

POSTGRESQL USAGE WITHIN THE SPARC CONTROL SYSTEM

E.Pace, G.Di Pirro, S.Fioravanti, INFN/LNF, Frascati, Italy

Abstract

The SPARC control system is heavily using a PostgreSQL database. Configuration information are stored in the database and retrieved at initialization time from the control system. At the same time information about the accelerator are continuously collected and stored in the database and are heavily used during offline analysis of data taken for machine studies. Data are stored both in database tables and in an electronic logbook (based on PostgreSQL) that has been developed by the SPARC team.

SPARC

SPARC is the free electron laser under commissioning at the INFN (Italian National Institution for Nuclear Physics) Frascati National Laboratory. A gun driven by a laser produces an electron beam that is accelerated and injected in a modulator system in order to produce FEL radiation [1].

The electron beam coming from the photon injector will also interact with a 0.3 PW (6 J, 20 fs pulse) Ti:Sa laser beam in order to realize new plasma acceleration experiments and an X/gamma ray tunable source using Thomson back-scattering (PLASMONX project) [2].

Furthermore, terahertz coherent radiation will be extracted from the SPARC FEL radiation and used for beam diagnostic, technological applications and experiments (TERASPARC project) [3].

THE SPARC CONTROL SYSTEM

The SPARC control system [4] is a distributed system made of some front-end CPU's (industrial PC's or embedded CPU's) connected via Gigabit Ethernet to some consoles (industrial PC's) (see Fig.1).

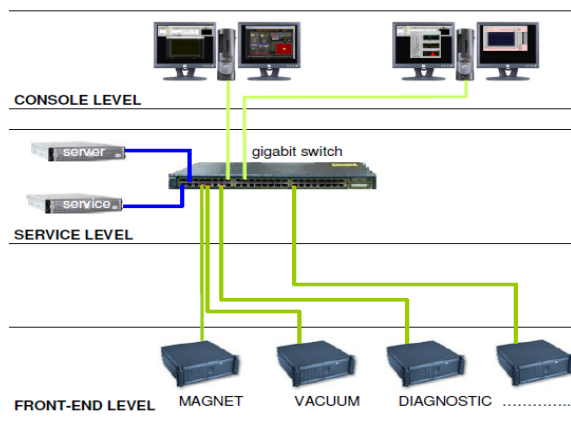


Figure 1: The SPARC control system.

Each front-end CPU controls one or few systems (e.g. ionic pumps, motors, cameras). Therefore, the control software that is running on each single front-end system has a common structure but it is specialized in acquiring a specific type of information.

At console level, clones of exactly the same program can be run on different computers. Each clone can monitor information coming from the front-end CPU's and issue commands in order to remotely operate the front-end systems (e.g. move a motor, change a power). Furthermore, some programs have been developed in order to automatize several measurements (e.g. QE gun map).

The communication between all the CPU's involved is via TCP/IP over Gigabit Ethernet.

WHEN SPARC NEEDS A DATABASE

The SPARC control system needs to know many information in order to work. They could be written on files but the number of them would easily diverge. So the usage of a database has been introduced. We decided to use PostgreSQL because, even if it is public domain, it offers performances that are enough for our purpose. Creation of the database tables has been quite easy because, generally, we do not have to correlate many information from a table to information contained in other tables.

Configuration Information

The first operation a front-end CPU has to perform is to initialize the hardware that it is going to control. Some initialization parameters are stored in the database, for example serial port speed.

Data monitor and Storage

Each front-end CPU continuously acquires information from the hardware it is controlling: this information is accessible from the console level software for monitoring or for performing automatic operations. At the same time it is crucial that this information is stored in the database so it can be retrieved off-line.

Old Data Retrieve

Data stored in the database can be retrieved off-line in order to study their historical evolution or to correlate them (see Fig.2). It is also important for checking operation status during the off-line analysis of data taken for machine studies

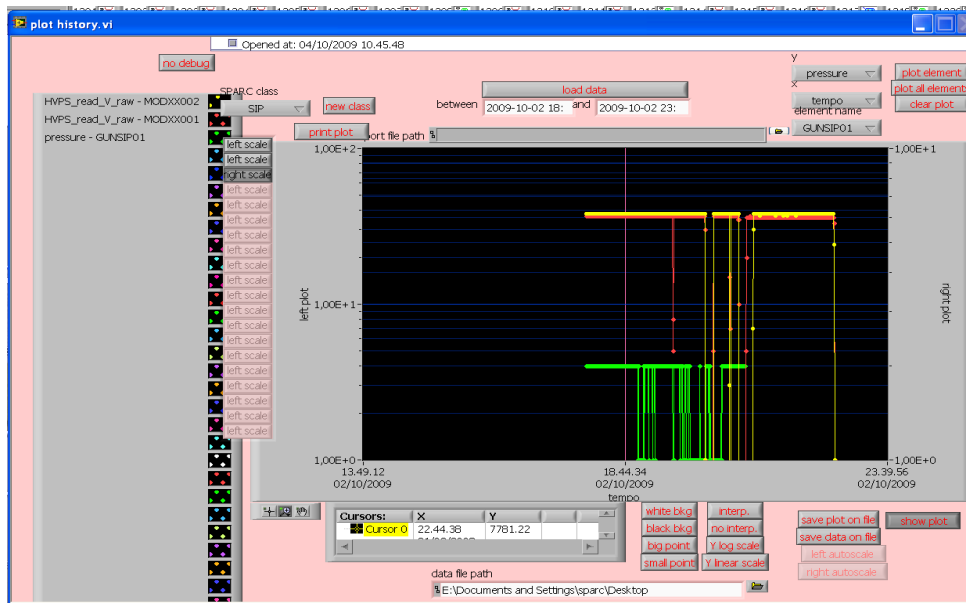


Figure 2: Retrieving old data.

Database and Console Programs

In order to work, console software has to read from the database the hardware configuration of the control system: tables in the database contain information about which CPU is controlling which hardware, which CPU controls a certain class of hardware, and the list of the commands that can be issued by the console on a certain hardware.

SPARC-BOOK AND THE DATABASE

SPARC-BOOK is an electronic book that has been specifically developed for SPARC. An electronic book is something very important for the life of a scientific activity where many persons are involved: it is the way to collect all the information about the ordinary and extraordinary life of the activity. But people are lazy, so it is very important that the access to the electronic book is really easy. So we decided to help people as much as possible, building software buttons on many control panels: pushing one of them, some information will be automatically register into the electronic book (e.g. vacuum status) (see Fig.3).



Figure 3: Example of software button for an automatic entry to SPARC-book.

SPARC-book has been written using html and php, and the information are stored in our PostgreSQL database. Software buttons for automatic entries in the database are developed in LabView directly into the control system. Entries are made writing into the database via TCP/IP.

LABVIEW AND POSTGRESQL

The SPARC control system is entirely written in Labview. Some vi's have been developed in order to read/write information stored in the database sending information via TCP/IP. In Fig.4 you can find an example:

- *connect* connects to the database(see Fig.5)
- *query* send queries in order to select data from the database or write (set) data (see Fig.6)
- *close*

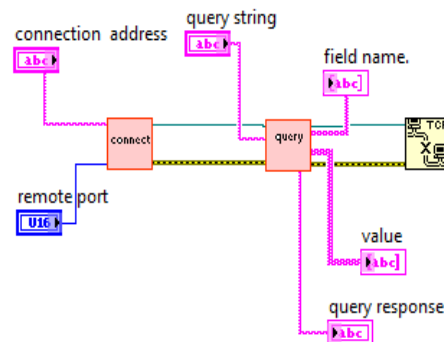


Figure 4: Labview code for accessing PostgreSQL.

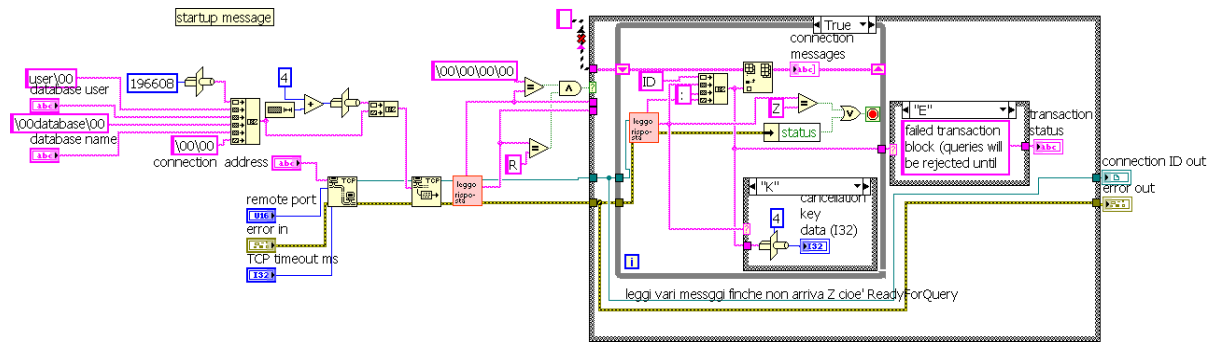


Figure 5: connect.vi

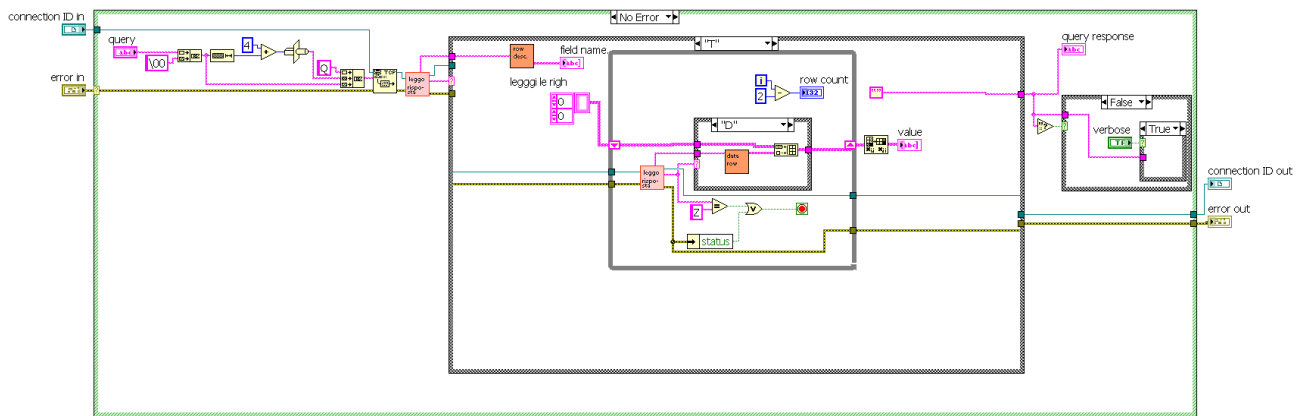


Figure 6: query.vi

CONCLUSIONS

The usage of a database in the SPARC control system helps a lot in scaling the system itself when it is necessary.

Furthermore it gives the possibility of looking at the past and look at what happened.

REFERENCES

- [1] M.Ferrario, et al., "Commissioning Results of the SPARC FEL", FEL09, Liverpool, August 2009.
- [2] A.Bacci, et al., "Status of Thomson source at SPARC/PLASMONX", NIM A **608** (2009) S90-S93.
- [3] S.Lupi, et al., "TERASPARC", INFN Commissione V, <http://agenda.infn.it/subContributionDisplay.py?subContId=1&contribId=4&confId=1718>.
- [4] F.Anelli et al., "The SPARC Control System", this conference.