PostgreSQL tablespace:

A tablespace is a disk location where PostgreSQL stores data files containing database objects such as indexes and tables.

PostgreSQL uses a tablespace to associate a logical name to a physical location on the disk.

PostgreSQL comes with two default tablespaces:

pg_default tablespace stores user data. (default tablespace)

pg_global tablespace stores global data.

To list all tablespaces in the current PostgreSQL database server, you use the **\db** command:

```
[postgres@ip-172-31-93-136 ~]$ psql
psql (17.2)
Type "help" for help.

postgres=# \db+
                                 List of tablespaces
    Name    |  Owner   | Location | Access privileges | Options |  Size   | Description
------------+----------+----------+-------------------+---------+---------+-------------
 pg_default | postgres |          |                   |         | 22 MB   |
 pg_global  | postgres |          |                   |         | 565 kB  |
(2 rows)

postgres=#
```

The basic syntax of the CREATE TABLESPACE statement:

CREATE TABLESPACE tablespace_name

[OWNER { new_owner | CURRENT_ROLE | CURRENT_USER | SESSION_USER }]

LOCATION 'directory'

[WITH (tablespace_option = value [, ...])];

To create a tablespace dbspace at file system location /data/dbs, first create the directory using operating system facilities and set the correct ownership:

mkdir -p /data/dbs

chown -R postgres:postgres /data/dbs

Then issue the tablespace creation command inside PostgreSQL:

CREATE TABLESPACE dbspace LOCATION '/data/dbs';

```
[root@ip-172-31-93-136 ~]# mkdir -p /data/dbs
[root@ip-172-31-93-136 ~]# chown -R postgres:postgres /data/dbs
[root@ip-172-31-93-136 ~]# su - postgres
Last login: Tue Jan  7 09:31:31 UTC 2025 on pts/1
[postgres@ip-172-31-93-136 ~]$ psql
psql (17.2)
Type "help" for help.

postgres=# CREATE TABLESPACE dbspace LOCATION '/data/dbs';
CREATE TABLESPACE
postgres=# \db+
                                 List of tablespaces
    Name    |  Owner   | Location  | Access privileges | Options |  Size   | Description
------------+----------+-----------+-------------------+---------+---------+-------------
 dbspace    | postgres | /data/dbs |                   |         | 0 bytes |
 pg_default | postgres |           |                   |         | 22 MB   |
 pg_global  | postgres |           |                   |         | 565 kB  |
(3 rows)
```

The directory **$PGDATA/pg_tblspc** contains symbolic links that point to each of the non-built-in tablespaces defined in the cluster.

```
[postgres@ip-172-31-93-136 ~]$ ls -ltrh $PGDATA/pg_tblspc/
total 0
lrwxrwxrwx. 1 postgres postgres 9 Jan  7 09:32 16391 -> /data/dbs
[postgres@ip-172-31-93-136 ~]$ ls -ltrh /data/dbs
total 0
drwx------. 2 postgres postgres 6 Jan  7 09:32 PG_17_202406281
[postgres@ip-172-31-93-136 ~]$
```

A user with appropriate privileges can pass **tablespace_name** to **CREATE DATABASE, CREATE TABLE, CREATE INDEX** to have the data files for these objects stored within the specified tablespace.

CREATE DATABASE db_name TABLESPACE tablespace_name;

CREATE TABLE table_name(col1 data_type1,col2 data_type 2,...) TABLESPACE tablespace_name;

CREATE INDEX index_name ON table_name(column_name) TABLESPACE tablespace_name;

```
postgres=# CREATE DATABASE test_db TABLESPACE dbspace;
CREATE DATABASE
postgres=# CREATE TABLE deliveries(delivery_id INT,order_date DATE,customer_id INT) TABLESPACE dbspace;
CREATE TABLE
postgres=# CREATE INDEX deliveries_customer_id_indx ON deliveries(customer_id) TABLESPACE dbspace;
CREATE INDEX
postgres=#
```

To create a tablespace owned by a different database user:

CREATE TABLESPACE dbs_new_tspace OWNER test_user LOCATION '/data/dbs_new';

```
[root@ip-172-31-93-136 ~]# mkdir /data/dbs_new
[root@ip-172-31-93-136 ~]# chown -R postgres:postgres /data/dbs_new
[root@ip-172-31-93-136 ~]# su - postgres
Last login: Tue Jan  7 09:55:08 UTC 2025 on pts/2
[postgres@ip-172-31-93-136 ~]$ psql
psql (17.2)
Type "help" for help.

postgres=# CREATE USER test_user PASSWORD 'test@123';
CREATE ROLE
postgres=# CREATE TABLESPACE dbs_new_tspace OWNER test_user LOCATION '/data/dbs_new';
CREATE TABLESPACE
postgres=# \db+
                                    List of tablespaces
     Name      |   Owner   |   Location    | Access privileges | Options |  Size   | Description
---------------+-----------+---------------+-------------------+---------+---------+-------------
 dbs_new_tspace | test_user | /data/dbs_new |                   |         | 0 bytes |
 dbspace        | postgres  | /data/dbs     |                   |         | 7425 kB |
 pg_default     | postgres  |               |                   |         | 22 MB   |
 pg_global      | postgres  |               |                   |         | 589 kB  |
(4 rows)

postgres=#
```

To change the default tablespace for the current session:

SET default_tablespace='tablespace_name';

CREATE TABLE foo(i int);

```
[postgres@ip-172-31-93-136 ~]$ psql
psql (17.2)
Type "help" for help.

postgres=# SHOW default_tablespace;
 default_tablespace
--------------------

(1 row)

postgres=# SET default_tablespace='dbs_new_tspace';
SET
postgres=# SHOW default_tablespace;
 default_tablespace
--------------------
 dbs_new_tspace
(1 row)

postgres=# CREATE TABLE foo(i int);
CREATE TABLE
postgres=# SELECT tablename,tablespace FROM pg_tables  WHERE tablename='foo';
 tablename |   tablespace
-----------+----------------
 foo       | dbs_new_tspace
(1 row)

postgres=#
```

Temporary Tablespace:

The **temp_tablespaces** parameter in PostgreSQL determines where temporary tables, indexes, and files (e.g., for sorting large datasets) are stored. It can be a list of tablespaces, allowing temporary object load to be distributed across multiple tablespaces. A random tablespace from the list is chosen for each temporary object.

Setup temp_tablespaces:

method 1):

mkdir -p /data/temp_tbls

chown -R postgres:postgres /data/temp_tbls

CREATE TABLESPACE temp_tbls LOCATION '/data/temp_tbls';

ALTER SYSTEM SET temp_tablespaces = 'temp_tbls'; #ALTER SYSTEM — change a server configuration parameter

SELECT pg_reload_conf(); #To reload the changes

```
postgres=# SHOW temp_tablespaces;
 temp_tablespaces
------------------

(1 row)

postgres=# CREATE TABLESPACE temp_tbls LOCATION '/data/temp_tbls';
CREATE TABLESPACE
postgres=# SHOW temp_tablespaces;
 temp_tablespaces
------------------

(1 row)

postgres=# ALTER SYSTEM SET temp_tablespaces = 'temp_tbls';
ALTER SYSTEM
postgres=# SELECT pg_reload_conf();
 pg_reload_conf
----------------
 t
(1 row)

postgres=# SHOW temp_tablespaces;
 temp_tablespaces
------------------
 temp_tbls
(1 row)

postgres=#
```

method 2):

Reset the changes:

ALTER SYSTEM RESET temp_tablespaces;

SELECT pg_reload_conf();

```
postgres=# SHOW temp_tablespaces;
 temp_tablespaces
------------------
 temp_tbls
(1 row)

postgres=# ALTER SYSTEM RESET temp_tablespaces;
ALTER SYSTEM
postgres=# SHOW temp_tablespaces;
 temp_tablespaces
------------------
 temp_tbls
(1 row)

postgres=# SELECT pg_reload_conf();
 pg_reload_conf
----------------
 t
(1 row)

postgres=# SHOW temp_tablespaces;
 temp_tablespaces
------------------

(1 row)

postgres=#
```

Set the **temp_tablespaces** in a $PGDATA/postgresql.conf file.

SELECT pg_reload_conf();

```
[postgres@ip-172-31-93-136 data]$ vim $PGDATA/postgresql.conf
[postgres@ip-172-31-93-136 data]$ cat $PGDATA/postgresql.conf |grep "temp_tablespaces"
temp_tablespaces = 'temp_tbls'                  # a list of tablespace names, '' uses
[postgres@ip-172-31-93-136 data]$
[postgres@ip-172-31-93-136 data]$ psql
psql (17.2)
Type "help" for help.

postgres=# SHOW temp_tablespaces;
 temp_tablespaces
------------------

(1 row)

postgres=# SELECT pg_reload_conf();
 pg_reload_conf
----------------
 t
(1 row)

postgres=# SHOW temp_tablespaces;
 temp_tablespaces
------------------
 temp_tbls
(1 row)

postgres=#
```

Create temporary table for testing:

create temporary table test_temp_table(id int);

select pg_relation_filepath(' test_temp_table ');

```
[postgres@ip-172-31-93-136 ~]$ psql
psql (17.2)
Type "help" for help.

postgres=# create temporary table test_temp_table(id int);
CREATE TABLE
postgres=# select pg_relation_filepath('test_temp_table');
           pg_relation_filepath
-----------------------------------------------
 pg_tblspc/16409/PG_17_202406281/5/t19_16422
(1 row)

postgres=# \! ls -ltrh /data/temp_tbls/PG_17_202406281/5/
total 0
-rw-------. 1 postgres postgres 0 Jan  7 11:25 t19_16422
postgres=# \q
[postgres@ip-172-31-93-136 ~]$ psql
psql (17.2)
Type "help" for help.

postgres=# select pg_relation_filepath('test_temp_table');
ERROR:  relation "test_temp_table" does not exist
LINE 1: select pg_relation_filepath('test_temp_table');
                                    ^
postgres=#
```

To moves the data file(s) associated with the database, table, index to the new tablespace:

CREATE DATABASE db_name;

ALTER DATABASE db_name SET TABLESPACE tablespace_name;

CREATE TABLE table_name(col1 data_type,....);

ALTER TABLE table_name SET TABLESPACE tablespace_name;

CREATE TABLE table_name(col1 data_type,....);

CREATE INDEX index_name ON table_name(col1);

ALTER INDEX index_name SET TABLESPACE tablespace_name;

```
postgres=# CREATE DATABASE testdb;
CREATE DATABASE
postgres=# ALTER DATABASE testdb SET TABLESPACE dbs_new_tspace;
ALTER DATABASE
postgres=# CREATE TABLE new_tbl(id INT);
CREATE TABLE
postgres=# ALTER TABLE new_tbl SET TABLESPACE dbs_new_tspace;
ALTER TABLE
postgres=# DROP TABLE new_tbl;
DROP TABLE
postgres=# CREATE TABLE new_tbl(id INT);
CREATE TABLE
postgres=# CREATE INDEX new_tbl_id_indx ON new_tbl(id);
CREATE INDEX
postgres=# ALTER INDEX new_tbl_id_indx SET TABLESPACE dbs_new_tspace;
ALTER INDEX
```

PostgreSQL does not allow altering the tablespace of a primary key constraint. Instead, you need to move the index associated with the primary key constraint to the new tablespace.

CREATE TABLE table_name(column_name data_type PRIMARY KEY);

ALTER INDEX index_name SET TABLESPACE tablespace_name;

```
postgres=# DROP TABLE new_tbl;
DROP TABLE
postgres=# CREATE TABLE new_tbl(id INT PRIMARY KEY);
CREATE TABLE
postgres=# \d+ new_tbl
                                    Table "public.new_tbl"
 Column |  Type   | Collation | Nullable | Default | Storage | Compression | Stats target | Description
--------+---------+-----------+----------+---------+---------+-------------+--------------+-------------
 id     | integer |           | not null |         | plain   |             |              |
Indexes:
    "new_tbl_pkey" PRIMARY KEY, btree (id)
Access method: heap

postgres=# ALTER INDEX new_tbl_pkey SET TABLESPACE dbs_new_tspace;
ALTER INDEX
postgres=#
```

ALTER TABLESPACE — change the definition of a tablespace:

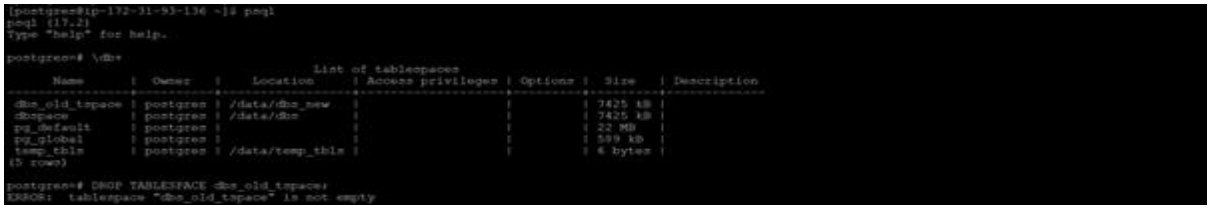
ALTER TABLESPACE old_tablespace_name RENAME TO new_tablespace_name;

ALTER TABLESPACE tablespace_name OWNER TO new_user;

```
postgres=# \db+ dbs_new_tspace;
                                  List of tablespaces
      Name      |   Owner   |   Location    | Access privileges | Options |  Size   | Description
----------------+-----------+---------------+-------------------+---------+---------+-------------
 dbs_new_tspace | test_user | /data/dbs_new |                   |         | 7425 kB |
(1 row)

postgres=# ALTER TABLESPACE dbs_new_tspace RENAME TO dbs_old_tspace;
ALTER TABLESPACE
postgres=# \db+ dbs_new_tspace;
                        List of tablespaces
 Name | Owner | Location | Access privileges | Options | Size | Description
------+-------+----------+-------------------+---------+------+-------------
(0 rows)

postgres=# \db+ dbs_old_tspace;
                                  List of tablespaces
      Name      |   Owner   |   Location    | Access privileges | Options |  Size   | Description
----------------+-----------+---------------+-------------------+---------+---------+-------------
 dbs_old_tspace | test_user | /data/dbs_new |                   |         | 7425 kB |
(1 row)

postgres=# ALTER TABLESPACE dbs_old_tspace OWNER TO postgres;
ALTER TABLESPACE
postgres=# \db+ dbs_old_tspace;
                                  List of tablespaces
      Name      |  Owner   |   Location    | Access privileges | Options |  Size   | Description
----------------+----------+---------------+-------------------+---------+---------+-------------
 dbs_old_tspace | postgres | /data/dbs_new |                   |         | 7425 kB |
(1 row)

postgres=#
```

DROP TABLESPACE — remove a tablespace:

The error **tablespace is not empty** in PostgreSQL occurs when you attempt to drop a tablespace that still contains objects like tables, indexes, or other database objects. To resolve this issue, you need to ensure that the tablespace is empty before dropping it.



Check Objects in the Tablespace:

SELECT relname AS object_name, relkind AS object_type FROM pg_class c JOIN pg_tablespace t ON c.reltablespace = t.oid WHERE t.spcname = 'dbs_old_tspace';

Check database in the Tablespace:

SELECT datname AS object_name FROM pg_database c JOIN pg_tablespace t ON c.dattablespace = t.oid WHERE t.spcname = 'dbs_old_tspace';

Move Objects and databases to Another Tablespace:

ALTER DATABASE db_name SET tablespace_name;

ALTER TABLE table_name SET tablespace_name;

ALTER INDEX index_name SET tablespace_name;

DROP TABLESPACE tablespace_name;