Scripting McIDAS-X in a Python environment

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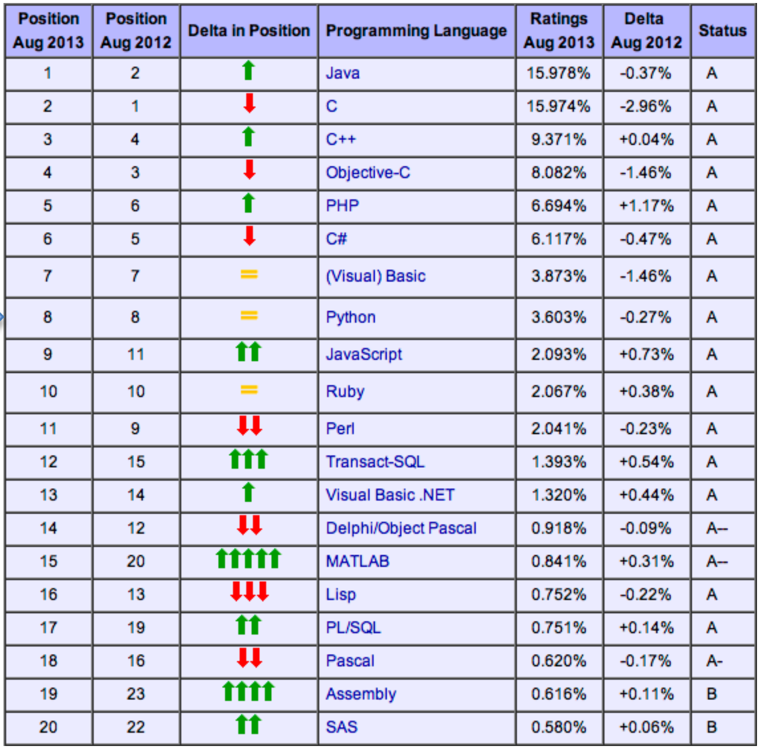
What problems are we trying to solve?

- Running a mcenv instance within a bash script requires redirection of stdin (i.e. "<< 'EOF'")
- Parsing text in bash can be clumsy, requires piping commands together to extract useful information.
- Manipulating dates in bash is messy, code can often depend on having a particular version of GNU date installed, for example.

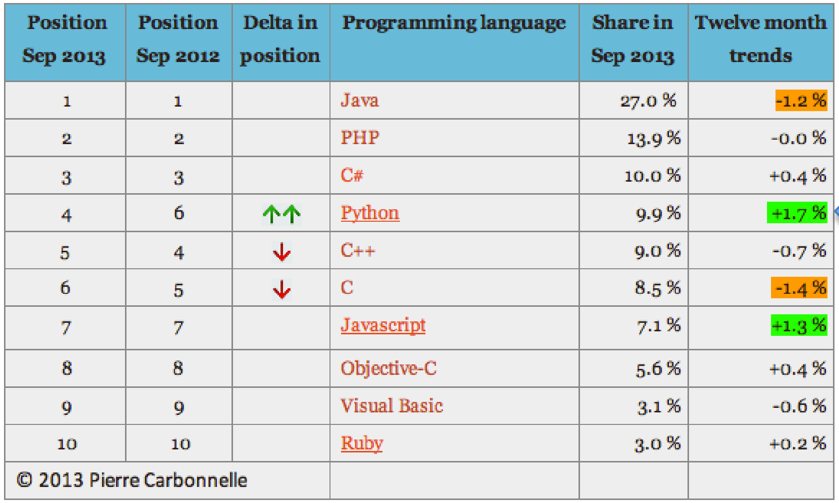
What is Python?

- Python is a general-purpose interpreted programming language that supports multiple programming paradigms, including both object-oriented and procedural programming.
- Python is very flexible and can be used to write anything from simple scripts to an entire application with a fully graphical interface.
- Because of the flexibility it provides, Python has been one of the most popular programming languages over the past 10 years.

What makes Python a good alternative?



Position Aug 2013	Position Aug 2012	Delta in Position	Programming Language	Ratings Aug 2013	Delta Aug 2012	Status
1	2	↑	Java	15.978%	-0.37%	A
2	1	↓	C	15.974%	-2.96%	A
3	4	↑	C++	9.371%	+0.04%	A
4	3	↓	Objective-C	8.082%	-1.46%	A
5	6	↑	PHP	6.694%	+1.17%	A
6	5	↓	C#	6.117%	-0.47%	A
7	7	=	(Visual) Basic	3.873%	-1.46%	A
8	8	=	Python	3.603%	-0.27%	A
9	11	↑↑	JavaScript	2.093%	+0.73%	A
10	10	=	Ruby	2.067%	+0.38%	A
11	9	↓↓	Perl	2.041%	-0.23%	A
12	15	↑↑↑	Transact-SQL	1.393%	+0.54%	A
13	14	↑	Visual Basic .NET	1.320%	+0.44%	A
14	12	↓↓	Delphi/Object Pascal	0.918%	-0.09%	A--
15	20	↑↑↑↑↑	MATLAB	0.841%	+0.31%	A--
16	13	↓↓↓	Lisp	0.752%	-0.22%	A
17	19	↑↑	PL/SQL	0.751%	+0.14%	A
18	16	↓↓	Pascal	0.620%	-0.17%	A-
19	23	↑↑↑↑	Assembly	0.616%	+0.11%	B
20	22	↑↑	SAS	0.580%	+0.06%	B



Position Sep 2013	Position Sep 2012	Delta in position	Programming language	Share in Sep 2013	Twelve month trends
1	1		Java	27.0 %	-1.2 %
2	2		PHP	13.9 %	-0.0 %
3	3		C#	10.0 %	+0.4 %
4	6	↑↑	Python	9.9 %	+1.7 %
5	4	↓	C++	9.0 %	-0.7 %
6	5	↓	C	8.5 %	-1.4 %
7	7		Javascript	7.1 %	+1.3 %
8	8		Objective-C	5.6 %	+0.4 %
9	9		Visual Basic	3.1 %	-0.6 %
10	10		Ruby	3.0 %	+0.2 %
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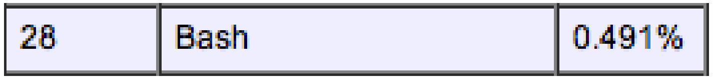
https://sites.google.com/site/pydatalog/pypl/PyPL-PopularitY-of-Programming-Language

http://www.tiobe.com/index.php/content/paperinfo/tpci/index.html

Where is bash?



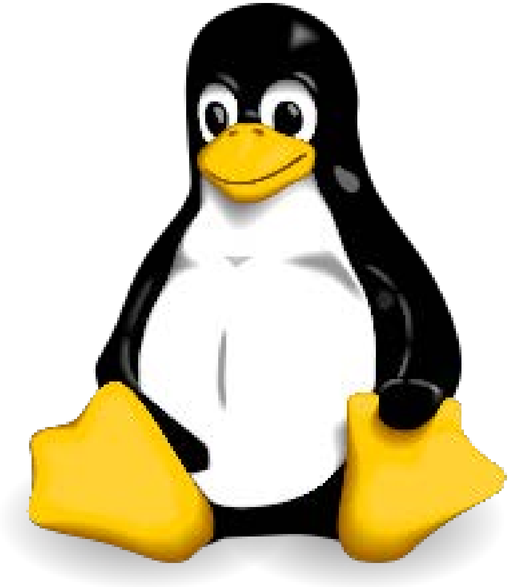
28	Bash	0.491%

What makes Python a good alternative?

- Existing Python modules such as NumPy and SciPy offer advanced mathematical/scientific analytical tools comparable to MATLAB or R.
- As implied by the name, Python modules are modular, allowing a user to import whichever modules they deem necessary for their project.
- Because of the nature of Python modules, code implementing the McIDAS-X module can easily be added to an existing project; similarly, any McIDAS-X Python script can be extended to use other modules.

What makes Python a good alternative?

Python is multi-platform



How our solution works

- The Python 'subprocess' module is used to spawn an instance of the mcenv shell in the backround
- mcenv shell commands are passed to the mcenv session using pseudo-native python functions, as in the following examples:
  - bash:

    ```
    imglist.k DATA/SET FORM=ALL
    ```
  - python:

    ```
    mcenv.imglist("DATA/SET FORM=ALL")
    ```
- In this case, the imglist method is not explicitly defined, but rather is interpreted such that the example bash command is run in the mcenv sub-shell.

bash example

```
#!/bin/bash
PATH=/home/mcidas/bin:$PATH
MCPATH=$HOME/mcidas/data:/home/mcidas/data
export PATH MCPATH
mcenv << 'EOF'
        logon.k ABC 1234
        dataloc.k ADD GROUP SERVER.DOMAIN
        imglist.k GROUP/DESCRIPTOR TIME=12:00

EOF
```

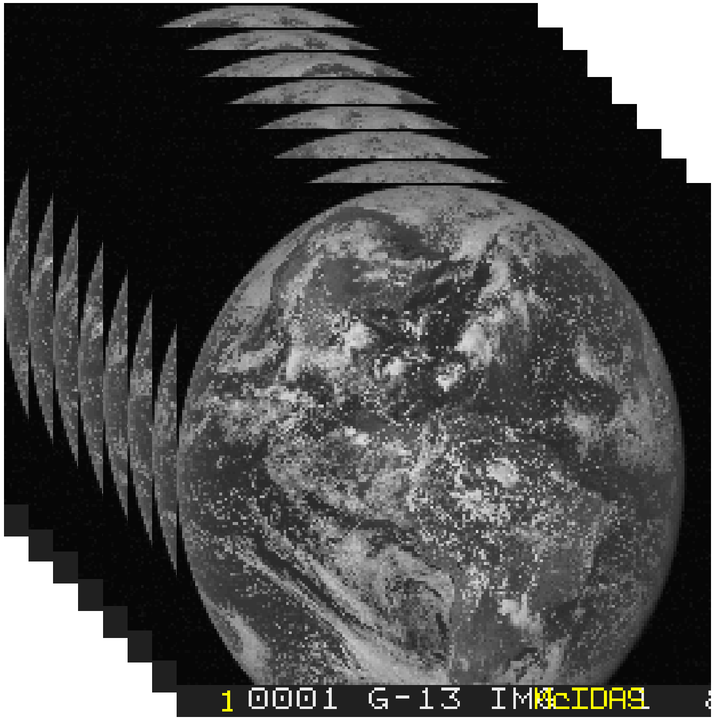
Python example

```
#!/usr/bin/env python
import mcidasx
import os
os.environ['PATH'] = "%s:%s" % ('/home/mcidas/bin', os.environ['PATH'])
os.environ['MCPATH'] = '%s/mcidas/data:~mcidas/data' % os.environ['HOME']

m = mcidasx.mcidas.mcenv()

m.logon('ABC 1234')
m.dataloc('ADD GROUP SERVER.DOMAIN')
m.imglist('GROUP/DESCRIPTOR TIME=12:00')
```

Setting environment variables could be further abstracted into the module import step in order to simplify code.

GOES East Full Disk over a range of days

```
#!/usr/bin/env python
import mcidasx
import os
Import sys
from datetime import datetime
from mcidasx.utilities import date_range

mcidas_home = '/home/mcidas'
os.environ['PATH'] = "%s:%s" % (mcidas_home + '/bin', os.environ['PATH'])
os.environ['MCPATH'] = '%s/mcidas/data:%s/data' % (os.environ['HOME'], mcidas_home)

def main(start_date, end_date):
    mcenv = mcidasx.mcidas.mcenv(frame_size='900x1200')

    mcenv.logon("ABC 1234")
    mcenv.dataloc("ADD AGOES13 GEOARC.SSEC.WISC.EDU")

    for day in date_range(start_date, end_date):
        d = day.strftime('%Y%j')
        mcenv.imgdisp("AGOES13/FD MAG=-10 -20 BAND=1 DAY=%s TIME=17:45" % d)
        mcenv.frmsave("1 test-%s.jpg" % d)


if __name__ == "__main__":
    start_date = datetime.strptime(sys.argv[1], '%Y-%m-%d')
    end_date = datetime.strptime(sys.argv[2], '%Y-%m-%d')
    main(start_date, end_date)
```



Relevant python modules

- NumPy
- SciPy
- netCDF4
- GDAL
- matplotlib
- PyTables
- pandas

How can users install the McIDAS-X python module?

- Care was taken to ensure that the McIDAS-X python module could be installed and imported just like any other python module.
- ftp://ftp.ssec.wisc.edu/pub/mug/mug_meeting/2013/python/mcidasx-python.tar.gz
- Decompress the archive, and run 'python setup.py install --user' in the new directory (or use a Python tool such as pip or easy_install to install the .tar.gz directly).
- Now, within python, add the command 'import mcidasx', and all of the functionality of this module should be available.

Future work

- Additional modules which offer more direct access to underlying McIDAS-X commands
  - For example, the imglist command could return a Python object with callable methods and accessible attributes, rather than returning a multi-line string (which needs to be manually parsed to be useful).
- Additional specialized/specific utility functions
  - Perhaps functions that generate commonly used McIDAS time/date formats
- Although we are giving this "McIDAS-X/Python" presentation at the MUG meeting, this project is not currently funded by MUG.
  - Funded by another project at SSEC where the use of Python was necessary
- Disclaimer – This project was initially designed as a proof-of-concept, and as such has not been thoroughly tested for every McIDAS-X command.

Questions?