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

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Due on	01/09/2016 (M12)
Delivered on	??/09/2016
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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 2016-09-20

- **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 that contains 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 (#96). The SageMath Jupyter kernel is a fundation for D4.5 (#94) Sage notebook / Jupyter notebook convergence.

We implemented basic kernels for:

- [ ] GAP:
    - ✓ https://github.com/gap-packages/jupyter-gap
    - [ ] pip package
    - [ ] optional Sage package: trac [#21416](https://github.com/OpenDreamKit/OpenDreamKit/issues
    - ✓ Features: tab-completion, documentation lookup, code introspection, output history, interruption, timing, debugger
    - Upcoming features in D4.7 (#96): 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
    - ✓ pip package

  – ✓ optional sage package: trac [#19372](https://github.com/OpenDreamKit/OpenDreamKit/issues
    [#19992](https://github.com/OpenDreamKit/OpenDreamKit/issues/19992)
  – ✓ Features: tab-completion, (short) documentation lookup, output history,
    interruption, timing
  – Upcoming features in D4.7 (#96): 2D/3D plots, syntax highlighting, pretty
    printing, long documentation lookup, live manual?, code introspection?, debug-
    ger
- [ ] Singular:
  – ✓ `https://github.com/sebasguts/jupyter-singular`
  – [ ] pip package
  – [ ] optional sage package
  – ✓ Features: tab completion, static 3D plots generated by surf, basic support for
    interactive widgets (IPyWidgets).
  – Upcoming features in D4.7 (#96): 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
  – Features: tab-completion, syntax highlighting, pretty printing, 2D/3D plots, doc-
    umentation lookup, live manual, code introspection, output history, interruption,
    timing, debugger.
  – Upcoming features: interactive widgets (IPyWidgets).

Finally, the following kernels have been included in the SageMath distribution:

- ✓ R: see trac [#19427](https://github.com/OpenDreamKit/OpenDreamKit/issues/19427)
- [ ] cl, maxima: see trac [#21445](https://github.com/OpenDreamKit/OpenDreamKit/issues/21445)

TODO:

- [ ] Make sure that all kernels are included in the Sage distribution, SageMathCloud,
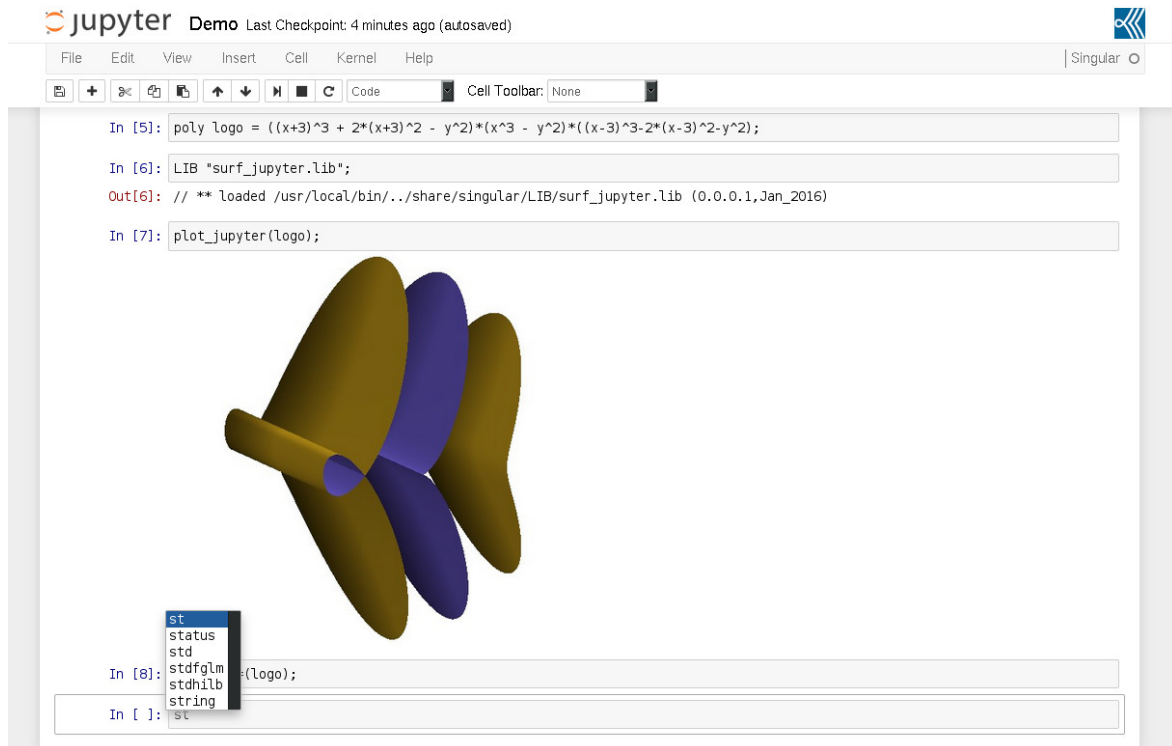 etc.

CONTENTS

1. SCREENSHOTS

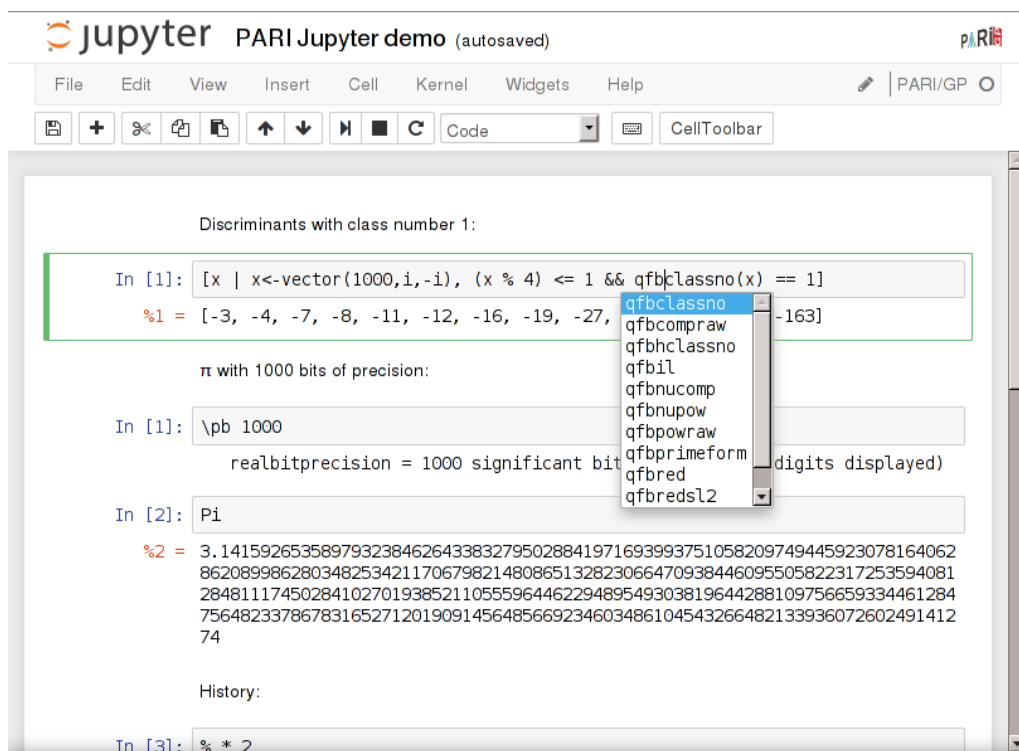FIGURE 1. GAP's Jupyter kernel in action, showcasing ....

FIGURE 2. Pari/GP's Jupyter kernel in action, showcasing discriminant calculations, history management, and code completion.
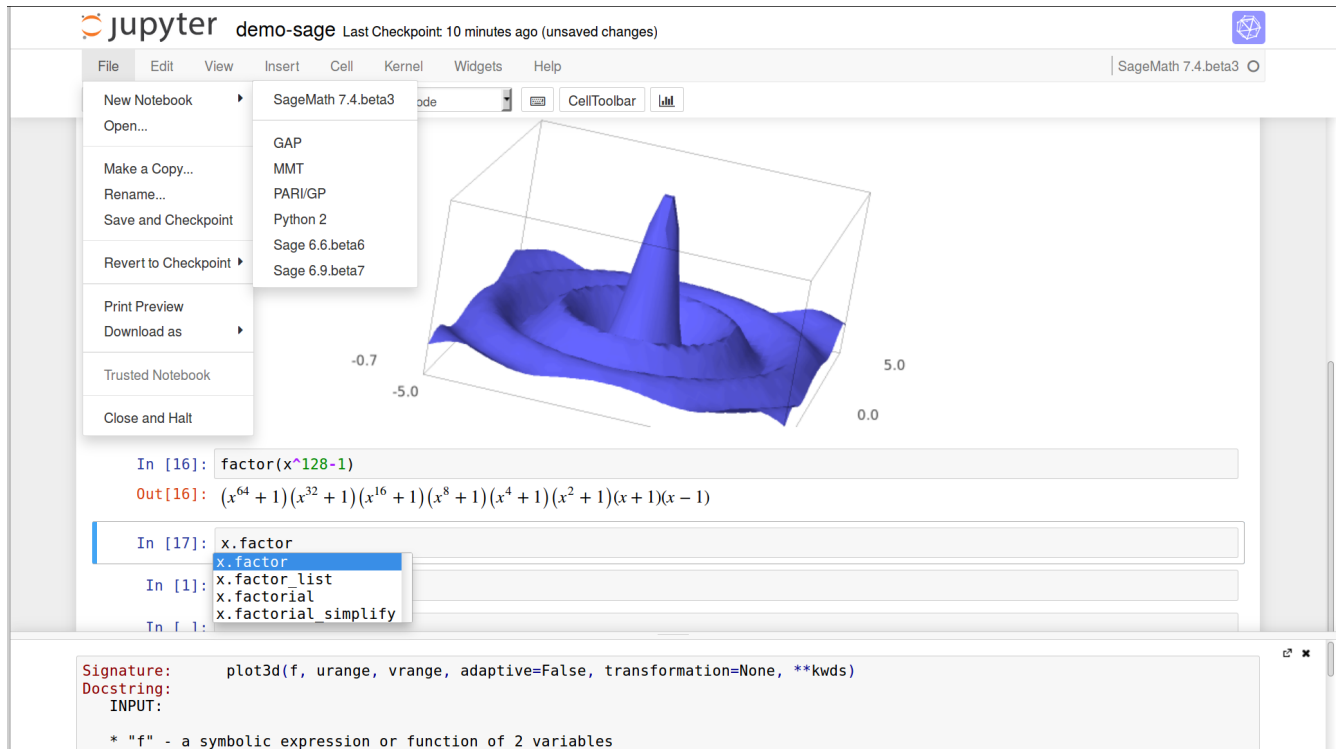
FIGURE 3. Sage's Jupyter kernel in action, showcasing Mathjax typesetting, 3D plots, tab-completion, documentation lookup, as well as the integration of the other kernels.
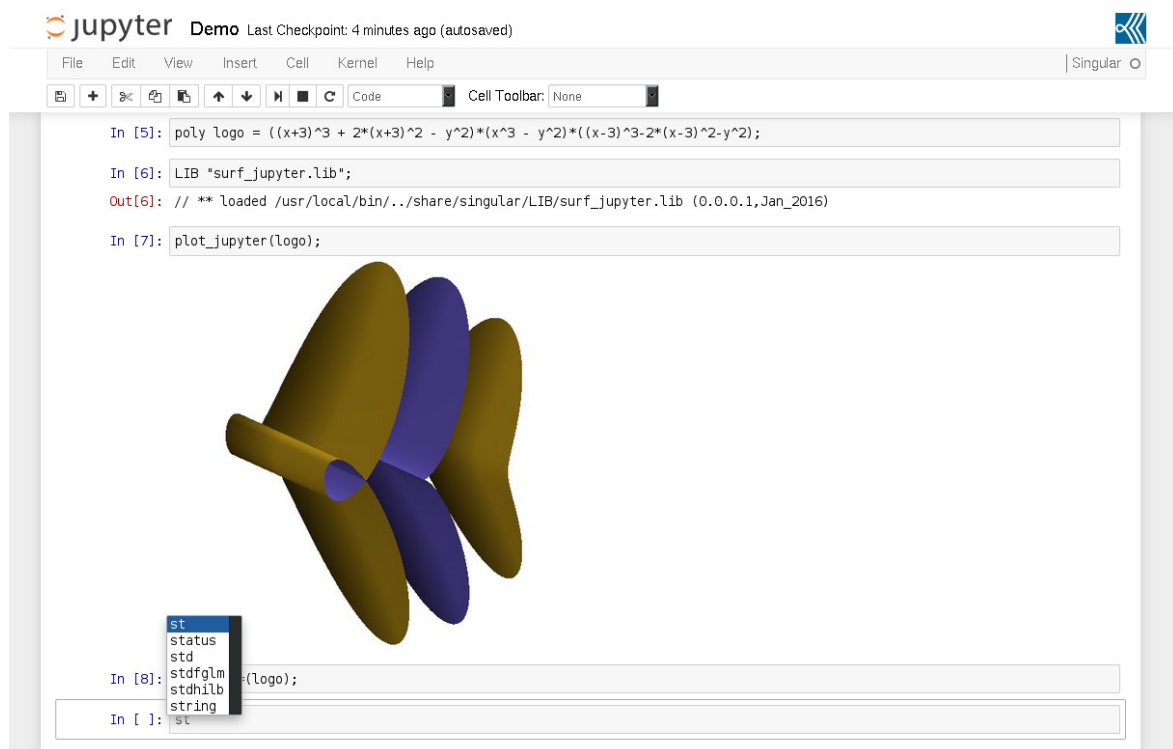

FIGURE 4. Singular's Jupyter kernel in action, showcasing polynomial calculations, 3D plots, and tab-completion.

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.