

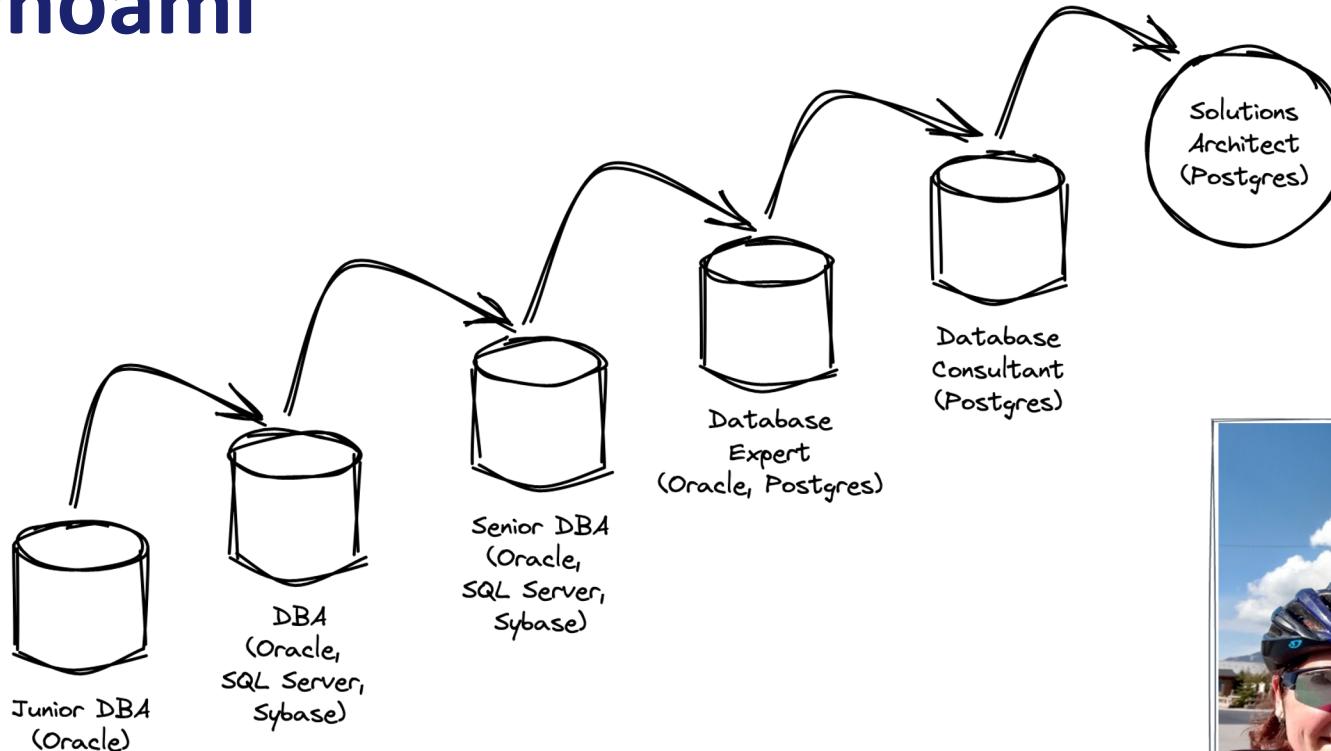


# Mission-Critical PostgreSQL Databases on Kubernetes

Karen Jex | Senior Solutions Architect @ Crunchy Data

KubeCon + CloudNativeCon Europe | April 2023

# whoami



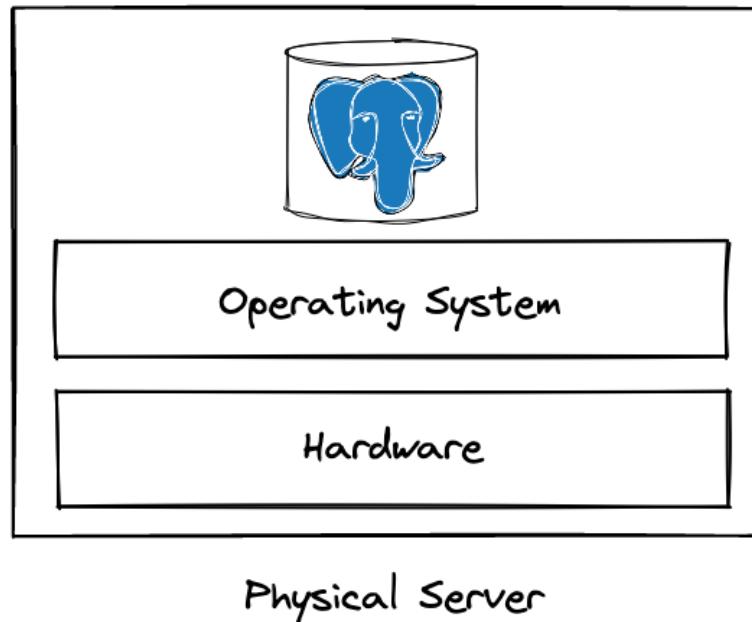
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- Evolution of Database Architecture
- Containers and Container Orchestration
- Deploying Postgres on Kubernetes
  - Why?
  - Where?
  - How?
- Demo

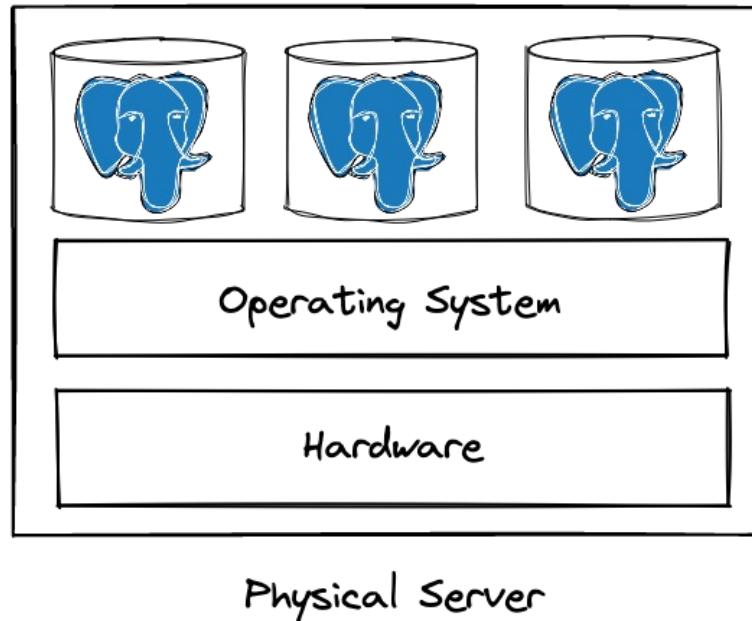
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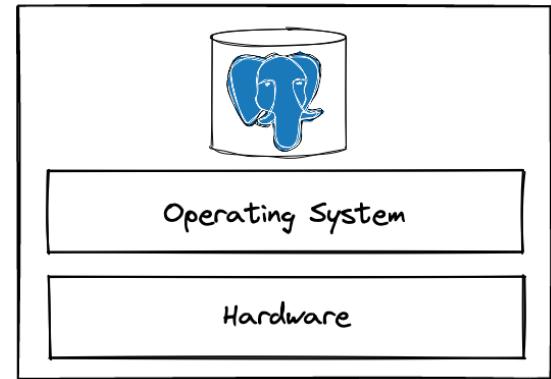
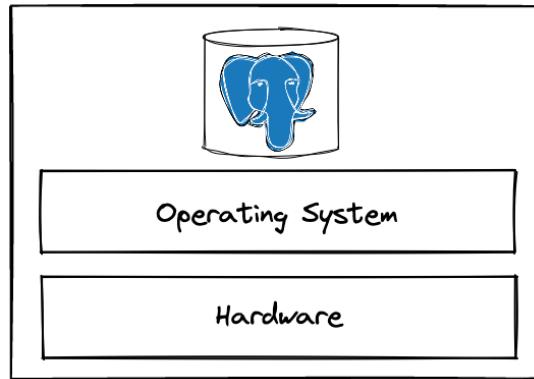
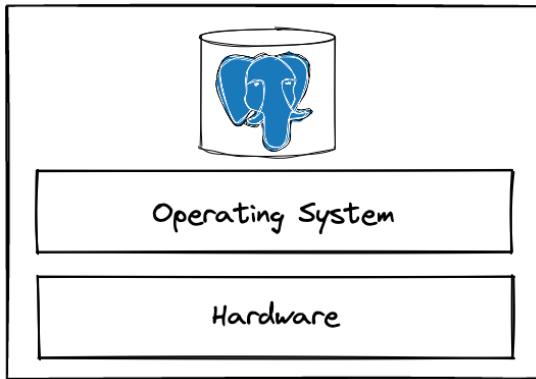
# Evolution of Database Architecture



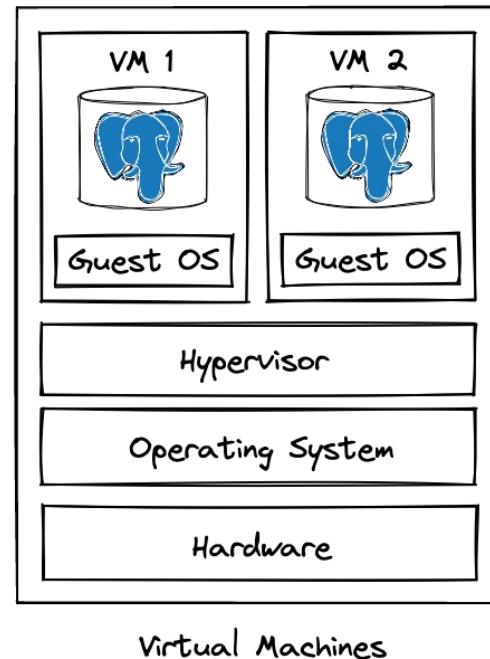
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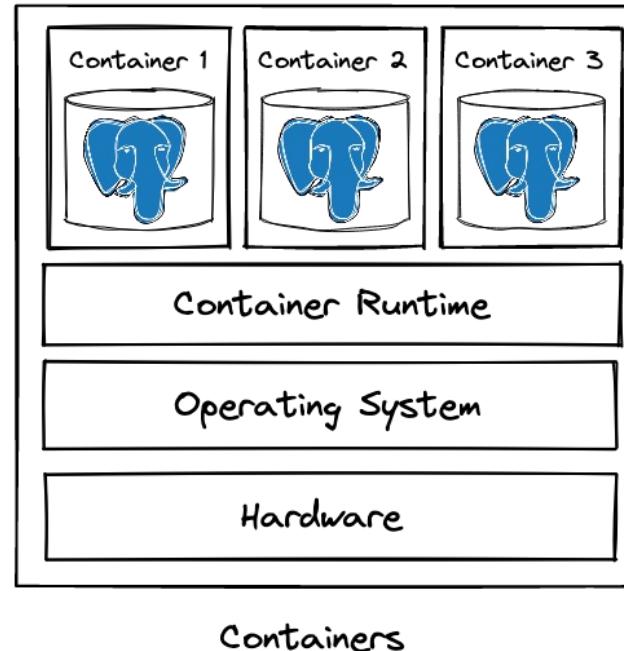
# Evolution of Database Architecture



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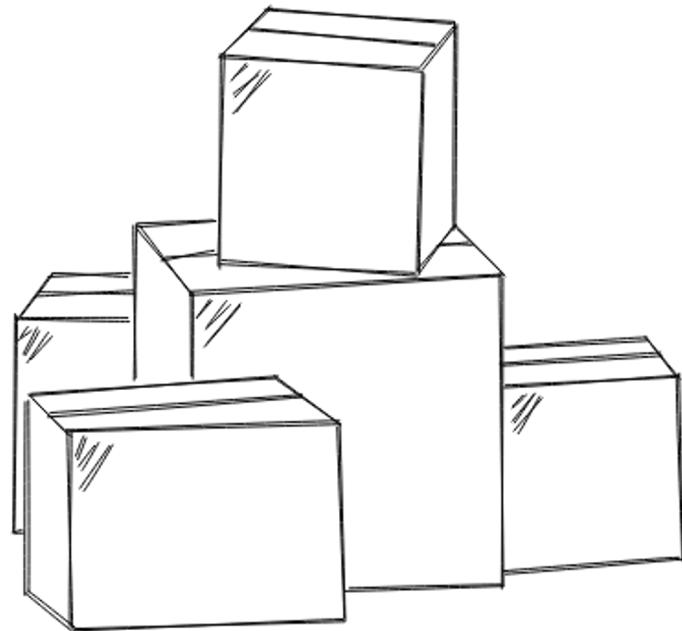


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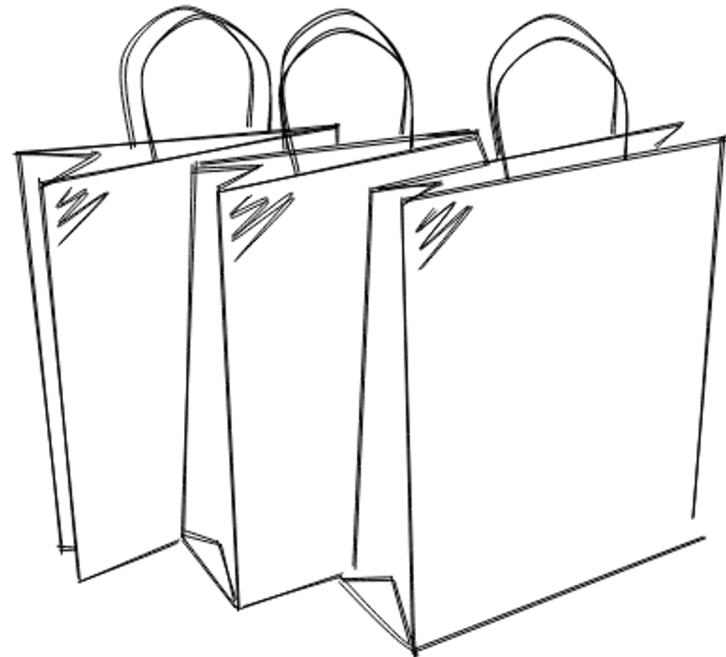
# What is a Container?

- Standalone, executable software package
- Share the host OS kernel
- Isolated from other containers
- Stateless and ephemeral



# Benefits of Containers

- Lightweight
- Scalable
- Portable
- Isolated





# Managing Containers

# Container Orchestration Tools

- Manage many containers
- Automate container lifecycle
- Integrate with DevOps tools
- Kubernetes (and others)

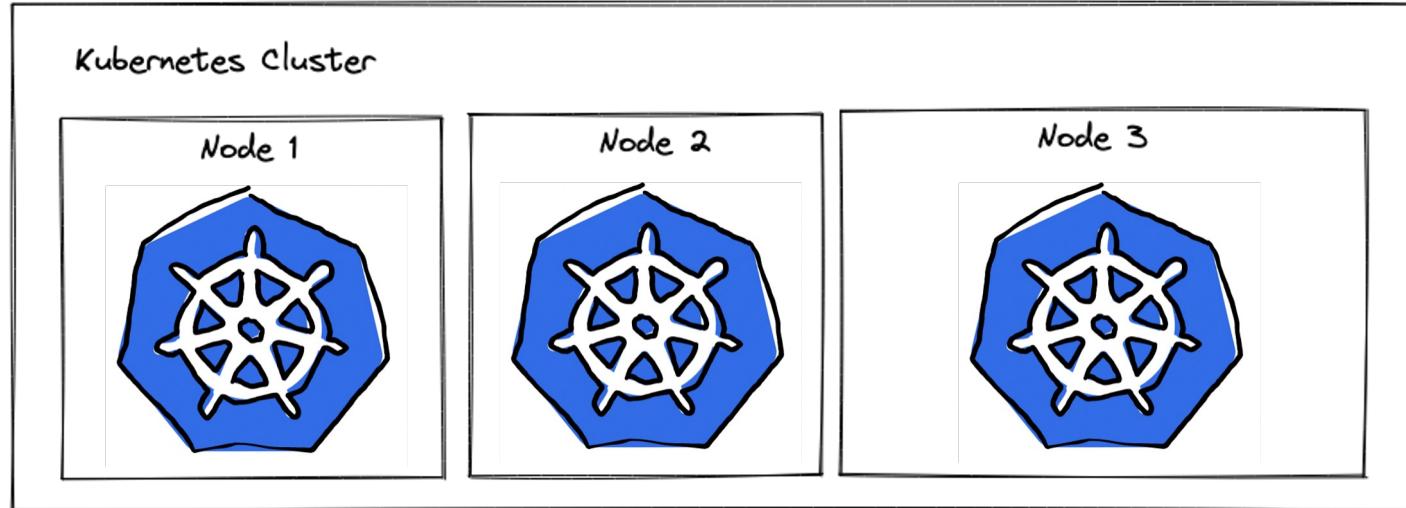


# Container Orchestration Tasks

- Provisioning
- Deployment
- Configuration
- Scheduling
- Scaling up and down
- Storage
- Resource allocation
- Availability
- Monitoring
- Load Balancing
- Networking
- Security

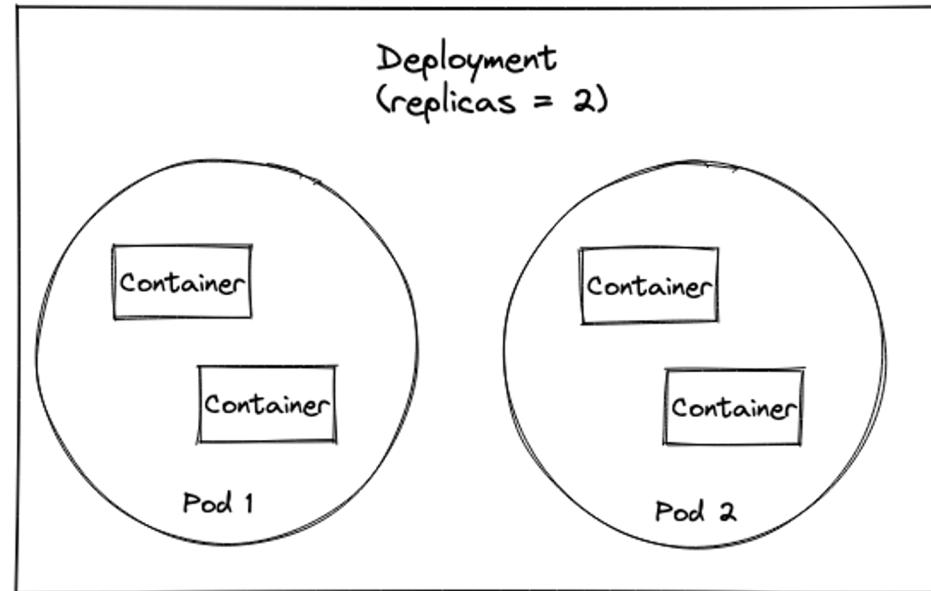
# Kubernetes Terminology

<https://kubernetes.io/docs/concepts/>

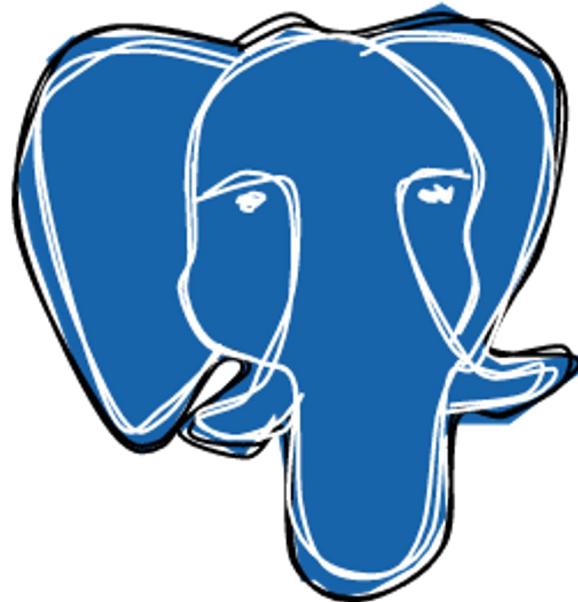


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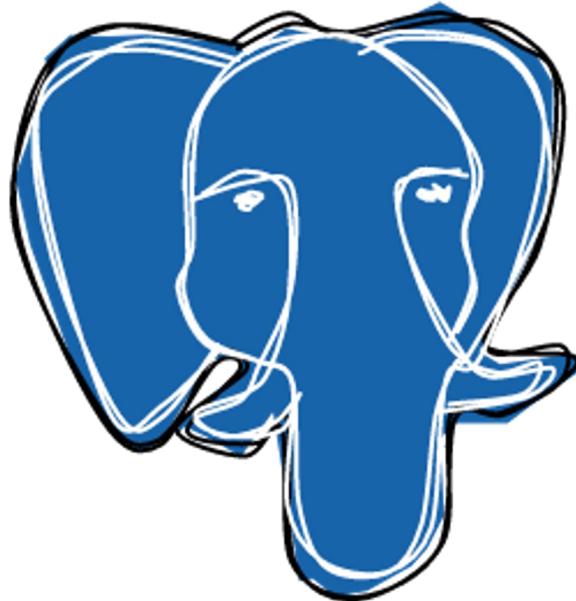


# What about my Database?



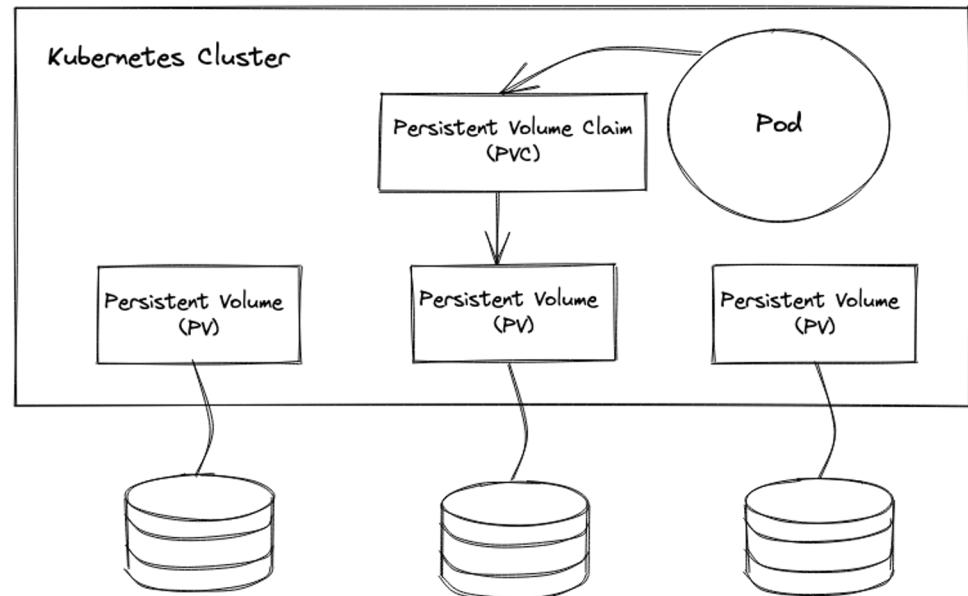
# What about my Database?

- I thought containers were **stateless** and **ephemeral**
- Databases are **stateful** and need **persistent data**



# Persistent Volumes (PV)

<https://kubernetes.io/docs/concepts/storage/volumes>



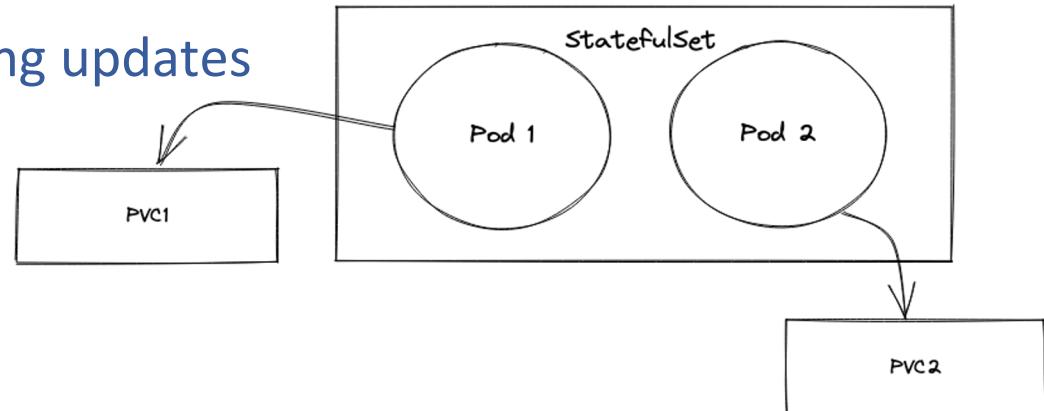
# What about Replica Databases?

- Pods in a deployment are interchangeable
- Primary and Standby Databases aren't the same
- Databases need ordered startup/shutdown

# StatefulSets

<https://kubernetes.io/docs/concepts/workloads/controllers/statefulset/>

- Stable, persistent storage
- Ordered, graceful deployment and scaling
- Ordered, automated rolling updates



# Sidecars

- “Helper” container
- Tightly coupled with main container in a pod
- e.g. metrics exporter



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# Postgres on Kubernetes: Why?

- Multi-tenancy
- Microservices
- Already using Kubernetes in application stack
- Automation
- Deploying at scale

# Postgres on Kubernetes: Why?

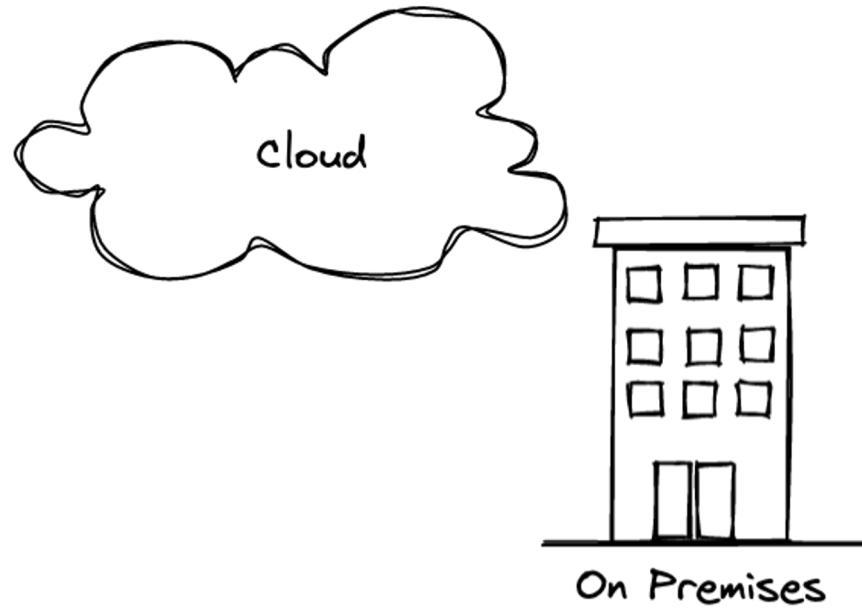
“Resistance to Containers is Futile”

<https://www.crunchydata.com/blog/deep-postgresql-thoughts-resistance-to-containers-is-futile>

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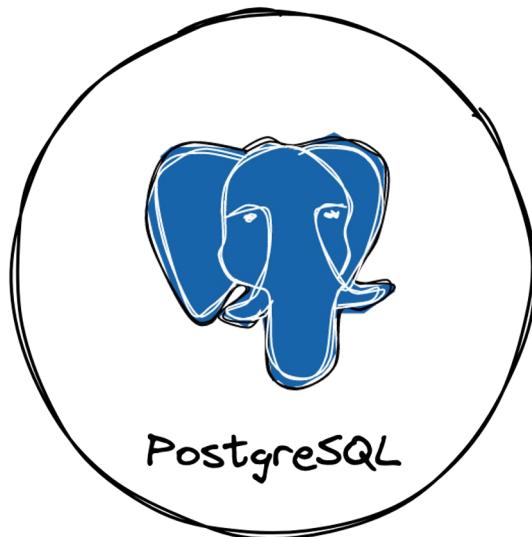
# Postgres on Kubernetes: Where?



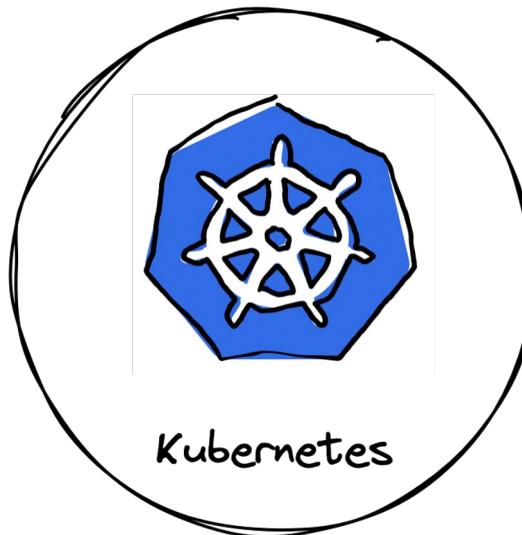
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# Postgres on Kubernetes: How?



PostgreSQL



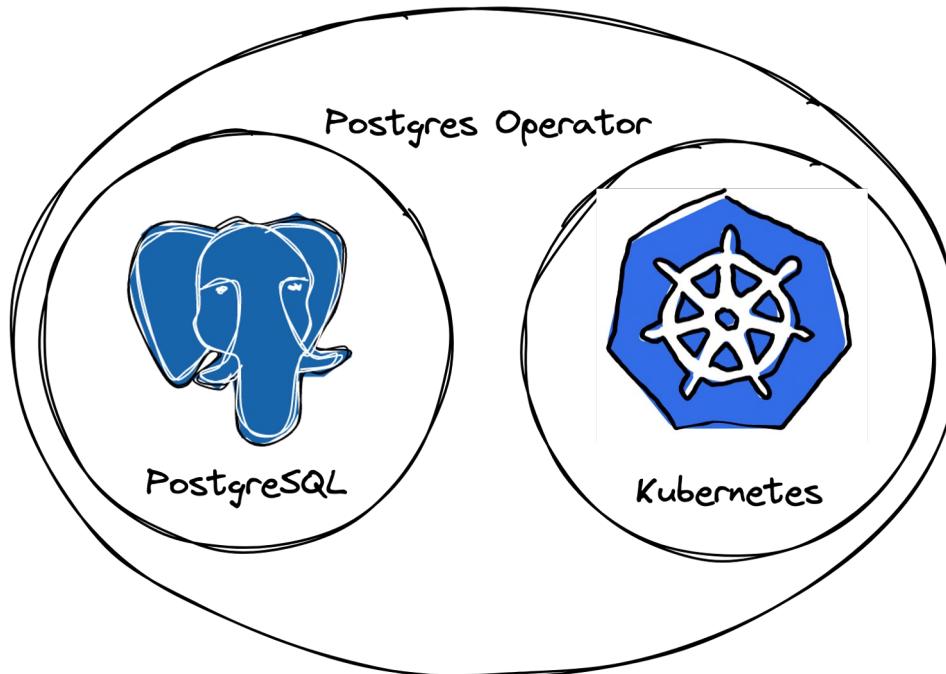
Kubernetes

# Kubernetes Operators

“Operators are software extensions to Kubernetes that make use of custom resources to manage applications and their components. Operators follow Kubernetes principles, notably the control loop.”

<https://kubernetes.io/docs/concepts/extend-kubernetes/operator/>

# Postgres Operators



# Postgres Operators

- Knowledge in Code
- Virtual DBA:
  - Create Databases
  - Backup & restore
  - Database Monitoring
  - Manage storage
  - High availability
  - Database upgrades

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# Demo

-  Deploy Postgres Operator
-  Deploy (HA) Postgres Cluster
-  Scale Up/Down
-  Perform Minor Upgrade
-  Deploy Monitoring

# Conclusions

- Kubernetes gives you a flexible, scalable DB architecture
- Benefit from expert knowledge: use a Postgres Operator
- Day-to-day DBA tasks can be automated



# Thank You!

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# Feedback

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# Image acknowledgements

- What is a container: based on Image by [harshahars](#) from [Pixabay](#)
- Container architecture: based on diagram here:  
<https://kubernetes.io/docs/concepts/overview/>
- Benefits of containers: based on Image by [Artur Konik](#) from [Pixabay](#)
- Container use-cases: Image by [Freddy](#) from [Pixabay](#)
- Managing containers: Image by [Dimitris Vetsikas](#) from [Pixabay](#)
- What is Kubernetes: Image by [Jason Goh](#) from [Pixabay](#)
- Sidecars: Image by [Jean photosstock](#) from [Pixabay](#)