

Developing cross-platform CPython extensions

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

```
cmake_minimum_required(VERSION 2.8.9)

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 "")
```

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

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 build system for CPython

Simple with built-in support for cross-compilation.

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Motivation

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

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	Command-Line Build Tool Generators	IDE Build Tool Generators
CodeBlocks	Borland Makefiles	Visual Studio 6
CodeLite	MSYS Makefiles	Visual Studio 7
Eclipse CDT4	MinGW Makefiles	Visual Studio 7 .NET 2003
KDevelop3	NMake Makefiles	Visual Studio 8 2005
Kate	NMake Makefiles JOM	Visual Studio 9 2008
Sublime Text 2	Ninja	Visual Studio 10 2010
	Unix Makefiles	Visual Studio 11 2012
	Watcom WMake	Visual Studio 12 2013
		Xcode

Configure

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

Download

- ✓ Python source [0]
- ✓ CMake [1]
- ✓ Python CMake build system [2]

Build

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

```
# Install build tools
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 -xzf Python-2.7.3.tgz

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

# Configure
mkdir python-install && mkdir python-build && cd $_
cmake \
  -DCMAKE_INSTALL_PREFIX=${HOME}/scratch/python-install

# Build
make -j4

# Install
make install
```

Build

```
cmake -C TryRunResults.cmake \
  -DCMAKE_TOOLCHAIN_FILE=Toolchain-RaspberryPi.cmake \
  -DCMAKE_INSTALL_PREFIX=/home/jchris/scratch/python-install-pi \
  ../python-cmake-buildsystem
make -j4
make install
```

Ubuntu 13.10 / CMake 2.8.9

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/scratch/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/scratch/python-install-pi \
  ../python-cmake-buildsystem
```

6. Cross-compile 7. Upload to target

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.

Integrate SetupTools with CMake

Install

Install tree layout similar to "Autoconf" one

Generation of pkg-config file

Configurable install prefix

```
cmake \
  -DCMAKE_INSTALL_PREFIX=/path/to/python-install
make install
```

Test

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

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].

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References

- [0] <http://www.python.org>
- [1] <http://www.cmake.org>
- [2] <https://github.com/davidansome/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>