Databases
-
Chapter I: Introduction

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References

Further study required

- "Fundamentals of Database Systems", Elmasri & Navathe, 6th Edition, Adison Wesley, 2011, *Chapter 1: Databases and Database Users*

Some concepts
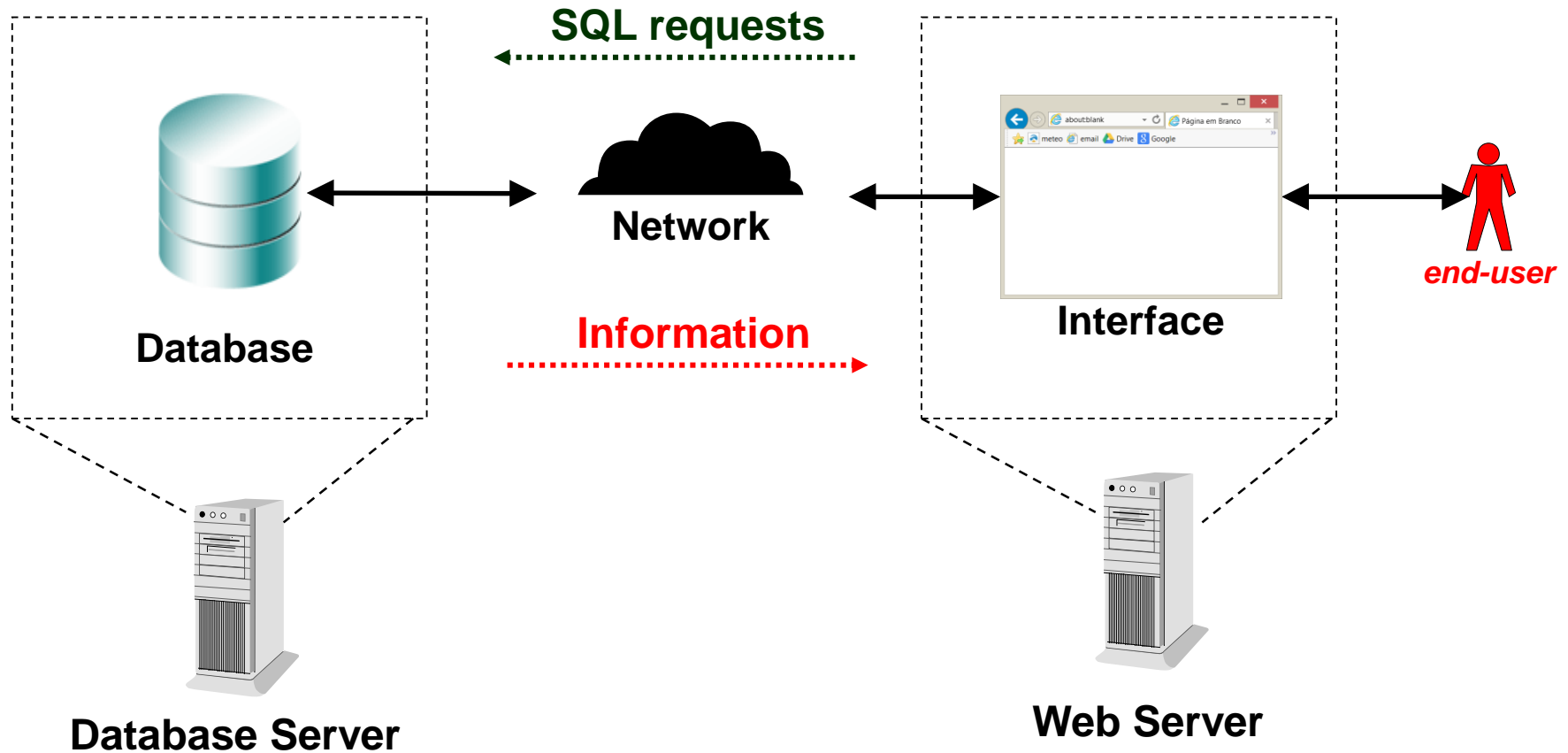
- Information system
- Data vs Information
- Database

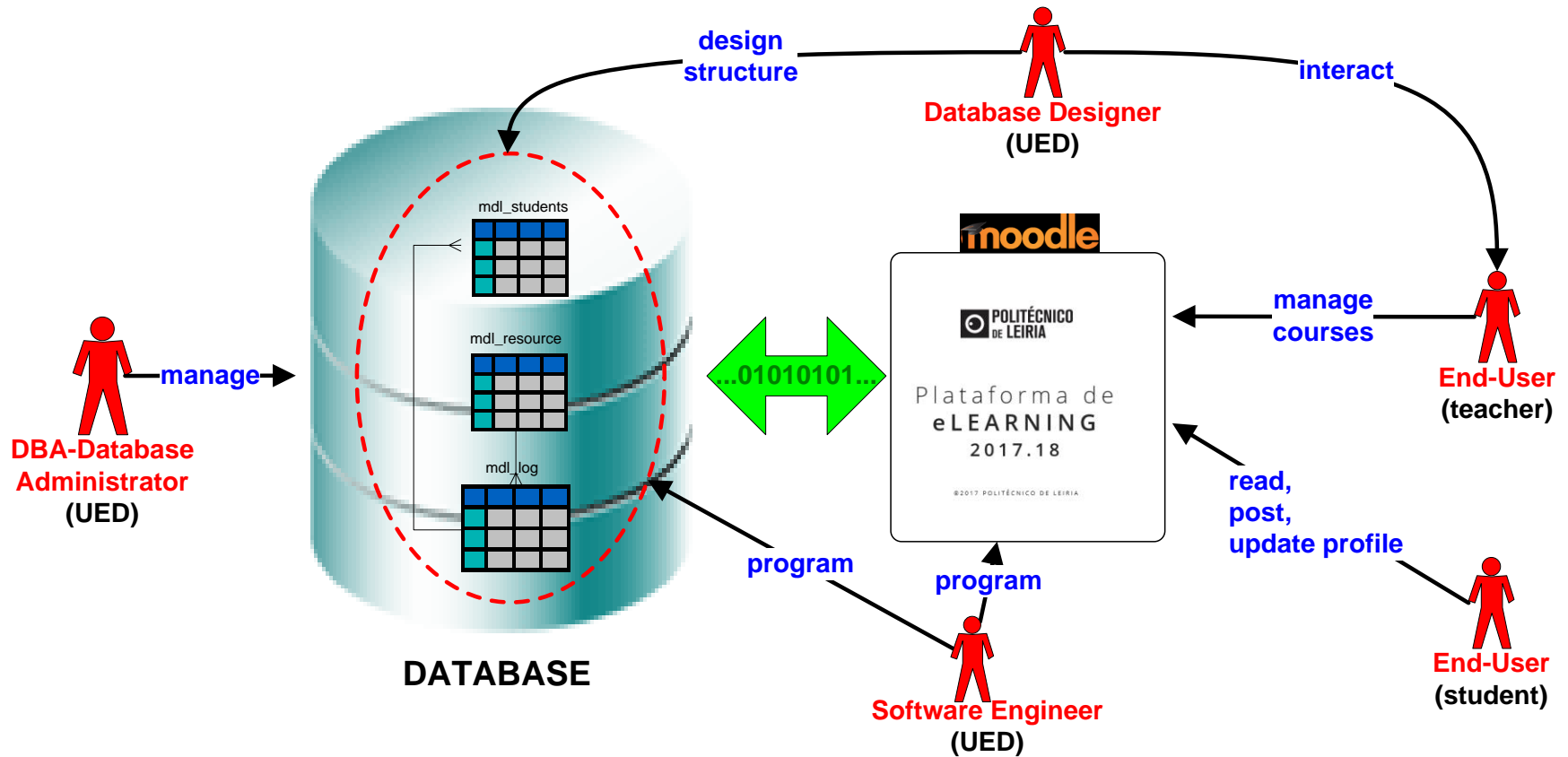"A database is a collection of related data"

(Elmasri & Navathe, 2009)

"A shared collection of logically related data,
 and a description of this data, designed to meet
 the information needs of an organization."

(Connolly & Begg, 2005)

Information Systems: a typical configuration

SQL requests

Network

Information

Database

Interface

Database Server

Web Server

end-user

Information Systems: an example

design structure → Database Designer (UED)

interact

manage → DBA-Database Administrator (UED)

mdl_students

mdl_resource

mdl_log

...01010101...

DATABASE

moodle

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manage courses ← End-User (teacher)

read, post, update profile ← End-User (student)
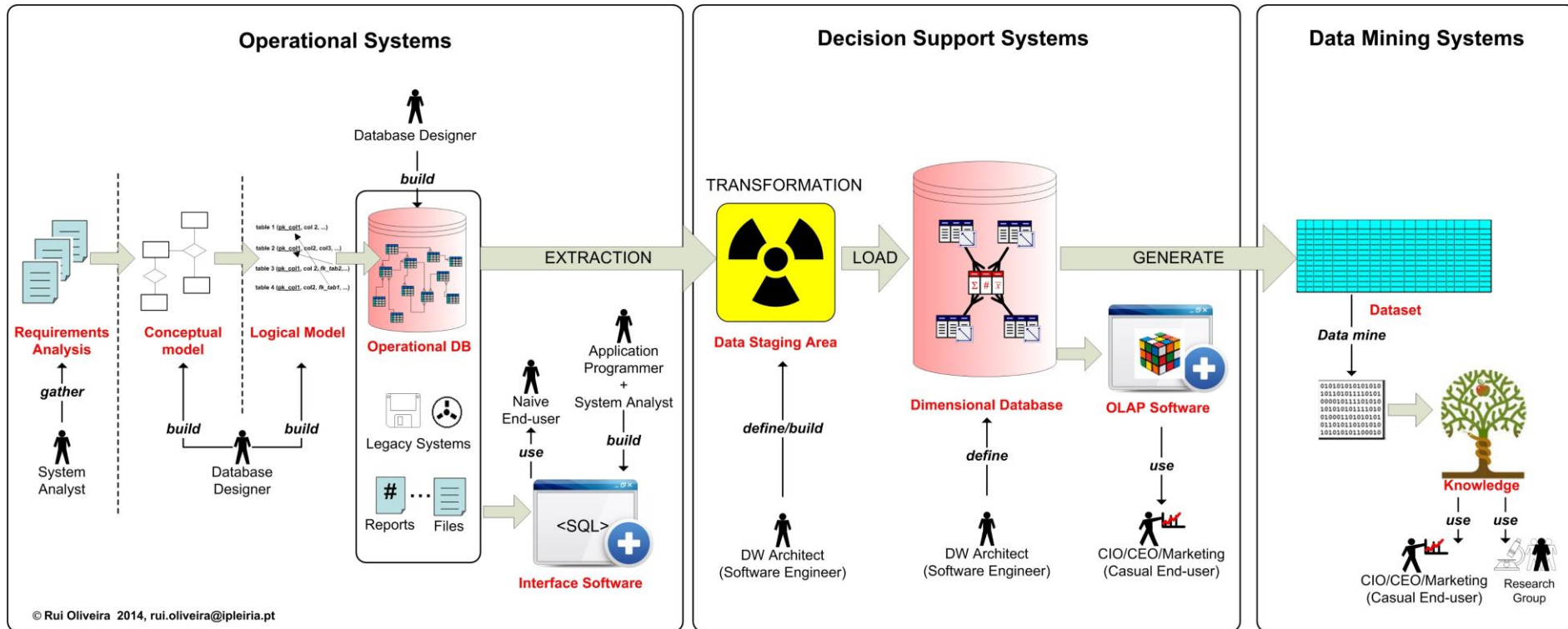
program → Software Engineer (UED)

program

type of actor

← *action* —

UED=Unidade de Ensino à Distância

Information Systems: main areas

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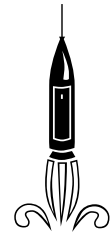
focus:
data

focus:
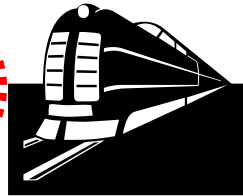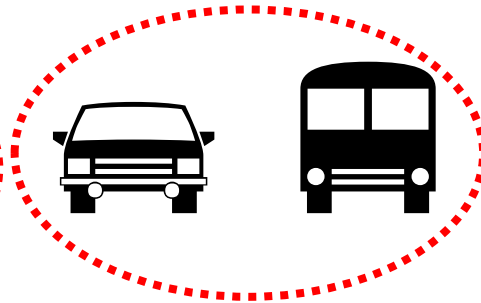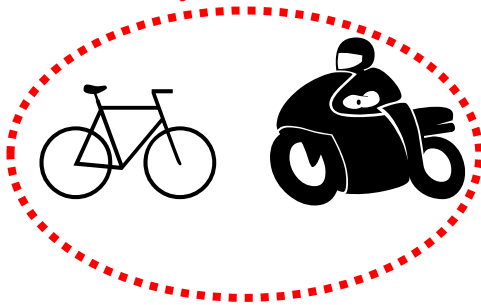**information**

focus:
knowledge

Databases: historical evolution

File Management Systems

Relational DB

Now

Once upon a time...

- System complexity
Processing capacity
Cost
Data volume and complexity
Information flexibility and complexity

+

Why relational Databases were born?

Relational Databases:

- Are based on the *Relational Model*

- Use bidimensional tables as data storage structures, using keys to **relate** data

- Use a simple, powerful and universally adopted language (SQL) to store data, to share and produce information

- Managed by a specific software, the Relational Database Management System (RDBMS or *Sistema de Gestão de Bases de Dados*, in PT). Examples: Oracle, Microsoft SQL Server, MySql

Common scenarios:

- Continente, Worten, Portal da Saúde, Moodle, GISEM

"Do I need a Relational Database?"

First, consider:

- What is the data volume and complexity?
- What security level is required at data access?
- How many users exist per type of user?
- Will data be simultaneously accessible by many?
- How reliable must the storage mechanism be?

Then, ask: "*Isn't a File Management System enough?*"

- XML, text files, shared files

Do I need a database?

Data is everywhere, everything is data

First ask

- How much data do I have?
- How complex is my data?
- How secure must the data be?
- Can I use simple file management? (XML, text files,...)
- How many users will access the data?

Examples near you

- Continente, Worten, SNS, Decathlon, Inscrições nos turnos, Moodle, IPMA, …

Will the world still need databases?

You will live,
your kids will will live,
your grandchildren will live,
your grand-grandchildren will have lived
and your data will still be ***stored*** *and* ***relevant***
to someone...

Accessing Databases

Universal programming language

- SQL, *Structured Query Language*

Available basic data operations

- Insert new rows
- Update old data
- Delete old data
- Select existing data

Data storage in a database

TABLE clients

id	name	address	phoneNr
1	António Freitas	Leiria	123456
2	Manuel da Silva	Lisboa	111222
...	...	...	...
100	Maria de Sousa	Porto	121212

ROW

COLUMN

What do users expect from a database?

Different scenarios => different expectations

- Is data safe from attacks?

- Will data be safely stored?

- Will information retrieval be fast? (what is fast?)

- Will GUI programmers easily build interfaces?

- Is the data scalable?

≠

What do users expect from a database?

Different scenarios => different expectations

$\neq$

Bad ways of looking at databases :(

Don't think like this…

- "I'm a Web programmer"
- "The database is self-managed by the operating system" (the **black box approach**)
- "What I really like is to code"

… just because you think or heard that

- "Databases are complex"
- "Databases are inflexible"
- "Databases are boring"
- "Databases will end **soooooon**" (old Inca prophecy?)
- "Databases *this*, databases *that...*"

No excuses allowed...

[you] "I only like programming"

[reality] Databases require heavy programming in SQL and PL/SQL (e.g., Oracle)

    => `become a Database Programmer`

[you] "I only like systems' management"

[reality] Databases need an optimized and always running database engine software and server

    => `become a Database Administrator`

[you] ""I'm *dig* idealizing solutions""

[reality] Databases require professionals with strong modeling and abstraction skills to keep it scalable

    => `become a Database Designer/Analyst`

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No excuses allowed...

[you] "I'm a security freak"

[reality] Databases require data protection and strong programming skills to keep data private and attack-safe

> => become a Database Administrator

[you] "I only like building interfaces"

[reality] Nowadays, interfaces require the access to data, so if you don't understand how the database works, your interfaces will perform poorly

> => learn strong SQL skills

> => learn the basics about database servers

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No excuses allowed...

[you] "I'm shy..."

[reality] So am I! But data makes an excellent conversation
   topic.

```
=> learn databases
```

[you] "I'm too tall"

[reality] Good for you, you will reach the top faster!

```
=> learn databases
```

[you] "No, you don't understand! I'm really tall!"

[reality] Good! You will see the world's problems from above
   and better discover how data can solve them.

```
=> learn databases
```

Skipping database learning
in a *data based* world: *utopia*

One often meets his
destiny on the road he
takes to avoid it.

Grand Master Oogway,
in **Kung-fu Panda**