Scalable Data Science with Dask

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Hi!
I’m Pavithra :)

- Evangelist at Coiled
- FOSS contributor - Bokeh & Wikimedia
- CSE Student, India
- @pavithraes on Twitter
- hi@pavithraes.me

What's your experience with Scalable Data Science?

On a scale of 1 - 5

1: *What is scalable compute?*

5: *I understand the challenges and have a solution that works for me*

We'll talk about

- Big data - What is it?
- Parallel and distributed computing
- Dask for scaling data science
- Coiled - Dask on the cloud

Big data

What is big data?

- Doesn’t fit on your local machine
- Traditional tools and methods fail

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- Doesn’t fit on your local machine
- Traditional tools and methods fail

Characteristics:

- Volume
- Velocity
- Variety
- Veracity

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Scalable compute

Parallel computing

- Working in parallel
- Use all CPU cores
- Multiple processes and shared memory

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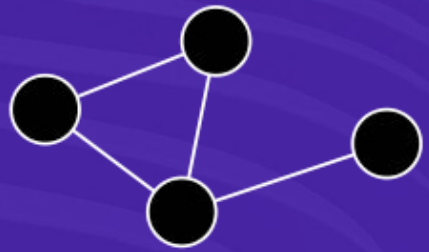
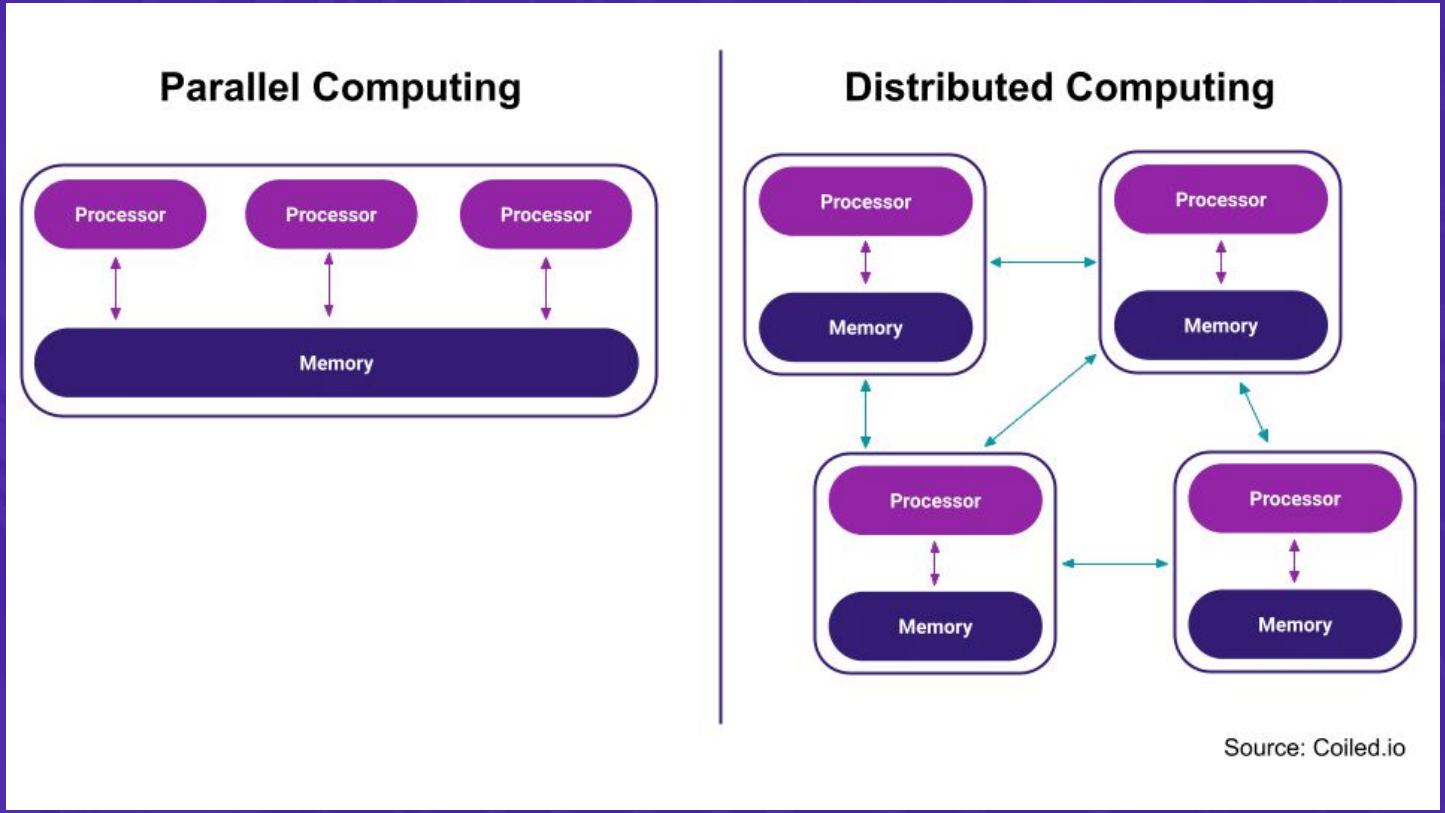
Distributed computing

- Using groups of machines
- Each machine has processors and memory

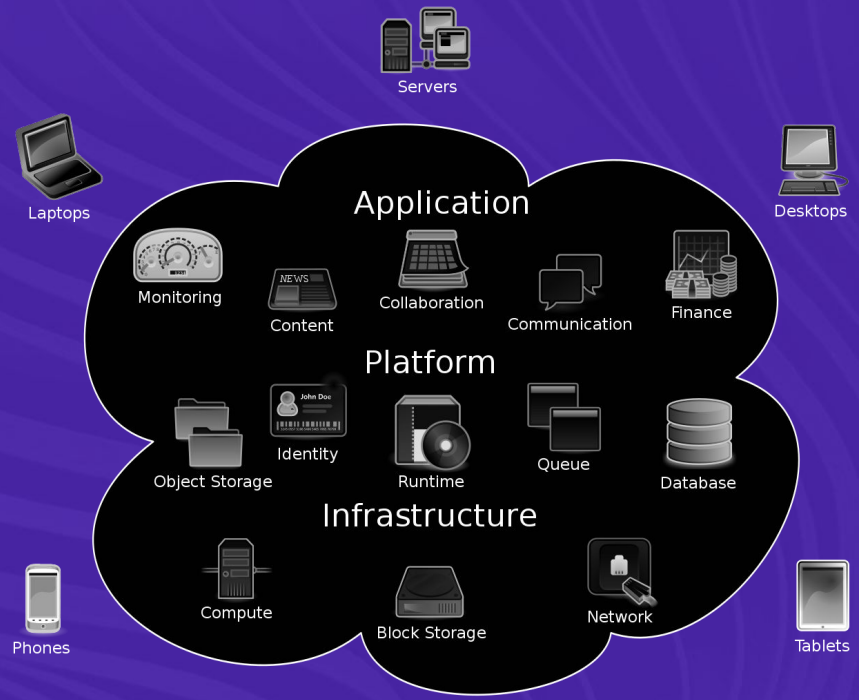




Source: [Coiled.io]

Cloud computing

- Using cloud resources
- AWS, Azure, GCP
- Lots of storage and computational power



Source: Wikimedia Commons

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Dask

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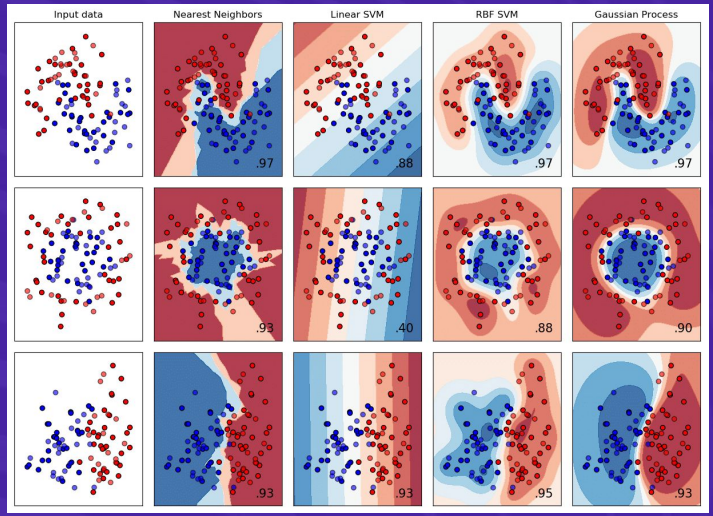
Dask

Library for parallel and distributed computing in Python

Dask

Makes it easy to scale-up your workflows to use all cores in your local machine



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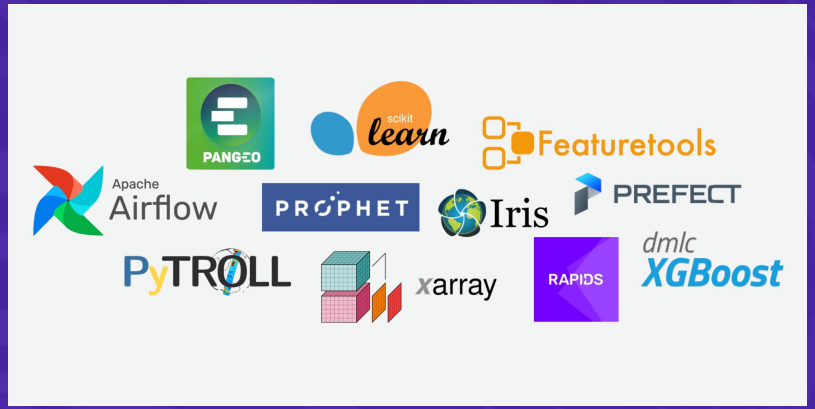
Dask

Provides a distributed computing framework

Powers tools like RAPIDS, Airflow, PyTorch, and more!



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Dask features

Familiar API

Resembles normal pandas, NumPy, scikit-learn code

```
import pandas as pd
df = pd.read_csv("data_taxi/yellow_tripdata_2019-01.csv")
df.groupby("passenger_count").tip_amount.mean()
```

```
import dask.dataframe as dd
df = dd.read_csv("data_taxi/yellow_tripdata_2019-*.csv")
mean_amount = df.groupby("passenger_count").tip_amount.mean()
mean_amount.compute()
```

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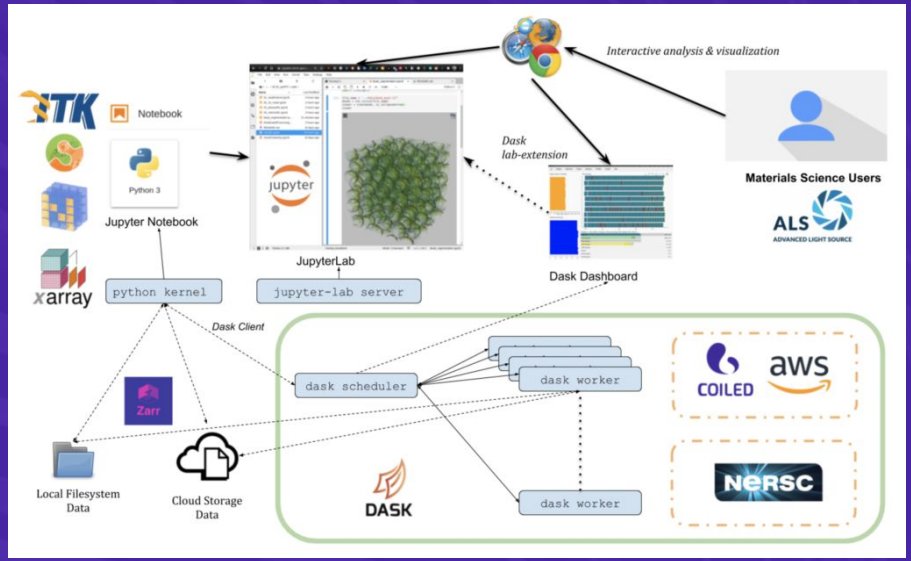
Dask features

Flexible

Local machine, on-prem, on the cloud, anywhere.



3D microstructure interactive image analysis and visualization system architecture.
Source: Article presented at Super Computing 2020

Dask users in retail

Walmart

- demand forecasting
- 500M+ store combinations
- 100x speedup from RAPIDS and Dask

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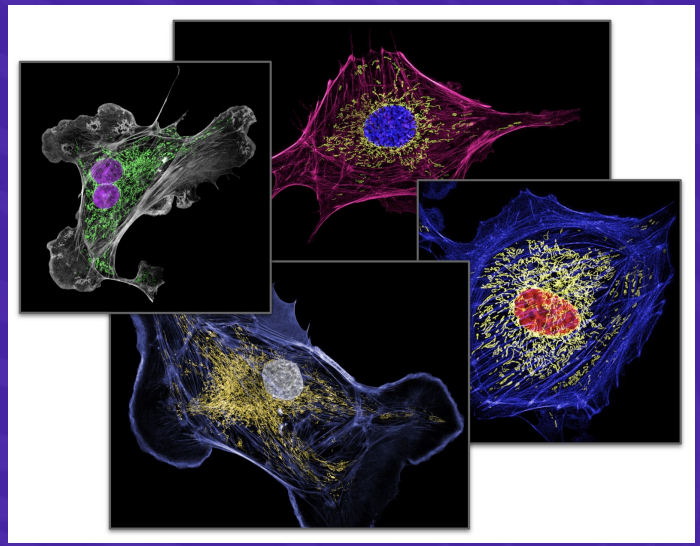
Dask users in life science

High resolution, 4-dimensional, cellular imagery

- Harvard Medical School
- Howard Hughes Medical Institute
- Chan Zuckerberg Initiative
- UC Berkeley Advanced Bioimaging Center



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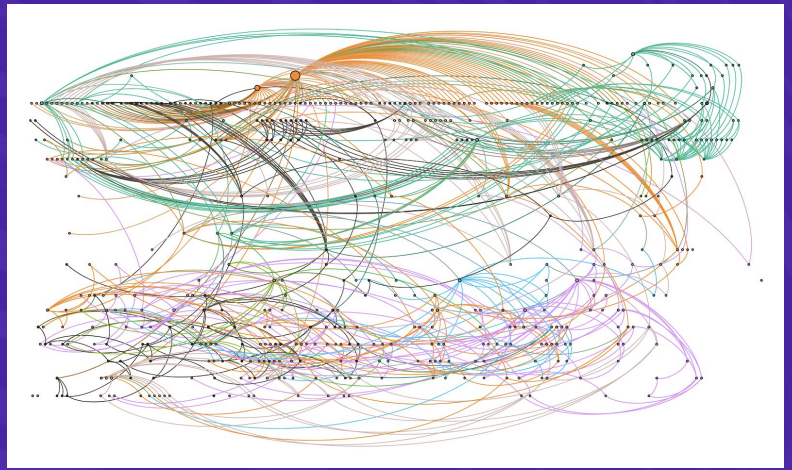
Dask users in finance

Capital One

- ETL and ML pipeline speedup

Barclays

- Financial system modelling



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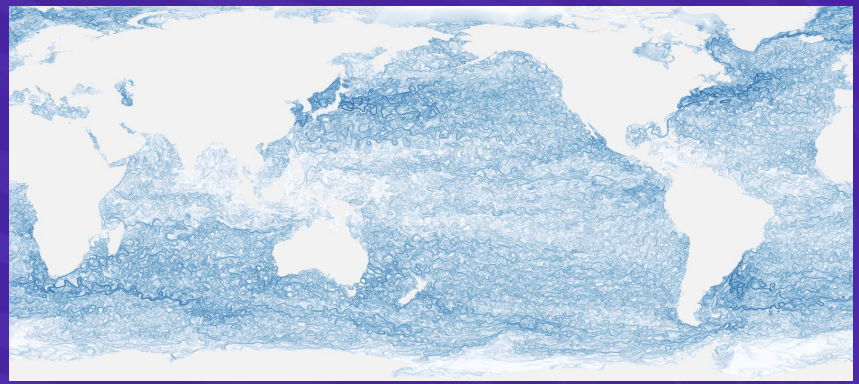
Dask users in Geo

Farallon Institute , Los Alamos National Labs



- Climate Science
- Energy
- Hydrology
- Meteorology
- Satellite Imaging

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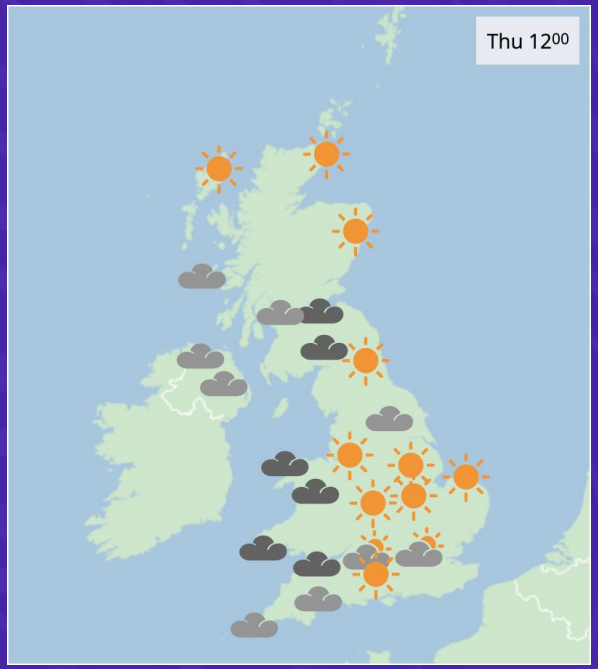
Dask users

Many many more!

NASA

Software Libraries



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Shout out to Matthew Rocklin, and the entire Dask community for this material!

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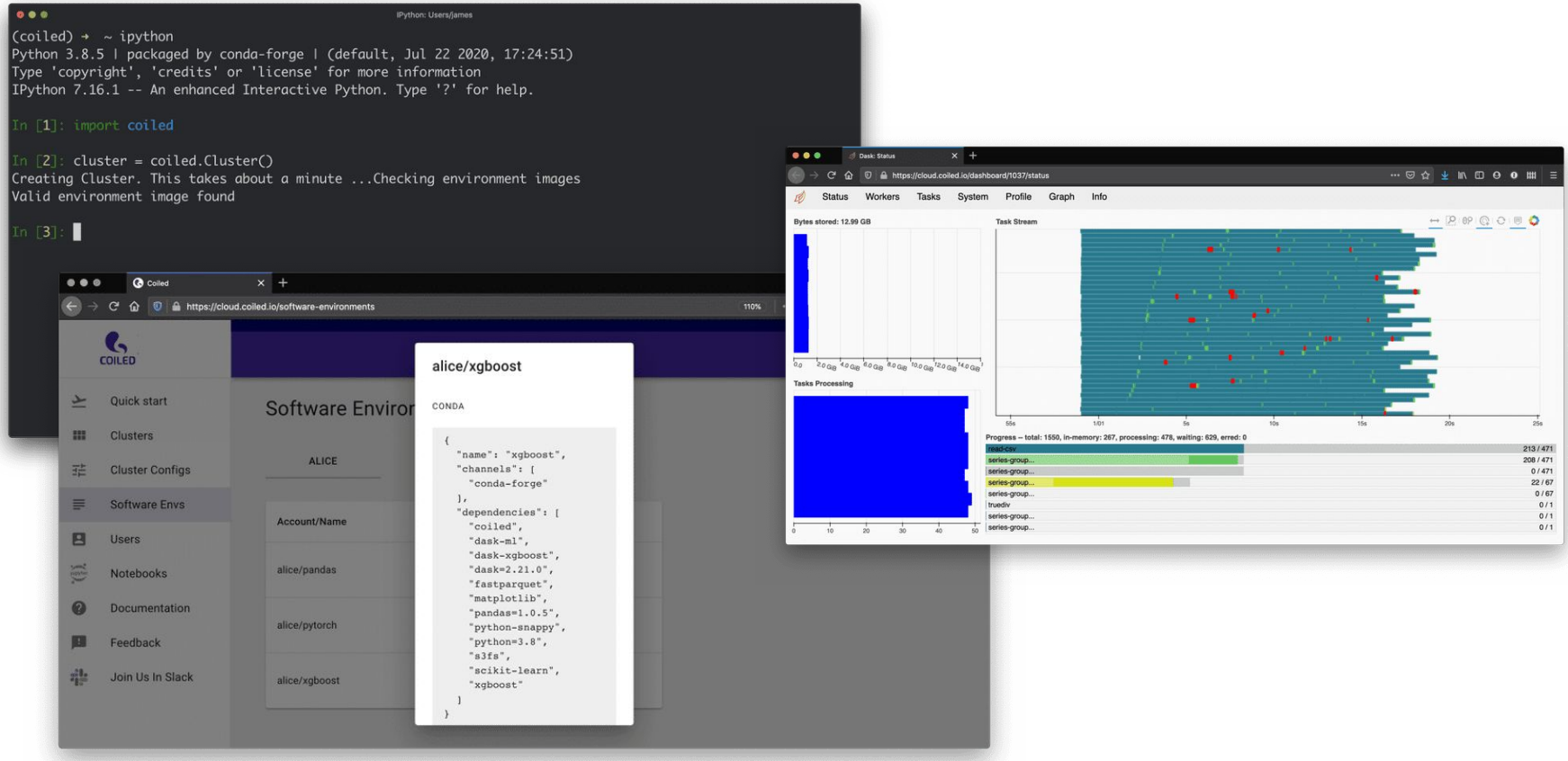
Built by Dask maintainers, contributors, and enthusiasts.

Open source culture is at the heart of Coiled.

Scalable computing
has some challenges

- Security concerns
- Managing software environments
- Cost optimization


IPython: Users/james
(coiled) ➜ ~ ipython
Python 3.8.5 | packaged by conda-forge | (default, Jul 22 2020, 17:24:51)
Type 'copyright', 'credits' or 'license' for more information
IPython 7.16.1 -- An enhanced Interactive Python. Type '?' for help.
In [1]: import coiled
In [2]: cluster = coiled.Cluster()
Creating Cluster. This takes about a minute ...Checking environment images
Valid environment image found
In [3]:
Coiled
https://cloud.coiled.io/software-environments
110%
COILED
Quick start
Clusters
Cluster Configs
Software Envs
Users
Notebooks
Documentation
Feedback
Join Us In Slack
Software Enviror
ALICE
Account/Name
alice/pandas
alice/pytorch
alice/xgboost
alice/xgboost
CONDA
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"channels": [
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"dask-xgboost",
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"fastparquet",
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"xgboost"
]
}
Dask: Status
https://cloud.coiled.io/dashboard/1037/status
Status
Workers
Tasks
System
Profile
Graph
Info
Bytes stored: 12.99 GB
Task Stream
Tasks Processing
Progress -- total: 1550, in-memory: 267, processing: 478, waiting: 629, erred: 0
read-csv
213 / 471
series-group...
208 / 471
series-group...
0 / 471
series-group...
22 / 67
series-group...
0 / 67
truediv
0 / 1
series-group...
0 / 1
series-group...
0 / 1

Coiled tackles these challenges for you.

welcome.coiled.io

Thank you!

Slides and notebook at:
bit.ly/pyladies-berlin-dask

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