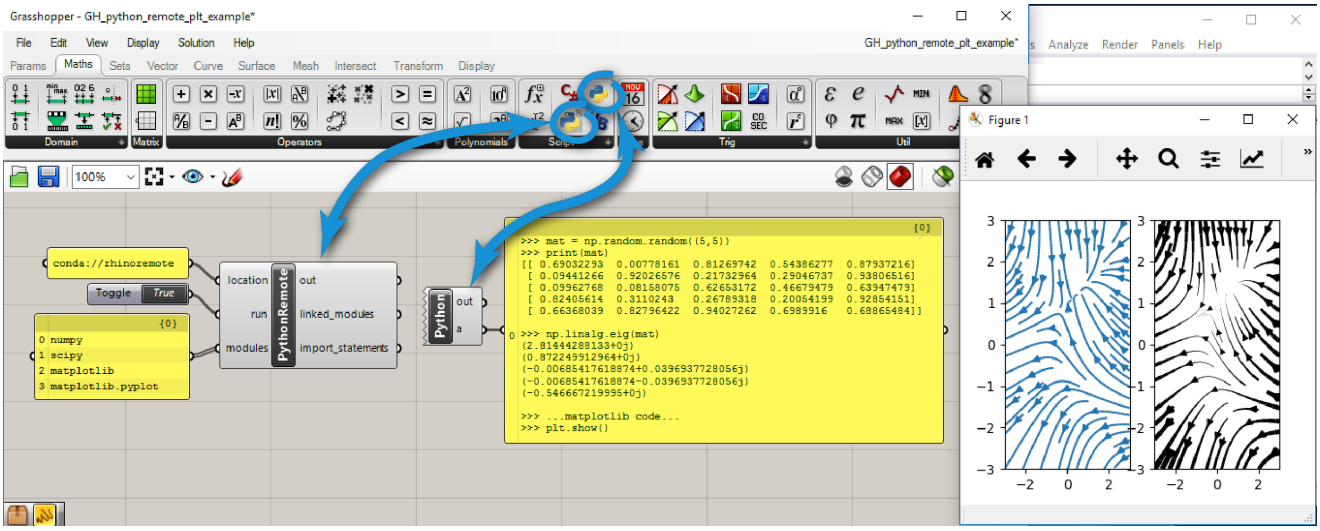
gh-python-remote

Connect an external python instance to Grasshopper, and vice-versa.
This lets you run any Python package directly from Grasshopper, including numpy and scipy!



Installation

Requires a Python 2.7 installation, not compatible with Python 3. Compatible with Mac and Windows with Rhino 7.

1. Install the software dependencies:

Before installing gh-python-remote in **Rhino 7**, you will need to install Python 2, Rhino 7, and open Grasshopper in Rhino 6 at least once.

Before installing gh-python-remote in **Rhino 6**, you will need to install Python 2, Rhino 6, and open Grasshopper in Rhino 6 at least once.

Before installing gh-python-remote in **Rhino 5**, you will need to install Python 2, Rhino 5, Grasshopper and GHPython, and drop the GHPython component on the Grasshopper canvas in Rhino 5 at least once.

Install the following:

Python 2.7:	gh-python-remote was developed with the Anaconda and Miniconda distributions in mind, but any Python 2.7 distribution works. If you already have Anaconda installed with Python 3, you do not need to reinstall it, you can create a virtual environment as explained below. *If you want to be able to name virtual environments in gh-python-remote by their conda name, select "Add conda to my PATH" when prompted during Anaconda's installation.* *On Mac, the python distributed with the OS is outdated and difficult to use by the end-user. It is* **highly** *recommended to use a conda- or brew -based Python.*
Python virtual environment (optional):	

	Isolate dependencies for each project by creating a new virtual environment. If you use Anaconda or Miniconda, creating a virtual environment is easy. • Open the Windows command prompt, or Mac terminal (or the Anaconda prompt if you chose not to add conda to your PATH during insallation) • Run the following command: `conda create --name rhinoremote python=2.7 numpy scipy` This will create a new virtual environment named `rhinoremote`, and install numpy and scipy in it.
Rhinoceros3D:	Version 7 is supported on Windows and Mac. Version 5 and 6 on Windows should work, but are not supported.
Grasshopper:	On Rhino 6 and 7, it is already installed. On Rhino 5, install version 0.9.0076. **Open it at least once before continuing.**
GH Python:	On Rhino 6 and 7, it is already installed. On Rhino 5, install version 0.6.0.3. **On Rhino 5, drop it on the Grasshopper canvas at least once before continuing.**

2. Install gh-python-remote:

From the Windows command prompt, or Mac terminal (or the special Anaconda, or Python prompt if pip is not in your path by default), run:

(If you are using a virtual environment, remember to **activate** *it first. With the conda virtual environment from above, you would need to run* `conda activate rhinoremote` *in the command prompt.)*

```
pip install gh-python-remote --upgrade
python -m ghpythonremote._configure_ironpython_installation
```

This will install gh-python-remote for Rhino 7, and install the gh-python-remote UserObject in all Grasshopper versions.

The `ghpythonremote._configure_ironpython_installation` script takes an optional location argument that can be `5`, `6`, `7` (default), or the path to a target IronPython package directory.

For example, to install for Rhino 5, replace the second command with:

```
python -m ghpythonremote._configure_ironpython_installation 5
```

To install to another location:

```
python -m ghpythonremote._configure_ironpython_installation ^
  "%APPDATA%\McNeel\Rhinoceros\7.0\Plug-ins\^
  IronPython (814d908a-e25c-493d-97e9-ee3861957f49)\settings\lib"
```

Usage

All the examples files are copied to `%APPDATA%\Grasshopper\UserObjects\gh-python-remote\examples` *on Windows, and* `~/Grasshopper/UserObjects/gh-python-remote/examples` *on Mac. You can also download them from the* github repo.

From Grasshopper to Python

Step-by-step

1. Open the example file `GH_python_remote.ghx` in Grasshopper, or drop the gh-python-remote component on the canvas.
2. Use the `location` input to define the location of the Python interpreter you want to connect to.
3. Use the `modules` input to define the modules you want to access in the GHPython component.

4. Change `run` to `True` to connect.
5. In the GHPython component, the imported modules will now be available via the sticky dictionary. For example if you are trying to use Numpy:

```
import scriptcontext
np = scriptcontext.sticky['numpy']
```

Notes

Creating remote array-like objects from large local lists is slow. For example, `np.array(range(10000))` takes more than 10 seconds. To solve this, you need to first send the list to the remote interpreter, then create the array from this remote object:

```
import scriptcontext as sc
import ghpythonremote
np = sc.sticky['numpy']
rpy = sc.sticky['rpy']

r_range = ghpythonremote.deliver(rpy, range(10000))
np.array(r_range)
```

Additionally, Grasshopper does not recognize remote list objects as lists. They need to be recovered to the local interpreter first:

```
import scriptcontext as sc
import ghpythonremote
from ghpythonlib.treehelpers import list_to_tree  # Rhino 6 only!
np = sc.sticky['numpy']

a = np.arange(15).reshape((3,5))
a = ghpythonremote.obtain(a.tolist())
a = list_to_tree(a, source=[0,0])
```

`ghpythonlib.treehelpers` is Rhino 6 only, see the treehelpers gist for an equivalent implementation if you need it on Rhino 5.

Quick-ref:

** marks an input that is only available by editing the gh-python-remote UserObject, or in* `GH_python_remote.ghx`.

Arguments:

***code (string):**	Path to the `GH_to_python.py` code file.
location (string):	
	Path to a python executable, or to a folder containing `python.exe`, or the name of a conda-created virtual environment prefixed by `conda://` (`conda://env_name`, requires `conda` available in your PATH). If empty, finds python from your windows `%PATH%`.
run (boolean):	Creates the connection, and imports new modules, when turned to True. Kills the connection, and deletes the references to the imports, when turned to False.
modules (string list):	
	List of module names to import in the remote python. They will be added to the `scriptcontext.sticky` dictionary, allowing them to be reused from other python components in the same Grasshopper document. Submodules (for example `numpy.linalg`) have to be added explicitly to this list to be available later, and importing the parent package is also required even if only the submodule is used.
***log_level (string from ['NOTSET', 'DEBUG', 'INFO', 'WARNING', 'ERROR', 'CRITICAL']):**	
	Logging level to use for the local IronPython and the remote python instance.
***working_dir (string):**	
	Working directory for the remote python instance.

Returns:	**out (string):**	Console output with DEBUG information.
	linked_modules (string list):	
		List of imported module names.
	rpy (rpyc connection object):	
		The object representing the remote Python interpreter.
	import_statements (string):	
		What to use in the GHPython component to actually use the imported modules.

From Python to Grasshopper

You can also use gh-python-remote to programmatically control a Rhinoceros instance, and connect to it via Python. Have a look at `examples/python_to_GH.py` for a full working example.

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Changelog

1.4.0 (2021-01-27)

New

- Add support for Rhino 7.
- Add support for MacOS.

1.3.1 (2020-04-01)

Changes

- Allow access to GH user objects from CPython. Access them from a PythonToGrasshopperRemote object as *py2gh.gh_remote_userobjects.<UO Name>*
- Remove GhCompService.get_component. Access remote GH components from a PythonToGrasshopperRemote object as *py2gh.gh_remote_components.<Component Name>*

Fix

- Fix CPython -> Rhino Python connections for Rhino 6.

1.3.0 (2020-03-20)

New

- Add option to select Rhino version in CPy to GH (#29).

Changes

- Better Rhino path finder.
- Catch conda env list failures.
- Upgrade to RPyC 4.1.4

Fix

- Fix missing file at installation.
- Fix async request timeout (#14).
- Repair log level passing to pythonservice.py.

1.2.1 (2019-07-24)

Fix

- Cleanup examples directory, and fix missing file at installation (#26).
- Update logger names in .ghuser file

1.2.0 (2019-07-08)

New

- Now fully compatible with Rhino 6.

Changes

- Revert using a special RPyC distribution, now explicitly using upstream.
- Upgrade to RPyC 4.1.0.
- Hide rpyc behind a special ghpythonremote import. `rpyc.utils` functions `deliver` and `obtain` are available as `ghpythonremote.deliver` and `ghpythonremote.obtain`; `rpyc` should be imported with `from ghpythonremote import rpyc` if ever needed.
- Expand the environment path in CPython subprocess, trying to match what conda would do, helping Numpy finds its DLLs.

Fix

- Repair pip install command on recent pip with pip.main deprecated.
- Repair incompatibilities with IronPython 2.7.0.
- Repair incompatibilities with RPyC 4.1.0, using monkey-patched compatibilty fixes for IronPython.
- Remove unnecessary pip install parameters.

1.1.4 (2018-02-28)

Fix

- Stop using the *exposed* prefix to remote attributes, per rpyc v4.

1.1.3 (2018-02-27)

Fix

- Rename `async` import from rpyc to `async_`.
- Bump rpyc version to pilcru/rpyc@3.4.6 to fix IronPython 2.7.0 dump bytes issues.

1.1.2 (2018-02-23)

Fix

- Use https file location for the dependencies, to remove the need for git when installing.

1.1.0 (2018-02-14)

New

- Documented `obtain` and `deliver` features of rpyc to speedup remote array-like objects creation and retrieval.

Changes

- Use the v4.0.0 pre-release of rpyc to fix IronPython <-> CPython `str` unpickling issues.
- Improve error messages when connection is lost.

Fix

- Repair the GH to python example, where argument passing (for the port configuration) was broken.

1.0.4 (2017-10-06)

Fix

- Fix quote escaping issue in pip install command for IronPython.

1.0.3 (2017-10-02)

First public release.