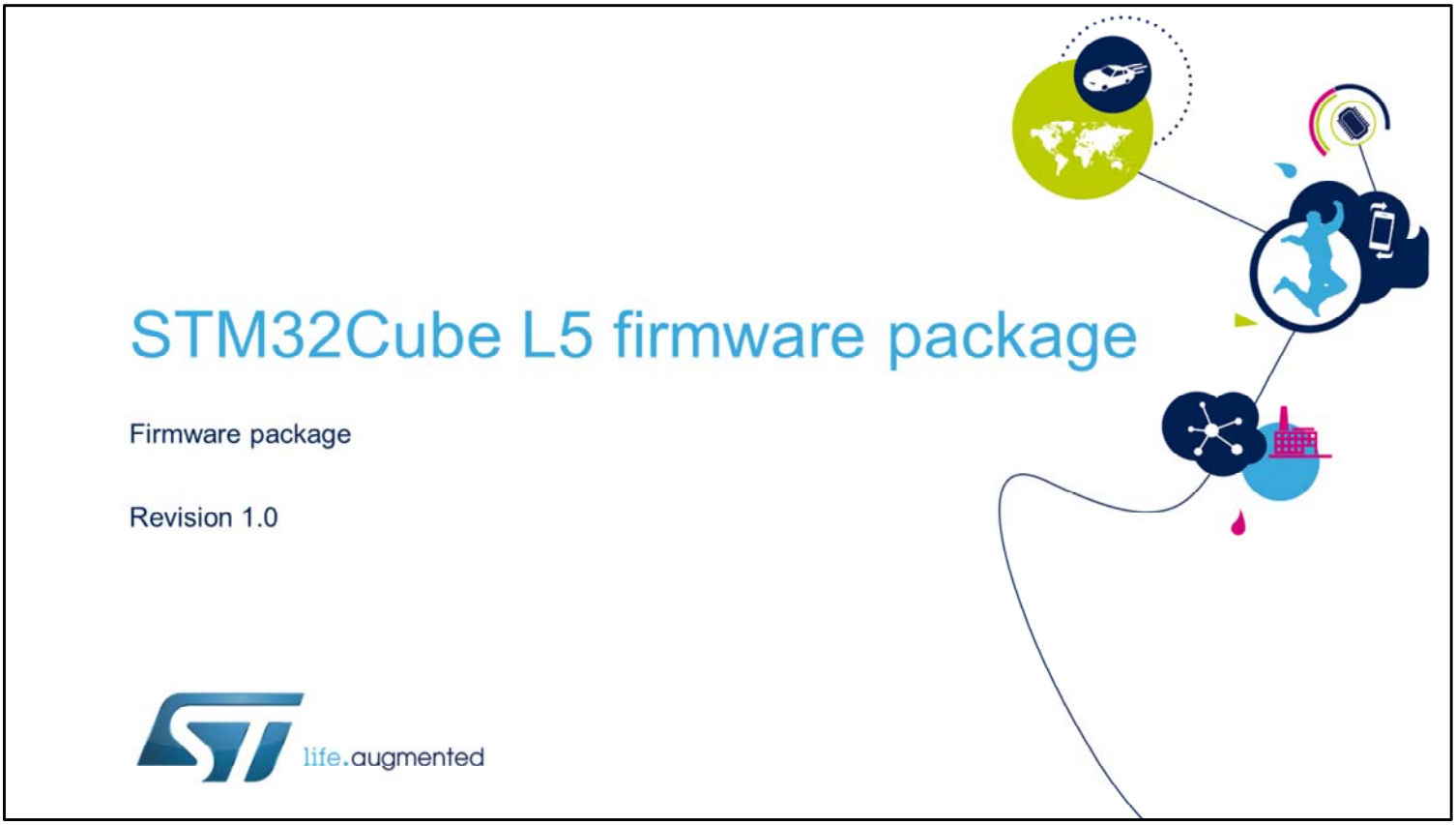
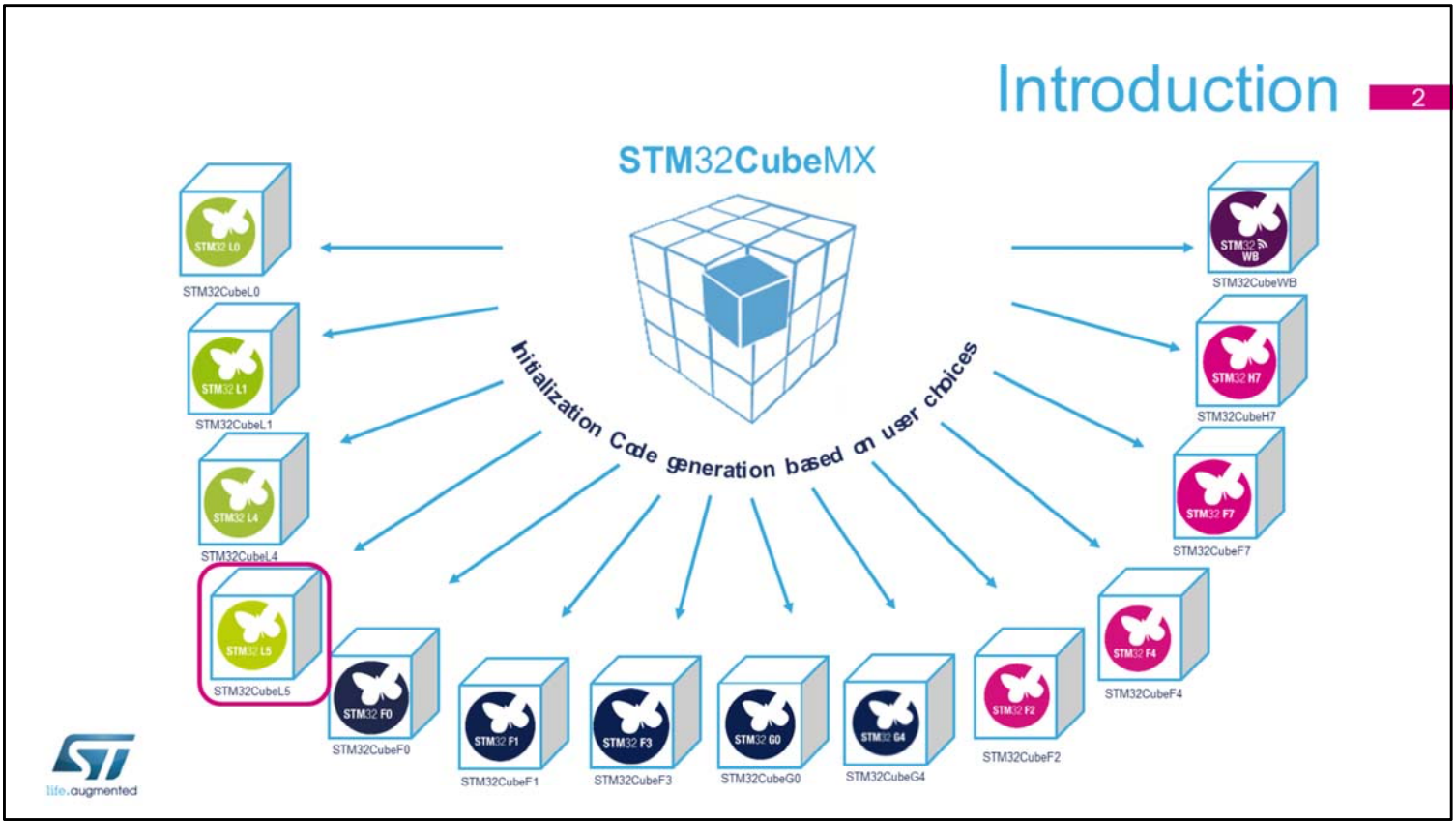
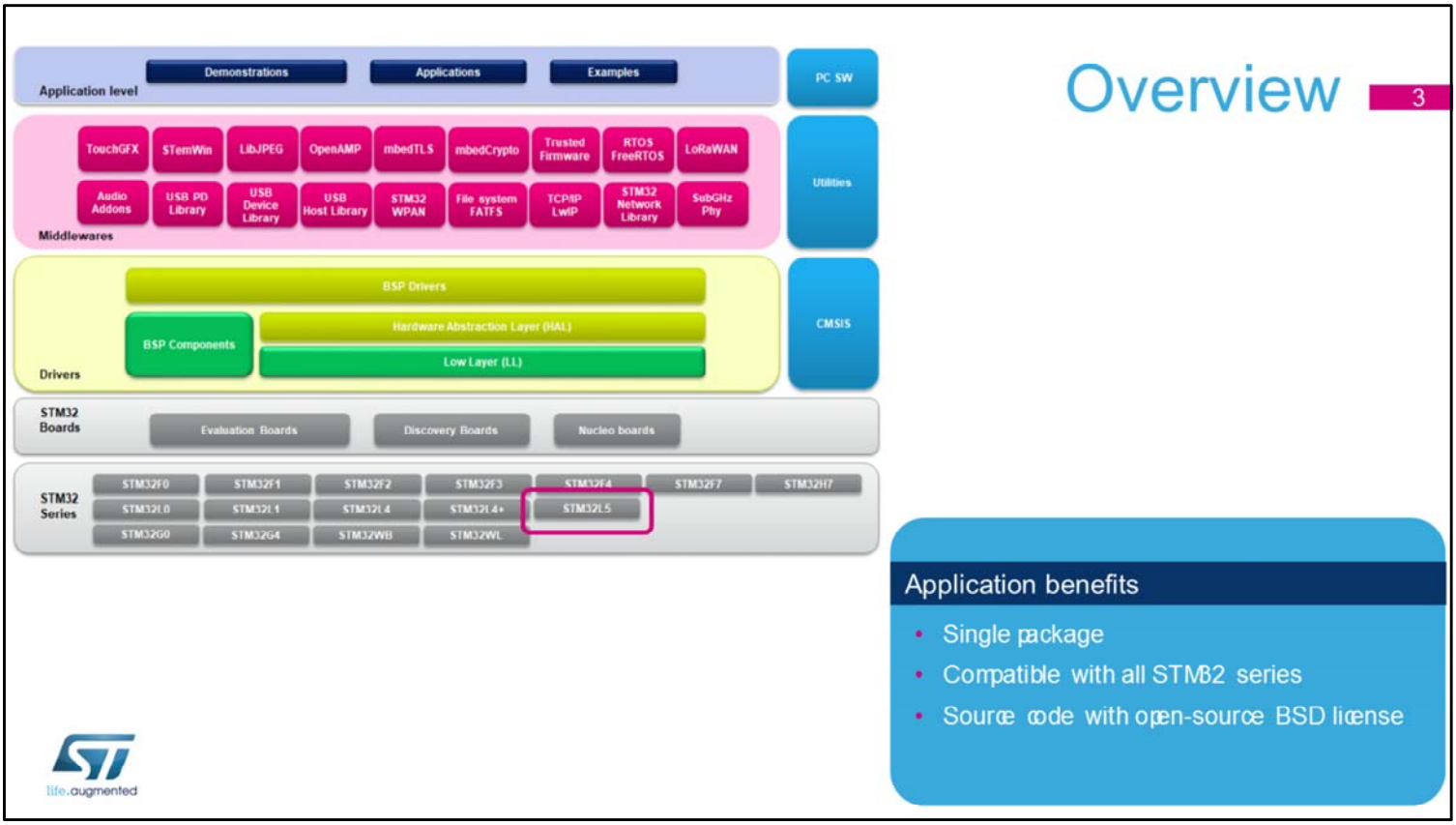


Hello, and welcome to this presentation of the STM32Cube firmware drivers including the hardware abstraction layer drivers.



While this presentation is specifically about the STM32L5, the STM32Cube comprehensive software tool offers:

- STM32CubeMX graphical software configuration tool used to generate initialization code based on user choices
- A complete embedded software package for each STM32 series (such as our STM32CubeL5) with:
  - Hardware Abstraction Layer (HAL) and low-layer (LL) APIs
  - A consistent set of middleware components: RTOS, USB, Trusted Firmware, File System, USB Power Delivery, …



The embedded software package is a layered approach:

- Low level : Hardware Abstraction Layer (HAL) and Low Layer (LL) drivers with examples
- Middleware level: Set of libraries with examples including RTOS, USB Device, USB Power Delivery, Trusted Firmware, …
- Application level: Demonstrations for use on ST boards

Embedded software is delivered by series (STM32L5, STM32L4, STM32WB, STM32G0, STM32H7, …) and common modules are covered with fully portable APIs.

Embedded software initialization code can be generated through STM32CubeMX allowing customers to remain focused on the core application code.

Key features

Layer	Category	Provided embedded software	Provided examples
HAL/LL	Analog	Analog/Digital conversion, Comparators, Operational Amplifier,	~280 examples on STM32L5 boards with/without TrustZone-M enabled in the system !
	Cryptography	CRC, AES, PKA, HASH, Random Number generator, On-The-Fly Decryption and Encryption engine	
	Connectivity	I2C, USART, SPI, USB, CAN-FD	
	Interface	External memory (FMC, OctoSPI), TSC, Serial audio, ...	
	Security	Global TrustZone Controler	
	System	Flash, RAM, IO, DMA, Clock, Power (low power modes), Instruction cache	
	Timers	Timers, RTC, Watchdogs, ...	
Middleware	RTOS	FreeRTOS open source RTOS with CMSIS-RTOS V2 wrapper	~48 applications on STM32L5 boards with/without TrustZone-M enabled in the system !
	USB	USB Device core Device classes: HID, MSC, CDC, Audio, MTP, DFU, and CCID	
	USB-PD	USB Power Delivery	
	Trusted Firmware	Trusted Firmware-M (with Arm MbedTLS and MbedCrypto)	
	TSC	Touch Sensing controler	
	File System	FatFS open-source file system	
Application	Demonstration	Full demonstrations for ST boards: Audio, Power measurements, AI, BlueNRG connection to Android/iOS ST BLE Sensor application	1 demonstration project per ST boards!

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The STM32Cube package is a complete embedded software offer that ensures maximum portability between all STM32 series through 3 software layers: HAL/LL, Middlewares and Applications.
The HAL/LL Layer is providing an API for the STM32 embedded peripherals from analog to connectivity and cryptography to security categories.
A rich set of examples is available to help developers start using the HAL and LL on the product.

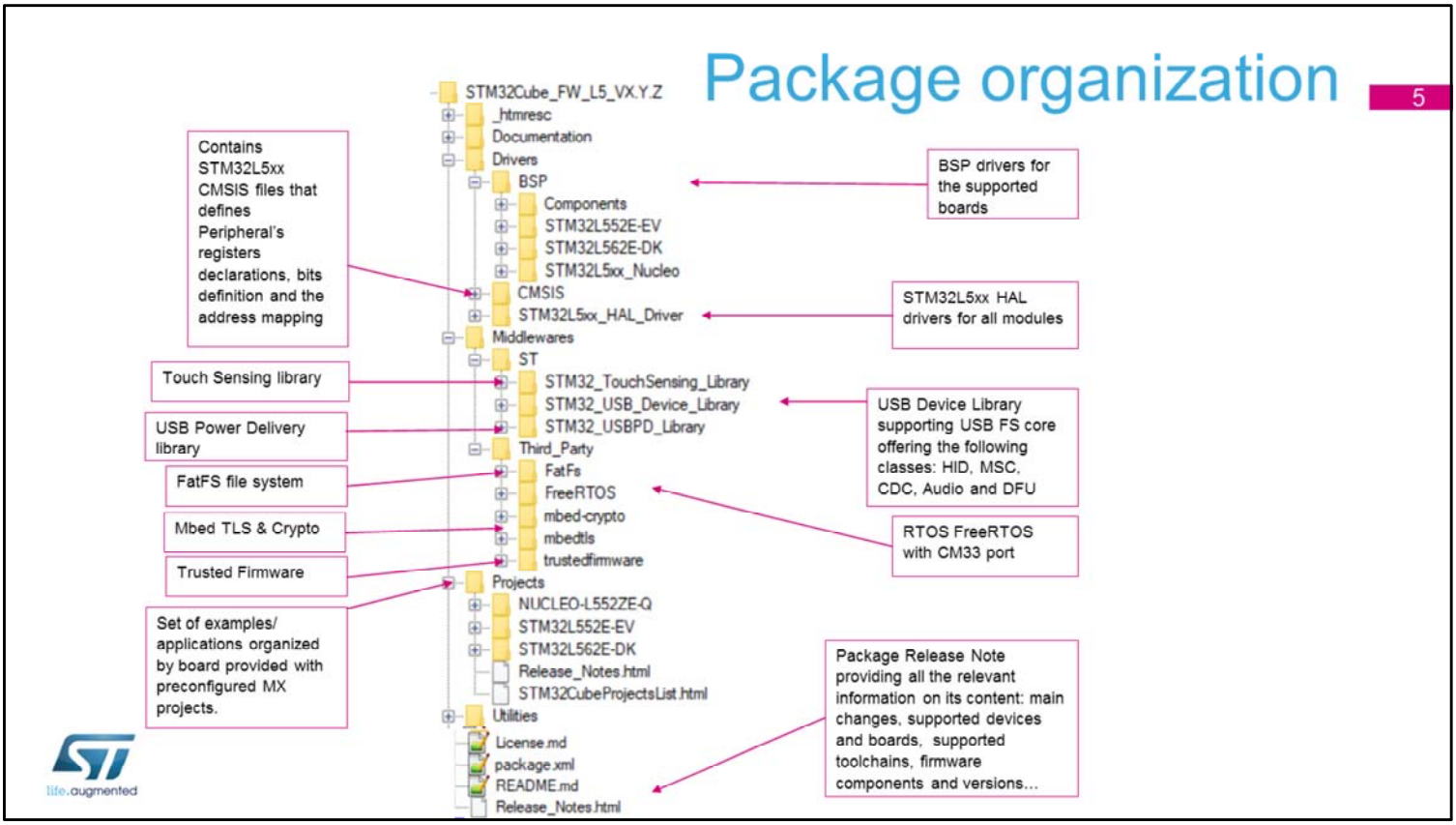
The middleware layer for STM32CubeL5 contains :

- CMSIS-RTOS implementation with FreeRTOS™ open source solution
- Full USB Device stack supporting the following device classes: HID, MSC, CDC, Audio, DFU, LPM, BCD
- USB Power Delivery library
- Arm Trusted Firmware-M (TF-M) integration solution
- Mbed TLS and Mbed Crypto libraries

- FAT file system based on open source FatFS solution
- STMTouch touch sensing library solution.

Advanced demos putting together all the embedded software components are also provided in the STM32CubeL5 package.
There is a complete set of documents including release notes, readme files or associated user manual.

The packages come with free and user-friendly license terms.



Like all STM32Cube firmware packages, the STM32CubeL5 firmware solution comes in a single ZIP file having the structure shown in this slide.

It's organized in several main folders:

- The Documentation folder contains the STM32Cube L5 getting starting document, helping developers to quickly become familiar with the firmware package and its contents.
- The Drivers folder contains all the ST-developed drivers.
    - CMSIS contains the files defining STM32L5xx supported devices, peripheral registers declarations, their associated bit definitions and address mapping.
    - STM32L5xx_HAL_Driver folder contains the drivers for all the peripherals.
    - The drivers for all supported boards are found in the BSP folder.

- Middleware contains the supported middleware libraries and stacks provided either by ST or third parties.
- The Projects folder contains templates, examples, applications and demonstrations for supported boards and with preconfigured projects and specific readme files that provides all necessary information for a quick and easy execution.
- The Utilities folder contains miscellaneous utility drivers that are used by the provided projects.

The Release Note lists the contents of all the packages, tracks the main changes and provides information on the supported devices and boards and any known limitations.

Supported devices & boards

Macro defined in stm32l5xx.h	STM32L5 Series devices
STM32L552xx	STM32L552CC, STM32L552CE, STM32L552ME, STM32L552QC, STM32L552QE, STM32L552RC, STM32L552RE, STM32L552VC, STM32L552VE, STM32L552ZC, STM32L552ZE.
STM32L562xx	STM32L562CE, STM32L562ME, STM32L562QE, STM32L562RE, STM32L562VE, STM32L562ZE.

Board	Example	Application	Demonstration
NUCLEO-L552ZE-Q	173	15	1
STM32L552E-EV	50	21	1
STM32L562E-DK	67	14	1

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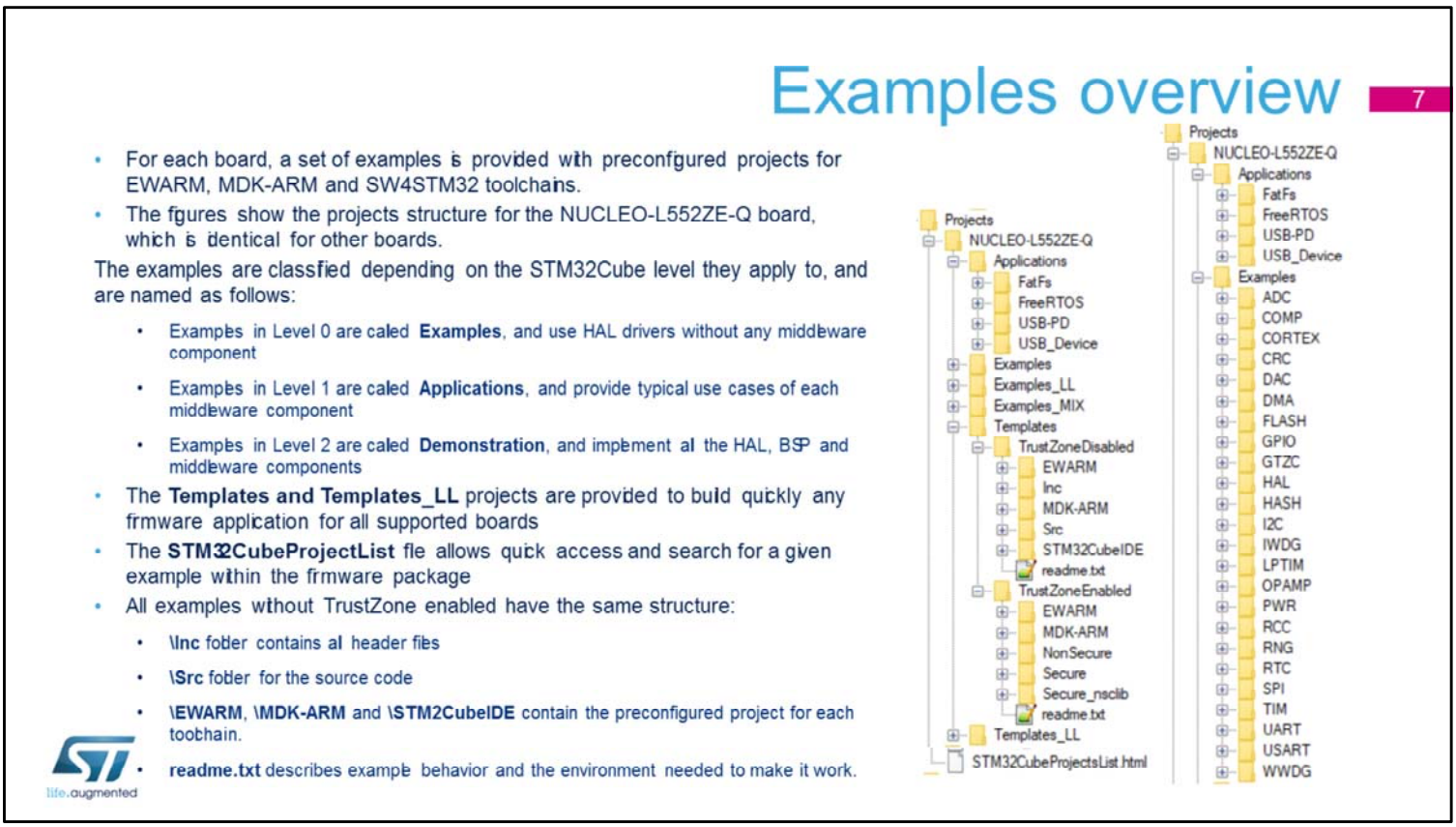
Through its generic architecture, STM32Cube offers a highly portable hardware abstraction layer (HAL). It allows developers to implement application functions by building on layers, such as the middleware layer, without requiring any in-depth knowledge of the MCU. This improves the re-usability of the library code and guarantees an easy portability to other devices.
In addition, thanks to its layered architecture, the STM32CubeL5 firmware package offers full support of all STM32L5 microcontrollers and the development boards designed by ST. The user has only to define the correct macro in the stm32l5xx.h file and get in touch with BSP drivers and example/application projects specific to each board provided within the firmware package.



For each board, a set of examples is provided with preconfigured projects for EWARM, MDK-ARM and STM32CubeIDE toolchains.

The right side figure shows the projects structure for the NUCLEO-L552ZE-Q board, which is identical for all the other boards.

The examples are classified depending on the STM32Cube level they apply to, and are named as follows:

- Examples in Level 0 are called Examples, and use HAL drivers without any middleware component.
- Examples in Level 1 are called Applications, and provide typical use cases of each middleware component.
- Examples in Level 2 are called Demonstration, and implement all the HAL, BSP and middleware components.

The Template project is provided to quickly build any firmware application for all supported boards.

The STM32CubeProjectList file allows a quick access and search for a given example within the firmware package.

All examples without TrustZone enabled in the system have the same structure as on other STM32 firmware package:

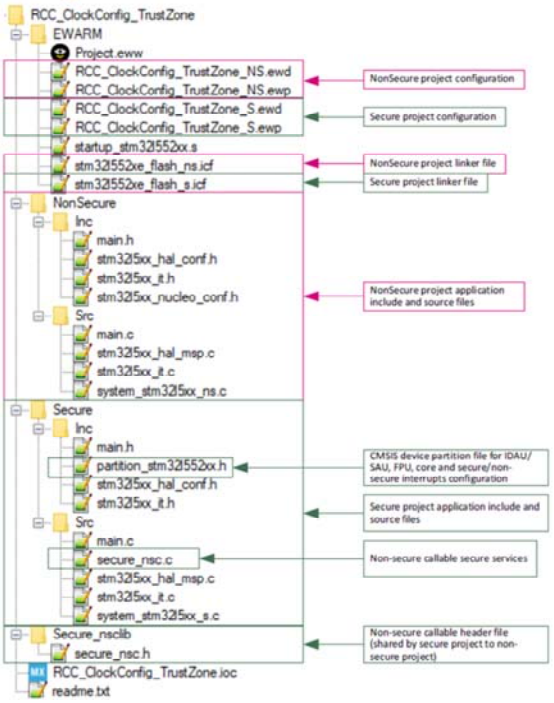
- \Inc folder contains all header files.
- \Src folder contains the sources code.
- \EWARM, \MDK-ARM and \STM32CubeIDE folders contain the preconfigured project for each toolchain.

A readme text file describes the example behavior and environment needed to make it work.

TrustZone Examples overview

- For each board, a set of examples are provided with TrustZone enabled in the system and are provided with preconfigured projects for EWARM, MDK-ARM and STM32CubeIDE toolchains.
- The TrustZone examples name ends with '_TrustZone' (except Trusted Firmware-M application)
- All TrustZone examples are provided with a multi-project structure composed of **secure** and **non-secure** sub-projects:

  Each sub-projects have the same structure:
  - **\Inc** folder contains all header files
  - **\Src** folder for the source code
  - **\EWARM**, **\MDK-ARM** and **\STM32CubeIDE** contain the preconfigured project for each toolchain.
  - **readme.txt** describes example behavior and the environment needed to make it work such as the required Flash user option bytes linked to TrustZone.

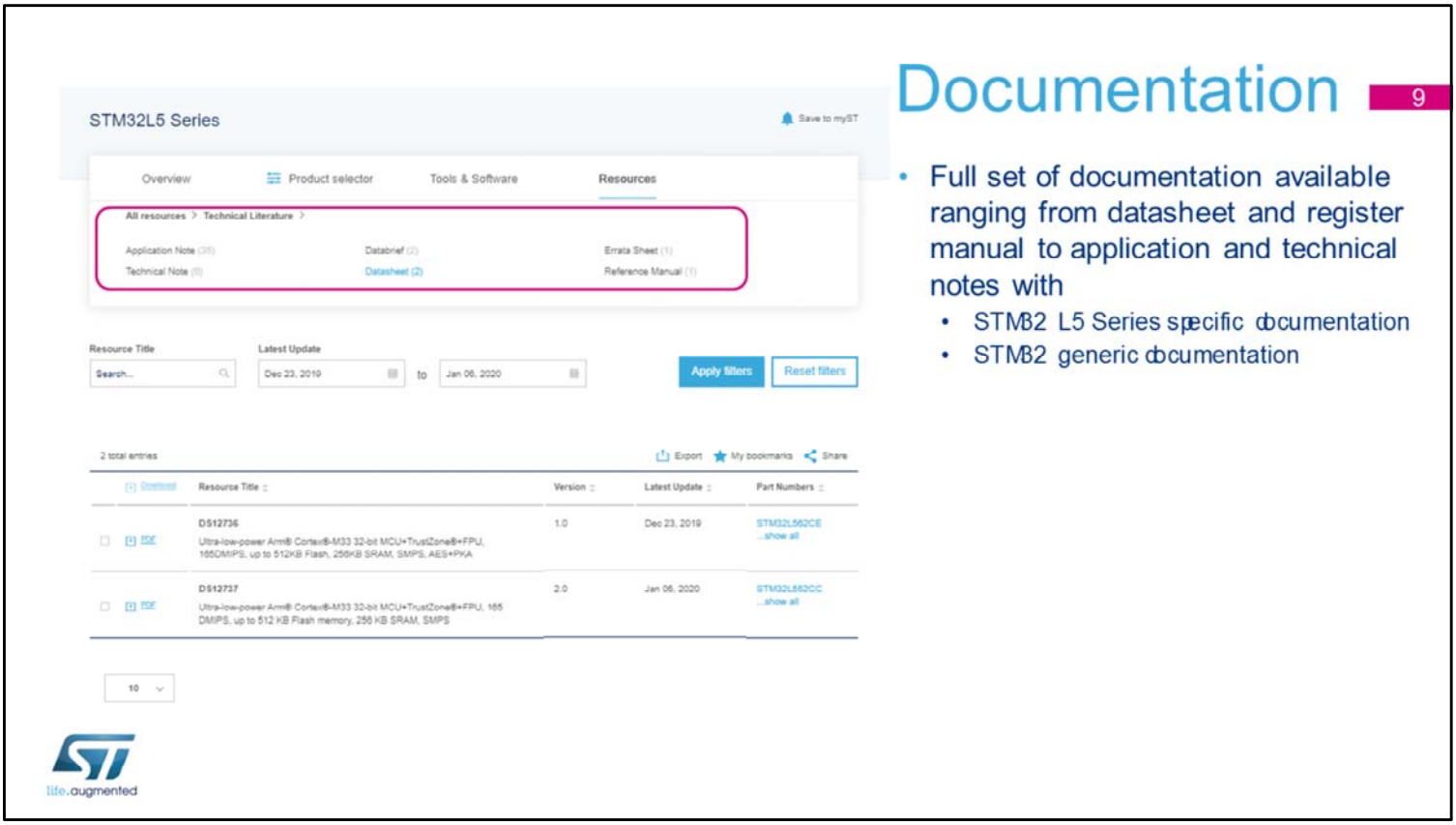


For each board, a set of examples are provided with TrustZone enabled in the system and are provided with preconfigured projects for EWARM, MDK-ARM and STM32CubeIDE toolchains.

The TrustZone examples name ends with '_TrustZone' (except Trusted Firmware-M application)

All TrustZone examples are composed of two are provided with a multi-project structure composed of secure and non-secure sub-projects

A readme text file describes the example behavior and environment needed to make it work.



Rich documentation is associated to the STM32CubeL5 Firmware package. Some documents are generic to all STM32 series and others are specific to the STM32L5 series.
The Getting started with the STM32CubeL5 Firmware Package user manual is the document that you need to read first when you start using the STM32Cube Firmware Package.

Reference

Exhaustive documentation list and STM32CubeL5 Firmware package can be accessed from ST's web site at www.st.com/stm32cubefw

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The STM32CubeL5 firmware can be downloaded from ST website at www.st.com/stm32cubefw
Thank you.