



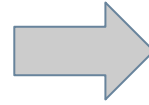
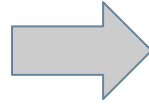
RDBMS

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Previously...

Where Are We?

Database Design
E/R Diagram



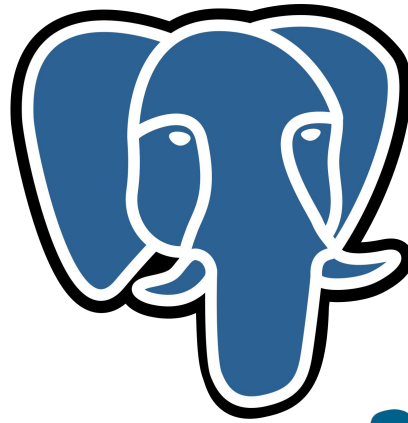
Database Queries
SQL

RDBMS

- RDBMS = Relational DataBase Management System
- An RDBMS is a software that allows users to interact with a relational database.
- Interactions:
 - *Data definition:* We need to define the tables of our relational database.
 - *Update:* We need to insert, update, or delete values in the tables.
 - *Query:* We need to access to the data.
 - *Administration:* We want to control the access of the users, monitor the performance, check data integrity, ...
- The RDBMSs use SQL, but there can be slight variations between them.
- Good news: SQL can be used almost everywhere!

Famous RDBMS

- PostgreSQL
- MySQL
- SQLite
 - Used for testing or small applications



Data Definition In SQL

We Start From a Database Schema

- Once we have designed the database schema using an E/R diagram, we translate it to a database schema.
- This database schema can be implemented through the RDBMS
- Example:
 - Wines(wineID: String, vineyard: String, year: Integer, degree: Float)
 - Harvests(wineID: String, producerID: String, weight: Float)
 - Producers(producerID: String, name: String, city: String)
 - Clients(clientID: String, name: String, city: String)
 - Orders(orderID: String, date: Date, **clientID**: String, **wineID**: String, quantity: Float)
 - Deliveries(orderID: String, status: String)

How To Create a Table?

```
CREATE TABLE table_name
```

```
(
```

```
    attribute1 data_type1,
```

```
    attribute2 data_type2,
```

```
    attribute3 data_type3,
```

```
    attribute4 data_type4,
```

```
    PRIMARY KEY (attribute1, attribute2),
```

```
    [FOREIGN KEY(column_name) REFERENCES other_table(other_column)]
```

```
)
```


Data Types In SQL

- String = TEXT
- Integer = INT
- Float/real number = FLOAT
- Date = DATE

Many other data types exist.

Example - Creation of Wines

```
CREATE TABLE Wines (  
  wineID TEXT,  
  vineyard TEXT,  
  year INT,  
  degree FLOAT,  
  PRIMARY KEY (wineID)  
)
```

wineID	vineyard	year	degree
--------	----------	------	--------

Example - Creation of Orders

CREATE TABLE Orders (

orderID **TEXT**,

date **DATE**,

clientID **TEXT**,

wineID **TEXT**,

quantity **FLOAT**,

PRIMARY KEY (orderID),

FOREIGN KEY(clientID) **REFERENCES** Clients(clientID),

FOREIGN KEY(wineID) **REFERENCES** Wines(wineID)

)

orderID	date	clientID	wineID	quantity
---------	------	----------	--------	----------

Example - Creation of Harvests

CREATE TABLE Harvests (

wineID **TEXT**,

producerID **TEXT**,

weight **FLOAT**,

PRIMARY KEY (wineID, producerID),

FOREIGN KEY(wineID) **REFERENCES** Wines(wineID),

FOREIGN KEY(producerID) **REFERENCES** Producers(producerID)

)

wineID	producerID	weight
--------	------------	--------

How To Delete a Table?

`DROP TABLE table_name;`

Example:

`DROP TABLE Wines;`



Data Modification In SQL

How To Insert New Values?

INSERT INTO table

VALUES ('value 1', 'value 2', ...),
('value 1', 'value 2', ...),
('value 1', 'value 2', ...),

Example - Insertion Into Wines

INSERT INTO Wines

VALUES ("W1", "Bordeaux", 1993, 13.5),
("W2", "Chinon", 2020, 12.5),
("W3", "Bordeaux", 2001, 11.0),
("W4", "Beaujolais", 2022, 12.0),
("W5", "Medoc", 2005, 11.0)

wineID	vineyard	year	degree
W1	Bordeaux	1993	13.5
W2	Chinon	2020	12.5
W3	Bordeaux	2001	11.0
W4	Beaujolais	2022	12.0
W5	Medoc	2005	11.0

Example - Insertion Into Harvests

```
INSERT INTO Harvests
VALUES ("W1", "P1", 11.9),
      ("W1", "P4", 1.7),
      ("W2", "P2", 6.3),
      ("W3", "P2", 23.0),
      ("W4", "P3", 4.8),
      ("W5", "P5", 10.3)
```

wineID	producerID	weight
W1	P1	11.9
W1	P4	1.7
W2	P2	6.3
W3	P2	23.0
W4	P3	4.8
W5	P5	10.3

How To Update a Value?

UPDATE table

SET attribute1 = 'new value 1', attribute2 = 'new value 2'

WHERE condition

Example - Changing the City of a Client

UPDATE Clients

SET city = "Pau"

WHERE clientID = "C2"

clientID	name	city
C1	Lois Leine	Bordeaux
C2	Georges Bout	Lyon
C3	Jules Vallet	Marseilles
C4	Arnold Miles	Bordeaux
C5	Claude Hars	Paris

Example - Changing the City of a Client

UPDATE Clients

SET city = "Pau"

WHERE clientID = "C2"

clientID	name	city
C1	Lois Leine	Bordeaux
C2	Georges Bout	Pau
C3	Jules Vallet	Marseilles
C4	Arnold Miles	Bordeaux
C5	Claude Hars	Paris

Example - Reusing Old Values

Double the harvests of wine W1:

UPDATE Harvests

SET weight = weight * 2

WHERE wineID = "W1"

wineID	producerID	weight
W1	P1	11.9
W1	P4	1.7
W2	P2	6.3
W3	P2	23
W4	P3	4.8
W5	P5	10.3

Example - Reusing Old Values

Double the harvests of wine W1:

UPDATE Harvests

SET weight = weight * 2

WHERE wineID = "W1"

wineID	producerID	weight
W1	P1	23.8
W1	P4	3.4
W2	P2	6.3
W3	P2	23
W4	P3	4.8
W5	P5	10.3

How To Delete Rows?

```
DELETE FROM table  
WHERE condition
```

Example - Deletion From Harvests

Delete all rows such that the weight is more than 20:

```
DELETE FROM Harvests  
WHERE weight > 20;
```

wineID	producerID	weight
W1	P1	23.8
W1	P4	3.4
W2	P2	6.3
W3	P2	23
W4	P3	4.8
W5	P5	10.3

Complements

Constraints

- We can apply constraints to a columns
 - E.g.: bank account must always have more than 0 euros, a person must be more than 18
- At the end of the table creation, we can add:
 - CHECK (condition)

Constraint - Example

```
CREATE TABLE BankAccounts(  
  userID TEXT,  
  amount FLOAT,  
  PRIMARY KEY (userID),  
  CHECK (amount >= 0)  
)
```

```
INSERT INTO BankAccounts  
VALUES ("U1", 10),  
      ("U2", 20)
```

```
UPDATE BankAccounts  
SET amount = amount - 20  
WHERE userID = "U1";
```



Transactions

- A transaction is a sequence of SQL commands that are connected.
 - E.g.: Transfer money from a bank account (send + receive), buy wine (check if there is enough stock + remove from stock + register the exchange in Orders)
 - A transaction is only composed of INSERT, UPDATE, and DELETE
- A transaction begins with:
 - **BEGIN TRANSACTION;**
- If the operations are successful, you can save the modifications with
 - **COMMIT;**
- Otherwise, you can decide to undo all the changes with:
 - **ROLLBACK;**

Transaction - Example 1

- Transfer 10€ from A to B:
 - a. Add 10€ to B's account
 - b. Remove 10€ from A's account

userID	amount
A	10
B	30

BEGIN TRANSACTION;

Transaction - Example 1

- Transfer 10€ from A to B:
 - a. Add 10€ to B's account
 - b. Remove 10€ from A's account

userID	amount
A	10
B	40

BEGIN TRANSACTION;

UPDATE BankAccounts

SET amount = amount + 10

WHERE userID = "B";

Transaction - Example 1

- Transfer 10€ from A to B:
 - a. Add 10€ to B's account
 - b. Remove 10€ from A's account

userID	amount
A	0
B	40

BEGIN TRANSACTION;

UPDATE BankAccounts

SET amount = amount + 10

WHERE userID = "B";

UPDATE BankAccounts

SET amount = amount - 10

WHERE userID = "A";

Transaction - Example 1

- Transfer 10€ from A to B:
 - a. Add 10€ to B's account
 - b. Remove 10€ from A's account

userID	amount
A	0
B	40

BEGIN TRANSACTION;

UPDATE BankAccounts

SET amount = amount + 10

WHERE userID = "B";

UPDATE BankAccounts

SET amount = amount - 10

WHERE userID = "A";

COMMIT;

Transaction - Example 2

- Transfer 20€ from A to B:
 - a. Add 20€ to B's account
 - b. Remove 20€ from A's account

userID	amount
A	10
B	30

BEGIN TRANSACTION;

Transaction - Example 2

- Transfer 20€ from A to B:
 - a. Add 20€ to B's account
 - b. Remove 20€ from A's account

userID	amount
A	10
B	50

BEGIN TRANSACTION;

UPDATE BankAccounts

SET amount = amount + 20

WHERE userID = "B";

Transaction - Example 2

- Transfer 20€ from A to B:
 - a. Add 20€ to B's account
 - b. Remove 20€ from A's account

userID	amount
A	10
B	50

BEGIN TRANSACTION;

UPDATE BankAccounts

SET amount = amount + 20

WHERE userID = "B";

UPDATE BankAccounts

SET amount = amount - 20

WHERE userID = "A";



Transaction - Example 2

- Transfer 20€ from A to B:
 - a. Add 20€ to B's account
 - b. Remove 20€ from A's account

userID	amount
A	10
B	30

BEGIN TRANSACTION;

UPDATE BankAccounts

SET amount = amount + 20

WHERE userID = "B";

UPDATE BankAccounts

SET amount = amount - 20

WHERE userID = "A";



ROLLBACK;

Creation And Modifications In Practice

Creation And Modifications In Practice

- The creation of the tables happens beforehand
- We need to translate the implicit and explicit inputs of the clients into SQL queries.

Creation And Modifications In Practice

Sign Up




It's quick and easy.

First name


Last name

Mobile number or email

New password

Birthday 

Mar 27 2023

Gender 

Female Male Custom

People who use our service may have uploaded your contact information to Facebook. [Learn more.](#)

By clicking Sign Up, you agree to our [Terms](#). Learn how we collect, use and share your data in our [Privacy Policy](#) and how we use cookies and similar technology in our [Cookies Policy](#). You may receive SMS Notifications from us and can opt out any time.

Sign Up

Programming Language
(PHP, Java, Python)

```
INSERT INTO Users  
VALUES (first_name,  
last_name,  
password,  
birthdate,  
gender,  
email  
)
```

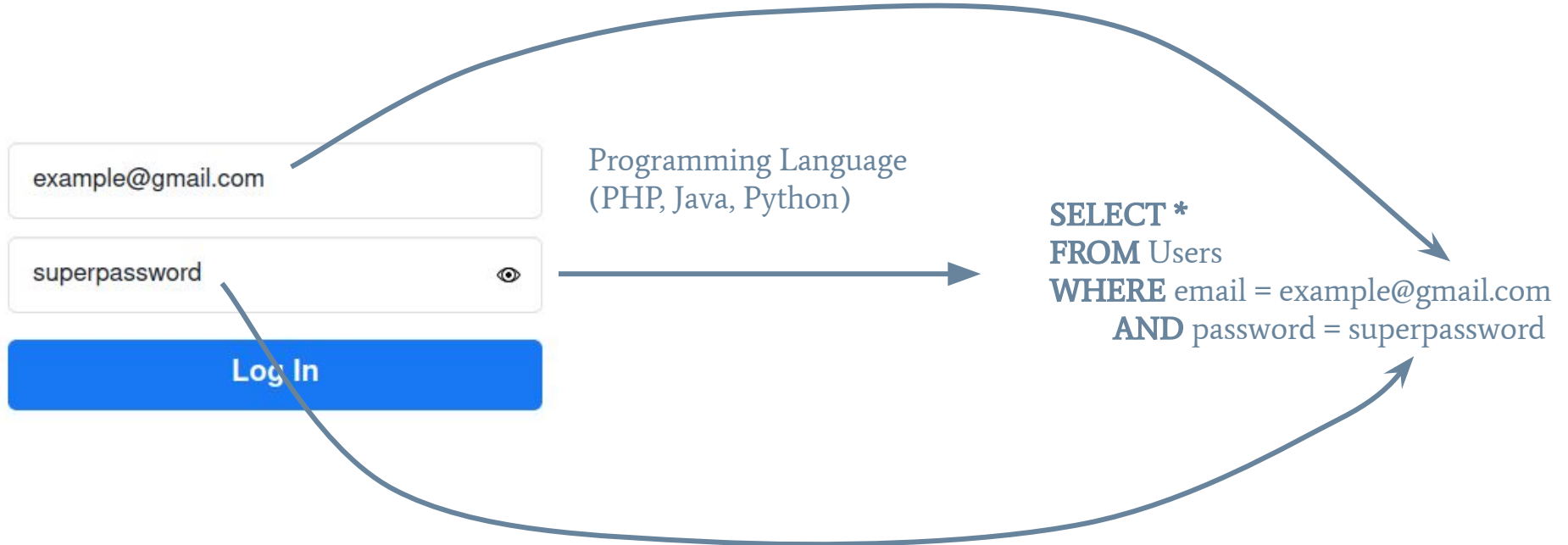
Creation And Modifications In Practice

Programming Language
(PHP, Java, Python)



```
SELECT *  
FROM Users  
WHERE email = my_email  
      AND password = my_password
```

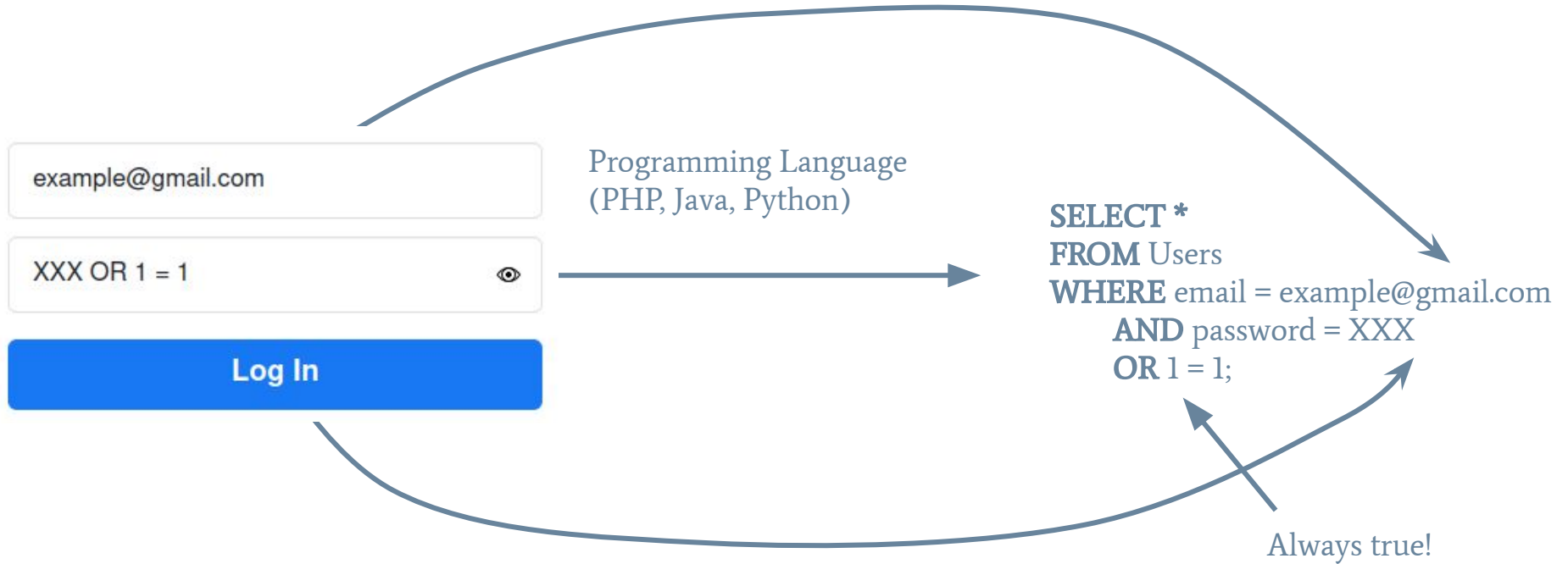

Creation And Modifications In Practice



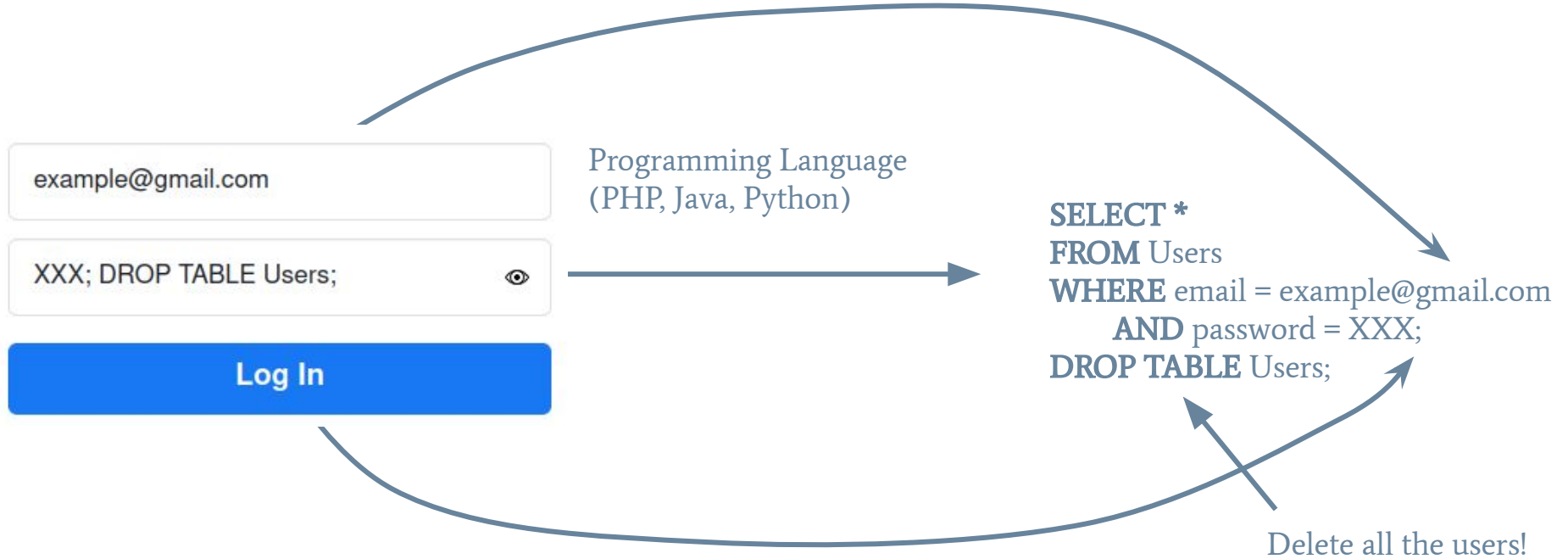
Security - SQL INJECTION

- A SQL injection is when you execute unwanted SQL code.
 - It often happens because of badly designed forms
- This problem can easily fixed if the programmer is aware of it.

Security - SQL INJECTION - Example



Security - SQL INJECTION - Example



Summary

- An RDBMS is a software that manages the interaction between a user and the data
- With SQL, we can:
 - Create and delete tables
 - Insert, update, and delete values from a table
 - Add constraint to the tables
 - Pack several operations into a single transaction
- Beware of SQL injections!