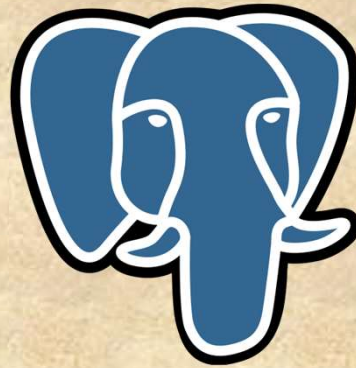




Introduction to PostgreSQL

- **Preface and Installation**



Ali Momen



A WORD FOR THE DATABASE ADMINISTRATORS

- Redgate recently launched their State of the Database Landscape 2024 survey results, from almost 4,000 database professionals from around the globe. A clear picture emerged from the results, suggesting that 2024 is the year that skill diversification among database professionals is imperative. There's the need to manage multiple databases, to migrate to the cloud, to introduce continuous delivery with DevOps, and even incorporating Generative AI into the mix.
- The key finding? That the pace of change in our industry is faster than ever. This is causing a recurring challenge to emerge: the rapid need for skill diversification from data professionals everywhere.
- 79% of businesses use two or more database platforms; introducing a new level of complexity for those responsible for database and data management.
- Read more at the link given below.



A WORD FOR THE DATABASE ADMINISTRATORS



RedGate Survey about skill diversification:

[Navigating the database landscape in 2024: Shifting skills to match constant demands - Redgate events \(red-gate.com\)](https://www.red-gate.com/hub/events/navigating-the-database-landscape-in-2024)

<https://www.red-gate.com/hub/events/navigating-the-database-landscape-in-2024>



MORE GENERAL INFO ABOUT POSTGRESQL

- The PostgreSQL Object-relational Database Management System (ORDBMS) is a powerful, stable, open-source, free, and transactional database management system with diverse, powerful, abundant features, and the ability to be developed with various procedural languages. These languages include PL/PGSQL, PL/Python, PL/Tcl, and PL/Perl. This makes PostgreSQL accessible to a wide range of developers. Its object-oriented features simplify the work for programmers using object-oriented programming capabilities. Other features include diverse data types and operator overloading, allows developers to define indexes in a broader and more complex manner. This RDBMS is specifically designed for free and open-source Unix-based operating systems, including Linux, but it can be installed and used on all major operating systems, including Windows, Unix, macOS, Solaris, BSD systems, and more, both natively and in containers. Additionally, this ORDBMS is used on numerous devices. PostgreSQL belongs to and is maintained by EnterpriseDB (EDB). The main Linux distribution that EDB uses is RHEL (for example, RHEL itself, RockyLinux, OracleLinux, CentOS, Fedora, Alma Linux, etc.), but PostgreSQL as noted is highly flexible with the hosting platform because it is widely used on numerous platforms. But some of the peripheral modules maintained by EDB are known to have some issues with some other platforms for example Ubuntu.



MORE GENERAL INFO ABOUT POSTGRESQL

- Like its main host, Linux, PostgreSQL is highly customizable and can be managed with numerous peripheral extensions and modules, allowing users to add desired features to enhance this RDBMS as needed. Some of these extensions are exclusive for PostgreSQL, while some others are intended for many other applications, as well. However, this feature also makes its management more complex like Linux. PostgreSQL modules include both commercial and free ones, but they are mostly open-source and free.
- This RDBMS is very popular and has a large community of experts who contribute to the enhancement of PostgreSQL and its modules and help solve other experts' problems. PostgreSQL can be used for free at the enterprise level, and its main host, Linux, is also free, which is why many companies use it as their primary data storage system or one of their data storage systems. This RDBMS is currently very popular and has established a strong base for itself.




POSTGRESQL'S ROBUSTNESS

- In the context of PostgreSQL, robustness refers to the database system's ability to provide reliable performance, maintain data integrity, and handle errors gracefully under various conditions. PostgreSQL is known for its robust feature set, which includes comprehensive support for different data types, advanced indexing, full ACID (Atomicity, Consistency, Isolation, Durability) compliance for transactions, and extensive capabilities for data integrity and disaster recovery.
- Robustness in PostgreSQL ensures that the system can manage large volumes of data and complex queries without compromising on performance. It also means that PostgreSQL can recover from failures and continue to operate effectively, which is crucial for maintaining the availability and reliability of applications that depend on the database



REFERENCES





- Some PostgreSQL References
- **postgresql.org:** 
It is the home of the PostgreSQL project
<https://www.postgresql.org>
- **PostgreSQL latest DOCs:**
Official PostgreSQL Documentation on postgresql.org for the latest stable release:
<https://www.postgresql.org/docs/current/index.html>
- **PostgreSQL feature matrix:**
PostgreSQL feature matrix
<https://www.postgresql.org/about/featurematrix/>
- **PostgreSQL Wiki:**
This wiki contains user documentation, how-tos, and tips 'n' tricks related to PostgreSQL
https://wiki.postgresql.org/wiki/Main_Page
This website also has a similar purpose:
<https://pgpedia.info>



REFERENCES



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- **Percona Blog:**  PERCONA
Percona is a website with useful tools and useful knowledge sources
<https://www.percona.com/blog/>
 - **EnterpriseDB:**  EDB
EnterpriseDB knowledge base
<https://knowledge.enterprisedb.com/hc/en-us>
 - **Download PostgreSQL:**
Download and install PostgreSQL instructions, repositories, etc. for different platforms and architectures.
<https://www.postgresql.org/download/>
 - **Download PostgreSQL deb/rpm packages:**
Download deb/rpm packages and install them using dpkg or rpm commands. (Mostly suited for offline installation purposes)
<https://apt.postgresql.org/pub/repos/>
 - **PostgreSQL Software Catalog:**
Some of the different solutions for different needs regarding PostgreSQL, listed on postgresql.org website. For instance, Administration/development tools, Clustering/replication solutions, extensions, etc.
<https://www.postgresql.org/download/product-categories/>
 - **PostgreSQL Contrib extension pack details:**
A clarification about different extensions included within the PostgreSQL Contrib side-package, version history, availability, and other useful info about them. The Contrib package is included by default with the PostgreSQL server main package since PostgreSQL 9.1.
<https://pgpedia.info/c/contrib-module.html>
 - **PostgreSQL Official Repository:**
Mirror of the official PostgreSQL GIT repositories on GitHub.
<https://github.com/postgres>



NOTATION



- pg stands for postgresql
- repo stands for repository
- distro stands for distribution
- * sometimes is used to replace version number (major and minor). Sometimes however, the version number is directly noted which is mostly 16 for this document.
- Deb stands for Debian
- RHEL stands for Red Hat Enterprise Linux.



COMPARING POSTGRESQL WITH SQL SERVER

Major Differences

SQL Server	PostgreSQL
Relational database management system	Object-relational database management system
Commercial product from Microsoft	Open source (completely free)
Runs only on Microsoft or Linux	Runs on most machines and operating systems
Uses Transact-SQL or T-SQL (standard SQL + extra functionality)	Uses Standard SQL



RDBMS vs. ORDBMS

SQL Server: traditional application tasks for data processing

PostgreSQL: applications that contain complex objects (Ex: new data types like video, audio, and image files)

Spatial Data Types



COMPARING POSTGRESQL WITH SQL SERVER

Terminology:

Some of the major differences between MSSQL-Windows and PG-Linux with respect to the terminology

PG	MSSQL
Replication	AlwaysOn
MVCC	Snapshot Isolation (SI)
Bash Scripting	PowerShell Scripting, Batch Scripting
Database Cluster	SQL Server Instance
Virtual IP (VIP)	Listener



Programming language support:

SQL Server: Java, JavaScript (Node.js), C#, C++, PHP, Python, and Ruby.

execute_external_script (OpenR, OpenPython)

PostgreSQL: Python, PHP, Perl, Tcl, Net, C, C++, Delphi, Java, JavaScript (Node.js), and more.



	SQL Server	PostgreSQL
SELECT ...	Select [col1], [col2]	SELECT col1, col2
Aliases for columns and tables	SELECT AVG(col1)=avg1	SELECT AVG(col1) AS avg1
Working with dates	GETDATE() DATEPART()	CURRENT_DATE() CURRENT_TIME() EXTRACT()



PostgreSQL:



Advantages	Disadvantages
Highly extensible to add functions, data types, languages, and more	Slower performance compared to other RDBMS like SQL Server and MySQL
Support for unstructured data types (for example, audio, video, and images)	Stronger focus on compatibility, speed improvements require extra work
MVCC for concurrent processing and high rates of transactions without almost no deadlock	Installation can be difficult for beginners
High availability and server failure recovery	
Advanced security features like data encryption, SSL certificates, and advanced authentication methods	
Active open source community continually improves and updates solutions	



SQL Server:



Advantages	Disadvantages
High performance and in-memory database capabilities	No support for MVCC, depends on default locking to avoid errors
Built-in security features, such as alerts, monitoring, data protection, and data classification	Licensing, support, and advanced feature costs are expensive
Simple to install and configure with easy-to-use interface and automatic updates	Hardware restrictions may require you to upgrade your machines to support newer SQL Server versions
Convenient backup and data recovery features and high availability tools	
Tasks can be scheduled using SQL Server Management Studio	
Works well with other Microsoft data analytics, development, and monitoring tools	