

Meet the other elephant



PostgreSQL

PHP Usergroup Düsseldorf

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History

- 1986 University of California at Berkeley (UCB) and named Postgres
- 1995 SQL was introduced, new name: Postgres95
- 1996 PostgreSQL 6.0



MVCC

- Multiversion Concurrency Control



Object Relational

- Inherit tables

```
CREATE TABLE cities (  
    name          text,  
    population     float,  
    altitude       int    -- in feet  
);  
  
CREATE TABLE capitals (  
    state          char(2)  
) INHERITS (cities);  
|
```



Object Types

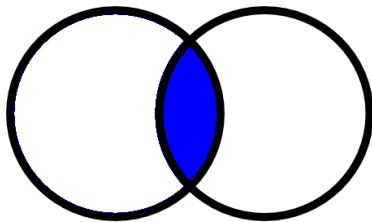
- Tablespaces
- Databases
- Schemas
- Tables
- Views
- Materialized Views
- Functions
- Trigger Functions



Joins between tables

- INNER JOIN

- **SELECT** *
FROM t1
INNER JOIN t2
ON t1.id = t2.t1_id
- Only those records, that match t1 and t2



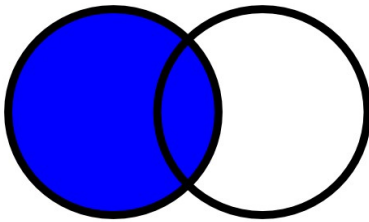


Joins between tables

- LEFT OUTER JOIN

- **SELECT** *
 - FROM** t1
 - LEFT OUTER JOIN** t2
 - ON** t1.id = t2.t1_id

- All records of t1 and all records of t2 that match with t1



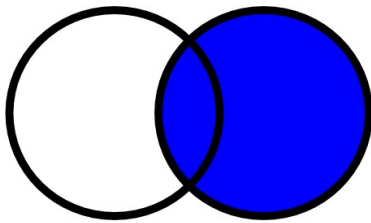


Joins between tables

- RIGHT OUTER JOIN

- **SELECT** *
 - FROM** t1
 - RIGHT OUTER JOIN** t2
 - ON** t1.id = t2.t1_id

- All records of t2 and all records of t1 that match with t2



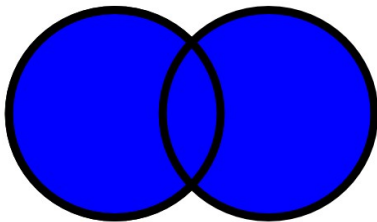


Joins between tables

- FULL OUTER JOIN

- **SELECT** *
 - FROM** t1
 - FULL OUTER JOIN** t2
 - ON** t1.id = t2.t1_id

- All records of t1 and all records of t2 that match on the id and all records from both tables that don't match

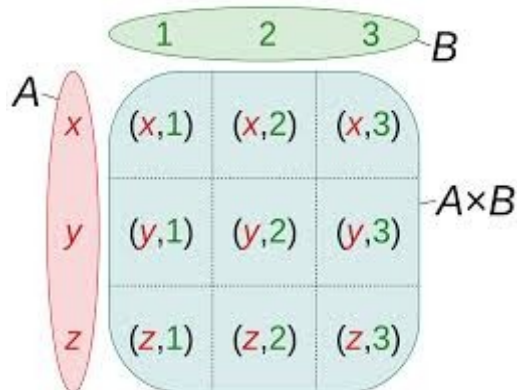




Joins between tables

- CROSS JOIN

- **SELECT** *
FROM t1
CROSS JOIN t2
ON t1.id = t2.t1_id
- A cartesian product, every record of t1 with every record of t2





Data Types

- Numbers
- Text
- Blob
- Arrays
- XML
- JSON (JSON und JSONB)
- User defined types



Key Value Store

- hstore is a classical key value store

```
k => v  
foo => bar, baz => whatever  
"1-a" => "anything at all"
```



Index Types

- There is more than one index type
 - B-tree
 - Hash
 - GiST
 - GIN
- Indexes on expression



Trigger

- Triggers are different:
 - You can attach one trigger to several tables
 - Trigger on **TRUNCATE**
 - Trigger on simple **VIEWS**
 - Trigger on complex **VIEWS** with **INSTEAD OF**



Procedural Languages

- Most used is PL/pgSQL
- Extensions, for example JavaScript based on Google V8



WITH Queries

(Common Table Expressions)

- Is another form of subqueries
- Definition exists in the ANSI SQL standard
- Advantages:
 - Better readable
 - Only parsed once
 - Recursions



WITH Queries

(Common Table Expressions)

- Example:

```
WITH RECURSIVE t(n) AS (  
    VALUES (1)  
    UNION ALL  
    SELECT n+1 FROM t WHERE n < 100  
)  
SELECT sum(n), min(n), max(n) FROM t;
```

- Result:

	sum bigint	min integer	max integer
1	5050	1	100



Window Functions

- Calculate data across defined rows
- See tapoueh.org for detailed explanations and examples



Window Functions

- Example

```
SELECT x,  
       row_number() OVER(),  
       lag(x, 1) OVER w,  
       lead(x, 1) OVER w  
FROM generate_series(1, 15, 2) AS  
t(x)  
WINDOW w AS (ORDER BY x);
```



Window Functions

- Result:

	x integer	row_number bigint	lag integer	lead integer
1	1	1		3
2	3	2	1	5
3	5	3	3	7
4	7	4	5	9
5	9	5	7	11
6	11	6	9	13
7	13	7	11	15
8	15	8	13	



Extensions

- **PostGIS**
 - Book recommendation:
PostGIS Cookbook
- **pguint** implements unsigned integers
- **PostgreSQL Multiple Precision Arithmetic**
- Lots available at **PGXN** or GitHub
- Or write your own if needed



Foreign data wrappers

- Defined in the ANSI SQL standard
- Can read and write foreign data
 - Oracle (pgxn.org)
 - MS SQL Server / Sybase ASE
readonly (pgxn.org)
 - MongoDB
readonly (pgxn.org)
 - MariaDB / MySQL (github.com)



Foreign data wrappers

- Example

```
CREATE EXTENSION mysql_fdw;

CREATE SERVER mysql_local
FOREIGN DATA WRAPPER mysql_fdw
OPTIONS (address '127.0.0.1', port '3306');

CREATE USER MAPPING FOR PUBLIC SERVER mysql_local
OPTIONS (username 'pg_test', password 'secret');

CREATE FOREIGN TABLE fdw_mysql_users (
    users_id BIGINT,
    username VARCHAR(100),
    firstname VARCHAR(100),
    lastname VARCHAR(100),
    pwhash VARCHAR(255)
)
SERVER mysql_local
OPTIONS (table 'pg_test.users');
```



JSON Functions

- Functions to return **JSON** datatypes
- For example:
 - `array_to_json`
 - `row_to_json`



Tool List

- [PgAdmin](#): Development and administration
- [PhpPgAdmin](#): Web administration
- [pgTAP](#): Database unit tests
- [psql](#): Terminal-based front-end
- [POWA](#): Workload Analyzer
- More on wiki.postgresql.org



Book List

- PostgreSQL Server Programming
- PostgreSQL 9.0 High Performance
- PostgreSQL 9 Admin Cookbook
- PostgreSQL: Up and Running
- PostgreSQL-Administration, 3rd Edition
- PostGIS Cookbook



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