

# Getting Started with PostgreSQL

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# Introduction: PostgreSQL in Context

## Industry trends: NoSQL databases (Redmond and Wilson 2012)

- ▶ Graph databases
- ▶ Key-value stores
- ▶ JSON document stores
- ▶ In-memory databases

## Industry trends: Backend frameworks (Apache/PHP, Ruby on Rails, Django)

- ▶ Work with *any* database (MySQL/MariaDB, SQLite, PostgreSQL)
- ▶ Just do the CRUD in the database, application logic is all in PHP / Ruby / Python / JavaScript code!
  - ▶ Create
  - ▶ Read (aka SELECT)
  - ▶ Update
  - ▶ Delete

## If all you want . . .

- ▶ If all you want is an industrial-strength open-source permissive-licensed CRUD engine that
  - ▶ Is fully ACID compliant
  - ▶ Scales to huge installations
  - ▶ Has replication / failover / high availability as standard equipment
- ▶ Yeah, PostgreSQL's got that.

## But if you also want . . .

- ▶ Full-text search
- ▶ Stored procedures in Python, Perl, Ruby, R, Tcl and Lua
- ▶ Foreign data (Text files, GIS data, MySQL/MariaDB, Redis) mapped into your database (foreign data wrappers)
- ▶ Key-value stores (hstore)
- ▶ JSON document stores (jsonb)
- ▶ Yeah, PostgreSQL's got that too!

## Speaking of industrial strength ...

- ▶ Geographic Information Systems (GIS)
- ▶ PostGIS
  - ▶ Read and write GIS data files
  - ▶ Process geometric, geographic and topology GIS data types
  - ▶ Both vector and raster data
  - ▶ Geocoding, reverse geocoding, address standardization
- ▶ pgRouting
  - ▶ Shortest / lowest cost routes from point A to point B
  - ▶ Traveling salesperson problem
  - ▶ Turn-by-turn directions for cars, bikes and pedestrians!
- ▶ Yeah, I want that stuff too!

## PostgreSQL on the Desktop - single user



## Windows or Mac

- ▶ Go to EnterpriseDB download site  
<https://www.enterprisedb.com/downloads/postgres-postgresql-downloads>.
- ▶ Select the latest version (10.3)
- ▶ Select your operating system (Windows or Mac)
- ▶ Installation: install everything but don't run StackBuilder yet

## Linux: use the PGDG repositories

- ▶ RHEL / CentOS / Fedora:  
<https://www.postgresql.org/download/linux/redhat/>
- ▶ Ubuntu: <https://www.postgresql.org/download/linux/ubuntu/>  
(probably works for Linux Mint)
- ▶ Debian: <https://www.postgresql.org/download/linux/debian/>
- ▶ Installation: install PostgreSQL 10.3 and pgAdmin 4 for desktop

## Connecting with pgAdmin

- ▶ Reference: R. Obe and Hsu (2017b), chapter 4

## Exploring the tree

## Creating a database

## Creating tables - DDL

## Reading a CSV file into a table - COPY

## Backing up a database



## Restoring a database

## Creating a query

## PostgreSQL on a (Linux) Server

## Two dialects of Linux

- ▶ Ubuntu 16.04.x LTS (most popular)
- ▶ RHEL 7 / CentOS 7

## Docker container

- ▶ Debian stable - similar to Ubuntu
- ▶ Alpine - avoid this unless you want to do a lot of research

## The PGDG repositories

## Configuring

- ▶ Initializing the cluster
- ▶ Enabling and starting the service

## Listening address and port



# Authentication

## Fine-grained permissions and roles

# Tablespaces

# PostGIS

## Reading in GIS data (Obe and Hsu 2015, chap. 4)

- ▶ Shapefiles
- ▶ “GDB” databases
- ▶ OpenStreetMap data

## Tagging points with a geometry column

## Geocoding (Obe and Hsu 2015, chap. 8)

# Spatial joins



## pgRouting - what it can do

## Turn-by-turn directions

- ▶ Reference: (R. Obe and Hsu 2017a)

## References

## References

Obe, Regina O., and Leo S. Hsu. 2015. *PostGIS in Action, Second Edition*. Manning Publications Co. <https://www.manning.com/books/postgis-in-action-second-edition>.

Obe, Regina, and Leo Hsu. 2017a. *PgRouting: A Practical Guide*. Locate Press LLC. <https://locatepress.com/pgrouting>.

———. 2017b. *PostgreSQL: Up and Running, 3rd Edition*. O'Reilly Media, Inc. <http://shop.oreilly.com/product/0636920052715.do>.

Redmond, Eric, and Jim R. Wilson. 2012. *Seven Databases in Seven Weeks*. The Pragmatic Programmers. <https://pragprog.com/book/rwdata/seven-databases-in-seven-weeks>.