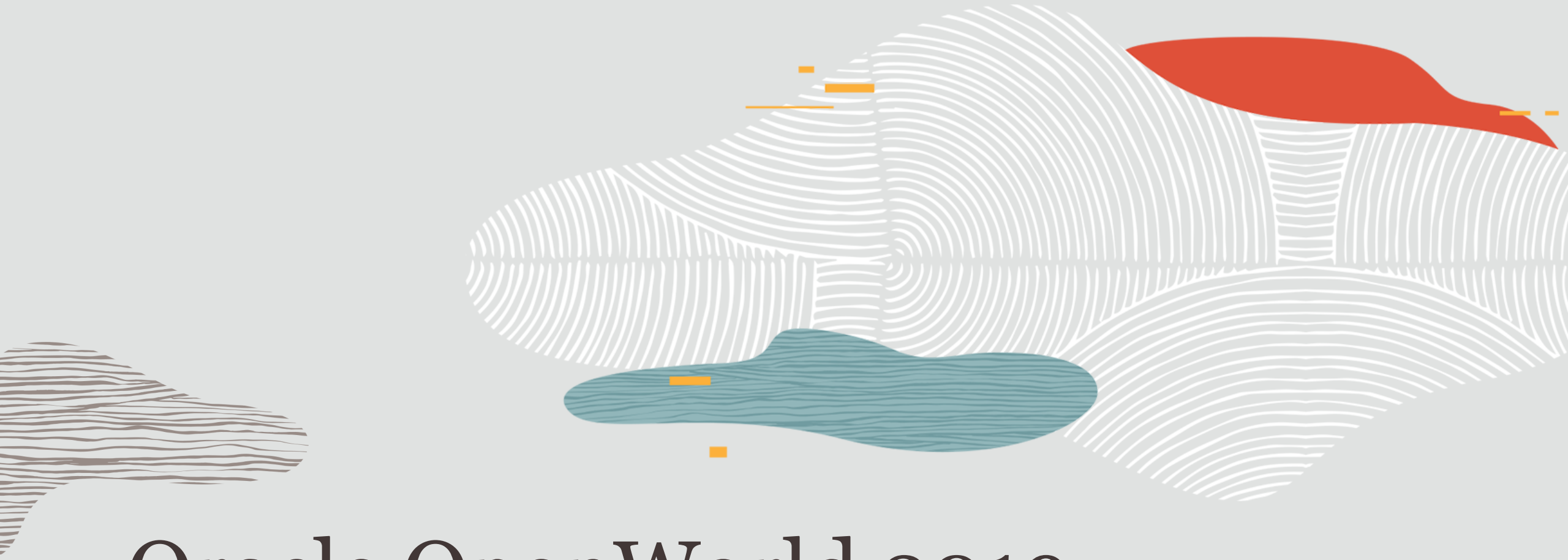
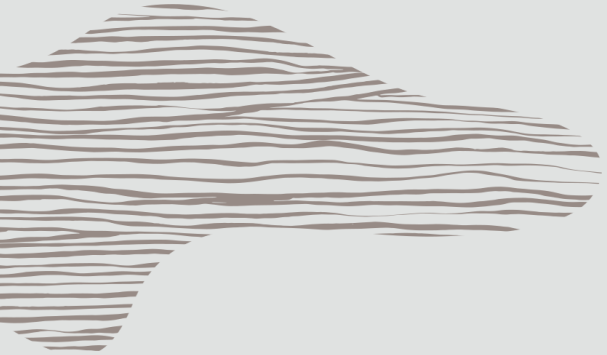


Oracle OpenWorld 2019

SAN FRANCISCO



The Glue between Oracle Cloud and CERN Private Cloud

Monica Riccelli – Principal Product Manager, Oracle

Antonio Nappi – DevOps Engineer, CERN

Safe Harbor

The preceding is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, timing, and pricing of any features or functionality described for Oracle's products may change and remains at the sole discretion of Oracle Corporation.

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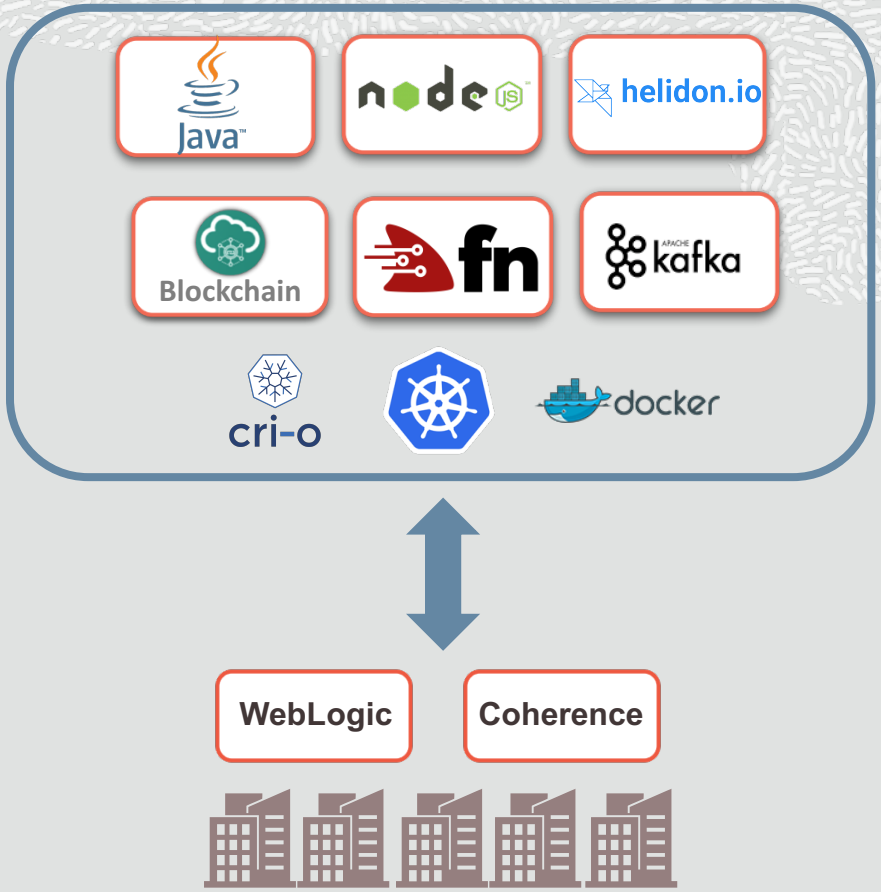
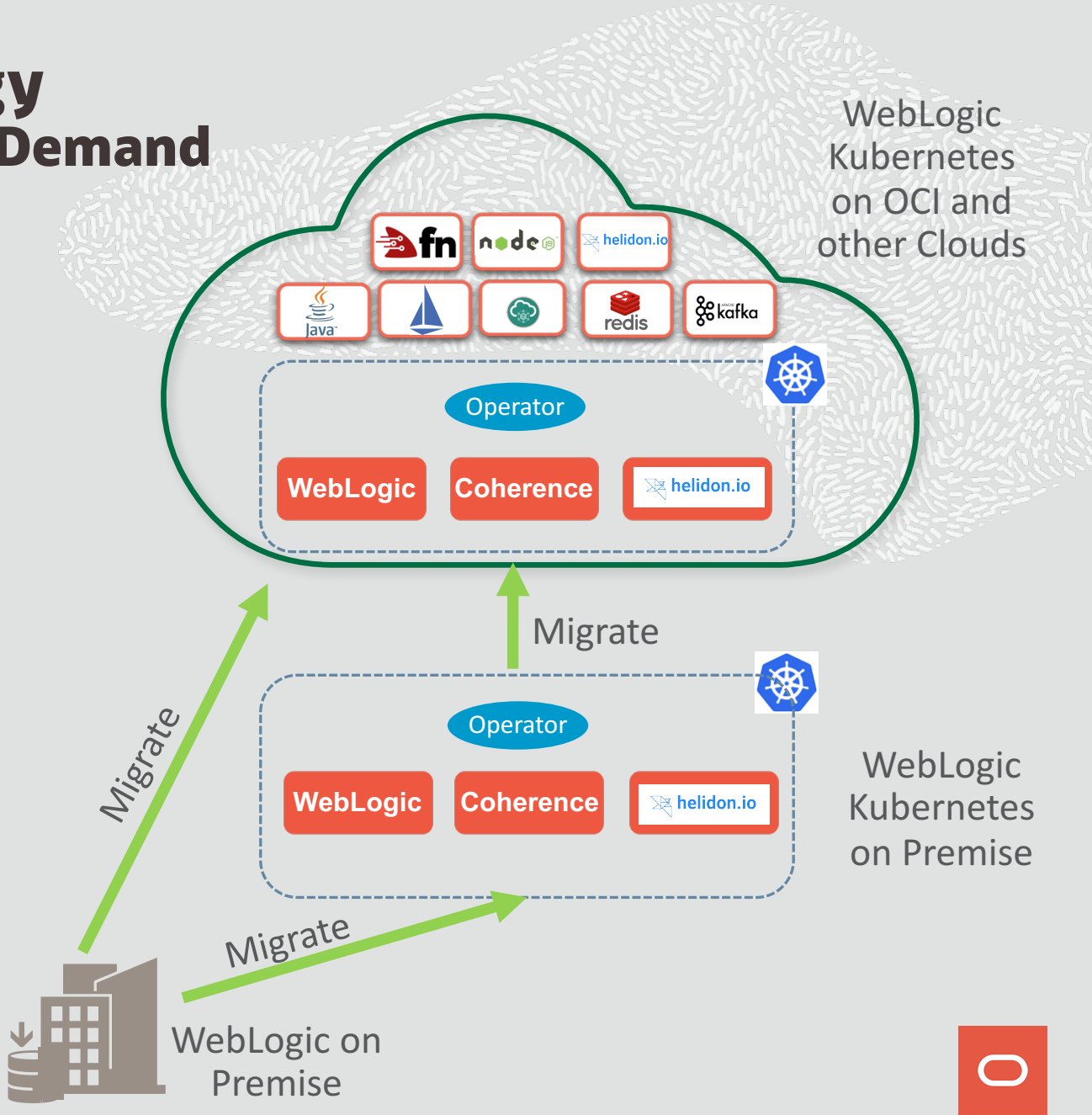
WebLogic, Coherence and Cloud Native Trends

- Industry trends
  - Microservices, serverless
  - Private and public clouds
  - Containers, orchestration frameworks
- WebLogic, Coherence customer demand
  - Leverage cloud neutral infrastructure
  - Integrate with new tools and services
  - Evolve WebLogic, Coherence for these environments



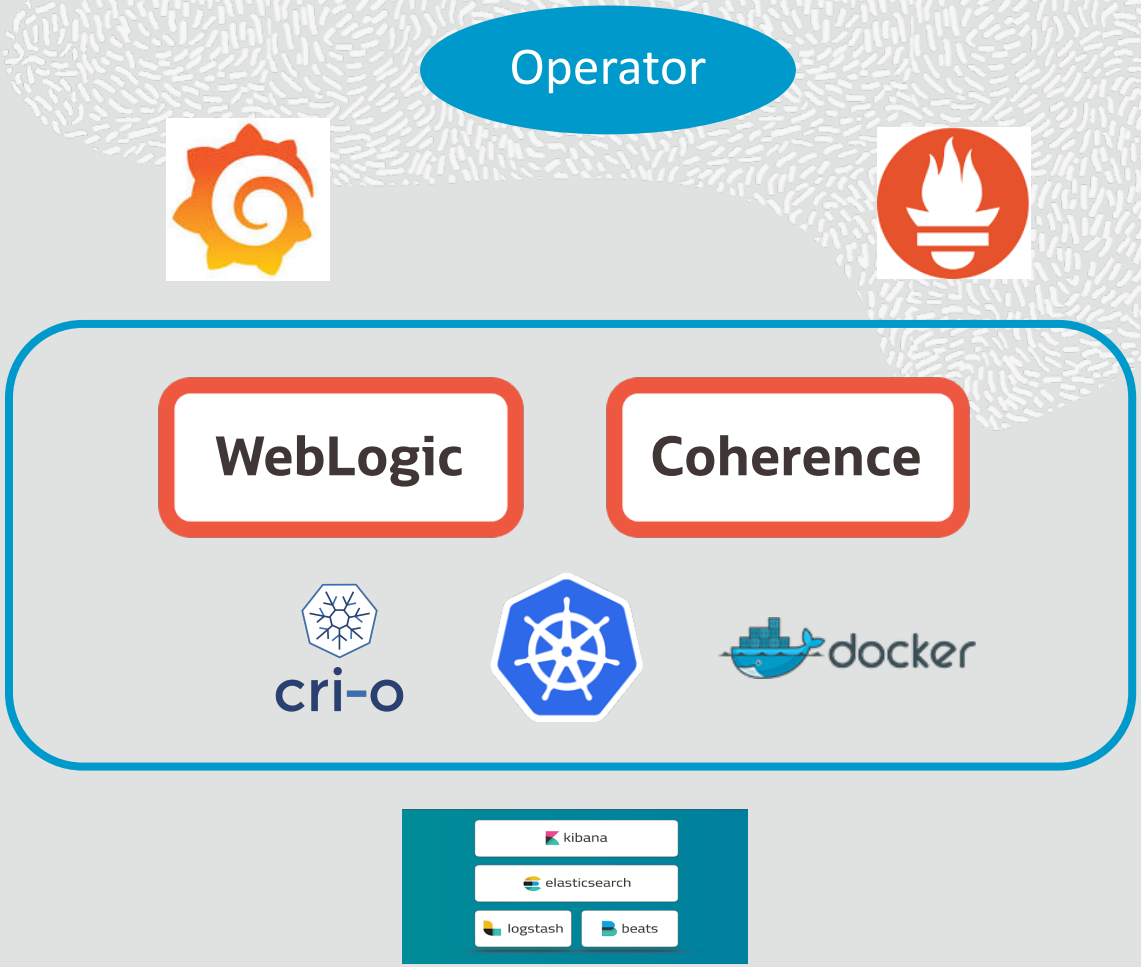
Oracle Enterprise Java Strategy
Evolve Products to Meet Customer Demand

- Migrate to Kubernetes on premise
  - Tools for migration and management
  - Support existing and new applications
- Migrate to Kubernetes on Oracle Cloud
  - Leverage management tools on OCI
  - Availability, security, scaling, low-cost
- Integrate with Microservices
  - Flexibility for developers
  - Evolve and manage applications



WebLogic Server on Kubernetes - Building Blocks

- Docker and CRI-O certification
  Docker images, Dockerfiles, examples
- WebLogic Kubernetes certification
  How-to, best practices
- Value add integration
  Management: Operator
  Monitoring: Exporter for Prometheus
  Migration: Deploy tooling
  Logging: Exporter for Elastic Stack
  Image Creation: WebLogic Image Tool



WebLogic Domain in Kubernetes
Domain Custom Resource

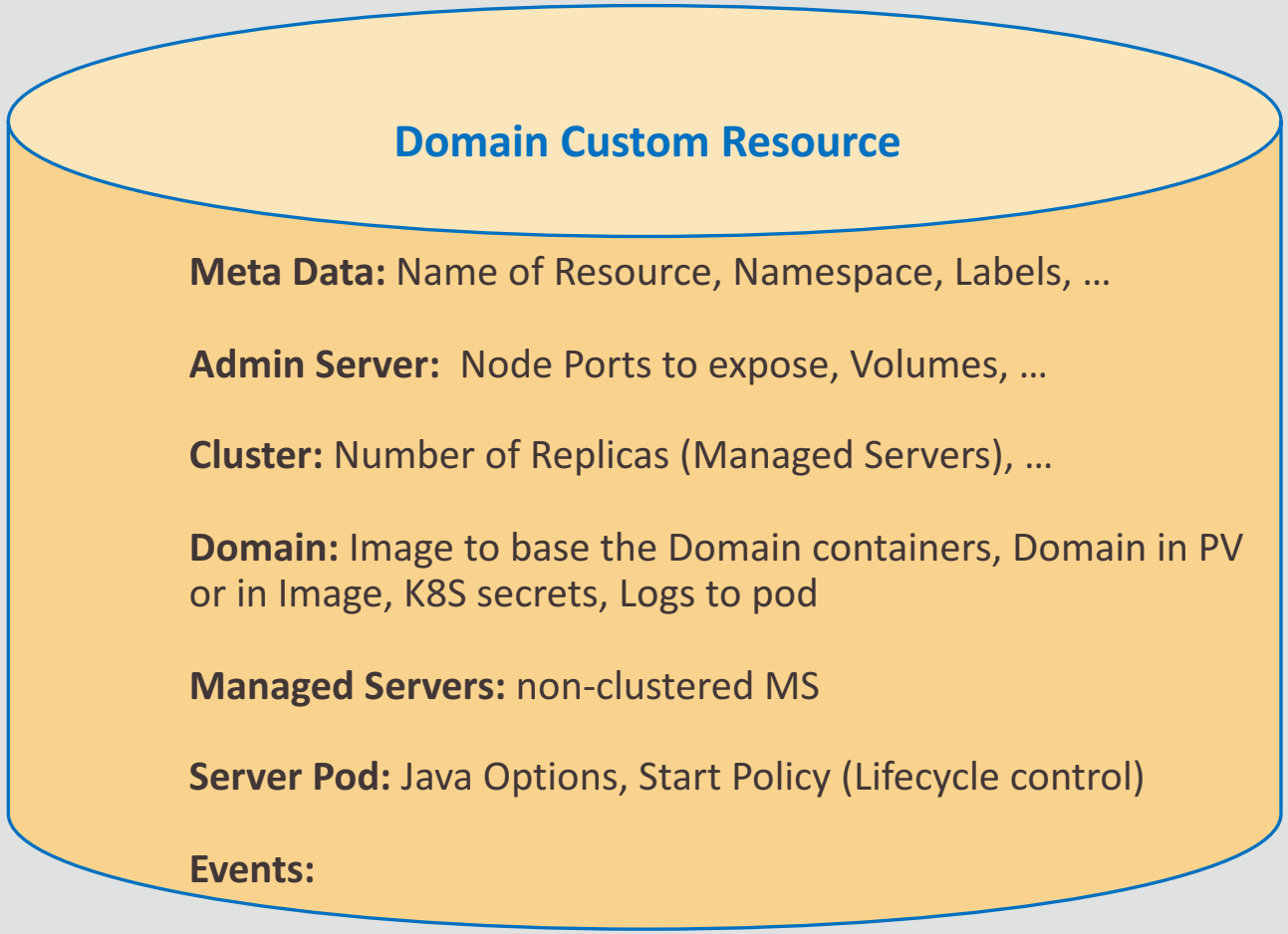
- We create a Kubernetes Resource Object for the WebLogic domain.

  This is a data structure representation of the WebLogic domain in Kubernetes.

- Domain Custom Resource allows you to *declare* or specify the desired state of the resource.

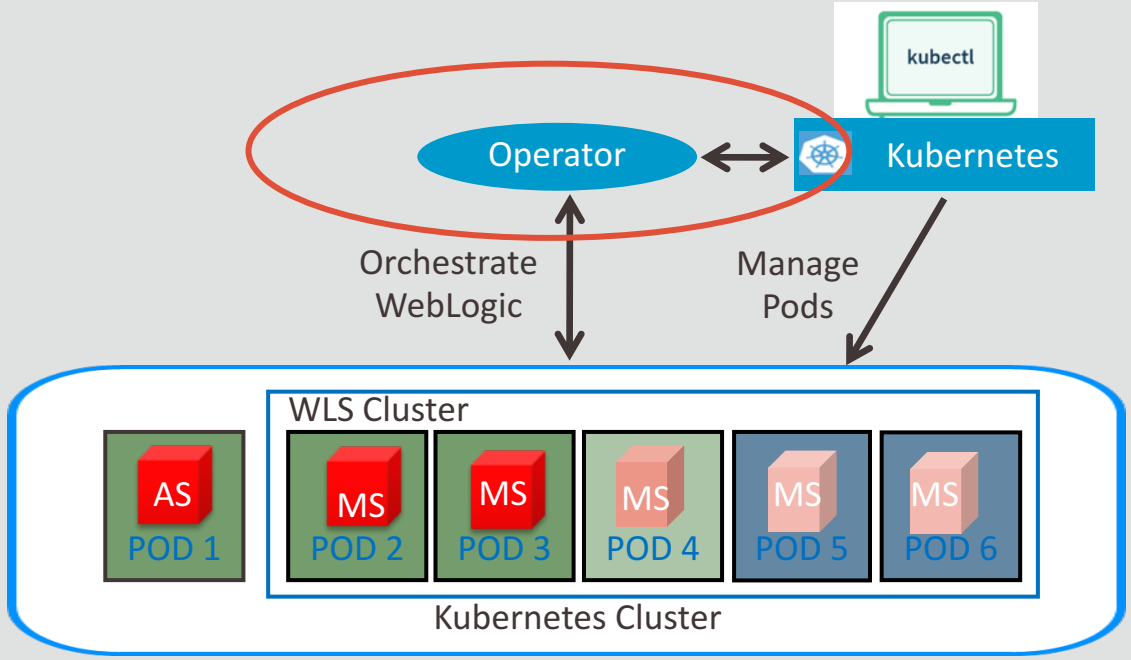
- Allows the Kubernetes API server to begin serving the custom resource object.

- The WebLogic Kubernetes Operator is a controller that is always looking at the Domain Custom Resource and tries to match the actual state to this desired state.



Why build the WebLogic Kubernetes Operator?

- Contains built-in knowledge about how to perform lifecycle operations on a domain
- Uses Kubernetes APIs to automate lifecycle operations.



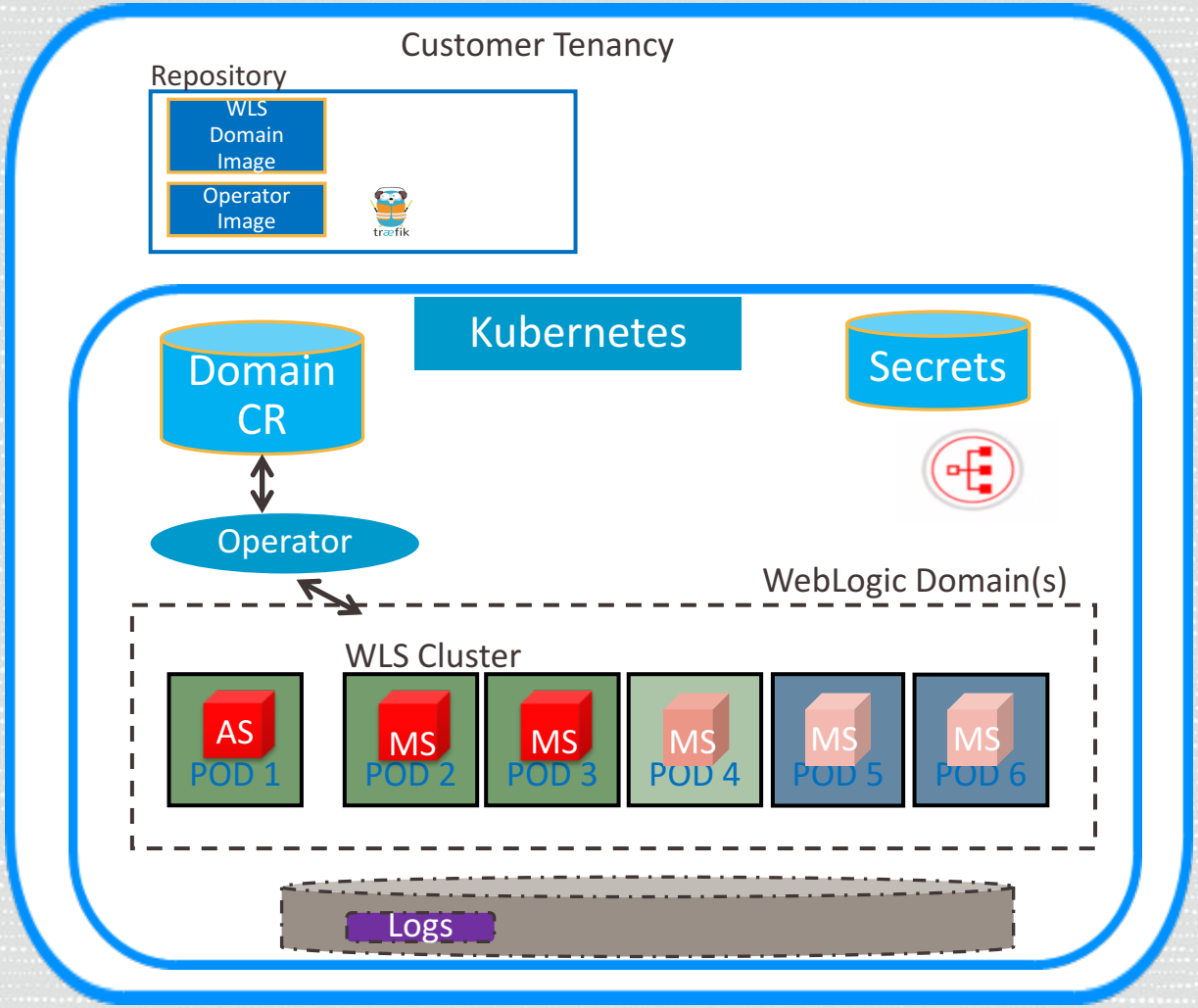
WebLogic Kubernetes Operator

1. Manages lifecycle operations (start, stop, scale, rolling restart, etc.) in Kubernetes
2. Automate configuration, e.g. clustering, channels/ports, configuration overrides
3. Supports standard k8s idioms like sidecars, init containers, custom resources

Open source and fully supported https://github.com/oracle/weblogic-kubernetes-operator

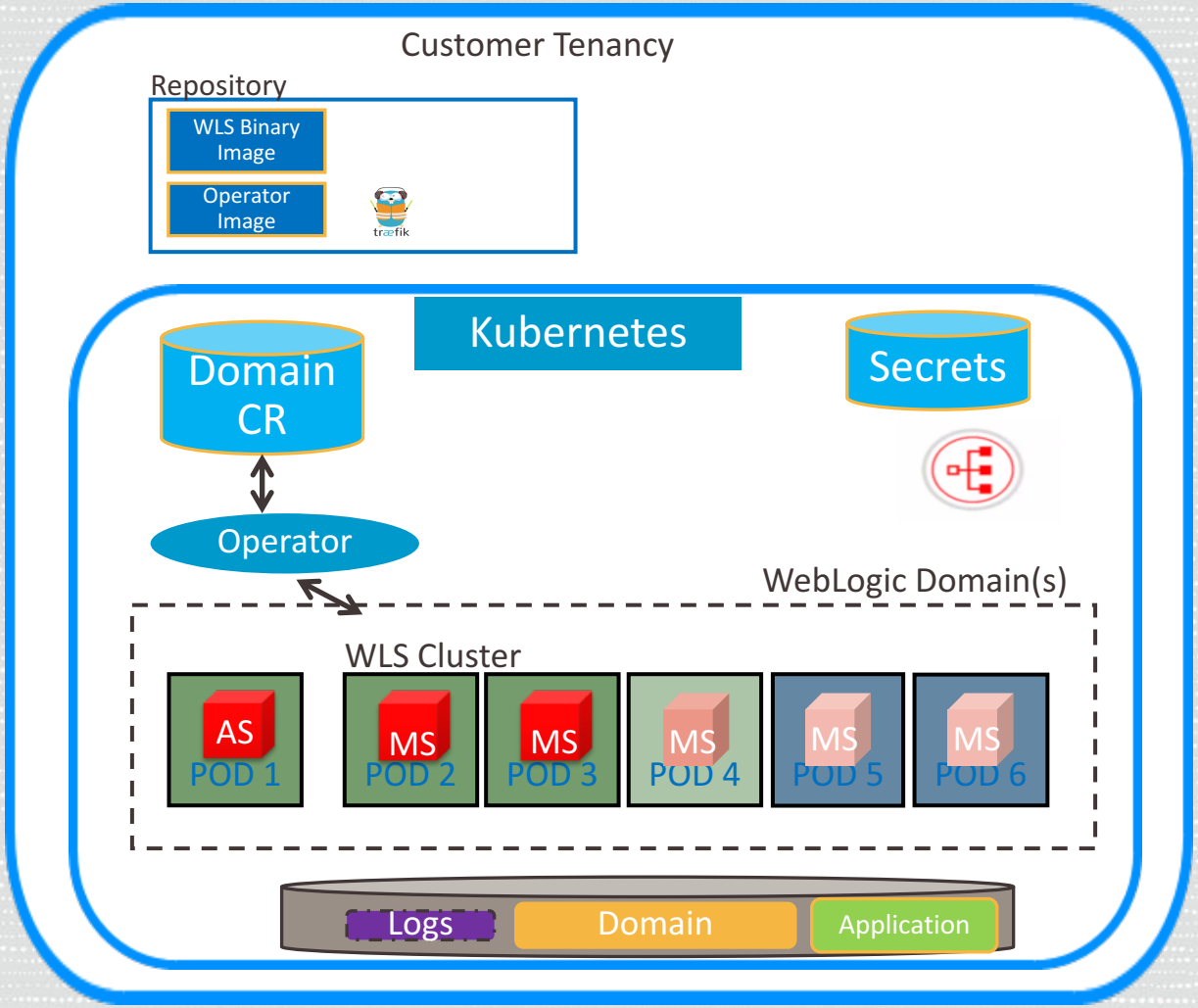
WebLogic Server Domain in Kubernetes

- **WebLogic Domain Image**
  - WebLogic binaries
  - Domain
  - Applications



WebLogic Server Domain in Kubernetes

- **WebLogic install Image**
  - WebLogic binaries
- **PV**
  - Domain
  - Applications



HA and DR in Kubernetes

Assigning WebLogic Pods to Nodes

- Use **Node Selector** to constrain a pod to only be able to run on particular nodes.
- Assign a **label** (*key=value*)to the node:
  kubectl label nodes kubernetes-foo-node-1 weblogic-cluster=true
- Edit the Domain Custom Resource at the domain/cluster/server level and assign *key:value* **nodeSelector**.

Edit Domain CR

```
serverPod:
  nodeSelector:
    weblogic:-cluster true
```

Domain Custom Resource

Inter-Pod Affinity and Anti-Affinity

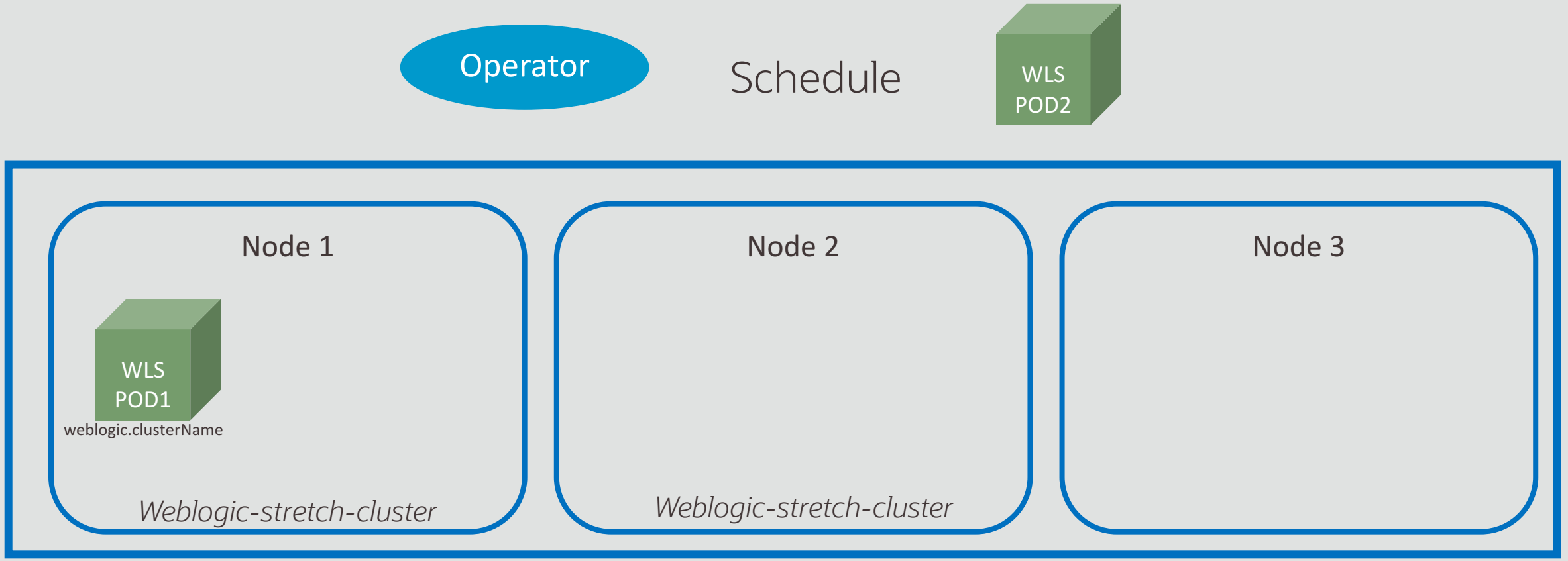
- Which K8s nodes to schedule or re-schedule pods with respect to other WebLogic pods

- Possible types of Node affinity/anti-affinity:
  - Preferred (soft affinity)
  - Required (hard affinity)

- Match labels for Affinity/Anti-affinity
  - Operator: In
  - Operator: Exists
  - Operator: NotIn
  - Operator: DoesNotExist

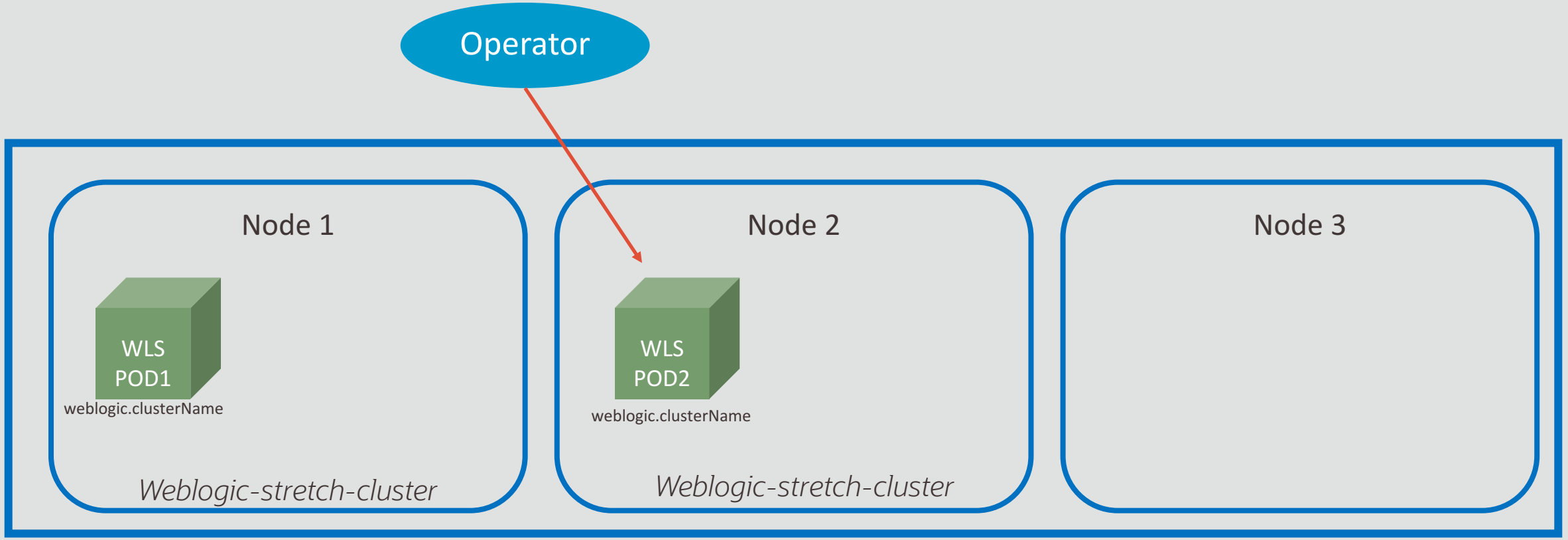
Edit Domain CR

```
serverPod:
   affinity: podAntiAffinity:
      preferredDuringSchedulingIgnoredDuringExecution:
        - labelSelector:
            matchExpressions:
              - key: "weblogic.clusterName"
                operator: In
                values: - cluster-1
          topologyKey: "kubernetes.io/hostname"
```



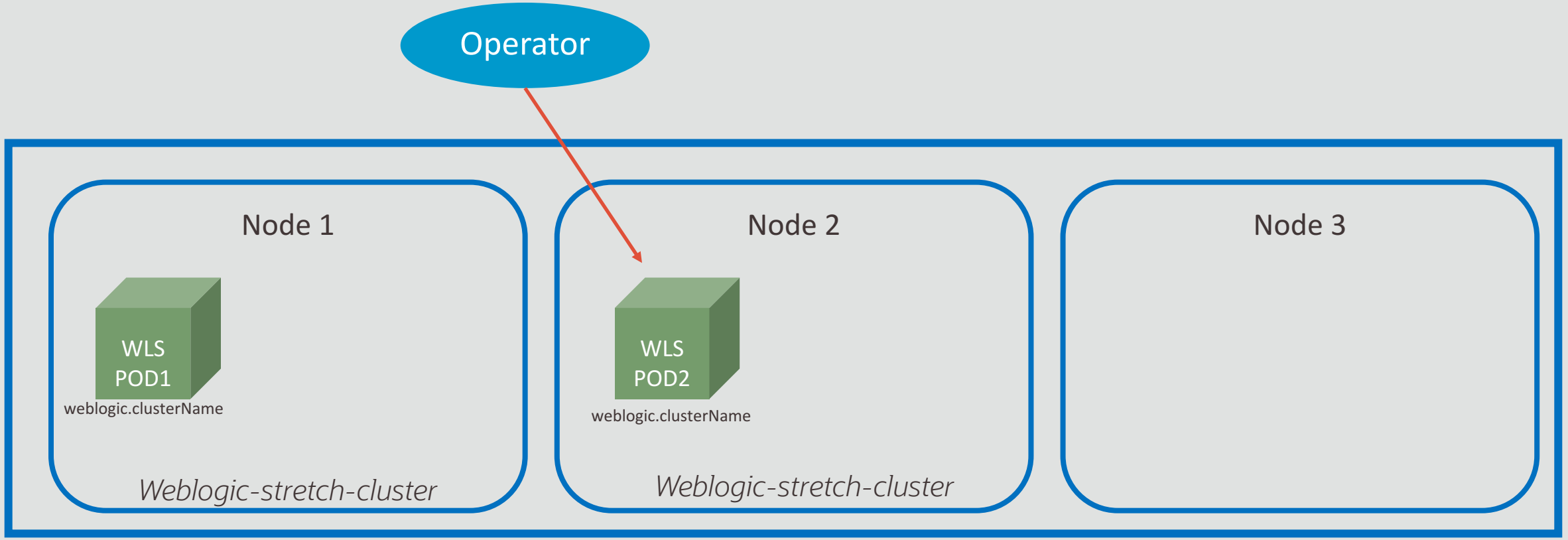

```
nodeSelector:
   weblogic-stretch-cluster: true

affinity: podAntiAffinity:
        preferredDuringSchedulingIgnoredDuringExecution:
          - labelSelector:
              matchExpressions:
                - key: "weblogic.clusterName"
-                     operator: In
```



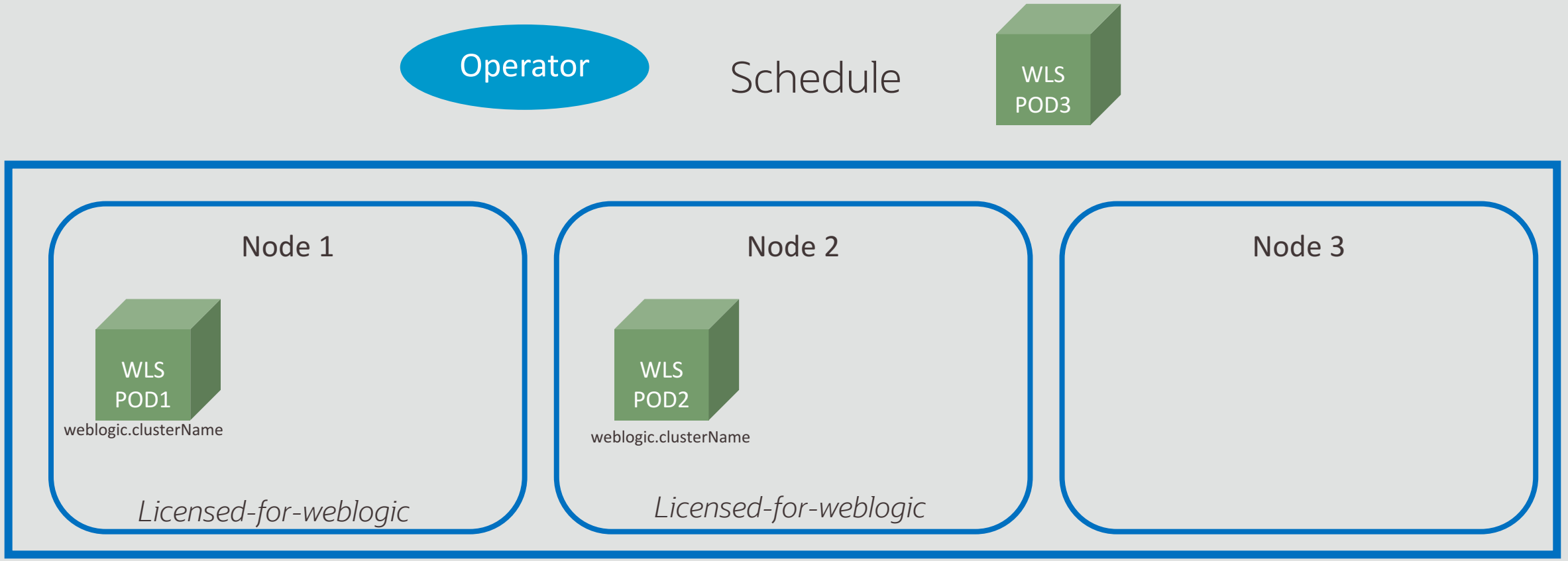

```
nodeSelector:
   weblogic-stretch-cluster: true

affinity: podAntiAffinity:
        preferredDuringSchedulingIgnoredDuringExecution:
          - labelSelector:
              matchExpressions:
                - key: "weblogic.clusterName"
-                     operator: In
```



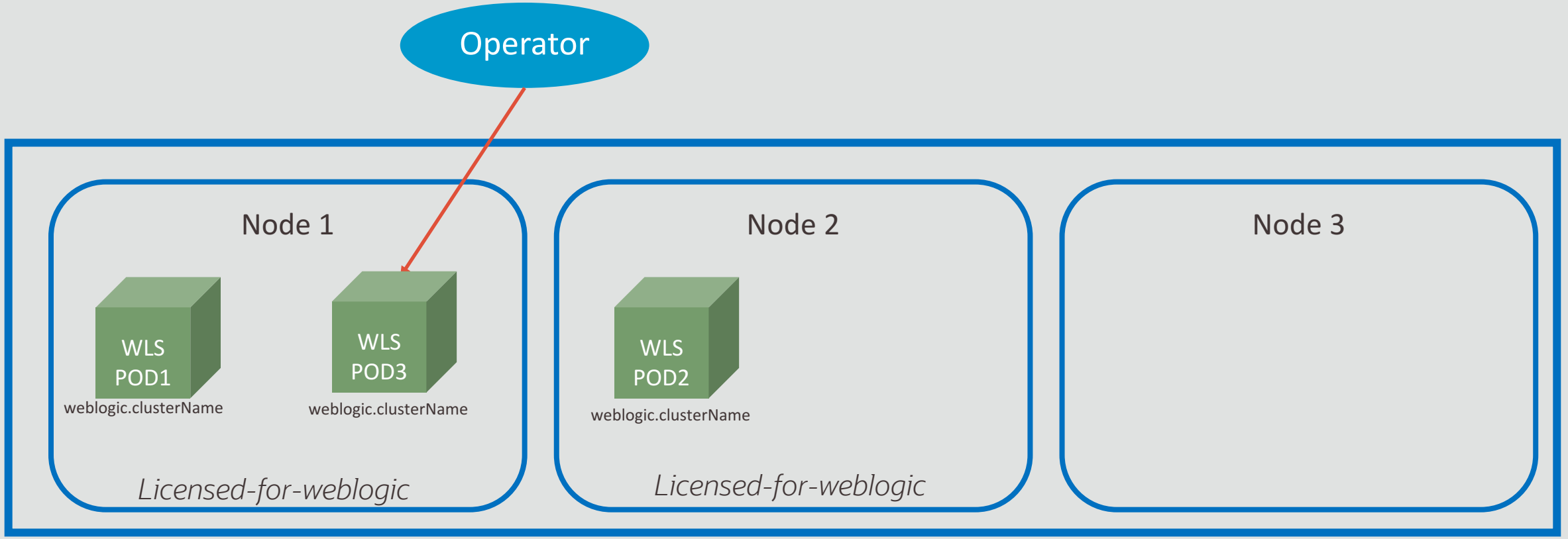

```
nodeSelector:
   weblogic-stretch-cluster: true

affinity: podAntiAffinity:
        preferredDuringSchedulingIgnoredDuringExecution:
          - labelSelector:
              matchExpressions:
                - key: "weblogic.clusterName"
-                     operator: In
```



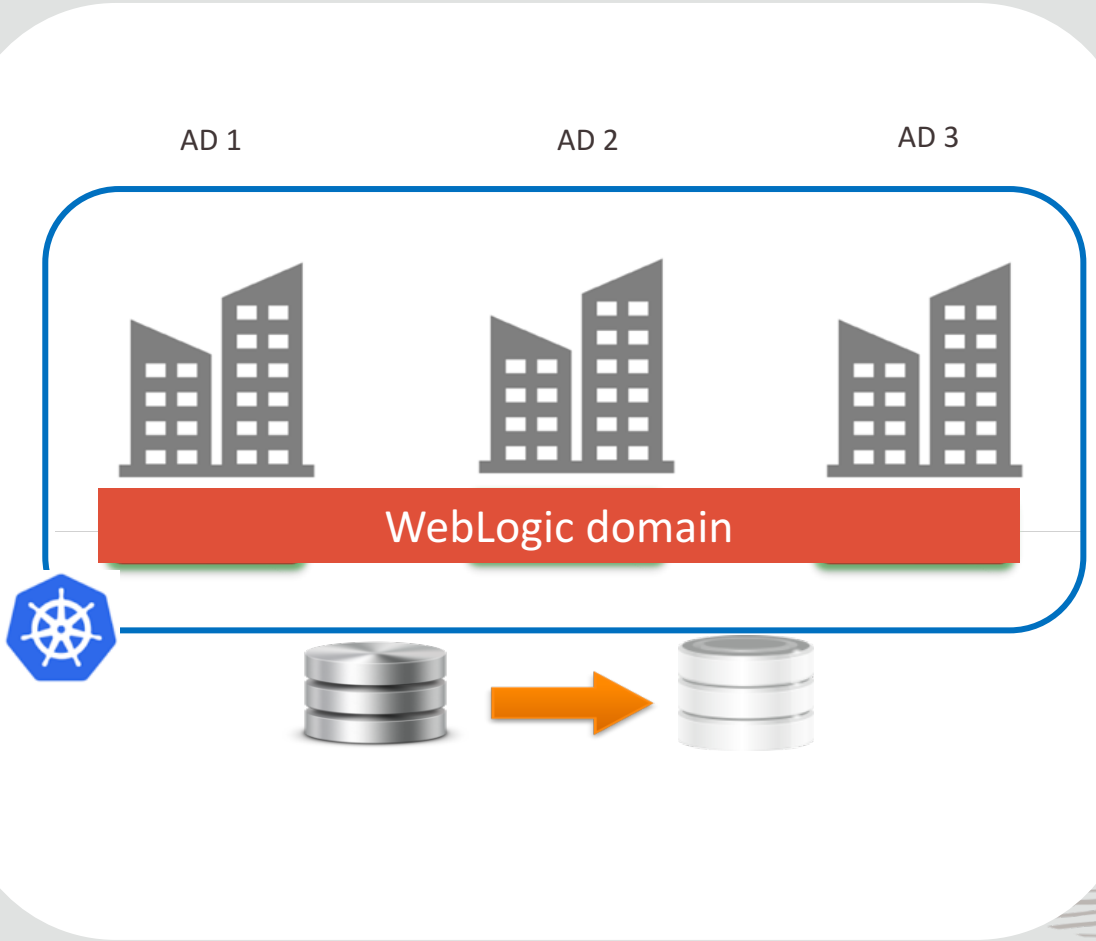

```
nodeSelector:
        licensed-for-weblogic: true

affinity: podAntiAffinity:
        preferredDuringSchedulingIgnoredDuringExecution:
          - labelSelector:
              matchExpressions:
                - key: "weblogic.clusterName"
-                     operator: In
```



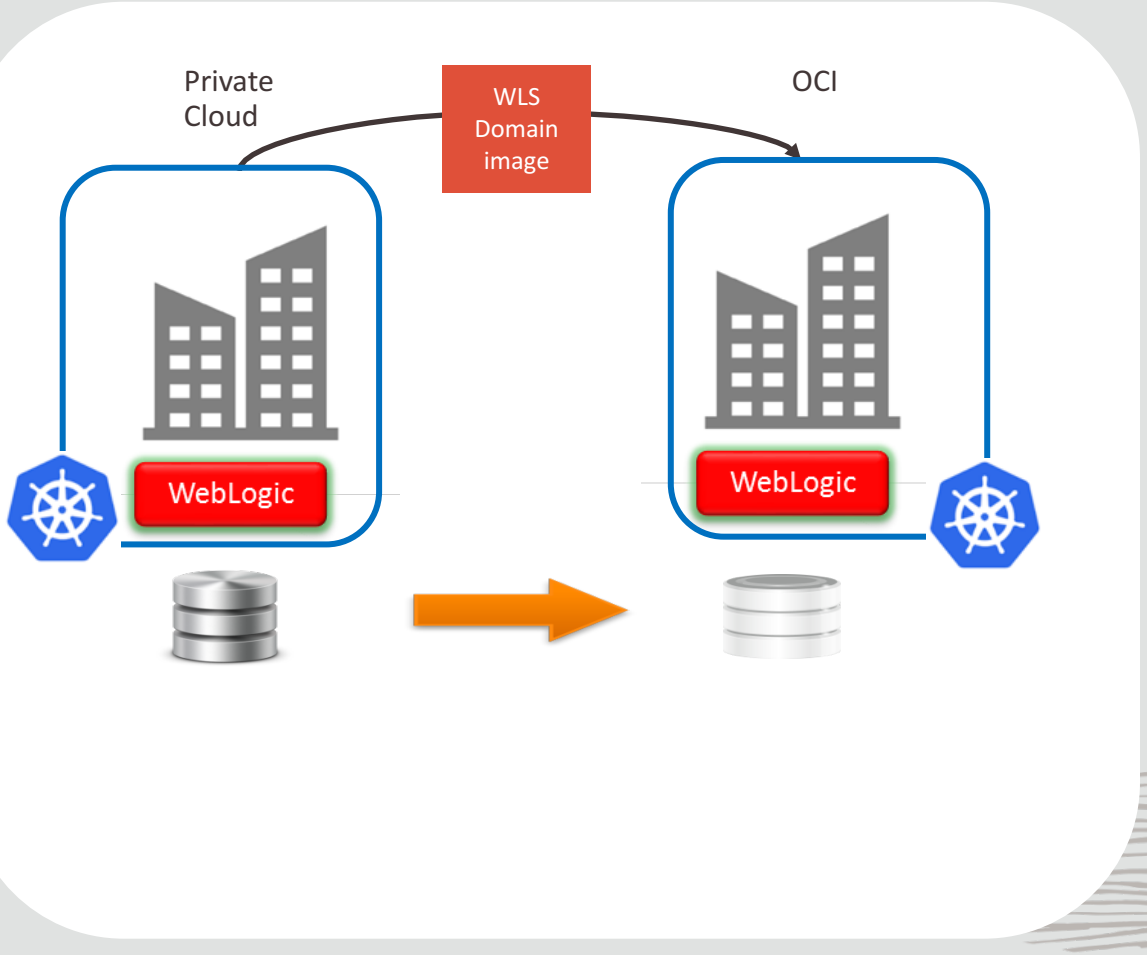

```
nodeSelector:
        licensed-for-weblogic: true

affinity: podAntiAffinity:
        preferredDuringSchedulingIgnoredDuringExecution:
          - labelSelector:
              matchExpressions:
                - key: "weblogic.clusterName"
-                     operator: In
```



WebLogic High Availability on OCI

- WebLogic High Availability across Data Centers with WebLogic Stretch Clusters.
- Span a WebLogic domain across several Availability Domains
- Single Kubernetes Cluster



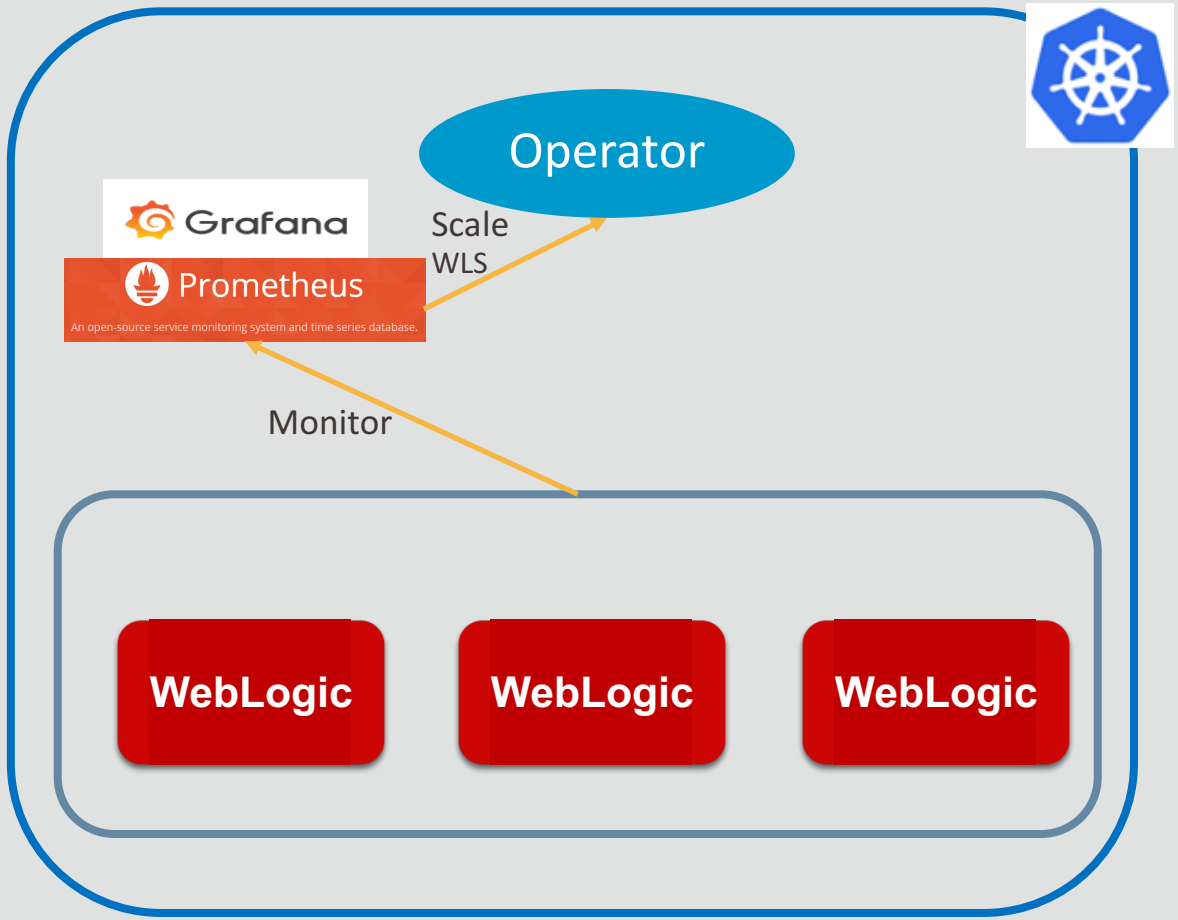
WebLogic Disaster Recovery

- WebLogic DR across Hybrid Environments made easier
- WebLogic domain image contains complete domain configuration
- State needs to be externalized to Database

Tooling

WebLogic Monitoring Exporter

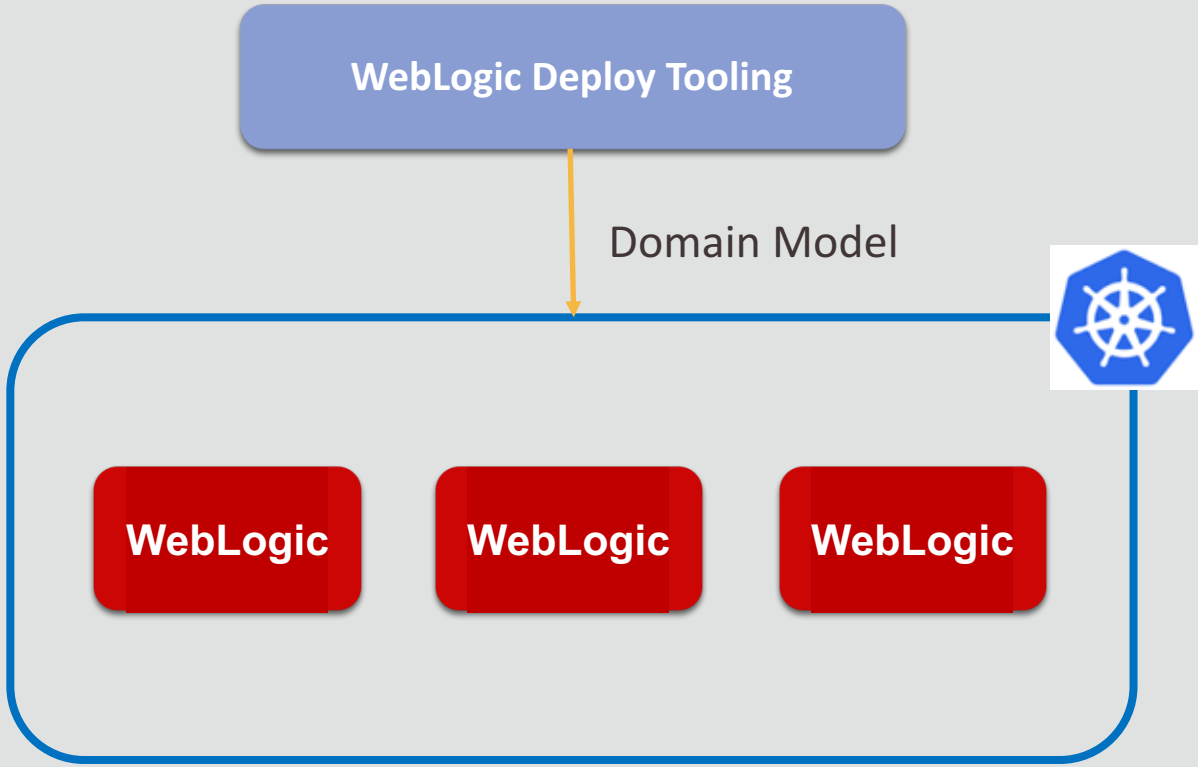
- Monitoring Exporter enables Prometheus monitoring of WebLogic
- Standard monitoring tools can be used for monitoring WebLogic
- Grafana Dashboards used for visualization
- Prometheus **auto-scaling** of WebLogic cluster



Out of the Box Grafana Dashboards

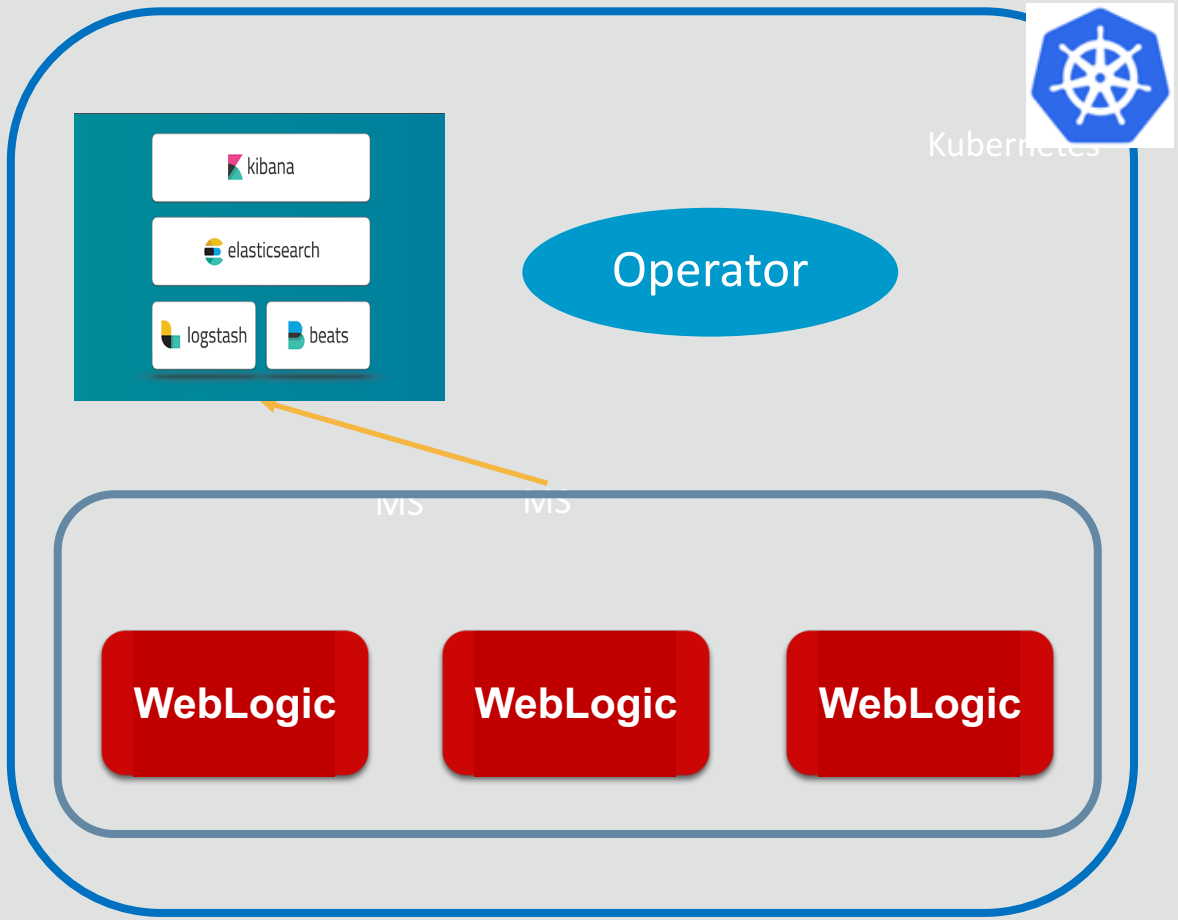
WebLogic Deploy Tooling

- Introspect domains
  - WebLogic 10.3.6, 12.1.3, 12.2.1.X
  - Create a model (yaml) of the domain
  - Migrate existing domains and applications Upgrade (if required) to 12.2.1.X
  - Supports ADF domain introspection
- Customize and Validate configuration to meet Kubernetes requirements.
- Create domains in Docker image
- Deploy Applications
- Modify/remove objects from the Domain configuration

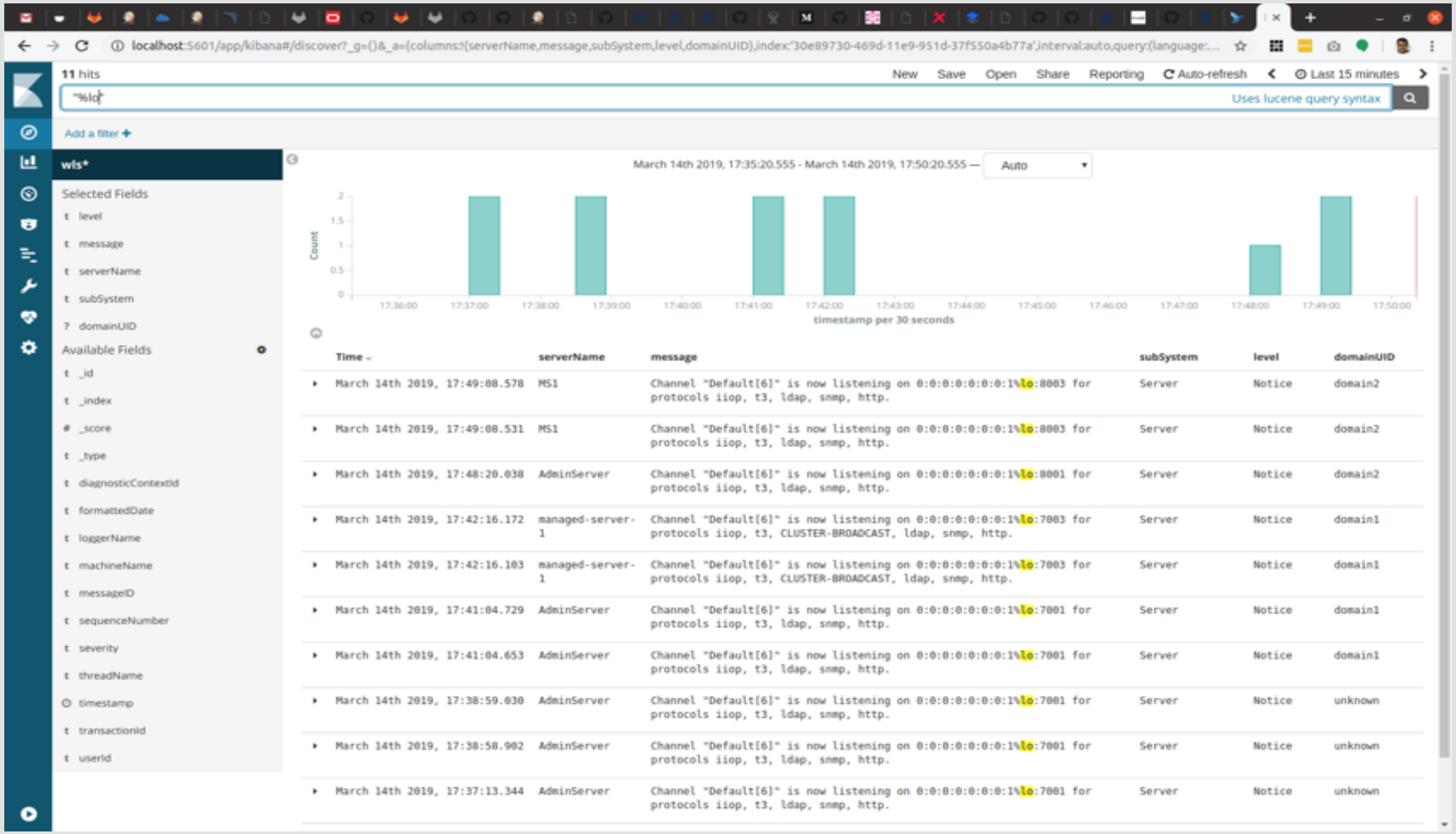


WebLogic Logging Exporter

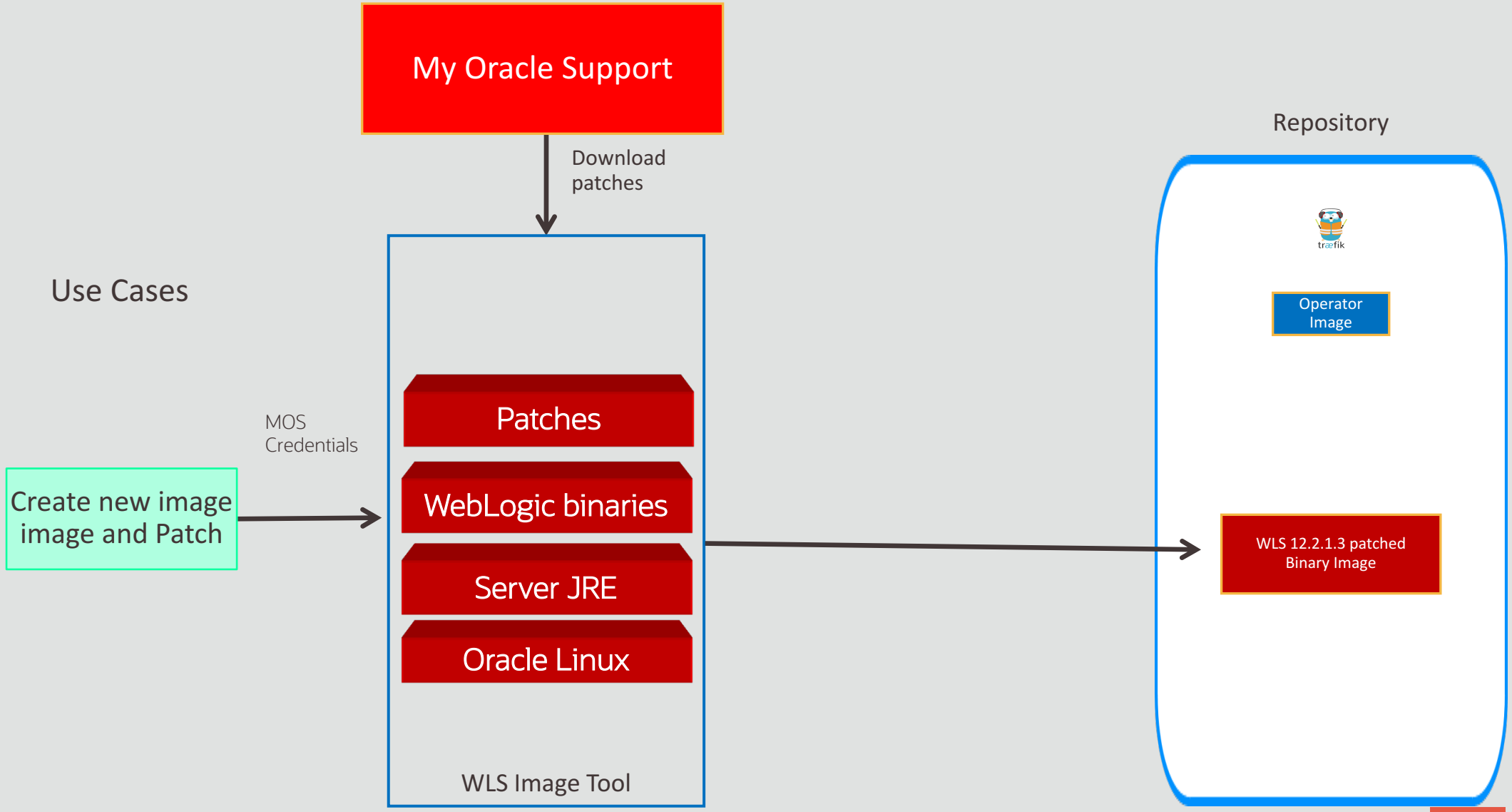
- Logging Exporter enables exporting WebLogic server logs to the Elastic Stack
- Store logs in the Elastic Stack
- Search and analyze logs in Elastichsearch
- Display logs in dashboards in Kibana



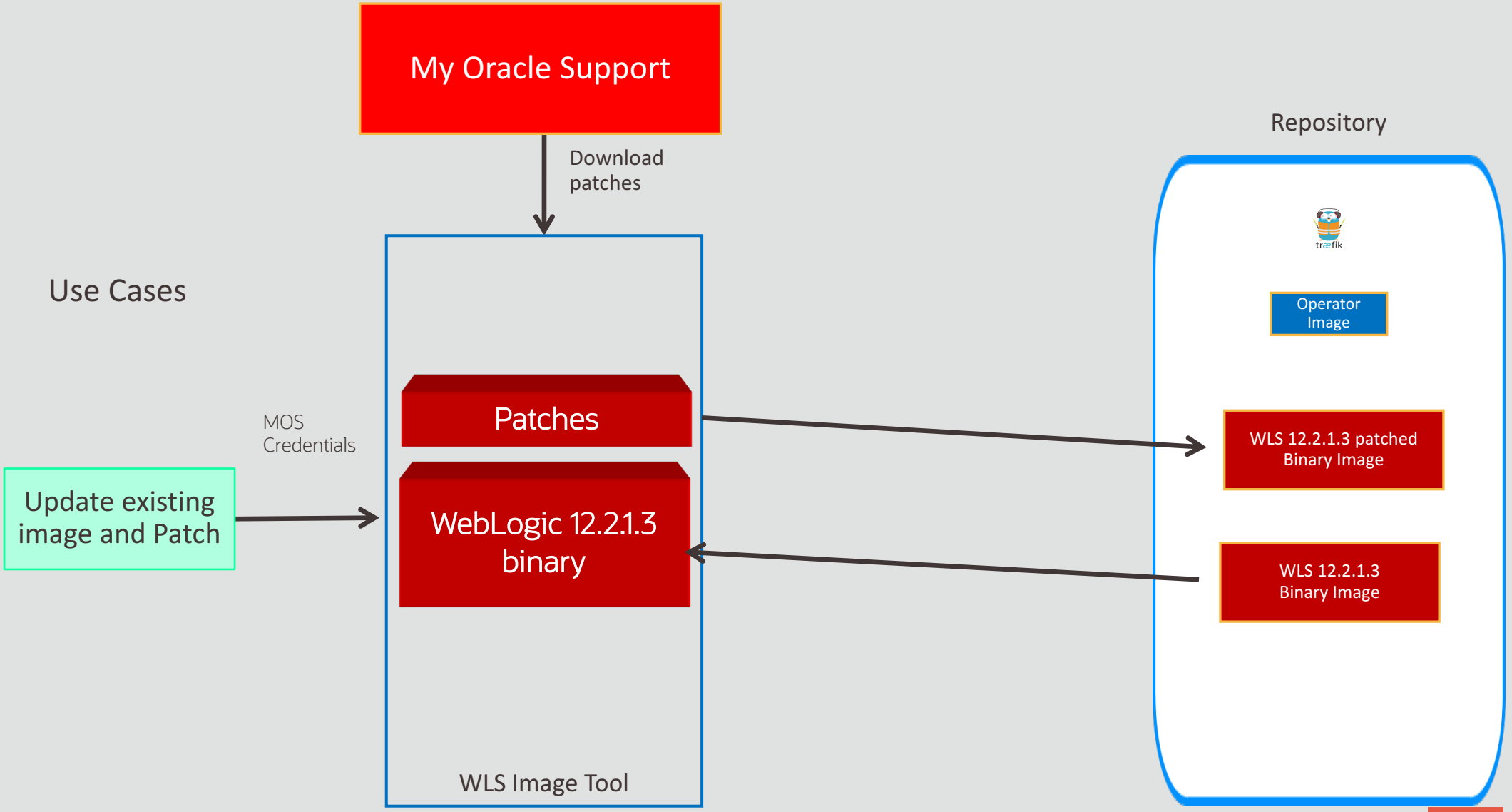
Kibana Dashboards



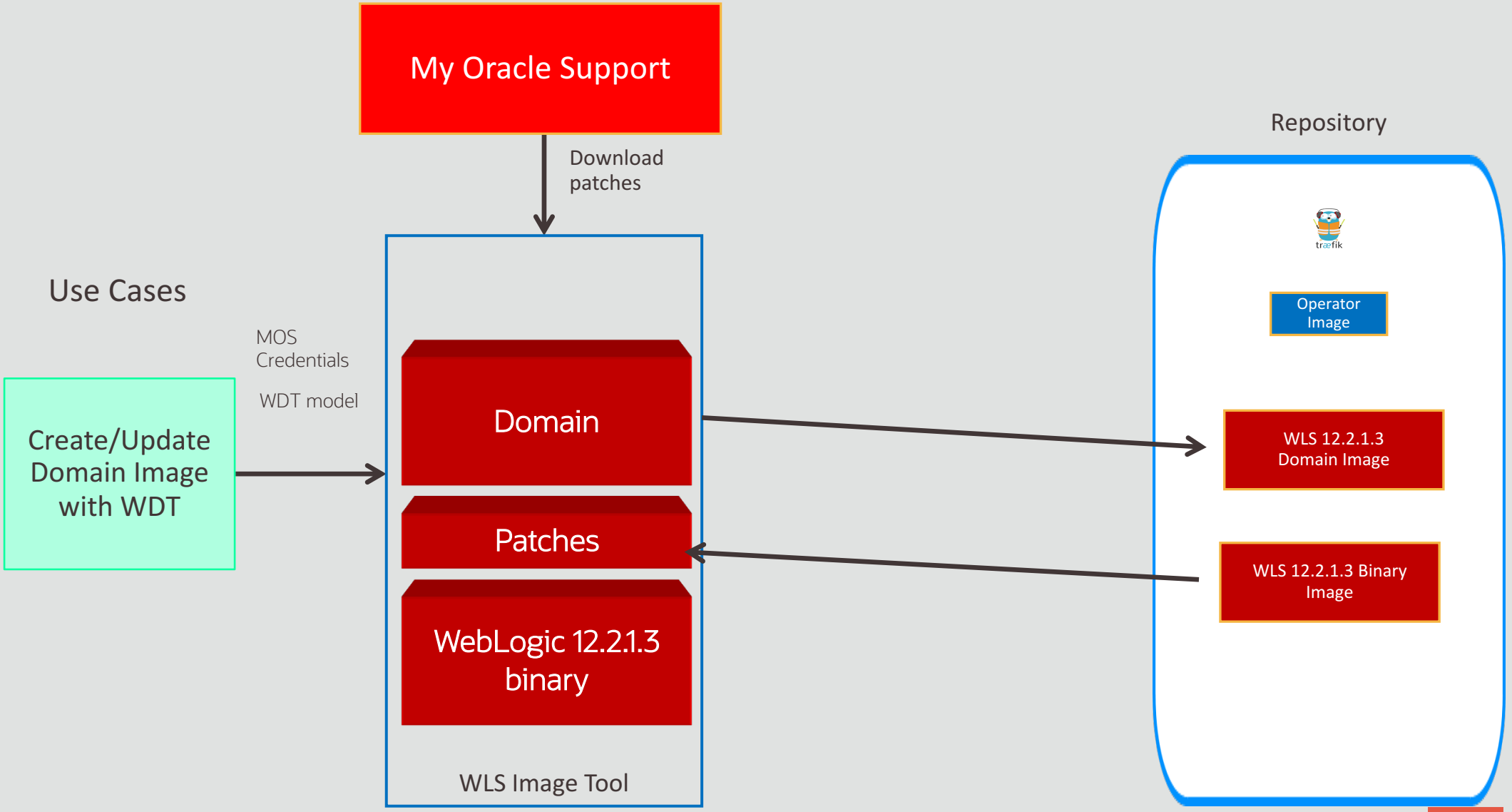
WebLogic Image Tool



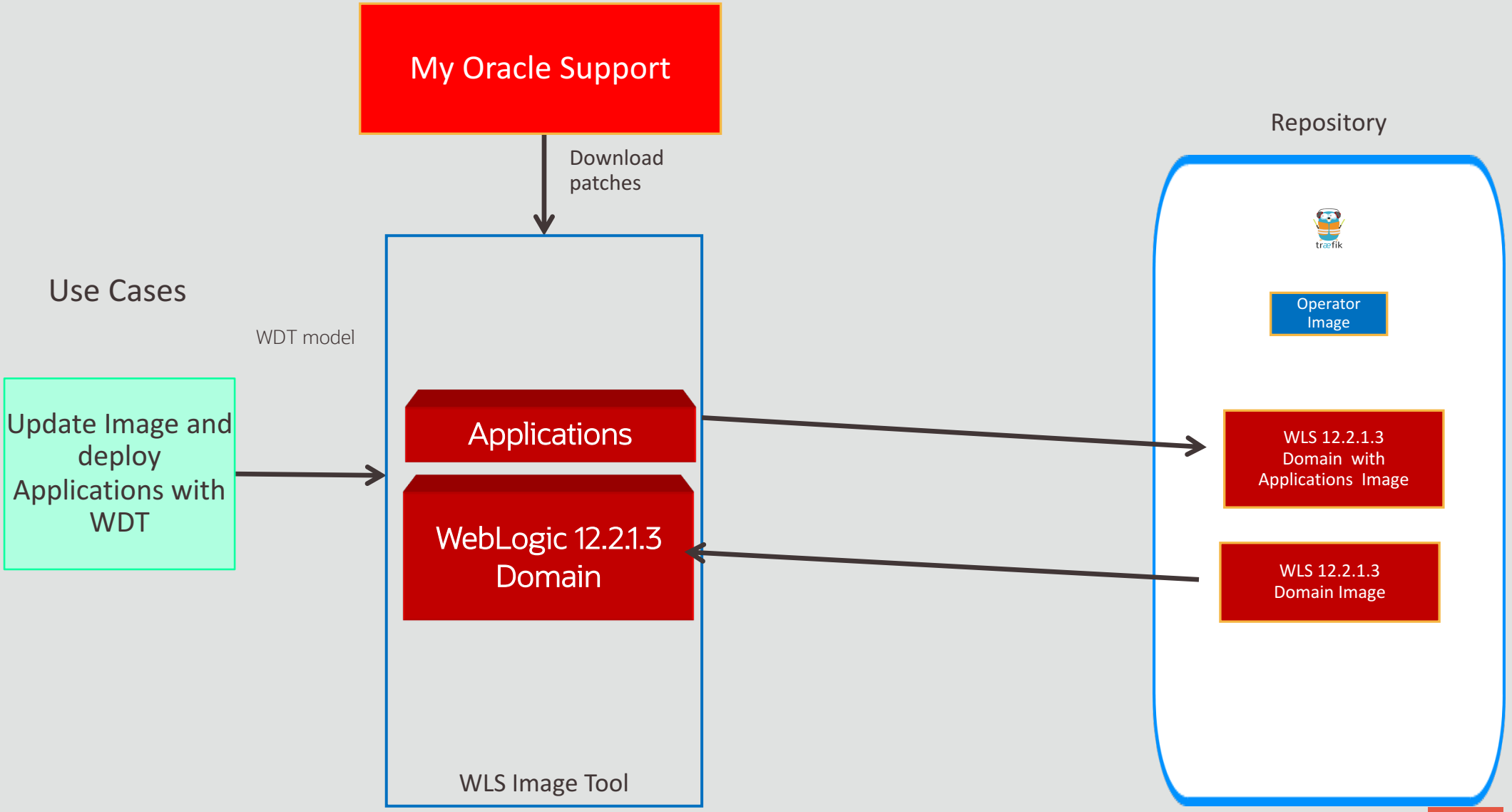
WebLogic Image Tool



WebLogic Image Tool

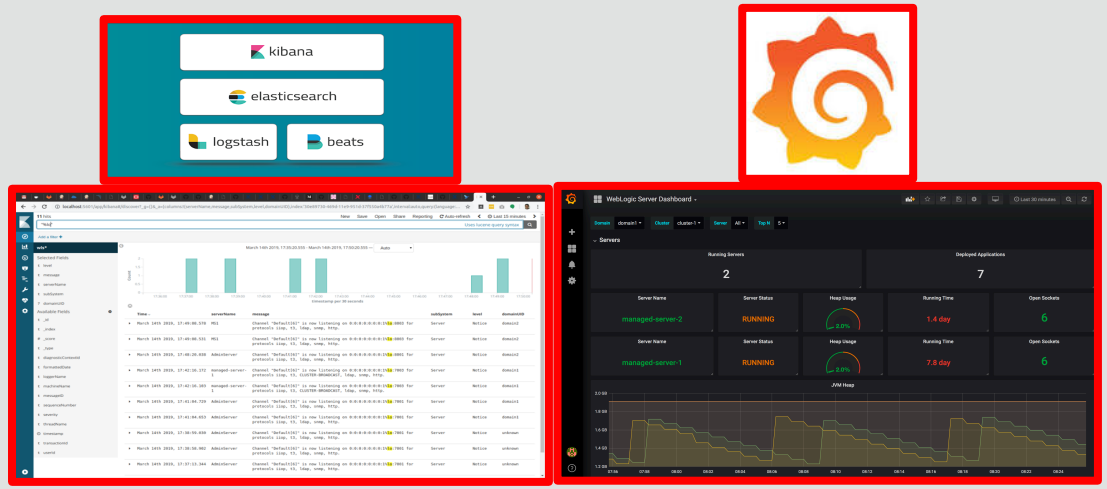


WebLogic Image Tool



CI/CD

Automating WebLogic Deployment
CI/CD with WebLogic Tooling



App v2

WDT model

Trigger: checkin

GitLab, Jenkins, etc.

Image Tool & WDT

Repository

WebLogic domain image

WebLogic domain v2 image

Pull image

Push Image

Step1: Update domain image

Domain.yaml

Step2: Update domain.yaml with new image name

Kubectl apply –f domain.yaml

Step3: Update Domain CR

Domain CR

Operator

Roll the domain

WebLogic Domain

WLS Cluster

AS POD 1

MS POD 2

MS POD 3

Kubernetes Cluster

Antonio Nappi

CERN

CERN openlab

Kubernetes: The Glue between Oracle Cloud and CERN Private Cloud

Oracle OpenWorld 2019

Antonio Nappi

23/10/2018

What is CERN?

European Organization for Nuclear Research

Member States:

Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Israel, Italy, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland and United Kingdom

Associate Members in the Pre-Stage to Membership:

Cyprus, Serbia

Associate Members:

India, Pakistan, Turkey, Ukraine

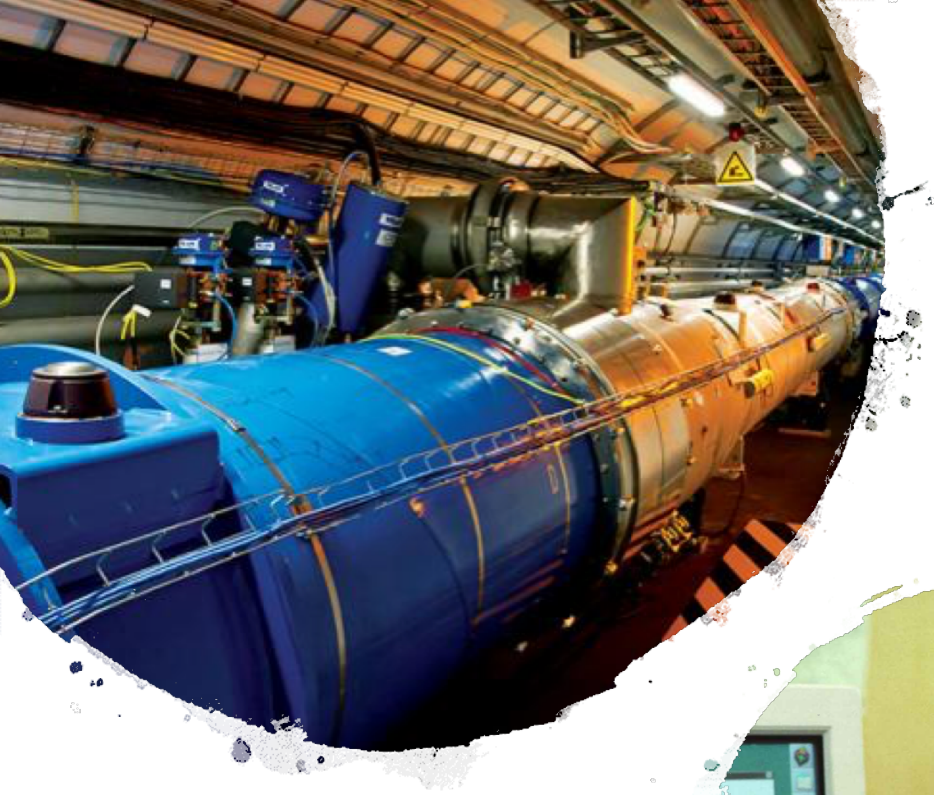
Observers to Council:

Japan, Russia, United States of America, the European Commission, Joint Institute for Nuclear Research and UNESCO

~ 3 000 members of personnel
Users from 100 different countries

Budget ~ 1 100 MCHF per year

FOUNDED IN 1954

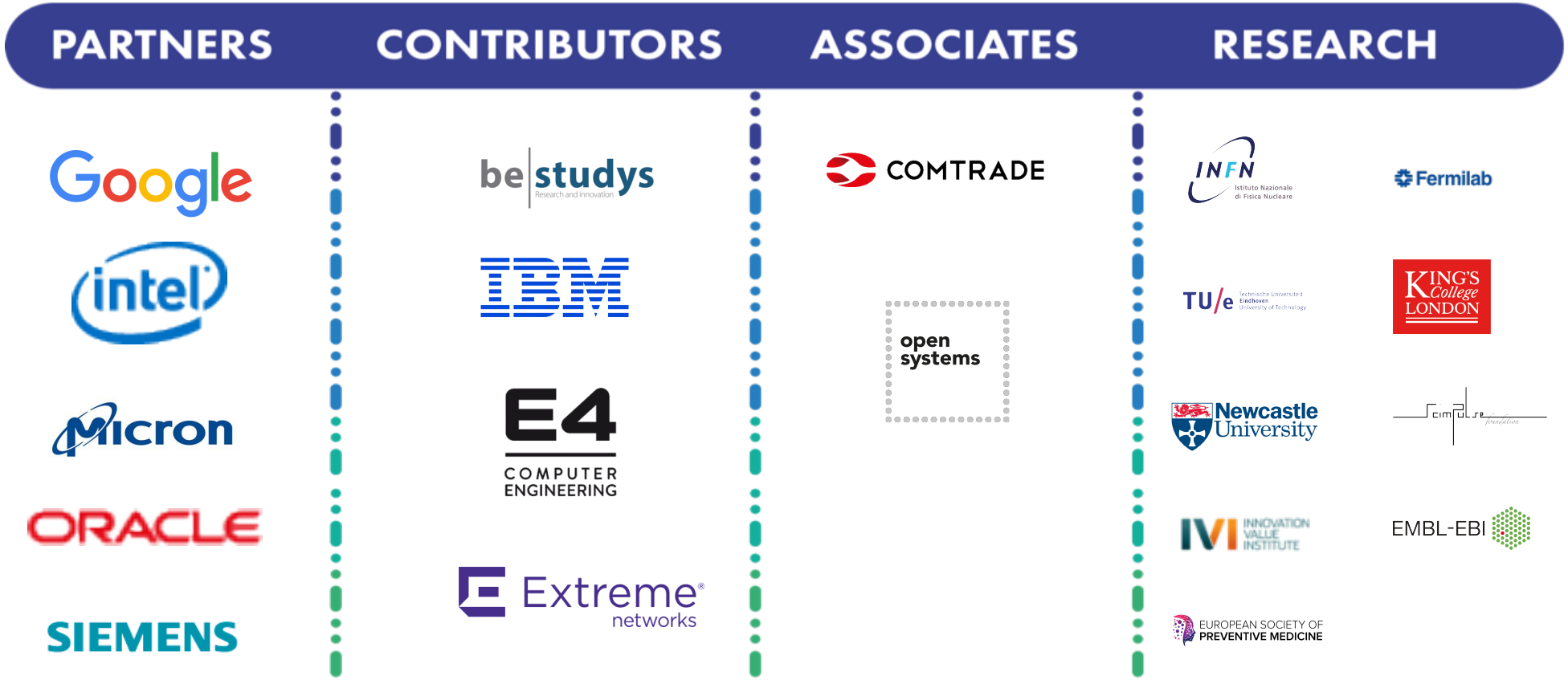


CERN: a unique environment

- **Study fundamental particles**
  - How they interact
  - Understand the fundamental laws of nature
- **Large Hadron Collider (LHC)**
  - Largest particle collider in the world
  - 27 km in circumference
  - Thousand of magnets
  - Collaboration with over 10000 scientists
- **Place where the Web was born**
- **Science for peace**
  - Melting pot

Openlab

A public-private partnership between the research community and industry



WebLogic at CERN

WebLogic 12.1.3 in production

- ~ 350 Clusters
- ~ 100 Applications
  - DEV / TEST / PREPROD / PROD
- Web Profile application Stateful
  - No Java Message Service
  - No Enterprise JavaBeans
- Users
  - Engineers
  - Administration
  - IT

WebLogic on Kubernetes at CERN

WebLogic on Kubernetes

- Different versions
  - 12.1.3
  - 12.2.1
- ~ 30 deployment
  - Across DEV/TEST/PREPROD
- 1 application prod

Why Kubernetes

Immutable
- Versioning
- Easier to track

Portable
- On Premise
- Public Cloud
- Disaster Recovery Plan easier

High Availability
- Auto-Healing

Fast Provisioning

Constraints

Transparent for developers

Replicate VM model

Logging

Monitoring

Use what CERN provides

OpenStack Private Cloud

https://www.saba.com/uk/blog/how-to-master-employee-engagement-constraints

Challenges

Habits

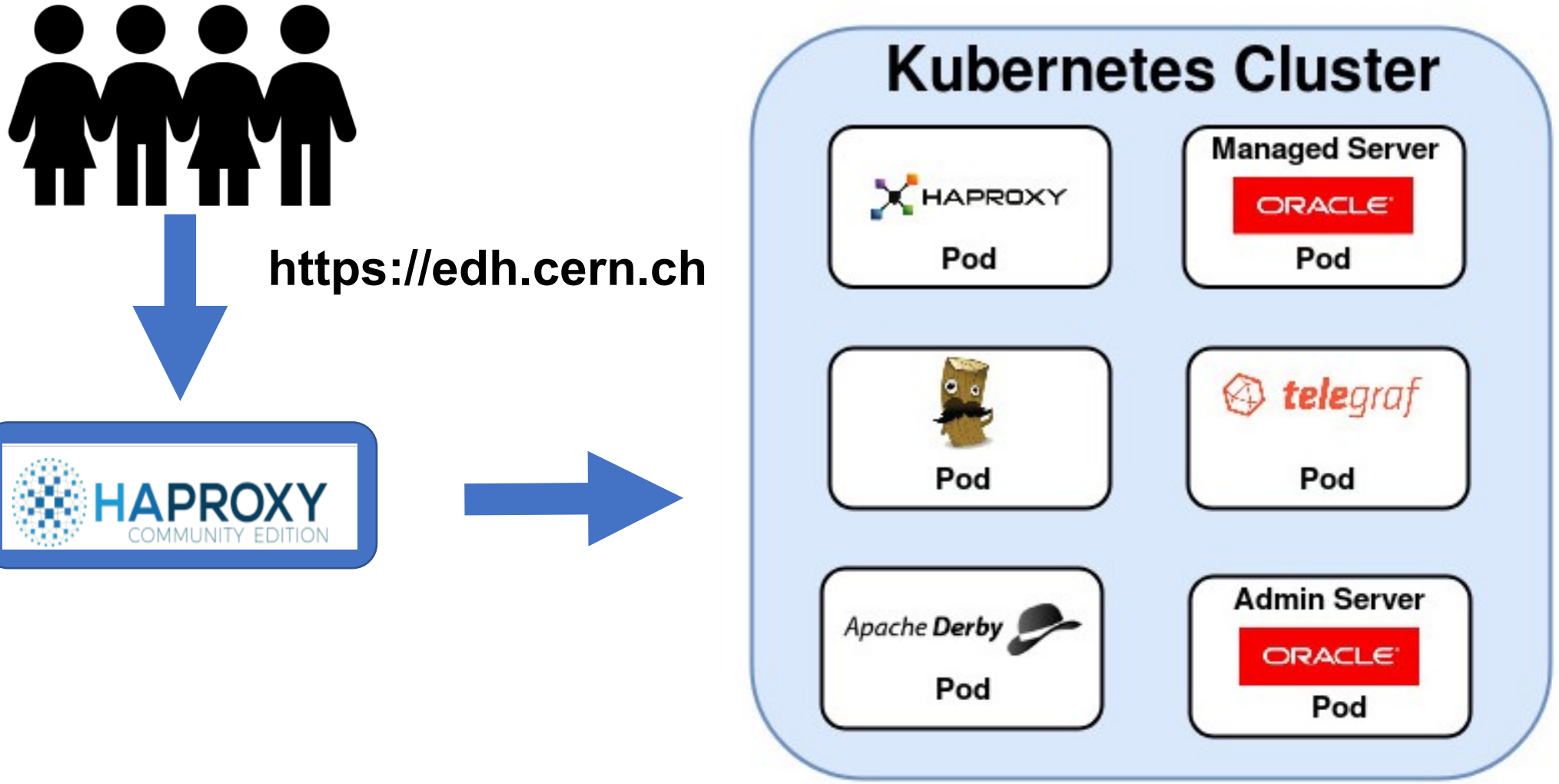
- SSH
- Transaction is slow
- People don’t trust
  - Took many months to try it
    - They are pushing to move

Technical

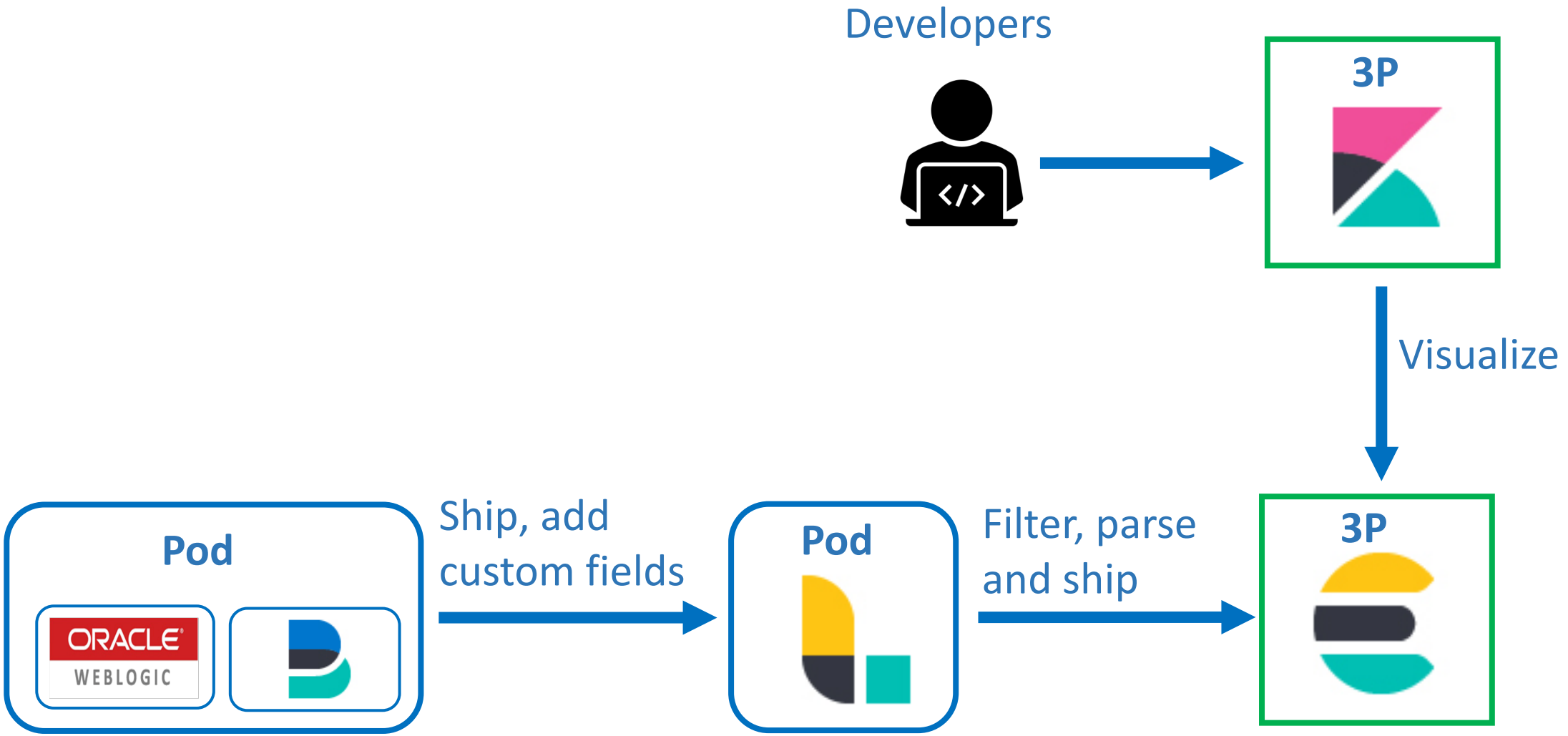
- Legacy Application
  - No session replication
  - Rely on IPs
- Secrets
  - Passwords
  - Certificates

https://hackernoon.com/13-major-challenges-faced-while-building-a-community-experts-roundup-e3a59aa28fbf

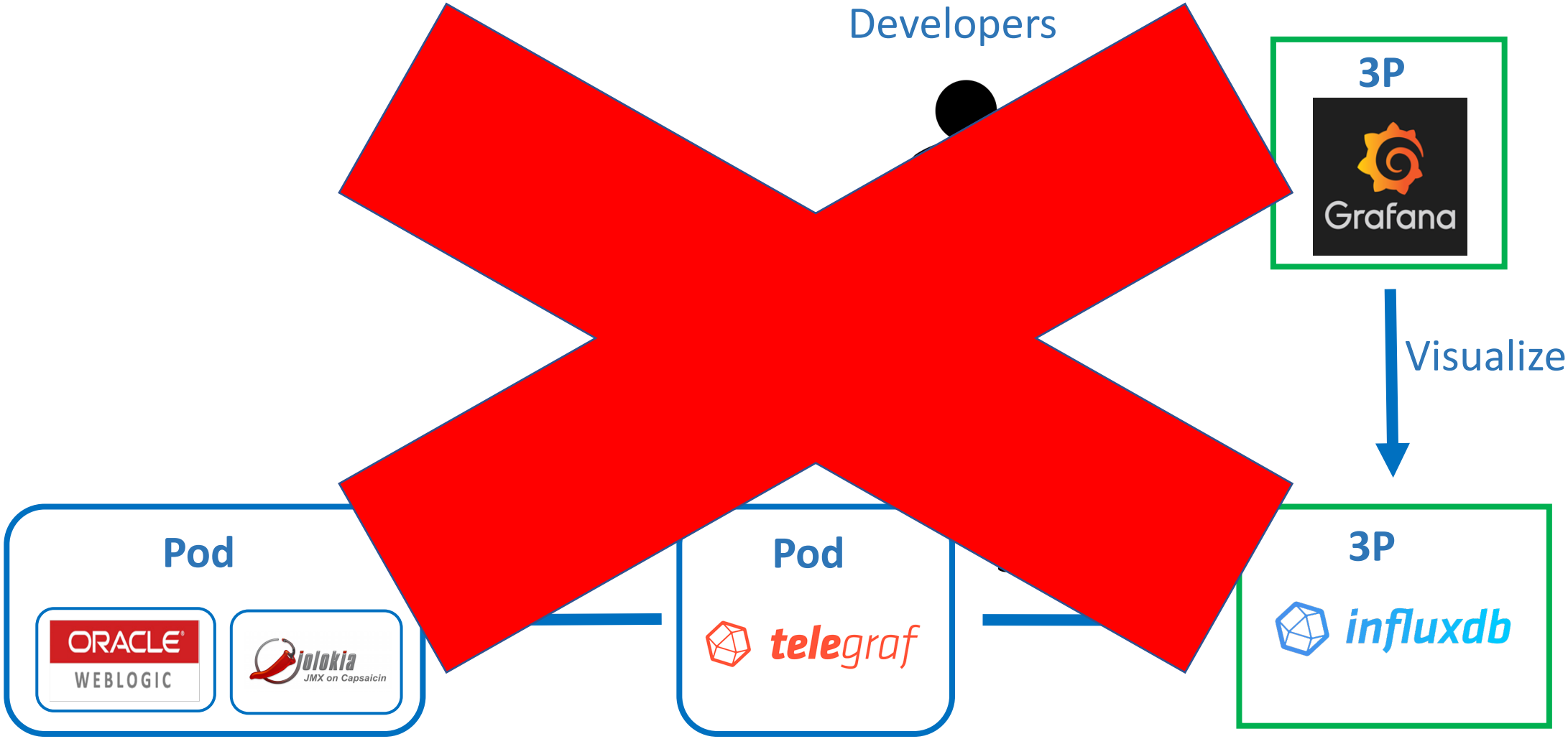
Architecture



Logging

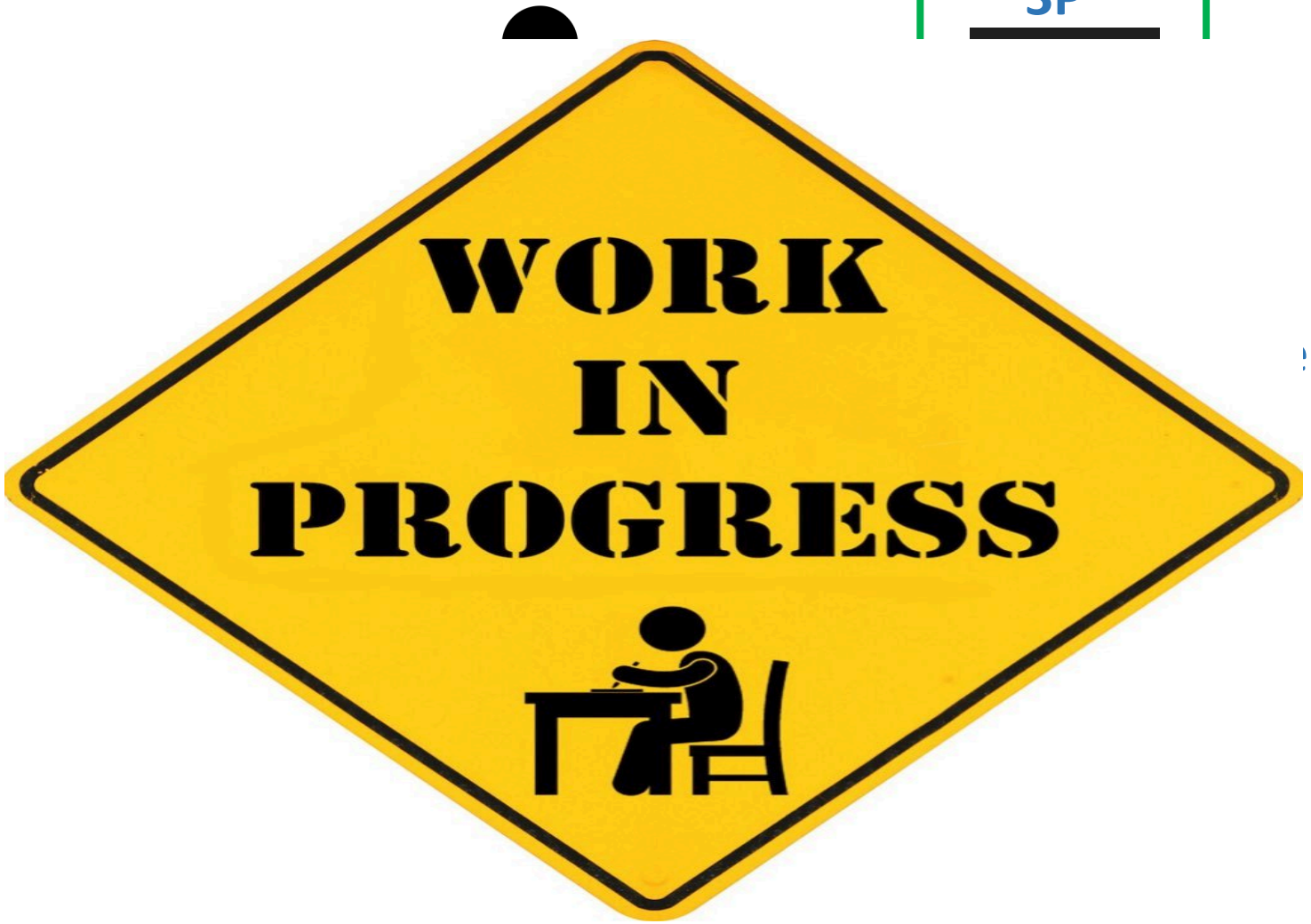

Developers
3P
Visualize
Pod
ORACLE
WEBLOGIC
Ship, add
custom fields
Pod
Filter, parse
and ship
3P

Metrics


Developers
3P
Grafana
Visualize
Pod
ORACLE
WEBLOGIC
jolokia
JMX on Capsaicin
Pod
telegraf
3P
influxdb

Metrics

Developers



Disaster Recovery Plan: Why

Not easy to define Disaster Recovery Plan for VMs

- Many dependencies on internal services

Wigner move out

- Historical backup datacenter for CERN
- Find an alternative

Kubernetes opens new doors

- Standardization of deployment
- Portability

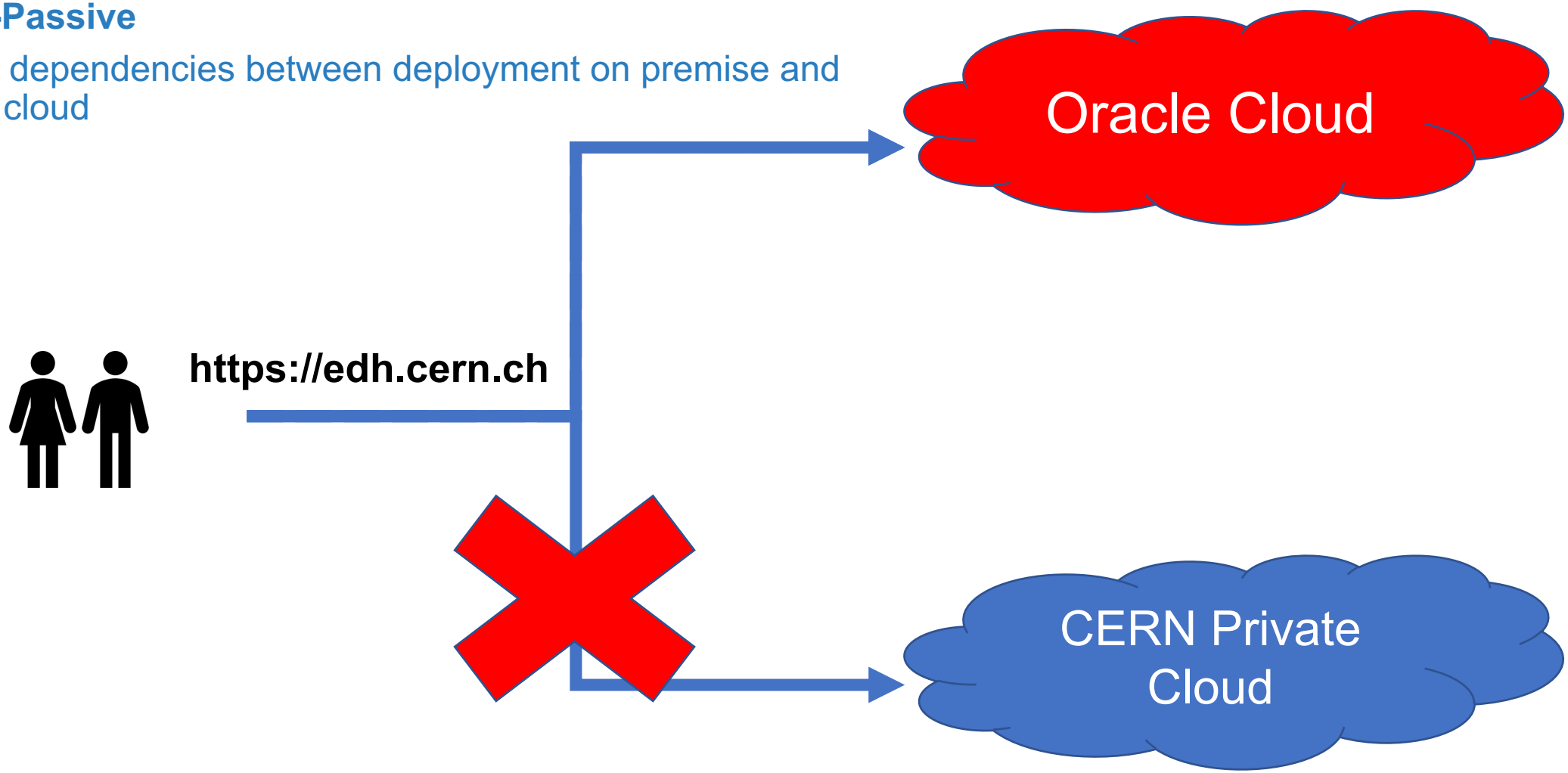
Accounting

- Help us to quantify our service
- Which level of SLA we can guaranty.

Disaster Recovery Plan: How

Active-Passive

No dependencies between deployment on premise and on cloud



Disaster Recovery Plan: How

Summer Student Project

- Automatize and simplify the deployment of Infrastructure
  - Terraform modules
    - ElasticSearch
    - InfluxDB
    - Grafana
    - Kubernetes Clusters
- Cloud agnostic deployment

Credit: Priyanshu Khandelwal

Disaster Recovery Plan: Challenges

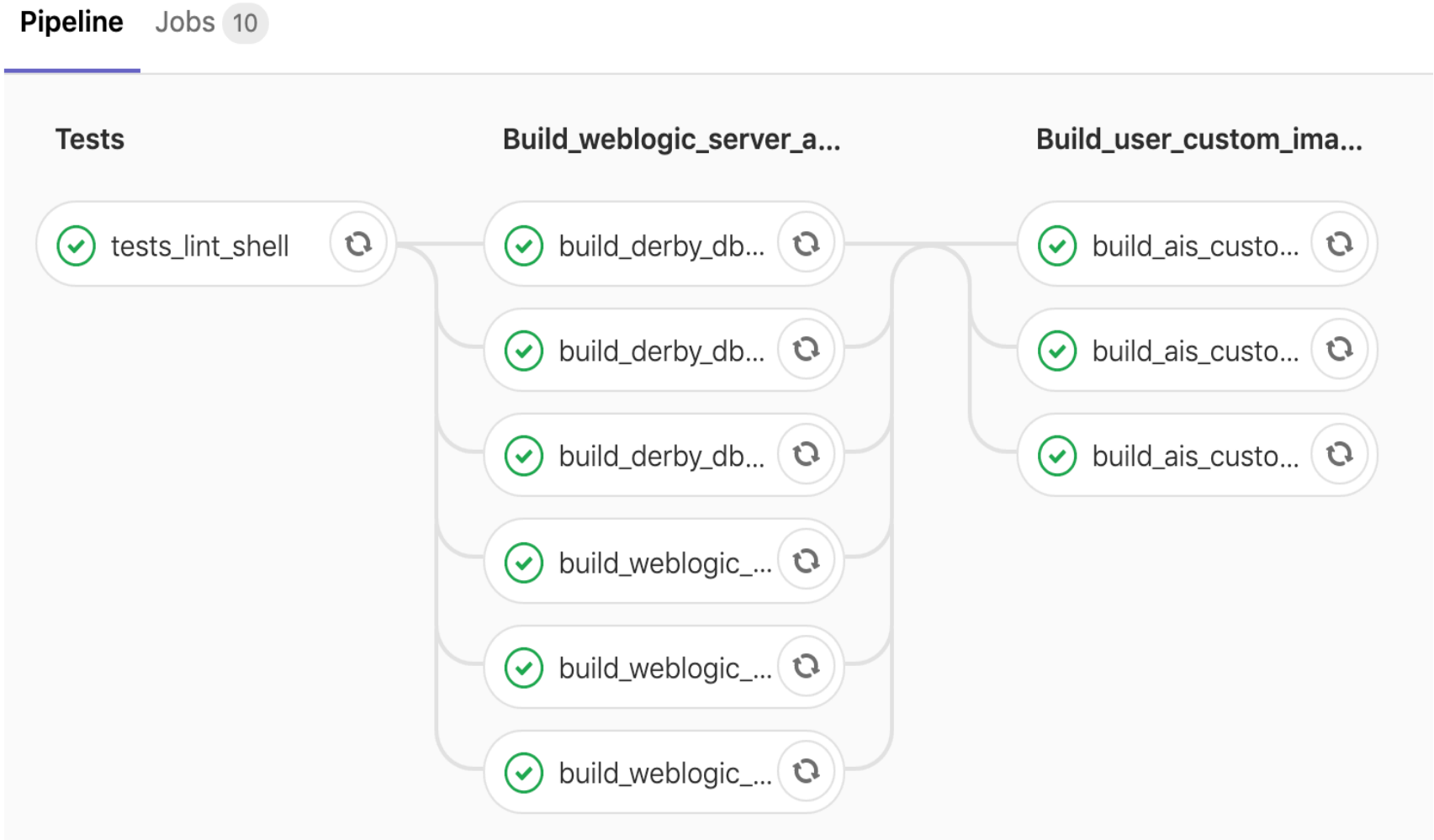
NFS and Database

- Database Syncro
- File synchronizat
- Configuration Da
- Dedicated ne

Pipeline building

- Deployment
- Images building

Resolve hostname



Collaboration with Oracle

Testing different opensource products

- WebLogic Kubernetes Operator
- WebLogic Deploy Tooling
- WebLogic Image Tool

WebLogic Kubernetes Operator

Pros

- Opensource!!
- Way to do it
  - Operator
  - Custom Resource Definition
- Use of deploy tooling
  - Extremely fast
  - Simpler

Cons

- No support for old version

WebLogic Deploy Tooling

Faster

Decreases sensitively our configuration time

Domain config in YAML file.

Easy to represent

Configuration at runtime

Increase dynamicity and flexibility

Works with different WebLogic versions

12.1.3

WebLogic Image Tool

Faster

Avoid to build our own rpms

Easier

just two commands

Possibility to base WLS images on custom ones

Not integrated yet

Some requirements were missing but they are met with latest version

Credit: Lukas Gedvilas

Conclusions

Happy of the migration

- Not easy

Kubernetes standard de facto

- Portable
- No vendor lock-in

Open-source tools

QUESTIONS?

antonio.nappi@cern.ch

Safe Harbor

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Thank You

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