



The LifeWatch ERIC Biodiversity
& Ecosystem eScience Conference

PLOVDIV, BULGARIA

7-10 JULY 2026

Notebook-as-a-VRE: a Virtual Research Environment

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University of Amsterdam



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Notebook as a
Virtual
Research
Environment

July 2026



Expected learning outcomes

- **Understand** the NaaVRE workflow co-development process
- **Be able to apply** the method co-develop a scientific workflow in NaaVRE



Outline

1. Jupyter notebooks and Virtual research environment
2. Virtual lab co-development
3. Hands on

1. Jupyter notebooks and Virtual research environment



Daily environment: Jupyter, R-Studio

jupyter Powerline extraction using PointCNN_raw Last Checkpoint: 04/12/2021 Autosave Failed! Logout

File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 3

```
In [7]: pc = PointCNN(data)
```

Finding optimal starting learning rate

Next, `lr_find()` function is used to find the optimal learning rate. It controls the rate at which existing information will be overwritten by newly acquired information throughout the training process. If no value is specified, the optimal learning rate will be extracted from the learning curve during the training process.

```
In [9]: pc.lr_find()
```

Out[9]: 0.0006918309709189362

RStudio

```
1 library(nycflights13) ## package containing flights dataset
2 library(lubridate)
3 library(dplyr)
4 library(ggplot2)
5
6 head(flights, n = 3)
7 daily <- flights %>%
8   mutate(date = make_date(year, month, day)) %>%
9   count(date) %>%
10  mutate(wday = wday(date, label = TRUE))
11 head(daily, n = 3)
12 ggplot(daily, aes(wday, n)) +
13   geom_boxplot(outlier.colour = "hotpink") +
14   labs(x = "Weekday", y = "Flights",
15        subtitle = "Number of 2013 New York Flights Each Weekday")
16
```

Environment History Connections Tutorial

R • Global Environment

Data

daily 365 obs. of 3 variables

\$ date: Date[1:365], format: "2013-01-01" "2013-01-02" ...

\$ n : int [1:365] 842 943 914 915 720 832 933 899 902...

\$ wday: Ord.factor w/ 7 levels "Sun"<"Mon"<"Tue"<...: 3 ...

Files Plots Packages Help Viewer

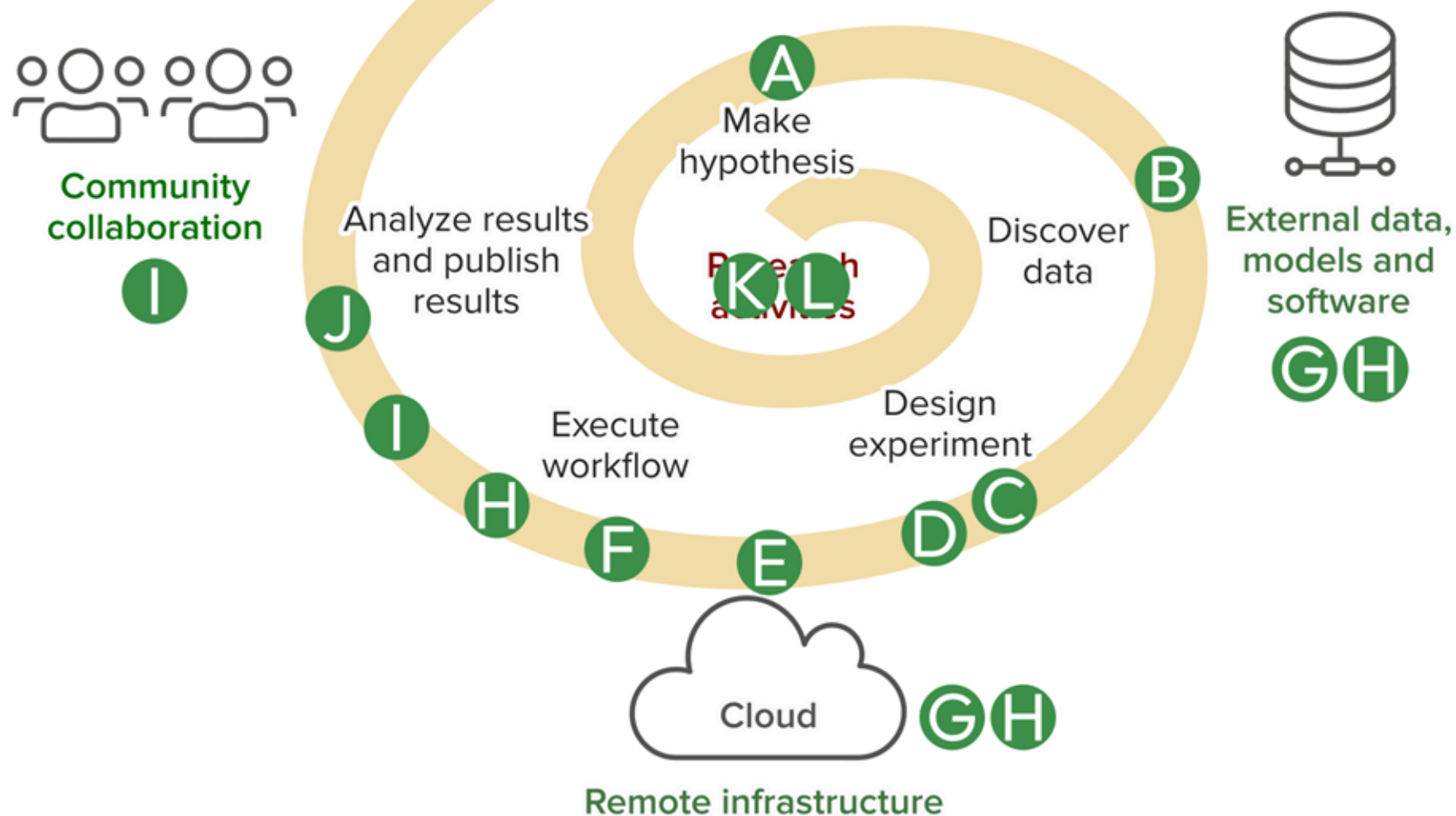
Zoom Export

Number of 2013 New York Flights Each Weekday

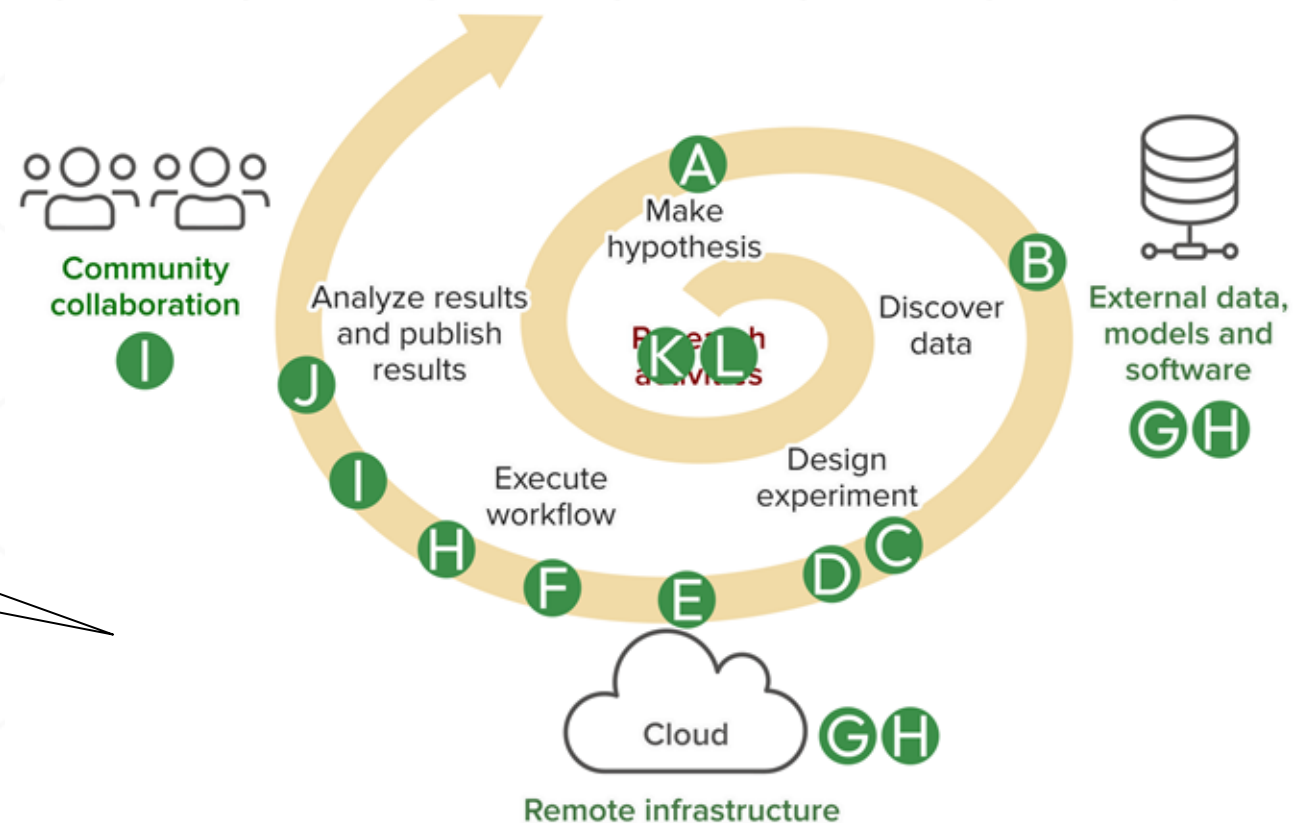
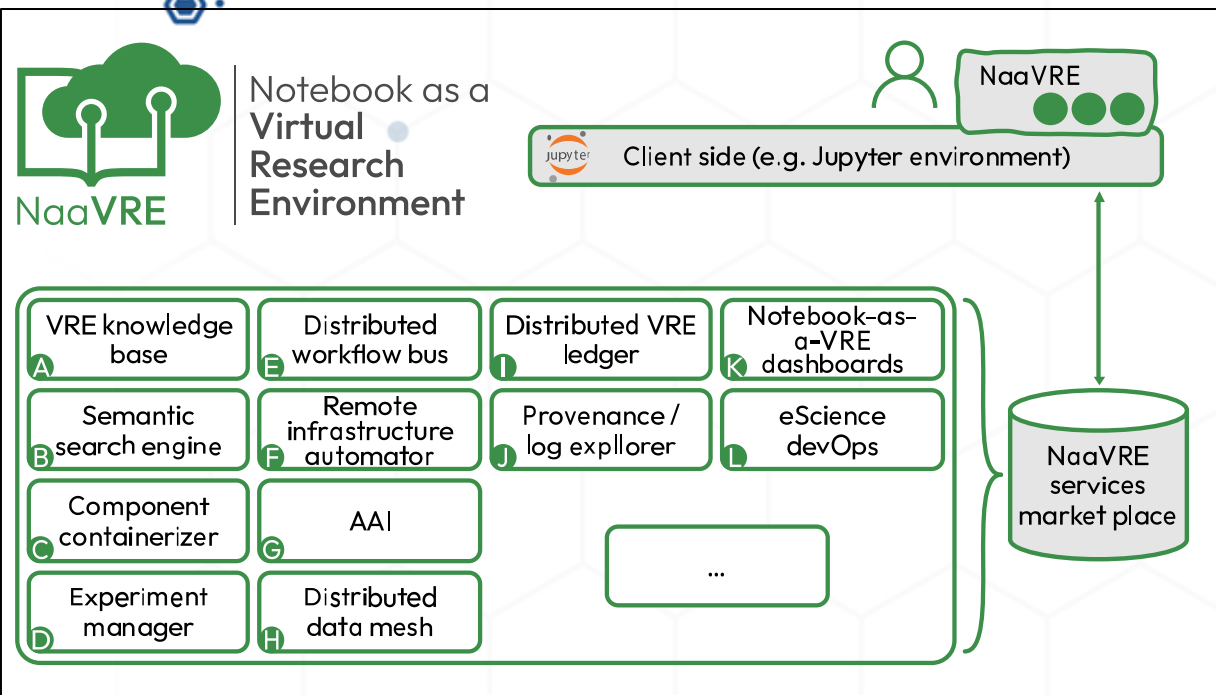
year	month	day	dep_time	sched_dep_time	dep_delay	arr_time	sched_arr_time	arr_delay	carrier
2013	1	1	517	515	2	830	819	11	UA
2013	1	1	533	529	4	850	830	20	UA
2013	1	1	542	540	2	923	850	33	AA

```
> daily <- flights %>%
+   mutate(date = make_date(year, month, day)) %>%
+   count(date) %>%
+   mutate(wday = wday(date, label = TRUE))
> head(daily, n = 3)
# A tibble: 3 x 3
  date       n wday
<date>   <int> <ord>
1 2013-01-01 842 Tue
2 2013-01-02 943 Wed
3 2013-01-03 914 Thu
> ggplot(daily, aes(wday, n)) +
+   geom_boxplot(outlier.colour = "hotpink") +
+   labs(x = "Weekday", y = "Flights",
+        subtitle = "Number of 2013 New York Flights Each Weekday")
```

Challenges



Research activities and Jupyter extensions



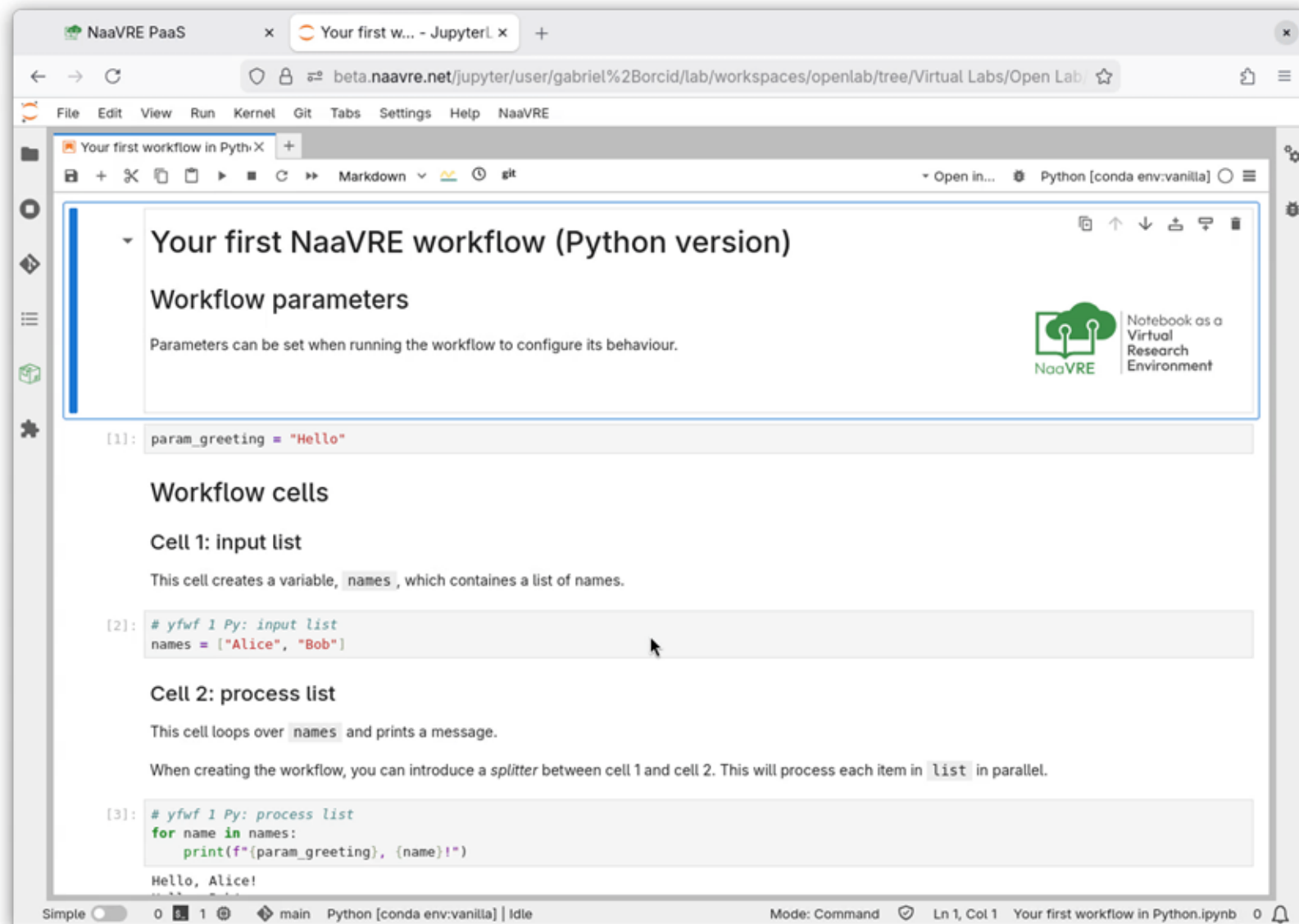
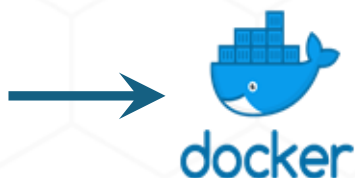


From notebooks to cloud workflows

Containerize notebook cell

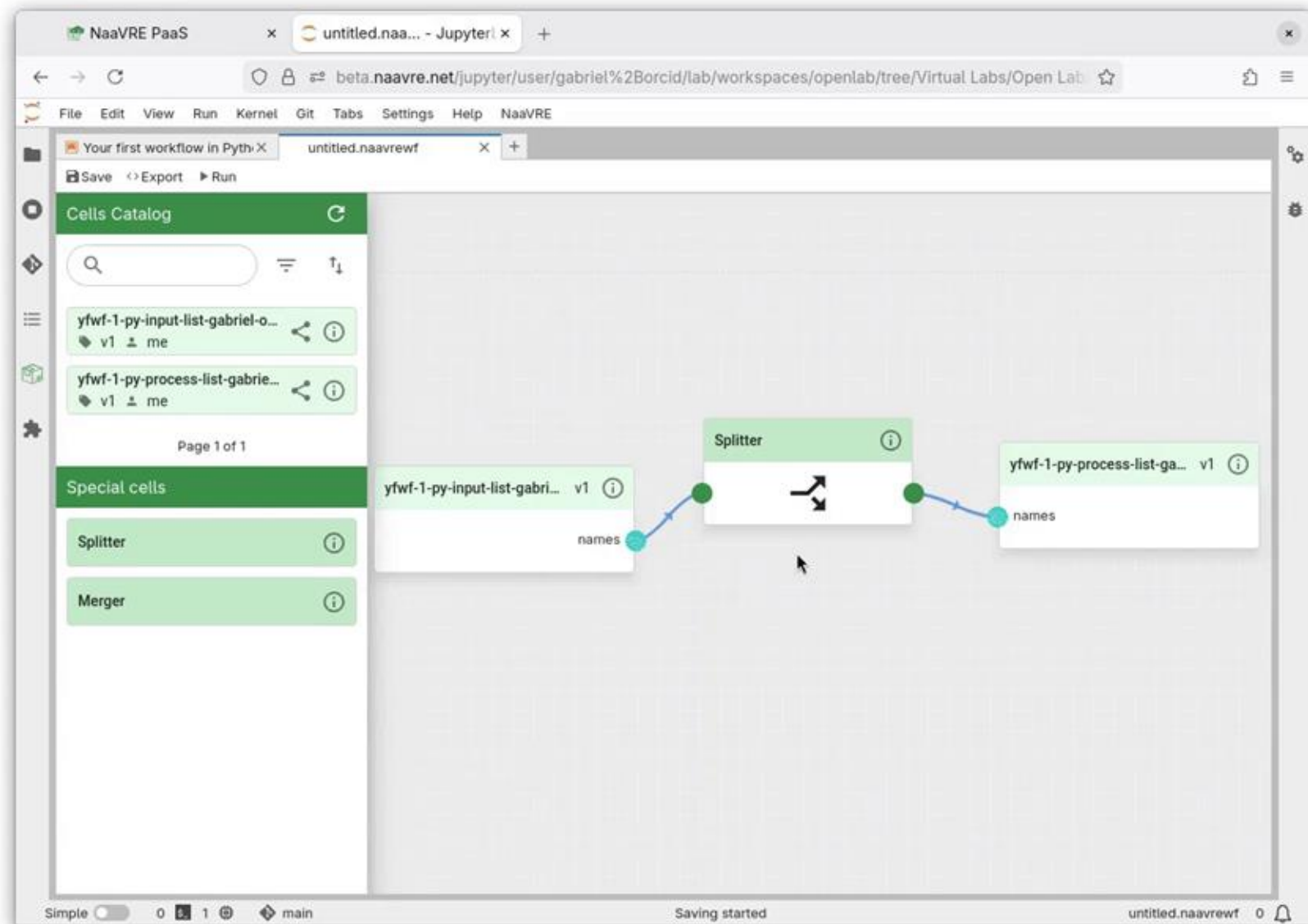
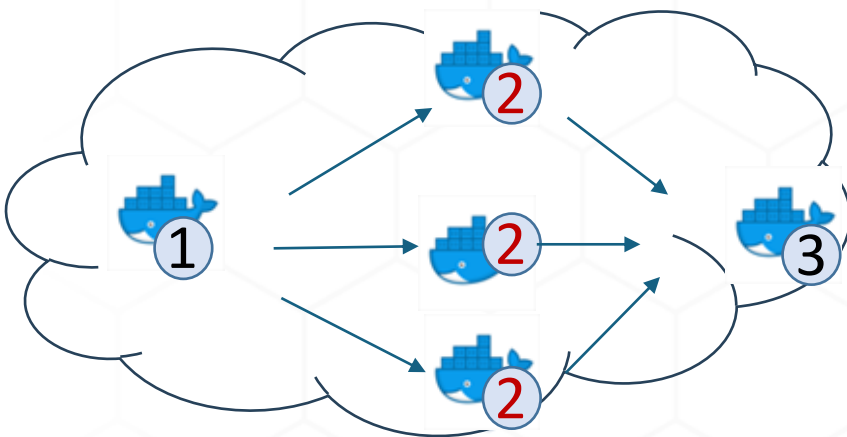
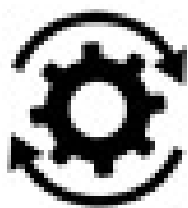
Encapsulate **user-selected cells** and **containerize** them as standardized **reusable workflow components**.

Code cell



From notebooks to cloud workflows

Run a workflow



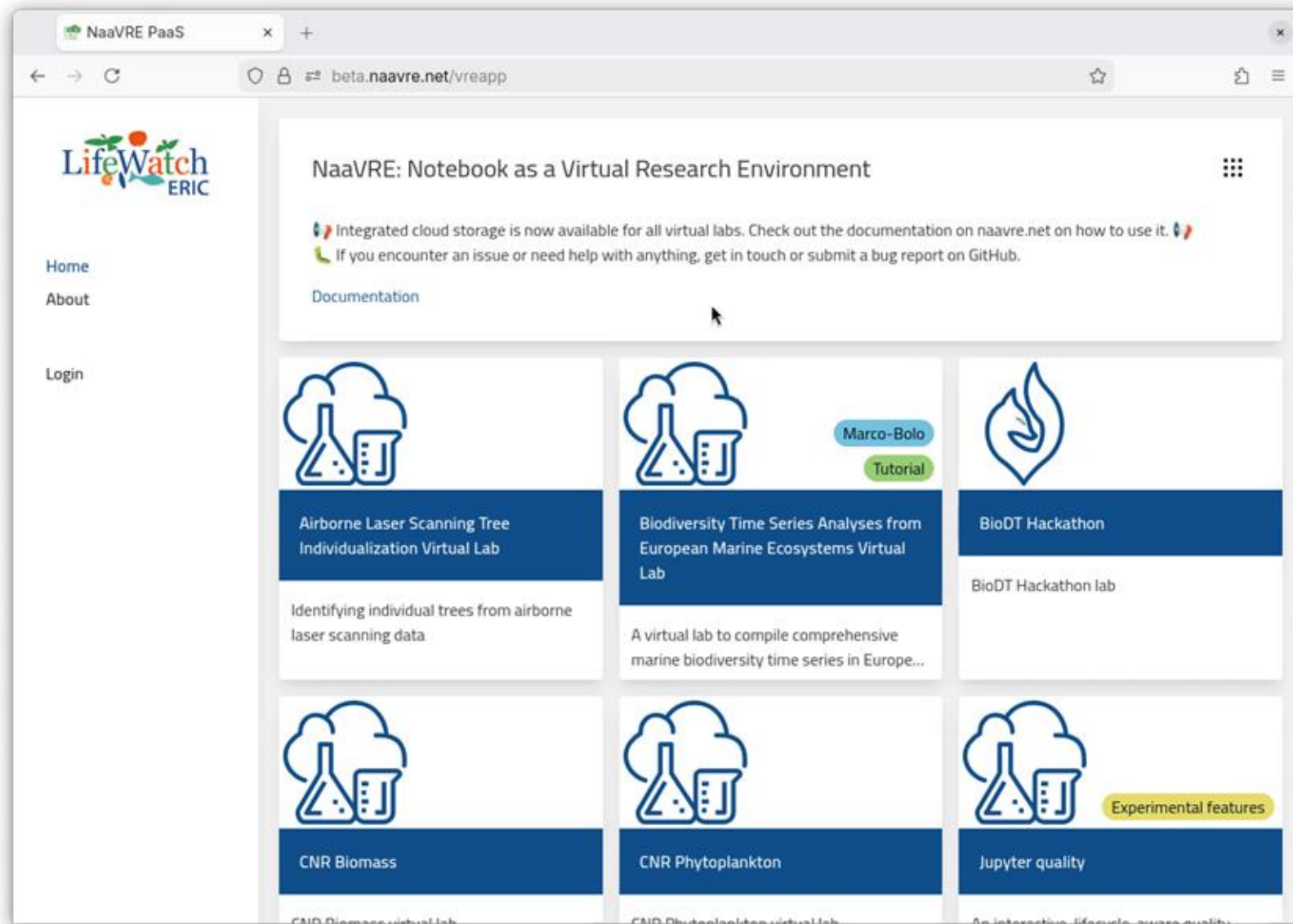
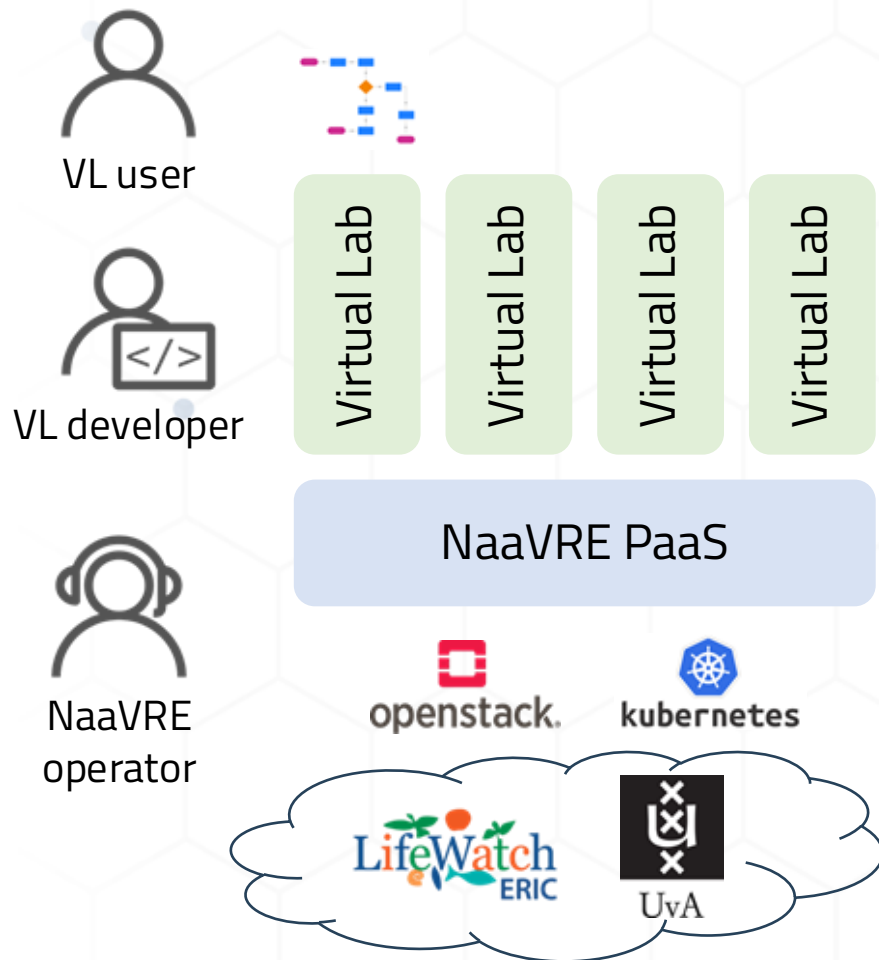


Workflow





Notebook-as-a-VRE and Virtual Labs





See for yourself



Notebook as a
Virtual
Research
Environment

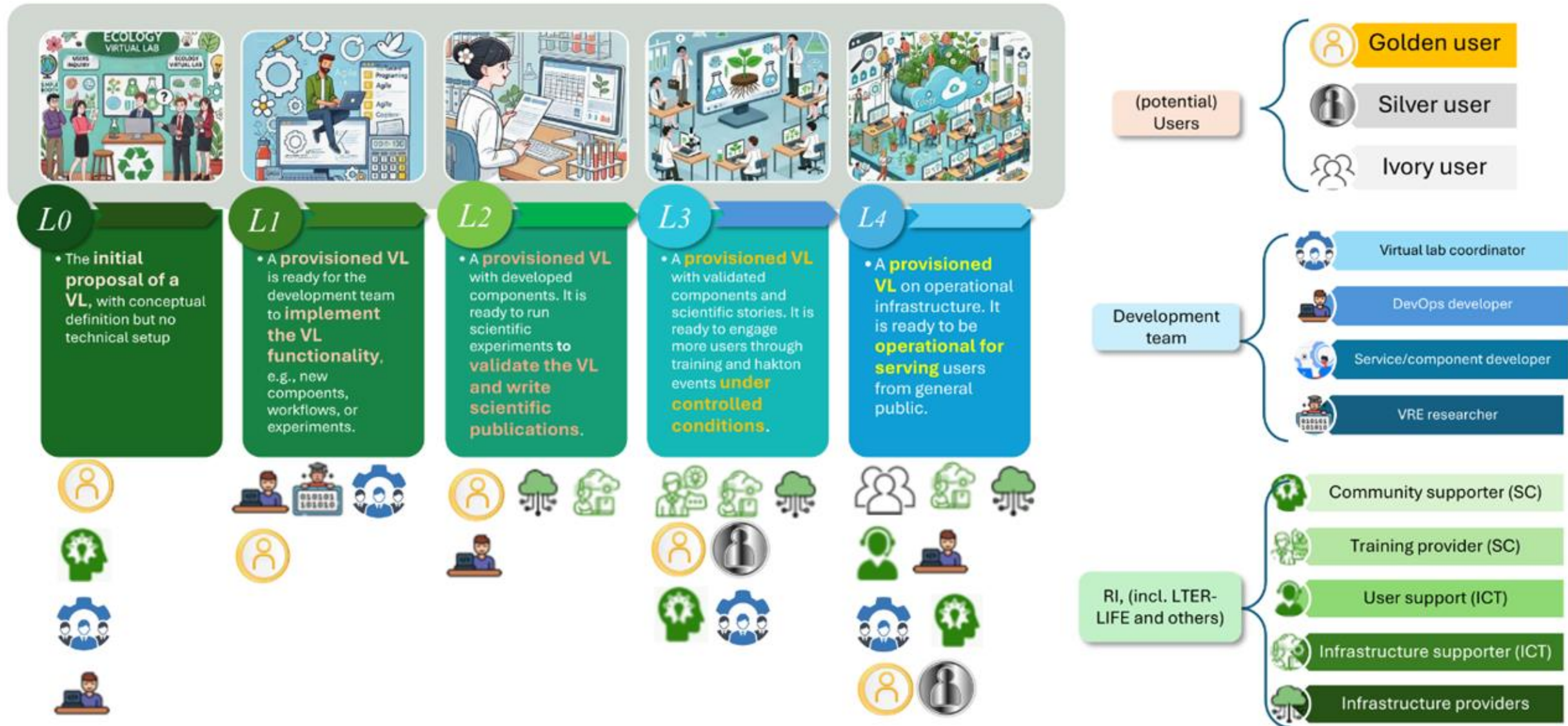


<https://naavre.net>

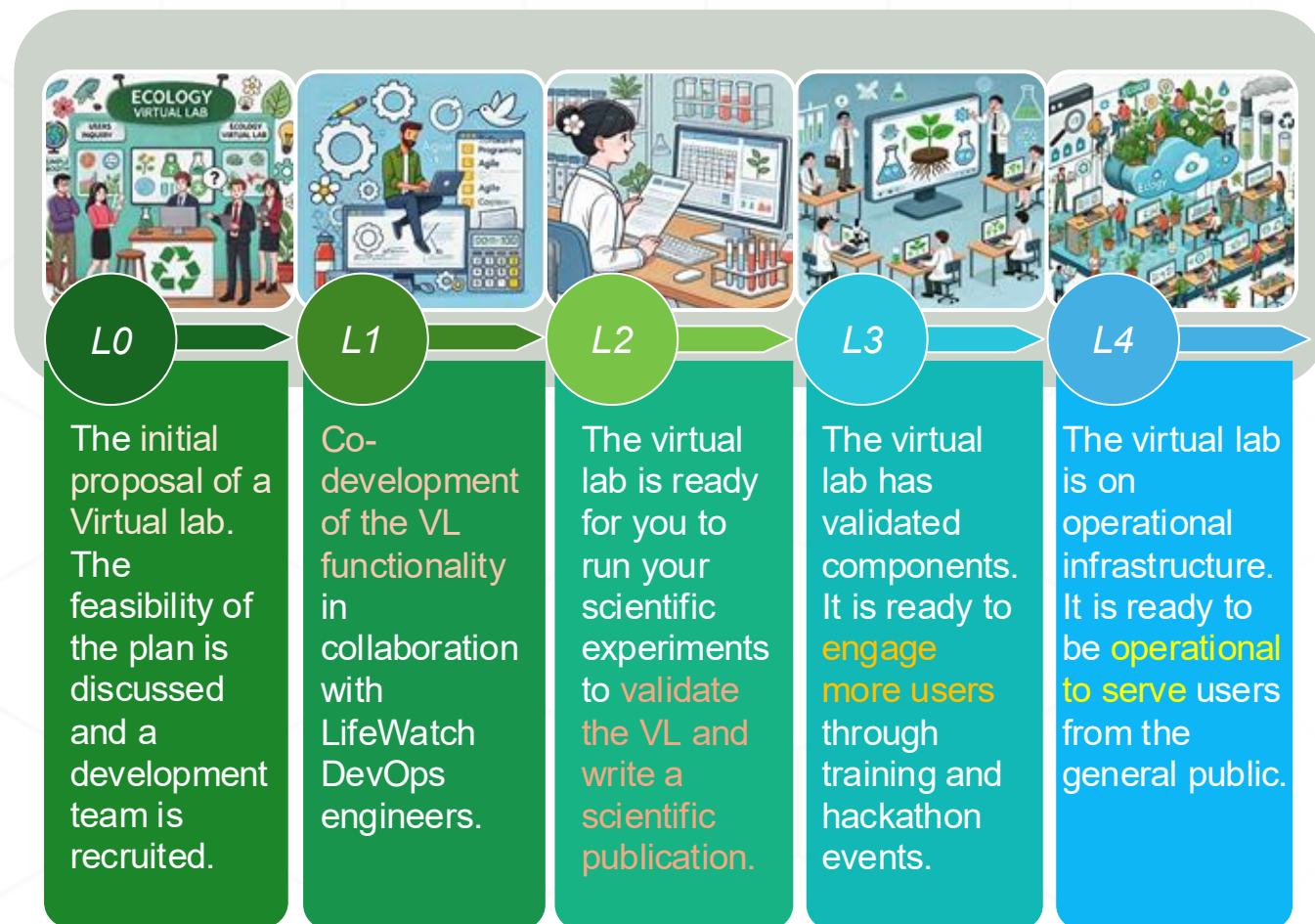
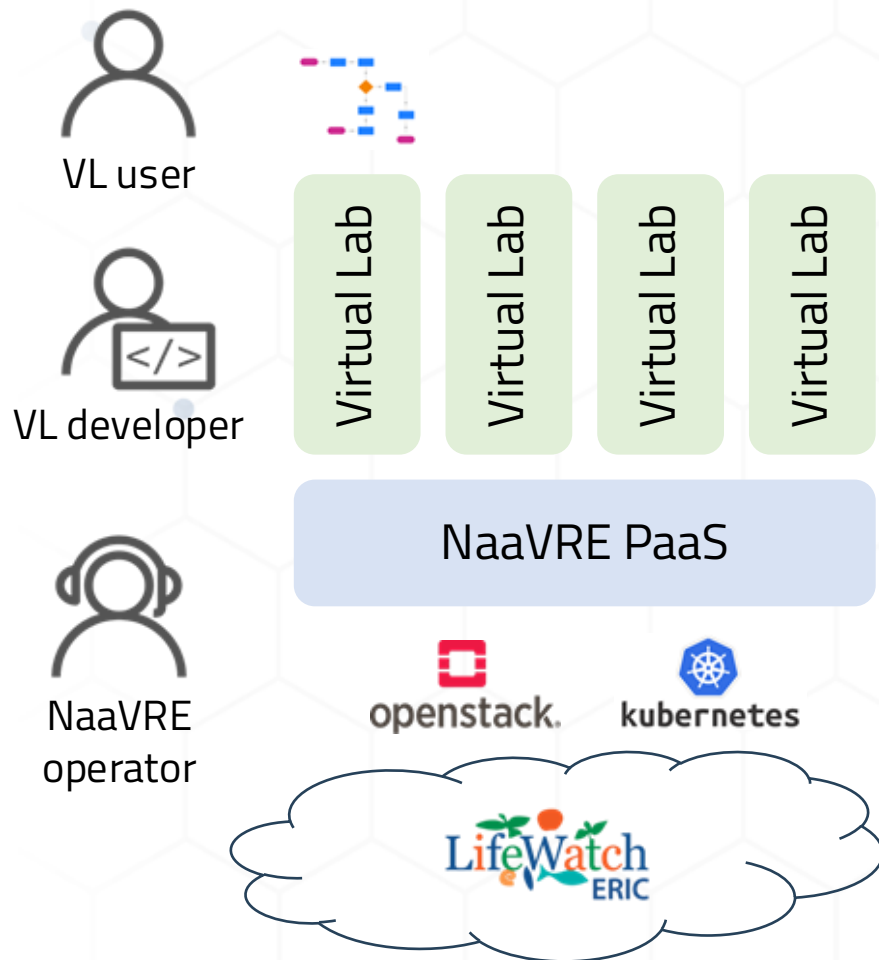
Learn, try, get in touch

2. Virtual lab co-development

Differentiate stakeholders into different roles



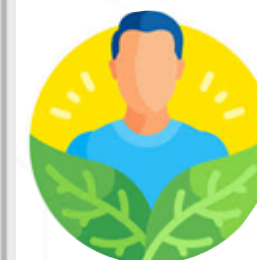
Co-development of Virtual Labs



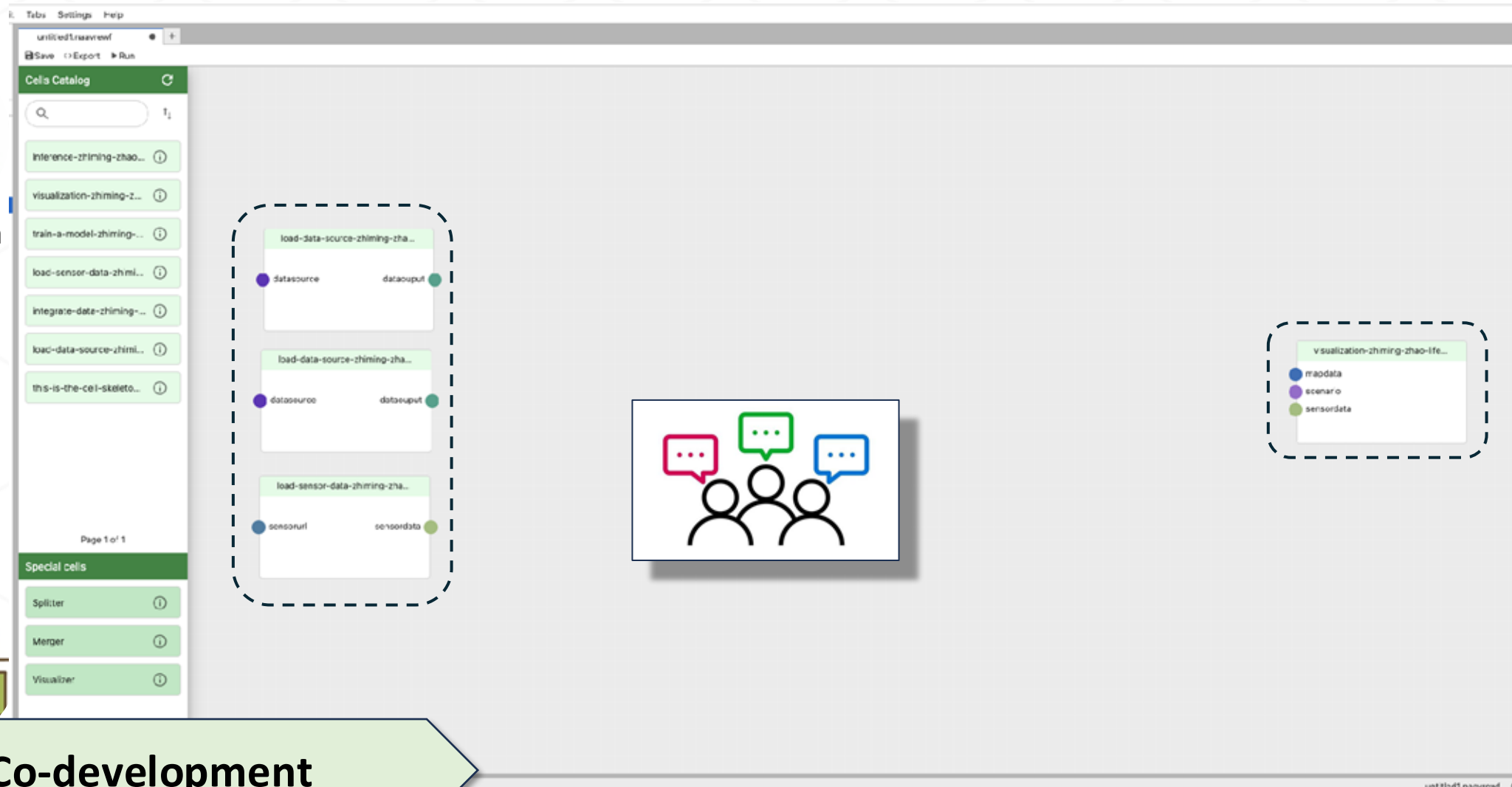
Co-Development approach



Research
software
engineer

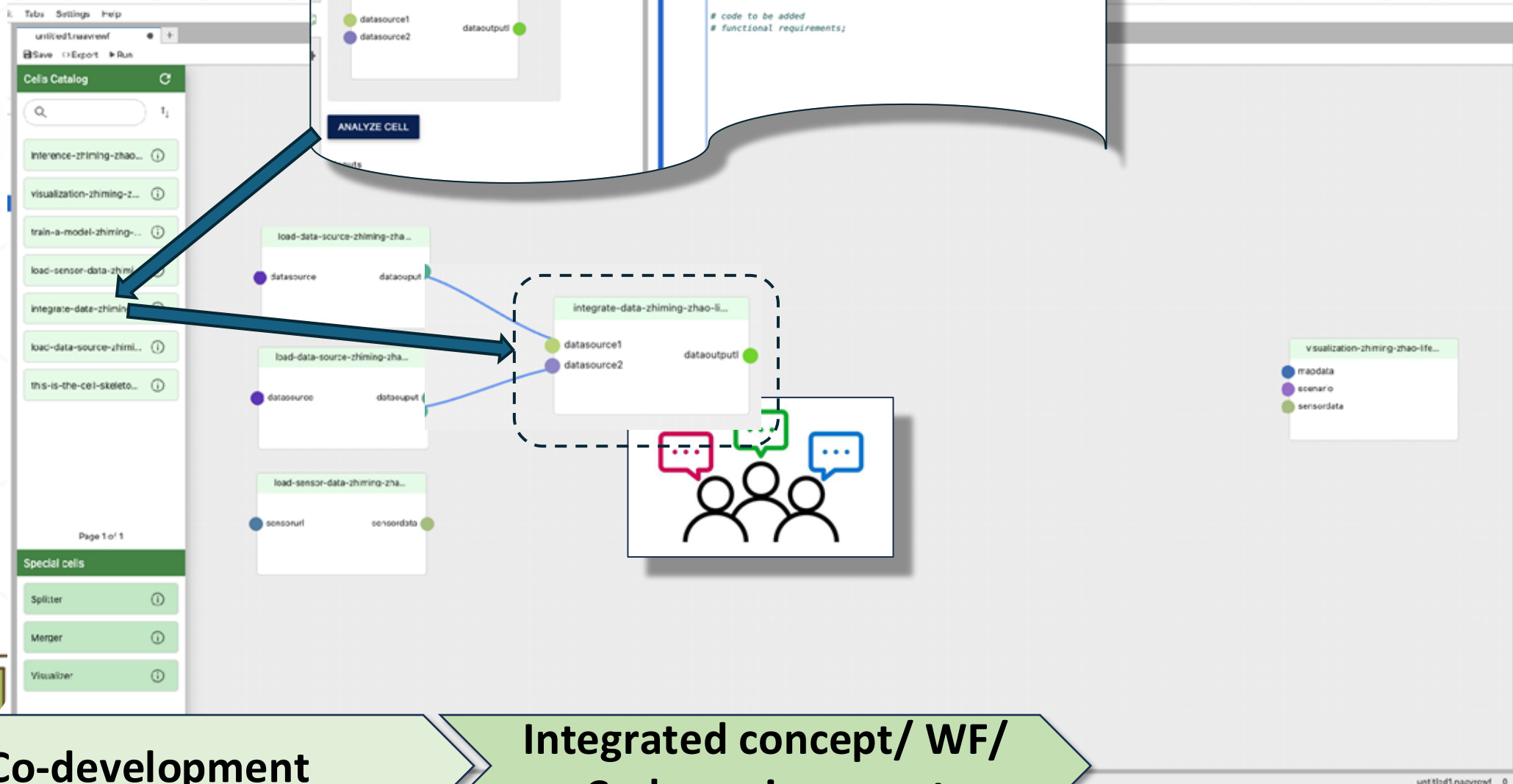
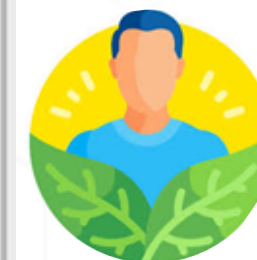


Domain
scientist



Co-development

Co-development



Co-development

Integrated concept/ WF/
Code environment

Co-Development approach

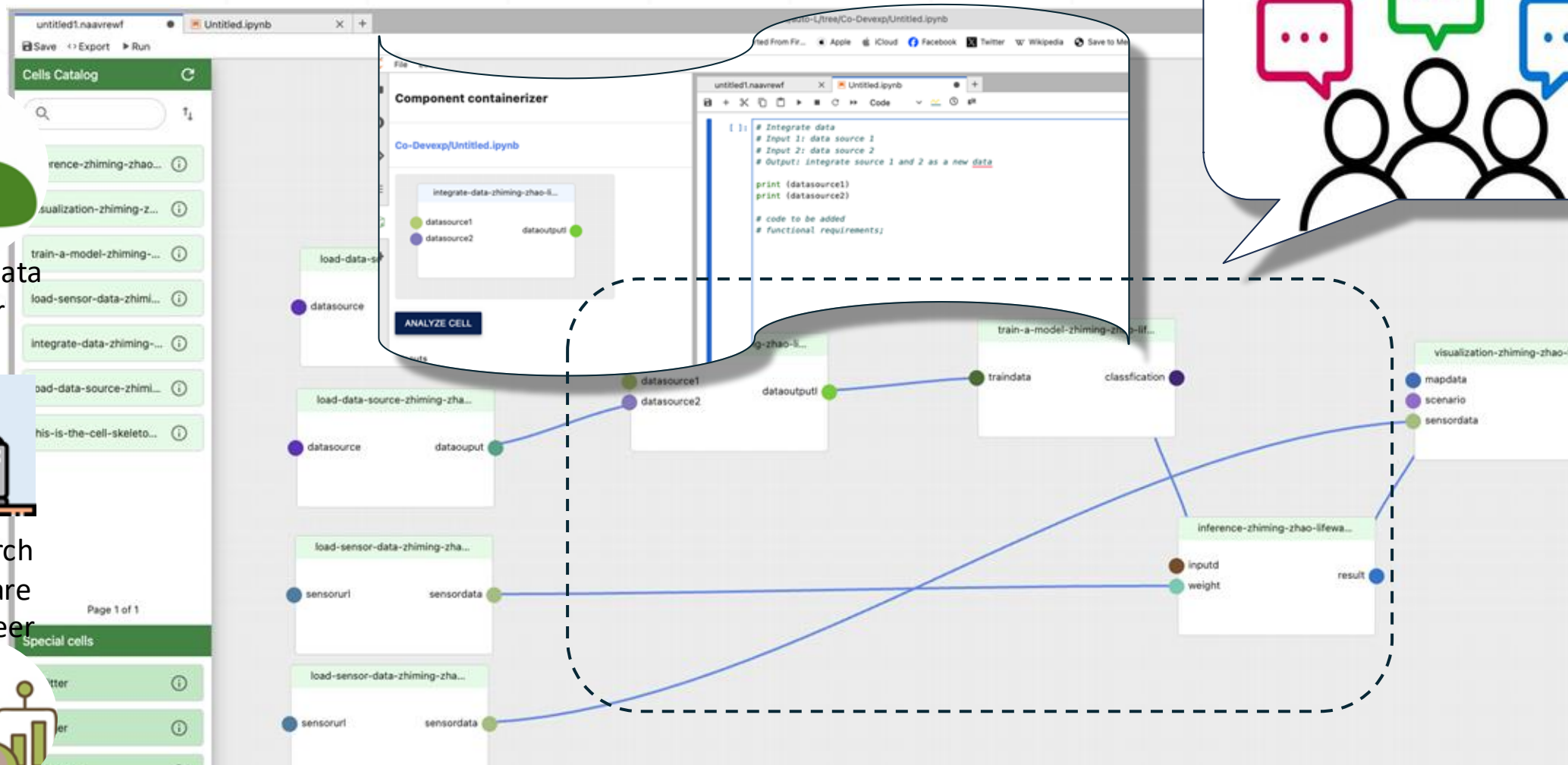
Research data provider



Research software engineer



Domain scientist



Co-development

Integrated concept/ WF/
Code environment

Iterative development

Co-Development approach



Research data
provider



Research
software
engineer



Domain
scientist

Projects overview

Assignees:

- Copilot: 1
- gpelouze: 572
- KoenGreuell: 191
- quanpan302: 48
- skoulouzis: 283
- No Assignees: 458

New (39)

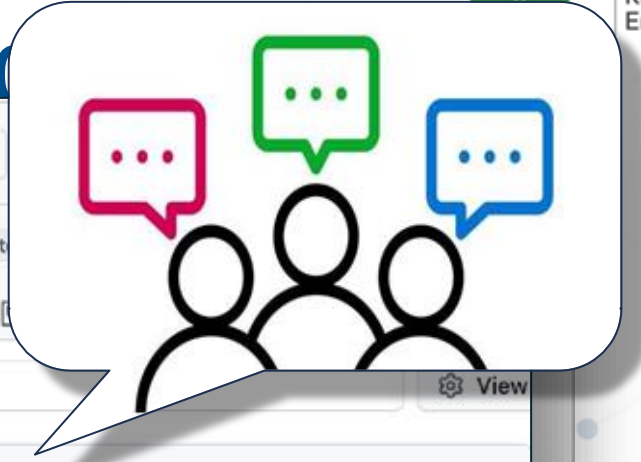
- projects_overview #582: Demo accounts (VL support, Note)
- projects_overview #326: Service requirements from ICT core (Infrastructure, Note)
- projects_overview #325: Laserfarm infrastructure from ICT-Core (Infrastructure, Note)
- projects_overview #92: NaaVRE terminology (NaaVRE, Note)

Backlog (139)

- NaaVRE-helm #251: Authentication sometimes fails on new minikube deployments (Low, NaaVRE, Bug)
- NaaVRE-containerizer-service #181: No outputs when analyzing cell with only a yaml header (Low, NaaVRE, Bug)
- NaaVRE #148: Run RStudio alongside Jupyter Lab (Low, NaaVRE)
- NaaVRE #142: Data access workflow components (Apr 1, 2026, Low, VL support)

Ready (41)

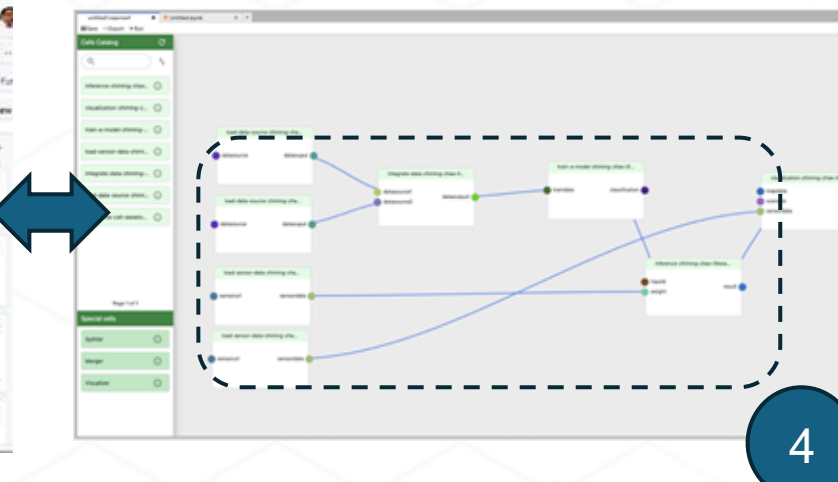
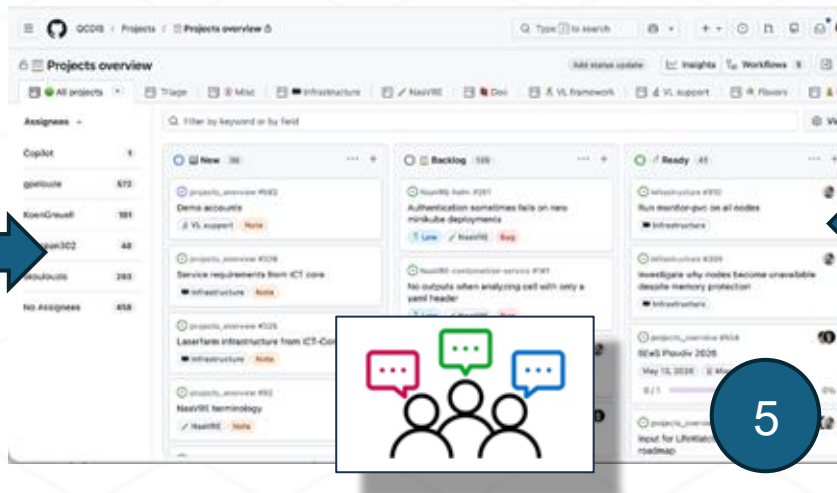
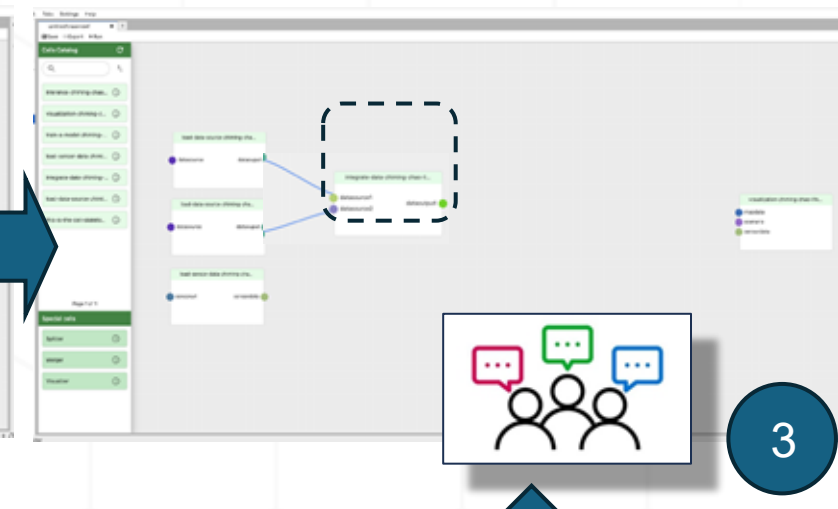
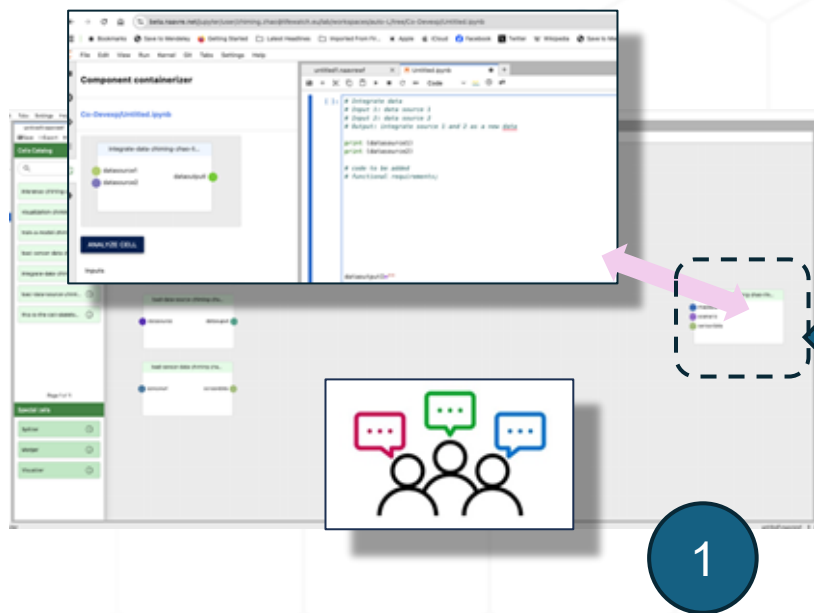
- infrastructure #310: Run monitor-pvc on all nodes (Infrastructure)
- infrastructure #309: Investigate why nodes become unavailable despite memory protection (Infrastructure)
- projects_overview #554: BEeS Plovdiv 2026 (May 13, 2026, Misc)
- projects_overview #580: Input for LifeWatch RO-crate integration roadmap



Co-development

Integrated concept / why
Code environment

Iterative development



3. Hands on



Activities

- Team up in groups of 3 people.
- Choose a subject
 - Create an ECV workflow
 - Create a weather radar data to aerial migration workflow
 - Create a LiDAR data to vegetation metrics workflow
 - Pick a subject relevant to your own field



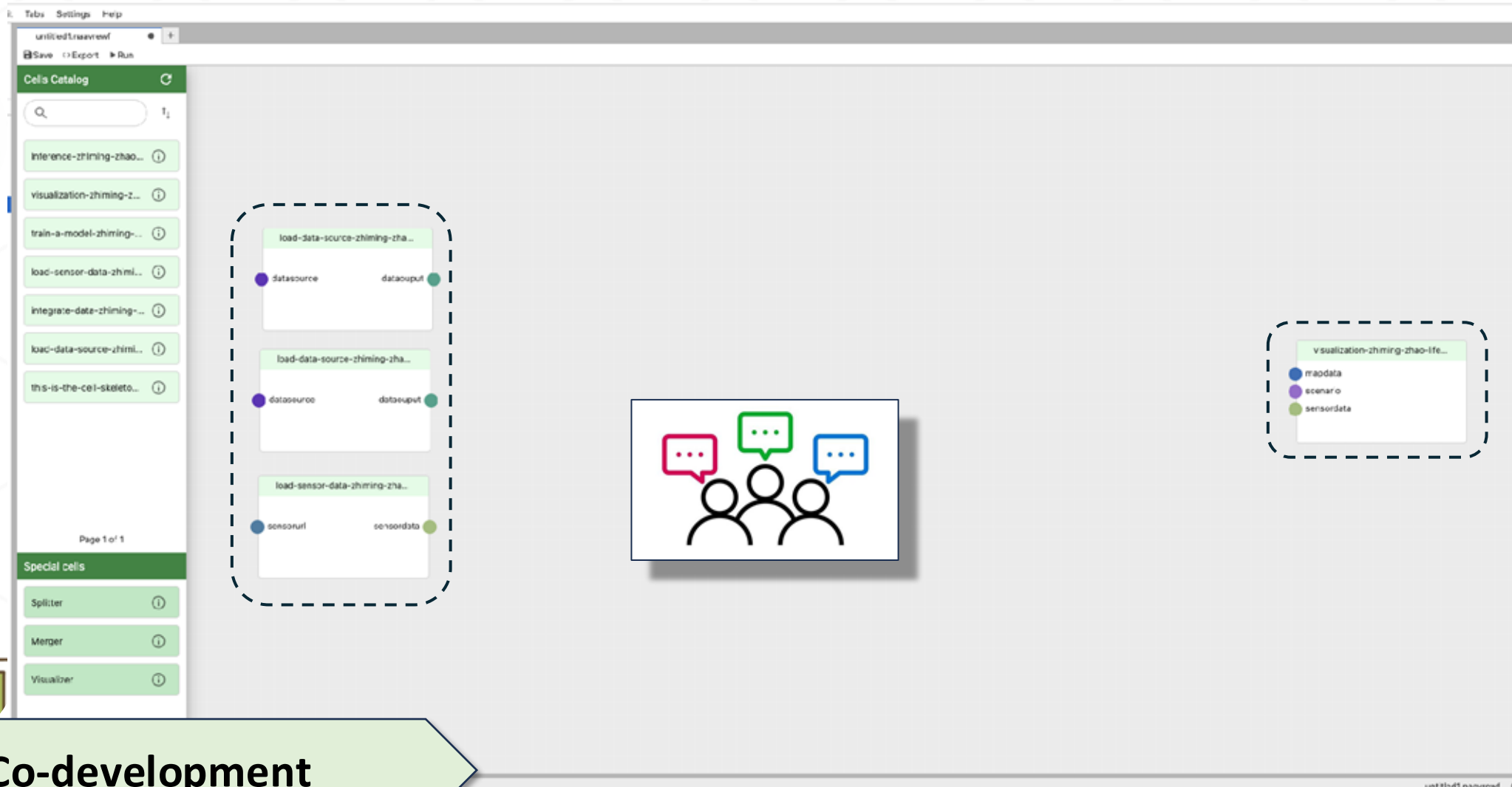
Research data
provider



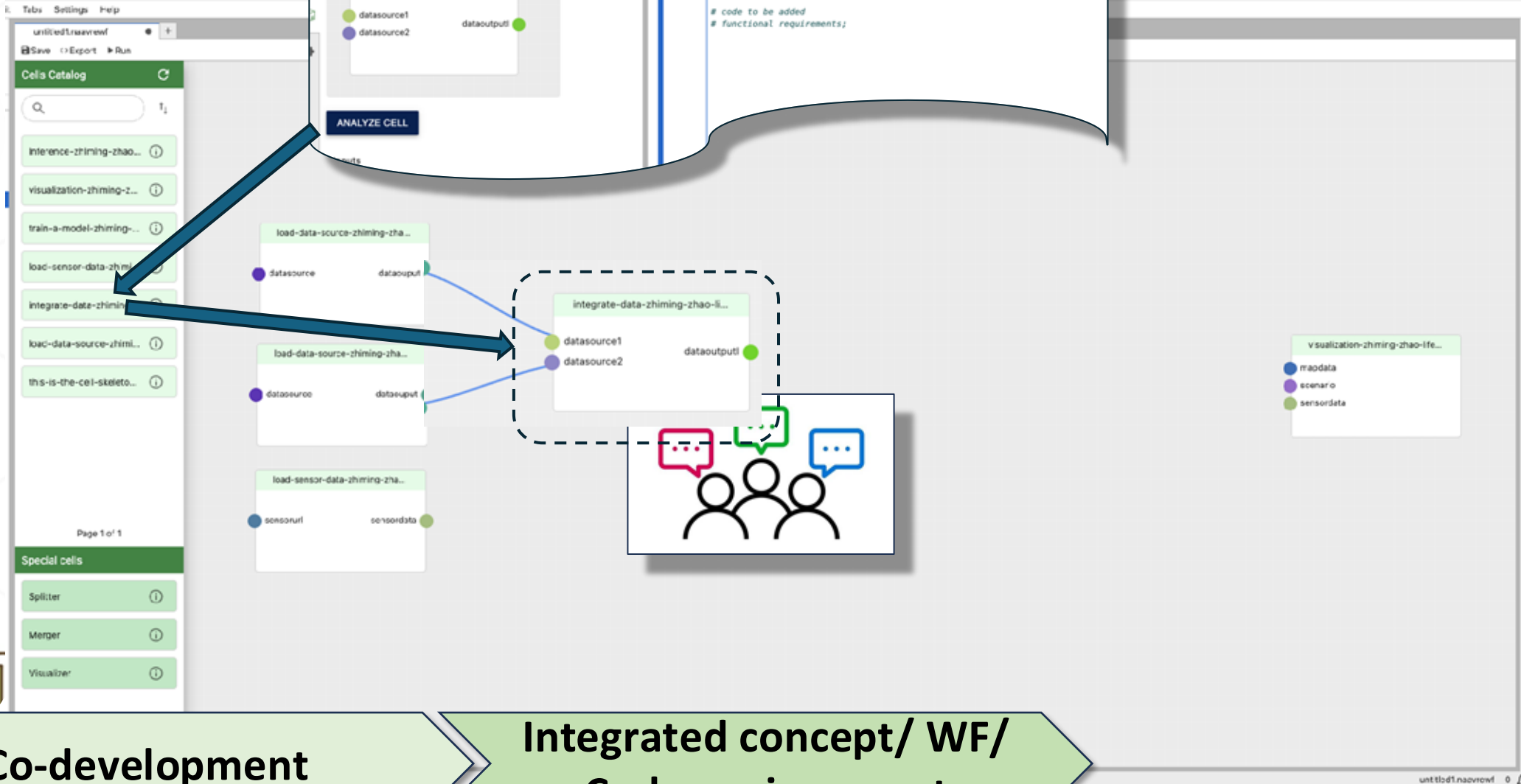
Research
software
engineer



Domain
scientist



Co-development



Co-development

Integrated concept/ WF/
Code environment

Group action 3



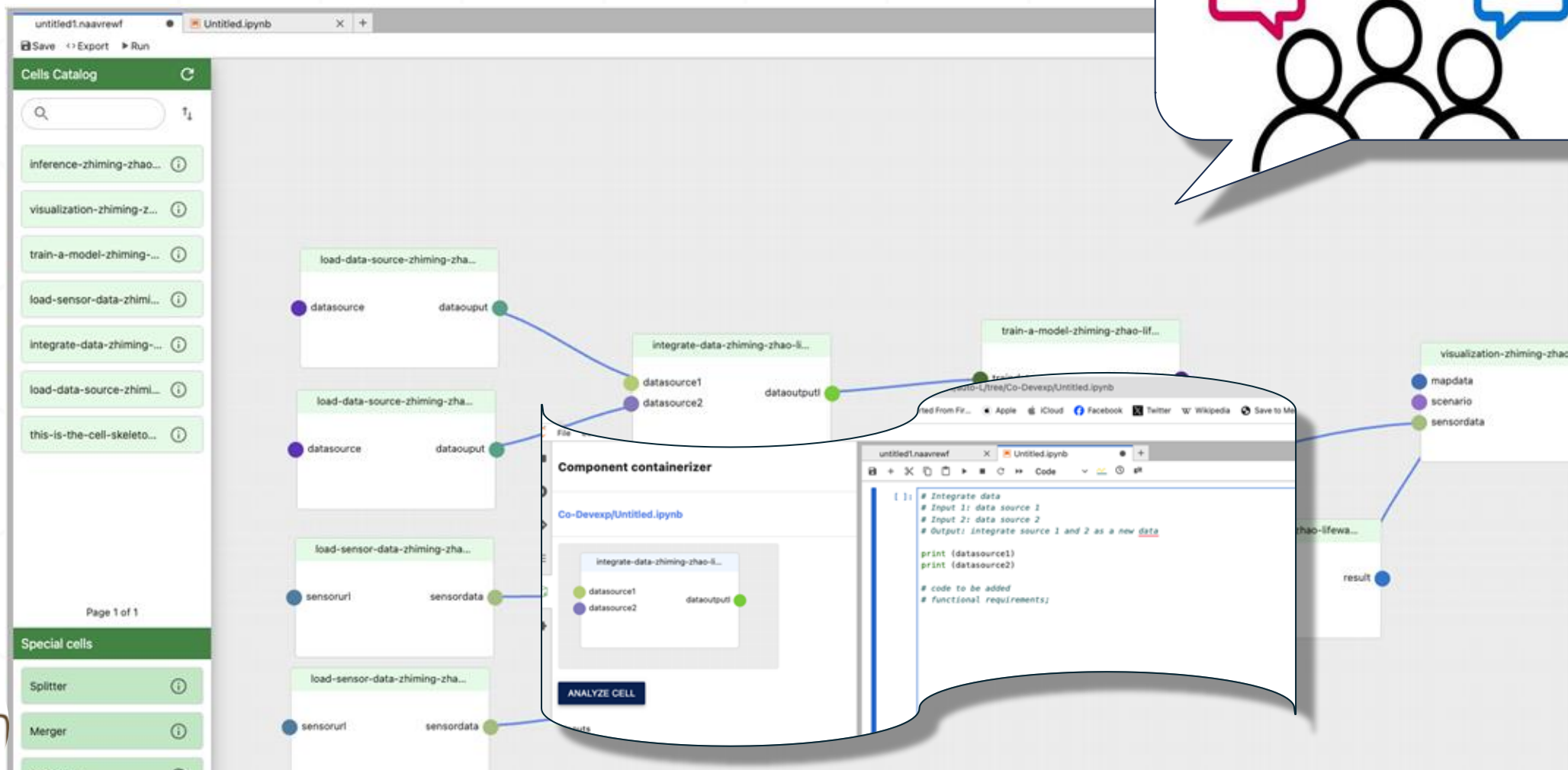
Notebook as a
Virtual
Research
Environment



Research
software
engineer



Domain
scientist



Co-development

Integrated concept/ WF/
Code environment

Iterative development

The screenshot shows the Nautilus Notebook website. At the top, there's a navigation bar with links like 'Home', 'About', 'Login as Existing User', and 'Sign Up'. Below the navigation bar, there's a header section with the Nautilus Notebook logo and a brief description: 'We have simplified the sharing of notebook files, workflow components, and workflow files. Check out the [Nautilus Notebook documentation](#) to learn more.' There are also links for 'Full documentation on how to use Nautilus Notebook' and 'Documentation'.

The main content area is divided into two sections: 'Powerful virtual labs' and 'All virtual labs'. The 'Powerful virtual labs' section features three cards: 'Nautilus Super Lab', 'Developer/Domain Scientist Virtual Lab', and 'Super quality'. The 'All virtual labs' section features a grid of cards: 'Adaptive Lab Learning Test Individualization Virtual Lab', 'MERS', 'Risk factor Planning Virtual Lab', 'Community Time Series Analysis from European Marine Ecosystems Virtual Lab', 'BioP4 Vaccination', and 'Q&A Services'.



How to access the Virtual Lab

beta.naavre.net/vreapp

LifeWatch ERIC

Home
About

Logged in as Thimma Thapa
[Logout]

NaaVRE: Notebook as a Virtual Research Environment

We have simplified the sharing of notebook files, workflow components, and workflow files. Check out [the assets catalogue documentation on naavre.net](#).

If you encounter an issue or need help with anything, [get in touch](#) or submit a bug report on [GitHub](#).

[Documentation](#)

Pinned virtual labs

NaaVRE Tutorial

NaaVRE Open Lab

Open experimentation with virtual labs

ECVs

Essential Climate Variables Virtual Lab

A virtual lab to access ECVs. The workflows in the VLab were developed by ENVRI-Hub-NEXT project.

Experimental features

Jupyter quality

An interactive, lifecycle-aware quality assessment tool for research software developed in Jupyter Notebooks.

All virtual labs

Search...

ANERIS ECVs Experimental features LTER-LIFE Marco-Bolo NaaVRE Tutorial Tutorial

ANERIS

Airborne Laser Scanning Tree Individualization Virtual Lab

Identifying individual trees from airborne laser scanning data

ANERIS

ANERIS

A virtual lab to access ANERIS.

Experimental features

BGIs Urban Planning Virtual Lab

Migrating a legacy urban planning application into a reusable Cloud Virtual Lab.

Tutorial

Marco-Bolo

Biodiversity Time Series Analyses from European Marine Ecosystems Virtual Lab

BioDT Hackathon

CHIR Biomass

LifeWatch ERIC

Essential Climate Variables Virtual Lab

A virtual lab to access ECVs. This is a contribution to the European Union Horizon 2020 project.

The primary objective of the ECVs VLab is to offer reusable components that enable users to support research activities, access ECVs and develop personal specific workflows.

The current version of the ECVs VLab program from the ENVRI-Hub project, which serves as a central gateway to environmental data and services provided by European environmental research infrastructures. The tool enables researchers to access and process data from various sources, making it easy to use for researchers and environmental managers.

Search ECVs and related services

Instances

Assets

About ECVs

An Essential Climate Variable (ECV) is a physical, chemical or biological variable or a group of related variables that contribute to the understanding of Earth system. Major climate observing system (MOS) currently open for ECVs. Several ECVs are currently available in the ECVs VLab.

How to access the Virtual Lab

beta.naavre.net/vresapp/vj/ecvs

LifeWatch ERIC

Home
About

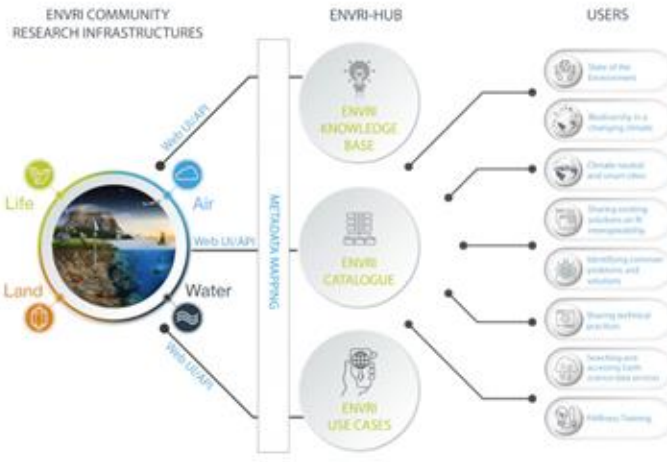
Logged in as Zhiming Zhao
[Logout]

Essential Climate Variables Virtual Lab

A virtual lab to access ECVs. The workflows in the VLab were developed by ENVRI-Hub-NEXT project.

The primary objective of the ECVs VLab is to offer reusable components that enable users to support research activities, access ECVs, and develop domain-specific workflows.

The concept behind ECVs VLab originates from the [ENVRI-Hub](#) project, which serves as a central gateway to environmental data and services provided by European environmental research infrastructures. The hub delivers interoperable data across Earth system disciplines, making it readily accessible and easy to use for interdisciplinary environmental research.



About ECVs

An Essential Climate Variable (ECV) is a physical, chemical or biological variable or a group of linked variables that critically contributes to the characterization of Earth's climate. Global Climate Observing System (GCOS) currently specifies 55 ECVs. Current ECV requirements according to the 2022 GCOS ECV Requirements (GCOS-245).

Instances

10 instances

Pelouze Greuell Hengveld Greuell Zhao Pan Mellado Islam Greuell Guerrero

☐ Hide my instance from this list

Start Virtual Lab Start Workshop

Assets

Workflow runs Data Products Geographic data products

0 workflow runs

beta.naavre.net/vresapp/vj/ecvs

LifeWatch ERIC

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About

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[Logout]

Harnessing the ENVRI-Hub: data, tools, and services for interdisciplinary research

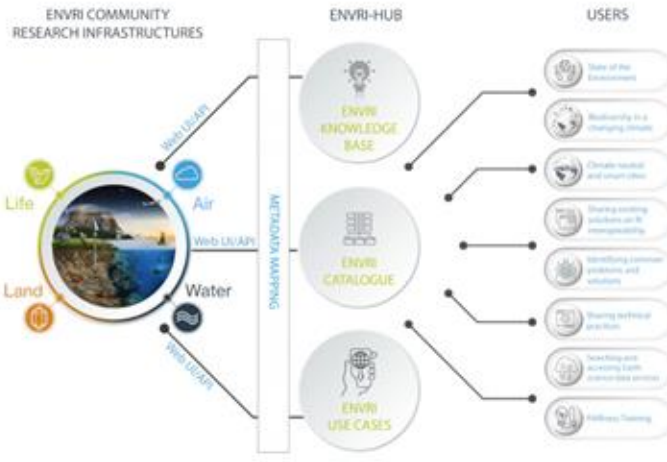
Part 1

Start the first part of the training session in [envri-hub](#).

Once finished with steps, continue the short course in [step 1](#), [step 2](#) and [step 3](#).

Part 2

The second part of the training session begins on page and paper. Once a third step exists on physical paper, it will be printed to [helpful](#) using the instructions in [Co-design of a virtual lab](#).



4. Feedback



Your feedback



menti.com
1306 0826



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PLOVDIV, BULGARIA

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THANK YOU!

Questions?

vlc@lifewatch.eu

