



Tutorial de Jupyter Notebook

Infraestrutura necessária

Carlos Adean
Junho de 2020



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

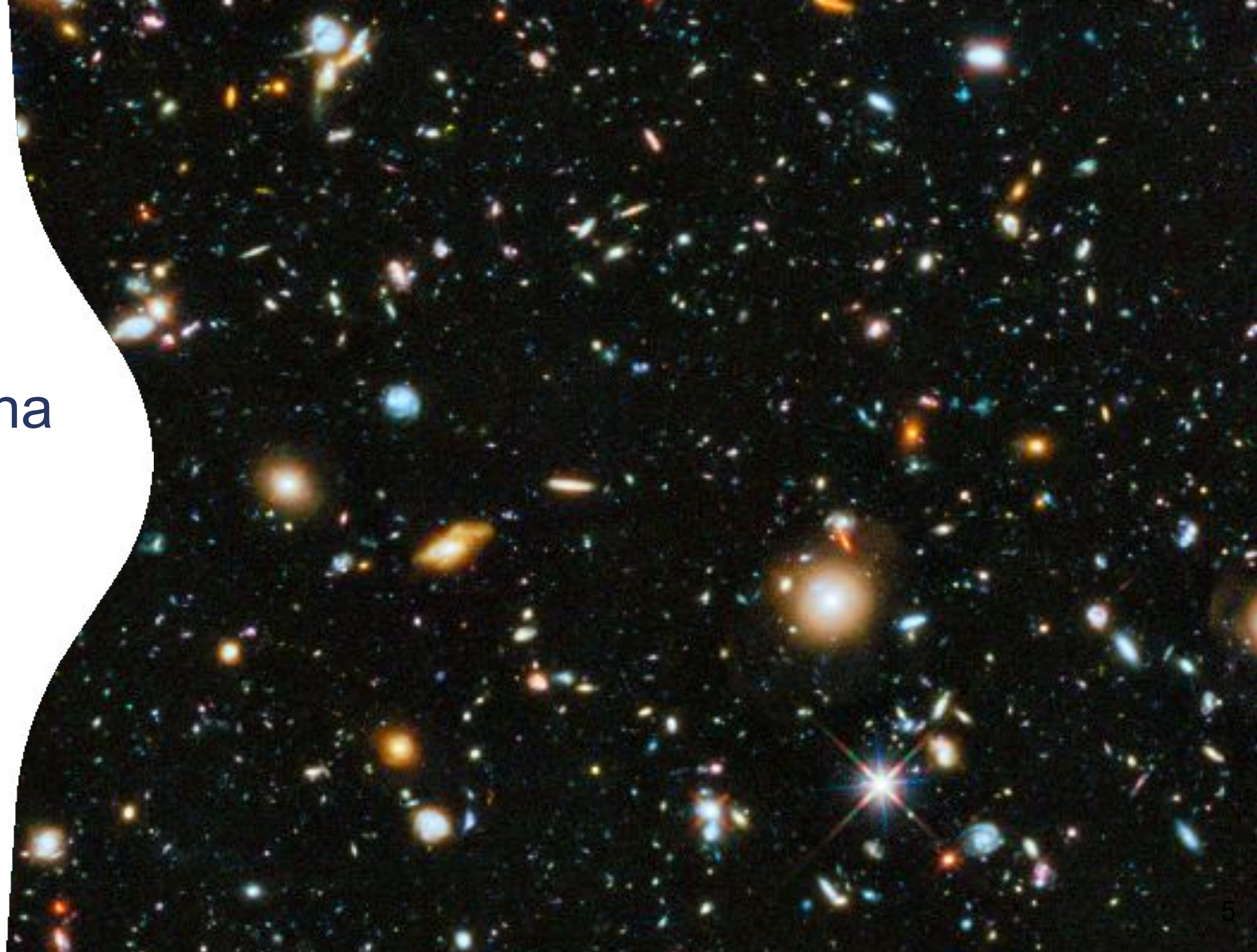
- » Como funciona o Jupyter Notebook
- » Como instalar no Windows e Linux
- » Extensões e widgets
- » Servidor JupyterHub



Dicionário de termos

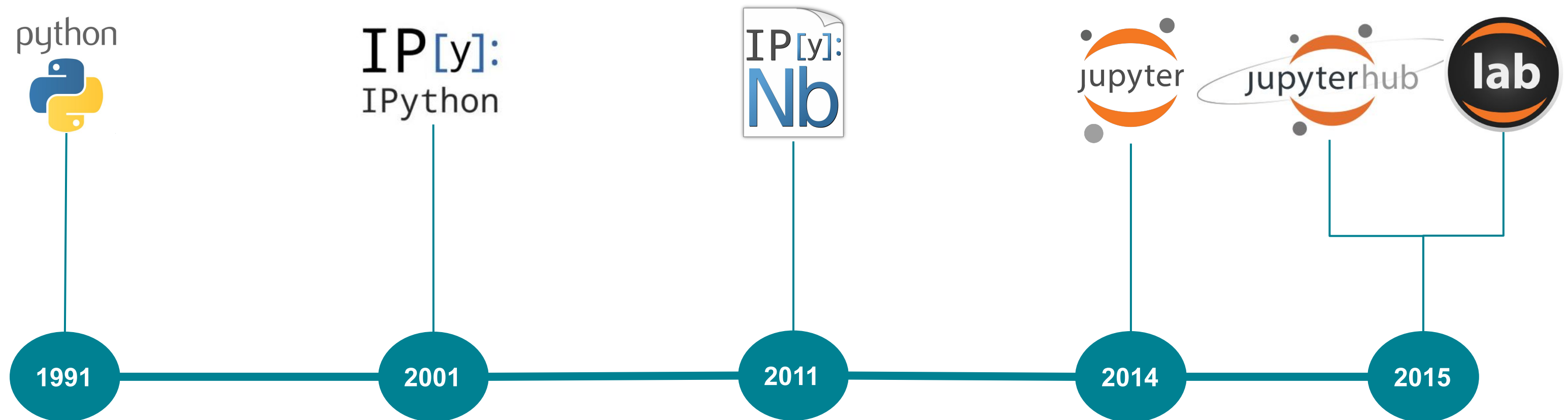
- » Servidor Jupyter Notebook ou Servidor Jupyter, tanto faz.
- » Servidor Jupyter é um servidor *standalone* e *single-user*.
- » JupyterLab é uma nova interface para o Servidor Jupyter.
- » Servidor JupyterHub é um servidor multiusuário.
- » Notebook é o arquivo que contém o código e as anotações.

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...

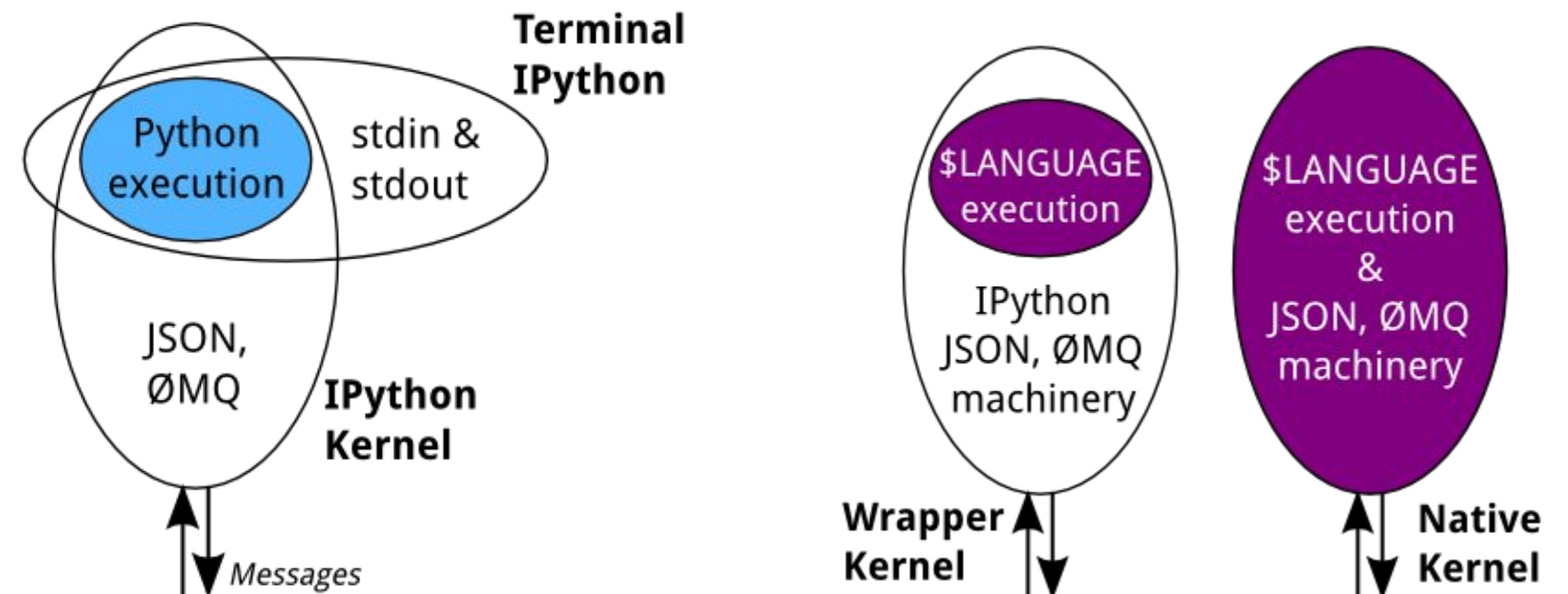
In [2]: import antigravity
```

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

Representação do modelo REPL

O kernel IPython

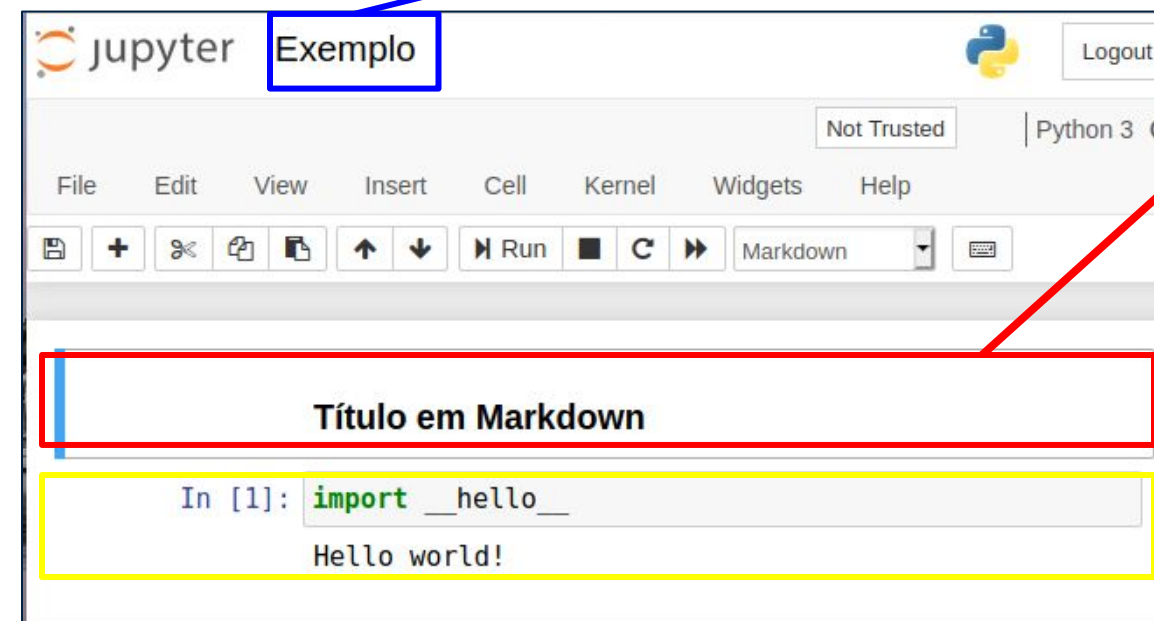
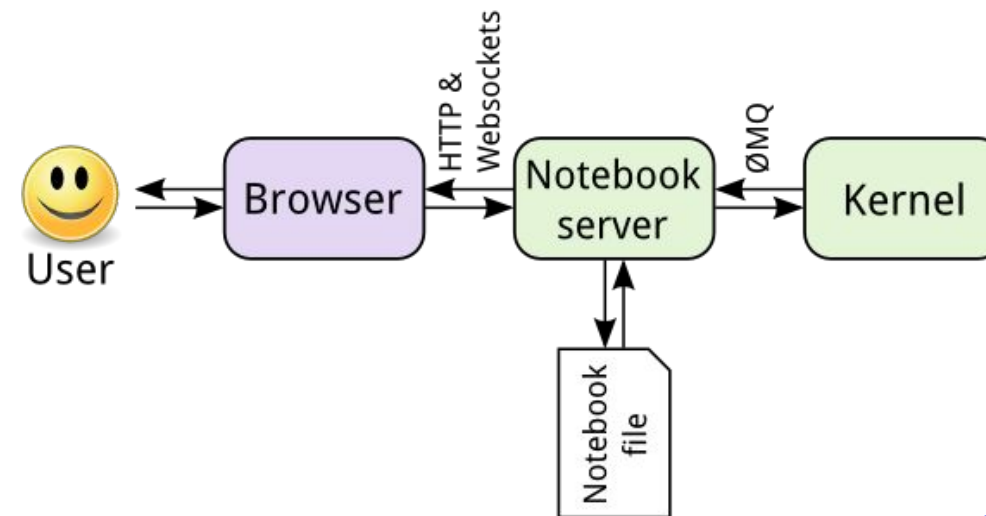
- » Kernel 'zero'
- » Executar o código e completar comandos
- » JSON para troca de mensagens
- » Interação do *Frontend* com o kernel é via socket zeroMQ
- » *Wrapper kernel* e *Native kernel*



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

O servidor Jupyter Notebook

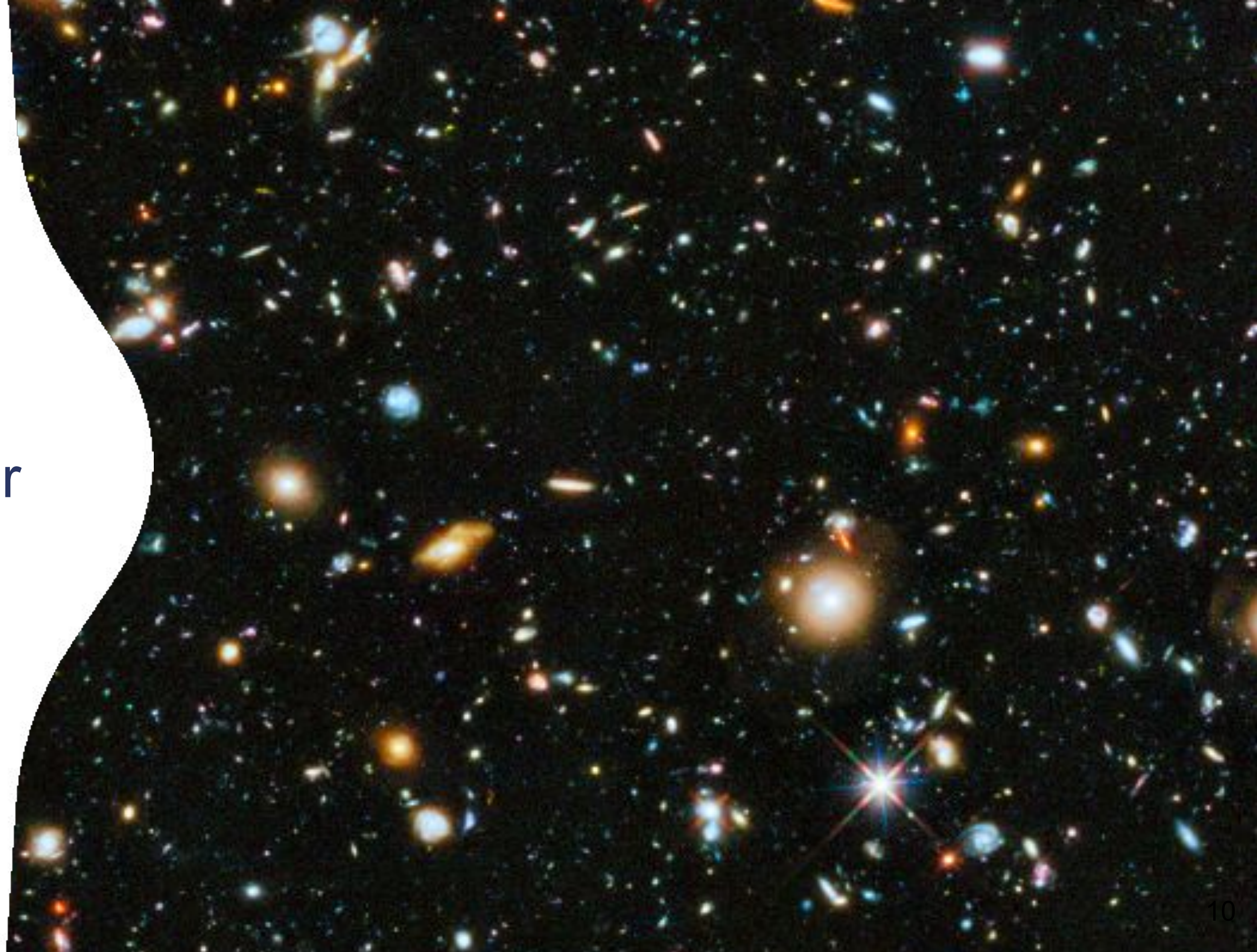
- » 'Executa' os códigos
- » Interface flexível e dinâmica
- » Armazena o código e sua saída junto com anotações em markdown
- » Notebook é um JSON com extensão .ipynb



Exemplo.ipynb

```
{
  "cells": [
    {
      "cell_type": "markdown",
      "metadata": {},
      "source": [
        "### Título em Markdown"
      ]
    },
    {
      "cell_type": "code",
      "execution_count": 1,
      "metadata": {},
      "outputs": [
        {
          "name": "stdout",
          "output_type": "stream",
          "text": [
            "Hello world!\n"
          ]
        }
      ],
      "source": [
        "import __hello__"
      ]
    }
  ],
  "nbformat": 4,
  "nbformat_minor": 0
}
```

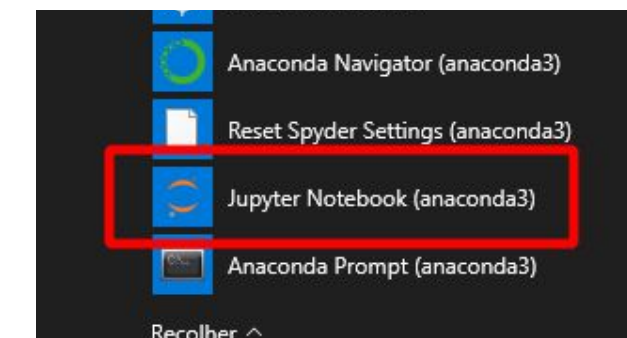
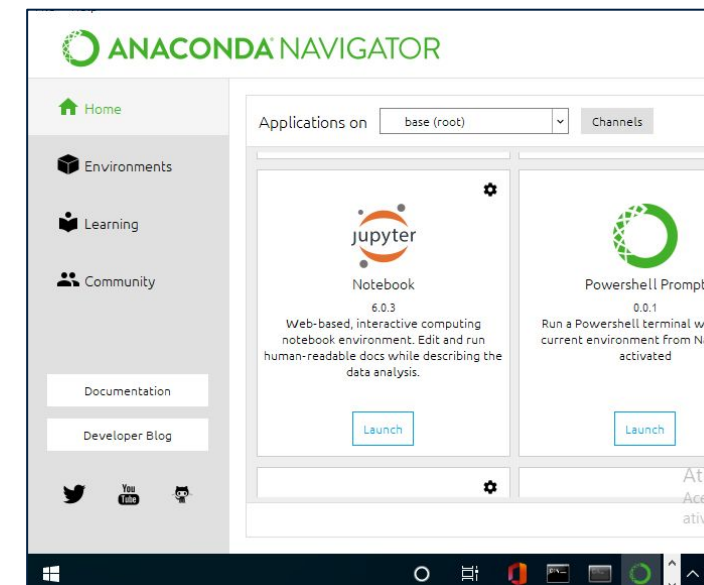
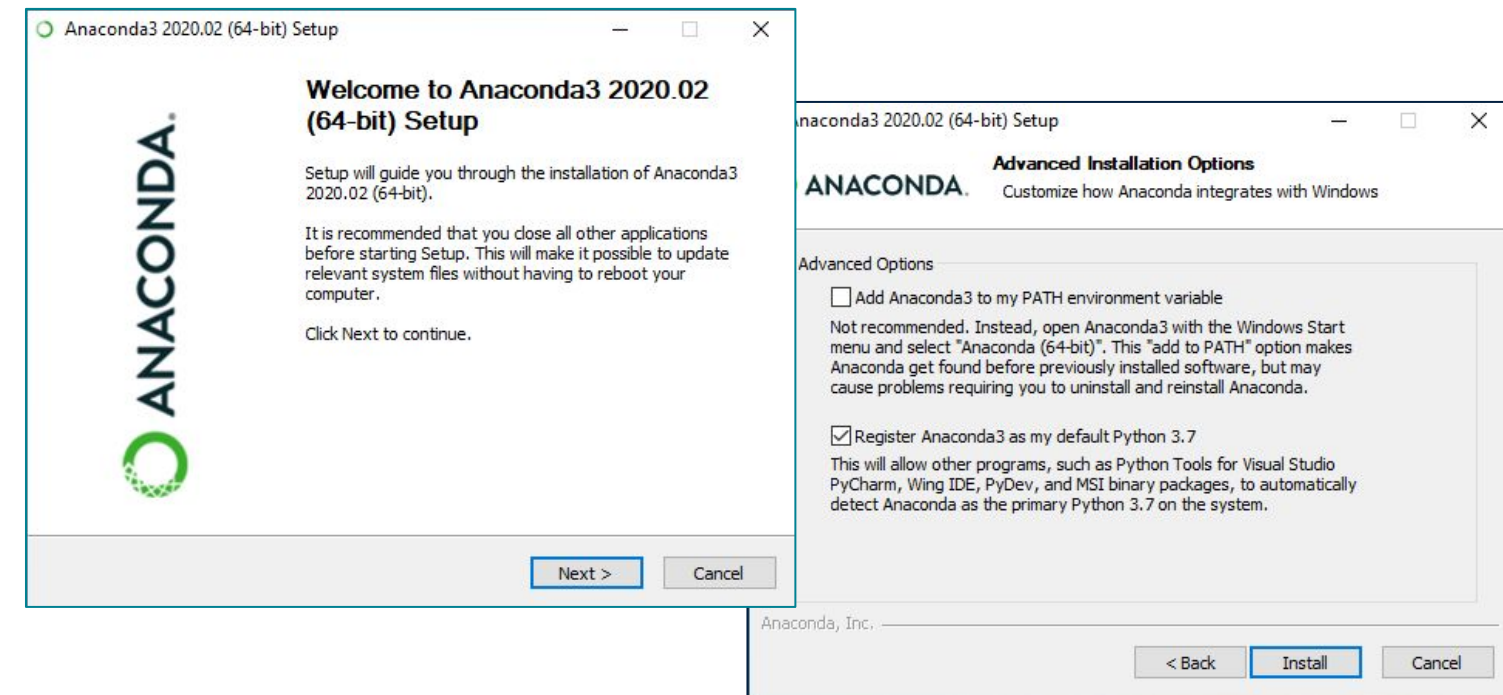

Como instalar



Como instalar

Windows

- » Anaconda Individual Edition
- » Gerenciador de pacotes
- » 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
```

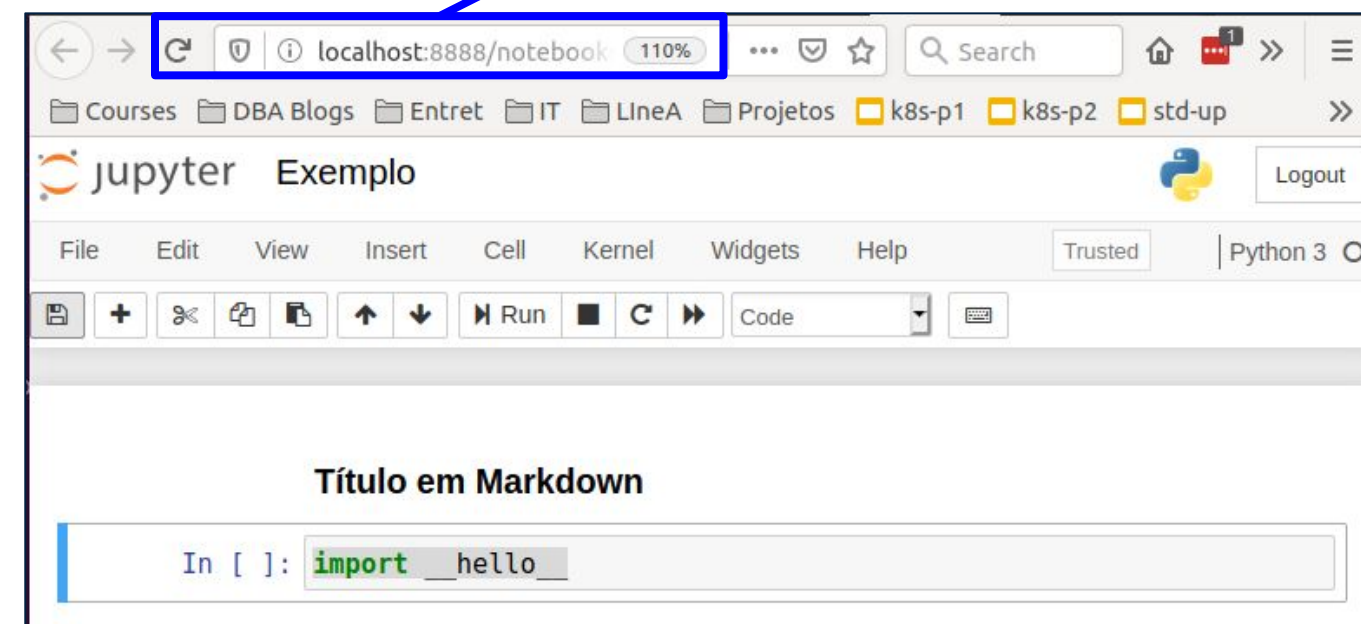
```
$ source jupyter-env/bin/activate
```

```
$ pip3 install jupyter
```

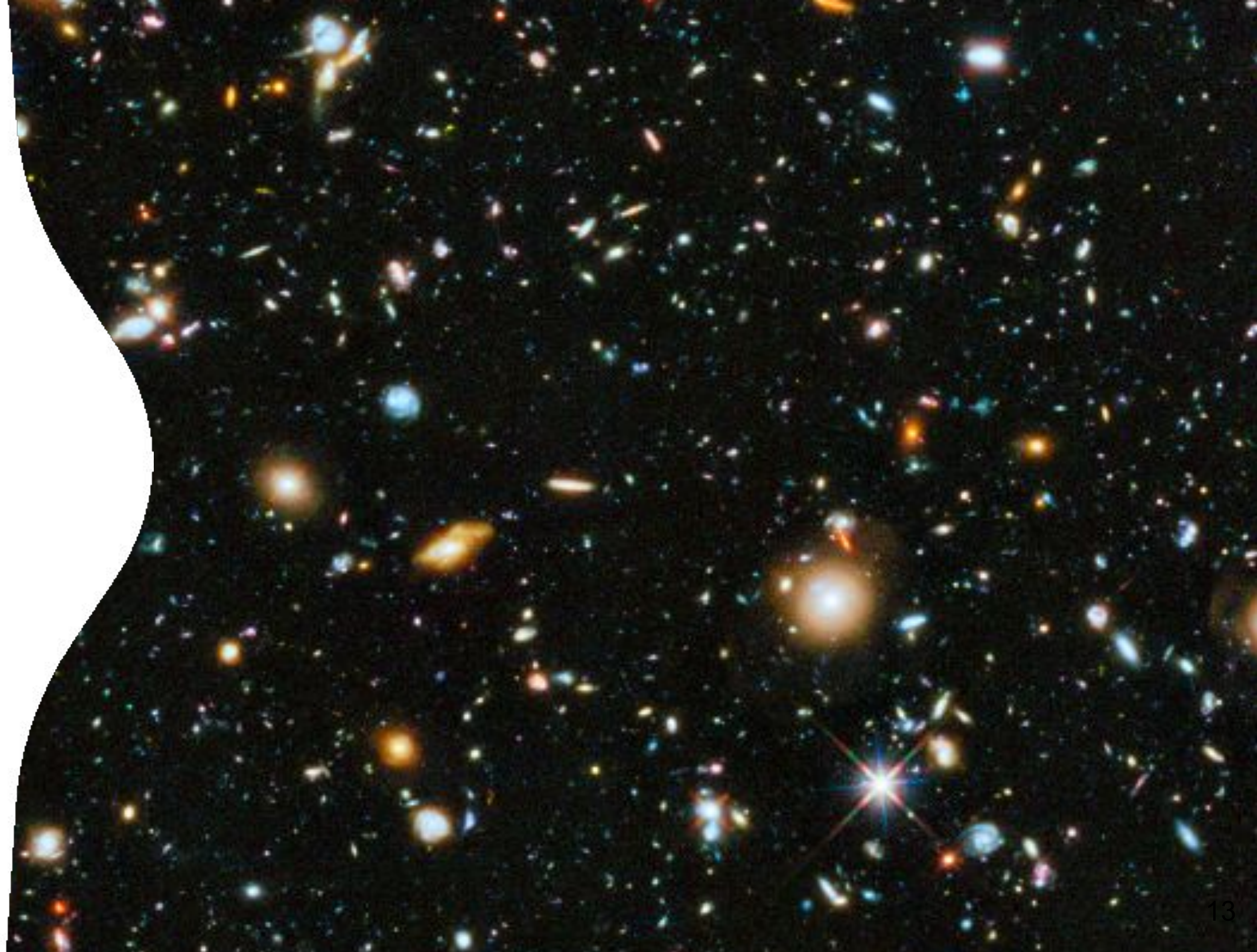
IPython é o kernel padrão

```
(base) carlosadeanu@zyon:~$ jupyter notebook
[I 10:42:06.417 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

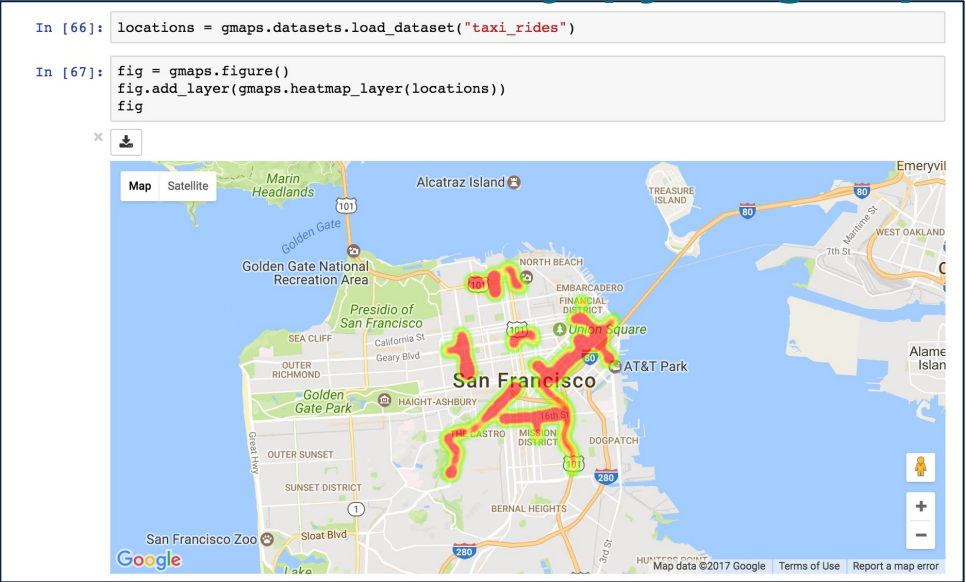


Extensões e widgets



Jupyter widgets

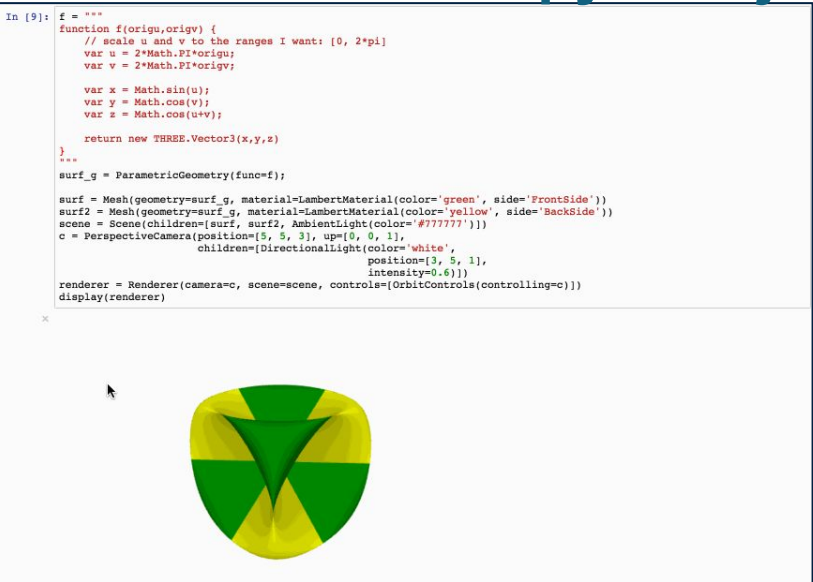
jupyter-gmaps



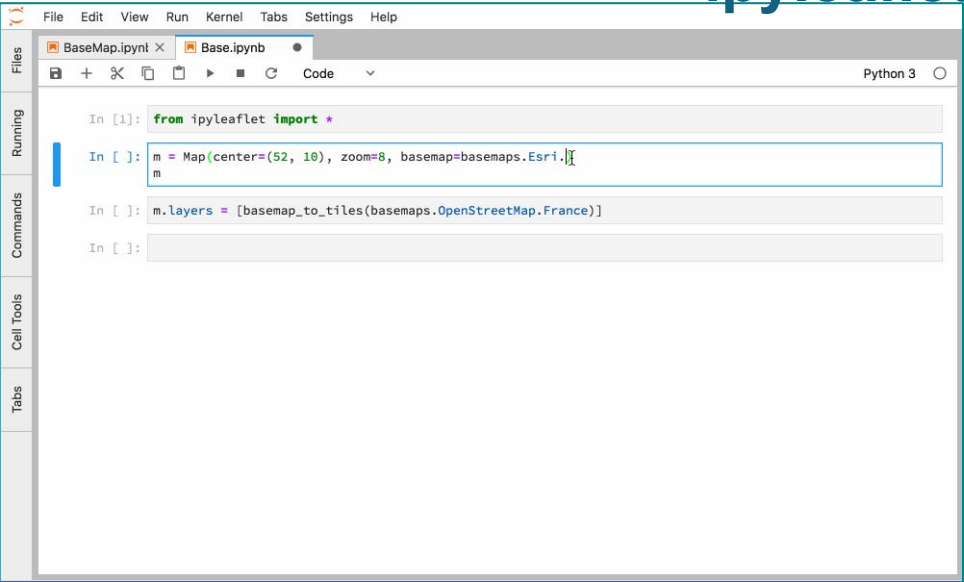
bqplot



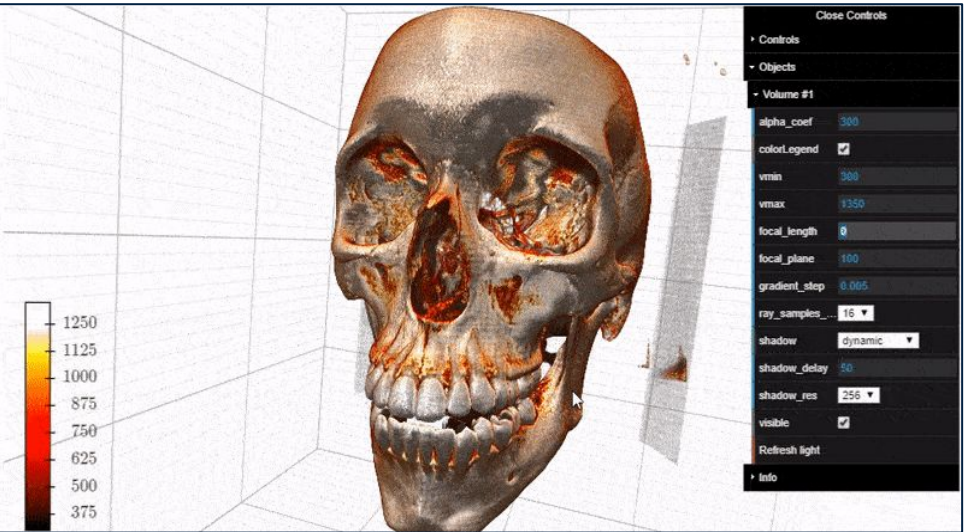
pythreejs



ipyleaflet



k3d-jupyter

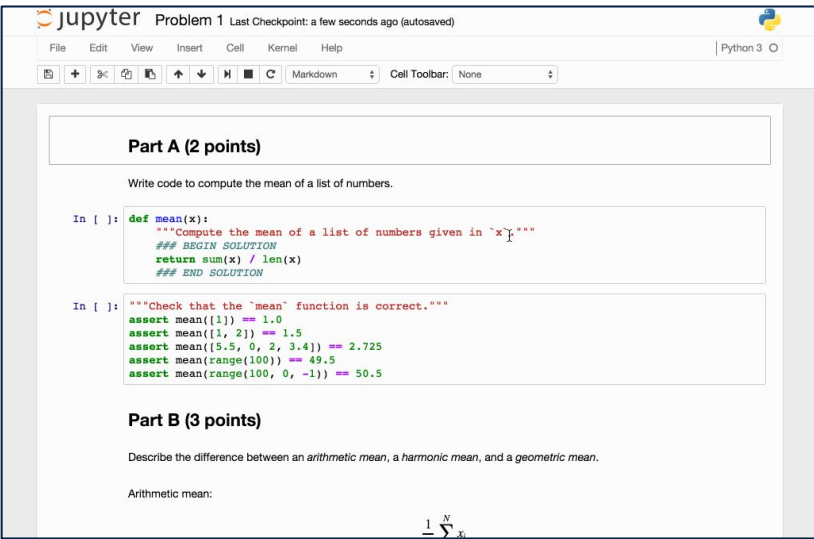


bakerx

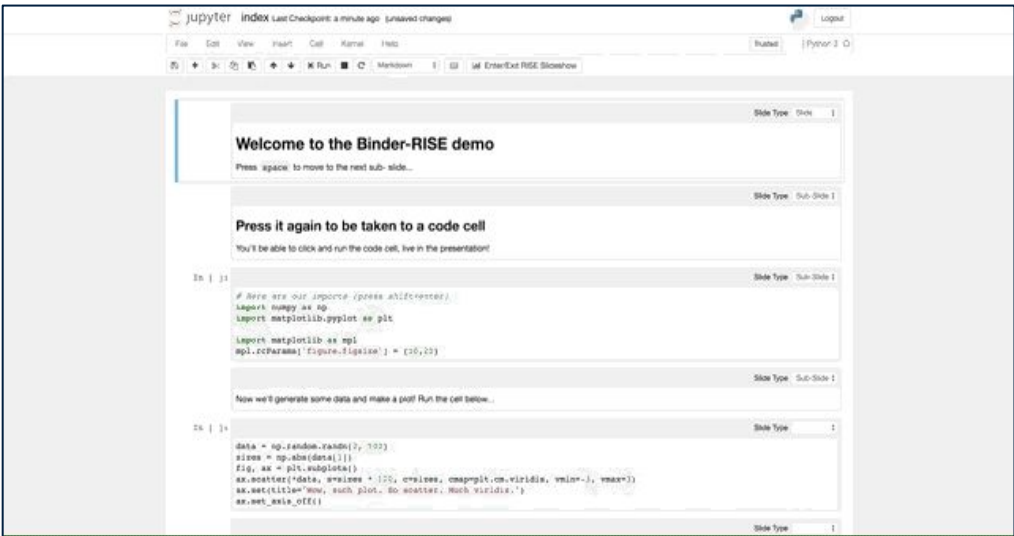
index	time	m3	m6	y1	y2	y3	y10	y5	y7	y30	spread
Show All Columns	100	Hide column				8.132	8.207	8.120	8.196	8.2586	0.309
Show Column	100	Filter by Expression				8.387	8.473	8.425	8.476	8.5037	0.471
Hide All Columns	100	Search for Substring				8.627	8.589	8.601	8.648	8.5632	0.419
Format	100	Format				8.783	8.786	8.768	8.813	8.756	0.745
Rows to Show	100	Sort Ascending				8.692	8.758	8.736	8.784	8.7314	0.751
Clear selection	100	Sort Descending				8.398	8.480	8.431	8.518	8.4576	0.493
Copy to Clipboard	100	No Sort				8.265	8.471	8.331	8.455	8.4981	0.597
Download All as CSV	100	Align Left				8.219	8.753	8.437	8.644	8.8635	1.058
Download Selected as CSV	100	Align Center				8.267	8.893	8.514	8.787	9.0289	1.295
Search for Substring	100	Align Right				8.069	8.720	8.328	8.594	8.8577	1.319
Filter by Expression	100	Heatmap	H			7.737	8.392	8.023	8.277	8.5405	1.101
Hide Filter	100	Data Bars	B			7.466	8.075	7.726	8.001	8.237	1.125
Reset All Interactions	100	Color by unique	U			7.378	8.092	7.700	7.971	8.2695	1.681
		Fix Left				7.077	7.855	7.473	7.733	8.0342	1.738
14	19910329 19:00:00.000 -0500	Move column to front				7.354	8.110	7.772	8.002	8.288	2.017
15	19910428 20:00:00.000 -0400	Move column to end				7.232	8.039	7.701	7.923	8.2095	2.214
16	19910529 20:00:00.000 -0400	Reset formatting				7.117	8.068	7.701	7.942	8.2673	2.434
17	19910628 20:00:00.000 -0400					7.391	8.284	7.937	8.171	8.472	2.533
18	19910729 20:00:00.000 -0400					7.751	8.774	8.305	8.578	8.8523	2.522

Jupyter extensions

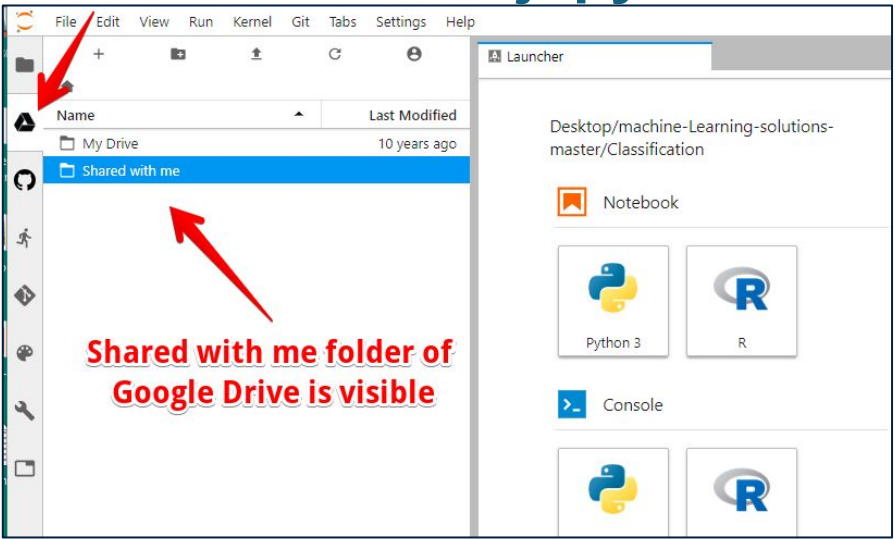
nbgrader



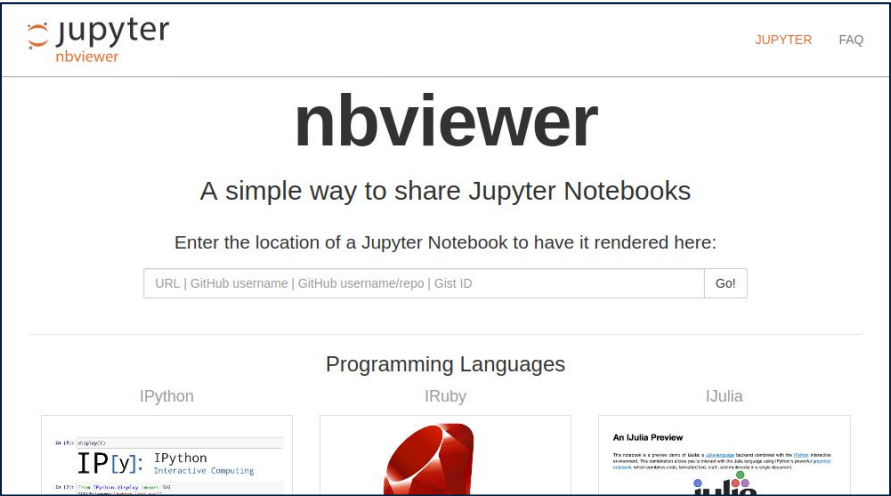
rise (presentation)



jupyter-drive



voilà



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>
```

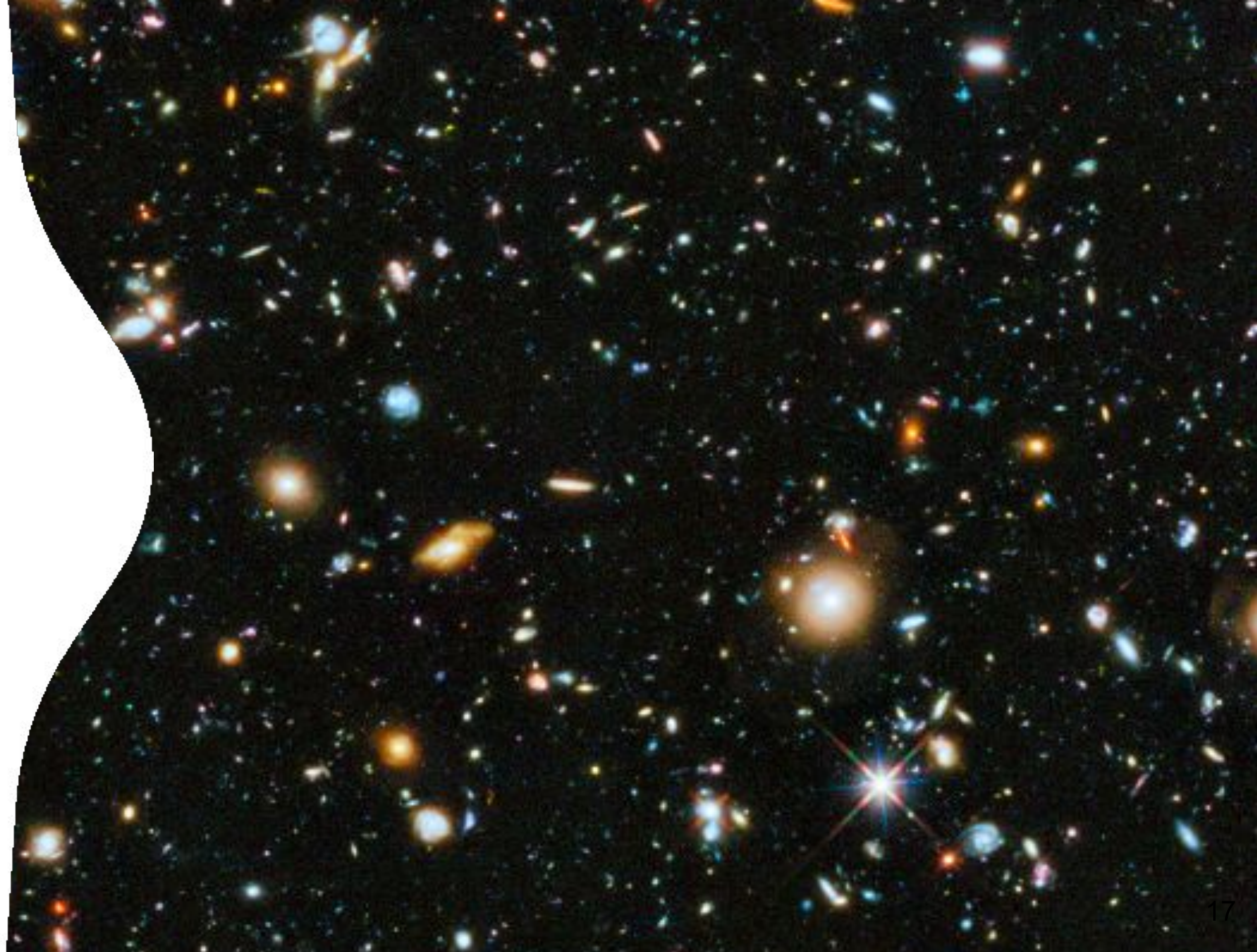
Para ativar o widget

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

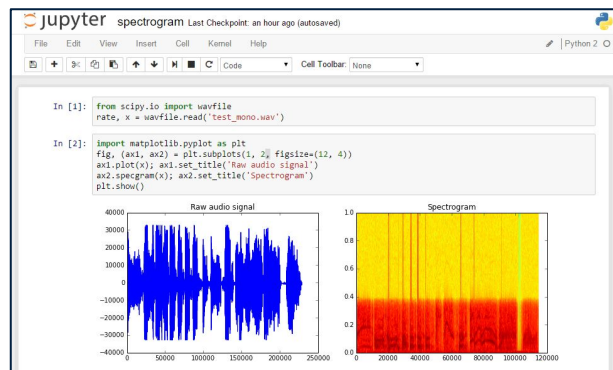
```
conda install -c conda-forge k3d  
jupyter nbextension enable k3d
```

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

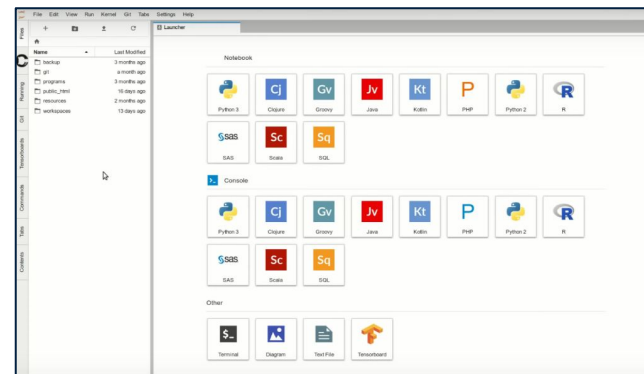

Servidor
JupyterHub



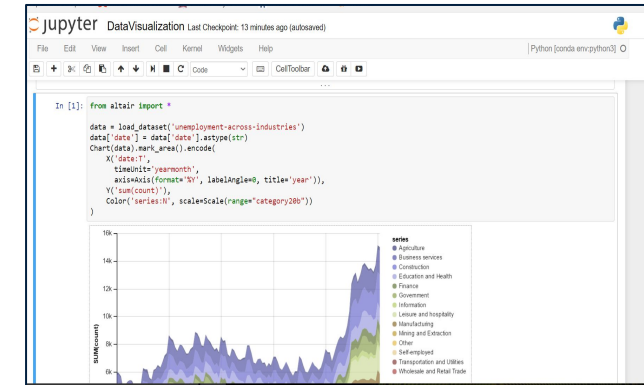
Jupyter Notebook vs JupyterHub



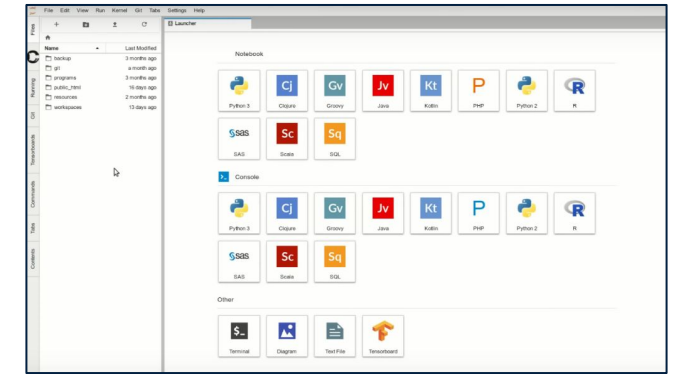
http://localhost:8888/



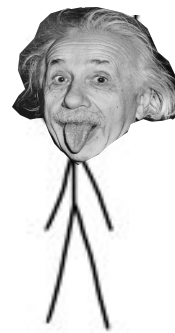
http://localhost:8888/



http://localhost:8888/

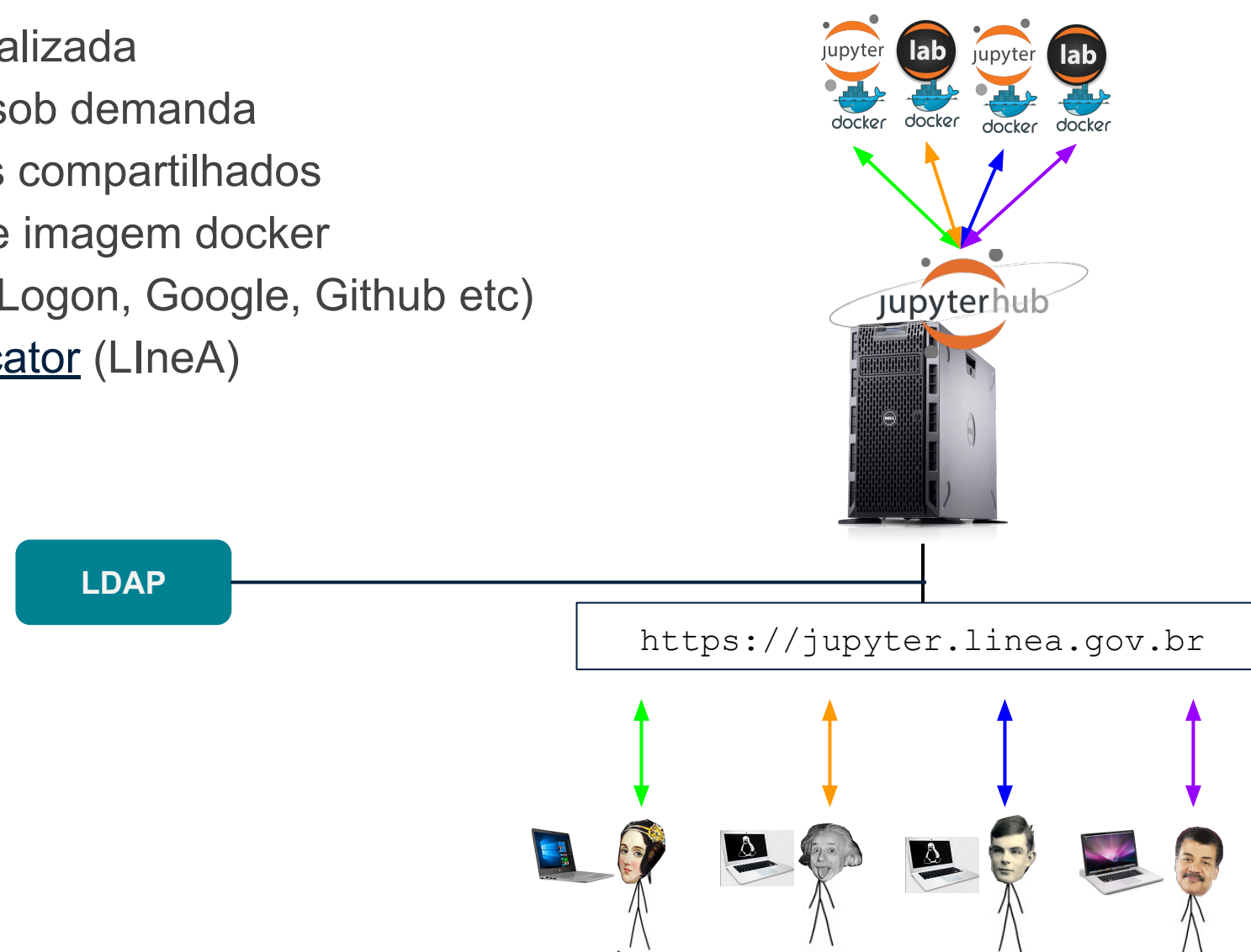


http://localhost:8888/



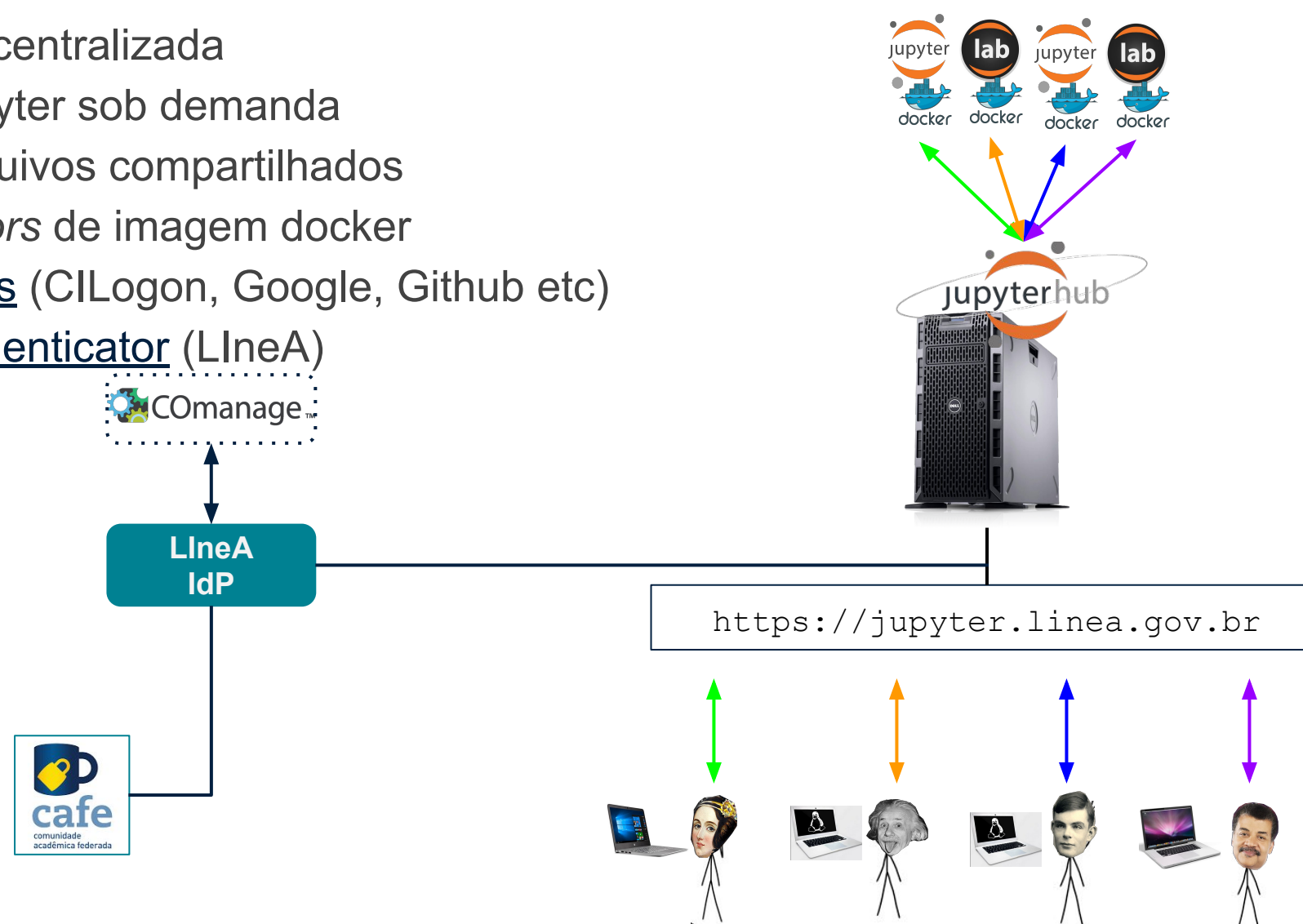
JupyterHub *standalone*

- » 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)



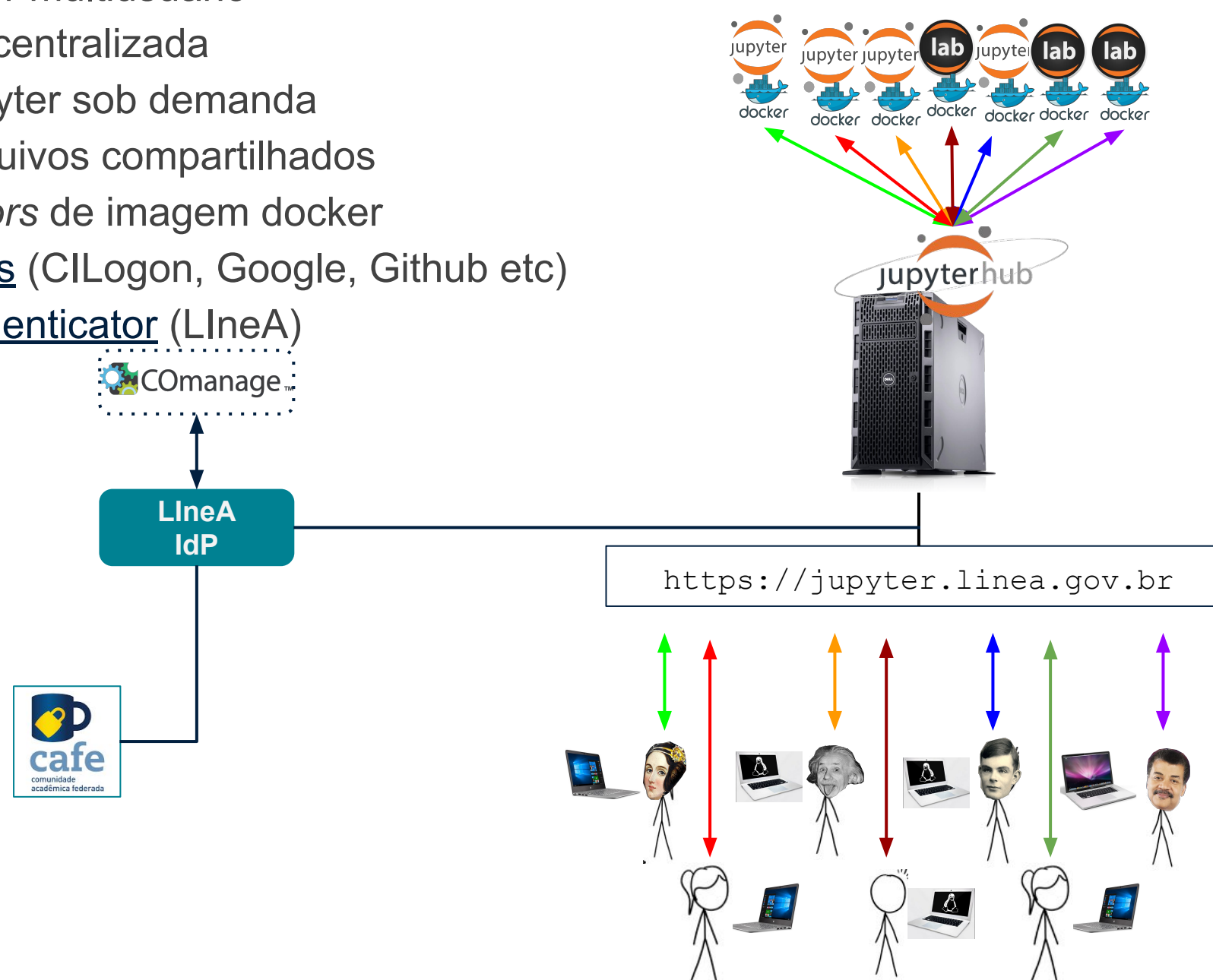
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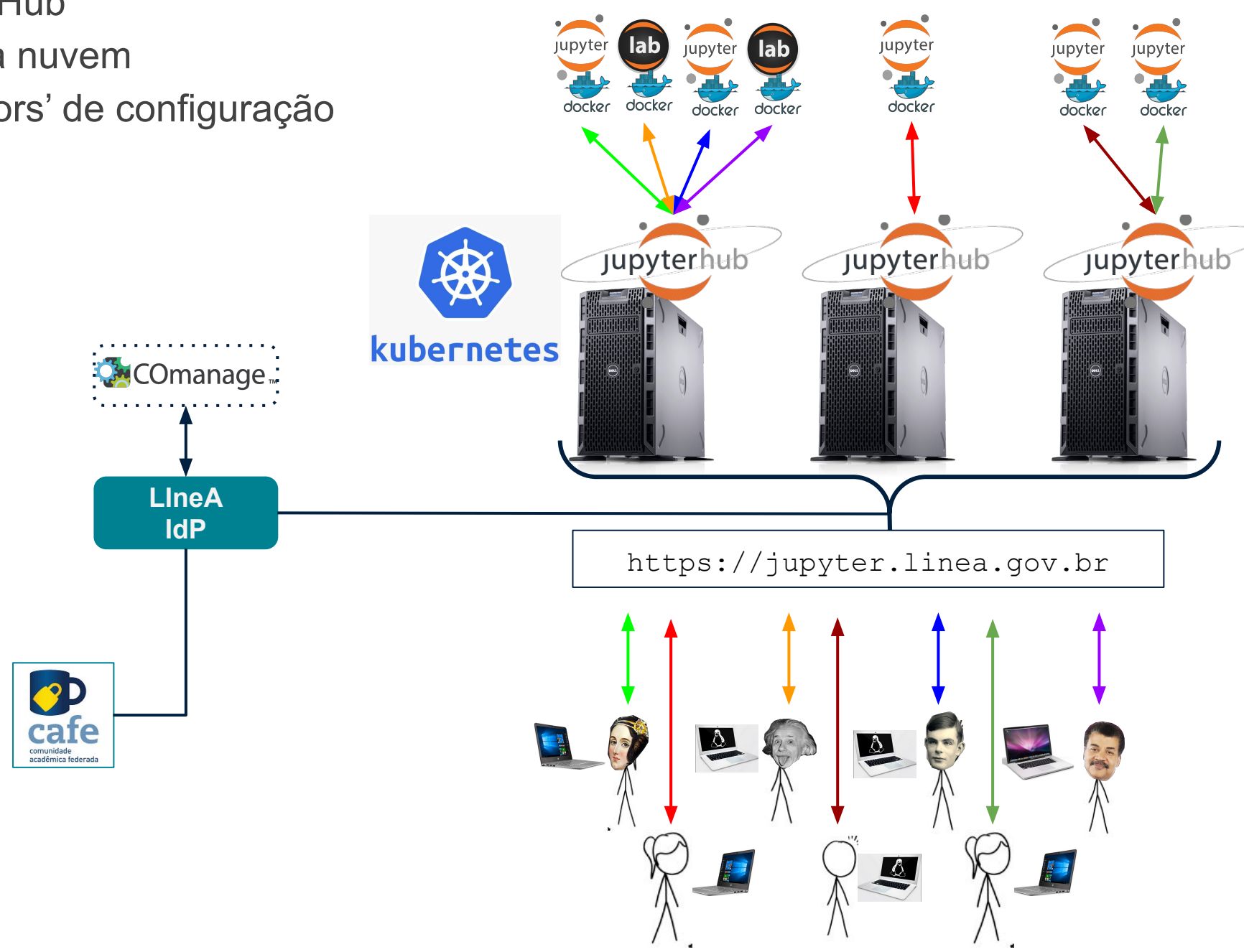
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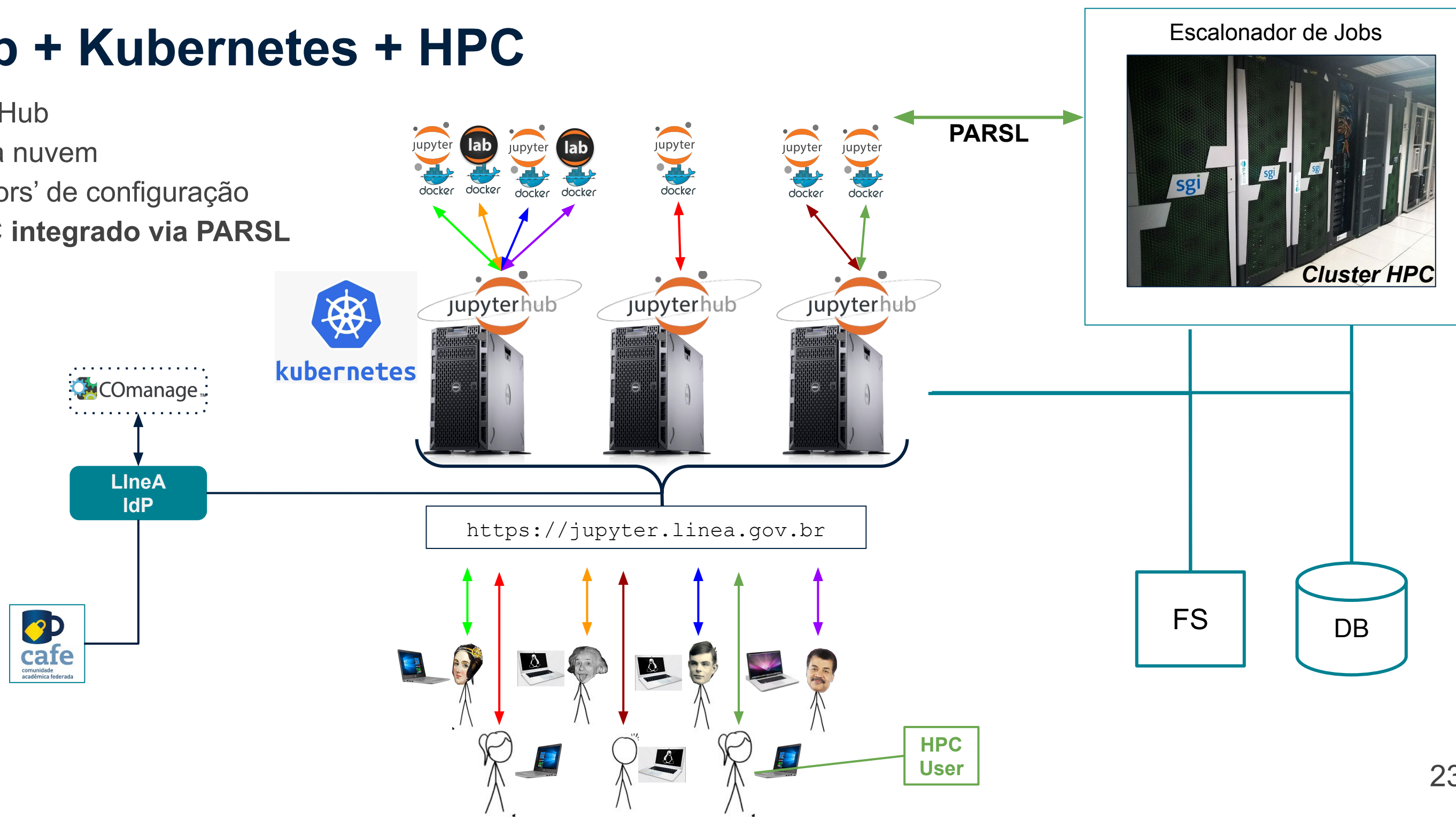
JupyterHub + Kubernetes

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



JupyterHub + Kubernetes + HPC

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



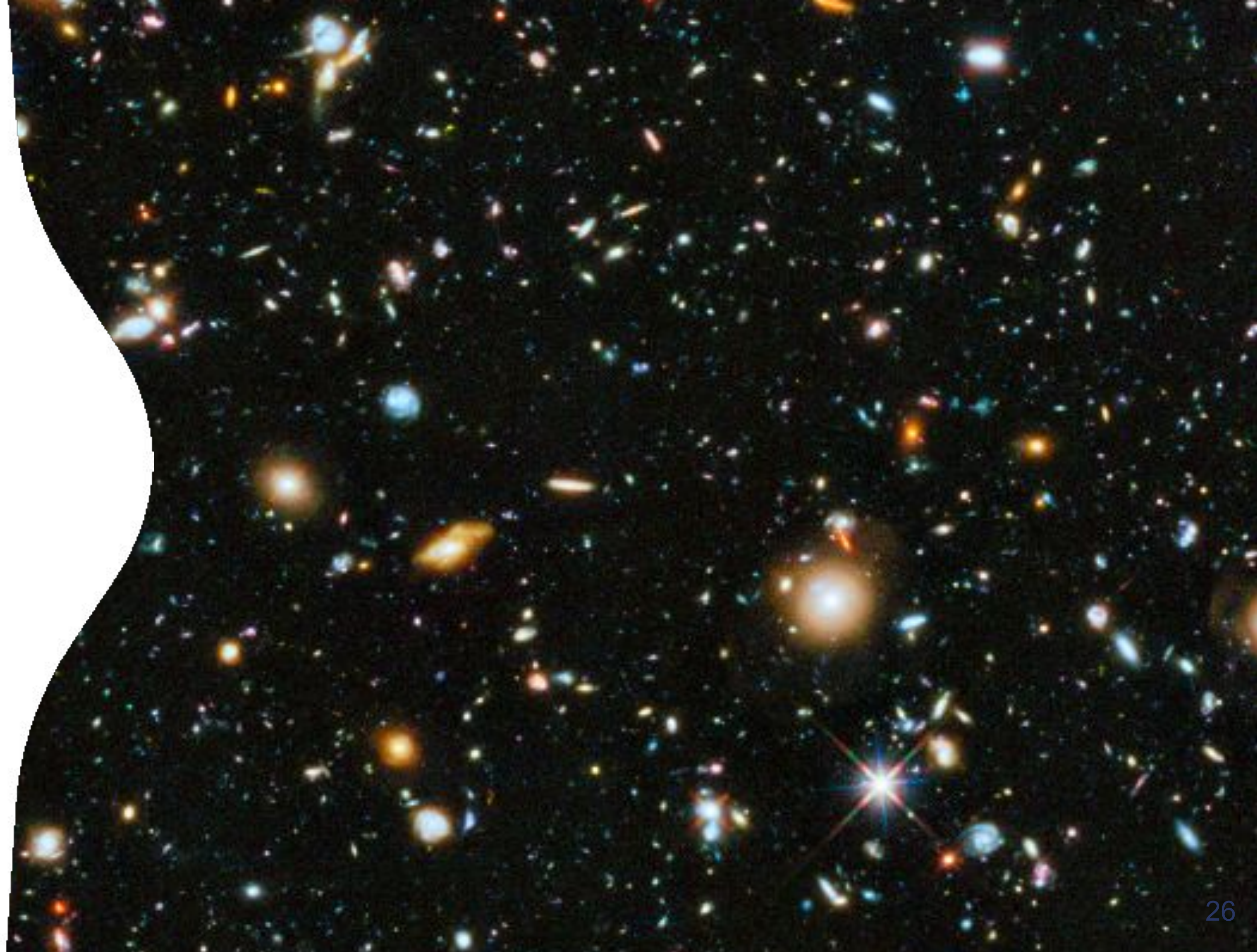
- <https://jupyter.org>
- <https://jupyterhub.readthedocs.io>
- <https://github.com/jupyter/jupyter/wiki/Jupyter-kernels>
- https://en.wikipedia.org/wiki/Project_Jupyter
- https://en.wikipedia.org/wiki/Albert_Einstein
- <https://zeromq.org>
- <https://ipython.org>
- <https://en.wikipedia.org/wiki/IPython>
- <https://youtu.be/GExKsQ-OU78>
- <https://youtu.be/4GJFNQBB26s>
- parsl-project.org
- kubernetes.io



Obrigado!

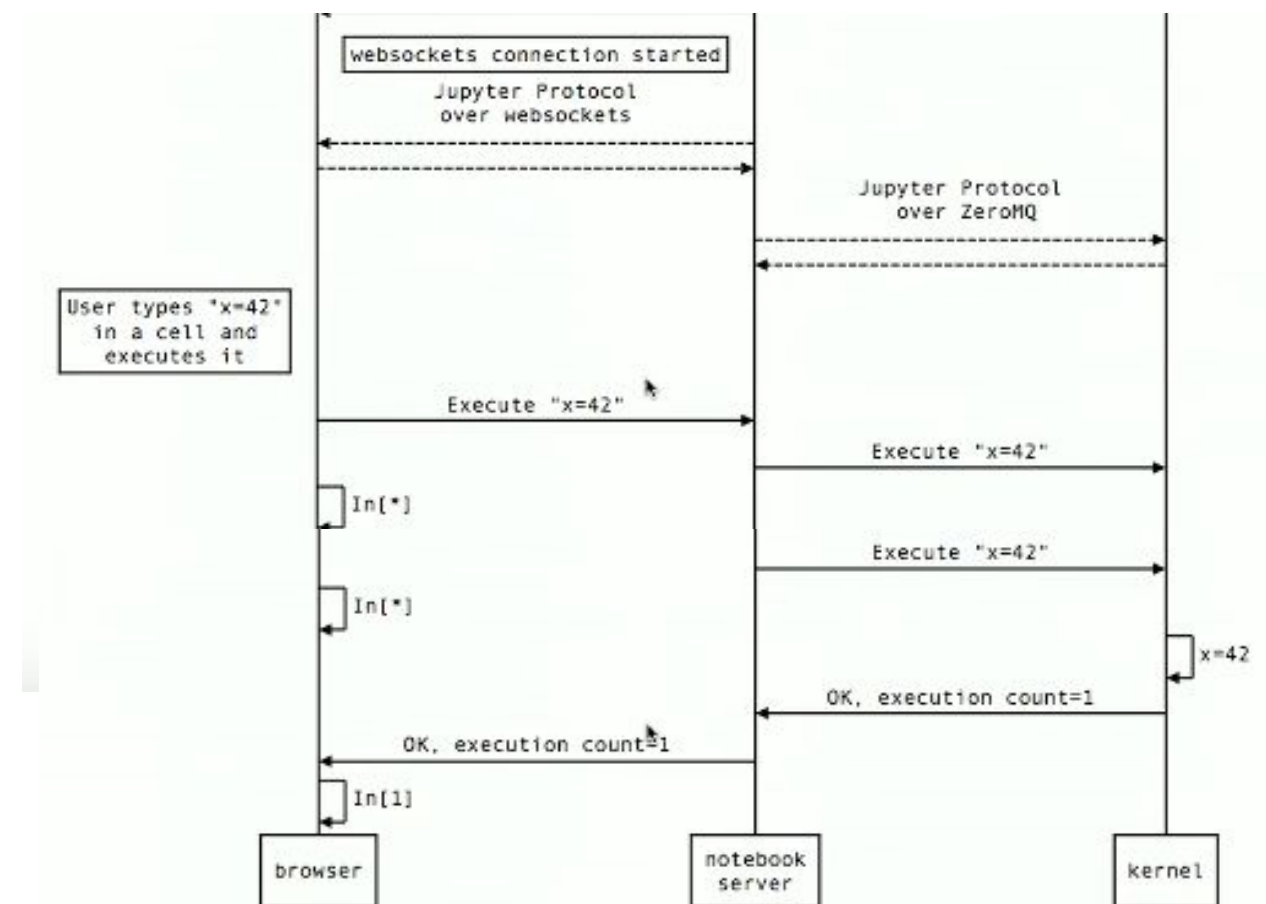
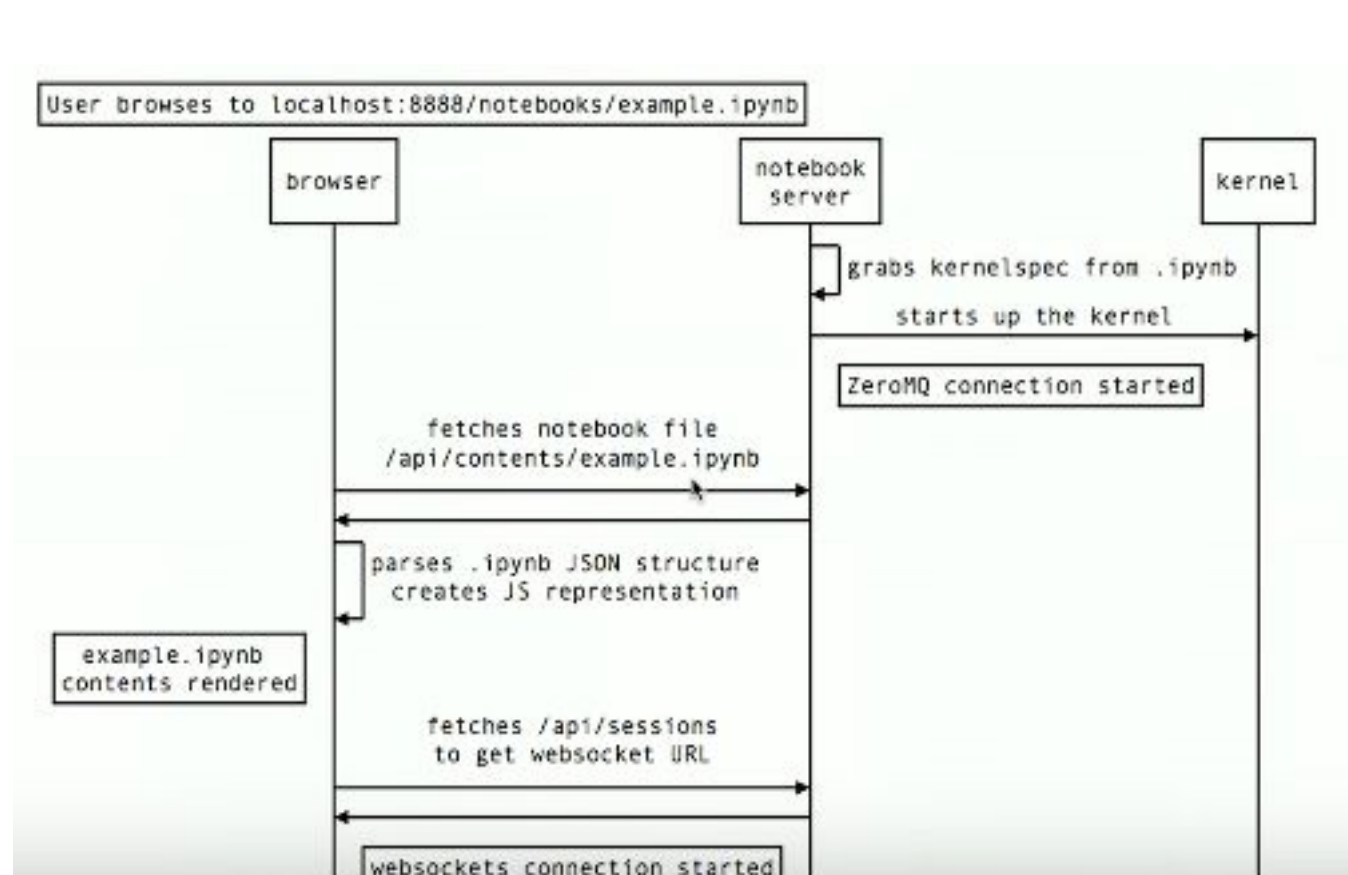
carlosadean@linea.gov.br

Extras



Como funciona o Jupyter Notebook

Diagrama de sequência de uma requisição



Arquitetura do servidor JupyterHub

