EGU General Assembly 2020

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Session HS 1.2.3

Converting scientific research into a practical tool co-designed with the stakeholders in R Shiny: a web-based application for managing the main reservoir of the drinking water supply system in the Romagna region, Italy

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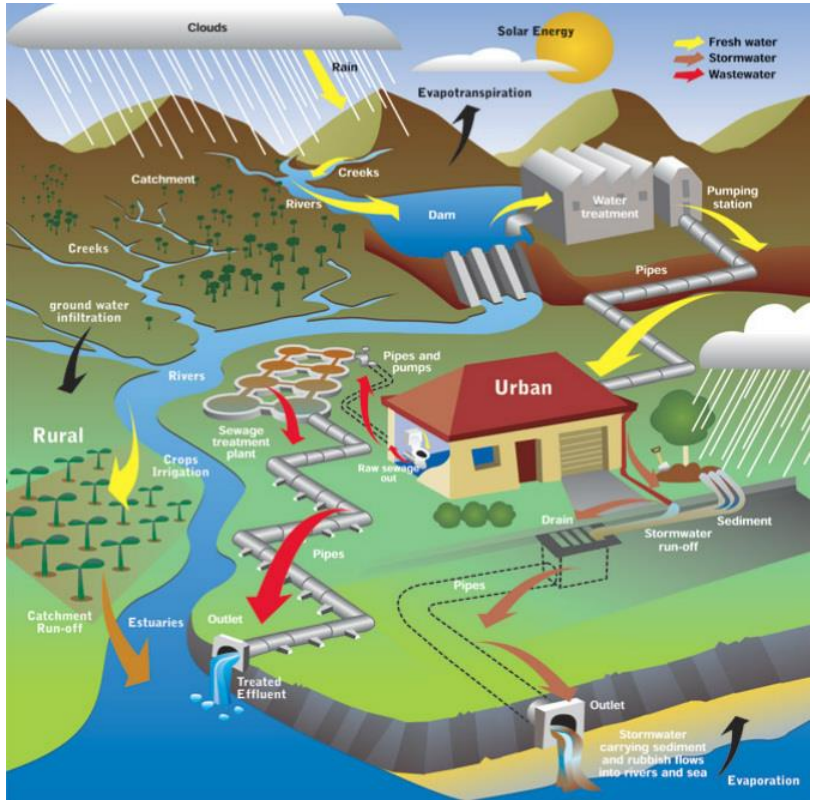
About that gap between research and stakeholders

Complex water optimization problems represent one of the biggest challenges of the near future due to human and climate impacts.

On the one hand, stakeholders in the water supply sector require high-level knowledge of the whole water cycle process at different scales, with the aim to either assess the risk for uncertain future water availability or rely on more analytic approaches for decision making.

We need a model of our water system with integrated optimization strategy

…but our budget is limited, and we don't have the right skills



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Researchers can have the solution to the water problem at hand.

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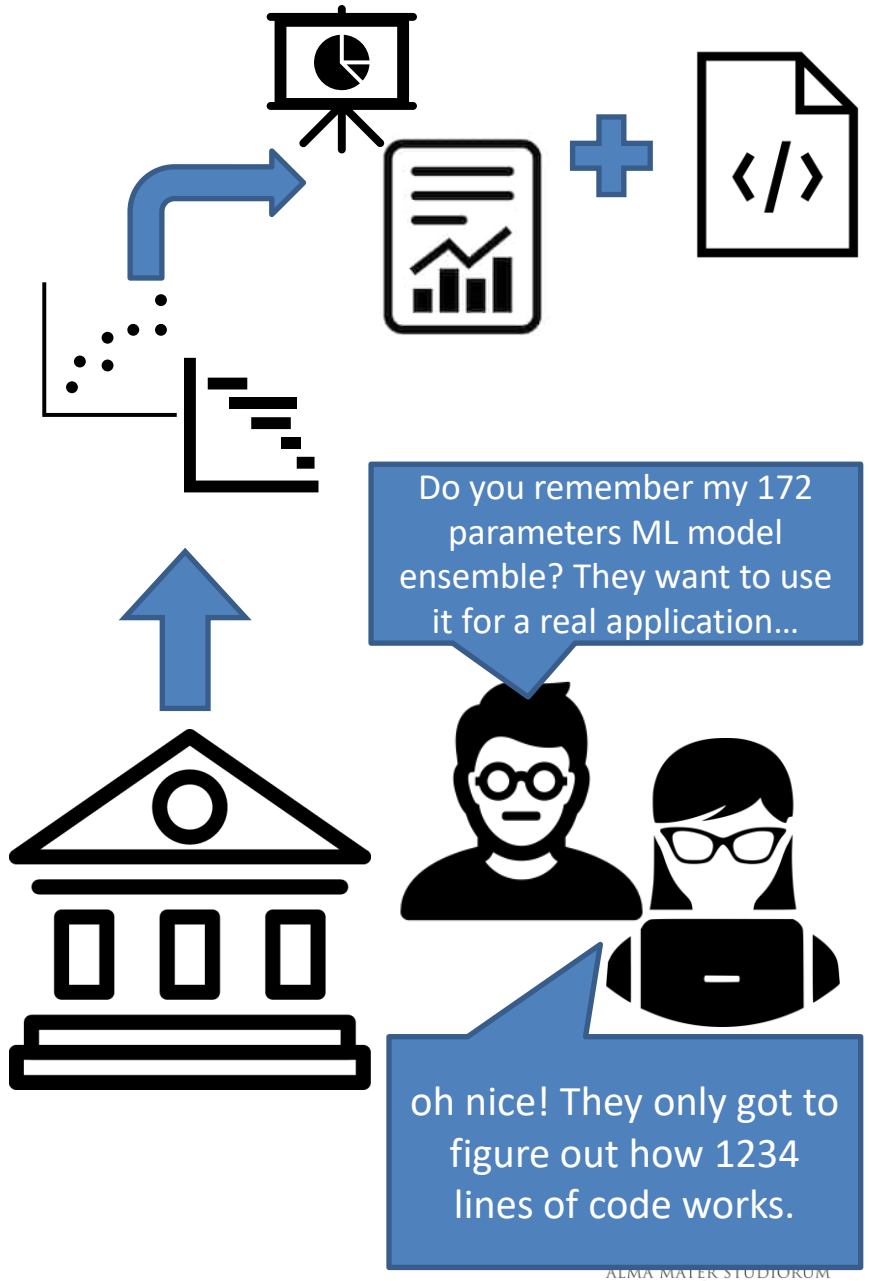
On the other hand, scientific research produces high quality models, algorithms and schemes capable of solving the water problems.

Typical research studies outcome are deployed as papers/reports, presentations, and (in some cases) software in the form of bare code scripts.



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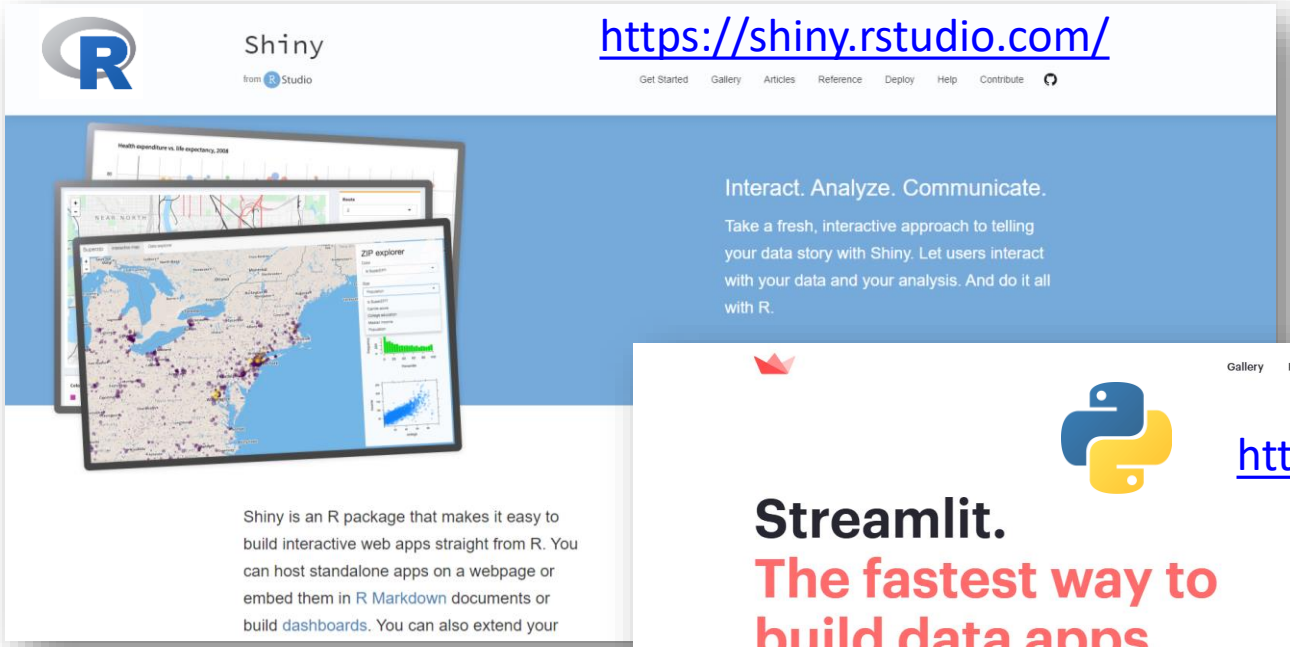
…but scientists often struggle when it comes to deploy tools that deliver their research outcomes to stakeholders and decision makers that ultimately will use them.

Basic web-applications

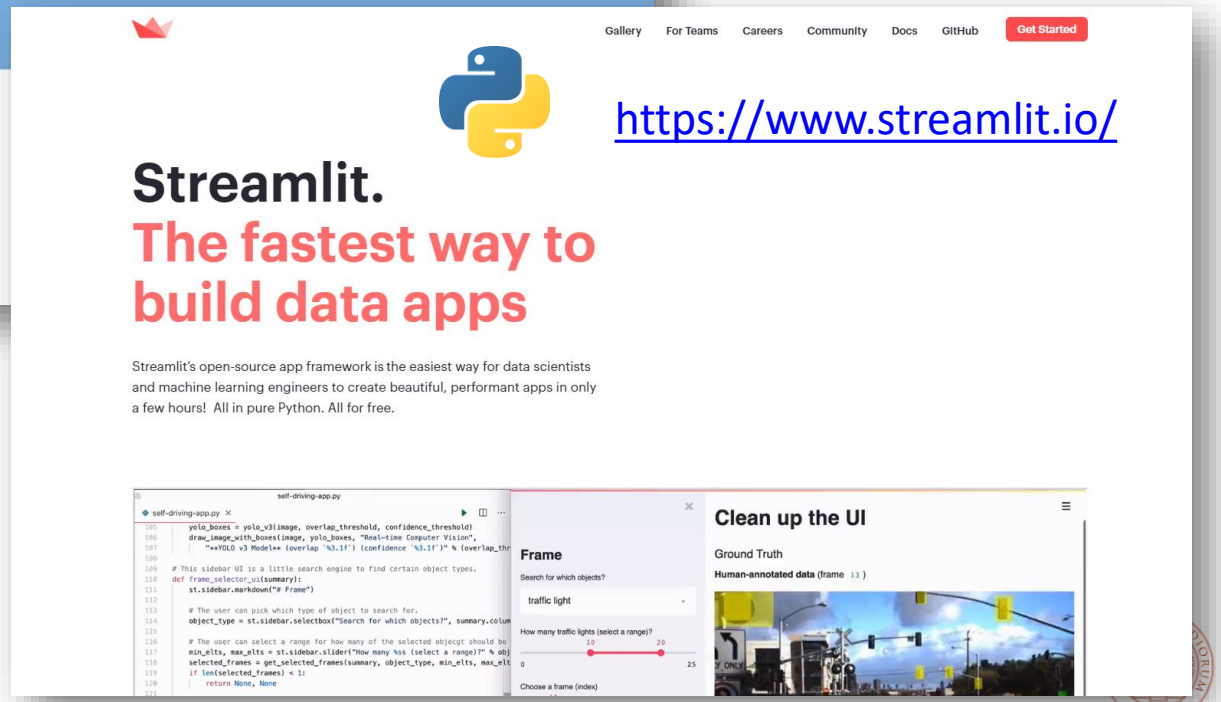
Researchers have now new tools to easily develop simple web-based applications, two main technologies are:

1. R Shiny
2. Python Streamlit



Downside:

- (little?) more programming effort
- Limited to small applications/projects

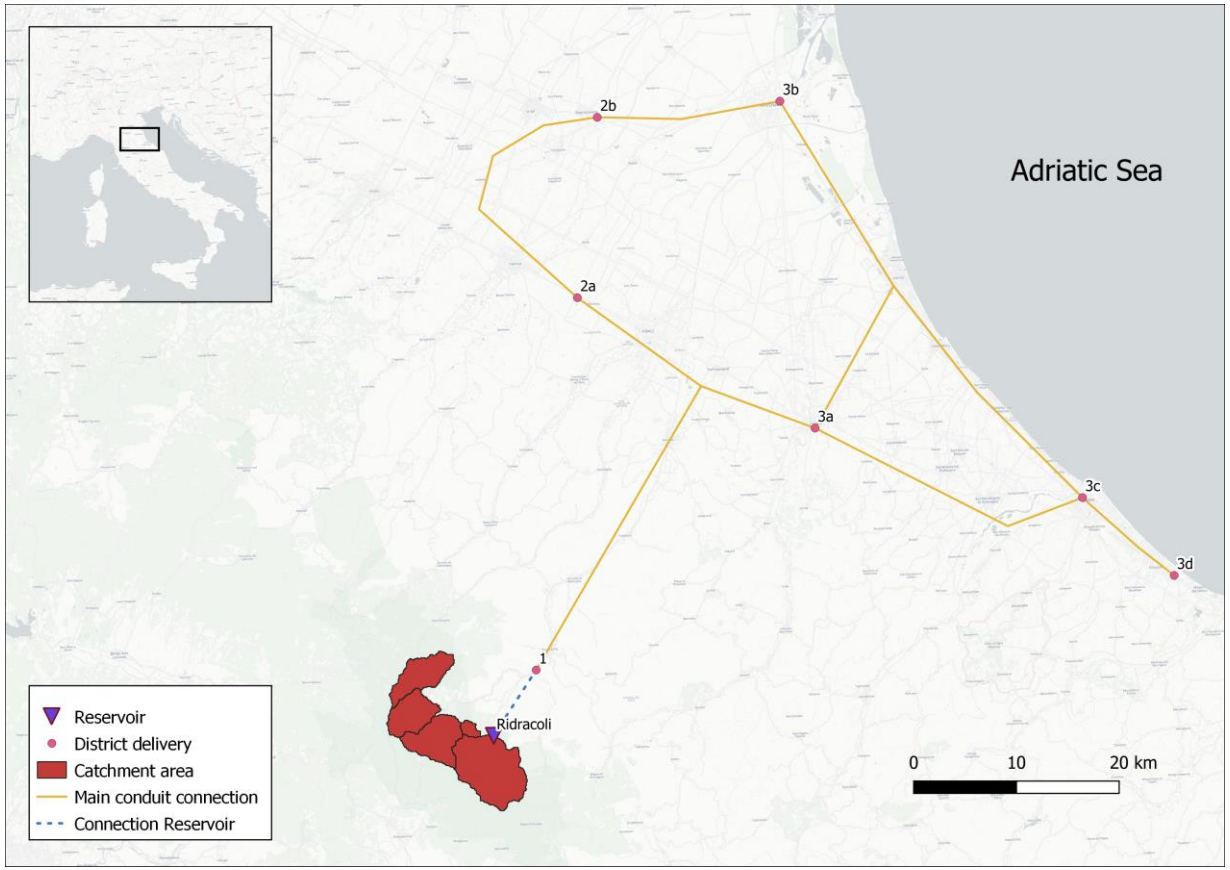


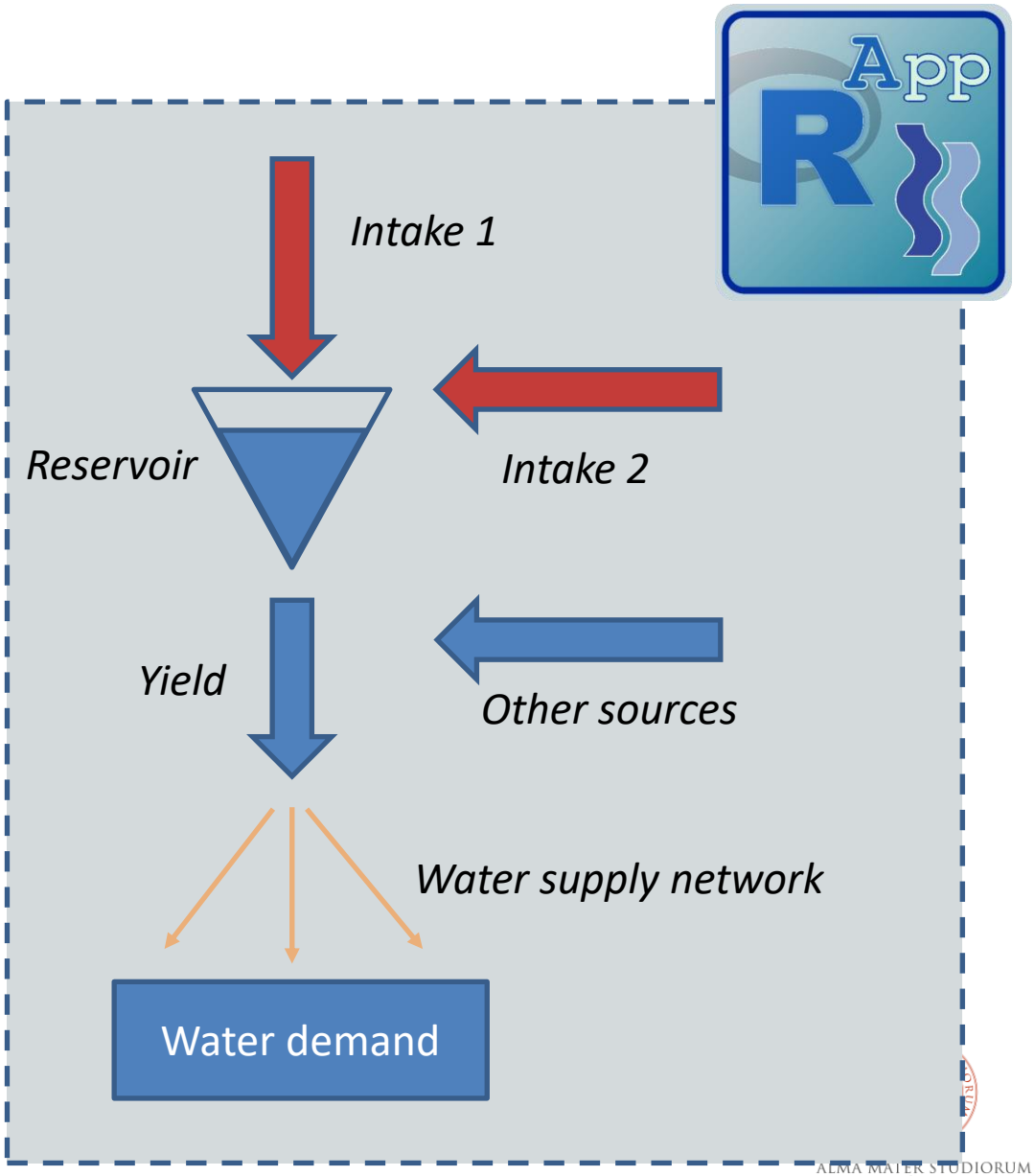
Advantages

- Effective research outcome deployment to non-technical public/users
- Reproducible experiments
- High level and interactive graphics/tables
- Doesn't require any specific programming skills other than regular R (or Python) scripting knowledge
- The final user doesn't need to install anything but a web-browser

Case study: Romagna Acque Application (RApp)

Romagna Acque SpA supplies drinking water by retail to the Romagna region (Emilia-Romagna, Italy), managing the whole process from the provision, the water treatment and distribution.

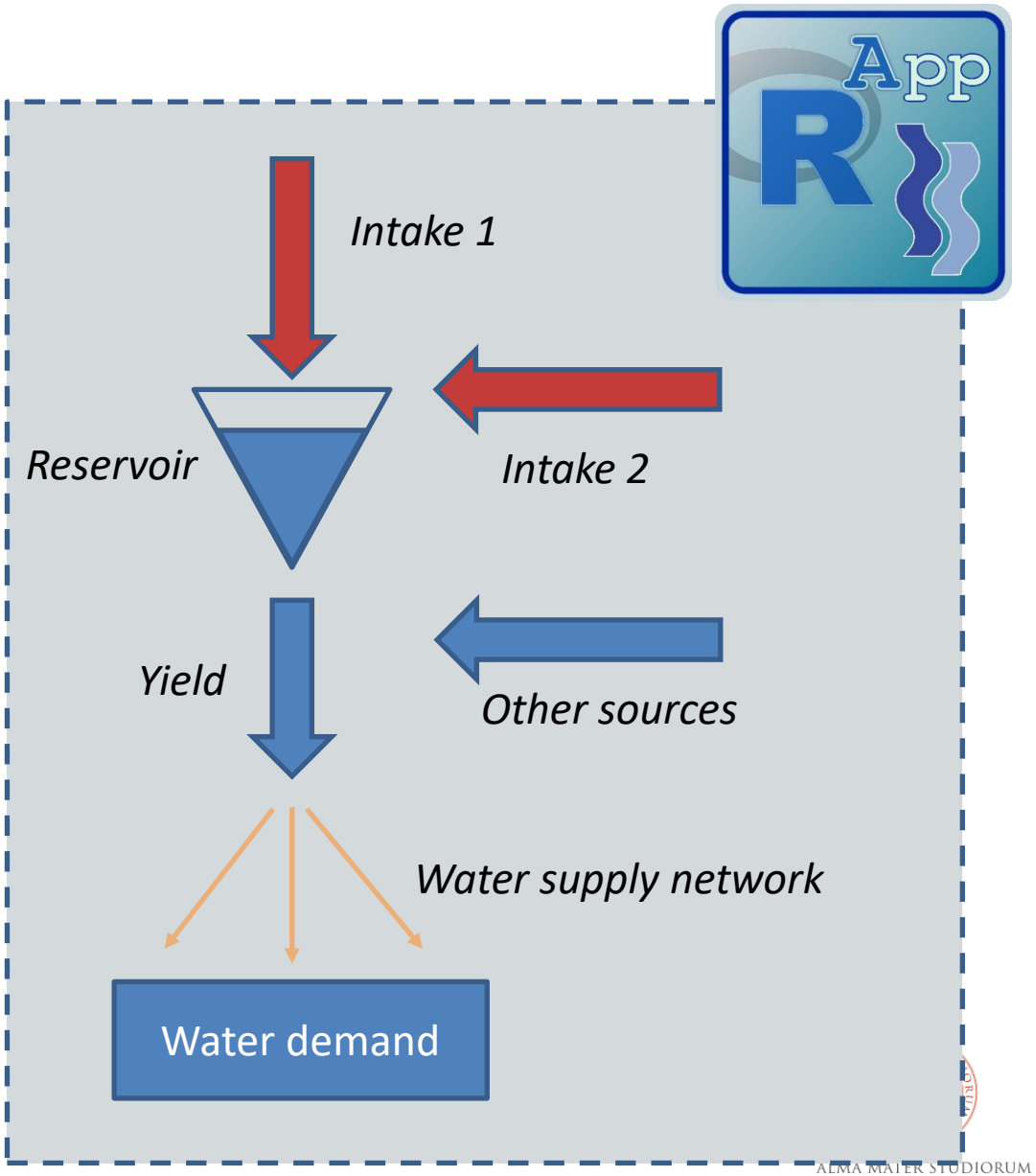




Case study: Romagna Acque Application (RApp)

We developed a decision support system, with the following main features:

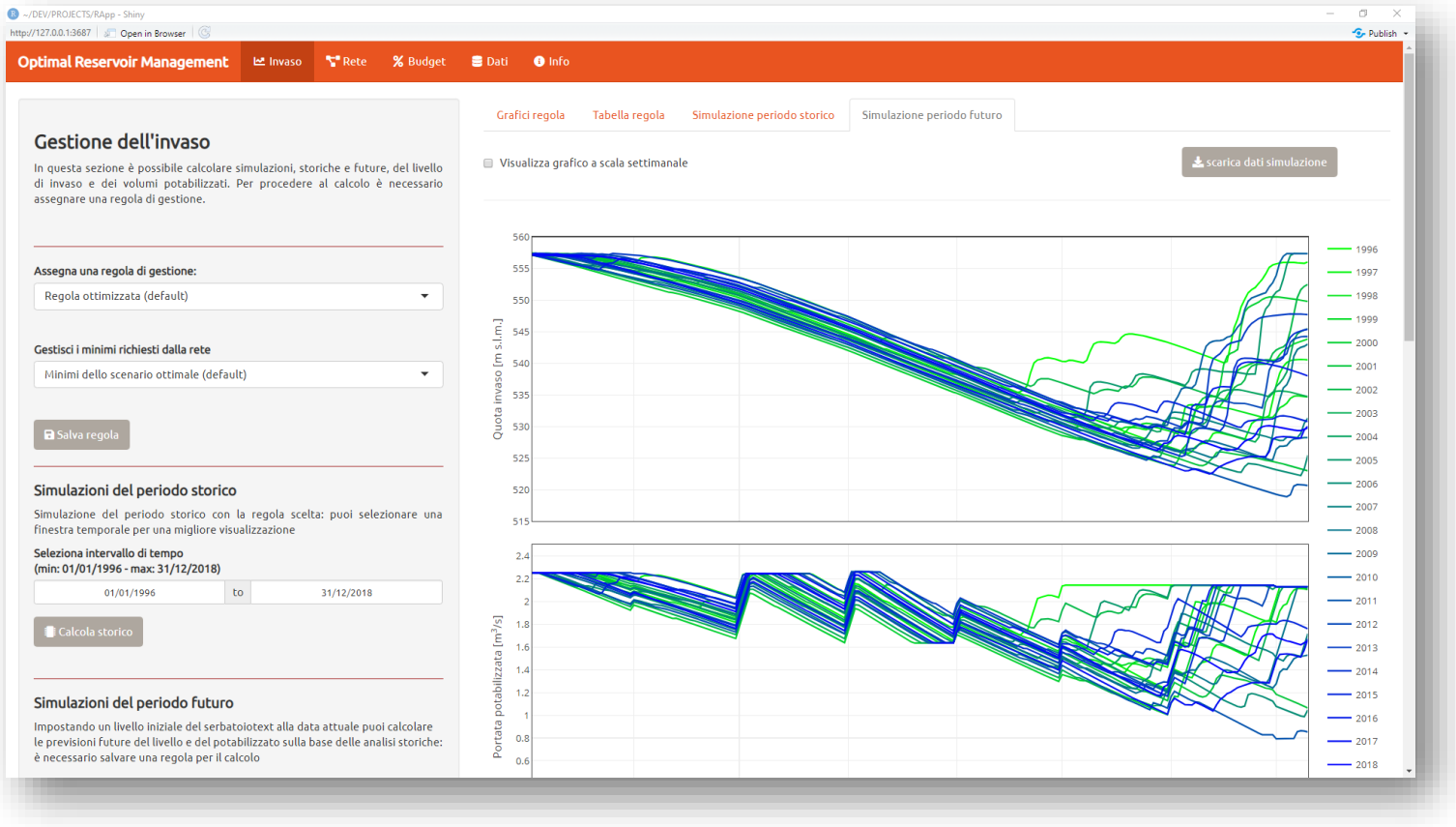
1. Simulate both historical and future reservoir yields and stored volumes;
2. produce quick reports in terms of either graphical or table outputs;
3. set different initial and boundary conditions provided arbitrarily by the users (e.g. initial stored volume, the expected inflows, user-defined management rules, the occurrence of an abrupt change in the water demand);
4. **Built-in optimized management rules**;
5. explore the impact of different scenarios and management options;
6. Maintain and keep the whole dataset up-to-date through the user interface.
7. **Computationally-intensive operations are accomplished on the server-side, while the client-side only visualize the results.**



RAPP video demonstration

Click on the link below for a demo of the app (~ 10 mins.)

https://youtu.be/B-7zRoeubQ4



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