cmd2 Documentation

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Contents

A python package for building powerful command-line interpreter (CLI) programs. Extends the Python Standard Library's cmd package.

The basic use of `cmd2` is identical to that of cmd.

1. Create a subclass of `cmd2.Cmd`. Define attributes and `do_*` methods to control its behavior. Throughout this documentation, we will assume that you are naming your subclass `App`:

```python
from cmd2 import Cmd
class App(Cmd):
    # customized attributes and methods here
```

2. Instantiate `App` and start the command loop:

```python
app = App()
app.cmdloop()
```

Getting Started

Building a new REPL or Command Line Interface application?

Already built an application that uses cmd from the python standard library and want to add more functionality with very little work?

cmd2 is a powerful python library for building command line applications. Start here to find out if this library is a good fit for your needs.

- *Installation Instructions* - how to install cmd2 and associated optional dependencies
- *First Application* - a sample application showing 8 key features of cmd2
- *Integrate cmd2 Into Your Project* - adding cmd2 to your project
- *Alternatives* - other python packages that might meet your needs
- *Resources* - related links and other materials

1.1 Getting Started

1.1.1 Installation Instructions

cmd2 works on Linux, macOS, and Windows. It requires Python 3.5 or higher, pip, and setuptools. If you've got all that, then you can just:

```
$ pip install cmd2
```

Note: Depending on how and where you have installed Python on your system and on what OS you are using, you may need to have administrator or root privileges to install Python packages. If this is the case, take the necessary steps required to run the commands in this section as root/admin, e.g.: on most Linux or Mac systems, you can precede them with sudo:

```
$ sudo pip install <package_name>
```

Prerequisites

If you have Python 3 >=3.5 installed from python.org, you will already have pip and setuptools, but may need to upgrade to the latest versions:

On Linux or OS X:

```
$ pip install -U pip setuptools
```

On Windows:

```
> python -m pip install -U pip setuptools
```

Install from PyPI

pip is the recommended installer. Installing packages from PyPI with pip is easy:

```
$ pip install cmd2
```

This will install the required 3rd-party dependencies, if necessary.

Install from GitHub

The latest version of cmd2 can be installed directly from the master branch on GitHub using pip:

```
$ pip install -U git+git://github.com/python-cmd2/cmd2.git
```

Install from Debian or Ubuntu repos

We recommend installing from pip, but if you wish to install from Debian or Ubuntu repos this can be done with apt-get.

For Python 3:

```
$ sudo apt-get install python3-cmd2
```

This will also install the required 3rd-party dependencies.

> **Warning:** Versions of cmd2 before 0.7.0 should be considered to be of unstable "beta" quality and should not be relied upon for production use. If you cannot get a version >= 0.7 from your OS repository, then we recommend installing from either pip or GitHub - see *Install from PyPI* or *Install from GitHub*.

Upgrading cmd2

Upgrade an already installed cmd2 to the latest version from PyPI:

```
pip install -U cmd2
```

This will upgrade to the newest stable version of cmd2 and will also upgrade any dependencies if necessary.

Uninstalling cmd2

If you wish to permanently uninstall cmd2, this can also easily be done with pip:

```
$ pip uninstall cmd2
```

macOS Considerations

macOS comes with the libedit library which is similar, but not identical, to GNU Readline. Tab-completion for cmd2 applications is only tested against GNU Readline.

There are several ways GNU Readline can be installed within a Python environment on a Mac, detailed in the following subsections.

gnureadline Python module

Install the gnureadline Python module which is statically linked against a specific compatible version of GNU Readline:

```
$ pip install -U gnureadline
```

readline via conda

Install the **readline** package using the conda package manager included with the Anaconda Python distribution:

```
$ conda install readline
```

readline via brew

Install the **readline** package using the Homebrew package manager (compiles from source):

```
$ brew install openssl
$ brew install pyenv
$ brew install readline
```

Then use pyenv to compile Python and link against the installed readline

1.1.2 First Application

Here's a quick walkthrough of a simple application which demonstrates 8 features of cmd2:

- *Settings*
- *Commands*
- *Argument Processing*

- *Generating Output*

- *Help*

- *Shortcuts*

- *Multiline Commands*

- *History*

If you don't want to type as we go, you can download the complete source for this example.

Basic Application

First we need to create a new `cmd2` application. Create a new file `first_app.py` with the following contents:

```python
#!/usr/bin/env python
"""A simple cmd2 application."""
import cmd2


class FirstApp(cmd2.Cmd):
    """A simple cmd2 application."""


if __name__ == '__main__':
    import sys
    c = FirstApp()
    sys.exit(c.cmdloop())
```

We have a new class `FirstApp` which is a subclass of *cmd2.Cmd*. When we tell python to run our file like this:

```
$ python first_app.py
```

it creates an instance of our class, and calls the `cmdloop()` method. This method accepts user input and runs commands based on that input. Because we subclassed `cmd2.Cmd`, our new app already has a bunch of features built in.

Congratulations, you have a working `cmd2` app. You can run it, and then type `quit` to exit.

Create a New Setting

Before we create our first command, we are going to add a setting to this app. `cmd2` includes robust support for *Settings*. You configure settings during object initialization, so we need to add an initializer to our class:

```python
def __init__(self):
    super().__init__()

    # Make maxrepeats settable at runtime
    self.maxrepeats = 3
    self.settable['maxrepeats'] = 'max repetitions for speak command'
```

In that initializer, the first thing to do is to make sure we initialize `cmd2`. That's what the `super().__init__()` line does. Then we create an attribute to hold our setting, and then add a description of our setting to the `settable` dictionary. If our attribute name isn't in `settable`, then it won't be treated as a setting. Now if you run the script, and enter the `set` command to see the settings, like this:

```
$ python first_app.py
(Cmd) set
```

you will see our `maxrepeats` setting show up with it's default value of `3`.

Create A Command

Now we will create our first command, called `speak` which will echo back whatever we tell it to say. We are going to use an *argument processor* so the `speak` command can shout and talk piglatin. We will also use some built in methods for *generating output*. Add this code to `first_app.py`, so that the `speak_parser` attribute and the `do_speak()` method are part of the `CmdLineApp()` class:

```python
speak_parser = argparse.ArgumentParser()
speak_parser.add_argument('-p', '--piglatin', action='store_true', help='atinLay')
speak_parser.add_argument('-s', '--shout', action='store_true', help='N00B EMULATION
→MODE')
speak_parser.add_argument('-r', '--repeat', type=int, help='output [n] times')
speak_parser.add_argument('words', nargs='+', help='words to say')


@cmd2.with_argparser(speak_parser)
def do_speak(self, args):
    """Repeats what you tell me to."""
    words = []
    for word in args.words:
        if args.piglatin:
            word = '%s%say' % (word[1:], word[0])
        if args.shout:
            word = word.upper()
        words.append(word)
    repetitions = args.repeat or 1
    for _ in range(min(repetitions, self.maxrepeats)):
        # .poutput handles newlines, and accommodates output redirection too
        self.poutput(' '.join(words))
```

Up at the top of the script, you'll also need to add:

```python
import argparse
```

There's a bit to unpack here, so let's walk through it. We created `speak_parser`, which uses the argparse module from the Python standard library to parse command line input from a user. There is nothing thus far that is specific to `cmd2`.

There is also a new method called `do_speak()`. In both cmd and `cmd2`, methods that start with `do_` become new commands, so by defining this method we have created a command called `speak`.

Note the `@cmd2.with_argparser` decorator on the `do_speak()` method. This decorator does 3 useful things for us:

1. It tells `cmd2` to process all input for the `speak` command using the argparser we defined. If the user input doesn't meet the requirements defined by the argparser, then an error will be displayed for the user.

2. It alters our `do_speak` method so that instead of receiving the raw user input as a parameter, we receive the namespace from the argparser.

3. It creates a help message for us based on the argparser.

You can see in the body of the method how we use the namespace from the argparser (passed in as the variable `args`). We build an array of words which we will output, honoring both the `--piglatin` and `--shout` options.

At the end of the method, we use our `maxrepeats` setting as an upper limit to the number of times we will print the output.

The last thing you'll notice is that we used the `self.poutput()` method to display our output. `poutput()` is a method provided by `cmd2`, which I strongly recommend you use anytime you want to *generate output*. It provides the following benefits:

1. Allows the user to redirect output to a text file or pipe it to a shell process

2. Gracefully handles `BrokenPipeWarning` exceptions for redirected output

3. Makes the output show up in a *transcript*

4. Honors the setting to strip embedded ansi sequences (typically used for background and foreground colors)

Go run the script again, and try out the `speak` command. Try typing `help speak`, and you will see a lovely usage message describing the various options for the command.

With those few lines of code, we created a *command*, used an *Argument Processor*, added a nice *help message* for our users, and *generated some output*.

Shortcuts

`cmd2` has several capabilities to simplify repetitive user input: *Shortcuts, Aliases, and Macros*. Let's add a shortcut to our application. Shortcuts are character strings that can be used instead of a command name. For example, `cmd2` has support for a shortcut `!` which runs the `shell` command. So instead of typing this:

```
(Cmd) shell ls -al
```

you can type this:

```
(Cmd) !ls -al
```

Let's add a shortcut for our `speak` command. Change the `__init__()` method so it looks like this:

```python
def __init__(self):
    shortcuts = cmd2.DEFAULT_SHORTCUTS
    shortcuts.update({'&': 'speak'})
    super().__init__(shortcuts=shortcuts)

    # Make maxrepeats settable at runtime
    self.maxrepeats = 3
    self.settable['maxrepeats'] = 'max repetitions for speak command'
```

Shortcuts are passed to the `cmd2` initializer, and if you want the built-in shortcuts of `cmd2` you have to pass them. These shortcuts are defined as a dictionary, with the key being the shortcut, and the value containing the command. When using the default shortcuts and also adding your own, it's a good idea to use the `.update()` method to modify the dictionary. This way if you add a shortcut that happens to already be in the default set, yours will override, and you won't get any errors at runtime.

Run your app again, and type:

```
(Cmd) shortcuts
```

to see the list of all of the shortcuts, including the one for speak that we just created.

Multiline Commands

Some use cases benefit from the ability to have commands that span more than one line. For example, you might want the ability for your user to type in a SQL command, which can often span lines and which are terminated with a semicolon. Let's add a *multiline command* to our application. First we'll create a new command called `orate`. This code shows both the definition of our `speak` command, and the `orate` command:

```python
@cmd2.with_argparser(speak_parser)
def do_speak(self, args):
    """Repeats what you tell me to."""
    words = []
    for word in args.words:
        if args.piglatin:
            word = '%s%say' % (word[1:], word[0])
        if args.shout:
            word = word.upper()
        words.append(word)
    repetitions = args.repeat or 1
    for _ in range(min(repetitions, self.maxrepeats)):
        # .poutput handles newlines, and accommodates output redirection too
        self.poutput(' '.join(words))

# orate is a synonym for speak which takes multiline input
do_orate = do_speak
```

With the new command created, we need to tell `cmd2` to treat that command as a multi-line command. Modify the super initialization line to look like this:

```python
super().__init__(multiline_commands=['orate'], shortcuts=shortcuts)
```

Now when you run the example, you can type something like this:

```
(Cmd) orate O for a Muse of fire, that would ascend
> The brightest heaven of invention,
> A kingdom for a stage, princes to act
> And monarchs to behold the swelling scene! ;
```

Notice the prompt changes to indicate that input is still ongoing. `cmd2` will continue prompting for input until it sees an unquoted semicolon (the default multi-line command termination character).

History

`cmd2` tracks the history of the commands that users enter. As a developer, you don't need to do anything to enable this functionality, you get it for free. If you want the history of commands to persist between invocations of your application, you'll need to do a little work. The *History* page has all the details.

Users can access command history using two methods:

- the readline library which provides a python interface to the GNU readline library
- the `history` command which is built-in to `cmd2`

From the prompt in a `cmd2`-based application, you can press `Control-p` to move to the previously entered command, and `Control-n` to move to the next command. You can also search through the command history using `Control-r`. The GNU Readline User Manual has all the details, including all the available commands, and instructions for customizing the key bindings.

The `history` command allows a user to view the command history, and select commands from history by number, range, string search, or regular expression. With the selected commands, users can:

- re-run the commands

- edit the selected commands in a text editor, and run them after the text editor exits

- save the commands to a file

- run the commands, saving both the commands and their output to a file

Learn more about the `history` command by typing `history -h` at any `cmd2` input prompt, or by exploring *Command History For Users*.

Conclusion

You've just created a simple, but functional command line application. With minimal work on your part, the application leverages many robust features of `cmd2`. To learn more you can:

- Dive into all of the *Features* that `cmd2` provides

- Look at more *Examples*

- Browse the *API Reference*

1.1.3 Integrate cmd2 Into Your Project

Once installed, you will want to ensure that your project's dependencies include `cmd2`. Make sure your `setup.py` includes the following:

```
install_requires=[
    'cmd2>=1,<2',
]
```

The `cmd2` project uses Semantic Versioning, which means that any incompatible API changes will be release with a new major version number. We recommend that you follow the advice given by the Python Packaging User Guide related to install_requires. By setting an upper bound on the allowed version, you can ensure that your project does not inadvertently get installed with an incompatible future version of `cmd2`.

Windows Considerations

If you would like to use *Completion*, and you want your application to run on Windows, you will need to ensure you install the `pyreadline` package. Make sure to include the following in your `setup.py`:

```
install_requires=[
    'cmd2>=1,<2',
    ":sys_platform=='win32'": ['pyreadline'],
]
```

1.1.4 Alternatives

For programs that do not interact with the user in a continuous loop - programs that simply accept a set of arguments from the command line, return results, and do not keep the user within the program's environment - all you need are sys.argv (the command-line arguments) and argparse (for parsing UNIX-style options and flags). Though some people may prefer docopt or click to argparse.

The curses module produces applications that interact via a plaintext terminal window, but are not limited to simple text input and output; they can paint the screen with options that are selected from using the cursor keys. However, programming a curses-based application is not as straightforward as using cmd.

Several Python packages exist for building interactive command-line applications approximately similar in concept to cmd applications. None of them share cmd2's close ties to cmd, but they may be worth investigating nonetheless. Two of the most mature and full featured are:

- Python Prompt Toolkit

- Click

Python Prompt Toolkit is a library for building powerful interactive command lines and terminal applications in Python. It provides a lot of advanced visual features like syntax highlighting, bottom bars, and the ability to create fullscreen apps.

Click is a Python package for creating beautiful command line interfaces in a composable way with as little code as necessary. It is more geared towards command line utilities instead of command line interpreters, but it can be used for either.

Getting a working command-interpreter application based on either Python Prompt Toolkit or Click requires a good deal more effort and boilerplate code than cmd2. cmd2 focuses on providing an excellent out-of-the-box experience with as many useful features as possible built in for free with as little work required on the developer's part as possible. We believe that cmd2 provides developers the easiest way to write a command-line interpreter, while allowing a good experience for end users. If you are seeking a visually richer end-user experience and don't mind investing more development time, we would recommend checking out Python Prompt Toolkit.

1.1.5 Resources

Project related links and other resources:

- cmd

- cmd2 project page

- project bug tracker

- PyOhio 2019: slides, video, examples

Building a new REPL or Command Line Interface application?

Already built an application that uses cmd from the python standard library and want to add more functionality with very little work?

cmd2 is a powerful python library for building command line applications. Start here to find out if this library is a good fit for your needs.

- *Installation Instructions* - how to install cmd2 and associated optional dependencies

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Migrating from cmd

If you're thinking of migrating your cmd app to cmd2, this section will help you decide if it's right for your app, and show you how to do it.

- *Why cmd2* - we try and convince you to use cmd2 instead of cmd

- *Incompatibilities* - cmd2 is not quite 100% compatible with cmd.

- *Minimum Required Changes* - the minimum changes required to move from cmd to cmd2. Start your migration here.

- *Next Steps* - Once you've migrated, here a list of things you can do next to add even more functionality to your app.

2.1 Migrating From cmd

2.1.1 Why cmd2

cmd

cmd is the Python Standard Library's module for creating simple interactive command-line applications. cmd is an extremely bare-bones framework which leaves a lot to be desired. It doesn't even include a built-in way to exit from an application!

Since the API provided by cmd provides the foundation on which cmd2 is based, understanding the use of cmd is the first step in learning the use of cmd2. Once you have read the cmd docs, return here to learn the ways that cmd2 differs from cmd.

cmd2

cmd2 is a batteries-included extension of cmd, which provides a wealth of functionality to make it quicker and easier for developers to create feature-rich interactive command-line applications which delight customers.

cmd2 can be used as a drop-in replacement for cmd with a few minor discrepancies as discussed in the *Incompatibilities* section. Simply importing cmd2 in place of cmd will add many features to an application without any further modifications. Migrating to cmd2 will also open many additional doors for making it possible for developers to provide a top-notch interactive command-line experience for their users.

Free Features

After switching from cmd to cmd2, your application will have the following new features and capabilities, without you having to do anything:

- More robust *History*. Both cmd and cmd2 have readline history, but cmd2 also has a robust history command which allows you to edit prior commands in a text editor of your choosing, re-run multiple commands at a time, and save prior commands as a script to be executed later.

- Users can redirect output to a file or pipe it to some other operating system command. You did remember to use self.stdout instead of sys.stdout in all of your print functions, right? If you did, then this will work out of the box. If you didn't, you'll have to go back and fix them. Before you do, you might consider the various ways cmd2 has of *Generating Output*.

- Users can load script files, which contain a series of commands to be executed.

- Users can create *Shortcuts, Aliases, and Macros* to reduce the typing required for repetitive commands.

- Embedded python shell allows a user to execute python code from within your cmd2 app. How meta.

- *Clipboard Integration* allows you to save command output to the operating system clipboard.

- A built-in *Timer* can show how long it takes a command to execute

- A *Transcript* is a file which contains both the input and output of a successful session of a cmd2-based app. The transcript can be played back into the app as a unit test.

Next Steps

In addition to the features you get with no additional work, cmd2 offers a broad range of additional capabilties which can be easily added to your application. *Next Steps* has some ideas of where you can start, or you can dig in to all the *Features*.

2.1.2 Incompatibilities

cmd2 strives to be drop-in compatible with cmd, however there are a few incompatibilities.

Cmd.emptyline()

The Cmd.emptyline() function is called when an empty line is entered in response to the prompt. By default, in cmd if this method is not overridden, it repeats and executes the last nonempty command entered. However, no end user we have encountered views this as expected or desirable default behavior. cmd2 completely ignores empty lines and the base class cmd.emptyline() method never gets called and thus the empty line behavior cannot be overridden.

Cmd.identchars

In cmd, the Cmd.identchars attribute contains the string of characters accepted for command names. cmd uses those characters to split the first "word" of the input, without requiring the user to type a space. For example, if

`identchars` contained a string of all alphabetic characters, the user could enter a command like `L20` and it would be interpreted as the command `L` with the first argument of `20`.

Since version 0.9.0, `cmd2` has ignored `identchars`; the parsing logic in `cmd2` splits the command and arguments on whitespace. We opted for this breaking change because while cmd supports unicode, using non-ascii unicode characters in command names while simultaneously using `identchars` functionality can be somewhat painful. Requiring white space to delimit arguments also ensures reliable operation of many other useful `cmd2` features, including *Completion* and *Shortcuts, Aliases, and Macros*.

If you really need this functionality in your app, you can add it back in by writing a *Postparsing Hook*.

Cmd.cmdqueue

In cmd, the Cmd.cmdqueue attribute contains A list of queued input lines. The cmdqueue list is checked in `cmdloop()` when new input is needed; if it is nonempty, its elements will be processed in order, as if entered at the prompt.

Since version 0.9.13 `cmd2` has removed support for `Cmd.cmdqueue`. Because `cmd2` supports running commands via the main `cmdloop()`, text scripts, Python scripts, transcripts, and history replays, the only way to preserve consistent behavior across these methods was to eliminate the command queue. Additionally, reasoning about application behavior is much easier without this queue present.

2.1.3 Minimum Required Changes

`cmd2.Cmd` subclasses `Cmd.cmd` from the standard library, and overrides most of the methods. Most apps based on the standard library can be migrated to `cmd2` in just a couple of minutes.

Import and Inheritance

You need to change your import from this:

```python
import cmd
```

to this:

```python
import cmd2
```

Then you need to change your class definition from:

```python
class CmdLineApp(cmd.Cmd):
```

to:

```python
class CmdLineApp(cmd2.Cmd):
```

Exiting

Have a look at the commands you created to exit your application. You probably have one called `exit` and maybe a similar one called `quit`. You also might have implemented a `do_EOF()` method so your program exits like many operating system shells. If all these commands do is quit the application, you may be able to remove them. See *Exiting*.

Distribution

If you are distributing your application, you'll also need to ensure that cmd2 is properly installed. You will need to add this to your setup() method in setup.py:

```
install_requires=[
    'cmd2>=1,<2`
]
```

See *Integrate cmd2 Into Your Project* for more details.

2.1.4 Next Steps

Once your current application is using cmd2, you can start to expand the functionality by levering other cmd2 features. The three ideas here will get you started. Browse the rest of the *Features* to see what else cmd2 can help you do.

Argument Parsing

For all but the simplest of commands, it's probably easier to use argparse to parse user input. cmd2 provides a @with_argparser() decorator which associates an ArgumentParser object with one of your commands. Using this method will:

1. Pass your command a Namespace containing the arguments instead of a string of text.

    2. Properly handle quoted string input from your users.

    3. Create a help message for you based on the ArgumentParser.

    4. Give you a big headstart adding *Completion* to your application.

    5. Make it much easier to implement subcommands (i.e. git has a bunch of subcommands such as git pull, git diff, etc).

There's a lot more about *Argument Processing* if you want to dig in further.

Help

If you have lot of commands in your application, cmd2 can categorize those commands using a one line decorator @with_category(). When a user types help the available commands will be organized by the category you specified.

If you were already using argparse or decided to switch to it, you can easily *standardize all of your help messages* to be generated by your argument parsers and displayed by cmd2. No more help messages that don't match what the code actually does.

Generating Output

If your program generates output by printing directly to sys.stdout, you should consider switching to *cmd2.cmd2.Cmd.poutput()*, *cmd2.cmd2.Cmd.perror()*, and *cmd2.cmd2.Cmd.pfeedback()*. These methods work with several of the built in *Settings* to allow the user to view or suppress feedback (i.e. progress or status output). They also properly handle ansi colored output according to user preference. Speaking of colored output, you can use any color library you want, or use the included *cmd2.ansi.style()* function. These and other related topics are covered in *Generating Output*.

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- *Incompatibilities* - `cmd2` is not quite 100% compatible with cmd.

- *Minimum Required Changes* - the minimum changes required to move from cmd to `cmd2`. Start your migration here.

- *Next Steps* - Once you've migrated, here a list of things you can do next to add even more functionality to your app.

Features

3.1 Features

3.1.1 Argument Processing

`cmd2` makes it easy to add sophisticated argument processing to your commands using the argparse python module.
`cmd2` handles the following for you:

1. Parsing input and quoted strings like the Unix shell

2. Parse the resulting argument list using an instance of `argparse.ArgumentParser` that you provide

3. Passes the resulting `argparse.Namespace` object to your command function. The `Namespace` includes the `Statement` object that was created when parsing the command line. It is stored in the `__statement__` attribute of the `Namespace`.

4. Adds the usage message from the argument parser to your command.

5. Checks if the `-h/--help` option is present, and if so, display the help message for the command

These features are all provided by the `@with_argparser` decorator which is importable from `cmd2`.

See the either the argprint or decorator example to learn more about how to use the various `cmd2` argument processing decorators in your `cmd2` applications.

Decorators provided by cmd2 for argument processing

`cmd2` provides the following decorators for assisting with parsing arguments passed to commands:

`cmd2.`**`with_argument_list`**(*, *preserve_quotes: bool = False*) → Callable[[List[T]], Optional[bool]]
  A decorator to alter the arguments passed to a do_* cmd2 method. Default passes a string of whatever the user typed. With this decorator, the decorated method will receive a list of arguments parsed from user input.

  Parameters

- **args** – Single-element positional argument list containing do_* method this decorator is wrapping

- **preserve_quotes** – if True, then argument quotes will not be stripped

Returns function that gets passed a list of argument strings

cmd2.**with_argparser**(*, ns_provider: Optional[Callable[[...], argparse.Namespace]] = None, preserve_quotes: bool = False) → Callable[[argparse.Namespace], Optional[bool]]

A decorator to alter a cmd2 method to populate its `args` argument by parsing arguments with the given instance of argparse.ArgumentParser.

Parameters

- **argparser** – unique instance of ArgumentParser

- **ns_provider** – An optional function that accepts a cmd2.Cmd object as an argument and returns an argparse.Namespace. This is useful if the Namespace needs to be prepopulated with state data that affects parsing.

- **preserve_quotes** – if True, then arguments passed to argparse maintain their quotes

Returns function that gets passed the argparse-parsed args in a Namespace A member called __statement__ is added to the Namespace to provide command functions access to the Statement object. This can be useful if the command function needs to know the command line.

cmd2.**with_argparser_and_unknown_args**(*, ns_provider: Optional[Callable[[...], argparse.Namespace]] = None, preserve_quotes: bool = False) → Callable[[argparse.Namespace, List[T]], Optional[bool]]

A decorator to alter a cmd2 method to populate its `args` argument by parsing arguments with the given instance of argparse.ArgumentParser, but also returning unknown args as a list.

Parameters

- **argparser** – unique instance of ArgumentParser

- **ns_provider** – An optional function that accepts a cmd2.Cmd object as an argument and returns an argparse.Namespace. This is useful if the Namespace needs to be prepopulated with state data that affects parsing.

- **preserve_quotes** – if True, then arguments passed to argparse maintain their quotes

Returns function that gets passed argparse-parsed args in a Namespace and a list of unknown argument strings A member called __statement__ is added to the Namespace to provide command functions access to the Statement object. This can be useful if the command function needs to know the command line.

All of these decorators accept an optional **preserve_quotes** argument which defaults to `False`. Setting this argument to `True` is useful for cases where you are passing the arguments to another command which might have its own argument parsing.

Using the argument parser decorator

For each command in the `cmd2` subclass which requires argument parsing, create a unique instance of `argparse.ArgumentParser()` which can parse the input appropriately for the command. Then decorate the command method with the `@with_argparser` decorator, passing the argument parser as the first parameter to the decorator. This changes the second argument to the command method, which will contain the results of `ArgumentParser.parse_args()`.

Here's what it looks like:

```python
import argparse
from cmd2 import with_argparser

argparser = argparse.ArgumentParser()
argparser.add_argument('-p', '--piglatin', action='store_true', help='atinLay')
argparser.add_argument('-s', '--shout', action='store_true', help='N00B EMULATION MODE
↪')
argparser.add_argument('-r', '--repeat', type=int, help='output [n] times')
argparser.add_argument('word', nargs='?', help='word to say')


@with_argparser(argparser)
def do_speak(self, opts)
    """Repeats what you tell me to."""
    arg = opts.word
    if opts.piglatin:
        arg = '%s%say' % (arg[1:], arg[0])
    if opts.shout:
        arg = arg.upper()
    repetitions = opts.repeat or 1
    for i in range(min(repetitions, self.maxrepeats)):
        self.poutput(arg)
```

> **Warning:** It is important that each command which uses the @with_argparser decorator be passed a unique instance of a parser. This limitation is due to bugs in CPython prior to Python 3.7 which make it impossible to make a deep copy of an instance of a argparse.ArgumentParser.
>
> See the table_display example for a work-around that demonstrates how to create a function which returns a unique instance of the parser you want.

Note: The @with_argparser decorator sets the prog variable in the argument parser based on the name of the method it is decorating. This will override anything you specify in prog variable when creating the argument parser.

Help Messages

By default, cmd2 uses the docstring of the command method when a user asks for help on the command. When you use the @with_argparser decorator, the docstring for the do_* method is used to set the description for the argparse.ArgumentParser.

With this code:

```python
import argparse
from cmd2 import with_argparser

argparser = argparse.ArgumentParser()
argparser.add_argument('tag', help='tag')
argparser.add_argument('content', nargs='+', help='content to surround with tag')
@with_argparser(argparser)
def do_tag(self, args):
    """create a html tag"""
    self.stdout.write('<{0}>{1}</{0}>'.format(args.tag, ' '.join(args.content)))
    self.stdout.write('\n')
```

the help tag command displays:

```
usage: tag [-h] tag content [content ...]

create a html tag

positional arguments:
  tag          tag
  content      content to surround with tag

optional arguments:
  -h, --help   show this help message and exit
```

If you would prefer you can set the `description` while instantiating the `argparse.ArgumentParser` and leave the docstring on your method empty:

```python
import argparse
from cmd2 import with_argparser

argparser = argparse.ArgumentParser(description='create an html tag')
argparser.add_argument('tag', help='tag')
argparser.add_argument('content', nargs='+', help='content to surround with tag')
@with_argparser(argparser)
def do_tag(self, args):
    self.stdout.write('<{0}>{1}</{0}>'.format(args.tag, ' '.join(args.content)))
    self.stdout.write('\n')
```

Now when the user enters `help tag` they see:

```
usage: tag [-h] tag content [content ...]

create an html tag

positional arguments:
  tag          tag
  content      content to surround with tag

optional arguments:
  -h, --help   show this help message and exit
```

To add additional text to the end of the generated help message, use the `epilog` variable:

```python
import argparse
from cmd2 import with_argparser

argparser = argparse.ArgumentParser(description='create an html tag',
                                    epilog='This command can not generate tags with␣
→no content, like <br/>.')
argparser.add_argument('tag', help='tag')
argparser.add_argument('content', nargs='+', help='content to surround with tag')
@with_argparser(argparser)
def do_tag(self, args):
    self.stdout.write('<{0}>{1}</{0}>'.format(args.tag, ' '.join(args.content)))
    self.stdout.write('\n')
```

Which yields:

```
usage: tag [-h] tag content [content ...]
```

```
create an html tag

positional arguments:
  tag         tag
  content     content to surround with tag

optional arguments:
  -h, --help  show this help message and exit

This command can not generate tags with no content, like <br/>
```

> **Warning:** If a command **foo** is decorated with one of cmd2's argparse decorators, then **help_foo** will not be
> invoked when `help foo` is called. The argparse module provides a rich API which can be used to tweak every
> aspect of the displayed help and we encourage `cmd2` developers to utilize that.

Receiving an argument list

The default behavior of `cmd2` is to pass the user input directly to your `do_*` methods as a string. The object passed
to your method is actually a `Statement` object, which has additional attributes that may be helpful, including
`arg_list` and `argv`:

```python
class CmdLineApp(cmd2.Cmd):
    """ Example cmd2 application. """

    def do_say(self, statement):
        # statement contains a string
        self.poutput(statement)

    def do_speak(self, statement):
        # statement also has a list of arguments
        # quoted arguments remain quoted
        for arg in statement.arg_list:
            self.poutput(arg)

    def do_articulate(self, statement):
        # statement.argv contains the command
        # and the arguments, which have had quotes
        # stripped
        for arg in statement.argv:
            self.poutput(arg)
```

If you don't want to access the additional attributes on the string passed to you``do_*`` method you can still have
`cmd2` apply shell parsing rules to the user input and pass you a list of arguments instead of a string. Apply the
`@with_argument_list` decorator to those methods that should receive an argument list instead of a string:

```python
from cmd2 import with_argument_list

class CmdLineApp(cmd2.Cmd):
    """ Example cmd2 application. """

    def do_say(self, cmdline):
        # cmdline contains a string
        pass
```

```python
    @with_argument_list
    def do_speak(self, arglist):
        # arglist contains a list of arguments
        pass
```

Unknown positional arguments

If you want all unknown arguments to be passed to your command as a list of strings, then decorate the command method with the `@with_argparser_and_unknown_args` decorator.

Here's what it looks like:

```python
import argparse
from cmd2 import with_argparser_and_unknown_args

dir_parser = argparse.ArgumentParser()
dir_parser.add_argument('-l', '--long', action='store_true', help="display in long
↪format with one item per line")

@with_argparser_and_unknown_args(dir_parser)
def do_dir(self, args, unknown):
    """List contents of current directory."""
    # No arguments for this command
    if unknown:
        self.perror("dir does not take any positional arguments:")
        self.do_help('dir')
        self.last_result = CommandResult('', 'Bad arguments')
        return

    # Get the contents as a list
    contents = os.listdir(self.cwd)

    ...
```

Using custom argparse.Namespace

In some cases, it may be necessary to write custom `argparse` code that is dependent on state data of your application. To support this ability while still allowing use of the decorators, both `@with_argparser` and `@with_argparser_and_unknown_args` have an optional argument called `ns_provider`.

`ns_provider` is a Callable that accepts a `cmd2.Cmd` object as an argument and returns an `argparse.Namespace`:

```
Callable[[cmd2.Cmd], argparse.Namespace]
```

For example:

```python
def settings_ns_provider(self) -> argparse.Namespace:
    """Populate an argparse Namespace with current settings"""
    ns = argparse.Namespace()
    ns.app_settings = self.settings
    return ns
```

To use this function with the argparse decorators, do the following:

```
@with_argparser(my_parser, ns_provider=settings_ns_provider)
```

The Namespace is passed by the decorators to the `argparse` parsing functions which gives your custom code access to the state data it needs for its parsing logic.

Subcommands

Subcommands are supported for commands using either the `@with_argparser` or `@with_argparser_and_unknown_args` decorator. The syntax for supporting them is based on argparse sub-parsers.

You may add multiple layers of subcommands for your command. Cmd2 will automatically traverse and tab-complete subcommands for all commands using argparse.

See the subcommands and tab_autocompletion example to learn more about how to use subcommands in your `cmd2` application.

3.1.2 Clipboard Integration

Nearly every operating system has some notion of a short-term storage area which can be accessed by any program. Usually this is called the clipboard, but sometimes people refer to it as the paste buffer.

`cmd2` integrates with the operating system clipboard using the pyperclip module. Command output can be sent to the clipboard by ending the command with a greater than symbol:

```
mycommand args >
```

Think of it as though you are redirecting output to an unnamed, ephemeral place, you know, like the clipboard. You can also append output to the current contents of the clipboard by ending the command with two greater than symbols:

```
mycommand arg1 arg2 >>
```

Developers

If you would like your `cmd2` based application to be able to use the clipboard in additional or alternative ways, you can use the following methods (which work uniformly on Windows, macOS, and Linux).

This module provides basic ability to copy from and paste to the clipboard/pastebuffer.

`cmd2.clipboard.`**`get_paste_buffer`**`()` → str
> Get the contents of the clipboard / paste buffer.
>
>> **Returns** contents of the clipboard

`cmd2.clipboard.`**`write_to_paste_buffer`**`(txt: str)` → None
> Copy text to the clipboard / paste buffer.
>
>> **Parameters** **`txt`** – text to copy to the clipboard

3.1.3 Commands

`cmd2` is designed to make it easy for you to create new commands. These commmands form the backbone of your application. If you started writing your application using cmd, all the commands you have built will work when you move to `cmd2`. However, there are many more capabilities available in `cmd2` which you can take advantage of to add

---

more robust features to your commands, and which makes your commands easier to write. Before we get to all the good stuff, let's briefly discuss how to create a new command in your application.

Basic Commands

The simplest `cmd2` application looks like this:

```python
#!/usr/bin/env python
"""A simple cmd2 application."""
import cmd2


class App(cmd2.Cmd):
    """A simple cmd2 application."""


if __name__ == '__main__':
    import sys
    c = App()
    sys.exit(c.cmdloop())
```

This application subclasses `cmd2.Cmd` but has no code of it's own, so all functionality (and there's quite a bit) is inherited. Lets create a simple command in this application called `echo` which outputs any arguments given to it. Add this method to the class:

```python
def do_echo(self, line):
    self.poutput(line)
```

When you type input into the `cmd2` prompt, the first space delimited word is treated as the command name. `cmd2` looks for a method called `do_commandname`. If it exists, it calls the method, passing the rest of the user input as the first argument. If it doesn't exist `cmd2` prints an error message. As a result of this behavior, the only thing you have to do to create a new command is to define a new method in the class with the appropriate name. This is exactly how you would create a command using the cmd module which is part of the python standard library.

Note: See *Generating Output* if you are unfamiliar with the `poutput()` method.

Statements

A command is passed one argument: a string which contains all the rest of the user input. However, in `cmd2` this string is actually a `Statement` object, which is a subclass of `str` to retain backwards compatibility.

`cmd2` has a much more sophsticated parsing engine than what's included in the cmd module. This parsing handles:

- quoted arguments
- output redirection and piping
- multi-line commands
- shortcut, macro, and alias expansion

In addition to parsing all of these elements from the user input, `cmd2` also has code to make all of these items work; it's almost transparent to you and to the commands you write in your own application. However, by passing your command the `Statement` object instead of just a plain string, you can get visibility into what `cmd2` has done with the user input before your command got it. You can also avoid writing a bunch of parsing code, because `cmd2` gives you access to what it has already parsed.

A `Statement` object is a subclass of `str` that contains the following attributes:

command Name of the command called. You already know this because of the method `cmd2` called, but it can sometimes be nice to have it in a string, i.e. if you want your error messages to contain the command name.

args A string containing the arguments to the command with output redirection or piping to shell commands removed. It turns out that the "string" value of the `Statement` object has all the output redirection and piping clauses removed as well. Quotes remain in the string.

command_and_args A string of just the command and the arguments, with output redirection or piping to shell commands removed.

argv A list of arguments a-la `sys.argv`, including the command as `argv[0]` and the subsequent arguments as additional items in the list. Quotes around arguments will be stripped as will any output redirection or piping portions of the command.

raw Full input exactly as typed by the user.

terminator Character used to end a multiline command. You can configure multiple termination characters, and this attribute will tell you which one the user typed.

For many simple commands, like the `echo` command above, you can ignore the `Statement` object and all of it's attributes and just use the passed value as a string. You might choose to use the `argv` attribute to do more sophisticated argument processing. Before you go too far down that path, you should check out the *Argument Processing* functionality included with `cmd2`.

Return Values

Most commands should return nothing (either by omitting a `return` statement, or by `return None`. This indicates that your command is finished (with or without errors), and that `cmd2` should prompt the user for more input.

If you return `True` from a command method, that indicates to `cmd2` that it should stop prompting for user input and cleanly exit. `cmd2` already includes a `quit` command, but if you wanted to make another one called `finis` you could:

```python
def do_finis(self, line):
    """Exit the application"""
    return True
```

Exit Codes

`cmd2` has basic infrastructure to support sh/ksh/csh/bash type exit codes. The `cmd2.Cmd` object sets an `exit_code` attribute to zero when it is instantiated. The value of this attribute is returned from the `cmdloop()` call. Therefore, if you don't do anything with this attribute in your code, `cmdloop()` will (almost) always return zero. There are a few built-in `cmd2` commands which set `exit_code` to `-1` if an error occurs.

You can use this capability to easily return your own values to the operating system shell:

```python
#!/usr/bin/env python
"""A simple cmd2 application."""
import cmd2


class App(cmd2.Cmd):
    """A simple cmd2 application."""

    def do_bail(self, line):
```

<div style="text-align: right">(continues on next page)</div>

```
    """Exit the application"""
    self.perror("fatal error, exiting")
    self.exit_code = 2
    return true

if __name__ == '__main__':
    import sys
    c = App()
    sys.exit(c.cmdloop())
```

If the app was run from the *bash* operating system shell, then you would see the following interaction:

```
(Cmd) bail
fatal error, exiting
$ echo $?
2
```

Exception Handling

You may choose to catch and handle any exceptions which occur in a command method. If the command method raises an exception, cmd2 will catch it and display it for you. The *debug setting* controls how the exception is displayed. If *debug* is *false*, which is the default, cmd2 will display the exception name and message. If *debug* is *true*, cmd2 will display a traceback, and then display the exception name and message.

Disabling or Hiding Commands

See *Disabling Commands* for details of how to:

- remove commands included in cmd2
- hide commands from the help menu
- disable and re-enable commands at runtime

3.1.4 Completion

cmd2 adds tab-completion of file system paths for all built-in commands where it makes sense, including:

- edit
- run_pyscript
- run_script
- shell

cmd2 also adds tab-completion of shell commands to the shell command.

Additionally, it is trivial to add identical file system path completion to your own custom commands. Suppose you have defined a custom command foo by implementing the do_foo method. To enable path completion for the foo command, then add a line of code similar to the following to your class which inherits from cmd2.Cmd:

```
complete_foo = self.path_complete
```

This will effectively define the `complete_foo` readline completer method in your class and make it utilize the same path completion logic as the built-in commands.

The built-in logic allows for a few more advanced path completion capabilities, such as cases where you only want to match directories. Suppose you have a custom command `bar` implemented by the `do_bar` method. You can enable path completion of directories only for this command by adding a line of code similar to the following to your class which inherits from `cmd2.Cmd`:

```
# Make sure you have an "import functools" somewhere at the top
complete_bar = functools.partialmethod(cmd2.Cmd.path_complete, path_filter=os.path.
↪isdir)
```

3.1.5 Disabling Commands

`cmd2` allows a developer to:

- remove commands included in `cmd2`
- prevent commands from appearing in the help menu (hide commands)
- disable and re-enable commands at runtime

Remove A Command

When a command has been removed, the command method has been deleted from the object. The command doesn't show up in help, and it can't be executed. This approach is appropriate if you never want a built-in command to be part of your application. Delete the command method in your initialization code:

```python
class RemoveBuiltinCommand(cmd2.Cmd):
    """An app which removes a built-in command from cmd2"""

    def __init__(self):
        super().__init__()
        # To remove built-in commands entirely, delete
        # the "do_*" function from the cmd2.Cmd class
        del cmd2.Cmd.do_edit
```

Hide A Command

When a command is hidden, it won't show up in the help menu, but if the user knows it's there and types the command, it will be executed. You hide a command by adding it to the `hidden_commands` list:

```python
class HiddenCommands(cmd2.Cmd):
    ""An app which demonstrates how to hide a command"""
    def __init__(self):
        super().__init__()
        self.hidden_commands.append('py')
```

As shown above, you would typically do this as part of initializing your application. If you decide you want to unhide a command later in the execution of your application, you can by doing:

```python
self.hidden_commands = [cmd for cmd in self.hidden_commands if cmd != 'py']
```

You might be thinking that the list comprehension is overkill and you'd rather do something like:

```
self.hidden_commands.remove('py')
```

You may be right, but `remove()` will raise a `ValueError` if `py` isn't in the list, and it will only remove the first one if it's in the list multiple times.

Disable A Command

One way to disable a command is to add code to the command method which determines whether the command should be executed or not. If the command should not be executed, your code can print an appropriate error message and return.

`cmd2` also provides another way to accomplish the same thing. Here's a simple app which disables the `open` command if the door is locked:

```python
class DisabledCommands(cmd2.Cmd):
    """An application which disables and enables commands"""

    def do_lock(self, line):
        self.disable_command('open', "you can't open the door because it is locked")
        self.poutput('the door is locked')

    def do_unlock(self, line):
        self.enable_command('open')
        self.poutput('the door is unlocked')

    def do_open(self, line):
        """open the door"""
        self.poutput('opening the door')
```

This method has the added benefit of removing disabled commands from the help menu. But, this method only works if you know in advance that the command should be disabled, and if the conditions for re-enabling it are likewise known in advance.

Disable A Category of Commands

You can group or categorize commands as shown in *Categorizing Commands*. If you do so, you can disable and enable all the commands in a category with a single method call. Say you have created a category of commands called "Server Information". You can disable all commands in that category:

```python
not_connected_msg = 'You must be connected to use this command'
self.disable_category('Server Information', not_connected_msg)
```

Similarly, you can re-enable all the commands in a category:

```python
self.enable_category('Server Information')
```

3.1.6 Embedded Python Shells

The `py` command will run its arguments as a Python command. Entered without arguments, it enters an interactive Python session. The session can call "back" to your application through the name defined in `self.pyscript_name` (defaults to `app`). This wrapper provides access to execute commands in your cmd2 application while maintaining isolation.

You may optionally enable full access to to your application by setting `locals_in_py` to `True`. Enabling this flag adds `self` to the python session, which is a reference to your Cmd2 application. This can be useful for debugging your application. To prevent users from enabling this ability manually you'll need to remove `locals_in_py` from the `settable` dictionary.

The `app` object (or your custom name) provides access to application commands through raw commands. For example, any application command call be called with `app("<command>")`.

```
>>> app('say --piglatin Blah')
lahBay
```

More Python examples:

```
(Cmd) py print("-".join("spelling"))
s-p-e-l-l-i-n-g
(Cmd) py
Python 3.5.3 (default, Jan 19 2017, 14:11:04)
[GCC 6.3.0 20170118] on linux
Type "help", "copyright", "credits" or "license" for more information.
(CmdLineApp)

End with `Ctrl-D` (Unix) / `Ctrl-Z` (Windows), `quit()`, `exit()`.
Non-python commands can be issued with: app("your command")
Run python code from external script files with: run("script.py")

>>> import os
>>> os.uname()
('Linux', 'eee', '2.6.31-19-generic', '#56-Ubuntu SMP Thu Jan 28 01:26:53 UTC 2010',
→'i686')
>>> app("say --piglatin {os}".format(os=os.uname()[0]))
inuxLay
>>> self.prompt
'(Cmd) '
>>> self.prompt = 'Python was here > '
>>> quit()
Python was here >
```

Using the `py` command is tightly integrated with your main `cmd2` application and any variables created or changed will persist for the life of the application:

```
(Cmd) py x = 5
(Cmd) py print(x)
5
```

The `py` command also allows you to run Python scripts via `py run('myscript.py')`. This provides a more complicated and more powerful scripting capability than that provided by the simple text file scripts discussed in *Scripting*. Python scripts can include conditional control flow logic. See the **python_scripting.py** cmd2 application and the **script_conditional.py** script in the `examples` source code directory for an example of how to achieve this in your own applications.

Using `py` to run scripts directly is considered deprecated. The newer `run_pyscript` command is superior for doing this in two primary ways:

- it supports tab-completion of file system paths

- it has the ability to pass command-line arguments to the scripts invoked

There are no disadvantages to using `run_pyscript` as opposed to `py run()`. A simple example of using `run_pyscript` is shown below along with the arg_printer script:

```
(Cmd) run_pyscript examples/scripts/arg_printer.py foo bar baz
Running Python script 'arg_printer.py' which was called with 3 arguments
arg 1: 'foo'
arg 2: 'bar'
arg 3: 'baz'
```

Note: If you want to be able to pass arguments with spaces to commands, then we strongly recommend using one of the decorators, such as `with_argument_list`. cmd2 will pass your **do_*** methods a list of arguments in this case.

When using this decorator, you can then put arguments in quotes like so:

```
$ examples/arg_print.py
(Cmd) lprint foo "bar baz"
lprint was called with the following list of arguments: ['foo', 'bar baz']
```

IPython (optional)

If IPython is installed on the system **and** the `cmd2.Cmd` class is instantiated with `use_ipython=True`, then the optional `ipy` command will be present:

```python
from cmd2 import Cmd
class App(Cmd):
    def __init__(self):
        Cmd.__init__(self, use_ipython=True)
```

The `ipy` command enters an interactive IPython session. Similar to an interactive Python session, this shell can access your application instance via `self` and any changes to your application made via `self` will persist. However, any local or global variable created within the `ipy` shell will not persist. Within the `ipy` shell, you cannot call "back" to your application with `cmd("")`, however you can run commands directly like so:

```
self.onecmd_plus_hooks('help')
```

IPython provides many advantages, including:

- Comprehensive object introspection
- Get help on objects with `?`
- Extensible tab completion, with support by default for completion of python variables and keywords

The object introspection and tab completion make IPython particularly efficient for debugging as well as for interactive experimentation and data analysis.

3.1.7 Generating Output

how to generate output

- poutput
- perror
- paging
- exceptions

- color support

Standard `cmd` applications produce their output with `self.stdout.write('output')` (or with `print`, but `print` decreases output flexibility). `cmd2` applications can use `self.poutput('output')`, `self.pfeedback('message')`, `self.perror('errmsg')`, and `self.ppaged('text')` instead. These methods have these advantages:

- Handle output redirection to file and/or pipe appropriately

- **More concise**

  - `.pfeedback()` destination is controlled by `quiet` parameter.

- Option to display long output using a pager via `ppaged()`

Cmd.**poutput**(*msg: Any*, *, *end: str = '\n'*) → None
> Print message to self.stdout and appends a newline by default

> Also handles BrokenPipeError exceptions for when a commands's output has been piped to another process and that process terminates before the cmd2 command is finished executing.

> **Parameters**
>> - **msg** – message to print (anything convertible to a str with '{}'.format() is OK)
>> - **end** – string appended after the end of the message, default a newline

static Cmd.**perror**(*msg: Any*, *, *end: str = '\n'*, *apply_style: bool = True*) → None
> Print message to sys.stderr

> **Parameters**
>> - **msg** – message to print (anything convertible to a str with '{}'.format() is OK)
>> - **end** – string appended after the end of the message, default a newline
>> - **apply_style** – If True, then ansi.style_error will be applied to the message text. Set to False in cases where the message text already has the desired style. Defaults to True.

Cmd.**pfeedback**(*msg: str*) → None
> For printing nonessential feedback. Can be silenced with *quiet*. Inclusion in redirected output is controlled by *feedback_to_output*.

Cmd.**ppaged**(*msg: str*, *end: str = '\n'*, *chop: bool = False*) → None
> Print output using a pager if it would go off screen and stdout isn't currently being redirected.

> Never uses a pager inside of a script (Python or text) or when output is being redirected or piped or when stdout or stdin are not a fully functional terminal.

> **Parameters**
>> - **msg** – message to print to current stdout (anything convertible to a str with '{}'.format() is OK)
>> - **end** – string appended after the end of the message if not already present, default a newline
>> - **chop** –

>>   **True -> causes lines longer than the screen width to be chopped (truncated) rather than wrapped**

>>>   - truncated text is still accessible by scrolling with the right & left arrow keys
>>>   - chopping is ideal for displaying wide tabular data as is done in utilities like pgcli

>>   **False -> causes lines longer than the screen width to wrap to the next line**

– wrapping is ideal when you want to keep users from having to use horizontal scrolling

WARNING: On Windows, the text always wraps regardless of what the chop argument is set to

Suppressing non-essential output

The `quiet` setting controls whether `self.pfeedback()` actually produces any output. If `quiet` is `False`, then the output will be produced. If `quiet` is `True`, no output will be produced.

This makes `self.pfeedback()` useful for non-essential output like status messages. Users can control whether they would like to see these messages by changing the value of the `quiet` setting.

Output Redirection

As in a Unix shell, output of a command can be redirected:

- sent to a file with >, as in `mycommand args > filename.txt`

- appended to a file with >>, as in `mycommand args >> filename.txt`

- piped (|) as input to operating-system commands, as in `mycommand args | wc`

Note: If you wish to disable cmd2's output redirection and pipes features, you can do so by setting the `allow_redirection` attribute of your `cmd2.Cmd` class instance to `False`. This would be useful, for example, if you want to restrict the ability for an end user to write to disk or interact with shell commands for security reasons:

```
from cmd2 import Cmd
class App(Cmd):
    def __init__(self):
        self.allow_redirection = False
```

cmd2's parser will still treat the >, >>, and | symbols as output redirection and pipe symbols and will strip arguments after them from the command line arguments accordingly. But output from a command will not be redirected to a file or piped to a shell command.

If you need to include any of these redirection characters in your command, you can enclose them in quotation marks, `mycommand 'with > in the argument'`.

Colored Output

The output methods in the previous section all honor the `allow_ansi` setting, which has three possible values:

Never poutput(), pfeedback(), and ppaged() strip all ANSI escape sequences which instruct the terminal to colorize output

Terminal (the default value) poutput(), pfeedback(), and ppaged() do not strip any ANSI escape sequences when the output is a terminal, but if the output is a pipe or a file the escape sequences are stripped. If you want colorized output you must add ANSI escape sequences using either cmd2's internal ansi module or another color library such as *plumbum.colors*, *colorama*, or *colored*.

Always poutput(), pfeedback(), and ppaged() never strip ANSI escape sequences, regardless of the output destination

Colored and otherwise styled output can be generated using the *ansi.style()* function:

ansi.**style**(*, *fg: str = ''*, *bg: str = ''*, *bold: bool = False*, *underline: bool = False*) → str
  Styles a string with ANSI colors and/or styles and returns the new string.

  The styling is self contained which means that at the end of the string reset code(s) are issued to undo whatever styling was done at the beginning.

  Parameters

  • **text** – Any object compatible with str.format()

  • **fg** – foreground color. Relies on *fg_lookup()* to retrieve ANSI escape based on name. Defaults to no color.

  • **bg** – background color. Relies on *bg_lookup()* to retrieve ANSI escape based on name. Defaults to no color.

  • **bold** – apply the bold style if True. Defaults to False.

  • **underline** – apply the underline style if True. Defaults to False.

  Returns the stylized string

3.1.8 Help

use the categorize() function to create help categories

Use help_method() to custom roll your own help messages.

See *Help Messages*

Categorizing Commands

By default, the help command displays:

```
Documented commands (type help <topic>):
========================================
alias   help      ipy    py     run_pyscript   set     shortcuts
edit    history   macro  quit   run_script     shell
```

If you have a large number of commands, you can optionally group your commands into categories. Here's the output from the example help_categories.py:

```
Documented commands (type help <topic>):

Application Management
======================
deploy   findleakers   redeploy   sessions   stop
expire   list          restart    start      undeploy

Command Management
==================
disable_commands   enable_commands

Connecting
==========
connect   which

Server Information
==================
```

```
resources   serverinfo  sslconnectorciphers   status   thread_dump   vminfo

Other
=====
alias    edit   history   py     run_pyscript   set      shortcuts
config   help   macro     quit   run_script     shell    version
```

There are 2 methods of specifying command categories, using the `@with_category` decorator or with the `categorize()` function. Once a single command category is detected, the help output switches to a categorized mode of display. All commands with an explicit category defined default to the category *Other*.

Using the `@with_category` decorator:

```python
@with_category(CMD_CAT_CONNECTING)
def do_which(self, _):
    """Which command"""
    self.poutput('Which')
```

Using the `categorize()` function:

> You can call with a single function:

```python
def do_connect(self, _):
    """Connect command"""
    self.poutput('Connect')

# Tag the above command functions under the category Connecting
categorize(do_connect, CMD_CAT_CONNECTING)
```

> Or with an Iterable container of functions:

```python
def do_undeploy(self, _):
    """Undeploy command"""
    self.poutput('Undeploy')

def do_stop(self, _):
    """Stop command"""
    self.poutput('Stop')

def do_findleakers(self, _):
    """Find Leakers command"""
    self.poutput('Find Leakers')

# Tag the above command functions under the category Application Management
categorize((do_undeploy,
            do_stop,
            do_findleakers), CMD_CAT_APP_MGMT)
```

The `help` command also has a verbose option (`help -v` or `help --verbose`) that combines the help categories with per-command Help Messages:

```
Documented commands (type help <topic>):

Application Management
================================================================================
deploy               Deploy command
expire               Expire command
```

```
findleakers         Find Leakers command
list                List command
redeploy            Redeploy command
restart             usage: restart [-h] {now,later,sometime,whenever}
sessions            Sessions command
start               Start command
stop                Stop command
undeploy            Undeploy command

Connecting
================================================================================
connect             Connect command
which               Which command

Server Information
================================================================================
resources            Resources command
serverinfo           Server Info command
sslconnectorciphers  SSL Connector Ciphers command is an example of a command that
→contains

                     multiple lines of help information for the user. Each line of
→help in a

                     contiguous set of lines will be printed and aligned in the
→verbose output

                     provided with 'help --verbose'
status               Status command
thread_dump          Thread Dump command
vminfo               VM Info command

Other
================================================================================
alias               Define or display aliases
config              Config command
edit                Edit a file in a text editor
help                List available commands with "help" or detailed help with "help
→cmd"
history             usage: history [-h] [-r | -e | -s | -o FILE | -t TRANSCRIPT] [arg]
py                  Invoke python command, shell, or script
quit                Exits this application
run_pyscript        Runs a python script file inside the console
run_script          Runs commands in script file that is encoded as either ASCII or
→UTF-8 text
set                 usage: set [-h] [-a] [-l] [settable [settable ...]]
shell               Execute a command as if at the OS prompt
shortcuts           Lists shortcuts available
unalias             Unsets aliases
version             Version command
```

3.1.9 History

For Developers

- Describe how cmd2 tracks history

- how persistent history works

- differences in history and bash shell history (we only store valid commands in history)

- reference the public code structures we use to store history

cmd2 adds the option of making this history persistent via optional arguments to `cmd2.Cmd.__init__()`:

Cmd.**__init__**(*completekey: str = 'tab', stdin=None, stdout=None, *, persistent_history_file: str = '', persistent_history_length: int = 1000, startup_script: str = '', use_ipython: bool = False, allow_cli_args: bool = True, transcript_files: Optional[List[str]] = None, allow_redirection: bool = True, multiline_commands: Optional[List[str]] = None, terminators: Optional[List[str]] = None, shortcuts: Optional[Dict[str, str]] = None*) → None
> An easy but powerful framework for writing line-oriented command interpreters, extends Python's cmd package.

> **Parameters**

>> - **completekey** – readline name of a completion key, default to Tab

>> - **stdin** – alternate input file object, if not specified, sys.stdin is used

>> - **stdout** – alternate output file object, if not specified, sys.stdout is used

>> - **persistent_history_file** – file path to load a persistent cmd2 command history from

>> - **persistent_history_length** – max number of history items to write to the persistent history file

>> - **startup_script** – file path to a script to execute at startup

>> - **use_ipython** – should the "ipy" command be included for an embedded IPython shell

>> - **allow_cli_args** – if True, then cmd2 will process command line arguments as either commands to be run or, if -t is specified, transcript files to run. This should be set to False if your application parses its own arguments.

>> - **transcript_files** – allow running transcript tests when allow_cli_args is False

>> - **allow_redirection** – should output redirection and pipes be allowed. this is only a security setting and does not alter parsing behavior.

>> - **multiline_commands** – list of commands allowed to accept multi-line input

>> - **terminators** – list of characters that terminate a command. These are mainly intended for terminating multiline commands, but will also terminate single-line commands. If not supplied, then defaults to semicolon. If your app only contains single-line commands and you want terminators to be treated as literals by the parser, then set this to an empty list.

>> - **shortcuts** – dictionary containing shortcuts for commands. If not supplied, then defaults to constants.DEFAULT_SHORTCUTS.

For Users

You can use the up and down arrow keys to move through the history of previously entered commands.

If the `readline` module is installed, you can press `Control-p` to move to the previously entered command, and `Control-n` to move to the next command. You can also search through the command history using `Control-r`.

Eric Johnson hosts a nice readline cheat sheet, or you can dig into the GNU Readline User Manual for all the details, including instructions for customizing the key bindings.

cmd2 makes a third type of history access available with the `history` command. Each time the user enters a command, cmd2 saves the input. The `history` command lets you do interesting things with that saved input. The examples to follow all assume that you have entered the following commands:

```
(Cmd) alias create one !echo one
Alias 'one' created
(Cmd) alias create two !echo two
Alias 'two' created
(Cmd) alias create three !echo three
Alias 'three' created
(Cmd) alias create four !echo four
Alias 'four' created
```

In it's simplest form, the `history` command displays previously entered commands. With no additional arguments, it displays all previously entered commands:

```
(Cmd) history
    1  alias create one !echo one
    2  alias create two !echo two
    3  alias create three !echo three
    4  alias create four !echo four
```

If you give a positive integer as an argument, then it only displays the specified command:

```
(Cmd) history 4
    4  alias create four !echo four
```

If you give a negative integer *N* as an argument, then it display the *Nth* last command. For example, if you give -1 it will display the last command you entered. If you give -2 it will display the next to last command you entered, and so forth:

```
(Cmd) history -2
    3  alias create three !echo three
```

You can use a similar mechanism to display a range of commands. Simply give two command numbers separated by `..` or `:`, and you will see all commands between, and including, those two numbers:

```
(Cmd) history 1:3
    1  alias create one !echo one
    2  alias create two !echo two
    3  alias create three !echo three
```

If you omit the first number, it will start at the beginning. If you omit the last number, it will continue to the end:

```
(Cmd) history :2
    1  alias create one !echo one
    2  alias create two !echo two
(Cmd) history 2:
    2  alias create two !echo two
    3  alias create three !echo three
    4  alias create four !echo four
```

If you want to display the last three commands entered:

```
(Cmd) history -- -3:
    2  alias create two !echo two
    3  alias create three !echo three
    4  alias create four !echo four
```

Notice the double dashes. These are required because the history command uses `argparse` to parse the command line arguments. As described in the argparse documentation , -3: is an option, not an argument:

> If you have positional arguments that must begin with - and don't look like negative numbers, you can insert the pseudo-argument '–' which tells parse_args() that everything after that is a positional argument:

There is no zeroth command, so don't ask for it. If you are a python programmer, you've probably noticed this looks a lot like the slice syntax for lists and arrays. It is, with the exception that the first history command is 1, where the first element in a python array is 0.

Besides selecting previous commands by number, you can also search for them. You can use a simple string search:

```
(Cmd) history two
    2  alias create two !echo two
```

Or a regular expression search by enclosing your regex in slashes:

```
(Cmd) history '/te\ +th/'
    3  alias create three !echo three
```

If your regular expression contains any characters that `argparse` finds interesting, like dash or plus, you also need to enclose your regular expression in quotation marks.

This all sounds great, but doesn't it seem like a bit of overkill to have all these ways to select commands if all we can do is display them? Turns out, displaying history commands is just the beginning. The history command can perform many other actions:

- running previously entered commands

- saving previously entered commands to a text file

- opening previously entered commands in your favorite text editor

- running previously entered commands, saving the commands and their output to a text file

- clearing the history of entered commands

Each of these actions is invoked using a command line option. The `-r` or `--run` option runs one or more previously entered commands. To run command number 1:

```
(Cmd) history --run 1
```

To rerun the last two commands (there's that double dash again to make argparse stop looking for options):

```
(Cmd) history -r -- -2:
```

Say you want to re-run some previously entered commands, but you would really like to make a few changes to them before doing so. When you use the `-e` or `--edit` option, `history` will write the selected commands out to a text file, and open that file with a text editor. You make whatever changes, additions, or deletions, you want. When you leave the text editor, all the commands in the file are executed. To edit and then re-run commands 2-4 you would:

```
(Cmd) history --edit 2:4
```

If you want to save the commands to a text file, but not edit and re-run them, use the `-o` or `--output-file` option. This is a great way to create *Scripts*, which can be executed using the `run_script` command. To save the first 5 commands entered in this session to a text file:

```
(Cmd) history :5 -o history.txt
```

The `history` command can also save both the commands and their output to a text file. This is called a transcript. See *Transcripts* for more information on how transcripts work, and what you can use them for. To create a transcript use the `-t` or `--transcription` option:

```
(Cmd) history 2:3 --transcript transcript.txt
```

The `--transcript` option implies `--run`: the commands must be re-run in order to capture their output to the transcript file.

The last action the history command can perform is to clear the command history using `-c` or `--clear`:

```
(Cmd) history -c
```

In addition to these five actions, the `history` command also has some options to control how the output is formatted. With no arguments, the `history` command displays the command number before each command. This is great when displaying history to the screen because it gives you an easy reference to identify previously entered commands. However, when creating a script or a transcript, the command numbers would prevent the script from loading properly. The `-s` or `--script` option instructs the `history` command to suppress the line numbers. This option is automatically set by the `--output_file`, `--transcript`, and `--edit` options. If you want to output the history commands with line numbers to a file, you can do it with output redirection:

```
(Cmd) history 1:4 > history.txt
```

You might use `-s` or `--script` on it's own if you want to display history commands to the screen without line numbers, so you can copy them to the clipboard:

```
(Cmd) history -s 1:3
```

cmd2 supports both aliases and macros, which allow you to substitute a short, more convenient input string with a longer replacement string. Say we create an alias like this, and then use it:

```
(Cmd) alias create ls shell ls -aF
Alias 'ls' created
(Cmd) ls -d h*
history.txt     htmlcov/
```

By default, the `history` command shows exactly what we typed:

```
(Cmd) history
    1  alias create ls shell ls -aF
    2  ls -d h*
```

There are two ways to modify that display so you can see what aliases and macros were expanded to. The first is to use `-x` or `--expanded`. These options show the expanded command instead of the entered command:

```
(Cmd) history -x
    1  alias create ls shell ls -aF
    2  shell ls -aF -d h*
```

If you want to see both the entered command and the expanded command, use the `-v` or `--verbose` option:

```
(Cmd) history -v
    1  alias create ls shell ls -aF
    2  ls -d h*
    2x shell ls -aF -d h*
```

If the entered command had no expansion, it is displayed as usual. However, if there is some change as the result of expanding macros and aliases, then the entered command is displayed with the number, and the expanded command is displayed with the number followed by an `x`.

3.1.10 Hooks

The typical way of starting a cmd2 application is as follows:

```python
import cmd2
class App(cmd2.Cmd):
    # customized attributes and methods here

if __name__ == '__main__':
    app = App()
    app.cmdloop()
```

There are several pre-existing methods and attributes which you can tweak to control the overall behavior of your application before, during, and after the command processing loop.

Application Lifecycle Hooks

You can register methods to be called at the beginning of the command loop:

```python
class App(cmd2.Cmd):
    def __init__(self, *args, *kwargs):
        super().__init__(*args, **kwargs)
        self.register_preloop_hook(self.myhookmethod)

    def myhookmethod(self):
        self.poutput("before the loop begins")
```

To retain backwards compatibility with *cmd.Cmd*, after all registered preloop hooks have been called, the `preloop()` method is called.

A similar approach allows you to register functions to be called after the command loop has finished:

```python
class App(cmd2.Cmd):
    def __init__(self, *args, *kwargs):
        super().__init__(*args, **kwargs)
        self.register_postloop_hook(self.myhookmethod)

    def myhookmethod(self):
        self.poutput("before the loop begins")
```

To retain backwards compatibility with *cmd.Cmd*, after all registered postloop hooks have been called, the `postloop()` method is called.

Preloop and postloop hook methods are not passed any parameters and any return value is ignored.

Application Lifecycle Attributes

There are numerous attributes of and arguments to `cmd2.Cmd` which have a significant effect on the application behavior upon entering or during the main loop. A partial list of some of the more important ones is presented here:

- **intro**: *str* - if provided this serves as the intro banner printed once at start of application, after `preloop` runs

- **allow_cli_args**: *bool* - if True (default), then searches for -t or –test at command line to invoke transcript testing mode instead of a normal main loop and also processes any commands provided as arguments on the command line just prior to entering the main loop

- **echo**: *bool* - if True, then the command line entered is echoed to the screen (most useful when running scripts)

- **prompt**: *str* - sets the prompt which is displayed, can be dynamically changed based on application state and/or command results

Command Processing Loop

When you call *.cmdloop()*, the following sequence of events are repeated until the application exits:

1. Output the prompt

2. Accept user input

3. Parse user input into *Statement* object

4. Call methods registered with *register_postparsing_hook()*

5. Redirect output, if user asked for it and it's allowed

6. Start timer

7. Call methods registered with *register_precmd_hook()*

8. Call *precmd()* - for backwards compatibility with `cmd.Cmd`

9. Add statement to history

10. Call *do_command* method

11. Call methods registered with *register_postcmd_hook()*

12. Call *postcmd(stop, statement)* - for backwards compatibility with `cmd.Cmd`

13. Stop timer and display the elapsed time

14. Stop redirecting output if it was redirected

15. Call methods registered with *register_cmdfinalization_hook()*

By registering hook methods, steps 4, 8, 12, and 16 allow you to run code during, and control the flow of the command processing loop. Be aware that plugins also utilize these hooks, so there may be code running that is not part of your application. Methods registered for a hook are called in the order they were registered. You can register a function more than once, and it will be called each time it was registered.

Postparsing, precommand, and postcommand hook methods share some common ways to influence the command processing loop.

If a hook raises a `cmd2.EmptyStatement` exception: - no more hooks (except command finalization hooks) of any kind will be called - if the command has not yet been executed, it will not be executed - no error message will be displayed to the user

If a hook raises any other exception: - no more hooks (except command finalization hooks) of any kind will be called - if the command has not yet been executed, it will not be executed - the exception message will be displayed for the user.

Specific types of hook methods have additional options as described below.

Postparsing Hooks

Postparsing hooks are called after the user input has been parsed but before execution of the command. These hooks can be used to:

- modify the user input

- run code before every command executes

- cancel execution of the current command

- exit the application

When postparsing hooks are called, output has not been redirected, nor has the timer for command execution been started.

To define and register a postparsing hook, do the following:

```python
class App(cmd2.Cmd):
    def __init__(self, *args, *kwargs):
        super().__init__(*args, **kwargs)
        self.register_postparsing_hook(self.myhookmethod)

    def myhookmethod(self, params: cmd2.plugin.PostparsingData) -> cmd2.plugin.
→PostparsingData:
        # the statement object created from the user input
        # is available as params.statement
        return params
```

`register_postparsing_hook()` checks the method signature of the passed callable, and raises a `TypeError` if it has the wrong number of parameters. It will also raise a `TypeError` if the passed parameter and return value are not annotated as `PostparsingData`.

The hook method will be passed one parameter, a `PostparsingData` object which we will refer to as `params`. `params` contains two attributes. `params.statement` is a `Statement` object which describes the parsed user input. There are many useful attributes in the `Statement` object, including `.raw` which contains exactly what the user typed. `params.stop` is set to `False` by default.

The hook method must return a `PostparsingData` object, and it is very convenient to just return the object passed into the hook method. The hook method may modify the attributes of the object to influece the behavior of the application. If `params.stop` is set to true, a fatal failure is triggered prior to execution of the command, and the application exits.

To modify the user input, you create a new `Statement` object and return it in `params.statement`. Don't try and directly modify the contents of a `Statement` object, there be dragons. Instead, use the various attributes in a `Statement` object to construct a new string, and then parse that string to create a new `Statement` object.

`cmd2.Cmd()` uses an instance of `cmd2.StatementParser` to parse user input. This instance has been configured with the proper command terminators, multiline commands, and other parsing related settings. This instance is available as the `self.statement_parser` attribute. Here's a simple example which shows the proper technique:

```python
def myhookmethod(self, params: cmd2.plugin.PostparsingData) -> cmd2.plugin.
→PostparsingData:
    if not '|' in params.statement.raw:
        newinput = params.statement.raw + ' | less'
        params.statement = self.statement_parser.parse(newinput)
    return params
```

If a postparsing hook returns a `PostparsingData` object with the `stop` attribute set to `True`:

- no more hooks of any kind (except command finalization hooks) will be called

- the command will not be executed

- no error message will be displayed to the user

- the application will exit

Precommand Hooks

Precommand hooks can modify the user input, but can not request the application terminate. If your hook needs to be able to exit the application, you should implement it as a postparsing hook.

Once output is redirected and the timer started, all the hooks registered with `register_precmd_hook()` are called. Here's how to do it:

```python
class App(cmd2.Cmd):
    def __init__(self, *args, *kwargs):
        super().__init__(*args, **kwargs)
        self.register_precmd_hook(self.myhookmethod)

    def myhookmethod(self, data: cmd2.plugin.PrecommandData) -> cmd2.plugin.
→PrecommandData:
        # the statement object created from the user input
        # is available as data.statement
        return data
```

`register_precmd_hook()` checks the method signature of the passed callable, and raises a `TypeError` if it has the wrong number of parameters. It will also raise a `TypeError` if the parameters and return value are not annotated as `PrecommandData`.

You may choose to modify the user input by creating a new `Statement` with different properties (see above). If you do so, assign your new `Statement` object to `data.statement`.

The precommand hook must return a `PrecommandData` object. You don't have to create this object from scratch, you can just return the one passed into the hook.

After all registered precommand hooks have been called, `self.precmd(statement)` will be called. To retain full backward compatibility with `cmd.Cmd`, this method is passed a `Statement`, not a `PrecommandData` object.

Postcommand Hooks

Once the command method has returned (i.e. the `do_command(self, statement) method` has been called and returns, all postcommand hooks are called. If output was redirected by the user, it is still redirected, and the command timer is still running.

Here's how to define and register a postcommand hook:

```python
class App(cmd2.Cmd):
    def __init__(self, *args, *kwargs):
        super().__init__(*args, **kwargs)
        self.register_postcmd_hook(self.myhookmethod)

    def myhookmethod(self, data: cmd2.plugin.PostcommandData) -> cmd2.plugin.
→PostcommandData:
        return data
```

Your hook will be passed a `PostcommandData` object, which has a `statement` attribute that describes the command which was executed. If your postcommand hook method gets called, you are guaranteed that the command method was called, and that it didn't raise an exception.

If any postcommand hook raises an exception, the exception will be displayed to the user, and no further postcommand hook methods will be called. Command finalization hooks, if any, will be called.

After all registered postcommand hooks have been called, `self.postcmd(statement)` will be called to retain full backward compatibility with `cmd.Cmd`.

If any postcommand hook (registered or `self.postcmd()`) returns a `PostcommandData` object with the stop attribute set to `True`, subsequent postcommand hooks will still be called, as will the command finalization hooks, but once those hooks have all been called, the application will terminate. Likewise, if `self.postcmd()` returns `True`, the command finalization hooks will be called before the application terminates.

Any postcommand hook can change the value of the `stop` parameter before returning it, and the modified value will be passed to the next postcommand hook. The value returned by the final postcommand hook will be passed to the command finalization hooks, which may further modify the value. If your hook blindly returns `False`, a prior hook's requst to exit the application will not be honored. It's best to return the value you were passed unless you have a compelling reason to do otherwise.

Command Finalization Hooks

Command finalization hooks are called even if one of the other types of hooks or the command method raise an exception. Here's how to create and register a command finalization hook:

```python
class App(cmd2.Cmd):
    def __init__(self, *args, *kwargs):
        super().__init__(*args, **kwargs)
        self.register_cmdfinalization_hook(self.myhookmethod)

    def myhookmethod(self, stop, statement):
        return stop
```

Command Finalization hooks must check whether the statement object is `None`. There are certain circumstances where these hooks may be called before the statement has been parsed, so you can't always rely on having a statement.

If any prior postparsing or precommand hook has requested the application to terminate, the value of the `stop` parameter passed to the first command finalization hook will be `True`. Any command finalization hook can change the value of the `stop` parameter before returning it, and the modified value will be passed to the next command finalization hook. The value returned by the final command finalization hook will determine whether the application terminates or not.

This approach to command finalization hooks can be powerful, but it can also cause problems. If your hook blindly returns `False`, a prior hook's requst to exit the application will not be honored. It's best to return the value you were passed unless you have a compelling reason to do otherwise.

If any command finalization hook raises an exception, no more command finalization hooks will be called. If the last hook to return a value returned `True`, then the exception will be rendered, and the application will terminate.

3.1.11 Initialization

Show how to properly initialize a `cmd2` app, showing parameters, sequencing, etc.

3.1.12 Miscellaneous Features

Timer

Turn the timer setting on, and `cmd2` will show the wall time it takes for each command to execute.

Exiting

Mention quit, and EOF handling built into `cmd2`.

Shell Command

cmd2 includes a `shell` command which executes it's arguments in the operating system shell:

```
(Cmd) shell ls -al
```

If you use the default *Shortcuts* defined in `cmd2` you'll get a `!` shortcut for `shell`, which allows you to type:

```
(Cmd) !ls -al
```

Commands At Invocation

You can send commands to your app as you invoke it by including them as extra arguments to the program. `cmd2` interprets each argument as a separate command, so you should enclose each command in quotation marks if it is more than a one-word command.

```
$ python examples/example.py "say hello" "say Gracie" quit
hello
Gracie
```

Note: If you wish to disable cmd2's consumption of command-line arguments, you can do so by setting the `allow_cli_args` argument of your `cmd2.Cmd` class instance to `False`. This would be useful, for example, if you wish to use something like Argparse to parse the overall command line arguments for your application:

```python
from cmd2 import Cmd
class App(Cmd):
    def __init__(self):
        super().__init__(allow_cli_args=False)
```

Initialization Script

You can execute commands from an initialization script by passing a file path to the `startup_script` argument to the `cmd2.Cmd.__init__()` method like so:

```python
class StartupApp(cmd2.Cmd):
    def __init__(self):
        cmd2.Cmd.__init__(self, startup_script='.cmd2rc')
```

This text file should contain a *Command Script*. See the AliasStartup example for a demonstration.

select

Presents numbered options to user, as bash `select`.

`app.select` is called from within a method (not by the user directly; it is `app.select`, not `app.do_select`).

Cmd.**select**(*opts: Union[str, List[str], List[Tuple[Any, Optional[str]]]], prompt: str = 'Your choice? '*) →
    str
    Presents a numbered menu to the user. Modeled after the bash shell's SELECT. Returns the item chosen.

    Argument `opts` can be:

        a single string -> will be split into one-word options

a list of strings -> will be offered as options

a list of tuples -> interpreted as (value, text), so that the return value can differ from the text advertised to the user

```python
def do_eat(self, arg):
    sauce = self.select('sweet salty', 'Sauce? ')
    result = '{food} with {sauce} sauce, yum!'
    result = result.format(food=arg, sauce=sauce)
    self.stdout.write(result + '\n')
```

```
(Cmd) eat wheaties
   1. sweet
   2. salty
Sauce? 2
wheaties with salty sauce, yum!
```

Disabling Commands

cmd2 supports disabling commands during runtime. This is useful if certain commands should only be available when the application is in a specific state. When a command is disabled, it will not show up in the help menu or tab complete. If a user tries to run the command, a command-specific message supplied by the developer will be printed. The following functions support this feature.

enable_command() Enable an individual command

enable_category() Enable an entire category of commands

disable_command() Disable an individual command and set the message that will print when this command is run or help is called on it while disabled

disable_category() Disable an entire category of commands and set the message that will print when anything in this category is run or help is called on it while disabled

See the definitions of these functions for descriptions of their arguments.

See the `do_enable_commands()` and `do_disable_commands()` functions in the HelpCategories example for a demonstration.

Exit code

The `self.exit_code` attribute of your cmd2 application controls what exit code is returned from `cmdloop()` when it completes. It is your job to make sure that this exit code gets sent to the shell when your application exits by calling `sys.exit(app.cmdloop())`.

Default to shell

Every cmd2 application can execute operating-system level (shell) commands with `shell` or a ! shortcut:

```
(Cmd) shell which python
/usr/bin/python
(Cmd) !which python
/usr/bin/python
```

However, if the parameter `default_to_shell` is `True`, then *every* command will be attempted on the operating system. Only if that attempt fails (i.e., produces a nonzero return value) will the application's own `default` method be called.

```
(Cmd) which python
/usr/bin/python
(Cmd) my dog has fleas
sh: my: not found
*** Unknown syntax: my dog has fleas
```

Quit on SIGINT

On many shells, SIGINT (most often triggered by the user pressing Ctrl+C) only cancels the current line, not the entire command loop. By default, a cmd2 application will quit on receiving this signal. However, if quit_on_sigint is set to False, then the current line will simply be cancelled.

```
(Cmd) typing a comma^C
(Cmd)
```

> **Warning:** The default SIGINT behavior will only function properly if **cmdloop** is running in the main thread.

3.1.13 Multiline Commands

Command input may span multiple lines for the commands whose names are listed in the multiline_commands argument to cmd2.Cmd.__init__(). These commands will be executed only after the user has entered a *terminator*. By default, the command terminator is ;; specifying the terminators optional argument to cmd2.Cmd.__init__() allows different terminators. A blank line is *always* considered a command terminator (cannot be overridden).

In multiline commands, output redirection characters like > and | are part of the command arguments unless they appear after the terminator.

3.1.14 Integrating with the OS

- how to redirect output
- executing OS commands from within cmd2
- editors
- paging
- exit codes
- Automation and calling cmd2 from other CLI/CLU tools via commands at invocation and quit

Invoking With Arguments

Typically you would invoke a cmd2 program by typing:

```
$ python mycmd2program.py
```

or:

```
$ mycmd2program.py
```

Either of these methods will launch your program and enter the cmd2 command loop, which allows the user to enter commands, which are then executed by your program.

You may want to execute commands in your program without prompting the user for any input. There are several ways you might accomplish this task. The easiest one is to pipe commands and their arguments into your program via standard input. You don't need to do anything to your program in order to use this technique. Here's a demonstration using the examples/example.py included in the source code of cmd2:

```
$ echo "speak -p some words" | python examples/example.py
omesay ordsway
```

Using this same approach you could create a text file containing the commands you would like to run, one command per line in the file. Say your file was called somecmds.txt. To run the commands in the text file using your cmd2 program (from a Windows command prompt):

```
c:\cmd2> type somecmds.txt | python.exe examples/example.py
omesay ordsway
```

By default, cmd2 programs also look for commands pass as arguments from the operating system shell, and execute those commands before entering the command loop:

```
$ python examples/example.py help

Documented commands (type help <topic>):
========================================
alias  help     macro   orate  quit          run_script  set    shortcuts
edit   history  mumble  py     run_pyscript  say         shell  speak

(Cmd)
```

You may need more control over command line arguments passed from the operating system shell. For example, you might have a command inside your cmd2 program which itself accepts arguments, and maybe even option strings. Say you wanted to run the speak command from the operating system shell, but have it say it in pig latin:

```
$ python example/example.py speak -p hello there
python example.py speak -p hello there
usage: speak [-h] [-p] [-s] [-r REPEAT] words [words ...]
speak: error: the following arguments are required: words
*** Unknown syntax: -p
*** Unknown syntax: hello
*** Unknown syntax: there
(Cmd)
```

Uh-oh, that's not what we wanted. cmd2 treated -p, hello, and there as commands, which don't exist in that program, thus the syntax errors.

There is an easy way around this, which is demonstrated in examples/cmd_as_argument.py. By setting allow_cli_args=False you can so your own argument parsing of the command line:

```
$ python examples/cmd_as_argument.py speak -p hello there
ellohay heretay
```

Check the source code of this example, especially the main() function, to see the technique.

3.1.15 Plugins

3.1.16 Prompt

`cmd2` can issue a prompt before soliciting user input.

Asynchronous Feedback

`cmd2` provides two functions to provide asynchronous feedback to the user without interfering with the command line. This means the feedback is provided to the user when they are still entering text at the prompt. To use this functionality, the application must be running in a terminal that supports VT100 control characters and readline. Linux, Mac, and Windows 10 and greater all support these.

async_alert() Used to display an important message to the user while they are at the prompt in between commands. To the user it appears as if an alert message is printed above the prompt and their current input text and cursor location is left alone.

async_update_prompt() Updates the prompt while the user is still typing at it. This is good for alerting the user to system changes dynamically in between commands. For instance you could alter the color of the prompt to indicate a system status or increase a counter to report an event.

`cmd2` also provides a function to change the title of the terminal window. This feature requires the application be running in a terminal that supports VT100 control characters. Linux, Mac, and Windows 10 and greater all support these.

set_window_title() Sets the terminal window title

The easiest way to understand these functions is to see the AsyncPrinting example for a demonstration.

3.1.17 Scripting

Operating system shells have long had the ability to execute a sequence of commands saved in a text file. These script files make long sequences of commands easier to repeatedly execute. `cmd2` supports two similar mechanisms: command scripts and python scripts.

Command Scripts

A command script contains a sequence of commands typed at the the prompt of a `cmd2` based application. Unlike operating system shell scripts, command scripts can't contain logic or loops.

Creating Command Scripts

Command scripts can be created in several ways:

- creating a text file using any method of your choice
- using the built-in `edit` command to create or edit an existing text file
- saving previously entered commands to a script file using `history -s`. See *History* for more details.

If you create create a text file from scratch, just include one command per line, exactly as you would type it inside a `cmd2` application.

Running Command Scripts

Command script files can be executed using the built-in `run_script` command. Both ASCII and UTF-8 encoded unicode text files are supported.

Comments

Any command line input where the first non-whitespace character is a # will be treated as a comment. This means any # character appearing later in the command will be treated as a literal. The same applies to a # in the middle of a multiline command, even if it is the first character on a line.

Comments are useful in scripts, but would be pointless within an interactive session.

```
(Cmd) # this is a comment
(Cmd) command # this is not a comment
```

Python Scripts

If you require logic flow, loops, branching, or other advanced features, you can write a python script which executes in the context of your `cmd2` app. This script is run using the `run_pyscript` command. See *Embedded Python Shells*.

3.1.18 Settings

- current settings and what they do
- how a developer can add their own
- how to hide built in settings from a user

Built In Settings

`cmd2` has a number of built in settings, which a developer can set a default value, and which users can modify to change the behavior of the application.

Timing

Setting `App.timing` to `True` outputs timing data after every application command is executed. The user can `set` this parameter during application execution. (See *Other user-settable parameters*)

Echo

If `True`, each command the user issues will be repeated to the screen before it is executed. This is particularly useful when running scripts.

Debug

Setting `App.debug` to `True` will produce detailed error stacks whenever the application generates an error. The user can `set` this parameter during application execution. (See *Other user-settable parameters*)

Other user-settable parameters

A list of all user-settable parameters, with brief comments, is viewable from within a running application with:

```
(Cmd) set --long
allow_ansi: Terminal            # Allow ANSI escape sequences in output (valid values:␣
↪Terminal, Always, Never)
continuation_prompt: >          # On 2nd+ line of input
debug: False                    # Show full error stack on error
echo: False                     # Echo command issued into output
editor: vim                     # Program used by ``edit``
feedback_to_output: False       # include nonessentials in `|`, `>` results
locals_in_py: False             # Allow access to your application in py via self
prompt: (Cmd)                   # The prompt issued to solicit input
quiet: False                    # Don't print nonessential feedback
timing: False                   # Report execution times
```

Any of these user-settable parameters can be set while running your app with the `set` command like so:

```
set allow_ansi Never
```

Create New Settings

Your application can define user-settable parameters which your code can reference. First create a class attribute with the default value. Then update the `settable` dictionary with your setting name and a short description before you initialize the superclass. Here's an example, from `examples/environment.py`:

```python
#!/usr/bin/env python
# coding=utf-8
"""
A sample application for cmd2 demonstrating customized environment parameters
"""
import cmd2


class EnvironmentApp(cmd2.Cmd):
    """ Example cmd2 application. """

    degrees_c = 22
    sunny = False

    def __init__(self):
        super().__init__()
        self.settable.update({'degrees_c': 'Temperature in Celsius'})
        self.settable.update({'sunny': 'Is it sunny outside?'})

    def do_sunbathe(self, arg):
        if self.degrees_c < 20:
            result = "It's {} C - are you a penguin?".format(self.degrees_c)
        elif not self.sunny:
            result = 'Too dim.'
        else:
            result = 'UV is bad for your skin.'
        self.poutput(result)

    def _onchange_degrees_c(self, old, new):
```

```python
        # if it's over 40C, it's gotta be sunny, right?
        if new > 40:
            self.sunny = True


if __name__ == '__main__':
    import sys
    c = EnvironmentApp()
    sys.exit(c.cmdloop())
```

If you want to be notified when a setting changes (as we do above), then define a method
`_onchange_{setting}()`. This method will be called after the user changes a setting, and will receive
both the old value and the new value.

```
(Cmd) set --long | grep sunny
sunny: False                    # Is it sunny outside?
(Cmd) set --long | grep degrees
degrees_c: 22                   # Temperature in Celsius
(Cmd) sunbathe
Too dim.
(Cmd) set degrees_c 41
degrees_c - was: 22
now: 41
(Cmd) set sunny
sunny: True
(Cmd) sunbathe
UV is bad for your skin.
(Cmd) set degrees_c 13
degrees_c - was: 41
now: 13
(Cmd) sunbathe
It's 13 C - are you a penguin?
```

3.1.19 Shortcuts, Aliases, and Macros

Shortcuts

Command shortcuts for long command names and common commands can make life more convenient for your users.
Shortcuts are used without a space separating them from their arguments, like `!ls`. By default, the following shortcuts
are defined:

? help

! shell: run as OS-level command

@ run script file

@@ run script file; filename is relative to current script location

To define more shortcuts, update the dict `App.shortcuts` with the {'shortcut': 'command_name'} (omit `do_`):

```python
class App(Cmd2):
    def __init__(self):
        shortcuts = dict(cmd2.DEFAULT_SHORTCUTS)
        shortcuts.update({'*': 'sneeze', '~': 'squirm'})
        cmd2.Cmd.__init__(self, shortcuts=shortcuts)
```

> **Warning:** Shortcuts need to be created by updating the `shortcuts` dictionary attribute prior to calling the `cmd2.Cmd` super class `__init__()` method. Moreover, that super class init method needs to be called after updating the `shortcuts` attribute This warning applies in general to many other attributes which are not settable at runtime.

Note: Command, alias, and macro names cannot start with a shortcut

Aliases

In addition to shortcuts, `cmd2` provides a full alias feature via the `alias` command. Aliases work in a similar fashion to aliases in the Bash shell.

The syntax to create an alias is: `alias create name command [args]`.

> Ex: `alias create ls !ls -lF`

For more details run: `help alias create`

Use `alias list` to see all or some of your aliases. The output of this command displays your aliases using the same command that was used to create them. Therefore you can place this output in a `cmd2` startup script to recreate your aliases each time you start the application

> Ex: `alias list`

For more details run: `help alias list`

Use `alias delete` to remove aliases

For more details run: `help alias delete`

Note: Aliases cannot have the same name as a command or macro

Macros

`cmd2` provides a feature that is similar to aliases called macros. The major difference between macros and aliases is that macros can contain argument placeholders. Arguments are expressed when creating a macro using {#} notation where {1} means the first argument.

The following creates a macro called my_macro that expects two arguments:

> macro create my_macro make_dinner -meat {1} -veggie {2}

When the macro is called, the provided arguments are resolved and the assembled command is run. For example:

> my_macro beef broccoli —> make_dinner -meat beef -veggie broccoli

For more details run: `help macro create`

The macro command has `list` and `delete` subcommands that function identically to the alias subcommands of the same name. Like aliases, macros can be created via a `cmd2` startup script to preserve them across application sessions.

For more details on listing macros run: `help macro list`

For more details on deleting macros run: `help macro delete`

Note: Macros cannot have the same name as a command or alias

3.1.20 Startup Commands

3.1.21 Transcripts

A transcript is both the input and output of a successful session of a `cmd2`-based app which is saved to a text file. With no extra work on your part, your app can play back these transcripts as a unit test. Transcripts can contain regular expressions, which provide the flexibility to match responses from commands that produce dynamic or variable output.

Creating From History

A transcript can automatically generated based upon commands previously executed in the *history* using `history -t`:

```
(Cmd) help
...
(Cmd) help history
...
(Cmd) history 1:2 -t transcript.txt
2 commands and outputs saved to transcript file 'transcript.txt'
```

This is by far the easiest way to generate a transcript.

> **Warning:** Make sure you use the **poutput()** method in your `cmd2` application for generating command output. This method of the `cmd2.Cmd` class ensure that output is properly redirected when redirecting to a file, piping to a shell command, and when generating a transcript.

Creating From A Script File

A transcript can also be automatically generated from a script file using `run_script -t`:

```
(Cmd) run_script scripts/script.txt -t transcript.txt
2 commands and their outputs saved to transcript file 'transcript.txt'
(Cmd)
```

This is a particularly attractive option for automatically regenerating transcripts for regression testing as your `cmd2` application changes.

Creating Manually

Here's a transcript created from `python examples/example.py`:

```
(Cmd) say -r 3 Goodnight, Gracie
Goodnight, Gracie
Goodnight, Gracie
Goodnight, Gracie
(Cmd) mumble maybe we could go to lunch
like maybe we ... could go to hmmm lunch
(Cmd) mumble maybe we could go to lunch
well maybe we could like go to er lunch right?
```

This transcript has three commands: they are on the lines that begin with the prompt. The first command looks like this:

```
(Cmd) say -r 3 Goodnight, Gracie
```

Following each command is the output generated by that command.

The transcript ignores all lines in the file until it reaches the first line that begins with the prompt. You can take advantage of this by using the first lines of the transcript as comments:

```
# Lines at the beginning of the transcript that do not
; start with the prompt i.e. '(Cmd) ' are ignored.
/* You can use them for comments. */

All six of these lines before the first prompt are treated as comments.

(Cmd) say -r 3 Goodnight, Gracie
Goodnight, Gracie
Goodnight, Gracie
Goodnight, Gracie
(Cmd) mumble maybe we could go to lunch
like maybe we ... could go to hmmm lunch
(Cmd) mumble maybe we could go to lunch
maybe we could like go to er lunch right?
```

In this example I've used several different commenting styles, and even bare text. It doesn't matter what you put on those beginning lines. Everything before:

```
(Cmd) say -r 3 Goodnight, Gracie
```

will be ignored.

Regular Expressions

If we used the above transcript as-is, it would likely fail. As you can see, the `mumble` command doesn't always return the same thing: it inserts random words into the input.

Regular expressions can be included in the response portion of a transcript, and are surrounded by slashes:

```
(Cmd) mumble maybe we could go to lunch
/.*\bmaybe\b.*\bcould\b.*\blunch\b.*/
(Cmd) mumble maybe we could go to lunch
/.*\bmaybe\b.*\bcould\b.*\blunch\b.*/
```

Without creating a tutorial on regular expressions, this one matches anything that has the words `maybe`, `could`, and `lunch` in that order. It doesn't ensure that `we` or `go` or `to` appear in the output, but it does work if mumble happens to add words to the beginning or the end of the output.

Since the output could be multiple lines long, `cmd2` uses multiline regular expression matching, and also uses the `DOTALL` flag. These two flags subtly change the behavior of commonly used special characters like `.`, `^` and `$`, so you may want to double check the [Python regular expression documentation](#).

If your output has slashes in it, you will need to escape those slashes so the stuff between them is not interpred as a regular expression. In this transcript:

```
(Cmd) say cd /usr/local/lib/python3.6/site-packages
/usr/local/lib/python3.6/site-packages
```

the output contains slashes. The text between the first slash and the second slash, will be interpreted as a regular expression, and those two slashes will not be included in the comparison. When replayed, this transcript would

---

therefore fail. To fix it, we could either write a regular expression to match the path instead of specifying it verbatim, or we can escape the slashes:

```
(Cmd) say cd /usr/local/lib/python3.6/site-packages
\/usr\/local\/lib\/python3.6\/site-packages
```

> **Warning:** Be aware of trailing spaces and newlines. Your commands might output trailing spaces which are impossible to see. Instead of leaving them invisible, you can add a regular expression to match them, so that you can see where they are when you look at the transcript:
>
> ```
> (Cmd) set prompt
> prompt: (Cmd)/ /
> ```
>
> Some terminal emulators strip trailing space when you copy text from them. This could make the actual data generated by your app different than the text you pasted into the transcript, and it might not be readily obvious why the transcript is not passing. Consider using *Output Redirection* to the clipboard or to a file to ensure you accurately capture the output of your command.
>
> If you aren't using regular expressions, make sure the newlines at the end of your transcript exactly match the output of your commands. A common cause of a failing transcript is an extra or missing newline.
>
> If you are using regular expressions, be aware that depending on how you write your regex, the newlines after the regex may or may not matter. `\Z` matches *after* the newline at the end of the string, whereas `$` matches the end of the string *or* just before a newline.

Running A Transcript

Once you have created a transcript, it's easy to have your application play it back and check the output. From within the `examples/` directory:

```
$ python example.py --test transcript_regex.txt
.
----------------------------------------------------------------------
Ran 1 test in 0.013s

OK
```

The output will look familiar if you use `unittest`, because that's exactly what happens. Each command in the transcript is run, and we `assert` the output matches the expected result from the transcript.

Note: If you have set `allow_cli_args` to False in order to disable parsing of command line arguments at invocation, then the use of `-t` or `--test` to run transcript testing is automatically disabled. In this case, you can alternatively provide a value for the optional `transcript_files` when constructing the instance of your `cmd2.Cmd` derived class in order to cause a transcript test to run:

```
from cmd2 import Cmd
class App(Cmd):
    # customized attributes and methods here

if __name__ == '__main__':
    app = App(transcript_files=['exampleSession.txt'])
    app.cmdloop()
```

Examples

4.1 Examples

4.1.1 Alternate Event Loops

Throughout this documentation we have focused on the **90%** use case, that is the use case we believe around **90+%** of our user base is looking for. This focuses on ease of use and the best out-of-the-box experience where developers get the most functionality for the least amount of effort. We are talking about running cmd2 applications with the `cmdloop()` method:

```python
from cmd2 import Cmd
class App(Cmd):
    # customized attributes and methods here
app = App()
app.cmdloop()
```

However, there are some limitations to this way of using `cmd2`, mainly that `cmd2` owns the inner loop of a program. This can be unnecessarily restrictive and can prevent using libraries which depend on controlling their own event loop.

Many Python concurrency libraries involve or require an event loop which they are in control of such as asyncio, gevent, Twisted, etc.

`cmd2` applications can be executed in a fashion where `cmd2` doesn't own the main loop for the program by using code like the following:

```python
import cmd2


class Cmd2EventBased(cmd2.Cmd):
    def __init__(self):
        cmd2.Cmd.__init__(self)

    # ... your class code here ...

if __name__ == '__main__':
```

(continues on next page)

```
app = Cmd2EventBased()
app.preloop()

# Do this within whatever event loop mechanism you wish to run a single command
cmd_line_text = "help history"
app.runcmds_plus_hooks([cmd_line_text])

app.postloop()
```

The **runcmds_plus_hooks()** method is a convenience method to run multiple commands via **onecmd_plus_hooks()**.

The **onecmd_plus_hooks()** method will do the following to execute a single cmd2 command in a normal fashion:

1. Parse user input into *Statement* object

2. Call methods registered with *register_postparsing_hook()*

3. Redirect output, if user asked for it and it's allowed

4. Start timer

5. Call methods registered with *register_precmd_hook()*

6. Call *precmd()* - for backwards compatibility with cmd.Cmd

7. Add statement to history

8. Call *do_command* method

9. Call methods registered with *register_postcmd_hook()*

10. Call *postcmd(stop, statement)* - for backwards compatibility with cmd.Cmd

11. Stop timer and display the elapsed time

12. Stop redirecting output if it was redirected

13. Call methods registered with *register_cmdfinalization_hook()*

Running in this fashion enables the ability to integrate with an external event loop. However, how to integrate with any specific event loop is beyond the scope of this documentation. Please note that running in this fashion comes with several disadvantages, including:

- Requires the developer to write more code

- Does not support transcript testing

- Does not allow commands at invocation via command-line arguments

Here is a little more info on runcmds_plus_hooks:

Cmd.**runcmds_plus_hooks**(*cmds: List[Union[cmd2.history.HistoryItem, str]], *, add_to_history: bool = True*) → bool
    Used when commands are being run in an automated fashion like text scripts or history replays. The prompt and command line for each command will be printed if echo is True.

> **Parameters**
>
> - **cmds** – commands to run
>
> - **add_to_history** – If True, then add these commands to history. Defaults to True.
>
> **Returns** True if running of commands should stop

API Reference

5.1 API Reference

5.1.1 cmd2.Cmd

class cmd2.cmd2.**Cmd**(*completekey: str = 'tab'*, *stdin=None*, *stdout=None*, ***, *persistent_history_file: str = ''*, *persistent_history_length: int = 1000*, *startup_script: str = ''*, *use_ipython: bool = False*, *allow_cli_args: bool = True*, *transcript_files: Optional[List[str]] = None*, *allow_redirection: bool = True*, *multiline_commands: Optional[List[str]] = None*, *terminators: Optional[List[str]] = None*, *shortcuts: Optional[Dict[str, str]] = None*)

An easy but powerful framework for writing line-oriented command interpreters.

Extends the Python Standard Library's cmd package by adding a lot of useful features to the out of the box configuration.

Line-oriented command interpreters are often useful for test harnesses, internal tools, and rapid prototypes.

aliases

    Read-only property to access the aliases stored in the StatementParser

allow_ansi

    Read-only property needed to support do_set when it reads allow_ansi

async_alert(*alert_msg: str*, *new_prompt: Optional[str] = None*) → None

    Display an important message to the user while they are at the prompt in between commands. To the user it appears as if an alert message is printed above the prompt and their current input text and cursor location is left alone.

    Raises a *RuntimeError* if called while another thread holds *terminal_lock*.

    IMPORTANT: This function will not print an alert unless it can acquire self.terminal_lock to ensure a prompt is onscreen. Therefore it is best to acquire the lock before calling this function to guarantee the alert prints.

    Parameters

- **alert_msg** – the message to display to the user

- **new_prompt** – if you also want to change the prompt that is displayed, then include it here see async_update_prompt() docstring for guidance on updating a prompt

async_update_prompt (*new_prompt: str*) → None

Update the prompt while the user is still typing at it. This is good for alerting the user to system changes dynamically in between commands. For instance you could alter the color of the prompt to indicate a system status or increase a counter to report an event. If you do alter the actual text of the prompt, it is best to keep the prompt the same width as what's on screen. Otherwise the user's input text will be shifted and the update will not be seamless.

Raises a *RuntimeError* if called while another thread holds *terminal_lock*.

IMPORTANT: This function will not update the prompt unless it can acquire self.terminal_lock to ensure a prompt is onscreen. Therefore it is best to acquire the lock before calling this function to guarantee the prompt changes.

If a continuation prompt is currently being displayed while entering a multiline command, the on-screen prompt will not change. However self.prompt will still be updated and display immediately after the multiline line command completes.

Parameters new_prompt – what to change the prompt to

cmd_func (*command: str*) → Optional[Callable]

Get the function for a command :param command: the name of the command

cmdloop (*intro: Optional[str] = None*) → int

This is an outer wrapper around _cmdloop() which deals with extra features provided by cmd2.

_cmdloop() provides the main loop equivalent to cmd.cmdloop(). This is a wrapper around that which deals with the following extra features provided by cmd2: - transcript testing - intro banner - exit code

Parameters intro – if provided this overrides self.intro and serves as the intro banner printed once at start

complete (*text: str*, *state: int*) → Optional[str]

Override of cmd2's complete method which returns the next possible completion for 'text'

This completer function is called by readline as complete(text, state), for state in 0, 1, 2, …, until it returns a non-string value. It should return the next possible completion starting with text.

Since readline suppresses any exception raised in completer functions, they can be difficult to debug. Therefore this function wraps the actual tab completion logic and prints to stderr any exception that occurs before returning control to readline.

Parameters

- **text** – the current word that user is typing

- **state** – non-negative integer

Returns the next possible completion for text or None

complete_help_command (*text: str*, *line: str*, *begidx: int*, *endidx: int*) → List[str]

Completes the command argument of help

complete_help_subcommands (*text: str, line: str, begidx: int, endidx: int, arg_tokens: Dict[str, List[str]]*) → List[str]

Completes the subcommands argument of help

default (*statement: cmd2.parsing.Statement*) → Optional[bool]

Executed when the command given isn't a recognized command implemented by a do_* method.

> **Parameters** **statement** – Statement object with parsed input

delimiter_complete(*text: str, line: str, begidx: int, endidx: int, match_against: Iterable[T_co], delimiter: str*) → List[str]

Performs tab completion against a list but each match is split on a delimiter and only the portion of the match being tab completed is shown as the completion suggestions. This is useful if you match against strings that are hierarchical in nature and have a common delimiter.

An easy way to illustrate this concept is path completion since paths are just directories/files delimited by a slash. If you are tab completing items in /home/user you don't get the following as suggestions:

/home/user/file.txt /home/user/program.c /home/user/maps/ /home/user/cmd2.py

Instead you are shown:

file.txt program.c maps/ cmd2.py

For a large set of data, this can be visually more pleasing and easier to search.

Another example would be strings formatted with the following syntax: company::department::name In this case the delimiter would be :: and the user could easily narrow down what they are looking for if they were only shown suggestions in the category they are at in the string.

> **Parameters**
>
> - **text** – the string prefix we are attempting to match (all matches must begin with it)
> - **line** – the current input line with leading whitespace removed
> - **begidx** – the beginning index of the prefix text
> - **endidx** – the ending index of the prefix text
> - **match_against** – the list being matched against
> - **delimiter** – what delimits each portion of the matches (ex: paths are delimited by a slash)
>
> **Returns** a list of possible tab completions

disable_category(*category: str*, *message_to_print: str*) → None

Disable an entire category of commands.

> **Parameters**
>
> - **category** – the category to disable
> - **message_to_print** – what to print when anything in this category is run or help is called on it while disabled. The variable COMMAND_NAME can be used as a placeholder for the name of the command being disabled. ex: message_to_print = "{} is currently disabled".format(COMMAND_NAME)

disable_command(*command: str*, *message_to_print: str*) → None

Disable a command and overwrite its functions :param command: the command being disabled :param message_to_print: what to print when this command is run or help is called on it while disabled

> The variable COMMAND_NAME can be used as a placeholder for the name of the command being disabled. ex: message_to_print = "{} is currently disabled".format(COMMAND_NAME)

do__relative_run_script(*args: argparse.Namespace*) → Optional[bool]

Run commands in script file that is encoded as either ASCII or UTF-8 text

Script should contain one command per line, just like the command would be typed in the console.

If the -t/–transcript flag is used, this command instead records the output of the script commands to a transcript for testing purposes.

If this is called from within an already-running script, the filename will be interpreted relative to the already-running script's directory.

do_alias(*args: argparse.Namespace*) → None
  Manage aliases

  An alias is a command that enables replacement of a word by another string.

do_edit(*args: argparse.Namespace*) → None
  Edit a file in a text editor

  The editor used is determined by a settable parameter. To set it:

    set editor (program-name)

do_eof(*_: argparse.Namespace*) → bool
  Called when <Ctrl>-D is pressed

do_help(*args: argparse.Namespace*) → None
  List available commands or provide detailed help for a specific command

do_history(*args: argparse.Namespace*) → Optional[bool]
  View, run, edit, save, or clear previously entered commands

do_macro(*args: argparse.Namespace*) → None
  Manage macros

  A macro is similar to an alias, but it can contain argument placeholders.

do_py(*args: argparse.Namespace*) → Optional[bool]
  Invoke Python command or shell

  Note that, when invoking a command directly from the command line, this shell has limited ability to parse Python statements into tokens. In particular, there may be problems with whitespace and quotes depending on their placement.

  If you see strange parsing behavior, it's best to just open the Python shell by providing no arguments to py and run more complex statements there.

do_quit(*_: argparse.Namespace*) → bool
  Exit this application

do_run_pyscript(*args: argparse.Namespace*) → Optional[bool]
  Run a Python script file inside the console

do_run_script(*args: argparse.Namespace*) → Optional[bool]
  Run commands in script file that is encoded as either ASCII or UTF-8 text

  Script should contain one command per line, just like the command would be typed in the console.

  If the -t/–transcript flag is used, this command instead records the output of the script commands to a transcript for testing purposes.

do_set(*args: argparse.Namespace*) → None
  Set a settable parameter or show current settings of parameters

  Accepts abbreviated parameter names so long as there is no ambiguity. Call without arguments for a list of settable parameters with their values.

do_shell(*args: argparse.Namespace*) → None
  Execute a command as if at the OS prompt

do_shortcuts(*_: argparse.Namespace*) → None
  List available shortcuts

enable_category(*category: str*) → None
    Enable an entire category of commands :param category: the category to enable

enable_command(*command: str*) → None
    Enable a command by restoring its functions :param command: the command being enabled

flag_based_complete(*text: str, line: str, begidx: int, endidx: int, flag_dict: Dict[str, Union[Iterable[T_co], Callable]], *, all_else: Union[None, Iterable[T_co], Callable] = None*) → List[str]
    Tab completes based on a particular flag preceding the token being completed.

        Parameters

- **text** – the string prefix we are attempting to match (all matches must begin with it)
- **line** – the current input line with leading whitespace removed
- **begidx** – the beginning index of the prefix text
- **endidx** – the ending index of the prefix text
- **flag_dict** – dictionary whose structure is the following: *keys* - flags (ex: -c, –create) that result in tab completion for the next argument in the command line *values* - there are two types of values: 1. iterable list of strings to match against (dictionaries, lists, etc.) 2. function that performs tab completion (ex: path_complete)
- **all_else** – an optional parameter for tab completing any token that isn't preceded by a flag in flag_dict

        Returns a list of possible tab completions

get_all_commands() → List[str]
    Return a list of all commands

get_help_topics() → List[str]
    Return a list of help topics

get_names()
    Return an alphabetized list of names comprising the attributes of the cmd2 class instance.

get_visible_commands() → List[str]
    Return a list of commands that have not been hidden or disabled

in_pyscript() → bool
    Return whether a pyscript is running

in_script() → bool
    Return whether a text script is running

index_based_complete(*text: str, line: str, begidx: int, endidx: int, index_dict: Mapping[int, Union[Iterable[T_co], Callable]], *, all_else: Union[None, Iterable[T_co], Callable] = None*) → List[str]
    Tab completes based on a fixed position in the input string.

        Parameters

- **text** – the string prefix we are attempting to match (all matches must begin with it)
- **line** – the current input line with leading whitespace removed
- **begidx** – the beginning index of the prefix text
- **endidx** – the ending index of the prefix text

- **index_dict** – dictionary whose structure is the following: *keys* - 0-based token indexes into command line that determine which tokens perform tab completion *values* - there are two types of values: 1. iterable list of strings to match against (dictionaries, lists, etc.) 2. function that performs tab completion (ex: path_complete)

- **all_else** – an optional parameter for tab completing any token that isn't at an index in index_dict

Returns a list of possible tab completions

onecmd (*statement: Union[cmd2.parsing.Statement, str], *, add_to_history: bool = True*) → bool
This executes the actual do_* method for a command.

If the command provided doesn't exist, then it executes default() instead.

Parameters

- **statement** – intended to be a Statement instance parsed command from the input stream, alternative acceptance of a str is present only for backward compatibility with cmd

- **add_to_history** – If True, then add this command to history. Defaults to True.

Returns a flag indicating whether the interpretation of commands should stop

onecmd_plus_hooks (*line: str, *, add_to_history: bool = True, py_bridge_call: bool = False*) → bool
Top-level function called by cmdloop() to handle parsing a line and running the command and all of its hooks.

Parameters

- **line** – command line to run

- **add_to_history** – If True, then add this command to history. Defaults to True.

- **py_bridge_call** – This should only ever be set to True by PyBridge to signify the beginning of an app() call from Python. It is used to enable/disable the storage of the command's stdout.

Returns True if running of commands should stop

parseline (*line: str*) → Tuple[str, str, str]
Parse the line into a command name and a string containing the arguments.

NOTE: This is an override of a parent class method. It is only used by other parent class methods.

Different from the parent class method, this ignores self.identchars.

Parameters **line** – line read by readline

Returns tuple containing (command, args, line)

path_complete (*text: str, line: str, begidx: int, endidx: int, *, path_filter: Optional[Callable[[str], bool]] = None*) → List[str]
Performs completion of local file system paths

Parameters

- **text** – the string prefix we are attempting to match (all matches must begin with it)

- **line** – the current input line with leading whitespace removed

- **begidx** – the beginning index of the prefix text

- **endidx** – the ending index of the prefix text

- **path_filter** – optional filter function that determines if a path belongs in the results this function takes a path as its argument and returns True if the path should be kept in the results

    Returns a list of possible tab completions

static perror(*msg: Any*, ***, *end: str = '\n'*, *apply_style: bool = True*) → None
  Print message to sys.stderr

  Parameters

- **msg** – message to print (anything convertible to a str with '{}'.format() is OK)

- **end** – string appended after the end of the message, default a newline

- **apply_style** – If True, then ansi.style_error will be applied to the message text. Set to False in cases where the message text already has the desired style. Defaults to True.

pexcept(*msg: Any*, ***, *end: str = '\n'*, *apply_style: bool = True*) → None
  Print Exception message to sys.stderr. If debug is true, print exception traceback if one exists.

  Parameters

- **msg** – message or Exception to print

- **end** – string appended after the end of the message, default a newline

- **apply_style** – If True, then ansi.style_error will be applied to the message text. Set to False in cases where the message text already has the desired style. Defaults to True.

pfeedback(*msg: str*) → None
  For printing nonessential feedback. Can be silenced with *quiet*. Inclusion in redirected output is controlled by *feedback_to_output*.

poutput(*msg: Any*, ***, *end: str = '\n'*) → None
  Print message to self.stdout and appends a newline by default

  Also handles BrokenPipeError exceptions for when a commands's output has been piped to another process and that process terminates before the cmd2 command is finished executing.

  Parameters

- **msg** – message to print (anything convertible to a str with '{}'.format() is OK)

- **end** – string appended after the end of the message, default a newline

ppaged(*msg: str*, *end: str = '\n'*, *chop: bool = False*) → None
  Print output using a pager if it would go off screen and stdout isn't currently being redirected.

  Never uses a pager inside of a script (Python or text) or when output is being redirected or piped or when stdout or stdin are not a fully functional terminal.

  Parameters

- **msg** – message to print to current stdout (anything convertible to a str with '{}'.format() is OK)

- **end** – string appended after the end of the message if not already present, default a newline

- **chop** –

    True -> causes lines longer than the screen width to be chopped (truncated) rather than wrapped

    - truncated text is still accessible by scrolling with the right & left arrow keys

    - chopping is ideal for displaying wide tabular data as is done in utilities like pgcli

> **False -> causes lines longer than the screen width to wrap to the next line**

> – wrapping is ideal when you want to keep users from having to use horizontal scrolling

> WARNING: On Windows, the text always wraps regardless of what the chop argument is set to

precmd(*statement: cmd2.parsing.Statement*) → cmd2.parsing.Statement
> Hook method executed just before the command is processed by `onecmd()` and after adding it to the history.

> > **Parameters** **statement** – subclass of str which also contains the parsed input

> > **Returns** a potentially modified version of the input Statement object

pwarning(*msg: Any*, *, *end: str = '\n'*) → None
> Apply the warning style to a message and print it to sys.stderr

> > **Parameters**

> > > • **msg** – message to print (anything convertible to a str with '{}'.format() is OK)

> > > • **end** – string appended after the end of the message, default a newline

register_cmdfinalization_hook(*func: Callable[[cmd2.plugin.CommandFinalizationData], cmd2.plugin.CommandFinalizationData]*) → None
> Register a hook to be called after a command is completed, whether it completes successfully or not.

register_postcmd_hook(*func: Callable[[cmd2.plugin.PostcommandData], cmd2.plugin.PostcommandData]*) → None
> Register a hook to be called after the command function.

register_postloop_hook(*func: Callable[[None], None]*) → None
> Register a function to be called at the end of the command loop.

register_postparsing_hook(*func: Callable[[cmd2.plugin.PostparsingData], cmd2.plugin.PostparsingData]*) → None
> Register a function to be called after parsing user input but before running the command

register_precmd_hook(*func: Callable[[cmd2.plugin.PrecommandData], cmd2.plugin.PrecommandData]*) → None
> Register a hook to be called before the command function.

register_preloop_hook(*func: Callable[[None], None]*) → None
> Register a function to be called at the beginning of the command loop.

runcmds_plus_hooks(*cmds: List[Union[cmd2.history.HistoryItem, str]], *, add_to_history: bool = True*) → bool
> Used when commands are being run in an automated fashion like text scripts or history replays. The prompt and command line for each command will be printed if echo is True.

> > **Parameters**

> > > • **cmds** – commands to run

> > > • **add_to_history** – If True, then add these commands to history. Defaults to True.

> > **Returns** True if running of commands should stop

select(*opts: Union[str, List[str], List[Tuple[Any, Optional[str]]]], prompt: str = 'Your choice? '*) → str
> Presents a numbered menu to the user. Modeled after the bash shell's SELECT. Returns the item chosen.

> Argument `opts` can be:

> > a single string -> will be split into one-word options
> > a list of strings -> will be offered as options

---

a list of tuples -> interpreted as (value, text), so that the return value can differ from the text advertised to the user

set_window_title(*title: str*) → None
    Set the terminal window title.

    Raises a *RuntimeError* if called while another thread holds *terminal_lock*.

    IMPORTANT: This function will not set the title unless it can acquire self.terminal_lock to avoid
        writing to stderr while a command is running. Therefore it is best to acquire the lock before calling this function to guarantee the title changes.

        Parameters **title** – the new window title

shell_cmd_complete(*text: str*, *line: str*, *begidx: int*, *endidx: int*, *, *complete_blank: bool = False*)
                    → List[str]
    Performs completion of executables either in a user's path or a given path

    Parameters

        • **text** – the string prefix we are attempting to match (all matches must begin with it)

        • **line** – the current input line with leading whitespace removed

        • **begidx** – the beginning index of the prefix text

        • **endidx** – the ending index of the prefix text

        • **complete_blank** – If True, then a blank will complete all shell commands in a user's path. If False, then no completion is performed. Defaults to False to match Bash shell behavior.

        Returns a list of possible tab completions

sigint_handler(*signum: int*, *frame*) → None
    Signal handler for SIGINTs which typically come from Ctrl-C events.

    If you need custom SIGINT behavior, then override this function.

        Parameters

            • **signum** – signal number

            • **frame** – required param for signal handlers

tokens_for_completion(*line: str*, *begidx: int*, *endidx: int*) → Tuple[List[str], List[str]]
    Used by tab completion functions to get all tokens through the one being completed.

        Parameters

            • **line** – the current input line with leading whitespace removed

            • **begidx** – the beginning index of the prefix text

            • **endidx** – the ending index of the prefix text

        Returns A 2 item tuple where the items are **On Success** - tokens: list of unquoted tokens - this is generally the list needed for tab completion functions - raw_tokens: list of tokens with any quotes preserved = this can be used to know if a token was quoted or is missing a closing quote Both lists are guaranteed to have at least 1 item. The last item in both lists is the token being tab completed **On Failure** - Two empty lists

visible_prompt
    Read-only property to get the visible prompt with any ANSI escape codes stripped.

Used by transcript testing to make it easier and more reliable when users are doing things like coloring the prompt using ANSI color codes.

> **Returns** prompt stripped of any ANSI escape codes

5.1.2 Decorators

cmd2.cmd2.**with_category**(*category: str*) → Callable
>   A decorator to apply a category to a command function.

cmd2.cmd2.**with_argument_list**(**args*, *preserve_quotes: bool = False*) → Callable[[List[T]], Optional[bool]]
>   A decorator to alter the arguments passed to a do_* cmd2 method. Default passes a string of whatever the user typed. With this decorator, the decorated method will receive a list of arguments parsed from user input.

> **Parameters**
>
> - **args** – Single-element positional argument list containing do_* method this decorator is wrapping
>
> - **preserve_quotes** – if True, then argument quotes will not be stripped

> **Returns** function that gets passed a list of argument strings

cmd2.cmd2.**with_argparser_and_unknown_args**(*argparser: argparse.ArgumentParser, *, ns_provider: Optional[Callable[[...], argparse.Namespace]] = None, preserve_quotes: bool = False*) → Callable[[argparse.Namespace, List[T]], Optional[bool]]
>   A decorator to alter a cmd2 method to populate its `args` argument by parsing arguments with the given instance of argparse.ArgumentParser, but also returning unknown args as a list.

> **Parameters**
>
> - **argparser** – unique instance of ArgumentParser
>
> - **ns_provider** – An optional function that accepts a cmd2.Cmd object as an argument and returns an argparse.Namespace. This is useful if the Namespace needs to be prepopulated with state data that affects parsing.
>
> - **preserve_quotes** – if True, then arguments passed to argparse maintain their quotes

> **Returns** function that gets passed argparse-parsed args in a Namespace and a list of unknown argument strings A member called __statement__ is added to the Namespace to provide command functions access to the Statement object. This can be useful if the command function needs to know the command line.

cmd2.cmd2.**with_argparser**(*argparser: argparse.ArgumentParser, *, ns_provider: Optional[Callable[[...], argparse.Namespace]] = None, preserve_quotes: bool = False*) → Callable[[argparse.Namespace], Optional[bool]]
>   A decorator to alter a cmd2 method to populate its `args` argument by parsing arguments with the given instance of argparse.ArgumentParser.

> **Parameters**
>
> - **argparser** – unique instance of ArgumentParser
>
> - **ns_provider** – An optional function that accepts a cmd2.Cmd object as an argument and returns an argparse.Namespace. This is useful if the Namespace needs to be prepopulated with state data that affects parsing.

- **`preserve_quotes`** – if True, then arguments passed to argparse maintain their quotes

Returns function that gets passed the argparse-parsed args in a Namespace A member called __statement__ is added to the Namespace to provide command functions access to the Statement object. This can be useful if the command function needs to know the command line.

5.1.3 Exceptions

exception `cmd2.cmd2.`**`EmbeddedConsoleExit`**
    Custom exception class for use with the py command.

exception `cmd2.cmd2.`**`EmptyStatement`**
    Custom exception class for handling behavior when the user just presses <Enter>.

5.1.4 Utility Classes

class `cmd2.utils.`**`StdSim`**(*inner_stream*, *echo: bool = False*, *encoding: str = 'utf-8'*, *errors: str = 'replace'*)
    Class to simulate behavior of sys.stdout or sys.stderr. Stores contents in internal buffer and optionally echos to the inner stream it is simulating.

class `cmd2.utils.`**`ByteBuf`**(*std_sim_instance: cmd2.utils.StdSim*)
    Used by StdSim to write binary data and stores the actual bytes written

class `cmd2.utils.`**`ProcReader`**(*proc: subprocess.Popen*, *stdout: Union[cmd2.utils.StdSim, TextIO]*, *stderr: Union[cmd2.utils.StdSim, TextIO]*)
    Used to capture stdout and stderr from a Popen process if any of those were set to subprocess.PIPE. If neither are pipes, then the process will run normally and no output will be captured.

class `cmd2.utils.`**`ContextFlag`**
    A context manager which is also used as a boolean flag value within the default sigint handler.

    Its main use is as a flag to prevent the SIGINT handler in cmd2 from raising a KeyboardInterrupt while a critical code section has set the flag to True. Because signal handling is always done on the main thread, this class is not thread-safe since there is no need.

class `cmd2.utils.`**`RedirectionSavedState`**(*self_stdout: Union[cmd2.utils.StdSim, TextIO]*, *sys_stdout: Union[cmd2.utils.StdSim, TextIO]*, *pipe_proc_reader: Optional[cmd2.utils.ProcReader]*)
    Created by each command to store information about their redirection.

5.1.5 Utility Functions

`cmd2.utils.`**`is_quoted`**(*arg: str*) → bool
    Checks if a string is quoted

        Parameters **`arg`** – the string being checked for quotes

        Returns True if a string is quoted

`cmd2.utils.`**`quote_string_if_needed`**(*arg: str*) → str
    Quote a string if it contains spaces and isn't already quoted

`cmd2.utils.`**`strip_quotes`**(*arg: str*) → str
    Strip outer quotes from a string.

        Applies to both single and double quotes.

> > > **Parameters** `arg` – string to strip outer quotes from
>
> > **Returns** same string with potentially outer quotes stripped

cmd2.cmd2.**categorize**(*func: Union[Callable, Iterable[Callable]], category: str*) → None
    Categorize a function.

> The help command output will group this function under the specified category heading
>
> > **Parameters**
> >
> > > • `func` – function or list of functions to categorize
> > >
> > > • `category` – category to put it in

cmd2.utils.**center_text**(*msg: str, *, pad: str = ' '*) → str
    Centers text horizontally for display within the current terminal, optionally padding both sides.

> > **Parameters**
> >
> > > • `msg` – message to display in the center
> > >
> > > • `pad` – if provided, the first character will be used to pad both sides of the message
> >
> > **Returns** centered message, optionally padded on both sides with pad_char

cmd2.utils.**strip_quotes**(*arg: str*) → str
    Strip outer quotes from a string.

> Applies to both single and double quotes.
>
> > **Parameters** `arg` – string to strip outer quotes from
>
> > **Returns** same string with potentially outer quotes stripped

cmd2.utils.**namedtuple_with_defaults**(*typename: str, field_names: Union[str, List[str]], default_values: collections.abc.Iterable = ()*)
    Convenience function for defining a namedtuple with default values

> From: https://stackoverflow.com/questions/11351032/namedtuple-and-default-values-for-optional-keyword-arguments

Examples:

```
>>> Node = namedtuple_with_defaults('Node', 'val left right')
>>> Node()
Node(val=None, left=None, right=None)
>>> Node = namedtuple_with_defaults('Node', 'val left right', [1, 2, 3])
>>> Node()
Node(val=1, left=2, right=3)
>>> Node = namedtuple_with_defaults('Node', 'val left right', {'right':7})
>>> Node()
Node(val=None, left=None, right=7)
>>> Node(4)
Node(val=4, left=None, right=7)
```

cmd2.utils.**cast**(*current: Any, new: str*) → Any
    Tries to force a new value into the same type as the current when trying to set the value for a parameter.

> > **Parameters**
> >
> > > • `current` – current value for the parameter, type varies
> > >
> > > • `new` – new value
> >
> > **Returns** new value with same type as current, or the current value if there was an error casting

cmd2.utils.**which**(*editor: str*) → Optional[str]

> Find the full path of a given editor.
>
> Return the full path of the given editor, or None if the editor can not be found.
>
> > **Parameters** **editor** – filename of the editor to check, ie 'notepad.exe' or 'vi'
> >
> > **Returns** a full path or None

cmd2.utils.**is_text_file**(*file_path: str*) → bool

> Returns if a file contains only ASCII or UTF-8 encoded text.
>
> > **Parameters** **file_path** – path to the file being checked
> >
> > **Returns** True if the file is a text file, False if it is binary.

cmd2.utils.**remove_duplicates**(*list_to_prune: List[T]*) → List[T]

> Removes duplicates from a list while preserving order of the items.
>
> > **Parameters** **list_to_prune** – the list being pruned of duplicates
> >
> > **Returns** The pruned list

cmd2.utils.**norm_fold**(*astr: str*) → str

> Normalize and casefold Unicode strings for saner comparisons.
>
> > **Parameters** **astr** – input unicode string
> >
> > **Returns** a normalized and case-folded version of the input string

cmd2.utils.**try_int_or_force_to_lower_case**(*input_str: str*) → Union[int, str]

> Tries to convert the passed-in string to an integer. If that fails, it converts it to lower case using norm_fold.
> :param input_str: string to convert :return: the string as an integer or a lower case version of the string

cmd2.utils.**alphabetical_sort**(*list_to_sort: Iterable[str]*) → List[str]

> Sorts a list of strings alphabetically.
>
> For example: ['a1', 'A11', 'A2', 'a22', 'a3']
>
> To sort a list in place, don't call this method, which makes a copy. Instead, do this:
>
> my_list.sort(key=norm_fold)
>
> > **Parameters** **list_to_sort** – the list being sorted
> >
> > **Returns** the sorted list

cmd2.utils.**unquote_specific_tokens**(*args: List[str], tokens_to_unquote: List[str]*) → None

> Unquote a specific tokens in a list of command-line arguments This is used when certain tokens have to be passed to another command :param args: the command line args :param tokens_to_unquote: the tokens, which if present in args, to unquote

cmd2.utils.**natural_sort**(*list_to_sort: Iterable[str]*) → List[str]

> Sorts a list of strings case insensitively as well as numerically.
>
> For example: ['a1', 'A2', 'a3', 'A11', 'a22']
>
> To sort a list in place, don't call this method, which makes a copy. Instead, do this:
>
> my_list.sort(key=natural_keys)
>
> > **Parameters** **list_to_sort** – the list being sorted
> >
> > **Returns** the list sorted naturally

`cmd2.utils.`**`natural_keys`**(*input_str: str*) → List[Union[int, str]]
> Converts a string into a list of integers and strings to support natural sorting (see natural_sort).
>
> For example: natural_keys('abc123def') -> ['abc', '123', 'def'] :param input_str: string to convert :return: list of strings and integers

`cmd2.utils.`**`expand_user_in_tokens`**(*tokens: List[str]*) → None
> Call expand_user() on all tokens in a list of strings :param tokens: tokens to expand

`cmd2.utils.`**`expand_user`**(*token: str*) → str
> Wrap os.expanduser() to support expanding ~ in quoted strings :param token: the string to expand

`cmd2.utils.`**`find_editor`**() → str
> Find a reasonable editor to use by default for the system that the cmd2 application is running on.

`cmd2.utils.`**`get_exes_in_path`**(*starts_with: str*) → List[str]
> Returns names of executables in a user's path
>
> > **Parameters** **`starts_with`** – what the exes should start with. leave blank for all exes in path.
> >
> > **Returns** a list of matching exe names

`cmd2.utils.`**`files_from_glob_patterns`**(*patterns: List[str], access=0*) → List[str]
> Return a list of file paths based on a list of glob patterns.
>
> Only files are returned, not directories, and optionally only files for which the user has a specified access to.
>
> > **Parameters**
> >
> > - **`patterns`** – list of file names and/or glob patterns
> > - **`access`** – file access type to verify (os.* where * is F_OK, R_OK, W_OK, or X_OK)
> >
> > **Returns** list of files matching the names and/or glob patterns

`cmd2.utils.`**`files_from_glob_pattern`**(*pattern: str, access=0*) → List[str]
> Return a list of file paths based on a glob pattern.
>
> Only files are returned, not directories, and optionally only files for which the user has a specified access to.
>
> > **Parameters**
> >
> > - **`pattern`** – file name or glob pattern
> > - **`access`** – file access type to verify (os.* where * is F_OK, R_OK, W_OK, or X_OK)
> >
> > **Returns** list of files matching the name or glob pattern

Meta

Documentation Conventions

6.1 Documentation Conventions

6.1.1 Guiding Principles

Follow the Documentation Principles described by Write The Docs

In addition:

- We have gone to great lengths to retain compatibility with the standard library cmd, the documentation should make it easy for developers to understand how to move from cmd to cmd2, and what benefits that will provide

- We should provide both descriptive and reference documentation.

- API reference documentation should be generated from docstrings in the code

- Documentation should include rich hyperlinking to other areas of the documentation, and to the API reference

6.1.2 Naming Files

- all lower case file names

- if the name has multiple words, separate them with an underscore

- all documentation file names end in '.rst'

6.1.3 Heirarchy of headings

show the heirarchy of sphinx headings we use, and the conventions (underline only, no overline)

Use '=', then '-', then '~'. If your document needs more levels than that, break it into separate documents.

You only have to worry about the heirarchy of headings within a single file. Sphinx handles the intra-file heirarchy magically on it's own.

Use two blank lines before every heading unless it's the first heading in the file. Use one blank line after every heading

6.1.4 Code

This documentation declares python as the default Sphinx domain. Python code or interactive python sessions can be presented by either:

- finishing the preceding paragraph with a `::` and indenting the code
- use the `.. code-block::` directive

If you want to show other code, like shell commands, then use `.. code-block:  shell`.

6.1.5 Table of Contents and Captions

6.1.6 Hyperlinks

If you want to use an external hyperlink target, define the target at the top of the page, not the bottom.

We use the Sphinx autosectionlabel extension. This allows you to reference any header in any document by:

```
See :ref:`features/argument_processing:Help Messages`
```

or

```
See :ref:`custom title<features/argument_processing:Help Messages>`
```

Which render like

See *Help Messages*

and

See *custom title*

[TODO what's the right way to link to source code? Can we make it link to the tag that the documentation is rendered from?]

6.1.7 Autolinking

6.1.8 Referencing cmd2 API documentation

6.1.9 Info and Warning Callouts

6.1.10 Wrapping

Hard wrap all text with line lengths no greater than 79 characters. It makes everything easier when editing documentation, and has no impact on reading documentation because we render to html.

6.1.11 Referencing cmd2

Whenever you reference `cmd2` in the documentation, enclose it in double backticks. This indicates an inline literal in restructured text, and makes it stand out when rendered as html.

6.1.12 Style Checker

Use doc8 to check the style of the documentation. This tool can be invoked using the proper options by typing:

```
$ invoke doc8
```

6.2 Copyright

The `cmd2` documentation is Copyright 2010-2019 by the cmd2 contributors and is licensed under a Creative Commons Attribution 4.0 International License.

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