

PostgreSQL Replication Solutions

BRUCE MOMJIAN



Replication is a complex feature. POSTGRESQL supports a variety of replication options.

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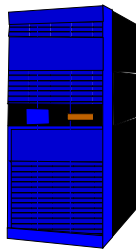
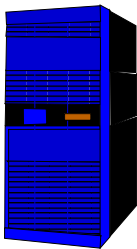
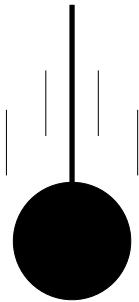
Last updated: September, 2015

Uses for Replication

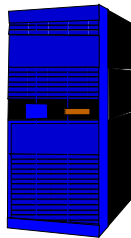
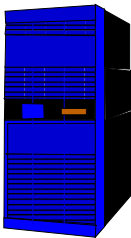
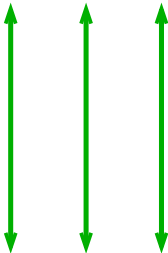


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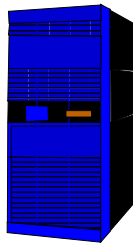
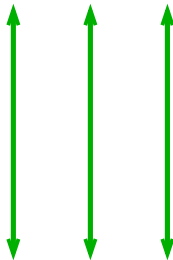
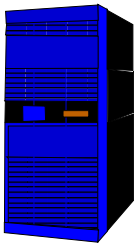
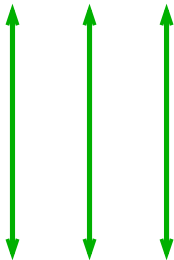
Fail Over



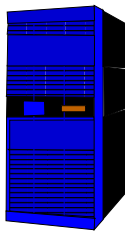
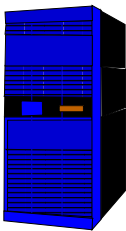
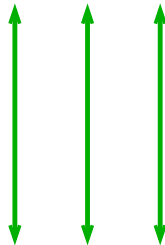
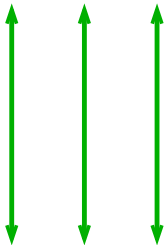
Data Warehousing



Load Balancing



Remote Servers



Mobile Servers

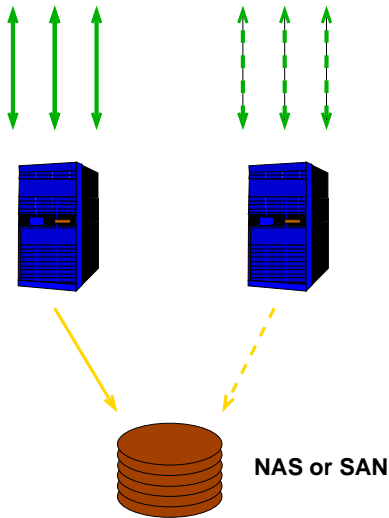


Replication Solutions



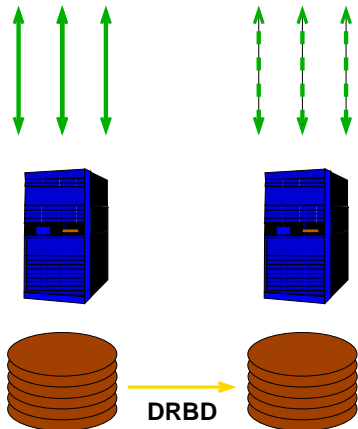
Taotaomona Computing

Shared Storage



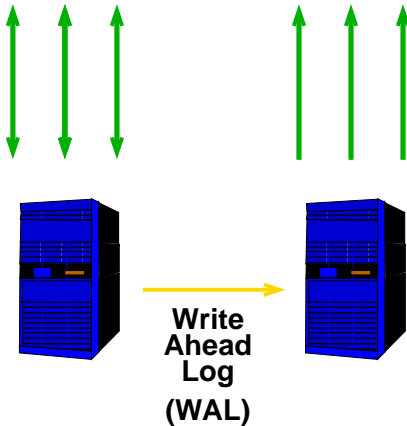
- ▶ No overhead
- ▶ No data loss on fail-over
- ▶ Slave cannot execute queries

Storage Mirroring



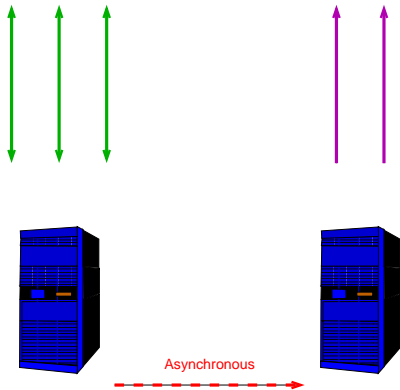
- ▶ No overhead on master
- ▶ Synchronous or asynchronous
- ▶ Possible data loss on fail-over when using asynchronous
- ▶ Slave cannot execute queries

Streaming Replication



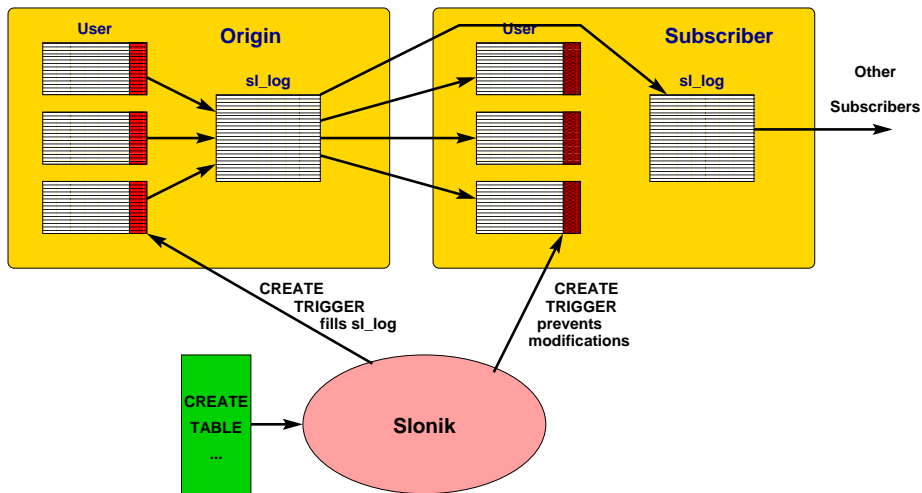
- ▶ No overhead on master
- ▶ Slaves can execute queries
- ▶ Possible data loss on fail-over when using asynchronous mode
- ▶ Synchronous option available (Postgres 9.1)

Slony

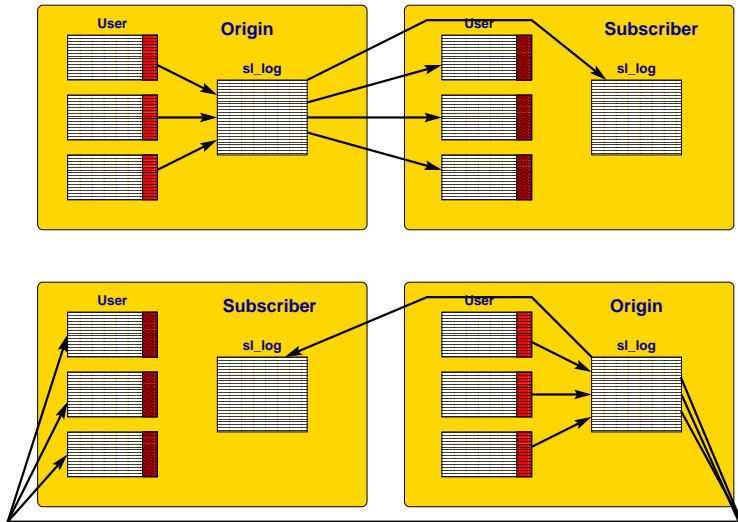


- ▶ Triggers add overhead to the master
- ▶ Possible data loss on fail-over
- ▶ Replication possible even over slow links
- ▶ Slave can execute read-only queries
- ▶ Table-level granularity allows complex data partitioning configurations

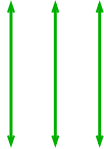
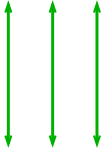
Slony Internals



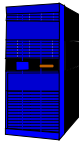
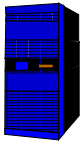
Slony Master Switching



Bucardo

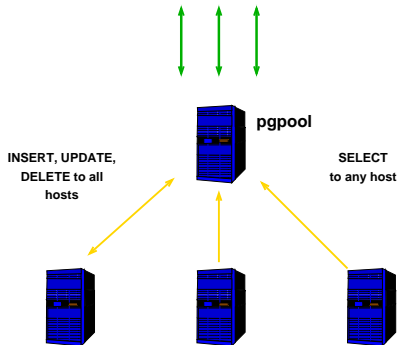


- ▶ Similar to Slony, except multi-master with conflict resolution
- ▶ Conflict resolution rules are user-configurable



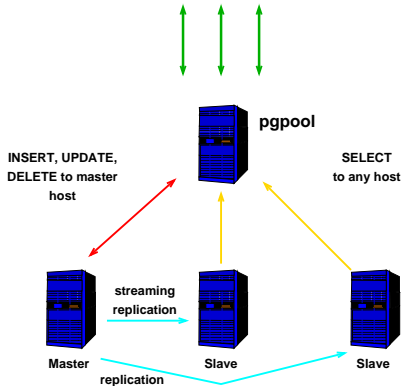
Asynchronous
↔
with Conflict Resolution

Pgpool II



- ▶ Automatically load-balances read queries
- ▶ Queries with non-deterministic behavior can cause inconsistency
- ▶ Allows parallel query execution on all nodes
- ▶ Also does connection pooling and query caching

Pgpool II With Streaming Replication



Streaming replication avoids the problem of non-deterministic queries producing different results on different hosts.

Summary

| Feature | Shared Disk Fail-over | File System Replic. | Transaction WAL Log Shipping | Trigger-based Replic. | Statement-Based Replication Middleware | Asynchronous Multi-Master Replic. | Synchronous Multi-Master Replic. |
|-------------------------------------|-----------------------|---------------------|------------------------------|-----------------------|--|-----------------------------------|----------------------------------|
| Most Popular Implementation | NAS | DRBD | Log shipping | Slony | pgpool-II | Bucardo | |
| Communication Method | shared disk | disk blocks | WAL | table rows | SQL | table rows | table rows & row locks |
| No Special hardware required | | • | • | • | • | • | • |
| Allows multiple master servers | | | | | • | • | • |
| No master server overhead | • | | • | | • | | |
| No waiting for multiple servers | • | | • | • | | • | |
| Master failure will never lose data | • | • | | | • | | • |
| Slaves accept read-only queries | | | • | • | • | • | • |
| Per-table granularity | | | | • | | • | • |
| No conflict resolution necessary | • | • | • | • | | | • |

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