Dark matters in EOSC Future

Fellowship project: developing an online collaborative platform to serve astro-particle physics communities

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Horizon 2020 ESCAPE European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures CERN EOSC Future

PROJECT OVERVIEW

What is EOSC-Future's long - term goal?

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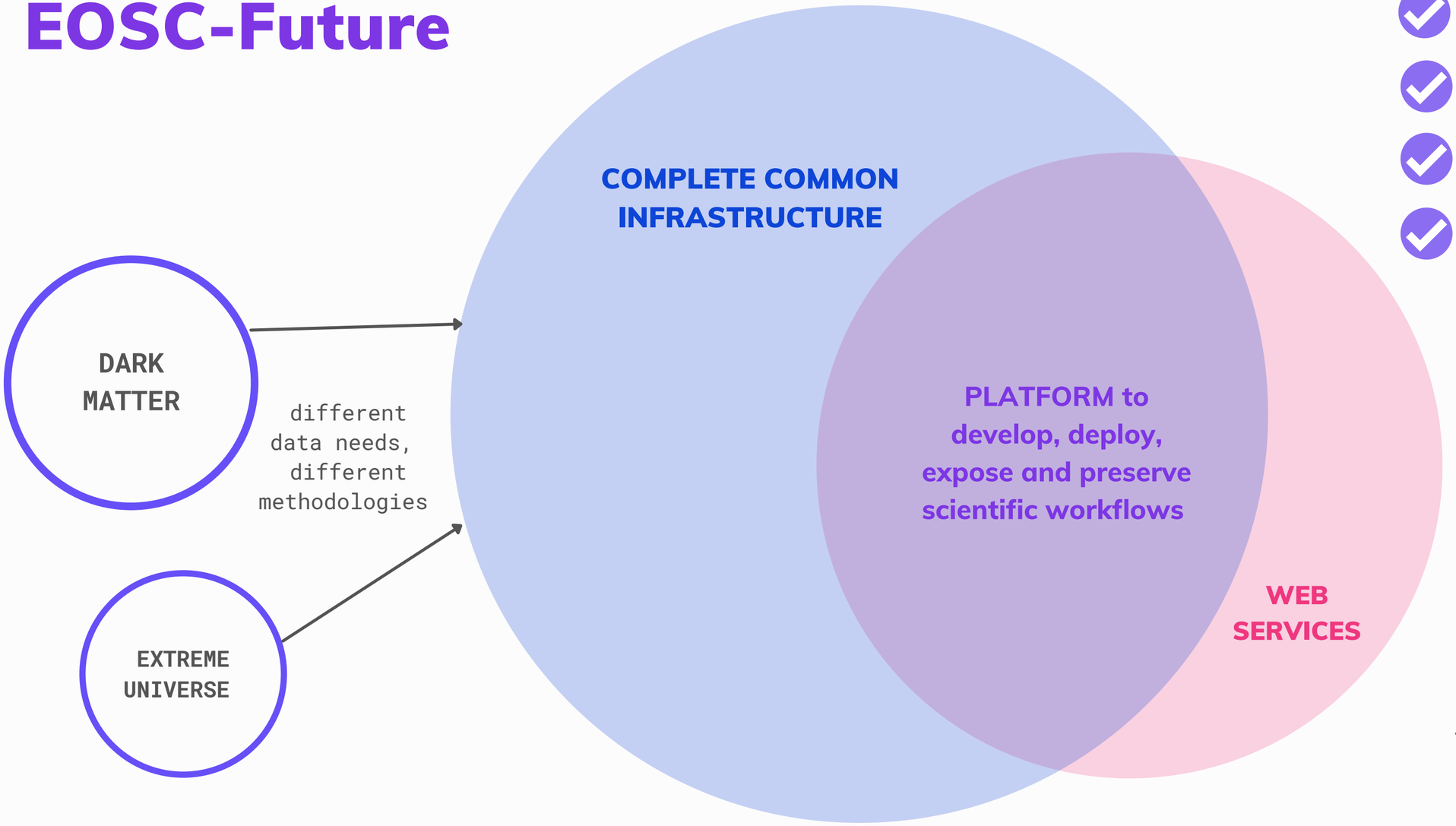
EOSC-Future



- OPEN SOURCE SCIENCE
- COLLABORATION
- FAIR DATA PRINCIPLES
- ANALYSIS PRESERVATION

OBJECTIVE

The project will serve as a science driver for other communities

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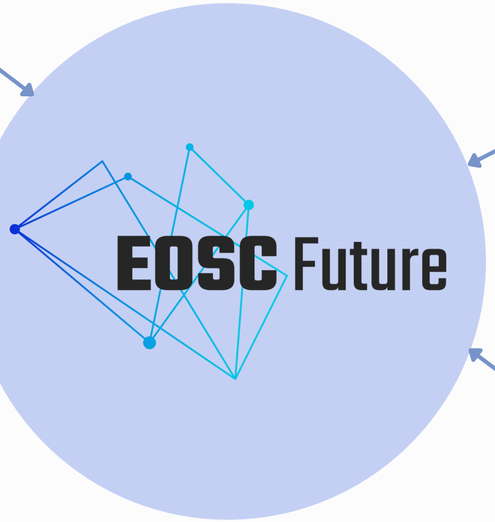
Synergies

ESCAPE OSSR | Open-source Scientific Software and Service Repository

for software preservation

ESCAPE DIOS | Data Infrastructure for Open Science

DATA LAKE for data Injection, Replication, Processing
+
DATA LAKE as a Service for user interface and online services



SCIENCE

postdocs in LAPP, CERN and FAU are already testing the infrastructure

reana

for workflows preservation in collaboration with IT-CDA

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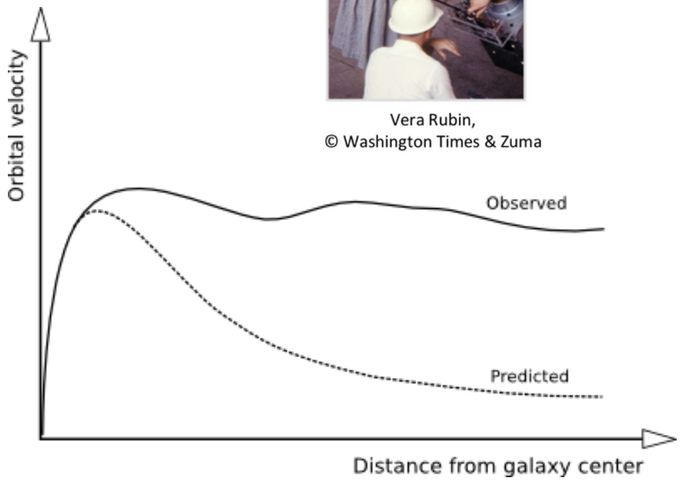
SCIENTIFIC MOTIVATION

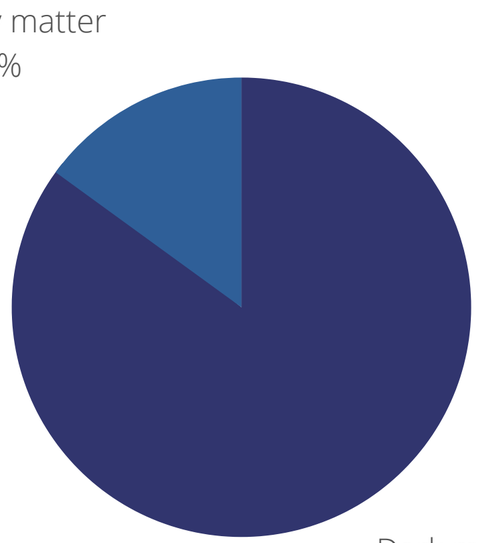
Why is this useful to the astro-particle physics community?

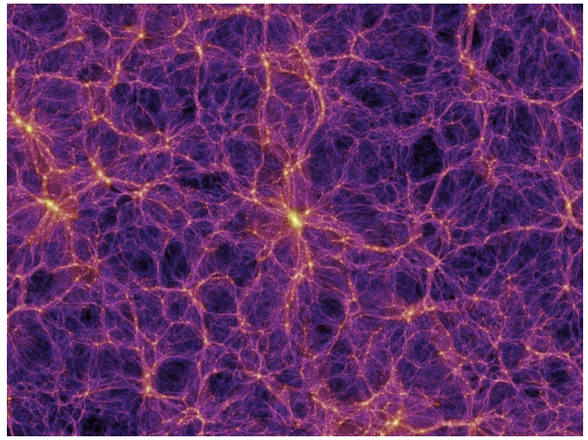
Science Project: Dark Matter

→ *Galaxy rotation curves* --> a larger amount of gravitational mass is expected to exist in the universe
→ It does not interact with the electromagnetic filed and *cannot therefore be seen*
→ Many DM candidates. Many experiments target the problem. Many different research approaches.

Vera Rubin,
© Washington Times & Zuma







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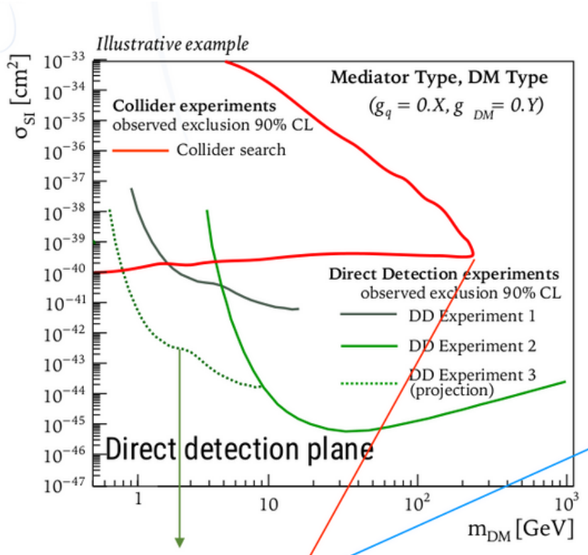
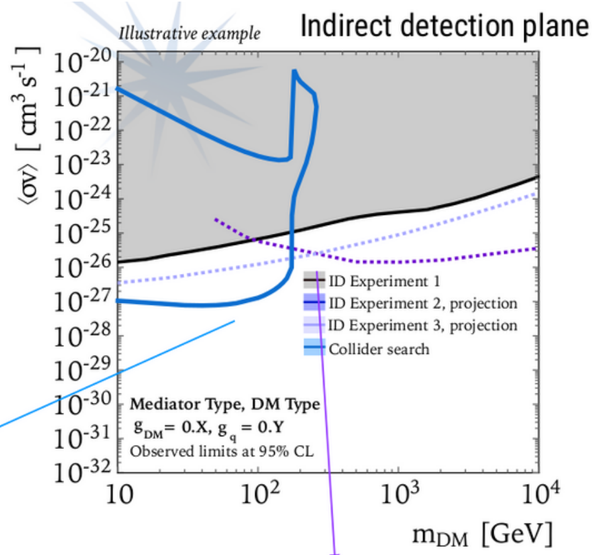
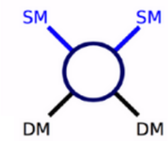
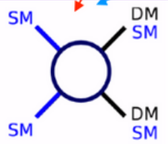
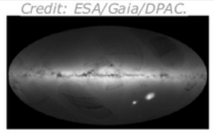
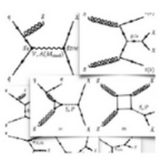
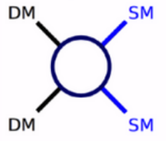
Expected outcomes

OBJECTIVE

- collect all the digital objects + workflows in a cohesive way
- output combined plots
- provide an interdisciplinary open science example from bottom-up effort





METHODS	 Direct Detection	 Colliders	 Astrophysics	 Theory	 Indirect Detection
RELEVANCE	DM that interacts inside the detector (WIMPs, axions)	produce DM and probe the dark interaction	necessary for all	necessary for all	detect annihilating/ decaying DM through its decays (i.e. neutrino searches, gamma rays)
EXPERIMENTS INVOLVED	Darkside	ATLAS			KM3Net, CTA

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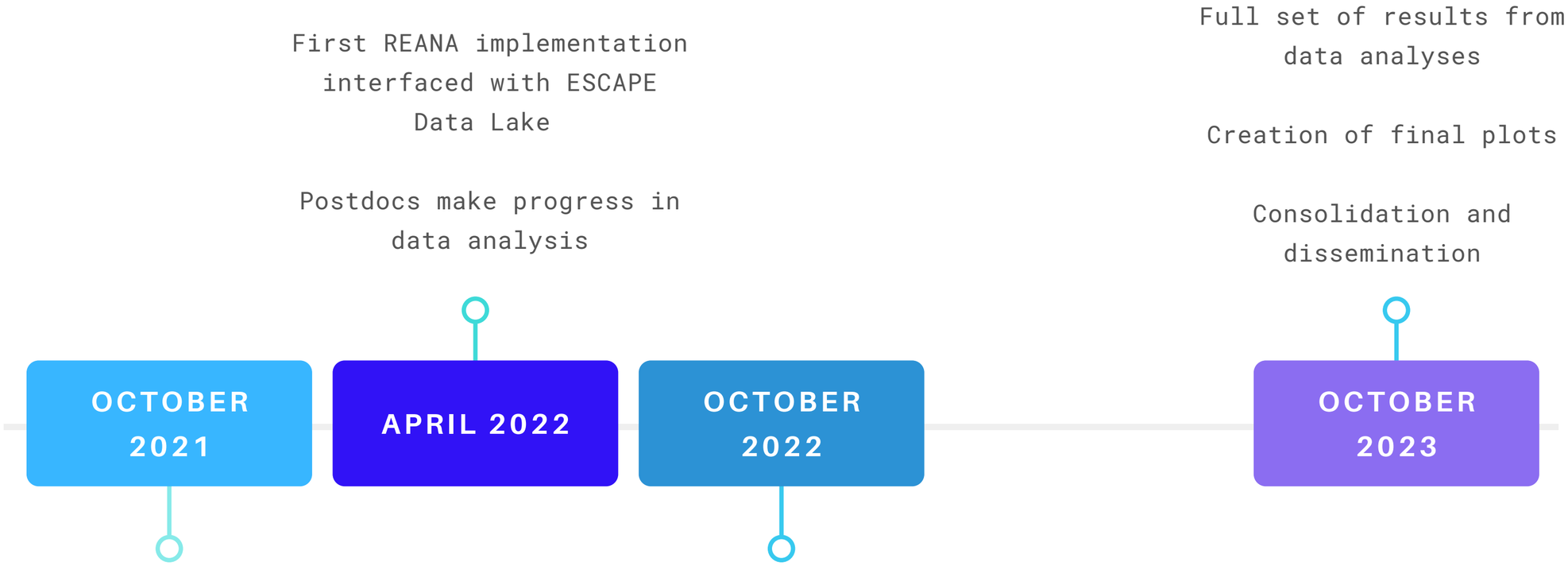
TIMELINE



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TECHNICAL IMPLEMENTATION

What exists already and what is being implemented?

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Analysis workflow

Generation and simulation of events

Experimental DATA

Data storage and processing

Including reconstruction and calibration path

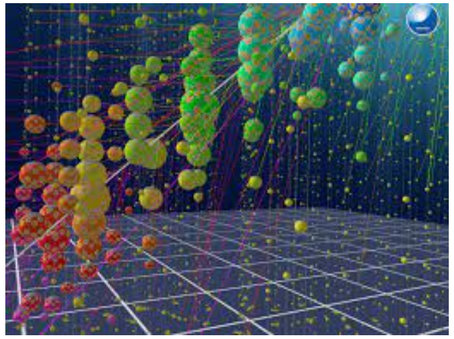
Analysis

Including background subtraction, estimation and statistical analysis

Interpretation of results

COMBINATION of results from different experiments

COMPARISON of results with other searches



Challenge for automatisation of periodic data injection from different institutes

DISCLAIMER: Making FAIR data *useful* is difficult!!

"CERN LHC and CERN CAST generate constraints on WIMP and axion DM, which in turn yield different predictions for observational astronomy (e.g. CMB polarisation), but it is difficult for an observational astronomer to engage with the original CERN constraints. And vice-versa". (*S.Serjeant, astronomer at Open University, UK)*

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Analysis workflow

Generation and simulation of events

Experimental DATA

from ESCAPE experiments

Data processing

Including reconstruction and calibration path

Analysis

Including background subtraction, estimation and statistical analysis

Interpretation of results

COMBINATION of results from different experiments

COMPARISON of results with other searches

ESCAPE's Data Lake running on a K8s cluster:
storage orchestration
+
data management

WebUI:
DataLake-as-a-Service
(credits to Riccardo Di Maria, Muhammad Aditya Hilmy)

reana
a platform to reproduce workflows running on various computing backends

THE VIRTUAL RESEARCH ENVIRONEMNT (VRE)

An online collaborative interactive platform:
the way forward

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RESOURCES

Virtual Research Enviroment

AN AGGREGATION PORTAL PROPOSAL

GET STARTED →

HOME

RESEARCH TOOLS

TEST SCIENCE PROJECT - HIGGS

TEST SCIENCE PROJECT - ASTRO

DOCS

ESCAPE RESEARCHER

EXTERNAL RESEARCHER

ESCAPE VRE

ESCAPE site | Let's Start! | Meetings | Users Cloud | Ticket System

Datalake - RSEs | Software and Services | Analysis Platform | Citizen Science | VO - Market

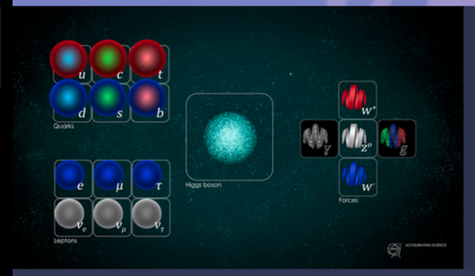
ESCAPE Wiki | Software DevOps | ESCAPE community | DLaaS - JupyterHub | Datalake - Monitoring

Get/Use Docker | Rucio Docs | ESCAPE School | Tutorials | Reset your password

TSP - Astro | Outreach - ATLAS

Test Science Project: the Higgs @ATLAS

AN EXERCISE OF HOW A PARTICLE PHYSICS TSP CAN LOOK LIKE



The Physics

Take a look at the fundamental physics that support and guide the experimental data analysis searches -and discoveries- relative to Higgs candidates, predicted by the Standard Model of Particle Physics.

LEARN MORE

The Experiments

The ATLAS experiment at the LHC is a many-layered instrument designed to detect some of the tiniest yet most energetic particles ever created on earth. It consists of six different detecting subsystems wrapped concentrically in layers around the collision point to record the trajectory, momentum, and

credits to Arturo Sanchez Pineda

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VRE PRINCIPLES

WebUI interface	Scalability	Portability	CI/CD	Flexibility
To facilitate onboarding. Good documentation is key.	Possibility of running jobs at various scales: from scientist's latops to large scale resources.	Many users interacting with infrastructure at the same time. Members will be able to upload the content directly.	Automating deployment of infrastructure and updating of software versions.	Supports different formats of data, containerization techniques, job submission protocols

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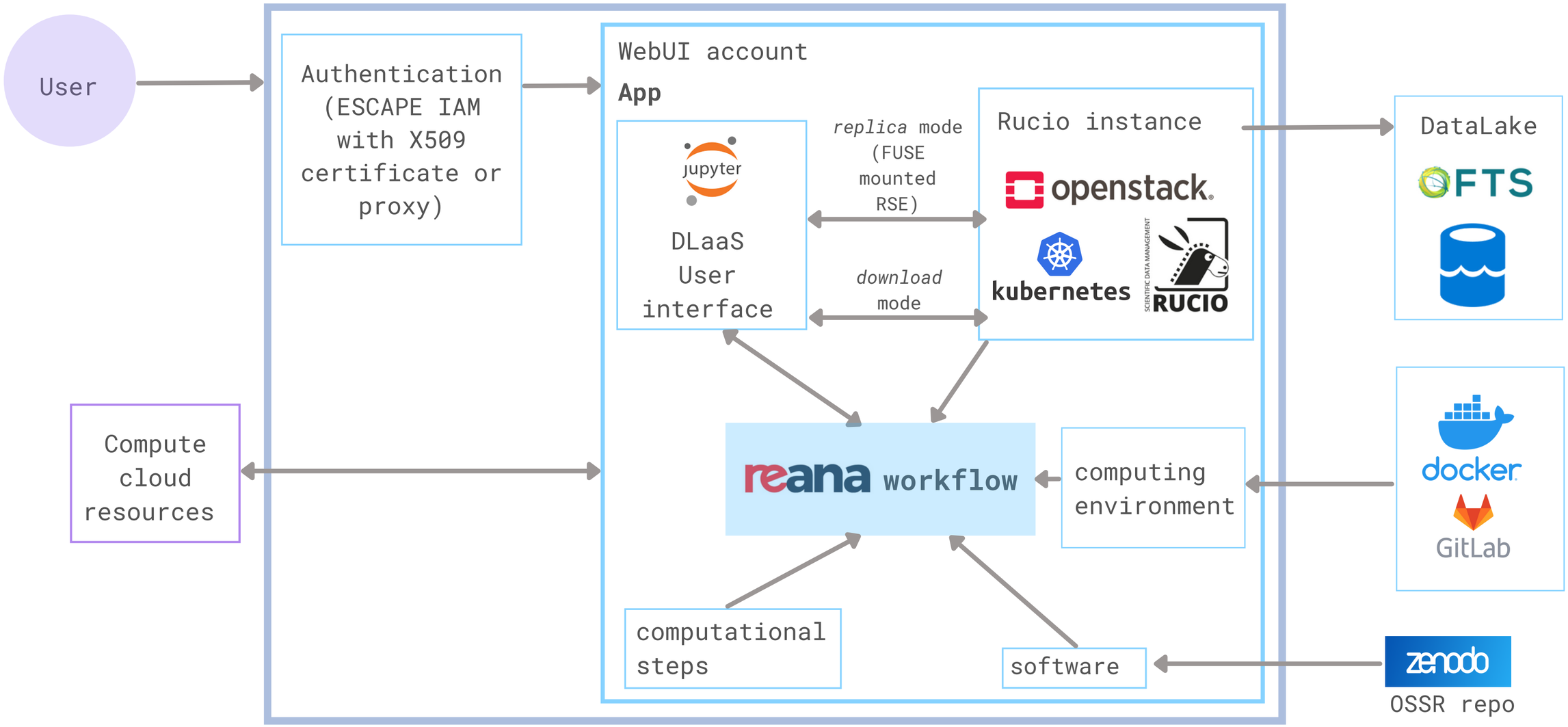
The VRE server



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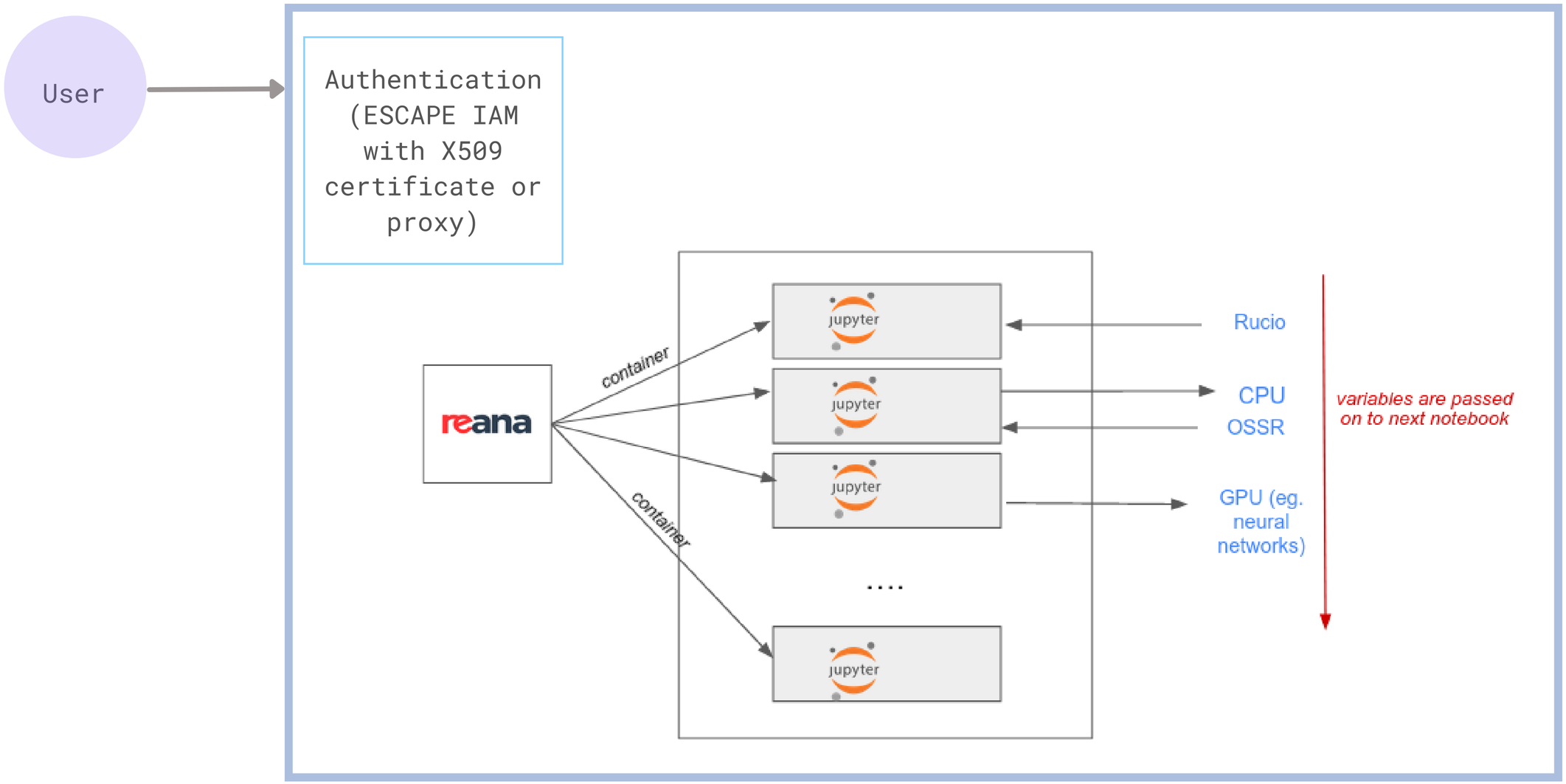

Thank you! Questions?

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VRE website

https://escape2020.pages.in2p3.fr/virtual-environment/home/

Where to find me

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