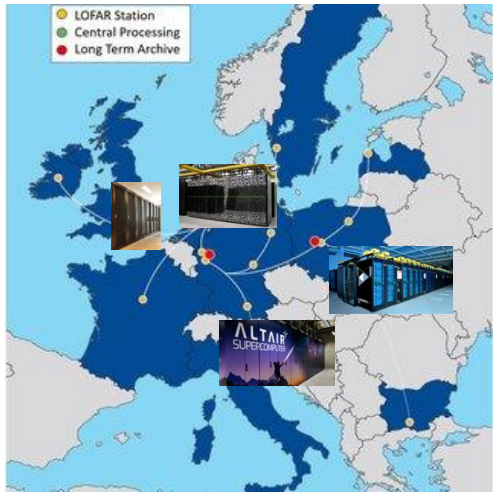
Programmable orchestration with BRANE in the EPI project

BRANE



https://enablingpersonalizedinterventions.nl

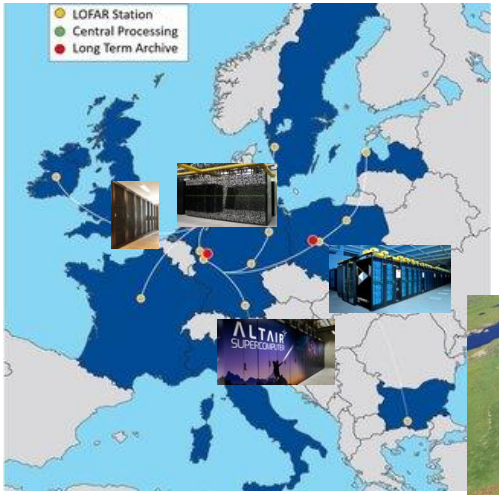
PROCESS

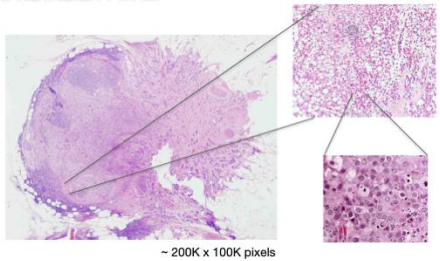
https://www.process-project.eu

BRANE ...

2018-2021: Brane framework

A distributed infrastructure for building **Exascale** Applications.





A framework for Orchestrating Applications & Networking

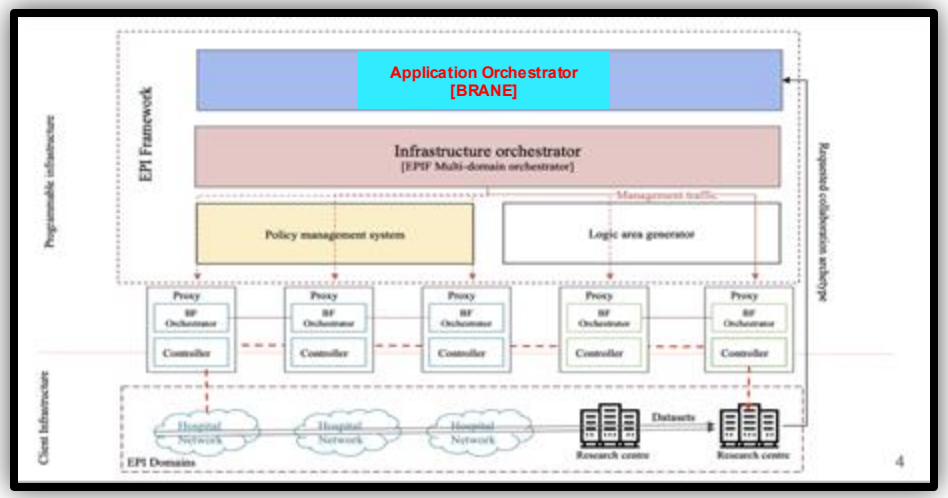
Documentation https://wiki.enablingpersonalizedinterventions.nl
GitHub Repository https://github.com/epi-project/brane

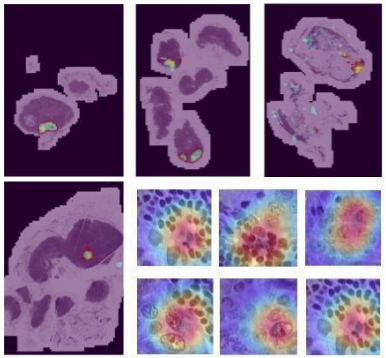
.... in EPI

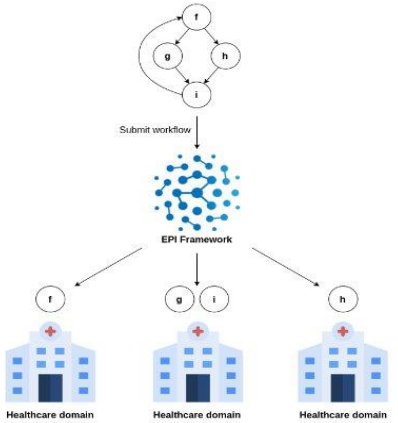
2021-2023: EPI- platform

Framework for **secure** data exchange across organizations.

EPI Framework





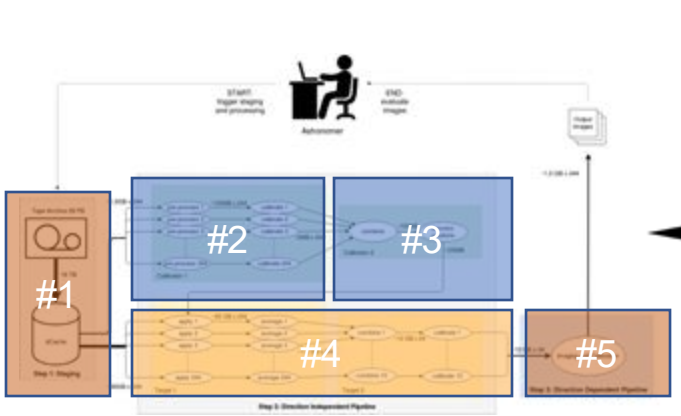


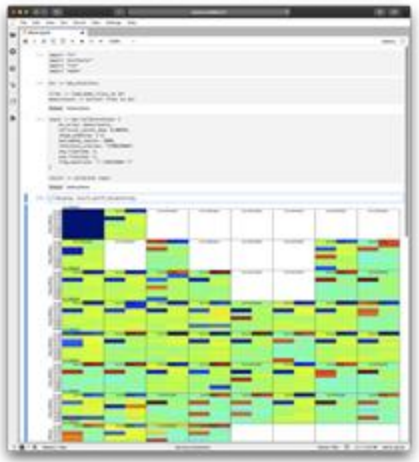
Slide courtesy of **J. El-kassem** (EPI consortium meeting, 22 April 2021).
https://enablingpersonalizedinterventions.nl/2021-04-22/index.html

BRANE a collaborative environment

https://www.process-project.eu

Brane aims to **simplify** and **streamline** the development and deployment of complex scientific applications, by enabling cross-disciplines collaboration.





HPC

Cloud

1) Engineers (system/software): prepare building blocks

2) Scientists: compose applications

3) BRANE deploys anywhere

Spreeuw, H., Madougou, S., Van Haren, R., Weel, B., Belloum, A., & Maassen, J. (2019, September). Unlocking the LOFAR LTA. In *2019 15th International Conference on eScience (eScience)* (pp. 467-470). IEEE.

BRANE Architecture / Programming model

1) Engineers: prepare building blocks

2) Scientists: compose applications

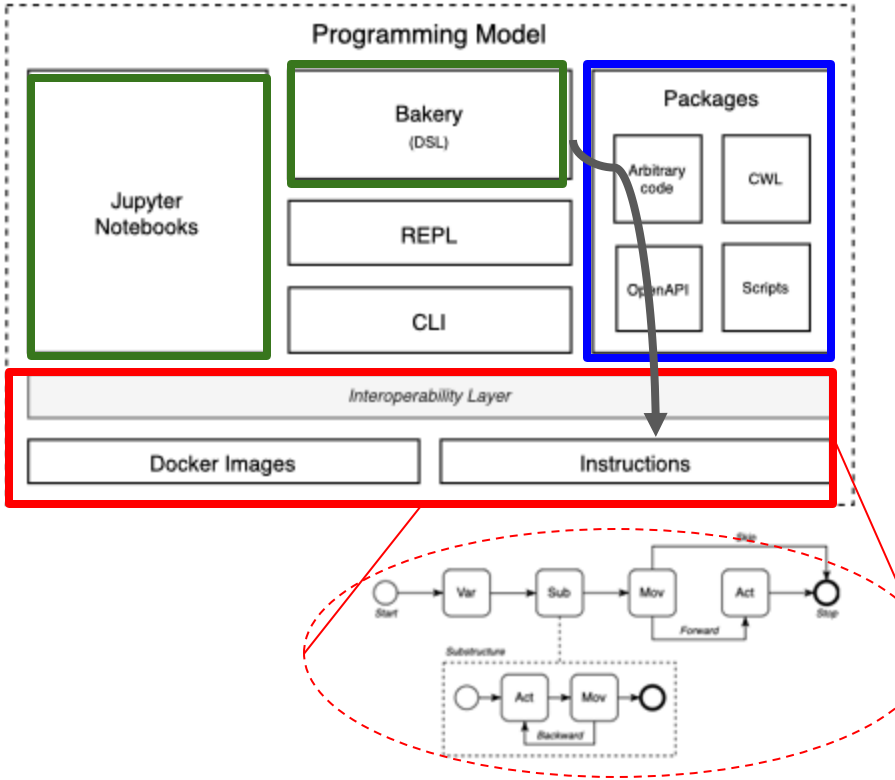
3) Deploy anywhere

BRANE Architecture / Programming model

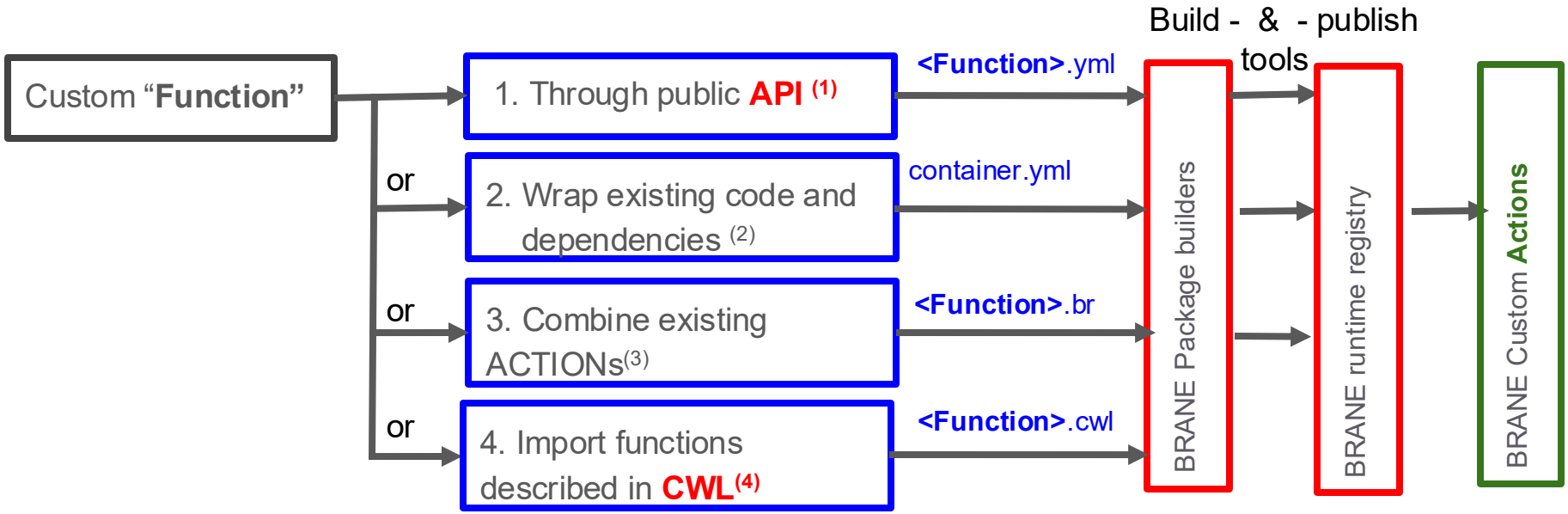
BRANE runtime system has a minimal set of functionalities.

BUT It can be, programmatically, adapted to a given application specific requirements **by adding**

- **custom functions** (ACTIONs) are added to the runtime system's registry as (Packages).
- **Data processing pipeline** are constructed using these custom functions using (Bakery DSL)



Adding new functionalities to **BRANE**

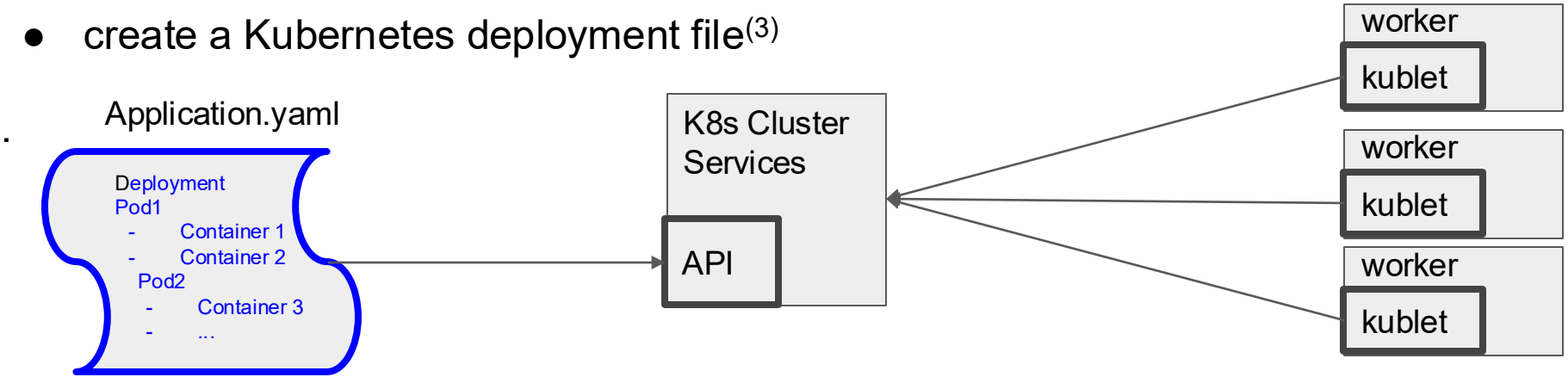


(1) describe the endpoint(s) using the OpenAPI specification, and let BRANE generate the desired function(s) for you (http://spec.openapis.org/oas/v3.0.3)
(2) Wrap existing code in containers, let BRANE generate package and expose them as ACTIONS for you BRANE's ECU specification
(3) Combine multiple ACTIONs create a pipeline Bakery DSL for application developers (https://onnovalkering.github.io/brane/bakery)
(4) https://www.commonwl.org/v1.1/

Infrastructure – Local and Distributed

BRANE can deploy application containers on single host (**Docker Compose** [1]) on geographically distributed computing resources using **Kubernetes**[2]

- a running Kubernetes cluster
- create a Kubernetes deployment file[3]



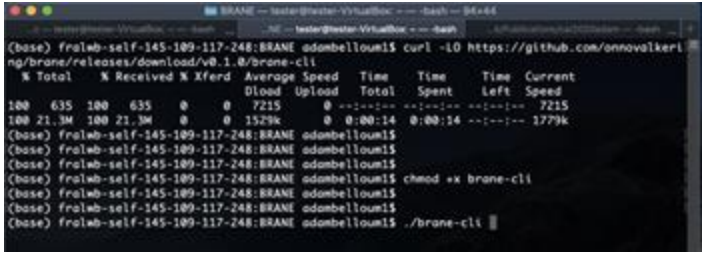
(1) https://docs.docker.com/compose/
(2) https://kubernetes.io/docs/home/
(3) https://kubernetes.io/docs/tutorials/kubernetes-basics/deploy-app/deploy-intro/

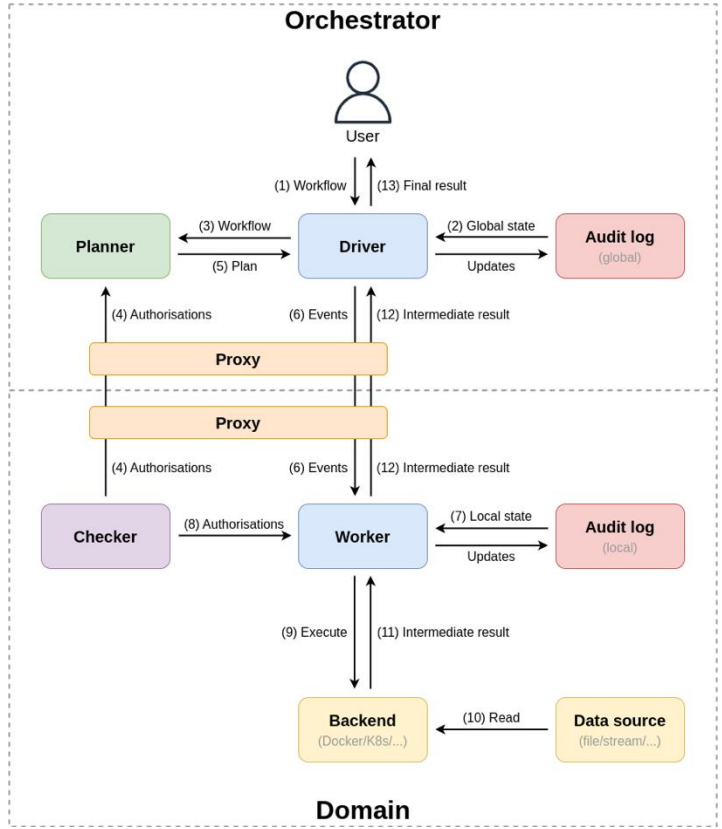
BRANE user interfaces-

Jupyter notebook [domain expert]

Gui [Data policy manager (data Steward**]**

CLI [Software engineer/system Admi]





https://wiki.enablingpersonalizedinterventions.nl/specification/implementation/bird_eye.html

BRANE DSL: Bakery

Key elements of Bakery Domain Specific Language(1)

- Bakery support: **variables**, **loops** and **function calls**
- Bakery statements are specified using a **pre-/in-/postfix** notation(2)

ACTIONS(3): elementary building blocks

⇒ Syntax: **Variable := ACTION [parameter]**

(1) - named as a tribute to Cookery DSL which inspired the language.

(2) - https://onnovalkering.github.io/brane/references/bakery.htm / https://github.com/onnovalkering/brane/tree/master/brane-dsl

(3) - ACTIONS are domain specific containerised programmers, that can be used to process the data at hand

BRANE in a nutshell

https://www.process-project.eu

Brane demo:
https://youtu.be/sUtKURs92aM

- Brane aims … loyment of complex sci… s.

LOFAR calibration pipeline in the **Bakery** DSL:

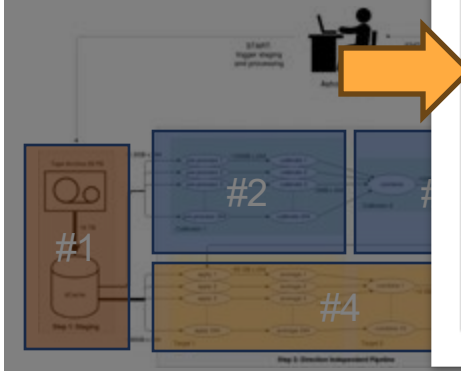
```
// Brings the relevant functions into scope
import filesystem, lofar-lta, prefactor;

// ID of the LOFAR observation is the input
observation := 246403;
directory := new_directory;

// Files are staged from tape drives to a cache (remote)
staging := stage observation files;
wait until staging status = "success";

archives := download observation files to directory
measuresets := extract archives to directory;

skymap := calibrate measuresets;
return skymap; // The sky map is the output
```



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BRANE

A framework for Orchestrating Applications & Networking

- Contact: A.S.Z.Belloum@uva.nl
- Documentation https://wiki.enablingpersonalizedinterventions.nl
- GitHub Repository https://github.com/epi-project/brane
- **BRANE** tutorials: https://wiki.enablingpersonalizedinterventions.nl/tutorials