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# Tutorial de Jupyter Notebook

Infraestrutura necessária

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## Carlos Adean

- » Graduação em Análise e Desenvolvimento de Sistemas
- » Pós-graduado em Administração de Banco de dados
- » Certificações LPIC e RedHat
- » Colaborador do LIneA desde 2011

# Agenda

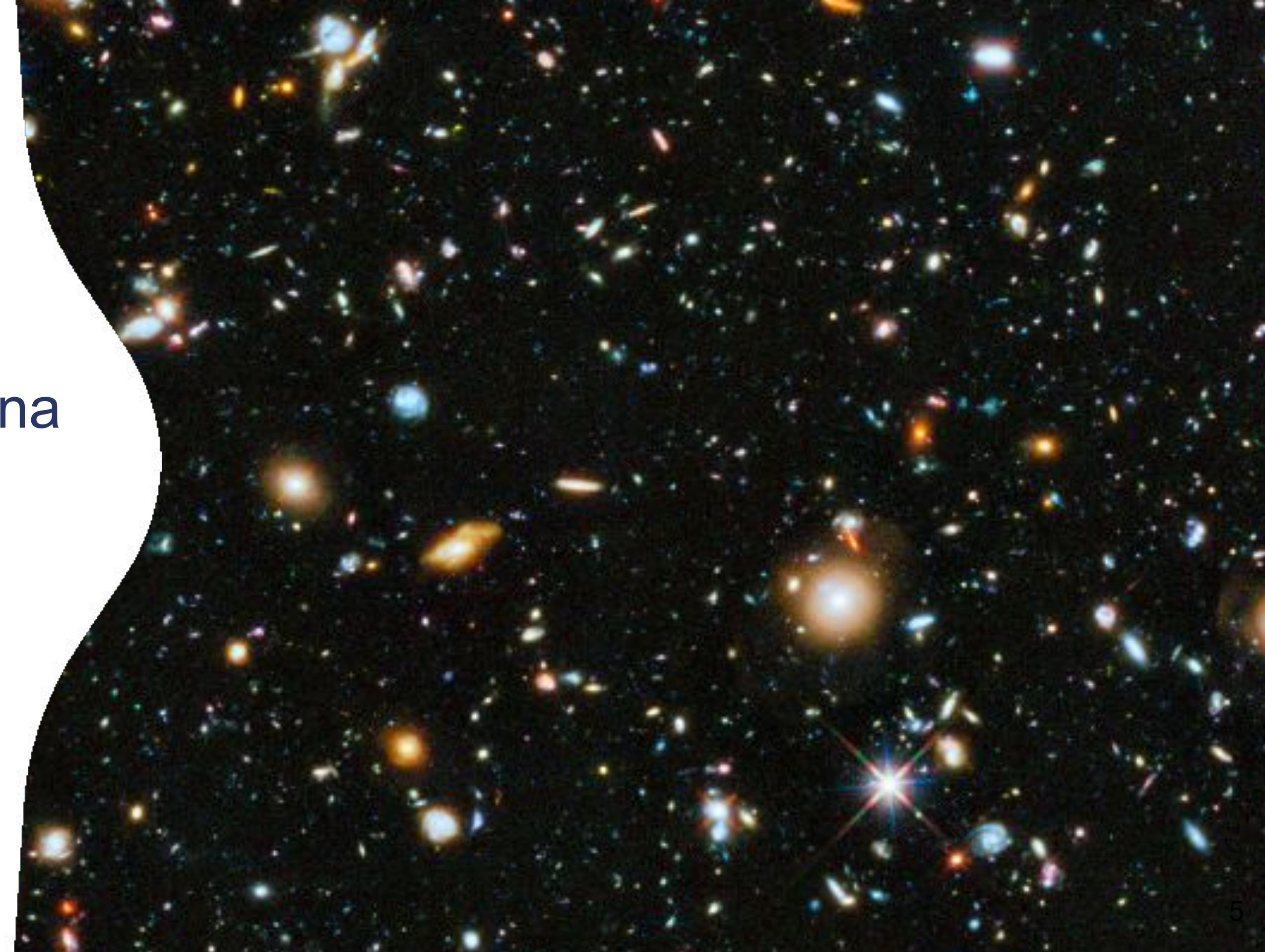
- » Como funciona o Jupyter Notebook
- » Como instalar no Windows e Linux
- » Extensões e widgets
- » Servidor JupyterHub



## Dicionário de termos

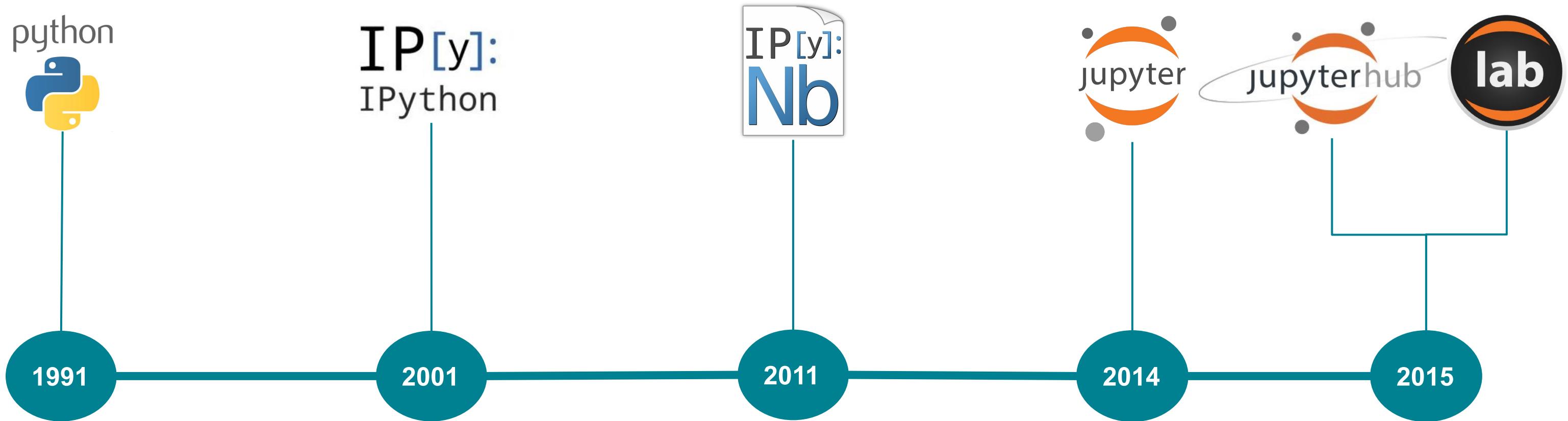
- » Servidor Jupyter Notebook ou Servidor Jupyter, tanto faz.
- » Servidor Jupyter é um servidor *standalone* e *single-user*.
- » JupyterLab é uma nova interface para o Servidor Jupyter.
- » Servidor JupyterHub é um servidor multiusuário.
- » Notebook é o arquivo que contém o código e as anotações.

Como funciona  
o Jupyter  
Notebook



# Como funciona o Jupyter Notebook

## Histórico



## Terminal IPython

- » Terminal interativo para Python
- » Interface original do IPython
- » Modelo REPL - Read-Eval-Print-Loop
- » Utiliza como *backend* o ipykernel (a.k.a kernel IPython)

```
einstein@linea:~$ ipython
Python 2.7.17 (default, Apr 15 2020, 17:20:14)
Type "copyright", "credits" or "license" for more information.

IPython 5.5.0 -- An enhanced Interactive Python.
?          -> Introduction and overview of IPython's features.
%quickref -> Quick reference.
help      -> Python's own help system.
object?   -> Details about 'object', use 'object??' for extra details.

In [1]: import __hello__
Hello world...

In [2]: import antigravity
```

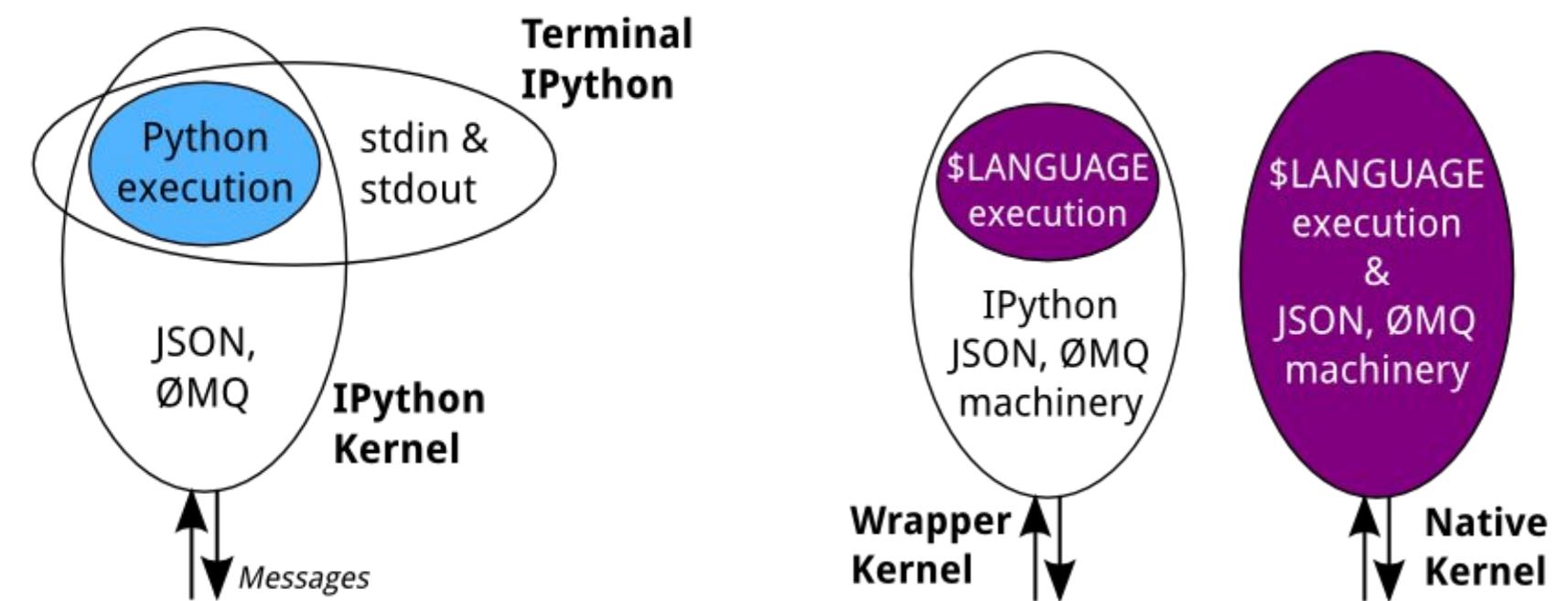
```
while True:
    code = input("">>>> ")
    exec(code)
```

*Representação do modelo REPL*

# Como funciona o Jupyter Notebook

## O kernel IPython

- » Kernel ‘zero’
- » Executar o código e completar comandos
- » JSON para troca de mensagens
- » Interação do *Frontend* com o kernel é via socket zeroMQ
- » *Wrapper kernel* e *Native kernel*

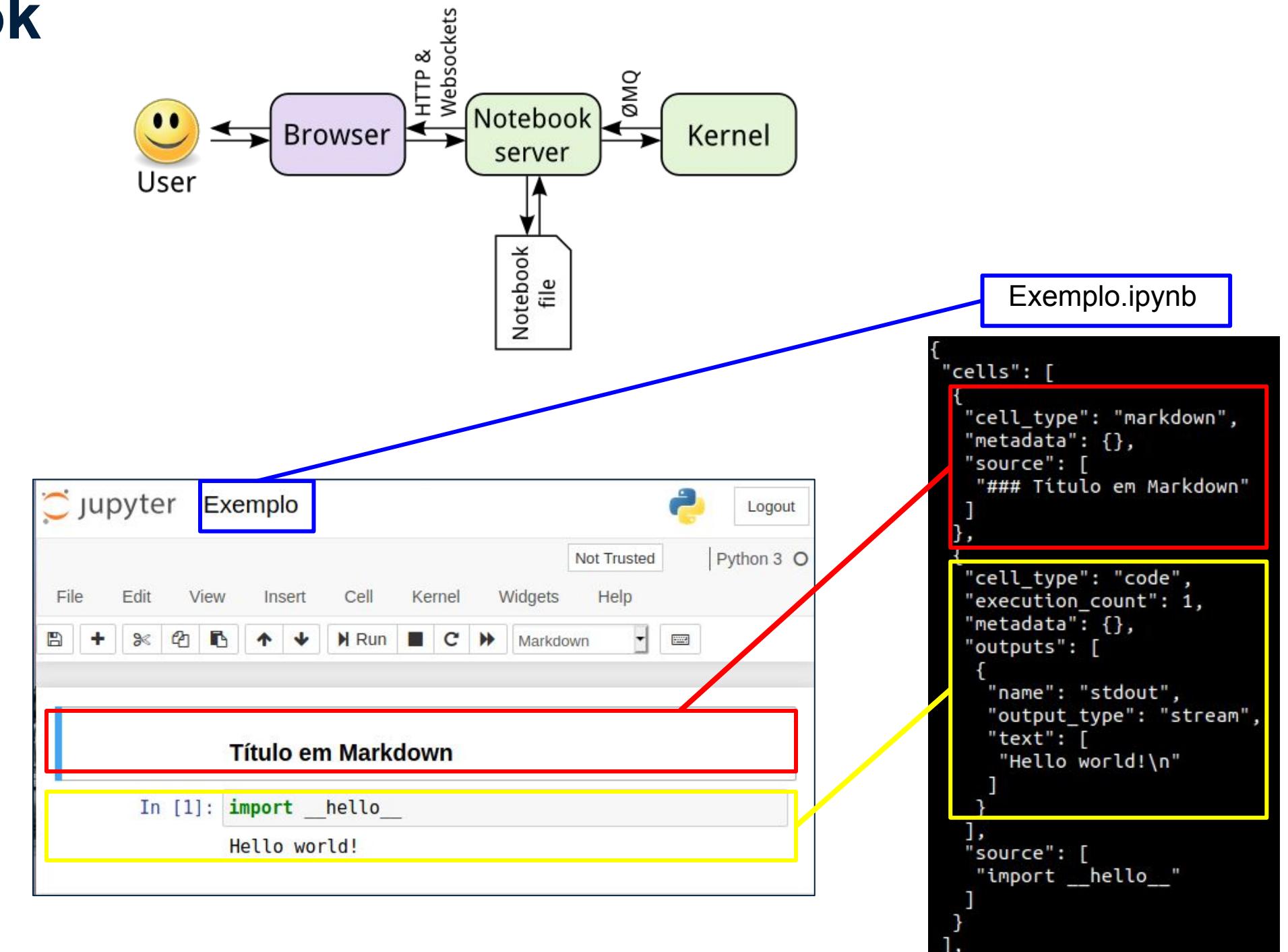


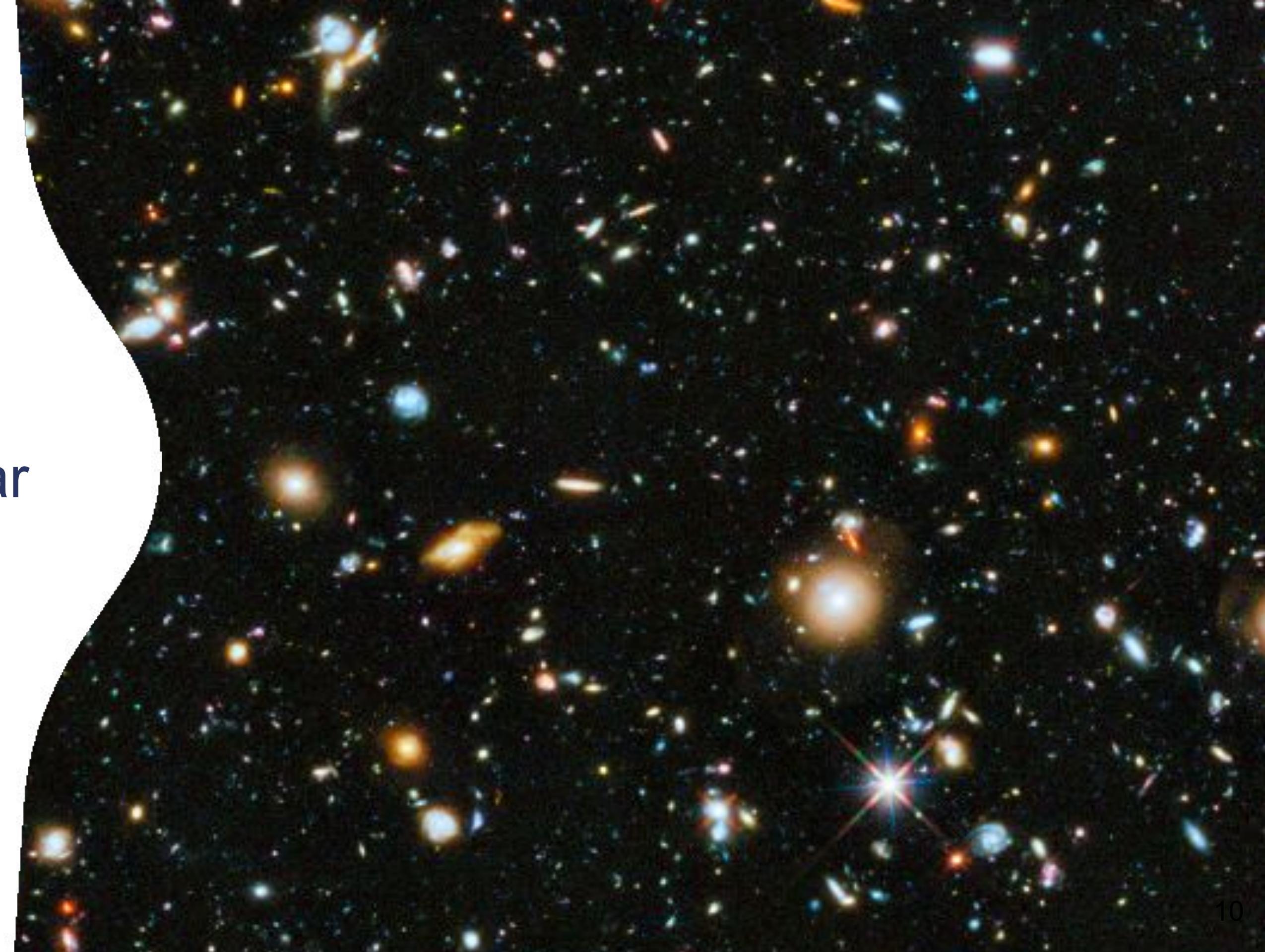
Exemplos de kernel para [Go](#) e [SSH](#)

# Como funciona o Jupyter Notebook

## O servidor Jupyter Notebook

- » ‘Executa’ os códigos
- » Interface flexível e dinâmica
- » Armazena o código e sua saída junto com anotações em markdown
- » Notebook é um JSON com extensão .ipynb



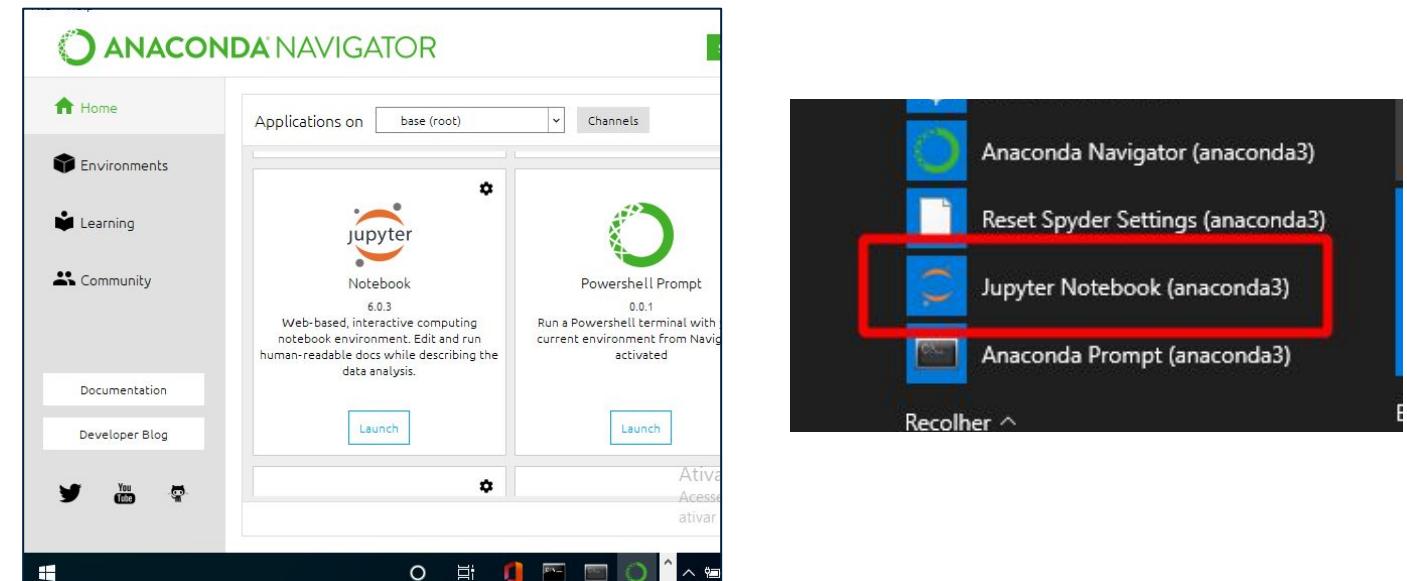
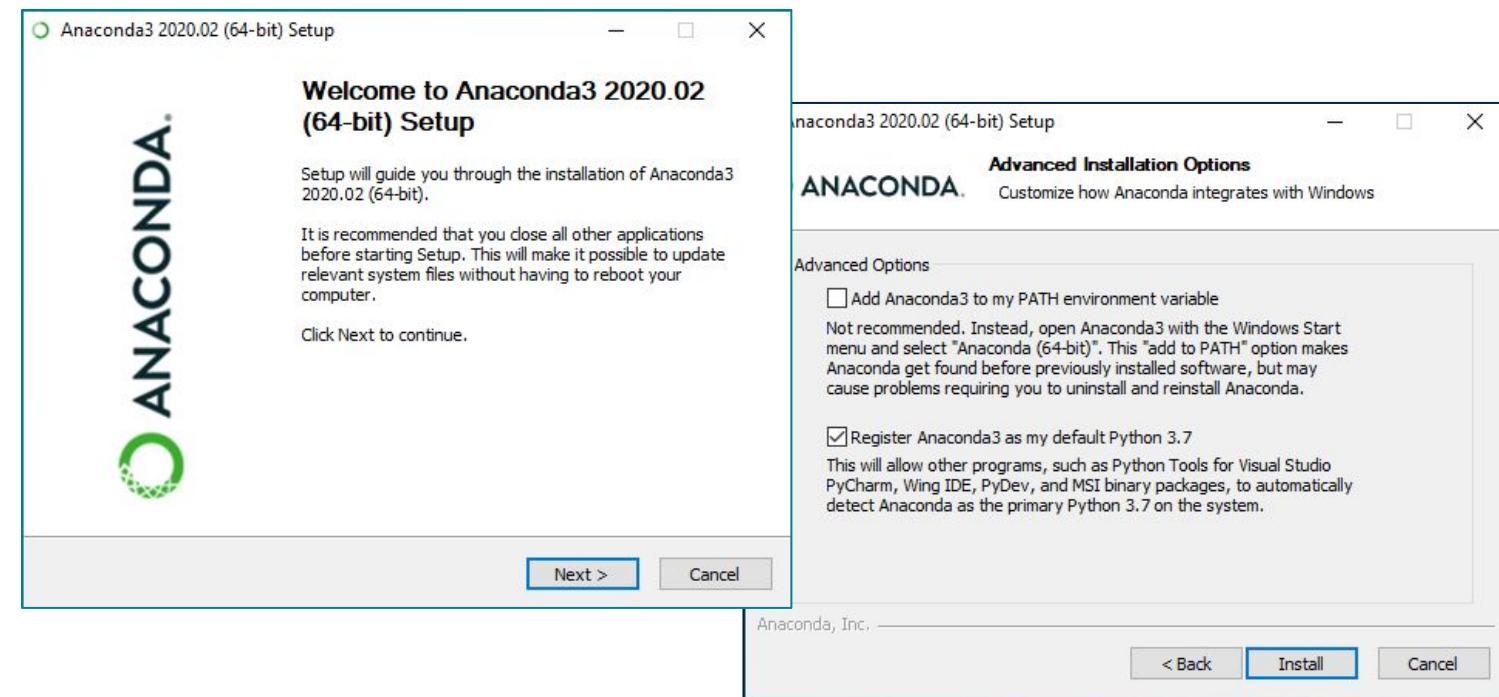
A wide-angle view of the universe filled with numerous galaxies of various sizes and colors, primarily in shades of blue, yellow, and white, set against a dark black background.

Como instalar

# Como instalar

## Windows

- » Anaconda Individual Edition
- » Gerenciador de pacotes
- » [www.anaconda.com/downloads](http://www.anaconda.com/downloads)
- » Next > Next > Next > Finish
- » Jupyter Notebook instalado por padrão



IPython é o kernel padrão

# Como instalar

## Linux

Via [python-pip](#), [anaconda](#) ou [docker](#)

**Debian / Ubuntu**

```
$ sudo apt install python3-pip python3-venv
```

**RedHat / CentOS / Fedora**

```
$ sudo yum install python3-pip python3-virtualenv
```

```
$ python3 -m venv jupyter-env
```

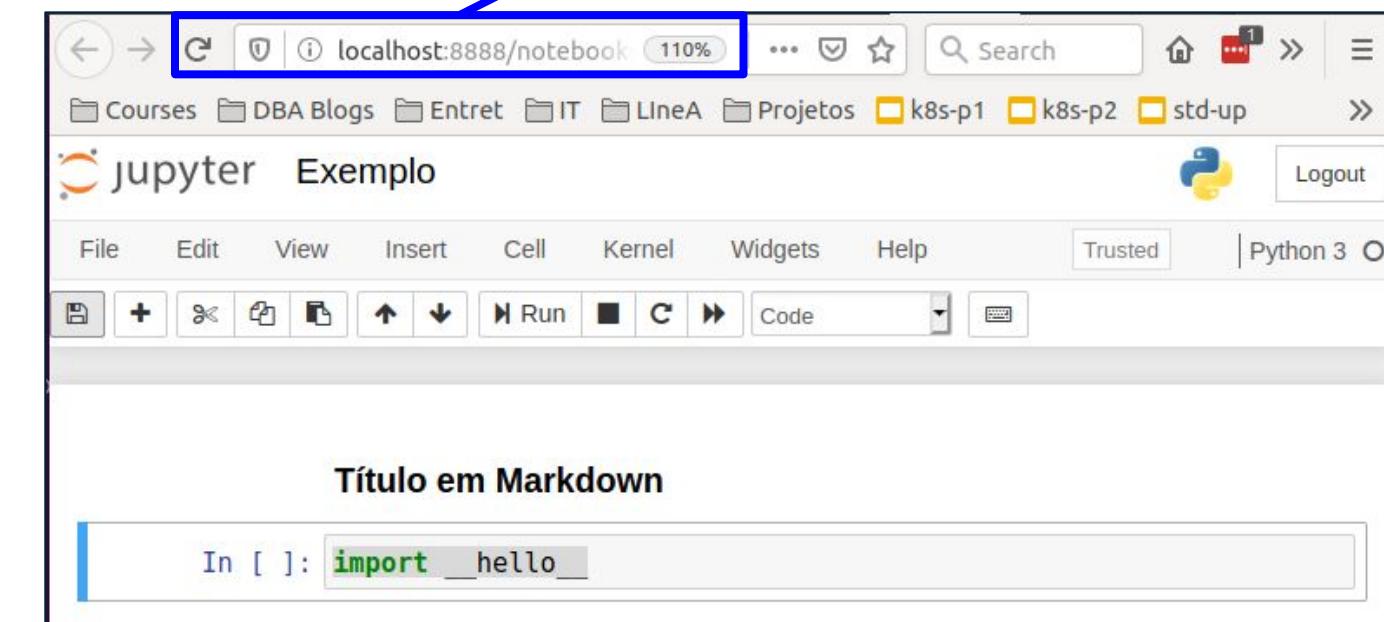
```
$ source jupyter-env/bin/activate
```

```
$ pip3 install jupyter
```

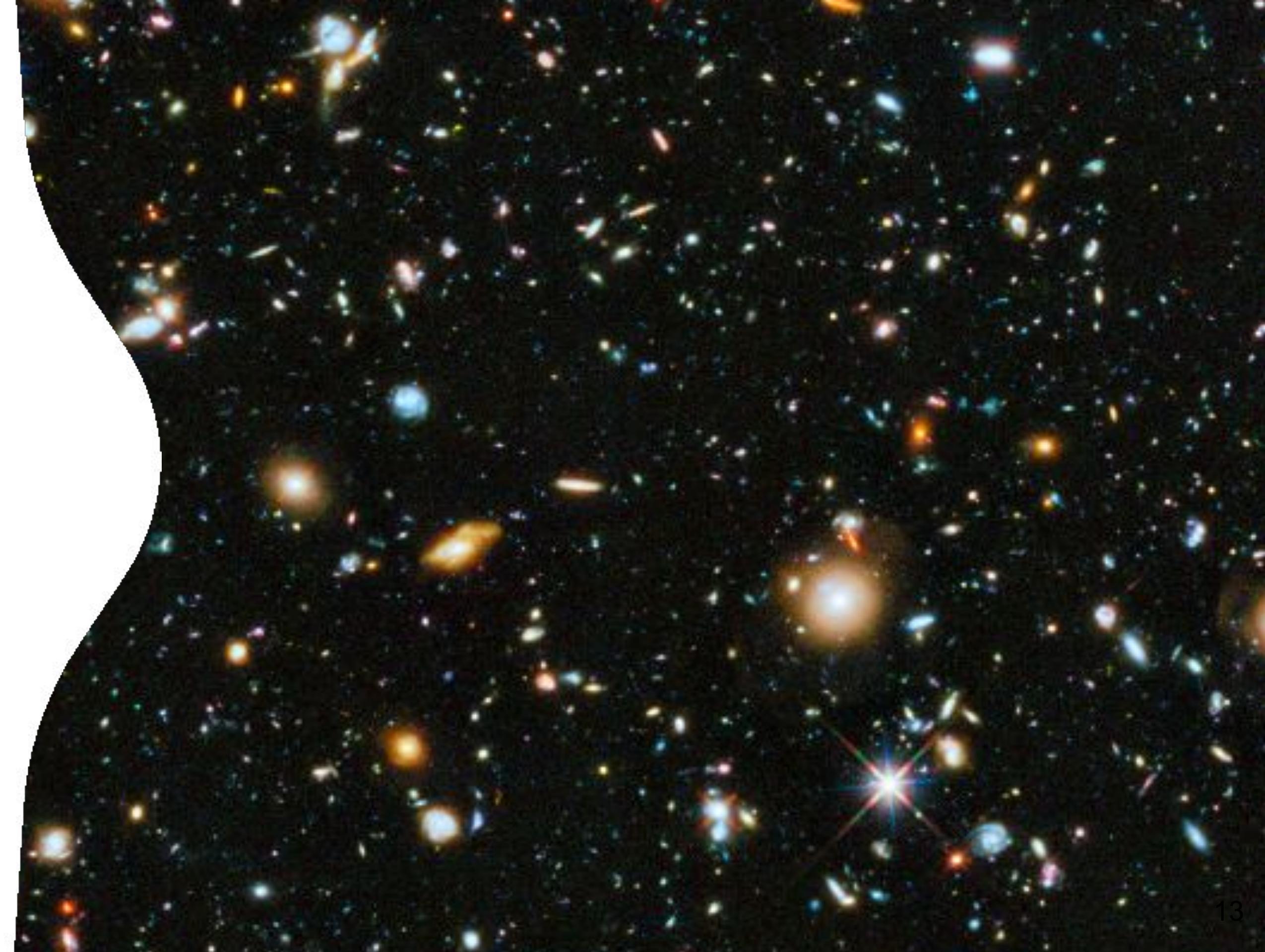
**IPython é o kernel padrão**

```
(base) carlosadeanu@zyon:~$ jupyter notebook
[I 10:42:00.417 NotebookApp] JupyterLab extension loaded from /home/carlosadeanu/anaconda3/lib/py
[I 10:42:06.417 NotebookApp] JupyterLab application directory is /home/carlosadeanu/anaconda3/sha
[I 10:42:07.305 NotebookApp] Serving notebooks from local directory: /home/carlosadeanu
[I 10:42:07.305 NotebookApp] The Jupyter Notebook is running at:
[I 10:42:07.305 NotebookApp] http://localhost:8888/?token=63eaf47ad3d7b39b34a01bb79f78693995037e6
[I 10:42:07.305 NotebookApp] or http://127.0.0.1:8888/?token=63eaf47ad3d7b39b34a01bb79f786939950
[I 10:42:07.305 NotebookApp] Use Control-C to stop this server and shut down all kernels (twice t
[C 10:42:07.382 NotebookApp]

To access the notebook, open this file in a browser:
  file:///home/carlosadeanu/.local/share/jupyter/runtime/nbserver-20929-open.html
Or copy and paste one of these URLs:
  http://localhost:8888/?token=63eaf47ad3d7b39b34a01bb79f78693995037e66a4efbc00
  or http://127.0.0.1:8888/?token=63eaf47ad3d7b39b34a01bb79f78693995037e66a4efbc00
```



# Extensões e widgets

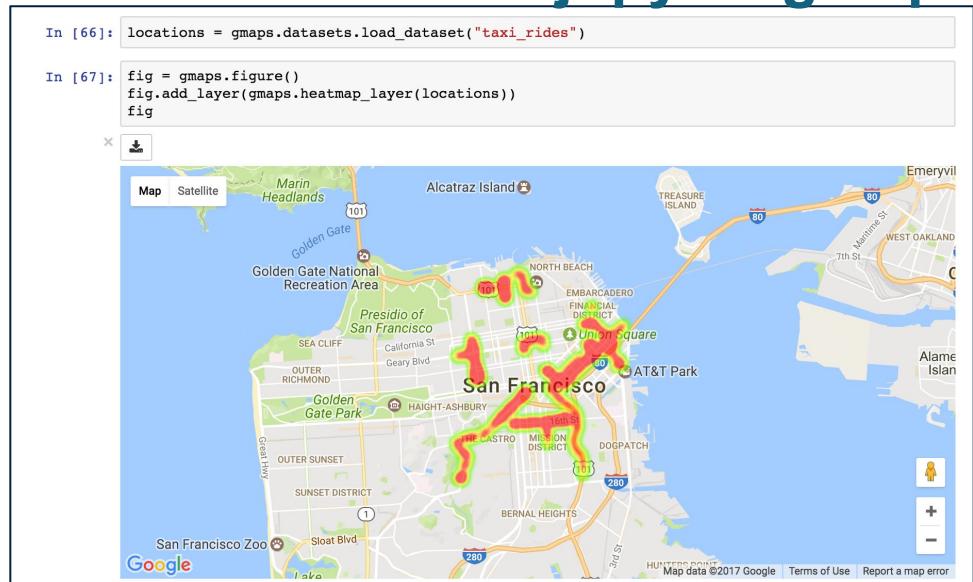


# Extensões e widgets



## Jupyter widgets

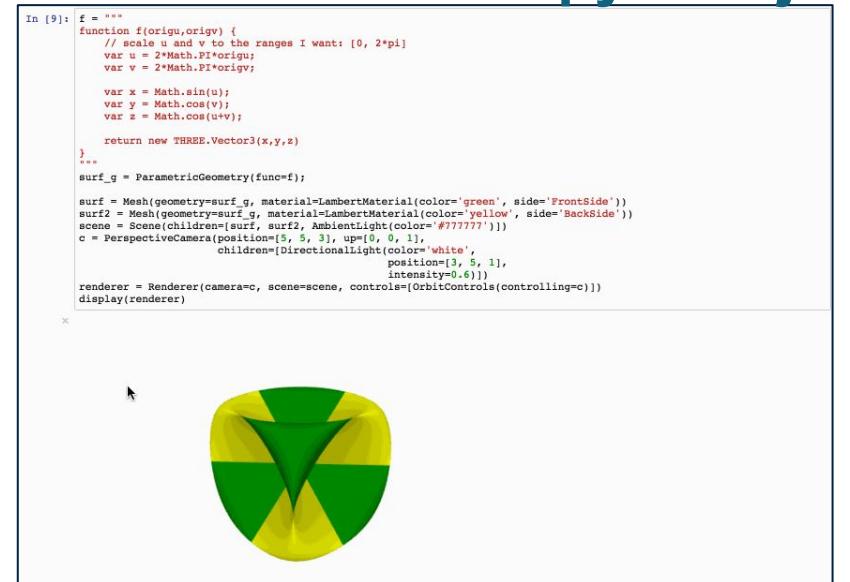
jupyter-gmaps



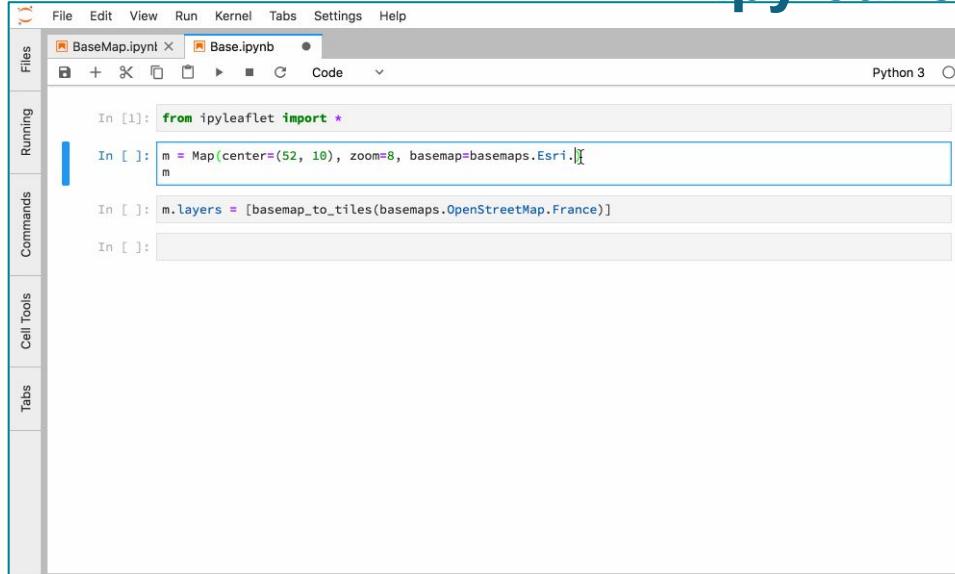
bqplot



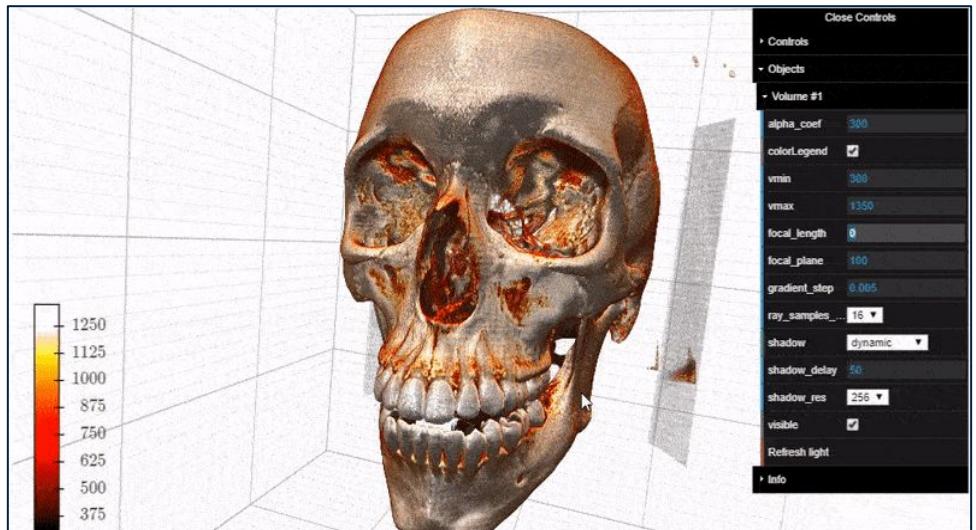
pythreejs



ipyleaflet



k3d-jupyter



bakerx

| index                    | time                        | m3                     | m6    | y1    | y2     | y3    | y10   | y5     | y7    | y30    | spread |
|--------------------------|-----------------------------|------------------------|-------|-------|--------|-------|-------|--------|-------|--------|--------|
| Show All Columns         | 00                          | Hide column            |       | 8.132 | 8.207  | 8.120 | 8.196 | 8.2586 |       | 0.309  |        |
| Show Column              | 00                          | ▼ Filter by Expression |       | 8.387 | 8.473  | 8.425 | 8.476 | 8.5037 |       | 0.471  |        |
| Hide All Columns         | 00                          | Q Search for Substring |       | 8.627 | 8.589  | 8.601 | 8.648 | 8.5632 |       | 0.419  |        |
| Format                   | 00                          | Format                 |       | 8.783 | 8.786  | 8.768 | 8.813 | 8.756  |       | 0.745  |        |
| Rows to Show             | 00                          | Sort Ascending         |       | 8.692 | 8.758  | 8.736 | 8.784 | 8.7314 |       | 0.751  |        |
| Clear selection          | 00                          | Sort Descending        |       | 8.398 | 8.480  | 8.431 | 8.518 | 8.4576 |       | 0.493  |        |
| Copy to Clipboard        | 00                          | ✓ No Sort              |       | 8.265 | 8.471  | 8.331 | 8.455 | 8.4981 |       | 0.597  |        |
| Download All as CSV      | 00                          | Align Left             |       | 8.219 | 8.753  | 8.437 | 8.644 | 8.8635 |       | 1.058  |        |
| Download Selected as CSV | 00                          | Align Center           |       | 8.267 | 8.893  | 8.514 | 8.787 | 9.0289 |       | 1.295  |        |
| Q Search for Substring   | 00                          | Align Right            |       | 8.069 | 8.720  | 8.328 | 8.594 | 8.8577 |       | 1.319  |        |
| ▼ Filter by Expression   | 00                          | Heatmap H              |       | 7.737 | 8.392  | 8.023 | 8.277 | 8.5405 |       | 1.101  |        |
| Hide Filter              | 00                          | Data Bars B            |       | 7.466 | 8.075  | 7.726 | 8.001 | 8.237  |       | 1.125  |        |
| Reset All Interactions   | 00                          | Color by unique U      |       | 7.378 | 8.092  | 7.700 | 7.971 | 8.2695 |       | 1.681  |        |
| Fix Left                 | 00                          | Move column to front   |       | 7.354 | 8.110  | 7.772 | 8.002 | 8.288  |       | 2.017  |        |
| Move column to end       | 00                          | Move column to end     |       | 7.232 | 8.039  | 7.701 | 7.923 | 8.2095 |       | 2.214  |        |
| Reset formating          | 00                          | Reset formating        |       | 7.391 | 8.284  | 7.937 | 8.171 | 8.472  |       | 2.533  |        |
| 17                       | 19910628 20:00:00.000 -0400 | 5/51                   | 5.9/4 | 6.3/6 | 6.9/18 | 7.376 | 8.273 | 7.911  | 8.147 | 8.4523 | 2.522  |

# Extensões e widgets



## Jupyter extensions

nbgrader

A screenshot of the Jupyter nbgrader interface. It shows a notebook with two sections: "Part A (2 points)" and "Part B (3 points)". In Part A, there is a text input field asking to compute the mean of a list of numbers, followed by a code cell with Python code. In Part B, there is a text input field asking to describe the difference between arithmetic, harmonic, and geometric means, followed by a formula for the arithmetic mean.

rise (presentation)

A screenshot of the Jupyter rise presentation mode. It shows a slide titled "Welcome to the Binder-RISE demo". The slide contains several code cells demonstrating how to use RISE. One cell shows imports for numpy and matplotlib, and another shows a histogram plot.

jupyter-drive

A screenshot of the Jupyter Drive interface. It shows a file browser with a sidebar for "Launcher" and a main area for "Desktop/machine-Learning-solutions-master/Classification". A red arrow points to a folder named "Shared with me" which is highlighted in blue. The text "Shared with me folder of Google Drive is visible" is overlaid in red.

voilá

A screenshot of the Jupyter nbviewer interface. It shows a rendered Jupyter notebook with the title "nbviewer". Below the title, it says "A simple way to share Jupyter Notebooks". There is a text input field for "Enter the location of a Jupyter Notebook to have it rendered here:" and a "Go!" button. At the bottom, there are sections for "Programming Languages" with links for IPython, IRuby, and IJulia.



## Como instalar widgets e extensões

Pode ser instalado via python-pip ou anaconda

### Anaconda

Abrir o terminal Anaconda

```
conda install -c conda-forge <nome>
```

### Pip

Abrir o terminal

```
$ source jupyter-env/bin/activate  
$ pip3 install <nome>
```

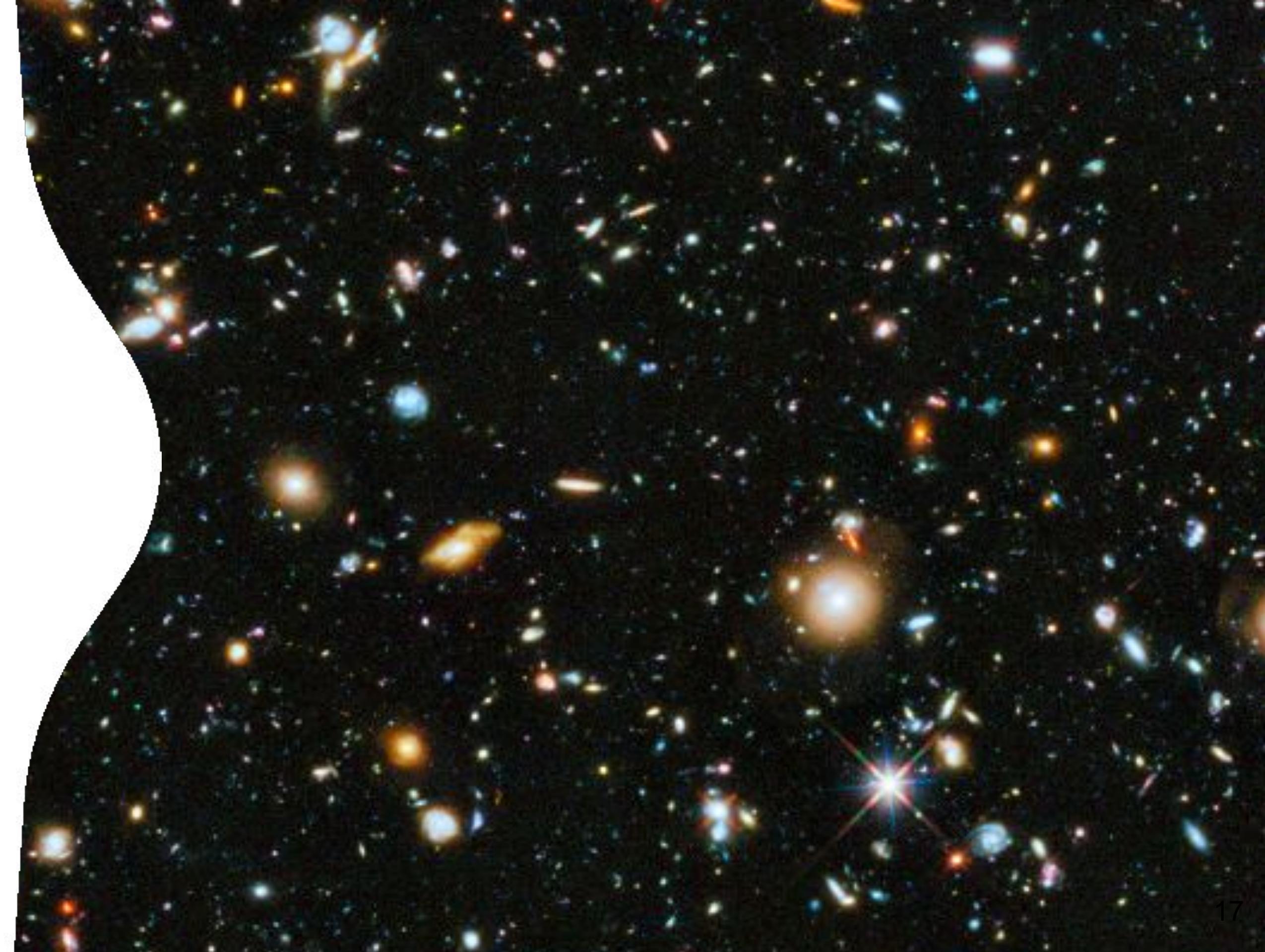
### Para ativar o widget

```
jupyter nbextension enable --py --sys-prefix <nome>
```

```
conda install -c conda-forge k3d  
jupyter nbextension enable k3d
```

```
source jupyter-env/bin/activate  
pip3 install k3d  
jupyter nbextension enable k3d
```

Servidor  
JupyterHub



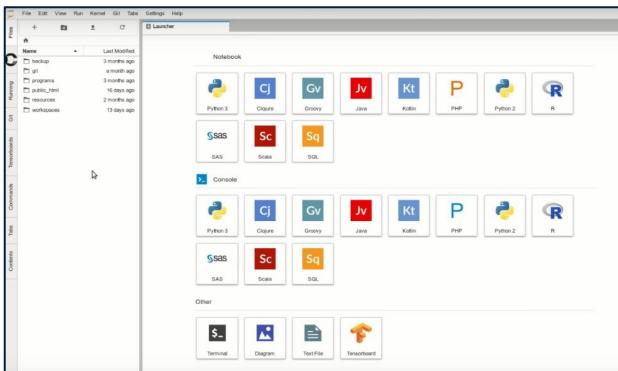
# Servidor JupyterHub



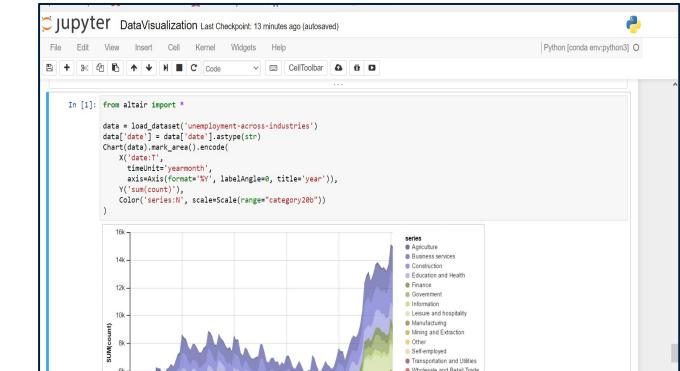
## Jupyter Notebook vs JupyterHub

```
In [1]: from scipy.io import wavfile  
rate, x = wavfile.read('test_mono.wav')  
  
In [2]: import matplotlib.pyplot as plt  
fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(12, 4))  
ax1.plot(x); ax1.set_title('Raw audio signal')  
ax2.specgram(x); ax2.set_title('Spectrogram')  
plt.show()
```

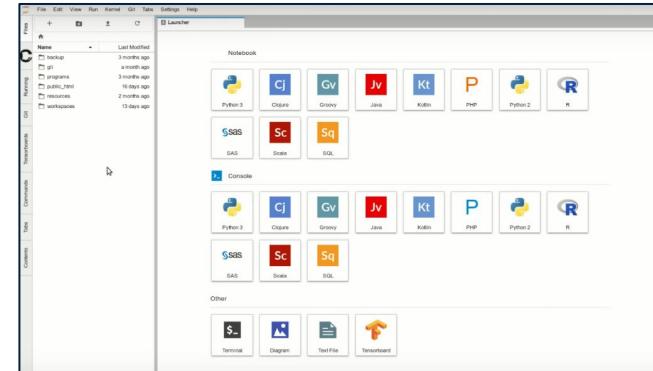
<http://localhost:8888/>



<http://localhost:8888/>



<http://localhost:8888/>

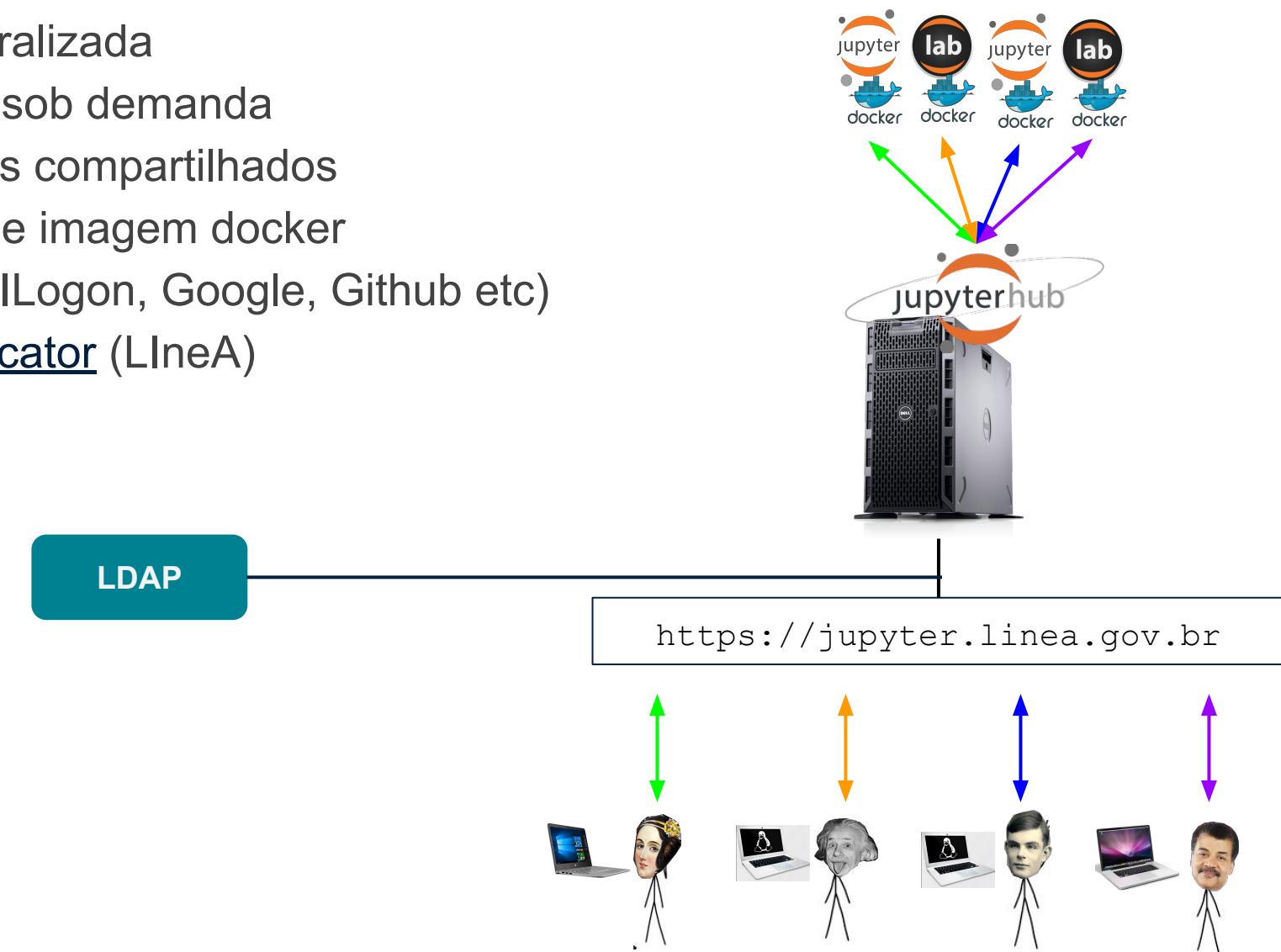


<http://localhost:8888/>



## JupyterHub *standalone*

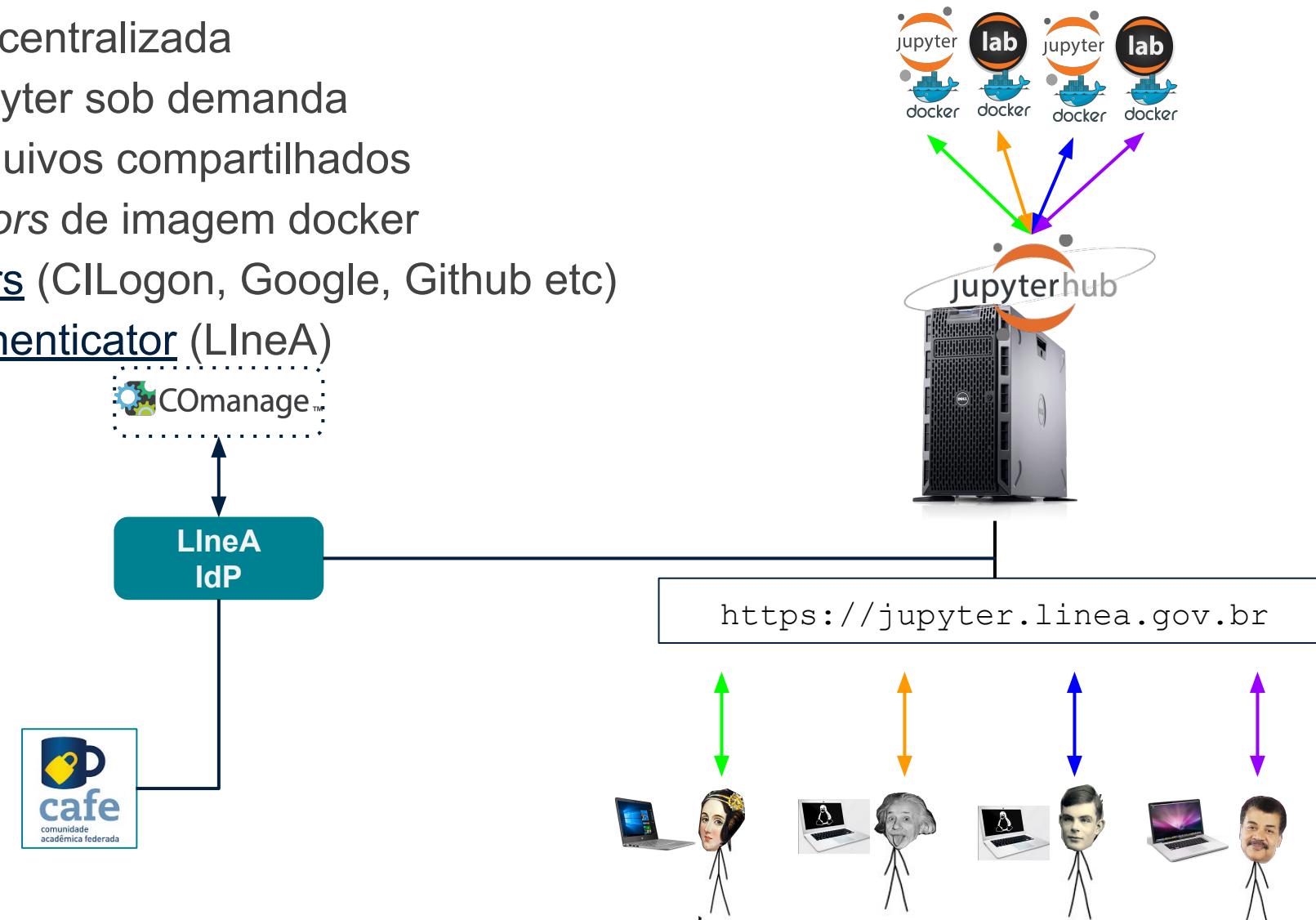
- » Servidor Jupyter multiusuário
- » Administração centralizada
- » Servidores Jupyter sob demanda
- » Sistema de arquivos compartilhados
- » Diferentes *flavors* de imagem docker
- » OAuth providers (CILogon, Google, Github etc)
- » Plugin Idapauthenticator (LIneA)



# Servidor JupyterHub

## JupyterHub *standalone*

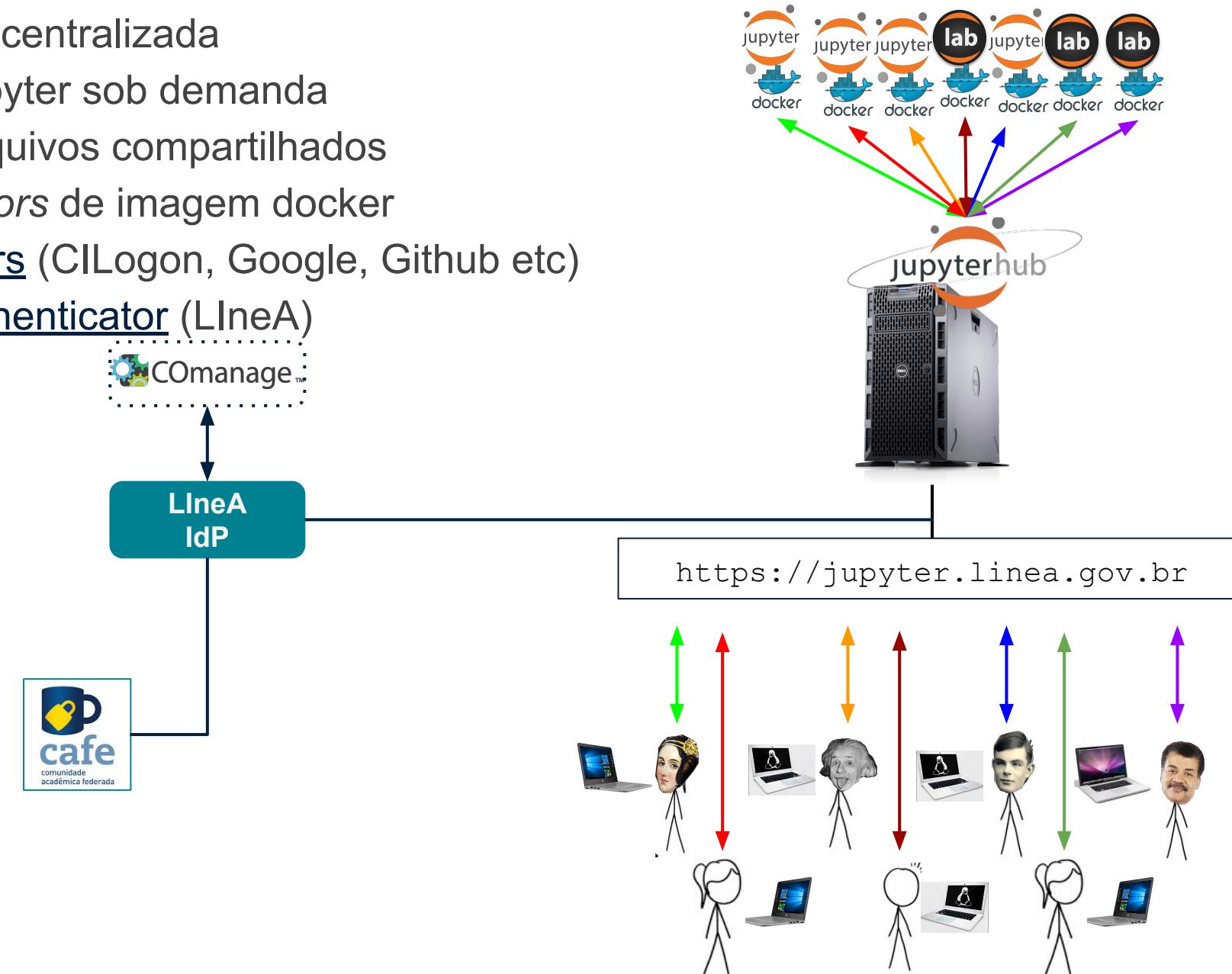
- » Servidor Jupyter multiusuário
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- » Sistema de arquivos compartilhados
- » Diferentes *flavors* de imagem docker
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# Servidor JupyterHub

## JupyterHub *standalone*

- » Servidor Jupyter multiusuário
- » Administração centralizada
- » Servidores Jupyter sob demanda
- » Sistema de arquivos compartilhados
- » Diferentes *flavors* de imagem docker
- » OAuth providers (CILogon, Google, Github etc)
- » Plugin Idapauthenticator (LIneA)

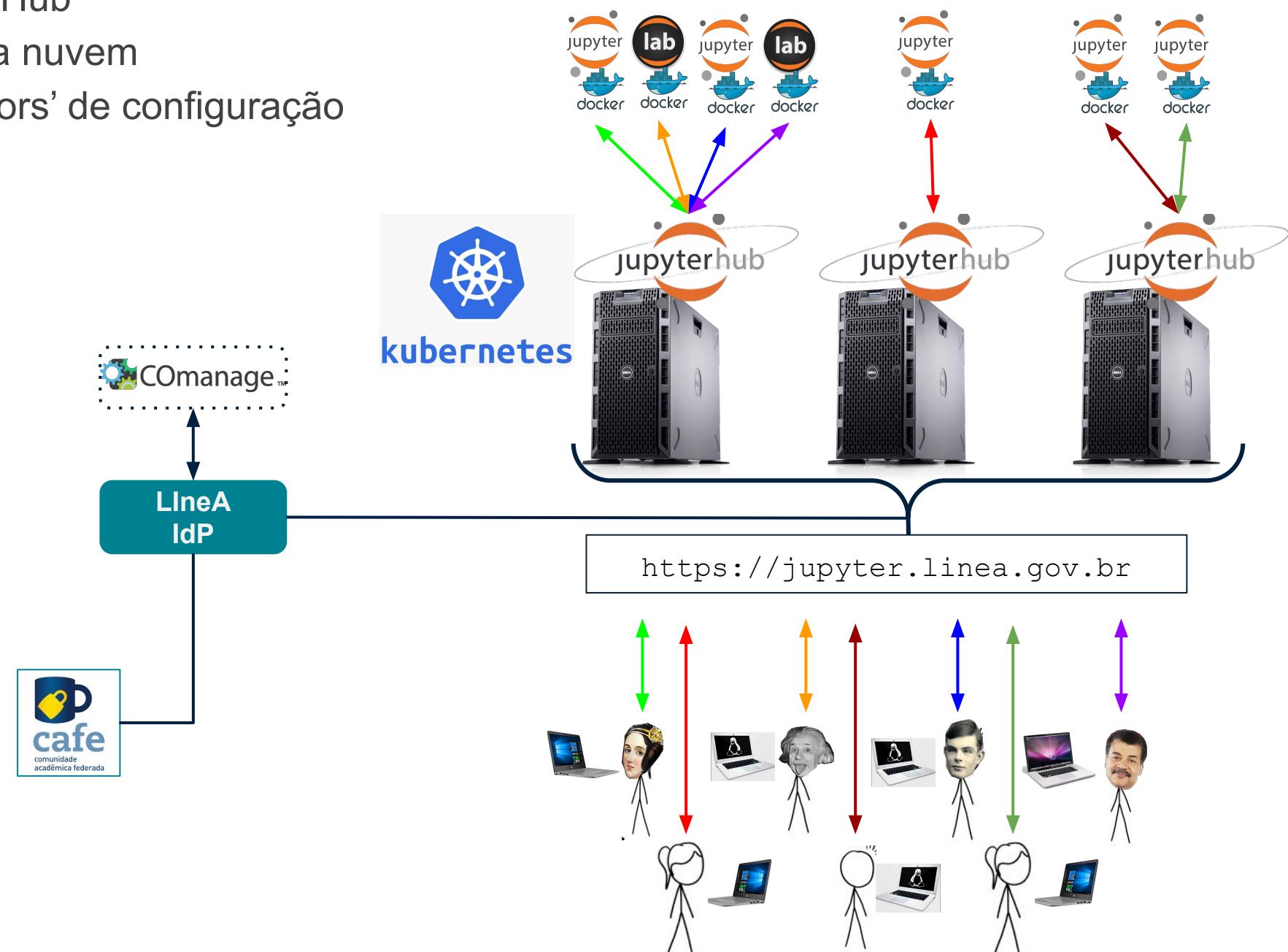


# Servidor JupyterHub



## JupyterHub + Kubernetes

- » Cluster JupyterHub
- » K8S local ou na nuvem
- » Diferentes 'flavors' de configuração

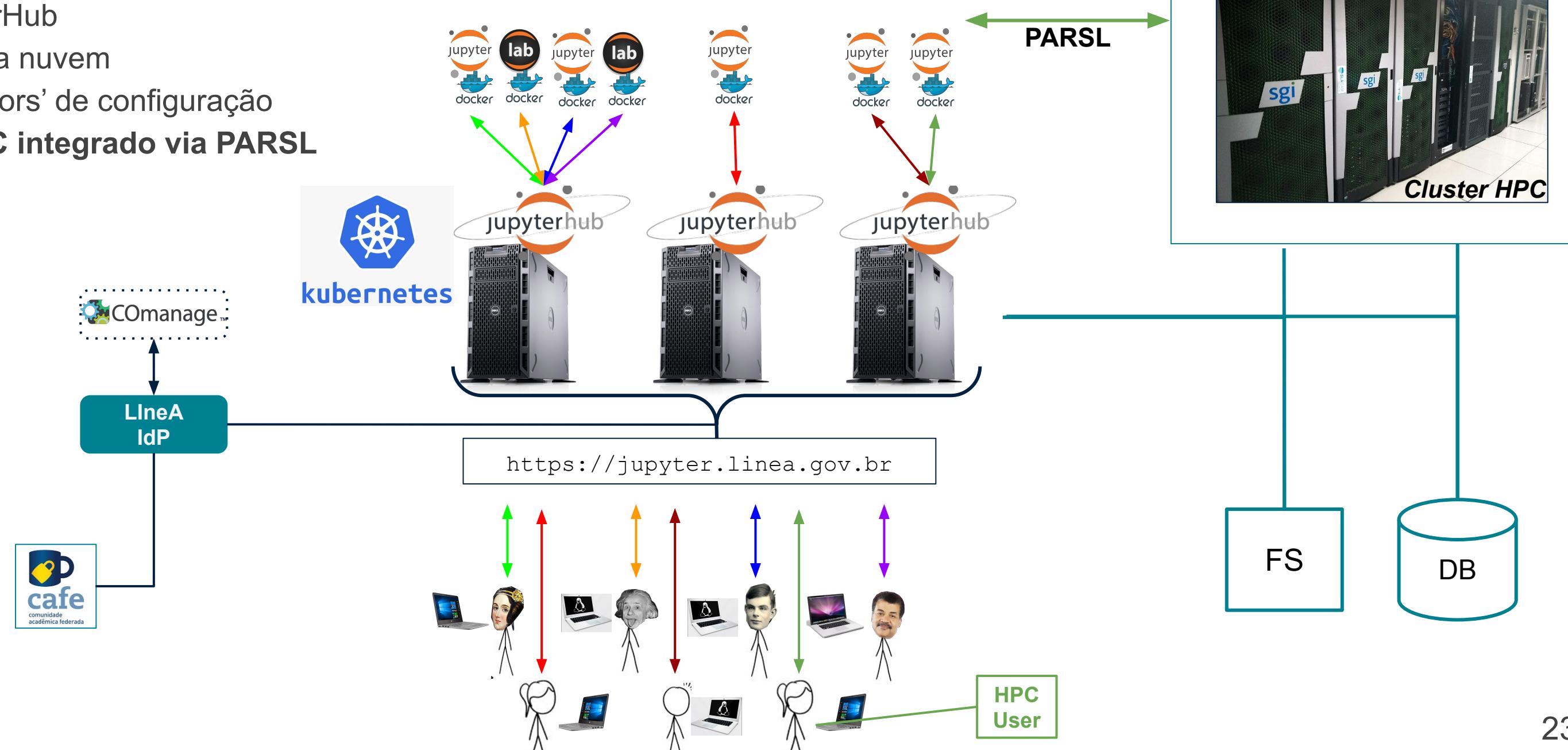


# Servidor JupyterHub



## JupyterHub + Kubernetes + HPC

- » Cluster JupyterHub
- » K8S local ou na nuvem
- » Diferentes 'flavors' de configuração
- » Ambiente HPC integrado via PARSL



# Links



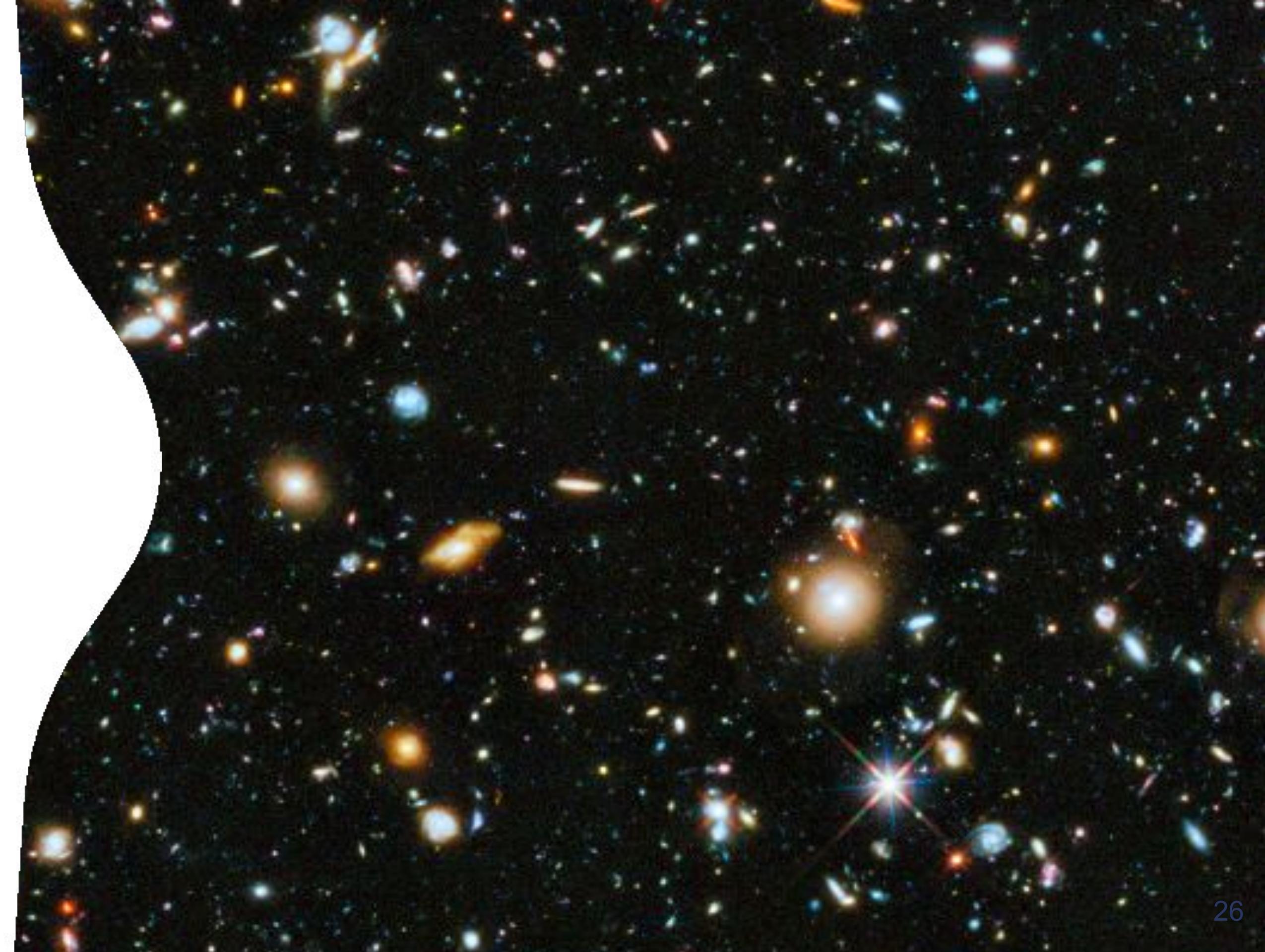
- <https://jupyter.org>
- <https://jupyterhub.readthedocs.io>
- <https://github.com/jupyter/jupyter/wiki/Jupyter-kernels>
- [https://en.wikipedia.org/wiki/Project\\_Jupyter](https://en.wikipedia.org/wiki/Project_Jupyter)
- [https://en.wikipedia.org/wiki/Albert\\_Einstein](https://en.wikipedia.org/wiki/Albert_Einstein)
- <https://zeromq.org>
- <https://ipython.org>
- <https://en.wikipedia.org/wiki/IPython>
- <https://youtu.be/GExKsQ-OU78>
- <https://youtu.be/4GJFNQBB26s>
- [parsl-project.org](https://parsl-project.org)
- [kubernetes.io](https://kubernetes.io)



Obrigado!

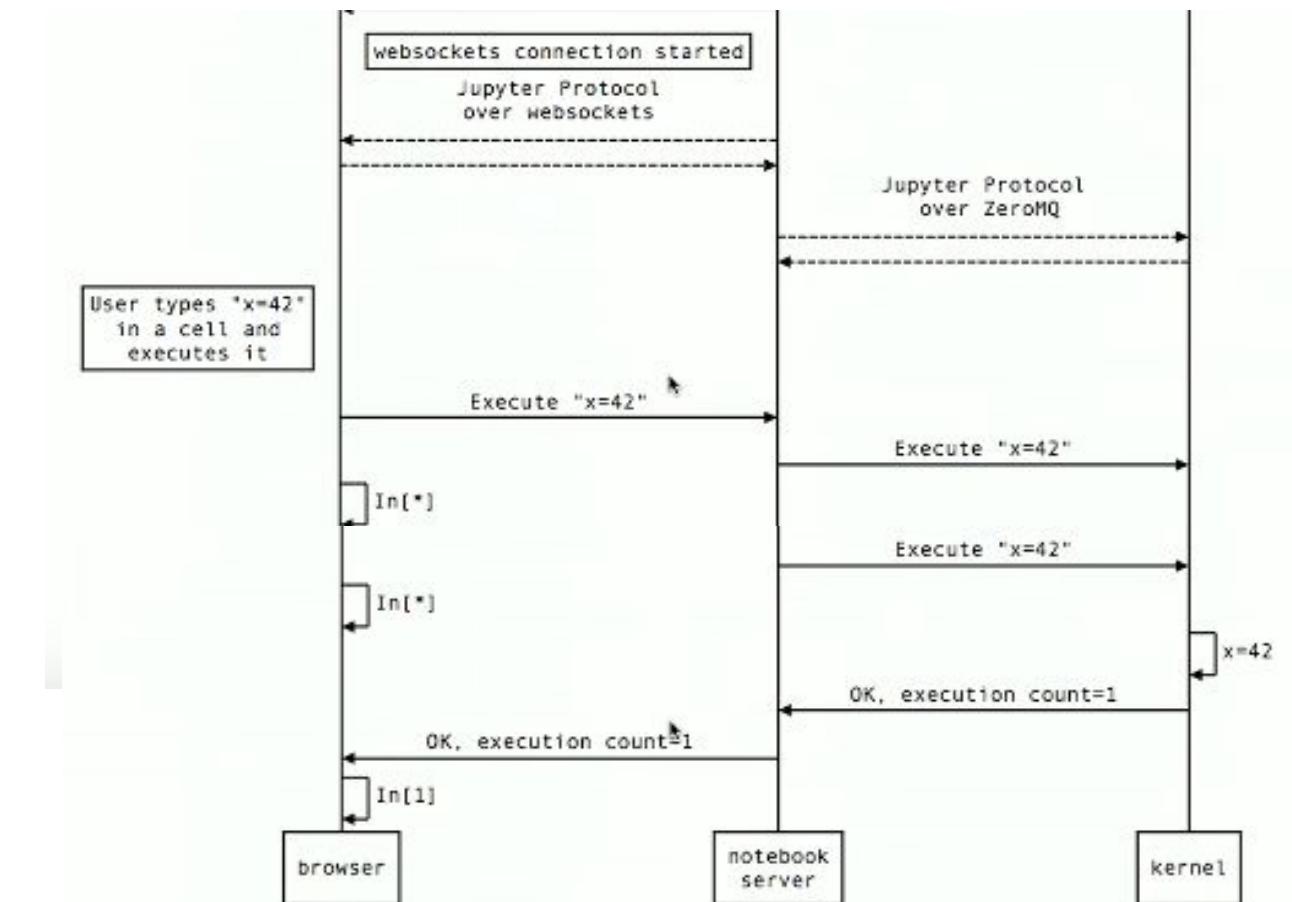
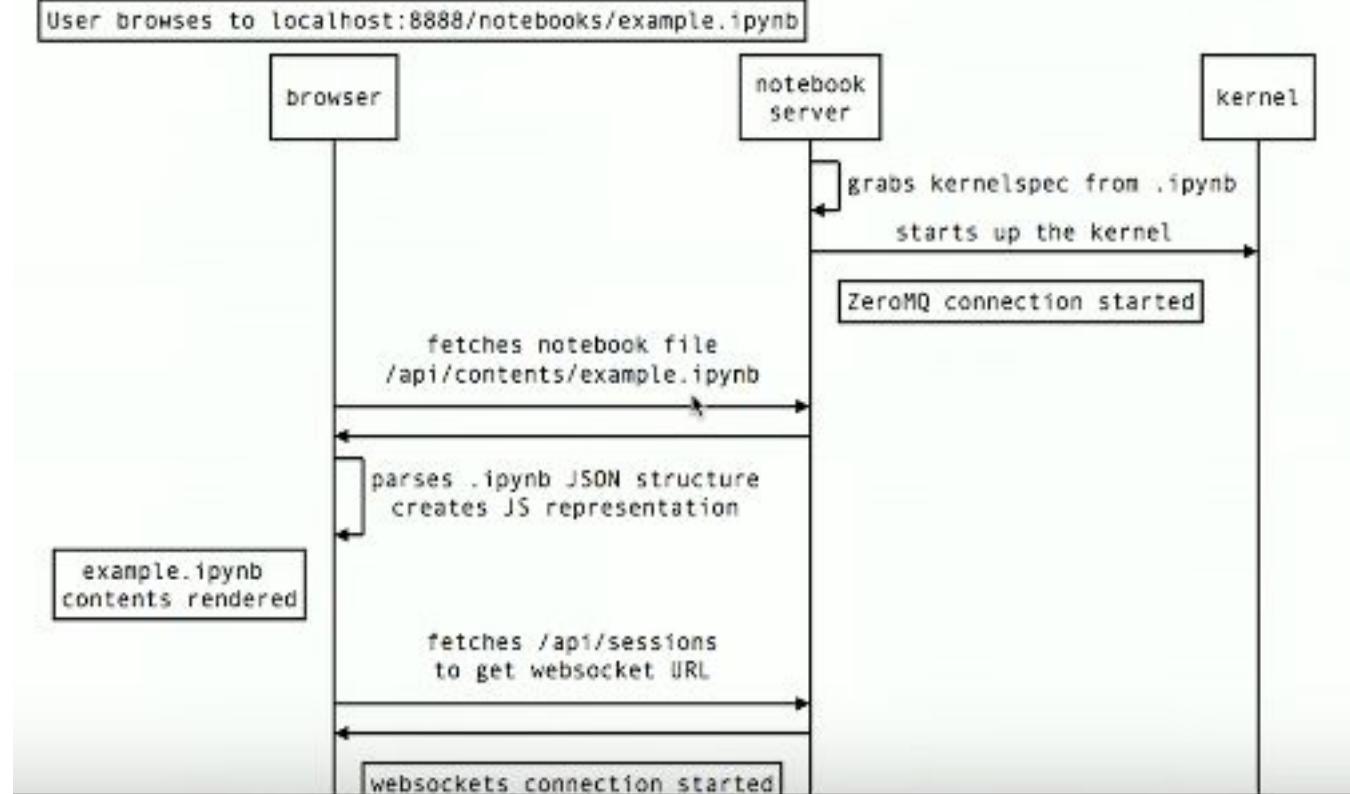
[carlosadean@linea.gov.br](mailto:carlosadean@linea.gov.br)

Extras



# Como funciona o Jupyter Notebook

## Diagrama de sequência de uma requisição



## Arquitetura do servidor JupyterHub

