

CS213

Principles of Database Systems(H)

Chapter 12

Shiqi YU 于仕琪

yusq@sustech.edu.cn

Most contents are from Stéphane Faroult's slides

12.1 Change data through views

Shiqi Yu 于仕琪

yusq@sustech.edu.cn



What about **CHANGING DATA** through views?

If views are in theory like tables, why not using them for controlling not only what you SEE, but what you CHANGE?

Lots of things can go wrong

It all depends on the view ... The problem is that most views are designed to provide a more user-friendly view of data: joins transforming codes into more legible values, functions making data prettier (date formatting, for instance). And by doing so you often lose information.

For instance if your view concatenates first_name and surname, splitting a single string in two parts is tough if you want to insert through the view.

case

```
when p.first_name is null then p.surname  
else p.first_name || ' ' || p.surname
```

end name



Tommy Lee Jones

Benicio Del Toro



Everybody isn't called 'Gary Cooper'.

```
create view vmovies
as select m.movieid,
          m.title,
          m.year_released,
          c.country_name
from movies m
      inner join countries c
            on c.country_code = m.country
```

And for updates ... Let's have a view that displays the country name rather than code.

from movies

from countries

movieid	title	year_released	country_name
2	Blade Runner	1982	United States
6	Das Boot	1985	Germany
9	Goodfellas	1990	United States
15	Le cinquième élément	1997	France
22	The Lord of the Rings	2001	New Zealand
27	We Feed the World	2005	Australia
25	Ying hung boon sik	1986	Hong Kong

Wrong!
AUSTRIA, not Australia!

CORRECTION

```
create view vmovies
as select m.movieid,
          m.title,
          m.year_released,
          c.country_name
     from movies m
      inner join countries c
            on c.country_code = m.country
```

SQL Server would let you update ... and try to change the name in table COUNTRIES.

Most products will express concern and prevent you from doing it.

The screenshot shows a MySQL Workbench interface. The toolbar at the top includes icons for execution, transaction status, and schema browser, followed by 'Tx: Auto' and other standard database management tools. The connection name 'filmdb.p...' is visible on the right. The main area displays a SQL query:

```
1 ! update vmovies
2   set country_name='Australia'
3   where movieid=27;
```

The third line of the query, 'where movieid=27;', is highlighted with a blue selection bar. The status bar at the bottom indicates the current row number as '4'.

[55000] ERROR: cannot update view "vmovies"

详细: Views that do not select from a single table or view are not automatically updatable.

建议: To enable updating the view, provide an INSTEAD OF UPDATE trigger or an unconditional ON UPDATE DO INSTEAD rule.

Abandon all hope, ye who enter here



In many cases, view update is simply impossible.

Most joins

Aggregates

Expressions

Omitted
mandatory columns
(insert)

**Sometimes
it works very well**

In some cases, view update is quite possible.

This will work fine with Oracle, which would have complained with a join

One table

```
create or replace view vmy_movies  
as select m.movieid,  
        m.title,  
        m.year_released,  
        m.country  
      from movies m  
     where m.country in  
           (select c.country_code  
            from countries c  
           inner join user_scope u  
                 on u.continent = c.continent  
            where u.username = user)
```

USER_SCOPE

Username	Continent
HUIZHONG	ASIA
PAVEL	EUROPE
IBRAHIM	AFRICA
AMINATA	AFRICA
MICHAEL	EUROPE
JUAN_CARLOS	AMERICA
SANDEEP	ASIA
PATRICIA	AMERICA
PATRICIA	EUROPE

USER_SCOPE

Username	Continent
HUIZHONG	ASIA
PAVEL	EUROPE
IBRAHIM	AFRICA
AMINATA	AFRICA
MICHAEL	EUROPE
JUAN_CARLOS	AMERICA
SANDEEP	ASIA
PATRICIA	AMERICA
PATRICIA	EUROPE

```
create or replace view vmy_movies
as select m.movieid,
          m.title,
          m.year_released,
          m.country
     from movies m
    where m.country in
        (select c.country_code
         from countries c
           inner join user_scope u
             on u.continent = c.continent
            where u.username = user)
```

Everything else
in a subquery

Which proves that in some cases join and subquery aren't exactly equivalent ...

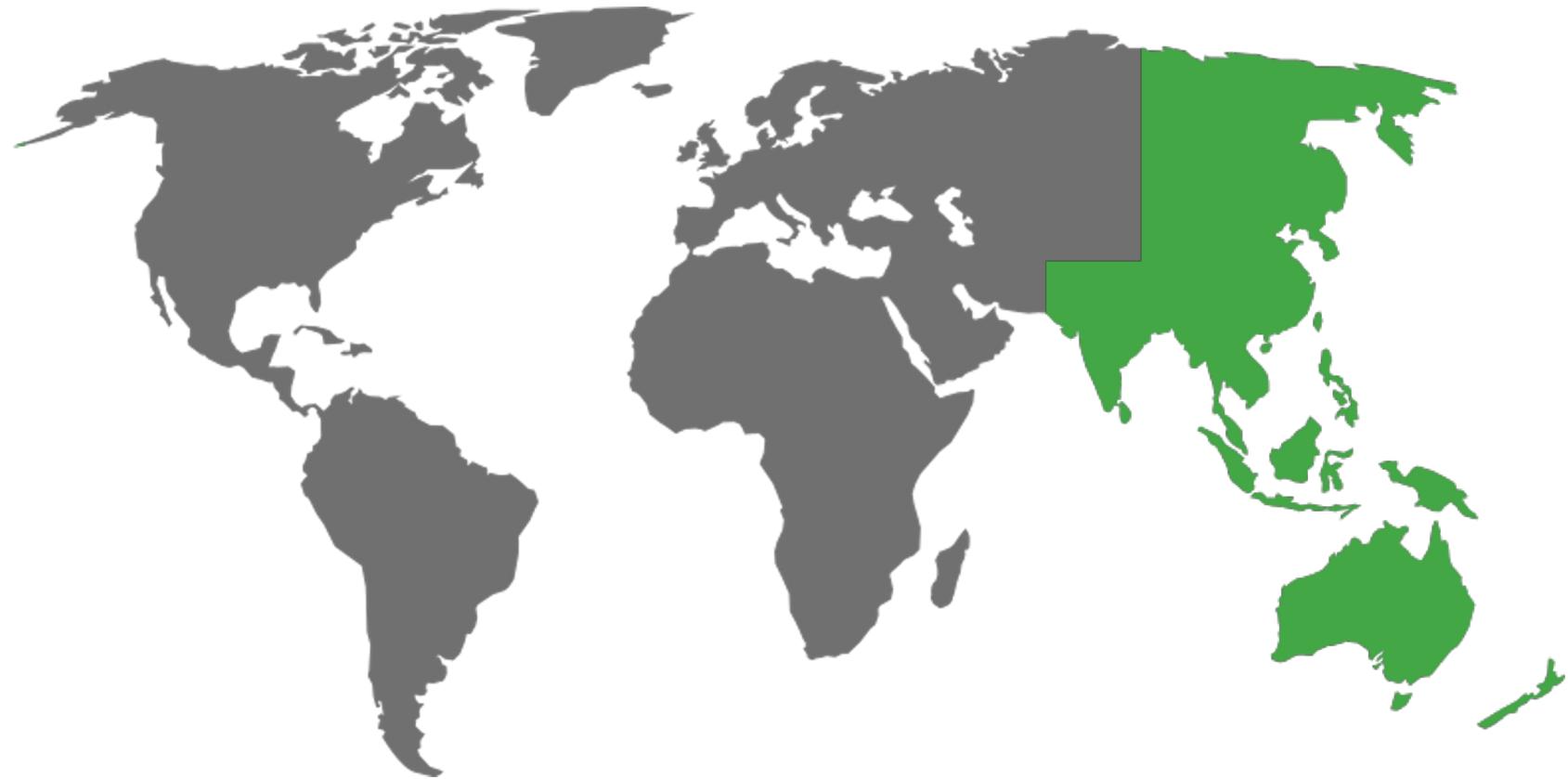
There is no problem because the view update maps to a simple table update.

Plain

insert/update/delete

of *movies*

Now, there may **STILL** be a problem.



Suppose that you are in charge of Asia/Pacific, and only see films from this region.

Consistency Issue

```
select * from vmy_movies;
```

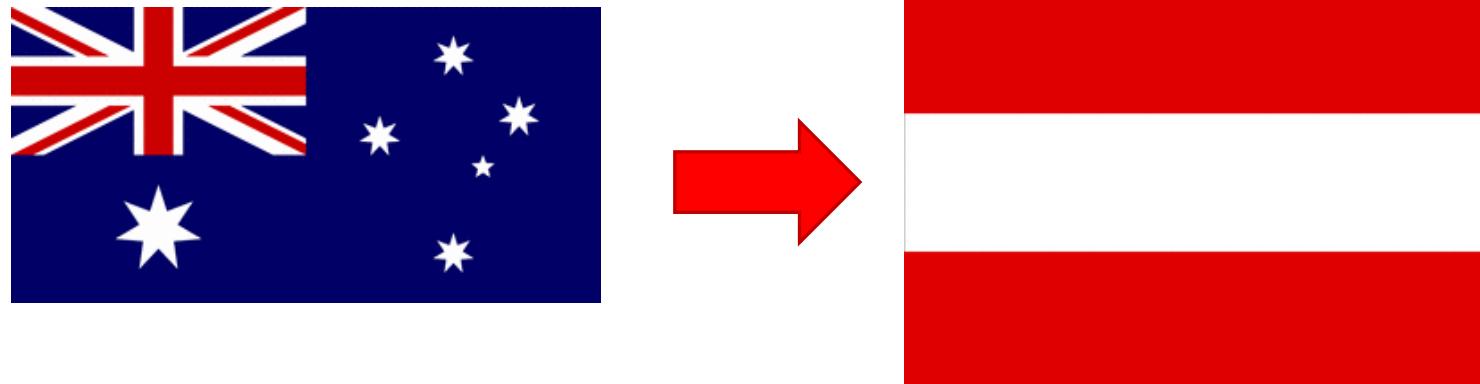
movieid	title	year_released	country
19	Pather Panchali	1955	in
20	Shichinin no Samurai	1954	jp
21	Sholay	1975	in
22	The Lord of the Rings	2001	nz
25	Da Nao Tian Gong	1965	cn
26	We Feed the World	2005	au

Ooops

Only from
Asia/Oceania

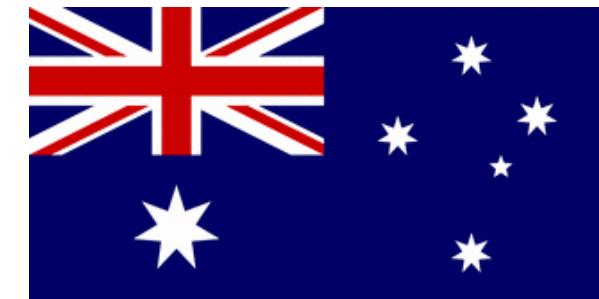
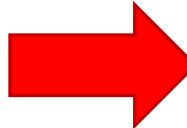
If you change the country from Australia to Austria (in Europe), poof! you no longer see it.

```
update vmy_movies  
set country = 'at'  
where movieid = 26
```



The following command cannot bring it back.

```
update vmy_movies  
set country = 'au'  
where movieid = 26
```



Nothing prevents from

```
insert into vmy_movies(movieid, title, year_released,  
country)  
values (9205, 'NEW MOVIE', 2020, 'us');
```

UNLESS

There is one special constraint, though, that exists for views: **WITH CHECK OPTION**.

```
create or replace view vmy_movies
as select m.movieid,
         m.title,
         m.year_released,
         m.country
   from movies m
  where m.country in
        (select c.country_code
         from countries c
            inner join user_scope u
              on u.continent = c.continent
             where u.username = user)
      with check option
```

The screenshot shows the MySQL Workbench interface with a SQL editor window. The toolbar at the top includes icons for execution, refresh, and schema browser, followed by dropdowns for transaction mode (Tx: Auto) and a checkmark. The SQL code entered is:

```
1 ! insert into vmy_movies(movieid,title, year_released, country)
2 values (9205, 'NEW MOVIE', 2020, 'us');
```

The first line has a red exclamation mark icon next to it, indicating an error. The entire query is highlighted with a light blue selection.

[44000] ERROR: new row violates check option for view "vmy_movies"
详细: Failing row contains (9205, NEW MOVIE, us, 2020, null).

CHECK OPTION would let you update
from Australia to any Asian country.

But not to a country from another region

cn in



au



id



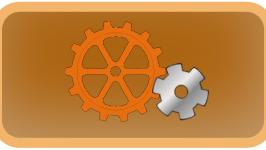
jp



at



Solution in some cases:



insert procedure

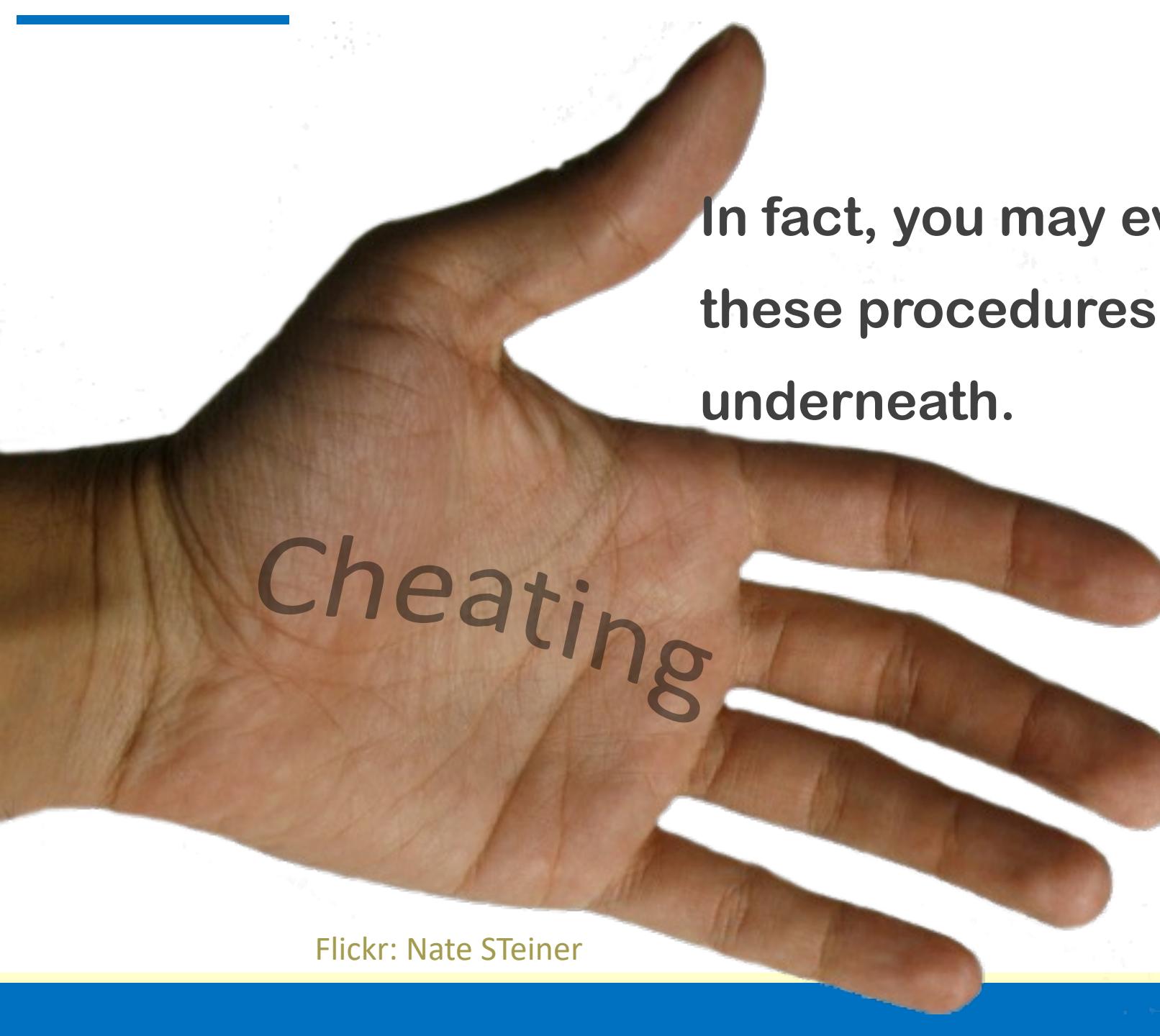


update procedure



delete procedure

If updating the view directly is impossible, in many cases (remember when we were displaying the country name) what should be applied to base tables is fairly obvious and can be performed by dedicated stored procedures.



In fact, you may even call
these procedures
underneath.

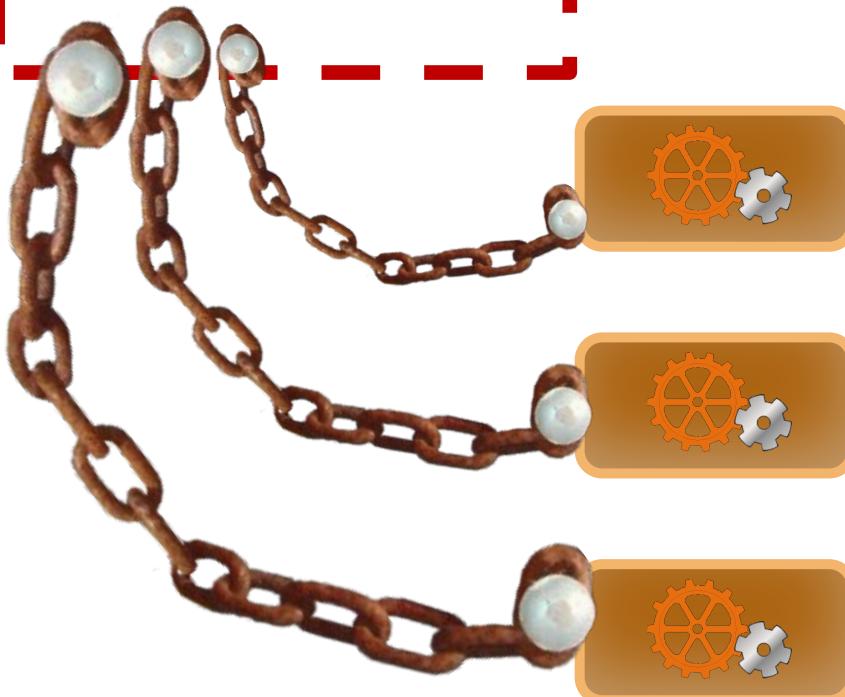
Cheating

View

There is a special type of trigger called an

| instead of trigger

- | It can be created on a view and lets you
- | call a procedure "instead of" performing
- | the triggering event



insert procedure

update procedure

delete procedure

CREATE TRIGGER -- define a new trigger

Synopsis

```
CREATE [ CONSTRAINT ] TRIGGER name { BEFORE | AFTER | INSTEAD OF } { event [ OR ... ] }
ON table_name
[ FROM referenced_table_name ]
[ NOT DEFERRABLE | [ DEFERRABLE ] { INITIALLY IMMEDIATE | INITIALLY DEFERRED } ]
[ FOR [ EACH ] { ROW | STATEMENT } ]
[ WHEN ( condition ) ]
EXECUTE PROCEDURE function_name ( arguments )
```

where *event* can be one of:

INSERT

UPDATE [OF *column_name* [, ...]]

DELETE

TRUNCATE

12.2 Data Dictionary

Shiqi Yu 于仕琪

yusq@sustech.edu.cn

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One very good example of view application is the set of tables that contain information about the objects in the database, collectively known as the

Data Dictionary

or sometime called the

Catalog

They are using all the features we have seen (you only have privileges to read views and only see what is relevant to your account)



databases



schemas



tables



columns

One catalog per database

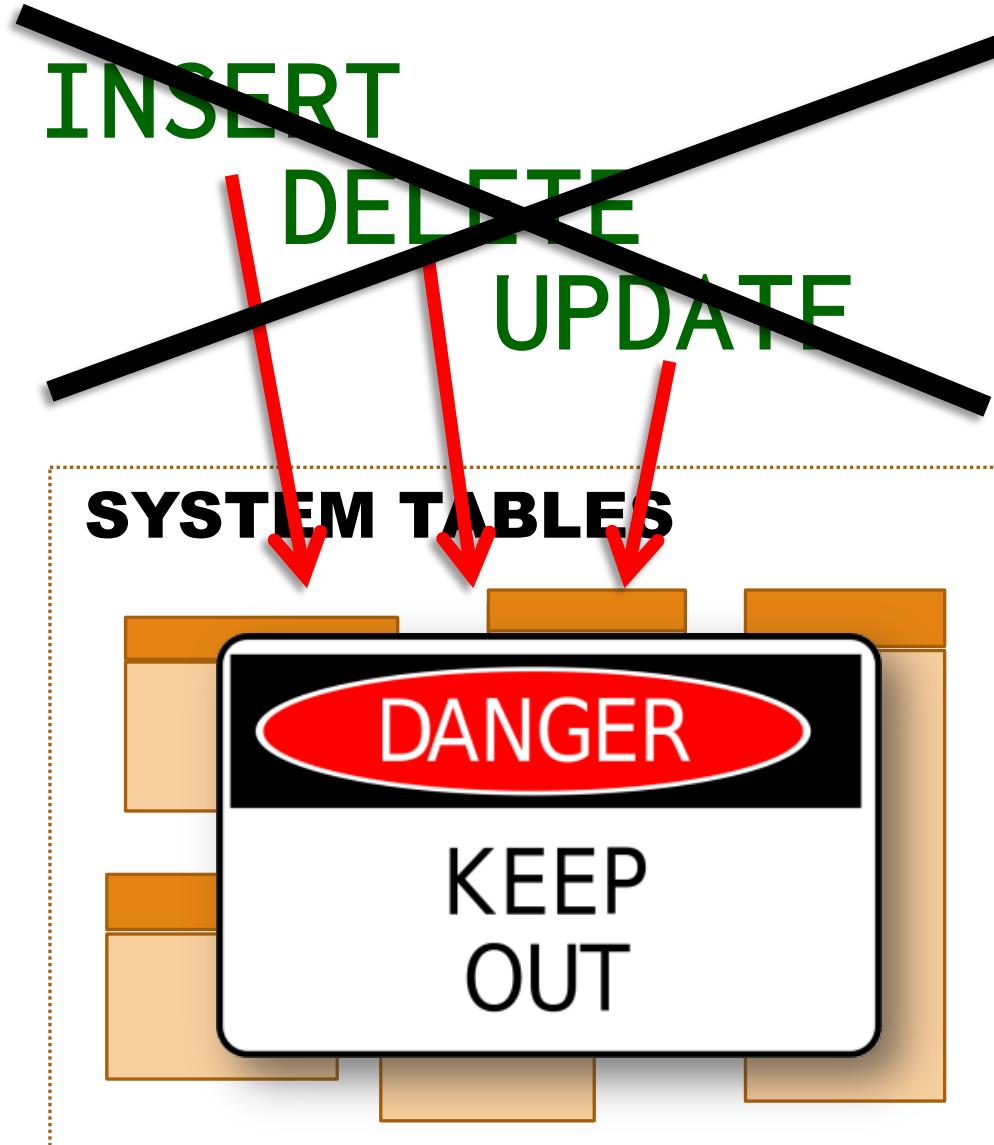
You always have ONE catalog per database. A database is an independent unit and you can have foreign keys only within (inside) one database; however, you can have several schemas in a database, and you can reference tables in another schema. There may also be metadata such as user accounts that is shared among databases. Most DBMS products can manage several databases at once; other than SQLite, the exception is MySQL that only has ONE catalog. What MySQL calls a *database* is actually a schema.

databases 1
fimdb 3
schemas 3
information_schema
pg_catalog
public
tables 11
alt_titles
countries
credits
films_francais
forum_members
forum_posts
forum_topics
merge_people
movie_title_ft index?
movies
movieid integer
title varchar(100)
country char(2)
year_released integer
runtime integer
movies_pkey (movieid)
movies_title_country_year_released_key (title, count)
movies_country_fkey (country) → countries (country_...
movies_nkey (movieid) UNIQUE
movies_title_country_year_released_lkey (title, count)
country length (length(country) <...
runtime numerical (runtime + 0) = ...
title length (length((title)::text))
year_released numerical (year_released + 0...
people
views 2

Any database stores "metadata" that describes the tables in your database (and not only them)

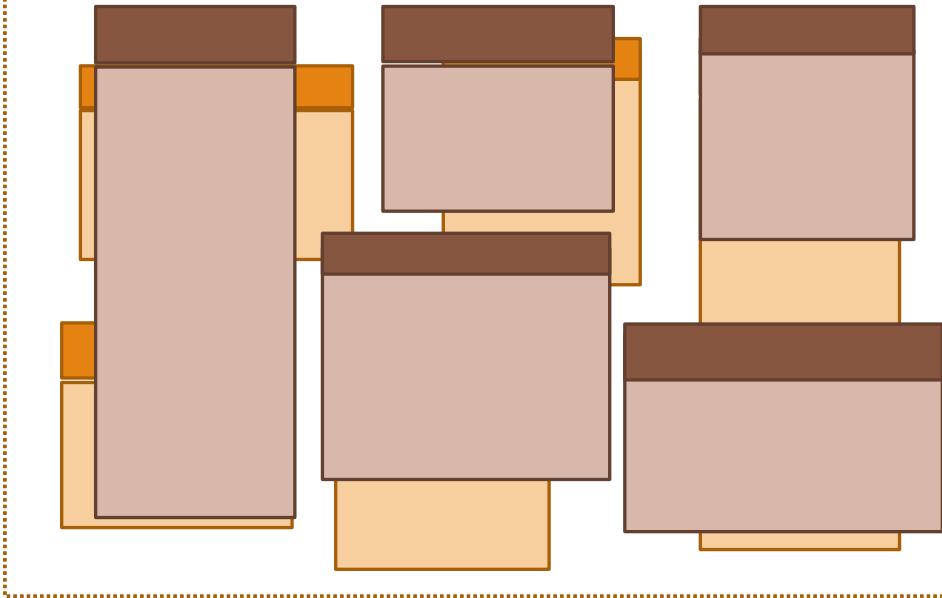
All client tools use this information to let you browse the structure of your tables (here it's SQL Server, Visual Studio)

CREATE
DROP
ALTER
GRANT
REVOKE



Whenever you are issuing DDL commands, you are actually modifying system tables. They must NEVER be directly changed.

SYSTEM TABLES



sqlite_master

Read access to these tables is provided through system views.

information_schema

sysibm



+ views in schema sys



+ views in schema syscat

PostgreSQL



+ pg_... views



INFORMATION_SCHEMA . TABLES

In these views you only see what YOU are allowed to see. Only administrators see everything.



PostgreSQL



SYSCAT . TABLES



USER_TABLES / ALL_TABLES

ORACLE®

PostgreSQL - filmdb@localhost 1 of 2

- databases 1
- filmdb 3
 - schemas 3
 - information_schema
 - tables 7
 - views 60

_pg_foreign_data_wrappers
_pg_foreign_servers
_pg_foreign_table_columns
_pg_foreign_tables
_pg_user_mappings
administrable_role_authorizations
applicable_roles
attributes
character_sets
check_constraint_routine_usage
check_constraints
collation_character_set_applicability
collations
column_domain_usage
column_options
column_privileges
column_udt_usage
columns
constraint_column_usage

```
SELECT table_catalog, table_schema, table_name, table_type  
FROM information_schema.tables  
where table_schema='public'
```

	table_catalog	table_schema	table_name	table_type
1	filmdb	public	merge_people	BASE TABLE
2	filmdb	public	countries	BASE TABLE
3	filmdb	public	people	BASE TABLE
4	filmdb	public	credits	BASE TABLE
5	filmdb	public	forum_members	BASE TABLE
6	filmdb	public	forum_topics	BASE TABLE
7	filmdb	public	forum_posts	BASE TABLE
8	filmdb	public	films_francais	BASE TABLE
9	filmdb	public	movies	BASE TABLE
10	filmdb	public	alt_titles	BASE TABLE
11	filmdb	public	movie_title_ft_index2	BASE TABLE
12	filmdb	public	vmovies	VIEW
13	filmdb	public	vmy_movies	VIEW

There are usually simpler commands to display the structure of a table, but these commands execute nothing more than this type of query. Everything is pulled out of the data dictionary.

```
1 ✓ SELECT table_name, column_name, ordinal_position, data_type  
2   FROM information_schema.columns  
3   WHERE table_name='movies'  
4
```

	table_name	column_name	ordinal_position	data_type
1	movies	movieid	1	integer
2	movies	title	2	character varying
3	movies	country	3	character
4	movies	year_released	4	integer
5	movies	runtime	5	integer

INFORMATION

As a developer, you can get from the data dictionary some information that is hard to get elsewhere (constraints, for instance). Database administrators use them a lot for scripting, because the data dictionary always reflects the current state of a database.

SCRIPTING (DBA)



```
select 'drop table ' ||  
       table_name || ';'   
from information_schema.tables  
where table_name like 'TMP%'  
and ...
```

```
drop table TMP_People;  
drop table TMP_Posts;  
drop table TMP_XYZ;  
drop table TMP_dump;
```

DBAs often use queries on the catalog to generate other SQL queries; it can be done in a script, or in a procedure with a cursor (a case when cursors are mandatory). They sometimes generate other commands, such as shell script, for instance for backing up database files (the name of which can be found in some remote corners of the catalog).