[**Logging, Managing packages with pip, and Floating-point Arithmetic**](https://classes.capaciti.org.za/courses/course-v1:CITI+CAP005+2021/course/#block-v1:CITI+CAP005+2021+type@sequential+block@4361e5423af24095bb3567eb8f140a94)

The logging module offers a full featured and flexible logging system. At its simplest, log messages are sent to a file or to sys.stderr:

import logging

logging.debug('Debugging information')

logging.info('Informational message')

logging.warning('Warning:config file %s not found', 'server.conf')

logging.error('Error occurred')

logging.critical('Critical error -- shutting down')

This produces the following output:

WARNING:root:Warning:config file server.conf not found

ERROR:root:Error occurred

CRITICAL:root:Critical error -- shutting down

By default, informational and debugging messages are suppressed and the output is sent to standard error. Other output options include routing messages through email, datagrams, sockets, or to an HTTP Server. New filters can select different routing based on message priority: DEBUG, INFO, WARNING, ERROR, and CRITICAL.

The logging system can be configured directly from Python or can be loaded from a user editable configuration file for customized logging without altering the application.

Python applications will often use packages and modules that don’t come as part of the standard library. Applications will sometimes need a specific version of a library, because the application may require that a particular bug has been fixed or the application may be written using an obsolete version of the library’s interface.

This means it may not be possible for one Python installation to meet the requirements of every application. If application A needs version 1.0 of a particular module but application B needs version 2.0, then the requirements are in conflict and installing either version 1.0 or 2.0 will leave one application unable to run.

The solution for this problem is to create a virtual environment, a self-contained directory tree that contains a Python installation for a particular version of Python, plus a number of additional packages.

Different applications can then use different virtual environments. To resolve the earlier example of conflicting requirements, application A can have its own virtual environment with version 1.0 installed while application B has another virtual environment with version 2.0. If application B requires a library be upgraded to version 3.0, this will not affect application A’s environment.

**Creating Virtual Environments**

The module used to create and manage virtual environments is called venv. venv will usually install the most recent version of Python that you have available. If you have multiple versions of Python on your system, you can select a specific Python version by running python3 or whichever version you want.

To create a virtual environment, decide upon a directory where you want to place it, and run the venv module as a script with the directory path:

python3 -m venv tutorial-env

This will create the tutorial-env directory if it doesn’t exist, and create directories inside it containing a copy of the Python interpreter, the standard library, and various supporting files.

Once you’ve created a virtual environment, you may activate it.

On Windows, run:

tutorial-env\Scripts\activate.bat

On Unix or MacOS, run:

source tutorial-env/bin/activate

(This script is written for the bash shell. If you use the csh or fish shells, there are alternate activate.csh and activate.fish scripts you should use instead.)

Activating the virtual environment will change your shell’s prompt to show what virtual environment you’re using, and modify the environment so that running python will get you that particular version and installation of Python. For example:

$ source ~/envs/tutorial-env/bin/activate

(tutorial-env) $ python

Python 3.5.1 (default, May  6 2016, 10:59:36)

  ...

>>> import sys

>>> sys.path

['', '/usr/local/lib/python35.zip', ...,

'~/envs/tutorial-env/lib/python3.5/site-packages']

>>>