Control System for VEPP-5 Electron-Positron Complex

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Abstract

The control system of the new VEPP-5 complex is discussed. The organization of the hardware, software and database is described. The first results are presented.

1 Introduction

A new complex VEPP-5 in the Budker Institute of Nuclear Physics (BINP) is being built. This complex includes electron and positron linacs, a damping ring, a PHI- and C-TAU factories.

The future control system for the VEPP-5 complex is under development. The hardware environment of this system consists of three levels: CAMAC hardware in crates with intelligent and "dummy" controllers (level 1), special server computer SC (level 2) connecting the intelligent controllers (IC) with a set of workstations (level 3). The computers form a control system local network via the Ethernet. Software has three levels as well: different *Drivers* for maintenance of CAMAC hardware and *Dispatchers* (this is a set of processes running in the IC), a *Server*, running in SC and a set of control programs (*Clients*) running in workstations. The Server provides communication between *Clients* and processes in the ICs.

2 The principles of system design

The main principles of the control system design are the same as for the previous generations of the BINP accelerator complexes [1]:

- only one program– the Server communicating with hardware directly, thus resolving possible conflicts;
- the Server maintaining a dynamic database (DDB), reflecting the current state of the whole system;
- the software is represented by a number of simple little programs, while the hardware is represented for them by the DDB;
- the static database describing the whole system.

3 Hardware organization

Fig.1 shows the hardware used. It includes several computers (P5-133 PCs) and some control electronics in CAMAC crates. All PCs are connected with Ethernet and communicate via TCP/IP. One PC acts as server. It provides "interaction" between all the PCs and CAMAC hardware.

The IC is based on a T805 transputer (2M RAM, 25MHz) and is implemented in a CAMAC standard. Each IC has 2 links, which enables to build a network of transputers.

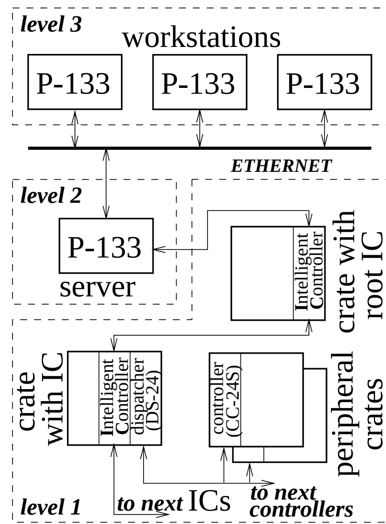

Figure. 1. Three levels of hardware.

The control electronics served by either ICs, or CC-24S controllers [3] is placed into CAMAC crates. The CC-24S crates are connected to the ICs via DS-24S dispatchers [3].

4 The software

Fig.2 shows the software organization. The components that are not fully implemented are represented by dashed lines).

The low level contains Dispatchers and Drivers for individual blocks. The Drivers work with CAMAC blocks directly and perform required read and write operations. The Dispatchers control the Drivers and provide transportation of data packets between the server PC and the transputer network, as well as inside the network itself.

The Server forms the middle level. It runs in a server PC. Its main services include booting the transputer network, providing access to the binary database (see below), dispatching the *Client's* requests to the Drivers and returning the Driver's responses, logging the history of all operations. The key function of the Server is the maintenance of the dynamic database. This database is a mirror of the current state of all the hardware. The Server works as a "data bank", which is used by all the Clients to obtain information about the hardware and to perform control operations. The Server is also responsible for administration of the system and for access control.

The top level consists of the Clients themselves, running in Linux PCs. The clients implement all the logics of control,

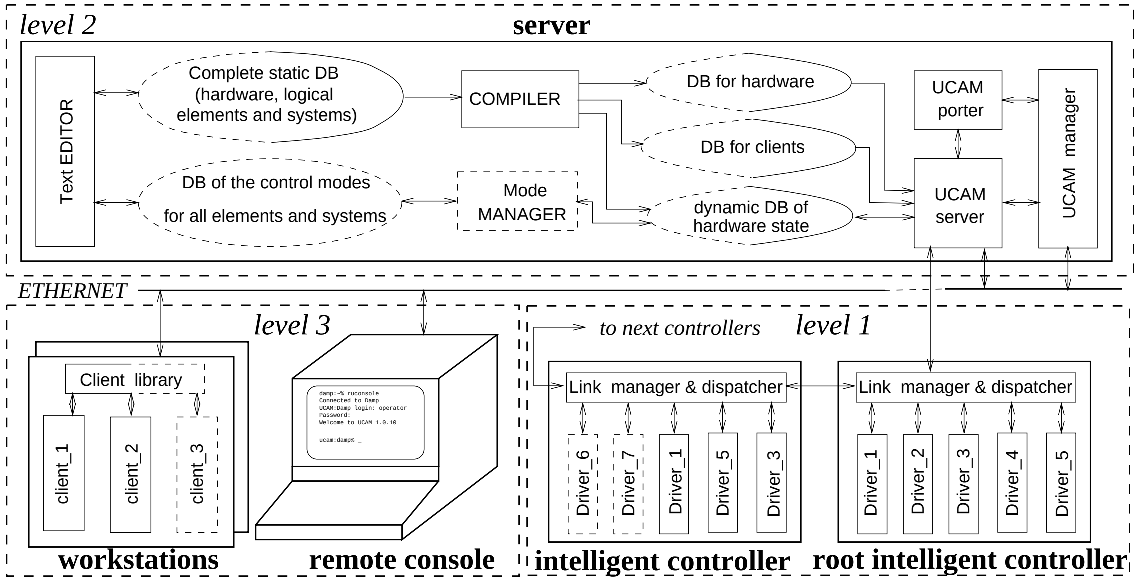

Figure. 2. Three levels of software.

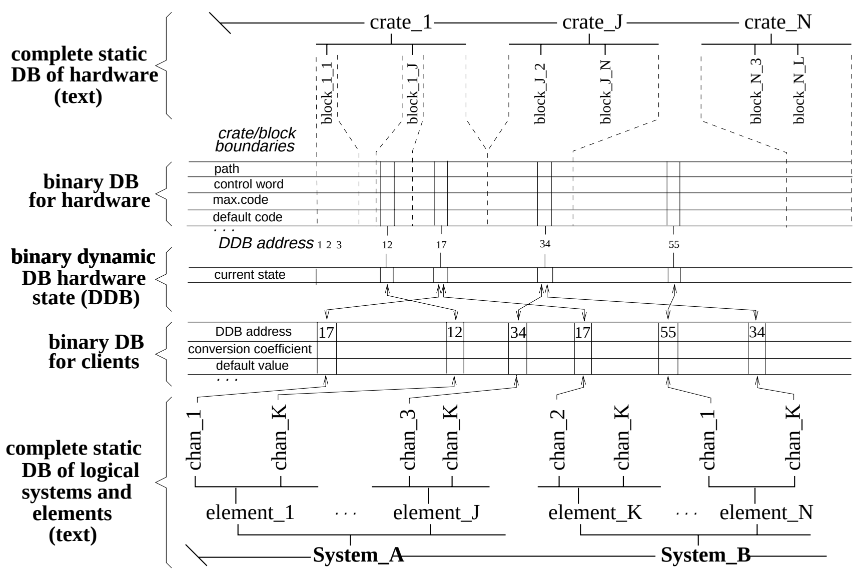

Figure. 3. Database organization.

i.e., the algorithms, used to control the system or some of its subsystems. The user interface is provided by Motif. Since the interaction with Server is implemented via TCP/IP, the Clients may work in any UNIX computer.

5 The database

The *Database* (see Fig.3) contains a complete description of the physical devices and their channels, as well as information about their grouping into *logical elements*. It provides effective control of all the systems on the complex. The Database is a set of text files, residing in a directory tree. A special *Compiler* translates it into a number of binary files. There are separate binaries for ICs, for Server, and for Clients. The main features of these binaries are as follows.

The database for Clients assigns each physical channel a position in the DDB. It also contains full information about logical structure: the hierarchy of systems, subsystems and elements, and about the properties of individual logical channels (such as min/max/default values, conversion coefficient etc.).

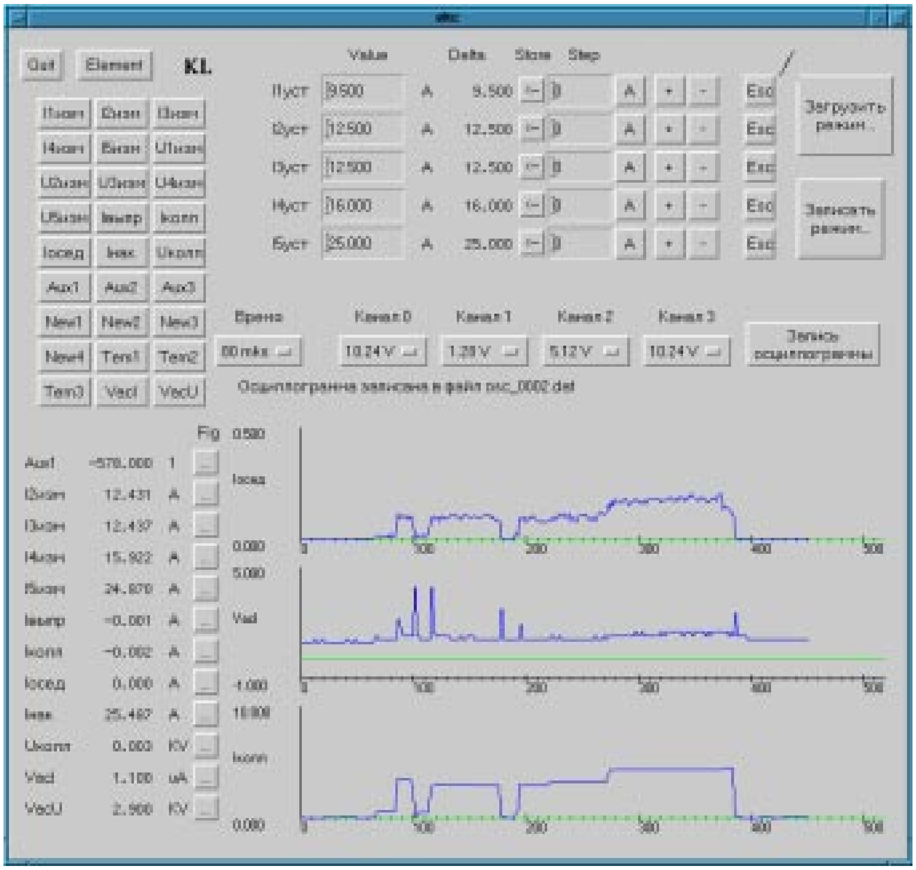

Figure. 4. A window of a client program.

The database for Server includes unique paths to each physical channel in the transputer network and their basic properties (input/output, allowed range of codes etc.).

The database for ICs contains hardware-dependent information such as block positions and control words. The database also includes a set of initialization files for individual elements and subsystems. The values of control channels for set up modes of operation are stored in these files.

All the clients access the Database only via the Server.

The organization of the database and availability of a library of drivers enables easy reconfiguration of the system.

6 Conclusion

Currently the first variant of this system is used for the control of the RF system of the damping ring. Fig.4 shows a screen snapshot of a working Client. Now the main working mode of the system with a frequency of 1 Hz is used. Evaluation of the system performance was made, and it confirmed the validity of the solutions being used. The design of the full version of the system is in progress.

References

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[3] V. Kozak. Preprint INP/88-24, Novosibirsk, 1988 (In Russian).