# Developing cross-platform CPython extensions

1) Create simple examplemodule/CMakeLists.txt describing the extension

project(examplemodule) find\_package(Python REQUIRED CONFIG) include\_directories(\${PYTHON\_INCLUDE\_DIRS}) add\_library(example MODULE examplemodule.cxx) target\_link\_libraries(example \${PYTHON\_LIBRARIES}) set\_target\_properties(example PROPERTIES PREFIX "")

cmake\_minimum\_required(VERSION 2.8.9)

2 Create examplemodule.cxx implementing the extension

3 Configure and build mkdir examplemodule && cd \$\_

cmake -DPython\_DIR=\${HOME}/scratch/python-build ../examplemodule make -j4

Require CMake >= 2.8.9

github.com/jcfr/python-cmake-custom-extension

#### Motivation

- Maintainable build system
- Easy embedding of CPython
- Built-in support for cross-compilation
- First class support for Visual Studio



Python source [0]

CMake [1]

Python CMake build system [2]

Install

Generation of pkg-config file

cmake \

make install

Configurable install prefix

Install tree layout similar to "Autoconf" one

-DCMAKE\_INSTALL\_PREFIX=/path/to/python-install

# CMake build system for CPython Simple with built-in support for cross-compilation.

Jean-Christophe Fillion-Robin, Matt McCormick

# Kitware

#### What is CMake?

- One simple language for all platforms
- Generates native build system
- Cross-platform
- Open-source BSD-like license
- Self-contained No dependencies
- Large community

#### CMake generators

A CMake Generator is responsible for writing the input files for a native build system.

Use cmake - G option to specify the generator for a new build tree.

Extra Generators for auxiliary IDE

CodeBlocks CodeLite Eclipse CDT4 KDevelop3 Kate

Sublime Text 2

Borland Makefiles

MSYS Makefiles MinGW Makefiles NMake Makefiles NMake Makefiles JOM Ninja Unix Makefiles

Watcom WMake

Command-Line Build Tool Generators IDE Build Tool Generators

Visual Studio 6 Visual Studio 7 Visual Studio 7 .NET 2003 Visual Studio 8 2005 Visual Studio 9 2008 Visual Studio 10 2010 Visual Studio 11 2012 Visual Studio 12 2013 Xcode



#### Support for cross-compilation

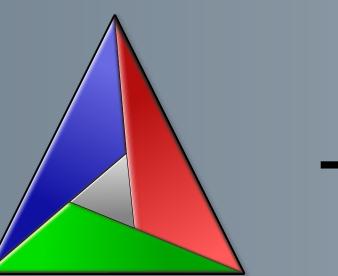
libpython: shared and/or static

Python modules: shared or built-in

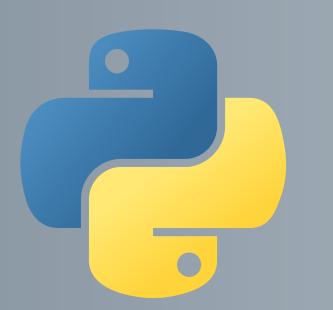
Dependencies: system or explicit

Support for in or out of source build

Configurable install prefix







davidsansome/python-cmake-buildsystem



#### Cross-compiling for RaspberryPi

1 Build the toolchain using crosstool-ng [5]

② Create Toolchain-RaspberryPi.cmake [6] set(CMAKE\_C\_COMPILER \${toolchain}/bin/arm-unknown-linux-gnueabi-gcc)

set(CMAKE\_FIND\_ROOT\_PATH \${toolchain}/arm-unknown-linux-gnueabi/sysroot)

3 Configure mkdir python-install-pi && mkdir python-build-pi && cd \$\_ cmake -DCMAKE\_TOOLCHAIN\_FILE=/path/to/Toolchain-RaspberryPi.cmake \ -DCMAKE\_INSTALL\_PREFIX=/home/jchris/sratch/python-install-pi \ ../python-cmake-buildsystem

4 Edit TryRunResults.cmake with expected values

(5) Re-configure

cmake -C TryRunResults.cmake -DCMAKE\_TOOLCHAIN\_FILE=Toolchain-RaspberryPi.cmake -DCMAKE\_INSTALL\_PREFIX=/home/jchris/sratch/python-install-pi ../python-cmake-buildsystem

6 Cross-compile 7 Upload to target

make install

Ubuntu 13.10 / CMake 2.8.

#### Unix/Ubuntu build (see ReadMe for Windows and others)

# Install build tools

Build

sudo apt-get install build-essential cmake git

# Create directory mkdir ~/scratch && cd \$\_

# Download python source wget python.org/ftp/python/2.7.3/Python-2.7.3.tgz tar -xzvf Python-2.7.3.tgz

# Download buildsystem git clone git@github.com:\ davidsansome/python-cmake-buildsystem.git

# Configure

mkdir python-install && mkdir python-build && cd \$\_ -DCMAKE\_INSTALL\_PREFIX=\${HOME}/scratch/python-install

# Build make -j4

# Install make install

#### Future work

Support 2.7.8 and 3.x

Document CMake buildsystem using sphinx.

Setup Travis CI

Setup dashboard for RaspberryPi

First class support for frozen module [7].

Integrate SetupTools with CMake

## Contributing

Follow the Github flow [8]:

Create a branch

Open a Pull Request

**→** Test

Discuss and review

Merge

#### Run tests

\$ ctest -D Experimental -j10 Test project /home/jchris/scratch/python-build Start 1: test\_site [...]

391/392 Test #374: test\_poll ...... Passed 10.16 sec 392/392 Test #255: test\_io ...... Passed 38.07 sec

Test

100% tests passed, 0 tests failed out of 392

Total Test time (real) = 66.09 sec

Test results submitted to CDash [3]

Website similar to buildbot [4] with built-in support for cmake and ctest

### Acknowledgments

Build system based on the original work of David Sansome, Alex Neundorf and David DeMarle.

RaspberryPi cross compilation based on work of Luis Ibañez [5][6].

Thanks to David Thompson for his poster feedback, and thanks to Mysha Sissine for her support.

Much of this work was supported by the National Institutes of Health, Roadmap Initiative for Medical Research under grant U54 EBO05149.

#### References

- [0] http://www.python.org
- [1] http://www.cmake.org
- [2] https://github.com/davidsansome/python-cmake-buildsystem
- [3] http://open.cdash.org/index.php?project=CPython
- [4] http://buildbot.python.org/all/waterfall
- [5] http://www.kitware.com/blog/home/post/426
- [6] http://www.kitware.com/blog/home/post/428 [7] http://conference.scipy.org/scipy2013/presentation\_detail.php?id=129
- [8] https://guides.github.com/introduction/flow/index.html

This work is licensed under a Creative Commons Attribution-ShareAlike 3.0 License.

Based on template from Felix Breuer - http://blog.felixbreuer.net/2010/10/24/poster.html