THE ON-LINE AND DATA ARCHIVING SYSTEM OF VIRGO

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In this paper we will describe the basic architecture of the on-line system and data archiving system of the VIRGO antenna. We will give also a global description of the data structure (frames) in connection with the architectures of the Frame Builder, On-line Processing and Data Archiving systems.

1 Introduction

The On-line and Data Archiving system acquires all the useful information for the VIRGO[1-3] on-line and off-line data analysis. In fact, all the locking and alignment signals, together with monitoring and environment ones, are acquired, structured, processed and stored on disks and on tapes together with the monitoring and environment ones.

2 Architecture

The configuration of the interferometer requires the implementation of a distributed readout system as shown in Fig. 1a. In fact, in each building a Local Readout System collects the available data and send them to the Frame Builder via a digital optical link (DOL). All these tasks are synchronized by a timing system which controls the acquisition (at a rate of 20 kHz) and the data transfer. A Slow Monitoring Network (Ethernet and/or FDDI) is used for data transfer of quantities which are sampled at low rate (a few Hz). The Frame Builder collects all these *raw* data, structures them into frames and send them to the Raw Data Archiving System and to the On-Line Processing System as shown in Fig. 1b (a rate of 2 MByte/sec is expected).

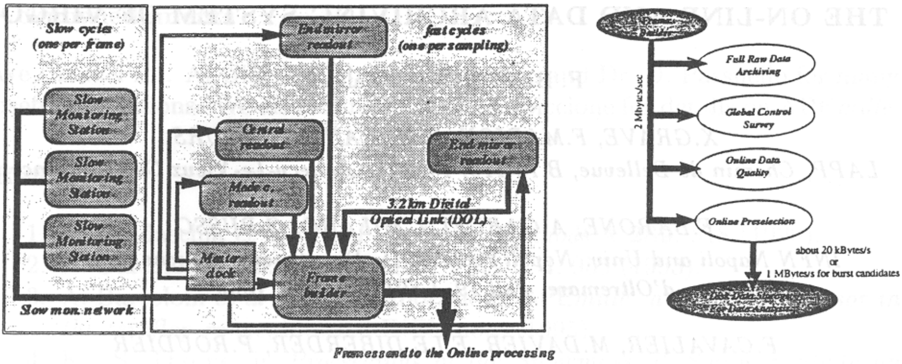

Figure 1: a) Distributed Data Acquisition System Architecture; b) On-Line Processing and Data Archiving Architecture.

The Raw Data Archiving System archives all the frames on DAT tapes, making it possible any retrieval and reprocessing of the original data. The On-Line Processing System converts the raw data to physical quantities, computes the corresponding h values and adds these information to the frame structure. It also runs on-line data analysis algorithms provided and validated by the VIRGO collaboration for the on-line selection of the frames in which a GW candidate may occur (e.g. bursts, binary coalescence). All the selected frames and subsets of the non-selected ones are then collected by the Data Distribution System which stores them on disks (on-line data distribution) and on DAT tapes (DST - Data Summary Tapes) for the VIRGO collaboration off-line data analysis.

The quality of the data is permanently surveyed by the On Line Data Quality Section, while the Global Control Survey reacts to faulty behaviours affecting the locking of the interferometer.

3 Data Structure

The frame is organized as a set of C structures described by an header holding pointers to additional structures and values of the parameters. The header is followed by an arbitrary number of additional structures, each holding the values of a rapidly varying parameter. The frame is divided into three main structures, as shown in Fig 2:
[1] Structures filled by the Frame Builder.
[2] Structures filled by the On-Line Processing or by the Off-Line Reprocessing.
[3] Structures filled by the simulation.

All this information is archived in the following way. All the sections [1] are stored by the Raw Data Archiving System on DAT tapes. The Data

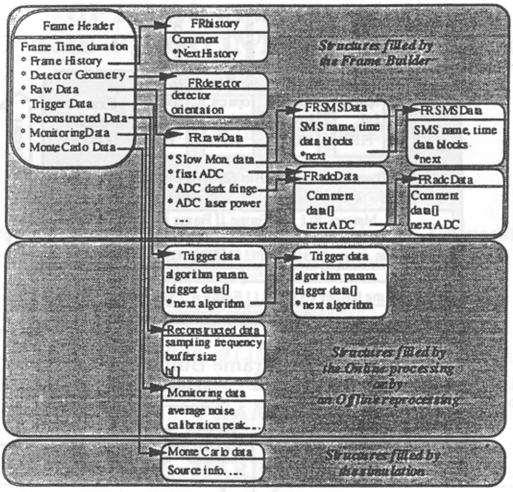

Figure 2: The frame structure.

Distribution System archives the sections [1][2][3] of the selected frames and the section [2] of the non-selected ones. If there is the need of reconstructing the whole frame, then the Data Distribution System reprocesses the sections [1] stored by the Raw Data Archiving System.

4 Implementation

The software-hardware structure is built within the framework of the client-server model. Communications among clients and servers is made via the multitask communication package, Cm [3].

4.1 Frame Builder

The Frame Builder architecture is shown in Fig 3. Synchronized by a clock, a processor collects the data from the FIFO memories for one frame, while the other one assembles the previous one and send it to the storage and on-line processing. The slow monitoring data are acquired by the master CPU and included in the frames.

4.2 Raw Data Archive

We have adopted a modular solution consisting in the parallel stage of the data on disks (up to 10 MByte/sec data flow) and then in the copy on DAT tapes. This solution makes it easy to reconfigure the system on the basis of the actual data flow. In Fig. 4 the architecture of the Raw Data Archive is shown [3].

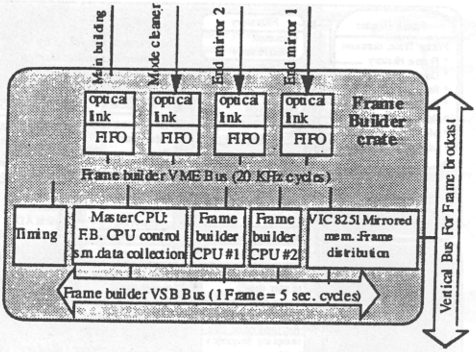

Figure 3: Frame Builder.

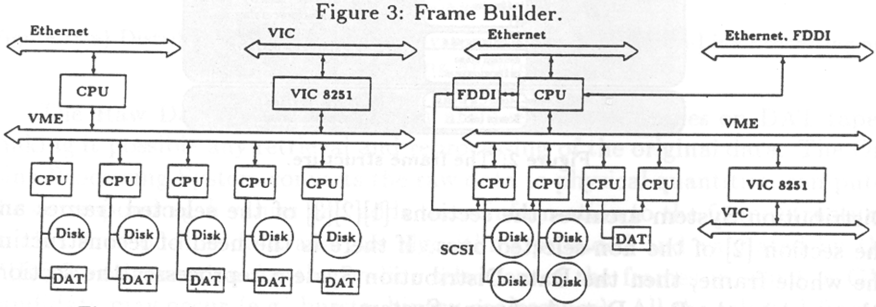

Figure 4: a) Raw Data Archiving System. b) Data Distribution System.

4.3 Data Distribution

The data acquisition and the data distribution follows two different channels. The data acquisition and storage is obtained using an open architecture multiprocessor system, with multiple buses for I/O and multiprotocol (VIC, VME, PCI) while the data distribution uses standard network access to the data (Ethernet, FDDI, VME, PCI). We foresee to have 500 GByte on line as a first step (80 disks 9 GByte each), but this structure can be easily expanded[3].

Acknowledgments

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References

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2. *VIRGO: Final Conceptual Design* (1992).
3. *VIRGO: Final Design*, (1995).