Python & C++ interoperability using Shiboken

Qt Webinars

About

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Outline

- Motivation: languages integration
- Qt for Python: Shiboken
- Development setup
- Examples
  - Hello World
  - Sample binding (from C++ to Python)
  - Scriptable application (Qt, C++, and Python)
- Resources

What's the deal with Python?

StackOverflow insights 2018

7th

Most Popular Languages

3rd

Most loved languages

1st

Most wanted languages

StackOverflow insights 2019

~~7th~~

4th

Most Popular Languages

~~3rd~~

2nd

Most loved languages

1st

Most wanted languages

Python key features

- Simple (Pseudo-code),
- Easy to read and learn,
- Not designed to be as efficient as C or C++,
- then...a *toy* language?

Python is written in C

...you can extend the language!

Popular numerical modules

- NumPy - numpy.org
- Pandas - pandas.pydata.org

NUMFOCUS
OPEN CODE = BETTER SCIENCE

and other modules like:

- PyTorch - pytorch.org
- TensorFlow - tensorflow.org

The story of PySide

2008	2015	2016	2018
Qt4 Development (PySide)	Qt5 Port (PySide2)	Back to the Qt Project	Released (Qt for Python)

How difficult is to write a module? (2007)

- SWIG - swig.org
- Boost::Python - boost.org
- Raw CPython

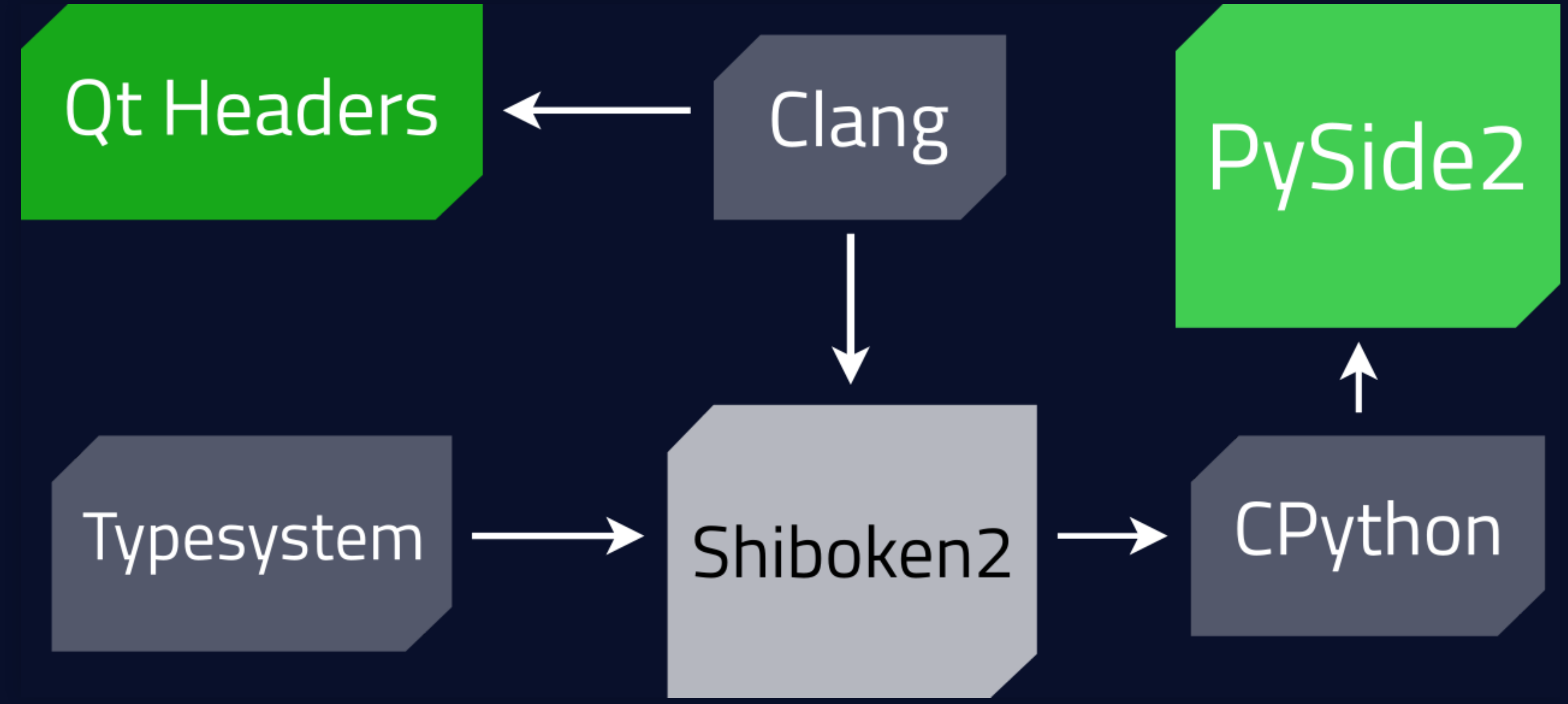
Let's write a simple CPython module!

Summary

	Type	C++	Python	License	Support
boost::python	Interface	C++11+	2.7, 3.0	BSL-1	Boost
SWIG	Code gen	C++11+	1.5+	GPL3	-
shiboken	Code gen	C++11 (*)	2.7, 3.5+	LGPLv3	Qt
sip	Code gen	C++11 (*)	3.5+	GPLv3	Riverbank
pyBind11	Interface	C++11 (*)	2.7, 3.x	BSD-3	-
cffi	Interface	C89, C99 (*)	2.6+, 3.0+	MIT	PyPy
cppyy	Interface	C++11+	2 and 3	UC	-

How does Qt for Python do it?

Binding generation process



Shiboken
死某剑

doc.qt.io/qtforpython/shiboken2

Shiboken: What do we need?

- A C++ library (to bind)
- List of headers
- A typesystem specification
- A build system

```
#ifndef WRAPPEDCLASSES_H
#define WRAPPEDCLASSES_H

#include "project_header_a.h"
#include "project_header_b.h"
...

#endif // WRAPPEDCLASSES_H
```

```
<typesystem package="PackageName">
   <object-type name="ClassA"/>
   <object-type name="ClassB"/>
   <value-type name="ClassC"/>
</typesystem>
```

```
CMakeLists.txt
YourApp.pro
Makefile
```

Development setup

- Python 3.8.1 (3.5+ recommended)
- Virtual environment (recommended)
- Qt 5.14.0
- Qt for Python 5.14.0 (pyside-setup repository)
- libclang 8.0
- CMake 3.15 (3.1+ recommended)

More info at: doc.qt.io/qtforpython/gettingstarted.html

PSA

```
pip install pyside2
```

doesn't install the Shiboken generator.

- Wheels: pyside2, shiboken2, and shiboken2_generator.
- The last one is not on PyPi

More info at: wiki.qt.io/Qt_for_Python#Frequently_Asked_Questions

Development setup: the simple way

```
pip install \
   --index-url=http://download.qt.io/official_releases/QtForPython/ \
   --trusted-host download.qt.io \
   shiboken2 pyside2 shiboken2_generator
```

But one needs to:

- Set CLANG_INSTALL_DIR to the libclang directory
- Add to PATH a Qt bin path with the same version
- Add to LD_LIBRARY_PATH the Qt lib path with the same version

Development setup: the hard way

- Set CLANG_INSTALL_DIR to the libclang directory

```
python setup.py install --qmake=/path/to/Qt/5.14.0/gcc_64/bin/qmake
# there are many other options!
```

Examples

Shiboken: Hello World!

- Exposing a C++ function to Python

Shiboken: Sample binding

- C++ library exposed to Python, no Qt involved.

Shiboken: Scriptable Application

- Qt/C++ UI that ships a Python interpreter, exposing the main window object.

Resources

- Technical Vision qt.io/blog/2019/08/19/technical-vision-qt-python
- Shiboken
  - qt.io/blog/2018/05/24/qt-for-python-under-the-hood
  - qt.io/blog/2018/05/31/write-python-bindings
  - qt.io/blog/2018/08/15/python-extensions
- QtWS 2019 resources.qt.io/youtube-all-videos-2/the-secret-to-enhancing-qt-for-python-applications

What's next?

- Currently in active development
- Improvements to the documentation
- Detailed tutorial for scriptableapplication
- Tooling to improve our lives.

but most importantly...

What do *you* need?

we are community driven.

Q&A

#qt-pyside on Freenode

Mailing list: bit.ly/pyside2
Web: qt.io/qt-for-python
Docs: doc.qt.io/qtforpython
Wiki: pyside.org

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