# 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

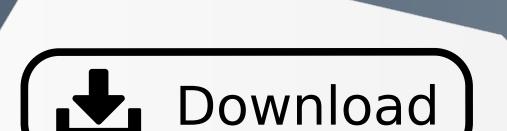
3 Configure and build mkdir examplemodule && cd \$\_ cmake -DPython\_DIR=\${HOME}/scratch/python-build ../examplemodule make -j4

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



## 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 Command-Line Build Tool Generators

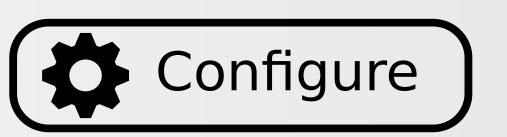
Borland Makefiles MSYS Makefiles MinGW Makefiles NMake Makefiles NMake Makefiles JOM Ninja

Unix Makefiles

Watcom WMake

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

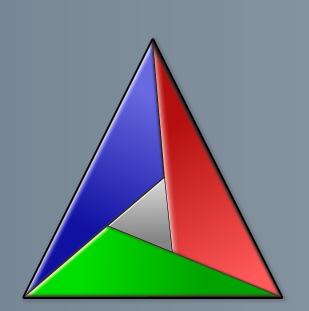
libpython: shared and/or static

Python modules: shared or built-in

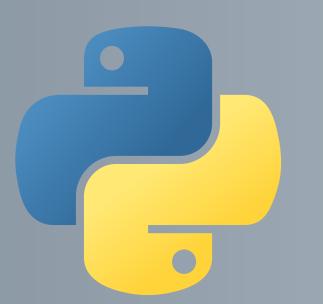
Dependencies: system or explicit

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 \

4 Edit TryRunResults.cmake with expected values

(5) Re-configure

../python-cmake-buildsystem

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 2.8.9

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

> # Install build tools sudo apt-get install build-essential cmake git

Build

# 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.

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## Reterences

- [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

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