



MySQL for Oracle Developers

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Presented by



O'REILLY

Version 1.2 20 April 2006

MySQL Introduction

- Solid penetration in open source community
- LAMP Stack
- Large number of open source projects
- Included by default in most Linux distros



Purpose of Presentation

- Maximise existing Oracle skill set
- Preparation for management requests
- Open Source introduction
- Terminology/Product Knowledge Transfer



My Background



- 16 years in Database Design Experience (1989)
- 10 years Oracle Experience (1996)
- 7 years MySQL Experience (1999)
- Active in MySQL, Java, XP, Oracle User Groups



Presentation Conventions

- Associated Talk for DBA's
- Oracle Specific Syntax

MySQL for Oracle DBA's

Oracle Command/Syntax

ORACLE_HOME=/usr/lib/oracle/xe/app/oracle/product/10.2.0/server

MYSQL_HOME=/usr/lib/mysql (*) MYSQL_DATA=/var/lib/mysql (*)

(*) For RPM install. Will differ depending on Distro, or .tar.gz install



Product Comparision

Current Versions at March 2006 (used in examples)

- MySQL 5.0 GA (5.0.20) Standard/Max

<http://www.mysql.com/products/database/>

- Oracle 10g Release 2 Express Edition (10.2.0.1)

<http://www.oracle.com/technology/products/database/xes>



Product Comparision



Other Production Versions

- Oracle 10g Release 2 (PE, SE1, SE, EE)
- Oracle 9i, 8i, 7.3
- MySQL 4.1, 4.0, 3.23
- MySQL MaxDB 7.6



Product Comparision

Development Versions

- MySQL 5.1 (currently beta 5.1.7)



- MySQL 5.2

- Open Source Availability

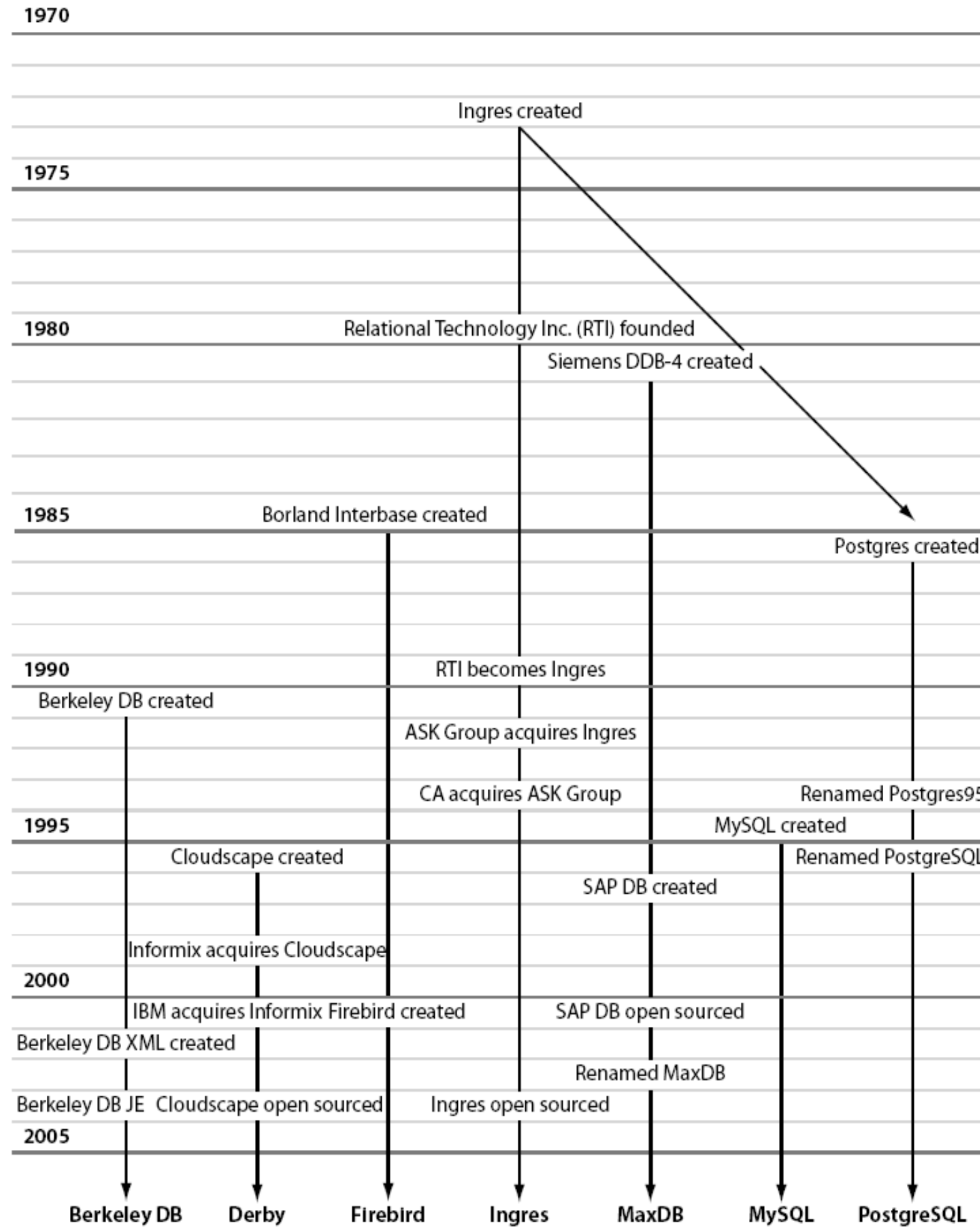


Oracle Developer Environments



- Oracle JDeveloper Java Application
- J2EE Application Development Framework (ADF)
- Application Express (HTMLDB)
- Oracle Forms 4.5, 6i, 9i, 10g
- PHP (Zend Core)





Source: Forrester Research, Inc.

Oracle

Oracle Developers

1977 Founded

1992 Version 7 ***

1997 Version 8

1999 Version 8i

2001 Version 9i

2003 Version 10g

Forrester Research

December 29, 2004

Open Source Databases
Come Of Age



Technical Resources

<u>ORACLE</u>	<u>MYSQL</u>
otn.oracle.com	dev.mysql.com forge.mysql.com
forums.oracle.com	forums.mysql.com
www.oracle.com/support	www.mysql.com/network
education.oracle.com	www.mysql.com/training
www.oracle.com/education/certification/	www.mysql.com/certification
blogs.oracle.com	www.planetmysql.org
www.oracle.com/technology/community/user_groups	dev.mysql.com/user-groups
www.oracle.com/technology/documentation	www.mysql.com/doc
www.orafaq.com	dev.mysql.com/tech-resources/faq.html



MySQL 5.0 For Developers (5 days)



http://www.mysql.com/training/workshops/mysql_dev.html

Objectives

- Describe the MySQL client/server architecture
- Understand the steps necessary to invoke MySQL client programs
- Utilize the general-purpose mysql client program to run queries and retrieve results
- Perform queries and analysis of data utilizing the MySQL Query Browser graphical user interface
- Explain the MySQL connectors that provide connectivity for client programs
- Select the best data type for representing information in MySQL
- Manage the structural characteristics of your databases
- Manage the structural characteristics of the tables within your databases
- Utilize the SELECT statement to retrieve information from database tables



MySQL 5.0 For Developers



- Utilize expressions in SQL statements to retrieve more detailed information
- Utilize SQL statements to modify the contents of database tables
- Write join expressions in your SQL statements to obtain information from multiple tables
- Utilize subqueries in your SQL statements
- Create views utilizing SELECT statements to produce "virtual tables" of specific data
- Perform bulk data import and export operations
- Create user defined variables, prepared statements and stored routines
- Create and manage triggers
- Use the INFORMATION_SCHEMA database to access metadata
- Debug MySQL applications
- Configure and Optimize MySQL



MySQL Installation



MySQL for Oracle DBA's

- Two Initial Databases
 - mysql
 - test

<http://dev.mysql.com/doc/refman/5.0/en/installing.html>

- Access Privileges
 - root

http://dev.mysql.com/doc/refman/5.0/en/privilege_system.html



Configuration/Log Files



MySQL for Oracle DBA's

- **my.cnf**

`$MYSQL_HOME/my.cnf, /etc/my.cnf`

`$ORACLE_HOME/dbs/init.ora`

- **Database Log**

`$MYSQL_DATA/hostname`.err`

`.../admin/XE/bdump/alert_XE.log`

- **N/A**

User Security (host)

`$ORACLE_HOME/network/admin/tnsnames.ora`



Terminology



<u>ORACLE</u>	<u>MYSQL</u>
Database (files)	Database Server Instance
Database Instance (memory)	Database Server Instance
Schema User	Database
User	User
Table Space	Table Space
	Storage Engine



MySQL Sample Database

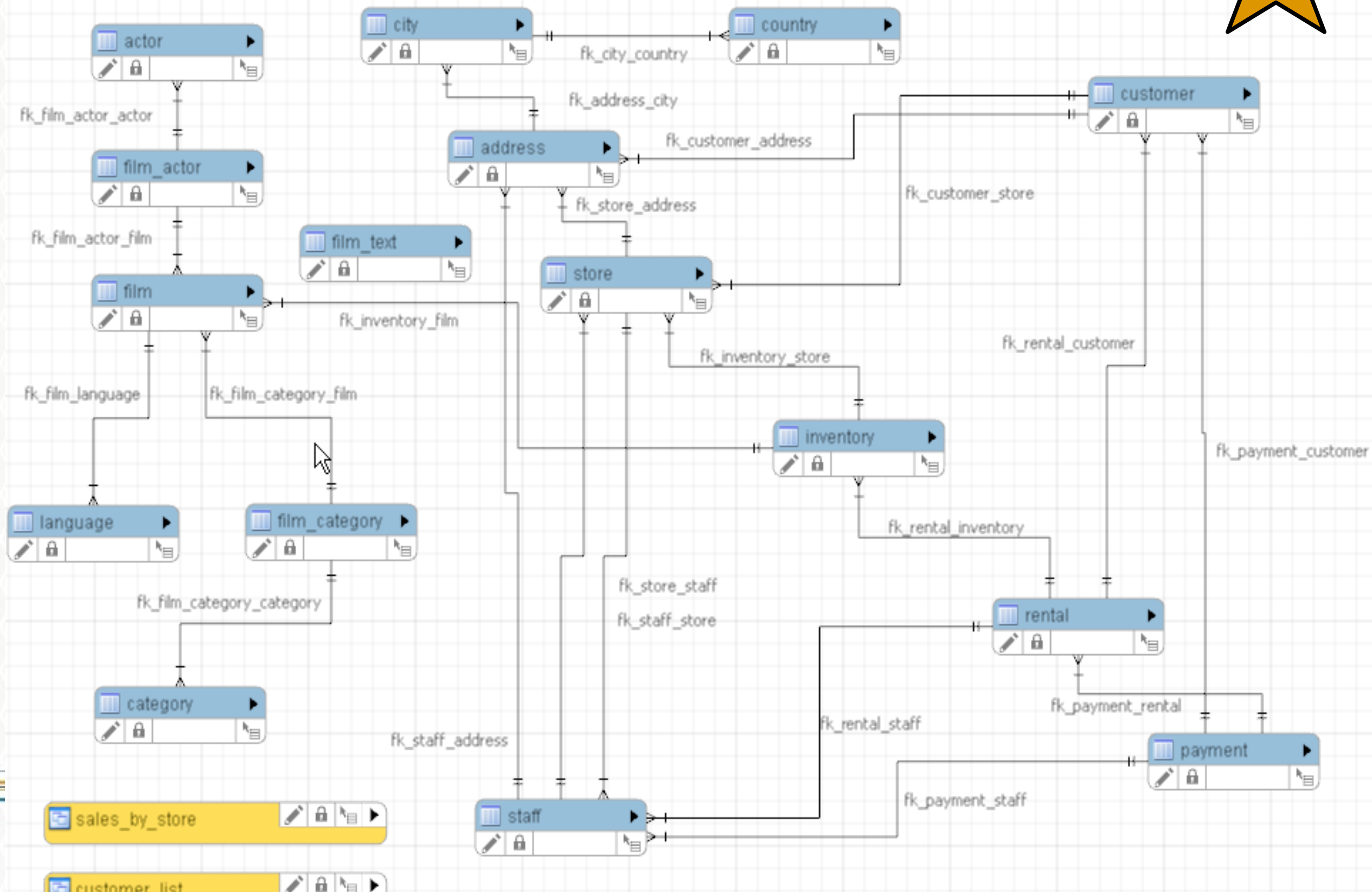
scott/tiger

- Sakila Sample Database
 - Announced at this Conference
 - Showcases Current MySQL features

<http://forums.mysql.com/list.php?121>



MySQL Sample Database



Command Line SQL

- mysql

sqlplus system/manager@netname

<http://dev.mysql.com/doc/refman/5.0/en/mysql.html>

- Command line syntax

mysql -u[username] -p[password] -h[host] [dbname]

mysql -p [dbname]

mysql --help

- Navigation commands

help or ? clear \c

quit \q edit

; \g \G tee [file]



Immediate SQL Differences

- DUAL
- SYSDATE
- DECODE()
- ROWNUM
- NVL
- JOIN (+) Syntax
- Date Functions
- Sequences
- Data Types
- Naming Standards
- Case Sensitivity
- Reserved Words



Case Sensitivity

- DDL Structure Names as Case **sensitive**
 - e.g. `CREATE TABLE FilmActor (...);`
 - Operating System Dependent
- LIKE for Data is Case **insensitive**
 - 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,`



DLL Structure 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` (...);`



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

CREATE SEQUENCE seq;

seq.CURRVAL

seq.NEXTVAL



Optional Table Name



DUAL

- `SELECT 1+1`
- No Table Required
- Provided for Oracle Compatibility
 - e.g. `SELECT 1+1 FROM DUAL`
 - e.g. `SELECT DUMMY FROM DUAL` *** Fails



Transactions

- MySQL provides ACID compliant transactions
- XA transactions (Distributed Transaction Processing)

<http://dev.mysql.com/doc/refman/5.0/en/xa.html>

- Supports transactional and non-transactional databases
- Satisfy both mission-critical 24/7 usage and heavy Web or logging usage



Transactions

- By default, SQL commands are auto-committed
- Transaction support with appropriate Storage Engines
 - START TRANSACTION / BEGIN [WORK]
 - ROLLBACK [WORK] / COMMIT [WORK]
 - SET AUTOCOMMIT = {0 | 1};
 - SAVEPOINT / ROLLBACK [WORK] TO SAVEPOINT
 - SET TRANSACTION (Isolation Level)

<http://dev.mysql.com/doc/refman/5.0/en/transactional-commands.html>



Storage Engines

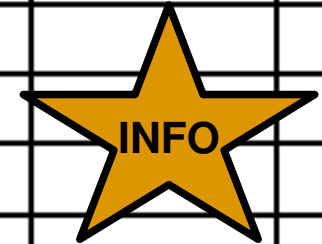


- MyISAM
- MERGE
- InnoDB
- BDB
- MEMORY
- ARCHIVE
- FEDERATED
- NDB (Cluster)
- CSV
- BLACKHOLE
- Example

<http://dev.mysql.com/doc/refman/5.0/en/storage-engines.html>



Feature	MyISAM	BDB	Memory	InnoDB	Archive	NDB
Storage Limits	No	No	Yes	64TB	No	Yes
Transactions (commit, rollback, etc.)		✓		✓		✓
Locking granularity	Table	Page	Table	Row	Row	Row
MVCC/Snapshot Read				✓	✓	✓
Geospatial support	✓					
B-Tree indexes	✓	✓	✓	✓		✓
Hash indexes			✓	✓		✓
Full text search index	✓					
Clustered index				✓		
Data Caches			✓	✓		✓
Index Caches	✓		✓	✓		✓
Compressed data	✓				✓	
Encrypted data (via function)	✓	✓	✓	✓	✓	✓
Storage cost (space used)	Low	Low	N/A	High	Very Low	Low
Memory cost	Low	Low	High	High	Low	High
Bulk Insert Speed	High	High	High	Low	Very High	High
Cluster database support						✓
Replication support	✓	✓	✓	✓	✓	✓
Foreign key support				✓		
Backup/Point-in-time recovery	✓	✓	✓	✓	✓	✓
Query cache support	✓	✓	✓	✓	✓	✓
Update Statistics for Data Dictionary	✓	✓	✓	✓	✓	✓



MySQL 5.0's Pluggable Storage Engine Architecture

http://www.mysql.com/why-mysql/white-papers/mysql_wp_pluggable.php



Locking

- Storage Engine Dependent
 - Table Level Locking (MyISAM, Memory)
 - Page Level Locking (BDB)
 - Row Level Locking (InnoDB, Archive, NDB)
- LOW_PRIORITY, HIGH_PRIORITY
 - changes WRITE/READ Lock Handling



Locking

- InnoDB
 - row-level locking
 - multi-versioning
 - non-locking repeatable reads
 - all four SQL standard isolation levels

Most Commonly
Used Transactional
Storage Engine



NULL

- [column] IS NULL, [column] IS NOT NULL
- IFNULL([value],")
- ISNULL([value])
- COALESCE([value],[value],[value])

NVL(), COALESCE()



SELECT

- SELECT/FROM/WHERE/GROUP BY/HAVING
- LIMIT n[,m]
- LIKE
- REGEXP

ROWNUM

ROWID

<http://dev.mysql.com/doc/refman/5.0/en/select.html>

- UNION, UNION ALL

UNION, UNION ALL
INTERSECT, MINUS

<http://dev.mysql.com/doc/refman/5.0/en/union.html>



JOIN

- ▶ INNER JOIN
- ▶ OUTER JOIN
- ▶ NO FULL OUTER JOIN

ON, NATURAL, USING
PARTITION BY

<http://dev.mysql.com/doc/refman/5.0/en/join.html>

join_table:

table_reference [INNER | CROSS] JOIN table_factor [join_condition]

table_reference STRAIGHT_JOIN table_factor

table_reference STRAIGHT_JOIN table_factor ON condition

table_reference LEFT [OUTER] JOIN table_reference join_condition

table_reference NATURAL [LEFT [OUTER]] JOIN table_factor

table_reference RIGHT [OUTER] JOIN table_reference join_condition

table_reference NATURAL [RIGHT [OUTER]] JOIN table_factor



Sub Queries

- IN, NOT IN
- ALL, ANY, SOME
- EXISTS, NOT EXISTS
- Correlated subqueries
- In FROM Clause

WITH



Full Text Search

- ♦ FULLTEXT Index

ORACLE TEXT

- ♦ MyISAM Storage Engine Only

- ♦ e.g. FULLTEXT KEY indx_title_description(title,description)

```
SELECT f.film_id, f.title, f.description FROM film_text f
WHERE MATCH (title,description) AGAINST ('MySQL');
SELECT f.film_id, f.title, f.description FROM film_text f
WHERE MATCH (title,description)
AGAINST ('+MySQL -Monkey' IN BOOLEAN MODE);
SELECT f.film_id, f.title, f.description FROM film_text f
WHERE MATCH (title,description)
AGAINST ('database' WITH QUERY EXPANSION);
```

<http://dev.mysql.com/doc/refman/5.0/en/fulltext-search.html>



INSERT

- INSERT INTO [table] SET [col]=[value], ...
- Multiple Row Insert
- DEFAULT values
 - DEFAULT or DEFAULT(col_name)
- AUTO_INCREMENT - NULL,0 or col not stated

INSERT ALL ... WHEN

<http://dev.mysql.com/doc/refman/5.0/en/insert.html>



UPDATE

- **ORDER BY/LIMIT**
 - e.g. UPDATE CacheTable SET expiry = NOW()
ORDER BY oldest LIMIT 10
- **Multiple Table Update**
 - UPDATE items,month SET items.price=month.price
WHERE items.id=month.id;

<http://dev.mysql.com/doc/refman/5.0/en/update.html>



DELETE

- ▶ **ORDER BY/LIMIT**
 - ▶ e.g. `DELETE FROM CacheTable ORDER BY oldest LIMIT 10;`
- ▶ **Multiple Table Delete**
 - ▶ `DELETE t1, t2 FROM t1, t2, t3 WHERE t1.id=t2.id AND t2.id=t3.id;`
 - ▶ `DELETE FROM t1, t2 USING t1, t2, t3 WHERE t1.id=t2.id AND t2.id=t3.id;`

<http://dev.mysql.com/doc/refman/5.0/en/delete.html>



REPLACE

- Combined Insert/Update
- REPLACE works exactly like INSERT, except that if an old record in the table has the same value as a new record on a unique index, the old record is deleted before the new record is inserted.
- Affects Trigger Operation

MERGE (very cumbersome)

<http://dev.mysql.com/doc/refman/5.0/en/replace.html>



DML Syntax Differences



- ▶ **LOW_PRIORITY**
 - ▶ execution of the INSERT is delayed until no other clients are reading from the table.
 - ▶ Not good on read-heavy environment
- ▶ **INSERT, UPDATE, DELETE, REPLACE**
 - ▶ `INSERT LOW_PRIORITY INTO LogTable VALUES ();`

Bad Idea



DML Syntax Differences



- **HIGH_PRIORITY**
 - gives the SELECT higher priority than a statement that updates
 - Only for queries that are very fast and must be done at once
- **SELECT, INSERT**
 - `SELECT HIGH_PRIORITY FROM CacheTable;`



DML Syntax Differences



- ▶ **DELAYED**

- ▶ the server puts the row or rows to be inserted into a buffer, and the client issuing the `INSERT DELAYED` statement can then continue immediately.

- ▶ **INSERT, REPLACE Statements**

- ▶ `INSERT DELAYED INTO LogTable VALUES ();`

Good Idea
Non Critical Data

<http://dev.mysql.com/doc/refman/5.0/en/insert-delayed.html>



DML Syntax Differences



- ▶ **IGNORE**
 - ▶ errors that occur while executing the INSERT statement are treated as warnings instead
- ▶ **INSERT, UPDATE, DELETE Statements**
 - ▶ `INSERT IGNORE INTO LogTable VALUES ();`

Poor
Programming
Practice



Data Types

- Numeric
 - TINYINT, SMALLINT, MEDIUMINT, INT, BIGINT
 - FLOAT, DOUBLE, DECIMAL, BIT
- Date
 - DATE, TIME, DATETIME, TIMESTAMP, YEAR

<http://dev.mysql.com/doc/refman/5.0/en/data-types.html>

<http://dev.mysql.com/doc/refman/5.0/en/storage-requirements.html>



Data Types

- String
 - CHAR, VARCHAR, BINARY, VARBINARY,
 - TINYTEXT, MEDIUMTEXT, TEXT, LONGTEXT
 - TINYBLOB, MEDIUMBLOB, BLOB, LONGBLOB
 - ENUM, SET

<http://dev.mysql.com/doc/refman/5.0/en/data-types.html>

<http://dev.mysql.com/doc/refman/5.0/en/storage-requirements.html>



Data Types

- Spatial
 - GEOMETRY, POINT, LINESTRING, POLYGON,
 - GEOMETRYCOLLECTION, MULTILINESTRING,
 - MULTIPOINT, MULTIPOLYGON

<http://dev.mysql.com/doc/refman/5.0/en/spatial-extensions.html>



Numeric Data Types

- FLOAT, DOUBLE – floating point types
 - e.g. lat FLOAT(10,6), lon FLOAT(10,6)
- DECIMAL – fixed point type
 - e.g. amt DECIMAL(10,2) NOT NULL,
- INT - Integer
- UNSIGNED, ZEROFILL
 - e.g. cnt INT(6) UNSIGNED ZEROFILL,

Floating Point NUMBER
Fixed Point NUMBER(p,s)
Integer NUMBER(p)



Date Data Types

TIMESTAMP (fraction precision)
WITH [LOCAL] TIMEZONE

▶ **TIMESTAMP**

- ▶ First TIMESTAMP column defaults to last update date/time
- ▶ Good for behind the scenes auditing
- ▶ Second only granularity

CREATE TABLE ...

```
last_update TIMESTAMP NOT NULL DEFAULT CURRENT_TIMESTAMP
                                ON UPDATE CURRENT_TIMESTAMP,
created TIMESTAMP NOT NULL DEFAULT CURRENT_TIMESTAMP,
...
```



Constraint Data Types

- ▶ ENUM

- ▶ size ENUM('S','M','L','XL','XXL')

<http://dev.mysql.com/doc/refman/5.0/en/enum.html>

- ▶ SET

- ▶ color SET ('Red','Blue','Green','White','Black')

<http://dev.mysql.com/doc/refman/5.0/en/set.html>

<http://dev.mysql.com/doc/refman/5.0/en/constraint-enum.html>



Large Objects (LOB)

CLOB, BLOB, NCLOB, BFILE

- TINYBLOB, BLOB, MEDIUMBLOB, LONGBLOB
- TINYTEXT, TEXT, MEDIUMTEXT, LONGTEXT
- 255 bytes, 64K, 16M, 4G

<http://dev.mysql.com/doc/refman/5.0/en/blob.html>



String Functions

- ♦ `SELECT CONCAT('A','B');`
- ♦ `SELECT CONCAT_WS(',', 'a','b','c','d');`
- ♦ `SET sql_mode='PIPES_AS_CONCAT';`
- ♦ `SELECT 'A' || 'B';`

'A' || 'B'
CONCAT('A','B')

<http://dev.mysql.com/doc/refman/5.0/en/string-functions.html>



String Functions

- Multiple Character Set Support
 - SHOW CHARACTER SET;
 - SELECT 'Test' = 'TEST';
 - SELECT _latin1 'Test' = 'TEST';
 - SELECT _latin1 'Test' = BINARY 'TEST';
- Collation
 - Defines String Comparisions
 - Defines Sorting Order

<http://dev.mysql.com/doc/refman/5.0/en/charset.html>



Date Calendar



Julian Dates?

http://www.oraFAQ.com/papers/dates_o.doc

- Proleptic Gregorian calendar
- October 4-15 1582 cutover
 - Pre Julian
 - Post Gregorian
- The “Year-Zero” rule
- The “Leap-Year Calculation” rule

<http://dev.mysql.com/doc/refman/5.0/en/mysql-calendar.html>



Date Functions

- `SELECT CURDATE(), NOW(), SYSDATE()`
- Second only granularity

<http://dev.mysql.com/doc/refman/5.0/en/date-and-time-functions.html>

- TimeZones - UTC or named
 - e.g. `SET time_zone = '+10:00';`
 - 'Europe/Helsinki', 'US/Eastern', 'MET', 'SYSTEM'
 - Manual Installation step to seed data

<http://dev.mysql.com/doc/refman/5.0/en/time-zone-support.html>



Control Flow Functions

• IF

- `SELECT IF(1>0,'yes','no');`
-> 'yes'

DECODE() CASE()

• CASE

- `SELECT CASE WHEN 1>0 THEN 'yes' ELSE 'no' END;`
-> 'true'
- `SELECT CASE 'B' WHEN 'a' THEN 1 WHEN 'b' THEN 2 END;`
-> 2
- `SELECT CASE BINARY 'B' WHEN 'a' THEN 1 WHEN 'b' THEN 2 END;`
-> NULL

<http://dev.mysql.com/doc/refman/5.0/en/control-flow-functions.html>



System Variables



- Server (e.g. /etc/my.cnf)
 - `sort_buffer_size=500000`
- GLOBAL
 - `SET GLOBAL sort_buffer_size=750000;`
- SESSION
 - `SET SESSION sort_buffer_size=1000000;`
 - `SELECT @@global.sort_buffer_size, @@session.sort_buffer_size;`



SHOW

- 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';



SQL Mode

- Key Modes
 - ANSI
 - STRICT_TRANS_TABLES
 - TRADITIONAL
- SHOW VARIABLES LIKE 'sql_mode';
- SET sql_mode='strict_all_tables';



SQL Mode

- ◆ Oracle Compatibility
 - ◆ SET sql_mode='PIPES_AS_CONCAT,ANSI_QUOTES,IGNORE_SPACE,NO_KEY_OPTIONS,NO_TABLE_OPTIONS,NO_FIELD_OPTIONS, NO_AUTO_CREATE_USER';

<http://dev.mysql.com/doc/refman/5.0/en/server-sql-mode.html>

<http://dev.mysql.com/tech-resources/articles/mysql-data-integrity.html>



Procedural Language Support

- Stored Procedures
- Functions
- UDF - User Defined Functions
- Triggers



Procedures

- No Package Capabilites
- <http://bugs.mysql.com/bug.php?id=11696>
- NO RAISE Error Capability
- No Named Parameters
- No Overloading



<http://dev.mysql.com/doc/refman/5.0/en/stored-procedures.html>

- General Purpose Stored Routines Library <http://www.nongnu.org/mysql-sr-lib/>



Procedures



```
DELIMITER //
CREATE PROCEDURE rewards_report (
  IN min_monthly_purchases TINYINT UNSIGNED
  , IN min_dollar_amount_purchased DECIMAL(10,2) UNSIGNED
  , OUT count_rewardees INT
)
LANGUAGE SQL
NOT DETERMINISTIC
READS SQL DATA
SQL SECURITY DEFINER
COMMENT 'Provides a customizable report on best customers'
proc: BEGIN

  DECLARE last_month_start DATE;
  DECLARE last_month_end DATE;

  /* Some sanity checks... */
  IF min_monthly_purchases = 0 THEN
    SELECT 'Minimum monthly purchases parameter must be > 0';
    LEAVE proc;
  END IF;
  SET last_month_start = DATE_SUB(CURRENT_DATE(), INTERVAL 1 MONTH);
  CREATE TEMPORARY TABLE tmpCustomer (customer_id SMALLINT UNSIGNED NOT NULL PRIMARY KEY);
  ...
  SELECT COUNT(*) FROM tmpCustomer INTO count_rewardees;
  DROP TABLE tmpCustomer;
END //
```



Functions

Example – Wrap IFNULL with NVL for Oracle Compatibility

```
DELIMITER //  
CREATE FUNCTION NVL(IN col VARCHAR(100), IN nullvalue VARCHAR(100))  
                RETURNS VARCHAR(100)  
BEGIN  
    RETURN IFNULL(col,nullvalue);  
END;  
//  
DELIMITER ;  
  
SELECT NVL(col,'Unknown') FROM table
```



Functions

```
SHOW CREATE FUNCTION 'NVL';
```

```
SHOW FUNCTION STATUS LIKE 'NVL';
```

```
SELECT routine_name, routine_schema, routine_type  
FROM INFORMATION_SCHEMA.routines;
```



User Defined Functions (UDF)



♦ Added as Object Files

```
$ gcc -I /usr/include/mysql/ -shared -o syslogudf.so syslogudf.c
```

```
$ cp syslogudf.so /usr/lib
```

```
mysql> create function logger returns integer soname 'syslogudf.so';
```

```
mysql> select logger('logging from ' + version());
```

```
$ tail /var/log/messages
```

<http://dev.mysql.com/doc/refman/5.0/en/adding-functions.html>



User Defined Functions (UDF)



```
#include <mysql.h>
#include <string.h>
#include <syslog.h>

my_bool logger_init(UDF_INIT *initid, UDF_ARGS *args, char *message) {
    initid->maybe_null=0;
    return 0;
}

long long logger(UDF_INIT *initid, UDF_ARGS *args, char *is_null, char *error) {
    if (args->arg_count != 1) {
        strcpy(error, "LOGGER(): needs message");
        return 1;
    }
    if (args->arg_type[0] != STRING_RESULT) {
        strcpy(error, "LOGGER() message should be string");
        return 1;
    }

    syslog(LOG_INFO,"%s",args->args[0]);
    *is_null = 0;
    *error = 0;
    return 0;
}
```

<http://dammit.it/stream/mysql/>



User Defined Functions (UDF)



- MySQL Message API
 - Utilises Spread Toolkit

www.spread.org

<http://forge.mysql.com/projects/view.php?id=2>



Triggers

- [BEFORE|AFTER] [INSERT|UPDATE|DELETE]
- Only one trigger per table per DML statement
- Missing
 - INSTEAD OF (used in Views)
 - No OR DML (e.g. INSERT OR UPDATE)
 - No OR REPLACE (e.g. CREATE OR REPLACE)
 - No WHEN Condition
 - Only for DML statements (e.g. No DROP)

<http://dev.mysql.com/doc/refman/5.0/en/triggers.html>



Triggers



```
DELIMITER ;;  
CREATE TRIGGER `ins_film` AFTER INSERT ON `film` FOR EACH ROW BEGIN  
    INSERT INTO film_text (film_id, title, description)  
        VALUES (new.film_id, new.title, new.description);  
END;;  
  
CREATE TRIGGER `upd_film` AFTER UPDATE ON `film` FOR EACH ROW BEGIN  
    IF (old.title != new.title) or (old.description != new.description)  
    THEN  
        UPDATE film_text  
            SET title=new.title,  
                description=new.description,  
                film_id=new.film_id  
        WHERE film_id=old.film_id;  
    END IF;  
END;;  
  
CREATE TRIGGER `del_film` AFTER DELETE ON `film` FOR EACH ROW BEGIN  
    DELETE FROM film_text WHERE film_id = old.film_id;  
END;;  
DELIMITER ;
```



Query Performance Analysis



- EXPLAIN [EXTENDED] SELECT select_options
- SELECT only
- [SELECT] PROCEDURE ANALYSE();

EXPLAIN PLAN FOR [statement]
PLAN_TABLE

<http://dev.mysql.com/doc/refman/5.0/en/explain.html>



Query Performance Analysis



- The Slow Query Log
 - `long_query_time=5` (my.cnf)
 - `mysqld --log-slow-queries=[filename]`
 - `--log-queries-not-using-indexes`
 - `--log-slow-admin-statements`

<http://dev.mysql.com/doc/refman/5.0/en/slow-query-log.html>



MySQL Commands



- mysql
- mysqld
- mysqladmin
- mysqlmanager
- mysqlcheck
- mysqldump
- mysqlimport
- mysqlcheck
- myisamchk
- myisamlog
- myisampack
- mysqlbinlog
- perror
- mysqlupgrade
- mysqlslap 

<http://dev.mysql.com/doc/refman/5.0/en/client-utility-programs.html>



INFORMATION_SCHEMA

- Smaller set of tables
 - TABLES, COLUMNS, VIEWS, ROUTINES, USER_PRIVILEGES
- PROCESSLIST 

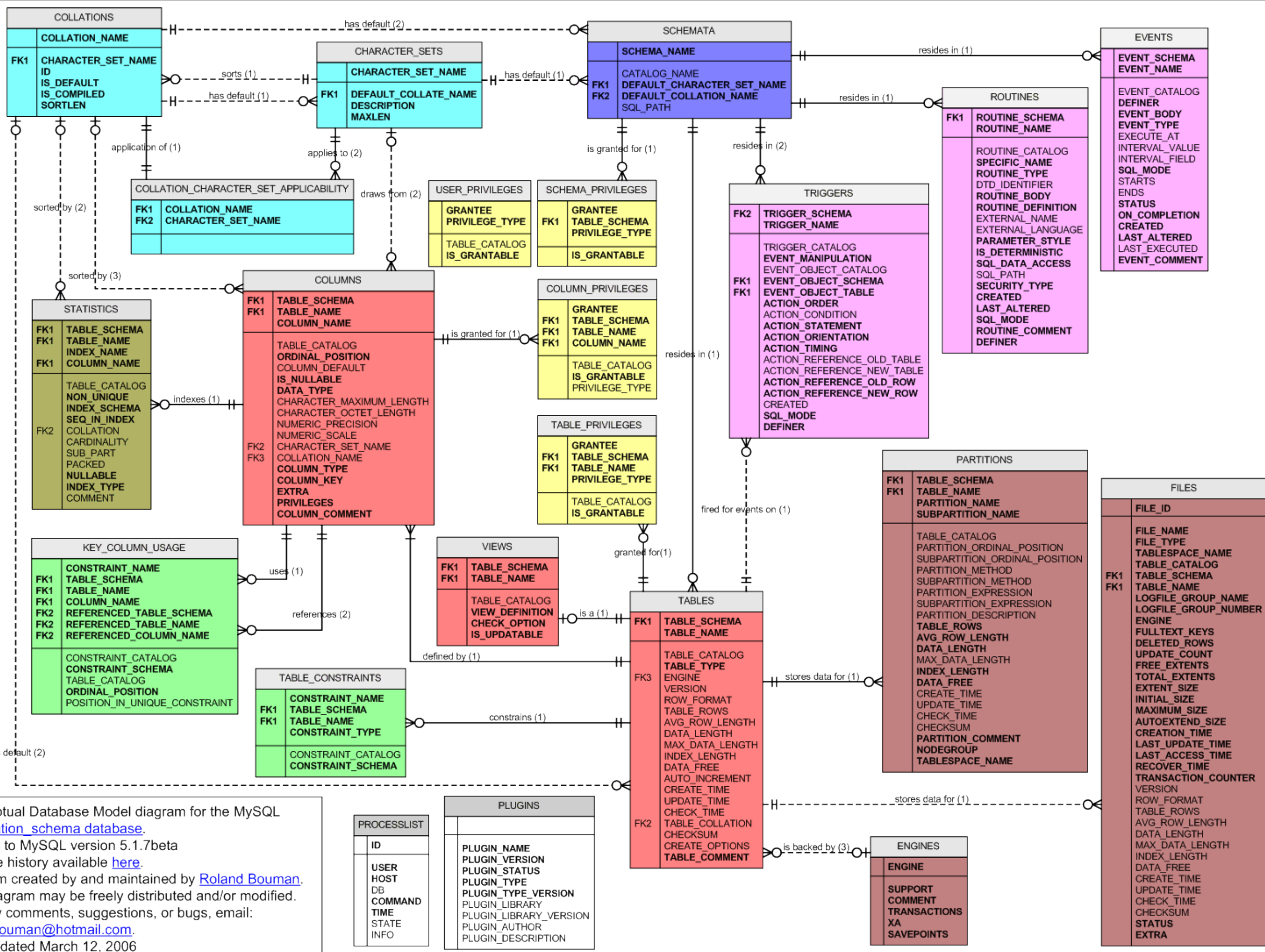
Oracle Data Dictionary

Dynamic Performance Views (V\$)

<http://dev.mysql.com/doc/refman/5.0/en/information-schema.html>

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





Conceptual Database Model diagram for the MySQL [information schema database](#).
Applies to MySQL version 5.1.7beta
Change history available [here](#).
Diagram created by and maintained by [Roland Bouman](#).
This diagram may be freely distributed and/or modified.
For any comments, suggestions, or bugs, email:
R_P_Bouman@hotmail.com.
Last updated March 12, 2006

INFORMATION_SCHEMA



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';
```



INFORMATION_SCHEMA



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
```



Helpful SQL Additions

- LOAD DATA INFILE
- SELECT INTO OUTFILE
- DROP [object] IF EXISTS [name]
 - DROP TABLE IF EXISTS TableName;



MySQL 5.1 Major Features



- Partitioning
- Log Tables
- Row Based Replication
- Events
- Federated Tables
- Cluster Replication



End User Tools

- MySQL Query Browser
- MySQL Administrator
- MySQL Workbench
- 3rd Party Products



MySQL Query Browser

- Query Toolbar
 - Easily Create, Edit, and Debug SQL Statements
- Script Editor
- Object Browser
- Database Explorer
- Table Editor
 - Visually Create and Modify Tables

SQL Developer / TOAD

<http://www.mysql.com/products/tools/query-browser/>



MySQL Administrator

- User Administration
- Single View Dynamic Health Monitoring
- Quickly Optimize MySQL
- Rapid Disaster Prevention and Recovery
- Server Information At-a-Glance
- View Replication Status
- View Server Logs

OEM, APEX

<http://www.mysql.com/products/tools/administrator/>



MySQL Workbench

- Reverse Engineer Database
- Database/Model synchronization
- Concept/Logical/Physical Designs
- DBDesigner4 import/export model
- Extending
 - Figure Stylesheets
 - Scripts
 - Plugins

Oracle Designer

http://forge.mysql.com/wiki/index.php/MySQL_Workbench



3rd Party Tools

- PhpMyAdmin

<http://www.phpmyadmin.net>

- Toad for MySQL

<http://www.toadsoft.com/toadmysql/>



Other MySQL Products



- MySQL Connectors
 - ODBC, JDBC, ADO.NET, MPX
- MySQL Migration Toolkit
- MySQL Network – Commercial Support
- Eventum



What's Missing

- Object Structure
- Table Snapshots
- Materialized Views
- Check Constraints
 - CREATE VIEW ... WITH CHECK OPTION;
- Flashback queries
- Synonyms

CREATE TYPE [obj] AS OBJECT



What's Missing

- SQL reports
- No Memory Pinning capabilities
- No wrapping capability (protect source)
- No Java procedural language support

COLUMN name FORMAT a40
SET LINESIZE 100
SPOOL [file]



What we covered?

- SQL
- SQL*Plus
- PL/SQL
- Tools Suite
- Open Source Opportunity
- Documentation References



For access to this paper, more detailed notes
and other information, please visit.

<http://www.arabx.com.au>



References



- <http://www.mysql.com> - MySQL Web Site
- <http://dev.mysql.com> - MySQL Developer Zone
- <http://forums.mysql.com> - MySQL Forums
- <http://www.mysql.com/training/certification/> - MySQL Certification
- <http://www.planetmysql.org> - MySQL Blogs
- www.mysqldevelopment.com - MySQL resources/tutorials



References



Storage Engines

- ▶ http://dev.mysql.com/tech-resources/articles/mysql_5.0_psea1.html
- ▶ http://dev.mysql.com/tech-resources/articles/mysql_5.0_psea2.html
- ▶ <http://dev.mysql.com/tech-resources/articles/creating-new-storage-engine.html>
- ▶ http://www.mysql.com/why-mysql/white-papers/mysql_wp_pluggable.php

Stored Procedures

- ▶ <http://www.nongnu.org/mysql-sr-lib/> - General Purpose Stored Routines Library
- ▶ <http://dev.mysql.com/tech-resources/articles/mysql-storedprocedures.html>



References



Recommended Reading

- ▶ MySQL by Paul DuBois

MySQL™

*The definitive guide to using, programming,
and administering MySQL 4.1 and 5.0*

Paul DuBois

Third Edition

