

EPI architecture: Brane

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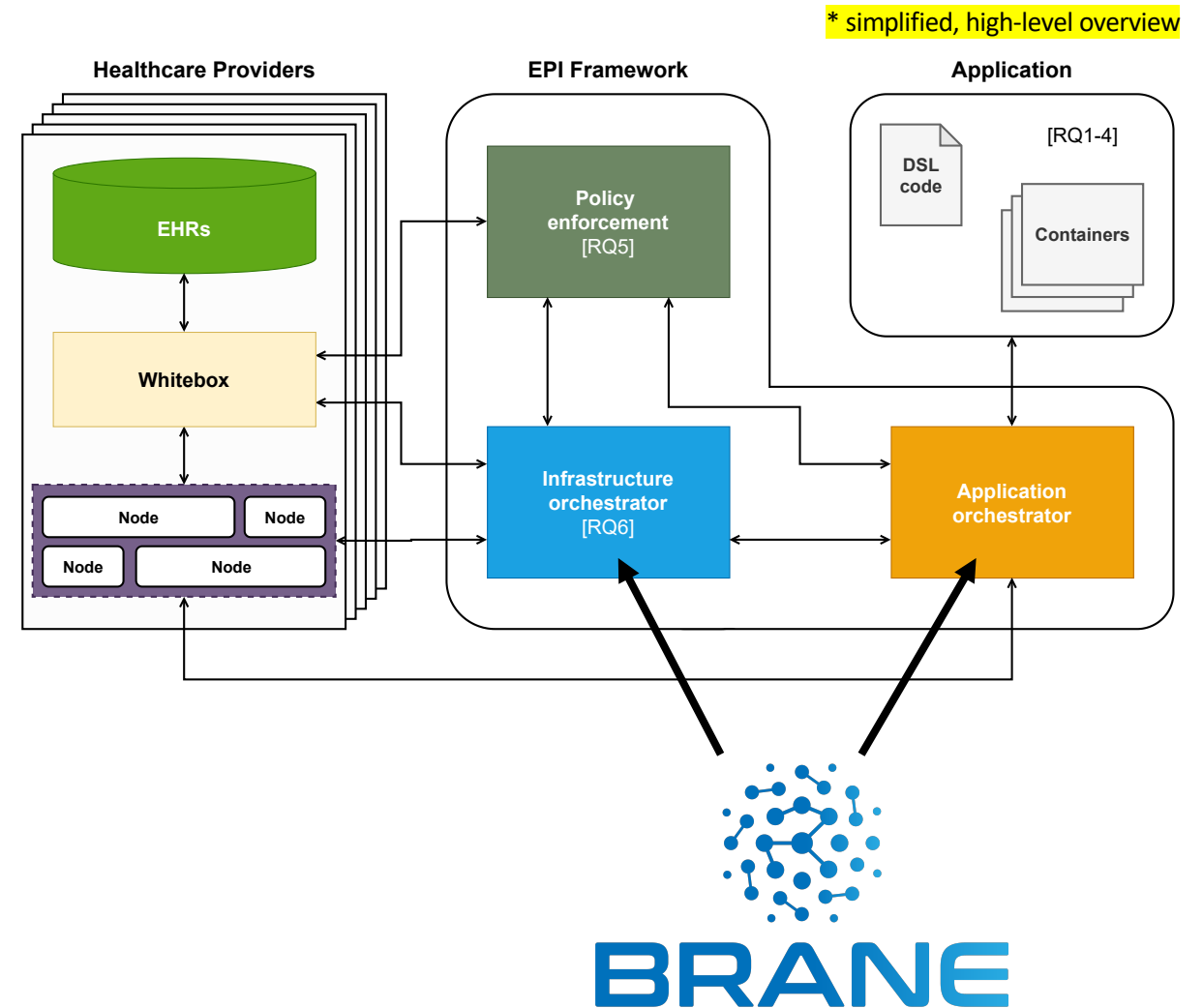


<https://mns-research.nl>

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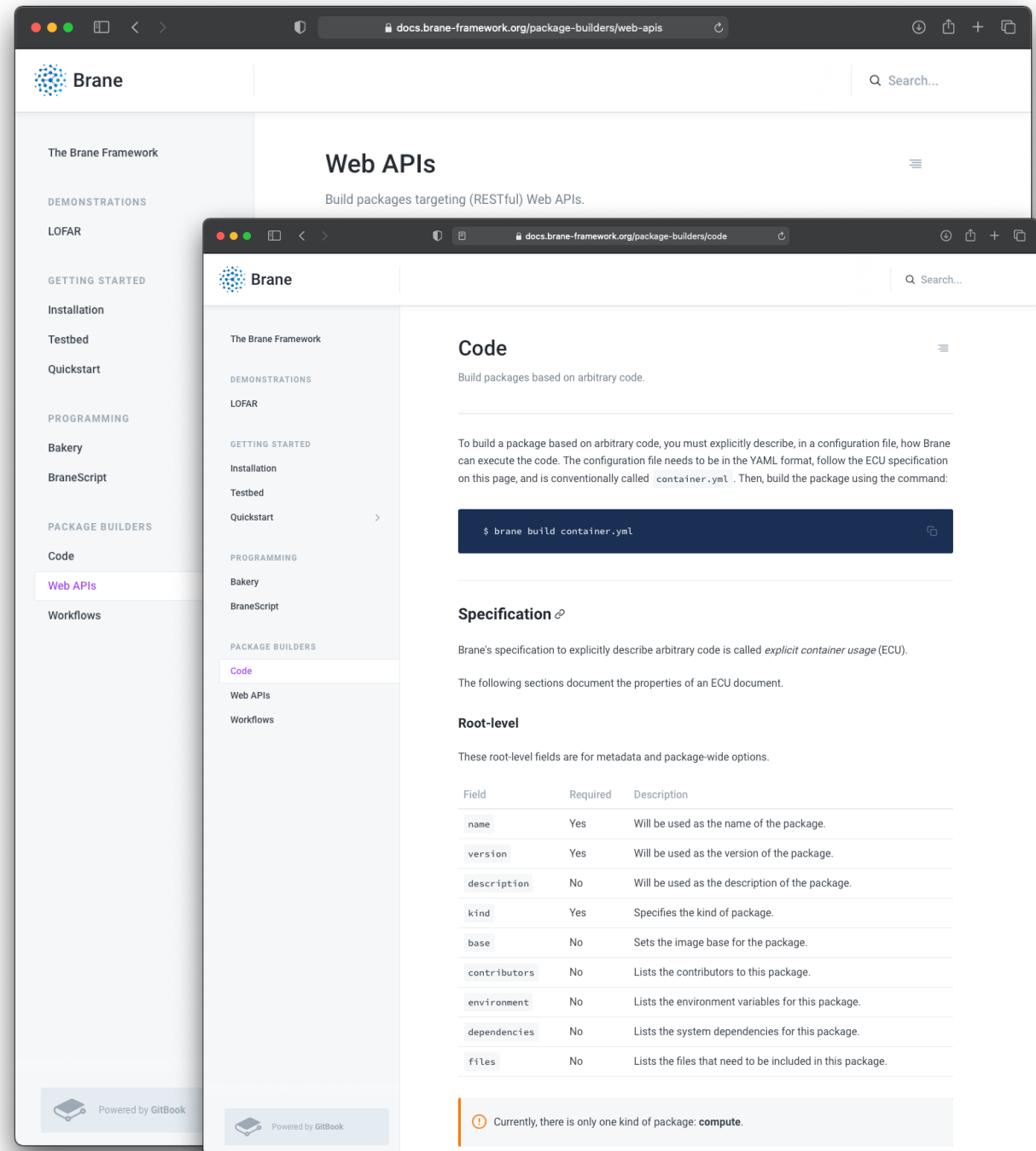
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Current features

1. Packaging

- Create self-contained and reusable building blocks.
- Code, Web APIs and Workflows.
- Export and import packages.
- Automatically convert for the container runtime on the target infrastructure.



Current features

2. Composition

- Two DSLs for different users, BraneScript for multi-site:

```
// Brings the relevant functions into scope
import distributed_dl;

let world_size := 3;

on "node1" {
  // The master service is running on node 1
  let master := startMaster(world_size);
  master.waitUntilStarted();

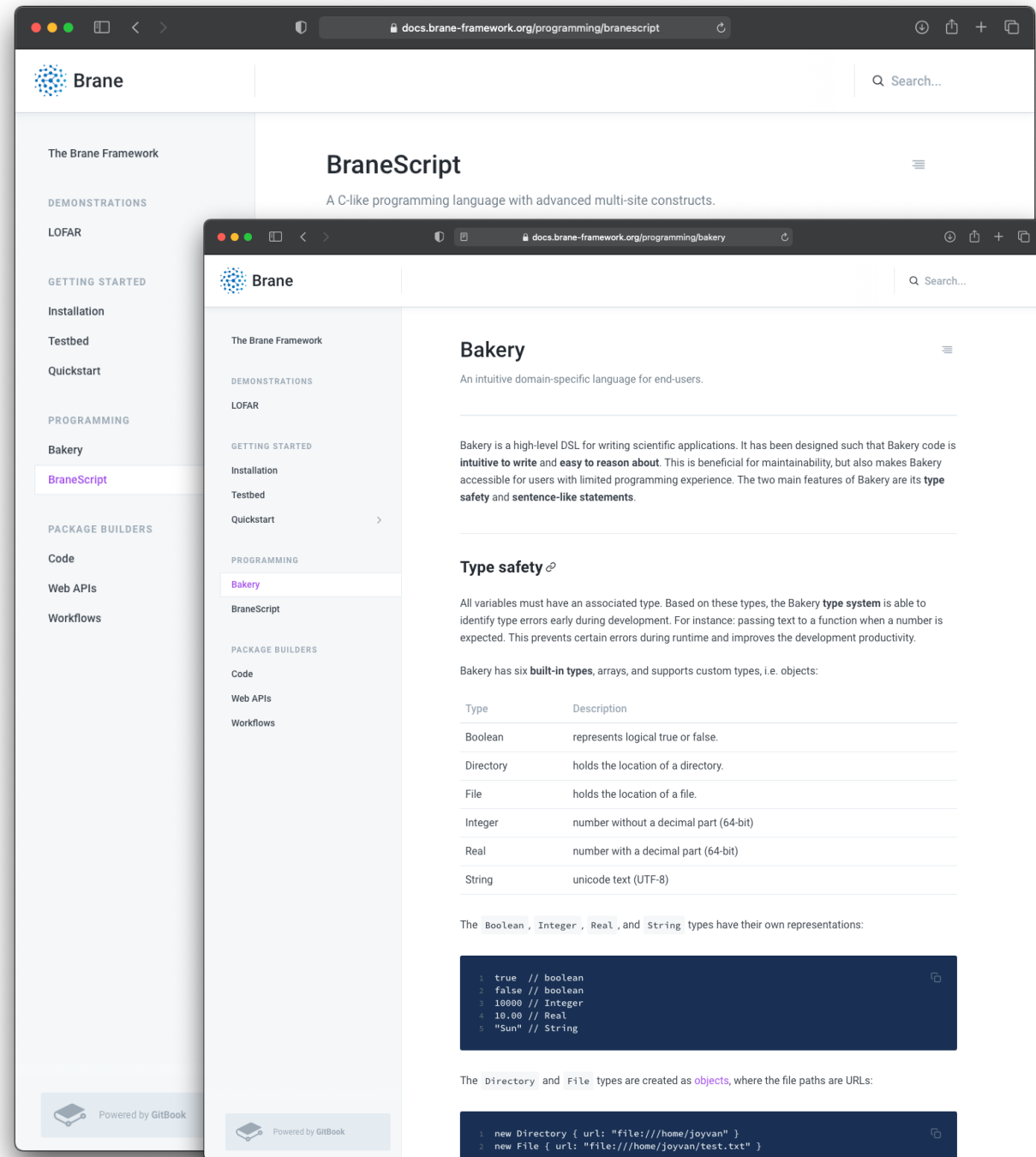
  // After the master service is ready, workers
  // are started, in parallel, on nodes 2 and 3
  parallel [
    on "node2" {
      let w1 := startWorker(
        world_size, 1, master.address
      );

      w1.waitUntilDone();
    },
    on "node3" {
      let w2 := startWorker(
        world_size, 2, master.address
      );

      w2.waitUntilDone();
    }
  ];

  // Let the application run until completion
  master.waitUntilDone();
}
```

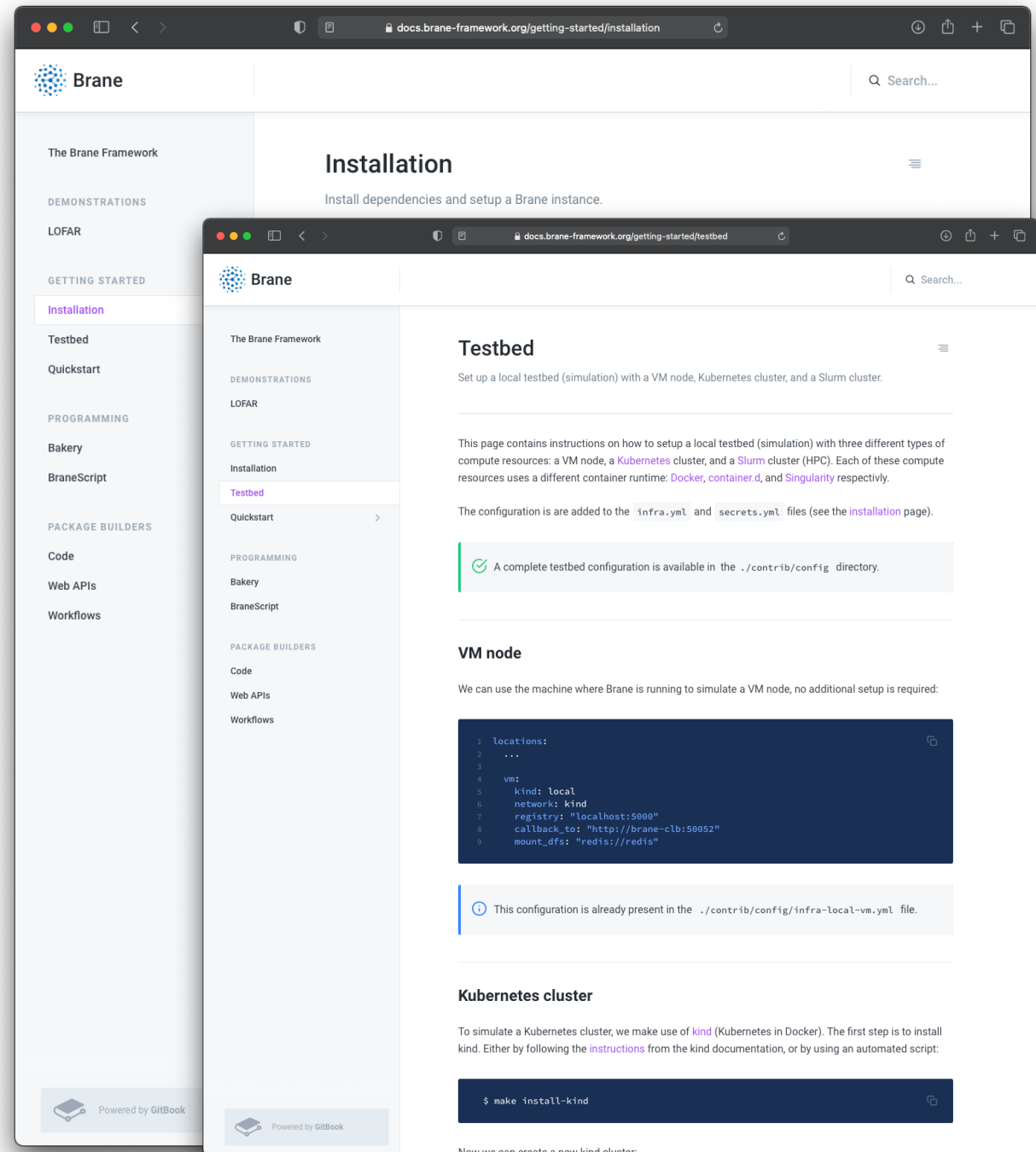
Listing 4: A deep learning application in the BraneScript DSL.



Current features

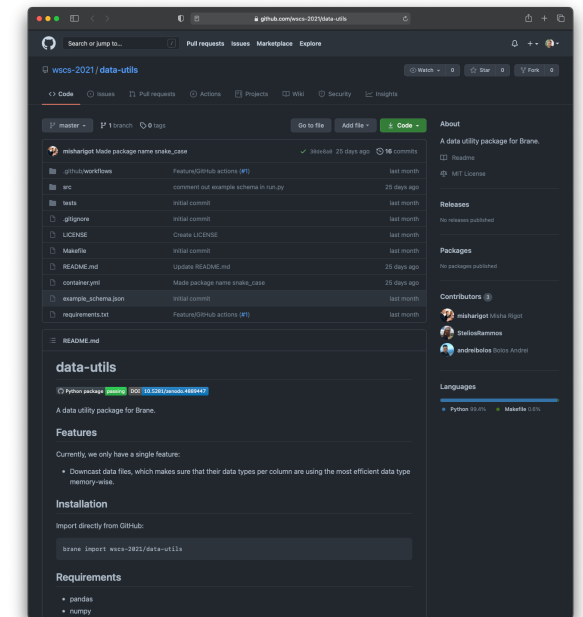
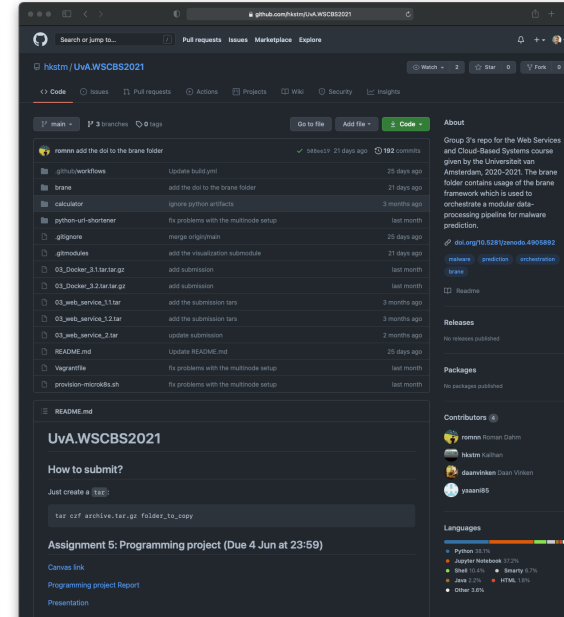
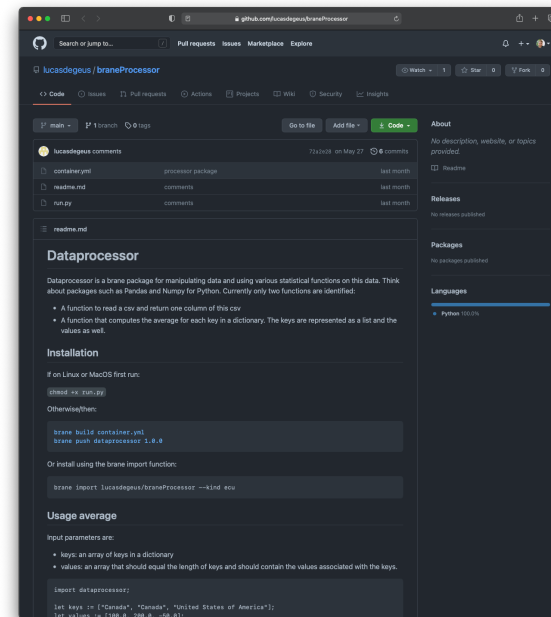
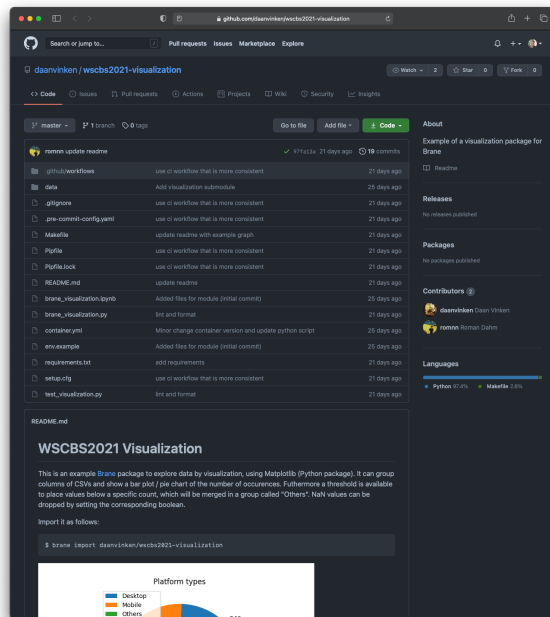
3. Deployment

- Locally, optionally with simulated VM, HPC, Kubernetes nodes.
- Single-site, on a Kubernetes cluster.
- Multi-site, centralized installation with external compute nodes.



Web Service and Cloud-based Systems (MSc)

- As part of the MSc WSCB course student teams have used the Brane framework to implement various ML pipelines (Kaggle challenges)
 - Result: multiple reusable “community” packages on GitHub.



Features in-development

- **Vantage6**

- Status: working “light” integration (API calls).
- Next: a “deep” integration is under investigation.

- **Network functions (RQ6)**

- Status: working low-level implementation (Rust).
- Next: a high-level interface is under construction (Python).

- **Whitebox**

- Status: gained insight in the technical operation of Whitebox.
- Next: adding a layer of indirection to Brane to support Whitebox.



Dissemination & adoption

- Paper submitted to the ReWorDS21 workshop (eScience 2021).
- **Software development**
 - Best practices: <https://guide.esciencecenter.nl>
 - Documentation and contributing guidelines.
 - Continuous Integration (CI) and automated tests.
 - Release cycle with long-term archiving on Zenodo.
 - Publicly available on GitHub under the Apache-2.0 license.

