



OpenShift Container Platform 3.11

Ansible Playbook Bundle Development Guide

Developing with Ansible Playbook Bundle (APB)

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Abstract

This guide outlines the design concepts and workflow of APB

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CHAPTER 1. INTRODUCTION

1.1. ABOUT THIS GUIDE

This guide outlines the design concepts and workflow of [Ansible Playbook Bundles \(APBs\)](#), shows how to install and use the **apb** CLI tooling, and provides a tutorial and reference material on writing your own APBs.

1.2. DESIGN OVERVIEW

An APB is a lightweight application definition that borrows several concepts from the [Nulecule](#) and [Atomicapp](#) projects, namely the concept of a short-lived container with the sole purpose of orchestrating the deployment of the intended application. For the case of APBs, this short-lived container is the APB itself: a container with an [Ansible](#) runtime environment plus any files required to assist in orchestration, such as playbooks, roles, and extra dependencies.

The [OpenShift Ansible broker](#) (OAB) is an implementation of the Open Service Broker (OSB) API that manages applications defined by APBs. The OAB is supported and deployed by default.

Specification of an APB is intended to be lightweight, consisting of several named playbooks and a metadata file to capture information such as parameters to pass into the application.

1.3. WORKFLOW

The APB workflow is broken up into the following steps:

1. Preparation
 - a. APB initialization
 - b. APB spec file
 - c. Actions (provision, deprovision, bind, unbind)
2. Build
3. Deploy

1.3.1. Preparation

You must prepare your APB's directory structure and spec file before you can build and deploy it. The [Getting Started](#) topic provides a step by step tutorial on creating your first APB, while the following sections briefly cover this workflow.

1.3.1.1. APB Initialization

The **apb init** command creates the required skeleton directory structure and a few required files (for example, the **apb.yml** spec file) for the APB.

The following shows an example directory structure of an APB:

Directory Structure

```
example-apb/
```

```

├── Dockerfile
├── apb.yml
├── roles/
│   ├── example-apb-openshift
│   │   ├── defaults
│   │   │   └── main.yml
│   │   └── tasks
│   │       └── main.yml
└── playbooks/
    ├── provision.yml
    ├── deprovision.yml
    ├── bind.yml
    └── unbind.yml

```

1.3.1.2. APB Spec File

An APB spec file (***apb.yml***) must be edited for your specific application. For example, the default spec file after running **apb init** looks as follows:

```

version: 1.0
name: my-test-apb
description: This is a sample application generated by apb init
bindable: False
async: optional
metadata: ❶
  displayName: my-test
plans:
  - name: default
    description: This default plan deploys my-test-apb
    free: True
    metadata: {}
    parameters: [] ❷

```

❶ The **metadata** field is optional and used when integrating with the OpenShift Container Platform service catalog.

❷ For APBs that do not have any parameters, the **parameters** field should be blank.



NOTE

See the [Reference](#) topic for a fully-defined example APB spec file.

1.3.1.3. Actions

The following are the actions for an APB. At a minimum, an APB must implement the provision and deprovision actions:

provision.yml

Playbook called to handle installing application to the cluster.

deprovision.yml

Playbook called to handle uninstalling.

bind.yml

Playbook to grant access to another service to use this service, such as generating credentials.

unbind.yml

Playbook to revoke access to this service.

test.yml

(Optional) Playbook to test that the APB is valid.

The required named playbooks correspond to methods defined by the OSB API. For example, when the OAB needs to provision an APB it will execute ***provision.yml***.

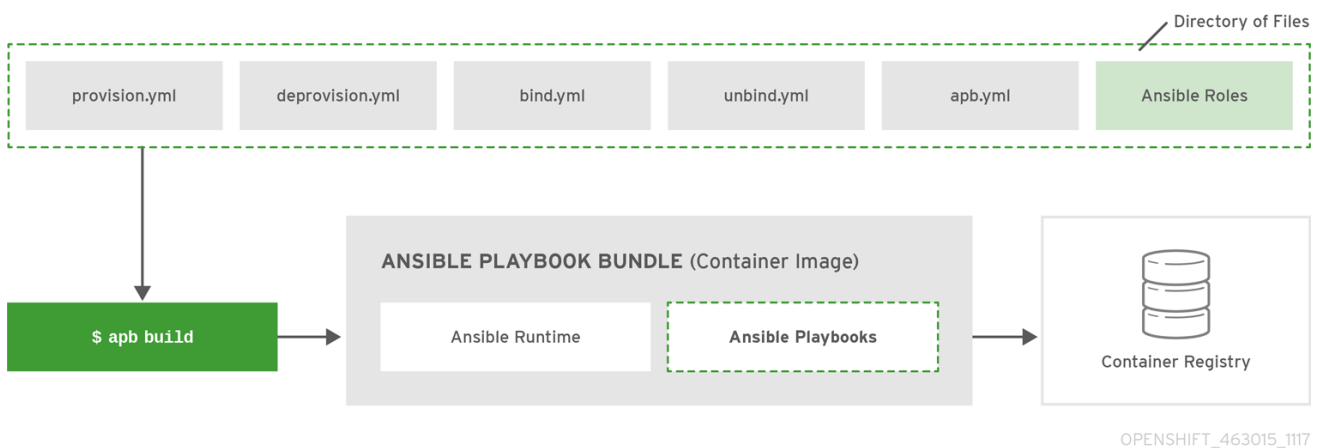
After the required named playbooks have been generated, the files can be used directly to test management of the application. A developer may want to work with this directory of files, make tweaks, run, repeat until they are happy with the behavior. They can test the playbooks by invoking Ansible directly with the playbook and any required variables.

1.3.2. Build

The build step is responsible for building a container image from the named playbooks for distribution. Packaging combines a base image containing an Ansible runtime with Ansible artifacts and any dependencies required to run the playbooks.

The result is a container image with an **ENTRYPOINT** set to take in several arguments, one of which is the method to execute, such as provision and deprovision.

Figure 1.1. APB Build



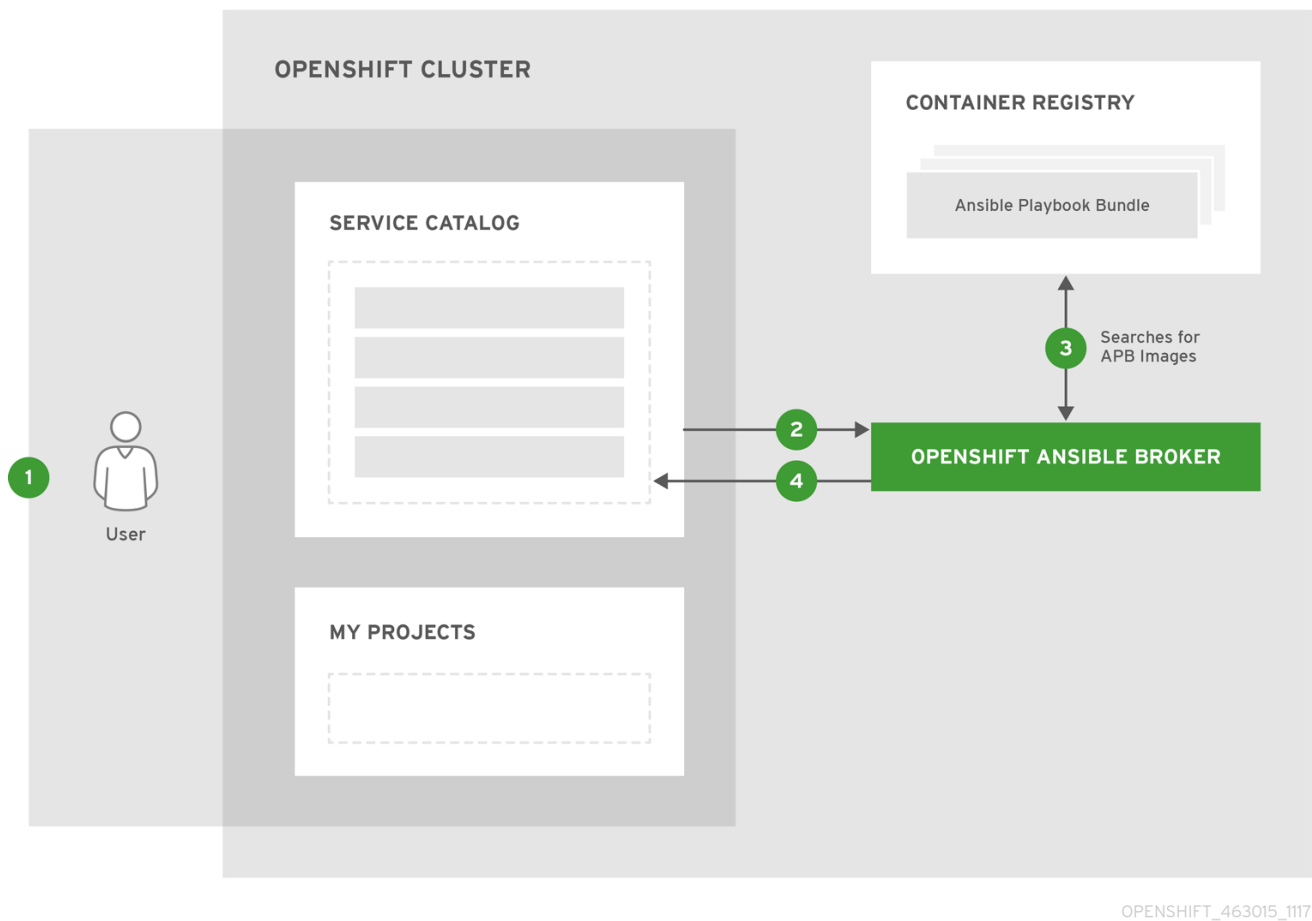
1.3.3. Deploy

Deploying an APB means invoking the container and passing in the name of the playbook to execute along with any required variables. It is possible to invoke the APB directly without going through the OAB. Each APB is packaged so its **ENTRYPOINT** will invoke Ansible when run. The container is intended to be short-lived, coming up to execute the Ansible playbook for managing the application then exiting.

In a typical APB deploy, the APB container will provision an application by running the ***provision.yml*** playbook, which executes an Ansible role. The role is responsible for creating the OpenShift Container Platform resources, perhaps through calling **oc create** commands or leveraging Ansible modules. The end result is that the APB runs Ansible to talk to OpenShift Container Platform to orchestrate the provisioning of the intended application.

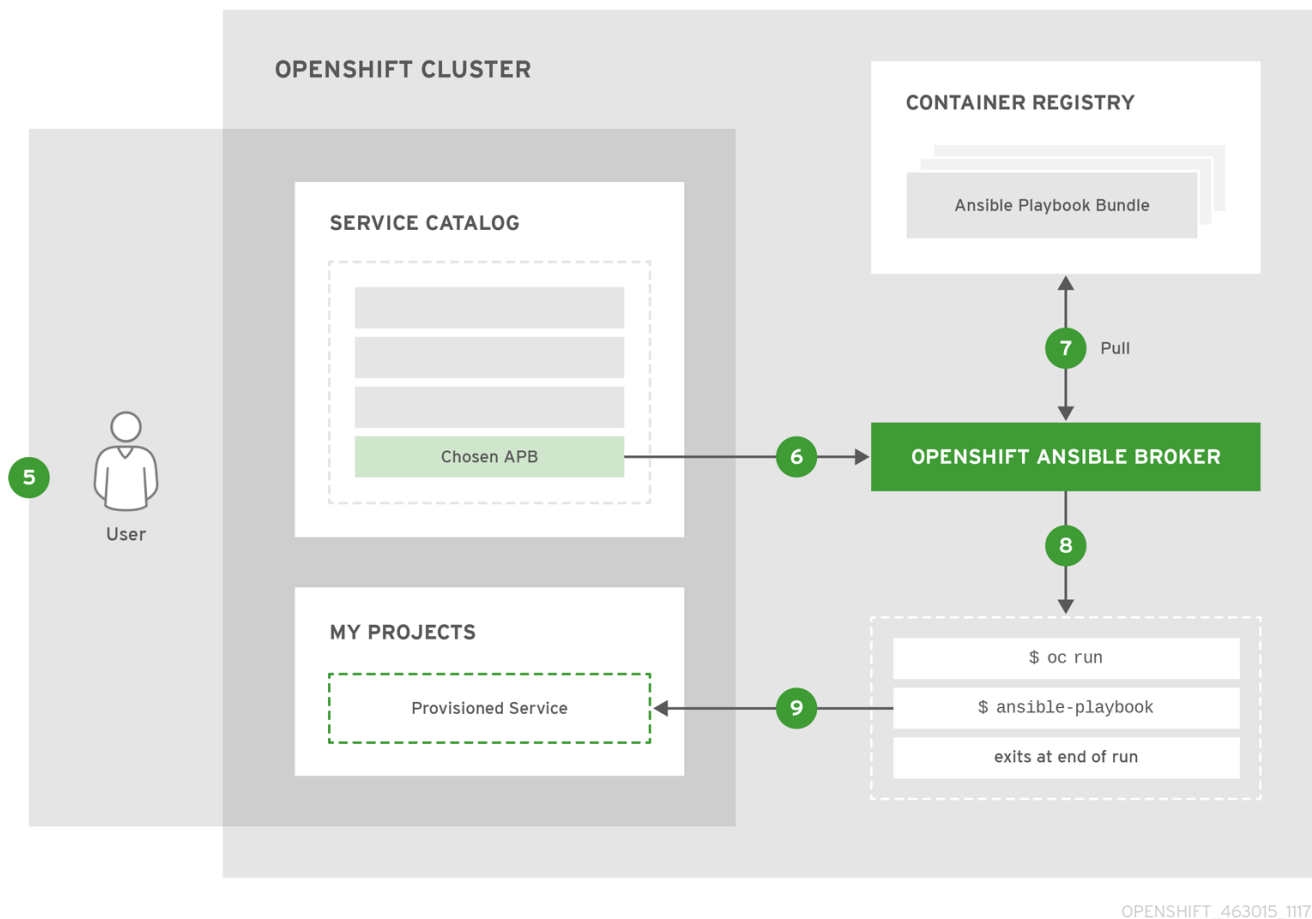
The following diagrams illustrate this deployment flow in two phases: a user discovering a list of available APBs and then requesting their chosen APB be provisioned to their project:

Figure 1.2. Listing Available APBs



- 1** An OpenShift Container Platform user is interested in provisioning a service into their project, so they interact with the service catalog by accessing the OpenShift Container Platform UI (web console or CLI) to discover any APBs that are already available.
- 2** The service catalog requests a list of APBs from the OAB to show the user.
- 3** The OAB searches all configured container registries (the cluster's OpenShift Container Registry or any other remote registry) for any APBs (images with a specific label, for example **LABEL=apb-1.0**).
- 4** The OAB returns the discovered list to the service catalog, to be viewed by the user in the OpenShift Container Platform UI.

Figure 1.3. Deploying a Chosen APB



5 The user now chooses an APB from the discovered list provided by the service catalog.

6 The service catalog communicates with the OAB that the user has requested use of the chosen APB.

7 The OAB initiates the image pull from the appropriate container image registry.

8 After the image is pulled, the OAB defers the logic for orchestrating the application to the APB. The service is deployed by running the APB container with a few parameters. To do so, the following command is issued against the OpenShift Container Platform cluster in a temporary namespace:

```
$ oc run $IMAGE $METHOD $VARS ansible-playbook ${METHOD}.yaml ${VARS}
```

To break this command down further:

1. The **oc run** command runs the APB image.
2. In the short-lived container that is created as a result, Ansible is launched using the **ansible-playbook** command, which runs the appropriate playbook (for example, **provision.yaml**) to execute the requested action. This creates OpenShift Container Platform resources in the user's project.
3. The container exits at the end of the run, and the temporary namespace is removed.

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As a result, the user views via the OpenShift Container Platform UI that their requested service has been successfully provisioned in their project.

CHAPTER 2. CLI TOOLING

2.1. OVERVIEW

The **apb** CLI tool helps Ansible Playbook Bundle (APB) authors create, build, and publish their APBs to container registries. It enforces best practices and takes care of the details so they should be easy to deploy.

2.2. INSTALLING THE TOOL

2.2.1. Prerequisites

2.2.1.1. Docker Daemon

The **docker** daemon must be correctly installed and running on the system.

2.2.1.2. Access Permissions

The **apb** tool requires you to be logged in as a tokened cluster user; the default **system:admin** system user is not sufficient because it does not have a token that can be used for the tool's authentication. In addition, there are a number of local roles (project-scoped) and cluster roles (cluster-wide) that must exist to permit the full breadth of the **apb** tool's functions (see [Cluster and Local RBAC](#)).

The easiest option is to ensure the user has the **cluster-admin** cluster role. To add this role to another user, you can run the following as a user that already has such permissions (for example, the **system:admin** default system user):



WARNING

This is effectively cluster **root** and should only be used in a development setting.

```
$ oc adm policy add-cluster-role-to-user cluster-admin <user>
$ oc login -u <user> <openshift_server>
```

If you would like a more strictly permissioned environment, an OpenShift template is provided that by default will permission a user called **developer**. The template must be run by a user with sufficient permissions to create the various roles. The **developer** user does not have such permissions, but the **system:admin** user is sufficient.

To run the template:

1. Download the [openshift-permissions.template.yaml](#) file locally.
2. Run the following command:

```
$ oc process -f openshift-permissions.template.yaml \
  -p BROKER_NAMESPACE=openshift-ansible-service-broker \
```

```
-p GLOBAL_IMAGE_PROJECT=default \
[-p USER=<your_desired_user>] \ 1
| oc create -f -
```

- 1** By default, the template will permission the **developer** user. You can optionally use the **-p** flag to override this default value with your desired user.

2.2.2. Installing via RPM

The APB CLI tool is provided by the **apb** package, which is available from the **rhel-7-server-ose-3.11-rpms** channel:

```
$ sudo yum install apb
```

2.2.3. Verifying the Installation

Run **apb help** to make sure the tool is installed correctly:

```
$ apb help
usage: apb [-h] [--debug] [--project BASE_PATH]
          {init,help,prepare,push,bootstrap,list,remove,build} ...

APB tooling for assisting in building and packaging APBs.

optional arguments:
  -h, --help            show this help message and exit
  --debug               Enable debug output
  --project BASE_PATH, -p BASE_PATH
                        Specify a path to your project. Defaults to CWD.

subcommand:
  {init,help,prepare,push,bootstrap,list,remove,build}
    init                Initialize the directory for APB development
    help                Display this help message
    prepare             Prepare an ansible-container project for APB
packaging
  push                 Push local APB spec to an OAB
  bootstrap            Tell OAB to reload APBs from the
                        container repository
  list                 List APBs from the target OAB
  remove               Remove APBs from the target OAB
  build                Build and package APB container
```

2.3. TYPICAL WORKFLOWS

2.3.1. Local Registry

In order to use the OpenShift Container Registry to source APBs, you must have configured the OpenShift Ansible broker to use the **local_openshift** type registry adapter. See the [config](#) section for more information.


```
$ apb init my-new-apb
$ cd my-new-apb
$ apb build
$ apb push
$ apb list
```

If you are using a namespace other than the default **openshift** namespace to host your APBs, then you can use the following command:

```
$ apb push --namespace <namespace>
```

2.3.2. Remote Registry

OAB can also be [configured](#) to use a remote registry and organization such as [docker.io/ansibleplaybookbundle](#) or your own personal account. In order to use this for developing APBs, you can build and push to your remote registry and then **bootstrap** to reload your APBs:

```
$ apb init my-new-apb
$ cd my-new-apb
$ apb build --tag docker.io/my-org/my-new-apb
$ docker push docker.io/my-org/my-new-apb
$ apb bootstrap
$ apb list
```

2.4. APB CREATION COMMANDS

2.4.1. init

Description

Initializes a directory structure for a new APB. Also creates example files for the new APB with sensible defaults.

Usage

```
$ apb init [OPTIONS] NAME
```

Arguments

NAME: Name of the APB and directory to be created.

Options

Option, Shorthand	Description
--help, -h	Show help message
--force	Force re-init and overwrite the directory
--async {required, optional, unsupported}	Specify asynchronous operation on application. Usually defaulted to optional .
--bindable	Generate an application with bindable settings

Option, Shorthand	Description
--skip-provision	Do not generate provision playbook and role
--skip-deprovision	Do not generate deprovision playbook and role
--skip-bind	Do not generate bind playbook and role
--skip-unbind	Do not generate unbind playbook and role
--skip-roles	Do not generate any roles

**NOTE**

Async bind and unbind is an experimental feature and is not supported or enabled by default.

Examples

Create directory **my-new-apb**:

```
$ apb init my-new-apb
# my-new-apb/
# |— apb.yml
# |— Dockerfile
# |— playbooks
# |   |— deprovision.yml
# |   |— provision.yml
# |— roles
#     |— deprovision-my-new-apb
#         |— tasks
#             |— main.yml
#     |— provision-my-new-apb
#         |— tasks
#             |— main.yml
```

Create directory **my-new-apb**, but skip generating deprovision playbook and roles:

```
$ apb init my-new-apb --skip-deprovision
# my-new-apb/
# |— apb.yml
# |— Dockerfile
# |— playbooks
# |   |— provision.yml
# |— roles
#     |— provision-my-new-apb
#         |— tasks
#             |— main.yml
```

Create directory **my-new-apb**, overwriting any old versions. The APB will be configured to be bindable and set async to optional:

■

```

$ apb init my-new-apb --force --bindable --async optional
# my-new-apb/
# └─ apb.yml
# └─ Dockerfile
# └─ playbooks
#     └─ bind.yml
#     └─ deprovision.yml
#     └─ provision.yml
#     └─ unbind.yml
# └─ roles
#     └─ bind-my-new-apb
#         └─ tasks
#             └─ main.yml
#     └─ deprovision-my-new-apb
#         └─ tasks
#             └─ main.yml
#     └─ provision-my-new-apb
#         └─ tasks
#             └─ main.yml
#     └─ unbind-my-new-apb
#         └─ tasks
#             └─ main.yml

```

2.4.2. prepare

Description

Compiles the APB into base64 encoding and writes it as a label to the *Dockerfile*.

This will allow the OAB to read the APB metadata from the registry without downloading the images. This command must be run from inside the APB directory. Running the **build** command will automatically run **prepare** as well, meaning you generally do not need to run **prepare** by itself.

Usage

```
$ apb prepare [OPTIONS]
```

Options

Option, Shorthand	Description
--help, -h	Show help message
--dockerfile DOCKERFILE, -f DOCKERFILE	Writes the APB spec to the target file name instead of a file named <i>Dockerfile</i>

Examples

Writes the label for the spec field in the *Dockerfile*:

```
$ apb prepare
```

Writes the label for the spec field in *Dockerfile-custom*:

```
$ apb prepare --dockerfile Dockerfile-custom
```

2.4.3. build

Description

Builds the image for the APB.

Similar to running **apb prepare** and **docker build** with a tag.

Usage

```
$ apb build [OPTIONS]
```

Options

Option, Shorthand	Description
--help, -h	Show help message
--tag TAG	Sets the tag of the built image to a string in the format <registry>/<org>/<name>
--registry	Registry portion of the tag of the image (e.g., docker.io)
--org, -o	User or organization portion of the tag of the image

Examples

Build the image and use the name field from **apb.yml** as the tag:

```
$ apb build
```

Build the image and use the tag **docker.io/my-org/my-new-apb**:

```
$ apb build --tag docker.io/my-org/my-new-apb
```

Build the image and use the tag **docker.io/my-org/<my-apb-name>**:

```
$ apb build --registry docker.io --org my-org
```

Build the image using the file **Dockerfile-custom** as the **Dockerfile** definition:

```
$ apb build --dockerfile Dockerfile-custom
```

2.4.4. push

Description

Uploads the APB to an OpenShift Container Registry or a broker mock registry where it will be read by the OAB.

When using the broker's mock registry, the spec is uploaded and will be displayed in OpenShift Container Platform, but OpenShift Container Platform will pull the image from the registry normally. Usually that means the registry where **oc cluster up** was performed.

When using the OpenShift Container Registry, the image is uploaded to OpenShift Container Platform directly.

Usage

```
$ apb push [OPTIONS]
```

Options

Option, Shorthand	Description
--help, -h	Show help message
--broker BROKER_URL	Route to the OAB
--namespace NAMESPACE	Namespace to push to the OpenShift Container Registry
--openshift, -o	Use the OpenShift Container Registry
--dockerfile DOCKERFILE, -f DOCKERFILE	<i>Dockerfile</i> to build internal registry image. Usually defaults to Dockerfile but can be set to any file name.
--secure	Use secure connection to OAB
--username USERNAME	Basic authentication user name to be used in broker communication
--password PASSWORD	Basic authentication password to be used in broker communication
--no-relist	Do not relist the catalog after pushing an APB to the broker
--broker-name	Name of the ServiceBroker Kubernetes resource

Examples

Push to the OAB development endpoint:

```
$ apb push
```

Push to the local OpenShift Container Registry:

```
$ apb push
```

Push to the local OpenShift Container Registry under namespace **myproject**:

```
$ apb push --namespace myproject
```

2.4.5. test

Description

Runs the APB unit tests.

Usage

```
$ apb test [OPTIONS]
```

Options

Option, Shorthand	Description
--help, -h	Show help message
--tag TAG	Sets the tag of the built image to a string in the format <registry>/<org>/<name>

Examples

Run the tests:

```
$ apb test
```

Run the tests but use a specific tag on the built image:

```
$ apb test --tag docker.io/my-org/my-new-apb
```

2.5. BROKER UTILITY COMMANDS

2.5.1. list

Description

Lists all the APBs the broker has loaded.

Usage

```
$ apb list [OPTIONS]
```

Options

Option, Shorthand	Description
--help, -h	Show help message
--broker BROKER_URL	Route to the OAB
--secure	Use secure connection to OAB
--verbose, -v	Output verbose spec information from OAB

Option, Shorthand	Description
--output {yaml,json}, -o {yaml,json}	Specify verbose output format in yaml (default) or json
--username BASIC_AUTH_USERNAME, -u BASIC_AUTH_USERNAME	Specify the basic authentication user name to be used
--password BASIC_AUTH_PASSWORD, -p BASIC_AUTH_PASSWORD	Specify the basic authentication password to be used

Examples

Basic list of APBs including name, ID, and description:

```
$ apb list
```

List verbose, easily readable specs:

```
$ apb list -v
```

List all the JSON output:

```
$ apb list -v -o json
```

2.5.2. bootstrap

Description

Requests the OAB to reload all APBs from the registries.

Usage

```
$ apb bootstrap [OPTIONS]
```

Options

Option, Shorthand	Description
--help, -h	Show help message
--broker BROKER_URL	Route to the OAB
--secure	Use secure connection to OAB
--no-relist	Do not relist the catalog after bootstrapping the broker
--username BASIC_AUTH_USERNAME, -u BASIC_AUTH_USERNAME	Specify the basic authentication user name to be used

Option, Shorthand	Description
--password BASIC_AUTH_PASSWORD, -p BASIC_AUTH_PASSWORD	Specify the basic authentication password to be used
--broker-name BROKER_NAME	Name of the ServiceBroker Kubernetes resource

Examples

Basic reload of APBs:

```
$ apb bootstrap
```

2.5.3. remove**Description**

Removes one (or all) APBs from the OAB.

Usage

```
$ apb remove [OPTIONS]
```

Options

Option, Shorthand	Description
--help, -h	Show help message
--broker BROKER_URL	Route to the OAB
--secure	Use secure connection to OAB
--all	Remove all stored APBs
--id ID	ID of APB to remove
--secure	Use secure connection to OAB
--username BASIC_AUTH_USERNAME, -u BASIC_AUTH_USERNAME	Specify the basic authentication user name to be used
--password BASIC_AUTH_PASSWORD, -p BASIC_AUTH_PASSWORD	Specify the basic authentication password to be used
--no-relist	Do not relist the catalog after deletion

Examples

Remove an APB using an ID:


```
$ apb remove --id ca91b61da8476984f18fc13883ae2fdb
```



NOTE

If you need an ID of an APB, use:

```
$ apb list
ID                                     NAME
DESCRIPTION
ca91b61da8476984f18fc13883ae2fdb  dh-etherpad-apb      Note
taking web application
```

Remove all APBs:

```
$ apb remove --all
```

2.5.4. relist

Description

Forces service catalog to relist the provided services to match the broker.

Usage

```
$ apb relist [OPTIONS]
```

Options

Option, Shorthand	Description
--help, -h	Show help message
--broker-name BROKER_NAME	Name of the ServiceBroker Kubernetes resource
--secure	Use secure connection to OAB
--username BASIC_AUTH_USERNAME, -u BASIC_AUTH_USERNAME	Specify the basic authentication user name to be used
--password BASIC_AUTH_PASSWORD, -p BASIC_AUTH_PASSWORD	Specify the basic authentication password to be used

Examples

```
$ apb relist
```

2.6. OTHER COMMANDS

2.6.1. help

Description

Displays a help message.

Usage

```
$ apb help
```

Examples

```
$ apb help
```

```
$ apb -h
```

CHAPTER 3. WRITING APBS

3.1. WRITING APBS: GETTING STARTED

3.1.1. Overview

In this tutorial, you will walk through the creation of some sample Ansible Playbook Bundles (APBs). You will create actions for them to allow provision, deprovision, bind, and unbind. You can find more information about the design of APBs in the [Design](#) topic. More in-depth information about writing APBs is available in the [Reference](#) topic.



NOTE

For the remainder of this tutorial, substitute your own information for items marked in brackets; for example, `<host>:<port>` might need to be replaced with `172.17.0.1.nip.io:8443`.

3.1.2. Before You Begin

Before getting started creating your own APBs, you must set up your development environment:

1. Ensure you have access to an OpenShift Container Platform cluster. The cluster should be running both the service catalog and the OpenShift Ansible broker (OAB), which are installed by default.
2. Install the APB tools as documented in the [CLI Tooling](#) topic. To verify, you can run the **apb help** command and check for a valid response.
3. If you are developing against an OpenShift Container Platform cluster that exists on a remote host or you do not have access to the **docker** daemon, see [Working with Remote Clusters](#) for alternative steps when using the **apb push** and **apb run** commands described in this guide.

3.1.3. Creating Your First APB

In this tutorial, you will create an APB for a containerized [hello world application](#). You will work through a basic APB that will mirror the APB [hello-world-apb](#).

1. Your first task is to initialize the APB using the **apb** CLI tool. This creates the skeleton for your APB. The command for this is simple:

```
$ apb init my-test-apb
```

After initialization, you will see the following file structure:

```
my-test-apb/
├── apb.yml
├── Dockerfile
├── playbooks
│   ├── deprovision.yml
│   └── provision.yml
├── roles
│   └── deprovision-my-test-apb
│       └── tasks
```

```

├── main.yml
└── provision-my-test-apb
    ├── tasks
    └── main.yml

```

Two files were created at the root directory: an ***apb.yml*** (the APB spec file) and a ***Dockerfile***. These are the minimum files required for any APB. For more information about the APB spec file, see the [Reference](#) topic. There is also an explanation of what you can do in the [Dockerfile](#).

apb.yml

```

version: 1.0
name: my-test-apb
description: This is a sample application generated by apb init
bindable: False
async: optional
metadata:
  displayName: my-test
plans:
  - name: default
    description: This default plan deploys my-test-apb
    free: True
    metadata: {}
    parameters: []

```

Dockerfile

```

FROM ansibleplaybookbundle/apb-base

LABEL "com.redhat.apb.spec"=\

COPY playbooks /opt/apb/actions
COPY roles /opt/ansible/roles
RUN chmod -R g=u /opt/{ansible,apb}
USER apb

```

2. In the ***Dockerfile***, there are two updates to make:

- a. Change the **FROM** directive to use the image from the Red Hat Container Catalog. The first line should now read:

```
FROM openshift3/apb-base
```

- b. Update **com.redhat.apb.spec** in the **LABEL** instruction with a base64 encoded version of ***apb.yml***. To do this, run **apb prepare**:

```

$ cd my-test-apb
$ apb prepare

```

This updates the ***Dockerfile*** as follows:

Dockerfile

```
FROM openshift3/apb-base
```

```

LABEL "com.redhat.apb.spec"=\
"dmVyc2lvcjogMS4wCm5hbWU6IG15LXRlc3QtYXBiCmRlc2NyaXB0aw9uOiBUaGlz
IGlzIGEgc2Ft\
cGx1IGFwcGxpY2F0aw9uIGd1bmVyYXRlZCBieSBhcGIgaw5pdApiaW5kYWJsZTogR
mFsc2UKYXN5\
bmM6IG9wdGlvbmFsCm1ldGFkYXRhOgogIGRpc3BsYXl0YW11OiBteS10ZXN0CnBsY
W5zOgogIC0g\
bmFtZTogZGVmYXVsdAogICAgZGVzY3JpcHRpb246IFRoXMGZGVmYXVsdCBwbGFuI
GRlcGxveXMg\
bXktdGVzdC1hcGKICAgIGZyZWU6IFRydWUKICAgIG1ldGFkYXRhOiB7fQogICAgc
GFyYW1ldGVy\
czogW10="

COPY playbooks /opt/apb/actions
COPY roles /opt/ansible/roles
RUN chmod -R g=u /opt/{ansible,apb}
USER apb

```

3. At this point, you have a fully formed APB that you can build. If you skipped using **apb prepare**, the **apb build** command will still prepare the APB before building the image:

```
$ apb build
```

4. You can now push the new APB image to the local OpenShift Container Registry:

```
$ apb push
```

5. Querying the OAB will now show your new APB listed:

```

$ apb list
ID                                     NAME                DESCRIPTION
< ----- ID -----> dh-my-test-apb This is a sample
application generated by apb init

```

Similarly, visiting the OpenShift Container Platform web console will now display the new APB named **my-test-apb** in the service catalog under the **All** and **Other** tabs.

3.1.4. Adding Actions

The brand new APB created in the last section does not do much in its current state. For that, you must add some actions. The actions supported are:

- provision
- deprovision
- bind
- unbind
- test

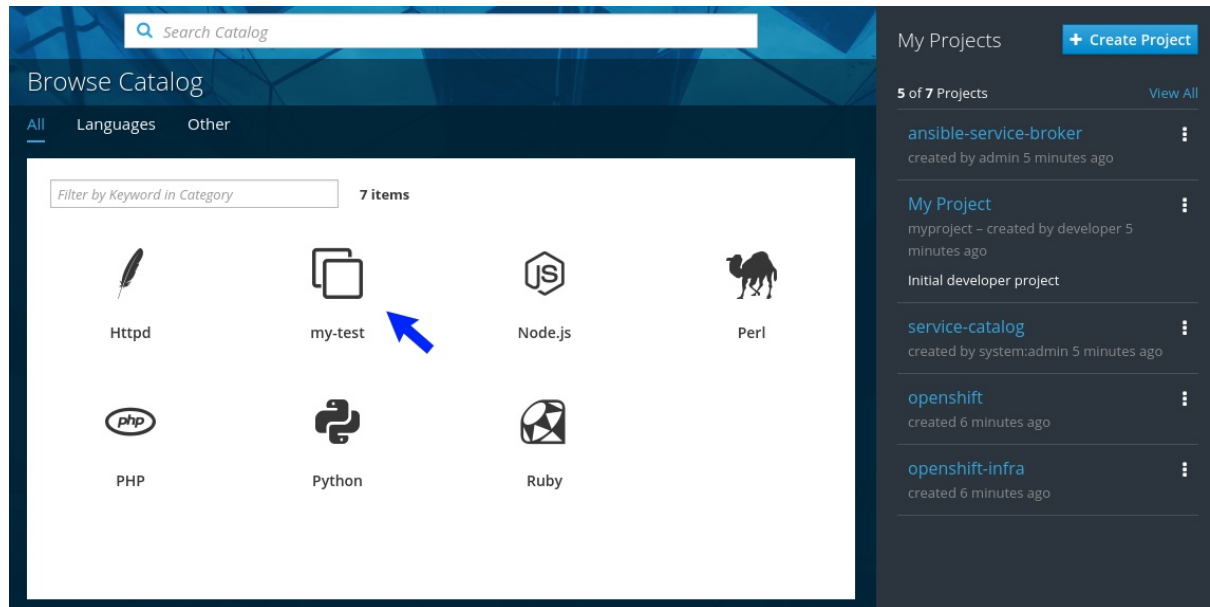
You will add each of these actions in the following sections. But before beginning:

1. Ensure that you are logged in to your OpenShift Container Platform cluster via the **oc** CLI. This will ensure the **apb** tool can interact with OpenShift Container Platform and the OAB:

```
# oc login <cluster_host>:<port> -u <user_name> -p <password>
```

2. Log in to the OpenShift Container Platform web console and verify your APB listed in the catalog:

Figure 3.1. OpenShift Container Platform Web Console



3. Create a project named **getting-started** where you will deploy OpenShift Container Platform resources. You can create it using the web console or CLI:

```
$ oc new-project getting-started
```

3.1.4.1. Provision

During the **apb init** process, two parts of the provision task were stubbed out. The playbook, **playbooks/provision.yml**, and the associated role in **roles/provision-my-test-apb**:

```
my-test-apb
├── apb.yml
├── Dockerfile
├── playbooks
│   └── provision.yml ①
├── roles
│   └── provision-my-test-apb
│       ├── tasks
│       └── main.yml ②
```

① Inspect this playbook.

② Edit this role.

The **playbooks/provision.yml** file is the Ansible playbook that will be run when the provision action is called from the OAB. You can change the playbook, but for now you can just leave the code as is.

playbooks/provision.yml

```

- name: my-test-apb playbook to provision the application
  hosts: localhost
  gather_facts: false
  connection: local
  roles:
    - role: ansible.kubernetes-modules
      install_python_requirements: no
    - role: ansibleplaybookbundle.asb-modules
    - role: provision-my-test-apb
  playbook_debug: false

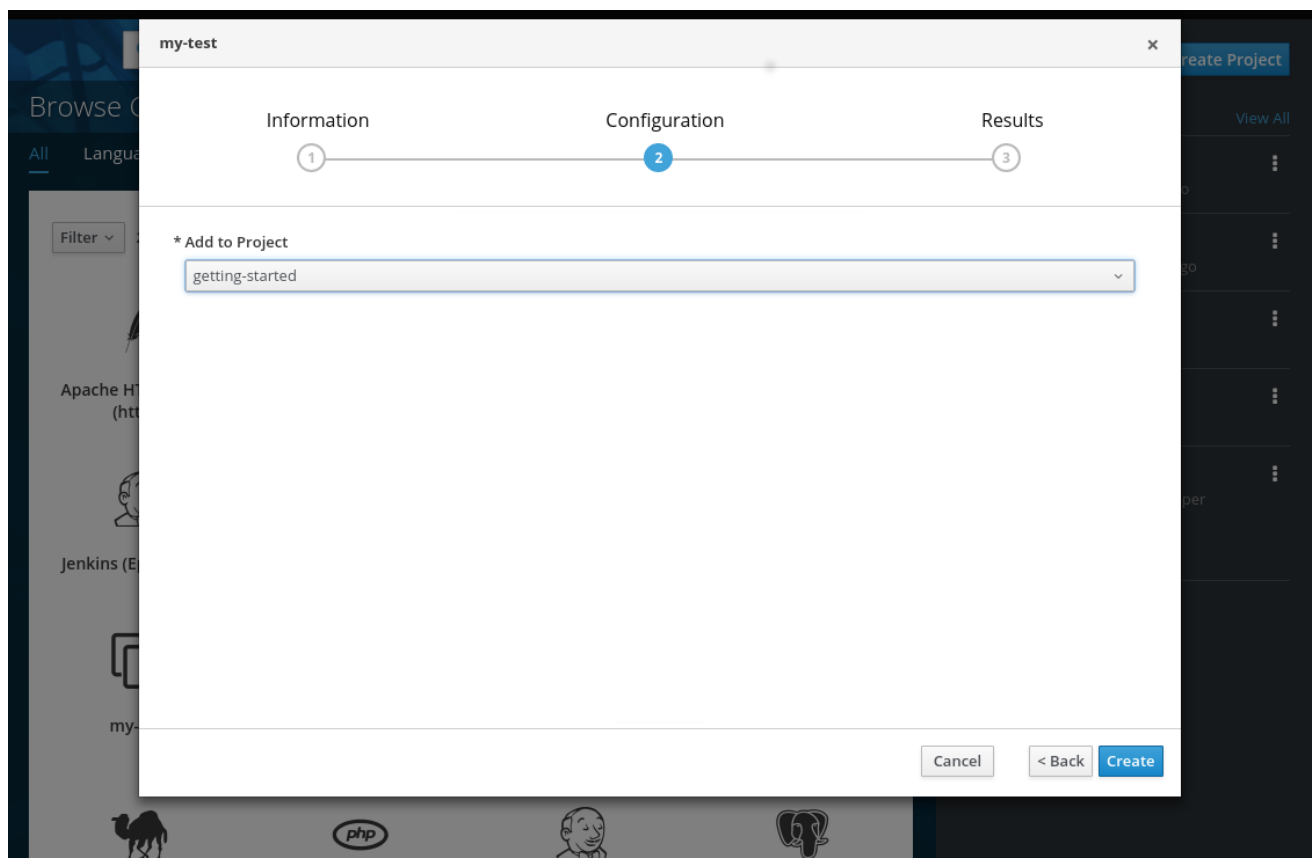
```

The playbook will execute on **localhost** and execute the role **provision-my-test-apb**. This playbook works on its local container created by the service broker. The **ansible.kubernetes-modules** role allow you to use the **kubernetes-modules** to create your OpenShift Container Platform resources. The **asb-modules** provide additional functionality for use with the OAB.

Currently, there are no tasks in the role. The contents of the **roles/provision-my-test-apb/tasks/main.yml** only contains comments showing common resource creation tasks. ou can currently execute the provision task, but since there are no tasks to perform, it would simply launch the APB container and exit without deploying anything.

You can try this now by clicking on the **my-test** APB and deploying it to the **getting-started** project using the web console:

Figure 3.2. Provisioning my-test



When the provision is executing, a new namespace is created with the name **dh-my-test-apb-prov-*<random>***. In development mode, it will persist, but usually this namespace would be deleted after successful completion. If the APB fails provisioning, the namespace will persist by default.

By looking at the pod resources, you can see the log for the execution of the APB. To view the pod's logs:

1. Find the namespaces by either using the web console to view all namespaces and sort by creation date, or using the following command:

```
$ oc get ns
NAME                                STATUS    AGE
ansible-service-broker             Active    1h
default                             Active    1h
dh-my-test-apb-prov-<random>        Active    4m
```

2. Switch to the project:

```
$ oc project dh-my-test-apb-prov-<random>
Now using project "dh-my-test-apb-prov-<random>" on server "
<cluster_host>:<port>".
```

3. Get the pod name:

```
$ oc get pods
NAME                                READY    STATUS    RESTARTS   AGE
<apb_pod_name>                     0/1      Completed 0           3m
```

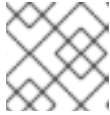
4. View the logs:

```
$ oc logs -f <apb_pod_name>
...
+ ansible-playbook /opt/apb/actions/provision.yml --extra-vars
'{"_apb_plan_id":"default","namespace":"getting-started"}'
PLAY [my-test-apb playbook to provision the application]
*****
TASK [ansible.kubernetes-modules : Install latest openshift client]
*****
skipping: [localhost]
TASK [ansibleplaybookbundle.asb-modules : debug]
*****
skipping: [localhost]
PLAY RECAP
*****
*
localhost                        : ok=0      changed=0    unreachable=0
failed=0
```

3.1.4.1.1. Creating a Deployment Configuration

At the minimum, your APB should deploy the application pods. You can do this by specifying a [deployment configuration](#):

1. One of the first tasks that is commented out in the ***provision-my-test-apb/tasks/main.yml*** file is the creation of the deployment configuration. You can uncomment it or paste the following:

**NOTE**

Normally, you would replace the **image:** value with your own application image.

```
- name: create deployment config
  openshift_v1_deployment_config:
    name: my-test
    namespace: '{{ namespace }}' ❶
    labels: ❷
      app: my-test
      service: my-test
    replicas: 1 ❸
    selector: ❹
      app: my-test
      service: my-test
    spec_template_metadata_labels:
      app: my-test
      service: my-test
    containers: ❺
      - env:
          image: docker.io/ansibleplaybookbundle/hello-world:latest
          name: my-test
          ports:
            - container_port: 8080
              protocol: TCP
```

- ❶ Designates which [namespace](#) the deployment configuration should be in.
- ❷ Used to help organize, group, and select objects.
- ❸ Specifies that you only want one [pod](#).
- ❹ The **selector** section is a [labels](#) query over pods.
- ❺ This **containers** section specifies a [container](#) with a **hello-world** application running on port 8080 on TCP. The [image](#) is stored at [docker.io/ansibleplaybookbundle/hello-world](#).

For more information, [Writing APBs: Reference](#) has more detail, and you can see the [ansible-kubernetes-modules documentation](#) for a full accounting of all fields.

2. Build and push the APB:

```
$ apb build
$ apb push
```

3. Provision the APB using the web console.
4. After provisioning, there will be a new running pod and a new deployment configuration. Verify by checking your OpenShift Container Platform resources:

```
$ oc project getting-started
$ oc get all
NAME          REVISION  DESIRED  CURRENT  TRIGGERED BY
dc/my-test    1         1        1        config
```

NAME	DESIRED	CURRENT	READY	AGE
rc/my-test-1	1	1	1	35s

NAME	READY	STATUS	RESTARTS	AGE
po/my-test-1-2pw4t	1/1	Running	0	33s

You will also be able to see the deployed application in the web console on the project's **Overview** page.

The only way to use this pod in its current state is to use:

```
$ oc describe pods/<pod_name>
```

to find its IP address and access it directly. If there were multiple pods, they would be accessed separately. To treat them like a single host, you need to create a *service*, described in the next section.

TIP

To clean up before moving on and allow you to provision again, you can delete the **getting-started** project and recreate it or create a new one.

3.1.4.1.2. Creating a Service

You will want to use multiple pods, load balance them, and create a [service](#) so that a user can access them as a single host:

1. Modify the *provision-my-test-apb/tasks/main.yml* file and add the following:

```
- name: create my-test service
  k8s_v1_service:
    name: my-test
    namespace: '{{ namespace }}'
    labels:
      app: my-test
      service: my-test
    selector:
      app: my-test
      service: my-test
    ports:
      - name: web
        port: 80
        target_port: 8080
```

The **selector** section will allow the **my-test** service to include the correct pods. The **ports** will take the target port from the pods (8080) and expose them as a single port for the service (80). Notice the application was running on 8080 but has now been made available on the default HTTP port of 80.

The **name** field of the port allows you to specify this port in the future with other resources. More information is available in the [k8s_v1_service](#) module.

2. Build and push the APB:

```
$ apb build
$ apb push
```

3. Provision the APB using the web console.

After provisioning, you will see a new service in the web console or CLI. In the web console, you can click on the new service under **Networking** in the application on the **Overview** page or under **Applications** → **Services**. The service's IP address will be shown which you can use to access the load balanced application.

To view the service information from the command line, you can do the following:

```
$ oc project getting-started
$ oc get services
$ oc describe services/my-test
```

The **describe** command will show the IP address to access the service. However, using an IP address for users to access your application is not generally what you want. Instead, you should create a *route*, described in the next section.

TIP

To clean up before moving on and allow you to provision again, you can delete the **getting-started** project and recreate it or create a new one.

3.1.4.1.3. Creating a Route

You can expose external access to your application through a reliable named [route](#):

1. Modify the **provision-my-test-apb/tasks/main.yml** file and adding the following:

```
- name: create my-test route
  openshift_v1_route:
    name: my-test
    namespace: '{{ namespace }}'
    labels:
      app: my-test
      service: my-test
    to_name: my-test
    spec_port_target_port: web
```

The **to_name** is the name of the target service. The **spec_port_target_port** refers to the name of the target service's port. More information is available in the [openshift_v1_route module](#).

2. Build and push the APB:

```
$ apb build
$ apb push
```

3. Provision the APB using the web console.

After provisioning, you will see the new route created. On the web console's **Overview** page for the **getting-started** project, you will now see an active and clickable route link listed on the application. Clicking on the route or visiting the URL will bring up the **hello-world** application.

You can also view the route information from the CLI:

```
$ oc project getting-started

$ oc get routes
NAME          HOST/PORT          PATH          SERVICES
PORT          TERMINATION        WILDCARD
my-test       my-test-getting-started.172.17.0.1.nip.io
web           None

```

```
$ oc describe routes/my-test
Name:      my-test
Namespace: getting-started
...
```

At this point, your **my-test** application is fully functional, load balanced, scalable, and accessible. You can compare your finished APB to the **hello-world** APB in the [hello-world-apb](#) example repository.

3.1.4.2. Deprovision

For the deprovision task, you must destroy all provisioned resources, usually in reverse order from how they were created.

To add the deprovision action, you need a **deprovision.yml** file under **playbooks/** directory and related tasks in the **roles/deprovision-my-test-apb/tasks/main.yml**. Both these files should already be created for you:

```
my-test-apb/
├── apb.yml
├── Dockerfile
├── playbooks
│   └── deprovision.yml ①
└── roles
    └── deprovision-my-test-apb
        ├── tasks
        └── main.yml ②
```

① Inspect this file.

② Edit this file.

The content of the **deprovision.yml** file looks the same as the provision task, except it is calling a different role:

playbooks/deprovision.yml

```
- name: my-test-apb playbook to deprovision the application
  hosts: localhost
  gather_facts: false
  connection: local
```

```
roles:
- role: ansible.kubernetes-modules
  install_python_requirements: no
- role: ansibleplaybookbundle.asb-modules
- role: deprovision-my-test-apb
  playbook_debug: false
```

Edit that role in the file **roles/deprovision-my-test-apb/tasks/main.yml**. By uncommenting the tasks, the resulting file without comments should look like the following:

```
- openshift_v1_route:
  name: my-test
  namespace: '{{ namespace }}'
  state: absent

- k8s_v1_service:
  name: my-test
  namespace: '{{ namespace }}'
  state: absent

- openshift_v1_deployment_config:
  name: my-test
  namespace: '{{ namespace }}'
  state: absent
```

In the **provision.yml** file created earlier, you created a deployment configuration, service, then route. For the deprovision action, you should delete the resources in reverse order. You can do so by identifying the resource by **namespace** and **name**, and then marking it as **state: absent**.

To run the deprovision template, click on the menu on the list of **Deployed Services** and select **Delete**.

3.1.4.2.1. Bind

From the previous sections, you learned how to deploy a standalone application. However, in most cases applications will need to communicate with other applications, and often with a data source. In the following sections, you will create a PostgreSQL database that the **hello-world** application deployed from **my-test-apb** can use.

3.1.4.2.1.1. Preparation

For a good starting point, create the necessary files for provision and deprovisioning PostgreSQL.



NOTE

A more in-depth example can be found at the [PostgreSQL example APB](#).

1. Initialize the APB using the **--bindable** option:

```
$ apb init my-pg-apb --bindable
```

This creates the normal APB file structure with a few differences:

```
my-pg-apb/
├── apb.yml 1
```

```

├── Dockerfile
├── playbooks
│   ├── bind.yml 2
│   ├── deprovision.yml
│   ├── provision.yml
│   └── unbind.yml 3
├── roles
│   ├── bind-my-pg-apb
│   │   └── tasks
│   │       └── main.yml 4
│   ├── deprovision-my-pg-apb
│   │   └── tasks
│   │       └── main.yml
│   ├── provision-my-pg-apb
│   │   └── tasks
│   │       └── main.yml 5
│   └── unbind-my-pg-apb
│       └── tasks
│           └── main.yml 6

```

1 **bindable** flag set to **true**

2 New file

3 New file

4 New empty file

5 Encoded binding credentials

6 New empty file

In addition to the normal files, new playbooks **bind.yml**, **unbind.yml**, and their associated roles have been stubbed out. The **bind.yml** and **unbind.yml** files are both empty and, because you are using the default binding behavior, will remain empty.

2. Edit the **apb.yml** file. Notice the setting **bindable: true**. In addition to those changes, you must add some parameters to the **apb.yml** for configuring PostgreSQL. They will be available fields in the web console when provisioning your new APB:

```

version: 1.0
name: my-pg-apb
description: This is a sample application generated by apb init
bindable: True
async: optional
metadata:
  displayName: my-pg
plans:
  - name: default
    description: This default plan deploys my-pg-apb
    free: True
    metadata: {}
    # edit the parameters and add the ones below.
    parameters:
      - name: postgresql_database

```

```

    title: PostgreSQL Database Name
    type: string
    default: admin
  - name: postgresql_user
    title: PostgreSQL User
    type: string
    default: admin
  - name: postgresql_password
    title: PostgreSQL Password
    type: string
    default: admin

```

The ***playbooks/provision.yml*** will look like the following:

```

- name: my-pg-apb playbook to provision the application
  hosts: localhost
  gather_facts: false
  connection: local
  roles:
    - role: ansible.kubernetes-modules
      install_python_requirements: no
    - role: ansibleplaybookbundle.asb-modules
    - role: provision-my-pg-apb
      playbook_debug: false

```

The ***playbooks/deprovision.yml*** will look like the following:

```

- name: my-pg-apb playbook to deprovision the application
  hosts: localhost
  gather_facts: false
  connection: local
  roles:
    - role: ansible.kubernetes-modules
      install_python_requirements: no
    - role: deprovision-my-pg-apb
      playbook_debug: false

```

3. Edit the ***roles/provision-my-pg-apb/tasks/main.yml*** file. This file mirrors your **hello-world** application in many respects, but adds a **persistent volume (PV)** to save data between restarts and various configuration options for the deployment configuration. In addition, a new task has been added at the very bottom after the provision tasks. To save the credentials created during the provision process, you must encode them for retrieval by the OAB. The new task, using the module **asb_encode_binding**, will do so for you.

You can safely delete everything in that file and replace it with the following:

```

# New persistent volume claim
- name: create volumes
  k8s_v1_persistent_volume_claim:
    name: my-pg
    namespace: '{{ namespace }}'
    state: present
    access_modes:
      - ReadWriteOnce
    resources_requests:

```

```

    storage: 1Gi
- name: create deployment config
  openshift_v1_deployment_config:
    name: my-pg
    namespace: '{{ namespace }}'
    labels:
      app: my-pg
      service: my-pg
    replicas: 1
    selector:
      app: my-pg
      service: my-pg
    spec_template_metadata_labels:
      app: my-pg
      service: my-pg
    containers:
      - env:
          - name: POSTGRESQL_PASSWORD
            value: '{{ postgresql_password }}'
          - name: POSTGRESQL_USER
            value: '{{ postgresql_user }}'
          - name: POSTGRESQL_DATABASE
            value: '{{ postgresql_database }}'
        image: docker.io/centos/postgresql-94-centos7
        name: my-pg
        ports:
          - container_port: 5432
            protocol: TCP
        termination_message_path: /dev/termination-log
        volume_mounts:
          - mount_path: /var/lib/pgsql/data
            name: my-pg
        working_dir: /
    volumes:
      - name: my-pg
        persistent_volume_claim:
          claim_name: my-pg
        test: false
        triggers:
          - type: ConfigChange
- name: create service
  k8s_v1_service:
    name: my-pg
    namespace: '{{ namespace }}'
    state: present
    labels:
      app: my-pg
      service: my-pg
    selector:
      app: my-pg
      service: my-pg
    ports:
      - name: port-5432
        port: 5432

```



```

    protocol: TCP
    target_port: 5432

# New encoding task makes credentials available to future bind
operations
- name: encode bind credentials
  asb_encode_binding:
    fields:
      DB_TYPE: postgres
      DB_HOST: my-pg
      DB_PORT: "5432"
      DB_USER: "{{ postgresql_user }}"
      DB_PASSWORD: "{{ postgresql_password }}"
      DB_NAME: "{{ postgresql_database }}"

```

The **encode bind credentials** task will make available several fields as environment variables: **DB_TYPE**, **DB_HOST**, **DB_PORT**, **DB_USER**, **DB_PASSWORD**, and **DB_NAME**. This is the default behavior when the **bind.yml** file is left empty. Any application (such as **hello-world**) can use these environment variables to connect to the configured database after performing a bind operation.

4. Edit the **roles/deprovision-my-pg-apb/tasks/main.yml** and uncomment the following lines so that the created resources will be deleted during deprovisioning:

```

- k8s_v1_service:
  name: my-pg
  namespace: '{{ namespace }}'
  state: absent

- openshift_v1_deployment_config:
  name: my-pg
  namespace: '{{ namespace }}'
  state: absent

- k8s_v1_persistent_volume_claim:
  name: my-pg
  namespace: '{{ namespace }}'
  state: absent

```

5. Finally, build and push your APB:

```

$ apb build
$ apb push

```

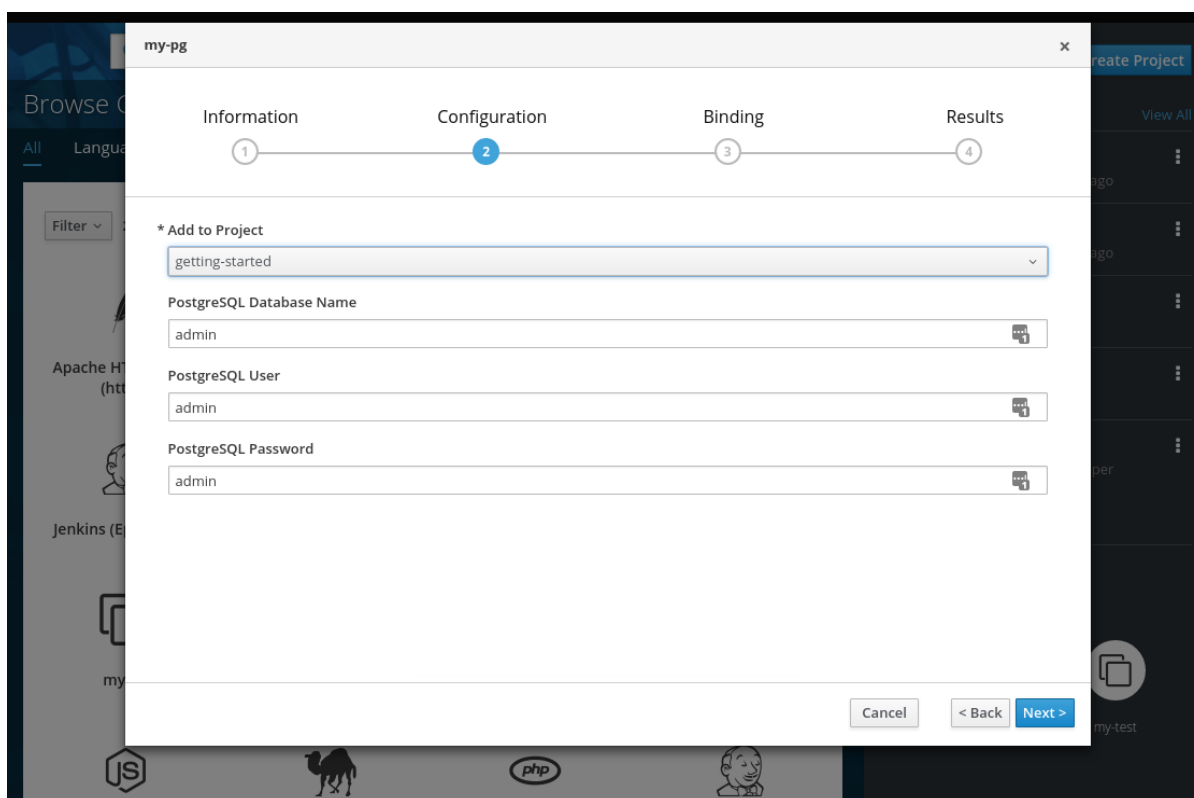
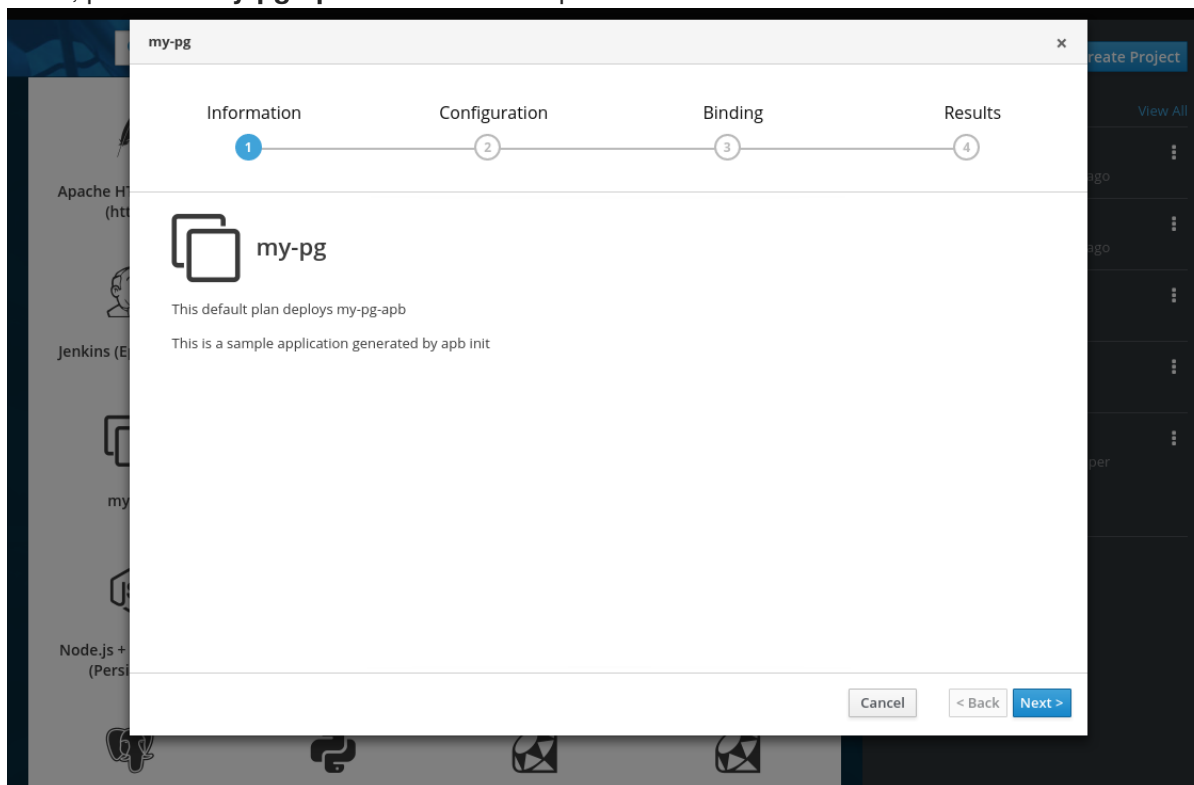
At this point, the APB can create a fully functional PostgreSQL database to your cluster. You can test it out in the next section.

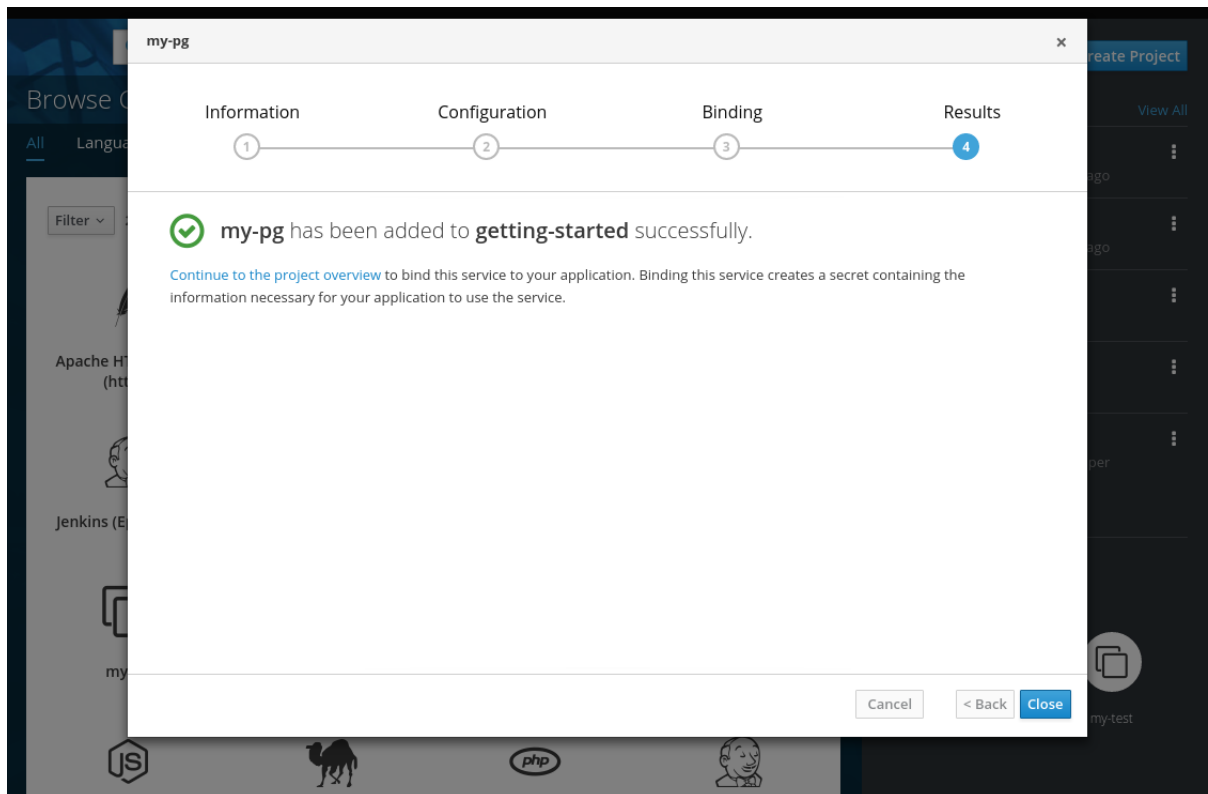
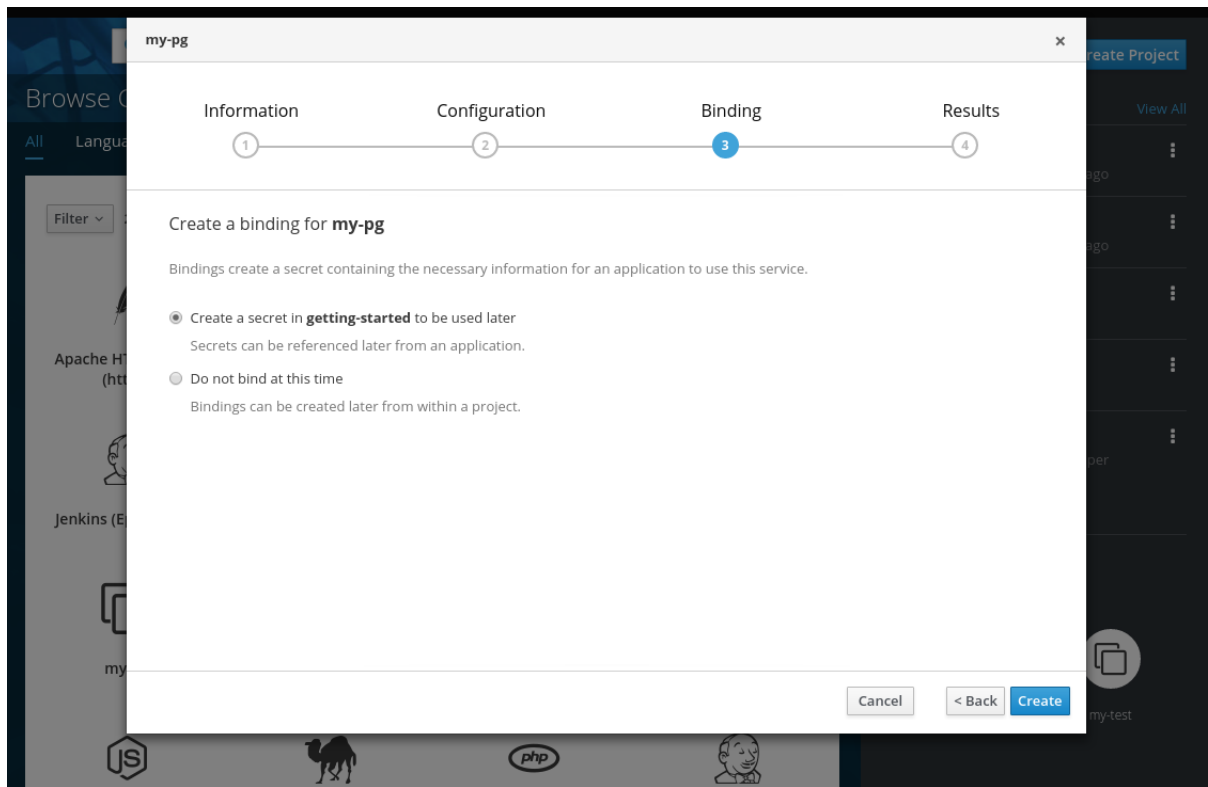
3.1.4.2.1.2. Executing From the UI

To test your application, you can bind a **hello-world** application to the provisioned PostgreSQL database. You can use the application previously created in the [Provision](#) section of this tutorial, or you can use the **hello-world-apb**:

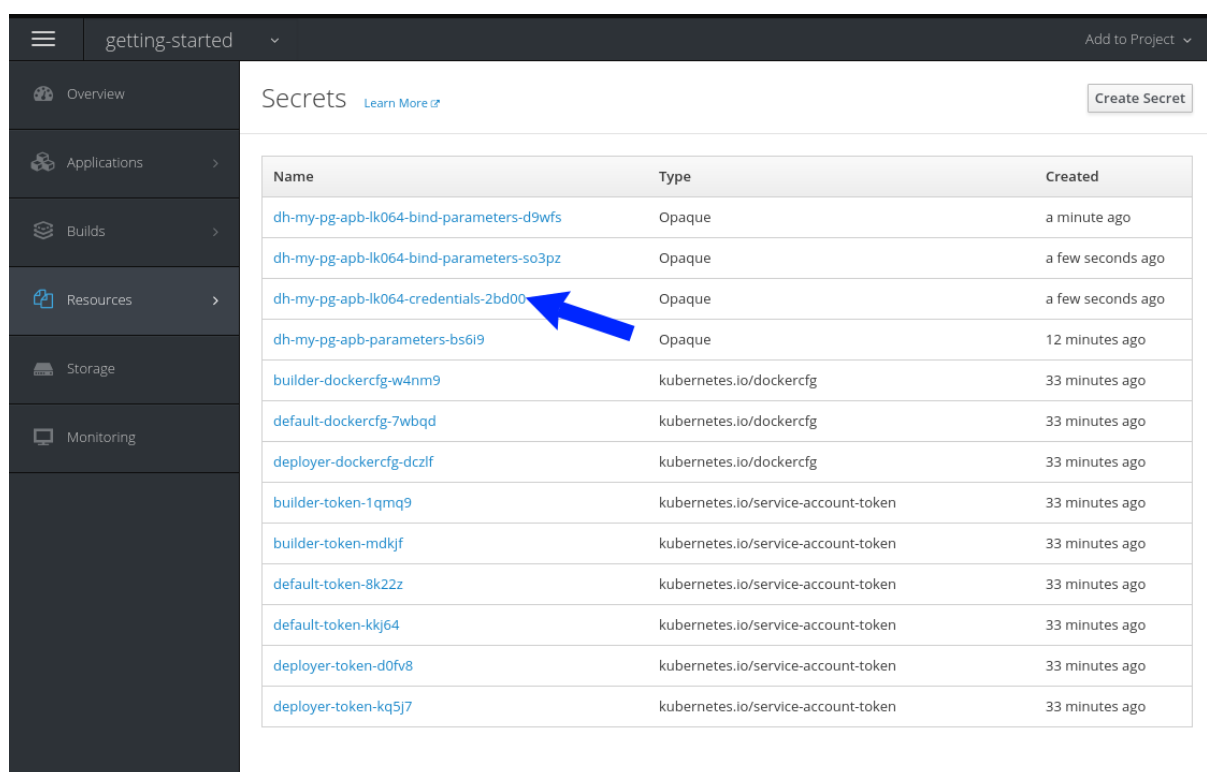
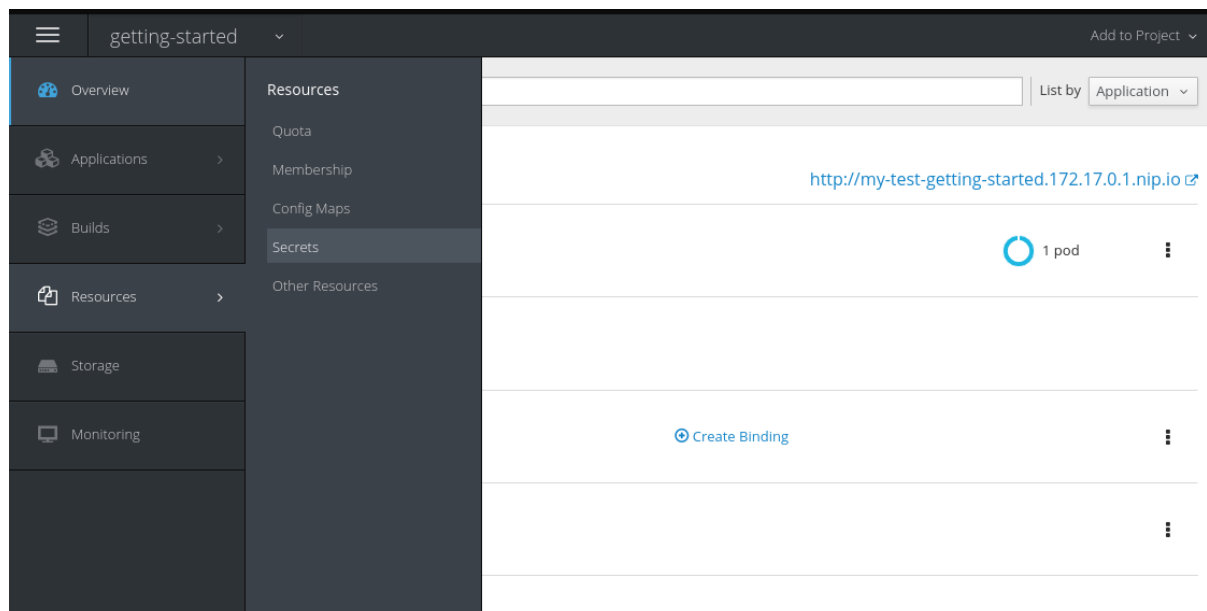
1. First, provision **my-test-apb**.

- Then, provision **my-pg-apb** and select the option to **Create a secret**:

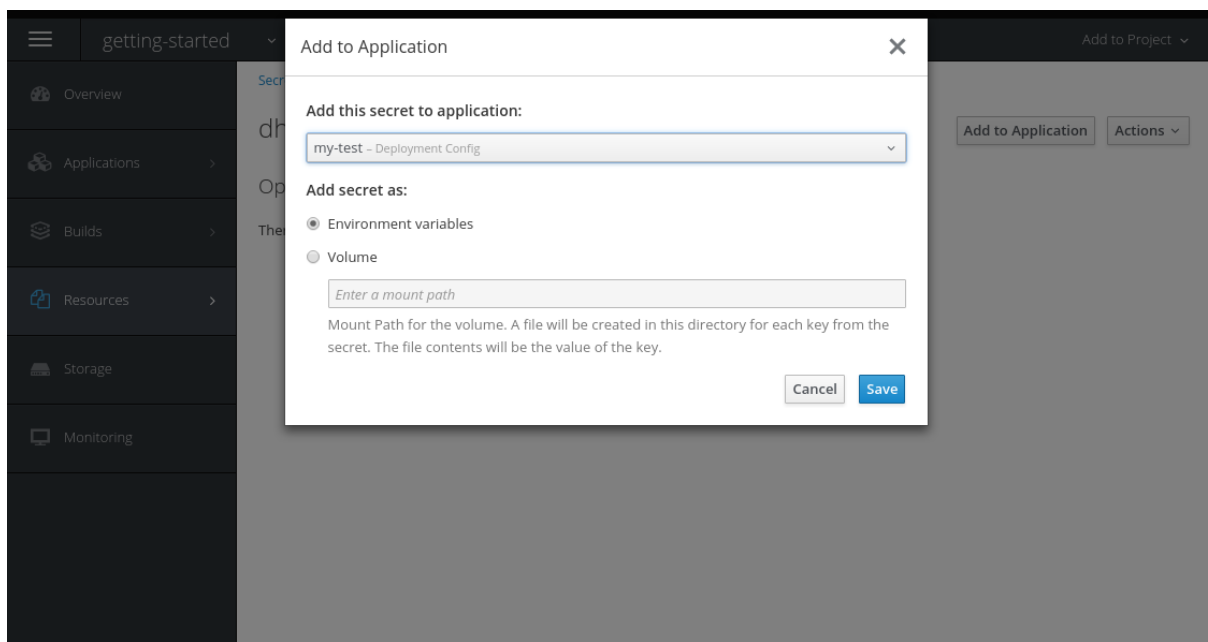
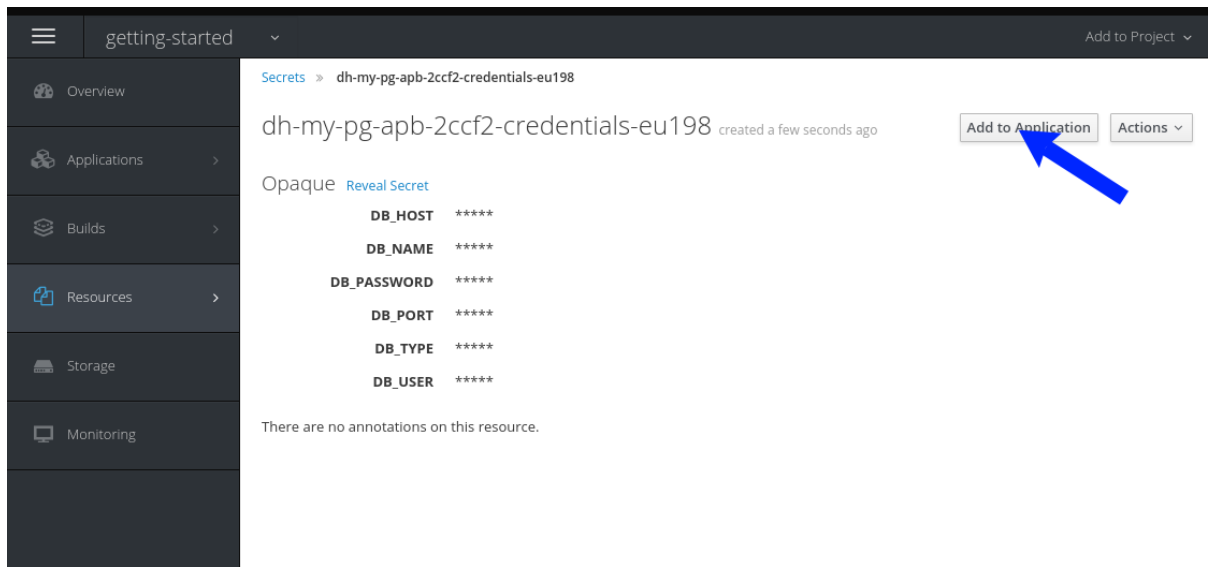




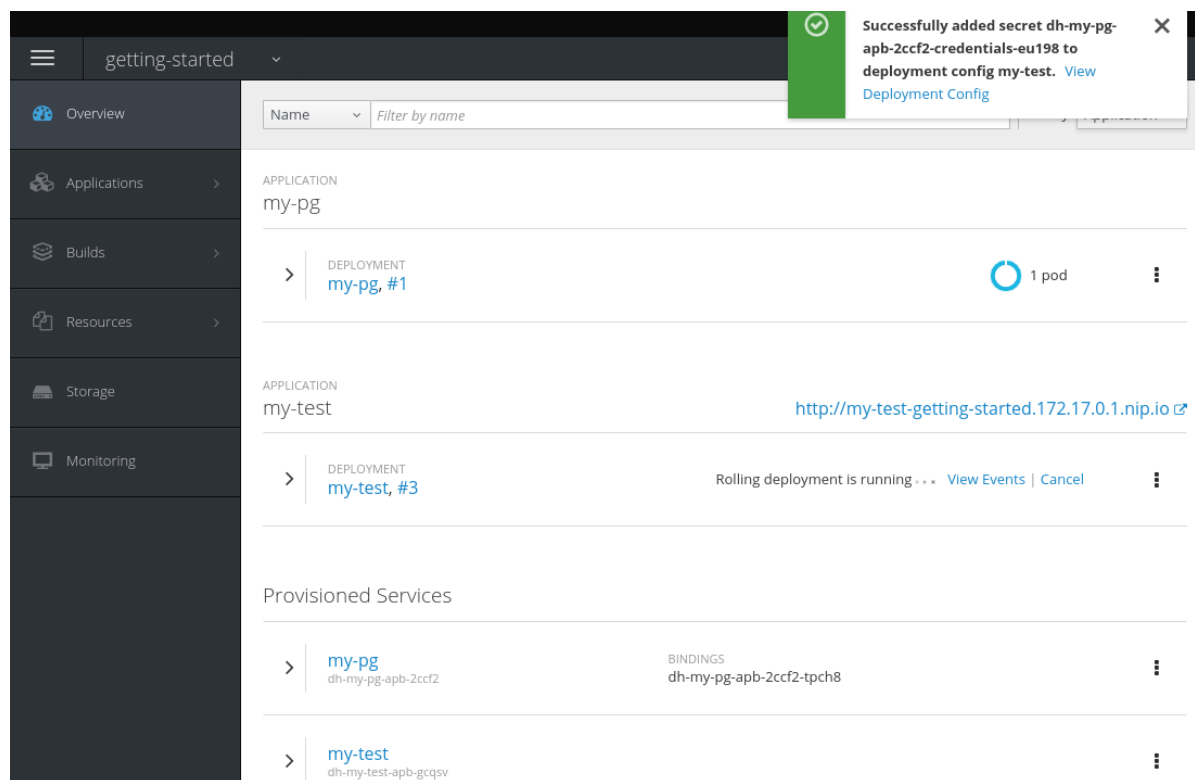
- Now, if you have not already done so, navigate to the project. You can see both your **hello-world** application and your PostgreSQL database. If you did not select to create a binding at provision time, you can also do so here with the **Create binding** link.
- After you the binding has been created, you must add the secret created by the binding into the application. First, navigate to the secrets on the **Resources** → **Secrets** page:



5. Add the secret as environment variables:



6. After this addition, you can return to the **Overview** page. The **my-test** application may still be redeploying from the configuration change. If so, wait until you can click on the route to view the application:



After clicking the route, you will see the **hello-world** application has detected and connected to the **my-pg** database:



3.1.4.2.2. Test

Test actions are intended to check that an APB passes a basic sanity check before publishing to the service catalog. They are not meant to test a live service. OpenShift Container Platform provides the ability to test a live service using [liveness and readiness probes](#), which you can add when provisioning.

The actual implementation of your test is left to you as the APB author. The following sections provide guidance and best practices.

3.1.4.2.2.1. Writing a Test Action

To create a test action for your APB:

- Include a ***playbooks/test.yml*** file.
- Include defaults for the test in the ***playbooks/vars/*** directory.

```
my-apb/
├── ...
├── playbooks/
│   ├── test.yml
│   └── vars/
│       └── test_defaults.yml
```

To orchestrate the testing of an APB, you should use the **`include_vars`** and **`include_role`** modules in your ***test.yml*** file:

test.yml

```
- name: test media wiki abp
  hosts: localhost
  gather_facts: false
  connection: local

  roles:
    - role: ansible.kubernetes-modules ❶
      install_python_requirements: no

  post_tasks:
    - name: Load default variables for testing ❷
      include_vars: test_defaults.yaml
    - name: create project for namespace
      openshift_v1_project:
        name: '{{ namespace }}'
    - name: Run the provision role. ❸
      include_role:
        name: provision-mediawiki-apb
    - name: Run the verify role. ❹
      include_role:
        name: verify-mediawiki-apb
```

- ❶ Load the Ansible Kubernetes modules.
- ❷ Include the default values needed for provision from the test role.
- ❸ Include the provision role to run.
- ❹ Include the verify role to run. See [Writing a Verify Role](#).

3.1.4.2.2.2. Writing a Verify Role

A *verify role* allows you to determine if the provision has failed or succeeded. The **`verify_<name>`** role should be in the ***roles/*** directory. This should be a normal [Ansible role](#).

```
my-apb/
```

```
└─ ...
└─ roles/
    └─ ...
        └─ verify_<name>
            └─ defaults
                └─ defaults.yml
            └─ tasks
                └─ main.yml
```

An example task in the *main.yml* file could look like:

```
- name: url check for media wiki
  uri:
    url: "http://{{ route.route.spec.host }}"
    return_content: yes
  register: webpage
  failed_when: webpage.status != 200
```

3.1.4.2.2.3. Saving Test Results

The **asb_save_test_result** module can also be used in the verify role, allowing the APB to save test results so that the **apb test** command can return them. The APB pod will stay alive for the tool to retrieve the test results.

For example, adding **asb_save_test_result** usage to the previous *main.yml* example:

```
- name: url check for media wiki
  uri:
    url: "http://{{ route.route.spec.host }}"
    return_content: yes
  register: webpage

- name: Save failure for the web page
  asb_save_test_result:
    fail: true
    msg: "Could not reach route and retrieve a 200 status code. Recieved
status - {{ webpage.status }}"
    when: webpage.status != 200

- fail:
    msg: "Could not reach route and retrieve a 200 status code. Recieved
status - {{ webpage.status }}"
    when: webpage.status != 200

- name: Save test pass
  asb_save_test_result:
    fail: false
    when: webpage.status == 200
```

3.1.4.2.2.4. Running a Test Action

After you have defined your test action, you can use the CLI tooling to run the test:

```
$ apb test
```


The test action will:

- build the image,
- start up a pod as if it was being run by the service broker, and
- retrieve the test results if any were saved.

The status of pod after execution has finished will determine the status of the test. If the pod is in an error state, then something failed and the command reports that the test was unsuccessful.

3.2. WRITING APBS: REFERENCE

3.2.1. Overview

While the [Getting Started](#) topic provides a step by step walkthrough on creating your first Ansible Playbook Bundle (APB), this topic provides more in-depth reference material. The fundamental components that make up an APB are explained in further detail to help an experienced APB developer get a better understanding of each individual component within an APB.

For completed APB examples, you can browse APBs in the [ansibleplaybookbundle](#) organization on GitHub.

3.2.2. Directory Structure

The following shows an example directory structure of an APB:

```
example-apb/
├── Dockerfile
├── apb.yml
├── roles/
│   └── example-apb-openshift
│       ├── defaults
│       │   └── main.yml
│       └── tasks
│           └── main.yml
└── playbooks/
    ├── provision.yml
    ├── deprovision.yml
    ├── bind.yml
    └── unbind.yml
```

3.2.3. APB Spec File

The APB spec file is located at ***apb.yml*** and is where the outline of your application is declared. The following is an example APB spec:

```
version: 1.0
name: example-apb
description: A short description of what this APB does
bindable: True
async: optional 1
metadata:
    documentationUrl: <link_to_documentation>
```

```

    imageUrl: <link_to_url_of_image>
    dependencies: ['<registry>/<organization>/<dependency_name_1>',
'<registry>/<organization>/<dependency_name_2>']
    displayName: Example App (APB)
    longDescription: A longer description of what this APB does
    providerDisplayName: "Red Hat, Inc."
  plans:
    - name: default
      description: A short description of what this plan does
      free: true
      metadata:
        displayName: Default
        longDescription: A longer description of what this plan deploys
        cost: $0.00
      parameters:
        - name: parameter_one
          required: true
          default: foo_string
          type: string
          title: Parameter One
          maxlength: 63
        - name: parameter_two
          required: true
          default: true
          title: Parameter Two
          type: boolean

```

1 Async bind and unbind is an experimental feature and is not supported or enabled by default.

3.2.3.1. Top-level Structure

Field	Description
version	Version of the APB spec. See APB Spec Versioning for details.
name	Name of the APB. Names must be valid ASCII and may contain lowercase letters, digits, underscores, periods, and dashes. See Docker's guidelines for valid tag names.
description	Short description of this APB.
bindable	Boolean option of whether or not this APB can be bound to. Accepted fields are true or false .
metadata	Dictionary field declaring relevant metadata information.
plans	A list of plans that can be deployed. See Plans for details.

3.2.3.2. Metadata

Field	Description
documentationUrl	URL to the application's documentation.
imageUrl	URL to an image which will be displayed in the web console for the service catalog.
dependencies	List of images which are consumed from within the APB.
displayName	The name that will be displayed in the web console for this APB.
longDescription	Longer description that will be displayed when the APB is clicked in the web console.
providerDisplayName	Name of who is providing this APB for consumption.

3.2.3.3. Plans

Plans are declared as a list. This section explains what each field in a plan describes.

Field	Description
name	Unique name of plan to deploy. This will be displayed when the APB is clicked from the service catalog.
description	Short description of what will be deployed from this plan.
free	Boolean field to determine if this plan is free or not. Accepted fields are true or false .
metadata	Dictionary field declaring relevant plan metadata information. See Plan Metadata for details.
parameters	List of parameter dictionaries used as input to the APB. See Parameters for details.

3.2.3.4. Plan Metadata

Field	Description
displayName	Name to display for the plan in the web console.

Field	Description
longDescription	Longer description of what this plan deploys.
cost	How much the plan will cost to deploy. Accepted field is \$x.yz .

3.2.3.5. Parameters

Each item in the **parameters** section can have several fields. The **name** field is required. The order of the parameters will be displayed in sequential order in the form in the OpenShift Container Platform web console.

```
parameters:
  - name: my_param
    title: My Parameter
    type: enum
    enum: ['X', 'Y', 'Z']
    required: True
    default: X
    display_type: select
    display_group: Group 1
```

Field	Description
name	Unique name of the parameter passed into the APB.
title	Displayed label in the web console.
type	Data type of the parameters as specified by link json-schema , such as string , number , int , boolean , or enum . Default input field type in the web console will be assigned if no display_type is assigned.
required	Whether or not the parameter is required for APB execution. Required field in the web console.
default	Default value assigned to the parameter.
display_type	Display type for the web console. For example, you can override a string input as a password to hide it in the web console. Accepted fields include text , textarea , password , checkbox , or select .

Field	Description
display_group	Will cause a parameter to display in groups with adjacent parameters with matching display_group fields. In the above example, adding another field below with display_group: Group 1 will visually group them together in the web console under the heading Group 1 .

When using a long list of parameters, it can be useful to use a shared parameter list. For an example of this, see the [rhscl-postgresql-apb](#).

3.2.3.6. APB Spec Versioning

The APB spec uses semantic versioning with the format of **x.y** where **x** is a major release and **y** is a minor release.

The current spec version is **1.0**.

3.2.3.6.1. Major Version

The APB spec will increment the major version whenever an API breaking change is introduced to the spec. Some examples include:

- Introduction or deletion of a required field.
- Changing the YAML format.
- New features.

3.2.3.6.2. Minor Version

The APB spec will increment the minor version whenever a non-breaking change is introduced to the spec. Some examples include:

- Introduction or deletion of an optional field.
- Spelling change.
- Introduction of new options to an existing field.

3.2.4. Dockerfile

The **Dockerfile** is what is used to actually build the APB image. As a result, sometimes you will need to customize it for your own needs. For example, if running a playbook that requires interactions with PostgreSQL, you may want to install the required packages by adding the **yum install** command:

```
FROM ansibleplaybookbundle/apb-base
MAINTAINER Ansible Playbook Bundle Community
```

```

LABEL "com.redhat.apb.spec"=\
"<-----base64-encoded-spec----->"

COPY roles /opt/ansible/roles
COPY playbooks /opt/apb/actions
RUN chmod -R g=u /opt/{ansible,apb}

### INSTALL THE REQUIRED PACKAGES
RUN yum -y install python-boto postgresql && yum clean all

USER apb

```

3.2.5. APB Actions (Playbooks)

An action for an APB is the command that the APB is run with. The standard actions that are supported are:

- provision
- deprovision
- bind
- unbind
- test

For an action to be valid, there must be a valid file in the **playbooks/** directory named **<action>.yml**. These playbooks can do anything, which also means that you can technically create any action you would like. For example, the [mediawiki-apb](#) has a playbook creating an **update** action.

Most APBs will normally have a provision action to create resources and a deprovision action to destroy the resources when deleting the service.

The bind and unbind actions are used when the coordinates of one service need to be made available to another service. This is often the case when creating a data service and making it available to an application. Currently, the coordinates are made available during the provision.

To properly make your coordinates available to another service, use the **asb_encode_binding** module. This module should be called at the end of the APB's provision role, and it will return bind credentials to the OpenShift Ansible broker (OAB):

```

- name: encode bind credentials
  asb_encode_binding:
    fields:
      EXAMPLE_FIELD: foo
      EXAMPLE_FIELD2: foo2

```

3.2.6. Working With Common Resources

This section describes a list of common OpenShift Container Platform resources that are created when developing APBs. See the [Ansible Kubernetes Module](#) for a full list of available resource modules.

3.2.6.1. Service

The following is a sample Ansible task to create a service named **hello-world**. The **namespace** variable in an APB will be provided by the OAB when launched from the web console.

Provision

```
- name: create hello-world service
  k8s_v1_service:
    name: hello-world
    namespace: '{{ namespace }}'
    labels:
      app: hello-world
      service: hello-world
    selector:
      app: hello-world
      service: hello-world
    ports:
      - name: web
        port: 8080
        target_port: 8080
```

Deprovision

```
- k8s_v1_service:
  name: hello-world
  namespace: '{{ namespace }}'
  state: absent
```

3.2.6.2. Deployment Configuration

The following is a sample Ansible task to create a deployment configuration for the image **docker.io/ansibleplaybookbundle/hello-world** which maps to service **hello-world**.

Provision

```
- name: create deployment config
  openshift_v1_deployment_config:
    name: hello-world
    namespace: '{{ namespace }}'
    labels:
      app: hello-world
      service: hello-world
    replicas: 1
    selector:
      app: hello-world
      service: hello-world
    spec_template_metadata_labels:
      app: hello-world
      service: hello-world
    containers:
      - env:
          image: docker.io/ansibleplaybookbundle/hello-world:latest
          name: hello-world
        ports:
```

```
- container_port: 8080
  protocol: TCP
```

Deprovision

```
- openshift_v1_deployment_config:
  name: hello-world
  namespace: '{{ namespace }}'
  state: absent
```

3.2.6.3. Route

The following is an example of creating a route named **hello-world** which maps to the service **hello-world**.

Provision

```
- name: create hello-world route
  openshift_v1_route:
    name: hello-world
    namespace: '{{ namespace }}'
    spec_port_target_port: web
    labels:
      app: hello-world
      service: hello-world
    to_name: hello-world
```

Deprovision

```
- openshift_v1_route:
  name: hello-world
  namespace: '{{ namespace }}'
  state: absent
```

3.2.6.4. Persistent Volume

The following is an example of creating a persistent volume claim (PVC) resource and deployment configuration that uses it.

Provision

```
# Persistent volume resource
- name: create volume claim
  k8s_v1_persistent_volume_claim:
    name: hello-world-db
    namespace: '{{ namespace }}'
    state: present
    access_modes:
      - ReadWriteOnce
    resources_requests:
      storage: 1Gi
```

In addition to the resource, add your volume to the deployment configuration declaration:


```
- name: create hello-world-db deployment config
  openshift_v1_deployment_config:
    name: hello-world-db
    ---
    volumes:
      - name: hello-world-db
        persistent_volume_claim:
          claim_name: hello-world-db
        test: false
        triggers:
          - type: ConfigChange
```

Deprovision

```
- openshift_v1_deployment_config:
  name: hello-world-db
  namespace: '{{ namespace }}'
  state: absent

- k8s_v1_persistent_volume_claim:
  name: hello-world-db
  namespace: '{{ namespace }}'
  state: absent
```

3.2.7. Optional Variables

You can add optional variables to an APB by using environment variables. To pass variables into an APB, you must escape the variable substitution in your *.yml* files.

For example, consider the following *roles/provision-etherpad-apb/tasks/main.yml* file in the [etherpad-apb](#):

```
- name: create mariadb deployment config
  openshift_v1_deployment_config:
    name: mariadb
    namespace: '{{ namespace }}'
    ...
  - env:
    - name: MYSQL_ROOT_PASSWORD
      value: '{{ mariadb_root_password }}'
    - name: MYSQL_DATABASE
      value: '{{ mariadb_name }}'
    - name: MYSQL_USER
      value: '{{ mariadb_user }}'
    - name: MYSQL_PASSWORD
      value: '{{ mariadb_password }}'
```

Variables for the APB are defined in the *roles/provision-etherpad-apb/defaults/main.yml* file:

```
playbook_debug: no
mariadb_root_password: "{{ lookup('env', 'MYSQL_ROOT_PASSWORD') |
  default('admin', true) }}"
mariadb_name: "{{ lookup('env', 'MYSQL_DATABASE') | default('etherpad',
  true) }}"
```

```

mariadb_user: "{{ lookup('env', 'MYSQL_USER') | default('etherpad', true)
}}"
mariadb_password: "{{ lookup('env', 'MYSQL_PASSWORD') | default('admin',
true) }}"
etherpad_admin_password: "{{ lookup('env', 'ETHERPAD_ADMIN_PASSWORD') |
default('admin', true) }}"
etherpad_admin_user: "{{ lookup('env', 'ETHERPAD_ADMIN_USER') |
default('etherpad', true) }}"
etherpad_db_host: "{{ lookup('env', 'ETHERPAD_DB_HOST') |
default('mariadb', true) }}"
state: present

```

3.2.8. Working with Remote Clusters

When developing APBs, there are a few factors which could prevent the developer from using the full development lifecycle that the **apb** tooling offers. Primarily, these factors are:

- Developing against an OpenShift Container Platform cluster that exists on a remote host.
- Developing APBs on a machine that does not have access to the **docker** daemon.

If a developer meets any of these criteria, use the following workflow to publish images to the internal OpenShift Container Platform registry so that the broker can bootstrap the image (the process of loading APB specs into the broker). The following sections show how to do these steps with the **apb** tooling and without.

3.2.8.1. Pushing APBs

To use the **apb push** command when working with a remote OpenShift Container Platform cluster:

1. Ensure the base64-encoded APB spec is a label in the Dockerfile. This is usually done using the **apb prepare** command. If you do not have the **apb** tooling installed, you can run:

```
$ cat apb.yml | base64
```

This will return the base64-encoded **apb.yml**, which you can copy and paste into the **Dockerfile** under the **LABEL "com.redhat.apb.spec"** like:

```

LABEL "com.redhat.apb.spec"=\
"dmVyc2lvcjogMS4wCm5hbWU6IG1lZG1hd2lraS1hcGIKZGVzY3JpcHRpb246IE1lZG1
hd2lraSBh\
cGlgaw1wbGVtZW50YXRpb24KYmluZGFibGU6IEZhbnHn1CmFzew5j0iBvcHRpb25hbApt
ZXRhZGF0\
YToKICBkb2N1bWVudGF0aW9uVXJsOiBodHRwciovL3d3dy5tZWRpYXdpa2kub3JnL3dp
a2kvRG9j\
dW1lbnRhdGlvbGogIGxvbmdEZXNjcmlwdGlvbjogQW4gYXBiIHRoYXQgZGVwbG95cyBN
ZWRpYXd\
a2kgMS4yMwogIGRlcGVuZGVuY2llczogWydkb2NrZXIuaw8vYW5zaWJsZXBsYXlib29r
YnVuZGx\
L21lZG1hd2lraTEyMzpsYXRlc3QnXQogIGRpc3BsYXl0YW1lOiBNZWRpYXdpa2kgKEFQ
QilmZGZk\
CiAgY29uc29sZS5vcGVuc2hpZnQuaw8vaWNvbknSYXNzOiBpY29uLW1lZG1hd2lraQog
IHByb3Zp\
ZGVyRGlzcGxheU5hbWU6ICJSZWQgSGF0LCBJbmMuIgpwbGFuczoKICAtIG5hbWU6IGRl
ZmF1bHQA\

```

```

ICAgIGRlc2NyaXB0aW9uOiBBbiBBUEIgdGhhdBkZXBsb3lzIE1lZG1hV2lraQogICAg
ZnJlZTog\
VHJlZQogICAgbWV0YWRhdGE6CiAgICAgIGRpc3BsYXl0YW1lOiBEZWZhdWx0CiAgICAg
IGxvbmde\
ZXNjcmlwdGlvbjogVGhpcyBwbGFuIGRlcGxveXMgYSBzaW5nbGUgbWVkaWF3aWtpIGlu
c3RhbmNl\
IHdpdGhvdXQgYSBEQgogICAgICBjb3N0OiAkMC4wMAogICAgcGFyYW1ldGVyczoKICAg
ICAgLSBu\
YW1lOiBtZWRpYXdpd2lfZGJfc2NoZW1hCiAgICAgICAgZGVmYXVsdDogbWVkaWF3aWtp
CiAgICAg\
ICAgdHlwZTogc3RyaW5nCiAgICAgICAgdG10bGU6IE1lZG1hd2lraSBEQiBTY2h1bWEK
ICAgICAg\
ICBwYXR0ZXJuOiAiXlthLXpBLVpfXVthLXpBLVowLTlfXSokIggogICAgICAgIHJlcXVp
cmVkeiBU\
cnVlCiAgICAgICAgbmFtZTogbWVkaWF3aWtpX3NpdGVfbmFtZQogICAgICAgIGRlZmF1
bHQ6IE1l\
ZG1hV2lraQogICAgICAgIHR5cGU6IHN0cm1uZWogICAgICAgIHRpdGx0iBNZWRpYXdp
a2kgU2l0\
ZSB0YW1lCiAgICAgICAgcGF0dGVyb2JogIl5bYS16QS1aXSskIggogICAgICAgIHJlcXVp
cmVkeiBU\
cnVlCiAgICAgICAgdXBkYXRhYmx0iBUcnVlCiAgICAgICAgbmFtZTogbWVkaWF3aWtp
X3NpdGVf\
bGFuZWogICAgICAgIGRlZmF1bHQ6IGVuCiAgICAgICAgdHlwZTogc3RyaW5nCiAgICAg
ICAgdG10\
bGU6IE1lZG1hd2lraSBTaXRlIEh1bmd1YWdlCiAgICAgICAgcGF0dGVyb2JogIl5bYS16
XXsyLDN9\
JCIKICAgICAgICByZXF1aXJlZDogVHJlZQogICAgICAtIG5hbWU6IG1lZG1hd2lraV9h
ZG1pb191\
c2VyCiAgICAgICAgZGVmYXVsdDogYWt4KICAgICAgICB0eXB0iBzdHJpbmcKICAg
ICAgICB0\
aXR5ZTogTWVkaWF3aWtpIEFkbWluIFVzZXIgaXN0bW5vdCBiZSB0aGUgc2FtZSB2YWx1
ZSBhcyBB\
ZG1pb2Vlc2VyIFBhc3N3b3JkKQogICAgICAgIHJlcXVpcmVkeiBUcnVlCiAgICAgICAg
bmFtZTog\
bWVkaWF3aWtpX2FkbWluX3Bhc3MKICAgICAgICB0eXB0iBzdHJpbmcKICAgICAgICB0
aXR5ZTog\
TWVkaWF3aWtpIEFkbWluIFVzZXIgaUGFzc3dvcmQKICAgICAgICByZXF1aXJlZDogVHJl
ZQogICAg\
ICAgIGRpc3BsYXlfdHlwZTogcGFzc3dvcmQK"

```

2. Populate the internal OpenShift Container Platform registry with your built APB image. This is normally handled by the **apb push** command. In order to build your image without using the **docker** CLI, you can take advantage of the S2I functionality of OpenShift Container Platform.

By default, the OAB is configured to look for published APBs in the **openshift** project, which is a global namespace that exposes its images and image streams to be available to any authenticated user on the cluster. You can take advantage of this by using the **oc new-app** command in the **openshift** project to build your image:

```

$ oc new-app <path_to_bundle_source> \
  --name <bundle_name> \
  -n openshift

```

After a couple of minutes, you should see your image in the internal registry:

```
$ oc get images | grep <bundle_name>
```

```
sha256:b2dcb4b95e178e9b7ac73e5ee0211080c10b24260f76cfec30b89e74e8ee6742
172.30.1.1:5000/openshift/<bundle_name>@sha256:b2dcb4b95e178e9b7ac73e5ee0211080c10b24260f76cfec30b89e74e8ee6742
```

3. Bootstrap the OAB. This is normally also handled by the **apb push** or **apb bootstrap** command. The **apb bootstrap** command is preferable for this step because it will also relist the service catalog without having to wait five to ten minutes. If you do not have the **apb** tooling installed, you can alternatively perform the following:

- a. Get the route name for the broker:

```
$ oc get route -n openshift-ansible-service-broker
```

NAME	HOST/PORT
asb-1338	asb-1338-openshift-ansible-service-broker.172.17.0.1.nip.io
reencrypt	None

- b. Get the list of supported paths for the broker:

```
$ curl -H "Authorization: Bearer $(oc whoami -t)" -k \
https://asb-1338-openshift-ansible-service-broker.172.17.0.1.nip.io/

{
  "paths": [
    "/apis",
    "/ansible-service-broker/", ❶
    "/healthz",
    "/healthz/ping",
    "/healthz/poststarthook/generic-apiserver-start-informers",
    "/metrics"
  ]
}
```

❶ This path provides the **v2/bootstrap** and **v2/catalog** paths.

- c. Curl the **v2/bootstrap** path using the value found from the previous step:

```
$ curl -H "Authorization: Bearer $(oc whoami -t)" -k -X POST \
https://asb-1338-openshift-ansible-service-broker.172.17.0.1.nip.io/ansible-service-broker/v2/bootstrap ❶

{
  "spec_count": 38,
  "image_count": 109
}
```

- 1 Replace **ansible-service-broker** if it differs from the value found in the previous step.



NOTE

The **oc whoami -t** command should return a token and the authenticated user must have permissions as described in [Access Permissions](#).

4. Verify the new APB exists in the OAB. This is normally the functionality of the **apb list** command. If you do not have the **apb** tooling installed, you can alternatively perform the following:
 - a. Curl the **v2/catalog** path using the route and supported path name gathered from the previous **v2/bootstrap** step:

```
$ curl -H "Authorization: Bearer $(oc whoami -t)" -k \
  https://asb-1338-openshift-ansible-service-
  broker.172.17.0.1.nip.io/ansible-service-broker/v2/catalog
```

You should see a list of all bootstrapped APB specs and one that is labeled **localregistry-<bundle_name>**. Use **|grep <bundle_name>** to help find it, since the output is in JSON.

3.2.8.2. Running APBs

Due to the limitations when working with remote clusters, you may want the same functionality as the **apb run** command without having to rely on the **apb push** command being successful. This is because **apb run** implicitly performs **apb push** first before attempting to provision the application.

In order to work around this:

1. Follow the steps described in [Pushing APBs](#) to push your image onto the internal OpenShift Container Platform registry. After the image exists, you should be able to see it with:

```
$ oc get images | grep <bundle_name>

sha256:bfaa73a5e15bf90faec343c7d5f8cc4f952987afdbc3f11a24c54c037528d
2ed
172.30.1.1:5000/openshift/<bundle_name>@sha256:bfaa73a5e15bf90faec34
3c7d5f8cc4f952987afdbc3f11a24c54c037528d2ed
```

2. To provision, use the **oc run** command to launch the APB:

```
$ oc new-project <target_namespace>
$ oc create serviceaccount apb
$ oc create rolebinding apb --clusterrole=admin --serviceaccount=
<target_namespace>:apb
$ oc run <pod_name> \
  --env="POD_NAME=<pod_name>" \
  --env="POD_NAMESPACE=<target_namespace>" \
  --image=<pull_spec> \ 1
  --restart=Never \
  --attach=true \
```

```
--serviceaccount=apb \
-- <action> -e namespace=<target_namespace> -e
cluster=openshift
```

- 1 Use the pull specification for the image shown when running **oc get images** from the previous step, since the registry will determine the fully-qualified domain name (FQDN).

3.2.9. Working With the Restricted SCC

When building an OpenShift Container Platform image, it is important that you do not have your application running as the root user when at all possible. When running under the **restricted** security context, the application image is launched with a random UID. This causes problems if your application folder is owned by the root user.

A good way to work around this is to add a user to the root group and make the application folder owned by the root group. See [OpenShift Container Platform-Specific Guidelines](#) for details on supporting arbitrary user IDs.

The following is a **Dockerfile** example of a node application running in **/usr/src**. This command would be run after the application is installed in **/usr/src** and the associated environment variables set:

```
ENV USER_NAME=haste \
    USER_UID=1001 \
    HOME=/usr/src

RUN useradd -u ${USER_UID} -r -g 0 -M -d /usr/src -b /usr/src -s
    /sbin/nologin -c "<username> user" ${USER_NAME} \
        && chown -R ${USER_NAME}:0 /usr/src \
        && chmod -R g=u /usr/src /etc/passwd

USER 1001
```

3.2.10. Using a ConfigMap Within an APB

There is a temporary workaround for creating ConfigMaps from Ansible due to a bug in the Ansible modules.

One common use case for ConfigMaps is when the parameters of an APB will be used within a configuration file of an application or service. The ConfigMap module allows you to mount a ConfigMap into a pod as a volume, which can be used to store the configuration file. This approach allows you to also leverage the power of Ansible's **template** module to create a ConfigMap out of APB parameters.

The following is an example of creating a ConfigMap from a Jinja template mounted into a pod as a volume:

```
- name: Create hastebin config from template
  template:
    src: config.js.j2
    dest: /tmp/config.js

- name: Create hastebin configmap
  shell: oc create configmap haste-config --from-file=haste-
    config=/tmp/config.js

<snip>
```

```

- name: create deployment config
  openshift_v1_deployment_config:
    name: hastebin
    namespace: '{{ namespace }}'
    labels:
      app: hastebin
      service: hastebin
    replicas: 1
    selector:
      app: hastebin
      service: hastebin
    spec_template_metadata_labels:
      app: hastebin
      service: hastebin
    containers:
      - env:
          image: docker.io/dymurray/hastebin:latest
          name: hastebin
          ports:
            - container_port: 7777
              protocol: TCP
          volumeMounts:
            - mountPath: /usr/src/haste-server/config
              name: config
      - env:
          image: docker.io/modularitycontainers/memcached:latest
          name: memcached
          ports:
            - container_port: 11211
              protocol: TCP
    volumes:
      - name: config
        configMap:
          name: haste-config
          items:
            - key: haste-config
              path: config.js

```

3.2.11. Customizing Error Messages

A default error message is returned in the web console when a provision call fails. For example:

```

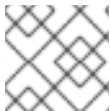
Error occurred during provision. Please contact administrator if the issue
persists.

```

To provide more information for troubleshooting purposes should a failure occur, you can write custom error messages for your APB that the web console can check for and return to the user.

Kubernetes allows pods to log fatal events to a termination log. The log file location is set by the **terminationMessagePath** field in a pod's specification and defaults to **/dev/termination-log**.

The broker checks this termination log for any messages that were written to the file and passes the content to the service catalog. In the event of a failure, the web console displays these messages.

**NOTE**

See [Kubernetes documentation](#) for more details on pod termination messages.

The following is an example of how this can be done in an APB utilizing a CloudFormation template:

```
- name: Writing Termination Message
  shell: echo "[CloudFormation Error] - {{ ansible_failed_result.msg }}" >
/dev/termination-log

- fail: msg="[APB Failed Plain - '{{ _apb_plan_id }}'] "
```

If an error occurs, this example custom message is written to the default termination log path before it fails the pod.