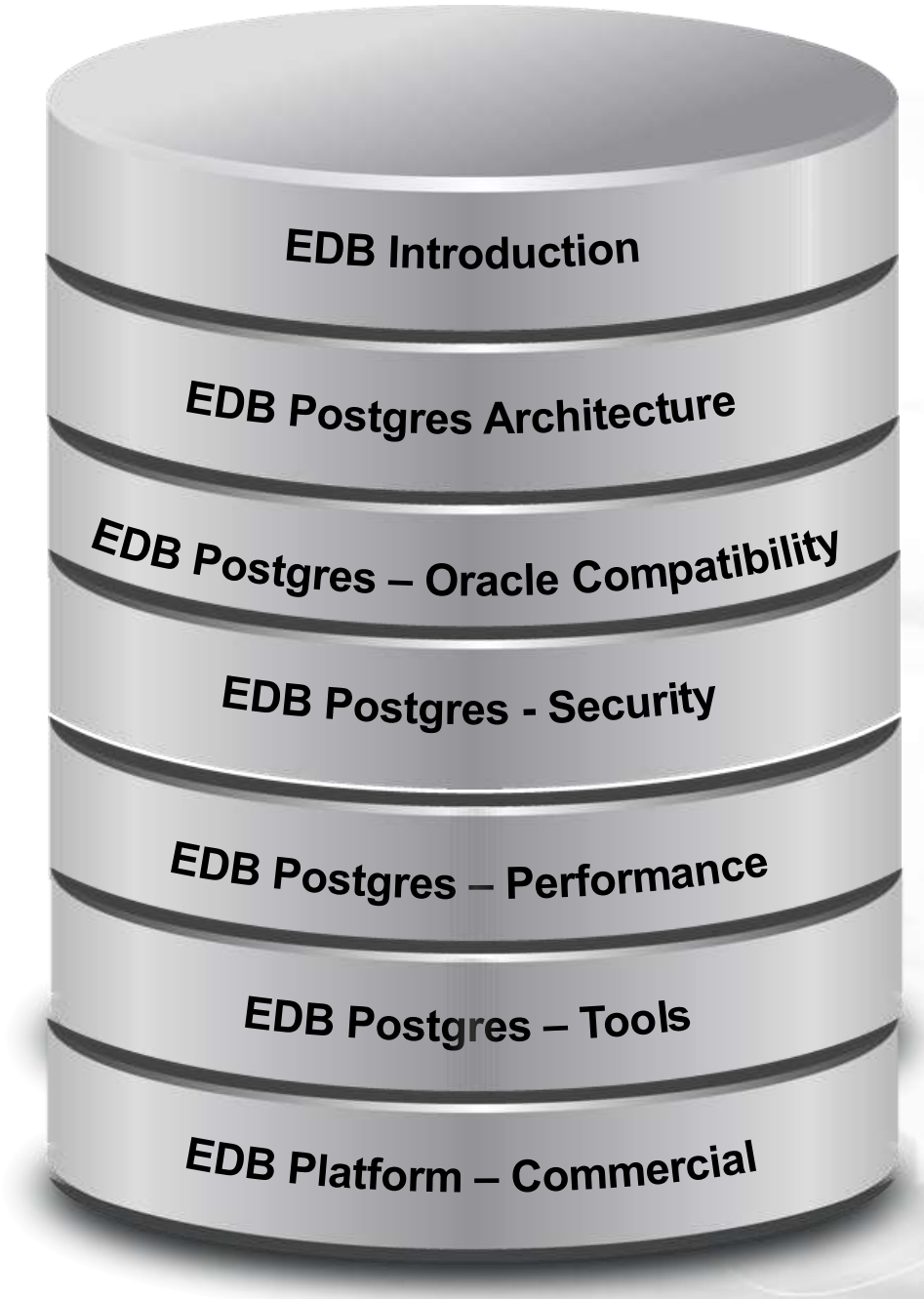
EDB Postgres
vs
Oracle

Ossi Karjalainen
EMEA Sales Engineering Director

Agenda



EDB POSTGRES

Introduction to EDB

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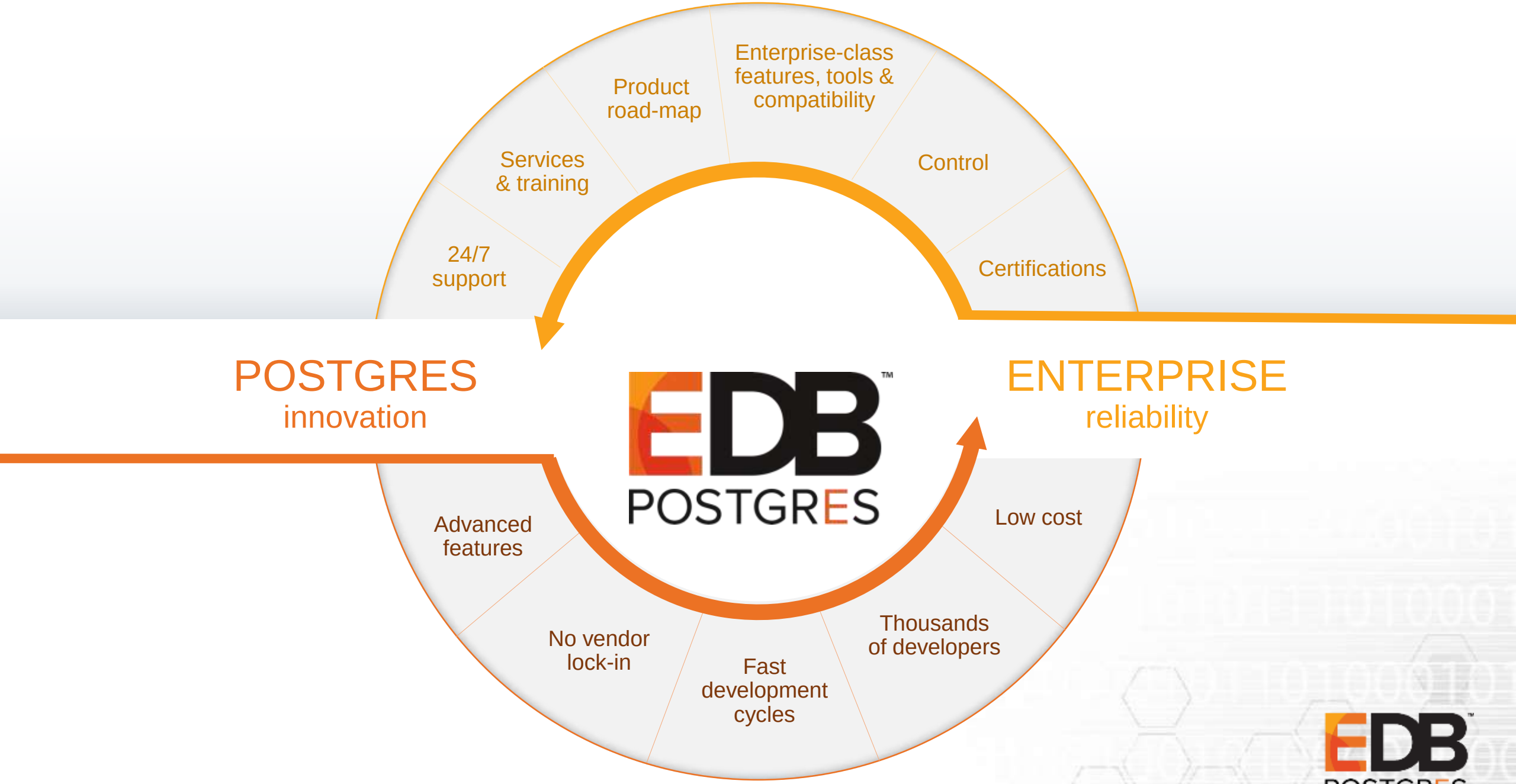

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EDB Customers

EDB currently has over 3,700 total customers including 85 of the Fortune 500 and 169 of the Forbes Global 2000

EDB POSTGRES

Gartner MQ: EDB is The Leading OSS-Based DBMS

Gartner Comments (Oct, 2016)

"**Growing visibility and community leadership**..."

"**Functionality and compatibility:** Steady release cadence and a strong roadmap are driving an increasingly rich array of features in EDB Postgres, leading to ratings in the top four for the traditional transactions and distributed variable data use cases..."

"**Deployment flexibility:** Virtualization (VMware, Docker) and cloud deployment (AWS, Google Cloud) have created significant opportunities for EDB Postgres in customers who are modernizing their environments..."

This graphic was published by Gartner, Inc. as part of a larger research document and should be evaluated in the context of the entire document. The Gartner document is available upon request from EnterpriseDB.

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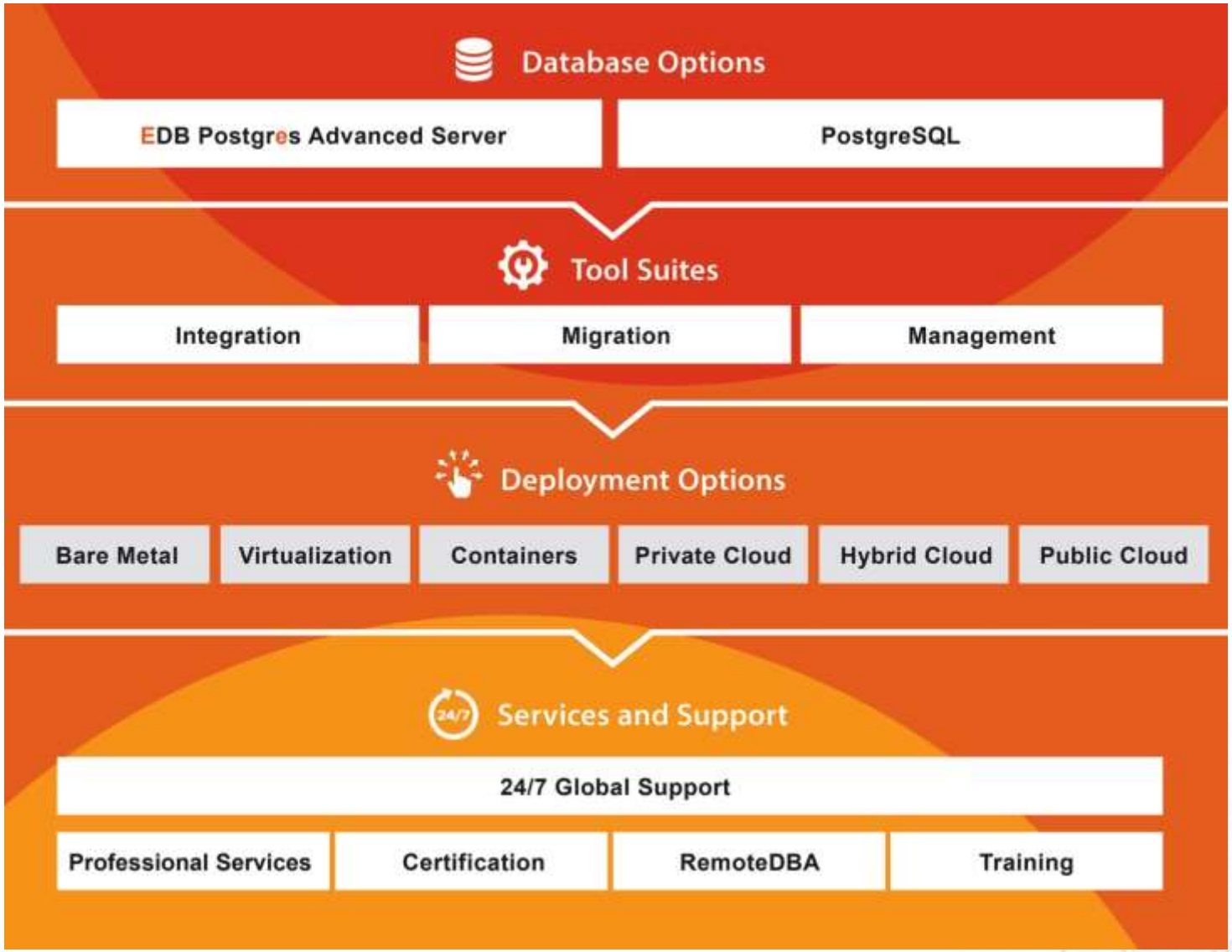
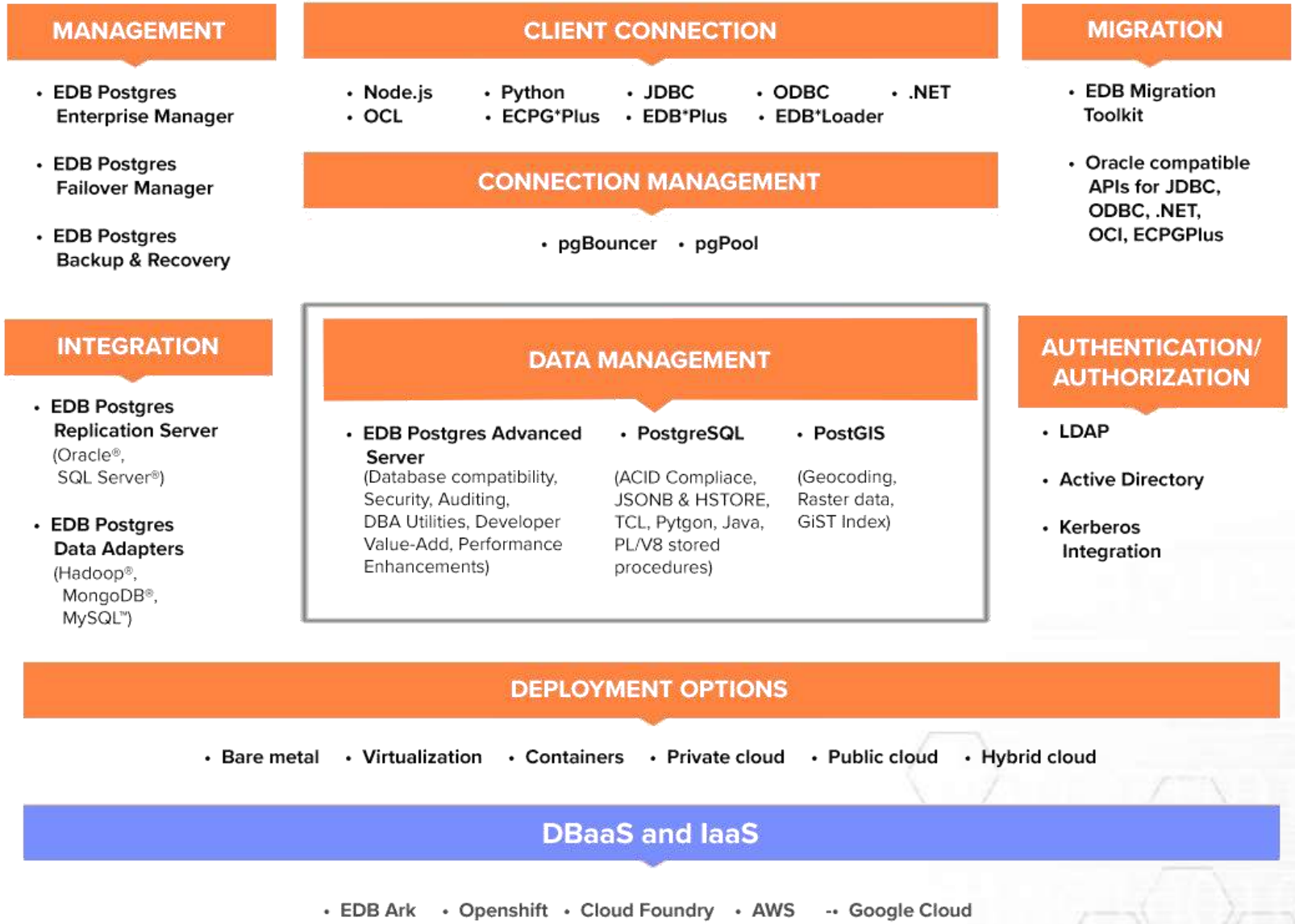
Figure 1. Magic Quadrant for Operational Database Management Systems

Source: Gartner (October 2016)

EDB Postgres Platform



EDB Technologies



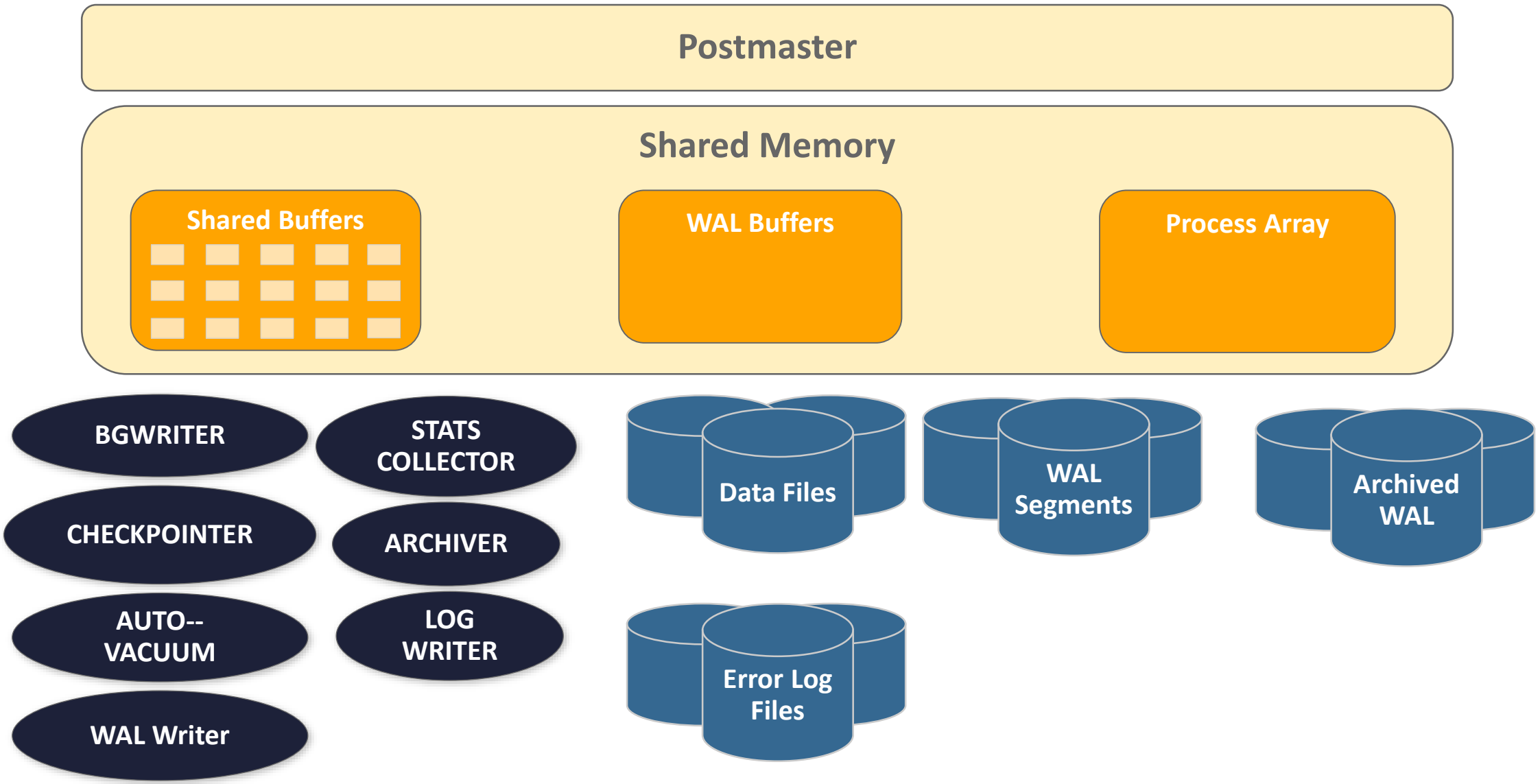
General Database Limits

Limit	Value
Maximum Database Size	Unlimited
Maximum Table Size	32 TB
Maximum Row Size	1.6 TB
Maximum Field Size	1 GB
Maximum Rows per Table	Unlimited
Maximum Columns per Table	250-1600 (Depending on Column types)
Maximum Indexes per Table	Unlimited

Common Database Object Names

Industry Term	PostgreSQL Term
Table or Index	Relation
Row	Tuple
Column	Attribute
Data Block	Page (when block is on disk)
Page	Buffer (when block is in memory)

Process and Memory Architecture



Utility Processes

- Background writer
  - Writes dirty data blocks to disk
- WAL writer
  - Flushes write-ahead log to disk
- Checkpointer process
  - Automatically performs a checkpoint based on config parameters
- Autovacuum launcher
  - Starts Autovacuum workers as needed
- Autovacuum workers
  - Recover free space for reuse

More Utility Process

- Logging collector
  - Routes log messages to syslog, eventlog, or log files
- Stats collector
  - Collects usage statistics by relation and block
- Archiver
  - Archives write-ahead log files

Database Compatibility for Oracle®

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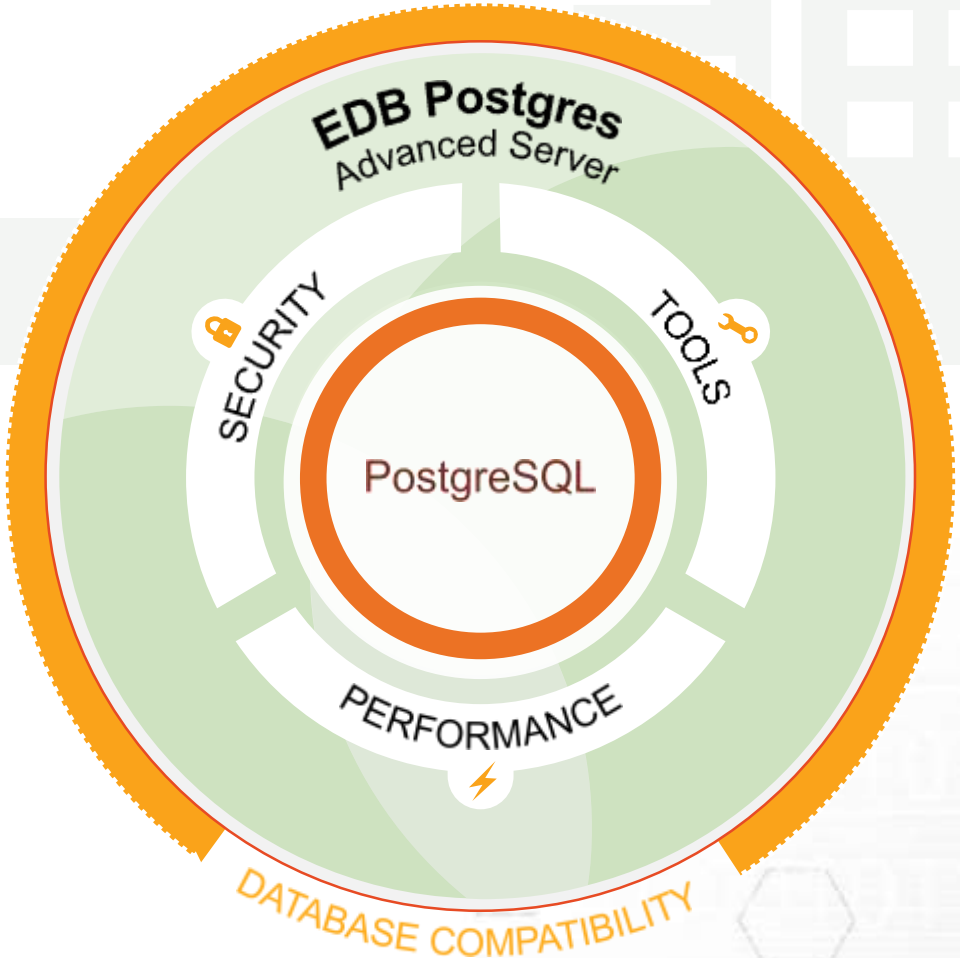
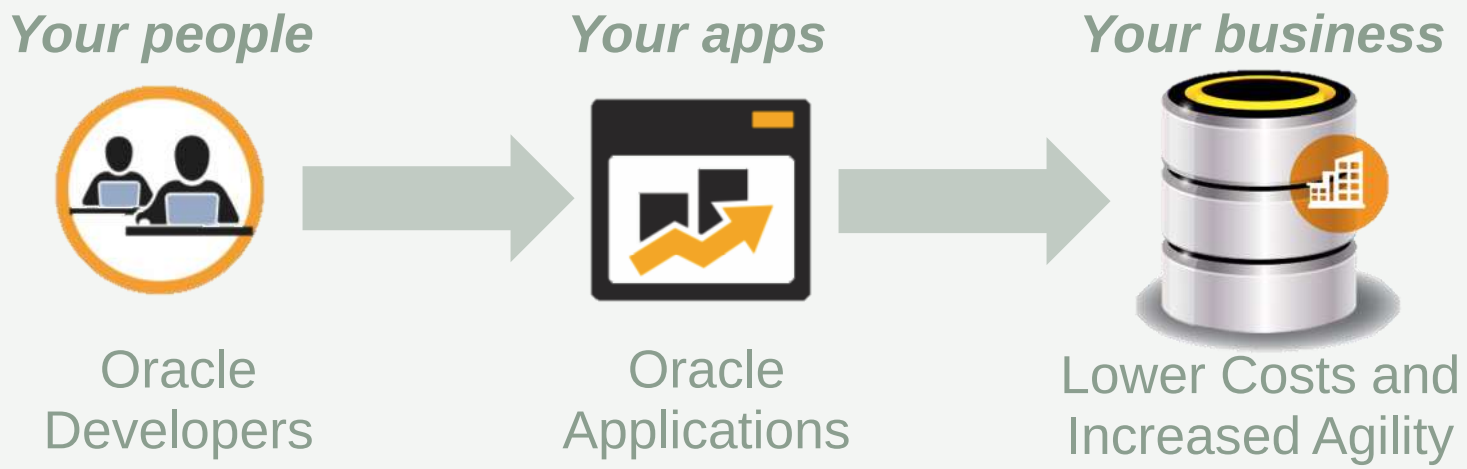
Database Compatibility for Oracle®

- Faster, easier migrations
- PL/SQL, OCI support
- Oracle SQL extensions
- User defined objects
- Function packages
- Database links
- Oracle-like tools:
  *EDB*Loader, EDB*Plus, EDB*Wrap*



Database Compatibility for Oracle®

Compatible with:



- Run applications written for Oracle virtually unchanged
- No need to retrain Oracle DBAs and developers
- Support for PL/SQL language and OCI interoperability
- Replication for easy sharing of data

No disruption to your ongoing operations!

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Database Compatibility for Oracle

- **SQL extension support**
  - Decode, NVL, Substr, NVL2, Date/time functions
  - DDL syntax support
- **PL/SQL support – native language**
  - REF Cursors, Implicit and explicit cursors
  - Looping, variable declarations, conditional statements
  - Collections: Associative Arrays, Varrays, Nested tables
  - Pragmas
  - Named parameters
  - User Defined Exceptions
  - Explicit Transaction Control(within sp)
- **Tools**
  - EDB*Plus – SQL*Plus look-a-like
  - EDB*Loader – SQL*Loader equivalent
- **Oracle-like Data Dictionary**
  - ALL_, DBA_, USER_ views
- **Wait Events**
  - System and session waits
  - Statspack-like reporting

- **Features**
  - Packages
  - Stored procedures
  - Functions
  - Triggers
  - Hints
  - Hierarchical Queries
  - Synonyms – Public and Private
  - Sequences
  - Rownum
  - Users/Roles
  - Dynamic SQL
  - Materialized Views
  - Partitioning
- **PL/SQL supplied packages**
  - 14 DBMS
  - 6 UTL
- **Data types**
  - Blobs, Clobs, XMLTYPE, VARCHAR2, NUMBER, CHAR, Integer

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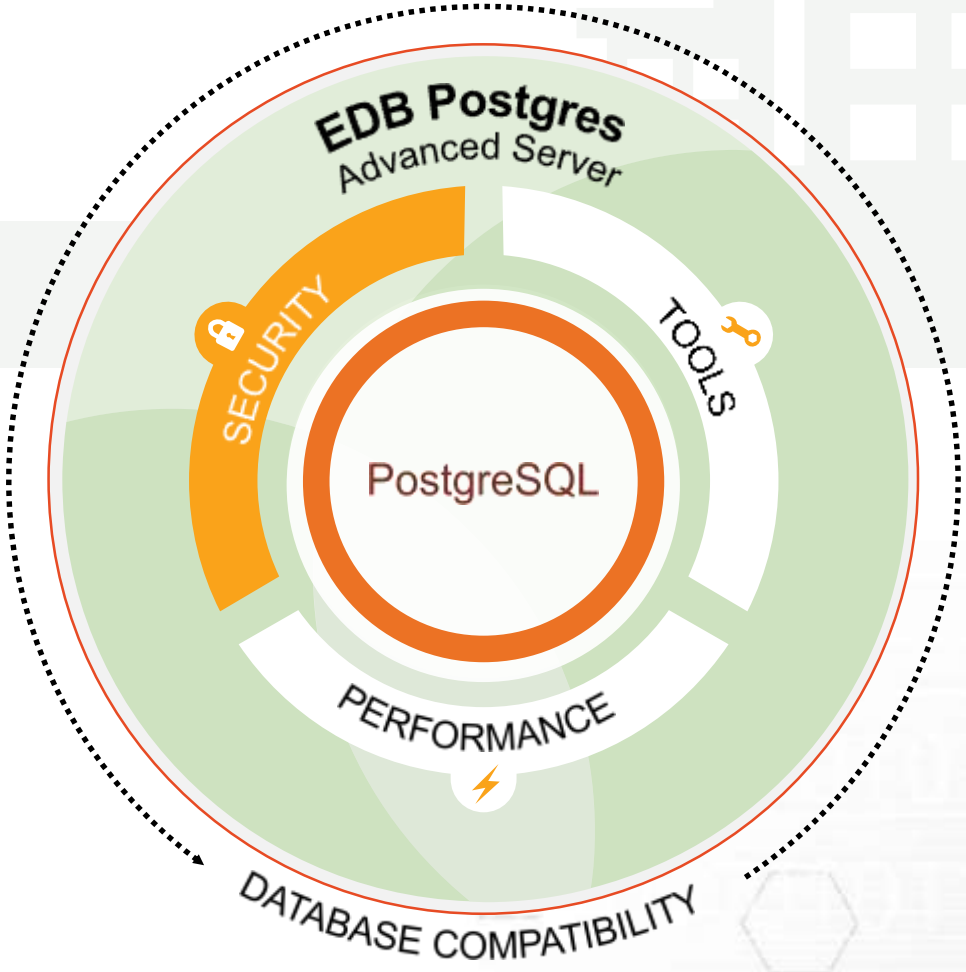


Security

- User account / password policy management
- Enhanced Auditing
- Row Level Security (VPD)
- SQL Injection attack guard
- Server-side code protection
- Multiple US Gov't certifications including STIG

EDB Postgres Advanced Server Security

- Object level privileges assigned to roles and users
- Row Level Security (Virtual Private Database)
- Profiles for Password
- Session Tag Auditing
- EAL2 Certification (augmented with ALC_FLR.2), NIPRNet, SIPRNet, JWICS
- Stored procedure obfuscation
- Protection against SQL injection attacks
- Kerberos and LDAP authentication
- SQL USAGE privilege and VIEW Security Barriers
- SSL communication
- Data Level Encryption (AES, 3DES, etc.)
- Ability to utilize 3rd party Key Stores in a full PKI Infrastructure
- Foundation for full compliance with the strictest of security standards (PCI Data Security Standard)

“By default, PostgreSQL is probably the most security-aware database available ...”
--Database Hacker's Handbook

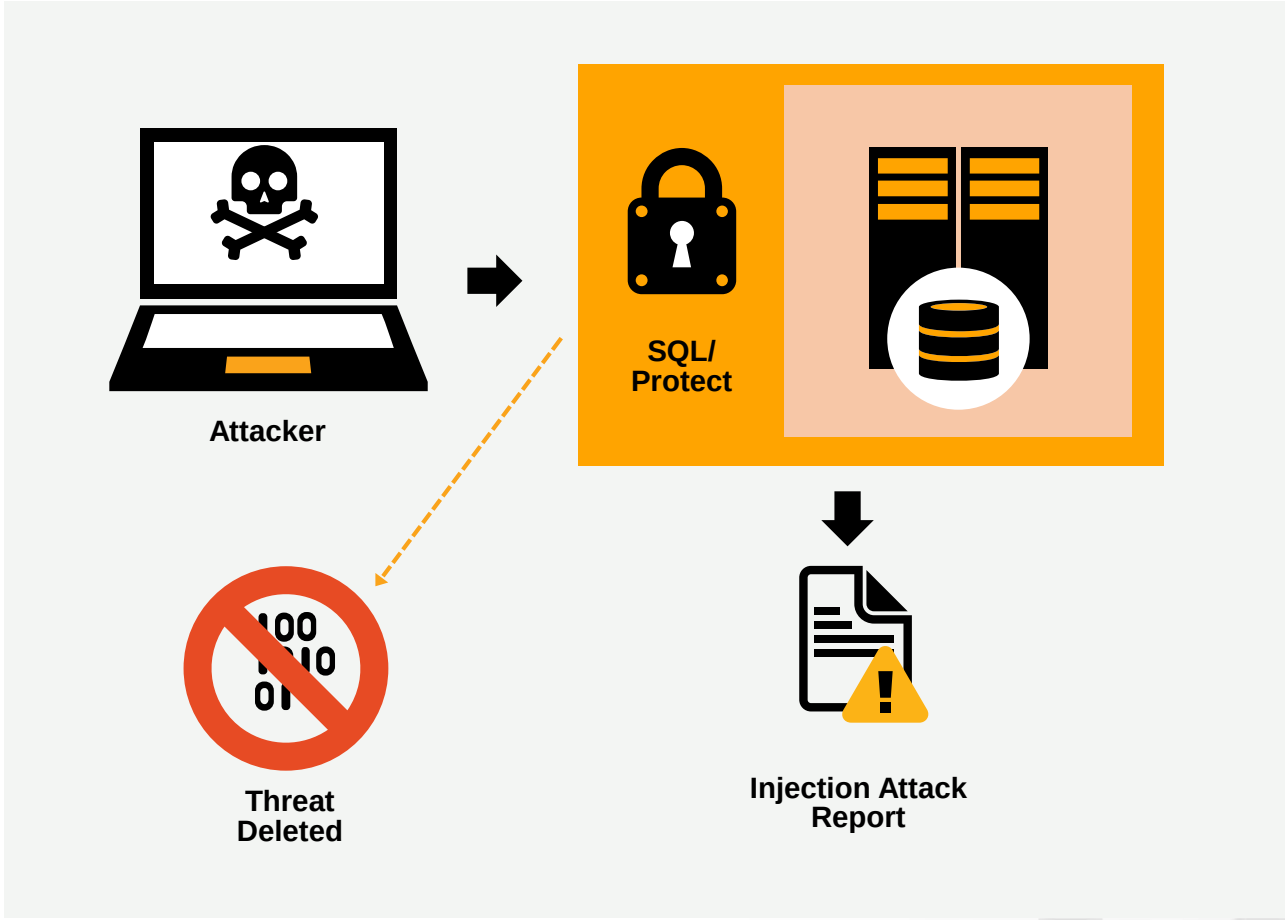
EDB
SQL/PROTECT

Preventing attacks *is normally the responsibility of the application developer. But with SQL/Protect, DBAs can now provide another layer of protection to prevent corruption or co-opting of the database.*

DBA Managed with Centralized SQL Injection Protection

PREVENTION TECHNIQUES

- Unauthorized Relations
- Utility Commands (e.g. DDL)
- SQL Tautology
- Unbounded DML



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EDB WRAP

- Safeguards sensitive code from prying eyes inside your firewall
- Protects critical algorithms, processes, seed values and more
- Restricts access to intellectual property on customer sites
- Additional layer of security beyond standard user ACLs

SQL pane

```
CREATE OR REPLACE FUNCTION secure()
  RETURNS character varying AS
$BODY$^o^
UTF8
dwb1NSunrTBA9mq4UPtRw9LYkf2QYndmG5Kn4hNZi3e+yoarpBdYayv4t
wb3r1ikQwlw32yJ7dNhZqE/lFqCq387mvqx60p1VXVWrGSWjVvN9iem0=
$BODY$
  LANGUAGE 'plpgsql0' VOLATILE
  COST 100;
ALTER FUNCTION secure() OWNER to postgres;
```

Included in Postgres Plus Enterprise Edition subscriptions!

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EDB Postgres

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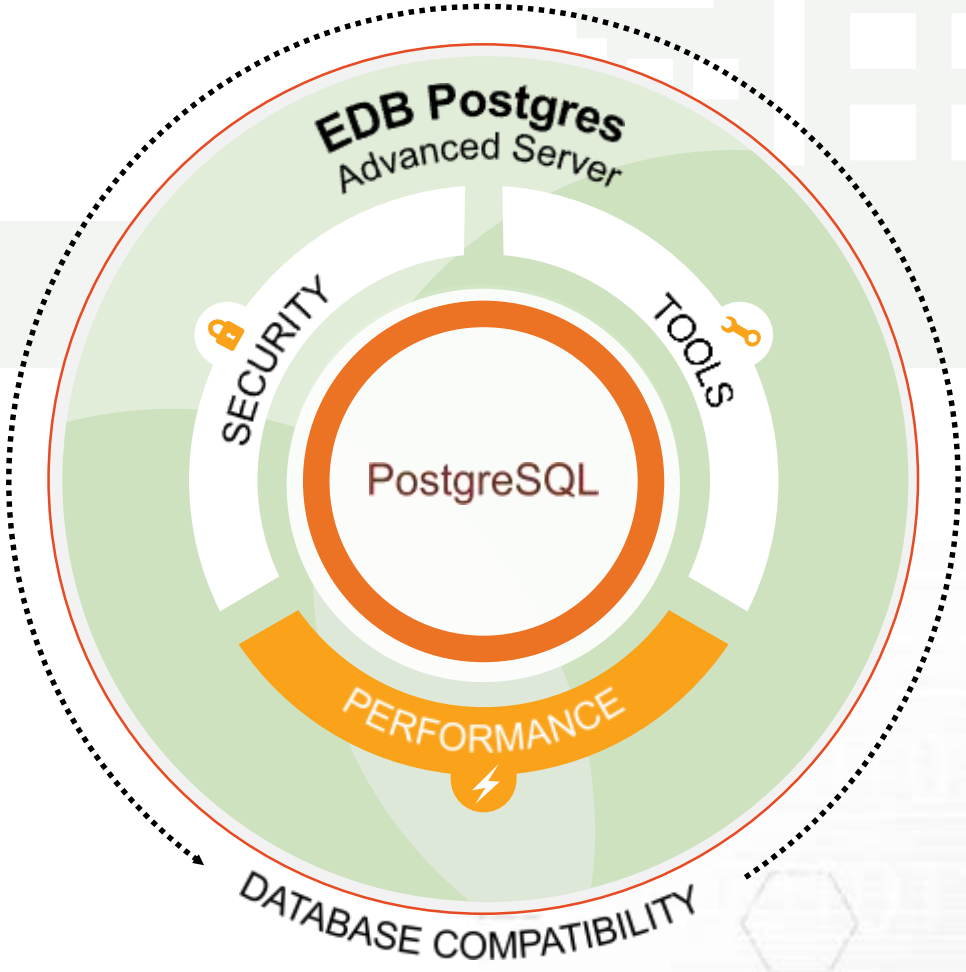

Performance

- Resource Manager – *adjust CPU & I/O resources on mixed workloads*
- Faster Partitioning - *400x faster writes & 76x faster selects*
- SQL Profiler – *fix slow workloads*
- Bulk Data Loader - *2x faster*
- Index Advisor - *speeds up inquiries*
- Query Hints - *optimizer control*
- DynaTune - *memory upgrades*
- Bulk Collect/Fetch/Binding of arrays
- Dynamic runtime statistics - *reveals SQL wait bottlenecks*

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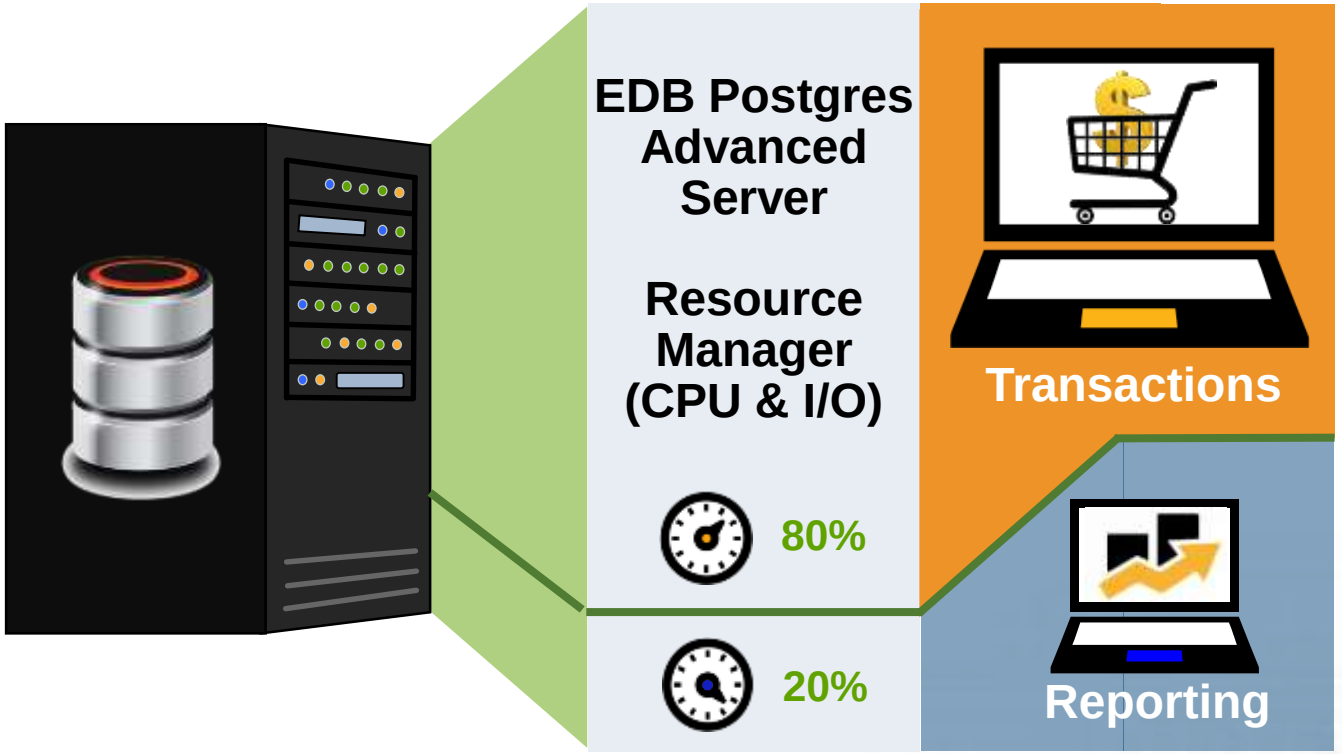
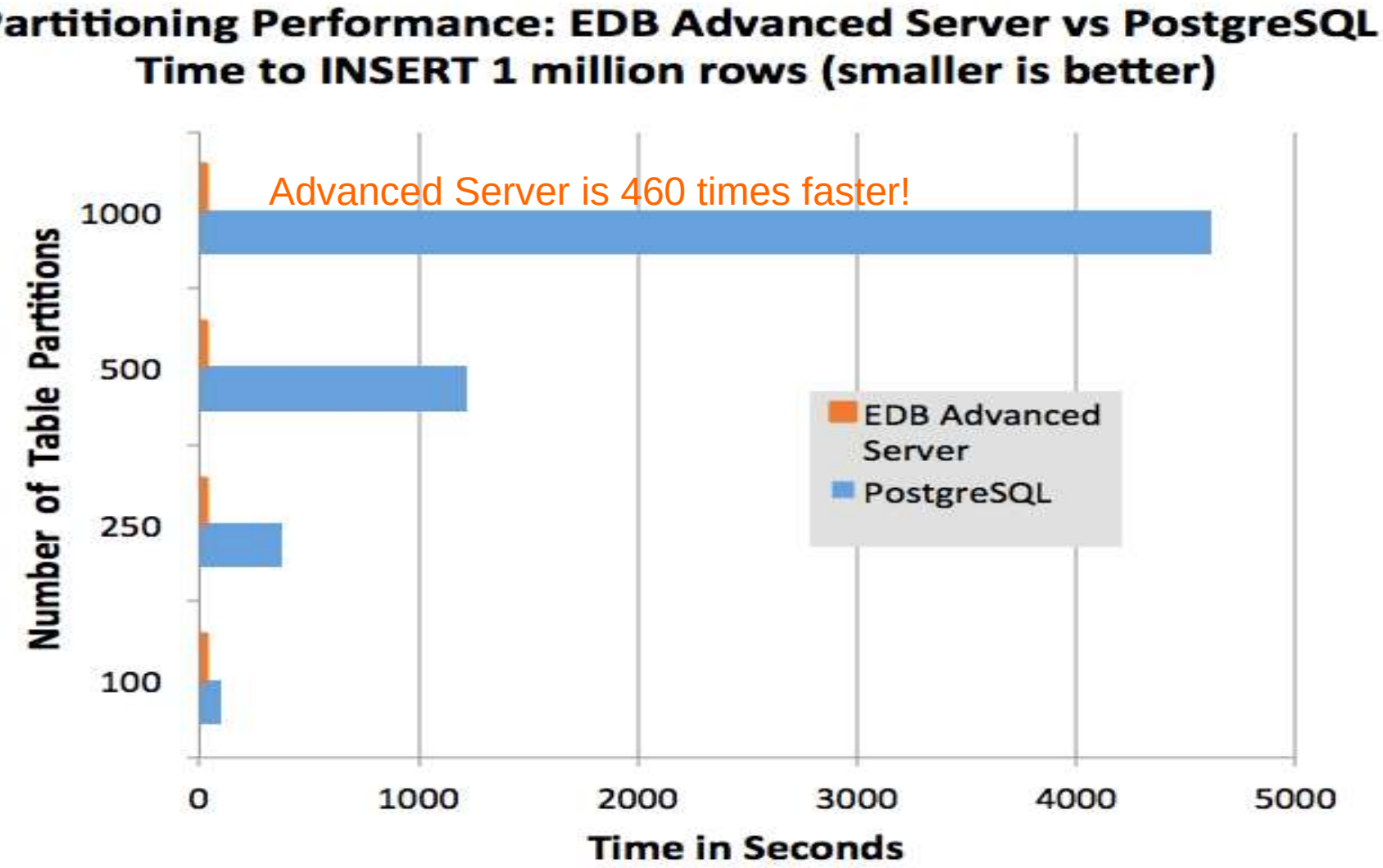
EDB Postgres Advanced Server Resource Manager



- DBA assigns CPU & I/O to job groups
- Allocates and prioritizes consumption of resources
- Low priority jobs don't hurt high priority jobs

Performance - Partitioning



Performance - Query Hints

- Allows app developers to influence the Query Optimizer’s choice of access plans when the developer knows more about the data and record structures than the optimizer’s assumptions.

- Default Optimizer Hints
- Access Method Hints
- Join Order Hints
- Join Relation Hints
- Global Hints
- Append Hints

Performance - Wait event statistics

DRITA (Dynamic Runtime Instrumentation Tools Architecture)

Low level SQL statement analysis and performance bottleneck troubleshooting

- Statistics (Sys, Session, SQL)
  - edbreport()
  - stat_db_rpt()
  - stat_tables_rpt()
  - statio_tables_rpt()
  - stat_indexes_rpt()
  - statio_indexes_rpt()
  - edb$system_waits
  - edb$session_waits
  - edb$session_wait_history

- Functions
  - get_snaps()
  - sys_rpt()
  - sess_rpt()
  - sessid_rpt()
  - sesshist_rpt()
  - purgesnap()
  - truncsnap()

- Catalog Views
  - edb$system_waits
  - edb$session_waits
  - edb$session_wait_history

SQL Performance Management

- Poorly optimized SQL code is the NUMBER ONE cause of database problems—EDB SQL Profiler & Index Advisor tools can help:
  - SQL Profiler captures a SQL workload and locates the worst running SQL
  - Both ad-hoc and scheduled operations supported
  - Provides a number of SQL-based performance metrics along with EXPLAIN analysis
  - Integrates with Index Advisor, which analyzes SQL statements and recommends new indexes to improve performance

EDB SQL Profiler & Index advisor are components of EDB Postgres Enterprise Manager

Sample Customer Performance Stats

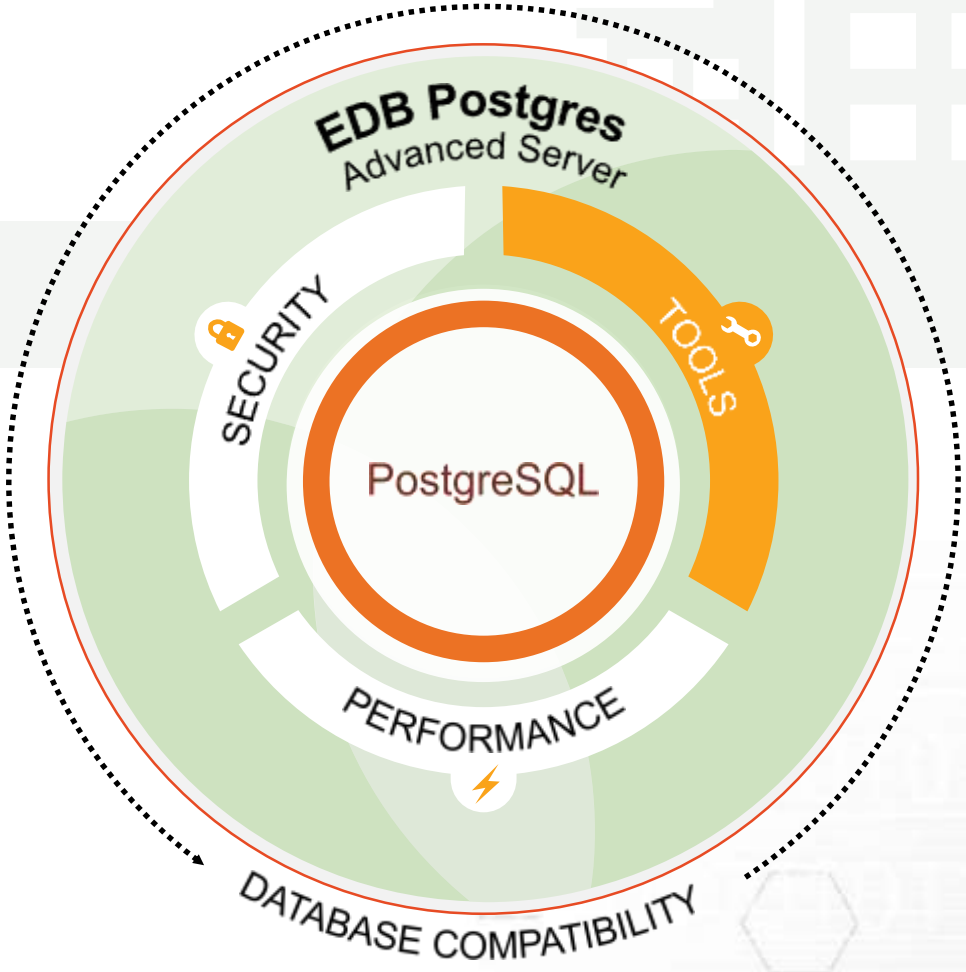
- Global mobile ad network
  - Largest database is 14TB
  - 1.2 billion transactions a day, 55K transaction per second
  - 400 concurrent users
  - Analyzes 240TB of data per day
- Online Brokerage Firm
  - 1 billion writes a day
  - 3,000 transactions per second
  - 800 concurrent users
- Global stock trade underwriter
  - Largest database is 8 TB
  - 6 to 10 million transactions per day
- Global consumer financial services provider
  - Example application database is 2 TB
  - 200K SELECT statements per second
  - 25K WRITE transactions per second

EDB Postgres

ADVANCED SERVER

Bundled Tools with Subscription

- Enterprise management, monitoring, and tuning
- HA failover management
- Oracle, SQL Server, and PostgreSQL to EDB Postgres Advanced Server replication
- Multi-master replication
- Oracle, SQL Server, and MySQL to EDB Postgres Advanced Server migration
- Update monitoring



EDB Postgres Enterprise Manager

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EDB Postgres Enterprise Manager (PEM)

MONITOR MANAGE TUNE

Only solution available that combines all three tasks into one tool

- Single management console allows easy visual control
- Works with both PostgreSQL and EDB Postgres Advanced Server
- Start/stop, configure, define and manage storage, security and database objects via single graphical console

Enhanced DBA Productivity with PEM

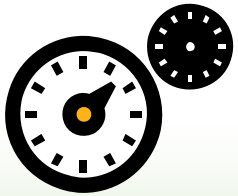
PEM Core Features

MONITOR

- Mission critical OS and database statistics collection
- Predefined (175+) and custom alerts via SMTP or SNMP
- Predefined & custom at-a-glance global dashboards
- Replication monitoring

MANAGE

- CRUD operations on all database objects
- Bulk operations across multiple servers
- Capacity Manager for planning & forecasting
- Customizable GUI charts, tables & graphs



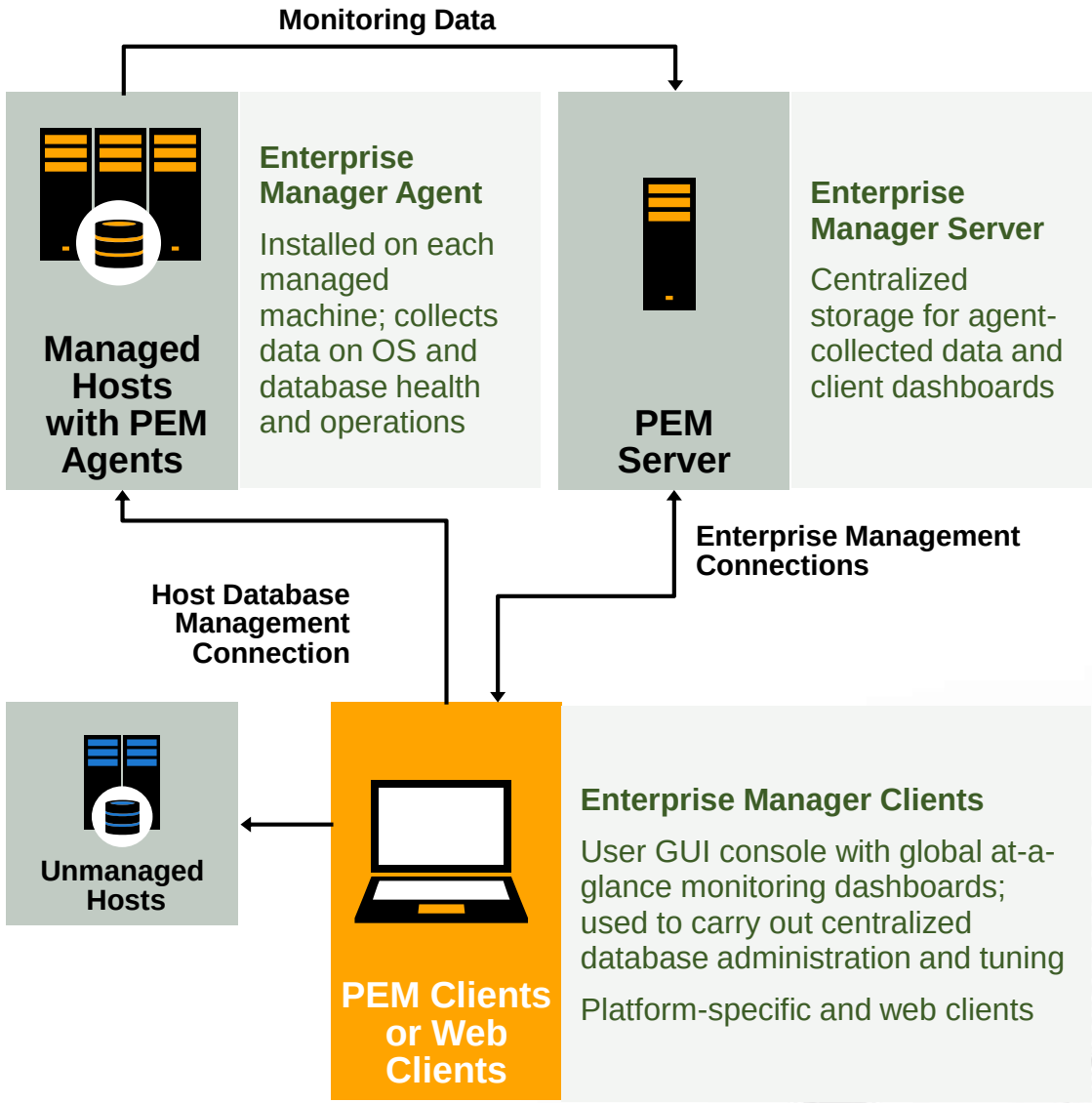
TUNE

- SQL/Profiler to speed up large workloads
- Index Advisor to suggest and create indexes
- Postgres Expert for best practice enforcement
- Tuning Wizard for machine utilization and load profiles

EDB

POSTGRES ENTERPRISE MANAGER (PEM)

An efficient distributed architecture perfectly suited for managing, monitoring and tuning large numbers of Postgres servers in multiple locations



EDB Postgres Enterprise Manager 6.0

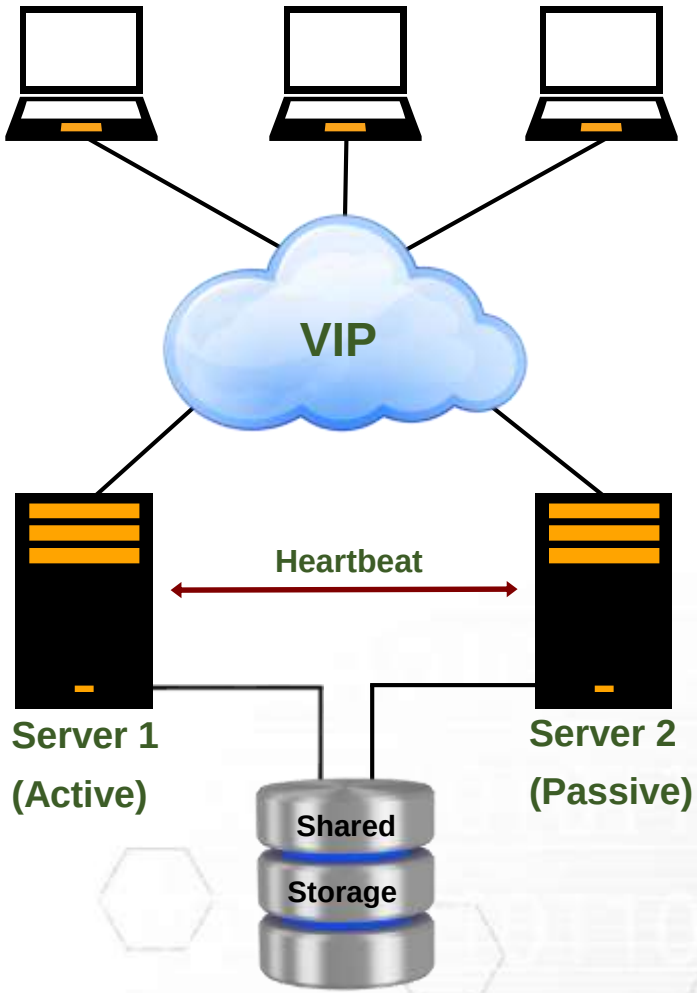
Simplify the management, governance and optimization of enterprise Postgres deployments

Nagios Support	Manage Postgres databases with the existing infrastructure
Failover Management	Integrate with Enterprise Failover Manager to simplify failover
Streaming Replication Wizard	Simplify the configuration of standby servers
Audit Log Alerts	Improve operational responsiveness and expand visibility
Operational Dashboards	Improved visibility to understand resource state at a glance
Alert Creation UI	Get more from PEM with custom alerts
Collaboration	Share information across teams through graphs, charts and custom dashboards

EDB Postgres Failover Manager (High Availability)

High Availability Options

- Active/passive clustering
- Near real-time streaming replication
- Warm standby databases
  (similar to Oracle® Data Guard)
- Hot standby databases
  (similar to Oracle® Active Data Guard)

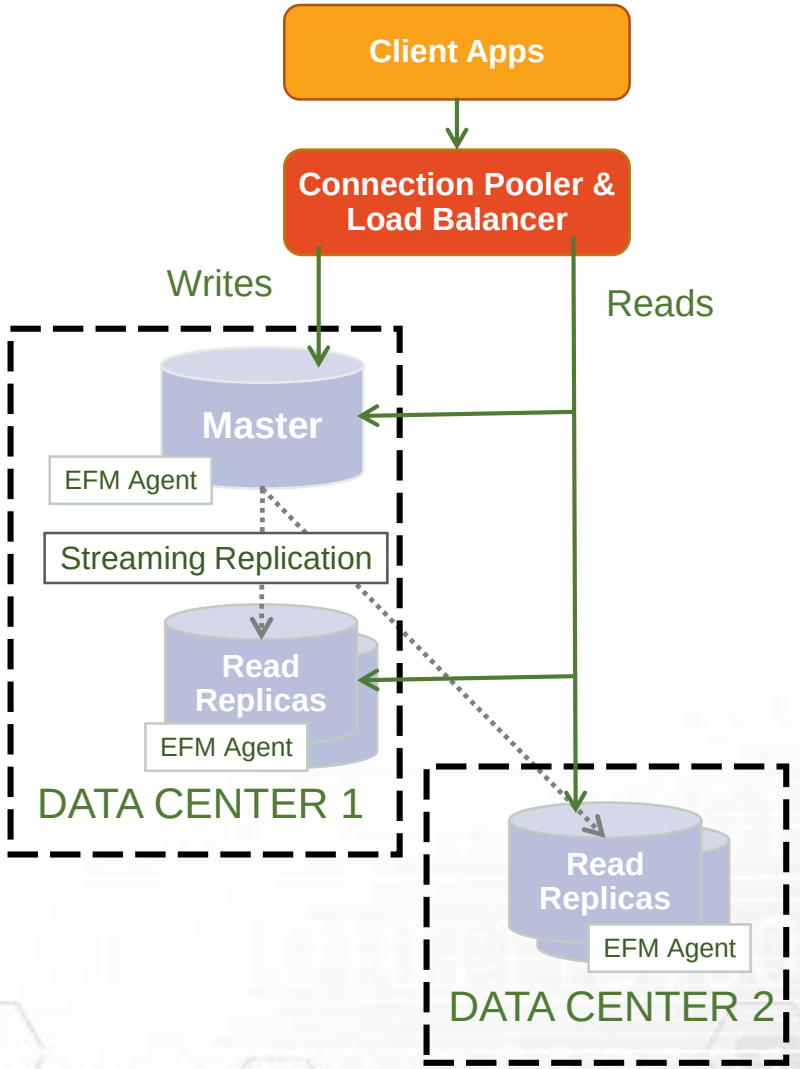


99.999%
Availability

Fault Tolerant Database Clusters

-EDB Failover Manager
- Basis For Mission Critical Application Support

- Supporting ***four 9s*** (52 mins of downtime / yr)
- Monitors the health of a Postgres HA configuration
- Automates failover process in the event of a failure
- Load balancer supports read scalability separating writes from reads
- Supports Disaster Recovery with offsite replicas
- Managed Switchover / Switchback



EDB Postgres Backup and Recovery

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Backup and Recovery Planning

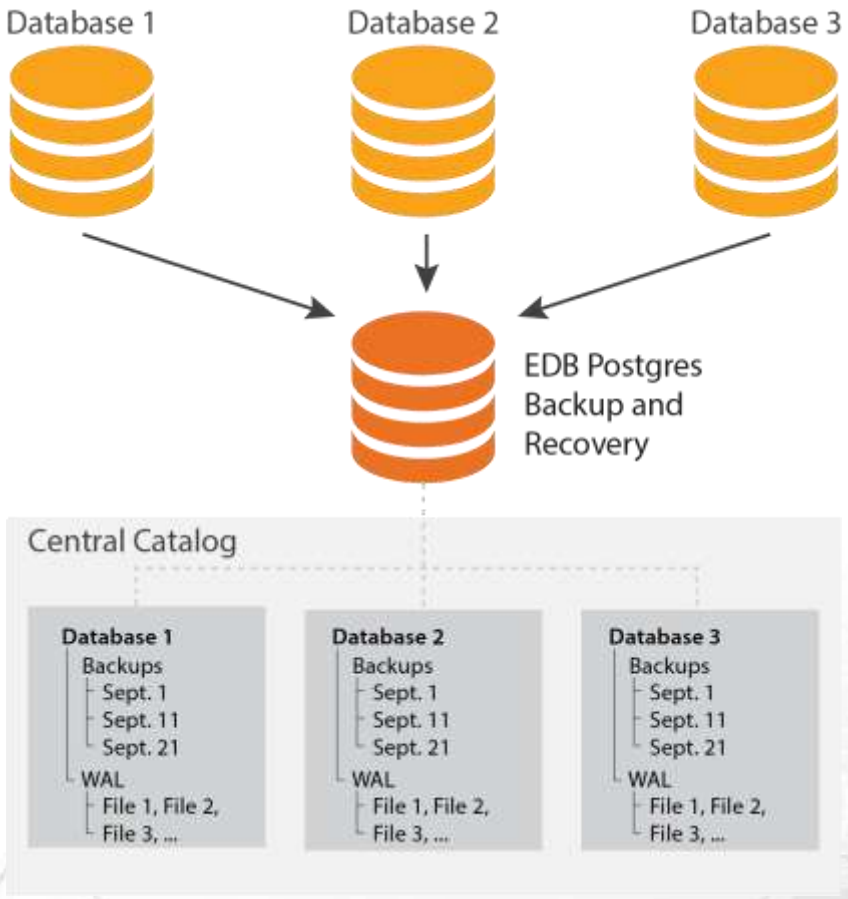
- Backup window
- Recovery Point Objective (RPO)
- Recovery Time Objective (RTO), Recovery SLAs
- Retention time
- Storage utilization

Backup and Recovery in Postgres without EDB Postgres Backup and Recovery

- Physical and logical backups available
- No retention management for backup files or WAL files
- No built-in compression
- Manual restore involves several steps including restore configuration and multiple files

EDB Postgres Backup and Recovery

- Scheduling of full and incremental backups
- Easy management and reporting from backup catalog
- File management according to retention policies
- File compression and verification
- Recovery automation including PITR



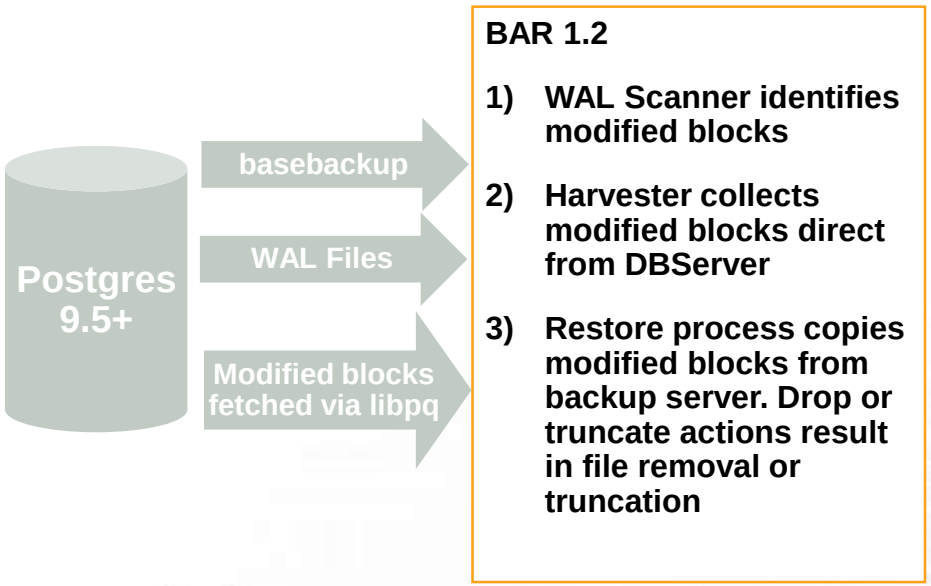
EDB Postgres Backup and Recovery Benefits

- Easy and ready-to-use backup solution
- Reliability for peace of mind
- Faster backups
- Less storage required

Block Level Incremental Backup

- Incremental Backup decreases amount of time required for backup and minimizes the amount of storage required

- Supported with Postgres 9.5+
  - WAL from DB scanned using the XLogReader API.
- Basic concept -
  - WAL scanner runs in the background & identifies data that has changed and the location of the modified blocks.
  - BAR generates an MBM (Modified Block Map) file for each WAL that indicates which blocks have changed.
  - A harvester process creates a CBM (Consolidated Block Map) out of the MBMs and fetches modified blocks.
  - Restore process copies blocks from CBM to restored server.



EDB Postgres Replication Server

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Data Replication in Postgres without EDB Postgres Replication Server

- Streaming replication of an entire set of databases
- One master, many read replicas (no multi-master)
- Failover results in a short downtime
- No cross-version replication

Replication Solutions for Postgres

Native Replication in Postgres	EDB Replication Server
Streaming Replication for full database replication only	Table based replication with row level filtering support
Read only replicas with no multi master capabilities	Options for read only (single master) or multi master
No replication to non-Postgres sources	Replicate to and from Oracle 10g, 11g, 12c* and SQL Server 2005, 2008, 2012*
Minimal cross version replication	Replication across PostgreSQL and EDB Postgres Advanced Server 9.1 to 9.6

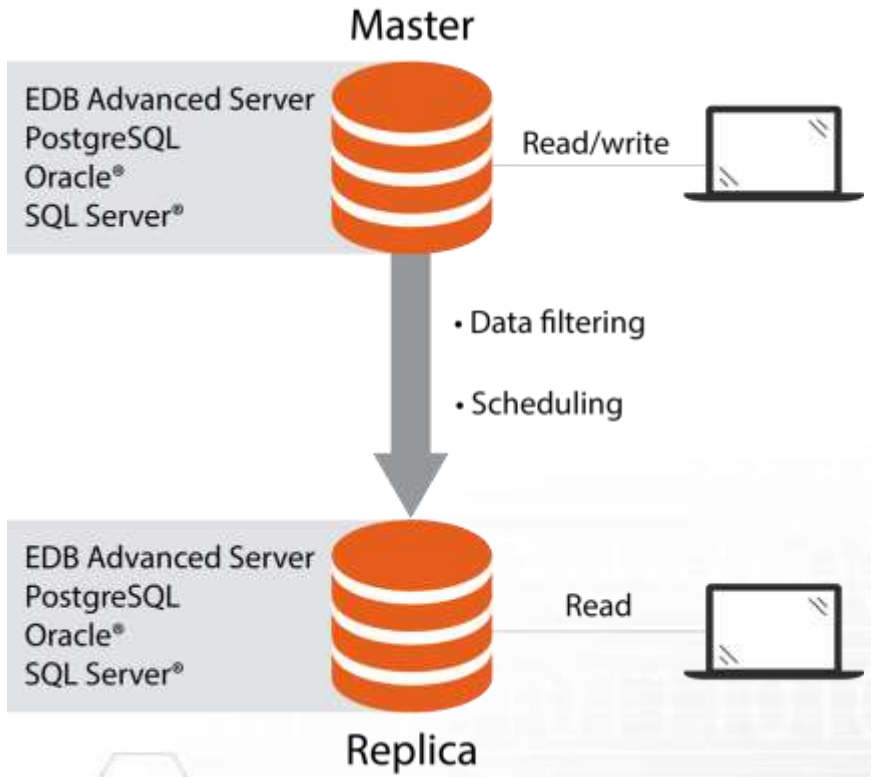
*** Updated in 6.1**

EDB Replication Server Highlights

- Distributed Publication / Subscription Architecture
  - Including support for Oracle 12c, SQL Server 2012
- Snapshot and continuous synchronization modes
  - Log Based replication from Postgres
  - Optimized for parallel synchronization with multiple active nodes
- Replicate one or more tables
  - Pattern matching selection rules for easier to configure publication tables
- Define and apply row filters
- Flexible replication scheduler
- Supports cascading replication
- Replication History Viewer
- Graphical Console and CLI

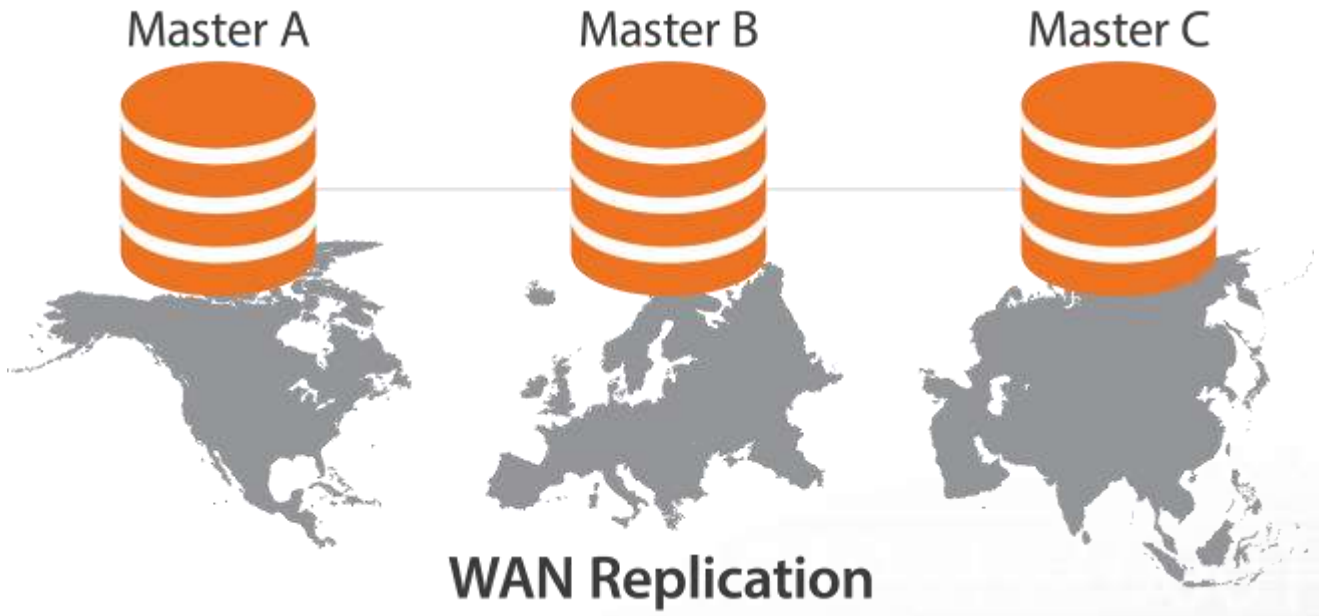
Single Master Replication (SMR) with EDB Postgres Replication Server

- Replication from a master to multiple replicas
- Integration with Oracle® and SQL Server® for a holistic view of data
- Better performance by offloading read workload
- Fine grained replication for customization
- Replication of subsets of data for testing
- Cross-version and legacy migration support



Multi-master Replication (MMR) with EDB Postgres Replication Server

- Localized data access for read and write availability in every geography
- Multiple masters for write scalability
- Hot standby for high availability
- Log-based replication for fast synchronization



EDB Postgres Replication Server Benefits

- Fast, flexible replication solution
- Integration with legacy databases
- Geographically dispersed databases
- High availability for peace of mind

EDB Postgres Migration Toolkit

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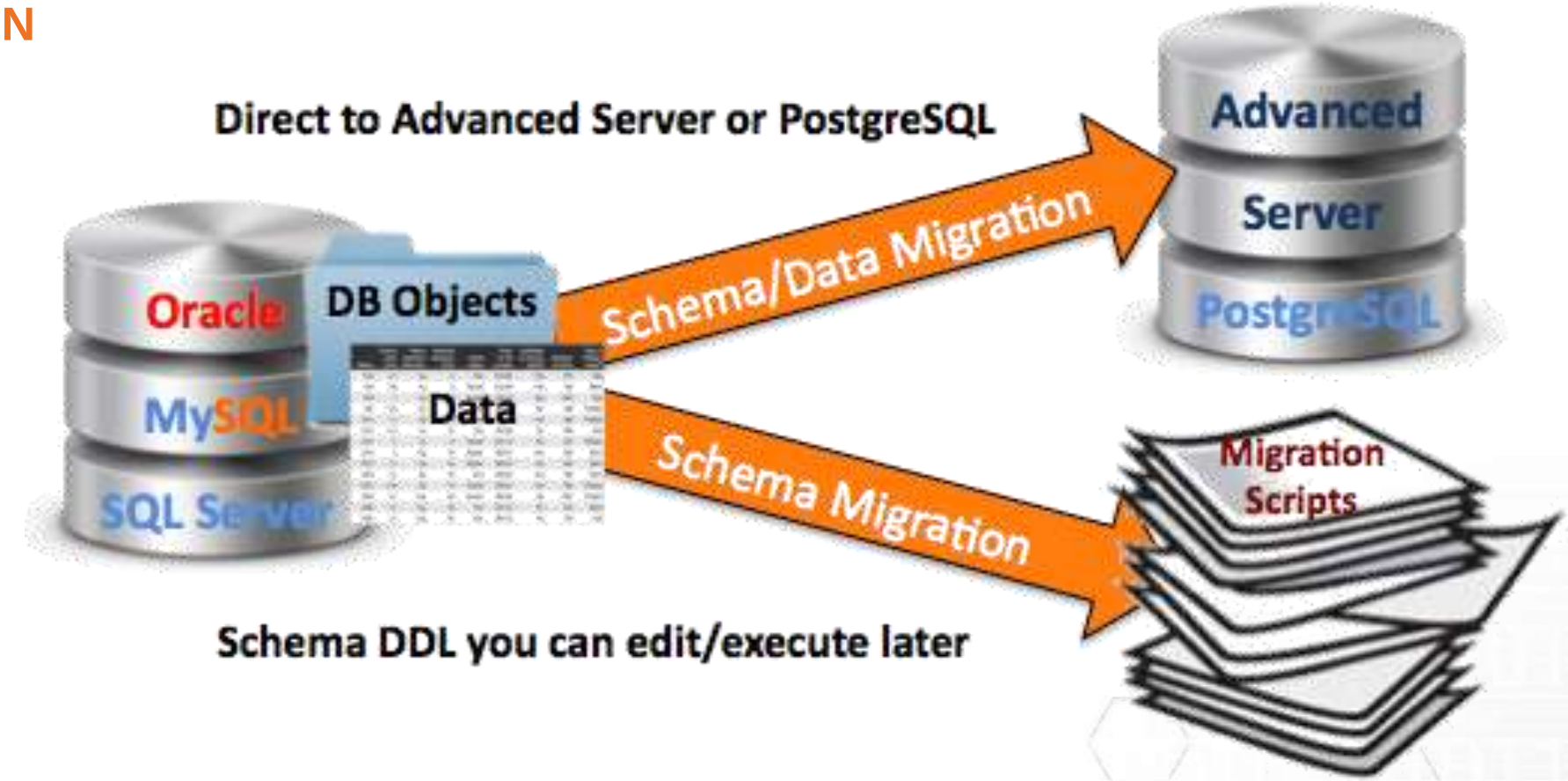
POSTGRES MIGRATION TOOLKIT



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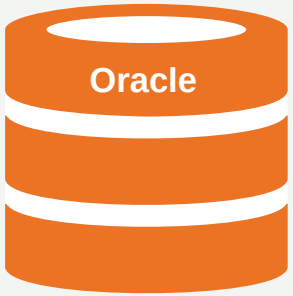
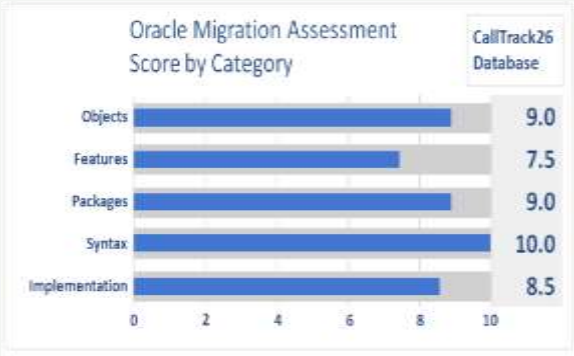
Database Migration Assessment

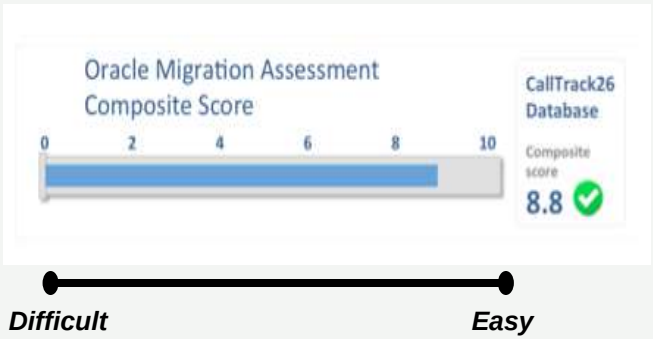


1. **Analyze Oracle schema layout for supported features in EDB Postgres Advanced Server**

2. **Review features used in Oracle client application**



3. **Supported features and recommended fixes**



4. **Overall composite score and migration plan with workarounds and time estimates**

Cost Containment

EDB POSTGRES

Strategic IT Budget Problem

UP TO

35%

of software budgets are spent on Database Management Systems:

DBMS Maintenance and Fees

EDB reduces your DBMS costs 80% or more enabling you to invest in emerging

technologies

BIG DATA

CLOUD COMPUTING

Oracle vs. EDB TCO Comparison on X86

	Oracle Enterprise Edition	EDB Postgres Advanced Server
License Fee Per Core	(8 cores) (x86 processor)	(8 cores) (x86 processor)
Database	$47,500	included in subscription
Partitioning	$11,500	Included
Data Guard	$11,500	Included
Diagnostics	$5,000	Included
Total License Fee per Core	$75,500	included in subscription
Total License Fee per Server (CapEx) (0.5 core factor)	**$302,000**	**$0**
Annual support/subscription cost per core	22% of License Fee	$1,750 per core
Annual Support/Maintenance per Server (OpEx)	**$66,440**	**$14,000**
Total 3 Year License and Support Cost	**$501,320**	**$42,000**

No CAPEX • Annual OPEX reduction **79%** • 3 YR TCO cost savings **92%**

Oracle vs. EDB TCO Comparison on IBM Power

License Fee Per Core	Oracle Enterprise Edition *(32 cores) (Power processor)*	EDB Postgres Advanced Server *(32 cores) (Power processor)*
Database	$47,500	included in subscription
Partitioning	$11,500	Included
Data Guard	$11,500	Included
Diagnostics	$5,000	Included
Total License Fee per Core	$75,500	included in subscription
Total License Fee per Server (CapEx)	**$2,416,000**	**$0**
Annual support/subscription cost per core	22% of License Fee	$1,750 per core
Annual Support/Maintenance per Server (OpEx)	**$531,520**	**$56,000**
Total 3 Year License and Support Cost	**$4,010,560**	**$168,000**

No CAPEX • Annual OPEX reduction **90%** • 3 YR TCO cost savings **96%**

EDB Business Terms are Simple & Easy

Business Terms	ORACLE	PostgreSQL	EDB Postgres Advanced Server
License fee (CAPEX)	per CORE	NONE	NONE
Maintenance/Support fee (OPEX)	per CORE	Per CORE	Per CORE (includes license)
Re-pricing penalty for maintenance reduction	YES	NO	NO
Retroactive penalty for maintenance re-start	YES	NO	NO
Virtualization hard partition restrictions	YES	NO	NO
Access to source code	NO	YES	NO
Influence over product development roadmap	YES	NO	YES

The EDB Postgres Platform - Subscriptions

Capabilities	Components	Subscriptions			Benefits
Database	EDB Postgres…	**Enterprise**	**Standard**	**Developer**	
Open source-based DB w. enterprise features (Oracle compatibility, performance & security)	Advanced Server	X		X	ACID compliant, reliable, high performance and extensible relational data store
Open source DB	PostgreSQL		X	X	
Management Suite					
GUI-based Management, Monitoring and Alerting	Enterprise Manager	X	X	X	Comprehensive management, monitoring, alerting and tuning with advanced backup/recovery operations and configurable database high availability;
Backup and Recovery	Backup and Recovery	X	X	X	
High Availability	Failover Manager	X	X	X	
Integration Suite					
Data Replication (SMR/MMR)	Replication Server (SQL Server, Oracle, Postgres)	X	X	X	Data Federation and Distributed Transaction Management capability to integrate the database with the enterprise data management environment. * Beta
Data Integration	Data Adapters (FDW)	X	X	X	
Distributed Transaction Management	XA Connector*	X		X	
Migration Suite					Tools to migrate applications from commercial databases to open source-based databases DMA Tool is available as part of a services engagement
Database Migration	Migration Toolkit (Oracle, Sybase, MS SQL)	X	X	X	
Database Migration Assessment Tool	Migration Assessment (Oracle)	X	X	X	

24 x 7 Global Support

Professional Services, RemoteDBA, Training, Certification

Deployment Options: Bare Metal, Virtual, Public, Private & Hybrid Clouds

Database Platform For Digital Business

EDB Postgres And EDB Ark

Summary: EDB Provides Best of Both Worlds

PostgreSQL

- Fast development cycles
- Thousands of developers
- Advanced features
- No vendor lock-in
- Low cost

Enterprise Requirements

- 24/7 support
- Services and training
- Enterprise-class features & tools
- Indemnification
- Product road-map
- Responsiveness, dependability & control

EDB Enables Postgres Innovation AND Enterprise Reliability

EDB POSTGRES

Discussion

- Q & A

EDB POSTGRES


THANK YOU
merci
spasiba
kam ouen
gratzias
manana
mahalo
cheers
toda
grassie
thank you
danki
grazie
tak
kitos
hvala
welalin
gracias
mahalo
danki
thanks
takk
gracias
domo arrigato
merci
dankon
talofa
miigwetch
danke
grattitude
thanks
na gode
mesi
modupe
kitos
takk
dziekuje