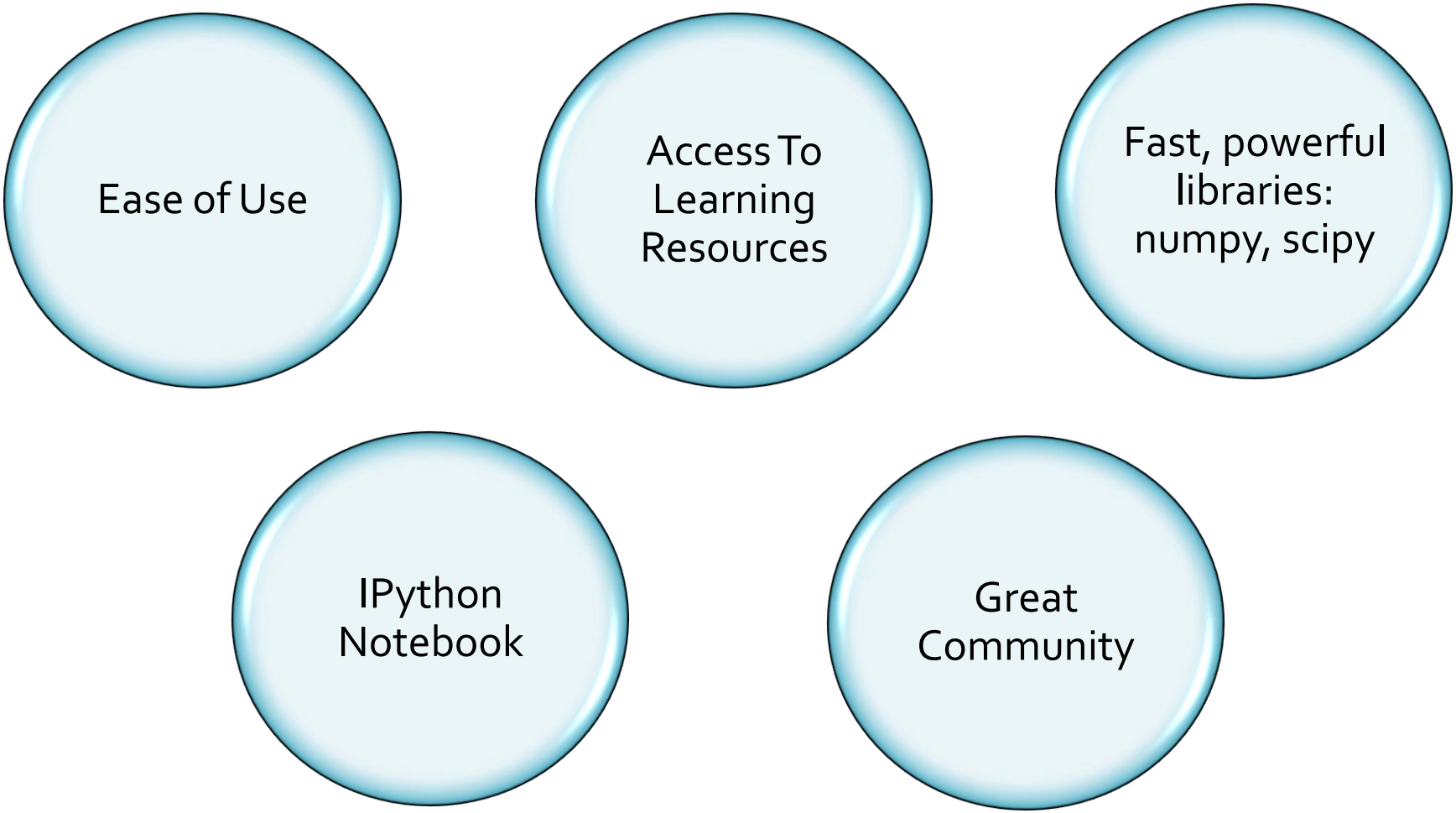
Tracy Miranda, Kichwa Coders – EclipseCon Europe 2015

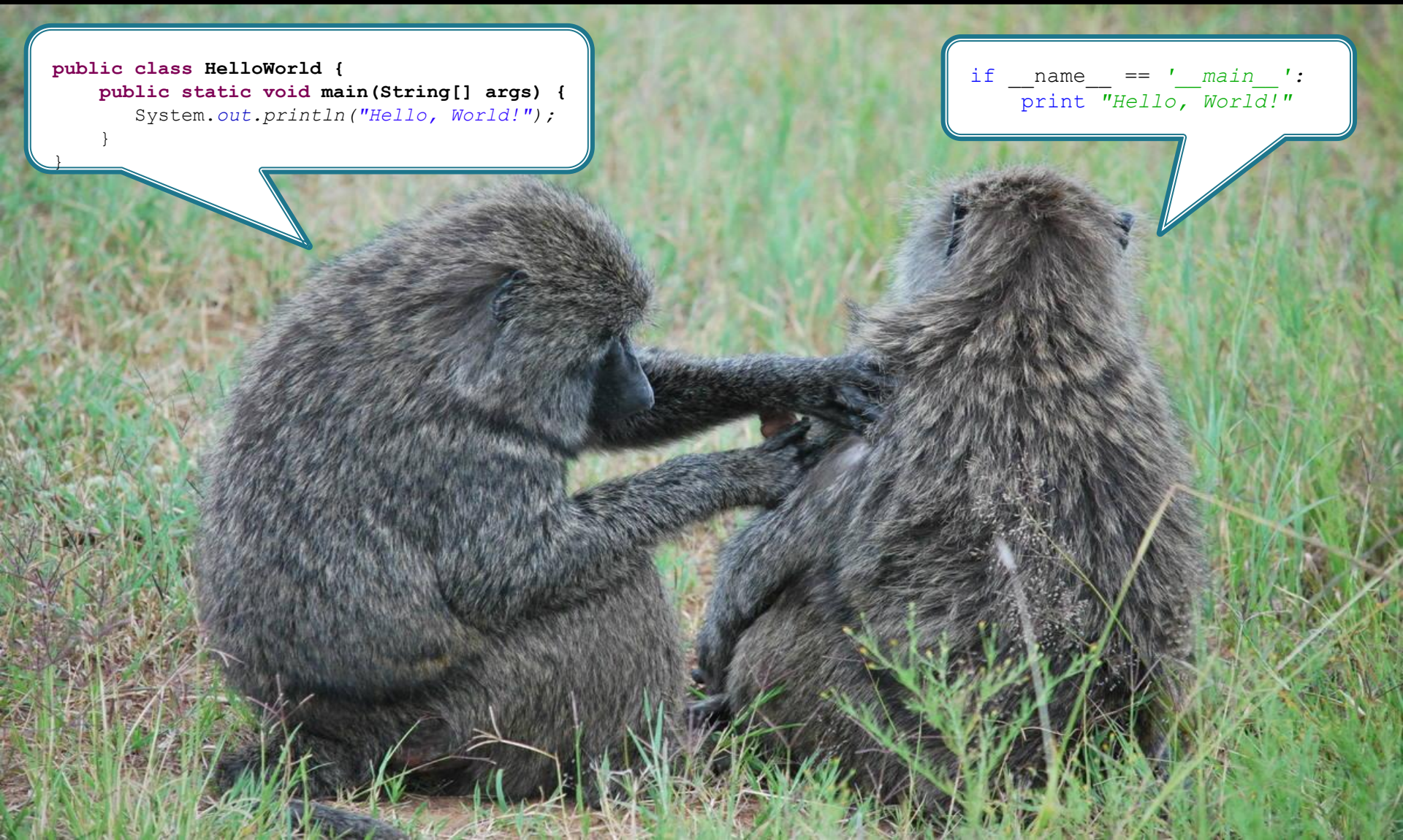
Integrating Java and Python

Python for Non-Traditional Programmers



JAVA		PYTHON
Statically -Typed		Dynamically-Typed
Verbose		Concise
Scales well		Ideal for beginners
Loved by tool developers and enterprise		Loved by academics and researchers
Eclipse RCP, SWT, EMF		Numpy, scipy, matplotlib, IPython notebook

JAVA + PYTHON: In Harmony Together



Case Study: Diamond LightSource

Scaling Scientific Tools

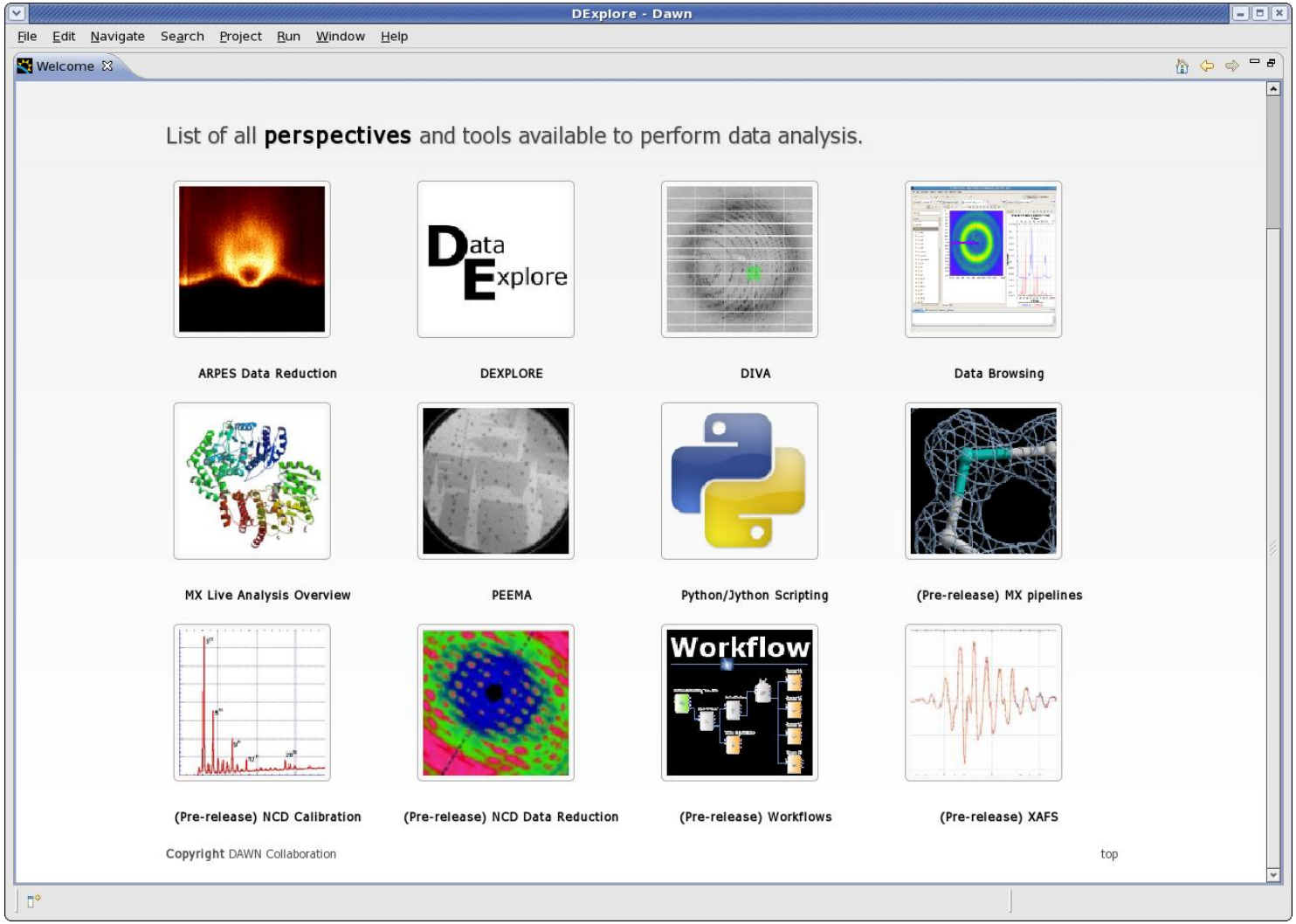
2005:

"I have all the data I have ever collected on a floppy disk and process it by hand…"

- Principal Beam Line Scientist
- Diamond Light Source Synchrotron

- (hat-tip: Mark Basham: Mark Basham - Python for High Throughput Science, PyData 2014)

DAWN SCIENCE

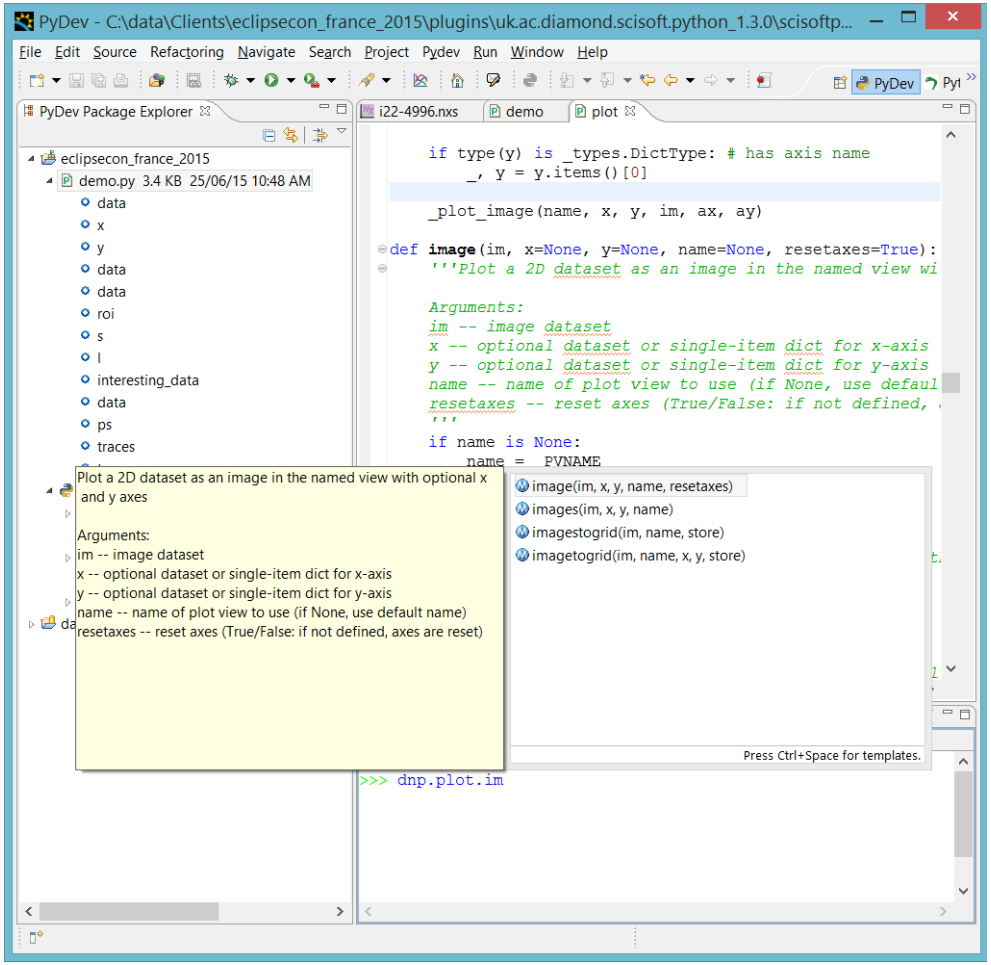


Requirements

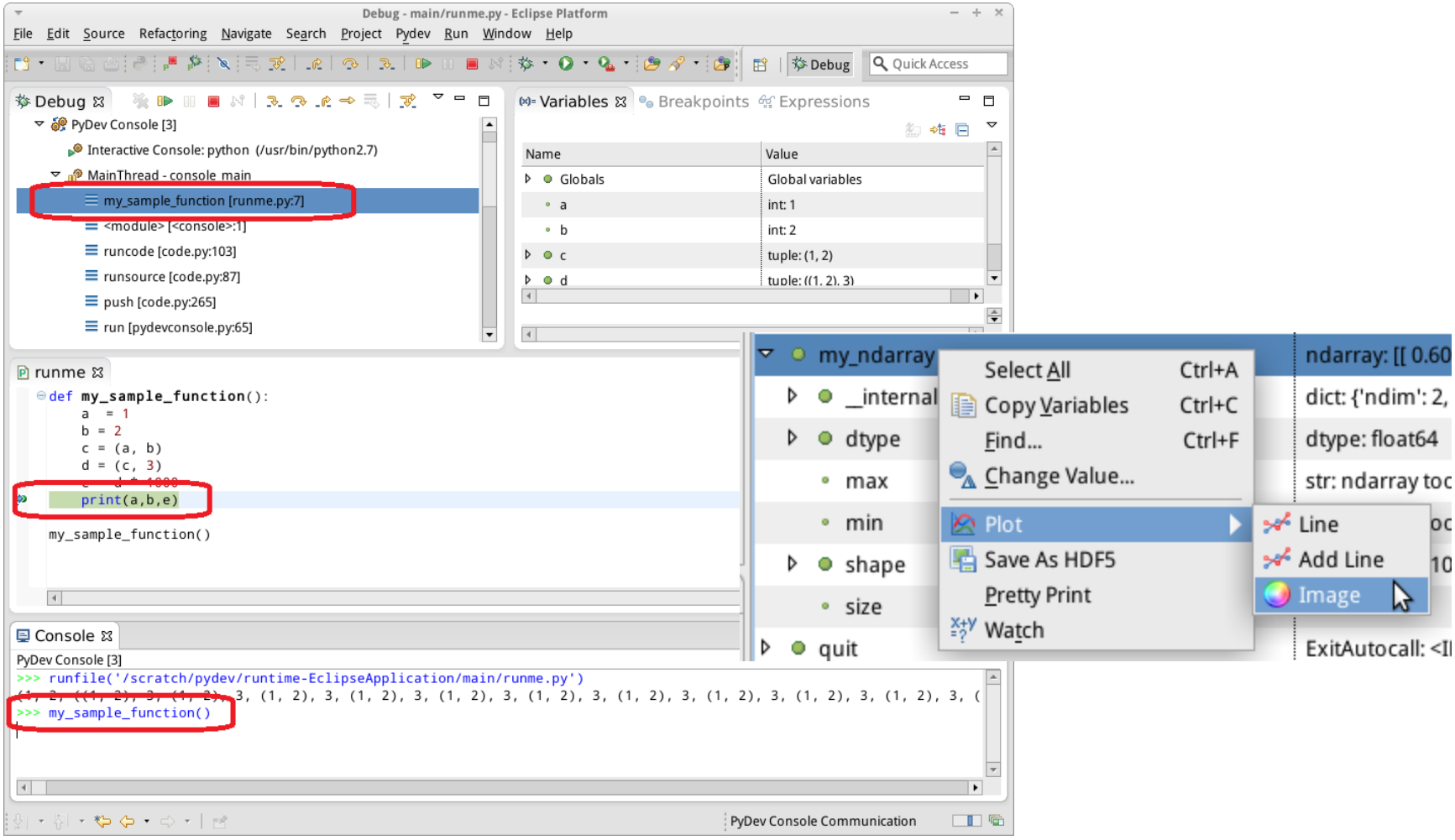
- Control the User Interface
- Python to Java
  - In Python, being able to access Java objects
  - Moving data around
  - Needed for Plotting arrays in the workbench
  - (while still running your existing scripts)
- Java to Python
  - In Java, code can access scripts in Python
  - Workflows, Extending Eclipse with Python

1. PyDev

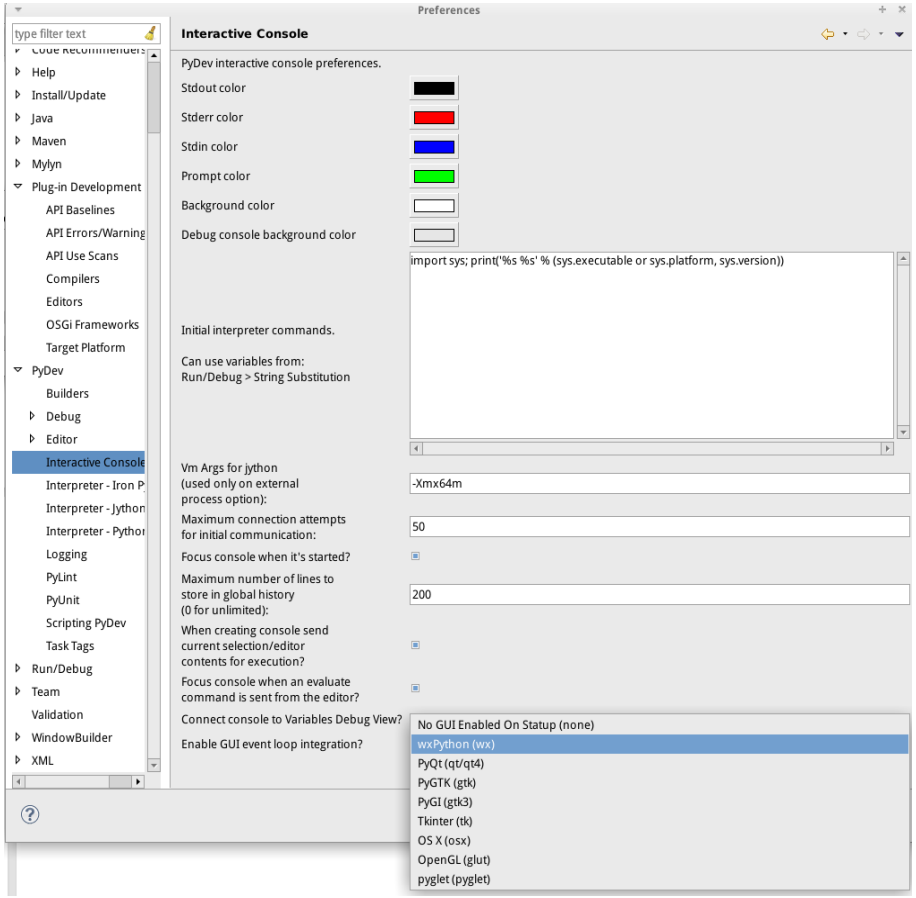
- C Python
- Jython
- PyPy
- IronPython
- Cython
- IPython

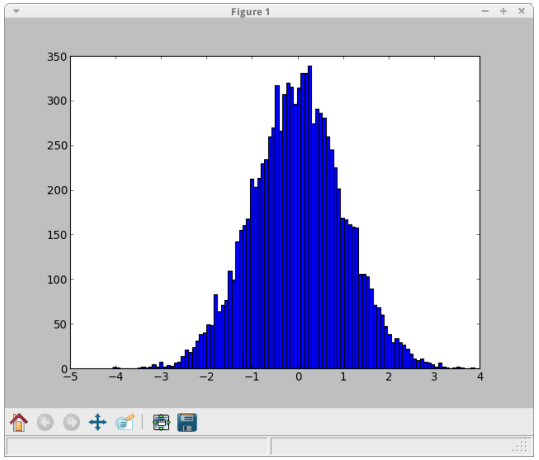


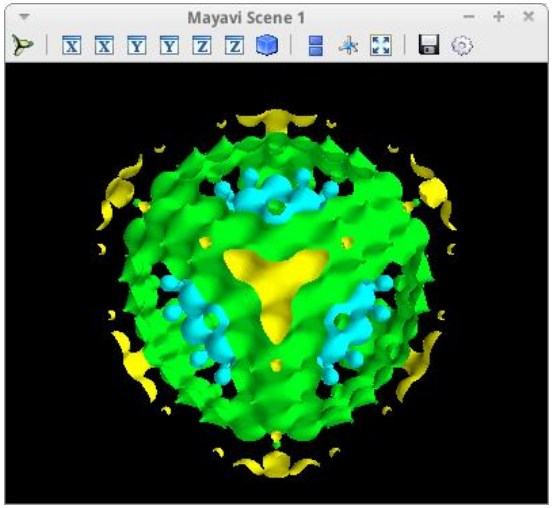
1. PyDev - Debug



1. PyDev - Integration



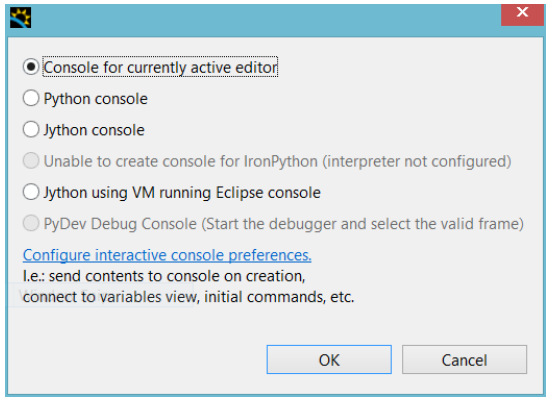




2. Jython

- ☑ Java implementation of Python
- ☑ Runs in JVM so can access all JAVA classes

- ✖ Jython cannot access C modules
- ✖ JyNi could solve this, but
  - ➢ Only initial numpy support
  - ➢ No Windows support
  - ➢ Licensing issues
- ✖ Separate environment



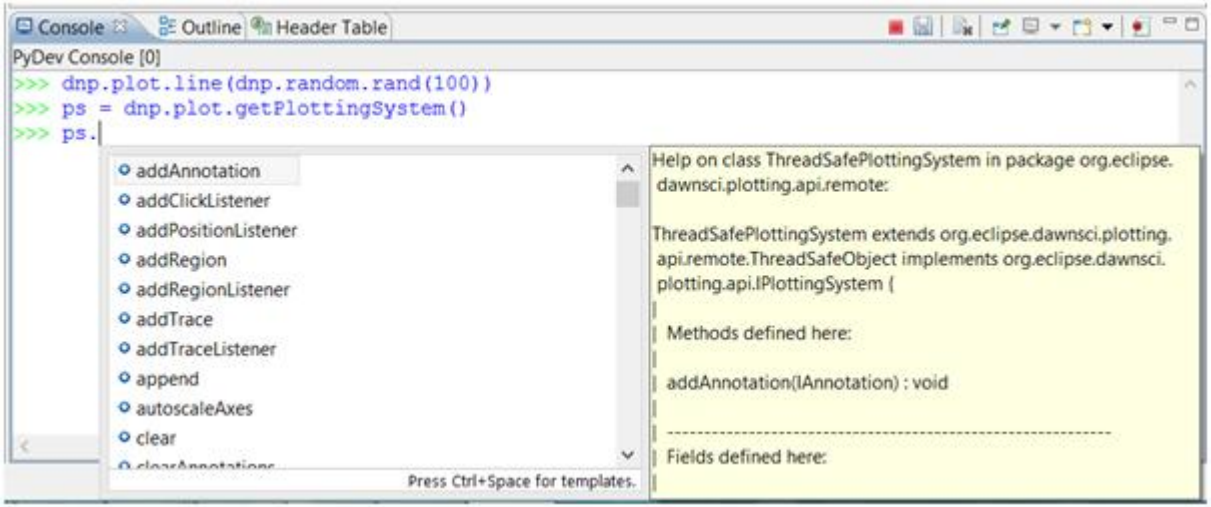
3. Py4J

- ☑ "A Bridge between Java and Python"
- ☑ Runs in JVM and allows Python to access JAVA classes
- ☑ Enables Python to Java
- ☑ Allows control of User Interface and ability to run your scripts

- ➢ Creates proxies rather than moving data
- ➢ Exposes everything
- ➢ No Java to Python support

3. Py4J

- Interactive autocompletion of Java code in Python
- Autogenerated pop-up help based on method signatures



4. AnalysisRPC

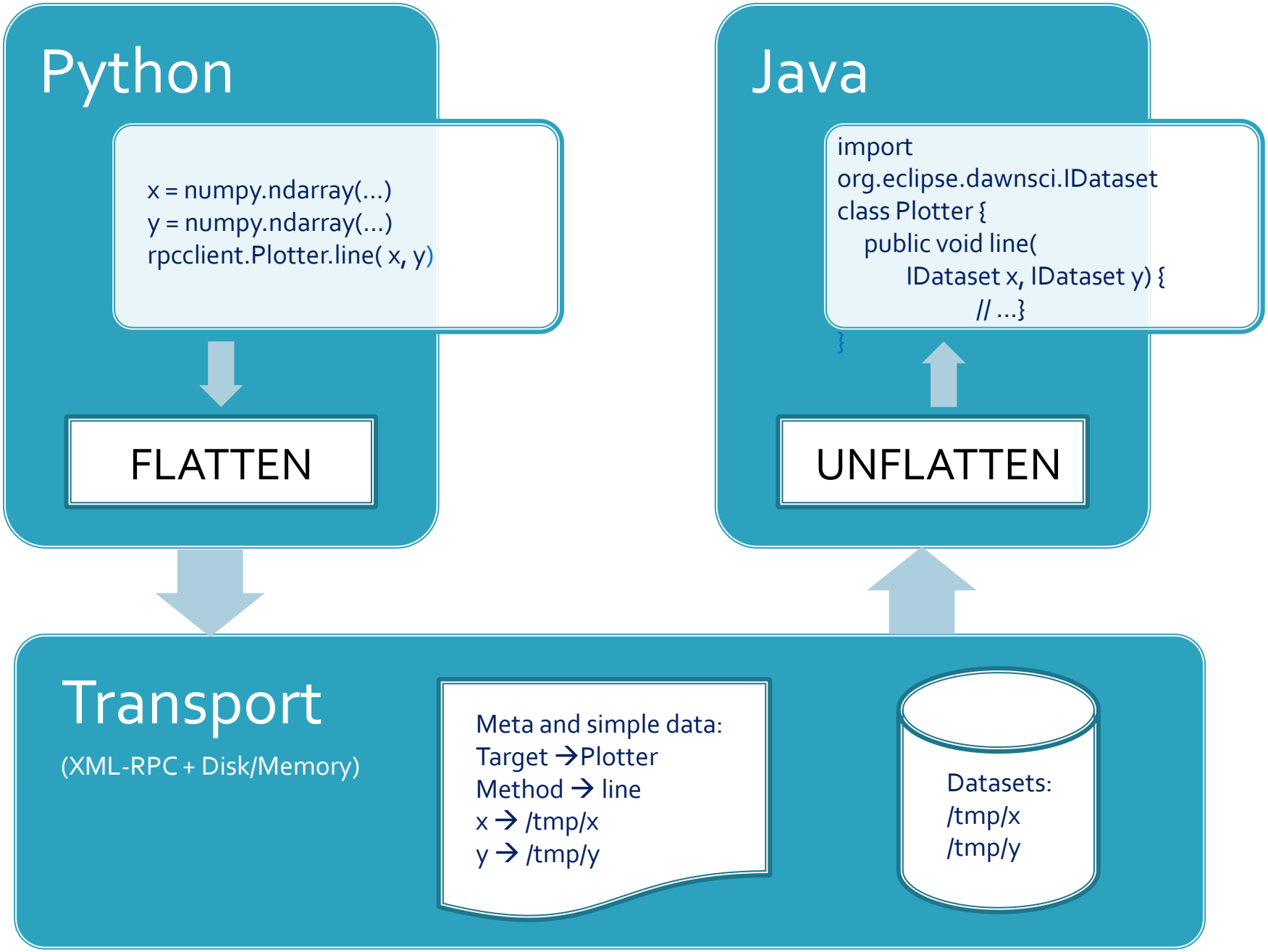
Custom solution to move data around

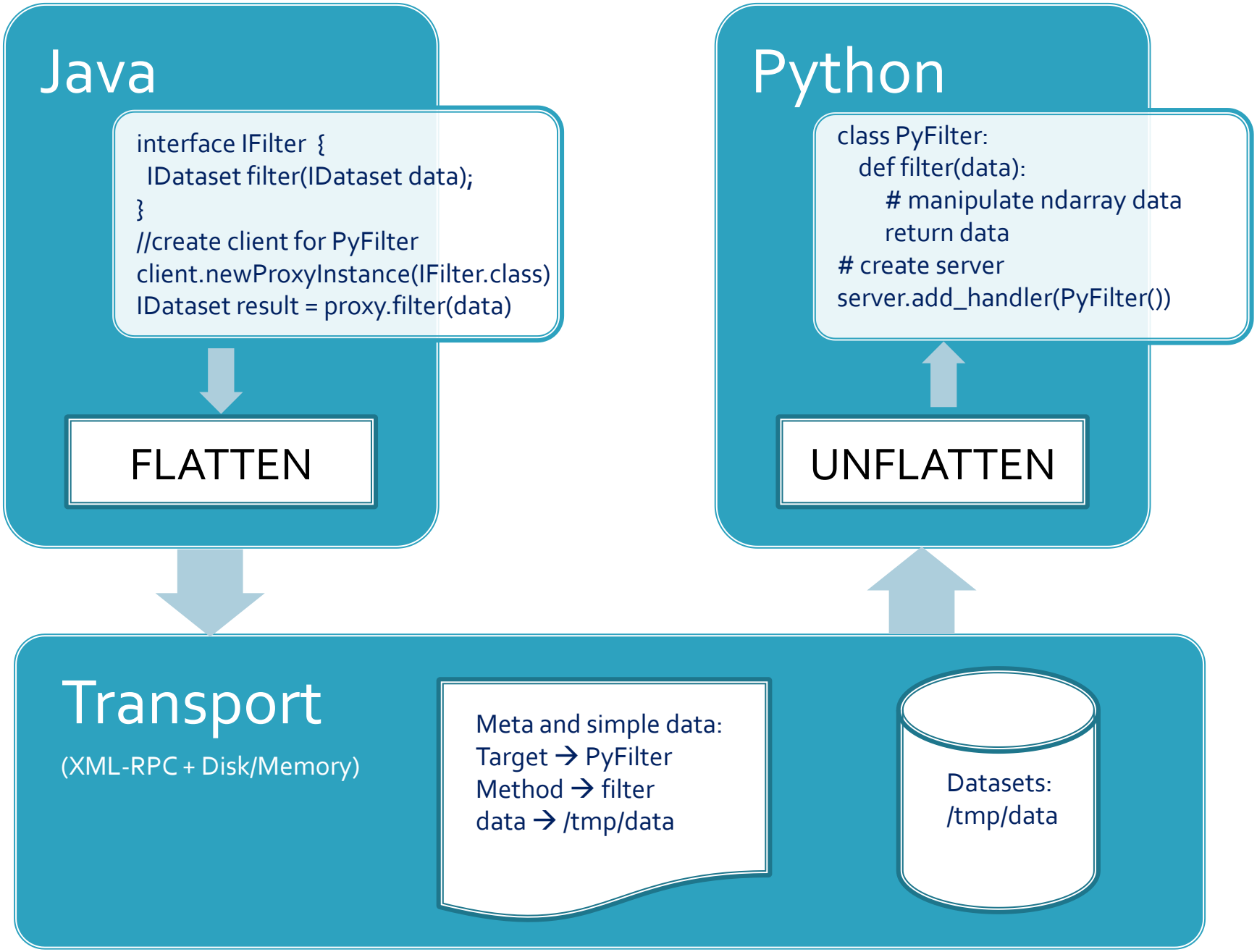
Enhanced Remote Procedure Call

- Datasets (ndarrays)
- Regions Of Interest (ROIs)
- Exceptions

Language Independent

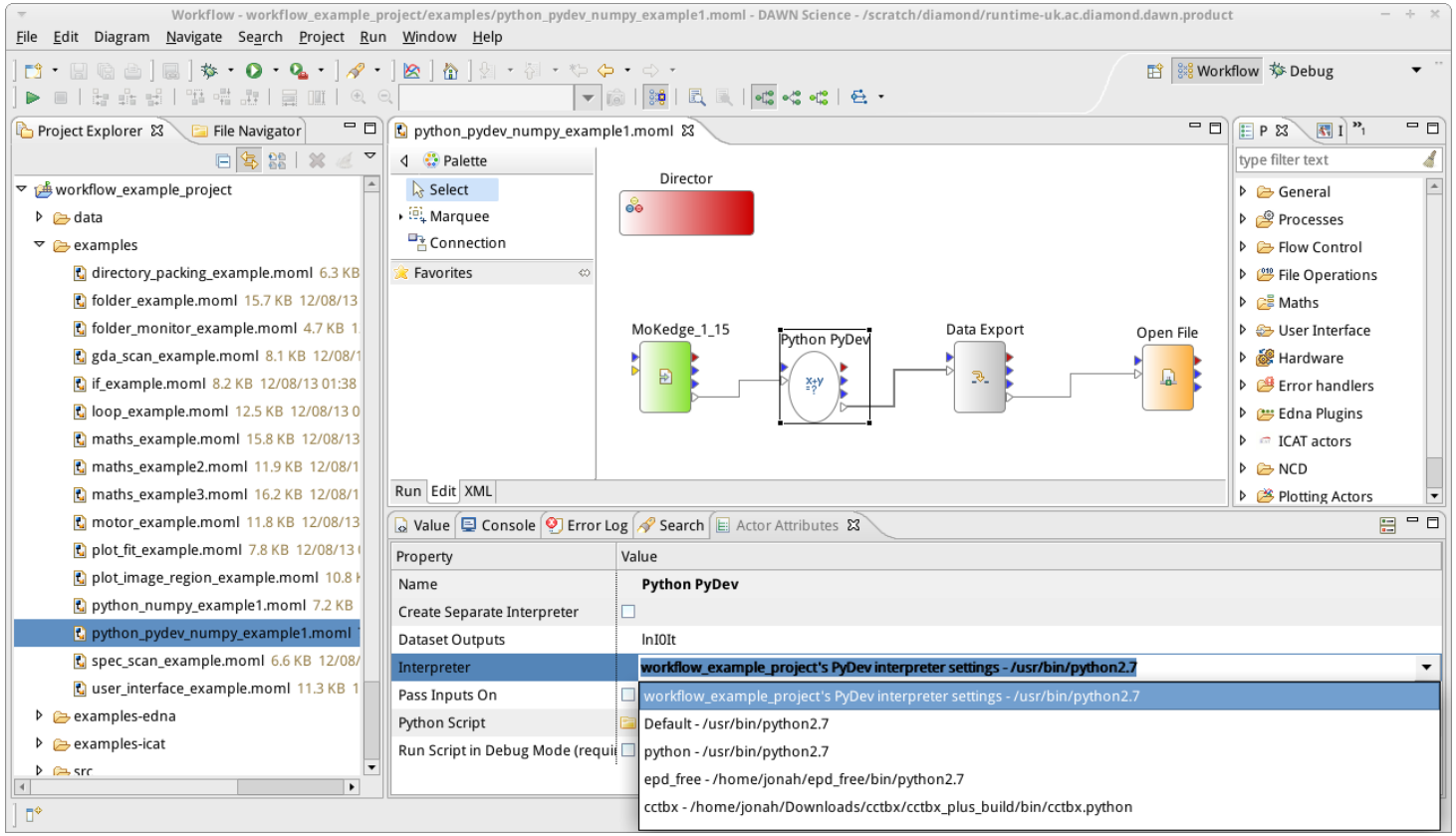
Server and client written for Java and Python


Python
x = numpy.ndarray(...)
y = numpy.ndarray(...)
rpcclient.Plotter.line(x, y)
FLATTEN
Java
import
org.eclipse.dawnsci.IDataset
class Plotter {
public void line(
IDataset x, IDataset y) {
// ...}
}
UNFLATTEN
Transport
(XML-RPC + Disk/Memory)
Meta and simple data:
Target →Plotter
Method → line
x → /tmp/x
y → /tmp/y
Datasets:
/tmp/x
/tmp/y


Java
interface IFilter {
IDataset filter(IDataset data);
}
//create client for PyFilter
client.newProxyInstance(IFilter.class)
IDataset result = proxy.filter(data)
FLATTEN
Python
class PyFilter:
def filter(data):
# manipulate ndarray data
return data
# create server
server.add_handler(PyFilter())
UNFLATTEN
Transport
(XML-RPC + Disk/Memory)
Meta and simple data:
Target → PyFilter
Method → filter
data → /tmp/data
Datasets:
/tmp/data

Python To Java

- Workflows – Python Actor



AnalysisRPC

- ☑ Allows moving data around efficiently
- ☑ Java to Python, Python to Java
- ☑ Generic Calling Infrastructure
- ☑ Way of Handling Exceptions

- ✖ In DAWNSci today – needs repackaging for use more widely.
- ✖ Support for custom datatypes

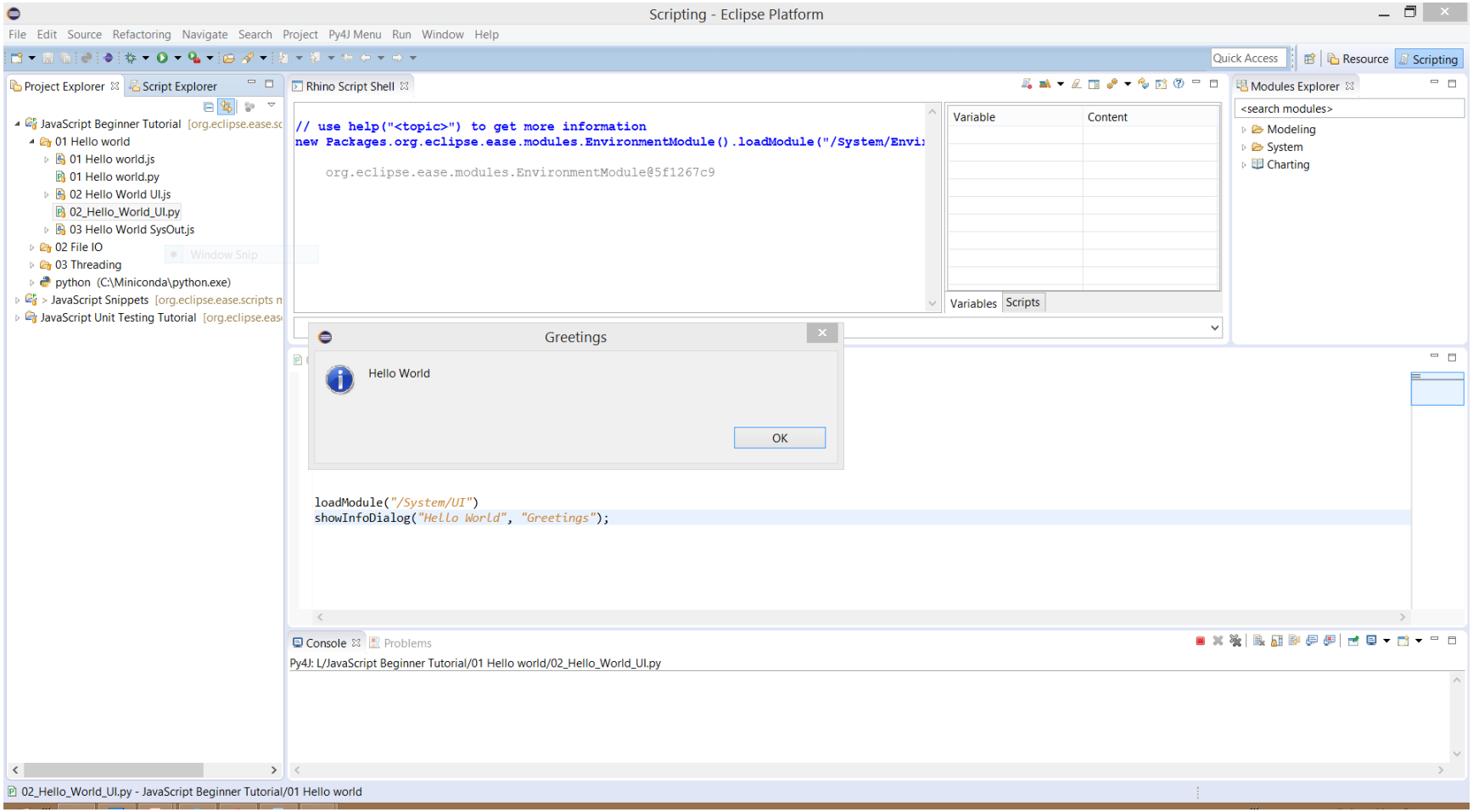
Java & Python

Java and Python Integration is possible thanks to a mix of different technologies:

- PyDev
- Jython
- AnalysisRPC
- Py4J

- Going forward can we unify this technology?

Eclipse Advanced Scripting Environment (EASE)



Uniting Python In Eclipse

1. Integrate Py4J into EASE
2. Integrate AnalysisRPC into EASE
3. Integrate EASE (now with Py4J and AnalysisRPC) into SWG projects

Scope?

- Support for additional data structures
- Annotations, code generation

Uniting Python in Eclipse

1. Integrate Py4J into EASE
   - Py4JPythonScriptEngine
     - Threading model
     - Memory Management
   - User Experience
     - Integrate best of PyDev
   - What about EASE into Eclipse Platform?

OAK RIDGE National Laboratory

Python & Java

With tight integration Java & Python work together to create a powerful environment for Science, and beyond!

Keep upto date with latest at science working group forum

science.eclipse.org

Questions?

- Tracy Miranda tracy@kichwacoders.com
- Jonah Graham

n