

# What's New in MySQL 5.7

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# Agenda

- Why MySQL?
- Highlights of 5.7 Improvements and Additions
- New Server Strategy for Releases
- New MySQL Document Store

# Best Choice for Next Generation Web & Cloud Applications

## Strong MySQL Momentum



World's Most Popular Open Source Database



Leading Open Source Database for Web Applications



#1 Open Source Database in the Cloud



Integrated with Hadoop in Big Data Platforms

# MySQL Powers The Web



Over 500 million Tweets/day. 143,200 Tweets/sec in Aug 2013

The Facebook logo, the word "facebook" in white lowercase letters on a blue rectangular background, is positioned to the left of the text.

facebook

"Many petabytes" of data. 11.2 Million Row changes & 2.5 billion rows read /sec handled in MySQL

The YouTube logo, the word "YouTube" in white lowercase letters on a red rounded rectangular background, is positioned to the left of the text.

YouTube

6 billion hours of video watched each month

The PayPal logo, the word "PayPal" in blue lowercase letters with a blue "P" icon, is positioned to the left of the text.

PayPal

Globally-distributed database with 100 terabytes of user-related data based on MySQL Cluster

# Power of the MySQL Community

# Benefit Highlights of MySQL 5.7

- Faster
  - Server – quicker queries, more IO, more connections
    - InnoDB engine, Faster Connect/Disconnect, More Optimized Queries
    - No need to use MyISAM – can have speed and consistency both now
  - Replication – scales higher, faster slave processing
    - Parallel replications (parallel replication) – order of magnitude faster(?)
  - GIS searching – quickly search geographic data
    - Native InnoDB Spatial indexes
  - Compression
    - Leverages new advanced Operating File System capabilities
    - Improves performance, saves space

# Benefit Highlights of MySQL 5.7 (con't)

## Easier

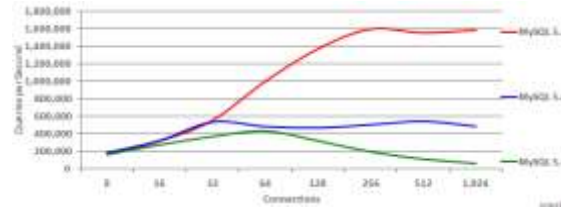
- Easier Configurability – dynamic “online” changes
- More Flexible
  - Native JSON support – datatype, binary storage format
  - Virtual Columns/Functional indexes – index any data and find quickly
- Simpler to Manage
  - More instruments, Easy access to data using SYS schema
- More Secure
  - By default and more options to secure the server



# MySQL 5.7 Sysbench Benchmark: **SQL** Point Selects / sec

**3x Faster than MySQL 5.6**

**4x Faster than MySQL 5.5**

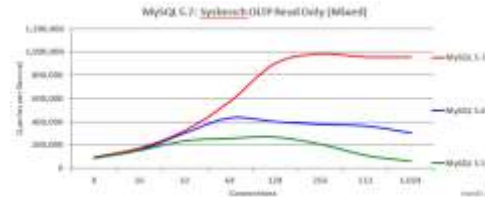


**1,600,000 QPS**

# MySQL 5.7 Sysbench Benchmark: Mixed OLTP Read Only

**3x Faster than MySQL 5.6**

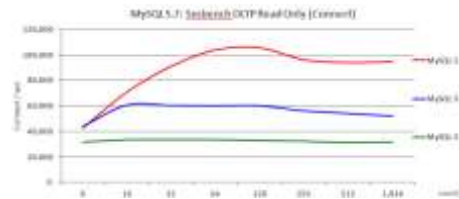
**6x Faster than MySQL 5.5**



**Near 1M QPS**

# MySQL 5.7 Sysbench Benchmark: Connect / sec

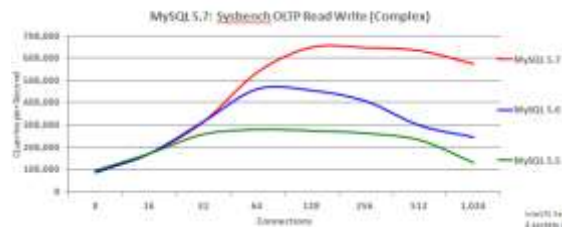
**82% Faster than MySQL 5.6**



**100K Connect / Sec**

# MySQL 5.7 Sysbench Benchmark: Connect / sec

**82% Faster than MySQL 5.6**



**100K Connect / Sec**



# MySQL 5.7: JSON Overview

- Native JSON data type
  - Native internal binary format for efficient processing & storage
- Built-in JSON functions
  - Allowing you to efficiently store, search, update, and manipulate Documents
- JSON Comparator
  - Allows for easy integration of Document data within your SQL queries
- Indexing of Documents using Generated Columns
  - InnoDB supports indexes on both stored and virtual Generated Columns
  - New expression analyzer automatically uses the best “functional” index available

# MySQL 5.7: Optimizer Improvements

**Queries execute faster, while using less CPU and disk space!**

- Optimizer and Parser refactoring
    - Cleanly separate the parsing, optimizing, and execution stages
  - **New** hint framework
    - Easier to manage
    - With support for additional **new** hints
  - Improved JSON EXPLAIN
  - EXPLAIN for running thread
  - Generated Columns
- **New** Cost based Optimizer
    - Configurable and tunable
      - mysql.server\_cost and mysql.engine\_cost tables
      - API for determining where data resides: on disk or in cache
  - Support for InnoDB based internal temp tables
  - SQL Standard compliant  
ONLY\_FULL\_GROUP\_BY mode is ON by default
  - Many specific new optimizations

# MySQL 5.7: Query Rewrite Plugin

- New pre and post parse query rewrite APIs
  - Users can write their own plug-ins
- Provides a post-parse query plugin
  - Rewrite problematic queries without the need to make application changes
  - Add hints
  - Modify join order
  - Many more ...
- Improve problematic queries from ORMs, third party apps, etc
- Eliminates many legacy use cases for proxies

# MySQL 5.7: Performance Schema

## Memory Instrumentation

- Aggregates statistics by
  - Type of memory used (caches, internal buffers, ...)
  - Thread/account/user/host indirectly performing the memory operation
- Attributes include
  - Memory used (bytes)
  - Operation counts
  - High/Low Water Marks

## Statement Instrumentation

- Stored Procedures
- Stored Functions
- Prepared Statements
- Transactions

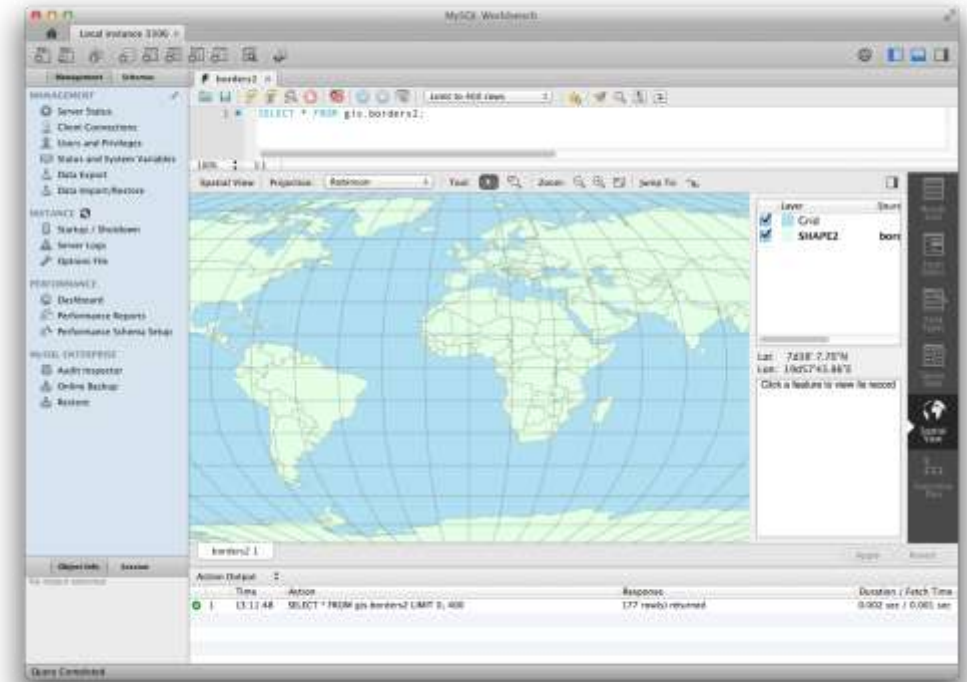
## Additional Information

- Replication slave status
- MDL lock instrumentation
- Status and variables per thread
- Server stage tracking
- Track long running SQL
- Improved configuration and ease-of-use
- All while **reducing** total footprint and overhead



# MySQL 5.7: GIS Improvements

- Replaced custom code with Boost.Geometry
  - For spatial calculations
  - For spatial analysis
  - Enabling full OGC compliance
  - We're also Boost.Geometry **contributors!**
- InnoDB R-tree based spatial indexes
  - Full ACID, MVCC, & transactional support
  - Index records contain minimum bounding box
- GeoHash
- GeoJSON
- Helper functions such as **ST\_Distance\_Sphere()** and **ST\_MakeEnvelope()**



# MySQL 5.7: InnoDB Improvements

- Native Partitioning
  - Eliminates previous limitations
  - Eliminates resource usage problems
  - Transportable tablespace support
- Native Full-Text Search
  - Including full **CJK support!**
- Native Spatial Indexes
- Transparent page compression
- Support for 32K and 64K pages
  - Use with transparent page compression for very high compression ratios
- General TABLESPACE support
  - Store multiple tables in user defined shared tablespaces
- Support for MySQL Group Replication
  - High priority transactions
- Improved support for cache preloading
  - Load your hottest data loaded at startup
- Configurable fill-factor
  - Allows for improvements in storage footprint
- Improved bulk-data load performance
- **Resize the InnoDB Buffer Pool online**



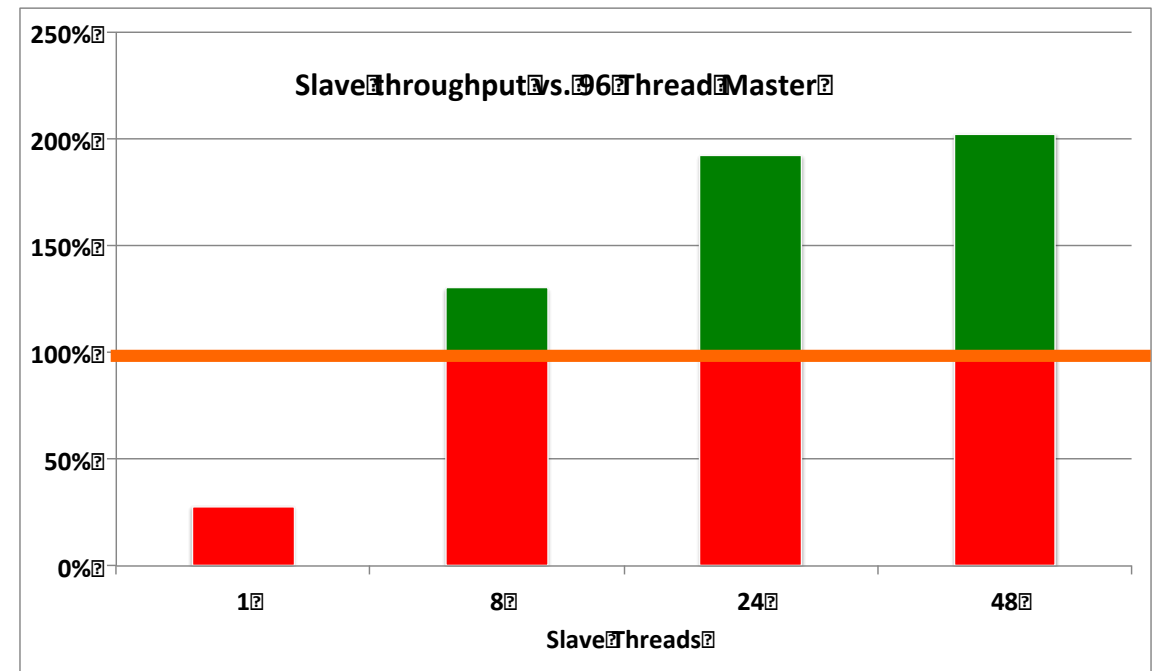
# MySQL 5.7: Security Improvements

- InnoDB Tablespace Encryption
  - MySQL KeyRing
  - AES 256 Encryption now the default
  - Password rotation policies
  - Deployment: enable secure unattended install by default
  - Easier instance initialization and setup: `mysqld --initialize`
  - New detection and support for `systemd`
- SSL
    - Enabled by default
    - Auto-detection of existing keys and certs
    - Auto generation of keys and certs when needed
    - New helper utility: `mysql_ssl_rsa_setup`
    - New `--require_secure_transport` option to prevent insecure communications
    - Added SSL support to binary log clients
  - Extended Proxy User Support
    - Added Built-in Authentication Plugins support for Proxy Users
    - Allows multiple users to share a single set of managed privileges

# MySQL 5.7: Replication Improvements

- GTID enhancements
  - On-line, phased deployment of GTIDs
  - Binary logging on slave now optional
- Enhanced Semi-synchronous replication
  - Write guaranteed to be received by slave before being observed by clients of the master
  - Option to wait on Acks from multiple slaves
- Multi-Source Replication
  - Consolidate updates from multiple Masters into one Slave
- Dynamic slave filters

- **8-10x** Faster slave throughput
  - Often removes slave as a bottleneck; keep pace with master with 8+ slave threads
  - Option to preserve Commit order
  - Automatic slave transaction retries



# New Release Model – Accelerating Innovation

- Introducing the concept of Rapid Plugins
- A much requested feature
- Users who want more of a balance between
  - Don't break it
  - Give me innovation sooner!
- Goals
  - Same Stability in the Core Server
  - Adds Optional Server Plugins for New Functionality
    - New plugins come with the server distribution – but you choose whether to turn ON or OFF
    - First Example MySQL Documents Store X Plugin

# We <3 Schemaless

- MySQL as a Document Store (new!)
- All the existing features of MySQL
  - Replication
  - InnoDB
  - Performance Schema
- With the addition of schemaless
  - Documents using JSON
  - Easy to program CRUD APIs

# MySQL – a One Stop Shop

## Combining Relational and Document Stores

- Expensive to manage many data stores
- Better few databases – more flexibility
  - Developers and DBAs
    - Can harness both NoSQL and SQL savvy
    - Already know the MySQL product
  - Less training – don't need to learn many products
  - Cross data store exchange – easier to move from docs to tables etc.
  - One connector/driver needed for apps

# One Database Many Models VS Many Databases Many Models

- One Extensible database
  - Do more with the MySQL database
  - Many can manage (with deep skills)
  - Stable
  - Cost-effective
  - Easy to move data between like database types
  - Fewer Drivers
  - Few Tools
  - SQL works, CRUD works
  - Operational and Analytical Together

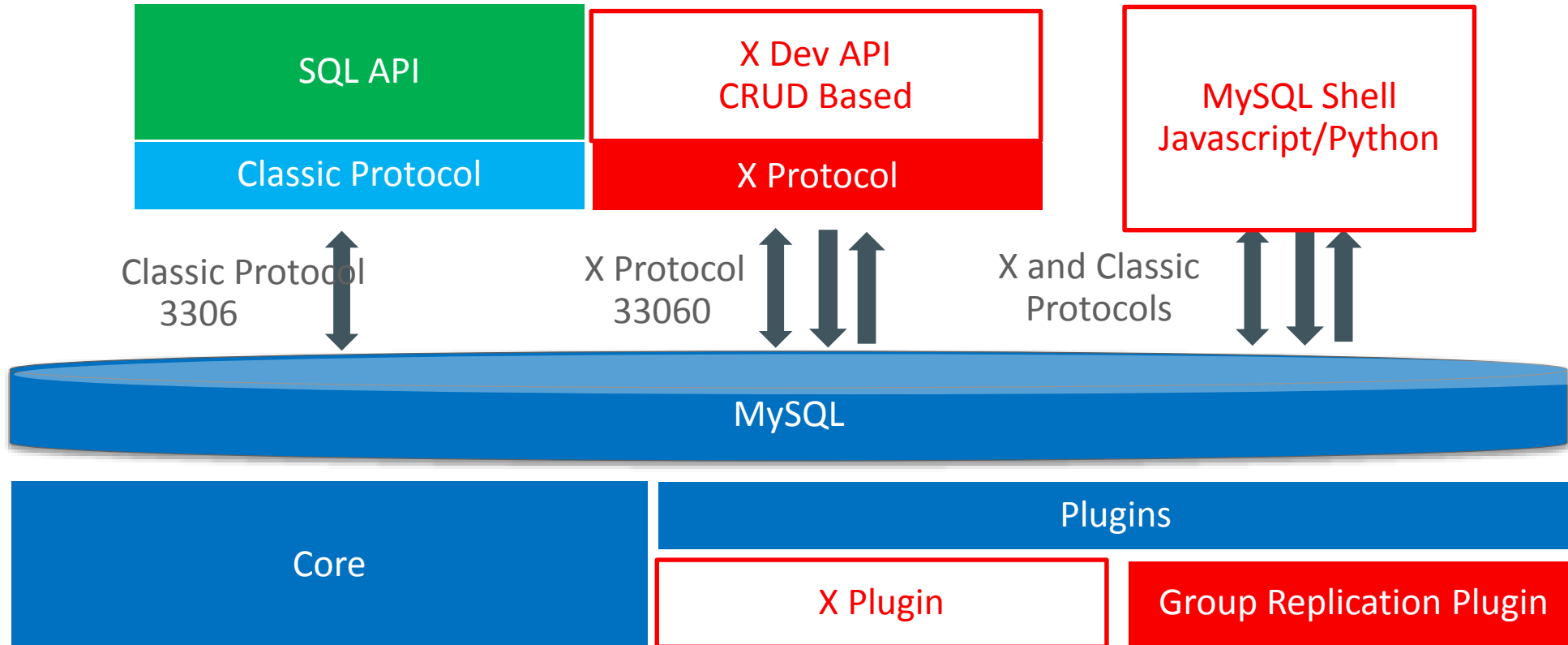
- Many different databases
  - Requires larger skill repertoire, more complex development ...
    - Harder to find deep skills
  - Many Drivers
  - Many Tools
  - More effort to share and exchange data
  - It's a lot more work
  - Operational and Analytical Separate

# MySQL Document Store

## Store, Retrieve, Search and Manage JSON documents

- Native JSON Datatype, Indexes on JSON Documents
- Native JSON Collections
- Interactive Shell “MySQL Shell” – Javascript, Python, SQL modes
- Connectors include NoSQL CRUD APIs
  - Java, New NodeJS, NET, C++/C, PHP, Python
  - Method Chaining and Pipelining
  - Supports Combined Document and Relational

# Architecture





# MySQL Document Store: What's New?

- **New** Document APIs – X Dev APIs
  - SQL and NoSQL/Document CRUD APIs will cross all Connectors
    - For BOTH Collections of Documents and Relational Tables
  - Initial DMR M1 includes Node.js, Java and .NET
- **New** Interactive Shell – MySQL Shell
  - Javascript, Python, SQL modes
- **New** Server Features – MySQL Document Store
  - Native JSON datatype and storage
  - Generated Columns with Indexing
  - Over 20+ Native JSON functions
  - New X Protocol

# New! MySQL Server Plugin – X Plugin

## Exposes Document APIs to the Connectors

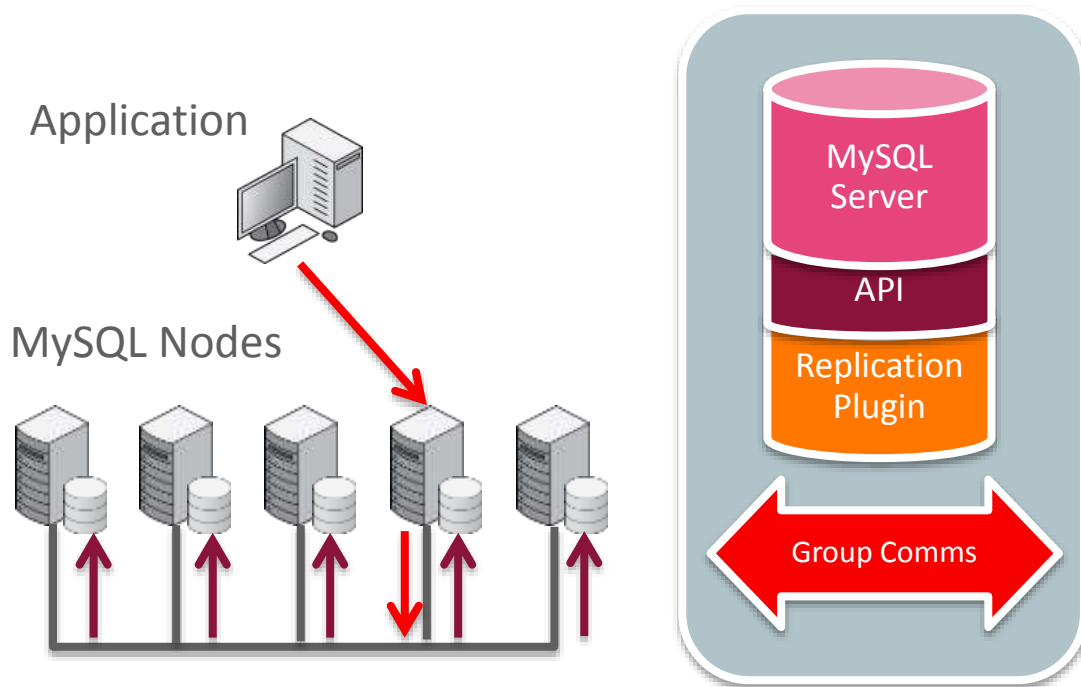
- Designed to enable rapid innovation in APIs and Protocol
- Supports new X Protocol
  - With new CRUD and other added interfaces
- Includes instruments for monitoring in Performance Schema
- Works concurrently with Standard SQL APIs
- Runs a new port - 33060

# MySQL Document Store

- ✓ Built on Proven MySQL/InnoDB/Replication
- ✓ Schema-less/Relational/Hybrid
- ✓ SQL/ACID/Transactions
- ✓ CRUD/JSON/Documents
- ✓ Modern Dev API
- ✓ Modern/Efficient Protocol
- ✓ SQL Queries/Analytics over JSON Documents

# MySQL Group Replication

labs.mysql.com



- Active/Active Update Anywhere
  - Conflict detection and resolution (transaction rollback)
  - Optimistic State Machine Replication
- Automatic group membership management and failure detection
  - No need for server fail-over
  - Elastic scale out/in
  - No single point of failure
  - Automatic reconfiguration
- Well integrated
  - InnoDB
  - GTID-based replication
  - PERFORMANCE\_SCHEMA

# MySQL Enterprise Edition: Security Features

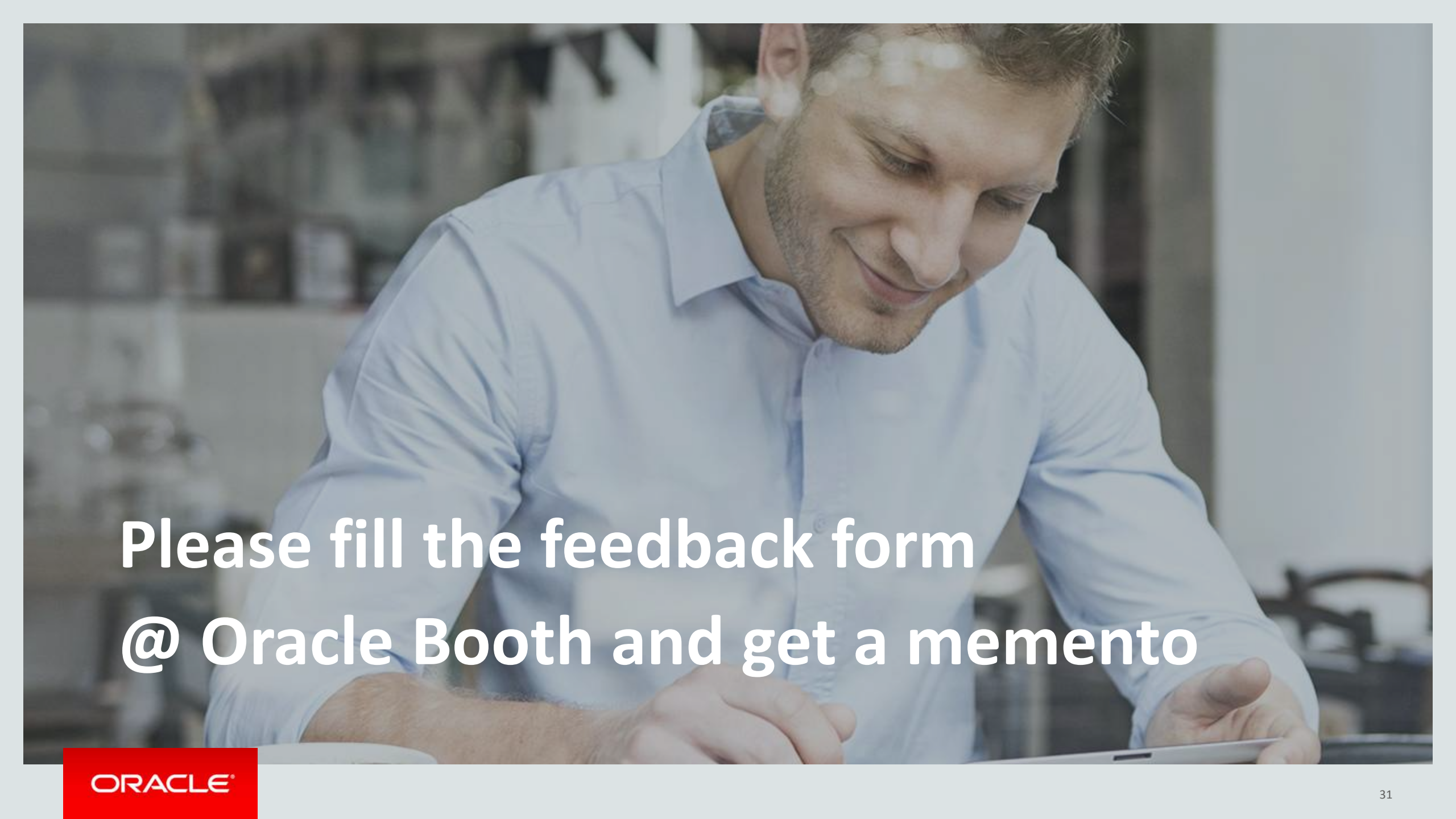
- **NEW!** MySQL Enterprise **Firewall**
  - Block SQL Injection Attacks
  - Intrusion Detection
- MySQL Enterprise **TDE**
  - Data-at-Rest Encryption
- MySQL Enterprise **Encryption**
  - Public/Private Key Cryptography
  - Asymmetric Encryption
  - Digital Signatures, Data Validation
- MySQL Enterprise **Authentication**
  - External Authentication Modules
    - Microsoft AD, Linux PAMs
- MySQL Enterprise **Audit**
  - User Activity Auditing, Regulatory Compliance
- MySQL Enterprise **Monitor**
  - Changes in Database Configurations, Users Permissions, Database Schema, Passwords
- MySQL Enterprise **Backup**
  - Securing Backups, AES 256 encryption



More information available at : <http://www.mysql.com/products/enterprise/>

# Customer comments on 5.7: Bookings.com

- Following MySQL 5.7 from DMR releases has been worthwhile
  - We hit a few bumps as might be expected
  - We received an excellent response to those issues we reported
    - Some changes were reverted, others added
- The migration to production has been very smooth
  - The few issues we've seen have been special cases and easy to work around
- MySQL 5.7 is the best MySQL release yet
  - A lot of high quality work has gone into this release
- Recent announcement of optional new features in 5.7.12 looks very interesting and will require ongoing evaluation

A man in a light blue button-down shirt is looking down at a tablet device. The image has a semi-transparent white overlay with text. The background is slightly blurred, showing what appears to be a booth or office setting.

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