



Introduction to Database Systems: CS312

An Overview of Databases

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2 Sept 2020



What is the function of a database?



- Database Applications:

- Banking: transactions
 - Airlines: reservations, schedules
 - Universities: registration, grades
 - Sales: customers, products, purchases
 - Online retailers: order tracking, customized recommendations
 - Manufacturing: production, inventory, orders, supply chain
 - Human resources: employee records, salaries, tax deductions

Databases at *Our College!*

Database
applications

I have
connections

Common
problems

Group Work



- Application:
 - Adding new students, instructors, and courses
 - Registering students for courses, and generate class rosters
 - Assigning grades to students,
 - Computing grade point averages (GPA)
 - Generating transcripts

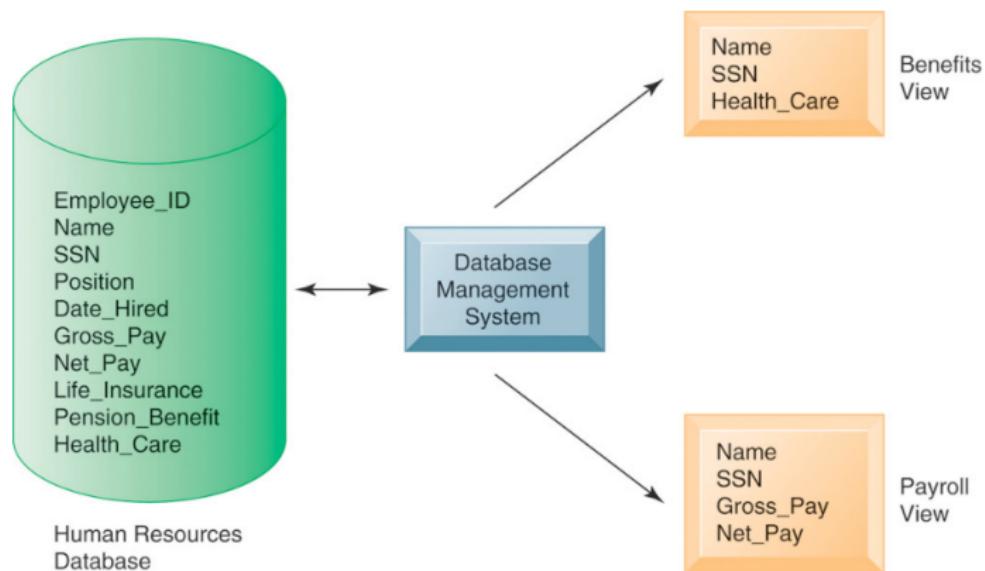
To connect data in some meaningful way

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Database - A *True Story* (sort of)

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*A long time ago
in a galaxy far,
far away...*

- Databases were not always used as they are today ...
- They were often disconnected systems
- Isolated from other systems that contained similar data.
- (Why would anyone use this configuration??)

Meanwhile at *Batman and Associates...*

One database was working well...

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- One (simple) working database containing all company information.

Two teams join *Batman and Associates...*

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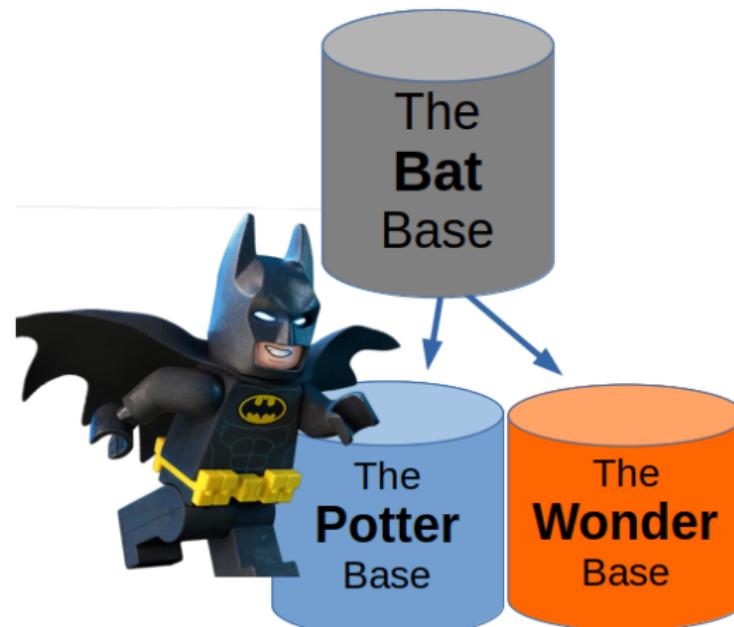


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- The database is copied into two new identical bases for use by two different teams in the Bat-cave.

Each team gets own DB...

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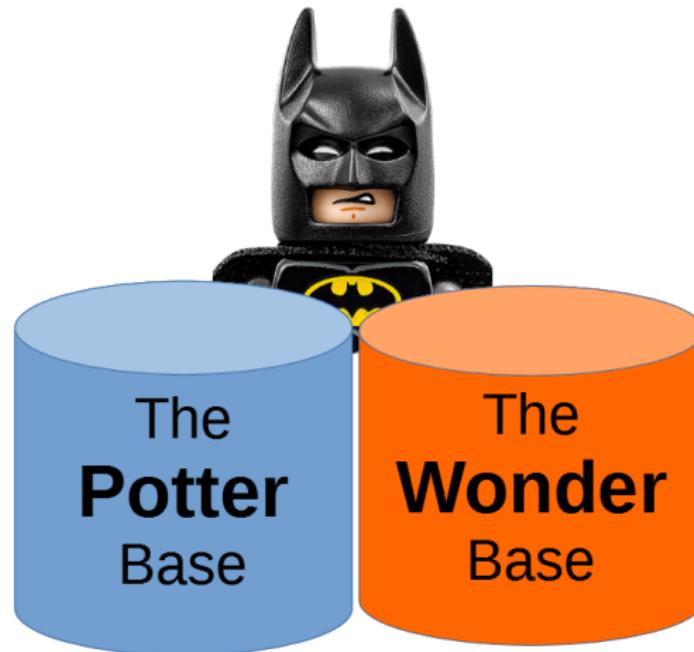


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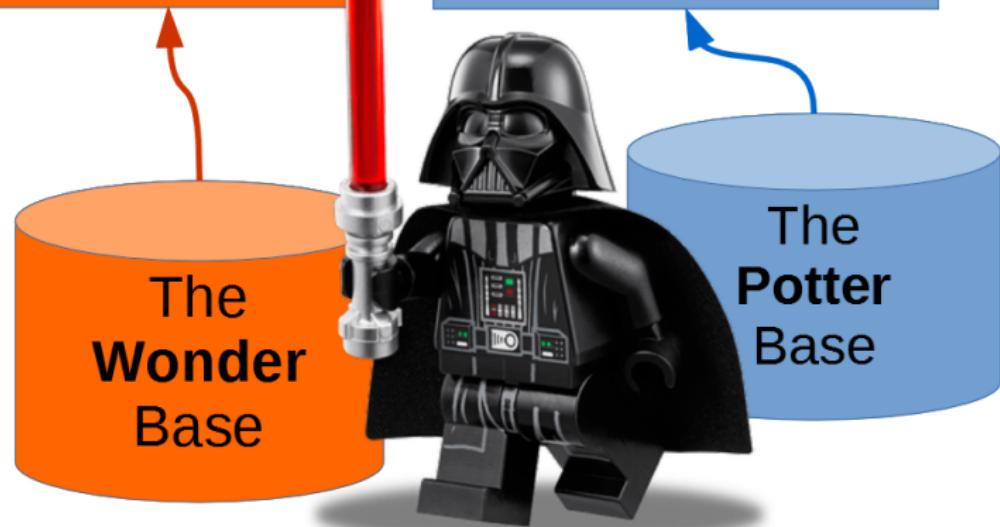
- *Nearly identical: no equal updating of each base.*
- Teams verbally communicate changes to each other



Dr. Vader's actual address?

1st Address:
221b Baker Street
London, England

2nd Address:
1600 Pennsylvania Avenue,
Washington, DC





How Many Databases Do You Need??

Common problems

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Let's talk about ...

Common Problems with Databases



How Many Databases Do You Need??

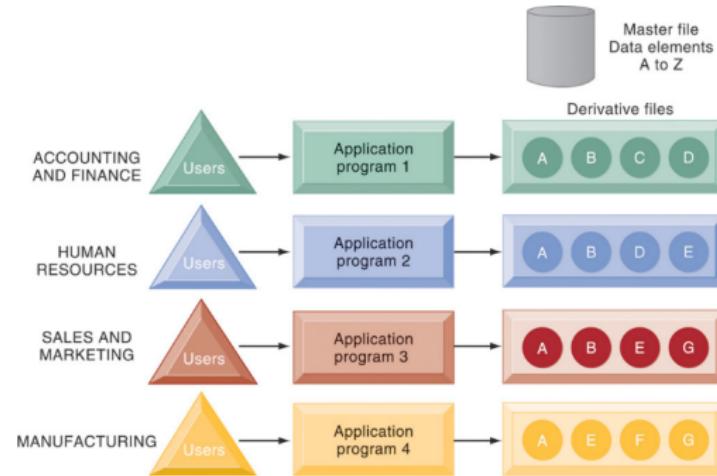
Common problems

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- Database applications were once built directly on top of file systems (i.e., permanent records of information in various spread-out files)
- A firm may have managed several information sources!
- Anything wrong with this picture?

Messy Data Storage?

Risks of having several different DBs for same information

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- Drawbacks of using file systems to store data
 - **Data redundancy and inconsistency**
 - Multiple file formats, duplication of information in different files - hard to share
 - Difficulty in accessing data
 - Need to write a new program to carry out each new task
 - **Data redundancy and inconsistency**
 - Data isolation - multiple files and formats

Messy Data Storage?

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- Drawbacks of using file systems to store data, continued
 - **Data redundancy and inconsistency**
 - Integrity problems - The data is not accurate and consistently stored
 - **Data redundancy and inconsistency**
 - Integrity constraints (i.e., account balance ≥ 0) become “buried” in program code rather than being stated explicitly
 - Hard to add new constraints or change existing ones

- How many times did you see, “**Data redundancy and inconsistency**”, here??
- How many times should you see the same data in your DB??

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• Atomicity of updates

- An *atomic* transaction is an indivisible and irreducible series of database operations such that either all occur, or nothing occurs.
- Failures may leave database in an inconsistent state with **partial** updates carried out
- Example: Transfer of funds from one account to another should either complete or not happen at all

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- **Concurrency:** transactions at same time

- Access by multiple users
- Access needed for performance - no slow-down
- Uncontrolled concurrent accesses can lead to inconsistencies Example: Two people reading a balance (say 100) and updating it by withdrawing money (say 50 each) at the same time



- Security problems
 - Hard to provide user access to some, but not all, data
 - Difficult to control how data is used
 - How to watch all databases, all the time?
 - Database systems offer solutions to all the above problems

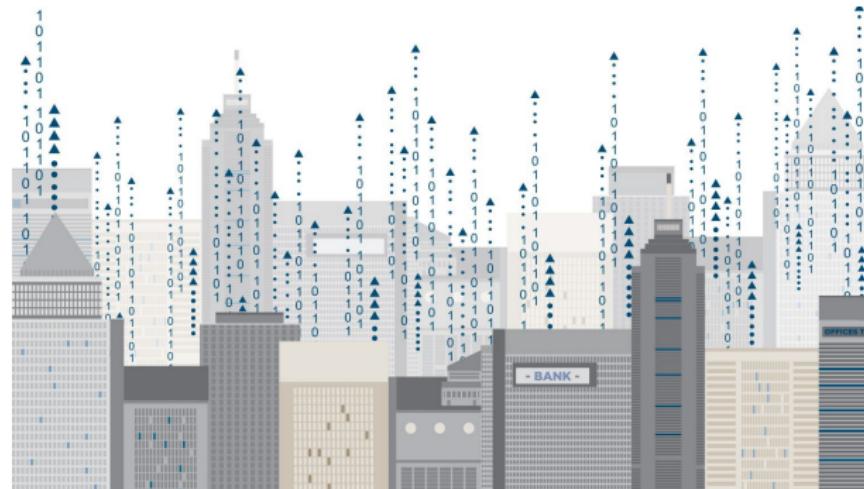
Video: Finding Trends in Data

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- Hans Rosling's 200 Countries, 200 Years, 4 Minutes - The Joy of Stats
- <https://www.youtube.com/watch?v=jbkSRLYSOjo>

Video: Questions

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- ① What kind of data was likely being used for this study?
- ② Where could a database serve in this project?
- ③ How was the data likely organized for the study?
- ④ What kinds of relationships were likely used to connect data points?
- ⑤ How could this study be done in absence of a database?