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# **pynsist Documentation**

***Release 1.9***

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pynsist is a tool to build Windows installers for your Python applications. The installers bundle Python itself, so you can distribute your application to people who don't have Python installed.

At present, pynsist requires Python 3.3 or above, or Python 2.7.



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## Quickstart

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1. Get the tools. Install [NSIS](#), and then install pynsist from PyPI by running `pip install pynsist`.
2. Write a config file `installer.cfg`, like this:

```
[Application]
name=My App
version=1.0
# How to launch the app - this calls the 'main' function from the 'myapp' package:
entry_point=myapp:main
icon=myapp.ico

[Python]
version=3.4.0

[Include]
# Importable packages that your application requires, one per line
packages = requests
          bs4
          html5lib

# Other files and folders that should be installed
files = LICENSE
       data_files/
```

See [The Config File](#) for more details about this.

3. Run `pynsist installer.cfg` to generate your installer. If `pynsist` isn't found, you can use `python -m nsist installer.cfg` instead.





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## Contents

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### 2.1 The Config File

All paths in the config file are relative to the directory where the config file is located, unless noted otherwise.

#### 2.1.1 Application section

**name**

The user-readable name of your application. This will be used for various display purposes in the installer, and for shortcuts and the folder in ‘Program Files’.

**version**

The version number of your application.

**entry\_point**

The function to launch your application, in the format `module:function`. Dots are allowed in the module part. `pynsist` will create a script like this, plus some boilerplate:

```
from module import function
function()
```

**script (optional)**

Path to the Python script which launches your application, as an alternative to `entry_point`.

Ensure that this boilerplate code is at the top of your script:

```
#!/python3.3
import sys
sys.path.insert(0, 'pkgs')
```

The first line tells it which version of Python to run with. If you use binary packages, packages compiled for Python 3.3 won’t work with Python 3.4. The other lines make sure it can find the packages installed along with your application.

**target (optional)****parameters (optional)**

Lower level definition of a shortcut, to create start menu entries for help pages or other non-Python entry points. You shouldn’t normally use this for Python entry points.

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**Note:** Either `entry_point`, `script` or `target` must be specified, but not more than one. Specifying `entry_point` is normally easiest and most reliable.

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**icon (optional)**

Path to a `.ico` file to be used for shortcuts to your application. Pynsist has a default generic icon, but you probably want to replace it.

**console (optional)**

If `true`, shortcuts will be created using the `py` launcher, which opens a console for the process. If `false`, or not specified, they will use the `pyw` launcher, which doesn't create a console.

**extra\_preamble (optional)**

Path to a file containing extra Python commands to be run before your code is launched, for example to set environment variables needed by `pygtk`. This is only valid if you use `entry_point` to specify how to launch your application.

If you use the Python API, this parameter can also be passed as a file-like object, such as `io.StringIO`.

## 2.1.2 Shortcut sections

One shortcut will always be generated for the application. You can add extra shortcuts by defining sections titled `Shortcut Name`. For example:

```
[Shortcut IPython Notebook]
entry_point=IPython.html.notebookapp:launch_new_instance
icon=scripts/ipython_nb.ico
console=true
```

**entry\_point****script (optional)****icon (optional)****console (optional)****target (optional)****parameters (optional)****extra\_preamble (optional)**

These options all work the same way as in the Application section.

## 2.1.3 Command sections

New in version 1.7.

Your application can install commands to be run from the Windows command prompt. This is not standard practice for desktop applications on Windows, but if your application specifically provides a command line interface, you can define one or more sections titled `Command name`:

```
[Command guessnumber]
entry_point=guessnumber:main
```

If you use this, the installer will modify the system `PATH` environment variable.

**entry\_point**

As with shortcuts, this specifies the Python function to call, in the format `module:function`.

**extra\_preamble (optional)**

As for shortcuts, a file containing extra code to run before importing the module from `entry_point`. This should rarely be needed.

## 2.1.4 Python section

### version

The Python version to download and bundle with your application, e.g. `3.4.3`. Python 3.3 or later and 2.7 are supported.

### bitness (optional)

32 or 64, to use 32-bit (x86) or 64-bit (x64) Python. On Windows, this defaults to the version you're using, so that compiled modules will match. On other platforms, it defaults to 32-bit.

### format (optional)

- `installer` includes a copy of the Python MSI installer in your application and runs it at install time, setting up Python systemwide. This is the default for Python up to 3.5.
- `bundled` includes an embeddable Python build, which will be installed as part of your application. This is available for Python 3.5 and above, and is the default for Python 3.6 and above.

Changed in version 1.9: The default switched to `bundled` for Python 3.6 and above.

### include\_msvcr (optional)

This option is only relevant with `format = bundled`. The default is `true`, which will include an app-local copy of the Microsoft Visual C++ Runtime, required for Python to run. The installer will only install this if it doesn't detect a system installation of the runtime.

Setting this to `false` will not include the C++ Runtime. Your application may not run for all users until they install it manually ([download from Microsoft](#)). You may prefer to do this for security reasons: the separately installed runtime will get updates through Windows Update, but app-local copies will not.

Users on Windows 10 should already have the runtime installed systemwide, so this does won't affect them. Users on Windows Vista, 7, 8 or 8.1 *may* already have it, depending on what else is installed.

New in version 1.9.

## Bundled Python

New in version 1.6: Support for bundling Python into the application.

Using `format = bundled`, an embeddable Python build will be downloaded at build time and packaged along with the application. When the installer runs, it will create a `Python` subfolder inside the install directory with the files Python needs to run.

This has the advantage of producing smaller, quicker installers (~7.5 MB for a trivial application), and more standalone installations. But it has a number of limitations:

- This option is only available for Python 3.5 and above. These versions of Python have dropped support for Windows XP, so your application will only work on Windows Vista and newer.
- Installing in Windows Vista to 8.1 (inclusive) may install an app-local copy of the Visual C++ runtime (see above). This isn't needed on Windows 10, which includes the necessary files.
- The embeddable Python builds don't include `tkinter`, to save space. Applications with a `tkinter` GUI can't easily use bundled Python. Workarounds may be found in the future.
- The user cannot easily install extra Python packages in the application's Python. If your application has plugins based on Python packages, this might require extra thought about how and where plugins are installed.

### 2.1.5 Include section

To write these lists, put each value on a new line, with more indentation than the line with the key:

```
key=value1
  value2
  value3
```

**packages (optional)**

A list of importable package and module names to include in the installer. Specify only top-level packages, i.e. without a `.` in the name.

**pypi\_wheels (optional)**

A list of packages to download from PyPI, in the format `name==version`. These must be available as wheels; Pynsist will not try to download sdist or eggs.

New in version 1.7.

**files (optional)**

Extra files or directories to be installed with your application.

You can optionally add `> destination` after each file to install it somewhere other than the installation directory. The destination can be:

- An absolute path on the target system, e.g. `C:\\` (but this is not usually desirable).
- A path starting with `$INSTDIR`, the specified installation directory.
- A path starting with any of the [constants NSIS provides](#), e.g. `$SYSDIR`.

The destination can also include `${PRODUCT_NAME}`, which will be expanded to the name of your application.

For instance, to put a data file in the (32 bit) common files directory:

```
[Include]
files=mydata.dat > $COMMONFILES
```

**exclude (optional)**

Files to be excluded from your installer. This can be used to include a Python library or extra directory only partially, for example to include large monolithic python packages without their samples and test suites to achieve a smaller installer file.

Please note:

- The parameter is expected to contain a list of files *relative to the build directory*. Therefore, to include files from a package, you have to start your pattern with `pkgs/<packagename>/`.
- You can use [wildcard characters](#) like `*` or `?`, similar to a Unix shell.
- If you want to exclude whole subfolders, do *not* put a path separator (e.g. `/`) at their end.
- The exclude patterns are only applied to packages and to directories specified using the `files` option. If your `exclude` option directly contradicts your `files` or `packages` option, the files in question will be included (you can not exclude a full package/extra directory or a single file listed in `files`).

Example:

```
[Include]
packages=PySide
files=data_dir
exclude=pkgs/PySide/examples
  data_dir/ignoredfile
```

### 2.1.6 Build section

**directory (optional)**

The build directory. Defaults to `build/nsis/`.

**installer\_name (optional)**

The filename of the installer, relative to the build directory. The default is made from your application name and version.

**nsi\_template (optional)**

The path of a template `.nsi` file to specify further details of the installer. The default template is [part of pynsist](#).

This is an advanced option, and if you specify a custom template, you may well have to update it to work with future releases of Pynsist.

See the [NSIS Scripting Reference](#) for details of the NSIS language, and the [Jinja2 Template Designer Docs](#) for details of the template format. Pynsist uses templates with square brackets (`[]`) instead of Jinja's default curly braces (`{}`).

## 2.2 Installer details

The installers pynsist builds do a number of things:

1. Unpack and run the Python `.msi` installer for the version of Python you specified.
2. Unpack and run the `.msi` installer for the [py launcher](#), if you're using Python 2 (in Python 3, this is installed as part of Python).
3. Install a number of files in the installation directory the user selects:
  - The launcher script(s) that start your application
  - The icon(s) for your application launchers
  - Python packages your application needs
  - Any other files you specified
4. Create a start menu shortcut for each launcher script. If there is only one launcher, it will go in the top level of the start menu. If there's more than one, the installer will make a folder named after the application.
5. Write an uninstaller, and the registry keys to put it in 'Add/remove programs'. The uninstaller only uninstalls your application (undoing steps 3-5); it leaves Python alone, because there might be other applications using Python.

The installer (and uninstaller) is produced using [NSIS](#), with the Modern UI.

### 2.2.1 Uncaught exceptions

If there is an uncaught exception in your application - for instance if it fails to start because a package is missing - the traceback will be written to `%APPDATA%\scriptname.log`. On Windows 7, APPDATA defaults to `C:\Users\username\AppData\Roaming`. If users report crashes, details of the problem will probably be found there.

You can override this by setting `sys.excepthook()`.

This is only provided if you specify your application using `entry_point`.

You can also debug an installed application by using the installed Python to launch the application. This will show tracebacks in the Command Prompt. In the installation directory run:

```
C:\\Program Files\\Application>Python\\python.exe "Application.launch.pyw"
```

## 2.2.2 Working directory

If users start your application from the start menu shortcuts, the working directory will be set to their home directory (%HOMEDRIVE%%HOMEPATH%). If they double-click on the scripts in the installation directory, the working directory will be the installation directory. Your application shouldn't rely on having a particular working directory; if it does, use `os.chdir()` to set it first.

## 2.3 FAQs

### 2.3.1 Building on other platforms

NSIS can run on Linux, so you can build Windows installers without running Windows. However, if your package relies on compiled extension modules, like PyQt4, lxml or numpy, you'll need to ensure that the installer is built with Windows versions of these packages. There are two ways to do this:

- Get the importable packages/modules, either from a Windows installation, or by extracting them from an installer. Copy them into a folder called `pynsist_pkgs`, next to your `installer.cfg` file. pynsist will copy everything in this folder to the build directory.
- Include exe/msi installers for those modules, and modify the `.nsi` template to extract and run these during installation. This can make your installer bigger and slower, and it may create unwanted start menu shortcuts (e.g. PyQt4 does), so the first option is usually better. However, if the installer sets up other things on the system, you may need to do this.

When running on non-Windows systems, pynsis will bundle a 32-bit version of Python by default, though you can override this *in the config file*. Whichever method you use, compiled libraries must have the same bit-ness as the version of Python that's installed.

### 2.3.2 Using data files

Applications often need data files along with their code. The easiest way to use data files with Pynsist is to store them in a Python package (a directory with a `__init__.py` file) you're creating for your application. They will be copied automatically, and modules in that package can locate them using `__file__` like this:

```
data_file_path = os.path.join(os.path.dirname(__file__), 'file.dat')
```

If you don't want to put data files inside a Python package, you will need to list them in the `files` key of the `[Include]` section of the config file. Your code can find them relative to the location of the launch script running your application (`sys.modules['__main__'].__file__`).

### 2.3.3 Code signing

People trying to use your installer will see an 'Unknown publisher' warning. To avoid this, you can sign it with a digital certificate. See [Mozilla's instructions on signing executables using Mono](#).

Signing requires a certificate from a trusted provider. These typically cost hundreds of dollars, but Certum [offers a certificate](#) for open source projects for €14 at the time of writing. You will need documents to prove your identity. I haven't used a Certum certificate, and this isn't an endorsement.

### 2.3.4 Alternatives

Other ways to distribute applications to users without Python installed include freeze tools, like `cx_Freeze` and `PyInstaller`, and Python compilers like `Nuitka`.

pynsist has some advantages:

- Python code often does things—like using `__file__` to find its location on disk, or `sys.executable` to launch Python processes—which don't work when it's run from a frozen exe. pynsist just installs Python files, so it avoids all these problems.
- It's quite easy to make Windows installers on other platforms, which is difficult with other tools.
- The tool itself is simpler to understand, and less likely to need updating for new Python versions.

And some disadvantages:

- Installers tend to be bigger because you're bundling the whole Python standard library.
- You don't get an exe for your application, just a start menu shortcut to launch it.
- pynsist only makes Windows installers.

Popular freeze tools also try to automatically detect what packages you're using. Pynsist could do the same thing, but in my experience, this detection is complex and often misses things, so for now it expects an explicit list of the packages your application needs.

Another alternative is `conda constructor`, which builds an installer out of conda packages. Conda packages are more flexible than PyPI packages, and many libraries are already packaged, but you have to make a conda package of your own code as well before using conda constructor to make an installer. Conda constructor can also make Linux and Mac installers, but unlike Pynsist, it can't make a Windows installer from Linux or Mac.

## 2.4 Release notes

### 2.4.1 Version 1.9

- When building an installer with Python 3.6 or above, *bundled Python* is now the default. For Python up to 3.5, 'installer' remains the default format. You can override the default by specifying `format` in the *Python section* of the config file.
- The C Runtime needed for bundled Python is now installed 'app-local', rather than downloading and installing Windows Update packages at install time. This is considerably simpler, but the app-local runtime will not be updated by Windows Update. A new `include_msvert` config option allows the developer to exclude the app-local runtime - their applications will then depend on the runtime being installed systemwide.

### 2.4.2 Version 1.8

- New example applications using: - PyQt5 with QML - OpenCV and PyQt5 - `Pywebview`
- The code to pick an appropriate wheel now considers wheels with Python version specific ABI tags like `cp35m`, as well as the stable ABI tags like `abi3`.
- Fixed a bug with fetching a wheel when another version of the same package is already cached.
- Fixed a bug in extracting files from certain wheels.
- Installers using *bundled Python* may need a Windows update package for the Microsoft C runtime. They now download this from the `RawGit` CDN, rather than hitting GitHub directly.

- If the Windows update package fails to install, an error message will be displayed.

### 2.4.3 Version 1.7

- Support for downloading packages as wheels from PyPI, and new [PyQt5](#) and [Pyglet](#) examples which use this feature.
- Applications can include commands to run at the Windows command prompt. See [Command sections](#).

### 2.4.4 Version 1.6

- Experimental support for creating installers that *bundle Python with the application*.
- Support for Python 3.5 installers.
- The user agent is set when downloading Python builds, so downloads from Pynsist can be identified.
- New example applications using PyGI, numpy and matplotlib.
- Fixed a bug with different path separators in `exclude` patterns.

### 2.4.5 Version 1.5

- New `exclude` option to cut unnecessary files out of directories and packages that are copied into the installer.
- The `installer.nsi` script is now built using [Jinja](#) templates instead of a custom templating system. If you have specify a custom `nsi_template` file, you will need to update it to use Jinja syntax.
- GUI applications (running under **pythonw**) have stdout and stderr written to a log file in `%APPDATA%`. This should catch all `print`, warnings, uncaught errors, and avoid the program freezing if it tries to print.
- Applications run in a console (under **python**) now show the traceback for an uncaught error in the console as well as writing it to the log file.
- Install **pynsist** command on Windows.
- Fixed an error message caused by unnecessarily rerunning the installer for the PEP 397 `py` launcher, bundled with Python 2 applications.
- **pynsist** now takes a `--no-makensis` option, which stops it before running **makensis** for debugging.

### 2.4.6 Version 1.0

- New `extra_preamble` option to specify a snippet of Python code to run before your main application.
- Packages used in the specified entry points no longer need to be listed under the Include section; they are automatically included.
- Write the crash log to a file in `%APPDATA%`, not in the installation directory - on modern Windows, the application can't normally write to its install directory.
- Added an example application using `pygtk`.
- [Installer details](#) documentation added.
- Install Python into `Program Files\Common Files` or `Program Files (x86)\Common Files`, so that if both 32- and 64-bit Pythons of the same version are installed, neither replaces the other.



- When using 64-bit Python, the application files now go in `Program Files` by default instead of `Program Files (x86)`.
- Fixed a bug in finding the NSIS install directory on 64-bit Windows.
- Fixed a bug that prevented using multiprocessing in installed applications.
- Fixed a bug where the `py.exe` launcher was not included if you built a Python 2 installer using Python 3.
- Better error messages for some invalid input.

### 2.4.7 Version 0.3

- Extra files can now be installed into locations other than the installation directory.
- Shortcuts can have non-Python commands, e.g. to create a start menu shortcut to a help file.
- The Python API has been cleaned up, and there is some [documentation](#) for it.
- Better support for modern versions of Windows:
  - Uninstall shortcuts correctly on Windows Vista and above.
  - Byte compile Python modules at installation, because the `.pyc` files can't be written when the application runs.
- The Python installers are now downloaded over HTTPS instead of using GPG to validate them.
- Shortcuts now launch the application with the working directory set to the user's home directory, not the application location.

### 2.4.8 Version 0.2

- Python 2 support, thanks to [Johannes Baiter](#).
- Ability to define multiple shortcuts for one application.
- Validate config files to produce more helpful errors, thanks to [Tom Wallroth](#).
- Errors starting the application, such as missing libraries, are now written to a log file in the application directory, so you can work out what happened.

## 2.5 Python API

### 2.5.1 Building installers

### 2.5.2 Writing NSIS files

### 2.5.3 Copying Modules and Packages

`class nsist.copymodules.ModuleCopier(py_version, path=None)`  
Finds and copies importable Python modules and packages.

There is a Python 3 implementation using `importlib`, and a Python 2 implementation using `imp`.

**copy** (*modname*, *target*)

Copy the importable module ‘modname’ to the directory ‘target’.

modname should be a top-level import, i.e. without any dots. Packages are always copied whole.

This can currently copy regular filesystem files and directories, and extract modules and packages from appropriately structured zip files.

## 2.6 Example applications

### 2.6.1 Simplified examples

The repository contains a number of simple examples for building applications with different frameworks:

- A console application
- A tkinter application
- A PyQt4 application
- A PyGTK application
- A PyGTK application including Numpy and Matplotlib (32 bit, Python 2.7)
- A PyGI (or PyGObject) application including Numpy and Matplotlib (64 bit, Python 3.4)
- A pygame application

### 2.6.2 Real-world examples

These may illustrate more complex uses of pynsist.

- The author’s own application, [Taxonome](#), is a Python 3, PyQt4 application for working with scientific names for species.
- [Spreads](#) is a book scanning tool, including a tkinter configuration system and a local webserver. Its use of pynsist (see `buildmsi.py`) includes working with setuptools info files.
- [InnStereo](#) is a GTK 3 application for geologists. Besides pygi, it uses numpy and matplotlib.

See also the [examples folder](#) in the repository.

The API is not yet documented here, because I’m still working out how it should be structured. The functions and classes have docstrings, and you’re welcome to use them directly, though they may change in the future.

**See also:**

[pynsist source code on Github](#)

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