How to build PyQt5 for Autodesk Maya 2020 64bit

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Building SIP and PyQt for Maya 2020 is a python binding to the Qt library. Because Maya uses Qt internally, you can use the PyQt modules in Maya python scripts to create custom UI. PyQt does not have the same licensing as Maya, Qt, or Python. Please consult the PyQt website for information about licensing for PyQt [<http://www.riverbankcomputing.com/>].

Maya 2020 uses Qt5.12.5 which is binary compatible with the latest version of PyQt - 5.13.2 / SIP - 4.19.19  
  
Use the Maya modified version of the Qt source code. A copy of the customized Qt 5.12.5 source is available from Autodesk's Open Source web-site [<http://www.autodesk.com/lgplsource>] and includes text files describing how to configure, build and install Qt for each platform supported by Maya.  
  
**Note**: There is no need to build PySide since it comes with Maya by default, nor have to rebuild Qt since the main Qt tools to build PyQt are now included in the Maya distributions (i.e. qmake, moc, …). Also coming by default in the Maya include and lib folders are libxml, openSSL, OpenAL, python2.7, qt-5.12.5, and tbb so you do not need to rebuild any of those libraries unless you have a very specific need.

Instructions

Here are the instructions for building a copy of the PyQt5 modules for Maya 2020.

Follow the instructions from the Maya Documentation (Maya Developer Help > Setting up your build environment) to setup your Windows, macOS, or Linux build environment.

Since Maya 2020 ships without the devkit, you can get the Maya 2020 devkit from the Maya Develop Center [<https://www.autodesk.com/developmaya>]. Download the devkit and unzip the files. Make sure to read the instructions in the Maya Documentation to install the devkit properly on your system.

Download SIP and PyQt source. I downloaded **'sip-4.19.19'** and **'PyQt5-5.13.2'**.

PyQt5: <https://www.riverbankcomputing.com/software/pyqt/download5>  
SIP: <http://www.riverbankcomputing.com/software/sip/download>

The next steps are specific to your environment so follow the instructions for Mac, Linux or Windows.

**Note:** The scripts used in this document are posted on [Github](https://github.com/cyrillef/Maya-PyQt-Scripts).

Mac

Unzip SIP and PyQt into one local folder

(e.g. */Users/<username>/Maya2020/Scripts/*).

*/Users/<username>/Maya2020/Scripts/sip-4.19.19*

*/Users/<username>/Maya2020/Scripts/PyQt5-5.13.2*

If you have multiple installation of Xcode and would like to use Xcode 10.X to compile it, backup /Applications/Xcode.app and use Xcode 10.X to replace it.   
  
Use xcode-select to change active xcode like below:

sudo xcode-select -switch /Applications/Xcode.app/Contents/Developer

The **qt.con**f file uses **MAYA\_LOCATION** and **DEVKIT\_LOCATION** to locate the expected header/library files. Therefore, you must set both environment variables before building PyQt5. Follow the Maya Documentation to properly set up your environment variables.  
  
**DEVKIT\_LOCATION** should point to the directory where the devkit include, mkspecs, cmake directories are located. Please make sure DEVKIT\_LOCATION/devkit/bin/moc and qmake are executable.   
  
Modify **/devkit/bin/qt.conf** as below:

**qt.conf**

[Paths]  
Prefix=  
Libraries=$(MAYA\_LOCATION)/MacOS  
Binaries=$(DEVKIT\_LOCATION)/devkit/bin  
Headers=$(DEVKIT\_LOCATION)/include/Qt  
ArchData=$(DEVKIT\_LOCATION)  
Data=$(DEVKIT\_LOCATION)  
HostData=$(DEVKIT\_LOCATION)  
HostBinaries=$(DEVKIT\_LOCATION)/devkit/bin  
HostLibraries=$(MAYA\_LOCATION)/MacOS

Untar the **/include/qt-5.12.5-include.tar.gz** into **/include/Qt**.  
  
Untar the **/mkspecs/qt-5.12.5-mkspecs.tar.gz** into **/mkspecs**.

You can update **qconfig.pri** to make the project compile only release by removing or replace debug flags with release.

Build Prerequisite for PyQt

You’ll need to build **setuptools** and **enum34** before installing SIP. You can find the source in PyPI.

After extracting the source code, use the following command to install them individually.

sudo /Applications/Autodesk/Maya2020/maya.app/Contents/bin/mayapy setup.py install

Build & Install SIP

Save the script below into the same folder as the SIP and PyQt folders. Use the script to build and install SIP.

**sip**

#!/usr/bin/env bash  
   
MAYAQTBUILD="`dirname \"$0\"`" # Relative  
export MAYAQTBUILD="`( cd \"$MAYAQTBUILD\" && pwd )`" # Absolutized and normalized  
pushd $MAYAQTBUILD  
   
export SIPDIR=$MAYAQTBUILD/sip-4.19.19  
export MAYA\_LOCATION=/Applications/Autodesk/Maya2020  
   
pushd $SIPDIR  
$MAYA\_LOCATION/Maya.app/Contents/bin/mayapy ./configure.py --arch=x86\_64 --sip-module PyQt5.sip  
make  
sudo make install  
popd  
  
popd

Build & Install PyQt

Save the script below into the same folder as the SIP and PyQt folders. Use the script to build and install PyQt.

**pyqt**

#!/usr/bin/env bash  
   
MAYAQTBUILD="`dirname \"$0\"`" # Relative  
export MAYAQTBUILD="`( cd \"$MAYAQTBUILD\" && pwd )`" # Absolutized and normalized  
pushd $MAYAQTBUILD  
   
export MAYA\_LOCATION=/Applications/Autodesk/Maya2020/Maya.app/Contents  
export DEVKIT\_LOCATION=/Applications/Autodesk/Maya2020  
export QTDIR=$DEVKIT\_LOCATION/devkit  
export QMAKESPEC=$DEVKIT\_LOCATION/mkspecs/macx-clang  
export INCDIR\_QT=$DEVKIT\_LOCATION/include/Qt  
export LIBDIR\_QT=$MAYA\_LOCATION/MacOS  
  
error=0  
if [ ! -f $QMAKESPEC/qmake.conf ];  
then  
  echo "You need to install qt-5.12.5-mkspecs.tar.gz in $QTDIR/mkspecs !"  
  error=1  
fi  
if [ ! -f $INCDIR\_QT/QtCore/qdir.h ];  
then  
  echo "You need to uncompress $MAYA\_LOCATION/devkit/include/qt-5.12.5-include.tar.gz in $INCDIR\_QT !"  
  error=1  
fi  
# qt.conf - /Applications/Autodesk/Maya2020/Maya.app/Contents/Resources  
if [ ! -f $QTDIR/bin/qt.conf ];  
then  
  echo "You need to copy $QTDIR/Resources/qt.conf in $QTDIR/bin !"  
  error=1  
fi  
   
test=`grep 'Data=$(DEVKIT\_LOCATION)' $QTDIR/bin/qt.conf`  
if [ -z "$test" ];  
then  
  echo "You need to edit $QTDIR/bin/qt.conf to use 'Data=\$(DEVKIT\_LOCATION)'"  
  error=1  
fi  
test=`grep 'Headers=$(DEVKIT\_LOCATION)/include/Qt' $QTDIR/bin/qt.conf`  
if [ -z "$test" ];  
then  
  echo "You need to edit $QTDIR/bin/qt.conf to use 'Headers=\$(DEVKIT\_LOCATION)/include/Qt'"  
  error=1  
fi  
test=`grep 'Libraries=$(MAYA\_LOCATION)/MacOS' $QTDIR/bin/qt.conf`  
if [ -z "$test" ];  
then  
  echo "You need to edit $QTDIR/bin/qt.conf to use 'Libraries=\$(MAYA\_LOCATION)/MacOS'"  
  error=1  
fi  
  
if [ $error -eq 1 ];  
then  
    exit  
fi  
   
export DYLD\_LIBRARY\_PATH=$MAYA\_LOCATION/MacOS  
export DYLD\_FRAMEWORK\_PATH=$MAYA\_LOCATION/Frameworks  
   
export SIPDIR=$MAYAQTBUILD/sip-4.19.19  
export PYQTDIR=$MAYAQTBUILD/PyQt5-5.13.2  
   
export SIP\_EXE=$MAYA\_LOCATION/Frameworks/Python.framework/Versions/2.7/bin/sip  
export SIP\_INCLUDE=$MAYA\_LOCATION/Frameworks/Python.framework/Versions/2.7/include/python2.7  
  
pushd $PYQTDIR  
export PATH=$QTDIR/bin:$PATH  
  
echo   
echo Environment  
echo -----------  
set  
echo -----------  
echo QT Settings  
echo -----------  
qmake -query  
echo -----------  
echo  
$MAYA\_LOCATION/bin/mayapy ./configure.py QMAKE\_MAC\_SDK=macosx10.14 QMAKE\_RPATHDIR+=$LIBDIR\_QT --sip=$SIP\_EXE --sip-incdir=$SIP\_INCLUDE -w --no-designer-plugin   
make -j 8  
sudo make install  
popd  
  
popd

**Note:** I am compiling against Mac OS X SDK 10.14 which is same as the developer environment. If you want to compile against other versions, modify the script (macosx10.14).  
  
You're done! Please check the testing paragraph at the end of the article.

Linux

Unzip SIP and PyQt into one local folder

(e.g. */home/<username>/Maya2020/Scripts/*).

*/home/<username>/Maya2020/Scripts/sip-4.19.19*

*/home/<username>/Maya2020/Scripts/PyQt5-5.13.2*  
  
  
The **qt.conf** file uses **MAYA\_LOCATION** and **DEVKIT\_LOCATION** to locate the expected header/library files. Therefore, users must set both environment variables before building the PyQt5. Follow the Maya Documentation to properly set up your environment variables.  
  
**DEVKIT\_LOCATION** should point to the directory where the devkit include, mkspecs, cmake directories are located.   
  
Please backup your **qt.conf** first, you'll need to restore it after building PyQt5.

Replace **…/bin/qt.conf** with below:

**qt.conf**

[Paths]   
Prefix=   
Libraries=$(MAYA\_LOCATION)/lib   
Binaries=$(DEVKIT\_LOCATION)/bin  
Headers=$(DEVKIT\_LOCATION)/include/Qt   
ArchData=$(DEVKIT\_LOCATION)   
Data=$(DEVKIT\_LOCATION)   
HostData=$(DEVKIT\_LOCATION)   
HostBinaries=$(DEVKIT\_LOCATION)/bin

Untar the **/include/qt-5.12.5-include.tar.gz** into **/include/Qt**.  
  
Untar the **/mkspecs/qt-5.12.5-mkspecs.tar.gz** into **/mkspecs**.  
  
Make **qmake** and **moc** into executables from the Maya bin directory. 

sudo chmod aog+x /usr/autodesk/Maya2020/bin/moc   
sudo chmod aog+x /usr/autodesk/Maya2020/bin/qmake

Build Prerequisite for PyQt

You’ll need to build **setuptools** and **enum34** before installing SIP. You can find the source in PyPI.

After extracting the source code, use the following command to install them individually.

sudo /usr/autodesk/Maya2020/bin/mayapy setup.py install

Build & Install SIP

Save the script below into the same folder as the SIP and PyQt folders. Use the script to build and install SIP.

PyQt requires to build private sip module since 5.11. You’ll need to add “–sip-module PyQt5.sip” to the configuration.

In Maya2020 release, the include/Python2.7 folder has been renamed to Python, so we’ll create a softlink for it.

sudo ln -s /usr/autodesk/Maya2020/include/Python /usr/autodesk/Maya2020/include/python2.7

**sip**

#!/usr/bin/env bash  
   
MAYAQTBUILD="`dirname \"$0\"`" # Relative  
export MAYAQTBUILD="`( cd \"$MAYAQTBUILD\" && pwd )`" # Absolutized and normalized  
pushd $MAYAQTBUILD  
   
export SIPDIR=$MAYAQTBUILD/sip-4.19.19  
export MAYA\_LOCATION=/usr/autodesk/Maya2020  
   
pushd $SIPDIR  
$MAYA\_LOCATION/bin/mayapy ./configure.py --sip-module PyQt5.sip  
make  
sudo make install  
popd  
  
popd

Build & Install PyQt

Save the script below into the same folder as the SIP and PyQt folders. Use the script to build and install PyQt. You’ll need to install OpenGL headers before compiling the PyQt. You could install it by installing mesa-libGL-devel or simply install glew and glew-devel to make sure nothing is missing.

**pyqt**

#!/usr/bin/env bash  
   
MAYAQTBUILD="`dirname \"$0\"`" # Relative  
export MAYAQTBUILD="`( cd \"$MAYAQTBUILD\" && pwd )`" # Absolutized and normalized  
pushd $MAYAQTBUILD  
   
export MAYA\_LOCATION=/usr/autodesk/Maya2020  
export QTDIR=$MAYA\_LOCATION  
export DEVKIT\_LOCATION=$MAYA\_LOCATION  
export QMAKESPEC=$QTDIR/mkspecs/linux-g++-64  
export INCDIR\_QT=$MAYA\_LOCATION/include/Qt  
export LIBDIR\_QT=$QTDIR/lib  
  
error=0  
if [ ! -f $QMAKESPEC/qmake.conf ];  
then  
  echo "You need to install qt-5.12.5-mkspecs.tar.gz in $QTDIR/mkspecs !"  
  error=1  
fi  
if [ ! -f $INCDIR\_QT/QtCore/qdir.h ];  
then  
  echo "You need to uncompress $MAYA\_LOCATION/include/qt-5.12.5-include.tar.gz in $INCDIR\_QT !"  
  error=1  
fi  
# qt.conf - $QTDIR/bin/qt.conf  
if [ ! -f $QTDIR/bin/qt.conf ];  
then  
  echo "You need to copy $QTDIR/Resources/qt.conf in $QTDIR/bin !"  
  error=1  
fi  
  
# The grep string should be in single quote('), if it is in double quote (""),   
# shell will expand the variable, hence the intension of the below grep will fail   
test=`grep 'Headers=$(DEVKIT\_LOCATION)/include/Qt' $QTDIR/bin/qt.conf`  
if [ -z "$test" ];  
then  
  echo "You need to edit $QTDIR/bin/qt.conf to use 'Headers=$(DEVKIT\_LOCATION)/include/Qt'"  
  error=1  
fi  
  
if [ $error -eq 1 ];  
then  
    exit  
fi  
   
export SIPDIR=$MAYAQTBUILD/sip-4.19.19  
export PYQTDIR=$MAYAQTBUILD/PyQt5-5.13.2  
   
pushd $PYQTDIR  
export PATH=$QTDIR/bin:$PATH  
$QTDIR/bin/mayapy ./configure.py LIBDIR\_QT=$LIBDIR\_QT INCDIR\_QT=$INCDIR\_QT MOC=$QTDIR/bin/moc -w --no-designer-plugin   
#change 8 to the count of cores your computer

make -j 8  
sudo make install  
popd  
  
popd

You're done! Please check the testing paragraph at the end of the article.

Windows

Unzip SIP and PyQt into one local folder

(e.g. *C:\Users\<username>\Maya2020\Scripts\*).

*C:\Users\<username>\Maya2020\Scripts\sip-4.19.19*

*C:\Users\<username>\Maya2020\Scripts\yQt5-5.13.2*

Please backup your **qt.conf** first, you'll need to restore it after building PyQt5.

Replace **…\bin\qt.conf** with below:

**qt.conf**

[Paths]  
Prefix=$(MAYA\_LOCATION)  
Libraries=lib   
Binaries=bin   
Headers=include/Qt  
Data=.  
Plugins=qt-plugins   
Translations=qt-translations   
Qml2Imports=qml

Unzip the **\include\qt-5.12.5-include.tar.gz** into **\include\Qt**   
  
Unzip the **\mkspecs\qt-5.12.5-mkspecs.tar.gz** into **\mkspecs.**

You can update **qconfig.pri** to make the project compile only release by removing or replace debug flags with release.

Modify \**mkspecs\common\msvc-destop.conf**. Find **QMAKE\_LIBS\_QT\_ENTRY** and make sure it is assigned to ***-lqtmain -lshell32.***

Rename the folder inside **\include\Qt\QtNfc** to **QtNfc.disabled**.

Run following build scripts with VS2017 x64 Native Tools Command Prompt. If your Maya is installed in folders that requires administrator privilege (e.g. Program files), please run the command prompt as Administrator.

Environment Setup

Save the script below into the same folder as the SIP and PyQt folders. Use the script to setup the environment.

**setup.bat**

@echo off  
  
set MAYAVERSION=2020  
set ADSKQTVERSION=5.12.5  
set SIPVERSION=4.19.19  
set PYQTVERSION=5.13.2  
set MAYADRIVE=m:  
set BUILDDRIVE=v:  
  
if exist %MAYADRIVE%\nul subst %MAYADRIVE% /d  
subst %MAYADRIVE% "C:\Program Files\Autodesk\Maya%MAYAVERSION%"  
set MAYA\_LOCATION=%MAYADRIVE%  
  
set MAYAPYQTBUILD=%~dp0  
rem Removing trailing \  
set MAYAPYQTBUILD=%MAYAPYQTBUILD:~0,-1%  
  
if exist %BUILDDRIVE%\nul subst %BUILDDRIVE% /d  
subst %BUILDDRIVE% "%MAYAPYQTBUILD%"  
  
set SIPDIR=%BUILDDRIVE%\sip-%SIPVERSION%  
set PYQTDIR=%BUILDDRIVE%\PyQt5-%PYQTVERSION%  
rem set ADSKQTDIR=%BUILDDRIVE%\qt-%ADSKQTVERSION%  
set QTDIR=%MAYA\_LOCATION%  
  
set PATH=%QTDIR%\bin;%PATH%  
set MSVC\_VERSION=2017  
set MSVC\_DIR=C:\Program Files (x86)\Microsoft Visual Studio 14.0  
set QMAKESPEC=%QTDIR%\mkspecs\win32-msvc  
set \_QMAKESPEC\_=win32-msvc  
  
if ["%LIBPATH%"]==[""] call "%MSVC\_DIR%\VC\vcvarsall" amd64  
  
set INCLUDE=%INCLUDE%;%MAYA\_LOCATION%\include\python  
set LIB=%LIB%;%MAYA\_LOCATION%\lib

Build Prerequisite for PyQt

You’ll need to build **setuptools** and **enum34** before installing SIP. You can find the source in PyPI.

After extracting the source code, use the following command with administrator privilege to install them individually.

"C:\Program Files\Autodesk\Maya2020\bin\mayapy.exe" setup.py install

Build & Install SIP

Save the script below into the same folder as the SIP and PyQt folders. Use the script to build and install SIP.

**sip.bat**

@echo off  
set XXX=%~dp0  
if ["%MAYAPYQTBUILD%"]==[""] call "%XXX%setup.bat"  
  
pushd %SIPDIR%  
rem "%MAYA\_LOCATION%\bin\mayapy" configure-ng.py --spec %\_QMAKESPEC\_%  
"%MAYA\_LOCATION%\bin\mayapy" configure.py --sip-module PyQt5.sip  
nmake  
nmake install  
popd

Build & Install PyQt

Save the script below into the same folder as the SIP and PyQt folders. Use the script to build and install PyQt.

**pyqt.bat**

@echo off  
set XXX=%~dp0  
if ["%MAYAPYQTBUILD%"]==[""] call "%XXX%setup.bat"  
  
set QMAKESPEC=%QTDIR%\mkspecs\%\_QMAKESPEC\_%  
if not exist "%QMAKESPEC%\qmake.conf" (  
    echo "You need to uncompress %MAYA\_LOCATION%\mkspecs\qt-5.12.5-mkspecs.tar.gz !"  
    goto end  
)  
if not exist "%MAYA\_LOCATION%\include\Qt\QtCore\qdir.h" (  
    echo "You need to uncompress %MAYA\_LOCATION%\include\qt-5.12.5-include.tar.gz in %MAYA\_LOCATION%\include\Qt !"  
    goto end  
)  
findstr /L /C:"Headers=include/Qt" "%MAYA\_LOCATION%\bin\qt.conf" >nul 2>&1  
if ERRORLEVEL 1 (  
    echo "You need to edit %MAYA\_LOCATION%\bin\qt.conf to use 'Headers=include/Qt'"  
    goto end  
)  
findstr /L /C:"-lqtmain -lshell32" "%QTDIR%\mkspecs\common\msvc-desktop.conf" >nul 2>&1  
if ERRORLEVEL 1 (  
    echo "You need to edit %QTDIR%\mkspecs\common\msvc-desktop.conf to use 'QMAKE\_LIBS\_QT\_ENTRY     = -lqtmain -lshell32'"  
    goto end  
)  
if not exist "%MAYA\_LOCATION%\include\Qt\qtnfc.disabled" (  
    echo "You need to rename %MAYA\_LOCATION%\include\Qt\qtnfc to %MAYA\_LOCATION\include\Qt\qtnfc.disabled"  
    goto end  
)  
      
pushd %PYQTDIR%  
  
"%MAYA\_LOCATION%\bin\mayapy" configure.py --spec %QMAKESPEC% LIBDIR\_QT="%QTDIR%\lib" INCDIR\_QT="%QTDIR%\include\Qt" MOC="%QTDIR%\bin\moc.exe" --sip="%QTDIR%\Python\sip.exe" --sip-incdir="%QTDIR%\Python\include" -w --no-designer-plugin  
nmake  
nmake install  
popd  
  
:end

You're done! Please check the testing paragraph at the end of the article.

Testing

Copy and paste this example in the Maya Script Editor (in a Python tab), and execute the code:

import sys   
from PyQt5.QtWidgets import (QWidget, QToolTip, QPushButton)   
from PyQt5.QtGui import QFont       
   
class Example(QWidget):  
    def \_\_init\_\_(self):  
        super(Example,self).\_\_init\_\_()  
        self.initUI()  
  
    def initUI(self):  
        QToolTip.setFont(QFont('SansSerif', 10))  
        self.setToolTip('This is a <b>QWidget</b> widget')  
        btn = QPushButton('Button', self)  
        btn.setToolTip('This is a <b>QPushButton</b> widget')  
        btn.resize(btn.sizeHint())  
        btn.move(50, 50)   
        self.setGeometry(300, 300, 300, 200)  
        self.setWindowTitle('Tooltips')  
        self.show()  
          
ex = Example()

If you see the dialog showing, you are all set.