Harnessing the Power of Python in ArcGIS Using the Conda Distribution

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https://github.com/scw/conda-uc-2017

High Quality PDF (2MB)

Python

Why Python? 

- Accessible for new-comers, and the most taught first language in US universites
- Extensive package collection (56 thousand on PyPI), broad user-base
- Strong glue language used to bind together many environments, both open source and commercial
- Open source with liberal license — do what you want

Why Python?

In the box:

- The SciPy Stack (NumPy, SciPy, Pandas, matplotlib, sympy)
  - Scientific Programming with the SciPy Stack
- xlrd, netCDF4, requests, PyPDF, pytz

Getting to Packages

Why Packages?

- Software is composed of many smaller components, often called *packages* or *libraries*.
- It's often better to reuse code that solves a problem well rather than recreating it
- But, sharing code is a **hard problem**. Do you have the same packages of the same versions as the developer did?

Package Management for Python

Why not pip, wheels, virtualenvs?

- Don’t handle the harder problem of system dependencies, considered out of scope by Python packagers — does it end up in site-packages?
- Package devs: On OSX and Linux, ‘easy’ to get the deps! Use a system package manager (e.g. apt, brew, yum) and the included compiler (e.g. clang, gcc).
- It’s still not easy to make reproducible builds, and what about Windows?

What about Windows?

- We are particularly stuck on Windows which lacks broadly used package management
- Only developers have a C compiler on their machine
- A hard problem
- Enter Conda

Why Conda?

- Scientific Python community identified that there was a gap not being addressed by the core Python infrastructure, limiting their ability to get packages into the hands of users
- Industry standard built by people who care about this space — Continuum Analytics

Why Conda?

- It solves a hard problem:
- Handles dependencies for many languages (C, C++, R and of course Python)
- Built for Python first, but it really solves a much broader infrastructural issue.
- E.g. Use it for isolated R installations, which are usually tricky

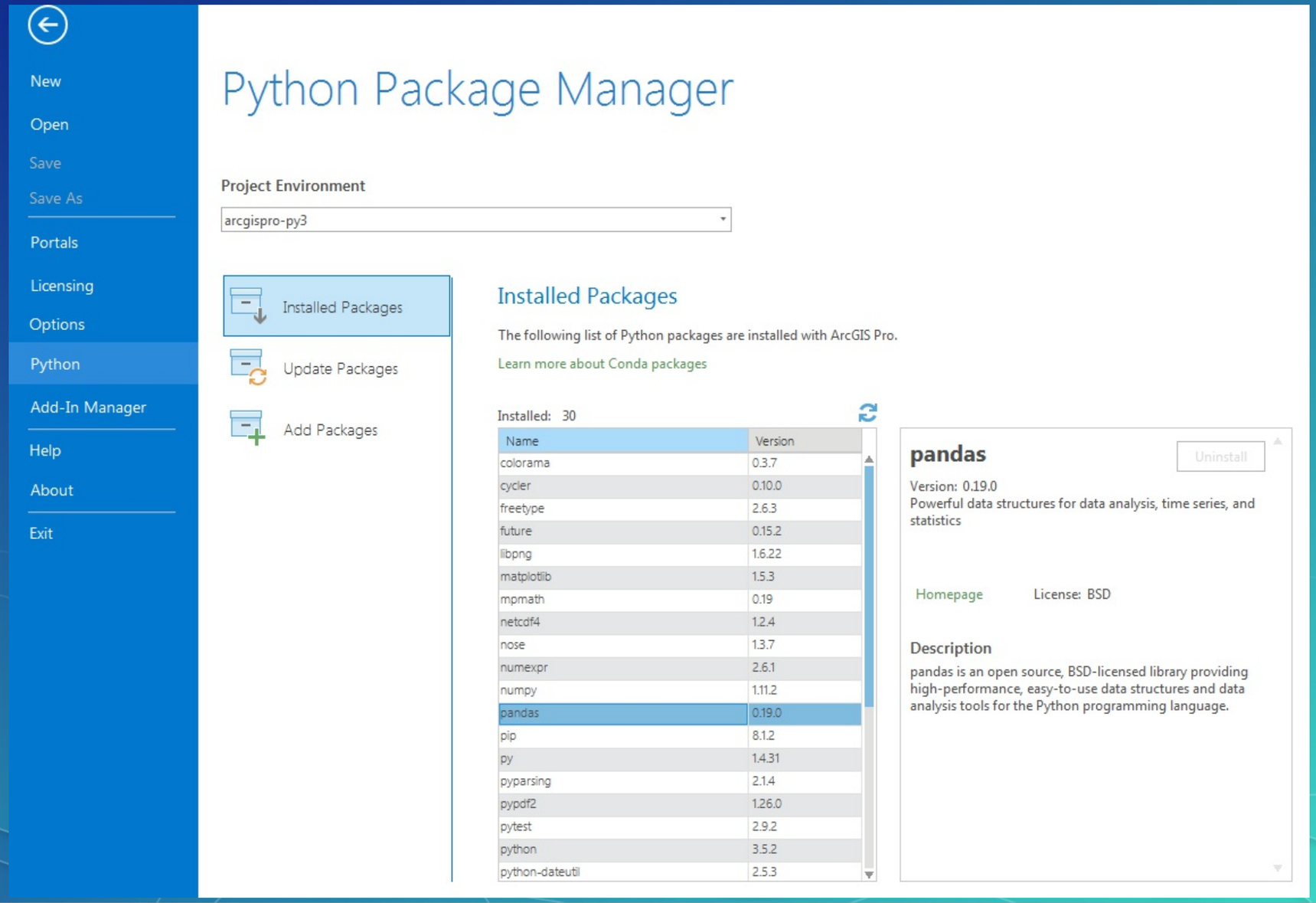
Conda

- Cross-platform: simply develop recipes for building and installing software on Linux, OS X and Windows.
- Open source: Esri is using it, you can use it in your own projects for other contexts

What can it install? Not just scientific packages. It can help with:

- GUI toolkits (PyQt, TKinter)
- C++ Libraries (Boost)
- IDEs (Spyder, Juptyer)

Conda in Pro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About
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Python Package Manager
Project Environment
arcgispro-py3
Installed Packages
Update Packages
Add Packages
Installed Packages
The following list of Python packages are installed with ArcGIS Pro.
Learn more about Conda packages
Installed: 30
Name
Version
colorama 0.3.7
cycler 0.10.0
freetype 2.6.3
future 0.15.2
libpng 1.6.22
matplotlib 1.5.3
mpmath 0.19
netcdf4 1.2.4
nose 1.3.7
numexpr 2.6.1
numpy 1.11.2
pandas 0.19.0
pip 8.1.2
py 1.4.31
pyparsing 2.1.4
pypdf2 1.26.0
pytest 2.9.2
python 3.5.2
python-dateutil 2.5.3
pandas
Uninstall
Version: 0.19.0
Powerful data structures for data analysis, time series, and statistics
Homepage
License: BSD
Description
pandas is an open source, BSD-licensed library providing high-performance, easy-to-use data structures and data analysis tools for the Python programming language.

- *Environments* —
  - A collection of packages and Python install is called an *environment*, the building block for managing Python with Conda
  - Flexibly make changes without affecting installed software
  - Can create multiple environments and switch seamlessly
- *Requirements* — include explicit state information, not just the package name.

Conda Basics

Activating environments, a couple ways:

- Use the shortcuts included in Pro
- Manually activate the environment:

```
cd C:\ArcGIS\bin\Python\Scripts
activate arcgispro-py3
```

Conda Basics

```
conda --help

conda info
```

Conda info is the starting point — it tells you the state of the environment.

Conda Basics Demo

Conda Basics

Once you’re in an environment get details with info:

```
conda info
```

Conda info is the starting point — it tells you the state of the environment.

Conda Basics

conda info

```
Current conda install:

             platform : win-64
        conda version : 4.0.6
  conda-build version : not installed
       python version : 3.5.1.final.0
     requests version : 2.9.1
     root environment : C:\ArcGIS\bin\Python  (writable)
  default environment : C:\ArcGIS\bin\Python\envs\arcgispro-py3
     envs directories : C:\ArcGIS\bin\Python\envs
        package cache : C:\ArcGIS\bin\Python\pkgs
         channel URLs : https://conda.anaconda.org/esri/win-64/
                        https://conda.anaconda.org/esri/noarch/
                        https://repo.continuum.io/pkgs/free/win-64/
                        https://repo.continuum.io/pkgs/free/noarch/
          config file : C:\ArcGIS\bin\Python\.condarc
```

Conda Basics

conda list

```
# packages in environment at C:\ArcGIS\bin\Python\envs\arcgispro-py3:
#
#
colorama                  0.3.7                    py35_0    defaults
cycler                   0.10.0                    py35_0    defaults
future                   0.15.2                    py35_0    defaults
matplotlib                1.5.3           np111py35_0e  [arcgispro]  esri
mpmath                     0.19                    py35_1    defaults
netcdf4                   1.2.4                 py35_0e  [arcgispro]  esri
nose                      1.3.7                    py35_1    defaults
numexpr                   2.6.1           np111py35_0e  [arcgispro]  esri
numpy                     1.11.2                py35_0e  [arcgispro]  esri
pandas                    0.19.0             np111py35_0    defaults
pip                      8.1.2                   py35_0    defaults
py                       1.4.31                  py35_0    defaults
pyparsing                 2.1.4                    py35_0    defaults
pypdf2                   1.26.0                    py_0    esri
pytest                   2.9.2                   py35_0    defaults
python                    3.5.2                      0    defaults
```

Conda Basics

Creating new environments:

- A few different ways. Can manually specify the dependencies:

```
conda create --name my_env python=3.5 numpy flask dask
```

- Can also use a file which includes all the dependencies:

```
conda create --name my_env --file my_sweet_depends.txt
```

These can contain explcit information about channels, to ensure that the new environment precisely matches the requirements.

Conda vs…

Name	Means	Will Ship?
Conda	The command itself	✓
Miniconda	A minimum set of Python packages to build and run Conda.	✓
Anaconda	A distribution 200+ packages built with Conda	
Anaconda Server	Host the full infrastructure internally	

Deeper Dive

Demo: Conda Package

Multiple Pythons

Currently:

Platform	Python version
Desktop	Python 2.7 (2.7.13)
Pro	Python 3.5 (3.5.3)

Multiple Pythons

Upgrade code? Python migration for ArcGIS Pro

- Do it! You can support 2 + 3 without that much work
- Still need to change `arcpy.mapping` to `arcpy.mp` when moving from Desktop to Pro, but no Python language level changes needed. . . .

But… this can be costly. For many organizations, a significant burden, even if the language changes are relatively small. Multiple Pythons is a solution to this.

Challenges

Have to make sure you're running the right Python (*what happens when you type python at the command line?*)

- Working to make this easy as possible
- It'll be easy to tell in app
- Isolated installation fixes a variety of issues
- Requires some user education over the "only one Python on the box" model
- Upgrades, what happens?

What Do I Get Out of the Box?

- Conda command and a Conda root Python install
- New modules (e.g. requests)
- Conda environment with all of the ArcGIS Pro dependencies as Conda packages

How can I use this?

- ArcGIS ships with the SciPy stack — powerful and out of the box in all products
- Conda command and a Conda root Python install
- New modules (e.g. requests), environment with Pro
- Python Package Manager in Pro . . .
- Get packages, expand your possibility space
- Package your work: this is an opportunity to distribute it

Where Can I Run This?

- ArcGIS Pro 1.3: first with conda
- ArcGIS Pro 2.0:
  - Python Package Manager
  - Python 3.5 with current package set
- ArcGIS Enterprise 10.5
- ArcGIS API for Python

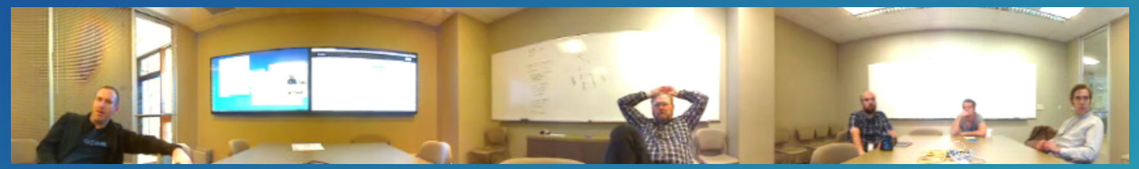
from future import *

- Effectively manage complex software dependencies with Conda.
- Thousands of packages exist today, can integrate it into your organization’s needs.

Closing

Thanks

Esri Conda Team:



Continuum Analytics for creating and open sourcing Conda

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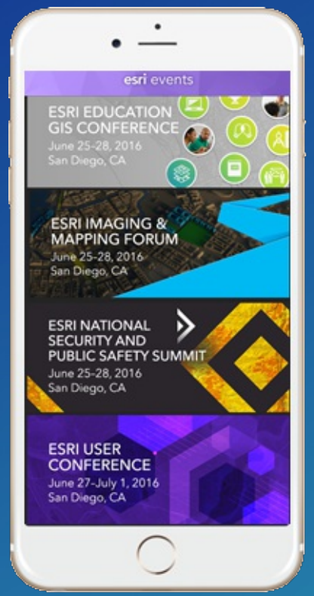

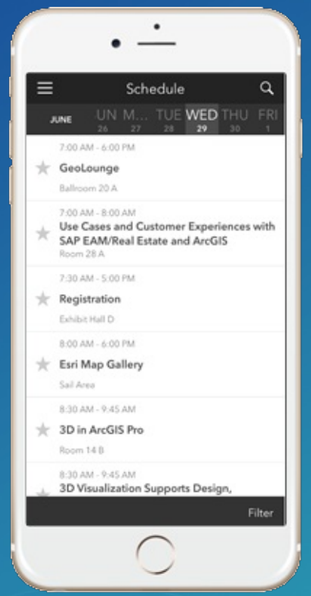

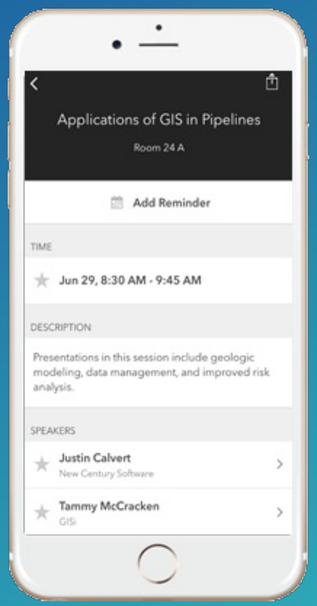

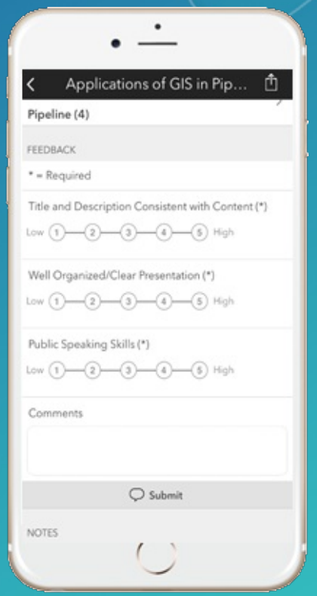


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