

Experience in Writing an RTEMS/PPC BSP for the MVME5500

RTEMS Primer and Workshop
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Introduction

- ◆ It is hard to conclude how much effort it will take to write a Board Support Package (BSP), which depends on the architecture of the board.
- ◆ It would be much easier if the hardware architecture of the board is similar to those boards that already have a BSP developed.
- ◆ This presentation is based on my experience in writing an RTEMS/PPC BSP for the MVME5500. Its hardware architecture is completely different from those of other boards that already have an RTEMS BSP developed.

The process

- ◆ Obtaining and reading documents and source codes are the key technical skills in writing an RTEMS BSP.
- ◆ The firmware of the MVME5500 facilitates the debugging of the BSP.
- ◆ Build the BSP with Cexp and GeSys so that it has a C expression interpreter command line tool. It provides access to the application's symbol table and features run-time loading of code.

<http://www.slac.stanford.edu/~strauman/rtems/>

- ◆ Integrate it into EPICS and applications.

Related document I downloaded from the OAR Corp.

- ◆ **The "BSP and Device Driver Development Guide"**
http://www.rtems.com/onlinedocs/releases/rtemsdocs-4.6.5/share/rtems/pdf/bsp_howto.pdf
- ◆ **"RTEMS network supplement"**
<http://www.rtems.com/onlinedocs/releases/doc-current/share/rtems/pdf/networking.pdf>
- ◆ **"RTEMS C User's Guide"**
http://www.rtems.com/onlinedocs/releases/rtemsdocs-4.6.5/share/rtems/pdf/c_user.pdf
- ◆ **RTEMS Mailing Lists Archive:** <http://www.rtems.com/ml/>

I "Google search" document from the Motorola site

- ◆ To read and write the assembly code: "Programming Environments Manual For 32-Bit Implementations of the PowerPC Architecture"
- ◆ User's Manual for the processor of the board: "MPC7450 RISC Microprocessor Family User's Manual"
- ◆ The firmware of the board for debugging: "MOTLoad Firmware Package User's Manual"

I "Google search " document from the Motorola site

- ◆ Programmer's Guide: "MVME5500 Single-Board Computer Programmer's Reference Guide"
- ◆ The datasheet of the MVME5500 which has the function description and block diagram of the board.
- ◆ The document for the system controller of the MVME5500 (665 pages) and its second Network Interface Card (NIC) which require the Non-Disclosure Agreement signed from two different sources.

Related Source Code -1

- ◆ To study the Operating System (OS) and source code of existing RTEMS/PPC BSPs to learn how the BSPs are interfaced to the RTEMS OS.
- ◆ The mini bootloader (e.g. preload.S) that Till Straumann of SLAC wrote for the SVGM PowerPC board, simplified and modernized the bootloader which was previously shared by the older series of PowerPC boards.
- ◆ To adapt as many files as possible in the "shared" directory, which are shared among other PowerPC boards. However, the unique system controller of MVME5500 still demands lots of extra code.

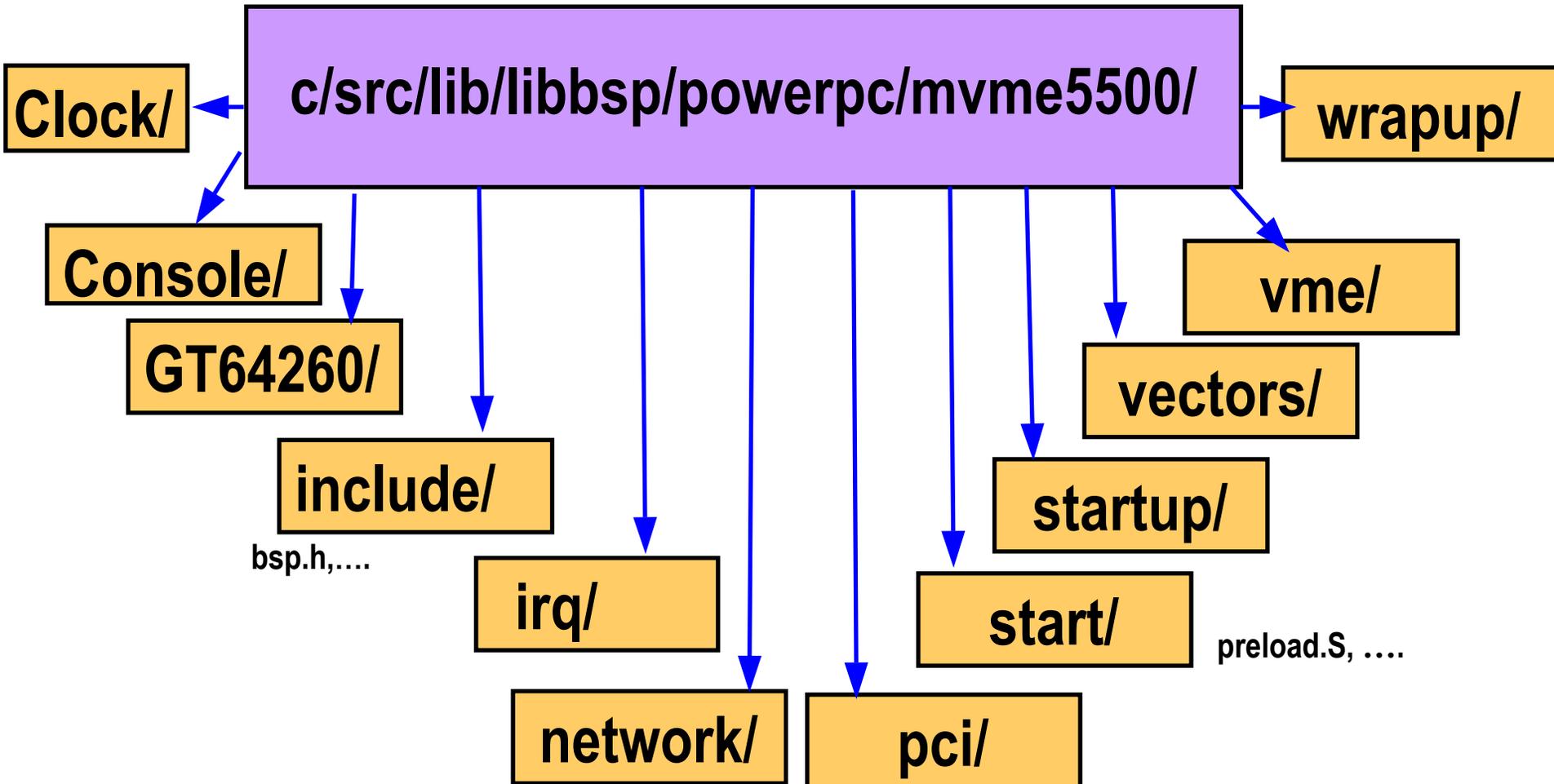
Related Source Code -2

- ◆ Downloading some related code from the <http://www.netbsd.org> turns out to be useful. The netBSD OS is not a hard real-time one that the conversion to RTEMS is crucial in optimizing the system performance.
- ◆ The RTEMS network drivers for the SVGM and MVME2306 boards provide templates. However, the specific features of both network interfaces still demand the study of the related document.

Original footprints in writing the BSP

- ◆ One can explore the original footprints of MVME5500 BSP and more information regarding the BSP boot/load at <http://www.nsls.bnl.gov/organization/UserScience/Detectors/Software>
- ◆ The directory “rtems-4.6.0-patch/”, which is included with the BSP describes the patches needed for the OS to add the new BSP.
- ◆ The source code of the BSP posted at the above URL is the version being used at NSLS for RTEMS4.6.x.
- ◆ Some PCI devices require Synchronization Barriers or PCI ordering for synchronization, which is explained in the “pci” directory.

Structure of the RTEMS/MVME5500 BSP



Conclusion

- ◆ Writing an RTEMS BSP is a task that demands intensive concentration to read through the related document and source code, and to implement it. It would be more effective not to have other major tasks assigned at the same time if the board is complicated.
- ◆ It is always an adventure to experience something new. The reward is to understand the hardware and software system better and to get ready for the next challenge.
- ◆ The performance of the RTEMS/MVME5500 BSP is comparable to that of vxWorks and it is reliable. Its performance is published. http://icalepcs2005.web.cern.ch/icalepcs2005/Presentations/11oct_Tuesday/TU4A/TU4A_1-50.ppt

Acknowledgement

- ◆ Acknowledgement to Till Straumann of SLAC for some contribution to the RTEMS/MVME5500 BSP.