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RENKU - 連句

Reproduce, Reuse, Recycle Research

Rok Roškar and the SDSC Renku team

Renku-Reana workshop @ CERN | 26.06.2018

Goals of Renku

1.
Provide the means to create **reproducible** data science

2.
Facilitate the **sharing** and **reuse** of research artefacts

3.
Foster a **collaborative environment** for interactive prototyping

4.
Enable the **discovery** of relevant data and methods

5.
Allow **federated access** across institutions giving each the freedom to impose its own access controls over resources

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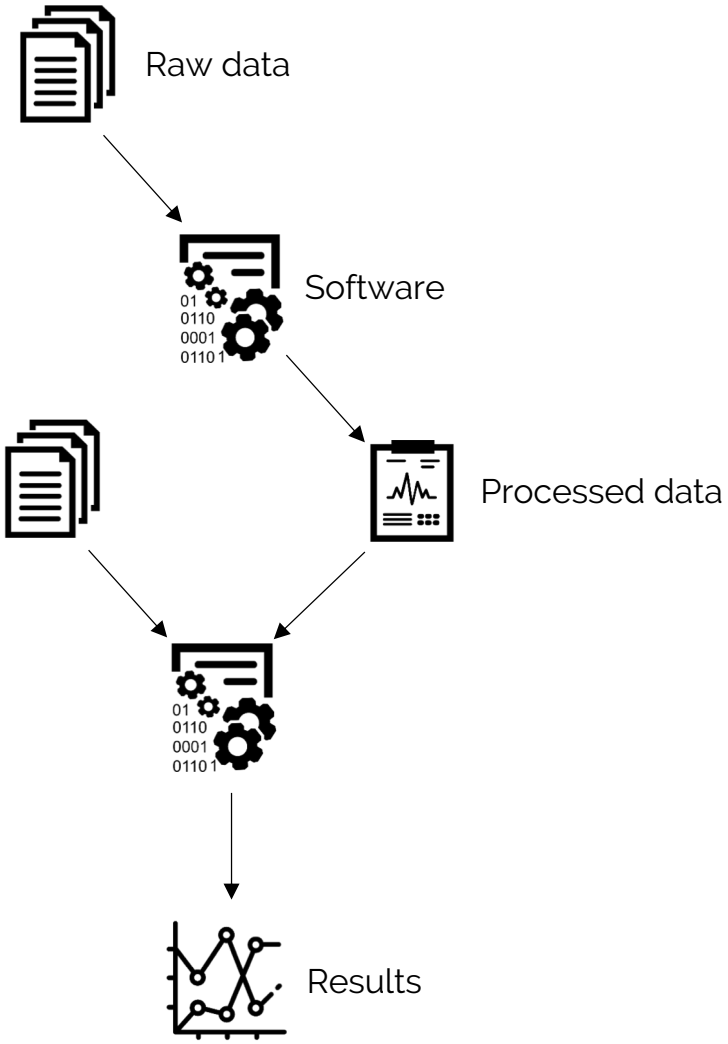
Capturing, recording and utilizing the lineage of results is the core of Renku

Terminology

- We borrow the **Renku** name from the Japanese word for *linked-verse poetry*
- A "**ku**" is a verse in a renku poem
- We use "**ku**" to mean a piece of the data analysis process – includes discussion, code, and results

Capture the scientific process

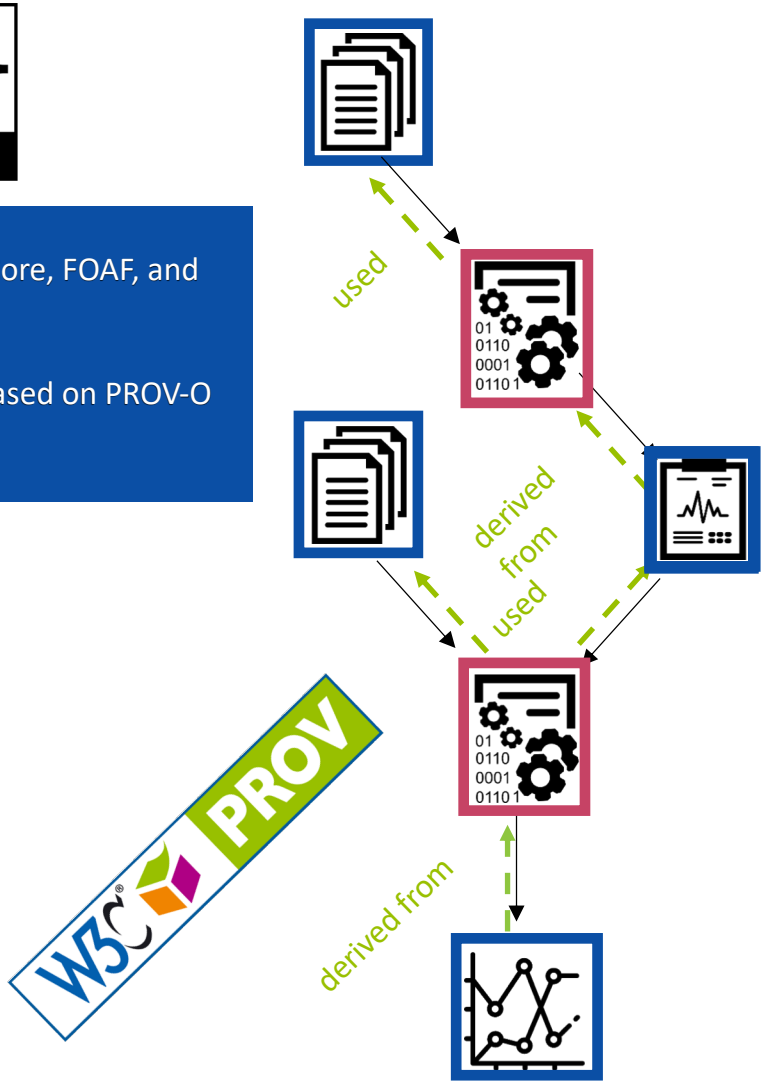


1. Lineage is recorded into a knowledge graph
2. Steps can be repeated and reused
3. Version control is built-in for data, code, and workflows
4. Lineage accessible via simple tools

Metadata

JSON-LD

- Metadata use Dublin Core, FOAF, and Schema.org
- Provenance graph is based on PROV-O W3C recommendation



COMMON WORKFLOW LANGUAGE

- CWL for representing all computational steps
- Capture individual steps from user input
- Tools for constructing workflows from basic pieces
- Rely on container technologies to ensure reproducibility

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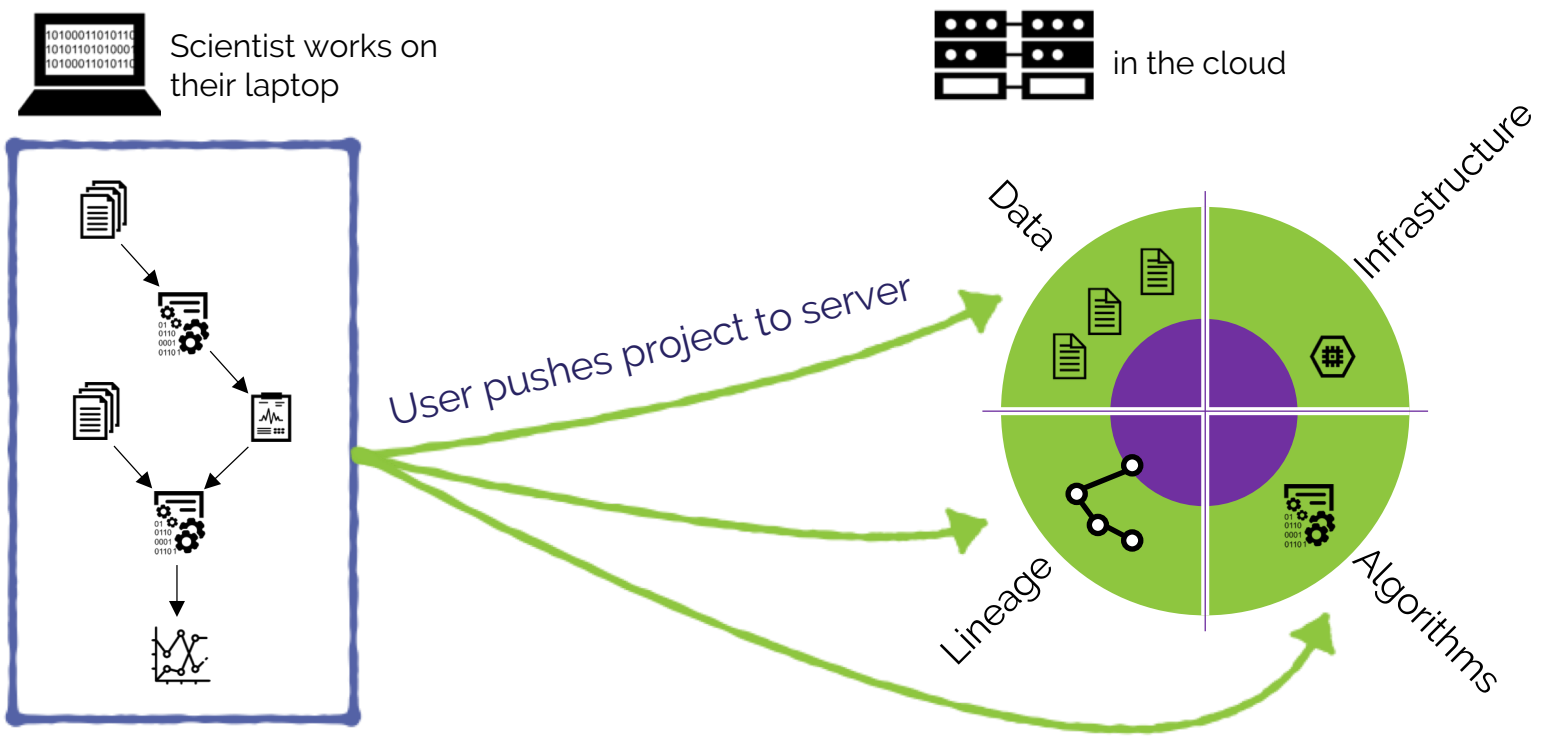
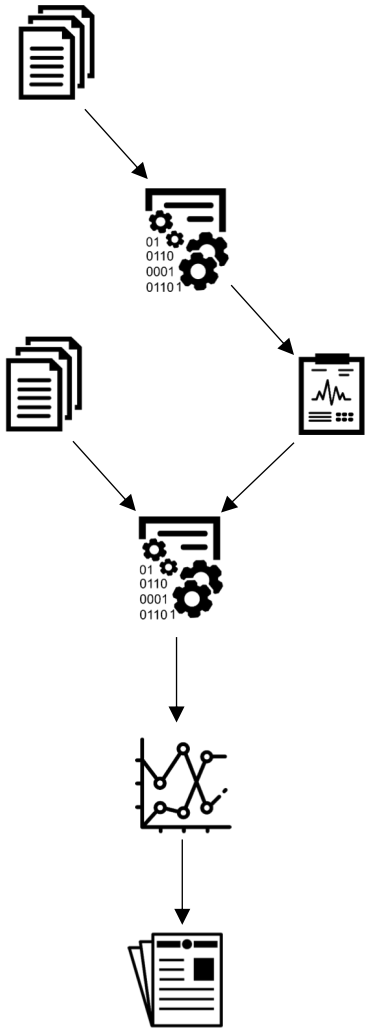
Verify and share results



1. Results automatically verified
2. Data lineage captured “live”
3. Knowledge graph populated
4. Shareable interactive environment created

Discover and understand the work of others

Graph-based search…

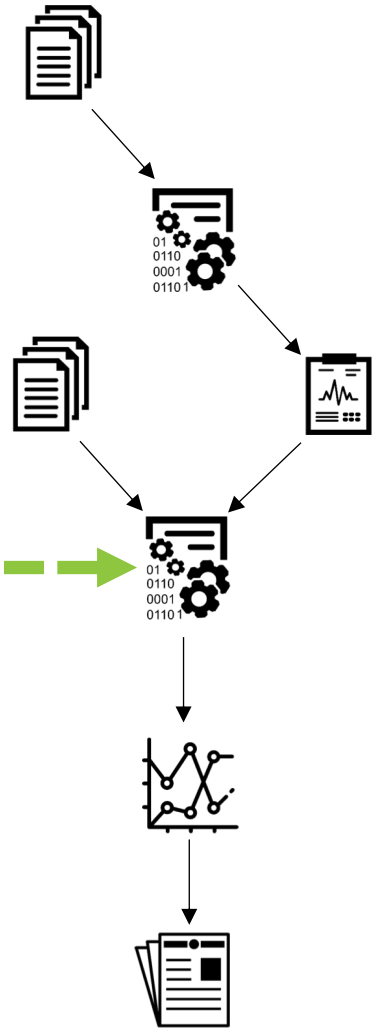


Ex: search for **data** and explore the tools to efficiently generate results

Discover and understand the work of others

Graph-based search…

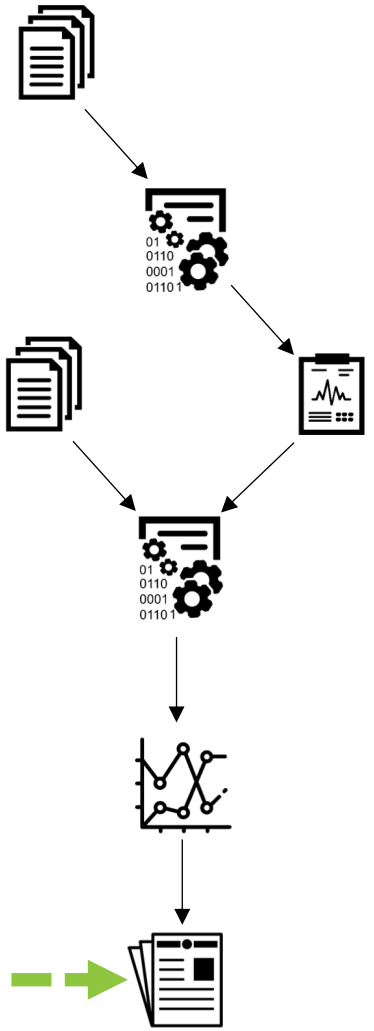
Ex: search for an **algorithm** and see its applications



Discover and understand the work of others

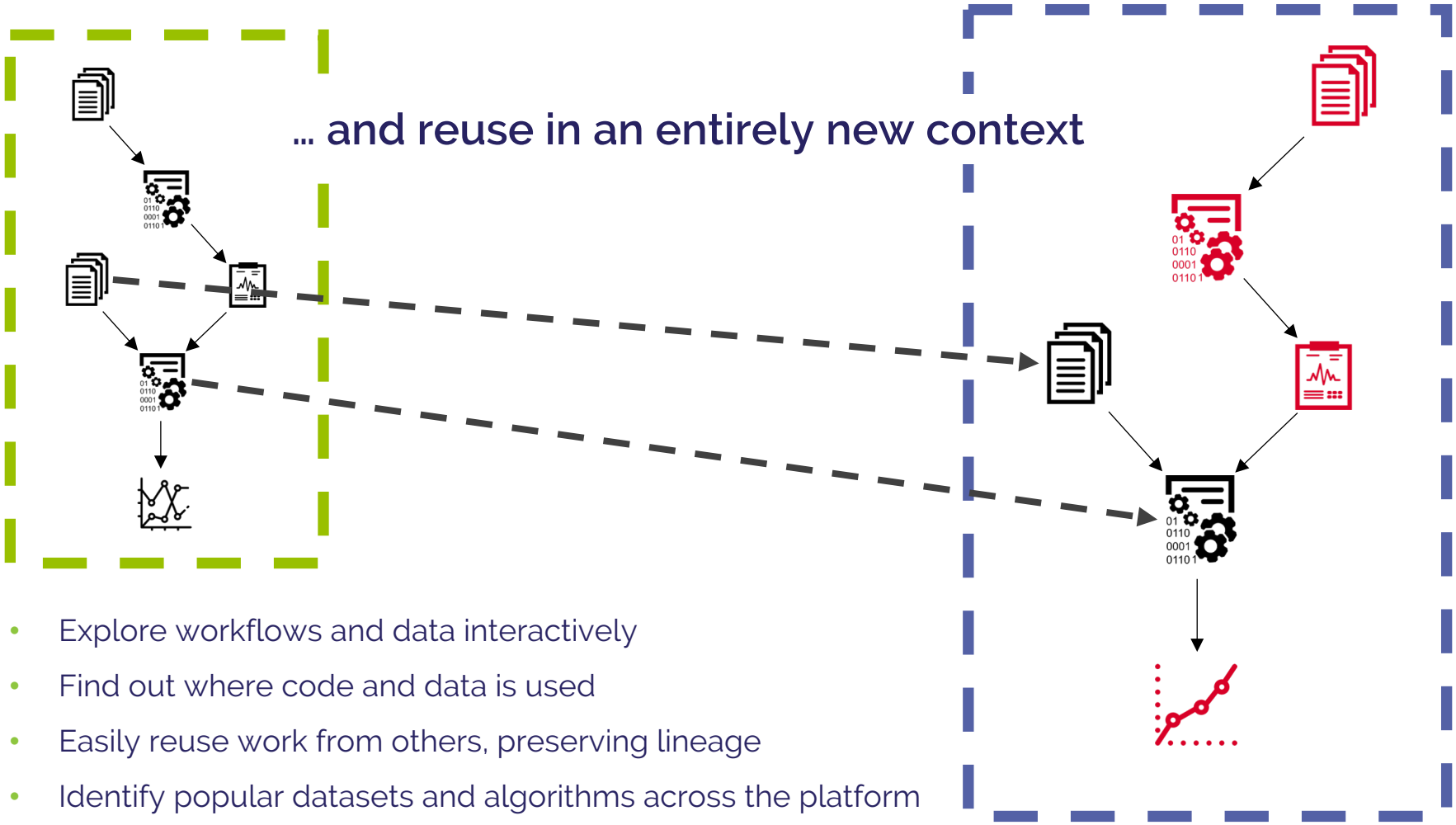
Graph-based search…

Ex: search for a **publication**, obtain a full view of how the results were obtained



Reuse and repeat

Search for relevant data or algorithms…



- Explore workflows and data interactively
- Find out where code and data is used
- Easily reuse work from others, preserving lineage
- Identify popular datasets and algorithms across the platform

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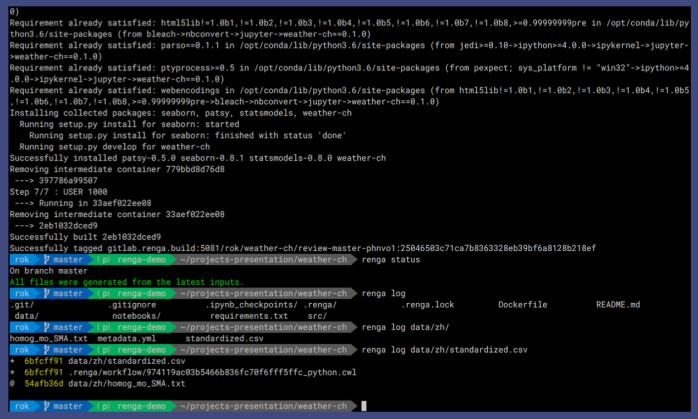
Typical Renku Flow

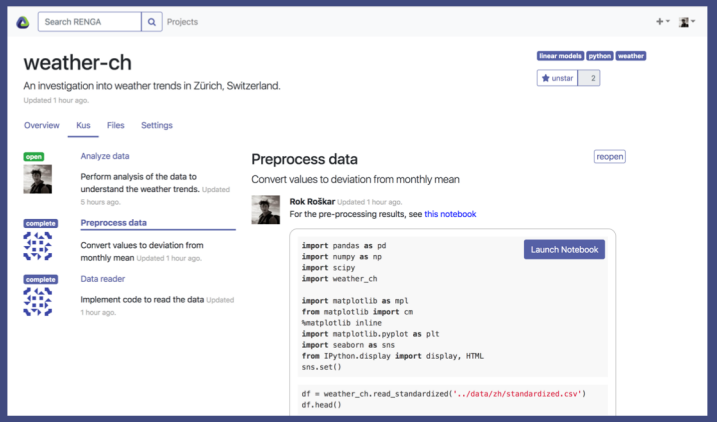
1. Initialize a project in the terminal with CLI
2. Import data
    1. URL/git/local filesystem
3. Execute some work generating a lineage of results
4. Push to server
    1. Optionally verify last step (CI for the workflow/step)
    2. Build an image for the commit
5. Share link to launch hosted notebook
    1. Create changes, commit back the notebook
6. Inspect workflow
    1. Adapt inputs/parameters
    2. Rerun workflow(s) on the cloud infrastructure
    3. Create new workflows from existing pieces (could be from other projects!)

Building easy-to-use tools on top of trusted technologies

Renku consolidates the open-source data science and software engineering technologies into a single platform



Command-line interface



Web-based front-end

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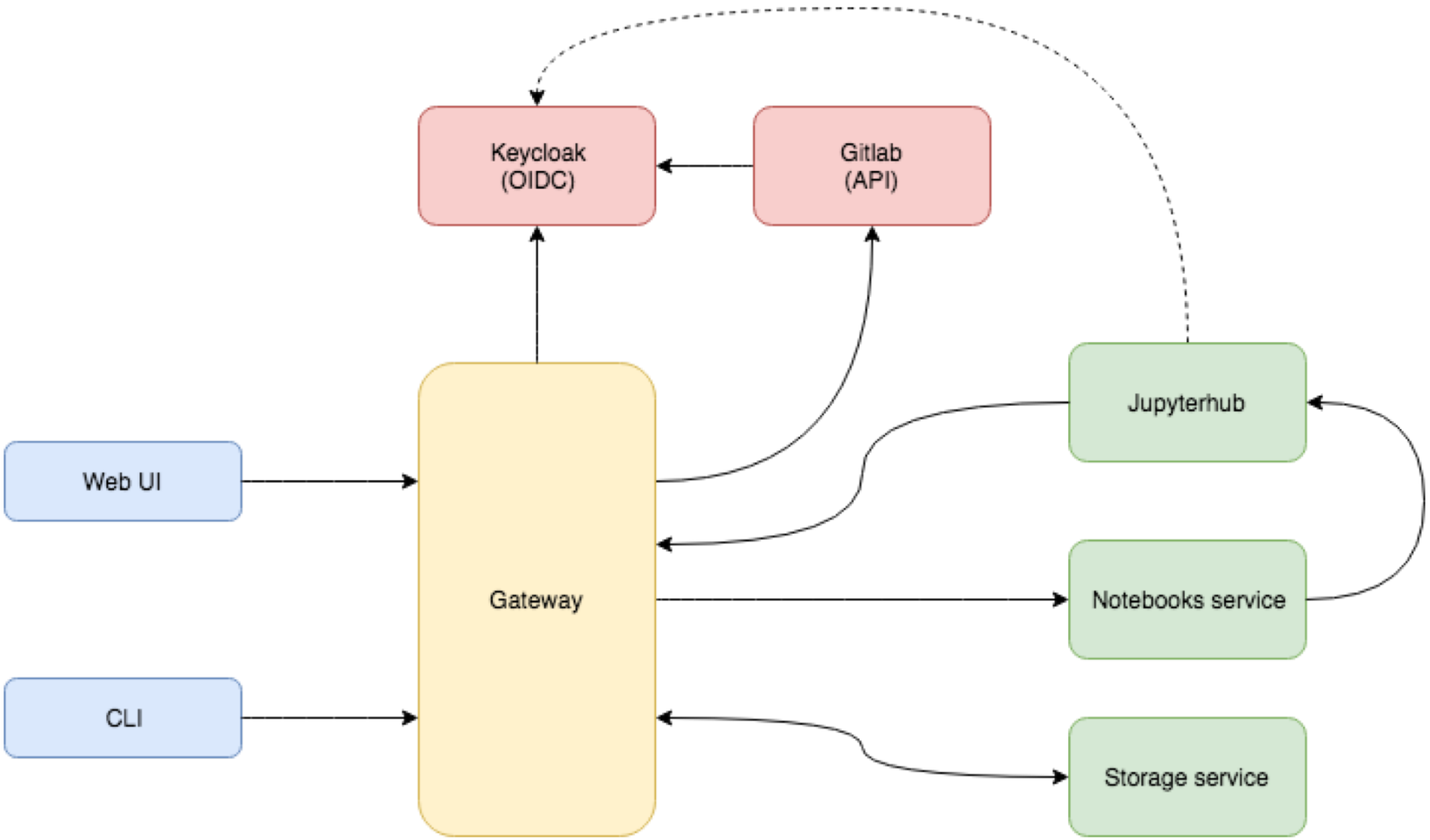
Platform components and technology

- **`renku-ui:`** react.js + bootstrap
- **`renku-python:`** click-based python CLI and API client
- **`renku-notebooks:`** flask app interacting with jupyterhub
- **`renku-storage:`** git-lfs & S3 API with scala/play
- **`renku-gateway:`** API Gateway (in-progress)
- **`renku-graph:`** Knowledge Graph (in progress)
- Workflow execution (CWL+???)
- Repository management + CI (vanilla GitLab)
- Authentication (Keycloak)
- Runtime (docker + kubernetes)

Basic Architecture



Deployment

- Deployed via kubernetes helm charts (docker-compose option for development)
- Main chart in top-level repo, but each service can be standalone
- Development charts pushed on every commit to a chart registry for continuous deployment
- Stable chart repository (upon release)
- Cloud (SWITCH OpenStack) + HPC environments (CSCS)

https://swissdatasciencecenter.github.io/helm-charts

Development and Roadmap

- Q1+Q2 2018: Redeveloped ground-up
  - Provide a user interface for project/discussions
  - Create interactive environments on-demand
  - Track lineage within and across projects
  - Automatic update of results based on lineage
  - Basic “cloud” workflow with interactive notebooks including custom images
- Q3 2018: solidify the base, fill in the gaps
  - Hosted platform for a limited audience
  - Collect use-cases, obtain feedback (bugfixes!)
  - Index data into an instance-wide Knowledge Graph
  - Capture component interactions on-line via events
  - Basic support for (re)executing workflows in the cloud through the UI
- Q4 2018:
  - Introduce access controls
  - Exploit the Knowledge Graph for user queries
- 2019 → federation

Current status

Platform is under very **active** development:

https://github.com/SwissDataScienceCenter

`renku` — services & deployment recipes
`renku-python` — CLI and Python API
`renku-ui` — Web front-end
`renku-notebooks` — external JH service
`renku-storage` — storage service (LFS+S3)