REPORT ON OpenDreamKit DELIVERABLE D4.4
Basic JUPYTER interface for GAP, PARI/GP, SAGE, Singular

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Due on	31/08/2016 (M12)
Delivered on	27/02/2017
Lead	Université Paris-Sud (UPSud)

Progress on and finalization of this deliverable has been tracked publicly at: `https://github.com/OpenDreamKit/OpenDreamKit/issues/93`

DELIVERABLE DESCRIPTION, AS TAKEN FROM GITHUB ISSUE #93 ON 2017-02-27

- **WP4:** User Interfaces
- **Lead Institution:** Université Paris-Sud
- **Due:** 2016-08-31 (month 12)
- **Nature:** Other
- **Task:** T4.1 (#69)
- **Proposal:** p.48
- **Final report**

The Jupyter Notebook is a web application that enables the creation and sharing of executable documents which contain live code, equations, visualizations and explanatory text. Thanks to a modular design, Jupyter can be used with any computational system that provides a so-called *Jupyter kernel* implementing the *Jupyter messaging protocol* to communicate with the notebook. OpenDreamKit therefore promotes the Jupyter notebook as user interface of choice, in particular since it is particularly suitable for building modular web based Virtual Research Environments.

This deliverable aims at ODK's main computational components all having basic Jupyter kernels implemented and distributed. Full featured Jupyter interfaces will follow up in deliverable D4.7. The SageMath Jupyter kernel is a foundation for D4.5: Sage notebook / Jupyter notebook convergence.

We have implemented basic kernels for:

- ✓ GAP:
    - ✓ `https://github.com/gap-packages/jupyter-gap`
    - ✓ pip package
    - [ ] Optional SageMath package `gap_jupyter`: trac #21416
    - [ ] SageMathCloud integration: `https://github.com/sagemathinc/smc/issues/1706`
    - ✓ Features: TAB-completion, documentation lookup, code introspection, output history, interruption, timing, debugger
    - Upcoming features in D4.7: syntax highlighting (should just require installing Code Mirror's syntax file for GAP), pretty printing, 2D/3D plots, live manual.
- ✓ PARI/GP:
    - ✓ `https://github.com/jdemeyer/pari_jupyter`

-   – ✓ PARI patches required for plotting: `jeroen-svg` branch of `http://pari.math.u-bordeaux.fr/git/pari.git`
  - – ✓ pip package
  - – ✓ Optional SageMath package `pari_jupyter`: trac #19372, #19992, #22177
  - – [ ] SageMathCloud integration: `https://github.com/sagemathinc/smc/issues/1709`
  - – ✓ Features: TAB-completion, (short) documentation lookup, output history, interruption, timing, 2D plots
  - – Upcoming features in D4.7: syntax highlighting, pretty printing, long documentation lookup, live manual?, code introspection?, debugger
- ✓ Singular:
  - – ✓ `https://github.com/sebasguts/jupyter-singular`
  - – ✓ pip package
  - – ✓ Optional SageMath package `singular_jupyter`: trac #22378
  - – ✓ SageMathCloud integration: `https://github.com/sagemathinc/smc/issues/1553`
  - – ✓ Features: TAB completion, static 3D plots generated by surf, basic support for interactive widgets (IPyWidgets).
  - – Upcoming features in D4.7: live 3D plots, . . .

Meanwhile, the following Jupyter kernel has been implemented by the community, with some help of the ODK participants:

- ✓ SageMath (built on top of Jupyter's Python kernel)
  - – ✓ see this series of trac tickets
  - – ✓ Part of the SageMath distribution
  - – ✓ SageMathCloud integration: native
  - – ✓ Features: TAB-completion, syntax highlighting, pretty printing, 2D/3D plots, documentation lookup, live manual, code introspection, output history, interruption, timing, debugger.
  - – Interactive widgets (IPyWidgets): see D4.5

Finally, the following kernel has been made available within SageMath:

- ✓ R: see trac #19427

CONTENTS
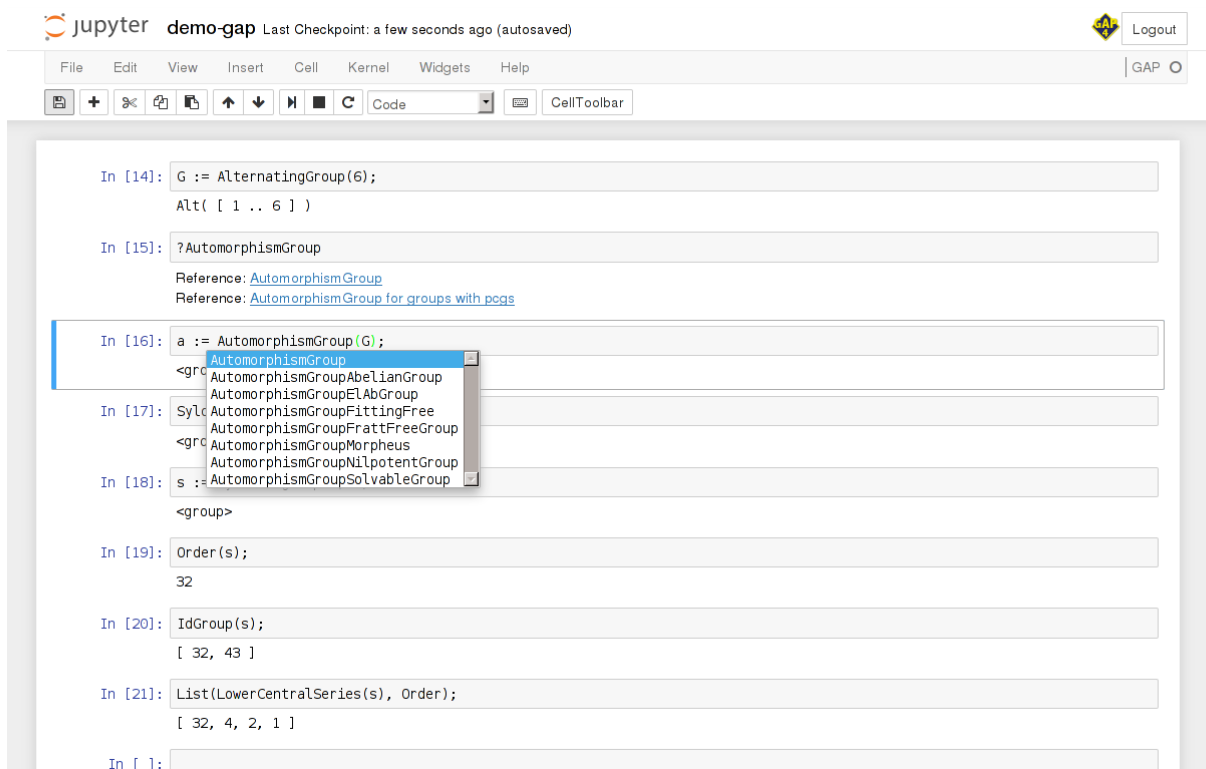
APPENDIX A. SCREENSHOTS

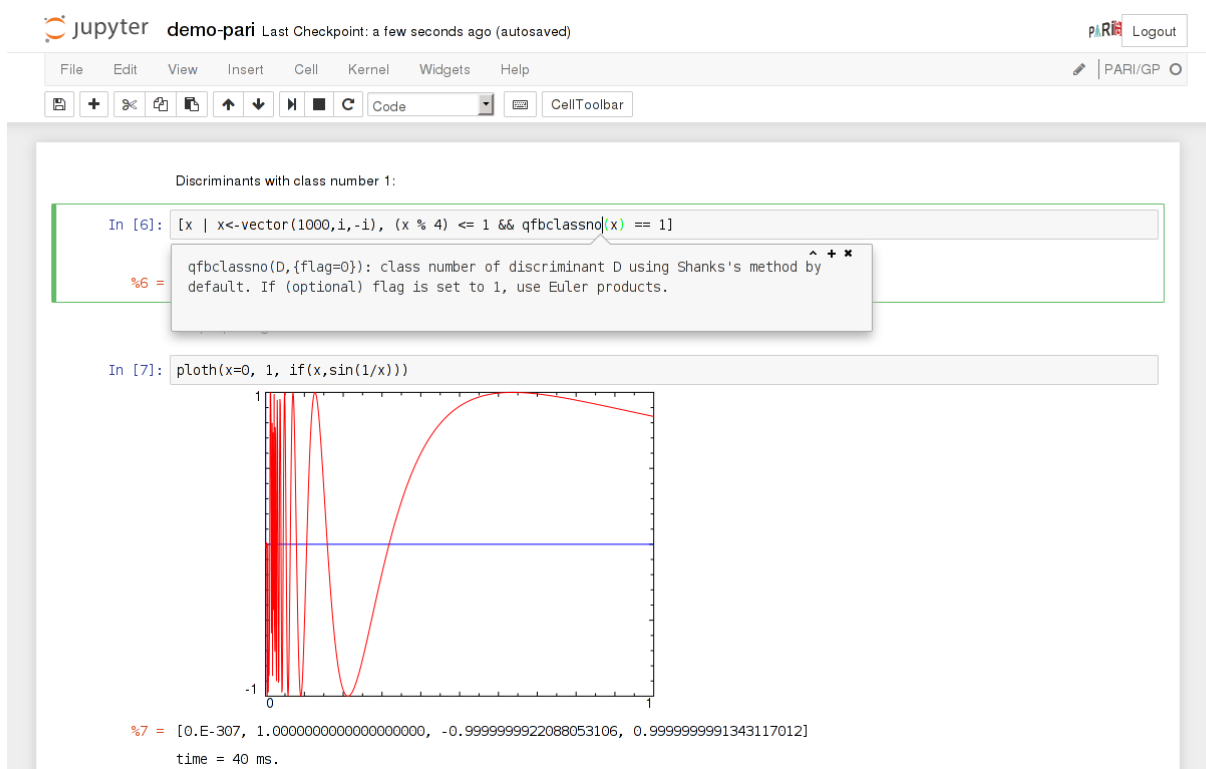FIGURE 1. GAP Jupyter kernel showing group computations, help and TAB-completion

FIGURE 2. PARI/GP Jupyter kernel showing discriminant calculations, plotting and short help.
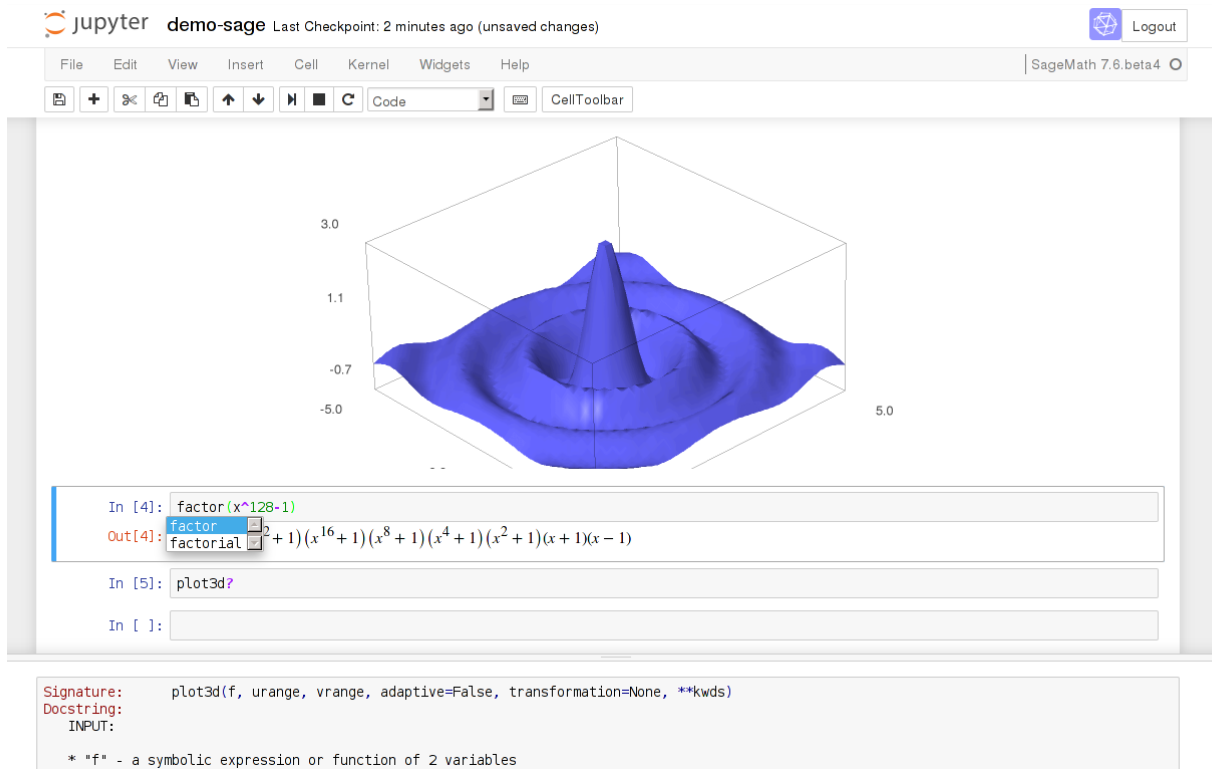
FIGURE 3. SageMath Jupyter kernel showing Mathjax typesetting, 3D plots, TAB-completion, documentation lookup.
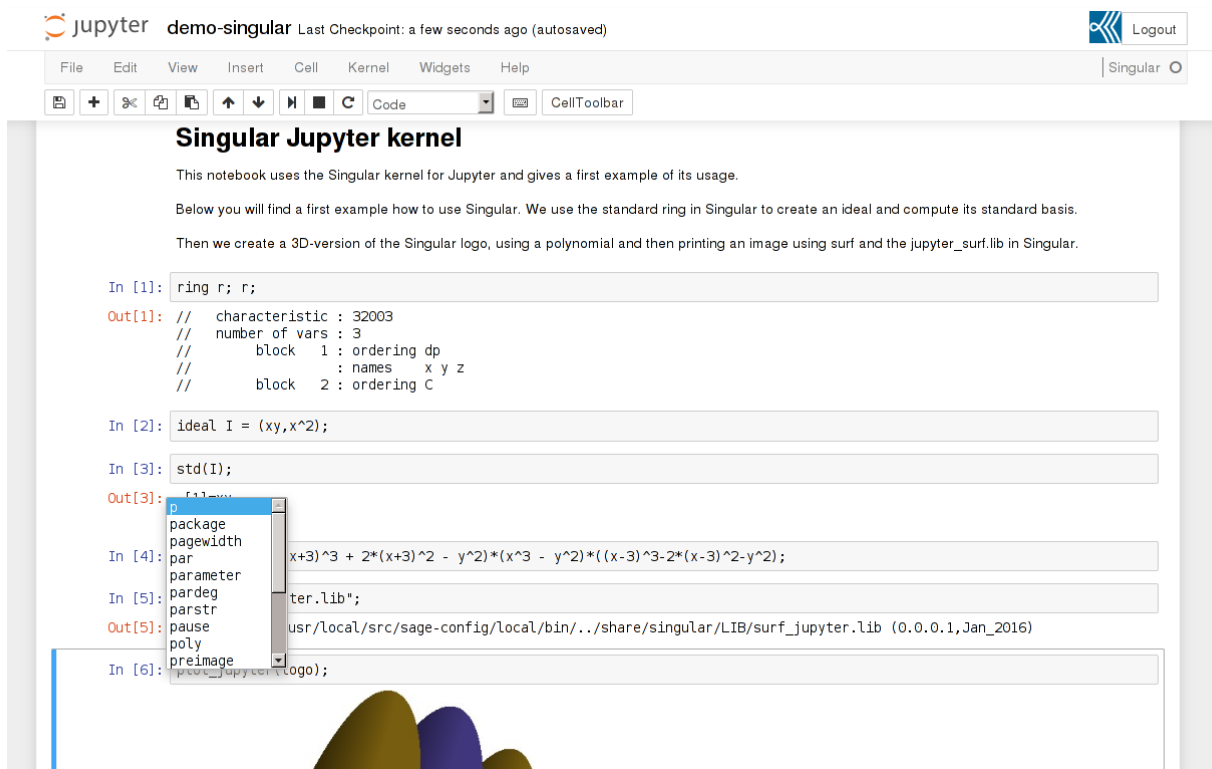

FIGURE 4. Singular Jupyter kernel showing polynomial calculations, 3D plots, and TAB-completion.

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.