Introduction to Research on AWS
Hands-On Lab

Getting Started with S3 and Cloud9

Workshop Overview

This lab simulates a research workflow. You will create an S3 bucket to store data, launch a Cloud9 IDE as a virtual workstation, install R, download and process a sample dataset, and upload the resulting graph to S3 for permanent storage.

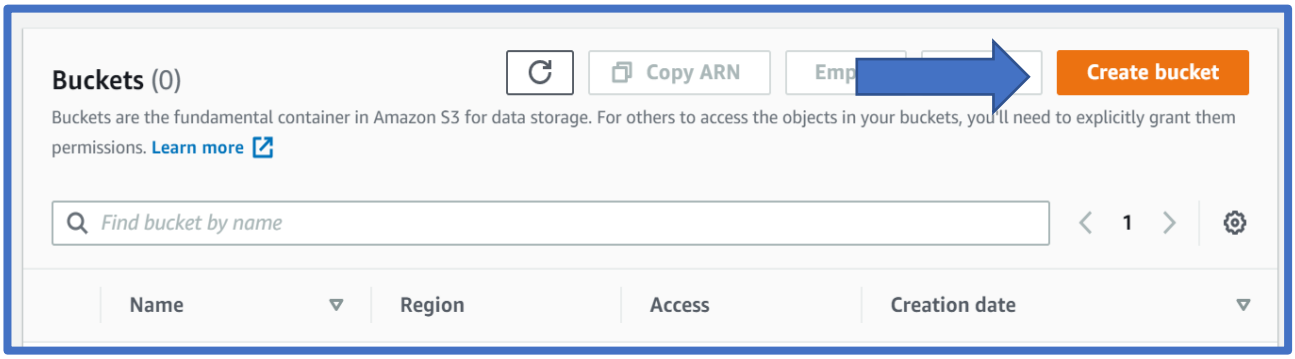
Create a Bucket in S3

To upload your data (photos, videos, documents etc.) to Amazon S3, you must first create an S3 bucket in one of the AWS Regions. You can then upload your data objects to the bucket. Every object you store in Amazon S3 resides in a bucket. You can use buckets to group related objects in the same way that you use a directory to group files in a file system.

Note: *You are not charged for creating a bucket; you are only charged for storing objects in the bucket and for transferring objects in and out of the bucket.*

Note: Transfer IN does not incur a charge, but Transfer OUT does. Data transfers are free if you are within the same region and within the same availability zone, and use a private IP address. Data transfers to other regions or services will have a cost associated with them. See https://aws.amazon.com/s3/pricing/ for more details.

1. Sign into the AWS Management Console and open the Amazon S3 console at https://console.aws.amazon.com/s3.
2. Click **Create Bucket**. The **Create a Bucket** wizard will open.



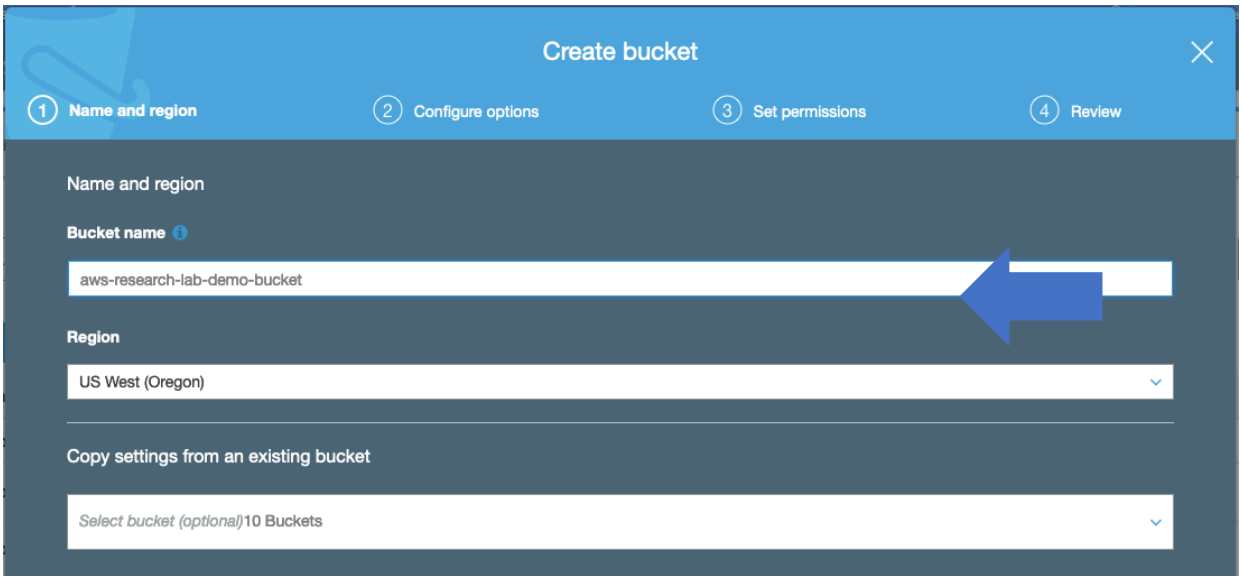
Note: Enter a bucket name in the Bucket Name field. Since S3 is a global service, the bucket name you choose must be unique across all existing bucket names in Amazon S3. One way to do that is to prefix your bucket names with your organization's name.

Bucket names must comply with the following requirements. The bucket name:

- Must be unique across all of Amazon S3
- Must be between 3 and 63 characters long
- Must not contain uppercase characters
- Can contain only lower-case characters, numbers, periods, and dashes
- Must Start with a lowercase letter or number
- Must Not contain underscores, end with a dash, have consecutive periods, or use dashes adjacent to periods.
- Cannot be formatted as an IP address (198.51.100.24).

Note: There might be additional restrictions on bucket names based on the region your bucket is in or how you intend to access the object. Once you create a bucket, you cannot change its name. In addition, the bucket name is visible in the URL that points to the objects stored in the bucket. Make sure the bucket name you choose is appropriate.

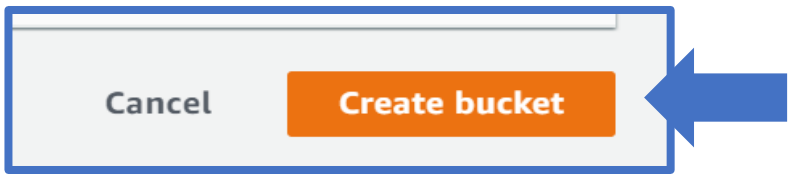
1. In the **Region** drop-down list box, select a region. Choose a Region close to you to minimize latency and costs and address regulatory requirements. Objects stored in a Region never leave that Region unless you explicitly transfer them to another Region



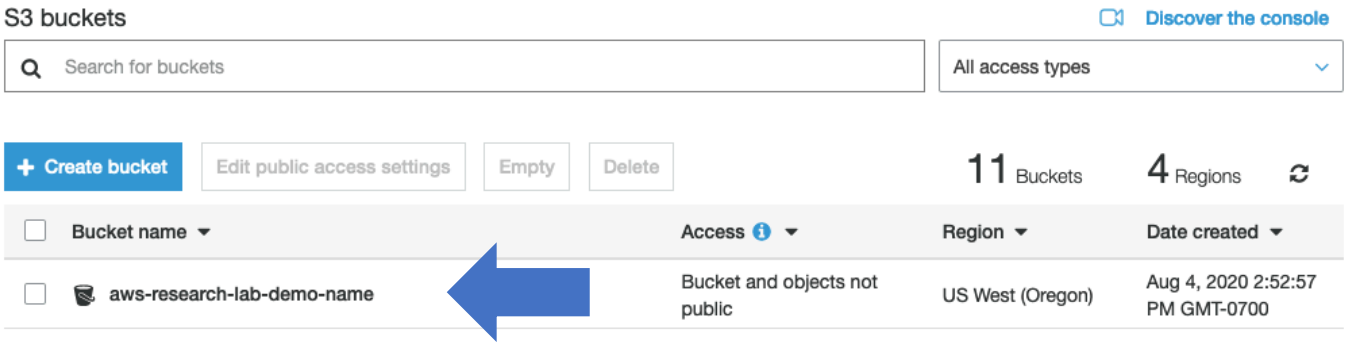
2. By default, all buckets are set to “block public access”. At this time, leave the default setting of block all public access. Learn More

3. Under Advanced settings, you have the option to enable Object Lock. Object Lock stores objects using a write-once-read-many (WORM) model to prevent objects from being deleted or overwritten for a fixed amount of time or indefinitely. For today’s lab, we will leave this disabled. Learn More

4. Click Create Bucket to create your bucket.



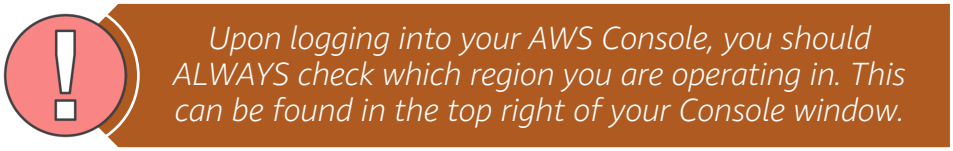
5. Once your bucket is created, you will be able to see it in your Buckets list. You can also see the region your bucket is in along with the access type.



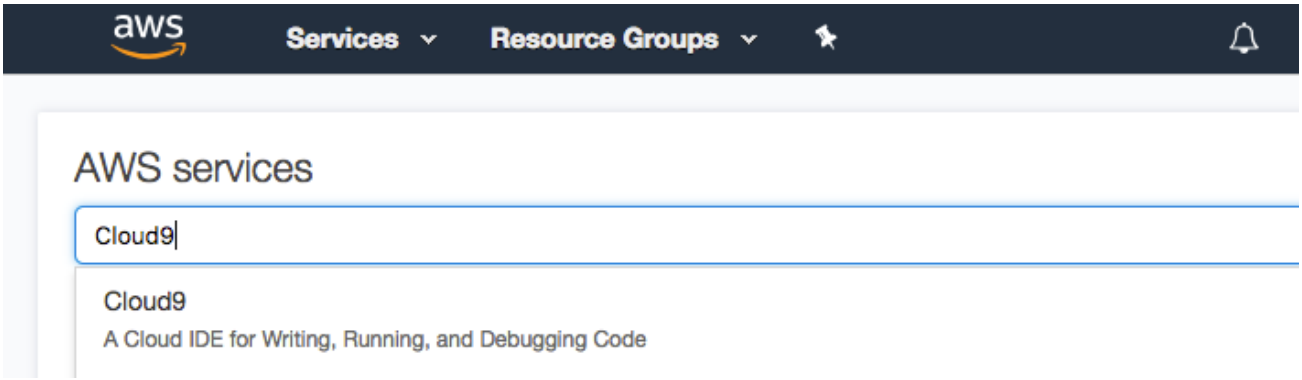
Well done – you have created your first bucket in Amazon S3!

Launch a Cloud9 Environment

For this lab we will be using AWS Cloud9, a cloud-based integrated development environment (IDE) that lets you write, run, and debug your code with just a browser. Each AWS Cloud9 IDE is backed by an EC2 instance. Cloud9 is an easy way to get access to the compute power of EC2, and will automatically shut down when not in use.

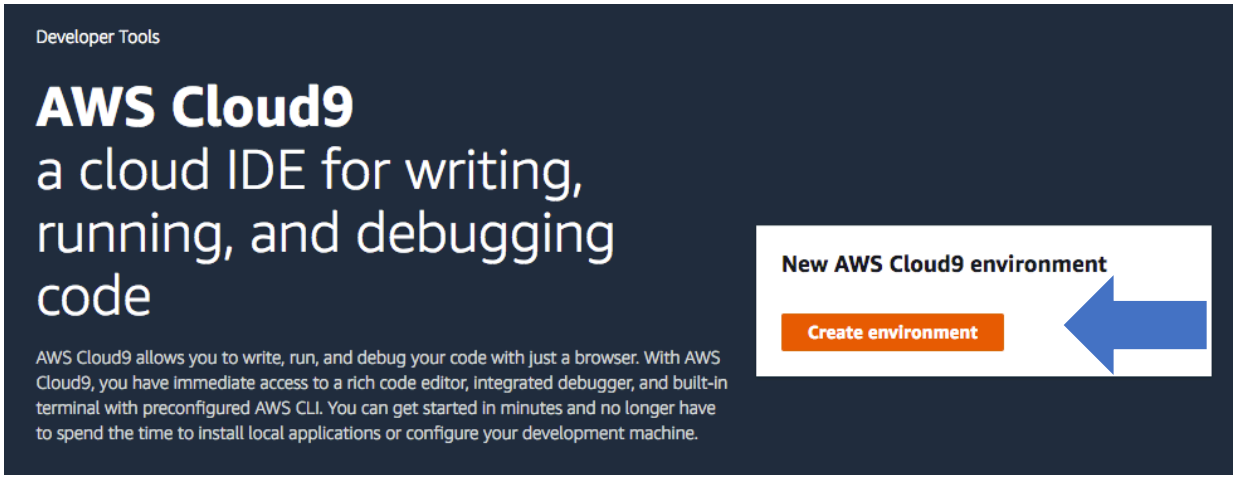


1. Sign into the AWS Management Console and On the AWS Console home page, type Cloud9 into the service search bar and select it.

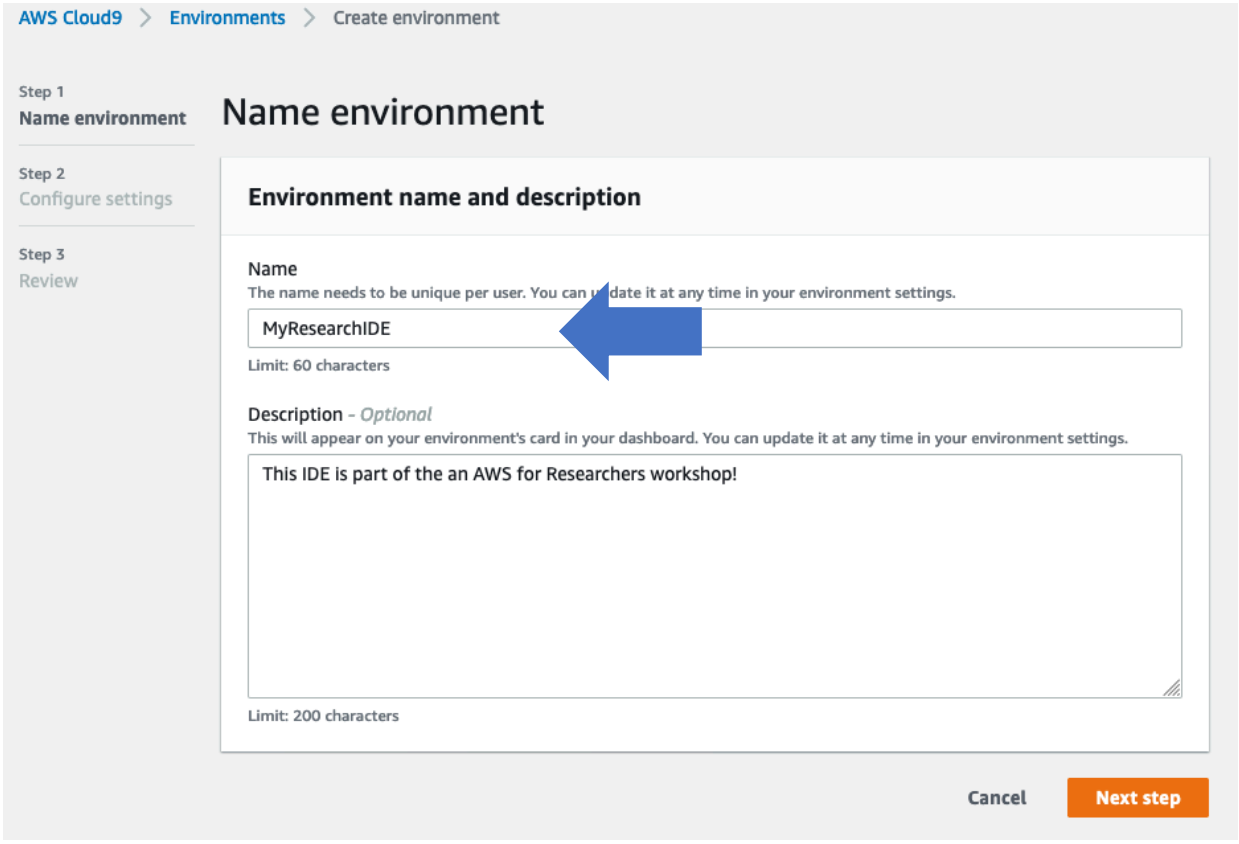


2. In the upper-right corner of the AWS Management Console, confirm you are in the desired AWS region (e.g., Oregon).

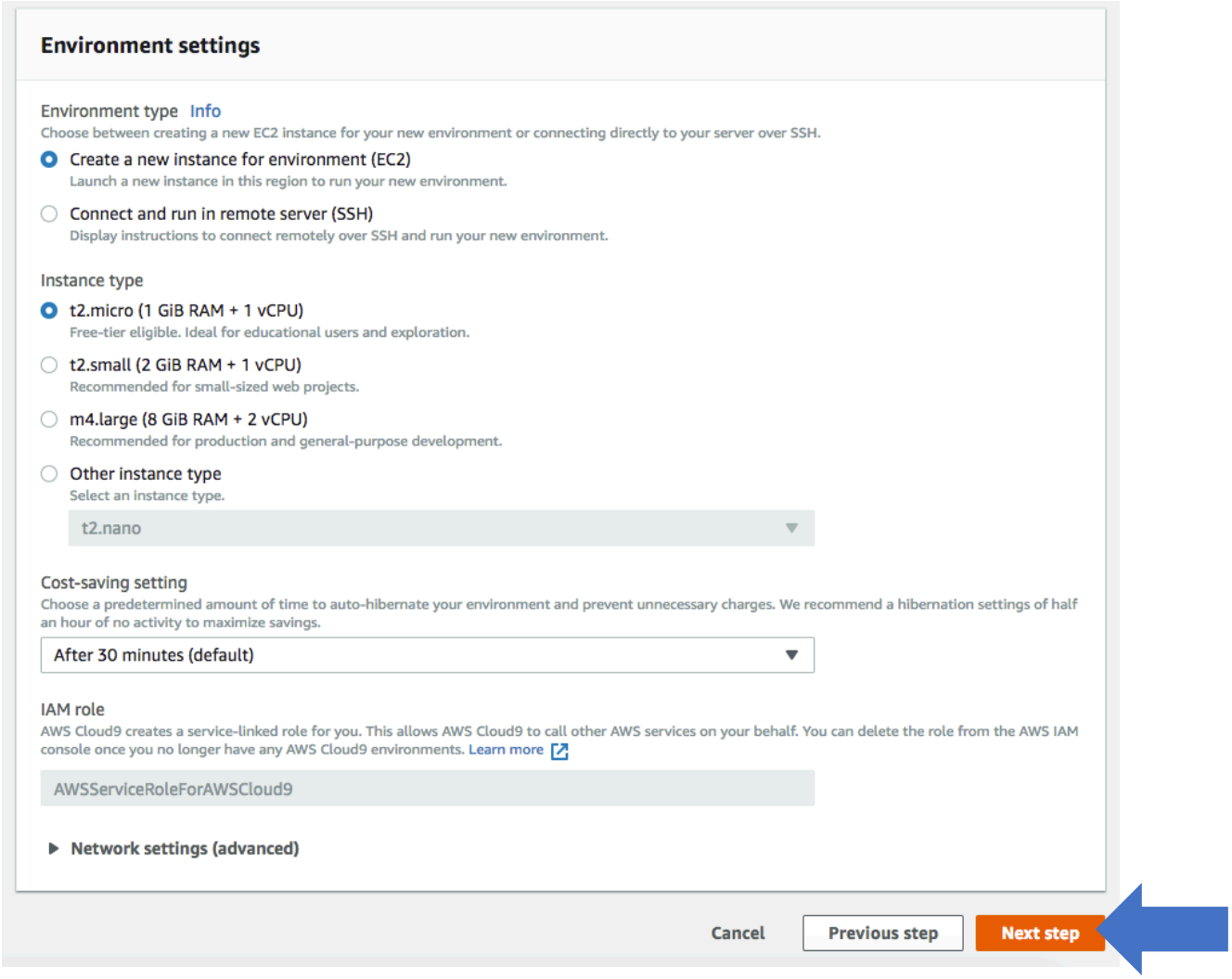
3. Click **Create Environment** on the Cloud9 home page:



4. Name your environment **MyResearchIDE** with any description you'd like, and click Next Step:

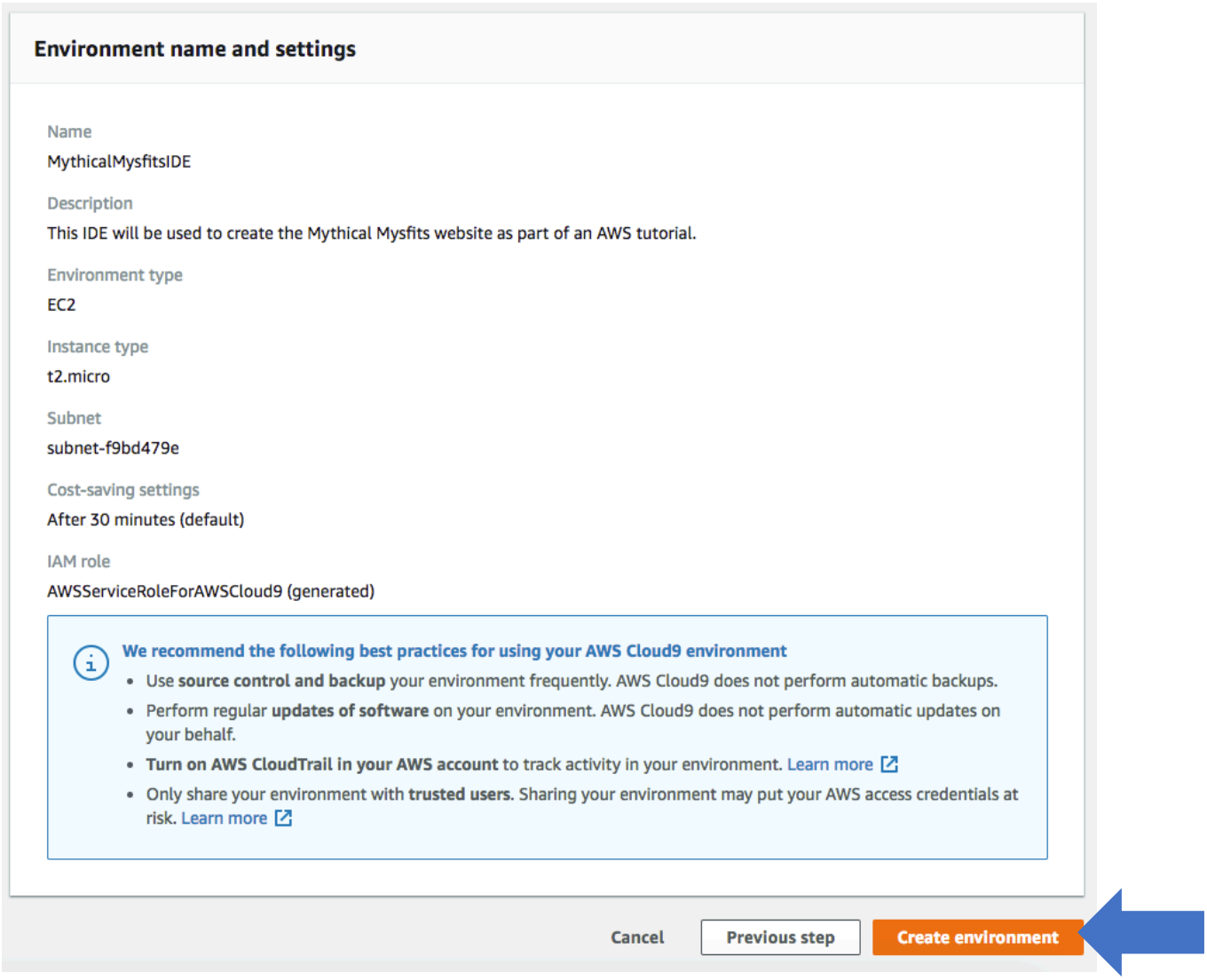


5. Leave the Environment settings as their defaults and click **Next Step**:

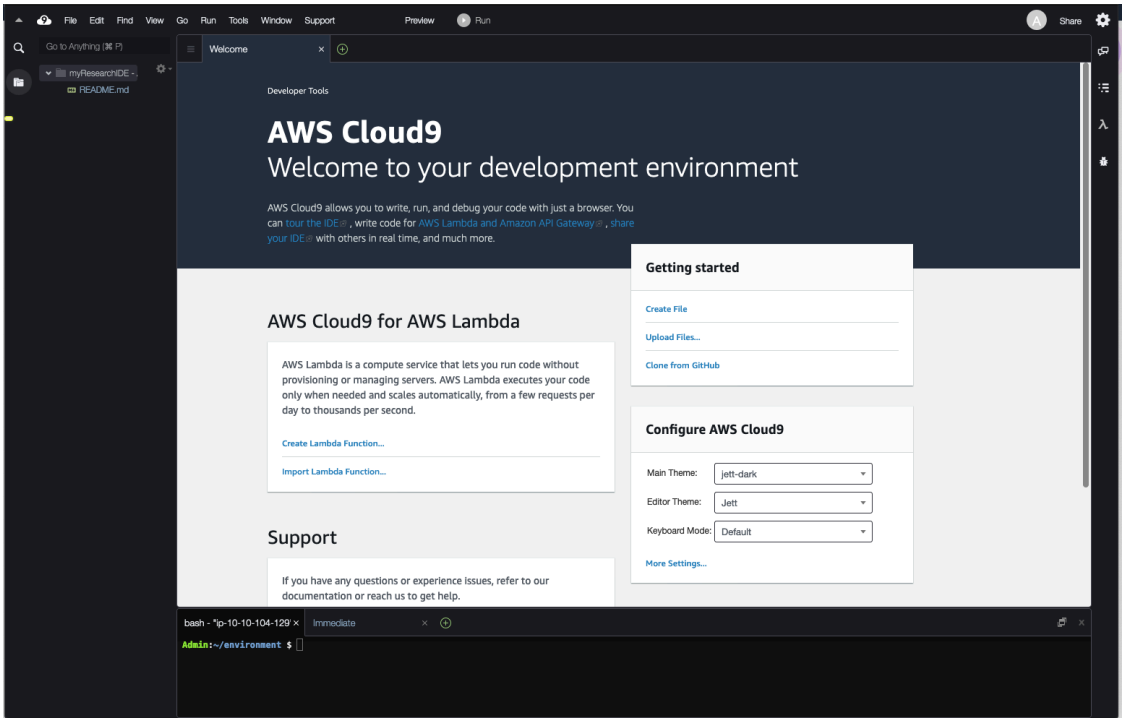


If you wanted a more powerful instance, you can select different instances from the "Other instance type" dropdown.

6. Click Create Environment:



7. When the IDE has finished being created for you, you'll be presented with a welcome screen that looks like this:



Install R on our Cloud9 IDE

In this example, we will launch an Amazon Linux 2 instance, bootstrap Apache/PHP, and install a basic web page that will display information about our instance.

In the bottom panel, you will see a terminal command line open and ready to use.

1. Enter the following in the console to install R.

```
Admin:~/environment $ sudo yum -y install R
```

2. Start R as root to install libraries

```
Admin:~/environment $ sudo -i R
```

3. Install the `readr` and `ggplot2` packages with `install.packages(c("readr","ggplot2"))` When prompted for a mirror, choose `58: USA (OR) [https]`

```
> install.packages(c("readr","ggplot2"))
Installing package into '/usr/lib64/R/library'
(as 'lib' is unspecified)
--- Please select a CRAN mirror for use in this session ---
Secure CRAN mirrors

 1: 0-Cloud [https]
 2: Australia (Canberra) [https]
 3: Australia (Melbourne 1) [https]
<snip>
57: USA (OH) [https]
58: USA (OR) [https]
59: USA (TN) [https]
60: USA (TX 1) [https]
61: Uruguay [https]
62: (other mirrors)

Selection: 58
```

4. Quit R by typing "`quit()`"

Run a computation and save the resulting plot

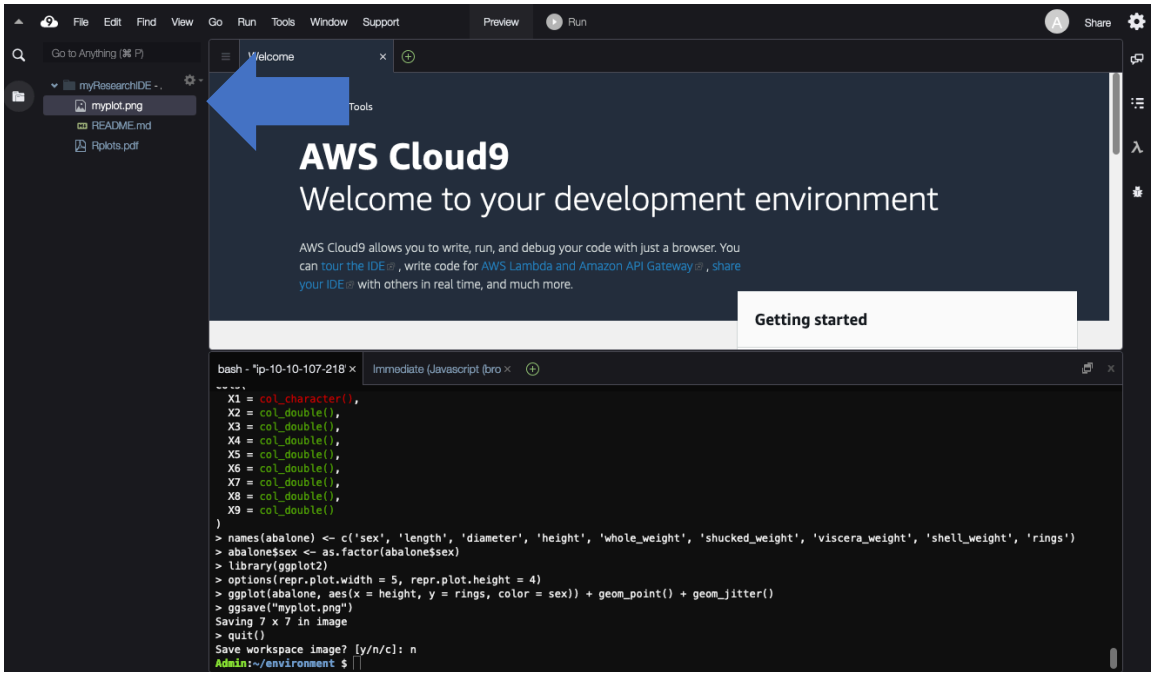
We will use the Abalone dataset from the UCI Machine Learning Repository, and generate a plot of abalone ring count by height and sex.

1. In the command line, type "R" to start R.

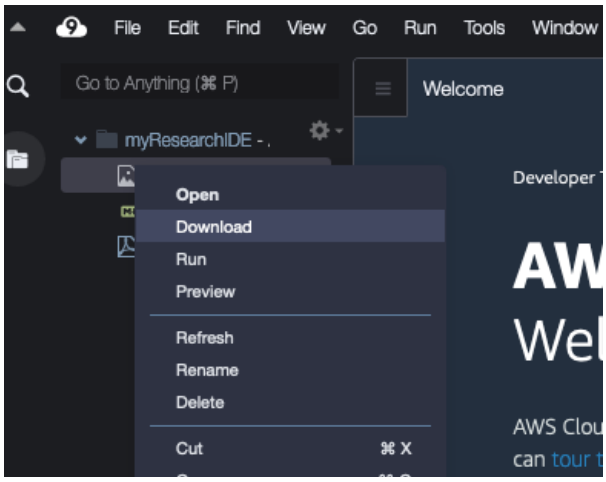
2. Copy and paste the following code to import the dataset and create a plot. Then quit R with `quit()`.

```
library(readr)
data_file <- 'http://archive.ics.uci.edu/ml/machine-learning-
databases/abalone/abalone.data'
abalone <- read_csv(file = data_file, col_names = FALSE)
names(abalone) <- c('sex', 'length', 'diameter', 'height', 'whole_weight',
'shucked_weight', 'viscera_weight', 'shell_weight', 'rings')
abalone$sex <- as.factor(abalone$sex)
library(ggplot2)
options(repr.plot.width = 5, repr.plot.height = 4)
ggplot(abalone, aes(x = height, y = rings, color = sex)) + geom_point() +
geom_jitter()
ggsave("myplot.png")
```

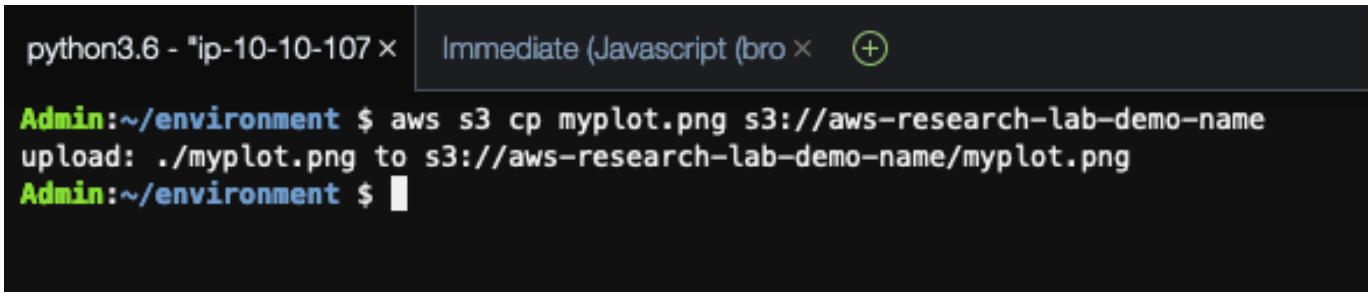
3. You will see “myplot.png” in the file browser on the right.



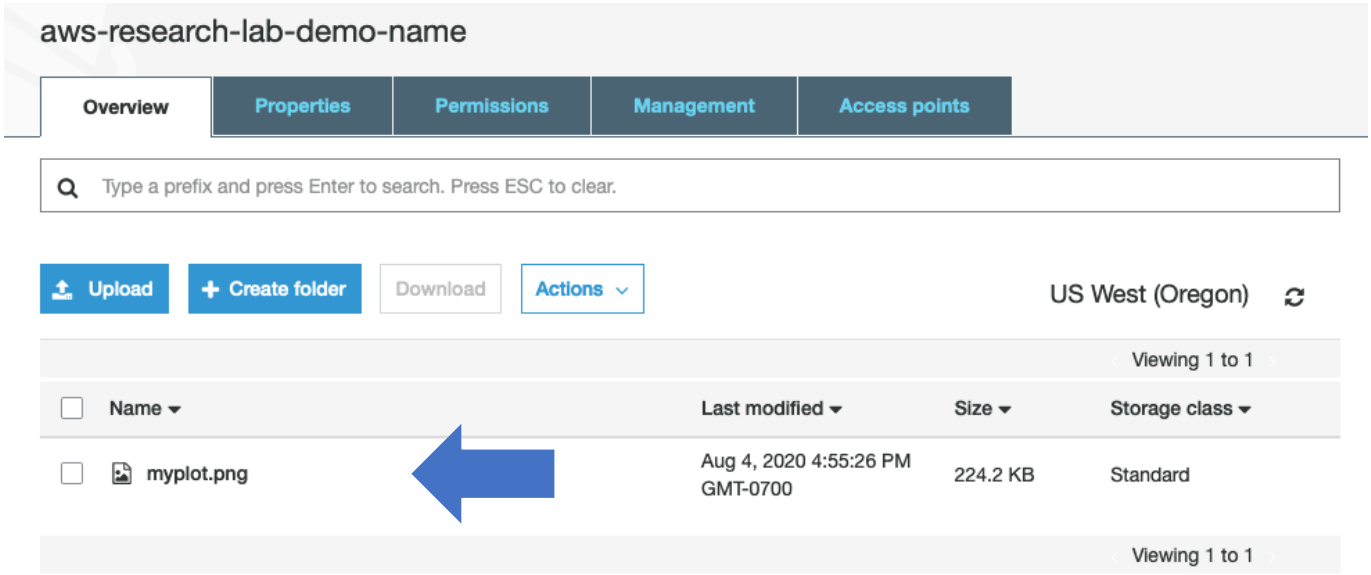
4. You can download that file by right clicking on the file.



5. We can also copy that file to our S3 bucket using the CLI. In the command line enter "`aws s3 cp myplot.png s3://<Bucket name>`" to copy to the S3 bucket.



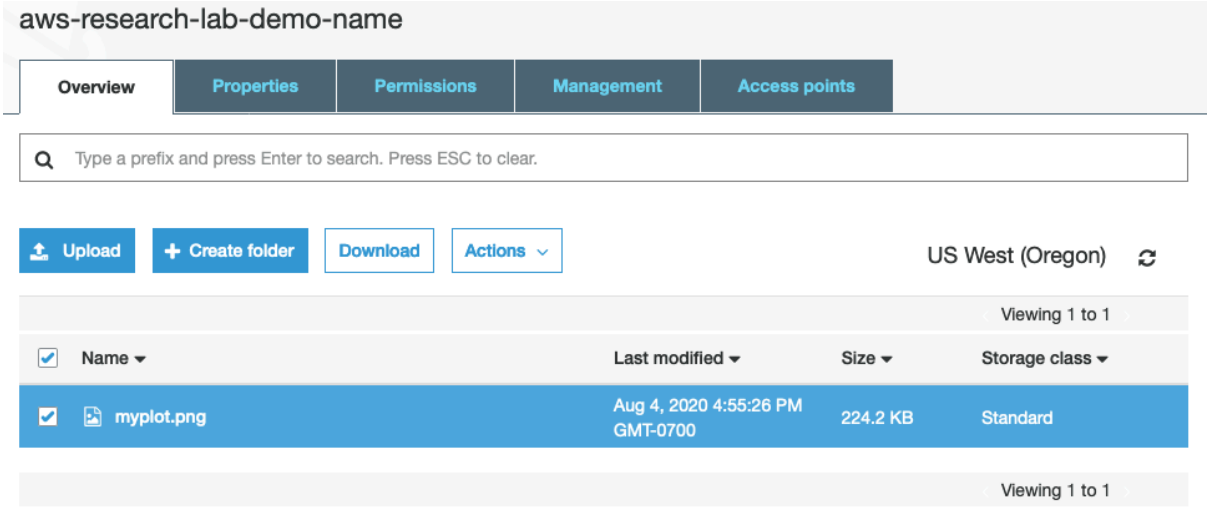
6. Go to the S3 console and you can verify that the file was uploaded successfully.



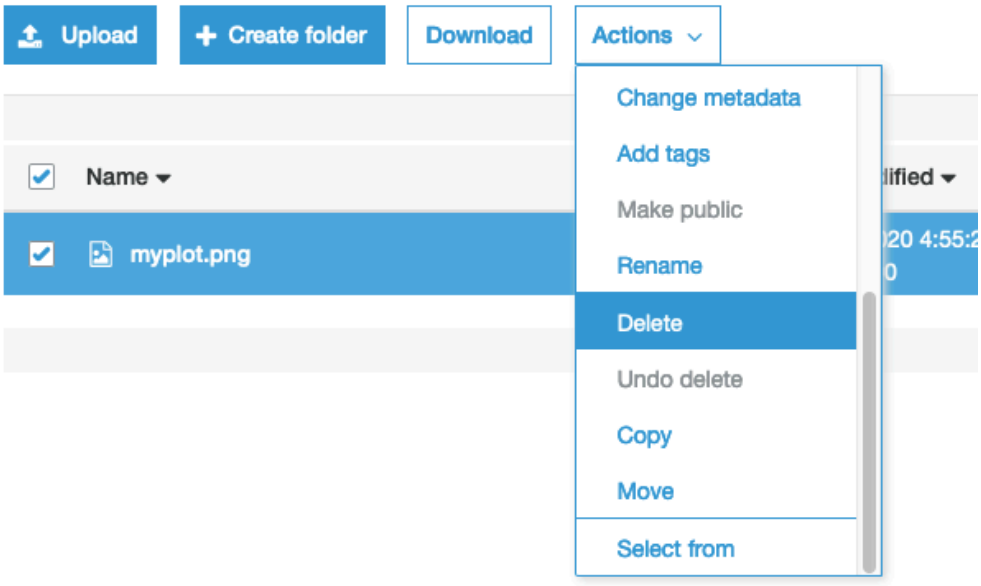
Delete an Object and Bucket

You have added an object to a bucket. Now, you can delete it and the bucket it is in. If you no longer need to store the objects you uploaded and moved while going through this guide, you should delete them so you do not incur further charges on those objects.

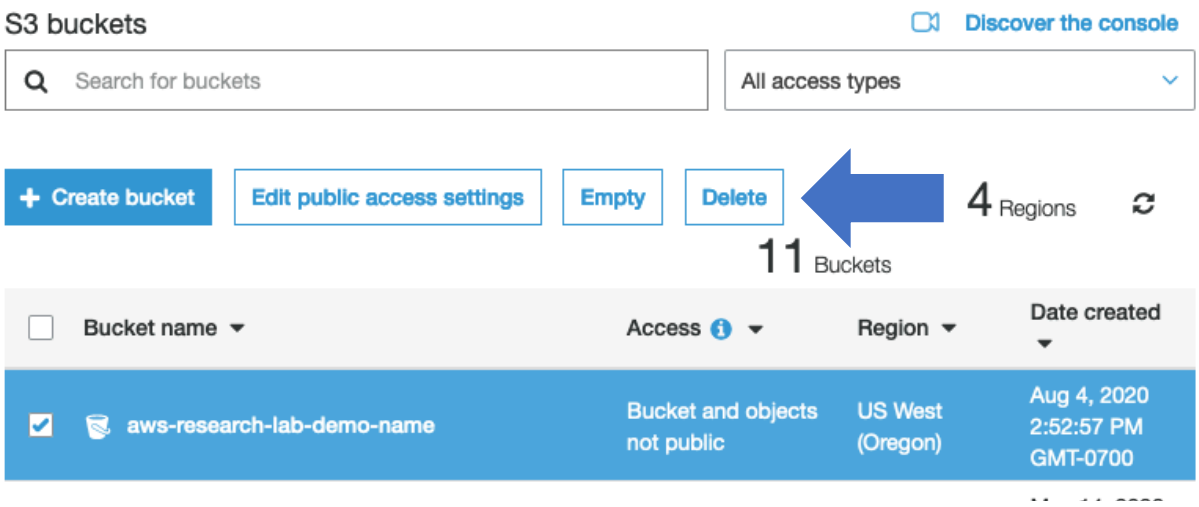
1. In the Amazon S3 console, click on the link representing the bucket containing the object(s) you want to delete. Then select the checkboxes for the object(s) you would like to delete.



2. Click the **Actions** button. Then select **Delete**. To confirm the action in the **Delete objects** dialogue, click **Delete**.



3. Navigate back to the S3 console and select the bucket icon of the bucket you want to delete (not the link to its right), and at the top of the page, click **Delete**. Confirm the deletion by typing its name verbatim at the **Delete bucket** prompt.



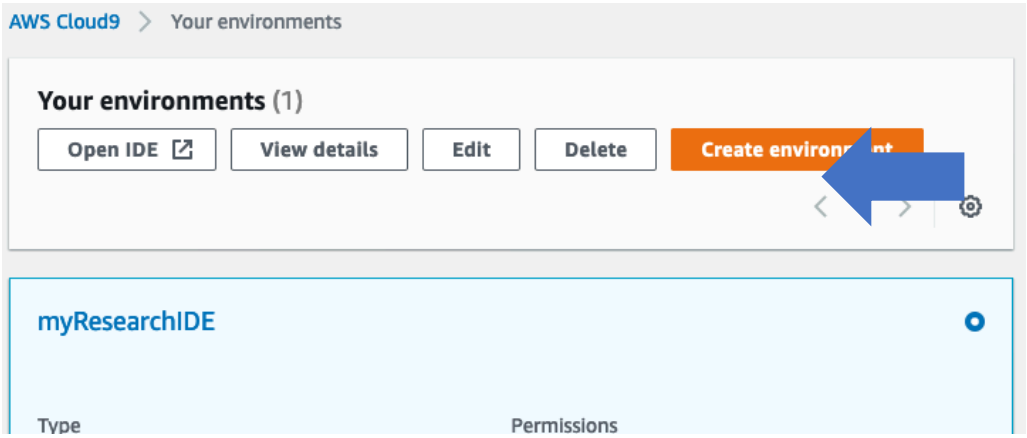
To delete a bucket, you must first delete all of the objects in it. If you haven't deleted all of the objects in your bucket, do that now.

Well done, your bucket is now deleted!

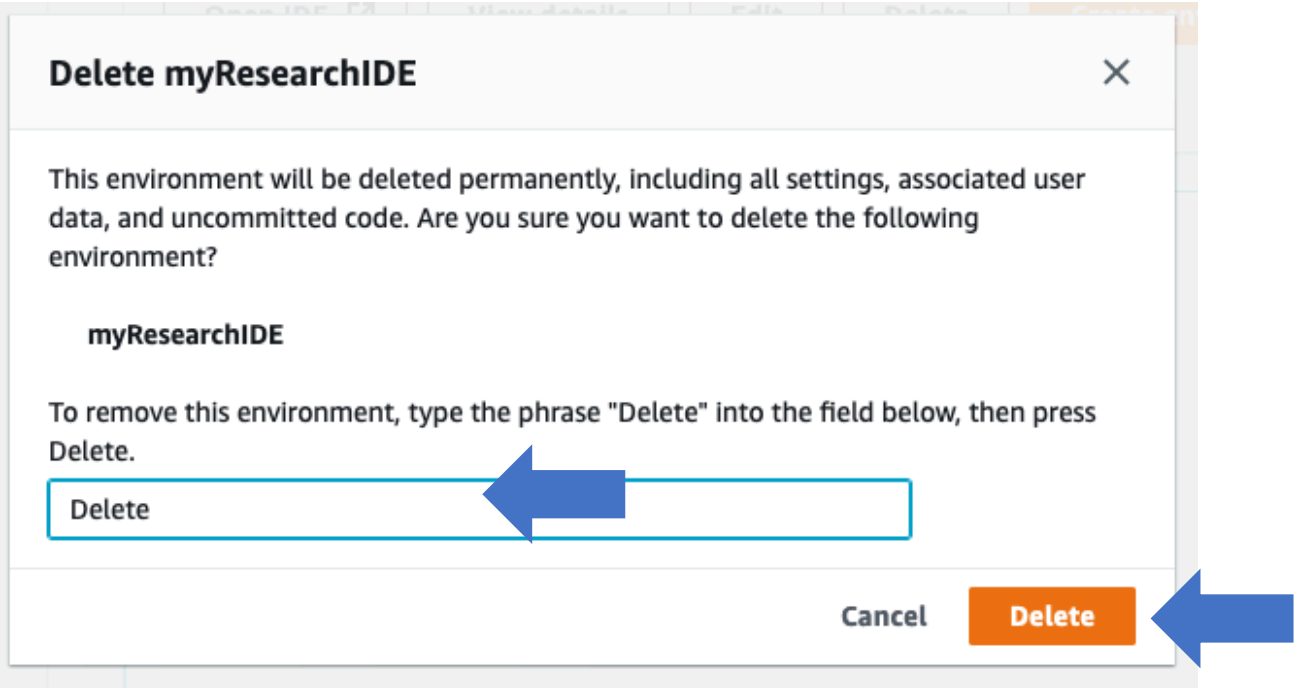
Delete a Cloud9 IDE

While the Cloud9 IDE will automatically shut down when it's not being used, it's good to completely delete the IDE if you don't intend to use it again. Even shut down, you will be billed for the storage that the Cloud9 IDE has provisioned.

1. Now we need to remove our AWS Cloud9 IDE. Navigate to the Cloud9 Dashboard, select your IDE and click the "Delete" button.



2. Type "Delete" in the pop-up and click the "Delete" button.



Congratulations you have deleted your Cloud9 IDE