source databases are MariaDB TX, (Oracle) MySQL Enterprise and EnterpriseDB Postgres Platform. However, when it comes to standardizing on an enterprise open source database, it is important to understand the differences both between the vendors and between the databases. The vendors have different business models while the databases have different architectures and features.

This white paper compares MariaDB, Oracle and EnterpriseDB and their databases: MariaDB TX, MySQL Enterprise Edition and EnterpriseDB Postgres Platform. It begins with a comparison of business models and licensing strategies and then focuses on the following database features:

- Disaster recovery
- High availability
- Security
- Firewall
- Performance and scalability
- Development
- Oracle compatibility

*The comparisons are based on MariaDB TX 3, EnterpriseDB Postgres Platform 10 and MySQL Enterprise 8.*

## Vendor Comparison

MySQL and EnterpriseDB follow an open core business model. MySQL Enterprise Edition extends MySQL with proprietary features (e.g., MySQL Enterprise Audit). EnterpriseDB Postgres Platform extends PostgreSQL with proprietary features (e.g., hash partitioning). However, MariaDB TX does not extend MariaDB Server with proprietary features.

MariaDB, MySQL and EnterpriseDB solutions include both open source and proprietary tools. However, for proprietary tools, MariaDB uses a Business Source License (BSL) that automatically converts to GPL on a specific date. MariaDB MaxScale 2.1, for example, will automatically convert from BSL to GPL on July 1, 2019.

In addition, whereas MySQL development is closed, MariaDB development is open and transparent, ensuring the community and customers have access to everything from test cases and security bugs to source code and road maps.

	EnterpriseDB	MySQL	MariaDB
Database: core	Similar to BSD/MIT	GPL	GPL
Database: enterprise features	Proprietary	Proprietary	GPL
Database: enterprise tools	Proprietary	Proprietary	BSL

## Product Comparison

### Disaster Recovery

The most basic disaster recovery plans include online failover and/or offline recovery. MariaDB, MySQL and EnterpriseDB support online failover with hot standbys (using replication), and offline recovery with backup and restore tools. However, only MariaDB supports online recovery via point-in-time rollback.

	EnterpriseDB	MySQL	MariaDB
Replication	Yes	Yes	Yes
Delayed replication	Yes	Yes	Yes
Backup and restore	Yes	Yes	Yes
<b>Point-in-time rollback</b>	<b>No</b>	<b>No</b>	<b>Yes</b>

### High Availability

The two most common approaches to high availability are master/slave replication with automatic failover and multi-master clustering. In addition, transparent routing is required to avoid application changes, and thus downtime, when the topology changes.

MariaDB, MySQL and EnterpriseDB support asynchronous master/slave replication with automatic failover. However, while MariaDB and MySQL support synchronous multi-master clustering as well, EnterpriseDB is limited to asynchronous, bi-directional replication via EnterpriseDB Replication Server – itself a single point of failure.

MariaDB leverages an advanced database proxy with automatic topology detection and intelligent routing. MySQL is limited to basic routing (e.g., no connection pooling), and EnterpriseDB has to rely on virtual IP addresses.

	EnterpriseDB	MySQL	MariaDB
Master/Slave replication	Yes	Yes	Yes
Multi-source replication	Yes	Yes	Yes
Multi-master clustering	No	Yes	Yes
Automatic failover	Yes	Yes	Yes
Transparent routing	Yes	Yes	Yes

## Security

The security requirements for databases have increased. While end-to-end encryption, authentication/authorization and auditing has long been considered the bare minimum, it is no longer enough. The frequency and severity of high-profile data breaches, and the introduction of new regulations (e.g., EU General Data Protection Regulation), has made sophisticated database firewalls and data protection critical features.

MariaDB and MySQL have comprehensive sets of security features. However, only MariaDB supports data obfuscation for anonymization and data masking for psuedoanonymization – features necessary to protect sensitive and/or personally identifiable information (SPI/PII). In addition, while MariaDB and MySQL support encryption at rest (i.e., transparent data encryption), EnterpriseDB does not – a high security risk.

	EnterpriseDB	MySQL	MariaDB
Encryption: data	No	Yes	Yes
Encryption: logs	No	Partial	Yes
Encryption: connections	Yes	Yes	Yes
<b>Encryption: external key management</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
Authentication: PAM	Yes	Yes	Yes
Authentication: LDAP	Yes	Yes	Yes (via PAM)
Authentication: Kerberos/NTLM	Yes	Yes	Yes
Authentication: SASL/SCRAM	Yes	No	No
Authentication: user/group mapping	Yes	Yes	Yes
Password strength check	Yes	Yes	Yes
Authorization: privileges	Yes	Yes	Yes
Authorization: roles	Yes	Yes	Yes
Authorization: resource limits	No	Yes	Yes
Auditing: format – CSV	Yes	No	Yes
Auditing: format – XML	Yes	Yes	No
Auditing: output – file	Yes	Yes	Yes
<b>Auditing: output – syslog</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Data masking (full and partial)</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Data obfuscation</b>	<b>No</b>	<b>No</b>	<b>Yes</b>

## Firewall

A database firewall is necessary to prevent unauthorized and/or unintended access to data, whether it is from internal bad actors or external attacks. MariaDB includes the world's most advanced database firewall. While MySQL and EnterpriseDB are limited to whitelisting specific queries (MySQL) or queries on specific tables (EnterpriseDB), MariaDB enables administrators to whitelist or blacklist queries based on syntax.

	EnterpriseDB	MySQL	MariaDB
Query: whitelist	Yes	Yes	Yes
<b>Query: blacklist</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Query: frequency</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
Rules: simple	Yes	Yes	Yes
<b>Rules: custom</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Rules: compound</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Rules: ordered</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
Syntax: specific	No	Yes	Yes
Syntax: with TABLE	Yes	No	Yes
<b>Syntax: with COLUMN</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Syntax: with FUNCTION</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Syntax: with FUNCTION on COLUMN</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Syntax: with a wildcard (*)</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
Syntax: without WHERE	Yes	No	Yes
Syntax: with unbounded WHERE	Yes	No	No
<b>Syntax: match regular expression</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Syntax: type</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
Syntax: DDL	Yes	No	Yes
<b>Users/roles: any</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
Users/roles: specific	Yes	Yes	Yes



## Performance and Scalability

In the digital era, defined by web, mobile and Internet of Things (IoT) applications, performance and scalability is necessary to engage thousands, if not millions, of customers while meeting rising user experience expectations.

MySQL and MariaDB implement a multi-threaded architecture to scale performance with the number of cores/processors. EnterpriseDB is limited by a process-based architecture, but it can use multiple processes to parallelize parts of queries.

However, only MariaDB improves scalability and performance using an advanced database proxy and multiple, purpose-built storage engines. The advanced database proxy can cache query results, route reads and writes to separate database nodes and convert a sequence of inserts within a transaction into a single data stream for a bulk insert. In addition, MariaDB supports read-optimized storage for mixed workloads, write-optimized storage for write-intensive workloads and distributed storage a la NoSQL for workloads with requiring high scalability and/or concurrency.

	EnterpriseDB	MySQL	MariaDB
Architecture: multi-threaded	No	Yes	Yes
Architecture: parallel query	Yes	No	No
Partitions: local	Yes	Yes	Yes
Partitions: local subpartitions	Yes	Yes	Yes
Compression: rows	No	Yes	Yes
Compression: columns	Partial	No	Yes
Compression: logs	Yes	No	Yes
<b>Proxy: query cache</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Proxy: read-write splitting</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Proxy: bulk insert streams</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
Storage: read optimized (B/B+tree)	Yes	Yes	Yes
<b>Storage: write optimized (LSM tree)</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
<b>Storage: distributed</b>	<b>No</b>	<b>No</b>	<b>Yes</b>

## Development

A database not only has to meet operational requirements (e.g., availability and security), it has to meet the requirements of developers, both new (e.g., JSON) and existing (e.g., stored procedures). It has to support faster development of web, mobile and IoT applications and services while at the same time supporting the maintenance of existing enterprise applications.

EnterpriseDB and MariaDB include broad support for modern application development, everything from common tables expressions and window functions to user-defined aggregate functions and table value constructors. However, only MariaDB has temporal support via built-in system-versioned tables and standard temporal query syntax (e.g., AS OF).

### Schema

	EnterpriseDB	MySQL	MariaDB
Dynamic columns	Yes	No	Yes
Virtual columns	No	Yes	Yes
Array columns	Yes	No	No
Invisible columns	No	No	Yes
Default value expressions	Yes	No	Yes
Check constraints	Yes	No	Yes
Multiple triggers per type and event	Yes	Yes	Yes
<b>System-versioned tables</b>	<b>No</b>	<b>No</b>	<b>Yes</b>

### SQL

	EnterpriseDB	MySQL	MariaDB
Operators: INTERSECT/EXCEPT	Yes	No	Yes
Expressions: common table expressions	Yes	Yes	Yes
<b>Expressions: FOR SYSTEM_TIME (temporal)</b>	<b>No</b>	<b>No</b>	<b>Yes</b>
Expressions: table value constructors	Yes	No	Yes
Functions: window	Yes	Yes	Yes
Functions: user-defined aggregate	Yes	No	Yes
Functions: ordered-set aggregate	Yes	No	Yes
Functions: JSON	Yes	Yes	Yes

	EnterpriseDB	MySQL	MariaDB
Functions: GIS	Yes	Yes	Yes

### Stored procedures

	EnterpriseDB	MySQL	MariaDB
Anonymous blocks	Yes	No	Yes
Variables: %TYPE and %ROWTYPE	Yes	No	Yes
Variables: TYPE IS RECORD	Yes	No	No
Dynamic SQL (EXECUTE IMMEDIATE)	Yes	No	Yes
Collections: associative arrays (IS TABLE OF)	Yes	No	No
Cursors: without arguments	Yes	Yes	Yes
Cursors: with arguments	Yes	No	Yes
Packages	Yes	No	Yes

## Oracle Compatibility

With enterprise open source databases having matured, organizations are in the process of migrating off of Oracle Database. Oracle Database compatibility not only simplifies the process, it reduces migration costs and time and enables DBAs and developers to continue applying the Oracle Database knowledge they have learned.

EnterpriseDB and MariaDB support Oracle PL/SQL, sequences, dynamic SQL (i.e., EXECUTE IMMEDIATE) and packages. MySQL has no plans for Oracle compatibility. MySQL is an Oracle product, and Oracle Database is Oracle's flagship product.

	EnterpriseDB	MySQL	MariaDB
Packages	Yes	No	Yes
PL/SQL stored procedures/functions	Yes	No	Yes
Sequences	Yes	No	Yes
Dynamic SQL	Yes	No	Yes

## Conclusion

MariaDB TX, (Oracle) MySQL Enterprise Edition and EnterpriseDB Postgres Platform are the leading enterprise open source databases. However, these databases have different architectures and unique features, and their vendors have various business models.

Oracle and EnterpriseDB include proprietary features in their databases, MariaDB does not. In addition, MariaDB development is open and transparent, leading to collaboration with innovators like Alibaba, Facebook, Google and Tencent. While all three vendors develop proprietary tools, MariaDB uses a Business Source License, guaranteeing they become open source.

MariaDB TX, (Oracle) MySQL Enterprise Edition and EnterpriseDB Postgres Platform have competitive disaster recovery and high availability features. However, MariaDB TX has the most comprehensive set of security features, and the most advanced firewall.

MariaDB TX and EnterpriseDB Postgres Platform have a comprehensive set of development features, more than (Oracle) MySQL Enterprise Edition. EnterpriseDB Postgres Platform and MariaDB TX have Oracle compatibility.

When it comes to standardizing on an enterprise open source database, MariaDB is the clear winner – born in the community, raised in the enterprise. It provides the best of both worlds.