MySQL for Oracle
DBAs and Developers

Presented by
MySQL Conference & Expo   O'REILLY

How can you tell an Oracle DBA has touched your MySQL Installation?

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Ronald Bradford, MySQL Inc

MySQL Conference & Expo 2007

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MYSQL_HOME=/home/oracle/products/mysql-version

mysqld_safe –user=oracle &

Outline

- DBA Tips, Tricks, Gotcha's & Tools

- Key Differences for Developers

- Migrating from Oracle to MySQL

- Questions & Answers

My Background

- 18 years in Database Technologies (1989)

- 10 years Oracle Experience (1996)

- 8 years MySQL Experience (1999)

- Active in MySQL, Java, XP User Groups

- Joined MySQL Professional Services (2006)

DBA

Important DBA Stuff

- Terminology
- Installation
- Directories
- Log Files
- Processes
- Ports & Sockets

- MySQL Data Dictionary
- Backup
- Tools
- Inherited LAMP Stack

Terminology

ORACLE

Database (files)	-->	Database Server Instance
Database Instance (memory)	-->	Database Server Instance
Schema User	-->	**Database**
User	-->	User
Table Space	-->	Table Space
	-->	**Storage Engine**

MySQL Installation

- OS packages place files in many areas and varies

  - e.g. /usr/lib, /var/lib, /var/log, /etc

- Recommend installing using .tar.gz

  - Centrally Manageable e.g. /opt/mysql-version

  - Upgradeable

  - Multiple Versions possible

- $MYSQL_HOME

Tip

MySQL Configuration

GOTCHA

- Multiple MySQL Instances

- my.cnf

  - Watch out for /etc/my.cnf, /etc/mysql/my.cnf

  - Best Practice $MYSQL_HOME/my.cnf

  - --defaults-file=<file>

http://dev.mysql.com/doc/refman/5.1/en/option-files.html

MySQL Directories

my.cnf options

- **basedir**   ($MYSQL_HOME)
    - e.g. /opt/mysql-5.1.16-beta-linux-i686-glib23

- **datadir**   (defaults to $MYSQL_HOME/data)

- **tmpdir**   (important as mysql behaves unpredictability if full)

- **innodb_[...]_home_dir**

    - mysql> SHOW GLOBAL VARIABLES LIKE '%dir'

MySQL Ports & Sockets

- Configured to listen on TCP/IP Port (default 3306)

- Additional Instances

  - Different Ports

  - Different IP's using default Port

- Local connection uses Socket

  - Even specifying Port, local client may use socket

MySQL Log Files

> my.cnf options
> mysqld arg

- Error Log
  - log-error

- Binary Log
  - log-bin   (my.cnf or mysqld arg)

- Slow Query Log
  - log-slow-queries,slow-query-time,log-queries-not-using-indexes

- General Log
  - log

http://dev.mysql.com/doc/refman/5.0/en/log-files.html

MySQL Meta Data

New Feature

- mysql Database

- general_log, slow_log   (5.1)

```
mysql> SET GLOBAL GENERAL_LOG=1;
mysql> ...
mysql> SELECT * FROM mysql.general_log;
```
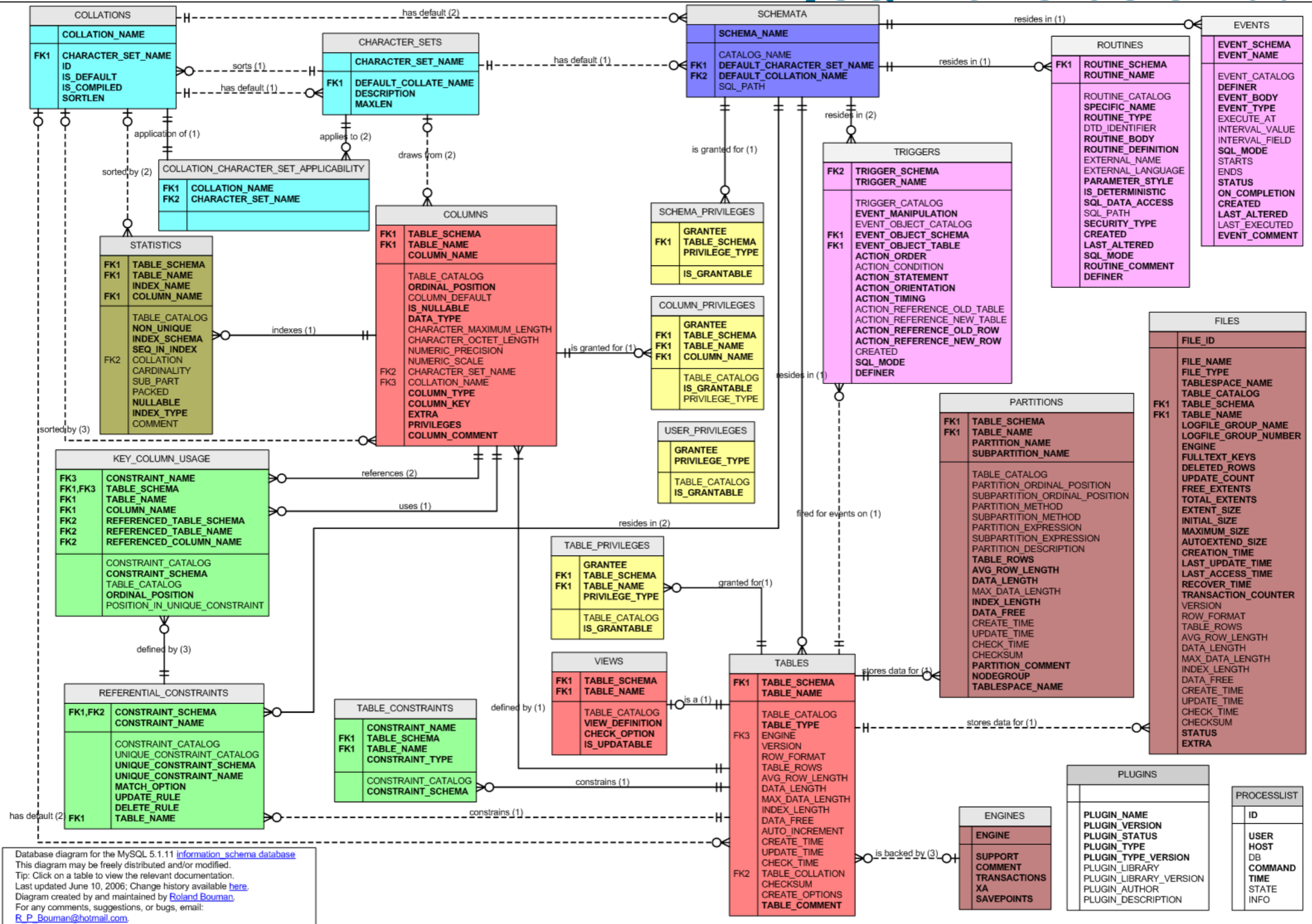
http://dev.mysql.com/doc/refman/5.1/en/log-tables.html

MySQL Data Dictionary

■ INFORMATION_SCHEMA

[DBA|USER|ALL]_ tables, V$

- TABLES, COLUMNS, VIEWS, USER_PRIVILEGES

- PROCESSLIST (5.1)

- [GLOBAL|SESSION]_[STATUS|VARIABLES] (5.1)

http://dev.mysql.com/doc/refman/5.1/en/information-schema.html

http://www.xcdsql.org/MySQL/information_schema/5.1/MySQL_5_1_INFORMATION_SCHEMA.html

Database diagram for the MySQL 5.1.11 information_schema database
This diagram may be freely distributed and/or modified.
Tip: Click on a table to view the relevant documentation.
Last updated June 10, 2006; Change history available here.
Diagram created by and maintained by Roland Bouman.
For any comments, suggestions, or bugs, email:
R_P_Bouman@hotmail.com.

MySQL Data Dictionary

- ## SQL Examples

```
SELECT TABLE_SCHEMA, SUM((DATA_LENGTH + INDEX_LENGTH) / (1024 * 1024)) AS SIZE_MB
FROM INFORMATION_SCHEMA.TABLES
GROUP BY TABLE_SCHEMA ORDER BY SIZE_MB DESC

SELECT ROUTINE_TYPE, ROUTINE_NAME FROM INFORMATION_SCHEMA.ROUTINES
WHERE ROUTINE_SCHEMA='dbname';

SELECT TRIGGER_NAME,EVENT_MANIPULATION,EVENT_OBJECT_TABLE,
ACTION_STATEMENT
FROM INFORMATION_SCHEMA.TRIGGERS WHERE TRIGGER_SCHEMA='dbname';

SELECT CONCAT('DROP TABLE ',table_name,';')
INTO OUTFILE '/sql/drop_tables.sql'
FROM INFORMATION_SCHEMA.TABLES WHERE TABLE_SCHEMA = 'test';
```

MySQL Data Dictionary

- SQL Examples

```
SELECT s.schema_name, CONCAT(IFNULL(ROUND((SUM(t.data_length)+
        SUM(t.index_length))/1024/1024,2),0.00),'Mb') total_size,
        CONCAT(IFNULL(ROUND(((SUM(t.data_length)+SUM(t.index_length))-
        SUM(t.data_free))/1024/1024,2),0.00),'Mb')
        data_used,CONCAT(IFNULL(ROUND(SUM(data_free)/1024/1024,2),0.00),'Mb') data_free,
        IFNULL(ROUND(((((SUM(t.data_length)+SUM(t.index_length))-
        SUM(t.data_free))/((SUM(t.data_length)+SUM(t.index_length)))*100),2),0) pct_used,
        COUNT(table_name) total_tables
FROM information_schema.schemata s
LEFT JOIN information_schema.tables t ON s.schema_name = t.table_schema
WHERE s.schema_name != 'information_schema'
GROUP BY s.schema_name  ORDER BY pct_used DESC\G
```

SHOW Commands

- SHOW TABLES;

- SHOW WARNINGS;

- SHOW STATUS; FLUSH STATUS;

- SHOW VARIABLES;

- SHOW VARIABLES LIKE '%size%';

- SHOW VARIABLES LIKE 'sort_buffer_size';

- SHOW GLOBAL VARIABLES LIKE 'sort_buffer_size';

Backup

- **Missing Functionality**
  - ◆ Commercial strength – unbreakable (Planned 6.0)

- **Storage Engine Driven**

- **Innodb**

- Hot Backup

  - mysqldump --single-transaction --master-data

  - InnoDB Hot Backup

Also PBXT, Falcon

Backup

- **MyISAM Only**

  - Cold Backup via File Copy

  - LVM Snapshot

- **SE Mixture**

  - Use Replication Slave

Online Backup/Recovery

MySQL 6.0 Demo

- Cross-engine. All major internal engines supported.

- Online, non-blocking for DML. DDL still blocked.

- SQL-command driven. Run from any mysql client.

- Backup to local disk, tape or remote file system.

- Full Server, database, and point-in-time recovery.

Backup ALL…

Tools

- Missing Functionality

  - Enterprise Level Monitoring

- SHOW PROFILE (5.0.38 - Community)

- Microsecond Patch (5.0.33 - Slow query granularity)

- mytop/innotop/ndbtop

- MySQL Toolkit   http://sourceforge.net/projects/mysqltoolkit

- phpMyAdmin

SHOW PROFILE

```
mysql> show profile SOURCE,MEMORY for query 4;
+---------------------+------------+----------------------+---------------+-------------+
| Status              | Duration   | Source_function      | Source_file   | Source_line |
+---------------------+------------+----------------------+---------------+-------------+
| Opening tables      | 0.00013200 | open_tables          | sql_base.cc   |        2106 |
| System lock         | 0.00001800 | mysql_lock_tables    | lock.cc       |         153 |
| Table lock          | 0.00000600 | mysql_lock_tables    | lock.cc       |         162 |
| init                | 0.00001300 | mysql_select         | sql_select.cc |        2073 |
| optimizing          | 0.00004800 | optimize             | sql_select.cc |         617 |
| statistics          | 0.00002500 | optimize             | sql_select.cc |         773 |
| preparing           | 0.00005200 | optimize             | sql_select.cc |         783 |
| executing           | 0.00002200 | exec                 | sql_select.cc |        1407 |
| Sending data        | 0.00000500 | exec                 | sql_select.cc |        1925 |
| end                 | 0.00786600 | mysql_select         | sql_select.cc |        2118 |
| query end           | 0.00001400 | mysql_execute_command| sql_parse.cc  |        5085 |
| freeing items       | 0.00000700 | mysql_parse          | sql_parse.cc  |        5973 |
| closing tables      | 0.00001900 | dispatch_command     | sql_parse.cc  |        2120 |
| logging slow query  | 0.00001000 | log_slow_statement   | sql_parse.cc  |        2178 |
| cleaning up         | 0.00000500 | dispatch_command     | sql_parse.cc  |        2143 |
+---------------------+------------+----------------------+---------------+-------------+
15 rows in set (0.01 sec)
```

- 95% time in one step

- Reference to Source Code

- "poor" Status names (internal code)

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GUI Tools

- MySQL Administrator

- Quest Spotlight

- Toad

- MySQL Network Monitoring & Network Services

MySQL Enterprise

Tools

TIP

- mysqladmin -r -i 1 extended-status

  - Gives change in status variables per second

  - Lacks timestamp

- Monitor specifics

  - Com_*

  - Innodb_*, Innodb_buffer_pool_*

  - Connections

  - Created_tmp_*

Tools

Example

■ Idle

- $ mysqladmin -r -i 1 extended-status | grep -v " | 0 "

```
+------------------------------------+------------+
| Variable_name                      | Value      |
+------------------------------------+------------+
| Bytes_received                     | 35         |
| Bytes_sent                         | 6155       |
| Com_show_status                    | 1          |
| Created_tmp_tables                 | 1          |
| Handler_read_rnd_next              | 246        |
| Handler_write                      | 245        |
| Questions                          | 1          |
| Select_scan                        | 1          |
| Uptime                             | 1          |
+------------------------------------+------------+
```

Tools

- **Under load**

  - $ mysqladmin -r -i 1 extended-status | grep -v " | 0 "

```
+--------------------------------+------------+
| Variable_name                  | Value      |
+--------------------------------+------------+
| Bytes_received                 | 1020909    |
| Bytes_sent                     | 195358     |
| Com_insert                     | 274        |
| Com_select                     | 132        |
| Com_set_option                 | 264        |
| Handler_read_key               | 505        |
| Handler_update                 | 252        |
| Handler_write                  | 519        |
| Questions                      | 1356       |
| Table_locks_immediate          | 536        |
| Table_locks_waited             | 2          |
+--------------------------------+------------+
```

> Erroneous Commands
> Causing Round Trips
>
> Buried in JDBC Usage
> PreparedStatement
> .setMaxRows()

Inherited LAMP Stack Product

TIP

- Problem: Frozen, some functions work

  - Lack of Free Disk Space

- Problem: Running slow

  - Increase Buffers

  - Change Storage Engine

- Problem: Can't connect

  - Connections

Inherited LAMP Stack Product

- A lot of products are non-transactional

- Not designed for large volume enterprises

Default Installation

- No 'root' user password

- Anonymous users mess with host based security

- Improve overall security

  $ mysql_secure_installation

  http://dev.mysql.com/doc/refman/5.0/en/mysql-secure-installation.html

GOTCHA

AUTO COMMIT

GOTCHA

■   By Default enabled in MySQL

- Ops I deleted the wrong data, I'll just ROLLBACK

- Non Transactional Storage Engines

- SET AUTOCOMMIT = {0 | 1};

SQL*Plus Reporting

- No Alternative

- Nice Feature- Vertical Output Display

  - SELECT columns FROM table \G

- Write your own in MySQL Source

Nice MySQL Features

TIP

- SELECT INTO OUTFILE ...

- LOAD DATA FILE ...

- DROP [object] IF EXISTS ...

- ALTER TABLE .. ADD ... AFTER [column]

- Query Cache

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Query Cache

- SELECT Cache (great for high read environments)

  - Being Added to Oracle v11

    http://dev.mysql.com/doc/refman/5.0/en/query-cache.html

Contrasting Buffers

Area	MySQL	Oracle	Microsoft SQL Server
Memory Caches	• MyISAM key caches • InnoDB data cache • InnoDB log cache • Dictionary cache • Falcon caches • Query Cache • User caches	• Data cache (variants) • Log buffer • Shared Pool • Java Pool • Large Pool • PGA	• Buffer cache • SQL cache • Misc caches (lock, connection, workspace, etc.)
Redo/Undo Logs	• InnoDB Undo Space • InnoDB Logs • Falcon Log • Binary Log	• Undo Tablespace (9i+) • Redo Logs • Archive Logs	• TempDB (2005+) • Transaction Logs
Data Storage	• Tablespaces • Table/Index Files • Format files	• Tablespaces • Datafiles	• Filegroups • Files
Optimizer	• Cost-based	• Cost-based	• Cost-based

DEVELOPER

Important Developer Stuff

- Sequence Replacement

- No DUAL Necessary

- Data Comparison

- DDL Syntax

- Stored Procedures

- Locking

- SQL_MODE

- TIMESTAMP Data Type

- New things

Sequences Replacement

- AUTO_INCREMENT

  e.g. id INT NOT NULL AUTO_INCREMENT,

  - Must be tied to a [table].[column]
  - Only one per table
  - No system wide capability
  - LAST_INSERT_ID()
  - No get next capability

Optional Table Name

- DUAL IS NOT REQUIRED

  - e.g.   SELECT 1+1

- Provided for Oracle Compatibility

  - e.g. SELECT 1+1 FROM DUAL

  - e.g. SELECT DUMMY FROM DUAL   *** Fails

Data Comparison

- LIKE compares data case-insensitive

  - Character Set/Collation dependent

  e.g. SELECT title FROM film WHERE title LIKE 'A%'

    Returns rows starting with 'ALIEN' and 'alien'

- BINARY DDL syntax

- e.g. title VARCHAR(100) NOT NULL **BINARY**

DDL Syntax

- Escaped Reserved Words are allowed

  e.g. CREATE TABLE `group` (...);

  e.g. CREATE TABLE "insert" (...);   * sql_mode

- Tables/Columns/Triggers/Stored Procedures

- Space and other special characters allowed

  Operating System Dependent

  e.g. CREATE TABLE `My Table Name` (...);

Stored Procedures

- Earlier Session

  "Using Stored Routines for MySQL Administration"

- Not a PL/SQL Replacement

- Missing Functionality

  - Types, Overloading, named parameters, pinning, packages

  - Built-in Packages

Stored Procedures

- MySQL Stored Routines Library

  - Globals

  - Arrays

  - Named Parameters

http://forge.mysql.com/projects/view.php?id=35

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Locking

- Storage Engine Specific

  - MyISAM/Memory – Table

  - InnoDB/Falcon/PBXT/Solid – Row

  - Nitro – quasi nothing

SQL_MODE

- SET SQL_MODE=TRADITIONAL,ORACLE

  http://dev.mysql.com/doc/refman/5.1/en/server-sql-mode.html

SQL_MODE

- String Concatenation

    - SELECT CONCAT('A','B');

    - SELECT CONCAT_WS(',','a','b','c',d');

    > Emulate Oracle Behaviour

- SET sql_mode='PIPES_AS_CONCAT';

    - SELECT 'A'||'B';

    > May break other tools

TIMESTAMP

TIP

- **Remove DB level auditing via triggers**

  - last_modified TIMESTAMP ON UPDATE CREATE_TIMESTAMP,

New things you may see

- Multi-record INSERT

- REPLACE

- LOW_PRORITY | HIGH PRIORITY

- INSERT DELAYED

MIGRATION

Migration
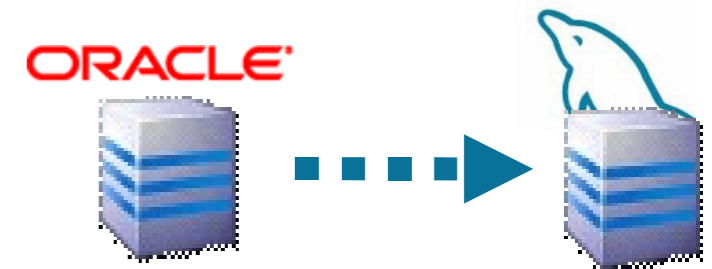

```
MYSQL =  (DESCRIPTION=
          (ADDRESS=(PROTOCOL=tcp)(HOST=localhost)(PORT=1521))
          (CONNECT_DATA=(SID=MYSQL))  (HS=OK))


CREATE DATABASE LINK mysql
        CONNECT TO "my_user" IDENTIFIED BY "my_password"
         USING 'mysql';
```

The Easy Way: Simply read/write directly to MySQL :)

Oracle Migration

- Good guide to identifying differences

- Schema

- Data

- Objects

- Application
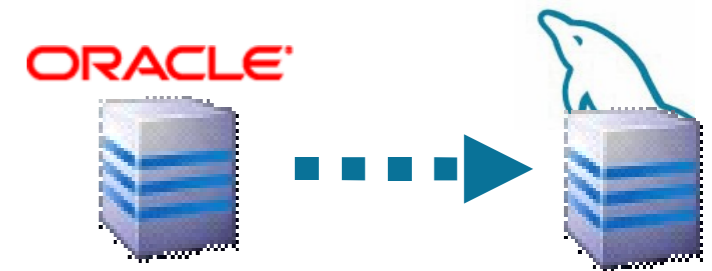
Oracle Migration

- **MySQL Migration Toolkit**

  - Does
    - Tables/Views
    - Data

  - Does Not (yet)
    - Sequences
    - Stored Procedures
    - Triggers

http://www.mysql.com/products/tools/migration-toolkit/
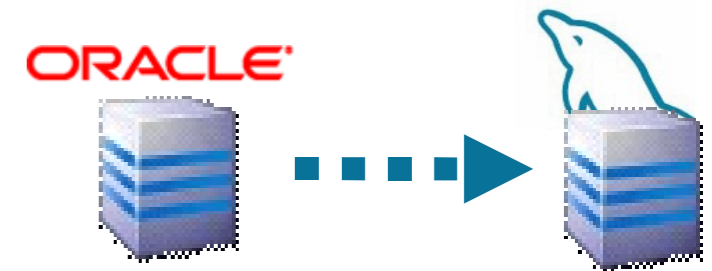
Oracle Migration - Schema

- Case Sensitive Table Names

- Data Types
  - INT, FLOAT/DOUBLE, NUMBER
  - UNSIGNED
  - BIT

NUMBER supports
* Integer
* Floating Point
* Fixed Point

- Sequences replacement – Auto Increment

- What's Missing
  - Snapshots, Check Constraints, Flashback queries, synonyms

Oracle Migration - Data

- Date Format – no NLS_DATE_FORMAT

- Silent conversions
  - Less likely due to Oracle as Source

- No Oracle Timestamp (no ms support)

- Data Verification necessary
  - COUNT(), SUM(), MD5()
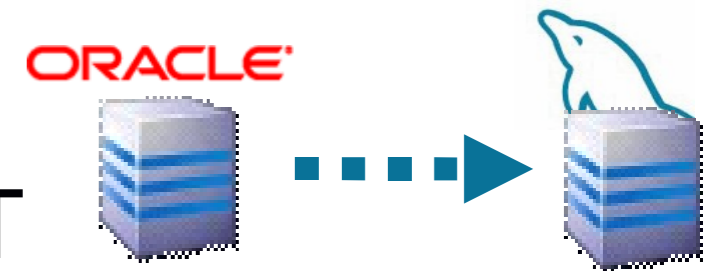
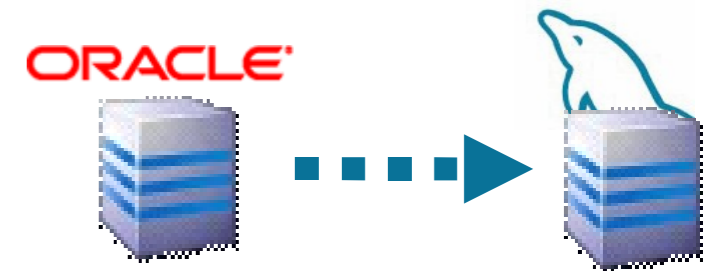# **Oracle Migration – Data Verification**

- Numeric Precision/Rounding

- Character Sets (multi-byte data)

- CHAR usage

  - CHAR(5)

    - Oracle   'abc   '   - 5 characters long
    - MySQL   'abc'   - 3 characters long
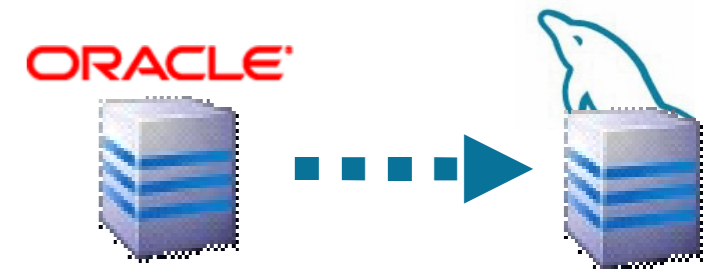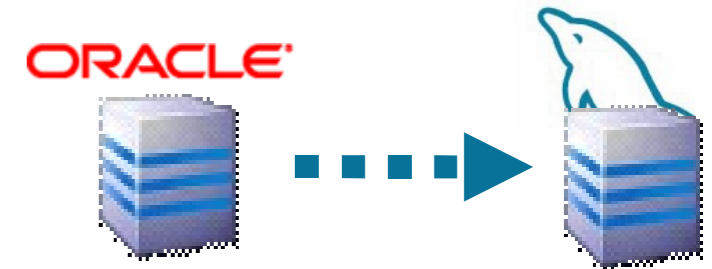
Oracle Migration - Objects

- No Packages

- Restricted Triggers

  - Only one trigger per table per DML statement

  - Missing

    - INSTEAD,

    - INSERT OR UPDATE

   - OR REPLACE

    - Only for DML Statements

Oracle Migration - Application

- NVL() --> IFNULL()

- ROWNUM --> LIMIT

- SEQ.CURRVAL --> LAST_INSERT_ID()

- SEQ.NEXTVAL --> NULL

- NO DUAL necessary   (SELECT NOW())

- NO DECODE()   --> IF() CASE()

- JOIN (+) Syntax --> INNER|OUTER LEFT|RIGHT

Oracle Migration - Application

- Date Functions
  - CURDATE(), NOW()

- Data Formats
  - Default is YYYY-MM-DD

- Case insensitive searching
  - no UPPER(column) = UPPER(value)
  - Character Set/Collation specific
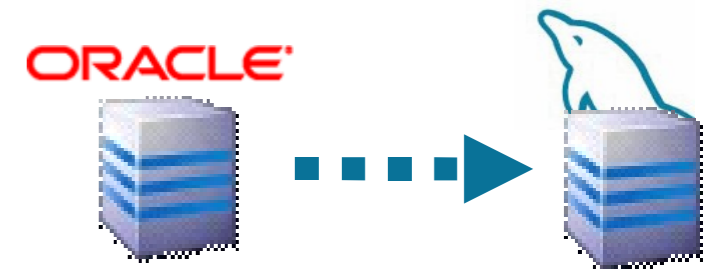
CLOSING

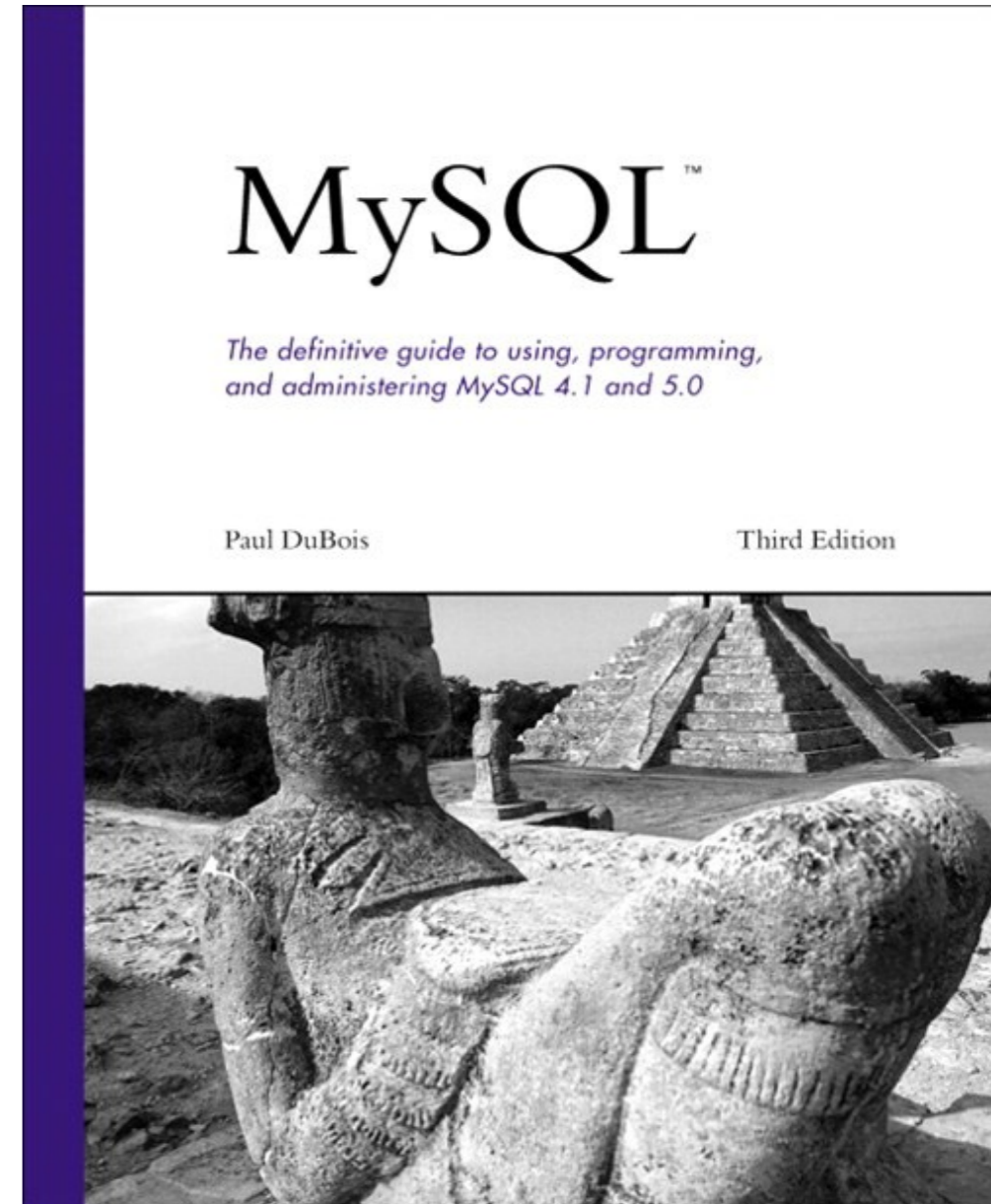# Pronunciation

"MySQL" is officially pronounced as

"My Ess Queue Ell"

References

- Developer Zone   http://dev.mysql.com

- Blog Aggregator   http://planetmysql.org

- Source Forge   http://forge.mysql.com

- Forums   http://forums.mysql.com

- Lists   http://lists.mysql.com

- User Groups   http://dev.mysql.com/user-groups

- Training   http://www.mysql.com/training

Recommended Reading

- MySQL by Paul DuBois

Support Me

Buy a T-shirt !

Q & A