IMPLEMENTING PORTABLE CHANNEL ACCESS SERVER SOFTWARE IN THE KEKB ACCELERATOR CONTROL SYSTEM

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Abstract

KEKB(KEK B-factory) accelerators are under construction and the control computer system for them is also in the last phase of installation. KEKB accelerators are composed of two storage rings, namely, HER(High Energy Ring for electrons of 8 GeV) and LER(Low Energy Ring for positrons of 3.5 GeV). These rings are placed in the underground tunnel in which former TRISTAN electron-positron colliding accelerator was. We have been constructing control system for KEKB from the scratch based on EPICS(Experimental Physics and Industrial Control Systems)[1][2][3]. But, for the injector linac, its control computer system was rejuvenated just a few years ago and it is not an EPICS based system but an original one. To operate KEKB accelerators, tuning of the linac as the injector for the KEKB rings is thought to be very essential. Ideally, KEKB control system can control both KEKB rings and linac. And both operators at linac control room and at KEKB control room should be able to monitor and adjust equipment of the other accelerators. For that purpose, we have to develop suitable method in between two systems to communicate with each other. In the EPICS collaborations, there is a Portable CA(Channel Access) Server for EPICS developed at Los Alamos National Laboratory[4] for SUN workstations. We decided to modify it for our purposes and have been implementing it to KEKB control system step by step. And now, we can monitor and set magnetic field of Q-magnets in the linac, control beam transport magnets in the linac beam line, control klystrons, and measure beam positions by strip-line monitors through EPICS. In the near future, other equipment of the linac will be added to the CA server before the commissioning of the KEKB rings.

1 EPICS CHANNEL ACCESS ARCHITECTURE

EPICS is a distributed database control system. The input/output data are distributed at each IOC(Input Output Computer) around the system and can be accessed by the CA(Channel Access) protocol based on TCP/IP communication through the network. On each IOC, there are "Records" that represents the value of I/O channels. CA protocol makes it possible to get or put values by using channel names but by physical or absolute address as shown in Figure 1.

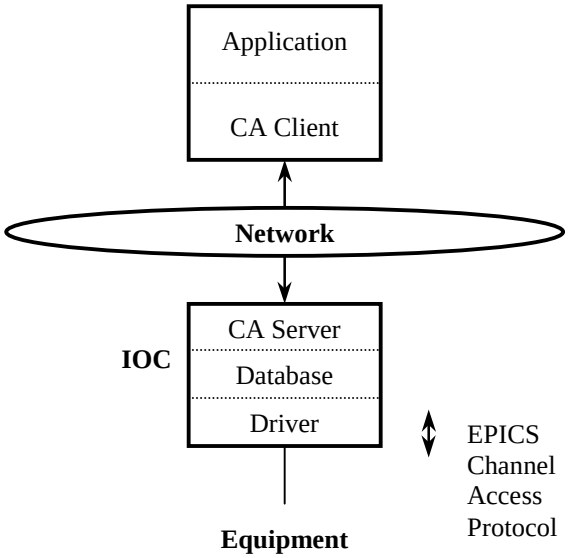

Figure 1. EPICS Channel Access architecture.

2 CONNECTION OF TWO CONTROL SYSTEMS

To connect KEKB control system and the existing linac control system, a gateway must be provided between two systems. Figures 2 and 3 show two possible configurations to realize it. In Figure 2, there is an IOC dedicated to linac and it keeps the database of parameters and values of linac equipment. In the KEKB case, the total number of channels is estimated to be very large and it is too much for an IOC. Therefore, this method may not be realistic.

On the other hand, a gateway workstation is provided in the configuration shown in Figure 3. The functionality of the EPICS CA is realized by the portable CA server implemented in the gateway workstation. The EPICS portable CA server was designed and developed by the members of EPICS collaboration society. Its aim is to integrate a control system not using EPICS into control system based on EPICS. A UNIX gateway computer will be placed between two systems and it translates messages between two languages, one is EPICS and the other is the protocol specific to the non-EPICS system. The CA protocol was implemented as a set of C++ classes. A User can easily extend CA server classes using inheritance technique to build a custom-made CA server.

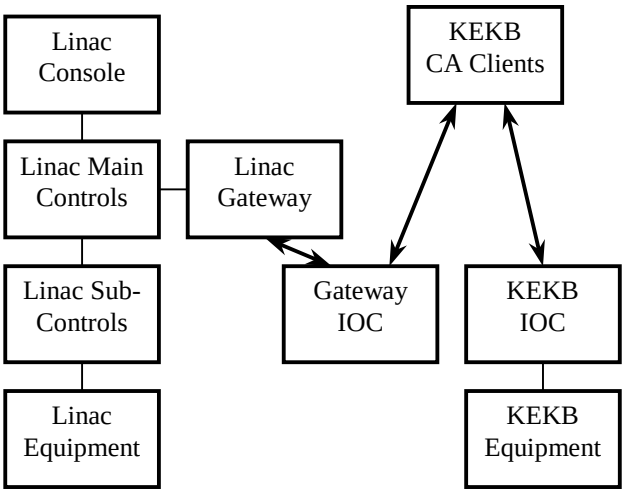

Figure 2. Connection using an IOC and a gateway.

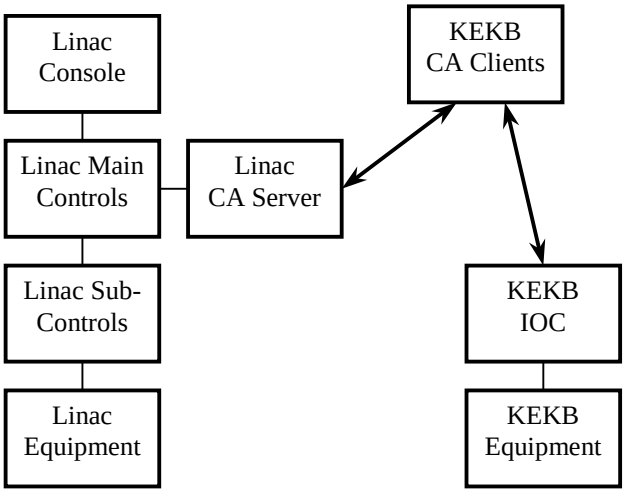

Figure 3. Connection using portable CA server.

3 IMPLEMENTATION OF CA SERVER

We have tested two ways described above. In both cases EPICS record database are automatically generated from the equipment database. And it is also useful to have the utility programs to generate screen configuration data for man-machine interface program MEDM(Motif based EDM). For these purposes tools were designed and developed.

A tool named **CreateLinacDatabase** was developed. It generates a linac parameter configuration file **Linac.conf**, which in turn converted to an EPICS database file using **dbLoadTemplate**, a database template file. Another tool **CreateLinacAdlFile** generates a screen description file for MEDM.

4 RESULTS

An example result of the implementation of the EPICS CA server is shown in Figures 4 and 5. Figure 4 shows plots of the beam positions of linac beam and Figure 5 shows an image of screen for linac beam transport line controls using MEDM. You can see the values and the sliders for adjusting 48 magnets in a screen.

5 CONCLUSION

We expect communication between KEKB control system and linac control system will be inevitable for KEKB accelerator operation that will start coming October 1998. And the link using a portable channel access server is a promising solution. By using this CA server approach, any existing control system would utilize EPICS tool kit and get benefits from it.

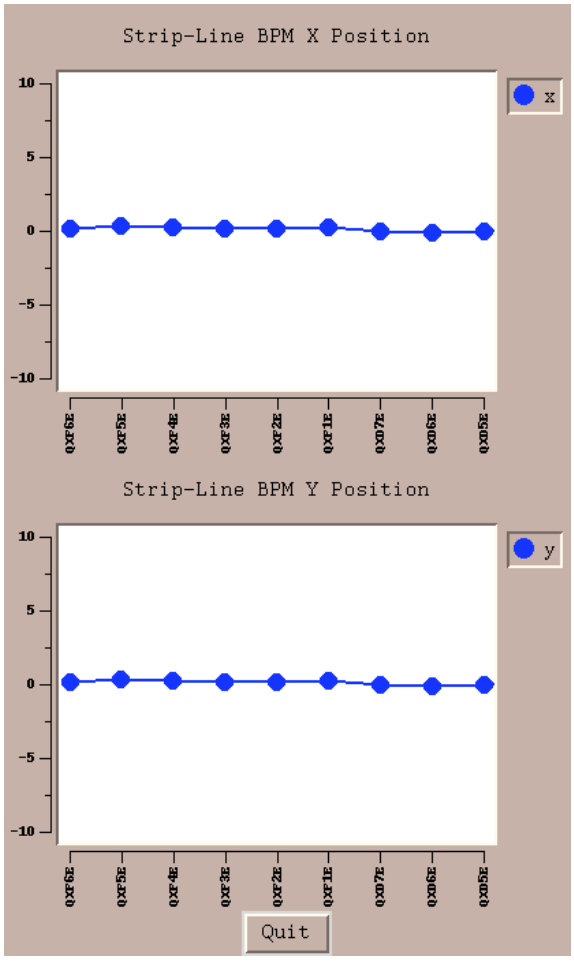

Figure 4. Beam position displays using strip-line monitors.

6 ACKNOWLEDGMENTS

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7 REFERENCES

[1] L.R. Dalesio, et al. ‘EPICS Architecture’, Proc. ICALEPCS’91, KEK, Tsukuba, Japan, 1991, pp.278-282.

[2] T. Katoh, T. Mimashi, T.T. Nakamura, N. Yamamoto, A. Akiyama, S. Araki, T. Kawamoto, I. Komada, K. Kudo, T. Naito, T. Takashima and S-I. Kurokawa, ‘Status of the KEKB Accelerator Control System Development’, ICALEPCS’95, Chicago, USA, 1995, pp. 899-902.

[3] T. Katoh, A. Akiyama, S. Araki, M. Kaji, T. Kitabayashi, T. Kawamoto, I. Komada, K. Kudo, T. Naito, J. Odagiri, M. Takagi, ‘Present Status of the KEKB Control System’, Proc. ICALEPCS’97, Beijing, China, 1997, to be published.

[4] S. Schaller and M. Oothoudt, ‘Generalized Control And Data Access At The LANSCE Accelerator Complex -- Gateways, Migrators, And Other Servers", Proc. ICALEPCS’95, Chicago, USA, 1995, pp. 943-948.

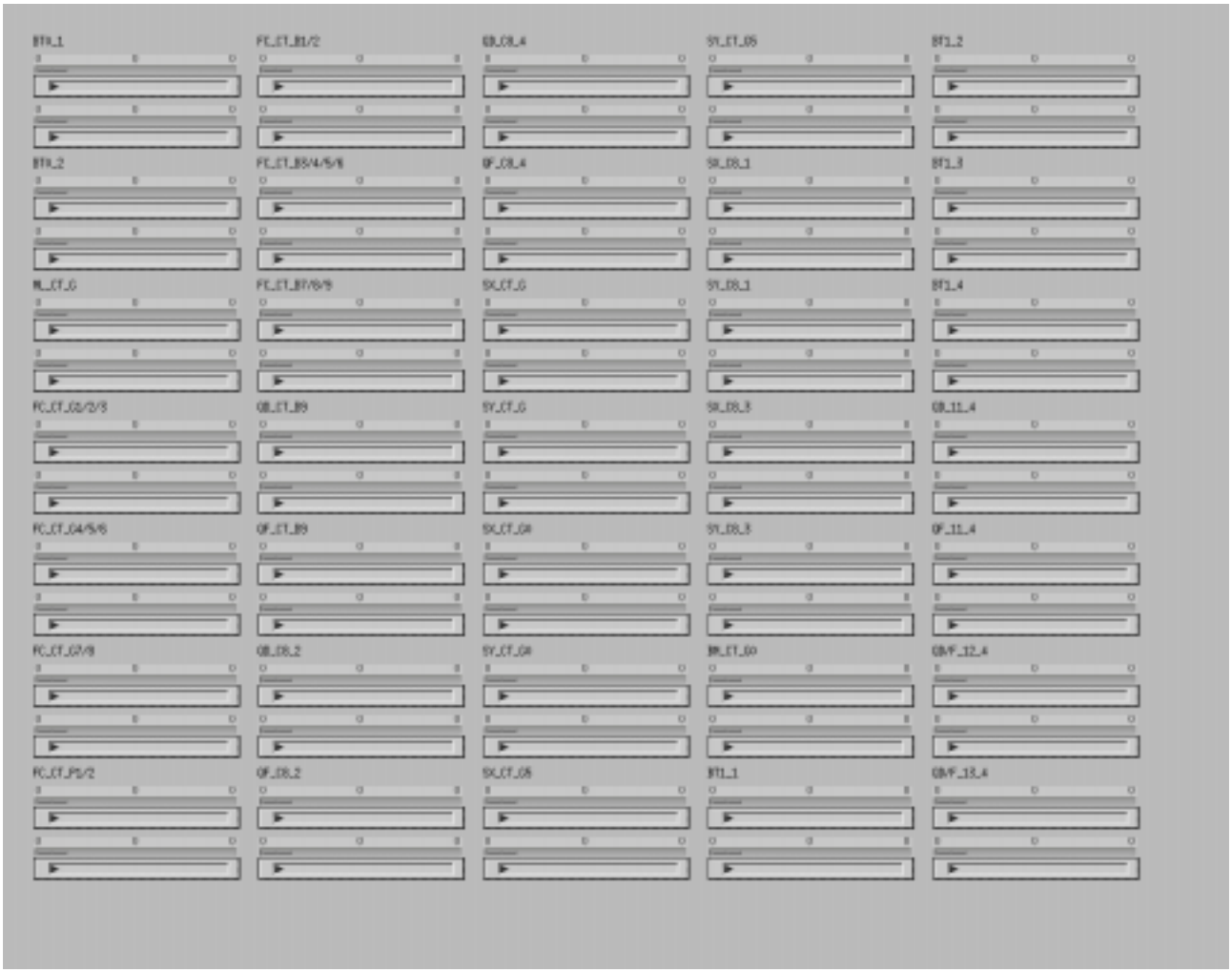

Figure 5. Screen image of the linac beam transport magnet controls.