Introduction to Multicore RTOS-based Application Development

DAY 1 : Multicore Application Architecture Design

Webinar Logistics

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THE SPEAKER

Jacob Beningo

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Beningo Embedded Group - President

Focus: Embedded Software Consulting

An independent consultant who specializes in the design of real-time, microcontroller based embedded software.
He has published two books:
- Reusable Firmware Development
- MicroPython Projects

Writes a weekly blog for DesignNews.com focused on embedded system design techniques and challenges.

Visit www.beningo.com to learn more ...

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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

Challenges Facing Embedded Software Developers

Quality	Development Costs	Time to Market	Scalable Solutions

- Buggy software
- Constant bug fixes
- Customer complaints

- Smaller budgets
- More features
- Increased complexity
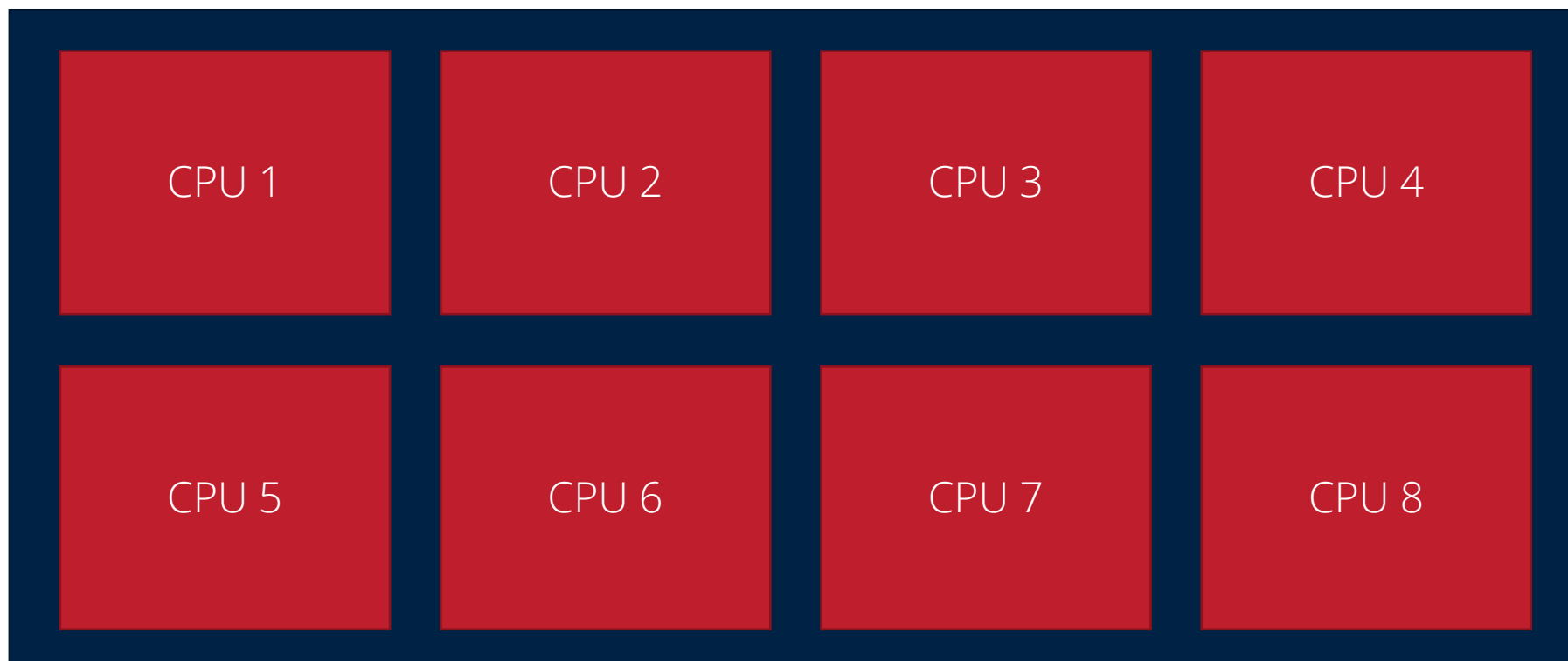
- More debugging
- Missed deadlines
- Integration woes

- Tightly coupled code
- Vendor dependency
- Inflexible architecture

Multicore Microcontrollers

CPU 1	CPU 2	CPU 3	CPU 4
CPU 5	CPU 6	CPU 7	CPU 8

Why are you interested in multicore microcontrollers?

- Application partitioning

- More computing throughput

- Enhanced security applications

- Other

Homogenous Multicore

Homogeneous multicore systems have more than one core and share the same architecture between cores.

CPU 1	CPU 2
Arm Cortex-M4	Arm Cortex-M4

Homogenous Multicore

ESP32 Example:
- Dual Xtensa 32-bit LX6 cores
  - One dedicated Wi-Fi / BT
  - One dedicated user application

Image Source: https://randomnerdtutorials.com/esp32-dual-core-arduino-ide/
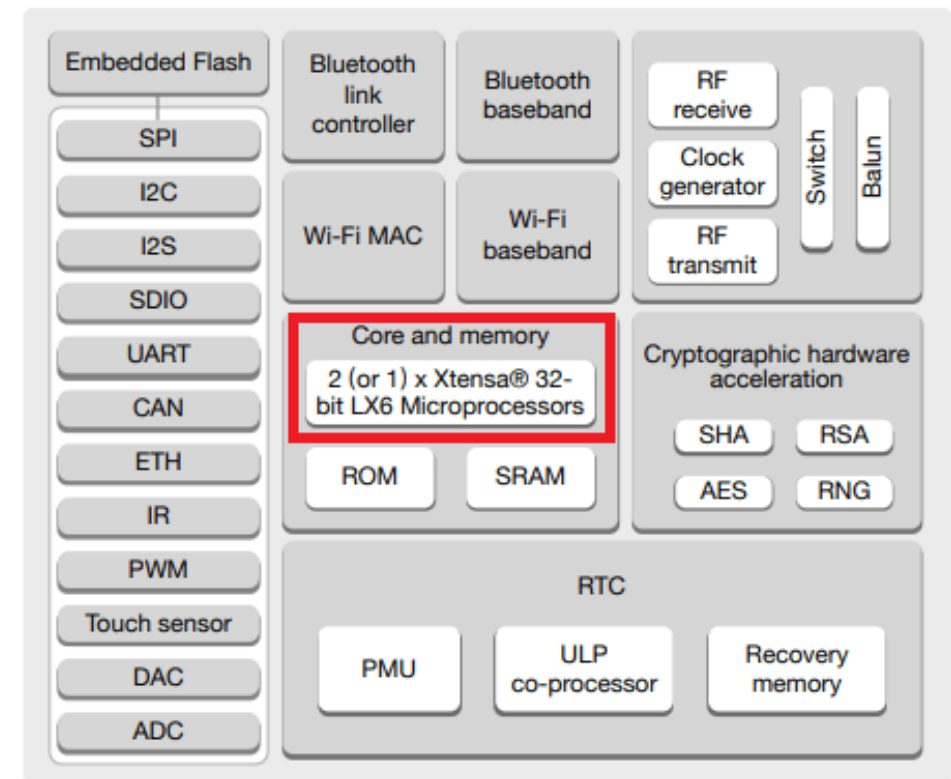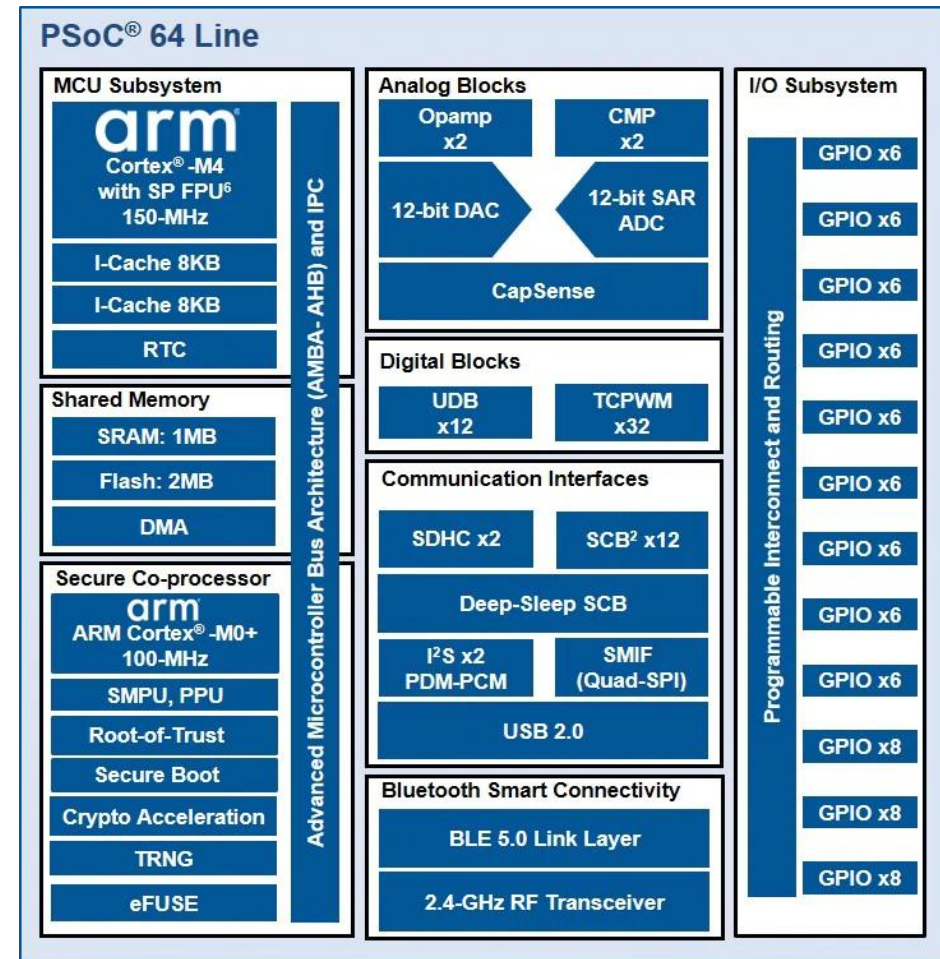
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Heterogenous Multicore

Heterogeneous multicore systems have more than one core that consist of different architectures between the cores.

CPU 1	CPU 2
Arm Cortex-M4	Arm Cortex-M0+

Heterogeneous Multicore

Cypress PSoC 64 Example:
- Cortex-M4 (150 MHz)
  - Application rich core
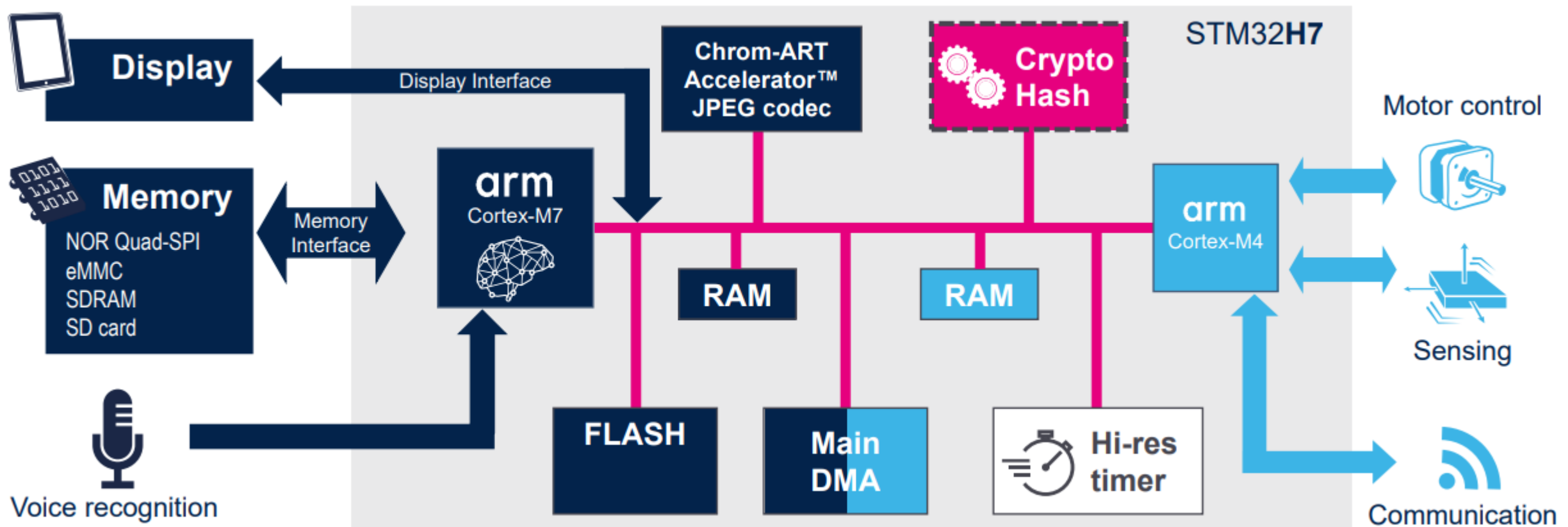- Cortex-M0+ (100 MHz)
  - Dedicated security core
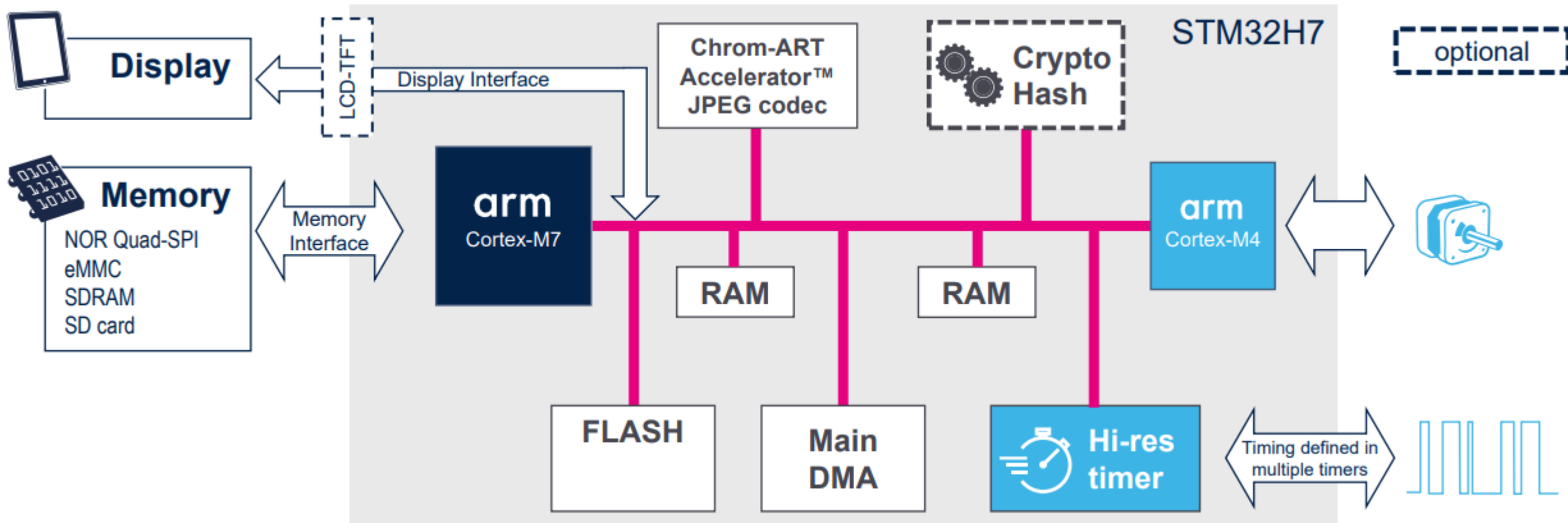
Which Multicore model is most interesting to you?
- Homogeneous Multicore
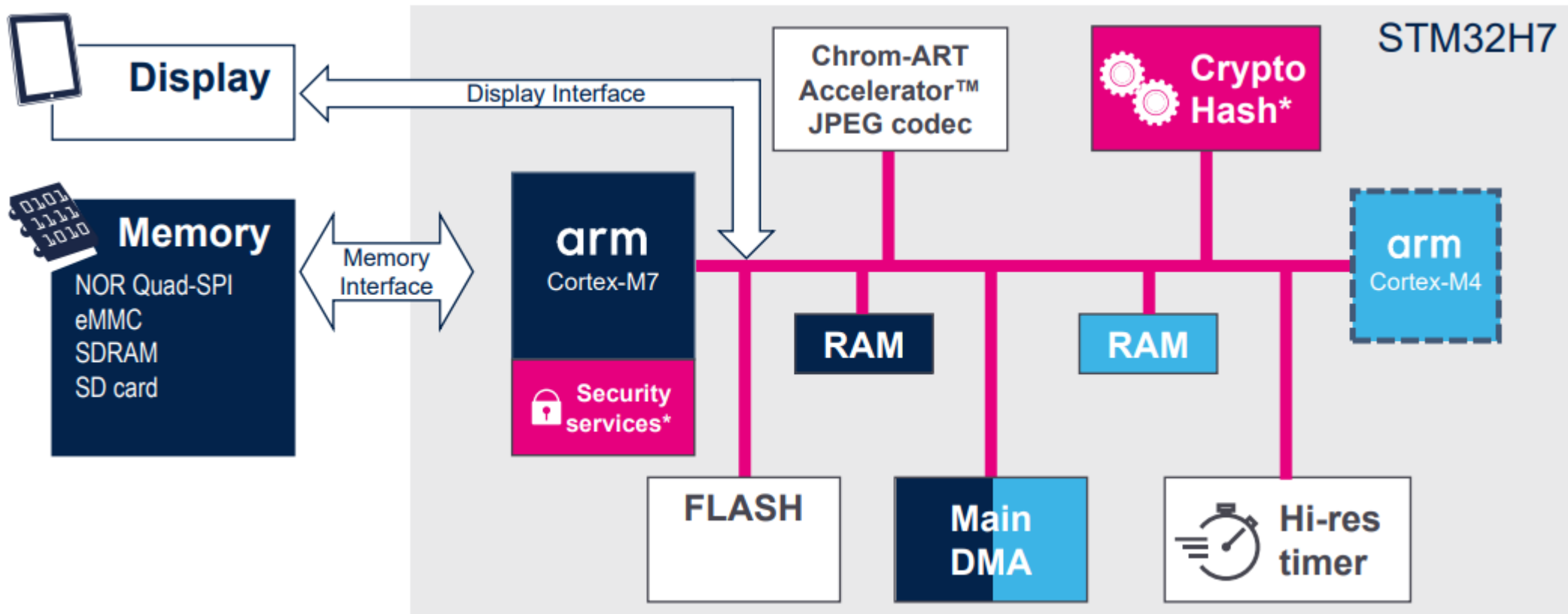- Heterogeneous Multicore

Application Example: AI and Real-time Control

Image Source : STM32H7 MCUs for rich and complex applications, Slide 16

Application Example: Real-time Control

Image Source : STM32H7 MCUs for rich and complex applications, Slide 29

Application Example: Security Solutions

Conclusions

- Multicore microcontrollers have several use cases that can be applied today.
- Partitioning application domains is the future of embedded systems.
- Heterogeneous Multicore is the most common microcontroller architecture.
- Primary use cases today:
  - Separating comms and real-time control
  - Application and security
  - AI/ML and real-time control
  - Rich graphics and real-time control

Thank you for attending

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