

Customized EDB PostgreSQL administration & Performance tuning

Part 1: Introduction

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

Part 2: PostgreSQL System Architecture

- 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

Part 3: Creating and Managing Databases

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

Part 4: Installation

- 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

Part 5: Configuration

- 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)

Part 6: Log Management

- Where to Log
- When to Log
- What to Log

Part 7: PSQL Commands

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

Part 8: pgAdmin 4

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

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- Triggers
- Types
- Views
- Tablespaces
- Roles

Part 9: Tablespaces

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

Part 10: Security

- 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

Part 11: Backup and Recovery & Point-in Time

- 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

Part 12: Postgres Data Dictionary

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

Part 13: Table Partitioning

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

Part 14: Routine Maintenance

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

Part 15: Replication & Failover (on Containerized based environment specifically on Kubernetes)

- Database High Availability
- Causes of Data Loss
- Plan for Common Errors

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- Selection Criteria
- High Availability Options
- Hot Streaming Replication,
- Architecture and Setup
- Streaming Replication Example
- Logical replication
- LABS

Part 16: Migration

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

Part 17. Postgres Client Server Architecture

- Client Server Architecture

Part 18. PostgreSQL client

- Introduction To PSQL
- Meta Commands, SQL queries and Parameters

Part 19. Remote client connection

- Postgres hosed based access configuration
- Multiple server installation on one machine
- Remote client connection using pgAdmin

Part 20. Vacuuming

- I. Introduction to vacuum
- II. Finding bloated tables / dead tuples
 - a. Using pg_stat_user_tables
 - b. Using pgstattuple extension

III. Vacuuming to solve bloating issues

- I. Autovacuum feature

Part 21. Indexing

- 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

Part 22. Making use of Statistics

- 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

Part 23. pgBouncer

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

Part 24. Tips for performance improvement

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- 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

Part 25. Connection Pooling

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

Part 26. Obtaining Metadata

Part 27. Database Administration

- Moving objects between schemas
- Moving objects between tablespaces

Part 28. Extensions

- File_fdw, hstore, citext, etc.

Part 29. Performance & Concurrency

- 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

Part 30. Connection Pooling

- Transactions & Concurrency
- Transaction Definition
- Effects of Concurrency on transactions
- Transaction Isolation Levels

PART 31. Working on join, union, sub-queries, window functions

PART 32. PostgreSQL Server Developer

- 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