REALIZATION OF LINUX PLATFORM IN DISTRIBUTED CONTROL SYSTEM BY EPICS AT BEPCII

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Abstract

IHEP will begin the BEPCII project that has been funded by the Chinese Government in order to further upgrade the BEPC (Beijing Electron Positron Collider) which has operated since 1989. As a part of this updating project, control system is decided to use EPICS. EPICS IOCs can run on many kinds of operating systems, for example VxWorks, Unix, Linux, Windows, RTEMS and so on. Based on the idea of creating EPICS OPI on Linux and downloading real-time database to VME IOC target board, this article is mainly about how to setup EPICS base and EPICS extension on Linux operating system and furthermore how to finish communication between server and Linux control platform. In order to come into being a friendly environment of application development we will try our best to supply some templates. At last this article will also discuss that how the Linux platform works in the distribute network environment created by EPICS.

INTRODUCTION

In view of PC and Linux's convenience, simpleness and low cost BEPCII control system decides to select some PCs based on Linux as a part of operator and monitor console.

What I do is to build EPICS environment on a single PC as an experimental sample. It related to the selecting of release, compatibility of all kinds of version and so on. Only EPICS system can run stably without any error a period of time on a computer sample, can we start to build the whole PC based on Linux console system.

BUILDING PROCESS

In according to building EPICS environment process I do the following things mainly:

- The selecting and installing of Linux release
- The installing of ftp server and downloading of VxWorks kernel
- The compiling and installing of cross-compiler
- The selecting and installing of EPICS base release
- The installing of a part of EPICS host software
- Building EPICS application
- The installing of CVS
- The application of NFS

The selecting and installing of Linux release

Red Hat Linux is popular extensively by most developer in the Linux operating system family. It is an open source, multitasking operating system, featuring outstanding reliability and flexibility. Because its installing and updating process are both very simple. It also has friendly operating interface and it supports software transplanting.

At present, Red Hat Linux has developed release 9. So I select the latest release-Red Hat Linux 9 as the operating system that is installed on PC.

The installing of ftp server and downloading of VxWorks kernel

After the Red Hat Linux 9 has been installed on one PC, ftp server should be also installed and started. The ftp server that I select is vsftpd whose ".rpm" instalation file is included in the Red Hat Linux 9's installation CDROM.

The VxWorks boot file should be in the special directory in order to download VxWorks kernel. The whole sample system is just like the following figure (see Fig. 1)

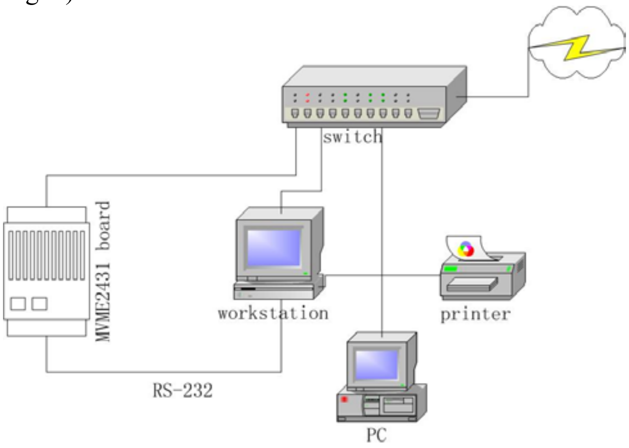

Figure 1: Linux platform based EPICS system

From the figure above, one side of the RS-232 series is linked to the MVME 2431 board's "bug" port, the other side is linked to the workstation's serial port.

VxWork boot parameters can be configured from workstation's "Terminal", please refer to the following configuration:

```
[VxWorks Boot] : p
boot device          : dc
unit number          : 0
processor number     : 0
host name            : zz
file name             : /home/epics/bootdir/vxWorks
inet on ethernet (e)  : 121.134.26.120
host inet (h)        : 121.134.26.125
user (u)             : epics
ftp password (pw)     : zhaozhuo
flags (f)             : 0x0
target name (tn)     : ppc1
```

when it shows the VxWorks boot window and the prompt "->" in the "Terminal", it means VxWorks has been started up in the MVME 2431 target board.

The compiling and installing of cross-compiler

The cross-compiler that I selected is crossgcc-2.7.2-WRS.src.tgz. It needs to be compressed so as that I can install it according to the "makeCrossGcc" file that it produced. Before I do it, I should copy the VxWorks head files into the special path. Certainly I also must modify some parameters' set in the "makeCrossGcc". For example, I must add the following code in the file:

```
ifeq ($(CPU),ppc604)
N1=ppc
N2=powerpc
CPU1=604
CPU2=PPC604
```

Because the target board that we used is conformed to PPC604 system architecture.

If it has no any error during the source is compiled, it proves the installation is successful.

The selecting and installing of EPICS base release

In order to be consistent with base release in the SUN workstation, I select the same release EPICS base3.13.8 in the PC. Before installing the EPICS base3.13.8, it should set the environment variable "HOST_ARCH", "LD_LIBRARY_PATH" etc. The configuration file "CONFIG_SITE" in the directory "base/config" should also be modified like the following:

```
CROSS_COMPILER_TARGET_ARCHS=ppc604
CROSS_COMPILER_HOST_ARCHS=Linux
TORNADO=YES
VX_DIR_YES=/home/epics/crossgcc
```

The four parameters above define respectively "cross compiler target architecture", "cross compiler host architecture", "whether using Vxworks release tornado or not" and "VxWorks directory for TORNADO=YES".

The shell that I used is "tcsh" and the tool is "gmake".

The installing of a part of EPICS host software

EPICS extensions include all kinds of software. I only select a part of these software that I think they are often used. I install a extensions RPM software package that include some host software such as ALH, ADT, BURT, MEDM, StripTool, SGA, Namecapture, probe etc. I also install the archive tool Channel Archiver. I shall install more host software that is needed later.

Making EPICS application

After I have done the job above, I can build an EPICS application to develop my own program.

I make a directory that is used to save all application files. The "makeBaseApp.pl" programme in the "base/bin/Linux" is used to build an EPICS application. After executing the programme and compiling by "gmake", it will produce an application.

The installing of CVS

The CVS source/release system make it standard and convenient to develop EPICS application. So I add CVS programme that is included in the Red hat Linux 9 installation CDROM.

I use CVS to administer the source that the engineers have developed so that the users can access the latest release from anywhere by network.

The application of NFS

In order to run the application locally that has been issued on server, I use the technology "NFS" to share the application.

It can realize the share of files among host that is based on different operating system by NFS. That is, we can run the application on the remote host just like on the local host.

At first, I must set the directory that will be shared on server. The command is:

```
share –F nfs –o ro=clientname /export/home/zhaozhuo
```

The second, I should boot the nfs server on the client. I make the PC/Linux as the client, so I run the command like the following:

```
/etc/rc.d/init.d/nfs.server start
```

At last, I can mount the shared filesystem on the client. I must rebuild a directory for example "/home" so that the shared directory can be loaded in it. The command is:

```
mount –t nfs servername:/export/home/zhaozhuo /home
```

Thus, the application in the shared direcotory "/export/home/zhaozhuo" can be run directly on local host.

CONCLUSION

PC/Linux system is a good solution to build man-machine interface in EPICS control system. It is inexpensive, hardware compatible, updating easy and so on.

By building a sample PC/Linux, we can test the feasibility of building PC/Linux as OPI of EPICS system. So PC/Linux console is also a considerable solution as the operator interface.

Above all, all kinds of software of building PC/Linux platform can be compatible each other. The test work has been finished basically. So let's summarize the release of every kind of software.

Red Hat Linux 9 (kernel 2.4.20-8)
vsftpd1.1.3-8
crossgcc-2.7.2
EPICS baseR3.13.8
adt 1.5.1
alh 1.2.10
Channel Archiver-1.10.2
medm 3.0.4Beta1
StripTool 2.5.2.12
Namecapture 1.7.1
probe 1.1.2
SGA 1.3.0
cvs-1.12.1

FUTURE DIRECTIONS

PC/Linux platform has been proven to be very feasible and has been used by several institutes. So the next step in PC/Linux platform will be to develop a system based network. The system will be divided by the function of each department's request. At last it will realize monitoring and controlling every subsystem from every PC/Linux console by network.

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