

uClinux on SmartFusion cSoC using ARM Cortex-M3

Live Webinar - Nov 18, 2011

QUESTIONS AND ANSWERS

Q: Any suggestions/guidance on implementing USB host, both in development and production?

A: SmartFusion doesn't provide a USB host interface in the MSS hardware so a USB host controller would have to be implemented using an FPGA-based IP block or an external USB device (eg. USB controller with an SPI interface). Linux provides a robust implementation of the upper layers of the USB host stack as well as a number of low-level device drivers for various USB controllers, which can be used as a starting point for development of new device drivers for an USB controller IP.

Q: Is the Libero project file for FPGA layout on the A2F-LNX-EVB provided with the board?

A: Yes, the Libero project for the A2F-LNX-EVB board is included in the Emcraft Linux for SmartFusion distribution.

Q: Are the drivers for the standard IP modules included in Libero included in your uCLinux distribution?

A: The standard Linux serial device driver for the 16550-style UART is compatible with the Core16500 IP. Similarly, the Ethernet and SPI device drivers for the MSS interfaces are compatible with the CoreMAC and CoreSPI IPs, respectively. The standard Linux GPIO device driver should be very easy to configure for operation with the CoreGPIO IP.

Q: Is there any public instruction of uClinux kernel build?

A: Emcraft's Linux Cortex-M User's Manual available from <u>www.emcraft.com</u> provides instructions on how to build the kernel for Cortex-M3.

Q: How fast does it boot "out of the box" - can this be speeded up? Any sense of how fast?

A: Linux takes 3 to 5 seconds to boot up from a power-on reset to the shell prompt on SmartFusion. Actual boot-up times depend on a specific U-Boot / Linux configuration. The most obvious way to improve the boot-up time is to carefully fine-tune the build-time configuration of the uClinux kernel in order to remove features and capabilities that are not required by a specific application.

Q: What is the Expansion Interface on the A2F-LNX-EVB Board?

A: The Expansion Interface of the A2F-LNX-EVB board is documented in Board Support Package Guide for the Emcraft A2F-LNX-EVB board. This document is available from the Emcraft web site.

Q: Is the custom GUI library open sourced?

A: Emcraft will be happy to provide the full source of that library on request.

Q: May I build Cortex-M1 in FPGA? In that case I will have 2 cores in SmartFusion. Do you think that it's interesting option?

A: It should be possible conceptually. The merits of such an architecture should be assessed against requirements of a specific application.

Q: This includes all software?

A: If I read the question correctly, the answer is, yes, Emcraft's Linux for SmartFusion distribution includes full source of all components licensed as GPL or using similar open-source licenses.

Q: What is the cost if SmartFusion IC?

A: Please contact Microsemi for information concerning SmartFusion pricing.

Q: Is the bootloader is opensource?

A: Yes, the full source of the U-Boot firmware is included in the Emcraft uClinux distribution.

Q: What price?

A: Please visit Emcraft's web site for information on the various Linux SmartFusion product options.

Q: Any benchmark for Ethernet WebServer, how many simulates sockets I can open?

A: We believe that the uClinux implementation of the socket-related APIs is fully compatible with POSIX. So the answer to this question should be: as many as allowed by POSIX.

Q: Add my bluetooth device BX10 <u>www.uelectronix.com</u>.

A: Request noted. We will work on adding support for that device as time and schedule allows.

Q: Any benchmark for file read and storing?

A: We haven't run such benchmarks yet. Linux does have various benchmarks that measure performance of the files and filesystem APIs. Those benchmarks should be easy to port to uClinux on Cortex-M.

Q: What is PSRAM?

A: From Wikipedia: PSRAM is dynamic RAM with built-in refresh and address-control circuitry to make it behave similarly to static RAM (SRAM). It combines the high density of DRAM with the ease of use of true SRAM.

Q: This COM is emulated USB connection?

A: If I read the question correctly, on the A2F-LNX-EVB board the serial console interface is implemented using an integrated MSS UART_0 port of SmartFusion together with a USB-UART bridge for an interface to a PC host.

Q: What is the size of uCLinux in Flash memory?

A: A reasonably powerful Linux configuration (shell, networking, Flash management / JFFS2 and more) would fit into under 2MB of Flash. Less if the boot is from a compressed image.

Q: Is this boot 5 sec because of speed of Cortex or because of SRAM and Flash speed?

A: Combination of various factors. Obviously, the Cortex-M3 core running at 80MHz is not the fastest processor in the world. Also, consider that there is lots of user functionality that Linux implements and that needs to be initialized during the boot-up time.

Q: Did you plan dual core? Can I add softcore at least to FPGA and run as dual core?

A: No specific plans to support a dual-core configuration, as of yet.

Q: What size for graphic lib need RAM?

A: Depends on which library you are asking about. A simple graphical library supporting just a handful of graphical primitives, such as the library used in the GUI demo for the SPIconnected LCD, will have very modest footrpint requirements, in the ballpark of several hundreds KBytes or less. On the other hand, Linux supports some feature-rich and powerful graphic libraries such as Qt. Such libraries would require substantial amounts of RAM and Flash. For example, a statically linked binary of an average Qt-based application may be 7-8 MBytes in size.

Q: How much RAM need to run uCLinux?

A: A very minimal Linux configuration would fit into 2 MBytes of RAM. For a reasonably powerful configuration we recommend at least 8MBytes of RAM.

Q: What is the recommended SW development environment and language? Eclipse, C++?

A: Linux Cortex-M supports user-space application written in C or C++. Integration with Eclipse IDE is in our plans.

Q: How to connect best to USB? Virtual COM port, HID or mass storage driver?

A: As mentioned above, SmartFusion doesn't provide a USB controller for either host or device interface. A USB controller would have to be implemented in the FPGA fabric or as an external USB device. Linux provides a powerful USB stack implementation both for the host and device roles so assuming there is IP for an FPGA-based USB controller, only a low-level device driver would have to be developed.

Q: Am I correct in my understanding that the eval kit includes the FPGA tools as well?

A: This is not correct. You will have to obtain the Libero IDE and other FPGA tools directly from Microsemi.

Q: As far as I could understand, the FPGA is used for I/O, including user interface, so how is done the integration to framebuffer native driver?

A: I assume the question is in regards to the GUI demo using the Actel A2F500-DEV-BRD. If so, that demo makes use of a full-fledged LCD controller implemented as an IP block in the FPGA fabric. That IP takes care of fetching "pixel data" from a framebuffer in external RAM and converting them into appropriate LCD signals. The framebuffer driver provides a standard interface to the framebuffer in RAM so that user-space libraries and applications can "draw pixels" by writing directly into the framebuffer in RAM.

Q: Which methods of implementations of shared libraries are supported in Emcraft uClinux?

A: As of today, Emcraft's distribution doesn't support shared libraries.

Q: Do we have a qemu emulator for SmartFusion?

A: We are not aware of such a configuration.

Q: Can we use the Qt applications on the uCLinux?

A: Yes, it is possible to run Qt with uClinux on Cortex-M3. However, you would have to plan on having at least 32MBytes of RAM to comfortably run Qt with uClinux.

Q: Is their any video tutorial available related to this webinar?

A: There are several videos available from Emcraft's web site.

Q: Is there any discount on Emcraft Linux SmartFusion eval kit for participants of webinar?

A: Together with Microsemi, Emcraft has shipped 3 eval kits to the most active webinar participants.

Q: How the synchronization is implemented in uCLinux/CortexM3?

A: Linux Cortex-M provides the standard synchronization APIs defined by POSIX, including full-fledged mutliprocessing and multithreading.

Q: Is there any support in uCLinux for wireless application?

A: Not explicitly with SmartFusion, as of today. Linux does provide support for various wireless protocols and devices and these features can be enabled in SmartFusion contexts.

Q: Do you intend to add real time features?

A: The Linux kernel provides "soft real-time response", which means that in most situations interrupt and task switching latencies are adequate, however in certain scenarios, infrequently, there can be surges in response times. This type of real-time behavior is not acceptable for "hard real-time applications", where not a single event can be missed, however it is quite adequate for many applications in which Cortex-M generally and SmartFusion in particular are used. There are certain projects that aim to improve the real-time response of the Linux kernel even further by applying patches that remove long interrupt lock-up times and generally improve the kernel pre-emptiness. Depending on demand from our customers, we may decide to add such patches to our distribution moving forward.

Q: Do you support a GUI for touch displays?

A: Not explicitly with SmartFusion, as of today. Linux does provide solid support for various touchscreen / touchpad devices.

Q: Is the presentation available to download anywhere?

A: The presentation is available for download. Please refer to the information available from Emcraft's and Actel's web sites.

Q: ssh is standalone or inetd?

A: The ssh daemon included with Linux SmartFusion is implemented using the popular 'dropbear' package. It is a "standalone" application.

Q: What about U-boot MAC address... is there a space offered by you or anyone should buy for itself?

A: You will have to obtain MAC addresses from appropriate organizations.

Q: To begin, what would we be purchasing from you with regard to a license & support? Please give an overview of the process for folks familiar with SmartFusion but not with uCLinux.

A: Pretty much all software components included in the Linux SmartFusion distribution are licensed using the GPL or similar open-source licenses. Emcraft provides 6-months email support and software upgrades to customers of our uClinux products.

Q: May I please have the boot-up console output? I would like to have a proper look at some of the details.

A: Please refer to the Linux Cortex-M User's Manual available from Emcraft's web site. It provides several snapshots of the boot-up console.

Q: Have the Actel 500 Dev board. Can I run your kernel from the 2M RAM - what is the size of code, filesystem and what is the "RAM"?

A: Emcraft provides explicit support for the Actel A2F500-DEV-BRD with a dedicated Board Support Package. Please refer to the web site for details. Running minimal Linux configurations out of the 2MB SRAM is possible however the configuration that we support with that BSP runs Linux out of the 16MB PSRAM device installed on the board in addition to the 2MB SRAM.

Q: What is the minimal memory size RAM/Flash? Can I use only the eNVM?

A: The absolutely minimal amount of RAM required by Linux is 2MB. It is impossible to run Linux just from the on-chip eNVM, without external RAM.

Q: Kent, UART drivers are work in progress and not usable at the moment?

A: This is not correct. uClinux provides fully functional serial device driver for the MSS UART ports as well as for Core16500-based ports that may be instantiated in the FPGA.

Q: Would the device be strong enough to drive and use a "big" 19 inch touch LCD with abt. 1024x768 or more resolution? Or would the screen build up slow?

A: It is hard to tell without trying. The above resolution is a lot of pixels that would need to be fetched from a framebuffer and translated to appropriate LCD interface signals. An FPGA-based IP for such an LCD controller may or may not be up to the job.

Q: Can the Emcraft Linux board be used with Libero IDE, for example, to set up/control programmable analog?

A: Libero IDE is used to set up various aspects of the SmartFusion operation, including configuration of the analog engine. Linux is used to control various hardware interfaces of SmartFusion at run time using appropriate device drivers. Note however that the Linux SmartFusion development environment is not integrated with the Libero IDE.

Q: Kent, does this mean, that analog values captured by the analog part of the device are not readable by uClinux?

A: Please refer to the answer for the previous question.

Q: The search on SparkFun does not find Emcraft or your part number. Suggestions?

A: The SPI-connected LCD monitor we used in our demo is not an Emcraft product. Sparkfun stocks and sells these devices: <u>http://www.sparkfun.com/products/9363</u>.

Q: SmartFusion can be programmed in POSIX OS?, without using MS windows?

A: Linux on SmartFusion provides the same set of the POSIX APIs as implemented in the "vanilla" Linux for MMU-full architectures, with some insignificant exceptions. So, the answer is, yes, Linux provides a full-fledged POSIX run-time environment for SmartFusion.

Q: There are official distributors in Italy?

A: No, as of yet.

Q: There support in "IAR IDE" or "KEIL IDE"?

A: Linux SmartFusion does not support the above tools.

Q: uClinux can be used in a2f-eval-kit (a2f200)?

A: No, uClinux requires at least several MBytes of RAM. The Actel A2F Eval Board doesn't provide that. Emcraft's A2F-LNX-EVB board provides 16MB of RAM and 8MB of NOR Flash.

Q: Is the on-chip NVM used for anything other than system boot? Seems like it's wasted. Same question for on-chip SRAM?

A: Emcraft's Linux for Cortex-M provides a kernel build-time configuration option which allows to run various kernel sub-systems from the fast on-chip eNVM.

Q: Because you can do LCD control without an OS clearly. What is the advantage of using the OS for this app? Is it development time?

A: Exactly. Using the standard Linux framebuffer interface, it is possible to get very advanced GUI capabilities, such as those implemented in the Qt library, supported with SmartFusion without substantial development effort.

Q: Is it possible to have the development of the some robot type structures using the FPGA and will it be economical or not?

A: Yes, the SmartFusion FPGA and analog engine would be a very good fit for such an application, at least at a conceptual level. A more thorough assessment would require understanding of detailed requirements of a specific application.

Q: What's the internal interface between the ARM and the FPGA? Thanks.

A: Please refer to the SmartFusion Data Sheet available from Actel's web site.

Q: What is the download link for the uCLinux kernel patches?

A: Emcraft provides a version of the Linux SmartFusion kernel for free download from our web site.