Experimental Data Management System for SND Experiment [1]

A.D. Bukin, I.A. Gaponenko, V.N. Ivanchenko, A.A. Korol [2]

Budker Institute of Nuclear Physics, Novosibirsk, 630090, Russia

To provide simple and reliable access to experimental data on magnetic tapes the program for experimental data management (ART) was developed. The program is in use on the SND detector since September, 1993. It works in close interaction with both online and off-line systems of the detector. Overall structure of the program, its interaction with other SND software components and an experience in its using is presented.

Key words: data management; mass storage; hierarchical storage management; archive

1 Introduction

The Spherical Neutral Detector (SND)[1] is a facility for experiments at the e+e- collider VEPP-2M in Novosibirsk. SND detector operates since 1995 at the energy region of 0.4-1.4 GeV[4].

Acquisition and processing data from detector creates and processes large amount of data. Total size of stored data sets can be more than hundred gigabytes. At present the only possible media with reasonable size/price ratio are magnetic tapes. But magnetic tapes have some known deficiencies related with sequential access to data on tapes. Some of them follow:

- lack of possibilities for logical grouping;
- data set information can be got only after reading tape — so it is impossible to know what data are written on tape before mounting it and reading;
- before reading it is also impossible to know on what medium required data set is located;
- very limited set of operations with files (only sequential ones);
- relatively long time of access to data.

To provide more convenient and reliable work with magnetic tapes on SND detector the program for experimental data management (ART, for Archive on Tapes) was developed [2]. ART has the following main features:

- hierarchical system of directories;
- 2-level protection (group/user);
- fast access to information about tapes and files on tapes;
- asynchronous processing of requests to store/get files to/from tape;
- caching files in disk pool for some period for optimization reason;
- based on directory structure automatic allocation of magnetic tapes;
- based on type and logical groups of tape automatic allocation of recorders;
- addition informational tags for files and tapes (comments);

[1] This work is supported in part by The Russian Fund of Fundamental Research (project code 96-02-19192)

[2] Corresponding author. Fax +7 3832 35 2163. E-mail korol@inp.nsk.su

The program works in close interaction with both online and off-line software of the detector. The calibration constant data base of SND is partially based on information provided by the program.

Functionality of the program can be compared in part with functionality of CERN FATMEN+VAXTAP[5,6] integrated in one program, but without network and disk files support and with shift to resources economy and minimal user interference to tapes and recorders allocation process.

2 Overall structure

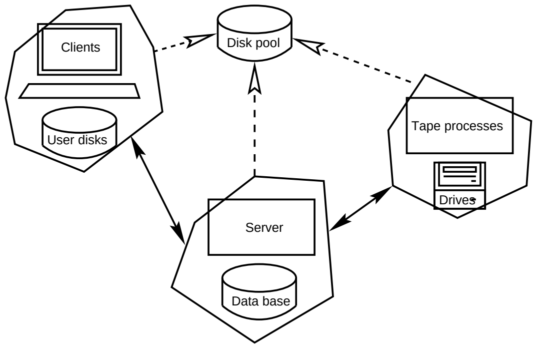

Fig. 1. Processes interaction layout

The program utilizes the client—server model (fig. 1). Client is either user program using program interface or special command interface program. Server receives requests from clients, supports database and starts processes for real I/O with magnetic tapes. Server, clients and tape processes can execute both on the same and on the different network sites.

Files are grouped in the hierarchical system of directories. Files registered in the same directory can be physically stored on different tapes. There is a simple 2-level protection (group/user) based on directory structure. All files and directories can be tagged with user character string (comment) that allows to identify their contents more accurately than names.

Data flow between user files and magnetic tapes passes through the disk pool. If user stores a file in ART it goes to disk pool and then server arrange tape process to store the file on the magnetic tape when it becomes possible. If user requests to get a file from ART, server provides reading the file from the magnetic tape to pool and then inform client if it is required.

Allocation of tapes for storing files is based on directory structure. One can attach a set of tapes to the directory so files created in its subdirectories will go to “active tape” from this set. Allocation of devices is based on types of tape/device and logical groups of tapes (places). To optimize number of mounting tape process occupies the device for some idle period of time which is specific for “place”.

3 Implementation and experience

The program was implemented using ANSI C language. It consists of $\sim 25,000$ lines of code. ART is linked as 4 different modules: server, tape process, command interface client and shared library for program interface client. For local and network interaction between client/server and server/tape process CERN RPC [3] for DECNET protocol was used. The program is in use beginning September,1993. During this period it becomes more reliable. It was used to store and operate with more than 200 GB of valuable experimental and secondary information. Now it works with 2 different types of tapes/recorders (Exabyte 8mm and HP DDS-2).

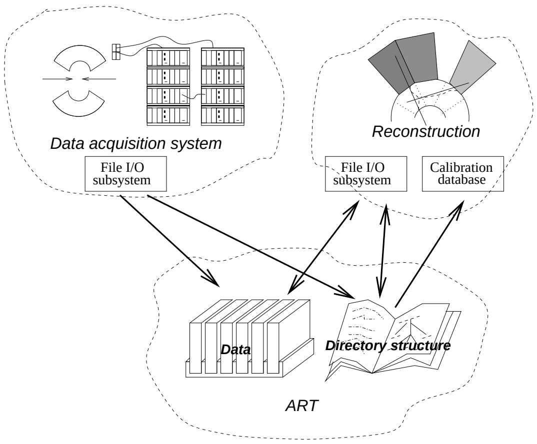

Fig. 2. Relations between ART and other software components

An interaction of ART with other SND detector software component is presented in Fig.2. Special subprocess in the data acquisition system[7] stores files with experimental data in ART. Reconstruction code[8] uses ART both to obtain and store files with data and to get information used in the calibrations data base.

4 Conclusion

The program for experimental data management was developed and used in SND detector software for four years. It provides the end user with necessary components for easy access to experimental data on tapes. Further development of the program will go in porting to Unix compatible systems and more reliability.

Acknowledgement

We would like to thank the whole SND detector team for help and fruitful discussions.

References

[1] V.M.Aulchenko et al., Proc. Workshop on Phys. and Detectors for DAΦNE, Frascati, April 1991, p. 605

[2] A.A.Korol, Prep. BINP 94-62 (in Russian)

[3] T.J.Bernes-Lee, Intro. to Remote Procedure Call, CERN, 1993

[4] V.M.Aulchenko et al., Proc. The 6th Inter. Conf. on Hadr. Spectroscopy "Hadron 95", Manchester, UK, 1995

[5] J.D.Shiers, FATMEN — Distributed File and Tape Management, Program Library Q123, CERN, 1992

[6] J.D.Shiers, VAXTAP — VAX/VMS Tape Handling Package, Program Library Z312, CERN, 1992

[7] D.A.Bukin et al., this Proceedings

[8] K.Hanssgen, V.N.Ivanchenko, this Proceedings