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# PyInstaller Documentation

*Release 5.4*

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**Version** PyInstaller 5.4

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PyInstaller bundles a Python application and all its dependencies into a single package. The user can run the packaged app without installing a Python interpreter or any modules. PyInstaller supports Python 3.7 and newer, and correctly bundles many major Python packages such as numpy, matplotlib, PyQt, wxPython, and others.

PyInstaller is tested against Windows, MacOS X, and Linux. However, it is not a cross-compiler; to make a Windows app you run PyInstaller on Windows, and to make a Linux app you run it on Linux, etc. x PyInstaller has been used successfully with AIX, Solaris, FreeBSD and OpenBSD but testing against them is not part of our continuous integration tests, and the development team offers no guarantee (all code for these platforms comes from external contributions) that PyInstaller will work on these platforms or that they will continue to be supported.



## QUICKSTART

Make sure you have the [Requirements](#) installed, and then install PyInstaller from PyPI:

```
pip install -U pyinstaller
```

Open a command prompt/shell window, and navigate to the directory where your `.py` file is located, then build your app with the following command:

```
pyinstaller your_program.py
```

Your bundled application should now be available in the `dist` folder.





## CONTENTS:

## 2.1 Requirements

### 2.1.1 Windows

PyInstaller runs in Windows 8 and newer. It can create graphical windowed apps (apps that do not need a command window).

### 2.1.2 macOS

PyInstaller runs on macOS 10.15 (Catalina) or newer. It can build graphical windowed apps (apps that do not use a terminal window). PyInstaller builds apps that are compatible with the macOS release in which you run it, and following releases. It can build `x86_64`, `arm64` or hybrid *universal2* binaries on macOS machines of either architecture. See *macOS multi-arch support* for details.

### 2.1.3 GNU/Linux

PyInstaller requires the `ldd` terminal application to discover the shared libraries required by each program or shared library. It is typically found in the distribution-package `glibc` or `libc-bin`.

It also requires the `objdump` terminal application to extract information from object files and the `objcopy` terminal application to append data to the bootloader. These are typically found in the distribution-package `binutils`.

### 2.1.4 AIX, Solaris, FreeBSD and OpenBSD

Users have reported success running PyInstaller on these platforms, but it is not tested on them. The `ldd` and `objdump` commands are needed.

Each bundled app contains a copy of a *bootloader*, a program that sets up the application and starts it (see *The Bootstrap Process in Detail*).

When you install PyInstaller using `pip`, the setup will attempt to build a bootloader for this platform. If that succeeds, the installation continues and PyInstaller is ready to use.

If the `pip` setup fails to build a bootloader, or if you do not use `pip` to install, you must compile a bootloader manually. The process is described under *Building the Bootloader*.

## 2.2 License

PyInstaller is distributed under a dual-licensing scheme using both the GPL 2.0 License, with an exception that allows you to use it to build commercial products - listed below - and the Apache License, version 2.0, which only applies to a certain few files. To see which files the Apache license applies to, and to which the GPL applies, please see the *COPYING.txt* file which can be found in the root of the PyInstaller source repository.

A quick summary of the GPL license exceptions:

- **You may use PyInstaller to bundle commercial applications out of your** source code.
- **The executable bundles generated by PyInstaller from your source code** can be shipped with whatever license you want, as long as it complies with the licenses of your dependencies.
- **You may modify PyInstaller for your own needs but changes to the** PyInstaller source code fall under the terms of the GPL license. That is, if you distribute your modifications you must distribute them under GPL terms.

## 2.3 How To Contribute

**You are very welcome to contribute!** PyInstaller is maintained by a group of volunteers. All contributions, like community support, bug reports, bug fixes, documentation improvements, enhancements and ideas are welcome.

PyInstaller is a free software project that is created and maintained by volunteers. It lives-and-dies based on the support it receives from others, and the fact that you're even considering contributing to PyInstaller is very generous of you.

Since as of now all core-developers are working on PyInstaller in their spare-time, you can help us (and the project) most if you are following some simple guidelines. The higher the quality of your contribution, the less work we have incorporating them and the earlier we will be able to incorporate them :-)

If you get stuck at any point you can [create a ticket on GitHub](#).

For more about our development process and methods, see the *Development Guide*.

### 2.3.1 Some ideas how you can help

Some ideas how you can help:

- **Answer support tickets:** Often the user just needs to be pointed to the fitting section in the manual.
- **Triage open issues**, which means: read the report; ask the issue requester to provide missing information and to try with the latest development version; ensure there is a *minimal* example; ensure the issue-reporter followed all steps in *When Things Go Wrong*. If you are able reproduce the problem and track down the bug, this would be a *great* help for the core developers.
- **Help improving the documentation:** There is a list of [documentation issues](#) you can pick one from. Please provide a pull-request for your changes. [Read more](#) »»
- **Pick an issue requesting a pull-request** and provide one.
- **Review pull requests:** Are the commit messages following the guideline *Please Write Good Commit Messages*; do all new files have a copyright-header (esp. for hooks this is often missing); is the code okay; etc.
- Scan the [list of open issues](#) and pick some task :-)

Thank you very much!

If you plan to contribute frequently, just ask for write access to the main git repository. We would be glad to welcome you in the team!

## 2.4 How to Install PyInstaller

PyInstaller is a normal Python package. You can download the archive from [PyPi](#), but it is easier to install using `pip` where it is available, for example:

```
pip install pyinstaller
```

or upgrade to a newer version:

```
pip install --upgrade pyinstaller
```

To install the current development version use:

```
pip install https://github.com/pyinstaller/pyinstaller/tarball/develop
```

### 2.4.1 Installing from the archive

If `pip` is not available, download the compressed archive from [PyPi](#). If you are asked to test a problem using the latest development code, download the compressed archive from the *develop* branch of [PyInstaller Downloads](#) page.

Expand the archive. Inside is a script named `setup.py`. Execute `python setup.py install` with administrator privilege to install or upgrade PyInstaller.

For platforms other than Windows, GNU/Linux and macOS, you must first build a bootloader program for your platform: see [Building the Bootloader](#). After the bootloader has been created, use `python setup.py install` with administrator privileges to complete the installation.

### 2.4.2 Verifying the installation

On all platforms, the command `pyinstaller` should now exist on the execution path. To verify this, enter the command:

```
pyinstaller --version
```

The result should resemble `4.n` for a released version, and `4.n.dev0-xxxxxx` for a development branch.

If the command is not found, make sure the execution path includes the proper directory:

- Windows: `C:\PythonXY\Scripts` where *XY* stands for the major and minor Python version number, for example `C:\Python38\Scripts` for Python 3.8)
- GNU/Linux: `/usr/bin/`
- macOS (using the default Apple-supplied Python) `/usr/bin`
- macOS (using Python installed by homebrew) `/usr/local/bin`
- macOS (using Python installed by macports) `/opt/local/bin`

To display the current path in Windows the command is `echo %path%` and in other systems, `echo $PATH`.

### 2.4.3 Installed commands

The complete installation places these commands on the execution path:

- `pyinstaller` is the main command to build a bundled application. See [Using PyInstaller](#).
- `pyi-makespec` is used to create a spec file. See [Using Spec Files](#).
- `pyi-archive_viewer` is used to inspect a bundled application. See [Inspecting Archives](#).
- `pyi-bindepend` is used to display dependencies of an executable. See [Inspecting Executables](#).
- `pyi-grab_version` is used to extract a version resource from a Windows executable. See [Capturing Windows Version Data](#).

If you do not perform a complete installation (installing via `pip` or executing `setup.py`), these commands will not be installed as commands. However, you can still execute all the functions documented below by running Python scripts found in the distribution folder. The equivalent of the `pyinstaller` command is `PyInstaller-folder/pyinstaller.py`. The other commands are found in `PyInstaller-folder/cliutils/` with meaningful names (`makespec.py`, etc.)

## 2.5 What PyInstaller Does and How It Does It

This section covers the basic ideas of PyInstaller. These ideas apply to all platforms. Options and special cases are covered below, under [Using PyInstaller](#).

PyInstaller reads a Python script written by you. It analyzes your code to discover every other module and library your script needs in order to execute. Then it collects copies of all those files – including the active Python interpreter! – and puts them with your script in a single folder, or optionally in a single executable file.

For the great majority of programs, this can be done with one short command,

```
pyinstaller myscript.py
```

or with a few added options, for example a windowed application as a single-file executable,

```
pyinstaller --onefile --windowed myscript.py
```

You distribute the bundle as a folder or file to other people, and they can execute your program. To your users, the app is self-contained. They do not need to install any particular version of Python or any modules. They do not need to have Python installed at all.

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**Note:** The output of PyInstaller is specific to the active operating system and the active version of Python. This means that to prepare a distribution for:

- a different OS
- a different version of Python
- a 32-bit or 64-bit OS

you run PyInstaller on that OS, under that version of Python. The Python interpreter that executes PyInstaller is part of the bundle, and it is specific to the OS and the word size.

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### 2.5.1 Analysis: Finding the Files Your Program Needs

What other modules and libraries does your script need in order to run? (These are sometimes called its “dependencies”.)

To find out, PyInstaller finds all the `import` statements in your script. It finds the imported modules and looks in them for `import` statements, and so on recursively, until it has a complete list of modules your script may use.

PyInstaller understands the “egg” distribution format often used for Python packages. If your script imports a module from an “egg”, PyInstaller adds the egg and its dependencies to the set of needed files.

PyInstaller also knows about many major Python packages, including the GUI packages `Qt` (imported via `PyQt` or `PySide`), `WxPython`, `TkInter`, `matplotlib`, and other major packages. For a complete list, see [Supported Packages](#).

Some Python scripts import modules in ways that PyInstaller cannot detect: for example, by using the `__import__()` function with variable data, using `importlib.import_module()`, or manipulating the `sys.path` value at run time. If your script requires files that PyInstaller does not know about, you must help it:

- You can give additional files on the `pyinstaller` command line.
- You can give additional import paths on the command line.
- You can edit the `myscript.spec` file that PyInstaller writes the first time you run it for your script. In the spec file you can tell PyInstaller about code modules that are unique to your script.
- You can write “hook” files that inform PyInstaller of hidden imports. If you create a “hook” for a package that other users might also use, you can contribute your hook file to PyInstaller.

If your program depends on access to certain data files, you can tell PyInstaller to include them in the bundle as well. You do this by modifying the spec file, an advanced topic that is covered under [Using Spec Files](#).

In order to locate included files at run time, your program needs to be able to learn its path at run time in a way that works regardless of whether or not it is running from a bundle. This is covered under [Run-time Information](#).

PyInstaller does *not* include libraries that should exist in any installation of this OS. For example in GNU/Linux, it does not bundle any file from `/lib` or `/usr/lib`, assuming these will be found in every system.

### 2.5.2 Bundling to One Folder

When you apply PyInstaller to `myscript.py` the default result is a single folder named `myscript`. This folder contains all your script’s dependencies, and an executable file also named `myscript` (`myscript.exe` in Windows).

You compress the folder to `myscript.zip` and transmit it to your users. They install the program simply by unzipping it. A user runs your app by opening the folder and launching the `myscript` executable inside it.

It is easy to debug problems that occur when building the app when you use one-folder mode. You can see exactly what files PyInstaller collected into the folder.

Another advantage of a one-folder bundle is that when you change your code, as long as it imports *exactly the same set of dependencies*, you could send out only the updated `myscript` executable. That is typically much smaller than the entire folder. (If you change the script so that it imports more or different dependencies, or if the dependencies are upgraded, you must redistribute the whole bundle.)

A small disadvantage of the one-folder format is that the one folder contains a large number of files. Your user must find the `myscript` executable in a long list of names or among a big array of icons. Also your user can create a problem by accidentally dragging files out of the folder.

### 2.5.3 How the One-Folder Program Works

A bundled program always starts execution in the PyInstaller bootloader. This is the heart of the `myscript` executable in the folder.

The PyInstaller bootloader is a binary executable program for the active platform (Windows, GNU/Linux, macOS, etc.). When the user launches your program, it is the bootloader that runs. The bootloader creates a temporary Python environment such that the Python interpreter will find all imported modules and libraries in the `myscript` folder.

The bootloader starts a copy of the Python interpreter to execute your script. Everything follows normally from there, provided that all the necessary support files were included.

(This is an overview. For more detail, see *The Bootstrap Process in Detail* below.)

### 2.5.4 Bundling to One File

PyInstaller can bundle your script and all its dependencies into a single executable named `myscript` (`myscript.exe` in Windows).

The advantage is that your users get something they understand, a single executable to launch. A disadvantage is that any related files such as a README must be distributed separately. Also, the single executable is a little slower to start up than the one-folder bundle.

Before you attempt to bundle to one file, make sure your app works correctly when bundled to one folder. It is *much* easier to diagnose problems in one-folder mode.

### 2.5.5 How the One-File Program Works

The bootloader is the heart of the one-file bundle also. When started it creates a temporary folder in the appropriate temp-folder location for this OS. The folder is named `_MEIxxxxxx`, where `xxxxxx` is a random number.

The one executable file contains an embedded archive of all the Python modules used by your script, as well as compressed copies of any non-Python support files (e.g. `.so` files). The bootloader uncompresses the support files and writes copies into the temporary folder. This can take a little time. That is why a one-file app is a little slower to start than a one-folder app.

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**Note:** PyInstaller currently does not preserve file attributes. see [#3926](#).

---

After creating the temporary folder, the bootloader proceeds exactly as for the one-folder bundle, in the context of the temporary folder. When the bundled code terminates, the bootloader deletes the temporary folder.

(In GNU/Linux and related systems, it is possible to mount the `/tmp` folder with a “no-execution” option. That option is not compatible with a PyInstaller one-file bundle. It needs to execute code out of `/tmp`. If you know the target environment, `--runtime-tmpdir` might be a workaround.)

Because the program makes a temporary folder with a unique name, you can run multiple copies of the app; they won’t interfere with each other. However, running multiple copies is expensive in disk space because nothing is shared.

The `_MEIxxxxxx` folder is not removed if the program crashes or is killed (kill -9 on Unix, killed by the Task Manager on Windows, “Force Quit” on macOS). Thus if your app crashes frequently, your users will lose disk space to multiple `_MEIxxxxxx` temporary folders.

It is possible to control the location of the `_MEIxxxxxx` folder by using the `--runtime-tmpdir` command line option. The specified path is stored in the executable, and the bootloader will create the `_MEIxxxxxx` folder inside of the specified folder. Please see *Defining the Extraction Location* for details.

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**Note:** Do *not* give administrator privileges to a one-file executable on Windows (“Run this program as an administrator”). There is an unlikely but not impossible way in which a malicious attacker could corrupt one of the shared libraries in the temp folder while the bootloader is preparing it. When distributing a privileged program in general, ensure that file permissions prevent shared libraries or executables from being tampered with. Otherwise, an unelevated process which has write access to these files may escalate privileges by modifying them.

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**Note:** Applications that use `os.setuid()` may encounter permissions errors. The temporary folder where the bundled app runs may not be readable after `setuid` is called. If your script needs to call `setuid`, it may be better to use one-folder mode so as to have more control over the permissions on its files.

---

### 2.5.6 Using a Console Window

By default the bootloader creates a command-line console (a terminal window in GNU/Linux and macOS, a command window in Windows). It gives this window to the Python interpreter for its standard input and output. Your script’s use of `print` and `input()` are directed here. Error messages from Python and default logging output also appear in the console window.

An option for Windows and macOS is to tell PyInstaller to not provide a console window. The bootloader starts Python with no target for standard output or input. Do this when your script has a graphical interface for user input and can properly report its own diagnostics.

As noted in the [CPython tutorial Appendix](#), for Windows a file extension of `.pyw` suppresses the console window that normally appears. Likewise, a console window will not be provided when using a `myscript.pyw` script with PyInstaller.

### 2.5.7 Hiding the Source Code

The bundled app does not include any source code. However, PyInstaller bundles compiled Python scripts (`.pyc` files). These could in principle be decompiled to reveal the logic of your code.

If you want to hide your source code more thoroughly, one possible option is to compile some of your modules with [Cython](#). Using Cython you can convert Python modules into C and compile the C to machine language. PyInstaller can follow import statements that refer to Cython C object modules and bundle them.

Additionally, Python bytecode can be obfuscated with AES256 by specifying an encryption key on PyInstaller’s command line. Please note that it is still very easy to extract the key and get back the original bytecode, but it should prevent most forms of “casual” tampering. See [Encrypting Python Bytecode](#) for details.

## 2.6 Using PyInstaller

The syntax of the `pyinstaller` command is:

```
pyinstaller [options] script [script ...] | specfile
```

In the most simple case, set the current directory to the location of your program `myscript.py` and execute:

```
pyinstaller myscript.py
```

PyInstaller analyzes `myscript.py` and:

- Writes `myscript.spec` in the same folder as the script.

- Creates a folder `build` in the same folder as the script if it does not exist.
- Writes some log files and working files in the `build` folder.
- Creates a folder `dist` in the same folder as the script if it does not exist.
- Writes the `myscript` executable folder in the `dist` folder.

In the `dist` folder you find the bundled app you distribute to your users.

Normally you name one script on the command line. If you name more, all are analyzed and included in the output. However, the first script named supplies the name for the spec file and for the executable folder or file. Its code is the first to execute at run-time.

For certain uses you may edit the contents of `myscript.spec` (described under *Using Spec Files*). After you do this, you name the spec file to PyInstaller instead of the script:

```
pyinstaller myscript.spec
```

The `myscript.spec` file contains most of the information provided by the options that were specified when **pyinstaller** (or **pyi-makespec**) was run with the script file as the argument. You typically do not need to specify any options when running **pyinstaller** with the spec file. Only *a few command-line options* have an effect when building from a spec file.

You may give a path to the script or spec file, for example

```
pyinstaller options... ~/myproject/source/myscript.py
```

or, on Windows,

```
pyinstaller "C:\Documents and Settings\project\myscript.spec"
```

## 2.6.1 Options

A full list of the `pyinstaller` command's options are as follows:

### Positional Arguments

#### **scriptname**

Name of scriptfiles to be processed or exactly one `.spec` file. If a `.spec` file is specified, most options are unnecessary and are ignored.

### Optional Arguments

#### **-h, --help**

show this help message and exit

#### **-v, --version**

Show program version info and exit.

#### **--distpath DIR**

Where to put the bundled app (default: `./dist`)

#### **--workpath WORKPATH**

Where to put all the temporary work files, `.log`, `.pyz` and etc. (default: `./build`)

#### **-y, --noconfirm**

Replace output directory (default: `SPECPATH/dist/SPECNAME`) without asking for confirmation



- upx-dir** UPX\_DIR  
Path to UPX utility (default: search the execution path)
- a, --ascii**  
Do not include unicode encoding support (default: included if available)
- clean**  
Clean PyInstaller cache and remove temporary files before building.
- log-level** LEVEL  
Amount of detail in build-time console messages. LEVEL may be one of TRACE, DEBUG, INFO, WARN, ERROR, CRITICAL (default: INFO).

## What To Generate

- D, --onedir**  
Create a one-folder bundle containing an executable (default)
- F, --onefile**  
Create a one-file bundled executable.
- specpath** DIR  
Folder to store the generated spec file (default: current directory)
- n** NAME, **--name** NAME  
Name to assign to the bundled app and spec file (default: first script's basename)

## What To Bundle, Where To Search

- add-data** <SRC;DEST or SRC:DEST>  
Additional non-binary files or folders to be added to the executable. The path separator is platform specific, `os.pathsep` (which is `;` on Windows and `:` on most unix systems) is used. This option can be used multiple times.
- add-binary** <SRC;DEST or SRC:DEST>  
Additional binary files to be added to the executable. See the `--add-data` option for more details. This option can be used multiple times.
- p** DIR, **--paths** DIR  
A path to search for imports (like using `PYTHONPATH`). Multiple paths are allowed, separated by `' : '`, or use this option multiple times. Equivalent to supplying the `pathex` argument in the spec file.
- hidden-import** MODULENAME, **--hiddenimport** MODULENAME  
Name an import not visible in the code of the script(s). This option can be used multiple times.
- collect-submodules** MODULENAME  
Collect all submodules from the specified package or module. This option can be used multiple times.
- collect-data** MODULENAME, **--collect-datas** MODULENAME  
Collect all data from the specified package or module. This option can be used multiple times.
- collect-binaries** MODULENAME  
Collect all binaries from the specified package or module. This option can be used multiple times.
- collect-all** MODULENAME  
Collect all submodules, data files, and binaries from the specified package or module. This option can be used multiple times.
- copy-metadata** PACKAGENAME  
Copy metadata for the specified package. This option can be used multiple times.

**--recursive-copy-metadata** PACKAGENAME

Copy metadata for the specified package and all its dependencies. This option can be used multiple times.

**--additional-hooks-dir** HOOKSPATH

An additional path to search for hooks. This option can be used multiple times.

**--runtime-hook** RUNTIME\_HOOKS

Path to a custom runtime hook file. A runtime hook is code that is bundled with the executable and is executed before any other code or module to set up special features of the runtime environment. This option can be used multiple times.

**--exclude-module** EXCLUDES

Optional module or package (the Python name, not the path name) that will be ignored (as though it was not found). This option can be used multiple times.

**--key** KEY

The key used to encrypt Python bytecode.

**--splash** IMAGE\_FILE

(EXPERIMENTAL) Add an splash screen with the image IMAGE\_FILE to the application. The splash screen can display progress updates while unpacking.

## How To Generate

**-d** {all,imports,bootloader,noarchive}, **--debug** {all,imports,bootloader,noarchive}

Provide assistance with debugging a frozen application. This argument may be provided multiple times to select several of the following options. - all: All three of the following options. - imports: specify the -v option to the underlying Python interpreter, causing it to print a message each time a module is initialized, showing the place (filename or built-in module) from which it is loaded. See <https://docs.python.org/3/using/cmdline.html#id4>. - bootloader: tell the bootloader to issue progress messages while initializing and starting the bundled app. Used to diagnose problems with missing imports. - noarchive: instead of storing all frozen Python source files as an archive inside the resulting executable, store them as files in the resulting output directory.

**--python-option** PYTHON\_OPTION

Specify a command-line option to pass to the Python interpreter at runtime. Currently supports “v” (equivalent to “-debug imports”), “u”, and “W <warning control>”.

**-s, --strip**

Apply a symbol-table strip to the executable and shared libs (not recommended for Windows)

**--noupX**

Do not use UPX even if it is available (works differently between Windows and \*nix)

**--upX-exclude** FILE

Prevent a binary from being compressed when using upx. This is typically used if upx corrupts certain binaries during compression. FILE is the filename of the binary without path. This option can be used multiple times.

## Windows And Mac Os X Specific Options

**-c, --console, --nowindowed**

Open a console window for standard i/o (default). On Windows this option has no effect if the first script is a ‘.pyw’ file.

**-w, --windowed, --noconsole**

Windows and Mac OS X: do not provide a console window for standard i/o. On Mac OS this also triggers building a Mac OS .app bundle. On Windows this option is automatically set if the first script is a ‘.pyw’ file. This option is ignored on \*NIX systems.

**-i** <FILE.ico or FILE.exe,ID or FILE.icns or Image or "NONE">, **--icon** <FILE.ico or FILE.exe,ID or FILE.icns or Image or "NONE">

FILE.ico: apply the icon to a Windows executable. FILE.exe,ID: extract the icon with ID from an exe. FILE.icns: apply the icon to the .app bundle on Mac OS. If an image file is entered that isn't in the platform format (ico on Windows, icns on Mac), PyInstaller tries to use Pillow to translate the icon into the correct format (if Pillow is installed). Use "NONE" to not apply any icon, thereby making the OS show some default (default: apply PyInstaller's icon)

**--disable-windowed-traceback**

Disable traceback dump of unhandled exception in windowed (noconsole) mode (Windows and macOS only), and instead display a message that this feature is disabled.

## Windows Specific Options

**--version-file** FILE

Add a version resource from FILE to the exe.

**-m** <FILE or XML>, **--manifest** <FILE or XML>

Add manifest FILE or XML to the exe.

**--no-embed-manifest**

Generate an external .exe.manifest file instead of embedding the manifest into the exe. Applicable only to onedir mode; in onefile mode, the manifest is always embedded, regardless of this option.

**-r** RESOURCE, **--resource** RESOURCE

Add or update a resource to a Windows executable. The RESOURCE is one to four items, FILE[,TYPE[,NAME[,LANGUAGE]]]. FILE can be a data file or an exe/dll. For data files, at least TYPE and NAME must be specified. LANGUAGE defaults to 0 or may be specified as wildcard \* to update all resources of the given TYPE and NAME. For exe/dll files, all resources from FILE will be added/updated to the final executable if TYPE, NAME and LANGUAGE are omitted or specified as wildcard \*. This option can be used multiple times.

**--uac-admin**

Using this option creates a Manifest that will request elevation upon application start.

**--uac-uiaccess**

Using this option allows an elevated application to work with Remote Desktop.

## Windows Side-By-Side Assembly Searching Options (Advanced)

**--win-private-assemblies**

Any Shared Assemblies bundled into the application will be changed into Private Assemblies. This means the exact versions of these assemblies will always be used, and any newer versions installed on user machines at the system level will be ignored.

**--win-no-prefer-redirects**

While searching for Shared or Private Assemblies to bundle into the application, PyInstaller will prefer not to follow policies that redirect to newer versions, and will try to bundle the exact versions of the assembly.

## Mac Os Specific Options

### **--argv-emulation**

Enable argv emulation for macOS app bundles. If enabled, the initial open document/URL event is processed by the bootloader and the passed file paths or URLs are appended to sys.argv.

### **--osx-bundle-identifier** BUNDLE\_IDENTIFIER

Mac OS .app bundle identifier is used as the default unique program name for code signing purposes. The usual form is a hierarchical name in reverse DNS notation. For example: com.mycompany.department.appname (default: first script's basename)

### **--target-architecture** ARCH, **--target-arch** ARCH

Target architecture (macOS only; valid values: x86\_64, arm64, universal2). Enables switching between universal2 and single-arch version of frozen application (provided python installation supports the target architecture). If not target architecture is not specified, the current running architecture is targeted.

### **--codesign-identity** IDENTITY

Code signing identity (macOS only). Use the provided identity to sign collected binaries and generated executable. If signing identity is not provided, ad-hoc signing is performed instead.

### **--osx-entitlements-file** FILENAME

Entitlements file to use when code-signing the collected binaries (macOS only).

## Rarely Used Special Options

### **--runtime-tmpdir** PATH

Where to extract libraries and support files in *onefile*-mode. If this option is given, the bootloader will ignore any temp-folder location defined by the run-time OS. The `_MEIxxxxxx`-folder will be created here. Please use this option only if you know what you are doing.

### **--bootloader-ignore-signals**

Tell the bootloader to ignore signals rather than forwarding them to the child process. Useful in situations where for example a supervisor process signals both the bootloader and the child (e.g., via a process group) to avoid signalling the child twice.

## 2.6.2 Shortening the Command

Because of its numerous options, a full `pyinstaller` command can become very long. You will run the same command again and again as you develop your script. You can put the command in a shell script or batch file, using line continuations to make it readable. For example, in GNU/Linux:

```
pyinstaller --noconfirm --log-level=WARN \  
  --onefile --nowindow \  
  --add-data="README:." \  
  --add-data="image1.png:img" \  
  --add-binary="libfoo.so:lib" \  
  --hidden-import=secret1 \  
  --hidden-import=secret2 \  
  --upx-dir=/usr/local/share/ \  
  myscript.spec
```

Or in Windows, use the little-known BAT file line continuation:

```
pyinstaller --noconfirm --log-level=WARN ^
--onefile --nowindow ^
--add-data="README;." ^
--add-data="image1.png;img" ^
--add-binary="libfoo.so;lib" ^
--hidden-import=secret1 ^
--hidden-import=secret2 ^
--icon=..\MLNMFLCN.ICO ^
myscript.spec
```

### 2.6.3 Running PyInstaller from Python code

If you want to run PyInstaller from Python code, you can use the `run` function defined in `PyInstaller.__main__`. For instance, the following code:

```
import PyInstaller.__main__

PyInstaller.__main__.run([
    'my_script.py',
    '--onefile',
    '--windowed'
])
```

Is equivalent to:

```
pyinstaller my_script.py --onefile --windowed
```

### 2.6.4 Using UPX

[UPX](#) is a free utility for compressing executable files and libraries. It is available for most operating systems and can compress a large number of executable file formats. See the [UPX](#) home page for downloads, and for the list of supported file formats.

When UPX is available, PyInstaller uses it to individually compress each collected binary file (executable, shared library, or python extension) in order to reduce the overall size of the frozen application (the one-dir bundle directory, or the one-file executable). The frozen application's executable itself is not UPX-compressed (regardless of one-dir or one-file mode), as most of its size comprises the embedded archive that already contains individually compressed files.

PyInstaller looks for the UPX in the standard executable path(s) (defined by `PATH` environment variable), or in the path specified via the `--upx-dir` command-line option. If found, it is used automatically. The use of UPX can be completely disabled using the `--noupx` command-line option.

---

**Note:** UPX is currently used only on Windows. On other operating systems, the collected binaries are not processed even if UPX is found. The shared libraries (e.g., the Python shared library) built on modern linux distributions seem to break when processed with UPX, resulting in defunct application bundles. On macOS, UPX currently fails to process .dylib shared libraries; furthermore the UPX-compressed files fail the validation check of the `codesign` utility, and therefore cannot be code-signed (which is a requirement on the Apple M1 platform).

---

## Excluding problematic files from UPX processing

Using UPX may end up corrupting a collected shared library. Known examples of such corruption are Windows DLLs with [Control Flow Guard \(CFG\) enabled](#), as well as [Qt5 and Qt6 plugins](#). In such cases, individual files may be need to be excluded from UPX processing, using the `--upx-exclude` option (or using the `upx_exclude` argument in the *.spec file*).

Changed in version 4.2: PyInstaller detects CFG-enabled DLLs and automatically excludes them from UPX processing.

Changed in version 4.3: PyInstaller automatically excludes Qt5 and Qt6 plugins from UPX processing.

Although PyInstaller attempts to automatically detect and exclude some of the problematic files from UPX processing, there are cases where the UPX excludes need to be specified manually. For example, 32-bit Windows binaries from the PySide2 package (Qt5 DLLs and python extension modules) have been [reported](#) to be corrupted by UPX.

Changed in version 5.0: Unlike earlier releases that compared the provided UPX-exclude names against basenames of the collect binary files (and, due to incomplete case normalization, required provided exclude names to be lowercase on Windows), the UPX-exclude pattern matching now uses OS-default case sensitivity and supports the wildcard (\*) operator. It also supports specifying (full or partial) parent path of the file.

The provided UPX exclude patterns are matched against *source* (origin) paths of the collected binary files, and the matching is performed from right to left.

For example, to exclude Qt5 DLLs from the PySide2 package, use `--upx-exclude "Qt*.dll"`, and to exclude the python extensions from the PySide2 package, use `--upx-exclude "PySide2\*.pyd"`.

## 2.6.5 Encrypting Python Bytecode

To encrypt the Python bytecode modules stored in the bundle, pass the `--key=key-string` argument on the command line.

For this to work, you need to run:

```
pip install pyinstaller[encryption]
```

The *key-string* is a string of 16 characters which is used to encrypt each file of Python byte-code before it is stored in the archive inside the executable file.

This feature uses the [tinyaes](#) module internally for the encryption.

## 2.6.6 Splash Screen (*Experimental*)

---

**Note:** This feature is incompatible with macOS. In the current design, the splash screen operates in a secondary thread, which is disallowed by the Tcl/Tk (or rather, the underlying GUI toolkit) on macOS.

---

Some applications may require a splash screen as soon as the application (bootloader) has been started, because especially in onefile mode large applications may have long extraction/startup times, while the bootloader prepares everything, where the user cannot judge whether the application was started successfully or not.

The bootloader is able to display a one-image (i.e. only an image) splash screen, which is displayed before the actual main extraction process starts. The splash screen supports non-transparent and hard-cut-transparent images as background image, so non-rectangular splash screens can also be displayed.

This splash screen is based on [Tcl/Tk](#), which is the same library used by the Python module [tkinter](#). PyInstaller bundles the dynamic libraries of tcl and tk into the application at compile time. These are loaded into the bootloader at startup of the application after they have been extracted (if the program has been packaged as an onefile archive). Since the

file sizes of the necessary dynamic libraries are very small, there is almost no delay between the start of the application and the splash screen. The compressed size of the files necessary for the splash screen is about *1.5 MB*.

As an additional feature, text can optionally be displayed on the splash screen. This can be changed/updated from within Python. This offers the possibility to display the splash screen during longer startup procedures of a Python program (e.g. waiting for a network response or loading large files into memory). You can also start a GUI behind the splash screen, and only after it is completely initialized the splash screen can be closed. Optionally, the font, color and size of the text can be set. However, the font must be installed on the user system, as it is not bundled. If the font is not available, a fallback font is used.

If the splash screen is configured to show text, it will automatically (as onefile archive) display the name of the file that is currently being unpacked, this acts as a progress bar.

### 2.6.7 The `pyi_splash` Module

The splash screen is controlled from within Python by the `pyi_splash` module, which can be imported at runtime. This module **cannot** be installed by a package manager because it is part of PyInstaller and is included as needed. This module must be imported within the Python program. The usage is as follows:

```
import pyi_splash

# Update the text on the splash screen
pyi_splash.update_text("PyInstaller is a great software!")
pyi_splash.update_text("Second time's a charm!")

# Close the splash screen. It does not matter when the call
# to this function is made, the splash screen remains open until
# this function is called or the Python program is terminated.
pyi_splash.close()
```

Of course the import should be in a `try ... except` block, in case the program is used externally as a normal Python script, without a bootloader. For a detailed description see *pyi\_splash Module (Detailed)*.

### 2.6.8 Defining the Extraction Location

In rare cases, when you bundle to a single executable (see *Bundling to One File* and *How the One-File Program Works*), you may want to control the location of the temporary directory at compile time. This can be done using the `--runtime-tmpdir` option. If this option is given, the bootloader will ignore any temp-folder location defined by the run-time OS. Please use this option only if you know what you are doing.

### 2.6.9 Supporting Multiple Platforms

If you distribute your application for only one combination of OS and Python, just install PyInstaller like any other package and use it in your normal development setup.

## Supporting Multiple Python Environments

When you need to bundle your application within one OS but for different versions of Python and support libraries – for example, a Python 3.6 version and a Python 3.7 version; or a supported version that uses Qt4 and a development version that uses Qt5 – we recommend you use [venv](#). With *venv* you can maintain different combinations of Python and installed packages, and switch from one combination to another easily. These are called *virtual environments* or *venvs* in short.

- Use *venv* to create as many different development environments as you need, each with its unique combination of Python and installed packages.
- Install PyInstaller in each virtual environment.
- Use PyInstaller to build your application in each virtual environment.

Note that when using *venv*, the path to the PyInstaller commands is:

- Windows: ENV\_ROOT\Scripts
- Others: ENV\_ROOT/bin

Under Windows, the [pip-Win](#) package makes it especially easy to set up different environments and switch between them. Under GNU/Linux and macOS, you switch environments at the command line.

See [PEP 405](#) and the official [Python Tutorial on Virtual Environments and Packages](#) for more information about Python virtual environments.

## Supporting Multiple Operating Systems

If you need to distribute your application for more than one OS, for example both Windows and macOS, you must install PyInstaller on each platform and bundle your app separately on each.

You can do this from a single machine using virtualization. The free [virtualBox](#) or the paid [VMWare](#) and [Parallels](#) allow you to run another complete operating system as a “guest”. You set up a virtual machine for each “guest” OS. In it you install Python, the support packages your application needs, and PyInstaller.

A [File Sync & Share](#) system like [NextCloud](#) is useful with virtual machines. Install the synchronization client in each virtual machine, all linked to your synchronization account. Keep a single copy of your script(s) in a synchronized folder. Then on any virtual machine you can run PyInstaller thus:

```
cd ~/NextCloud/project_folder/src # GNU/Linux, Mac -- Windows similar
rm *.pyc # get rid of modules compiled by another Python
pyinstaller --workpath=path-to-local-temp-folder \
            --distpath=path-to-local-dist-folder \
            ...other options as required... \
            ./myscript.py
```

PyInstaller reads scripts from the common synchronized folder, but writes its work files and the bundled app in folders that are local to the virtual machine.

If you share the same home directory on multiple platforms, for example GNU/Linux and macOS, you will need to set the PYINSTALLER\_CONFIG\_DIR environment variable to different values on each platform otherwise PyInstaller may cache files for one platform and use them on the other platform, as by default it uses a subdirectory of your home directory as its cache location.

It is said to be possible to cross-develop for Windows under GNU/Linux using the free [Wine](#) environment. Further details are needed, see [How to Contribute](#).



### 2.6.10 Capturing Windows Version Data

A Windows app may require a Version resource file. A Version resource contains a group of data structures, some containing binary integers and some containing strings, that describe the properties of the executable. For details see the Microsoft [Version Information Structures](#) page.

Version resources are complex and some elements are optional, others required. When you view the version tab of a Properties dialog, there's no simple relationship between the data displayed and the structure of the resource. For this reason PyInstaller includes the `pyi-grab_version` command. It is invoked with the full path name of any Windows executable that has a Version resource:

```
pyi-grab_version executable_with_version_resource
```

The command writes text that represents a Version resource in readable form to standard output. You can copy it from the console window or redirect it to a file. Then you can edit the version information to adapt it to your program. Using `pyi-grab_version` you can find an executable that displays the kind of information you want, copy its resource data, and modify it to suit your package.

The version text file is encoded UTF-8 and may contain non-ASCII characters. (Unicode characters are allowed in Version resource string fields.) Be sure to edit and save the text file in UTF-8 unless you are certain it contains only ASCII string values.

Your edited version text file can be given with the `--version-file` option to `pyinstaller` or `pyi-makespec`. The text data is converted to a Version resource and installed in the bundled app.

In a Version resource there are two 64-bit binary values, `FileVersion` and `ProductVersion`. In the version text file these are given as four-element tuples, for example:

```
filevers=(2, 0, 4, 0),
prodvers=(2, 0, 4, 0),
```

The elements of each tuple represent 16-bit values from most-significant to least-significant. For example the value `(2, 0, 4, 0)` resolves to `00020000000040000` in hex.

You can also install a Version resource from a text file after the bundled app has been created, using the `pyi-set_version` command:

```
pyi-set_version version_text_file executable_file
```

The `pyi-set_version` utility reads a version text file as written by `pyi-grab_version`, converts it to a Version resource, and installs that resource in the *executable\_file* specified.

For advanced uses, examine a version text file as written by `pyi-grab_version`. You find it is Python code that creates a `VSVersionInfo` object. The class definition for `VSVersionInfo` is found in `utils/win32/versioninfo.py` in the PyInstaller distribution folder. You can write a program that imports `versioninfo`. In that program you can `eval` the contents of a version info text file to produce a `VSVersionInfo` object. You can use the `.toRaw()` method of that object to produce a Version resource in binary form. Or you can apply the `unicode()` function to the object to reproduce the version text file.

### 2.6.11 Building macOS App Bundles

Under macOS, PyInstaller always builds a UNIX executable in `dist`. If you specify `--onedir`, the output is a folder named `myscript` containing supporting files and an executable named `myscript`. If you specify `--onefile`, the output is a single UNIX executable named `myscript`. Either executable can be started from a Terminal command line. Standard input and output work as normal through that Terminal window.

If you specify `--windowed` with either option, the `dist` folder also contains a macOS application named `myscript.app`.

As you probably know, an application is a special type of folder. The one built by PyInstaller contains a folder always named `Contents` which contains:

- A folder `Frameworks` which is empty.
- A folder `Resources` that contains an icon file.
- A file `Info.plist` that describes the app.
- A folder `MacOS` that contains the the executable and supporting files, just as in the `--onedir` folder.

Use the `--icon` argument to specify a custom icon for the application. It will be copied into the `Resources` folder. (If you do not specify an icon file, PyInstaller supplies a file `icon-windowed.icns` with the PyInstaller logo.)

Use the `--osx-bundle-identifier` argument to add a bundle identifier. This becomes the `CFBundleIdentifier` used in code-signing (see the [PyInstaller code signing recipe](#) and for more detail, the [Apple code signing overview](#) technical note).

You can add other items to the `Info.plist` by editing the spec file; see [Spec File Options for a macOS Bundle](#) below.

### 2.6.12 Platform-specific Notes

#### GNU/Linux

##### Making GNU/Linux Apps Forward-Compatible

Under GNU/Linux, PyInstaller does not bundle `libc` (the C standard library, usually `glibc`, the Gnu version) with the app. Instead, the app expects to link dynamically to the `libc` from the local OS where it runs. The interface between any app and `libc` is forward compatible to newer releases, but it is not backward compatible to older releases.

For this reason, if you bundle your app on the current version of GNU/Linux, it may fail to execute (typically with a runtime dynamic link error) if it is executed on an older version of GNU/Linux.

The solution is to always build your app on the *oldest* version of GNU/Linux you mean to support. It should continue to work with the `libc` found on newer versions.

The GNU/Linux standard libraries such as `glibc` are distributed in 64-bit and 32-bit versions, and these are not compatible. As a result you cannot bundle your app on a 32-bit system and run it on a 64-bit installation, nor vice-versa. You must make a unique version of the app for each word-length supported.

Note that PyInstaller does bundle other shared libraries that are discovered via dependency analysis, such as `libstdc++.so.6`, `libfontconfig.so.1`, `libfreetype.so.6`. These libraries may be required on systems where older (and thus incompatible) versions of these libraries are available. On the other hand, the bundled libraries may cause issues when trying to load a system-provided shared library that is linked against a newer version of the system-provided library.

For example, system-installed mesa DRI drivers (e.g., `radeonsi_dri.so`) depend on the system-provided version of `libstdc++.so.6`. If the frozen application bundles an older version of `libstdc++.so.6` (as collected from the build system), this will likely cause missing symbol errors and prevent the DRI drivers from loading. In this case, the bundled `libstdc++.so.6` should be removed. However, this may not work on a different distribution that provides `libstdc++.so.6`

older than the one from the build system; in that case, the bundled version should be kept, because the system-provided version may lack the symbols required by other collected binaries that depend on `libstdc++.so.6`.

## Windows

The developer needs to take special care to include the Visual C++ run-time .dlls: Python 3.5+ uses Visual Studio 2015 run-time, which has been renamed into “[Universal CRT](#)” and has become part of Windows 10. For Windows Vista through Windows 8.1 there are Windows Update packages, which may or may not be installed in the target-system. So you have the following options:

1. Build on *Windows 7* which has been reported to work.
2. Include one of the VCRedist packages (the redistributable package files) into your application’s installer. This is Microsoft’s recommended way, see “[Distributing Software that uses the Universal CRT](#)” in the above-mentioned link, numbers 2 and 3.
3. Install the [Windows Software Development Kit \(SDK\) for Windows 10](#) and expand the .spec-file to include the required DLLs, see “[Distributing Software that uses the Universal CRT](#)” in the above-mentioned link, number 6.

If you think, PyInstaller should do this by itself, please [help improving](#) PyInstaller.

## macOS

### Making macOS apps Forward-Compatible

On macOS, system components from one version of the OS are usually compatible with later versions, but they may not work with earlier versions. While PyInstaller does not collect system components of the OS, the collected 3rd party binaries (e.g., python extension modules) are built against specific version of the OS libraries, and may or may not support older OS versions.

As such, the only way to ensure that your frozen application supports an older version of the OS is to freeze it on the oldest version of the OS that you wish to support. This applies especially when building with [Homebrew](#) python, as its binaries usually explicitly target the running OS.

For example, to ensure compatibility with “Mojave” (10.14) and later versions, you should set up a full environment (i.e., install python, PyInstaller, your application’s code, and all its dependencies) in a copy of macOS 10.14, using a virtual machine if necessary. Then use PyInstaller to freeze your application in that environment; the generated frozen application should be compatible with that and later versions of macOS.

### Building 32-bit Apps in macOS

---

**Note:** This section is largely obsolete, as support for 32-bit application was removed in macOS 10.15 Catalina (for 64-bit multi-arch support on modern versions of macOS, see [here](#)). However, PyInstaller still supports building 32-bit bootloader, and 32-bit/64-bit Python installers are still available from [python.org](#) for (some) versions of Python 3.7.

---

Older versions of macOS supported both 32-bit and 64-bit executables. PyInstaller builds an app using the the word-length of the Python used to execute it. That will typically be a 64-bit version of Python, resulting in a 64-bit executable. To create a 32-bit executable, run PyInstaller under a 32-bit Python.

To verify that the installed python version supports execution in either 64- or 32-bit mode, use the `file` command on the Python executable:

```
$ file /usr/local/bin/python3
/usr/local/bin/python3: Mach-O universal binary with 2 architectures
/usr/local/bin/python3 (for architecture i386):      Mach-O executable i386
/usr/local/bin/python3 (for architecture x86_64):    Mach-O 64-bit executable x86_64
```

The OS chooses which architecture to run, and typically defaults to 64-bit. You can force the use of either architecture by name using the `arch` command:

```
$ /usr/local/bin/python3
Python 3.7.6 (v3.7.6:43364a7ae0, Dec 18 2019, 14:12:53)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> import sys; sys.maxsize
9223372036854775807

$ arch -i386 /usr/local/bin/python3
Python 3.7.6 (v3.7.6:43364a7ae0, Dec 18 2019, 14:12:53)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "help", "copyright", "credits" or "license" for more information.
>>> import sys; sys.maxsize
2147483647
```

---

**Note:** PyInstaller does not provide pre-built 32-bit bootloaders for macOS anymore. In order to use PyInstaller with 32-bit python, you need to [build the bootloader](#) yourself, using an XCode version that still supports compiling 32-bit. Depending on the compiler/toolchain, you may also need to explicitly pass `--target-arch=32bit` to the `waf` command.

---

## Getting the Opened Document Names

When user double-clicks a document of a type that is registered with your application, or when a user drags a document and drops it on your application's icon, macOS launches your application and provides the name(s) of the opened document(s) in the form of an `OpenDocument AppleEvent`.

These events are typically handled via installed event handlers in your application (e.g., using Carbon API via `ctypes`, or using facilities provided by UI toolkits, such as `tkinter` or `PyQt5`).

Alternatively, PyInstaller also supports conversion of open document/URL events into arguments that are appended to `sys.argv`. This applies only to events received during application launch, i.e., before your frozen code is started. To handle events that are dispatched while your application is already running, you need to set up corresponding event handlers.

For details, see [this section](#).

## AIX

Depending on whether Python was build as a 32-bit or a 64-bit executable you may need to set or unset the environment variable `OBJECT_MODE`. To determine the size the following command can be used:

```
$ python -c "import sys; print(sys.maxsize <= 2**32)"
True
```

When the answer is `True` (as above) Python was build as a 32-bit executable.

When working with a 32-bit Python executable proceed as follows:

```
$ unset OBJECT_MODE
$ pyinstaller <your arguments>
```

When working with a 64-bit Python executable proceed as follows:

```
$ export OBJECT_MODE=64
$ pyinstaller <your arguments>
```

## 2.7 Run-time Information

Your app should run in a bundle exactly as it does when run from source. However, you may want to learn at run-time whether the app is running from source or whether it is bundled (“frozen”). You can use the following code to check “are we bundled?”:

```
import sys
if getattr(sys, 'frozen', False) and hasattr(sys, '_MEIPASS'):
    print('running in a PyInstaller bundle')
else:
    print('running in a normal Python process')
```

When a bundled app starts up, the bootloader sets the `sys.frozen` attribute and stores the absolute path to the bundle folder in `sys._MEIPASS`. For a one-folder bundle, this is the path to that folder. For a one-file bundle, this is the path to the temporary folder created by the bootloader (see *How the One-File Program Works*).

When your app is running, it may need to access data files in one of the following locations:

- Files that were bundled with it (see *Adding Data Files*).
- Files the user has placed with the app bundle, say in the same folder.
- Files in the user’s current working directory.

The program has access to several variables for these uses.

### 2.7.1 Using `__file__`

When your program is not bundled, the Python variable `__file__` refers to the current path of the module it is contained in. When importing a module from a bundled script, the PyInstaller bootloader will set the module's `__file__` attribute to the correct path relative to the bundle folder.

For example, if you import `mypackage.mymodule` from a bundled script, then the `__file__` attribute of that module will be `sys._MEIPASS + 'mypackage/mymodule.pyc'`. So if you have a data file at `mypackage/file.dat` that you added to the bundle at `mypackage/file.dat`, the following code will get its path (in both the non-bundled and the bundled case):

```
from os import path
path_to_dat = path.abspath(path.join(path.dirname(__file__), 'file.dat'))
```

In the main script (the `__main__` module) itself, the `__file__` variable contains path to the script file. In Python 3.8 and earlier, this path is either absolute or relative (depending on how the script was passed to the python interpreter), while in Python 3.9 and later, it is always an absolute path. In the bundled script, the PyInstaller bootloader always sets the `__file__` variable inside the `__main__` module to the absolute path inside the bundle directory, as if the byte-compiled entry-point script existed there.

For example, if your entry-point script is called `program.py`, then the `__file__` attribute inside the bundled script will point to `sys._MEIPASS + 'program.py'`. Therefore, locating a data file relative to the main script can be either done directly using `sys._MEIPASS` or via the parent path of the `__file__` inside the main script.

The following example will get the path to a file `other-file.dat` located next to the main script if not bundled and inside the bundle folder if it is bundled:

```
from os import path
bundle_dir = path.abspath(path.dirname(__file__))
path_to_dat = path.join(bundle_dir, 'other-file.dat')
```

Or, if you'd rather use `pathlib`:

```
from pathlib import Path
path_to_dat = Path(__file__).resolve().with_name("other-file.dat")
```

Changed in version 4.3: Formerly, the `__file__` attribute of the entry-point script (the `__main__` module) was set to only its basename rather than its full (absolute or relative) path within the bundle directory. Therefore, PyInstaller documentation used to suggest `sys._MEIPASS` as means for locating resources relative to the bundled entry-point script. Now, `__file__` is always set to the absolute full path, and is the preferred way of locating such resources.

### Placing data files at expected locations inside the bundle

To place the data-files where your code expects them to be (i.e., relative to the main script or bundle directory), you can use the `dest` parameter of the `--add-data=source:dest` command-line switches. Assuming you normally use the following code in a file named `my_script.py` to locate a file `file.dat` in the same folder:

```
from os import path
path_to_dat = path.abspath(path.join(path.dirname(__file__), 'file.dat'))
```

Or the `pathlib` equivalent:

```
from pathlib import Path
path_to_dat = Path(__file__).resolve().with_name("file.dat")
```

And `my_script.py` is **not** part of a package (not in a folder containing an `__init__.py`), then `__file__` will be `[app root]/my_script.pyc` meaning that if you put `file.dat` in the root of your package, using:

```
PyInstaller --add-data=/path/to/file.dat:.
```

It will be found correctly at runtime without changing `my_script.py`.

---

**Note:** Windows users should use `;` instead of `:` in the above line.

---

If `__file__` is checked from inside a package or library (say `my_library.data`) then `__file__` will be `[app root]/my_library/data.pyc` and `--add-data` should mirror that:

```
PyInstaller --add-data=/path/to/my_library/file.dat:./my_library
```

However, in this case it is much easier to switch to *the spec file* and use the `PyInstaller.utils.hooks.collect_data_files()` helper function:

```
from PyInstaller.utils.hooks import collect_data_files

a = Analysis(...,
              datas=collect_data_files("my_library"),
              ...)
```

## 2.7.2 Using `sys.executable` and `sys.argv[0]`

When a normal Python script runs, `sys.executable` is the path to the program that was executed, namely, the Python interpreter. In a frozen app, `sys.executable` is also the path to the program that was executed, but that is not Python; it is the bootloader in either the one-file app or the executable in the one-folder app. This gives you a reliable way to locate the frozen executable the user actually launched.

The value of `sys.argv[0]` is the name or relative path that was used in the user's command. It may be a relative path or an absolute path depending on the platform and how the app was launched.

If the user launches the app by way of a symbolic link, `sys.argv[0]` uses that symbolic name, while `sys.executable` is the actual path to the executable. Sometimes the same app is linked under different names and is expected to behave differently depending on the name that is used to launch it. For this case, you would test `os.path.basename(sys.argv[0])`

On the other hand, sometimes the user is told to store the executable in the same folder as the files it will operate on, for example a music player that should be stored in the same folder as the audio files it will play. For this case, you would use `os.path.dirname(sys.executable)`.

The following small program explores some of these possibilities. Save it as `directories.py`. Execute it as a Python script, then bundled as a one-folder app. Then bundle it as a one-file app and launch it directly and also via a symbolic link:

```
#!/usr/bin/env python3
import sys, os
frozen = 'not'
if getattr(sys, 'frozen', False):
    # we are running in a bundle
    frozen = 'ever so'
    bundle_dir = sys._MEIPASS
else:
```

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```
# we are running in a normal Python environment
bundle_dir = os.path.dirname(os.path.abspath(__file__))
print( 'we are', frozen, 'frozen')
print( 'bundle dir is', bundle_dir )
print( 'sys.argv[0] is', sys.argv[0] )
print( 'sys.executable is', sys.executable )
print( 'os.getcwd is', os.getcwd() )
```

## 2.7.3 LD\_LIBRARY\_PATH / LIBPATH considerations

This environment variable is used to discover libraries, it is the library search path - on GNU/Linux and \*BSD `LD_LIBRARY_PATH` is used, on AIX it is `LIBPATH`.

If it exists, PyInstaller saves the original value to `*_ORIG`, then modifies the search path so that the bundled libraries are found first by the bundled code.

But if your code executes a system program, you often do not want that this system program loads your bundled libraries (that are maybe not compatible with your system program) - it rather should load the correct libraries from the system locations like it usually does.

Thus you need to restore the original path before creating the subprocess with the system program.

```
env = dict(os.environ) # make a copy of the environment
lp_key = 'LD_LIBRARY_PATH' # for GNU/Linux and *BSD.
lp_orig = env.get(lp_key + '_ORIG')
if lp_orig is not None:
    env[lp_key] = lp_orig # restore the original, unmodified value
else:
    # This happens when LD_LIBRARY_PATH was not set.
    # Remove the env var as a last resort:
    env.pop(lp_key, None)
p = Popen(system_cmd, ..., env=env) # create the process
```

## 2.8 Using Spec Files

When you execute

```
pyinstaller options..myscript.py
```

the first thing PyInstaller does is to build a spec (specification) file `myscript.spec`. That file is stored in the `--specpath` directory, by default the current directory.

The spec file tells PyInstaller how to process your script. It encodes the script names and most of the options you give to the `pyinstaller` command. The spec file is actually executable Python code. PyInstaller builds the app by executing the contents of the spec file.

For many uses of PyInstaller you do not need to examine or modify the spec file. It is usually enough to give all the needed information (such as hidden imports) as options to the `pyinstaller` command and let it run.

There are four cases where it is useful to modify the spec file:

- When you want to bundle data files with the app.



- When you want to include run-time libraries (.dll or .so files) that PyInstaller does not know about from any other source.
- When you want to add Python run-time options to the executable.
- When you want to create a multiprogram bundle with merged common modules.

These uses are covered in topics below.

You create a spec file using this command:

```
pyi-makespec options name.py [other scripts ...]
```

The *options* are the same options documented above for the `pyinstaller` command. This command creates the *name.spec* file but does not go on to build the executable.

After you have created a spec file and modified it as necessary, you build the application by passing the spec file to the `pyinstaller` command:

```
pyinstaller options name.spec
```

When you create a spec file, most command options are encoded in the spec file. When you build from a spec file, those options cannot be changed. If they are given on the command line they are ignored and replaced by the options in the spec file.

Only the following command-line options have an effect when building from a spec file:

- `--upx-dir`
- `--distpath`
- `--workpath`
- `--noconfirm`
- `--ascii`
- `--clean`

## 2.8.1 Spec File Operation

After PyInstaller creates a spec file, or opens a spec file when one is given instead of a script, the `pyinstaller` command executes the spec file as code. Your bundled application is created by the execution of the spec file. The following is a shortened example of a spec file for a minimal, one-folder app:

```
block_cipher = None
a = Analysis(['minimal.py'],
            pathex=['/Developer/Pytests/minimal'],
            binaries=None,
            datas=None,
            hiddenimports=[],
            hookspath=None,
            runtime_hooks=None,
            excludes=None,
            cipher=block_cipher)
pyz = PYZ(a.pure, a.zipped_data,
          cipher=block_cipher)
exe = EXE(pyz,... )
coll = COLLECT(...)
```

The statements in a spec file create instances of four classes, `Analysis`, `PYZ`, `EXE` and `COLLECT`.

- A new instance of class `Analysis` takes a list of script names as input. It analyzes all imports and other dependencies. The resulting object (assigned to `a`) contains lists of dependencies in class members named:
  - `scripts`: the python scripts named on the command line;
  - `pure`: pure python modules needed by the scripts;
  - `pathex`: a list of paths to search for imports (like using `PYTHONPATH`), including paths given by the `--paths` option.
  - `binaries`: non-python modules needed by the scripts, including names given by the `--add-binary` option;
  - `datas`: non-binary files included in the app, including names given by the `--add-data` option.
- An instance of class `PYZ` is a `.pyz` archive (described under *Inspecting Archives* below), which contains all the Python modules from a `.pure`.
- An instance of `EXE` is built from the analyzed scripts and the `PYZ` archive. This object creates the executable file.
- An instance of `COLLECT` creates the output folder from all the other parts.

In one-file mode, there is no call to `COLLECT`, and the `EXE` instance receives all of the scripts, modules and binaries.

You modify the spec file to pass additional values to `Analysis` and to `EXE`.

## 2.8.2 Adding Files to the Bundle

To add files to the bundle, you create a list that describes the files and supply it to the `Analysis` call. When you bundle to a single folder (see *Bundling to One Folder*), the added data files are copied into the folder with the executable. When you bundle to a single executable (see *Bundling to One File*), copies of added files are compressed into the executable, and expanded to the `_MEIxxxxxx` temporary folder before execution. This means that any changes a one-file executable makes to an added file will be lost when the application ends.

In either case, to find the data files at run-time, see *Run-time Information*.

### Adding Data Files

You can add data files to the bundle by using the `--add-data` command option, or by adding them as a list to the spec file.

When using the spec file, provide a list that describes the files as the value of the `datas=` argument to `Analysis`. The list of data files is a list of tuples. Each tuple has two values, both of which must be strings:

- The first string specifies the file or files as they are in this system now.
- The second specifies the name of the *folder* to contain the files at run-time.

For example, to add a single README file to the top level of a one-folder app, you could modify the spec file as follows:

```
a = Analysis(...
    datas=[ ('src/README.txt', '.') ],
    ...
)
```

And the command line equivalent (see *What To Bundle, Where To Search* for platform-specific details):

```
pyinstaller --add-data 'src/README.txt:.' myscript.py
```

You have made the `datas=` argument a one-item list. The item is a tuple in which the first string says the existing file is `src/README.txt`. That file will be looked up (relative to the location of the spec file) and copied into the top level of the bundled app.

The strings may use either `/` or `\` as the path separator character. You can specify input files using “glob” abbreviations. For example to include all the `.mp3` files from a certain folder:

```
a = Analysis(...
    datas= [ ('/mygame/sfx/*.mp3', 'sfx' ) ],
    ...
)
```

All the `.mp3` files in the folder `/mygame/sfx` will be copied into a folder named `sfx` in the bundled app.

The spec file is more readable if you create the list of added files in a separate statement:

```
added_files = [
    ( 'src/README.txt', '.' ),
    ( '/mygame/sfx/*.mp3', 'sfx' )
]
a = Analysis(...
    datas = added_files,
    ...
)
```

You can also include the entire contents of a folder:

```
added_files = [
    ( 'src/README.txt', '.' ),
    ( '/mygame/data', 'data' ),
    ( '/mygame/sfx/*.mp3', 'sfx' )
]
```

The folder `/mygame/data` will be reproduced under the name `data` in the bundle.

## Using Data Files from a Module

If the data files you are adding are contained within a Python module, you can retrieve them using `pkgutil.get_data()`.

For example, suppose that part of your application is a module named `helpmod`. In the same folder as your script and its spec file you have this folder arrangement:

```
helpmod
  __init__.py
  helpmod.py
  help_data.txt
```

Because your script includes the statement `import helpmod`, PyInstaller will create this folder arrangement in your bundled app. However, it will only include the `.py` files. The data file `help_data.txt` will not be automatically included. To cause it to be included also, you would add a `datas` tuple to the spec file:

```
a = Analysis(...
    datas= [ ('helpmod/help_data.txt', 'helpmod' ) ],
```

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```
...
)
```

When your script executes, you could find `help_data.txt` by using its base folder path, as described in the previous section. However, this data file is part of a module, so you can also retrieve its contents using the standard library function `pkgutil.get_data()`:

```
import pkgutil
help_bin = pkgutil.get_data( 'helpmod', 'help_data.txt' )
```

This returns the contents of the `help_data.txt` file as a binary string. If it is actually characters, you must decode it:

```
help_utf = help_bin.decode('UTF-8', 'ignore')
```

## Adding Binary Files

---

**Note:** *Binary* files refers to DLLs, dynamic libraries, shared object-files, and such, which PyInstaller is going to search for further *binary* dependencies. Files like images and PDFs should go into the *datas*.

---

You can add binary files to the bundle by using the `--add-binary` command option, or by adding them as a list to the spec file. In the spec file, make a list of tuples that describe the files needed. Assign the list of tuples to the `binaries=` argument of `Analysis`.

Adding binary files works in a similar way as adding data files. As described in [Adding Binary Files](#), each tuple should have two values:

- The first string specifies the file or files as they are in this system now.
- The second specifies the name of the *folder* to contain the files at run-time.

Normally PyInstaller learns about `.so` and `.dll` libraries by analyzing the imported modules. Sometimes it is not clear that a module is imported; in that case you use a `--hidden-import` command option. But even that might not find all dependencies.

Suppose you have a module `special_ops.so` that is written in C and uses the Python C-API. Your program imports `special_ops`, and PyInstaller finds and includes `special_ops.so`. But perhaps `special_ops.so` links to `libiodbc.2.dylib`. PyInstaller does not find this dependency. You could add it to the bundle this way:

```
a = Analysis(...
    binaries=[ ( '/usr/lib/libiodbc.2.dylib', '.' ) ],
    ...
```

Or via the command line (again, see [What To Bundle, Where To Search](#) for platform-specific details):

```
pyinstaller --add-binary '/usr/lib/libiodbc.2.dylib:.' myscript.py
```

If you wish to store `libiodbc.2.dylib` on a specific folder inside the bundle, for example `vendor`, then you could specify it, using the second element of the tuple:

```
a = Analysis(...
    binaries=[ ( '/usr/lib/libiodbc.2.dylib', 'vendor' ) ],
    ...
```

As with data files, if you have multiple binary files to add, to improve readability, create the list in a separate statement and pass the list by name.

### Advanced Methods of Adding Files

PyInstaller supports a more advanced (and complex) way of adding files to the bundle that may be useful for special cases. See *The TOC and Tree Classes* below.

## 2.8.3 Giving Run-time Python Options

You can pass command-line options to the Python interpreter. The interpreter takes a number of command-line options but only the following are supported for a bundled app:

- `v` to write a message to stdout each time a module is initialized.
- `u` for unbuffered stdio.
- `W` and an option to change warning behavior: `W ignore` or `W once` or `W error`.

To pass one or more of these options, create a list of tuples, one for each option, and pass the list as an additional argument to the EXE call. Each tuple has three elements:

- The option as a string, for example `v` or `W ignore`.
- `None`
- The string `OPTION`

For example modify the spec file this way:

```
options = [ ('v', None, 'OPTION'), ('W ignore', None, 'OPTION') ]
a = Analysis( ...
    )
...
exe = EXE(pyz,
    a.scripts,
    options, <--- added line
    exclude_binaries=...
    )
```

**Note:** The unbuffered stdio mode (the `u` option) enables unbuffered binary layer of `stdout` and `stderr` streams on all supported Python versions. The unbuffered text layer requires Python 3.7 or later.

## 2.8.4 Spec File Options for a macOS Bundle

When you build a windowed macOS app (that is, running in macOS, you specify the `--onefile --windowed` options), the spec file contains an additional statement to create the macOS application bundle, or app folder:

```
app = BUNDLE(exe,
    name='myscript.app',
    icon=None,
    bundle_identifier=None)
```

The `icon=` argument to `BUNDLE` will have the path to an icon file that you specify using the `--icon` option. The `bundle_identifier` will have the value you specify with the `--osx-bundle-identifier` option.

An `Info.plist` file is an important part of a macOS app bundle. (See the [Apple bundle overview](#) for a discussion of the contents of `Info.plist`.)

PyInstaller creates a minimal `Info.plist`. The `version` option can be used to set the application version using the `CFBundleShortVersionString` Core Foundation Key.

You can add or overwrite entries in the plist by passing an `info_plist=` parameter to the `BUNDLE` call. Its argument should be a Python dict with keys and values to be included in the `Info.plist` file. PyInstaller creates `Info.plist` from the `info_plist` dict using the Python Standard Library module `plistlib`. `plistlib` can handle nested Python objects (which are translated to nested XML), and translates Python data types to the proper `Info.plist` XML types. Here's an example:

```
app = BUNDLE(exe,
    name='myscript.app',
    icon=None,
    bundle_identifier=None,
    version='0.0.1',
    info_plist={
        'NSPrincipalClass': 'NSApplication',
        'NSAppleScriptEnabled': False,
        'CFBundleDocumentTypes': [
            {
                'CFBundleTypeName': 'My File Format',
                'CFBundleTypeIconFile': 'MyFileIcon.icns',
                'LSItemContentTypes': ['com.example.myformat'],
                'LSHandlerRank': 'Owner'
            }
        ]
    },
)
```

In the above example, the key/value `'NSPrincipalClass': 'NSApplication'` is necessary to allow macOS to render applications using retina resolution. The key `'NSAppleScriptEnabled'` is assigned the Python boolean `False`, which will be output to `Info.plist` properly as `<false/>`. Finally the key `CFBundleDocumentTypes` tells macOS what filetypes your application supports (see [Apple document types](#)).

### 2.8.5 POSIX Specific Options

By default all required system libraries are bundled. To exclude all or most non-Python shared system libraries from the bundle, you can add a call to the function `exclude_system_libraries` from the `Analysis` class. System libraries are defined as files that come from under `/lib*` or `/usr/lib*` as is the case on POSIX and related operating systems. The function accepts an optional parameter that is a list of file wildcards exceptions, to not exclude library files that match those wildcards in the bundle. For example to exclude all non-Python system libraries except “libexpat” and anything containing “krb” use this:

```
a = Analysis(...)
a.exclude_system_libraries(list_of_exceptions=['libexpat*', '*krb*'])
```

## 2.8.6 The Splash Target

For a splash screen to be displayed by the bootloader, the `Splash` target must be called at build time. This class can be added when the spec file is created with the command-line option `--splash IMAGE_FILE`. By default, the option to display the optional text is disabled (`text_pos=None`). For more information about the splash screen, see [Splash Screen \(Experimental\)](#) section. The `Splash` Target looks like this:

```
a = Analysis(...)

splash = Splash('image.png',
               binaries=a.binaries,
               datas=a.datas,
               text_pos=(10, 50),
               text_size=12,
               text_color='black')
```

`Splash` bundles the required resources for the splash screen into a file, which will be included in the `CArchive`.

A `Splash` has two outputs, one is itself and one is stored in `splash.binaries`. Both need to be passed on to other build targets in order to enable the splash screen. To use the splash screen in a **onefile** application, please follow this example:

```
a = Analysis(...)

splash = Splash(...)

# onefile
exe = EXE(pyz,
          a.scripts,
          splash,                # <-- both, splash target
          splash.binaries,       # <-- and splash binaries
          ...)
```

In order to use the splash screen in a **onedir** application, only a small change needs to be made. The `splash.binaries` attribute has to be moved into the `COLLECT` target, since the splash binaries do not need to be included into the executable:

```
a = Analysis(...)

splash = Splash(...)

# onedir
exe = EXE(pyz,
          splash,                # <-- splash target
          a.scripts,
          ...)
coll = COLLECT(exe,
               splash.binaries,  # <-- splash binaries
               ...)
```

On Windows/macOS images with per-pixel transparency are supported. This allows non-rectangular splash screen images. On Windows the transparent borders of the image are hard-cuted, meaning that fading transparent values are not supported. There is no common implementation for non-rectangular windows on Linux, so images with per-pixel transparency is not supported.

The splash target can be configured in various ways. The constructor of the `Splash` target is as follows:

Splash.\_\_init\_\_(image\_file, binaries, datas, \*\*kwargs)

### Parameters

- **image\_file** (*str*) – A path-like object to the image to be used. Only the PNG file format is supported.

---

**Note:** If a different file format is supplied and PIL (Pillow) is installed, the file will be converted automatically.

---

---

**Note:** *Windows:* Due to the implementation, the color Magenta/ RGB(255, 0, 255) must not be used in the image or text.

---

---

**Note:** If PIL (Pillow) is installed and the image is bigger than max\_img\_size, the image will be resized to fit into the specified area.

---

- **binaries** (*TOC*) – The TOC of binaries the Analysis build target found. This TOC includes all extensionmodules and their dependencies. This is required to figure out, if the users program uses tkinter.
- **datas** (*TOC*) – The TOC of data the Analysis build target found. This TOC includes all data-file dependencies of the modules. This is required to check if all splash screen requirements can be bundled.

### Keyword Arguments

- **text\_pos** – An optional 2x integer tuple that represents the origin of the text on the splash screen image. The origin of the text is its lower left corner. A unit in the respective coordinate system is a pixel of the image, its origin lies in the top left corner of the image. This parameter also acts like a switch for the text feature. If omitted, no text will be displayed on the splash screen. This text will be used to show textual progress in onefile mode.
- **text\_size** – The desired size of the font. If the size argument is a positive number, it is interpreted as a size in points. If size is a negative number, its absolute value is interpreted as a size in pixels. Default: 12
- **text\_font** – An optional name of a font for the text. This font must be installed on the user system, otherwise the system default font is used. If this parameter is omitted, the default font is also used.
- **text\_color** – An optional color for the text. Either RGB HTML notation or color names are supported. Default: black (*Windows:* Due to a implementation issue the color magenta/ rgb(255, 0, 255) is forbidden)
- **text\_default** – The default text which will be displayed before the extraction starts. Default: “Initializing”
- **full\_tk** – By default Splash bundles only the necessary files for the splash screen (some tk components). This options enables adding full tk and making it a requirement, meaning all tk files will be unpacked before the splash screen can be started. This is useful during development of the splash screen script. Default: `False`
- **minify\_script** – The splash screen is created by executing an Tcl/Tk script. This option enables minimizing the script, meaning removing all non essential parts from the script.



Default: True

- **rundir** – The folder name in which tcl/tk will be extracted at runtime. There should be no matching folder in your application to avoid conflicts. Default: `__splash`
- **name** – An optional alternative filename for the .res file. If not specified, a name is generated.
- **script\_name** – An optional alternative filename for the Tcl script, that will be generated. If not specified, a name is generated.
- **max\_img\_size** – Maximum size of the splash screen image as a tuple. If the supplied image exceeds this limit, it will be resized to fit the maximum width (to keep the original aspect ratio). This option can be disabled by setting it to None. Default: (760, 480)
- **always\_on\_top** – Force the splashscreen to be always on top of other windows. If disabled, other windows (e.g., from other applications) can cover the splash screen by user bringing them to front. This might be useful for frozen applications with long startup times. Default: True

## 2.8.7 Multipackage Bundles

Some products are made of several different apps, each of which might depend on a common set of third-party libraries, or share code in other ways. When packaging such a product it would be a pity to treat each app in isolation, bundling it with all its dependencies, because that means storing duplicate copies of code and libraries.

You can use the multipackage feature to bundle a set of executable apps so that they share single copies of libraries. You can do this with either one-file or one-folder apps. Each dependency (a DLL, for example) is packaged only once, in one of the apps. Any other apps in the set that depend on that DLL have an “external reference” to it, telling them to extract that dependency from the executable file of the app that contains it.

This saves disk space because each dependency is stored only once. However, to follow an external reference takes extra time when an app is starting up. All but one of the apps in the set will have slightly slower launch times.

The external references between binaries include hard-coded paths to the output directory, and cannot be rearranged. If you use one-folder mode, you must install all the application folders within a single parent directory. If you use one-file mode, you must place all the related applications in the same directory when you install the application.

To build such a set of apps you must code a custom spec file that contains a call to the **MERGE** function. This function takes a list of analyzed scripts, finds their common dependencies, and modifies the analyses to minimize the storage cost.

The order of the analysis objects in the argument list matters. The **MERGE** function packages each dependency into the first script from left to right that needs that dependency. A script that comes later in the list and needs the same file will have an external reference to the prior script in the list. You might sequence the scripts to place the most-used scripts first in the list.

A custom spec file for a multipackage bundle contains one call to the **MERGE** function:

```
MERGE(*args)
```

**MERGE** is used after the analysis phase and before **EXE** and **COLLECT**. Its variable-length list of arguments consists of a list of tuples, each tuple having three elements:

- The first element is an Analysis object, an instance of class `Analysis`, as applied to one of the apps.
- The second element is the script name of the analyzed app (without the .py extension).
- The third element is the name for the executable (usually the same as the script).

**MERGE** examines the Analysis objects to learn the dependencies of each script. It modifies these objects to avoid duplication of libraries and modules. As a result the packages generated will be connected.

### Example MERGE spec file

One way to construct a spec file for a multipackage bundle is to first build a spec file for each app in the package. Suppose you have a product that comprises three apps named (because we have no imagination) `foo`, `bar` and `zap`:

```
pyi-makespec options as appropriate... foo.py
```

```
pyi-makespec options as appropriate... bar.py
```

```
pyi-makespec options as appropriate... zap.py
```

Check for warnings and test each of the apps individually. Deal with any hidden imports and other problems. When all three work correctly, combine the statements from the three files `foo.spec`, `bar.spec` and `zap.spec` as follows.

First copy the Analysis statements from each, changing them to give each Analysis object a unique name:

```
foo_a = Analysis(['foo.py'],
                 pathex=['/the/path/to/foo'],
                 hiddenimports=[],
                 hookspath=None)

bar_a = Analysis(['bar.py'], etc., etc...)

zap_a = Analysis(['zap.py'], etc., etc...)
```

Now call the MERGE method to process the three Analysis objects:

```
MERGE( (foo_a, 'foo', 'foo'), (bar_a, 'bar', 'bar'), (zap_a, 'zap', 'zap') )
```

The Analysis objects `foo_a`, `bar_a`, and `zap_a` are modified so that the latter two refer to the first for common dependencies.

Following this you can copy the PYZ, EXE and COLLECT statements from the original three spec files, substituting the unique names of the Analysis objects where the original spec files have `a.`, for example:

```
foo_pyz = PYZ(foo_a.pure)
foo_exe = EXE(foo_pyz, foo_a.scripts, ... etc.
foo_coll = COLLECT( foo_exe, foo_a.binaries, foo_a.datas... etc.

bar_pyz = PYZ(bar_a.pure)
bar_exe = EXE(bar_pyz, bar_a.scripts, ... etc.
bar_coll = COLLECT( bar_exe, bar_a.binaries, bar_a.datas... etc.
```

(If you are building one-file apps, there is no COLLECT step.) Save the combined spec file as `foobarzap.spec` and then build it:

```
pyi-build foobarzap.spec
```

The output in the `dist` folder will be all three apps, but the apps `dist/bar/bar` and `dist/zap/zap` will refer to the contents of `dist/foo/` for shared dependencies.

There are several multipackage examples in the PyInstaller distribution folder under `tests/functional/specs`.

Remember that a spec file is executable Python. You can use all the Python facilities (`for` and `with` and the members of `sys` and `io`) in creating the Analysis objects and performing the PYZ, EXE and COLLECT statements. You may also need to know and use *The TOC and Tree Classes* described below.

## 2.8.8 Globals Available to the Spec File

While a spec file is executing it has access to a limited set of global names. These names include the classes defined by PyInstaller: Analysis, BUNDLE, COLLECT, EXE, MERGE, PYZ, TOC, Tree and Splash, which are discussed in the preceding sections.

Other globals contain information about the build environment:

**DISTPATH** The relative path to the dist folder where the application will be stored. The default path is relative to the current directory. If the `--distpath` option is used, DISTPATH contains that value.

**HOMEPATH** The absolute path to the PyInstaller distribution, typically in the current Python site-packages folder.

**SPEC** The complete spec file argument given to the `pyinstaller` command, for example `myscript.spec` or `source/myscript.spec`.

**SPECPATH** The path prefix to the SPEC value as returned by `os.path.split()`.

**specnm** The name of the spec file, for example `myscript`.

**workpath** The path to the build directory. The default is relative to the current directory. If the `workpath=` option is used, `workpath` contains that value.

**WARNFILE** The full path to the warnings file in the build directory, for example `build/warn-myscript.txt`.

## 2.9 Notes about specific Features

### 2.9.1 Ctypes Dependencies

Ctypes is a foreign function library for Python, that allows calling functions present in shared libraries. Those libraries are not imported as Python packages, because they are not picked up via Python imports: their path is passed to ctypes instead, which deals with the shared library directly; this caused <1.4 PyInstaller import detect machinery to miss those libraries, failing the goal to build self-contained PyInstaller executables:

```
from ctypes import *
# This will pass undetected under PyInstaller detect machinery,
# because it's not a direct import.
handle = CDLL("/usr/lib/library.so")
handle.function_call()
```

### Solution in PyInstaller

PyInstaller contains a pragmatic implementation of Ctypes dependencies: it will search for simple standard usages of ctypes and **automatically** track and bundle the referenced libraries. The following usages will be correctly detected:

```
CDLL("library.so")
WinDLL("library.so")
ctypes.DLL("library.so")
cdll.library # Only valid under Windows - a limitation of ctypes, not PyInstaller's
windll.library # Only valid under Windows - a limitation of ctypes, not PyInstaller's
cdll.LoadLibrary("library.so")
windll.LoadLibrary("library.so")
```

More in detail, the following restrictions apply:

- **only libraries referenced by bare filenames (e.g. no leading paths) will be handled;** handling absolute paths would be impossible without modifying the bytecode as well (remember that while running frozen, ctypes would keep searching the library at that very absolute location, whose presence on the host system nobody can guarantee), and relative paths handling would require recreating in the frozen executable the same hierarchy of directories leading to the library, in addition of keeping track of which the current working directory is;
- **only library paths represented by a literal string will be detected and included in the final executable:** PyInstaller import detection works by inspecting raw Python bytecode, and since you can pass the library path to ctypes using a string (that can be represented by a literal in the code, but also by a variable, by the return value of an arbitrarily complex function, etc...), it's not reasonably possible to detect **all** ctypes dependencies;
- **only libraries referenced in the same context of ctypes' invocation will be handled.**

We feel that it should be enough to cover most ctypes' usages, with little or no modification required in your code.

If PyInstaller does not detect a library, you can add it to your bundle by passing the respective information to `--add-binary` option or *listing it in the .spec-file*. If your frozen application will be able to pick up the library at run-time can not be guaranteed as it depends on the detailed implementation.

## Gotchas

The ctypes detection system at *Analysis time* is based on `ctypes.util.find_library()`. This means that you have to make sure that while performing Analysis and running frozen, all the environment values `find_library()` uses to search libraries are aligned to those when running un-frozen. Examples include using `LD_LIBRARY_PATH` or `DYLD_LIBRARY_PATH` to widen `find_library()` scope.

## 2.9.2 SWIG support

PyInstaller tries to detect binary modules created by SWIG. This detection requires:

- The Python wrapper module must be imported somewhere in your application (or by any of the modules it uses).
- The wrapper module must be available as source-code and it's first line must contain the text automatically generated by SWIG.
- The C-module must have the same name as the wrapper module prefixed with an underscore (`_`). (This is a SWIG restriction already.)
- The C-module must sit just beside the wrapper module (thus a relative import would work).

Also some restrictions apply, due to the way the SWIG wrapper is implemented:

- The C-module will become a *global* module. As a consequence, you can not use two SWIG modules with the same basename (e.g. `pkg1._cmod` and `pkg2._cmod`), as one would overwrite the other.

## 2.9.3 Cython support

PyInstaller can follow import statements that refer to Cython C object modules and bundle them – like for any other module implemented in C.

But – again, as for any other module implemented in C – PyInstaller can not determine if the Cython C object module is importing some Python module. These will typically show up as in a traceback like this (mind the `.pyx` extension):

```
Traceback (most recent call last):
[...]
File "myapp\cython_module.pyx", line 3, in init myapp.cython_module
ModuleNotFoundError: No module named 'csv'
```

So if you are using a Cython C object module, which imports Python modules, you will have to list these as `--hidden-import`.

## 2.9.4 macOS multi-arch support

With the introduction of Apple Silicon M1, there are now several architecture options available for python:

- single-arch `x86_64` with thin binaries: older *python.org* builds, [Homebrew](#) python running natively on Intel Macs or under *rosetta2* on M1 Macs
- single-arch `arm64` with thin binaries: [Homebrew](#) python running natively on M1 macs
- multi-arch `universal2` with fat binaries (i.e., containing both `x86_64` and `arm64` slices): recent *universal2 python.org* builds

PyInstaller aims to support all possible combinations stemming from the above options:

- single-arch application created using corresponding single-arch python
- `universal2` application created using `universal2` python
- single-arch application created using `universal2` python (i.e., reducing `universal2` fat binaries into either `x86_64` or `arm64` thin binaries)

**By default, PyInstaller targets the current running architecture and produces a single-arch binary** (`x86_64` when running on Intel Mac or under *rosetta2* on M1 Mac, or `arm64` when running on M1 Mac). The reason for that is that even with a `universal2` python environment, some packages may end up providing only single-arch binaries, making it impossible to create a functional `universal2` frozen application.

The alternative options, such as creating a `universal2` version of frozen application, or creating a non-native single-arch version using `universal2` environment, must therefore be explicitly enabled. This can be done either by specifying the target architecture in the `.spec` file via the `target_arch=` argument to `EXE()`, or on command-line via the `--target-arch` switch. Valid values are `x86_64`, `arm64`, and `universal2`.

### Architecture validation during binary collection

To prevent run-time issues caused by missing or mismatched architecture slices in binaries, the binary collection process performs strict architecture validation. It checks whether collected binary files contain required arch slice(s), and if not, the build process is aborted with an error message about the problematic binary.

In such cases, creating frozen application for the selected target architecture will not be possible unless the problem of missing arch slices is manually addressed (for example, by downloading the wheel corresponding to the missing architecture, and stitching the offending binary files together using the `lipo` utility).

Changed in version 4.10: In earlier PyInstaller versions, the architecture validation was performed on all collected binaries, such as python extension modules and the shared libraries referenced by those extensions. As of PyInstaller 4.10, the architecture validation is limited to only python extension modules.

The individual architecture slices in a multi-arch `universal2` extension may be linked against (slices in) `universal2` shared libraries, or against distinct single-arch thin shared libraries. This latter case makes it impossible to reliably validate architecture of the collected shared libraries w.r.t. the target application architecture.

However, the extension modules do need to be fully compatible with the target application architecture. Therefore, their continued validation should hopefully suffice to detect attempts at using incompatible single-arch python packages<sup>0</sup>.

<sup>0</sup> Although nothing really prevents a package from having distinct, architecture-specific extension modules...

## Trimming fat binaries for single-arch targets

When targeting a single architecture, the build process extracts the corresponding arch slice from any collected fat binaries, including the bootloader. This results in a completely thin build even when building in `universal2` python environment.

## 2.9.5 macOS binary code signing

With Apple Silicon M1 architecture, macOS introduced mandatory code signing, even if ad-hoc (i.e., without actual code-signing identity). This means that `arm64` arch slices (but possibly also `x86_64` ones, especially in `universal2` binaries) in collected binaries always come with signature.

The processing of binaries done by PyInstaller (e.g., library path rewriting in binaries' headers) invalidates their signatures. Therefore, the signatures need to be re-generated, otherwise the OS refuses to load a binary.

**By default, PyInstaller ad-hoc (re)signs all collected binaries and the generated executable itself.** Instead of ad-hoc signing, it is also possible to use real code-signing identity. To do so, either specify your identity in the `.spec` file via `codesign_identity=` argument to `EXE()`, or on command-line via the `--codesign-identity` switch.

Being able to provide codesign identity allows user to ensure that all collected binaries in either `onefile` or `onedir` build are signed with their identity. This is useful because for `onefile` builds, signing of embedded binaries cannot be performed in a post-processing step.

---

**Note:** When codesign identity is specified, PyInstaller also turns on *hardened runtime* by passing `--options=runtime` to the `codesign` command. This requires the codesign identity to be a valid Apple-issued code signing certificate, and will not work with self-signed certificates.

Trying to use self-signed certificate as a codesign identity will result in shared libraries failing to load, with the following reason reported:

```
[libname]: code signature in ([libname]) not valid for use in process using Library Validation: mapped
file has no Team ID and is not a platform binary (signed with custom identity or adhoc?)
```

---

Furthermore, it is possible to specify entitlements file to be used when signing the collected binaries and the executable. This can be done in the `.spec` file via `entitlements_file=` argument to `EXE()`, or on command-line via the `--osx-entitlements-file` switch.

## App bundles

PyInstaller also automatically attempts to sign *.app bundles*, either using ad-hoc identity or actual signing identity, if provided via `--codesign-identity` switch. In addition to passing same options as when signing collected binaries (identity, hardened runtime, entitlement), deep signing is also enabled via by passing `--deep` option to the `codesign` utility.

Should the signing of the bundle fail for whatever reason, the error message from the `codesign` utility will be printed to the console, along with a warning that manual intervention and manual signing of the bundle are required.

## 2.9.6 macOS event forwarding and argv emulation in app bundles

The user interaction with macOS app bundles takes place via so called Apple Events. When the user double clicks on the application's icon, the application is started and receives an Open Application ('oapp') event. Dragging a document on the application's icon or attempting to open an application-registered file generates an Open Document ('odoc') event. Similarly, launching an URL with application-registered schema generates a Launch/Get URL ('GURL') event. Typically, a long-running UI application installs Carbon or Cocoa event handlers (or their equivalents provided by higher-level UI toolkit) to handle these requests during its runtime.

PyInstaller provides two aspects of support for macOS event handling; automatic *event forwarding*, which enables frozen application to receive events in `onefile` mode, and optional *argv emulation* for converting initial opening event into `sys.argv` arguments. Both aspects apply only to app bundles (i.e., the windowed bootloader variant) and not to POSIX (command-line) frozen applications.

Changed in version 5.0: In earlier PyInstaller versions, *argv emulation* was always enabled in `onefile` mode and was unavailable in `onedir` mode. As PyInstaller 5.0, *argv emulation* must be explicitly opted-in, and is available in both `onefile` and `onedir` mode.

### Event forwarding

In PyInstaller `onedir` bundles, the application runs as a single process, and therefore receives Apple Events normally, as other macOS applications would.

In `onefile` bundles, the application has a parent launcher process and the child process; the open document requests generated by user are received by the parent process, and are automatically forwarded to the child process, where the frozen python code is running.

Event forwarding is implemented for the following types of Apple Events:

- `kAEOpenDocuments ('odoc')`: open document request
- `kAEGetURL ('GURL')`: open/launch URL request
- `kAEReopenApplication ('rapp')`: reopen application
- `kAEAActivate ('actv')`: activate application (bring to front)

### Optional argv emulation

PyInstaller implements an optional feature called *argv emulation*, which can be toggled via `argv_emulation=` argument to `EXE()` in the *.spec file*, or enabled on command-line via `--argv-emulation` flag.

If enabled, the bootloader performs initial Apple Event handling to intercept events during the application's start-up sequence, and appends file paths or URLs received via Open Document/URL ('odoc' and 'GURL') events to `sys.argv`, as if they were received via command-line.

This feature is intended for simple applications that do not implement the event handling, but still wish to process initial open document request. This applies only to initial open events; events that occur after the frozen python code is started are dispatched via event queue (in `onedir` mode directly, and forwarded to child process in `onefile` mode.) and as such need to be handled via event handlers.

---

**Note:** This feature is not suitable for long-running applications that may need to service multiple open requests during their lifetime. Such applications will require proper event handling anyway, and therefore do not benefit from having initial events processed by *argv emulation*.

---



**Warning:** The initial event processing performed by bootloader in `onedir` mode may interfere with UI toolkit used by frozen python application, such as Tcl/Tk via `tkinter` module. The symptoms may range from window not being brought to front when the application startup to application crash with segmentation fault.

While PyInstaller tries to mitigate the issue on its end, we recommend against using *argv emulation* in combination with UI toolkits.

## Practical examples

This section provides some practical examples on handling file and URL open events in macOS application bundles, via *argv emulation* in a simple one-shot program, or via installed event handlers in a GUI application.

### Registering supported file types and custom URL schemas

In order for macOS application bundle to handle open operations on files and custom URL schemas, the OS needs to be informed what file types and what URL schemas the application supports. This is done in the bundle's `Info.plist` file, via `CFBundleDocumentTypes` and `CFBundleURLTypes` entries:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/DTDs/
PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
  [...] <!-- preceding entries --->
  <key>CFBundleDocumentTypes</key>
  <array>
    <dict>
      <key>CFBundleTypeName</key>
      <string>MyCustomFileType</string>
      <key>CFBundleTypeExtensions</key>
      <array>
        <string>mcf</string>
      </array>
      <key>CFBundleTypeRole</key>
      <string>Viewer</string>
    </dict>
  </array>
  <key>CFBundleURLTypes</key>
  <array>
    <dict>
      <key>CFBundleURLName</key>
      <string>MyCustomUrlSchema</string>
      <key>CFBundleTypeRole</key>
      <string>Viewer</string>
      <key>CFBundleURLSchemes</key>
      <array>
        <string>my-url</string>
      </array>
    </dict>
  </array>
```

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```
</dict>
</plist>
```

In the above example, the application declares itself a viewer for made-up .mcf files, and as a viewer for URLs beginning with my-url://.

PyInstaller automatically generates an Info.plist file for your application bundle; to have it include the entries shown above, add the info\_plist argument to the BUNDLE() directive in the *.spec file*, and set its content as follows:

```
app = BUNDLE(
    # [...]
    info_plist={
        'CFBundleURLTypes': [{
            'CFBundleURLName': 'MyCustomUrlSchema',
            'CFBundleTypeRole': 'Viewer',
            'CFBundleURLSchemes': ['my-url', ],
        }],
        'CFBundleDocumentTypes': [{
            'CFBundleTypeName': 'MyCustomFileType',
            'CFBundleTypeExtensions': ['mcf', ],
            'CFBundleTypeRole': "Viewer",
        }],
    }
)
```

## Open event handling with argv emulation

Consider the following python script that began its life as a command-line utility, to be invoked from the terminal:

```
python3 img2gray.py image1.png image2.png ...
```

The script processes each passed image, converts it to grayscale, and saves it next to the original, with *-gray* appended to the file name:

```
# img2gray.py
import sys
import os

import PIL.Image

if len(sys.argv) < 2:
    print(f"Usage: {sys.argv[0]} <filename> [filenames...]")
    sys.exit(1)

# Convert all given files
for input_filename in sys.argv[1:]:
    filename, ext = os.path.splitext(input_filename)
    output_filename = filename + '-gray' + ext

    img = PIL.Image.open(input_filename)
```

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```
img_g = img.convert('L')
img_g.save(output_filename)
```

If you generate an application bundle (as opposed to a command-line POSIX application), the most likely way of user interaction will be dragging image files onto the bundle's icon or using `Open with...` entry from the image file's context menu. Such interaction generates open file events, and in general requires your application code to implement event handling.

Enabling *argv emulation* in PyInstaller causes its bootloader to process events during the application startup, and extend `sys.argv` with any file paths or URLs that might have been received via open file or URL requests. This allows your application to process the received filenames as if they were passed via command-line, without any modifications to the code itself.

The following *.spec file* provides a complete example for a `onedir` application bundle that allows conversion of `.png` and `.jpg` images:

```
# img2gray.spec
a = Analysis(['img2gray.py'], )

pyz = PYZ(a.pure, a.zipped_data)

exe = EXE(
    pyz,
    a.scripts,
    exclude_binaries=True,
    name='img2gray',
    debug=False,
    bootloader_ignore_signals=False,
    strip=False,
    upx=False,
    console=False,
    argv_emulation=True, # enable argv emulation
)

coll = COLLECT(
    exe,
    a.binaries,
    a.zipfiles,
    a.datas,
    strip=False,
    upx=False,
    upx_exclude=[],
    name='img2gray'
)

app = BUNDLE(
    coll,
    name='img2gray.app',
    # Register .png and .jpg as supported file types
    info_plist={
        'CFBundleDocumentTypes': [{
            'CFBundleTypeName': "Convertible image types",
            'CFBundleTypeExtensions': [
```

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```

        'png', 'jpg',
    ],
    'CFBundleTypeRole': "Viewer",
}],
}
)

```

The user can now drag image file(s) onto the icon of the resulting `img2gray` application bundle, or select `img2gray` under the `Open with...` entry in the image file's context menu.

**Note:** The *argv emulation* handles only initial open event, which is received before your frozen python code is started. If you wish to handle subsequent open requests while the application is still running, you need to implement proper event handling in your python code.

## Open event handling in a tkinter-based GUI application

The Tcl/Tk framework used by `tkinter` allows application to provide event handlers for pre-defined types of Apple Events, by registering `macOS-specific commands`.

The handler for open file events can be registered via `::tk::mac::OpenDocument` command, while the handler for open URL events can be registered via `::tk::mac::LaunchURL` command. The latter is available starting with Tcl/Tk 8.6.10<sup>0</sup>.

The following application illustrates the event handling using `tkinter`, by logging all received open file/URL events into a scrollable text widget:

```

# eventlogger_tk.py
import sys

import tkinter
import tkinter.scrolledtext

class Application:
    def __init__(self):
        # Create UI
        self.window = tkinter.Tk()
        self.window.geometry('800x600')
        self.window.title("Tk-based event logger")

        self.text_view = tkinter.scrolledtext.ScrolledText()
        self.text_view.pack(fill=tkinter.BOTH, expand=1)
        self.text_view.configure(state='disabled')

        # Register event handlers
        # See https://tcl.tk/man/tcl/TkCmd/tk_mac.html for list of
        # macOS-specific commands

```

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<sup>0</sup> At the time of writing, python.org builds use Tcl/Tk 8.6.5, except for the Python 3.9.x *macOS 64-bit universal2 installer* builds, which use Tcl/Tk 8.6.10. Homebrew Python requires `tkinter` to be explicitly installed as `python-tk`, and uses latest version of Tcl/Tk, 8.6.11. Registering `::tk::mac::LaunchURL` command with versions of Tcl/Tk older than 8.6.10 is essentially no-op.

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```

        self.window.createcommand("::tk::mac::OpenDocument", self.open_document_handler)
        self.window.createcommand("::tk::mac::LaunchURL", self.open_url_handler) #_
↳works with Tcl/Tk >= 8.6.10

    def append_message(self, msg):
        """Append message to text view."""
        self.text_view.configure(state='normal')
        self.text_view.insert('end', msg + '\n')
        self.text_view.configure(state='disabled')

    def run(self):
        """Run the main loop."""
        app.append_message("Application started!")
        app.append_message(f"Args: {sys.argv[1:]}")
        self.window.mainloop()

# Event handlers
def open_document_handler(self, *args):
    app.append_message(f"Open document event: {args}")

def open_url_handler(self, *args):
    app.append_message(f"Open URL event: {args}")

if __name__ == '__main__':
    app = Application()
    app.run()

```

The corresponding *.spec* file that builds a onedir application bundle with a custom file association (*.pyi\_tk*) and a custom URL schema (*pyi-tk://*):

```

a = Analysis(['eventlogger_tk.py'])

pyz = PYZ(a.pure, a.zipped_data)

exe = EXE(
    pyz,
    a.scripts,
    exclude_binaries=True,
    name='eventlogger_tk',
    debug=False,
    bootloader_ignore_signals=False,
    strip=False,
    upx=False,
    console=False,
    argv_emulation=False, # unnecessary as app handles events
)

coll = COLLECT(
    exe,
    a.binaries,
    a.zipfiles,

```

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```

    a.datas,
    strip=False,
    upx=False,
    name='eventlogger_tk'
)

app = BUNDLE(
    coll,
    name='eventlogger_tk.app',
    # Register custom protocol handler and custom file extension
    info_plist={
        'CFBundleURLTypes': [{
            'CFBundleURLName': 'MyCustomUrlSchemaTk',
            'CFBundleTypeRole': 'Viewer',
            'CFBundleURLSchemes': ['pyi-tk'],
        }],
        'CFBundleDocumentTypes': [{
            'CFBundleTypeName': 'MyCustomFileTypeTk',
            'CFBundleTypeExtensions': [
                'pyi_tk',
            ],
            'CFBundleTypeRole': "Viewer",
        }],
    },
)

```

Once running, the application logs all received open file and open URL requests. These are generated either by trying to open a file with `.pyi_tk` extension using the UI, or using open command from the terminal:

```

$ touch file1.pyi_tk file2.pyi_tk file3.pyi_tk file4.pyi_tk

$ open file1.pyi_tk
$ open file2.pyi_tk

$ open pyi-tk://test1
$ open pyi-tk://test2

$ open file3.pyi_tk file4.pyi_tk

```

## Open event handling in a Qt-based GUI application

In Qt-based applications, open file and open URL requests are handled by installing application-wide event filter for `QFileOpenEvent`.

This event abstracts both open file and open URL request, with file open requests having `file://` URL schema. An event contains a single file name or URL, so an open request containing multiple targets generates corresponding number of `QFileOpenEvent` events.

Below is an example application and its corresponding *.spec* file:

```

# eventlogger_qt.py
import sys

```

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```

import signal

from PySide2 import QtCore, QtWidgets

class Application(QtWidgets.QApplication):
    """
    QtWidgets.QApplication with extra handling for macOS Open
    document/URL events.
    """
    openFileRequest = QtCore.Signal(QtCore.QUrl, name='openFileRequest')

    def event(self, event):
        if event.type() == QtCore.QEvent.FileOpen:
            # Emit signal so that main window can handle the given URL.
            # Or open a new application window for the file, or whatever
            # is appropriate action for your application.
            self.openFileRequest.emit(event.url())
            return True
        return super().event(event)

class MainWindow(QtWidgets.QMainWindow):
    """
    Main window.
    """
    def __init__(self, *args, **kwargs):
        super().__init__(*args, **kwargs)

        self.resize(800, 600)

        self.setWindowTitle("Qt-based event logger")

        # Construct the UI
        self.scroll_area = QtWidgets.QScrollArea()
        self.scroll_area.setWidgetResizable(True)
        self.setCentralWidget(self.scroll_area)

        self.text_edit = QtWidgets.QTextEdit()
        self.scroll_area.setWidget(self.text_edit)
        self.text_edit.setReadOnly(True)

    def append_message(self, msg):
        """
        Append message to text view.
        """
        self.text_edit.append(msg)

    def handle_open_file_request(self, url):
        self.append_message(f"Open request: {url.toString()}")

```

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```

if __name__ == '__main__':
    # Make Ctrl+C work
    signal.signal(signal.SIGINT, signal.SIG_DFL)

    app = Application(list(sys.argv))

    window = MainWindow()
    window.show()

    window.append_message("Application started!")
    window.append_message(f"Args: {sys.argv[1:]}")

    app.openFileRequest.connect(window.handle_open_file_request)

    app.exec_()

```

```

# eventlogger_qt.spec
a = Analysis(['eventlogger_qt.py'])

pyz = PYZ(a.pure, a.zipped_data)

exe = EXE(
    pyz,
    a.scripts,
    exclude_binaries=True,
    name='eventlogger_qt',
    debug=False,
    bootloader_ignore_signals=False,
    strip=False,
    upx=False,
    console=False,
    argv_emulation=False, # unnecessary as app handles events
)

coll = COLLECT(
    exe,
    a.binaries,
    a.zipfiles,
    a.datas,
    strip=False,
    upx=False,
    name='eventlogger_qt'
)

app = BUNDLE(
    coll,
    name='eventlogger_qt.app',
    # Register custom protocol handler and custom file extension
    info_plist={
        'CFBundleURLTypes': [{
            'CFBundleURLName': 'MyCustomUrlSchemaQt',
            'CFBundleTypeRole': 'Viewer',

```

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```

        'CFBundleURLSchemes': ['pyi-qt'],
    }],
    'CFBundleDocumentTypes': [{
        'CFBundleTypeName': 'MyCustomFileTypeQt',
        'CFBundleTypeExtensions': [
            'pyi-qt',
        ],
        'CFBundleTypeRole': "Viewer",
    }],
}
)

```

The application behaves in the same way as its `tkinter`-based counterpart, except that the associated file extension and URL schema have been adjusted to prevent interference between the two example applications.

### Initial open event

This section contains notes about behavior of the initial open event received by application, as seen by the frozen python code (or the UI toolkit it uses).

When application is opened normally, this is done via Open Application ('oapp') event, which is the first event received by the application. If application is opened in response to open document or open URL request (i.e., it is not yet running when request is made), then the first received event is 'odoc' or 'GURL', respectively.

In PyInstaller-frozen `onefile` bundles, the child process always starts with 'oapp' event, regardless how the application was started. This is because the child is always started “normally”, and it is the parent who receives the actual opening event; if the parent was opened with 'odoc' or 'GURL' event, then event is either forwarded to child or converted to `sys.argv` that is passed to the child, depending on whether *argv emulation* is enabled or not.

Therefore, in `onefile` mode, *argv emulation* has no direct effect on the initial open event (as seen by the frozen python code), which is always 'oapp'.

In `onedir` bundles, there application consists of single process, which receives the events. Without *argv emulation*, the initial open event (as seen by the frozen python code) may be either 'oapp', 'odoc', or 'GURL', depending on how application was started.

However, if *argv emulation* is enabled in a `onedir` bundle, its processing of initial event leaves the event queue empty. The lack of initial open event seems to cause segmentation fault with Tcl/Tk 8.6.11 and [Homebrew](#) Python 3.9.6 (#5581). As a work-around, the bootloader attempts to submit an 'oapp' event to itself, so that when the frozen python code inspects the event queue, it finds an initial open event (i.e., 'oapp'). These potential side effects of *argv emulation* on UI toolkits are the reason why we recommend against using them together.

## 2.9.7 Signal handling in console Windows applications and onefile application cleanup

The signal handling in console applications on Windows differs from POSIX-based operating systems, such as linux and macOS. While signals generated by abnormal conditions, such as SIGABRT (abnormal termination; for example due to C code calling `abort`), SIGFPE (floating-point error), and SIGSEGV (illegal storage access), are generated and can be handled using handlers installed via the `signal` function, this is not the case for signals associated with program interruption and termination.

Specifically, interrupting a console-enabled program by pressing `Ctrl+C` does not generate the SIGINT signal, but rather a special *console control signal* called `CTRL_C_EVENT`, which can be handled by a handler installed via the



`SetConsoleCtrlHandler` win32 API function<sup>1</sup>. Similarly, as noted in MSDN documentation on [signal](#), the `SIGTERM` signal is not generated under Windows. Instead, there are [several console control signals](#):

- `CTRL_C_EVENT`: interrupt via *Ctrl+C* key combination
- `CTRL_BREAK_EVENT`: interrupt via *Ctrl+Break* key combination
- `CTRL_CLOSE_EVENT`: closing the parent console window
- `CTRL_LOGOFF_EVENT`: a user logging off
- `CTRL_SHUTDOWN_EVENT`: system shutting down

When a console control signal is generated, the handler installed via `SetConsoleCtrlHandler` (if any) is executed *in a separate thread*, spawned within the program process by the operating system. In other words, the handler function is executed in parallel to the main program thread, which is necessary as the latter might be waiting on a blocking operation or performing an endless loop.

As noted [here](#), upon receiving `CTRL_CLOSE_EVENT`, `CTRL_LOGOFF_EVENT`, or `CTRL_SHUTDOWN_EVENT`, the handler function can perform any necessary clean-up<sup>2</sup>, and either:

- call `ExitProcess` to terminate the process.
- return `FALSE` (0). Other registered handlers are called, and if none returned `TRUE`, the default handler terminates the process by calling `ExitProcess`.
- return `TRUE` (non-zero). The system terminates the process immediately, without calling any other registered handler functions.

In other words, all options result in eventual program termination.

On the other hand, the default handler for `CTRL_C_EVENT` and `CTRL_BREAK_EVENT` also terminates the process, but this behavior can be modified by suppressing the default handler by returning `TRUE` in the user-installed one.

Another important aspect of console control signals is that handling `CTRL_CLOSE_EVENT`, `CTRL_LOGOFF_EVENT`, and `CTRL_SHUTDOWN_EVENT` is subject to system-imposed [time-outs](#) (e.g., five seconds for the `CTRL_CLOSE_EVENT`); if the process does not exit within the time-out limit, the operating system itself unconditionally terminates the process.

The above effectively means that once the program receives such control signal, its termination is inevitable (i.e., the signal cannot be ignored). At best, the termination can be delayed to perform any necessary clean-up, but even this must be done within system-imposed time limits.

### Example of console control signal handling in python application

The following code demonstrates the basic implementation of a graceful console application shutdown. If the application is interrupted by user pressing *Ctrl+C* or *Ctrl+Break*, or closed due to user closing the console window, the application's state is stored to a file, so it can be restored on a subsequent run.

```
# console_counter.py
import sys
import time
import pathlib

import win32api # pip install pywin32
```

(continues on next page)

<sup>1</sup> The higher-level programming languages, such as python, might emulate the standard signals; but under-the-hood mechanics still involve console control signals discussed in this section.

<sup>2</sup> Note that at this point, however, the program is essentially a multi-threaded one, so usual multi-threading caveats may apply.

(continued from previous page)

```

def console_handler(signal):
    print(f"Console handler (signal {signal})!")
    global keep_running
    keep_running = False
    # Sleep until process either finishes or is killed by the OS
    time.sleep(20)
    return True

if __name__ == '__main__':
    keep_running = True

    # Install console handler
    win32api.SetConsoleCtrlHandler(console_handler, 1)

    # Restore state, if available
    state_file = pathlib.Path.home() / 'counter_state.txt'
    if state_file.is_file():
        print(f"Restoring state from {state_file}...", file=sys.stderr)
        try:
            with open(state_file, 'r') as fp:
                counter = int(fp.readline())
        except Exception:
            print("Failed to restore state from file!", file=sys.stderr)
            counter = 0
    else:
        print("State file does not exist!", file=sys.stderr)
        counter = 0

    print(f"Initial counter value: {counter}", file=sys.stderr)

    # Main loop
    while keep_running:
        print(f"Counter value: {counter}")
        counter += 1
        time.sleep(1)

    # Clean-up
    print(f"Storing state to {state_file}...", file=sys.stderr)
    try:
        with open(state_file, 'w') as fp:
            print(f"{counter}", file=fp)
    except Exception:
        print(f"Failed to store state to {state_file}!", file=sys.stderr)

    print("Goodbye!")
    time.sleep(1) # Delay exit for another second

```

The console control signal handler in the above code handles *all* console signals. This includes *Ctrl+C* event, which would otherwise generate a `KeyboardInterrupt` exception in the program's main thread<sup>3</sup>. After signalling the loop

<sup>3</sup> The `KeyboardInterrupt` exception could have been used to terminate the loop as well. However, that would not handle the `Ctrl+Break` key combination nor console window being closed.

in the main thread to exit via the global boolean variable, the handler sleeps “forever”. This approach works because the handler is executed in a separate thread, and this thread is terminated once the process ends - either due to main thread reaching its end, or due to the operating system terminating the process.

The above code should work as expected when executed as an unfrozen python script, and also when frozen by PyInstaller as a *onedir* application. However, *onefile* applications frozen with PyInstaller versions prior to 5.3 exhibit a problem; due to the lack of console control signals handling in the parent application process, the latter is always terminated immediately and leaves behind the unpacked temporary directory.

Changed in version 5.3: implemented handling of console control signals in the frozen application’s parent process, which allows us to delay its termination until after the child process is terminated, and clean up the unpacked temporary directory. However, various caveats still apply, as discussed in the following sub-sections.

## Onefile mode and temporary directory cleanup

The *onefile* mode in PyInstaller uses two processes. When the application is launched, the parent process extracts the contents of the embedded archive into a temporary directory, sets up the environment and library search paths, and launches the child process. The child process sets up the embedded python interpreter and runs the frozen python application. Meanwhile, the parent process waits for the child process to exit; when that happens, it cleans up the extracted temporary data, and exits.

From the perspective of the parent process, it does not matter whether the child process exits cleanly (i.e., with success code), or exits with an error code (for example, python code throws an exception that is not handled), or exits abnormally (e.g., crashes due to abnormal operation raising the SIGABRT signal), or is terminated by the OS (for example, from the Task Manager). In all cases, after the child process exits or is terminated, the parent process performs the cleanup, then exits with the exit code that was returned from the child process.

Therefore, in order for the application’s temporary directory to be cleaned up, the parent process must never be forcefully terminated (for example, via the `TerminateProcess` function). If that happens, the clean-up code has no chance to run, and the temporary directory is left behind. On the other hand, from the perspective of the temporary directory clean-up, the child process can be terminated in any way, even forcefully. For the proper clean-up during a graceful shutdown triggered via console control signal (for example, due to `Ctrl+C` being pressed, or due to console window being closed), the bootloader in PyInstaller 5.3 and later attempts to delay the shut-down of the parent process so that the child process has time to exit and the main thread of the parent process has the chance to run the clean-up code.

The following sections provide additional details on this behavior for different situations.

## Interrupting via Ctrl+C or Ctrl+Break

When `Ctrl+C` or `Ctrl+Break` is pressed in the console window, the `CTRL_C_EVENT` or `CTRL_BREAK_EVENT` is sent to all processes attached to that console<sup>4</sup>.

In a *onefile* frozen application, the parent process ignores/suppresses the signal, so the outcome depends on how the frozen python code in the child process handles the signal. If the python code exits (for example, no handler is installed and `KeyboardInterrupt` exception interrupts the program flow), the parent process performs the clean-up and exits as well. If the python code in the child process handles the signal without shutting the child process down, the application keeps running.

This behavior is readily available in any PyInstaller version; in versions prior to 5.3, the parent process explicitly ignores SIGABRT and SIGBREAK signals, which achieves the same result as handling the corresponding console control signals, which is implemented from version 5.3 on.

<sup>4</sup> If a *windowed/noconsole* application is started from a console, it is completely independent from it as long as it has a window. If the application has no window (i.e., a “hidden” application), its process does not receive `CTRL_C_EVENT` and `CTRL_BREAK_EVENT` signals in response to `Ctrl+C` and `Ctrl+Break` being pressed in the console, but is nevertheless terminated when the console is closed. The termination seems to be immediate and unconditional, i.e., without `CTRL_CLOSE_EVENT` signal being received.

## Closing the console window

When the console window is closed (by pressing *X* button on title bar), the `CTRL_CLOSE_EVENT` is sent to all processes attached to that console<sup>?</sup>.

In a *onefile* frozen application, the parent process receives the signal and suspends the handler's execution thread for 20 seconds. This way, the termination of the parent process is delayed, in order to give time to the child process (who also received the signal) to exit, and to the main thread of the parent process to perform cleanup and exit (which then also terminates the handler's execution thread). This behavior was implemented in PyInstaller 5.3 to ensure that closing the console window cleans up the application's temporary directory.

In versions prior to 5.3, the `CTRL_CLOSE_EVENT` is not handled; the parent process is terminated immediately without having the chance to perform the cleanup, leaving the application's temporary directory behind.

---

**Note:** The child process (i.e., the frozen python application code) might install its own console control signal handler in order to perform its own cleanup (for example, save the application's state). If so, it is important to keep in mind the system-imposed five-second timeout, and the fact that the parent process can perform the temporary directory cleanup only after the child process exits. In other words, if the clean up in the child process takes close to five seconds, the parent process may not have a chance to perform its own clean up before the OS kills the process.

---

## Terminating the application via the Task Manager

Terminating the application via the Task Manager is somewhat unpredictable due to distinction between “Apps” and “Background processes”.

“Apps” are closed by sending a close request to the application. Such applications may close gracefully if they close their window in response to the request, or, if they have a console, they handle the resulting `CTRL_CLOSE_EVENT` console control signal.

“Background processes” are terminated unconditionally using the `TerminateProcess`, leaving no hope for graceful shut-down and clean up.

The distinction between the two is based on *whether the program has a visible window or not*, but in practice, there are additional nuances when it comes to console-enabled applications and applications with multiple processes.

To see the detailed classification on per-process basis, right click on the header of the process list view in the Task Manager, and enable display of the Type column. The newly added column will show the process classification for each process, and not just for the whole process group.

In the following sub-sections, we detail the behavior when attempting to shut down different processes involved with frozen applications. Roughly, the behavior highly depends on the following factors:

- build type: *onedir* (single-process) vs. *onefile* (two-process) PyInstaller build option.
- console enabled or not: *console* vs. *noconsole/windowed* PyInstaller build option.
- application has a window or not: regardless of whether an application has console enabled or not, it might have a window (window + console) or not (pure console-based application; or a “hidden”, window-less and console-less, application that runs as a background process).
- how the application is launched: by double-clicking on the executable (“stand-alone”, with its own console window) or by running it in an already-opened command prompt.

## Windowed/noconsole onedir applications

*Windowed/noconsole onedir* applications are single-process applications without console, so they are the easiest to understand when it comes to the Task Manager and the shutdown behavior.

If the application has a window (for example, a Qt-based GUI), it is treated as an “App”. It is listed under “Apps”, and its process name is listed next to the top-level entry in the list. Shutting it down via the “*End task*” results in a window close event being posted, which allows for graceful application shutdown.

If the application has no window (a window-less and console-less “hidden” application), it is treated as a “Background process”, and is listed under “Background processes”. Shutting it down via the “*End task*” results in its unconditional termination, with no hope for graceful application shutdown.

As noted in earlier sections, *windowed/noconsole* applications are independent of the console even if they are launched from one, as long as they have a window. On the other hand, if an application has no window, the shutdown of the console process results in the immediate and unconditional termination of the application process (background process within the console).

Because *onedir* applications do not need to unpack their contents to the temporary directory, the termination mode does not really affect the clean-up from PyInstaller’s perspective. But it may be of concern if the application wishes to perform some clean-up on its own; for example, saving the current state during the shutdown as was done in *the earlier example*.

## Console-enabled onedir applications

The shutdown behavior of Task Manager and *console-enabled onedir* applications depends on whether the application itself has a window (for example, a Qt-based GUI application with console enabled) or not (a “pure” console application), and whether the application owns the console window or not.

### Pure console onedir application, ran via double-click

Running a pure-console application by double clicking on the executable opens a new console with the application running in it. The top-level entry in the process list is placed under “Apps”; however, it does not have a process name listed next to it. Instead, it is a group consisting of a “*Console Window Host*” (a “Windows process”) and the actual application process, which is classified as an “App”.

Shutting down the whole group (i.e., the top-level entry) via the “*End task*” results in everything being unconditionally terminated.

Shutting down the application process results in it receiving the CTRL\_CLOSE\_EVENT for graceful shutdown.

### Pure console onedir application, ran in existing console

Opening a new command prompt results in a new “*Windows Command Processor*” group entry being added under “Apps”. It consists of a “*Console Window Host*” (a “Windows process”) and a “*Command Prompt*” (an “App”). Running a pure-console application from the opened command prompt results in a new process being added to the existing “*Windows Command Processor*” group, and the process is classified as a “Background process”.

Therefore, shutting down the whole group results in everything being unconditionally terminated.

Shutting down the application process results in it being unconditionally terminated.

Shutting down the “*Command Prompt*” process results in application process receiving the CTRL\_CLOSE\_EVENT for graceful shutdown.

### Console-enabled onedir application with window, ran via double-click

Running a console-enabled application with a window via double-click behaves similarly to the corresponding pure-console application case. The resulting process list entry is placed under “Apps”, and is a group consisting of a “*Console Window Host*” (a “Windows process”) and the actual application process, which is classified as an “App”.

Shutting down the whole group results in everything being unconditionally terminated.

Shutting down the application process results in it receiving the `CTRL_CLOSE_EVENT` for graceful shutdown.

### Console-enabled onedir application with window, ran in existing console

Running a console-enabled application with a window from an existing command prompt does not place the application process under the existing “*Windows Command Processor*” group, but rather results in a new “App” top-level entry in the process list. This entry behaves similarly to the *windowed onedir* case; it has process name listed next to it and shutting it down via the “*End task*” results in a window close event being posted, which allows for graceful application shutdown.

Shutting down the whole “*Windows Command Processor*” closes the console, but the application itself keeps running (although its console handles likely become invalid<sup>5</sup>).

Shutting down the “*Command Prompt*” process within the “*Windows Command Processor*” group results in the application process receiving the `CTRL_CLOSE_EVENT` for graceful shutdown.

### Console-enabled onefile applications

The shutdown behavior of *onefile* applications is complicated by the fact that two processes are involved, and that application contents need to be extracted to the temporary directory that should, ideally, be cleaned up when the application is shut down.

### Pure-console onefile application, ran via double-click

Running a pure-console application by double clicking on the executable opens a new console with the application running in it. The top-level entry in the process list is placed under “Apps”, and is a group consisting of:

- a “*Console Window Host*” (a “Windows process”)
- the parent process, classified as an “App”
- the child process, classified as a “Background process”

Shutting down the whole group results in everything being unconditionally terminated. The temporary directory is left behind.

Shutting down the child process results in its immediate and unconditional termination. After the child process is terminated, the parent process performs temporary directory cleanup and exits, which also closes the console. The only potential drawback of this situation is that the application code cannot perform its own clean up.

Shutting down the parent process results in the `CTRL_CLOSE_EVENT` received by both parent and child process. After the child performs its cleanup (if any) and exits, the parent performs temporary directory cleanup and exits as well. This is the ideal situation<sup>6</sup>.

---

<sup>5</sup> Invalid console handles might, in turn, end up causing an error when the application code tries to use them, for example to print a message to the (now non-existent) console.

<sup>6</sup> Assuming the potential cleanup in the application code does not delay the shutdown to the point where the OS ends up killing the parent process before it has the chance to perform the temporary directory cleanup...

### Pure console onefile application, ran in existing console

Running a pure-console application from the opened command prompt results in two new processes being added to the existing “*Windows Command Processor*” group, and both of them are classified as a “Background process”.

Shutting down the whole “*Windows Command Processor*” group results in everything being unconditionally terminated, and the temporary directory being left behind.

Shutting down the parent process results in its immediate and unconditional termination. The console accepts input again, while the child process (the actual application) keeps running in the background (i.e., still writing its output to the console). Since the parent process was terminated before it could perform clean-up, the temporary directory is left behind.

Shutting down the child process similarly results in its immediate and unconditional termination. After the child process is terminated, the parent process performs temporary directory cleanup and exits. The only potential drawback of this situation is that the application code cannot perform its own clean up.

Shutting down the “*Command Prompt*” process is the best choice, as it results in both the parent and the child process receiving the `CTRL_CLOSE_EVENT` for graceful shutdown.

But perhaps the most surefire way of closing the application in this case would be using *Ctrl+C* or *Ctrl+Break*, or even closing the console window.

### Console-enabled onefile application with window, ran via double-click

Running a console-enabled application with a window via double-click results in two top-level entries in the process list.

The first entry is a group that belongs to the parent process; it contains a “*Console Window Host*” (a “Windows process”) and the parent process, which is classified as an “App”.

The child process is listed as a separate top-level entry that is also classified as an “App” and has process name listed next to it.

Shutting down the whole parent process group results in everything in that group being unconditionally terminated, while the child process (the actual application) keeps running. The temporary directory is left behind.

Shutting down the parent process results in the `CTRL_CLOSE_EVENT` received by both the parent and the child process. After the child performs its cleanup (if any) and exits, the parent performs temporary directory cleanup and exits as well. This is the ideal situation<sup>?</sup>.

Shutting down the child process results in it receiving the `CTRL_CLOSE_EVENT` for graceful shutdown. After the child performs its cleanup (if any) and exits, the parent performs temporary directory cleanup and exits as well. This is the ideal situation; in this case, the parent process performs temporary directory cleanup even if the child process exceeds the signal handling timeout and is forcefully terminated by the operating system.

### Console-enabled onefile application with window, ran in existing console

Running a console-enabled application with a window from the opened command prompt results in parent process being added to the existing “*Windows Command Processor*” group, as a “Background process”.

The child process is listed as a separate top-level entry that is classified as an “App” and has process name listed next to it.

Shutting down the whole “*Windows Command Processor*” closes the console and results in immediate and unconditional termination of the parent process. The child process (the application itself) keeps running (although its console handles likely become invalid<sup>?</sup>). The temporary directory is left behind.



Shutting down the parent process results in its immediate and unconditional termination. The console is left open and accepts input again, while the child process (the actual application) keeps running in the background (i.e., still writing its output to the console). Since the parent process was terminated before it could perform clean-up, the temporary directory is left behind.

Shutting down the child process results in it receiving the `CTRL_CLOSE_EVENT` for graceful shutdown. After the child performs its cleanup (if any) and exits, the parent performs temporary directory cleanup and exits as well. This is the ideal situation; in this case, the parent process performs temporary directory cleanup even if the child process exceeds the signal handling timeout and is forcefully terminated by the operating system.

Shutting down the “*Command Prompt*” process results in both the parent and the child application process receiving the `CTRL_CLOSE_EVENT` for graceful shutdown. This is the ideal situation<sup>?</sup>.

### Windowed/noconsole onefile applications

In case of *windowed/noconsole onefile* applications, the application’s parent process is usually classified as a “Background process”. The classification of the child process depends on whether the application has a window or not.

#### Noconsole onefile application without window, ran via double-click

Running a “hidden” application (*noconsole/windowed* application without a window) by double clicking on the executable results in parent and child process being added to the process list as two distinct top-level entries, under “Background processes”.

Shutting down the parent process results in its immediate and unconditional termination. The child process (the actual application) keeps running. Since the parent process was terminated before it could perform clean-up, the temporary directory is left behind.

Shutting down the child process also results in its immediate and unconditional termination. After the child process is terminated, the parent process performs temporary directory cleanup and exits. The only potential drawback of this situation is that the application code cannot perform its own clean up.

#### Noconsole onefile application without window, ran in existing console

Running a “hidden” application from the opened command prompt results in two new processes being added to the existing “*Windows Command Processor*” group, and both of them are classified as a “Background process”.

Shutting down the whole “*Windows Command Processor*” group results in everything being unconditionally terminated, and the temporary directory being left behind.

Shutting down the parent process results in its immediate and unconditional termination. The child process (the actual application) keeps running as a background process. Since the parent process was terminated before it could perform clean-up, the temporary directory is left behind.

Shutting down the child process similarly results in its immediate and unconditional termination. After the child process is terminated, the parent process performs temporary directory cleanup and exits. The only potential drawback of this situation is that the application code cannot perform its own clean up.

Shutting down the “*Command Prompt*” process closes the console, but both parent and child process keep on running as background processes. Their entries are moved from the removed “*Windows Command Processor*” group into a new group entry under “Background processes”.



### Noconsole onefile application with window, ran via double-click

Running a regular GUI *noconsole* application via double click results in the parent process being classified as a “Background process” and the child process being classified as an “App”. Each of them get their own top-level entry in the process list (under “Background processes” and under “Apps”, respectively), and both have their process name listed next to them.

Shutting down the parent process results in its immediate and unconditional termination. The child process (the actual application) keeps running. Since the parent process was terminated before it could perform clean-up, the temporary directory is left behind.

Shutting down the child process results in a window close request (and the `CTRL_CLOSE_EVENT` signal) being sent to the child process for a graceful shutdown. After the child performs its cleanup (if any) and exits, the parent performs temporary directory cleanup and exits as well. This is the ideal situation; in this case, the parent process performs temporary directory cleanup even if the child process exceeds the signal handling timeout and is forcefully terminated by the operating system.

### Noconsole onefile application with window, ran in existing console

Running a regular GUI *noconsole* application from an existing console is similar to running it via double-click, except that the parent process (classified as a “Background process”) is listed under the “*Windows Command Processor*” group under “Apps” instead of a stand-alone entry under “Background processes”.

Shutting down the whole “*Windows Command Processor*” closes the console and results in immediate and unconditional termination of the parent process. The child process (the application itself) keeps running. The temporary directory is left behind.

Shutting down the parent process results in its immediate and unconditional termination. This affects neither console nor the child process, both of which keep running. Since the parent process was terminated before it could perform clean-up, the temporary directory is left behind.

Shutting down the child process results in it receiving the `CTRL_CLOSE_EVENT` for graceful shutdown. After the child performs its cleanup (if any) and exits, the parent performs temporary directory cleanup and exits as well. This is the ideal situation; in this case, the parent process performs temporary directory cleanup even if the child process exceeds the signal handling timeout and is forcefully terminated by the operating system.

Shutting down the “*Command Prompt*” process results in console being closed and the parent process being immediately and unconditionally terminated. The child process keeps running. Since the parent process was terminated before it could perform clean-up, the temporary directory is left behind.

## 2.10 When Things Go Wrong

The information above covers most normal uses of PyInstaller. However, the variations of Python and third-party libraries are endless and unpredictable. It may happen that when you attempt to bundle your app either PyInstaller itself, or your bundled app, terminates with a Python traceback. Then please consider the following actions in sequence, before asking for technical help.

### 2.10.1 Recipes and Examples for Specific Problems

The PyInstaller [FAQ](#) page has work-arounds for some common problems. Code examples for some advanced uses and some common problems are available on our [PyInstaller Recipes](#) page. Some of the recipes there include:

- A more sophisticated way of collecting data files than the one shown above ([Adding Files to the Bundle](#)).
- Bundling a typical Django app.
- A use of a run-time hook to set the PyQt5 API level.
- A workaround for a multiprocessing constraint under Windows.

and others. Many of these Recipes were contributed by users. Please feel free to contribute more recipes!

### 2.10.2 Finding out What Went Wrong

#### Build-time Messages

When the **Analysis** step runs, it produces error and warning messages. These display after the command line if the `--log-level` option allows it. Analysis also puts messages in a warnings file named `build/name/warn-name.txt` in the `work-path=` directory.

Analysis creates a message when it detects an import and the module it names cannot be found. A message may also be produced when a class or function is declared in a package (an `__init__.py` module), and the import specifies `package.name`. In this case, the analysis can't tell if `name` is supposed to refer to a submodule or package.

The “module not found” messages are not classed as errors because typically there are many of them. For example, many standard modules conditionally import modules for different platforms that may or may not be present.

All “module not found” messages are written to the `build/name/warn-name.txt` file. They are not displayed to standard output because there are many of them. Examine the warning file; often there will be dozens of modules not found, but their absence has no effect.

When you run the bundled app and it terminates with an `ImportError`, that is the time to examine the warning file. Then see [Helping PyInstaller Find Modules](#) below for how to proceed.

#### Build-Time Dependency Graph

On each run PyInstaller writes a cross-referencing file about dependencies into the build folder: `build/name/xref-name.html` in the `work-path=` directory is an HTML file that lists the full contents of the import graph, showing which modules are imported by which ones. You can open it in any web browser. Find a module name, then keep clicking the “imported by” links until you find the top-level import that causes that module to be included.

If you specify `--log-level=DEBUG` to the `pyinstaller` command, PyInstaller additionally generates a [GraphViz](#) input file representing the dependency graph. The file is `build/name/graph-name.dot` in the `work-path=` directory. You can process it with any [GraphViz](#) command, e.g. `dot`, to produce a graphical display of the import dependencies.

These files are very large because even the simplest “hello world” Python program ends up including a large number of standard modules. For this reason the graph file is not very useful in this release.

## Build-Time Python Errors

PyInstaller sometimes terminates by raising a Python exception. In most cases the reason is clear from the exception message, for example “Your system is not supported”, or “Pyinstaller requires at least Python 3.7”. Others clearly indicate a bug that should be reported.

One of these errors can be puzzling, however: `IOError("Python library not found!")` PyInstaller needs to bundle the Python library, which is the main part of the Python interpreter, linked as a dynamic load library. The name and location of this file varies depending on the platform in use. Some Python installations do not include a dynamic Python library by default (a static-linked one may be present but cannot be used). You may need to install a development package of some kind. Or, the library may exist but is not in a folder where PyInstaller is searching.

The places where PyInstaller looks for the python library are different in different operating systems, but `/lib` and `/usr/lib` are checked in most systems. If you cannot put the python library there, try setting the correct path in the environment variable `LD_LIBRARY_PATH` in GNU/Linux or `DYLD_LIBRARY_PATH` in macOS.

## Getting Debug Messages

The `--debug=all` option (and its *choices*) provides a significant amount of diagnostic information. This can be useful during development of a complex package, or when your app doesn’t seem to be starting, or just to learn how the runtime works.

Normally the debug progress messages go to standard output. If the `--windowed` option is used when bundling a Windows app, they are sent to any attached debugger. If you are not using a debugger (or don’t have one), the [DebugView](#) the free (beer) tool can be used to display such messages. It has to be started before running the bundled application.

For a `--windowed` macOS app they are not displayed.

Consider bundling without `--debug` for your production version. Debugging messages require system calls and have an impact on performance.

## Getting Python’s Verbose Imports

You can build the app with the `--debug=imports` option (see [Getting Debug Messages](#) above), which will pass the `-v` (verbose imports) flag to the embedded Python interpreter. This can be extremely useful. It can be informative even with apps that are apparently working, to make sure that they are getting all imports from the bundle, and not leaking out to the local installed Python.

Python verbose and warning messages always go to standard output and are not visible when the `--windowed` option is used. Remember to not use this for your production version.

## Figuring Out Why Your GUI Application Won’t Start

If you are using the `--windowed` option, your bundled application may fail to start with an error message like `Failed to execute script my_gui`. In this case, you will want to get more verbose output to find out what is going on.

- For macOS, you can run your application on the command line, i.e. `./dist/my_gui` in *Terminal* instead of clicking on `my_gui.app`.
- For Windows, you will need to re-bundle your application without the `--windowed` option. Then you can run the resulting executable from the command line, i.e. `my_gui.exe`.
- For Unix and GNU/Linux there is no `--windowed` option. Anyway, if a your GUI application fails, you can run your application on the command line, i.e. `./dist/my_gui`.

This should give you the relevant error that is preventing your application from initializing, and you can then move on to other debugging steps.

## Operation not permitted error

If you use the `--onefile` and it fails to run your program with error like:

```
./hello: error while loading shared libraries: libz.so.1:
failed to map segment from shared object: Operation not permitted
```

This can be caused by wrong permissions for the `/tmp` directory (e.g. the filesystem is mounted with `noexec` flags).

A simple way to solve this issue is to set, in the environment variable `TMPDIR`, a path to a directory in a filesystem mounted without `noexec` flags, e.g.:

```
export TMPDIR=/var/tmp/
```

## 2.10.3 Helping PyInstaller Find Modules

### Extending the Path

If Analysis recognizes that a module is needed, but cannot find that module, it is often because the script is manipulating `sys.path`. The easiest thing to do in this case is to use the `--paths` option to list all the other places that the script might be searching for imports:

```
pyi-makespec --paths=/path/to/thisdir \
             --paths=/path/to/otherdir myscript.py
```

These paths will be noted in the spec file in the `pathex` argument. They will be added to the current `sys.path` during analysis.

### Listing Hidden Imports

If Analysis thinks it has found all the imports, but the app fails with an import error, the problem is a hidden import; that is, an import that is not visible to the analysis phase.

Hidden imports can occur when the code is using `__import__()`, `importlib.import_module()` or perhaps `exec()` or `eval()`. Hidden imports can also occur when an extension module uses the Python/C API to do an import. When this occurs, Analysis can detect nothing. There will be no warnings, only an `ImportError` at run-time.

To find these hidden imports, build the app with the `--debug=imports` flag (see *Getting Python's Verbose Imports* above) and run it.

Once you know what modules are needed, you add the needed modules to the bundle using the `--hidden-import` command option, or by editing the spec file, or with a hook file (see *Understanding PyInstaller Hooks* below).

### Extending a Package's `__path__`

Python allows a script to extend the search path used for imports through the `__path__` mechanism. Normally, the `__path__` of an imported module has only one entry, the directory in which the `__init__.py` was found. But `__init__.py` is free to extend its `__path__` to include other directories. For example, the `win32com.shell.shell` module actually resolves to `win32com/win32comext/shell/shell.pyd`. This is because `win32com/__init__.py` appends `../win32comext` to its `__path__`.

Because the `__init__.py` of an imported module is not actually executed during analysis, changes it makes to `__path__` are not seen by PyInstaller. We fix the problem with the same hook mechanism we use for hidden imports, with some additional logic; see *Understanding PyInstaller Hooks* below.

Note that manipulations of `__path__` hooked in this way apply only to the Analysis. At runtime all imports are intercepted and satisfied from within the bundle. `win32com.shell` is resolved the same way as `win32com.anythingelse`, and `win32com.__path__` knows nothing of `../win32comext`.

Once in a while, that's not enough.

## Changing Runtime Behavior

More bizarre situations can be accommodated with runtime hooks. These are small scripts that manipulate the environment before your main script runs, effectively providing additional top-level code to your script.

There are two ways of providing runtime hooks. You can name them with the option `--runtime-hook=path-to-script`.

Second, some runtime hooks are provided. At the end of an analysis, the names in the module list produced by the Analysis phase are looked up in `loader/rthooks.dat` in the PyInstaller install folder. This text file is the string representation of a Python dictionary. The key is the module name, and the value is a list of hook-script pathnames. If there is a match, those scripts are included in the bundled app and will be called before your main script starts.

Hooks you name with the option are executed in the order given, and before any installed runtime hooks. If you specify `--runtime-hook=file1.py --runtime-hook=file2.py` then the execution order at runtime will be:

1. Code of `file1.py`.
2. Code of `file2.py`.
3. Any hook specified for an included module that is found in `rthooks/rthooks.dat`.
4. Your main script.

Hooks called in this way, while they need to be careful of what they import, are free to do almost anything. One reason to write a run-time hook is to override some functions or variables from some modules. A good example of this is the Django runtime hook (see `loader/rthooks/pyi_rth_django.py` in the PyInstaller folder). Django imports some modules dynamically and it is looking for some `.py` files. However `.py` files are not available in the one-file bundle. We need to override the function `django.core.management.find_commands` in a way that will just return a list of values. The runtime hook does this as follows:

```
import django.core.management
def _find_commands(_):
    return """cleanup shell runfcgi runserver""".split()
django.core.management.find_commands = _find_commands
```

### 2.10.4 Getting the Latest Version

If you have some reason to think you have found a bug in PyInstaller you can try downloading the latest development version. This version might have fixes or features that are not yet at [PyPI](#). You can download the latest stable version and the latest development version from the [PyInstaller Downloads](#) page.

You can also install the latest version of PyInstaller directly using `pip`:

```
pip install https://github.com/pyinstaller/pyinstaller/archive/develop.zip
```

## 2.10.5 Asking for Help

When none of the above suggestions help, do ask for assistance on the [PyInstaller Email List](#).

Then, if you think it likely that you see a bug in PyInstaller, refer to the [How to Report Bugs](#) page.

## 2.11 Advanced Topics

The following discussions cover details of PyInstaller internal methods. You should not need this level of detail for normal use, but such details are helpful if you want to investigate the PyInstaller code and possibly contribute to it, as described in [How to Contribute](#).

### 2.11.1 The Bootstrap Process in Detail

There are many steps that must take place before the bundled script can begin execution. A summary of these steps was given in the Overview ([How the One-Folder Program Works](#) and [How the One-File Program Works](#)). Here is more detail to help you understand what the bootloader does and how to figure out problems.

#### Bootloader

The bootloader prepares everything for running Python code. It begins the setup and then returns itself in another process. This approach of using two processes allows a lot of flexibility and is used in all bundles except one-folder mode in Windows. So do not be surprised if you will see your bundled app as two processes in your system task manager.

What happens during execution of bootloader:

A. First process: bootloader starts.

1. If one-file mode, extract bundled files to `temppath/_MEIxxxxxx`.
2. Modify various environment variables:
  - GNU/Linux: If set, save the original value of `LD_LIBRARY_PATH` into `LD_LIBRARY_PATH_ORIG`. Prepend our path to `LD_LIBRARY_PATH`.
  - AIX: same thing, but using `LIBPATH` and `LIBPATH_ORIG`.
  - OSX: unset `DYLD_LIBRARY_PATH`.
3. Set up to handle signals for both processes.
4. Run the child process.
5. Wait for the child process to finish.
6. If one-file mode, delete `temppath/_MEIxxxxxx`.

B. Second process: bootloader itself started as a child process.

1. On Windows set the [activation context](#).
2. Load the Python dynamic library. The name of the dynamic library is embedded in the executable file.
3. Initialize Python interpreter: set `sys.path`, `sys.prefix`, `sys.executable`.
4. Run python code.

Running Python code requires several steps:

1. Run the Python initialization code which prepares everything for running the user's main script. The initialization code can use only the Python built-in modules because the general import mechanism is not yet available. It sets up the Python import mechanism to load modules only from archives embedded in the executable. It also adds the attributes `frozen` and `_MEIPASS` to the `sys` built-in module.
2. Execute any run-time hooks: first those specified by the user, then any standard ones.
3. Install python "egg" files. When a module is part of a zip file (.egg), it has been bundled into the `./eggs` directory. Installing means appending .egg file names to `sys.path`. Python automatically detects whether an item in `sys.path` is a zip file or a directory.
4. Run the main script.

## Python imports in a bundled app

PyInstaller embeds compiled python code (.pyc files) within the executable. PyInstaller injects its code into the normal Python import mechanism. Python allows this; the support is described in [PEP 302](#) "New Import Hooks".

PyInstaller implements the PEP 302 specification for importing built-in modules, importing "frozen" modules (compiled python code bundled with the app) and for C-extensions. The code can be read in `./PyInstaller/loader/pyi_mod03_importers.py`.

At runtime the PyInstaller [PEP 302](#) hooks are appended to the variable `sys.meta_path`. When trying to import modules the interpreter will first try PEP 302 hooks in `sys.meta_path` before searching in `sys.path`. As a result, the Python interpreter loads imported python modules from the archive embedded in the bundled executable.

This is the resolution order of import statements in a bundled app:

1. Is it a built-in module? A list of built-in modules is in variable `sys.builtin_module_names`.
2. Is it a module embedded in the executable? Then load it from embedded archive.
3. Is it a C-extension? The app will try to find a file with name `package.subpackage.module.pyd` or `package.subpackage.module.so`.
4. Next examine paths in the `sys.path`. There could be any additional location with python modules or .egg filenames.
5. If the module was not found then raise `ImportError`.

## Splash screen startup

---

**Note:** This feature is incompatible with macOS. In the current design, the splash screen operates in a secondary thread, which is disallowed by the Tcl/Tk (or rather, the underlying GUI toolkit) on macOS.

---

If a splash screen is bundled with the application the bootloaders startup procedure and threading model is a little more complex. The following describes the order of operation if a splash screen is bundled:

1. The bootloader checks if it runs as the outermost application (Not the child process which was spawned by the bootloader).
2. If splash screen resources are bundled, try to extract them (onefile mode). The extraction path is inside `temp_path/_MEIxxxxxx/__splashx`. If in onedir mode, the application assumes the resources are relative to the executable.
3. Load the tcl and tk shared libraries into the bootloader.
  - Windows: `tcl86t.dll/tk86t.dll`



- Linux: libtcl.so/libtk.so
4. Prepare a minimal environment for the **Tcl/Tk** interpreter by replacing/modifying the following functions:
    1. `::tclInit`: This command is called to find the standard library of tcl. We replace this command to force tcl to load/execute only the bundled modules.
    2. `::tcl_findLibrary`: Tk uses this function to source all its components. The overwritten function sets the required environment variable and evaluates the requested file.
    3. `::exit`: This function is modified to ensure a proper exit of the splash screen thread.
    4. `::source`: This command executes the contents of a passed file. Since we run in a minimal environment we mock the execution of not bundled files and execute those who are.
  5. Start the tcl interpreter and execute the splash screen script which was generated by PyInstaller's build target **Splash** at build time. This script creates the environment variable `_PYIBOOT_SPLASH`, which is also available to the python interpreter. It also initializes a tcp server socket to receive commands from python.

---

**Note:** The tcl interpreter is started in a separate thread. Only after the tcl interpreter has executed the splash screen script, the bootloader thread, which is responsible for extraction/starting the python interpreter, is resumed.

---

## 2.11.2 pyi\_splash Module (Detailed)

This module connects to the bootloader to send messages to the splash screen.

It is intended to act as an RPC interface for the functions provided by the bootloader, such as displaying text or closing. This makes the users python program independent of how the communication with the bootloader is implemented, since a consistent API is provided.

To connect to the bootloader, it connects to a local tcp server socket whose port is passed through the environment variable `_PYIBOOT_SPLASH`. The bootloader connects to the socket via the python module `_socket`. Although this socket is bidirectional, the module is only configured to send data. Since the `os`-module, which is needed to request the environment variable, is not available at boot time, the module does not establish the connection until initialization.

This module does not support reloads while the splash screen is displayed, i.e. it cannot be reloaded (such as by `importlib.reload()`), because the splash screen closes automatically when the connection to this instance of the module is lost.

### Functions

---

**Note:** Note that if the `_PYIBOOT_SPLASH` environment variable does not exist or an error occurs during the connection, the module will **not** raise an error, but simply not initialize itself (i.e. `pyi_splash.is_alive()` will return `False`). Before sending commands to the splash screen, one should check if the module was initialized correctly, otherwise a `RuntimeError` will be raised.

---

#### `is_alive()`

Indicates whether the module can be used.

Returns `False` if the module is either not initialized or was disabled by closing the splash screen. Otherwise, the module should be usable.

#### `update_text(msg)`

Updates the text on the splash screen window.



**Parameters** `msg` (*str*) – the text to be displayed

**Raises**

- **ConnectionError** – If the OS fails to write to the socket
- **RuntimeError** – If the module is not initialized

**close()**

Close the connection to the ipc tcp server socket

This will close the splash screen and renders this module unusable. After this function is called, no connection can be opened to the splash screen again and all functions if this module become unusable

### 2.11.3 The TOC and Tree Classes

PyInstaller manages lists of files using the TOC (Table Of Contents) class. It provides the `Tree` class as a convenient way to build a TOC from a folder path.

#### TOC Class (Table of Contents)

Objects of the TOC class are used as input to the classes created in a spec file. For example, the `scripts` member of an `Analysis` object is a TOC containing a list of scripts. The `pure` member is a TOC with a list of modules, and so on.

Basically a TOC object contains a list of tuples of the form

*(name, path, typecode)*

In fact, it acts as an ordered set of tuples; that is, it contains no duplicates (where uniqueness is based on the *name* element of each tuple). Within this constraint, a TOC preserves the order of tuples added to it.

A TOC behaves like a list and supports the same methods such as appending, indexing, etc. A TOC also behaves like a set, and supports taking differences and intersections. In all of these operations a list of tuples can be used as one argument. For example, the following expressions are equivalent ways to add a file to the `a.datas` member:

```
a.datas.append( [ ('README', 'src/README.txt', 'DATA' ) ] )
a.datas += [ ('README', 'src/README.txt', 'DATA' ) ]
```

Set-difference makes excluding modules quite easy. For example:

```
a.binaries - [('badmodule', None, None)]
```

is an expression that produces a new TOC that is a copy of `a.binaries` from which any tuple named `badmodule` has been removed. The right-hand argument to the subtraction operator is a list that contains one tuple in which *name* is `badmodule` and the *path* and *typecode* elements are `None`. Because set membership is based on the *name* element of a tuple only, it is not necessary to give accurate *path* and *typecode* elements when subtracting.

In order to add files to a TOC, you need to know the *typecode* values and their related *path* values. A *typecode* is a one-word string. PyInstaller uses a number of *typecode* values internally, but for the normal case you need to know only these:

typecode	description	name	path
'DATA'	Arbitrary files.	Run-time name.	Full path name in build.
'BINARY'	A shared library.	Run-time name.	Full path name in build.
'EXTENSION'	A binary extension to Python.	Run-time name.	Full path name in build.
'OPTION'	A Python run-time option.	Option code	ignored.

The run-time name of a file will be used in the final bundle. It may include path elements, for example `extras/mydata.txt`.

A `BINARY` file or an `EXTENSION` file is assumed to be loadable, executable code, for example a dynamic library. The types are treated the same. `EXTENSION` is generally used for a Python extension module, for example a module compiled by `Cython`. PyInstaller will examine either type of file for dependencies, and if any are found, they are also included.

### The Tree Class

The `Tree` class is a way of creating a TOC that describes some or all of the files within a directory:

```
Tree(root, prefix=run-time-folder, excludes=string_list, typecode=code | 'DATA' )
```

- The *root* argument is a path string to a directory. It may be absolute or relative to the spec file directory.
- The *prefix* argument, if given, is a name for a subfolder within the run-time folder to contain the tree files. If you omit *prefix* or give `None`, the tree files will be at the top level of the run-time folder.
- The *excludes* argument, if given, is a list of one or more strings that match files in the *root* that should be omitted from the Tree. An item in the list can be either:
  - a name, which causes files or folders with this basename to be excluded
  - `*.ext`, which causes files with this extension to be excluded
- The *typecode* argument, if given, specifies the TOC typecode string that applies to all items in the Tree. If omitted, the default is `DATA`, which is appropriate for most cases.

For example:

```
extras_toc = Tree('../src/extras', prefix='extras', excludes=['tmp', '*.pyc'])
```

This creates `extras_toc` as a TOC object that lists all files from the relative path `../src/extras`, omitting those that have the basename (or are in a folder named) `tmp` or that have the type `.pyc`. Each tuple in this TOC has:

- A *name* composed of `extras/filename`.
- A *path* consisting of a complete, absolute path to that file in the `../src/extras` folder (relative to the location of the spec file).
- A *typecode* of `DATA` (by default).

An example of creating a TOC listing some binary modules:

```
cython_mods = Tree( '../src/cy_mods', excludes=['*.pyx', '*.py', '*.pyc'], typecode=  
↳ 'EXTENSION' )
```

This creates a TOC with a tuple for every file in the `cy_mods` folder, excluding any with the `.pyx`, `.py` or `.pyc` suffixes (so presumably collecting the `.pyd` or `.so` modules created by `Cython`). Each tuple in this TOC has:

- Its own filename as *name* (no prefix; the file will be at the top level of the bundle).
- A *path* as an absolute path to that file in `../src/cy_mods` relative to the spec file.
- A *typecode* of `EXTENSION` (`BINARY` could be used as well).

## 2.11.4 Inspecting Archives

An archive is a file that contains other files, for example a `.tar` file, a `.jar` file, or a `.zip` file. Two kinds of archives are used in PyInstaller. One is a `ZlibArchive`, which allows Python modules to be stored efficiently and, with some import hooks, imported directly. The other, a `CArchive`, is similar to a `.zip` file, a general way of packing up (and optionally compressing) arbitrary blobs of data. It gets its name from the fact that it can be manipulated easily from C as well as from Python. Both of these derive from a common base class, making it fairly easy to create new kinds of archives.

### ZlibArchive

A `ZlibArchive` contains compressed `.pyc` or `.pyo` files. The `PYZ` class invocation in a spec file creates a `ZlibArchive`.

The table of contents in a `ZlibArchive` is a Python dictionary that associates a key, which is a member's name as given in an `import` statement, with a seek position and a length in the `ZlibArchive`. All parts of a `ZlibArchive` are stored in the `marshalled` format and so are platform-independent.

A `ZlibArchive` is used at run-time to import bundled python modules. Even with maximum compression this works faster than the normal import. Instead of searching `sys.path`, there's a lookup in the dictionary. There are no directory operations and no file to open (the file is already open). There's just a seek, a read and a decompress.

A Python error trace will point to the source file from which the archive entry was created (the `__file__` attribute from the time the `.pyc` was compiled, captured and saved in the archive). This will not tell your user anything useful, but if they send you a Python error trace, you can make sense of it.

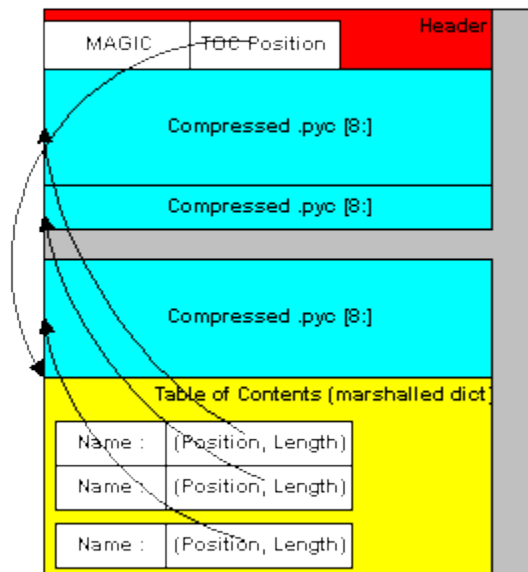


Fig. 1: Structure of the ZlibArchive

## CArchive

A CArchive can contain any kind of file. It's very much like a .zip file. They are easy to create in Python and easy to unpack from C code. A CArchive can be appended to another file, such as an ELF and COFF executable. To allow this, the archive is made with its table of contents at the end of the file, followed only by a cookie that tells where the table of contents starts and where the archive itself starts.

A CArchive can be embedded within another CArchive. An inner archive can be opened and used in place, without having to extract it.

Each table of contents entry has variable length. The first field in the entry gives the length of the entry. The last field is the name of the corresponding packed file. The name is null terminated. Compression is optional for each member.

There is also a type code associated with each member. The type codes are used by the self-extracting executables. If you're using a CArchive as a .zip file, you don't need to worry about the code.

The ELF executable format (Windows, GNU/Linux and some others) allows arbitrary data to be concatenated to the end of the executable without disturbing its functionality. For this reason, a CArchive's Table of Contents is at the end of the archive. The executable can open itself as a binary file, seek to the end and 'open' the CArchive.

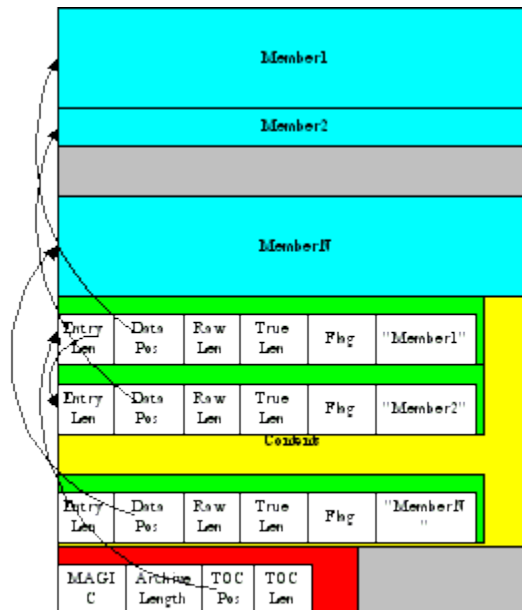


Fig. 2: Structure of the CArchive

## Using pyi-archive\_viewer

Use the `pyi-archive_viewer` command to inspect any type of archive:

```
pyi-archive_viewer archivefile
```

With this command you can examine the contents of any archive built with PyInstaller (a PYZ or PKG), or any executable (.exe file or an ELF or COFF binary). The archive can be navigated using these commands:

**O name** Open the embedded archive *name* (will prompt if omitted). For example when looking in a one-file executable, you can open the PYZ-00.pyz archive inside it.

**U** Go up one level (back to viewing the containing archive).

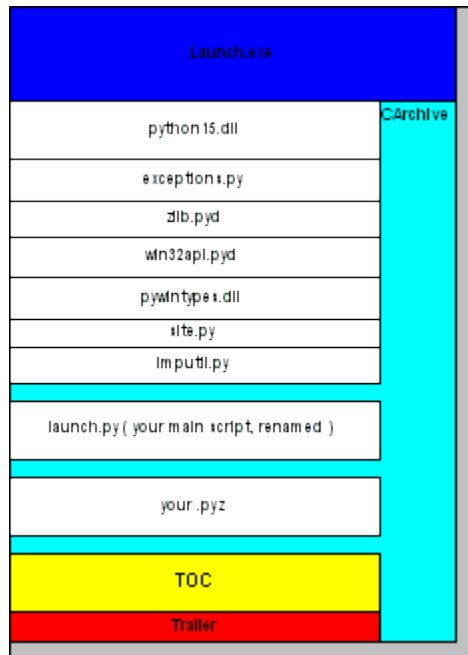


Fig. 3: Structure of the Self Extracting Executable

**X** *name* Extract *name* (will prompt if omitted). Prompts for an output filename. If none given, the member is extracted to stdout.

**Q** Quit.

The `pyi-archive_viewer` command has these options:

- h, --help** Show help.
- l, --log** Quick contents log.
- b, --brief** Print a python evaluable list of contents filenames.
- r, --recursive** Used with -l or -b, applies recursive behaviour.

### 2.11.5 Inspecting Executables

You can inspect any executable file with `pyi-bindepend`:

```
pyi-bindepend executable_or_dynamic_library
```

The `pyi-bindepend` command analyzes the executable or DLL you name and writes to stdout all its binary dependencies. This is handy to find out which DLLs are required by an executable or by another DLL.

`pyi-bindepend` is used by PyInstaller to follow the chain of dependencies of binary extensions during Analysis.

### 2.11.6 Creating a Reproducible Build

In certain cases it is important that when you build the same application twice, using exactly the same set of dependencies, the two bundles should be exactly, bit-for-bit identical.

That is not the case normally. Python uses a random hash to make dicts and other hashed types, and this affects compiled byte-code as well as PyInstaller internal data structures. As a result, two builds may not produce bit-for-bit identical results even when all the components of the application bundle are the same and the two applications execute in identical ways.

You can ensure that a build will produce the same bits by setting the `PYTHONHASHSEED` environment variable to a known integer value before running PyInstaller. This forces Python to use the same random hash sequence until `PYTHONHASHSEED` is unset or set to 'random'. For example, execute PyInstaller in a script such as the following (for GNU/Linux and macOS):

```
# set seed to a known repeatable integer value
PYTHONHASHSEED=1
export PYTHONHASHSEED
# create one-file build as myscript
pyinstaller myscript.spec
# make checksum
cksum dist/myscript/myscript | awk '{print $1}' > dist/myscript/checksum.txt
# let Python be unpredictable again
unset PYTHONHASHSEED
```

Changed in version 4.8: The build timestamp in the PE headers of the generated Windows executables is set to the current time during the assembly process. A custom timestamp value can be specified via the `SOURCE_DATE_EPOCH` environment variable to achieve [reproducible builds](#).

## 2.12 Understanding PyInstaller Hooks

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**Note:** We strongly encourage package developers to provide hooks with their packages. See section [Providing PyInstaller Hooks with your Package](#) for how easy this is.

---

In summary, a “hook” file extends PyInstaller to adapt it to the special needs and methods used by a Python package. The word “hook” is used for two kinds of files. A *runtime* hook helps the bootloader to launch an app. For more on runtime hooks, see [Changing Runtime Behavior](#). Other hooks run while an app is being analyzed. They help the Analysis phase find needed files.

The majority of Python packages use normal methods of importing their dependencies, and PyInstaller locates all their files without difficulty. But some packages make unusual uses of the Python import mechanism, or make clever changes to the import system at runtime. For this or other reasons, PyInstaller cannot reliably find all the needed files, or may include too many files. A hook can tell about additional source files or data files to import, or files not to import.

A hook file is a Python script, and can use all Python features. It can also import helper methods from `PyInstaller.utils.hooks` and useful variables from `PyInstaller.compat`. These helpers are documented below.

The name of a hook file is `hook-full.import.name.py`, where *full.import.name* is the fully-qualified name of an imported script or module. You can browse through the existing hooks in the `hooks` folder of the PyInstaller distribution folder and see the names of the packages for which hooks have been written. For example `hook-PyQt5.QtCore.py` is a hook file telling about hidden imports needed by the module `PyQt5.QtCore`. When your script contains `import PyQt5.QtCore` (or `from PyQt5 import QtCore`), Analysis notes that `hook-PyQt5.QtCore.py` exists, and will call it.

Many hooks consist of only one statement, an assignment to `hiddenimports`. For example, the hook for the `dnspython` package, called `hook-dns.rdata.py`, has only this statement:

```
hiddenimports = [
    "dns.rdtypes.*",
    "dns.rdtypes.ANY.*"
]
```

When Analysis sees `import dns.rdata` or `from dns import rdata` it calls `hook-dns.rdata.py` and examines its value of `hiddenimports`. As a result, it is as if your source script also contained:

```
import dns.rdtypes.*
import dns.rdtypes.ANY.*
```

A hook can also cause the addition of data files, and it can cause certain files to *not* be imported. Examples of these actions are shown below.

When the module that needs these hidden imports is useful only to your project, store the hook file(s) somewhere near your source file. Then specify their location to the `pyinstaller` or `pyi-makespec` command with the `--additional-hooks-dir` option. If the hook file(s) are at the same level as the script, the command could be simply:

```
pyinstaller --additional-hooks-dir=. myscript.py
```

If you write a hook for a module used by others, please ask the package developer to *include the hook with her/his package* or send us the hook file so we can make it available.

### 2.12.1 How a Hook Is Loaded

A hook is a module named `hook-full.import.name.py` in a folder where the Analysis object looks for hooks. Each time Analysis detects an import, it looks for a hook file with a matching name. When one is found, Analysis imports the hook's code into a Python namespace. This results in the execution of all top-level statements in the hook source, for example import statements, assignments to global names, and function definitions. The names defined by these statements are visible to Analysis as attributes of the namespace.

Thus a hook is a normal Python script and can use all normal Python facilities. For example it could test `sys.version` and adjust its assignment to `hiddenimports` based on that. There are many hooks in the PyInstaller installation, but a much larger collection can be found in the `community hooks` package. Please browse through them for examples.

### 2.12.2 Providing PyInstaller Hooks with your Package

As a package developer you can provide hooks for PyInstaller within your package. This has the major benefit that you can easily adopt the hooks when your package changes. Thus your package's users don't need to wait until PyInstaller might catch up with these changes. If both PyInstaller and your package provide hooks for some module, your package's hooks take precedence, but can still be overridden by the command line option `--additional-hooks-dir`.

You can tell PyInstaller about the additional hooks by defining some simple `setuptools` entry-points in your package. Therefore add entries like these to your `setup.cfg`:

```
[options.entry_points]
pyinstaller40 =
    hook-dirs = pyi_hooksample.__pyinstaller:get_hook_dirs
    tests      = pyi_hooksample.__pyinstaller:get_PyInstaller_tests
```

This defines two entry-points:

**pyinstaller40.hook-dirs for hook registration** This entry point refers to a function that will be invoked with no parameters. It must return a sequence of strings, each element of which provides an additional absolute path to search for hooks. This is equivalent to passing the `--additional-hooks-dir` command-line option to PyInstaller for each string in the sequence.

In this example, the function is `get_hook_dirs() -> List[str]`.

**pyinstaller40.tests for test registration** This entry point refers to a function that will be invoked with no parameters. It must return a sequence of strings, each element of which provides an additional absolute path to a directory tree or to a Python source file. These paths are then passed to *pytest* for test discovery. This allows both testing by this package and by PyInstaller.

In this project, the function is `get_PyInstaller_tests() -> List[str]`.

A sample project providing a guide for integrating PyInstaller hooks and tests into a package is available at <https://github.com/pyinstaller/hoodsample>. This project demonstrates defining a library which includes PyInstaller hooks along with tests for those hooks and sample file for integration into CD/CI testing. Detailed documentation about this sample project is available at <https://pyinstaller-sample-hook.readthedocs.io/en/latest/>.

### 2.12.3 Hook Global Variables

A majority of the existing hooks consist entirely of assignments of values to one or more of the following global variables. If any of these are defined by the hook, Analysis takes their values and applies them to the bundle being created.

**hiddenimports** A list of module names (relative or absolute) that should be part of the bundled app. This has the same effect as the `--hidden-import` command line option, but it can contain a list of names and is applied automatically only when the hooked module is imported. Example:

```
hiddenimports = ['_gdbm', 'socket', 'h5py.defs']
```

**excludedimports** A list of absolute module names that should *not* be part of the bundled app. If an excluded module is imported only by the hooked module or one of its sub-modules, the excluded name and its sub-modules will not be part of the bundle. (If an excluded name is explicitly imported in the source file or some other module, it will be kept.) Several hooks use this to prevent automatic inclusion of the `tkinter` module. Example:

```
excludedimports = ['tkinter']
```

**datas** A list of files to bundle with the app as data. Each entry in the list is a tuple containing two strings. The first string specifies a file (or file “glob”) in this system, and the second specifies the name(s) the file(s) are to have in the bundle. (This is the same format as used for the `datas=` argument, see [Adding Data Files](#).) Example:

```
datas = [ ('/usr/share/icons/education_*.png', 'icons') ]
```

If you need to collect multiple directories or nested directories, you can use helper functions from the `PyInstaller.utils.hooks` module (see below) to create this list, for example:

```
datas = collect_data_files('submodule1')
datas += collect_data_files('submodule2')
```

In rare cases you may need to apply logic to locate particular files within the file system, for example because the files are in different places on different platforms or under different versions. Then you can write a hook() function as described below under [The hook\(hook\\_api\) Function](#).

**binaries** A list of files or directories to bundle as binaries. The format is the same as `datas` (tuples with strings that specify the source and the destination). Binaries is a special case of `datas`, in that PyInstaller will check each file to see if it depends on other dynamic libraries. Example:



```
binaries = [ ('C:\\Windows\\System32\\*.dll', 'dlls') ]
```

Many hooks use helpers from the `PyInstaller.utils.hooks` module to create this list (see below):

```
binaries = collect_dynamic_libs('zmq')
```

**warn\_on\_missing\_hiddenimports** A boolean flag indicating whether missing hidden imports from the hook (set via `hiddenimports`) should generate warnings or not. By default, missing hidden imports generate warnings, but individual hooks can opt out of this behavior by setting this variable to `False`. Example:

```
warn_on_missing_hiddenimports = False
```

**module\_collection\_mode** A setting controlling the collection mode for module(s). The value can be either a string or a dictionary.

When set to a string, the variable controls the collection mode for the hooked package/module. Valid values are:

- `'pyz'`: collect byte-compiled modules into the embedded PYZ archive. This is the default behavior when no collection mode is specified. If the `noarchive` flag is used with `Analysis`, the PYZ archive is not used, and `pyz` collection mode is automatically turned into `pyc` one.
- `'pyc'`: collect byte-compiled modules as external data files (as opposed to collecting them into the PYZ archive).
- `'py'`: collect source `.py` files as external data files. Do not collect byte-compiled modules.
- `'pyz+py'` or `'py+pyz'`: collect byte-compiled modules into the embedded PYZ archive and collect corresponding source `.py` files as external data files.

If `noarchive` flag is in effect, the byte-compiled modules are collected as external data files, which causes python to ignore them due to the source files being placed next to them.

The setting is applied to all child modules and subpackages, unless overridden by the setting in their corresponding hook.

Alternatively, the variable can be set to a dictionary comprising module/package names and corresponding collection mode strings. This allows a hook to specify different settings for its main package and subpackages, but also settings for other packages. When multiple hooks provide a setting for the same module name, the end result depends on the hook execution order.

Example:

```
# hook-mypackage.py

# This package must be collected in source form, due to its code
# searching for .py files on the filesystem...
module_collection_mode = 'py'
```

Example:

```
# hook-mypackage.py

# Collect only a sub-package / module as source
# (without creating a hook for the sub-package).
module_collection_mode = {
    'mypackage.src_subpackage': 'py'
}
```

Example:

```
# hook-mypackage.py

# Collect whole package as source except for a single sub-package
# (without creating a hook for the sub-package).
module_collection_mode = {
    'mypackage': 'py',
    'mypackage.bin_subpackage': 'pyz'
}
```

Example:

```
# hook-mypackage.py

# Force collection of other packages in source form.
module_collection_mode = {
    'myotherpackage1': 'py',
    'myotherpackage2': 'py',
}
```

The ability to control collection mode for other modules/packages from a given hook is intended for cases when the hooked module provides functionality for other modules that requires those other modules to be collected in the source form (for example, JIT compilation available in some deep learning frameworks). However, detection of specific function imports and calls via bytecode scanning requires an access to the modulegraph, and consequently the use of the *the hook(hook\_api) function*. In such cases, the collection mode can be modified using the *set\_module\_collection\_mode method* from the `hook_api` object instead of setting the global hook variable.

## 2.12.4 Useful Items in `PyInstaller.compat`

Various classes and functions to provide some backwards-compatibility with previous versions of Python onward.

A hook may import the following names from *PyInstaller.compat*, for example:

```
from PyInstaller.compat import base_prefix, is_win
```

**is\_py36, is\_py37, is\_py38, is\_py39, is\_py310**

True when the current version of Python is at least 3.6, 3.7, 3.8, 3.9, or 3.10, respectively.

**is\_win**

True in a Windows system.

**is\_cygwin**

True when `sys.platform == 'cygwin'`.

**is\_darwin**

True in macOS.

**is\_linux**

True in any GNU/Linux system.

**is\_solar**

True in Solaris.

**is\_aix**

True in AIX.

**is\_freebsd**

True in FreeBSD.

**is\_openbsd**

True in OpenBSD.

**is\_venv**

True in any virtual environment (either virtualenv or venv).

**base\_prefix**

String, the correct path to the base Python installation, whether the installation is native or a virtual environment.

**EXTENSION\_SUFFIXES**

List of Python C-extension file suffixes. Used for finding all binary dependencies in a folder; see `hook-cryptography.py` for an example.

## 2.12.5 Useful Items in `PyInstaller.utils.hooks`

A hook may import useful functions from `PyInstaller.utils.hooks`. Use a fully-qualified import statement, for example:

```
from PyInstaller.utils.hooks import collect_data_files, eval_statement
```

The functions listed here are generally useful and used in a number of existing hooks.

**exec\_statement(statement)**

Execute a single Python statement in an externally-spawned interpreter, and return the resulting standard output as a string.

Examples:

```
tk_version = exec_statement("from _tkinter import TK_VERSION; print(TK_VERSION)")

mpl_data_dir = exec_statement("import matplotlib; print(matplotlib.get_data_path())")
↳
datas = [ (mpl_data_dir, "") ]
```

### Notes

As of v5.0, usage of this function is discouraged in favour of the new `PyInstaller.isolated` module.

**eval\_statement(statement)**

Execute a single Python statement in an externally-spawned interpreter, and `eval()` its output (if any).

Example:

```
databases = eval_statement('''
import sqlalchemy.databases
print(sqlalchemy.databases.__all__)
''')
for db in databases:
    hiddenimports.append("sqlalchemy.databases." + db)
```

## Notes

As of v5.0, usage of this function is discouraged in favour of the new `PyInstaller.isolated` module.

**is\_module\_satisfies**(*requirements*, *version=None*, *version\_attr='\_\_version\_\_'*)

Test if a [PEP 0440](#) requirement is installed.

### Parameters

- **requirements** (*str*) – Requirements in `pkg_resources.Requirements.parse()` format.
- **version** (*str*) – Optional PEP 0440-compliant version (e.g., `3.14-rc5`) to be used *\_instead\_* of the current version of this module. If non-*None*, this function ignores all *setuptools* distributions for this module and instead compares this version against the version embedded in the passed requirements. This ignores the module name embedded in the passed requirements, permitting arbitrary versions to be compared in a robust manner. See examples below.
- **version\_attr** (*str*) – Optional name of the version attribute defined by this module, defaulting to `__version__`. If a *setuptools* distribution exists for this module (it usually does) *\_and\_* the *version* parameter is *None* (it usually is), this parameter is ignored.

**Returns** Boolean result of the desired validation.

**Return type** `bool`

### Raises

- **AttributeError** – If no *setuptools* distribution exists for this module *\_and\_* this module defines no attribute whose name is the passed *version\_attr* parameter.
- **ValueError** – If the passed specification does *\_not\_* comply with `pkg_resources.Requirements` syntax.

## Examples

```
# Assume PIL 2.9.0, Sphinx 1.3.1, and SQLAlchemy 0.6 are all installed.
>>> from PyInstaller.utils.hooks import is_module_satisfies
>>> is_module_satisfies('sphinx >= 1.3.1')
True
>>> is_module_satisfies('sqlalchemy != 0.6')
False

>>> is_module_satisfies('sphinx >= 1.3.1; sqlalchemy != 0.6')
False

# Compare two arbitrary versions. In this case, the module name "sqlalchemy" is
↪ simply ignored.
>>> is_module_satisfies('sqlalchemy != 0.6', version='0.5')
True

# Since the "pillow" project providing PIL publishes its version via the custom
↪ "PILLOW_VERSION" attribute
# (rather than the standard "__version__" attribute), an attribute name is passed
↪ as a fallback to validate PIL
# when not installed by setuptools. As PIL is usually installed by setuptools, this
↪ optional parameter is
# usually ignored.
```

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```
>>> is_module_satisfies('PIL == 2.9.0', version_attr='PILLOW_VERSION')
True
```

See also:

[pkg\\_resources.Requirements](#) for the syntax details.

**collect\_all**(*package\_name*, *include\_py\_files*=True, *filter\_submodules*=None, *exclude\_datas*=None, *include\_datas*=None, *on\_error*='warn once')

Collect everything for a given package name.

#### Parameters

- **package\_name** – An import-able package name.
- **include\_py\_files** – Forwarded to [collect\\_data\\_files\(\)](#).
- **filter\_submodules** – Forwarded to [collect\\_submodules\(\)](#).
- **exclude\_datas** – Forwarded to [collect\\_data\\_files\(\)](#).
- **include\_datas** – Forwarded to [collect\\_data\\_files\(\)](#).
- **on\_error** – Forwarded onto [collect\\_submodules\(\)](#).

#### Returns

A (datas, binaries, hiddenimports) triplet containing:

- All data files, raw Python files (if **include\_py\_files**), and package metadata folders.
- All dynamic libraries as returned by [collect\\_dynamic\\_libs\(\)](#).
- All submodules of **packagename** and its dependencies.

#### Return type [tuple](#)

Typical use:

```
datas, binaries, hiddenimports = collect_all('my_module_name')
```

**collect\_submodules**(*package*, *filter*=<function <lambda>>, *on\_error*='warn once')

List all submodules of a given package.

#### Parameters

- **package** ([str](#)) – An import-able package.
- **filter** ([Callable](#)[[[str](#)], [bool](#)]) – Filter the submodules found: A callable that takes a submodule name and returns True if it should be included.
- **on\_error** ([str](#)) – The action to take when a submodule fails to import. May be any of:
  - raise: Errors are reraised and terminate the build.
  - warn: Errors are downgraded to warnings.
  - warn once: The first error issues a warning but all subsequent errors are ignored to minimise *stderr pollution*. This is the default.
  - ignore: Skip all errors. Don't warn about anything.

**Returns** All submodules to be assigned to `hiddenimports` in a hook.

This function is intended to be used by hook scripts, not by main PyInstaller code.

Examples:

```
# Collect all submodules of Sphinx don't contain the word ``test``.
hiddenimports = collect_submodules(
    "Sphinx", ``filter=lambda name: 'test' not in name)
```

Changed in version 4.5: Add the **on\_error** parameter.

**is\_module\_or\_submodule**(*name*, *mod\_or\_submod*)

This helper function is designed for use in the *filter* argument of [collect\\_submodules\(\)](#), by returning True if the given name is a module or a submodule of *mod\_or\_submod*.

### Examples

The following excludes `foo.test` and `foo.test.one` but not `foo.testifier`.

```
collect_submodules('foo', lambda name: not is_module_or_submodule(name, 'foo.test
↪'))``
```

**is\_package**(*module\_name*)

Check if a Python module is really a module or is a package containing other modules, without importing anything in the main process.

**Parameters** *module\_name* (*str*) – Module name to check.

**Returns** True if module is a package else otherwise.

**collect\_data\_files**(*package*, *include\_py\_files=False*, *subdir=None*, *excludes=None*, *includes=None*)

This function produces a list of (*source*, *dest*) non-Python (i.e., data) files that reside in *package*. Its output can be directly assigned to *datas* in a hook script; for example, see `hook-sphinx.py`. Parameters:

- The *package* parameter is a string which names the package.
- By default, all Python executable files (those ending in `.py`, `.pyc`, and so on) will NOT be collected; setting the *include\_py\_files* argument to True collects these files as well. This is typically used with Python functions (such as those in `pkgutil`) that search a given directory for Python executable files and load them as extensions or plugins.
- The *subdir* argument gives a subdirectory relative to *package* to search, which is helpful when submodules are imported at run-time from a directory lacking `__init__.py`.
- The *excludes* argument contains a sequence of strings or Paths. These provide a list of [globs](#) to exclude from the collected data files; if a directory matches the provided glob, all files it contains will be excluded as well. All elements must be relative paths, which are relative to the provided package's path (/ *subdir* if provided).

Therefore, `*.txt` will exclude only `.txt` files in *package*'s path, while `**/*.txt` will exclude all `.txt` files in *package*'s path and all its subdirectories. Likewise, `**/__pycache__` will exclude all files contained in any subdirectory named `__pycache__`.

- The *includes* function like *excludes*, but only include matching paths. *excludes* override *includes*: a file or directory in both lists will be excluded.

This function does not work on zipped Python eggs.

This function is intended to be used by hook scripts, not by main PyInstaller code.

**collect\_dynamic\_libs**(*package*, *destdir*=None)

This function produces a list of (source, dest) of dynamic library files that reside in package. Its output can be directly assigned to `binaries` in a hook script. The package parameter must be a string which names the package.

**Parameters** `destdir` – Relative path to `./dist/APPNAME` where the libraries should be put.

**get\_module\_file\_attribute**(*package*)

Get the absolute path to the specified module or package.

Modules and packages *must not* be directly imported in the main process during the analysis. Therefore, to avoid leaking the imports, this function uses an isolated subprocess when it needs to import the module and obtain its `__file__` attribute.

**Parameters** `package` (*str*) – Fully-qualified name of module or package.

**Returns** Absolute path of this module.

**Return type** *str*

**get\_module\_attribute**(*module\_name*, *attr\_name*)

Get the string value of the passed attribute from the passed module if this attribute is defined by this module `_or_` raise `AttributeError` otherwise.

Since modules cannot be directly imported during analysis, this function spawns a subprocess importing this module and returning the string value of this attribute in this module.

**Parameters**

- **module\_name** (*str*) – Fully-qualified name of this module.
- **attr\_name** (*str*) – Name of the attribute in this module to be retrieved.

**Returns** String value of this attribute.

**Return type** *str*

**Raises** `AttributeError` – If this attribute is undefined.

**get\_package\_paths**(*package*)

Given a package, return the path to packages stored on this machine and also returns the path to this particular package. For example, if `pkg.subpkg` lives in `/abs/path/to/python/libs`, then this function returns `(/abs/path/to/python/libs, /abs/path/to/python/libs/pkg/subpkg)`.

NOTE: due to backwards compatibility, this function returns only one package path along with its base directory. In case of PEP 420 namespace package with multiple location, only first location is returned. To obtain all package paths, use the `get_all_package_paths` function and obtain corresponding base directories using the `package_base_path` helper.

**copy\_metadata**(*package\_name*, *recursive*=False)

Collect distribution metadata so that `pkg_resources.get_distribution()` can find it.

This function returns a list to be assigned to the `datas` global variable. This list instructs PyInstaller to copy the metadata for the given package to the frozen application's data directory.

**Parameters**

- **package\_name** (*str*) – Specifies the name of the package for which metadata should be copied.
- **recursive** (*bool*) – If true, collect metadata for the package's dependencies too. This enables use of `pkg_resources.require('package')` inside the frozen application.

**Returns** This should be assigned to `datas`.

Return type `list`

### Examples

```
>>> from PyInstaller.utils.hooks import copy_metadata
>>> copy_metadata('sphinx')
[('c:\python27\lib\site-packages\Sphinx-1.3.2.dist-info',
  'Sphinx-1.3.2.dist-info')]
```

Some packages rely on metadata files accessed through the `pkg_resources` module. Normally PyInstaller does not include these metadata files. If a package fails without them, you can use this function in a hook file to easily add them to the frozen bundle. The tuples in the returned list have two strings. The first is the full pathname to a folder in this system. The second is the folder name only. When these tuples are added to `datas`, the folder will be bundled at the top level.

Changed in version 4.3.1: Prevent `dist-info` metadata folders being renamed to `egg-info` which broke `pkg_resources.require` with *extras* (see [#3033](#)).

Changed in version 4.4.0: Add the **recursive** option.

### `collect_entry_point(name)`

Collect modules and metadata for all exporters of a given entry point.

**Parameters** `name` (`str`) – The name of the entry point. Check the documentation for the library that uses the entry point to find its name.

**Returns** A `(datas, hiddenimports)` pair that should be assigned to the `datas` and `hiddenimports`, respectively.

For libraries, such as `pytest` or `keyring`, that rely on plugins to extend their behaviour.

### Examples

Pytest uses an entry point called `'pytest11'` for its extensions. To collect all those extensions use:

```
datas, hiddenimports = collect_entry_point("pytest11")
```

These values may be used in a hook or added to the `datas` and `hiddenimports` arguments in the `.spec` file. See [Using Spec Files](#).

New in version 4.3.

### `get_homebrew_path(formula="")`

Return the homebrew path to the requested formula, or the global prefix when called with no argument.

Returns the path as a string or `None` if not found.

### `include_or_exclude_file(filename, include_list=None, exclude_list=None)`

Generic inclusion/exclusion decision function based on filename and list of include and exclude patterns.

#### Parameters

- **filename** – Filename considered for inclusion.
- **include\_list** – List of inclusion file patterns.
- **exclude\_list** – List of exclusion file patterns.

**Returns** A boolean indicating whether the file should be included or not.



If `include_list` is provided, `True` is returned only if the filename matches one of include patterns (and does not match any patterns in `exclude_list`, if provided). If `include_list` is not provided, `True` is returned if filename does not match any patterns in `exclude_list`, if provided. If neither list is provided, `True` is returned for any filename.

## Support for Conda

Additional helper methods for working specifically with Anaconda distributions are found at `PyInstaller.utils.hooks.conda_support` which is designed to mimic (albeit loosely) the `importlib.metadata` package. These functions find and parse the distribution metadata from json files located in the `conda-meta` directory.

New in version 4.2.0.

This module is available only if run inside a Conda environment. Usage of this module should therefore be wrapped in a conditional clause:

```
from PyInstaller.compat import is_pure_conda

if is_pure_conda:
    from PyInstaller.utils.hooks import conda_support

    # Code goes here. e.g.
    binaries = conda_support.collect_dynamic_libs("numpy")
    ...
```

Packages are all referenced by the *distribution name* you use to install it, rather than the *package name* you import it with. I.e., use `distribution("pillow")` instead of `distribution("PIL")` or use `package_distribution("PIL")`.

### `distribution(name)`

Get distribution information for a given distribution **name** (i.e., something you would `conda install`).

**Return type** `Distribution`

### `package_distribution(name)`

Get distribution information for a **package** (i.e., something you would import).

**Return type** `Distribution`

For example, the package `pkg_resources` belongs to the distribution `setuptools`, which contains three packages.

```
>>> package_distribution("pkg_resources")
Distribution(name="setuptools",
             packages=['easy_install', 'pkg_resources', 'setuptools'])
```

### `files(name, dependencies=False, excludes=None)`

List all files belonging to a distribution.

#### Parameters

- **name** – The name of the distribution.
- **dependencies** – Recursively collect files of dependencies too.
- **excludes** – Distributions to ignore if **dependencies** is true.

**Returns** All filenames belonging to the given distribution.

With `dependencies=False`, this is just a shortcut for:

`conda_support.distribution(name).files`

**requires**(*name*, *strip\_versions=False*)

List requirements of a distribution.

**Parameters**

- **name** (*str*) – The name of the distribution.
- **strip\_versions** (*bool*) – List only their names, not their version constraints.

**Return type** `List[str]`**Returns** A list of distribution names.**class** **Distribution**(*json\_path*)

A bucket class representation of a Conda distribution.

This bucket exports the following attributes:

**Variables**

- **name** – The distribution’s name.
- **version** – Its version.
- **files** – All filenames as `PackagePath()`s included with this distribution.
- **dependencies** – Names of other distributions that this distribution depends on (with version constraints removed).
- **packages** – Names of importable packages included in this distribution.

This class is not intended to be constructed directly by users. Rather use `distribution()` or `package_distribution()` to provide one for you.

**class** **PackagePath**(\**args*)A filename relative to Conda’s root (`sys.prefix`).

This class inherits from `pathlib.PurePosixPath` even on non-Posix OSs. To convert to a `pathlib.Path` pointing to the real file, use the `locate()` method.

**locate()**

Return a path-like object for this path pointing to the file’s true location.

**walk\_dependency\_tree**(*initial*, *excludes=None*)Collect a `Distribution` and all direct and indirect dependencies of that distribution.**Parameters**

- **initial** – Distribution name to collect from.
- **excludes** – Distributions to exclude.

**Returns** A `{name: distribution}` mapping where `distribution` is the output of `conda_support.distribution(name)`.

**collect\_dynamic\_libs**(*name*, *dest='.'*, *dependencies=True*, *excludes=None*)Collect DLLs for distribution **name**.**Parameters**

- **name** – The distribution’s project-name.
- **dest** – Target destination, defaults to `'.'`.
- **dependencies** – Recursively collect libs for dependent distributions (recommended).

- **excludes** – Dependent distributions to skip, defaults to None.

**Returns** List of DLLs in PyInstaller’s (source, dest) format.

This collects libraries only from Conda’s shared lib (Unix) or Library/bin (Windows) folders. To collect from inside a distribution’s installation use the regular `PyInstaller.utils.hooks.collect_dynamic_libs()`.

### 2.12.6 Subprocess isolation with `PyInstaller.isolated`

PyInstaller hooks typically will need to import the package which they are written for but doing so may manipulate globals such as `sys.path` or `os.environ` in ways that affect the build. For example, on Windows, Qt’s binaries are added to then loaded via PATH in such a way that if you import multiple Qt variants in one session then there is no guarantee which variant’s binaries each variant will get!

To get around this, PyInstaller does any such tasks in an isolated Python subprocess and ships a `PyInstaller.isolated` submodule to do so in hooks.

```
from PyInstaller import isolated
```

This submodule provides:

- `isolated.call()` to evaluate functions in isolation.
- `@isolated.decorate` to mark a function as always called in isolation.
- `isolated.Python()` to efficiently call many functions in a single child instance of Python.

**call**(function, \*args, \*\*kwargs)

Call a function with arguments in a separate child Python. Retrieve its return value.

**Parameters**

- **function** – The function to send and invoke.
- **\*args** –
- **\*\*kwargs** – Positional and keyword arguments to send to the function. These must be simple builtin types - not custom classes.

**Returns** The return value of the function. Again, these must be basic types serialisable by `marshal.dumps()`.

**Raises** `RuntimeError` – Any exception which happens inside an isolated process is caught and reraised in the parent process.

To use, define a function which returns the information you’re looking for. Any imports it requires must happen in the body of the function. For example, to safely check the output of `matplotlib.get_data_path()` use:

```
# Define a function to be ran in isolation.
def get_matplotlib_data_path():
    import matplotlib
    return matplotlib.get_data_path()

# Call it with isolated.call().
get_matplotlib_data_path = isolated.call(matplotlib_data_path)
```

For single use functions taking no arguments like the above you can abuse the decorator syntax slightly to define and execute a function in one go.

```
>>> @isolated.call
... def matplotlib_data_dir():
...     import matplotlib
...     return matplotlib.get_data_path()
>>> matplotlib_data_dir
'/home/brenainn/.pyenv/versions/3.9.6/lib/python3.9/site-packages/matplotlib/mpl-
↳data'
```

Functions may take positional and keyword arguments and return most generic Python data types.

```
>>> def echo_parameters(*args, **kwargs):
...     return args, kwargs
>>> isolated.call(echo_parameters, 1, 2, 3)
(1, 2, 3), {}
>>> isolated.call(echo_parameters, foo=["bar"])
(), {'foo': ['bar']}
```

## Notes

To make a function behave differently if it's isolated, check for the `__isolated__` global.

```
if globals().get("__isolated__", False):
    # We're inside a child process.
    ...
else:
    # This is the master process.
    ...
```

## `decorate(function)`

Decorate a function so that it is always called in an isolated subprocess.

## Examples

To use, write a function then prepend `@isolated.decorate`.

```
@isolated.decorate
def add_1(x):
    "Add 1 to `x`, displaying the current process ID."
    import os
    print(f"Process {os.getpid()}: Adding 1 to {x}.")
    return x + 1
```

The resultant `add_1()` function can now be called as you would a normal function and it'll automatically use a subprocess.

```
>>> add_1(4)
Process 4920: Adding 1 to 4.
5
>>> add_1(13.2)
Process 4928: Adding 1 to 13.2.
14.2
```

**class Python**

Start and connect to a separate Python subprocess.

This is the lowest level of public API provided by this module. The advantage of using this class directly is that it allows multiple functions to be evaluated in a single subprocess, making it faster than multiple calls to `call()`.

**Examples**

To call some predefined functions `x = foo()`, `y = bar("numpy")` and `z = bazz(some_flag=True)` all using the same isolated subprocess use:

```
with isolated.Python() as child:
    x = child.call(foo)
    y = child.call(bar, "numpy")
    z = child.call(bazz, some_flag=True)
```

**call**(*function*, \**args*, \*\**kwargs*)

Call a function in the child Python. Retrieve its return value. Usage of this method is identical to that of the `call()` function.

**2.12.7 The hook(hook\_api) Function**

In addition to, or instead of, setting global values, a hook may define a function `hook(hook_api)`. A `hook()` function should only be needed if the hook needs to apply sophisticated logic or to make a complex search of the source machine.

The Analysis object calls the function and passes it a `hook_api` object which has the following immutable properties:

**\_\_name\_\_**: The fully-qualified name of the module that caused the hook to be called, e.g., `six.moves.tkinter`.

**\_\_file\_\_**: The absolute path of the module. If it is:

- A standard (rather than namespace) package, this is the absolute path of this package's directory.
- A namespace (rather than standard) package, this is the abstract placeholder `-`.
- A non-package module or C extension, this is the absolute path of the corresponding file.

**\_\_path\_\_**: A list of the absolute paths of all directories comprising the module if it is a package, or `None`. Typically the list contains only the absolute path of the package's directory.

**co**: Code object compiled from the contents of `__file__` (e.g., via the `compile()` builtin).

**analysis**: The Analysis object that loads the hook.

The `hook_api` object also offers the following methods:

**add\_imports( \*names )**: The `names` argument may be a single string or a list of strings giving the fully-qualified name(s) of modules to be imported. This has the same effect as adding the names to the `hiddenimports` global.

**add\_datas( tuple\_list )**: The `tuple_list` argument has the format used with the `datas` global variable. This call has the effect of adding items to that list.

**add\_binaries( tuple\_list )**: The `tuple_list` argument has the format used with the `binaries` global variable. This call has the effect of adding items to that list.

**set\_module\_collection\_mode( name, mode )**: Set the *package collection mode* for the specified package/module name. Valid values for `mode` are: `'pyz'`, `'pyc'`, `'py'`, `'pyz+py'`, `'py+pyz'` and `None`. `None` clears/resets the setting for the given package/module name - but only within the current hook's context! The collection mode may be set for the hooked package, its sub-module or sub-package, or for other packages. If `name` is `None`, it is substituted with the hooked package/module name.

The `hook()` function can add, remove or change included files using the above methods of `hook_api`. Or, it can simply set values in the four global variables, because these will be examined after `hook()` returns.

Hooks may access the user parameters, given in the `hooksconfig` argument in the spec file, by calling `get_hook_config()` inside a `hook()` function.

**get\_hook\_config**(*hook\_api, module\_name, key*)

Get user settings for hooks.

#### Parameters

- **module\_name** (*str*) – The module/package for which the key setting belong to.
- **key** (*str*) – A key for the config.

**Returns** The value for the config. `None` if not set.

The `get_hook_config` function will lookup settings in the `Analysis.hooksconfig` dict.

The hook settings can be added to `.spec` file in the form of:

```
a = Analysis(["my-app.py"],
    ...
    hooksconfig = {
        "gi": {
            "icons": ["Adwaita"],
            "themes": ["Adwaita"],
            "languages": ["en_GB", "zh_CN"],
        },
    },
    ...
)
```

### 2.12.8 The `pre_find_module_path( pfmp_api )` Method

You may write a hook with the special function `pre_find_module_path( pfmp_api )`. This method is called when the hooked module name is first seen by Analysis, before it has located the path to that module or package (hence the name “pre-find-module-path”).

Hooks of this type are only recognized if they are stored in a sub-folder named `pre_find_module_path` in a hooks folder, either in the distributed hooks folder or an `--additional-hooks-dir` folder. You may have normal hooks as well as hooks of this type for the same module. For example PyInstaller includes both a `hooks/hook-distutils.py` and also a `hooks/pre_find_module_path/hook-distutils.py`.

The `pfmp_api` object that is passed has the following immutable attribute:

**module\_name:** A string, the fully-qualified name of the hooked module.

The `pfmp_api` object has one mutable attribute, `search_dirs`. This is a list of strings that specify the absolute path, or paths, that will be searched for the hooked module. The paths in the list will be searched in sequence. The `pre_find_module_path()` function may replace or change the contents of `pfmp_api.search_dirs`.

Immediately after return from `pre_find_module_path()`, the contents of `search_dirs` will be used to find and analyze the module.

For an example of use, see the file `hooks/pre_find_module_path/hook-distutils.py`. It uses this method to redirect a search for `distutils` when PyInstaller is executing in a virtual environment.

### 2.12.9 The `pre_safe_import_module( psim_api )` Method

You may write a hook with the special function `pre_safe_import_module( psim_api )`. This method is called after the hooked module has been found, but *before* it and everything it recursively imports is added to the “graph” of imported modules. Use a pre-safe-import hook in the unusual case where:

- The script imports *package.dynamic-name*
- The *package* exists
- however, no module *dynamic-name* exists at compile time (it will be defined somehow at run time)

You use this type of hook to make dynamically-generated names known to PyInstaller. PyInstaller will not try to locate the dynamic names, fail, and report them as missing. However, if there are normal hooks for these names, they will be called.

Hooks of this type are only recognized if they are stored in a sub-folder named `pre_safe_import_module` in a hooks folder, either in the distributed hooks folder or an `--additional-hooks-dir` folder. (See the distributed hooks/`pre_safe_import_module` folder for examples.)

You may have normal hooks as well as hooks of this type for the same module. For example the distributed system has both a `hooks/hook-gi.repository.GLib.py` and also a `hooks/pre_safe_import_module/hook-gi.repository.GLib.py`.

The `psim_api` object offers the following attributes, all of which are immutable (an attempt to change one raises an exception):

**module\_basename:** String, the unqualified name of the hooked module, for example `text`.

**module\_name:** String, the fully-qualified name of the hooked module, for example `email.mime.text`.

**module\_graph:** The module graph representing all imports processed so far.

**parent\_package:** If this module is a top-level module of its package, `None`. Otherwise, the graph node that represents the import of the top-level module.

The last two items, `module_graph` and `parent_package`, are related to the module-graph, the internal data structure used by PyInstaller to document all imports. Normally you do not need to know about the module-graph.

The `psim_api` object also offers the following methods:

**add\_runtime\_module( fully\_qualified\_name ):** Use this method to add an imported module whose name may not appear in the source because it is dynamically defined at run-time. This is useful to make the module known to PyInstaller and avoid misleading warnings. A typical use applies the name from the `psim_api`:

```
psim_api.add_runtime_module( psim_api.module_name )
```

**add\_alias\_module( real\_module\_name, alias\_module\_name ):** `real_module_name` is the fully-qualified name of an existing module, one that has been or could be imported by name (it will be added to the graph if it has not already been imported). `alias_module_name` is a name that might be referenced in the source file but should be treated as if it were `real_module_name`. This method ensures that if PyInstaller processes an import of `alias_module_name` it will use `real_module_name`.

**append\_package\_path( directory ):** The hook can use this method to add a package path to be searched by PyInstaller, typically an import path that the imported module would add dynamically to the path if the module was executed normally. `directory` is a string, a pathname to add to the `__path__` attribute.

## 2.13 Hook Configuration Options

As of version 4.4, PyInstaller implements a mechanism for passing configuration options to the hooks. At the time of writing, this feature is supported only in *.spec files* and has no command-line interface equivalent.

The hook configuration options consist of a dictionary that is passed to the `Analysis` object via the `hooksconfig` argument. The keys of the dictionary represent *hook identifiers* while the values are dictionaries of hook-specific keys and values that correspond to hook settings:

```
a = Analysis(
    ["program.py"],
    ...,
    hooksconfig={
        "some_hook_id": {
            "foo": ["entry1", "entry2"],
            "bar": 42,
            "enable_x": True,
        },
        "another_hook_id": {
            "baz": "value",
        },
    },
    ...,
)
```

### 2.13.1 Supported hooks and options

This section lists hooks that implement support for configuration options. For each hook (or group of hooks), we provide the *hook identifier* and the list of supported options.

#### GObject introspection (gi) hooks

The options passed under *gi* hook identifier control the collection of GLib/Gtk resources (themes, icons, translations) in various hooks related to `GObject introspection` (i.e., `hook-gi.*`).

They are especially useful when freezing Gtk3-based applications on linux, as they allow one to limit the amount of themes and icons collected from the system `/usr/share` directory.

**Hook identifier:** `gi`

#### Options

- `languages` [*list of strings*]: list of locales (e.g., `en_US`) for which translations should be collected. By default, `gi` hooks collect all available translations.
- `icons` [*list of strings*]: list of icon themes (e.g., `Adwaita`) that should be collected. By default, `gi` hooks collect all available icon themes.
- `themes` [*list of strings*]: list of Gtk themes (e.g., `Adwaita`) that should be collected. By default, `gi` hooks collect all available icon themes.
- `module-versions` [*dict of version strings*]: versions of `gi` modules to use. For example, a key of `'GtkSource'` and value to `'4'` will use `gtksourceview4`.

#### Example



Collect only Adwaita theme and icons, limit the collected translations to British English and Simplified Chinese, and use version 3.0 of Gtk and version 4 of GtkSource:

```
a = Analysis(
    ["my-gtk-app.py"],
    ...,
    hooksconfig={
        "gi": {
            "icons": ["Adwaita"],
            "themes": ["Adwaita"],
            "languages": ["en_GB", "zh_CN"],
            "module-versions": {
                "Gtk": "3.0",
                "GtkSource": "4",
            },
        },
    },
    ...,
)
```

**Note:** Currently the module-versions configuration is available only for GtkSource, Gtk, and Gdk.

## GStreamer (gi.repository.Gst) hook

The collection of GStreamer is subject to both the general `gi` hook configuration (for example, collection of translations file as controlled by the `languages` option) and by special hook configuration named `gststreamer`<sup>1</sup> that controls collection of GStreamer plugins.

The GStreamer framework comes with a multitude of plugins that are typically installed as separate packages (`gststreamer-plugins-base`, `gststreamer-plugins-good`, `gststreamer-plugins-bad`, and `gststreamer-plugins-ugly`; the naming varies between packaging systems). By default, PyInstaller collects *all* available plugins as well as their binary dependencies; therefore, having all GStreamer plugins installed in the build environment will likely result in collection of many unnecessary plugins and increased frozen application size due to potential complex dependency chains of individual plugins and the underlying shared libraries.

**Hook identifier:** `gststreamer`<sup>2</sup>

### Options

- `include_plugins` [*list of strings*]: list of plugin names to include in the frozen application. Specifying the include list implicitly excludes all plugins that do not appear in the list.
- `exclude_plugins` [*list of strings*]: list of plugin names to exclude from the frozen application. If include list is also available, the exclude list is applied after it; if not, the exclude list is applied to all available plugins.

Both include and exclude list expect base plugin names (e.g., `audioparsers`, `matroska`, `x264`, `flac`). Internally, each name is converted into a pattern (e.g., `'**/*flac.*'`), and matched using `fnmatch` against actual plugin file names. Therefore, it is also possible to include the wildcard (`*`) in the plugin name<sup>2</sup>.

### Basic example: excluding an unwanted plugin

Exclude the `opencv` GStreamer plugin to prevent pulling OpenCV shared libraries into the frozen application.

<sup>1</sup> While the hook is called `gi.repository.Gst`, the identifier for GStreamer-related options was chosen to be simply `gststreamer`.

<sup>2</sup> And it is also possible to get away with accidentally specifying the plugin prefix, which is typically `libgst`, but can also be `gst`, depending on the toolchain that was used to build GStreamer.

```
a = Analysis(
    ["my-gstreamer-app.py"],
    ...,
    hooksconfig={
        "gstreamer": {
            "exclude_plugins": [
                "opencv",
            ],
        },
    },
    ...,
)
```

#### Advanced example: including only specific plugins

When optimizing the frozen application size, it is often more efficient to explicitly include only the subset of the plugins that are actually required for the application to function.

Consider the following simple player application:

```
# audio_player.py
import sys
import os

import gi
gi.require_version('Gst', '1.0')
from gi.repository import GLib, Gst

if len(sys.argv) != 2:
    print(f"Usage: {sys.argv[0]} <filename>")
    sys.exit(-1)

filename = os.path.abspath(sys.argv[1])
if not os.path.isfile(filename):
    print(f"Input file {filename} does not exist!")
    sys.exit(-1)

Gst.init(sys.argv)
mainloop = GLib.MainLoop()

playbin = Gst.ElementFactory.make("playbin", "player")
playbin.set_property('uri', Gst.filename_to_uri(filename))
playbin.set_property('volume', 0.2)
playbin.set_state(Gst.State.PLAYING)

mainloop.run()
```

Suppose that, although the application is using the generic playbin and player elements, we intend for the frozen application to play only audio files. In that case, we can limit the collected plugins as follows:

```
# The not-completely-optimized list of gstreamer plugins for playing a FLAC
# (and possibly some other) audio files on linux and Windows.
gst_include_plugins = [
    # gstreamer
```

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```

"coreelements",
# gstreamer-plugins-base
"alsa", # Linux audio output
"audioconvert",
"audiomixer",
"audiorate",
"audioresample",
"ogg",
"playback",
"rawparse",
"typefindfunctions",
"volume",
"vorbis",
# gstreamer-plugins-good
"audioparsers",
"auparse",
"autodetect",
"directsound", # Windows audio output
"flac",
"id3demux",
"lame",
"mpg123",
"osxaudio", # macOS audio output
"pulseaudio", # Linux audio output
"replaygain",
"speex",
>taglib",
"twolame",
"wavparse",
# gstreamer-plugins-bad
"wasapi", # Windows audio output
]

a = Analysis(
    ["audio_player.py"],
    ...,
    hooksconfig={
        "gstreamer": {
            "include_plugins": gst_include_plugins,
        },
    },
    ...,
)

```

Determining which plugins need to be collected may require good knowledge of GStreamer pipelines and their plugin system, and may result in several test iterations to see if the required multimedia functionality works as expected. Unfortunately, there is no free lunch when it comes to optimizing the size of application that uses a plugin system like that. Keep in mind that in addition to obviously-named plugins (such as `flac` for FLAC-related functionality), you will likely need to collect at least some plugins that come from `gstreamer` itself (e.g., the `coreelements` one) and at least some that are part of `gstreamer-plugins-base`.

## Matplotlib hooks

The hooks for the matplotlib package allow user to control the backend collection behavior via `backends` option under the matplotlib identifier, as described below.

**Hook identifier:** matplotlib

### Options

- `backends` [*string* or *list of strings*]: backend selection method or name(s) of backend(s) to collect. Valid string values: 'auto', 'all', or a human-readable backend name (e.g., 'TkAgg'). To specify multiple backends to be collected, use a list of strings (e.g., ['TkAgg', 'Qt5Agg']).

### Backend selection process

If `backends` option is set to 'auto' (or not specified), the hook performs auto-detection of used backends, by scanning the code for `matplotlib.use()` function calls with literal arguments. For example, `matplotlib.use('TkAgg')` being used in the code results in the TkAgg backend being collected. If no such calls are found, the default backend is determined as the first importable GUI-based backend, using the same priority list as internally used by the `matplotlib.get_backend()` and `matplotlib.pyplot.switch_backend()` functions: ['MacOSX', 'Qt5Agg', 'Gtk3Agg', 'TkAgg', 'WxAgg']. If no GUI-based backend is importable, the headless 'Agg' is collected instead.

---

**Note:** Due to limitations of the bytecode-scanning approach, only specific forms of `matplotlib.use()` invocation can be automatically detected. The backend must be specified as string literal (as opposed to being passed via a variable). The second optional argument, `force`, can also be specified, but it must also be a literal and must not be specified as a keyword argument:

```
import matplotlib

matplotlib.use('TkAgg') # detected
matplotlib.use('TkAgg', False) # detected

backend = 'TkAgg'
matplotlib.use(backend) # not detected

matplotlib.use('TkAgg', force=False) # not detected
```

In addition to matplotlib module name, its common alias, `mpl` is also recognized:

```
import matplotlib as mpl
mpl.use('TkAgg') # detected
```

Importing the function from the module should also work:

```
from matplotlib import use
use('TkAgg') # detected
```

---

If `backends` option is set to 'all', all (importable) backends are selected, which corresponds to the behavior of PyInstaller 4.x and earlier. The list of importable backends depends on the packages installed in the environment; for example, the Qt5Agg backend becomes importable if either the PyQt5 or the PySide2 package is installed.

Otherwise, the value of the `backends` option is treated as a backend name (if it is a string) or a list of backend names (if it is a list). In the case of user-provided backend names, no additional validation is performed; the backends are collected regardless of whether they are importable or not.

### Example

```

a = Analysis(
    ["my-matplotlib-app.py"],
    ...,
    hooksconfig={
        "matplotlib": {
            "backends": "auto", # auto-detect; the default behavior
            # "backends": "all", # collect all backends
            # "backends": "TkAgg", # collect a specific backend
            # "backends": ["TkAgg", "Qt5Agg"], # collect multiple backends
        },
    },
    ...,
)

```

**Note:** The Qt5Agg backend conditionally imports both the PyQt5 and the PySide2 package. Therefore, if both are installed in your environment, PyInstaller will end up collecting both. In addition to increasing the frozen application's size, this might also cause conflicts between the collected versions of the shared libraries. To prevent that, use the `--exclude-module` option to exclude one of the two packages (i.e., `--exclude-module PyQt5` or `--exclude-module PySide2`).

### 2.13.2 Adding an option to the hook

Implementing support for hook options requires access to `hook_api` object, which is available only when hook implements the `hook(hook_api)` function (as described [here](#)).

The value of a hook's configuration option can be obtained using the `get_hook_config()` function:

```

# hook-mypackage.py
from PyInstaller.utils.hooks import get_hook_config

# Processing unrelated to hook options, using global hook values
binaries, datas, hiddenimports = ...

# Collect extra data
def hook(hook_api):
    # Boolean option 'collect_extra_data'
    if get_hook_config(hook_api, 'mypackage', 'collect_extra_data'):
        extra_datas = ... # Collect extra data
        hook_api.add_datas(extra_datas)

```

After implementing option handling in the hook, please add a section documenting it under *Supported hooks and options*, to inform the users of the option's availability and the meaning of its value(s).

The above hook example allows the user to toggle the collection of extra data from `mypackage` by setting the corresponding option in their `.spec` file:

```

a = Analysis(
    ["program-using-mypackage.py"],
    ...,
    hooksconfig={
        "mypackage": {

```

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```
        "collect_extra_data": True,
    },
},
...,
)
```

## 2.14 Building the Bootloader

PyInstaller comes with pre-compiled bootloaders for some platforms in the `bootloader` folder of the distribution folder. When there is no pre-compiled bootloader for the current platform (operating-system and word-size), the `pip` setup will attempt to build one.

If there is no precompiled bootloader for your platform, or if you want to modify the bootloader source, you need to build the bootloader. To do this,

- Download and install Python, which is required for running `waf`,
- *git clone* or download the source from our [GitHub repository](#),
- `cd` into the folder where you cloned or unpacked the source to,
- `cd bootloader`, and
- make the bootloader with: `python ./waf all`,
- test the build by ref:running (parts of) the test-suite <running-the-test-suite>.

This will produce the bootloader executables for your current platform (of course, for Windows these files will have the `.exe` extension):

- `../PyInstaller/bootloader/OS_ARCH/run`,
- `../PyInstaller/bootloader/OS_ARCH/run_d`,
- `../PyInstaller/bootloader/OS_ARCH/runw` (macOS and Windows only), and
- `../PyInstaller/bootloader/OS_ARCH/runw_d` (macOS and Windows only).

The bootloaders architecture defaults to the machine's one, but can be changed using the `--target-arch` option – given the appropriate compiler and development files are installed. E.g. to build a 32-bit bootloader on a 64-bit machine, run:

```
python ./waf all --target-arch=32bit
```

If this reports an error, read the detailed notes that follow, then ask for technical help.

By setting the environment variable `PYINSTALLER_COMPILE_BOOTLOADER` the `pip` setup will attempt to build the bootloader for your platform, even if it is already present.

Supported platforms are

- GNU/Linux (using `gcc`)
- Windows (using Visual C++ (VS2015 or later) or MinGW's `gcc`)
- Mac OS X (using `clang`)

Contributed platforms are

- AIX (using `gcc` or `xlc`)

- HP-UX (using gcc or xlc)
- Solaris

For more information about cross-building please read on and mind the section about the virtual machines provided in the Vagrantfile.

## 2.14.1 Building for GNU/Linux

### Development Tools

For building the bootloader you'll need a development environment. You can run the following to install everything required:

- On Debian- or Ubuntu-like systems:

```
sudo apt-get install build-essential zlib1g-dev
```

- On Fedora, RedHat and derivatives:

```
sudo yum groupinstall "Development Tools"
sudo yum install zlib-devel
```

- For other Distributions please consult the distributions documentation.

Now you can build the bootloader as shown above.

Alternatively you may want to use the *linux64* build-guest provided by the Vagrantfile (see below).

### Building Linux Standard Base (LSB) compliant binaries (optional)

By default, the bootloaders on GNU/Linux are "normal", non-LSB binaries, which should be fine for all GNU/Linux distributions.

If for some reason you want to build Linux Standard Base (LSB) compliant binaries<sup>1</sup>, you can do so by specifying `--lsb` on the waf command line, as follows:

```
python ./waf distclean all --lsb
```

LSB version 4.0 is required for successfully building of bootloader. Please refer to `python ./waf --help` for further options related to LSB building.

### Cross Building for Different Architectures

Bootloaders can be built for other architectures such as ARM or MIPS using [Docker](#). The [Dockerfile](#) contains the instructions on how to do this. Open it in some flavour of text previewer to see them:

```
less bootloader/Dockerfile
```

<sup>1</sup> Linux Standard Base (LSB) is a set of open standards that should increase compatibility among GNU/Linux distributions. Unfortunately it is not widely adopted and both Debian and Ubuntu dropped support for LSB in autumn 2015. Thus PyInstaller bootloaders are no longer provided as LSB binary.

### 2.14.2 Building for macOS

On macOS please install [Xcode](#), Apple's suite of tools for developing software for macOS. Instead of installing the full *Xcode* package, you can also install and use [Command Line Tools for Xcode](#). Installing either will provide the *clang* compiler.

If the toolchain supports *universal2* binaries, the 64-bit bootloaders are by default built as *universal2* fat binaries that support both *x86\_64* and *arm64* architectures. This requires a recent version of *Xcode* (12.2 or later). On older toolchains that lack support for *universal2* binaries, a single-arch *x86\_64* thin bootloader is built. This behavior can be controlled by passing `--universal2` or `--no-universal2` flags to the *waf* build command. Attempting to use `--universal2` flag and a toolchain that lacks support for *universal2* binaries will result in configuration error.

The `--no-universal2` flag leaves the target architecture unspecified letting the resultant executable's architecture be the C compiler's default (which is almost certainly the architecture of the build machine). Should you want to build a thin executable of either architecture, use the `--no-universal2` flag and then optionally override the compiler, adding the `-arch` flag, via the `CC` environment variable.

Build a thin, native executable:

```
python waf --no-universal2 all
```

Build a thin, *x86\_64* executable (regardless of the build machine's architecture):

```
CC='clang -arch=x86_64' python waf --no-universal2 all
```

Build a thin, *arm64* executable (regardless of the build machine's architecture):

```
CC='clang -arch=arm64' python waf --no-universal2 all
```

By default, the build script targets macOS 10.13, which can be overridden by exporting the `MACOSX_DEPLOYMENT_TARGET` environment variable.

### Cross-Building for macOS

For cross-compiling for macOS you need the Clang/LLVM compiler, the *cctools* (*ld*, *lipo*, ...), and the OSX SDK. Clang/LLVM is a cross compiler by default and is available on nearly every GNU/Linux distribution, so you just need a proper port of the *cctools* and the macOS SDK.

This is easy to get and needs to be done only once and the result can be transferred to your build-system. The build-system can then be a normal (somewhat current) GNU/Linux system.<sup>2</sup>

### Preparation: Get SDK and Build-tools

For preparing the SDK and building the *cctools*, we use the very helpful scripts from the [OS X Cross](#) toolchain. If you are interested in the details, and what other features OS X Cross offers, please refer to its homepage.

To save you reading the OSXCross' documentation, we prepared a virtual box definition that performs all required steps. If you are interested in the precise commands, please refer to `packages_osxcross_debianoid`, `prepare_osxcross_debianoid`, and `build_osxcross` in the Vagrantfile.

Please proceed as follows:

---

<sup>2</sup> Please keep in mind that to avoid problems, the system you are using for the preparation steps should have the same architecture (and possibly the same GNU/Linux distribution version) as the build-system.



1. Download [Command Line Tools for Xcode](#) 12.2 or later. You will need an *Apple ID* to search and download the files; if you do not have one already, you can register it for free.

Please make sure that you are complying to the license of the respective package.

2. Save the downloaded *.dmg* file to `bootloader/_sdks/osx/Xcode_tools.dmg`.
3. Use the Vagrantfile to automatically build the SDK and tools:

```
vagrant up build-osxcross && vagrant halt build-osxcross
```

This should create the file `bootloader/_sdks/osx/osxcross.tar.xz`, which will then be installed on the build-system.

If for some reason this fails, try running `vagrant provision build-osxcross`.

4. This virtual machine is no longer used, you may now want to discard it using `vagrant destroy build-osxcross`.

## Building the Bootloader

Again, simply use the Vagrantfile to automatically build the macOS bootloaders:

```
export TARGET=OSX # make the Vagrantfile build for macOS
vagrant up linux64 && vagrant halt linux
```

This should create the bootloaders in `* ../PyInstaller/bootloader/Darwin-*/`.

If for some reason this fails, try running `vagrant provision linux64`.

3. This virtual machine is no longer used, you may now want to discard it using:

```
vagrant destroy build-osxcross
```

4. If you are finished with the macOS bootloaders, unset *TARGET* again:

```
unset TARGET
```

If you don't want to use the build-guest provided by the Vagrant file, perform the following steps (see `build_bootloader_target_osx` in the Vagrantfile):

```
mkdir -p ~/osxcross
tar -C ~/osxcross --xz -xf /vagrant/sdks/osx/osxcross.tar.xz
PATH=~/osxcross/bin/:$PATH
python ./waf all CC=x86_64-apple-darwin15-clang
python ./waf all CC=i386-apple-darwin15-clang
```

### 2.14.3 Building for Windows

The pre-compiled bootloader coming with PyInstaller are self-contained static executable that imposes no restrictions on the version of Python being used.

When building the bootloader yourself, you have to carefully choose between three options:

1. Using the Visual Studio C++ compiler.

This allows creating self-contained static executables, which can be used for all versions of Python. This is why the bootloaders delivered with PyInstaller are build using Visual Studio C++ compiler.

Visual Studio 2015 or later is required.

2. Using the [MinGW-w64](#) suite.

This allows to create smaller, dynamically linked executables, but requires to use the same level of Visual Studio<sup>3</sup> as was used to compile Python. So this bootloader will be tied to a specific version of Python.

The reason for this is, that unlike Unix-like systems, Windows doesn't supply a system standard C library, leaving this to the compiler. But Mingw-w64 doesn't have a standard C library. Instead it links against `msvcrt.dll`, which happens to exist on many Windows installations – but is not guaranteed to exist.

3. Using cygwin and MinGW.

This will create executables for cygwin, not for 'plain' Windows.

In all cases you may want

- to set the path to include python, e.g. `set PATH=%PATH%;c:\python35,`
- to peek into the Vagrantfile or `../appveyor.yml` to learn how we are building.

You can also build the bootloaders for cygwin.

#### Build using Visual Studio C++

- With our `wscript` file, you don't need to run `vcvarsall.bat` to 'switch' the environment between VC++ installations and target architecture. The actual version of C++ does not matter and the target architecture is selected by using the `--target-arch=` option.
- If you are not using Visual Studio for other work, installing only the standalone C++ build-tools might be the best option as it avoids bloating your system with stuff you don't need (and saves *a lot* if installation time).

---

**Hint:** We recommend installing the build-tools software using the [chocolatey](#) package manager. While at a first glance it looks like overdose, this is the easiest way to install the C++ build-tools. It comes down to two lines in an administrative powershell:

```
... one-line-install as written on the chocolatey homepage
choco install -y python3 visualstudio2019-workload-vctools
```

---

- Useful Links:
  - [Microsoft Visual C++ Build-Tools 2015](#)
  - [Microsoft Build-Tools for Visual Studio 2017.](#)

After installing the C++ build-tool you can build the bootloader as shown above.

---

<sup>3</sup> This description seems to be technically incorrect. I ought to depend on the C++ run-time library. If you know details, please open an [issue](#).

## Build using MinGW-w64

Please be aware of the restrictions mentioned above.

If Visual Studio is not convenient, you can download and install the MinGW distribution from one of the following locations:

- [MinGW-w64](#) required, uses gcc 4.4 and up.
- [TDM-GCC](#) - MinGW (not used) and MinGW-w64 installers

Note: Please mind that using cygwin's python or MinGW when running `./waf` will create executables for cygwin, not for Windows.

On Windows, when using MinGW-w64, add `PATH_TO_MINGW\bin` to your system `PATH.` variable. Before building the bootloader run for example:

```
set PATH=C:\MinGW\bin;%PATH%
```

Now you can build the bootloader as shown above. If you have installed both Visual C++ and MinGW, you might need to add `run python ./waf --gcc all`.

## Build using cygwin and MinGW

Please be aware that this will create executables for cygwin, not for 'plain' Windows.

Use cygwin's `setup.exe` to install *python* and *mingw*.

Now you can build the bootloader as shown above.

### 2.14.4 Building for AIX

- By default AIX builds 32-bit executables.
- For 64-bit executables set the environment variable `OBJECT_MODE`.

If Python was built as a 64-bit executable then the AIX utilities that work with binary files (e.g., `.o`, and `.a`) may need the flag `-X64`. Rather than provide this flag with every command, the preferred way to provide this setting is to use the environment variable `OBJECT_MODE`. Depending on whether Python was build as a 32-bit or a 64-bit executable you may need to set or unset the environment variable `OBJECT_MODE`.

To determine the size the following command can be used:

```
$ python -c "import sys; print(sys.maxsize <= 2**32)"
True
```

When the answer is `True` (as above) Python was build as a 32-bit executable.

When working with a 32-bit Python executable proceed as follows:

```
unset OBJECT_MODE
./waf configure all
```

When working with a 64-bit Python executable proceed as follows:

```
export OBJECT_MODE=64
./waf configure all
```

---

**Note:** The correct setting of `OBJECT_MODE` is also needed when you use PyInstaller to package your application.

---

To build the bootloader you will need a compiler compatible (identical) with the one used to build python.

---

**Note:** Python compiled with a different version of gcc that you are using might not be compatible enough. GNU tools are not always binary compatible.

---

If you do not know which compiler that was, this command can help you determine if the compiler was gcc or an IBM compiler:

```
python -c "import sysconfig; print(sysconfig.get_config_var('CC'))"
```

If the compiler is gcc you may need additional RPMs installed to support the GNU run-time dependencies.

When the IBM compiler is used no additional prerequisites are expected. The recommended value for `CC` with the IBM compilers is `:command:xlc_r`.

### 2.14.5 Building for FreeBSD

A FreeBSD bootloader may be built with clang using *the usual steps* on a FreeBSD machine. Beware, however that any executable compiled natively on FreeBSD will only run on equal or newer versions of FreeBSD. In order to support older versions of FreeBSD, you must compile the oldest OS version you wish to support.

Alternatively, the FreeBSD bootloaders may be cross compiled from Linux using Docker and a [FreeBSD cross compiler image](#). This image is kept in sync with the oldest non end of life FreeBSD release so that anything compiled on it will work on all active FreeBSD versions.

In a random directory:

- Start the docker daemon (usually with `systemctl start docker` - possibly requiring `sudo` if you haven't setup rootless docker).
- Download the latest cross compiler `.tar.xz` image from [here](#).
- Import the image: `docker image load -i freebsd-cross-build.tar.xz`. The cross compiler image is now saved under the name `freebsd-cross-build`. You may discard the `.tar.xz` file if you wish.

Then from the root of this repository:

- Run:

```
docker run -v $(pwd):/io -it freebsd-cross-build bash -c "cd /io/bootloader; ./waf_
↪ all"
```

### 2.14.6 Vagrantfile Virtual Machines

PyInstaller maintains a set of virtual machine description for testing and (cross-) building. For managing these boxes, we use [vagrant](#).

All guests<sup>4</sup> will automatically build the bootloader when running `vagrant up GUEST` or `vagrant provision GUEST`. They will build both 32- and 64-bit bootloaders.

---

<sup>4</sup> Except of guest *osxcross*, which will build the OS X SDK and cctools as described in section [Cross-Building for macOS](#).

When building the bootloaders, the guests are sharing the PyInstaller distribution folder and will put the built executables onto the build-host (into `../PyInstaller/bootloader/`).

Most boxes requires two *Vagrant* plugins to be installed:

```
vagrant plugin install vagrant-reload vagrant-scp
```

Example usage:

```
vagrant up linux64      # will also build the bootloader
vagrant halt linux64    # or `destroy`

# verify the bootloader has been rebuild
git status ../PyInstaller/bootloader/
```

You can pass some parameters for configuring the Vagrantfile by setting environment variables, like this:

```
GUI=1 TARGET=OSX vagrant up linux64
```

or like this:

```
export TARGET=OSX
vagrant provision linux64
```

We currently provide this guests:

**linux64** GNU/Linux (some recent version) used to build the GNU/Linux bootloaders.

- If `TARGET=OSX` is set, cross-builds the bootloaders for macOS (see *Cross-Building for macOS*).
- If `TARGET=WINDOWS` is set, cross-builds the bootloaders for Windows using mingw. Please have in mind that this imposes the restrictions mentioned above.
- Otherwise (which is the default) bootloaders for GNU/Linux are build.

**windows10** Windows 10, used for building the Windows bootloaders using Visual C++.

- If `MINGW=1` is set, the bootloaders will be build using MinGW. Please be aware of the restrictions mentioned above.

---

**Note:** The Windows box uses password authentication, so in some cases you need to enter the password (which is *Passw0rd!*).

---

**build-osxcross** GNU/Linux guest used to build the OS X SDK and *cctools* as described in section *Cross-Building for macOS*.

## 2.15 Changelog for PyInstaller

### 2.15.1 5.4 (2022-09-10)

#### Features

- (Windows) When collecting a DLL that was discovered via link-time dependency analysis of a collected binary/extension, attempt to preserve its parent directory structure instead of collecting it into application's top-level directory. This aims to preserve the parent directory structure of DLLs bundled with python packages in

PyPI wheels, while the DLLs collected from system directories (as well as from `Library\bin` directory of the Anaconda's environment) are still collected into top-level application directory. (#7028)

- Add support for `setuptools`-provided `distutils`, available since `setuptools >= 60.0`. (#7075)
- Implement a generic file filtering decision function for use in hooks, based on the source filename and optional inclusion and exclusion pattern list (`PyInstaller.utils.hooks.include_or_exclude_file()`). (#7040)
- Rework the module exclusion mechanism. The excluded module entries, specified via `excludedimports` list in the hooks, are now used to suppress module imports from corresponding nodes *during modulegraph construction*, rather than to remove the nodes from the graph as a post-processing step. This should make the module exclusion more robust, but the main benefit is that we avoid running (potentially many and potentially costly) hooks for modules that would end up excluded anyway. (#7066)

### Bugfix

- (Windows) Attempt to extend DLL search paths with directories found in the `PATH` environment variable and by tracking calls to the `os.add_dll_directory` function during import of the packages in the isolated sub-process that performs the binary dependency scanning. (#6924)
- (Windows) Ensure that ANGLE DLLs (`libEGL.dll` and `libGLESv2.dll`) are collected when using Anaconda-installed PyQt5 and Qt5. (#7029)
- Fix `AssertionError` during build when analysing a `.pyc` file containing more than 255 variable names followed by an import statement all in the same namespace. (#7055)

### Incompatible Changes

- (Windows) PyInstaller now attempts to preserve parent directory structure of DLLs that are collected from python packages (e.g., bundled with packages in PyPI wheels) instead of collecting them to the top-level application directory. This behavior might be incompatible with 3rd party hooks that assume the old behavior, and may result in duplication of DLL files or missing DLLs in hook-provided runtime search paths. (#7028)

### Hooks

- Implement new `gststreamer` hook configuration group with `include_plugins` and `exclude_plugins` options that enable control over `GStreamer` plugins collected by the `gi.repository.Gst` hook. (#7040)
- Provide hooks for additional `gststreamer` modules provided via `GObject` introspection (`gi`) bindings: `gi.repository.GstAllocators`, `gi.repository.GstApp`, `gi.repository.GstBadAudio`, `gi.repository.GstCheck`, `gi.repository.GstCodecs`, `gi.repository.GstController`, `gi.repository.GstGL`, `gi.repository.GstGLEGL`, `gi.repository.GstGLWayland`, `gi.repository.GstGLX11`, `gi.repository.GstInsertBin`, `gi.repository.GstMpegts`, `gi.repository.GstNet`, `gi.repository.GstPlay`, `gi.repository.GstPlayer`, `gi.repository.GstRtp`, `gi.repository.GstRtsp`, `gi.repository.GstRtspServer`, `gi.repository.GstSdp`, `gi.repository.GstTranscoder`, `gi.repository.GstVulkan`, `gi.repository.GstVulkanWayland`, `gi.repository.GstVulkanXCB`, and `gi.repository.GstWebRTC`. (#7074)

## 2.15.2 5.3 (2022-07-30)

### Features

- (Windows) Implement handling of console control signals in the `onefile` bootloader parent process. The implemented handler suppresses the `CTRL_C_EVENT` and `CTRL_BREAK_EVENT` to let the child process deal with them as they see it fit. In the case of `CTRL_CLOSE_EVENT`, `CTRL_LOGOFF_EVENT`, or `CTRL_SHUTDOWN_EVENT`, the handler attempts to delay the termination of the parent process in order to buy time for the child process to exit and for the main thread of the parent process to clean up the temporary directory before exiting itself. This should prevent the temporary directory of a `onefile` frozen application being left behind when the user closes the console window. (#6591)
- Implement a mechanism for controlling the collection mode of modules and packages, with granularity ranging from top-level packages to individual sub-modules. Therefore, the hooks can now specify whether the hooked package should be collected as byte-compiled `.pyc` modules into embedded PYZ archive (the default behavior), or as source `.py` files collected as external data files (without corresponding modules in the PYZ archive). (#6945)

### Bugfix

- (non-Windows) Avoid generating debug messages in POSIX signal handlers, as the functions involved are generally not signal-safe. Should also fix the endless spam of `SIGPIPE` that occurs under certain conditions when shutting down the frozen application on linux. (#5270)
- (non-Windows) If the child process of a `onefile` frozen application is terminated by a signal, delay re-raising of the signal in the parent process until after the clean up has been performed. This prevents `onefile` frozen applications from leaving behind their unpacked temporary directories when either the parent or the child process is sent the `SIGTERM` signal. (#2379)
- When building with `noarchive=True` (e.g., `--debug noarchive` or `--debug all`), PyInstaller no longer pollutes user-writable source locations with its `.pyc` or `.pyo` files written next to the corresponding source files. (#6591)
- When building with `noarchive=True` (e.g., `--debug noarchive` or `--debug all`), the source paths are now stripped from the collected `.pyc` modules, same as if PYZ archive was used. (#6591)

### Hooks

- Add `PyGObject` hook for `gi.repository.freetype2`. Remove warning for hidden import not found for `gi._gobject` with `PyGObject 3.25.1+`. (#6951)
- Remove `pkg_resources` hidden imports that aren't available including `py2_warn`, `markers`, and `_vendor.pyparsing.diagram`. (#6952)

### Documentation

- Document the signal handling behavior Windows and various quirks related to the frozen application shutdown via the Task Manager. (#6935)

### 2.15.3 5.2 (2022-07-08)

#### Features

- Detect if an icon file (.ico or .icns) is of another image type but has been mislabelled as a native icon type via its file suffix then either normalise to a genuinely native image type if pillow is installed or raise an error. (#6870)
- Exit gracefully with an explanatory `SystemExit` if the user moves or deletes the application whilst it's still running. Note that this is only detected on trying to load a module which has not already been loaded. (#6856)
- Implement new standard hook variable, called `warn_on_missing_hiddenimports`. This optional boolean flag allows a hook to opt out from warnings generated by missing hidden imports originating from that hook. (#6914)

#### Bugfix

- (Linux) Fix potential mismatch between the collected Python shared library name and the name expected by the bootloader when using Anaconda environment. The mismatch would occur on some attempts to freeze a program that uses an extension that is also linked against the python shared library. (#6831)
- (Linux) Fix the missing `gi.repository` error in an application frozen on RHEL/Fedora linux with GObject introspection installed from the distribution's RPM package. (#6780)
- (macOS) The QtWebEngine hook now makes QtOpenGL and QtDBus available to the renderer process with framework installs of Qt 6. (#6892)
- (Windows) Optimize EXE PE headers fix-up process in an attempt to reduce the processing time and the memory footprint with large onefile builds. (#6874)
- Add a try/except guard around `ctypes.util.find_library()` to protect against CPython bug #93094 which leads to a `FileNotFoundError`. (#6864)
- Fix regression in PyInstaller v5 where an import of a non-existent GObject introspection (`gi`) module (for example, an optional dependency) in the program causes a build-time error and aborts the build process. (#6897)
- If passed a name of an importable module instead of a package, the `PyInstaller.utils.hooks.collect_submodules()` function now returns a list containing the module's name, same as it would for a package without submodules. (#6850)
- Prevent `PyInstaller.utils.hooks.collect_submodules()` from recursing into sub-packages that are excluded by the function passed via the `filter` argument. (#6846)
- The `PyInstaller.utils.hooks.collect_submodules()` function now excludes un-importable subpackages from the returned modules list. (#6850)

#### Hooks

- (macOS) Disable QtWebEngine sandboxing for Qt6 in the corresponding PySide6 and PyQt6 run-time hooks as a work-around for the QtWebEngineProcess helper process crashing. This is required as of Qt 6.3.1 due to the way PyInstaller collects Qt libraries, but is applied regardless of the used Qt6 version. If you are using an older version of Qt6 and would like to keep the sandboxing, reset the `QTWEBENGINE_DISABLE_SANDBOX` environment variable at the start of your program, before importing Qt packages. (#6903)
- Add support for GTK4 by adding dependencies and updating `gi.repository.Gtk` and `gi.repository.Gdk` to work with module-versions in hooksconfig for `gi`. (#6834)
- Refactor the GObject introspection (`gi`) hooks so that the processing is performed only in hook loading stage or in the `hook()` function, but not in the mixture of two. (#6901)



- Update the GObject introspection (gi) hooks to use newly-introduced GiModuleInfo object to:
  - Check for module availability.
  - Perform typelib data collection; equivalent of old `get_gi_typelibs` function call.
  - Obtain associated shared library path, equivalent of old `get_gi_libdir` function call.

The `get_gi_typelibs` and `get_gi_libdir` functions now internally use `GiModuleInfo` to provide backwards-compatibility for external users. (#6901)

## 2.15.4 5.1 (2022-05-17)

### Bugfix

- (Windows) Fix the regression causing the (relative) spec path ending up prepended to relative icon path twice, resulting in icon not being found. (#6788)
- Prevent collection of an entire Python site when using `collect_data_files()` or `collect_dynamic_libs()` for single-file modules (#6789)
- Prevent the hook utility functions, such as `collect_submodules()`, `collect_data_files()`, and `collect_dynamic_libs()`, from failing to identify a package when its PEP451-compliant loader does not implement the optional `is_package` method. (#6790)
- The `get_package_paths()` function now supports PEP420 namespace packages - although for backwards-compatibility reasons, it returns only the first path when multiple paths are present. (#6790)
- The hook utility functions `collect_submodules()`, `collect_data_files()`, and `collect_dynamic_libs()` now support collection from PEP420 namespace packages. (#6790)
- The user-provided spec file path and paths provided via `--workpath` and `--distpath` are now resolved to absolute full paths before being passed to PyInstaller's internals. (#6788)

### Hooks

- Exclude doctest in the pickle hook. Update PySide2, PySide6, PyQt5, and PyQt6 hooks with hidden imports that were previously pulled in by doctest (that was in turn pulled in by pickle). (#6797)

### Bootloader

- (Windows) Update the bundled zlib sources to v1.2.12. (#6804)

### Bootloader build

- Building on Windows with MSVC no longer falls to bits if the PyInstaller repo is stored in a directory with a long path. (#6806)

### 2.15.5 5.0.1 (2022-04-25)

#### Bugfix

- (Linux) Have `glib` runtime hook prepend the frozen application's data dir to the `XDG_DATA_DIRS` environment variable instead of completely overwriting it. This should fix the case when `xdg-open` is used to launch a system-installed application (for example, opening an URL in a web browser via the `webbrowser` module) and no registered applications being found. (#3668)
- Prevent unactionable errors raised by UPX from terminating the build. (#6757)
- Restore the pre PyInstaller 5.0 behavior of resolving relative paths to icons as relative to the spec file rather than the current working directory. (#6759)
- (Windows) Update system DLL inclusion list to allow collection of DLLs from Visual Studio 2012 (VC11) runtime and Visual Studio 2013 (VC12) runtime, as well as the latest version of Visual Studio 2015/2017/2019/2022 (VC14) runtime (14.3). (#6778)

#### Hooks

- Refactor `QtWebEngine` hooks to support both pure Widget-based and pure QML/Quick-based applications. (#6753)
- Update `PySide6` and `PyQt6` hooks for compatibility with Qt 6.3. `QtWebEngine` on Windows and Linux does not provide the `qt.conf` file for the helper executable anymore, so we generate our own version of the file in order for `QtWebengine` -based frozen applications to work. (#6769)

### 2.15.6 5.0 (2022-04-15)

#### Features

- (macOS) App bundles built in `onedir` mode can now opt-in for *argv emulation* so that file paths passed from the UI (*Open with...*) are reflected in `sys.argv`. (#5908)
- (macOS) App bundles built in `onedir` mode can now opt-in for *argv emulation* so that file paths received in initial drag & drop event are reflected in `sys.argv`. (#5436)
- (macOS) The *argv emulation* functionality is now available as an optional feature for app bundles built in either `onefile` or `onedir` mode. (#6089)
- (Windows) Embed the manifest into generated `onedir` executables by default, in order to avoid potential issues when user renames the executable (e.g., the manifest not being found anymore due to activation context caching when user renames the executable and attempts to run it before also renaming the manifest file). The old behavior of generating the external manifest file in `onedir` mode can be re-enabled using the `--no-embed-manifest` command-line switch, or via the `embed_manifest=False` argument to `EXE()` in the .spec file. (#6223)
- (Wine) Prevent collection of Wine built-in DLLs (in either PE-converted or fake/placeholder form) when building a Windows frozen application under Wine. Display a warning for each excluded Wine built-in DLL. (#6149)
- Add a *PyInstaller.isolated* submodule as a safer replacement to *PyInstaller.utils.hooks.exec\_statement()*. (#6052)
- Improve matching of UPX exclude patterns to include OS-default case sensitivity, the wildcard operator (`*`), and support for parent directories in the pattern. Enables use of patterns like `"Qt*.dll"` and `"PySide2*.pyd"`. (#6161)
- Make the error handling of *collect\_submodules()* configurable. (#6052)

## Bugfix

- (macOS) Fix potential loss of Apple Events during onefile app bundle start-up, when the child process is not yet ready to receive events forwarded by the parent process. (#6089)
- (Windows) Remove the attempt to load the manifest of a onefile frozen executable via the activation context, which fails with *An attempt to set the process default activation context failed because the process default activation context was already set.* message that can be observed in debug builds. This approach has been invalid ever since #3746 implemented direct manifest embedding into the onefile executable. (#6203)
- Fix an import leak when `PyInstaller.utils.hooks.get_module_file_attribute()` is called with a sub-module or a sub-package name. (#6169)
- Fix an import leak when `PyInstaller.utils.hooks.is_package()` is called with a sub-module or a sub-package name. (#6169)
- Fix import errors when calling `get_gi_libdir()` during packaging of GTK apps. Enable CI tests of GTK by adding PyGObject dependencies for the Ubuntu builds. (#6300)
- Issue an error report if a `.spec` file will not be generated, but command-line options specific to that functionality are given. (#6660)
- Prevent onefile cleanup from recursing into symlinked directories and just remove the link instead. (#6074)

## Incompatible Changes

- (macOS) App bundles built in onefile mode do not perform *argv emulation* by default anymore. The functionality of converting initial open document/URL events into `sys.argv` entries must now be explicitly opted-in, via `argv_emulation=True` argument to `EXE()` in the `.spec` file or via `--argv-emulation` command-line flag. (#6089)
- (Windows) By default, manifest is now embedded into the executable in onedir mode. The old behavior of generating the external manifest file can be re-enabled using the `--no-embed-manifest` command-line switch, or via the `embed_manifest=False` argument to `EXE()` in the `.spec` file. (#6223)
- Issue an error report if a `.spec` file will not be generated, but command-line options specific to that functionality are given. (#6660)
- The `PyInstaller.utils.hooks.get_module_attribute()` function now returns the actual attribute value instead of its string representation. The external users (e.g., 3rd party hooks) of this function must adjust their handling of the return value accordingly. (#6169)
- The `matplotlib.backends` hook no longer collects all available matplotlib backends, but rather tries to auto-detect the used backend(s) by default. The old behavior can be re-enabled via the *hook configuration option*. (#6024)

## Hooks

- Rework the `matplotlib.backends` hook to attempt performing auto-detection of the used backend(s) instead of collecting all available backends. Implement *hook configuration option* that allows users to switch between this new behavior and the old behavior of collecting all backends, or to manually specify the backend(s) to be collected. (#6024)

### Bootloader

- Change the behaviour of the `--no-universal2` flag so that it now assumes the target architecture of the compiler (which may be overridden via the `CC` environment variable to facilitate cross compiling). (#6096)
- Refactor Apple Events handling code and move it into a separate source file. (#6089)

### Documentation

- Add a *new section* describing Apple Event forwarding behavior on macOS and the optional *argv emulation* for macOS app bundles, along with its caveats. (#6089)
- Update documentation on using UPX. (#6161)

### PyInstaller Core

- Drop support for Python 3.6. (#6475)

### Bootloader build

- (Windows) Enable *Control Flow Guard* for the Windows bootloader. (#6136)

## 2.15.7 4.10 (2022-03-05)

### Features

- (Wine) Prevent collection of Wine built-in DLLs (in either PE-converted or fake/placeholder form) when building a Windows frozen application under Wine. Display a warning for each excluded Wine built-in DLL. (#6622)

### Bugfix

- (Linux) Remove the timeout on `objcopy` operations to prevent wrongful abortions when processing large executables on slow disks. (#6647)
- (macOS) Limit the strict architecture validation for collected binaries to extension modules only. Fixes architecture validation errors when a `universal2` package has its multi-arch extension modules' arch slices linked against distinct single-arch thin shared libraries, as is the case with `scipy 1.8.0` macOS `universal2` wheel. (#6587)
- (macOS) Remove the 60 seconds timeout for each `codesign` and `lipo` operation which caused build abortion when processing huge binaries. (#6644)
- (Windows) Use a made up (not `.exe`) suffix for intermediate executable files during the build process to prevent antiviruses from attempting to scan the file whilst PyInstaller is still working on it leading to a `PermissionError` at build time. (#6467)
- Fix an attempt to collect a non-existent `.pyc` file when the corresponding source `.py` file has `st_mtime` set to zero. (#6625)

## Hooks

- Add IPython to the list of excluded packages in the PIL hook in order to prevent automatic collection of IPython when it is not imported anywhere else. This in turn prevents whole matplotlib being automatically pulled in when using PIL.Image. (#6605)

## Bootloader

- Fix detection of 32-bit arm platform when Thumb instruction set is enabled in the compiler. In this case, the `ctx.env.DEST_CPU` in waf build script is set to `thumb` instead of `arm`. (#6532)

### 2.15.8 4.9 (2022-02-03)

## Bugfix

- Add support for external paths when running `pkgutil.iter_modules`. Add support for multiple search paths to `pkgutil.iter_modules`. Correctly handle `pkgutil.iter_modules` with an empty list. (#6529)
- Fix finding `libpython3x.so` when Python is installed with pyenv and the python executable is not linked against `libpython3x.so`. (#6542)
- Fix handling of symbolic links in the path matching part of the PyInstaller's `pkgutil.iter_modules` replacement/override. (#6537)

## Hooks

- Add hooks for `PySide6.QtMultimedia` and `PyQt6.QtMultimedia`. (#6489)
- Add hooks for `QtMultimediaWidgets` of all four supported Qt bindings (`PySide2`, `PySide6`, `PyQt5`, and `PySide6`). (#6489)
- Add support for `setuptools 60.7.1` and its vendoring of `jaraco.text` in `pkg_resources`. Exit with an error message if `setuptools 60.7.0` is encountered due to incompatibility with PyInstaller's loader logic. (#6564)
- Collect the `QtWaylandClient`-related plugins to enable Wayland support in the frozen applications using any of the four supported Qt bindings (`PySide2`, `PyQt5`, `PySide6`, and `PyQt6`). (#6483)
- Fix the issue with missing `QtMultimediaWidgets` module when using `PySide2.QtMultimedia` or `PySide6.QtMultimedia` in combination with PySide's `true_property` feature. (#6489)

### 2.15.9 4.8 (2022-01-06)

## Features

- (Windows) Set the executable's build time in PE header to the current time. A custom timestamp can be specified via the `SOURCE_DATE_EPOCH` environment variable to allow reproducible builds. (#6469)
- Add strictly unofficial support for the Termux platform. (#6484)
- Replace the dual-process `onedir` mode on Linux and other Unix-like OSes with a single-process implementation. This makes `onedir` mode on these OSes comparable to Windows and macOS, where single-process `onedir` mode has already been used for a while. (#6407)

## Bugfix

- (macOS) Fix regression in generation of `universal2` executables that caused the generated executable to fail `codesign` strict validation. (#6381)
- (Windows) Fix `onefile` extraction behavior when the run-time temporary directory is set to a drive letter. The application's temporary directory is now created directly on the specified drive as opposed to the current directory on the specified drive. (#6051)
- (Windows) Fix compatibility issues with python 3.9.8 from python.org, arising from the lack of embedded manifest in the `python.exe` executable. (#6367)
- (Windows) Fix stack overflow in *pyarmor*-protected frozen applications, caused by the executable's stack being smaller than that of the python interpreter. (#6459)
- (Windows) Fix the `python3.dll` shared library not being found and collected when using Python from MS App Store. (#6390)
- Fix a bug that prevented traceback from uncaught exception to be retrieved and displayed in the windowed boot-loader's error reporting facility (uncaught exception dialog on Windows, syslog on macOS). (#6426)
- Fix a crash when a `onefile` build attempts to overwrite an existing `onedir` build on macOS or Linux (#6418)
- Fix build errors when a linux shared library (`.so`) file is collected as a binary on macOS. (#6327)
- Fix build errors when a Windows DLL/PYD file is collected as a binary on a non-Windows OS. (#6327)
- Fix handling of encodings when reading the collected `.py` source files via `FrozenImporter.get_source()`. (#6143)
- Fix hook loader function not finding hooks if path has whitespaces. (Re-apply the fix that has been inadvertently undone during the codebase reformatting.) (#6080)
- Windows: Prevent invalid handle errors when an application compiled in `--windowed` mode uses `subprocess` without explicitly setting `stdin`, `stdout` and `stderr` to either `PIPE` or `DEVNULL`. (#6364)

## Hooks

- (macOS) Add support for Anaconda-installed `PyQtWebEngine`. (#6373)
- Add hooks for `PySide6.QtWebEngineWidgets` and `PyQt6.QtWebEngineWidgets`. The `QtWebEngine` support in PyInstaller requires Qt6 v6.2.2 or later, so if an earlier version is encountered, we exit with an error instead of producing a defunct build. (#6387)
- Avoid collecting the whole `QtQml` module and its dependencies in cases when it is not necessary (i.e., the application does not use `QtQml` or `QtQuick` modules). The unnecessary collection was triggered due to extension modules being linked against the `libQt5Qml` or `libQt6Qml` shared library, and affected pure widget-based applications (`PySide2` and `PySide6` on Linux) and widget-based applications that use `QtWebEngineWidgets` (`PySide2`, `PySide6`, `PyQt5`, and `PyQt6` on all OSes). (#6447)
- Update `numpy` hook for compatibility with version 1.22; the hook cannot exclude `distutils` and `numpy.distutils` anymore, as they are required by `numpy.testing`, which is used by some external packages, such as `scipy`. (#6474)

## Bootloader

- (Windows) Set the bootloader executable's stack size to 2 MB to match the stack size of the python interpreter executable. (#6459)
- Implement single-process `onedir` mode for Linux and Unix-like OSes as a replacement for previously-used two-process implementation. The new mode uses `exec()` without `fork()` to restart the bootloader executable image within the same process after setting up the environment (i.e., the `LD_LIBRARY_PATH` and other environment variables). (#6407)
- Lock the PKG sideload mode in the bootloader unless the executable has a special signature embedded. (#6470)
- When user script terminates with an uncaught exception, ensure that the exception data obtained via `PyErr_Fetch` is normalized by also calling `PyErr_NormalizeException`. Otherwise, trying to format the traceback via `traceback.format_exception` fails in some circumstances, and no traceback can be displayed in the windowed bootloader's error report. (#6426)

## Bootloader build

- The bootloader can be force compiled during pip install by setting the environment variable `PYINSTALLER_COMPILE_BOOTLOADER`. (#6384)

### 2.15.10 4.7 (2021-11-10)

## Bugfix

- Fix a bug since v4.6 where certain Unix system directories were incorrectly assumed to exist and resulted in a `FileNotFoundError`. (#6331)

## Hooks

- Update sphinx hook for compatibility with latest version (4.2.0). (#6330)

## Bootloader

- (Windows) Explicitly set `NTDDI_VERSION=0x06010000` and `_WIN32_WINNT=0x0601` when compiling Windows bootloaders to request Windows 7 feature level for Windows headers. The windowed bootloader requires at least Windows Vista feature level, and some toolchains (e.g., mingw cross-compiler on linux) set too low level by default. (#6338)
- (Windows) Remove the check for the unused windres utility when compiling with MinGW toolchain. (#6339)
- Replace use of `PyRun_SimpleString` with `PyRun_SimpleStringFlags`. (#6332)

### 2.15.11 4.6 (2021-10-29)

#### Features

- Add support for Python 3.10. (#5693)
- (Windows) Embed the manifest into generated onedir executables by default, in order to avoid potential issues when user renames the executable (e.g., the manifest not being found anymore due to activation context caching when user renames the executable and attempts to run it before also renaming the manifest file). The old behavior of generating the external manifest file in onedir mode can be re-enabled using the `--no-embed-manifest` command-line switch, or via the `embed_manifest=False` argument to `EXE()` in the .spec file. (#6248)
- (Windows) Respect [PEP 239](#) encoding specifiers in Window's VSVersionInfo files. (#6259)
- Implement basic resource reader for accessing on-filesystem resources (data files) via `importlib.resources` (python >= 3.9) or `importlib_resources` (python <= 3.8). (#5616)
- Ship precompiled wheels for musl-based Linux distributions (such as Alpine or OpenWRT) on x86\_64 and aarch64. (#6245)

#### Bugfix

- (macOS) Ensure that executable pre-processing and post-processing steps (target arch selection, SDK version adjustment, (re)signing) are applied in the stand-alone PKG mode. (#6251)
- (macOS) Robustify the macOS assembly pipeline to work around the issues with the `codesign` utility on macOS 10.13 High Sierra. (#6167)
- (Windows) Fix collection of `sysconfig` platform-specific data module when using MSYS2/MINGW python. (#6118)
- (Windows) Fix displayed script name and exception message in the unhandled exception dialog (windowed mode) when bootloader is compiled using the MinGW-w64 toolchain. (#6199)
- (Windows) Fix issues in onedir frozen applications when the bootloader is compiled using a toolchain that forcibly embeds a default manifest (e.g., the MinGW-w64 toolchain from msys2). The issues range from manifest-related options (e.g., `uac-admin`) not working to windowed frozen application not starting at all (with the `The procedure entry point LoadIconMetric could not be located...` error message). (#6196)
- (Windows) Fix the declared length of strings in the optional embedded product version information resource structure. The declared lengths were twice too long, and resulted in trailing garbage characters when the version information was read using `ctypes` and `winver` API. (#6219)
- (Windows) Remove the attempt to load the manifest of a onefile frozen executable via the activation context, which fails with `An attempt to set the process default activation context failed because the process default activation context was already set.` message that can be observed in debug builds. This approach has been invalid ever since #3746 implemented direct manifest embedding into the onefile executable. (#6248)
- (Windows) Suppress missing library warnings for `api-ms-win-core-*` DLLs. (#6201)
- (Windows) Tolerate reading Windows VSVersionInfo files with unicode byte order marks. (#6259)
- Fix `sys.executable` pointing to the external package file instead of the executable when in package side-load mode (`pkg_append=False`). (#6202)
- Fix a runaway glob which caused `ctypes.util.find_library("libfoo")` to non-deterministically pick any library matching `libfoo*` to bundle instead of `libfoo.so`. (#6245)
- Fix compatibility with MIPS and loongarch64 architectures. (#6306)



- Fix the `FrozenImporter.get_source()` to correctly handle the packages' `__init__.py` source files. This in turn fixes missing-source-file errors for packages that use `pytorch JIT` when the source `.py` files are collected and available (for example, `kornia`). (#6237)
- Fix the location of the generated stand-alone `pkg` file when using the side-load mode (`pkg_append=False`) in combination with `onefile` mode. The package file is now placed next to the executable instead of next to the `.spec` file. (#6202)
- When generating spec files, avoid hard-coding the spec file's location as the `pathex` argument to the `Analysis`. (#6254)

## Incompatible Changes

- (Windows) By default, manifest is now embedded into the executable in `onedir` mode. The old behavior of generating the external manifest file can be re-enabled using the `--no-embed-manifest` command-line switch, or via the `embed_manifest=False` argument to `EXE()` in the `.spec` file. (#6248)

## Hooks

- (macOS) Fix compatibility with Anaconda PyQt5 package. (#6181)
- Add a hook for `pandas.plotting` to restore compatibility with `pandas 1.3.0` and later. (#5994)
- Add a hook for `QtOpenGLWidgets` for PyQt6 and PySide6 to collect the new `QtOpenGLWidgets` module introduced in Qt6 (#6310)
- Add hooks for `QtPositioning` and `QtLocation` modules of the Qt5-based packages (PySide2 and PyQt5) to ensure that corresponding plugins are collected. (#6250)
- Fix compatibility with PyQt5 5.9.2 from conda's main channel. (#6114)
- Prevent potential error in hooks for Qt-based packages that could be triggered by a partial PyQt6 installation. (#6141)
- Update `QtNetwork` hook for PyQt6 and PySide6 to collect the new `tls` plugins that were introduced in Qt 6.2. (#6276)
- Update the `gi.repository.GtkSource` hook to accept a `module-versions` `hooksconfig` dict in order to allow the hook to be used with `GtkSource` versions greater than 3.0. (#6267)

## Bootloader

- (Windows) Suppress two `snprintf` truncation warnings that prevented bootloader from building with `winlibs MinGW-w64` toolchain. (#6196)
- Update the Linux bootloader cross compiler Dockerfile to allow using the official PyPA base images in place of the dockcross ones. (#6245)

### 2.15.12 4.5.1 (2021-08-06)

#### Bugfix

- Fix hook loader function not finding hooks if path has whitespaces. (#6080)

### 2.15.13 4.5 (2021-08-01)

#### Features

- (POSIX) Add `exclude_system_libraries` function to the `Analysis` class for `.spec` files, to exclude most or all non-Python system libraries from the bundle. Documented in new *POSIX Specific Options* section. (#6022)

#### Bugfix

- (Cygwin) Add `_MEIPASS` to DLL search path to fix loading of python shared library in onefile builds made in cygwin environment and executed outside of it. (#6000)
- (Linux) Display missing library warnings for “not found” lines in `ldd` output (i.e., `libsomething.so => not found`) instead of quietly ignoring them. (#6015)
- (Linux) Fix spurious missing library warning when `libc.so` points to `ldd`. (#6015)
- (macOS) Fix python shared library detection for non-framework python builds when the library path cannot be inferred from imports of the python executable. (#6021)
- (macOS) Fix the crashes in `onedir` bundles of `tkinter`-based applications created using Homebrew python 3.9 and Tcl/Tk 8.6.11. (#6043)
- (macOS) When fixing executable for codesigning, update the value of `vm_size` field in the `__LINKEDIT` segment. (#6039)
- Downgrade messages about missing dynamic link libraries from `ERROR` to `WARNING`. (#6015)
- Fix a bytecode parsing bug which caused tuple index errors whilst scanning modules which use `ctypes`. (#6007)
- Fix an error when `rhooks` for `pkgutil` and `pkg_resources` are used together. (#6018)
- Fix architecture detection on Apple M1 (#6029)
- Fix crash in windowed bootloader when the traceback for unhandled exception cannot be retrieved. (#6070)
- Improve handling of errors when loading hook entry-points. (#6028)
- Suppress missing library warning for `shiboken2` (PySide2) and `shiboken6` (PySide6) shared library. (#6015)

#### Incompatible Changes

- (macOS) Disable processing of Apple events for the purpose of `argv` emulation in `onedir` application bundles. This functionality was introduced in PyInstaller 4.4 by (#5920) in response to feature requests (#5436) and (#5908), but was discovered to be breaking `tkinter`-based `onedir` bundles made with Homebrew python 3.9 and Tcl/Tk 8.6.11 (#6043). As such, until the cause is investigated and the issue addressed, this feature is reverted/disabled. (#6048)

## Hooks

- Add a hook for `pandas.io.formats.style` to deal with indirect import of `jinja2` and the missing template file. (#6010)
- Simplify the `PySide2.QWebEngineWidgets` and `PyQt5.QWebEngineWidgets` by merging most of their code into a common helper function. (#6020)

## Documentation

- Add a page describing hook configuration mechanism and the currently implemented options. (#6025)

## PyInstaller Core

- Isolate discovery of 3rd-party hook directories into a separate subprocess to avoid importing packages in the main process. (#6032)

## Bootloader build

- Allow statically linking `zlib` on non-Windows specified via either a `--static-zlib` flag or a `PYI_STATIC_ZLIB=1` environment variable. (#6010)

## 2.15.14 4.4 (2021-07-13)

### Features

- (macOS) Implement signing of `.app` bundle (ad-hoc or with actual signing identity, if provided). (#5581)
- (macOS) Implement support for Apple Silicon M1 (arm64) platform and different targets for frozen applications (thin-binary `x86_64`, thin-binary `arm64`, and fat-binary `universal2`), with build-time arch validation and ad-hoc resigning of all collected binaries. (#5581)
- (macOS) In onedir windowed (`.app` bundle) mode, perform an interaction of Apple event processing to convert `odoc` and `GURL` events to `sys.argv` before entering frozen python script. (#5920)
- (macOS) In windowed (`.app` bundle) mode, always log unhandled exception information to `syslog`, regardless of debug mode. (#5890)
- (Windows) Add support for Python from Microsoft App Store. (#5816)
- (Windows) Implement a custom dialog for displaying information about unhandled exception and its traceback when running in windowed/noconsole mode. (#5890)
- Add **recursive** option to `PyInstaller.utils.hooks.copy_metadata()`. (#5830)
- Add `--codesign-identity` command-line switch to perform code-signing with actual signing identity instead of ad-hoc signing (macOS only). (#5581)
- Add `--osx-entitlements-file` command-line switch that specifies optional entitlements file to be used during code signing of collected binaries (macOS only). (#5581)
- Add `--target-arch` command-line switch to select target architecture for frozen application (macOS only). (#5581)

- Add a splash screen that displays a background image and text: The splash screen can be controlled from within Python using the `pyi_splash` module. A splash screen can be added using the `--splash IMAGE_FILE` option. If optional text is enabled, the splash screen will show the progress of unpacking in onefile mode. This feature is supported only on Windows and Linux. A huge thanks to [@Chrisg2000](#) for programming this feature. ([#4354](#), [#4887](#))
- Add hooks for PyQt6. ([#5865](#))
- Add hooks for PySide6. ([#5865](#))
- Add option to opt-out from reporting full traceback for unhandled exceptions in windowed mode (Windows and macOS only), via `--disable-windowed-traceback` PyInstaller CLI switch and the corresponding `disable_windowed_traceback` boolean argument to `EXE()` in spec file. ([#5890](#))
- Allow specify which icon set, themes and locales to pack with Gtk applications. Pass a keyword arg `hooksconfig` to `Analysis`.

```
a = Analysis(["my-gtk-app.py"],
    ...,
    hooksconfig={
        "gi": {
            "icons": ["Adwaita"],
            "themes": ["Adwaita"],
            "languages": ["en_GB", "zh_CN"]
        }
    },
    ...)
```

([#5853](#))

- Automatically exclude Qt plugins from UPX processing. ([#4178](#))
- Collect distribution metadata automatically. This works by scanning collected Python files for uses of:
  - `pkg_resources.get_distribution()`
  - `pkg_resources.require()`
  - `importlib.metadata.distribution()`
  - `importlib.metadata.metadata()`
  - `importlib.metadata.files()`
  - `importlib.metadata.version()`

In all cases, the metadata will only be collected if the distribution name is given as a plain string literal. Anything more complex will still require a hook containing `PyInstaller.utils.hooks.copy_metadata()`. ([#5830](#))

- Implement support for `pkgutil.iter_modules()`. ([#1905](#))
- Windows: Provide a meaningful error message if given an icon in an unsupported Image format. ([#5755](#))

## Bugfix

- (macOS) App bundles built in `onedir` mode now filter out `-psnxxx` command-line argument from `sys.argv`, to keep behavior consistent with bundles built in `onefile` mode. (#5920)
- (macOS) Ensure that the macOS SDK version reported by the frozen application corresponds to the minimum of the SDK version used to build the bootloader and the SDK version used to build the Python library. Having the application report more recent version than Python library and other bundled libraries may result in macOS attempting to enable additional features that are not available in the Python library, which may in turn cause inconsistent behavior and UI issues with `tkinter`. (#5839)
- (macOS) Remove spurious MacOS/ prefix from `CFBundleExecutable` property in the generated `Info.plist` when building an app bundle. (#4413, #5442)
- (macOS) The drag & drop file paths passed to app bundles built in `onedir` mode are now reflected in `sys.argv`. (#5436)
- (macOS) The file paths passed from the UI (*Open with...*) to app bundles built in `onedir` mode are now reflected in `sys.argv`. (#5908)
- (macOS) Work around the `tkinter` UI issues due to problems with dark mode activation: black Tk window with macOS Intel installers from `python.org`, or white text on bright background with Anaconda python. (#5827)
- (Windows) Enable collection of additional VC runtime DLLs (`msvcp140.dll`, `msvcp140_1.dll`, `msvcp140_2.dll`, and `vcruntime140_1.dll`), to allow frozen applications to run on Windows systems that do not have *Visual Studio 2015/2017/2019 Redistributable* installed. (#5770)
- Enable retrieval of code object for `__main__` module via its associated loader (i.e., `FrozenImporter`). (#5897)
- Fix `inspect.getmodule()` failing to resolve module from stack-frame obtained via `inspect.stack()`. (#5963)
- Fix `__main__` module being recognized as built-in instead of module. (#5897)
- Fix a bug in `ctypes dependency scanning` which caused references to be missed if the preceding code contains more than 256 names or 256 literals. (#5830)
- Fix collection of duplicated `_struct` and `zlib` extension modules with mangled filenames. (#5851)
- Fix python library lookup when building with RH SCL python 3.8 or later. (#5749)
- Prevent `PyInstaller.utils.hooks.copy_metadata()` from renaming `[...].dist-info` metadata folders to `[...].egg-info` which breaks usage of `pkg_resources.requires()` with *extras*. (#5774)
- Prevent a bootloader executable without an embedded CArchive from being misidentified as having one, which leads to undefined behavior in frozen applications with side-loaded CArchive packages. (#5762)
- Prevent the use of `sys` or `os` as variables in the global namespace in frozen script from affecting the `ctypes` hooks that are installed during bootstrap. (#5797)
- Windows: Fix EXE being rebuilt when there are no changes. (#5921)

### Hooks

- – Add `PostGraphAPI.analysis` attribute. Hooks can access the `Analysis` object through the `hook()` function.
  - Hooks may access a `Analysis.hooksconfig` attribute assigned on `Analysis` construction.  
A helper function `get_hook_config()` was defined in `utils.hooks` to get the config. (#5853)
- Add support for PyQt5 5.15.4. (#5631)
- Do not exclude `setuptools.py27compat` and `setuptools.py33compat` as they are required by other `setuptools` modules. (#5979)
- Switch the library search order in `ctypes` hooks: first check whether the given name exists as-is, before trying to search for its basename in `sys._MEIPASS` (instead of the other way around). (#5907)

### Bootloader

- (macOS) Build bootloader as `universal2` binary by default (can be disabled by passing `--no-universal2` to `waf`). (#5581)
- Add Tcl/Tk based Splash screen, which is controlled from within Python. The necessary module to create the Splash screen in PyInstaller is under `Splash` available. A huge thanks to @Chrisg2000 for programming this feature. (#4887)
- Provide a Dockerfile to build Linux bootloaders for different architectures. (#5995)

### Documentation

- Document the new macOS multi-arch support and code-signing behavior in corresponding sub-sections of Notes about specific Features. (#5581)

### Bootloader build

- Update `clang` in `linux64` Vagrant VM to `clang-11` from `apt.llvm.org` so it can build `universal2` macOS bootloader. (#5581)
- Update `crossosx` Vagrant VM to build the toolchain from `Command Line Tools for Xcode` instead of full `Xcode` package. (#5581)

## 2.15.15 4.3 (2021-04-16)

### Features

- Provide basic implementation for `FrozenImporter.get_source()` that allows reading source from `.py` files that are collected by hooks as data files. (#5697)
- Raise the maximum allowed size of `CArchive` (and consequently `onefile` executables) from 2 GiB to 4 GiB. (#3939)
- The `unbuffered_stdio` mode (the `u` option) now sets the `Py_UnbufferedStdioFlag` flag to enable unbuffered stdio mode in Python library. (#1441)
- Windows: Set EXE checksums. Reduces false-positive detection from antiviral software. (#5579)

- Add new command-line options that map to collect functions from hookutils: `--collect-submodules`, `--collect-data`, `--collect-binaries`, `--collect-all`, and `--copy-metadata`. (#5391)
- Add new hook utility `collect_entry_point()` for collecting plugins defined through setuptools entry points. (#5734)

## Bugfix

- (macOS) Fix Bad CPU type in executable error in helper-spawned python processes when running under arm64-only flavor of Python on Apple M1. (#5640)
- (OSX) Suppress missing library error messages for system libraries as those are never collected by PyInstaller and starting with Big Sur, they are hidden by the OS. (#5107)
- (Windows) Change default cache directory to LOCALAPPDATA (from the original APPDATA). This is to make sure that cached data doesn't get synced with the roaming profile. For this and future versions AppData\Roaming\pyinstaller might be safely deleted. (#5537)
- (Windows) Fix onefile builds not having manifest embedded when icon is disabled via `--icon NONE`. (#5625)
- (Windows) Fix the frozen program crashing immediately with Failed to execute script pyiboot01\_bootstrap message when built in noconsole mode and with import logging enabled (either via `--debug imports` or `--debug all` command-line switch). (#4213)
- CArchiveReader now performs full back-to-front file search for MAGIC, allowing pyi-archive\_viewer to open binaries with extra appended data after embedded package (e.g., digital signature). (#2372)
- Fix MERGE() to properly set references to nested resources with their full shared-package-relative path instead of just basename. (#5606)
- Fix onefile builds failing to extract files when the full target path exceeds 260 characters. (#5617)
- Fix a crash in pyi-archive\_viewer when quitting the application or moving up a level. (#5554)
- Fix extraction of nested files in onefile builds created in MSYS environments. (#5569)
- Fix installation issues stemming from unicode characters in file paths. (#5678)
- Fix the build-time error under python 3.7 and earlier when ctypes is manually added to hiddenimports. (#3825)
- Fix the return code if the frozen script fails due to unhandled exception. The return code 1 is used instead of -1, to keep the behavior consistent with that of the python interpreter. (#5480)
- Linux: Fix binary dependency scanner to support changes to ldconfig introduced in glibc 2.33. (#5540)
- Prevent MERGE (multipackage) from creating self-references for duplicated TOC entries. (#5652)
- PyInstaller-frozen onefile programs are now compatible with staticx even if the bootloader is built as position-independent executable (PIE). (#5330)
- Remove dependence on a private function removed in matplotlib 3.4.0rc1. (#5568)
- Strip absolute paths from .pyc modules collected into base\_library.zip to enable reproducible builds that are invariant to Python install location. (#5563)
- (OSX) Fix issues with pycryptodomex on macOS. (#5583)
- Allow compiled modules to be collected into base\_library.zip. (#5730)
- Fix a build error triggered by scanning ctypes.CDLL('libc.so') on certain Linux C compiler combinations. (#5734)
- Improve performance and reduce stack usage of module scanning. (#5698)

### Hooks

- Add support for Conda Forge’s distribution of NumPy. (#5168)
- Add support for package content listing via `pkg_resources`. The implementation enables querying/listing resources in a frozen package (both PYZ-embedded and on-filesystem, in that order of precedence) via `pkg_resources.resource_exists()`, `resource_isdir()`, and `resource_listdir()`. (#5284)
- Hooks: Import correct typelib for GtkosxApplication. (#5475)
- Prevent matplotlib hook from collecting current working directory when it fails to determine the path to matplotlib’s data directory. (#5629)
- Update pandas hook for compatibility with version 1.2.0 and later. (#5630)
- Update hook for `distutils.sysconfig` to be compatible with `pyenv-virtualenv`. (#5218)
- Update hook for `sqlalchemy` to support version 1.4.0 and above. (#5679)
- Update hook for `sysconfig` to be compatible with `pyenv-virtualenv`. (#5018)

### Bootloader

- Implement full back-to-front file search for the embedded archive. (#5511)
- Perform file extraction from the embedded archive in a streaming manner in order to limit memory footprint when archive contains large files. (#5551)
- Set the `__file__` attribute in the `__main__` module (entry-point script) to the absolute file name inside the `_MEIPASS`. (#5649)
- Enable cross compiling for FreeBSD from Linux. (#5733)

### Documentation

- Doc: Add version spec file option for macOS Bundle. (#5476)
- Update the Run-time Information section to reflect the changes in behavior of `__file__` inside the `__main__` module. (#5649)

### PyInstaller Core

- Drop support for python 3.5; EOL since September 2020. (#5439)
- Collect python extension modules that correspond to built-ins into `lib-dynload` sub-directory instead of directly into bundle’s root directory. This prevents them from shadowing shared libraries with the same basename that are located in a package and loaded via `ctypes` or `cffi`, and also declutters the bundle’s root directory. (#5604)



## Breaking

- No longer collect `pyconfig.h` and `makefile` for `sysconfig`. Instead of `get_config_h_filename()` and `get_makefile_filename()`, you should use `get_config_vars()` which no longer depends on those files. (#5218)
- The `__file__` attribute in the `__main__` module (entry-point script) is now set to the absolute file name inside the `_MEIPASS` (as if script file existed there) instead of just script filename. This better matches the behavior of `__file__` in the unfrozen script, but might break the existing code that explicitly relies on the old frozen behavior. (#5649)

## 2.15.16 4.2 (2021-01-13)

### Features

- Add hooks utilities to find binary dependencies of Anaconda distributions. (#5213)
- (OSX) Automatically remove the signature from the collected copy of the Python shared library, using `codesign --remove-signature`. This accommodates both `onedir` and `onefile` builds with recent python versions for macOS, where invalidated signature on PyInstaller-collected copy of the Python library prevents the latter from being loaded. (#5451)
- (Windows) PyInstaller's console or windowed icon is now added at freeze-time and no longer built into the bootloader. Also, using `--icon=NONE` allows to not apply any icon, thereby making the OS to show some default icon. (#4700)
- (Windows) Enable `longPathAware` option in built application's manifest in order to support long file paths on Windows 10 v.1607 and later. (#5424)

### Bugfix

- Fix loading of plugin-type modules at run-time of the frozen application: If the plugin path is one character longer than `sys._MEIPATH` (e.g. `"$PWD/p/plugin_1"` and `"$PWD/dist/main"`), the plugin relative-imports a sub-module (of the plugin) and the frozen application contains a module of the same name, the frozen application module was imported. (#4141, #4299)
- Ensure that spec for frozen packages has `submodule_search_locations` set in order to fix compatibility with `importlib_resources` 3.2.0 and later. (#5396)
- Fix: No rebuild if "noarchive" build-option changes. (#5404)
- (OSX) Fix the problem with Python shared library collected from recent python versions not being loaded due to invalidated signature. (#5062, #5272, #5434)
- (Windows) PyInstaller's default icon is no longer built into the bootloader, but added at freeze-time. Thus, when specifying an icon, only that icon is contained in the executable and displayed for a shortcut. (#870, #2995)
- (Windows) Fix "toc is bad" error messages when passing a `VSVersionInfo` as the `version` parameter to `EXE()` in a `.spec` file. (#5445)
- (Windows) Fix exception when trying to read a manifest from an exe or dll. (#5403)
- (Windows) Fix the `--runtime-tmpdir` option by creating paths if they don't exist and expanding environment variables (e.g. `%LOCALAPPDATA%`). (#3301, #4579, #4720)

## Hooks

- (GNU/Linux) Collect `xcbglinTEGRATIONS` and `egldeviceintegrations` plugins as part of Qt5Gui. (#5349)
- (macOS) Fix: Unable to code sign apps built with GTK (#5435)
- (Windows) Add a hook for `win32ctypes.core`. (#5250)
- Add hook for `scipy.spatial.transform.rotation` to fix compatibility with SciPy 1.6.0. (#5456)
- Add hook-gi.repository.GtkosxApplication to fix `TypeError` with Gtk macOS apps. (#5385)
- Add hooks utilities to find binary dependencies of Anaconda distributions. (#5213)
- Fix the Qt5 library availability check in PyQt5 and PySide2 hooks to re-enable support for Qt5 older than 5.8. (#5425)
- Implement `exec_statement_rc()` and `exec_script_rc()` as exit-code returning counterparts of `exec_statement()` and `exec_script()`. Implement `can_import_module()` helper for hooks that need to query module availability. (#5301)
- Limit the impact of a failed sub-package import on the result of `collect_submodules()` to ensure that modules from all other sub-packages are collected. (#5426)
- Removed obsolete `pygame` hook. (#5362)
- Update `keyring` hook to collect metadata, which is required for backend discovery. (#5245)

## Bootloader

- (GNU/Linux) Reintroduce executable resolution via `readlink()` on `/proc/self/exe` and preserve the process name using `prctl()` with `PR_GET_NAME` and `PR_SET_NAME`. (#5232)
- (Windows) Create temporary directories with user's SID instead of S-1-3-4, to work around the lack of support for the latter in wine. This enables `onefile` builds to run under wine again. (#5216)
- (Windows) Fix a bug in path-handling code with paths exceeding `PATH_MAX`, which is caused by use of `_snprintf` instead of `snprintf` when building with MSC. Requires Visual Studio 2015 or later. Clean up the MSC codepath to address other compiler warnings. (#5320)
- (Windows) Fix building of bootloader's test suite under Windows with Visual Studio. This fixes build errors when `cmocka` is present in the build environment. (#5318)
- (Windows) Fix compiler warnings produced by MinGW 10.2 in order to allow building the bootloader without having to suppress the warnings. (#5322)
- (Windows) Fix `windowed+debug` bootloader variant not properly displaying the exception message and trace-back information when the frozen script terminates due to uncaught exception. (#5446)

## PyInstaller Core

- (Windows) Avoid using UPX with DLLs that have control flow guard (CFG) enabled. (#5382)
- Avoid using `.pyo` module file suffix (removed since PEP-488) in `noarchive` mode. (#5383)
- Improve support for PEP-420 namespace packages. (#5354)
- Strip absolute paths from `.pyc` modules collected in the CArchive (PKG). This enables build reproducibility without having to match the location of the build environment. (#5380)

## 2.15.17 4.1 (2020-11-18)

### Features

- Add support for Python 3.9. (#5289)
- Add support for Python 3.8. (#4311)

### Bugfix

- Fix endless recursion if a package's `__init__` module is an extension module. (#5157)
- Remove duplicate logging messages (#5277)
- Fix `sw_64` architecture support (#5296)
- (AIX) Include python-malloc labeled libraries in search for libpython. (#4210)

### Hooks

- Add `exclude_datas`, `include_datas`, and `filter_submodules` to `collect_all()`. These arguments map to the `excludes` and `includes` arguments of `collect_data_files`, and to the *filter* argument of `collect_submodules`. (#5113)
- Add hook for `difflib` to not pull in `doctests`, which is only required when run as main program.
- Add hook for `distutils.util` to not pull in `lib2to3 unittests`, which will be rarely used in frozen packages.
- Add hook for `heapq` to not pull in `doctests`, which is only required when run as main program.
- Add hook for `multiprocessing.util` to not pull in python test-suite and thus e.g. `tkinter`.
- Add hook for `numpy._pytesttester` to not pull in `pytest`.
- Add hook for `pickle` to not pull in `doctests` and `argparse`, which are only required when run as main program.
- Add hook for `PIL.ImageFilter` to not pull `numpy`, which is an optional component.
- Add hook for `setuptools` to not pull in `numpy`, which is only imported if installed, not mean to be a dependency
- Add hook for `zope.interface` to not pull in `pytest unittests`, which will be rarely used in frozen packages.
- Add hook `gi.repository.HarfBuzz` to fix Typelib error with Gtk apps. (#5133)
- Enable overriding Django settings path by `DJANGO_SETTINGS_MODULE` environment variable. (#5267)
- Fix `collect_system_data_files` to scan the given input path instead of its parent. File paths returned by `collect_all_system_data` are now relative to the input path. (#5110)
- Fix argument order in `exec_script()` and `eval_script()`. (#5300)
- Gevent hook does not unnecessarily bundle HTML documentation, `__pycache__` folders, tests nor generated `.c` and `.h` files (#4857)
- gevent: Do not pull in test-suite (still to be refined)
- Modify hook for `gevent` to exclude test submodules. (#5201)
- Prevent `.pyo` files from being collected by `collect_data_files` when `include_py_files` is `False`. (#5141)
- Prevent output to `stdout` during module imports from ending up in the modules list collected by `collect_submodules`. (#5244)

- Remove runtime hook and fix regular hook for matplotlib's data to support `matplotlib>=3.3.0`, fix deprecation warning on version `3.1<= & <3.3`, and behave normally for versions `<3.1`. (#5006)
- Remove support for deprecated PyQt4 and PySide (#5118, #5126)
- `setuptools`: Exclude outdated compat modules.
- Update `sqlalchemy` hook to support v1.3.19 and later, by adding `sqlalchemy.ext.baked` as a hidden import (#5128)
- Update `tkinter` hook to collect Tcl modules directory (`tcl8`) in addition to Tcl/Tk data directories. (#5175)
- (GNU/Linux) {PyQt5,PySide2}.QtWebEngineWidgets: fix search for extra NSS libraries to prevent an error on systems where `/lib64/nss/*.so` comes up empty. (#5149)
- (OSX) Avoid collecting data from system Tcl/Tk framework in `tkinter` hook as we do not collect their shared libraries, either. Affects only python versions that still use the system Tcl/Tk 8.5. (#5217)
- (OSX) Correctly locate the tcl/tk framework bundled with official python.org python builds from v.3.6.5 on. (#5013)
- (OSX) Fix the `QTWEBENGINEPROCESS_PATH` set in PyQt5.QtWebEngineWidgets rthook. (#5183)
- (OSX) PySide2.QtWebEngineWidgets: add QtQmlModels to included libraries. (#5150)
- (Windows) Remove the obsolete python2.4-era `_handle_broken_tcl_tk` work-around for old virtual environments from the `tkinter` hook. (#5222)

### Bootloader

- Fix freeing memory allocated by Python using `free()` instead of `PyMem_RawFree()`. (#4441)
- (GNU/Linux) Avoid segfault when temp path is missing. (#5255)
- (GNU/Linux) Replace a `strncpy()` call in `pyi_path_dirname()` with `snprintf()` to ensure that the resulting string is always null-terminated. (#5212)
- (OSX) Added capability for already-running apps to accept URL & drag'n drop events via Apple Event forwarding (#5276)
- (OSX) Bump `MACOSX_DEPLOYMENT_TARGET` from 10.7 to 10.13. (#4627, #4886)
- (OSX) Fix to reactivate running app on "reopen" (#5295)
- (Windows) Use `_wfullpath()` instead of `_fullpath()` in `pyi_path_fullpath` to allow non-ASCII characters in the path. (#5189)

### Documentation

- Add `zlib` to build the requirements in the Building the Bootloader section of the docs. (#5130)

## PyInstaller Core

- Add informative message what do to if RecursionError occurs. (#4406, #5156)
- Prevent a local directory with clashing name from shadowing a system library. (#5182)
- Use module loaders to get module content instead of a quirky way stemming from early Python 2.x times. (#5157)
- (OSX) Exempt the Tcl/Tk dynamic libraries in the system framework from relative path overwrite. Fix missing Tcl/Tk dylib on older python.org builds that still make use of the system framework. (#5172)

## Test-suite and Continuous Integration

- Replace `skipif_xxx` for platform-specific tests by markers. (#1427)
- Test/CI: Test failures are automatically retried once. (#5214)

## Bootloader build

- Fix AppImage builds that were broken since PyInstaller 3.6. (#4693)
- Update build system to use Python 3.
- OSX: Fixed the ineffectiveness of the `--distpath` argument for the BUNDLE step. (#4892)
- OSX: Improve codesigning and notarization robustness. (#3550, #5112)
- OSX: Use high resolution mode by default for GUI applications. (#4337)

## 2.15.18 4.0 (2020-08-08)

### Features

- Provide `setuptools` entrypoints to enable other packages to provide PyInstaller hooks specific to that package, along with tests for these hooks.  
  
Maintainers of Python packages requiring hooks are invited to use this new feature and provide up-to-date PyInstaller support along with their package. This is quite easy, see our [sample project](#) for more information (#4232, #4301, #4582). Many thanks to Bryan A. Jones for implementing the important parts.
- A new package `pyinstaller-hooks-contrib` provides monthly updated hooks now. This package is installed automatically when installing PyInstaller, but can be updated independently. Many thanks to Legorooj for setting up the new package and moving the hooks there.
- Added the `excludes` and `includes` arguments to the hook utility function `collect_data_files`.
- Change the hook collection order so that the hook-priority is command line, then entry-point, then PyInstaller builtins. (#4876)

## Bugfix

- (AIX) Include python-malloc labeled libraries in search for libpython. (#4738)
- (win32) Fix Security Alerts caused by subtle implementation differences between posix and windows in `os.path.dirname()`. (#4707)
- (win32) Fix struct format strings for versioninfo. (#4861)
- (Windows) cv2: bundle the `opencv_videoio_ffmpeg*.dll`, if available. (#4999)
- (Windows) GLib: bundle the spawn helper executables for `g_spawn*` API. (#5000)
- (Windows) PySide2.QtNetwork: search for SSL DLLs in `PrefixPath` in addition to `BinariesPath`. (#4998)
- (Windows) When building with 32-bit python in onefile mode, set the `requestedExecutionLevel` manifest key every time and embed the manifest. (#4992)
- – (AIX) Fix uninitialized variable. (#4728, #4734)
- Allow building on a different drive than the source. (#4820)
- Consider `Python<version>` as possible library binary path. Fixes issue where python is not found if Python3 is installed via brew on OSX (#4895)
- Ensure shared dependencies from onefile packages can be opened in the bootloader.
- Ensuring repeatable builds of `base_library.zip`. (#4654)
- Fix `FileNotFoundError` showing up in `utils/misc.py` which occurs when a namespace was processed as an filename. (#4034)
- Fix multipackaging. The `MERGE` class will now have the correct relative paths between shared dependencies which can correctly be opened by the bootloader. (#1527, #4303)
- Fix regression when trying to avoid hard-coded paths in `.spec` files.
- Fix SIGTSTP signal handling to allow typing Ctrl-Z from terminal. (#4244)
- Update the base library to support encrypting Python bytecode (`--key` option) again. Many thanks to Matteo Bertini for finally fixing this. (#2365, #3093, #3133, #3160, #3198, #3316, #3619, #4241, #4652)
- When stripping the leading parts of paths in compiled code objects, the longest possible import path will now be stripped. (#4922)

## Incompatible Changes

- Remove support for Python 2.7. The minimum required version is now Python 3.5. The last version supporting Python 2.7 was PyInstaller 3.6. (#4623)
- Many hooks are now part of the new `pyinstaller-hooks-contrib` repository. See below for a detailed list.

## Hooks

- Add hook for `scipy.stats._stats` (needed for `scipy` since 1.5.0). ([#4981](#))
- Prevent hook-nltk from adding non-existing directories. ([#3900](#))
- Fix `importlib_resources` hook for modern versions (after 1.1.0). ([#4889](#))
- Fix hidden imports in `pkg_resources` and `packaging` ([#5044](#))
  - Add yet more hidden imports to `pkg_resources` hook.
  - Mirror the `pkg_resources` hook for `packaging` which may or may not be duplicate of `pkg_resources._vendor.packaging`.
- Update `pkg_resources` hook for `setuptools` v45.0.0.
- Add `QtQmlModels` to included libraries for `QtWebEngine` on OS X ([#4631](#)).
- Fix detecting Qt5 libraries and dependencies from conda-forge builds ([#4636](#)).
- Add an `AssertionError` message so that users who get an error due to Hook conflicts can resolve it ([#4626](#)).
- These hooks have been moved to the new `pyinstaller-hooks-contrib` repository: `BTrees`, `Crypto`, `Cryptodome`, `IPython`, `OpenGL`, `OpenGL_accelerate`, `Xlib`, `accessible_output2`, `adios`, `aliyunsdkcore`, `amazonproduct`, `appdirs`, `appy`, `astor`, `astroid`, `astropy`, `avro`, `bacon`, `boto`, `boto3`, `botocore`, `certifi`, `clr`, `countrycode`, `cryptography`, `cv2`, `cx_Oracle`, `cytoolz`, `dateparser`, `dclab`, `distorm3`, `dns`, `docutils`, `docx`, `dynaconf`, `enchant`, `enzyme`, `eth_abi`, `eth_account`, `eth_hash`, `eth_keyfile`, `eth_utils`, `faker`, `flex`, `fmpy`, `gadfly`, `gooey`, `google.*`, `gst`, `gtk`, `h5py`, `httplib`, `httplib2`, `imageio`, `imageio_ffmpeg`, `jedi`, `jinja2`, `jira`, `jsonpath_rw_ext`, `jsonschema`, `jupyterlab`, `kinterbasdb`, `langcodes`, `lensfunpy`, `libaudioverse`, `llvmlite`, `logilab`, `lxml`, `lz4`, `magic`, `mako`, `markdown`, `migrate`, `mpl_toolkits`, `mssql`, `mysql`, `nacl`, `names`, `nanite`, `nbconvert`, `nbdime`, `nbformat`, `ncclient`, `netCDF4`, `nlTK`, `numpy`, `notebook`, `numba`, `openpyxl`, `osgeo`, `passlib`, `paste`, `patsy`, `pendulum`, `phonenumbers`, `pint`, `pinyin`, `psychopy`, `psycpg2`, `pubsub`, `pyarrow`, `pycountry`, `pycparser`, `pyexcel`, `pyexcelerate`, `pylint`, `pymssql`, `pyodbc`, `pyopencl`, `pyproj`, `pysnmp`, `pytest`, `pythoncom`, `pyttsx`, `pywintypes`, `pywt`, `radicale`, `raven`, `rawpy`, `rdflib`, `redmine`, `regex`, `reportlab`, `reportlab`, `resampy`, `selenium`, `shapely`, `skimage`, `sklearn`, `sound_lib`, `sounddevice`, `soundfile`, `speech_recognition`, `storm`, `tables`, `tcod`, `tensorflow`, `tensorflow_corethon`, `text_unidecode`, `textdistance`, `torch`, `ttkthemes`, `ttkwidgets`, `uldb`, `umap`, `unidecode`, `uniseg`, `usb`, `uvloop`, `vtkpython`, `wavefile`, `weasyprint`, `web3`, `webRTCvad`, `webview`, `win32com`, `wx`, `xml.dom`, `xml.sax`, `xsgui`, `zeep`, `zmq`.
- These hooks have been added while now moved to the new `pyinstaller-hooks-contrib` repository: `astor` ([#4400](#), [#4704](#)), `argon2` ([#4625](#)) `bcrypt`. ([#4735](#)), (Bluetooth Low Energy platform Agnostic Klient for Python) ([#4649](#)) `jaraco.text` ([#4576](#), [#4632](#)), `LightGBM`. ([#4634](#)), `xmldiff` ([#4680](#)), `puremagic` (identify a file based off it's magic numbers) ([#4709](#)) `webassets` ([#4760](#)), `tensorflow_core` (to support tensorflow module forwarding logic ([#4400](#), [#4704](#)))
- These changes have been applied to hooks now moved to the new `pyinstaller-hooks-contrib` repository
  - Update `Bokeh` hook for v2.0.0. ([#4742](#), [#4746](#))
  - Fix `shapely` hook on Windows for non-conda shapely installations. ([#2834](#), [#4749](#))

### Bootloader

- Rework bootloader from using strcpy/strncpy with “is this string terminated”-check to use snprintf(); check success at more places. (This started from fixing GCC warnings for strncpy and strncat.)
- Fix: When copying files, too much data was copied in most cases. This corrupted the file and inhibited using shared dependencies. (#4303)
- In debug and windowed mode, show the traceback in dialogs to help debug pyiboot01\_bootstrap errors. (#4213, #4592)
- Started a small test-suite for bootloader basic functions. (#4585)

### Documentation

- Add platform-specific usage notes and bootloader build notes for AIX. (#4731)

### PyInstaller Core

- Provide setuptools entrypoints to enable other packages to provide PyInstaller hooks specific to that package, along with tests for these hooks. See <https://github.com/pyinstaller/hooks/sample> for more information. (#4232, #4582)

### Bootloader build

- (AIX) The argument -X32 or -X64 is not recognized by the AIX loader - so this code needs to be removed. (#4730, #4731)
- (OSX) Allow end users to override MACOSX\_DEPLOYMENT\_TARGET and mmacosx-version-min via environment variables and set 10.7 as the fallback value for both. (#4677)
- Do not print info about --noconfirm when option is already being used. (#4727)
- Update **waf** to version 2.0.20 (#4839)

## 2.15.19 Older Versions

### Changelog for PyInstaller 3.0 – 3.6

#### 3.6 (2020-01-09)

**Important:** This is the last release of PyInstaller supporting Python 2.7. Python 2 is end-of-life, many packages are about to [drop support for Python 2.7](#) - or already did it.



## Security

- [SECURITY] (Win32) Fix CVE-2019-16784: Local Privilege Escalation caused by insecure directory permissions of `sys._MEIPATH`. This security fix effects all Windows software frozen by PyInstaller in “onefile” mode. While PyInstaller itself was not vulnerable, all Windows software frozen by PyInstaller in “onefile” mode is vulnerable.

If you are using PyInstaller to freeze Windows software using “onefile” mode, you should upgrade PyInstaller and rebuild your software.

## Features

- (Windows): Applications built in windowed mode have their debug messages sent to any attached debugger or DebugView instead of message boxes. (#4288)
- Better error message when file exists at path we want to be dir. (#4591)

## Bugfix

- (Windows) Allow usage of *VSVersionInfo* as version argument to EXE again. (#4381, #4539)
- (Windows) Fix MSYS2 dll's are not found by modulegraph. (#4125, #4417)
- (Windows) The temporary copy of bootloader used add resources, icons, etc. is not created in `—workpath` instead of in `%TEMP%`. This fixes issues on systems where the anti-virus cleans `%TEMP%` immediately. (#3869)
- Do not fail the build when `ldconfig` is missing/inoperable. (#4261)
- Fixed loading of IPython extensions. (#4271)
- Fixed pre-find-module-path hook for *distutils* to be compatible with *virtualenv* `>= 16.3`. (#4064, #4372)
- Improve error reporting when the Python library can't be found. (#4162)

## Hooks

- Add hook for avro (serialization and RPC framework) (#4388), django-babel (#4516), enzyme (#4338), google.api (resp. google.api.core) (#3251), google.cloud.bigquery (#4083, #4084), google.cloud.pubsub (#4446), google.cloud.speech (#3888), numpy (#4483), passlib (#4520), pyarrow (#3720, #4517), pyexcel and its plugins io, ods, ods3, odsr, xls, xlsx, xlsw (#4305), pysnmp (#4287), scrapy (#4514), skimage.io (#3934), sklearn.mixture (#4612), sounddevice on macOS and Windows (#4498), text-unidecode (#4327, #4530), the google-cloud-kms client library (#4408), tkinter (#4484), and webtrcvad (#4490).
- Correct the location of Qt translation files. (#4429)
- Exclude imports for `pkg_resources` to fix bundling issue. (#4263, #4360)
- Fix hook for pywebview to collect all required libraries and data-files. (#4312)
- Fix hook numpy and hook scipy to account for differences in location of extra dlls on Windows. (#4593)
- Fix pysoundfile hook to bundle files correctly on both OSX and Windows. (#4325)
- Fixed hook for `pint` to also copy metadata as required to retrieve the version at runtime. (#4280)
- Fixed PySide2.QtNetwork hook by mirroring PyQt5 approach. (#4467, #4468)
- Hook for pywebview now collects data files and dynamic libraries only for the correct OS (Windows). Hook for pywebview now bundles only the required ‘lib’ subdirectory. (#4375)

- Update hooks related to PySide2.QtWebEngineWidgets, ensure the relevant supporting files required for a QtWebEngineView are copied into the distribution. (#4377)
- Update PyQt5 loader to support PyQt >=5.12.3. (#4293, #4332)
- Update PyQt5 to package 64-bit SSL support DLLs. (#4321)
- Update PyQt5 to place OpenGL DLLs correctly for PyQt >= 5.12.3. (#4322)
- (GNU/Linux) Make hook for GdkPixbuf compatible with Ubuntu and Debian (#4486).

### Bootloader

- (OSX): Added support for appending URL to program arguments when applications is launched from custom protocol handler. (#4397, #4399)
- (POSIX) For one-file binaries, if the program is started via a symlink, the second process now keeps the basename of the symlink. (#3823, #3829)
- (Windows) If bundled with the application, proactively load `ucrtbase.dll` before loading the Python library. This works around unresolved symbol errors when loading `python35.dll` (or later) on legacy Windows (7, 8, 8.1) systems with Universal CRT update is not installed. (#1566, #2170, #4230)
- Add our own implementation for `strndup` and `strnlen` to be used on platforms one of these is missing.

### PyInstaller Core

- Now uses hash based `.pyc` files as specified in [PEP 552](#) in `base_library.zip` when using Python 3.7 (#4096)

### Bootloader build

- (MinGW-w64) Fix `.rc.o` file not found error. (#4501, #4586)
- Add a check whether `strndup` and `strnlen` are available.
- Added OpenBSD support. (#4545)
- Fix build on Solaris 10.
- Fix checking for compiler flags in `configure` phase. The check for compiler flags actually did never work. (#4278)
- Update url for public key in `update-waf` script. (#4584)
- Update waf to version 2.0.19.

## 3.5 (2019-07-09)

### Features

- (Windows) Force `--windowed` option if first script is a `.pyw` file. This might still be overwritten in the spec-file. (#4001)
- Add support for relative paths for icon-files, resource-files and version-resource-files. (#3333, #3444)
- Add support for the RedHat Software Collections (SCL) Python 3.x. (#3536, #3881)
- Install platform-specific dependencies only on that platform. (#4166, #4173)

- New command-line option `--upx-exclude`, which allows the user to prevent binaries from being compressed with UPX. (#3821)

## Bugfix

- (conda) Fix detection of conda/anaconda platform.
- (GNU/Linux) Fix Anaconda Python library search. (#3885, #4015)
- (Windows) Fix UAC in one-file mode by embedding the manifest. (#1729, #3746)
- (Windows\Py3.7) Now able to locate pylib when VERSION.dll is listed in python.exe PE Header rather than pythonXY.dll (#3942, #3956)
- Avoid errors if PyQt5 or PySide2 is referenced by the modulegraph but isn't importable. (#3997)
- Correctly parse the `--debug=import`, `--debug=bootloader`, and `--debug=noarchive` command-line options. (#3808)
- Don't treat PyQt5 and PySide2 files as resources in an OS X windowed build. Doing so causes the resulting frozen app to fail under Qt 5.12. (#4237)
- Explicitly specify an encoding of UTF-8 when opening *all* text files. (#3605)
- Fix appending the content of datas in a *spec* files to binaries instead of the internal datas. (#2326, #3694)
- Fix crash when changing from `--onefile` to `--onedir` on consecutive runs. (#3662)
- Fix discovery of Qt paths on Anaconda. (#3740)
- Fix encoding error raised when reading a XML manifest file which includes non-ASCII characters. This error inhibited building an executable which has non-ASCII characters in the filename. (#3478)
- Fix inputs to `QCoreApplication` constructor in `Qt5LibraryInfo`. Now the core application's initialization and finalization in addition to system-wide and application-wide settings is safer. (#4121)
- Fix installation with pip 19.0. (#4003)
- Fixes PE-file corruption during version update. (#3142, #3572)
- In the fake `'site'` module set `USER_BASE` to empty string instead of None as Jupyter Notebook requires it to be a `'str'`. (#3945)
- Query PyQt5 to determine if SSL is supported, only adding SSL DLLs if so. In addition, search the path for SSL DLLs, instead of looking in Qt's `BinariesPath`. (#4048)
- Require `pywin32-ctypes` version 0.2.0, the minimum version which supports Python 3.7. (#3763)
- Use `pkgutil` instead of filesystem operations for interacting with the modules. (#4181)

## Incompatible Changes

- PyInstaller is no longer tested against Python 3.4, which is end-of-live.
- Functions `compat.architecture()`, `compat.system()` and `compat.machine()` have been replace by variables of the same name. This avoids evaluating the save several times.
- Require an option for the `--debug` argument, rather than assuming a default of `all`. (#3737)

## Hooks

- Added hooks for [aliyunSDKcore](#) (#4228), [astropy](#) (#4274), [BTrees](#) (#4239), [dateparser.utils.strptime](#) (#3790), [faker](#) (#3989, #4133), [gooey](#) (#3773), [GtkSourceView](#) (#3893), [imageio\\_ffmpeg](#) (#4051), [importlib\\_metadata](#) and [importlib\\_resources](#) (#4095), [jsonpath\\_rw\\_ext](#) (#3841), [jupyterlab](#) (#3951), [lz4](#) (#3710), [magic](#) (#4267), [nanite](#) (#3860), [nbconvert](#) (#3947), [nbdime](#) (#3949), [nbformat](#) (#3946), [notebook](#) (#3950), [pendulum](#) (#3906), [pysoundfile](#) (#3844), [python-docx](#) (#2574, #3848), [python-wavefile](#) (#3785), [pytzdata](#) (#3906), [PyWavelets](#) [pywt](#) (#4120), [pywebview](#) (#3771), [radicale](#) (#4109), [rdflib](#) (#3708), [resampy](#) (#3702), [sqlalchemy-migrate](#) (#4250), [textdistance](#) (#4239), [tcod](#) (#3622), [ttkthemes](#) (#4105), and [umap-learn](#) (#4165).
- Add runtime hook for [certifi](#). (#3952)
- Updated hook for ‘notebook’ to look in all Jupyter paths reported by [jupyter\\_core](#). (#4270)
- Fixed hook for ‘notebook’ to only include directories that actually exist. (#4270)
- Fixed pre-safe-import-module hook for [setuptools.extern.six](#). (#3806)
- Fixed QtWebEngine hook on OS X. (#3661)
- Fixed the QtWebEngine hook on distributions which don’t have a NSS subdir (such as Archlinux) (#3758)
- Include dynamically-imported backends in the [eth\\_hash](#) package. (#3681)
- Install platform-specific dependencies only on that platform. (#4168)
- Skip packaging PyQt5 QML files if the QML directory doesn’t exist. (#3864)
- Support ECC in [PyCryptodome](#). (#4212, #4229)
- Updated PySide2 hooks to follow PyQt5 approach. (#3655, #3689, #3724, #4040, #4103, #4136, #4175, #4177, #4198, #4206)
- Updated the [jsonschema](#) hook for v3.0+. (#4100)
- Updated the Sphinx hook to correctly package Sphinx 1.8.

## Bootloader

- Update bundled zlib library to 1.2.11 address vulnerabilities. (#3742)

## Documentation

- Update the text produced by `--help` to state that the `--debug` argument requires an option. Correctly format this argument in the Sphinx build process. (#3737)

## Project & Process

- Remove the PEP-518 “build-system” table from `pyproject.toml` to fix installation with pip 19.0.

## PyInstaller Core

- Add support for folders in *COLLECT* and *BUNDLE*. (#3653)
- Completely remove *pywin32* dependency, which has erratic releases and the version on pypi may no longer have future releases. Require *pywin32-ctypes* instead which is pure python. (#3728, #3729)
- modulegraph: Align with upstream version 0.17.
- Now prints a more descriptive error when running a tool fails (instead of dumping a trace-back). (#3772)
- Suppress warnings about missing UCRT dependencies on Win 10. (#1566, #3736)

## Test-suite and Continuous Integration

- Fix Appveyor failures of `test_stderr_encoding()` and `test_stdout_encoding()` on Windows Python 3.7 x64. (#4144)
- November update of packages used in testing. Prevent pyup from touching `test/requirements-tools.txt`. (#3845)
- Rewrite code to avoid a `RemovedInPytest4Warning: Applying marks directly to parameters is deprecated, please use pytest.param(..., marks=...) instead.`
- Run Travis tests under Xenial; remove the deprecated `sudo: false` tag. (#4140)
- Update the Markdown test to comply with [Markdown 3.0 changes](#) by using correct syntax for [extensions](#).

## 3.4 (2018-09-09)

### Features

- Add support for Python 3.7 (#2760, #3007, #3076, #3399, #3656), implemented by Hartmut Goebel.
- Improved support for Qt5-based applications (#3439). By emulating much of the Qt deployment tools' behavior most PyQt5 variants are supported. However, Anaconda's PyQt5 packages are not supported because its `QlibraryInfo` implementation reports incorrect values. CI tests currently run on PyQt5 5.11.2. Many thanks to Bryan A. Jones for taking this struggle.
- `--debug` now allows more debugging to be activated more easily. This includes bootloader messages, Python's "verbose imports" and store collected Python files in the output directory instead of freezing. See `pyinstaller --help` for details. (#3546, #3585, #3587)
- Hint users to install development package for missing *pyconfig.h*. (#3348)
- In `setup.py` specify Python versions this distribution is compatible with.
- Make `base_library.zip` reproducible: Set time-stamp of files. (#2952, #2990)
- New command-line option `--bootloader-ignore-signals` to make the bootloader forward all signals to the bundle application. (#208, #3515)
- (OS X) Python standard library module `plistlib` is now used for generating the `Info.plist` file. This allows passing complex and nested data in `info_plist`. (#3532, #3541)

## Bugfix

- Add missing warnings module to `base_library.zip`. (#3397, #3400)
- Fix and simplify search for libpython on Windows, msys2, cygwin. (#3167, #3168)
- Fix incompatibility with *pycryptodome* (a replacement for the apparently abandoned *pycrypto* library) when using encrypted PYZ-archives. (#3537)
- Fix race condition caused by the bootloader parent process terminating before the child is finished. This might happen e.g. when the child process itself plays with `switch_root`. (#2966)
- Fix wrong security alert if a filename contains `...` (#2641, #3491)
- Only update resources of cached files when necessary to keep signature valid. (#2526)
- (OS X) Fix: App icon appears in the dock, even if `LSUIElement=True`. (#1917, #2075, #3566)
- (Windows) Fix crash when trying to add resources to Windows executable using the `--resource` option. (#2675, #3423)
- (Windows) Only update resources when necessary to keep signature valid (#3323)
- (Windows) Use UTF-8 when reading XML manifest file. (#3476)
- (Windows) `utils/win32`: trap invalid `--icon` arguments and terminate with a message. (#3126)

## Incompatible Changes

- Drop support for Python 3.3 (#3288), Thanks to Hugo and xoviat.
- `--debug` now expects an (optional) argument. Thus using `... --debug script.py` will break. Use `... script.py --debug` or `... --debug=all script.py` instead. Also `--debug=all` (which is the default if no argument is given) includes `noarchive`, which will store all collected Python files in the output directory instead of freezing them. Use `--debug=bootloader` to get the former behavior. (#3546, #3585, #3587)
- (minor) Change naming of intermediate build files and the *warn* file. This only effects 3rd-party tools (if any exists) relying on the names of these files.
- (minor) The destination path for `--add-data` and `--add-binary` must no longer be empty, use `.` instead. (#3066)
- (minor) Use standard path, not dotted path, for C extensions (Python 3 only).

## Hooks

- New hooks for bokeh visualization library (#3607), Champlain, Clutter (#3443) dynaconf (#3641), flex (#3401), FMPy (#3589), gi.repository.xlib (#2634, #3396) google-cloud-translate, google-api-core (#3658), jedi (#3535, #3612), nltk (#3705), pandas (#2978, #2998, #2999, #3015, #3063, #3079), phonenumbers (#3381, #3558), pinyin (#2822), PySide.phonon, PySide.QtSql (#2859), pytorch (#3657), scipy (#2987, #3048), uvloop (#2898), web3, eth\_account, eth\_keyfile (#3365, #3373).
- Updated hooks for Cryptodome 3.4.8, Django 2.1, gevent 1.3. Crypto (support for PyCryptodome) (#3424), Gst and GdkPixbuf (to work on msys2, #3257, #3387), sphinx 1.7.1, setuptools 39.0.
- Updated hooks for PyQt5 (#1930, #1988, #2141, #2156, #2220, #2518, #2566, #2573, #2577, #2857, #2924, #2976, #3175, #3211, #3233, #3308, #3338, #3417, #3439, #3458, #3505), among others:
  - All QML is now loaded by `QtQml.QQmlEngine`.
  - Improve error reporting when determining the PyQt5 library location.

- Improved method for finding `qt.conf`.
- Include OpenGL fallback DLLs for PyQt5. (#3568).
- Place PyQt5 DLLs in the correct location (#3583).
- Fix hooks for cryptodome (#3405), PySide2 (style mismatch) (#3374, #3578)
- Fix missing SSL libraries on Windows with PyQt5.QtNetwork. (#3511, #3520)
- Fix zmq on Windows Python 2.7. (#2147)
- (GNU/Linux) Fix hook usb: Resolve library name reported by usb.backend. (#2633, #2831, #3269)
- Clean up the USB hook logic.

## Bootloader

- Forward all signals to the child process if option `pyi-bootloader-ignore-signals` to be set in the archive. (#208, #3515)
- Use `waitpid` instead of `wait` to avoid the bootloader parent process gets signaled. (#2966)
- (OS X) Don't make the application a GUI app by default, even in `--windowed` mode. Not enforcing this programmatically in the bootloader allows to control behavior using `Info.plist` options - which can be set in PyInstaller itself or in the `.spec`-file. (#1917, #2075, #3566)
- (Windows) Show respectively print utf-8 debug messages ungarbled. (#3477)
- Fix `setenv()` call when `HAVE_UNSETENV` is not defined. (#3722, #3723)

## Module Loader

- Improved error message in case importing an extension module fails. (#3017)

## Documentation

- Fix typos, smaller errors and formatting errors in documentation. (#3442, #3521, #3561, #3638)
- Make clear that `--windowed` is independent of `--onedir`. (#3383)
- Mention imports using `import imp.find_module()` are not detected.
- Reflect actual behavior regarding `LD_LIBRARY_PATH`. (#3236)
- (OS X) Revise section on `info_plist` for `plistlib` functionality and use an example more aligned with real world usage. (#3532, #3540, #3541)
- (developers) Overhaul guidelines for commit and commit-messages. (#3466)
- (developers) Rework developer's quick-start guide.

### Project & Process

- Add a `pip requirements.txt` file.
- Let *pyup* update package requirements for “Test – Libraries” every month only.
- Use *towncrier* to manage the change log entries. ([#2756](#), [#2837](#), [#3698](#))

### PyInstaller Core

- Add `requirements_for_package()` and `collect_all()` helper functions for hooks.
- Add a explanatory header to the `warn`-file, hopefully reducing the number of those posting the file to the issue tracker.
- Add module `enum` to `base_library.zip`, required for module `re` in Python 3.6 (and `re` is required by `warnings`).
- Always write the `warn` file.
- Apply `format_binaries_and_datas()` (which converts hook-style tuples into TOC-style tuples) to binaries and datas added through the hook api.
- Avoid printing a useless exceptions in the `get_module_file_attribute()` helper function..
- Don’t gather Python extensions in `collect_dynamic_libc()`.
- Fix several `ResourceWarnings` and `DeprecationWarnings` ([#3677](#))
- Hint users to install necessary development packages if, in `format_binaries_and_datas()`, the file not found is `pyconfig.h`. ([#1539](#), [#3348](#))
- Hook helper function `is_module_satisfies()` returns `False` for packages not found. ([#3428](#), [#3481](#))
- Read data for cache digest in chunks. ([#3281](#))
- Select correct file extension for C-extension file-names like `libzmq.cp36-win_amd64.pyd`.
- State type of import (conditional, delayed, etc.) in the `warn` file again.
- (modulegraph) Unbundle *altgraph* library, use from upstream. ([#3058](#))
- (OS X) In `--console` mode set `LSBackgroundOnly=True` in `Info.plist` to hide the app-icon in the dock. This can still be overruled by passing `info_plist` in the `.spec`-file. ([#1917](#), [#3566](#))
- (OS X) Use the python standard library `plistlib` for generating the `Info.plist` file. ([#3532](#), [#3541](#))
- (Windows) Completely remove *pywin32* dependency, which has erratic releases and the version on pypi may no longer have future releases. Require *pywin32-ctypes* instead, which is pure python. ([#3141](#))
- (Windows) Encode manifest before updating resource. ([#3423](#))
- (Windows) Make import compatible with python.net, which uses an incompatible signature for `__import__`. ([#3574](#))



## Test-suite and Continuous Integration

- Add script and dockerfile for running tests in docker. (Contributed, not maintained) (#3519)
- Avoid log messages to be written (and captured) twice.
- Fix decorator `skipif_no_compiler`.
- Fix the test for the “W” run-time Python option to verify module *warnings* can actually be imported. (#3402, #3406)
- Fix unicode errors when not capturing output by pytest.
- Run `pyinstaller -h` to verify it works.
- `test_setuptools_nspkg` no longer modifies source files.
- Appveyor:
  - Add documentation for Appveyor variables used to `appveyor.yml`.
  - Significantly clean-up `appveyor.yml` (#3107)
  - Additional tests produce > 1 hour runs. Split each job into two jobs.
  - Appveyor tests run on 2 cores; therefore, run 2 jobs in parallel.
  - Reduce disk usage.
  - Split Python 2.7 tests into two jobs to avoid the 1 hour limit.
  - Update to use Windows Server 2016. (#3563)
- Travis
  - Use build-stages.
  - Clean-up `travis.yml` (#3108)
  - Fix Python installation on OS X. (#3361)
  - Start a X11 server for the “Test - Libraries” stage only.
  - Use target python interpreter to compile bootloader to check if the build tool can be used with that this Python version.

## Bootloader build

- Print invoking python version when compiling.
- Update *waf* build-tool to 2.0.9 and fix our *wscript* for *waf* 2.0.
- (GNU/Linux) When building with `--debug` turn of `FORTIFY_SOURCE` to ease debugging.

## Known Issues

- Anaconda's PyQt5 packages are not supported because its `QLibraryInfo` implementation reports incorrect values.
- All scripts frozen into the package, as well as all run-time hooks, share the same global variables. This issue exists since v3.2 but was discovered only lately, see [#3037](#). This may lead to leaking global variables from run-time hooks into the script and from one script to subsequent ones. It should have effects in rare cases only, though.
- Data-files from wheels, unzipped eggs or not an egg at all are not included automatically. This can be worked around using a hook-file, but may not suffice when using `--onefile` and something like *python-daemon*.
- The multipackage (MERGE) feature ([#1527](#)) is currently broken.
- (OSX) Support for OpenDocument events ([#1309](#)) is broken.
- (Windows) With Python 2.7 the frozen application may not run if the user-name (more specifically `%TEMPDIR%`) includes some Unicode characters. This does not happen with all Unicode characters, but only some and seems to be a windows bug. As a work-around please upgrade to Python 3 ([#2754](#), [#2767](#)).
- (Windows) For Python `>= 3.5` targeting *Windows < 10*, the developer needs to take special care to include the Visual C++ run-time .dlls. Please see the section *Platform-specific Notes* in the manual. ([#1566](#))

### 3.3.1 (2017-12-13)

## Hooks

- Fix imports in hooks `accessible_output` and `sound_lib` ([#2860](#)).
- Fix `ImportError` for `sysconfig` for 3.5.4 Conda ([#3105](#), [#3106](#)).
- Fix shapely hook for conda environments on Windows ([#2838](#)).
- Add hook for `unidecode`.

## Bootloader

- (Windows) Pre-build bootloaders (and custom-build ones using MSVC) can be used on Windows XP again. Set minimum target OS to XP ([#2974](#)).

## Bootloader build

- Fix build for FreeBSD ([#2861](#), [#2862](#)).

## PyInstaller Core

- Usage: Add help-message clarifying use of options when a spec-file is provided (#3039).
- Add printing infos on UnicodeDecodeError in `exec_command(_all)`.
- (win32) Issue an error message on errors loading the icon file (#2039).
- (aarch64) Use correct bootloader for 64-bit ARM (#2873).
- (OS X) Fix replacement of run-time search path keywords (@. . . ) (#3100).
- Modulegraph
  - Fix recursion too deep errors cause by reimporting SWIG-like modules (#2911, #3040, #3061).
  - Keep order of imported identifiers.

## Test-suite and Continuous Integration

- In Continuous Integration tests: Enable flake8-diff linting. This will refuse all changed lines not following PEP 8.
- Enable parallel testing on Windows,
- Update requirements.
- Add more test cases for modulegraph.
- Fix a test-case for order of module import.
- Add test-cases to check scripts do not share the same global vars (see *Known Issues*).

## Documentation

- Add clarification about treatment of options when a spec-file is provided (#3039).
- Add docs for running PyInstaller with Python optimizations (#2905).
- Add notes about limitations of Cython support.
- Add information how to handle undetected ctypes libraries.
- Add notes about requirements and restrictions of SWIG support.
- Add note to clarify what *binary files* are.
- Add a Development Guide.
- Extend “How to Contribute”.
- Add “Running the Test Suite”.
- Remove badges from the Readme (#2853).
- Update outdated sections in man-pages and other enhancements to the man-page.

## Known Issues

- All scripts frozen into the package, as well as all run-time hooks, share the same global variables. This issue exists since v3.2 but was discovered only lately, see [#3037](#). This may lead to leaking global variables from run-time hooks into the script and from one script to subsequent ones. It should have effects in rare cases only, though.
- Further see the *Known Issues for release 3.3*.

## 3.3 (2017-09-21)

- **Add Support for Python 3.6!** Many thanks to xiovat! ([#2331](#), [#2341](#))
- New command line options for adding data files (`--datas`, [#1990](#)) and binaries (`--binaries`, [#703](#))
- Add command line option `--runtime-tmpdir`.
- Bootloaders for Windows are now build using MSVC and statically linked with the run-time-library (CRT). This solved a lot of issues related to .dlls being incompatible with the ones required by `python.dll`.
- Bootloaders for GNU/Linux are now officially no LSB binaries. This was already the case since release 3.1, but documented the other way round. Also the build defaults to non-LSB binaries now. ([#2369](#))
- We improved and stabilized both building the bootloaders and the continuous integration tests. See below for details. Many thanks to all who worked on this.
- To ease solving issues with packages included wrongly, the html-file with a cross-reference is now always generated. It's visual appearance has been modernized ([#2765](#)).

## Incompatible changes

- Command-line option obsoleted several version ago are not longer handled gracefully but raise an error ([#2413](#))
- Installation: PyInstaller removed some internal copies of 3rd-party packages. These are now taken from their official releases at PyPI ([#2589](#)). This results in PyInstaller to no longer can be used from just an unpacked archive, but needs to be installed like any Python package. This should effect only a few people, e.g. the developers.
- Following [PEP 527](#), we only release one source archive now and decided to use `.tar.gz` ([#2754](#)).

## Hooks

- New and Updated hooks: `accessible_output2` ([#2266](#)), `ADIOS` ([#2096](#)), `CherryPy` ([#2112](#)), `PySide2` ([#2471](#), [#2744](#)) ([#2472](#)), `Sphinx` ([#2612](#), [2708](#)) ([#2708](#)), `appdir` ([#2478](#)), `clr` ([#2048](#)), `cryptodome` ([#2125](#)), `cryptography` ([#2013](#)), `dclab` ([#2657](#)), `django` ([#2037](#)), `django migrations` ([#1795](#)), `django.contrib` ([#2336](#)), `google.cloud`, `google.cloud.storage`, `gstreamer` ([#2603](#)), `imageio` ([#2696](#)), `langcodes` ([#2682](#)), `libaudioverse` ([#2709](#)), `mpl_toolkits` ([#2400](#)), `numba`, `llvmlite` ([#2113](#)), `openpyxl` ([#2066](#)), `pylint`, `pymssql`, `pyopencl`, `pyproj` ([#2677](#)), `pytest` ([#2119](#)), `qtawesome` ([#2617](#)), `redmine`, `requests` ([#2334](#)), `setuptools`, `setuptools` ([#2565](#)), `shapely` ([#2569](#)), `sound_lib` ([#2267](#)), `sysconfig`, `uniseg` ([#2683](#)), `urllib3`, `wx.rc` ([#2295](#)),
  - `numpy`: Look for .dylib libraries, too ( [#2544](#)), support numpy MKL builds ([#1881](#), [#2111](#))
  - `osgeo`: Add conda specific places to check for auxiliary data ([#2401](#))
  - QT and related
    - \* Add hooks for PySide2
    - \* Eliminate run-time hook by placing files in the correct directory

- \* Fix path in homebrew for searching for qmake (#2354)
- \* Repair Qt dll location (#2403)
- \* Bundle PyQt 5.7 DLLs (#2152)
- \* PyQt5: Return qml plugin path including subdirectory (#2694)
- \* Fix hooks for PyQt5.QtQuick (#2743)
- \* PyQt5.QtWebEngineWidgets: Include files needed by QWebEngine
- GKT+ and related
  - \* Fix Gir file path on windows.
  - \* Fix unnecessary file search & generation when GI's typelib is exists
  - \* gi: change gir search path when running from a virtualenv
  - \* gi: package gdk-pixbuf in osx codesign agnostic dir
  - \* gi: rewrite the GdkPixbuf loader cache at runtime on Linux
  - \* gi: support onefile mode for GdkPixbuf
  - \* gi: support using gdk-pixbuf-query-loaders-64 when present
  - \* gi: GIR files are only required on OSX
  - \* gio: copy the mime.cache also
  - \* Fix hooks for PyGObject on windows platform (#2306)
- Fixed hooks: botocore (#2384), clr (#1801), gstreamer (#2417), h5py (#2686), pylint, Tix data files (#1660), usb.core (#2088), win32com on non-windows-systems (#2479)
- Fix multiprocessing spawn mode on POSIX OSs (#2322, #2505, #2759, #2795).

## Bootloader

- Add *tempdir* option to control where bootloader will extract files (#2221)
- (Windows) in releases posted on PyPI requires msvc\*.dll (#2343)
- Fix unsafe string manipulation, resource and memory leaks. Thanks to Vito Kortbeek (#2489, #2502, #2503)
- Remove a left-over use of `getenv()`
- Set proper LISTEN\_PID (set by *systemd*) in child process (#2345)
- Adds PID to bootloader log messages (#2466, #2480)
- (Windows) Use `_wputenv_s()` instead of `SetEnvironmentVariableW()`
- (Windows) Enhance error messages (#1431)
- (Windows) Add workaround for a Python 3 issue <http://bugs.python.org/issue29778> (#2496, #2844)
- (OS X): Use single process for `–onedir` mode (#2616, #2618)
- (GNU/Linux) Compile bootloaders with `–no-lsb` by default (#2369)
- (GNU/Linux) Fix: linux64 bootloader requires glibc 2.14 (#2160)
- (GNU/Linux) `set_dynamic_library_path` change breaks plugin library use (#625)

### Bootloader build

The bootloader build was largely overhauled. In the wscript, the build no longer depends on the Python interpreter's bit-size, but on the compiler. We have a machine for building bootloaders for Windows and cross-building for OS X. Thus all maintainers are now able to build the bootloaders for all supported platforms.

- Add “official” build-script.
- (GNU/Linux) Make `--no-lsb` the default, add option `--lsb`.
- Largely overhauled Vagrantfile:
  - Make Darwin bootloaders build in OS X box (unused)
  - Make Windows bootloaders build using MSVC
  - Allow specifying cross-target on linux64.
  - Enable cross-building for OS X.
  - Enable cross-building for Windows (unused)
  - Add box for building osxcross.
- Largely overhauled wscript:
  - Remove options `--target-cpu`.
  - Use compiler's target arch, not Python's.
  - Major overhaul of the script
  - Build zlib if required, not if “on windows”.
  - Remove obsolete warnings.
  - Update Solaris, AIX and HP-UX support.
  - Add flags for ‘strip’ tool in AIX platform.
  - Don't set POSIX / SUS version defines.
- (GNU/Linux) for 64-bit arm/aarch ignore the **gcc** flag `-m64` (#2801).

### Module loader

- Implement PEP-451 ModuleSpec type import system (#2377)
- Fix: Import not thread-safe? (#2010, #2371)

### PyInstaller Core

- Analyze: Check Python version when testing whether to rebuild.
- Analyze: Don't fail on syntax error in modules, simply ignore them.
- Better error message when *datas* are not found. (#2308)
- Building: OSX: Use unicode literals when creating Info.plist XML
- Building: Don't fail if “datas” filename contain glob special characters. (#2314)
- Building: Read runtime-tmpdir from .spec-file.
- Building: Update a comment.

- building: warn users if bincache gets corrupted. (#2614)
- Cli-utils: Remove graceful handling of obsolete command line options.
- Configure: Create new parent-dir when moving old cache-dir. (#2679)
- Depend: Include vcruntime140.dll on Windows. (#2487)
- Depend: print nice error message if analyzed script has syntax error.
- Depend: When scanning for ctypes libs remove non-basename binaries.
- Enhance run-time error message on ctypes import error.
- Fix #2585: py2 non-unicode sys.path been tempted by os.path.abspath(). (#2585)
- Fix crash if extension module has hidden import to ctypes. (#2492)
- Fix handling of obsolete command line options. (#2411)
- Fix versioninfo.py breakage on Python 3.x (#2623)
- Fix: “Unicode-objects must be encoded before hashing” (#2124)
- Fix: UnicodeDecodeError - collect\_data\_files does not return filenames as unicode (#1604)
- Remove graceful handling of obsolete command line options. (#2413)
- Make grab version more polite on non-windows (#2054)
- Make utils/win32/versioninfo.py round trip the version info correctly.
- Makespec: Fix version number processing for PyCrypto. (#2476)
- Optimizations and refactoring to modulegraph and scanning for ctypes dependencies.
- pyinstaller should not crash when hitting an encoding error in source code (#2212)
- Remove destination for COLLECT and EXE prior to copying it (#2701)
- Remove uninformative traceback when adding not found data files (#2346)
- threading bug while processing imports (#2010)
- utils/hooks: Add logging to collect\_data\_files.
- (win32) Support using pypiwin32 or pywin32-ctypes (#2602)
- (win32) Use os.path.normpath to ensure that system libs are excluded.
- (win32) Look for libpython%.%.dll in Windows MSYS2 (#2571)
- (win32) Make versioninfo.py round trip the version info correctly (#2599)
- (win32) Ensure that pywin32 isn’t imported before check\_requirements is called
- (win32) pyi-grab\_version and –version-file not working? (#1347)
- (win32) Close PE() object to avoid mmap memory leak (#2026)
- (win32) Fix: ProductVersion in windows version info doesn’t show in some cases (#846)
- (win32) Fix multi-byte path bootloader import issue with python2 (#2585)
- (win32) Forward DYLD\_LIBRARY\_PATH through *arch* command. (#2035)
- (win32) Add vcruntime140.dll to \_win\_includes for Python 3.5 and 3.6 (#2487)
- (OS X) Add libpython%.%.dylib to Darwin (is\_darwin) PYDYLIB\_NAMES. (#1971)
- (OS X) macOS bundle Info.plist should be in UTF-8 (#2615)

- (OS X) multiprocessing spawn in python 3 does not work on macOS (#2322)
- (OS X) Pyinstaller not able to find path (@rpath) of dynamic library (#1514)
- Modulegraph
  - Align with upstream version 0.13.
  - Add the upstream test-suite
  - Warn on syntax error and unicode error. (#2430)
  - Implement `enumerate_instructions()` (#2720)
  - Switch byte-code analysis to use *Instruction* (like dis3 does) (#2423)
  - Log warning on unicode error instead of only a debug message (#2418)
  - Use standard logging for messages. (#2433)
  - Fix to reimport failed SWIG C modules (1522, #2578).
- Included 3rd-party libraries
  - Remove bundled `pefile` and `macholib`, use the releases from PyPI. (#1920, #2689)
  - altgraph: Update to altgraph 0.13, add upstream test-suite.

### Utilities

- **grab\_version.py**: Display a friendly error message when utility fails (#859, #2792).

### Test-suite and Continuous Integration

- Rearrange requirements files.
- Pin required versions – now updated using `pyup` (#2745)
- Hide useless trace-backs of helper-functions.
- Add a test for `PyQt5.QtQuick`.
- Add functional tests for `PySide2`
- Add test for new feature `--runtime-tmpdir`.
- Fix regression-test for #2492.
- unit: Add test-cases for `PyiModuleGraph`.
- unit/altgraph: Bringing in upstream altgraph test-suite.
- unit/modulegraph: Bringing in the modulegraph test-suite.
- Continuous Integration
  - Lots of enhancements to the CI tests to make them more stabile and reliable.
  - Pin required versions – now updated using `pyup` (#2745)
  - OS X is now tested along with GNU/Linux at Travis CI (#2508)
  - Travis: Use stages (#2753)
  - appveyor: Save cache on failure (#2690)



- appveyor: Verify built bootloaders have the expected arch.

## Documentation

- Add information how to donate (#2755, #2772).
- Add how to install the development version using pip.
- Fix installation instructions for development version. (#2761)
- Better examples for hidden imports.
- Clarify and fix “Adding Data Files” and “Adding Binary Files”. (#2482)
- Document new command line option ‘–runtime-tmpdir’.
- pyinstaller works on powerpc linux, big endian arch (#2000)
- Largely rewrite section “Building the Bootloader”, update from the wiki page.
- Describe building LSB-compliant bootloader as (now) special case.
- help2rst: Add cross-reference labels for option-headers.
- Enable sphinx.ext.intersphinx and links to our website.
- Sphinx should not “adjust” display of command line documentation (#2217)

## Known Issues

- Data-files from wheels, unzipped eggs or not ad egg at all are not included automatically. This can be worked around using a hook-file, but may not suffice when using `--onefile` and something like *python-daemon*.
- The multipackage (MERGE) feature (#1527) is currently broken.
- (OSX) Support for OpenDocument events (#1309) is broken.
- (Windows) With Python 2.7 the frozen application may not run if the user-name (more specifically %TEMPDIR%) includes some Unicode characters. This does not happen with all Unicode characters, but only some and seems to be a windows bug. As a work-around please upgrade to Python 3 (#2754, #2767).
- (Windows) For Python >= 3.5 targeting *Windows < 10*, the developer needs to take special care to include the Visual C++ run-time .dlls. Please see the section *Platform-specific Notes* in the manual. (#1566)
- For Python 3.3, imports are not thread-safe (#2371#). Since Python 3.3 is end of live at 2017-09-29, we are not going to fix this.

### 3.2.1 (2017-01-15)

- New, updated and fixed hooks: botocore (#2094), gi (#2347), jira (#2222), PyQt5.QtWebEngineWidgets (#2269), skimage (#2195, 2225), sphinx (#2323,) xsge\_gui (#2251).

Fixed the following issues:

- Don’t fail if working directory already exists (#1994)
- Avoid encoding errors in main script (#1976)
- Fix hasher digest bytes not str (#2229, #2230)
- (Windows) Fix additional dependency on the msvcrt10.dll (#1974)

- (Windows) Correctly decode a bytes object produced by pefile (#1981)
- (Windows) Package `pefile` with pyinstaller. This partially undoes some changes in 3.2 in which the packaged pefiles were removed to use the pypi version instead. The pypi version was considerably slower in some applications, and still has a couple of small issues on PY3. (#1920)
- (OS X) PyQt5 packaging issues on MacOS (#1874)
- (OS X) Replace run-time search path keyword (#1965)
- (OS X) (Re-) add argv emulation for OSX, 64-bit (#2219)
- (OS X) use `decode("utf-8")` to convert bytes in `getImports_macholib()` (#1973)
- (Bootloader) fix segfaults (#2176)
- (setup.py) pass option `--no-lsb` on GNU/Linux only (#1975)
- Updates and fixes in documentation, manuals, et al. (#1986, 2002, #2153, #2227, #2231)

### 3.2 (2016-05-03)

- Even the “main” script is now byte-compiled (#1847, #1856)
- The manual is on [readthedocs.io](http://readthedocs.io) now (#1578)
- On installation try to compile the bootloader if there is none for the current platform (#1377)
- (Unix) Use `objcopy` to create a valid ELF file (#1812, #1831)
- (Linux): Compile with `_FORTIFY_SOURCE` (#1820)
- New, updated and fixed hooks: CherryPy (#1860), Cryptography (#1425, #1861), enchant (1562), `gi.repository.GdkPixbuf` (#1843), `gst` (#1963), `Lib2to3` (#1768), `PyQt4`, `PyQt5`, `PySide` (#1783, #1897, #1887), `SciPy` (#1908, #1909), `sphinx` (#1911, #1912), `sqlalchemy` (#1951), `traitlets wx.lib.pubsub` (#1837, #1838),
- For windowed mode add `isatty()` for our dummy `NullWriter` (#1883)
- Suppress “Failed to execute script” in case of `SystemExit` (#1869)
- Do not apply Upx compressor for bootloader files (#1863)
- Fix absolute path for lib used via `ctypes` (#1934)
- (OSX) Fix binary cache on NFS (#1573, #1849)
- (Windows) Fix message in `grab_version` (#1923)
- (Windows) Fix wrong icon parameter in Windows example (#1764)
- (Windows) Fix win32 unicode handling (#1878)
- (Windows) Fix unnecessary rebuilds caused by rebuilding `winmanifest` (#1933)
- (Cygwin) Fix finding the Python library for Cygwin 64-bit (#1307, #1810, #1811)
- (OSX) Fix compilation issue (#1882)
- (Windows) No longer bundle `pefile`, use package from pypi for windows (#1357)
- (Windows) Provide a more robust means of executing a Python script
- AIX fixes.
- Update waf to version 1.8.20 (#1868)
- Fix `excludedimports`, more predictable order how hooks are applied #1651

- Internal improvements and code clean-up (#1754, #1760, #1794, #1858, #1862, #1887, #1907, #1913)
- Clean-ups fixes and improvements for the test suite

#### Known Issues

- Apps built with Windows 10 and Python 3.5 may not run on Windows versions earlier than 10 (#1566).
- The multipackage (MERGE) feature (#1527) is currently broken.
- (OSX) Support for OpenDocument events (#1309) is broken.

### 3.1.1 (2016-01-31)

Fixed the following issues:

- Fix problems with setuptools 19.4 (#1772, #1773, #1790, #1791)
- 3.1 does not collect certain direct imports (#1780)
- Git reports wrong version even if on unchanged release (#1778)
- Don't resolve symlinks in modulegraph.py (#1750, #1755)
- ShortFileName not returned in win32 util (#1799)

### 3.1 (2016-01-09)

- Support reproducible builds (#490, #1434, #1582, #1590).
- Strip leading parts of paths in compiled code objects (#1059, #1302, #1724).
- With `--log-level=DEBUG`, a dependency graph-file is emitted in the build-directory.
- Allow running pyinstaller as user *root*. By popular demand, see e.g. #1564, #1459, #1081.
- New Hooks: `boto3`, `boto3`, `distorm3`, `GObject`, `GI` (G Introspection), `GStreamer`, `GEvent`, `kivy`, `lxml.isoschematron`, `pubsub.core`, `PyQt5.QtMultimedia`, `scipy.linalg`, `shelve`.
- Fixed or Updated Hooks: `astroid`, `django`, `jsonschema` `logilab`, `PyQt4`, `PyQt5`, `skimage`, `sklearn`.
- Add option `--hiddenimport` as an alias for `--hidden-import`.
- (OSX): Fix issues with `st_flags` (#1650).
- (OSX) Remove warning message about 32bit compatibility (#1586).
- (Linux) The cache is now stored in `$XDG_CACHE_HOME/pyinstaller` instead of `$XDG_DATA_HOME` - the cache is moved automatically (#1118).
- Documentation updates, e.g. about reproducible builds
- Put back full text of GPL license into `COPYING.txt`.
- Fix crashes when looking for ctypes DLLs (#1608, #1609, #1620).
- Fix: Imports in byte-code not found if code contains a function (#1581).
- Fix recursion into bytes-code when scanning for ctypes (#1620).
- Fix PyCrypto modules to work with crypto feature (`--key` option) (#1663).
- Fix problems with `excludedimports` in some hook excluding the named modules even if used elsewhere (#1584, #1600).

- Fix freezing of pip 7.1.2 (#1699).
- FreeBSD and Solaris fixes.
- Search for `ldconfig` in `$PATH` first (#1659)
- Deny processing outdated package `_xmlplus`.
- Improvements to the test-suite, testing infrastructure and continuous integration.
- For non-release builds, the exact git revision is not used.
- Internal code refactoring.
- Enhancements and clean-ups to the hooks API - only relevant for hook authors. See the manual for details. E.g:
  - Removed `attrs` in hooks - they were not used anymore anyway.
  - Change `add/del_import()` to accept arbitrary number of module names.
  - New hook utility function `copy_metadata()`.

### Known Issues

- Apps built with Windows 10 and Python 3.5 may not run on Windows versions earlier than 10 (#1566).
- The multipackage (MERGE) feature (#1527) is currently broken.
- (OSX) Support for OpenDocument events (#1309) is broken.

### 3.0 (2015-10-04)

- Python 3 support (3.3 / 3.4 / 3.5).
- Remove support for Python 2.6 and lower.
- Full unicode support in the bootloader (#824, #1224, #1323, #1340, #1396)
  - (Windows) Python 2.7 apps can now run from paths with non-ASCII characters
  - (Windows) Python 2.7 onefile apps can now run for users whose usernames contain non-ASCII characters
  - Fix `sys.getfilesystemencoding()` to return correct values (#446, #885).
- (OSX) Executables built with PyInstaller under OS X can now be digitally signed.
- (OSX) 32bit precompiled bootloader no longer distributed, only 64bit.
- (Windows) for 32bit bootloader enable flag `LARGEADDRESSAWARE` that allows to use 4GB of RAM.
- New hooks: `amazon-product-api`, `appy`, `certifi`, `countrycode`, `cryptography`, `gi`, `httplib2`, `jsonschema`, `keyring`, `lensfunpy`, `mpl_toolkits.basemap`, `ncclient`, `netCDF4`, `OpenCV`, `osgeo`, `patsy`, `PsychoPy`, `pycountry`, `pycparser`, `PyExcelerate`, `PyGobject`, `pymssql`, `PyNaCl`, `PySiDe.QtCore`, `PySide.QtGui`, `rawpy`, `requests`, `scapy`, `scipy`, `six`, `SpeechRecognition`, `uldb`, `weasyprint`, `Xlib`.
- Hook fixes: `babel`, `ctypes`, `django`, `IPython`, `pint`, `PyEnchant`, `Pygments`, `PyQt5`, `PySide`, `pyusb`, `sphinx`, `sqlalchemy`, `tkinter`, `wxPython`.
- Add support for automatically including data files from eggs.
- Add support for directory eggs support.
- Add support for all kind of namespace packages e.g. `zope.interface`, PEP302 (#502, #615, #665, #1346).
- Add support for `pkgutil.extend_path()`.
- New option `--key` to obfuscate the Python bytecode.

- New option `--exclude-module` to ignore a specific module or package.
- (Windows) New option `--uac-admin` to request admin permissions before starting the app.
- (Windows) New option `--uac-uiaccess` allows an elevated application to work with Remote Desktop.
- (Windows) New options for Side-by-side Assembly searching:
  - `--win-private-assemblies` bundled Shared Assemblies into the application will be changed into Private Assemblies
  - `--win-no-prefer-redirects` while searching for Assemblies PyInstaller will prefer not to follow policies that redirect to newer versions.
- (OSX) New option `--osx-bundle-identifier` to set .app bundle identifier.
- (Windows) Remove old COM server support.
- Allow override PyInstaller default config directory by environment variable `PYINSTALLER_CONFIG_DIR`.
- Add FreeBSD support.
- AIX fixes.
- Solaris fixes.
- Use library modulegraph for module dependency analysis.
- Bootloader debug messages `LOADER: ...` printed to stderr.
- PyInstaller no longer extends `sys.path` and bundled 3rd-party libraries do not interfere with their other versions.
- Enhancements to `Analysis()`:
  - New arguments `excludedimports` to exclude Python modules in import hooks.
  - New argument `binaries` to bundle dynamic libraries in `.spec` file and in import hooks.
  - New argument `datas` to bundle additional data files in `.spec` file and in import hooks.
- A lot of internal code refactoring.
- Test suite migrated to pytest framework.
- Improved testing infrastructure with continuous integration (Travis - Linux, Appveyor - Windows)
- Wiki and bug tracker migrated to github.

### Known Issues

- Apps built with Windows 10 and Python 3.5 may not run on Windows versions earlier than 10 (#1566).
- The multipackage (MERGE) feature (#1527) is currently broken.
- (OSX) Support for OpenDocument events (#1309) is broken.

## Changelog for PyInstaller 2.x

### 2.1 (2013-09-27)

- Rewritten manual explaining even very basic topics.
- PyInstaller integration with setuptools (direct installation with `easy_install` or `pip` from PYPI - <https://pypi.python.org/pypi>). After installation there will be available command 'pyinstaller' for PyInstaller usage.
- (Windows) Alter `-version-file` resource format to allow unicode support.

- (Windows) Fix running frozen app running from paths containing foreign characters.
- (Windows) Fix running PyInstaller from paths containing foreign characters.
- (OSX) Implement `-icon` option for the `.app` bundles.
- (OSX) Add `argv` emulation for OpenDocument AppleEvent (see manual for details).
- Rename `-buildpath` to `-workpath`.
- Created app is put to `-distpath`.
- All temporary work files are now put to `-workpath`.
- Add option `-clean` to remove PyInstaller cache and temporary files.
- Add experimental support for Linux arm.
- Minimum supported Python version is 2.4.
- Add import hooks for docutils, jinja2, sphinx, pytz, idlelib, sqlite3.
- Add import hooks for IPython, Scipy, pygst, Python for .NET.
- Add import hooks for PyQt5, Bacon, raven.
- Fix django import hook to work with Django 1.4.
- Add rthook for twisted, pygst.
- Add rthook for pkg\_resource. It fixes the following functions for frozen app `pkg_resources.resource_stream()`, `pkg_resources.resource_string()`.
- Better support for pkg\_resources (.egg manipulation) in frozen executables.
- Add option `-runtime-hook` to allow running custom code from frozen app before loading other Python from the frozen app. This is useful for some specialized preprocessing just for the frozen executable. E.g. this option can be used to set SIP api v2 for PyQt4.
- Fix runtime option `-Wignore`.
- Rename utils to lowercase: `achieve_viewer.py`, `bindepend.py`, `build.py`, `grab_version.py`, `make_comserver.py`, `makespec.py`, `set_version.py`.
- (OSX) Fix missing `qt_menu.nib` in dist directory when using PySide.
- (OSX) Fix bootloader compatibility with Mac OS X 10.5
- (OSX) Search `libpython` in `DYLD_LIBRARY_PATH` if `libpython` cannot be found.
- (OSX) Fix Python library search in `virtualenv`.
- Environment variable `PYTHONHOME` is now unset and path to python home is set in bootloader by function `Py_SetPythonHome()`. This overrides `sys.prefix` and `sys.exec_prefix` for frozen application.
- Python library filename (e.g. `python27.dll`, `libpython2.7.so.1.0`, etc) is embedded to the created exe file. Bootloader is not trying several filenames anymore.
- Frozen executables now use PEP-302 import hooks to import frozen modules and C extensions. (`sys.meta_path`)
- Drop old import machinery from `iu.py`.
- Drop own code to import modules from zip archives (.egg files) in frozen executables. Native Python implementation is kept unchanged.
- Drop old crypto code. This feature was never completed.
- Drop bootloader dependency on Python headers for compilation.

- (Windows) Recompile bootloaders with VS2008 to ensure win2k compatibility.
- (Windows) Use 8.3 filenames for homepath/temppath.
- Add prefix LOADER to the debug text from bootloader.
- Allow running PyInstaller programmatically.
- Move/Rename some files, code refactoring.
- Add more tests.
- Tilde is in PyInstaller recognized as \$HOME variable.

## 2.0 (2012-08-08)

- Minimum supported Python version is 2.3.
- (OSX) Add support for Mac OS X 64-bit
- (OSX) Add support Mac OS X 10.7 (Lion) and 10.8 (Mountain Lion).
- (OSX) With argument `--windowed` PyInstaller creates application bundle (.app) automatically.
- Add experimental support for AIX (thanks to Martin Gamwell Dawids).
- Add experimental support for Solaris (thanks to Hywel Richards).
- Add Multipackage function to create a collection of packages to avoid library duplication. See documentation for more details.
- New symplified command line interface. `Configure.py/Makespec.py/Build.py` replaced by `pyinstaller.py`. See documentation for more details.
- Removed cross-building/bundling feature which was never really finished.
- Added option `--log-level` to all scripts to adjust level of output (thanks to Hartmut Goebel).
- `rthooks.dat` moved to `support/rthooks.dat`
- Packaged executable now returns the same return-code as the unpackaged script (thanks to Brandyn White).
- Add import hook for PyUSB (thanks to Chien-An “Zero” Cho).
- Add import hook for `wx.lib.pubsub` (thanks to Daniel Hyams).
- Add import hook for `pyttsx`.
- Improve import hook for Tkinter.
- Improve import hook for PyQt4.
- Improve import hook for `win32com`.
- Improve support for running PyInstaller in `virtualenv`.
- Add cli options `--additional-hooks-dir` and `--hidden-import`.
- Remove cli options `-X`, `-K`, `-C`, `--upx`, `--tk`, `--configfile`, `--skip-configure`.
- UPX is used by default if available in the `PATH` variable.
- Remove compatibility code for old platforms (dos, os2, MacOS 9).

- Use Python logging system for message output (thanks to Hartmut Goebel).
- Environment variable MEIPASS2 is accessible as `sys._MEIPASS`.
- Bootloader now overrides PYTHONHOME and PYTHONPATH. PYTHONHOME and PYTHONPATH is set to the value of MEIPASS2 variable.
- Bootloader uses absolute paths.
- (OSX) Drop dependency on otool from Xcode on Mac OSX.
- (OSX) Fix missing qt\_menu.nib in dist directory when using PyQt4.
- (OSX) Bootloader does not use DYLD\_LIBRARY\_PATH on Mac OS X anymore. `@loader_path` is used instead.
- (OSX) Add support to detect .dylib dependencies on Mac OS X containing `@executable_path`, `@loader_path` and `@rpath`.
- (OSX) Use macholib to detect dependencies on dynamic libraries.
- Improve test suite.
- Improve source code structure.
- Replace `os.system()` calls by `subprocess` module.
- Bundle fake 'site' module with frozen applications to prevent loading any user's Python modules from host OS.
- Include runtime hooks (rthooks) in code analysis.
- Source code hosting moved to github: <https://github.com/pyinstaller/pyinstaller>
- Hosting for running tests daily: <https://jenkins.shiningpanda-ci.com/pyinstaller/>

## Changelog for PyInstaller 1.x

### 1.5.1 (2011-08-01)

- New default PyInstaller icon for generated executables on Windows.
- Add support for Python built with `--enable-shared` on Mac OSX.
- Add requirements section to documentation.
- Documentation is now generated by `rst2html` and `rst2pdf`.
- Fix wrong path separators for bootloader-file on Windows
- Add workaround for incorrect `platform.system()` on some Python Windows installation where this function returns 'Microsoft' instead 'Windows'.
- Fix `--windowed` option for Mac OSX where a console executable was created every time even with this option.
- Mention dependency on otool, ldd and objdump in documentation.
- Fix typo preventing detection of DLL libraries loaded by `ctypes` module.



### 1.5 (2011-05-05)

- Full support for Python 2.7.
- Full support for Python 2.6 on Windows. No manual redistribution of DLLs, CRT, manifest, etc. is required: PyInstaller is able to bundle all required dependencies (thanks to Florian Hoech).
- Added support for Windows 64-bit (thanks to Martin Zibricky).
- Added binary bootloaders for Linux (32-bit and 64-bit, using LSB), and Darwin (32-bit). This means that PyInstaller users on this platform don't need to compile the bootloader themselves anymore (thanks to Martin Zibricky and Lorenzo Mancini).
- Rewritten the build system for the bootloader using waf (thanks to Martin Zibricky)
- Correctly detect Python unified binary under Mac OSX, and bail out if the unsupported 64-bit version is used (thanks to Nathan Weston).
- Fix TkInter support under Mac OSX (thanks to Lorenzo Mancini).
- Improve bundle creation under Mac OSX and correctly support also one-dir builds within bundles (thanks to Lorenzo Mancini).
- Fix spurious KeyError when using dbhash
- Fix import of nested packages made from Pyrex-generated files.
- PyInstaller is now able to follow dependencies of binary extensions (.pyd/.so) compressed within .egg-files.
- Add import hook for PyTables.
- Add missing import hook for QtWebKit.
- Add import hook for pywinauto.
- Add import hook for reportlab (thanks Nevar).
- Improve matplotlib import hook (for Mac OSX).
- Improve Django import hooks.
- Improve compatibility across multiple Linux distributions by being more careful on which libraries are included/excluded in the package.
- Improve compatibility with older Python versions (Python 2.2+).
- Fix double-bouncing-icon bug on Mac OSX. Now windowed applications correctly start on Mac OSX showing a single bouncing icon.
- Fix weird "missing symbol" errors under Mac OSX (thanks to Isaac Wagner).

### 1.4 (2010-03-22)

- Fully support up to Python 2.6 on Linux/Mac and Python 2.5 on Windows.
- Preliminar Mac OSX support: both one-file and one-dir is supported; for non-console applications, a bundle can be created. Thanks to many people that worked on this across several months (Daniele Zannotti, Matteo Bertini, Lorenzo Mancini).
- Improved Linux support: generated executables are fatter but now should now run on many different Linux distributions (thanks to David Mugnai).
- Add support for specifying data files in import hooks. PyInstaller can now automatically bundle all data files or plugins required for a certain 3rd-party package.

- Add intelligent support for ctypes: PyInstaller is now able to track all places in the source code where ctypes is used and automatically bundle dynamic libraries accessed through ctypes. (Thanks to Lorenzo Mancini for submitting this). This is very useful when using ctypes with custom-made dynamic libraries.
- Executables built with PyInstaller under Windows can now be digitally signed.
- Add support for absolute imports in Python 2.5+ (thanks to Arve Knudsen).
- Add support for relative imports in Python 2.5+.
- Add support for cross-compilation: PyInstaller is now able to build Windows executables when running under Linux. See documentation for more details.
- Add support for .egg files: PyInstaller is now able to look for dependencies within .egg files, bundle them and make them available at runtime with all the standard features (entry-points, etc.).
- Add partial support for .egg directories: PyInstaller will treat them as normal packages and thus it will not bundle metadata.
- Under Linux/Mac, it is now possible to build an executable even when a system packages does not have .pyc or .pyo files available and the system-directory can be written only by root. PyInstaller will in fact generate the required .pyc/.pyo files on-the-fly within a build-temporary directory.
- Add automatic import hooks for many third-party packages, including:
  - PyQt4 (thanks to Pascal Veret), with complete plugin support.
  - pyodbc (thanks to Don Dwiggins)
  - cElementTree (both native version and Python 2.5 version)
  - lxml
  - SQLAlchemy (thanks to Greg Copeland)
  - email in Python 2.5 (though it does not support the old-style Python 2.4 syntax with Python 2.5)
  - gadfly
  - PyQt5
  - mako
  - Improved PyGTK (thanks to Marco Bonifazi and foxx).
  - paste (thanks to Jamie Kirkpatrick)
  - matplotlib
- Add fix for the very annoying “MSVCRT71 could not be extracted” bug, which was caused by the DLL being packaged twice (thanks to Idris Aykun).
- Removed C++-style comments from the bootloader for compatibility with the AIX compiler.
- Fix support for .py files with DOS line endings under Linux (fixes PyOpenGL).
- Fix support for PIL when imported without top-level package (“import Image”).
- Fix PyXML import hook under NT (thanks to Lorenzo Mancini)
- Fixed problem with PyInstaller picking up the wrong copy of optparse.
- Improve correctness of the binary cache of UPX’d/strip’d files. This fixes problems when switching between multiple versions of the same third-party library (like e.g. wxPython allows to do).
- Fix a stupid bug with modules importing optparse (under Linux) (thanks to Louai Al-Khanji).

- Under Python 2.4+, if an exception is raised while importing a module inside a package, the module is now removed from the parent's namespace (to match the behaviour of Python itself).
- Fix random race-condition at startup of one-file packages, that was causing this exception to be generated: "PYZ entry 'encodings' (0j) is not a valid code object".
- Fix problem when having unicode strings among path elements.
- Fix random exception ("bad file descriptor") with "prints" in non-console mode (actually a pythonw "bug" that's fixed in Python 3.0).
- Sometimes the temporary directory did not get removed upon program exit, when running on Linux.
- Fixed random segfaults at startup on 64-bit platforms (like x86-64).

### 1.3 (2006-12-20)

- Fix bug with user-provided icons disappearing from built executables when these were compressed with UPX.
- Fix problems with packaging of applications using PIL (that was broken because of a bug in Python's import machinery, in recent Python versions). Also add a workaround including Tcl/Tk with PIL unless ImageTk is imported.
- (Windows) When used under Windows XP, packaged programs now have the correct look & feel and follow user's themes (thanks to the manifest file being linked within the generated executable). This is especially useful for applications using wxPython.
- Fix a buffer overrun in the bootloader (which could lead to a crash) when the built executable is run from within a deep directory (more than 70-80 characters in the pathname).
- Bootstrap modules are now compressed in the executable (so that they are not visible in plaintext by just looking at it with a hex editor).
- Fixed a regression introduced in 1.1: under Linux, the bootloader does not depend on libpythonX.X.so anymore.

### 1.2 (2006-06-29)

- Fix a crash when invoking UPX with certain kinds of builds.
- Fix icon support by re-adding a resource section in the bootloader executable.

### 1.1 (2006-02-13)

- (Windows) Make single-file packages not depend on MSVCRT71.DLL anymore, even under Python 2.4. You can eventually ship your programs really as single-file executables, even when using the newest Python version!
- Fix problem with incorrect python path detection. Now using helpers from distutils.
- Fix problem with rare encodings introduced in newer Python versions: now all the encodings are automatically found and included, so this problem should be gone forever.
- Fix building of COM servers (was broken in 1.0 because of the new build system).
- Mimic Python 2.4 behaviour with broken imports: sys.modules is cleaned up afterwards. This allows to package SQLAlchemy applications under Windows with Python 2.4 and above.
- Add import hook for the following packages:
  - GTK

- PyOpenGL (tested 2.0.1.09)
- dsnpython (tested 1.3.4)
- KInterasDB (courtesy of Eugene Prigorodov)
- Fix packaging of code using “time.strptime” under Python 2.3+.
- (Linux) Ignore linux-gate.so while calculating dependencies (fix provided by Vikram Aggarwal).
- (Windows) With Python 2.4, setup UPX properly so to be able to compress binaries generated with Visual Studio .NET 2003 (such as most of the extensions). UPX 1.92+ is needed for this.

### 1.0 (2005-09-19) with respect to McMillan’s Python Installer 5b5

- Add support for Python 2.3 (fix packaging of codecs).
- Add support for Python 2.4 (under Windows, needed to recompile the bootloader with a different compiler version).
- Fix support for Python 1.5.2, should be fully functional now (required to rewrite some parts of the string module for the bootloader).
- Fix a rare bug in extracting the dependencies of a DLL (bug in PE header parser).
- Fix packaging of PyQt programs (needed an import hook for a hidden import).
- Fix imports calculation for modules using the “from \_\_init\_\_ import” syntax.
- Fix a packaging bug when a module was being import both through binary dependency and direct import.
- Restyle documentation (now using docutils and reStructuredText).
- New Windows build system for automatic compilations of bootloader in all the required flavours (using Scons)

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- Louai Al-Khanji - fixes with optparse module.
- Thomas Heller - set custom icon of Windows exe files.
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## 2.17 Man Pages

### 2.17.1 pyinstaller

#### SYNOPSIS

`pyinstaller <options> SCRIPT...`

`pyinstaller <options> SPECFILE`



## DESCRIPTION

PyInstaller is a program that freezes (packages) Python programs into stand-alone executables, under Windows, GNU/Linux, macOS, FreeBSD, OpenBSD, Solaris and AIX. Its main advantages over similar tools are that PyInstaller works with Python 3.7-3.10, it builds smaller executables thanks to transparent compression, it is fully multi-platform, and use the OS support to load the dynamic libraries, thus ensuring full compatibility.

You may either pass one or more file-names of Python scripts or a single *.spec*-file-name. In the first case, `pyinstaller` will generate a *.spec*-file (as `pyi-makespec` would do) and immediately process it.

If you pass a *.spec*-file, this will be processed and most options given on the command-line will have no effect. Please see the PyInstaller Manual for more information.

## OPTIONS

### Positional Arguments

scriptname

Name of scriptfiles to be processed or exactly one *.spec* file. If a *.spec* file is specified, most options are unnecessary and are ignored.

### Optional Arguments

<b>-h, --help</b>	show this help message and exit
<b>-v, --version</b>	Show program version info and exit.
<b>--distpath DIR</b>	Where to put the bundled app (default: <code>./dist</code> )
<b>--workpath WORKPATH</b>	Where to put all the temporary work files, <code>.log</code> , <code>.pyz</code> and etc. (default: <code>./build</code> )
<b>-y, --noconfirm</b>	Replace output directory (default: <code>SPECPATH/dist/SPECNAME</code> ) without asking for confirmation
<b>--upx-dir UPX_DIR</b>	Path to UPX utility (default: search the execution path)
<b>-a, --ascii</b>	Do not include unicode encoding support (default: included if available)
<b>--clean</b>	Clean PyInstaller cache and remove temporary files before building.
<b>--log-level LEVEL</b>	Amount of detail in build-time console messages. LEVEL may be one of TRACE, DEBUG, INFO, WARN, ERROR, CRITICAL (default: INFO).

### What To Generate

<b>-D, --onedir</b>	Create a one-folder bundle containing an executable (default)
<b>-F, --onefile</b>	Create a one-file bundled executable.
<b>--specpath DIR</b>	Folder to store the generated spec file (default: current directory)
<b>-n NAME, --name NAME</b>	Name to assign to the bundled app and spec file (default: first script's base-name)

## What To Bundle, Where To Search

- add-data <SRC;DEST or SRC:DEST>** Additional non-binary files or folders to be added to the executable. The path separator is platform specific, `os.pathsep` (which is `;` on Windows and `:` on most unix systems) is used. This option can be used multiple times.
- add-binary <SRC;DEST or SRC:DEST>** Additional binary files to be added to the executable. See the `--add-data` option for more details. This option can be used multiple times.
- p DIR, --paths DIR** A path to search for imports (like using `PYTHONPATH`). Multiple paths are allowed, separated by `' '`, or use this option multiple times. Equivalent to supplying the `pathex` argument in the spec file.
- hidden-import MODULENAME, --hiddenimport MODULENAME** Name an import not visible in the code of the script(s). This option can be used multiple times.
- collect-submodules MODULENAME** Collect all submodules from the specified package or module. This option can be used multiple times.
- collect-data MODULENAME, --collect-datas MODULENAME** Collect all data from the specified package or module. This option can be used multiple times.
- collect-binaries MODULENAME** Collect all binaries from the specified package or module. This option can be used multiple times.
- collect-all MODULENAME** Collect all submodules, data files, and binaries from the specified package or module. This option can be used multiple times.
- copy-metadata PACKAGENAME** Copy metadata for the specified package. This option can be used multiple times.
- recursive-copy-metadata PACKAGENAME** Copy metadata for the specified package and all its dependencies. This option can be used multiple times.
- additional-hooks-dir HOOKSPATH** An additional path to search for hooks. This option can be used multiple times.
- runtime-hook RUNTIME\_HOOKS** Path to a custom runtime hook file. A runtime hook is code that is bundled with the executable and is executed before any other code or module to set up special features of the runtime environment. This option can be used multiple times.
- exclude-module EXCLUDES** Optional module or package (the Python name, not the path name) that will be ignored (as though it was not found). This option can be used multiple times.
- key KEY** The key used to encrypt Python bytecode.
- splash IMAGE\_FILE (EXPERIMENTAL)** Add an splash screen with the image `IMAGE_FILE` to the application. The splash screen can display progress updates while unpacking.

## How To Generate

`-d {all,imports,bootloader,noarchive}, --debug {all,imports,bootloader,noarchive}`

Provide assistance with debugging a frozen application. This argument may be provided multiple times to select several of the following options. - all: All three of the following options. - imports: specify the -v option to the underlying Python interpreter, causing it to print a message each time a module is initialized, showing the place (filename or built-in module) from which it is loaded. See <https://docs.python.org/3/using/cmdline.html#id4>. - bootloader: tell the bootloader to issue progress messages while initializing and starting the bundled app. Used to diagnose problems with missing imports. - noarchive: instead of storing all frozen Python source files as an archive inside the resulting executable, store them as files in the resulting output directory.

**--python-option PYTHON\_OPTION** Specify a command-line option to pass to the Python interpreter at runtime. Currently supports “v” (equivalent to “--debug imports”), “u”, and “W <warning control>”.

**-s, --strip** Apply a symbol-table strip to the executable and shared libs (not recommended for Windows)

**--noupX** Do not use UPX even if it is available (works differently between Windows and \*nix)

**--upx-exclude FILE** Prevent a binary from being compressed when using upx. This is typically used if upx corrupts certain binaries during compression. FILE is the filename of the binary without path. This option can be used multiple times.

## Windows And Mac Os X Specific Options

**-c, --console, --nowindowed** Open a console window for standard i/o (default). On Windows this option has no effect if the first script is a ‘.pyw’ file.

**-w, --windowed, --noconsole** Windows and Mac OS X: do not provide a console window for standard i/o. On Mac OS this also triggers building a Mac OS .app bundle. On Windows this option is automatically set if the first script is a ‘.pyw’ file. This option is ignored on \*NIX systems.

**-i <FILE.ico or FILE.exe,ID or FILE.icns or Image or “NONE”>, --icon <FILE.ico or FILE.exe,ID or FILE.icns or Image or “NONE”>** FILE.ico: apply the icon to a Windows executable. FILE.exe,ID: extract the icon with ID from an exe. FILE.icns: apply the icon to the .app bundle on Mac OS. If an image file is entered that isn’t in the platform format (ico on Windows, icns on Mac), PyInstaller tries to use Pillow to translate the icon into the correct format (if Pillow is installed). Use “NONE” to not apply any icon, thereby making the OS show some default (default: apply PyInstaller’s icon)

**--disable-windowed-traceback** Disable traceback dump of unhandled exception in windowed (noconsole) mode (Windows and macOS only), and instead display a message that this feature is disabled.

## Windows Specific Options

- version-file FILE** Add a version resource from FILE to the exe.
- m <FILE or XML>, --manifest <FILE or XML>** Add manifest FILE or XML to the exe.
- no-embed-manifest** Generate an external .exe.manifest file instead of embedding the manifest into the exe. Applicable only to onedir mode; in onefile mode, the manifest is always embedded, regardless of this option.
- r RESOURCE, --resource RESOURCE** Add or update a resource to a Windows executable. The RESOURCE is one to four items, FILE[,TYPE[,NAME[,LANGUAGE]]]. FILE can be a data file or an exe/dll. For data files, at least TYPE and NAME must be specified. LANGUAGE defaults to 0 or may be specified as wildcard \* to update all resources of the given TYPE and NAME. For exe/dll files, all resources from FILE will be added/updated to the final executable if TYPE, NAME and LANGUAGE are omitted or specified as wildcard \*. This option can be used multiple times.
- uac-admin** Using this option creates a Manifest that will request elevation upon application start.
- uac-uiaccess** Using this option allows an elevated application to work with Remote Desktop.

## Windows Side-By-Side Assembly Searching Options (Advanced)

- win-private-assemblies** Any Shared Assemblies bundled into the application will be changed into Private Assemblies. This means the exact versions of these assemblies will always be used, and any newer versions installed on user machines at the system level will be ignored.
- win-no-prefer-redirects** While searching for Shared or Private Assemblies to bundle into the application, PyInstaller will prefer not to follow policies that redirect to newer versions, and will try to bundle the exact versions of the assembly.

## Mac Os Specific Options

- argv-emulation** Enable argv emulation for macOS app bundles. If enabled, the initial open document/URL event is processed by the bootloader and the passed file paths or URLs are appended to sys.argv.
- osx-bundle-identifier BUNDLE\_IDENTIFIER** Mac OS .app bundle identifier is used as the default unique program name for code signing purposes. The usual form is a hierarchical name in reverse DNS notation. For example: com.mycompany.department.appname (default: first script's basename)
- target-architecture ARCH, --target-arch ARCH** Target architecture (macOS only; valid values: x86\_64, arm64, universal2). Enables switching between universal2 and single-arch version of frozen application (provided python installation supports the target architecture). If not target architecture is not specified, the current running architecture is targeted.
- codesign-identity IDENTITY** Code signing identity (macOS only). Use the provided identity to sign collected binaries and generated executable. If signing identity is not provided, ad-hoc signing is performed instead.

**--osx-entitlements-file FILENAME** Entitlements file to use when code-signing the collected binaries (macOS only).

### Rarely Used Special Options

**--runtime-tmpdir PATH** Where to extract libraries and support files in *onefile*-mode. If this option is given, the bootloader will ignore any temp-folder location defined by the run-time OS. The `_MEIxxxxxx`-folder will be created here. Please use this option only if you know what you are doing.

**--bootloader-ignore-signals** Tell the bootloader to ignore signals rather than forwarding them to the child process. Useful in situations where for example a supervisor process signals both the bootloader and the child (e.g., via a process group) to avoid signalling the child twice.

### ENVIRONMENT VARIABLES

**PYINSTALLER\_CONFIG\_DIR** This changes the directory where PyInstaller caches some files. The default location for this is operating system dependent, but is typically a subdirectory of the home directory.

### SEE ALSO

`pyi-makespec(1)`, The PyInstaller Manual <https://pyinstaller.readthedocs.io/>, Project Homepage <http://www.pyinstaller.org>

## 2.17.2 pyi-makespec

### SYNOPSIS

```
pyi-makespec <options> SCRIPT [SCRIPT ...]
```

### DESCRIPTION

The spec file is the description of what you want PyInstaller to do with your program. `pyi-makespec` is a simple wizard to create spec files that cover basic usages:

```
pyi-makespec [--onefile] yourprogram.py
```

By default, `pyi-makespec` generates a spec file that tells PyInstaller to create a distribution directory contains the main executable and the dynamic libraries. The option `--onefile` specifies that you want PyInstaller to build a single file with everything inside.

In most cases the specfile generated by `pyi-makespec` is all you need. If not, see *When things go wrong* in the manual and be sure to read the introduction to *Spec Files*.

## OPTIONS

### Positional Arguments

scriptname

### Optional Arguments

- h, --help** show this help message and exit
- log-level LEVEL** Amount of detail in build-time console messages. LEVEL may be one of TRACE, DEBUG, INFO, WARN, ERROR, CRITICAL (default: INFO).

### What To Generate

- D, --onedir** Create a one-folder bundle containing an executable (default)
- F, --onefile** Create a one-file bundled executable.
- specpath DIR** Folder to store the generated spec file (default: current directory)
- n NAME, --name NAME** Name to assign to the bundled app and spec file (default: first script's base-name)

### What To Bundle, Where To Search

- add-data <SRC;DEST or SRC:DEST>** Additional non-binary files or folders to be added to the executable. The path separator is platform specific, `os.pathsep` (which is `;` on Windows and `:` on most unix systems) is used. This option can be used multiple times.
- add-binary <SRC;DEST or SRC:DEST>** Additional binary files to be added to the executable. See the `--add-data` option for more details. This option can be used multiple times.
- p DIR, --paths DIR** A path to search for imports (like using `PYTHONPATH`). Multiple paths are allowed, separated by `:`, or use this option multiple times. Equivalent to supplying the `pathex` argument in the spec file.
- hidden-import MODULENAME, --hiddenimport MODULENAME** Name an import not visible in the code of the script(s). This option can be used multiple times.
- collect-submodules MODULENAME** Collect all submodules from the specified package or module. This option can be used multiple times.
- collect-data MODULENAME, --collect-datas MODULENAME** Collect all data from the specified package or module. This option can be used multiple times.
- collect-binaries MODULENAME** Collect all binaries from the specified package or module. This option can be used multiple times.
- collect-all MODULENAME** Collect all submodules, data files, and binaries from the specified package or module. This option can be used multiple times.
- copy-metadata PACKAGENAME** Copy metadata for the specified package. This option can be used multiple times.

- recursive-copy-metadata PACKAGENAME** Copy metadata for the specified package and all its dependencies. This option can be used multiple times.
- additional-hooks-dir HOOKSPATH** An additional path to search for hooks. This option can be used multiple times.
- runtime-hook RUNTIME\_HOOKS** Path to a custom runtime hook file. A runtime hook is code that is bundled with the executable and is executed before any other code or module to set up special features of the runtime environment. This option can be used multiple times.
- exclude-module EXCLUDES** Optional module or package (the Python name, not the path name) that will be ignored (as though it was not found). This option can be used multiple times.
- key KEY** The key used to encrypt Python bytecode.
- splash IMAGE\_FILE (EXPERIMENTAL)** Add an splash screen with the image IMAGE\_FILE to the application. The splash screen can display progress updates while unpacking.

## How To Generate

`-d {all,imports,bootloader,noarchive}, --debug {all,imports,bootloader,noarchive}`

R|Provide assistance with debugging a frozen application. This argument may be provided multiple times to select several of the following options. - all: All three of the following options. - imports: specify the -v option to the underlying Python interpreter, causing it to print a message each time a module is initialized, showing the place (filename or built-in module) from which it is loaded. See <https://docs.python.org/3/using/cmdline.html#id4>. - bootloader: tell the bootloader to issue progress messages while initializing and starting the bundled app. Used to diagnose problems with missing imports. - noarchive: instead of storing all frozen Python source files as an archive inside the resulting executable, store them as files in the resulting output directory.

- python-option PYTHON\_OPTION** Specify a command-line option to pass to the Python interpreter at runtime. Currently supports “v” (equivalent to “--debug imports”), “u”, and “W <warning control>”.
- s, --strip** Apply a symbol-table strip to the executable and shared libs (not recommended for Windows)
- noupX** Do not use UPX even if it is available (works differently between Windows and \*nix)
- upx-exclude FILE** Prevent a binary from being compressed when using upx. This is typically used if upx corrupts certain binaries during compression. FILE is the filename of the binary without path. This option can be used multiple times.

## Windows And Mac Os X Specific Options

- c, --console, --nowindowed** Open a console window for standard i/o (default). On Windows this option has no effect if the first script is a ‘.pyw’ file.
- w, --windowed, --noconsole** Windows and Mac OS X: do not provide a console window for standard i/o. On Mac OS this also triggers building a Mac OS .app bundle. On Windows this option is automatically set if the first script is a ‘.pyw’ file. This option is ignored on \*NIX systems.

- i <FILE.ico or FILE.exe,ID or FILE.icns or Image or “NONE”>, --icon <FILE.ico or FILE.exe,ID or FILE.icns or Image or “NONE”>** FILE.ico: apply the icon to a Windows executable. FILE.exe,ID: extract the icon with ID from an exe. FILE.icns: apply the icon to the .app bundle on Mac OS. If an image file is entered that isn't in the platform format (ico on Windows, icns on Mac), PyInstaller tries to use Pillow to translate the icon into the correct format (if Pillow is installed). Use “NONE” to not apply any icon, thereby making the OS show some default (default: apply PyInstaller's icon)
- disable-windowed-traceback** Disable traceback dump of unhandled exception in windowed (noconsole) mode (Windows and macOS only), and instead display a message that this feature is disabled.

## Windows Specific Options

- version-file FILE** Add a version resource from FILE to the exe.
- m <FILE or XML>, --manifest <FILE or XML>** Add manifest FILE or XML to the exe.
- no-embed-manifest** Generate an external .exe.manifest file instead of embedding the manifest into the exe. Applicable only to onedir mode; in onefile mode, the manifest is always embedded, regardless of this option.
- r RESOURCE, --resource RESOURCE** Add or update a resource to a Windows executable. The RESOURCE is one to four items, FILE[,TYPE[,NAME[,LANGUAGE]]]. FILE can be a data file or an exe/dll. For data files, at least TYPE and NAME must be specified. LANGUAGE defaults to 0 or may be specified as wildcard \* to update all resources of the given TYPE and NAME. For exe/dll files, all resources from FILE will be added/updated to the final executable if TYPE, NAME and LANGUAGE are omitted or specified as wildcard \*. This option can be used multiple times.
- uac-admin** Using this option creates a Manifest that will request elevation upon application start.
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## Windows Side-By-Side Assembly Searching Options (Advanced)

- win-private-assemblies** Any Shared Assemblies bundled into the application will be changed into Private Assemblies. This means the exact versions of these assemblies will always be used, and any newer versions installed on user machines at the system level will be ignored.
- win-no-prefer-redirects** While searching for Shared or Private Assemblies to bundle into the application, PyInstaller will prefer not to follow policies that redirect to newer versions, and will try to bundle the exact versions of the assembly.



## Mac Os Specific Options

- argv-emulation** Enable argv emulation for macOS app bundles. If enabled, the initial open document/URL event is processed by the bootloader and the passed file paths or URLs are appended to sys.argv.
- osx-bundle-identifier BUNDLE\_IDENTIFIER** Mac OS .app bundle identifier is used as the default unique program name for code signing purposes. The usual form is a hierarchical name in reverse DNS notation. For example: com.mycompany.department.appname (default: first script's basename)
- target-architecture ARCH, --target-arch ARCH** Target architecture (macOS only; valid values: x86\_64, arm64, universal2). Enables switching between universal2 and single-arch version of frozen application (provided python installation supports the target architecture). If not target architecture is not specified, the current running architecture is targeted.
- codesign-identity IDENTITY** Code signing identity (macOS only). Use the provided identity to sign collected binaries and generated executable. If signing identity is not provided, ad-hoc signing is performed instead.
- osx-entitlements-file FILENAME** Entitlements file to use when code-signing the collected binaries (macOS only).

## Rarely Used Special Options

- runtime-tmpdir PATH** Where to extract libraries and support files in *onefile*-mode. If this option is given, the bootloader will ignore any temp-folder location defined by the run-time OS. The `_MEIxxxxxx`-folder will be created here. Please use this option only if you know what you are doing.
- bootloader-ignore-signals** Tell the bootloader to ignore signals rather than forwarding them to the child process. Useful in situations where for example a supervisor process signals both the bootloader and the child (e.g., via a process group) to avoid signalling the child twice.

## ENVIRONMENT VARIABLES

- PYINSTALLER\_CONFIG\_DIR** This changes the directory where PyInstaller caches some files. The default location for this is operating system dependent, but is typically a subdirectory of the home directory.

## SEE ALSO

pyinstaller(1), The PyInstaller Manual <https://pyinstaller.readthedocs.io/>, Project Homepage <http://www.pyinstaller.org>

## 2.18 Development Guide

### 2.18.1 Quickstart

- Our git repository is at <https://github.com/pyinstaller/pyinstaller>:

```
git clone https://github.com/pyinstaller/pyinstaller
```

- Development is done on the *develop* branch. Pull-request shall be filed against this branch.
- Releases will reside on the *master* branch.

- Install required testing tools:

```
pip install -r tests/requirements-tools.txt
```

- Commit as often as you'd like, but squash or otherwise rewrite your commits into logical patches before asking for code review. `git rebase -i` is your friend. Read the »» [Detailed Commit Guideline](#) for more information. Reformatting code without functional changes will generally not be accepted (for rationale see [#2727](#)).
- Write meaningful commit messages.
  - The first line shall be a short sentence that can stand alone as a short description of the change, written in the present tense, and prefixed with the *subsystem-name*.
  - The body of the commit message should explain or justify the change. Read the »» [Detailed Commit Message Rules](#) for more information.
- Provide tests that cover your changes and try to run the tests locally first.
- Submit pull-requests against the *develop* branch. Mind adding a [changelog entry](#) so our users can learn about your change!
- For new files mind adding the copyright header, see `PyInstaller/__init__.py` (also mind updating to the current year).
- In response to feedback, squash the new “fix up” commits into the respective commit that is being fixed with an interactive rebase (`git rebase -i`). [Push the new, rewritten branch](#) with a `git push --force`. (Scary! But github doesn't play nicely with a safer method.)

### 2.18.2 New to GitHub or Git?

Our development workflow is build around Git and GitHub. Please take your time to become familiar with these. If you are new to GitHub, [GitHub has instructions](#) for getting you started. If you are new to Git there are a [tutorial](#) and an [excellent book](#) available online.

#### Further Reading

- [Please Write Good Commit Messages](#)
- [Creating Pull-Requests](#)
- [Updating a Pull-Request](#)
- [PyInstaller's Branch Model](#)

### 2.18.3 Coding conventions

The PyInstaller project follows the [PEP 8](#) Style Guide for Python Code for new code. It uses [yapf](#) to do the bulk of the formatting (mostly putting spaces in the correct places) automatically and [flake8](#) to validate [PEP 8](#) rules which [yapf](#) doesn't cover.

Before submitting changes to PyInstaller, please check your code with both tools.

To install them run:

```
pip install flake8 yapf==0.32.0 toml
```

Reformat your code automatically with [yapf](#):

```
yapf -rip .
```

Then manually adjust your code based on any suggestions given by [flake8](#):

```
git diff -U0 last-commit-id-which-you-did-not-write -- | flake8 --diff -
```

Please abstain from reformatting existing code, even if it doesn't follow PEP 8. We will not accept reformatting changes since they make it harder to review the changes and to follow changes in the long run. For a complete rationale please see [#2727](#).

### 2.18.4 Running the Test Suite

To run the test-suite, please proceed as follows.

1. If you don't have a git clone of PyInstaller, first fetch the current development head, either using pip, ...:

```
pip download --no-deps https://github.com/pyinstaller/pyinstaller/archive/develop.
↪zip
unzip develop.zip
cd pyinstaller-develop/
```

... or using git:

```
git clone https://github.com/pyinstaller/pyinstaller.git
cd pyinstaller
```

2. Then setup a fresh [virtualenv](#) for running the test suite in and install all required tools:

```
pip install --user virtualenv
virtualenv /tmp/venv
. /tmp/venv/bin/activate
pip install -r tests/requirements-tools.txt
```

3. To run a single test use e.g.:

```
pytest tests/unit -k test_collect_submod_all_included
```

4. Run the test-suite:

```
pytest tests/unit tests/functional
```

This only runs the tests for the core functionality and some packages from the Python standard library.

5. To get better coverage, including many of the available hooks, you need to download the Python packages to be tested. For this please run:

```
pip install -U -r tests/requirements-libraries.txt
pytest tests/unit tests/functional
```

To learn how we run the test-suite in the continuous integration tests please have a look at `.travis.yml` (for GNU/Linux and macOS) and `appveyor.yml` (for Windows).

### 2.18.5 Guidelines for Commits

**Please help keeping code and changes comprehensible for years. Provide a readable commit-history following this guideline.**

A commit

- stands alone as a single, complete, logical change,
- has a descriptive commit message (see *below*),
- has no extraneous modifications (whitespace changes, fixing a typo in an unrelated file, etc.),
- follows established coding conventions (**PEP 8**) closely.

Avoid committing several unrelated changes in one go. It makes merging difficult, and also makes it harder to determine which change is the culprit if a bug crops up.

If you did several unrelated changes before committing, `git gui` makes committing selected parts and even selected lines easy. Try the context menu within the windows diff area.

This results in a more readable history, which makes it easier to understand why a change was made. In case of an issue, it's easier to *git bisect* to find breaking changes any revert those breaking changes.

#### In Detail

A commit should be one (and just one) logical unit. It should be something that someone might want to patch or revert in its entirety, and never piece-wise. If it could be useful in pieces, make separate commits.

- Make small patches (i.e. work in consistent increments).
- Reformatting code without functional changes will generally not be accepted (for rationale see [#2727](#)). If such changes are required, separate it into a commit of its own and document as such.  
This means that when looking at patches later, we don't have to wade through loads of non-functional changes to get to the relevant parts of the patch.
- Especially don't mix different types of change, and put a standard prefix for each type of change to identify it in your commit message.
- Abstain refactorings! If any, restrict refactorings (that should not change functionality) to their own commit (and document).
- Restrict functionality changes (bug fix or new feature) to their own changelists (and document).
- If your commit-series includes any "fix up" commits ("Fix typo.", "Fix test.", "Remove commented code.") please use `git rebase -i ...` to clean them up prior to submitting a pull-request.
- Use `git rebase -i` to sort, squash, and fixup commits prior to submitting the pull-request. Make it a readable history, easy to understand what you've done.

## Please Write Good Commit Messages

**Please help keeping code and changes comprehensible for years. Write good commit messages following this guideline.**

Commit messages should provide enough information to enable a third party to decide if the change is relevant to them and if they need to read the change itself.

PyInstaller is maintained since 2005 and we often need to comprehend years later why a certain change has been implemented as it is. What seemed to be obvious when the change was applied may be just obscure years later. The original contributor may be out of reach, while another developer needs to comprehend the reasons, side-effects and decisions the original author considered.

We learned that commit messages are important to comprehend changes and thus we are a bit picky about them.

We may ask you to reword your commit messages. In this case, use `git rebase -i ...` and `git push -f ...` to update your pull-request. See [Updating a Pull-Request](#) for details.

### Content of the commit message

**Write meaningful commit messages.**

- The first line shall be a short sentence that can stand alone as a short description of the change, written in the present tense, and prefixed with the *subsystem-name*. See [below](#) for details.
- The body of the commit message should explain or justify the change, see [below](#) for details.

Examples of good commit messages are [@5c1628e](#) or [@73d7710](#).

### The first Line

The first line of the commit message shall

- be a short sentence ( 72 characters maximum, but shoot for 50),
- use the present tense (“Add awesome feature.”)<sup>1</sup>,
- be prefixed with an identifier for the *subsystem* this commit is related to (“tests: Fix the frob.” or “building: Make all nodes turn faster.”),
- always end with a period.
- Ending punctuation other than a period should be used to indicate that the summary line is incomplete and continues after the separator; “...” is conventional.

### The Commit-Message Body

The body of a commit log should:

- explain or justify the change,
  - If you find yourself describing implementation details, this most probably should go into a source code comment.
  - Please include motivation for the change, and contrasts its implementation with previous behavior.

---

<sup>1</sup> Consider these messages as the instructions for what applying the commit will do. Further this convention matches up with commit messages generated by commands like `git merge` and `git revert`.

- For more complicate or serious changes please document relevant decisions, contrast them with other possibilities for chosen, side-effect you experienced, or other thinks to keep in mind when touching this peace of code again. (Although the later *might* better go into a source code comment.)
- for a bug fix, provide a ticket number or link to the ticket,
- explain what changes were made at a high level (The [GNU ChangeLog](#) standard is worth a read),
- be word-wrapped to 72 characters per line, don't go over 80; and
- separated by a blank line from the first line.
- Bullet points and numbered lists are okay, too:

- \* Typically a hyphen **or** asterisk **is** used **for** the bullet, preceded by a single space, **with** blank lines **in** between, but conventions vary here.
  - \* Use a hanging indent.
- Do not start your commit message with a hash-mark (#) as git some git commands may dismiss these message. (See [this discussion](#). for details.)

### Standard prefixes

Please state the “subsystem” this commit is related to as a prefix in the first line. Do learn which prefixes others used for the files you changed you can use `git log --oneline path/to/file/or/dir`.

Examples for “subsystems” are:

- Hooks for hook-related changes
- Bootloader, Bootloader build for the bootloader or it's build system
- depend for the dependency detection parts (PyInstaller/depend)
- building for the building part (PyInstaller/building)
- compat for code related to compatibility of different Python versions (primary PyInstaller/compat.py)
- loader
- utils, utils/hooks
- Tests, Test/CI: For changes to the test suite (incl. requirements), resp. the CI.
- modulegraph: changes related to PyInstaller/lib/modulegraph
- Doc, Doc build for the documentation content resp. it's build system. You may want to specify the chapter or section too.

### Please set the correct Author

Please make sure you have setup git to use the correct name and email for your commits. Use the same name and email on all machines you may push from. Example:

```
# Set name and email
git config --global user.name "Firstname Lastname"
git config --global user.email "your_email@youremail.com"
```

This will set this name and email-address to be used for all git-repos you are working on on this system. To set it for just the PyInstaller repo, remove the `--global` flag.

Alternatively you may use **git gui** → *Edit* → *Options* ... to set these values.

## Further Reading

Further hints and tutorials about writing good commit messages can also be found at:

- [FreeBSD Committer's Guide](#)
- <http://365git.tumblr.com/post/3308646748/writing-git-commit-messages>
- <http://wincent.com/blog/commit-messages: The Good, the Bad and the Ugly>.
- [http://wiki.scummvm.org/index.php/Commit\\_Guidelines](http://wiki.scummvm.org/index.php/Commit_Guidelines)
- <http://lbrandy.com/blog/2009/03/writing-better-commit-messages/>
- <http://blog.looplabel.net/2008/07/28/best-practices-for-version-control/>
- <http://subversion.apache.org/docs/community-guide/conventions.html> (Targeted a bit too much to subversion usage, which does not use such fine-grained commits as we ask you strongly to use.)

## Credits

This page was composed from material found at

- <http://hackage.haskell.org/trac/ghc/wiki/WorkingConventions/Git>
- <http://lbrandy.com/blog/2009/03/writing-better-commit-messages/>
- <http://365git.tumblr.com/post/3308646748/writing-git-commit-messages>
- <http://www.catb.org/esr/dvcs-migration-guide.html>
- <https://git.dthompson.us/presentations.git/tree/HEAD:/happy-patching>
- and other places.

## 2.18.6 Improving and Building the Documentation

PyInstaller's documentation is created using **Sphinx**. Sphinx uses **reStructuredText** as its markup language, and many of its strengths come from the power and straightforwardness of reStructuredText and its parsing and translating suite, **Docutils**.

The documentation is maintained in the Git repository along with the code and pushing to the `develop` branch will create a new version at <https://pyinstaller.readthedocs.io/en/latest/>.

For **small changes** (like typos) you may just fork PyInstaller on Github, edit the documentation online and create a pull-request.

For anything else we ask you to clone the repository and verify your changes like this:

```
pip install -r doc/requirements.txt
cd doc
make html
xdg-open _build/html/index.html
```

Please watch out for any warnings and errors while building the documentation. In your browser check if the markup is valid prior to pushing your changes and creating the pull-request. Please also run:

```
make clean
...
make html
```

to verify once again everything is fine. Thank you!

We may ask you to rework your changes or reword your commit messages. In this case, use `git rebase -i ...` and `git push -f ...` to update your pull-request. See *Updating a Pull-Request* for details.

### PyInstaller extensions

For the PyInstaller documentation there are roles available<sup>0</sup> in addition to the ones from [Sphinx](#) and [docutils](#).

#### **:commit:**

Refer to a commit, creating a web-link to the online git repository. The commit-id will be shortened to 8 digits for readability. Example: `:commit:`a1b2c3d4e5f6a7b8c9`` will become [@a1b2c3d](#).

#### **:issue:**

Link to an issue or pull-request number at Github. Example: `:issue:`123`` will become [#123](#).

### reStructuredText Cheat-sheet

- Combining markup and links:

```
The easiest way to install PyInstaller is using |pip|_::

.. |pip| replace:: :command:`pip`
.. _pip: https://pip.pypa.io/
```

## 2.18.7 Creating Pull-Requests

### Example

- Create an account on <https://github.com>
- Create a fork of project [pyinstaller/pyinstaller](#) on github.
- Set up your git client by following [this documentation on github](#).
- Clone your fork to your local machine.:

```
git clone git@github.com:YOUR_GITHUB_USERNAME/pyinstaller.git
cd pyinstaller
```

- Develop your changes (aka “hack”)
  - Create a branch to work on (optional):

```
git checkout -b my-patch
```

---

<sup>0</sup> Defined in `doc/_extensions/pyi_sphinx_roles.py`



- If you are going to implement a hook, start with creating a minimalistic build-test (see below). You will need to test your hook anyway, so why not use a build-test from the start?
- Incorporate your changes into PyInstaller.
- Test your changes by running *all* build tests to ensure nothing else is broken. Please test on as many platform as you can.
- You may reference relevant issues in commit messages (like #1259) to make GitHub link issues and commits together, and with phrase like “fixes #1259” you can even close relevant issues automatically.
- Synchronize your fork with the PyInstaller upstream repository. There are two ways for this:
  1. Rebase you changes on the current development head (preferred, as it results in a straighter history and conflicts are easier to solve):

```
git remote add upstream https://github.com/pyinstaller/pyinstaller.git
git checkout my-patch
git pull --rebase upstream develop
git log --online --graph
```

2. Merge the current development head into your changes:

```
git remote add upstream https://github.com/pyinstaller/pyinstaller.git
git fetch upstream develop
git checkout my-patch
git merge upstream/develop
git log --online --graph
```

For details see [syncing a fork at github](#).

- Push your changes up to your fork:

```
git push
```

- Open the *Pull Requests* page at [https://github.com/YOUR\\_GITHUB\\_USERNAME/pyinstaller/pulls](https://github.com/YOUR_GITHUB_USERNAME/pyinstaller/pulls) and click “New pull request”. That’s it.

## Updating a Pull-Request

We may ask you to update your pull-request to improve it’s quality or for other reasons. In this case, use `git rebase -i ...` and `git push -f ...` as explained below.<sup>1</sup> Please *do not* close the pull-request and open a new one – this would kill the discussion thread.

This is the workflow without actually changing the base:

```
git checkout my-branch
# find the commit your branch forked from 'develop'
mb=$(git merge-base --fork-point develop)
# rebase interactively without actually changing the base
git rebase -i $mb
# ... process rebase
git push -f my-fork my-branch
```

Or if you want to actually base your code on the current development head:

<sup>1</sup> There are other ways to update a pull-request, e.g. by “amending” a commit. But for casual (and not-so-casual :-)) users `rebase -i` might be the easiest way.

```
git checkout my-branch
# rebase interactively on 'develop'
git rebase -i develop
# ... process rebase
git push -f my-fork my-branch
```

### 2.18.8 Changelog Entries

If your change is noteworthy, there needs to be a changelog entry so our users can learn about it!

To avoid merge conflicts, we use the `towncrier` package to manage our changelog. `towncrier` uses independent files for each pull request – called *news fragments* – instead of one monolithic changelog file. On release, those news fragments are compiled into our `doc/CHANGELOG.rst`.

You don't need to install `towncrier` yourself, you just have to abide by a few simple rules:

- For each pull request, add a new file into `news/` with a filename adhering to the `pr#.(feature|bugfix|breaking).rst` schema: For example, `news/42.feature.rst` for a new feature that is proposed in pull request #42.

Our categories are: `feature`, `bugfix`, `breaking` (breaking changes), `hooks` (all hook-related changes), `bootloader`, `moduleloader`, `doc`, `process` (project infrastructure, development process, etc.), `core`, `build` (the bootloader build process), and `tests`.

- As with other docs, please use `semantic newlines` within news fragments.
- Prefer present tense or constructions with “now” or “new”. For example:
  - Add hook for my-fancy-library.
  - Fix crash when trying to add resources to Windows executable using `--resource` option.

If the change is relevant only for a specific platform, use a prefix, like here:

- (GNU/Linux) When building with `--debug` turn of `FORTIFY_SOURCE` to ease debugging.
- Wrap symbols like modules, functions, or classes into double backticks so they are rendered in a monospace font. If you mention functions or other callables, add parentheses at the end of their names: `is_module()`. This makes the changelog a lot more readable.
- If you want to reference multiple issues, copy the news fragment to another filename. `towncrier` will merge all news fragments with identical contents into one entry with multiple links to the respective pull requests. You may also reference to an existing newsfragment by copying that one.
- If your pull-request includes several distinct topics, you may want to add several news fragment files. For example `4242.feature.rst` for the new feature, `4242.bootloader` for the accompanying change to the bootloader.

Remember that a news entry is meant for end users and should only contain details relevant to an end user.

## 2.18.9 pyenv and PyInstaller

**Note:** This section is still a draft. Please *help extending it*.

- clone pyenv repository:

```
git clone https://github.com/yyuu/pyenv.git ~/.pyenv
```

- clone virtualenv plugin:

```
git clone https://github.com/yyuu/pyenv-virtualenv.git \
  ~/.pyenv/plugins/pyenv-virtualenv
```

- add to *.bashrc* or *.zshrc*:

```
# Add 'pyenv' to PATH.
export PYENV_ROOT="$HOME/.pyenv"
export PATH="$PYENV_ROOT/bin:$PATH"

# Enable shims and autocompletion for pyenv.
eval "$(pyenv init -)"
# Load pyenv-virtualenv automatically by adding
# the following to ~/.zshrc:
#
eval "$(pyenv virtualenv-init -)"
```

- Install python version with shared libpython (necessary for PyInstaller to work):

```
env PYTHON_CONFIGURE_OPTS="--enable-shared" pyenv install 3.5.0
```

- setup virtualenv `pyenv virtualenv 3.5.0 venvname`
- activate virtualenv `pyenv activate venvname`
- deactivate virtualenv `pyenv deactivate`

## 2.18.10 PyInstaller's Branch Model

**develop branch** We consider *origin/develop* to be the main branch where the source code of HEAD always reflects a state with the latest delivered development changes for the next release. Some would call this the “integration branch”.

**master branch** We consider *origin/master* to be the main branch where the source code of HEAD always reflects a *production-ready* state. Each commit to master is considered a new release and will be tagged.

The PyInstaller project doesn't use long living branches (beside *master* and *develop*) as we don't support bugfixes for several major releases in parallel.

Occasionally you might find these branches in the repository:<sup>1</sup>

**release/ branches** These branches are for preparing the next release. This is for example: updating the version numbers, completing the change-log, recompiling the bootloader, rebuilding the manuals. See ref:*release-workflow* for details about the release process and what steps have to be performed.

<sup>1</sup> This branching-model is basically the same as Vincent Driessen described in this blog. But currently we are not following it strictly.

***hotfix/* branches** These branches are also meant to prepare for a new production release, albeit unplanned. This is what is commonly known as a “hotfix”.

***feature/* branches** Feature branches (or sometimes called topic branches) are used to develop new features for the upcoming or a distant future release.

## 2.19 Indices and tables

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- [modindex](#)
- [search](#)

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