T-EMU TERMA

The Terma Emulator (T-EMU) is a full system simulation framework containing a suite of instruction-level emulators of the ERC32, LEON2, LEON3 and LEON4 processors, as well as associated peripherals. T-EMU supports the emulation of multi-core processors and is provided as a stand-alone application as well as a set of libraries that can be integrated in an existing simulator.

T-EMU is based on the LLVM framework, enabling the application of custom domain specific optimisations and transformations of the emulator core. In short, T-EMU offers **very high performance**.

T-EMU **runs unmodified operating systems** (RTEMS and Linux) **and application software. T-EMU** is suitable for **software debugging and development**, S**oftware Validation Facilities (SVF)** and **Operational Simulators**.

Support for **several processors**, including the **SPARCv8** based ERC32, LEON2 (AT687E, AT687F), LEON3 (UT699, UT700) and LEON4 (GR740/NGMP). **Additional architectures (e.g. ARM, MIPS, and PowerPC) can be supported on request.**

Multi-core and multi-system emulation supported out of the box, user can define systems with a virtually arbitrary number of processors or use one of the default configurations.

Several bundled peripheral models: MEC, LEON2 on-chip devices, most important devices from GRLIB. These include UARTs, timers, interrupt controllers and various bus controllers.

Multiple **transactional bus models built in**, including serial ports, GPIO, MIL-STD-1553A/B, SpaceWire. Additional bus models can easily be added by either the user or by Terma.

Designed for timing accuracy. Each CPU core has a static timing model, and can be connected to custom cache models, both exact content based models and statistical models.

Designed for performance. The emulator core is written in LLVM assembler, enabling specific custom optimisations and the use of the existing LLVM suite of optimisations. The emulator is further optimised using threaded, code, idle loop handling, power down mode support, etc.

Software debugging support. T-EMU comes with a command line interface capable of low level **non-intrusive debugging** and a GDB remote protocol server, enabling the use of existing graphical debuggers such as DDD and Eclipse. T-EMU is **fully deterministic**, meaning the user can be assured that bugs detected in the emulator can always be replicated.

http://t-emu.terma.com/
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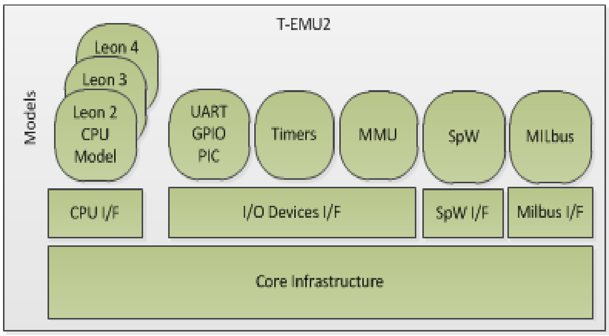
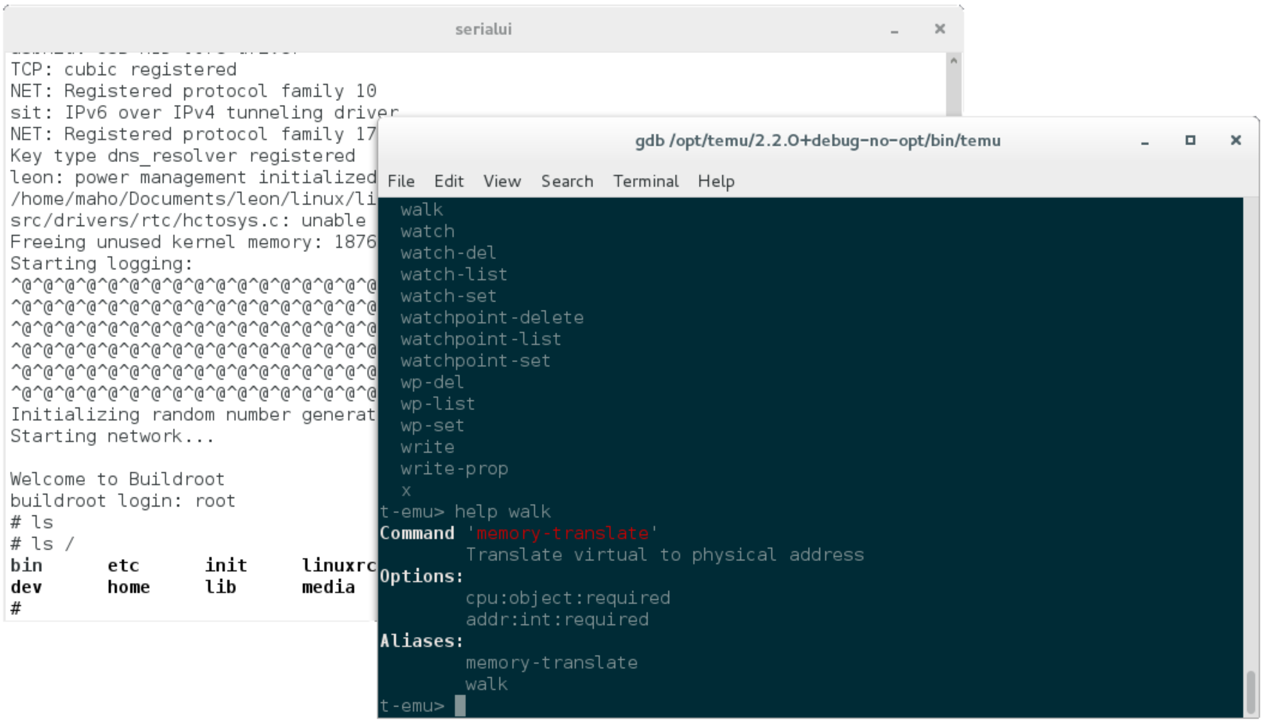
Fully featured **Application Programmer Interface** (API) supporting the **modelling of memory mapped devices, data buses and remote terminals**, in addition the API supports the integration of T-EMU in existing simulators such as Software Validation Facilities and Operational Simulators.

Portable. T-EMU can run on different operating systems, currently the emulator is regularly built and tested on different UNIX and POSIX based systems such as GNU/Linux and OS X. Windows support can added if needed.

Evaluation version available for free.



Layered Architecture



```
TCP: cubic registered
NET: Registered protocol family 10
sit: IPv6 over IPv4 tunneling driver
NET: Registered protocol family 17
Key type dns_resolver registered
leon: power management initialized
/home/maho/Documents/leon/linux/li
src/drivers/rtc/hctosys.c: unable
Freeing unused kernel memory: 1876
Starting logging:
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Initializing random number generat
Starting network...

Welcome to Buildroot
buildroot login: root
# ls
# ls /
bin       etc       init      linuxrc
dev       home      lib       media
#
```

```
  walk
  watch
  watch-del
  watch-list
  watch-set
  watchpoint-delete
  watchpoint-list
  watchpoint-set
  wp-del
  wp-list
  wp-set
  write
  write-prop
  x
t-emu> help walk
Command 'memory-translate'
        Translate virtual to physical address
Options:
        cpu:object:required
        addr:int:required
Aliases:
        memory-translate
        walk
t-emu> 
```

Booting an Unmodified Linux Kernel

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