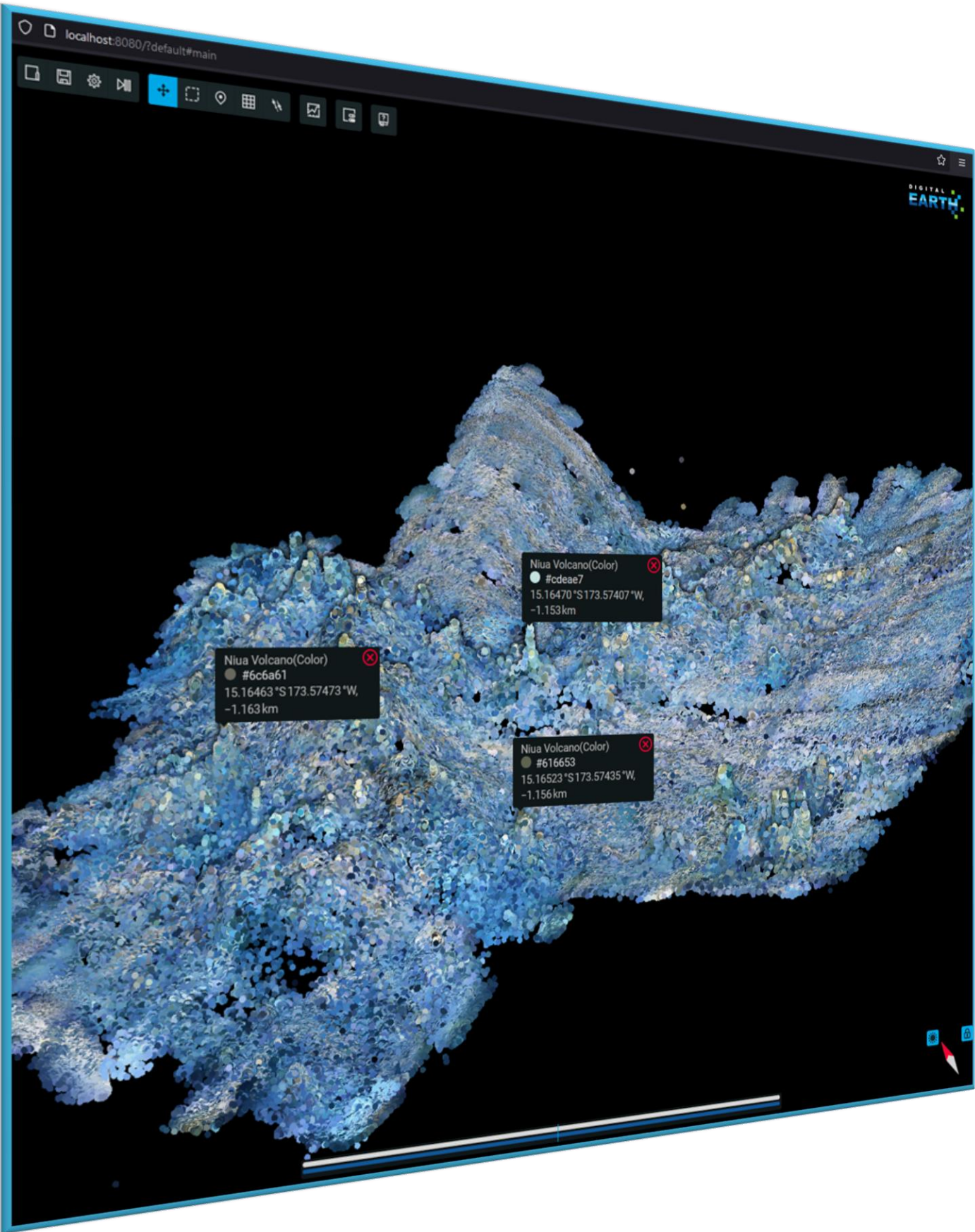


# The Digital Lab Book:

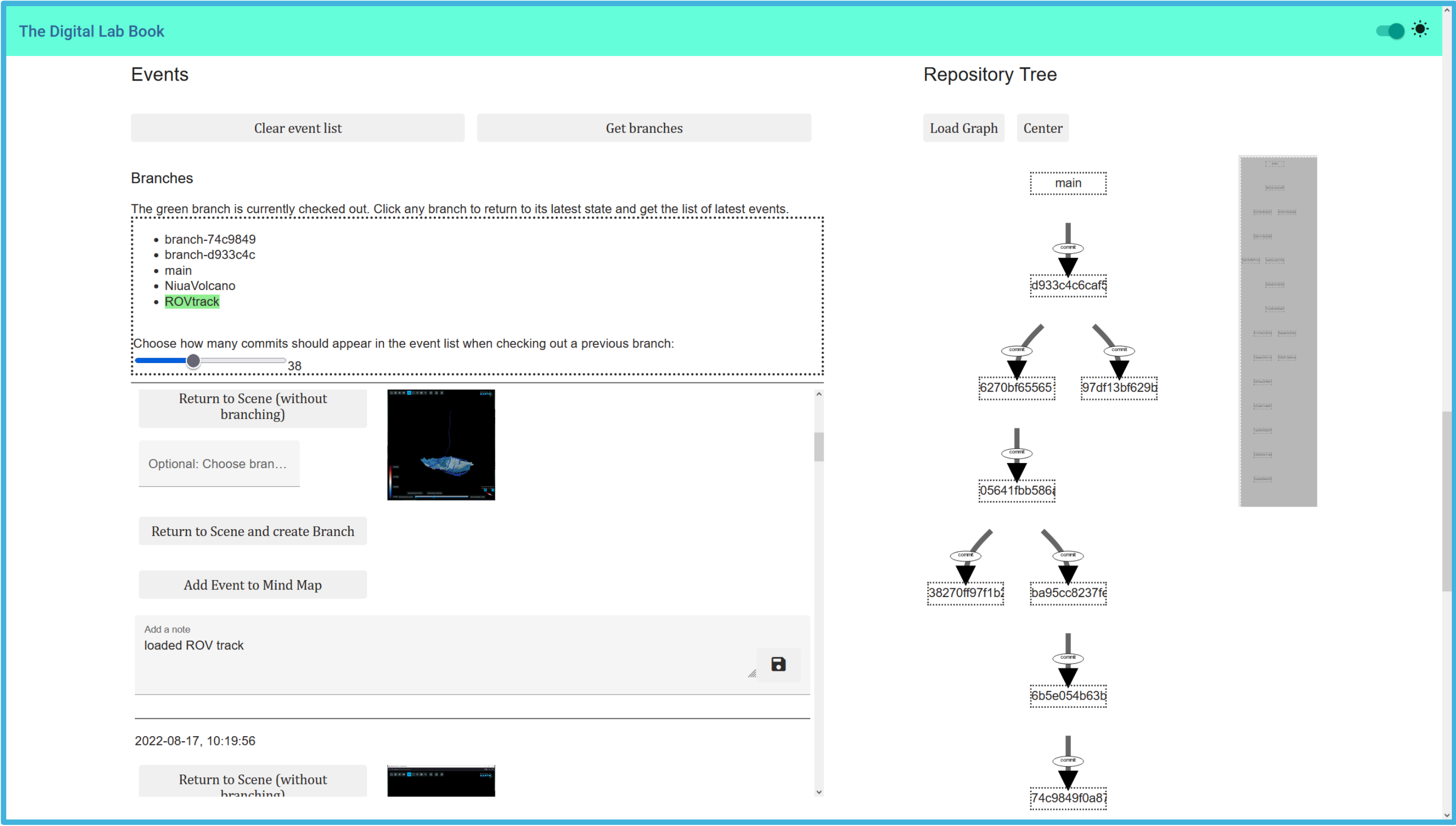
## Provenance and Workflow Documentation in Visual Data Exploration

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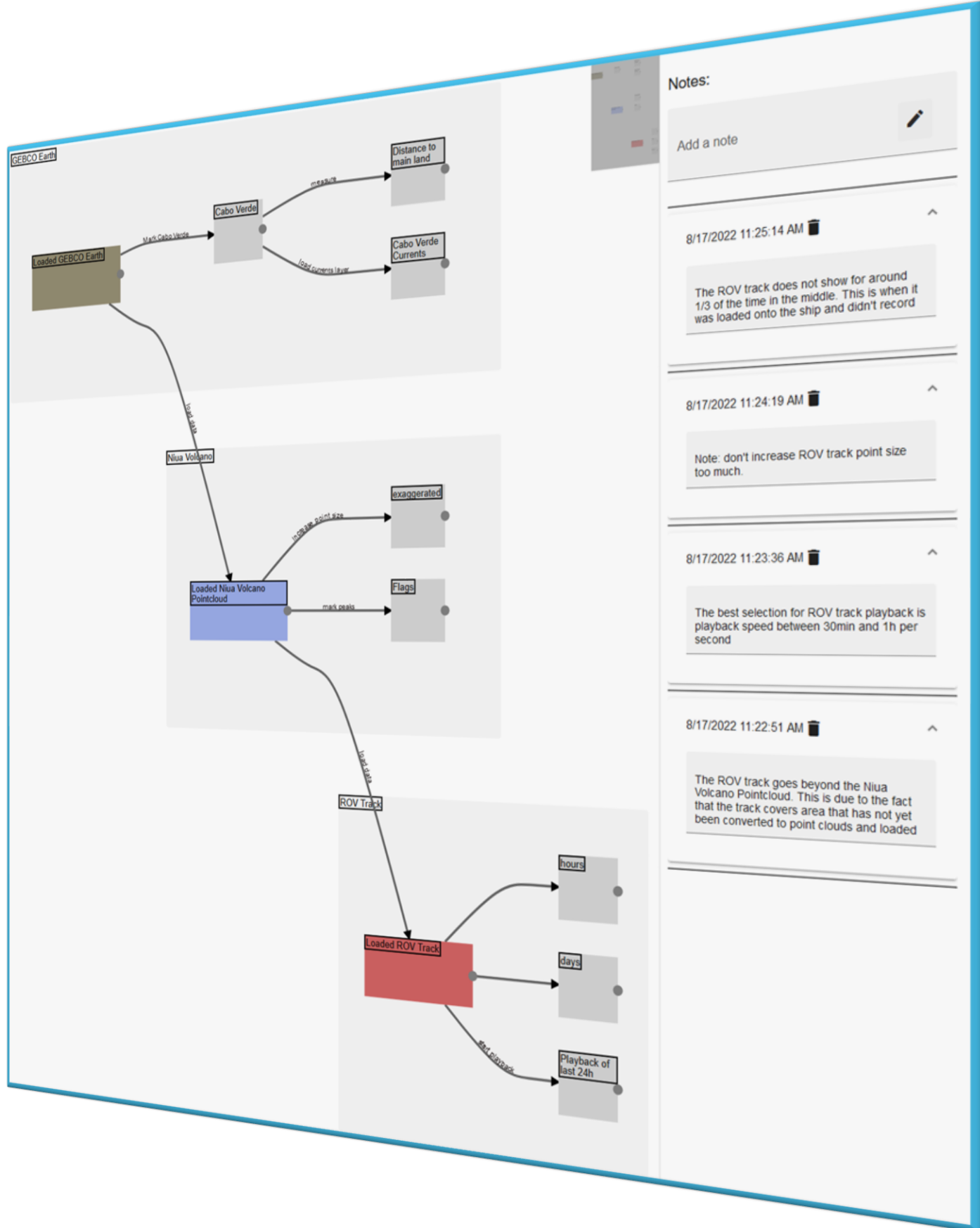
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SCHOOL FOR MARINE  
DATA SCIENCE



a) The Digital Earth Viewer, one of the visualization applications currently supported by the Digital Lab Book. The visualized data is a point cloud of an undersea volcano field including user annotations.



b) Part of the main Digital Lab Book web application. On the left side: A list of visualization states/events including screen shots, several user interface elements, and a list of the branches in the current project. The right side shows part of the current provenance graph/history.



c) An exemplary mind map built in the mind map component of the Digital Lab Book resulting from an interaction session with the visualization seen in Fig. 1a).

Fig. 1: Components of the “Digital Lab Book”

## Motivation

- How can immersive, collaborative visual analytics deliver reproducible, ready-to-publish results in ocean sciences?
- How can the value of a visualization be assessed?
- What aspects of immersion, collaboration, and interaction are important for reproducibility of immersive analytics workflows and sessions?

**Provenance** is the trace of actions and intermediate products throughout a scientific data processing workflow.  
Here: **The history of interaction with visualization software in a scientific sensemaking process.**

## Goals

1. Identification of **provenance** artifacts in collaborative, immersive data visualization and visual analytics workflows
2. Implementation of a **provenance** visualization and management tool to record and support interaction with visualized data in visual analytics workflows. A specific focus lies on immersive visualization inside the ARENA2 at GEOMAR  
Exemplary use-cases:
  - Simulating geologists’ analysis of deep sea volcanoes in real-life scale as if it was field work above sea level.
  - Displaying micro-organisms in large scale for marine biologists
3. Evaluation of the developed tool in user studies with domain scientists to assess its worth in real-world scientific work.

## The Tool

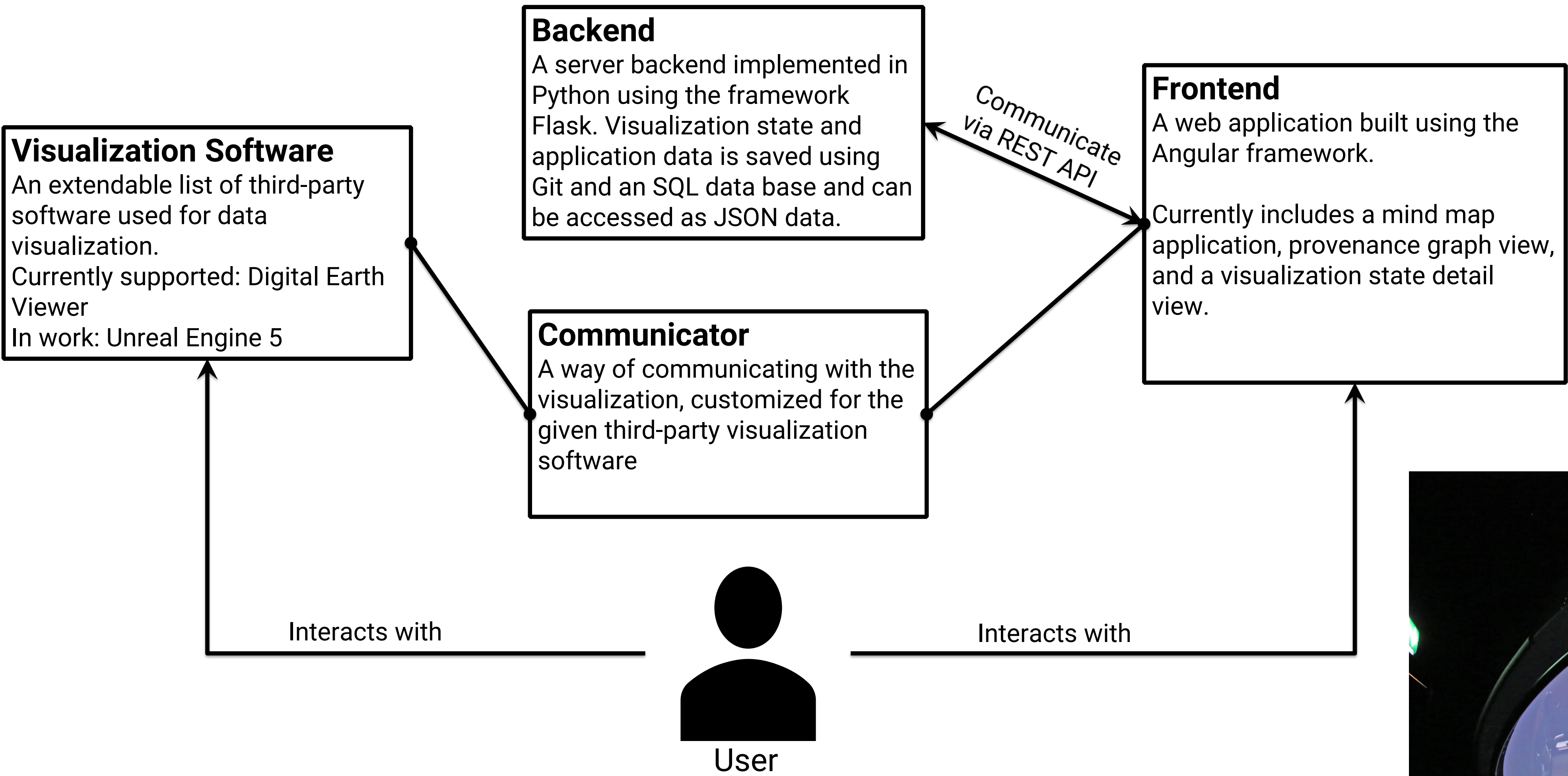


Fig. 2: The structure of the “Digital Lab Book” application: A provenance visualization and management tool

## Application Scenarios

- Record and play back visual analytics sessions
- Compare repeated or alternative sessions (“what if?”-scenarios)
- Share and modify sessions
- Export data and derive quantitative data supplements

## The ARENA2

The ARENA2 is a digital projection dome at GEOMAR Helmholtz Centre for Ocean Research in Kiel, Germany. It was built in 2019 with the purpose of being a facility to enable collaborative work in small groups inside an immersive environment. It facilitates visual analytics by allowing domain scientists working in ocean research to interact with visualized data.



Fig. 3: A view of the inside of the ARENA2. Visible in the lower half is a conference table which emphasizes the purpose of collaboration in small groups. The center shows the dome of the ARENA2, tilted at an angle of 21° with video content playing. In the front upper half of the picture one of the five projectors is located.

Buck et al., 2021 “Digital Earth Viewer: a 4D Visualisation Platform for Geoscience Datasets”. doi:10.2312/envirvis.20211081.  
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**GEOMAR**  
Helmholtz Centre for Ocean Research Kiel  
**HELMHOLTZ** | SPITZENFORSCHUNG FÜR  
GROSSE HERAUSFORDERUNGEN



# The Digital Lab Book:

## Provenance and Workflow Documentation in Visual Data Exploration

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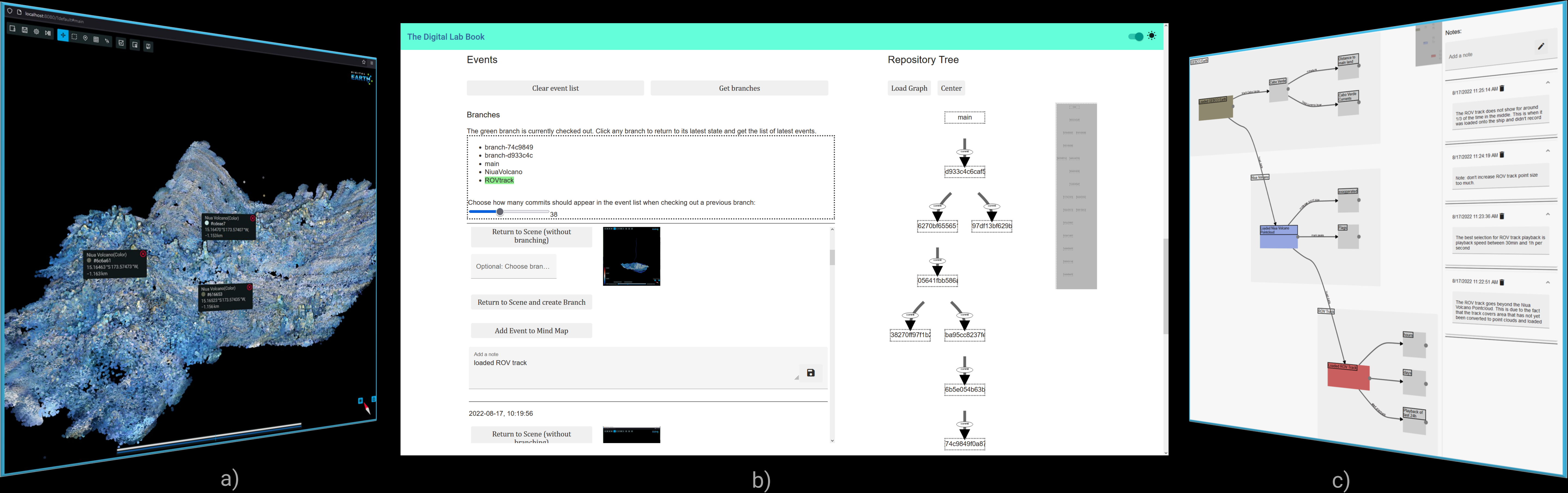


Fig. 1: Parts of the “Digital Lab Book”.  
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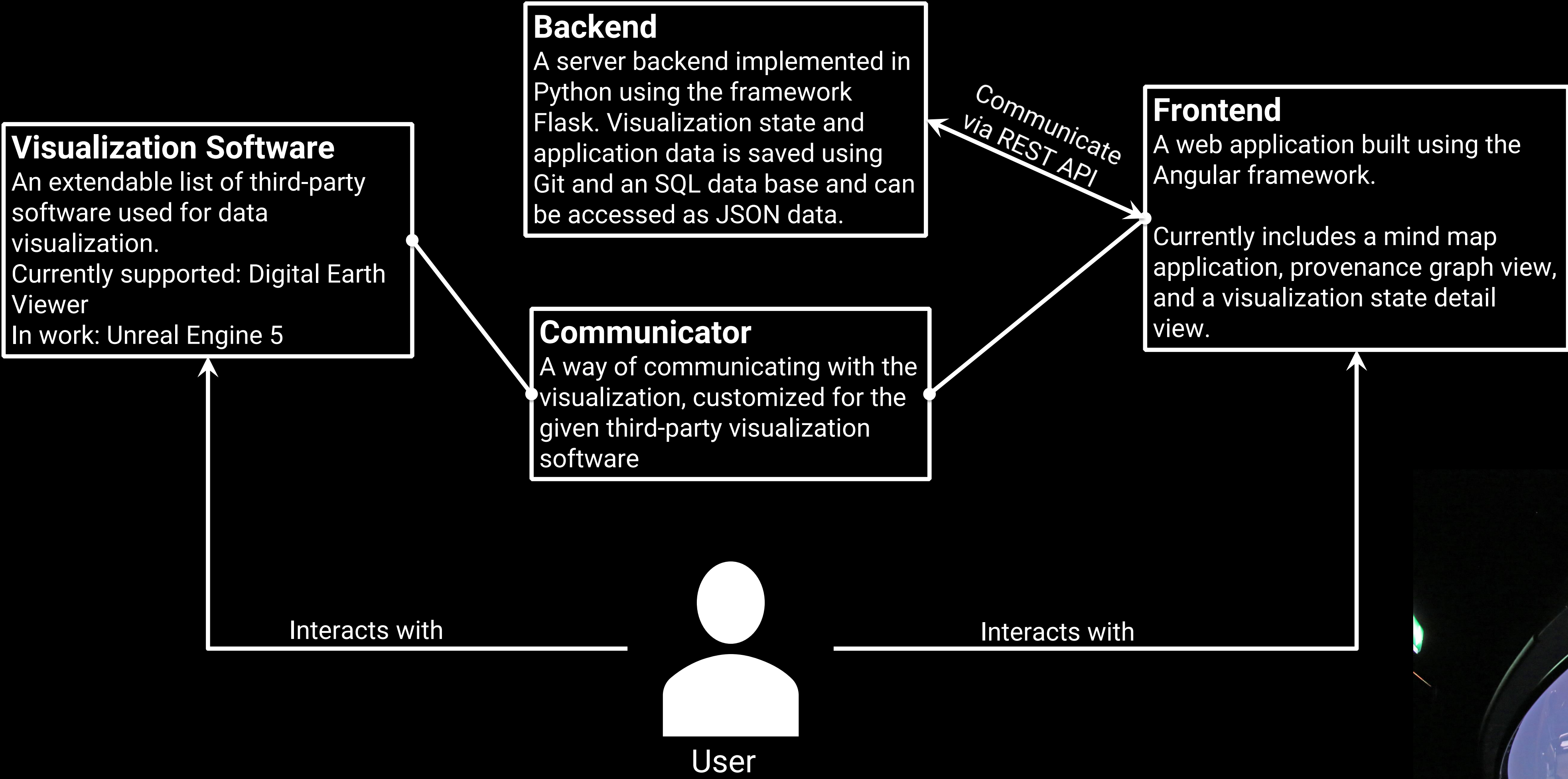


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