90101

GMRT OBSERVING PROGRAM -- Overview of Software
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THE HARDWARE

The purpose of this note is to bring out the most important tasks spawned in the Online Computer System during any observation. The on-line computer system is a set of computers ranging from microcontrollers at each station to the powerful file-server or workstations at the GMRT Control Room. The following is a functional list of computers used for an observation with GMRT, with the abbreviations used in this note for brevity.

CON -- The Operator Console (could be a separate workstation)
W/S -- A workstation for online display of visibilities etc.
SER -- The Online Server (where peripherals like disks are located)
RTS -- The Real-Time-System, a single board computer running the real time operating system VxWorks;
CCR -- The Central Communication Router (At the Central Station; hardware almost identical to SSC)
SSC -- The Station Supervisory Computer
MCM -- The Monitor/Control Module (always runs permanently resident software)
SCC -- The Servo Control Computer (runs the resident software developed by BARC)

Among these, CCR, SSC and MCM in-house boards designed by A. Ramakrishna and SCC is designed by BARC.

At each station, SSC is connected to a set of MCM on RS 422 (bus-mode), to SCC through RS 232, while all SSC are linked to CCR through the optical fibre (HDLC link operating at 256 kbits/sec).

At the Central Electronics Building (CEB), the three serial ports of CCR are connected to (a) the SSCs by the HDLC link, (B) the MCMs for monitor functions at CEB through the RS 422 link, and (c) the SER by RS 422 link.

All the machines at the Central Electronics Building will be connected to the on-line server (SER). The CCR is connected to it by a RS232/RS422, while the others (RTS, CON, W/S) have ethernet connection. The RTS is connected to the Long Term Accumulator of the correlator system by the VME backplane.

During the initial test stage, Sun 3/260 will be the online server, and it will also perform the role of CON and W/S. The RTS is a single-board computer sharing the VME bus with the long-term accumulator of the correlator system, and running the real-time operating system VxWorks. It will have on-board ethernet, SCSI and serial controllers. The final hardware is expected to be SUN 1E -- a single board computer based on SPARC cpu.

SOFTWARE

Before any observation can begin, the operator runs the program "master" from his console (CON). This will first spawn a process called comServe on the Server. In turn, comServe will first read from a file the list of available antennas and initializes the process comX on the CCR, by sending the list of stations. This makes comX to send a special packet to SSC at all relevant stations announcing itself. SSC will then send "OK" to comX, which will then send "OK" to comServe indicating links are

established to stations. This completes initialisation of comServe which will now send "OK" to master signalling that all communication has been set up and observation can begin. Master will now type out "READY" on the console and is ready to accept commands from the operator.

Clearly, master (or any other process) cannot wait indefinitely for the other processes to be initialized. If master does not receive "OK" within a specified time, it will type out the appropriate error message on the operator console. In case of errors in link between SSC and CCR, comX will return to comServe the list of stations from which contact with SSC was successful; comServe will, in turn, communicate this to the master to print the list on the console.

Depending on the message on the console, the operator types SETUP (upper and/or lower case) as the first command. If the master had not got "OK" from comServe, the operator is asked to confirm the action to be taken on stations with failed link -- whether to include them or exclude them from the list to be polled in the current session. The list cannot be modified during a session. (Note that antennas which are likely to be activated later on during the current session should be included in the list right from the beginning.) The end of a session is signified by the command STOP which will send appropriate signals to the chain of processes in the network to write all buffers to disk, close all files, etc; but all processes are still active. In case the operator wishes to re-define the list of antennas for the next session, this is the time to use the appropriate command. The next session is begun by re-issuing the command SETUP.

The command SETUP will result in a chain of new processes to be spawned, which will be terminated on receiving STOP command. The most important of these are:

ComLog, spawned by comServe for logging the monitored data in disk;
ShowMon, spawned by master for the standard operator display of monitored database;
DatAq, spawned by master on the Real-Time-System (RTS) for data acqusition - this initialises the software and sets up the list of baselines to be used for recording visibilities; (this is only a set-up and the actual data acquisition will not begin until the observing program comes into picture).

At this stage, the operator is now ready to start scheduled observations. Here, the first step is to define the sub-arrays required for the session and the names of corresponding online software (obsSub_M for sub-array M) and their respective input files (obsfile_M). According to our definition of a session, the list of sub-arrays cannot be modified during a session. Any change in the intended differences in the start of observations in different sub-arrays can be reflected in the scan times specified in the OBSFILEs.

Each of the programs obsSub_N will spawn a set of associated processes, e.g., MonCon on SSC for the control/monitor functions relevant to the specific observation; dataLog1 on the Real-Time-System for storing the appropriate visibility data on separate files on the server for different sub-arrays (data on Exabyte will have all active baselines and do not distinguish between different different sub-arrays for the purpose of archiving); monLog for logging the monitor data-base in the server disk; antSol on the server if a calibrator is being observed, showMon for the specific display on the console.

At this stage, all initialization is complete for the session and the operator can type OBSERVE to enable the programs to start reading the OBSFILEs for scheduling desired scans.

Another important process spawned by master is "showVis" for displaying

selected visibility channels graphically. Amplitude and phase will be displayed. This process is active as long as the process datAq is active on the RTS. It will choose a new set of default channels each time a session begins (OBSERVE command), which may be modified by the operator if necessary. Amplitudes and phases of visibilities will be displayed for the selected channels. The time axis will run continuously from the beginning of each session, and gaps will appear in the plots corresponding to durations in which the respective visibilities were not recorded.