Development of Radio Astronomical Data Reduction Software NEWSTAR

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Abstract. NEWSTAR was developed for processing data from the 45-m radio telescope of the Nobeyama Radio Observatory (NRO). Based on AIPS, and developed under Solaris and IRIX, NEWSTAR has been expanded to include LINUX and HP-UX versions that have considerably improved the reduction performance of NRO observational data.

1. Introduction

NEWSTAR is a radio astronomical data reduction package for the 45-m radio telescope and the Nobeyama Millimeter Array (NMA) of the Nobeyama Radio Observatory (NRO), Japan. Since NEWSTAR was originally developed for data reduction within NRO on Solaris, Sun and IRIX platforms, users wanting off-site access to NEWSTAR formerly had to obtain computers similar to those at NRO or access NRO machines remotely. In order to improve this situation, LINUX and HP-UX versions of NEWSTAR were created, giving users access to NEWSTAR virtually anywhere.

2. Structure of NEWSTAR

NEWSTAR consists of an AIPS core plus the original application. The AIPS core provides file management, mapping processes for interferometer data, and so on. The original application was designed to reduce spectral data obtained by the 45-m telescope and make data cubes from the spectral data. Users can also reduce UV-data of the NMA using NEWSTAR before further processing with AIPS.

NEWSTAR also adds graphical user interfaces (GUIs). Users can input parameters for each task from the GUI, and the parameters are saved, obviating the need for learning native AIPS commands and permitting NEWSTAR use

Figure 1.   NEWSTAR has several window panels, e.g., the Task-Selection panel (bottom left), a parameter-input window (top center) and the Tektronics window (bottom right).

easily without references. (Users can use still invoke native AIPS commands from the AIPS window.)

3. UIs

NEWSTAR has several window panels, samples of which are shown in Figure 1. The Task-Selection panel lists tasks included in NEWSTAR, and users can select tasks from this panel. Each task has a parameter-input window. Users can see mapping points and a list of files from this panel. The Tektronics window displays spectra and/or maps.

NEWSTAR also has an AIPS window permitting users to execute native AIPS commands. From the "File List" window, users can list, delete, rename and backup data files.

4. Treatment of data

The flow of the data reduction of NEWSTAR is shown in Figure 2. Raw data obtained by the 45-m telescope are saved through the archival system. The saved data are under AIPS control. Users can craete spectra by integrating the raw data, make map data (cube data) from the spectra, and handle them again by using several AIPS tasks.
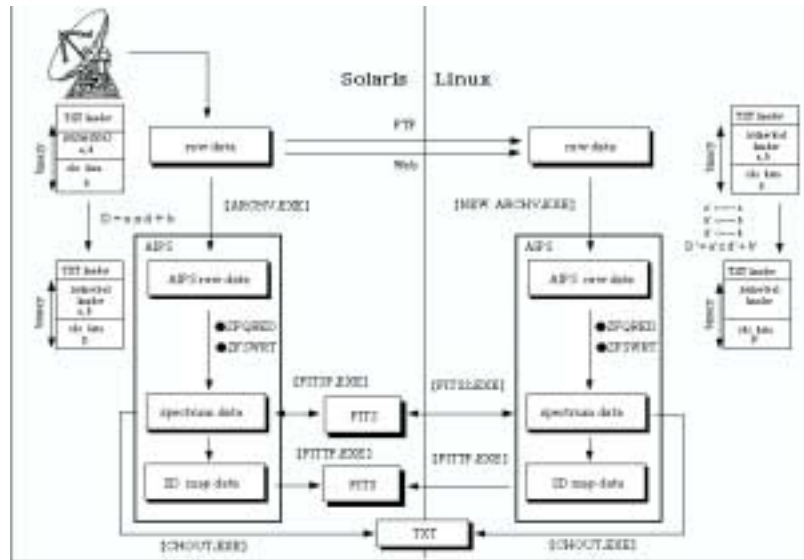
Figure 2.   NEWSTAR data reduction flow under Solaris (left side)
and LINUX (right side)

At NRO, Solaris 2.7 is adopted as the operating system of the workstations
for data reduction. When users continue data reduction using NEWSTAR on
other operating systems, difference of data endian should be considered. For
example, in the case of LINUX, it is necessary to convert from big to little
endians. The flow of the data reduction in the LINUX version is shown in the
right side of Figure 2. The raw data transfered from the NRO archival system
are transformed by task "NEW ARCHV.EXE" for LINUX. The data endian is
transformed at that time. The spectral data and the map (cube) data made
in the Solaris NEWSTAR are transformed to FITS files, and the FITS files are
read using the LINUX version of NEWSTAR. Conversely, FITS file made in the
LINUX version can be reduced under Solaris NEWSTAR.

For other operating systems, the flow of the data reduction is similar to
that above.

5. Summary

The NEWSTAR radio astronomical data reduction software was originally de-
veloped for data reduction within NRO. By porting it to LINUX, HP-UX, and
IRIX, users now have access to its data reduction capabilities in their home
institutions, and the performance of NRO data reduction software has be con-
siderably improved.