

Common Astronomical Software Applications - 6.0

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Abstract. CASA, the Common Astronomy Software Applications for processing radio data, has always been distributed as a single, integrated application, including a Python interpreter and all the libraries, packages and modules. As part of the ongoing development of CASA 6, and the switch from Python 2 to 3, CASA will provide greater flexibility for users to integrate CASA into existing Python workflows. In CASA 6, tasks and tools, as well as important functionality like CARTA, the CASA viewer, and plotms, will optionally be available as independent Python 3 modules that can be installed through PIP wheels. These proceedings give an overview of CASA 6 project, as presented Oct 6–10 at the 2019 Astronomical Data Analysis Software & Systems (ADASS) conference in Groningen, the Netherlands.

1. Introduction

The Common Astronomy Software Applications package CASA (McMullin et al. 2007, CASA team et al. in prep.) is the data processing software used by the Atacama Large Millimeter/submillimeter Array (ALMA) and the Karl G. Jansky Very Large Array (VLA), and supports the various pipelines for ALMA, VLA and VLA Sky Survey (VLASS). CASA has a versatility that also benefits the reduction and imaging of data from other interferometric and single-dish radio telescopes.

The CASA infrastructure consists of a set of C++ tools bundled together under an iPython interface as data reduction tasks that are scriptable or can be called via task interface. CASA has always been distributed as a single, integrated application, including a Python interpreter and all the libraries, packages and modules. For some users, this is ideal, but other users found that a monolithic distribution makes it difficult

to use CASA tools and tasks along with the other python packages for astronomy that they are accustomed to using.

As part of the ongoing development of CASA 6, and the switch from Python 2 to 3, CASA will provide greater flexibility for users to integrate CASA into existing Python workflows, with tools and tasks as standard Python modules. In these proceedings, we provide a status update of the CASA 6 project. The CASA team presented these results at the 29th Astronomical Data Analysis Software & Systems (ADASS) conference that was held from 6–10 October 2019 in Groningen, the Netherlands.

2. CASA & Python

The first release of CASA was in the fall of 2009 using Python 2.5.2. In the intervening years, CASA has upgraded Python a number of times, through 2.6 versions and 2.7 versions. In 2020, the Python community will no longer support Python 2 and CASA will move to Python 3.

Python 3.0 was released on 3 December 2008, and it was not designed to be backward compatible. While backward compatibility was not maintained, many Python 3.0 features were backported to the later Python 2.7 versions to make it easier for users to migrate. The majority of incompatibilities that most users will face have obvious fixes, but the required fixes may sometimes be numerous. For example, all print statements must use parenthesis. So for example: `print "hello world!"` in Python 2.7.12, becomes: `print("hello world!")`

Another change with Python 3 is that the standard division operator performs floating point division when the dividend and divisor are integers, whereas for Python 2 integer division was performed. So, for example, with Python 2, `5 / 2` returns 2 (an integer), but with Python 3, the result is 2.5. Both Python 2 and Python 3 do have an integer division operator. With both versions, `5 // 2` returns 2. There are many changes, but most affect things like calls to C routines (e.g. with Python 3 conversion from/to unicode are required) or accessing the internal state of Python objects (e.g. what was `func.func_code` is now `func.__code__`).¹



Figure 1. Python and CASA.

¹For more information, see <https://docs.python.org/3/howto/pyporting.html>

3. CASA 6: modular integration into Python

As part of the ongoing development of CASA 6, and the switch from Python 2 to 3, CASA will provide greater flexibility for users to integrate CASA into existing Python workflows, with tools and tasks as standard Python modules. From CASA 6 onward, CASA should really be thought of as the system described in Figure 1, comprising only the tools and tasks that CASA 5 currently provides. In addition, the plan is for important functionality like CARTA, the CASA viewer, and CASA plotms to be available as independent Python 3 modules (like `casatools` and `casatasks`). For example, the CASA viewer process would correspond to one of the "process" ellipses in the diagram.

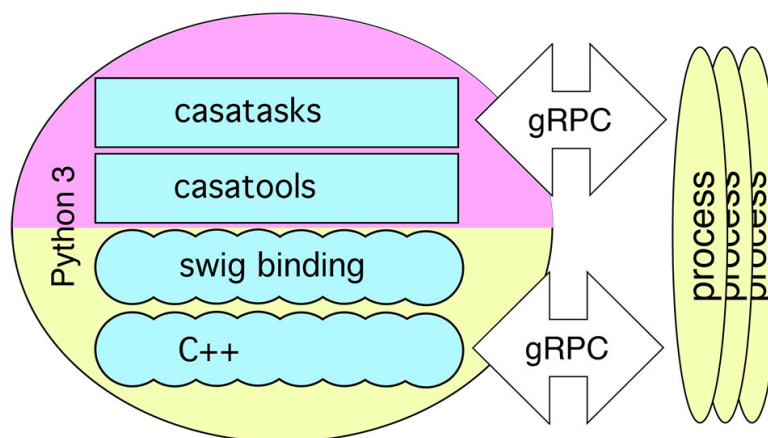


Figure 2. Schematic overview of processes in CASA 6.

PIP wheels for `casatools` and `casatasks` are made available from `casa-pip.nrao.edu`. `casa-pip.nrao.edu` is a public PyPI server providing the Python 3 modules which CASA produces as PIP wheels. The `casatools` wheel is necessarily a binary wheel so there will likely be compatibility issues for some time as we work toward making wheels available for important Python configurations. Initially, we are targeting Python 3.6 as provided by RedHat for our wheel production, although we have had some success on other Linux-based platforms as well. More information about using PIP wheel for CASA 6 can be found in our latest CASA Newsletter.² To do: we need to update this paragraph with useful instructions.

In addition to making CASA more Pythonic in the way that it is accessible within Python, there will also be some more cleanup of problems that have accumulated over the last decade of development with Python. All of this means that a period of change is ahead for both CASA and CASA's users. To ease the transition, CASA will support two versions for one year. One version will be a single monolithic application based on Python 2.7. The other version, CASA 6.0, will be based upon Python 3.

²https://science.nrao.edu/eneews/casa_008/index.shtml

4. Monolithic version of CASA 6

For users that are not interested in these new functionalities, CASA plans to continue to provide an all-inclusive distribution under Python 3 that keeps changes to a minimum compared to earlier CASA versions. For the time being, the ALMA and VLA pipeline will also be build on this monolithic version of CASA 6.

Users are welcome to send any feedback on CASA 6 to casa-feedback@nrao.edu



CASA is developed by an international consortium of scientists based at the National Radio Astronomical Observatory (NRAO), the European Southern Observatory (ESO), the National Astronomical Observatory of Japan (NAOJ), the Academia Sinica Institute of Astronomy and Astrophysics (ASIAA), the CSIRO division for Astronomy and Space Science (CASS), and the Netherlands Institute for Radio Astronomy (ASTRON), under the guidance of NRAO.

Acknowledgments. The CASA team thanks the organizers of the ADASS 2019. The National Radio Astronomy Observatory is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc. ALMA is a partnership of ESO (representing its member states), NSF (USA) and NINS (Japan), together with NRC (Canada), NSC and ASIAA (Taiwan), and KASI (Republic of Korea), in cooperation with the Republic of Chile. The Joint ALMA Observatory is operated by ESO, AUI/NRAO and NAOJ.

References

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