

Cross Compiling EPICS/RTEMS

Case TMS570

Outline

- Installing cross compiler tools: RTEMS tms570
- Installing RTEMS
- Installing EPICS

Installing cross compiling tools

- Two ways known to me + one on progress
 - Install all by source compiling (Long)
 - RTEMS Source Builder (short)
 - Use a prepared docker container (short)

Install by compiling

See: <https://gcc.gnu.org/install/prerequisites.html>

- Prerequisites: ISL, gnat, make, tar
- Choose prefix (example: /opt/rtems-4.11)
- Download (tested versions):
 - mpc-1.0.3
 - mpfr-3.1.3
 - gmp-6.1.0
 - newlib-2.2.0.2
 - binutils-2.25
 - gcc-4.9.1
 - gdb-7.8

```
gcc configuration: ../gcc-4.9.1/configure  
--target=arm-rtems4.11 --with-gnu-as --with-gnu-ld  
--with-newlib --verbose --enable-threads --enable-languages=c,c++ --prefix=/opt/rtems-4.11  
--disable-libstdcxx-pch --with-gnu-as --enable-target-optspace --with-system-zlib --disable-nls  
--without-included-gettext --disable-win32-registry --enable-plugin --enable-newlib-io-c99-formats  
--enable-version-specific-runtime-libs --enable-newlib-iconv --disable-lto
```

```
Binutils/gdb configuration: ../binutils-2.25/configure --target=arm-rtems4.11  
--prefix=/opt/rtems-4.11
```

Install by compiling

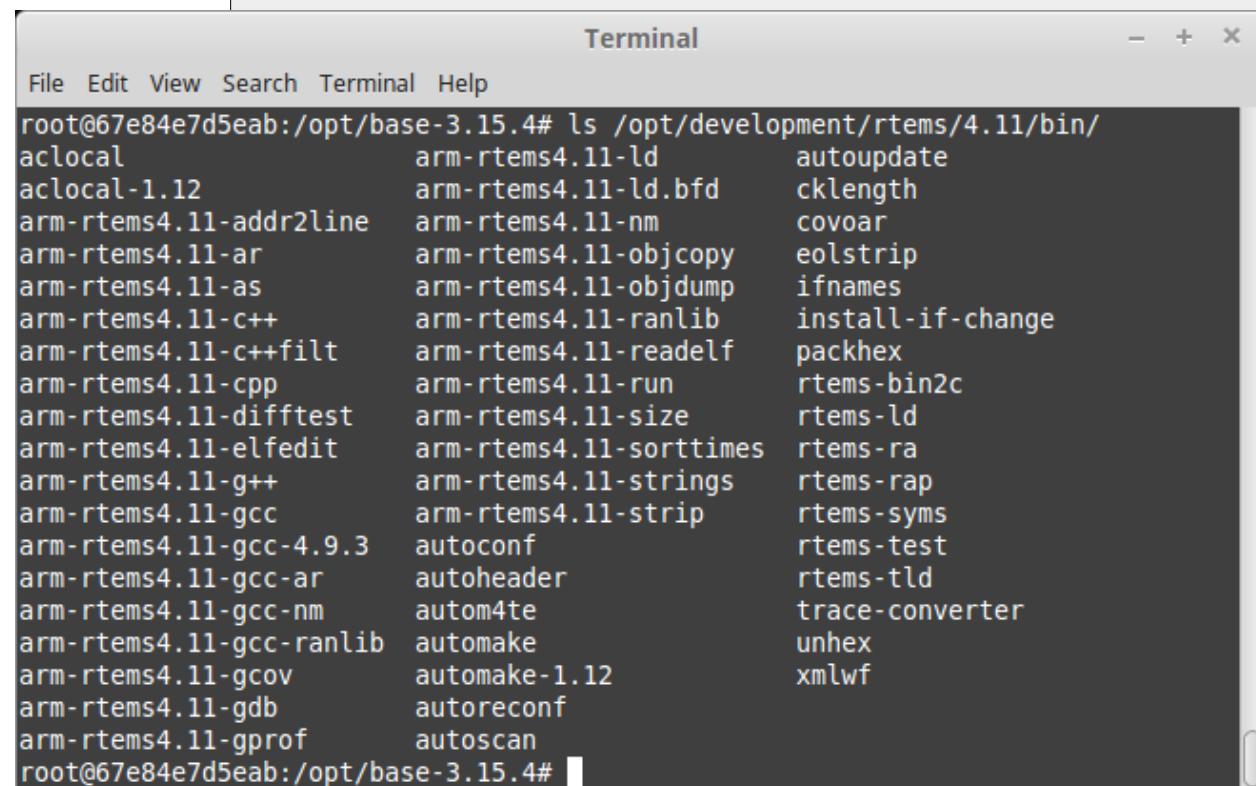
- Make sure first to make a virtual link in the gcc-4.9.1 to the newlib-2.2.0.2/newlib after having installed newlib

RTEMS Source builder

- Straight forward, git:
- Specify version:

```
git clone git://git.rtems.org/rtems-source-builder.git
```

```
./source-builder/sb-set-builder --log=1-arm.txt \
--prefix=$HOME/development/rtems/4.11 4.11/rtems-
arm
```



The screenshot shows a terminal window titled "Terminal". The window has a menu bar with "File", "Edit", "View", "Search", "Terminal", and "Help". The main area of the terminal displays a list of files in the directory "/opt/development/rtems/4.11/bin". The files listed are:

```
root@67e84e7d5eab:/opt/base-3.15.4# ls /opt/development/rtems/4.11/bin/
acllocal
acllocal-1.12
arm-rtems4.11-addr2line
arm-rtems4.11-ar
arm-rtems4.11-as
arm-rtems4.11-c++
arm-rtems4.11-c++filt
arm-rtems4.11-cpp
arm-rtems4.11-difftest
arm-rtems4.11-elfedit
arm-rtems4.11-g++
arm-rtems4.11-gcc
arm-rtems4.11-gcc-4.9.3
arm-rtems4.11-gcc-ar
arm-rtems4.11-gcc-nm
arm-rtems4.11-gcc-ranlib
arm-rtems4.11-gcov
arm-rtems4.11-gdb
arm-rtems4.11-gprof
root@67e84e7d5eab:/opt/base-3.15.4#
```

The terminal window has a standard window frame with minimize, maximize, and close buttons.

More info:
https://docs.rtems.org/rsb/#_quick_start

Install RTEMS

- `git clone --single-branch -b 4.11 git://git.rtems.org/rtems.git`
- Export xcompiling tools path
- Bootstrap, configure, make and make install

Installing EPICS

- Download base
- Cd base<version>
- Specify cross tools path (configure/os/CONFIG_SITE.Common.RTEMS)

```
RTEMS_VERSION = 4.11
```

```
RTEMS_BASE = /opt/rtems/${RTEMS_VERSION}
```

- Specify cross compiler arch (configure/os/CONFIG_SITE.linux-x86_64.Common)

```
CROSS_COMPILER_TARGET_ARCHS = RTEMS-tms570ls3137_hdksdram
```

- Create CONFIG.Common.RTEMS-tms570ls3137_hdksdram with

```
RTEMS_TARGET_CPU=arm
```

```
include $(CONFIG)/os/CONFIG.Common.RTEMS
```

- make
- make install

Problems that may arise (happened)

- RTEMS 4.11: unknown type name
`'rtems_malloc_statistics_t'`
 - Need to use `heap_statistics` instead → patch in process
- Error in `osdMutex.c`
- Error in other `osd<Files>.c`
 - Solution: work on EPICS/rtems new versions compatibility
- EPICS not compatible with RTEMS 4.12 (apis)

RTEMS/EPICS on TMS570

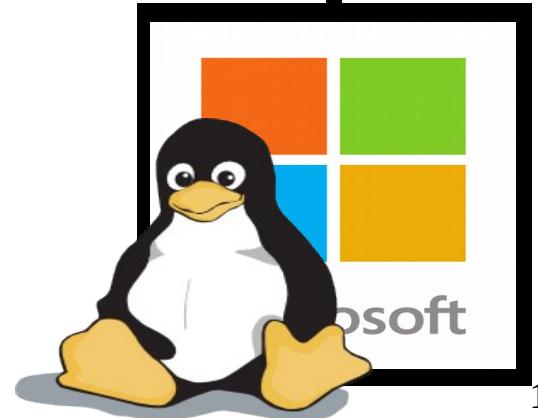
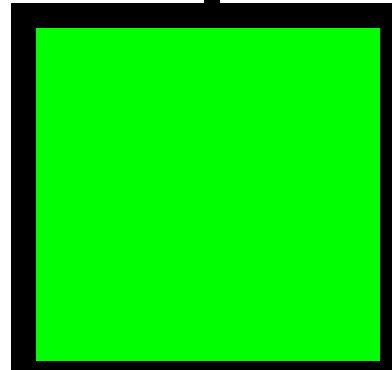
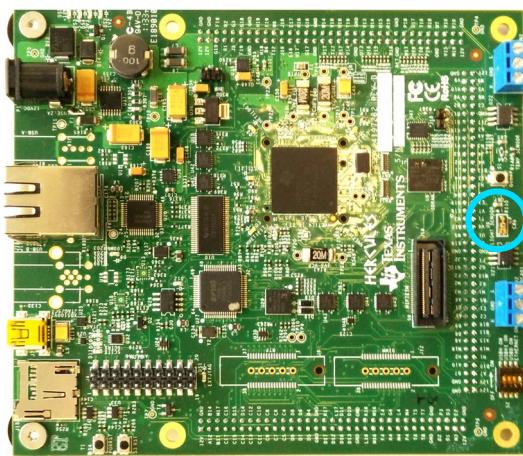
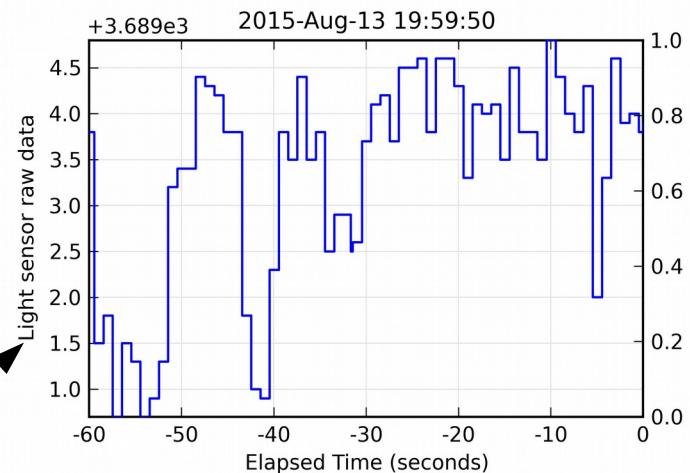
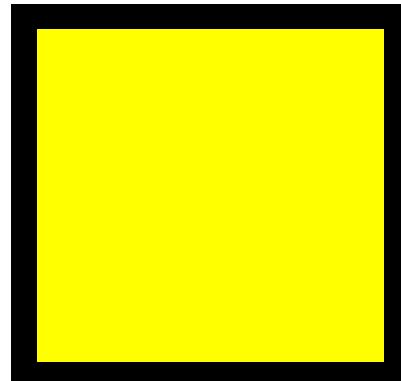
Embedded With



www.TMS570

ARM®

Cortex™-R4
Microcontrollers



Create Docker Container

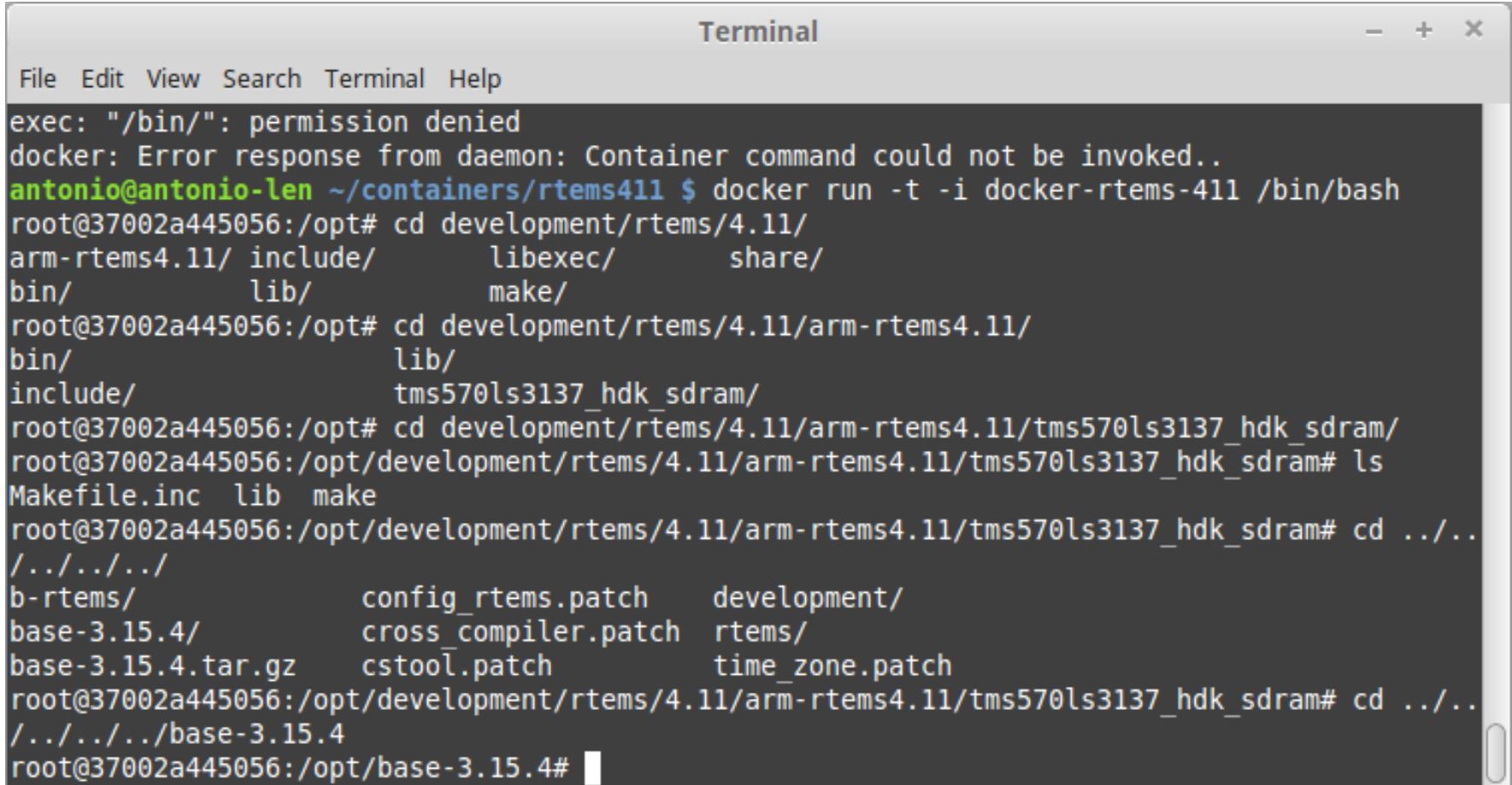
- Docker image containing rtems xtools + rtems + epics
- Steps (jalm Repository still not uploaded)
- Install Docker
- Load rtems image by:



```
docker run -t -i jalm/rtems-411 /bin/bash
```

- Creates Debian Jessie container with all the tools and libraries needed
- Docker runs on Mac OSX, Windows, and Linux
- Container images are similar to virtual machines with no previous HD allocation thus more flexible

Docker container



The screenshot shows a terminal window titled "Terminal". The window has a standard title bar with icons for minimize, maximize, and close. The menu bar includes "File", "Edit", "View", "Search", "Terminal", and "Help". The main area of the terminal displays the following text:

```
exec: "/bin/": permission denied
docker: Error response from daemon: Container command could not be invoked..
antonio@antonio-len ~/containers/rtems411 $ docker run -t -i docker-rtems-411 /bin/bash
root@37002a445056:/opt# cd development/rtems/4.11/
arm-rtems4.11/ include/ libexec/ share/
bin/ lib/ make/
root@37002a445056:/opt# cd development/rtems/4.11/arm-rtems4.11/
bin/ lib/
include/ tms570ls3137_hdksdram/
root@37002a445056:/opt# cd development/rtems/4.11/arm-rtems4.11/tms570ls3137_hdksdram/
root@37002a445056:/opt/development/rtems/4.11/arm-rtems4.11/tms570ls3137_hdksdram# ls
Makefile.inc lib make
root@37002a445056:/opt/development/rtems/4.11/arm-rtems4.11/tms570ls3137_hdksdram# cd ../..
/.....
b-rtems/ config_rtems.patch development/
base-3.15.4/ cross_compiler.patch rtems/
base-3.15.4.tar.gz cstool.patch time_zone.patch
root@37002a445056:/opt/development/rtems/4.11/arm-rtems4.11/tms570ls3137_hdksdram# cd ../..
/.....
root@37002a445056:/opt/base-3.15.4#
```

Thank you!