Port Embedded Linux to XUP Virtex-II Pro Development Board

Presented by

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Points of Interest

- Embedded Linux
- XUP Virtex-II Pro Development Board

Embedded Linux

- What?
  - Linux on Embedded Systems
  - Static - For limited resources
- Why?
  - Easily Customizable
  - Free
  - Rich code resource
- Who?
  - Motorola, Nokia, Panasonic, UT Starcom, Cisco, Philips, Linksys

Embedded Linux

- The Boot-loader
- The Linux Kernel
- The Root Filesystem

SoPC – System on Programmable Chip

- What?
  - Includes CPU + Mixed Signal Arrays of ICs
  - FPGAs
- Why?
  - Flexibility
  - Speed and Reliability
- How?
  - The Core
  - Configurable Analog and Digital blocks
  - Programmable Routing and Interconnect
  - BSP provides support for OS I/O

Xilinx XUP Virtex II Pro

- FPGA Development System
- PowerPC 205 Processors
- DDR SDRAM DIMM that can accept up to 2Gbytes of RAM
- 10/100 Ethernet port
- USB2 port (for FPGA configuration only)
- Compact Flash for FPGA configuration and data storage
- PS/2 and RS232 port

Xilinx XUP Virtex II Pro

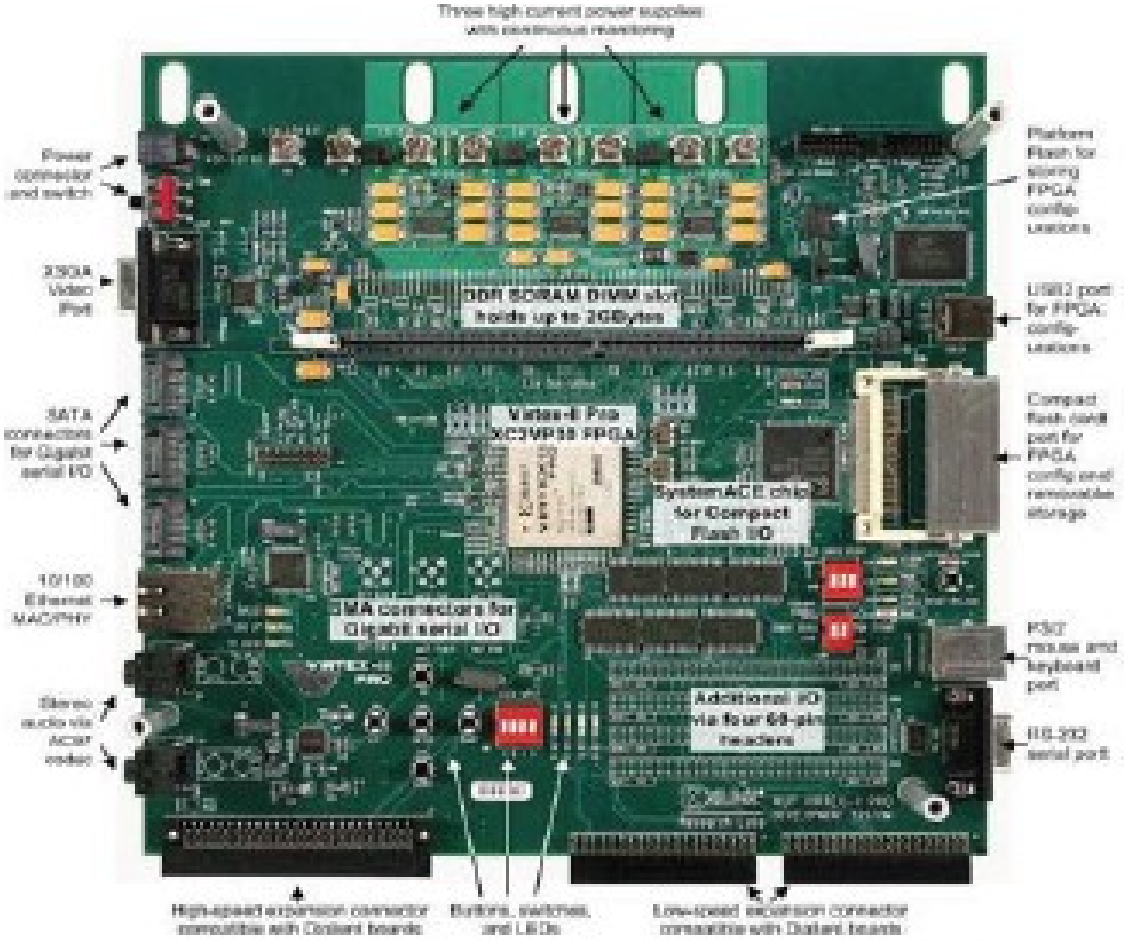

Figure 2. XUP Virtex-II Pro Development System

Porting Embedded Linux – Development Flow

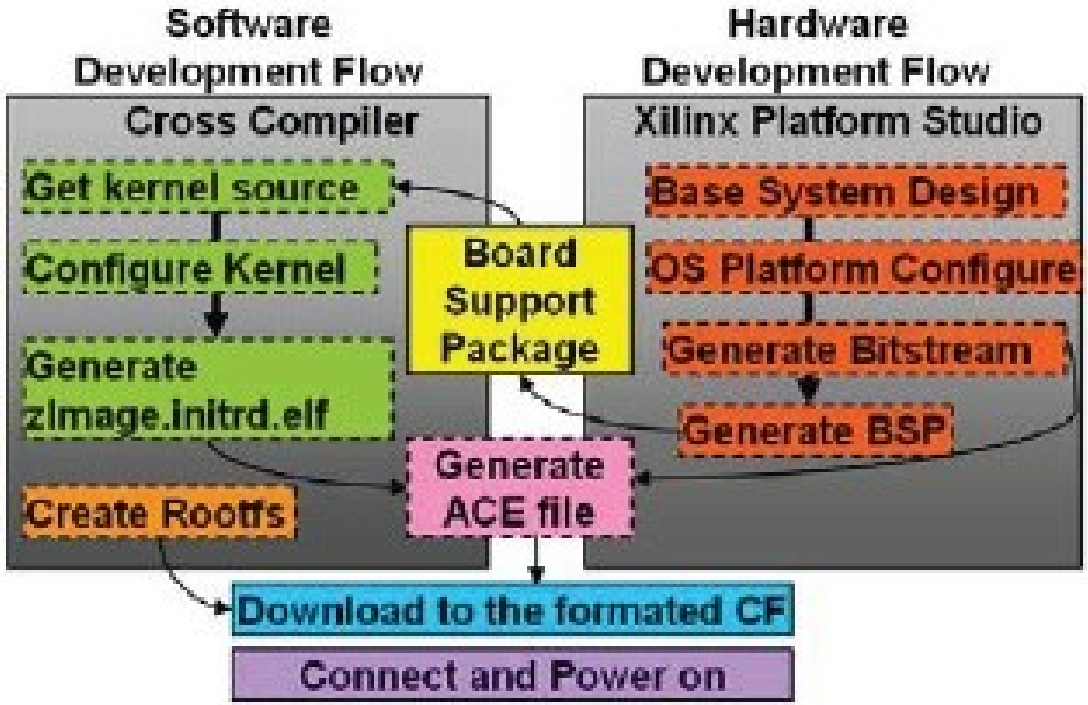

Figure 1. System Development Flow

Base System Building

Table 1. The major IP cores' parameter

IP Core Name	Parameter
PPC405	300MHz
OPB_UART16550	Use interrupt
OPB_SystemACE	Use interrupt
OPB_Ethenet_MAC	No DMA and use interrupt
PLB_DDR_256MB	256MB and use interrupt
PLB_BRAM_IF_CNTLR	128KB

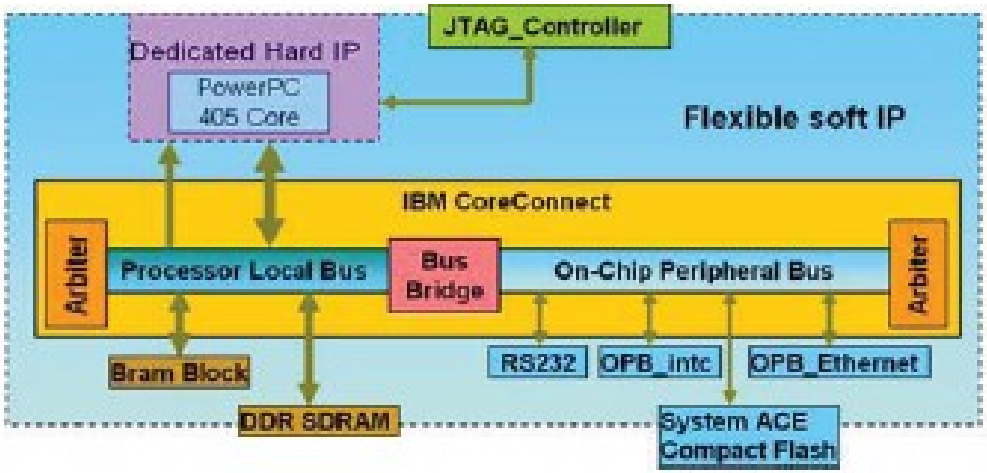

Figure 3. Base System Architecture

OS Platform Configure

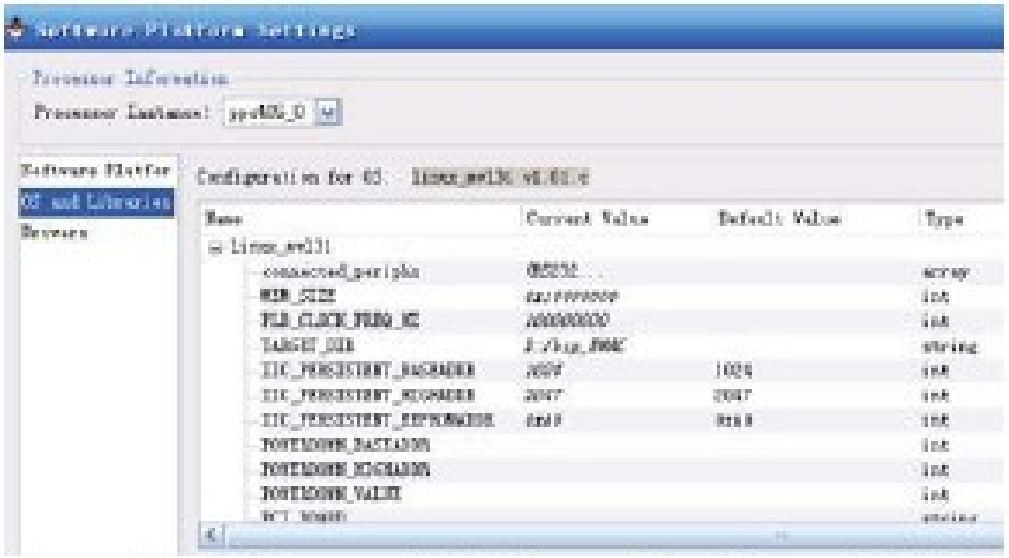

Figure 4. Software Platform Settings Table

Generate BSP and Bitstream

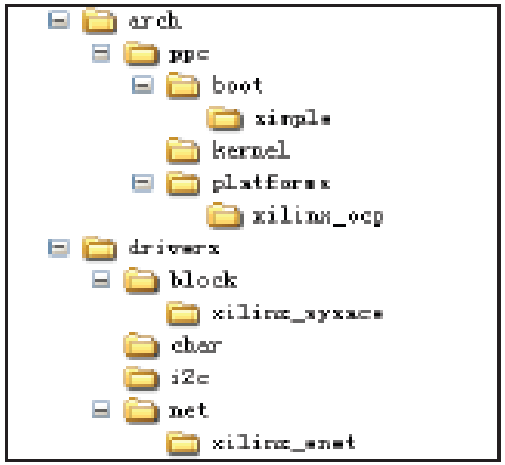

Figure 5. Generated BSP directory structure

Build cross-compiling environment for PPC

- tar –zxvf crosstool-0.43.tar.gz
- cd crosstool-0.43
- Edit demo-powerpc-405.sh file and amend similar content like that:
- TARBALLS_DIR=$HOME/crosstool-0.43 RESULT_TOP=/opt/crosstool
- sh all.sh –notest
- sudo mkdir /opt/crosstool
- sudo chown $USER /opt/crosstool
- sh demo-powerpc-405.sh

Getting the kernel sources

- wget http://www.bitmover.com/bk-client2.0.shar
- sh bk-client2.0.shar
- cd bk-client2.0
- sh demo.sh
- ./bkf clone bk://ppc.bkbits.net/linuxppc_2_4_devel linuxppc-2.4.26
- export PATH=/opt/crosstool/gcc-3.3.6-glibc-2.3.2/powerpc-405-linux-gnu/bin:$PATH

Configure and Compile kernel

- make menuconfig
- Processor Type:40x
- Machine Type:Xilinx-ML300
- TTYS0 device and default console:UART0
- Networking support: Enable
- Default bootloader kernel arguments: Enable
- Initial kernel command string: ”console = ttyS0, 38400 ip=on root=/dev/xsysace/disc0/part3,rw”

Configure and Compile kernel

Block Devices

- Xilinx on-chip System ACE: Enable
- RAM disk support: Enable
- Default RAM disk size:16384

Character devices

- Standard/generic(8250/16550 and compatible UARTs) serial support: Enable
- File systems
- Virtual memory file system support: Enable
- Second extended fs support: Enable

Build Root FileSystem

- cd mkroofs
- Modify some parameters (listed as following) in mkrootfs.sh:
  LFS= the prefix location of the rootfs
  CC= cross compiler
  TARGET_PREFIX=location of cross toolchain library file
  BUILD_TOOLS= directory of cross toolchain
  PPC_KERNEL= directory of kernel source
  PPC_KERNEL_VERSION=2.4.26
- Replace “busybox-1.00-pre2” with desired busybox directory
- sh mkrootfs.sh

Building ACE File

Edit genace.opt file, the content as following:

-jprog

-board user

-target ppc_hw

-hw download.bit

-elf zImage.initrd.elf

-debugdevice devicenr 1 cpunr 1

-ace system.ace

Download & Test

- Format flash
- Set the COM Port
- Baud Rate: 38400
- Boot Linux