

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
```

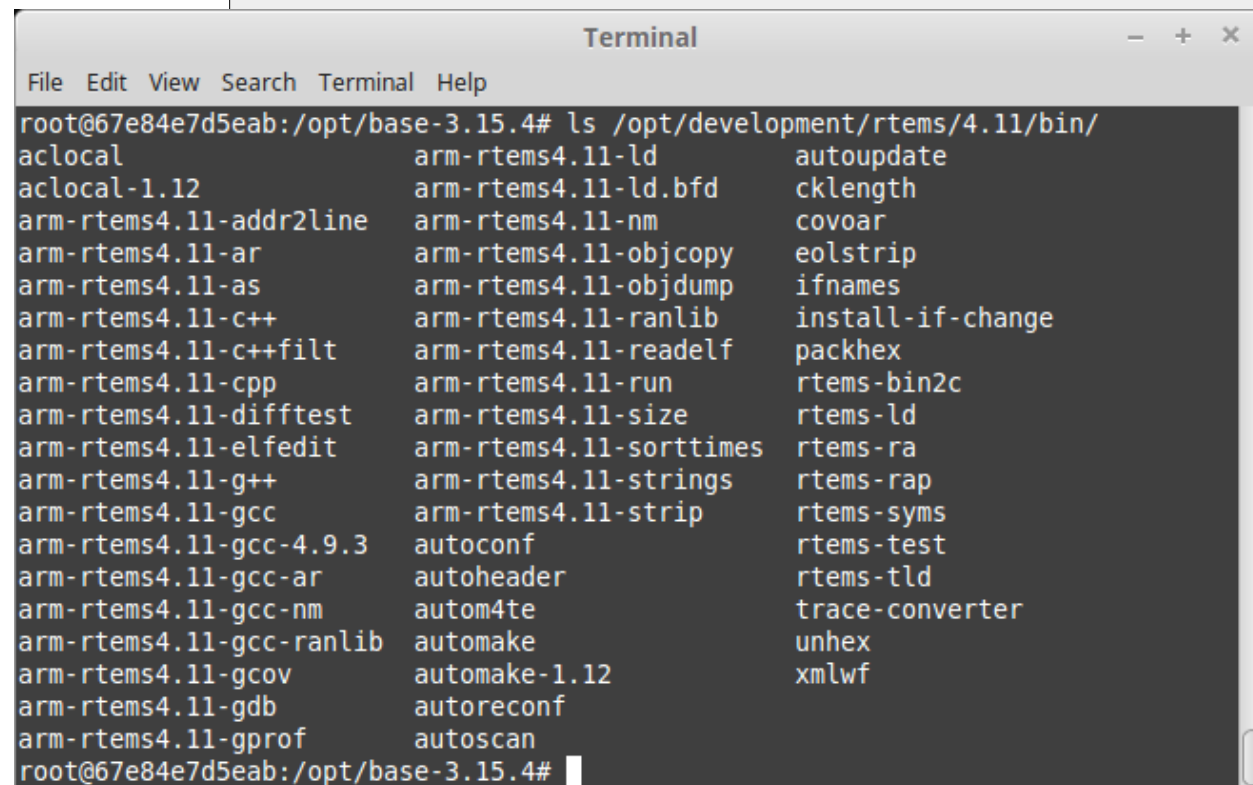
```
Binutils/gdb configuration: ../binutils-
2.25/configure --target=arm-rtems4.11
--prefix=/opt/rtems-4.11
```

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: `git clone git://git.rtems.org/rtems-source-builder.git`
- Specify version: `../source-builder/sb-set-builder --log=1-arm.txt \ --prefix=$HOME/development/rtems/4.11 4.11/rtems-arm`



```
Terminal
File Edit View Search Terminal Help
root@67e84e7d5eab:/opt/base-3.15.4# ls /opt/development/rtems/4.11/bin/
aclocal                arm-rtems4.11-ld        autoupdate
aclocal-1.12           arm-rtems4.11-ld.bfd   cklength
arm-rtems4.11-addr2line arm-rtems4.11-nm        covoar
arm-rtems4.11-ar        arm-rtems4.11-objcopy  eolstrip
arm-rtems4.11-as        arm-rtems4.11-objdump  ifnames
arm-rtems4.11-c++       arm-rtems4.11-ranlib    install-if-change
arm-rtems4.11-c++filt  arm-rtems4.11-readelf  packhex
arm-rtems4.11-cpp       arm-rtems4.11-run      rtems-bin2c
arm-rtems4.11-difftest arm-rtems4.11-size      rtems-ld
arm-rtems4.11-elfedit  arm-rtems4.11-sorttimes rtems-ra
arm-rtems4.11-g++       arm-rtems4.11-strings  rtems-rap
arm-rtems4.11-gcc       arm-rtems4.11-strip    rtems-syms
arm-rtems4.11-gcc-4.9.3 autoconf                rtems-test
arm-rtems4.11-gcc-ar    autoheader              rtems-tld
arm-rtems4.11-gcc-nm    autom4te                 trace-converter
arm-rtems4.11-gcc-ranlib automake                  unhex
arm-rtems4.11-gcov      automake-1.12           xmlwf
arm-rtems4.11-gdb       autoreconf
arm-rtems4.11-gprof     autoscan
root@67e84e7d5eab:/opt/base-3.15.4#
```

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_hdk_sdram
```

- Create CONFIG.Common.RTEMS-tms570ls3137_hdk_sdram 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

RTEMS

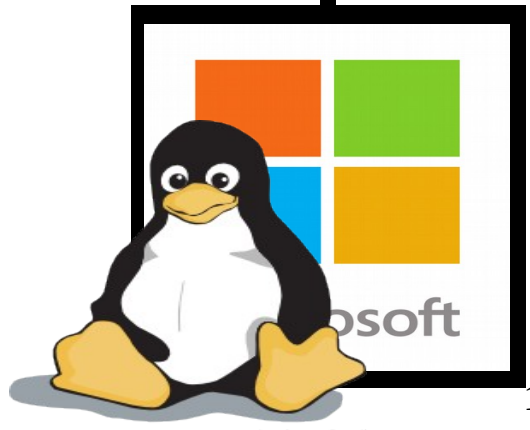
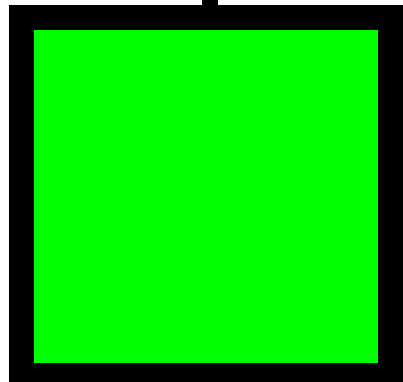
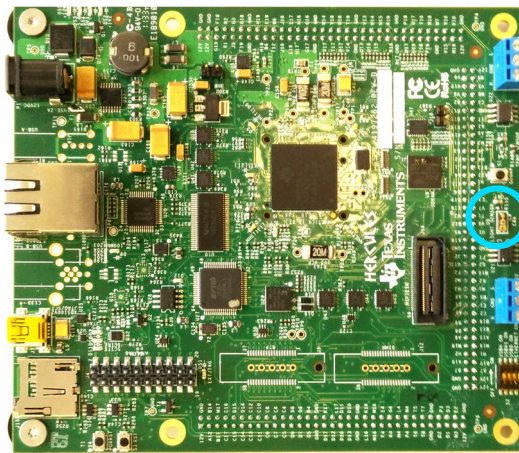
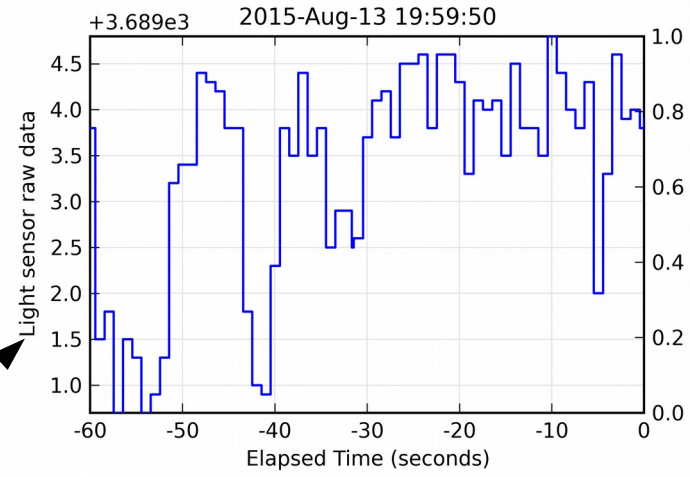
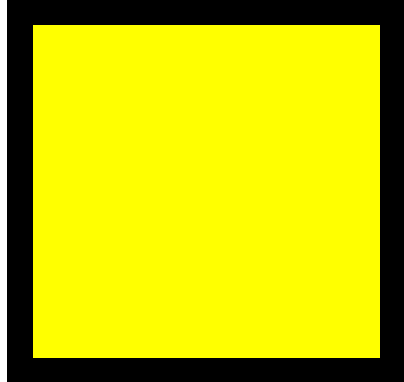
www.tms570

ARM®

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Microcontrollers



TEXAS
INSTRUMENTS



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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

```
Terminal
File Edit View Search Terminal Help
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_hdk_sdram/
root@37002a445056:/opt# cd development/rtems/4.11/arm-rtems4.11/tms570ls3137_hdk_sdram/
root@37002a445056:/opt/development/rtems/4.11/arm-rtems4.11/tms570ls3137_hdk_sdram# ls
Makefile.inc lib make
root@37002a445056:/opt/development/rtems/4.11/arm-rtems4.11/tms570ls3137_hdk_sdram# 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_hdk_sdram# cd ../../
../../../../base-3.15.4
root@37002a445056:/opt/base-3.15.4#
```

Thank you!