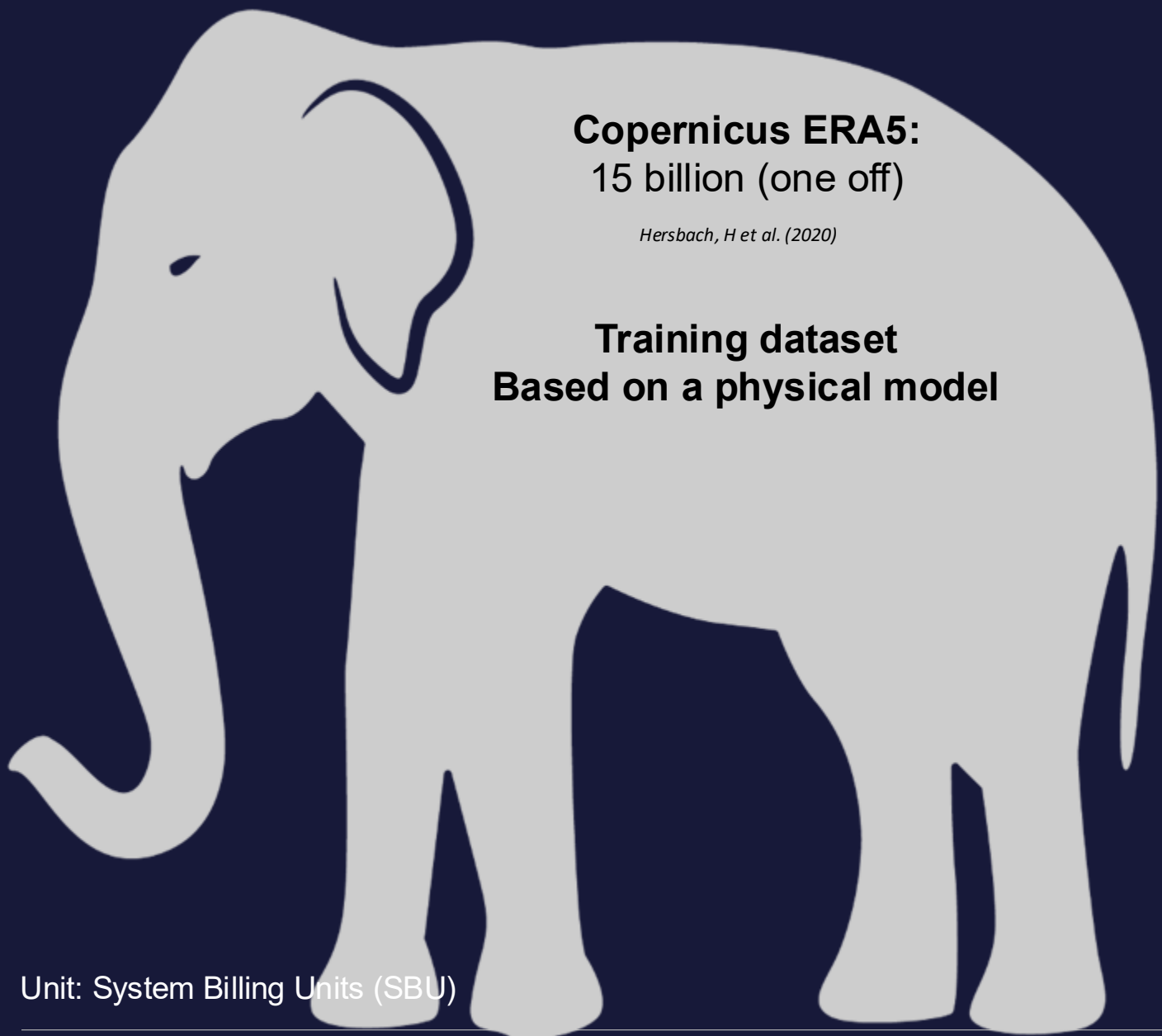# Forecast-In-A-Box

Leveraging EWC to run on-demand data-driven weather forecasts

European Weather Cloud (EWC) User Workshop 2025

Harrison Cook*, Vojtech Tuma, Corentin Carton de Wiart,
James Hawkes, Tiago Quintino, Ana Prieto Nemesio,
Matthew Chantry

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Destination Earth

ECMWF

Copernicus ERA5:
15 billion (one off)

Hersbach, H et al. (2020)

Training dataset
Based on a physical model

Physics-based Forecast:
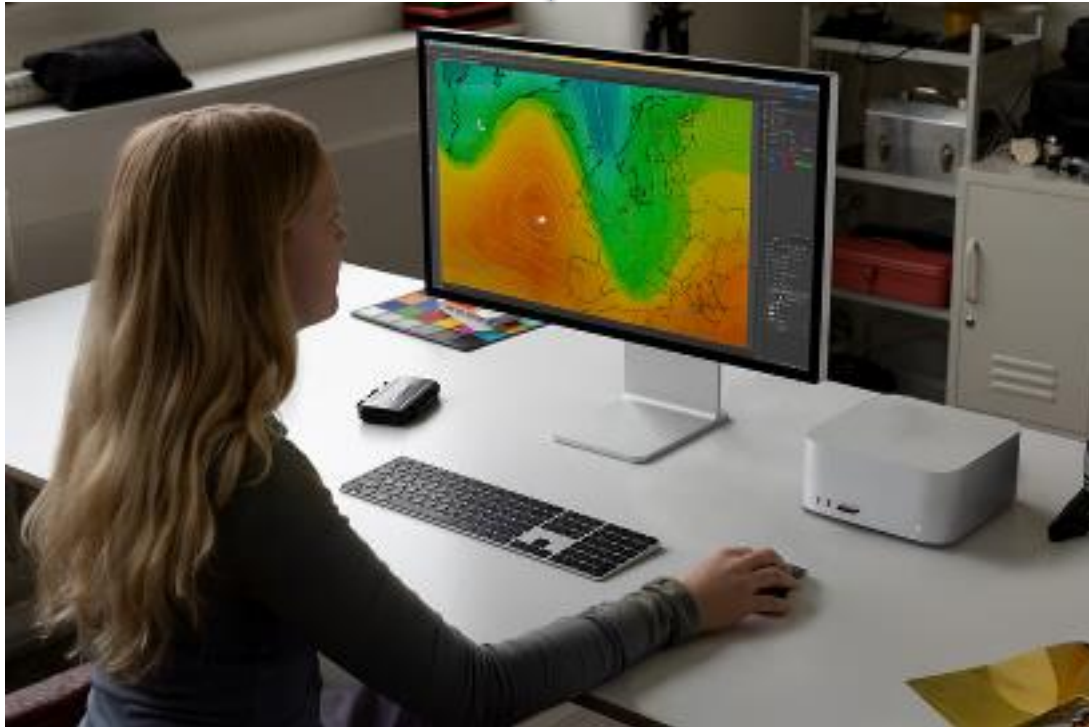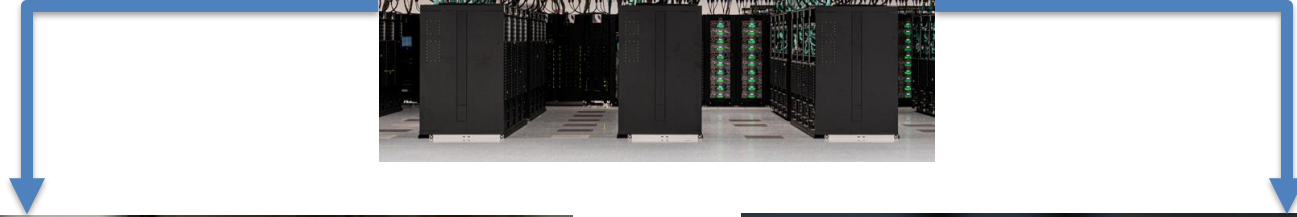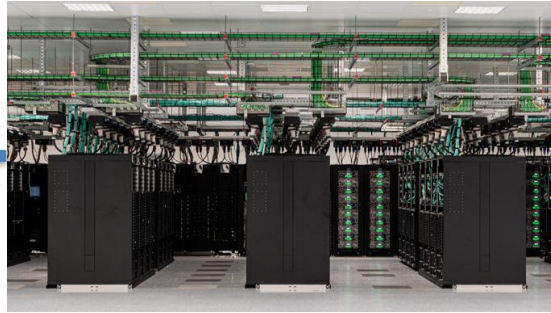180 000
per forecast

AI Model:
0.3
per forecast

~1000x
reduction in
energy
Forecast time
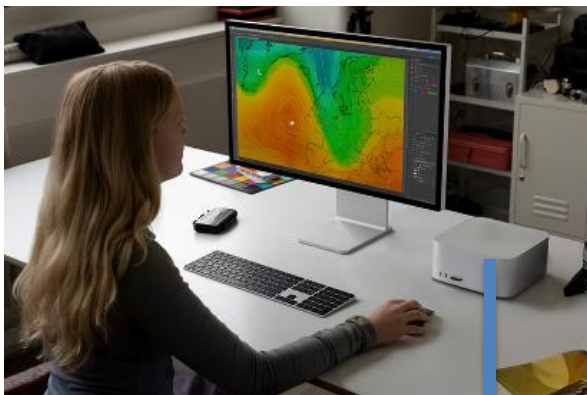reduced from
~30minutes to
~3minutes

Unit: System Billing Units (SBU)

From Supercomputer to Super Convenient!

Forecast-in-a-Box: a Forecasting System on your Desk

New Paradigm:

Instead of shipping huge forecast data, we can

send the model instead

Give them the *"box"* that makes the data

earthkit

anemoi

Forecast-In-A-Box – What is it?

- **Forecast, not only Model**
  - Includes all the the product generation and processing capabilities
  - Includes catalogue of outputs and products
  - Visualisation of graphical products

- **Packaged in a 'Box'**
  - Easy to Install, Run and Use
  - Hardware agnostic - "Whatever works for you …"
  - Workflow designed to work on resource constrained environments

Forecast-In-A-Box – What is it?

- **Product Driven**
  - Focus on what products are needed for the usecase
  - Work backwards from the users request the workflow graph
  - Execute in the environment provided by the user

- **Customise**
  - The box contains the knowledge of how to make the products
  - Just produce what you need
  - Change or tweak the model, and even the number of ensembles

Forecast-In-A-Box – "What's in the box?"

- **UI + Catalogue**
  - Provides control to the user, whilst keeping it accessible
  - Web Interface

Forecast-In-A-Box – "What's in the box?"

- **Task Definitions**
  - Constructed from Anemoi and Earthkit functions

UI

Fetch Initial Conditions

Compute statistics

Regrid and Interpolate

Transform outputs

anemoi

earthkit

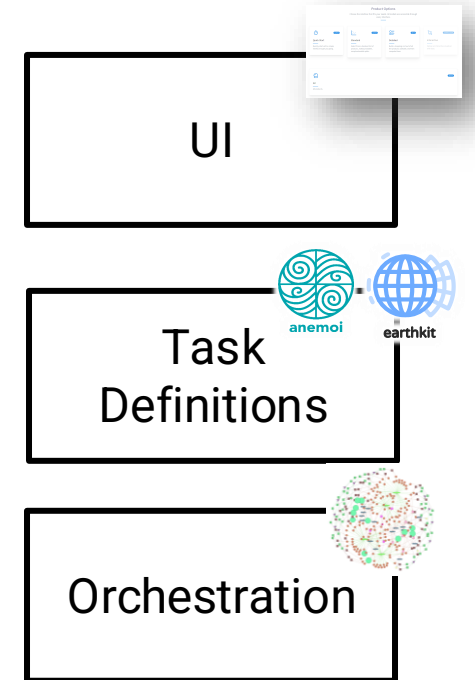Execute ML model

Visualise

Forecast-In-A-Box – "What's in the box?"

- **Orchestration**
  - Task graph construction and scheduling

UI

Task Definitions
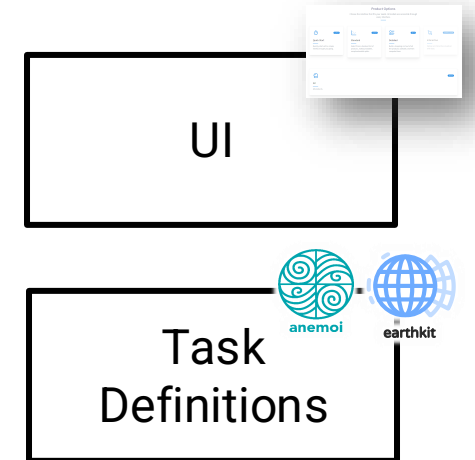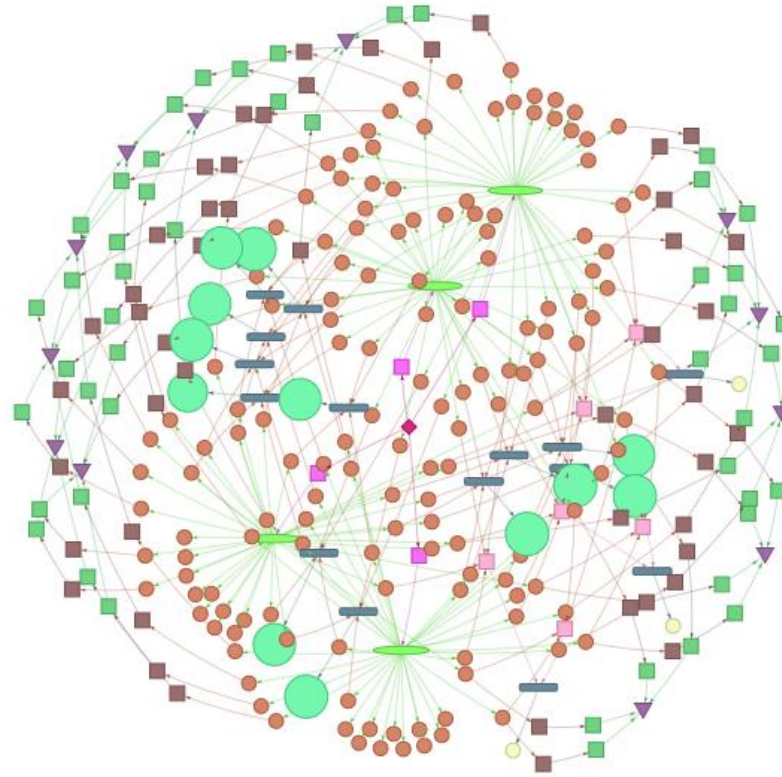
- **Execution Layer**
  - Executes the task graph
  - Hardware agnostic
  - Heterogenous execution environment

UI

Task Definitions

Orchestration

Forecast-In-A-Box – "What's in the box?"

- **Putting it all together**

  – A complete forecasting system

  – Capable of running any Anemoi inference model

  – Runs ECMWF's full operational product and post processing software

  – Provides ECMWF production quality graph and plotting software

UI

Task Definitions

Orchestration

Execution

Forecast-In-A-Box – "What's in the box?"

- Can be deployed in many ways…

Everything Local

Execution

Orchestration

Task
Definitions

UI
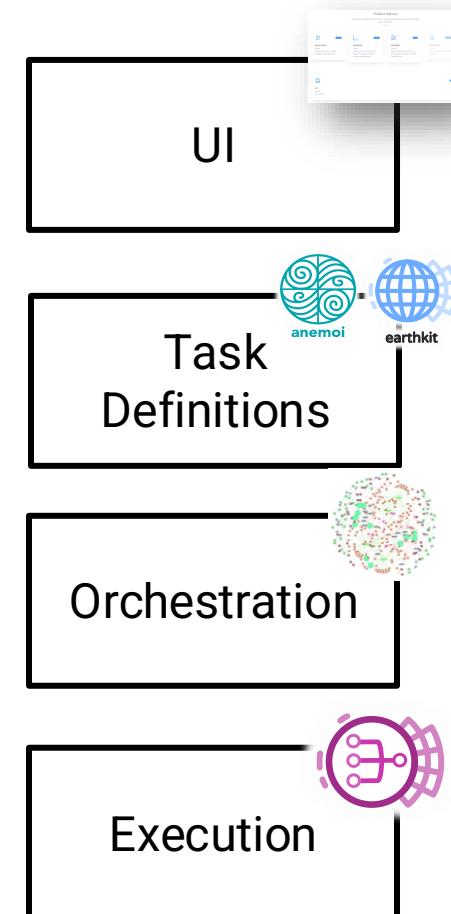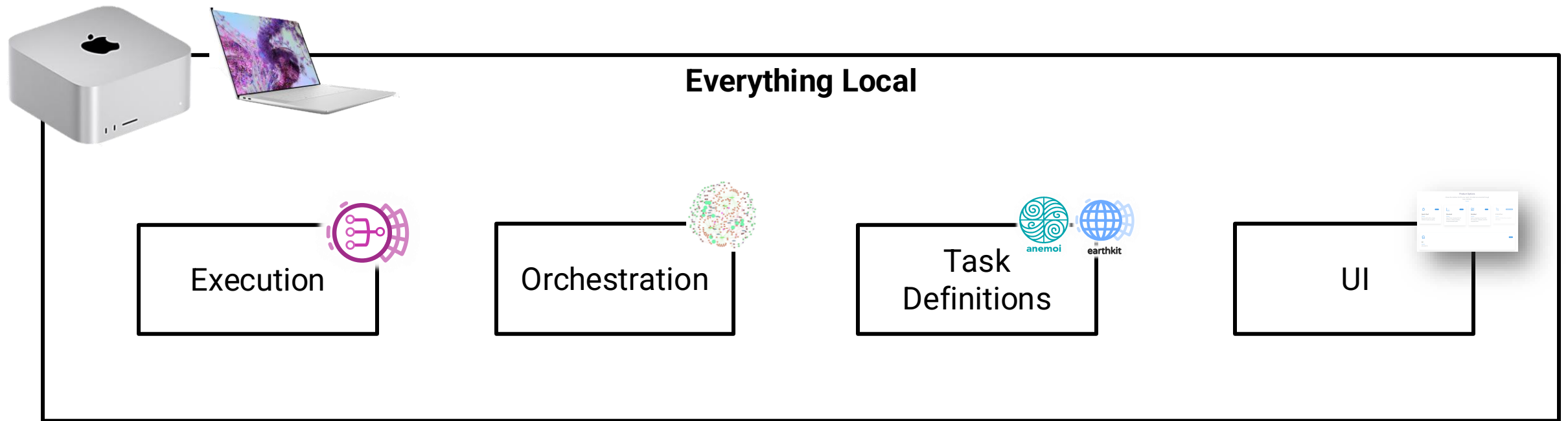
Forecast-In-A-Box – "What's in the box?"

- Can be deployed in many ways…

Forecast-In-A-Box – "What's in the box?"
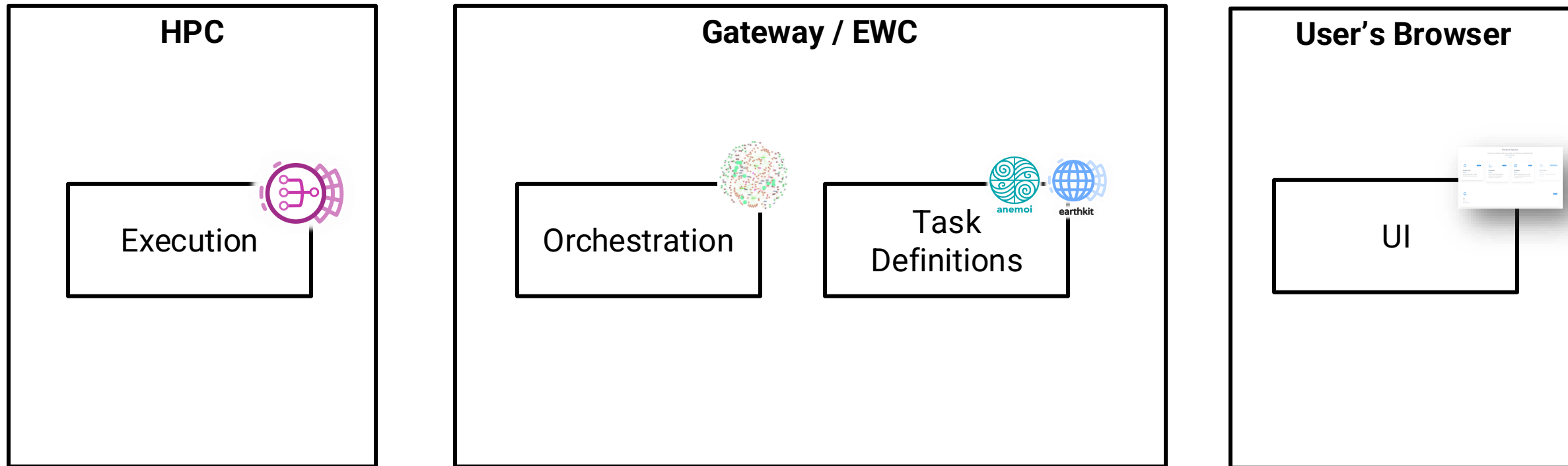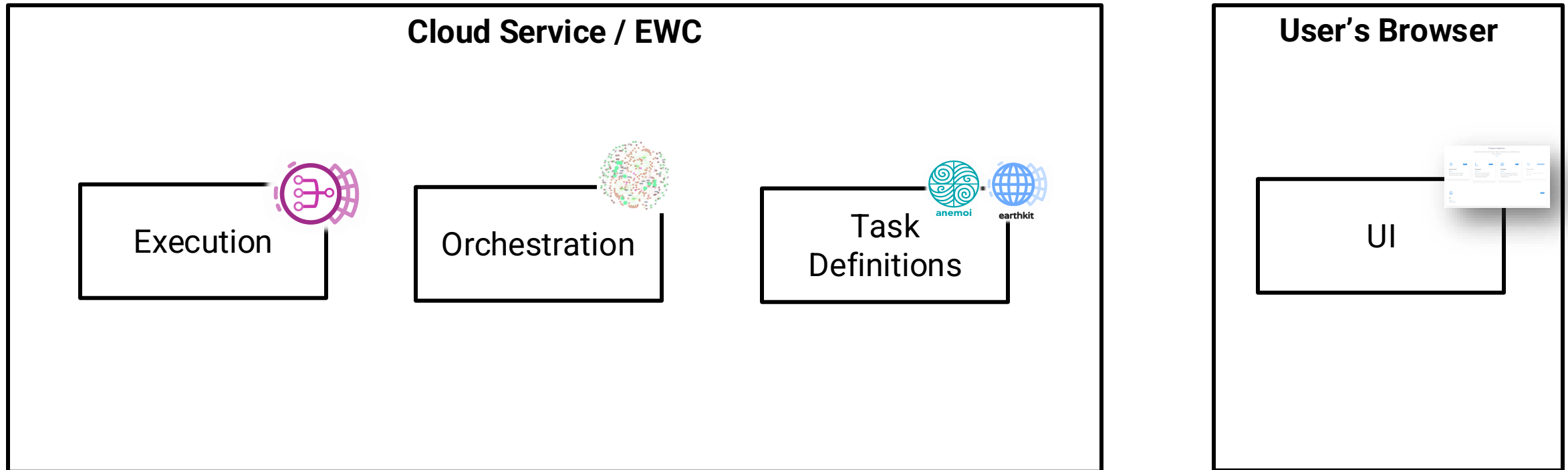
- Can be deployed in many ways…

Cloud Service / EWC

Execution

Orchestration

Task Definitions

anemoi · earthkit

User's Browser

UI

Forecast-In-A-Box – Implementation on EWC

Forecast-In-A-Box – Implementation on EWC - Current

- Benefits
  - Collocated with ATOS
  - Initial conditions retrieval from MARS

  - Simple allocation of GPU's & VM's
  - Full control over system
  - Easy collaboration

Currently deployed on the EWC, and has been for months

Forecast-In-A-Box – Implementation on EWC - Future

- Use Kubernetes Clusters to run at scale
  - Dynamic Re-allocation of resources
  - Missing GPU's currently ☹

- Systems deployed on various hardware
  - Database doesn't need a GPU, etc…

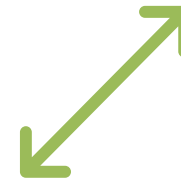# Forecast-In-A-Box − Usage of the EWC

Easy
prototyping

Simple
deployment

https://jellyseerr.eldrest.com

Stable Interface
and system

Expandable to
meet needs

Forecast-In-A-Box – Projects

Global Gateway

Africa – EU Space Programme – Strengthening Early Warning in Africa (AESPP – SEWA): Co-designed impact-based forecast tools and trainings to advise on early warning

Implemented in partnership with AUC and EUMETSAT

African Union

Destination Earth

WMO

Integrated Processing and Prediction System (WIPPS)

Pilot Project in Malawi