BEPCII EPICS DATA ARCHIVING AND RETRIEVING SYSTEM

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Abstract

IHEP has installed the BEPCII (Beijing Electron Positron Collider II) project that has been funded by the Chinese Government in order to further upgrade the BEPC which has operated since 1989. As a part of this updating project, control system is decided to adopt the Experimental Physics and Industrial Control System, EPICS. The Channel Archiver is an archiving toolset for EPICS. It can archive any EPICS channel value that is available via ChannelAccess (CA), the EPICS network protocol. The paper will introduce how to establish EPICS data archiving and retrieving system in BEPCII. It will also talk about how to configure and install Channel Archiver and Archive Viewer software framework based on HP Server and Disk Array platform.

INTRODUCTION

BEPCII distributed control system is based on many EPICS IOCs which are connected though Ethernet and a lot of EPICS PVs are running on. Every EPICS PV means one control channel, we often need save these channels' value as history data in order to retrieve and analyze them in case of some problem. As BEPCII control system running stably, EPICS control subsystem such as Power Supply, Vaccum, Beam Measurement will produce plenty of new data. We should have the data be saved whenever we wanted search them. Channel Archiver is a very suitable and useful tool which can help store any EPICS channel's value and timestamp, furthermore, retrieve specified channel's value according to the timestamp.

ARCHIVER SERVER BUILDING

We usually use "Archiver Server" refer to BEPCII EPICS Data Archiving and Retrieving System server. We choose HP server and disk array as hardware platform of Archiver Server and installed RedHat Linux operating system and Channel Archiver toolkits as software environment of Archiver Server.

Hardware Platform

We configured the archiver server two same separated 146G SATA disks and one hardware RAID controller card in order to make RAID1 for the two disks as mirrored operating system drive. RAID1 means writes two copies of data simultaneously. If one of the mirrored drives suffers a mechanical failure or does not respond, the remaining drive will continue to function. A duplicated set of data will supply higher fault tolerance performance and higher system security and reliability.

We configured the DiskArray with 12 pieces of 750G SATA disks and one hardware RAID controller so that we can make RAID5 plus Hot Spare for all the drives, then at last the data storage capacity is about 7T. RAID5 plus Hot Spare can solve loss of the data because of a second drive failure in the same RAID5 redundancy group before the administrator discovered the drive damage and rebuilding it. This reduces the mean time to recovery (MTTR) validly.

Software Environment

We installed RedHat Enterprise Linux WS4 operating system on the two made RAID1 drives. We also installed the Third Party tools and EPICS software including:

- JRE1.5
- EPICS BaseR3.14.7
- EPICS Extensions, Channel Archiver,
- Archiver Viewer etc

ARCHIVER SERVER APPLICATION

Archiver Server can help us to store and retrieve history data by channel archvier and archiver viewer. Three tools we used will be discussed in the following.

Archiver Engine

After setting up EPICS Channel Archiver, we can start Archiver Engine to store data. First, we configure ".xml" files, and then initiate the Channel Archiver Engine process. When the Engine is running, the value and timestamp of EPICS channels will be automatically stored.

For example, we make a new directory named "PS" for the sake of saving EPICS channel values of Power supply control subsystem. In the directory, we configure a new file named "engineconfigure.xml" as the XML format file. We list channels need to be saved in the file, and then we run the command "ArchiveEngine -p 4831 engineconfigure.xml index" and start the ArchiveEngine process. Here "-p" is configured as a TCP port, and "index" is a default archiving index file. When the ArchiveEngine is initiated, one binary format data file at most 30M such as 20081120-1 will be saved in the directory. We can access the website "http://server1:4831" by firefox browser to look up the running state of ArchiveEngine, on this web browser window shown in Figure 1, we can also check the configuration of ArchiveEngine or stop it.

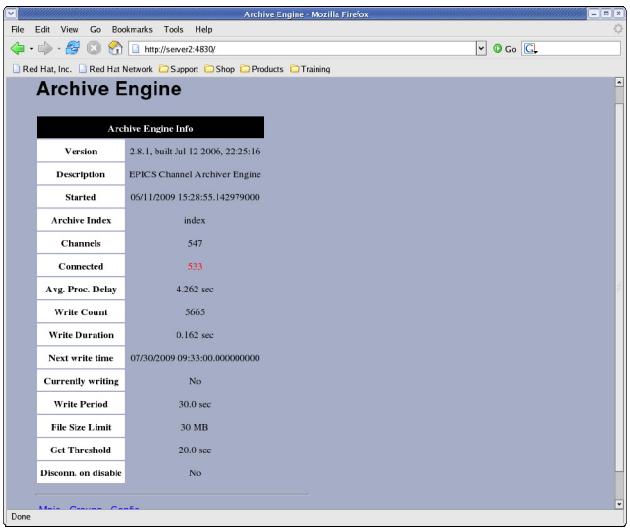

Figure 1: The Web Browser Window of Running ArchiveEngine for Storing BEPCII EPICS data.

Archiver Export

The stored data file is a binary file. We need to export it into a text file that we can read. We can do this by ArchiveExport tool. For example, in the directory including the binary file, we run the command "ArchiveExport -start "2008/11/20 10:00:00" -end "2008/11/20 13:00:00" -o OutFile -f decimal -p 4 index rps:ISet", and a text file named "OutFile" will be produced. And then we can use text view tool such as "less" to read it.

ArchiveViewer

Another retrieving data method is to use graphical user interface tool ArchiveViewer. ArchiveViewer is a Java Archive Client tool. We can use it to browse the available data, generate plots, and export data to spreadsheets from any computer on the network by accessing archiver data server. It is an open source client application and is written in Java for processing archived EPICS data. The user can run it on many operating systems such as Linux, Windows or Solaris on which JRE1.4 or later is installed. It can produce different kinds of visual time plots output including lines, scatters and steps. Here, we need to install Java Running Environment (JRE1.5), Apache2.2 and ArchiveViewer software packet. And then we need to configure "serverconfig.xml" in the apache cgi-bin path. In the file, we list all index files that are created by ArchiveEngine so that the requests from Archiver Viewer clients know where it can get the data on the Apache server. We can run the command "Archvieviewer –u http://server1/cgi-bin/archiver/ArchiveDataServer.cgi" and get the data via ArchiverViewer clients over the Ethernet. The interactive GUI is shown in Figure2.

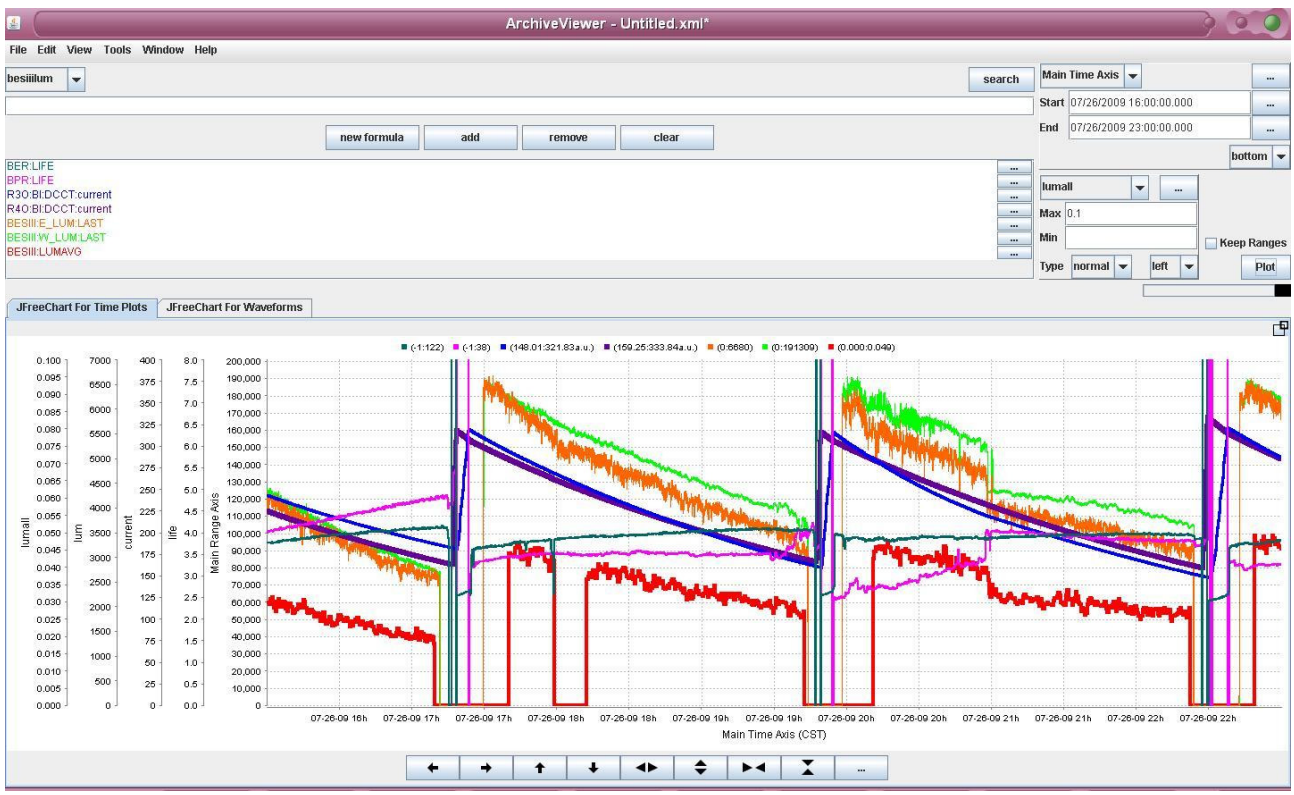

Figure 2: The ArchiveViwer window of BEPCII EPICS data retrieving.

CONCLUSION

Archiver server has stored the data about 2T for BEPCII control system since it was initiated in Nov 2006. It is very helpful and useful for BEPCII commissioning physicist and hardware engineers to analyze problems and solve device fails etc. It has been a very important and necessary tool to retrieve history data and diagnose system for BEPCII operator.

I would like to thank the EPICS community in Control Group for their support. In particular my colleague Liu Shu who ever did a lot of work in debugging and installation, and Prof. Wang ChunHong who arranged the whole history data archiving and retrieving system framework and suggested to use Archive Viewer client graph tool for the first time.

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