

# LEON Software Tools and Evaluation Boards

#### **Gaisler Research Tools and Boards**

#### **Software Development**

Bare-C C/C++ Compiler RTEMS C/C++ Compiler VxWorks-5.4 & 6.x Ecos Real-time kernel Linux kernel and tools Mkprom PROM builder Eclipse C/C++ IDE

#### **Simulation & Debug**

GRMON Debug monitor TSIM LEON2/3 Simulator GRSIM Multi-Proc Simulator

#### **Boards**

AT697 cPCI Eval board Virtex2/4 prototype boards

#### **LEON General Software Flow**



## **Bare-C (BCC) Compiler**

- Compiles standard non-tasking C/C++ applications
- Interrupt support, timer, simple I/O, optional pthreads lib.
- Used for compilation of LEON2/3 test bench
- Supports flat window model, V8 mul/div, soft-float
- GCC 3.4.4 for ~ 10% higher performance (-O6)
- Small run-time: ~ 15 Kbyte
- Mkprom boot-PROM builder
- Can generate code that runs in PROM
- Linux and Cygwin hosts

## **RTEMS cross-compiler (RCC)**

- Based on official tool-chain from OAR
- Compiler and kernel merged to avoid using 'make' files
- RTEMS-4.6.6 kernel with networking support
- Rich set of real-time primitives
- Optional POSIX threads API
- Kernel can be re-compiled inside the compiler
- ~ 100 Kbyte minimum size
- Linux and Cygwin hosts
- Used in many military, aerospace and consumer products
- Fully open-source with LGPL license

## Wind-River VxWorks 5.4 & 6.x

- VxWorks-5.4 BSP for LEON2/3 available from GR
  - Workbench support via 10/100 Mbit ethernet
- VxWorks-6.0 for LEON2/3 available now
  - MMU support with real-time processes/signals
- VxWorks-6.3 for LEON2/3 in Q4-2006
  - Workbench support via 10/100 Mbit ethernet
- Delivered by Gaisler Research
  - Source code of kernel (6.x) and BSP
  - Compiled by DIAB compiler from WR

### **Eclipse CDT IDE for RTEMS and Bare-C**



#### **GDB/DDD debug example**



## **LEON Simulators**

- TSIM : single-cpu simulator (~ 15 MIPS)
- Emulates the LEON2/3 processor, all on-chip peripherals + any amount of memory (PROM, SRAM, SDRAM).
- Processors can be configured with arbitrary cache size and organization, FPU and MUL/DIV options.
- Emulation of pipeline effects, caches, EDAC & memory
- Symbol handling, built-in trace buffer, GDB interface
- Loadable modules to model any additional on- or off-chip functionality + library version for integration into larger frameworks
- GRSIM : multi-cpu simulator (~ 5 MIPS)

#### **LEON DSU Interfaces**



## **GRMON debug monitor**

- Communicates with target hardware through many interfaces: serial, JTAG, Ethernet, PCI, USB-2.0, Spacewire RMAP
- Downloading and execution of LEON applications
- Can display all on-chip memory and registers
- Breakpoint, watchpoint & trace buffer handling
- Non-intrusive profiling (LEON3)
- Flash PROM programming
- Can be connected to GDB for source-level debugging
- Loadable modules allow IP vendors to provide own drivers

### **LEON on-chip instruction trace**

time	address	instruction	result
120828287	400096c0	sethi %hi(0x40013800), %o0	[40013800]
120828294	400096c4	1dd [%00 + 0x220], %f2	[3ff00000 0000000]
120828304	400096c8	fcmped %f0, %f2	[3ff00000]
120828314	400096cc	nop	[0000000]
120828315	400096d0	fbule 0x40009754	[0000000]
120828316	400096d4	sethi %hi(0x40013800), %o0	[40013800]
120828320	40009754	ldd [%fp - 0x38], %f0	[bfe8ab1d 4daa6a20]
120828325	40009758	ret	[40009758]
120828328	4000975c	restore	[0000000]
120828337	40004578	ba,a 0x400045d4	

## **Mkprom**

- BCC/RCC generates binaries for RAM, without initialization
- Mkprom encapsulates application binary in a boot PROM
- Initializes the system and loads application to RAM
- Custom initialization possible
- Can compress application with ~ 2x size reduction
- Can also create applications that runs in PROM

## **AT697E cPCI Evaluation board**



## **AT697E cPCI Evaluation Board**

- AT697E @ 100 MHz
- 8 Mbyte FLASH, 4 Mbyte SRAM w. ECC
- Up to 256 Mbyte SDRAM with ECC
- 100 MHz operation with SRAM (1 ws), 90 MHz with SDRAM
- LAN9C111 10/100 Ethernet MAC
- Software support
  - RTEMS bsp
  - VxWorks 5.4 bsp + Workbench support
  - VxWorks 6.3 port/bsp + Workbench support
  - GRMON Debug monitor
  - Other kernel: linux, eCos, Bare-C

## **XC2V6000 Evaluation Board**

- Xilinx Virtex2 XC2V6000 FPGA
- 8 Mbyte FLASH, 10/100 Mbit PHY
- 64-Bit SDRAM SODIMM socket
- Will fit complete LEON2FT /AT697 in less than 50% area
- LEON2FT @ 40 Mhz, non-FT @50 Mhz
- Several mezzanine boards available:
  - SpW connectors and drivers
  - 1553, RS422, CAN
  - 8 Mbyte SRAM with ECC

## XC2V6000 cPCI Development board for LEON prototyping

