

PostgreSQL 16 Essentials and Administration

Duration: 40 Hours (5 Days)

The PostgreSQL 16 Essentials and Administration course provides a comprehensive introduction to PostgreSQL 16 database administration concepts, architecture, configuration, security, backup and recovery, monitoring, maintenance, and high availability features. It is designed to help participants understand how PostgreSQL works internally and how to manage PostgreSQL databases effectively in enterprise environments.

The course covers both theoretical concepts and practical administration tasks required for managing PostgreSQL databases. Participants will learn installation, configuration, database management, security implementation, backup and recovery strategies, routine maintenance, data loading techniques, and replication technologies.

By the end of the course, participants will be able to:

- Understand PostgreSQL architecture and internal components
- Install and configure PostgreSQL 16
- Manage databases, users, roles, and schemas
- Perform administrative operations using command-line tools and pgAdmin
- Implement database security and access control
- Monitor database activities and performance
- Perform backup, recovery, and point-in-time recovery (PITR)
- Execute routine maintenance tasks
- Load and move data efficiently
- Configure replication and high availability solutions

Target Audience

This course is suitable for:

- Database Administrators (DBAs)
- Oracle DBAs transitioning to PostgreSQL
- MySQL or MSSQL DBAs learning PostgreSQL
- System Administrators managing PostgreSQL servers
- IT Professionals interested in open-source databases

Prerequisites

Participants should have:

- Basic understanding of relational database concepts
- Basic SQL knowledge
- Familiarity with Linux/Unix command-line environment

Course Syllabus

Day 1

Module 1: Introduction

- EDB Portfolio
- History of PostgreSQL
- Major Features
- Architectural Overview
- General Database Limits
- Common Database Object Names

Module 2: System Architecture

- Architectural Summary
- Process and Memory Architecture
- Utility Processes
- Connection Request and Response
- Disk Read Buffering
- Disk Write Buffering
- Background Writer Cleaning Scan
- Commit and Checkpoint Processing
- Statement Processing
- Physical Database Architecture
- Data Directory Layout
- Installation Directory Layout
- Page Layout

Module 3: PostgreSQL Installation

- Deployment Options
- OS User and Permissions
- Package Installation
- Installation Examples and Practice Labs
- Setting Environmental Variables

Module 4: User Tools – Command Line Interfaces

- Introduction to psql
- Connecting to Database
- psql Command Line Parameters

- psql Meta-Commands
- Conditional and Information Commands

Day 2

Module 5: Database Clusters

- Database Clusters
- Creating a Database Cluster
- Starting and Stopping the Server using pg_ctl
- Connecting to the Server using psql

Module 6: Configuration

- Server Parameter File – postgresql.conf
- Viewing and Changing Server Parameters
- Configuration Parameters – Security, Resources and WAL
- Configuration Parameters – Error Logging, Planner and Maintenance
- Viewing Compilation Settings
- Using File Includes

Module 7: Data Dictionary

- The System Catalog Schema
- System Information Tables and Views
- System Information and Administration Functions

Day 3

Module 8: Creating and Managing Databases

- Object Hierarchy
- Users and Roles
- Tablespaces
- Databases
- Access Control
- Creating Schemas
- Schema Search Path

Module 9: Database Security

- Database Security Requirements and Protection Plan
- Levels of Security in PostgreSQL
- Access Control using pg_hba.conf
- Introduction to Row Level Security

- Data Encryption
- General Security Recommendations

Module 10: Monitoring and Administrative Tools

- Overview and Features of pgAdmin
- Accessing pgAdmin
- Registering and Connecting to a Database Server
- General Database Administration
- Object Browser, View Data, Query Tool and Server Status
- Overview of Postgres Enterprise Manager (PEM)

Day 4

Module 11: SQL Primer

- Data Types
- Structured Query Language (SQL)
- DDL, DML and DCL Statements
- Transaction Control Statements
- Tables and Constraints
- Views and Materialized Views
- Sequences
- Domains
- SQL Joins and Functions
- Explain Plans
- Quoting in PostgreSQL
- Indexes

Module 12: Backup, Recovery and PITR

- Backup Types
- Database SQL Dumps
- Restoring SQL Dumps
- Offline Physical Backups
- Continuous Archiving
- Online Physical Backups using pg_basebackup
- Point-in-Time Recovery (PITR)
- Recovery Settings
- Backup Tools – Barman and pgBackRest

Day 5

Module 13: Routine Maintenance Tasks

- Updating Optimizer Statistics
- Handling Data Fragmentation using Routine Vacuuming
- Preventing Transaction ID Wraparound Failures
- Automatic Maintenance using Autovacuum
- Re-indexing in PostgreSQL

Module 14: Moving Data using COPY Command

- Loading Flat Files
- Import and Export Data using COPY
- Examples of COPY Command
- Using COPY FREEZE for Performance

Module 15: Replication and High Availability Tools

- Data Replication
- Data Replication in PostgreSQL
- Streaming Replication and Architecture
- Synchronous, Asynchronous and Cascaded Replication
- Setting Up Streaming Replication
- Logical Replication Architecture
- Overview of:
 - EDB Postgres Distributed
 - EDB Failover Manager (EFM)
 - Replication Server
 - Replication Manager (repmgr)