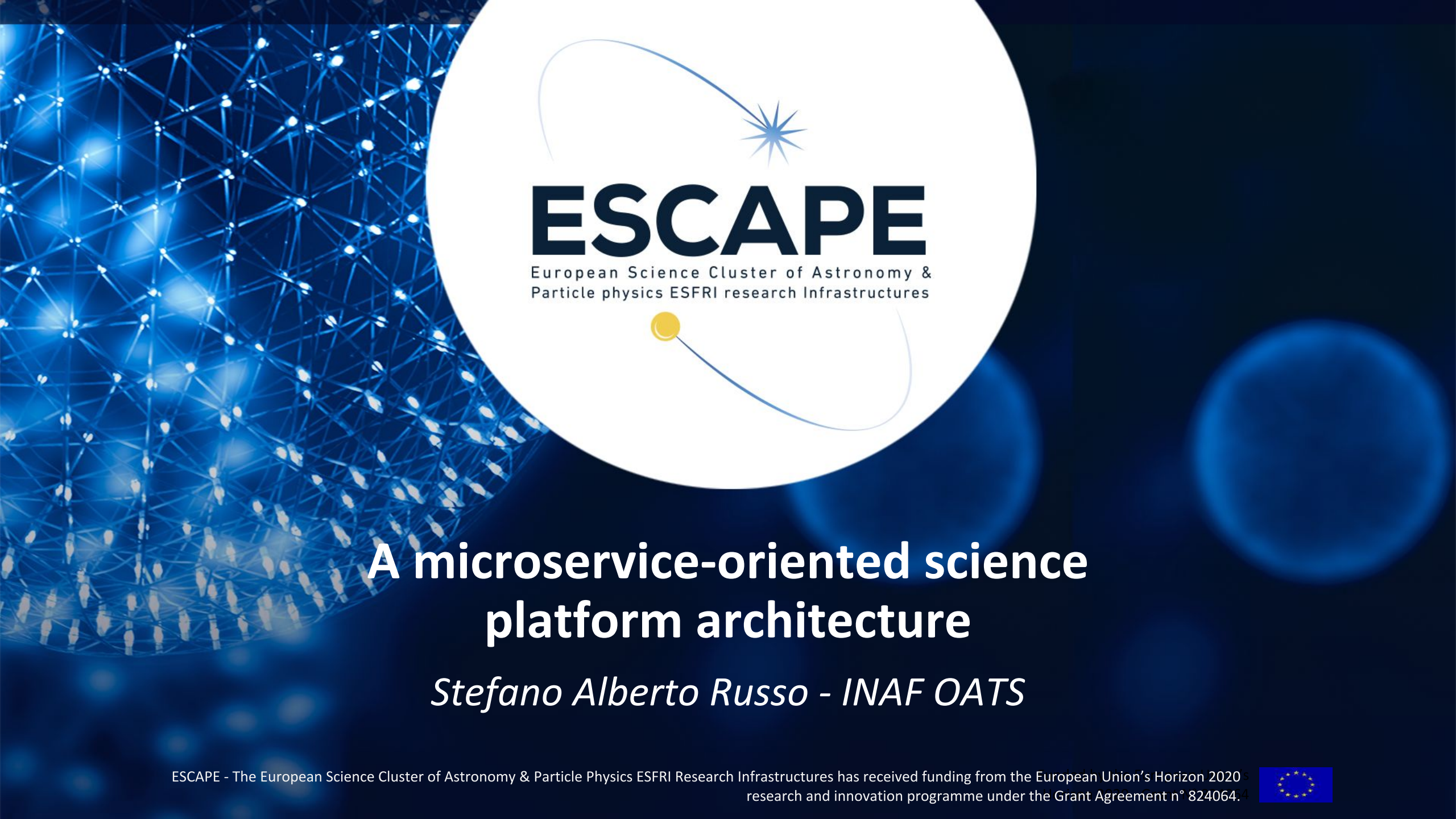

A microservice-oriented science platform architecture

Stefano Alberto Russo - INAF OATS

ESCAPE - The European Science Cluster of Astronomy & Particle Physics ESFRI Research Infrastructures has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement n° 824064.

Introduction

What is a Science Platform?

- An environment designed to offer users a smoother experience when interacting with data and computing resources
  → *possibly bringing the user to the data and not vice-versa*

- We usually assume a web-based environment based on Jupyter notebooks or similar, and software containerisation.

- Other approaches or definitions may be also feasible (e.g. full interactive desktop access).

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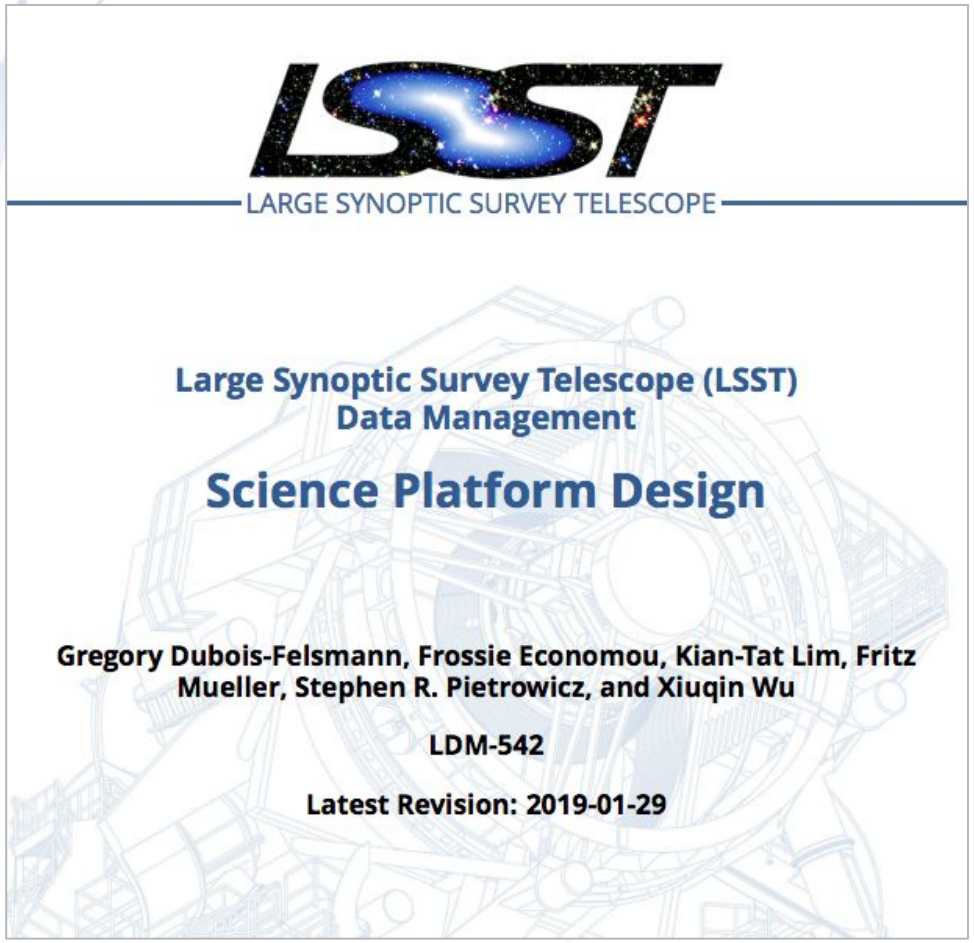
LSST Science Platform definition

"a web Portal, designed to provide essential data access and visualization services through a simple-to-use website, a Notebook environment, that will provide a Jupyter Notebook-like interface, based on JupyterLab, enabling next-to-the-data analysis”

Juric et al. 2017



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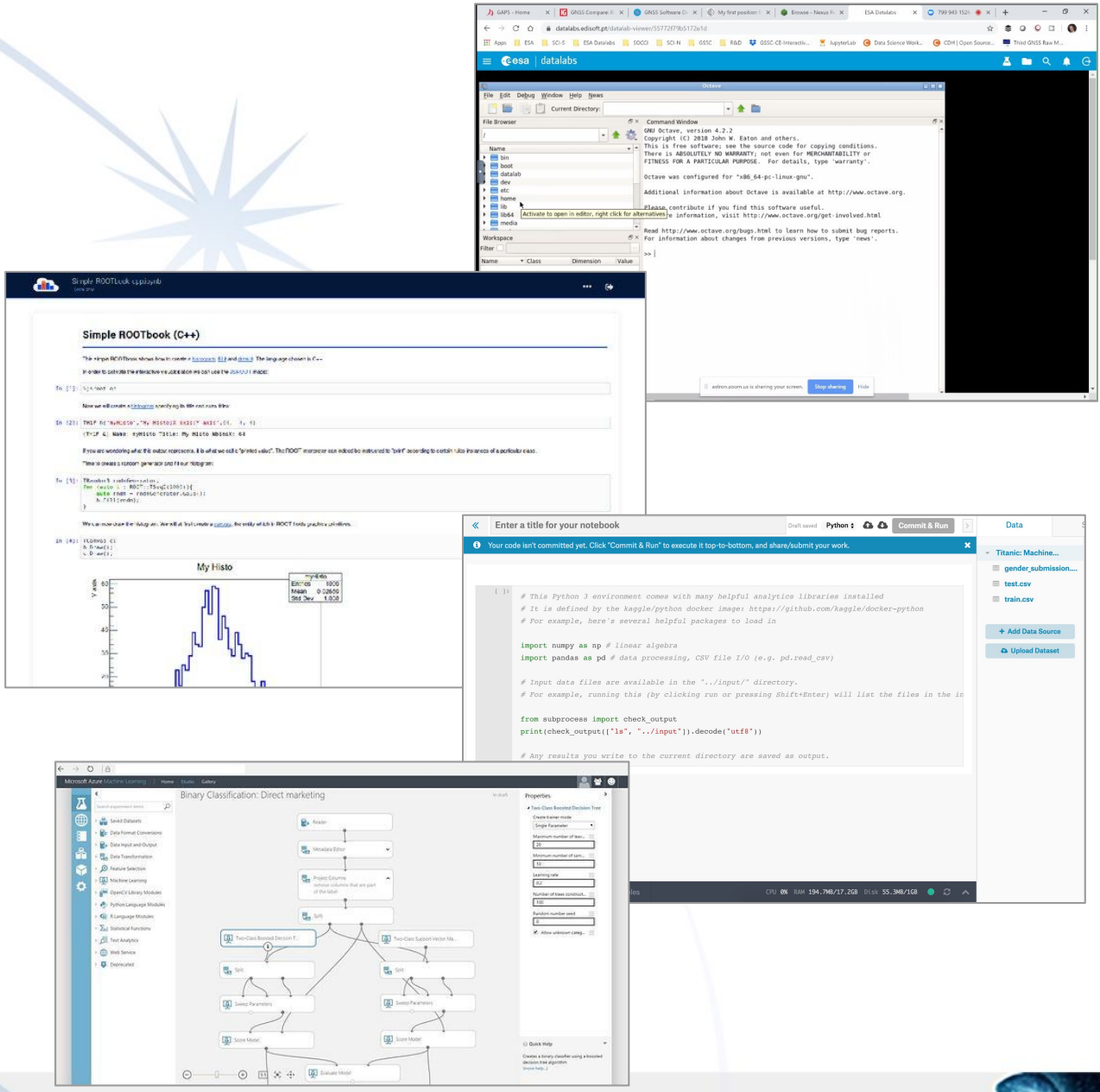
Some examples

Public Research/ Academia:

- CERN SWAN
- ESA Datalabs
- LSST Science Platform
- ...

Private Research / Industry:

- Google Colabs
- Kaggle Kernels
- Azure Machine Learning Studio
- ...



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Limitations

There are some strong limitations with the standard approach:

1. A user cannot run in an environment not supported by the platform
   → from a different Python version to a different Linux distribution.

2. A user cannot change the interface for using the Science Platform
   → a web-based notebook (Jupyter or similar) interface makes it impossible to run native GUI applications (common in Astrophysics).

3. It is required to support all the (yet limited) softwares and versions
   → from an administrative perspective this is a huge overhead

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Microservices

Microservices are independent and self-contained units that perform a given and well-defined task.

→ From just summing two numbers to running a neural network.

They are commonly used for the building blocks of the various Science Platforms cited before, in terms of “devops”.

how about using them even for the user tasks?

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Microservice interfaces

Microservices are interacted with using interfaces.

Examples:

- REST APIs
- HTTP
- SSH
- RPC

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Microservices and containers

- Microservices fit naturally in the containerisation approach:
  → each microservice is a container.

- Once a microservice is containerised:
  - completely unaware about the underlying computing infrastructure
  - only the interface is relevant.

- We consider only TCP/IP based interfaces.

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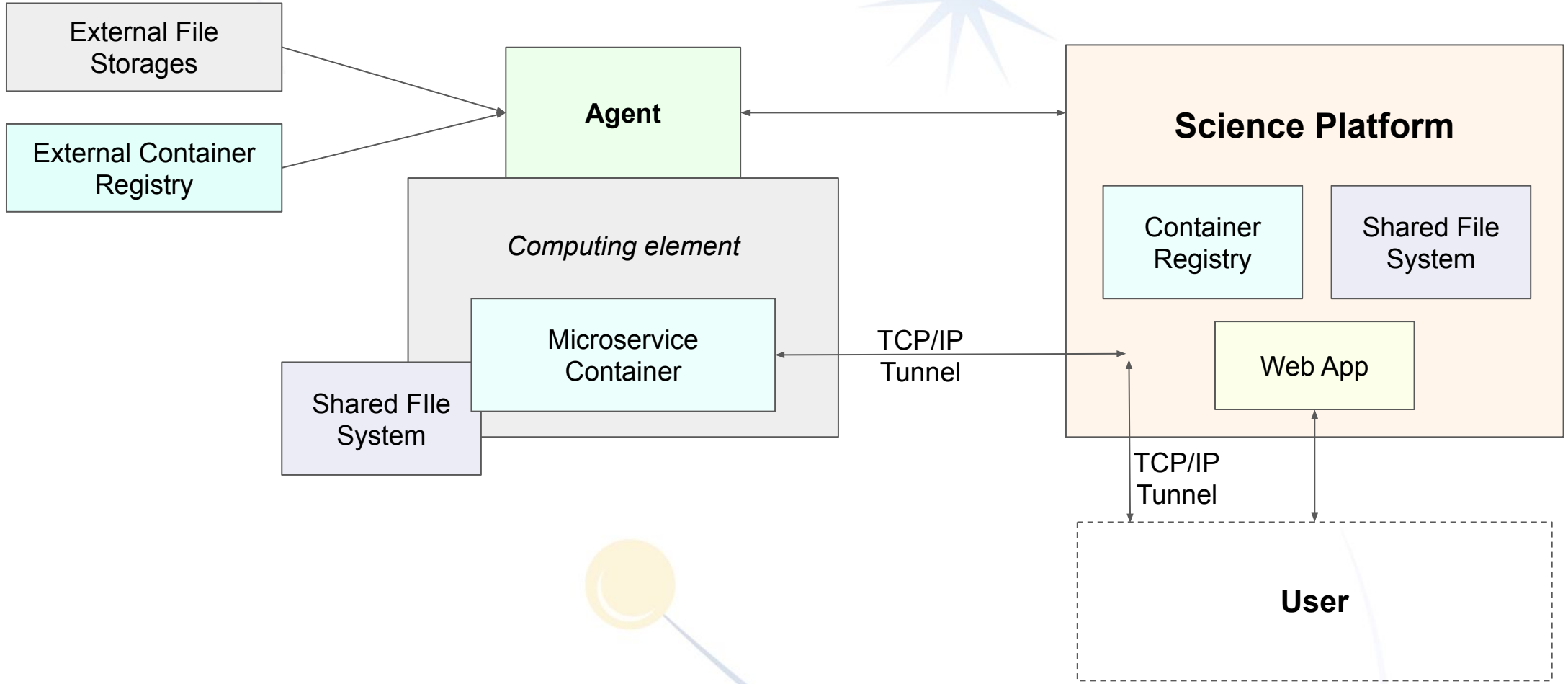
A Science Platform architecture



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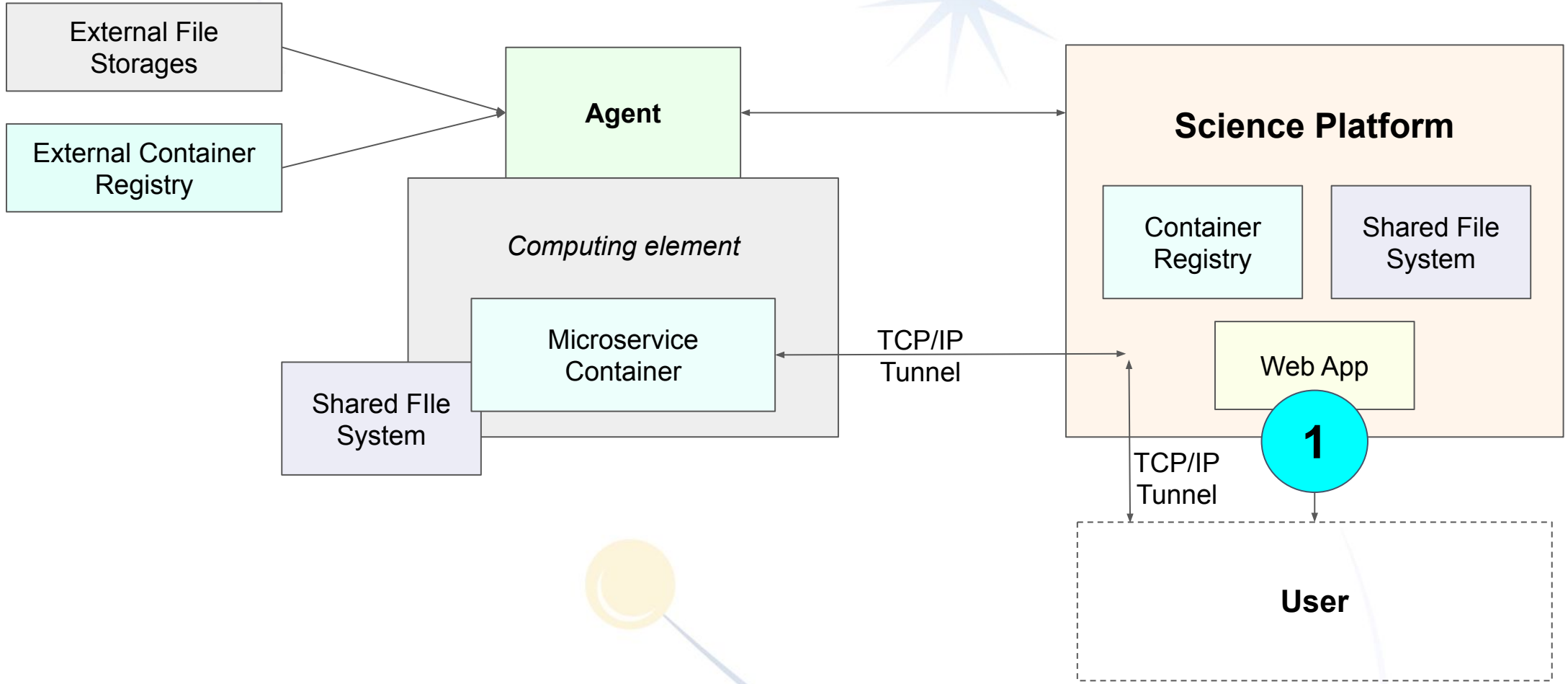
A Science Platform architecture



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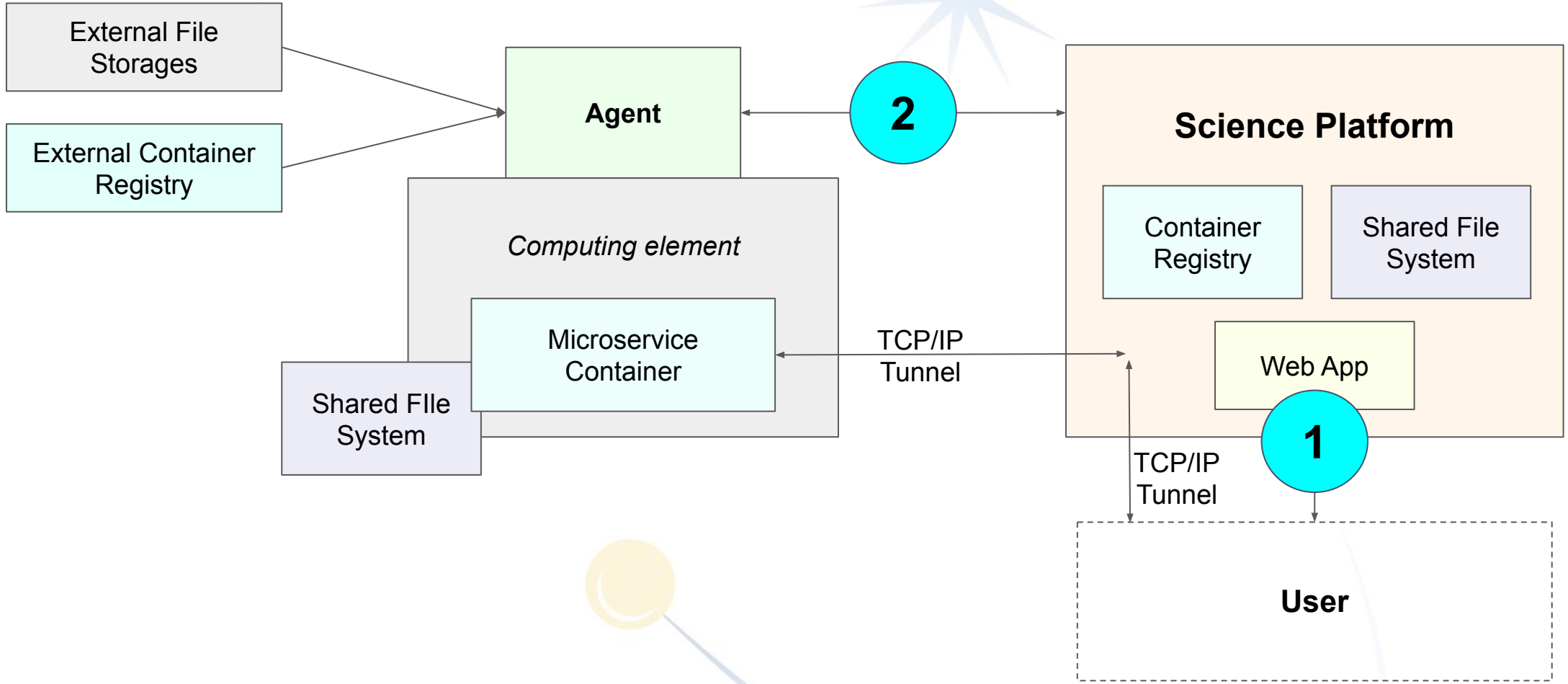
A Science Platform architecture



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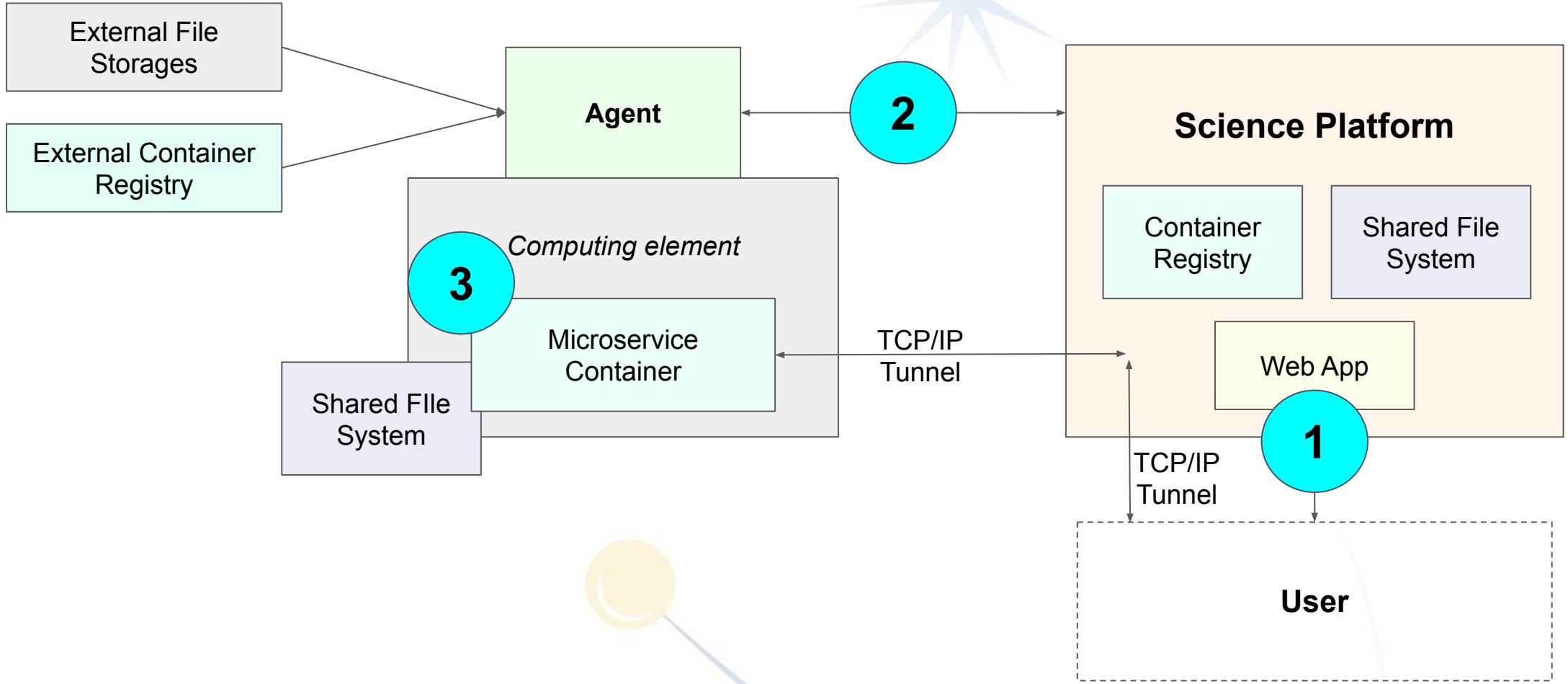
A Science Platform architecture



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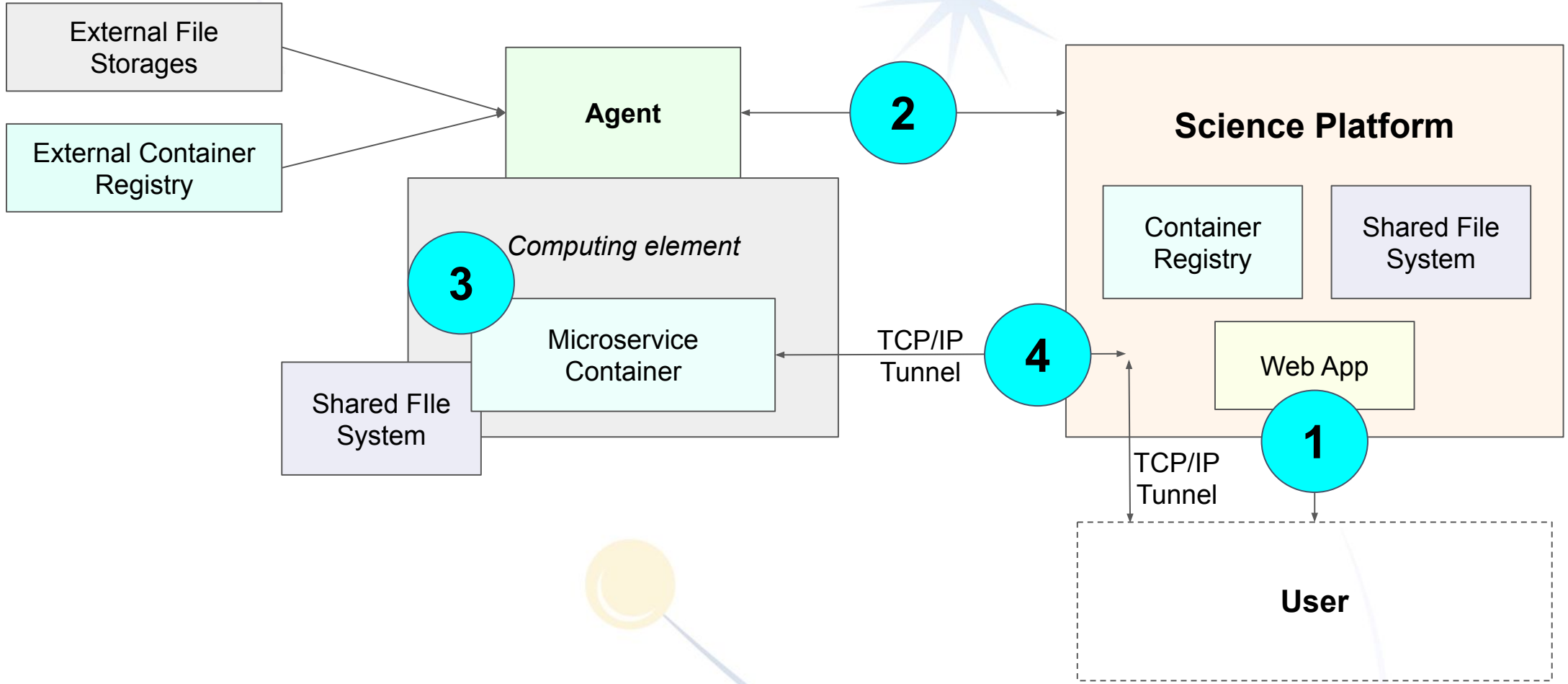
A Science Platform architecture



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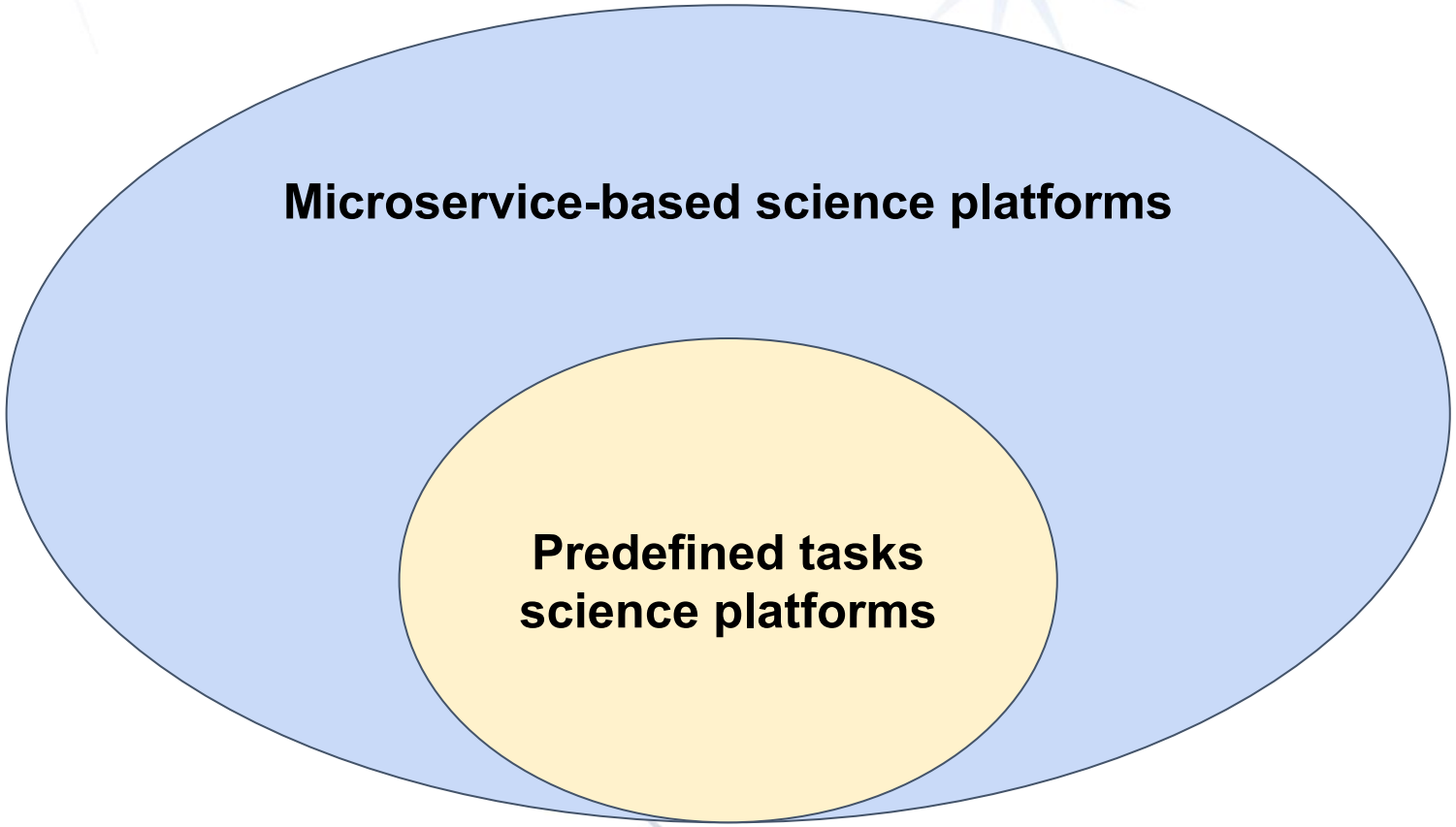
Capabilities of this approach



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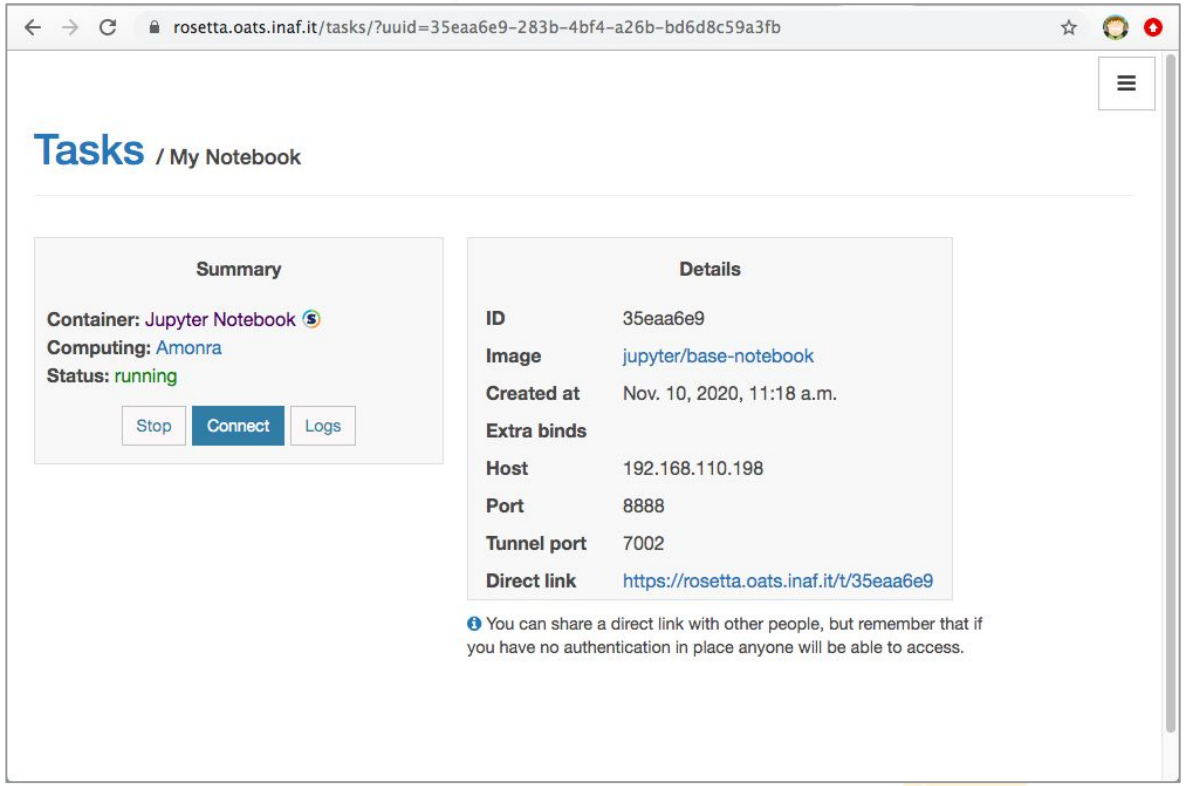
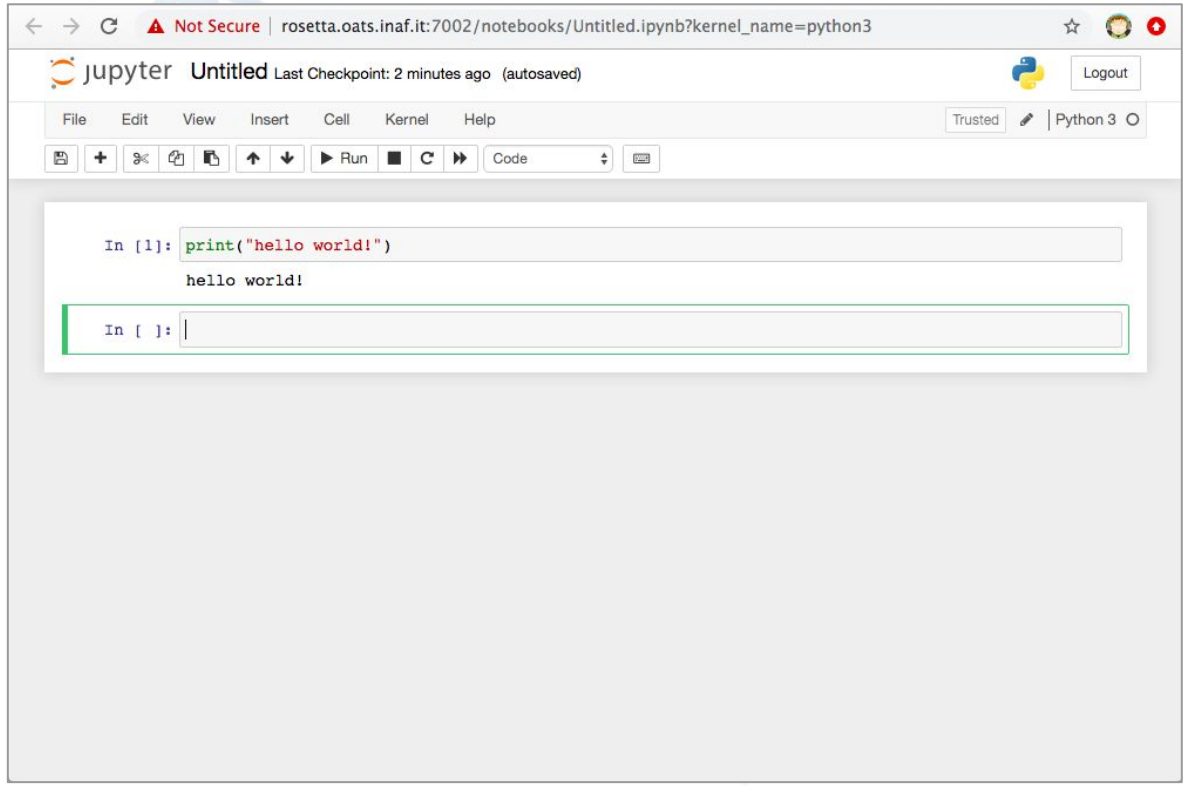
Our prototype at INAF





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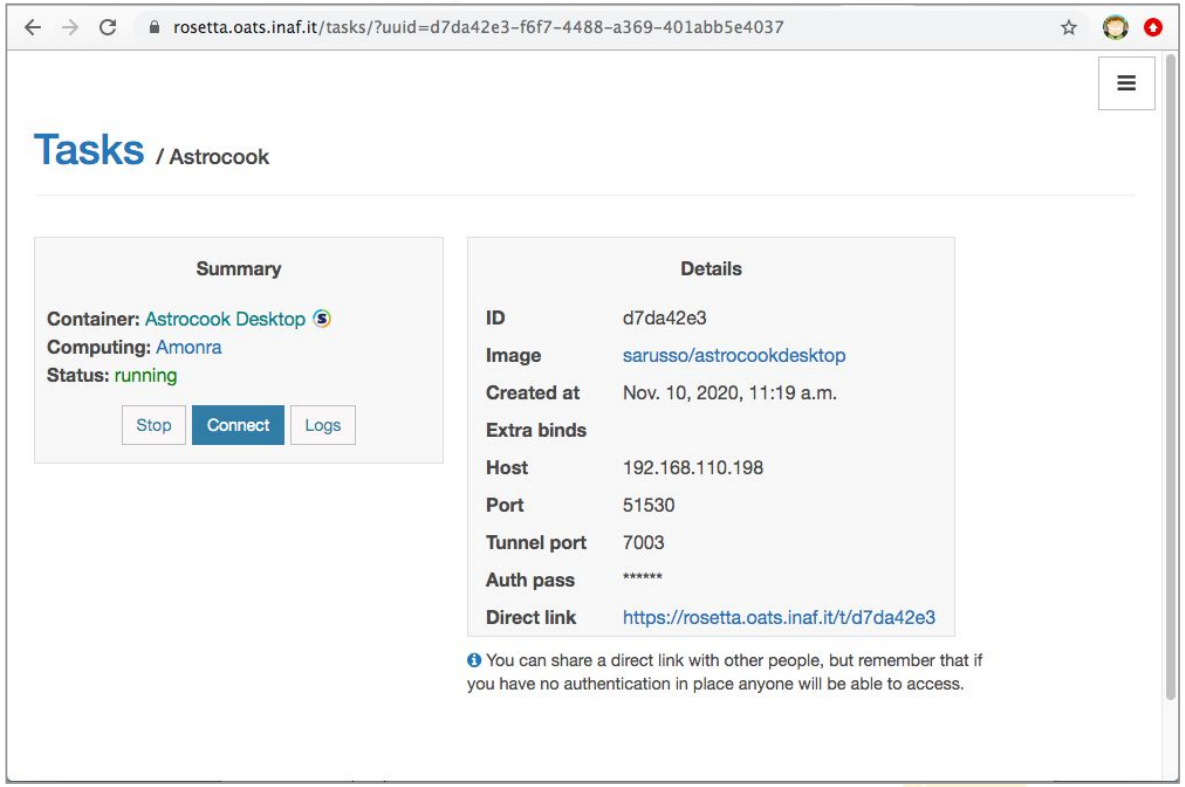

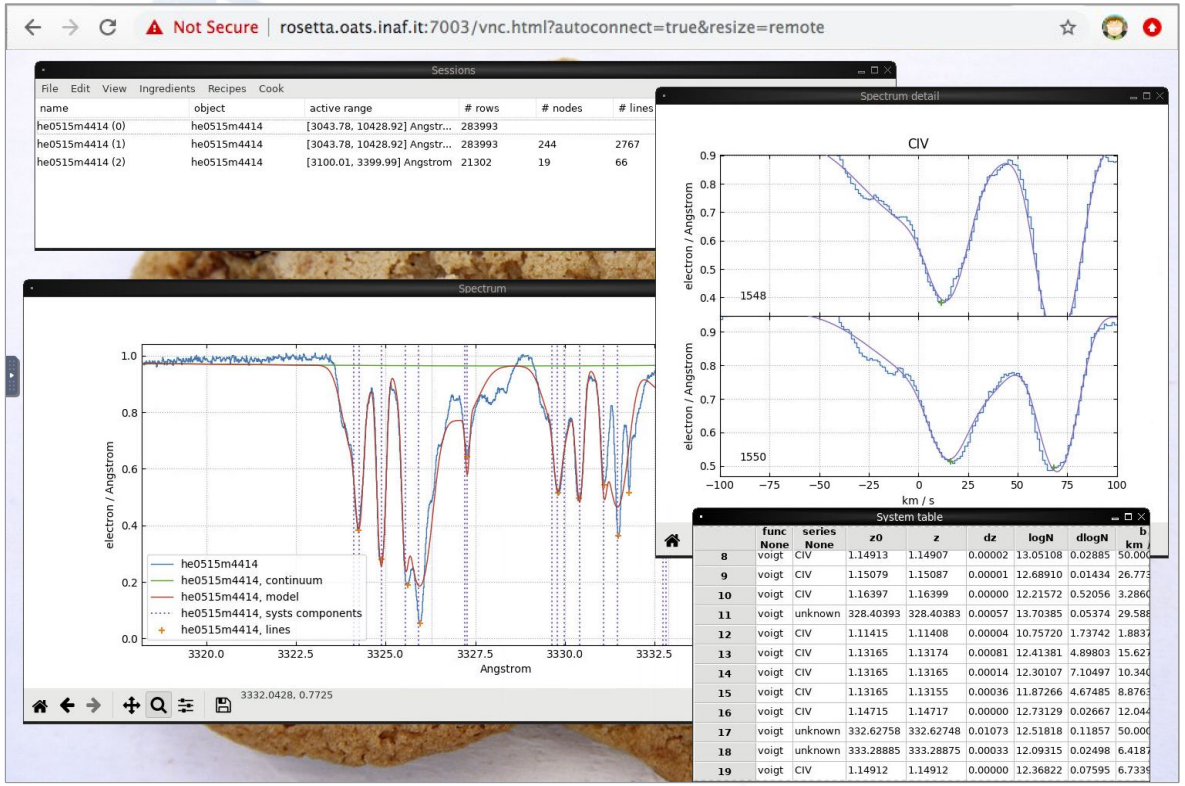

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Wrapping up

- Capabilities of this approach are a super-set of the standard approach
- Users can run whatever software they want
  → *remote desktops, web applications, even databases...*
- Containers make it safe to run custom software
- Huge improvements in terms of reproducibility
  → *users have control over what container version to run*

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THANKS!

Questions?

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