L14: Database-Dependent Websites

CS1106/CS6503: Intro to Relational Databases

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Semester One, 2023-24

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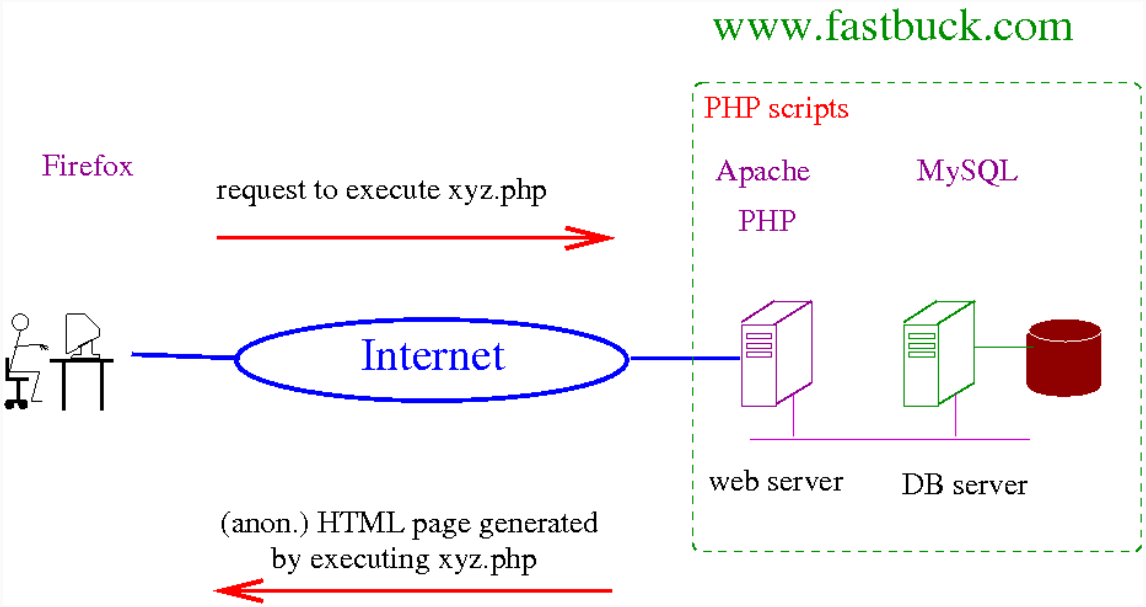
Summary

Integration of databases and websites. Python scripts for managing HTML-form and DB interaction. Jolly Roger case study. Summary of JRA's DB. Sample queries.

Typical E-Commerce Architecture

- Most e-commerce sites are are built around a DB; typically DB houses info. on stock, customers, billing etc.



- User's interaction with site mediated by scripts (e.g. in Python/PHP) executing on the server
- Scripts can "talk to" DB to extract/insert/modify information

Python and SQL

- Can "embed" SQL queries within Python scripts and arrange to execute script (and query) in response to (say) submit event for HTML form.
- Script takes care of:
  - establishing DB connection etc.
  - dispatching query to DB server
- (Script may also "process" query result and e.g. build a "response page" (HTML) out of result data.)

Suggestion box example

Implement simple on-line suggest box for CS1106.

Elements:

- (Server) Simple DB table:

  `suggestions(id, comment, users, email, date)`

- (Server) SQL query to insert a fresh comment:

```
INSERT INTO suggestions VALUES
    ("12345", "Wow!", "KTH", "kth@ucc.ie", "2017-11-03")
```

- (Server) Python script including query triggered when form submitted (over)
- (Client) HTML form with text box (for text of suggestion) and submit button (also text fields for user details).

Template for Python script

record_suggestion.py

Input: *Details of the customer's contact details and suggestion from HTML form*
Output: *HTML page thanking customer for suggestion*

Operation:
Submit following SQL query to DB server:

```
INSERT INTO suggestions VALUES ( . . .);
```

Generate response page summarizing customer's suggestion and acknowledging same.

How this works

Client

1. User views form in `suggestion_box.html` and completes it.

Server

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Server

Script `record_suggestion.py`:

3.1 Extracts form data

3.2 Embeds data in SQL command– to insert suggestion details in DB table `suggestions`

3.3 Submits SQL command to DB server

3.4 Generates response page, thanking user for suggestion

How this works

Client

1. User views form in `suggestion_box.html` and completes it.
2. User clicks submit.
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4. User's browser displays response

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Script `record_suggestion.py`:

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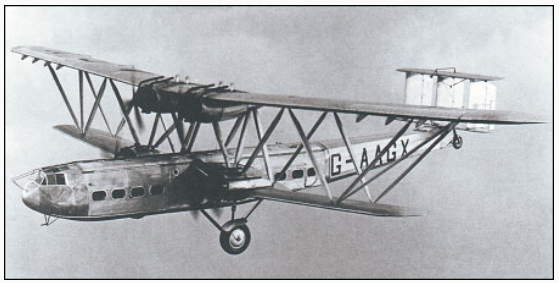
Jolly Roger Airlines

Example of website-database interaction

- Low-cost airline *Jolly Roger Airlines* (JRA) in need of on-line reservation system



  - DB to house data (services, availability, prices, bookings etc.)
  - Scripts to handle various stages of booking process

Typical booking session with JRA website

Client

1. Customer submits trip details using form

Server

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2.

Server

Script `check_services` interrogates DB for suitable services, "packages" results as HTML response page and returns this to client

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Typical booking session with JRA website

Client	Server
1. Customer submits trip details using form	
2.	Script `check_services` interrogates DB for suitable services, "packages" results as HTML response page and returns this to client
3. Customer views response and chooses desired flights	
4.	Script `check_availability` interrogates DB for price and availability of selected flights and packages results as HTML page and returns this to client.

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5. Customer submits payment details.	

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6.	Script `process_booking` records details of booking, updates flight

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Some Simplifying Assumptions

- One-way, point to point, single-seat bookings only
- Every service operates daily, 365 days a year

A Database Design

- A DB schema:

```
services(code, origin, destination, departure,
         duration, schedule)
flights(code, date, capacity, availability, price)
airports(code, name, timezone)
customers(customer_id, first_name, last_name,
        email, password)
bookings(booking_code, customer, service,
        date, credit_card)
```

Design cont'd

- ```
  services(code, origin, destination, departure,
           duration, schedule)
  flights(code, date, capacity, availability, price)
  ```
  ```

Design cont'd

- ```
  services(code, origin, destination, departure,
           duration, schedule)
  flights(code, date, capacity, availability, price)
  ```
- Each *service* e.g. `JR822` from `ORK` to `CDG`, operates daily at the same time
  - origin and destination represented by airport codes, e.g. `ORK`
  - all times expressed GMT (time-zone adjustment possible using `airports` time-zone values)
  ```

Design cont'd

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  flights(code, date, capacity, availability, price)
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- Each *service* e.g. `JR822` from `ORK` to `CDG`, operates daily at the same time
  - origin and destination represented by airport codes, e.g. `ORK`
  - all times expressed GMT (time-zone adjustment possible using `airports` time-zone values)
- Distinct *flight* for each service-date combination, e.g. JR822 on 1 Dec 2012
  - `capacity` reflects num. of seats on plane (fixed)
  - `availability` reflects num. of seats left
  - fixed `price` for each flight
  ```

Design cont'd

- `customers(customer_id, first_name, last_name, email, passwor`
- Repeat customers can re-use same customer id

Design cont'd

- `flights(code, date, capacity, availability, price)`
  `customers(customer_id, first_name, last_name, email, pa`
  `bookings(booking_code, customer, service, date, credit_`
- `bookings` models relationship of which customers are booked on which flights
  - `booking_code` unique alphanumeric code for this booking
  - `customer` customer's id number
  - `flight` flight's code

A query checking for suitable services

- Imagine customer is interested in flights from Cork(ORK) to Paris(CDG) (extracted from form data submitted by customer)

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- Query

```
SELECT *
FROM services
WHERE
    services . origin  =  ORK  AND
    services . destination  =  CDG ;
```

- Script "embeds" customer requirements (boxed elements) into query
- Selection of date-specific flights comes at next stage

A Query cont'd

check_services.py

Input: *Details of customer's requirements as entered in HTML form*

Output: *HTML page summarizing suitable options*

A Query cont'd

check_services.py

Input: *Details of customer's requirements as entered in HTML form*

Output: *HTML page summarizing suitable options*

Operation:

1. Extract form data detailing customer requirements
2. Construct SQL query (incorporating reqs.) and submit to DB server

```
SELECT * FROM services ...
```

3. Take query result received from DB and generate HTML response page therefrom

Checking Availability And Price

- Similarly script `check_availability` would be built around the following query

```
SELECT price, . . .
FROM
    services JOIN flights
    ON services.code = flight .code
WHERE
    services . origin = ORK
    AND services. destination = CDG
    AND flight.date = 1/12/2012
    AND availability > 0;
```

-
  - Particularizes search to specific date
  - Displays prices for available flights only

Recording Booking

- Script `process_booking` would be built around a number of statements
  - Record the customer's details

```
INSERT INTO customers VALUES
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  - Record the details of this booking

```
INSERT INTO bookings VALUES
    ( booking code , . . . );
```

  - Update the availability information for this flight

```
UPDATE flights
SET availability = availability − 1
WHERE flight.code = JR666 AND
    flight .date = 1/12/2012 ;
```

A Potential Snag . . .

Customer 1 **Customer 2**

A Potential Snag . . .

	Customer 1	Customer 2
09:00	Customer 1 queries ORK-CDG flights for 1 December 2012	

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	Customer 1	Customer 2
09:00	Customer 1 queries ORK-CDG flights for 1 December 2012	
09:01		Customer 2 queries ORK-CDG flights for 1 December 2012

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	Customer 1	Customer 2
09:00	Customer 1 queries ORK-CDG flights for 1 December 2012	
09:01		Customer 2 queries ORK-CDG flights for 1 December 2012
09:02	Customer 1 views response indicating one seat left; quickly tries to book flight	

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	Customer 1	Customer 2
09:00	Customer 1 queries ORK-CDG flights for 1 December 2012	
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09:02	Customer 1 views response indicating one seat left; quickly tries to book flight	
09:03		Customer 2 views response indicating one seat left; quickly tries to book flight

A Potential Snag . . .

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09:00	Customer 1 queries ORK-CDG flights for 1 December 2012	
09:01		Customer 2 queries ORK-CDG flights for 1 December 2012
09:02	Customer 1 views response indicating one seat left; quickly tries to book flight	
09:03		Customer 2 views response indicating one seat left; quickly tries to book flight
09:04	Customer 1's booking is reflected in DB	

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09:03		Customer 2 views response indicating one seat left; quickly tries to book flight
09:04	Customer 1's booking is reflected in DB	
09:05		??????

Need some mechanism to prevent "simultaneous" bookings interfering with one another and potentially corrupting the DB

Notes and Acknowledgements

The photograph of the ancient aircraft is from the website `www.aviastar.org`. The Jolly Roger is from Wikicommons.