CMake Python Distributions Documentation

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Jean-Christophe Fillion-Robin

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User guide

CMake is used to control the software compilation process using simple platform and compiler independent configuration files, and generate native makefiles and workspaces that can be used in the compiler environment of your choice.

The suite of CMake tools were created by Kitware in response to the need for a powerful, cross-platform build environment for open-source projects such as ITK and VTK.

The CMake python wheels provide CMake 3.14.4.

CHAPTER 1

Installation

1.1 Install package with pip

To install with pip:

```
$ pip install cmake
```

1.2 Install from source

See *Building the CMake Python wheel*

1.3 Dependencies

1.3.1 Python Packages

The development dependencies (for testing and coverage) are:

```
codecov>=2.0.5
coverage>=4.2
flake8>=3.0.4
path.py>=11.5.0
pytest>=3.0.3
pytest-cov>=2.4.0
pytest-runner>=2.9
pytest-virtualenv>=1.2.5
scikit-build>=0.10.0
setuptools>=28.0.0
twine
virtualenv>=15.0.3
```

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```
wheel
wheeltools
```

CHAPTER 2

Usage

After *installing* the package using *pip*, the executables `cmake`, `cpack` and `ctest` will be available in the `PATH` and can be used to configure and build any projects.

CHAPTER 3

Building the CMake Python wheel

3.1 Overview

This project has been designed to work with scikit-build.

It provides a *setup.py* and allows to create both source and binary distributions of CMake.

This is done ensuring source files and build artifacts are copied and/or generated in expected locations.

3.2 Prerequisites

In addition of `Git`, `Python` and CMake, building the wheel with `BUILD_CMAKE_FROM_SOURCE` set to `ON` also requires a `C++ Compiler`.

3.3 Quick start

Build the CMake Python wheel with the following command:

```
mkvirtualenv build-cmake
pip install -r requirements-dev.txt
python setup.py bdist_wheel
```

3.4 Source distribution (sdist)

CMake sources will always be downloaded in the `<ROOT>/src` directory.

This will ensure that the rules specified in `<ROOT>/MANIFEST.in` can successfully glob the source files.

The source distribution is generated using the following command:

```
python setup.py sdist
```

3.5 Binary distribution (build, bdist, bdist_wheel)

The project has two mode of operations:

1. build CMake from source (`BUILD_CMAKE_FROM_SOURCE` set to `ON`)
2. download CMake binaries (`BUILD_CMAKE_FROM_SOURCE` set to `OFF`)

The binary distribution is generated using the following command:

```
python setup.py bdist_wheel
```

Changing the default mode is achieved by explicitly passing the option to CMake:

```
python setup.py bdist_wheel -- -DBUILD_CMAKE_FROM_SOURCE:BOOL=ON
```

3.6 Default value for `BUILD_CMAKE_FROM_SOURCE`

Depending on the platform, option `BUILD_CMAKE_FROM_SOURCE` has different default:

- Linux: ON
- MacOSX: OFF
- Windows: OFF

3.7 Controlling verbosity

3.7.1 configure and build output

By default, the output associated to the configure and build steps of the *CMakeProject-build* external project are logged into files. This can be changed by setting the `BUILD_VERBOSE` option:

```
python setup.py bdist_wheel -- -DBUILD_VERBOSE:BOOL=1
```

3.7.2 list of files copied into the distributions

By default, the complete list of files copied into the distributions are reported. This can be changed passing the `--hide-listing` option:

```
python setup.py --hide-listing sdist
python setup.py --hide-listing bdist_wheel
```

3.8 Optimizations

On a given platform, when building different "flavor" of CMake python wheels (one for each <python tag>-<abi> tag), the whole process can be made faster in two ways.

3.8.1 Caching downloads

To avoid the re-download of CMake sources and/or binary packages, passing the option -DCMakePythonDistributions_ARCHIVE_DOWNLOAD_DIR:PATH=/path/to/cache enables successive build to re-use existing archives instead of re-downloading them.

3.8.2 Re-using build tree

And finally, on a given platform, to avoid rebuilding CMake, the idea is to first create a standalone build of the CMake project and then building the wheel using it.

Step 1: Standalone build:

```
mkdir -p standalone-build && cd $_
cmake -DCMakePythonDistributions_ARCHIVE_DOWNLOAD_DIR:PATH=/path/to/cache -G Ninja ../
```

Step 2: Faster build reusing download and build directories:

```
python setup.py bdist_wheel -- \
   -DCMakePythonDistributions_ARCHIVE_DOWNLOAD_DIR:PATH=/path/to/cache \
   -DCMakeProject_BINARY_DIR:PATH=/path/to/standalone-build
```

CHAPTER 4

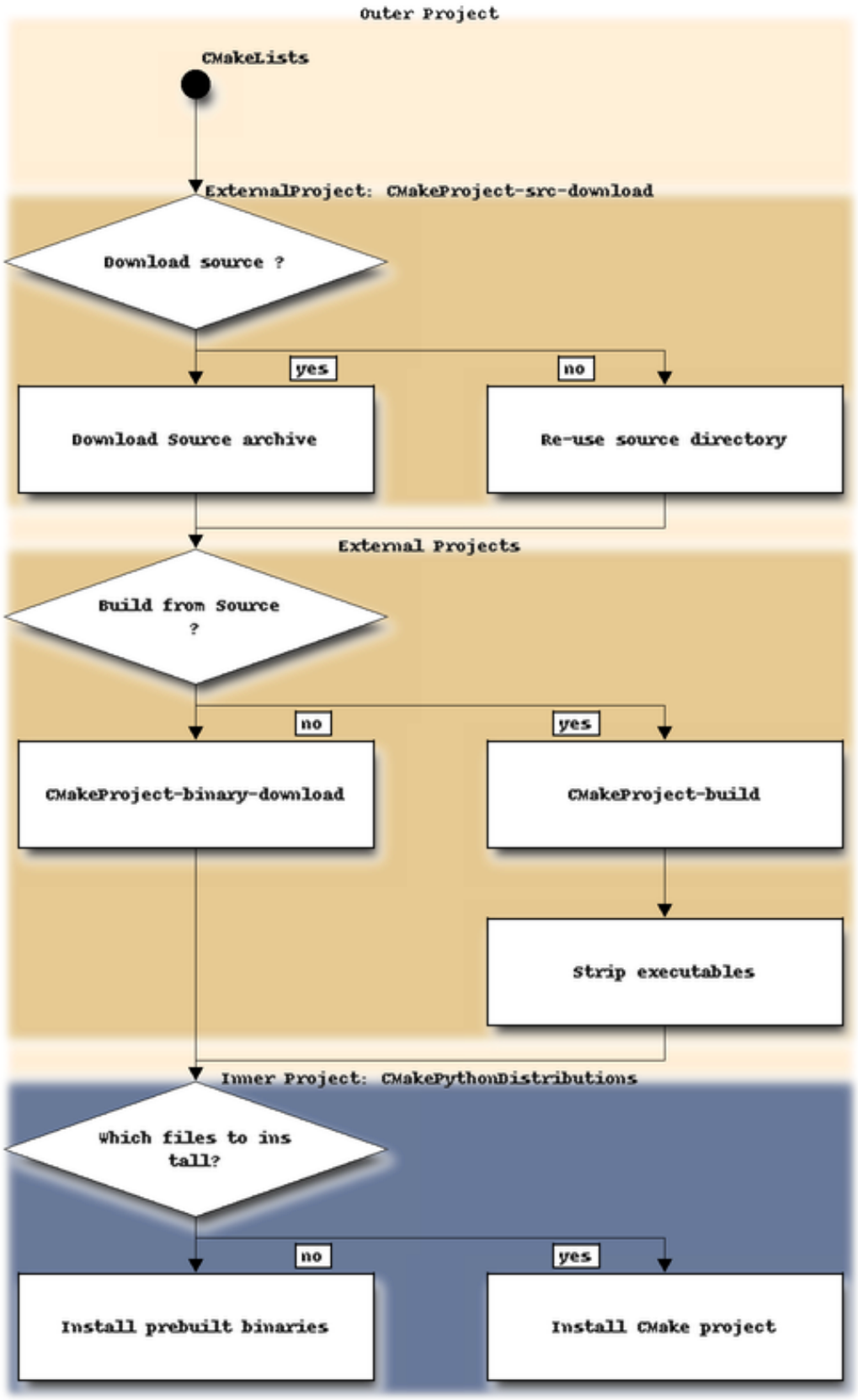
Understanding the Build-system

4.1 CMakeLists.txt

The build system is described by the CMakeLists.txt and is composed of few projects each responsible for a specific task. Once configured, the *Outer Project* is responsible for driving the overall build composed of multiple project called *external project*. Here is the list of *external project*:

- `CMakeProject-src-download`
- `CMakeProject-binary-download`
- `CMakeProject-build`
- `CMakePythonDistributions`: This corresponds to the *Inner Project* represented below.

The flow chart represented below illustrates which external projects are included based on the configure options and describes the role of each one:


Outer Project
CMakeLists
ExternalProject: CMakeProject-src-download
Download source ?
yes
no
Download Source archive
Re-use source directory
External Projects
Build from Source ?
no
yes
CMakeProject-binary-download
CMakeProject-build
Strip executables
Inner Project: CMakePythonDistributions
Which files to install?
no
yes
Install prebuilt binaries
Install CMake project

Name	Description
CMakeLists	See CMakeLists.txt
Download source ?	If option `CMakeProject_SOURCE_DIR` is set, skip source download.
Download Source archive	External project downloading archives from https://cmake.org/files/.
Re-use source directory	Empty external project.
Build from Source ?	Answer based on option `BUILD_CMAKE_FROM_SOURCE`
CMakeProject-binary-download	External project downloading pre-built binary archives from https://cmake.org/files/.
CMakeProject-build	External project building CMake from source.
Strip executables	If possible, reduce wheel size stripping cmake, cpack and ctest executables
Which files to install?	Answer based on option `BUILD_CMAKE_FROM_SOURCE`
Install prebuilt binaries	Recursively glob all files and explicitly add install rules.
Install CMake project	Achieved by including `${CMakeProject_BINARY_DIR}/cmake_install.cmake`.

CHAPTER 5

Contributing

Contributions are welcome, and they are greatly appreciated! Every little bit helps, and credit will always be given.

5.1 Types of Contributions

You can contribute in many ways:

5.1.1 Report Bugs

Report bugs at https://github.com/scikit-build/cmake-python-distributions/issues.

If you are reporting a bug, please include:

- Your operating system name and version.
- Any details about your local setup that might be helpful in troubleshooting.
- Detailed steps to reproduce the bug.

5.1.2 Fix Bugs

Look through the GitHub issues for bugs. Anything tagged with “bug” is open to whoever wants to implement it.

5.1.3 Implement Features

Look through the GitHub issues for features. Anything tagged with “feature” is open to whoever wants to implement it.

5.1.4 Write Documentation

The cmake-python-distributions project could always use more documentation. We welcome help with the official cmake-python-distributions docs, in docstrings, or even on blog posts and articles for the web.

5.1.5 Submit Feedback

The best way to send feedback is to file an issue at https://github.com/scikit-build/cmake-python-distributions/issues.

If you are proposing a new feature:

- Explain in detail how it would work.
- Keep the scope as narrow as possible, to make it easier to implement.
- Remember that this is a volunteer-driven project, and that contributions are welcome :)

5.2 Get Started

Ready to contribute? Here's how to set up *cmake-python-distributions* for local development.

1. Fork the *cmake-python-distributions* repo on GitHub.
2. Clone your fork locally:

```
$ git clone git@github.com:your_name_here/cmake-python-distributions.git
```

3. Install your local copy into a virtualenv. Assuming you have virtualenvwrapper installed (*pip install virtualenvwrapper*), this is how you set up your cloned fork for local development:

```
$ mkvirtualenv cmake-python-distributions
$ cd cmake-python-distributions/
$ pip install -r requirements-dev.txt
```

4. Create a branch for local development:

```
$ git checkout -b name-of-your-bugfix-or-feature
```

   Now you can make your changes locally.

5. When you're done making changes, check that your changes pass flake8 and the tests:

```
$ flake8
$ python setup.py bdist_wheel
$ python setup.py test
```

6. Commit your changes and push your branch to GitHub:

```
$ git add .
$ git commit -m "Your detailed description of your changes."
$ git push origin name-of-your-bugfix-or-feature
```

7. Submit a pull request through the GitHub website.

5.3 Pull Request Guidelines

Before you submit a pull request, check that it meets these guidelines:

1. The pull request should include tests.
2. If the pull request adds functionality, the docs should be updated. Put your new functionality into a function with a docstring, and add the feature to the list in *README.rst*.
3. The pull request should work for Python 2.7, and 3.3, 3.4, 3.5. Check AppVeyor, CircleCI and TravisCi and make sure that the tests pass for all supported Python versions.

5.4 Tips

To run a subset of tests:

```
$ pytest tests/test_cmake.py
```

CHAPTER 6

Credits

Please see the GitHub project page at https://github.com/scikit-build/cmake-python-distributions/graphs/contributors

CHAPTER 7

History

cmake-python-distributions was initially developed in September 2016 by Jean-Christophe Fillion-Robin to facilitate the distribution of project using scikit-build and depending on CMake.

CHAPTER 8

Updating the CMake version

A developer should use the following steps to update the version `X.Y.Z` of CMake associated with the current CMake python distributions.

Available CMake archives can be found at https://cmake.org/files.

1. Install *requests*:

```
$ pip install requests
```

2. Execute *scripts/update_cmake_version.py* command line tool with the desired `X.Y.Z` CMake version available for download. For example:

```
$ release=3.14.4
$ python scripts/update_cmake_version.py ${release}
Collecting URLs and SHA256s from 'https://api.github.com/repos/Kitware/CMake/
↪releases/tags/v3.14.4'
[...]
Collecting URLs and SHA256s from 'https://api.github.com/repos/Kitware/CMake/
↪releases/tags/v3.14.4' - done
Updating 'CMakeUrls.cmake' with CMake version 3.14.4
Updating 'CMakeUrls.cmake' with CMake version 3.14.4 - done
Updating docs/index.rst
Updating docs/index.rst - done
Updating README.rst
Updating README.rst - done
Updating tests/test_distribution.py
Updating tests/test_distribution.py - done
```

3. Create a topic named *update-to-cmake-X.Y.Z* and commit the changes. For example:

```
release=3.14.4
git checkout -b update-to-cmake-${release}
git add CMakeUrls.cmake docs/index.rst README.rst tests/test_distribution.py
git commit -m "Update to CMake ${release}"
```

4. Push the topic and create a *Pull Request*.

5. If all CI tests are passing, merge the topic and consider *making a new release*.

CHAPTER 9

Making a release

A core developer should use the following steps to create a release *X.Y.Z* of **cmake-python-distributions** on PyPI.

This is usually done after *Updating the CMake version*.

9.1 Prerequisites

- All CI tests are passing on AppVeyor, CircleCI and Travis CI.
- You have a GPG signing key.

9.2 Documentation conventions

The commands reported below should be evaluated in the same terminal session.

Commands to evaluate starts with a dollar sign. For example:

```
$ echo "Hello"
Hello
```

means that `echo "Hello"` should be copied and evaluated in the terminal.

9.3 Setting up environment

1. First, register for an account on PyPI.
2. If not already the case, ask to be added as a `Package Index Maintainer`.
3. Create a `~/.pypirc` file with your login credentials:

```
[distutils]
index-servers =
  pypi
  pypitest

[pypi]
username=<your-username>
password=<your-password>

[pypitest]
repository=https://test.pypi.org/legacy/
username=<your-username>
password=<your-password>
```

where `<your-username>` and `<your-password>` correspond to your PyPI account.

9.4 PyPI: Step-by-step

1. Make sure that all CI tests are passing on AppVeyor, CircleCI and Travis CI.
2. Download the latest sources

```
$ cd /tmp && \
  git clone git@github.com:scikit-build/cmake-python-distributions cmake-
↪python-distributions-release && \
  cd cmake-python-distributions-release
```

3. List all tags sorted by version

```
$ git fetch --tags && \
  git tag -l | sort -V
```

4. Choose the next release version number

```
$ release=X.Y.Z
```

> **Warning:** To ensure the packages are uploaded on PyPI, tags must match this regular expression: `^[0-9]+(\.[0-9]+)*(\.post[0-9]+)?$`.

5. In *README.rst*, update PyPI download count after running this big table query and commit the changes.

```
$ git add README.rst && \
  git commit -m "README: Update download stats [ci skip]"
```

> **Note:** To learn more about *pypi-stats*, see How to get PyPI download statistics.

5. Tag the release

```
$ git tag --sign -m "cmake-python-distributions ${release}" ${release}␣
↪origin/master
```

Warning: We recommend using a GPG signing key to sign the tag.

6. Publish the release tag

```
$ git push origin ${release}
```

Note: This will trigger builds on each CI services and automatically upload the wheels and source distribution on PyPI.

7. Check the status of the builds on AppVeyor, CircleCI and Travis CI.
8. Once the builds are completed, check that the distributions are available on PyPI.
9. Create a clean testing environment to test the installation

```
$ pushd $(mktemp -d) && \
  mkvirtualenv cmake-${release}-install-test && \
  pip install cmake && \
  cmake --version
```

Note: If the `mkvirtualenv` command is not available, this means you do not have virtualenvwrapper installed, in that case, you could either install it or directly use virtualenv or venv.

10. Cleanup

```
$ popd && \
  deactivate  && \
  rm -rf dist/* && \
  rmvirtualenv cmake-${release}-install-test
```

CHAPTER 10

Indices and tables

- genindex
- modindex
- search

CHAPTER 11

Resources

This project is maintained by Jean-Christophe Fillion-Robin from Kitware Inc. It is covered by the Apache License, Version 2.0.

CMake is distributed under the OSI-approved BSD 3-clause License. For more information about CMake, visit http://cmake.org

- Documentation: http://cmake-python-distributions.readthedocs.io/en/latest/
- Source code: https://github.com/scikit-build/cmake-python-distributions
- Mailing list: https://groups.google.com/forum/#!forum/scikit-build