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F27WD: Web Design & Databases

Databases Lecture 5:

Management

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More on DBMSs, plus
Adding, deleting and modifying columns

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What is a database?

- A collection of:
  - Data
  - Metadata: data about data - e.g.,
    - the description of the data
    - the relationships between types of data

- In general, metadata can mean lots of different things - timestamps, information about where the data came from, etc.

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How do we maintain & manage DBs?

We need a Database Management System

A database management system (DBMS) is a software package designed to define, manipulate, retrieve and manage data in a database. A DBMS generally manipulates the data itself, the data format, field names, record structure and file structure. It also defines rules to validate and manipulate this data. A DBMS relieves users of framing programs for data maintenance. Fourth-generation query languages, such as SQL, are used along with the DBMS package to interact with a database[1].

[1]https://www.techopedia.com/definition/24361/database-management-systems-dbms

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Main roles of the DBMS

A DBMS controls access to a database, providing

security, to prevent unauthorised access

integrity, to maintain consistency of stored data

concurrency control, to permit shared access

recovery control, to recover from software or hardware failure

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Altering the schema of DBs

We saw last week how we could update the data within tables in a database.

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Altering the schema of DBs

We saw last week how we could update the data within tables in a database.

Now we will look at how the DBMS will allow us to change the tables themselves.

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Altering the schema of DBs

To alter a table, we use the ALTER TABLE command!

ALTER TABLE <*table to alter*> <*WHAT WE WANT TO DO*> <*column to alter*> <*datatype (if nec)*>

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Altering the schema of DBs

There are three things we can do:

ALTER TABLE <*table to alter*> ADD <*column to alter*> <*datatype*>

ALTER TABLE <*table to alter*> DROP COLUMN <*column to alter*>

ALTER TABLE <*table to alter*> ALTER COLUMN <*column to alter*> <*datatype*>

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Adding columns

ALTER TABLE <*table to alter*> ADD <*column to alter*> <*datatype*>

This will add a column with a given datatype to the table … for example:

ALTER TABLE Agent ADD address VARCHAR(50);

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Adding columns

ALTER TABLE <*table to alter*> ADD <*column to alter*> <*datatype*>

This will add a column with a given datatype to the table … for example:

ALTER TABLE Agent ADD address VARCHAR(50);

Agent			
AgentName	Contact	Account	Address
Smith	729002394	19280293	(null)
Jones	483920493	16394053	(null)
Lane	593029348	15293013	(null)

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Adding columns

Agent			
AgentName	Contact	Account	Address
Smith	729002394	19280293	(null)
Jones	483920493	16394053	(null)
Lane	593029348	15293013	(null)

We don’t yet have any data for this new column. We need to add that. What command to we use for that?

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Adding columns

Agent			
AgentName	Contact	Account	Address
Smith	729002394	19280293	(null)
Jones	483920493	16394053	(null)
Lane	593029348	15293013	(null)

We don't yet have any data for this new column. We need to add that. What command to we use for that?

INSERT INTO to used to create a **new row**. We **don't** want to do that here - the rows already exist.

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Adding columns

Agent			
AgentName	Contact	Account	Address
Smith	729002394	19280293	(null)
Jones	483920493	16394053	(null)
Lane	593029348	15293013	(null)

The simplest way is to use UPDATE.

UPDATE Agent SET address = "29 Acacia Ave";

What will this give us?

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Adding columns

Agent			
AgentName	Contact	Account	Address
Smith	729002394	19280293	(null)
Jones	483920493	16394053	(null)
Lane	593029348	15293013	(null)

The simplest way is to use UPDATE.

UPDATE Agent SET address = "29 Acacia Ave";

Agent			
AgentName	Contact	Account	Address
Smith	729002394	19280293	29 Acacia Ave
Jones	483920493	16394053	29 Acacia Ave
Lane	593029348	15293013	29 Acacia Ave

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Adding columns

To give different address to different agents, we need to use a WHERE clause, and add different UPDATE clauses for every row we want to give new information about.

UPDATE Agent SET address = "29 Acacia Ave" WHERE name = "Lane";

UPDATE Agent SET address = "15 Brunswick St" WHERE name = "Smith";

Agent			
AgentName	Contact	Account	Address
Smith	729002394	19280293	15 Brunswick St
Jones	483920493	16394053	(null)
Lane	593029348	15293013	29 Acacia Ave

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Dropping columns

Agent			
AgentName	Contact	Account	Address
Smith	729002394	19280293	15 Brunswick St
Jones	483920493	16394053	(null)
Lane	593029348	15293013	29 Acacia Ave

If we want to drop a column, we use DROP.

e.g., ALTER TABLE Agent DROP COLUMN contact

Note: we need to use the word ‘COLUMN’ after DROP (which we don’t need to for ADD. We also don’t need to specify a datatype - it doesn’t matter what the datatype is for a column you are deleting.

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Dropping columns

Agent		
AgentName	Account	Address
Smith	19280293	15 Brunswick St
Jones	16394053	(null)
Lane	15293013	29 Acacia Ave

What would happen if we state:

ALTER TABLE Agent DROP COLUMN account?

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Altering columns

Agent		
AgentName	Account	Address
Smith	19280293	15 Brunswick St
Jones	16394053	(null)
Lane	15293013	29 Acacia Ave

What would happen if we state:

ALTER TABLE Agent DROP COLUMN account?

We would get an error: *Cannot drop index 'account': needed in a foreign key constraint*

Account is a **foreign key**, so if we want to remove it, we have to first remove the statement of it being a foreign key.

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Dropping columns

Agent		
AgentName	Account	Address
Smith	19280293	15 Brunswick St
Jones	16394053	(null)
Lane	15293013	29 Acacia Ave

What would happen if we state:

ALTER TABLE Agent DROP COLUMN address?

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Dropping columns

Agent		
AgentName	Account	Address
Smith	19280293	15 Brunswick St
Jones	16394053	(null)
Lane	15293013	29 Acacia Ave

What would happen if we state:

ALTER TABLE Agent DROP COLUMN address?

It will delete that column *and all the data it contains.*

Agent	
AgentName	Account
Smith	19280293
Jones	16394053
Lane	15293013

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Modifying columns

Agent		
AgentName	Account	Address
Smith	19280293	15 Brunswick St
Jones	16394053	(null)
Lane	15293013	29 Acacia Ave

We can also alter the datatype of columns. For this, you need to either use ALTER COLUMN, MODIFY COLUMN or MODIFY - depending on what version of SQL you are using. In SQL Fiddle (which I am using during lectures), we use MODIFY COLUMN.

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Modifying columns

Agent		
AgentName	Account	Address
Smith	19280293	15 Brunswick St
Jones	16394053	(null)
Lane	15293013	29 Acacia Ave

What would happen if we stated:

ALTER TABLE Agent MODIFY COLUMN address INT;

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Modifying columns

Agent		
AgentName	Account	Address
Smith	19280293	15 Brunswick St
Jones	16394053	(null)
Lane	15293013	29 Acacia Ave

What would happen if we stated:

ALTER TABLE Agent MODIFY COLUMN address INT;

We would get an error - we have data in that column that is not of type INT.

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Modifying columns

Agent		
AgentName	Account	Address
Smith	19280293	15 Brunswick St
Jones	16394053	(null)
Lane	15293013	29 Acacia Ave

We could nullify all our data:

UPDATE Agent SET address = null;

Then the modify column command would work.

This is effectively deleting a column and adding a new one (with the same name).

Agent		
AgentName	Account	Address
Smith	19280293	(null)
Jones	16394053	(null)
Lane	15293013	(null)

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Modifying columns - a new datatype

Agent		
AgentName	Account	Address
Smith	19280293	15 Brunswick St
Jones	16394053	(null)
Lane	15293013	29 Acacia Ave

We could state:

ALTER TABLE Agent MODIFY COLUMN address TEXT;

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Modifying columns - a new datatype

Agent		
AgentName	Account	Address
Smith	19280293	15 Brunswick St
Jones	16394053	(null)
Lane	15293013	29 Acacia Ave

But we could state:

ALTER TABLE Agent MODIFY COLUMN address TEXT;

So what is **TEXT**? Anything of type TEXT is also of type VARCHAR(X) - as long as it's not longer than X characters.

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Views

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What are views?

Views are relevant presentations of the data within a DB.

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What are views?

Views are relevant presentations of the data within a DB.

They are important because seeing everything is chaotic and confusing - *users need to be shown only relevant data.*

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How is this possible?

You can choose exactly what you want to see by developing complex queries — we've already looked at how to extract exactly what we want.

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How is this possible?

You can choose exactly what you want to see by developing complex queries — we've already looked at how to extract exactly what we want.

But there are often common things certain users want to see.

A DB administrator can create a **view** so that they can easily see this without having to develop a complex query.

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Views - an example

The university has a DB of lecturers, including things like: name, office, courses, home address, salary, bank account.

Students *need a view on lecturers giving name, office and courses.*

Finance *need a view including salary and bank account.*

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Permissions

Permissions allow the DBMS to restrict access to certain kinds of data to certain kinds of users.

We're not going to look into this in this course, but views are one way in which DBMSs can enforce permissions.

e.g., if you are registered as a **student user**, you can only see the **student view** of the data

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Views in our running example

Remember this?

```
UPDATE BankAccount SET balance=
(
  SELECT balance FROM (SELECT * FROM BankAccount) AS oldBalance
  WHERE number=(
    SELECT account FROM Actor WHERE name="Jemma Laurence"
  )
) - 100000
WHERE number=(
  SELECT account FROM Actor WHERE name="Jemma Laurence"
);
```

We can simplify this using a VIEW

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Views in our running example

CREATE VIEW <*ViewName*> AS <*query*>

CREATE VIEW NameBalance AS

SELECT name, balance FROM Actor JOIN BankAccount ON account=number;

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Views in our running example

```
UPDATE NameBalance SET balance=
(
  SELECT balance from (SELECT * from NameBalance) AS oldBalance WHERE
name="Jemma Laurence"
) - 100000
WHERE name="Jemma Laurence";
```

It still not simple, but it's simpler than it was …

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Levels

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The three levels of DBs

An important role of the DBMS is the separation of the different levels of a database:

- Physical / internal layer
- Logical / conceptual layer
- View / external layer

This keeps users from seeing more technical detail than they need.

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Physical or internal layer

The **physical schema** describes how the data is stored.

It deals with complex, low-level data structures, file structures and access methods in detail.

It also deals with data compression and encryption techniques if they are used.

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Logical or conceptual layer

The **logical layer** describes what data is stored in the database and what relationships exist among the data.

This is the layer the database administrator works at. When you are creating E-R diagrams and turning them into databases, you are working at the logical layer.

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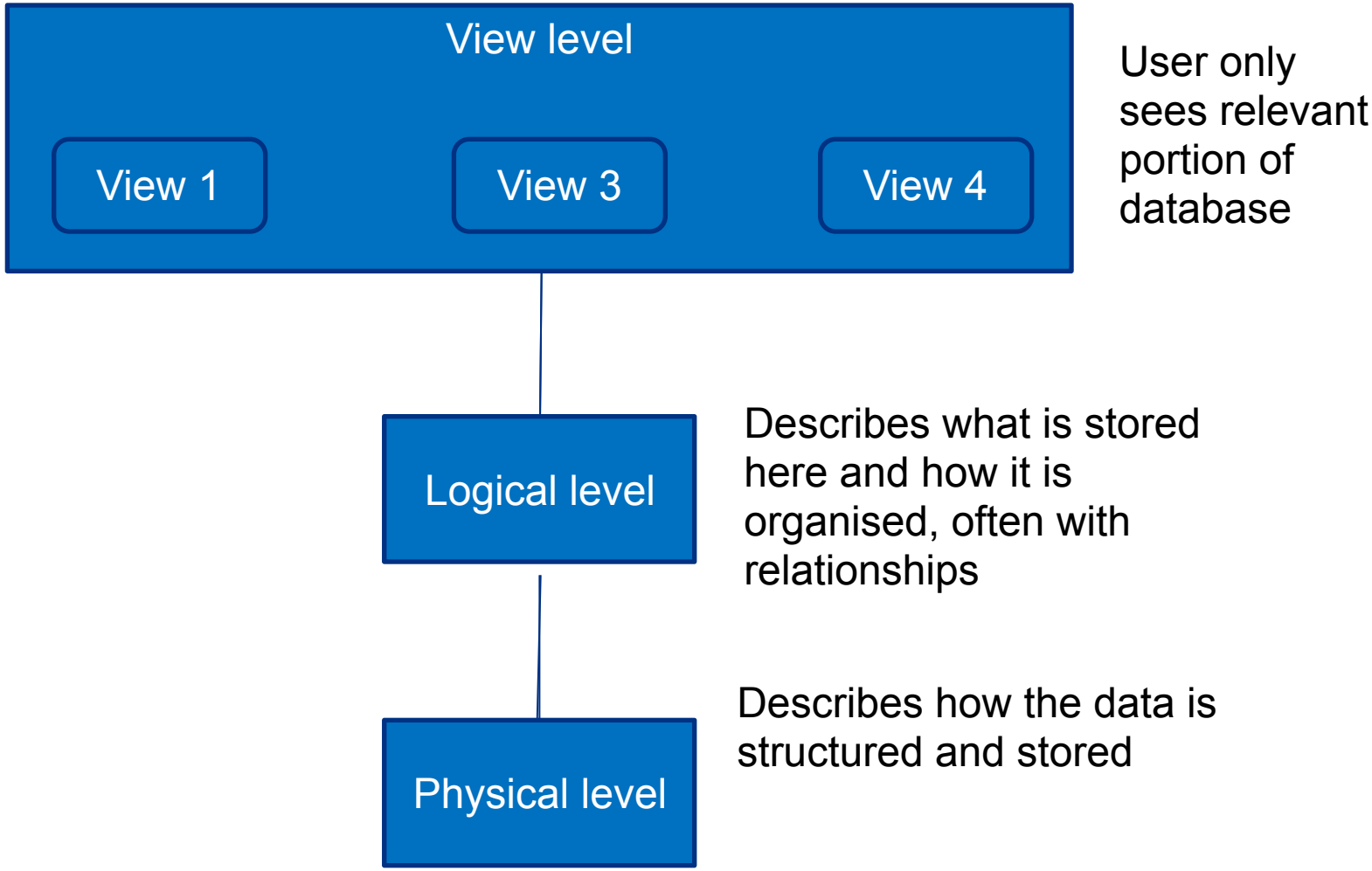
View or external layer

The **view layer** describes the part of the database that users can access.

A user need only see those parts of the database that directly concern them.

Permissions can be used so that a user is **only able** to view some parts of the database.


View level
View 1
View 3
View 4
User only sees relevant portion of database
Logical level
Describes what is stored here and how it is organised, often with relationships
Physical level
Describes how the data is structured and stored

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Summary

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MySQL and SQL

- This is the end of our look at SQL and MySQL
- This is the last lecture of the course that contains new material

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What's next?

- Today's lab:
  - Keep working on any sheet (SQL or PHP) that you haven't finished.
  - If you have done all of these, you can use the time work in your groups on your assignment.
  - Lab helpers will only give you very general advice around assignments!

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What's next?

- Wednesday's lecture:
  - A hands-on session looking back at SQL and relational diagrams
  - Optional - for those that would like a bit more practice
  - Please bring a laptop and something to draw diagrams on (paper if you prefer, or something like power point)

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What's next?

- Monday's lecture:
  - A review of the whole course, focussing on what's likely to be in the exam.
  - Discussion about what the exam will be like and how to do it.
  - Strongly recommended for everyone - even those who've found the course straightforward.