REPORT ON OpenDreamKit DELIVERABLE D4.5

SAGE notebook / JUPYTER notebook convergence

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Due on	01/09/2016 (M12)
Delivered on	28/02/2017
Lead	Université Paris-Sud (UPSud)
Progress on and finalization of this deliverable has been tracked publicly at: `https://github.com/OpenDreamKit/OpenDreamKit/issues/94`	

DELIVERABLE DESCRIPTION, AS TAKEN FROM GITHUB ISSUE #94 ON 2017-02-28

- **WP4:** User Interfaces
- **Lead Institution:** Université Paris-Sud
- **Due:** 2016-08-31 (month 12)
- **Nature:** Demonstrator
- **Tasks:** T4.1 (#69) Uniform notebook interface for all interactive components, T4.6 (#74) Structured documents
- **Proposal:** p. 48
- **Final report**

The goal of this deliverable is to replace the old Sage Notebook server by the newer Jupyter server. This has two aspects: first of all, there needs to be an easy way to convert Sage notebooks to Jupyter. Second, the Jupyter notebook needs to have the same features that the Sage notebook had.

Since 2014, a lot of work was put into this by the SageMath community, and in particular Volker Braun. Recently, this work has been continued thanks to OpenDreamKit.

Done:

- ✓ #19877: Conversion of legacy notebooks to Jupyter notebooks @vbraun, @videlec, @marcinofulus
- ✓ #19740 : Run `sagenb_export` by default
- ✓ #20690, #22458: Live documentation @fcayre, @nthiery, @videlec
- [ ] Interacts/widgets: full support and backward compatibility with the legacy SageNB #21267 (closed installation issues: #21260 #21261 #20218 #21256) @jdemeyer

Future work:

- [ ] WYSIWYG editor for the markdown cells, such as TinyMCE (see this post for motivation)
- [ ] [#20316](`https://trac.sagemath.org/ticket/20316`): Add button to export SageNB notebooks to Jupyter

CONTENTS

1. Report

The default notebook application in SageMath is now `sagenb_export`. This is a small web application, built on top of Jupyter, which can convert Sage notebooks to Jupyter. It also has buttons to run either the old Sage notebook server or the new Jupyter notebook server. See Figure 1.

An important use case of the notebook is *interactive functions*: these allow the user to control the input of a function using *widgets* such as sliders and text boxes. See Figure 2 for an example. This way, the user can easily investigate how some function changes when the input changes. Once the interact is created, it can be used by people having no experience at all with Sage or Python. Interacts have been implemented independently in the Sage notebook and in Jupyter (package `ipywidgets`). For the conversion of Sage notebooks to Jupyter to be useful, also interacts should work the same way. This has been implemented in the Jupyter kernel for Sage: see Figure 3 for the same example as Figure 2, this time in Jupyter.

A handy feature of the old Sage notebook is *live documentation*. In the Sage notebook, the documentation of Sage is "live": the examples from the documentation become editable notebook cells. This way, the user can run those examples and experiment with them. This has now been implemented also in the Jupyter notebook using the Thebe package from O'Reilly Media. Thebe allows embedding Jupyter notebook cells in arbitrary webpages and this has been used to turn the Sage documentation live when viewed through the Jupyter notebook. See Figure 4 for an example.

Appendix A. Screenshots

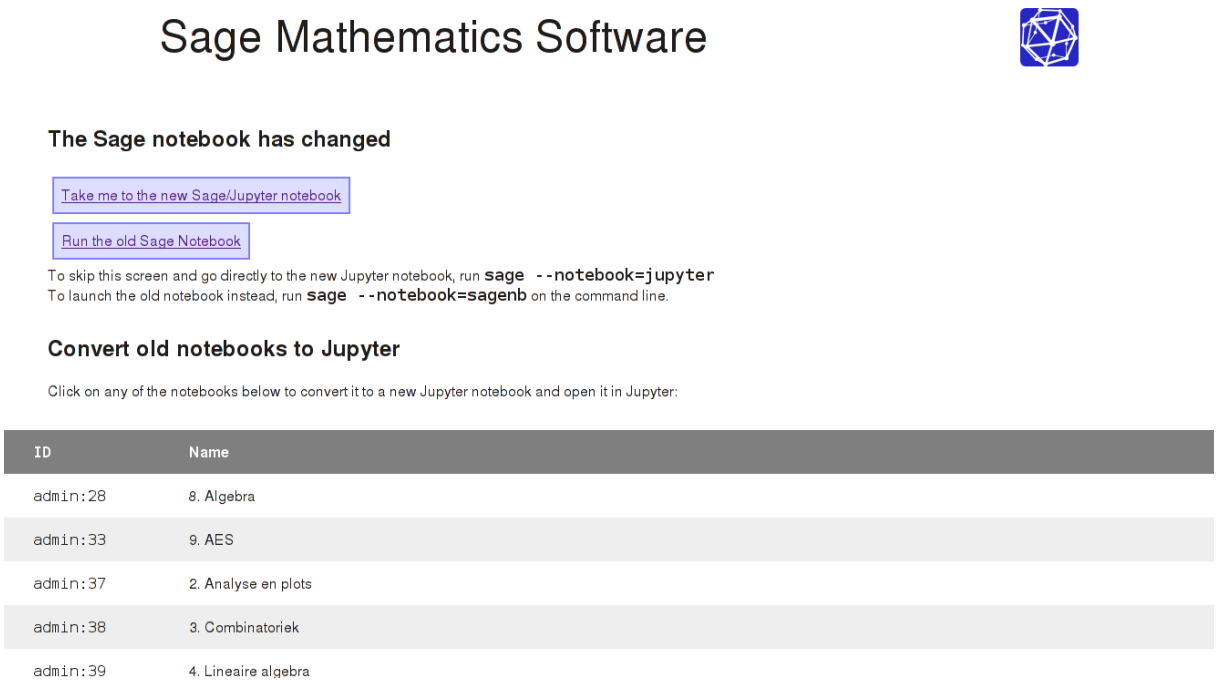

Figure 1. The `sagenb_export` application, showing buttons to run the Sage or Jupyter notebook and a list of Sage notebooks to convert to Jupyter.

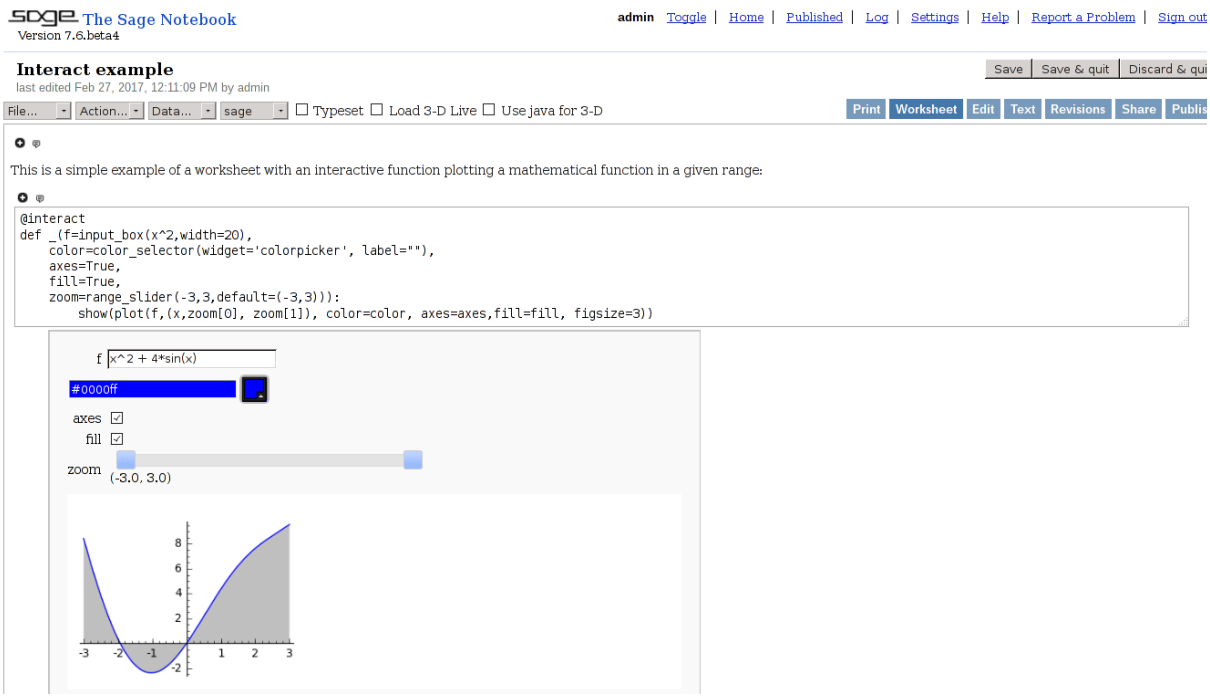

FIGURE 2. An example of an interact in the old Sage notebook.

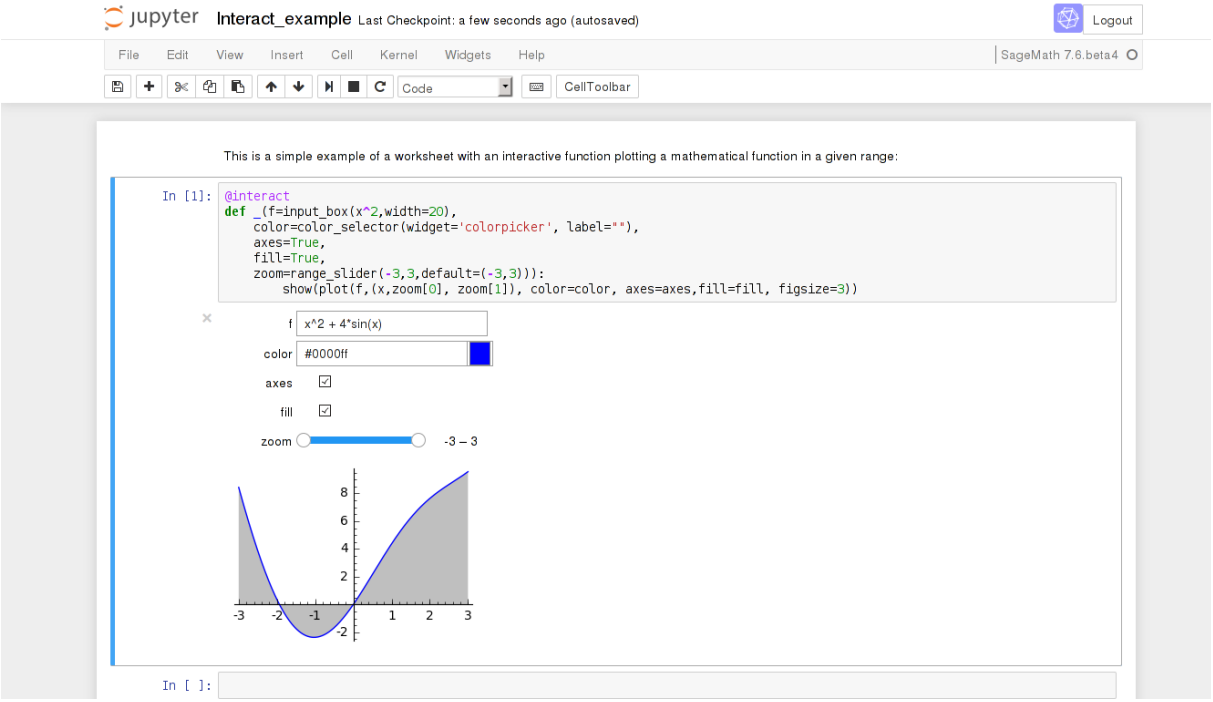

FIGURE 3. The same example interact, converted to Jupyter using `sagenb_export`. Note the identical functionality, despite a different visual interface.

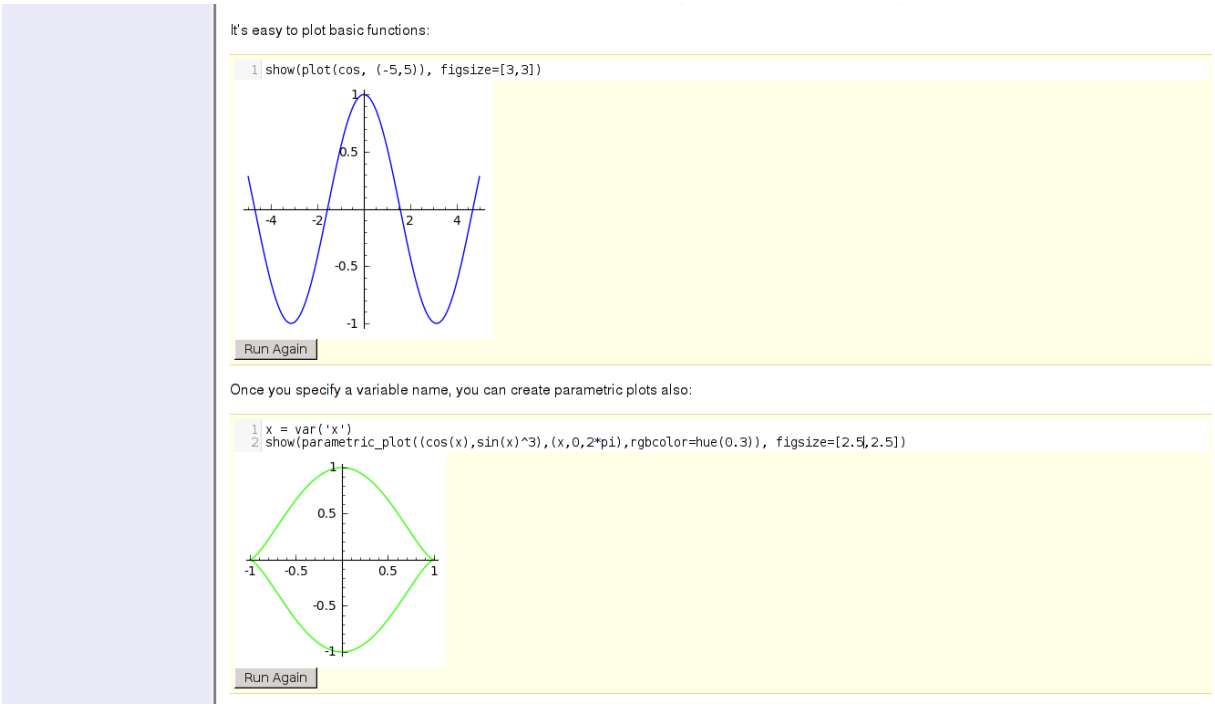

FIGURE 4. Live documentation in the Jupyter notebook: the user can edit the examples in the documentation and run them using the “Run Again” buttons.

Disclaimer: this report, together with its annexes and the reports for the earlier deliverables, is self contained for auditing and reviewing purposes. Hyperlinks to external resources are meant as a convenience for casual readers wishing to follow our progress; such links have been checked for correctness at the time of submission of the deliverable, but there is no guarantee implied that they will remain valid.