

**DARWIN IT-PROFESSIONALS**  
IT Driven Evolution

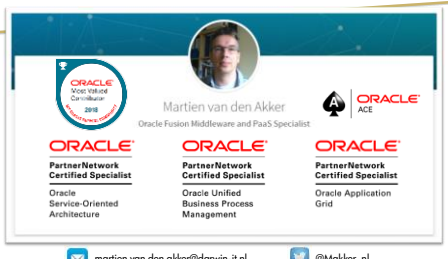


## The Kubernetes WebLogic Revival

Martien van den Akker  
Frank Brink  
2019

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## Who I am



Martien van den Akker  
Oracle Fusion Middleware and PaaS Specialist

**ORACLE** 2018  
WebLogic Contributor

**ORACLE**  
PartnerNetwork Certified Specialist  
Oracle Service-Oriented Architecture

**ORACLE**  
PartnerNetwork Certified Specialist  
Oracle Unified Business Process Management


**ORACLE**  
PartnerNetwork Certified Specialist  
Oracle Application Grid

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## Who Frank Brink is



- Senior Cloud Consultant
- Certified Oracle Cloud Infrastructure 2018 Architect Associate
- Oracle Middleware specialist

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### WHAT IS WEBLOGIC 12C?

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## JEE/Jakarta EE

- Java Enterprise Edition – Jakarta Enterprise Edition
  - Set of specifications on top of Java SE
  - API's and Frameworks such as
    - JDBC Datasources
    - JNDI (Java Naming Directory Interface)
    - JMS (Java Messaging Service)
    - WebServices/REST Services
    - Servlets/Java Server Pages/Java Server Faces
- Reference: GlassFish Server OS, JEE 8 fully certified

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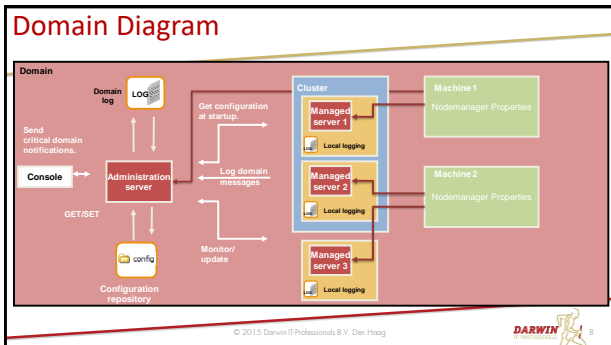
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## Weblogic

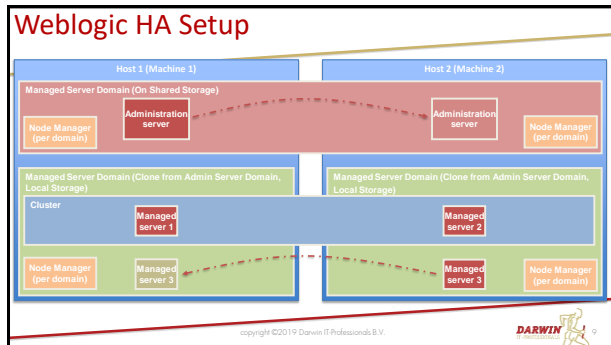
- Fully supports JEE 7 as of 12.2.1, JEE 8 as of 14.1
- Commercial App Server, by BEA Systems
- Acquired by Oracle in 2008
- Strategic Application Server, replacing OC4J
  - (Oracle has 3 JEE AppServers...)
- Very rich support for (amongst others)
  - Clustering
  - High Availability
  - Diagnostics and Monitoring
  - JDBC
  - JMS
  - REST & SOAP

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- ### Weblogic Clustering
- Share resources (Deployments, Datasources, JMS)
  - Supports Service Migration and Whole Server Migration
  - 12c+:
    - Dynamic Clustering, based on Server templates, supports scale up, scale down
    - Simpler JMS Configuration, based on Dynamic Clusters
    - Chooses MS as Cluster Master to control cluster member health
  - Declarative configuration
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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
- 
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- ### 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
- 
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## WebLogic 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](#)

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## 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.

Domain Custom Resource

- Meta Data:** Name of Resource, Namespace, Labels, ...
- Admin Server:** Node Ports to expose, Volumes, ...
- Cluster:** Number of Replicas (Managed Servers), ...
- Domain:** Image to base the Domain containers, Domain in PV or in Image, K8S secrets, Logs to pod
- Managed Servers:** non-clustered MS
- Server Pod:** Java Options, Start Policy (Lifecycle control)
- Events:**

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## 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.

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## 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>

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### DEPLOY WEBLOGIC IN KUBERNETES

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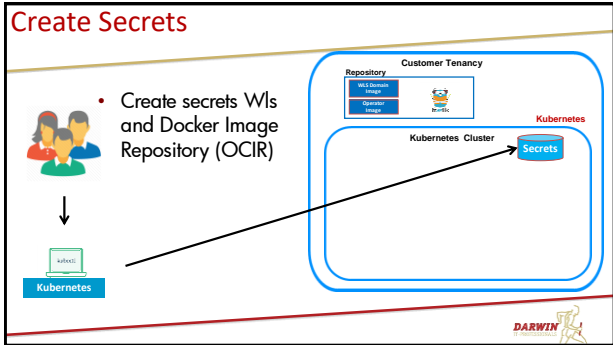
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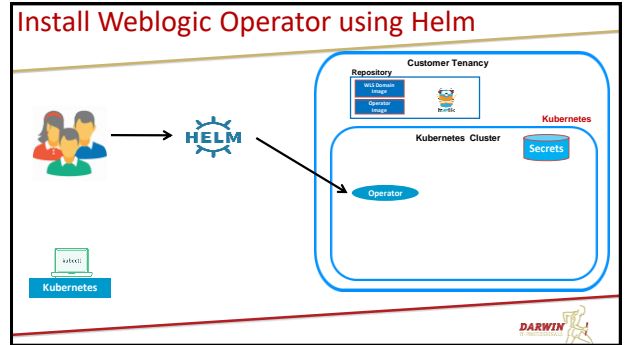
## WebLogic Domain in Kubernetes Operator

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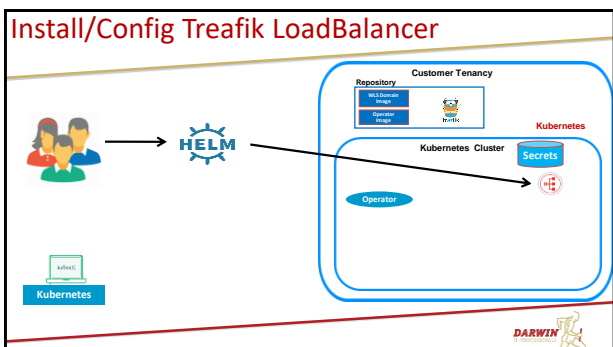
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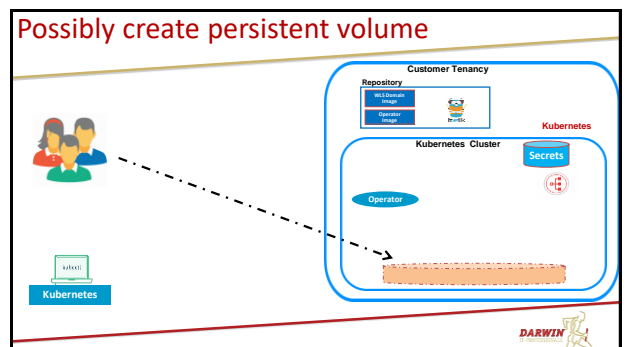
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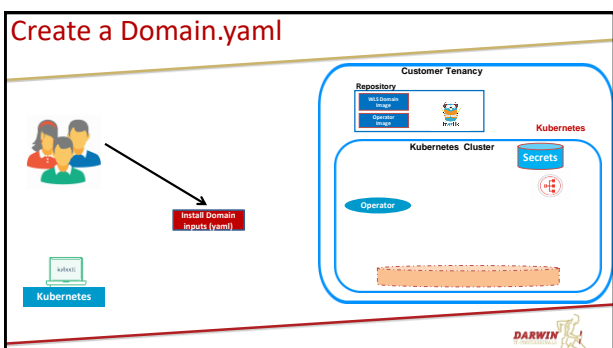
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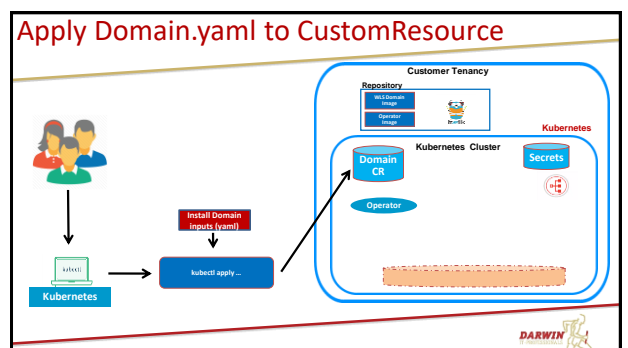
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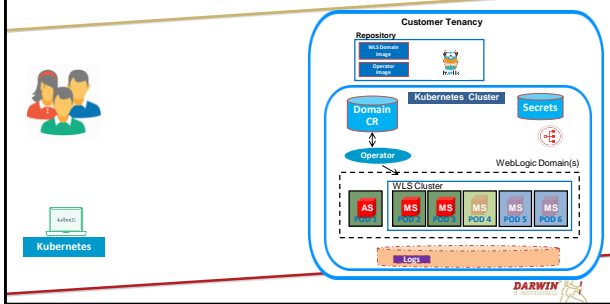


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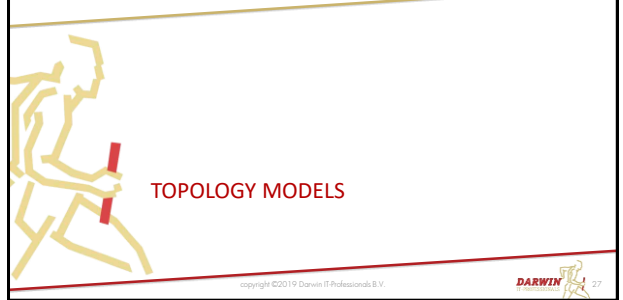
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## Operator creating pods



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## 2 Topology Models

Options	Domain in PV/C	Domain in Image
Domain Topology Changes	Apply to domain in PV (w/ist online)	New Image
Configuration Changes (tunables, credentials, ...)	Change configuration in domain in PV	Overrides Only
Patching	New Image	CI/CD (new image)
Application Updates	Apply to domain in PV	CI/CD (new image)
Management of PV/PVC	More complex (filesystem shared per domain)	Simple (not shared, per server)
Administration Console	App deployments and Configuration Changes, can not do lifecycle mgt.	Monitoring and Diagnosis. Invalidate configuration changes.
Log Persistence	Supported (PV, Pod FS, Elastic Stack, Standard Out)	Supported (PV, Pod FS, Elastic Stack, Standard Out)
HA Across Availability Domain	Limited (requirement for shared PV)	Supported (No requirement for shared PV)
DR across Regions	Supported Active/Passive (like on Premise user responsible for sync domain config across DC)	Supported Active/Passive (easier, user does not need to sync domain config across DC)

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## Which model should I use?

- The key difference is how updates are handled
  - Java updates
  - WebLogic patching
  - WebLogic configuration changes
  - Application updates
- Are you fully embracing the CI/CD "DevOps" model and intend to manage change through that process?
  - E.g. create new images every time there is an update.
- Are you making changes to configurations and deployments in running systems?
  - E.g. run WLST online to dynamically change your domain configuration.

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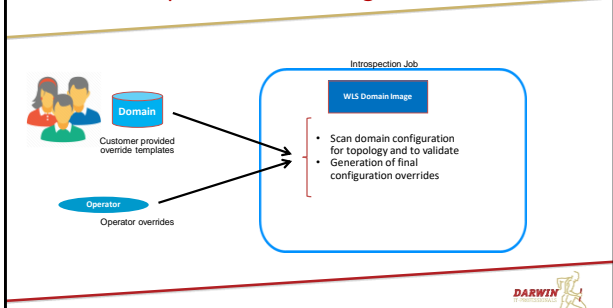
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## Configuration Overrides

- WebLogic Images containing Application, domain configuration, resources are immutable.
- These Docker images must be portable
  - Development -> Testing -> Production.
- Follow the customer's CI/CD process.
- Therefore, customers need a mechanism to override certain domain configuration
  - E.g. Provide data source URL and credentials

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## Domain Introspection and Config Override Generation



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## User Configuration Overrides

- Typical attributes for overrides include:
  - User names, passwords, and URLs for:
    - JDBC datasources
    - JMS bridges, foreign servers, and SAF
  - Network channel public addresses:
    - For remote RMI clients (T3, JMS, EJB, JTA)
    - For remote WLST clients
  - Debugging
  - Tuning (MaxMessageSize, etc.)

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## Configuration Overrides

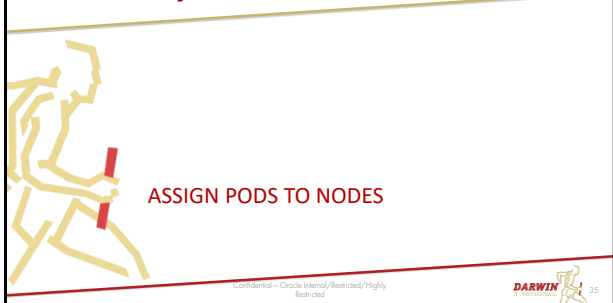
- Create a Kubernetes configuration map that contains:
  - Override templates
- Create Kubernetes secrets that contains:
  - Data source username and password.
- Set your domain CR
  - Config map.
  - Secret with the Config Override
- Start or restart your domain.

```
apiVersion: "weblogic.oracle/v2"
kind: Domain
metadata:
  name: domain1
  namespace: default
  labels:
    weblogic.resourceVersion: domain1-v2
    weblogic.domainID: domain1
spec:
  [...]
  weblogicCredentialSecret:
    name: domain1-credential-secret
  configOverrides: domain-override-config-map
  configOverrideSecrets: domain-override-ssl-server, domain-override-secret
  [...]

```

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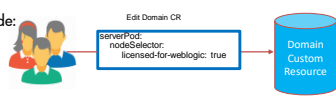
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## Assigning WebLogic Pods to Nodes

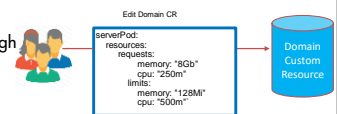
- Use Node Selector to constrain a pod to only be able to run on particular nodes.
- Assign a label (key=value) to the node:
  - kubectl label nodes kubernetes-foo-node-1 licensed-for-weblogic=true
- Edit the Domain Custom Resource at the domain/cluster/server level and assign key:value nodeSelector.



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## Assigning WebLogic Pods to Nodes

- Assign pods to Nodes based on resources, e.g. CPU and Memory usage
- A Pod is scheduled to run on a Node only if the Node has enough CPU resources available.



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### 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"
            
```

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Operator Schedule WLS POD2

Node 1 Node 2 Node 3

WLS POD1 WLS POD2

weblogic.clusterName weblogic.clusterName weblogic.clusterName

Licensed-for-weblogic Licensed-for-weblogic

```

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

```

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

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Operator

Node 1 Node 2 Node 3

WLS POD1 WLS POD2

weblogic.clusterName weblogic.clusterName weblogic.clusterName

Licensed-for-weblogic Licensed-for-weblogic

```

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

```

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

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Operator Schedule WLS POD3

Node 1 Node 2 Node 3

WLS POD1 WLS POD2 WLS POD3

weblogic.clusterName weblogic.clusterName weblogic.clusterName

Licensed-for-weblogic Licensed-for-weblogic

```

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

```

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

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Operator

Node 1 Node 2 Node 3

WLS POD1 WLS POD3 WLS POD2

weblogic.clusterName weblogic.clusterName weblogic.clusterName

Licensed-for-weblogic Licensed-for-weblogic

```

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

```

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

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## HA AND DR IN KUBERNETES

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### WebLogic High Availability

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

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### WebLogic Disaster Recovery

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

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TOOLING

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### 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
- Prometheus and Grafana example [GitHub Sample](#)

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### Out of the Box Grafana Dashboards

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### 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
- Customize and Validate configuration to meet Kubernetes requirements
- Create domains in Docker image [GitHub Sample](#)

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## 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 Elasticsearch
- Display logs in dashboards in Kibana
- Integrate with FluentD (future)
- [GitHub weblogic-logging-exporter](#)

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## Kibana Dashboards

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## Patching WL Image with WebLogic Image Tool

Future

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DEMO WEBLOGIC WITHIN OKE CLUSTER

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## VCN, AD's, Public and Private Subnets, OKE Cluster and OKE Nodes

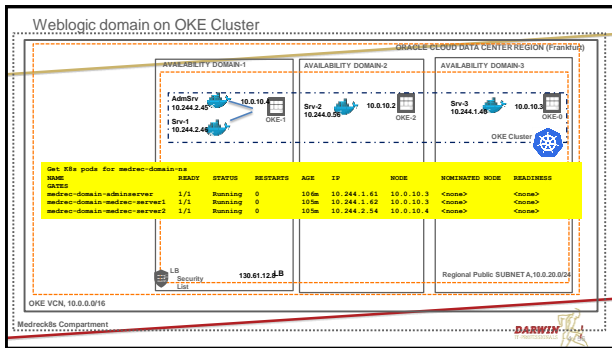
Mediatek's Comment

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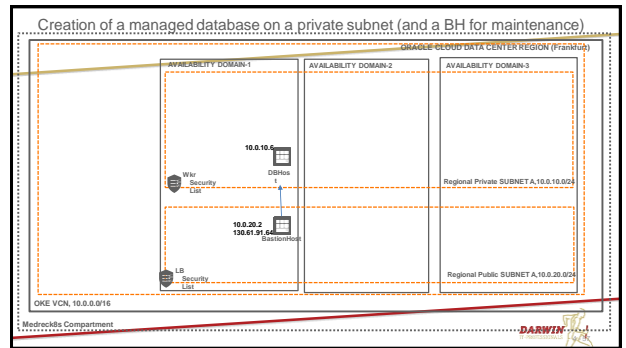
## Generated Security Lists per (regional subnet) applicable for all nodes within SN

Mediatek's Comment

55



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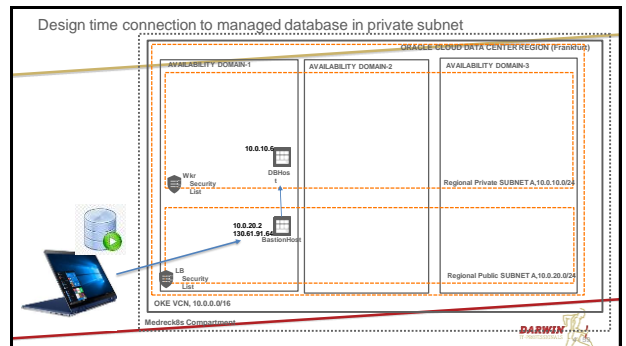
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### Managed Database Creation

- Private Subnet (use PSN created by the OKE cluster)
- Database Shape/Edition/Release/BYOL versus fully licenses
  - VM.Standard1.1;SE/19.x/BYOL
- Access
  - Design Time via BH (tunneling)
  - Runtime (Weblogic within OKE cluster) via k8s service
  - Security lists and/or Security groups
    - Incoming (ingress) traffic: which node/ip/protocol?
- PDB/CDB (default multitenant since release 19.x)
  - OCI Console provides connect String to CDB
  - PDB connect string
    - Select \* from v\$Services
    - SSH to DBHOST
    - Query listener status

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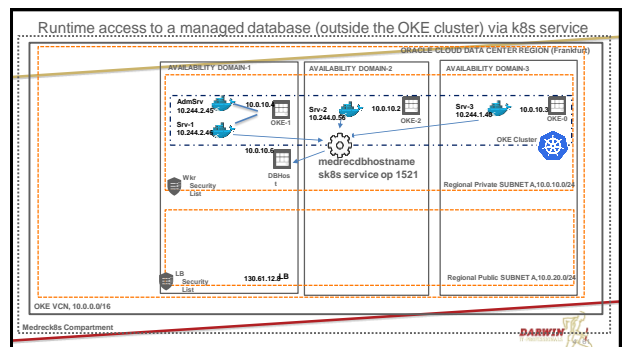
58



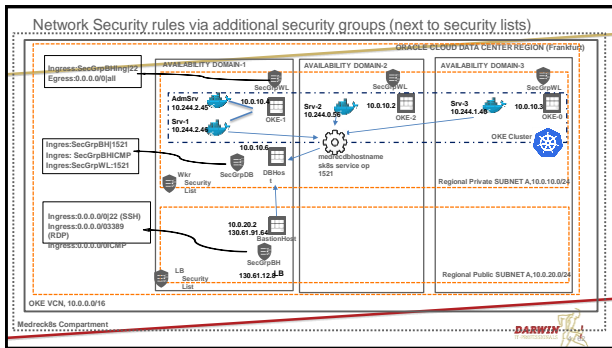
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### Design Time Connection (tunneling)

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- Links
- Oracle Weblogic Kubernetes Operator
    - <https://oracle.github.io/weblogic-kubernetes-operator>
  - Oracle Weblogic Kubernetes Operator Samples
    - <https://oracle.github.io/weblogic-kubernetes-operator/samples/>
  - Oracle Weblogic Slack Inviter
    - <https://weblogic-slack-inviter.herokuapp.com/>
  - Cloud Customer Connect – Containers and Kubernetes forum
    - <https://cloudcustomerconnect.oracle.com/resources/654f18469/summary>
  - OPN PaasForum/SummerCamps '19 Tutorial by Peter Nagy (to be forked)
    - <https://github.com/nagyepeter/weblogic-operator-tutorial>
  - End2End example monitoring wl server with Grafana dashboards
    - <https://blogs.oracle.com/weblogicserver/end-to-end-example-of-monitoring-weblogic-server-with-grafana-dashboards-on-the-oci-container-engine-for-kubernetes>
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