

EDB PostgreSQL Administration & Performance Tuning (Comprehensive)

Learn to install, configure, secure, back up and tune PostgreSQL databases, from architecture and replication to indexing and connection pooling.

32

MODULES

204

TOPICS

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HANDS-ON LAB

COURSE OVERVIEW

This course covers PostgreSQL's architecture, installation and configuration, including memory settings, WAL, logging and database and tablespace management through psql and pgAdmin 4. It addresses security, backup and point-in-time recovery, the data dictionary, table partitioning, routine maintenance, and replication and failover in containerised and Kubernetes environments, along with migration from Oracle or MSSQL. It then covers client-server setup, remote connections, vacuuming, indexing, statistics gathering, connection pooling with pgBouncer and pgpool-II, performance tuning tips, metadata, schema and tablespace administration, extensions, query performance and concurrency, transactions, and server-side development topics such as constraints, full text search and large objects.

WHO THIS COURSE IS FOR

Database Administrators

Database Developers

System Administrators

Performance Engineers

Migration Specialists

LEARNING OBJECTIVES

- Explain PostgreSQL architecture, MVCC and write-ahead logging
- Configure PostgreSQL parameters, memory, WAL and logging settings
- Manage databases, tablespaces and roles using psql and pgAdmin 4
- Apply authentication, access control and data encryption measures
- Plan and perform backups, point-in-time and table recovery
- Implement table partitioning, vacuuming and routine maintenance tasks
- Configure replication and failover with pgBouncer and pgpool-II
- Analyse query performance using statistics, indexes and explain plans

32 Modules, 204 Topics

01

Introduction

TOPICS

History of PostgreSQL · Major Features · New Features of PostgreSQL · Multi Version Concurrency Control · Write-Ahead Logging · Architectural Overview · Limits

02

PostgreSQL System Architecture

TOPICS

- Architectural Summary
- Shared Memory
- Statement Processing
- Utility Processes
- Disk Read Buffering
- Write Buffering
- Background Writer Cleaning Scan
- Commit & Checkpoint
- Physical Database Architecture
- Data Directory Layout
- Page Layout

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Creating and Managing Databases

TOPICS

Object Hierarchy · Schema Search Path · Roles, Users & Groups · Access Control

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Installation

TOPICS

OS User & Permissions · Installation · Setting environment variables · Clusters · Creating a database cluster · Starting and Stopping the Server (pg_ctl) · Connect to the server using psql

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Configuration

TOPICS

- Setting PostgreSQL Parameters
- Access Control
- Connection Settings
- Security and Authentication
- Settings
- Memory Settings
- Query Planner Settings
- WAL Settings
- Error Reporting & Logging
- Background Writer Settings
- Statement Behaviour
- Vacuum Cost Settings - psql plus (ipo module 4)

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Log Management

TOPICS

Where to Log · When to Log · What to Log

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PSQL Commands

TOPICS

Introduction · Conventions · Connecting to PostgreSQL · PSQL Command Line Parameters · Entering PSQL Commands · PSQL Meta-Commands · PSQL SET Parameters · Information Commands

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pgAdmin 4

TOPICS

- Registering a server
- Viewing and Editing Data
- Query Tool
- Databases
- Languages
- Schemas
- Domains
- Functions
- Sequences
- Tables
- Columns
- Constraints
- Indexes
- Maintenance
- Rules
- Triggers
- Types
- Views
- Tablespaces
- Roles

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Tablespaces

TOPICS

Tablespaces and Datafiles · pg_global and pg_default · Advantages of Tablespaces · Creating Tablespaces · Changing Default Tablespace · Usage Example · Altering Tablespaces · Dropping Tablespaces

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Security

TOPICS

- Authentication
- Authorization
- Levels of security
- pg_hba.conf file
- Users
- Object ownership/ Ownership, etc
- Access control
- Application access parameters
- Superuser
- Groups and Access Control
- Preventing Connections
- Checking secure password
- Auditing Changes (AUDIT should be very deep)
- Encrypting Sensitive data

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Backup and Recovery & Point-in Time

TOPICS

- Recovery
- Planning backups
- Backup Types
- SQL Dump
- Cluster Dump
- Offline Copy Backup
- Continuous Archiving
- pg_basebackup
- Point-In Time Recovery
- pg_upgrade
- Restore
- Pg restore
- Recovery to a point in time
- Restore physical backup
- Recovery of a dropped/damaged table
- Recovery of a dropped/damaged database

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Postgres Data Dictionary

TOPICS

The System Catalog Schema · System Information views/tables · System Information Functions

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Table Partitioning

TOPICS

Partitioning · Partitioning Methods · When to Partition · Partitioning Setup · Partitioning Example · Partitioning and Constraint · Exclusion · Caveats

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Routine Maintenance

TOPICS

Explain and Explain Analyze · Table Statistics · Updating Planner Statistics · Scheduling Auto Vacuum · Preventing Transaction ID Wraparound Failures · The Visibility Map · Routine Reindexing

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Replication & Failover (on Containerized Based Environment Specifically on Kubernetes)

TOPICS

- Database High Availability
- Causes of Data Loss
- Plan for Common Errors
- Selection Criteria
- High Availability Options
- Hot Streaming Replication
- Architecture and Setup
- Streaming Replication Example
- Logical replication

LABS

- LABS

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Migration

TOPICS

- Introduction to Migration Toolkit (Oracle/MSSQL to PostgreSQL)
- Migration Assessment
- Oracle Compatibility
- Demo - Migration from Oracle to PostgreSQL

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Postgres Client Server Architecture

TOPICS

Client Server Architecture

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PostgreSQL Client

TOPICS

Introduction To PSQL · Meta Commands, SQL queries and Parameters

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Remote Client Connection

TOPICS

Postgres hosted based access configuration · Multiple server installation on one machine · Remote client connection using pgAdmin

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Vacuuming

TOPICS

Introduction to vacuum

FINDING BLOATED TABLES / DEAD TUPLES

Using `pg_stat_user_tables` · Using `pgstattuple` extension

Vacuuming to solve bloating issues · Autovacuum feature

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Indexing

TOPICS

- Creating an index
- Checking performance with and without indexes
- Checking performance using index only scans
- Indexing foreign keys
- Partial Indexes
- Checking index bloating using `pgstatindex`
- Reindexing to address index bloating
- Fill factor of the table

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Making Use of Statistics

TOPICS

- Knowing the statistics information using `Pg_stat_activity`, `pg_stat_database`, and `pg_stat_user_tables`
- Checking active user connections
- Knowing active and blocked sessions
- Listing blocking PIDs

HANDLING BLOCKING PIDS

- Waiting for session to complete
- Killing a PID to release locks
- `Pg_stat_statements` extension

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pgBouncer

TOPICS

Introduction to connection Pooling · Building pgBouncer setup · Installing and configuring pgBouncer · Connecting to pgBouncer · Advanced settings for performance

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Tips for Performance Improvement

TOPICS

- Setting min and max time limit for query execution
- Finding slow running queries
- Logging statements
- Setting shared_buffers
- Parallel Queries
- Handling Joins, order by and distinct clauses
- Reducing number of SQL statements

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Connection Pooling

TOPICS

Pgpool-II · Pgpool-II Features · Install and Configure pgpool-II · Pgpool II Modes · Starting/Stopping pgpool-II · Pgpool-II Example

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Obtaining Metadata

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Database Administration

TOPICS

Moving objects between schemas · Moving objects between tablespaces

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Extensions

TOPICS

File_fdw, hstore, citext, etc.

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Performance & Concurrency

TOPICS

- Find and Tune Slow Running Queries
- Collecting regular statistics from pg_stat* views
- Finding out what makes SQL slow
- Speeding up queries without rewriting them
- Discovering why a query is not using an index
- Forcing a query to use an index

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Connection Pooling

TOPICS

Transactions & Concurrency · Transaction Definition · Effects of Concurrent on transactions · Transaction Isolation Levels

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Working on Join, Union, Subqueries, Window Functions

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PostgreSQL Server Developer

TOPICS

- Designing and Implementing Databases and Tables
- Ensuring Data Integrity Through Constraints and Rules
- Working with Full Text Search
- Working with Transactions & Error handling
- Dealing with Large Objects
- Communicating with PostgreSQL Using LibPQ

WHAT IS INCLUDED

Everything You Need to Succeed

- Koenig course material for every module
- Delivery by certified instructors and subject matter experts
- Hands-on exercises throughout the course
- Course completion certificate from Koenig

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