CMake build system for CPython

Simple with built-in support for cross-compilation.

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Kitware

Developing cross-platform CPython extensions

START HERE

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

Motivation

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

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

Download

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

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

davidsansome/python-cmake-buildsystem

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 -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 $_
cmake \
  -DCMAKE_INSTALL_PREFIX=${HOME}/scratch/python-install

# Build
make -j4

# Install
make install
```

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 -j4
make install
```

Ubuntu 13.10 / CMake 2.8.9

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

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].

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 EB005149.

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

SciPy2014

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