An innovative software development within the framework of "SIRGAS in real time"

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Abstract

"SIRGAS in real time" is a pilot project which was originated at the last SIRGAS Conference (Montevideo, 2008). This project is meant to study the possible ways in which GNNS observations can be distributed in real time. Within this framework, we have developed an original program to capture, store and distribute raw observations coming from an Original Equipment Manufacturer (OEM) GPS device.

The main advantages of the products presented here are: the possibility of working with high performance OEM equipment, dual frequency code and P with relatively low cost and without using a GPS receiver; offering real-time data, having the possibility of transmitting these data over the Internet, the flexibility of having a self-made development. This last point denotes the independence of the manufacturer in terms of support, the ability to adapt the software to different operating systems and platforms. This flexibility translates in independence on the part of the manufacturer in terms of support, the ability to adapt the software to different operating systems and platforms.

We believe there are two added values to this work: 1. the fact that the development has a General Public License (GNU GPL) and 2. the fact that the equipment used is a 15-year-old receiver which has not been used for nearly 10 years.

1 Introduction

The *NovAtel ProPak*, (see Figure 1), has been designed for the GPS navigation or positioning systems built around the *NovAtel GPSCard*. The *ProPak* is a **rugged**, reliable GPS receiver for adverse environments.

It is about a very high value-added equipment, that has neither more technical support from *NovAtel* nor software for its use. It was doomed to live in a shelf.

Figure 1: OEM Series GPSCard

To recover these equipments it was only needed to build suitable software to transform them in permanent GPS stations; given the existence of a quite non homogeneous variety of these equipments, the software for them should be completely modular, so that it could be adapted to different GPS devices from similar characteristics.

1.1 Situation

Nowadays, there is a growing request of GPS stations in our territory. Sadly, Argentina does not usually count with financial resources, needed to acquire new equipments specially designed for this purpose.

1.2 Motivation

The *Facultad de Ciencias Astronómicas y Geofísicas* at *Universidad Nacional de La Plata* used to have a former equipment forgotten on a shelf available, which possessed all the characteristics needed to be used as a GPS station:

- Dual frequency.
- Code P

1.3 Proposal

We would like to transform this instrument with high-power value for geodesics in a permanent station, performing a 100% original development.

This development would allow:

- Non-dependence on the manufacturer and on the life-cycle that it suggests for the product, as much as in support or software supply.
- Porting it to different platforms (operating systems) that were needed according to the location of each particular station.
- To provide it with a license such as GPL (*GNU General Public License*) so that the code could be used in other stations, or as a ground for any development that includes GPS manipulation data or GPS devices.

2 Development

The development was written in **C** language, and so far it has only been used in *GNU/Linux* platforms.

Because of the absence of the internal memory in the equipment, the data should flow in real time through a serial port; therefore, we require a capture program and a stable operating system, even though the service exit from the capture equipment implies data loss.

We have called our program **GPS DUMP**; it can be configured through command line and configuration files; the header information for the output files *RINEX* are performed with configuration files.

2.1 *GPS DUMP*

Figure 2 shows the life cycle of the **GPS DUMP** program. In *GNU/Linux* platform, **GPS DUMP** runs as common normal daemon.

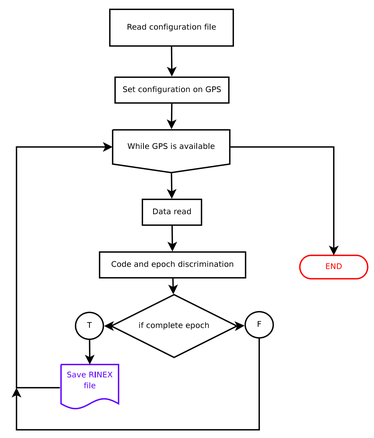

Figure 2: *GPS DUMP* life cycle

2.2 Modular designed

Figure 3 shows the modules that conform the program. The module "`gps_data`" implements the format *RINEX* while "`gps_file`" handles the output archives. To adapt the program into another GPS device, only the "`gps_rs232`" module needs to be rewritten.

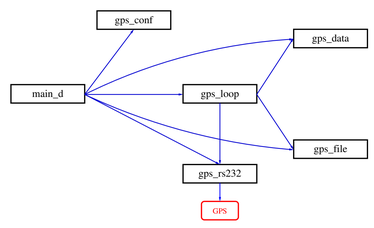

Figure 3: General view of modularization

Figure 4 shows the calling graph of all functions defined in the program. Only `soft_read_time_out` function listen data from GPS device.

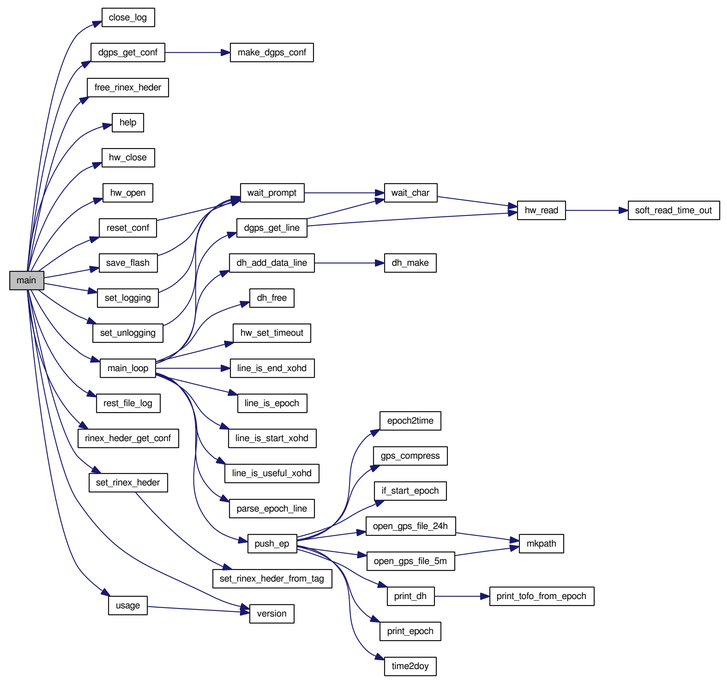

Figure 4: Call graph of entire program

The next options are defined in *gpsd* program daemon:

```
fede@libertad:~$ gpsd --help
GPSD - Dump GPS data: gpsd version 0.0.2
Usage:  gpsd [-vnhf][--nodaemon][--nolog][--flash][--help]
  -v              - Verbose mode (incremental).
  -n, --nodaemon  - No run as a daemon.
  --nolog         - Don't write events to syslog.
  -V              - Show program version.
  --help          - This help !!!.
  -f, --flash     - Saves the current configuration in flash
                    memory
```

The next other esential parameters (Figure 5) are defined in `gpsd.conf`'s file:

```
# GPSD - Dump GPS data daemon
# Configuration file
# Federico A. Bareilles fede@iar.unlp.edu.ar
# 31/10/2007
#

station = SRLP
device = /dev/ttyS0                    # Serial port from computers side.
data_dir = /home/gpsuser/data
rinex_header = /etc/gpsd/rinex.conf  # RINEX header (fix parameters).
log_port = com1                        # Serial port from devices side.
log_period = 2                         # Trigger time for GPS devices.
user_id=503                            # User ID for data storage.
group_id=100                           # Grup ID for data storage
```

Figure 5: GPSD daemon configuration file

Figure 6 also shows an example of *RINEX* header configuration parameters (`rinex.conf`).

```
# GPSD - Configures RINEX log user defined fields
# Federico A. Bareilles fede@iar.unlp.edu.ar
# 03/11/2007

# Configures RINEX log user defined fields in observation log header:
COMMENT =                                  # Add comment to navigation
AGENCY = Catastro de La Pampa - CRICYT     # Define name of agency
MARKNAME = SRLP                            # Define marker name
MARKERNUM =                                # Define marker number
OBSERVER = H. Erburu                       # Define name of observer
RECNUM =                                   # Define receiver number
ANTNUM =                                   # Define antenna number
ANTTYPE = NOV502+CR                        # Define antenna type
ANTDN = 0.0                                # Define antenna delta North
ANTDE = 0.0                                # Define antenna delta East
ANTDH = 0.0                                # Define antenna delta Height
```

Figure 6: *RINEX* header (fix parameters).

3 Permanent Station installation

During the first week of May 2008 the *NovAtel ProPak* receiver was placed in a concrete shelter allocated in the roof of the chief administrative building of La Pampa province located in Santa Rosa. The installation is composed by a PC, a UPS and the GPS receiver with its choke ring antenna mounted on a pole. Since the equipment is located in a difficult access area the whole system can be remotely controlled from the cadastral office via Intranet.

Figure 7: Location of antenna the at Civic Center

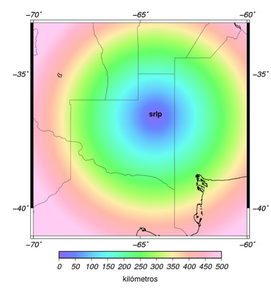

Figure 8: Coverage area of SRLP

4 Data access

The information is presented with a correct header, which has a dome number assigned by *IGS*. *Information is presented, not raw data*.

Previously to the publication of the first *RINEX* data, who was at the development stage, one weak of our *RINEX* files were tested with: **Ashtech Solution**, **GPPS** and **Bernese**, and online processing services: **AUSPOS**, **GIPSY** and **CANSPACE**.

The data from **SRLP** Permanent Station are published in: http://www.catastro.lapampa.gov.ar/GPS/ASP/Archivos.asp, since July 2008. Figure 9 shows an example of the web page written above.

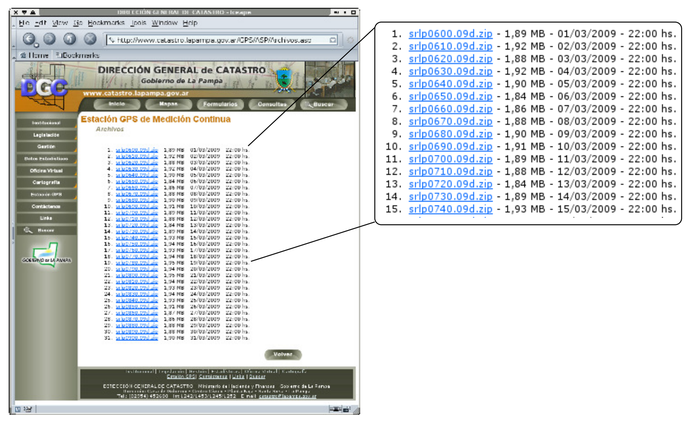

Figure 9: Example of data publication at "*Catastro Provincial de La Pampa*"

5 Future improvements

The next step in this development is for us to create the support for *NTRIP* standard; we are also going to adapt the program to other old GPS devices.

6 Acknowledgements

We thank Horacio Mazzaferro, Héctor Erburu, Julio Sitz, Guillermo Arhex, Héctor Acevedo and the technical staff of "Centro de Sistematización de Datos" at Catastro's Office, La Pampa.

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[2] GPSCard Command Description Manual *OM-20000008 Rev 3*, 1999/02/02, NovAtel Inc.

[3] OEM4 Family "User Manual - Vol 2", "Command and Log Reference", *OM-20000047 Rev 13*, 2004/08/30, NovAtel Inc.

[4] Manual sections 2 and 3 from operating system GNU/Linux.