DAHLIA

Very High Performance Microprocessor for Space Applications

Jean-Luc Poupat (Airbus)

ADCSS 2017

Introduction

Consortium

Development Plan

DAHLIA Key Features

ARM Technology

Conclusion

Context & Objectives

DAHLIA is an answer to the H2020 topic
"*COMPET-1-2016: Critical Space Technologies for European Strategic Non-Dependence*"

DAHLIA is an **ARM-based System on Chip** implemented in 28nm FDSOI technology designed to boost competitiveness and ensure strategic non dependence of future European Space equipment.

DAHLIA brings to reality what was still a dream few years ago, addressing the new expectations and new mindset of Space industry.

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Organization

7 partners from 4 countries involving the main actors of European Space industry

- ST *France*, coordinator
- Airbus D&S *Germany* & *France*
- Thales Alenia Space *Italy* & *France*
- ISD *Greece* & NanoXplore *France*

AIRBUS

ThalesAlenia Space
A Thales / Finmeccanica Company

life.augmented

ISD S.A.
Integrated Systems Development

NanoXplore

DAHLIA

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Development Plan

- Kick-Off in 2017
- Development in 2017-2018-2019
- SoC FPGA prototyping in 2018
- DAHLIA product available end 2019

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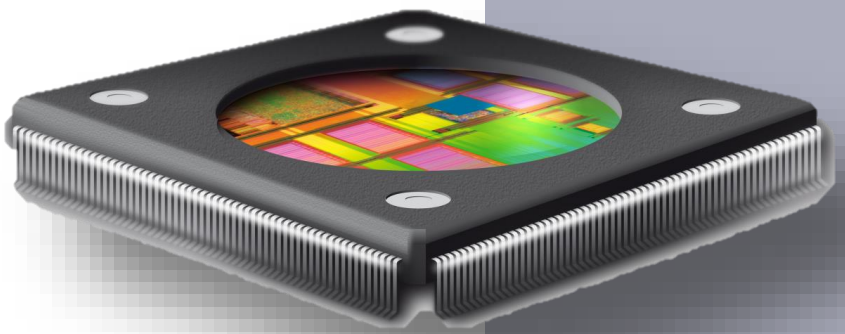
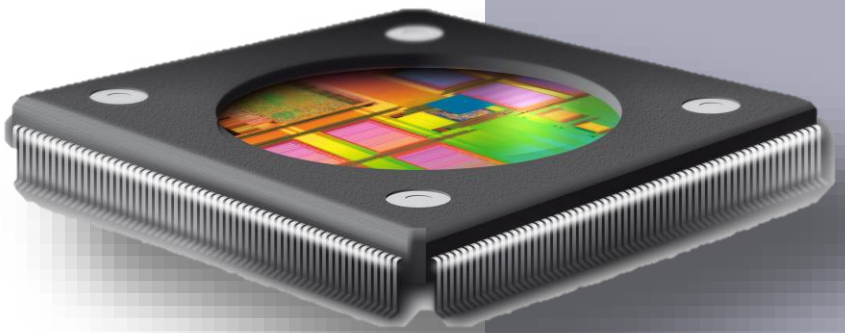
Features

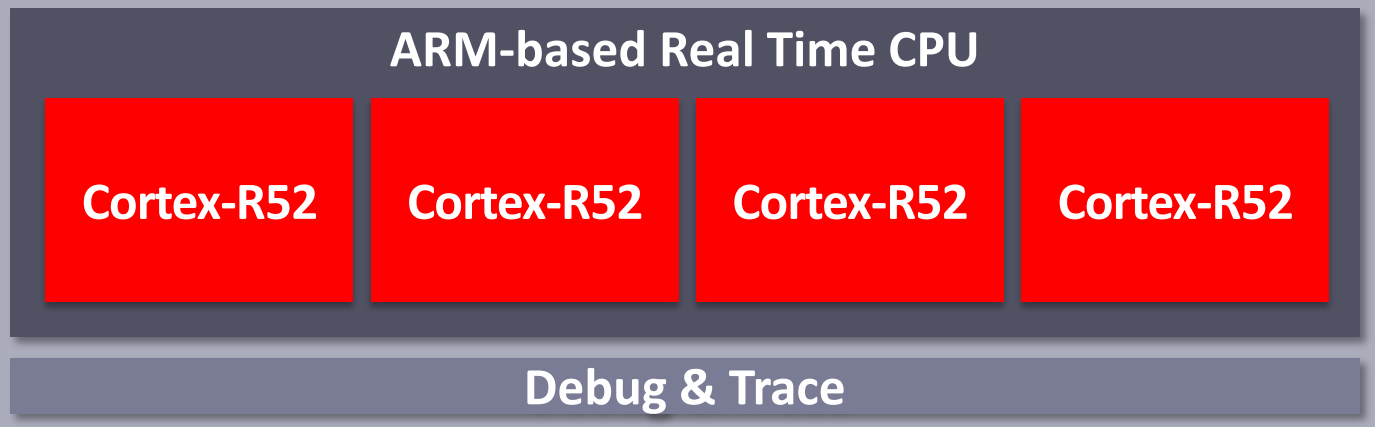


ARM-based Real Time CPU

- Cortex-R52
- Cortex-R52
- Cortex-R52
- Cortex-R52

Features

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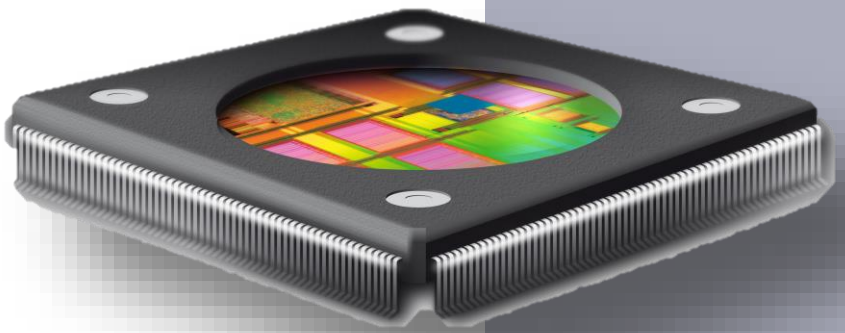
Cortex-R52
Debug & Trace

Features



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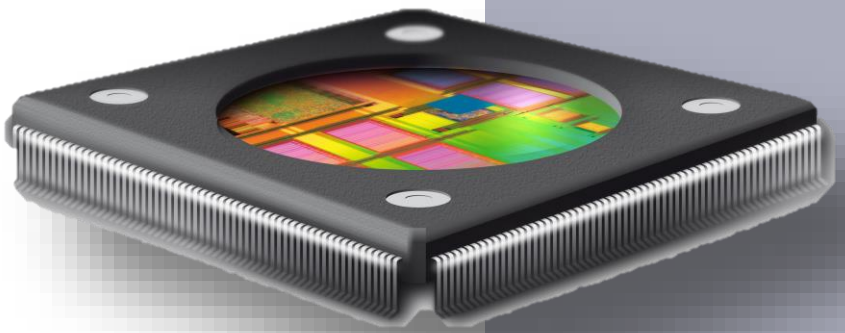
SoC Services

- Clocks & PLL
- WatchDog
- CCSDS OBT
- Security

Features



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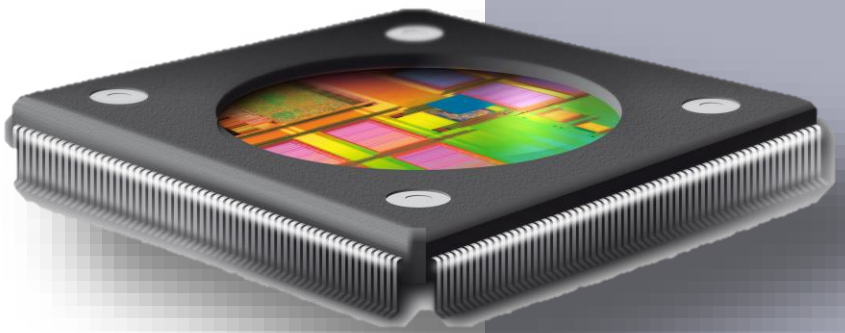
On chip Memory

- eRAM w/ECC
- eROM w/ECC

External Memory Interface

- DDR w/ECC
- FLASH w/ECC

Features



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DMA Controller

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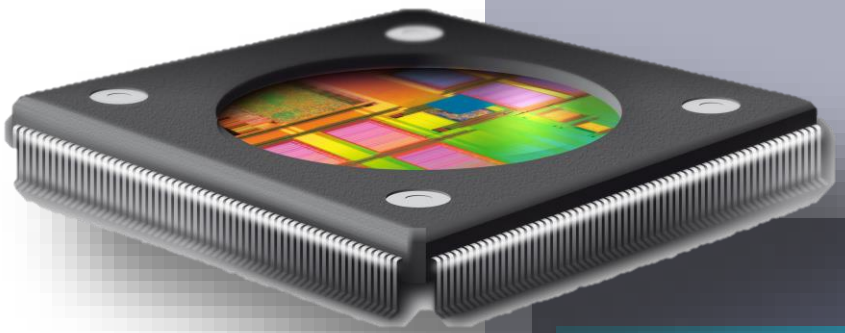

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Connectivity

GPIO	CAN, SPI	HSSL	GNSS
UART	1553 BC & RT	SpW RMAP	CCSDS TM & TC

Features

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Debug & Trace

Scalability

- Embedded FPGA

On chip Memory

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- eROM w/ECC

External Memory Interface

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DMA Controller

Connectivity

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eROM w/ECC

External Memory Interface

DDR w/ECC

FLASH w/ECC

DMA Controller

Enhanced Internal AXI Interconnect System Bus

Connectivity

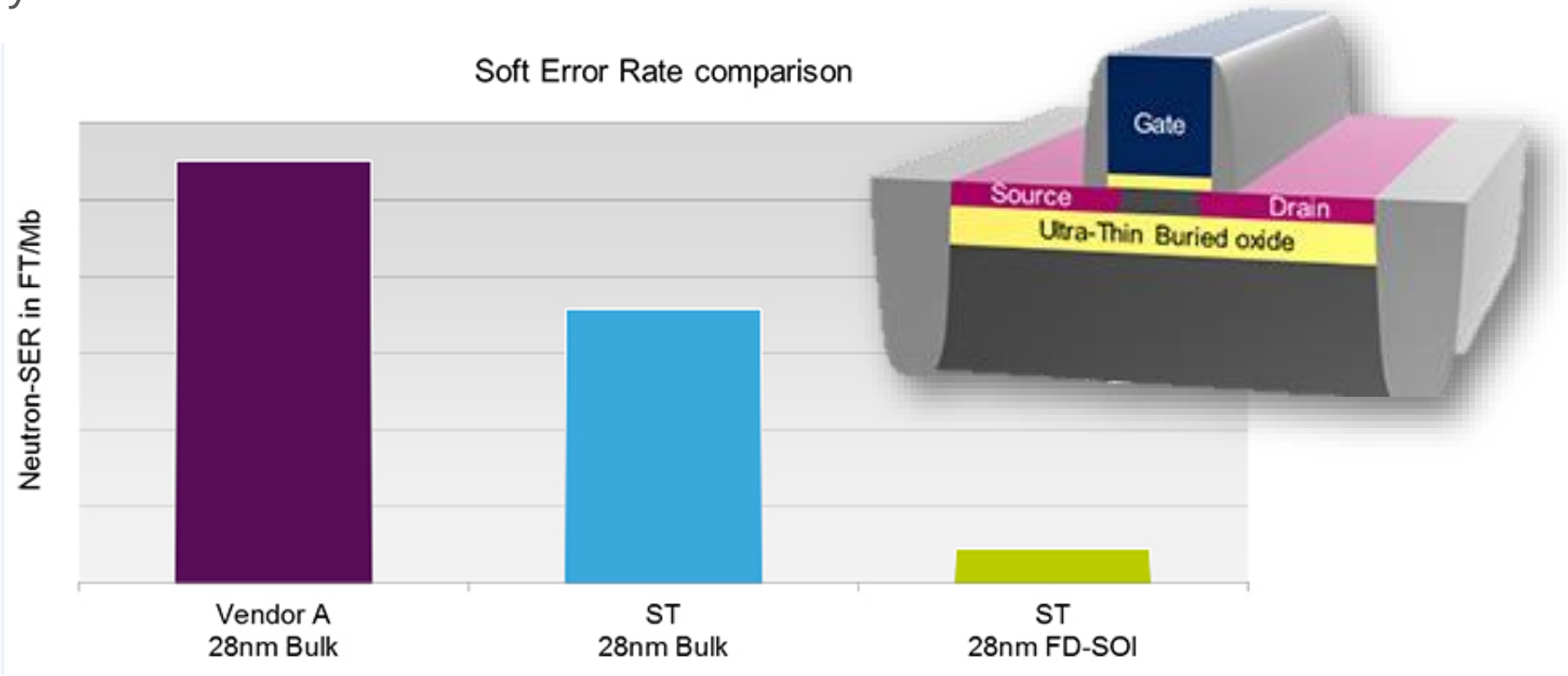
GPIO	CAN, SPI	HSSL	GNSS
UART	1553 BC & RT	SpW RMAP	CCSDS TM & TC

STM 28nm FDSOI Technology

Intrinsically immune to Latch-up

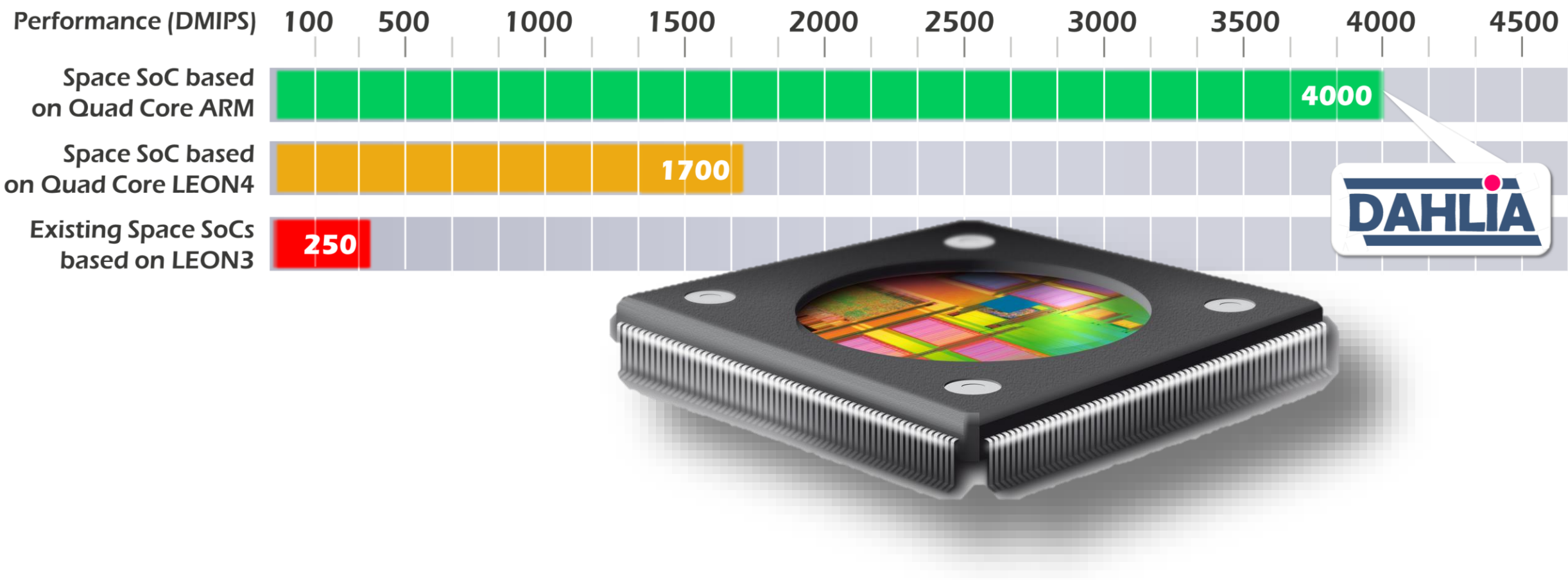
Reduced pitch size providing good dose tolerance

Very good immunity to SEU



28 nm → Moore's Law is (as usual) on our side

Designed for ultimate performances



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Why looking at ARM ?

100 BILLIONS OF CHIPS

Why looking at ARM ?

- ↗ Wide dissemination of ARM CPUs in embedded systems
- ↗ Available as an RTL IP Core with full access to source code
- ↗ ARM ecosystem
- ↗ Code density better that its competitors
- ↗ Many development languages
- ↗ European technology (UK & FR)
- ↗ Low power
- ↗ Now focused on safety critical applications

- ↘ New SW development & environment
- ↘ ARM market business plan
- ↘ Radiation assessment

ARM Technology Selection

Cortex-A

Highest performance
Optimized for rich operating systems

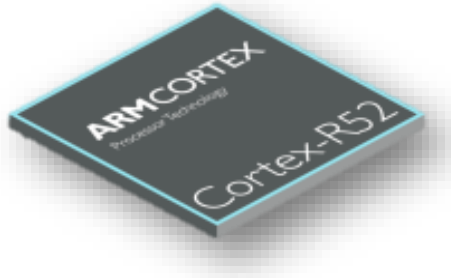
Cortex-R

Fast response
Optimized for high-performance, hard real-time applications

Cortex-M

Smallest/lowest power
Optimized for discrete processing and microcontroller

ARM Technology Selection



Cortex-R7
High performance 4G modem and storage

Cortex-R8
Highest performance 5G modem and storage

Storage & Modem

Cortex-R4
Real-time performance

Cortex-R5
Real-time performance with functional safety

Cortex-R52
Most advanced processor for functional safety

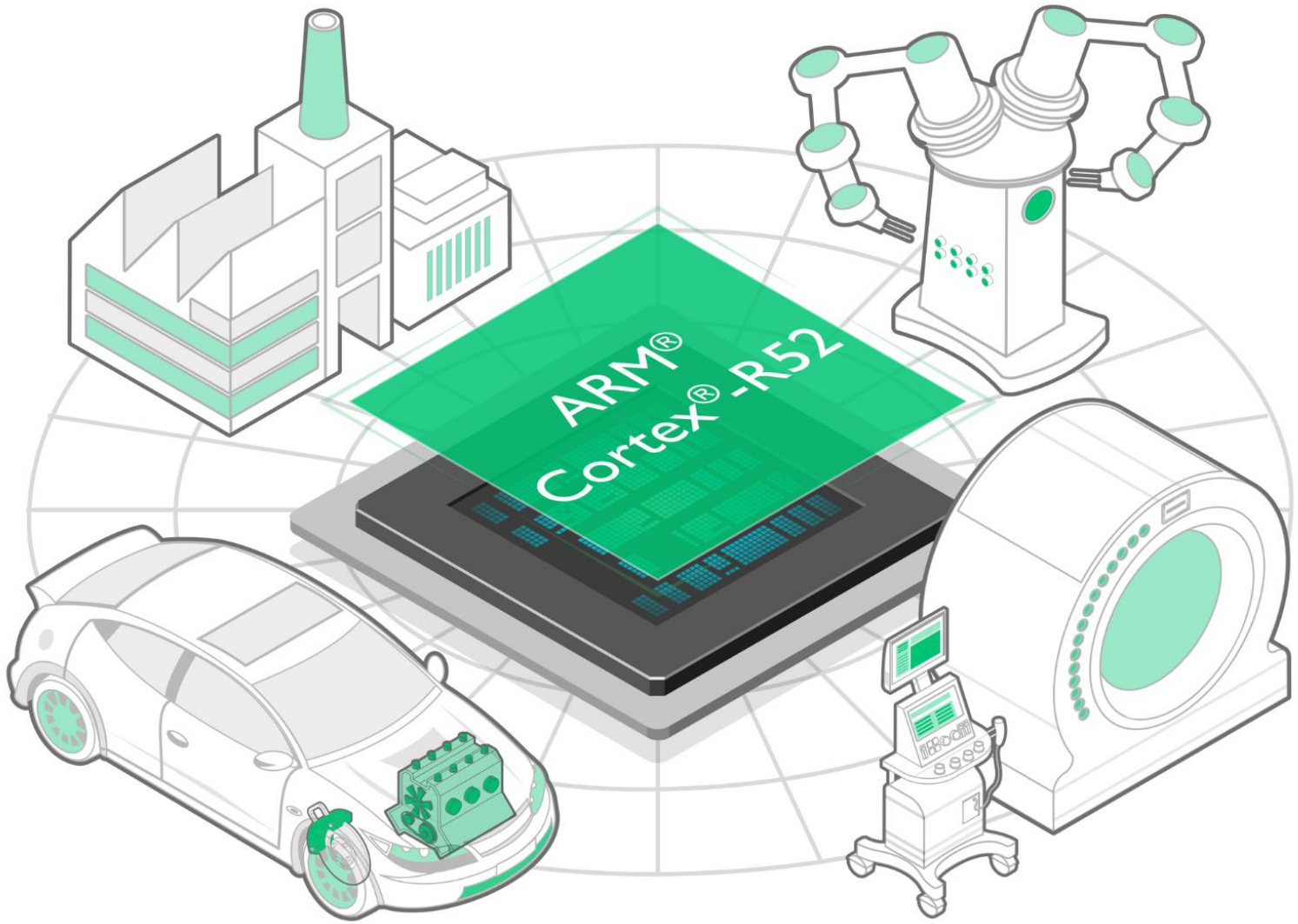
Functional Safety

ARMv7-R

ARMv8-R

Cortex-R52

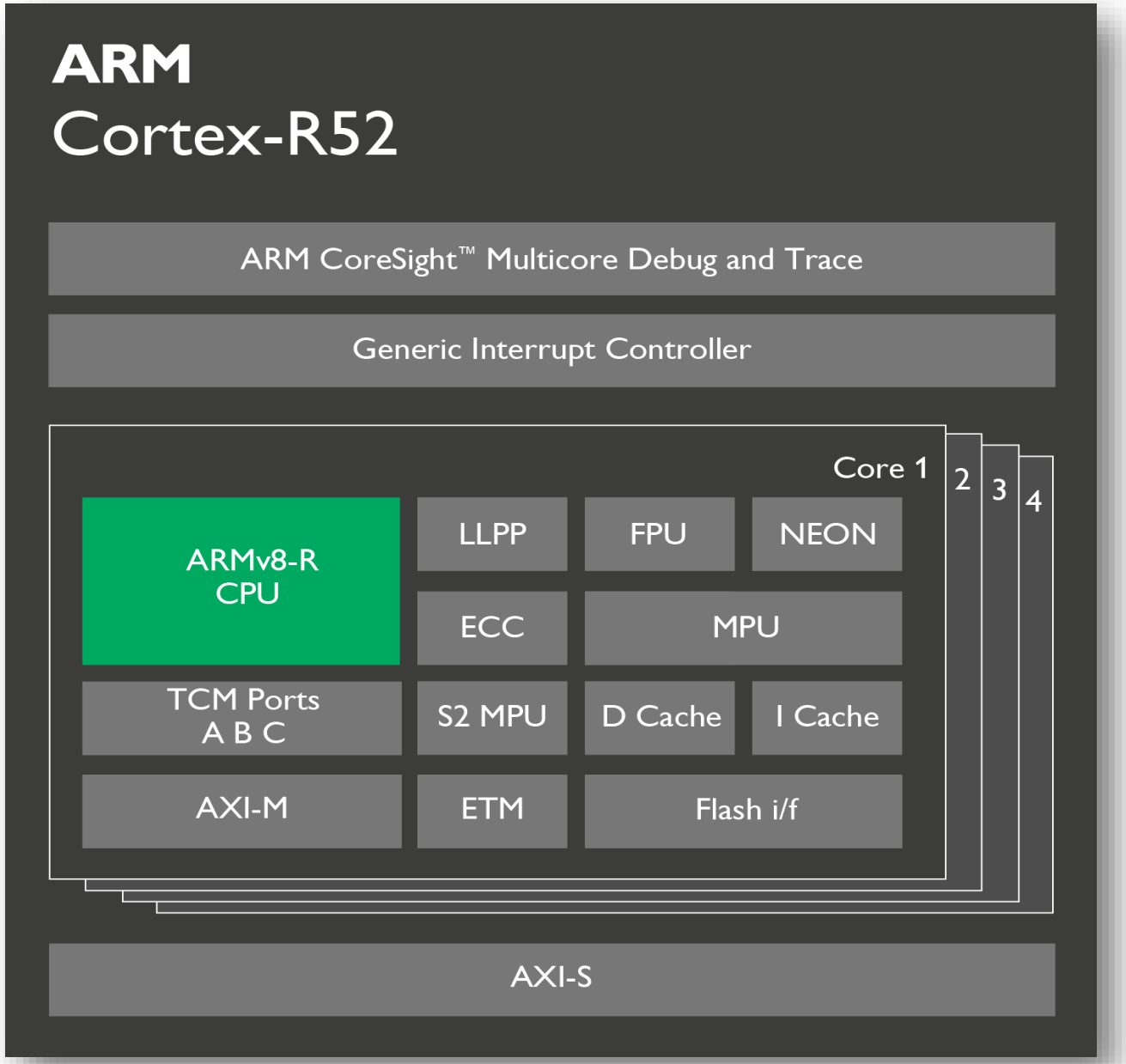
- ARM’s most advanced processor for safety
- Dedicated for safety applications including automotive, industrial and healthcare
- Simplifies integration of software in complex safety systems



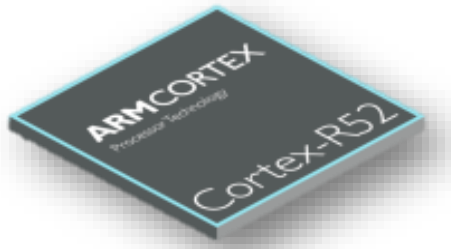
Cortex-R52

Safety features dedicated to random errors

- ECC protected memory
- Software BIST libraries
- Error management
- Level 2 MPU
- New privilege level
- …

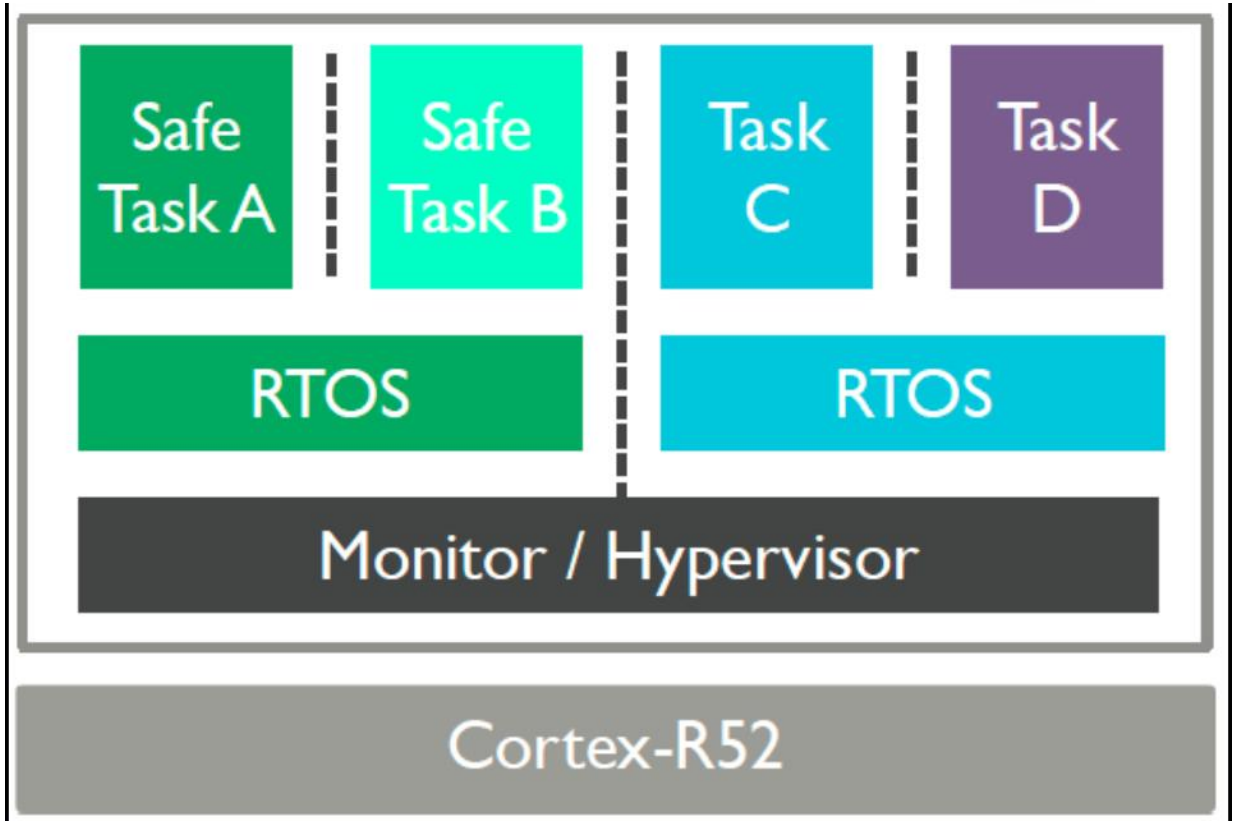


Cortex-R52 simplifies real-time SW isolation



- ARMv8-R introduces new privilege level
- Create ‘sandboxes’ protected from other SW
- Monitor or Hypervisor manages software separation and simplifies isolation of tasks
- Real time switch rapidly between tasks and ‘sandboxes’
- Simplified integration of complex SW from multiple sources

→ Optimized for TSP



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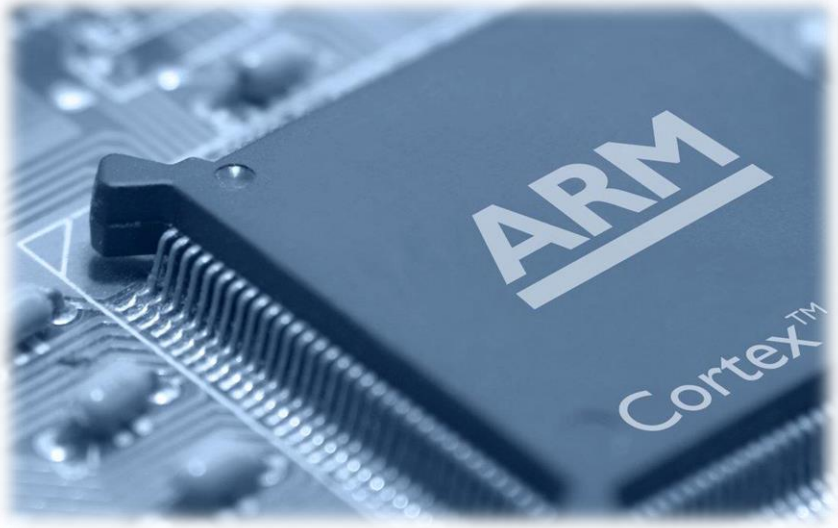
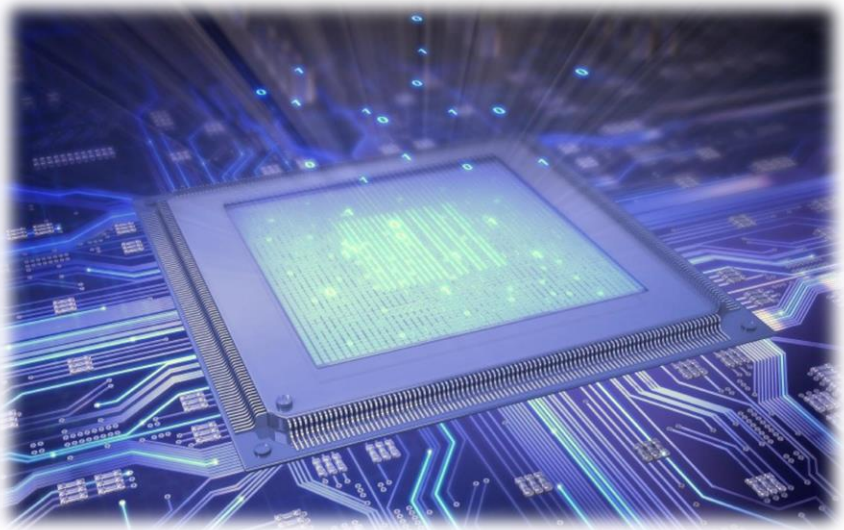
DAHLIA Keypoints



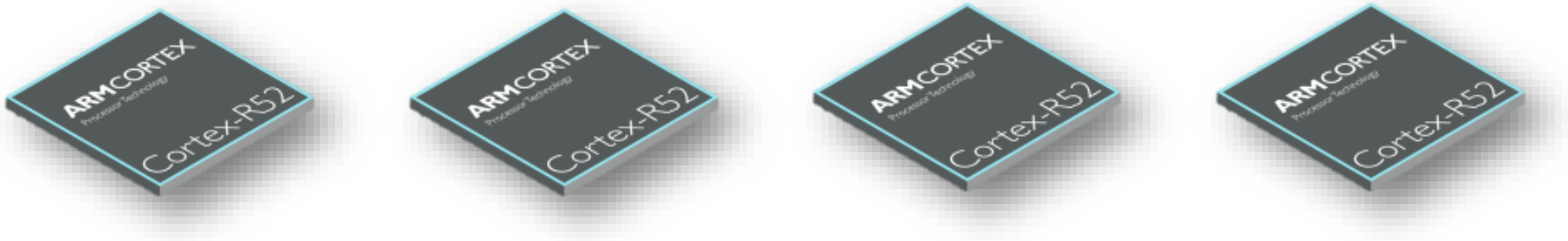
Powerful combination of innovative technology adapted for Space



Optimized to support time and space partitioning for centralized avionics

Designed to face the new challenges of Space such as mega-constellations

Conclusion



The DAHLIA H2020 project covers the development of a rad-hard high performance quad-core ARM R52 SoC in 28nm FDSOI technology, with eFPGA for flexibility and key IPs.

It will enable faster and cost-efficient development of products for multiple space applications.

Beyond Space applications, DAHLIA will enable the convergence with terrestrial applications benefiting from the strong ARM ecosystem.

DAHLIA brings to reality what was still a dream few years ago, addressing the new expectations and new mindset of Space industry.

dahlia-h2020.eu

More details on DAHLIA are available the project website

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Thank you

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