

Establishing an EDA Platform on OpenShift

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What is Event-Driven Architecture ?

To understand what is the meaning of Event-Driven Architecture, let see what the industry describe it as, by looking at different definitions given by vendors and analysts:

An event-driven architecture is a software design pattern in which microservices react to changes in state, called events. Events can either carry a state (such as the price of an item or a delivery address) or events can be identifiers (a notification that an order was received or shipped, for example).

— Google, <https://cloud.google.com/eventarc/docs/event-driven-architectures>

Event-driven architecture (EDA) is a design paradigm in which a software component executes in response to receiving one or more event notifications. EDA is more loosely coupled than the client/server paradigm because the component that sends the notification doesn't know the identity of the receiving components at the time of compiling.

— Gartner, [https://www.gartner.com/en/information-technology/glossary/eda-event-driven-architecture#:~:text=Event%2Ddriven%20architecture%20\(EDA\)%20is%20a%20design%20paradigm%20in](https://www.gartner.com/en/information-technology/glossary/eda-event-driven-architecture#:~:text=Event%2Ddriven%20architecture%20(EDA)%20is%20a%20design%20paradigm%20in)

An event-driven architecture uses events to trigger and communicate between decoupled services and is common in modern applications built with microservices. An event is a change in state, or an update, like an item being placed in a shopping cart on an e-commerce website. Events can either carry the state (the item purchased, its price, and a delivery address) or events can be identifiers (a notification that an order was shipped).

— AWS, <https://aws.amazon.com/event-driven-architecture/>

And for comparison, Red Hat's definition :-

Event-driven architecture is a **software architecture** and model for **application design**. With an event-driven system, the **capture, communication, processing, and persistence** of events are the core structure of the solution. This differs from a traditional request-driven model.

Many modern application designs are event-driven, such as customer engagement frameworks that must utilize customer data in real time. Event-driven apps can be created in **any programming language** because event-driven is a programming approach, not a language. Event-driven architecture enables minimal coupling, which makes it a good option for modern, distributed application architectures.

An event-driven architecture is loosely coupled because event producers don't know which event consumers are listening for an event, and the event doesn't know what the consequences are of its occurrence.

— Red Hat, <https://www.redhat.com/en/topics/integration/what-is-event-driven-architecture>

Part I: Openshift Container Overview

Chapter 1. Storage Subsystem (Optional)

1.1. OpenShift Data Foundation Capabilities

OpenShift Data Foundation (ODF) is an integrated collection of storage and data services for OpenShift.

1.2. Role in EDA Platform

From an EDA Platform point of view, ODF gives us the capability to store information in a highly available replicated clustered environment on different types of storage types, block, file system and even Simple Storage System (S3), using native devices, or virtual devices offered by the underlying compute/cloud provider.



ODF Documentation

OpenShift ODF Documentation access.redhat.com/documentation/en-us/red_hat_openshift_data_foundation



YouTube Video

Installing ODF on Red Hat Virtualization using builtin Ovirt storage class - youtu.be/5kqyFDlyv54

Chapter 2. Serverless



2.1. Capabilities

OpenShift Serverless gives our EDA Platform the infrastructure to create Cloud Native Eventing and Serving capabilities.

On the serving side, it gives us access to automatic scaling and rapid deployment of applications.

Scaling includes traffic-splitting across different versions, flexible routing and scale to zero, which saves resources if deployment is not in use.

Eventing opens a host of features directly related to EDA processing, channels (publish/subscribe), broker (filter based subscription) and cloud events, or CloudEvents, referring to the product.

CloudEvents forms an important part of EDA, and acts as the internal payload definition, with typically HTTP as the communication protocol.

A sample CloudEvent:

```
{
  "specversion": "1.0",
  "type": "dev.knative.samples.helloworld",
  "source": "dev.knative.samples/helloworldsource",
  "id": "536808d3-88be-4077-9d7a-a3f162705f79",
  "data": {"msg": "Hello Knative2!"}
}
```

CloudEvents caters for the following features:

- Consistency
- Accessibility
- Portability

2.2. Role in EDA Platform

Serverless handles the internal eventing in a Cloud Native environment.

Not only does it allow to scale on demand (or lack of), but it also provides a canonical message model, based on CloudEvents.



Serverless Documentation
OpenShift Documentation

https://access.redhat.com/documentation/en-us/OpenShift_container_platform/4.10/html/serverless/index



CloudEvents
cloudevents

<https://cloudevents.io/>

Chapter 3. Distributed Tracing Platform



3.1. Capabilities

Chapter 4. Conclusion

Part II: Application Foundation Overview

Chapter 5. AMQ Streams (Kafka)

Apache Kafka is an open-source distributed publish-subscribe messaging system for fault-tolerant real-time data feeds. AMQ Streams is based Apache Kafka.

5.1. AMQ Streams Capabilities

AMQ Streams is a containerized deployment managed by OpenShift supplied AMQ Streams operator. The AMQ Streams Operator are purpose-built with specialist operational knowledge to ease the management of Kafka.

- Optimized for Microservices and other streaming/eventing applications
- Messaging order guaranteed
- Horizontal scalability using OpenShift infrastructure
- Fault tolerant
- Quick access to high volumes of data

5.2. Role in EDA Platform

Red Hat AMQ Streams is a massively scalable, distributed, and high-performance data streaming platform based on the Apache Kafka project. AMQ Streams provides an event streaming backbone that allows microservices and other application components to exchange data with extremely high throughput and low latency.

Chapter 6. Red Hat Integration - Camel K

6.1. Camel K Capabilities

Red Hat Integration's Camel K is a light weight integration framework, built from the upstream Apache Camel K runtime.

Camel K runs natively on top of OpenShift and takes advantage of Quarkus, as a runtime, and can be used in conjunction with Serverless to allow for autoscaling of deployments.

Camel K gives developers the following advantages:

- Predefined integration templates, called **Kamelets**, which allows for quick configuration of integrations. Kamelets are pure Camel DSL and can embody all the logic that allows to consume or produce data from public SaaS or enterprise systems and only expose to the final users a clean interface that describes the expected parameters, input and output.
- Code in the form of Java, Groovy, Kotlin, JavaScript and XML or Yaml DSL deployment for quick deployment.
- Container creation is automated by a code compilation optimized subsystem, called the integration platform.
- Multiple development tool support, for example Karavan a plugin for Visual Studio Code, and also a full CLI implementation

Supports multiple traits, which can be enabled globally on integration platform level, or per deployment. Traits are automated and usually only requires a couple configuration parameters to be enabled. An example of a trait is tracing,

Traits includes technologies like:

- 3scale (API Management), Swagger, OpenAPI
- Ingress Control
- Service Mesh, Serverless
- Jolokia, JVM
- Health endpoints, Logging, tracing, Prometheus
- Deployment configuration, mounts, pull secrets, route, tolerations, resources

6.2. Kamelets

Preconfigured Kamelets are shipped with Camel K, which includes a wide range of technologies.



Kamelet Catalog

To see the current list of available Kamelets, see the Apache Camel Kamelets catalog: camel.apache.org/camel-kamelets/

On top of all the features like Kamelets and traits, Camel K also support standard Camel Components.



Camel Components

To see the current list of available components, see the Apache Camel Component Documentation: camel.apache.org/components/

Chapter 7. Debezium

Debezium enables you to capture events from a database, when there is any changes on data.

Debezium is built on top of Kafka, and records the history of database changes (Change Data Capture aka. CDC) in Kafka logs. Even if your Debezium configuration is not active, events will be captured as soon as the configuration is restarted.

Debezium is based on log mining, and requires no changes to your data models.

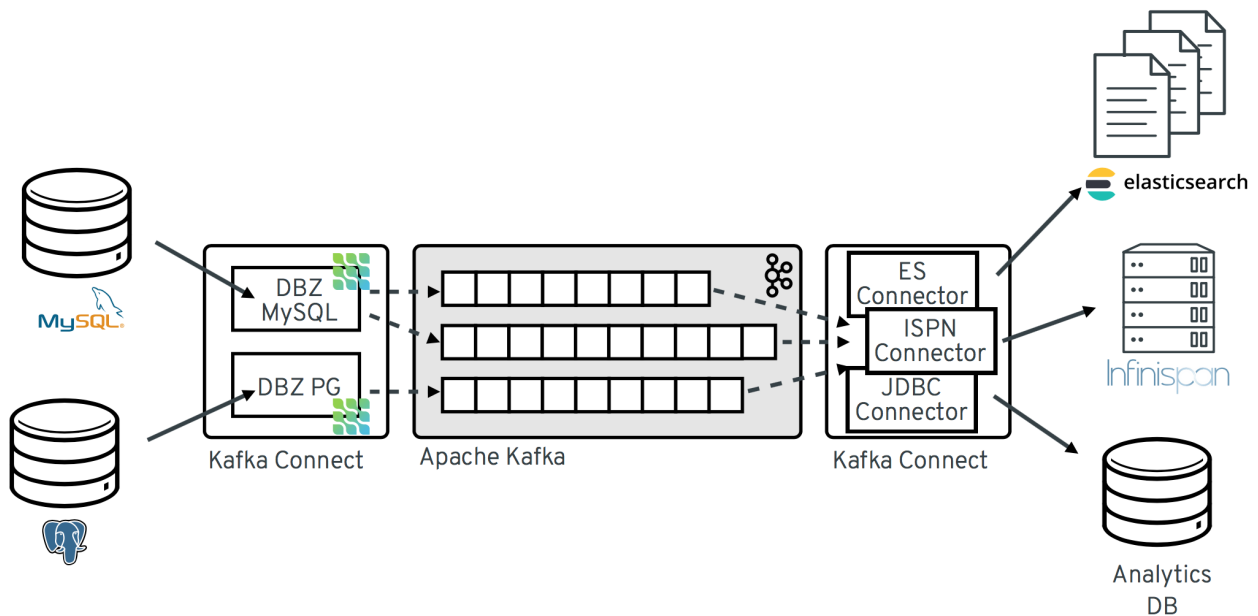


Figure 1. Debezium Architecture

7.1. Supported Databases

Debezium supports the following databases:

- DB2
- MongoDB
- Postgresql
- Oracle
- SQLServer

7.2. Implementation

7.2.1. Database Configuration

Database configuration is required, and depends on the flavor of the database. Debezium utilizes built in functionality of a specific database.

For example, for Oracle, you have to configure snapshots.

7.2.2. Debezium Connector

For the connector configuration, you specify:

- Database connection information
- Kafka connection information
- Filters, a set of schemas, tables and columns to include/exclude
- Masking, optionally hide sensitive data
- Optionally converters, how the information is published to Kafka, with support of JSON, Protobuf and AVRO.
- Optionally value converters stored in the Service Registry

7.3. Role in EDA Platform

Most third party applications provides some sort of method to subscribe/publish events, but it is not always true in all cases. In these special cases, you can tap into the power of the database to capture changes on a database level using Debezium, without any code changes to the application, or the underlying database schema.

Debezium can also be used to enable events, in applications where it is difficult to retrofit event publishers.



A bit more work is required, as a typical database event requires some logic to recreate an event. For example, a new order event, consists of the order information and associated order lines. The new order event can be based on a table order, but the Debezium event needs the logic to extract the full event, including querying the order lines from the database.

Chapter 8. Quarkus

Chapter 9. Service Registry

Chapter 10. Conclusion

Part III: Third Party Requirements

Chapter 11. Maven Repository



11.1. Mirrors

It is advised to use a local maven mirror repository to speed up deployments.

Camel K, Quarkus, supporting components of AMQ, all use maven artifacts.

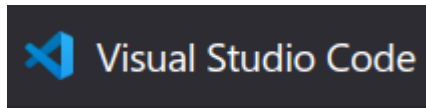
The supported versions of Red Hat supplied artifacts all comes from the following repositories.

- maven.repository.redhat.com/ga
- maven.repository.redhat.com/earlyaccess/all

Other used repositories include:

- packages.confluent.io/maven/

Chapter 12. Visual Studio Code



Visual Studio Code is a downstream implementation of VSCodeium.

code.visualstudio.com/

vscodium.com/

12.1. Plugins

12.1.1. Red Hat Plugins

Lost of plugins are available:

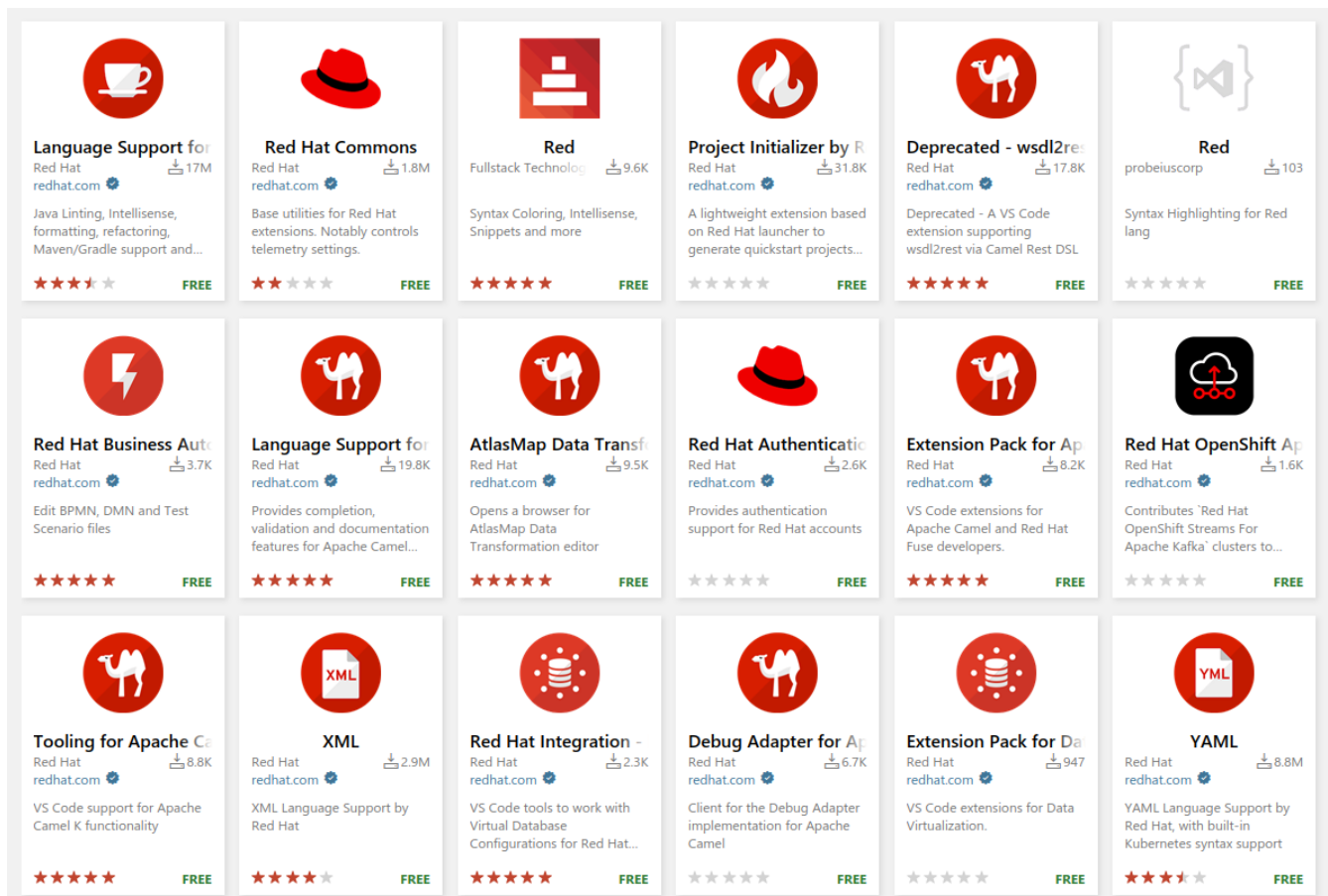


Figure 2. Red Hat supply a range of plugins for Microsoft Visual Studio Code

12.1.2. Other Plugins

12.1.2.1. Karavan - Camel K

marketplace.visualstudio.com/publishers/camel-karavan

Chapter 13. Conclusion

Part IV: Sample EDA Platform and Demo implementation

Chapter 14. Installing Operators

Creation of the infrastructure, and Camel K, we are going to use OpenShift operators. Most of these operators provides a quick start, which we are going to use for installation.

To access the quick starts available, from the Openshift Console, in Administrator perspective, got to Home→Overview, and under "Getting Started resources", you will see the link "View all quick starts".

14.1. Openshift Data Foundation (Optional)



Installation is straight forward using the OpenShift Data Foundation Operator, which includes a wizard to create a storage subsystem.

During the wizard you are presented with a choice of using an existing storage class, local storage, or connecting to an existing ceph cluster. You also have the option to taint the nodes, to be dedicated storage nodes.

For in depth information on installing ODF see the documentation.



Quick Start for OpenShift Data Foundation

[console-openshift-console.apps.](#)

clustername.domain.com/quickstart?quickstart=odf-install-tour

14.2. Serverless Operator

Configuring the OpenShift Serverless environment requires the installation of the OpenShift Serverless Operator, and the configuration of the KNative and K Serving deployments. For our needs we are going to use defaults, but keep in mind that customized configuration can be done.

Use the "Install the Openshift Serverless Operator" Quick start wizard to complete the installation.



Serverless Quick Start - OpenShift console

Install the OpenShift Serverless Operator using the guided wizard offered by a Quick Start

```
https://console-OpenShift-  
console.apps.*clustername*.*yourdomain*.com/quickstart?quickstart=install-  
serverless
```

14.3. Camel K



To install the Red Hat Camel K Operator:

- From the **Administrator** perspective, got to the OperatorHub from the Operators section of the navigation pane.
- In the **All Items** filter, type in **Camel K**
- Click the Red Hat Integration - Camel K tile, to open the Operator details
- At the top of Red Hat Integration - Camel K Operator panel, click Install
- Leave all fields the defaults and click Install
- After a few minutes, you will get a confirmation that Operator is ready for use.



If you running into an issue deploying Camel K Operator, where the deployment fails with a ImagePullBackOff error. You can view the progress on the issue at the following link: issues.redhat.com/browse/ENTESB-19495?focusedCommentId=20637854&page=com.atlassian.jira.plugin.system.issuetabpanels%3Acomment-tabpanel#comment-20637854

As a workaround, we are going to patch the Camel K Cluster Service Version, to pull the operator image based on version, not hash:

- Operators → Installed Operators → Red Hat Integration - Camel K → YAML Tab:
- On Line: 423 - replace registry.redhat.io/integration/camel-k-rhel8-operator:1.6.8
- Save the change
- Delete the camel-k-operator deployment, under Deployments, project openshift-operators to force a redploy, with corrected iamge.

14.4. Red Hat Integration - Service Registry



To install the Red Hat Service Registry Operator:

- From the **Administrator** perspective, got to the OperatorHub from the Operators section of the navigation pane.
- In the **All Items** filter, type in **registry operator**

- Click the Red Hat Integration - Service Registry tile, to open the Operator details
- At the top of Red Hat Integration - Service Registry Operator panel, click Install
- Leave all fields the defaults and click Install
- After a few minutes, you will get a confirmation that Operator is ready for use.

14.5. Red Hat Openshift distributed tracing platform

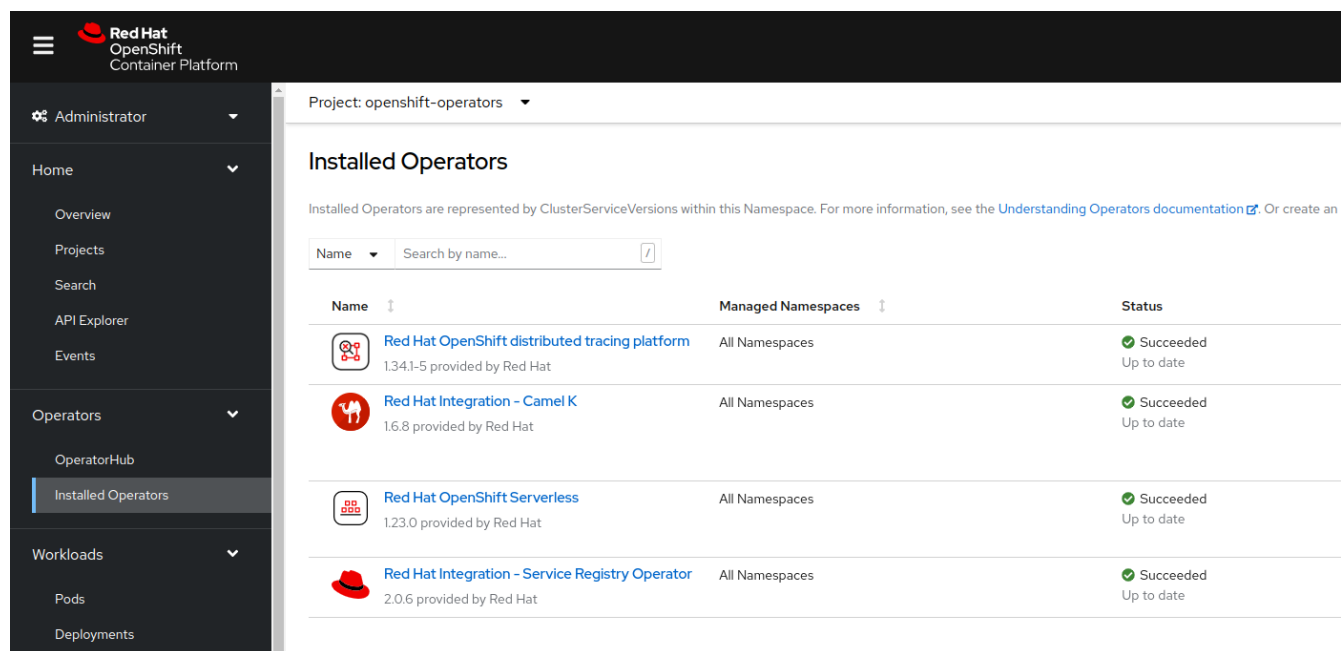


To install the Red Hat distributed tracing platform:

- From the **Administrator** perspective, got to the OperatorHub from the Operators section of the navigation pane.
- In the **All Items** filter, type in **distributed tracing**
- Click the Red Hat OpenShift distributed tracing platform tile, to open the Operator details
- At the top of Red Hat OpenShift distributed tracing platform panel, click Install
- Leave all fields the defaults and click Install
- After a few minutes, you will get a confirmation that Operator is ready for use.

14.6. Summary

After the process of installing required operators, you should be able to confirm the Installed Operators, by looking at the project openshift-operators, and Installed Operators.



The screenshot shows the Red Hat OpenShift Container Platform console interface. The left sidebar contains navigation menus for Administrator, Home, Operators, and Workloads. The main content area is titled 'Project: openshift-operators' and 'Installed Operators'. It includes a search bar and a table listing installed operators.





| Name | Managed Namespaces | Status |
|---|--------------------|---------------------------|
|  Red Hat OpenShift distributed tracing platform 1.34.1-5 provided by Red Hat | All Namespaces | ✓ Succeeded Up to date |
|  Red Hat Integration - Camel K 1.6.8 provided by Red Hat | All Namespaces | ✓ Succeeded Up to date |
|  Red Hat OpenShift Serverless 1.23.0 provided by Red Hat | All Namespaces | ✓ Succeeded Up to date |
|  Red Hat Integration - Service Registry Operator 2.0.6 provided by Red Hat | All Namespaces | ✓ Succeeded Up to date |

Figure 3. Installed Operators Summary

Chapter 15. Demo ERP - ODOO



Our third party application is going to be ODOO.

Odoo is a suite of open source business apps that cover all your company needs: CRM, eCommerce, accounting, inventory, point of sale, project management, etc.

Odoo's unique value proposition is to be at the same time very easy to use and fully integrated.

— ODOO, <https://odoo.com>



Keep in mind, however, that even if ODOO is open source, that it can be replaced with Oracle eBusiness Suite, SAP, Workday and a multitude of other ERP, CRM, Supply Chain and other off-the-shelf applications.

15.1. Installing Odoo



First we have to create a namespace for Odoo.

- From the **Administrator** perspective, go to **Projects** from the **Home** section of the navigation pane.
- On the list of projects, click on **Create Project**
- Call the namespace odoo and give a description, and click on Create namespace

Create Project

An OpenShift project is an alternative representation of a Kubernetes namespace.
[Learn more about working with projects](#)

Name * ⓘ

odoo

Display name

Odoo

Description

Cancel Create

For the installation we are going to use a template to build the application.

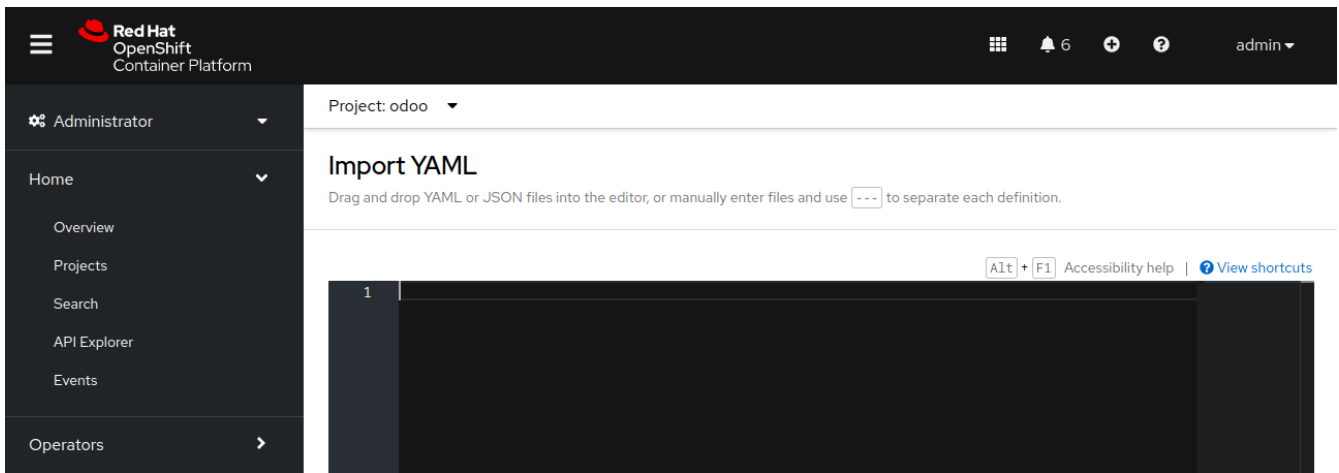
The template was translated and modified from the original template which developed by Franklin Gomez.

There is also an Odoo Operator, but it requires a lot of pre-configuration.

15.1.1. Creating Template and Instantiating Template

To install the template:

- From the **Administrator** perspective, got to **Projects** from the **Home** section of the navigation pane.
- In the **Projects** panel, click on the project **odoo**
- On the top, next to your user name, and the **?**, there is a **+** sign. Click on the **+** sign:



- Paste the contents of the Odoo Template in the Import YAML, and click create.

Odoo Template

raw.githubusercontent.com/pmalan-rh/EDAOpenShift-code/main/odoo/odoo-template.yaml

- Switch perspective to **Developer**
- Click on **+Add**
- Under **Developer Catalog**, click on **All Services**
- In the search box, type in **odoo**
- Select **Odoo**
- In the popup window, click on **Instantiate Template**
- In the template, specify **odoo** for **Project Name**, leaving the others as defaults
- Click **Create**

After a few minutes, you will see the deployments in ready state as indicated by the blue rings around it.

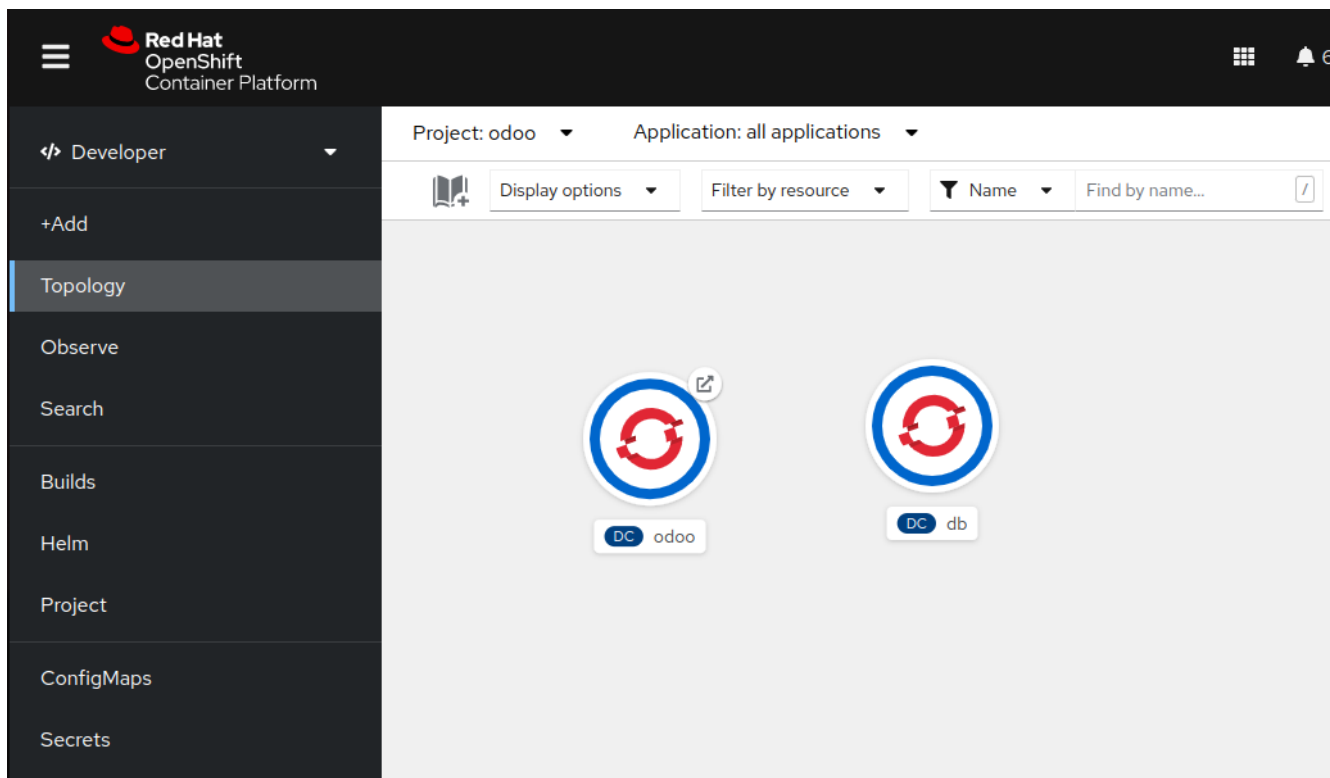


Figure 4. Odoo Deployment Completed

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