

CMake Framework User Manual

Document Revision Details

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1	Initial Documentation of CMake Framework	rtss_cmake_scripts_v0.1
2	Cmake support for GNSS-M55 core	rtss_cmake_scripts_v0.2
3	Contents of scripts directory moved to base directory	rtss_cmake_scripts_v0.3
4	Additional Compiler Arguments support	rtss_cmake_scripts_v0.4
5	GCC compiler Support	rtss_cmake_scripts_v0.5
6	Support for Windows Host machine	rtss_cmake_scripts_v0.6
7	Multi test applications build support	rtss_cmake_scripts_v0.7
8	Optimizing running steps and feature enhancement	rtss_cmake_scripts_v0.8
9	Update running steps	rtss_cmake_scripts_v0.9
10	Adding support to build from pack	rtss_cmake_scripts_v1.0
11	Device Selection support added	rtss_cmake_scripts_v1.1
12	Help Option is added	rtss_cmake_scripts_v1.2
13	Revamped configuration of CMake using preset	rtss_cmake_scripts_v2.0

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rtss_cmake_scripts

This document contains detailed information on how to use the CMake scripts and helper shell scripts, to clone git repos or pack setup, compile test applications and generate binary files with respect to **Cortex-M55**.

System Requirements to run the Scripts

Ubuntu

1. CMake version on the Linux Host system should be having the latest version **3.25** and above.
2. Ubuntu OS version on the Host system should be at least **18.4 and above**.

Steps to update the CMake version on the Host

Run the below commands on the terminal to update the Cmake version to the latest version.

1. `sudo apt purge --auto-remove cmake`
2. `wget -O - https://apt.kitware.com/keys/kitware-archive-latest.asc 2>/dev/null | gpg --dearmor - | sudo tee /etc/apt/trusted.gpg.d/kitware.gpg >/dev/null`

For Ubuntu 18.04

1. `sudo apt-add-repository 'deb https://apt.kitware.com/ubuntu/ bionic main'`
2. `sudo apt update`
3. `sudo apt install cmake`

Windows

1. CMake version on the Windows Host system should be having the latest version **3.25** and above.
2. MingW64 should be installed, which provides the application named "GitBash".
3. Git should be installed.
4. Git bash application should be used as Terminal console while using this CMake Framework.

Contents of the 'cmake folder

1. **rtss** → This directory contains all the CMake files, related to tool-chain and projects source files with respect to rtss.
2. **Include_RTE_Comp** → This directory contains "RTE_Components.h" header file specifically for Crescendo or Ensemble packs.
3. **Cmake Presets and Shell Scripts** → Cmake Presets will help to set the configuration/build/test using cmake. Run.sh is wrapper script over presets which will run all available preset.

rtss directory

1. **device_cmake** → This contains cmake file which has the details related to Devices bolt_extsys_driver or extsys0 and extsys1 for HP and HE).
2. **drivers_cmake** → This contains cmake file which has the details of source files and header files of all the supporting drivers for cortex_m55.
3. **ensemble_cmake** → This contains cmake file which has the details of source files and header files with respect to Ensemble package.
4. **netxduo_cmake** → This contains cmake file which has the details of source files and header files with respect to netowrk module.
5. **os_cmake** → This contains cmake files which have the details of source files and header files to include with respect to different Operating Systems. It also has details of test applications to be built w.r.t each OS.
6. **Toolchains** → This contains cmake file which has the compiler toolchain related details with respect to Cortex-M55 and default configurable compiler argument variables for *Cortex-M55*
7. **usbx_cmake** → This contains cmake file which has the details of source files and header files of USBX driver.
8. **CMakeLists.txt** → This is the main cmake file, which links all the above cmake files based on the configuration and requirement.
9. **utilities_func.cmake** → This cmake file has helper functions and macro definitions required for the build.

Include_RTE_Comp

1. **ensemble** → This directory consists of **RTE_Components.h** header file specifically for **Ensemble pack**. It is modified during the run time, to match with Device type **M55_HE** or **M55_HP**.

Preset files and Shell Script

1. **CMakePresets.json** → This Json basically setups the environment variables and other configuration parameters for user. User can have multiple entry inside *configurePresets*, *buildPresets*/ *testPresets*/*workflowPresets*. In workflow user can have their own custom flow.

Note: Users need to add proper paths to set environments variable in global preset environment setting.

```
.....{
.....  "name": "global-settings",
.....  "description": "Common settings shared by all configure presets",
.....  "hidden": true,
.....  "environment": {
.....    "COMPILER_BIN_PATH": "/opt/arm/developmentstudio-2022.0/sw/ARMCompiler6.18/bin",
.....    "ARM_PRODUCT_DEF": "/opt/arm/developmentstudio-2022.0/sw/mappings/gold.elmap",
.....    "ARMLMD_LICENSE_FILE": "27000@10.10.2.99",
.....    "CMSIS_PACK_PATH": "/mnt/c/Users/RajRanjan/AppData/Local/Arm/Packs/ARM/CMSIS/5.9.0",
.....    "CMSIS_COMPILER_PATH": "/mnt/c/Users/RajRanjan/AppData/Local/Arm/Packs/ARM/CMSIS-Compiler/2.1.0"
.....  }
.....}
```

2. **run.sh** → This script is wrapper shell script over CmakePresets. By running this all combination of available/added configPreset and buildPreset can be run.

Steps to run the Preset and Shell Script.

Compilation without ./run.sh

- ♣ To check available configuration, we can run command **“cmake --list-presets”** or **“cmake --list-presets=configure”**

```
rajranjan@ALIFSEMI: /mnt/d/hhh/galaxy/ensemble-cmsis-dfp_DEV/scripts/cmake$ cmake --list-presets
Available configure presets:

"tcm" - Alif TCM config
"nram" - Alif NRAM config
rajranjan@ALIFSEMI: /mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$
```

- ♣ To check available build configuration, we can run command **“cmake --build --list-presets”** or **“cmake --list-presets=build”**

```
rajranjan@ALIFSEMI: /mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$ cmake --build --list-presets
Available build presets:

"default"
rajranjan@ALIFSEMI: /mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$
```

- ♣ To check available build configuration, we can run command “**cmake --build --list-presets**” or “**cmake --list-presets=test**”

```
rajranjan@ALIFSEMI:/mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$
rajranjan@ALIFSEMI:/mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$ cmake --list-presets=test
Available test presets:

    "test_tcm"
    "test_mram"
rajranjan@ALIFSEMI:/mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$ |
```

- ♣ “**cmake --preset tcm**” ➔ To configure cmake with tcm preset. Users can set variables e.g compiler, device etc in cache section.
- “**cmake --preset tcm -DCOMPILER=GCC**” ➔ Change/Override the COMPILER variable with GCC with command line.
- “**cmake --preset tcm -DENABLE_USART=1**” ➔ Enable USART driver with command line.

- ♣ “**cmake --build --preset default**” ➔ To compile configured cmake.

- ♣ “**cmake --workflow --preset default**” ➔ To run complete work flow i.e. configuration + compile + test + package.

```
rajranjan@ALIFSEMI:/mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$
rajranjan@ALIFSEMI:/mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$
rajranjan@ALIFSEMI:/mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$ cmake --workflow --preset default
Executing workflow step 1 of 4: configure preset "tcm"
```

Preset CMake variables:

```
BOARD_NAME="DevKit-e7"
BOARD_REV="B0"
BOOT="TCM"
COMPILER="ARMCLANG"
CPU="M55"
DEVICE="AE722F80F55D5XX"
DEVICE_SERIES="E7"
OS="NONE"
RTE_COMP_DIR="/mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake/Include_RTE_Comp/ensemble"
RTSS="HP"
TEST_APP="UART4_Baremetal"
```



Compilation with ./run.sh

- “**./run.sh**” ➔ By default, we have 2 presets (TCM & MRAM) and only one build config (initially, later more presets can be added). With this command all presets, i.e. configure, build will run back-to-back.

```
rajranjan@ALIFSEMI:/mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$
rajranjan@ALIFSEMI:/mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$
rajranjan@ALIFSEMI:/mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake$ ./run.sh
```

Running CMake with configuration preset: “tcm” and build preset “default”
Preset CMake variables:

```
BOARD_NAME="DevKit-e7"
BOARD_REV="B0"
BOOT="TCM"
COMPILER="ARMCLANG"
CPU="M55"
DEVICE="AE722F80F55D5XX"
DEVICE_SERIES="E7"
OS="NONE"
RTE_COMP_DIR="/mnt/d/hhh/github/ensemble-cmsis-dfp_DEV/scripts/cmake/Include_RTE_Comp/ensemble"
RTSS="HP"
TEST_APP="UART4_Baremetal"
```

Preset environment variables:

```
ARMLMD_LICENSE_FILE="27000@10.10.2.99"
ARM_PRODUCT_DEF="/opt/arm/developmentstudio-2022.0/sw/mappings/gold.elmap"
CMSIS_COMPILER_PATH="/mnt/c/Users/RajRanjan/AppData/Local/Arm/Packs/ARM/CMSIS-Compiler/2.1.0"
CMSIS_PACK_PATH="/mnt/c/Users/RajRanjan/AppData/Local/Arm/Packs/ARM/CMSIS/5.9.0"
COMPILER_BIN_PATH="/opt/arm/developmentstudio-2022.0/sw/ARMCompiler6.18/bin"
PATH="/opt/arm/developmentstudio-2022.0/sw/ARMCompiler6.18/bin:/home/rajranjan/.local/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/usr/lib/wsl/lib:/mnt/c/Program Files (x86)/teraterm:/mnt/c/WINDOWS/system32:/mnt/c/WINDOWS:/mnt/c/WINDOWS/System32/Wbem:/mnt/c/WINDOWS/System32/OpenSSH:/mnt/c/Program Files/Microsoft SQL Server/150/Tools/Binn:/mnt/c/Program Files/Microsoft SQL Server/Client SDK/ODBC/170/Tools/Binn:/mnt/c/Program Files/dotnet:/mnt/c/Users/RajRanjan/AppData/Roaming/Python/Python311/Scripts:/mnt/c/Program Files/Git/cmd:/mnt/c/Program Files/PuTTY:/mnt/c/WINDOWS/System32/WindowsPowerShell/v1.0:/mnt/
```

Change Configuration Parameter with Existing Presets

- ♣ **`“./run.sh -c -DRTSS=HE -DENABLE_RTC=1”`** ➔ With existing presets these parameters will be added/override in configuration and compiled.
- ♣ **`“./run.sh -b -jobs=32”`** ➔ With existing presets these parameters will be added/override in configuration and compiled.
- ♣ **`“./run.sh -p -DRTSS=HE”`** ➔ Default preset will be selected and RTSS configuration will be added/override in configuration, compiled and tested.

Modifying CMake scripts

When it comes to modifying cmake script files, care should be taken as wrong changes would result in compilation error or even make file generation fail. There are different steps involved in modifying any cmake scripts.

Please follow the below steps, if cmake script modification is necessary.

Adding New Driver Files

1. The **drivers.cmake** script file is present in the directory path **scripts/cmake/rtss/driver_cmake/**.
2. This cmake file has each driver source file and headers files included with respect to each driver available.
3. Each driver related files are included to the build, based on respective macros which are enabled in the **RTE_Components.h** header file.

```
18  /* AlifSemiconductor::CMSIS Driver.SOC Peripherals.PINCONF */
19  #define RTE_Drivers_LL_PINCONF 1 /* Driver PinPAD and PinMux */
20  /* AlifSemiconductor::CMSIS Driver.USART */
21  #define RTE_Drivers_USART 1 /* Driver UART */
22  /* AlifSemiconductor::CMSIS Driver.SOC Peripherals.GPIO */
23  #define RTE_Drivers_GPIO 1 /* Driver GPIO */
```

4. When a new driver is added to the drivers folder, please make sure to add the same files in this cmake file, so that it will be compiled for the new build.

```
target_sources(${DRIVER_LIB} PRIVATE
...#Pin.Config
...$<$<BOOL:${ENABLE_PIN_CONF}>:${ALIF_ENSEMBLE_DRIVERS_SRC_DIR}/pinconf.c>
...#ADC.Driver
...$<$<BOOL:${ENABLE_ADC}>:${ALIF_ENSEMBLE_DRIVERS_SRC_DIR}/adc.c>
...$<$<BOOL:${ENABLE_ADC}>:${ALIF_CMSIS_DRIVER_SRC_DIR}/Driver_ADC.c>
```

With **ENABLE_ADC** flag add all required files needed for specific driver with proper file path.

Editing/Adding Test Applications in cmake for the Build

1. While cmake is being built, the test applications are considered according to the OS and name given in variable **TEST_APP**.
2. The cmake files for each OS type are available in the directory **scripts/cmake/rtss/os_cmake**
3. For each OS, specific cmake script has been added and it will contain all relevant commands.
4. Specific test app is added as follows with relevant flags

```
51 COND_FILE_ADD(${BARE_METAL_APP_DIR}/UART4_Baremetal.c.....ENABLE_USART.....TEST_APP_SRCS..."test-apps")
52 COND_FILE_ADD(${BARE_METAL_APP_DIR}/UART2_Baremetal.c.....ENABLE_USART.....TEST_APP_SRCS..."test-apps")
53 COND_FILE_ADD(${BARE_METAL_APP_DIR}/LPUART_Baremetal.c.....ENABLE_USART.....TEST_APP_SRCS..."test-apps")
```

If any supporting file is needed to compile specific testapp, user can add as follows

```
COND_FILE_ADD(${BARE_METAL_APP_DIR}/i2c_using_i3c_Baremetal.c      ENABLE_I2C      TEST_APP_SRCS  "test-apps")

eval_flags(TMP_FLAG      AND      ENABLE_RTC      ENABLE_LPTIMER)
if(${TMP_FLAG})
    COND_FILE_ADD(${BARE_METAL_APP_DIR}/Demo_pm_baremetal.c      ${TMP_FLAG}      TEST_APP_SRCS  "test-apps")
else()
    list(APPEND      RM_TEST_APPS_LIST      "Demo_pm_baremetal")
endif()
```

Note: Add test-app with flag/s and if that flag is not enabled, include in **RM_TEST_APPS_LIST** list.

A]. If any test-app depends on files that need to add as dependency, user has to do 2 things

```
COND_FILE_ADD(${BARE_METAL_APP_DIR}/Demo_SD_fatFS_Baremetal.c      ENABLE_SD      TEST_APP_SRCS  "test-apps")
COND_FILE_ADD(${BARE_METAL_APP_DIR}/FatFS/diskio.c      ENABLE_SD      SD_TEST_APP_DEP_SRCS  "dependency")
COND_FILE_ADD(${BARE_METAL_APP_DIR}/FatFS/ff.c      ENABLE_SD      SD_TEST_APP_DEP_SRCS  "dependency")
COND_FILE_ADD(${BARE_METAL_APP_DIR}/FatFS/ffsystem.c      ENABLE_SD      SD_TEST_APP_DEP_SRCS  "dependency")
COND_FILE_ADD(${BARE_METAL_APP_DIR}/FatFS/ffunicode.c      ENABLE_SD      SD_TEST_APP_DEP_SRCS  "dependency")
```

B]. Based-on test-app name add specific variable for example **SD_TEST_APP_DEP_SRCS** to

addonsourcefiles and reset for others.

```
267
268 foreach (testApp ${TEST_APPS})
269     set(TEST_FOUND_FLAG "Not Found")
270     foreach (testsourcefile ${TEST_APP_SRCS})
271
272         # Collectiong Test app names one by one
273         get_filename_component (tempname "${testsourcefile}" NAME)
274         string (REPLACE ".c" "" testname ${tempname} )
275
276         if("${testname}" STREQUAL "Demo_SD_fatFS_Baremetal")
277             set(addonsourcefiles ${SD_TEST_APP_DEP_SRCS})
278         else()
279             set(addonsourcefiles "")
280         endif()
```

5. If **ALL** is passed as the test application name i.e. **TEST_APP**, all the test applications under that given OS type will be considered.

Editing/Adding RTE_Components.h header file for the Build

1. There are two **RTE_Components.h** header files in the directory **scripts/cmake.Include_RTE_Comp**, one for **Ensemble** pack .
2. Based on the values passed with **RTSS (HE/HP)** and CPU (**M55**) as arguments/macros to **run.sh** script, the header file will be modified by the cmake script on the run time, with respect to the given configuration.
3. If there are any new Drivers added in the git repo source, then driver cmake is updated with the same. And make sure to add the required macro definitions in **RTE_Components.h** to enable the particular drivers for the compilation.

```
18  /* AlifSemiconductor::CMSIS Driver.SOC Peripherals.PINCONF */
19  #define RTE_Drivers_LL_PINCONF 1 /* Driver PinPAD and PinMux */
20  /* AlifSemiconductor::CMSIS Driver.USART */
21  #define RTE_Drivers_USART 1 /* Driver UART */
22  /* AlifSemiconductor::CMSIS Driver.SOC Peripherals.GPIO */
23  #define RTE_Drivers_GPIO 1 /* Driver GPIO */
```

4. To add specific driver users must do following thing
 - Add specific define in **RTE_Components.h** and that processing in **get_rte_macros** function in file (**rtss/utilities_func.cmake**)

```
GET_MACRO_VALUE("${RTEcomponentFile}" RTE_Drivers_WDT ENABLE_WDT)
GET_MACRO_VALUE("${RTEcomponentFile}" RTE_Drivers_WIFI ENABLE_WIFI)
GET_MACRO_VALUE("${RTEcomponentFile}" RTE_Drivers_DMA ENABLE_DMA)
GET_MACRO_VALUE("${RTEcomponentFile}" RTE_Drivers_I2C ENABLE_I2C)
```
 - Based on variable *for example* **ENABLE_I2C** is Boolean type and based on this flag in **drivers_cmake /drivers.cmake** corresponding driver files should be added.

```
target_sources(${DRIVER_LIB} PRIVATE
    #MHU Driver
    ${<<BOOL:${ENABLE_MHU}>:${ALIF_ENSEMBLE_DRIVERS_SRC_DIR}/mhu_driver.c>
    ${<<BOOL:${ENABLE_MHU}>:${ALIF_ENSEMBLE_DRIVERS_SRC_DIR}/mhu_receiver.c>
    ${<<BOOL:${ENABLE_MHU}>:${ALIF_ENSEMBLE_DRIVERS_SRC_DIR}/mhu_sender.c>

    #Pin Config
    ${<<BOOL:${ENABLE_PIN_CONF}>:${ALIF_ENSEMBLE_DRIVERS_SRC_DIR}/pinconf.c>

    #UART Driver
    ${<<BOOL:${ENABLE_USART}>:${ALIF_ENSEMBLE_DRIVERS_SRC_DIR}/uart.c>
    ${<<BOOL:${ENABLE_USART}>:${ALIF_CMSIS_DRIVER_SRC_DIR}/Driver_USART.c>

    #GPIO Driver
    ${<<BOOL:${ENABLE_GPIO}>:${ALIF_CMSIS_DRIVER_SRC_DIR}/Driver_GPIO.c>
```