

# Introduction to Anaconda

Emilie Skoog

Summer 2021

# Itinerary

- What is conda?
- What is a conda environment?
- Benefits of conda environments
- Installing conda on your local computer (tutorial)
- Creating conda environments (tutorial)
- Installing programs within a conda environment (tutorial)

# What is conda?

“Anaconda is a distribution of the Python and R programming languages for scientific computing, that aims to simplify package management and deployment.” “It is an open source **package** and **environment** management system.”

Types of conda:

- Miniconda:  
**Lightweight** distribution of conda; only contains the necessary python packages.
- Anaconda:  
A **data science platform** distribution of conda; comes with a lot of scientific python packages.

# What is a conda environment?

- A tool that helps to keep dependencies required by different projects separate by creating isolated spaces for them that contain per-project dependencies for them.
- You can think of it as a virtual space that you have created to perform certain tasks.

# Analogy #1: Tents

You can think of each conda environment as a tent. You can enter into that tent and bring whatever belongings (data) you need to work on into that tent with whatever tools are in that tent (installed programs), and when you are done, you can exit that tent and enter another bringing whatever needed belongings (data) with you for further work (analysis).



Each tent is a different conda environment.

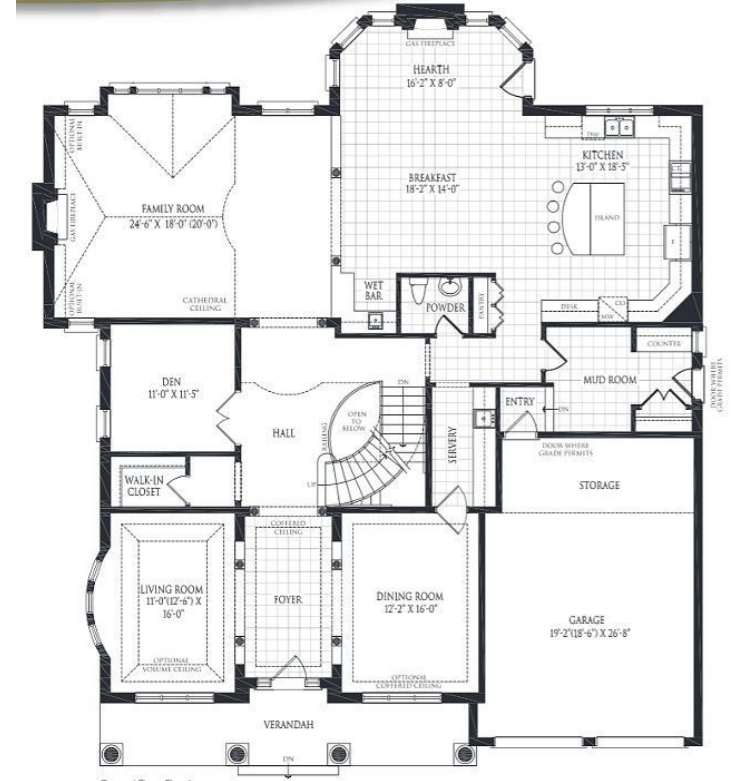
# Analogy #2: House

You have many rooms in your house.

Each room has certain furniture/appliances/ tools that you use to do a specific task in that “environment.” For example, you cook in the kitchen, not in the bathroom (hopefully) and you use the bathroom in the bathroom rather than the bedroom (also hopefully).

Each environment has dedicated resources within it and you can enter or exit each of these environments to perform whatever tasks you want to do within that environment.

Having rooms or environments within your house creates organization and makes doing specific tasks a lot easier. (If you had all of your furniture piled on top of itself in the same room, then it would make it really hard to cook without catching your sofa on fire (programs can clash), for example).



# Benefits of creating and having conda environments

There are many more, but here are some reasons most relevant to us:

1. Keeps programs with different dependencies separate (no clashing dependencies)
2. Control over program versions
3. Organization
4. Reproducibility

# Installing conda on your local computer



download anaconda



All



Books



Videos



News



Shopping



More

Settings

Tools

About 34,000,000 results (0.58 seconds)

<https://www.anaconda.com/products/individual> ⋮

## Individual Edition - Anaconda

**Download..** Open Source. **Anaconda** Individual Edition is the world's most popular Python distribution platform with over 25 million users worldwide. You can ...

<https://www.anaconda.com> ⋮

## Anaconda | The World's Most Popular Data Science Platform

**Anaconda** is the birthplace of Python data science. We are a movement of data scientists, data-driven enterprises, and open source communities.



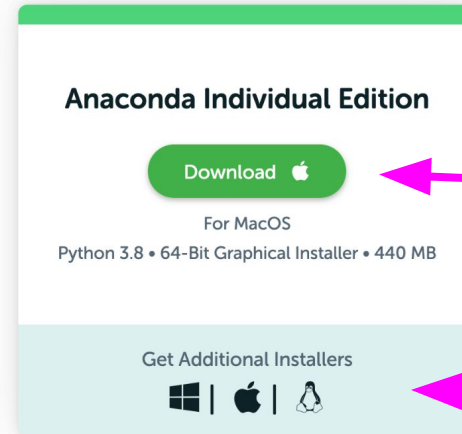
# Installing conda on your local computer

[Products ▾](#)[Pricing](#)[Solutions ▾](#)[Resources ▾](#)[Blog](#)[Company ▾](#)[Get Started](#)

Individual Edition

## Your data science toolkit

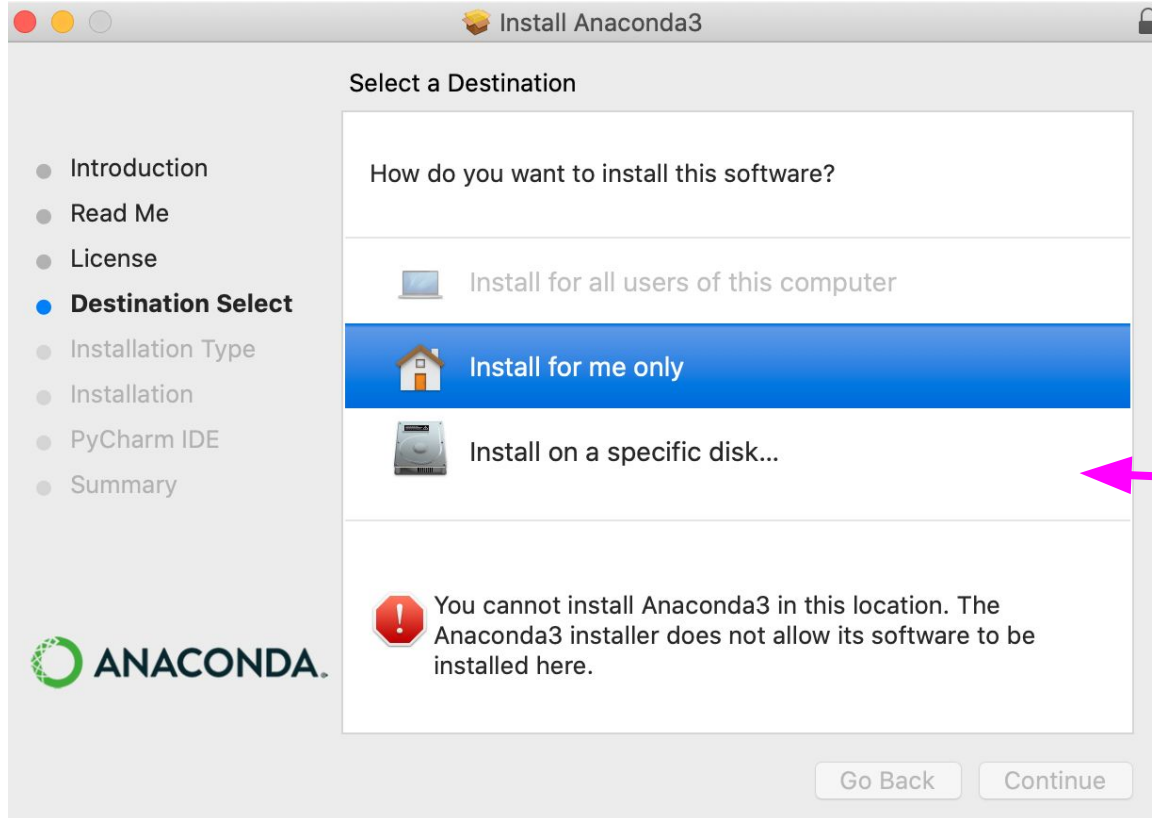
With over 25 million users worldwide, the open-source Individual Edition (Distribution) is the easiest way to perform Python/R data science and machine learning on a single machine. Developed for solo practitioners, it is the toolkit that equips you to work with thousands of open-source packages and libraries.



MacOS

(For others)

# Installing conda on your local computer



Will likely  
need to select  
this option

# Installing conda on your local computer



# Check installation

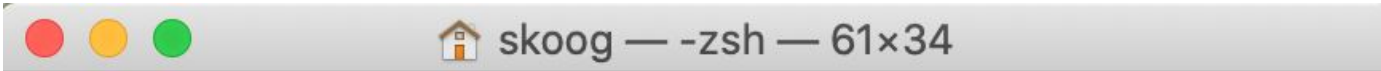
1. Open your terminal (IMPORTANT: if it was already open, close it and reopen it)

# Check installation

1. Open your terminal (IMPORTANT: if it was already open, close it and reopen it)
2. Type `conda -V` (make sure the 'V' is capitalized)

# Check installation

1. Open your terminal (IMPORTANT: if it was already open, close it and reopen it)
2. Type **conda -V** (make sure the 'V' is capitalized)



A screenshot of a macOS terminal window. The title bar shows three colored window control buttons (red, yellow, green) on the left, a home icon, and the text 'skoog — -zsh — 61x34'. The terminal content shows the command 'conda -V' being entered and executed, resulting in the output 'conda 4.10.1'. A pink arrow points from a box labeled 'version' to the output 'conda 4.10.1'. Another pink arrow points from a box explaining the flag to the command 'conda -V'.

```
[(base) skoog@dhcp-10-29-115-208 ~ % conda -V  
conda 4.10.1  
(base) skoog@dhcp-10-29-115-208 ~ % █
```

This flag asks conda to tell us which version of conda we have installed

version

# How do we create and use a conda environment?

Step 1: Create a conda environment

Step 2: Enter your conda environment

Step 3: Install programs inside of conda environment

Step 4: Use conda environment

# Step 0: Checking out our conda environments

Conda command that enables us to see what environments we have:

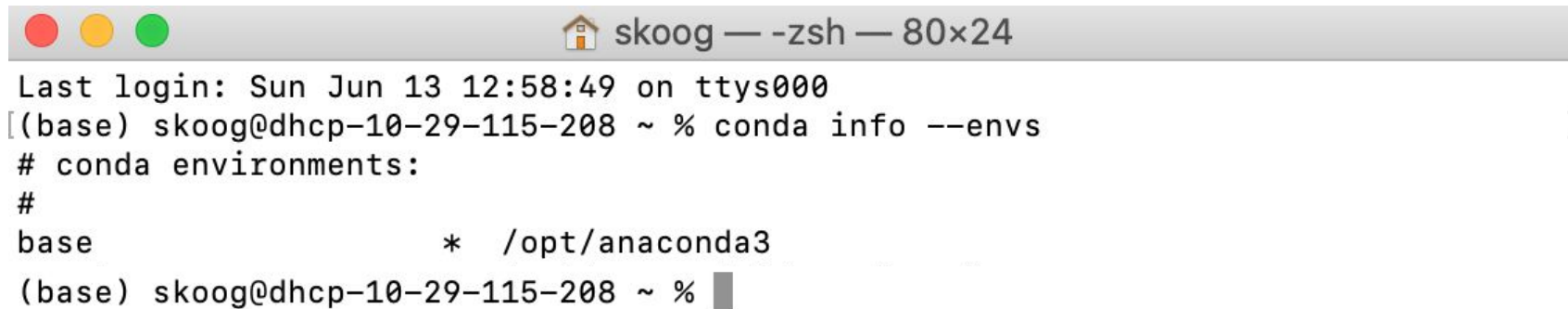
```
conda info --envs
```

Can visit this site (also linked under resources on GitHub) to see conda cheat sheet for all commands for creating, checking, removing, etc. conda environments:

<https://conda.io/projects/conda/en/latest/user-guide/tasks/manage-environments.html>

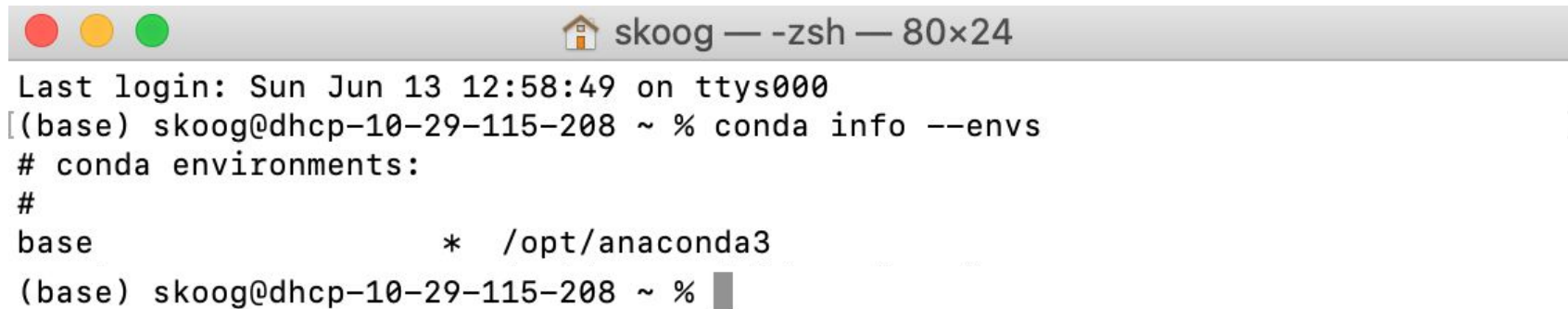


# Step 0: Checking out our conda environments

A screenshot of a terminal window. The title bar at the top shows three colored circles (red, yellow, green) on the left, a house icon in the center, and the text 'skoog — -zsh — 80x24' on the right. The terminal content shows the output of the 'conda info --envs' command. It starts with 'Last login: Sun Jun 13 12:58:49 on ttys000', followed by the command prompt and the command. The output lists the 'base' environment as the active one, located at '/opt/anaconda3'.

```
skoog — -zsh — 80x24
Last login: Sun Jun 13 12:58:49 on ttys000
(base) skoog@dhcp-10-29-115-208 ~ % conda info --envs
# conda environments:
#
base                        * /opt/anaconda3
(base) skoog@dhcp-10-29-115-208 ~ %
```

# Step 0: Checking out our conda environments

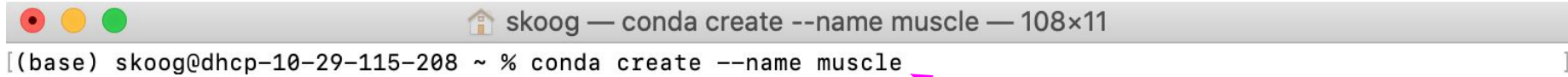
A screenshot of a terminal window. The title bar shows three colored circles (red, yellow, green) on the left, a house icon in the center, and the text 'skoog — -zsh — 80x24' on the right. The terminal content shows the output of the 'conda info --envs' command. It starts with 'Last login: Sun Jun 13 12:58:49 on ttys000', followed by the command prompt and the command. The output lists the 'base' environment as the active one, located at '/opt/anaconda3'.

```
skoog — -zsh — 80x24
Last login: Sun Jun 13 12:58:49 on ttys000
[(base) skoog@dhcp-10-29-115-208 ~ % conda info --envs
# conda environments:
#
base                * /opt/anaconda3
(base) skoog@dhcp-10-29-115-208 ~ %
```

'base' conda environment is our simplest conda 'environment' which basically just lets us execute commands to install programs and build other environments.

If you installed conda properly, you will have a 'base' conda environment.

# Step 1: Create conda environment



A terminal window with a grey title bar containing three colored window control buttons (red, yellow, green) on the left and a home icon followed by the text "skoog — conda create --name muscle — 108x11" on the right. The terminal content shows the prompt "[ (base) skoog@dhcp-10-29-115-208 ~ % " followed by the command "conda create --name muscle" and a closing bracket "]" on the right.

```
[ (base) skoog@dhcp-10-29-115-208 ~ % conda create --name muscle ]
```

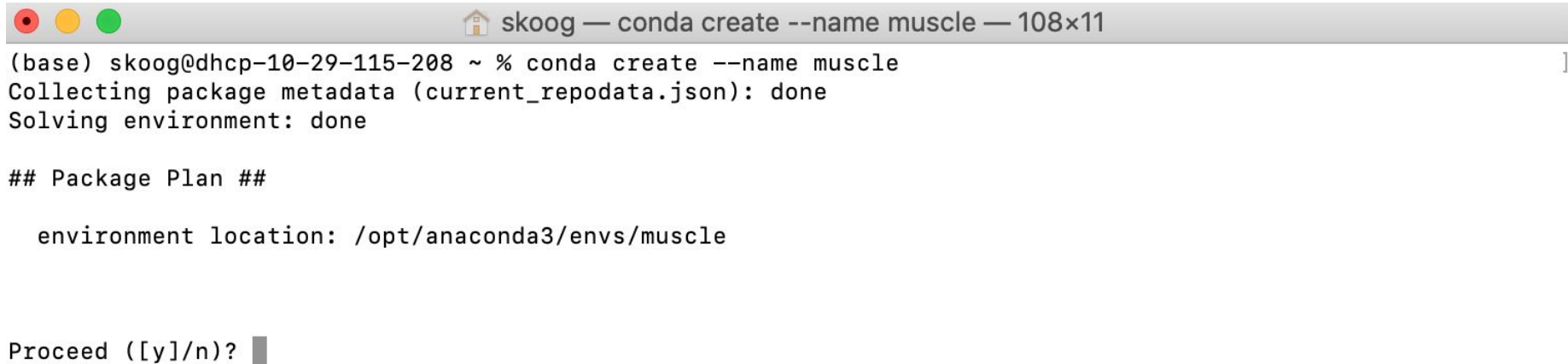
Conda command  
(says lets create  
an environment)

This flag is used to set up the  
command so that the next part of  
the command states what the  
name of the environment should be

Name that we want environment to be called  
(usually program or project name)

(Use the online conda cheat sheet to see what command to use to create a new environment)

# Step 1: Create conda environment

A terminal window with a grey title bar. The title bar contains three colored window control buttons (red, yellow, green) on the left, a home icon and the text "skoog — conda create --name muscle — 108×11" in the center. The terminal text shows the execution of the 'conda create' command, the completion of metadata collection and environment solving, the display of a package plan, the environment location, and a prompt to proceed.

```
(base) skoog@dhcp-10-29-115-208 ~ % conda create --name muscle  
Collecting package metadata (current_repodata.json): done  
Solving environment: done  
  
## Package Plan ##  
  
  environment location: /opt/anaconda3/envs/muscle  
  
Proceed ([y]/n)? █
```

# Step 1: Create conda environment

```
skoog — conda create --name muscle — 108×11
(base) skoog@dhcp-10-29-115-208 ~ % conda create --name muscle
Collecting package metadata (current_repodata.json): done
Solving environment: done

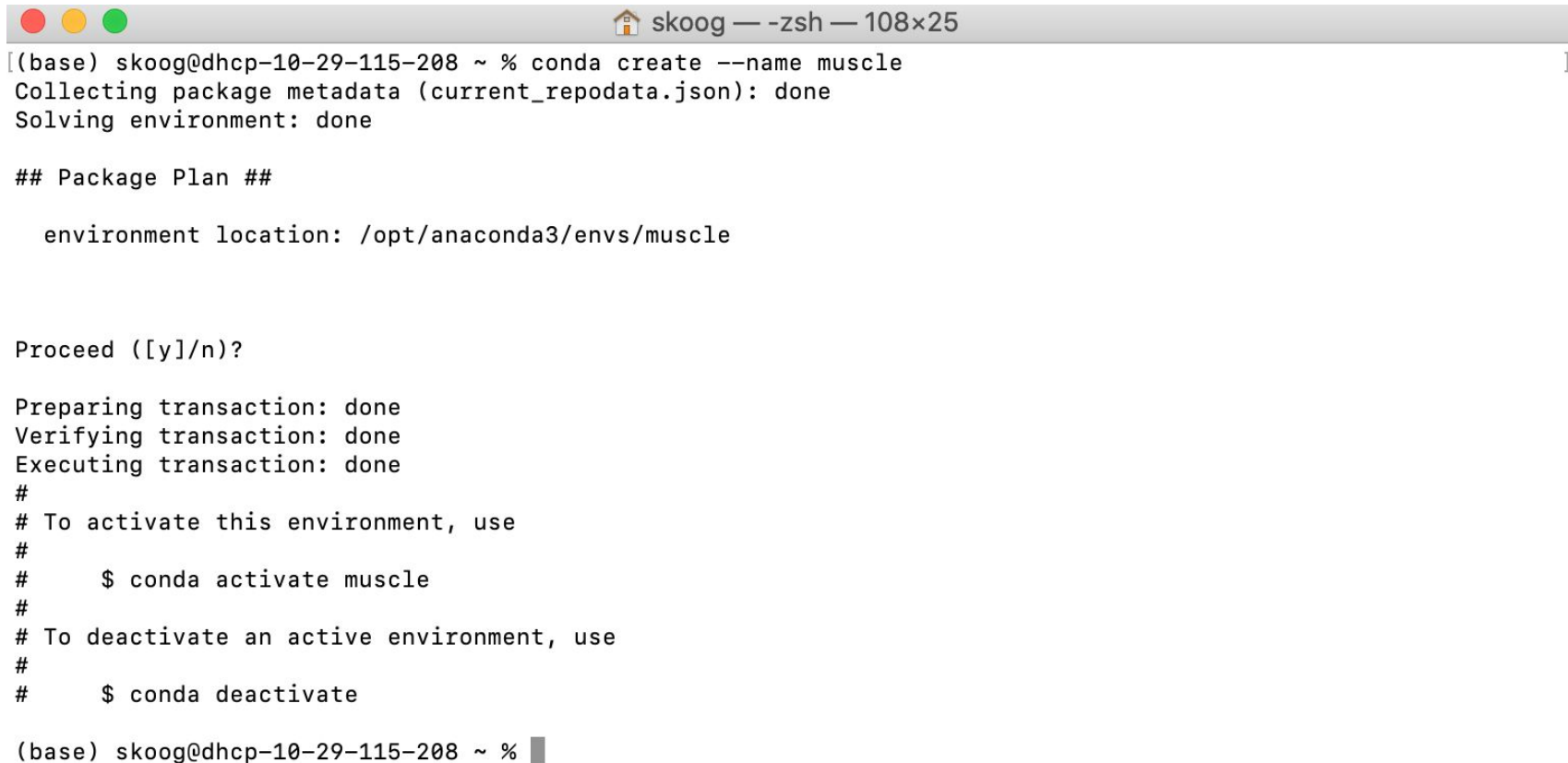
## Package Plan ##

  environment location: /opt/anaconda3/envs/muscle

Proceed ([y]/n)? █
```

Hit enter  
[ ] means default  
Could either type 'y' or hit enter.  
If you want 'no', must type 'n'

# Step 1: Create conda environment



```
skoog — -zsh — 108x25
[(base) skoog@dhcp-10-29-115-208 ~ % conda create --name muscle
Collecting package metadata (current_repodata.json): done
Solving environment: done

## Package Plan ##

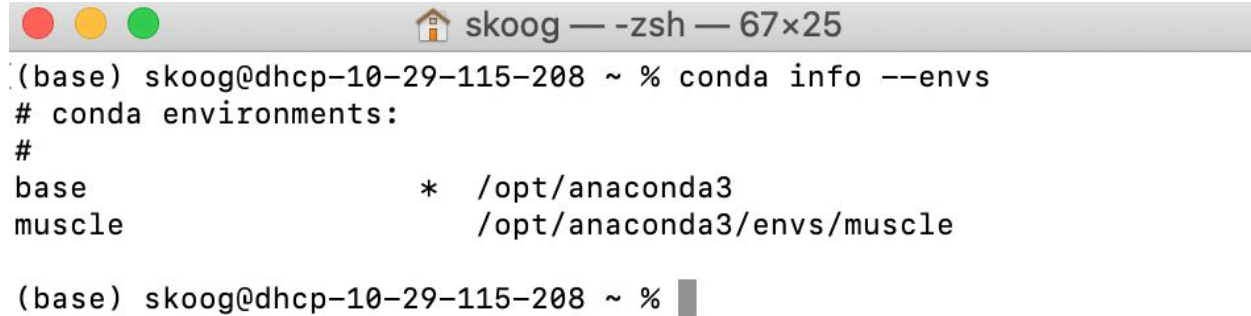
  environment location: /opt/anaconda3/envs/muscle

Proceed ([y]/n)?

Preparing transaction: done
Verifying transaction: done
Executing transaction: done
#
# To activate this environment, use
#
#     $ conda activate muscle
#
# To deactivate an active environment, use
#
#     $ conda deactivate

(base) skoog@dhcp-10-29-115-208 ~ %
```

We can now check to see that we have a new environment

A terminal window with a title bar containing three colored circles (red, yellow, green) and a house icon followed by the text 'skoog — -zsh — 67x25'. The terminal content shows the command 'conda info --envs' being executed, which lists two environments: 'base' at '/opt/anaconda3' and 'muscle' at '/opt/anaconda3/envs/muscle'. The prompt '(base) skoog@dhcp-10-29-115-208 ~ %' is visible at the bottom.

```
(base) skoog@dhcp-10-29-115-208 ~ % conda info --envs  
# conda environments:  
#  
base                * /opt/anaconda3  
muscle              /opt/anaconda3/envs/muscle  
  
(base) skoog@dhcp-10-29-115-208 ~ %
```

# How do we create and use a conda environment?

Step 1: Create a conda environment



Step 2: Enter your conda environment

Step 3: Install programs inside of conda environment

Step 4: Use conda environment



## Step 2: Enter your environment

```
skoog — -zsh — 108x25
[(base) skoog@dhcp-10-29-115-208 ~ % conda create --name muscle
Collecting package metadata (current_repodata.json): done
Solving environment: done

## Package Plan ##

  environment location: /opt/anaconda3/envs/muscle

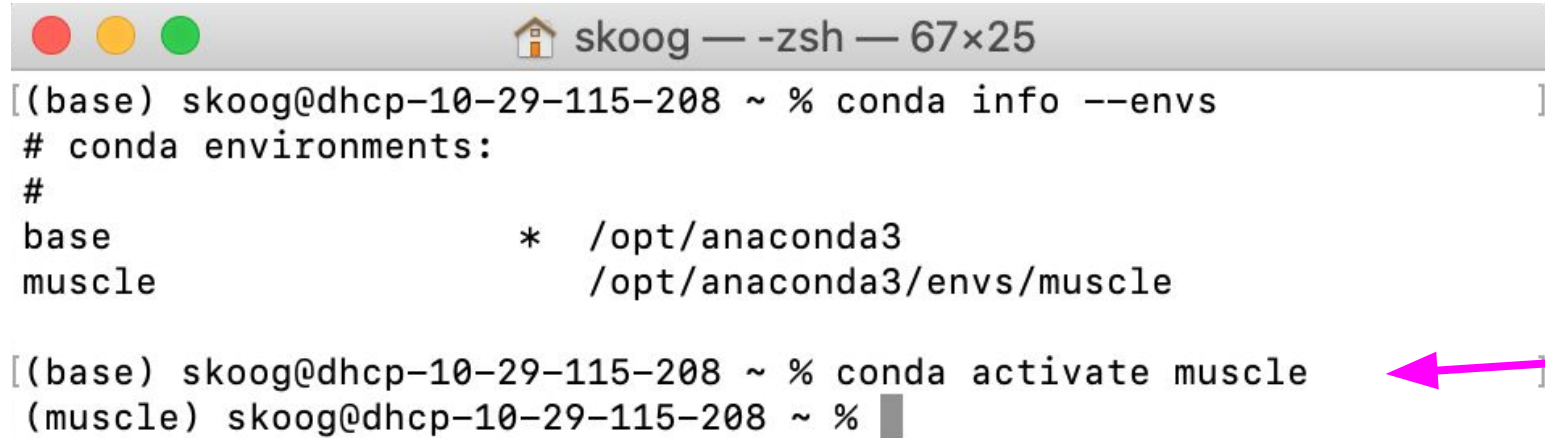
Proceed ([y]/n)?

Preparing transaction: done
Verifying transaction: done
Executing transaction: done
#
# To activate this environment, use
#
#     $ conda activate muscle
#
# To deactivate an active environment, use
#
#     $ conda deactivate

(base) skoog@dhcp-10-29-115-208 ~ %
```

Enter environment

## Step 2: Enter your environment



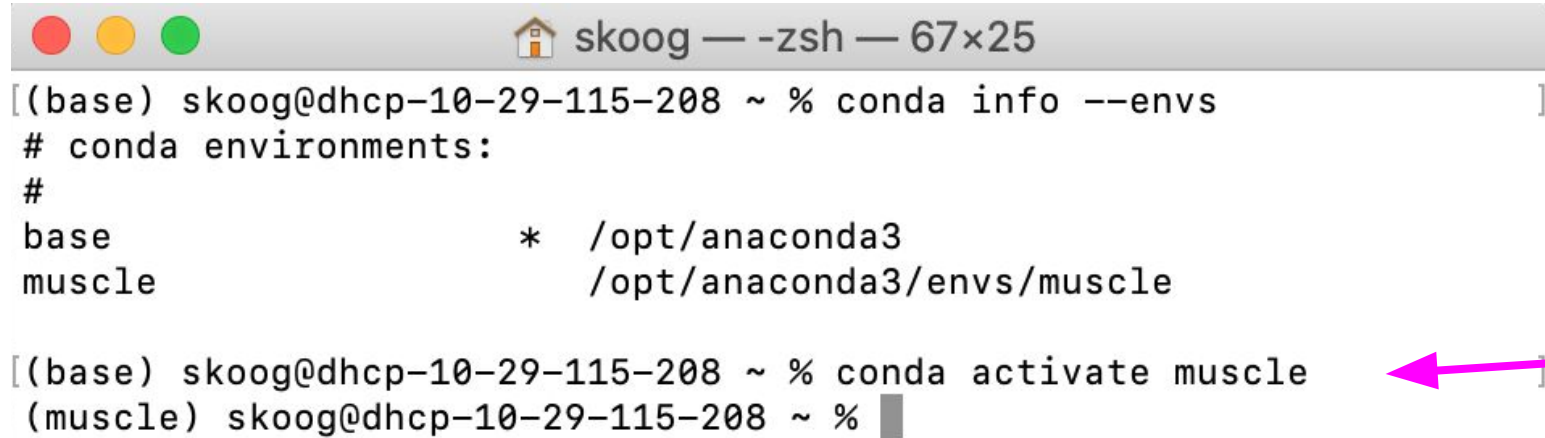
A terminal window with a title bar showing 'skoog — -zsh — 67x25'. The window contains the following text:

```
[(base) skoog@dhcp-10-29-115-208 ~ % conda info --envs  
# conda environments:  
#  
base                *  /opt/anaconda3  
muscle              /opt/anaconda3/envs/muscle  
  
[(base) skoog@dhcp-10-29-115-208 ~ % conda activate muscle  
(muscle) skoog@dhcp-10-29-115-208 ~ %
```

Two pink arrows highlight the environment change. One arrow points from the right margin to the 'muscle' environment listed in the output of the first command. The second arrow points from a text box at the bottom left to the prompt '(muscle) skoog@dhcp-10-29-115-208 ~ %' in the second command line.

Notice change in  
conda environment

## Step 2: Enter your environment



A terminal window with a title bar showing three colored window control buttons (red, yellow, green) on the left, a home icon, and the text 'skoog — -zsh — 67x25'. The terminal content shows the output of 'conda info --envs' and the command to activate the 'muscle' environment. A pink arrow points from the bottom-left box to the 'conda activate muscle' command, and another pink arrow points from the right to the same command.

```
[(base) skoog@dhcp-10-29-115-208 ~ % conda info --envs  
# conda environments:  
#  
base                * /opt/anaconda3  
muscle              /opt/anaconda3/envs/muscle  
  
[(base) skoog@dhcp-10-29-115-208 ~ % conda activate muscle  
(muscle) skoog@dhcp-10-29-115-208 ~ %
```

Notice change in  
conda environment

Note that so far, we have only created an environment with the name of the program that we want (could have also named it anything else). We still have to ADD (or install) that program inside the conda environment. (It's like having a kitchen without any appliances. We need to install the appliances before a room called the kitchen can actually function as our kitchen!)

# How do we create and use a conda environment?

Step 1: Create a conda environment



Step 2: Enter your conda environment

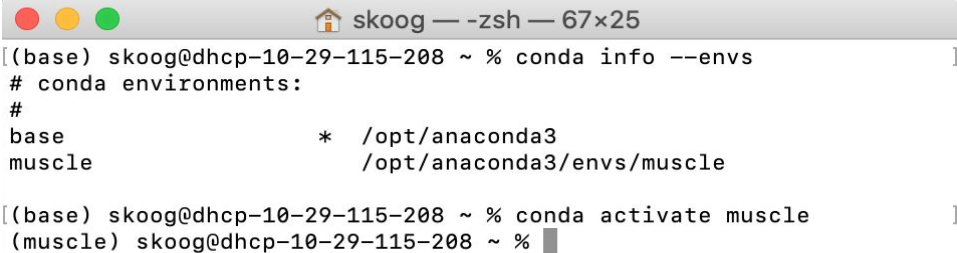


Step 3: Install programs inside of conda environment

Step 4: Use conda environment

## Step 3: Install program inside of environment

First, always check to make sure you are actually inside of your environment.

A terminal window titled 'skoog — -zsh — 67x25'. The prompt is '[(base) skoog@dhcp-10-29-115-208 ~ %]'. The user enters 'conda info --envs'. The output shows two environments: 'base' at '/opt/anaconda3' and 'muscle' at '/opt/anaconda3/envs/muscle'. The user then enters 'conda activate muscle'. The prompt changes to '(muscle) skoog@dhcp-10-29-115-208 ~ %'. A pink arrow points from the text 'are actually inside of your environment.' to the 'muscle' environment entry in the terminal output.

```
[(base) skoog@dhcp-10-29-115-208 ~ % conda info --envs  
# conda environments:  
#  
base * /opt/anaconda3  
muscle /opt/anaconda3/envs/muscle  
  
[(base) skoog@dhcp-10-29-115-208 ~ % conda activate muscle  
(muscle) skoog@dhcp-10-29-115-208 ~ %
```

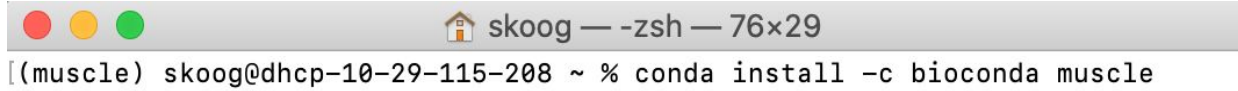
Second, install program.

A terminal window titled 'skoog — -zsh — 76x25'. The prompt is '(muscle) skoog@dhcp-10-29-115-208 ~ %'. The user enters 'conda install -c bioconda muscle'.

```
(muscle) skoog@dhcp-10-29-115-208 ~ % conda install -c bioconda muscle
```

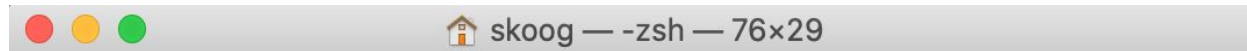
Note: To figure out how to install any program using anaconda, literally google “install [program] anaconda” (ex. install muscle anaconda)

## Step 3: Install program inside of environment

A screenshot of a terminal window. The title bar at the top shows three colored circles (red, yellow, green) on the left, a house icon in the center, and the text "skoog — -zsh — 76x29" on the right. The terminal content shows a prompt "[ (muscle) ]" followed by the command "skoog@dhcp-10-29-115-208 ~ % conda install -c bioconda muscle".

```
[ (muscle) ] skoog@dhcp-10-29-115-208 ~ % conda install -c bioconda muscle
```

# Step 3: Install program inside of environment



```
[(muscle) skoog@dhcp-10-29-115-208 ~ % conda install -c bioconda muscle  
Collecting package metadata (current_repodata.json): done  
Solving environment: done
```

```
## Package Plan ##
```

```
environment location: /opt/anaconda3/envs/muscle
```

```
added / updated specs:  
- muscle
```

```
The following NEW packages will be INSTALLED:
```

libcxx	pkgs/main/osx-64::libcxx-10.0.0-1
muscle	bioconda/osx-64::muscle-3.8.1551-h770b8ee_5

```
Proceed ([y]/n)?
```



Hit enter

# Step 3: Install program inside of environment

skoog — -zsh — 76x29

```
[(muscle) skoog@dhcp-10-29-115-208 ~ % conda install -c bioconda muscle  
Collecting package metadata (current_repodata.json): done  
Solving environment: done
```

```
## Package Plan ##
```

```
environment location: /opt/anaconda3/envs/muscle
```

```
added / updated specs:  
- muscle
```

Shows us path (location) of program within conda. Here located in the conda environment (envs) directory

```
The following NEW packages will be INSTALLED:
```

libcxx	pkgs/main/osx-64::libcxx-10.0.0-1
muscle	bioconda/osx-64::muscle-3.8.1551-h770b8ee_5

```
Proceed ([y]/n)?
```



# Step 3: Install program inside of environment



```
[(muscle) skoog@dhcp-10-29-115-208 ~ % conda install -c bioconda muscle  
Collecting package metadata (current_repodata.json): done  
Solving environment: done
```

```
## Package Plan ##
```

```
environment location: /opt/anaconda3/envs/muscle
```

```
added / updated specs:  
- muscle
```

```
The following NEW packages will be INSTALLED:
```

libcxx	pkgs/main/osx-64::libcxx-10.0.0-1
muscle	bioconda/osx-64::muscle-3.8.1551-h770b8ee_5



Shows us the packages that will be installed within the muscle program

```
Proceed ([y]/n)?
```

# Step 3: Install program inside of environment

```
skoog — -zsh — 76x29
[(muscle) skoog@dhcp-10-29-115-208 ~ % conda install -c bioconda muscle
Collecting package metadata (current_repodata.json): done
Solving environment: done

## Package Plan ##

  environment location: /opt/anaconda3/envs/muscle

  added / updated specs:
    - muscle

The following NEW packages will be INSTALLED:

  libcxx                pkgs/main/osx-64::libcxx-10.0.0-1
  muscle                bioconda/osx-64::muscle-3.8.1551-h770b8ee_5

Proceed ([y]/n)?

Preparing transaction: done
Verifying transaction: done
Executing transaction: done
(muscle) skoog@dhcp-10-29-115-208 ~ %
```

# Step 3: Install program inside of environment

```
skoog — -zsh — 76x29
[(muscle) skoog@dhcp-10-29-115-208 ~ % conda install -c bioconda muscle
Collecting package metadata (current_repodata.json): done
Solving environment: done

## Package Plan ##

  environment location: /opt/anaconda3/envs/muscle

  added / updated specs:
    - muscle

The following NEW packages will be INSTALLED:

  libcxx                pkgs/main/osx-64::libcxx-10.0.0-1
  muscle                bioconda/osx-64::muscle-3.8.1551-h770b8ee_5

Proceed ([y]/n)?

Preparing transaction: done
Verifying transaction: done
Executing transaction: done
(muscle) skoog@dhcp-10-29-115-208 ~ %
```

Successful

# Step 3: Install program inside of environment

```
skoog — -zsh — 76x29
[(muscle) skoog@dhcp-10-29-115-208 ~ % conda install -c bioconda muscle
Collecting package metadata (current_repodata.json): done
Solving environment: done

## Package Plan ##

  environment location: /opt/anaconda3/envs/muscle

  added / updated specs:
    - muscle

The following NEW packages will be INSTALLED:

  libcxx                pkgs/main/osx-64::libcxx-10.0.0-1
  muscle                bioconda/osx-64::muscle-3.8.1551-h770b8ee_5

Proceed ([y]/n)?

Preparing transaction: done
Verifying transaction: done
Executing transaction: done
(muscle) skoog@dhcp-10-29-115-208 ~ %
```

Command line back. We are now able to execute next command.

## Step 3: Install program inside of environment

If, for example, you want to have a specific environment for one of your projects and you want several different programs inside this one environment (assuming they don't clash with one another and cause problems (clashing dependency versions, for example)), **you can install many programs within one environment.**

Maybe you want a single environment called “tree\_building” where you have all the programs you need to align sequences and then use this output to make a tree, then you can install muscle (alignment program) and iqtree (a tree building program) within the same environment (... or you could also keep them separate).

# How do we create and use a conda environment?

Step 1: Create a conda environment



Step 2: Enter your conda environment



Step 3: Install programs inside of conda environment



Step 4: Use conda environment

Step 4: Use our conda environment!



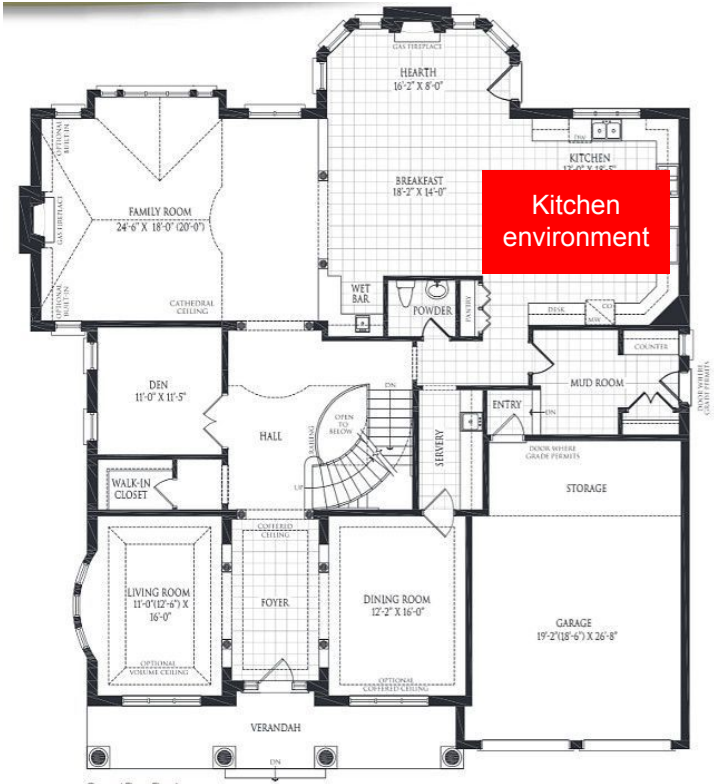
Stay tuned for phylogenetics tutorial (and others)!

# Overview: Kitchen analogy



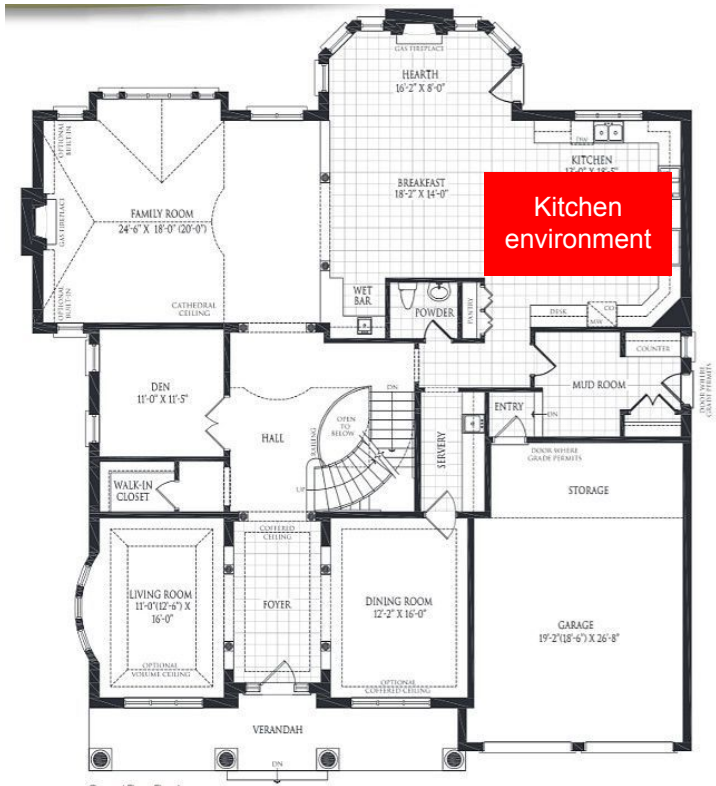
# Overview: Kitchen analogy

## Step 1: Build/create conda environment (build kitchen)



# Overview: Kitchen analogy

Step 1: Build/create conda environment (build kitchen)

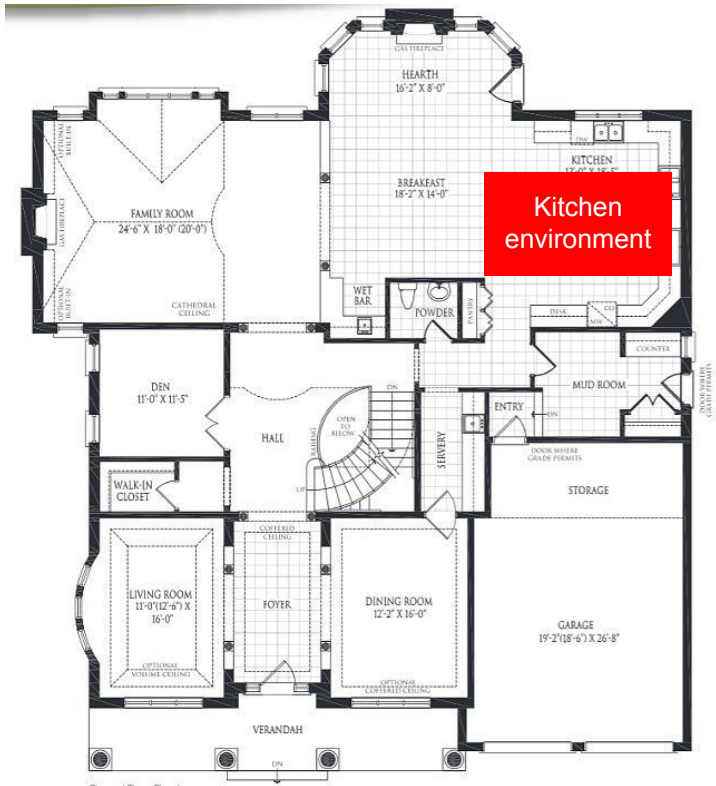


Step 2: Enter conda environment (enter kitchen)



# Overview: Kitchen analogy

Step 1: Build/create conda environment (build kitchen)



Step 2: Enter conda environment (enter kitchen)



Step 3: Install program for use (install kitchen appliances for kitchen use)



# Overview: Kitchen analogy

Step 1: Build/create conda environment (build kitchen)

Step 2: Enter conda environment (enter kitchen)



Now you can use the  
kitchen as intended!

Install kitchen appliances for kitchen use)

