

GitOps with ArgoCD

Continuous Delivery in Kubernetes

Class Labs: Revision 2.4 - 10/22/22

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Important Note: Prior to starting with this document, you should have the ova file for the class (the virtual machine already loaded into Virtual Box and have ensured that it is startable. See the setup doc [gitops-setup.pdf](#) in <http://github.com/skilldocs/gitops> for instructions and other things to be aware of. You should also have a GitHub account.

Note: It is suggested to go ahead and do step 1 of lab 1 after you start the VM as it can take a few minutes to complete.

Setup: To do before Lab 1

1. Enable networking by selecting the up/down arrow icon at top right and selecting the option. See screenshot below.



2. To start, we'll need to get the minikube environment up and running as well as the argocd instance. Open a terminal window and enter the commands below. This will take a while to run.

```
$ cd argo-setup  
$ ./setup.sh
```

3. Take note of the initial ArgoCD password that is dumped out at the end of the script running (surrounded by exclamation points). Copy this as you'll need it later!
4. We also need to setup port-forwarding for the argocd server. Open up a separate terminal window via the mouse icon (upper left) or via Terminal Emulator icon on the desktop and run the command below.

```
$ cd argo-setup  
$ ./setup-forward.sh
```

Lab 1: Getting Started with Argo CD

Purpose: In this lab, we'll start working with Argo CD by creating an app that represents our manifests and deploying that to the cluster.

- Once your cluster starts up, you will have argocd running in its own argocd namespace. Go back to the original terminal session (if you're in the one where you started the port forward). You can see the various pieces that are running there by looking at it in Kubernetes.

```
$ k get all -n argocd
```

- Now, we need to login to our argocd instance. The startup script should have run a port-forward, so we can access the ArgoCD instance on port 9090. Answer "y" to the question about proceeding insecurely. Use username = admin and pw = the value from step 3 above.

```
$ argocd login localhost:9090
```

OPTIONAL: After you login , you can change the default password through the command line utility if you want. Note that you will need to login again with the new password afterwards.

```
$ argocd account update-password
```

- Next we need to point argocd to the cluster we want to work with. Since we only have one cluster on this machine, it would default to that one automatically. But we'll go ahead and add it so we can see how its done. Answer "y" to the questions about cluster-level privileges and ignore the broken pipe message.

```
$ argocd cluster add minikube
```

You should see output like the following:

```
INFO[0000] ServiceAccount "argocd-manager" created in namespace "kube-system"  
INFO[0000] ClusterRole "argocd-manager-role" created  
INFO[0000] ClusterRoleBinding "argocd-manager-role-binding" created  
Cluster 'https://10.0.2.15:8443' added
```

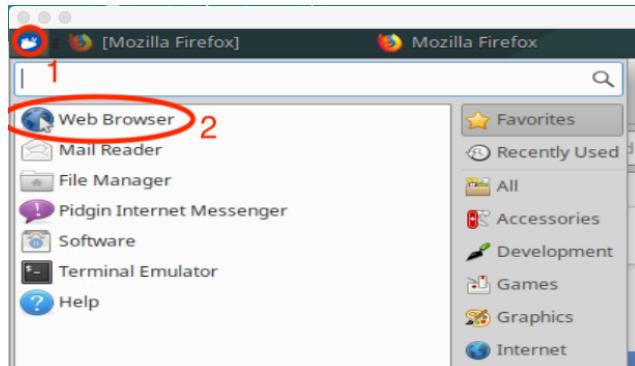
- Let's set a couple of environment variables for convenience. The first one, ARGOCD_OPTS, tells the CLI which namespace ArgoCD is running in. You could skip this, but then you would have to supply that argument on every argocd command. The second variable tells ArgoCD where the API URL is for the target cluster.

```
$ export ARGOCD_OPTS='--port-forward-namespace argocd'
```

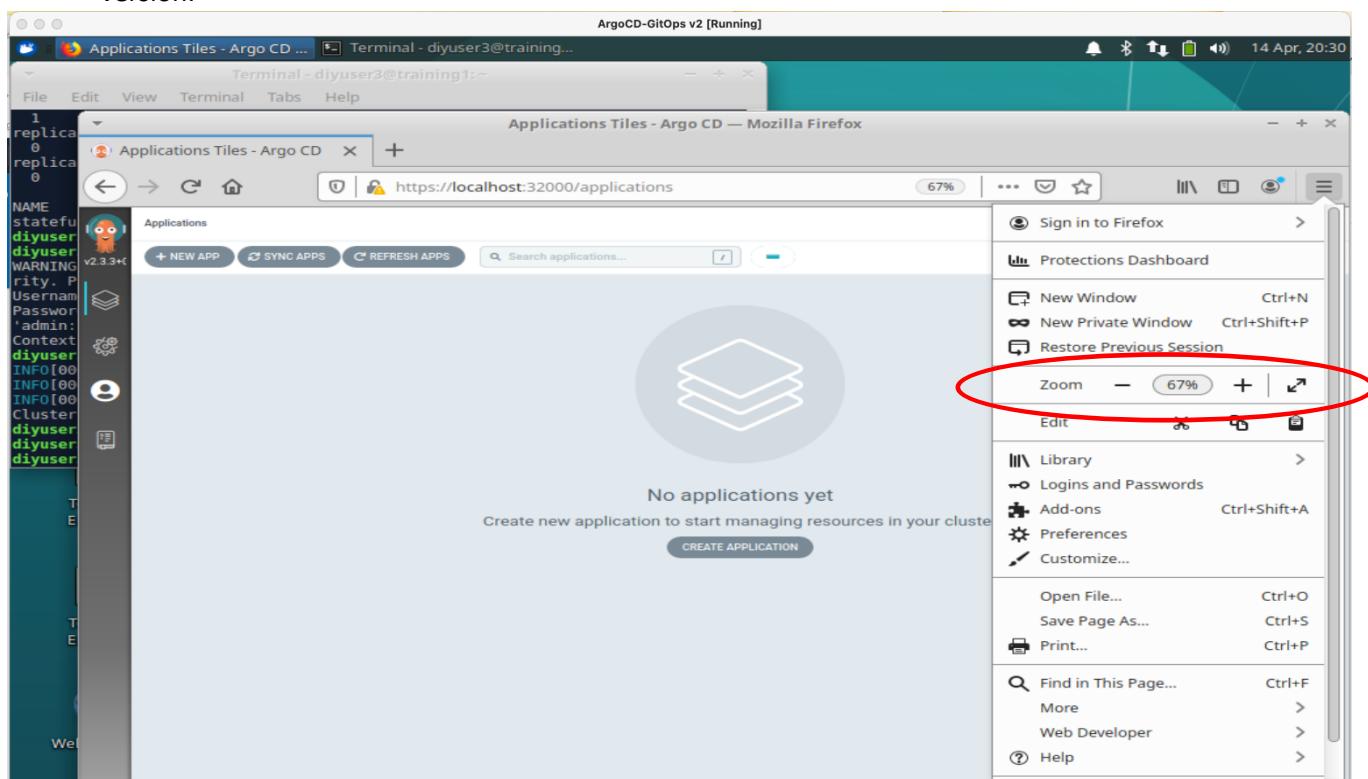
```
$ export CLUSTER_IP=https://$(sudo minikube ip):8443
```

- Before we go further, let's open up the browser interface to Argo CD. Do that by opening up a browser and then going to the url <https://localhost:9090/> (At the security risk message, click on Advanced and Accept...). Then login with the same Username and Password used on the command line.

(The screenshots below show how to get a browser window (there's also a shortcut on the desktop).



- You can scale out the screen by clicking on the settings and then set the Zoom value back to a smaller version.



- Now, we can create an "app" in Argo CD - essentially a way to manage the collection of Kubernetes manifests for services, deployments, etc.

We'll use an existing set of manifests in GitHub for the ROAR webapp and database pieces. We'll also supply the destination cluster and namespace.

Back in the terminal, enter the command below. (Note: Make sure you've done this in a terminal where the preceding environment variables are set (from step 5).). If you encounter any errors running this, make sure you have all 3 lines in the command and there are spaces as shown in the command string.

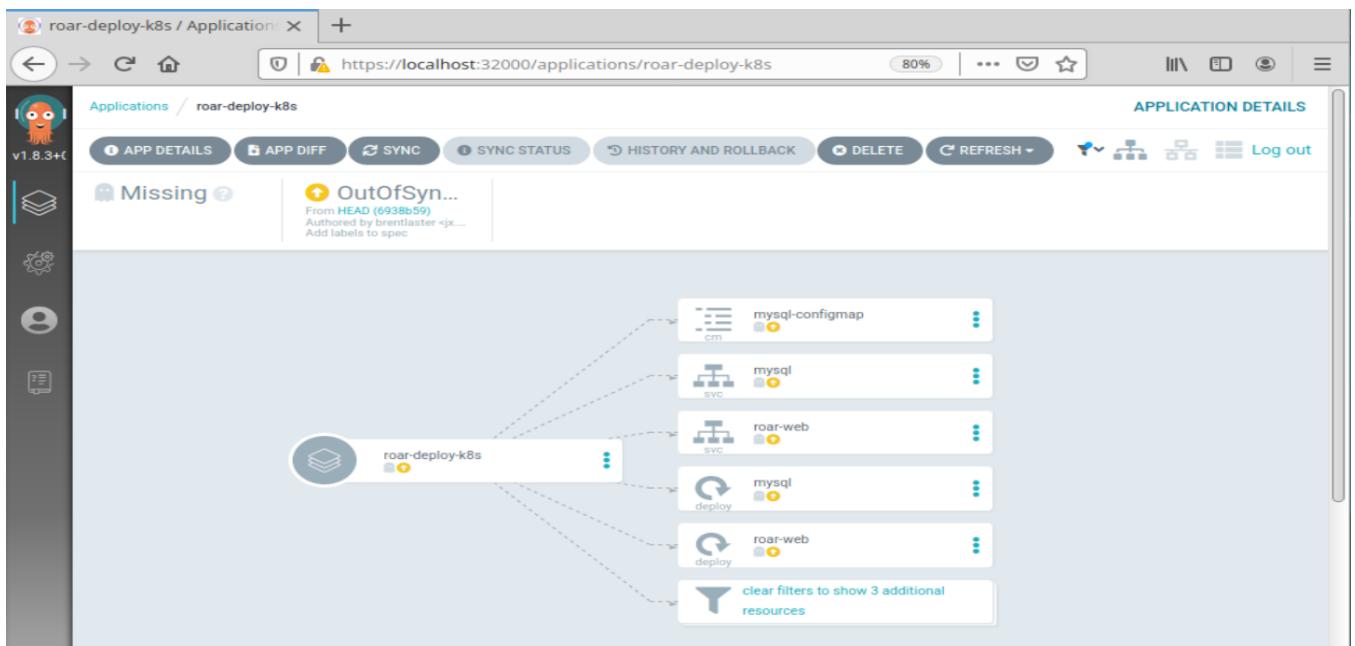
```
$ argocd app create roar-deploy-k8s --repo  
https://github.com/brentlaster/roar-deploy-k8s --path . --dest-server  
$CLUSTER_IP --dest-namespace roar
```

9. You should get a message like "application 'roar-deploy-k8s' created". And if you go back to the browser, you'll be able to see a representation for the app and the set of objects making it up. Click on the large, single box to see the set of items that make it up as shown below.

The screenshot shows the Argo CD web interface at <https://localhost:32322/applications>. On the left is a sidebar with icons for New App, Sync Apps, and Search applications. The main area displays the 'roar-deploy-k8s' application. Its details are as follows:

Project	default
Labels	Missing, OutOfSync
Status	Missing
Repo	https://github.com/brentlaster/roar-deploy-k8s
Targ...	
Path	.
Desti...	minikube
Nam...	roar

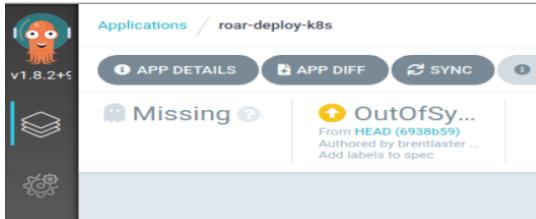
At the bottom are buttons for SYNC, RELOAD, and DELETE.



10. Back in the terminal, run the command below to see the current state of the app you just created.

\$ argocd app list

The output should show you a number of fields with info about the app. Notice that the STATUS is currently "OutOfSync" and HEALTH is currently "Missing". If you look in the browser you'll see these same indicators near the top of the screen.



11. The reason for the OutOfSync and Missing statuses is that while we've told Argo CD about the app, we haven't yet deployed it to the target cluster and namespace. Let's take a more detailed look at what will be deployed with our app. From the command line:

```
$ argocd app get roar-deploy-k8s
```

Notice the set of KIND objects in the list and other information.

12. Before we sync our app, let's make one edit to it to automatically create the namespace for us.

Whether we use the command line or the UI to create the app, what we really get is a yaml file that is the “manifest” for the app. We can edit that to make changes. Edit the app and make the changes in the editor to add the yaml to automatically create the namespace.

```
$ export EDITOR=gedit  
$ argocd app edit roar-deploy-k8s
```

Make the last 3 lines in the file equal to the set below - pay attention to the spacing and spelling - see the screenshot as a reference.

```
syncPolicy:  
  syncOptions:  
    - CreateNamespace=true
```

```

Open + roar-deploy-k8s-245878466-edit.yaml Save Settings - + X
1 # Please edit the object below. Lines beginning with a '#' will be ignored,
2 # and an empty file will abort the edit. If an error occurs while saving this file will be
3 # reopened with the relevant failures."
4
5 destination:
6   namespace: roar
7   server: https://10.0.2.15:8443
8 project: default
9 source:
10  path: .
11  repoURL: https://github.com/brentlaster/roar-deploy-k8s
12 syncPolicy:
13  syncOptions:
14    - CreateNamespace=true

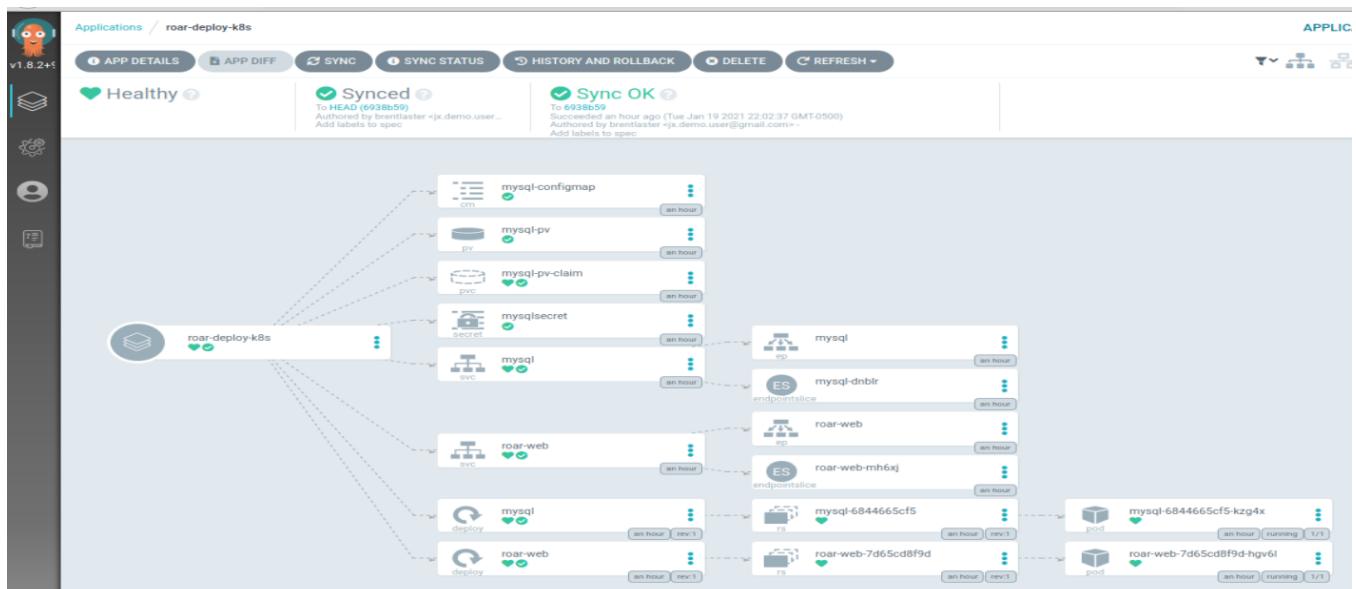
```

When you are done, save your changes and exit the editor. (You can ignore the Gtk warning message from the editor.)

13. While ArgoCD can do automatic syncs to the target cluster and namespace, it defaults to manual syncs. So let's go ahead and tell it to sync now from the command line. Enter the command below.

\$ argocd app sync roar-deploy-k8s

14. You'll see updated status for the various kinds scroll by. And if you look back in the browser, you'll see that the sync has completed, and things are starting up. (You may need to click on the "clear filters" items to see all of these.)



Optional: You can click on either of the pod objects on the far right (with the cube icons) to see information about the object as its running in the cluster. The SUMMARY tab shows the live manifest of the object (spec + status). The EVENTS tab shows the Kubernetes events that have occurred, and the LOGS tab shows the logs from the application in the pod.

SUMMARY	EVENTS	LOGS
KIND	Pod	
NAME	mysql-6844665cf5-kzg4x	
NAMESPACE	roar	
CREATED_AT	01/19/2021 22:02:37	
IMAGES	quay.io/bcilatero/roar-db.1.0.2	
STATE	Running	
LIVE MANIFEST		
<pre>1 apiVersion: v1 2 kind: Pod 3 metadata: 4 creationTimestamp: '2021-01-20T03:02:37Z' 5 generateName: mysql-6844665cf5- 6 labels: 7 app: roar-db 8 name: mysql 9 pod-template-hash: 6844665cf5 10 managedFields: 11 - apiVersion: v1 12 fieldType: FieldsV1 13 fieldsV1: 14 'f:metadata': 15 'f:generateName': {} 16 'f:labels': 17 ': O 18 'f:app': {} 19 'f:filename': {} 20 'f:podTemplateHash': {} 21 'f:ownerReferences': 22 ': O 23 'k:'uid': '989678d4-f211-4715-b3de-7f9dbb654a03'; 24 'O 25 'f:apiVersion': {}</pre>		

Optional: You can also see our app running in the cluster. From a command line, find the node port for the application and then open the URL shown below in a browser.

```
$ k get svc -n roar roar-web
```

Look for the port number that is between "8089:" and "/TCP". Plug that into the URL below.

<http://localhost:<port number>/roar/>

You should see the app running similar to this screenshot.

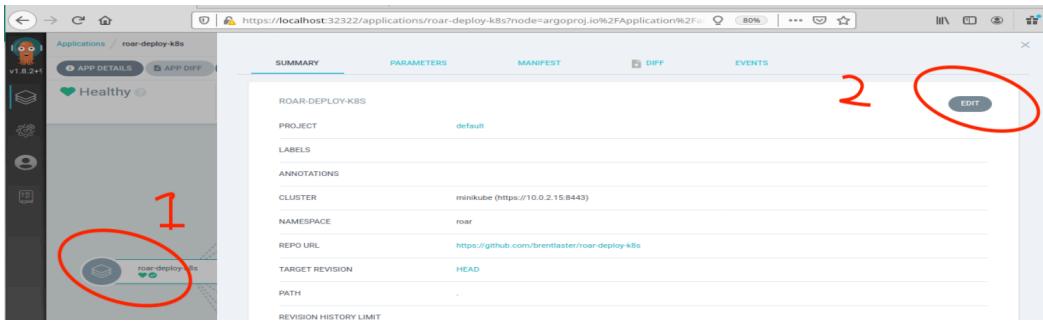
R.O.A.R (Registry of Animal Responders) Agents						
Show 10 entries						Search:
	Name	Species	Date of First Service	Date of Last Service	Adversary	Adversary Tech
1	Road Runner	bird	1955-01-20	1995-02-15	Wile E. Coyote	ACME product du jour
2	Scooby	dog	1969-05-19	2000-02-11	fake ghosts	mask
3	Perry	platypus	2013-01-20	2015-04-09	H. Doofensmirtz	...inator
4	Mr. Krabs	crab	2010-06-17	2014-07-07	Plankton	various
5	Bugs Bunny	rabbit	1966-05-22	1988-04-15	E. Fudd	wabbit gun

Lab 2: Dealing with Failed Deployments and Rollback

Purpose: In this lab, we'll see what a failed deployment looks like and how to roll it back.

1. Let's see what happens when a deployment fails. First, we'll edit the app to change the Target Revision field.

In the browser tab with ArgoCD, click on the main app icon on the far left, then click the EDIT button in the upper right.



- On the summary screen, edit the TARGET REVISION to change it from empty or “HEAD” to “future”. Then click the SAVE button in the upper right corner to save the changes.

PROJECT	default	SAVE	CANCEL	
LABELS	No items			
ANNOTATIONS	No items			
CLUSTER	https://10.0.2.15:8443	URL	▼	
NAMESPACE	roar			
REPO URL	https://github.com/brentlaster/roar-deploy-k8s			
TARGET REVISION	future	Branches	▼	
PATH	-			
REVISION HISTORY LIMIT	10			
SYNC OPTIONS	<input checked="" type="checkbox"/> Use a schema to validate resource manifests <input checked="" type="checkbox"/> Auto-create namespace			

- You'll see the STATUS field immediately change to “OutOfSync”. Click the X in the upper left corner to close the parameters screen.

TARGET REVISION	future
PATH	-
REVISION HISTORY LIMIT	
SYNC OPTIONS	CreateNamespace, policy=strict
STATUS	OutOfSync From future (d6acaf9)
HEALTH	Healthy
IMAGES	quay.io/bclaster/roar-db:1.0.2 quay.io/bclaster/roar-web:1.0.1

- Now you can see which element is out of sync - the mysql deployment. (The mysql box directly connected to the main app box)



- Click on that element and then on the **SUMMARY** screen, select the **DIFF** tab. In the DIFF tab on the upper right, click on both boxes for Compact diff and Inline Diff. You'll then be able to see the lines that are different.

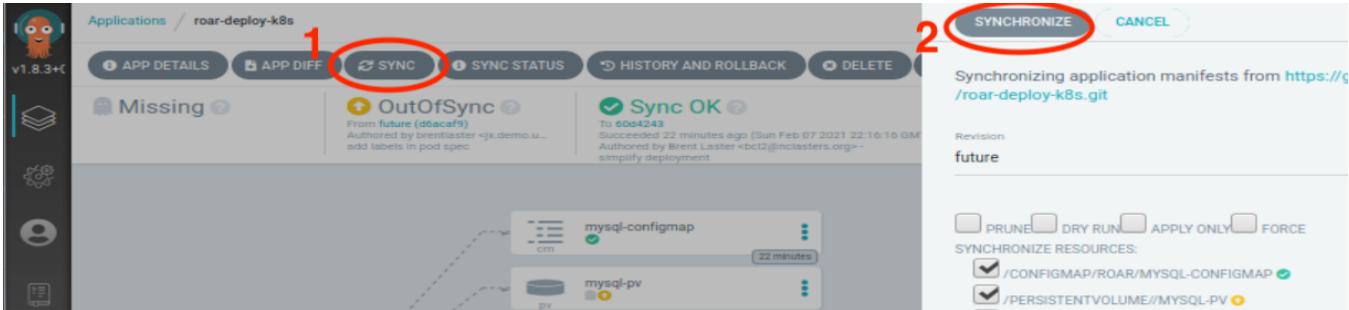
You can also see the manifest that is active in the cluster versus the one that is ready to be deployed by clicking on the **LIVE MANIFEST** vs **DESIRED MANIFEST** tabs, respectively.

LIVE MANIFEST	DIFF	DESIRED MANIFEST
196 197 198 199	<code>configMapKeyRef:</code> <code>key: mysql.user</code> <code>name: mysql-configmap</code> <code>image: 'quay.io/bclaster/roar-db:1.0.2'</code>	

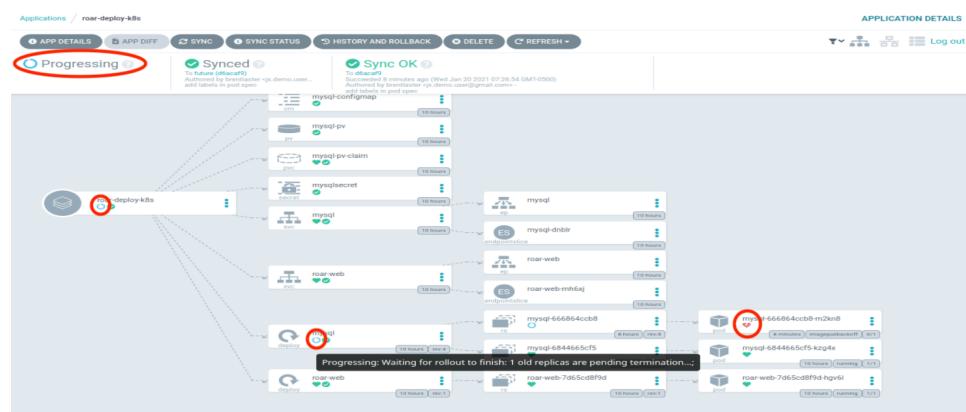
LIVE MANIFEST	DIFF	DESIRED MANIFEST
186 187 188 189 190		<input checked="" type="checkbox"/> Compact diff <input checked="" type="checkbox"/> Inline Diff
	<code>key: mysql.user</code> <code>name: mysql-configmap</code>	
	<code>image: 'quay.io/bclaster/roar-db:1.0.2'</code>	
	<code>image: 'quay.io/bclaster/roar-db:1.2.3'</code>	
	<code>imagePullPolicy: IfNotPresent</code>	
	<code>name: mysql</code>	

Close the screen by clicking on the “X” in the upper right corner when done.

- Manually synchronize the desired state to the cluster by clicking on the “**SYNC**” button on the top of the screen. When the popup appears, leave everything as it is and click on the “**SYNCHRONIZE**” button. Then you can close the dialog.



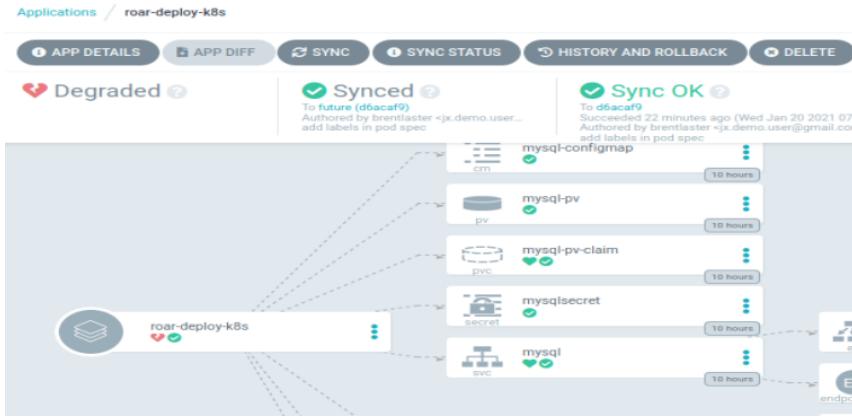
- After the sync is attempted, you'll see that the app is in a "Progressing" state as it tries to reconcile the desired deployment with the live one. You'll also notice that there is a pod that is not ready yet, indicated by the broken red heart icon. (See circled sections in the second screenshot below.)



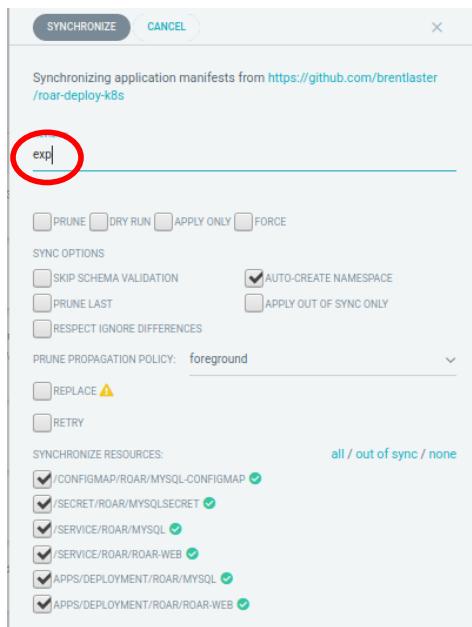
- If you click on the un-synced pod element (the one with the broken red heart), you can see what is going on by looking at the EVENTS tab. After you are done, close that screen via the "X" in the upper right.

SUMMARY	EVENTS	LOGS		
REASON	MESSAGE	COUNT	FIRST OCCURRED	LAST OCCURRED
Scheduled	Successfully assigned roar/mysql-6666864ccb8-m2kn8 to training1			
Pulling	Pulling image "quay.io/bclaster/roar-db:1.2.3"	4	2021-01-20T12:26:55Z	2021-01-20T12:28:22Z
Failed	Failed to pull image "quay.io/bclaster/roar-db:1.2.3": rpc error: code = Unknown desc = Error response from daemon: manifest for quay.io/bclaster /roar-db:1.2.3 not found	4	2021-01-20T12:26:55Z	2021-01-20T12:28:23Z
Failed	Error: ErrImagePull	4	2021-01-20T12:26:55Z	2021-01-20T12:28:23Z
BackOff	Back-off pulling image "quay.io/bclaster/roar-db:1.2.3"	6	2021-01-20T12:26:56Z	2021-01-20T12:28:09Z
Failed	Error: ImagePullBackOff	45	2021-01-20T12:26:56Z	2021-01-20T12:37:06Z

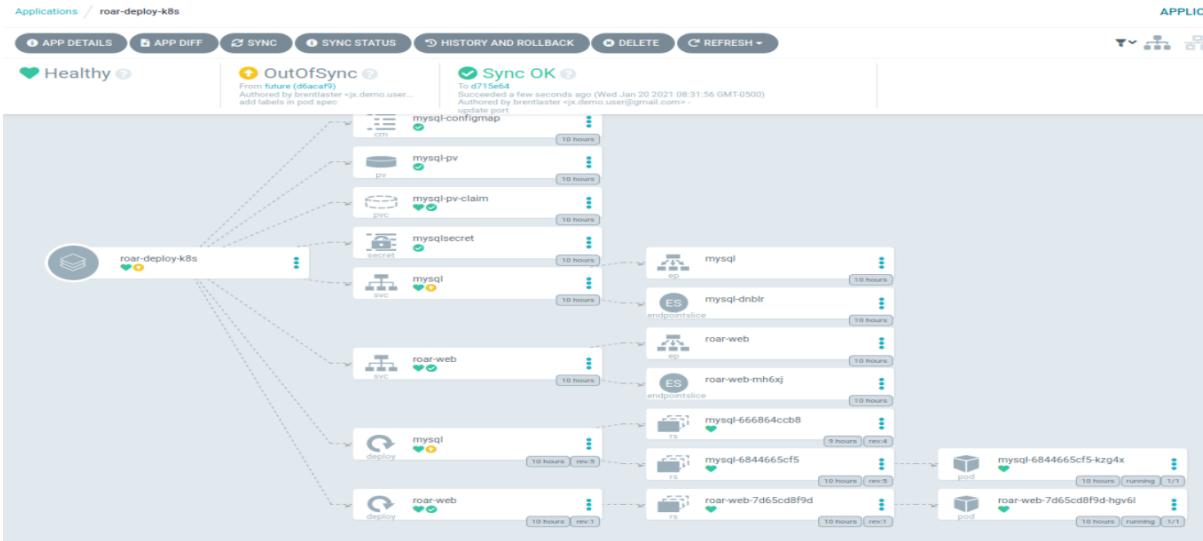
- Eventually, the app status will switch to an overall status of "DEGRADED". (You don't need to wait for this.) Note that your original deployment is still synched and running though.



10. Let's try another branch. Click the “SYNC” button at the top. Then in the pop-up dialog (the one for **SYNCHRONIZE**) change the “Revision” field to be “exp”. This represents an experimental branch on our project. After making that change, click on the “SYNCHRONIZE” button.



11. After this, you'll be able to see that a couple of items still show up as “Out Of Sync” (yellow circle with arrows). This is because the version in the app is “future” and the version synched to the cluster is from the “exp” branch.



12. Now take a look at the app from “exp” running in the cluster. From a command line, find the node port for the application and then open the URL shown below in a browser.

```
$ k get svc -n roar roar-web
```

Look for the port number that is between “8089:” and “/TCP”. Plug that in to the URL below.

<http://localhost:<port number>/roar/>

You'll see something like below. Note that there is no data showing.

13. (Optional) If you want to see why this is broken, you can click on the revision link (“d715e64”) at the top of the ArgoCD tab to go to the code in GitHub.

14. We want to rollback to a working state - meaning the original code deployed from main. To do that, go back to the Argo tab in the browser (if not already there), and click on the “HISTORY AND ROLLBACK” button at the top. You'll then see a list of deployments like the one below.

The screenshot shows the 'HISTORY AND ROLLBACK' tab selected in the top navigation bar. Below it, a green 'Sync OK' status indicator is present. The main area displays three deployment entries:

- Revision 1:** Deployed At: 8 minutes ago (Wed Jan 20 2021 08:31:56 GMT-0500). Revision: d715e64. Authored by brentlaster <jx.demo.user@gmail.com>. Time to deploy: 0:02 min. Active for: 07:42 min.
- Revision 2:** Deployed At: an hour ago (Wed Jan 20 2021 07:26:54 GMT-0500). Revision: d6acaf9. Authored by brentlaster <jx.demo.user@gmail.com>. Time to deploy: 0:02 min. Active for: 01:05 hours.
- Revision 3:** Deployed At: 2 hours ago (Wed Jan 20 2021 06:51:59 GMT-0500). Revision: 6938b59. Authored by brentlaster <jx.demo.user@gmail.com>. Time to deploy: 0:02 min. Active for: 34:55 min.

15. Find the entry for the original (first/bottom) revision, click on the 3 dots on the right and then click on the “ROLLBACK” pop-up button. Click on “OK” at the prompt.

This screenshot shows the detailed view for the third deployment entry (Revision 6938b59). The 'Active for' field shows 01:05 hours. The deployment details are as follows:

- Deployed At: 12 hours ago (Wed Jan 20 2021 06:51:59 GMT-0500).
- Revision: 6938b59.
- Authored by brentlaster <jx.demo.user@gmail.com>.
- Time to deploy: 0:02 min.
- Active for: 34:55 min.

A prominent 'Rollback' button is visible in the top right corner of the card.

16. The rollback syncs the cluster back to the desired version, but does not modify the app. So, while the app still reflects the “future” settings, the cluster is now synched to the desired revision. You can see this at the top of the screen.

The top navigation bar displays two status indicators:

- OutOfSync**: From future (d6acaf9). Authored by brentlaster <jx.demo.user...> Add labels to spec.
- Sync OK**: To 6938b59. Authored by brentlaster <jx.demo.user@gmail.com>. Add labels to spec.

17. Now, assuming the service port hasn't changed, if you refresh the screen where the roar web application is, you should see the version with the data in it - indicating that the correct version was applied back to the cluster.

Lab 3: Helm Projects and Automated Sync

Purpose: In this lab, we'll see how to add a Helm project to ArgoCD with automatic syncing. And then we'll make a change to correct an issue and see the automatic sync in action.

1. First, let's create a new project to work with instead of the default one. In a terminal, create a new project with the command below.

```
$ argocd proj create helmpproj
```

2. Now, we need to add local ssh information to argocd so the argocd pods can recognize the ssh requests for our local git repos.

The middle command below will find and add ssh information to argocd. The top and bottom commands will show the entries before and after. (10.0.2.15 is the minikube ip address)

```
$ argocd cert list --cert-type ssh
```

```
$ ssh-keyscan 10.0.2.15 | argocd cert add-ssh --batch
```

```
$ argocd cert list --cert-type ssh
```

3. Now we'll add a local Git repo as a repo for our project. After running the command below, you should see a message that indicates the repository was added.

```
$ argocd repo add git@10.0.2.15:/git/repos/roar-k8s-helm.git --ssh-private-key-path ~/.ssh/id_rsa
```

(NOTE: ONLY if you happen to hit an error here, the port-forward may have stopped. Go to the other terminal, run the setup-forward.sh command again and then back in the original terminal, run the ssh-keyscan and argocd add commands again.

```
$ ./setup-forward.sh (in other terminal)
```

```
$ ssh-keyscan 10.0.2.15 | argocd cert add-ssh --batch
```

```
$ argocd repo add git@10.0.2.15:/git/repos/roar-k8s-helm.git --ssh-private-key-path ~/.ssh/id_rsa
```

```
)
```

4. Also add it to our project as a source AND add the cluster as a destination to the project with a namespace at the end.

```
$ argocd proj add-source helmpproj git@10.0.2.15:/git/repos/roar-k8s-helm.git
```

```
$ argocd proj add-destination helmpproj https://10.0.2.15:8443 helm-demo
```

5. We will also need to allow access to cluster resources to allow creation of the namespace. Use the command below for that.

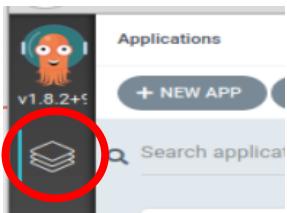
```
$ argocd proj allow-cluster-resource helmpproj '*' '*'
```

(Note: If you get an error here around "portforward.go" you can ignore it.)

6. Create a new namespace for our project

```
$ k create ns helm-demo
```

7. Now, let's create a new app definition in the UI for our project. Back in the browser, on the Argo tab, click on the "stack of squares" on the left side, then select the "+ NEW APP" button. Set the values as follows: (Notice that along the way, ArgoCD recognizes there are Helm charts in the repo and automatically adds the "Helm" section at the bottom.)



GENERAL

Application Name = helm-demo

Project = helmpproj

SYNC POLICY = Automatic and check both boxes

SYNC OPTIONS - Check the box for "Auto-Create Namespace"

PRUNE PROPAGATION POLICY - skip

CREATE CANCEL

GENERAL

Application Name
helm-demo

Project
helmpoj

SYNC POLICY

Automatic

PRUNE RESOURCES ⓘ
 SELF HEAL ⓘ

SYNC OPTIONS

Skip Schema Validation
 Prune Last
 Respect Ignore Differences

Auto-Create Namespace
 Apply Out of Sync Only

PRUNE PROPAGATION POLICY: foreground

REPLACE ⚠️
 RETRY

SOURCE

Repository URL = <git@10.0.2.15:/git/repos/roar-k8s-helm.git>

Revision = HEAD

Path = helm

SOURCE

Repository URL
git@10.0.2.15:/git/repos/roar-k8s-helm.git GIT ✓

Revision
HEAD Branches ▾

Path
helm

DESTINATION

Cluster URL = <https://10.0.2.15:8443>

Namespace = helm-demo

DESTINATION

Cluster URL.
<https://10.0.2.15:8443>

Namespace
helm-demo

HELM

VALUES FILES = values.yaml
You can leave the rest of it as-is.

Helm ▾

HELM

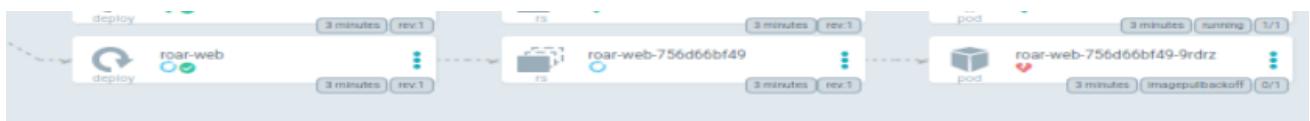
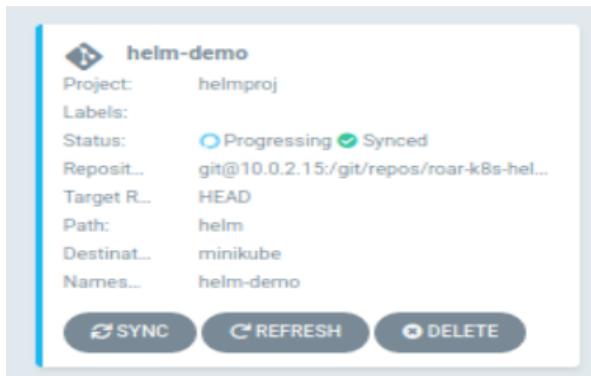
VALUES FILES **values.yaml** x

VALUES

PARAMETERS

roar-db.image.pullPolicy	Always
roar-db.image.repository	quay.io/bclaster/roar-db
roar-db.image.tag	1.0.2
roar-web.image.pullPolicy	Always
roar-web.image.repository	quay.io/bclaster/roar-web
roar-web.image.tag	1.10.1

- When you're done, click on the “CREATE” button at the top to save the app. Click on the new app you created. You should see the new app automatically going through the “Progressing” stage while it tries to get things starting up. However, there is a problem with the web pod as indicated by the red broken heart. (Click on the app to see that.)



- Click on that item (the one with the red heart) and look at the SUMMARY and/or EVENTS tabs to see what's wrong.

SUMMARY	EVENTS	LOGS
KIND	Pod	
NAME	roar-web-756d66bf49-9rdrz	
NAMESPACE	helm-demo2	
CREATED_AT	01/20/2021 23:09:01	
IMAGES	quay.io/bclaster/roar-web:1.10.1	
STATE	ImagePullBackOff	
STATE DETAILS	Back-off pulling image "quay.io/bclaster/roar-web:1.10.1"	

SUMMARY	EVENTS	LOGS
REASON	MESSAGE	
Scheduled	Successfully assigned helm-demo2/roar-web-756d66bf49-9rdrz to training1	
Pulling	Pulling image "quay.io/bclaster/roar-web:1.10.1"	
Failed	Failed to pull image "quay.io/bclaster/roar-web:1.10.1": rpc error: code = Unknown desc = Error response from daemon: manifest for quay.io/bclaster/roar-web:1.10.1 not found	
Failed	Error: ErrImagePull	
BackOff	Back-off pulling image "quay.io/bclaster/roar-web:1.10.1"	
Failed	Error: ImagePullBackOff	

- The deployment can't get the requested disk image. The reason is that there is a typo here in the images semantic version tag: Instead of “1.10.1”, it should be “1.0.1”. Let's fix that with the following sequence. (All commands should be run in a terminal)

```
$ git clone git@10.0.2.15:/git/repos/roar-k8s-helm.git
```

(answer yes if prompted for confirmation to connect)

```
$ cd roar-k8s-helm/helm
```

```
$ gedit values.yaml
```

Change the tag on line 12 from “1.10.1” to “1.0.1”, save your changes and exit the editor.

```
1 # Default values for roar charts.
2 # This is a YAML-formatted file.
3 # Declare variables to be passed into your templates
4 roar-db:
5   image:
6     repository: quay.io/bclaster/roar-db
7     tag: 1.0.2
8     pullPolicy: Always
9 roar-web:
10  image:
11    repository: quay.io/bclaster/roar-web
12    tag: 1.0.1
13    pullPolicy: Always
14
15
```

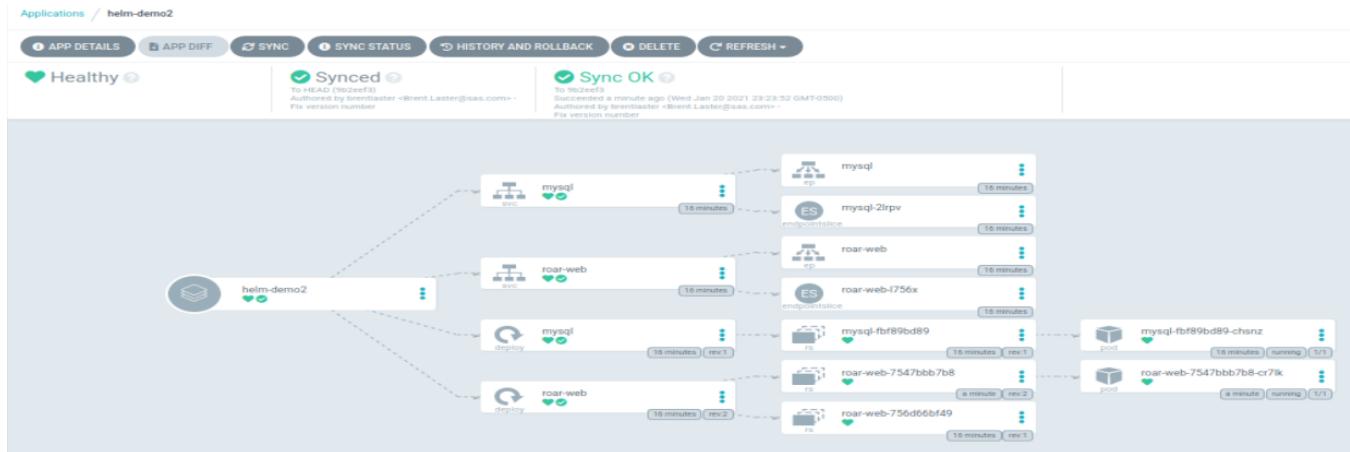
\$ git diff (This is just to verify this is the only change that has been made in your repo.)

\$ git commit -am "Fix version number"

\$ git push origin main

- After this, you can go back to the main app page. (Close the dialog for the pod item if open.) After about 3 minutes or so (be patient), the automated sync setting will kick in and the stage will change to “Progressing” and eventually should all go green.

(Since the auto sync interval in ArgoCD is so long, you may just want to let this run while we go through the next section.)



- If you want, you can find the service node port and use it to look at the running app as we've done before.

Lab 4: Working with CI/CD pipelines, Jenkins, and ArgoCD

Purpose: In this lab, we'll see how to use Jenkins to run a simple CI/CD pipeline that can be paired with ArgoCD to automatically deploy changes.

1. First, let's take a look at a pipeline we have setup in Jenkins to work with. We're using a pipeline script stored in an external Jenkinsfile. To access it, we need to clone down the "roar-min" repository first.

```
$ cd ~  
  
$ git clone git@localhost:/git/repos/roar-min  
  
$ gedit roar-min/Jenkinsfile
```

2. You can scroll down through the code to see what the pipeline does. It is divided into sections called "stages" for the main operations. The lines that start with "sh" are making calls out to the shell (OS) to run commands.

Basically, it

1. pulls code for our ROAR app
 2. builds the deliverables and packages them up
 3. then pulls them in to Docker images
 4. those Docker images are pushed into our local Docker repository running on the minikube instance
 5. Finally, the deploy stages use Kustomize to update the Kubernetes yaml files (manifests) for the project and push them into Git. That is where ArgoCD will kick in.
3. As you look through this, you can see that we have a "**checkout scm**" command to pull down the source code in the project, then a stage to build the binaries of the project with the build tool gradle. Then we have stages to create updated Docker images - one for the "**stage**" level and one for the "**prod**" level. These Docker images get tagged with the version numbers of "**0.0.<Build Number>**" and "**1.0.<Build Number>**" respectively.
 4. Finally, we have stages to use a tool called Kustomize to update the manifests with those version numbers (the tags of the Docker images) and push those updates to a Git repository.

This is the repository (roar-min-deploy) that our ArgoCD instance is watching and will sync from to update our cluster when changes are made.

5. Now, let's look at the Jenkins project that references this. **Open up Jenkins at localhost:8080 and sign in** with the userid and password provided in class.
6. On the Jenkins dashboard (home screen) you'll see there is one project with the name starting with "ArgoCD". This is a multibranch pipeline project which means it will monitor for any changes in a branch in the repository and if that branch has a Jenkinsfile with the pipeline in it, it will execute that pipeline in Jenkins.

The screenshot shows the Jenkins dashboard with a sidebar on the left containing links like 'New Item', 'People', 'Build History', 'Project Relationship', 'Check File Fingerprint', 'Manage Jenkins', and 'My Views'. The main area displays a table for a 'Multibranch Pipeline project to build content to deploy to Kubernetes'. The table has columns: S, W, Name, Last Success, Last Failure, and Last Duration. One row is shown for the 'main' branch, which was last successful 41 seconds ago. There are buttons for 'Add description', 'Icon: S M L', 'Legend', and three Atom feed options.

7. This multibranch project automatically creates a “sub-job” for every branch it finds in the repository that has a Jenkinsfile in it. In this case, the only branch we have is “main” so if you click on the name of the top-level project, you’ll see the project for “main”.

The screenshot shows the details page for the 'main' branch of the 'ArgoCD Multibranch Pipeline project to build content to deploy to Kubernetes'. The page title is 'ArgoCD Multibranch Pipeline project to build content to deploy to Kubernetes'. It shows the folder name 'argocd-mb-pipe' and a 'Disable Multibranch Pipeline' button. Below this is a table for 'Branches (1)'. The table has columns: S, W, Name, Last Success, Last Failure, and Last Duration. The 'main' branch is listed with its last success at 12 minutes and 35 seconds ago. There are buttons for 'Icon: S M L', 'Legend', and three Atom feed options.

8. If you want to see how that project was configured, you can select the “Configure” menu entry on the left side and look at the details. Probably the most interesting part is the “Branch Sources” which points to the deploy repository to watch and the scan interval (lower part of the page) with the interval set to 1 minute.

- Let's setup a new project and related pieces in ArgoCD to react to updates to the deployment files in Git.

Back in the terminal session, first, we'll create the project and add the repo and cluster we're interested in as the source (-s) and destination (-d) respectively. (The "*" means any namespace.)

```
$ argocd proj create jenkins-proj -d https://10.0.2.15:8443,* -s
git@10.0.2.15:/git/repos/roar-min-deploy.git
```

Note that the repo is only for the deployment manifests as that's all ArgoCD is interested in - not the actual project source code or Docker files.

- We will also need to allow access to cluster resources to allow creation of the namespace. Use the command below for that.

```
$ argocd proj allow-cluster-resource jenkins-proj '*' '*'
```

11. Next, we'll add the deployment repo so we can use it in our app.

```
$ cd ~  
$ argocd repo add git@10.0.2.15:/git/repos/roar-min-deploy.git --ssh-private-key-path ~/.ssh/id_rsa
```

12. Now we'll create an app with a single command-line invocation:

```
$ argocd app create jenkins-stage --project jenkins-proj --repo git@10.0.2.15:/git/repos/roar-min-deploy.git --dest-server https://10.0.2.15:8443 --path overlays/stage --sync-policy auto
```

13. Let's look at what the app will be applying. Clone down a copy of the roar-min-deploy repository.

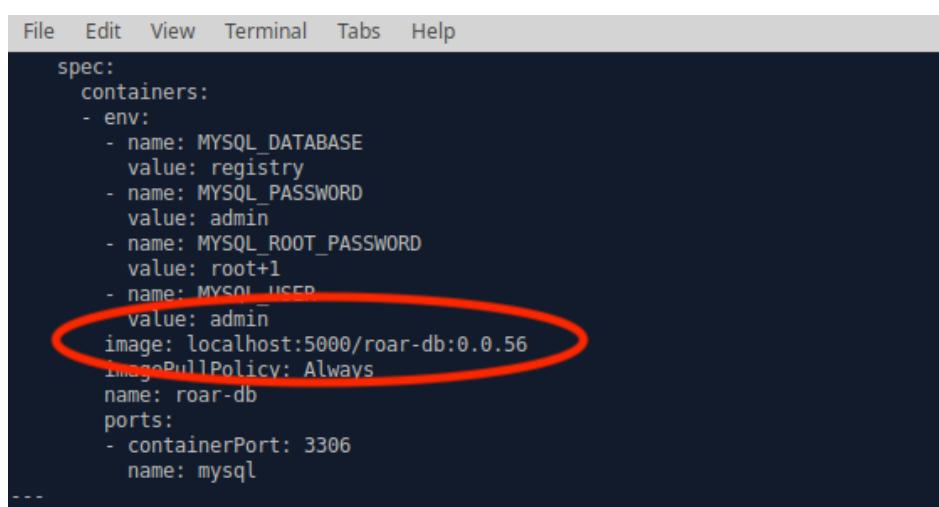
```
$ git clone git@localhost:/git/repos/roar-min-deploy
```

14. Change into the cloned directory area for the staged version and run kustomize to build the manifests.

```
$ cd roar-min-deploy/overlays/stage  
$ kustomize build
```

15. The output is the manifests that will be fed into Kubernetes, constructed by applying the overlay pieces and patch on top of the base resources.

If you scroll and look at the image definitions in the deployment parts, you'll see that it's trying to pull images from our local registry (localhost:5000).

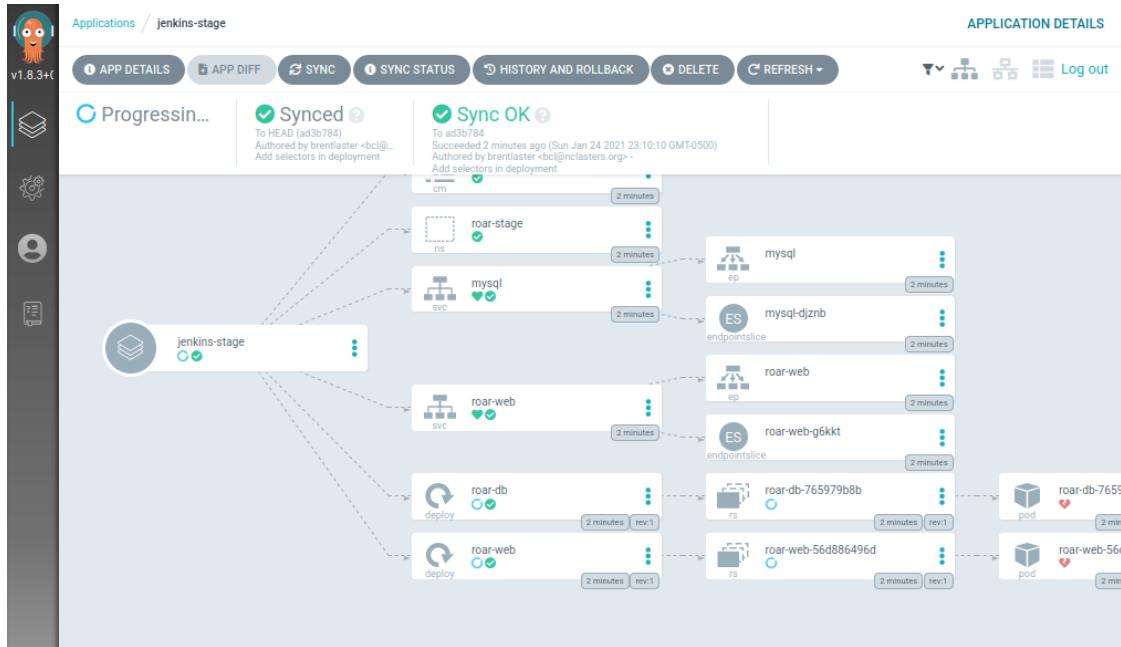


```
File Edit View Terminal Tabs Help  
spec:  
  containers:  
    - env:  
      - name: MYSQL_DATABASE  
        value: registry  
      - name: MYSQL_PASSWORD  
        value: admin  
      - name: MYSQL_ROOT_PASSWORD  
        value: root+1  
      - name: MYSQL_USER  
        value: admin  
      image: localhost:5000/roar-db:0.0.56  
      imagePullPolicy: Always  
    name: roar-db  
    ports:  
      - containerPort: 3306  
        name: mysql  
---
```

A screenshot of a terminal window showing a YAML configuration file. The file defines a container with several environment variables and a specific image specification. The image is set to 'localhost:5000/roar-db:0.0.56' with a 'Always' pull policy. A red oval highlights this image definition.

But we haven't pushed any images to that repo yet. So, we would expect our pods trying to pull those images to fail.

Switch back to ArgoCD in the browser. Click on the **jenkins-stage** app and notice that that is the case here - the pods are failing to start (as indicated by the red broken heart in the pod blocks on the far right).



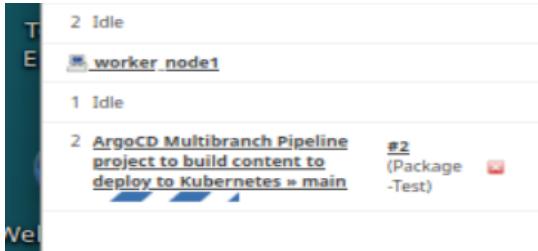
16. Switch to the browser tab with Jenkins.

To see if our pipeline works, start the Jenkins pipeline running by getting out of the Configuration screen for the project and going back to the main project page (<http://localhost:8080/job/argocd-mb-pipe/>). Click on the small button at the end of the status row to schedule a build run.

Branches (1)					
S	W	Name	Last Success	Last Failure	Last Duration
		main	41 min - #6	N/A	35 sec

Icon: S M L Legend:

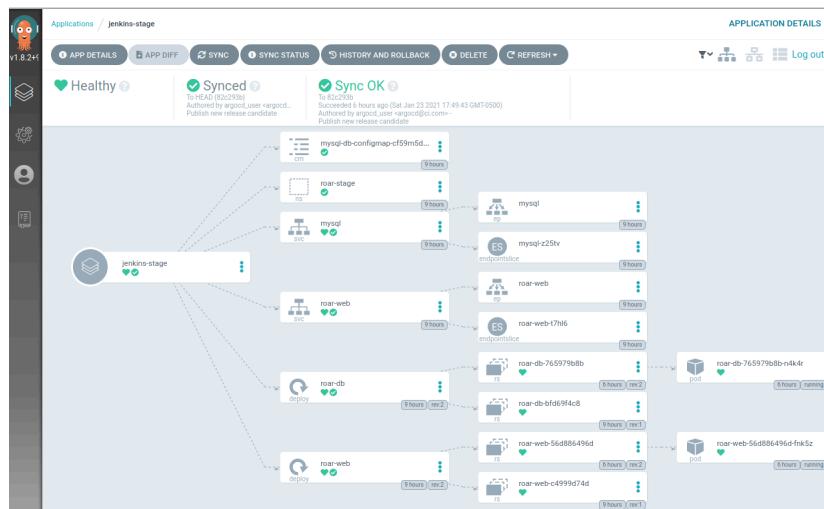
17. This will execute the pipeline and eventually cause our ArgoCD instance to sync the changes to the cluster. You'll be able to see activity happening in the lower left of the Jenkins screen. You can leave this running while we go on to the next section.



Lab 5: Deploying to Production

Purpose: In this lab, we'll, create an app to deploy our prod version.

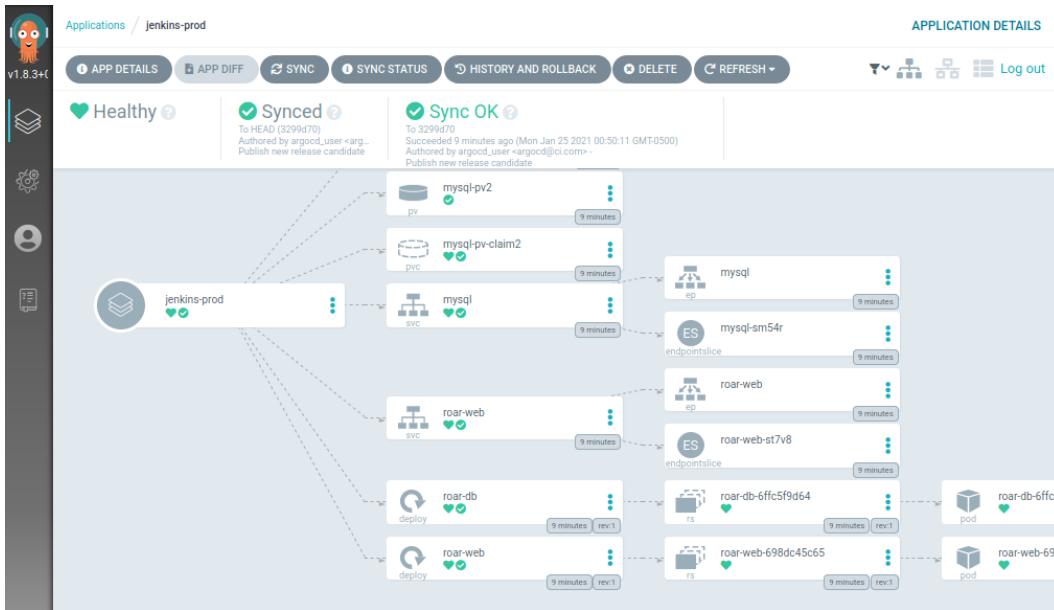
1. Look at the jenkins-stage app we did in the last lab. At this point, if everything built and got deployed ok, you should see everything in sync and healthy (all green).



2. This was all for the stage level. Now, let's add another app for the RC (production) level. Execute the command below:

```
$ argocd app create jenkins-prod --project jenkins-proj --repo
git@10.0.2.15:/git/repos/roar-min-deploy.git --dest-server
https://10.0.2.15:8443 --path overlays/prod --sync-policy auto
```

3. Since we setup the automatic sync, this should start up and sync everything and get it running. Go to the list of apps (stacked squares icon) and select the "jenkins-prod" one. It should look similar to the below.



- Now if you want to verify that the stage and prod are running the expected versions of the images we generated, you can use the commands below.

```
$ k describe -n roar-stage pod -l app=roar-web | grep Image:
```

You should see image numbers starting with “0.0”

```
$ k describe -n roar-prod pod -l app=roar-web | grep Image:
```

You should see image numbers starting with “1.0”

- You can also see that we've deployed two different versions of our application. Take a look first at the stage version.

```
$ k get svc -n roar-stage
```

Look for the 5 digit port # that starts with “3” after the “8089” in the PORT(S) column.

Open up the link in the browser as <http://localhost:<port>/roar/>

You should see something like this:

R.O.A.R (Registry of Animal Responders) Agents						
Show 10 entries		Search:				
Id	Name	Species	Date of First Service	Date of Last Service	Adversary	Adversary Tech
1	(Test 2) Mr. Krabs	crab	2010-06-17	2014-07-07	Plankton	various
2	(Test 2) Bugs Bunny	rabbit	1966-05-22	1988-04-15	E. Fudd	wabbit gun
3	(Test 2) Woody Woodpecker	bird	1959-05-22	1979-04-15	Buzz Buzzard	menacing stare

Showing 1 to 3 of 3 entries Previous 1 Next

6. Now let's look at the prod version of our application. Similar procedure for the other namespace.

\$ k get svc -n roar-prod roar-web

Look for the 5 digit port # that starts with “3” after the “8089” in the PORT(S) column.

Open up the link in the browser as <http://localhost:<port>/roar/>

You should see something like this:

R.O.A.R (Registry of Animal Responders) Agents						
Show 10 entries		Search:				
Id	Name	Species	Date of First Service	Date of Last Service	Adversary	Adversary Tech
1	Road Runner	bird	1955-01-20	1995-02-15	Wile E. Coyote	ACME product du jour
2	Scooby	dog	1969-05-19	2000-02-11	fake ghosts	mask
3	Perry	platypus	2013-01-20	2015-04-09	H. Doofensmirtz	...inator
4	Mr. Krabs	crab	2010-06-17	2014-07-07	Plankton	various
5	Bugs Bunny	rabbit	1966-05-22	1988-04-15	E. Fudd	wabbit gun

Showing 1 to 5 of 5 entries Previous 1 Next

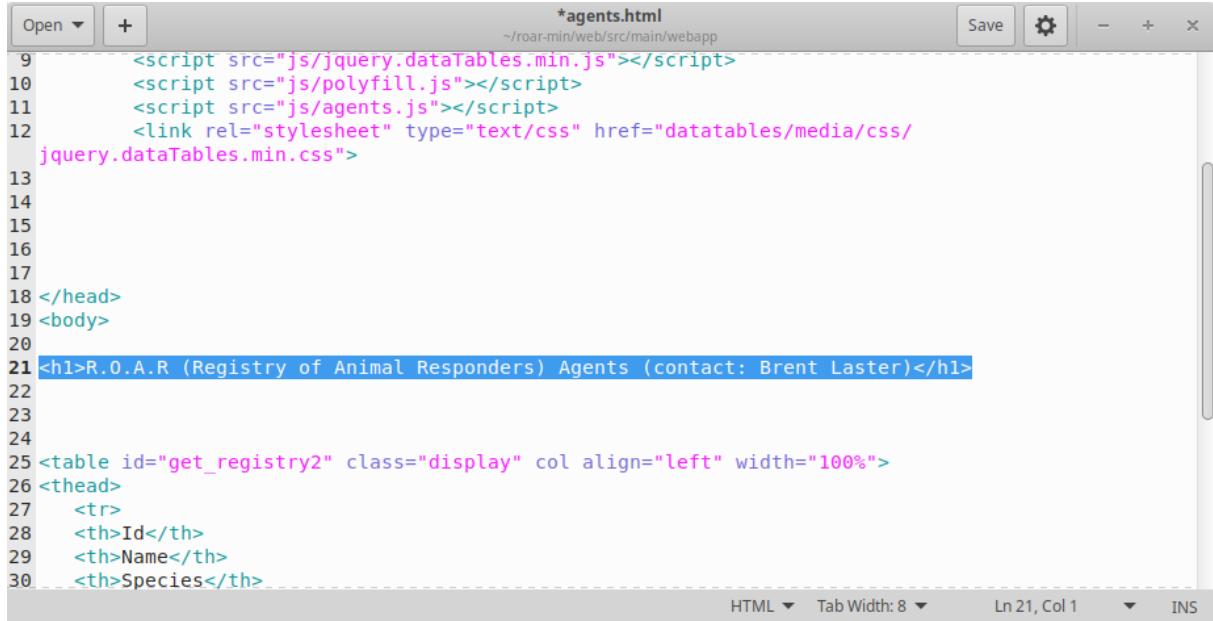
Lab 6: Seeing the entire workflow.

Purpose: In this lab, we'll make a change to our source code and see the whole pipeline in practice through having our changes deployed into Kubernetes with ArgoCD.

- We have a clone of the repository for our app already. Change into that directory and edit the file web/src/main/webapp/agents.html.

```
$ cd ~/roar-min  
$ gedit web/src/main/webapp/agents.html
```

2. Change line 21 (that starts with “`<h1>`” and add/modify the text between the “`<h1>`” and “`</h1>`” tags in some way. For my example, I put in the “(contact: Brent Laster)” text.

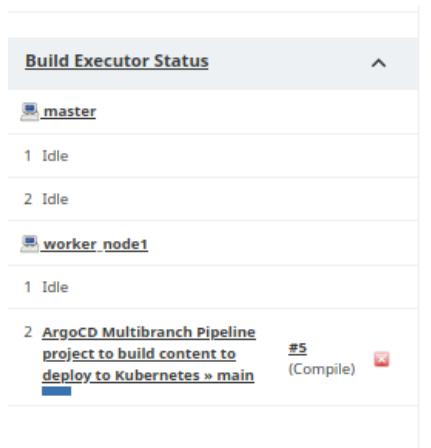


```
*agents.html  
~/roar-min/web/src/main/webapp  
Save  
9 <script src="js/jquery.dataTables.min.js"></script>  
10 <script src="js/polyfill.js"></script>  
11 <script src="js/agents.js"></script>  
12 <link rel="stylesheet" type="text/css" href="datatables/media/css/  
jquery.dataTables.min.css">  
13  
14  
15  
16  
17  
18 </head>  
19 <body>  
20  
21 <h1>R.O.A.R (Registry of Animal Responders) Agents (contact: Brent Laster)</h1>  
22  
23  
24  
25 <table id="get_registry2" class="display" col align="left" width="100%">  
26 <thead>  
27   <tr>  
28     <th>Id</th>  
29     <th>Name</th>  
30     <th>Species</th>
```

3. Save your changes and close the editor. Back on the command line, commit and push your changes into the git repository.

```
$ git commit -am "update page text"  
$ git push origin main:main
```

4. At this point, switch back to the Jenkins instance. (You may need to log in again.) After a minute or so, you should see the change be detected and a new build for the multibranch pipeline be automatically kicked off.



- After a few moments, the build pipeline should complete successfully and if you look at the output, you can see the green success indication in the various stages that it ran.

The screenshot shows the Jenkins Pipeline main view for the 'ArgoCD Multibranch Pipeline project to build content to deploy to Kubernetes'. The left sidebar includes links for Up, Status, Changes, Build Now, View Configuration, Full Stage View, Pipeline Syntax, and Build History. The Build History section shows a search bar for 'find' and a timestamp of 'Jan 25, 2021, 11:35 PM'. The main content area features a 'Pipeline main' header with a 'Recent Changes' section (indicated by a notepad icon) and a 'Stage View' section. The Stage View table has columns for Declarative: Checkout SCM, Source, Compile, Package-Test, Package-Prod, Deploy STAGE, and Deploy PROD. The first row shows average stage times: 681ms for Source, 9s for Compile, 8s for Package-Test, 7s for Package-Prod, 2s for Deploy STAGE, and 1s for Deploy PROD. Below this, a specific build row for Jan 25, 2021, at 23:35 shows 3 commits. The Stage View table rows are color-coded in green, light blue, and light green.

Declarative: Checkout SCM	Source	Compile	Package-Test	Package-Prod	Deploy STAGE	Deploy PROD	
Average stage times: (Average full run time: ~32s)	681ms	785ms	9s	8s	7s	2s	1s
Jan 25 23:35	3 commits	727ms	874ms	10s	9s	8s	2s
							1s

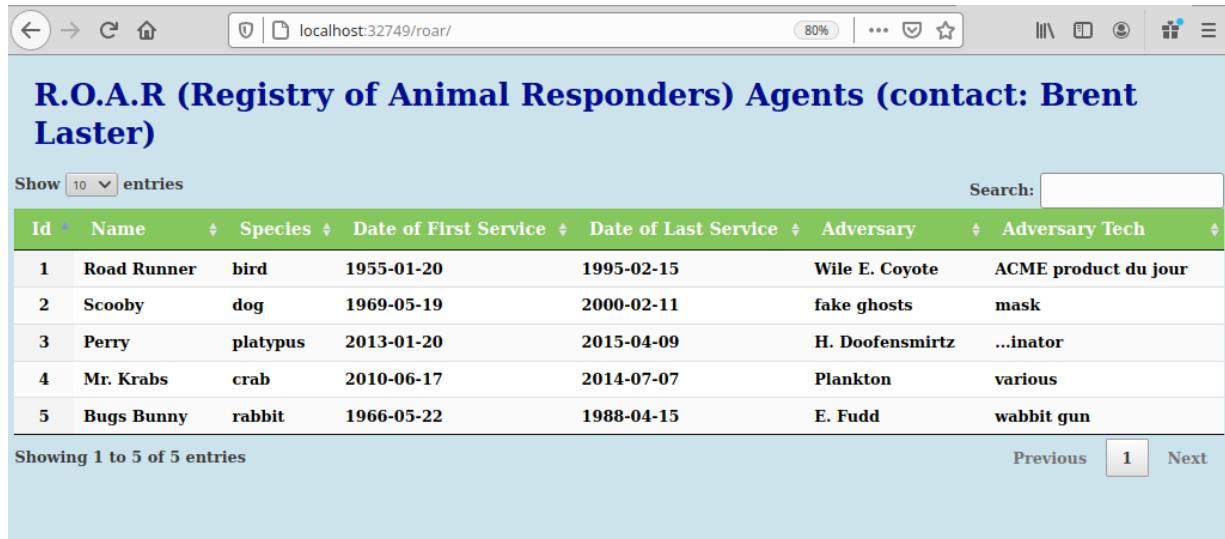
6. Switch back to the ArgoCD instance in the browser. (You may need to login again.) After a few minutes, our prod app should automatically sync things up as indicated in the GUI interface.

The screenshot shows the 'jenkins-prod' application details page. At the top, there are tabs for 'APP DETAILS', 'APP DIFF', 'SYNC', 'SYNC STATUS', 'HISTORY AND ROLLBACK', 'DELETE', and 'REFRESH'. The 'APP DETAILS' tab is active. Below the tabs, there are two status cards: one for 'Synced' (green checkmark) and one for 'Sync OK' (green checkmark). Both cards show commit information: 'To HEAD (69d74b2)' and 'Authored by argocd: user <argocd@ci.com>'. A large diagram below illustrates the application's components and their dependencies. Components include 'roar-prod' (ns), 'mysql-pv2' (pv), 'mysql-pv-claim2' (pvc), 'mysql' (ep), 'ES mysql-sm54r' (endpoint), 'roar-web' (ep), 'ES roar-web-st7v8' (endpoint), 'roar-db-54b5c576ff' (fs), and 'roar-db-5856bbc5d7' (fs). Dashed lines connect 'jenkins-prod' to 'roar-prod', 'roar-prod' to 'mysql-pv2', 'mysql-pv2' to 'mysql-pv-claim2', 'mysql-pv-claim2' to 'mysql', 'mysql' to 'ES mysql-sm54r', 'roar-web' to 'roar-db-54b5c576ff', and 'roar-web' to 'roar-db-5856bbc5d7'. Each component has a 'Sync' button next to its name.

- At this point, you can get the service ports for the staging and production instances so you can view the updates. (They may be the same as before.)

```
$ k get svc -n roar-stage roar-web  
$ k get svc -n roar-prod roar-web
```

8. Refresh the screen with your app running and you should be able to see your change in prod as it has been deployed into the cluster automatically. (Note: You may need to clear the cache on your browser to see the update.)

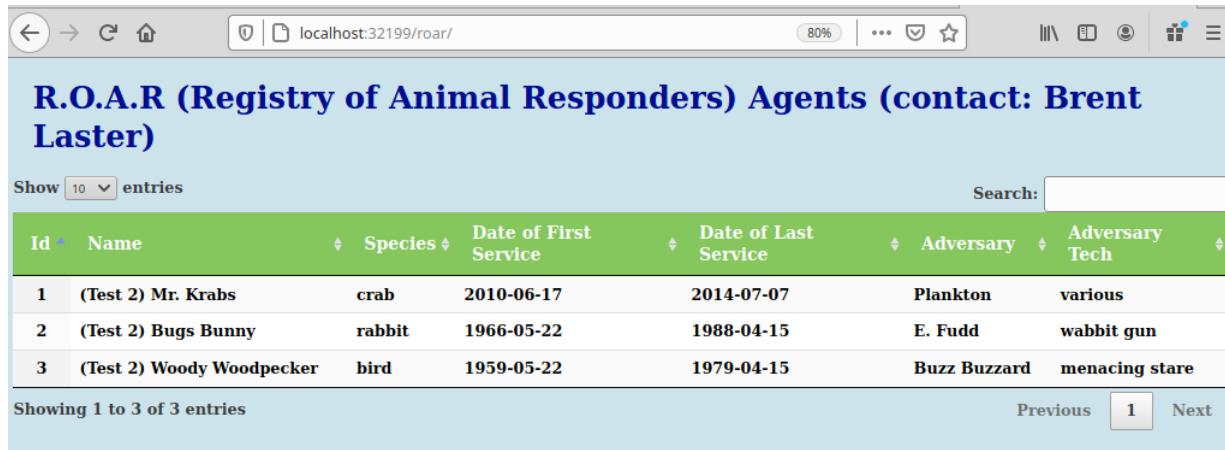


A screenshot of a web browser displaying a table titled "R.O.A.R (Registry of Animal Responders) Agents (contact: Brent Laster)". The table shows five entries with columns: Id, Name, Species, Date of First Service, Date of Last Service, Adversary, and Adversary Tech. The entries are:

	Id	Name	Species	Date of First Service	Date of Last Service	Adversary	Adversary Tech
1	Road Runner	bird	1955-01-20	1995-02-15		Wile E. Coyote	ACME product du jour
2	Scooby	dog	1969-05-19	2000-02-11		fake ghosts	mask
3	Perry	platypus	2013-01-20	2015-04-09		H. Doofensmirtz	...inator
4	Mr. Krabs	crab	2010-06-17	2014-07-07		Plankton	various
5	Bugs Bunny	rabbit	1966-05-22	1988-04-15		E. Fudd	wabbit gun

Showing 1 to 5 of 5 entries

9. You can also go back and manually sync the staging area and see your change in that version as well.



A screenshot of a web browser displaying a table titled "R.O.A.R (Registry of Animal Responders) Agents (contact: Brent Laster)". The table shows three entries with columns: Id, Name, Species, Date of First Service, Date of Last Service, Adversary, and Adversary Tech. The entries are:

	Id	Name	Species	Date of First Service	Date of Last Service	Adversary	Adversary Tech
1	(Test 2) Mr. Krabs	crab	2010-06-17	2014-07-07		Plankton	various
2	(Test 2) Bugs Bunny	rabbit	1966-05-22	1988-04-15		E. Fudd	wabbit gun
3	(Test 2) Woody Woodpecker	bird	1959-05-22	1979-04-15		Buzz Buzzard	menacing stare

Showing 1 to 3 of 3 entries

Note: If you need to clear the cache, you can go to Preferences, then enter “cache” in the search box, select the “Clear Data” button, then check “Cached Web Content” and select the “Clear” button.

