

# Galaxy Interactive Environments

Björn Grüning and Eric Rasche

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# Interactive Environment (IEs)

Interactive  
Environments

BG & ER

What are IEs?

Demo

How?

Who?

Why?

Use Cases

Teaching  
Research

Available IEs

IPython  
RStudio

Thanks

Q&A

- New way to interact with your data, without leaving Galaxy
- Flexible, efficient, extensible, and interactive
- Full spectrum of use; Teaching, Research, and Development

# Your favourite Data Science tools...

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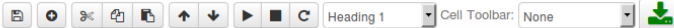
IPython  
RStudio

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Q&A

## IP[y]: Notebook ipython\_galaxy\_notebook

File Edit View Insert Cell Kernel Help



### Welcome to the interactive Galaxy IPython Notebook.

You can access your data via the dataset number. For example, `handle = open(get(42), 'r')`. To save data, write your data to a file, and then call `put('filename.txt')`. The dataset will then be available in your galaxy history. Notebooks can be saved to Galaxy by clicking the large green button at the top right of the IPython interface.

More help and informations can be found on the project [website](#).

In [1]:

# ... Inside of Galaxy

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The screenshot displays the Galaxy web interface. At the top, a dark navigation bar contains the 'Galaxy' logo and several menu items: 'Analyze Data', 'Workflow', 'Shared Data', 'Visualization', 'Admin', 'Help', and 'User'. Below this, the main content area is divided into three panels. The left panel, titled 'Tools', contains a search bar and a list of tool categories such as 'Get Data', 'Send Data', 'Lift-Over', 'Text Manipulation', 'Filter and Sort', 'Join, Subtract and Group', 'Convert Formats', 'Extract Features', 'Fetch Sequences', 'Fetch Alignments', 'Statistics', and 'Graph/Display Data'. The middle panel, titled 'IP[y]: Notebook ipython\_galaxy\_notebook', features a menu bar (File, Edit, View, Insert, Cell, Kernel, Help) and a toolbar with various icons. The main text area of the notebook displays a welcome message: 'Welcome to the interactive Galaxy IPython Notebook.' followed by instructions on how to access data via dataset numbers and save data to a file. Below the text is a code input area with the prompt 'In [1]:'. The right panel, titled 'History', contains a search bar and shows an 'Unnamed history' with 1 shown and 2 datasets. It lists a '4 lines' dataset in 'txt' format, with a 'Pasted Entry' section showing a table of data. The table has two columns, 'T' and 'A', and five rows of data: (1, 2), (3, 4), and (5, 6). The bottom of the interface features a series of navigation icons for navigating between different views and datasets.

Galaxy

Analyze Data Workflow Shared Data Visualization Admin Help User

Tools

search tools

Get Data  
Send Data  
Lift-Over  
Text Manipulation  
Filter and Sort  
Join, Subtract and Group  
Convert Formats  
Extract Features  
Fetch Sequences  
Fetch Alignments  
Statistics  
Graph/Display Data

Workflows  
• All workflows

IP[y]: Notebook ipython\_galaxy\_notebook

File Edit View Insert Cell Kernel Help

Heading 1 Cell Toolbar: None

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In [1]:

History

search datasets

Unnamed history  
1 shown, 2 [datasets](#)  
47 bytes

3: Pasted Entry  
4 lines  
format: txt, database: ?  
uploaded txt file

T	A
1	2
3	4
5	6

# IE Demonstration

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- We'll demonstrate some analysis ...
- `www.youtube.com/watch?v=U0FFkDuJxgk`

# How does this magic work?

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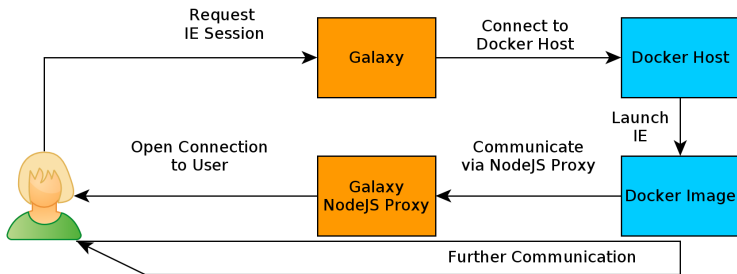
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# Who should use IEs?

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Q&A

- Everyone!
- IPython/RStudio are great for bioinformaticians and Data Scientists
- The upcoming iobio visualization IEs are great for Life Scientists

# Why use IEs instead of ... Galaxy Tools/Viz?

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- Tools are not one-size-fits-all
- Visualisations are restrictive
- Complete freedom!



# Why use IEs instead of ... “normal” service deployments?

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- IPython Notebooks are stored as history elements
- Notebooks are re-runnable, maintaining reproducibility
- API interactions required to access data are all 100% transparent
- Transparently integrates with standard Galaxy deployments and authentication schemes
- Notebooks are rendered into HTML for easy viewing/sharing, without launching an IE

# Teaching

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- Ideal for teaching:
  - Researchers
  - Bioinformatics
  - Data Wrangling
  - and Scientific Programming
- Share notebooks with students inside of Galaxy
- Use “literate programming” in IPython to teach students how analyses work, line-by-line

# Research

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- Reproducible and transparent scripts
- Share “hotfix” scripts easily between bioinformaticians and researchers

# Development

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Q&A

- Rapidly prototype new scripts and tools for your organisation
- Immediately test them on your large, real datasets
- Does an existing visualisation not meet your goals? Build a new one immediately in IPython/RStudio.

# IEs

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## Available Now

- IPython (included in Galaxy 15.05/Cloudman)
- RStudio (coming in Galaxy 15.07)

## Coming Soon

- iobio BAM
- iobio VCF

## In the Works

- Apache Zeppelin
- WebApollo
- Jupyter 3/4 (Python/R/Julia/Perl/Ruby)

# IPython IE Features

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Q&A

- Baked in Bioblend access to Galaxy
- Easily get data from/put data into Galaxy
- Bash and R “magics”
- Pre-installed: numpy biopython scikit-learn pandas  
scipy sklearn-pandas bioblend matplotlib patsy  
pysam khmer dendropy ggplot mpld3 sympy rpy2

# RStudio IE Features

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- Easily get data from/put data into Galaxy
- R version 3.2.1
- Knitr/Sweave available
- R Packages: RCurl, XML, markdown, shiny, ggvis, dplyr, ggplot2, plyr, reshape2, devtools, RODBC, maps, pheatmap, readr, tidyr, dplyr, RJSONIO, shinyapps, knitr
- Bioconductor: edgeR, Rgraphviz, biomaRt, topGO, limma, DESeq2, cummeRbund, Biostrings, GenomicRanges, Rsamtools, affy

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A big thank you to:

- John Chilton for his help getting the IE codebase merged into Galaxy originally
- Enis Afgan for getting the IEs into Cloudman
- the Galaxy Team for supporting this exciting new feature we've developed.



# Q&A

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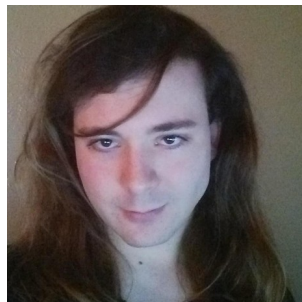
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Q&A



`github.com/bgruening`



`github.com/erasche`

- IPython <http://bit.ly/gxIEipython>
- RStudio <http://bit.ly/gxIERstudio>