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# What's New in MySQL 5.7?

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# Agenda

- 1 Performance and scalability
- 2 Optimizer
- 3 JSON and generated columns support
- 4 InnoDB improvements
- 5 Performance schema & SYS schema
- 6 Security
- 7 GIS

A young woman with long, wavy blonde hair is seen from the side, looking down at her smartphone. She is wearing a light blue long-sleeved shirt and blue jeans, and has a large black backpack on her back. She is standing in a crowded airport terminal with many other people in the background, some with luggage. The scene is brightly lit, and the background is slightly blurred, emphasizing the woman and her phone. The text "Performance and scalability" is overlaid in white on the image.

# Performance and scalability

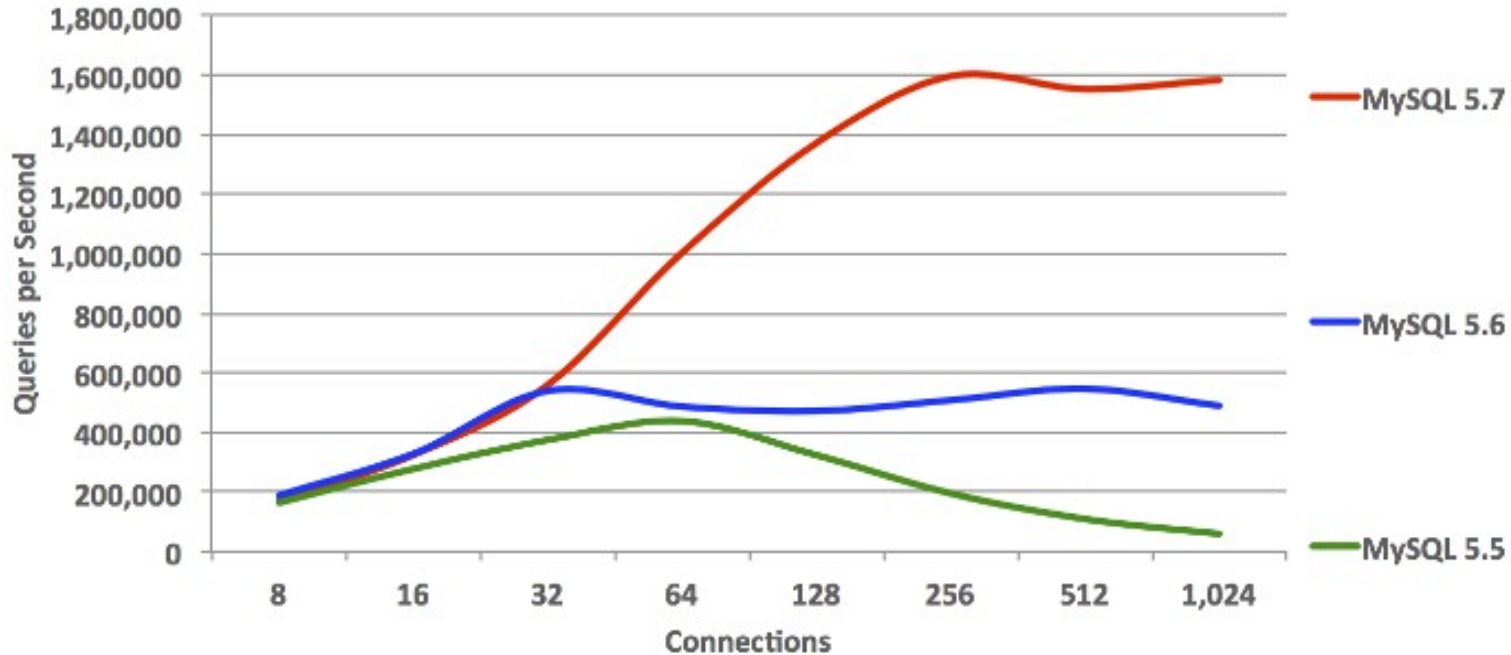
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# Performance and scalability

- Improved InnoDB scalability
- Improved InnoDB temporary table performance
- Faster online operations
- Faster bulk operations

# Point selects

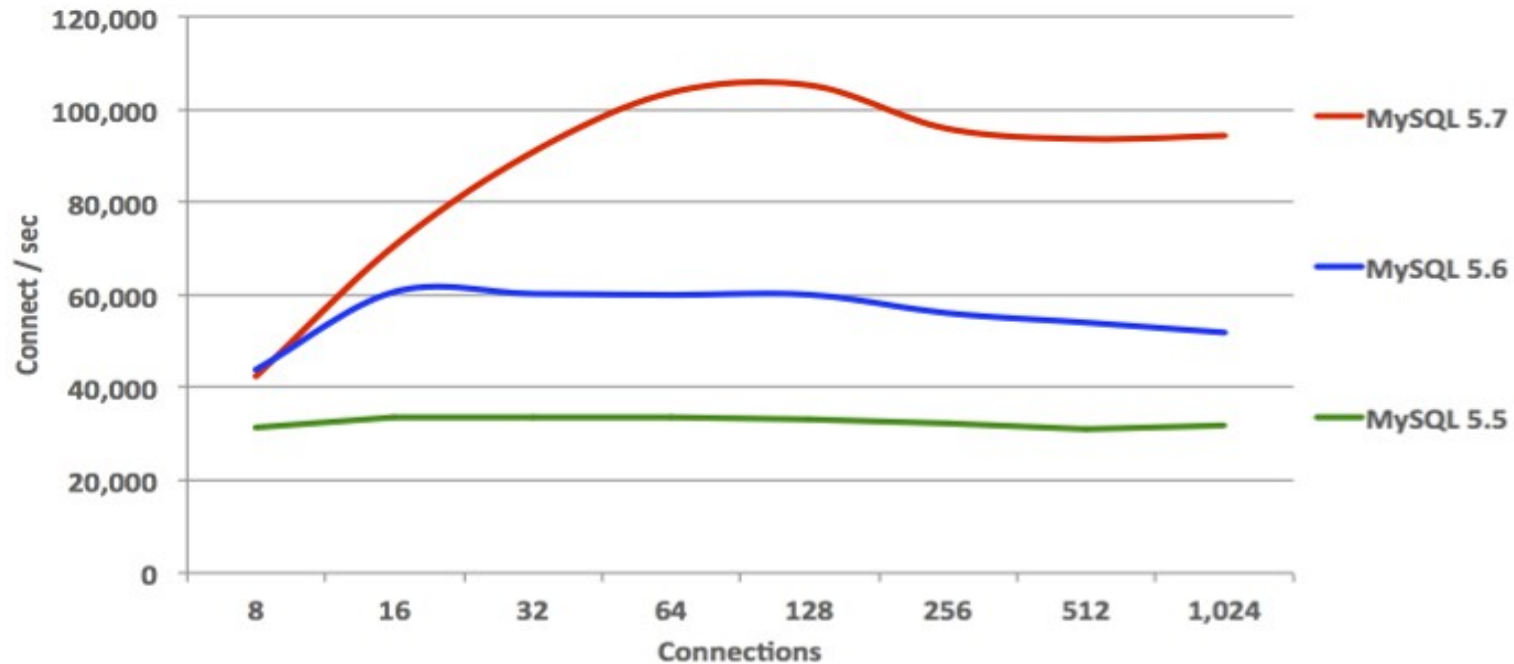


## Sources:

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

<http://dimitrik.free.fr/blog/archives/2015/10/mysql-performance-yes-we-can-do-more-than-16m-qps-sql-on-mysql-57-ga.html>

# Connections per second



Sources:

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





# Optimizer



# Optimizer

- Parser and optimizer refactoring
  - Improves readability, maintainability, stability
  - Cleaner separation of parsing, resolving, optimization and execution phases
  - Allows for faster feature development with less risk
- Improved EXPLAIN
  - Cost numbers in JSON output, displayed in Workbench visual explain
  - EXPLAIN for running thread

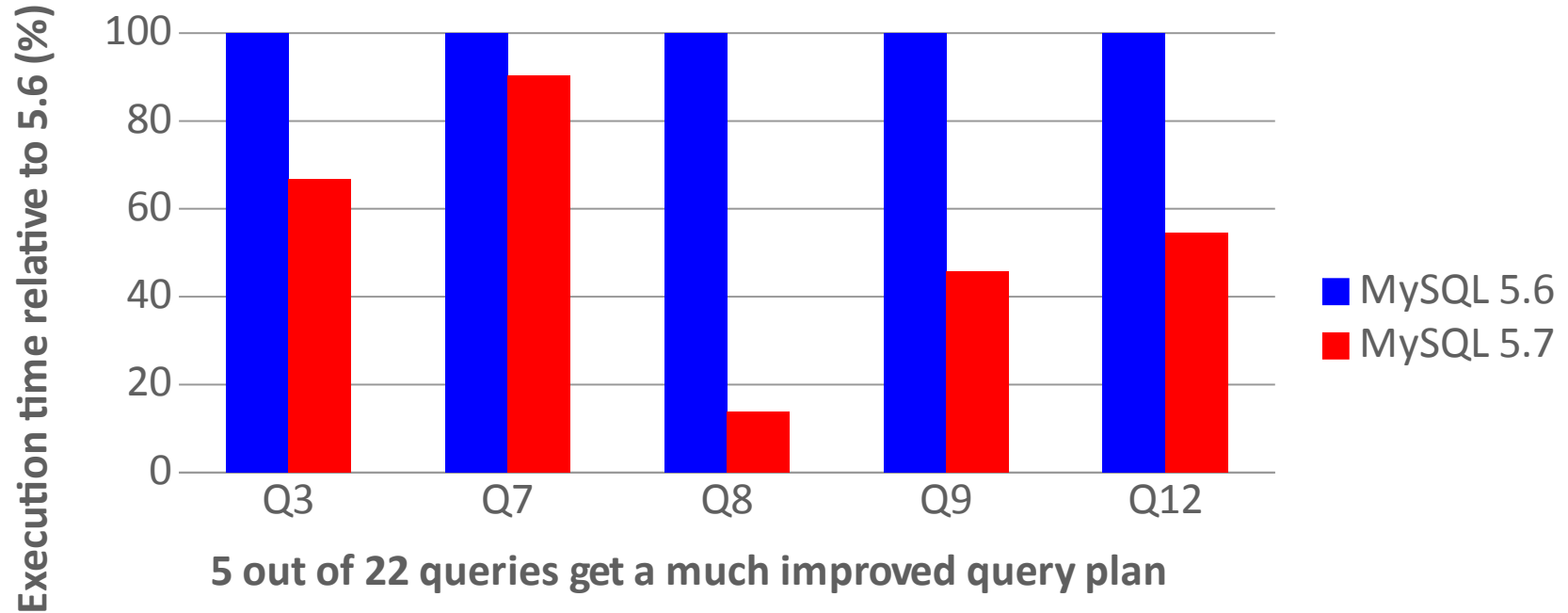
# Optimizer

- New cost model
- New hint framework
  - Easier to manage
  - More hints
- Support for InnoDB internal temporary tables
- Many smaller, specific optimizations

# New cost model

- More accurate cost estimates
  - Better optimizer decisions, faster execution
- Adapt to new hardware developments
  - SSD, larger memory sizes, caching
- More maintainable implementation
  - Avoid hard-coded constants
- Configurable and tunable
  - `mysql.server_cost`, `mysql.engine_cost` tables

# New cost model



DBT-3, size factor 10, CPU bound

# Query rewrite plugin

- New plugin APIs
  - Hooks before or after parsing
- New post-parse plugin
  - Rewrite queries without changing the application
  - Add hints to pick a different plan
  - Anything else you want to do to your queries
- Improve queries from ORMs, third party apps, etc.
- Eliminates many legacy use cases for proxies



# JSON and generated columns

# JSON

- Native JSON data type
  - Binary format for more efficient processing and storage
- Built-in JSON functions
  - Store, search and manipulate documents
- JSON comparator
  - Integrate JSON operations within your SQL queries
- Indexing using generated columns
  - InnoDB indexes both stored and virtual generated columns
  - New expression analyzer automatically uses the best functional index available



# JSON type tech specs

- utf8mb4 character set
- Optimized for read intensive load
- Parse and validate on insert only
- Dictionary
  - Sorted object attribute names (“keys”)
  - Fast access to array cells by index
- Supports all native JSON types
  - Number, string, bool, object, array
- Extended with MySQL types
  - Date, time, datetime, timestamp, etc.

# Generated columns

- CREATE TABLE *t* (*i1* INT, *i2* INT GENERATED ALWAYS AS (*i1*+1) VIRTUAL);
- Not only for JSON
  - But very useful for functional indexes on JSON documents
- Stored
  - Computed and stored on disk
- Virtual
  - Computed on the fly
- Both stored and virtual generated columns can be indexed

# InnoDB improvements

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# InnoDB improvements

- Native partitioning
  - Transportable tablespace support
- Native full text search
  - Including CJK support
- Transparent page compression
- General tablespace support
  - Store multiple tables in user defined tablespaces
- High priority transactions for MySQL Group Replication

# InnoDB improvements

- Improved support for cache preloading
- Configurable fill-factor
- Improved bulk data load performance
- Much faster index creation
- Online buffer pool resizing
- Additional online ALTER TABLE support
  - Enlarge VARCHAR, rename index

# InnoDB improvements

- New separate tablespace for temporary tables
  - Optimized for temporary tables
    - No redo logging, no change buffering, less locking
  - Tailored ACID and MVCC semantics for internal temporary tables
  - Light-weight and ultra fast
  - Default for internal temporary tables



# Performance schema & SYS schema

# Performance schema

- New instrumentation
  - Memory usage
  - Stored routines
    - Functions
    - Procedures
  - Triggers
  - Events
  - And more ...



# SYS schema

- Helps you use performance schema data
  - Similar to Oracle's V\$ and MS SQL Server's dynamic management views (DMVs)
- Simplifies DBA tasks
  - Monitor server health, user and host statistics
  - Spot, diagnose and tune performance issues
  - IO hot spots, locking, costly SQL statements
  - Schema, table and index statistics
- Integrated with Workbench

A control room with multiple operators at computer workstations. The room is filled with rows of desks, each equipped with several computer monitors. The monitors display various data visualizations, including maps and charts. In the foreground, a woman with long dark hair, wearing a light blue button-down shirt, is pointing her right index finger towards a monitor. A man in a similar shirt is seated next to her, looking in the same direction. The background shows other operators and more workstations, creating a sense of a busy, professional environment.

# Security

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# Security

- Secure install by default
  - SSL on by default
  - No passwordless root user
- Password rotation policies
  - Global and per user
- Extended proxy user support
  - Deny login for role accounts
  - Allows multiple users to share a single set of managed privileges



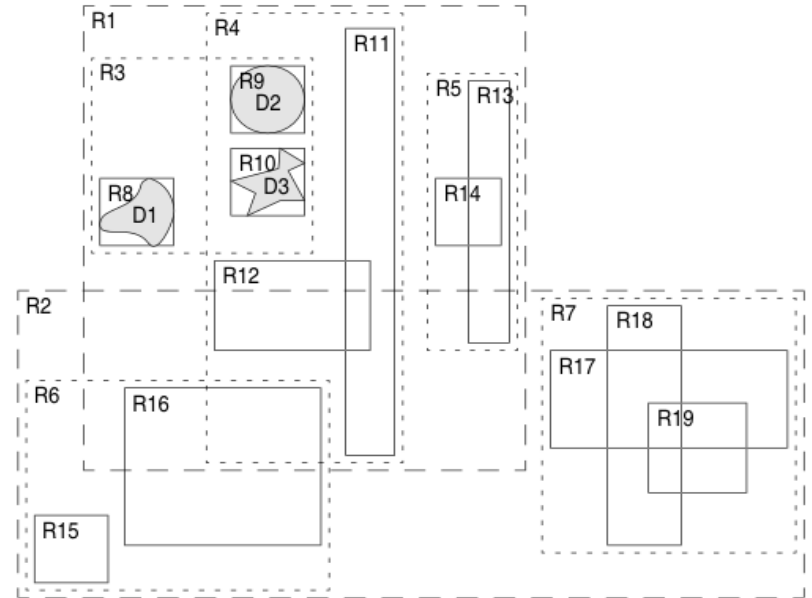
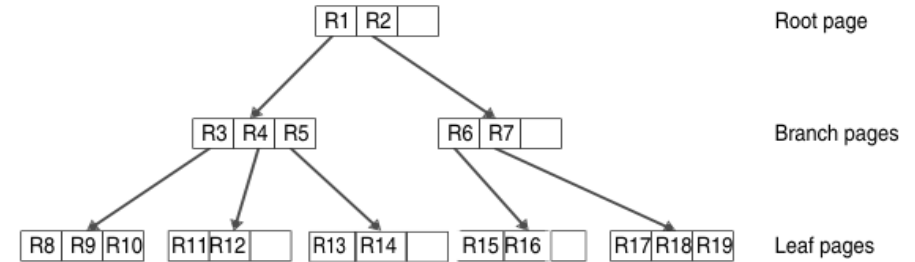
GIS

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# InnoDB spatial indexes

- R-tree indexes
- Transactional
  - Full ACID compliance
- Predicate locking to prevent phantoms
- No longer necessary to use MyISAM for GIS




# New GIS engine

- Boost.Geometry
  - Replaces the old homegrown GIS engine
    - Removes a number of bugs
  - We're contributing features and bugfixes back to Boost
- Faster feature development
- Stricter and more standard compliant behavior
  - Preparing for future extensions
  - Deprecated confusing and non-standard function aliases

# New GIS functionality

- New import/export formats
  - Geohash
  - GeoJSON
    - Using the new JSON datatype
- ST\_Distance\_Sphere
- Other helper functions
- Supporting all geometry types for all functions
  - Including GeometryCollection



... and much, much more

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