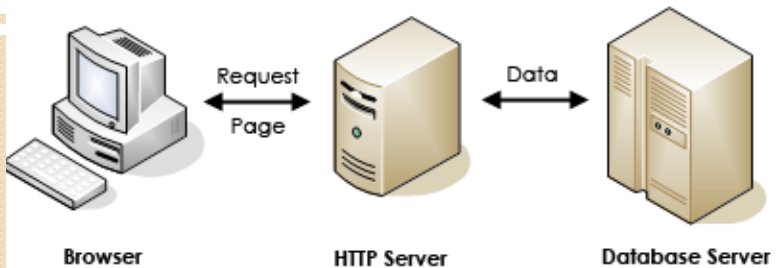




Relational Databases

Three Tier Architecture





RDBMS

- Relational Database Management Systems
- A way of saving and accessing data on persistent (disk) storage.

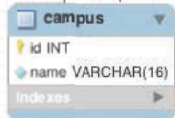
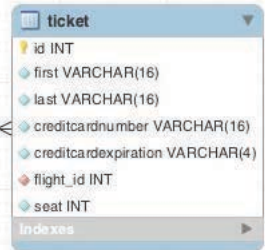
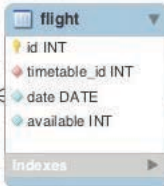
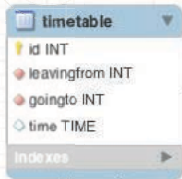
Why Use an RDBMS

- Query optimized
- Standardized
- Portability
- Data integrity
- Fault tolerance
- Concurrent access
- Scalability
- Data safety
- Reporting

Relational Model

- First published by Edgar F. Codd in 1970
 - Received Turing Award in 1981
- A relational database consists of a collection of tables
- A table consists of rows and columns
- Each row represents a record
- Each column represents an attribute of the records contained in the table

Example



Structured Query Language (SQL)

- Queries

```
select c1.name as 'from', c2.name as 'to', t.time, f.date, f.available  
from flight f, timetable t, campus c1, campus c2  
where f.timetable_id = t.id and t.leavingfrom = c1.id and t.goingto = c2.id;
```

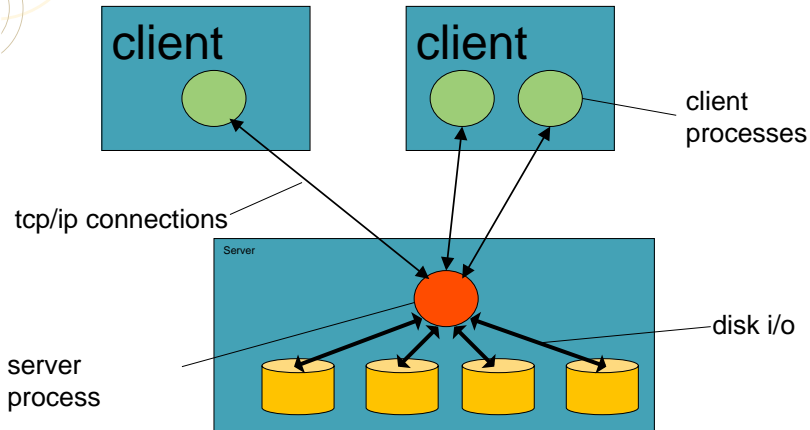
- Data manipulation

```
insert into flight (timetable_id, date, available) values (1, current_date(), 3)
```

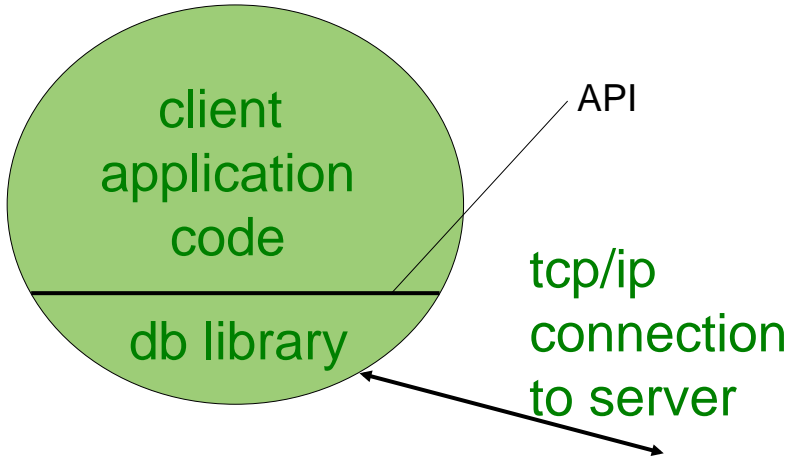
```
update flight set available = 2 where id = 3
```

```
delete from flight
```

Client/Server Databases



Inside the Client Process



CodeIgniter DB API

- Implemented by DB.php library
 - CODEIGNITER_ROOT/core/database
- Configuration
 - CODEIGNITER_ROOT/application/config/database.php

```
$db['default']['hostname'] = 'bungle07.cs.toronto.edu';  
$db['default']['username'] = 'c2delara';  
$db['default']['password'] = '1273837';  
$db['default']['database'] = 'airuoft';  
$db['default']['dbdriver'] = 'mysql';
```
- Loading
 - CODEIGNITER_ROOT/application/config/autoload.php

```
$autoload['libraries'] = array('database');
```
 - Controller function

```
$this->load->database();
```

Running Queries

- `$query = $this->db->query('YOUR QUERY HERE');`
- Return values
 - Read queries → false if failure, result object if success
 - Write queries → false if failure, true if success
- Error handling
 - `$this->db->_error_message();`
 - `$this->db->_error_number();`

Processing Results

- `$query->num_rows()` → num of rows returned by query
- `$query->result()` → array of objects
- `$query->row(n)` → a specific object for the *nth* tuple

- `$query->result(Class)` → array of objects of type *Class*
- `$query->row(n, Class)` → a specific object for the *nth* tuple

- `$query->result_array()` → result as pure array
- `$query->row_array(n)` → an array for the *nth* tuple

- `$query->list_fields()` → array with field names
- `$query->field_data()` → array with field info (name, max_length, primary_key, type)

```

1 <?php
2
3 class Main extends CI_Controller {
4
5
6     function __construct() {
7         // Call the Controller constructor
8         parent::__construct();
9     }
10
11    function index() {
12        $data['title']='csc309 db examples';
13        $data['main']='home.php';
14        $this->load->view('template',$data);
15    }
16
17    function trivial() {
18
19
20
21        $data['title']='Trivial DB Example';
22        $data['main']='campus.php';
23        $this->load->view('template',$data);
24    }
25
26    function commander() {
27        $data['title']='SQL Commander';
28        $data['main']='commander.php';
29        $this->load->view('template',$data);
30    }
31
32    function commanderRunQuery() {
33        $this->load->library('form_validation');
34        $this->form_validation->set_rules('query','Query','required');
35
36        if ($this->form_validation->run() == true) {
37
38
39
40
41
42
43
44
45
46        }
47
48        $data['title']='SQL Commander';
49        $data['main']='commander.php';
50        $this->load->view('template',$data);
51    }
52 }
53

```

```
1<!DOCTYPE html>
2<html>
3<head>
4  <meta charset=utf-8" />
5  <title><?php echo $title; ?></title>
6  <link rel="stylesheet" href="<?= base_url(); ?>css/template.css">
7</head>
8<body>
9  <div id="header">
10 <?php $this->load->view('header');?>
11 </div>
12
13 <div id="nav">
14 <?php $this->load->view('navigation');?>
15 </div>
16
17 <div id="main">
18 <?php $this->load->view($main);?>
19 </div>
20
21</body>
22</html>
23
```

```
1 header.php
2
3
4 <h1>CSC309 DB Examples</h1>
5
6
7 navigation.php
8
9 <?php
10 echo anchor('main/trivial','Trivial Example') . "<br />";
11 echo anchor('main/commander','SQL Commander') . "<br />";
12 ?>
```

```
1 <h2>Campus Table</h2>
2 <?php
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17 ?>
18
19
```



```
1 <h2>SQL Commander</h2>
2 <?php
3     //echo validation_errors();
4
5     echo form_open('main/commanderRunQuery');
6     echo form_label('Query');
7     echo form_error('query');
8     echo form_textarea('query',set_value('query'));
9     echo form_submit('submit', 'Run');
10    echo form_close();
11
12
13
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39
40
41
42
43 ?>
44
45
```