Teleset and ABCcom, a new Telemetry software chain

ABCcom is a software running on a Linux PC to replace the current ABC PIU. It performs the telemetry operations of an antenna. Installing ABCcom requires to change as well the Online program, since all the communication protocol between Online and ABC is changed. The new Online program is called Teleset.
With this new telemetry software chain, the heavy part of the telemetry intelligence is shifted from the Online PC, to the ABC PC. Indeed in the actual system, all data packets are generated from the Online PC and PIU ABC just transmits them. ABCcom is now generating all the commands, and only high level parameters are sent by Teleset.
For instance, monitoring the LO system implies to generate 30 messages to MCM 2 and 3. Instead of Online sending all those messages, Teleset just transmits a short LO monitor command to ABCcom which composes and sends by itself the 30 packets. The communication between CEB and antennas is reduced and thus the information is transmitted faster.
Besides this, Online is a program that had been implemented and modified during several years in C and Fortran languages.Teleset is now a new C++ program which re-implements the telemetry tasks in an organized and concise manner.

Teleset specifications and remaining developments

Teleset can perform many of Online operations. More precisely, Teleset has the following list of specifications:

- ✔ it provides a user interface for the Operator commands,
- ✔ it composes commands according to Teleset - ABCcom protocol,
- ✔ it sends messages to several ABCcom connected in parallel, and collects their answer,
- ✔ it decodes ABCcom answers according to the communication protocol,
- ✔ it fills a shared memory and some history files with each of its activity results.
- ✔ it allows a multi user configuration which divides GMRT into several sub arrays of antenna.

Nevertheless some important developments remain to have a full Telemetry software for GMRT:

- ✗ communication with Correlator System
- ✗ communication with Base Band System
- ✗ improvement of Operator interfaces

Like Online PC, Correlator and Base Band systems are located inside the CEB. They have specific sets of commands / answers which follow a specific format (message queue, ASCII), independently from Teleset-ABCcom protocol.

Teleset configuration

1.Link between Teleset and ABCcom PCs

Teleset and ABCcom PCs are linked with Ethernet based TCP/IP socket program,In earlier version Teleset program used to link with ABCcom PCs using Multi Serial port.

2. Automatic State command, LowUser and HighUser classes

Beside sending commands entered by the Operator, Teleset also sends by itself a State command to ABCcom PCs every 3 secs. This is very important since it allows Teleset to get regularly and automatically the state of antennas (parameters values, current operations and eventual errors).
For the design of Teleset software, it means that there must be a process (or a thread) which is doing the

automatic State command, while another process (or thread) is waiting for the next Operator command.

- One process is implemented in HighUser class. It gets an Operator command, composes its communication packet and places it in a buffer. It then signals whether the command has been accepted or not.
- The other process is coded in LowUser class. This class transmits HighUser commands on sockets(Ethernet based TCP/IP protocol),receives and decodes corresponding ABCcom answers. When there is no pending HighUser command, every 3 secs LowUser generates an ABC State command to ABCcom PCs and treats their answer

3. Sub-Array concept and shared memory

Teleset software is designed to allow the multi sub-array feature. It has to be extensively test with the new modification done for socket communication.

From the beginning of a Teleset program execution, two different configurations can be run:

A Master configuration:

It is the first Teleset program launched. A Shared Memory is allocated. A HighUser object starts in a thread and corresponds with a LowUser object which runs in the main process. For any additional sub-array index [i], the Master adds a LowUser [i] in a thread.

A secondary User configuration:

It is when a Teleset program is launched, whereas a Master is already running. After a proper index [i] is entered, a HighUser process gets Operator commands and transmit them to the LowUser [i] via the shared memory. No command is accepted until a valid sub-array of available ABCcom PCs is entered.

Thus one HighUser and one LowUser object are dedicated to each of GMRT sub-arrays. These objects are from the same respective classes, just the Master has extra facilities to add and remove Users.
This configuration choice is implemented in TeleUser class (mainteleset files). When Teleset program starts, the first object called is a TeleUser class object. It first tries to open a teleset.dat file. If this one does not exist, or if it contains the integer 0, it becomes a Master. If the file exists and contains the integer 1, it becomes a secondary User.

4. Teledisp program and shared memory

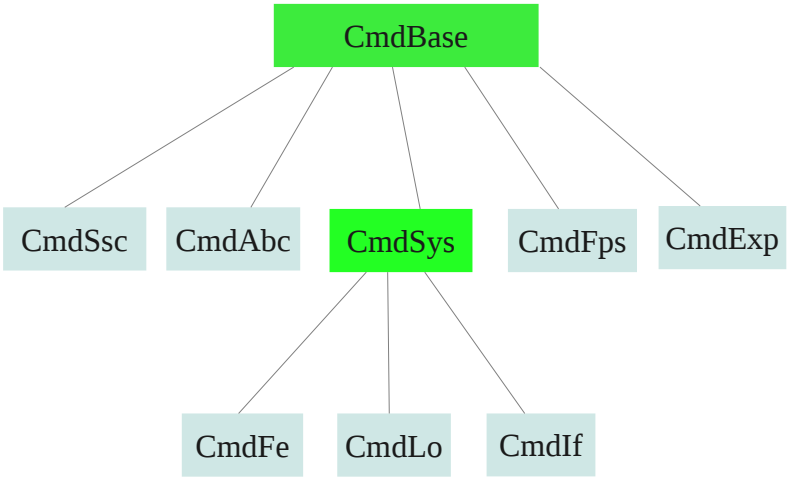
The GMRT Operator is using Teleset to control and monitor antennas with ABCcom. Teledisp is a separate Linux program that allows to observe on line all Teleset activity and results. Different persons can at the same time log into the Control Room PC where Teleset is running, and launch a Teledisp program. When Teleset first starts, it creates a shared memory in which is stored all its data. Teledisp program reads this shared memory and displays in a graphical interface all the telemetry information.
Teledisp is developed with QT Designer. The final design being not yet decided, a basic Teledisp was implemented for this project.

5. Cmd System Classes

Cmd System classes are composing command packets according to Teleset-ABCcom protocol.Their inputs are script words entered by the Operator in the shell interface, and they can refer to some input files stored in a specific directory. When they are created, these objects get pointers on the shared memory and on HighUser history file. Whenever they get new parameters for their system, they store those values inside the shared memory so that Teledisp can read whatever setting has been lastly done. Their operations and parameters are also written in the history file.

Each Cmd System class is dedicated to one GMRT system. There are CmdSsc, CmdAbc,

CmdFps, CmdExp, CmdFe, CmdLo and CmdIf classes respectively for Servo, ABC, FPS, EXP, FE, LO and IF systems. Their implementation follows the inheritance tree below

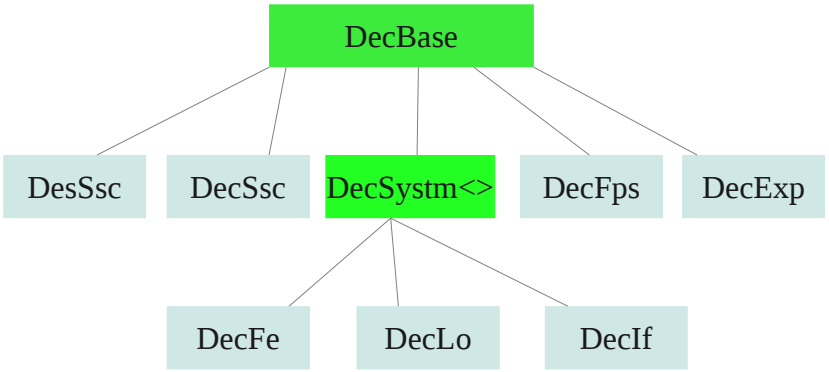


6. Decode classes

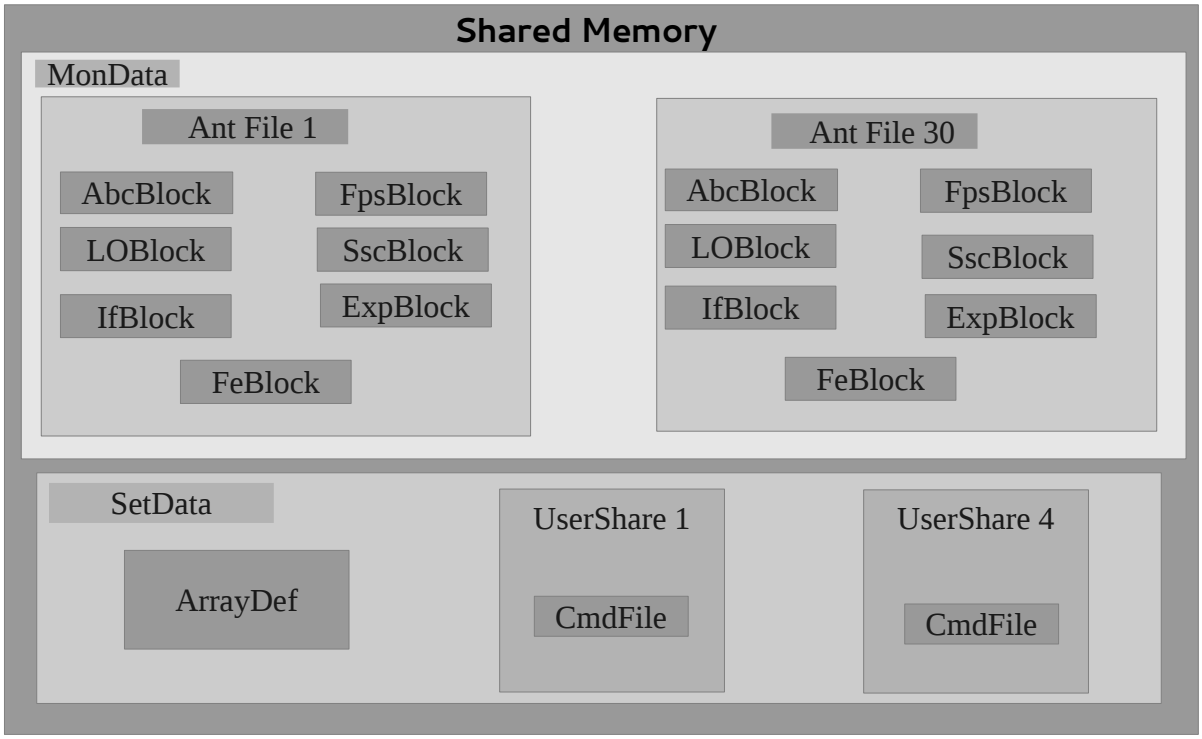
Decode class is decoding answer messages from ABCcom according to the Teleset-ABCcom protocol. Results are written in Teleset shared memory so that Teledisp program can read them. A Decode object is inside each LowUser object, they share the same history file.
When a LowUser object receives a message from an ABCcom, it immediately calls its Decode object to analyze it. This stage offers the main advantage that the decoding work is done once by Teleset, so its output (shared memory and history files) can be straigthly read by others (Teledisp programs...).

----> *Dec System classes*

Dec System classes are used to analyze answer sub-packets received from ABCcom. They write their results in the shared memory and in LowUser history file. Similarly to Cmd System classes, each Dec System class is dedicated to one GMRT system. There are DecSsc, DecAbc, DecFps, DecExp, DecFe, DecLo and DecIf class respectively for Servo, ABC, FPS, EXP, FE, LO and IF systems.
ABCcom answer sub-packets can be of 3 types: a 'State' answer, an 'Askparam' answer, and an Acknowledgment. These answers have a lot of similarities between Systems, and accordingly their implementation is following the inheritance tree below.



TELESET Shared Memory



ABCcom project

The ABCcom project aims at replacing the ABC PIU by an ABC Pentium PC. Under Linux OS, this PC runs ABCcom program. This replacement offers the following advantages:

- better hardware stability, less maintenance and small risks of electronics failures.
- better performances and capacities (PC memory, processor, human interface...)
- more flexible and easy to evolve (C++ program)

List of ABCcom functionalities

To resume ABCcom functionalities, one must first resume each Telemetry task in respect to antenna systems, and then see how this task intelligence is divided between ABCcom and Teleset programs.

Teleset	ABCcom
● Servo system telemetry:	
➢ **operational commands (position, hold, stop, stow elevation / azimuth...)**	
send packet and read answer	by pass
➢ display commands (read angles, read motor currents...)	
read answers	send packets every second
➢ set mode commands (set time, set high / low limit for elevation / azimuth...)	
send packet and read answer	by pass
➢ load antenna parameters (angle offsets, latitude and longitude)	
send parameters	store parameters
➢ track command: every 30 sec, send updated positions to follow a source	
read answer	calculate angles and send command every 30 sec
➢ analyze events sent by SSC (motor speed high, stow released...)	
read events	by-pass in priority
● FPS system telemetry:	
➢ load turret angles for the feed selection	
send parameters	store parameters
➢ move to the appropriate feed	
send feed number	send move command with the proper angle
➢ monitor the turret angle to check the position	
read angle	send monitor command at regular intervals
➢ set the FPS parameters (calibrate angle, maximum rotation speed...)	
send packet and read answer	by pass

- LO, IF and FE systems telemetry:

  - load antenna parameters
    send parameters store parameters
  - set current parameters (frequencies, attenuations, bandwidth, feeds…)
    send parameters store parameters
    send all MCM commands to set parameters
  - monitor the system state and signal errors
    read error code send all MCM commands to monitor at regular intervals
    decode and return a error code
  - other specific operations (reboot, switch FE box off…)
    send operation code send respective MCM commands

Beside this, ABCcom has several additional functionalities:

Local Teleset: During maintenance operations inside an antenna shell, a small local Teleset program can be launched from ABC PC to directly control this antenna systems without requesting the Control Room. After a command from the main Teleset, ABCcom also communicates with the local Teleset through a shared memory.
MCM Expert: The Teleset operator chooses one MCM and communicates with it according to the MCM protocol. This is useful for very specific operations.
LogFile: ABCcom writes in log files the history of its activity, organized by systems and periodically refreshed.