

THE DISAPPEARANCE OF THE BARRIER IN THE CONCEPT OF THE COMPUTER

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Abstract

The performance enhancement of the cheap computer quickly develops, and the effect also permeates in the field of equipment control of which the high reliability is required. The low power consumption technology used by the book-size personal computer practically is utilized even in the field of the equipment control. A demand of upgrading of a processing demand and short period of the development is strong in the equipment control, and in the conventional real-time multitask kernel, the dissatisfaction comes out in the functionality. The following are coming out : Goods and technology that there is a similar demand in various fields and that it solves it. It recently has the function of resemblance and DOS/V personal computer, and VME board of the low power consumption is also variously sold. It is possible to utilize advanced OS (Windows, LINUX, FreeBSD), and the workability is often more effective than the real-time multitask kernel for the short period development. The means of this species is utilized even in the control of 12GeV PS for a part of function. Intends to utilize and consider the technology of this species even in MR-Control of J-PARC. These outlines are introduced.

INTRODUCTION

Each age background is reflected for the control equipment of 12GeV accelerator which works in High Energy Accelerator Research Organization (kek), various systems have been adopted, and what becomes a core is the system which combined the VME computer with the network called the MAP. This control system was widely utilized for operation and information collection of various equipment of the accelerator. Program development environment called OBJP as a frame of the control system was developed and was utilized. However, the basic design was made to be an ancient around 20, and it was not possible to reflect the rapid evolution of the computing environment. Then, the control unit was constructed by the latest technology on the outside of the MAP network, and it was connected by Ethernet. By connecting the Ethernet and MAP network in the bridge, the old system would be able to be manipulated from the latest system. The set of the program as a bridge was homemade, and it was flexibly able to cope in the equipment trouble. The first-generation of the Ethernet side computer of the bridge was made using SunOS. FreeBSD was used for the recovery as OS, when it broke down, and the bridge of the

second generation was constructed. This report concerns the system made for the bridge of the second generation.

Only, though it is the usual talk, if this has been mounted on PC of usual IBM-PC compatibility type, what is used by this new and old both systems is the VME computer. It is advantageous to utilize the input/output board for the process control which moves on VMEbus. And, the construction is also easy on VMEbus on the system formed by the asymmetric multi- CPU for the special purpose like this report. It was possible to make the system which there is an interest, as the merit with the easy expansion is combined with the operability of the personal computer. This is the first half division of the report.

The latter half division of the report is the talk on the plan which utilizes LINUX at J-PARC. In 50GeV synchrotron control section of J-PARC, LINUX is used considering the comprehensibility as it utilizes and learns for the input/output control [1].

The common theme of this report is to introduce the two new and old trials which simplify the development task by using DOS/V compatibility technology which widely spreads recently in the process control field.

DATA TRANSFER BETWEEN NETWORKS OF ETHERNET AND MAP

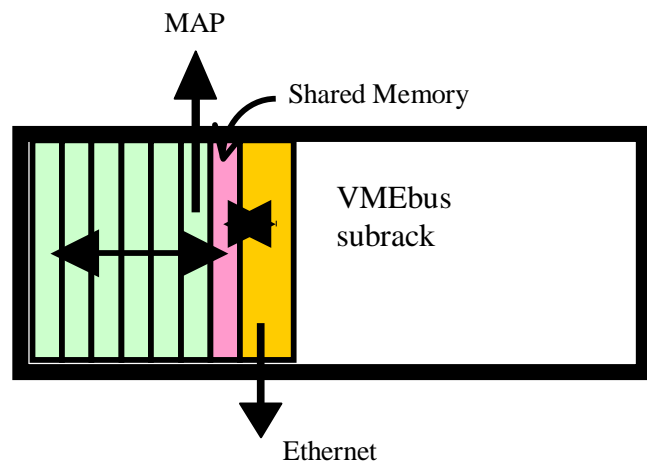


Figure 1: MAP <-> Shared Memory <-> Ethernet.

Though the data transfer between networks of Ethernet and MAP was called "bridge" here, in the exact meaning, it is not a bridge of the concept of the network. The receiver program deciphers the content of the data received from the network with Ethernet in each of the

MAP. Then, it is written in shared memory in order to hand it for delivery program of the other party. The program received from shared memory is sent out by the specific protocol. SunOS+Sparc was spent in the Ethernet side in the initial stage. FreeBSD is used after the troubleshooting as a Ethernet side OS. The program for the bridge rebaked the original program. The aspect which has delivered information between two CPU's on shared memory through the VME bus is shown in figure of 1.

The rewriting of the program was the work in the UNIX system, and the transplanted was simple except

existence of the OSI model. However, this program group did the large contribution for the accelerator operation, when there was no product, even if the concept exists. For the reason, it was not possible with the end operated in the trouble. Moreover, it had to be restored in the short time, and the operability with personal computer for the development and compatibility was useful for the transplanted work of the program.

UTILIZATION OF LINUX AT J-PARC

Priority was given to the convenience in the development further than the real time in the development of control system of the 50GeV synchrotron of J-PARC with the problem in the development man in the news resources. Assumed period is long with the range from 3 seconds to 10 seconds, and in addition, IOC not require the fast-response of the millisecond, since the advanced intelligence in the equipment side is being given. For such reason, LINUX

should be adopted in OS of the IOC part of EPICS.

Schematic drawings of the network around IOC which uses LINUX in OS are shown in figures of 4. Though IOC gives the function of router/firewall/nat, etc. in proportion to the situation, both of upstream (the center side) and downstream (the equipment side) are tcp/ip or udp/ip, and there is no complexity as an MAP system. In the reason, there is either no necessity of constructing the asymmetric multiprocessor system. The standard server function of natd/ntpd/named/ftpd, etc. is utilized in proportion to the content necessary for the IOC. By using LINUX in OS, and utilizing Ethernet for the network for the connection in the equipment side, the program construction of the support work variously can be very much simplified. The details is announced in reference literature 1 in this conference.

It is considered that it utilizes the kind of nfs on the file transfer for the data storage and wants to simplify the work. In the control of the 50GeV synchrotron of J-PARC, the development process of the server of the PC application is utilized maximally in all planes, and simplification of the system construction and easiness of the maintenance are realized.

for the problem of the byte order. In VME board which uses the INTEL CPU, the byte order in accessing VMEBs is automatically converted. However, a confusion occurs, when reading and writing of the ASCII column be done as word and long word. The transplanted work is easy, when the situation can be grasped

The following are shown in figures of 2 : Resident program on FreeBSD and resident program of VersaDOS. These programs can be divided roughly for the file transfer and statement transfer. These programs have done the communication by doing reading and writing of the shared memory. By handing the result for the program of the outside, the work is completed. There is a program of about 10 in the FreeBSD side, when the ancillary program is added.

Through this bridge, computer group which was tied in the MAP is manipulated from OPI in the Ethernet side in figures of 3. It is used for the setting of the pattern of pattern current-outputting power source equipment of the extract system, and acquisition of orbital data and steering data have been set. And, orbital data were automatically acquired, and it was also used for the experiment which adjusted the data of the steering.

The communication concept existed on the communication of IEEE-802.4 and IEEE802.3 by the

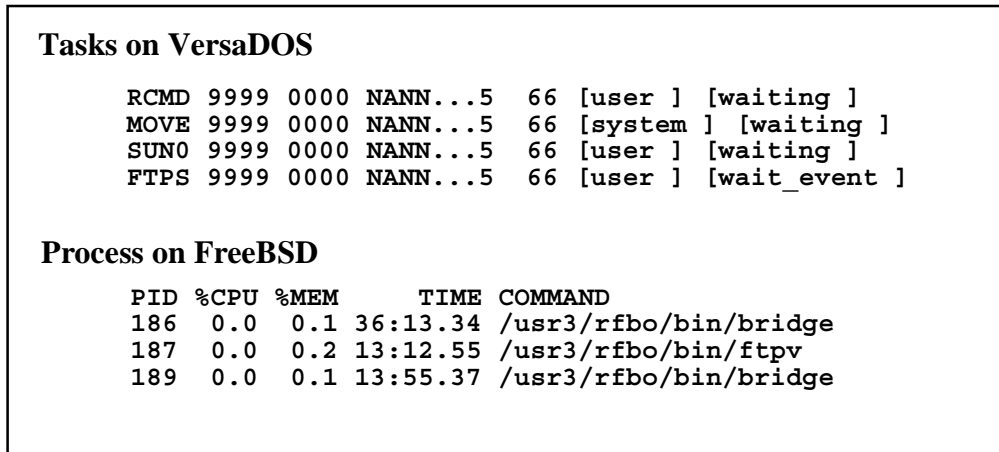


Figure 2: Tasks for bridge on both VersaDos & FreeBSD.

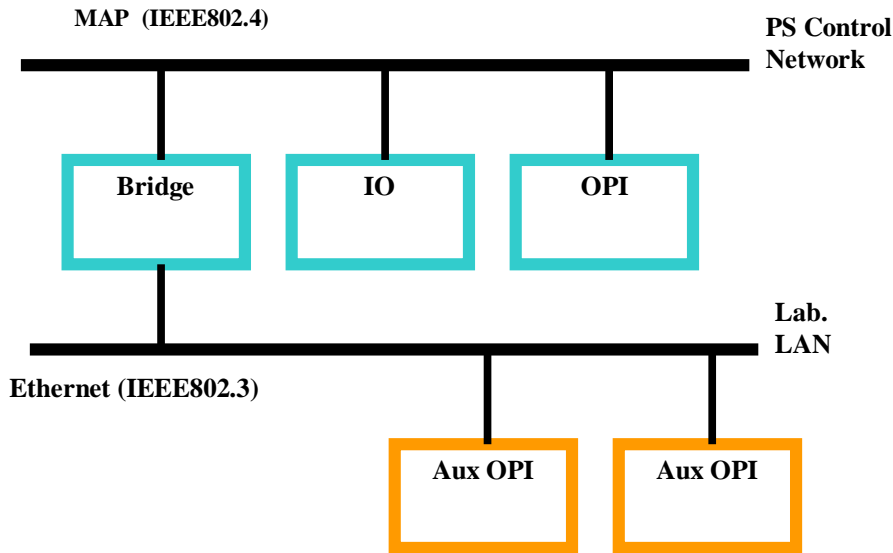


Figure 3: Networks of 12GeV PS.

SUMMARY

In the 12GeV synchrotron, FreeBSD is utilized, and in the 50GeV synchrotron, LINUX does be used, but this is not based on the evaluation of both functional superiority. There be seem to no an essential difference to both, when it is the utilization like us. Rather, the utilization of LINUX was decided from the viewpoint of the development efficiency based on the habituation of the worker.

And, there are various branches in LINUX, and the BSD series UNIX is also similar. It is considered that the

flexible correspondence would want to be possible for what kind of change, when the composition of the whole system is considered. It is also the decision from such viewpoint to make the equipment variously to be the Ethernet connection.

In the 12GeV synchrotron, FreeBSD is very much useful. In the 50GeV synchrotron, it is expected that LINUX is very much useful.

REFERENCES

- [1] Guobao Shen et.al. ,”Development of Linux-based IOC with VME-bus computer”, PCaPAC 2005, Hayama, March 2005, WEP43

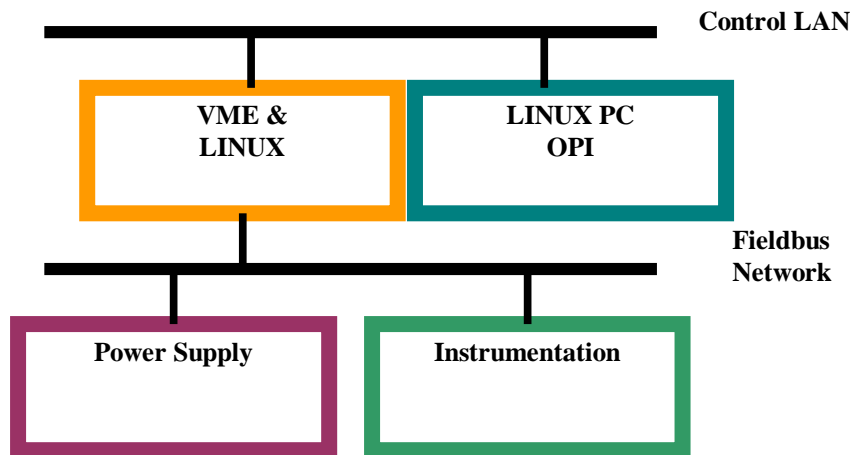


Figure 4: Networks of J-PARC 50GeV Synchrotron.