Carnegie Mellon University
15-415/615 Database Applications
Spring 2014,
C. Faloutsos & A. Pavlo

HW7: Database Application

TAs: Alex Beutel; Vagelis Papalexakis
Shen Wang; Ming Zhong

Overview

- Design & implement a simple web application
- CMU Fictitious light-weight Twitter → Flitter
- Today:
  - Application specs
  - Homework deliverables
  - Very brief intro to PHP

Data requirements

- **Users**
  - Username (4-50 characters)
  - Password
  - Can follow or be followed
- **Tweets**
  - Up to 140 characters
  - Have to record **when** they were posted

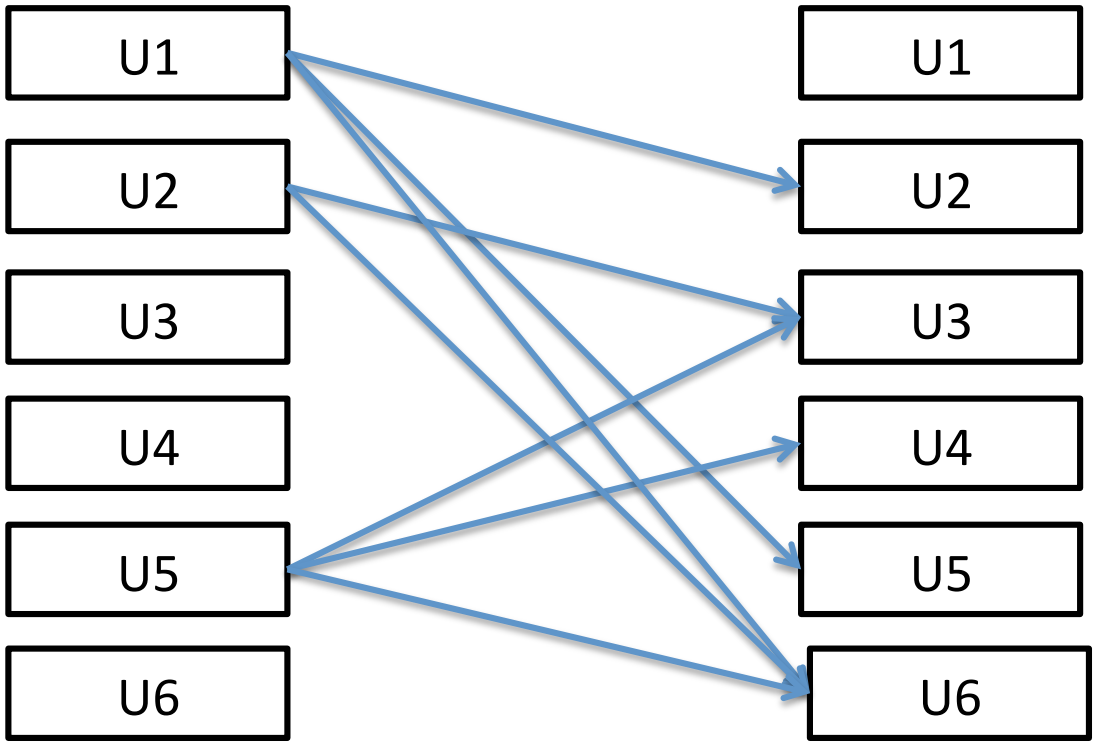
Functionality requirements

1. Create user account
2. Reset database
3. Login
4. Timeline
5. Post a tweet
6. Search for user
7. Check if follows
8. Follow
9. Unfollow

Functionality requirements

10. Recommend users to follow
    - For user U recommend two-step away followees
    - Users followed by the users that U follows
    - Rank them according to how many users follow them
    - Don’t include users that U already follows

User recommendation example



Recommend users to U1

- **U3, rank 2**
- **U4, rank 1**

Note that U6 is not recommended!

Functionality requirements

11. List all followers & followees
12. List all tweets of a user
13. String search in tweets
14. User statistics
    - #followers
    - #followees
    - #tweets
15. Global statistics
    - Most popular user
    - Most active
    - Most connected

Example web application

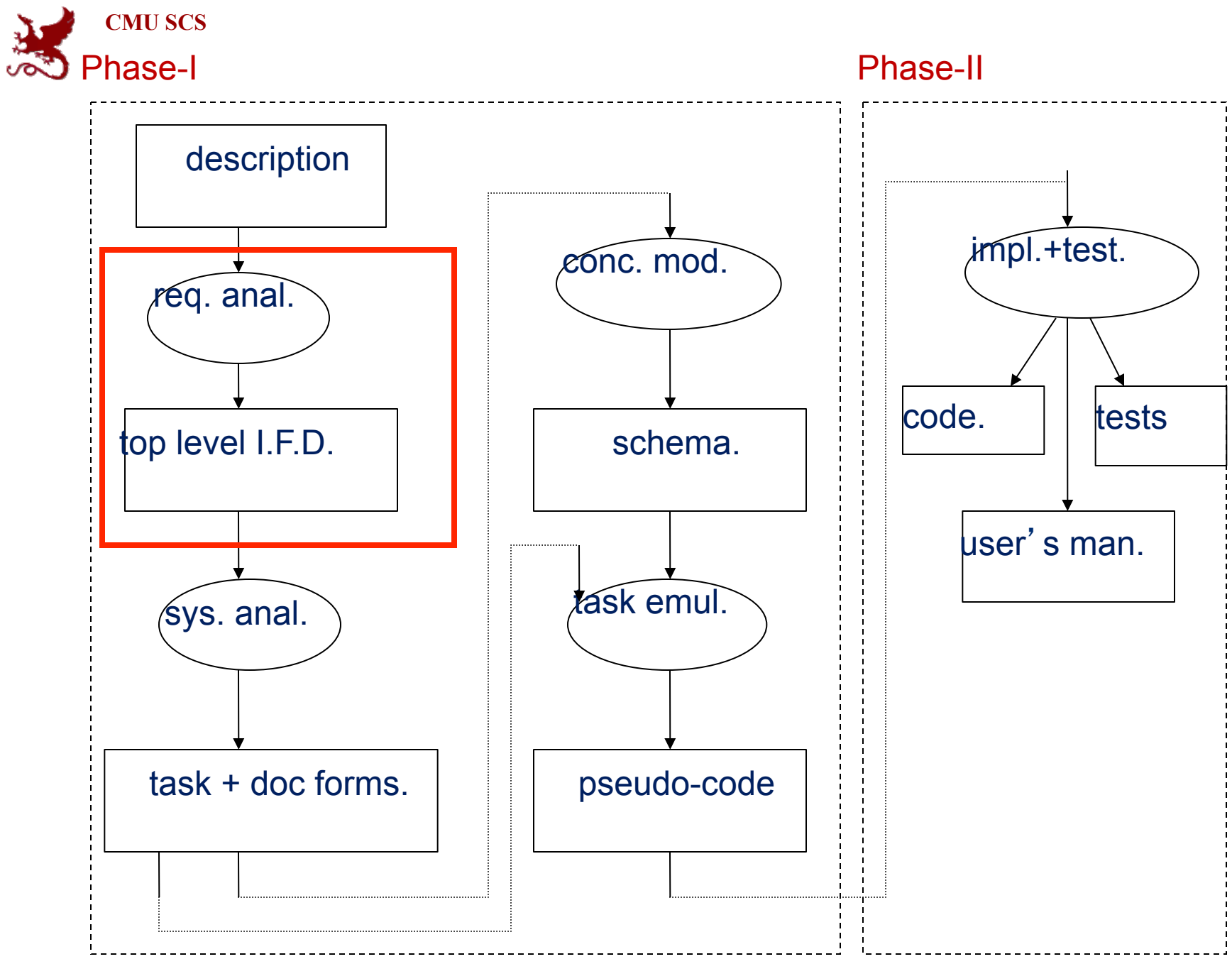
http://gs11696.sp.cs.cmu.edu/~abeutel/flitter/

Homework Specifics

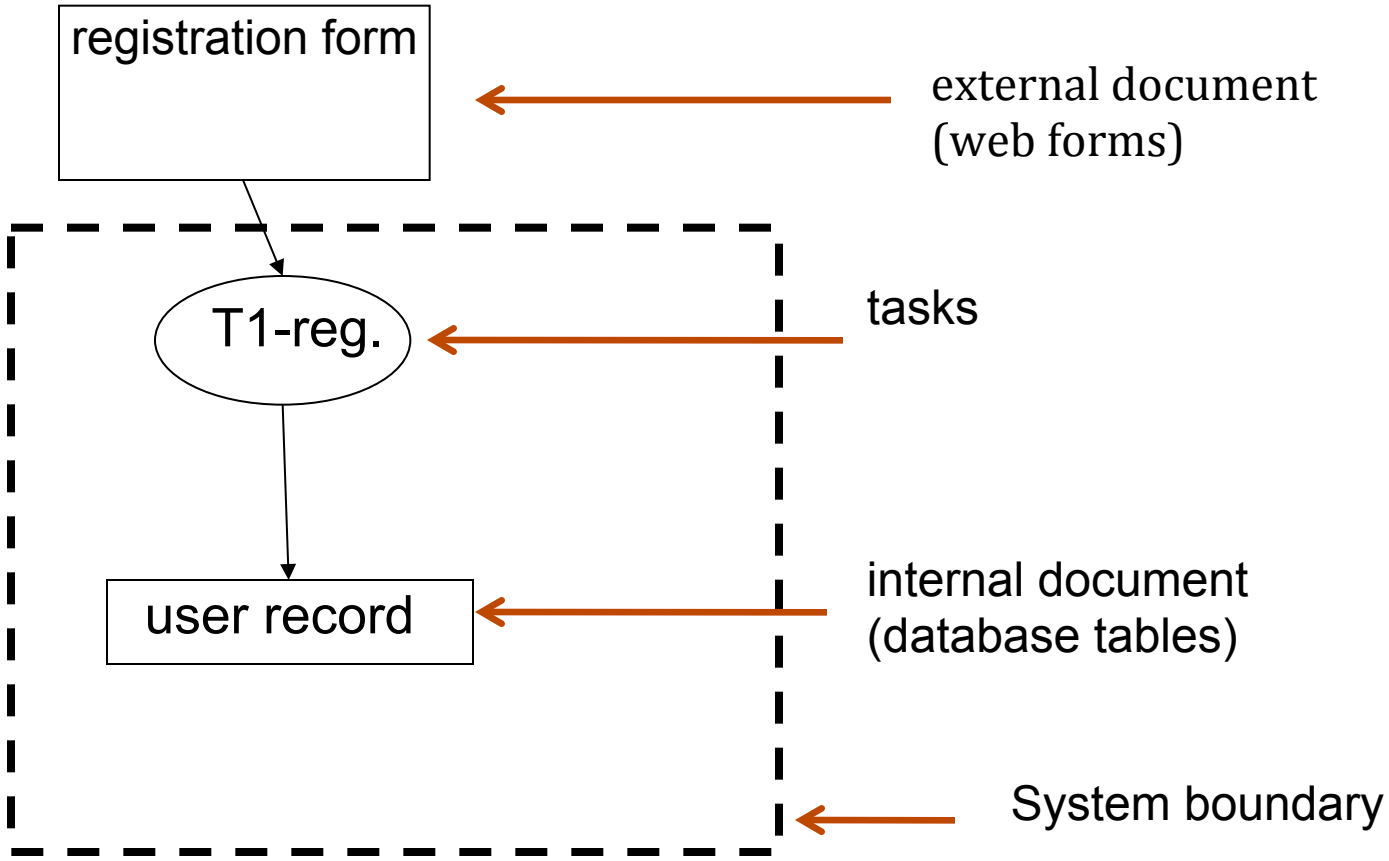
- Follow the design methodology from **Lecture 19**
- Organized in 2 Phases
  - Phase 1 – Design: **due 4/1**
  - Phase 2 – Implementation: **due 4/10**

Phase 1

- You are free to come up with your own design choices as long as
  - they follow the methodology
  - they are reasonable
  - you are able to justify unconventional choices

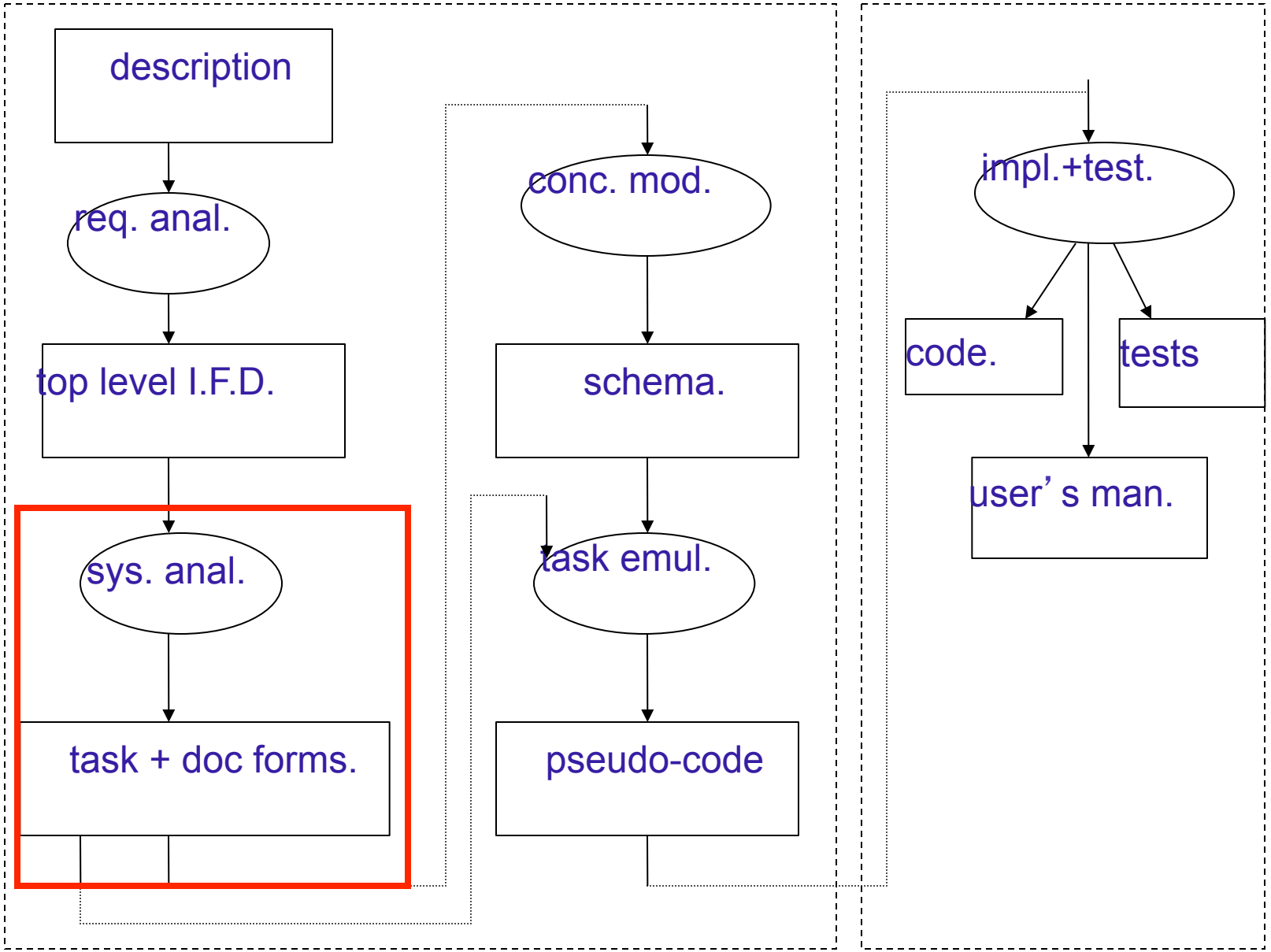

Phase-I
Phase-II
description
req. anal.
top level I.F.D.
sys. anal.
task + doc forms.
conc. mod.
schema.
task emul.
pseudo-code
impl.+test.
code.
tests
user's man.

Top level information flow diagram



Phase-I

Phase-II



Document + Task forms

Task forms and task list

- not required for this homework

Document forms and document list

- D1: registration form
- D2: login form
- D3: timeline form
- …
- Dx: user record
- …

external

internal

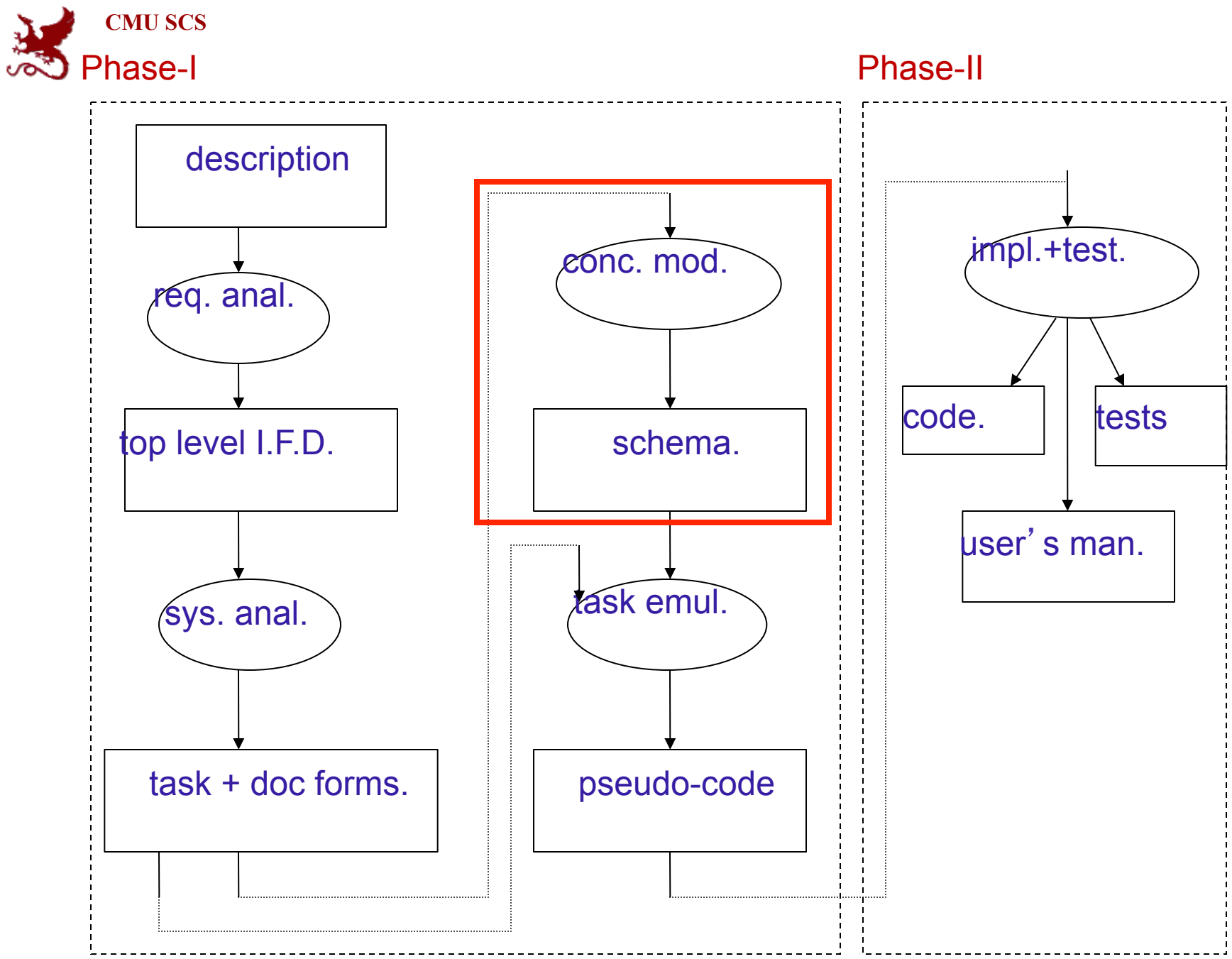
Document forms

D1: registration form

- username
- Password

Dx: user record

- username
- Password


Phase-I
Phase-II
description
req. anal.
top level I.F.D.
sys. anal.
task + doc forms.
conc. mod.
schema.
task emul.
pseudo-code
impl.+test.
code.
tests
user's man.

E-R diagram

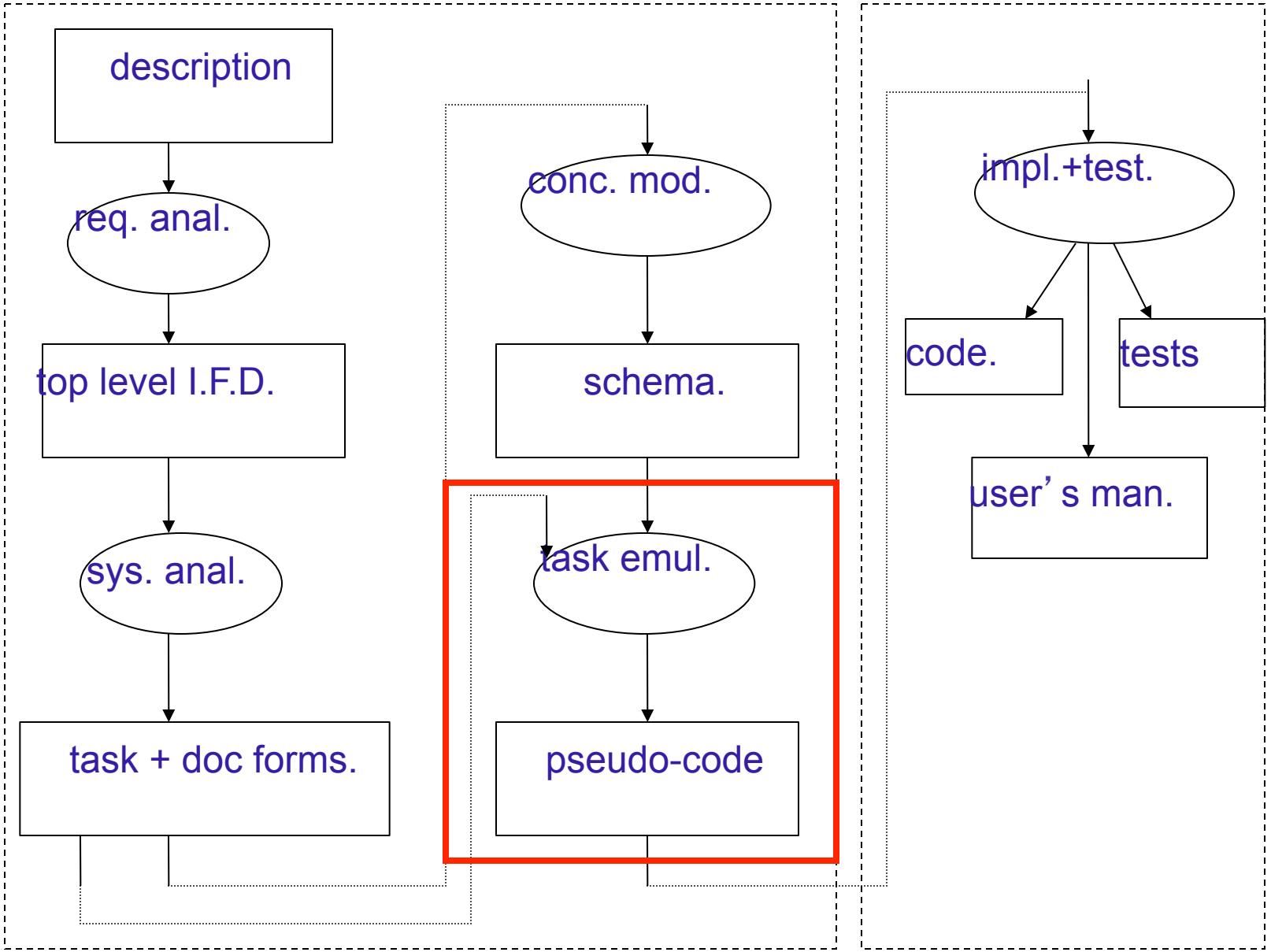
- Specify cardinalities
- Think about weak/strong entities
- Justify unconventional choices

Relational schema

- Give the definition of the schema
- Give SQL DDL statements **including constraints**.

Phase-I

Phase-II



Task emulation/pseudo-code

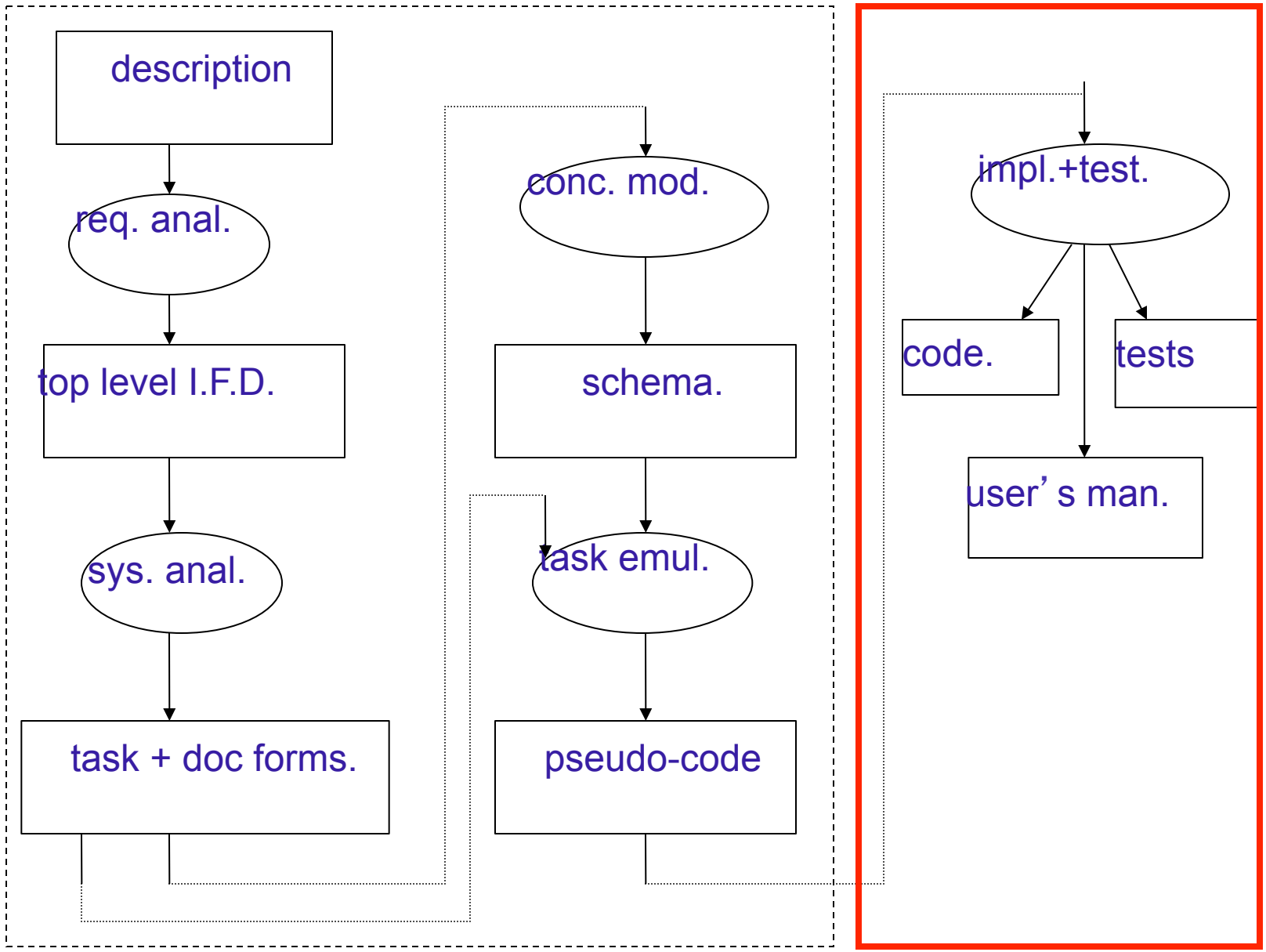
- No need to write pseudocode
- Simply give all SQL DML statements for all tasks

Phase 1: What to hand-in

- **Due 4/1**
- **Hard copy** (in class)
- **Electronic copy** (Blackboard)

Phase-I

Phase-II



Phase 2

- We provide an API in **PHP**
- Implements the web site functionality
- Has empty calls to the database
- write PHP code that
  - wraps the SQL statements
  - returns the output to the rest of the given code (PHP arrays)
- No need to provide user manual

Phase 2

- Unzip `hw7.zip`
- You need to edit 2 files
  - `config.php`
    - add **your** login & url info
  - `functions.php`
    - Contains empty definitions of the functions that you have to implement

PHP & Postgres

```php
<?php
// Connecting, selecting database
$dbconn = pg_connect("host=localhost dbname=publishing user=www password=foo")
    or die('Could not connect: ' . pg_last_error());

// Performing SQL query
$query = 'SELECT * FROM authors';
$result = pg_query($query) or die('Query failed: ' . pg_last_error());

// Printing results in HTML
echo "<table>\n";
while ($line = pg_fetch_array($result, null, PGSQL_ASSOC)) {
    echo "\t<tr>\n";
    foreach ($line as $col_value) {
        echo "\t\t<td>$col_value</td>\n";
    }
    echo "\t</tr>\n";
}
echo "</table>\n";

// Free resultset
pg_free_result($result);

// Closing connection
pg_close($dbconn);
?>
```

Start connection

Issue query & read results

See more at: http://www.php.net/manual/en/book.pgsql.php

PHP arrays

Array creation:

```
$array = array(
    "foo" => "bar",
    "bar" => "foo",
);
```

Bulk insertion (like stack):

```
<?php
$stack = array("orange", "banana");
array_push($stack, "apple", "raspberry");
print_r($stack);
?>
```

See more at: http://www.php.net/manual/en/language.types.array.php

Securing your application

- SQL injection

```
statement = "SELECT * FROM users WHERE name ='" + userName + "';"
```

- Set name equal to `' or '1'='1`
- The SQL statement that gets executed is

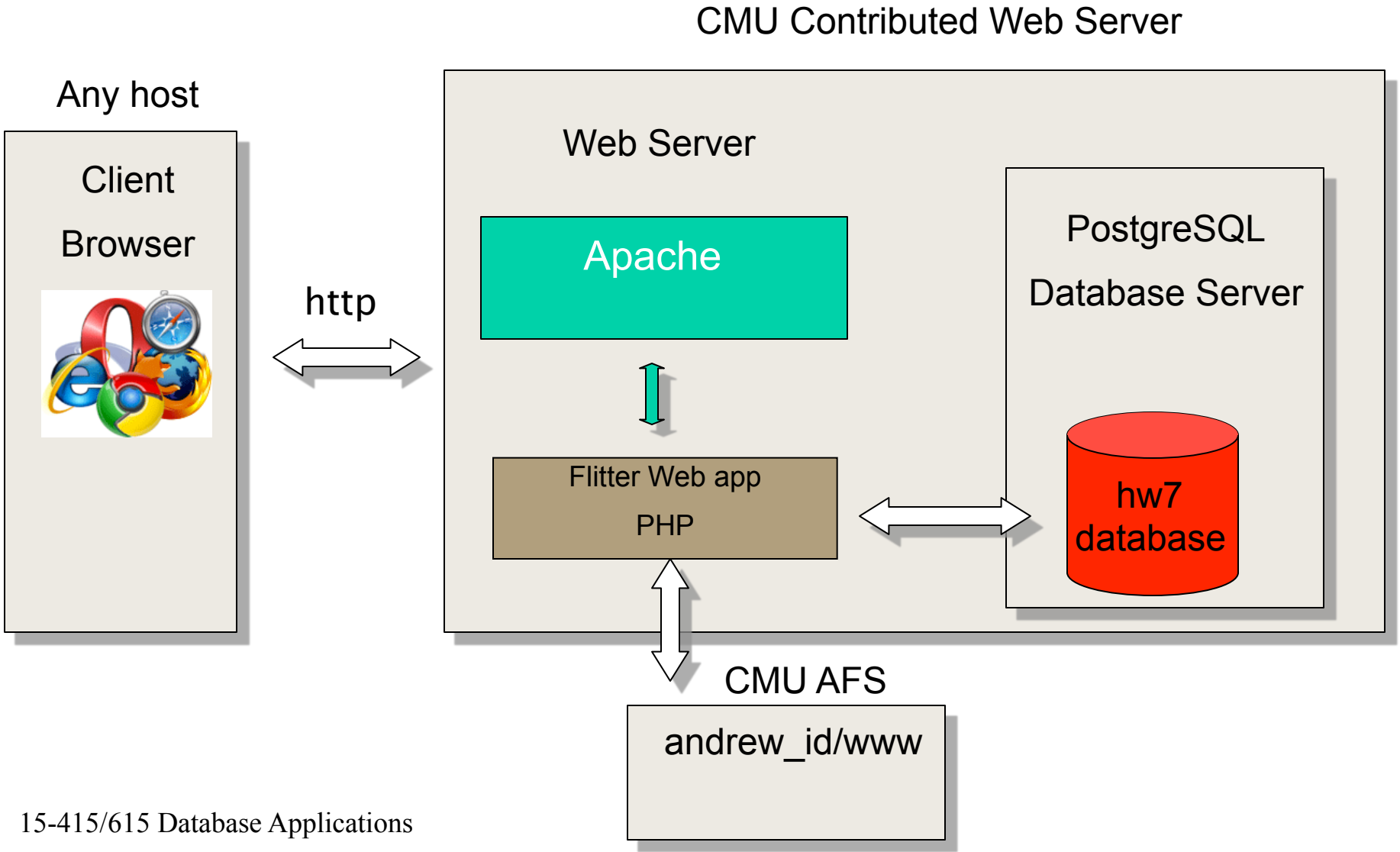
```
SELECT * FROM users WHERE name = '' OR '1'='1';
```

- **Results in un-authorized log-in!!!!**
- Your code has to account for that
  - Hint: `pg_escape_string()`

Phase 2: What to hand-in

- **Due 4/10**
- **Website (IMPORTANT)**: See hw7.pdf for details
- **Hard copy** (in class): ONLY new/changed code (save the trees ☺)
- **Electronic copy:** A .zip with all the code

Homework 7: Architecture



Access to web server

- You will use the Computer Club Contributed Web Server
- Apache server + Postgres DB server
- Publishes *.php code in your AFS 'www' directory
- More details
  - http://www.club.cc.cmu.edu/doc/contribweb.php
  - HW7 description (read carefully)

Publishing your web app

- **Please do the following ASAP and let us know if it doesn't work!**

1. Sign up for the web server here
   http://my.contrib.andrew.cmu.edu
2. Create DB user account here
   http://www.club.cc.cmu.edu/doc/contribweb/sql.php
3. Unzip hw7.zip and copy contents on folder 'flitter_s14' under your AFS www directory
4. Edit config.php with your own db+server parameters
5. Edit folder content permissions: chmod +rx
6. Go to
   http://www.contrib.andrew.cmu.edu/~andrew_id/flitter_s14

Questions?

- Come to **office hours** (4 TAs + 2 instructors)
- Post your questions on **blackboard**.