GSFC Technology Development Center Report

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Abstract

This report summarizes the activities of the GSFC Technology Development Center (TDC) for 2007 and forecasts planned activities for 2008. The GSFC TDC develops station software including the Field System, scheduling software (SKED), hardware including tools for station timing and meteorology, scheduling algorithms and operational procedures, and it provides a pool of individuals to assist with station implementation, check-out, upgrades, and training.

1. Technology Center Activities

The GSFC IVS Technology Development Center (TDC) develops hardware, software, algorithms, and operational procedures. It provides manpower for station visits for training and upgrades. Other technology development areas at GSFC are covered by other IVS components such as the GSFC Analysis Center. The current staff of the GSFC TDC consists of John Gipson and Ed Himwich, both employed by NVI, Inc. The remainder of this report covers the status of the main areas of development that are currently being pursued.

2. Field System

The GSFC TDC is responsible for development, maintenance, and documentation of the Field System (FS) software package. The FS provides equipment control at VLBI stations. It interprets the .snp schedule and .prc procedure file (both as prepared by DRUDG from the .skd schedule). The FS controls the antenna, data acquisition hardware, and related ancillary equipment needed for making VLBI measurements. All major VLBI data acquisition backends are supported. The FS is customizable to allow it to control station specific equipment. It is used at all the IVS network stations (over 30) and also at many stations that do VLBI only for astronomical observations. The only major observatories not using it are the VLBA and VERA.

During this period some of the new features that were released in FS version 9.10 were:

- Support was added for Mark 5B recorders and sampler modules. This included developing documentation for operations with these systems.

- The FS Linux 6 distribution (based on Debian 'sarge') was developed and deployed. This included changing to use a RAID1 array for the system disks and developing new disk back-up and rotation procedures for RAID disks.

- The 'systests' system test data acquisiton and analysis suite was improved and updated. This included support for new hardware systems and expanded capabilities for analysis and plotting.

- Numerous small bug fixes and improvements were added.

In the next year, several other improvements are expected; among these are: (1) Support for DBBC and DBE racks, (2) a complete update to the documentation and conversion to a more modern format that will be easier to use; (3) conversion of the FORTRAN source to use the g77

compiler; this will enable use of the source level debugger, *gdb* for development and field debugging; (4) use of *fsvue* or Real VNC for remote operation; (5) *chekr* support for Mark 5A and 5B systems; (6) use of the Mark IV Decoder for phase-cal extraction in the field; (7) FS Linux 7 ('etch') development; and (8) support for periodic firing of the noise diode during observations.

3. SKED and DRUDG

The GSFC TDC is responsible for the development, maintenance, and documentation of SKED and DRUDG. These two programs are very closely related, and they operate as a pair for the preparation of the detailed observing schedule for a VLBI session, and its proper execution in the field. In the normal data flow for geodetic schedules, first SKED is run at the Operation Centers to generate the .skd file that contains the full network observing schedule. Then stations use the .skd as input to DRUDG for making the control files and procedures for their station. Catalogs are used to define the equipment, stations, sources, and observing modes which are selected when writing a schedule with SKED.

During 2007 many changes were made to SKED and DRUDG. SKED and DRUDG continue to improve because of changing needs and users' requests. In both SKED and DRUDG, the maximum number of stations was increased to 40, the maximum number of sources to 1000, and the maximum number of scans to 20,000. Many changes were made to SKED to support simulation studies for VLBI2010. Other changes were made to make scheduling easier. The following summarizes some of the SKED and DRUDG changes.

3.1. SKED

The following changes were made to SKED.

- SKED used to have an implicit limit of only scheduling for 24 hours. The user can now schedule for longer than 24 hours.

- Fixed a bug in the calculation of total recorded bits when using Mark5. In most cases, the number of data channels taken is the same as the number of data channels recorded. Sometimes this is not true because Mark5 is limited to recording 4, 8, 16, 32 or 64 channels. If the number of data channels taken is not a power of 2, some channels are duplicated in recording. For example, in the R4's prior to 2006, only 14 data channels were taken, although 16 channels were recorded using Mark5. The first two channels were recorded twice. Another example occurs where some stations do not have the full complement of BBCs. Sked used to calculate the total disk requirement using the amount of data taken. It now uses the amount of data recorded.

- Changes were made to the downtime command to make it more flexible.

- A bug in the time window command was fixed. The command *major last x* is supposed to set the time window to x hours. Here the time window is used in calculating sky coverage and covariance information. We discovered that SKED ignored this parameter and used all observations regardless of the value of x. This was fixed.

- The *fill-in* mode was made more flexible. Previously the minimum sub-net size and the length of idle time before considering were hard-wired. These are now user settable parameters.

- The *master* command was introduced. This has two modes: *master check* checks the schedule against the master file to make sure that the stations and the times are correct; *master get* reads the stations and the times from the master file and modifies the schedule accordingly. The location of the master file must be specified in the `master` line of `skedf.ctl`, e.g.: `master /usr/local/bin/master08.txt`.

- The extended listing command was made more flexible. Previously any time you turned on one option it would turn off all other options. It now toggles the options, and many options can be specified on a line.

- A sky coverage function was added. SKED divides the sky into 13 equal sized pixels at each station. The pixel number for each station, and the total number of distinct pixels covered over the preceding time window can be displayed by turning on the 'sky' extended listing: *xl sky*. The time window considered is specified by the major command: *maj last 0.5* sets a time window of 0.5 hours.

3.2. DRUDG

The following changes were made to DRUDG.

- Many changes were made to support changing specifications.

- Two new rack types were introduced: Mark 5 and VLBA5.

- Dymo printer support was added for FS Linux 6 ('sarge'). The *cups* driver had a bug which we had to work around.

- Various minor bugs were fixed.