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MySQL Technology Update

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Northern California Oracle Users Group August 2013

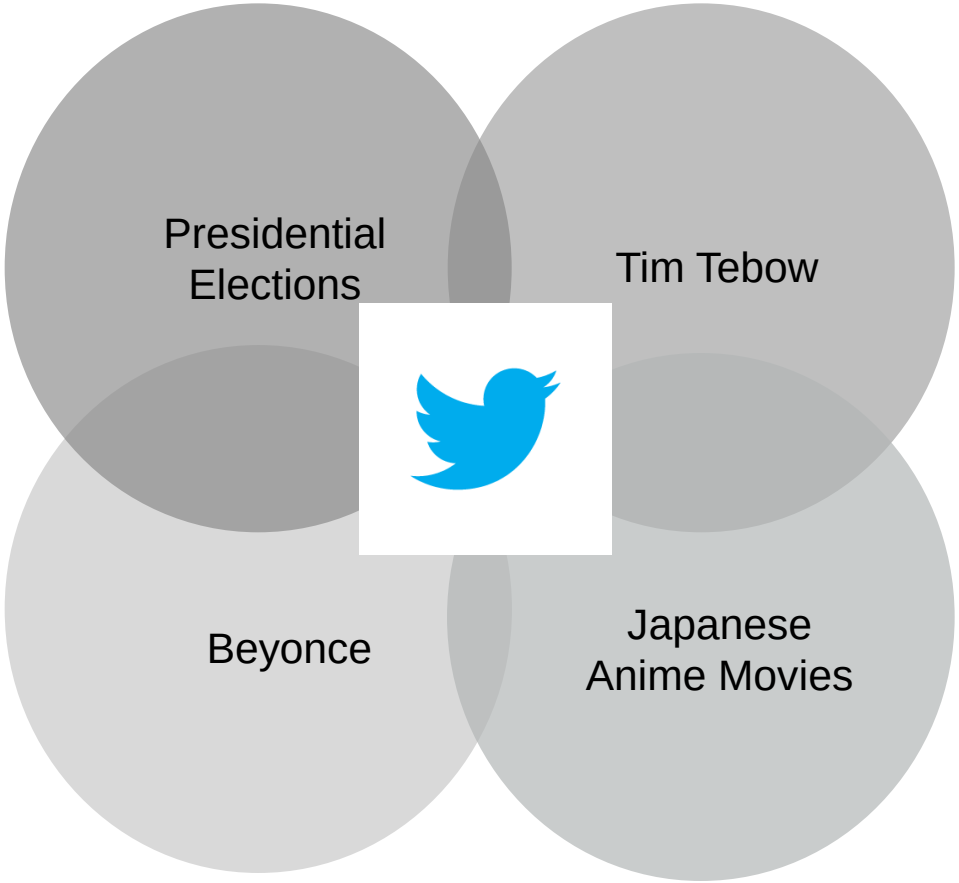
Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decision. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

Agenda

- Oracle's MySQL Strategy and Overview
- Performance, Optimizer, and Online Operations
- Hadoop Integration
- NoSQL API
- Oracle Product Integrations
- Quickstart suggestions
- Q&A

Intersection?



Tweets

- Anime: 25,000 per second
- Beyonce:327,452 per minute
- Election: 9,965 per second 8-9 pm
- Tebow: 15,107 8:20 pm

Random Server at Twitter

- 212 days

  uptime of random MySQL server at twitter

- 127 billion

  number of queries executed on single server

- 24.9 trillion

  innodb_rows_read, 1.36M per second

source: Jeremy Cole, Twitter DBA, MySQL UC 2011

Industry Leaders Rely on MySQL

Driving MySQL Innovation

MySQL Enterprise Monitor 2.2
MySQL Cluster 7.1
MySQL Cluster Manager 1.0
MySQL Workbench 5.2
MySQL Database 5.5
MySQL Enterprise Backup 3.5
MySQL Enterprise Monitor 2.3
MySQL Cluster Manager 1.1

All GA!

2010

MySQL Enterprise Backup 3.7
Oracle VM Template for MySQL Enterprise Edition
MySQL Enterprise Oracle Certifications
MySQL Windows Installer
New MySQL Enterprise Commercial Extensions

All GA!

MySQL Database 5.6 DMR*
MySQL Cluster 7.2 DMR
MySQL Labs!
("early and often")

2011

MySQL Cluster 7.2
MySQL Utilities 1.0.6
Database Migration Wizard
New Windows Tools/Features
New MySQL Enterprise Commercial Extensions

MySQL Database 5.6
MySQL Cluster 7.3
Workbench 6.0

All GA!

2012

*Development Milestone Release

MySQL Database Architecture

Performance, Reliability, Ease of Use

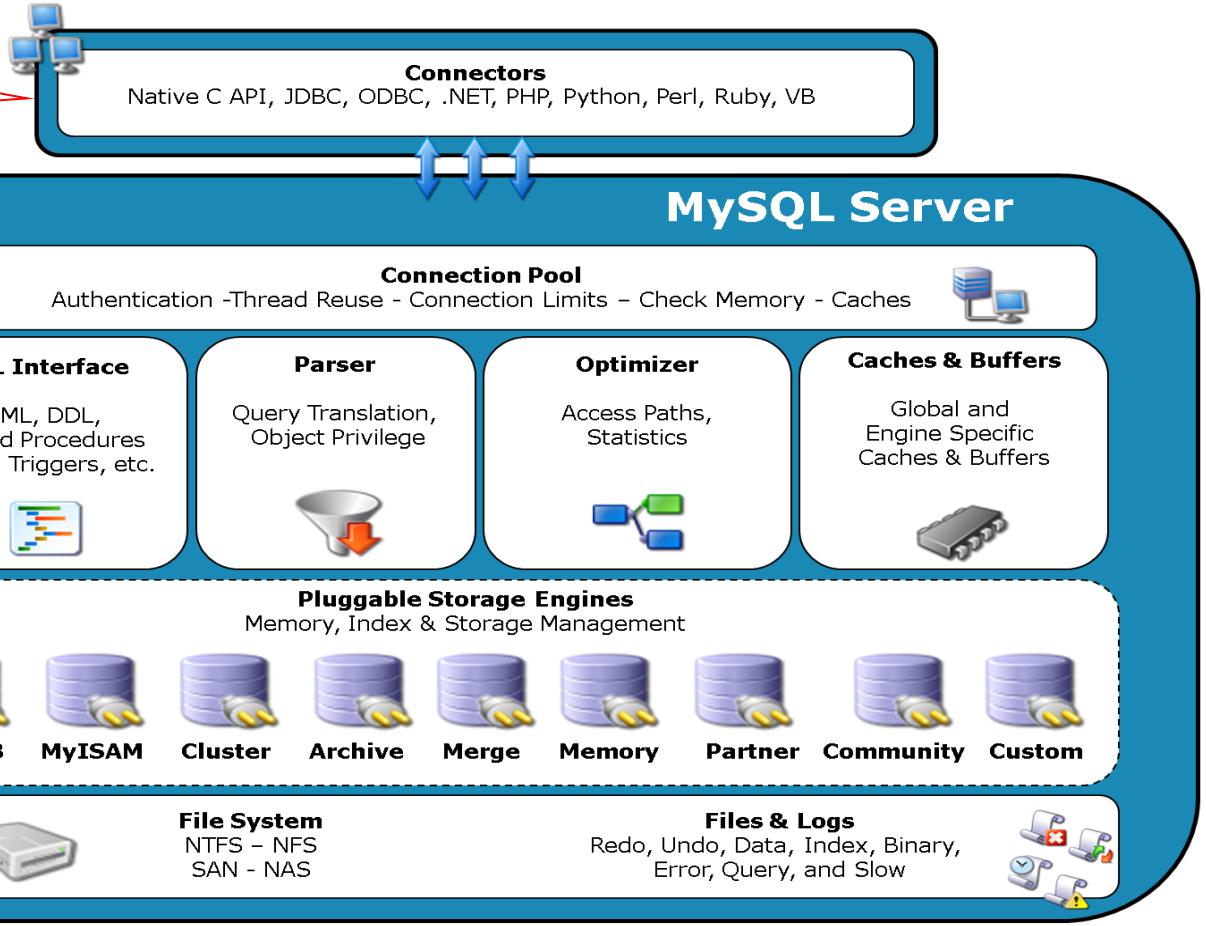
Support for common development languages/platforms

Efficient multi-threaded session handling

Full DML, DDL parsing, cost based optimizer, caching of queries and result sets

Flexible Storage Engine options for application specific storage needs

Flexible logging and physical storage options

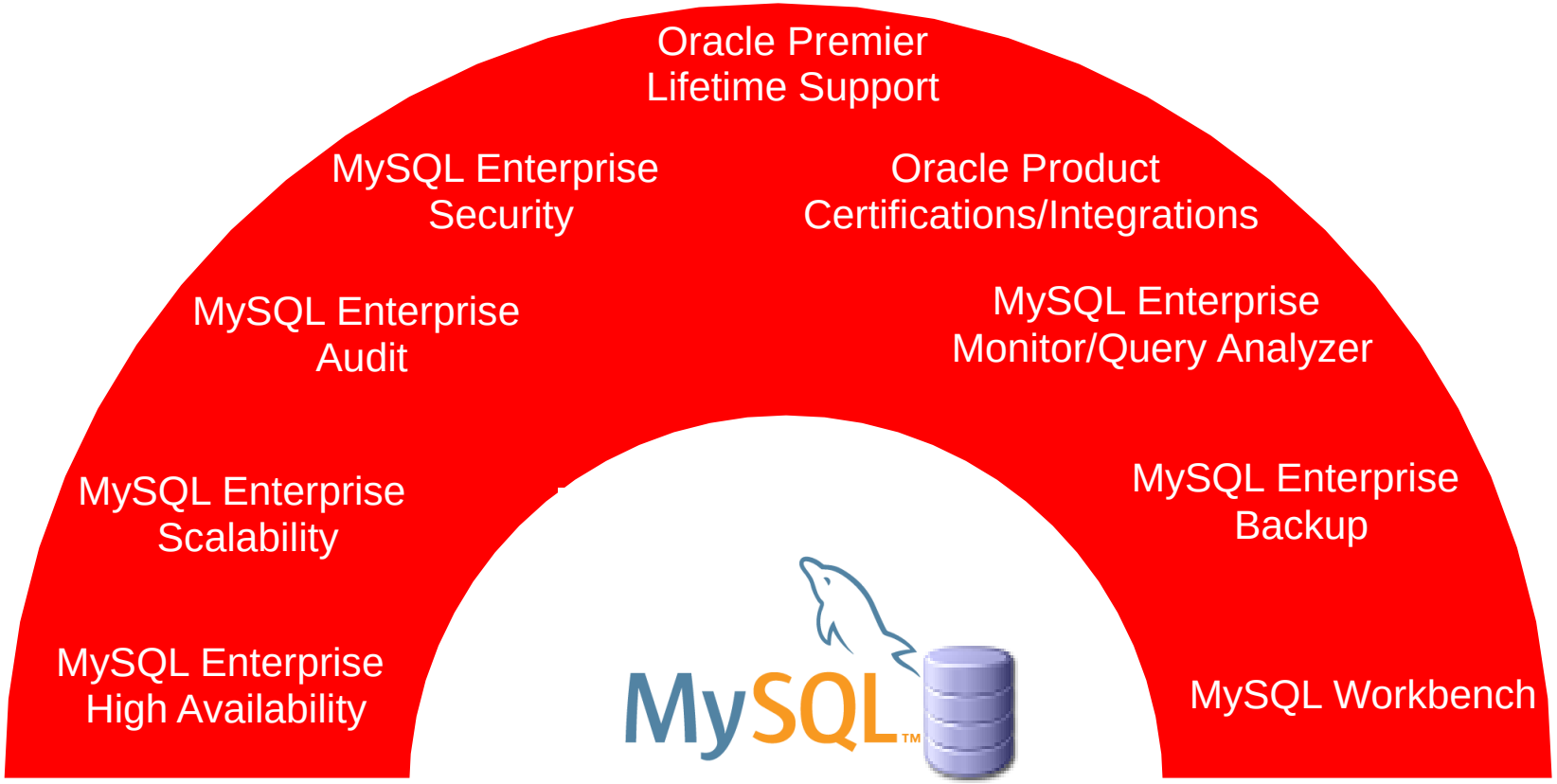


MySQL Editions

- Commercial
  - Standard
  - Enterprise – tools and additional features, integrations
  - Cluster (Carrier Grade Edition , CGE) – very scalable, high availability, includes tools and integrations
  - Embedded (OEM, ISV)
- Community

MySQL Enterprise Edition

Highest Levels of Security, Performance and Availability

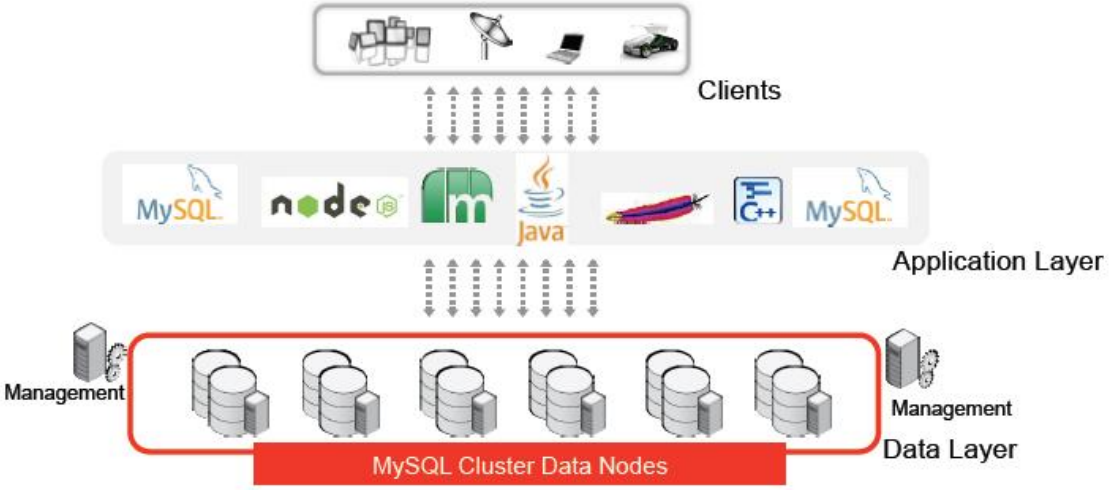


5.5 Enterprise Extensions and Tools

- Security: External Authentication
- Auditing
- Scalability: Thread Pool
- High Availability: Windows Failover
- High Availability: DRBD support
- High Availability: Solaris Clustering
- High Availability: Oracle VM Template
- High Availability and Performance :MySQL Enterprise Monitor
- Hot, Online Backup: MySQL Enterprise Backup

MySQL Cluster

- 99.999 % availability
- Active/active geographic replication
- No single point of failure
- Auto sharding for write scalability
- SQL/NoSQL interfaces
- Online scaling and schema updates
- Scaling across data centers

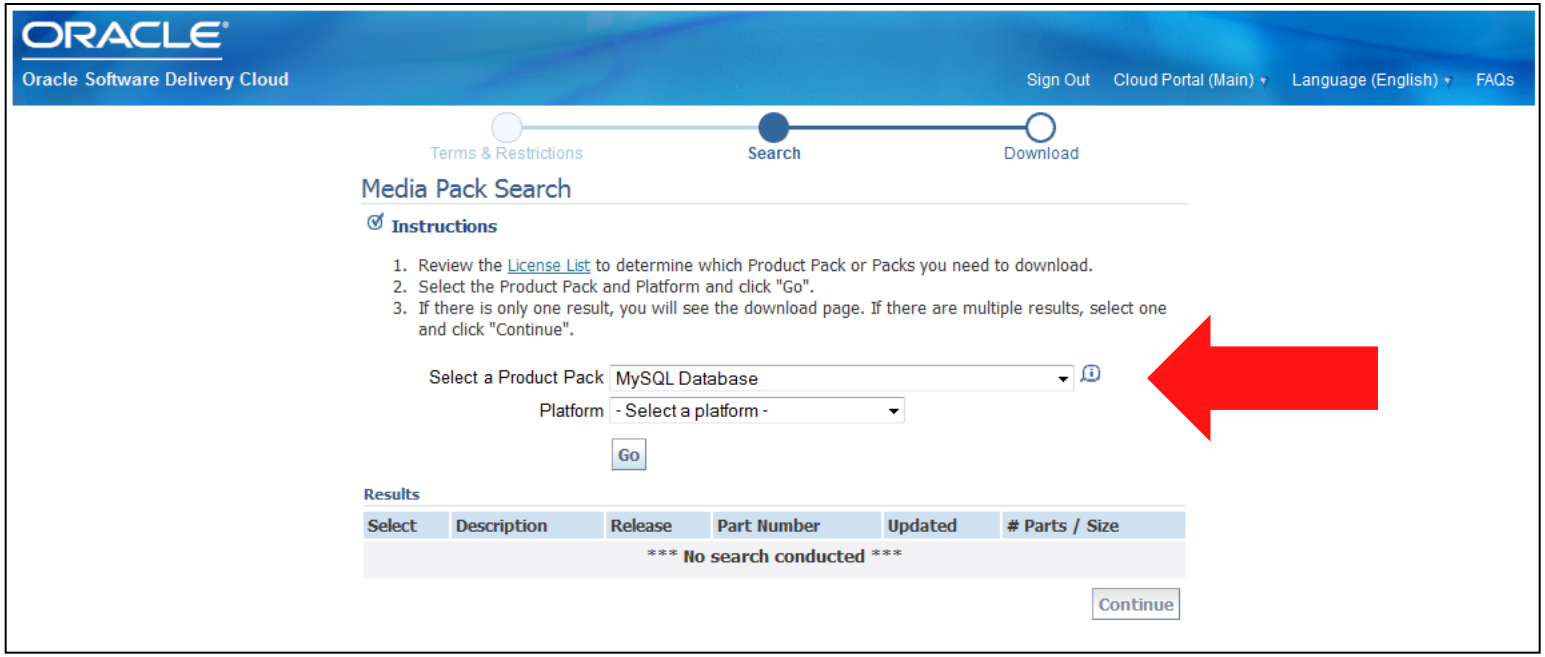


Subscription Model

- Not the same as Oracle database licensing
  - Single or multi year subscription
  - Embedded model is different
- All subscriptions include support and consultative support
- Enterprise Edition includes tools and additional features
- Cluster Edition includes tools and is built on top of base MySQL codeline

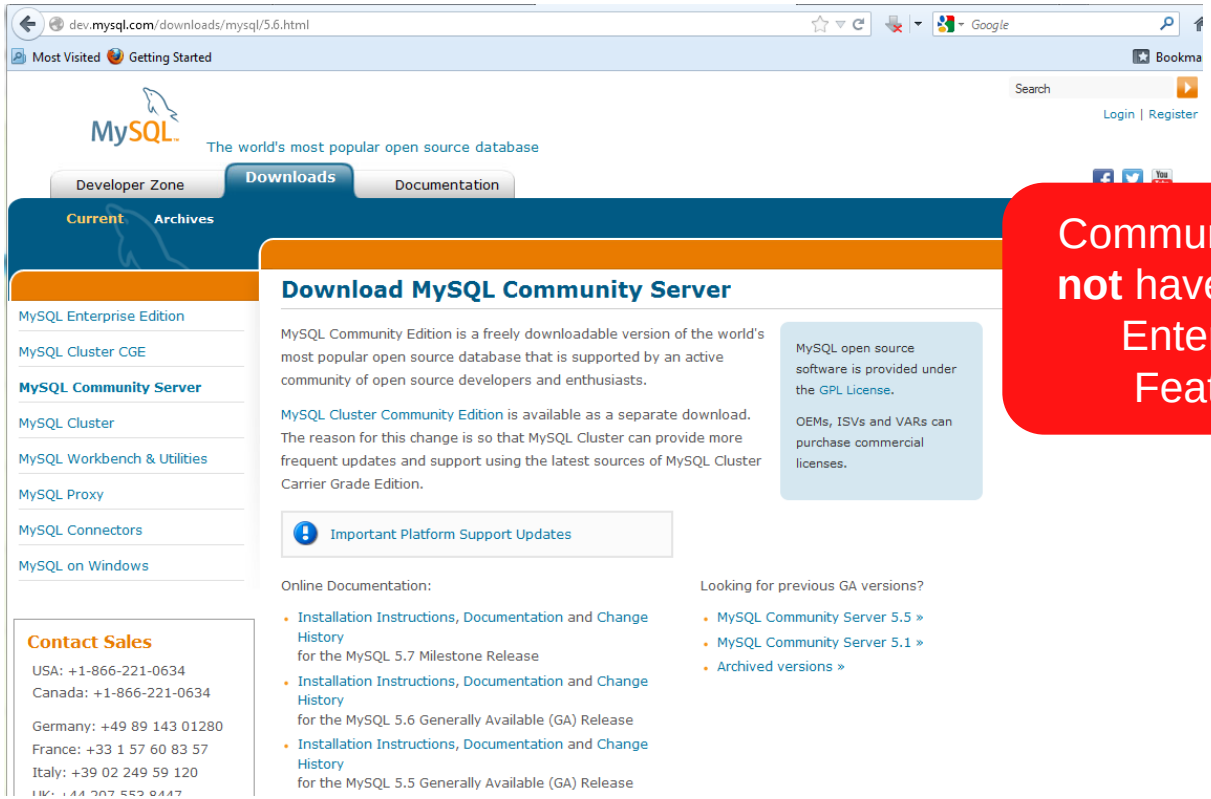
Where do I get MySQL from?

edelivery.oracle.com or mysql.com/downloads



Where do I get MySQL Community from?

- Community dev.mysql.com/downloads/mysql

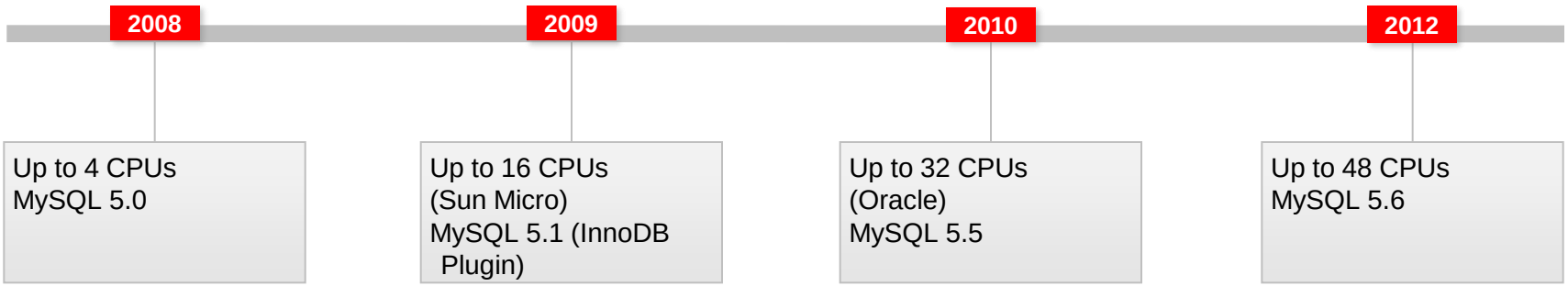


Community does **not** have MySQL Enterprise Features

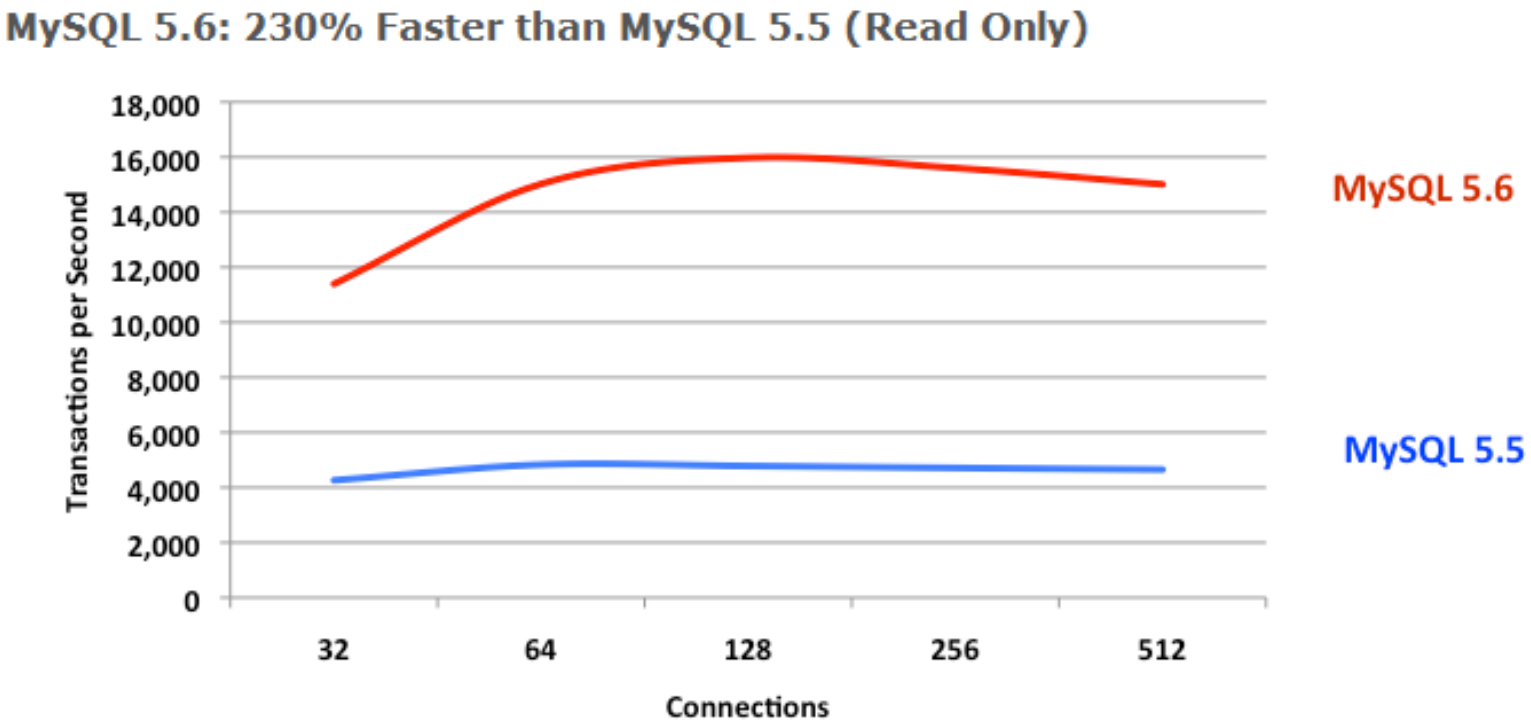
MySQL 5.6

Performance

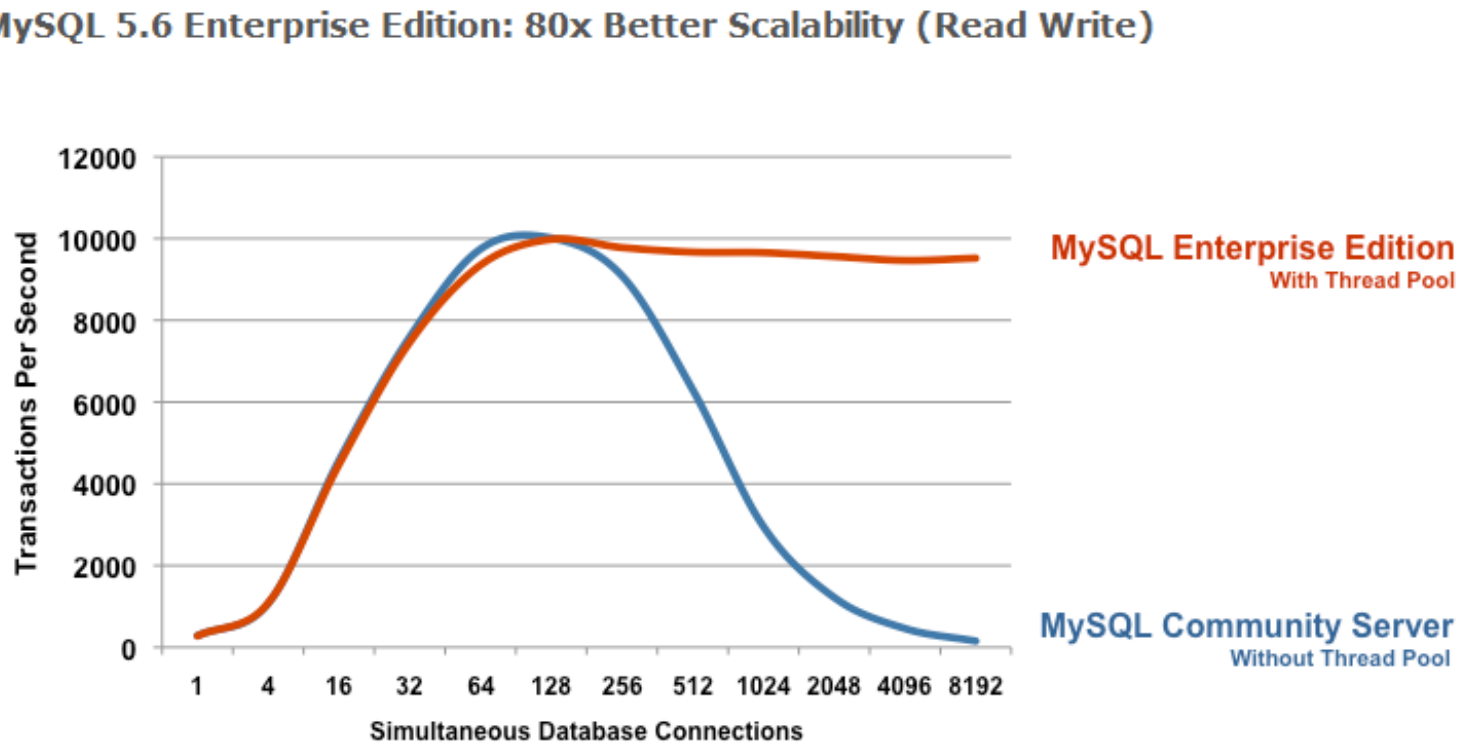
MySQL Scalability



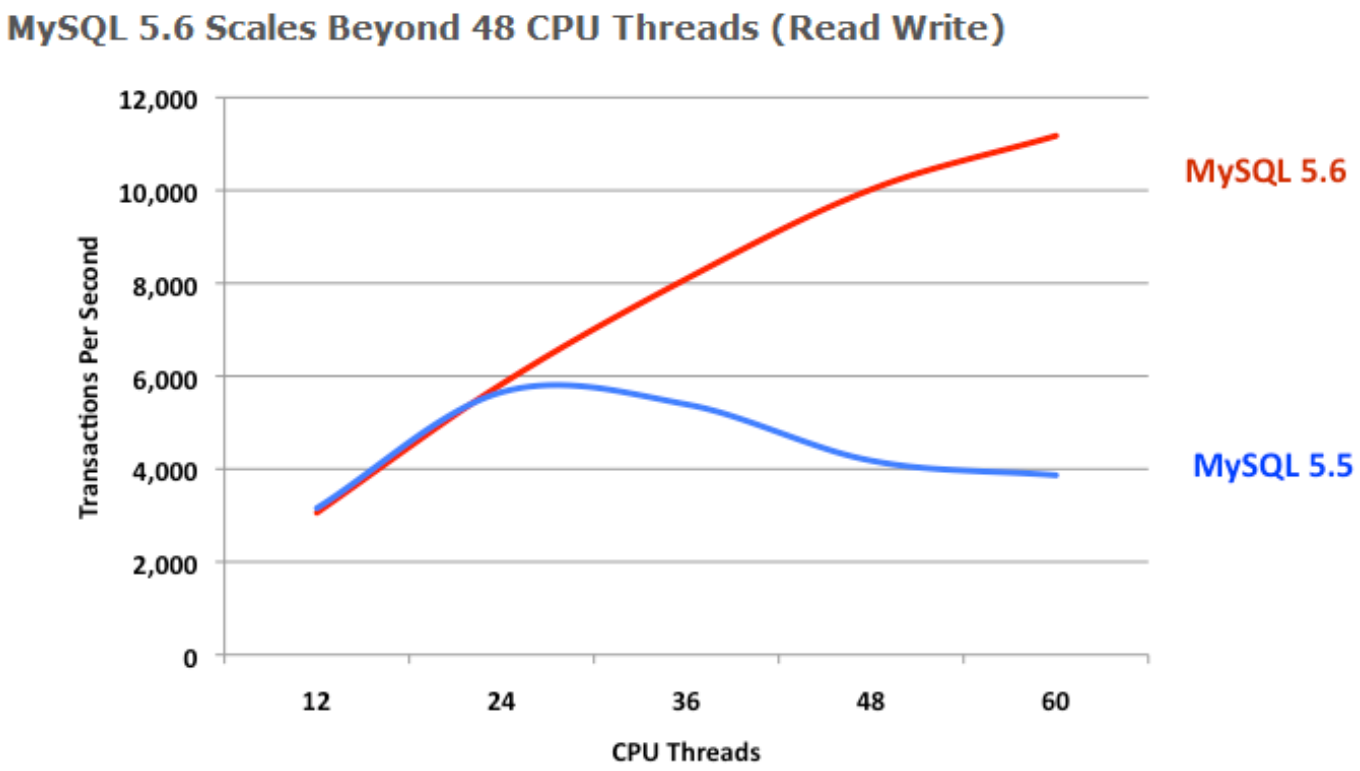
Benchmarks 5.6 - Up to 230% Faster Than 5.5



Benchmarks 5.6 Enterprise Edition - 13x Better Scalability with New Thread Pool



Benchmarks 5.6 Scales Beyond 48 CPU Threads



Performance Improvements

InnoDB and MySQL

- Refactored InnoDB
  - Split kernel mutex for better concurrent access
  - Separate thread for flushing operations
  - Multi-threaded purge
  - Reduced buffer pool contention
  - New adaptive hashing algorithm
- MySQL
  - Memory Allocation
    - Switch from malloc to better memory allocators for multi-threaded concurrency
  - Lock_open contention (bottleneck when opening tables)

MySQL 5.6 – Performance Schema

- Resource-intensive queries
- Tables/indexes with most load
- Users consuming the most resources
- Network load
- Aggregated statistics by
  - thread
  - user
  - host
  - object

Instrumentation and Diagnostic Improvements

MySQL Performance

More Detail

- **Benchmark details**

http://www.mysql.com/why-mysql/benchmarks/

- **Performance Schema Blog**

http://marcalff.blogspot.com/2013/02/mysql-56-performance-schema-is-ga.html

Online Operations

Online DDL for InnoDB and Cluster

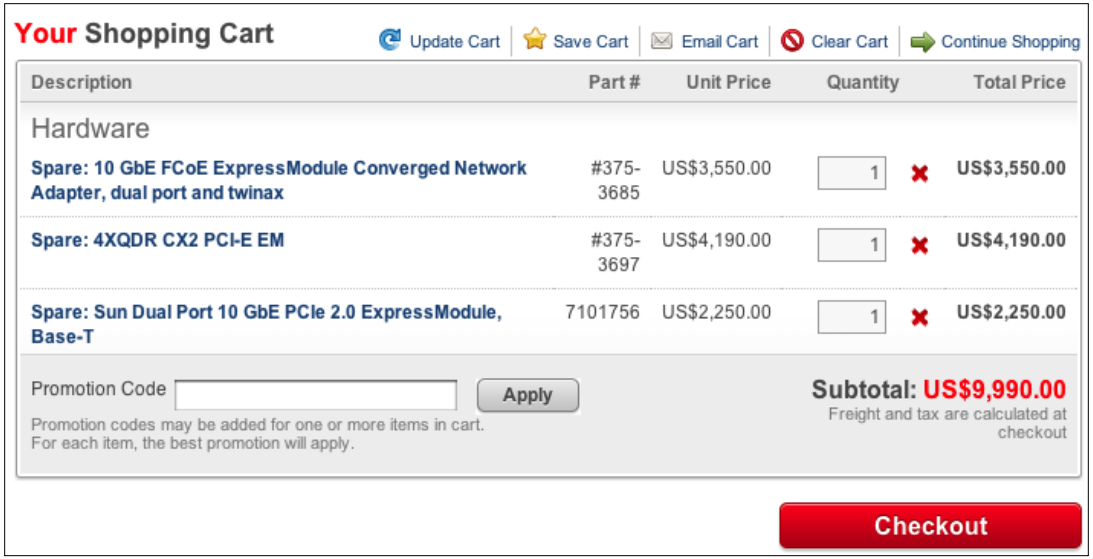
ADD INDEX

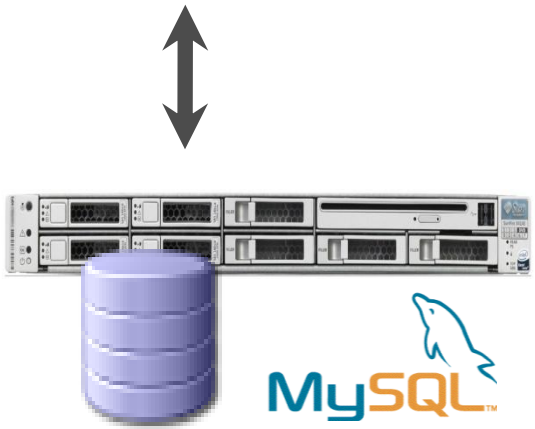
DROP INDEX

ADD COLUMN

DROP COLUMN

RENAME COLUMN





Optimizer

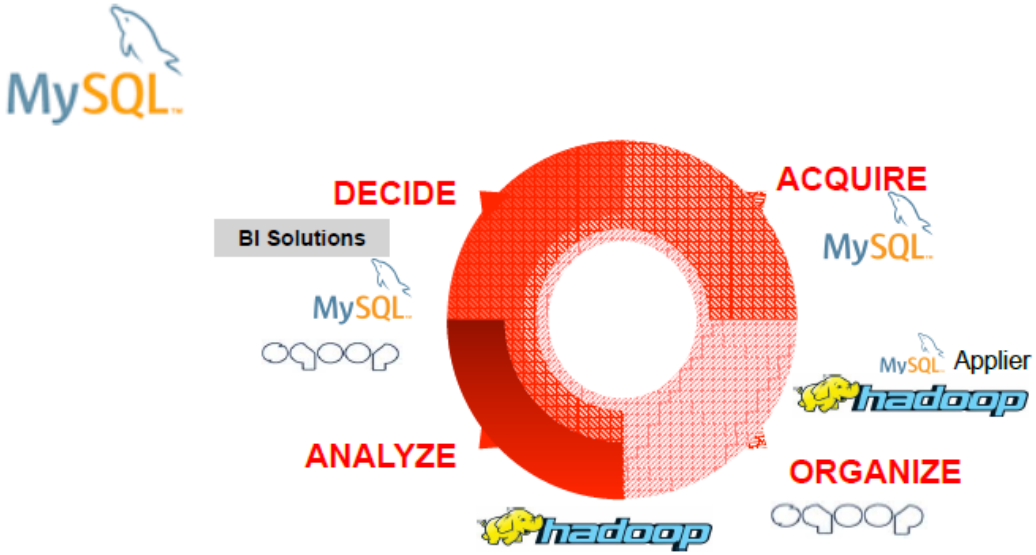
Optimizer Summary

- Index condition pushdown moves more processing for WHERE clauses into storage engine
- Larger, sequential I/O requests
- Additional Optimizations for Complex Queries
  - Optimize Many Tables in Join 25+
  - Postpone Materialization of Views/Subqueries in FROM
  - Indexes for Derived Tables
- Continued Improvements for Online Apps
  - Optimize “IN” clause
  - Optimized SELECT col1, … FROM t1 .. ORDER BY name LIMIT 10
  - Better Optimizer Diagnostics
    - EXPLAIN for INSERT, UPDATE and DELETE
    - EXPLAIN output in JSON

http://mysqloptimizerteam.blogspot.co.uk/

Hadoop Integration

MySQL in the Big Data Pipeline



80% of Hadoop deployments are integrated with MySQL

Batch: Apache SQUOOP
Realtime: MySQL Applier for Hadoop (not GA but available for testing)

MySQL and Hadoop

More Detail

- **White paper: MySQL and Hadoop – Big Data Integration**

http://www.mysql.com/why-mysql/white-papers/mysql-and-hadoop-guide-to-big-data-integration/

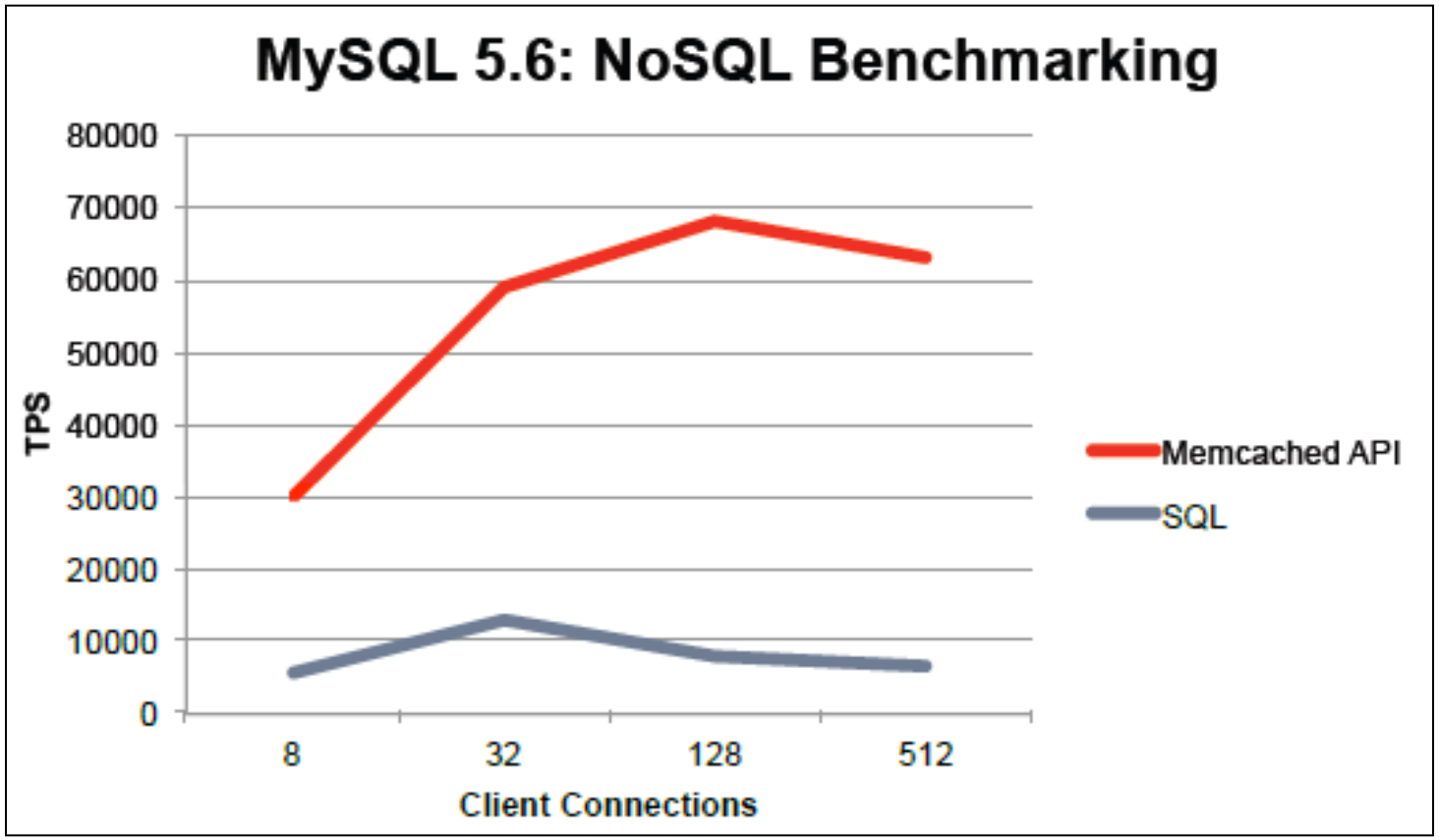
- **MySQL Applier for Hadoop**
  - YouTube demo video
    http://www.youtube.com/watch?v=mZRAtCu3M1g&feature=youtu.be
  - Implementation details

http://innovating-technology.blogspot.com/2013/04/mysql-hadoop-applier-part-2.html

NoSQL API

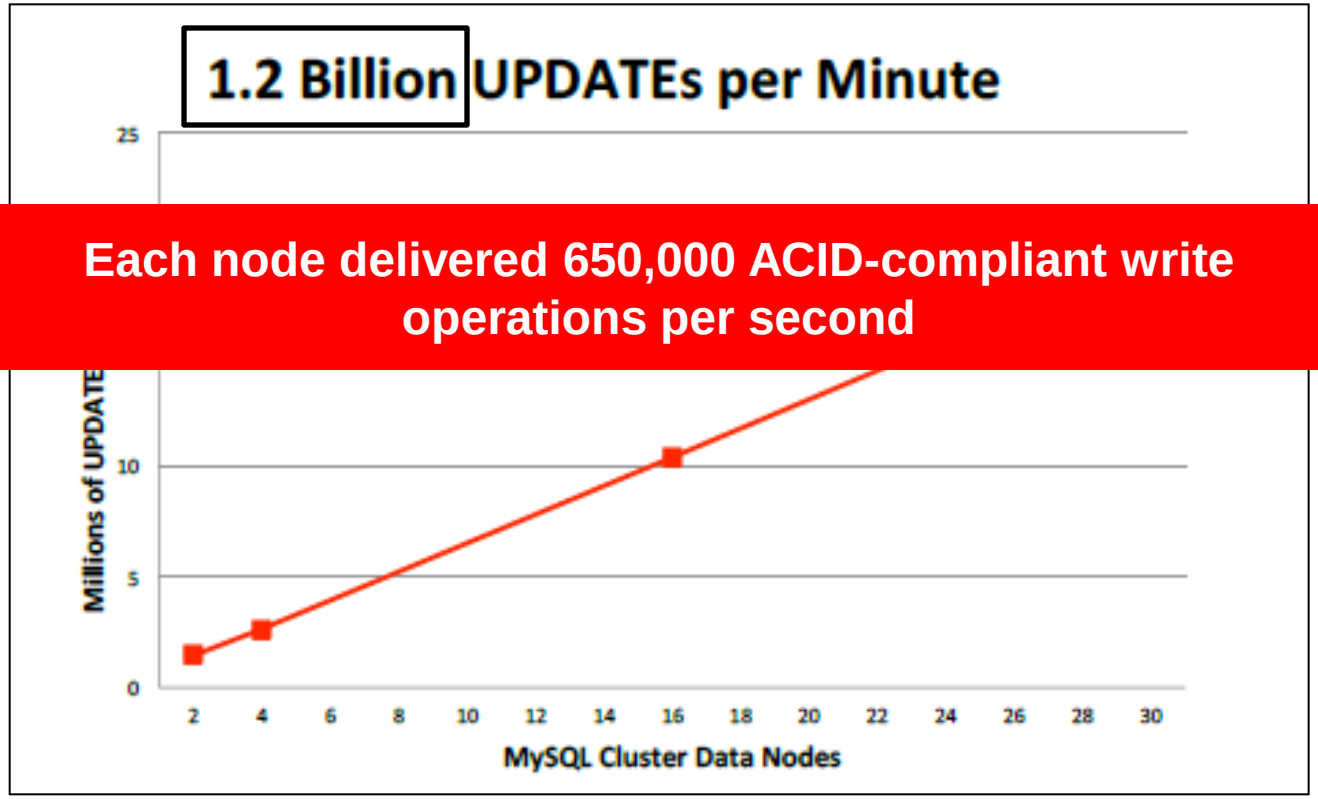
MySQL NoSQL API

- Bypass SQL layer, no parsing, no optimization
- InnoDB and NDB storage engines
- Key-value data with ACID guarantees
- Use SQL on same data set
- MySQL Cluster has additional NoSQL APIs
  - Node.js
  - Java
  - JPA
  - HTTP/REST
  - C++



Over 9x faster INSERT operations

The benchmark was run on an 8-core Intel server configured with 16GB of memory and the Oracle Linux operating system.



MySQL Cluster performance scaling out on commodity nodes and **NoSQL API**

Cluster of 30 commodity dual socket (2.6GHz), 8-core Intel servers, each equipped with 64GB of RAM, running Linux and connected via Infiniband

MySQL and NoSQL

More Detail

- **Guide to MySQL and NoSQL – Delivering the Best of Both Worlds**

  http://www.mysql.com/why-mysql/white-papers/guide-to-mysql-and-nosql-deli

- **Writing applications for InnoDB memcached Interface**

  http://dev.mysql.com/doc/refman/5.6/en/innodb-memcached-developing.html

- **MySQL Cluster API Developer Guide**
  - http://dev.mysql.com/doc/ndbapi/en/index.html

Replication

MySQL Replication

- Replication
  - Simple
  - Robust
  - Proven

K.I.S.S

MySQL Replication

Tao of YouTube

"Choose the simplest solution possible with the loosest guarantees that are practical"

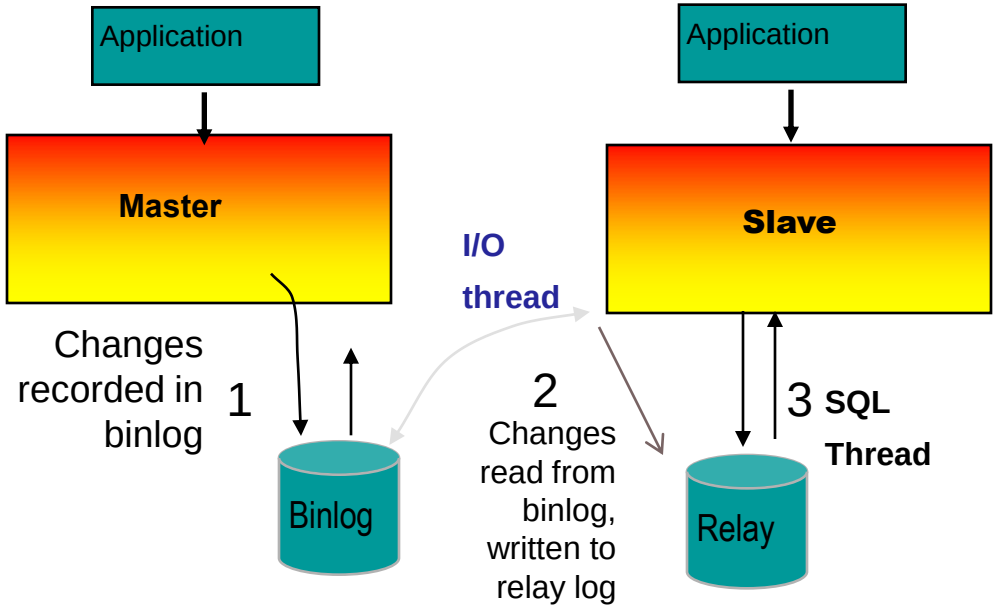
To solve a problem: One word - simple.

"Look for the most simple thing that will address the problem space…"

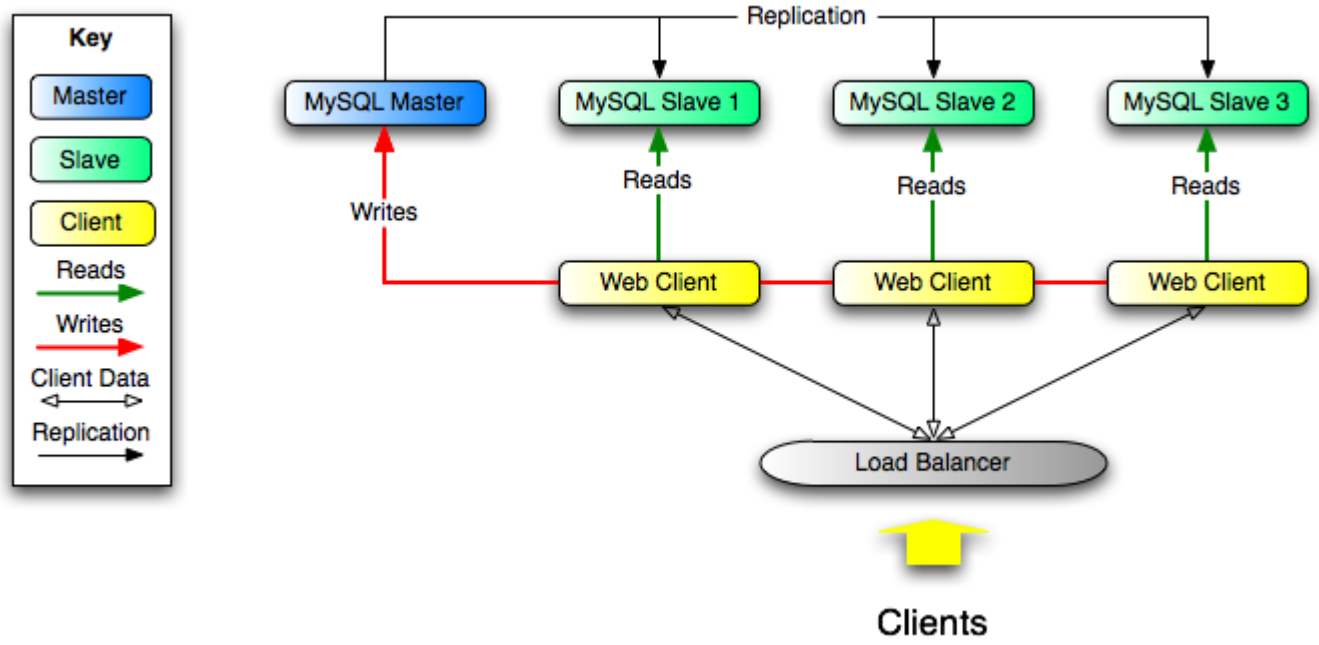
http://highscalability.com/blog/2012/3/26/7-years-of-youtube-scalability-lessons-in-30-minutes.html

Replication Basics: the Big Picture

- Native in MySQL
- Each slave adds minimal load on master

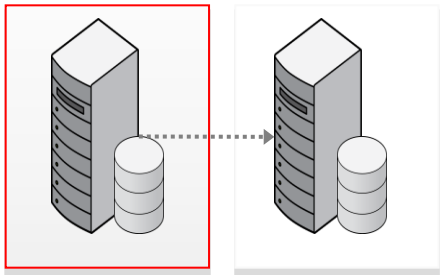


Replication Basics: Scale Out Example

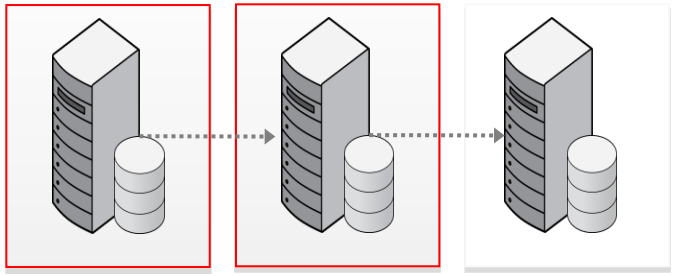


Replication Basics: Topologies

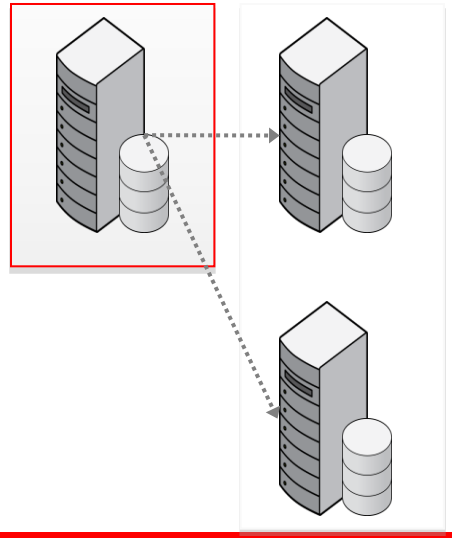
Single



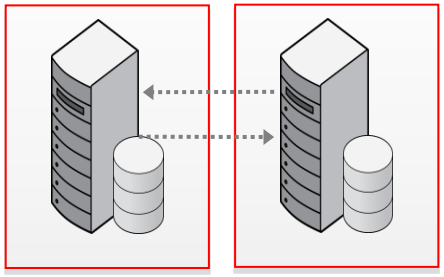
Chain



Multiple



Dual Master/Circular

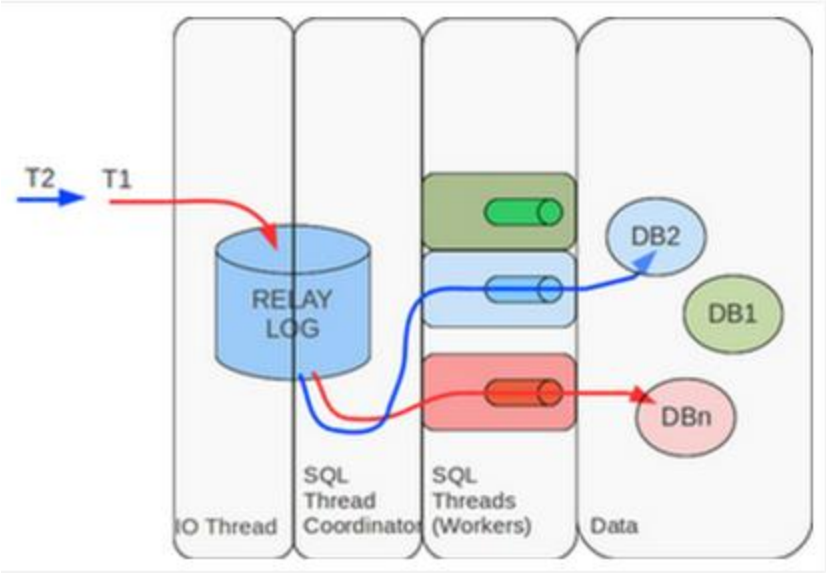


Master

Slave

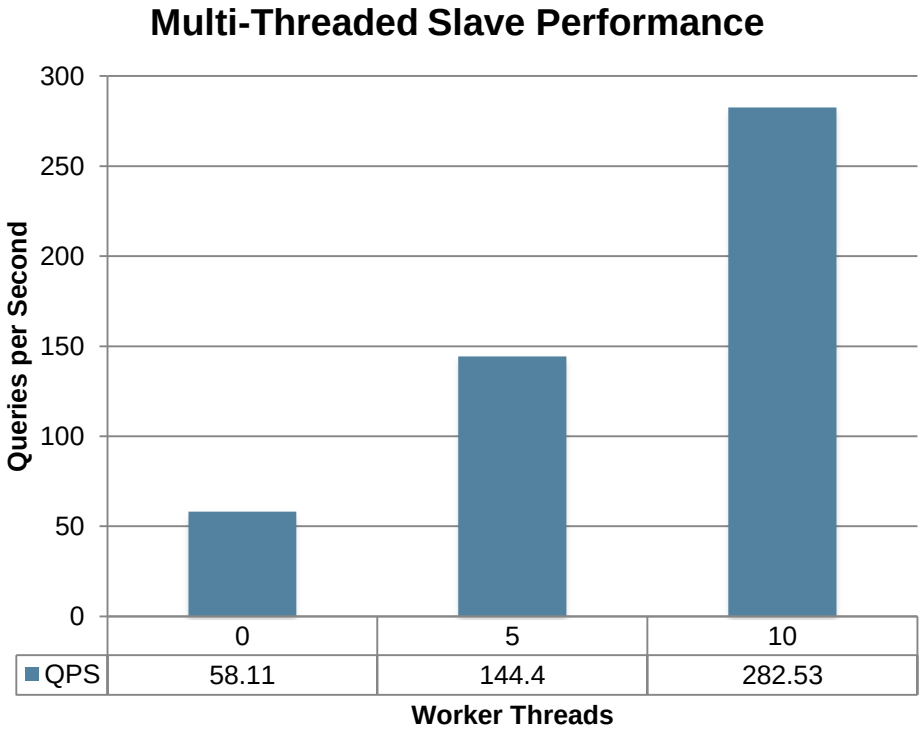
5.6 Replication Multi Threaded Slaves

- Improves replication performance by using multiple threads to apply events
- Slave SQL thread acts as the coordinator for slave worker threads
- Threads split based on schema



5.6 Multi-Threaded Slaves

- 5x Performance Gain
- Reduce Slave Latency
- Per Schema
  - Threads per Schema
  - Multi-tenancy

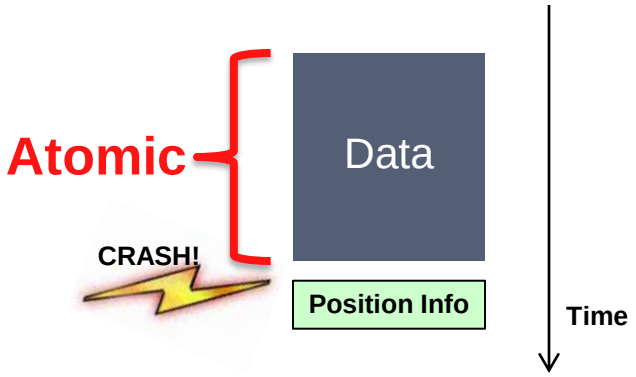


Oracle Linux 6.1, Oracle Sun Fire x4150 m2 Server

MySQL 5.6 Crash-Safe Slaves

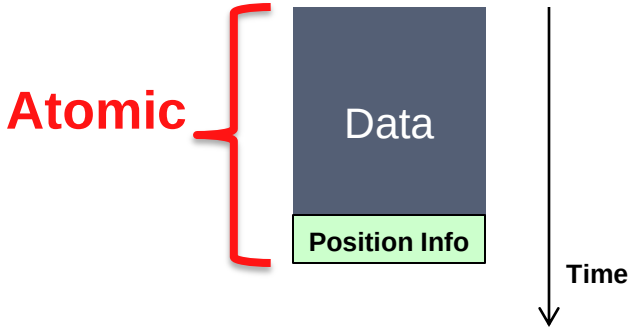
Before:

- Transaction Data: **in tables**
- Replication Info: **in files**



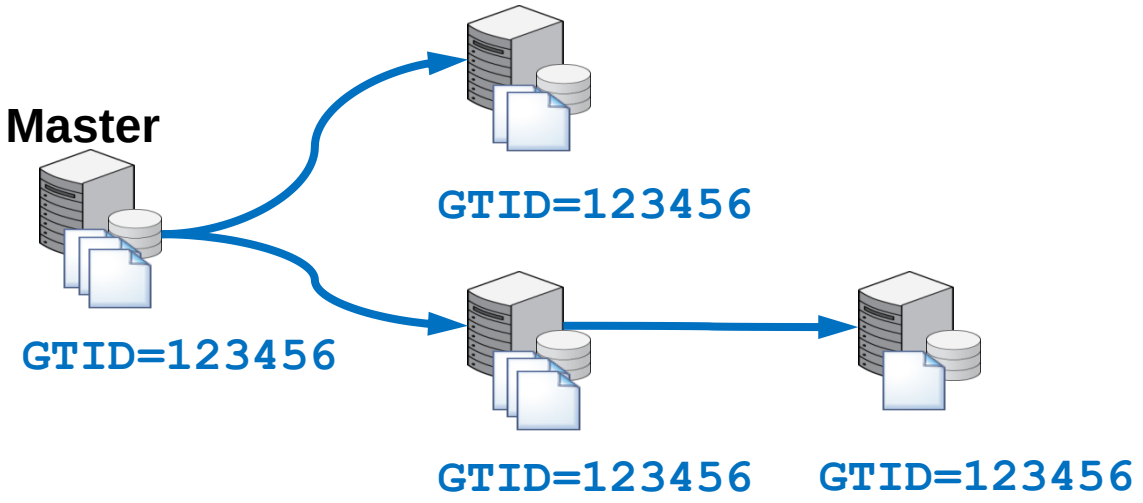
MySQL 5.6

- Transaction Data: **in tables**
- Replication Info: **in tables**



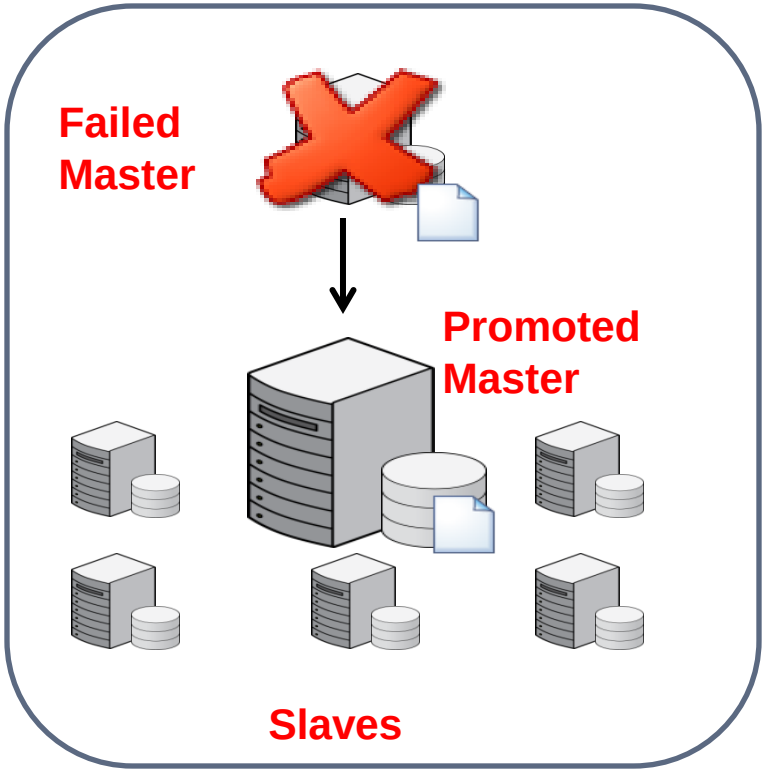
MySQL 5.6 Global Transaction Identifier

- Unique ID for Binlog
- Locate and Track Transactions
- Automate Failover



MySQL 5.6 High Availability Utilities

- failover
  - automatically promote slave on failure
- switchover
  - Automatically promotes slave on switchover
- mysqlreplfailover
  - automatically promote slave on failure
- Workbench download



MySQL 5.6 Binary Log Group Commit

- Significantly Reduce Replication Overhead
- Multiple Transactions
- One Commit

MySQL Replication

More Detail

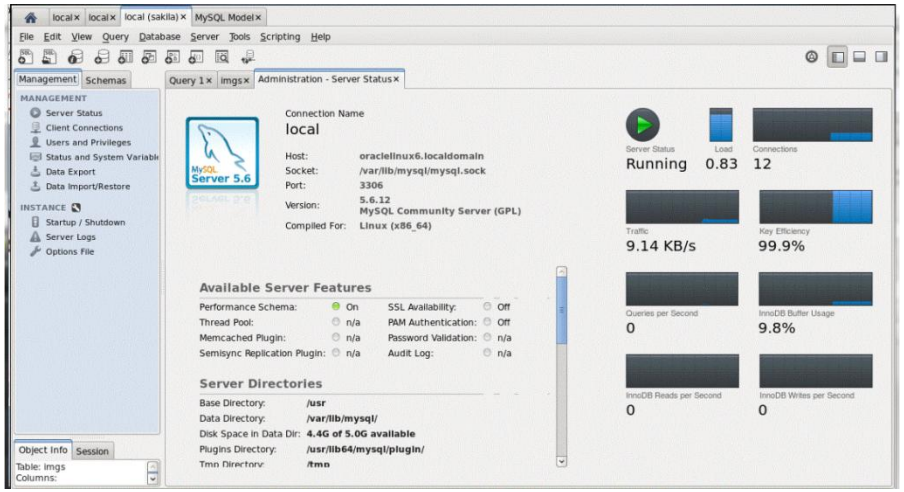
- **MySQL 5.6 Replication - Enabling the Next Generation of Web & Cloud Services**

http://dev.mysql.com/tech-resources/articles/mysql-5.6-replication.html

Workbench 6

New MySQL Workbench

- New streamlined user interface
- Visually design, model, generate, and manage databases
- Create and execute MySQL queries
- Configure servers, administer users, backup and recovery, inspect audit data
- Database migration
  - SQL Server
  - Sybase ASE
  - Postgres
  - ODBC



MySQLWorkbench 6

More Detail

- **Download**
  - **Commercial – edelivery.oracle.com**
- **MySQL Workbench: Database Design, Development, Administration, and Migration**

  http://www.mysql.com/why-mysql/white-papers/mysql-workbench-database-design-development-administration/
- **Video Tutorial**
  - http://www.youtube.com/watch?v=X_umYKqKaF0
- **Tomas Ulin (Engineering VP) Blog**

  http://insidemysql.com/mysql-workbench-6-0-a-sneak-preview/

Oracle Product Integrations

Oracle Product Certifications[6]			
Certified with Oracle Linux[6]	√	√	√
Certified with Oracle VM[6]	√	√	√
Certified with Oracle Solaris[6]	√	√	√
Certified with Oracle GoldenGate[6]		√	√
Certified with Oracle Fusion Middleware[6]		√	√
Certified with Oracle Secure Backup[6]		√	√
Certified with Oracle Database Firewall[6]		√	√

Oracle Integrations

- GoldenGate
- Database Firewall
- Oracle Secure Backup
- WebLogic Server
- Database Adapter for Oracle SOA Suite
- Oracle Business Process Management
- Oracle Virtual Directory
- Oracle Data Integrator

Quickstarts for MySQL

MySQL Editions Page

- Best place to start: mysql.com/products

MySQL Editions

MySQL is the world's most popular open source database. Whether you are a fast growing web property, technology ISV or large enterprise, MySQL can cost-effectively help you deliver high performance, scalable database applications.

MySQL Community Edition is the freely downloadable version of the world's most popular open source database.

- Learn more about the MySQL Community Edition
- Download the MySQL Community Edition

Commercial customers have the flexibility of choosing from multiple editions to meet specific business and technical requirements:

- MySQL Standard Edition
- MySQL Enterprise Edition
- MySQL Cluster Carrier Grade Edition

ISVs, OEMs and VARs can learn more about MySQL as an Embedded Database

	MySQL Standard Edition	MySQL Enterprise Edition	MySQL Cluster Carrier Grade Edition
Annual Subscription[2,3,4,5] /1-4 Socket Server /Year	USD 2,000 Buy Now	USD 5,000 Buy Now	USD 10,000 Buy Now
Oracle Premier Support[3]			
24x7 Support	√	√	√
Unlimited Support Incidents	√	√	√
Knowledge Base	√	√	√
Maintenance Releases, Bug Fixes, Patches, Updates	√	√	√
MySQL Consultative Support	√	√	√
MySQL Features			
MySQL Database Server	√	√	√
MySQL Connectors	√	√	√
MySQL Replication	√	√	√
MySQL Partitioning		√	√
MySQL Workbench[1]	√	√	√

MySQL Connect Conference

September 21-23, 2013 in San Francisco

- Conference
- Enhanci
- Replicati
- Getting S
- Performa

http://www.or

http://www.or

Upgrade your expe

- JavaOne
- MySQL Connect
- Oracle PartnerN

$100 each

Saturday September 21, 10:30 a.m.–11:00 a.m.

Current MySQL Usage Models and Future Developments

MySQL 5.6 and MySQL Cluster 7.3 delivered numerous highly anticipated features, strengthening MySQL's position as the leading web and cloud database. How and why are the foremost social networking companies and e-commerce businesses successful with MySQL today, and what future developments should be considered to ensure that MySQL will meet their requirements moving forward? Join panelists from Facebook, Twitter, LinkedIn, and PayPal as they share their perspectives and insights.

Panelists:

Davi Arnaut, Senior Software Engineer, LinkedIn

Daniel Austin, Chief Architect, PayPal

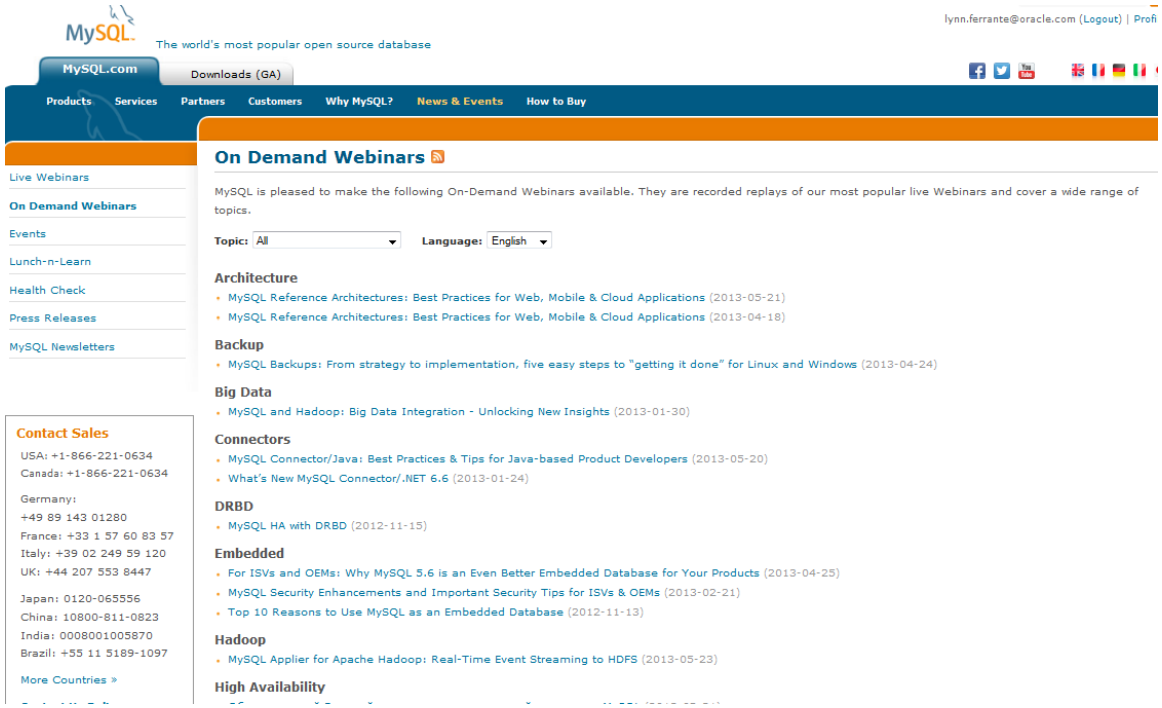
Mark Callaghan, Member of the Technical Staff, Facebook

Calvin Sun, Senior Engineering Manager, Twitter

MySQL Webinars

- Live and on-demand

http://www.mysql.com/news-and-events/on-demand-webinars/



Online MySQL Demos

- Improving your SQL Performance using MySQL Query Analyzer
- Monitor your MySQL Servers
- Get your "Virtual MySQL DBA Assistant"
- Customize your MySQL Advisors
- Monitor MySQL Replication and Scale Out
- MySQL Cluster
- MySQL Cluster Auto Installer
- Workbench

Oracle University

- MySQL for Database Administrators
- MySQL for Beginners
- MySQL Cluster
- MySQL High Availability
- MySQL Performance Tuning

- Some of the classes may be taken as self-study

MySQL 5.6: Best Release Ever!

IMPROVED PERFORMANCE AND SCALABILITY

- Scales to 48 CPU Threads
- Up to 230% performance gain over MySQL 5.5

IMPROVED INNODB

- Better transactional throughput and availability

IMPROVED OPTIMIZER

- Better query exec times and diagnostics for query tuning and debugging

IMPROVED REPLICATION

- Higher performance, availability and data integrity

IMPROVED PERFORMANCE SCHEMA

- Better Instrumentation, User/Application level statistics and monitoring

New! NoSQL ACCESS TO INNODB

- Fast, Key Value access with full ACID compliance, better developer agility

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MySQL 5.6

Questions?


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