MySQL

Not *your* SQL, understand?

MySQL

- Relational Database Management System
  - RDBMS
- Stores stuff in Tables
- Tables have named columns
- Tables have multiple rows with the same columns for each row
- Tables can be related to each other

Connecting

- AWS VM
- From your command line:

```
$ mysql
```

markfischer — fischerm@fischerm:~ — ssh fischerm@52.35.157.11 —...

```
[fischerm@fischerm ~]$ mysql
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 568
Server version: 5.5.46 MySQL Community Server (GPL)

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql>
```

Databases

- `show databases;`
- Lists all the databases on this server
- `use <database>;`
- Select a database to send commands to

```
mysql> show databases;
+--------------------+
| Database           |
+--------------------+
| information_schema |
| cs337              |
| mysql              |
| performance_schema |
| test               |
| tictactoe          |
+--------------------+
6 rows in set (0.00 sec)

mysql> use cs337;
Database changed
mysql>
```

Looking At Tables

- `show tables;`
- Lists all tables in the database
- `describe <tablename>;`
- Print out the column structure of the given table

markfischer — ssh —

```
mysql> show tables;
+-----------------+
| Tables_in_cs337 |
+-----------------+
| staff           |
+-----------------+
1 row in set (0.00 sec)

mysql>
```

markfischer — ssh —

```
mysql> desc staff;
+-------+---------------+------+-----+---------+---
| Field | Type          | Null | Key | Default | Ex
+-------+---------------+------+-----+---------+---
| id    | int(11)       | NO   | PRI | NULL    | au
| name  | varchar(1024) | YES  |     | NULL    |
| phone | varchar(1024) | YES  |     | NULL    |
| email | varchar(1024) | YES  |     | NULL    |
+-------+---------------+------+-----+---------+---
4 rows in set (0.00 sec)

mysql>
```

SQL

- SQL - **S**tructured **Q**uery **L**anguage
- An english like syntax to interact with a databases
- Basic Verbs initiate Commands
  - `SELECT`
  - `INSERT`
  - `UPDATE`
  - `DELETE`

CREATE TABLE

- Make a new table to hold stuff
- Think about the columns you want to have in your table
- Data Modeling

```
CREATE TABLE `staff` (
  `id` int(11) NOT NULL auto_increment,
  `name` varchar(1024) default NULL,
  `phone` varchar(1024) default NULL,
  `email` varchar(1024) default NULL,
  PRIMARY KEY  (`id`)
) ENGINE=InnoDB DEFAULT CHARSET=latin1;
```

MySQL Datatypes

http://dev.mysql.com/doc/en/data-types.html

- Several ways to hold a string
  - CHAR and VARCHAR
  - Also BLOB and TEXT
- Numbers
  - INT, SMALLINT, BIGINT etc
  - DECIMAL, NUMERIC, FLOAT, DOUBLE, BIT
- Dates & Times
  - DATE, TIME, TIMESTAMP, DATETIME

CRUD

- You'll hear people mention CRUD in connection with databases
  - **C**reate
  - **R**etrieve
  - **U**pdate
  - **D**elete

SQL

CRUD	SQL Verb
Create	`INSERT`
Retrieve	`SELECT`
Update	`UPDATE`
Delete	`DELETE`

select

- Getting data out of tables

```
SELECT <fields> FROM <tables> [WHERE <conditions>];
```

markfischer — ssh — 81×17

```
mysql> select * from staff;
+----+----------+----------+---------------------------+
| id | name     | phone    | email                     |
+----+----------+----------+---------------------------+
|  1 | Mark     | 626-1541 | fischerm@email.arizona.edu |
|  2 | Margrit  | 626-1541 | memcinto@email.arizona.edu |
|  3 | Tracey   | 626-1541 | thummel@email.arizona.edu  |
|  4 | Cindy    | 626-1541 | ccamp@email.arizona.edu    |
|  5 | Jan      | 626-1541 | jknight@email.arizona.edu  |
|  6 | Danielle | 626-1541 | danistil@email.arizona.edu |
|  7 | Michael  | 626-1541 | martelle@email.arizona.edu |
+----+----------+----------+---------------------------+
7 rows in set (0.00 sec)

mysql>
```

select

- SQL is case in-sensitive
- These all work the same

```
select * from staff;
SELECT * FROM staff;
Select * From Staff;
```

- The Asterisk `'*'` means “All the fields in the tables”
- Can select just specific fields by specifying which ones

markfischer — ssh — 81×16

```
mysql> select name, email from staff;
+----------+---------------------------+
| name     | email                     |
+----------+---------------------------+
| Mark     | fischerm@email.arizona.edu |
| Margrit  | memcinto@email.arizona.edu |
| Tracey   | thummel@email.arizona.edu  |
| Cindy    | ccamp@email.arizona.edu    |
```

selecting specific things

- The WHERE clause for a SELECT statement allows us to limit the rows selected from a set of tables

```
SELECT * FROM staff WHERE name='Mark';
```

markfischer — ssh — 81×16

```
mysql> SELECT * FROM staff WHERE name='Mark';
+----+------+----------+---------------------------+
| id | name | phone    | email                     |
+----+------+----------+---------------------------+
|  1 | Mark | 626-1541 | fischerm@email.arizona.edu |
+----+------+----------+---------------------------+
1 row in set (0.00 sec)

mysql>
```

`selecting` specific things

- Doesn't have to be an *exact* match – `LIKE`
- `%` is our wildcard match character for strings in SQL

```
SELECT * FROM staff WHERE name LIKE 'M%';
```

markfischer — ssh — 81×16

```
mysql> SELECT * FROM staff WHERE name LIKE 'M%';
+----+---------+----------+---------------------------+
| id | name    | phone    | email                     |
+----+---------+----------+---------------------------+
|  1 | Mark    | 626-1541 | fischerm@email.arizona.edu |
|  2 | Margrit | 626-1541 | memcinto@email.arizona.edu |
|  7 | Michael | 626-1541 | martelle@email.arizona.edu |
+----+---------+----------+---------------------------+
3 rows in set (0.00 sec)

mysql>
```

insert

- Adding new rows to a table
- Values must match positions with their field names
- Values must be correct for the datatype of the field
- Strings must be surrounded by single quotes – 'some string'

```
INSERT INTO <table>
(field1, field2, ...) VALUES (value1, value2, ...);
```

markfischer — ssh — 103×34

```
mysql> select * from staff;
+----+----------+----------+---------------------------+
| id | name     | phone    | email                     |
+----+----------+----------+---------------------------+
|  1 | Mark     | 626-1541 | fischerm@email.arizona.edu |
|  2 | Margrit  | 626-1541 | memcinto@email.arizona.edu |
|  3 | Tracey   | 626-1541 | thummel@email.arizona.edu  |
|  4 | Cindy    | 626-1541 | ccamp@email.arizona.edu    |
|  5 | Jan      | 626-1541 | jknight@email.arizona.edu  |
|  6 | Danielle | 626-1541 | danistil@email.arizona.edu |
|  7 | Michael  | 626-1541 | martelle@email.arizona.edu |
+----+----------+----------+---------------------------+
7 rows in set (0.00 sec)

mysql> INSERT INTO staff (name, phone, email) VALUES ('Adam', '621-1541', 'adam@email.arizona.edu');
Query OK, 1 row affected (0.01 sec)

mysql> select * from staff;
+----+----------+----------+---------------------------+
| id | name     | phone    | email                     |
+----+----------+----------+---------------------------+
|  1 | Mark     | 626-1541 | fischerm@email.arizona.edu |
|  2 | Margrit  | 626-1541 | memcinto@email.arizona.edu |
|  3 | Tracey   | 626-1541 | thummel@email.arizona.edu  |
|  4 | Cindy    | 626-1541 | ccamp@email.arizona.edu    |
|  5 | Jan      | 626-1541 | jknight@email.arizona.edu  |
|  6 | Danielle | 626-1541 | danistil@email.arizona.edu |
|  7 | Michael  | 626-1541 | martelle@email.arizona.edu |
|  8 | Adam     | 621-1541 | adam@email.arizona.edu     |
+----+----------+----------+---------------------------+
8 rows in set (0.00 sec)

mysql>
```

insert

```
INSERT INTO staff
(name, phone, email) VALUES
('Adam', '621-1541', 'adam@email.arizona.edu');
```

- Why didn't we specify the `id` field?
- Where does the `8` come from?

markfischer — ssh — 83×18

```
mysql> select * from staff;

+----+----------+----------+---------------------------+
| id | name     | phone    | email                     |
+----+----------+----------+---------------------------+
|  1 | Mark     | 626-1541 | fischerm@email.arizona.edu |
|  2 | Margrit  | 626-1541 | memcinto@email.arizona.edu |
|  3 | Tracey   | 626-1541 | thummel@email.arizona.edu  |
|  4 | Cindy    | 626-1541 | ccamp@email.arizona.edu    |
|  5 | Jan      | 626-1541 | jknight@email.arizona.edu  |
|  6 | Danielle | 626-1541 | danistil@email.arizona.edu |
|  7 | Michael  | 626-1541 | martelle@email.arizona.edu |
|  8 | Adam     | 621-1541 | adam@email.arizona.edu     |
+----+----------+----------+---------------------------+
8 rows in set (0.00 sec)

mysql>
```

AUTO INCREMENT

- When defining a table, you can specify a `PRIMARY KEY` field be `AUTO INCREMENT`
- This does pretty much what it sounds like
- Anytime a new row is inserted into the table, MySQL will automatically assign a new value, incrementing an internal counter

markfischer — ssh — 81×17

```
mysql> desc staff;
+-------+--------------+------+-----+---------+----------------+
| Field | Type         | Null | Key | Default | Extra          |
+-------+--------------+------+-----+---------+----------------+
| id    | int(11)      | NO   | PRI | NULL    | auto_increment |
| name  | varchar(1024) | YES  |     | NULL    |                |
| phone | varchar(1024) | YES  |     | NULL    |                |
| email | varchar(1024) | YES  |     | NULL    |                |
+-------+--------------+------+-----+---------+----------------+
4 rows in set (0.00 sec)
```

update

- Change a value for a field or set of fields.

```
UPDATE <table> SET field1=value1, field2=value2
WHERE [conditions];
```

- **WATCH OUT!**

- If you don't specify any conditions, you will update **EVERY ROW!**

update

```
UPDATE staff SET phone='626-TECH' WHERE id=1;
```

markfischer — ssh — 83×22

```
mysql> select * from staff where name='Mark';
+----+------+----------+---------------------------+
| id | name | phone    | email                     |
+----+------+----------+---------------------------+
|  1 | Mark | 626-1541 | fischerm@email.arizona.edu |
+----+------+----------+---------------------------+
1 row in set (0.00 sec)

mysql> UPDATE staff SET phone='626-TECH' WHERE id=1;
Query OK, 1 row affected (0.01 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> select * from staff where name='Mark';
+----+------+----------+---------------------------+
| id | name | phone    | email                     |
+----+------+----------+---------------------------+
|  1 | Mark | 626-TECH | fischerm@email.arizona.edu |
+----+------+----------+---------------------------+
1 row in set (0.00 sec)

mysql>
```

delete

- Deletes rows from a table

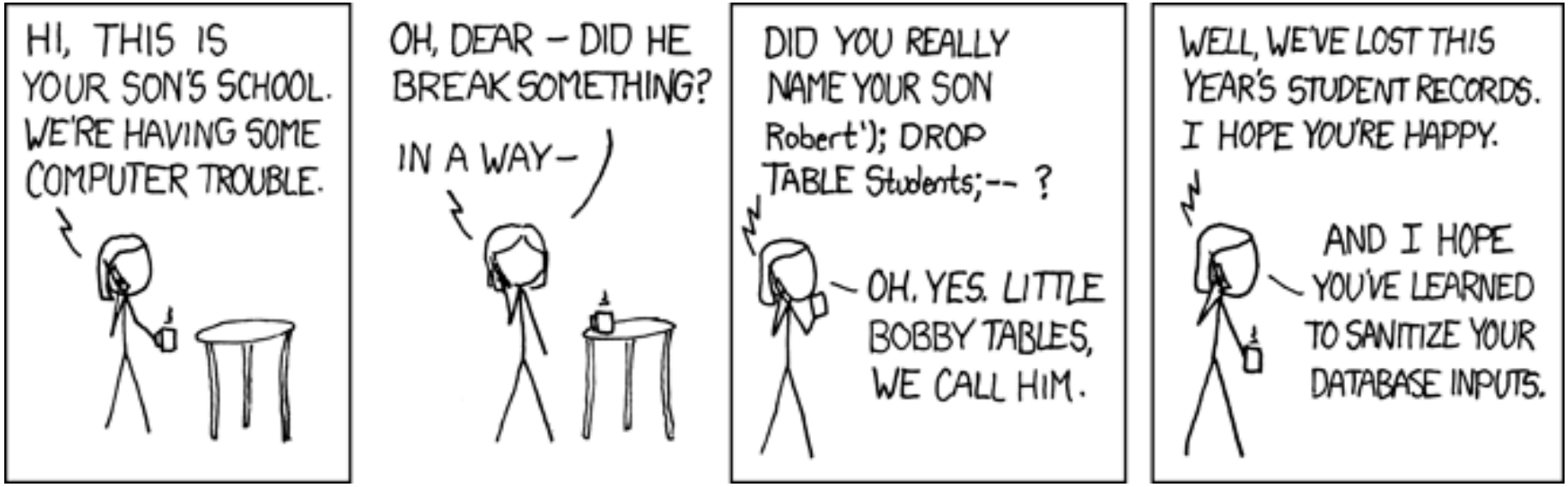
```
DELETE FROM <table> WHERE [conditions];
```

- **WATCH OUT!**
- If you don't specify any conditions, you will **DELETE EVERY ROW!**

```
DELETE FROM staff WHERE id=8;
```

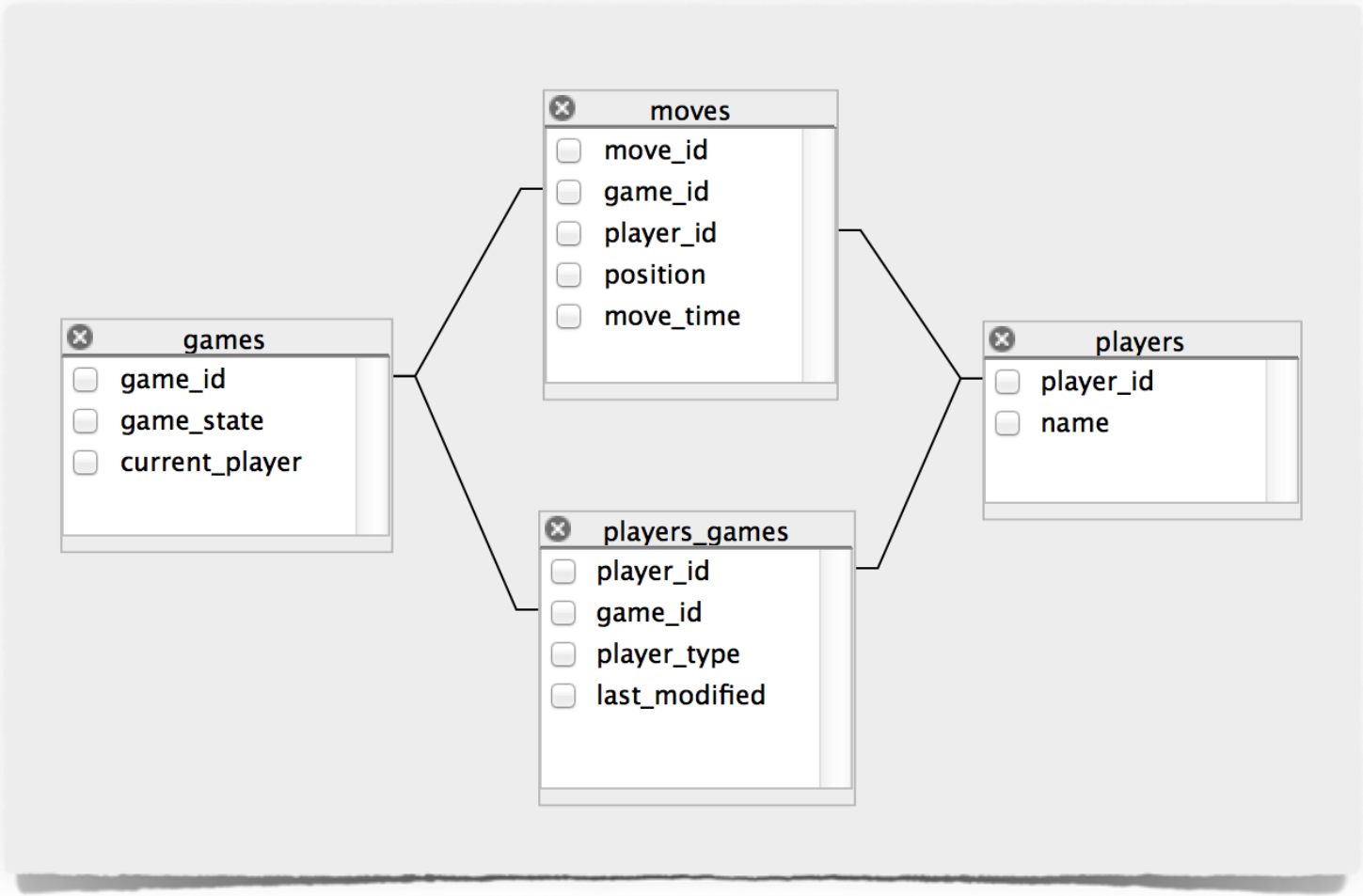
markfischer — ssh — 83×33

```
mysql> select * from staff;
+----+----------+----------+---------------------------+
| id | name     | phone    | email                     |
+----+----------+----------+---------------------------+
|  1 | Mark     | 626-TECH | fischerm@email.arizona.edu |
|  2 | Margrit  | 626-1541 | memcinto@email.arizona.edu |
|  3 | Tracey   | 626-1541 | thummel@email.arizona.edu  |
|  4 | Cindy    | 626-1541 | ccamp@email.arizona.edu    |
|  5 | Jan      | 626-1541 | jknight@email.arizona.edu  |
|  6 | Danielle | 626-1541 | danistil@email.arizona.edu |
|  7 | Michael  | 626-1541 | martelle@email.arizona.edu |
|  8 | Adam     | 621-1541 | adam@email.arizona.edu     |
+----+----------+----------+---------------------------+
8 rows in set (0.00 sec)

mysql> DELETE FROM staff WHERE id=8;
Query OK, 1 row affected (0.00 sec)

mysql> select * from staff;
+----+----------+----------+---------------------------+
| id | name     | phone    | email                     |
+----+----------+----------+---------------------------+
|  1 | Mark     | 626-TECH | fischerm@email.arizona.edu |
|  2 | Margrit  | 626-1541 | memcinto@email.arizona.edu |
|  3 | Tracey   | 626-1541 | thummel@email.arizona.edu  |
|  4 | Cindy    | 626-1541 | ccamp@email.arizona.edu    |
|  5 | Jan      | 626-1541 | jknight@email.arizona.edu  |
|  6 | Danielle | 626-1541 | danistil@email.arizona.edu |
|  7 | Michael  | 626-1541 | martelle@email.arizona.edu |
+----+----------+----------+---------------------------+
7 rows in set (0.00 sec)

mysql>
```


HI, THIS IS YOUR SON'S SCHOOL. WE'RE HAVING SOME COMPUTER TROUBLE.
OH, DEAR – DID HE BREAK SOMETHING?
IN A WAY–
DID YOU REALLY NAME YOUR SON Robert'); DROP TABLE Students;-- ?
OH. YES. LITTLE BOBBY TABLES, WE CALL HIM.
WELL, WE'VE LOST THIS YEAR'S STUDENT RECORDS. I HOPE YOU'RE HAPPY.
AND I HOPE YOU'VE LEARNED TO SANITIZE YOUR DATABASE INPUTS.

Joins

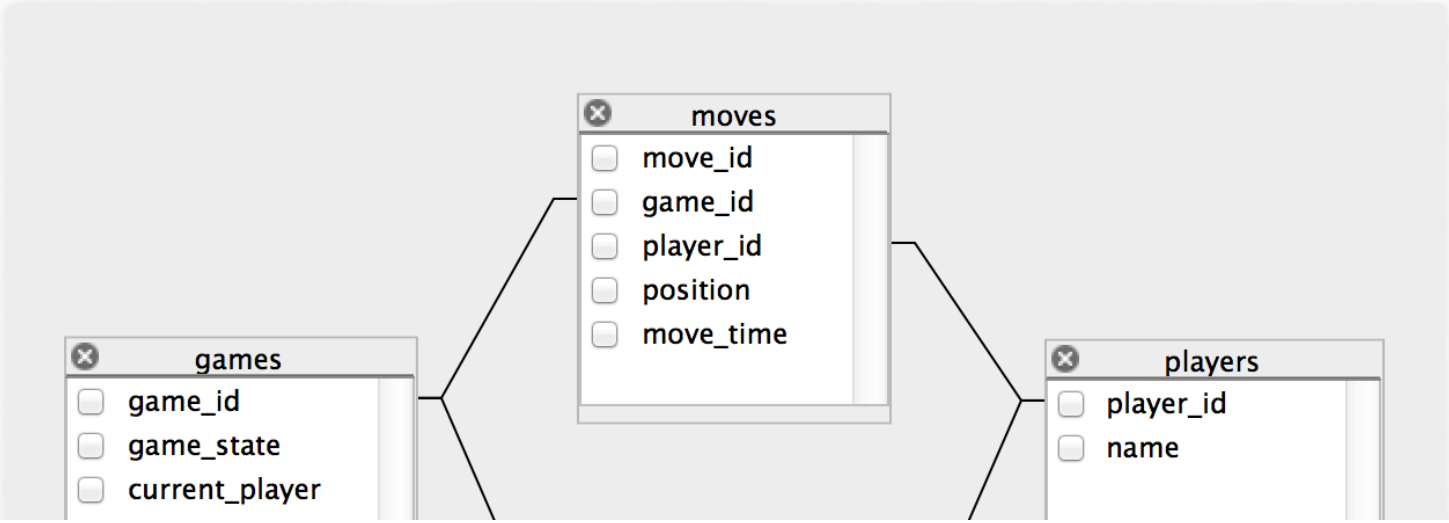
- The Relational part of RDBMS



Joins

- You can SELECT from multiple tables in a single query

```
SELECT games.game_state,
  games.game_id,
  players_games.player_id
FROM players_games INNER JOIN games
  ON players_games.game_id = games.game_id;
```



Joins

- When specifying fields to select from multiple tables, you prefix the field name by the table name
  - `tablename.fieldname`

```
SELECT
 games.game_state,
 games.game_id,
 players_games.player_id
...
```

Table Name

Field Name

```sql
SELECT games.game_state,
  games.game_id,
  players_games.player_id
FROM players_games INNER JOIN games
  ON players_games.game_id = games.game_id;
```

php — fischerm@workbench:~ — ssh — 66×22

```
mysql> SELECT games.game_state,
    -> games.game_id,
    -> players_games.player_id
    -> FROM players_games INNER JOIN games
    -> ON players_games.game_id = games.game_id;
+------------+---------+----------------------------------+
| game_state | game_id | player_id                        |
+------------+---------+----------------------------------+
| playing    |      60 | 57fd375464bab393065734b8d3e4cf1d |
| playing    |      60 | d29c3e8b83e01f68e97458182e3d4039 |
| ended      |      61 | d29c3e8b83e01f68e97458182e3d4039 |
| ended      |      62 | d9dd132068c07304cab89c4659c80c0d |
| ended      |      63 | 32d6df3d5e59f71a927ed5bea1a6c4bb |
| ended      |      63 | d9dd132068c07304cab89c4659c80c0d |
| open       |      64 | d9dd132068c07304cab89c4659c80c0d |
+------------+---------+----------------------------------+
7 rows in set (0.00 sec)

mysql>
```

Lots Of Other Stuff

- Lots of built-in functions
  - ABS, AVG, POW, RAND, SYSDATE, VARIANCE
- Standard Operators
  - + - / * = > etc
- Stored Procedures
  - Write your code directly in the database, then make SQL calls to the functions
- Can store JSON natively now
- Transactions

Great!

Now go do all that from PHP!