Introduction to Multicore RTOS-based Application Development

DAY 4 : Toolchain Setup for Dual Core MCU’s

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Webinar Logistics

- Turn on your system sound to hear the streaming presentation.
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- Participate in ‘Group Chat’ by maximizing the chat widget in your dock.
- Submit questions for the lecturer using the Q&A widget. They will follow-up after the lecture portion concludes.

Course Sessions

- Multicore Application Architecture Design
- A Quick Review of RTOS Fundamentals
- Digging into the Dual-Core STM32H7 MCU's
- Toolchain Setup for Dual Core MCU's
- Writing Multicore Microcontroller Applications

The Toolchain

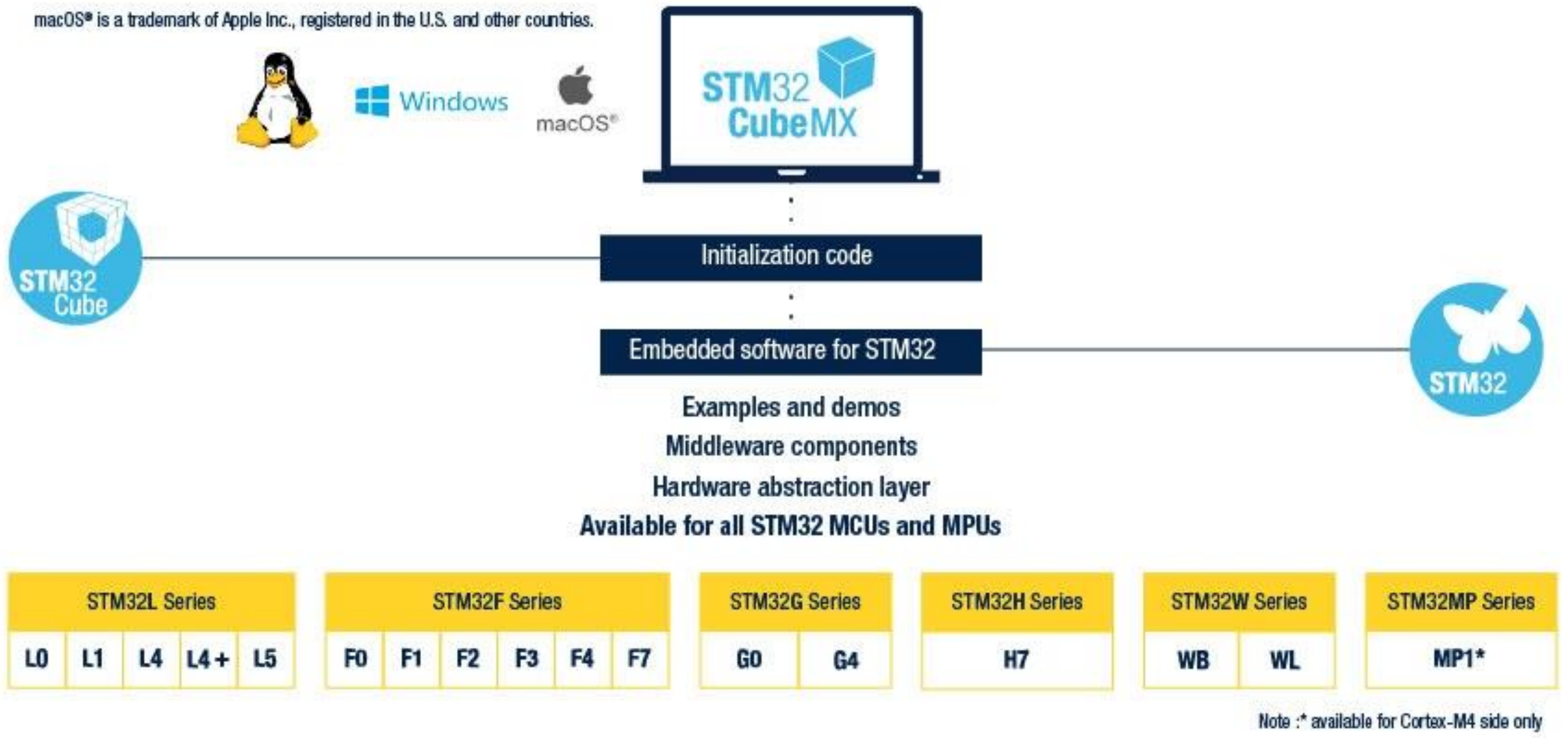


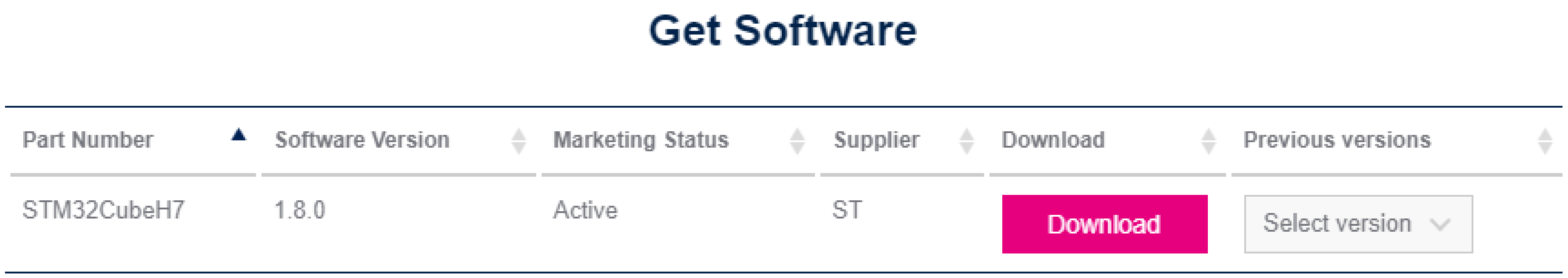
Image Source: ST Microelectronics

What toolchain do you typically use for development?

- IAR
- Keil
- STM32CubeIDE
- Eclipse
- Other

Downloading the Software Package

URL: https://www.st.com/en/embedded-software/stm32cubeh7.html#get-software



Get Software

Part Number	Software Version	Marketing Status	Supplier	Download	Previous versions
STM32CubeH7	1.8.0	Active	ST	Download	Select version

Note: The package is over 1 GB and may take 10 – 15 minutes to download!

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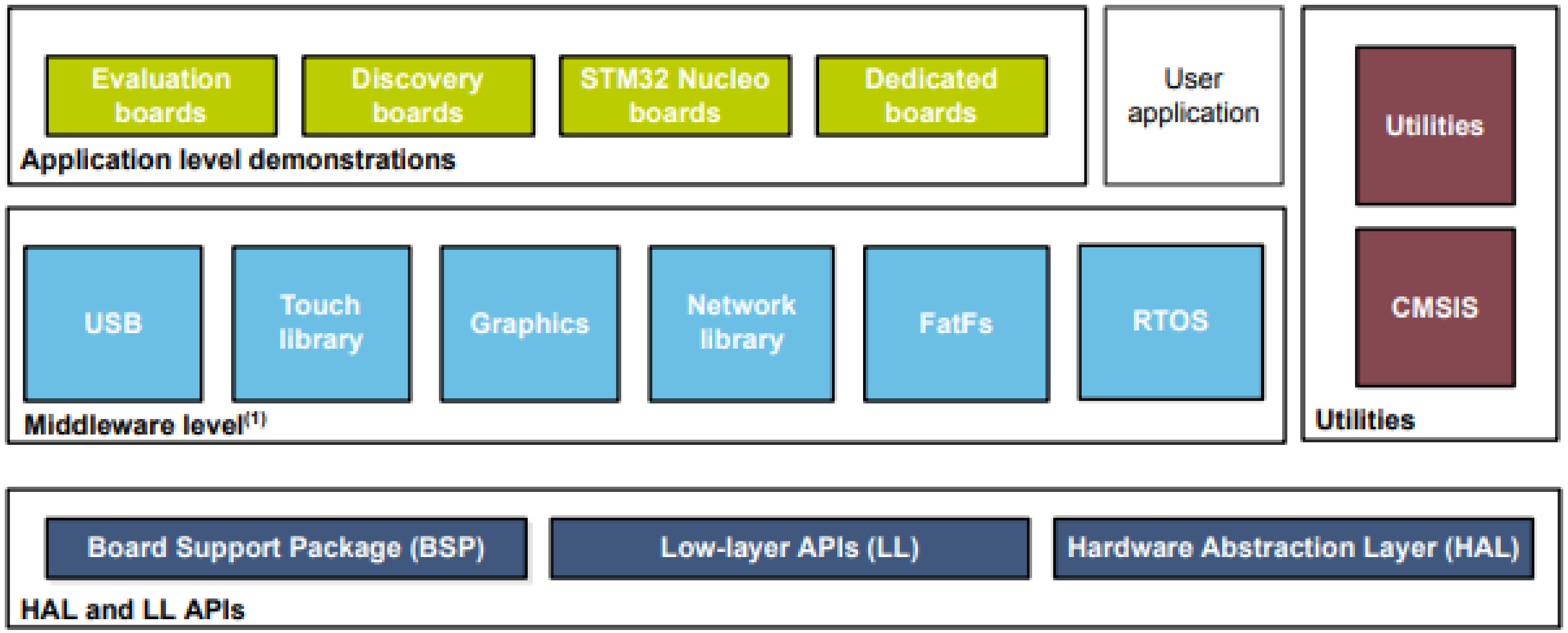
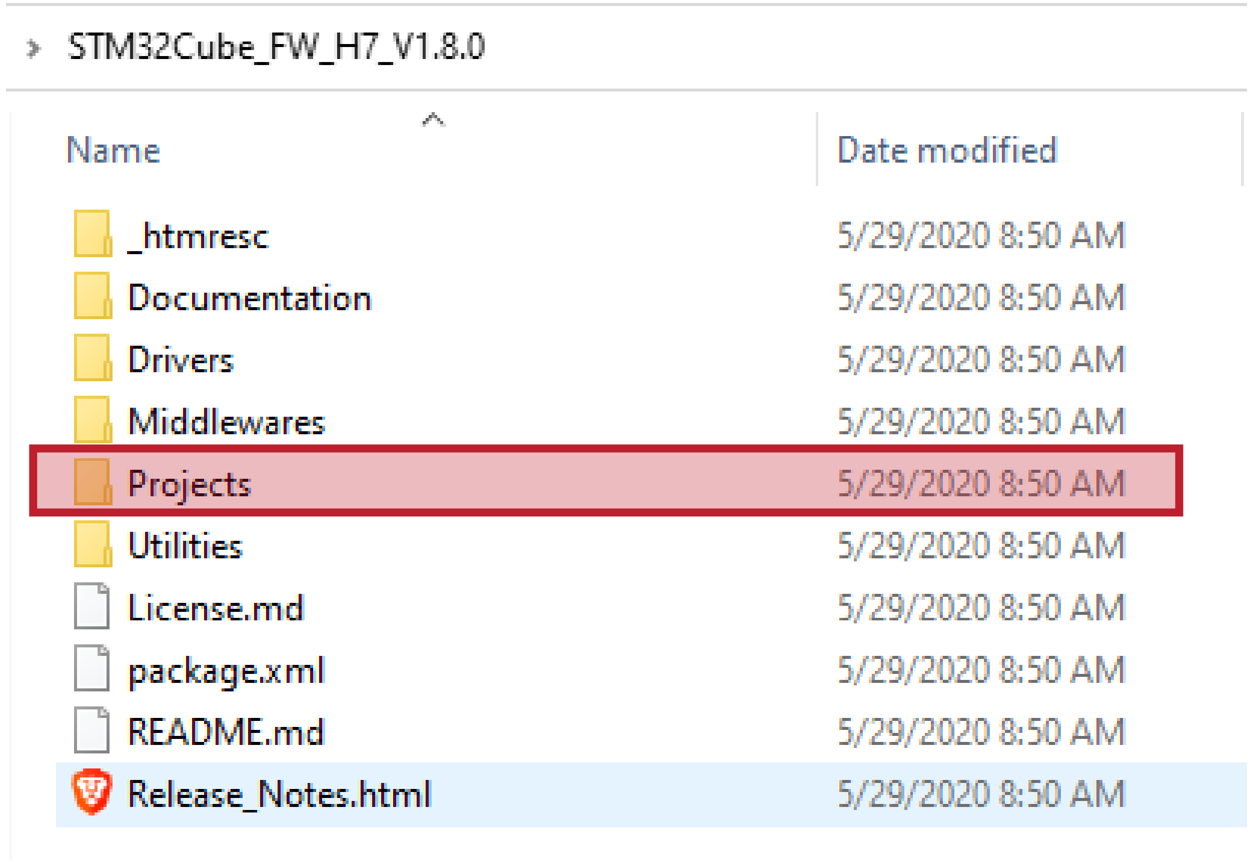
STM32CubeH7 MCU Package Overview



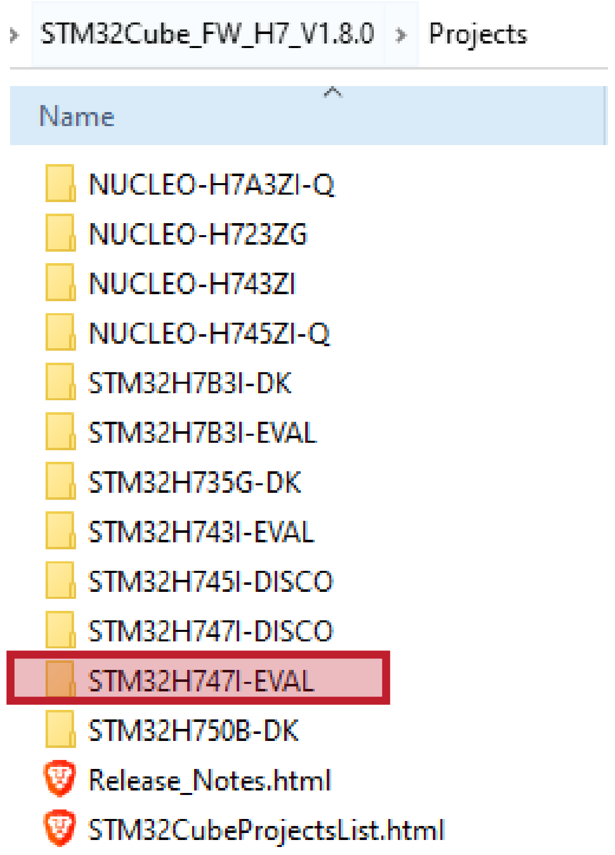
Source: STM

STM32CubeH7 MCU Package Overview



› STM32Cube_FW_H7_V1.8.0

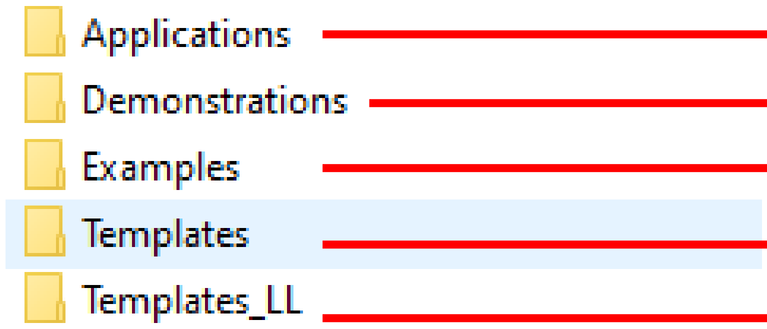
Name	Date modified
_htmresc	5/29/2020 8:50 AM
Documentation	5/29/2020 8:50 AM
Drivers	5/29/2020 8:50 AM
Middlewares	5/29/2020 8:50 AM
Projects	5/29/2020 8:50 AM
Utilities	5/29/2020 8:50 AM
License.md	5/29/2020 8:50 AM
package.xml	5/29/2020 8:50 AM
README.md	5/29/2020 8:50 AM
Release_Notes.html	5/29/2020 8:50 AM



› STM32Cube_FW_H7_V1.8.0 › Projects

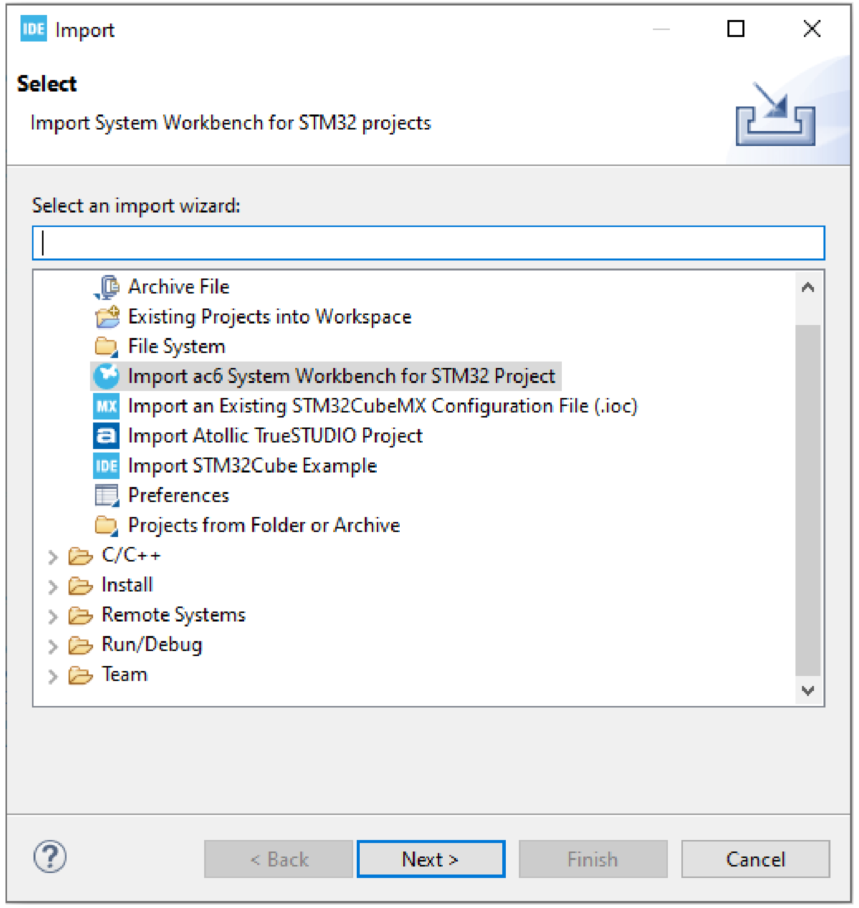
Name
NUCLEO-H7A3ZI-Q
NUCLEO-H723ZG
NUCLEO-H743ZI
NUCLEO-H745ZI-Q
STM32H7B3I-DK
STM32H7B3I-EVAL
STM32H735G-DK
STM32H743I-EVAL
STM32H745I-DISCO
STM32H747I-DISCO
STM32H747I-EVAL
STM32H750B-DK
Release_Notes.html
STM32CubeProjectsList.html

STM32CubeH7 MCU Package Overview



Applications	FreeRTOS, 3rd Party Libraries
Demonstrations	Prebuilt binary examples
Examples	Peripheral Examples
Templates	Multicore Baseline Projects
Templates_LL	Multicore Baseline Projects

Importing a Test Project



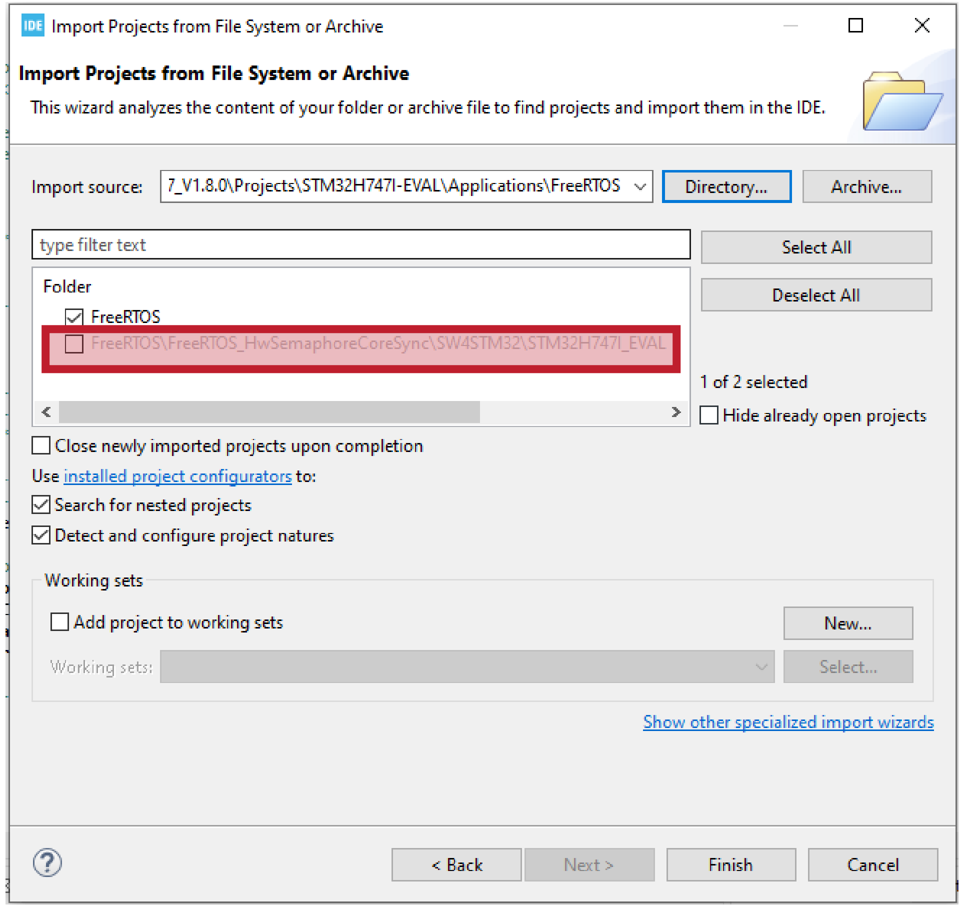
Import

Select

Import System Workbench for STM32 projects

Select an import wizard:

- Archive File
- Existing Projects into Workspace
- File System
- Import ac6 System Workbench for STM32 Project
- Import an Existing STM32CubeMX Configuration File (.ioc)
- Import Atollic TrueSTUDIO Project
- Import STM32Cube Example
- Preferences
- Projects from Folder or Archive
- C/C++
- Install
- Remote Systems
- Run/Debug
- Team



Import Projects from File System or Archive

Import Projects from File System or Archive

This wizard analyzes the content of your folder or archive file to find projects and import them in the IDE.

Import source: 7_V1.8.0\Projects\STM32H747I-EVAL\Applications\FreeRTOS

type filter text

Folder
- [✓] FreeRTOS
- [ ] FreeRTOS\FreeRTOS_HwSemaphoreCoreSync\SW4STM32\STM32H747I_EVAL

1 of 2 selected

- [ ] Hide already open projects
- [ ] Close newly imported projects upon completion

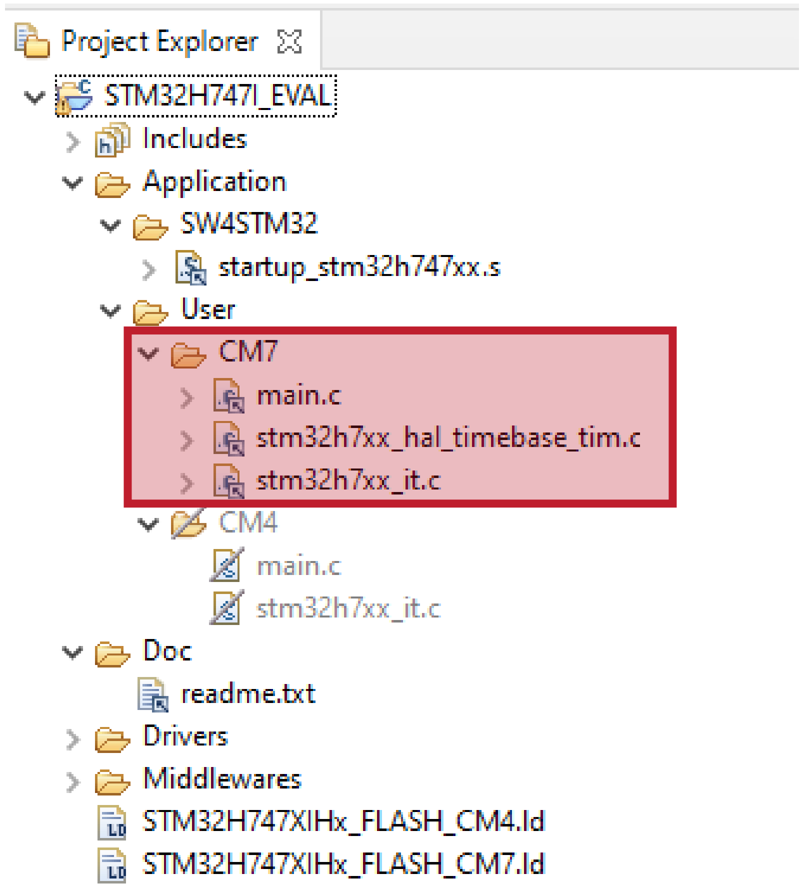
Use installed project configurators to:
- [✓] Search for nested projects
- [✓] Detect and configure project natures

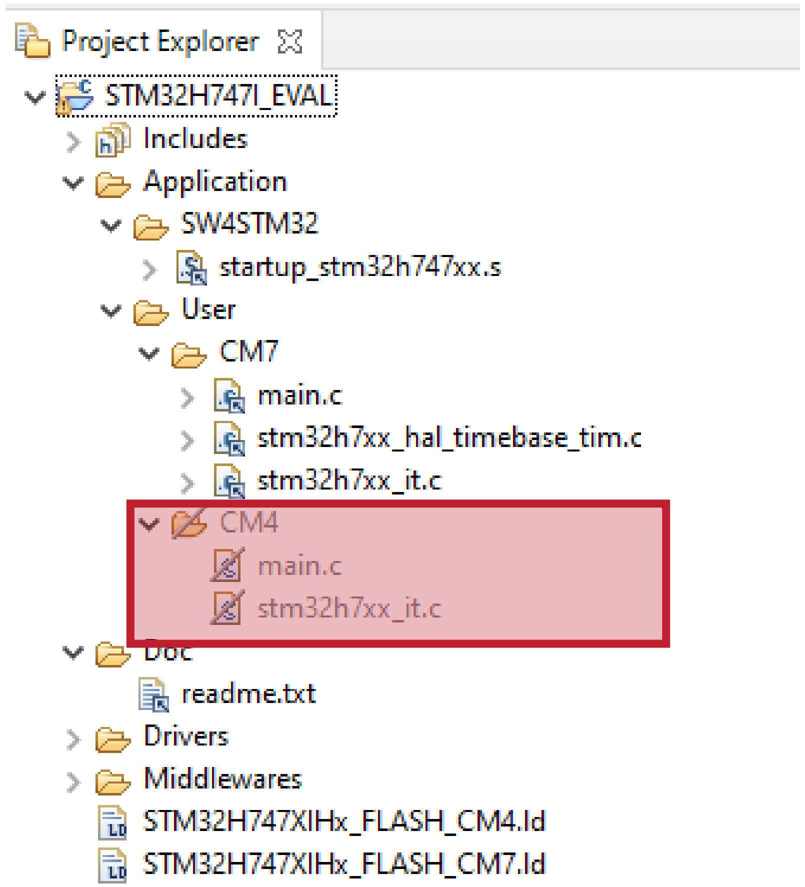
Working sets
- [ ] Add project to working sets

Working sets:

Show other specialized import wizards

Exploring a Multicore Project


Project Explorer
- STM32H747I_EVAL
  - Includes
  - Application
    - SW4STM32
      - startup_stm32h747xx.s
    - User
      - CM7
        - main.c
        - stm32h7xx_hal_timebase_tim.c
        - stm32h7xx_it.c
      - CM4
        - main.c
        - stm32h7xx_it.c
  - Doc
    - readme.txt
  - Drivers
  - Middlewares
  - STM32H747XIHx_FLASH_CM4.ld
  - STM32H747XIHx_FLASH_CM7.ld


Project Explorer
- STM32H747I_EVAL
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      - startup_stm32h747xx.s
    - User
      - CM7
        - main.c
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  - Doc
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  - Drivers
  - Middlewares
  - STM32H747XIHx_FLASH_CM4.ld
  - STM32H747XIHx_FLASH_CM7.ld

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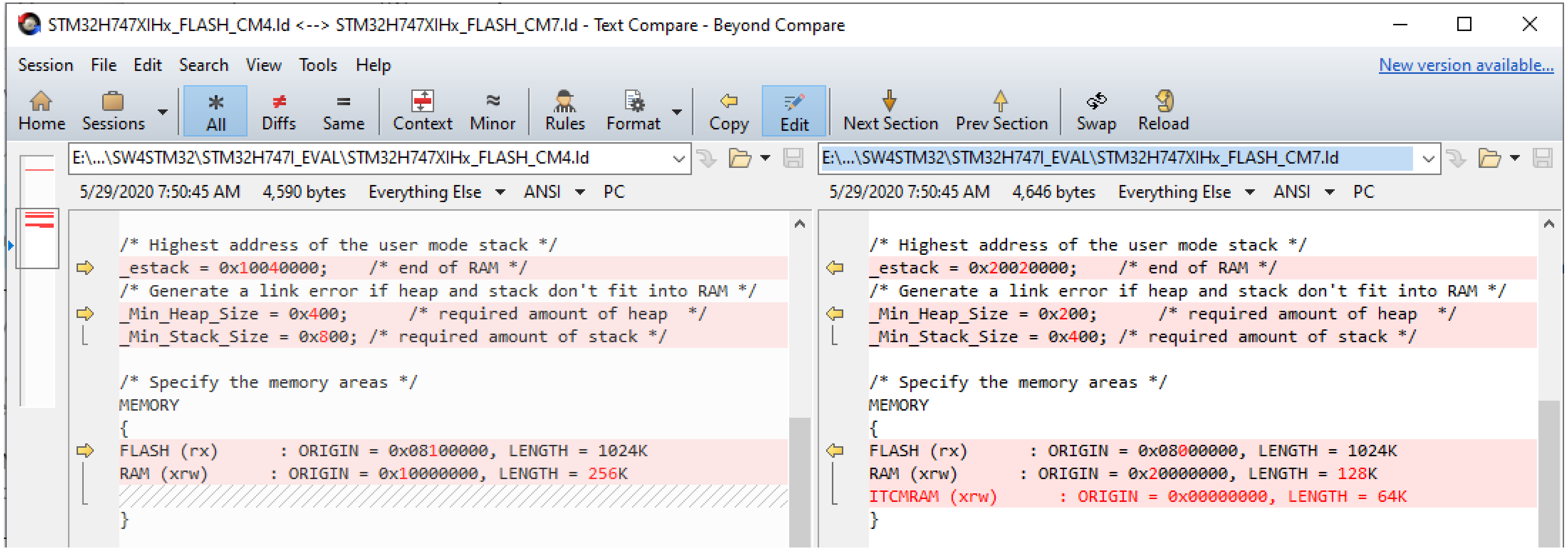
Exploring a Multicore Project


STM32H747XIHx_FLASH_CM4.ld <--> STM32H747XIHx_FLASH_CM7.ld - Text Compare - Beyond Compare
Session File Edit Search View Tools Help
New version available...
Home Sessions All Diffs Same Context Minor Rules Format Copy Edit Next Section Prev Section Swap Reload

E:\...\SW4STM32\STM32H747I_EVAL\STM32H747XIHx_FLASH_CM4.ld
5/29/2020 7:50:45 AM 4,590 bytes Everything Else ANSI PC

```
/* Highest address of the user mode stack */
_estack = 0x10040000;    /* end of RAM */
/* Generate a link error if heap and stack don't fit into RAM */
_Min_Heap_Size = 0x400;      /* required amount of heap  */
_Min_Stack_Size = 0x800; /* required amount of stack */

/* Specify the memory areas */
MEMORY
{
FLASH (rx)      : ORIGIN = 0x08100000, LENGTH = 1024K
RAM (xrw)      : ORIGIN = 0x10000000, LENGTH = 256K

}
```

E:\...\SW4STM32\STM32H747I_EVAL\STM32H747XIHx_FLASH_CM7.ld
5/29/2020 7:50:45 AM 4,646 bytes Everything Else ANSI PC

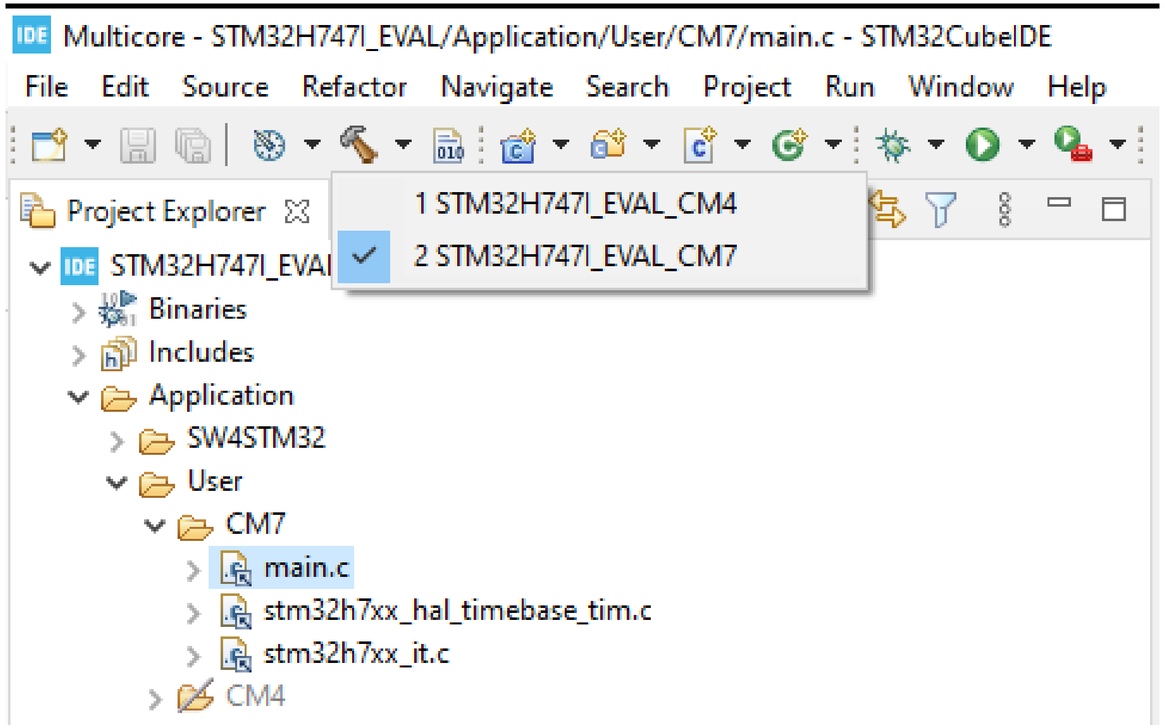
```
/* Highest address of the user mode stack */
_estack = 0x20020000;    /* end of RAM */
/* Generate a link error if heap and stack don't fit into RAM */
_Min_Heap_Size = 0x200;      /* required amount of heap  */
_Min_Stack_Size = 0x400; /* required amount of stack */

/* Specify the memory areas */
MEMORY
{
FLASH (rx)      : ORIGIN = 0x08000000, LENGTH = 1024K
RAM (xrw)      : ORIGIN = 0x20000000, LENGTH = 128K
ITCMRAM (xrw)      : ORIGIN = 0x00000000, LENGTH = 64K
}
```

What procedure can you follow if an imported project doesn’t build?

- Create a new project and copy the contents over
- Try to import as an STM32 or ac6 project
- Copy a dual core template project
- All the above
- None of the above

Building a Multicore Project


Multicore - STM32H747I_EVAL/Application/User/CM7/main.c - STM32CubeIDE

Multiple Projects to Build

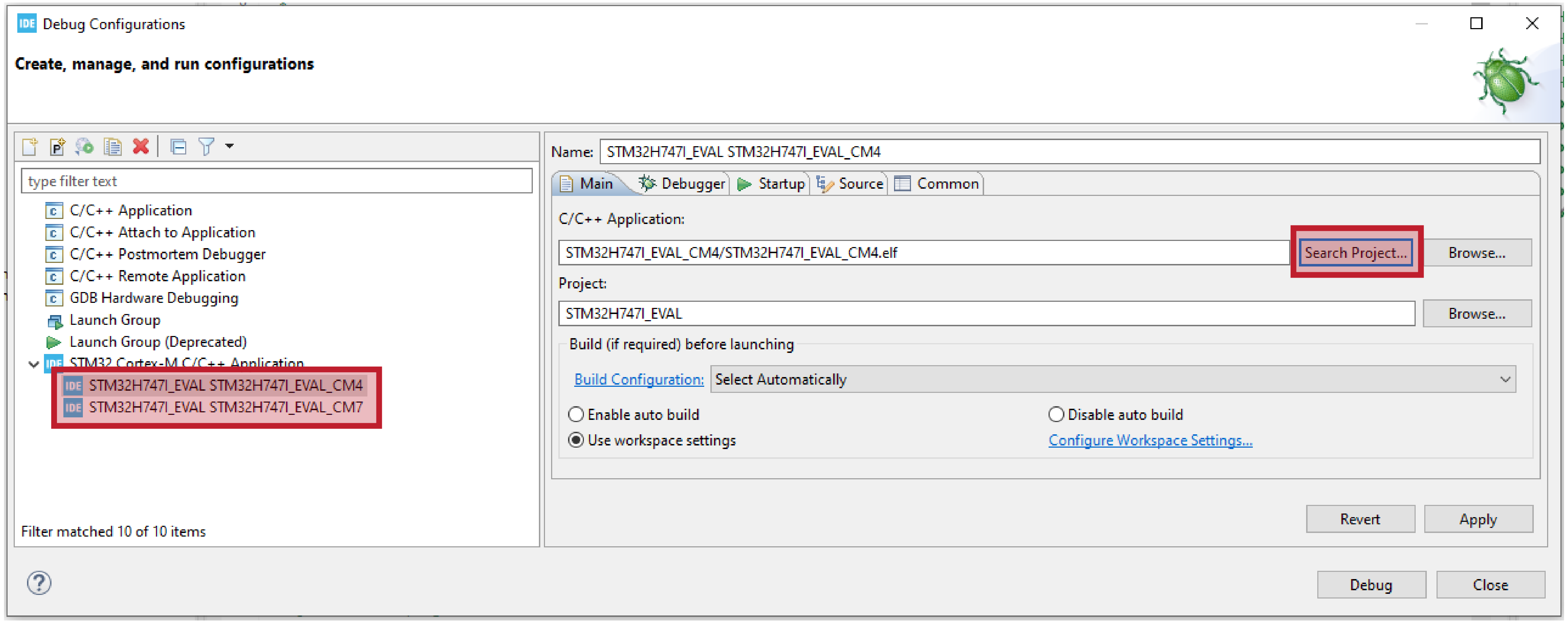
```
Finished building target: STM32H747I_EVAL_CM4.elf

arm-none-eabi-size   STM32H747I_EVAL_CM4.elf
   text    data     bss     dec     hex filename
  14412      84    5556   20052    4e54 STM32H747I_EVAL_CM4.elf
Finished building: default.size.stdout


arm-none-eabi-size   STM32H747I_EVAL_CM7.elf
   text    data     bss     dec     hex filename
  15144      84    4092   19320    4b78 STM32H747I_EVAL_CM7.elf
Finished building: default.size.stdout
```

Multiple Cores to Debug

Debugging A Multicore Project


Debug Configurations

Create, manage, and run configurations

type filter text

- C/C++ Application
- C/C++ Attach to Application
- C/C++ Postmortem Debugger
- C/C++ Remote Application
- GDB Hardware Debugging
- Launch Group
- Launch Group (Deprecated)
- STM32 Cortex-M C/C++ Application
  - STM32H747I_EVAL STM32H747I_EVAL_CM4
  - STM32H747I_EVAL STM32H747I_EVAL_CM7

Filter matched 10 of 10 items

Name: STM32H747I_EVAL STM32H747I_EVAL_CM4

Main | Debugger | Startup | Source | Common

C/C++ Application: STM32H747I_EVAL_CM4/STM32H747I_EVAL_CM4.elf [Search Project...] [Browse...]

Project: STM32H747I_EVAL [Browse...]

Build (if required) before launching

Build Configuration: Select Automatically

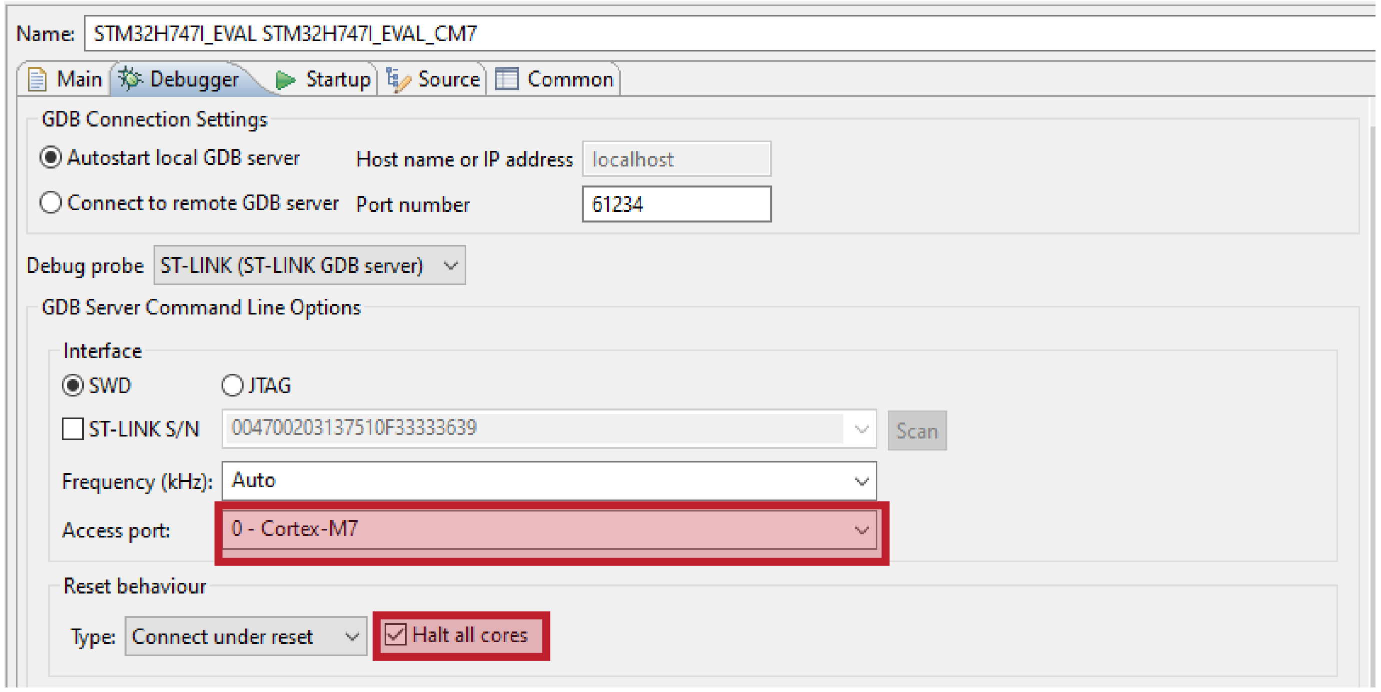
Enable auto build — Disable auto build

[✓ Use workspace settings] — Configure Workspace Settings...

Revert Apply

Debug Close

Debugging a Multicore Project



Name: STM32H747I_EVAL STM32H747I_EVAL_CM7

GDB Connection Settings

(● Autostart local GDB server) ○ Connect to remote GDB server

Host name or IP address: localhost

Port number: 61234

Debug probe: ST-LINK (ST-LINK GDB server)

GDB Server Command Line Options

Interface

(● SWD) ○ JTAG

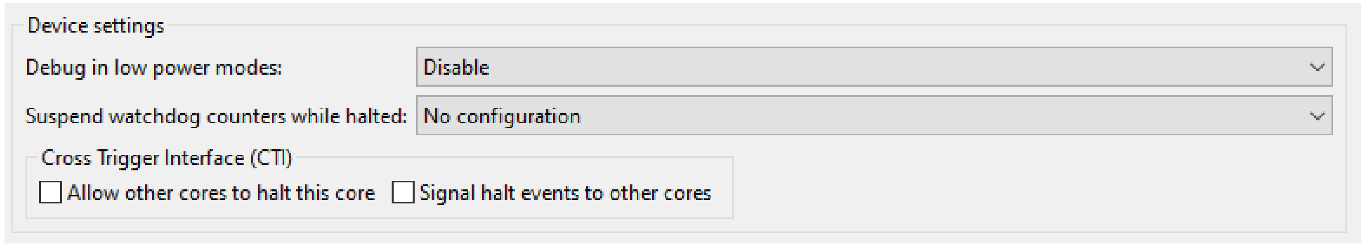
☐ ST-LINK S/N: 004700203137510F33333639 Scan

Frequency (kHz): Auto

Access port: 0 - Cortex-M7

Reset behaviour

Type: Connect under reset ☑ Halt all cores



Device settings

Debug in low power modes: Disable

Suspend watchdog counters while halted: No configuration

Cross Trigger Interface (CTI)

☐ Allow other cores to halt this core ☐ Signal halt events to other cores

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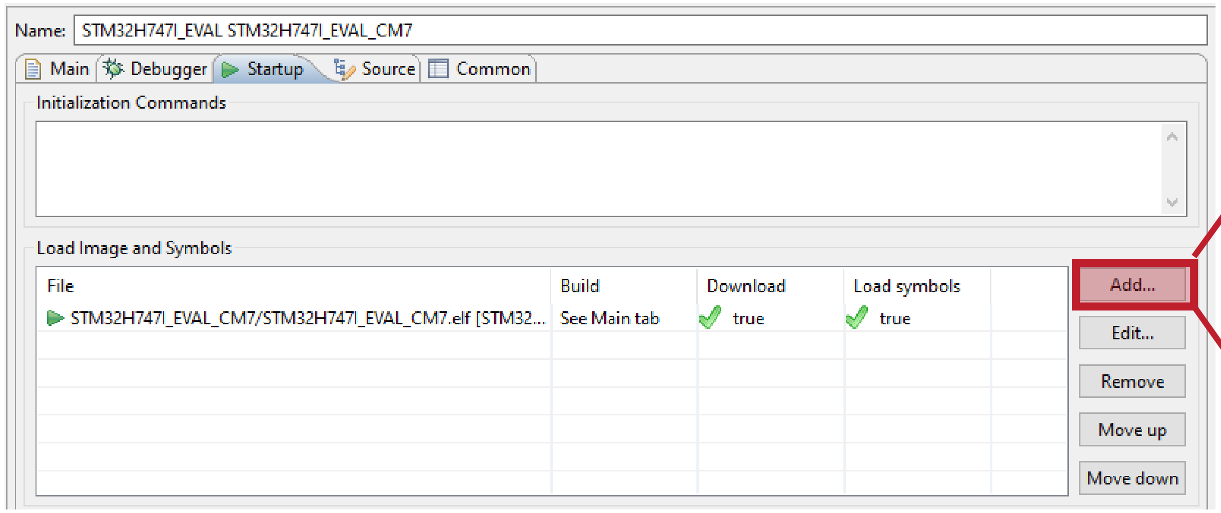
Debugging a Multicore Project

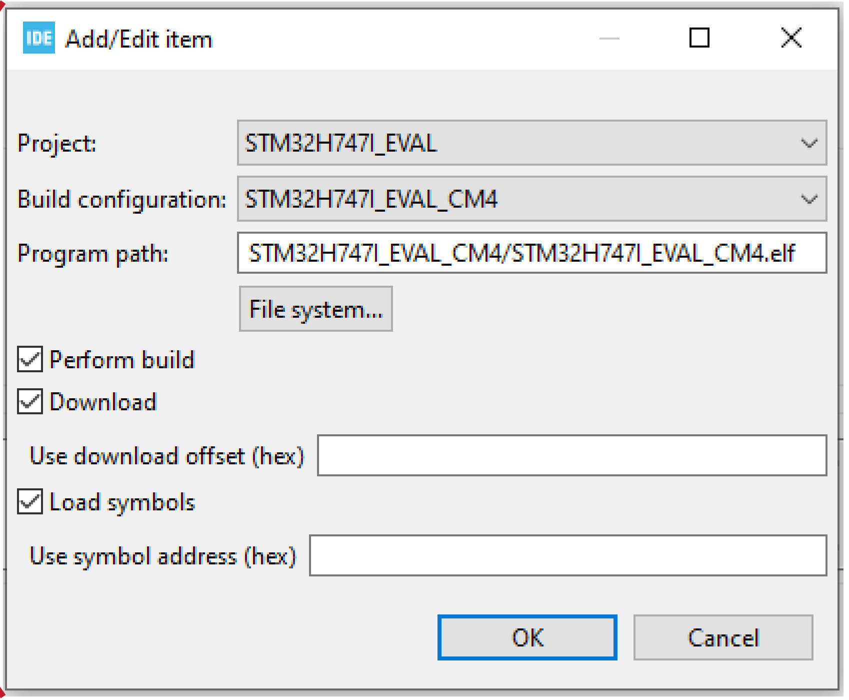


Name: STM32H747I_EVAL STM32H747I_EVAL_CM7

Initialization Commands

Load Image and Symbols

File	Build	Download	Load symbols
STM32H747I_EVAL_CM7/STM32H747I_EVAL_CM7.elf [STM32...	See Main tab	✓ true	✓ true



Add/Edit item

Project: STM32H747I_EVAL

Build configuration: STM32H747I_EVAL_CM4

Program path: STM32H747I_EVAL_CM4/STM32H747I_EVAL_CM4.elf

[✓] Perform build

[✓] Download

Use download offset (hex)

[✓] Load symbols

Use symbol address (hex)

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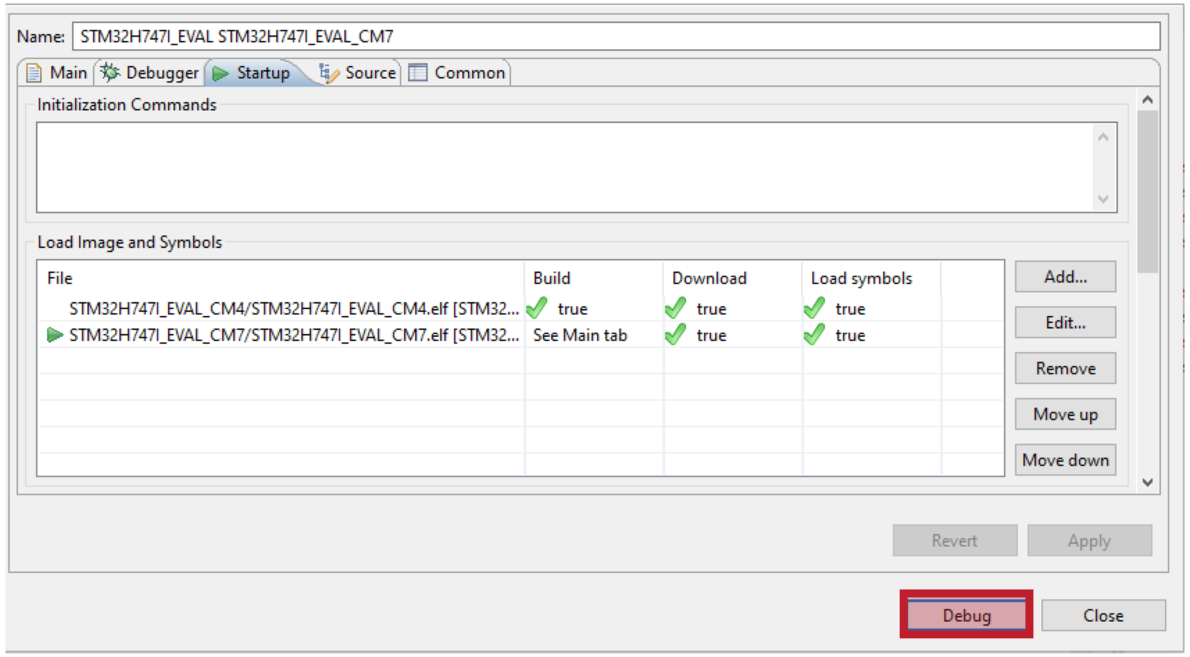
Debugging a Multicore Project



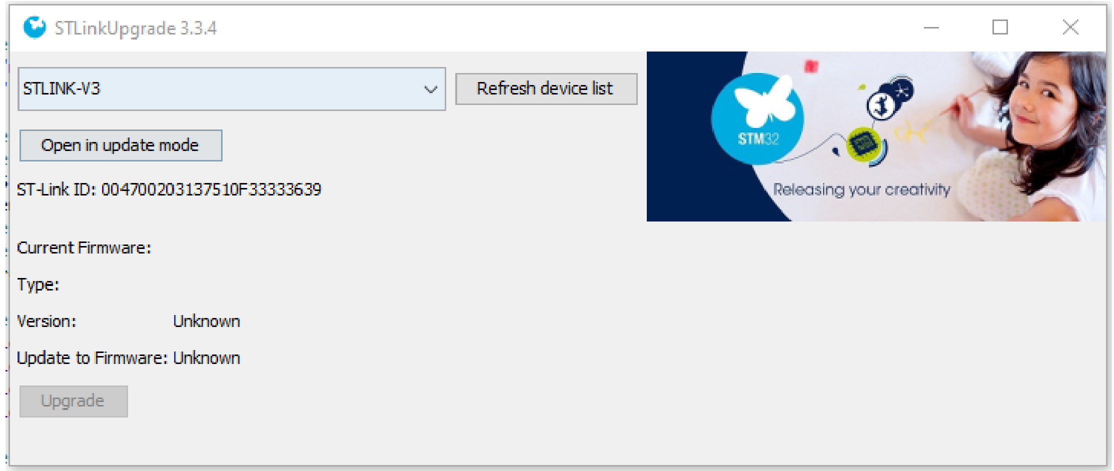
Name: STM32H747I_EVAL STM32H747I_EVAL_CM7

Main | Debugger | Startup | Source | Common

Initialization Commands

Load Image and Symbols

File	Build	Download	Load symbols
STM32H747I_EVAL_CM4/STM32H747I_EVAL_CM4.elf [STM32...	✓ true	✓ true	✓ true
▶ STM32H747I_EVAL_CM7/STM32H747I_EVAL_CM7.elf [STM32...	See Main tab	✓ true	✓ true



STLinkUpgrade 3.3.4

STLINK-V3

ST-Link ID: 004700203137510F33333639

Current Firmware:

Type:

Version: Unknown

Update to Firmware: Unknown

What do you see as the biggest challenge to debugging multicore applications?
- Access to a single core
- Real-time synchronization
- Debugger Setup
- Other

Thank you for attending

Please consider the resources below:

- www.beningo.com
    - Blog, White Papers, Courses
    - Embedded Bytes Newsletter
        - http://bit.ly/1BAHYXm

From www.beningo.com under

- Blog > CEC – Introduction to Multicore RTOS-based Application Development

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