Postgres on Kubernetes Workshop Leuven

6 June | Leuven, Belgium

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Senior Sales Engineer, EDB

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Sales Engineer, EDB

Agenda

Start	End	Session
09:00	09:30	Registration & Welcome
09:30	09:45	Piros and Zebanza Introduction
09:45	10:00	Red Hat OpenShift & EDB Partnership
10:00	10:15	Introduction to CloudNativePG and EDB
10:15	10:45	CNPG Operator Reference Architecture
10:45	11:15	Functionalities for CNPG
11:15	13:00	Interactive session & demo
13:00	14:00	Lunch

Piros & Zebanza Introduction

Red Hat
Premier
Business Partner
Solution Provider
Datacenter infrastructure
Middleware solutions
Cloud infrastructure

Red Hat
Premier
Business Partner
Solution provider
Container platform specialist

Red Hat
Advanced
Training Partner
Authorized reseller

What connects us all?
Open-Source at the core!

JFrog

Grafana

cilium

ZABBIX
CERTIFIED
SPECIALIST

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CERTIFIED
PROFESSIONAL

ZABBIX
CERTIFIED PARTNER

Angelo Jacobs -
Business Development
Manager

Piros Partnerships

Piros.

Piros in numbers

18 YEARS RED HAT PARTNERSHIP

7 YEARS ZABBIX PARTNERSHIP

+ 57% GROWTH IN 2024

+ 40 CERTIFIED RED HAT & ZABBIX ENGINEERS

+ 150 ENGINEERS IN THE CRONOS RED HAT COMMUNITY

+ 11.000 DE CRONOS GROEP COLLEAGUES

+ 600 COMPETENCE CENTERS

zebanza

Your Partner for Open Source Databases

Passionate
Solution Driven
Customer Focused

Expertise & Partners

PostgreSQL

MariaDB MySQL

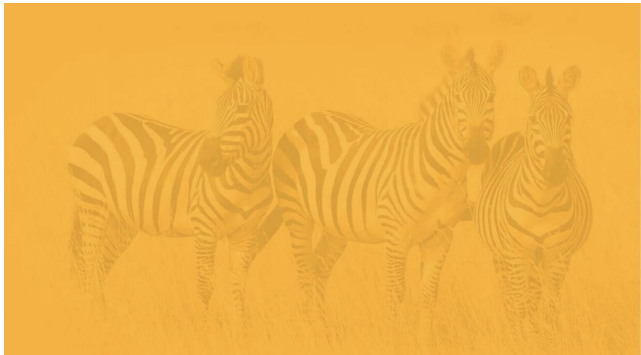
mongoDB

EDB

Official Reselling Partner

Our Services:

- **Consultancy:** Expert **DBA support**: short-term help, a long-term partnership, or specialized training.
- **Project Work**: **Migrations**, Critical upgrades, Performance Tuning, Automation, **Security Assessment**, Brainstorm Sessions,…
- **Managed Services**: **8/18 or 24/7** - We provide proactive support, monitoring, and incident response.



Red Hat Openshift and EDB Partnership

Red Hat OpenShift with EDB

Tom D'Hont
Senior Account Solution
Architect - Ecosystem

Red Hat

Red Hat is a Leader in the 2024 Gartner® Magic Quadrant™: Container Management

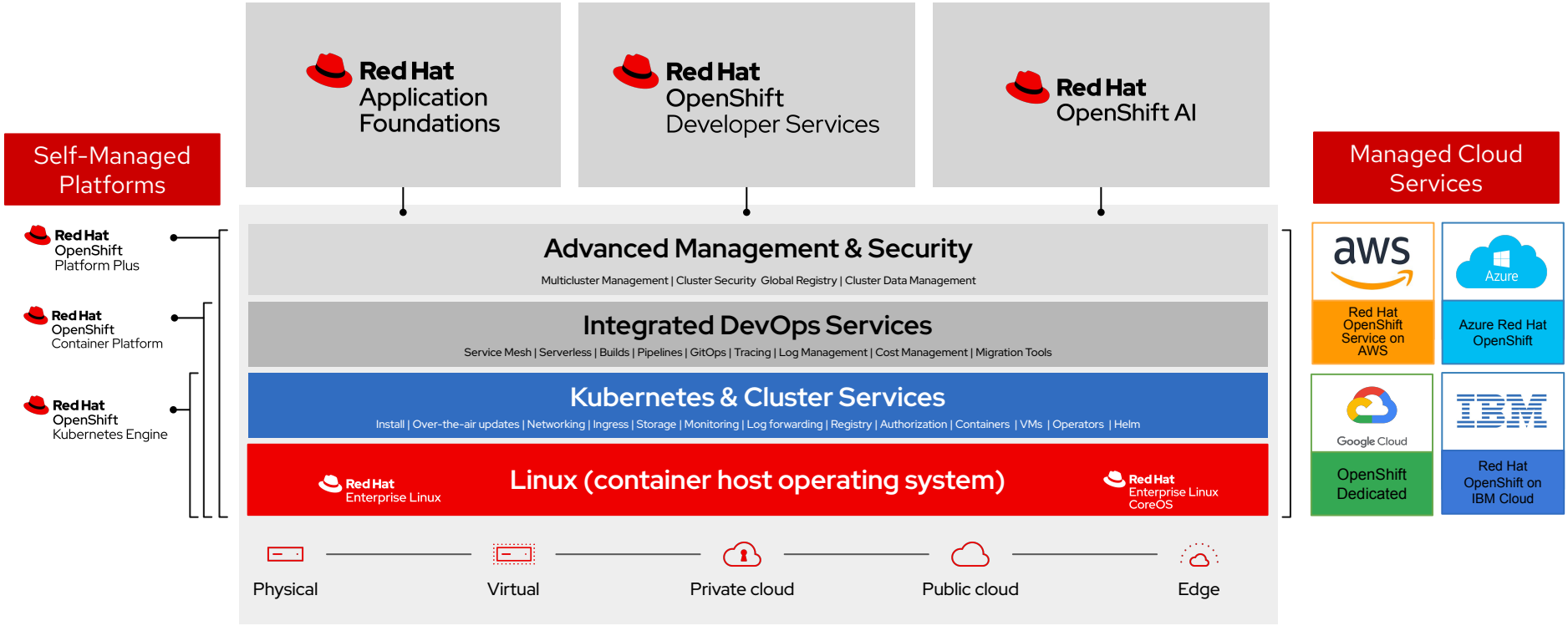
Figure 1: Magic Quadrant for Container Management

Gartner

Source: Gartner, "Magic Quadrant for Container Management," September 2024.

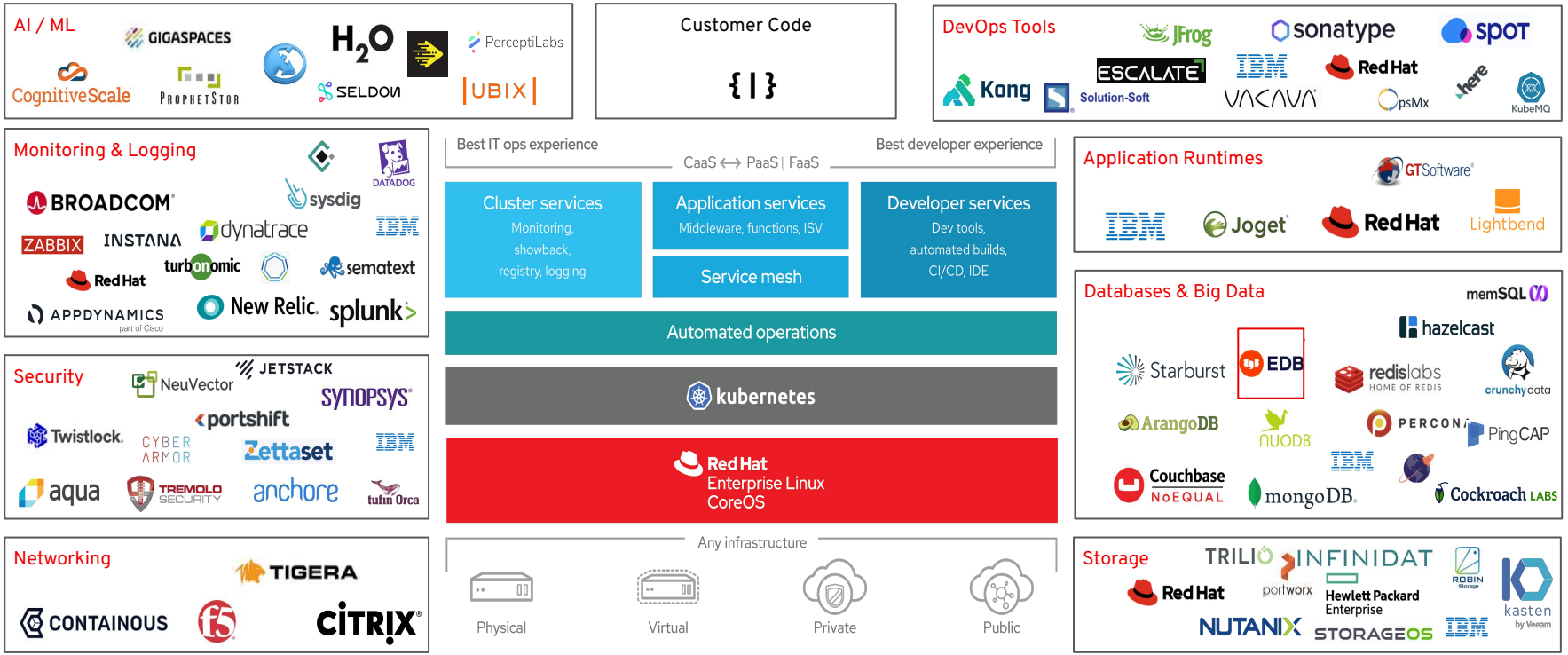
Red Hat

Hybrid Cloud Application Platform



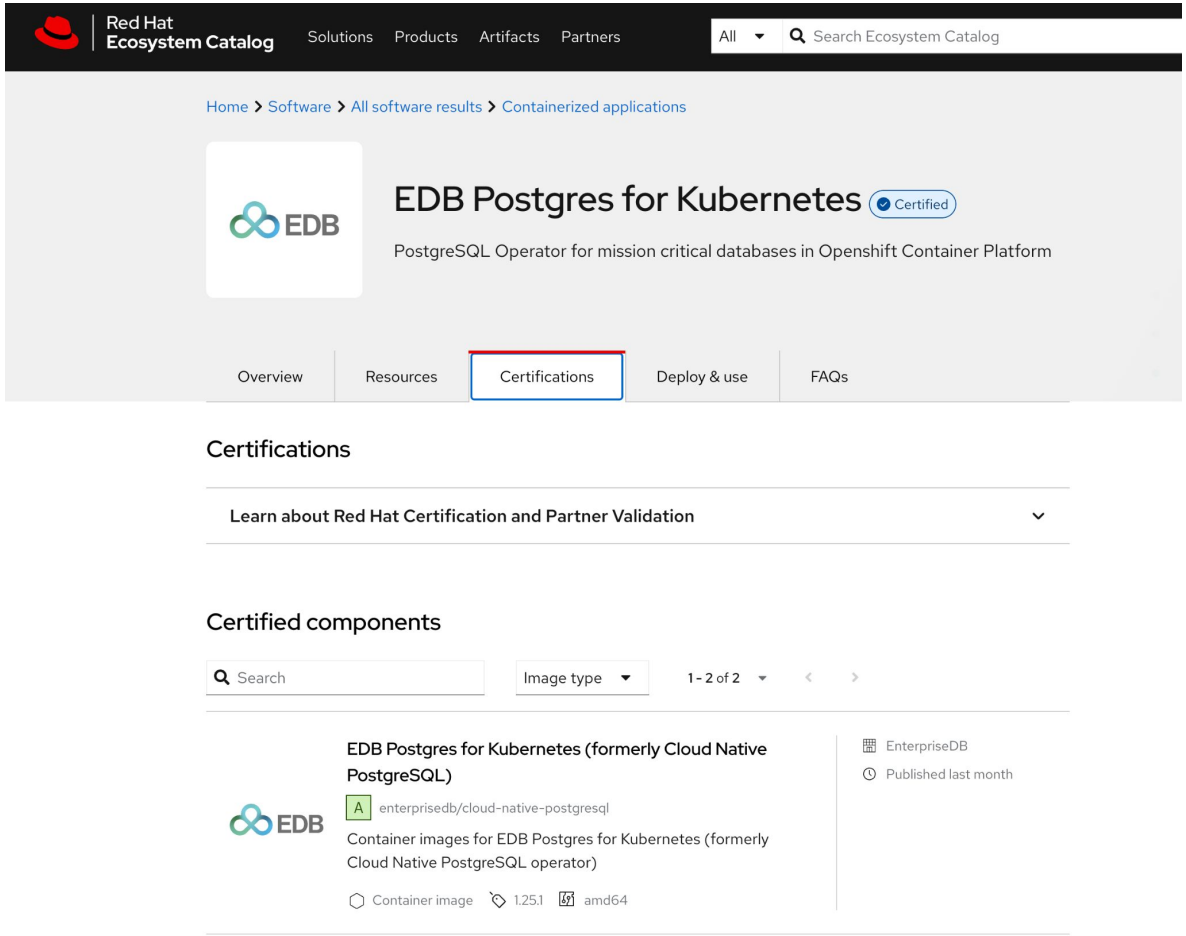
Red Hat

Red Hat open hybrid cloud platform with ISV ecosystem



Red Hat

Why Red Hat OpenShift for EDB: operator certification

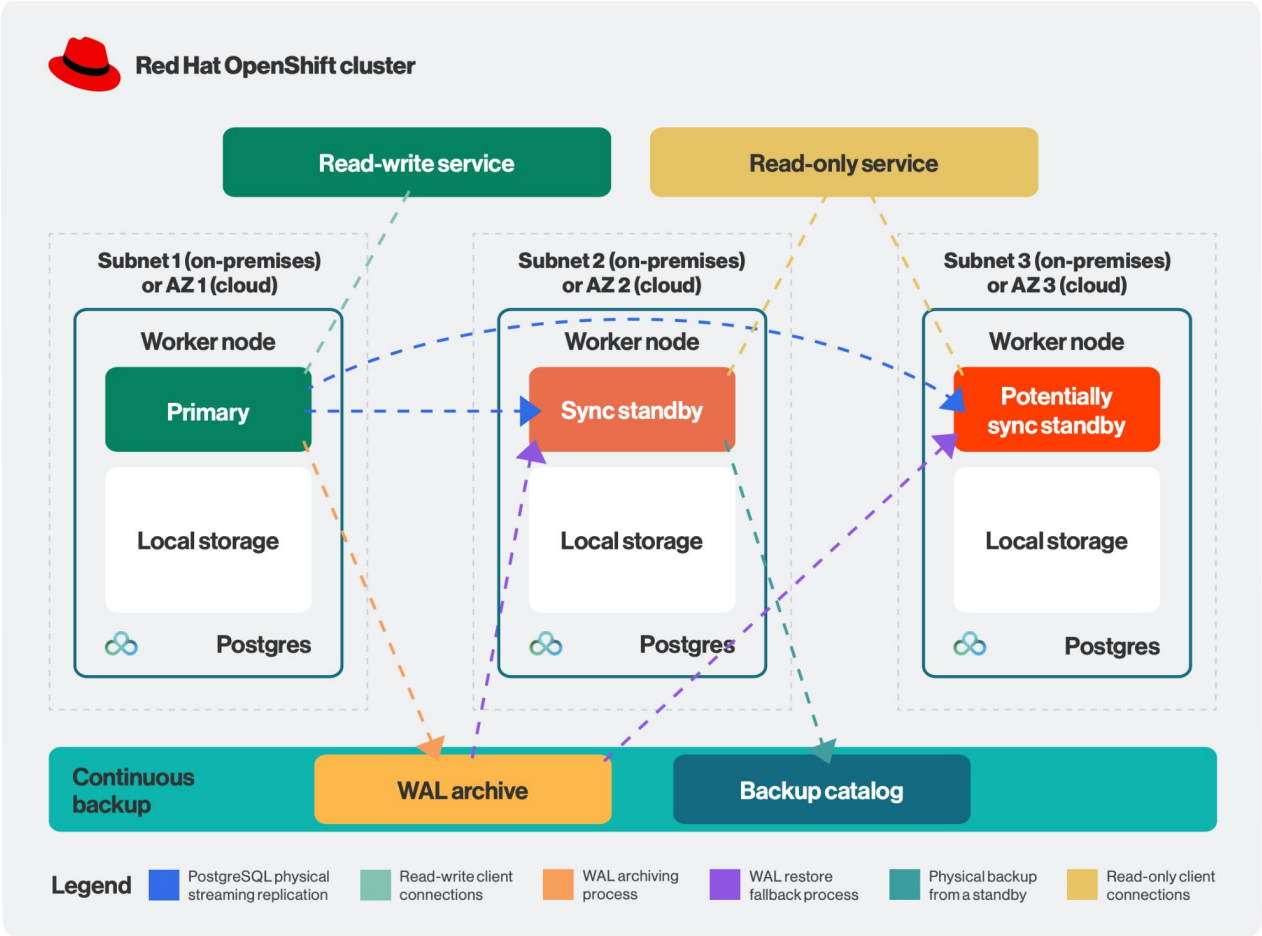


EDB Postgres for Kubernetes is a certified Level 5 Operator for Red Hat OpenShift

- This is designed to streamline Day 2 operations of PostgreSQL databases
- Enhanced Database Management
- Supports point-in-time recovery (PITR)
- Ensures robust data protection and recovery options
- Integration with business continuity solutions such as Red Hat OpenShift API for Data Protection (OADP) and Veeam Kasten, Trilio, Portworx Backup, IBM Fusion, and others

Red Hat

Why Red Hat OpenShift for EDB : reference architecture



Red Hat

EDB on OpenShift use cases

- Cloud-Native Database Deployment
- Database as a Service (DBaaS)
- High Availability and Disaster Recovery (HA & DR)
- DevOps and Continuous Integration/Continuous Deployment (CI/CD)
- Microservices and Application Modernization
- Move from VMWare to OpenShift
- Data Security and Compliance (using **TDE** and Advanced Security provided by EPAS)
- Hybrid and Multi-Cloud Deployments
- Multi-Tenant Applications (isolation)

Euro Information

Company profile

Euro-Information is the fintech company of the Crédit Mutuel group. Euro-Information manages the IT systems of 16 federations of Crédit Mutuel as well as those of CIC and of all the financial, insurance, property, consumer credit, private banking, financing, telephony and technological subsidiaries.

- Red Hat OpenShift
- EDB Postgres for Kubernetes
- PostgreSQL
- EPAS

- EDB considerably reduces IT costs associated with database maintenance.
- 280 cores: Enterprise Plan + Production Support

Summary

Use Case	On prem DBaaS (in Production)
Workload	Transactional
Application Name	All internal Postgres applications
EDB Tools of Interest	PostgreSQL and EDB Postgres for Kubernetes

Problem

- Fast database deployment
- Adopt a supported and secure Open Source platform
- Onprem DBaaS
- Align to in-house RDBMS standardization

Solution

- Use Postgres capabilities to build and maintain local applications
- Use Red Hat OpenShift platform to accelerate the provisioning of databases and applications

Results

- Applications running with PostgreSQL databases in a centralized environment
- Massive reduction of TCO of database service operations

La Poste

Company profile

La Poste is a postal service company in France, operating in Metropolitan France, the five French overseas departments and regions and the overseas collectivity of Saint Pierre and Miquelon. Under bilateral agreements, La Poste also has responsibility for mail services in Monaco through La Poste Monaco and in Andorra alongside the Spanish company Correos.

- Red Hat OpenShift
- EDB Postgres for Kubernetes
- PostgreSQL

- EDB considerably reduces IT costs associated with database maintenance.
- 12 Cores: Standard Plan + Premium Support

Summary

Use Case	On prem DBaaS with HA and DR (In Production)
Workload	Transactional
Application Name	Portail XaaS
EDB Tools of Interest	PostgreSQL and EDB Postgres for Kubernetes

Problem

- Provide a database HA solution for Ansible Automation Platform (AAP)
- Database must be in HA and DR

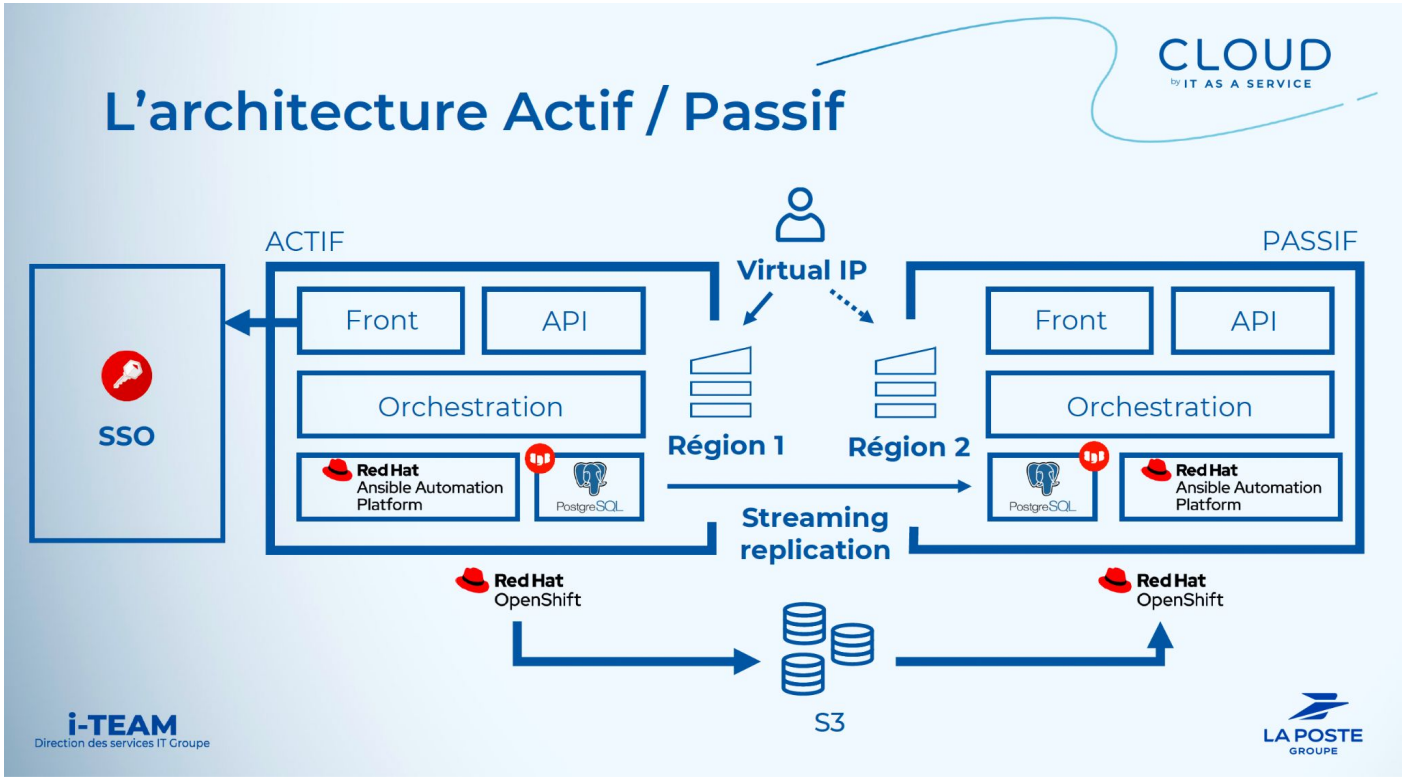
Solution

- Use EDB Postgres for Kubernetes to provide a HA and DR solution for PostgreSQL databases
- Deploy in 2 OpenShift clusters our operator

Results

- La Poste developer can use their internal ‘La Post Service Portal’ to provision more than 64 backends.
- Reduce risk deploying EDB solutions.

La Poste Architecture



Red Hat

Thank you

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Red Hat

Introduction to CloudNativePG and EDB

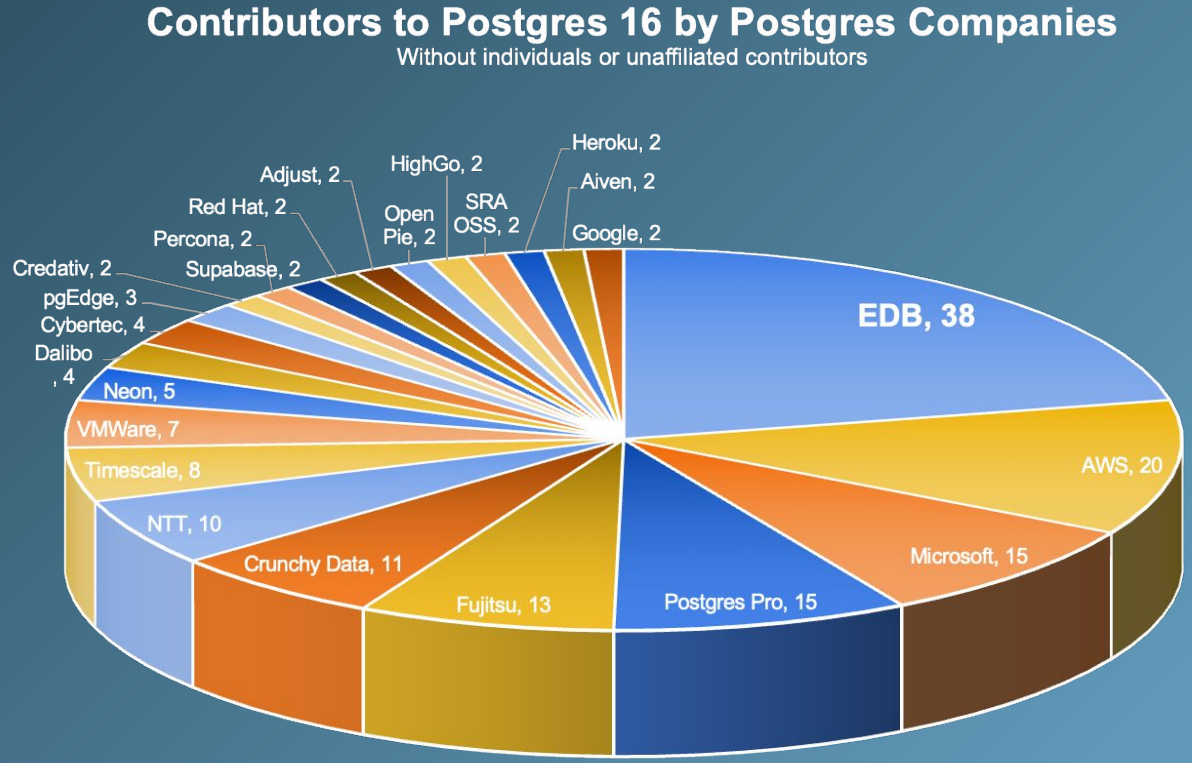
EDB
Postgres® for the AI Generation

20+ years of Postgres innovation & adoption

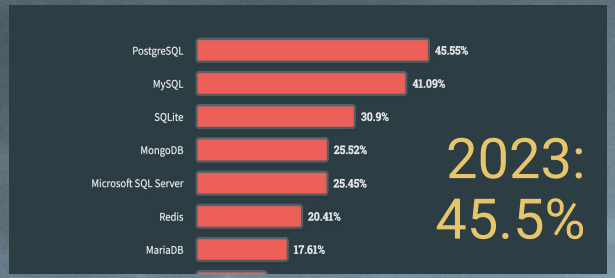
- Number one contributor to Postgres, fastest-growing and most loved Database in the world
  - 2 Core Team members, 7 Committers, 9 Major Contributors, 10 Contributors, #1 site for desktop downloads
- Over 700 employees in more than 30 countries
- EDB Postgres AI
  - The industry's first platform that can be deployed as cloud, software or physical appliance
  - Secure, compliant and enterprise grade performance guaranteed

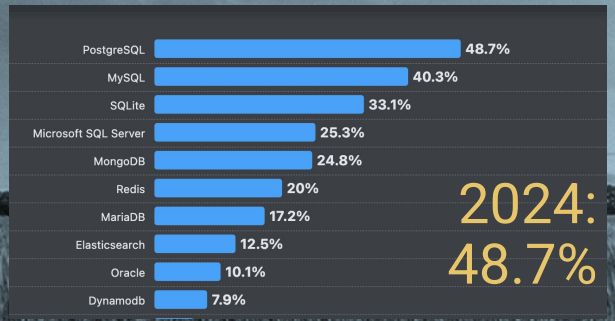
Large Developer Community

- 407 + contributors to Postgres 16
- 111 companies actively contributing to Postgres 16



Postgres has won the database race

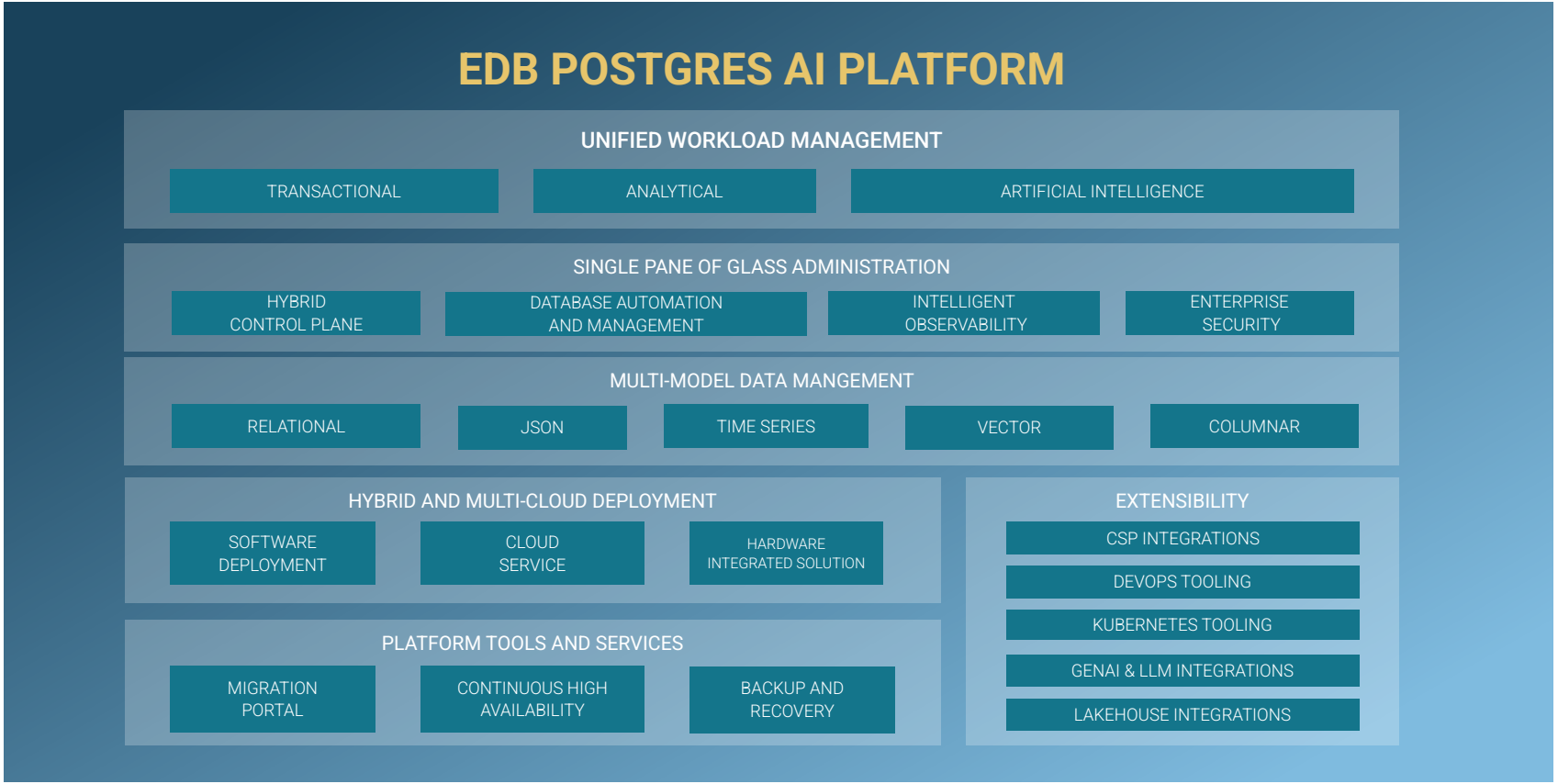




Stack Overflow Survey 2023/2024

LEADING ENTERPRISES TRUST EDB

EDB POSTGRES AI PLATFORM



EDB + Red Hat

Piros + zebanza

Chance to WIN LEGO Technic 42207 Ferrari!

CNPG Operator: Reference Architecture and functionalities

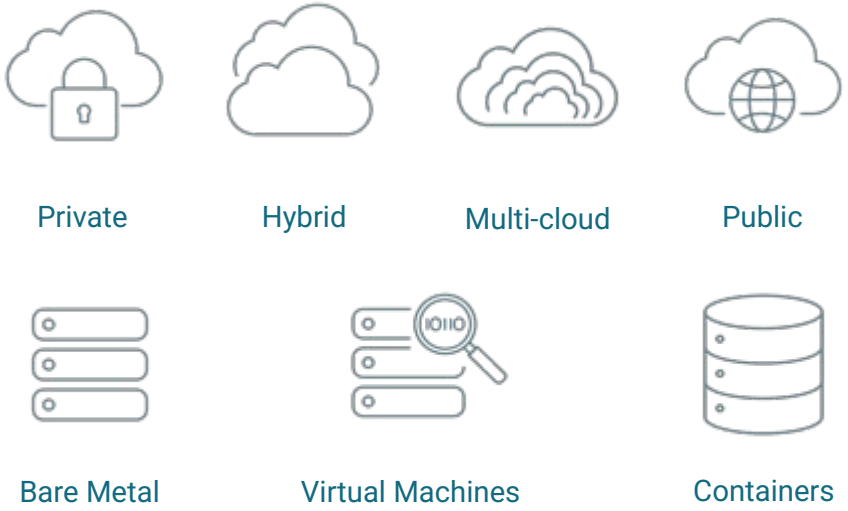
Kubernetes timeline

- 2014, June: Google open sources Kubernetes
- 2015, July: Version 1.0 is released
- 2015, July: Google and Linux Foundation start the CNCF
- 2016, November: The operator pattern is introduced in a blog post
- 2018, August: The Community takes the lead
- 2019, April: Version 1.14 introduces Local Persistent Volumes
- 2019, August: EDB team starts the Kubernetes initiative
- 2020, June: we publish this blog about benchmarking local PVs on bare metal
- 2020, June: Data on Kubernetes Community founded
- 2021, February: EDB Cloud Native Postgres (CNP) 1.0 released
- 2022, May: EDB donates CNP and open sources it under CloudNativePG
- 2025, January: CloudNativePG was recognized as an official #CNCF project

Enabling the same PostgreSQL everywhere

From self-managed to fully managed DBaaS in the Cloud

- Same applications
- Faster innovation
- Performance and scalability
- Stability, security and control
- Seamless integration
- Obsolescence



A kubernetes operator for Postgres

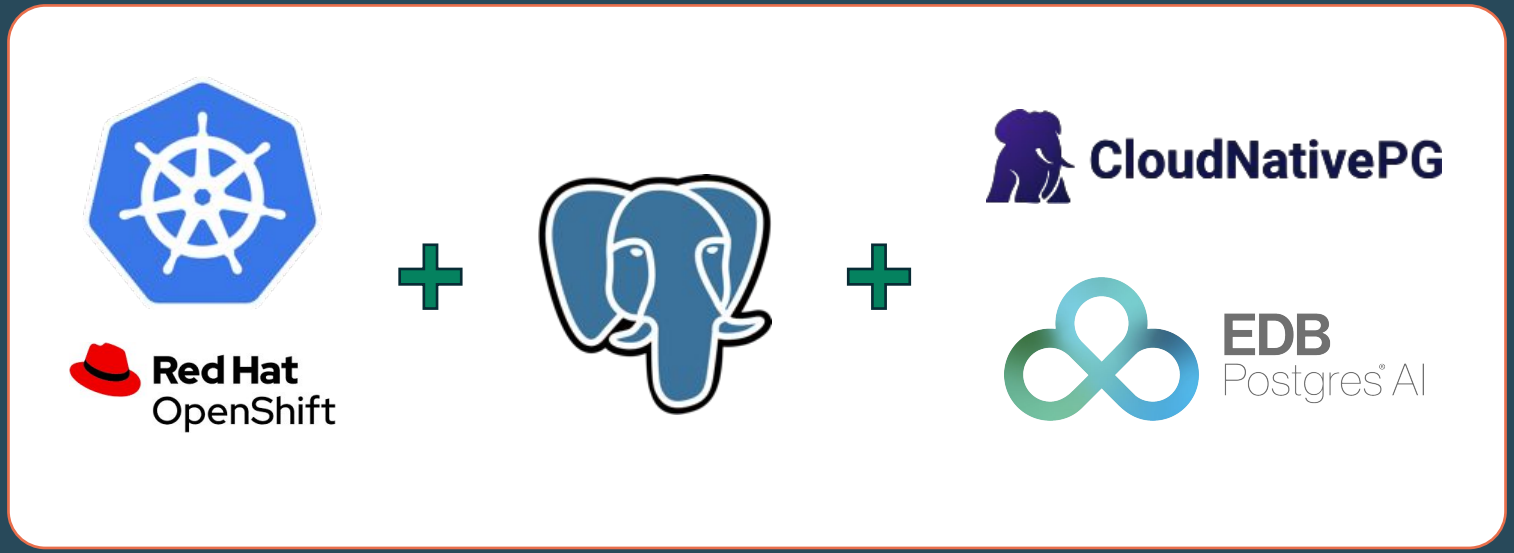
Kubernetes adoption is rising and it is already the de facto standard orchestration tool

PostgreSQL clusters “management the kubernetes way” enables many cloud native usage patterns, e.g. spinning up, disposable clusters during tests, one cluster per microservice and one database per cluster

CNPG tries to encode years of experience managing PostgreSQL clusters into an Operator which should automate all the known tasks a user could be willing to do

Our PostgreSQL operator must simulate the work of a DBA

Win Technology



Autopilot

It automates the steps that a human operator would do to deploy and to manage a Postgres database inside Kubernetes, including automated failover.

Security

CloudNativePG is secured by default.

It doesn’t rely on statefulsets and uses its own way to manage persistent volume claims where the PGDATA is stored.

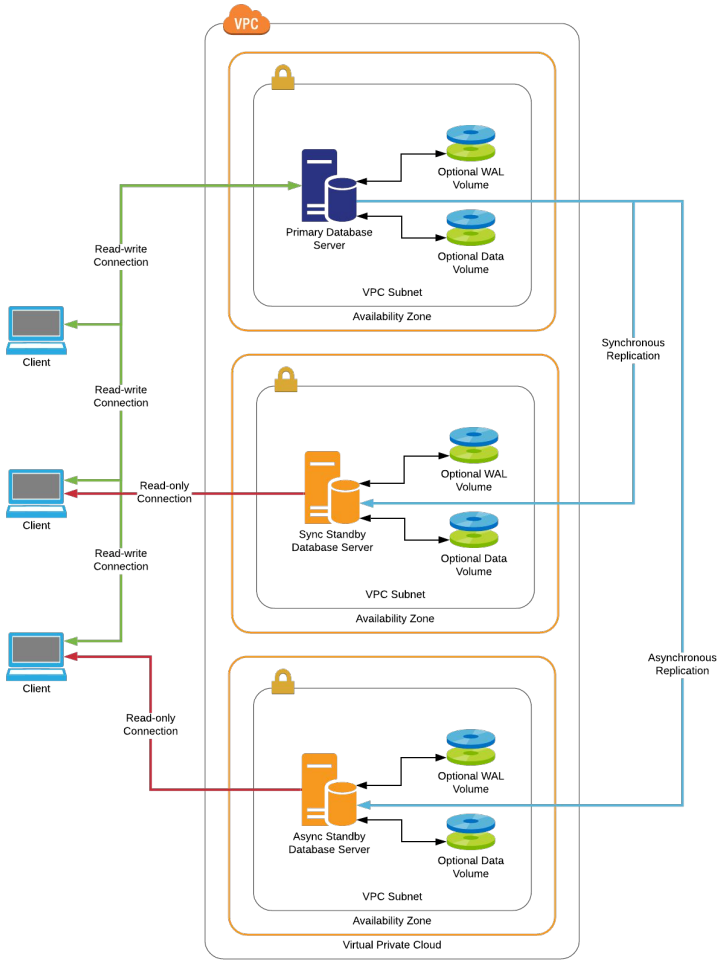
Data persistence

Designed for Kubernetes

It’s entirely declarative, and directly integrates with the Kubernetes API server to update the state of the cluster — for this reason, it does not require an external failover management tool.

Imperative vs Declarative

- Create and configure VMs
- Create a PostgreSQL 13 instance
- Configure for replication
- Clone a second one
- Set it as a replica
- Clone a third one
- Set it as a replica
- Configure networking
- Configure security
- etc.



Convention over configuration

Declarative - simple to install, simple to maintain

There's a PostgreSQL 17 cluster with 2 replicas:

```
apiVersion: postgresql.k8s.enterprisedb.io/v1
kind: Cluster
metadata:
  name: myapp-db
spec:
  instances: 3
  imageName: quay.io/enterprisedb/postgresql:17

  storage:
    size: 10Gi
```

Features

Deployment	Administration	Backup & Recovery	Monitoring	Security	High Availability
Kubernetes operator	Single node	Backup	Prometheus	TDE	Switchover
Kubernetes plugin	Cluster (Multi node)	Recovery	Grafana dashboards	Certificates	Failover
EDB Postgres (EPAS)	PostgreSQL configuration	PITR	Postgres Enterprise Manager	Data redaction	Scale out / scale down
PostGIS	Pooling	Volume Snapshots	Logging	Password management	Minor / Major updates

Decision-making for choosing the deployment platform

When to choose Kubernetes over VMs?

01 | Cloud Native Applications that already run in Kubernetes

02 | Scalable, replicated databases

03 | Applications requiring automated failover and self-healing

04 | Teams skilled in Kubernetes who want a unified infrastructure

Advantage of deploying Postgres Databases in Kubernetes

01 | Automation & Orchestration

- Self-healing
- Automated scaling
- Rolling updates

02 | Self-healing

- Best resource utilization
- Dynamic Resource allocation

03 | Rolling updates

- Cloud-agnostic
- Consistent deployment

04 | Service discovery & networking

- Built-it service discovery
- Load Balancing

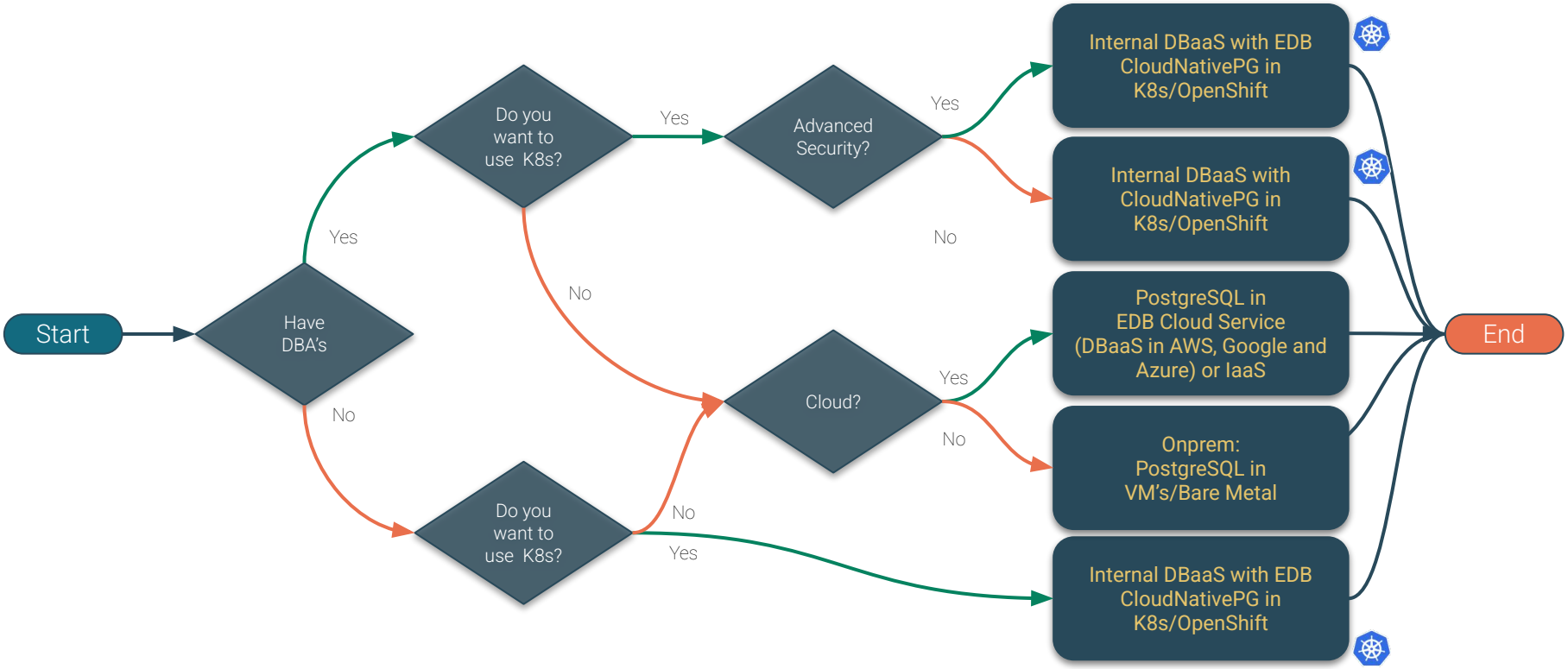
05 | Automated backups and disaster recovery

- Automated backups
- Multi-region failover

06 | Security & access control

- RBAC
- Secret management

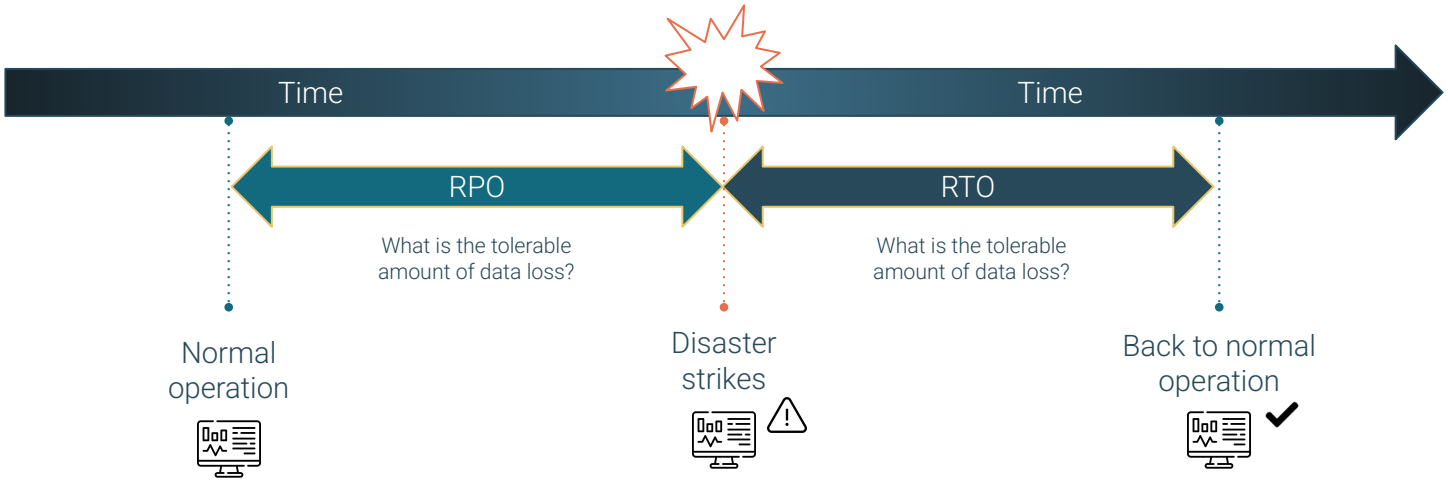
Decision-making for choosing the deployment platform



Architectures

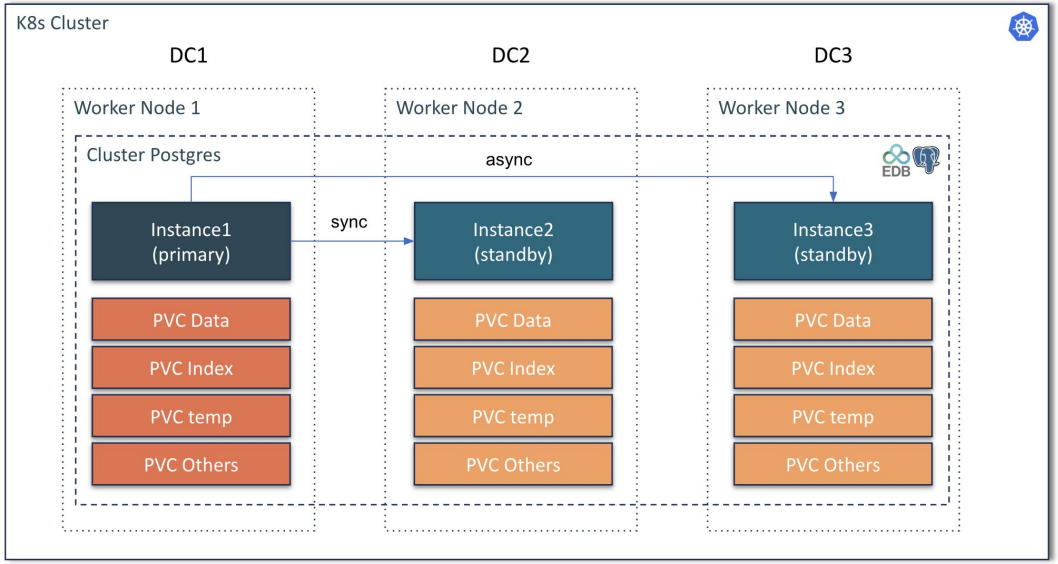
Concepts

- Recovery Point Objective (**RPO**) and Recovery Time Objective (**RTO**) are key concepts in disaster recovery and business continuity planning, particularly related to data loss and system downtime.



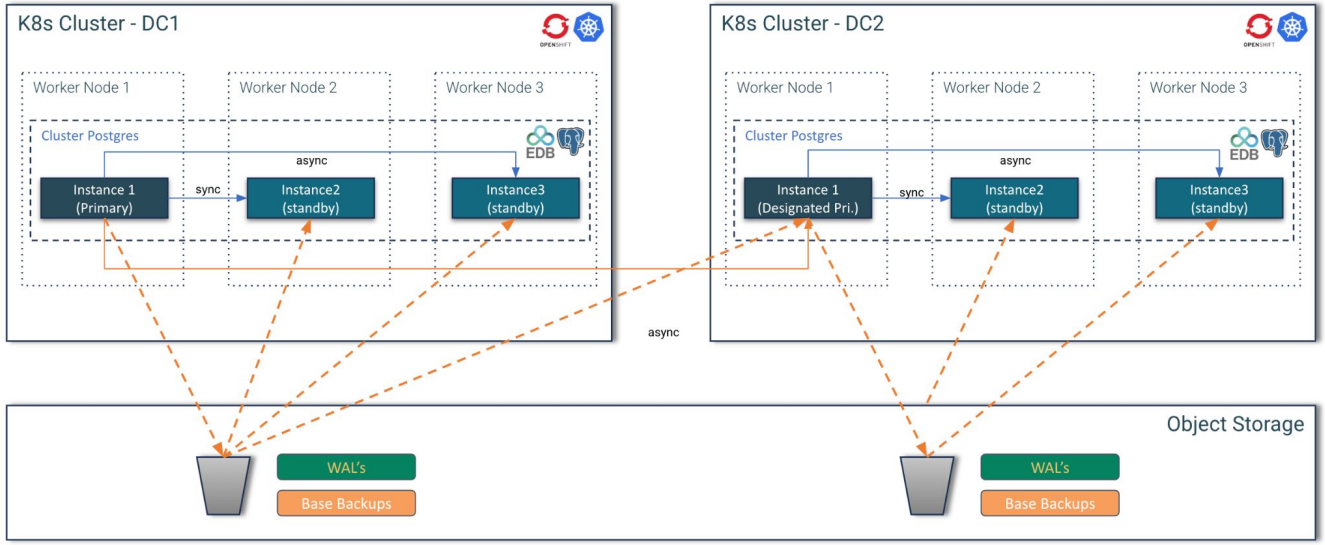
Red Hat Recommendation

Red Hat recommend stretched clusters ONLY when latencies don't exceed 5 milliseconds (ms) round-trip time (RTT) between the nodes in different locations, with a maximum RTT of 10 ms.

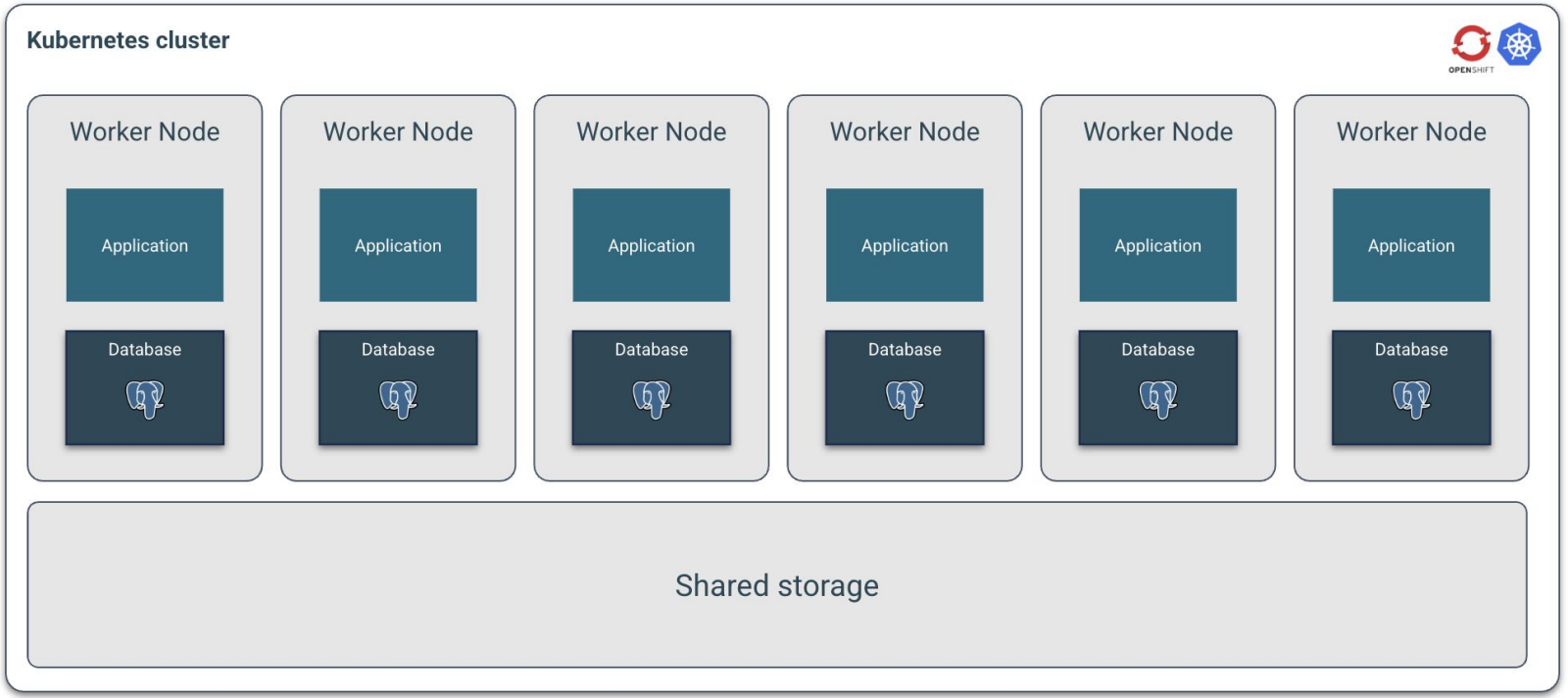


Two separate single data center Kubernetes clusters

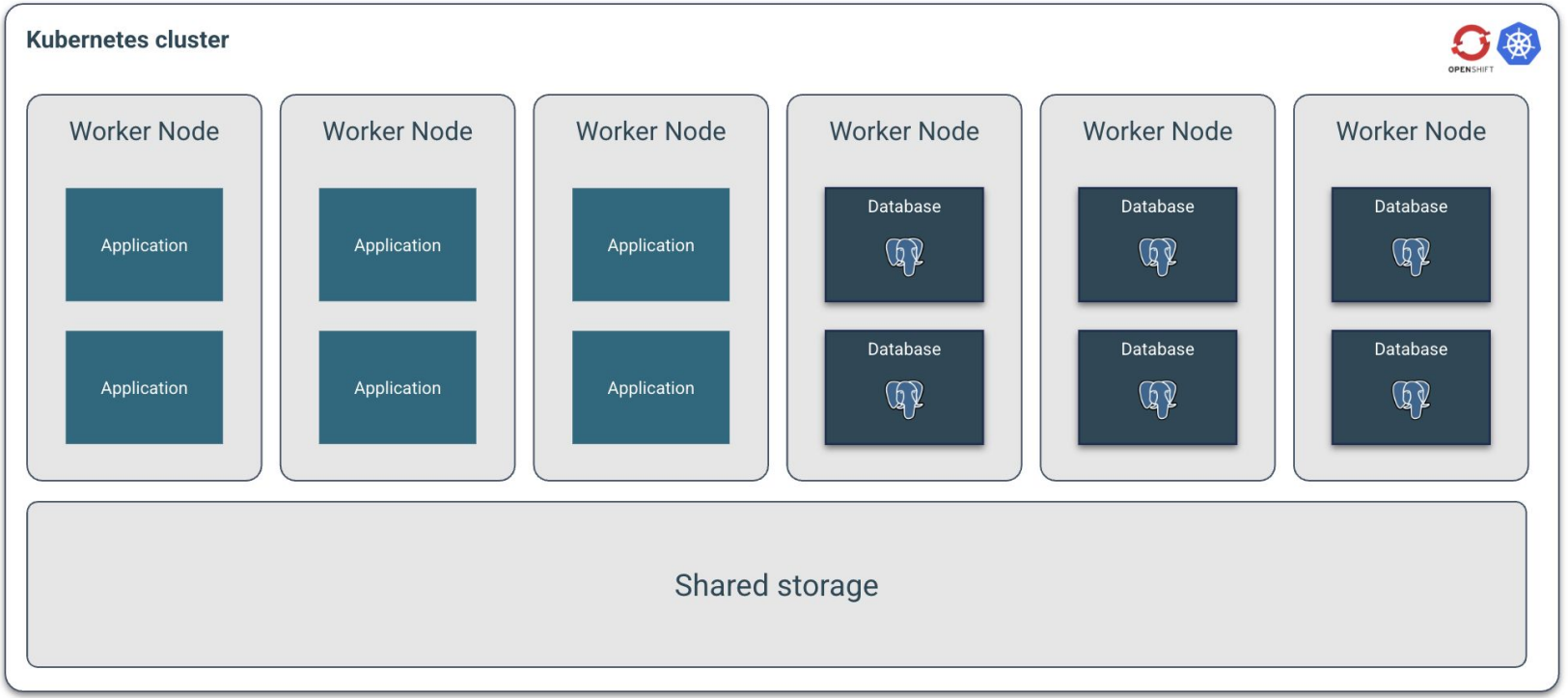
In case you cannot go beyond two data centers and you end up with two separate Kubernetes clusters, don't despair.



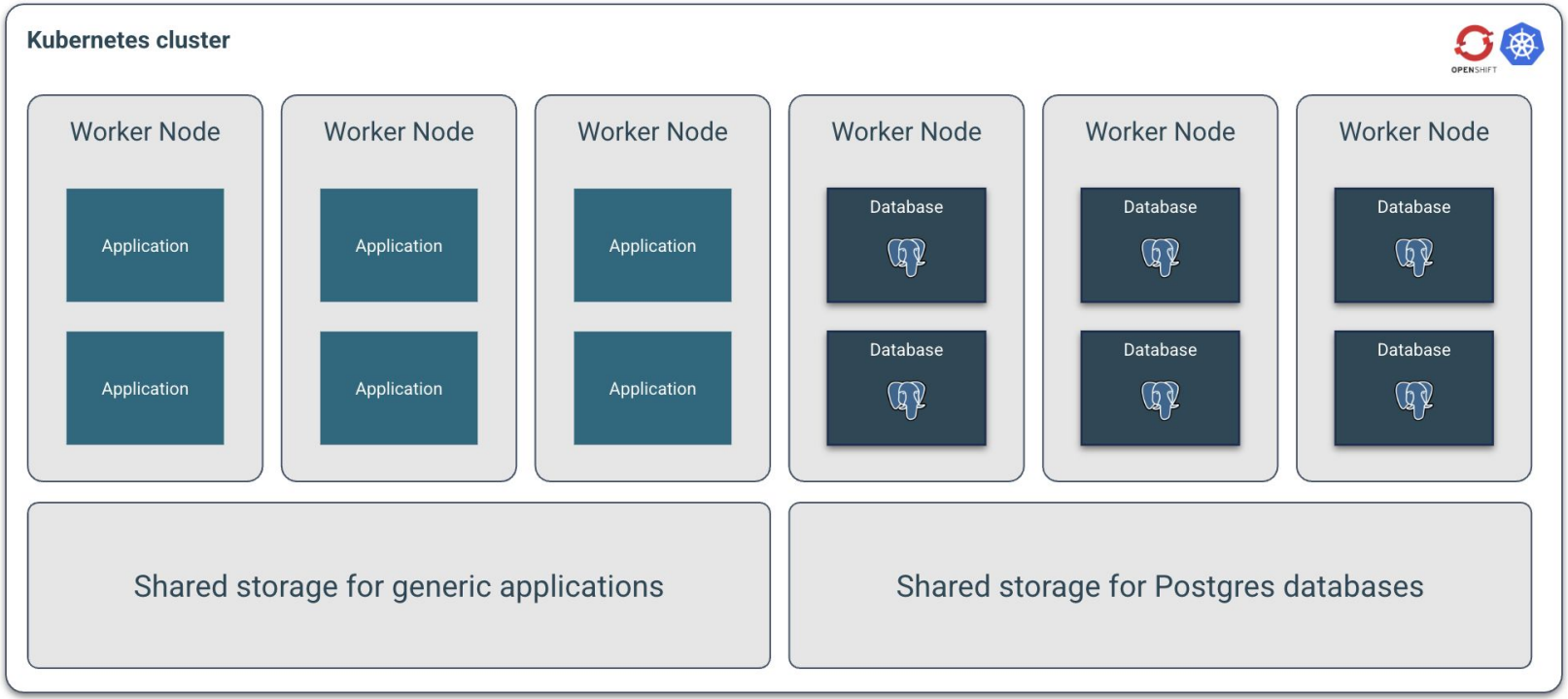
Shared workload, shared storage



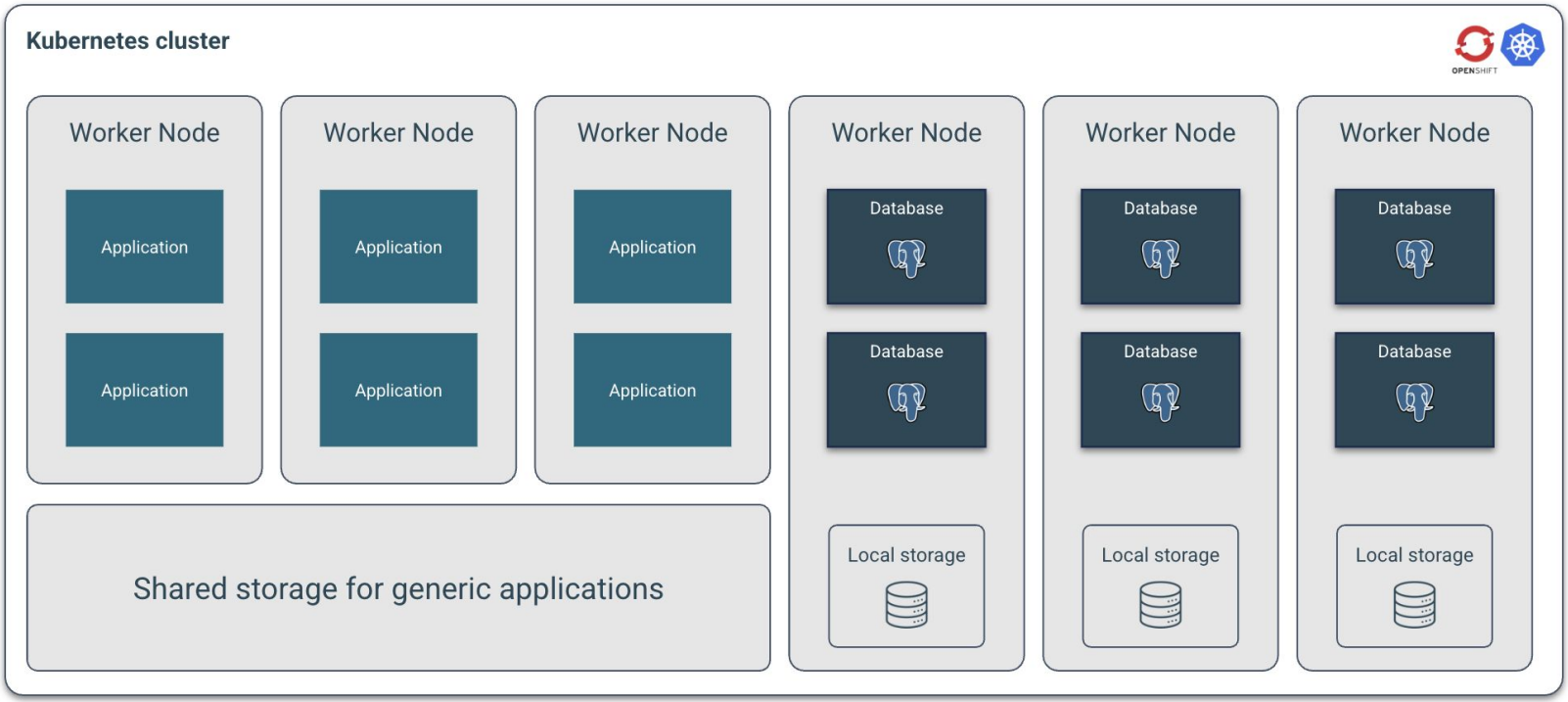
Shared workload, shared storage



Shared workload, shared storage

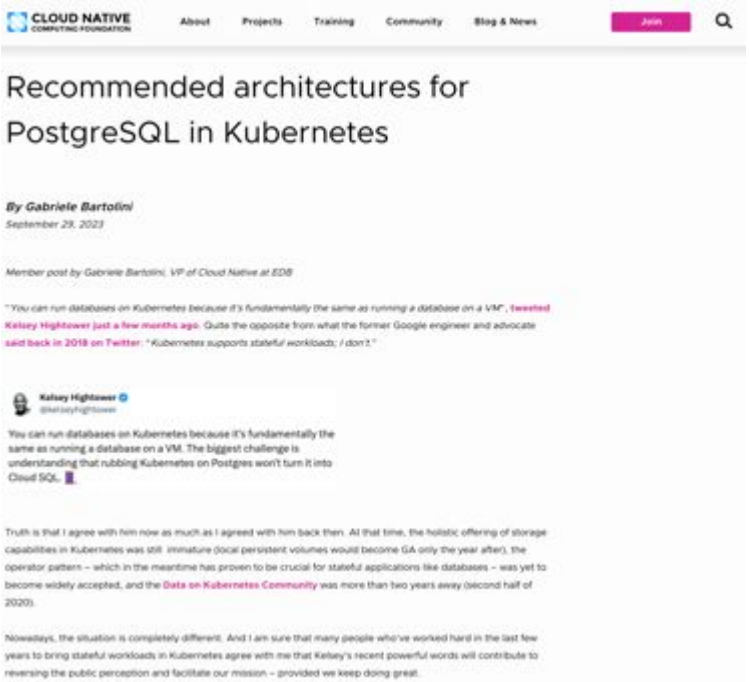


Shared workloads, local storage



Recommended architectures

https://www.cncf.io/blog/2023/09/29/recommended-architectures-for-postgresql-in-kubernetes/



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Recommended architectures for PostgreSQL in Kubernetes

By Gabriele Bartolini
September 29, 2023

Member post by Gabriele Bartolini, VP of Cloud Native at EDB

"*You can run databases on Kubernetes because it's fundamentally the same as running a database on a VM*", tweeted Kelsey Hightower just a few months ago. Quite the opposite from what the former Google engineer and advocate said back in 2018 on Twitter: "*Kubernetes supports stateful workloads; I don't.*"

Kelsey Hightower
@kelseyhightower

You can run databases on Kubernetes because it's fundamentally the same as running a database on a VM. The biggest challenge is understanding that rubbing Kubernetes on Postgres won't turn it into Cloud SQL.

Truth is that I agree with him now as much as I agreed with him back then. At that time, the holistic offering of storage capabilities in Kubernetes was still immature (local persistent volumes would become GA only the year after), the operator pattern – which in the meantime has proven to be crucial for stateful applications like databases – was yet to become widely accepted, and the Data on Kubernetes Community was more than two years away (second half of 2020).

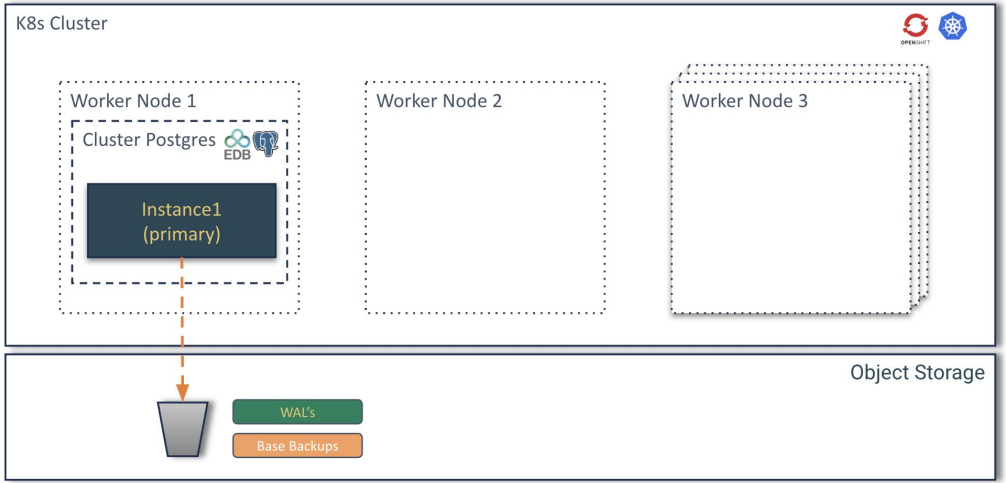
Nowadays, the situation is completely different. And I am sure that many people who've worked hard in the last few years to bring stateful workloads in Kubernetes agree with me that Kelsey's recent powerful words will contribute to reversing the public perception and facilitate our mission – provided we keep doing great.

Use Cases

Use case 1 architecture

A single database is the simplest setup, involving one instance of a database server.

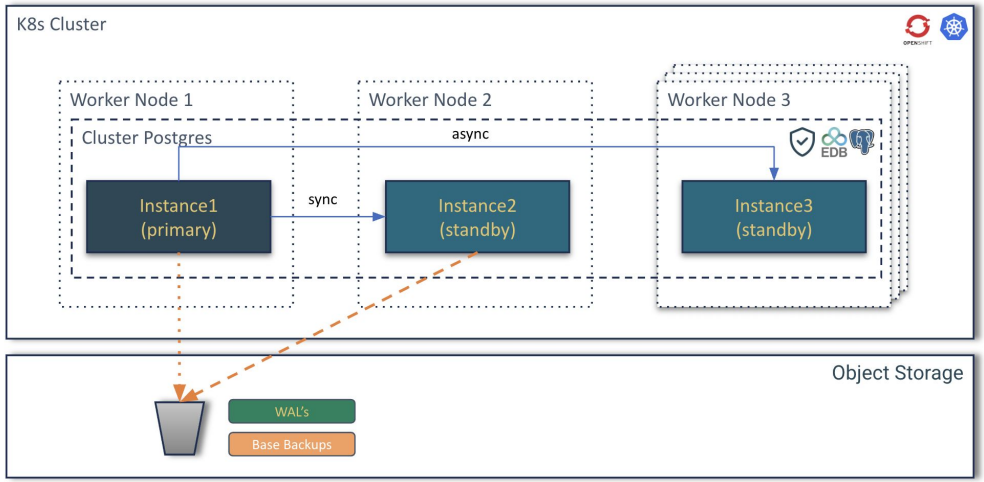
- Development and testing environments
- Small applications with low traffic
- Non-critical data analysis
- Applications with high tolerance for downtime
- Cost-sensitive projects



Use case 2 architecture

An HA database setup aims to minimize downtime by having redundant components. If one component fails, another takes over automatically or with minimal intervention. This usually involves techniques like clustering, replication, or mirroring within the same data center or availability zone.

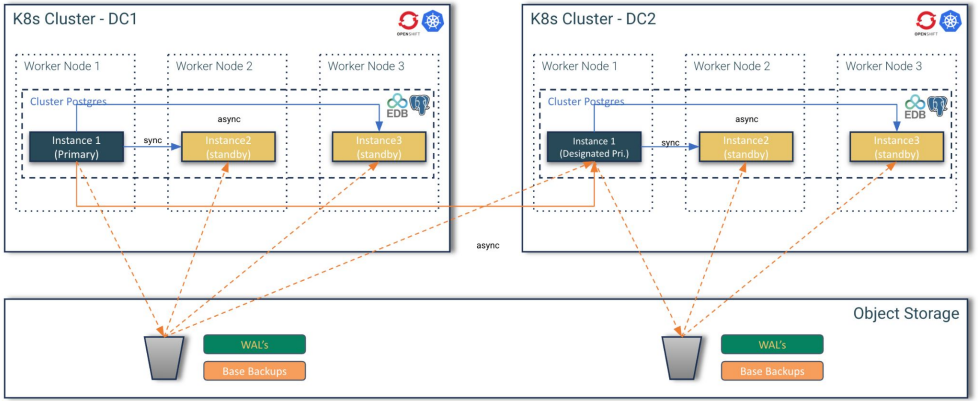
- Business critical Applications
- Applications with stringent SLAs
- Real-time systems
- Improving user experience
- Minimizing planned downtime



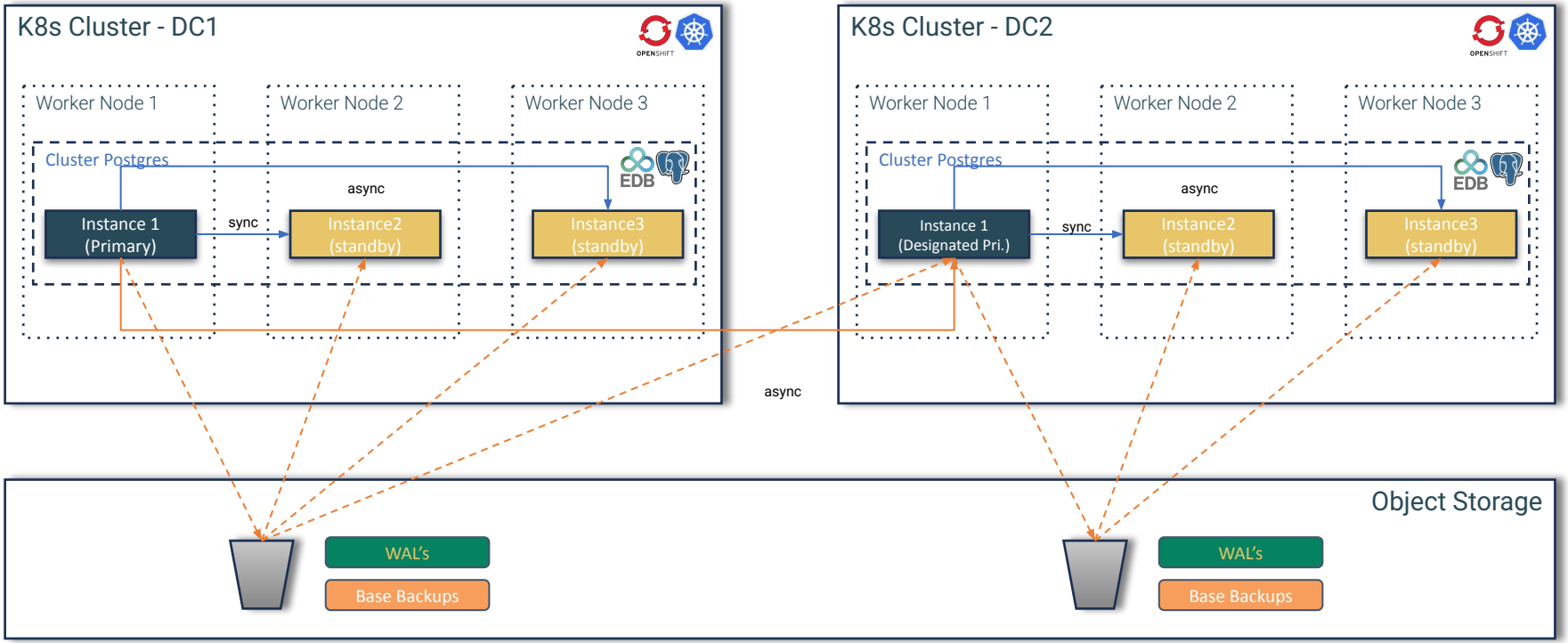
Use case 3 architecture

A DR database setup focuses on protecting data and ensuring business continuity in the event of a large-scale disaster affecting an entire data center or region (e.g., natural disasters, power outages, cyberattacks). This typically involves replicating data to a geographically separate location.

- Regulatory compliance
- Protecting against catastrophic data loss
- Ensuring business continuity for mission-critical systems



Use case 3 architecture



Interactive session
It’s time to go hands-on!

Hand-on documentation

Download this presentation

https://tinyurl.com/3j7cbjh3

Links:

Openshift Console:

https://console-openshift-console.apps.cluster-m6pll.m6pll.sandbox3121.opentlc.com

Users:

name: user2..user40
Password: edb-workshop

Devspaces url:

https://devspaces.apps.cluster-m6pll.m6pll.sandbox3121.opentlc.com/

Short url to Devspaces:

https://tinyurl.com/yy9dswmk

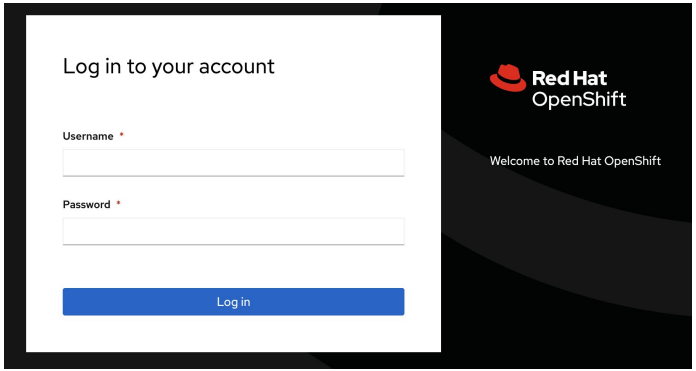
Minio:

UI: https://minio-ui-default.apps.cluster-m6pll.m6pll.sandbox3121.opentlc.com
API: https://minio-api-default.apps.cluster-m6pll.m6pll.sandbox3121.opentlc.com

User: minio
Password: edb-workshop

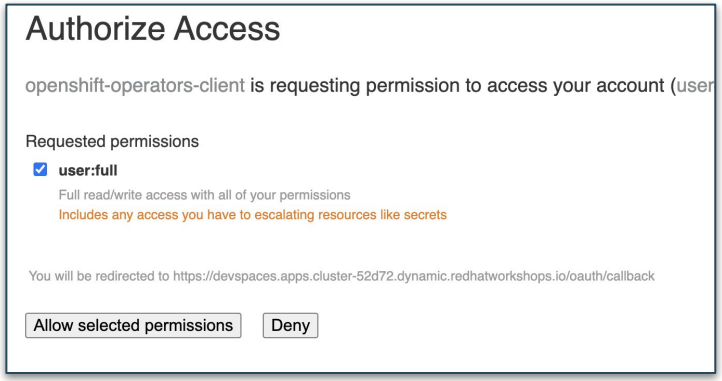
Open the following URL in your browser: https://red.ht/edb-cph25

https://tinyurl.com/yy9dswmk



Username and password provided to you

Red Hat



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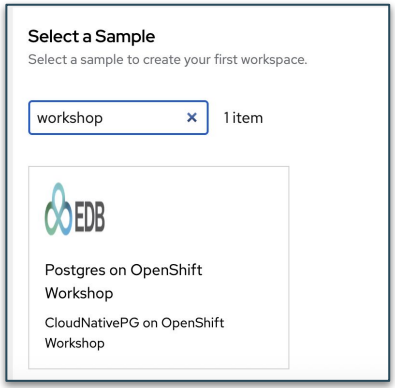

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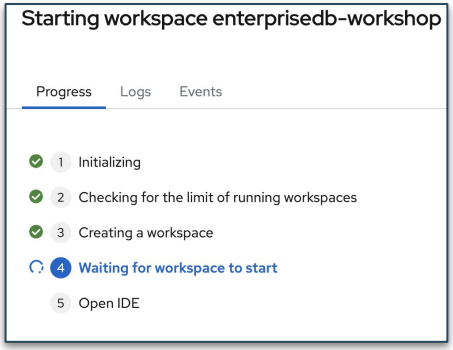
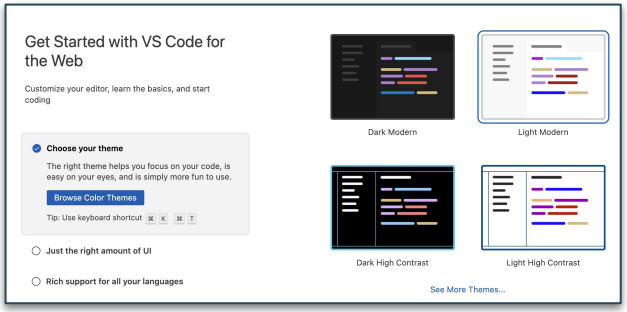
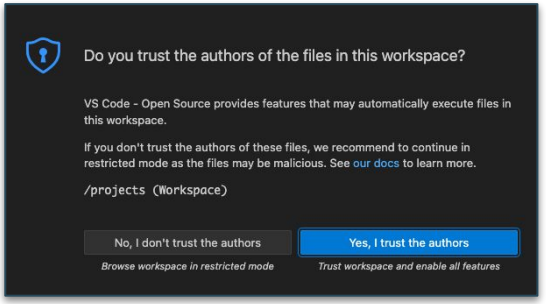


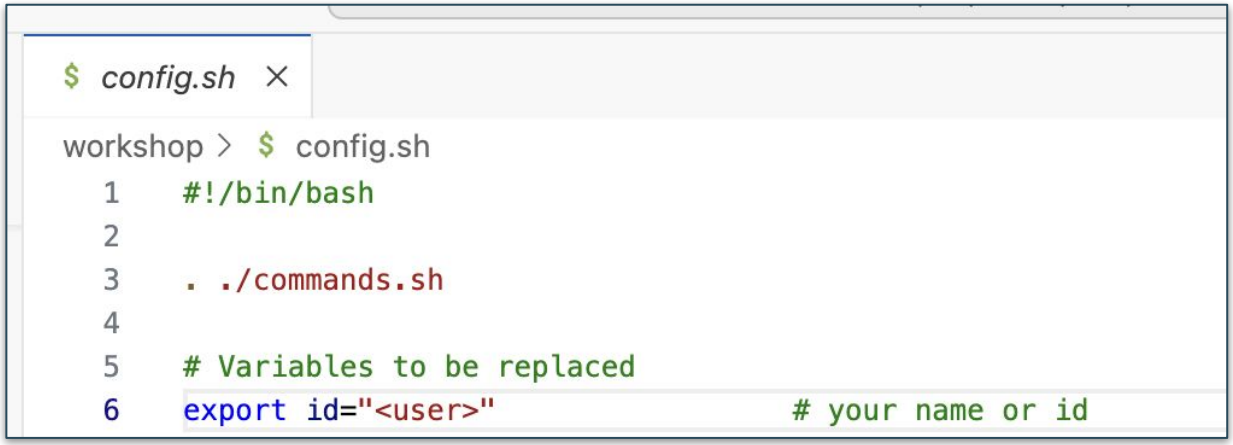
Your workshop is loading ...



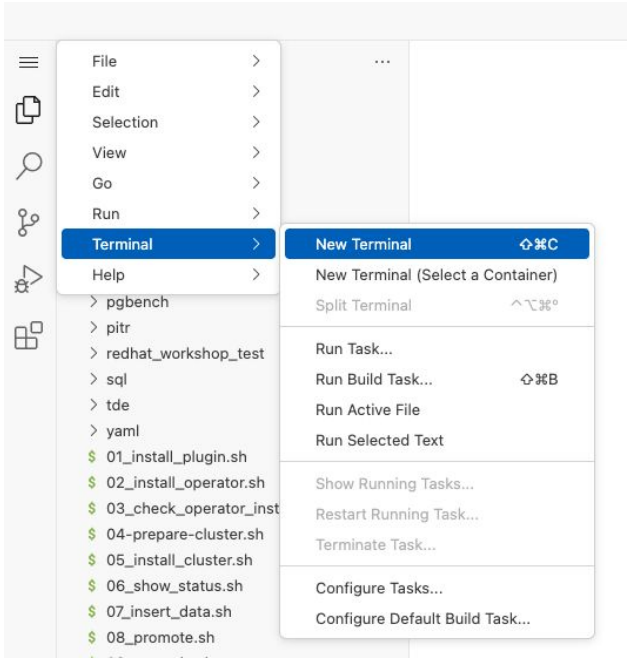
Select your theme



And trust the authors



Update your id with the user name you have been assigned



Open a new terminal

Use case
The environment

Features shown during the demo

- Kubernetes plugin install
- Check the CloudNativePG operator status
- Postgres cluster install
- Insert data in the cluster
- Failover
- Backup
- Recovery
- Scale out/down
- Fencing
- Hibernation
- Monitoring
- Rolling updates (minor and major)

Last CloudNativePG tested version is 1.25

This demo is in

https://github.com/sergioenterprisedb/edb-postgres-for-kubernetes-in-openshift

http://bit.ly/4duKxm7

Use case
Plug-in installation

The “cnp” plugin for kubectl

- The official CLI for CloudNativePG
  - Available also as RPM or Deb package
- Extends the ‘kubectl’ command:
  - Customize the installation of the operator
  - Status of a cluster
  - Perform a manual switchover (promote a standby) or a restart of a node
  - Issue TLS certificates for client authentication
  - Declare start and stop of a Kubernetes node maintenance
  - Destroy a cluster and all its PVC
  - Fence a cluster or a set of the instances
  - Hibernate a cluster
  - Generate jobs for benchmarking via pgbench and fio
  - Issue a new backup
  - Start pgadmin

NOT NEEDED DURING WORKSHOP
For illustrative purposes.

```
Name:               cluster-example
Namespace:          default
System ID:          7100921006673293335
PostgreSQL Image:   ghcr.io/cloudnative-pg/postgresql:14.3
Primary instance:   cluster-example-2
Status:             Cluster in healthy state
Instances:          3
Ready instances:    3
Current Write LSN:  0/C000060 (Timeline: 4 - WAL File: 0000000400000000000000C)

Certificates Status
Certificate Name             Expiration Date               Days Left Until Expiration
----------------             ---------------               --------------------------
cluster-example-replication  2022-08-21 13:15:00 +0000 UTC  89.95
cluster-example-server       2022-08-21 13:15:00 +0000 UTC  89.95
cluster-example-ca           2022-08-21 13:15:00 +0000 UTC  89.95

Continuous Backup status
First Point of Recoverability:  2022-05-23T13:37:08Z
Working WAL archiving:          OK
WALs waiting to be archived:    0
Last Archived WAL:              0000000400000000000000B   @   2022-05-23T13:42:09.37537Z
Last Failed WAL:                -

Streaming Replication status
Name              Sent LSN   Write LSN  Flush LSN  Replay LSN  Write Lag  Flush Lag  Replay Lag  State      Sync State  Sync Priority
----              --------   ---------  ---------  ----------  ---------  ---------  ----------  -----      ----------  -------------
cluster-example-3  0/C000060  0/C000060  0/C000060  0/C000060   00:00:00   00:00:00   00:00:00    streaming  async       0
cluster-example-1  0/C000060  0/C000060  0/C000060  0/C000060   00:00:00   00:00:00   00:00:00    streaming  async       0

Instances status
Name              Database Size  Current LSN  Replication role  Status  QoS         Manager Version
----              -------------  -----------  ----------------  ------  ---         ---------------
cluster-example-3  33 MB          0/C000060    Standby (async)   OK      BestEffort  1.15.0
cluster-example-2  33 MB          0/C000060    Primary           OK      BestEffort  1.15.0
cluster-example-1  33 MB          0/C000060    Standby (async)   OK      BestEffort  1.15.0
```

NOT NEEDED DURING WORKSHOP
For illustrative purposes.

Install CNPG plugin

NOT NEEDED DURING WORKSHOP
For illustrative purposes.

- In the web terminal run the script 01_install_plugin.sh:

```
./01_install_plugin.sh
```

- Call the help for the CNPG Plugin, run:

```
kubectl-cnp help
```

Try it for yourself

05:00

Use case
Operator installation

Operator Installation demonstration

- Install the operator
- Check the installed CNP Operator in the console
- Discover the features of the Operator in the OpenShift environment
- Check the installed CNP Operator in the web terminal

NOT NEEDED DURING WORKSHOP
For illustrative purposes.

Install the CNPG Operator and check the it in the web terminal

- In the web terminal check the installation of the operator:

./02_install_operator.sh (**will require admin privs on Openshift**)

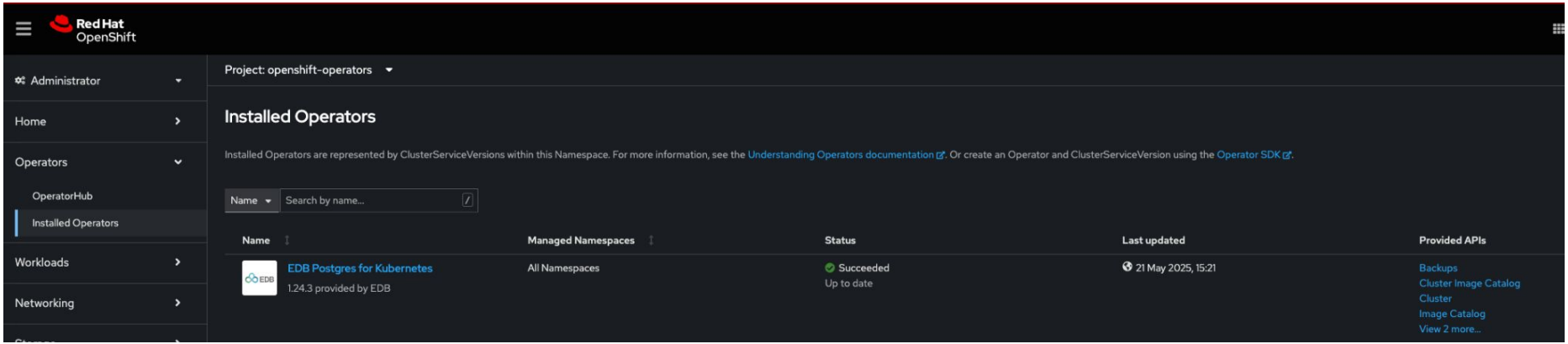
./03_check_operator_installed.sh

NOT NEEDED DURING WORKSHOP
For illustrative purposes.

Check the installed CNPG Operator in the Openshift console

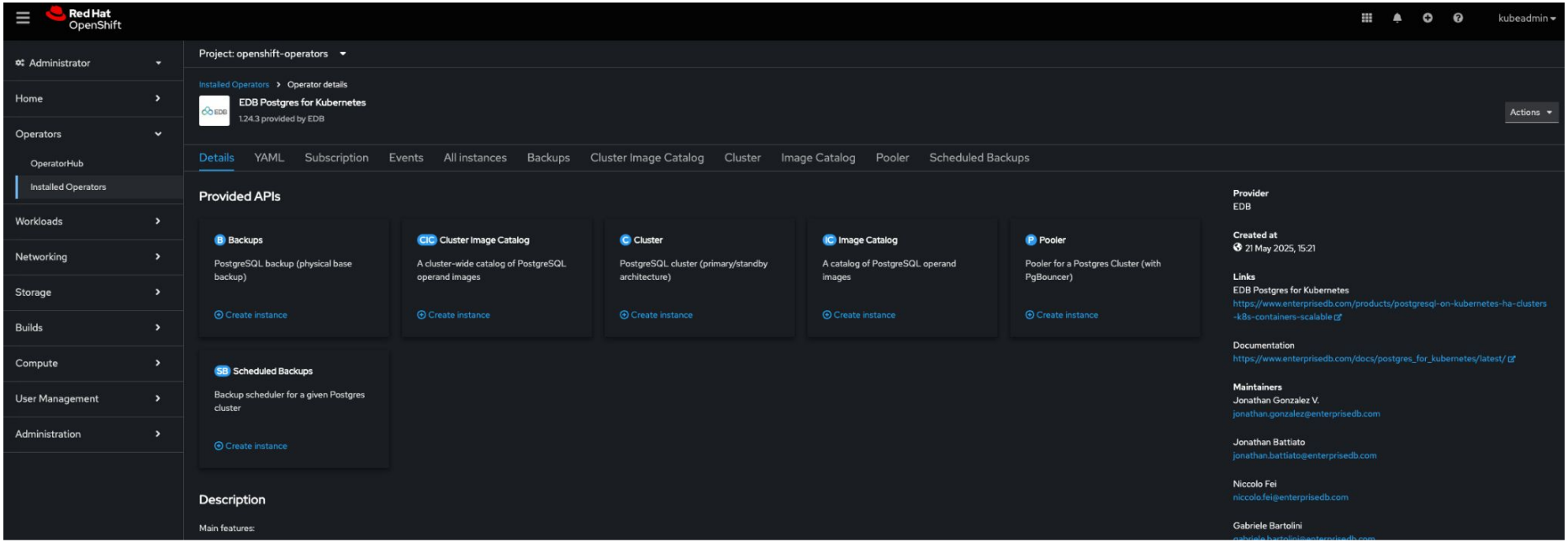
- In the OpenShift console navigate to:
  - -> Operators
  - -> Installed Operators
  - -> Klick on the Operator installed in your namespace, for example: user1:

NOT NEEDED DURING WORKSHOP
For illustrative purposes.



Discover the features of the Operator in the OpenShift environment

NOT NEEDED DURING WORKSHOP
For illustrative purposes.



Use case
Create the postgres cluster

Bootstrap - different ways of creating a cluster

- Create a new cluster from scratch
  - “initdb”: named after the standard “initdb” process in PostgreSQL that initializes an instance
- Create a new cluster from an existing one:
  - Directly (“pg_basebackup”), using physical streaming replication
  - Directly (logical backup/restore) using pg_dump and pg_restore
  - Indirectly (“recovery”), from an object store
    - To the end of the WAL
      - Can be used to start independent replica clusters in continuous recovery
    - Using PITR

Configure and Install the Postgres cluster

- Prepare for cluster-creation (ensure minio secrets are in place)

  ./04-prepare-cluster

- Create a new 3-node cluster by running

  ./05_install_cluster.sh

- Check the status of the cluster (using the CNP plugin):

  ./06_show_status.sh

Create table test with 1000 rows

- Once cluster is running … (minimum the primary) run the script:

  ./07_insert_data.sh

Try it for yourself

Use case
Promote & Upgrade the postgres cluster

Rolling updates

- Update of a deployment with ~zero downtime
  - Standby servers are updated first
  - Then the primary:
    - supervised / unsupervised
    - switchover / restart
- When they are triggered:
  - Security update of Postgres images
  - Minor update of PostgreSQL
  - Configuration changes when restart is required
  - Update of the operator
    - Unless in-place upgrade is enabled

Check the cluster status

- In terminal **1**: (prepare a terminal for status - and one to run the admin-commands):
  - Run the command

    ./06_show_status.sh
  - Review the output:
    - check Postgres version: “PostgreSQL Image: quay.io/enterprisedb/postgresql:**16.2**”
    - check “Continuous Backup status”: “**Not configured**”
  - Check the updated cluster configuration - file cluster-example-upgrade.yaml

    less ./yaml/cluster-sample-upgrade.yaml
    - Check Postgres version: “imageName: quay.io/enterprisedb/postgresql:**16.4**”
    - Check the Backup section

Run the Promote and Upgrade

- With this step we will:
  - Promote node-2 to become the primary
  - Run the postgres minor update from the version 16.2 to 16.4
  - We will configure the WAL files backup to the S3 storage
- In the web terminal **2**:
  - Check the upgrade status:

    ./06_show_status.sh
- In the terminal **1**:
  - Run the script:

    ./08_promote.sh
  - Run the script:

    ./09_upgrade.sh

Try it for yourself

Use case
Backup & Restore

Backup and Recovery - Part 1

- Continuous physical backup on “backup object stores”
  - Scheduled and on-demand base backups
  - Continuous WAL archiving (including parallel)
  - From primary or a standby
  - Support for recovery window retention policies (e.g. 30 days)
- Recovery means creating a new cluster starting from a “recovery object store”
  - Then pull WAL files (including in parallel) and replay them
  - Full (End of the WAL) or PITR
- Both rely on Barman Cloud technology
  - AWS S3
  - Azure Storage compatible
  - Google Cloud Storage
  - MinIO

Backup and Recovery - Part 2

- WAL management
  - Object store
- Physical Base backups
  - Object store
  - Kubernetes level backup integration (Velero/OADP, Veem Kasten K10, generic interface)
  - Kubernetes Volume Snapshots

Kubernetes Volume Snapshot: major advantages

- Transparent support for:
  - Incremental backup and recovery at block level
  - Differential backup and recovery at block level
  - Based on copy on write
- Leverage the storage class to manage the snapshots, including:
  - Data mobility across network (availability zones, Kubernetes clusters, regions)
  - Relay files on a secondary location in a different region, or any subsequent one
  - Encryption
- Enhances Very Large Databases (VLDB) adoption

Backup & Recovery via Snapshots: some numbers

Let's now talk about some initial benchmarks I have performed on volume snapshots using 3 `r5.4xlarge` nodes on AWS EKS with the `gp3` storage class. I have defined 4 different database size categories (tiny, small, medium, and large), as follows:

Cluster name	Database size	pgbench init scale	PGDATA volume size	WAL volume size	pgbench init duration
tiny	4.5 GB	300	8 GB	1 GB	67s
small	44 GB	3,000	80 GB	10 GB	10m 50s
medium	438 GB	3,0000	800 GB	100 GB	3h 15m 34s
large	4,381 GB	300,000	8,000 GB	200 GB	32h 47m 47s

The table below shows the results of both backup and recovery for each of them.

Cluster name	1st backup duration	2nd backup duration after 1hr of pgbench	Full recovery time
tiny	2m 43s	4m 16s	31s
small	20m 38s	16m 45s	27s
medium	2h 42m	2h 34m	48s
large	3h 54m 6s	2h 3s	2m 2s

https://www.enterprisedb.com/postgresql-disaster-recovery-with-kubernetes-volume-snapshots-using-cloudnativepg

Create the full backup

- With this step we will:
  - Create the full backup of the postgres cluster in the MinIO storage:
- In the web terminal 1:
  - Run the script:

    cd /projects/workshop

    ./10_backup_cluster.sh

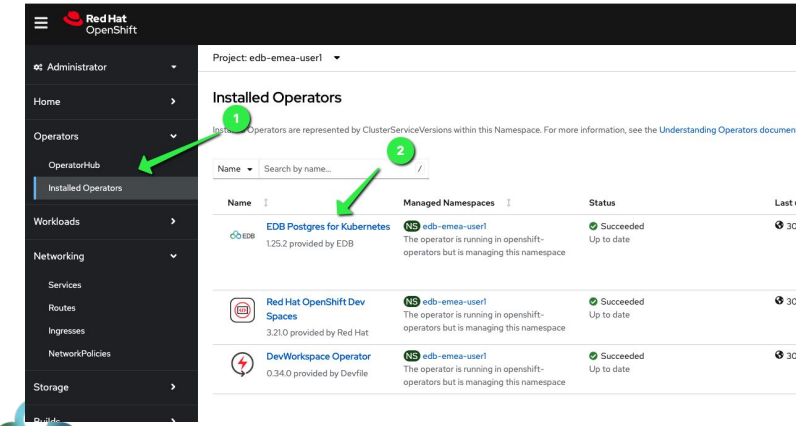
  - Check the backup status:

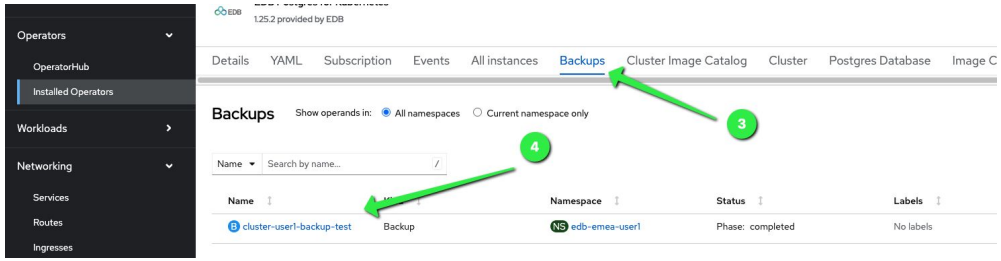
    cd /projects/workshop

    ./11_backup_describe.sh

Check Backup in the Openshift Console

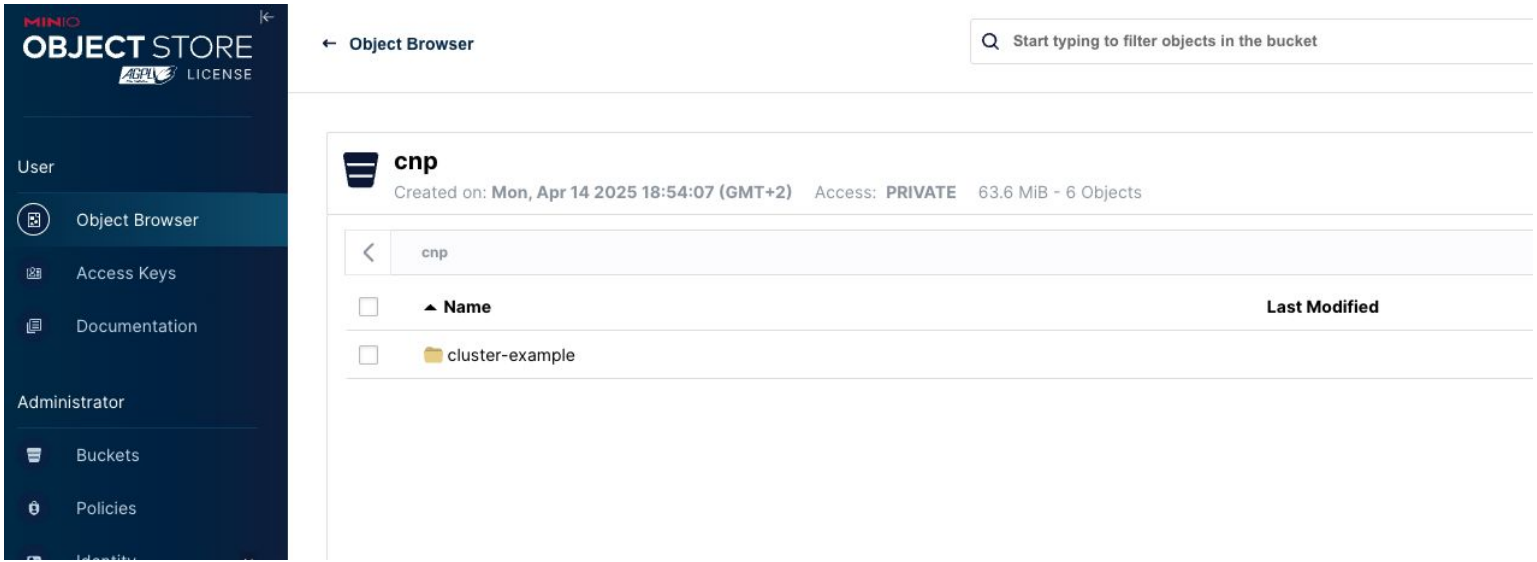
- Obtain the OPenShift Console URL from the Slide **#56** and open the URL:
- Navigate to:
  - -> Operators
  - -> Installed Operators
  - -> EDB Postgres for Kubernetes Operator
  - -> Go to the Backup section and show the created backup:





Check Backup in MinIO UI

- Obtain the MinIO URL from the Slide **#56** and open the URL:
- Connect as user **minio** with the password: **edb-workshop**
- The page will appear:



Restore the database from the backup

- With this step we will:
  - Create the new cluster cluster-restore
  - Restore the full backup created in the previous step in the new cluster:
- In the terminal 1:
  - Run the restore:

    ./12_restore_cluster.sh
  - Check the creation status:

    kubectl get pods -w # after creation stop the execution with <ctrl>+c
  - Check the table test in the cluster-restore, run the script:

    oc exec -it cluster-restore-user<X>-1 -- psql -U postgres -c "\d test"

    oc exec -it cluster-restore-user1-1 -- psql -U postgres -c "select count(*) from test;"
  - Delete the cluster-restore-user<x> to avoid resource problems during the workshop:

    oc delete cluster cluster-restore-user<X>

Backup demonstration

- Create the full backup
- Check Backup in the Openshift Console
- Check Backup in MinIO UI
- Restore the database from the backup

Try it for yourself

Use case: Failover

Run failover test

- With this step we will:
  - Delete the primary database of the cluster cluster-example
  - Check the cluster status in the another terminal window
- In the web terminal 1:
  - Run the script:

    ./13_failover.sh
- In the web terminal **2**:
  - Check the failover cluster status:

    ./06_show_status.sh

Try it for yourself

05:00

Use case
Scale-out and scale-down

Scale-out the postgres cluster

- With this step we will:
  - Add the 1 standby to the cluster
- In the web terminal 1:
  - Run the script:

    ./14_scale_out.sh (using –replicas=X… another way would be to update the YAML)

- In the web terminal **2**:
  - Check the cluster status:

    ./06_show_status.sh

Scale-down the postgres cluster

- With this step we will:
  - Remove 2 standby pods from the cluster
- In the web terminal 1:
  - Run the script:

    ./15_scale_down.sh

- In the web terminal **2**:
  - Check the cluster status:

    ./06_show_status.sh

Try it for yourself

05:00

Use Case
Fencing

Stop postgres process on the pod

- In the web terminal 1:
  - Run the script:

    ./30_fencing_on.sh

- In the web terminal **2**:
  - Check the cluster status:

    ./06_show_status.sh

Start the postgres process on the pod

- In the terminal 1:
  - Run the script:

    ./31_fencing_off.sh

- In the terminal **2**:
  - Check the cluster status:

    ./06_show_status.sh

Try it for yourself

05:00

Use case Hibernation

Stop the postgres cluster

- In the terminal 1:
  - Run the script:

    ./32_hibernation_on.sh

- In the terminal **2**:
  - Check the cluster status:

    ./06_show_status.sh

Start the postgres cluster

- In the terminal 1:
  - Run the script:

    ./33_hibernation_off.sh

- In the terminal **2**:
  - Check the cluster status:

    ./06_show_status.sh

Try it for yourself

05:00

Use case
Major version Upgrade

Delete cluster restore and upgrade cluster

- In the web terminal 1:
  - Run the script:

    ./20_upgrade_major_version.sh
  - Check the cluster creation process:

    kubectl get pods -w
  - Check the table test in the cluster-user<X>-17, run the command:

    oc exec -it cluster-user**<X>**-17-1 -- psql -U postgres -d app -c "\d test"

    oc exec -it cluster-user**<X>**-17-1 -- psql -U postgres -d app -c "select count(*) from test;"

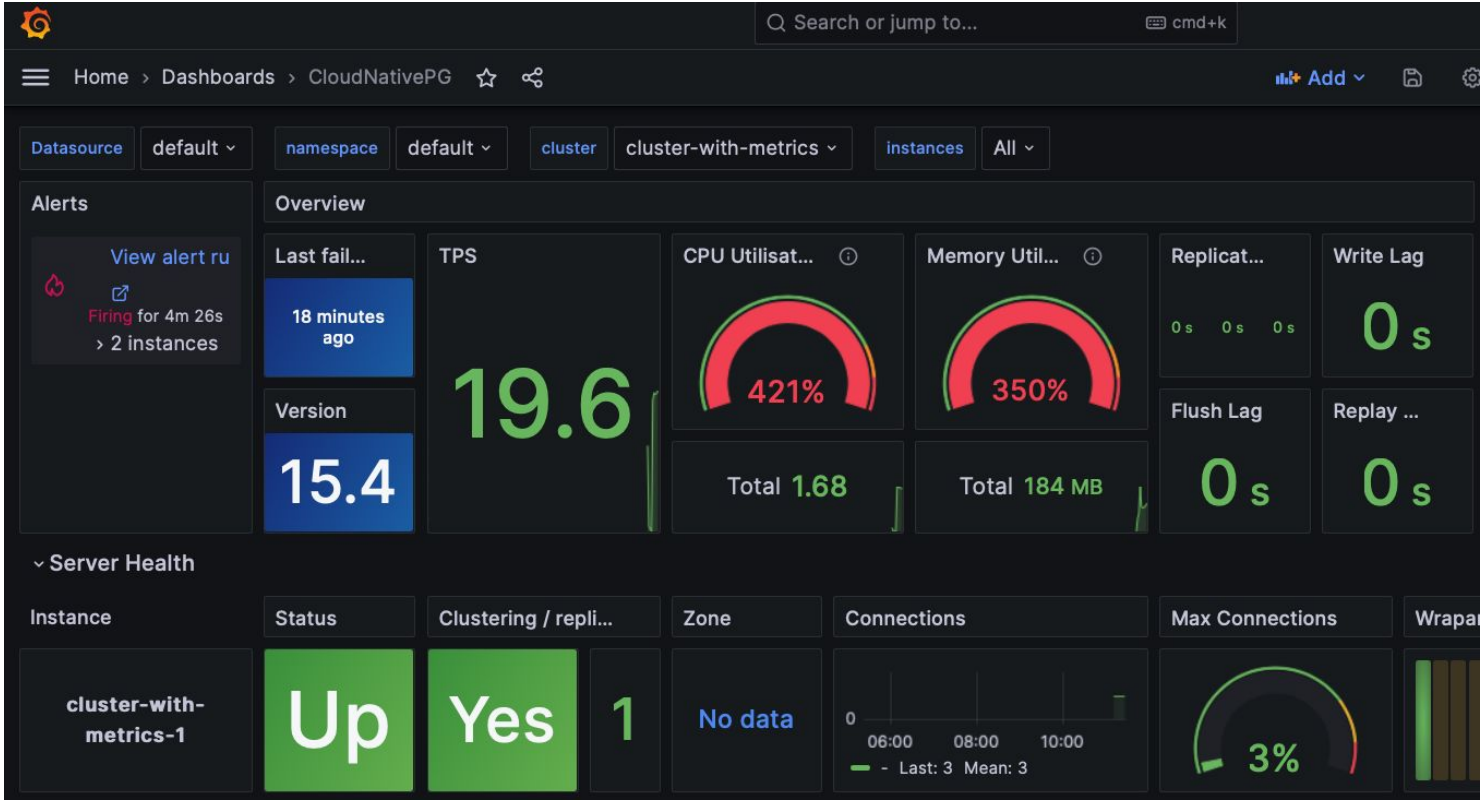
What more?

(some additional features from EDB)

What we didn’t show you today ….

- PgBouncer (Pooler) integration
  - Create a PgBouncer deployment and automatically configure to the cluster.
- Monitoring using Prometheus and Grafana
  - Exporting to OpenMetrics (Prometheus)

Grafana Dashboard



Advanced Security

Password policy management

DBA managed password profiles, compatible with Oracle profiles

Audit compliance

Track and analyze database activities and user connections

Virtual private databases

Fine grained access control limits user views

EDB/SQL protect

SQL firewall, screens queries for common attack profiles

Data redaction

Protect sensitive information for GDPR, PCI and HIPAA compliance

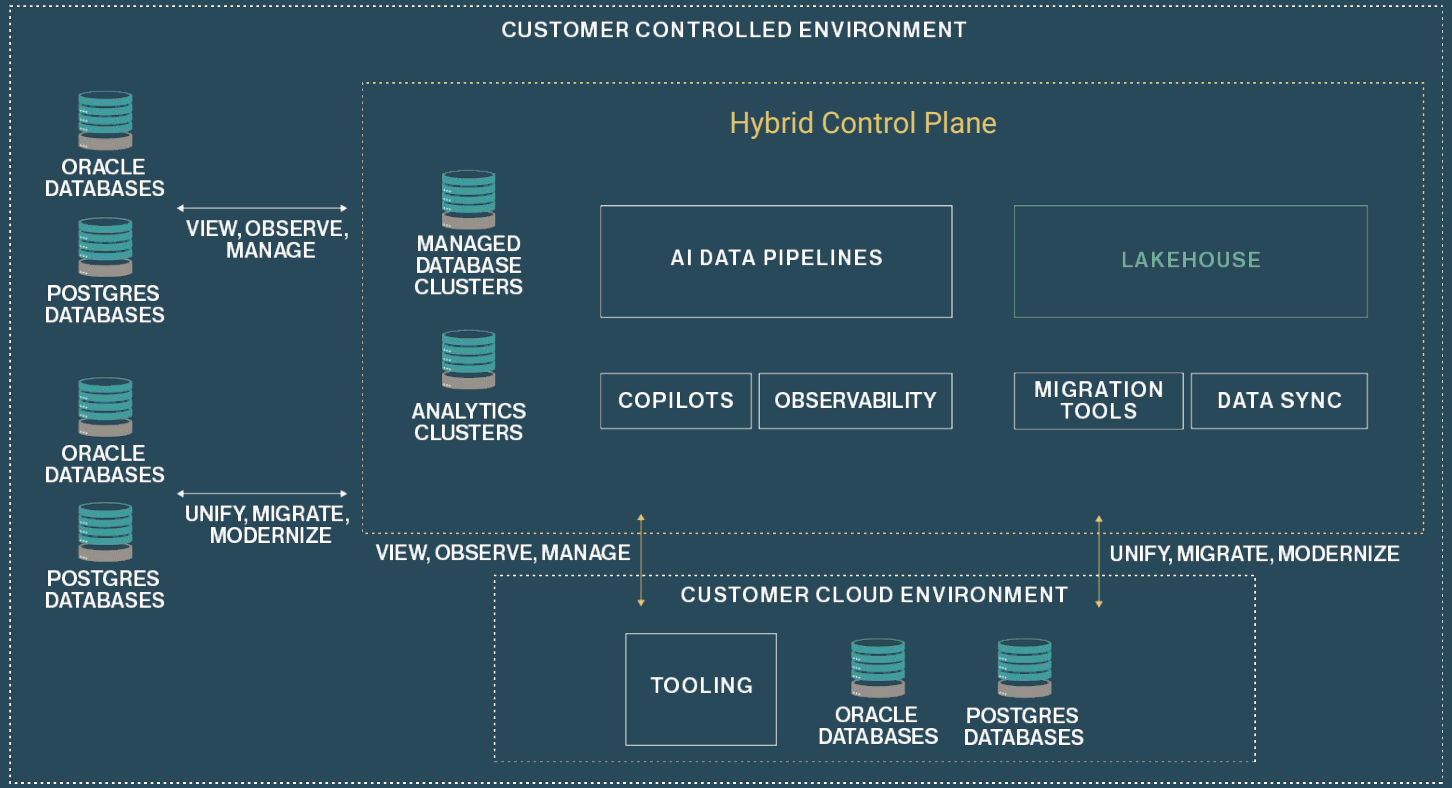
Code protection

Protects sensitive IP, algorithms or financial policies

Transparent Data Encryption (EDB-only features)

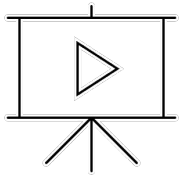
- Transparent Data Encryption (TDE) is a feature of EDB Postgres Advanced Server and EDB Postgres Extended Server that prevents unauthorized viewing of data in operating system files on the database server and on backup storage
- Data encryption and decryption is managed by the database and does not require application changes or updated client drivers
- EDB Postgres Advanced Server and EDB Postgres Extended Server provide hooks to key management that is external to the database allowing for simple passphrase encrypt/decrypt or integration with enterprise key management solutions, with initial support for:
  - Amazon AWS Key Management Service (KMS)
  - Google Cloud - Cloud Kay Management Service
  - Microsoft Azure Key Vault
  - HashiCorp Vault (KMIP Secrets Engine and Transit Secrets Engine)
  - Thales CipherTrust Manager
- Data will be unintelligible for unauthorized users if stolen or misplaced

Hybrid Control Plane at a glance



Hybrid Control Plane

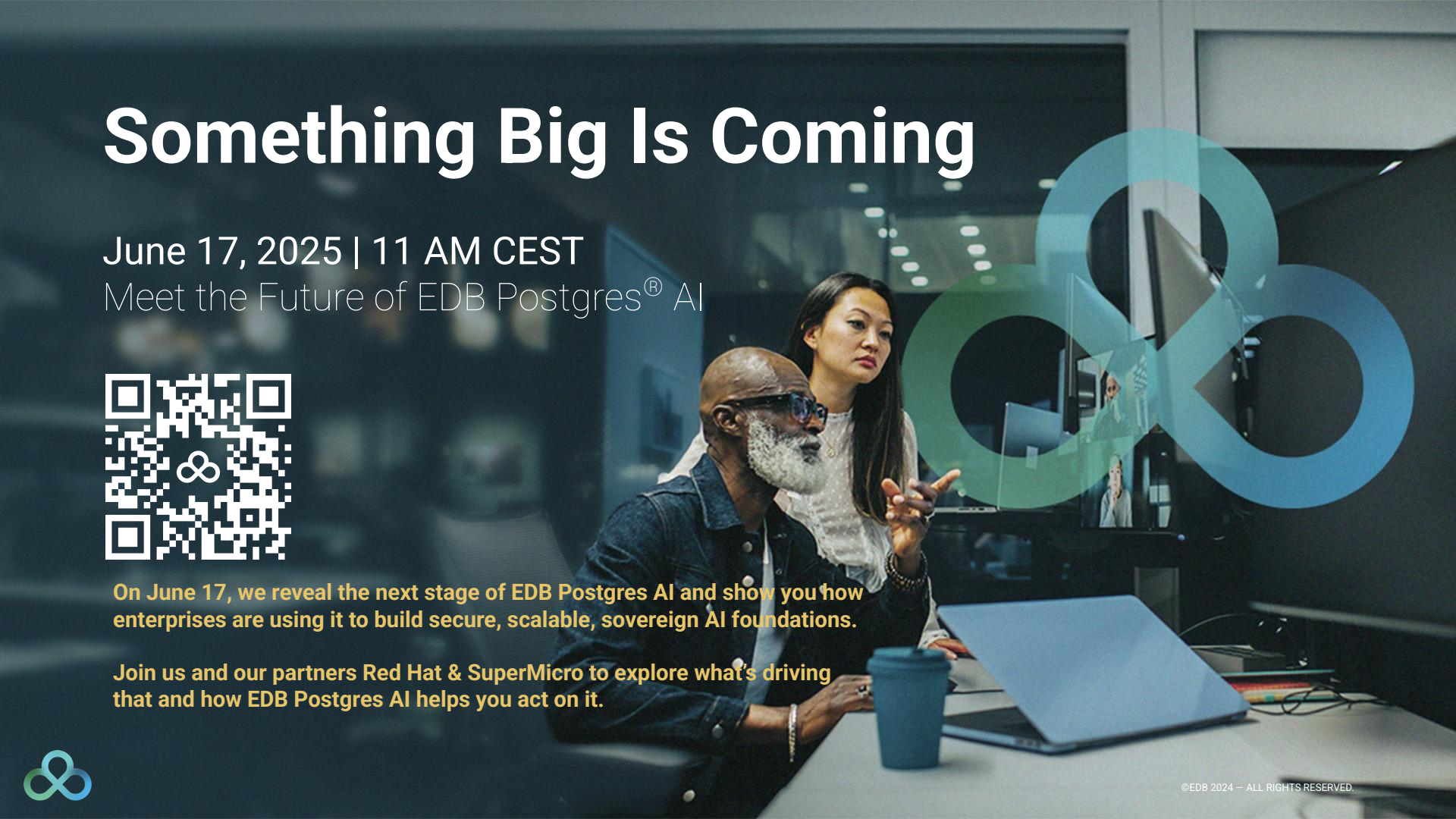
LIVE DEMO



Something Big Is Coming

June 17, 2025 | 11 AM CEST

Meet the Future of EDB Postgres® AI



On June 17, we reveal the next stage of EDB Postgres AI and show you how enterprises are using it to build secure, scalable, sovereign AI foundations.

Join us and our partners Red Hat & SuperMicro to explore what's driving that and how EDB Postgres AI helps you act on it.

EDB + Red Hat

Piros. + zebanza

Share Your Opinion & Win a LEGO

LEGO Technic 42207 Ferrari!

Scan the QR Code & complete the survey
to let us know your feedback!

By accepting this prize, you confirm that the prize conforms to your employer's internal rules, policies, and codes of conduct.

EDB + Red Hat

Piros + zebanza

Thank you for participating in the

Postgres on Kubernetes Workshop

Please pick up your certificate :-)