DevOps in Oracle's Application PaaS for Java SE and Node Applications

Oracle Korea Middleware

Contents

1 Before You Begin

The Oracle Application Container Cloud can deploy and run Java SE and Node.js applications. To deploy an application, it must be contained in a `zip` or `tgz` archive file which includes required configuration information. Once you have the application, you can use either the Oracle Application Container Cloud graphical user interface or the REST API to deploy your application.

The purpose of this guide is to introduce you to packaging and deploying an application to the Oracle Application Container Cloud. The approximate time to complete this lab is 45 minutes.

This section is mainly important lecture before going hands-on in the next section.

1.1 Software Prerequisite

When deploying an application using the REST API you will need the CURL network utility, which you can obtain at http://curl.haxx.se/.

1.2 Cloud Deployment Summary

To properly package and deploy your application, you must go through the following steps:

1. Create an application that is *configurable* at runtime. That is, an application that's configuration is read from the environment rather than hard coded.
2. Collect all your application resources including required libraries into a *single directory hierarchy or single Java JAR* in preparation for deployment archive creation.
3. Create an application archive that contains your application resources *and* a `manifest.json` in a single file. The `manifest.json` file must be stored in the `root` directory of your archive.
4. Deploy your application archive to Oracle Application Container Cloud.

1.3 Developing an Application for Cloud Deployment

To properly package, deploy, and execute your application in Oracle Application Container Cloud there are a few key concepts you must understand:

Container Considerations

Oracle Application Container Cloud applications run in Docker containers. Docker is an open-source software container project. Think of a container as of a lightweight virtual machine. Your application runs in its own isolated execution space which has its own memory, file system, and network access. So access to these operating system resources takes place without the cost of having to implement an entire virtual operating system.

When you deploy your application to the Application Container Cloud, a container is dynamically generated for your application. The implication of this is that all the typical configuration information like host name and port number are also dynamically generated. Therefore, **any application that runs in this environment must be read key configuration information from the environment before the application starts.**

Additionally, containers for your application can be dynamically allocated to scale up or down as is required by the application load. This dynamic scaling feature is made possible by the **load balancers** provided by the Application Container Cloud. The balancer routes traffic to the application instances thus "balancing" the load.
Given the setup of the service, this has the following implications for your applications.

Application Considerations for Running in a Container

For an application to run properly on Oracle Application Container Cloud, there are a few requirements that must be met.

- **Applications must be stateless**: Since the service can run multiple instances of the same application, applications cannot share state. For example, items added to a shopping cart application on one instance would not be available to other instances of the application. Since application load is balanced between instances, there is no guarantee that the next request would be handled by the same instance as the last request. Thus trying to store application state would result in possible data loss. Therefore, state information should be stored outside your application in a database. Modern databases are designed to handle connections from multiple concurrent clients.
- **Applications communicate via network ports**: The only way to communicate to a running application is through its assigned network port.
- **Applications must be configurable at runtime**: Applications must be able to start and execute based on values set by the container. Values are passed to an application through environment variables.
- **All dependencies must be included with the application:** This means that if your application requires a library to execute, that library must be included with the application archive when it is deployed. You can accomplish this in two ways:
    1. **Create an Uber Jar (Java SE only):** When creating your application, all dependent libraries are included in the `jar` with the application.
    2. **Archived Libraries:** Include dependent libraries in the application archive you create. For Java, separate `jars` can be referenced using the `CLASSPATH` command line option in the application launch command. For Node, you should install locally required libraries in the `node_modules` folder and include them in the application archive as well.

1.4 Configuring Your Application to Run in the Cloud

To make your Java SE application run on the Application Container Cloud, you must let the container assign the host name and port number of your application. These values are set by the container using environment variables. Specifically, your application needs to read the `HOSTNAME` and `PORT` environment variables, then start your application using those values.

In Java 8, the new `Optional` class makes it fairly easy to read these values, check for `null`, and then return the values from the environment or default values. What follows is a new version of the `Main` class which checks for the `PORT` and `HOSTNAME` environment variables at run time. If the values are set, they are used to launch the server. If the values are not set, default values are used instead. This allows your application to run stand alone locally or in the cloud using the service. The example class uses Grizzly and Jersey to have an HTTP server exposing JAX-RS.

`Main.java`

```
package com.example.rest;

import org.glassfish.grizzly.http.server.HttpServer;
import org.glassfish.jersey.grizzly2.httpserver.GrizzlyHttpServerFactory;
import org.glassfish.jersey.server.ResourceConfig;

import java.io.IOException;
import java.net.URI;
import java.util.Optional;

/**
 * Main class
 */
public class Main{

    // Base URI the Grizzly HTTP server will listen on
    public static final String BASE_URI;
    public static final String protocol;
    public static final Optional<String> host;
    public static final String path;
    public static final Optional<String> port;

    static{
      protocol = "http://";
      host = Optional.ofNullable(System.getenv("HOSTNAME"));
```

```
        port = Optional.ofNullable(System.getenv("PORT"));
        path = "myapp";
        BASE_URI = protocol + host.orElse("localhost") + ":" + port.orElse("8080") + "/" + path + "/";
    }

    /**
     * Starts Grizzly HTTP server exposing JAX-RS resources defined in this application.
     * @return Grizzly HTTP server.
     */
    public static HttpServer startServer() {
        // create a resource config that scans for JAX-RS resources and providers
        // in com.example.rest package
        final ResourceConfig rc = new ResourceConfig().packages("com.example.rest");

        // create and start a new instance of grizzly http server
        // exposing the Jersey application at BASE_URI
        return GrizzlyHttpServerFactory.createHttpServer(URI.create(BASE_URI), rc);
    }

    /**
     * Main method.
     * @param args
     * @throws IOException
     */
    public static void main(String[] args) throws IOException {
        final HttpServer server = startServer();
        System.out.println(String.format("Jersey app started with WADL available at "
                + "%sapplication.wadl\nHit enter to stop it...", BASE_URI));
        System.in.read();
        server.stop();
    }
}
```

A couple of key points:

- At the top of the class notice two `Optional<String>` variables are declared. The `port` and `host` fields will store the result of our environment variable lookup.
- In the `static` initialization block, the `System.getenv` method is used to get the environment variable. Notice that the `Optional.ofNullable` method is called. This method will return either the value stored in the environment variable or an empty `Optional` if no value is returned.
- The `BASE_URI` field now uses the `Optional` variables to create the URI. The `orElse` method sets a default value if the optional is empty.

With these improvements, you can set the host name or port using environment variables. The additional code is clear and concise.

2 Creating a Cloud Ready Package Using `manifest.json`

To package your application and get it ready for the cloud, you need to combine your application archive with the `manifest.json` file.

2.1 Creating a Java Application Archive using Maven

Java applications can employ a single uber JAR as a way to collect all application resources and dependencies required to run the application. This way, your entire application can be distributed in a single file without messy `CLASSPATH` variables or extra software installations. To do this, using Maven, you must change the `pom.xml` file.

If you use the default Maven settings to create a JAR, only the class files generated from source file are included in the JAR. This works fine when executing an application from Maven since any dependencies are downloaded into the local Maven cache. However, this does not produce a standalone application file that can be run anywhere. You must include the dependencies.

To do this, some changes are required to the pom.xml file. The first change to the file is the addition of the `assembly` plugin.

1. Locate the `pom.xml` file in the `employees-app` sample project provided on this lab. Open the file and identify the following snippet of code:

```
<plugin>
    <groupId>org.apache.maven.plugins</groupId>
    <artifactId>maven-assembly-plugin</artifactId>
    <configuration>
        <descriptorRefs>
            <descriptorRef>jar-with-dependencies</descriptorRef>
        </descriptorRefs>
        <finalName>${project.build.finalName}-${project.version}</finalName>
        <archive>
            <manifest>
                <mainClass>com.example.employees.Main</mainClass>
            </manifest>
        </archive>
    </configuration>
    <executions>
        <execution>
            <phase>package</phase>
            <goals>
                <goal>single</goal>
            </goals>
        </execution>
    </executions>
</plugin>
```

The **assembly** plugin is typically used to create JAR or WAR files that package Java applications into a file. Notice that the `Main` class is set so that an executable JAR is created. Doing this allows the JAR file to execute using the `java -jar` command line option. Also note that the `finalName` value has been updated to match the rest of the project and that by adding `<descriptorRef>jar-with-dependencies</descriptorRef>` the required libraries for the application are added to the jar.

2.2 The `manifest.json` File

The `manifest.json` file provides metadata about your Java application. This information includes the version of Java and the command used to execute the application. You can also include notes about your application along with release information:

```
{
    "runtime": {
        "majorVersion": "7"
    },
    "command": "bash -l start.sh",
    "release": {
        "build": "150520.1154",
        "commit": "d8c2596364d9584050461",
        "version": "15.1.0"
    },
    "notes": "notes related to release"
}
```

In the example above you can see the following JSON properties:

- **runtime**:
    - **majorVersion**: version of the runtime e.g. for Java it would be 7 or 8
- **command**: Command to execute after deploying the application
- **release**:
    - **build**: User specified text value identifying this build

- **commit**: User specified text value related to this commit
- **version**: Version text string maintained by user

A very minimal `manifest.json` file would look like this:

```
{
    "runtime": {"majorVersion": "7"},
    "command": "bash -l start.sh"
}
```

1. Locate the `manifest.json` file sample file provided on this lab. Open the file and identify the following snippet of code:

```
{
    "runtime": {
        "majorVersion": "8"
    },
    "command": "java -jar employees-app-1.0-SNAPSHOT-jar-with-dependencies.jar",
    "release": {
        "build": "2015-09",
        "commit": "commitString",
        "version": "v2.0"
    },
    "notes": "Oracle Sample Application - Web application Bootstrap"
}
```

Note: This is an uber JAR deployment given the simplicity of the command to launch the application. This application also uses Java version 8. If your application needs any special command line switches to run, this is where you would specify them.

2.3 Creating the Final Archive

As a final step, you create an archive containing the application archive and `manifest.json`. Both files are stored at the root level of the archive file.

1. Select the `manifest.json`, `employees-app-1.0-SNAPSHOT-jar-with-dependencies.jar` files and create a zip file with them. You can just right click after selecting them and select the **Send to -> Compressed (zipped folder)** option. Make sure to name the archive `employees-web-app.zip`.

   Optionally, you can use the `zip` command:

   ```
   zip employees-web-app.zip manifest.json employees-app-1.0-SNAPSHOT-jar-with-
   dependencies.jar
   ```

   You can also use the `tar` command:

   ```
   tar cvfz employees-web-app.tgz manifest.json employees-app-1.0-SNAPSHOT-jar-with-
   dependencies.jar
   ```

The resulting archive file `employees-web-app.zip` has the following structure:

```
/
|---> manifest.json
 |---> employees-app-1.0-SNAPSHOT-jar-with-dependencies.jar
```

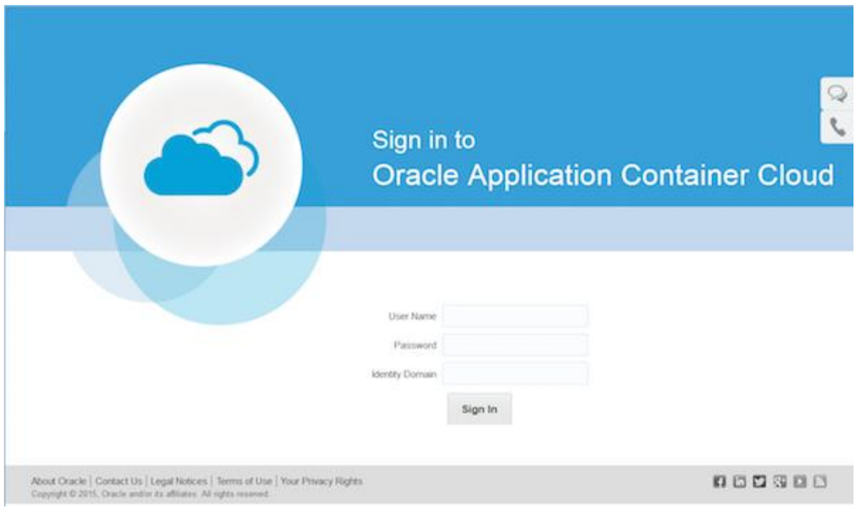
Note: Both files **are contained in the root directory** of the archive file.

Once you have packaged your application for deployment on Oracle Application Container Cloud, you are ready to deploy it. The steps for deploying your application are next.

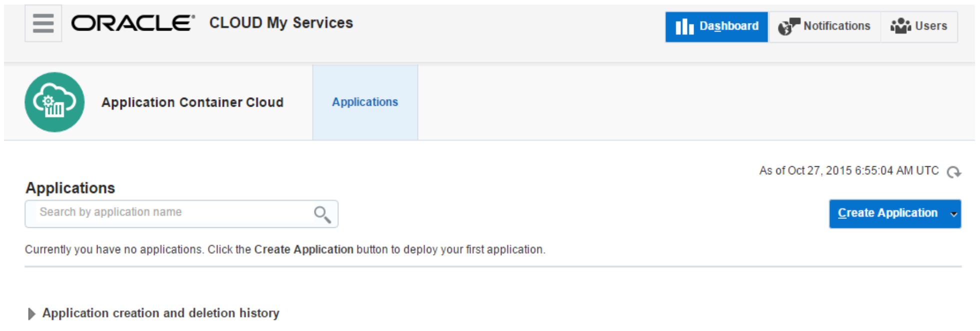
3 Deploying your Application using the Web User Interface

This section describes the steps to deploy a Java SE application to Oracle Application Container Cloud using the web user interface.

1. To deploy an application to Oracle Application Container Cloud, package your application in a zip or tgz file. Or, you can use the zip application provided in this tutorial and explore the user interface using this prepackaged application.
2. Log into the Application Container Cloud with your credentials.


Sign in to
Oracle Application Container Cloud
User Name
Password
Identity Domain
Sign In
About Oracle | Contact Us | Legal Notices | Terms of Use | Your Privacy Rights
Copyright © 2015, Oracle and/or its affiliates. All rights reserved.

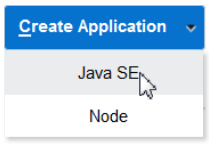
The application list view is displayed.


ORACLE CLOUD My Services
Dashboard
Notifications
Users
Application Container Cloud
Applications
Applications
As of Oct 27, 2015 6:55:04 AM UTC
Search by application name
Create Application

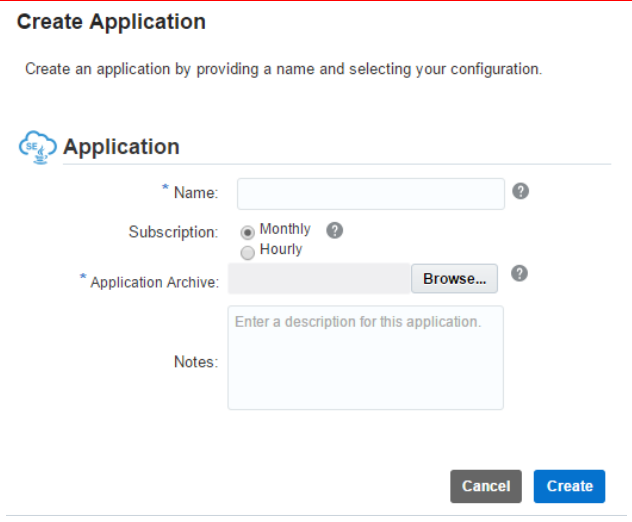
Currently you have no applications. Click the **Create Application** button to deploy your first application.

Application creation and deletion history

3. Click the **Create Application** button. A choice of what kind of application is displayed (Java SE or Node).



4. Select Java SE for the application. The **Create Application** dialog appears.


Create Application

Create an application by providing a name and selecting your configuration.

Application

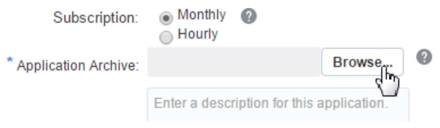
* Name:

Subscription: [✓ Monthly] Hourly

* Application Archive: Browse...

Notes: Enter a description for this application.

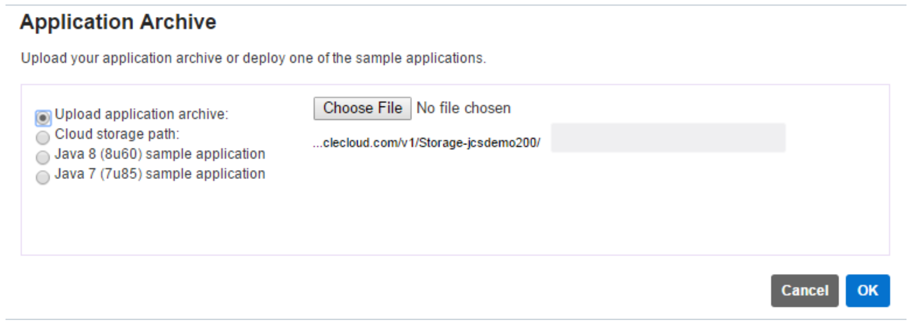
4.1. Enter a name for your Application.
4.2. Select the subscription type (Monthly or Hourly).
4.3. Click **Browse** button in the Application Archive field.


Subscription: [✓ Monthly] Hourly

* Application Archive: Browse...

Enter a description for this application.

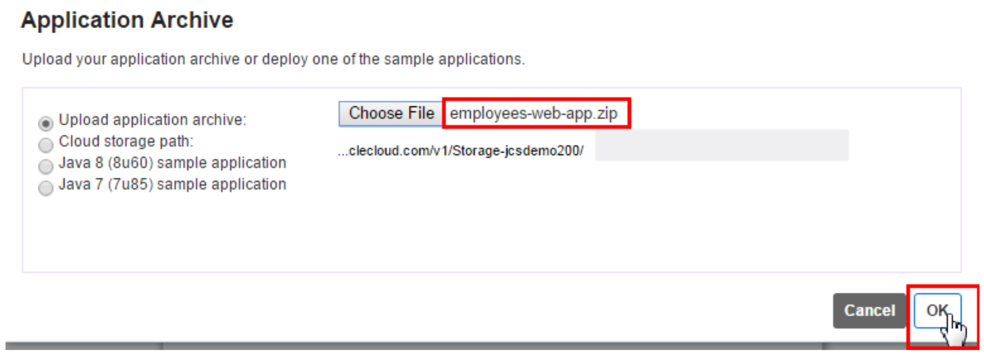
The **Application Archive** dialog is displayed.


Application Archive

Upload your application archive or deploy one of the sample applications.

[✓ Upload application archive:] Choose File No file chosen
Cloud storage path: ...clecloud.com/v1/Storage-jcsdemo200/
Java 8 (8u60) sample application
Java 7 (7u85) sample application

4.4. Select **Upload application archive**.
4.5. Click **Choose File** and select the `employees-web-app.zip` file you created in the previous section. Click **OK**.

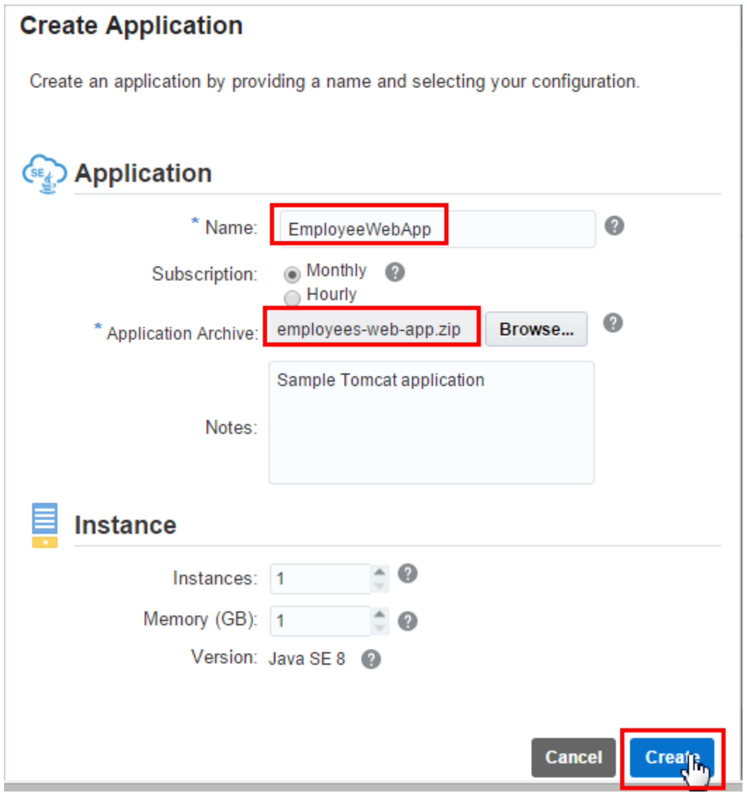

Application Archive

Upload your application archive or deploy one of the sample applications.

[✓ Upload application archive:] Choose File employees-web-app.zip
Cloud storage path: ...clecloud.com/v1/Storage-jcsdemo200/
Java 8 (8u60) sample application
Java 7 (7u85) sample application

4.6. Once you are back on the **Create Application** dialog, enter any notes you may be about the application in the **Notes** field.

5. Review the number of instances and memory size for your application in the **Instance** section. Make any adjustments you feel are necessary.
6. Click **Create** to deploy your application to Oracle Application Container Cloud.


Create Application

Create an application by providing a name and selecting your configuration.

Application

* Name: EmployeeWebApp

Subscription: [✓ Monthly] Hourly

* Application Archive: employees-web-app.zip

Notes: Sample Tomcat application

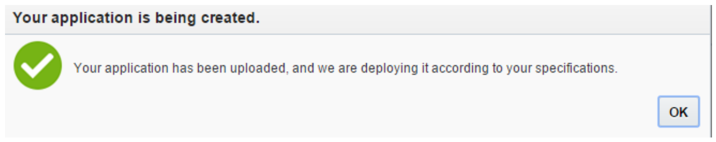
Instance

Instances: 1

Memory (GB): 1

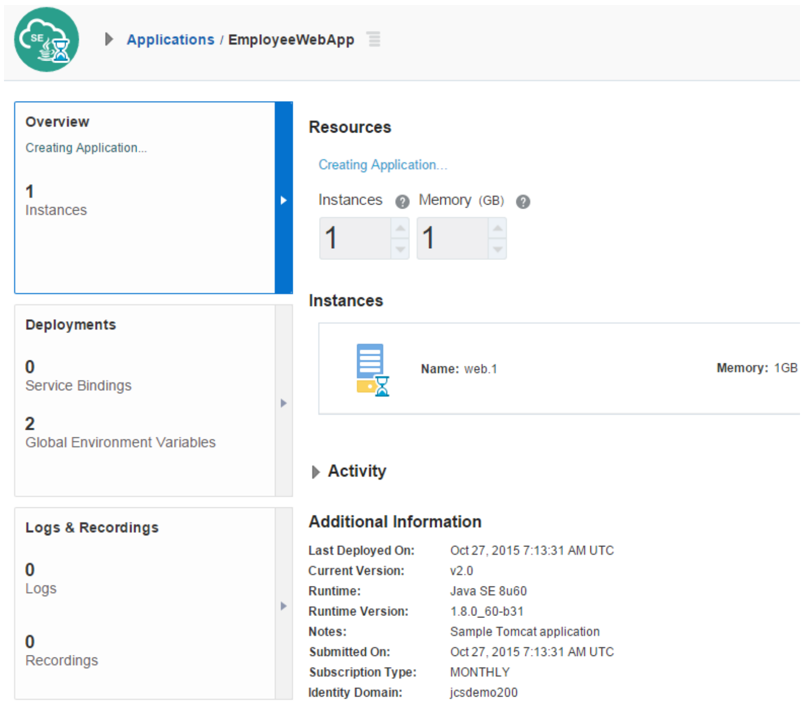
Version: Java SE 8

After a few seconds, your application should be deployed on the Oracle Application Container Cloud.


Your application is being created.

Your application has been uploaded, and we are deploying it according to your specifications.

The **Overview** tile will appear next giving you an overview of your application.



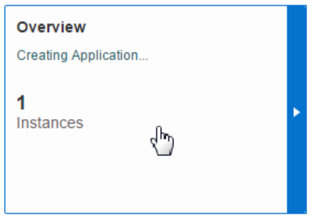
Additional Information

Last Deployed On:	Oct 27, 2015 7:13:31 AM UTC
Current Version:	v2.0
Runtime:	Java SE 8u60
Runtime Version:	1.8.0_60-b31
Notes:	Sample Tomcat application
Submitted On:	Oct 27, 2015 7:13:31 AM UTC
Subscription Type:	MONTHLY
Identity Domain:	jcsdemo200

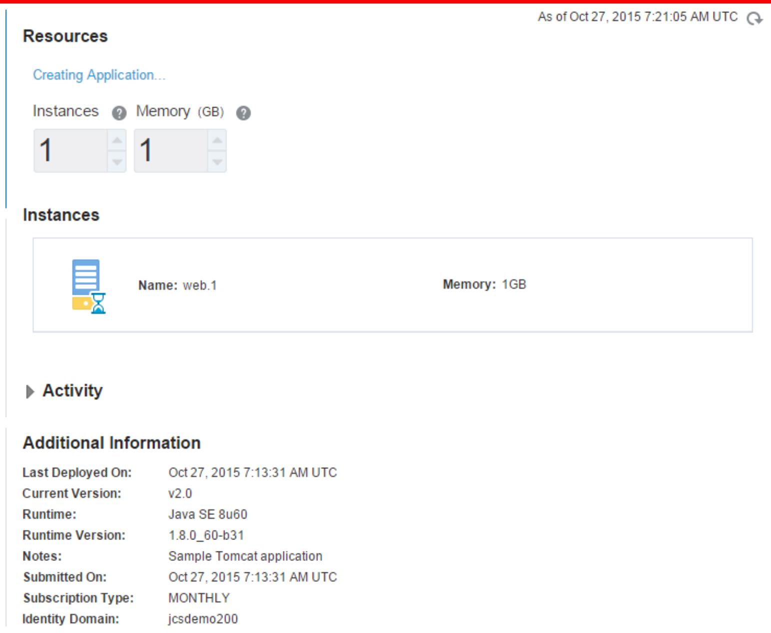
4 Configuring your Application using Web User Interface

After your application is deployed, there are a number of configuration views available to you. Each one provides you with detailed configuration options and information about your current configuration settings.

1. Click the **Overview** tile on the left side menu.



The Overview view is displayed:


As of Oct 27, 2015 7:21:05 AM UTC

Resources

Creating Application...

Instances 1 Memory (GB) 1

Instances

Name: web.1 Memory: 1GB

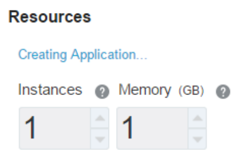
Activity

Additional Information

Last Deployed On:	Oct 27, 2015 7:13:31 AM UTC
Current Version:	v2.0
Runtime:	Java SE 8u60
Runtime Version:	1.8.0_60-b31
Notes:	Sample Tomcat application
Submitted On:	Oct 27, 2015 7:13:31 AM UTC
Subscription Type:	MONTHLY
Identity Domain:	jcsdemo200

The **Overview** view is the default view for an application. This view shows information about the number of running instances, the memory size of each instance and other data related to your application. The sections included in **Overview** view are:

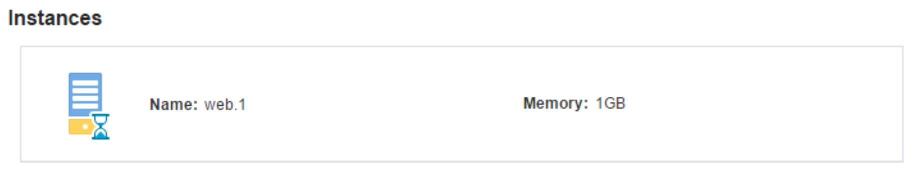
- **Resources**: Detailed information about the number of instances the amount of memory assigned to each instance.


Resources

Creating Application...

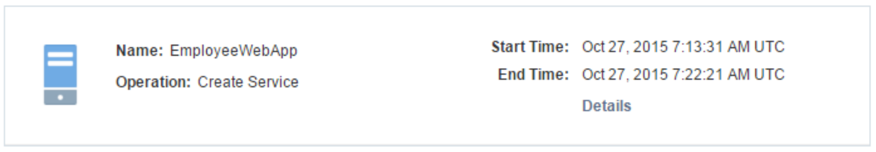
Instances 1 Memory (GB) 1

- **Instances**: A graphical representation of each instance.


Instances

Name: web.1 Memory: 1GB

- **Activity**: Information about the time of the last operation.


Name: EmployeeWebApp

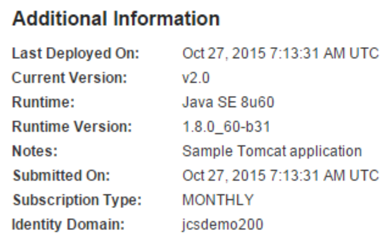
Operation: Create Service

Start Time: Oct 27, 2015 7:13:31 AM UTC

End Time: Oct 27, 2015 7:22:21 AM UTC

Details

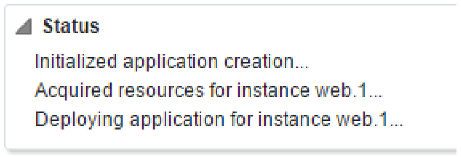
- **Additional Information**: Shows metadata related to the application. Includes things like Java version, date and time deployed, and identity domain.



Additional Information

Last Deployed On:	Oct 27, 2015 7:13:31 AM UTC
Current Version:	v2.0
Runtime:	Java SE 8u60
Runtime Version:	1.8.0_60-b31
Notes:	Sample Tomcat application
Submitted On:	Oct 27, 2015 7:13:31 AM UTC
Subscription Type:	MONTHLY
Identity Domain:	jcsdemo200

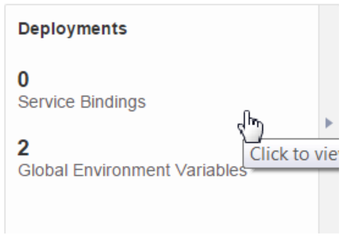
- **Status**: Shows the current status of the application.



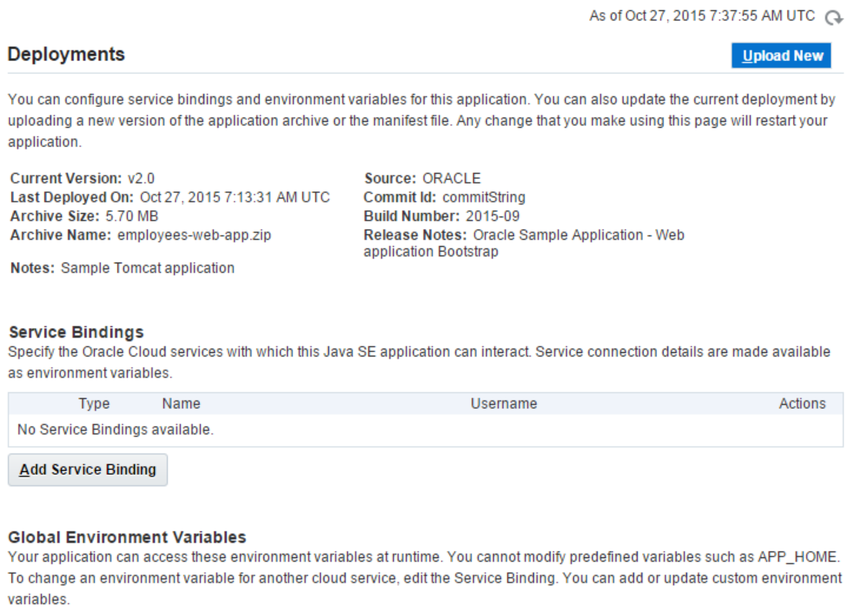
Status

Initialized application creation...
Acquired resources for instance web.1...
Deploying application for instance web.1...

2. Click the **Deployments** tile on the left side menu.



The Deployments view is displayed:



As of Oct 27, 2015 7:37:55 AM UTC

Deployments

You can configure service bindings and environment variables for this application. You can also update the current deployment by uploading a new version of the application archive or the manifest file. Any change that you make using this page will restart your application.

Current Version: v2.0
Last Deployed On: Oct 27, 2015 7:13:31 AM UTC
Archive Size: 5.70 MB
Archive Name: employees-web-app.zip

Notes: Sample Tomcat application

Source: ORACLE
Commit Id: commitString
Build Number: 2015-09
Release Notes: Oracle Sample Application - Web application Bootstrap

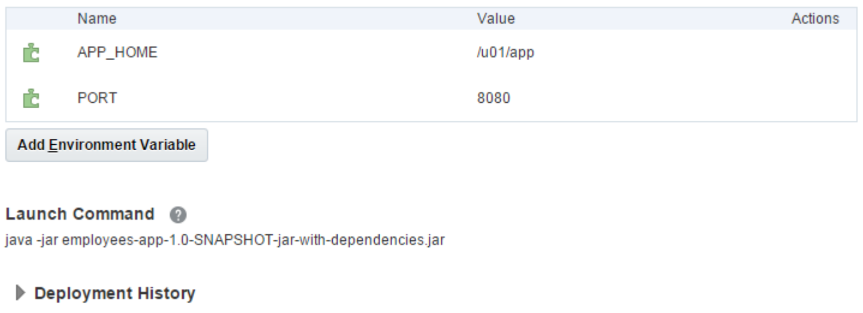
Service Bindings

Specify the Oracle Cloud services with which this Java SE application can interact. Service connection details are made available as environment variables.

Type	Name	Username	Actions
No Service Bindings available.			

Global Environment Variables

Your application can access these environment variables at runtime. You cannot modify predefined variables such as APP_HOME. To change an environment variable for another cloud service, edit the Service Binding. You can add or update custom environment variables.



Name	Value	Actions
APP_HOME	/u01/app	
PORT	8080	

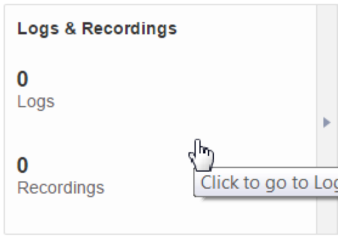
Launch Command

```
java -jar employees-app-1.0-SNAPSHOT-jar-with-dependencies.jar
```

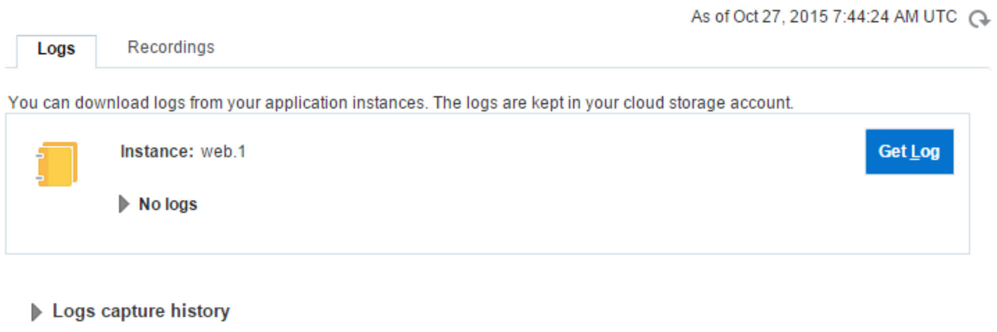
The **Deployments View** provides detailed information about the current applications deployment. Information shown here includes service bindings to other cloud services, global environment variables, and the launch command used to start your instances. The following sections are included in this view:

- **Deployments**: This section shows metadata about the deployment. This includes information like archive name and archive size.
- **Service Bindings**: This section specifies service information about other cloud services this application connects too. For example, if a database service is required for the application, the host name and login information would be specified here.
- **Global Environment Variables**: This sections list global environment variables that are available to each of your instances.
- **Launch Command**: This section shows the launch command used to start each application instance.
- **Deployment History**: This section keeps a record of the configuration files used for each application instance. The `manifest.json` and `deployment.json` files are stored here. In addition, a historical record of past configuration files is also kept.

3. Click the **Logs & Recordings** tile on the left side menu.



The **Logs** tab is displayed:

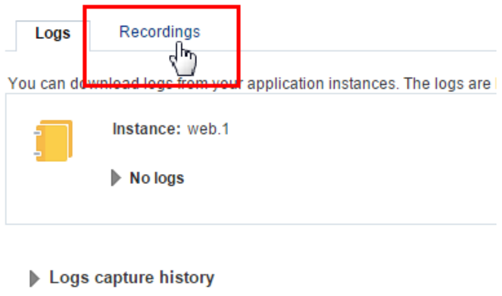


You can download logs from your application instances. The logs are kept in your cloud storage account.

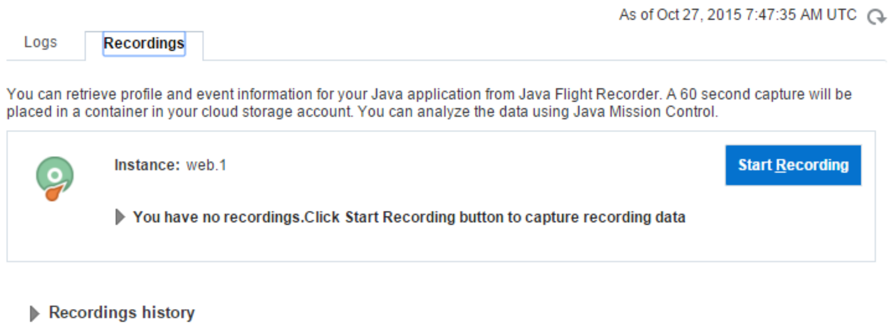
Instance: web.1

The logs tab allows you to generate the log file from your instances and then download that log to your local machine. The tab also includes a history of when logs have been captured.

4. Click the **Recordings** tab.


Logs
Recordings
You can download logs from your application instances. The logs are
Instance: web.1
No logs
Logs capture history

The Recordings tab content is displayed.


As of Oct 27, 2015 7:47:35 AM UTC
Logs
Recordings
Instance: web.1
Start Recording
You have no recordings.Click Start Recording button to capture recording data
Recordings history

You can retrieve profile and event information for your Java application from Java Flight Recorder. A 60 second capture will be placed in a container in your cloud storage account. You can analyze the data using Java Mission Control.

The Recording Tab allows you to record 1 minute of performance data from your application using Java Flight Recorder. You can then download the recording to your local machine and analyze it using Java Mission Control.

5 Deploying your Application using the REST API

This section describes the steps to deploy your Java SE application to Oracle Application Container Cloud using the REST API. Typically, this is accomplished using the CURL network utility. CURL can run on any of the major operating systems (Windows, Mac OS X, or Linux).

5.1 Cloud Deployment by Using REST API Summary

The steps needed to deploy the sample application to Oracle Application Container Cloud are the following.
Note: It is assumed that you have installed CURL on the system you are using to deploy this sample application.

1. Create a properly packaged version of your application (.zip or .tgz). Or, you can use the sample zip file provided on this tutorial and test the following CURL scripts using this prepackaged application.
2. Create CURL scripts to upload your application to the **Oracle Application Container Cloud Storage** service.
3. Execute the CURL scripts and upload your application to the storage service.
4. Create a CURL script to deploy your archive.
5. Execute the CURL script. After executing the script, your application should be deployed on Oracle Application Container Cloud.

5.2 Creating a CURL Script to Copy the App to the Storage Service

Before you can deploy your application, you must first copy it to the storage service. You can obtain the required information you need to copy the file from Oracle Application Container Cloud. Once you have the login information and host name execute a CURL script that uses the following format.
Here are the values used in the example.

Storage

- **Storage ID Domain**: johndoeStorage
- **Storage User ID**: johndoeSt

- **Storage Password**: johnStpassword

Additional Data

- **App Name**: EmployeeWebApp
- **Archive file name**: employees-web-app.zip
- **Path to local file**: target/employees-web-app.zip
- **Username**: johndoe
- **Password**: johnpassword
- **Identity Domain**: john-acct01
- **Hostname**: apaas.oraclecloud.com

1. Run the following script to create a storage container.

```
# CREATE STORAGE CONTAINER
curl -i -X PUT \
  -u johndoeSt:johnStpassword \
  https://storage.oraclecloud.com/v1/Storage-johndoeStorage/EmployeeWebApp
```

The syntax of the command is the following:

```
# CREATE STORAGE CONTAINER
curl -i -X PUT \
  -u Storage-User-ID:Storage-Password \
  https://hostname/v1/Storage-Storage-Id-Domain/App-Name
```

Once the storage container has been created, you can upload your archive to the container.

2. Run the following script to deploy to the Oracle Application Container Cloud.

```
# PUT ARCHIVE IN STORAGE CONTAINER
curl -i -X PUT \
  -u johndoeSt:johnStpassword \
   https://storage.oraclecloud.com/v1/Storage-johndoeStorage/EmployeeWebApp/
   employees-web-app.zip -T target/ employees-web-app.zip
```

The syntax of the command is the following:

```
# PUT ARCHIVE IN STORAGE CONTAINER
curl -i -X PUT \
-u User-Name:Password \
https://host-name/v1/Storage-Storage-ID-Domain/App-Name/Archive-File-Name -T Path-to-
local-file/Archive-File-Name
```

5.3 Creating a CURL Script to Deploy the App

To deploy an application using the REST API, your script needs to include some standard information.

1. Run the following deployment script.

```
 # Deployment Script
  url -i -X POST  \
     -u johndoe:johnpassword \
     -H "X-ID-TENANT-NAME:john-acct01" \
     -H "Content-Type: multipart/form-data" \
     -F "name=EmployeeWebApp" \
     -F "runtime=java" \
     -F "subscription=Monthly" \
     -F "deployment=@deployment.json" \
     -F "archiveURL=EmployeeWebApp/employees-web-app.zip" \
     -F "notes=REST app for testing" \
     https://apaas.oraclecloud.com/paas/services/apaas/api/v1.1/apps/john-acct01
```

After running this script, your application should be deployed on Oracle Application Container Cloud. Go to the web GUI to view any application details.
The following is a sample script with place holders for the information you must provide.

```
# Mock Deployment Script
url -i -X POST  \
   -u User-Name:Password \
   -H "X-ID-TENANT-NAME:Identity-Domain" \
   -H "Content-Type: multipart/form-data" \
   -F "name=App-Name" \
   -F "runtime=java" \
   -F "subscription=Monthly" \
   -F "deployment=@deployment.json" \
   -F "archiveURL=App-name/Archive-File-Name" \
   -F "notes=Your Notes here" \
   https://hostname/paas/services/apaas/api/v1.1/apps/Identity-Domain
```

Here are a few key points about this example:

- **-H** specifies headers that are added to the HTTP request.
- **-F** allows `curl` to submit data like it is coming from a form. Thus the POST as the HTTP method.
- **archiveURL** specifies where your archive file is located. Notice the URL is made up of your application name, a "/" and the archive file name.

Note: Rather than using default values for your application, a `deployment.json` file can be specified at deployment.

5.4 Using a deployment.json File

When deploying using the REST API you have the option of referring to a `deployment.json` file. The file provides configuration settings for the container your application runs in. These settings include the memory size of the application and specific information about the environment.

1. Create a JSON file with name `deployment.json`, with the following content:

```
{
 "memory": "2G",
 "instances": "1",
 "environment":{
     "TEST_ENV_VAR": "TestValue"
 }
}
```

2. Run the following deployment script.

```
# Deployment Script
 url -i -X POST  \
    -u johndoe:johnpassword \
    -H "X-ID-TENANT-NAME:john-acct01" \
    -H "Content-Type: multipart/form-data" \
    -F "name=EmployeeWebApp" \
    -F "runtime=java" \
    -F "subscription=Monthly" \
    -F "deployment=@deployment.json" \
    -F "archiveURL=EmployeeWebApp/employees-web-app.zip" \
    -F "notes=REST app for testing" \
    https://apaas.oraclecloud.com/paas/services/apaas/api/v1.1/apps/john-acct01
```

When the application is deployed, the settings defined in the file are used to deploy the app.

If we have the following `deployment.json` file:

```
{
    "memory": "2G",
    "instances": "1",
    "environment": {
        "NO_OF_CONNECTIONS":"25",
        "TWITTER_ID":"JAVA"
    },
    "services": [{
        "identifier": "ProdService",
        "name": "Jaas Service",
        "type": "JAAS"
        "username": "username",
        "password": "***"
    }]
}
```

Then the JSON fields are defined as follows:

- **memory**: Defines the size of the applications container. Values accepted 1G to 7G.
- **instances**: Number of application instances to run.
- **notes**: Notes about the deployment plan.
- **environment**:
  - **key**: Name of an environment variable used by the application.
  - **value**: Value of the environment variable used by the application.
- **services**
  - **identifier**: Identifier given by user
  - **name**: Name of the service
  - **type**: Type of the service
  - **username**: Username used to access service(OPTIONAL)
  - **password**: Password for the service(OPTIONAL)

6 Updating and Redeploying your Application

In addition to deploying your application, you can update its configuration settings or redeploy the entire application.

1. Run the following command to update the deployment configuration of the application.

```
curl -X PUT \
-u johndoe:johnpassword \
-H "X-ID-TENANT-NAME:john-acct01" \
-H "Content-Type: multipart/form-data"\
-F deployment=@deployment.json" \
-F "notes=notes for deployment" \
    https://apaas.oraclecloud.com/paas/service/apaas/api/v1.1/apps/john-acct01/
    EmployeeWebApp
```

Note at the end of the URL the Identity Domain and App name are used to specify what gets updated. The `deployment.json` file contains your changes to the configuration. Changes will restart your application or start new instances.

2. Run the following command to redeploy and update the entire application.

```
curl -X PUT \
-u johndoe:johnpassword \
-H "X-ID-TENANT-NAME:john-acct01" \
-H "Content-Type: multipart/form-data"\
-F "deployment=@deployment.json" \
-F "archiveURL=/path-to-myapp/jersey-service-intro.zip" \
-F "notes=notes for deployment" \
https://apaas.oraclecloud.com/paas/service/apaas/api/v1.1/apps/john-acct01/
EmployeeWebApp
```

Note at the end of the URL the Identity Domain and App name are used to specify what gets updated. The `deployment.json` file contains your changes to the configuration, but the file is not required. If you wish to leave the deployment setting at their current value do not specify a file. In this case you application will restart.

You have completed this Lab.