



Wing Tutorial

This tutorial introduces Wing Pro by taking you through its feature set with a small coding example. For a faster introduction, see the [Quick Start Guide](#).

If you are new to programming, you may want to check out the book [Python Programming Fundamentals](#) and accompanying screen casts, which use Wing 101 to teach programming with Python.

Our [How-Tos](#) show how to use Wing with 3rd party GUI toolkits, web development frameworks, Python-based modeling, rendering & compositing systems, and other Python frameworks and toolkits.

To get started, press the `Next` (down arrow) icon in the toolbar immediately above this page: 

Tutorial: Getting Started

To get started, you need to:

(1) Install Python and Wing

If you don't already have them on your system, install [Python](#) and [Wing](#). For detailed instructions, see [Installing Wing](#).

(2) Start Wing

Wing can be started from a menu, desktop, or tray icon or using the command line executable. For detailed instructions, see [Running the IDE](#).

If you don't have a license, you can obtain a 30-day trial the first time you start Wing.

Once Wing is running, you should switch to using the `Tutorial` listed in Wing's `Help` menu because it contains links directly into the IDE's functionality (this includes step (3) below).

(3) Copy the Tutorial Directory

Next, copy the entire `tutorial` directory out of the top level of your Wing IDE installation to a location where you will have write access to the files in it. You can do this manually or use the following link, which will prompt you to select the target directory into which to copy the tutorial: `Copy Tutorial Now`

Note

We welcome feedback, which can be submitted with `Submit Feedback` in Wing's `Help` menu or by emailing [support at wingware.com](mailto:support@wingware.com)

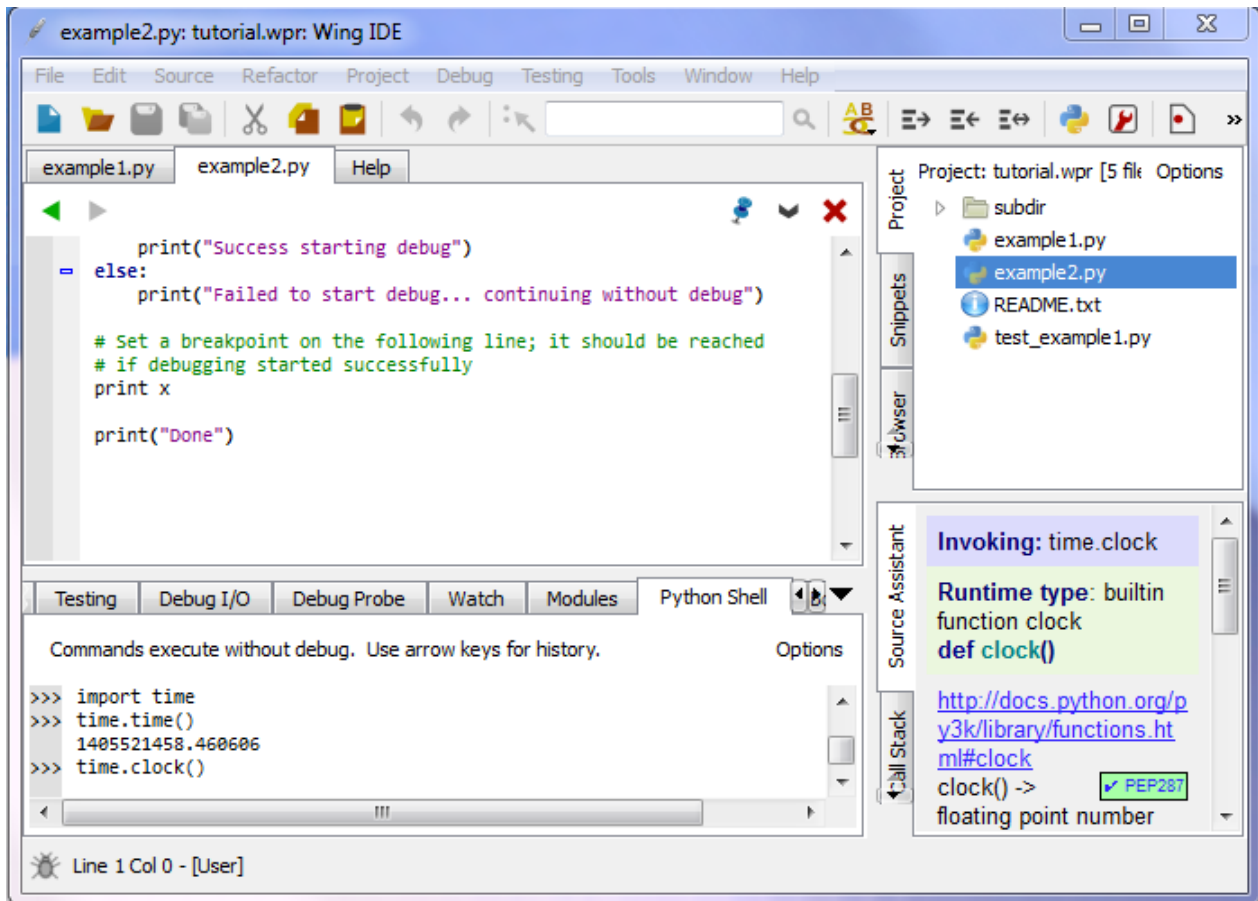
To get to the next page in the tutorial, use the `Next Page` icon shown in the toolbar just above this text:



Tutorial: Getting Around Wing

Let's start with some basics that will help you get around Wing while working with this tutorial.

Wing's user interface is divided into an editor area and two toolboxes separated by draggable dividers. Try pressing F1 and F2 now to show or hide the two toolboxes. Also try Shift-F2 to maximize the editor area temporarily, hiding both tool areas and toolbar until Shift-F2 is pressed again.



Tool and editor tabs can be dragged to rearrange the user interface, optionally creating a new split. Right click on the tabs for a menu of additional options, such as adding or removing splits or to move the toolbox from right to left. The number of splits shown by default in toolboxes will vary according to the size of your monitor.

Notice that you can click on an already-active tool tab to minimize that tool area. Click again on any tab to restore the toolbox to its previous size.

By default, the editor shows all open files in all splits, making it easy to work on different parts of a file simultaneously. This can be changed by unchecking Show All Files in All Splits in the right-click context menu on the editor tabs.

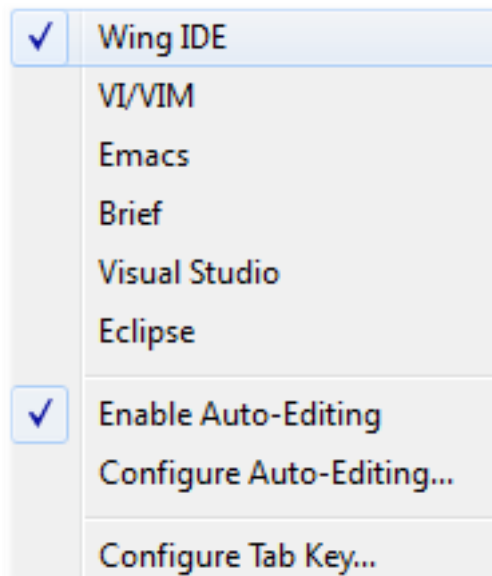
❗ Splitting your editor area makes it easier to get around this tutorial. To do this now, right click on the editor tab area and select **Split Side by Side**. On small monitors and laptops, it may be preferable to create a new window for the tutorial by right clicking on its tab and selected **Move Wing Help to New Window**.

Context Menus

In general, right-clicking provides a menu for interacting with or configuring a part of the user interface. The text that follows refers to these menus as "context menus".

Configuring the Keyboard

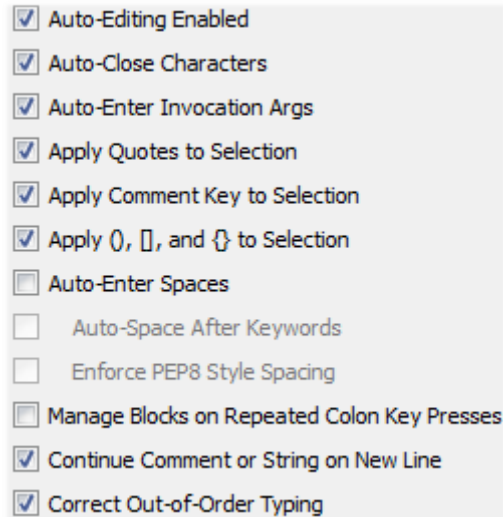
Use the `Edit > Keyboard Personality` menu or `User Interface > Keyboard > Personality` preference to tell Wing to emulate another editor, such as Visual Studio, VI/Vim, Emacs, Eclipse, or Brief.



The `Configure Tab Key` item in the `Edit > Keyboard Personality` menu or the `User Interface > Keyboard > Tab Key Action` preference can be used to select among available behaviors for the tab key. The default is to match the selected Keyboard Personality. When the Keyboard Personality is set to Wing, the tab key acts differently according to context. For example, if lines are selected, repeated presses of the tab key moves the lines among syntactically valid indent positions. And, when the caret is at the end of a line, pressing the tab key adds one indent level.

Auto-Editing

Wing Pro implements a variety of auto-editing operations, which are designed to speed up typing and reduce common errors. A subset of the available operations that does not require learning different keystrokes is enabled by default. For example, when `(` is typed Wing will enter the closing `)` automatically. If the closing `)` is pressed anyway, Wing just skips over it. Auto-editing can be disabled as a whole using the `Editor > Auto-Editing > Enable Auto-Editing` preference or individual operations can be selected.



This topic will be covered in more detail later in the tutorial.

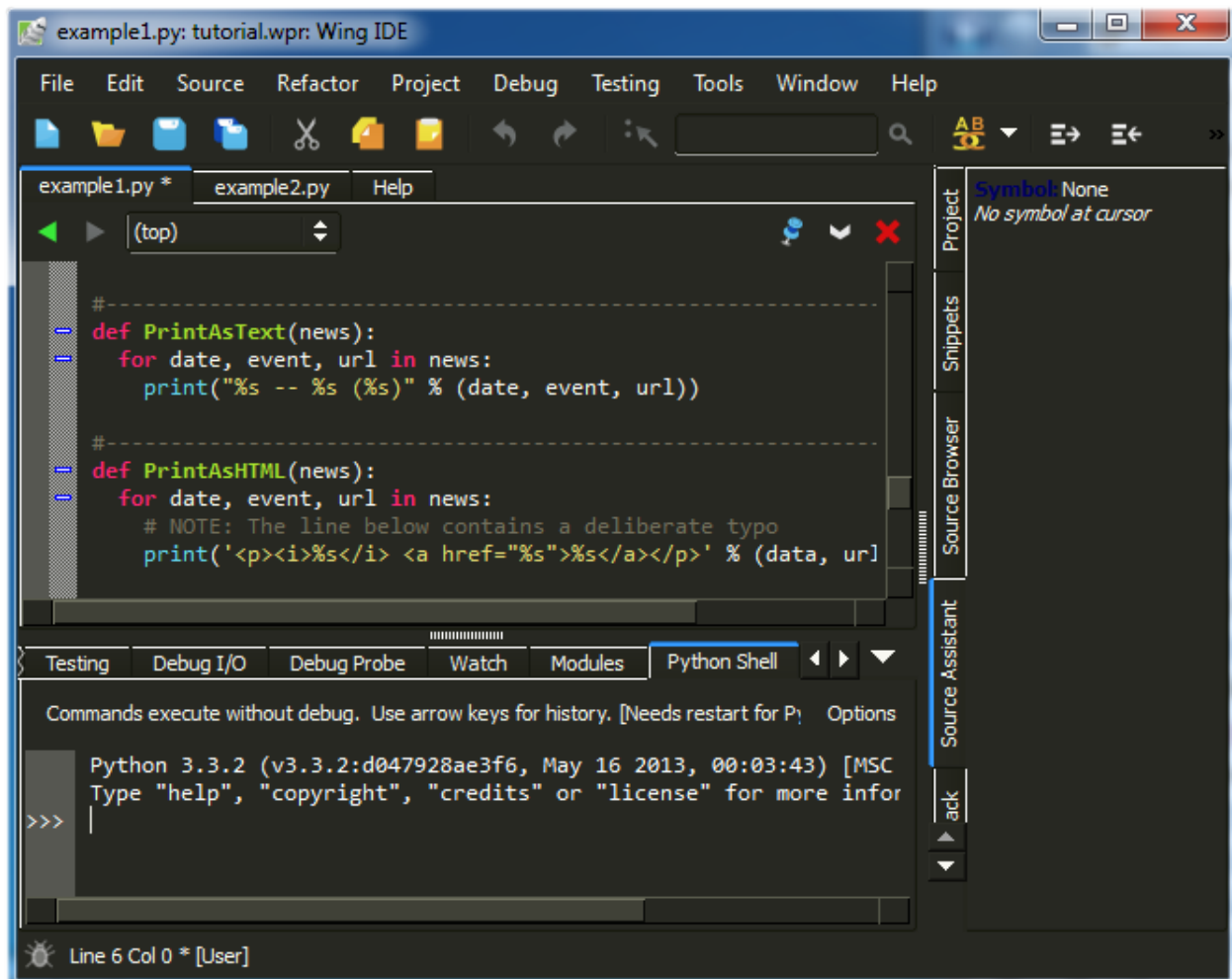
Auto-Completion

There are many options for Wing's auto-completer. These are set in the `Editor > Auto-completion` preferences group. For example, if you are used to using the `Enter` key for completion, you may wish to add that now to the `Editor > Auto-completion > Completion Keys` preference.

Other Configuration Options

Wing's cross-platform GUI adjusts to the OS on which you are running it (except on Linux where it cannot use the system-provided UI). You can set the colors used in the editor with the `User Interface > Editor Color Palette` preference. To apply this palette also to the rest of the UI (outside of editors), enable the `Use Editor Palette Throughout the UI` preference.

To set a dark background display style select one of `One Dark`, `Monikai`, `Black Background`, or `Solarized - Dark` as the `Editor Color Palette`.



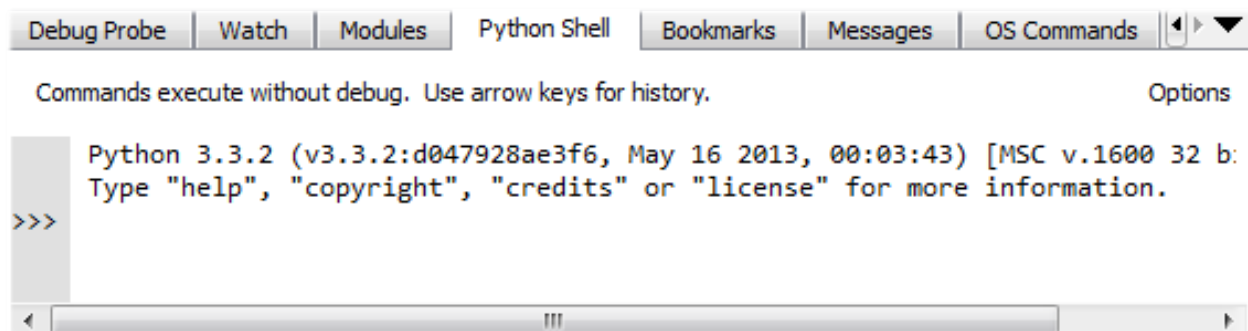
The User Interface > Fonts > Display Font/Size and User Interface > Fonts > Editor Font/Size preferences select fonts for the user interface and editor.

The size and type of tools used in the toolbar at the top of Wing's main window can be changed by right clicking on one of the enabled tools.

For more information on adjusting the user interface to your needs, see the [Customization](#) chapter of the manual.

Tutorial: Check your Python Integration

Before starting with some code, let's make sure that Wing has succeeded in finding your Python installation. Bring up the `Python Shell` tool now from the `Tools` menu. If all goes well, it should start up Python and show you the Python command prompt like this:



If this is not working, or the wrong version of Python is being used, you can point Wing in the right direction with the `Python Executable` setting in `Project Properties`, available from the toolbar and `Project` menu.

An easy way to determine the path to use here is to start the Python you wish to use with Wing and type the following at Python's `>>>` prompt:

```
import sys
sys.executable
```

This can also be typed into the IDLE that is associated with your Python install, if IDLE is installed. On OS X this is generally the easiest way to find the correct executable to use.

You will need to `Restart Shell` from `Options` in the `Python Shell` tool after altering `Python Executable`.

Once the shell works, copy/paste or drag and drop these lines of Python code into it:

```
for i in range(0, 10):
    print('*' * i)
```

This should print a triangle as follows:

```
>>> for i in range(0, 10):
...     print('*' * i)
...
*
**
***
****
*****
*****
*****
*****
*****
*****
>>>
```

Notice that the shell removes common leading white space when blocks of code are copied into it. This is useful when trying out code from source files.

Now type something in the shell, such as:

```
import sys
sys.getrefcount(i)
```

Note that Wing offers auto-completion as you type and (in Wing Pro and Wing Personal) shows call signature and documentation information in the `Source Assistant`. Use the `Tab` key to enter a selected completion. Other keys can be set up as completing keys using the `Editor > Auto-completion > Completion Keys` preference.

You can create as many instances of the Python Shell tool as you wish. Each one runs in its own private process space that is kept totally separate from Wing and your debug process.

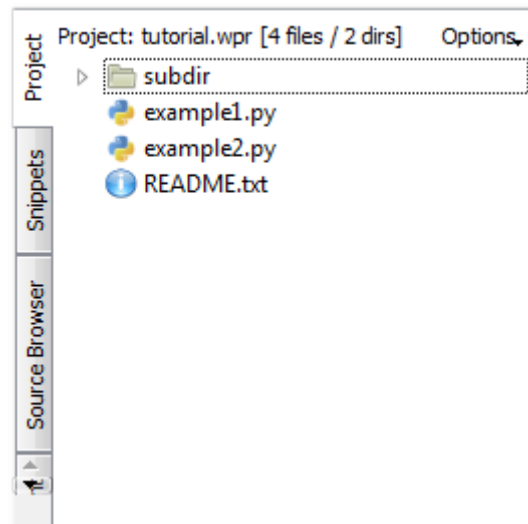
Tutorial: Set Up a Project

Now we're ready to get started with some coding. The first step in working with Wing is to set up a project file so that Wing can find and analyze your source code and store your work across sessions.

If you haven't already copied the `tutorials` directory from your Wing installation, please do so now as described in [Tutorial: Getting Started](#).

Wing starts up initially with the Default Project. Start by creating a new project for your work on this tutorial, using `Save Project As` in the `Project` menu. Use `tutorial.wpr` as the project file name and place it in the `tutorial` directory that you created earlier.

Next, use the `Add Existing Directory` item in the `Project` menu to add your copy of the `tutorials` directory. Leave the default options checked so that all files in that directory are added to the project.

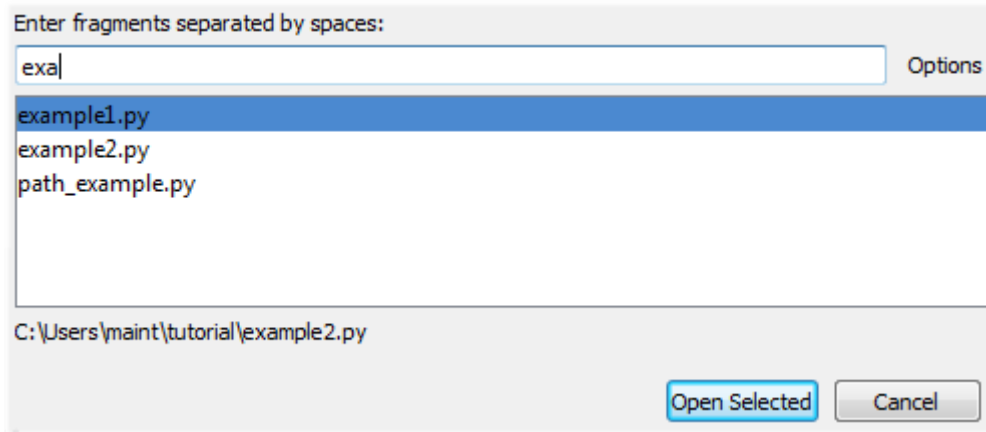


To make it easier to work on source code and read this tutorial at the same time, you may want to right-click on the editor tab area and select `Split Side by Side`.

Opening Files

Files in your project can be opened by double-clicking in the `Project` tool, by typing fragments into the `Open From Project` dialog, and in other ways that will be described later.

Try the `Open From Project` dialog now by using the key binding listed for it in the `File` menu. Type `ex` as the file name fragment and use the arrow keys and then `Enter` to open the file `example1.py`. Now try it again with the fragment `sub ex`. This matches only files with both `sub` and `ex` in their full path names. In larger projects, `Open From Project` is usually the easiest way to open a file.



Transient, Sticky, and Locked Files

Wing opens files in one of several modes in order to keep more relevant files open, while auto-closing others. To see this in action, right-click on `os` in `import os` at the top of `example1.py` and select `Goto Definition`. The file `os.py` will be opened non-sticky, so that it is automatically closed when hidden.

The mode in which a file is opened is indicated with an icon in the top right of the editor area:



- The file is sticky and will be kept open until it is closed by the user.

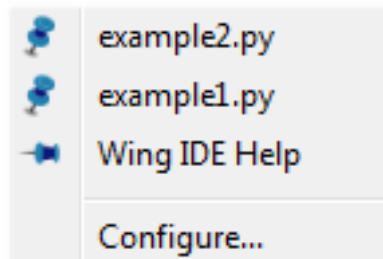


- The file is non-sticky and will be kept open only while visible. When a non-sticky file is edited, it immediately converts to sticky.



- The file is locked in the editor, so that the editor will not be reused to display other newly opened files. This mode is only available when multiple editor splits are present.

Clicking on the stick pin icon toggles between the available modes. Right-clicking on the icon displays a menu of recently visited files. Note that this contains both non-sticky and sticky files, while the `Recent` list in the `File` menu contains only sticky files.



The number of non-sticky editors to keep open, in addition to those that are visible, is set with the `Editor > Advanced > Maximum Non-Sticky Editors` preference.

This mechanism is also used in multi-file searches and other features that navigate through many files. In general you can ignore the modes and Wing will keep open the files you are actually working on, while auto-closing those that you have only visited briefly.

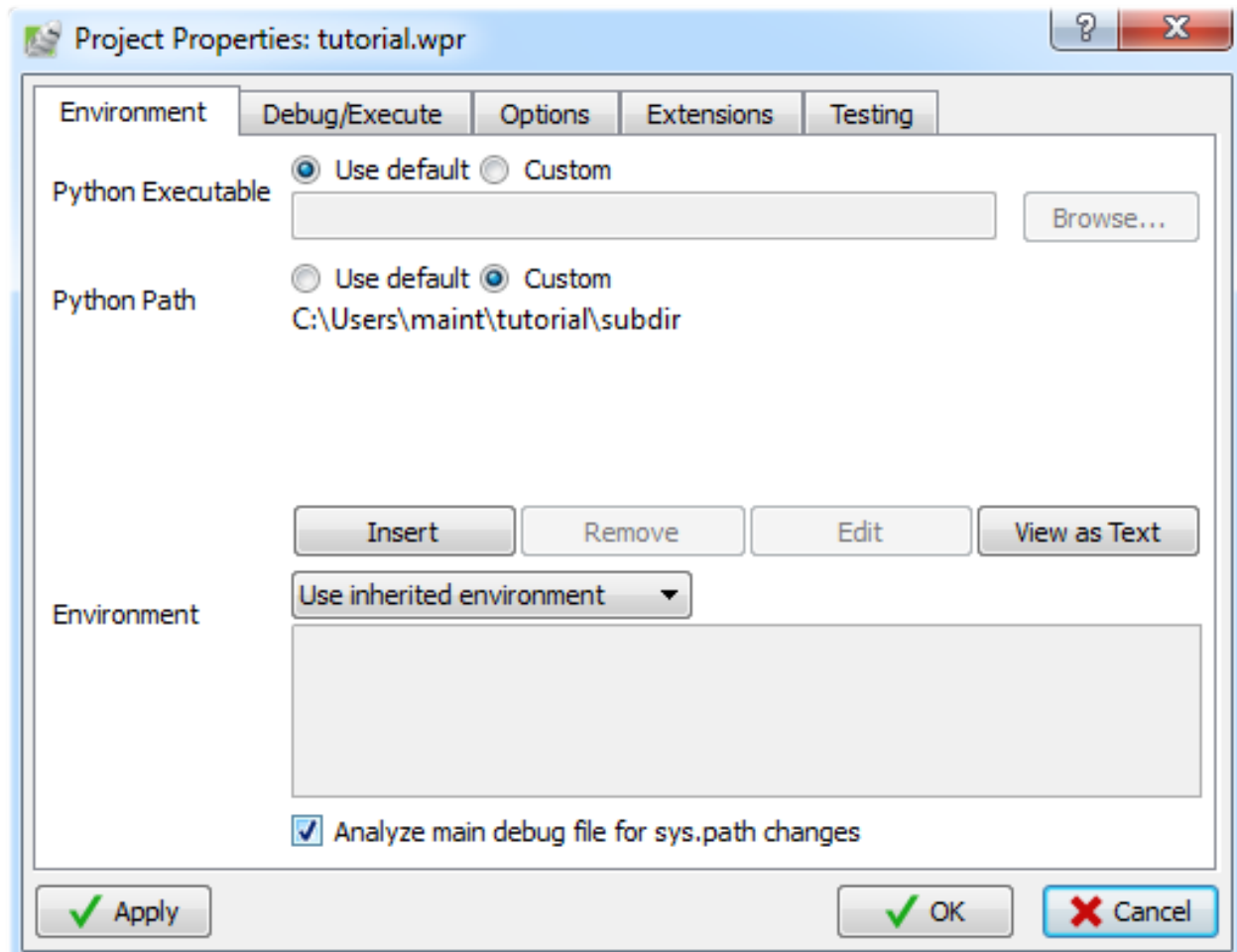
Shared Project Files

Wing Pro actually writes two files for each project, for example `tutorial.wpr` and `tutorial.wpu`. If you plan to use Wing projects with a revision control system such as Mercurial, Git, Subversion, or Perforce, you should check in only the `*.wpr` file. For details on setting up a sharable project, see [Sharing Projects](#).

Tutorial: Setting Python Path

Whenever your Python source depends on `PYTHONPATH`, either set externally or by altering `sys.path` at runtime, you will also need to tell Wing about your path.

This value can be entered in `Python Path` in the `Project Properties` dialog, which is accessible from the `Project` menu and the toolbar:



For this tutorial, you need to add the `subdir` sub-directory of your `tutorials` directory to `Python Path`, as shown above. This directory contains a module used as part of the first coding example.

Note that the full path to the directory `subdir` is used. This is strongly recommended because it avoids potential problems finding source code when the starting directory is ambiguous or changes over time. If relative paths are needed to make a project work on different machines, use an environment variable like `${WING:PROJECT_DIR}/subdir`. This is described in more detail in [Environment Variable Expansion](#).

The configuration used here is for illustrative purposes only. You could run the example code without altering `PYTHONPATH` by moving the `path_example.py` file to the same location as the example scripts, or by placing it into your Python installation's site-packages directory, which is in the default `PYTHONPATH`.


Python Path Hints

If your main entry point is Python code that alters `sys.path`, and the file is set as the `Main Entry Point` in `Project Properties` then Wing can often determine the correct `PYTHONPATH` to use without any changes to `Python Path` in `Project Properties`.

When in doubt, compare value of `sys.path` at runtime in your code with the value reported by `Show Python Environment` in the `Source` menu.

Tutorial: Introduction to the Editor

Now that you have set up your project, Wing will have found and analyzed the tutorial examples, and all the modules that are imported and used by them. This analysis process runs in the background and is used for auto-completion, call tips, and other features. With larger code bases, you may notice the CPU load from this process, and Wing will indicate that processing is active by displaying `Analyzing Files` in the status area at the bottom left of the main IDE window:



However, with this tutorial analysis will have happened instantaneously after the project was configured.

Editing with Wing

Let's start by trying out a subset of Wing's editor features, focusing on the auto-completer, `Source Assistant`, and some of Wing's auto-editing operations.

Open the file `example1.py` from the `Project` tool. Then bring up the `Source Assistant` tool the `Tools` menu or by clicking on its tab. This is where Wing shows documentation, call signature, and other information as you move around in your source code or work with other tools.

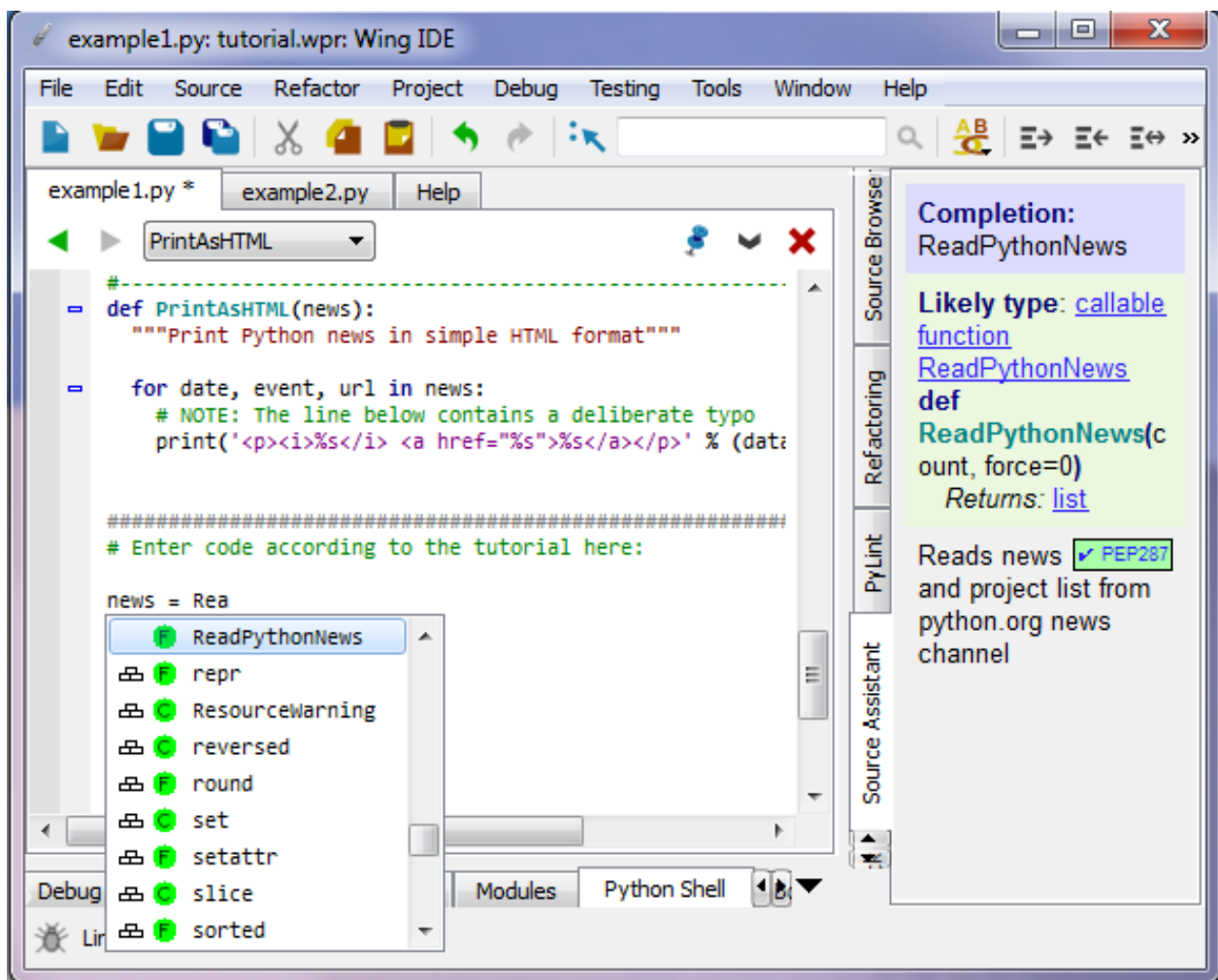
Scroll down to the bottom of `example1.py` and enter the following code by typing (not pasting) it into the file:

```
news = Rea
```

Wing displays a context-sensitive auto-completer as you type. You can scroll around in the list with the arrow keys, type `Esc` or `Ctrl-G` to abort completion, or `Tab` to enter the currently selected completion.

! If you are used to using the `Enter` key for auto-completion, add it to the `Editor > Auto-Completion > Completion Keys` preference now.

When you first typed "news" this completer wasn't helpful because you had not yet defined `news` as a symbol in your source. However, once you move on to type `= Re`, Wing displays another completion list with `ReadPythonNews` highlighted. Notice that the `Source Assistant` updates to show call information for that function, or for whatever value is selected in the auto-completer:



Next, press **Tab** to enter the completion of `ReadPythonNews` and type `(` (left parenthesis). In Wing Pro, you should now see the following code in your editor because Wing auto-enters the argument list and closing parenthesis:

```
news = ReadPythonNews(count, force=0)
```

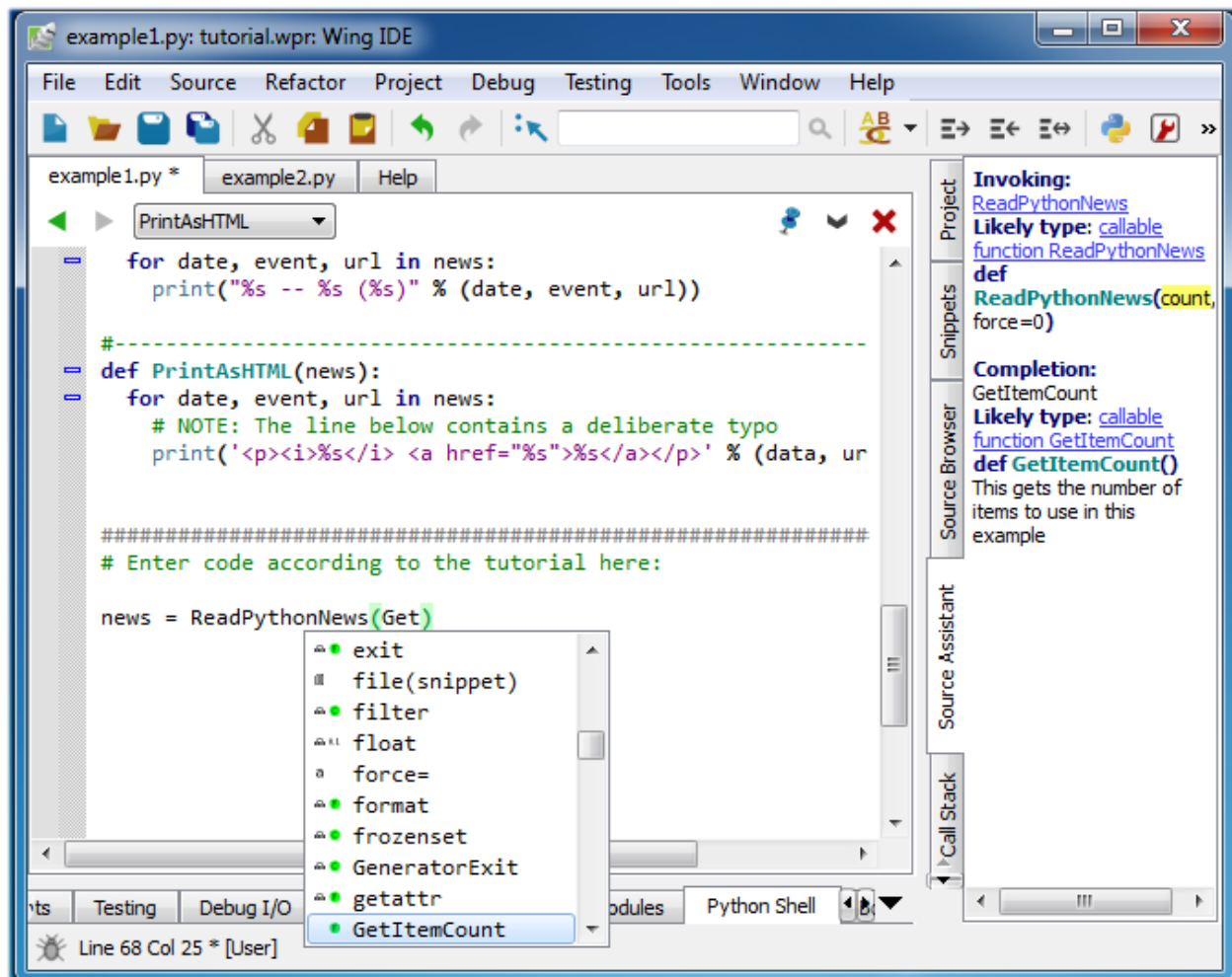
Notice that when Wing Pro auto-enters arguments, it starts with all arguments selected so you have the option of simply typing over them. Alternatively, the **Tab** key can be used to move between and replace arguments or just the default value in keyword arguments (like `force` in this example). When argument entry is completed by pressing `)` at the end of the list or by moving the caret out of the list, Wing automatically removes any keyword arguments with unaltered defaults.

Try this a few times now to get a feel for how the tab order works. **Undo** can be used to easily undo all changes made during argument entry. If you prefer not to use this feature, it can be turned off with the **Editor > Auto-Editing > Auto-Enter Invocation Args** preference. The same preferences page can be used to disable auto-editing entirely or to enable and disable other operations. The default set of enabled auto-editing operations are those that should not interfere significantly with finger memory. The other operations will be described later.

Now edit the code you have entered so it reads as follows and the caret is inside the `()`:

```
news = ReadPythonNews( )
```

Now type `Get` to start entering arguments for your invocation of `ReadPythonNews`. You will see the Source Assistant alter its display to highlight the first argument in the call signature for `ReadPythonNews` and add information on the argument's completion value:



The docstring for `ReadPythonNews` is temporarily hidden to conserve screen space. This behavior can be toggled with the `Show docstring during completion` option in the Source Assistant's context menu.

Now continue entering the rest of the source line so you have the following complete line of source code:

```
news = ReadPythonNews(GetItemCount())
```

Notice that typing a close parenthesis at the end of the invocation in Wing Pro skips over the close parenthesis that was previously auto-entered.

To play around with the editor a bit more, enter the following additional lines of code:

```
PrintAsText(news)
PromptToContinue()
PrintAsHTML(news)
```

At this point you have a complete program that can be run in the debugger. Don't try it yet, however. It contains some deliberate bugs and first we should take a look at some of Wing's code navigation features.

Tutorial: Navigating Code

As already noted, the `Source Assistant` updates as you move your insertion caret around the editor, or when browsing through the auto-completer. For example, try moving between the invocation of `PrintAsText` and the variable `news` in the code you just typed. The blue links in the `Source Assistant` can be used to jump to the points of definition of each symbol listed there.

If you click on one of the links in the `Source Assistant`, use the green back arrow at the top left of the editor to return from the value or type definition:



The link after `Symbol:` goes to the point of definition of that variable, while any links after `Likely Type:` go to the point of definition of that data type. These are the same if the symbol is a function, method, or class, but they differ for variables. For example, for `news` the point of definition is the line where it is first assigned a value and the type is a Python list.

Python Documentation

For built-ins and code in the Python standard library, Wing tries to add links into the Python documentation. For example, type `open` in the editor and try out the <https://docs.python.org> link. The documentation will be opened in your default web browser.

Symbol: [open](#)



Likely type: [builtin function open](#)
`def open(file, mode='r', buffering=_1, encoding=None, errors=None, newline=None, closefd=True, opener=None)`
Returns: [TextIOWrapper](#)

<http://docs.python.org/py3k/library/functions.html#open>
`open(file, mode='r', buffering=-1, encoding=None, errors=None, newline=None, closefd=True, opener=None) -> file object`
Open file and return a stream. Raise IOError upon failure.

Now use `Undo` or press the `delete` key to remove `open` from your code.

Goto-Definition

A quicker way to visit the point of definition of a symbol is to click on it and press `F4` or right click and use one of the `Goto Definition` context menu items. Again, you can use the history back/forward arrows at the top left of the editor to return from the point of definition.

Try this for `ParseRDFNews` in `example1.py`. Wing will open up the file `path_example.py` and show the point of definition of `ParseRDFNews`. Notice that the file is opened in non-sticky mode  and will auto-close unless you toggle the stick pin icon to  or edit the file.

Source Index

Wing maintains a set of source index menus at the top of the editor area. The menus are updated as you move around code, and additional levels of menus are added as needed, based on context.

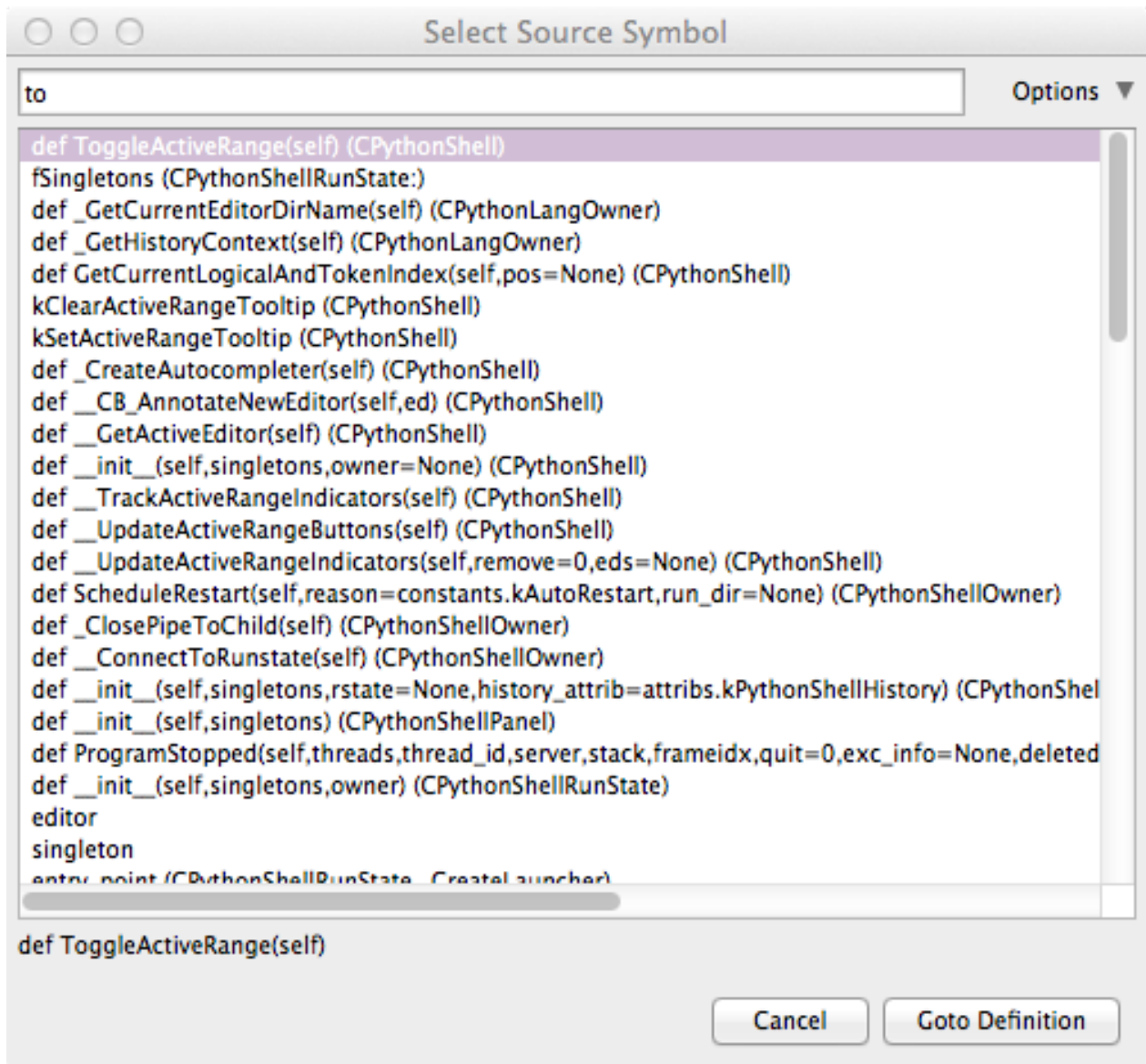


Try these now to navigate to `CHandler` in `path_example.py`, and then use the second menu to navigate to `endElement`.

Now use the history back arrow at top left of the editor area to return to the invocation of `ParseRDFNews` in `example1.py`. You will need to press the arrow several times to move back through your visit history.

Find Symbol

If you are looking for a symbol defined in the current scope, use `Find Symbol` in the `Source` menu. This displays a dialog where you can type a fragment matching the symbol name. Use the arrow keys to traverse the matches and press `Enter` to visit the symbol's point of definition.



`Find Symbol in Project` in Wing Pro functions in the same way but searches all files in the project.

Find Points of Use

In Wing Pro it is also possible to enumerate and visit all points of use of a symbol. Try this now by right clicking on `news` and selecting `Find Points of Use`. Wing will display the `Uses` tool with a list of all the points of use for that symbol. Click on the uses to visit them in the editor.


```
Uses of news in example1 ▾ ↑ ↓ ✕ Options
example1.py, line 69: news = ReadPythonNews(count)
example1.py, line 70: PrintAsText(news)
example1.py, line 72: PrintAsHTML(news)
```

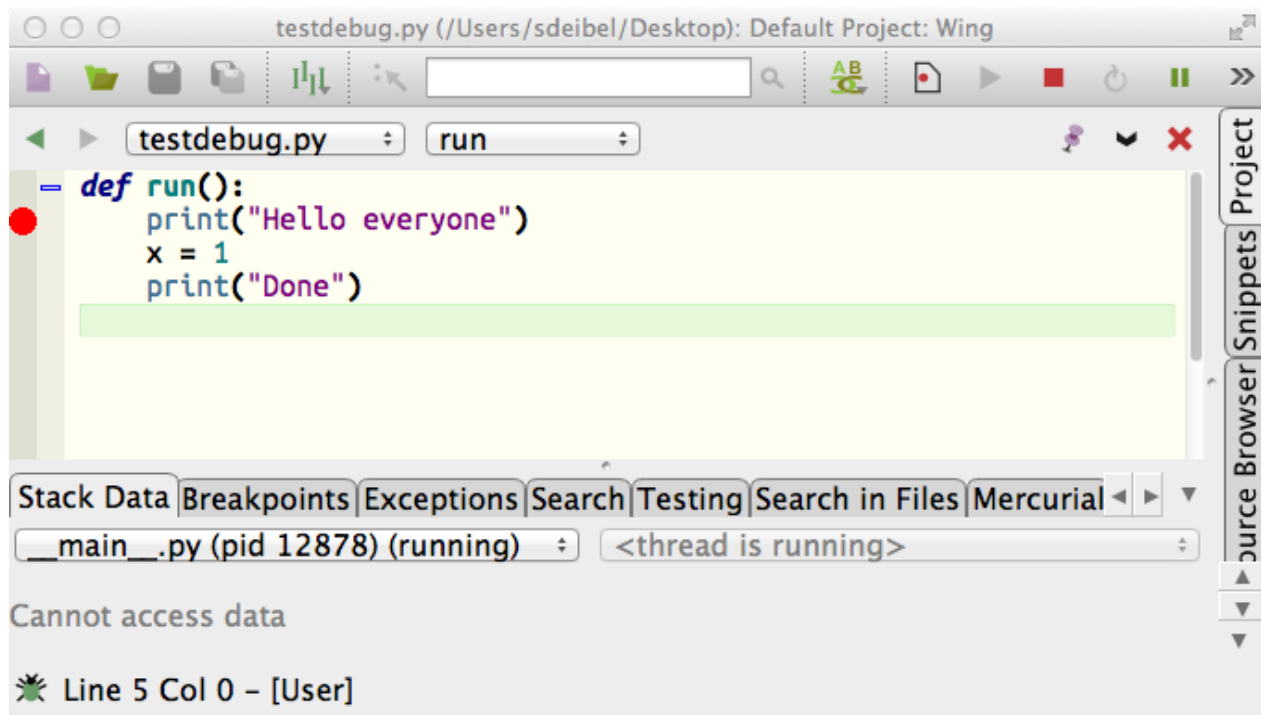
Note that Wing distinguishes between the `news` that is defined at the top level of `example1.py` (in the code that you typed) and the like-named but independent variables `news` inside the various functions here. For an example, use `F4` to go to the definition of `ReadPythonNews` and run `Find Uses` on the variable `news` defined at the bottom of the function. The results are distinct from those returned for the top-level `news`.

There are many other editor features worth learning, but we'll get back to those later in this tutorial, after we try out the debugger.

Tutorial: Debugging

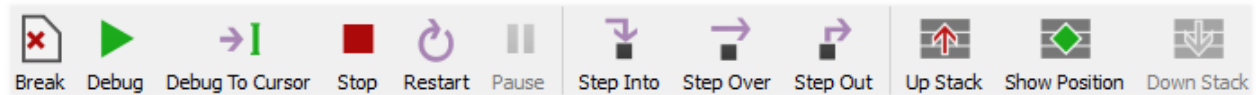
The `example1.py` program you have just created connects to `python.org` via HTTP, reads and parses the Python-related news feed in RDF format, and then prints the most recent five items as text and HTML. Don't worry if you are working offline. The script has canned data it will use when it cannot connect to `python.org`.

To start debugging, set a breakpoint on the line that reads `return 5` in the `GetItemCount` function. This can be done by clicking on the line and selecting the `Break` toolbar item, or by clicking on the left-most margin to the left of the line. The breakpoint should appear as a filled red circle:



Next start the debugger with the green arrow icon in the toolbar or the `Start/Continue` item in the `Debug` menu. Wing will show the `Debug Properties` dialog with the properties that will be used during the debug run. Just ignore this for now, uncheck the `Show this dialog before each run` checkbox at the bottom, and press `OK`.

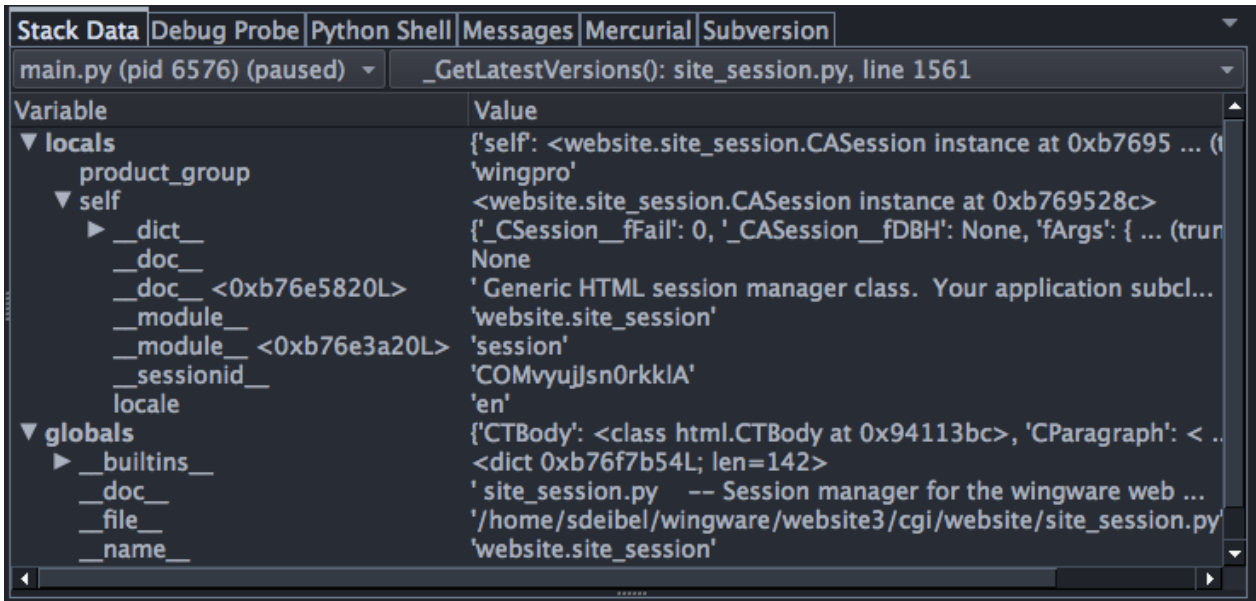
Wing will run to the breakpoint and stop, placing a red indicator on the line. Notice that the toolbar changes to include additional debug tools, as shown below:



Your display may vary depending on the size of your screen or if you have altered the toolbar's configuration. Wing displays tooltips explaining what the tools do when you mouse over them.

Now you can inspect the program state at that point with the `Stack Data` tool and by going up and down the stack from the toolbar or `Debug` menu. The stack can also be viewed as a list using the `Call Stack` tool.

Notice that the `Debug` status indicator in the lower left of Wing's main window changes color depending on the state of the debug process. Mouse over the indicator to see detailed status in a tooltip:

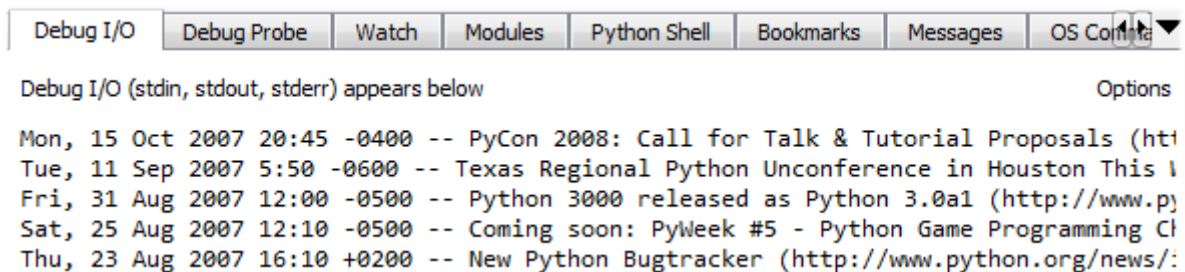


Next, try stepping out to the enclosing call to `ReadPythonNews`. In this particular context, you can achieve this in a single click with the `Step Out` toolbar icon or `Debug` menu item. Two clicks on `Step Over` also work. `ReadPythonNews` is a good function to step through in order to try out the basic debugger features covered above.

8.1. Tutorial: Debug I/O

Before continuing any further in the debugger, bring up the `Debug I/O` tool so you can watch the subsequent output from the program. This is also where keyboard input takes place in debug code that requests for it.

Once you step over the line `PrintAsText(news)` you should see output appear as follows:



For code that tries to read from `stdin` or uses `input` (or in Python 2.x `raw_input`), the `Debug I/O` tool is where you would type your input to your program. Try this now by stepping over the `PromptToContinue` call. You will see the prompt "Press Enter to Continue" appear in the `Debug I/O`

tool and the debugger will not complete the `Step Over` operation until you press `Enter` while focus is in the `Debug I/O` tool.

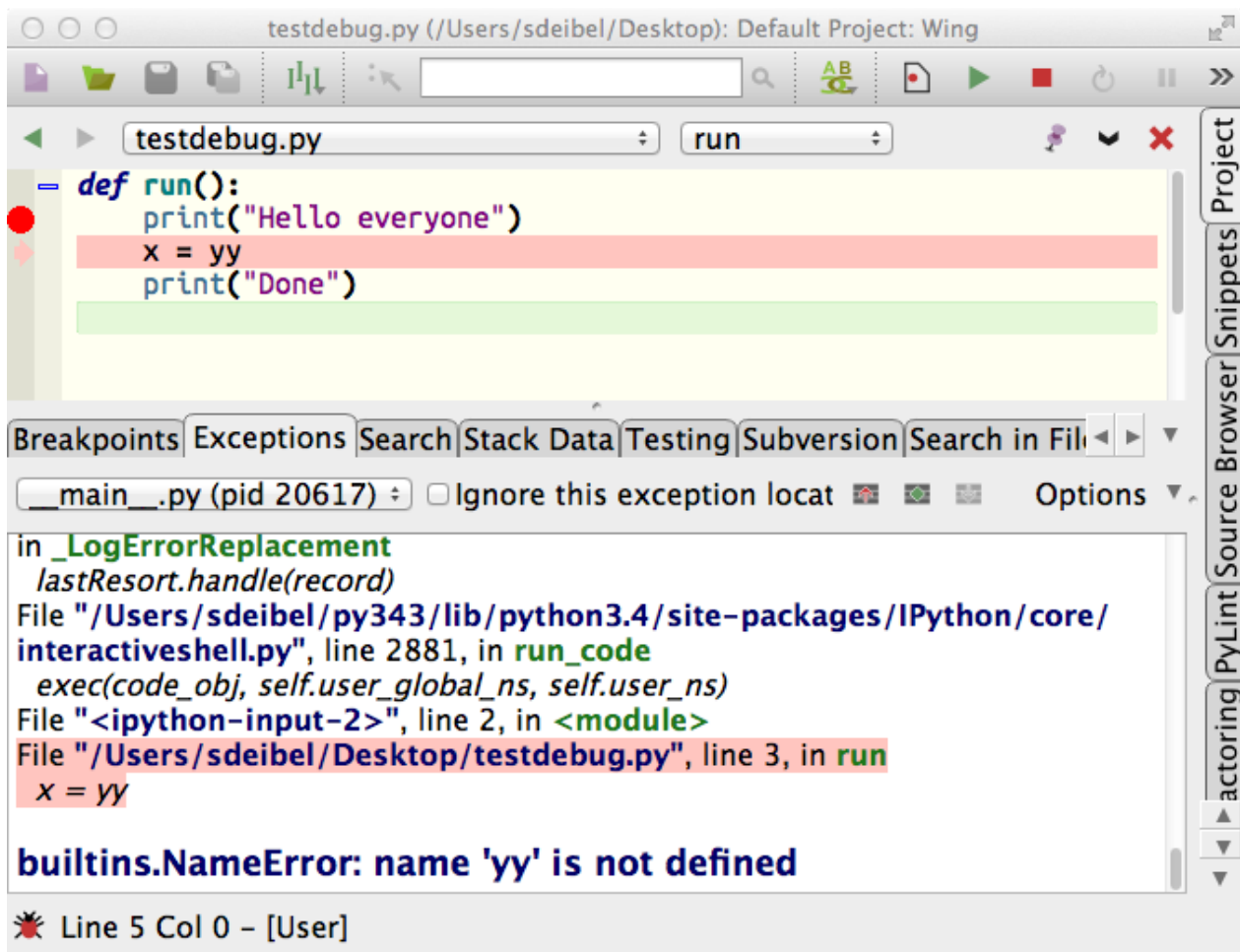
Note that you can also configure Wing to use an external console from the `Options` menu in the `Debug I/O` tool. This is useful for code that depends on details of the `Debug I/O` environment (such as cursor control with special output characters).

8.2. Tutorial: Debug Process Exception Reporting

Wing's debugger reports any exceptions that would be printed when running the code outside of the debugger.

Try this out by continuing execution of the debug process with the `Debug` toolbar item or `Start / Continue` item in the `Debug` menu.

Wing will stop on an incorrect line of code in `PrintAsHTML` and will report the error in the `Exceptions` tool:



Notice that this tool highlights the current stack frame and that you can click on frames to navigate the exception backtrace. Whenever you are stopped on an exception, the Debugger Status indicator in the lower left of Wing's main window turns red.

Advanced Options

Wing Pro and Wing Personal's debugger provides several exception handling modes, which differ in how they determine which exceptions should be reported. It is also possible to add specific exception types to always report or never report. This is described in more detail in [Managing Exceptions](#). Most users will not need to alter these options, but being aware of them is useful.

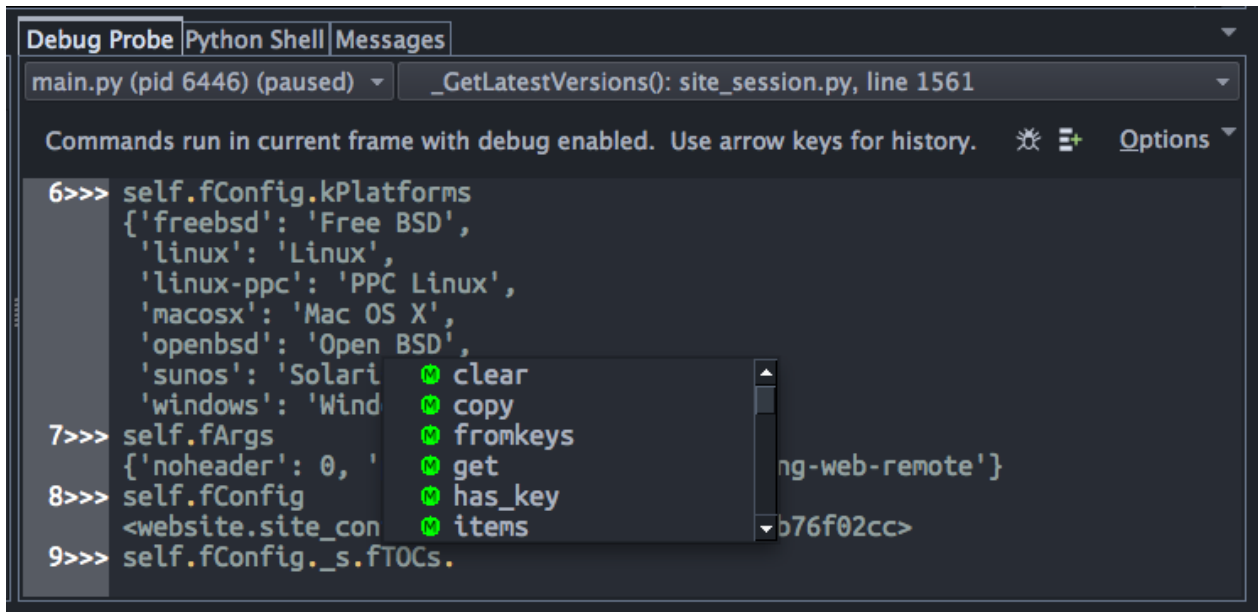
8.3. Tutorial: Interactive Debugging

Wing Pro's `Debug Probe` provides a powerful way to find and fix bugs, and to try out new code interactively in the live runtime state. This works much like the Python Shell but lets you interact directly with your paused debug program, in the context of the current stack frame:

Try it out from the point of exception reached earlier by typing this:

```
news[0][0]
```

This will print the date of the first news item:



Wing offers auto-completion as you type and shows call signature and documentation information in the Source Assistant, just as when you work in the editor. However, in the Debug Probe the data displayed is obtained from the live runtime state and not only from static analysis of your source code.

Next, try this:

```
news[0][0] = '2013-06-15'
```

This is one way to change program state while debugging, which can be useful when testing out code that will go into a bug fix. Try this now:

```
PrintAsText(news)
```

This executes the function call and prints its output to the Debug Probe using the modified value for `news`.

Here is another possibility. Copy/paste or drag and drop this block of code to the Debug Probe:

```
def PrintAsHTML(news):
    for date, event, url in news:
        print('<p><i>%s</i> <a href="%s">%s</a></p>' % (date, url, event))
```

This replaces the buggy definition of `PrintAsHTML` found in the `example1.py` source file for the life of the debug process, so that you can now execute it without errors as follows:

```
PrintAsHTML(news)
```

The Debug Probe is useful in designing fixes for bugs that depend on lots of program state, or that happen in a context that is hard to reproduce outside of a debugger.

Conditional Breakpoints

Since the Debug Probe is all about working in a selected runtime context, now is a good time to take a look at conditional breakpoints, which are a good way to get the debugger to stop in the context you want to work with.

To set a conditional breakpoint, right click on the breakpoint margin and select Set Conditional Breakpoint. This brings up a dialog in which you can enter any Python

expression. If the expression evaluates to `True` or raises an exception, the debugger will stop on it. If the expression is not `True` then the debugger will continue running.

Try this now by first selecting `Remove All Breakpoints` from the `Debug` menu and then setting a conditional breakpoint on the `print` within the `for` loop in `PrintAsText`. Use a conditional such as `'beta' in event`. You may need to replace the word `beta` with some other word or fragment to get the debugger to stop here, since this depends on the news items that are currently listed on `python.org`. If necessary, take a look at the output from your previous runs of `example1.py` to find a word that appears in only one of the news items.

Once this is done, press the `Restart Debug` icon in the toolbar or select `Restart Debugging` in the `Debug` menu. Wing should stop on your conditional breakpoint in the loop iteration where it is true. In more complex code, this would be a quick way to get to the program state that is causing a bug or for which you want to write some new code.

Working in the Editor While Debugging

When the debugger is active, Wing uses both its static analysis of your code and introspection of the live runtime state to offer auto-completion, call tips, and goto-definition in the editor, whenever you are working in code that is active on the debug stack.

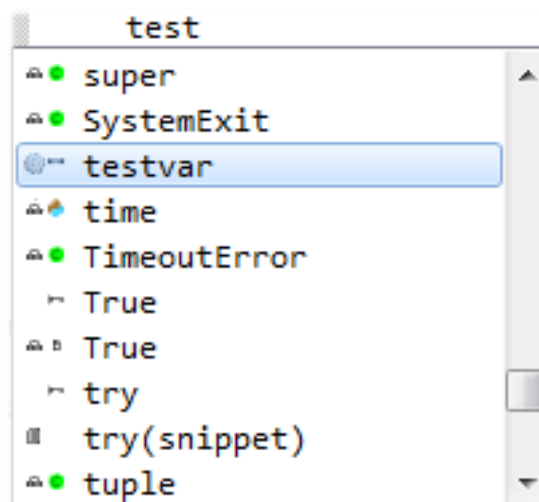
Try this now by typing the following in the `Debug Probe`:

```
testvar = 'test'
```

Then switch to `example1.py` and in `PrintAsText` (where you are currently stopped on a conditional breakpoint) create a new line and type this:

```
test
```

Notice that the newly created variable `testvar` shows up in the completer, with a cog icon to indicate that it was found in the runtime state:



This is a handy way to get correct auto-completion in dynamic code where static analysis is not able to find all the symbols that will be defined when code is executed.

8.4. Tutorial: Execution Environment

In this tutorial we've been running code in the default environment and with the default Python interpreter. In a real project you may want to specify one or more of the following:

- Python interpreter and version
- PYTHONPATH

- Environment variables
- Initial run directory
- Options sent to Python
- Command line arguments

Wing lets you set these for your project as a whole and for specific files.

Project Properties

The `Environment` and `Debug/Execute` tabs in the `Project Properties` dialog, accessed from the `Project` menu, can be used to select the Python interpreter that is being used, the effective `PYTHONPATH`, the values of environment variables, the initial directory for the debug process, and any options passed to Python itself.

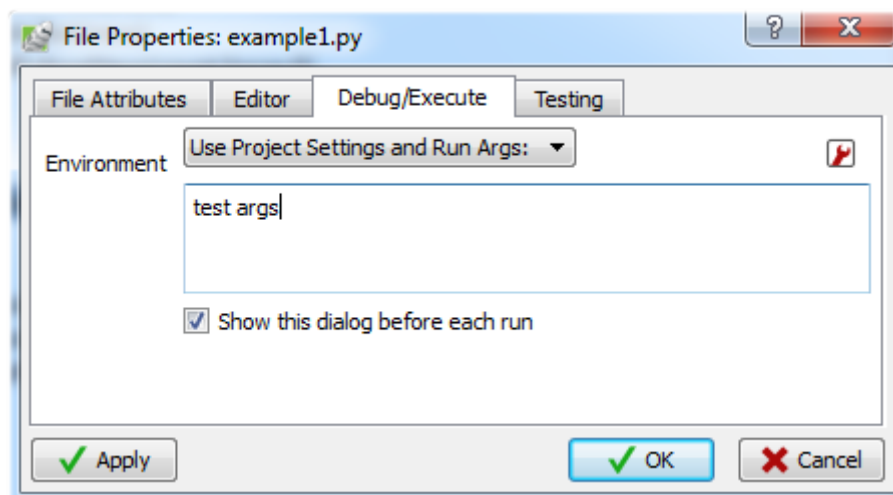
In most cases, `Project Properties` is where you will make changes to the runtime environment for all the project code that you execute and debug.

Try this out now by adding an environment variable `TESTPROJECT=1` to the `Environment` in `Project Properties`. Then restart debugging and look at `os.environ` to confirm that the new environment variable is defined.

File Properties (and Launch Configurations)

`File Properties` are used to configure the command line arguments sent to a file when it is executed or debugged, and (optionally) to override the project-defined environment.

The `File Properties` dialog is accessed from the `Current File Properties` item in the `Source` menu or by right-clicking on a file in the editor or `Project` tool and selecting `Properties`.



The most common use of `File Properties` is simply to set the command line arguments to use with a file. Try this now by bringing up `File Properties` for `example1.py` and set the run arguments in the `Debug/Execute` tab to `test args`.

Now if you restart debugging and type the following in the `Debug Probe` you will see that the environment and arguments have been set:

```
os.environ.get('TESTPROJECT')
sys.argv[1:]
```

The output should be:

```
1
['test', 'args']
```

To also override the project-defined environment for a particular file, define a Launch Configuration and select it in File Properties. Launch configurations set up an environment like that which can be specified in Project Properties, paired with a particular set of command line arguments.

Try this now by bringing up File Properties for `example1.py` again and selecting Use Selected Launch Configuration for Environment under the Debug/Execute tab. Press the New button that appear, use ``My Launch Config`` as the name for the new launch configuration, and press OK. Wing will show the properties dialog for the new launch configuration.

Next enter run arguments `other args` and change the Environment to Add to Project Values and enter `TESTFILE=2` and `TESTPROJECT=.`. This adds environment variable `TESTFILE` and removes the `TESTPROJECT` from the inherited project-defined environment.

Now restart debugging again and enter this in the Debug Probe:

```
os.environ.get('TESTPROJECT')
os.environ.get('TESTFILE')
sys.argv[1:]
```

The output should be:

```
None
2
['other', 'args']
```

Main Debug File

You can specify one file in your project as the main entry point for debugging. When this is set, debugging will always start there unless you use Debug Current File in the Debug menu.

To set a main debug file use Set Current as Main Debug File in the Debug menu, right click on the Project tool and select Set as Main Debug File, or use the Main Debug File property in the Debug tab of the Project Properties dialog.

Try this now by setting `example1.py` as the main debug file. Now it is no longer necessary to bring `example1.py` to front in order to start debugging it.

Whether or not you set a main debug file depends on the nature of your project.

Named Entry Points

In some projects it is more convenient to define multiple entry points for executing and debugging code. To accomplish this, Named Entry Points can be set up from the Debug menu. Each named entry point binds an environment, either specified in the project or in a launch configuration, to a particular file. Once defined, they can be assigned a key binding or accessed from the Debug Named Entry Point and Execute Named Entry Point items in the Debug menu.

Named Entry Points are a good way to launch a single file with different arguments or environment.

8.5. Tutorial: Debugging from the Python Shell

In addition to launching code to debug from Wing's menu bar and Debug menu, it is also possible to debug code that is entered into the Python Shell (and in Wing Pro the Debug Probe).

Enable this now by clicking on the bug icon in the top right of the Python Shell. Once this is done, the status message at the top of the Python Shell should change to include Commands will be debugged and an extra margin is shown in which you can set breakpoints. Wing will reach those breakpoints, as well as any breakpoints in editors for code that is invoked. Any exceptions will also be reported in the debugger.

Let's try this out. Paste the following into the Python Shell and press Enter so that you are returned to the `>>>` prompt:

```
def test_function():
    x = 10
    print(x)
    x += 5
    y = 20
    print(x+y)
```

Then place a breakpoint on the line that reads `print(x)` by clicking in the breakpoint margin at the left of the line text and prompt.

Next type this into the `Python Shell` and press `Enter`:

```
test_function()
```

Wing should reach the breakpoint on the `print(x)` line.

You can now work with the debugger in the same way that you would if you have launched code from the toolbar or `Debug` menu. Try stepping and viewing the values of `x` and `y` as they change, either in the `Stack Data` tool or by hovering the mouse over the variable names.

Take a look at the stack in the `Call Stack` or `Stack Data` tool to see how stack frames that occur withing the `Python Shell` are listed. You can move up and down the stack just as you would if your stack frames were in an editor.

Notice that if you step off the end of the call, you will return to the shell prompt. If you press the red `Stop` button in the toolbar or select `Stop Debugging` from the `Debug` menu, Wing will complete execution of the code without debug and return you to the `>>>` prompt. Note that the code is still executed to completion in this case because there is no way to simply abandon a number of stack frames in the Python interpreter.

Recursive Debugging

By default Wing will not return you to the `>>>` prompt until your code has finished executing. In Wing Pro, it is possible to enable recursive debugging but this can be quite confusing, so it is disabled by default.

To try this out, check the `Enable Recursive Debug` item in the `Options` menu in the `Python Shell`. Then type `test_function()` again in the `Python Shell`. You will see that the shell returns immediately to the `>>>` prompt even though you are now at the breakpoint you set earlier on `print(x)`. Note that the message area in the `Python Shell` indicates that you are debugging recursively and gives you the level to which you have recursed (for example `Debugging recursively (R=2)` indicates two levels of recursive debugging).

Try typing `test_function()` again (or just press the `Up` arrow on the keyboard) and press `Enter`. This is essentially the same thing as invoking `test_function()` from the line at which the debugger is currently paused, in this case within `test_function` itself.

Try doing this several times. Each time you do this, another level of recursive debugging is entered. Look at the `Call Stack` tool and go up and down the stack to better understand what is happening.

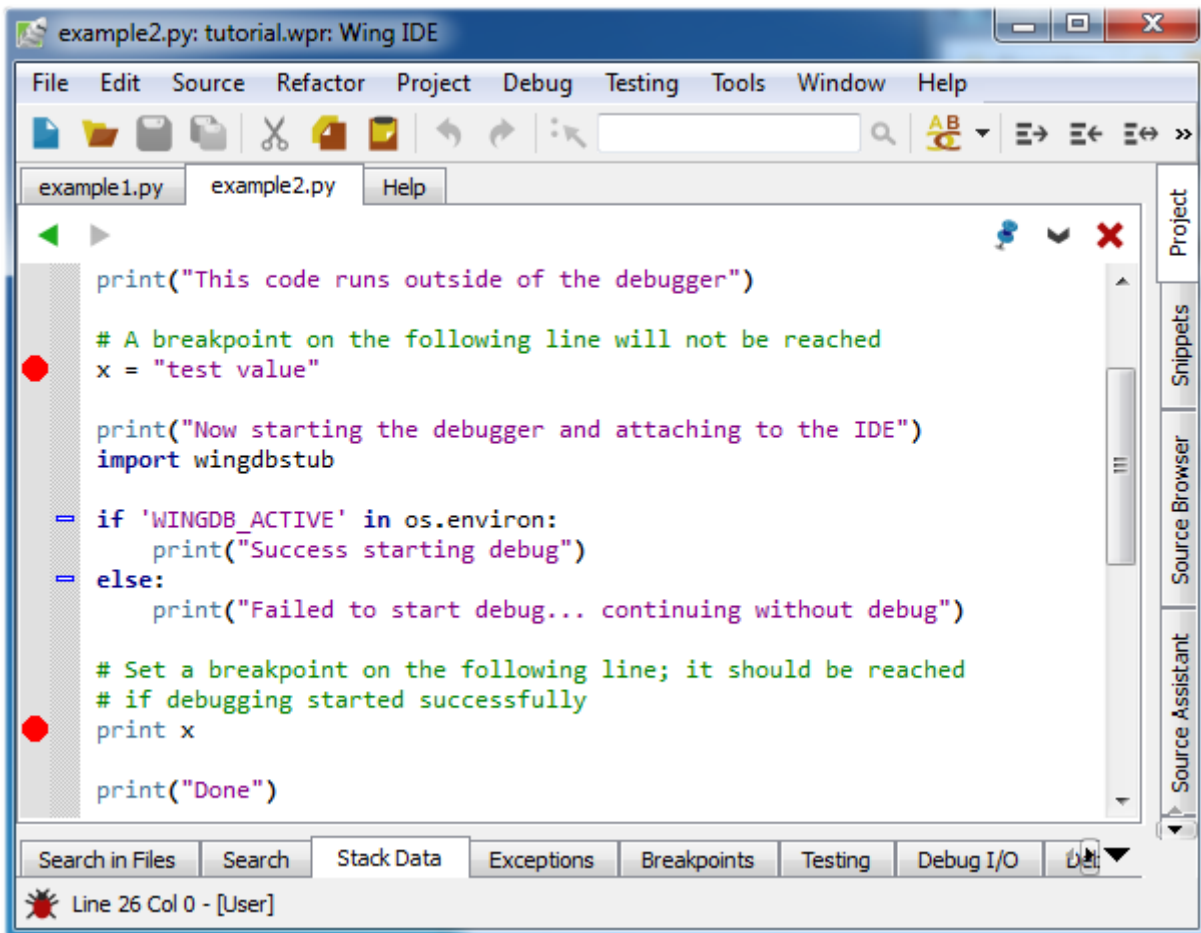
Now if you press `Continue` in the toolbar or use `Start / Continue` in the `Debug` menu you will exit one level of recursion. Similarly, `Stop` exits one level of recursion without debugging the remainder of that recursive invocation.

8.6. Tutorial: Debugging Code Not Launched by the IDE

So far we've been debugging code launched from inside of Wing. Wing can also debug processes that are running within a web framework, as scripts in a larger application, or that get launched from the command line. These are cases where a debug process cannot be launched from the IDE, so another method is needed to initiate debug.

Let's try this now with `example2.py` in your tutorial directory. First, copy `wingdbstub.py` out of install directory listed in Wing's `About` box. Place this in the same directory as `example2.py`. Next, click on

the bug icon in the lower left of Wing's main window and select **Accept Debug Connections**. Then set a breakpoint on lines 10 and 22 of `example2.py`:



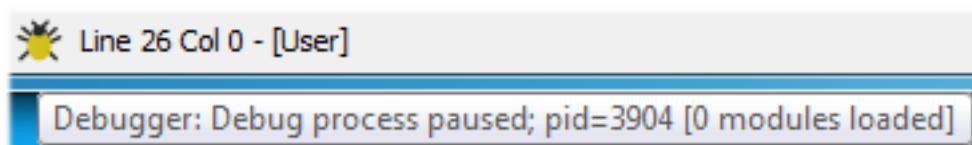
If you are working on OS X, using the Windows `zip` install, or using the Linux `tar` install of Wing, you will need to edit `wingdbstub.py` to set `WINGHOME` to the full path to the Wing installation directory (on OS X, this is the name of Wing's `.app` directory). This is done automatically by the regular Windows installer and Debian and RPM installs on Linux. If you are using one of those you can skip this step.

Now we're ready to debug `example2.py` when it is launched from outside of the IDE. To launch it, use the DOS Command prompt on Windows, a `bash` or similar command prompt on Linux, or Terminal or an `xterm` on OS X by typing:

```
python example2.py
```

You may need to specify the full path to `python` if it is not on your path.

This should start up the code, print some messages, connect to the IDE, and stop on the breakpoint on line 22. Read through the code and the messages printed to understand what is happening. You can verify that the debugger attached by looking at the color of the bug icon in the lower left of the IDE window, and by hovering the mouse over it:



Once you are stopped at a breakpoint or exception in externally launched code, the debugger works just as it would had you launched the debug process from the IDE. The only difference is that the environment

is set up by the process itself and the settings specified in `Project Properties` and `File Properties` are not used.

When you continue the debugger from the toolbar or `Debug` menu, the program should print the value of `x` and exit.

This is a very simple example to illustrate how externally launched code can be debugged. The import of `wingdbstub` can also be placed in functions or methods, and there is a [debugging API](#) that provides control over starting and stopping debugging.

See [Debugging Externally Launched Code](#) for details and the [How-To guides](#) for information on setting this up with specific web frameworks, compositing and rendering tools, and other applications.

Remote Debugging

Using the same mechanism, it is also possible to debug Python code launched on another machine. This is documented in [Debugging Externally Launched Remote Code](#) in the Wing manual.

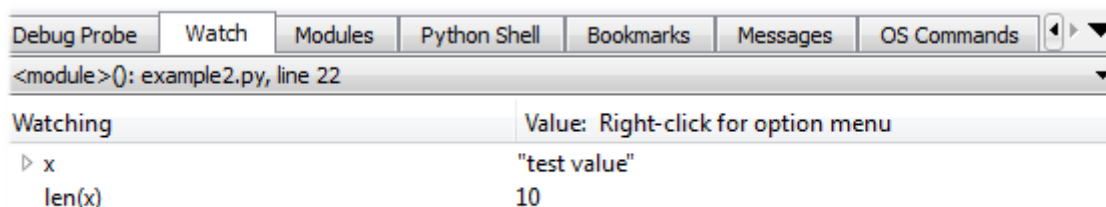
Wing Pro also has the ability to work remotely through a secure SSH tunnel to a configured remote host. This supports all of Wing's features, so you can edit, search, debug, test, and manage remote code as if the remote files and directories were stored locally, and you can run `Python Shell` and `OS Commands` on the remote host. This is the preferred way to work with code on a remote host, although you may still need to use `wingdbstub` to initiate debug if your code cannot be launched from the IDE. For details, see [Remote Hosts](#).

8.7. Tutorial: Other Debugger Features

Before moving on to the rest of the IDE's features, here are a few details worth knowing about the debugger:

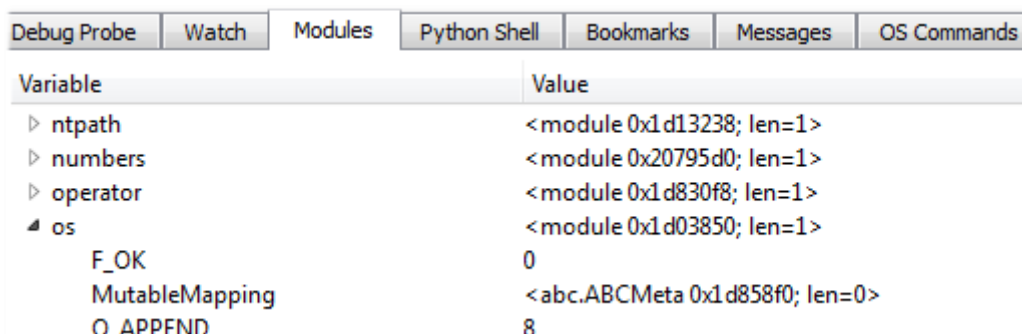
Watch Tool

The `Watch` tool lets you watch variables over time by symbolic name or object reference, by right-clicking on them in the `Stack Data` or `Watch` tools. You can also watch expressions typed into the `Watch` tool.



Modules Data View

By default, Wing filters out modules and some other data types from the values shown in the `Stack Data` tool. In some cases, it is useful to view values stored in modules. This can be done with the `Modules` tool, which is simply a list of all modules found in `sys.modules`:



Breakpoint Manager

The `Breakpoints` tool accessed from the `Tools` menu shows a list of all defined breakpoints and allows enabling/disabling, editing the breakpoint conditional, setting an ignore count, and inspecting the number of times a breakpoint has been reached during the life of a debug process.

Breakpoints	Testing	Debug I/O	Debug Probe	Watch	Modules	Python Shell
Enabled	Location	Condition	Temporary	Ignores	Ignores Left	Hits
<input checked="" type="checkbox"/>	example1.py, line 19		<input checked="" type="checkbox"/>	0		0
<input type="checkbox"/>	example2.py, line 10		<input type="checkbox"/>	0		0
<input checked="" type="checkbox"/>	example2.py, line 22		<input type="checkbox"/>	0		1

Tutorial: Auto-Editing

Let's revisit Auto-Editing, which was introduced before we tried out the debugger. So far we've seen the editor auto-enter invocation arguments and closing parentheses. There are a number of other auto-editing operations available as well:

Applying Characters to a Selection

If you select a range of text in the editor and press a quote, parenthesis, brace, bracket, or #, Wing applies that key stroke to the selection.

For example, try selecting a few lines of non-comment code and press #. Wing will comment out those lines using the comment style configured in the `Editor > Block Comment Style` preference. Pressing # a second time will remove the comment characters.

Also, selecting some text and pressing " (double quote) will surround it with double quotes, or pressing ((open parenthesis) will surround it with parentheses. This also works when typing single quotes, triple quotes, back ticks, brackets, and braces.

Similarly, placing the caret next to a quote in a string and pressing either double quote or single quote will convert that string to either a double quoted or single quoted string.

These operations are on by default and may be disabled with the `Apply Quotes to Selection`, `Apply Comment Key to Selection`, and `Apply [], (), and {} to Selection` preferences in the `Editor > Auto-Editing` preference group.

Auto-Entering Spacing

Wing can also auto-enter spaces as you type code, optionally enforcing PEP8 style spacing. This auto-editing operation is off by default but can be turned on with the `Editor > Auto-Editing > Auto-Enter Spaces` preference. Try turning this on now and slowly typing the following into an editor:

```
import os
if os.environ['TEST'] == 'X' * 3:
    pass
```

Notice that Wing is auto-entering a space after the `]`, `=`, and other characters according to the context in the code. If you press the space anyway, it is ignored.

If you also enable the `Editor > Auto-Editing > Enforce PEP8 Style Spacing` preference, Wing will try to enforce PEP8 style spacing as you type. For example, typing the following disallows extra spaces around `=`:

```
x = 'test'
```

According to PEP8, spaces should not be used in argument lists. This is also the default behavior for Wing, whether or not PEP8 enforcement is on. To override this, enable the `Editor > Auto-Editing > Spaces in Argument Lists` preference.

Managing Blocks with the Colon Key

This operation saves a lot of typing but is off by default to avoid confusing new users. Enable it now with the `Editor > Auto-Editing > Manage Blocks on Repeated Colon Key Presses` preference then type the following into an editor:

```
if x == 1:
```

Notice that Wing will auto-insert a new line and indentation after the colon.

Now try typing the following before `txt = None` on line 36 of `example1.py`, inside `ReadPythonNews`:

```
if force:
```

A new line and indent are added as before. Now, without moving the caret press `:` again. Wing will move the first following line (`txt = None`) under the new block so it looks like this:

```
if force:
    txt = None
if not force and os.path.exists(newscache):
    mtime = os.stat(newscache).st_mtime
    if time.time() - mtime < 60 * 60 * 24:
        f = open(newscache)
        txt = f.read()
        f.close()
```

Again without moving the caret press `:` a third time. Wing now moves the entire following block, up until the next blank line or first line indented less than the current one, so it looks like this:

```
if force:
    txt = None
    if not force and os.path.exists(newscache):
        mtime = os.stat(newscache).st_mtime
        if time.time() - mtime < 60 * 60 * 24:
            f = open(newscache)
            txt = f.read()
            f.close()
```

Line Continuations

If you press `Enter` inside a comment (or string inside `()`) and there is text after the caret, Wing auto-continues the line, placing the necessary comment or quote characters. For example, pressing `Enter` after the word `code` on the first line of `example1.py` results in the following:

```
# This is example code
# |for use with the Wing IDE tutorial, which
# is accessible from the Help menu of the IDE
```

This is on by default and can be disabled with the `Editor > Auto-Completion > Continue Comment or String on New Line` preference.

Correcting Out-of-Order Typing

Wing also tries to correct out-of-order typing. For example, type the following in an editor:

```
def y(:)
```

Wing figures out that the colon is misplaced and auto-corrects this to read:

```
def y():
```

Similarly, if you type the following:

```
y()x
```

Wing figures out that a `.` is probably missing and auto-corrects this to read:

```
y().x
```

By relying on this, it is possible to save key strokes for caret movement when coding.

This auto-editing operation is on by default and can be disabled with the `Editor > Auto-Completion > Correct Out-of-Order Typing` preference.

Tutorial: Turbo Completion Mode

Auto-completion normally requires pressing a completion key, as configured in the `Editor > Auto-Completion > Completion Keys` preference, before a completion is entered into the editor.

Wing also has an experimental Turbo auto-completion mode for Python where completion can occur on any key that cannot be part of a symbol. This can greatly reduce typing required for coding but it takes some effort to learn to use this feature.

Try it now by enabling the `Python Turbo Mode` preference. Then go to the bottom of `example1.py` and press the following keys in order: `R (G e t (`. You will see the following code in the editor produced by these six key strokes:

```
ReadPythonNews(GetItemCount())
```

Depending on your Python version you may not need as many keystrokes before `GetItemCount` is selected in the completer. As soon as it is, the final `(` may be pressed.

Turbo completion mode distinguishes between contexts where a new symbol may be defined and those where an existing symbol must be used. For example try typing the following keystrokes on a new line: `=`. Wing knows that the `=` indicates you are defining a new symbol so it does not place the current selection from the auto-completer.

In a context where you are trying to type something other than what is in the completer, pressing `Ctrl` briefly by itself will hide the auto-completer and thus disable turbo-completion until you type more symbol characters and the completer is shown again.

This mode is still considered experimental because it doesn't always do the right thing, but on the whole enabling `Python Turbo Mode` cuts back considerably on unnecessary typing.

Tutorial: Refactoring

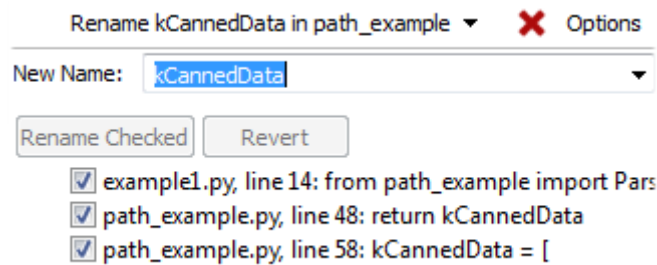
Refactoring is a general term for renaming or restructuring code in a way that does not alter its functionality. It is useful for cleaning up code or to prepare code for easier extension or reuse.

Wing implements a number of refactoring operations. Let's try some of these now in `example1.py`.

Rename Symbol

Right click on `kCannedData` in the `import` statement at the top of the file and select `Rename Symbol` from the `Refactor` sub-menu (or just click on `kCannedData` and select the operation from the `Refactor` menu).

Wing will bring the refactoring tool to the front and enumerates the points of use for the symbol you have selected:



Now enter `kCannedTuna` as the new name to use and press `Enter` or the `Rename Checked` button. Wing instantly renames all uses of the symbol.

Move Symbol

Now try moving `PromptToContinue` into `subdir/path_example.py` with the `Move Symbol` operation. In the refactoring tool, use `Browse...` to select `subdir/path_example.py` as the target location and leave `Scope` set to `<module global scope>`. Then press `Move & Update Checked`. Wing moves the point of definition into the target file and introduces the necessary `import` so it can still be used from `example1.py`.

Note that the whole module is imported and you would have to manually fix up the import if you wished to add the symbol to list in the `from path_example import` statement instead.

Extract Function/Method

Next select the first larger block in `ReadPythonNews` as follows:

```
#-----
def ReadPythonNews(count, force=0):
    """Reads news and project list from python.org news channel"""

    newscache = 'newscache.rdf'

    txt = None
    if not force and os.path.exists(newscache):
        mtime = os.stat(newscache).st_mtime
        if time.time() - mtime < 60 * 60 * 24:
            f = open(newscache)
            txt = f.read()
            f.close()

    if txt is None:
        try:
            svc = urllib.urlopen("http://www.python.org/channews.rdf")
```

Then select the `Extract Function/Method` refactoring operation and enter `ReadNewsCache` as the name for a new top-level function. Wing will create a new function and convert the point of use to a call to that function, as follows, inserting all the necessary arguments and return values:

```
txt = ReadNewsCache(force, newscache)
```

Click on `ReadNewsCache` and use `F4` to visit its point of definition. Then use the history back arrow to get back to the point of use and press `Revert` in the `Refactoring` tool to undo this change.

Try it again now after selecting `Nested Function` instead to see how that operation differs. Then press `Revert` again.

Introduce Variable

Wing can also introduce new variables for an expression. For example, select `time.time() - mtime` in `ReadPythonNews` and use `Introduce Variable` to create a variable called `duration`. Wing inserts the variable and substitutes it into the original expression:

```
txt = None
if not force and os.path.exists(newscache):
    mtime = os.stat(newscache).st_mtime
    duration = time.time() - mtime
    if duration < 60 * 60 * 24:
        f = open(newscache)
        txt = f.read()
        f.close()
```

If there had been multiple instances of `time.time() - mtime` in the scope, all of them would have been replaced.

Symbol to *

Several refactoring operations are given to easily convert the name of a symbol between `UpperCamelCase`, `lowerCamelCase`, `under_scored_name`, and `UNDER_SCORED_NAME` naming styles. These work the same way as `Rename Symbol` but prefill the new symbol name field with the selected style of name.

Tutorial: Indentation Features

Since indentation is syntactically significant in Python, Wing provides a number of features to make working with indentation easier.

Auto-Indentation

By now you will have noticed that Wing auto-indents lines as you type, according to context. This can be disabled with the `Auto-Indent` preference.

Wing also adjusts the indentation of blocks of code that are pasted into the editor. If the indentation change is not what you wanted, a single `Undo` removes the indentation adjustment, if there was one.

Block Indentation

In Wing's default keyboard personality, the `Tab` key is defined to indent the current line or blocks of lines, rather than entering a tab character (which can be done with `Ctrl-T`). As noted earlier, the `Tab Key Action` preference can be used to customize how the tab key behaves.

One or more selected lines can be increased or reduced in indentation, or adjusted to match indentation according to context, from the Indentation toolbar group:



Repeated presses of the `Match Indent` tool will move the selected lines among the possible correct indent levels for that context.

These indentation features are also available in the `Source` menu, where their key bindings are listed.

Converting Indentation Styles

In Wing Pro and Wing Personal, the `Indentation` tool can be used to analyze and convert the style of indentation found in source files. See [Indentation Manager](#) for details.

Folding

Unless the feature is disabled with the `Enable Folding` preference, Wing Pro and Wing Personal can fold editor code by indentation levels to hide areas that are not currently of interest or as a way to see a quick summary of the contents of a source file.

The folding operations are enumerated in the `Folding` sub-menu of the `Source` menu and in the fold margin context menu.

Folding acts in such a way that selecting across a fold and copying will copy the text, including its hidden portions. Take a look at the `Folding` sub-menu in the `Source` menu and refer to [Folding](#) for details.

Tutorial: Other Editor Features

There are a number of other editor features that are worth knowing about:

Goto-Line

Navigate quickly to a numbered source line with the `Goto Line` item in the `Edit` menu, or with the key binding displayed there. In some keyboard personalities, the line number is typed into the data entry area that appears at the bottom of the window. Press `Enter` to complete the action.

In Wing Pro and Wing Personal, line numbers can be shown in the editor with the `Show Line Numbers` item in the `Edit` menu.

Selecting Code

Wing supports character, line, and block mode selection from the `Selection Mode` item in the `Edit` menu.

In Wing Pro and Wing Personal, multiple selections can be made at the same time with the `Edit > Multiple Selections` menu item, multiple selections toolbar item, and by pressing `Ctrl+Alt` (or `Command+Alt` on the Mac) while making a selection with the mouse. Once there are multiple selections, edits made will be applied in the same way to all the selections concurrently.

In Python code, the `Select` sub-menu in the `Edit` menu can be used to easily select and traverse logical blocks of code. The `Select More` and `Select Less` operations are particularly useful when preparing to type over or copy/paste ranges of text. Try these out now on `urllib` in `ReadPythonNews` in `example1.py`. Each repeated press of `Ctrl-Up` will select more code in logical units. Press `Ctrl-Down` to select less code.

The other operations in the `Select` sub-menu can be used for selecting and moving forward or backward over whole statements, blocks, or scopes. If you plan to use these and your selected `User Interface > Keyboard > Keyboard Personality` preference does not support them, then you will want to define key bindings for them using the `User Interface > Keyboard > Custom Key Bindings` preference. The command names are `select-x`, `next-x`, and `previous-x` where `x` is either `statement`, `block`, or `scope`.

Line Editing

In Wing Pro and Wing Personal, lines can quickly be inserted, deleted, duplicated, swapped, or moved up or down with the operations in the `Line Editing` sub-menu of the `Source` menu. If your keyboard personality does not support them, then you can define key bindings for those you are interested in using. The command names are: `new-line-before`, `new-line-after`, `duplicate-line-above`, `duplicate-line`, `move-line-up`, `move-line-down`, `delete-line`, and `swap-lines`.

Code Snippets

In Wing Pro, the `Snippets` tool in the `Tools` menu can be used to define and use code snippets for commonly repeated motifs, such as class or def skeletons or documentation templates.

You may already have noticed that these appear in Wing's auto-completer. Try this now by typing `def` into the top level of a file in the editor. Then select the `def (snippet)` completion choice. Wing will place the snippet into the editor and enter into a data entry mode similar to the mode used for entering arguments when the `Auto-Enter Invocation Arg`s` auto-editing operation is enabled. Type any text you want in each field within the snippet and press `Tab` to move between the fields. Data-entry mode will end at the last tab stop or if you move out of the snippet body.

Now try it again with `class` and then inside the scope of the class use the `def` snippet again. Notice that the form of snippet in this context differs from the one used at the top level (it includes `self`). Like-named snippets can be defined in this way for the following contexts: Module, class, function, method, attribute (after a period), comment, and string.

For details see [Code Snippets](#).

Block Commenting

Lines of code can be commented out or un-commented quickly from the `Source` menu or, in Wing Pro, by pressing the `#` key while several lines of Python code are selected. In Python code, the `Block Commenting Style` preference controls the type of commenting that is used. The default is to use indented single `#` characters since this works better with some of Wing's other features.

Brace Matching

Wing highlights brace matching as you type unless disabled from the `Auto Brace Match` preference. The `Match Braces` item in the `Source` menu causes Wing to select all the code that is contained in the nearest matching braces found from the current insertion point on the editor. Repeated invocations of the command will traverse outward or forward in the file.

Text Reformatting

Code can be re-wrapped to the configured `Reformatting Wrap Column` with the `Justify Rewrap` item in the `Source` menu. This will limit wrapping to a single logical line of code, so it can be used to reformat an argument list or long list or tuple without altering surrounding code.

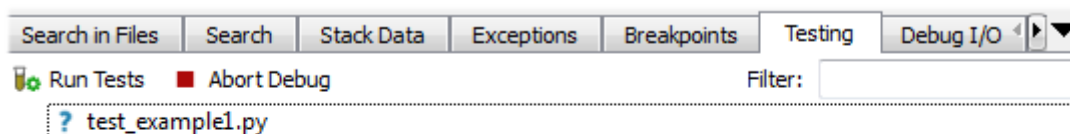
Bookmarks

Wing Pro's `Bookmarks` tool in the `Tools` menu, and the bookmarking commands in the `Source` menu and editor context menu, can be used to define and jump to marked locations in the editor. In Python files, these bookmarks are defined relative to the named scope in the file so they move around with the scope as the file is edited. See [Bookmarks](#) for details.

Tutorial: Unit Testing

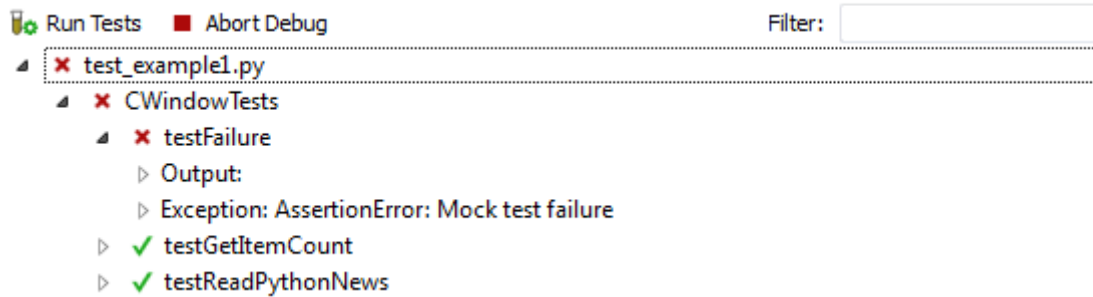
Wing's `Testing` tool makes it easy to run and debug units tests written for the `unittest`, `doctest`, `pytest`, `nose`, and `Django` unit testing frameworks.

Let's try this out now. First, open up `Project Properties` and under the `Testing` tab insert a `Test File Pattern` that is set to `Glob / Wildcard` and `test_*.py`. This tells Wing which of your project files are unit test files. Press `OK` or `Apply` and bring up the `Testing` tool from the `Tools` menu. This should now contain an entry for the file `test_example1.py`:



Next comment out the line that reads `PromptToContinue` in `example1.py` so that the module can be loaded by the tests without prompting. One way to do this is to click on the line and use `Toggle Block Comment` from the `Source` menu.

Then press `Run Tests` in the `Testing` tool. You should see two of the three tests pass, and one will fail. You can expand the tree to see details of the failed tests, including any output printed by the test and the exception that occurred. Double clicking on the test results and exception will take you to the relevant code.



Now run the failed `testFailure` in the debugger by right clicking on it and selecting `Debug Test`. Wing should stop at the exception and you can use the debugger on the test as you would for any other Python code.

Note that you can also run tests from the editor by clicking on the test you want to run and selecting `Run Tests at Cursor` from the `Testing` menu.

Environment

When unit tests are run in the `Testing` tool, by default they run in the same environment that is used for debugging and executing code. This can be changed by specifying a `Launch Configuration` to use instead, with `Environment` under the `Testing` tab of `Project Properties` or `File Properties` on the unit test file.

Tutorial: Version Control Systems

Wing provides integrations with the `Mercurial`, `Git`, `Subversion`, `Perforce`, `Bazaar`, and `CVS` revision control systems. These auto-enable based on the contents of your project.

If you have a code base that is in revision control you might want to try this out now, by creating a project for your code base. To make this easier, you can launch a second instance of Wing by running it from the command line with the `--new` option.

Once you have added files to the project and saved it, Wing should auto-detect the revision control system and add a menu to the menu bar. You can now select `Project Status` from that menu or use the `Tools` menu to bring up the appropriate revision control tool. Right click on the tool or use the menu bar menu to initiate operations.

If you have a project with files in multiple revision control systems or want to keep a particular system active at all times, you can do this from the `Version Control` preferences group.

See the [Version Control](#) documentation for details.

Difference and Merge Tool

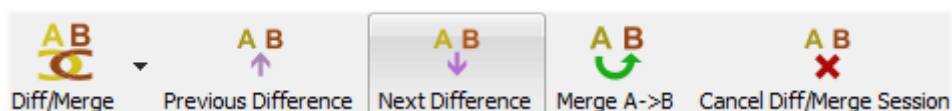
When a revision control system is active, you can right click on items in the appropriate revision control tool or on the editor or `Project` tool to initiate graphical comparison of changes relative to the repository.

This tool can also be used to compare two files, two directories, and an unsaved file with the disk:

Try it now by making several changes to `example1.py` without saving them to disk. Then click on the `Difference/Merge` icon in the toolbar to `Compare Buffer With Disk`:



Wing will split the editor area to show two editors side by side and will show additional icons in the toolbar to control the difference and merge session:



Use the previous/next buttons in the `Difference/Merge` toolbar group to move forward and backward between the differences, and then the `A->B` tool to undo each unsaved change.

When comparing directories, Wing will show the `Diff/Merge` tool while the session is active, and will highlight the current file being compared as you move through the session. You can also click on files in this tool to move to a specific comparison.

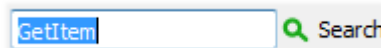
`Difference/Merge` is particularly useful for reviewing changes before committing to a revision control repository, so you can avoid committing unintended changes and can undo any spurious or whitespace-only changes.

Tutorial: Searching

Wing provides several different interfaces for searching your code. Which you use depends on your task.

Toolbar Search

A quick way to search through the current editor is to enter your search string in the area provided in the toolbar:



If you enter only lower case the search will be case-insensitive. Entering one or more upper-case letter causes the search to become case-sensitive.

Try this now in `example1.py`: Type `GetItem` in the toolbar search area and Wing will immediately, starting with the first letter typed, search for matching text in the editor. Press the `Enter` key to move on to the next match, wrapping around to the top of the file if necessary.

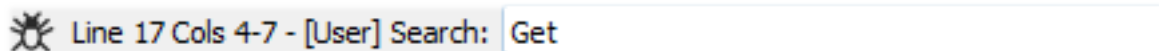
Toolbar-based searches always go forward (downward) in the file from the current cursor position.

Keyboard-driven Search

If you prefer a more powerful search interface using the keyboard only, try the key bindings for the items in the `Mini-search` sub-menu of the `Edit` menu (the bindings vary by keyboard personality). From here, you can initiate searching forward and backward in the current editor, optionally using the current selection in the editor as the search string or using regular expression matching. You can also initiate replace operations.

Try this in the `example1.py` file: If using the default editor mode, press the `Ctrl-U`. For others, refer to the `Mini-search` group in the `Edit` menu.

This will display an entry area at the bottom of the IDE window and will place focus there:



Continue by typing `G`, then `e`, then `t`. Notice how Wing searches incrementally with each keypress. This lets you type only as much as you need to find the source code you are looking for.

While the mini-search area is still active, try pressing the same key combination you used to display it again and Wing will search for the next matching occurrence. Note that if no match is found `Failed Search` will be displayed. However, pressing the mini search key combination again will wrap around and start searching again at the top of the file, if there are any matches.

As in toolbar search, typing lower case letters results in case-insensitive search, and using one or more upper case letters results in case-sensitive search.

Search direction can be changed during searching by pressing the key bindings assigned to forward and backward mini-search. You can exit from the search by pressing the `Esc` key or `Ctrl-G`.

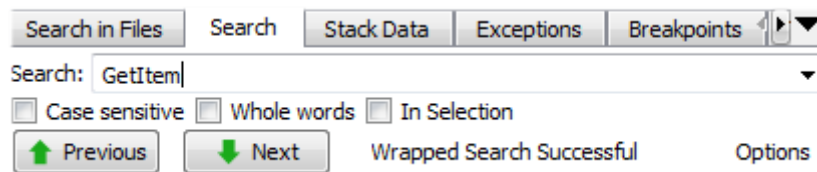
The regular expression based search options found in the `Mini-search` menu group work similarly but expect regular expressions for the search criteria (see below).

Keyboard-driven mini-replace works similarly, except that you will be presented with two entry areas, one for your search string and one for the replace string. Use `Query/Replace` to be prompted for `Y` and `N` for each replace location, and `Replace String` to replace all matches globally in the file.

Wing adjusts some details of how mini-search behaves according to keyboard personality. For example, in emacs mode `Ctrl-G` will cancel the search and in vi mode the search is always case sensitive, as in VI/VIM.

Search Tool

The `Search` tool provides a familiar GUI-based search and replace tool for operating on the current editor. Key bindings for operations on this tool are given in the `Search` and `Replace` group in the `Edit` menu.

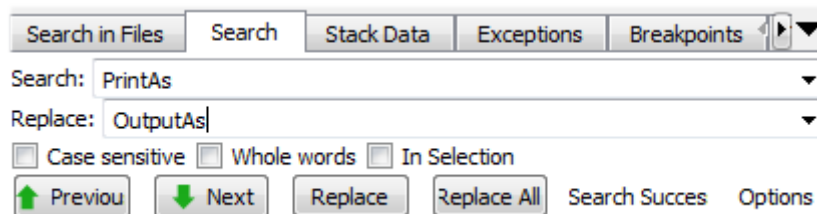


Searches may span the whole file or be constrained to the current selection, can be case sensitive or insensitive, and may optionally be constrained to matching only whole words.

By default, searching is incremental while you type your search string. To disable this, uncheck `Incremental` in the `Options` menu.

Replacing

When the `Show Replace` item in `Options` is activated, Wing will show an area for entering a replace string and add `Replace` and `Replace All` buttons to the `Search` tool:



Try replacing `example1.py` with search string `PrintAs` and replace string `OutputAs`.

Select the first result match and then `Replace` repeatedly. One search match will be replaced at a time. Search will occur again after each replace automatically unless you turn off the `Find After Replace` option. Changes can be undone in the editor, one at a time. Do this now to avoid saving this replace operation.

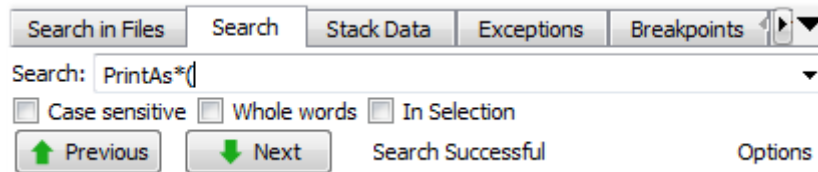
Next, try `Replace All` instead. Wing will simply replace all occurrences in the file at the same time. When this is done, a single undo in the editor will cancel the entire replace operation.

Wildcard Searching

By default, Wing searches for straight text matches on the strings you type. In Wing Pro and Wing Personal, wildcard and regular expression searching are also available in the `Options` menu.

The easier one of these to learn is wildcard searching, which allows you to specify a search string that contains `*` to match anything, `?` to match a single character, or ranges of characters specified within `[]` and `]` to match any of the specified characters. This is the same syntax supported by the Python `glob` module and is described in more detail in the [Wildcard Search Syntax](#) manual page.

Try a wildcard search now by selecting Wild Card from the Options menu and making sure `example1.py` is your current editor. Set the search string to `PrintAs*()`. This should display match all occurrences of the string `PrintAs`, followed by zero or more characters, followed by `()`:



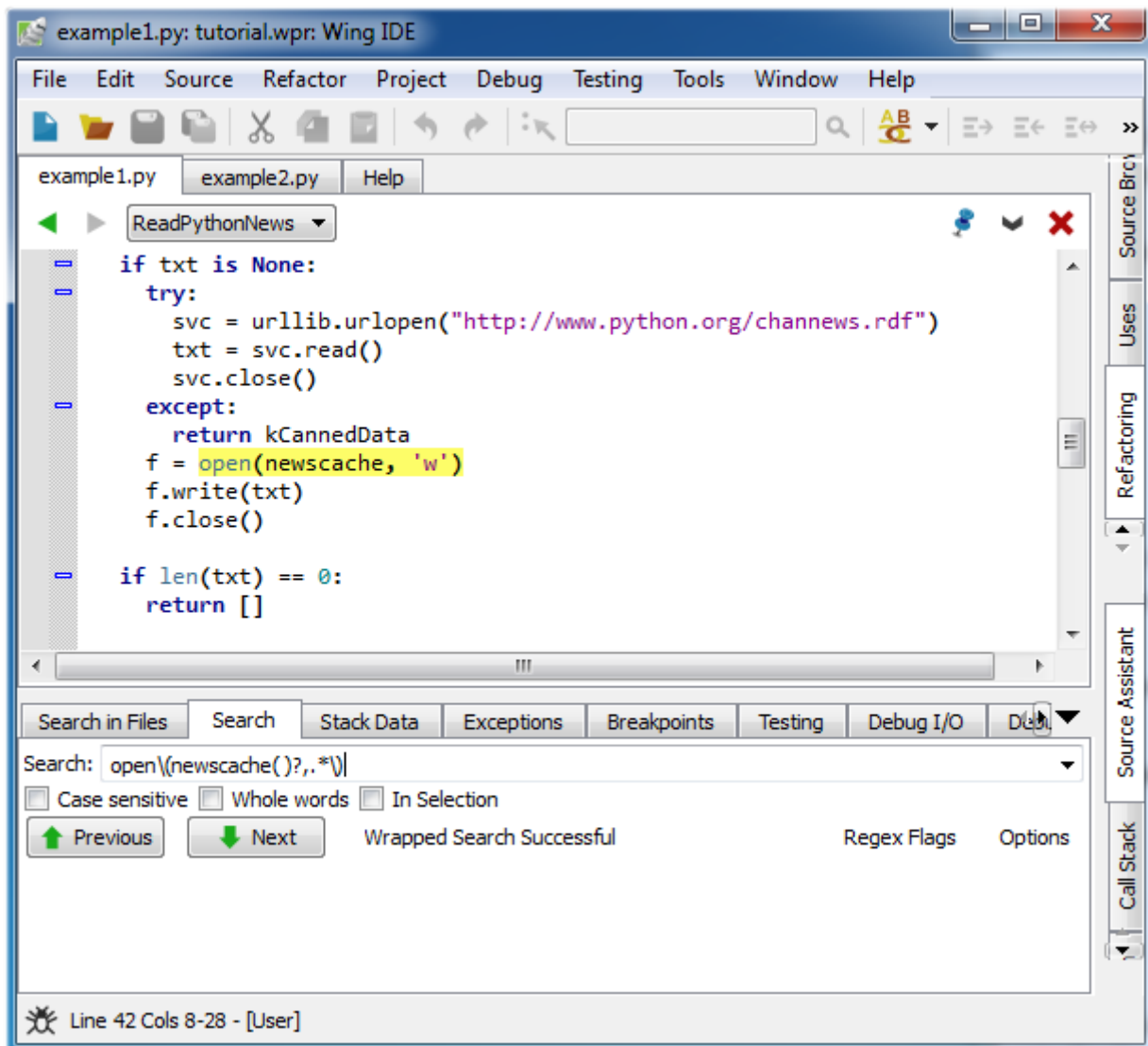
Also try searching on `PrintAs*[A-Z]()` with the Case Sensitive search option turned on. This matches all strings starting with `PrintAs` followed by zero or more characters, followed by any capital letter from A to Z, followed by `()`.

Finally, try `PrintAsT???`, which will match any string starting with `PrintAsT` followed by any three characters.

Regular Expression Search

In Wing Pro and Wing Personal, regular expressions can also be used for searching. These are most useful for complicated search tasks, such as finding all calls to a particular function that occur as part of an assignment statement.

For example, `open\(newscache()?, .*\)` matches only calls to the function `open` where the first argument is named `newscache` and there are at least two parameters. If you try this with `example1.py`, you should get exactly one search match:

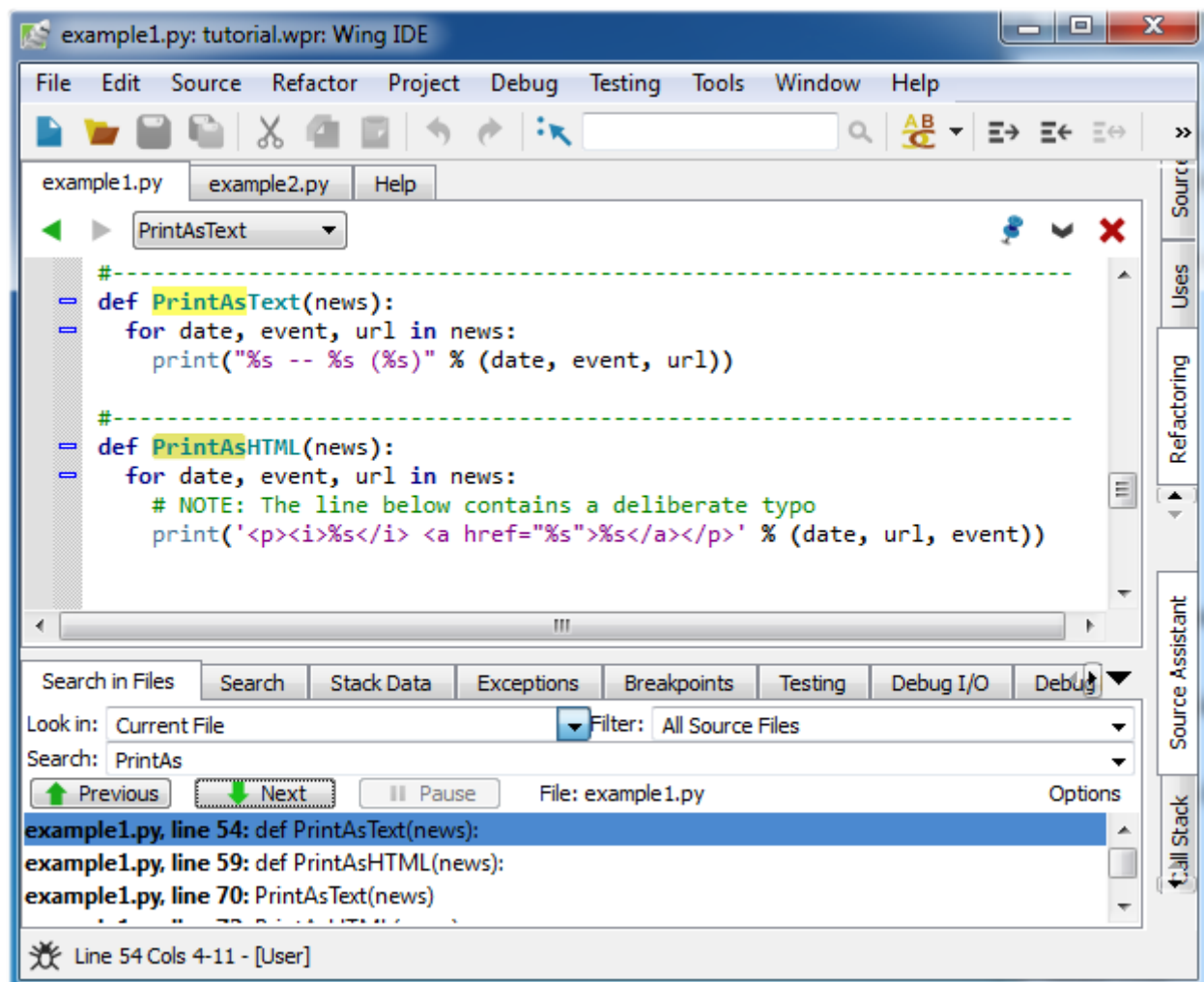


In this mode, the replace string can reference regex match groups with `\\1`, `\\2`, etc, as in the Python `re.sub()` call.

The details of regular expression syntax and usage can be very complicated, so this tutorial does not cover them. For that, see the [Regular Expression Syntax](#) documentation in the Python manual.

Search in Files Tool

The Search in Files tool in Wing Pro and Wing Personal is the most powerful search option available in Wing. It supports multi-file batch search of the disk, project, open editors, or other sets of files. It can also search using wildcards and can do regular expression based search/replace.



Before worrying about the details, try a simple batch search on the `example1.py` file. Select `Current File` from the `Look in` selector on the `Search in Files` tool. Then enter `PrintAs` into the search area.

Wing will start searching immediately, restarting the search whenever you alter the search string or make other changes that affect the result set. When you are done, you should see results like those shown in the screen shot above. Click on the first result line to select it. This will also display `example1.py` with the corresponding search match highlighted.

You can use the forward/backward arrows in the `Search in Files` tool to traverse your results.

File Filters

Next, change the `Look in` selector to `All Files in Project` and change your search string to `HTML`. This works the same way as searching a single file, but lists the results for all files in your project. You can also search all currently open files in this way.

In many cases, searching is more useful if constrained to a subset of files in your projects such as only Python files. This can be done with by selecting `Python Files` in the `Filter` selector. You can also define your own file filters using the `Create/Edit Filters...` item in the `Filter` selector. This will display the `Files > File Types > File Filters` preference:

File Filters	Name	Specification
	All Source Files	: Wild Card on File Name: *.pyo; Wild Card on File Name: *\$py.class; Wild Card .
	C/C++ Files	Mime Type: text/x-c-source; Mime Type: text/x-cpp-source; Wild Card on Direct
	HTML and XML Files	Mime Type: text/html; Mime Type: text/xml; Mime Type: text/x-zope-pt; Wild C;
	Hidden & Temporary Files	Wild Card on File Name: *.pyo; Wild Card on File Name: *\$py.class; Wild Card ...
	Python Files	Mime Type: text/x-cython; Mime Type: text/x-python; Wild Card on Directory N
	Insert	Remove Edit

Each file filter has a name and a list of include and exclude specifications. Each of these specifications can be applied to the file name, directory name, or the file's MIME type. A simple example would be to specify *.pas wildcard for matching Pascal files by name, or using the text/html mime type for all HTML files.

Searching Disk

Wing can also search directly on disk. Try this by typing a directory path in the Look in area. Assuming you haven't changed the search string, this should search for HTML in all text files in that directory.

Disk search can be recursive, in which case Wing searches all sub-directories as well. This is done by selecting a directory in the Look in scope selector and checking Recursive Directory Search in the Options menu.

You can alter the format of the result list with the Show Line Numbers item and Result File Name group in the Options menu, which contains several other search options as well.

Note that searching Project Files is usually faster than searching a directory structure because the set of files is precomputed and thus the search only needs to look in the files and not spend time discovering them.

Multi-File Replace

When working with multiple files in the result set, Wing opens each changed file into an editor, whether or not it is already open. This allows you to undo changes by not saving files or by issuing Undo within each editor.

If you check Replace Operates on Disk in the Options menu within the Search in Files tool, Wing will change files directly on disk instead of opening editors into the IDE. This can be much faster but is not recommended unless you have a revision control system that can get you out of hot water if mistakes are made.

Note that even when operating directly on disk, Wing will replace changes in already-open editors only within the IDE. This avoids creating two versions of a file if there are already edits in the IDE's copy. We recommend selecting Save All from the file menu immediately after each replace operation. This avoids losing parts of a replace, resulting in inconsistent application of a replace operation to the files in your source base.

Tutorial: Other IDE Features

By now you have seen many of the IDE's features. Before we call it a day, let's look at a few other major features that are worth knowing about.

Remote Development

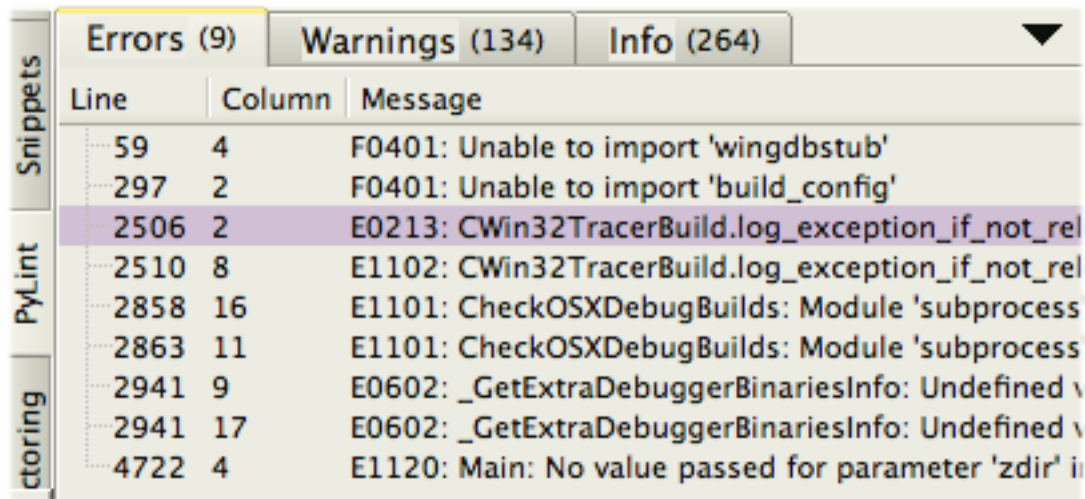
Wing Pro makes it possible to work with Python source code that resides on a remote host. This is done by setting up SSH access to the remote host, then configuring Wing using Remote Hosts in the Project menu, and pointing Python Executable in Project Properties at that remote host.

Once this is done, remote files and directories can be added to the project. Then Wing will be able to edit, debug, test, search, inspect, refactor, and manage remote files, and it can run Python Shell and OS Commands on the remote host.

For configuration details, see [Remote Hosts](#).

PyLint Integration

Wing's `PyLint` tool, available in the `Tools` menu, provides a simple integration with the command line code inspection tool `pylint`. To use this, you need to download and install `pylint` separately. Then right-click on the `PyLint` tool in Wing to configure the integration. Use the `Update` items in the right-click context menu on the `PyLint` tool to update the tool's contents for the current file or package. Clicking on errors, warnings, and informational messages takes you to the source code that `pylint` is flagging.

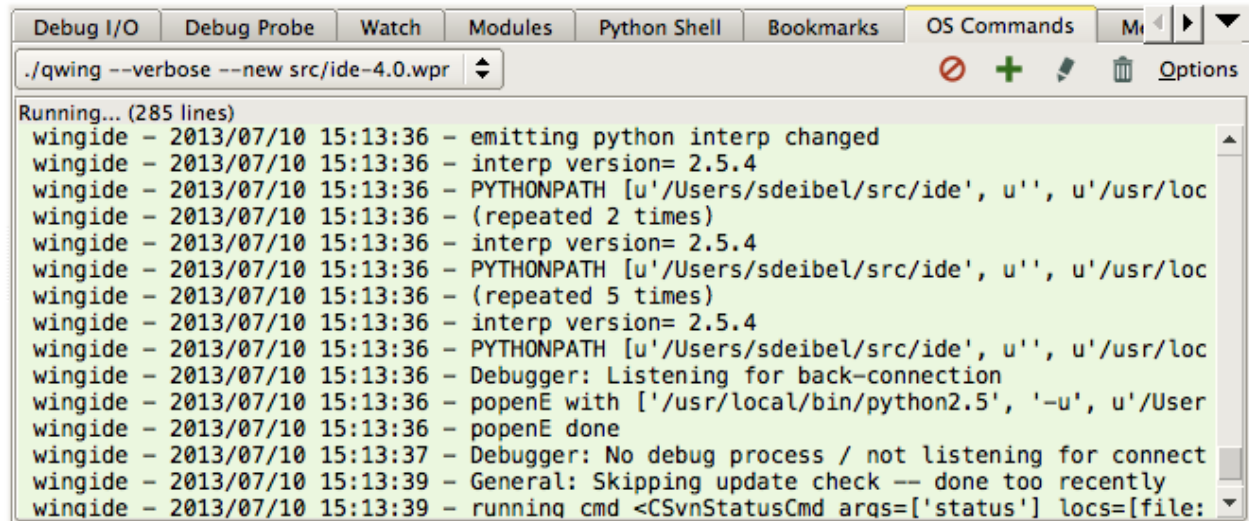


Line	Column	Message
59	4	F0401: Unable to import 'wingdbstub'
297	2	F0401: Unable to import 'build_config'
2506	2	E0213: CWin32TracerBuild.log_exception_if_not_rel
2510	8	E1102: CWin32TracerBuild.log_exception_if_not_rel
2858	16	E1101: CheckOSXDebugBuilds: Module 'subprocess
2863	11	E1101: CheckOSXDebugBuilds: Module 'subprocess
2941	9	E0602: _GetExtraDebuggerBinariesInfo: Undefined \
2941	17	E0602: _GetExtraDebuggerBinariesInfo: Undefined \
4722	4	E1120: Main: No value passed for parameter 'zdir' i

Note that this screenshot was taken with `User Interface > Editor Color Palette` preference set to `Lin` color palette and with `User Interface > Apply Editor Palette Throughout the UI` enabled (with non-native display style). Each of the screenshots that follows uses a different display style.

OS Commands

The `OS Commands` tool can be used to set up, execute, and interact with external commands, for building, deployment, and other tasks. The `Build Command` field in the `Debug/Execute` tab of `Project Properties` can be used to configure and select one command to execute automatically before any debug session begins.



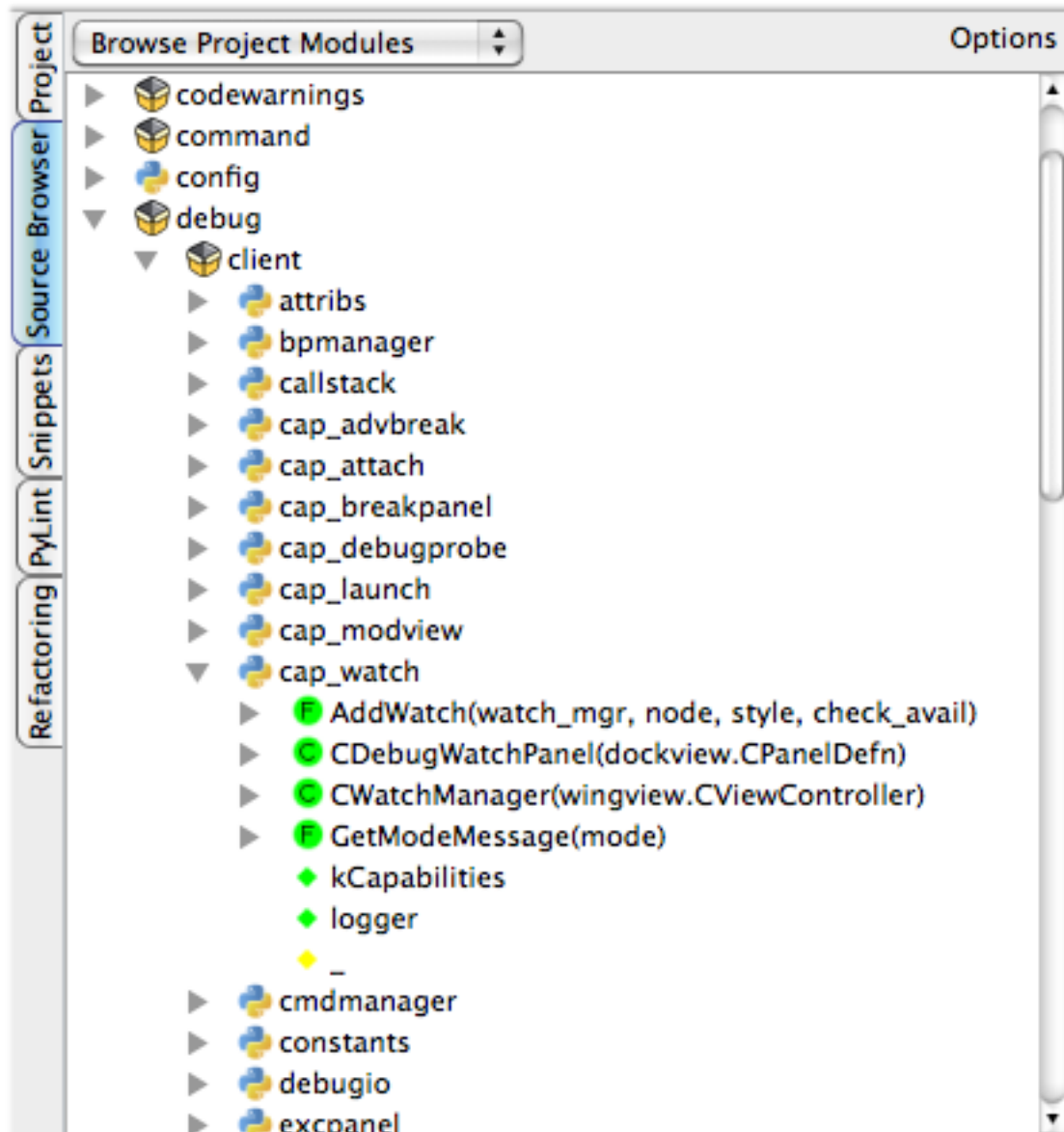
The screenshot shows the 'OS Commands' tab in the Wing IDE interface. The command bar at the top contains the text `./qwing --verbose --new src/ide-4.0.wpr`. The main area displays a log of messages from the `wingide` process, starting with 'Running... (285 lines)'. The log entries include timestamps, process names, and messages such as 'emitting python interp changed', 'interp version= 2.5.4', 'PYTHONPATH [u'/Users/sdeibel/src/ide', u'', u'/usr/loc', and 'Debugger: Listening for back-connection'. The window has a standard toolbar with icons for stop, add, edit, delete, and options.

```
Running... (285 lines)
wingide - 2013/07/10 15:13:36 - emitting python interp changed
wingide - 2013/07/10 15:13:36 - interp version= 2.5.4
wingide - 2013/07/10 15:13:36 - PYTHONPATH [u'/Users/sdeibel/src/ide', u'', u'/usr/loc
wingide - 2013/07/10 15:13:36 - (repeated 2 times)
wingide - 2013/07/10 15:13:36 - interp version= 2.5.4
wingide - 2013/07/10 15:13:36 - PYTHONPATH [u'/Users/sdeibel/src/ide', u'', u'/usr/loc
wingide - 2013/07/10 15:13:36 - (repeated 5 times)
wingide - 2013/07/10 15:13:36 - interp version= 2.5.4
wingide - 2013/07/10 15:13:36 - PYTHONPATH [u'/Users/sdeibel/src/ide', u'', u'/usr/loc
wingide - 2013/07/10 15:13:36 - Debugger: Listening for back-connection
wingide - 2013/07/10 15:13:36 - popenE with ['/usr/local/bin/python2.5', '-u', u'/User
wingide - 2013/07/10 15:13:36 - popenE done
wingide - 2013/07/10 15:13:37 - Debugger: No debug process / not listening for connect
wingide - 2013/07/10 15:13:39 - General: Skipping update check -- done too recently
wingide - 2013/07/10 15:13:39 - running cmd <CSvnStatusCmd args=['status'] locs=[file:
```

For details see [OS Commands Tool](#).

Source Browser

Wing Pro and Wing Personal include a [Source Browser](#) that can be used to inspect and navigate the module and class structure of your source code.



By default, the browser will display classes, methods, attributes, functions, and variables defined in the currently displayed source editor. The popup menu at the top left of the source browser can be used to alter the display to include all classes or all modules in the project. The Options menu in the top right allows filtering by origin, accessibility, and type of source symbols. The Options menu also allows sorting the view alphabetically, by type, or in the order that symbols occur in the source file.

Double clicking on items in the Source Browser opens them into an editor. When Follow Selection is enabled in the Options menu, Wing also opens files that are single-clicked or visited by keyboard navigation in the Source Browser. In this case, files are opened in non-sticky mode.

Notice that the Source Assistant tool is integrated with the Source Browser, and will update its content as you move around the Source Browser tree as it does for the editor, shells, and Project tool.

File Sets

Wing allows you to create named sets of files which you can open as a group or search with the Search in Files tool. File sets can be created and opened from the File Sets item in the File menu, by selecting items and right-clicking in the Project tool, by right-clicking in the Open Files tool, and from the Filter and Options menus in the Search in Files tool.

Note that the `Open Files` tool is also useful for closing particular files or closing all files except a selected set.

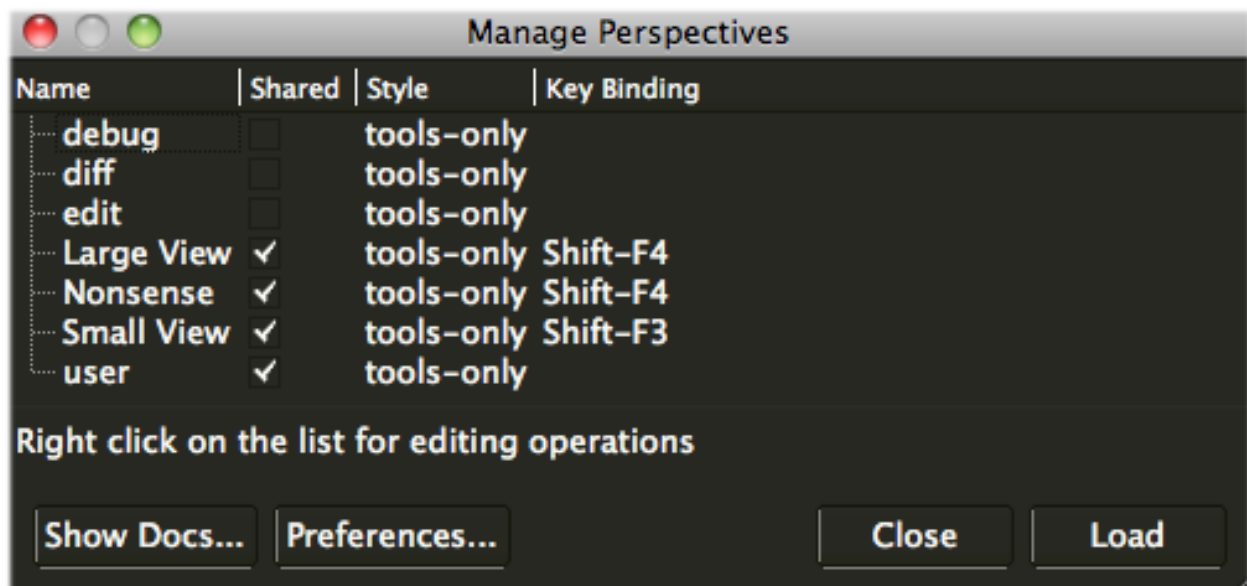
File Operations

Files can be created, deleted, moved, and renamed from the `Project` tool by right-clicking, dragging, and clicking on names in the tree. Deleted files are moved to the system's trash or recycling bin. When files are in a revision control system, Wing will also issue the necessary revision control commands to create, delete, move, or rename the file.

Perspectives

Perspectives are a way to store and later revisit particular arrangements of the user interface. For example, you may set up one set of visible tools to use when testing, another for working on documentation, and still another for debugging.

Perspectives are accessed from the `Tools` menu.



Optionally, Wing can automatically switch perspectives whenever debugging starts or stops, so that the user interface differs according to how the tools were left when last editing or debugging. This is done by selecting `Enable Auto-Perspectives` in the `Tools` menu.

For more information see [Perspectives](#).

Extending the IDE

Wing can be extended by writing Python scripts that call into the IDE's scripting API. This is useful for adding everything from simple editor commands and debugger add-ons to new tools (although the latter is for advanced users only; the `PyLint` tool mentioned above is an example of a tool implemented by a script).

There is a collection of user-contributed scripts for Wing in the [contributed materials](#) area.

See also [Scripting and Extending Wing](#).

Tutorial: Further Reading

Congratulations! You've finished the tutorial. As you work with Wing on your own software development projects, the following resources may be useful:

- [Wing Support Website](#) which includes our mailing lists and other information for Wing users.
- [Wing Reference Manual](#) which documents the features in detail.

- [How-To Guides](#) for information on using Wing with frameworks like Django, Plone, Google App Engine, matplotlib, Autodesk Maya, NUKE, and others.