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Postgresql in Kubernetes

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About me

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- Armin Nesiren
  - Developer
  - 10 years as DBA
  - Devops
  - Lately dealing with Kubernetes in production

Motivation

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- Service oriented aritecture - SOA
- Future of kubernetes
- Test it home, it's free
- Postgresql available for everyone, quickly

What I will talk about

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- Kubernetes basics
- Kubernetes storage
- Deploying PostgreSQL inside kubernetes simple way
- Deploying PostgreSQL automated

Kubernetes basics

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- Containers generally
  - We like containers because: lightweight, standalone, on any env
  - Resource efficiennt
- K8s is dealing with containers
  - Written in Golang
  - scaling, loadbalancing

Bare betal vs Cloud provides

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Figure 1: k8s providers

- Bare metal:
  - as low as 3-5 nodes
  - needs to take care of persistent storage
  - exposing of services

K8s simple arhitecture

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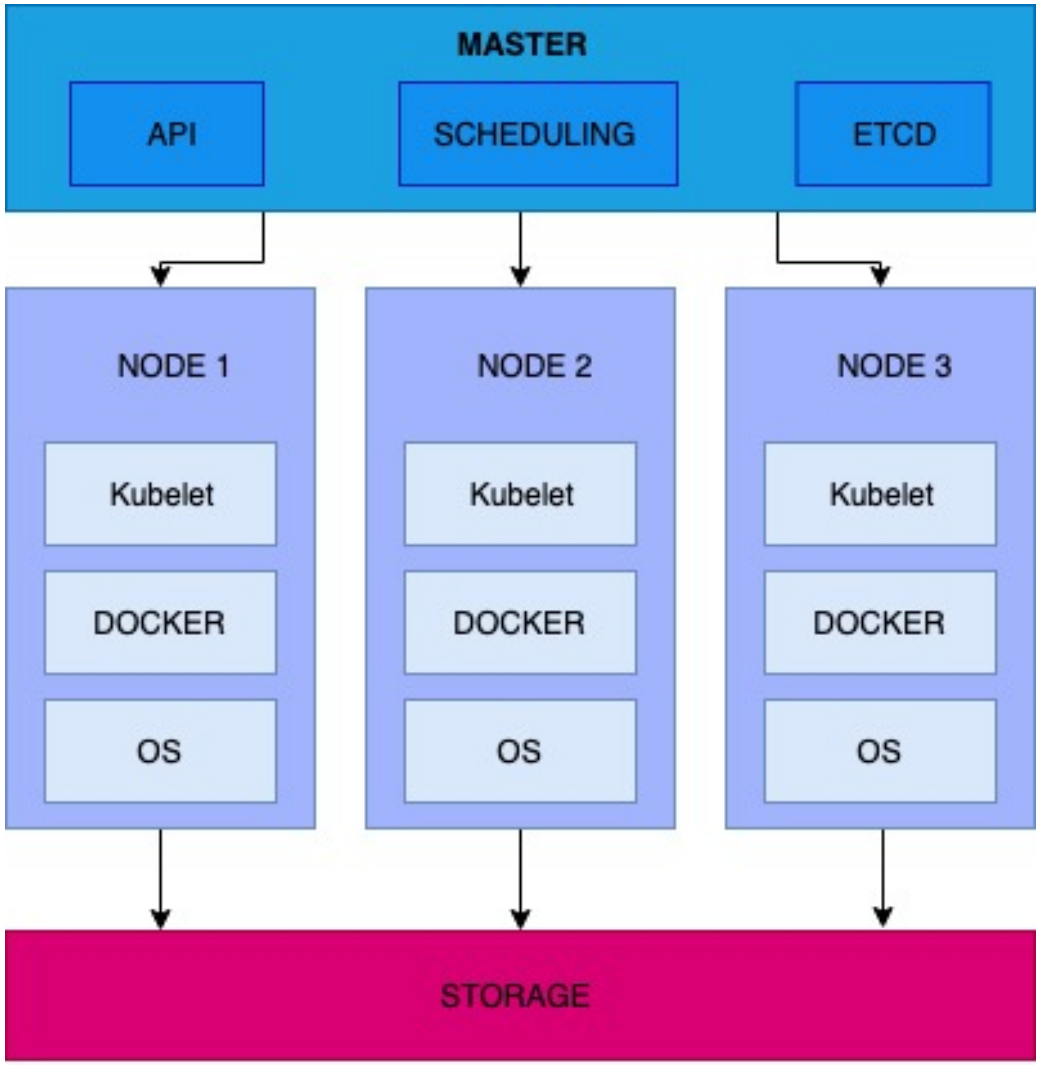

Software distributed storage

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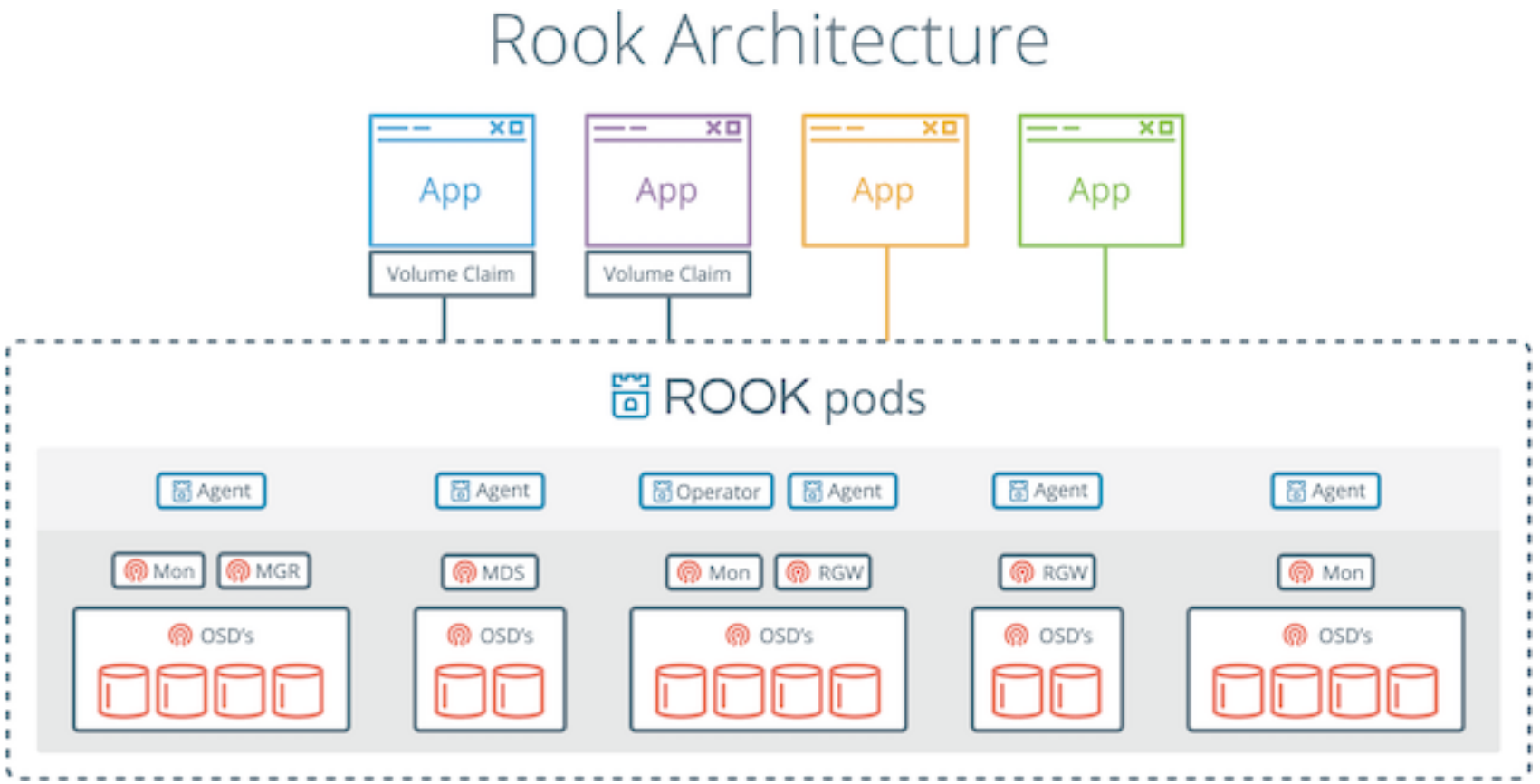

Figure 3: rook and ceph architecture

Kubernetes resources wise

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- Concept of pods
  - Group of one or more containers
  - shared storage/network
  - always co-located and co-sheduled
- namespaces
  - virtual cluster inside of a cluster
- secrets
  - storing sensitive information
- Deployment of pods
  - describing desired state of a pod
- Services
  - ClusterIP, NodePort, LoadBalancer, ExternalName

How to talk to k8s

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- kubectl
  - command line
- Yaml
- Client library
  - Go, Python, Java, dotnet, JavaScript and more

Yaml example

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```yaml
apiVersion: apps/v1beta1
kind: Deployment
metadata:
  name: nginx-deployment
specs:
  replicas: 3
  template:
    metadata:
      labels:
        app: nginx
    specs:
      containers:
      - name: hello-world
        image: hello-world:latest
        ports:
        - containerPort: 80
```

Figure 4: yaml example

What if we have. . . (Spilo)

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- All supported PostgreSQL versions inside one image
- Plenty of extensions (pg_partman, pg_cron, postgis. . .)
- Aditional tools (pgq, pgbouncer, wal-e/wal-g)
- PGDATA on external volume
- Environment-variables based configuration
- Light! ~120MB

And than we also need. . . Patroni

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- Automatic failover solution for streaming replication
- A python daemon that manages one PostgreSQL instance
- Keeps the cluster state in DCS (etcd, Zookeeper, Consul)
  - Uses DCS for leader elections
- Helps automate things like:
  - New cluster deployment
  - Scaling out and in
  - Postgresql configuration management

Spilo & Patroni together

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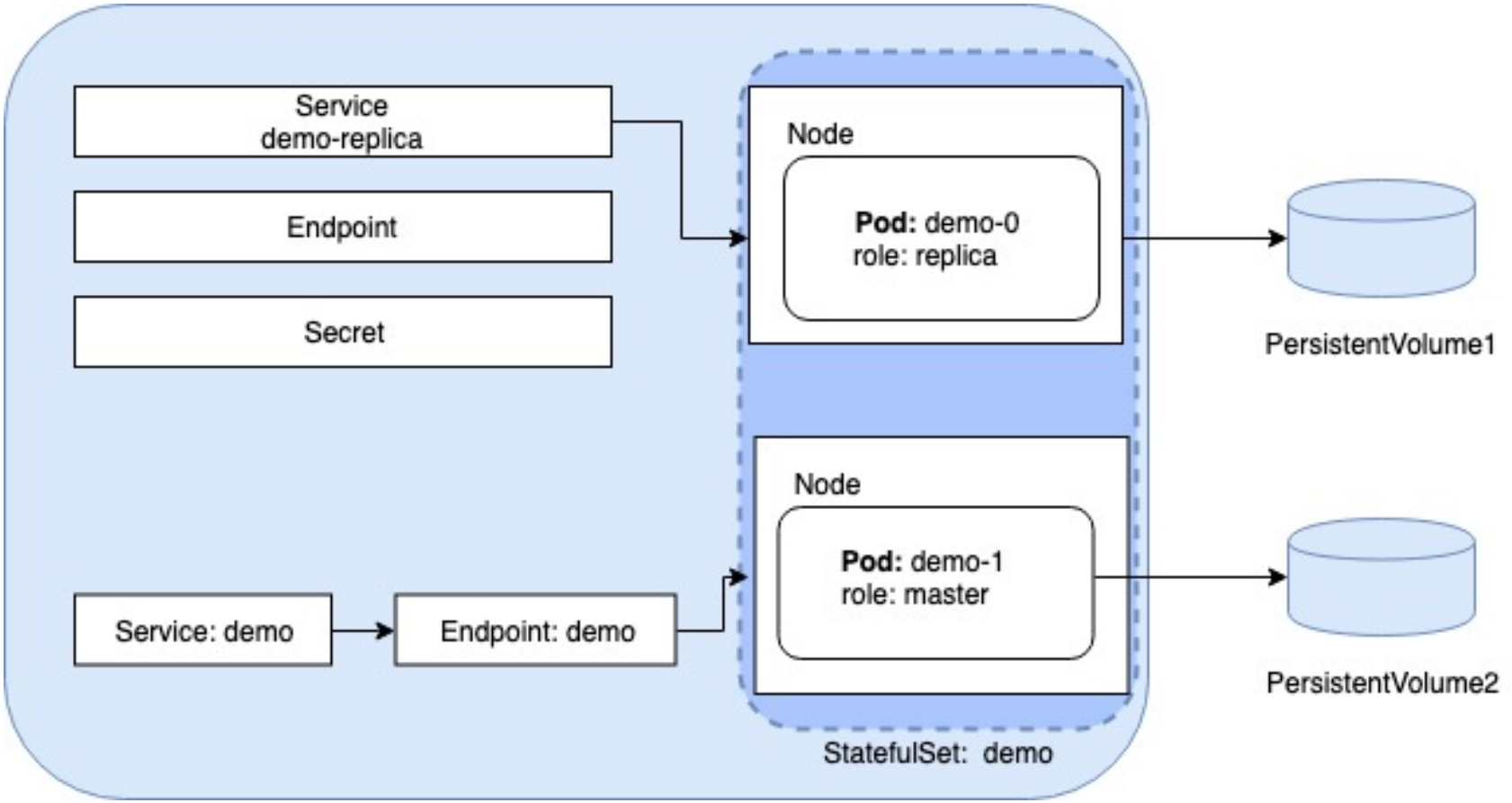

Simple deployment of Postgresql

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- Long YAML
- Hard to configure
- Not easy to manipulate with clusters (update, delete...)
- Manual generation of DB objects after setup

Why not helm

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- Templated manifests
- Requres spetial pod (tiller) in your cluster
- Only one place for configuration
- Still problem with cluster update

Postgresql typical lifecycle

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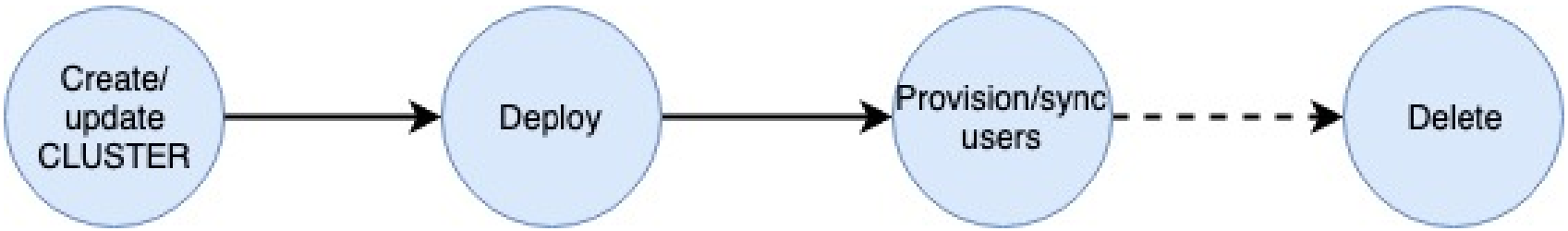

Kubernetes operator

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- Encapsulates knoweledge of a human operating the service
- Fully automated: deployments, cluster upgrdes, user management

Zalando Postgresql-Operator

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- Defines CDR (Postgresql)
- Watches instances, creates/updates/deletes
- Create DB objects, roles, passwords. . .
- Allows updating of resources (memory, cpu, volumes), postgresql configuration
- Auto-repairs, smart rolling updates

Postgresql Manifest

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```yaml
apiVersion: "acid.zalan.do/v1"
kind: postgresql
metadata:
  name: ct-minimal-cluster
specs:
  teamID: "CT"
  volume:
    size: 1G
  numberOfInstances: 2
  users:
    testuser:
      - createrole
      - createdb
  database:
    foo: testdb
  postgresql:
    version: "10"
```

Final operator chart

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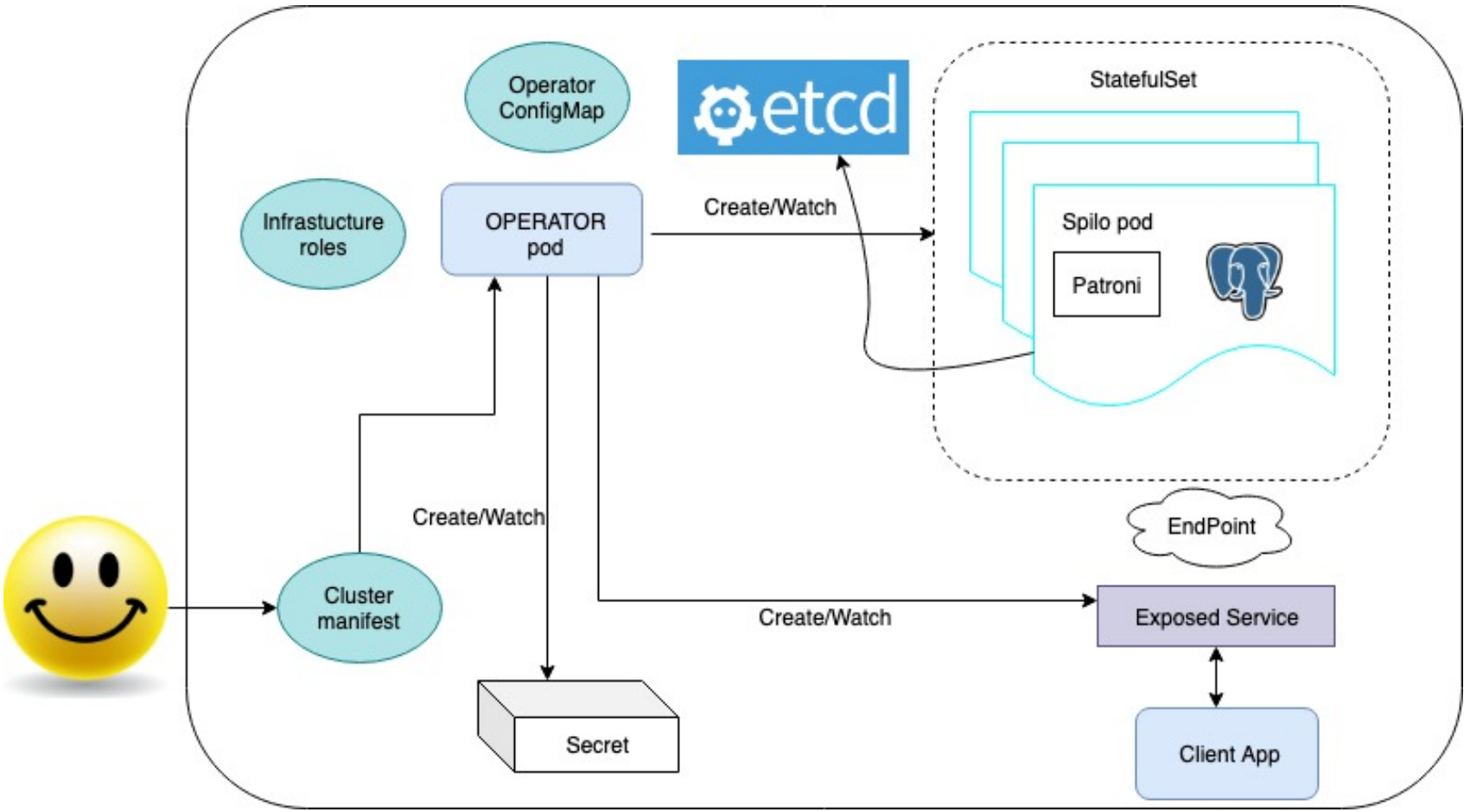

End

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THANK YOU

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