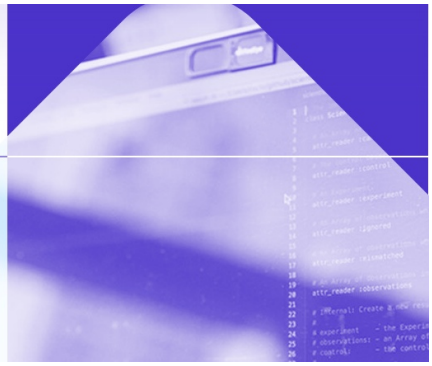
Jumpmind

SymmetricDS



WHITE PAPER

Heterogeneous Data Replication

Abstract

This white paper will give you an overview of SymmetricDS data replication, including its key features, modular architecture, and common use cases. Data replication can provide high availability, load distribution, and disconnected operation. It can ensure applications have reliable uptime and fast response times. It can improve performance by balancing load across databases or offloading work to a reporting database. SymmetricDS can enable a distributed workforce on laptops and mobile devices that are occasionally connected. An enterprise with disparate and heterogeneous systems can use replication as part of an integration strategy for enriching application databases, Data Warehouses, mobile devices, and cloud-based solutions.

INTRODUCTION

SymmetricDS is cross platform data replication that keeps databases and file systems in synchronization. Using web server technology, it builds on a familiar and proven platform for scaling to thousands of sources and targets. Data is replicated continuously in the background, enabling real-time access to information. It can also subset data, apply conditions, resolve conflicts, and transform data. With an emphasis on resilience and interoperability, it can run across different networks, operating systems, and databases.

KEY FEATURES

SymmetricDS offers a rich set of features with a flexible configuration for large scale deployment in a mixed environment of multiple systems.

Data Replication - Change data capture for relational databases and file replication for file systems can be periodic or real-time, with an initial load feature to fully populate a node.

Cross Platform – Support for most major databases (over 20 dialects) and operating systems, with options for deploying to the cloud and mobile devices.

Automatic Recovery - Data delivery is durable and low maintenance, withstanding periods of downtime and automatically recovering from a network outage.

Secure and Efficient - Communication uses a minimal, compressed data protocol designed for low bandwidth networks and streamed over HTTPS for encrypted transfer.

Central Management - Configure, monitor, and troubleshoot replication from a central web console where conflicts and errors can be investigated and resolved.

Transformation - Manipulate data during multiple phases to filter, subset, translate, merge, and enrich data.

Conflict Management - Enforce consistency of two-way synchronization by configuring rules for automatic and manual resolution.

Extendable - Scripts and Java code can be configured to handle events, transform data, and create customized behavior using available configuration and plug-in points.

Flexible Deployment - The software can be installed either as a self-contained server that stands alone, deployed to a web application server, or embedded within an application.

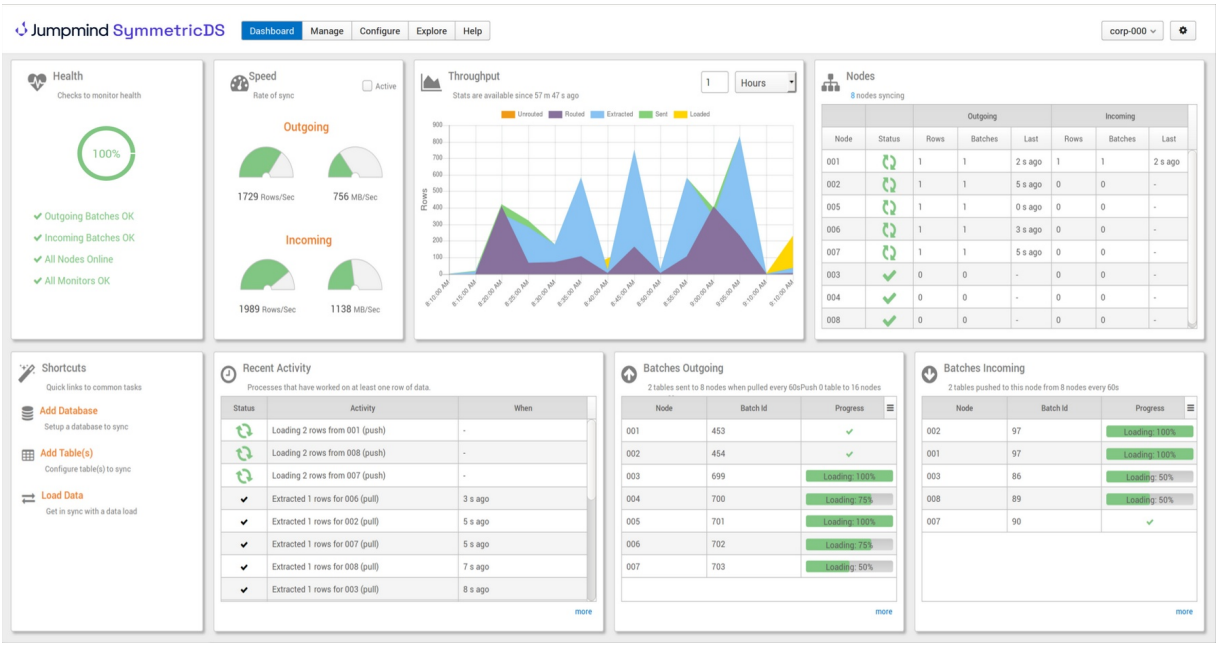


Figure 1: *The web console simplifies configuration, monitoring, and troubleshooting from a central location.*

ARCHITECTURE

The architecture for SymmetricDS consists of modular services that process change data from a source database and loads them into a target database. Each database is managed by a ***node*** running these services, which connects to the database using JDBC for creation of runtime objects and handling of change data. Nodes are configured inside a running instance of SymmetricDS. When communicating across a WAN, the best performance is achieved by installing an instance next to each database. The durability of the database is used to guarantee that data is replicated and acknowledged, despite any adverse network conditions, power loss, or server crashes.

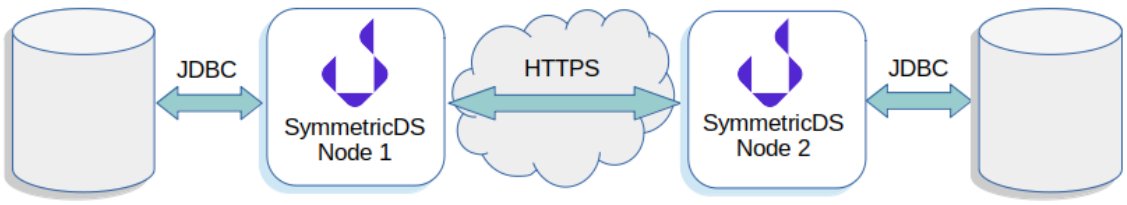


Figure 2: *Nodes connect to the nearby database with JDBC over the LAN and connect to remote nodes with HTTPS over the WAN.*

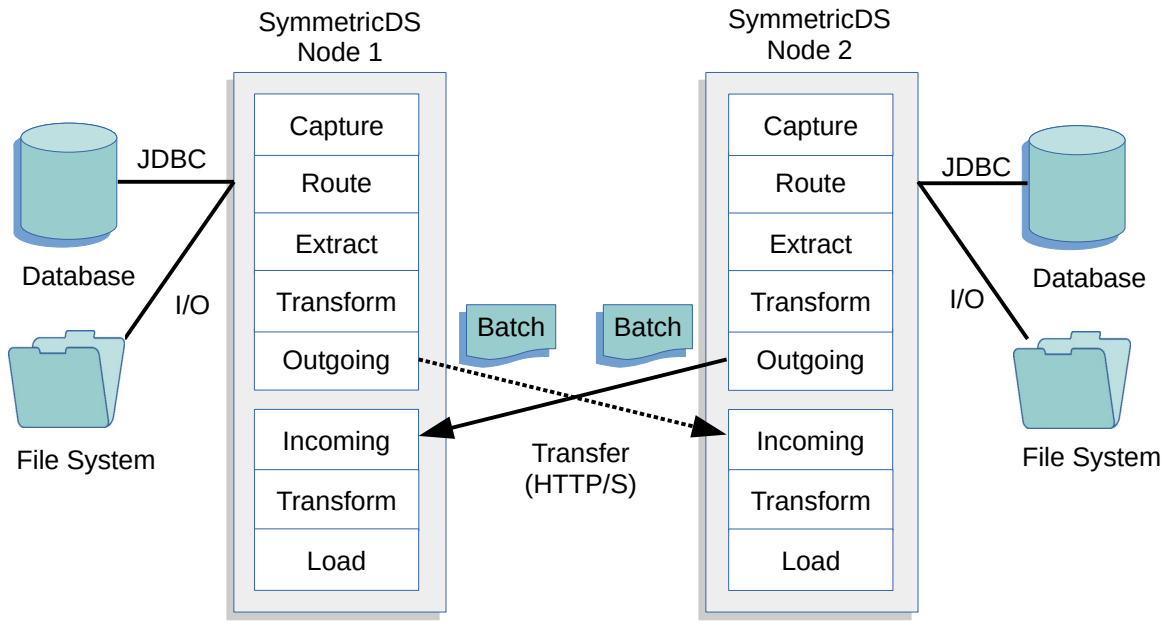


Figure 3: *The SymmetricDS architecture uses multiple phases to process change data, with each phase offering settings and plug-in points.*

Capture

Change data capture occurs at the source database where changes are recorded by triggers into a runtime table. Each change includes a sequence number and transaction identifier to preserve the order and grouping of committed rows. Capture is configured for specific tables and columns, and rows can be matched with conditional values.

Route

Changes are grouped together into batches and assigned to targets that will receive them. Routing can distribute rows across multiple targets and send rows to a target based on matching values in a row or looking up values from another table.

Extract

Batches are extracted from the database and written to a temporary staging area, which is compressed and encrypted. Staging is optional but recommended to improve performance because it avoids the overhead and lag of holding open the database and network resources.

Transform

During extraction at the source or before loading at the target, transformation can be performed on change data to map, filter, translate, and modify rows, columns, and their

values. Data is transformed using built-in functions or custom scripts. The local database can be queried to enhance data.

Load

Outgoing batches from the source are transferred over HTTP/S to the target as an incoming batch to be loaded. Channels are configured to control the number of batches sent on the connection and how much bandwidth can be consumed. Communication can be initiated by either source or target using a “push” or “pull” method, allowing for traversal of firewalls. Batch data is committed along with a status, and the status is acknowledged to the source.

COMMON USE CASES

SymmetricDS has a flexible configuration that allows databases to be replicated across a range of topologies from simple to complex. Common uses cases include:

- Data consolidation at central location and distribution across branch locations
- Consolidating disparate systems into a Data Warehouse
- Offloading an operational database to a reporting database
- Transforming data between different application databases
- Backup and fail-over of critical business data
- Cloud integration between providers and on-premise systems
- Disconnected operation on devices for a distributed workforce

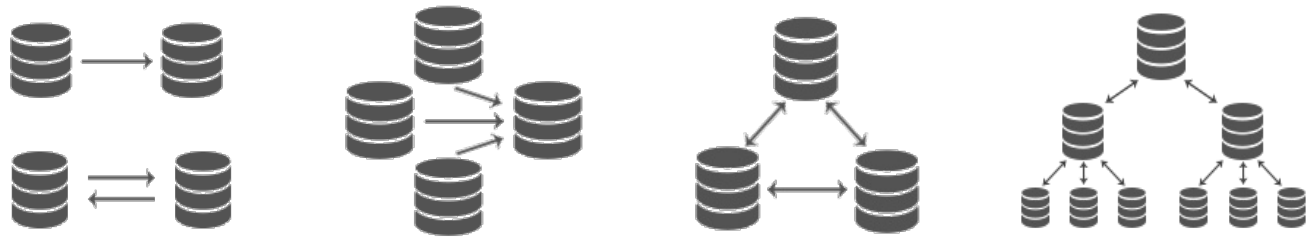


Figure 4: *Multiple use cases are possible, including 1-way, bi-directional, one source to multiple targets, multiple sources to one target, multi-master, and tiered replication.*

PERFORMANCE

SymmetricDS includes features for performance scaling and fault tolerance. Each remote node is serviced with separate threads to run extract, transfer, and load phases in parallel. Additional threads can be configured for parallel loading of data by assigning tables to different channels. By deploying across multiple servers and enabling clustering, many simultaneous requests can be handled, with deployments in production supporting more than ten thousand (10,000) nodes. With a load balancer in front of the cluster, the central servers become highly available to remote nodes. Large networks of nodes can be grouped into tiers for more control and efficiency, with each group synchronizing data to the next tier.

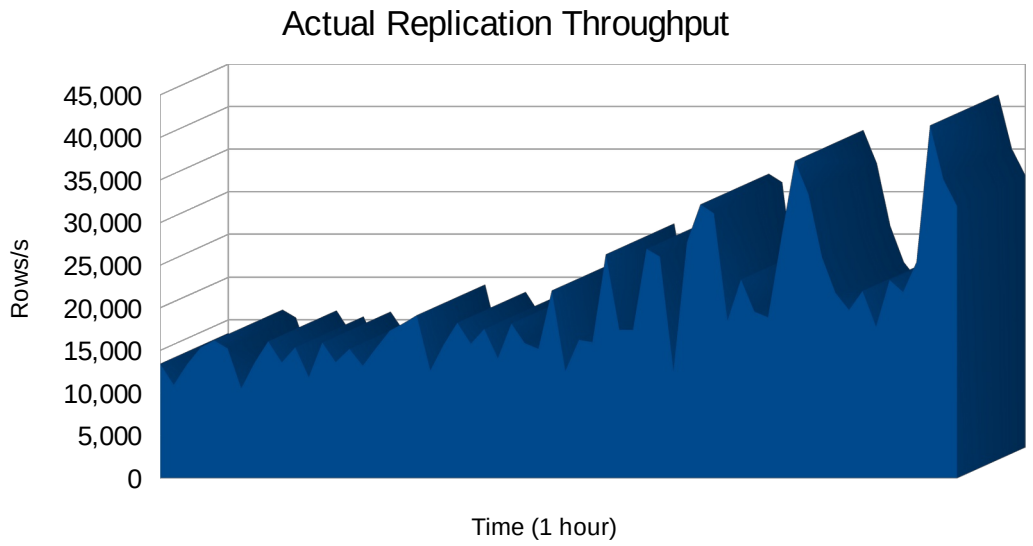


Figure 5: *SymmetricDS data replication performance with load increasing to a peak of 41,418 rows/second between two Oracle 11.2 databases. Tested with SymmetricDS 3.8 on Redhat Enterprise Linux 7 with 4-core, 64-bit CPU and 2 GB of memory.*

ENABLING BUSINESS

Cross platform data replication can be part of an integration strategy that improves access to critical business data. Real-time integration gives a competitive advantage through business intelligence and enabling new kinds of services. Customers expect self-service applications and web sites to include interaction with real-time data. An architecture with real-time information and on-demand processing can positively affect the decision-making process within an organization. SymmetricDS offers a flexible, feature-rich data replication solution that offers high value, low maintenance, and a diverse platform support that can work across a heterogeneous enterprise.