Continuent Tungsten

Benefits And Configurations

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What is Continuent Tungsten?

Continuent Tungsten allows enterprises running business-critical database applications to affordably achieve commercial-grade high availability (HA), globally redundant disaster recovery (DR) and performance scaling.

Tungsten Clustering makes it simple to create database clusters in the cloud or in your private data center, to keep the data available even when systems fail.

In addition, Tungsten Replicator provides data replication from relational databases to high-performance NoSQL and data analytics engines to derive insight from big data for better business decisions.

The key benefits include:

- **Deployment Flexibility** – Build database clusters in any bare-metal, private cloud (VMware, Open Stack) or public cloud (Amazon AWS, Red Hat OpenShift) environments.
- **Zero-Downtime Maintenance** – Perform database maintenance, such as schema changes, upgrades to a new version of MySQL or adding new hardware, without application or service interruptions.
- **High Availability** – Replace a failed master DBMS server within seconds while maintaining continuous availability and without losing any transactions.
- **Disaster Recovery** – Switch to a hot-standby disaster recovery site running a Tungsten Clustering cluster with a single command without losing application connectivity.
- **Multi-Site Operations with Geo-Clustering** – Implement multi-master, multi-site database clusters that span sites and are ready for immediate failover.
- **Affordable Oracle Replication** – Replicate data from Oracle to MySQL, from MySQL to Oracle, and from Oracle to Oracle. Think "Oracle GoldenGate power with Continuent price!"
- **Real-Time Integration Between RDBMS and Analytics** – Replicate quickly and efficiently to high-performance NoSQL and data analytics engines to derive insight from big data for better business decisions.
- **Supports off-the-shelf MySQL, MariaDB and Percona Server** – No software upgrade, data migration, application or DDL changes are required.

Continuent Tungsten Products

Tungsten Clustering

Tungsten Clustering provides full clustering support, including load balancing, failover, and multi-master, multi-site deployments. Enables replication to another server or cluster to handle disaster recovery scenarios.

Tungsten Replicator

Tungsten Replicator provides core replication between MySQL, MariaDB and Percona servers and replication to and from Oracle up to Oracle 12c. Additionally, Tungsten Replicator can extract from MySQL and Oracle sources and apply to various Hadoop distributions (including Pivotal HD, Hive, MapR, HortonWorks, and Cloudera), Amazon Redshift, Vertica by HPE, Elasticsearch, Kafka, Cassandra and MongoDB.

Feature	Tungsten Clustering	Tungsten Replicator
Flexible MySQL clustering	Yes	
Zero-downtime maintenance	Yes	
HA with automatic failover	Yes	
Disaster recovery	Yes	
Multi-master, multi-site	Yes	Yes
Improved performance	Yes	Yes
Real-time data loading to analytics and big data		Yes
Oracle replication		Yes
Supports MySQL, MariaDB and Percona Server	Yes	Yes

Key Benefits of Tungsten Clustering

High availability (HA), disaster recovery (DR), and continuous operations

- Tungsten Clustering handles data access from existing applications transparently for various cluster configurations, and maintains continuous connectivity during database maintenance or failover.
- Tungsten Clustering provides automatic failover that can switch away from a failed local master to a new master within seconds.
- Tungsten Clustering manages seamless re-integration of failed nodes when corrected and available.
- Tungsten Clustering protects against a site failure with easy-to-manage DR configuration and failover capabilities.
- Tungsten Clustering offers a true multi-master distributed solution, supporting clusters across multiple data centers or cloud-computing regions with real-time updates and failure handling.

Ease of use and zero-downtime operations

- Setup in minutes in cloud or on-premises environments.
- Perform database maintenance and application upgrades without service interruptions.
- Reduce ongoing DBA operations. Run large deployments with fewer DBA resources, resulting in significant cost savings.

Load balancing

- Tungsten Clustering increases throughput by automatically and transparently load balancing read operations across multiple slaves.
- Read/Write splitting supported through packet inspection, and explicit port, host and connection string configuration.

Improved performance

- Tungsten Clustering improves database performance by transparently splitting reads to the slaves and writes to master, thus reducing master load.
- Tungsten Clustering can increase replication performance over native MySQL and increases transaction volumes using intelligent parallel methods.

Supports cloud operations

- Deploy Tungsten Clustering clusters in the cloud with a single command.
- Augment your existing individual or clustered DBMS, in your local data center or at a managed hosting facility, with a failover disaster recovery Tungsten Clustering cluster in the cloud.
- Create multi-site, multi-master Tungsten Clustering clusters reaching over multiple regions and availability zones.

No migration, no application changes

- Tungsten Clustering works with off-the-shelf MySQL, MySQL Community and Enterprise versions (5.0 to 5.7), MariaDB (5.5, 10.0, 10.1) and Percona Server (5.5 and 5.6).
- Tungsten Clustering does not require any application changes for a default implementation. It may be beneficial to consider application changes to leverage all Tungsten Clustering features.

Advanced Continuent Tungsten Replicator Features

Multi-master replication

- Tungsten Clustering and Tungsten Replicator enable global real-time transaction processing with flexible multi-master replication configurations between clusters.
- Tungsten Clustering and Tungsten Replicator make real-time data aggregation of reporting data simple by replicating from multiple locations into a single database server without the need for data transformation.

Parallel replication

- Tungsten Clustering and Tungsten Replicator increase replication performance over native MySQL and increases transaction volumes using parallel slave apply.

Oracle replication

- Tungsten Clustering and Tungsten Replicator can replicate MySQL transactions to and from Oracle databases.
- Tungsten Clustering and Tungsten Replicator can also replicate from Oracle to Oracle.

Real-time analytics and big data

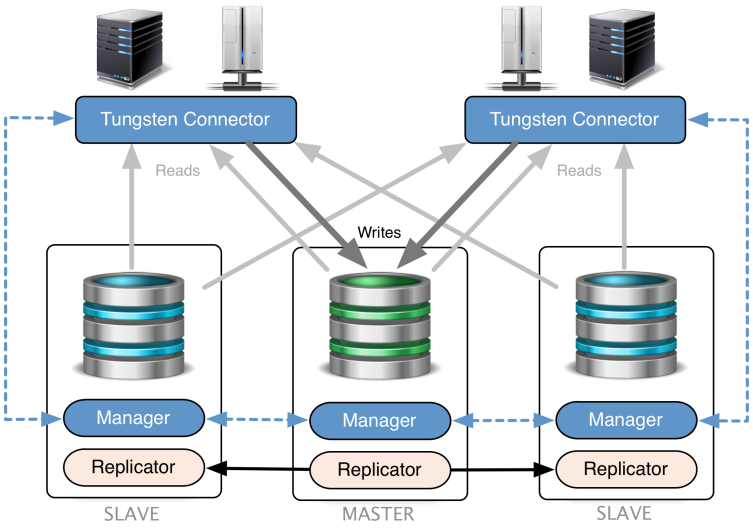
- Tungsten Clustering and Tungsten Replicator support real-time analytics replicating data quickly and efficiently to high-performance analytics engines, such as Vertica.
- Tungsten Clustering and Tungsten Replicator can publish data in real-time from SQL to NoSQL implementations, such as MongoDB.
- Tungsten Clustering scales manageable data volumes to 50TB and more through arrays of database clusters.

Tungsten Clustering Components

Tungsten Clustering includes three main components:

Tungsten Replicator

Tungsten Replicator™ is an open source replication engine supporting a variety of different extractor and applier modules. During replication, Tungsten Replicator assigns data a unique global transaction ID, and enables flexible statement and/or row-based replication of data. This enables data to be exchanged between different databases and different database versions. Information can be filtered and modified in-flight, and deployment can be between on-premise or cloud-based databases.



Tungsten Manager

The Tungsten Manager™ is responsible for monitoring and managing a Continuent Tungsten data service. The manager has a number of control and supervisory roles for the operation of the cluster, and acts both as a control and a central information source for the status and health of the data service as a whole.

Tungsten Connector

The Tungsten Connector™ is a service that sits between your application server and your MySQL database. The connector routes connections from your application servers to the data sources within the cluster, automatically distributing and redirecting queries to each data source according to load balancing and availability requirements.

Tungsten Clustering Configurations

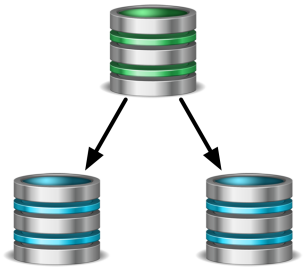
The configuration examples below highlight typical installations and typologies. Here are explanations of the nodes we use:

Symbol	Role	Description
	Master	Read and Write
	Slave	Read-Only, Failover-Ready
	Relay	Relay Master is the master in a Composite (DR) Slave Cluster – **available for read queries, but not writes**. This node is responsible for pulling the transactions from the Master cluster.

Single-Site High Availability Solutions

High availability clusters are usually located in a single physical datacenter, or in a single cloud region. Tungsten Clustering supports nodes in multiple availability zones in AWS.

Tungsten Clustering HA

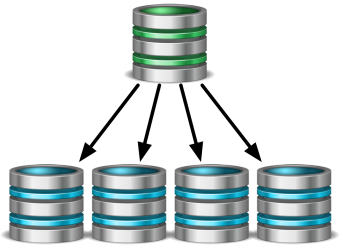


1 Master + 2 Failover/Read Slaves

The Tungsten Clustering HA configuration is designed for any site that strives to ensure constant HA. This configuration ensures the ability to perform maintenance on any DBMS server and still maintain an environment capable of HA failover at any time.

This is the preferred configuration for all applications.

Tungsten Clustering HA with Read Scaling



1 master + 4 or more failover/read slaves

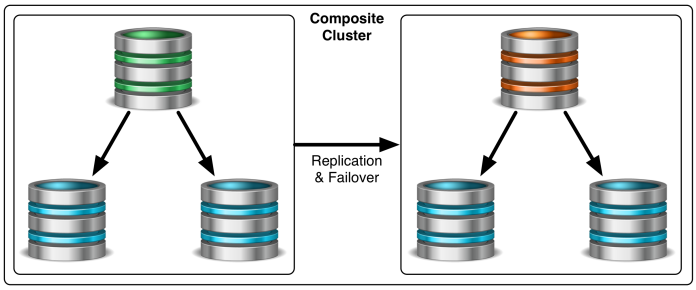
Tungsten Clustering HA with Read Scaling is ideal for sites that require HA in addition to needing read-scaling for enhanced performance under heavy load. Media and consumer web sites should consider this option. Tungsten Clustering enables the use of additional read slaves with minimal performance impact to the HA cluster.

Multi-Site Solutions – Active/Passive and Active/Active

Tungsten Composite Cluster for Disaster Recovery (DR)

1 master + 2 failover/read slaves and 1 relay/read node + 2 failover/read slaves

Active/Passive



The Tungsten Composite Cluster topology provides a highly available local operation plus an active failover site that is also available for reads. They are well suited for customers who seek the highest level of HA protection without altering applications, with the ability to operate applications on both sites.

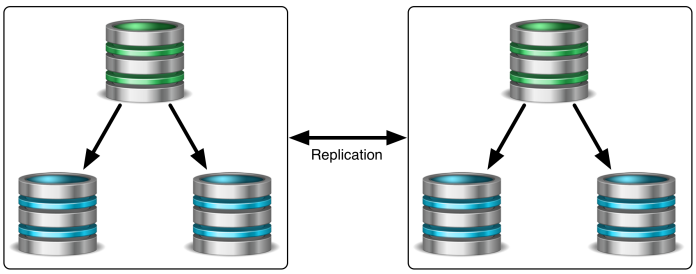
In this topology, there is just one single write-able Master across all sites, and all writes are directed to that master by the Connectors no matter which site received the write request. The Connectors in this topology are multi-site aware and will automatically react to a site failover. Replication flows in one direction only, from the current Primary cluster to the DR cluster(s).

Discounts are available for DR site nodes that will be not be used as active read sources for applications.

Tungsten Multi-Site/Multi-Master Cluster for multi-site operations

Two or more clusters each consisting 1 master + 2 failover/read slaves

Active/Active



The Tungsten Multi-Site/Multi-Master topology links highly available clusters across sites to enable constant availability for updates in two or more locations separated by high-latency networks. It is recommended for applications like credit card payment gateways or online testing services that must always be available for business.

In this topology, there is one write-able Master per cluster, and all writes are directed to that master by the Connectors. In this topology, the Connectors have zero knowledge of any other site, and there is no site-to-site DR failover; instead, all sites are write-able at all times via the local Master and replication goes in both directions.

Additional Tungsten Clustering Information

It is possible to have a 2-node cluster with one master and only one failover/read slave. Clusters with only two database servers must have either a passive or an active witness server to ensure proper quorum during failovers. There is no license fee for witness servers.

We do not recommend 2-node cluster setup, always consider adding a third node to your cluster.

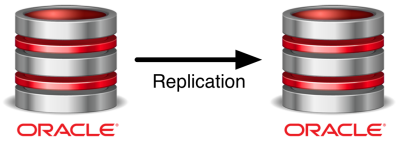
In order to be able to avoid split brain, a cluster needs an odd number of members such that if there is a network partition, there's always a chance that a majority of the members are in one of the network partitions. If there is not a majority, it's not possible to establish a quorum and the partition with the master, and no majority, will end up with a shunned master until such time a quorum is established.

To operate with an even number of database nodes, a witness node is required, preferably an active witness, since the dynamics of establishing a quorum are more likely to succeed with an active witness than with a passive witness.

Advanced Tungsten Replicator Topologies

Tungsten Replicator -- Oracle to Oracle

Oracle master + Oracle slave or Oracle RAC + Oracle RAC or Oracle slave

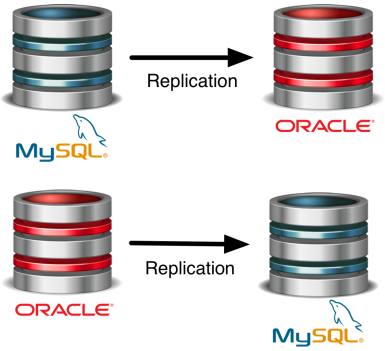


Tungsten Replicator real-time Oracle-to-Oracle replication is ideal for customers seeking an efficient, low-cost DR solution for Oracle databases. It works with individual Oracle instances as well as Oracle RAC.

Tungsten Replicator can be used during migration, for on-boarding a new platform, or for replication between different releases and versions, for example from Standard Edition to Enterprise Edition, or from Oracle 9i/10g/11g to 12c.

Tungsten Replicator -- Between MySQL and Oracle

MySQL master + Oracle slave, Oracle master + MySQL slave

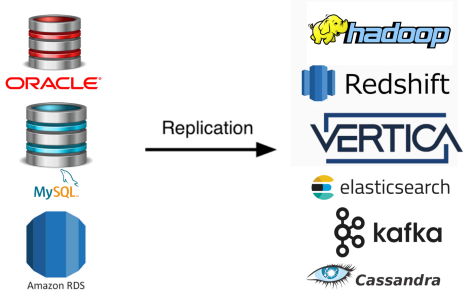


The MySQL-Oracle configurations are ideally suited for integrating systems that contain both MySQL as well as Oracle applications. Examples include MySQL e-commerce application that transfer transactions to Oracle based system for the order fulfillment or reporting, and applications that publish legacy Oracle application data on the MySQL based front-end web interface.

Native Applier Replication (e.g. MongoDB)

For heterogeneous replication where data is written into a target database using a native applier, such as MongoDB, the row-based information is written into the database using the native API. With MongoDB, for example, data is reformatted into BSON and then applied into MongoDB using the native insert/update/delete API calls.

Tungsten Replicator for Analytics and Big Data



MySQL/Oracle to analytics and big data replication enables users to publish transactions from MySQL, Oracle and RDS systems in real-time to Hadoop, Redshift, Vertica, Elasticsearch, Kafka and Cassandra.

This (near) real-time deployment model is recommended for businesses that need to deliver complex analytics quickly on rapidly changing data.

Advanced topologies such as fan-in (from multiple sources to one target) or fan-out (one source to multiple targets) are also supported. Sources and targets can also be mixed and matched, for example, combining Oracle and MySQL data into both Vertica and Hadoop cluster. Furthermore, filtering and data manipulation allow for augmenting data (for example, to identify the source database), or concentration (by renaming multiple identical source tables into a single target table). This allows for data concentration during data-warehousing, or disseminating data to remote installation.

About Continuent

Continuent is a leading provider of database clustering and replication, enabling enterprises to run business-critical applications on cost-effective open source software. Continuent Tungsten provides enterprise-class high availability, globally redundant data distribution and real-time heterogeneous data integration in cloud and on-premises environments. Our customers represent the most innovative and successful organizations in the world, handling billions of transactions daily across a wide range of industries.

For more information on our products and services, please visit www.continuent.com, email us at sales@continuent.com or call us at (800) 270-9035, and follow us on Twitter @Continuent.