MySQL 5.7

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MySQL Releases since 2010

- Enterprise Monitor 2.2, 2.3
- Cluster 7.1, 7.2, 7.3
- Cluster Manager 1, 1.1, 1.3
- Workbench 5.2, 6, 6.1
- Database 5.5, 5.6, DMR 5.7
- Backup 3.5, 3.7, 3.1
- Oracle VM for MySQL
- Oracle Product Certifications
- Windows Installer
- Utilities 1.0.6
- Audit
- Fabric (RC)

- More Developers
- More QA
- More Support
- Making $$
- Classes popular
  - Instructor lead
  - Self-paced
- We're hiring!
Happy Anniversary!

- 20 years of MySQL
- 10 years of InnoDB
- 5 years Oracle
MySQL 5.6 GA 24 Months Ago – Best GA Ever

- **Performance**
  - Scales to 48 CPU threads
  - Up to 230% faster than 5.5

- **InnoDB**
  - Better Transactional throughput

- **Faster Optimizer**
  - Performance
  - Diagnostics
  - Better Instrumentation

- **Improved Replication**

- **NoSQL**
  - Fast – 9x
  - Key/value, ACID
MySQL Repositories

• Benefits users and distros
• Simple/convenient way to install/upgrade
• Supports
  - RHEL/Oracle
  - Fedora
  - Debian/Ubuntu
• Database, Workbench, Utilities, ODBC & Python Connectors
MySQL 5.7 DMR 7 - Building on 5.6

- InnoDB more throughput
- Replication
- Utilities
- Performance Schema
- Optimizer
- Higher Connecting rates, efficiency
- GB18030 Character Set (12c and SQL Server do not support)
Optimizer

- Explain on running queries
  - EXPLAIN [FORMAT=JSON|TRADITIONAL] FOR CONNECTION <id>;
- VISUAL EXPLAIN
- Cost details in JSON output
- New cost model
  - Configurable in the future (RAM, SSD, HDD)
- Allow storage engines to provide more accurate statistics
InnoDB

- Improved Online Alter Table
  - Online rename index, online change varchar
- FusionIO
  - Automatic detection turns off double write buffer
- Parallel Dirty Page Flushing
- Transparent Page Level Compression in background threads
  - Reduces I/O, includes tablespace and UNDO logs
  - Thanks FusionIO!!
- Separate InnoDB temp table space
Server-side statement timeouts

- Global, session or for individual SELECT statements
- `SELECT MAX_STATEMENT TIME = 120 * FROM Customer;`

Put in your boss's ~/.my.cnf
Security

- AES 256 Default
- Password Rotation Policies
  - Globally and at user level
- Deploy unattended default secure install
  - Secure by default
  - Random password set on install
  - No anonymous accounts
  - No test account, test schema, or demo files
GIS

- InnoDB Spatial Index Support
  - Optimize R-tree indexes
- Boot.Geometry integration
  - Improved accuracy
  - Improved performance
  - Full Open Geospatial Consortium compliance
Performance Schema

- Memory usage
  - 200 types
  - Aggregate stats by type cache, buffers, etc.
  - Thread/account/user/host performing operation
  - Memory used, operation counts, high/low watermarks

- Statement instruments extended
  - Stored procedures, stored functions, prepared statements, transactions

- Replication status
SYS Schema

• Simplified views on PS and IS
  - Help simplify DBA tasks by monitoring health, growth rates
  - Spot, diagnose and tune performance problems

• Easy to understand insights into
  - IO hot spots
  - Costly SQL statements
  - Dynamic statistics on tables, indexes, and schemas
  - Wait times, locking
  - InnoDB stats
Replication – Faster, higher, stronger

- Higher throughput
  - Slave: Apply transactions in parallel even within same database
  - Master: Better sync between replication-user sessions
- Better semi-sync performance
  - Loss less replication
- PS tables for monitoring
- Dynamic replication filters
Multi-Source Replication

- Consolidate updates from multiple masters to one slave
  - Consolidate view of all shards
  - Centralized backups
  - Master-specific slave filters planned for GA
- Application must keep data disjointed between sources
Multi-Threaded Slave

- 6x slave output
- Tune size of group commit buckets on master
- Evolution
  - 2010 inter-schema 5.6 labs
  - 2013 Inter-schema 5,6 GA
  - 2014 Intra-schema 5.7.2
Fabric: High Availability + Sharding-based Scale-out

- **High Availability**
  - Server monitoring w/ auto-promotion and application fail over

- **Fabric-aware connectors**
  - Python, Java, & PHP

- **Optionally scale-out through sharding**
  - Application provide shard key
  - Range or Hash
  - Tool for re-sharding
  - Global updates & tables
MySQL Cluster 7.4

- Performance gain over 7.3
  - 47% read-only
  - 38% read-write
- Faster Node Restart
# Oracle MySQL HA & Scaling Solutions

<table>
<thead>
<tr>
<th></th>
<th>MySQL Replication</th>
<th>MySQL Fabric</th>
<th>Oracle VM Template</th>
<th>Solaris Cluster</th>
<th>Windows Cluster</th>
<th>DRBD</th>
<th>MySQL Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clustering Mode</strong></td>
<td>Master + Slaves</td>
<td>Master + Slaves</td>
<td>Active/Passive</td>
<td>Active/Passive</td>
<td>Active/Passive</td>
<td>Active/Passive</td>
<td>Multi-Master</td>
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<tr>
<td><strong>App Auto-Failover</strong></td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td><strong>Data Layer Auto-Failover</strong></td>
<td>✗</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td><strong>Zero Data Loss</strong></td>
<td>MySQL 5.7</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td><strong>Failover Time</strong></td>
<td>N/A</td>
<td>Secs</td>
<td>Secs +</td>
<td>Secs +</td>
<td>Secs +</td>
<td>Secs +</td>
<td>&lt; 1 Sec</td>
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<td><strong>Scale-out</strong></td>
<td>Reads</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
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<td><strong>Cross-shard operations</strong></td>
<td>N/A</td>
<td>✗</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>✓</td>
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<tr>
<td><strong>Transparent routing</strong></td>
<td>✗</td>
<td>For HA</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td><strong>Shared Nothing</strong></td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
<td>✗</td>
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<tr>
<td><strong>Storage Engine</strong></td>
<td>InnoDB</td>
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<td>InnoDB</td>
<td>InnoDB</td>
<td>InnoDB</td>
<td>NDB</td>
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<tr>
<td><strong>Single Vendor Support</strong></td>
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<td>✓</td>
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<tr>
<td><strong>Platform Support</strong></td>
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<td>Linux</td>
<td>Solaris</td>
<td>Windows</td>
<td>Linux</td>
<td>All</td>
</tr>
</tbody>
</table>

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But 5.7 will BREAK some things

- Yes, we KNOW it is painful!
- We are trying to be
  - As careful as possible
  - Provide as much notice as possible
  - Let you know why we made the change
Things to do to help the change

- Change the default to use desired behavior
- Issue warnings about feature deprecations
- Remove features

We are doing all three
Proposal: enable sql mode to ONLY_FULL_GROUP

- Default behavior for other databases
- In 5.6 and lower, MySQL was guessing what to use for non-grouped fields.
  - New ANY_VALUE() SQL Function to allow 'non-deterministic' statements so things can work 'old way'
Replication

- 5.6 provided more durable replication with group commit
- 5.7 proposal – make durable the default
  - sync_binlog =1
  - Master-info-repository = TABLE
  - Relay-log-infor-repository = TABLE
Proposal

- Deprecate SHOW ENGINE INNODB MUTEX
  - Overlaps with Performance Schema

- Deprecate InnoDB Monitor tables
  - Developed long before Performance Schema
SYS Schema

- Derived from Mark Leith's ps_helper
  - Over 80 views, versions, self updating, version aware
  - Supporting 5.5, 5.6, and 5.7

- Similar to
  - Oracle V$ catalog
  - SQL Server Dynamic Management Views
  - DB2 SYSIBM Catalog

- Available with Workbench 6.1 or Github
Proposal – make STRICT the default SQL Mode

- Lot of criticism that MySQL is too permissive, truncating out-of-range, zero dates, etc.
- Roll ERROR_FOR_DIVISION_BY_ZERO, NO_ZERO_DATE, and NO_ZERO_IN_DATE into STRICT Mode
Proposal

- Deprecate EXPLAIN PARTITIONS
- Deprecate EXPLAIN EXTENDED
Alter Ignore Table

- Useful for adding PRIMARY/UNIQUE keys on tables with duplicate keys
  - Will silently drop rows for you
  - Deprecated 5.7.17
  - Removed in DMR4
  - Was a MySQL-only extension
Query Cache

- Defaults to DISABLED in 5.6
- Plans for other options in later releases
Deprecate NULL synonym \N

- Anyone using? We DO want feedback!!
- For removal in 5.7 or 5.8
FEDERATE & MERGE Storage Engines

- We recommend multi-source replication over Federated
- We want your feedback if you are still using Federated!!
- Similar to Partitioning but MyISAM ONLY
  - Major limitations with Partition Exchange
  - Anyone using?
Slide to check if audience is still awake
Driving Innovation AND Quality

- 191 Worklogs for 5.6
- 191 Bugs fixed in 5.6
- 3763 Bugs in total since 5.5 GA
- 911 New MTR tests in MySQL 5.6
- Tripled QA team – 400 man/years experience
MySQL Database Development Priorities

- Optimized for Web, Cloud-based, Embedded use cases
- Simplified, Pluggable architecture
  - Maintainability, more extensible
  - More NoSQL options (HTTP, JSON, JavaScript, etc.)
- Re factoring
  - Data Dictionary in InnoDB
  - Optimizer/Parser/Protocol
- InnoDB
  - Optimized for SSD
  - GIS
- Easy HA, Replication and Sharding
Connections Per Second

- 5.5.23 ~ 19k without P_S and ~18k with
- 5.6.15 ~ 24K and 19.5k
- 5.7.2 ~44k and ~18k
- 5.7.3 ~45k and ~44k
- Thanks to help from Facebook!!
Optimizer

- Improved JSON based explain
  - VISUAL EXPLAIN
  - Better traces
- Improved “IN” performance
- Non sorted fields in sort buffer compacted, reduces disk sorts
Triggers

- Multiple Triggers per table
- Set execution order
- Check column constraints at end of trigger execution
Error logging

- Three levels
  - Errors Only
  - Errors + Warnings
  - Errors + Warnings + Notes (default)
- --log-error-verbosity = 1
- SET GLOBAL log_error_verbosity=1;
- --log_timestamps = SYSTEM UTC (default)
- Send to SYSLOG
Learn More

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MySQL for Database Administrators NEW

<table>
<thead>
<tr>
<th>Schedule/Purchase</th>
<th>Training Formats</th>
<th>Price</th>
<th>Duration</th>
<th>Course Materials</th>
<th>Language</th>
</tr>
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<tbody>
<tr>
<td>View Schedule</td>
<td>Classroom Training</td>
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<tr>
<td>View Schedule</td>
<td>Live Virtual Class</td>
<td>US$ 2,250</td>
<td>5 Days</td>
<td>English</td>
<td>Multiple</td>
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</tbody>
</table>

What You WILL Learn

The MySQL for Database Administrators course is for DBAs and other database professionals who want to install and configure the MySQL Server, set up replication and security, perform database backups and performance tuning, and protect MySQL databases.

Learn To:

• Describe the MySQL Architecture
• Install and upgrade MySQL
• Configure MySQL server options at runtime
• Evaluate data types and character sets for performance issues
• Understand the use of the InnoDB storage engine with MySQL
• Perform backup and restore operations.

Setting up the Server and Databases

This course teaches you how to install, configure, maintain and tune databases for a wide variety of workloads and environments. You will install and configure MySQL and set appropriate configuration options. You will also connect to the server using both graphical and command-line clients, while creating and populating databases.

Maintaining and Securing Data

Expert Oracle instructors will also help you examine the structure of tables, their columns and data types and the different ways to check and repair tables. You will learn to program MySQL stored routines, events and triggers to process data in complex and automated ways. Explore how to partition tables, work with locking and transactions, and protect your data.

You will develop an understanding of how data is processed, stored, and retrieved.
MySQL 5.7

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