PRESENT STATUS AND UPGRADE OF VME COMPUTERS IN KEKB

K. Yoshii#, T. Nakamura, T. Aoyama
Mitsubishi Electric System & Service Co., Ltd., Tsukuba, Ibaraki, 305-0045, Japan

K. Furukawa, T. T. Nakamura, E. Kikutani, K. Mori
High Energy Accelerator Research Organization (KEK), Tsukuba, Ibaraki, 305-0801, Japan

Abstract

KEKB accelerator has been controlled with EPICS-based control system. We had stabilized the operation and development based on the release 3.13 of EPICS and the CPU of power-PC 6750, which we have used from the beginning. However, it became difficult to meet the speed and feature requirements for CPUs, network and EPICS software with the current configuration. Thus, we started development to upgrade CPU with PPC-MVME5500 and EPICS with 3.14 from 2006. We have succeeded in the VME control by CPU PPC-MVME5500, which carried a VXI interconnect, trigger receiver, a digital I/O module, and a CAMAC interface so far. We upgraded five I/O controllers at KEKB operation, now.

In addition, we schedule the upgrade and the exchange of CPU and EPICS based on the result. Here, this reports on the present status and upgrade of VME computers in KEKB.

INTRODUCTION

In KEKB, many components of the accelerator were controlled from VME computers, which used the EPICS software frameworks. When the beam operation of KEKB started, the VME computer was composed of PowerPC (PPC) 6750 and EPICS3.13, and the operating system of PPC6750 was VxWorks-5.3. This combination accounts for 78% of the entire VME computer in KEKB.

We have done the operation and development with EPICS and CPU that has been used from the startup of KEKB operation. However, the necessity of the renewal of EPICS and CPU has risen for the following reasons.

- Upgrade of KEKB operation towards Faster processing and faster communication with newer software environment
- Maintenance difficulties of old hardware and software

We started the software development in 2006 to renew software to EPICS3.14, VxWorks5.5, and CPU to MVME5500 of the same CPU type of PPC.

THE PRESENT CONDITIONS OF THE VME MODULES

As for the present conditions of CPU in the VME computers that are used in KEKB, PPC6750 has the majority as shown in Table 1. (The table includes numbers from PF-AR accelerator as we share the development environment.)

However, it became necessary to upgrade the CPU because the maker already discontinued the support of CPU6750. In order to meet the requirements, EPICS and VxWorks software environment was upgraded as well as device support software for various I/O modules.

Table 1: CPU Conditions (Lower: Newer CPU)

CPU TYPE (PPC)	Available	Spare
FORCE SYS68K CPU-40B/16	6	7
FORCE SYS68K CPU-64D	9	4
FORCE PPC6603	7	1
PPC6750	**99**	9
EMERSON MVME5500	6	11

Table 2 shows the present conditions of I/O modules used with the VME computers in KEKB.

VME computers and modules are different by each combination, but it was necessary module's software development for CPU upgrade.

Table 2: I/O Modules Conditions (typical modules)

Module TYPE	Available	Spare	VME
GPIB	81	6	75
ARD (ARCNET)	69	11	24
CSD (CAMAC)	47	8	47
MXI (I, II)	27	5	27
EVR	25	6	25
EVT	25	1	21

EXAMINATION AND PROBLEM

The reasons to upgrade CPU6750 are the following items.

- Production and sales had already finished. No maker support any more.
- The CPU and network interface is slow. Therefore, it takes time for the start and download.

In order to upgrade the CPU following items are considered.

- Selection of VME controller group that shares the same hardware and software environment.
- Software upgrade of I/O modules for the new environment

The VME computer of CPU6750 that uses VXI, Trigger Receiver, GPIB, and CAMAC is exceeding 90 places.

Moreover, the following problems had occurred in KEKB.

- Ethernet speed is not raised due to the driver software problem. Therefore, ethernet speed is limited.
- On the certain VME computer, the resource consumption of the network socket occurred.

Therefore, it was necessary to do reboot regularly to reset the scarcity of resources.

Ethernet speed of is not raised due to the software problem. The driver software on CPU cannot set appropriate network 100Mbps configuration. When the CPU connects with network switch at 100Mbps, the collision of packets occurs, and it fails in the communication. Therefore, we could not help being not raised Ethernet speed and operating it by 10Mbps fixation. It had already turned out that it was the software problem by the inquiry. The software upgrade decided to be executed by renewing CPU this time.

There are two patterns that decrease the resource about the problem where the resource of the network socket is insufficient.

- Network sockets suddenly increases in about one hour (Figure 1). It becomes impossible to connect with CPU when the increases started.
- Network sockets gradually increase (Figure 2). It becomes connection trouble when becoming memory shortage of CPU.

Network sockets seem to have increased as for either pattern. However, it is actually the problem that the socket resource decreases because the socket has been liberated. There was the possibility of improving these problems by upgrading EPICS and CPU. Therefore, the upgrade was examined.

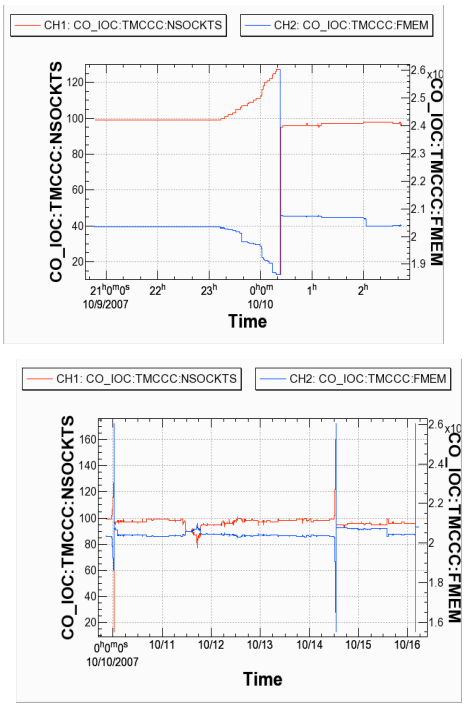

Figure 1: Network sockets sudden increase.

Horizontal: Time (Upper Fig: 1 day,
Lower fig: 1 week)

Vertical: Left (red: Network sockets)

Right (blue: Memory)

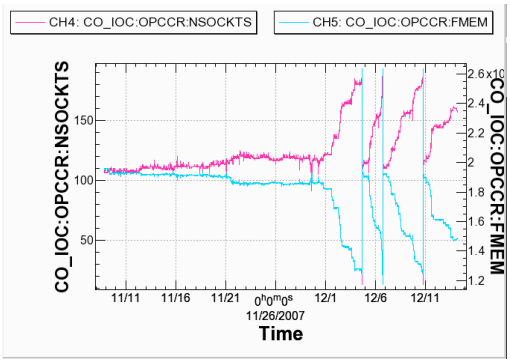

Figure 2: Network sockets gradually increase

Horizontal: Time (1 month)

Vertical: Left (red: Network sockets)

Right (blue: Memory)

CPU UPGRADE REPORTS

Simple CPU Upgrade

We upgraded the VME computer composed only of CPU to MVME5500 and EPICS3.14 first. This VME computer was needed high speed and steady ethernet speed. As a result, 100Mbps and 1,000Mbps is enabled by this upgrade, and are applying it to 1,000Mbps of auto negotiation by this VME now.

Supports to VXI (MXI) and Trigger Receiver

In the next step, the upgrade of the CPU was performed for KEKB BPM (Beam Position Monitor) VME composed of VXI (MXI) and Trigger Receiver module [1]. This development was started in the summer of 2007. The initial performance test was completed. This development was for the additional VMEs this time. At the same time the CPU upgrade of existent VME controllers of the same configuration become possible, too.

The replacement VME computer

In the next step, the substitution of the VME computer was executed. We are beginning operation of reading BT (Beam Transport) BPM using the DPO7104 oscilloscope. The development is continuing now [2]. To develop software running on windows, we installed Cygwin and Microsoft compiler to DPO7104. The development and the operation of the EPICS software are performed. The EPICS application that operates by DPO7104 is feeding the position data of BPM by acquiring and processing the signal waveform from the oscilloscope.

Supports to CAMAC

In the next step, the development of the upgrade of CPU was performed for VME composed of CAMAC interface. We modified the driver software of CAMAC

and it enables the CPU upgrade. In the future, CAMAC will be replaced because of the limitation of maintenance. However, the operation of CAMAC became possible by this development. Therefore, CPU upgrade of VME from which CAMAC was composed became possible.

Supports to network socket resources problem

In order to cure the problem of the rapid consumption of network sockets, two VME computers were made to allot the module installed in one VME computer, and the division investigation of hardware was executed. As a result, the problem was reproduced with a single digital I/O board, PVME501. Therefore, the upgrade of CPU and PVME501 software was performed. Afterwards, the problem was not reproduced even after 6-month operation. (Figure 3)

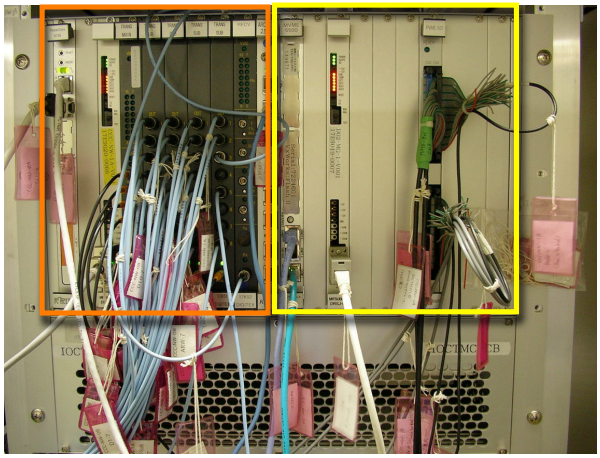

Figure 3: VME divided (Right: CPU5500)

On the other hand, about the problem that network sockets gradually increase, the problem has not been improved though the upgrade of CPU was executed (Figure 4). However, the memory of CPU has increased by having upgraded CPU. Therefore, the operating time of CPU has expanded. The inquiry of the client that increases the number of sockets will be examined in the future.

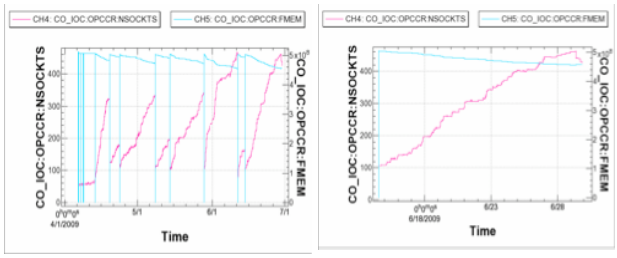

Figure 4: Network sockets gradually increase (Red)
*Memory increased -> long-term operation possibility
Horizontal: Time (Left Fig: 3 month,
Right Fig: 1.5 month)
Vertical: Left (Red: network sockets)
Right (Blue: memory)

CONCLUSION

When we pass by past experience for five years, various limitations occur, and upgrade becomes difficult when it passes for ten years. We understood that hardware, the operating system, middleware, the update plan that we got of the balance of the applications software were necessary in the next around 5 years.

We push forward upgrade of VME, but the part which is not settled is left. KEKB will have the plan of long maintenance in future. We include the present conditions, and examination is more necessary about the following items.

- Development of support software with other I/O modules (GPIB, ARCNET)
- Network sockets problem should pursue
- VXI (MXI), development promotion of the Trigger Receiver module software
- Examination of CPU replacement timing
- Selection of upgrading CPUs
- Examination of Other Computer than VME (PLC, Linux PC)

We will use the GPIB controller of network connection [2]. The reason is to improve the degree of freedom of GPIB. It is necessary to examine upgrade in total.

REFERENCES

[1] T. Nakamura et al., “UPGRADING THE CONTROL SYSTEM OF THE MOVABLE MASKS FOR KEKB”, in this conference

[2] T. Aoyama et al., “UPGRADE OF READOUT SYSTEM FOR BEAM POSITION MONITORS IN THE KEKB BEAM TRANSPORT LINE”, in this conference