OpenShift Commons Briefing:
Database Disaster Recovery Made Easy

Building a Metro HA Postgres Cluster with OpenShift Data Foundation

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Red Hat

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Director of Operator Engineering
Crunchy Data

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Red Hat

Crunchy Data

Your partner in deploying open source PostgreSQL throughout your enterprise.

- Leading Team in Postgres – 10 contributors
- Certified Open Source PostgreSQL Distribution
- Leader in Postgres Technology for Kubernetes
- Crunchy Bridge: Fully managed cloud service

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Crunchy Postgres for Kubernetes

Declarative Postgres: your Postgres infrastructure automatically managed by open source PGO, the open source Postgres Operator from Crunchy Data.

Production Postgres Made Easy.

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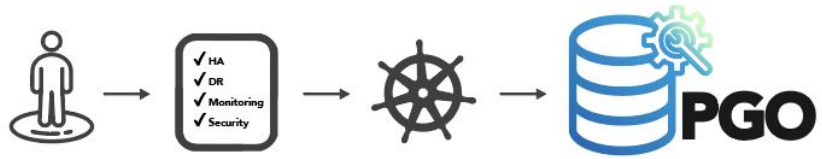
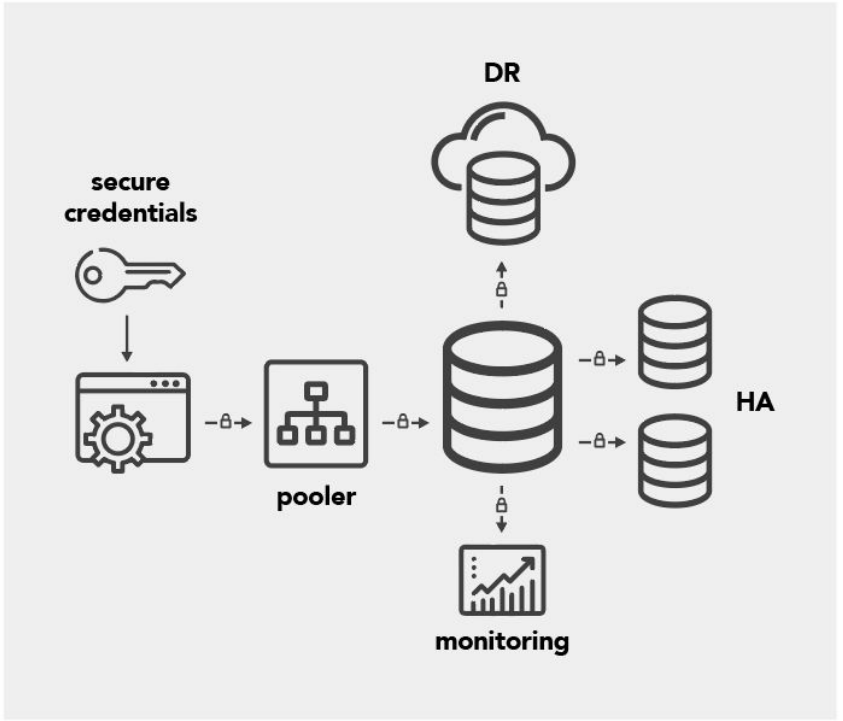
Fully Declarative Postgres



PostgreSQL the way you want it, **automatically configured** for your production requirements.



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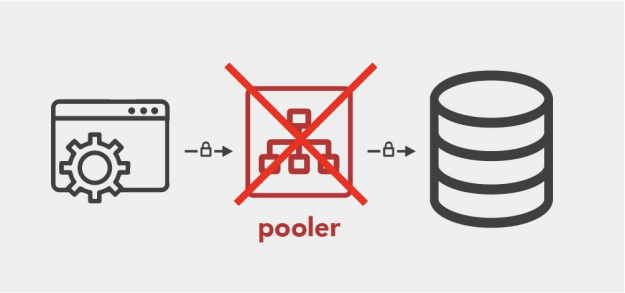
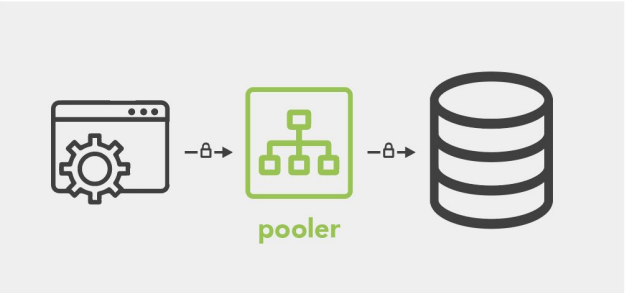
Auto Management and Healing

No matter what your environment throws at at it, Crunchy PostgreSQL for Kubernetes **will keep your database up and running**.





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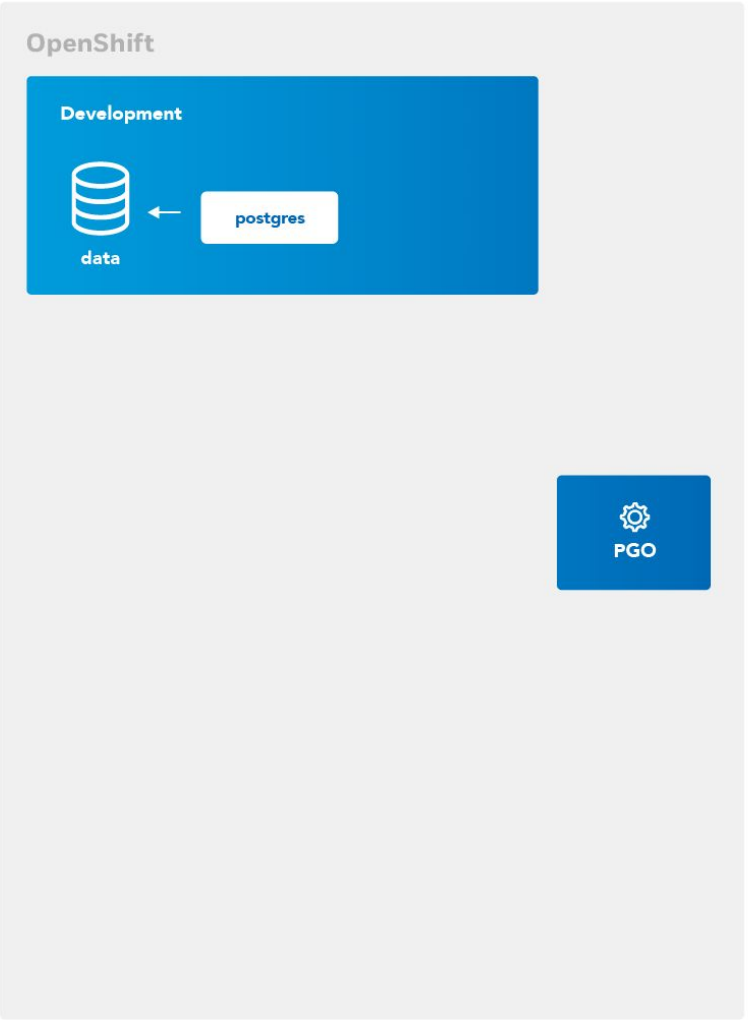
Built for GitOps

Run Postgres conveniently at **every stage of your release pipeline**. Crunchy PostgreSQL for Kubernetes is ready for continuous delivery of your applications.



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Update Without Interruption

Kubernetes moves fast. We're ready.

Crunchy PostgreSQL for Kubernetes uses rolling updates so you can easily update your Postgres instances without disrupting your applications.

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The Best of Postgres for Kubernetes

High Availability. Consensus-based and scalable across multiple Kubernetes clusters enables flexible “always on” architectures.

Disaster Recovery. From zero to many terabytes. Available in your choice of storage - Kubernetes, S3, GCS, Azure.

Monitoring. Kubernetes-specific Postgres insights and alerts to spot problems before they occur.

Security. Unprivileged, locked-down containers with TLS enabled by default coupled with secure credential management.

Convenience. Easy customizations, cloning data and connection pooling make it easier to maintain applications.

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Crunchy Postgres for Kubernetes

Fully Declarative. Manages your Postgres clusters based on your specifications.

GitOps Ready. Deploy with your choice of Helm, Kustomize, or OLM.

Easy to Get Started. Designed to get your applications up and running.

Easy to Upgrade. Seamless upgrades alongside the fast-moving Kubernetes ecosystem.

Production Grade. Trusted by leaders in Kubernetes for Production Ready Postgres.

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OpenShift Data Foundation is built on open source projects

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Data Services

Operator framework

Makes packaging, deploying, and managing Kubernetes applications easier

Rook

Automates administration and management tasks across multiple storage systems

Ceph

Provides a 3-in-1 interface for object, block, and file storage

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OCP 4 with ODF 4 - Technology Stack

Easy & Automated Management with Operators

Highly Resilient & Scalable Storage System

Multi-Cloud & Hybrid Object Storage

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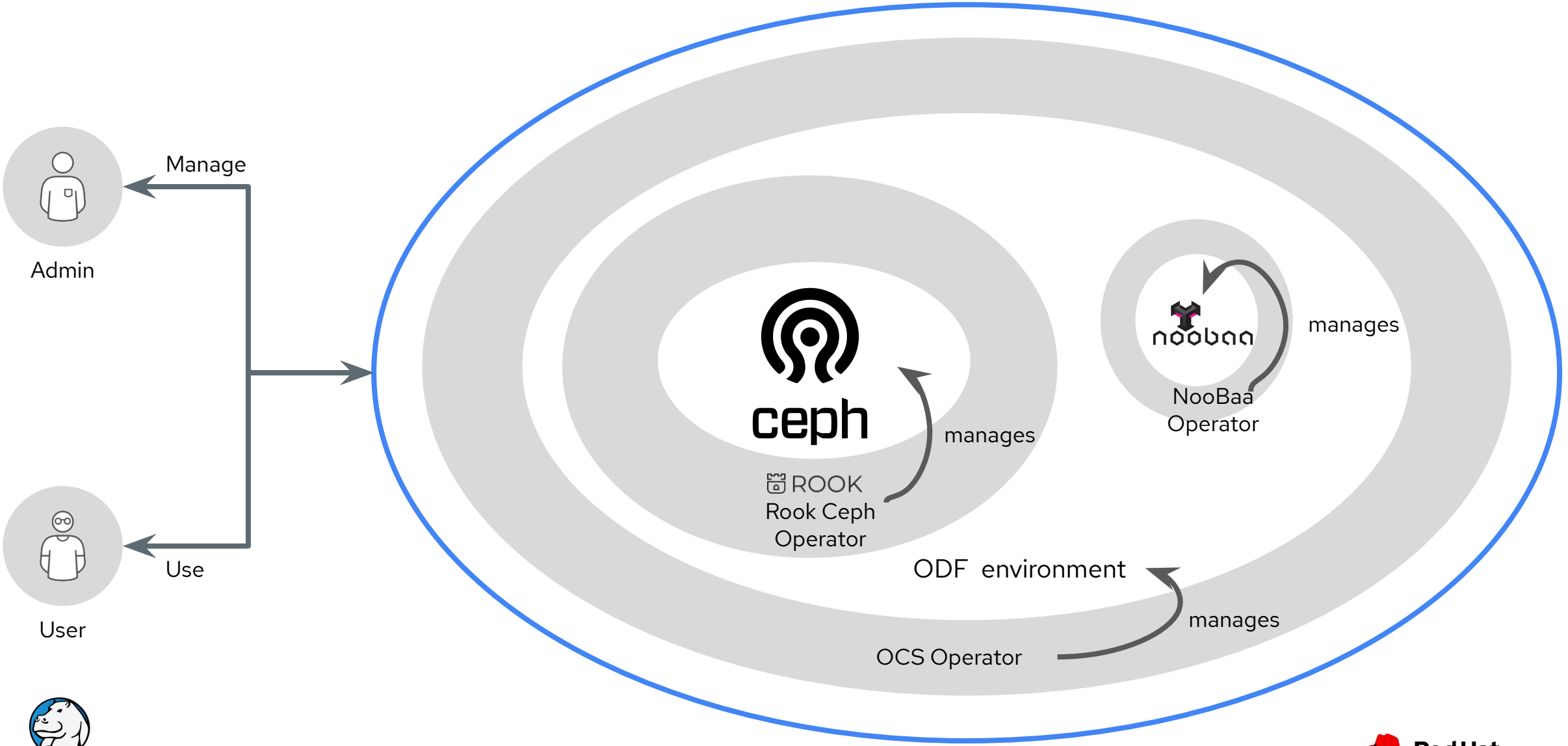
Interacting with ODF via OpenShift Console



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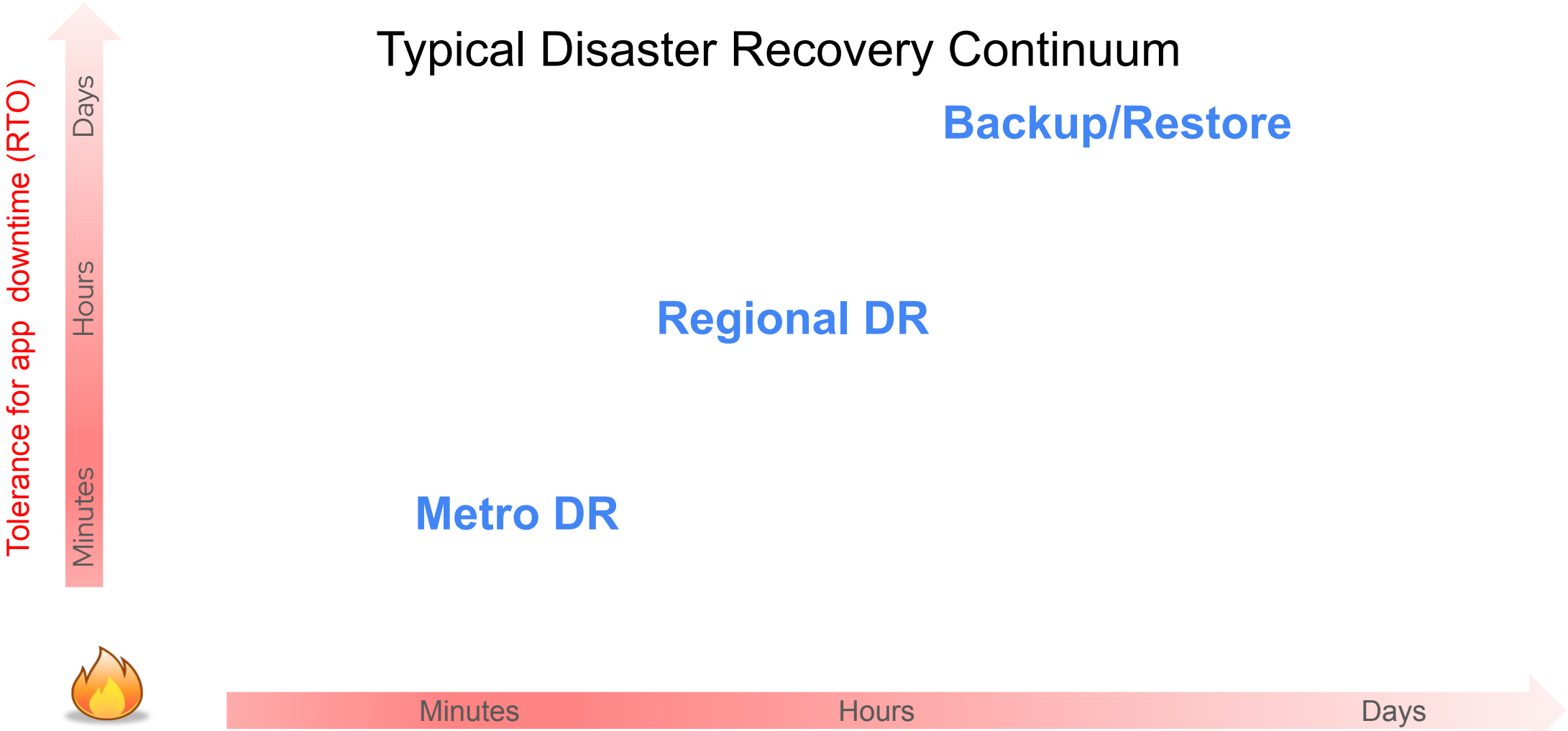
Typical Disaster Recovery Continuum



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Disaster Recovery Continuum

Tolerance for app downtime (RTO)

Minutes → Hours → Days

Backup/Restore

- ODF CSI-compliant snapshots and clones
- ISV backup solution integration

Regional DR

- 2 sites (regionally dispersed)
- ODF async RBD data replication

Metro DR

- 2 site + arbiter location (metro area)
- Zero-touch failover*
- ODF sync data replication
- <5ms RTT between data sites

Minutes → Hours → Days

Tolerance for Data loss (RPO)

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*RWO exception: Custom scripting required to force-delete terminating app pods with RWO PVs attached, after 6 min timeouts.

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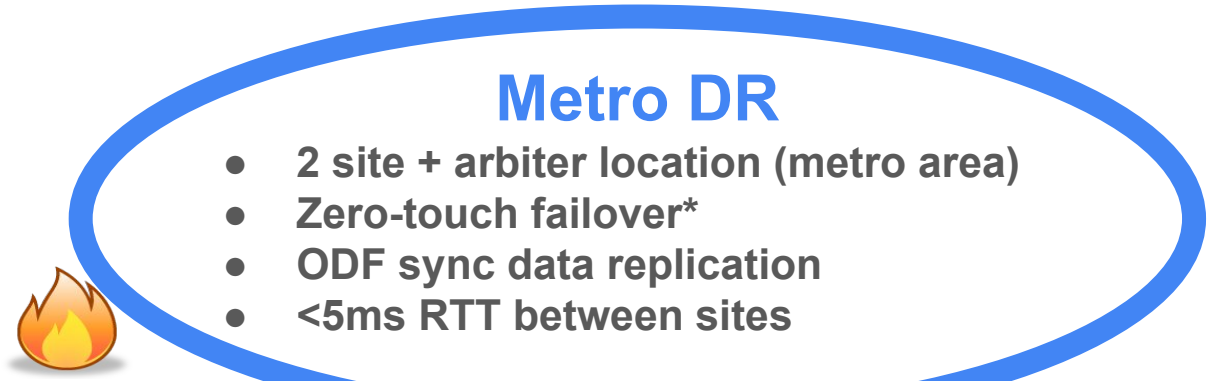
Metro DR - What's Currently Possible with ODF



If App pods are using:

- ODF or S3 Object Storage
  - Possible: 0-7 minute RTO, 0 RPO
  - Zero-touch failover across metro sites
- ODF RWX/RWO Storage
  - Possible: 0-7 minute RTO, 0 RPO
  - Zero-touch failover across metro sites
- ODF RW0 Storage
  - Blocker (out-of-the-box): app pods with RWO PVCs do not failover due to kubernetes issue #65392
  - Workaround requires force delete of stuck pods

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*Custom scripting required to force-delete terminating app pods with RWO PVs attached, after 6 min timeouts.

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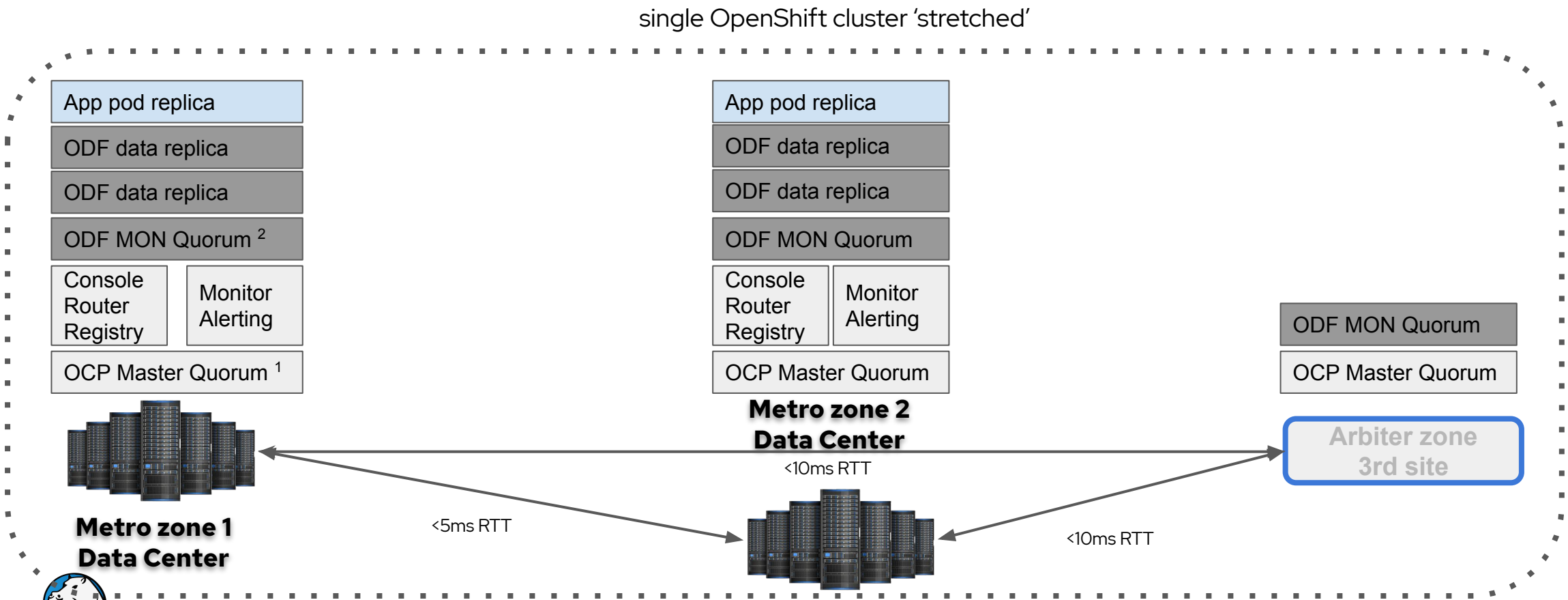
Important: Deploy services/pods in separate topology zones



1 - ODF Master Quorum (e.g. etcd member pods)
2- ODF Ceph Monitors

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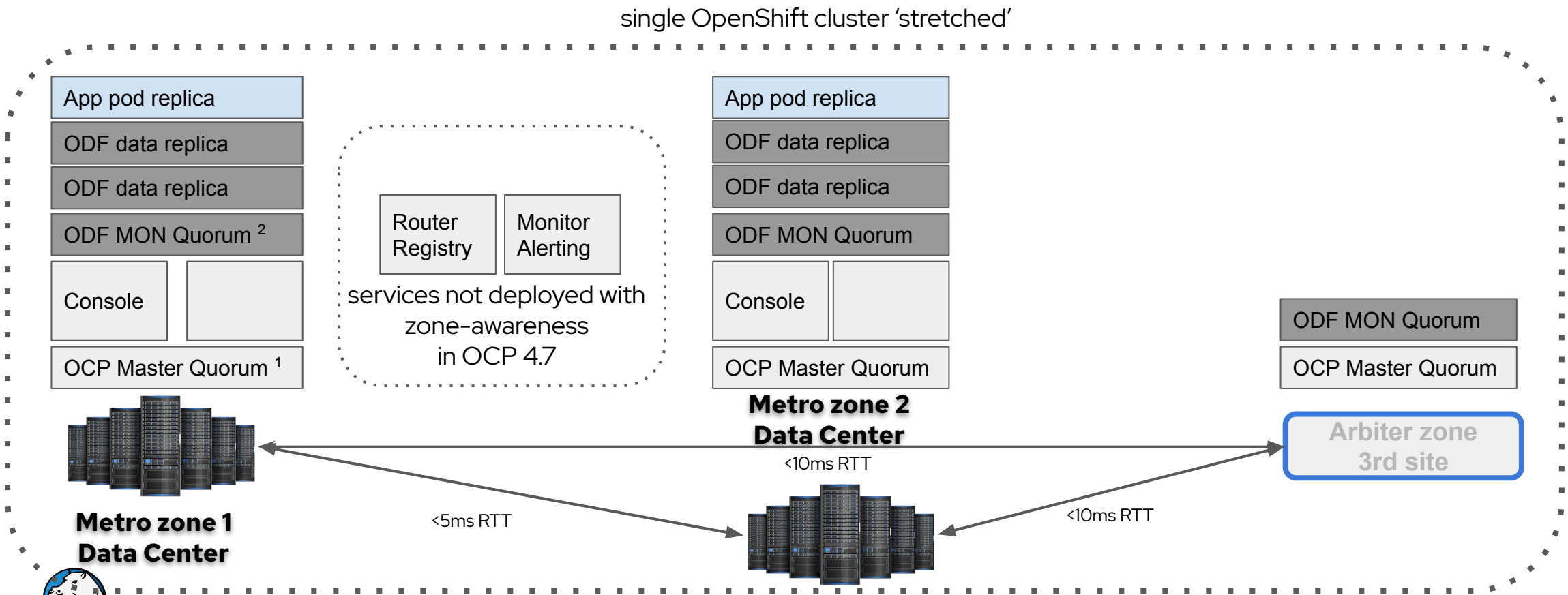
Default OCP services missing zone-awareness



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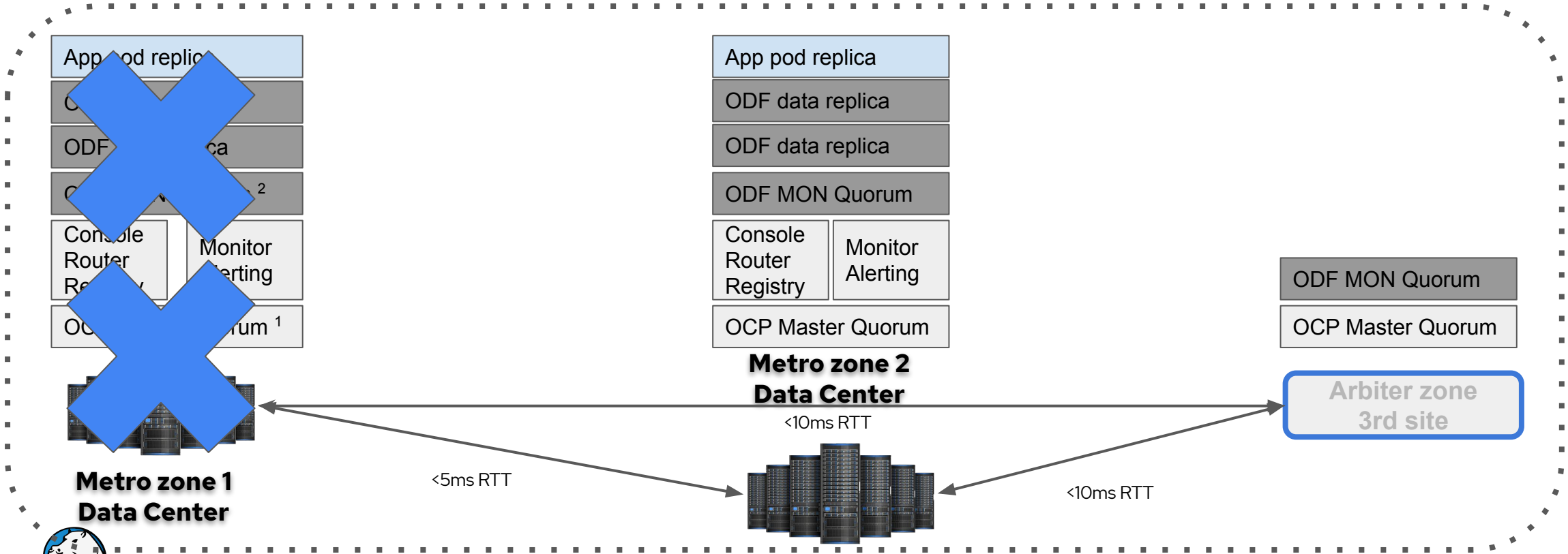
Surviving pods in zone 2 continue without disruption*



*Except pods in the failed zone attached to RWO PVs, which must receive a force-delete to enable pods in surviving zone to attach to PV.

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Methods to Configure Zone-Awareness Apps

- Starting with OCP 4.6 TopologySpreadConstraints are supported
  - For reference see here for OCP instructions. Similar parameters have to be added to your application pod specs.

```
spec:
  topologySpreadConstraints:
    - labelSelector:
        matchLabels:
          deployment: file-uploader
      maxSkew: 1
      topologyKey: topology.kubernetes.io/zone
      whenUnsatisfiable: DoNotSchedule
    - labelSelector:
        matchLabels:
          deployment: file-uploader
      maxSkew: 1
      topologyKey: kubernetes.io/hostname
      whenUnsatisfiable: ScheduleAnyway
```

- When added to the pod spec in the app deployment config, pods will be evenly spread between zones and between nodes in a zone.

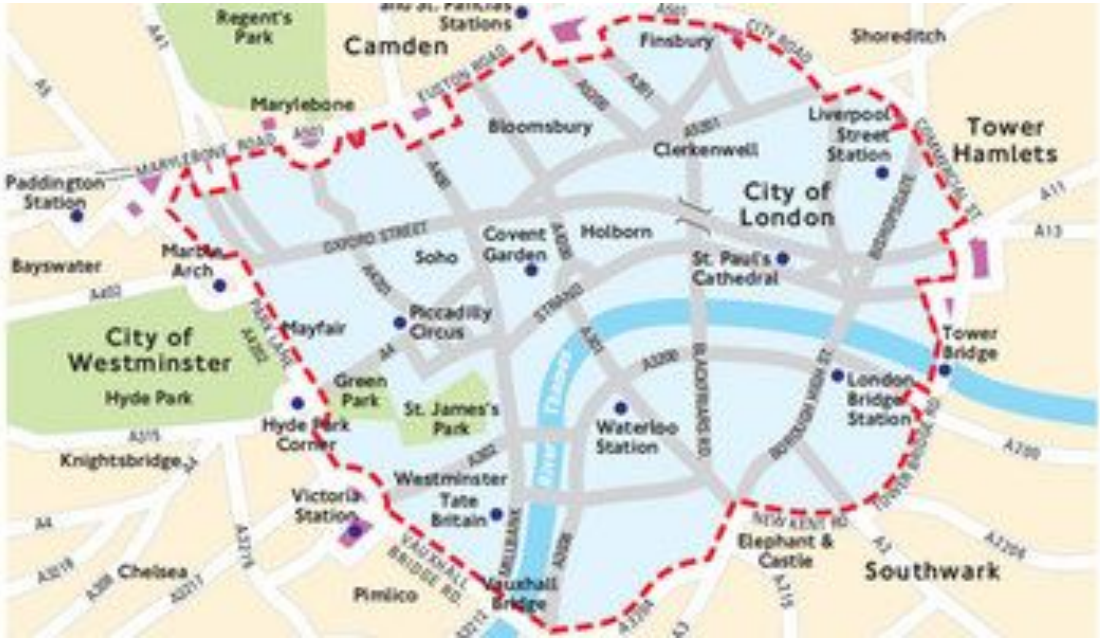
Smart City - Green City

Business Needs

Reduce Congestion - Charge all vehicles a fee for driving within the city during peak hours

Reduce Pollution - Charge ‘dirty’ vehicles an extra fee for driving a vehicle that doesn’t meet emission standards

Locate Wanted Vehicles - notify officials when when vehicles matching AmberAlerts™ or stolen vehicle descriptions enter the city



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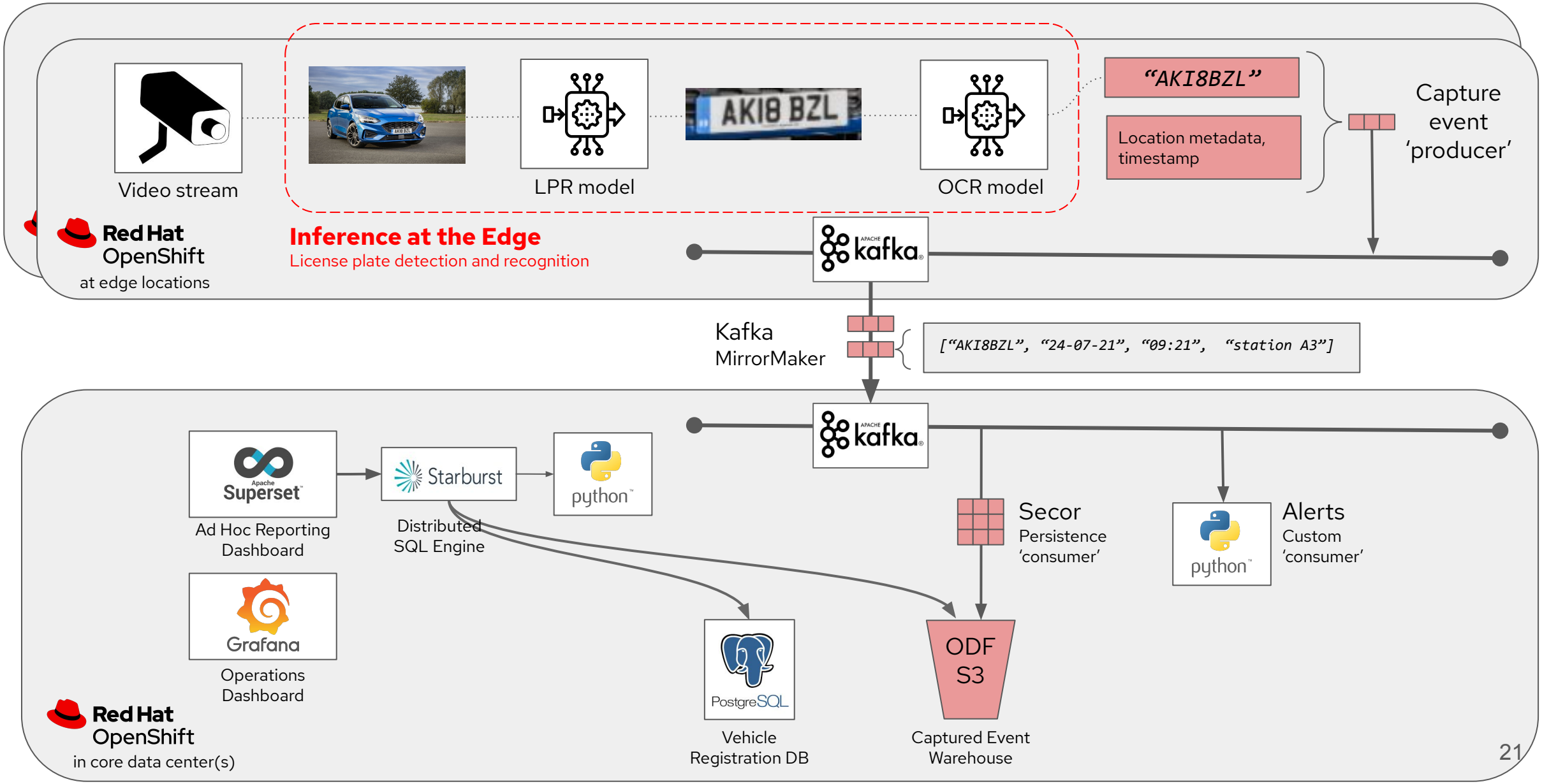
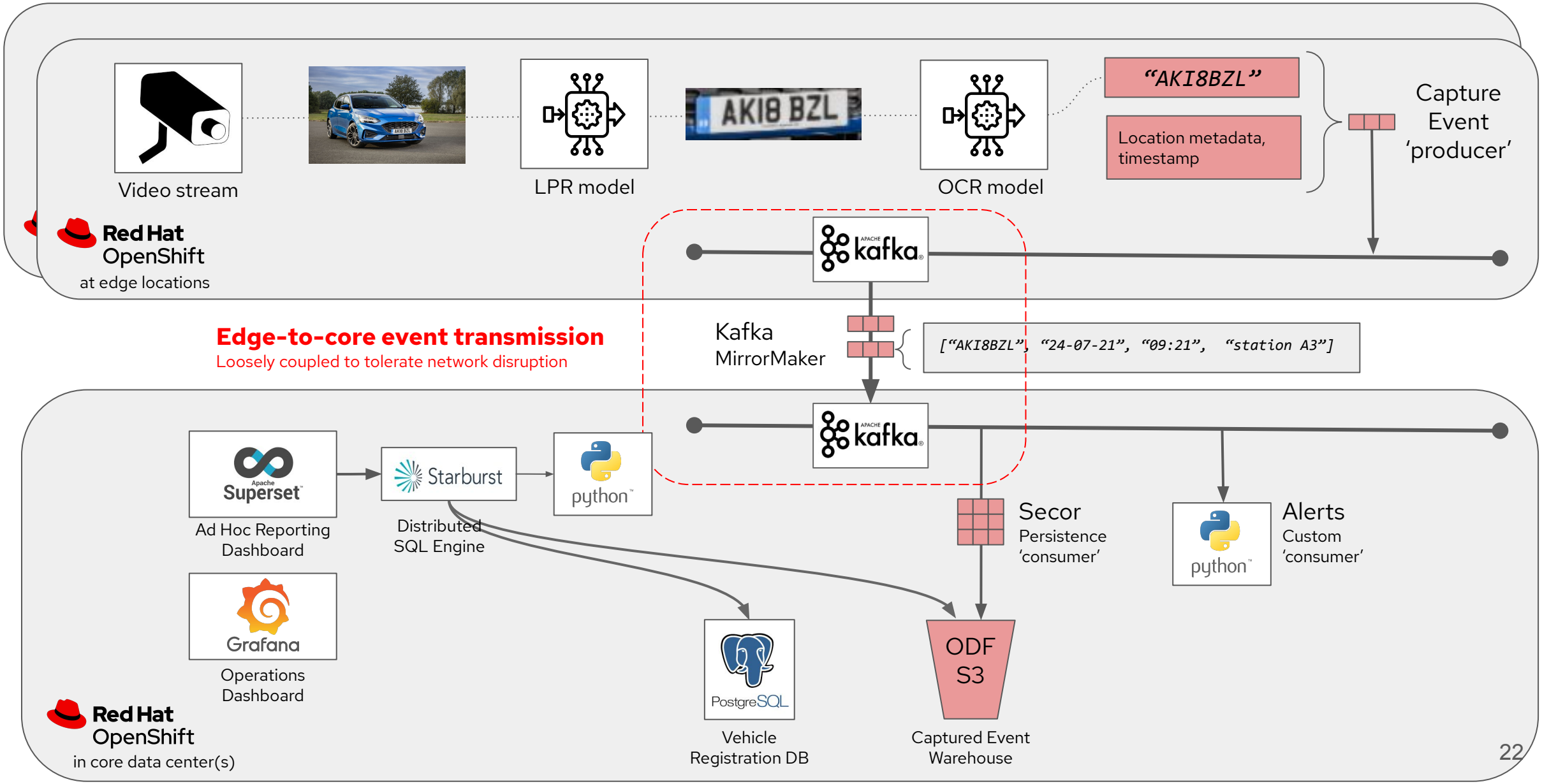
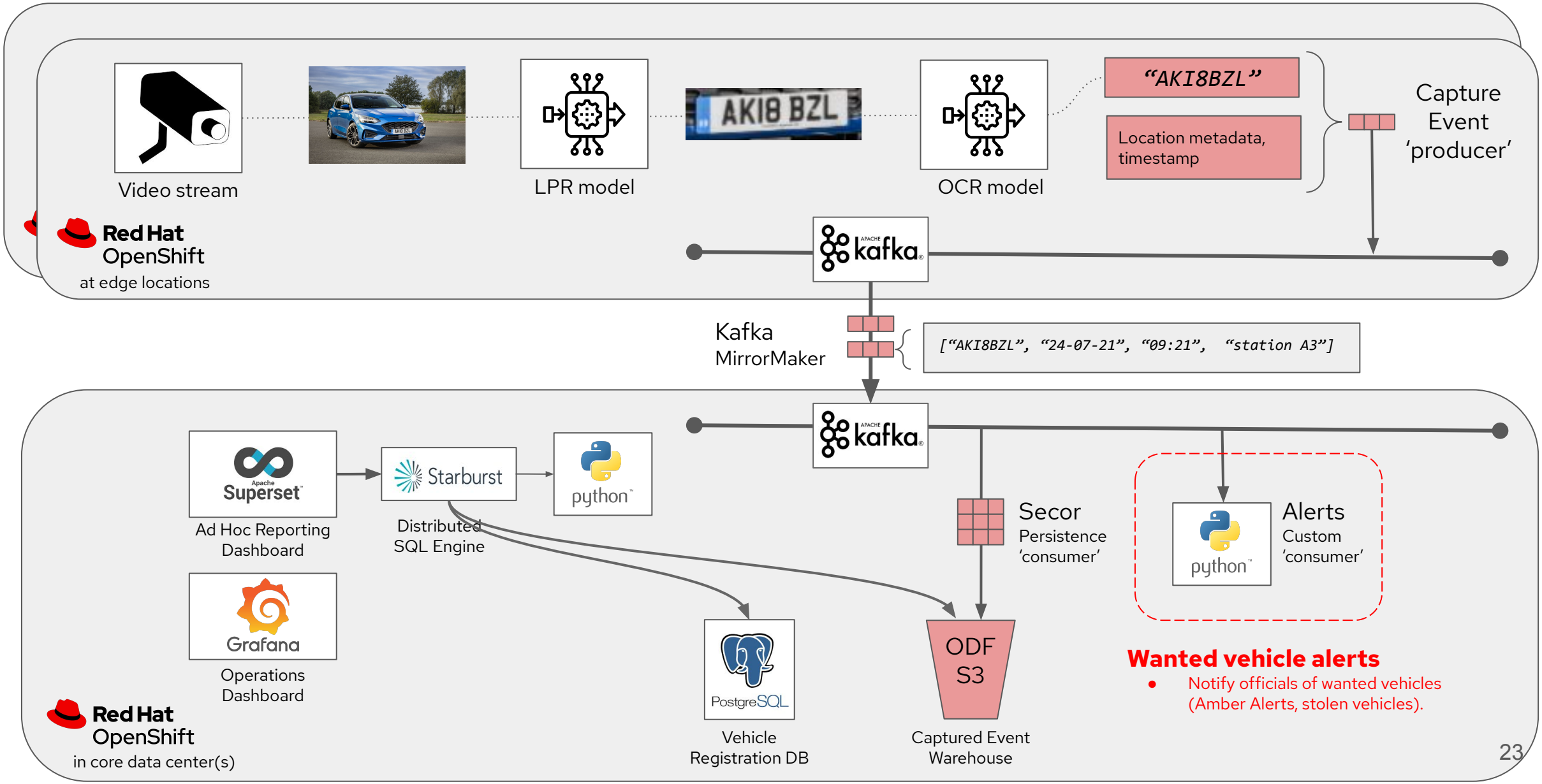
Pipeline Architecture - Stage 1 of 4



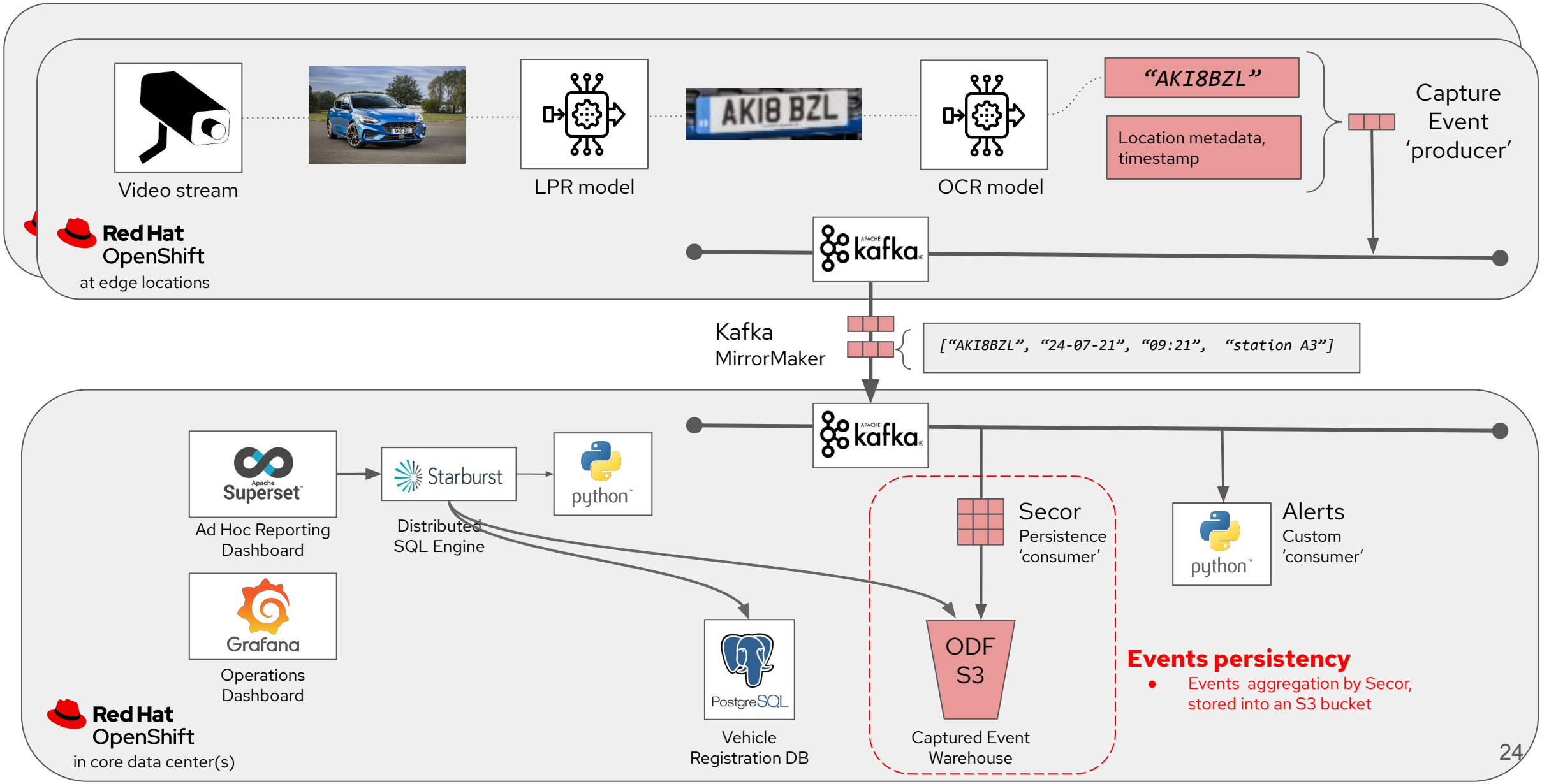
Pipeline Architecture - Stage 2 of 4



Pipeline Architecture - Stage 3 of 4



Pipeline Architecture - Stage 3 of 4



Pipeline Architecture - Stage 4 of 4

Video stream

LPR model

OCR model

"AKI8BZL"

Location metadata, timestamp

Capture Event 'producer'

Red Hat OpenShift at edge locations

Kafka MirrorMaker

["AKI8BZL", "24-07-21", "09:21", "station A3"]

Ad Hoc Reporting Dashboard

Distributed SQL Engine

Secor Persistence consumer

Alerts Custom consumer

Operations Dashboard

Toll Processing + Analytics

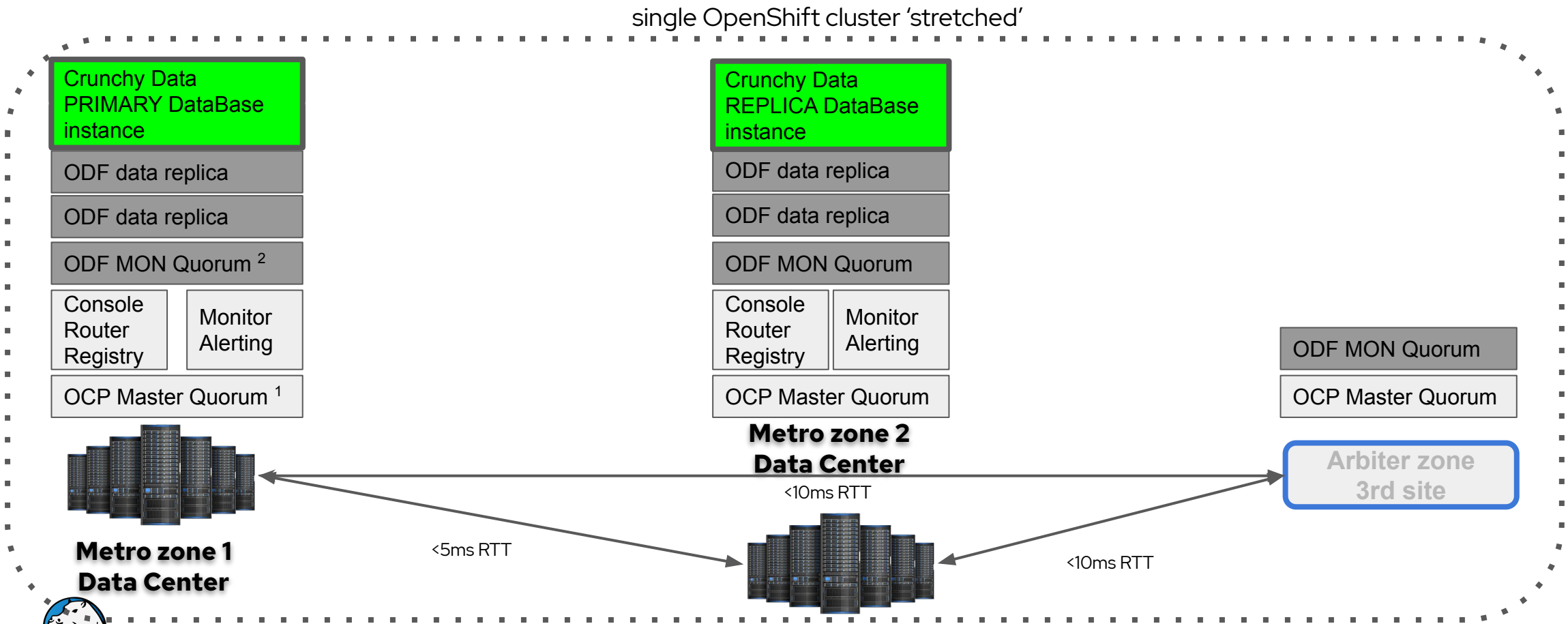
1. Calculate fee for entering the city (one fee per day vehicle enters city).
2. Add 'dirty' vehicle fee if needed.

Vehicle Registration DB

Captured Event Warehouse

Red Hat OpenShift in core data center(s)

Resilient Crunchy Data Postgresql Database



1 - OCP Master Quorum (e.g. etcd member pods)
2- ODF Control Plane (Ceph Monitors)

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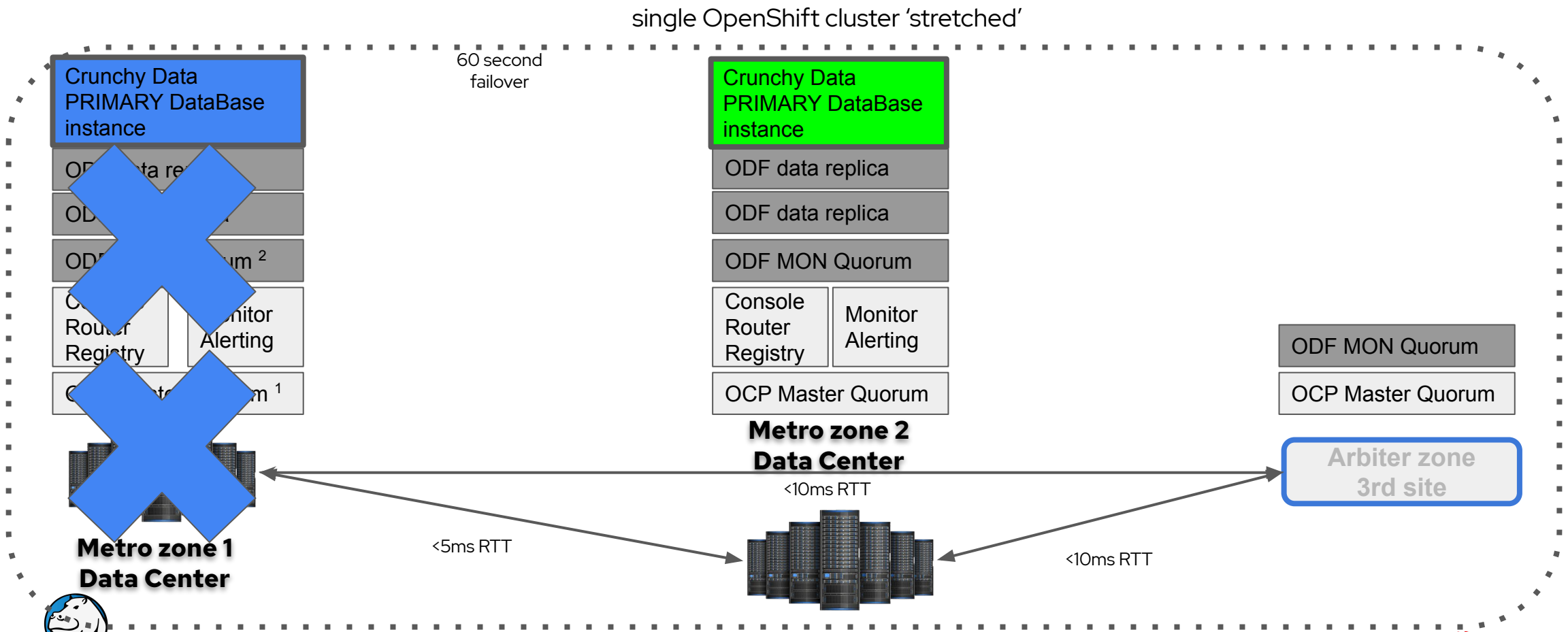
Failover for Crunchy Data Postgresql Database



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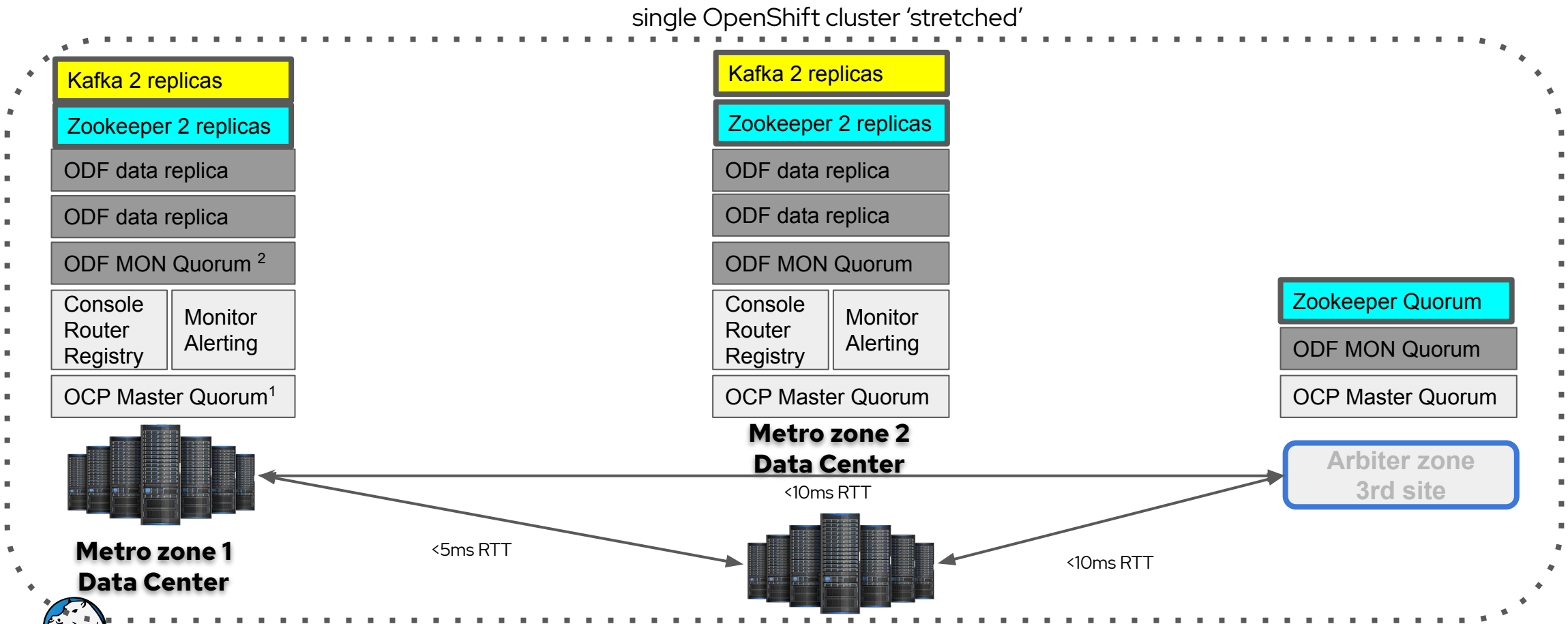
Resilient Red Hat AMQ Kafka/Zookeeper



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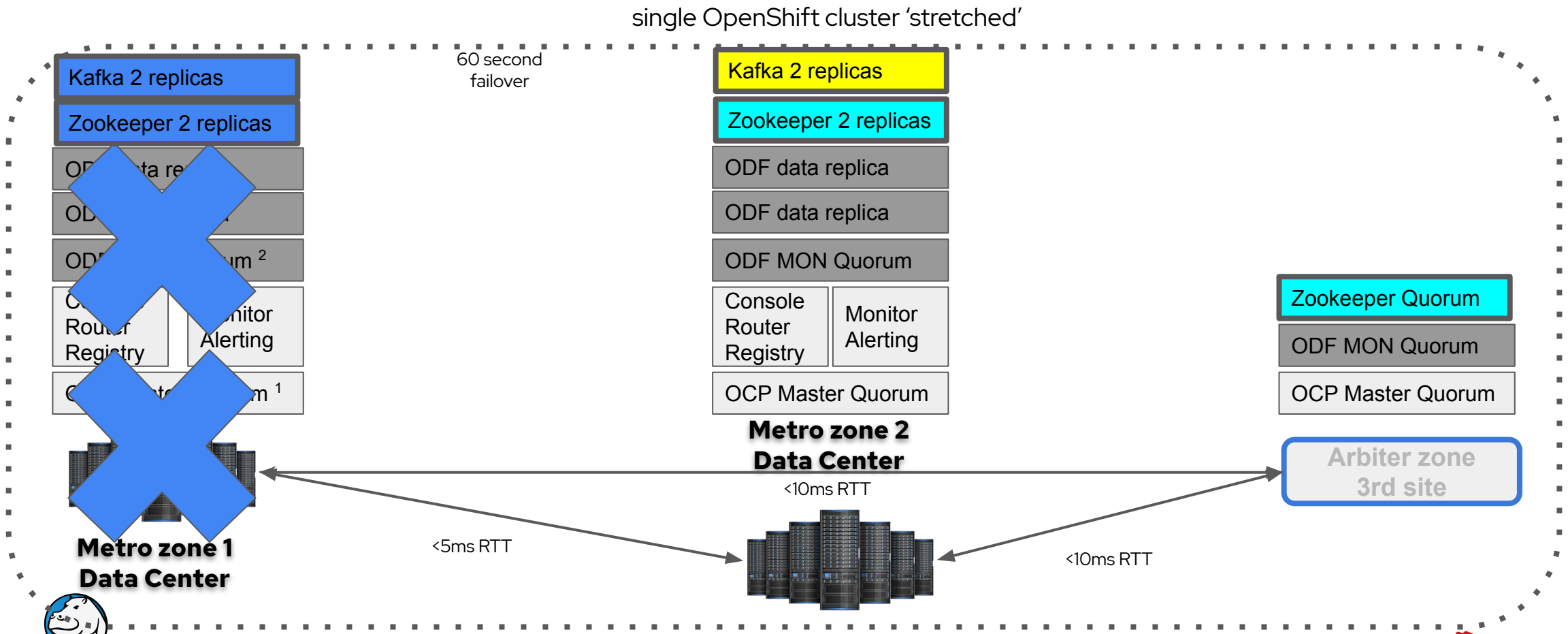
Failover for Hat AMQ Streams Kafka/Zookeeper



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Smart City DR Demo

Find out more

- ODF demonstration ~8 minutes
- Evaluations - redhat.com/TryODF
- Hands on demos - learn.openshift.com/persistence
- Jumpstart Library Smart City
- Configuring OpenShift Container Storage For Metro-DR Stretch Cluster
- Recovering a Metro-DR Stretch Cluster
- PGO, Postgres Operator from Crunchy Data
- Postgres Operator Examples

Thank you

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