

An Environment Supporting the Production of Live Research Objects



Understanding Scientific Research



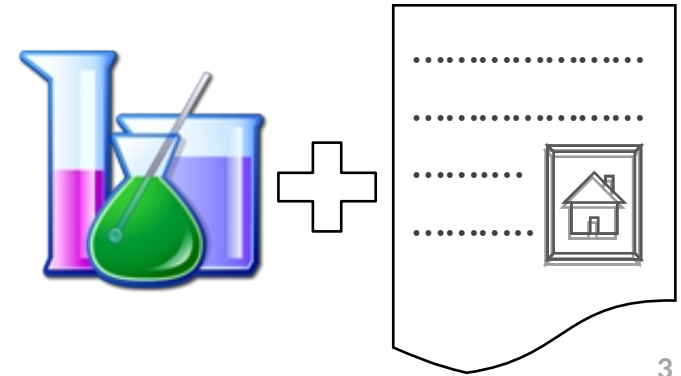
“Publishing data in a reusable form to support findings must be mandatory” [Science as an Open Enterprise, The Royal Society]

- all the elements exploited (primarily grey elements) are **not available** or **not linked** to the scientific result;
- It makes difficult to completely **understand** the results;
- It makes difficult to **validate** the results.



Live Research objects in a nutshell

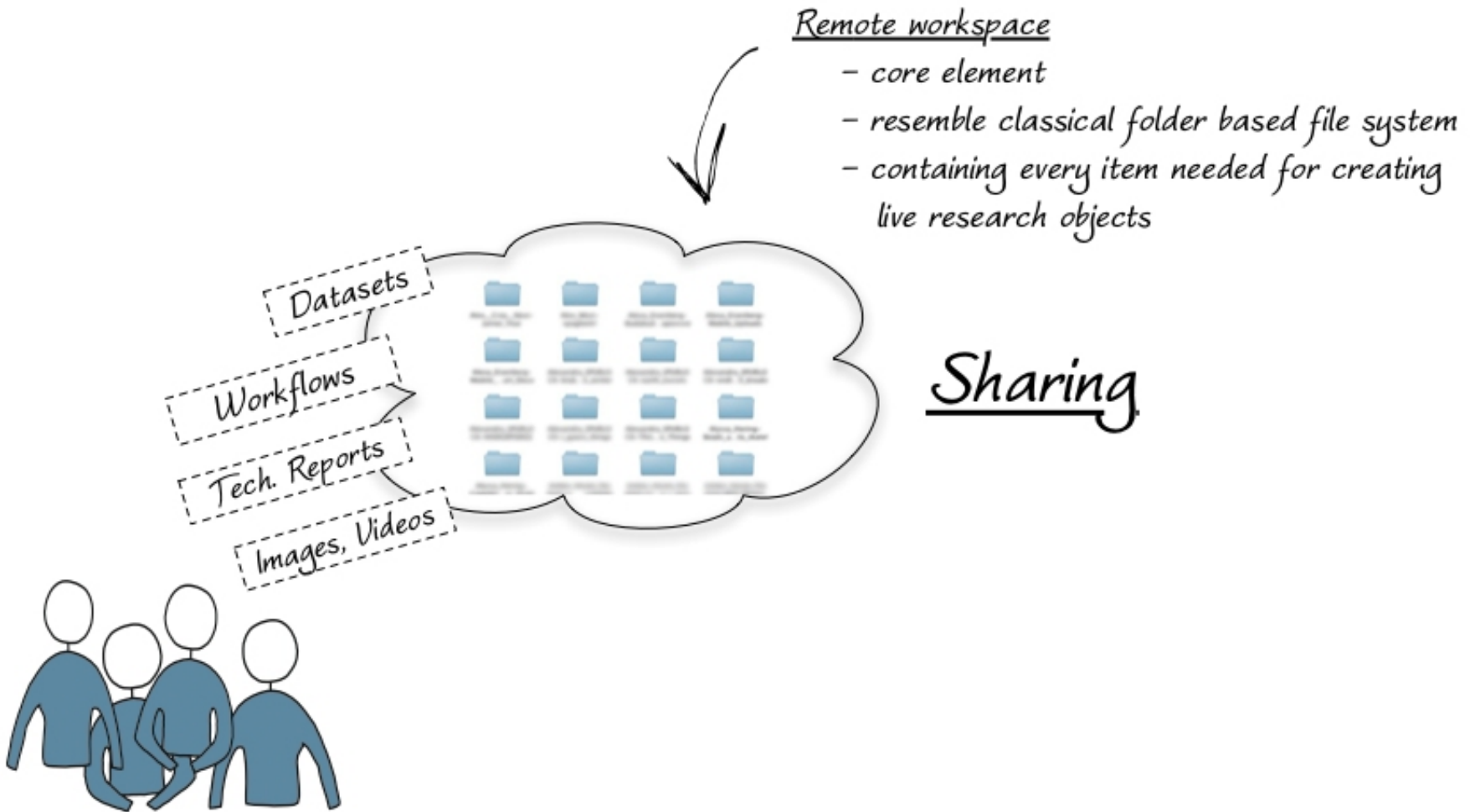
- An abstraction for communicating, sharing and reusing research results:
- **aggregate** all the “pieces” that contribute to a research result.



How can all these pieces stand together?

How can you produce live research objects?

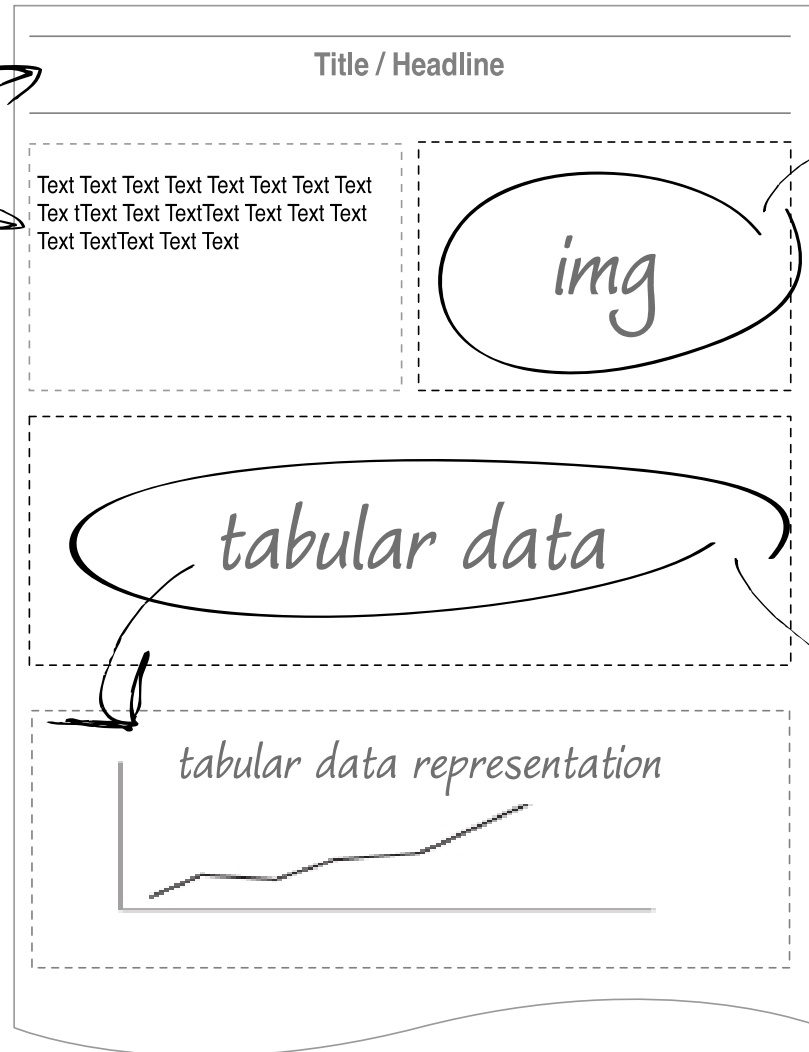
The idea: producing live research object/ **Virtual workspace**



Producing live research object/ **Editing phase**

static structured text

- sections
- headings
- paragraphs



static or dynamic image e.g.

- result of a computation
- satellite periodic measurements

"filtered" quantitative data set

(with rich metadata and provenance information) e.g.

- observations
- statistics
- time series

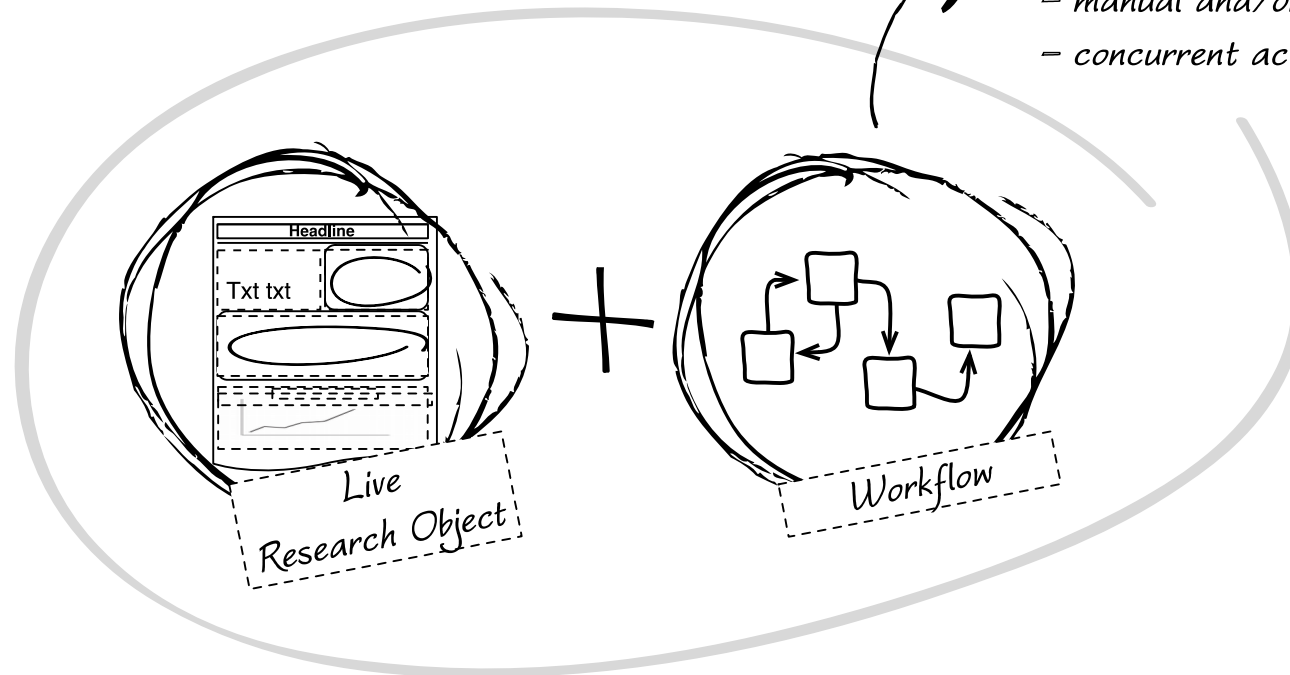
Producing live research object/ **collaborative work**

People to work collaboratively to the creation

- drafting
- writing
- assembling
- reviewing

Workflow governing the production

- several iterative phases (steps)
- responsible person and permissions
- manual and/or automatic routing
- concurrent access



Production of live research objects

➤ Virtual Workspace

- from binary files to compound information objects

➤ Editing framework

- define the structure of a live research object
- entering content and compile them

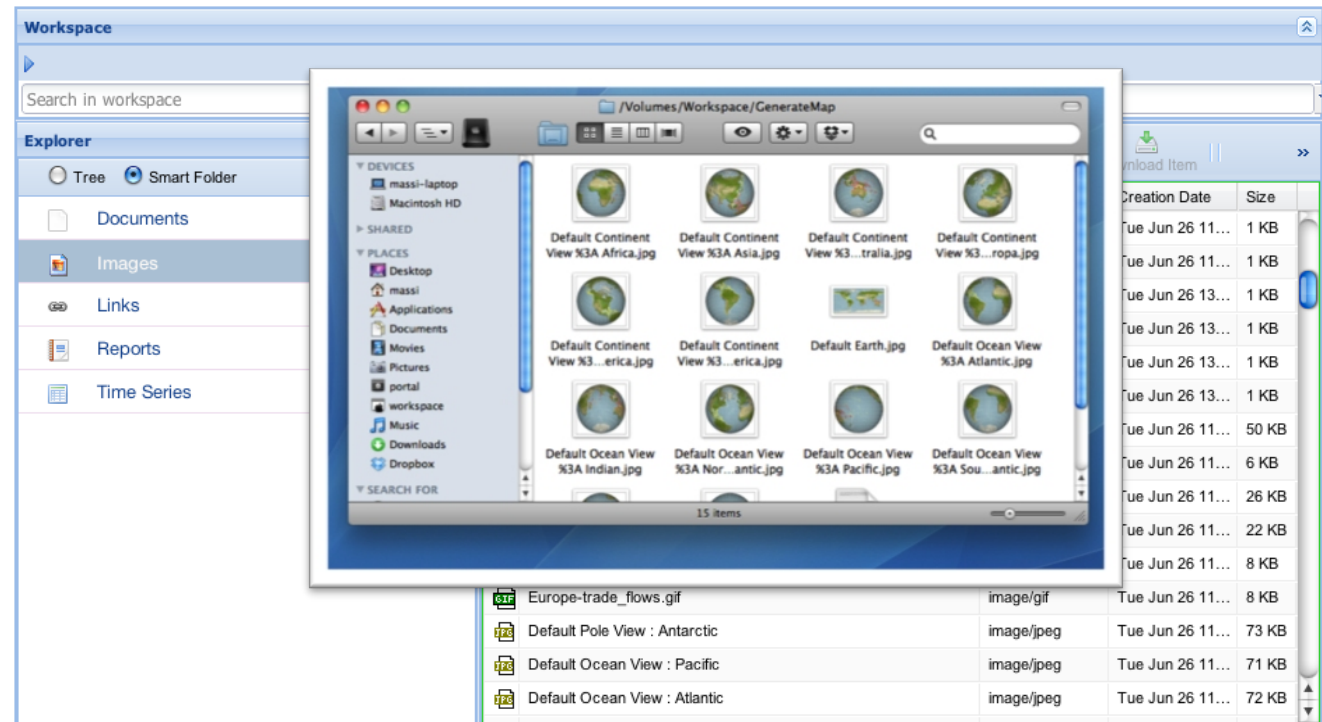
➤ Workflow Engine

- define the workflow governing their production
- specifying the phases and users



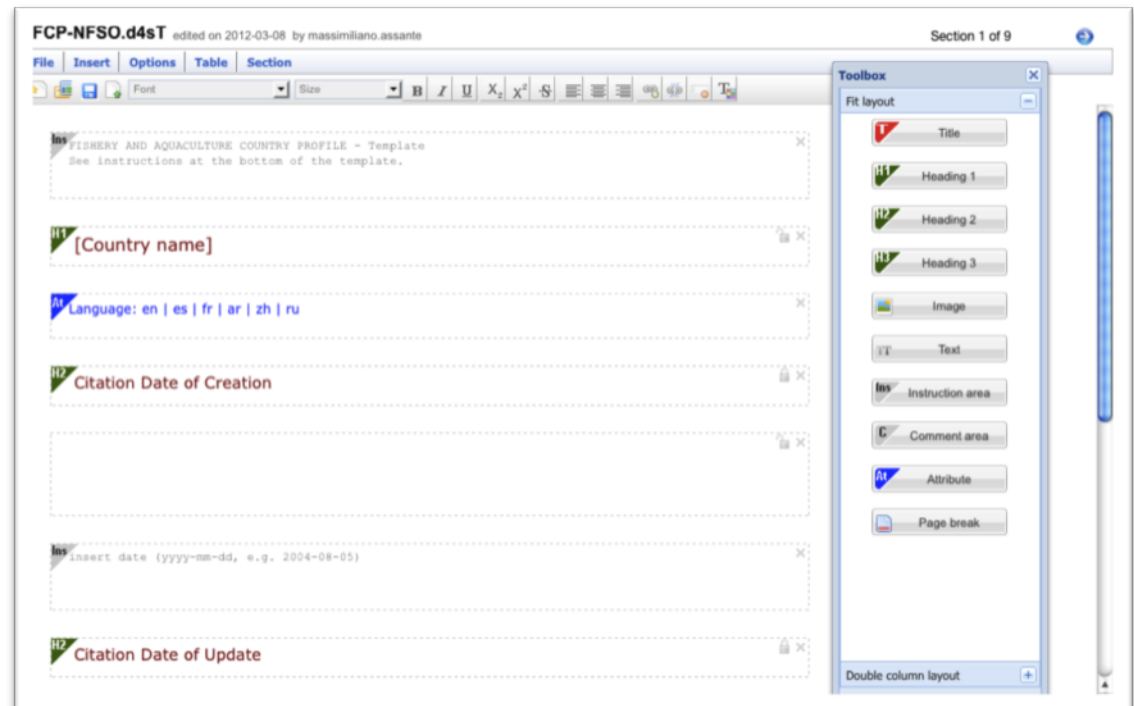
Virtual Workspace

- Users can organise and share very different items
 - tabular data, species distribution maps, time series
- Sharing
- Smart Folders
- Desktop Access



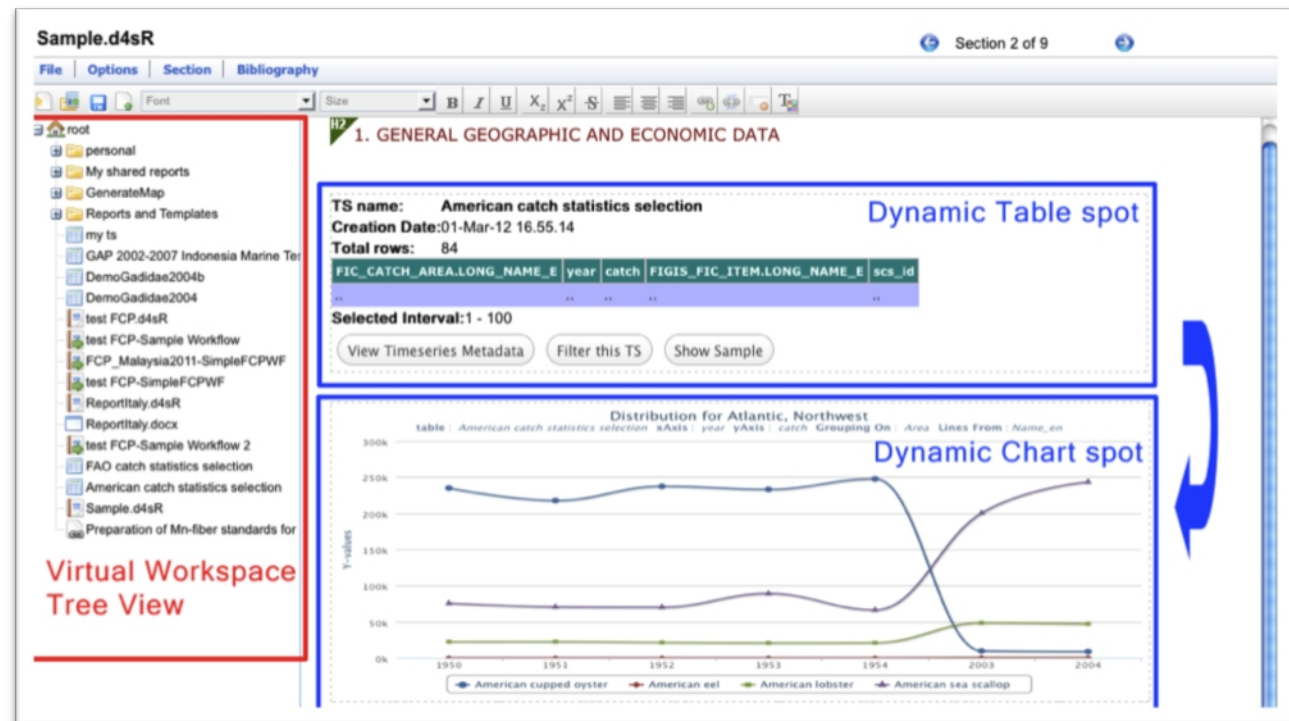
Editing Framework

- Defining the structure
 - define the structure of a live research object
 - component oriented approach (static & dynamic)



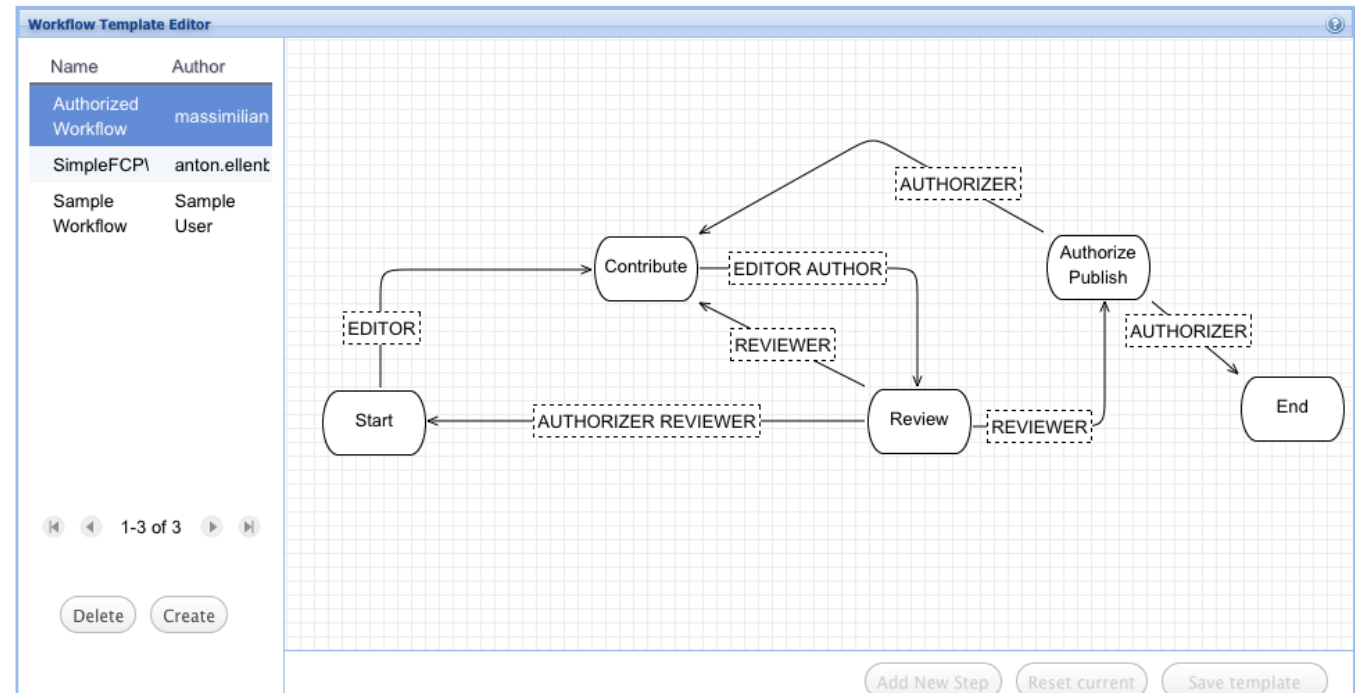
Editing Framework

- Compiling a Live research object
 - compliant with one of the defined templates
 - complete or instantiate the dynamic components



Workflow Engine – defining a workflow

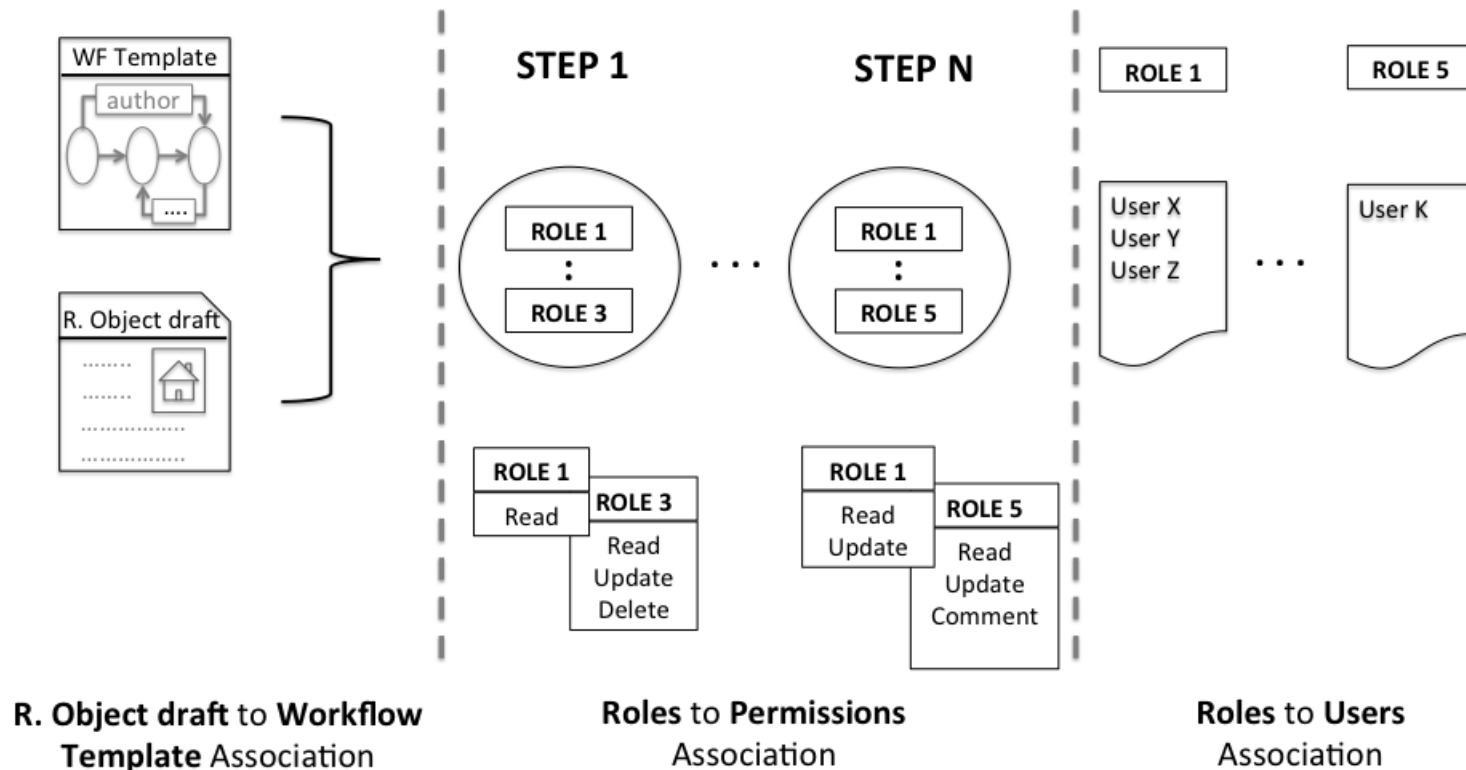
- Work collaboratively to the creation of a live research object
- Define the workflow governing the production of a live research object
- Reuse



Workflow Engine – associating Research Objects

➤ Specify the steps and the relative responsible actor(s)

➤ 3 phases



Production of live research objects: behind the scenes

- exploits the capabilities offered by an underlying **Data Infrastructure*** (DI).
[*digital infrastructure for data sharing and consumption]

- The **gCube software system**, whose technological development has been coordinated by ISTI-CNR and funded by E.C implements the **DI** approach.
 - operates a **large federation** of computational and storage resources;
 - equipped with **software frameworks** for data management;
 - **supported data types** cover a wide spectrum ranging from **tabular data** to **research products**.



- Production of Live Research Objects aimed at estimating the probability of marine species distribution in a global scale:
 - some descriptive **text**
 - data on the species gathered from authoritative **data sources**
 - **environmental data** reporting on ecological elements
 - **algorithms** aimed at estimating the probability of the occurrence of a species in a given area
 - images of **maps** resulting from the algorithm(s)

Conclusion

- A comprehensive framework supporting the entire lifecycle of Live Research Objects production and management
- It has been designed and implemented in the context of two successive EU projects:
 - D4Science-II (www.d4science.eu)
 - iMarine (www.i-marine.eu)
- Available as a WebApp in the D4Science e-Infrastructure
<http://www.d4science.org/>