The End of the Reign of Oracle RAC: Postgres-BDR Always On

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September 2021

EDB™

Agenda

- EDB — Postgres for the enterprise

- From High Availability to Always On

- Who cares about 'Always On'?

- Postgres-BDR — RAC-like high availability for Postgres

- Are RDS, Aurora, or other DBaaS solutions valid options?

- Dollars and sense - why make the switch

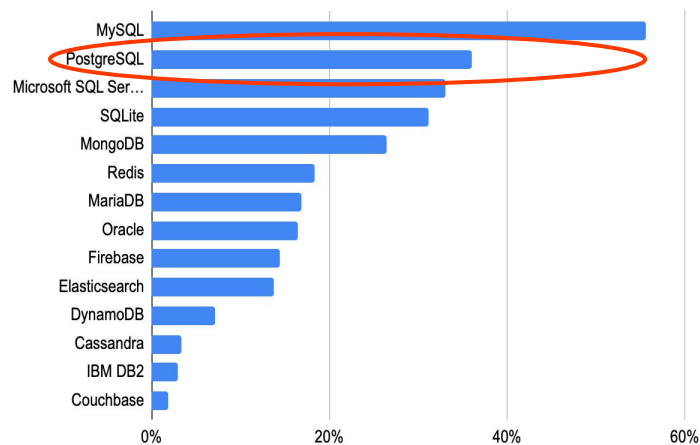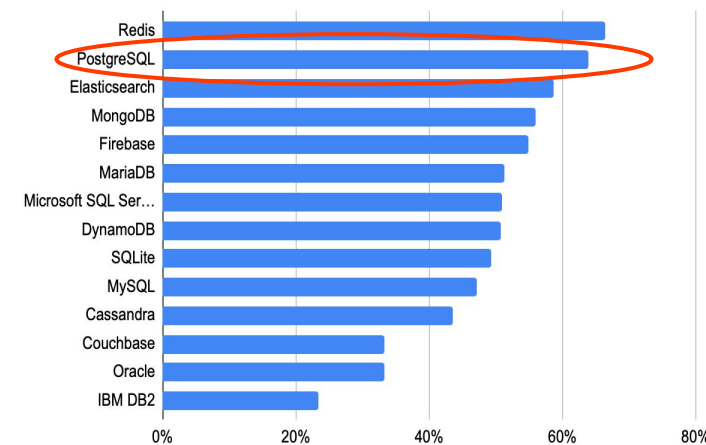# EDB - Postgres for the enterprise

PostgreSQL wins!

DBMS of the YEAR 2017 — DB-Engines.com

DBMS of the YEAR 2018 — DB-Engines.com

DBMS of the YEAR 2020 — DB-Engines.com

Most Commonly Used Database

Most used database

MySQL	
PostgreSQL	
Microsoft SQL Ser...	
SQLite	
MongoDB	
Redis	
MariaDB	
Oracle	
Firebase	
Elasticsearch	
DynamoDB	
Cassandra	
IBM DB2	
Couchbase	

0%   20%   40%   60%

1/13 ▼

Source: Stack Overflow Developer Survey, 2020 (65,000 developers)

Most Loved Database

Most loved database

Redis	
PostgreSQL	
Elasticsearch	
MongoDB	
Firebase	
MariaDB	
Microsoft SQL Ser...	
DynamoDB	
SQLite	
MySQL	
Cassandra	
Couchbase	
Oracle	
IBM DB2	

0%   20%   40%   60%   80%

Postgres Popularity

DB-Engines Ranking

Oracle
MySQL
Microsoft SQL Server
PostgreSQL
MongoDB
IBM Db2
Redis
Elasticsearch
SQLite
Microsoft Access
Cassandra
MariaDB
Splunk
Hive
Microsoft Azure SQL Database
Amazon DynamoDB
Teradata
SAP HANA
Neo4j
Solr
SAP Adaptive Server
FileMaker
HBase
Google BigQuery
Microsoft Azure Cosmos DB
Couchbase
Snowflake
PostGIS
InfluxDB
Memcached
Firebird
Amazon Redshift
Informix
Vertica
Spark SQL

Score (logarithmic scale)

1k
800
600
400
200
100

2013 2014 2015 2016 2017 2018 2019 2020 2021

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1/13 ▼

Source: DB-Engines.com, 2020

Postgres wins in containers: Datadog November 2020

Top Technologies Running on Docker

% of organizations running this technology

- NGINX — ~52%
- REDIS — ~36%
- POSTGRES — ~21%
- ELASTICSEARCH — ~15%
- MYSQL — ~13%
- RABBITMQ, CALICO (tie) — ~12%
- MONGO — ~12%
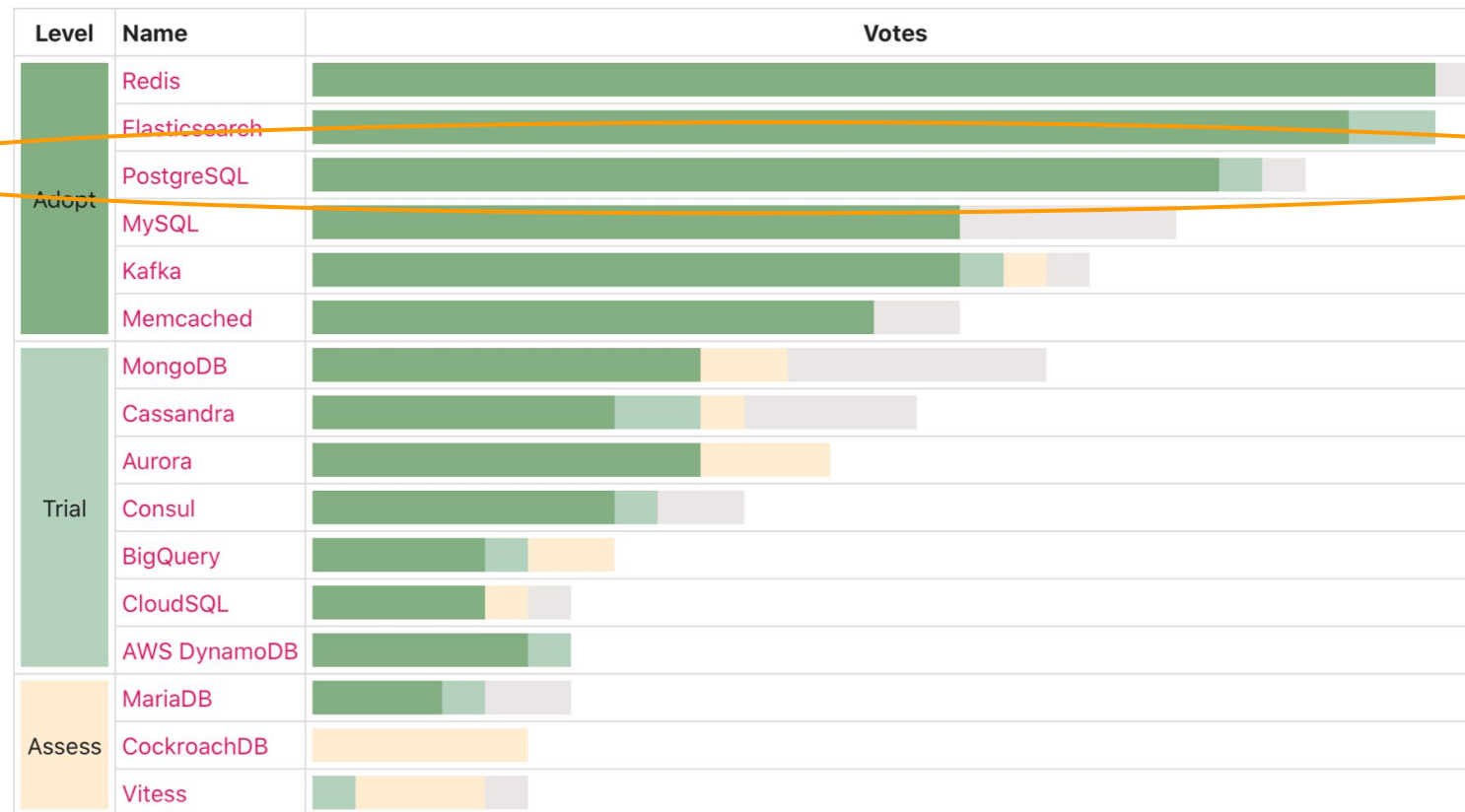- KAFKA — ~11%
- GITLAB, JENKINS (tie) — ~9%
- VAULT — ~8%
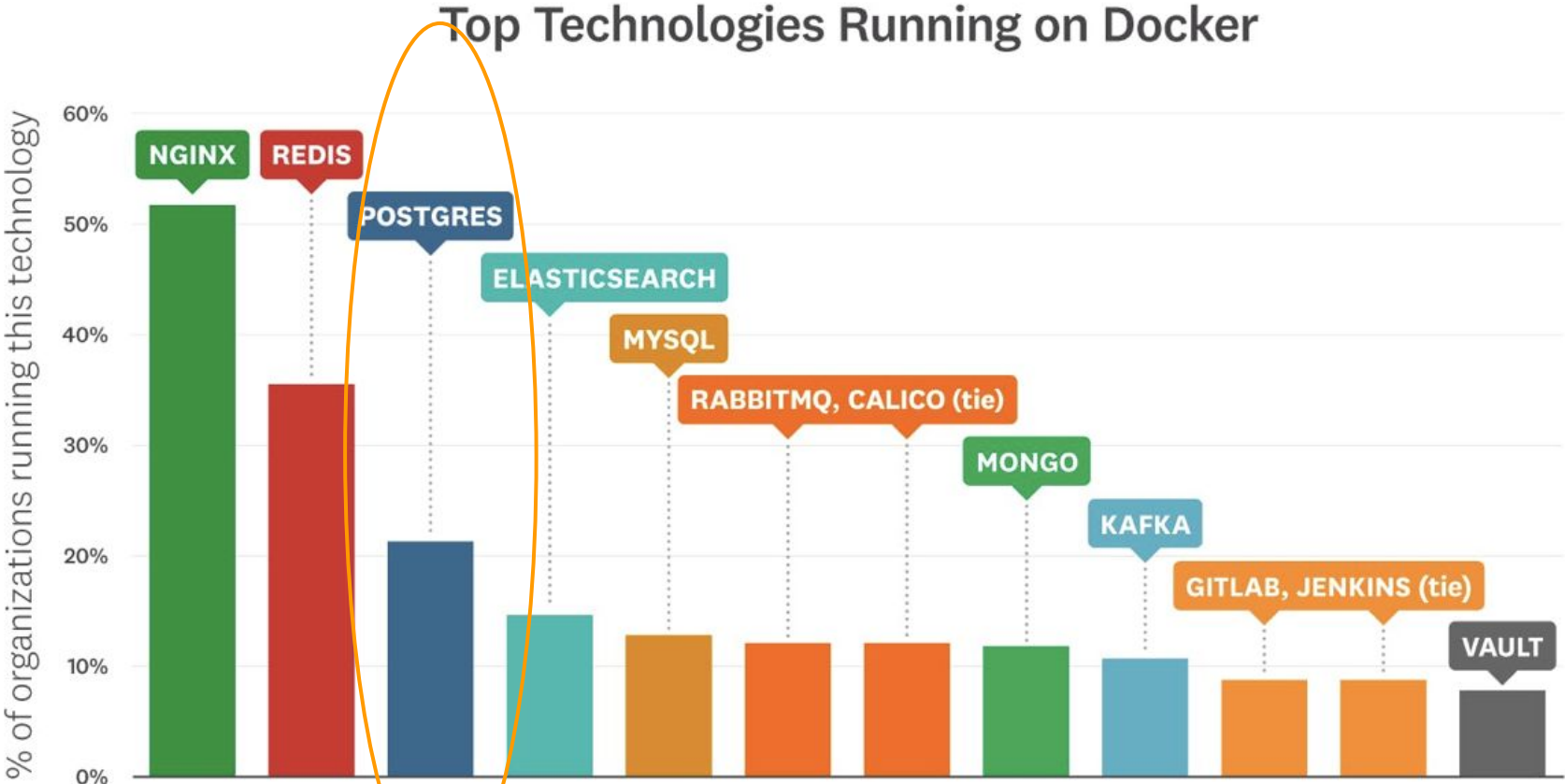
Source: Datadog

Postgres wins in cloud native architectures: CNCF's Technology Radar for Database Storage (Nov 2020)

The CNCF End User Community was asked to describe what their companies recommend for different solutions: Adopt, Trial, Assess or Hold. This table shows how the End User companies rated each technology.

Level	Name	Votes
Adopt	Redis	
	Elasticsearch	
	PostgreSQL	
	MySQL	
	Kafka	
	Memcached	
Trial	MongoDB	
	Cassandra	
	Aurora	
	Consul	
	BigQuery	
	CloudSQL	
	AWS DynamoDB	
Assess	MariaDB	
	CockroachDB	
	Vitess	

26 companies contributed 217 data points

Screenshot

Postgres is the most transformative open source tech since Linux

EDB: Database fanatics who care deeply about Postgres

Market leadership
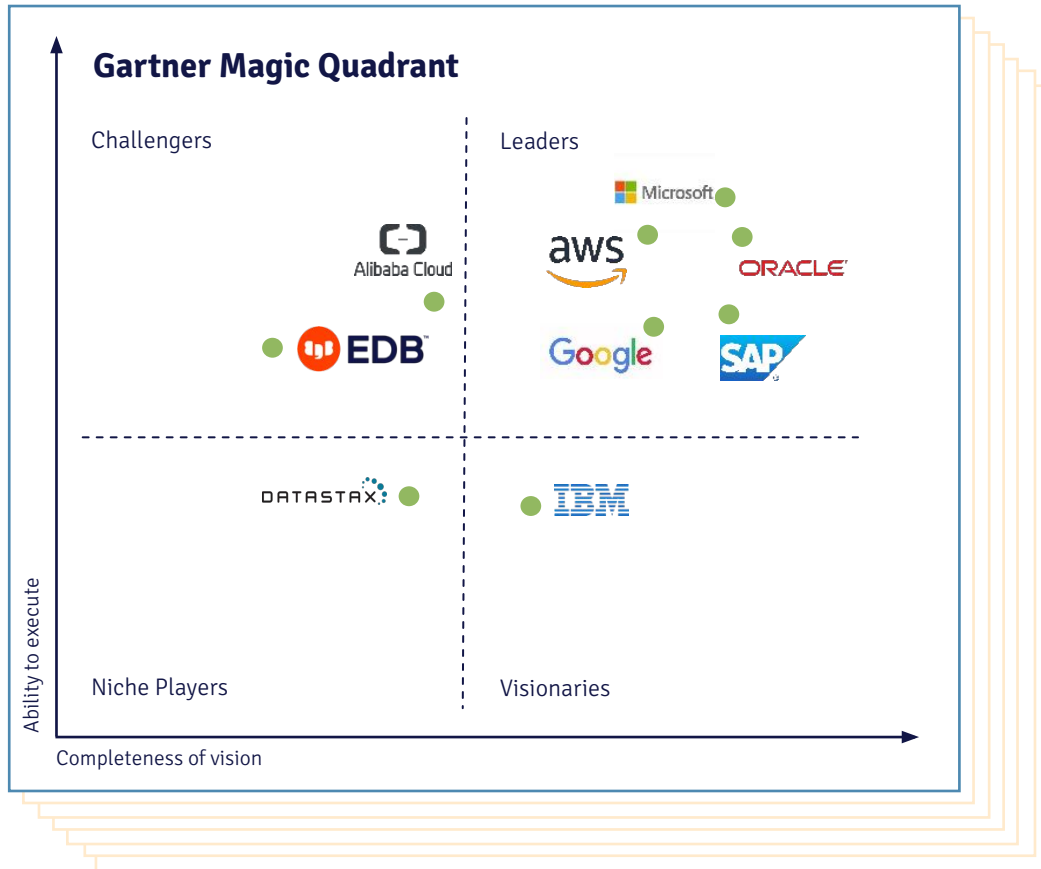
PostgreSQL leadership & vision
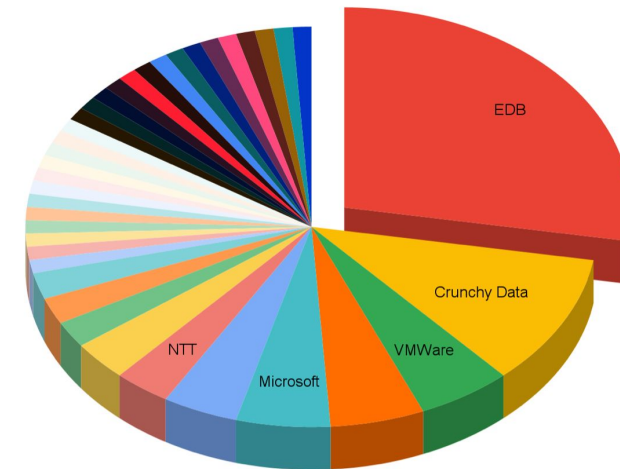
The most PostgreSQL experts

EDB team includes:

300+ PostgreSQL technologists

29 PostgreSQL community contributors and committers

Including founders and leaders like

Michael Stonebraker
"Father of Postgres"
and EDB Advisor

Bruce Momjian
Co-founder, PostgreSQL
Development Corp and
PostgreSQL Core Team

Peter Eisentraut
PostgreSQL
Core Team member

Robert Haas
PostgreSQL Major
Contributor and Committer

Simon Riggs
PostgreSQL Major
Contributor, Founder
of 2ndQuadrant

EDB Postgres - technology for the enterprise

Technology

PostgreSQL
ACID compliant; MVCC; object relational; extensible; scalable; reliable

EDB Postgres Advanced Server
Oracle compatibility: PL/SQL, 26 native packages, hints, password profiles, OCI/JDBC/ODBC/.NET drivers; Security; Manageability

High Availability
Streaming replication, logical replication, near-zero downtime operation

Management
Database monitoring, alerting, management by exception

Integration
Replication from/to 3rd party; FDW/SQL MED; geo-distributed replication

Migration
Schemas, stored procedures, data, snapshot migration, change data capture
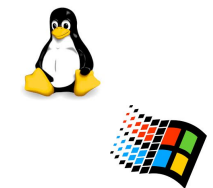
Platforms

Self-managed

Virtualized
aws
Microsoft Azure
Google Cloud
vmware

Bare Metal

Containerized
RED HAT OPENSHIFT
docker
Amazon EKS
Azure Kubernetes Service (AKS)
Google Kubernetes Engine

Managed
EDB DBaaS (preview)

IBM Cloud

POLARDB
Alibaba DBaaS

High Availability

or

Always On?

Poll

'High Availability' or 'Always On'

Always On - the next step for high availability

- Historic perspective

  - Protects against hardware, network, and software failures

  - Assumes maintenance windows

  - Postgres tools: EDB Failover Manager, Repmgr, Patroni

- Always On - the new business imperative

  - Near-zero downtime, or "Always On" - a must-have for successful digital transformation in a global economy.

  - No more maintenance windows - but patches and upgrades have to be applied

  - 99.99% is the minimally acceptable level (ITIC 2020 Global Server Hardware, OS Reliability Survey)

Why is this so hard?

No downtime for maintenance!

HA Rating	Downtime/month (days:hours:min:secs)	Downtime/year (days:hours:min:secs)
99%	00:07:18:00	03:15:36:00
99.5%	00:03:39:00	01:19:48:00
99.9%	00:00:43:48	00:08:45:36
99.99%	00:00:04:23	00:00:52:34
99.999%	00:00:00:26	00:00:05:15

Patches, updates, and security fixes: at least four maintenance operations per year!
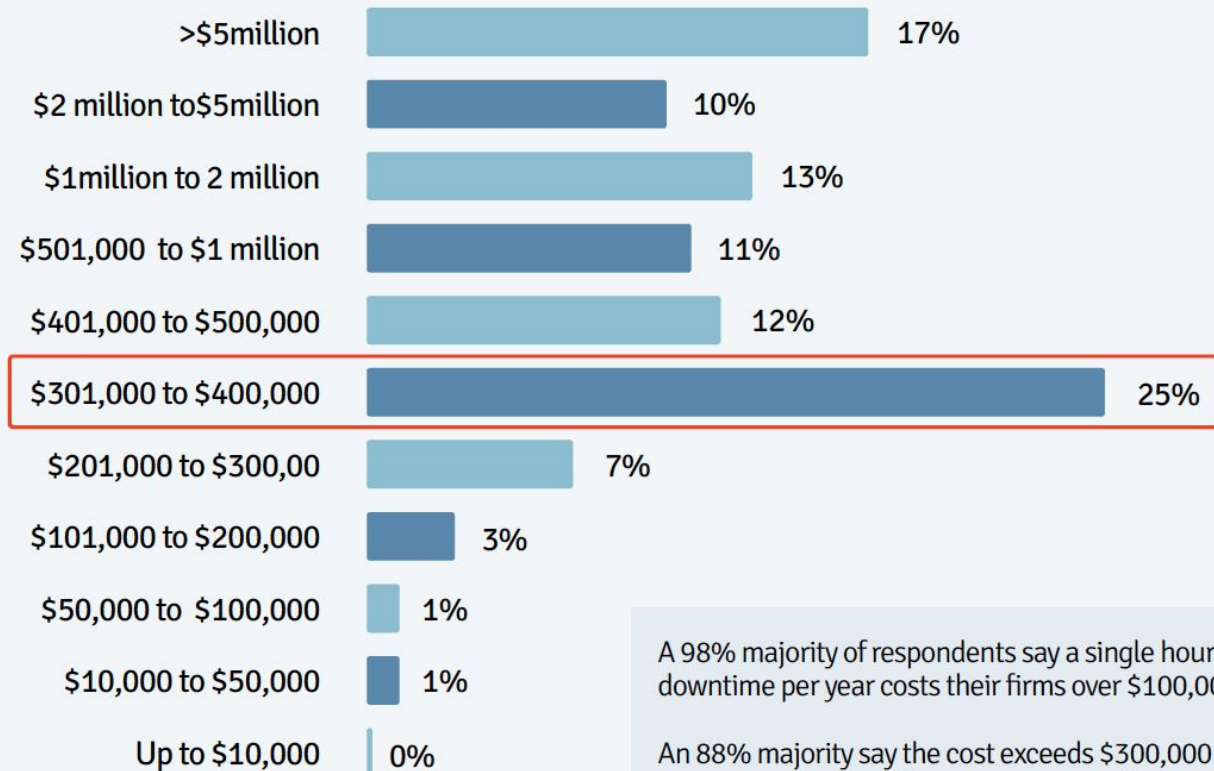
Who cares about 'Always On'?

How important is Always On?

- 99.99% is the standard today
- Downtime costs money and customers
  - Credit cards
  - Websites
  - Payment gateways
  - Single-sign on sites
  - ….

Eighty-eight Percent of Firms Say Hourly Downtime Costs Exceed $300K in 2020

Category	Percent
>$5million	17%
$2 million to $5million	10%
$1million to 2 million	13%
$501,000 to $1 million	11%
$401,000 to $500,000	12%
$301,000 to $400,000	25%
$201,000 to $300,00	7%
$101,000 to $200,000	3%
$50,000 to $100,000	1%
$10,000 to $50,000	1%
Up to $10,000	0%

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Source: ITIC 2020

A 98% majority of respondents say a single hour of downtime per year costs their firms over $100,000

An 88% majority say the cost exceeds $300,000 up from 76% in 2014 and 81% in 2018. And 40% - four in 10 enterprises - say hourly downtime costs their firms $1M to >5M
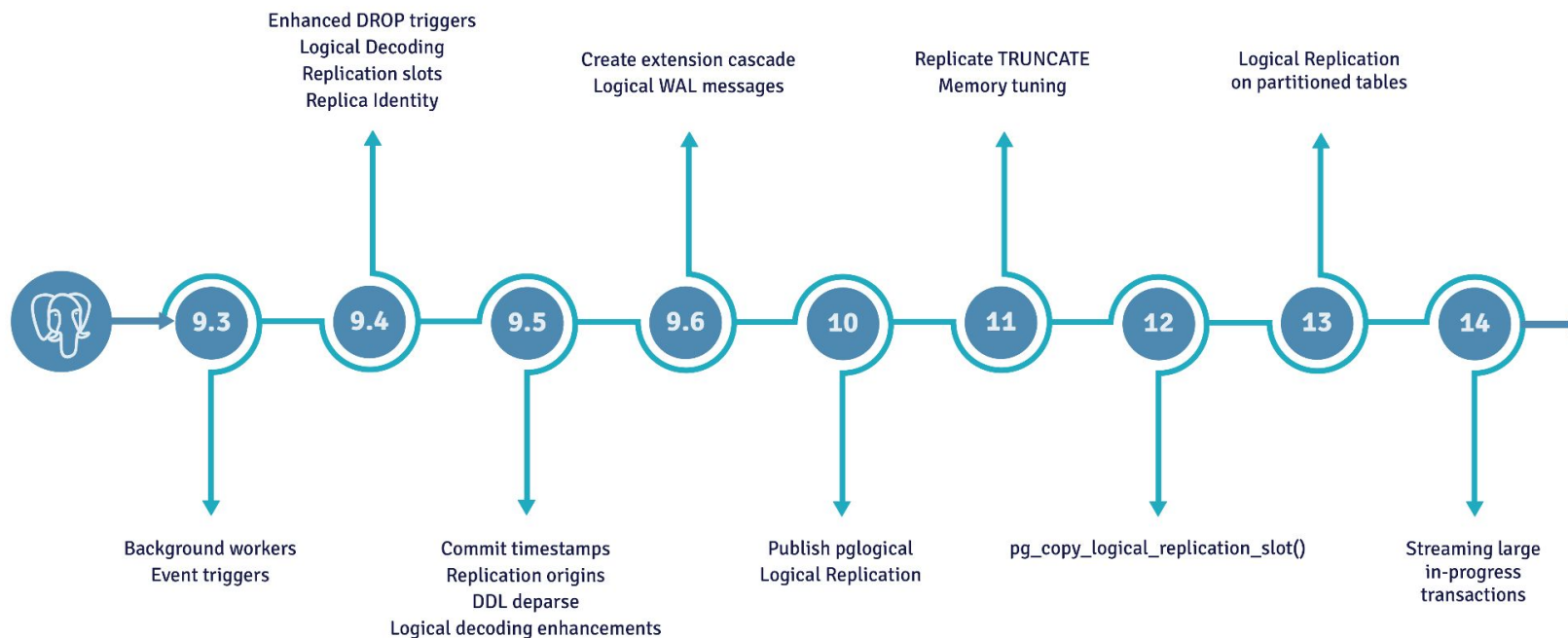
Postgres-BDR: RAC-like availability for Postgres

Postgres-BDR — the next step in Postgres replication

- Londiste, Bucardo, Slony
- Streaming replication - evolution of log shipping
- Hot standbys and synchronous replication
- Logical replication
- DDL replication, ….

Enhanced DROP triggers
Logical Decoding
Replication slots
Replica Identity

Create extension cascade
Logical WAL messages

Replicate TRUNCATE
Memory tuning

Logical Replication
on partitioned tables

9.3   9.4   9.5   9.6   10   11   12   13   14

Background workers
Event triggers

Commit timestamps
Replication origins
DDL deparse
Logical decoding enhancements

Publish pglogical
Logical Replication

pg_copy_logical_replication_slot()

Streaming large
in-progress
transactions

Postgres Native Logical Replication

Not a great HA solution

- No DDL replication

- No failover

- No integration with backup and recovery

- No built-in procedures for maintenance, updates and upgrades

- Unidirectional - no easy way to 'fall back'

Postgres-BDR

Multi-master logical replication in a mesh network

- Automatic DDL and DML replication in an active-active mesh network

- Failover and switchover infrastructure to re-route traffic in case of failures or during maintenance operation

- Advanced conflict detection and conflict management

- Management of distributed sequences

- Differentiated replication sets to control which data gets replicated and to which downstream databases

- Cluster expansion/consolidation

- Rolling database software upgrades

- Rolling schema change/migration using cross-schema replication

Postgres-BDR - Always On Platinum
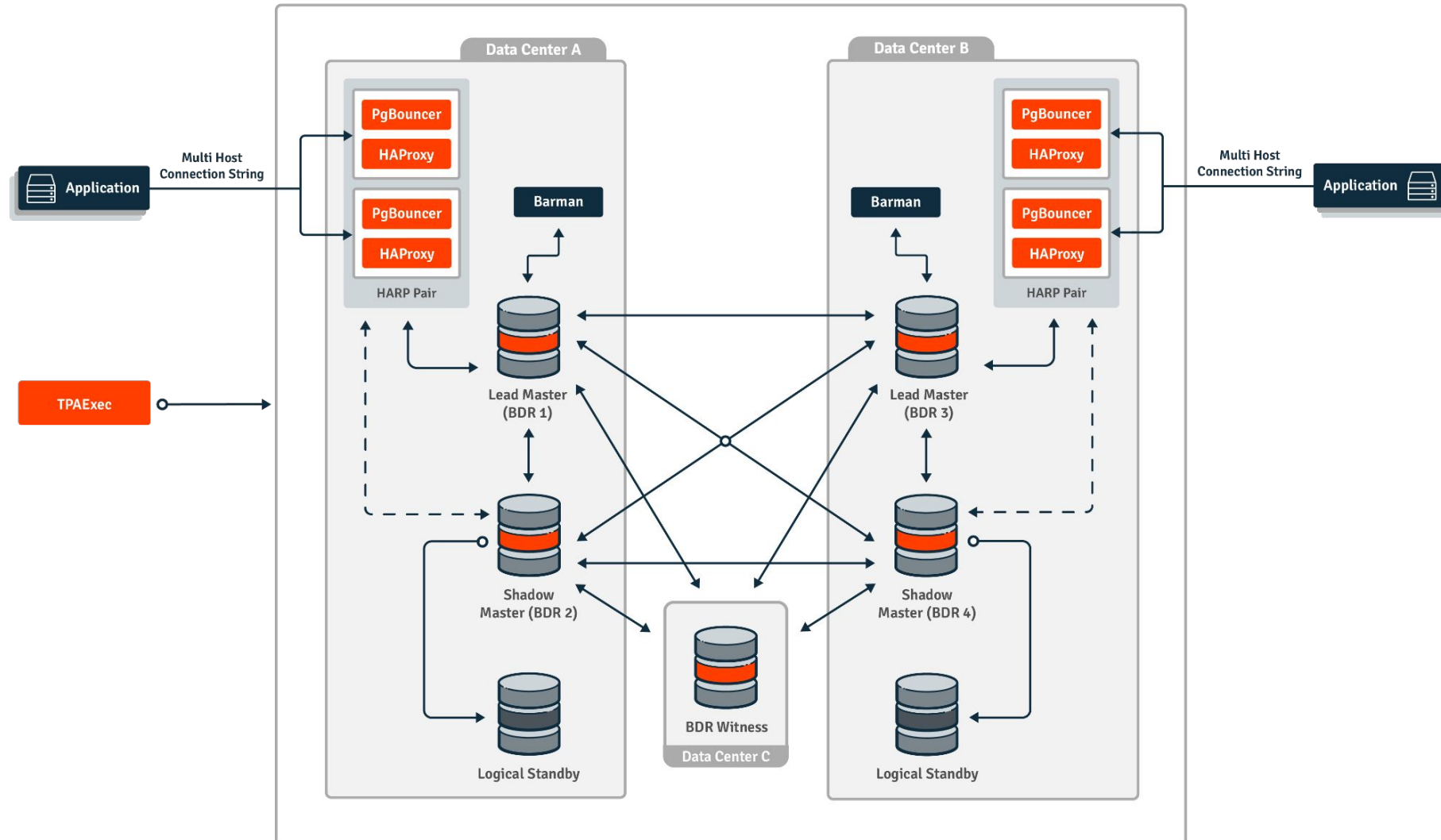
Postgres BDR and Oracle RAC

Two different approaches to high availability
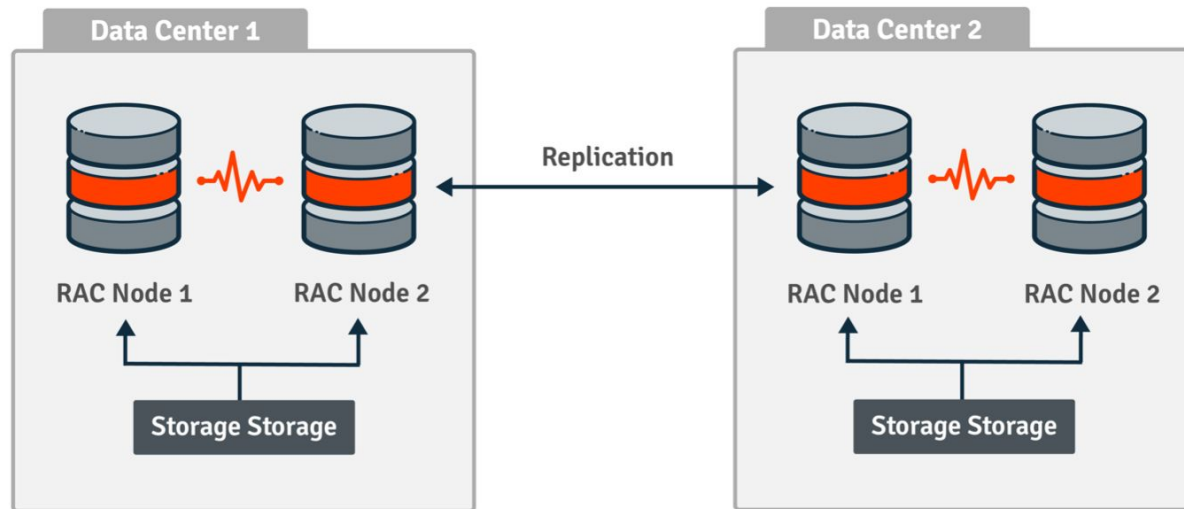
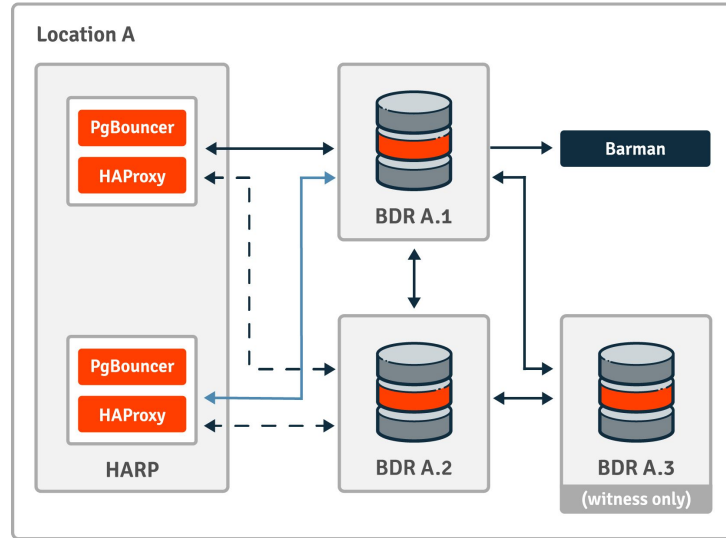Oracle RAC — Shared storage, high speed interconnect, replication
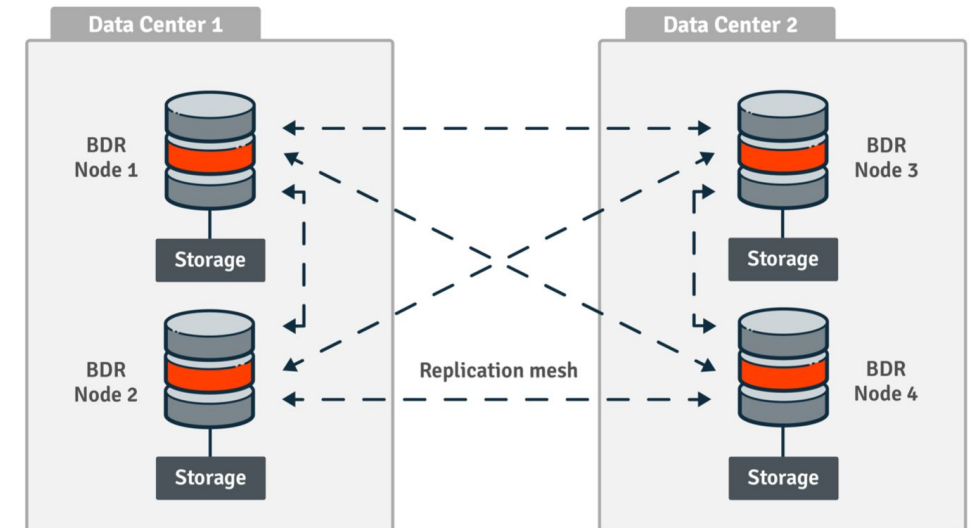
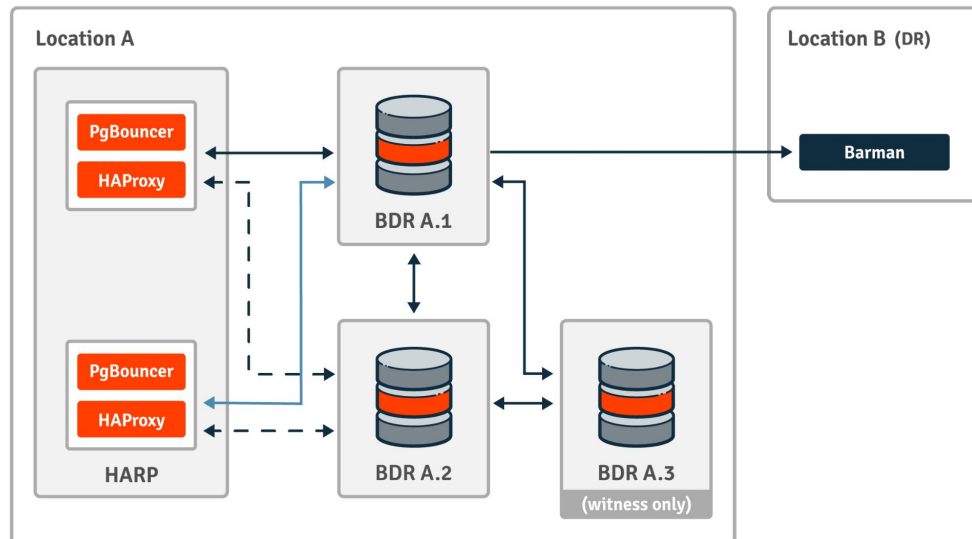Postgres-BDR — Shared nothing, mesh network, commodity hardware, all public clouds
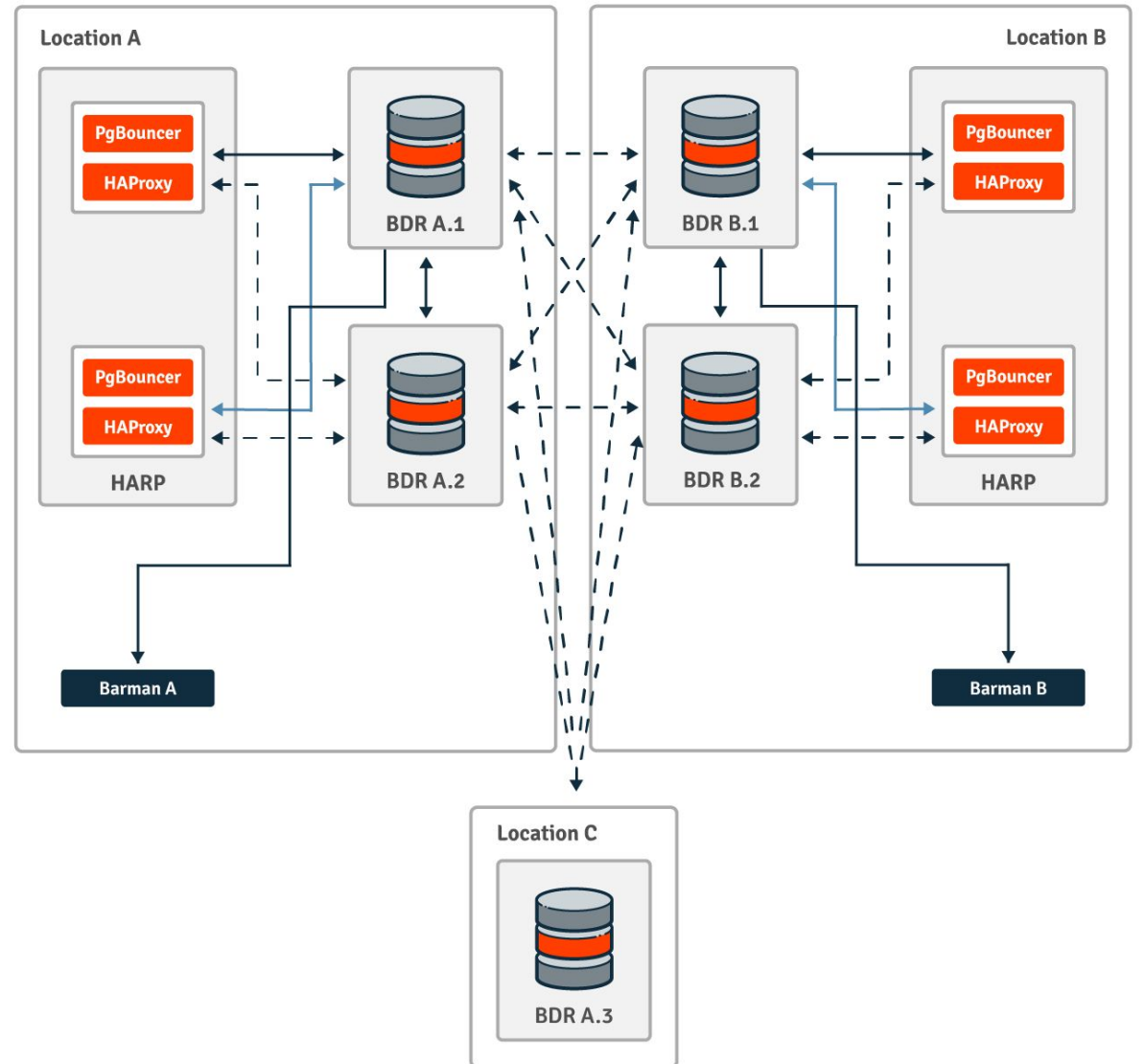
Always On Architectures

Always On Bronze (single active location)

Always On Silver (single active location, backup in DR location)

Always On Gold (two active location)

Case Study - ClickUp

SaaS Project Management and Collaboration

- Massive growth
- Global customers
- Long term Postgres user
- Geo distributed and highly available

EDB's support has helped us to upgrade our PostgreSQL and BDR version with zero downtime and resolve any issues that have come up with using the extension, as well as analyze our PostgreSQL server configurations to ensure we are getting the best performance out of our database cluster.
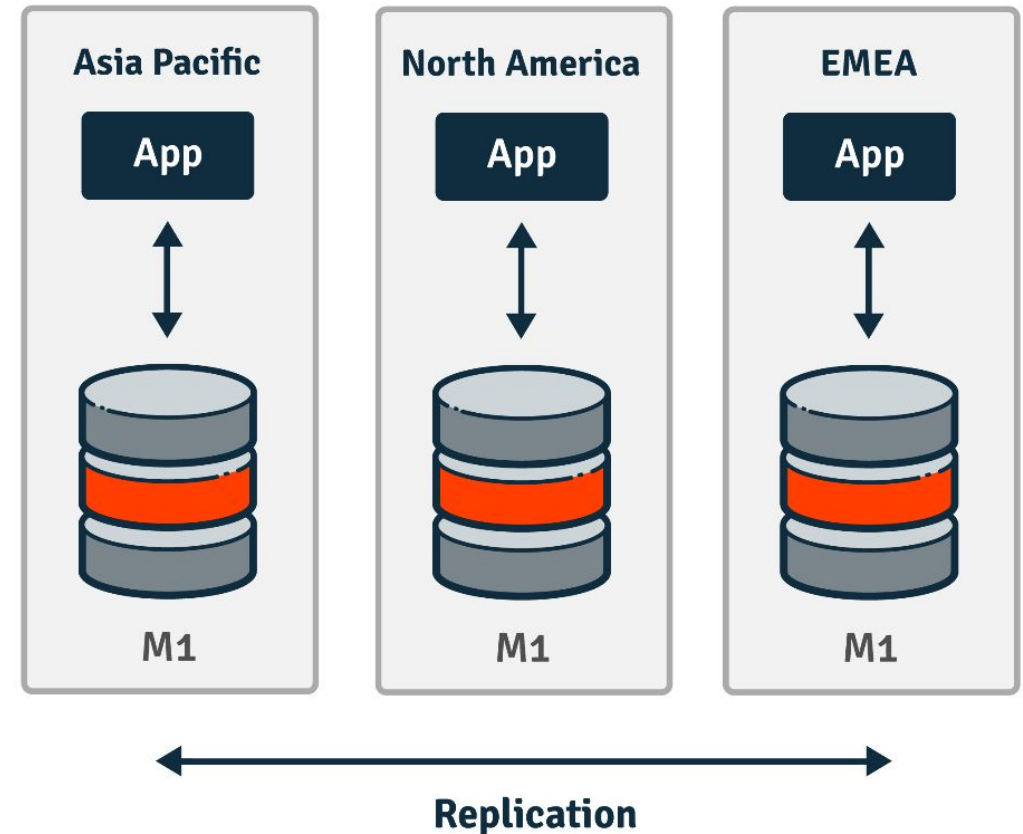
RDS, Aurora, and other CSP DBaaS solutions — are they an option?

"If the DB cluster has one or more Aurora Replicas, then an Aurora Replica is promoted to the primary instance during a failure event. A failure event results in a brief interruption, during which read and write operations fail with an exception. However, service is typically restored in less than 120 seconds, and often less than 60 seconds."
(https://docs.aws.amazon.com/AmazonRDS/latest/AuroraUserGuide/Concepts.AuroraHighAvailability.html)

AWS SLA is limited to 99.99% (https://aws.amazon.com/rds/aurora/sla/).

Dollars and sense – why make the switch?

Why switch?

Cost is a major driver - but not the only reason

- Cost
  - Oracle RAC: Oracle licenses + annual maintenance + proprietary hardware + enterprise grade SAN + limited cloud platforms
  - Postgres-BDR: Annual subscription + commodity hardware + every public cloud

    ⇒ Significant ROI!

- Flexibility and innovation
  - Run in every public cloud
  - Deploy the same license anywhere
  - Take advantage of Postgres (PostGIS, JSONB, KVP, …)
  - Combine with EDB Postgres Advanced Server for Oracle PL/SQL compatibility

Conclusion

- Postgres-BDR uses logical replication and mesh-based multi-master architecture

- Enables multiple deployment architectures

- Achieves 99.999% availability on prem and in the cloud

- Provides a high availability alternative to Oracle RAC

- Significant ROI and flexibility advantage

Learn more about Postgres-BDR

Whitepapers, webinars and conference presentations
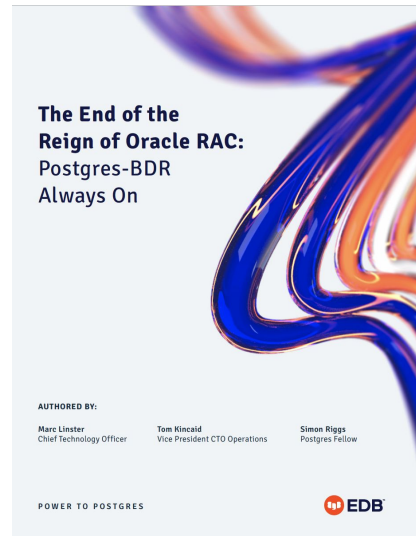
EDB Webinar:
- Upgrade easily with BDR; Simon Riggs; August 18 2021

Conference presentations:
- Building a business that never sleeps; Simon Riggs; Postgres Vision 2021
- A Case Study in "What If" PostgreSQL-BDR High-Availability/Disaster Recovery Analysis; Dominic Mortimer, Principal Software Engineer, ACI; 2Q Postgres Conference 2019

Blogs and Customer Success Stories
- [How to Achieve Five Nines with Database Extreme High Availability](): An Integral Part of Any Oracle Replacement Strategy, [Jan Karremans]() · Sep 10, 2021
- [4 Reasons Why You Probably Don't Need RAC](), [Jan Karremans]() · Aug 24, 2021
- [Project Management SaaS company uses Postgres-BDR to achieve consistent performance globally]() EDB Team · Aug 19, 2021
- [Application High Availability and Resiliency](): Steps to Improve Transaction Retry, [Tom Kincaid]() Jul 30, 2021
- [ACI Worldwide Modernizes Software Architecture]() While Reducing Risk and Lowering Costs with PostgreSQL; EDB Team · Mar 2, 2021