Database views

DATABASE DESIGN

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Database views

> In a database, a **view** is the result set of a stored query on the data, which the database users can query just as they would in a persistent database collection object *(Wikipedia)*

Virtual table that is not part of the physical schema

- Query, not data, is stored in memory
- Data is aggregated from data in tables
- Can be queried like a regular database table
- No need to retype common queries or alter schemas

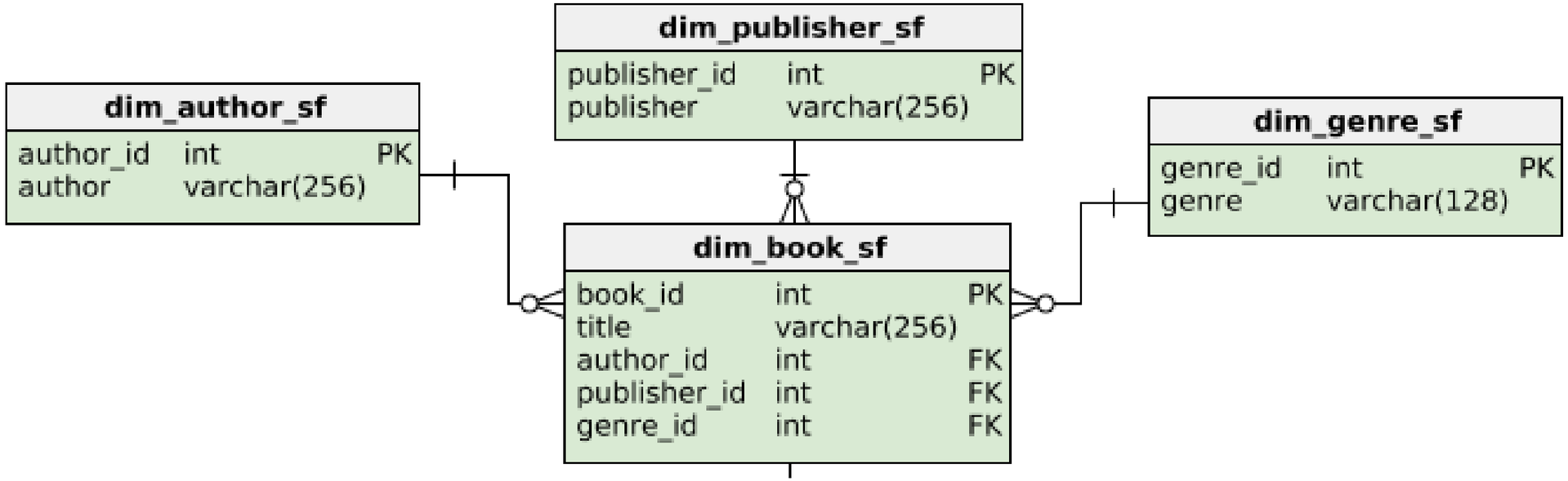
[1] https://en.wikipedia.org/wiki/View_(SQL)

Creating a view (syntax)

```
CREATE VIEW view_name AS
```

```
SELECT col1, col2
FROM table_name
WHERE condition;
```

Creating a view (example)



Goal: Return titles and authors of the `science fiction` genre

Creating a view (example)

```
CREATE VIEW scifi_books AS
```

```
SELECT title,  author, genre
FROM dim_book_sf
JOIN dim_genre_sf ON dim_genre_sf.genre_id = dim_book_sf.genre_id
JOIN dim_author_sf ON dim_author_sf.author_id = dim_book_sf.author_id
WHERE dim_genre_sf.genre = 'science fiction';
```

Querying a view (example)

```
SELECT * FROM scifi_books
```

title	author	genre
The Naked Sun	Isaac Asimov	science fiction
The Robots of Dawn	Isaac Asimov	science fiction
The Time Machine	H.G. Wells	science fiction
The Invisible Man	H.G. Wells	science fiction
The War of the Worlds	H.G. Wells	science fiction
Wild Seed (Patternmaster, #1)	Octavia E. Butler	science fiction
...	...	...

Behind the scenes

```
SELECT * FROM scifi_books
```

=

```
SELECT * FROM
(SELECT title,  author, genre
FROM dim_book_sf
JOIN dim_genre_sf ON dim_genre_sf.genre_id = dim_book_sf.genre_id
JOIN dim_author_sf ON dim_author_sf.author_id = dim_book_sf.author_id
WHERE dim_genre_sf.genre = 'science fiction');
```

Viewing views

(in PostgreSQL)

```
SELECT * FROM INFORMATION_SCHEMA.views;
```

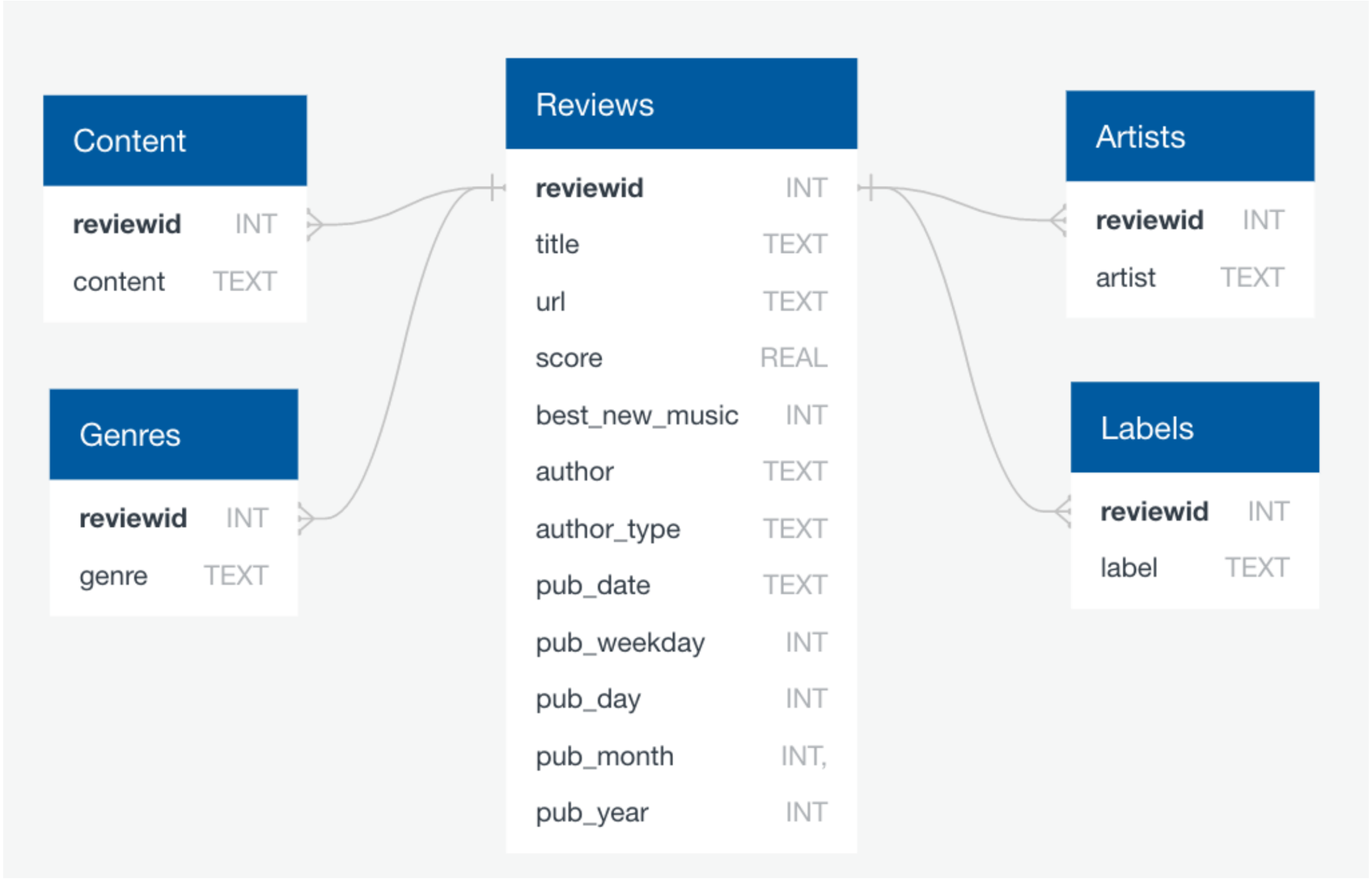
Includes system views

```
SELECT * FROM information_schema.views
WHERE table_schema NOT IN ('pg_catalog', 'information_schema');
```

Excludes system views

Benefits of views

- Doesn't take up storage
- A form of **access control**
  - Hide sensitive columns and restrict what user can see
- Masks complexity of queries
  - Useful for highly normalized schemas



[1] https://www.kaggle.com/nolanbconaway/pitchfork-data

Let's practice!

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Managing views

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Creating more complex views

- **Aggregation:** `SUM()`, `AVG()`, `COUNT()`, `MIN()`, `MAX()`, `GROUP BY`, etc
- **Joins:** `INNER JOIN`, `LEFT JOIN`. `RIGHT JOIN`, `FULL JOIN`
- **Conditionals:** `WHERE`, `HAVING`, `UNIQUE`, `NOT NULL`, `AND`, `OR`, `>`, `<`, etc

Granting and revoking access to a view

`GRANT privilege(s)` or `REVOKE privilege(s)`

`ON object`

`TO role` or `FROM role`

- **Privileges:** `SELECT`, `INSERT`, `UPDATE`, `DELETE`, etc
- **Objects:** table, view, schema, etc
- **Roles:** a database user or a group of database users

Granting and revoking example

```
GRANT UPDATE ON ratings TO PUBLIC;
```

```
REVOKE INSERT ON films FROM db_user;
```

Updating a view

```
UPDATE films SET kind = 'Dramatic' WHERE kind = 'Drama';
```

Not all views are updatable

- View is made up of one table
- Doesn't use a window or aggregate function

[1] https://www.postgresql.org/docs/9.5/sql-update.html

Inserting into a view

```
INSERT INTO films (code, title, did, date_prod, kind)
    VALUES ('T_601', 'Yojimbo', 106, '1961-06-16', 'Drama');
```

Not all views are insertable

[1] https://www.postgresql.org/docs/9.5/sql-insert.html

Inserting into a view

```
INSERT INTO films (code, title, did, date_prod, kind)
    VALUES ('T_601', 'Yojimbo', 106, '1961-06-16', 'Drama');
```

Not all views are insertable

Takeaway: avoid modifying data through views

[1] https://www.postgresql.org/docs/9.5/sql-insert.html

Dropping a view

```
DROP VIEW view_name [ CASCADE | RESTRICT ];
```

- `RESTRICT` (default): returns an error if there are objects that depend on the view
- `CASCADE` : drops view and any object that depends on that view

Redefining a view

```
CREATE OR REPLACE VIEW view_name AS new_query
```

- If a view with `view_name` exists, it is replaced
- `new_query` must generate the same column names, order, and data types as the old query
- The column output may be different
- New columns may be added at the end

If these criteria can't be met, drop the existing view and create a new one

[1] https://www.postgresql.org/docs/9.2/sql-createview.html

Altering a view

```
ALTER VIEW [ IF EXISTS ] name ALTER [ COLUMN ] column_name SET DEFAULT expression
ALTER VIEW [ IF EXISTS ] name ALTER [ COLUMN ] column_name DROP DEFAULT
ALTER VIEW [ IF EXISTS ] name OWNER TO new_owner
ALTER VIEW [ IF EXISTS ] name RENAME TO new_name
ALTER VIEW [ IF EXISTS ] name SET SCHEMA new_schema
ALTER VIEW [ IF EXISTS ] name SET ( view_option_name [= view_option_value] [, ... ]
ALTER VIEW [ IF EXISTS ] name RESET ( view_option_name [, ... ] )
```

[1] https://www.postgresql.org/docs/9.2/sql-alterview.html

Let's practice!

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Materialized views

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Two types of views

Views

- Also known as **non-materialized views**
- How we've defined views so far

Two types of views

Views

- Also known as **non-materialized views**
- How we've defined views so far

Materialized views

- Physically materialized

Materialized views

- Stores the ***query results***, not the ***query***
- Querying a materialized view means accessing the stored query results
  - Not running the query like a non-materialized view
- Refreshed or rematerialized when prompted or scheduled

When to use materialized views

- Long running queries
- Underlying query results don't change often
- Data warehouses because OLAP is not write-intensive
  - Save on computational cost of frequent queries

Implementing materialized views

(in PostgreSQL)

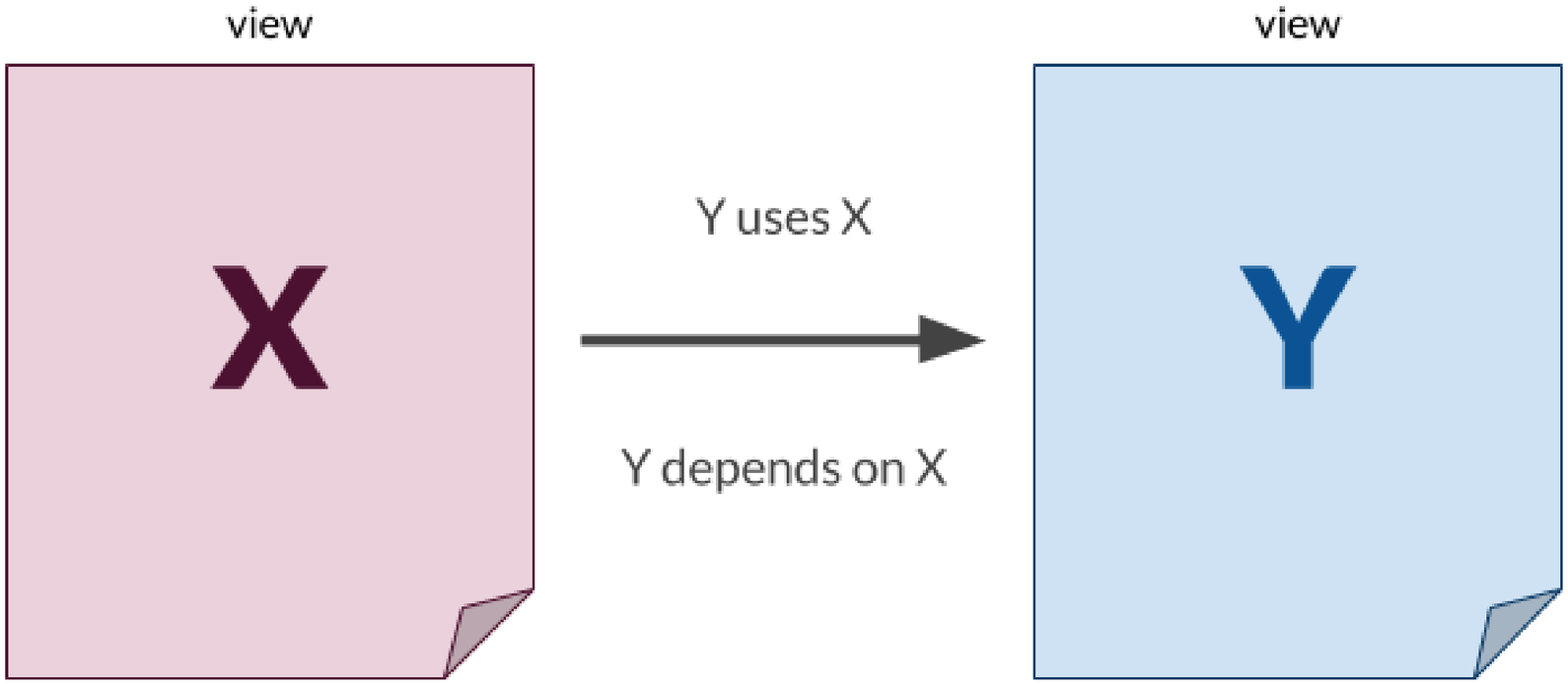
```
CREATE MATERIALIZED VIEW my_mv AS SELECT * FROM existing_table;
```

```
REFRESH MATERIALIZED VIEW my_mv;
```

Managing dependencies

- Materialized views often depend on other materialized views

Dependency example

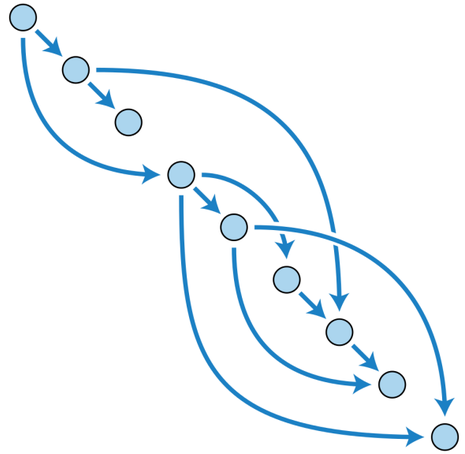


Managing dependencies

- Materialized views often depend on other materialized views
- Creates a **dependency chain** when refreshing views
- Not the most efficient to refresh all views at the same time

Tools for managing dependencies

- Use Directed Acyclic Graphs (**DAGs**) to keep track of views



- Pipeline scheduler tools

Let's practice!

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