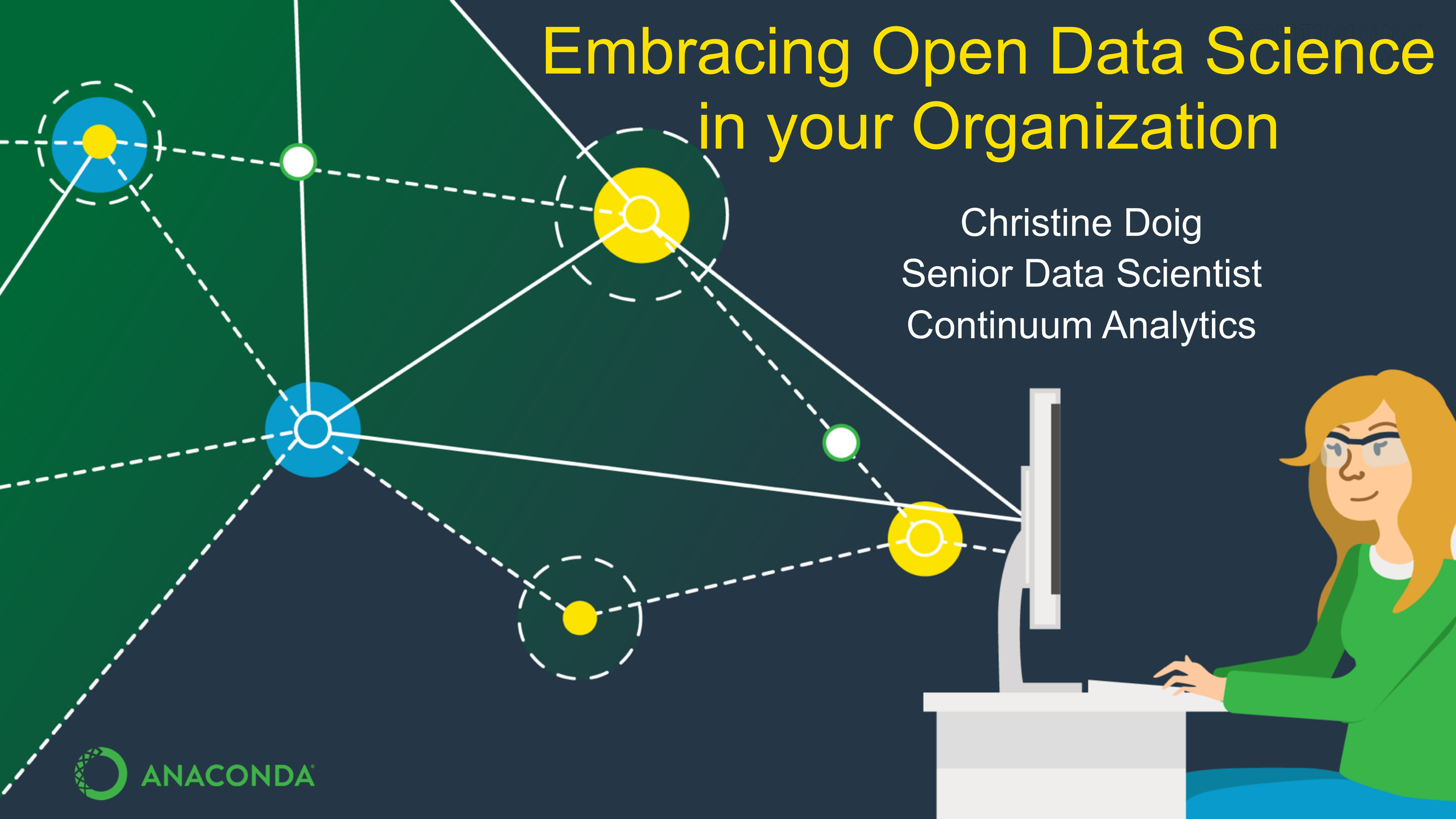
Embracing Open Data Science in your Organization

Christine Doig
Senior Data Scientist
Continuum Analytics



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Agenda

- Introduction to Data Science
- Data Science Challenges in Organizations
- Anaconda Distribution
- Anaconda Community Innovation
- Anaconda Enterprise Platform

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INTRODUCTION TO DATA SCIENCE

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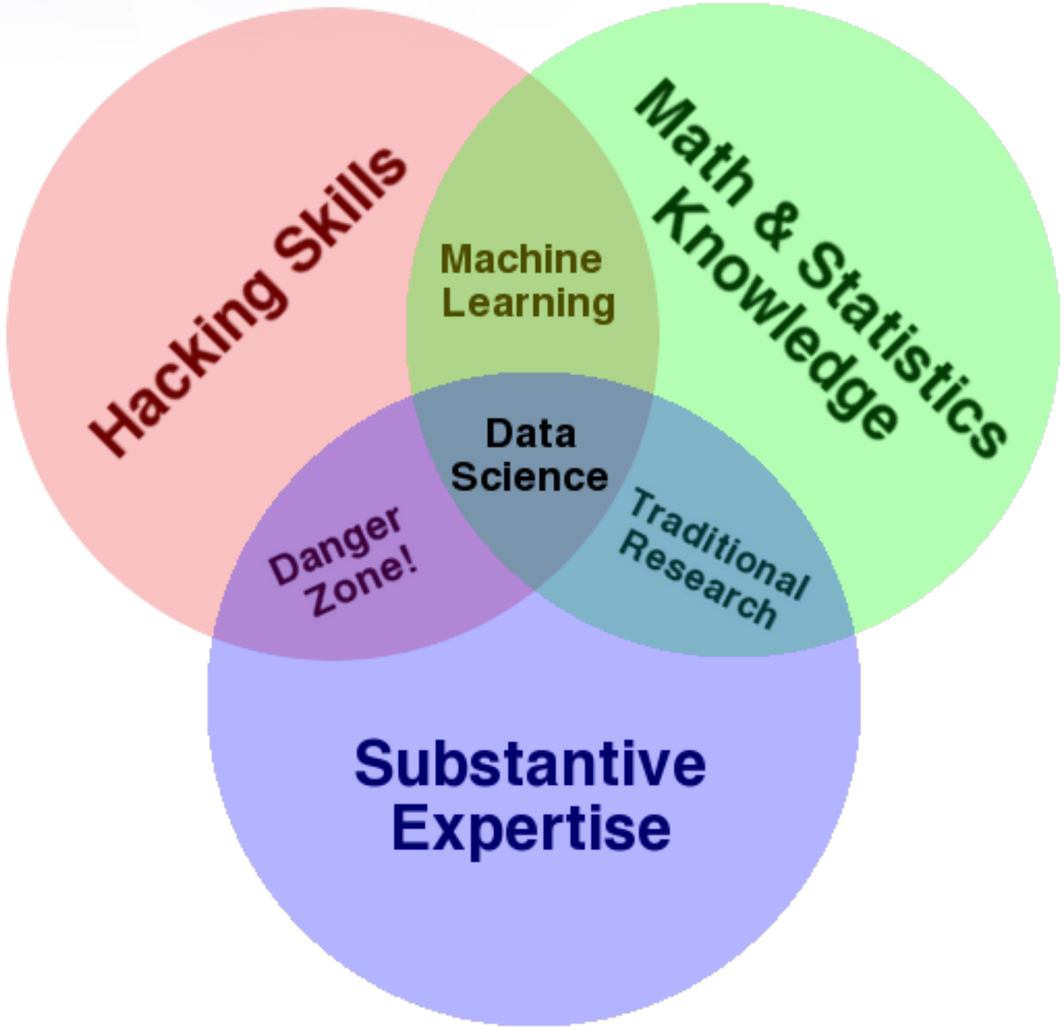
The Data Science Venn Diagram



http://drewconway.com/zia/2013/3/26/the-data-science-venn-diagram

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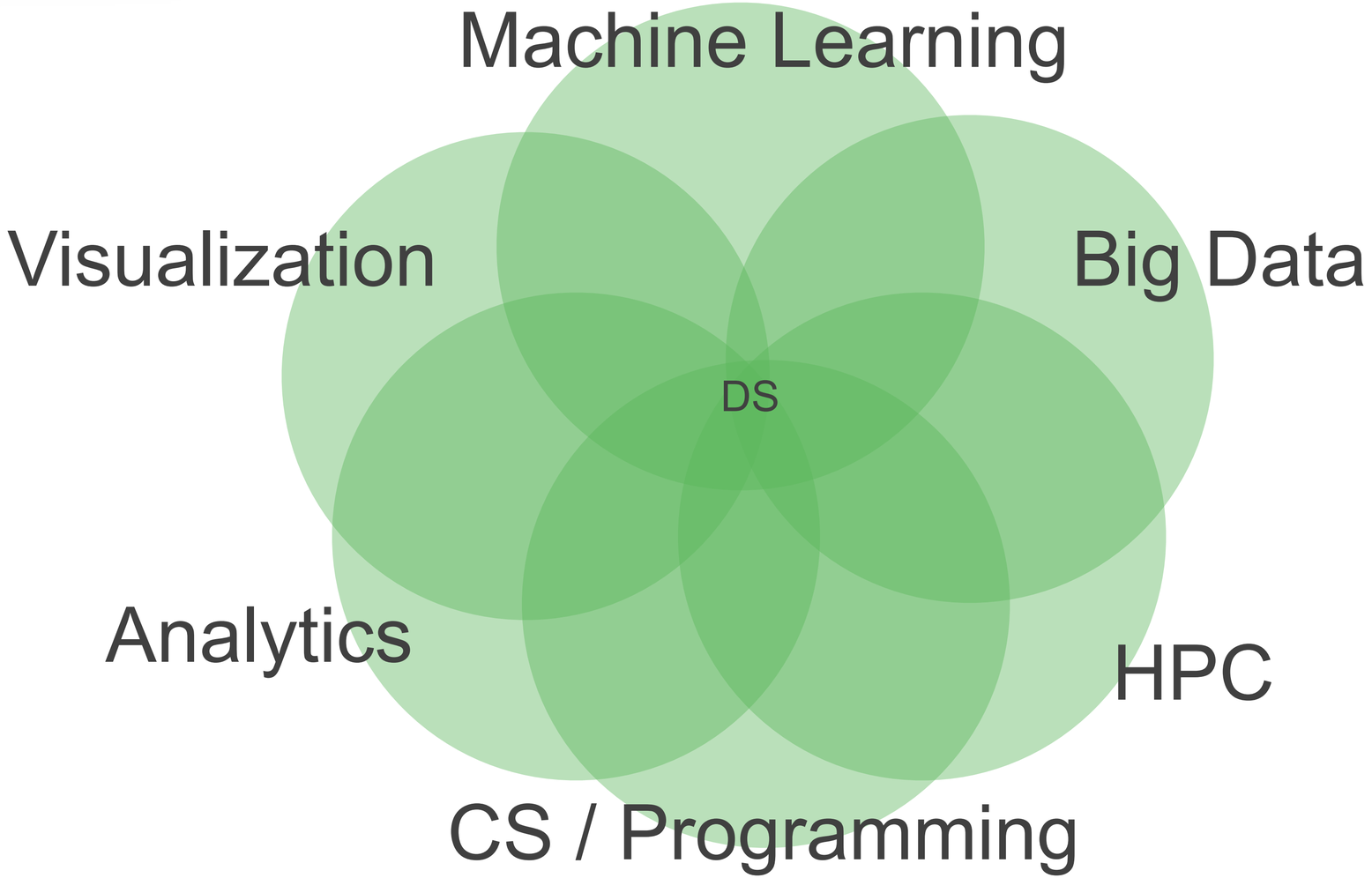
The Data Science Venn Diagram Revisited



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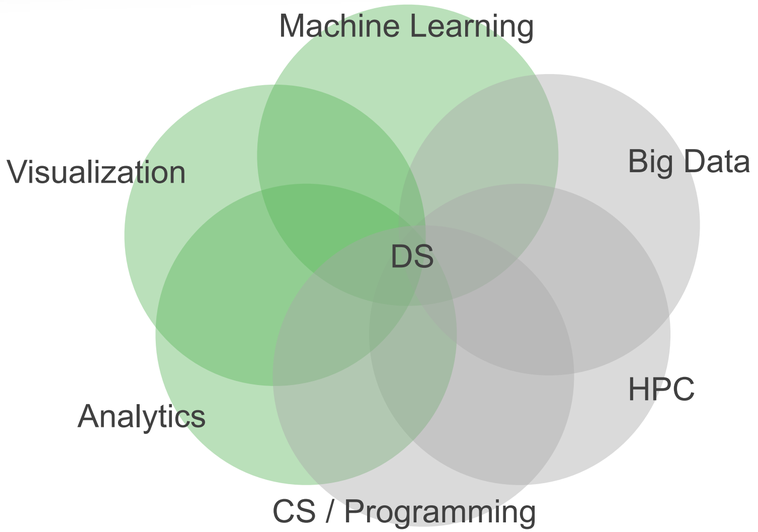
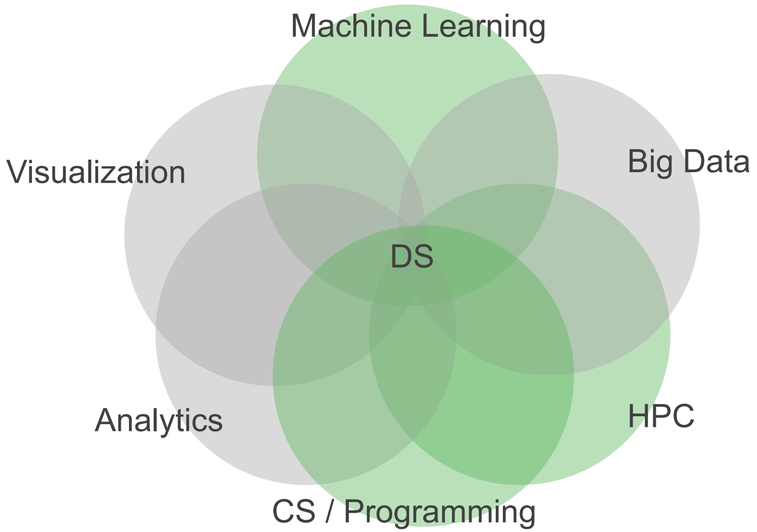
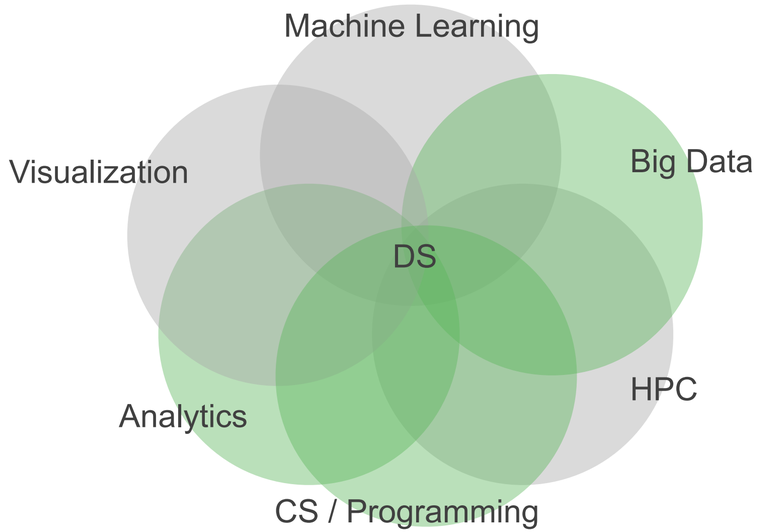
Data Scientist come with different skills and backgrounds



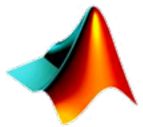




Statistician / Analyst

Research / Computational Scientist

Developer / Engineer



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Data Science in summary:

- is a team sport
- formed by team members with very diverse backgrounds
- both in terms of knowledge (CS, Statistics, Viz, ML…)
- and technology stacks (R, SAS, Python…)

How can companies organize efficiently in this environment?

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Open Data Science

With an inclusive movement

that makes open source tools

for data science -- data, analytics, & computation – easily work together as a connected ecosystem

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Open Data Science
Vibrant and Growing Community

Python Community
30M+

Packages in Anaconda
720+

ANACONDA Downloads*
3M+

R Community
16M+

Spark Python Usage
50%+

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* As of Dec 2015. Another 2.7M download YTD

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Open Data Science means…

Availability

Innovation

Interoperability

Transparency

For everyone in the data science team

OPEN DATA SCIENCE is the
FOUNDATION TO MODERNIZATION

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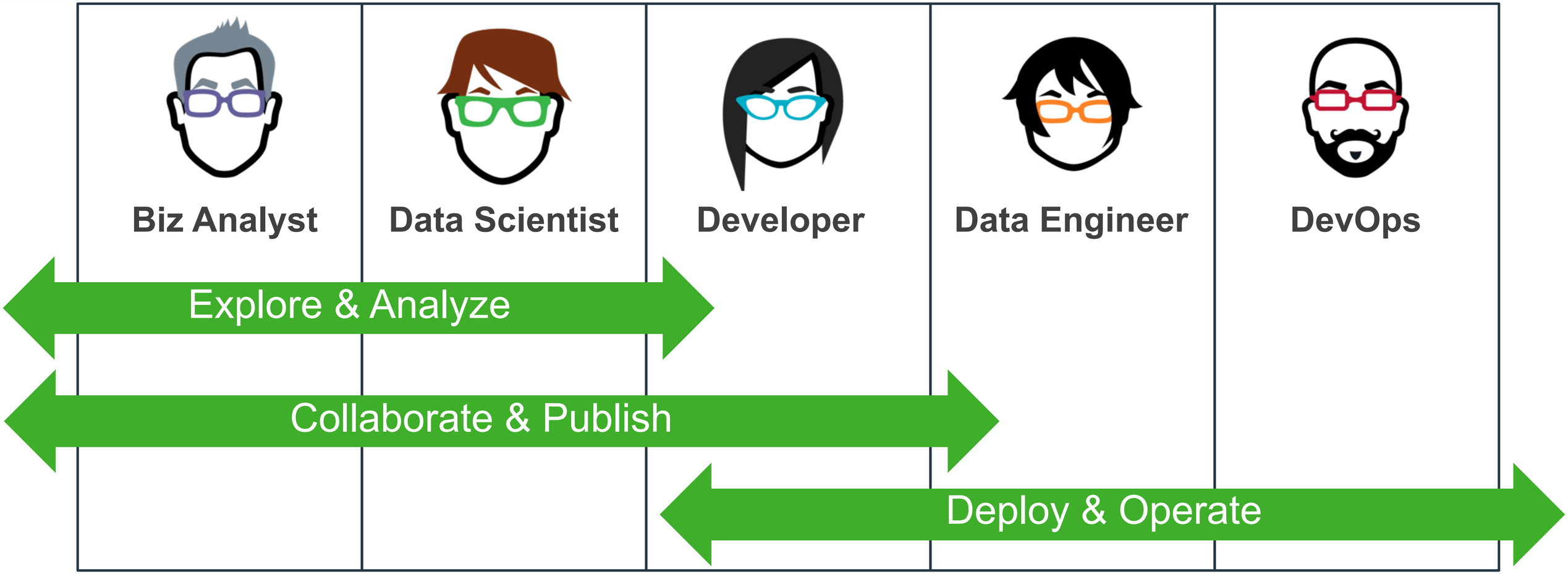
Data Scientists are not the only player in the Data Science Team



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Data Science assets

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Biz Analyst

Spreadsheets
Reports
Presentations

Data Scientist

Notebooks
Scripts
Visualizations

Developer

Software packages
Web applications

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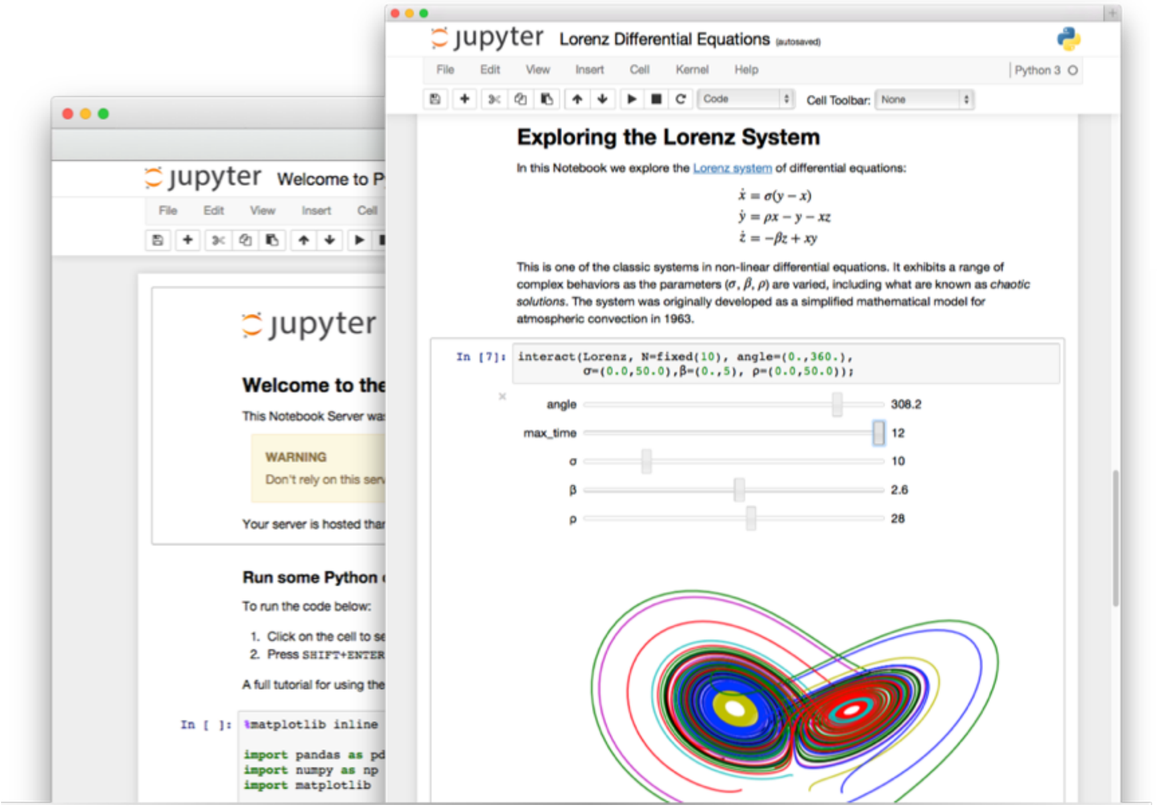
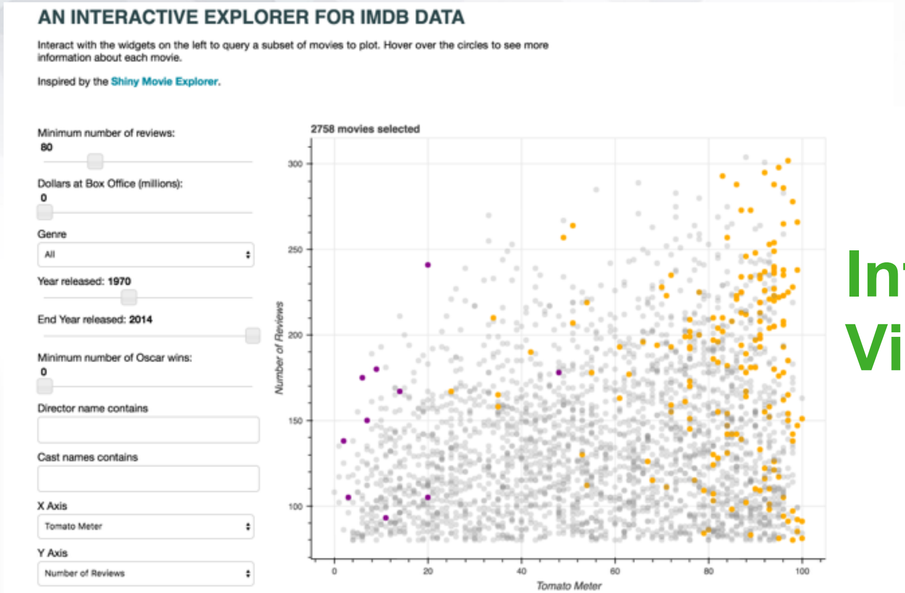
assets

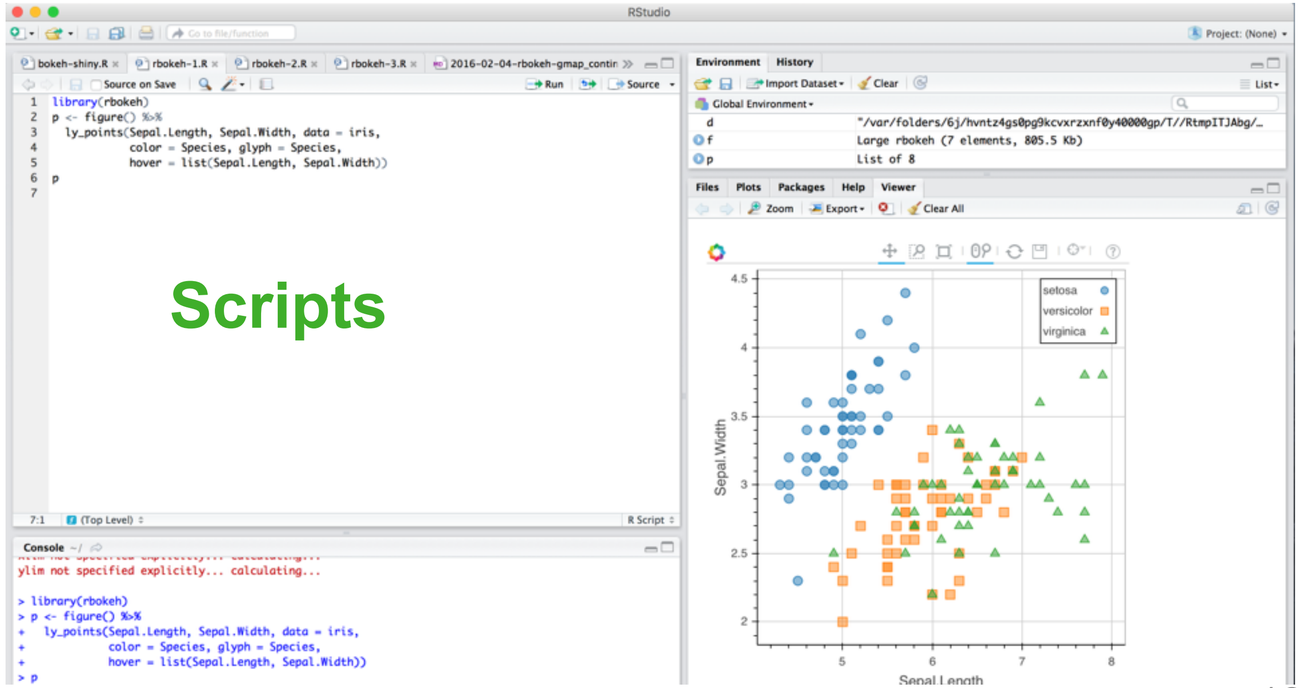
Data Scientist



Notebooks



Interactive Data Visualizations



Scripts

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Data Science workflows

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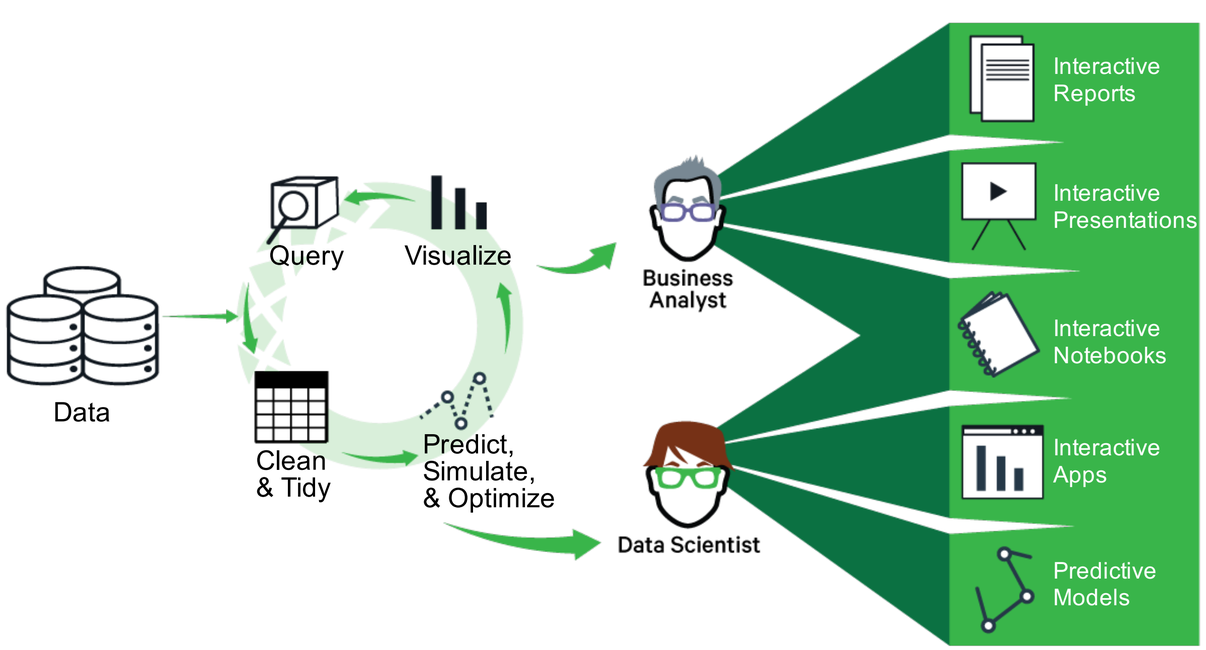
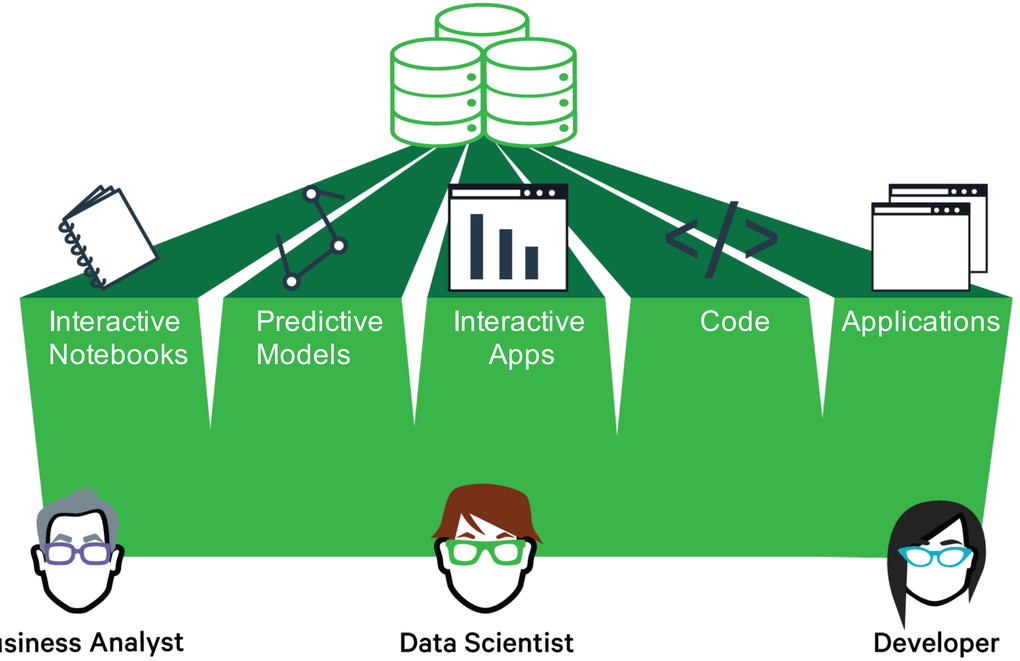
Explore & Analyze

Collaborate & Publish





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Data Science workflows

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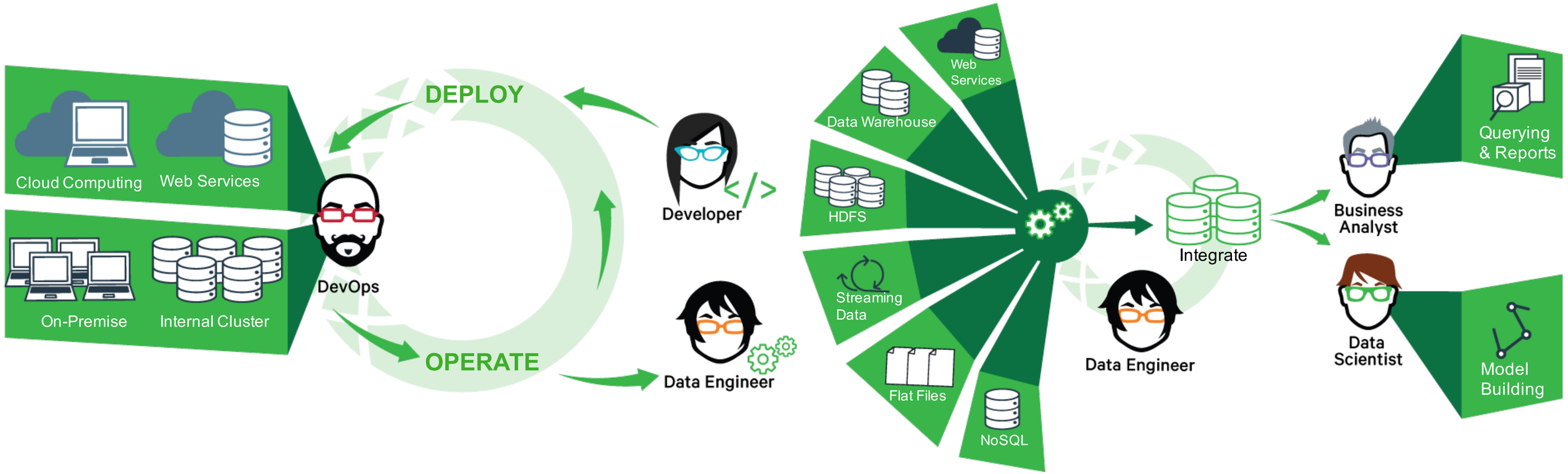
Deploy & Operate



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DATA SCIENCE CHALLENGES IN ORGANIZATIONS

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Challenges

- Manage reproducible heterogeneous Data Science environments
- Distribute, share and publish Data Science assets
- Get diverse data scientists (languages, tools, data models, assets…) to collaborate effectively
- Enable Data Scientists to easily leverage Big Data technologies
- Deploy data science assets into production applications
- Share insights with decision makers
- Enable Business Analysts and Managers to leverage Data Science

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How are we solving those challenges through:

- Anaconda Distribution
- Anaconda Community Innovation
  - Jupyter, JupyterLab and extensions
  - Bokeh for interactive data visualizations
  - Datashader for large scale visualizations
  - Dask for parallel computing
  - Numba for high performance computing
- Anaconda Enterprise

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ANACONDA DISTRIBUTION

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The Distribution for Data Science

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Machine Learning

Visualization

Big Data

Bokeh

Numba

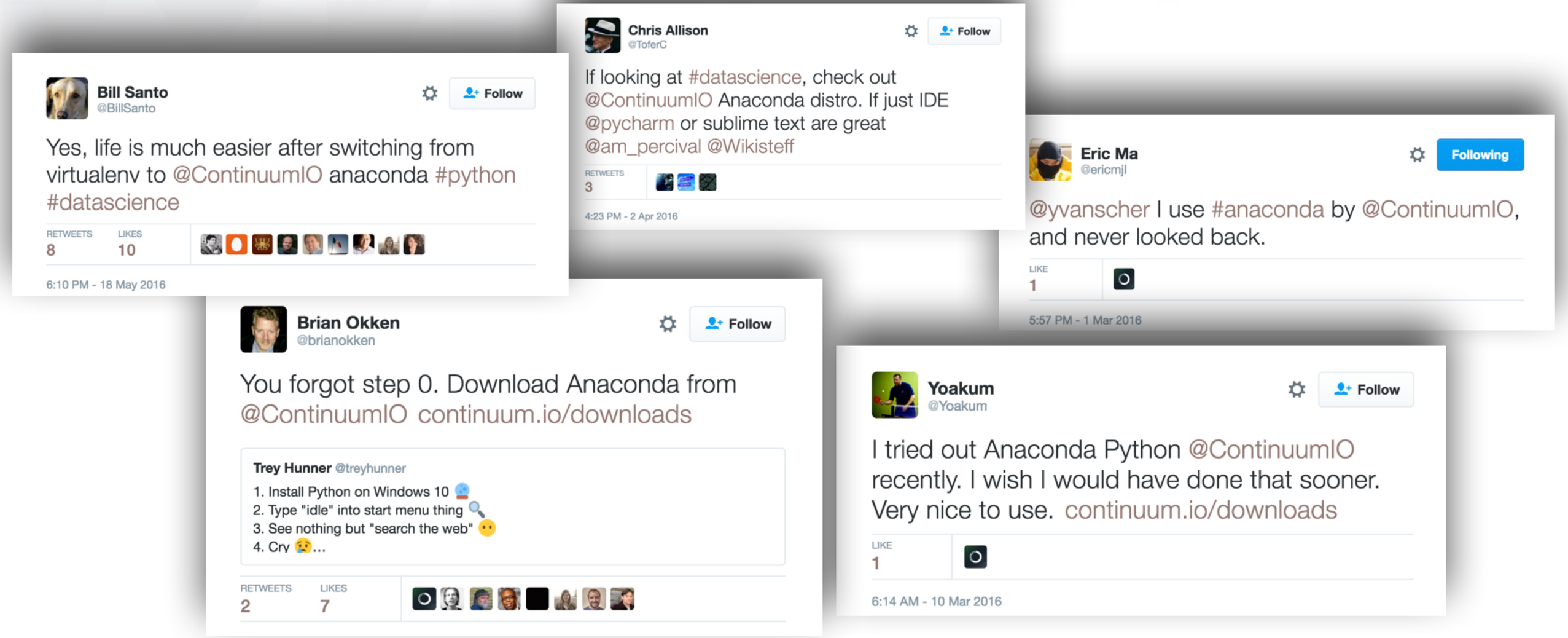
Analytics

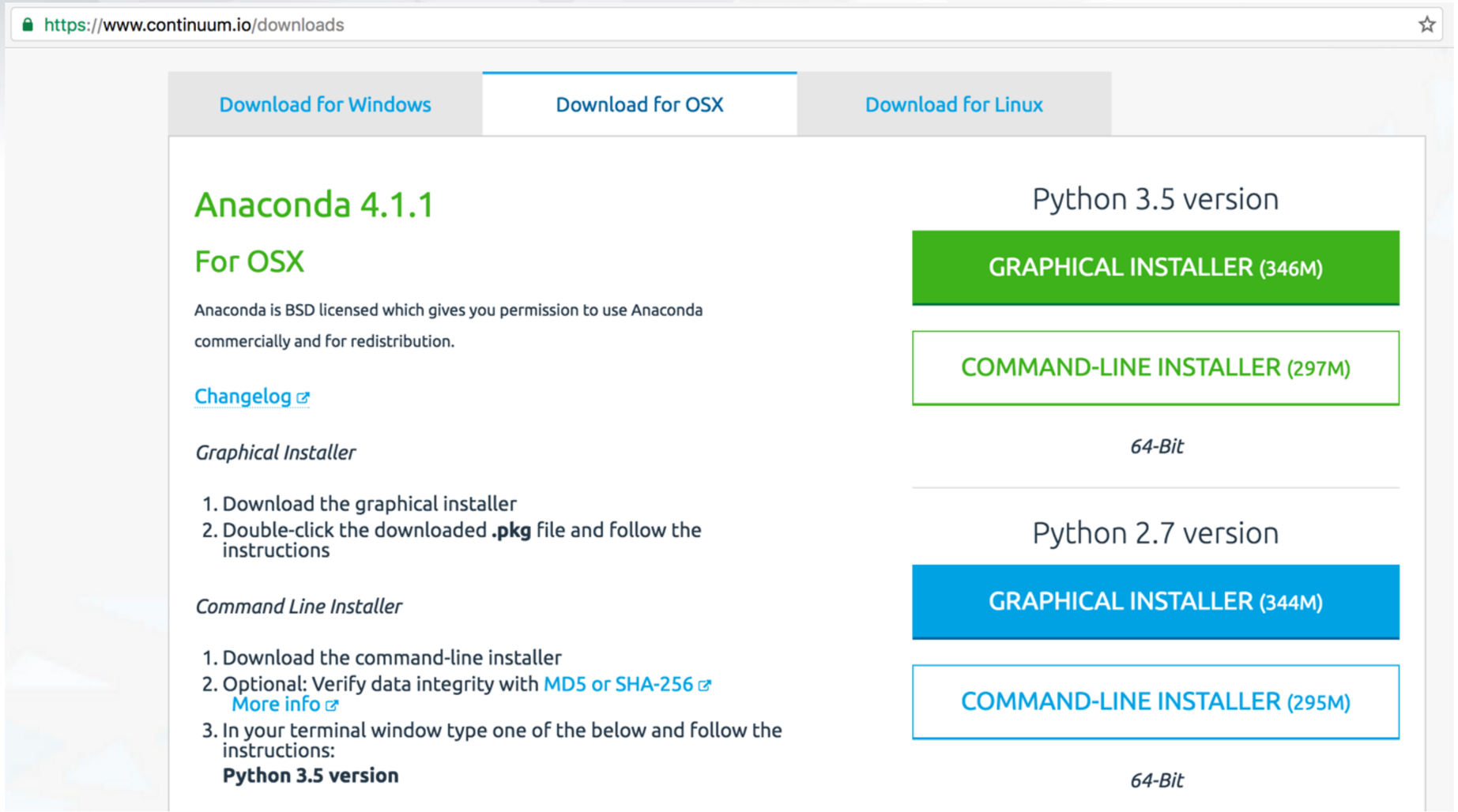
Scientific computing

Blaze

CS / Programming

… with an amazing community!





Download for free: www.continuum.io/downloads

Anaconda Distribution Glossary

PYTHON

NumPy, SciPy, Pandas, Scikit-learn, Jupyter / IPython, Numba, Matplotlib, Spyder, Numexpr, Cython, Theano, Scikit-image, NLTK, NetworkX and 150+ packages

conda

Anaconda distribution

PYTHON

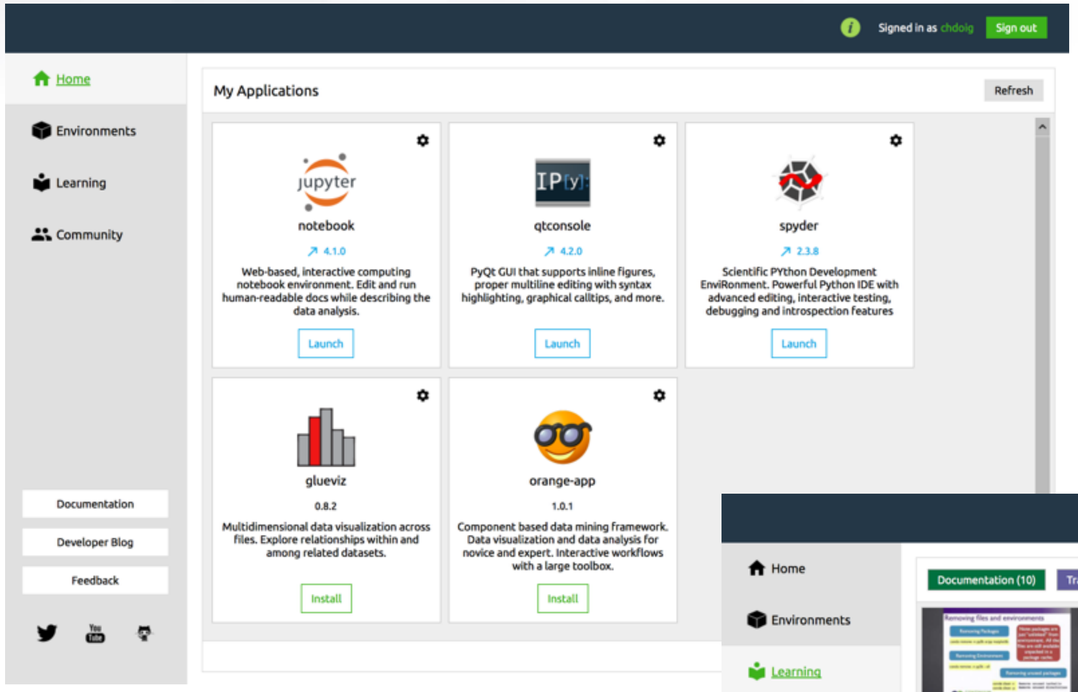
conda

Miniconda

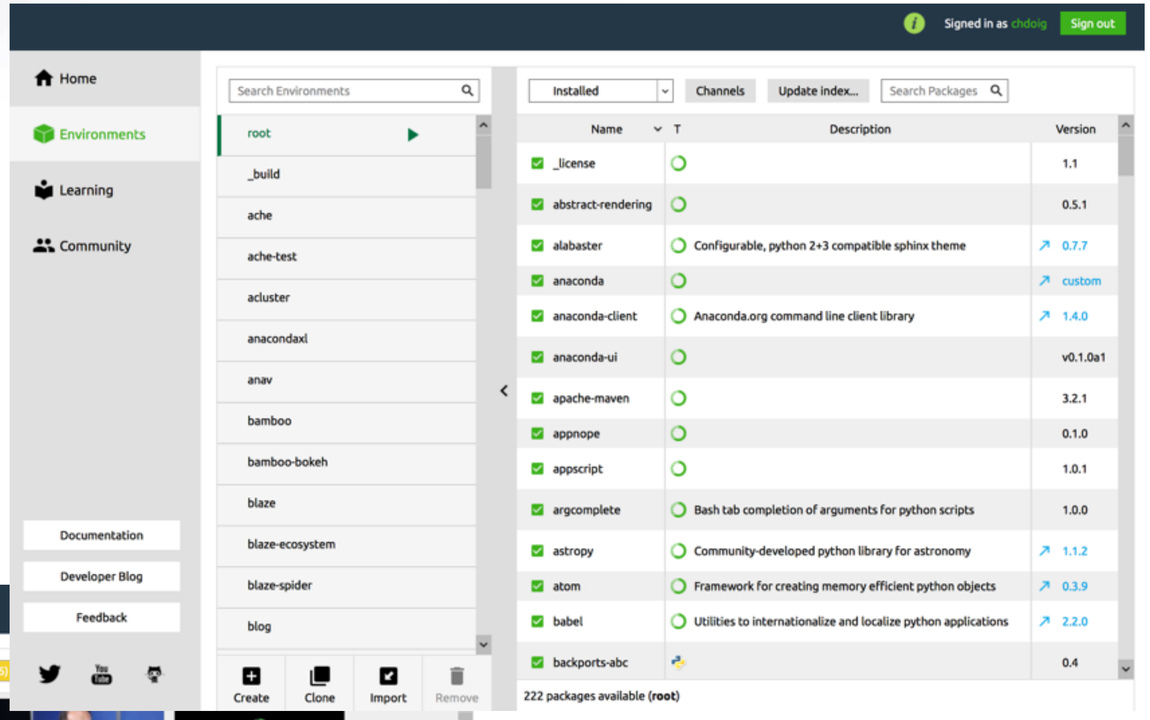
- **Anaconda distribution**: Python distribution that includes 150+ packages for data science (in the installer)
- **Miniconda**: Lightweight version of Anaconda, with just Python and conda.
- **Anaconda Cloud:** Cloud service to host and share public (free) and private data science assets
- **Anaconda Navigator:** Anaconda distribution UI to manage environments, launch applications and learn about what's happening in the community

Anaconda Navigator

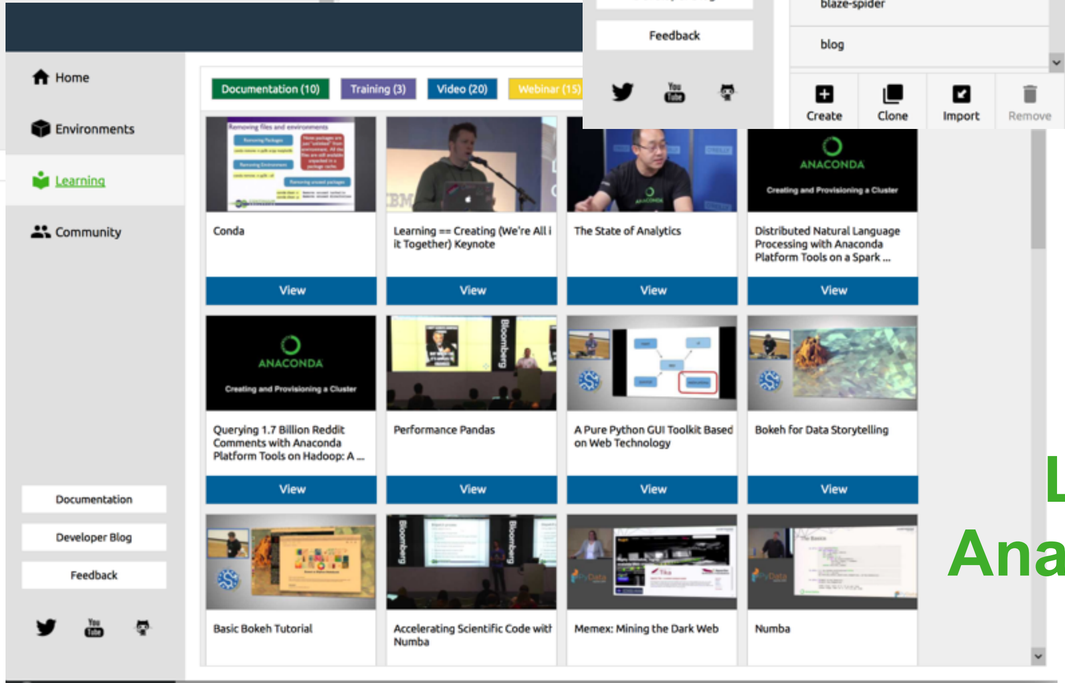
CONTINUUM ANALYTICS



Launch applications



Manage environments



Learn about the Anaconda community

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- **conda**: Cross-platform and language agnostic package and environment manager
- **conda-forge:** A community led collection of recipes, build infrastructure and distributions for the conda package manager
- **conda environments:** custom isolated sandboxes to easily reproduce and share data science projects
- **conda kapsel:** reproducible, executable project directories

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CONDA

```
$ conda install python=2.7
$ conda install pandas
$ conda install -c r r
$ conda install -c conda-forge tensorflow
```

Install dependencies

```
name: myenv
channels:
  - chdoig
  - r
  - foo
dependecies:
  - python=2.7
  - r
  - r-ldavis
  - pandas
  - mongodb
  - spark=1.5
  - pip
  - pip:
    - flask-migrate
    - bar=1.4
```

```
$ conda env create
$ source activate myenv
```

Manage multiple environments

```
$ conda kapsel run plot --show
```

Deploy an interactive visualization

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What challenges does Anaconda Distribution solve?

PYTHON

NumPy, SciPy, Pandas, Scikit-learn, Jupyter / IPython, Numba, Matplotlib, Spyder, Numexpr, Cython, Theano, Scikit-image, NLTK, NetworkX and 150+ packages

conda

Anaconda distribution

PYTHON

conda

Miniconda

- Easy to install on all platforms
- Language agnostic - Python, R, Scala…
- Trusted by industry leaders
- Trusted by the community - Large user base: 3M+ downloads
- BSD license
- Extensible - easily build, share and install proprietary libraries with Anaconda Cloud
- Allows isolated custom sandboxes with different versions of packages - conda environments
- Allows for easy encapsulation and deployment of data science assets - conda kapsel

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COMMUNITY INNOVATION

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- Anaconda Distribution
- Anaconda Community Innovation
  - Jupyter, JupyterLab and extensions
  - Bokeh for interactive data visualizations
  - Datashader for large scale visualizations
  - Dask for parallel computing
- Anaconda Enterprise

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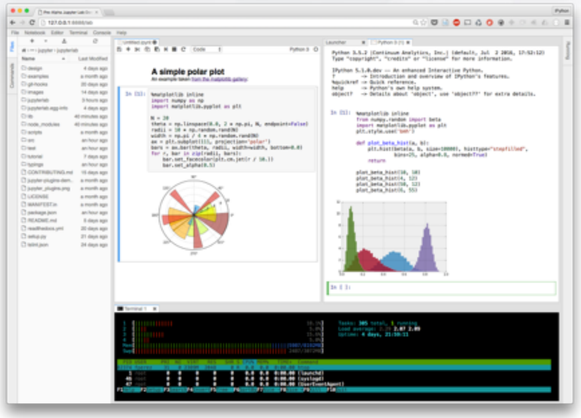
Continuum Analytics contributions to the Python ODS ecosystem

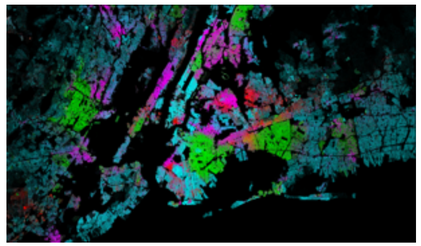


JupyterLab

- Next generation Data Science IDE

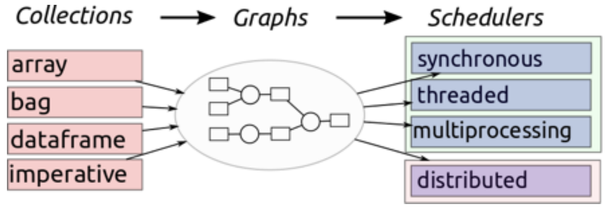
Bokeh

- Web interactive data visualizations (no JS)



Datashader

- Graphics pipeline system for creating meaningful representations of large amounts of data



Dask

- Parallel computing framework

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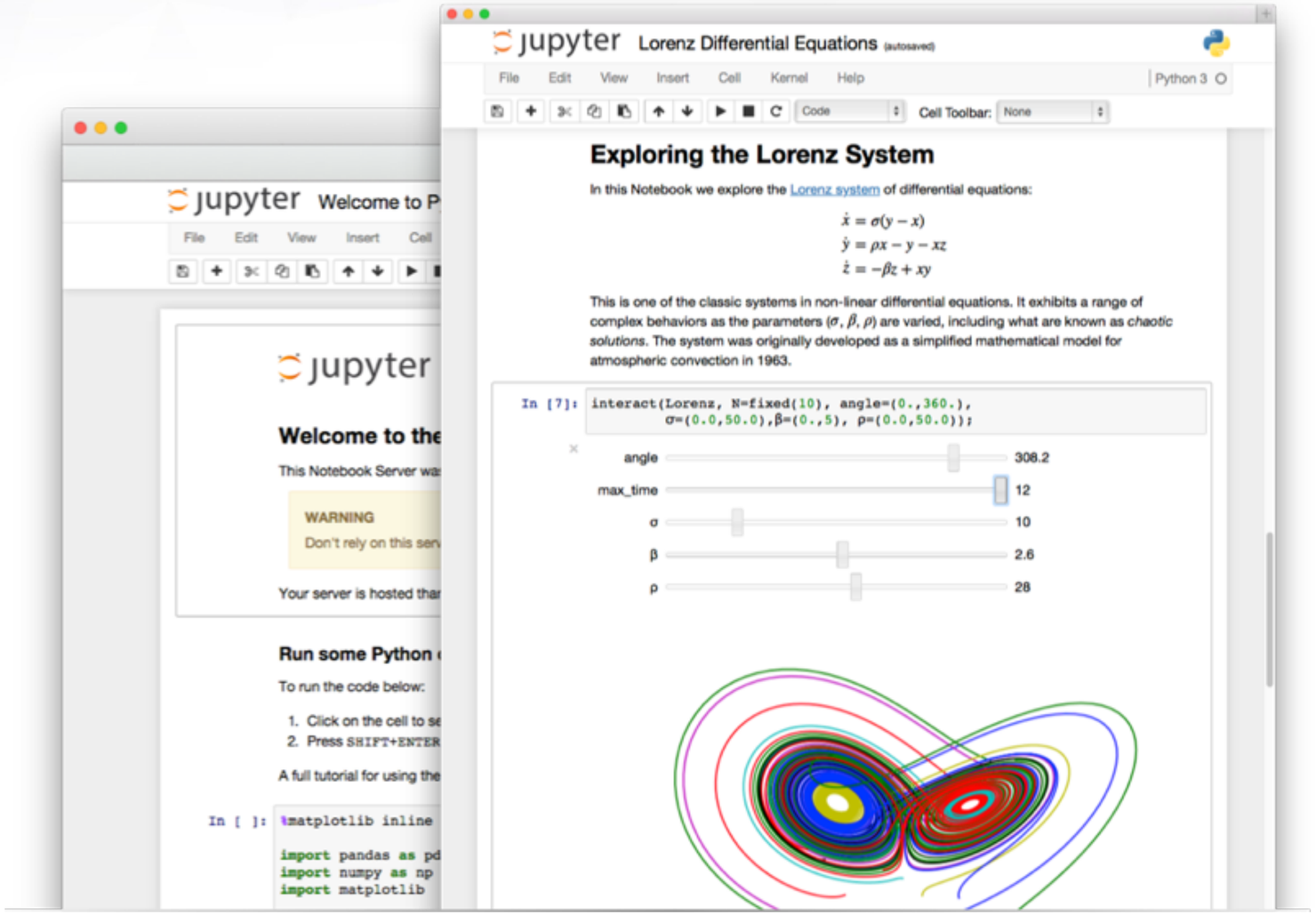
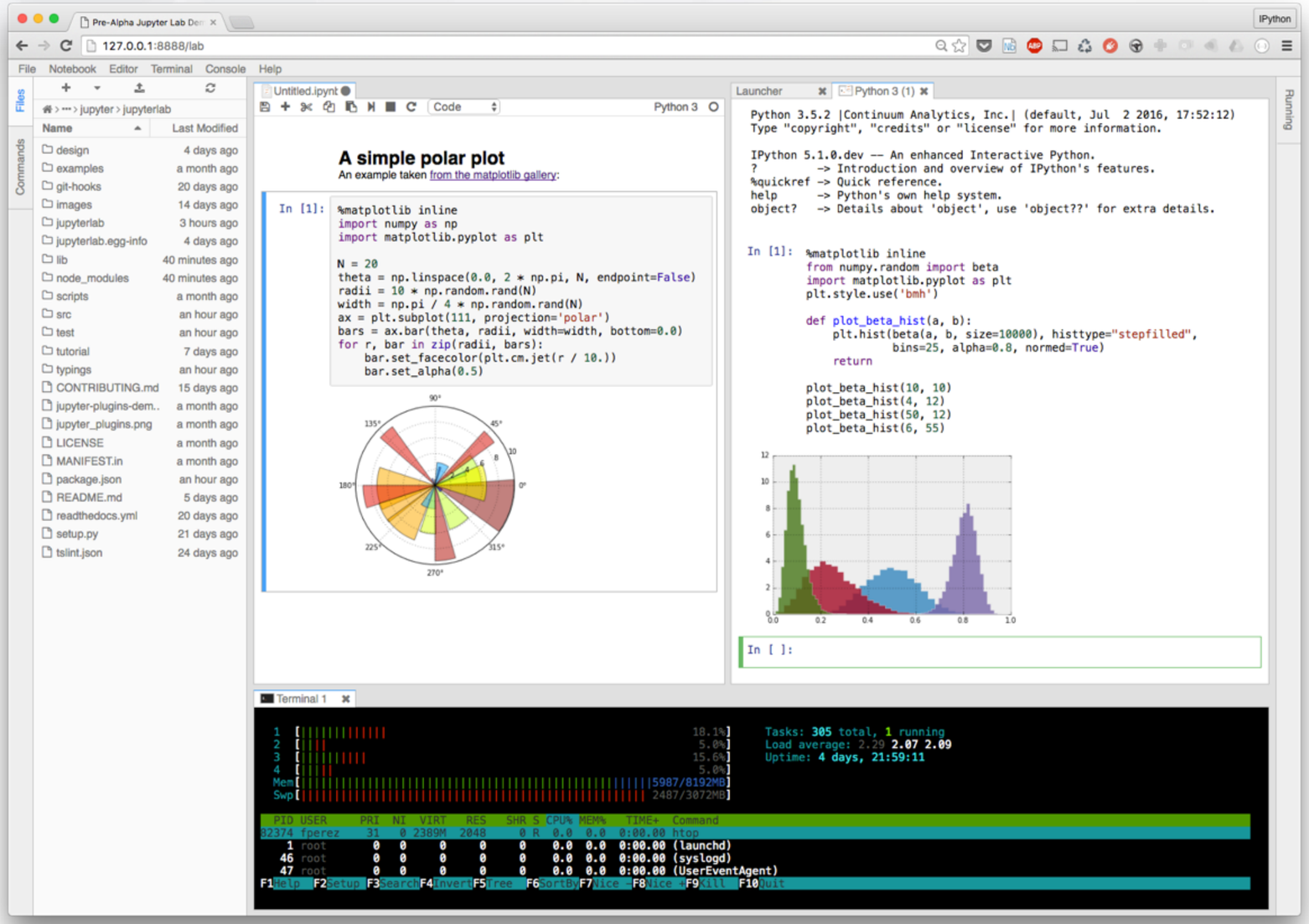
Jupyter Notebook

Web application that allows you to create and share documents that contain live code, equations, visualizations and explanatory text.

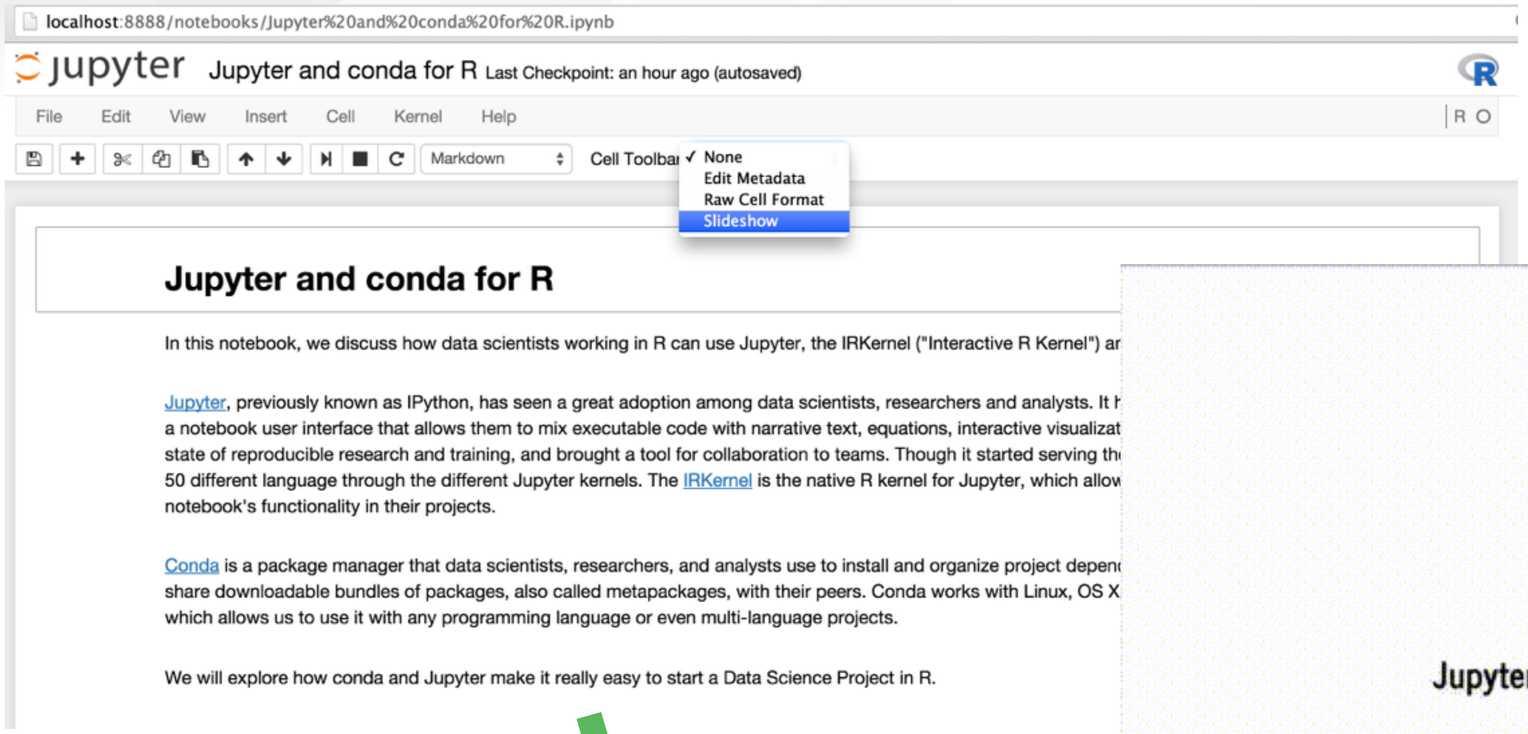
```
$ jupyter notebook
```



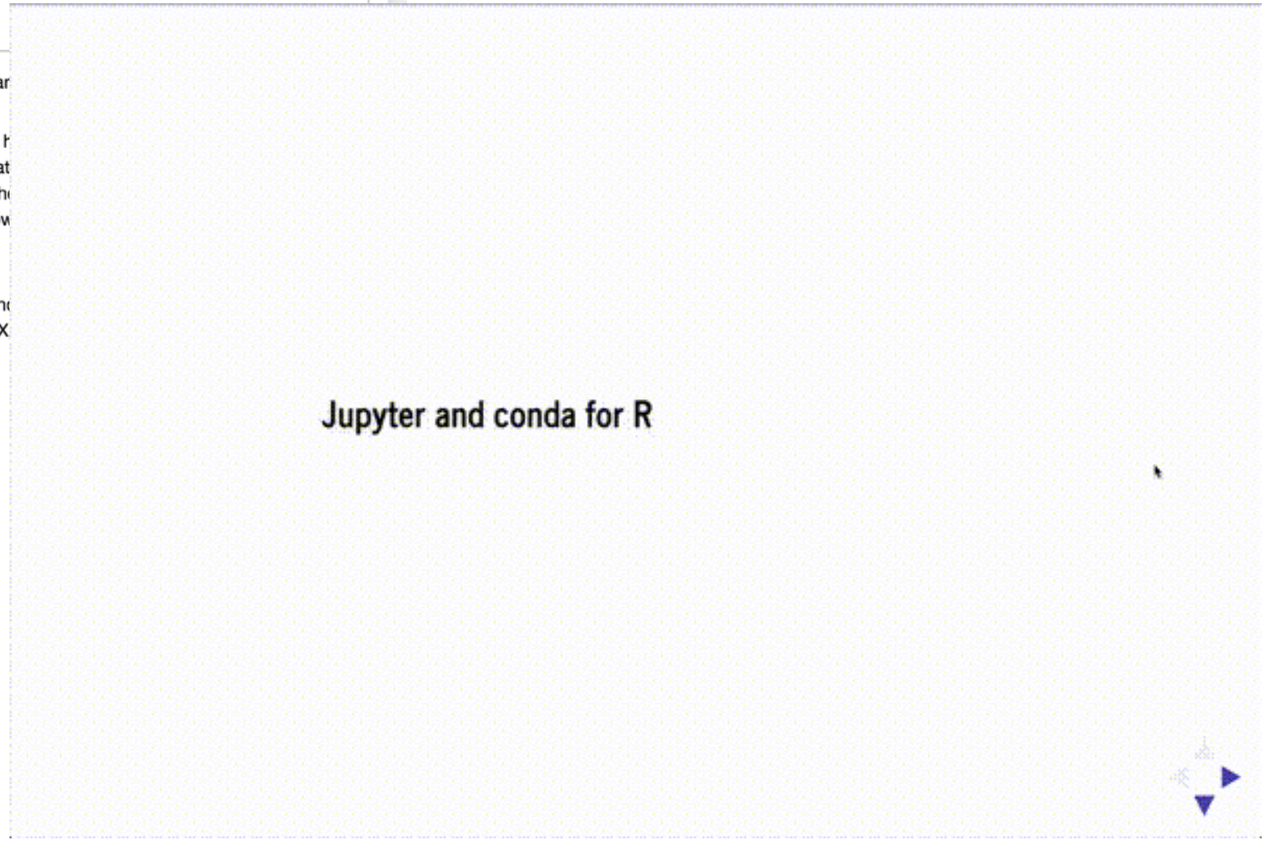
JupyterLab: the next generation



Sharing insights with decision makers



From text, code and visualizations directly to slides



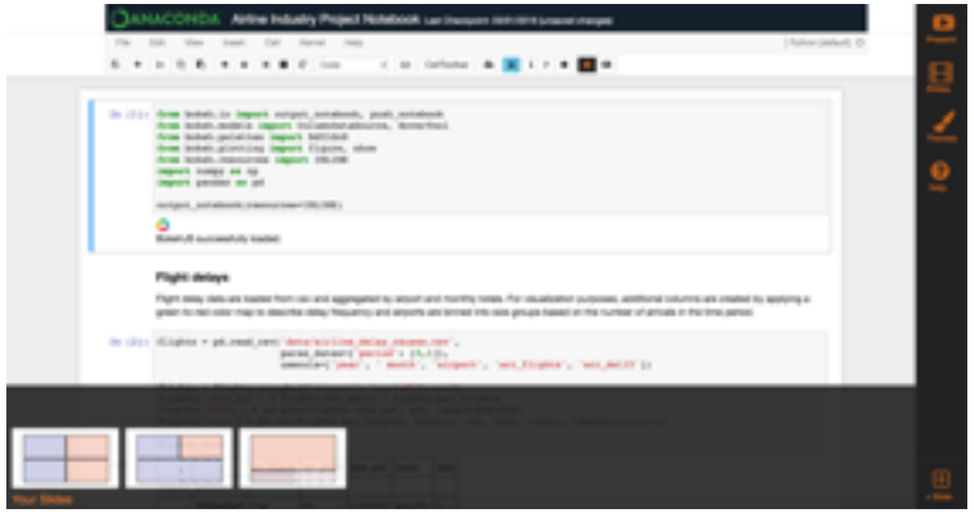
Jupyter: Extensions - nbpresent

remix your Jupyter Notebooks as interactive slideshows with a UI editor

- Edit slides, layout and themes

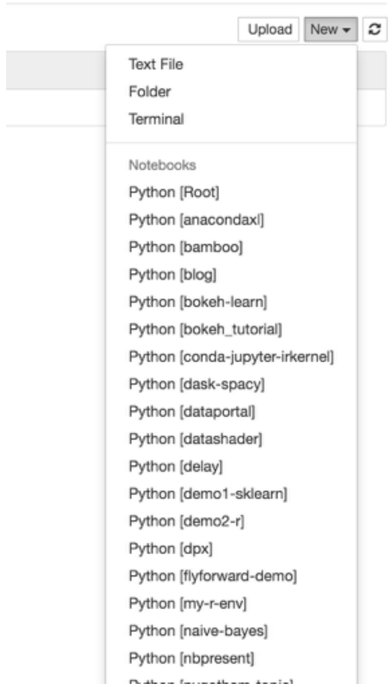
```
conda install -c anaconda-nb-extensions nbpresent

jupyter notebook
```

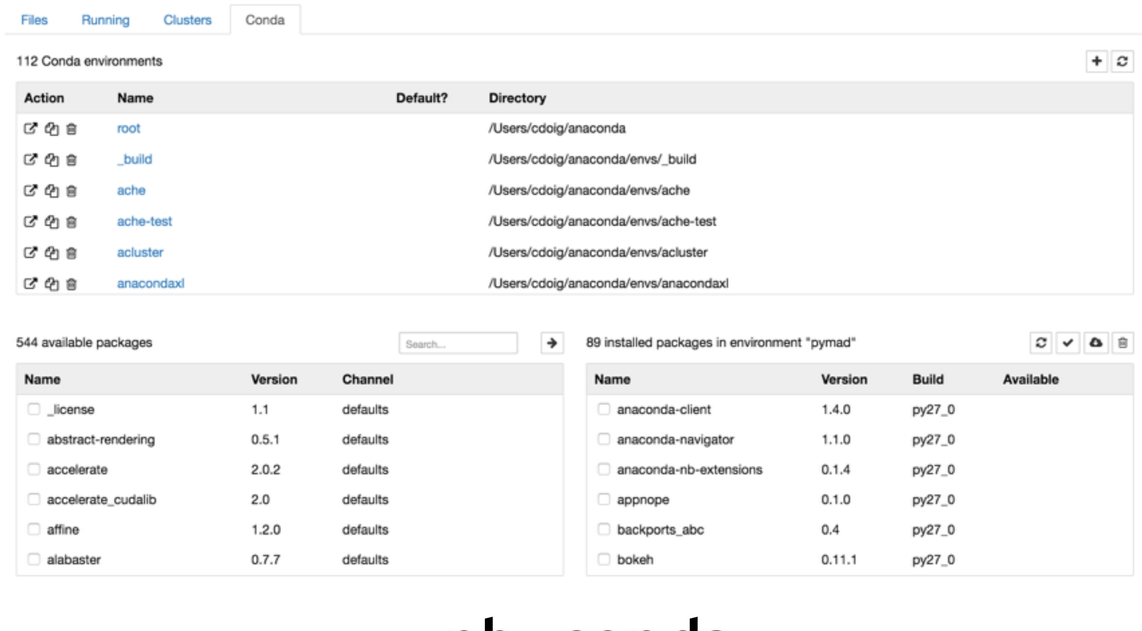


Jupyter extensions - anaconda-nb-extensions

- **nb_condakernel:** use the kernel-switching dropdown inside notebook UI to switch between conda envs
- **nb_conda:** help manage conda envs from inside file viewer of jupter notebook

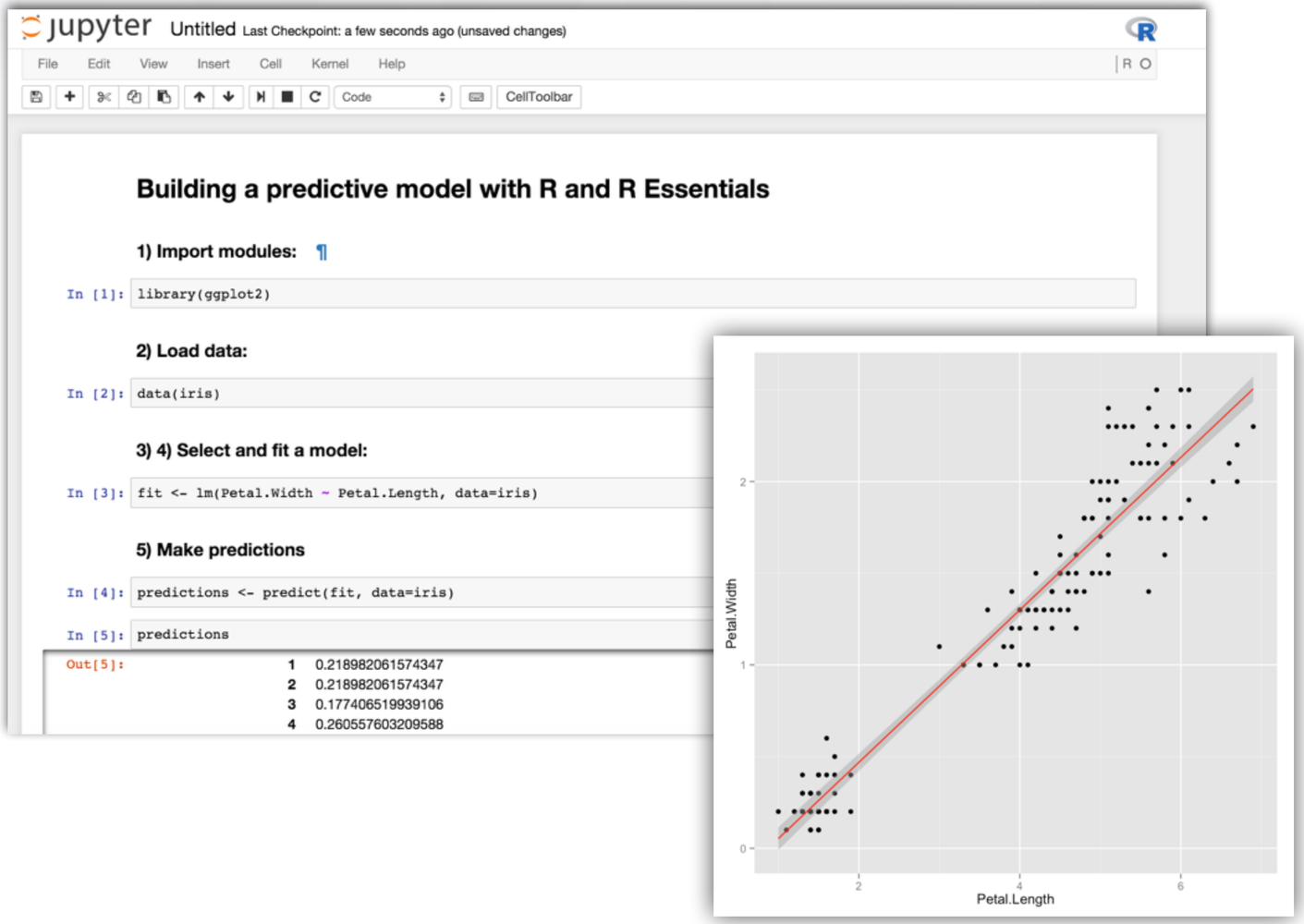


nb_condakernel



nb_conda

Jupyter: IRkernel

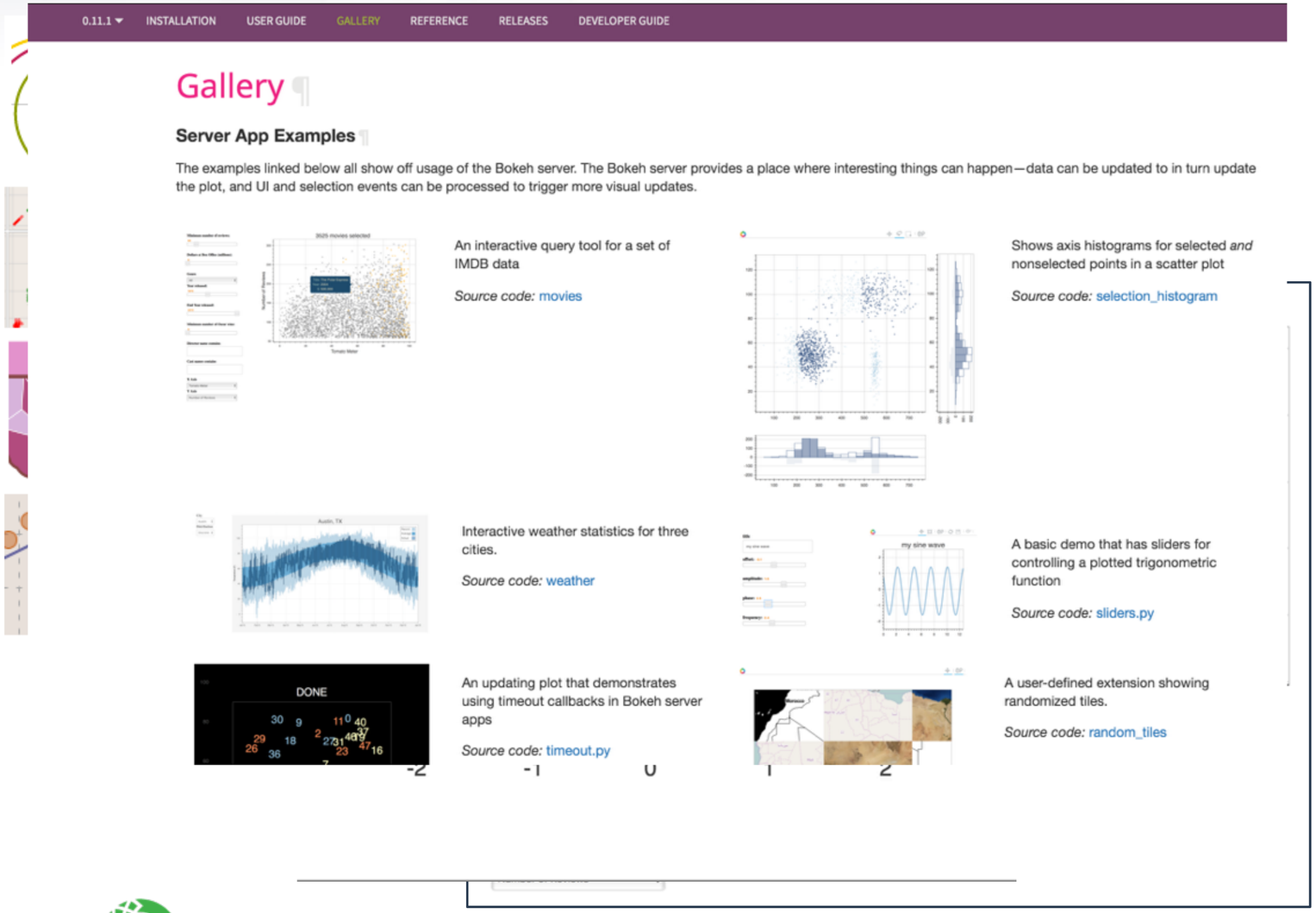


Trivial to get started writing R notebooks the same way you write Python ones.

```
conda config --add channels r
conda install r-essentials
jupyter notebook
```

https://www.continuum.io/blog/developer/jupyter-and-conda-r

Bokeh



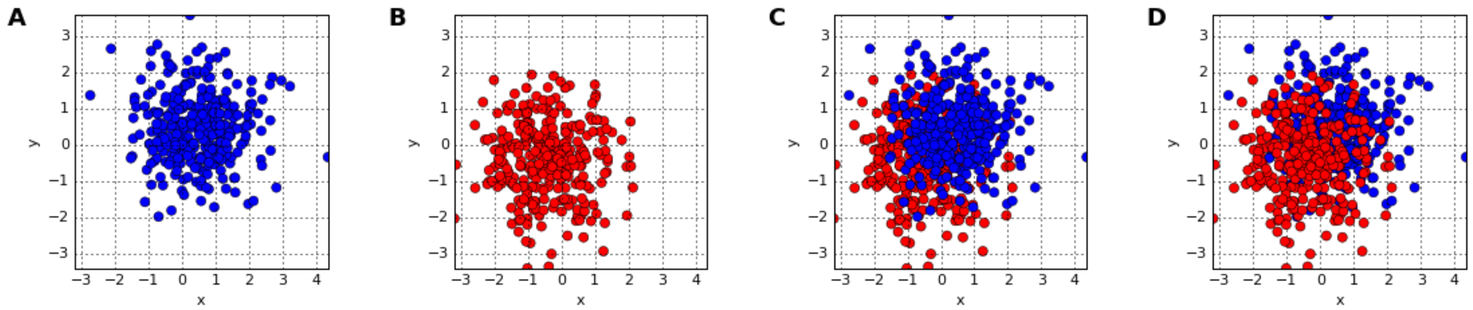
Interactive visualization framework that targets modern web browsers for presentation

- No JavaScript
- Python, R, Scala and Lua bindings
- Easy to embed in web applications
- Server apps: data can be updated, and UI and selection events can be processed to trigger more visual updates.

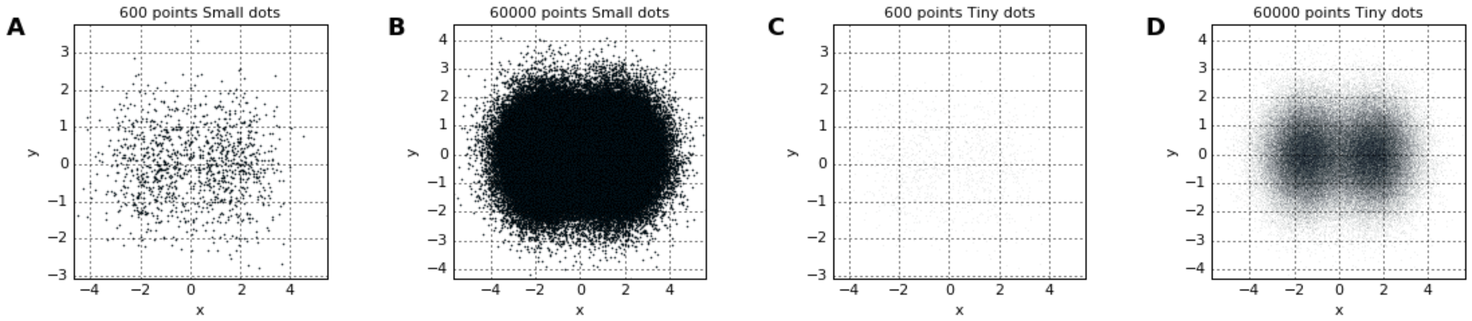
http://bokeh.pydata.org/en/latest/

Datashader - Plotting pitfalls

Overplotting:



Undersampling:



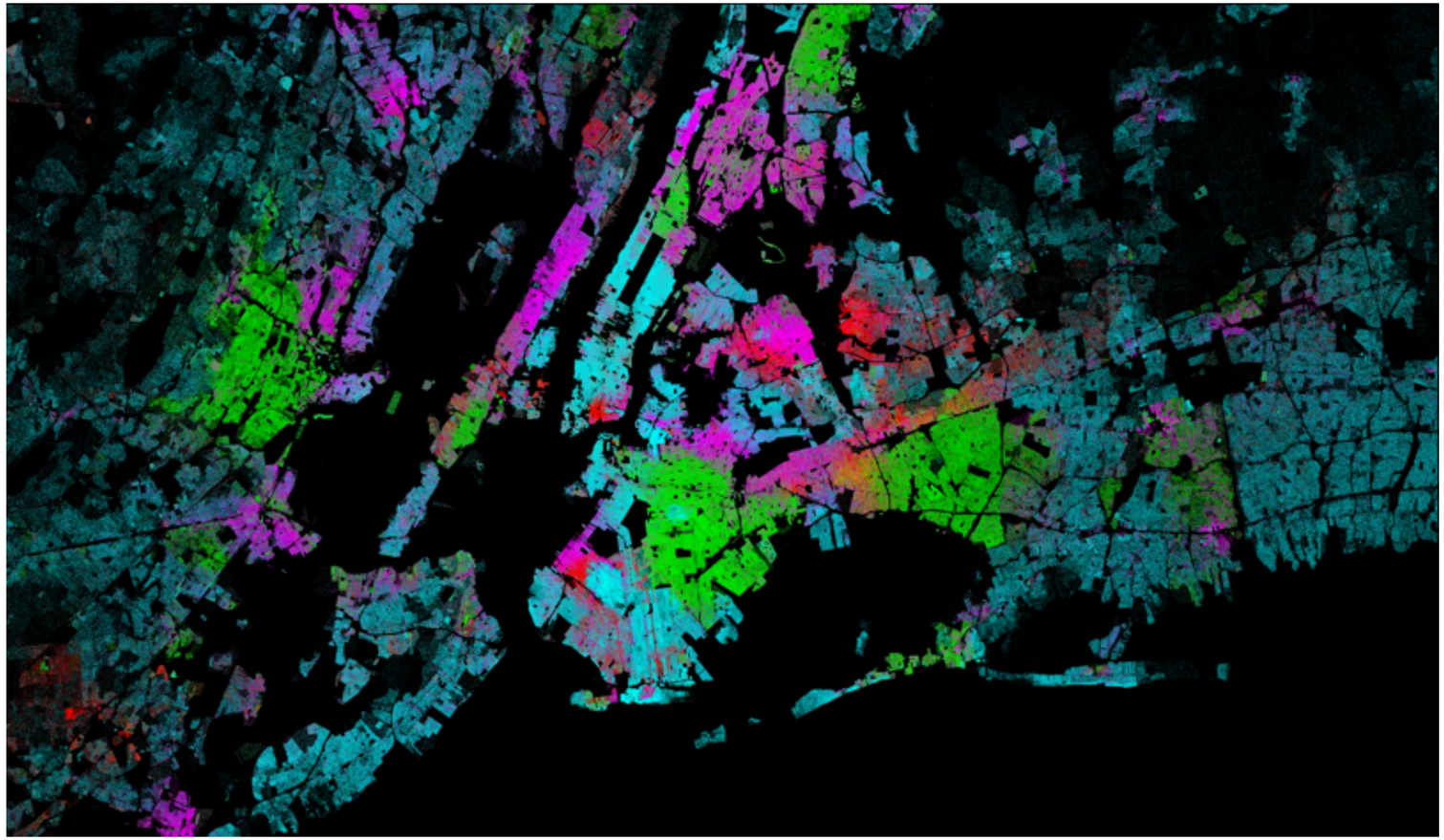
https://anaconda.org/jbednar/plotting_pitfalls/notebook

Datashader

graphics pipeline system for creating meaningful representations of large amounts of data

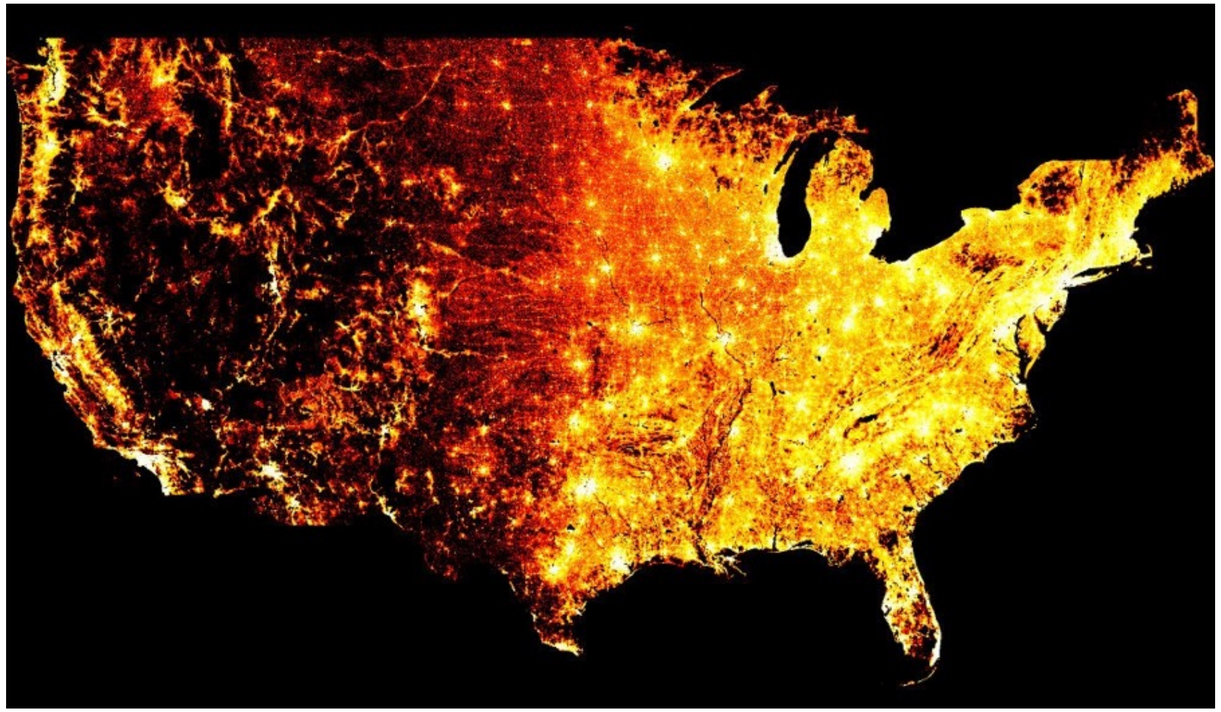
- Provides automatic, nearly parameter-free visualization of datasets
- Allows extensive customization of each step in the data-processing pipeline
- Supports automatic downsampling and re-rendering with Bokeh and the Jupyter notebook
- Works well with dask and numba to handle very large datasets in and out of core (with examples using billions of datapoints)

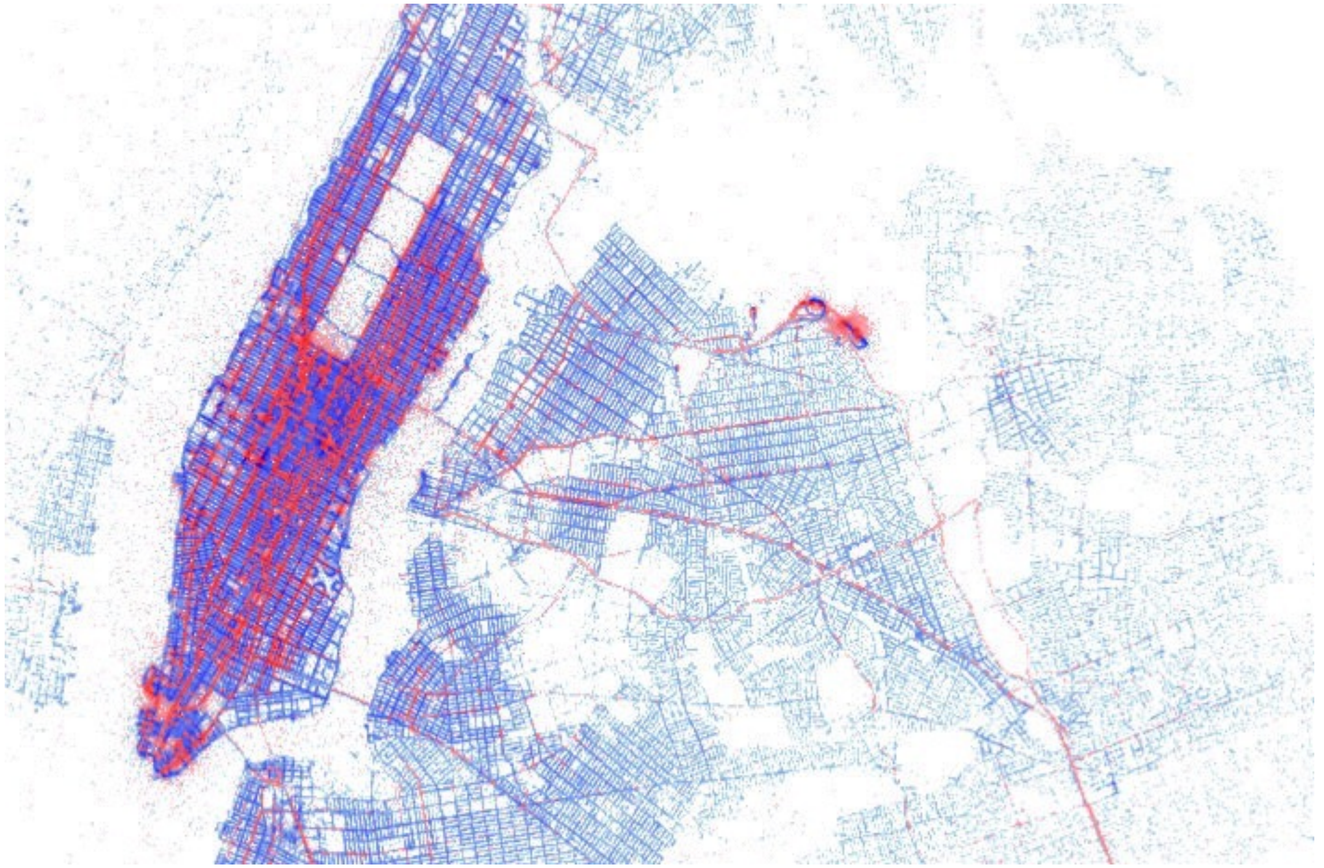
https://github.com/bokeh/datashader



NYC census data by race

Datashader





More examples:

https://anaconda.org/jbednar/notebooks

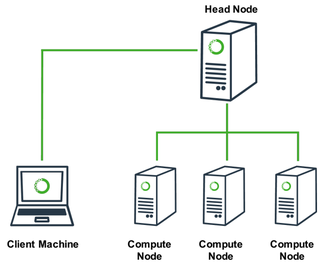
CONTINUUM ANALYTICS

Dask: Scaling Data Analysis

One month CSV file ~ 2GBs

Six month CSV file ~ 12GBs

Two years CSV files ~ 50GB



HDFS +

DASK

+ distributed

Scaling Data Analysis

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Dask Dataframes

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```
>>> import pandas as pd

>>> df = pd.read_csv('iris.csv')

>>> df.head()

   sepal_length  sepal_width  petal_length
petal_width       species
0           5.1          3.5           1.4
0.2  Iris-setosa
1           4.9          3.0           1.4
0.2  Iris-setosa
```

Dask dataframes look and feel like pandas dataframes, but operate on datasets larger than memory using multiple threads

```
>>> max_sepal_length_setosa = df[df.species ==
'setosa'].sepal_length.max()

5.7999999999999998
```

```
>>> import dask.dataframe as dd

>>> ddf = dd.read_csv('*.csv')

>>> ddf.head()

   sepal_length  sepal_width  petal_length
petal_width       species
0           5.1          3.5           1.4
0.2  Iris-setosa
1           4.9          3.0           1.4
0.2  Iris-setosa
2           4.7          3.2           1.3
   -setosa
3           4.6          3.1           1.5
   -setosa
4           5.0          3.6           1.4
   -setosa
...

>>> d_max_sepal_length_setosa = ddf[ddf.species ==
'setosa'].sepal_length.max()

>>> d_max_sepal_length_setosa.compute()

5.7999999999999998
```

Distributed

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Distributed is a lightweight library for distributed computing in Python.
It extends dask APIs to moderate sized clusters.

```
>>> from distributed import Executor, hdfs, progress
>>> e = Executor('127.0.0.1:8786')
>>> e
<Executor: scheduler=127.0.0.1:8786 workers=64 threads=64>

>>> nyc2014 = hdfs.read_csv('/nyctaxi/2014/*.csv',
...                         parse_dates=['pickup_datetime', 'dropoff_datetime'],
...                         skipinitialspace=True)

>>> nyc2015 = hdfs.read_csv('/nyctaxi/2015/*.csv',
...                         parse_dates=['tpep_pickup_datetime', 'tpep_dropoff_datetime'])

>>> nyc2014, nyc2015 = e.persist([nyc2014, nyc2015])
```

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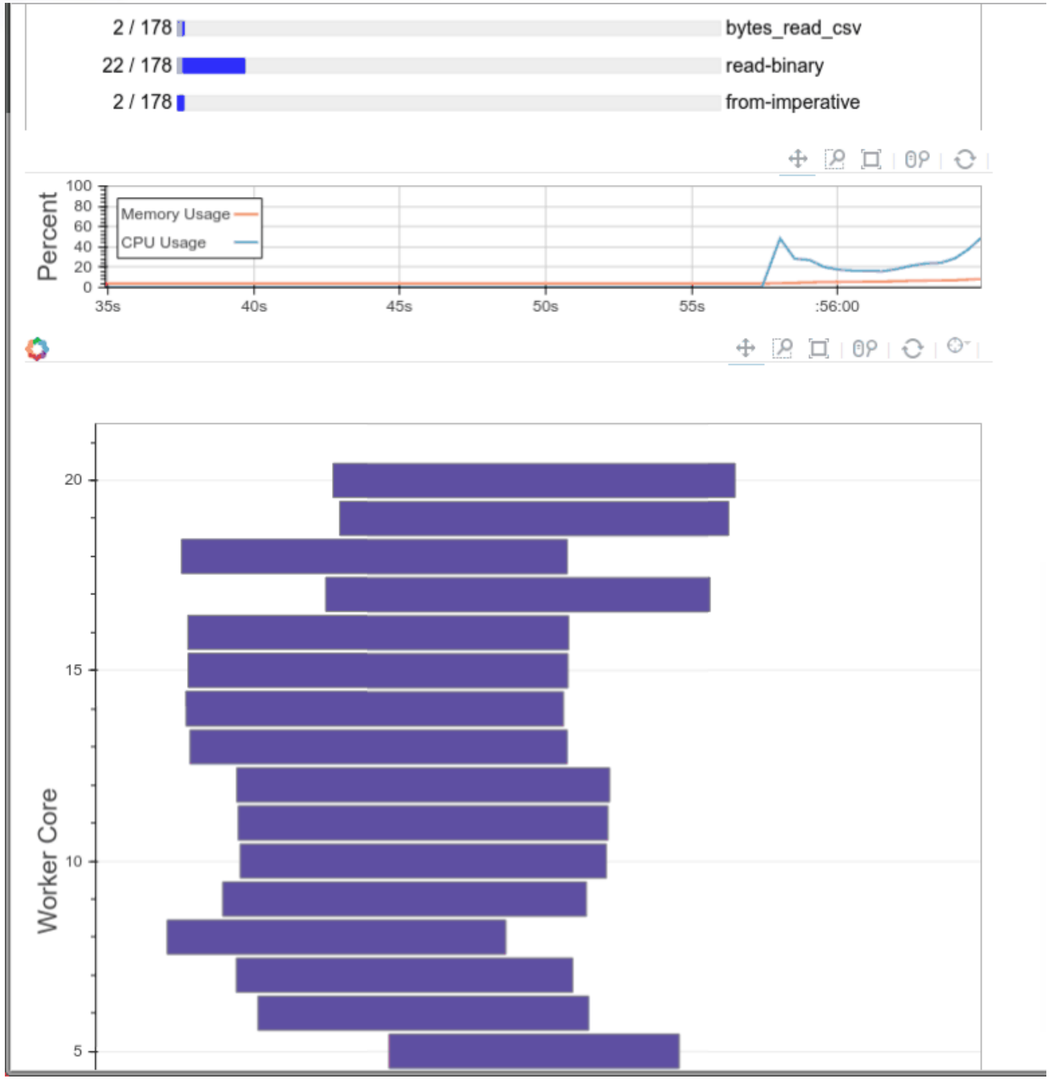
http://distributed.readthedocs.io/en/latest/

Web UI

Dask.distributed includes a web interface to help deliver information about the current state of the network helps to track progress, identify performance issues, and debug failures over a normal web page in real time.



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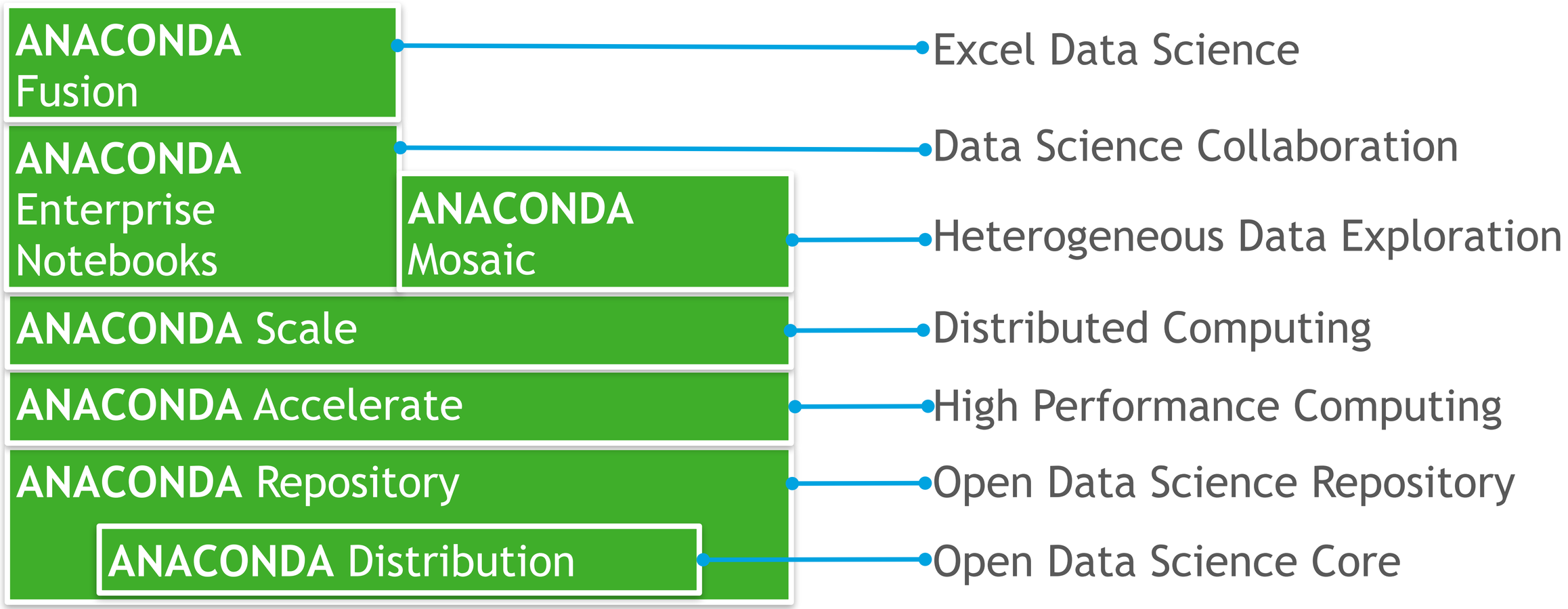
ANACONDA platform



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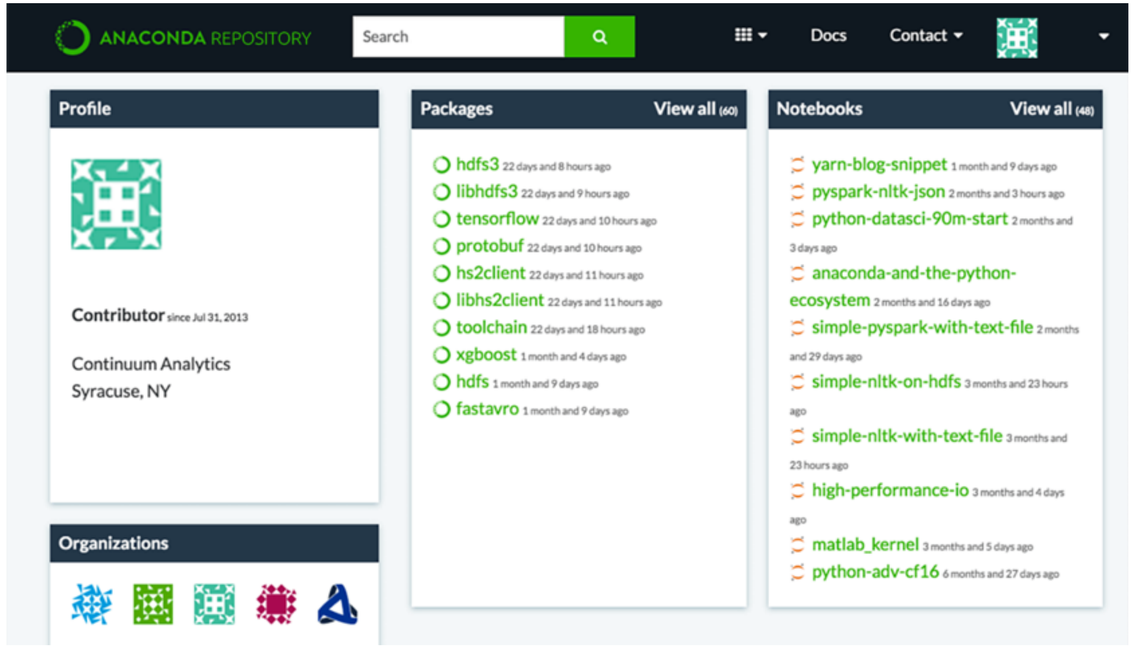
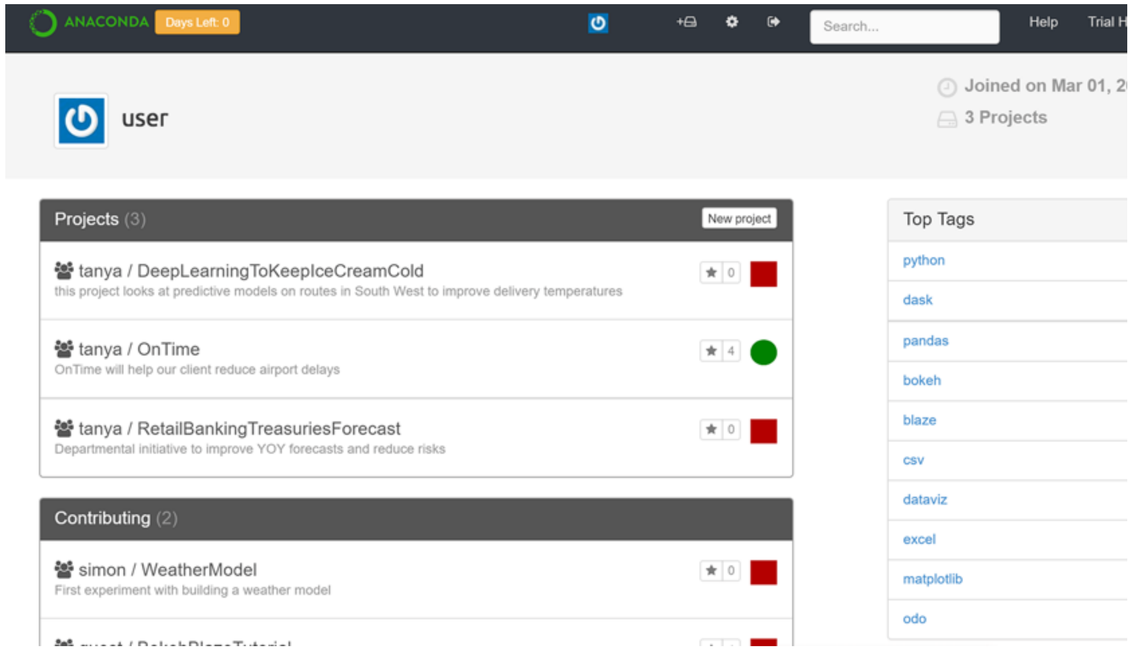
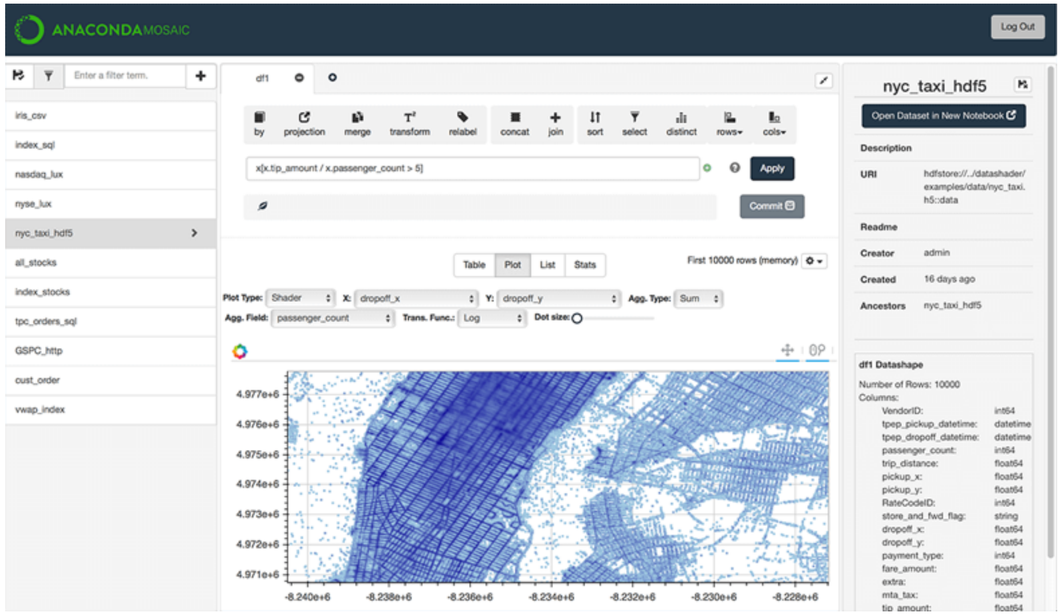


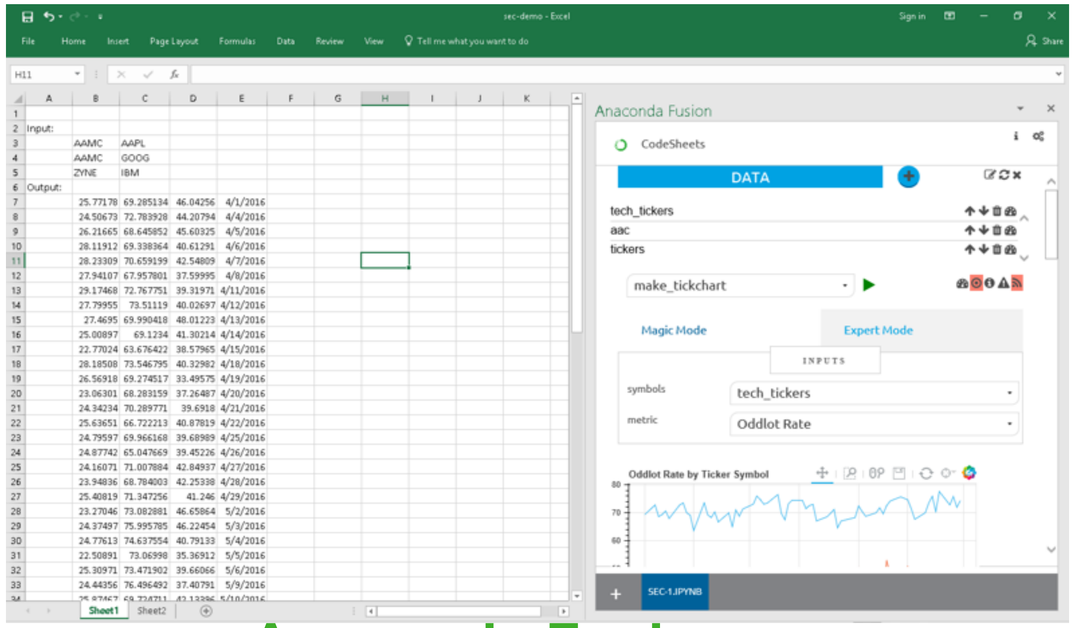
Anaconda Repository



Anaconda Enterprise Notebooks



Anaconda Mosaic



Anaconda Fusion

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Challenges revisited

- Manage reproducible Data Science environments
- Distribute Data Science assets
- Get diverse data scientists (languages, tools, data models, deliverables…) to collaborate effectively
- Enable Data Scientists to easily leverage Big Data technologies
- Deploy data science assets into production applications
- Share insights with decision makers

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Thank you!

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