The EnterpriseDB Engine of PostgreSQL Development

The adoption of Postgres is accelerating as organizations realize new levels of operational flexibility and performance in recent releases. Organizations have benefited from expanding feature sets while placing greater demands for new capabilities.

Six versions of EDB Postgres™ Advanced Server and PostgreSQL have been released since 2012: v9.2, 9.3, 9.4, 9.5, 9.6, and 10. (As of October 2017, EDB Postgres Advanced Server featuring v10 is code complete and in testing for release in late 2017.)

Performance and security improvements as well as new DBA and developer features have been introduced in each of these releases. EnterpriseDB® (EDB™) has also expanded support for a wider variety of new deployment environments.

EDB has the reputation for leadership in the PostgreSQL development community and for building major functionality, performance enhancements, enterprise features and contributing the technology to the PostgreSQL code base.

EDB engineers are responsible for many of the recent major advances in PostgreSQL indexing, query parallelism, partitioning, performance, and scalability.

Among EDB's engineers are two members of the PostgreSQL Global Development Group Core Team—Bruce Momjian, the co-founder of the Global Developer Development Group; and Dave Page, the inventor of pgAdmin and current project leader as well as EnterpriseDB Vice President, Chief Architect, Tools and Installers. EDB engineers also include multiple Major Contributors to the Postgres code base who are officially recognized by the Core Team, including Robert Haas, EnterpriseDB Vice President, Chief Database Architect, who is widely known as one of the leading Postgres experts in the world, and Amit Kapila, a Senior Database Architect.

The following summary highlights EDB's contributions and leadership in the Postgres community while also detailing the major improvements and features in Postgres by version:

Created By	Feature/Capability
PostgreSQL v10	
OPEN SOURCE COMMUNITY	» Declarative Partitioning eliminates user creation of triggers » Logical Replication allows partial replication of the database » SCRAM authentication supports improved password security » ICU Collation Support eases database migrations and special sorting needs » Extended Statistics improves the efficiency of the query planner
ENTERPRISEDB	» Parallel Query support for index and bitmap heap scans improves performance » Durable hash indexes provide upgrade to in-memory hash indexes » Executor performance improvements » Foreign Data Wrapper (FDW) aggregates push down logic improves distributed database performance » Improved wait events visibility improves monitoring and troubleshooting tasks

Created By	Feature/Capability

EDB Postgres Advanced Server v10

ENTERPRISEDB	» Includes all community PostgreSQL v10 features » Partitioning improvements (hash, row movement, pruning) for maintenance and performance » Auditing improvements (DDL or DML configurable by user/database, output to syslog) improve activity tracking » Clone schema quickly copies an entire schema » Customizable WAL segment size for finer control on durability » Automatic Pre-warm saves/reloads buffer cache reducing time to reach full operating performance on re-starts » IN OUT Parameters for EXECUTE IMMEDIATE for easier transitions from Oracle

PostgreSQL v9.6

OPEN SOURCE COMMUNITY	» Vacuum improvements reduces maintenance tasks » Full-text search for phrases (lexemes) improves query versatility and performance » Remote joins, sorts and updates in distributed Postgres databases improves performance » Improved monitoring statistics provides finer level views of performance
ENTERPRISEDB	» Parallel query with sequential scans, joins and aggregates for increased performance » Synchronous replication support for multiple simultaneous standbys for improved scalability

EDB Postgres Advanced Server v9.6

ENTERPRISEDB	» Includes all community PostgreSQL v9.6 features » Database integrated message queuing allows inter-application communications (Syntactically compatible with Oracle) » Nested sub-procedures (Compatible with Oracle) allow more sophisticated processing » Partitioned table performance enhancements » Database link performance enhancements » EDB*Loader enhancements » Compatibility with additional Oracle features for easier transitions from Oracle

Created By	Feature/Capability

PostgreSQL v9.5

OPEN SOURCE COMMUNITY	» Block Range Indexes (BRIN) improve query performance in very large tables » UPSERT allows conditional processing for possible duplicates violations » Row Level Security policies segregates users from each other's data » Grouping Sets, ROLLUP and CUBE for summarizing data sets easily » JSONB modifying functions added for comprehensive JSON support » Schema creation for Foreign Data Wrappers automatically generates local tables
ENTERPRISEDB	» Multiple performance improvements: sorting, in-memory hash and concurrency locking » Parallelism infrastructure

EDB Postgres Advanced Server v9.5

ENTERPRISEDB	» Includes all community PostgreSQL v9.5 features » Password profiles allow database controlled User account and password management rules (Compatible with Oracle) » Audit Log tagging captures middleware and client data for true end user tracking » XA two-phase commit support for Tuxedo and Oracle » Improved performance under high concurrency

PostgreSQL 9.4

OPEN SOURCE COMMUNITY	» JSONB data type & indexing for high performance JSON document processing » Additional JSON & JSONB functions to support a wider variety of document based applications » Logical Decoding for improved cluster scalability » Ability to delay application of replication for tighter controls over data » GIN index improvements for 3x performance increase » Linux® Huge Pages support for improved performance on large-memory systems
ENTERPRISEDB	» pg_prewarm saves/reloads buffer cache reducing time to reach full operating performance on re-starts » ALTER SYSTEM command makes changing postgresql.conf configuration easier » Concurrently updated Materialized Views provides refresh without blocking concurrent READs » MongoDB FDW & MySQL FDW with bidirectional data for easy integration/ joining of external databases

Created By	Feature/Capability

EDB Postgres Advanced Server v9.4

ENTERPRISEDB

» Includes all community PostgreSQL v9.4 features
» Resource Manager prioritizes CPU and I/O resources protecting high priority processes from low priority loads
» Unicode collation support allows customizable sort orders
» Compatibility with the following Oracle features:
　» CONNECT_BY_ROOT Operator for expanded hierarchical queries
　» SQL Aggregation with CUBE, ROLLUP and GROUPING SETS expands into Data Warehousing applications
　» Comprehensive UTL_HTTP Package adds database versatility with direct Internet calls
　» In-memory hash partitioning improves performance of searching large busy tables for exact matches
» SQL/Protect logging to table for improved analyses (SQL/Protect is EDB's SQL Injection Protection module)
» EDB*Loader improved error handling (EDB*Loader is syntactically compatible with Oracle SQL*Loader)

PostgreSQL v9.3

OPEN SOURCE COMMUNITY

» 64 bit LOBs up to 4 TB in size increase the range of applications possible
» Custom background workers eliminate the need for external scripts to run companion programs
» Writable Postgres Foreign Data Wrappers for bidirectional data movement
» Parallel processing for pg_dump and pg_upgrade improve operational performance

ENTERPRISEDB

» Materialized Views improve performance by avoiding processing of large underlying tables

EDB Postgres Advanced Server v9.3

ENTERPRISEDB

» Includes all community PostgreSQL v9.3 features
» Partition pruning dramatically improving performance for SELECT and INSERT across extensive partitioning
» Syntactically compatible with Oracle for Materialized Views for easier transitions from Oracle
» Compatibility with eight Oracle function packages for easier transitions from Oracle

Created By	Feature/Capability

PostgreSQL 9.2

OPEN SOURCE COMMUNITY	» Multiple Lock Management improvements help support more users » Cascaded streaming replication provides DBAs more replication configuration options » JSON document data type supports popular web application persistence format » Range Types give developers more options for better calendaring, scientific and financial applications » View Security Barriers prevent data leakage from Views in other usage scopes
ENTERPRISEDB	» Index Only Scans improves performance when SELECT data resides in index » MySQL Foreign Data Wrapper for SQL/MED provides a direct channel to data in MySQL

EDB Postgres Advanced Server v9.2

ENTERPRISEDB	» Includes all community PostgreSQL v9.2 features » INSERT APPEND hint improves performance when adding new rows to frequently updated tables » Oracle Object Type compatibility support provides object oriented data types for developers » PL/SQL sub-types provide increased readability, compatibility and reliability of code » Multiple Nested Table improvements reduce programmer's workload

— Continued —

EDB Postgres™ Platform Architecture Expansion

In addition to database features, EDB has built an enterprise platform around Postgres to provide the necessary tooling and software needed for robust, secure, highly available, scalable and reliable data infrastructures. Below is a list of the most notable achievements:

EDB Postgres™ Failover Manager (2013)
EnterpriseDB released EDB Postgres Failover Manager (EFM) to create and manage highly available PostgreSQL environments. EFM allows managed switchovers, monitors Postgres cluster members' health, identifies and verifies database failures quickly and reliably, and if configured, automatically fails over a standby node to be the cluster master, and issues alerts. Like all EDB Postgres tools, EFM is included as part of an EDB database subscription at no additional cost.

EDB Postgres™ Backup and Recovery (2014)
EnterpriseDB released the EDB Postgres Backup and Recovery (BAR) to facilitate performing and managing Postgres backups and recovery operations. BAR implements retention policies, supports point-in-time recovery, and provides block-level incremental backup capabilities. Like all EDB Postgres tools, BAR is included as part of an EDB database subscription at no additional cost.

EDB Postgres™ Enterprise Manager
EnterpriseDB has continued to release improvements to the EDB Postgres Enterprise Manager (PEM). PEM collects performance and status data—from databases it monitors, the operating system, and data resulting from jobs it executes on the database host—then displays it in dashboards where it's analyzed for alert conditions. Alerts can be relayed to operators or to other enterprise-level management systems. PEM also allows DBAs and developers to work with the databases directly, execute DDL and DML commands, tune queries, manage indexes, run backups, and deploy software updates. The latest version of PEM was re-architected to take advantage of modern web application technologies, which makes it easier to deploy, configure, and use in enterprise environments. Like all EDB Postgres tools, PEM is included as part of an EDB database subscription at no additional cost.

EDB Postgres™ Replication Server
EnterpriseDB has continued to release improvements to the EDB Postgres Replication Server (EPRS) (formerly known as xDB Replication Server). EPRS provides a robust data replication platform that replicates between Postgres databases in a single-master or multi-master mode, or from non-Postgres databases to Postgres in a single master mode. EPRS provides geographic load balancing, simplifies real-time migration, and enables heterogeneous data integration. Replication from EDB Postgres Advanced Server 9.4 or higher and PostgreSQL 9.4 or higher uses high speed log-based replication, extracting any changes from the Write-Ahead Logs (WAL) of the master and applying these changes to the replicas, reducing the overhead on the master and reducing latency significantly. Trigger-based replication is also available. Like all EDB Postgres tools, EDB Postgres Replication Server is included as part of an EDB database subscription at no additional cost.

EDB Postgres™ Ark DBaaS Infrastructure (2016)
EDB Postgres Ark is a DBaaS infrastructure that works with multiple cloud providers including: public AWS, private OpenStack® and public Microsoft Azure™ clouds. EDB Postgres Ark deploys development instances and robust production Postgres clusters in minutes, supporting programmers' agile development methods while providing operations personnel visibility, control and choice over their data infrastructure. A GUI self-service option

complements a ReSTful API for integration into DevOps infrastructures based on Chef or Puppet scripting or IT Service Management systems like BMC Software® Inc.'s Remedy™ or ServiceNOW®. EDB Postgres Ark deployments are load-balanced, connection pooled and highly available. They further have integrated backup and disaster recovery, support cross-platform replication (database, provider and geo), have self-healing capabilities and provide controls over storage and read replica elasticity. EDB Postgres Ark gives IT managers the ideal combination of deployment flexibility combined with centralized control and monitoring while providing developers point and

click simplicity, flexibility and speed when developing and deploying applications.

Expanded Deployment Targets
EnterpriseDB provides support for deploying and configuring Postgres using modern DevOps technologies and solutions including OpenStack, Docker™, Kubernetes®/ Openshift®, Pivotal Cloud Foundry® and others. EDB makes available Docker containers for master and standby databases, backup and recovery, and EDB Postgres Enterprise Manager.

EnterpriseDB Technology Portfolio

MANAGEMENT
- EDB Postgres Enterprise Manager
- EDB Postgres Failover Manager
- EDB Postgres Backup and Recovery

CLIENT CONNECTION
- Node.js
- OCL
- Python
- ECPG*Plus
- JDBC
- EDB*Plus
- ODBC
- EDB*Loader
- .NET

CONNECTION MANAGEMENT
- pgBouncer
- pgPool

MIGRATION
- EDB Migration Toolkit
- Oracle compatible APIs for JDBC, ODBC, .NET, OCI, ECPGPlus

INTEGRATION
- EDB Postgres Replication Server (Oracle®, SQL Server®)
- EDB Postgres Data Adapters (Hadoop®, MongoDB®, MySQL™)

DATA MANAGEMENT
- EDB Postgres Advanced Server
  (Database compatibility, Security, Auditing, DBA Utilities, Developer Value-Add, Performance Enhancements)
- PostgreSQL
  (ACID Compliace, JSONB & HSTORE, TCL, Python, Java, PL/V8 stored procedures)
- PostGIS
  (Geocoding, Raster data, GiST Index)

AUTHENTICATION/ AUTHORIZATION
- LDAP
- Active Directory
- Kerberos Integration

DEPLOYMENT OPTIONS
- Bare metal
- Virtualization
- Containers
- Private cloud
- Public cloud
- Hybrid cloud

DBaaS and IaaS
- EDB Ark
- OpenShift®
- Cloud Foundry®
- AWS™
- Google Cloud™