LEON Linux Overview

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LINOV
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1. Introduction

This document aims to give an overview of the current components and tools used in Linux development for the LEON architecture and how the different components are tied together.

1.1. Component Summary

The table below try the summarize the current LEON Linux components that Aeroflex Gaisler distributes patches for. Of course Linux is not limited to these components, there are lots and lots of other software available.

LINUXBUILD tries to tie some of the components below together to provide a rapid starting point for Linux development on the LEON architecture. It is recommended to set up a custom development flow that suits your particular development project. LINUXBUILD may serve as an initial setup to get started with Linux development for the LEON architecture.

Table 1.1. Component summary

Tool	Components/Options
Toolchain	• prebuilt toolchains • Crosstool-NG (not part of LINUXBUILD) • Buildroot built toolchain
Linux Kernel	• Official Kernel Tree • LEON kernel Patches • GRLIB Driver Package (not part of LINUXBUILD)
Distribution	• Buildroot
Boot Loader	• mklinuximg - LEON Linux RAM Loader • MKPROM2 - PROM loader • U-Boot (not part of LINUXBUILD)

1.2. Documentation

Aeroflex Gaisler provides documentation for the utilities developed and various LEON specific information about the Linux kernel and usage. The documentation related to Linux is summaried in the table below.

Table 1.2. Additional Aeroflex Gaisler documentation

Document	Description
LEON Linux User's Manual	Documentation about configuration and usage of the LEON Linux kernel.
MKLINUXIMG User's Manual	MKLINUXIMG RAM Loader utility manual
LINUXBUILD User's Manual	LINUXBUILD build environment manual
GRLIB Driver Package Manual	Documentation about the additional GRLIB drivers distributed separately.

1.3. Download Location

Patches and build scripts can be downloaded from the Aeroflex Gaisler web server at http://gaisler.com/anonftp/linux/linux-2.6. The official sources can be found via each project's homepage, some of the major projects used directly or indirectly are listed below.

Table 1.3. Project homepages

Tool	Homepage
GRLIB/LEON patches and tools	www.gaisler.com/anonftp/linux/linux-2.6

Tool	Homepage
GNU GCC compiler	gcc.gnu.org
GNU BINUTILS	www.gnu.org/software/binutils
Linux Kernel	www.kernel.org
LTSI Linux Kernel	ltsi.linuxfoundation.org
GNU C Library (GLIBC)	www.gnu.org/software/libc
uClibc C Library	www.uclibc.org
Buildroot	www.buildroot.org
Busybox	www.busybox.net
Crosstool-NG	crosstool-ng.org
U-Boot	www.denx.de, and the SPARC repository of the U-Boot project is located at http://git.denx.de/?p=u-boot/u-boot-sparc.git;a=summary

1.4. Linux Kernel

The current official Linux sources available at kernel.org has support for LEON3 and LEON4. Aeroflex Gaisler actively develops the Linux kernel's LEON support, submitting patches to the official kernel. Patches that hasn't reached the official kernel sources yet are provided in a separate LEON Linux kernel distribution. In this document "LEON Linux" is used to identify the official Linux kernel with the unofficial LEON patches (if any). The LEON Linux kernel distribution features back ported fixes and drivers for LEON from mainline into the longterm stable kernel version used.

The LTS kernel version selected is based on the selection made by the Long Term Stable Initiative (LTSI) project. The LEON Linux kernel is branched from the LTS releases from kernel.org, thus it does not contain patches from LTSI but they can easily be applied.

The GRLIB IP-cores currently supported by a vanilla offical Linux kernel is listed below.

- LEON3, LEON4, LEON3-SMP and LEON4-SMP
- MMU, V8, FPU
- GPTIMER System Clock Timer
- IRQMP or IRQAMP interrupt controller
- APBUART system console
- GRETH 10/100 and 10/100/1000 Network driver using the MDIO layer of the Linux kernel
- GRPCI or GRPCI2 PCI Host support
- GRUSBHC USB 1.1/2.0 Host controller
- GRUSBDC USB 1.1/2.0 Device controller
- GRVGA Graphical Frame Buffer
- GRPS2 mouse/keyboard PS/2 controller
- GRCAN and OCCAN implements the Linux socket CAN 2.0b interface
- GRGPIO supports the generic General Purpose I/O model of Linux
- SPICTRL supports SPI master interface through the spi-fsl driver
- I2CMST support I2C master interface through the i2c-ocores driver

The LEON Linux kernel distribution available from Aeroflex Gaisler also includes the above drivers and the driver listed below.

- SPIMCTRL SPI master access interface

A separate Linux driver package is also distributed under the name "GRLIB Linux driver package". The intention with the driver package is to provide support for some IP-cores part of the GRLIB IP library that will not be submitted to the official kernel sources in the near future, due to different reasons. The drivers are released only for selected kernel versions. The current drivers available for GRLIB cores are listed hereafter.

- GRSPW2 DMA SpaceWire Packet kernel library
- GRSPW2 DMA SpaceWire Packet driver

- SpaceWire Router APB register configuration driver

1.5. Hardware Requirements

This section provides a brief listing of some of the hardware requirements for LEON Linux kernel/toolchain.

- LEON3 or LEON4
- SPARC V8 mul/div
- MMU
- GPTIMER for system clock
- IRQMP or IRQ(A)MP for interrupt support
- D-Cache snooping
- FPU is recommended

The additional requirements that applies for *SMP* are listed below.

- Inter Processor Interrupt must have dedicated IRQ line (no IRQ sharing)
- D-Cache fast snooping

1.6. Toolchain

The kernel and user application are built using a GNU GCC toolchain either prebuilt and distributed by Aeroflex Gaisler or a custom built toolchain typically using the crosstool-NG or buildroot packages. The crosstool-NG package distributed by Aeroflex Gaisler contains fixes for GCC and toolchain configurations ready to build custom GLIBC toolchains. Buildroot can be used to build a custom uClibC toolchain, for embedded targets that need a small footprint LibC or for some other reason need uClibC.

1.7. Buildroot distribution

There are a lot of different Linux distributions available, however many of them lack support for SPARC or embedded small footprint targets. Now that both GCC and the Linux kernel have official support for the LEON family it is easier to port distributions to LEON. Aeroflex Gaisler focus on maintaining support for the buildroot distribution.

Buildroot is a very flexible cross-compile build system which can build a major number of user-space applications. The file system image created can be used as root file system mounted via MTD from FLASH, networking NFS share or built into the kernel directly using the initramfs support (CPIO image).

1.8. Loader

The resulting Linux kernel (`linux/vmlinux`) must be loaded into the proper location in RAM, a basic MMU table must be setup and an OpenBoot PROM must be available that the Linux kernel request basic operations from, before the SPARC Linux kernel can successfully run.

The LEON Linux RAM Loader (**mklinuximg**) developed by Aeroflex Gaisler combines the virtually linked Linux kernel with a loader with the functionality described above. The LEON Linux RAM image generated by MKLINUXIMG can be loaded into RAM and executed by using GRMON, TSIM or GRSIM.

The LEON Linux RAM image can be booted from FLASH by using the MKPROM2 utility. It provides an efficient and fast boot FLASH/PROM procedure. The LEON Linux kernel can also be booted using the more complex networked U-Boot (sparc repository).

1.9. LINUXBUILD build environment

Aeroflex Gaisler have developed a build environment named LINUXBUILD that ties together some of the above components together in one place, using make-scripts to build the separate components. Even though it is recommended to setup a custom development flow that suits your particular development project. LINUXBUILD may serve as an initial setup to get started with Linux development for the LEON architecture. Please see the LINUXBUILD documentation PDF.

The LINUXBUILD package can be downloaded from Aeroflex Gaisler web server in the linux/linux-2.6/linuxbuild subdirectory.

2. Support

For Support, contact the Aeroflex Gaisler support team at support@gaisler.com.

3. Disclaimer

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