STM32MP1 training

Overall view

STM32 MP1

Planning

life.augmented

Training planning

- Day 1 : (9:00am to 5:00pm):
  - STM32MP1 overall presentation
  - MP1 HW presentation (architecture, external memories – Flash & DDR)
  - SW architecture
  - Boot mechanism
  - Lunch break
  - Starter package : presentation and hands on with usage of STM32CubeProgrammer
  - Developer package : presentation and demo

Training planning

- Day 2 (9:00am to 3:30pm)
  - Distribution package : introduction and demo
  - CubeMx : device tree generation and integration
  - DDR tools : presentation and hand on
  - Lunch break
  - M4 firmware generation and debug

STM32MP1 introduction

- First General Purpose STM32 MPU
  - Roadmap extension of STM32H7, new microprocessor based on Cortex-A7
    - Sub-gigahertz product, targeting low to mid end MPU applications
    - Add to STM32 ecosystem the support for Linux & Android
    - Embed an additional Cortex-M4 core and common STM32 MCU IP / peripherals to address real time constraints and low power processing
    - Keeps fully compatible with existing STM32 MCU software ecosystem & tools
    - Industrial qualification -40°C/125°C Tj on all packages
    - 40nm product with 10year lifetime guarantee

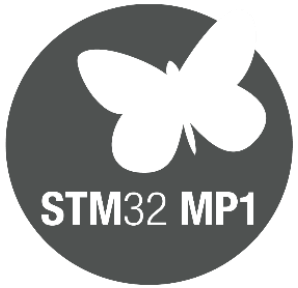
MCU
Cortex-M7 @400MHz
Cortex-M4 @200MHz

MPU
Dual Cortex-A7 @650MHz
Cortex-M4 @200MHz

life.augmented

First STM32 performance line MPU

Microprocessors



Dual Cortex-A7 @650MHz (2x 1235DMIPS)
Cortex-M4 @200MHz (250DMIPS)

Microcontrollers

Cortex-M7 @400MHz (856DMIPS)
Cortex-M4 @200MHz (250DMIPS)

Cortex-M7 @216MHz (462DMIPS)

Cortex-M4 @180MHz (225DMIPS)

Cortex-M3 @120MHz (150DMIPS)

STM32 Performance Line

life.augmented

STM32MP1 product lines
24 sales type in production now

STM32MP157

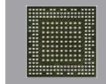
Dual Arm Cortex-A7 + Cortex-M4
3D GPU – DSI – CAN FD

STM32MP153

Dual Arm Cortex-A7 + Cortex-M4
CAN FD

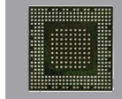
STM32MP151

Arm Cortex-A7 + Cortex-M4

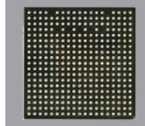


TFBGA257 10x10mm p0.5
4 layers PTH PCB

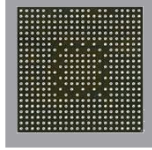
smallest package for dual Cortex-A GP MPU



TFBGA361 12x12mm p0.5
4 layers PTH + Laser via PCB



LFBGA354 16x16mm p0.8
4 layers PTH PCB



LFBGA448 18x18mm p0.8
6 layers PTH PCB

3 Product Lines — Optional Security — **4** Packages

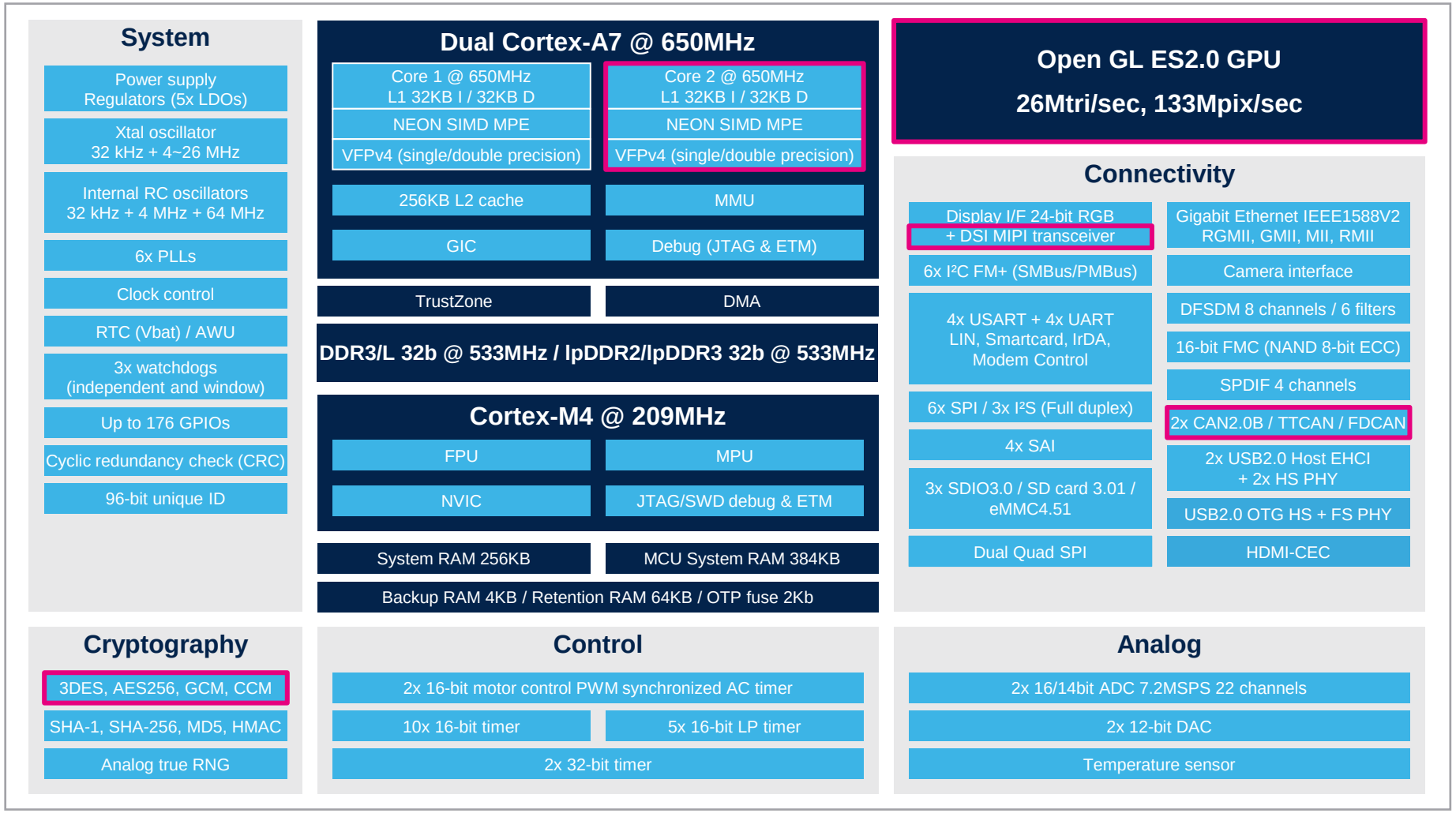
life.augmented

STM32 MP1

STM32MP157

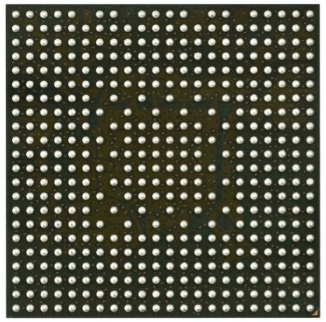
life.augmented

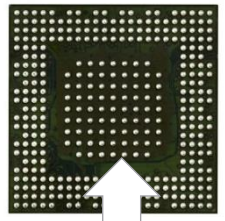
STM32MP157 block diagram



Not Available on all product lines

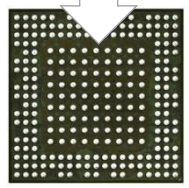
Packages

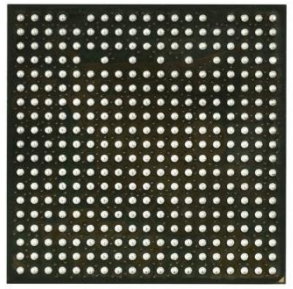




	0.8mm – DDR3	0.5mm – LPDDR2/3 & DDR3
Full features	**LFBGA448** 18x18mm pitch 0.8 32-bit DDR3I/F 176 GPIOs 6 layers PTH PCB	**TFBGA361** 12x12mm pitch 0.5 32-bit LPDDR2/LPDDR3/DDR3I/F 148 GPIOs 4 layers PCB
Low cost	**LFBGA354** 16x16mm pitch 0.8 16-bit DDR3I/F 98 GPIOs 4 layers PTH PCB	**TFBGA257** 10x10mm pitch 0.5 16-bit LPDDR2/LPDDR3/DDR3I/F 98 GPIOs 4 layers PCB

Pitch 0.65 on inner ball matrix to ease PCB supply routing





Industrial qualification : -40°C / 125°C Tj

life.augmented

STM32MP1 product lines

Arm® Cortex®-A7 – 650 MHz

ACCELERATION
- Dual core* Arm® Cortex®-A7 processor
- L1 and L2 caches
- 3D Graphic Processing Unit*
- Floating Point Unit + Arm® NEON™
- Arm® Cortex®-M4 209MHz coprocessor
- MDMA + DMA
- LPDDR2/LPDDR3 16/32**-bits 533MHz
- DDR3/DDR3L 16/32**-bits 533MHz

CONNECTIVITY
- 2 x USB2.0 HS Host
- USB2.0 OTG FS/HS
- 3 x SDMMC/SDIO
- USART, UART, SPI, I²C
- 2 x (TT)FDCAN2.0*
- HDMI-CEC
- Gigabit Ethernet IEEE 1588***
- FMC (NAND Flash)
- Camera I/F
- Dual mode Quad-SPI
- DSI 2Gbit/s*

AUDIO
- I²S + audio PLL
- 4 x SAI + 8 x DFSDM + SPDIF-RX
- 2 x 12-bit DAC

OTHER
- 16- and 32-bit timers
- 2 x 16-bit ADC (7.2 MSPS)

Product RPN	f_{CPU} (MHz)	Cortex®-A7 cores	f_{MCU} (MHz)	Cortex®-M4 cores	f_{GPU} (MHz)	Cortex®-A7 L1 cache (I/D) L2 cache	RAM (Kbytes)	HW Crypto	3D GPU	FDCAN	MIPI®-DSI
STM32MP151A	650	1	209	1	-	32K+32K + 256K	640K + 64K retention + 4K backup	-	-	-	-
STM32MP151C								●			
STM32MP153A	650	2	209	1	-	2x (32K+32K) + 256K	640K + 64K retention + 4K backup	-	-	2	-
STM32MP153C								●			
STM32MP157A	650	2	209	1	533	2x (32K+32K) + 256K	640K + 64K retention + 4K backup	-	●	2	●
STM32MP157C								●			

Notes:
* not available in all product lines
** 16/32-bits for LFBGA448 and TFBGA361 packages, 16-bits only for LFBGA354 and TFBGA257 packages
*** 10/100M Ethernet only for LFBGA354 and TFBGA257 packages

life.augmented

STM32 MP1

Power management IC

life.augmented

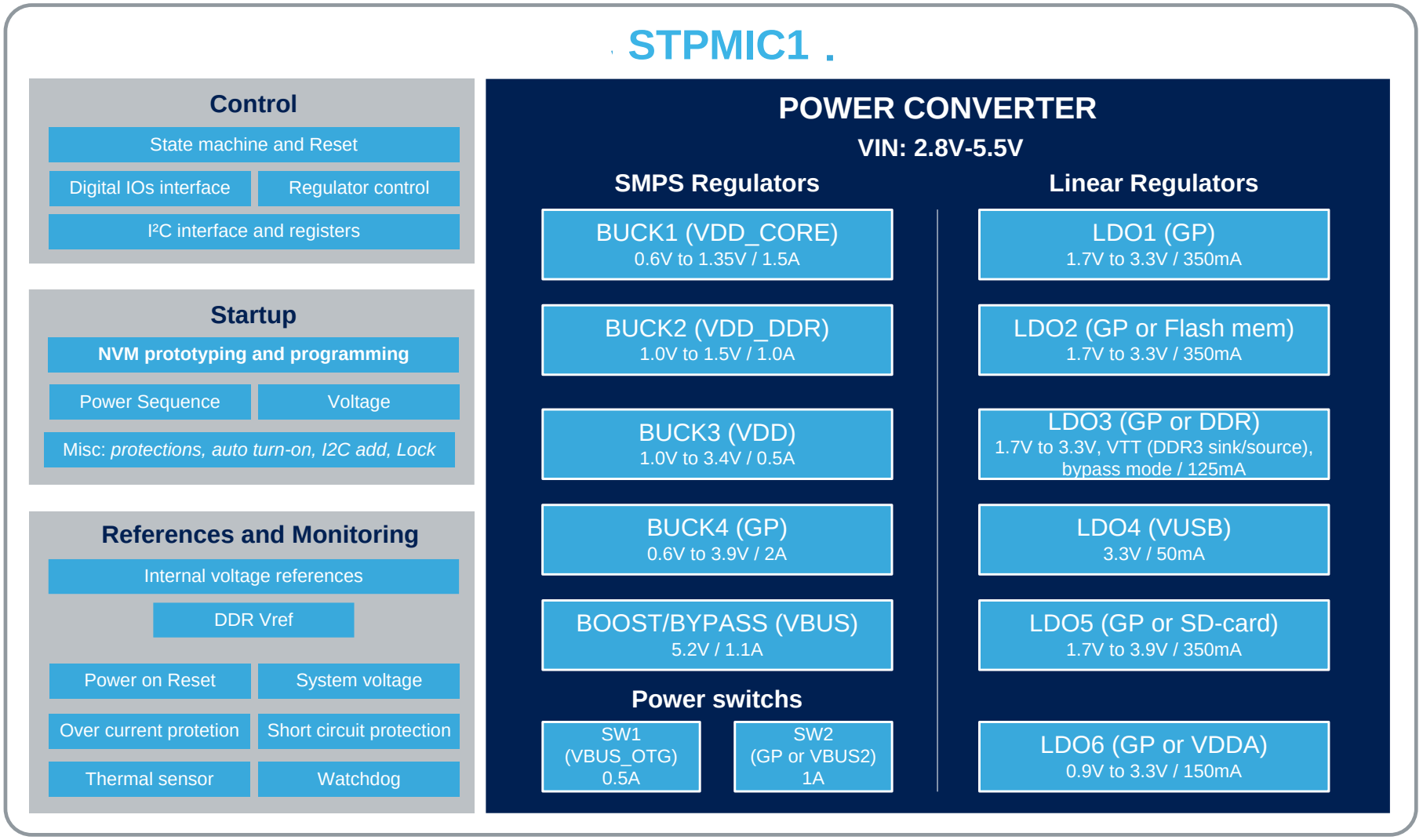
STPMIC1

- Power management companion IC for STM32MP1
  - Large input range (2.8~5.5V) compatible with 3.7V battery
    - No Battery charger integrated, external battery charging device to be added if needed
  - Provides all the supply for STM32MP1, DRAM and few external components
    - Combination of 4 switching regulators + 6 linear regulators
    - Integrated 5V boost regulator for USB Vbus with 2 ports power switching capability
  - Control via through I2C interface and digital I/O
    - Power control, reset, interrupt, wake up, …
  - Programmable configuration with NVM
    - Straighforward NVM (re)programming via I2C
    - Default output voltage, soft start
    - Start sequence
    - Protections, …

STPMIC1

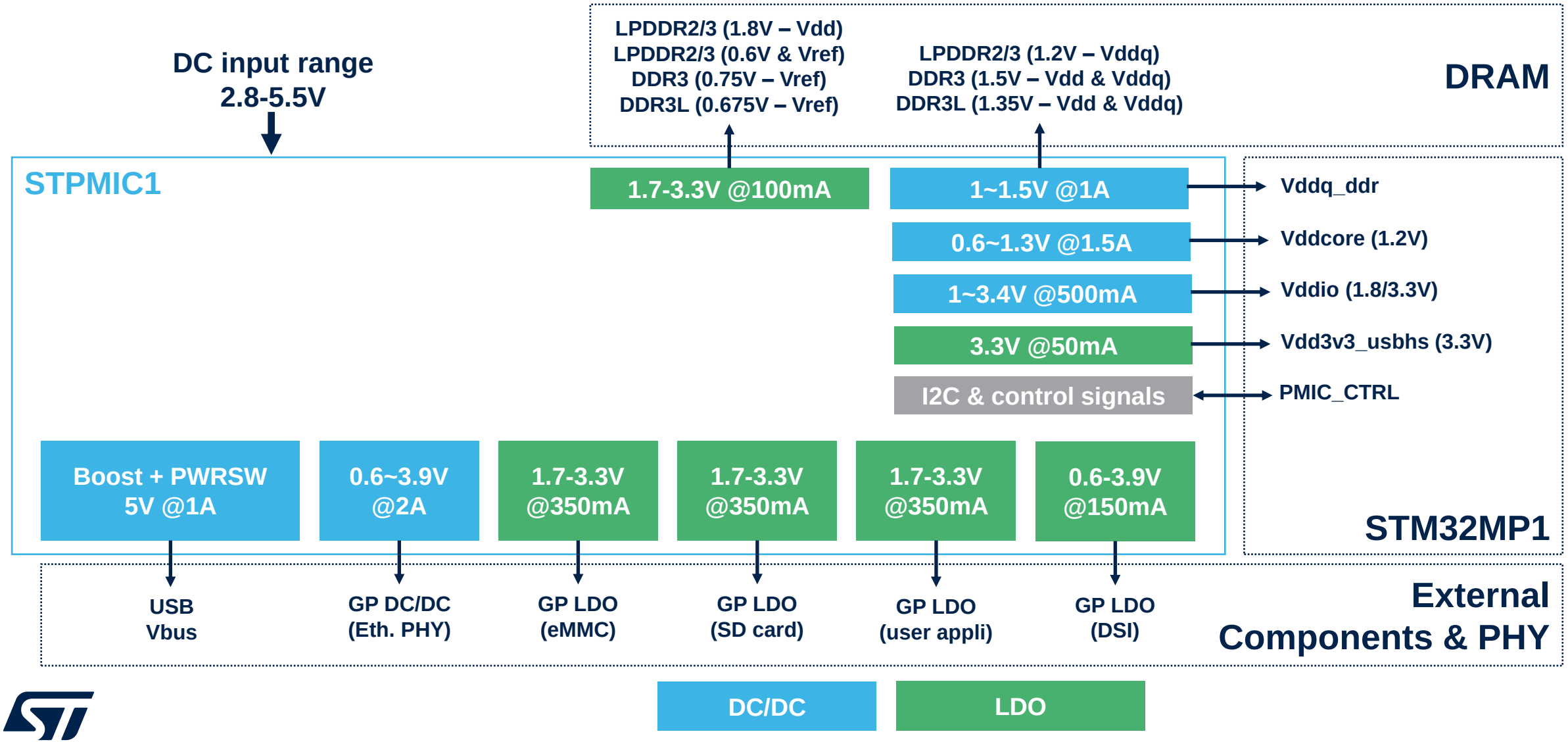
- Power management companion IC for STM32MP1
  - Packaging
    - QFN44 5x6x0.4mm
    - Industrial and consumer temperature range

STPMIC1 functional block diagram



BUCK converter = Switched Mode Power Supply step-down converter

PMIC



life.augmented

STM32 MP1

Hardware ecosystem

life.augmented

STM32MP1 hardware solutions

Speed-up evaluation, prototyping and design

EV1

Available at **$399**

DK2

Available at **$99**

DK1

Available at **$69**

Evaluation Board

Full feature STM32MP1 evaluation

- STM32MP157A-EV1
- STM32MP157C-EV1

2 Versions

Discovery Board

Flexible prototyping & demo

- STM32MP157A-DK1
- STM32MP157C-DK2
  + MIPI DSI WVGA display
  + Wi-Fi/BT combo module

2 Versions

Boards & SoM*s

3rd Parties Boards for prototyping and production

- Board Specification from Linaro (96boards.org)
- Commercial SoM w/ different forms

life.augmented

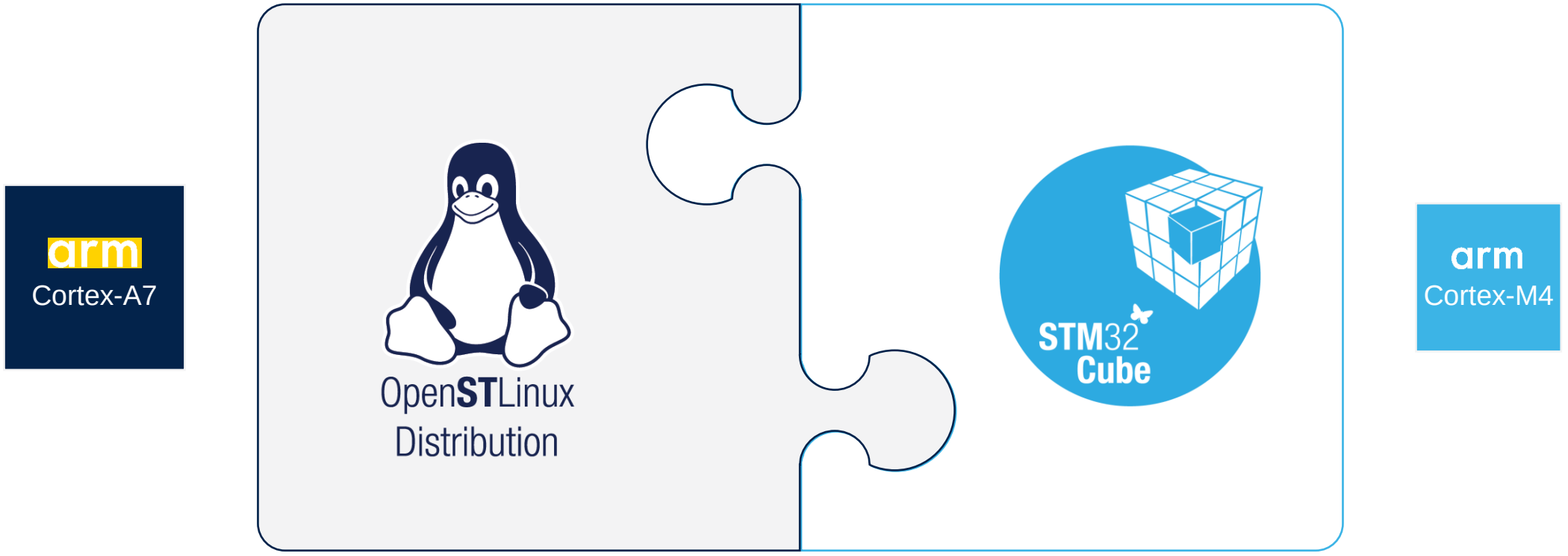
*System on Module

STM32 MP1

Software ecosystem

life.augmented

A fully integrated design suite leveraging the stm32cube environment

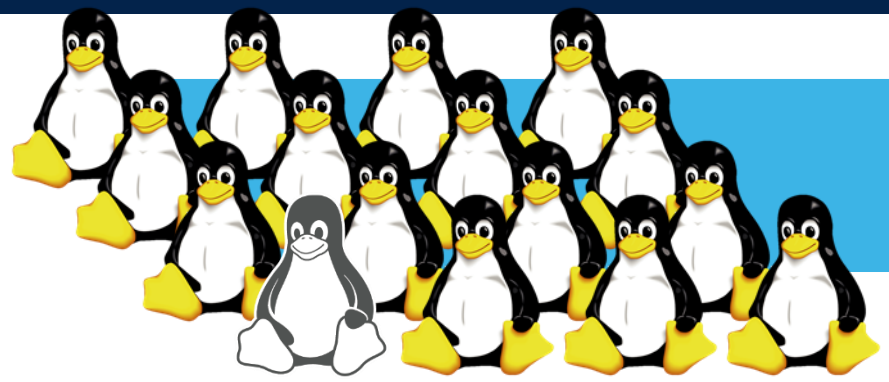


STM32MPU Embedded Software Distribution

life.augmented

Simplify your linux development

Fully mainlined open source Linux distribution for Arm Cortex-A7



OpenSTLinux Distribution

STM32MP1 SoC drivers
already adopted by the Linux community

STM32MP1 supported in Linux 4.19 LTS

Fully compliant with open-source standards

THE LINUX FOUNDATION

yocto PROJECT

Linaro

Pre-integrated Secure OS

OP-TEE .org

life.augmented

STM32CUBEMP1 package

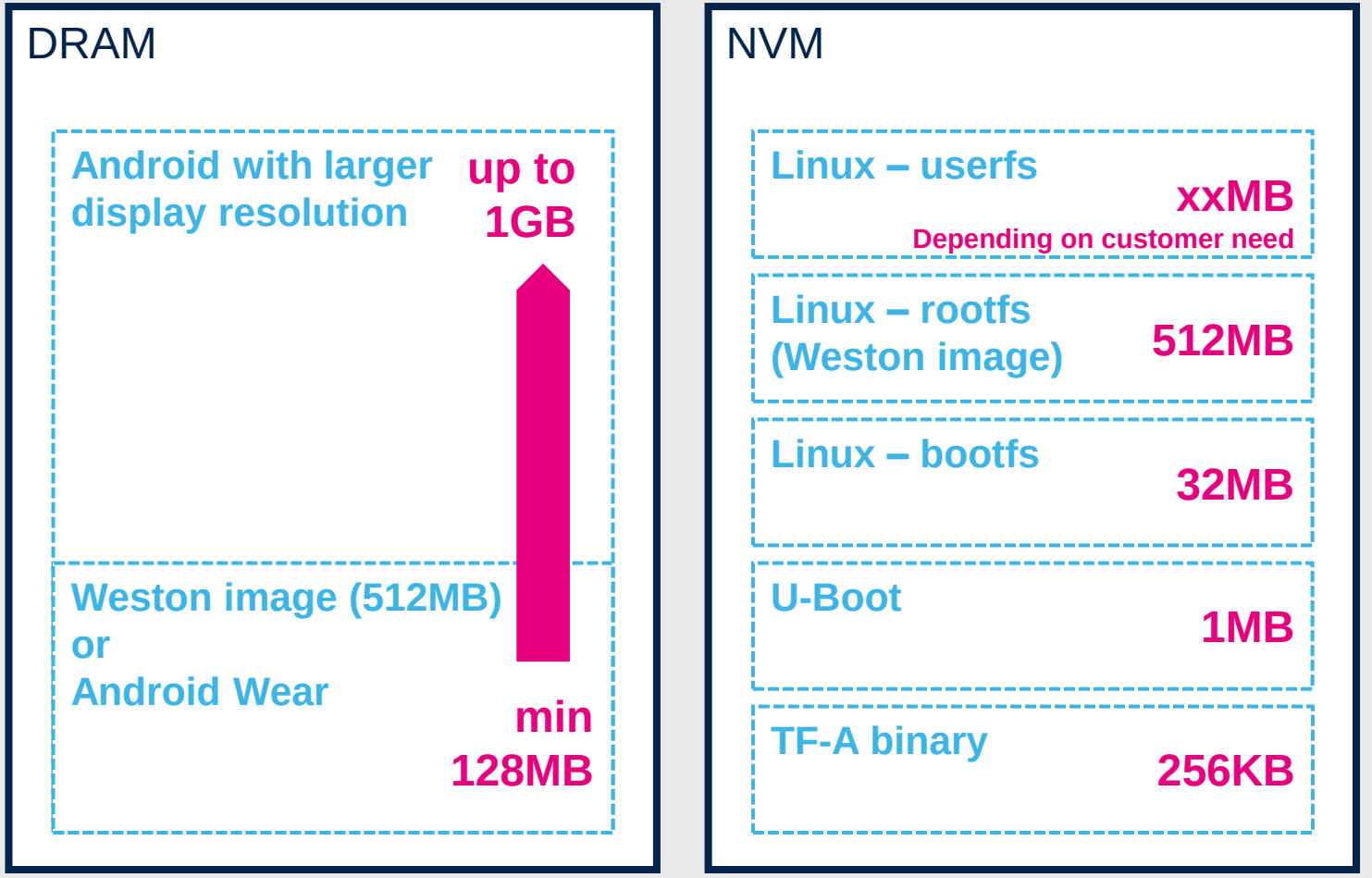
Full re-use of STM32 MCU Cube firmware on Arm Cortex-M

- Several APIs to access peripherals
- Collection of Middleware components for Cortex-M
- Hundreds of Examples
- Production-ready Quality
- Business-friendly license terms

life.augmented

Memory footprints

ST software footprints
(footprints can be reduced depending on the implemented application)



STM32 MP1

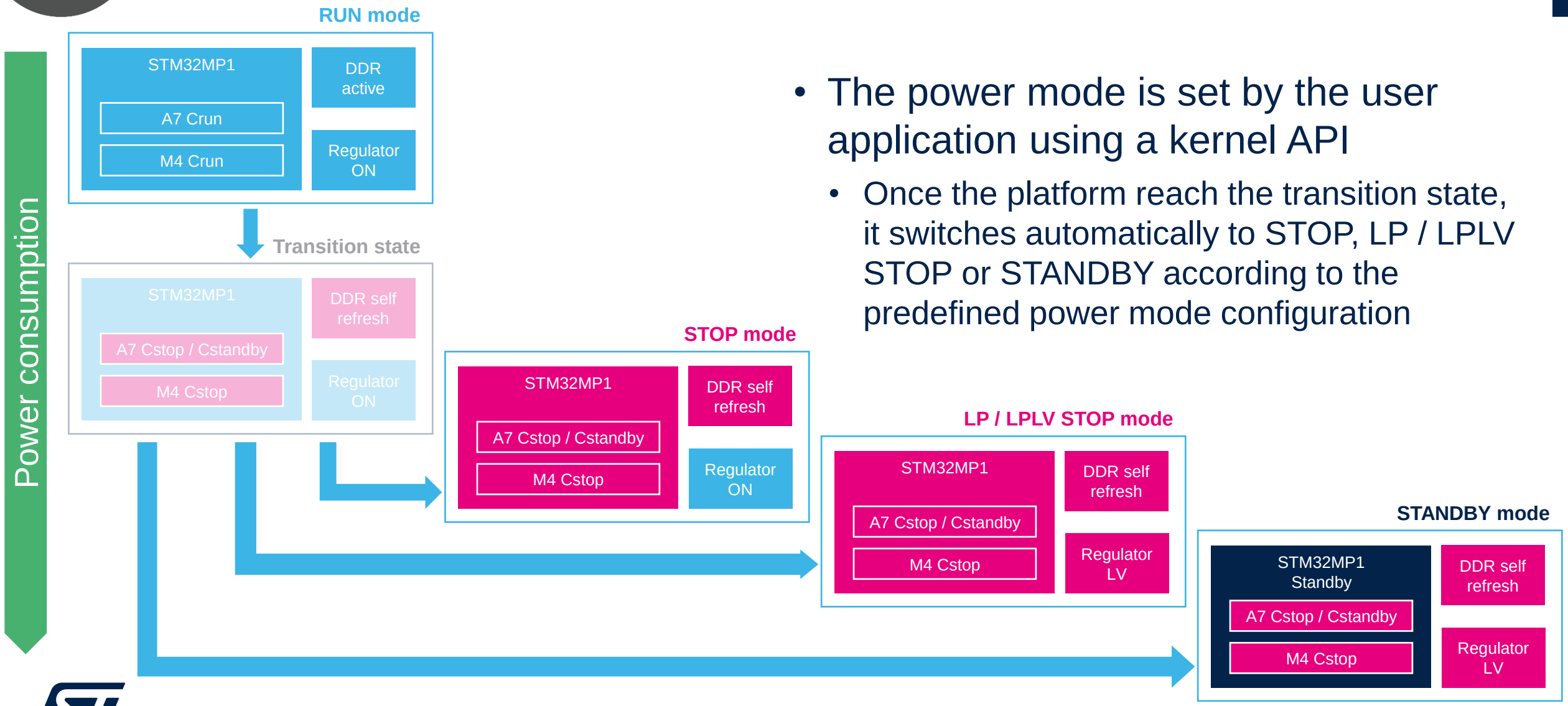
Power modes

life.augmented

Power modes

- Power management at platform and cluster level
  - STM32MP1 has 4 power states
    - Run
    - Stop
    - LP / LPLV-Stop => Same as Stop with low voltage supply (Vcore = 0.9V)
    - Standby => Only Vdd remains (Vcore = OFF) and wakeup only with a reset
  - Each cluster has its own power management
    - A7 cluster has 4 power modes
      - Crun
      - Csleep (core clock stopped)
      - Cstop (core + IP clock stopped)
      - Cstandby (core + IP clock stopped and wakeup only with a reset)
    - M4 cluster has 3 power modes
      - Crun
      - Csleep (core clock stopped)
      - Cstop (core + IP clock stopped)

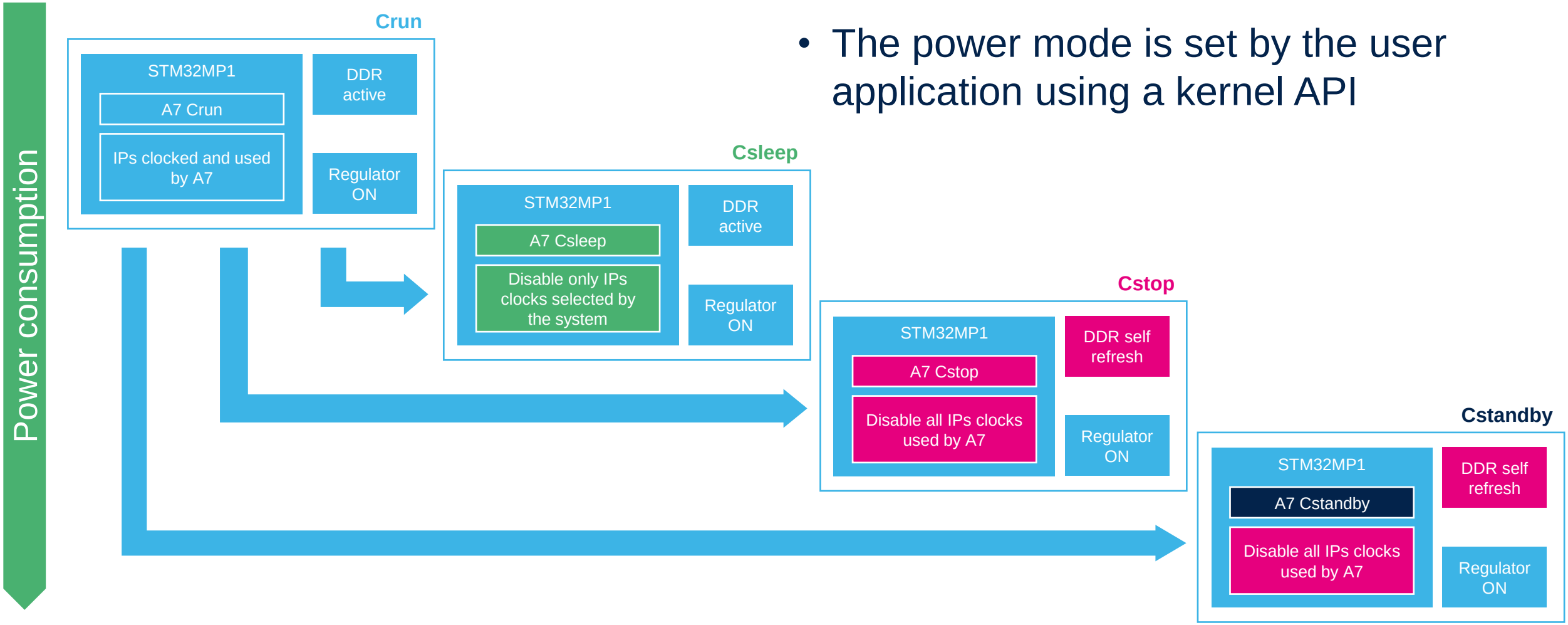
Platform power mode



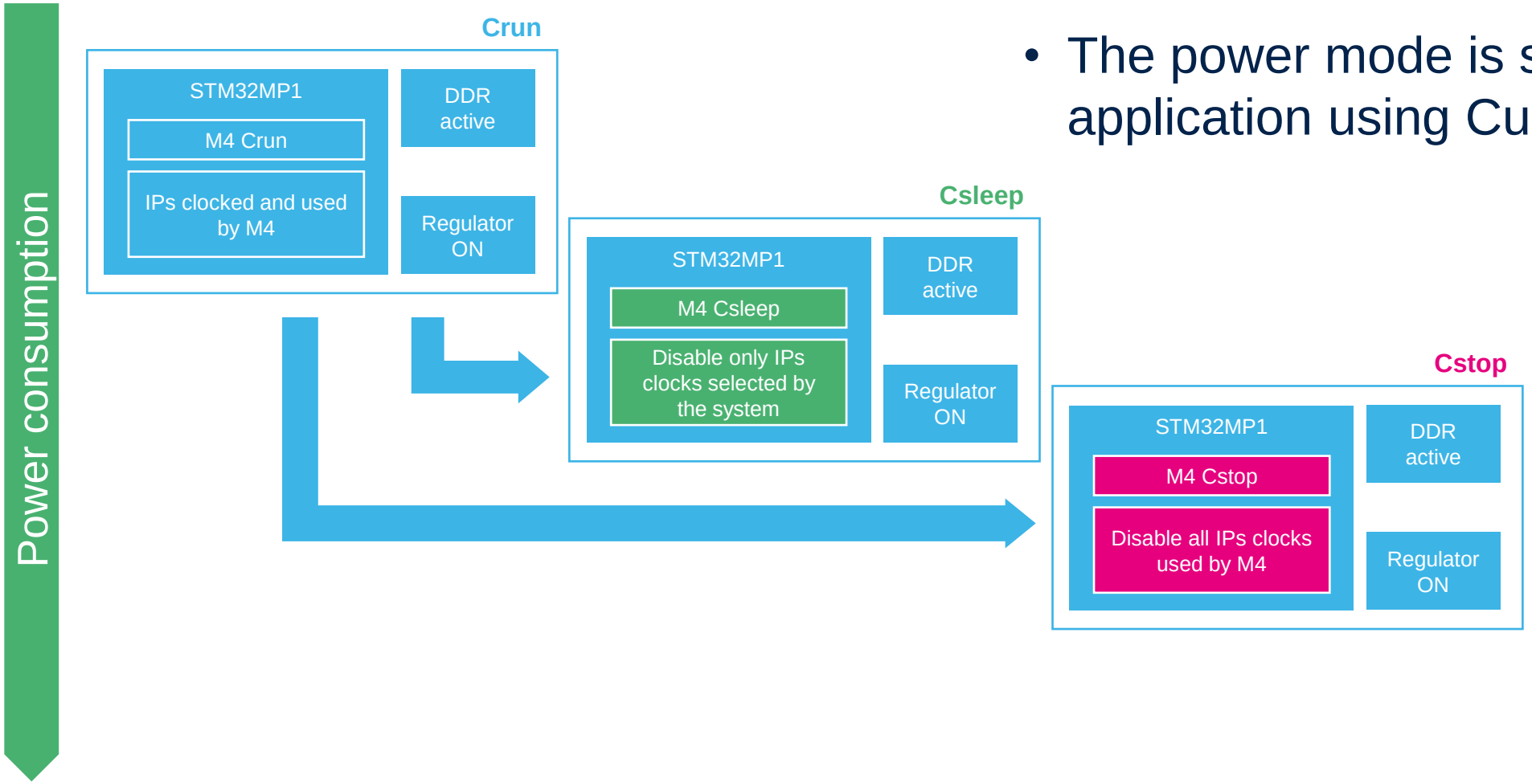
- The power mode is set by the user application using a kernel API
  - Once the platform reach the transition state, it switches automatically to STOP, LP / LPLV STOP or STANDBY according to the predefined power mode configuration

A7 cluster power mode

- The power mode is set by the user application using a kernel API



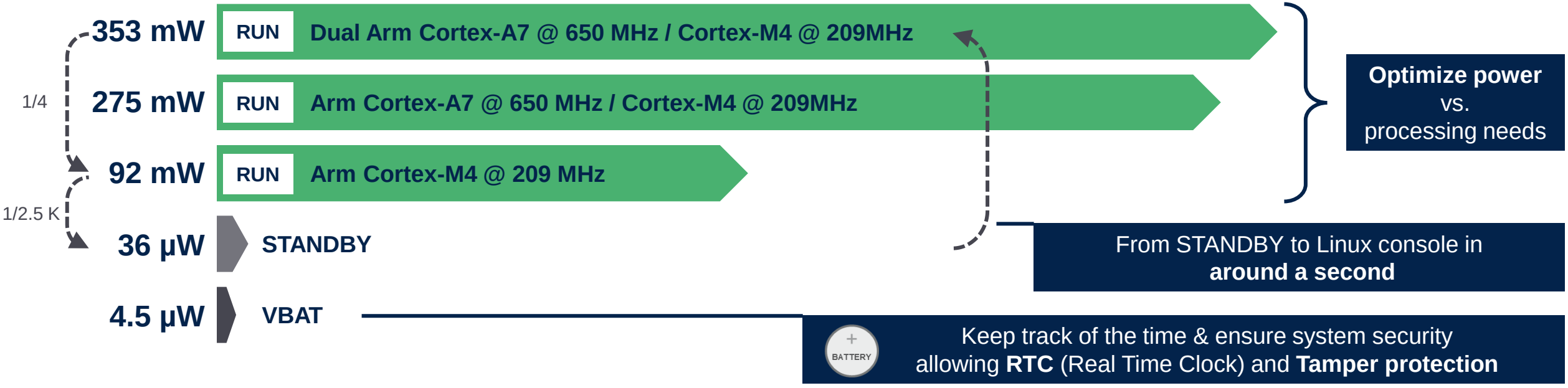
M4 cluster power mode



- The power mode is set by the user application using Cube FW

Flexible architecture for power efficiency

Power figures



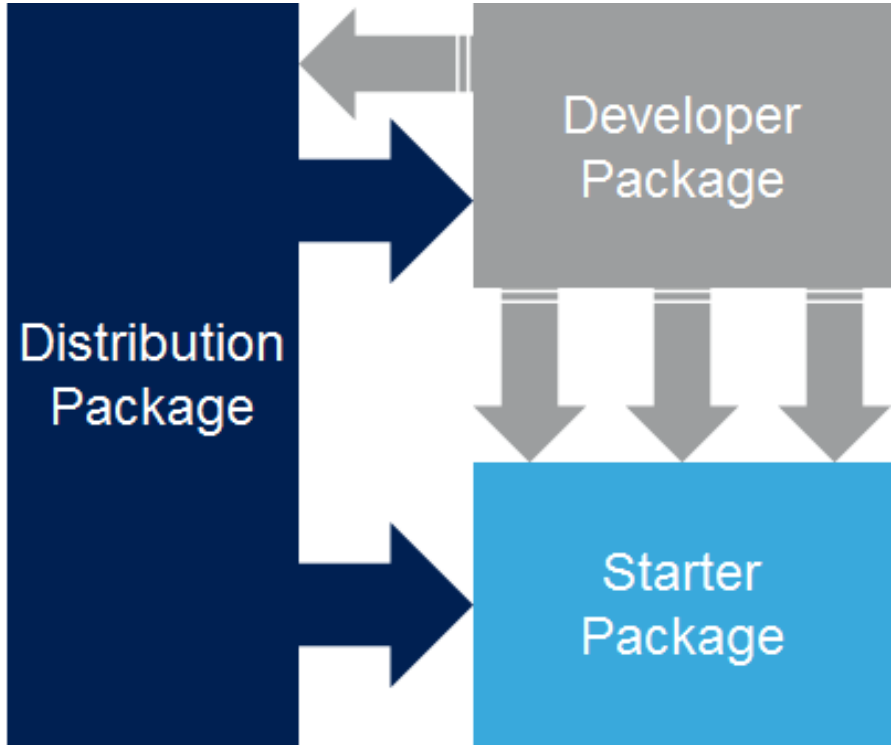
Typ @ VDDCORE = 1.2V, VDD = 3.3V @ 25 °C, Peripherals OFF

life.augmented

Software distribution

One distribution, three packages

- Open STLinux
- Starter Package
  - To quickly and easily start with any STM32MP1
- Developer Package
  - To add your own developments on top of the STM32MP1 Embedded Software distribution
- Distribution Package
  - To create your own Linux® distribution, your own Starter Package and your own Developer Package

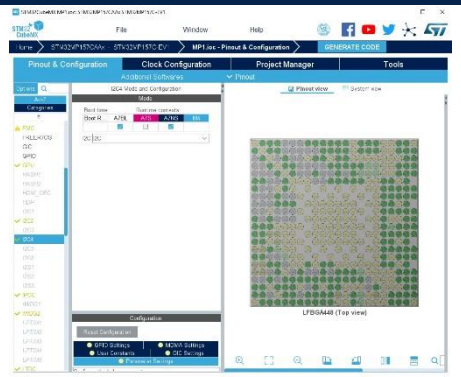


life.augmented

STM32MP1 tools

STM32MP1 software tools

Complete support of Arm Cortex-A + Cortex-M architecture



STM32CubeMX

STM32CubeMX enhanced for MPU

- Configure and generate Code
- DRAM interface tuning tool
- Device Tree generation

IDEs
Compile and Debug

Multi-Core Solutions

- Partners IDE
- Free IDE based on Eclipse
- Multi-core debugging

STM32 Programming Tool

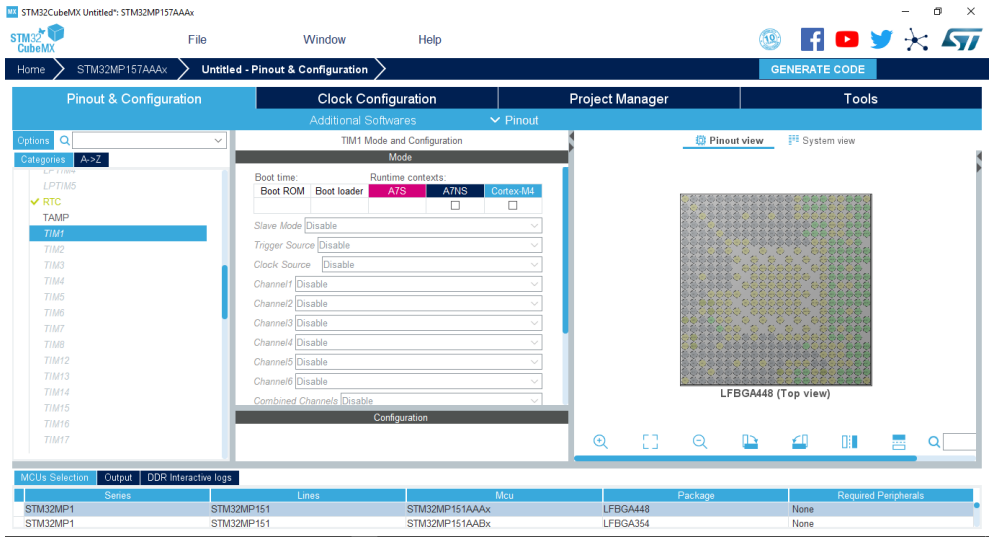
STM32CubeProgrammer

- Flash, DRAM and/or system memory
- OTP programming
- Signing tool & Keys generation

life.augmented

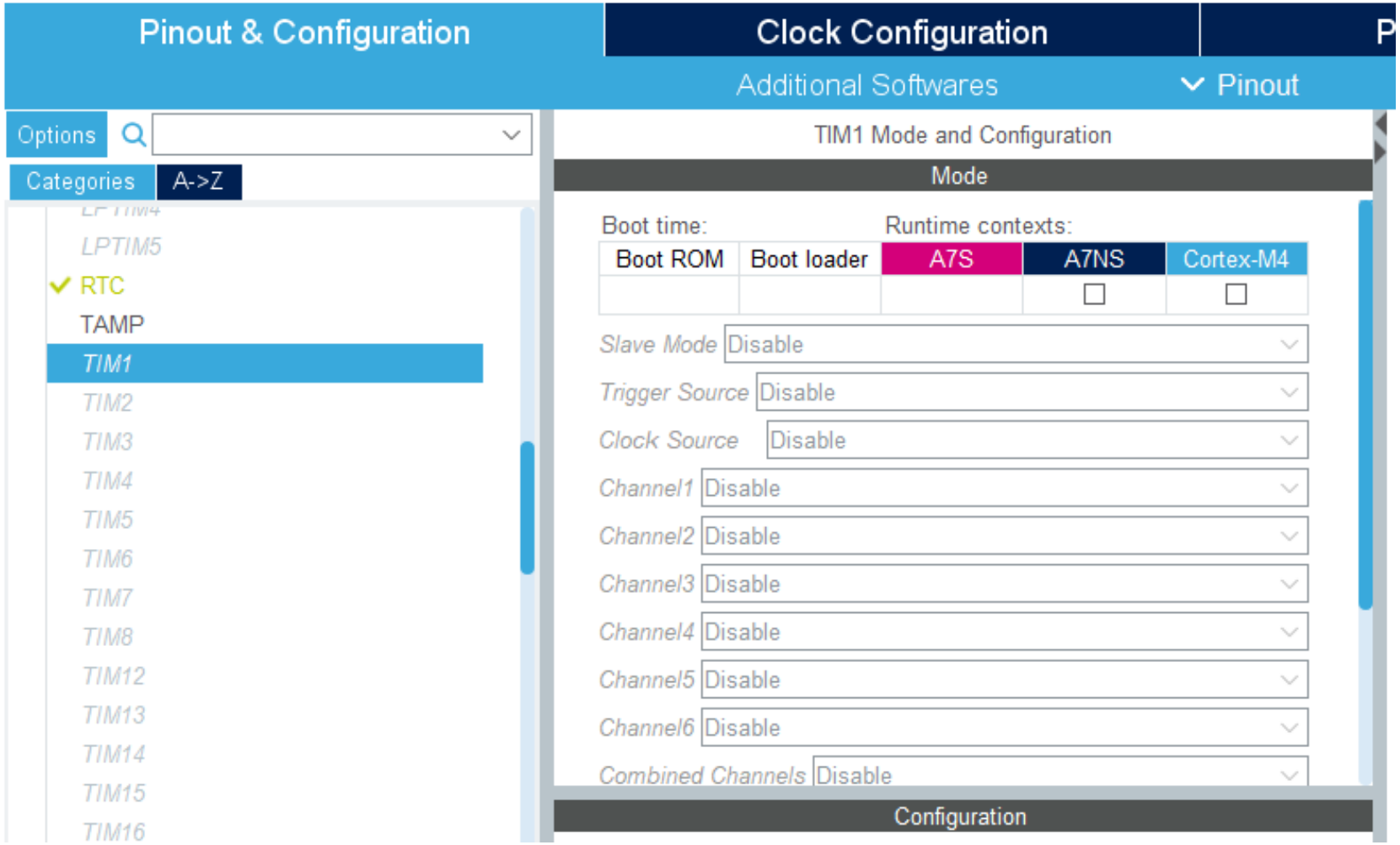
STM32CubeMX

- For STM32MP1
  - Manages the GPIOs multiplexing & the clock setup (like for STM32 MCU)
  - Manages the interactive peripherals assignment to Cortex-A & Cortex-M cores
- For the Cortex-A side
  - Handles the DRAM configuration & tuning
  - Generates the configuration => device tree (for TF-A, U-Boot & Linux)
    - GPIOs multiplexing, clock setup, peripherals assignment
- For the Cortex-M side
  - Generates the code & configuration (like for STM32 MCU)
    - GPIOs multiplexing, clock setup, peripherals assignment

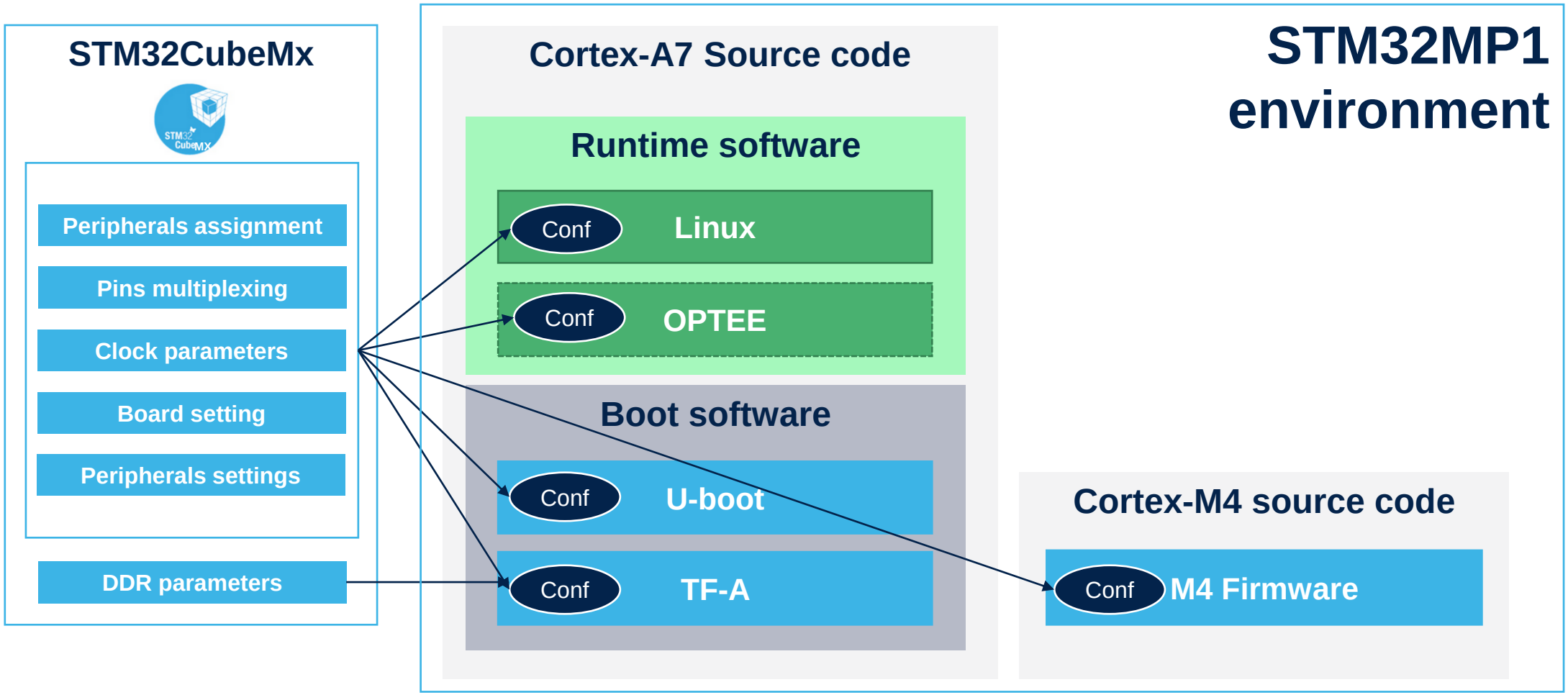


STM32CubeMX – peripheral assignment

- Allows user to make specific assignment core ⇔ peripherals (ex. TIM1)

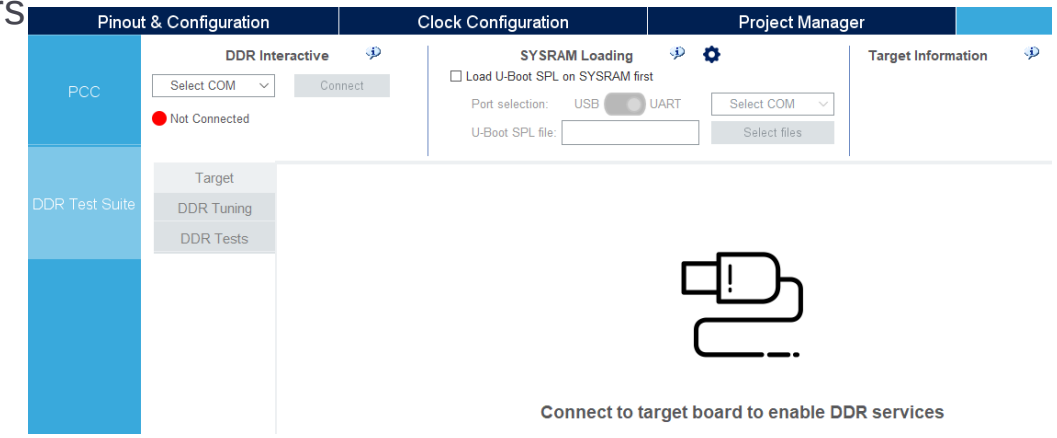


STM32CubeMX – device tree



STM32CubeMX – DDR plugin

- The DDR plugin handles the configuration, test and tuning of the DRAM controller
  - Configuration
    - Basic / advanced wizard to generate the memory controller configuration based on the DRAM datasheet
    - Test the DRAM configuration on board
    - Generates a configuration report
  - Test
    - Set of default tests provided to check hardware reliability
    - Generates a test report
  - Tuning
    - Run tuning, collect back the results and adjust parameters
    - Adjust the default configuration with tuned parameters



IDE – STM32CubeIDE

- STM32CubeIDE

Latest version 1.4.2

  - Description
    - Support STM32MP1 now.
    - Does everything same as system workbench.
  - IDE
    - Eclipse
  - Compiler

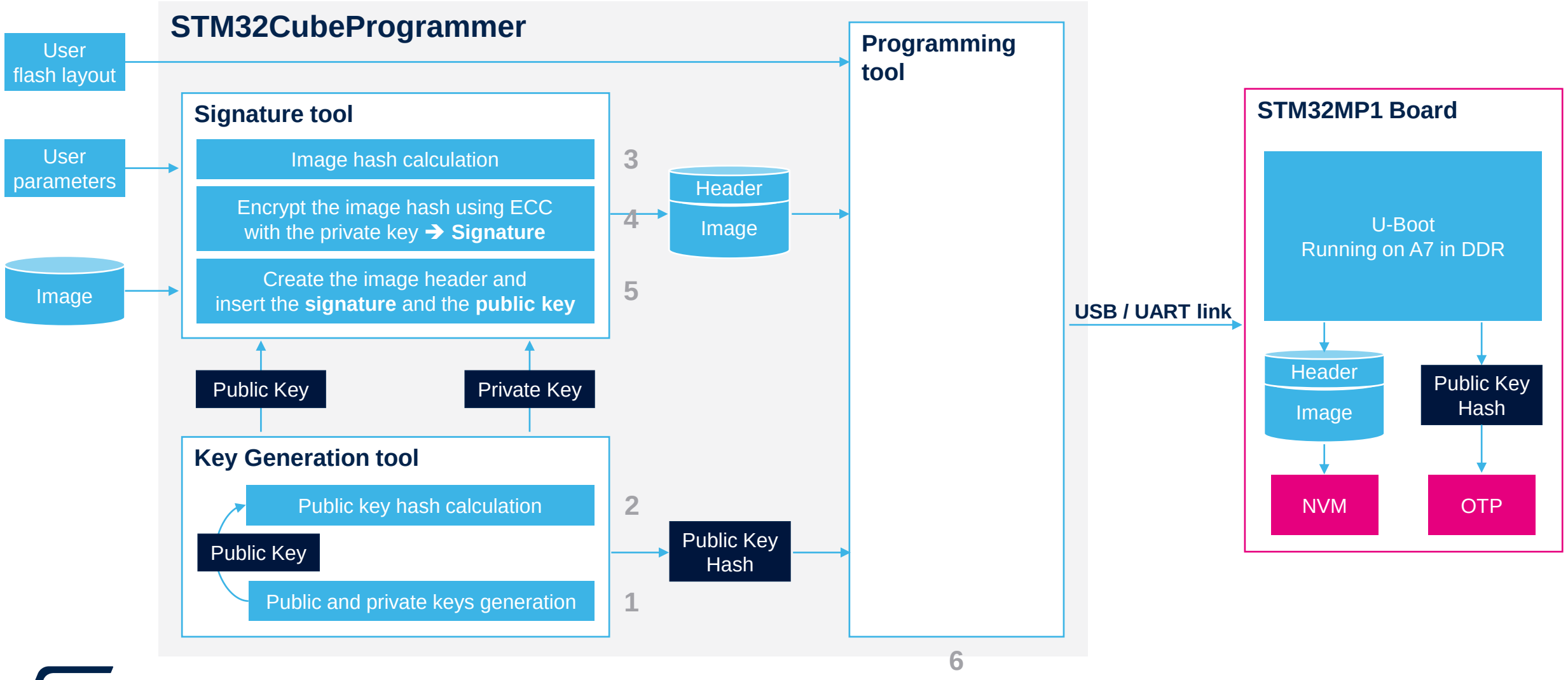
Available via command line

    - GCC C/C++
  - Debugger
    - OpenOCD/GDB-based
  - Debug probe
    - ST-Link

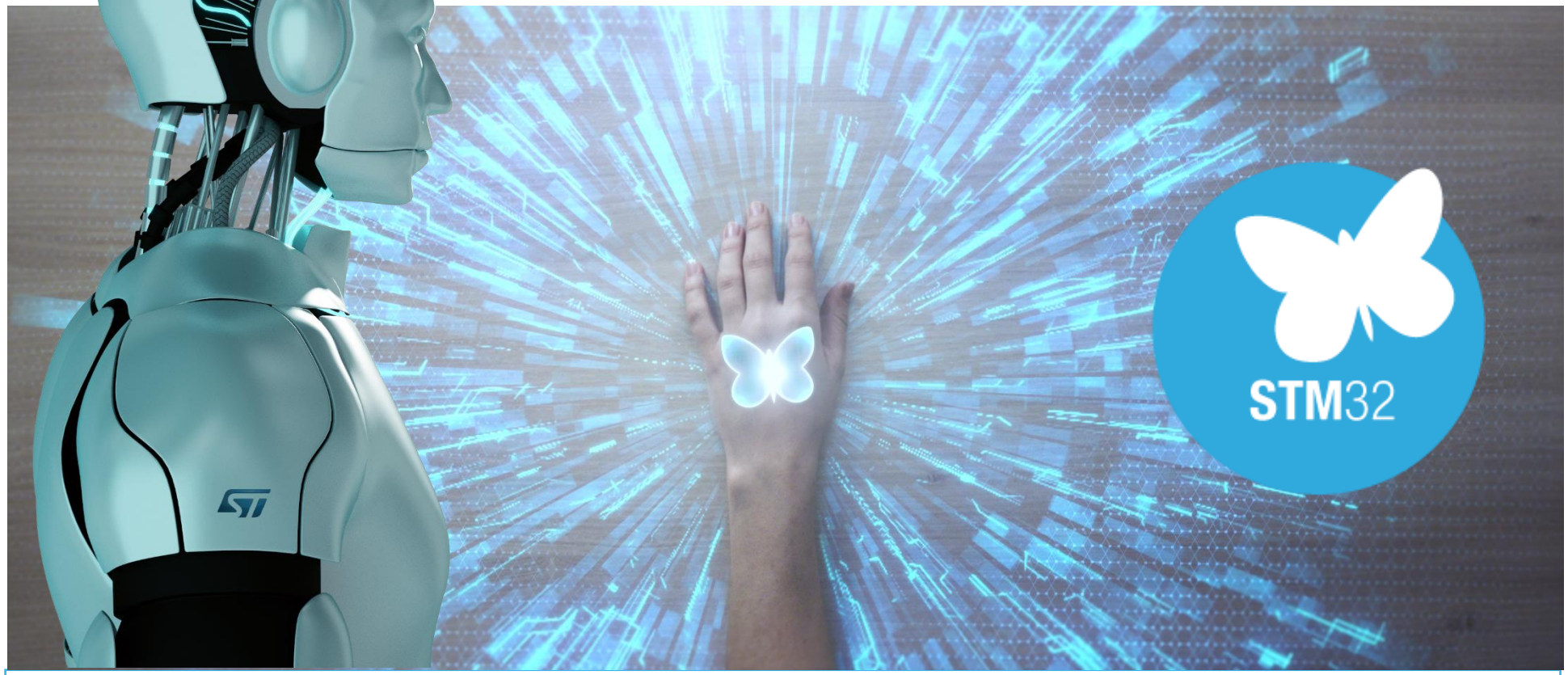
Stm32cubeprogrammer

- The STM32CubeProgammer tool set is made of three software
  - Key generation tool
    - ECC key generation (private & public keys)
    - Public hash key generation
  - Signature tool
    - Create binary header with
      - User information (image entry point, load address, image version, ECC algorithm and option parameter)
      - ECC signature
      - ECC public key
    - Concatenate the header with the image
  - Programming tool
    - Utility to program STM32MPU1 NVMs/OTP through UART and USB
    - Flashing services & OTP programming via U-Boot
    - Support NOR, NAND, SDCARD, eMMC
    - PMIC NVM programming via U-Boot (I2C)
    - Secure secret programming

Stm32cubeprogrammer



Releasing your creativity with the STM32



/STM32 @ST_World community.st.com

Famous video here

www.st.com/stm32

life.augmented