Clarity project - Scilab

Yann Debray - Scilab - ESI Group

This summary describes the achievements of the Scilab team in the frame of the Clarity Project, as well as the features and implementation of a Melody-Xcos connector.

Capella is the Free and Open Source version of the software Melody, developed by Thales. This solution for Model-Based Systems Engineering provides a tool together with a method allowing the graphical modeling of architecture of systems, software and hardware, compliant with the Arcadia method.

Xcos is a Free and Open Source software integrated in Scilab and dedicated to the simulation of dynamic systems (in continuous and discrete time domains). It enables the simulation of both physical systems (thanks to the support of Modelica language) and control systems.

1. Introduction & context

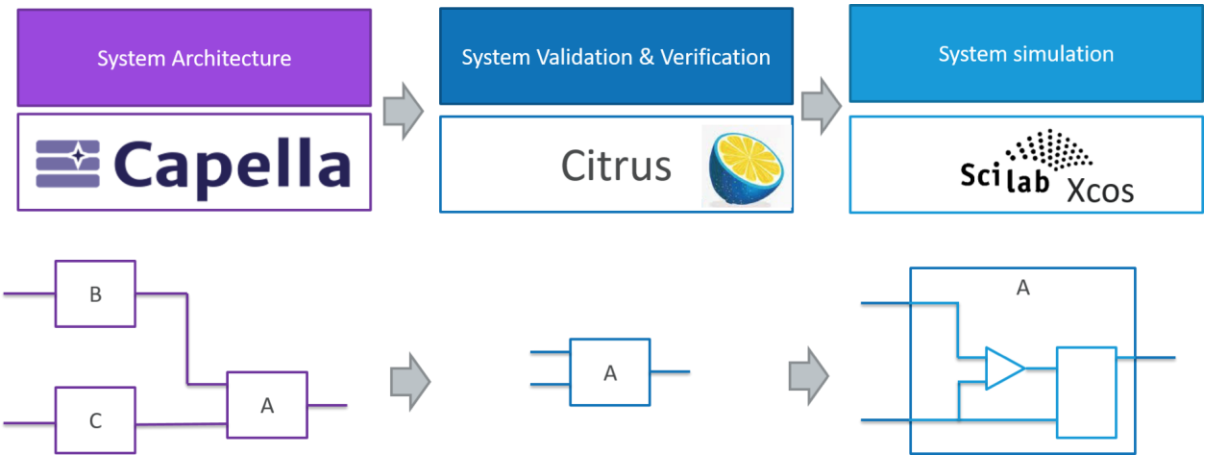
The goals of the Scilab implication in the Clarity project was to contribute to the two viewpoints (Simulation and Validation of Modes & States), through the integration of Scilab/Xcos as simulation plaform.

The integration of the simulation in the systems engineering workflow:

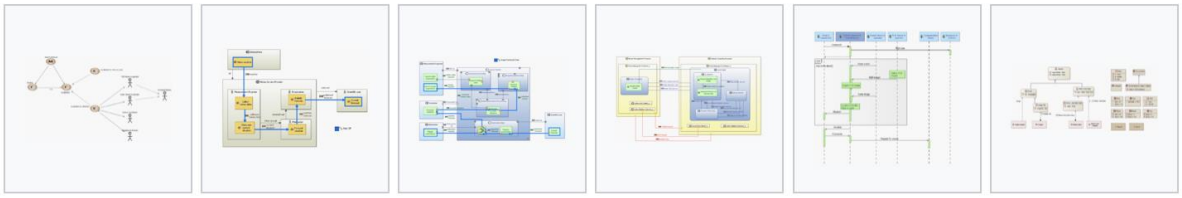
- A user can add specifications and search for existing models implementing specified characteristics
- This search is based on a model database, both locally and on the cloud (via Scilab Cloud API), enabling re-use of private project and sharing in a public knowledge base
- The search feature enables third parties (companies within the ecosystem, or colleagues within a group from different departments) to expose models (either free or commercial) and to store the database associated with the specifications.

2. Architecture of the solution

The connection from Melody to Xcos works in the following workflow:

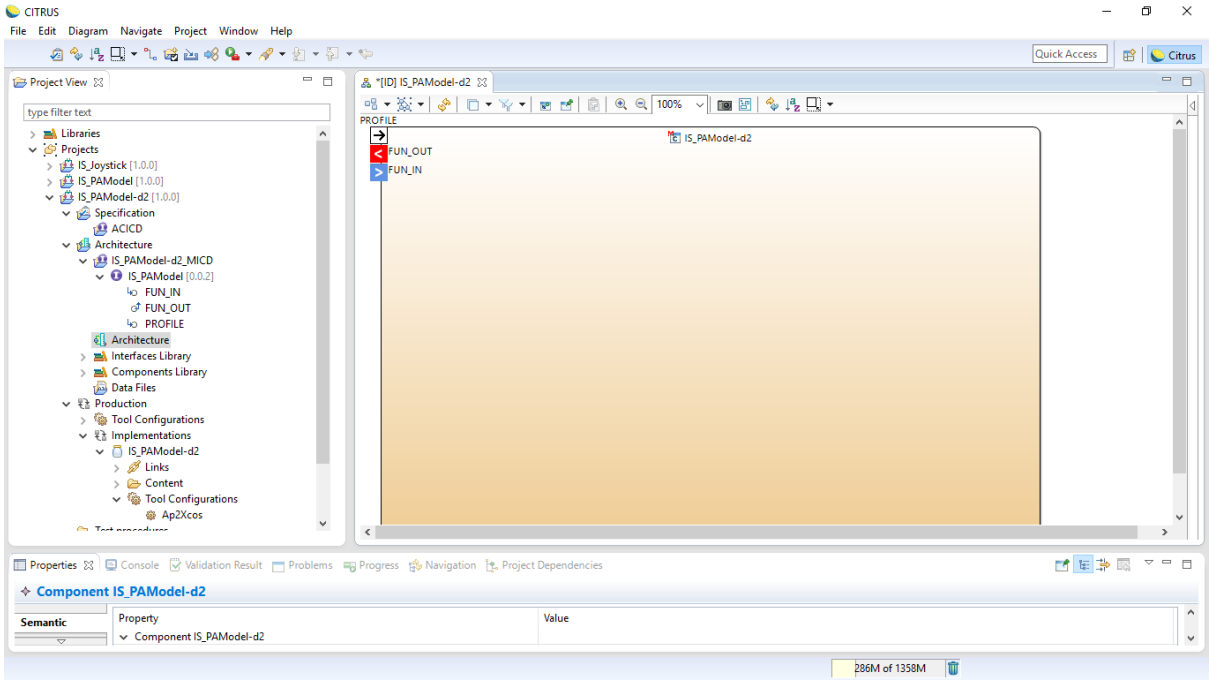


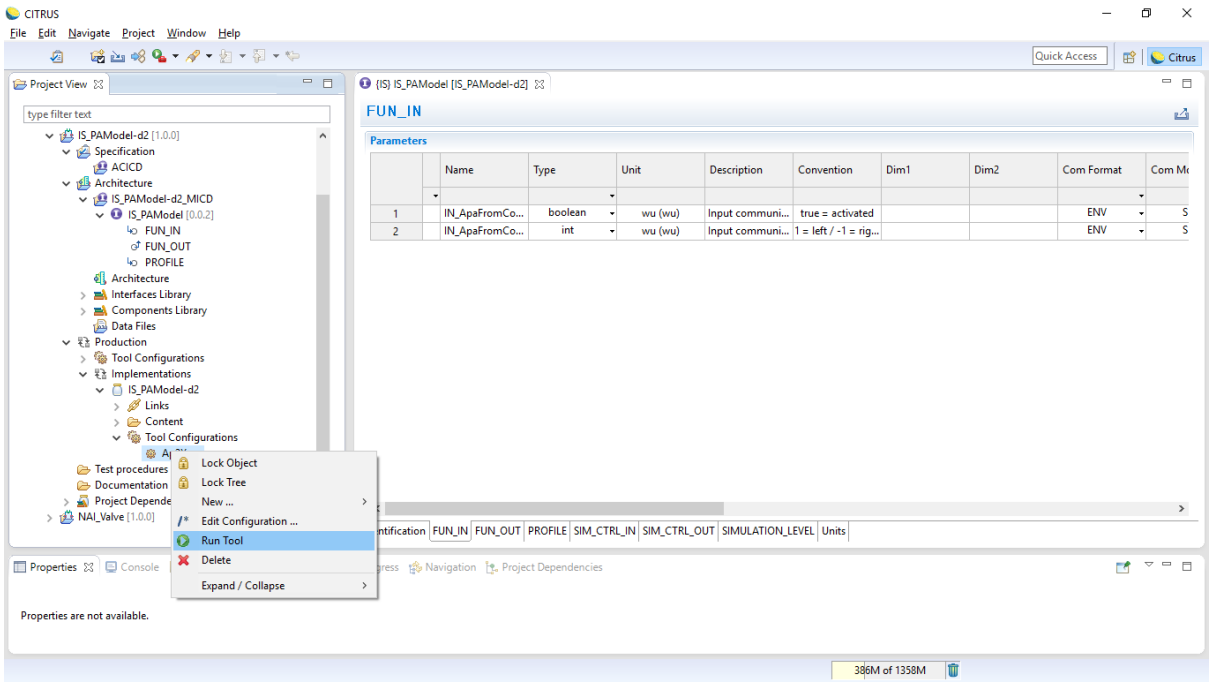
The information of the systems architecture is instantiated in Citrus, in order to define test scenarios, then gathered in Xcos to add the necessary physics behavior for actual testing:



3.1. Export of meta-model from Melody/Capella to Citrus

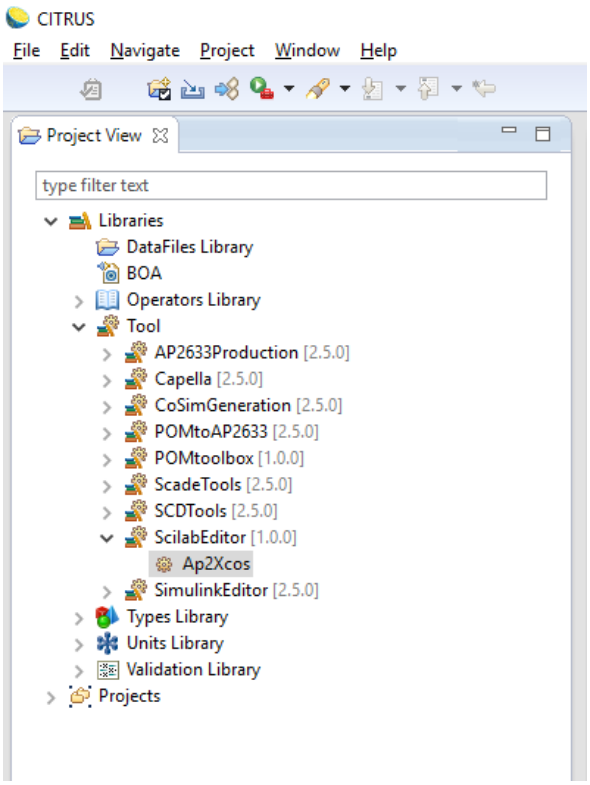
In the following functional mode (systems validation & verification), the information of a sub-system under test are extracted from Melody/Capella, with the XMI format. The exported information comes from the physical and logical layers.



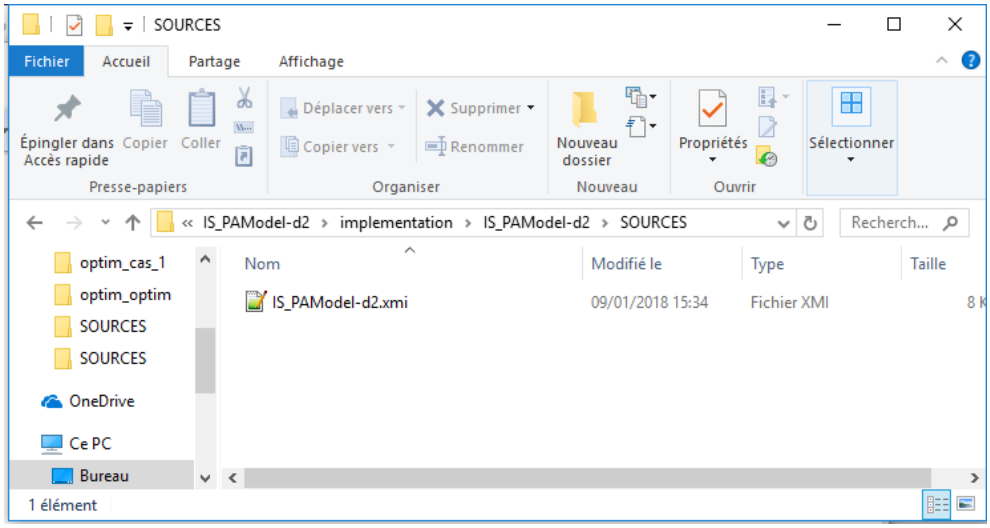


3.2. XMI export tool from Citrus to Xcos

Citrus define a tree of export toolfor different software and different format. Our connector appears in this tree :

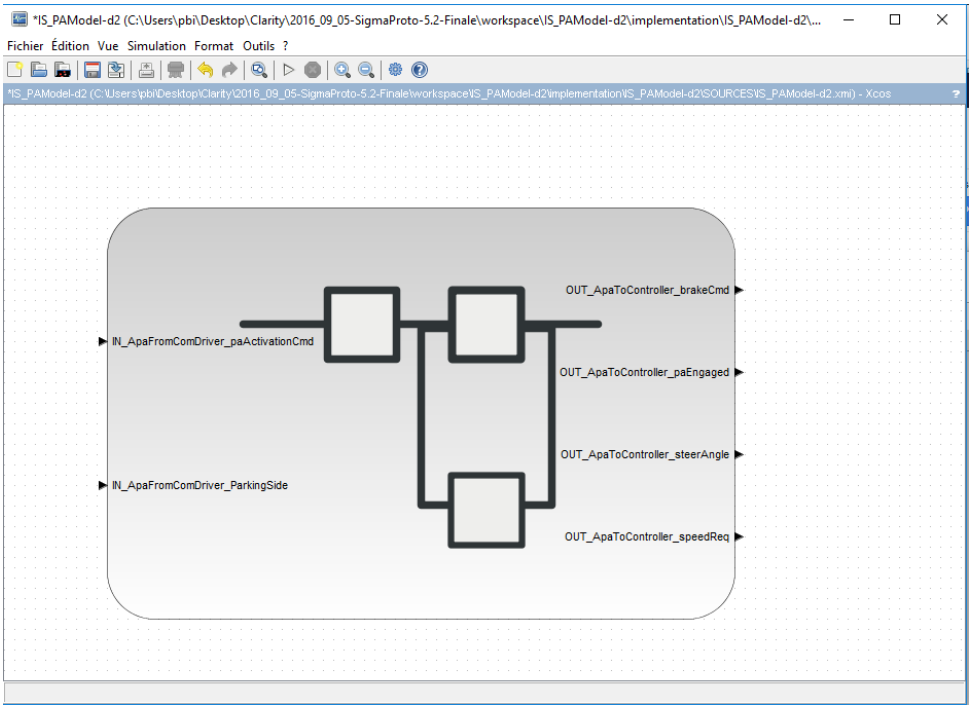


By executing the tool Ap2Xcos (Ap linked to the naming of norm Airbus AP2633, presented in this use case), a XMI file is generated, that contains the interfaces of the model (input and output variables).

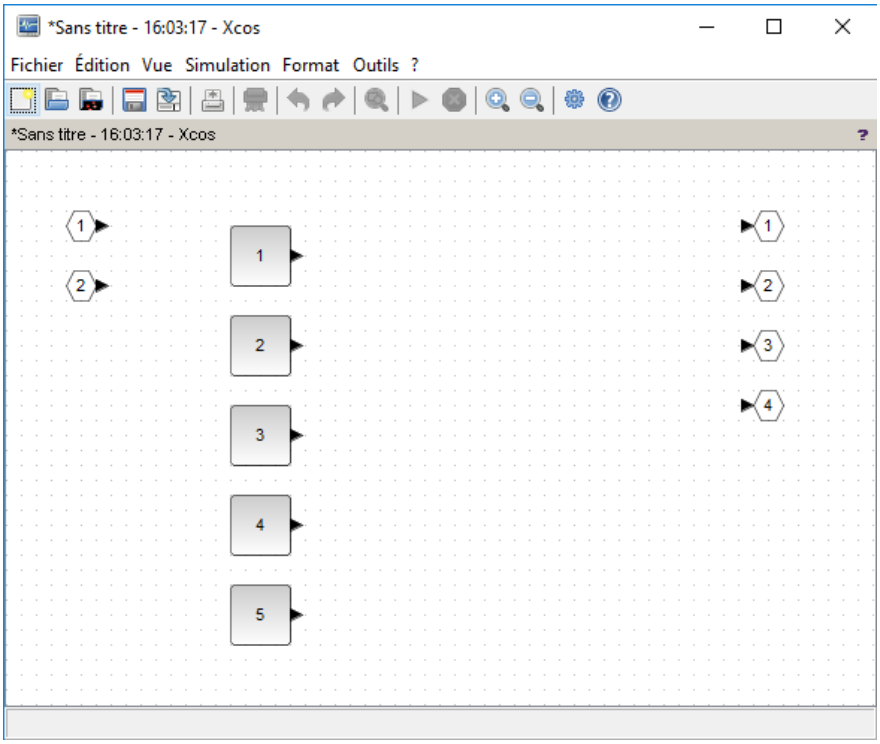


3.3. Open a system model in Xcos

The XMI format is now supported by Xcos in order to save diagrams developed in the frame of Clarity. The exported file can be visualized as follow :

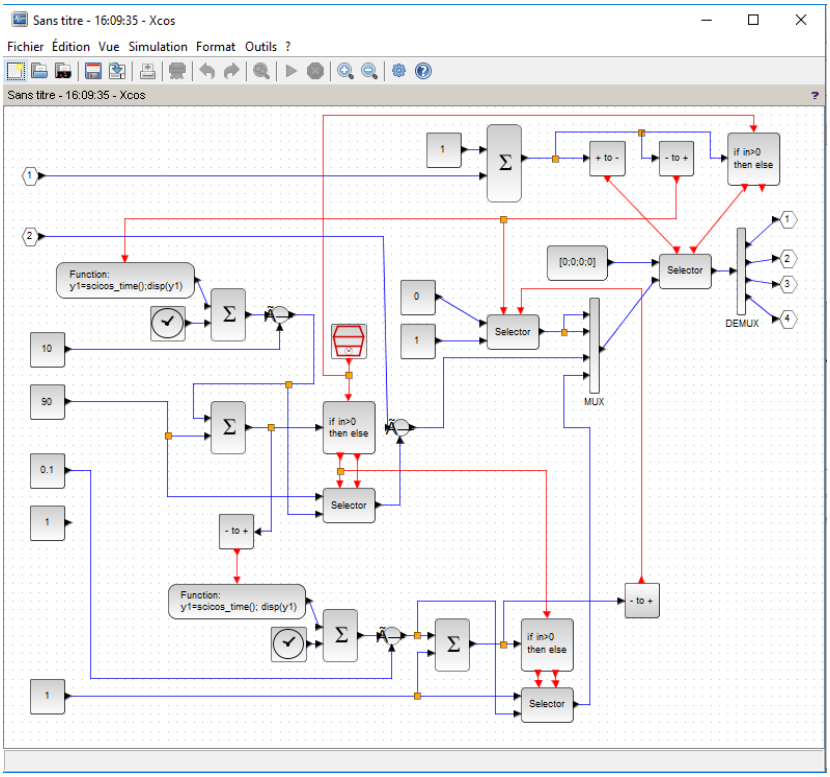


As you can see by double-clicking on the super-block, it is empty… and must be enriched by the physical behavior :



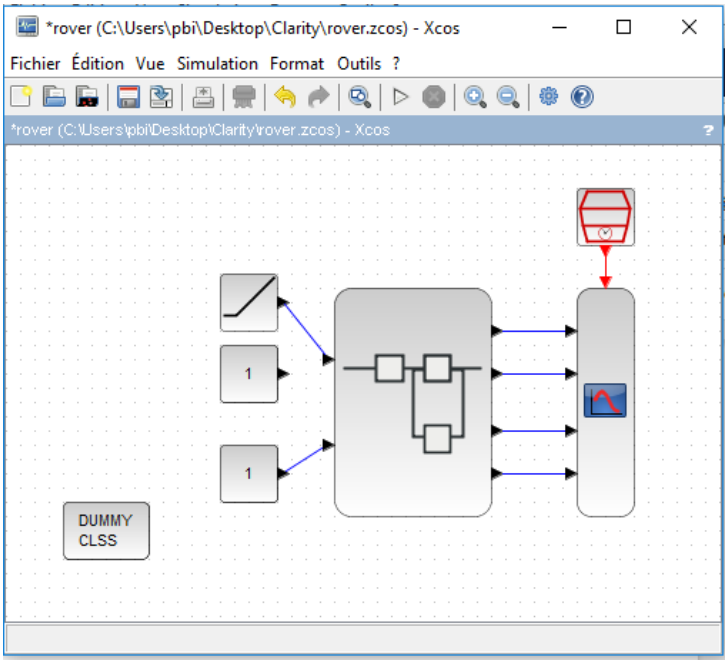
3.3.1. Enrich blocks by a physical behavior

This functional behavior can be described as follow, then stored in a model database (local or cloud):



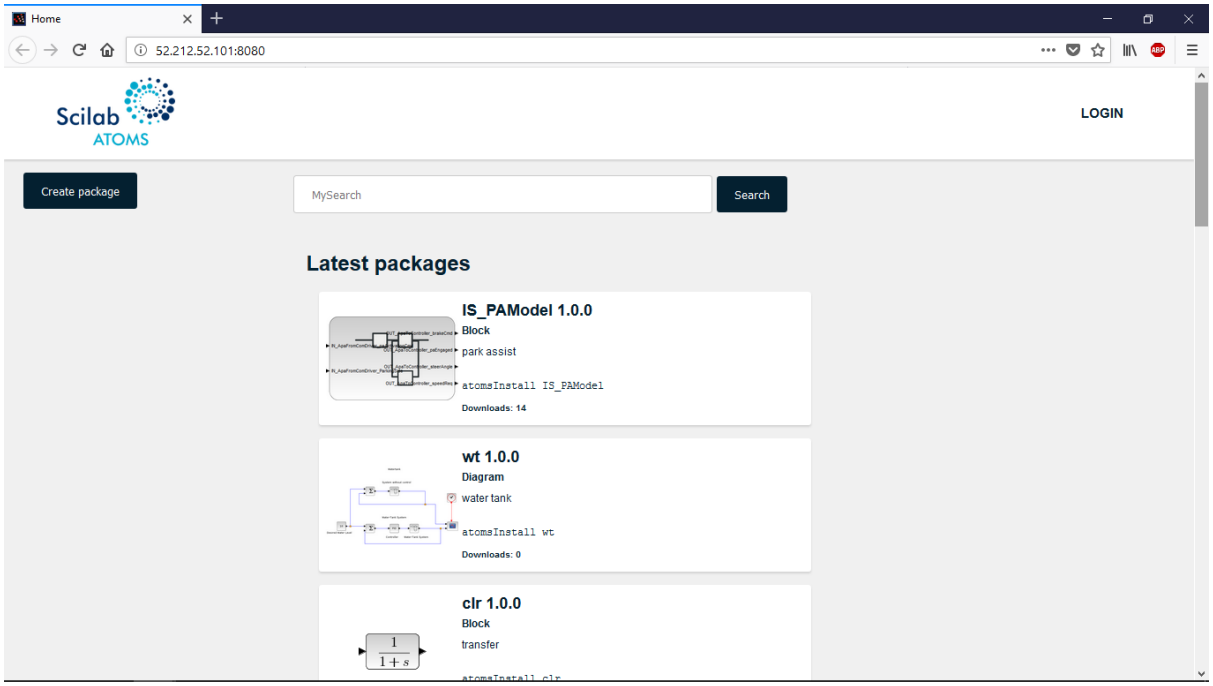
3.3.2. Enrich the environment for Model in the Loop

In order to define a test scenario, environment elements have to be modeled in order to perform MiL simulation (Model in the Loop):

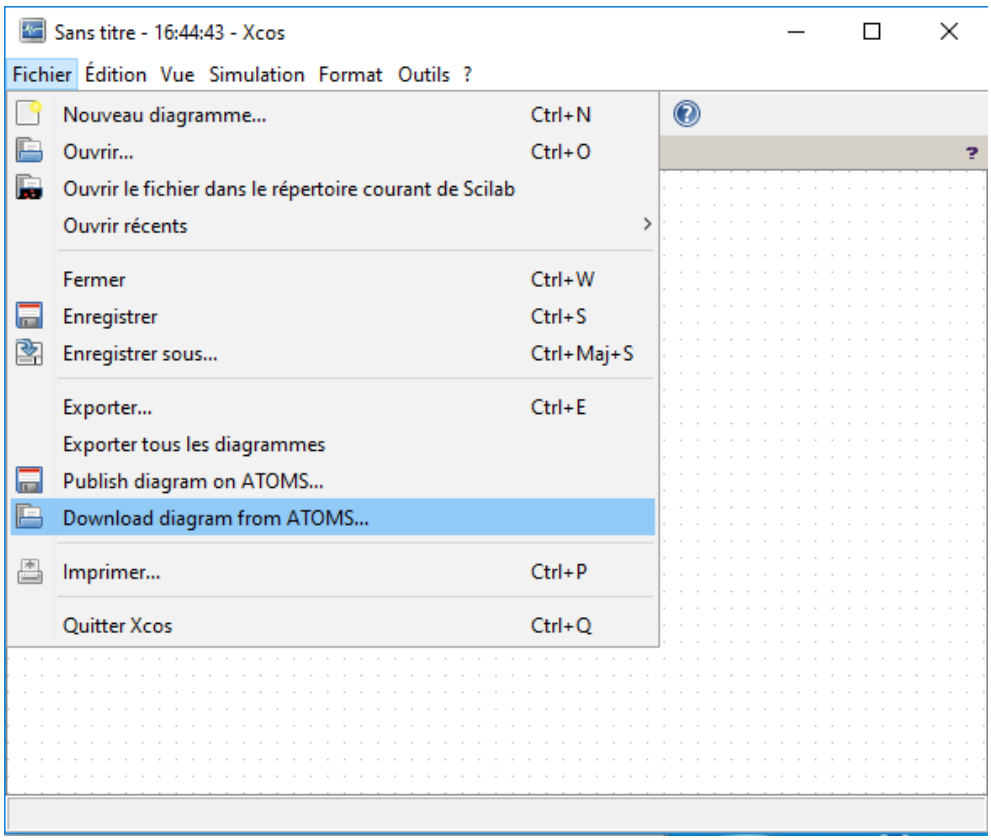


3.4. Store models on a cloud database

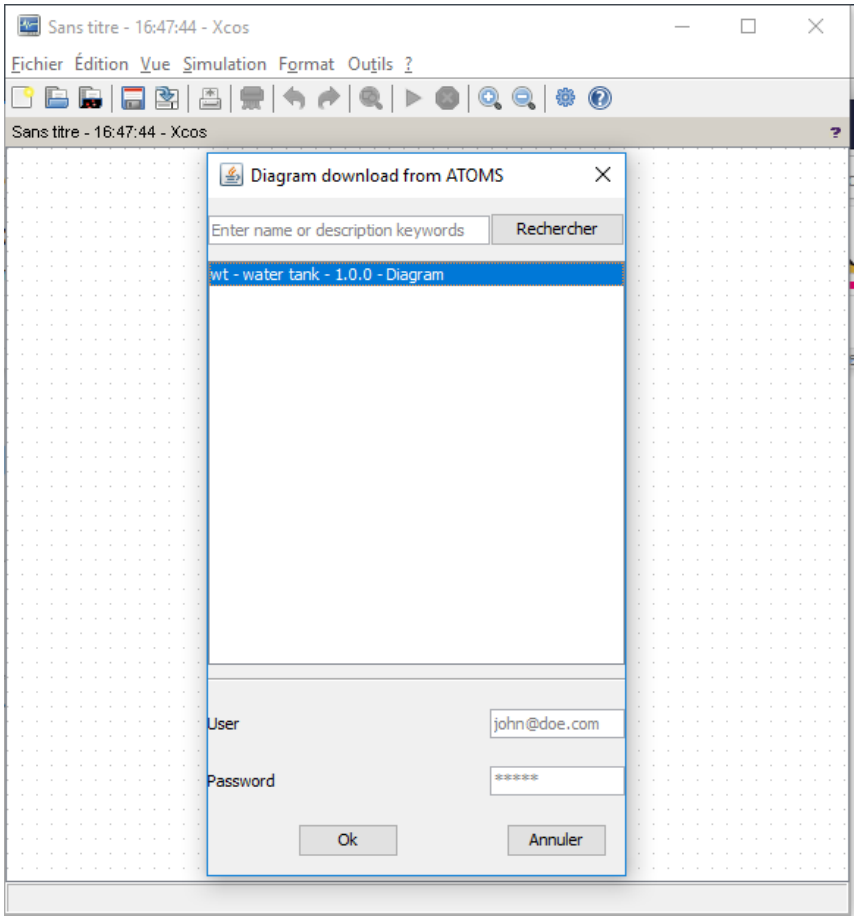
Scilab Cloud provides a simulation model repository, used in the frame of the Clarity project in order to store system models on the cloud.



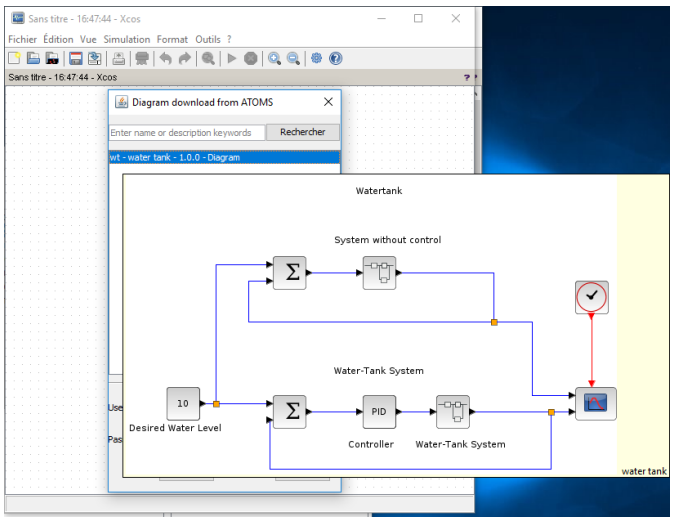
3.4.1. Download models from Scilab desktop

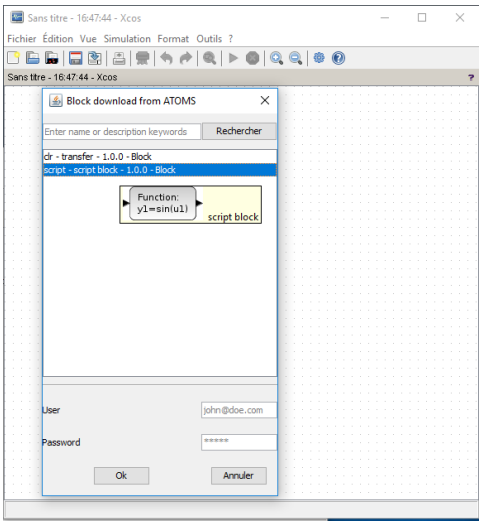


A search field allows to select models and diagrams :

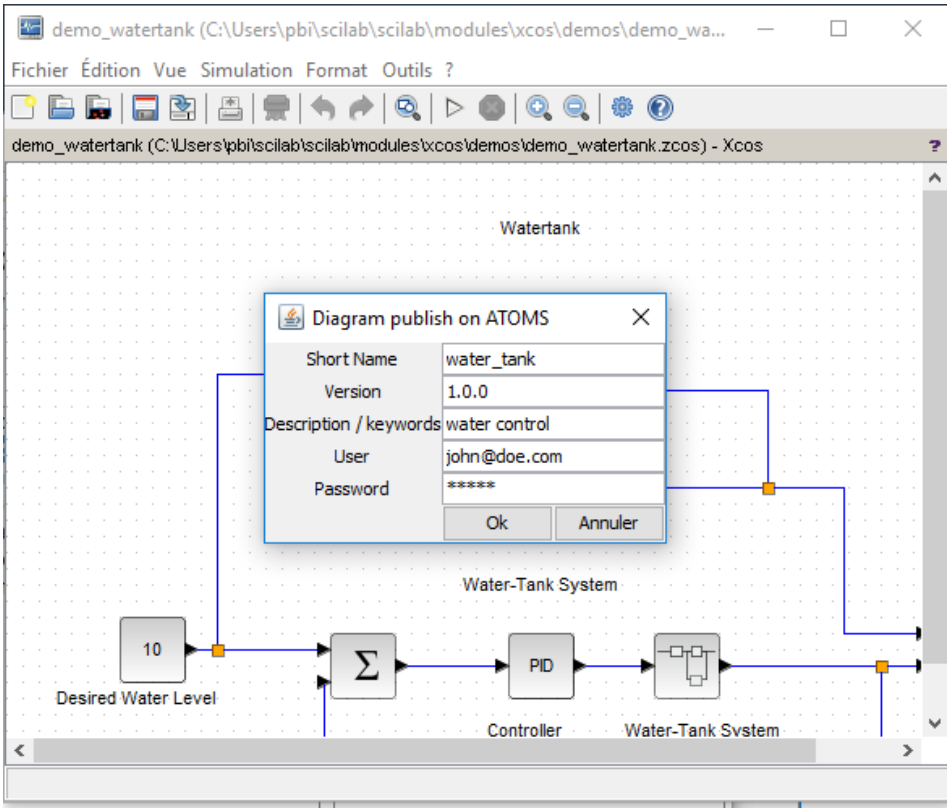


The list of available diagrams is interactive and provide a mouseover representation of the diagram:



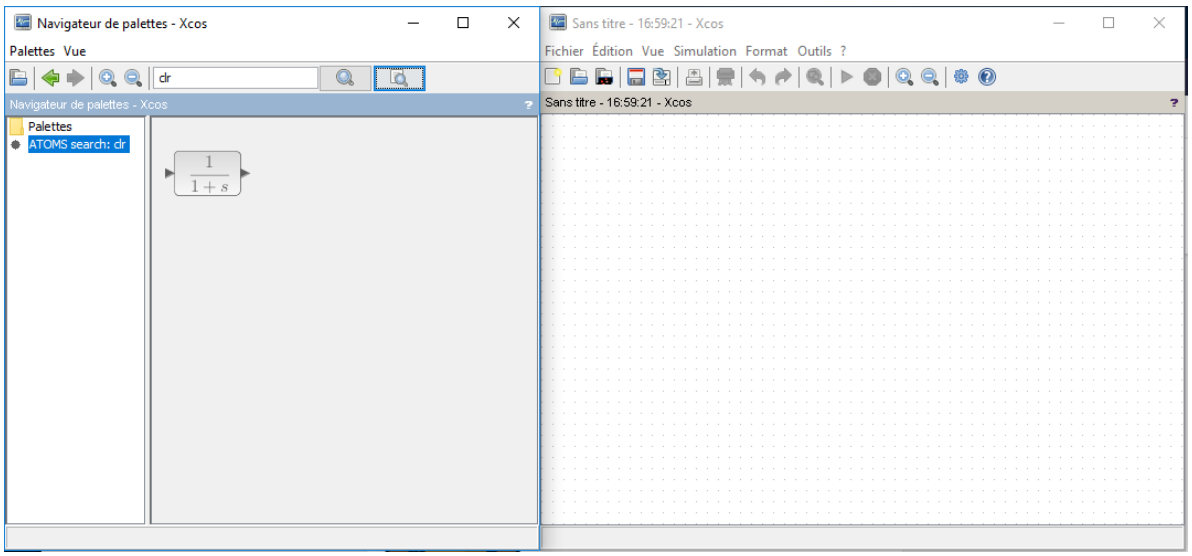


3.4.2. Publish models from the Scilab desktop client



The same way, we can upload/publish models and diagrams developed in Scilab/Xcos.

3.4.3. Search blocks in the Xcos palette



3.4.4. Support of the Functional Mock-Up Interface

The FMI standard is a tool independent standard to support both model exchange and co-simulation of dynamic models using a combination of xml-files and compiled C-code (see overview in PDF or PPTformat).