JavaOne - STMicroelectronics

STM32 Microcontrollers and ME8

Steve Miller

Stuart McLaren

STMicroelectronics

- A global semiconductor leader
- 2014 revenues of **$7.40B**

Research & Development

Main Sales & Marketing

Front-End

Back-End

- Approximately **43,600** employees worldwide
- Approximately **8,700** people working in R&D
- **11** manufacturing sites
- Over **75** sales & marketing offices

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Listed on New York Stock Exchange, Euronext Paris
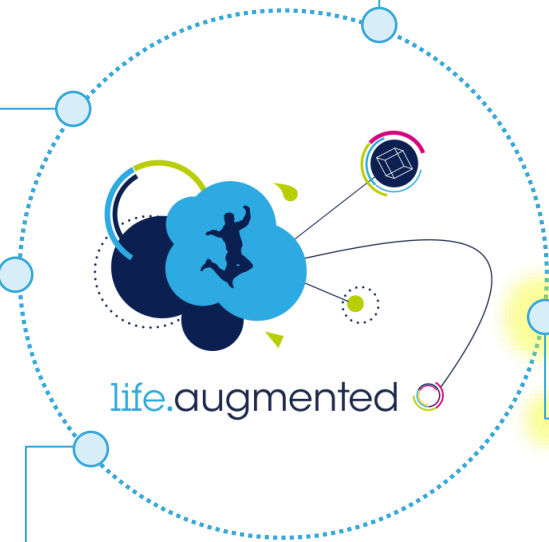and Borsa Italiana, Milano

Our MEMS & Sensors are augmenting the consumer experience

Our digital consumer products are powering the augmented digital lifestyle
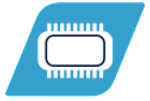
Our automotive products are making driving safer, greener and more entertaining

Our Microcontrollers (MCU) are everywhere making everything smarter and more secure

Our smart power products are allowing our mobile products to operate longer and making more of our energy resources
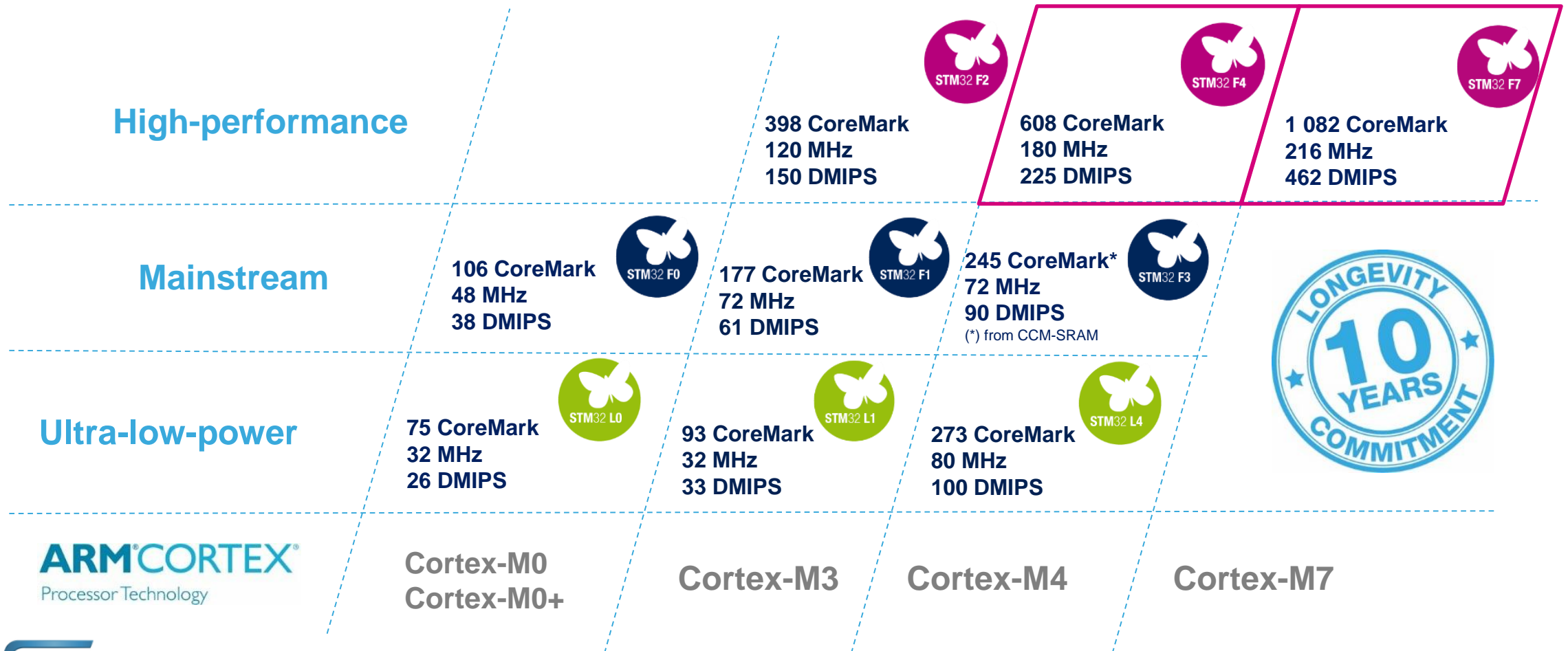
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Revenue in Millions USD

2013 Rank	2014 Rank	Company Name	2013 Revenue ($)	2014 Revenue ($)	Revenue Percent Change	Revenue Percent of Total
1	1	Renesas Electronics Corporation	1 499	1 465	-2,3%	18,0%
2	2	Microchip Technology	1 001	1 093	9,2%	13,4%
3	3	Atmel Corporation	874	916	4,8%	11,2%
5	4	STMicroelectronics	565	786	39,1%	9,7%
4	5	Texas Instruments	650	730	12,3%	9,0%
6	6	Freescale Semiconductor	503	556	10,5%	6,8%
9	7	NXP	248	361	45,6%	4,4%
8	8	Spansion	283	281	-0,7%	3,4%
7	9	Cypress Semiconductor	289	277	-4,2%	3,4%
11	10	Infineon Technologies	166	194	16,9%	2,4%
		Top 10 Companies	6 078	6 659	9,6%	81,8%
		All Others	1 722	1 486	-13,7%	18,2%
		Total Semiconductor	7 800	8 145	4,4%	100,0%

(*) without Automotive and Secure MCUs
Source: IHS iSuppli CLT March 17th 2015
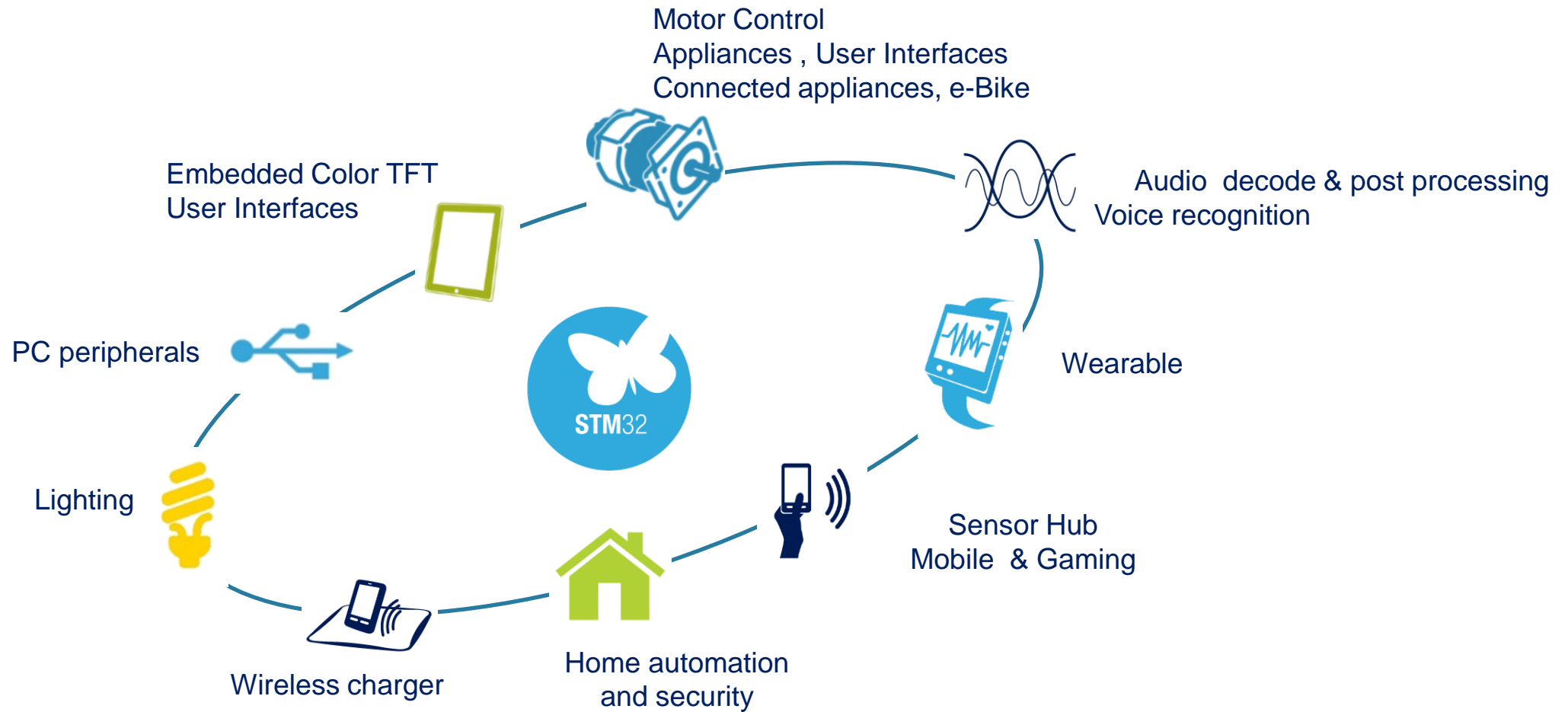
Today - STM32 portfolio positioning

More than 30 product lines

High-performance

398 CoreMark
120 MHz
150 DMIPS

STM32 F2

608 CoreMark
180 MHz
225 DMIPS

STM32 F4

1 082 CoreMark
216 MHz
462 DMIPS

STM32 F7

Mainstream

106 CoreMark
48 MHz
38 DMIPS

STM32 F0

177 CoreMark
72 MHz
61 DMIPS

STM32 F1

245 CoreMark*
72 MHz
90 DMIPS
(*) from CCM-SRAM

STM32 F3

Ultra-low-power

75 CoreMark
32 MHz
26 DMIPS

STM32 L0

93 CoreMark
32 MHz
33 DMIPS

STM32 L1

273 CoreMark
80 MHz
100 DMIPS

STM32 L4

LONGEVITY
10 YEARS
COMMITMENT

ARM CORTEX®
Processor Technology

Cortex-M0
Cortex-M0+

Cortex-M3

Cortex-M4

Cortex-M7

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Examples of STM32 applications

Motor Control
Appliances , User Interfaces
Connected appliances, e-Bike

Embedded Color TFT
User Interfaces

Audio decode & post processing
Voice recognition

PC peripherals

Wearable

Lighting

Sensor Hub
Mobile & Gaming

Wireless charger

Home automation
and security

STM32

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The Gear Fit, on the other hand, is using a more simple chip behind the scenes – the STM32F439, a Cortex-M4 chip that is more of a microcontroller than a full-blown processor, which is more than enough to power the real-time operating system running on the Gear Fit.

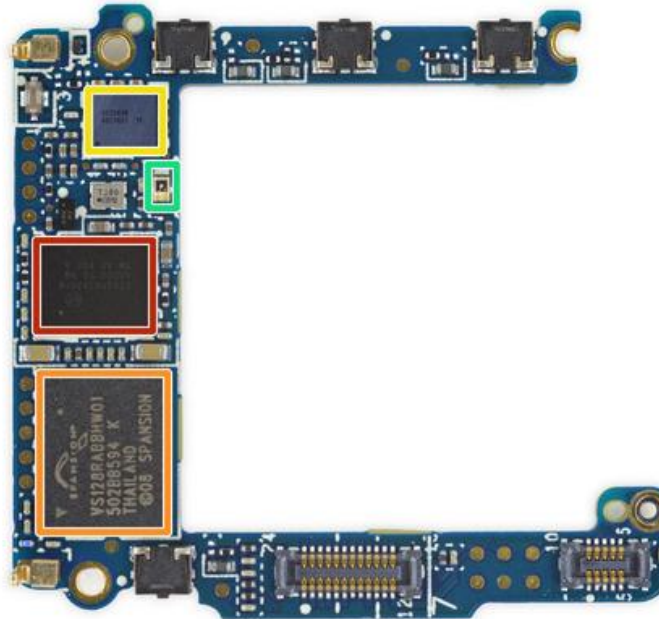Update: ifixit published a full teardown of the Gear 2 which also shows the Exynos 3250 SoC.
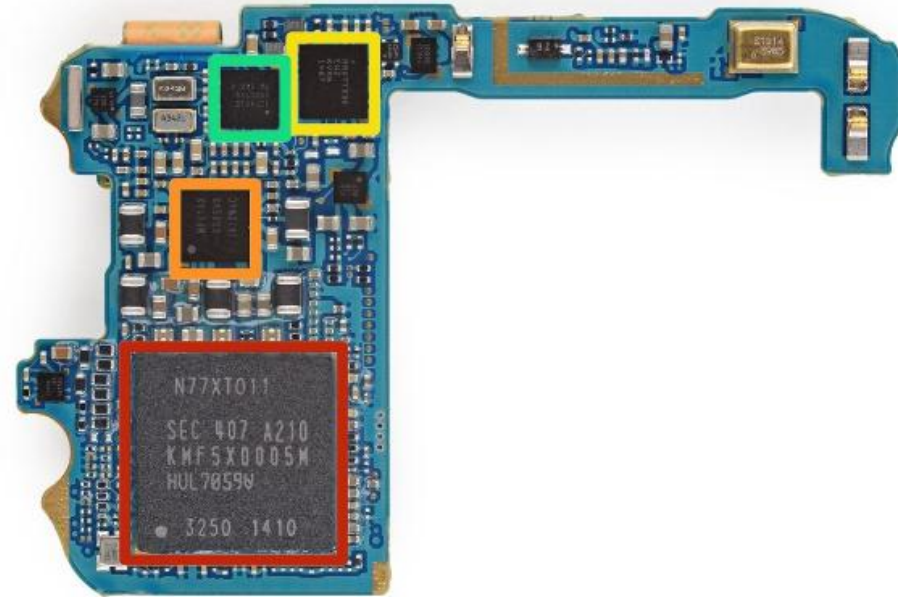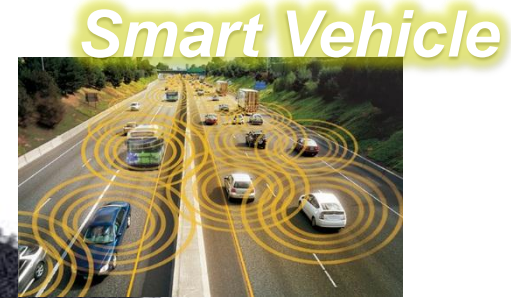
Step 9   Edit 1 💬

- We've chipped away at this Pebble—now let's have a look at the motherboard. Front-side ICs include:

- 🔴 ST Micro STM32F439ZG 180 MHz ARM Cortex-M4-based MCU

- 🟠 Spansion S29VS128R 128 Mb, 65 nm MirrorBit Flash

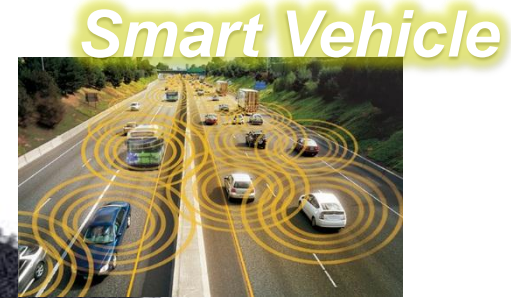- 🟡 Texas Instruments CC2564B Bluetooth and Dual-Mode Controller

- 🟢 Ambient light sensor

https://www.ifixit.com/Teardown/Pebble+Time+Teardown/42382?utm_content=buffer6b e84&utm_medium=social&utm_source=facebook.com&utm_campaign=buffer

STM32 key features for IoT

Smart Home

Smart Vehicle

Smart SOHO

Smart Life Augmented

- Diverse Connectivity
- Dedicated Security IPs
- High MCU Performance
- Low power solution

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STM32 key features for IoT

USB

UART

SPI

Ethernet
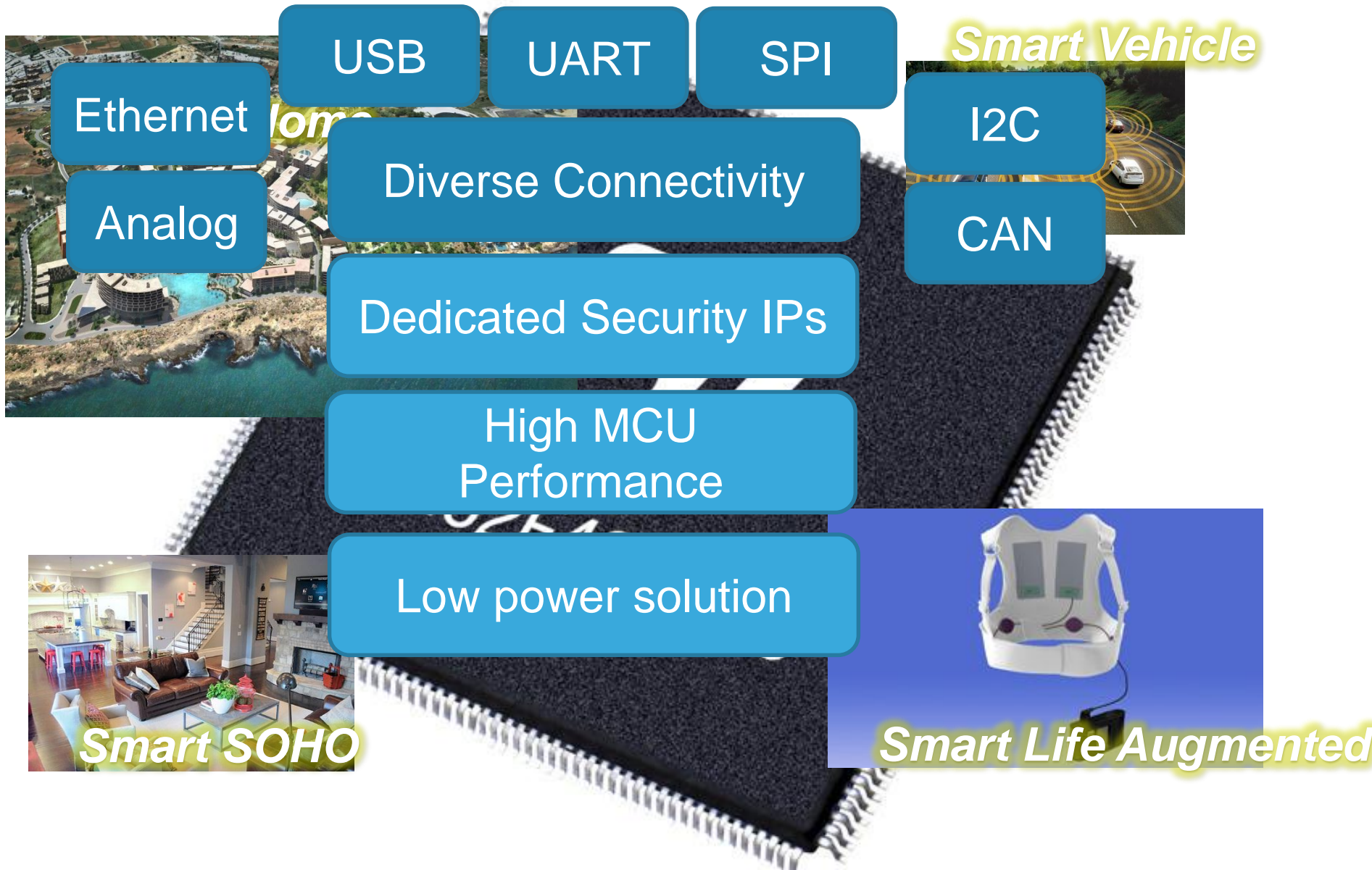
Analog

Diverse Connectivity

Dedicated Security IPs

High MCU Performance

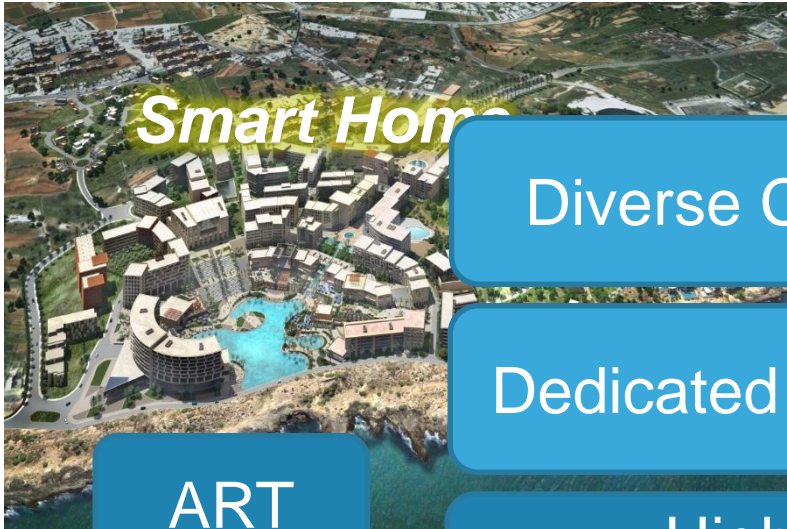Low power solution

Smart Vehicle

I2C

CAN

Smart SOHO

Smart Life Augmented

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STM32 key features for IoT

Smart Home

Smart Vehicle

Smart SOHO

Smart Life Augmented

- Diverse Connectivity
- Dedicated Security IPs
- High MCU Performance
- Low power solution

- AES
- TRNG

- HASH
- MPU

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STM32 key features for IoT

Smart Vehicle

Smart Home

Diverse Connectivity

Dedicated Security IPs

ART

Cache

High MCU Performance

CCM

Cortex M4/M7

Low power solution

Smart SOHO

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STM32 key features for IoT

Smart Home

Smart Vehicle

Smart SOHO

Smart Life Augmented

Diverse Connectivity

Dedicated Security IPs

High MCU Performance

Low power solution

Process

Design

Clocks

RTC

Java ME Embedded
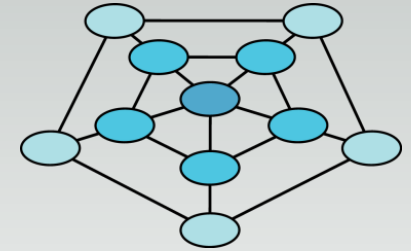
Features at a Glance

Proven Java embedded platform based latest Java ME 8 standards
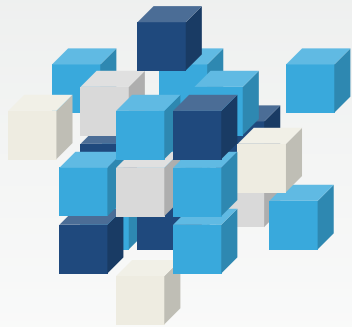
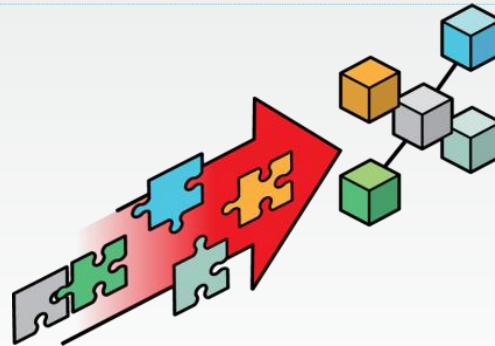**Highly optimized, robust multitasking Java Virtual Machine**

Fully headless operation with wired & wireless connectivity

Versatile, cross-platform access to peripherals and networks

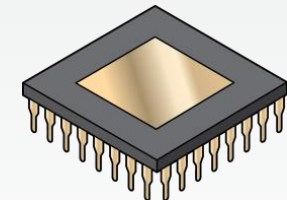**Modular software platform, ideal for granular in-field upgrades**

Remote software deployment and management

Multiple RTOS or bare metal supported

Scalable from microcontroller-class systems upwards

What is Oracle Java ME Embedded?

- A modern, embedded Java software platform for small devices
  - Aligned with the Java 8 platform
  - Dedicated embedded features including
    - Robust multi-tasking execution
    - Comprehensive security
    - Remote software provisioning and management
    - Versatile connectivity, including cellular
    - Integration with peripheral devices

- Supports wide range of devices, from micro-controllers upwards
  - As little as 128 KB RAM and 1 MB Flash

- Brings the Java ecosystem and value-proposition to small devices

Java ME 8 Platform Overview

Use Case Software
(e.g. smart pen)

Use Case Software
(e.g. wireless module)

Use Case Software
(e.g. control unit)

Use Case Software
(e.g. smart meter)

Additional APIs (Examples)

| Messaging | Wireless Communication | Protocols and Data Conversion | Security and Management | Additional Optional APIs |
| Location | Web Services | Sensors | Additional Optional JSRs | Vertical Specific APIs |

On-Device I/O Access

Device I/O API

Generic Connection Framework

GCF 8

Application Platform

Java ME Embedded Profile (MEEP) 8 (JSR 361)

Security and Trust Services

SATSA (JSR 177)

Java VM

Java ME Connected Limited Device Configuration (CLDC) 8 (JSR 360)

Java for MCUs

- Java provides a high level uniform environment
  - Targets advanced embedded IoT applications
  - Large number of widely used APIs

- Rapid development and deployment
  - High level language
  - Code reuse
  - Flexible communications busses
  - Simplified OTA/field updates

STM32F429/439

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Java for MCUs

- Current Java ME 8.1 is full stack on STM32F429 Eval board

- High level applications deployed over ethernet

- Some application development can now be done by Java developers with little or no embedded experience

MCU vs MPU

- MCUs can be used for endpoint or edge devices

- Expensive MPUs can be reserved for hub activities where MCU does not have compute power or connectivity bandwidth

- There is some overlap in needed capabilities – sometimes in MCU is all that's needed

- MCU performance continually improving
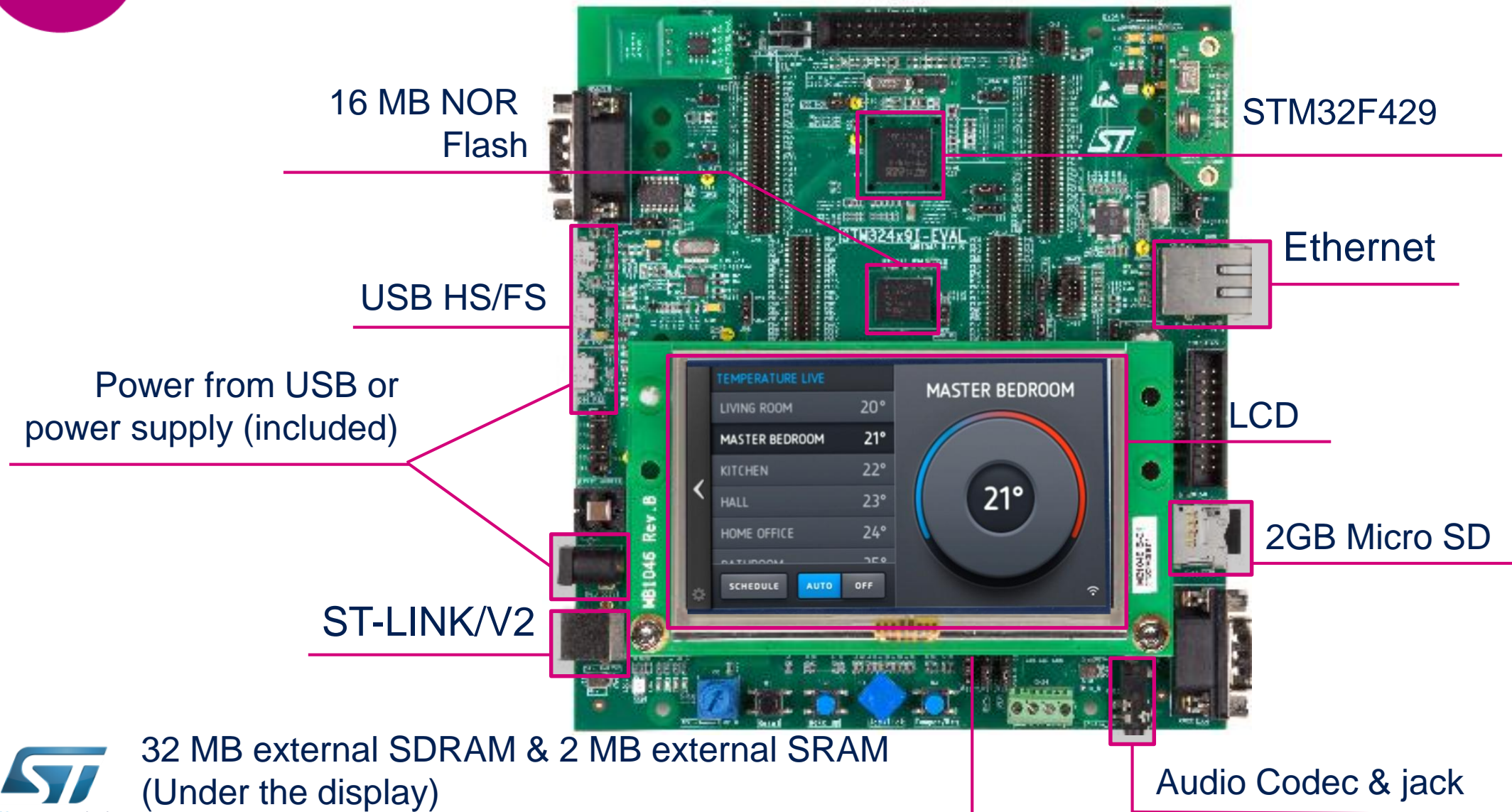 - MCU can handle many tasks that previously needed an MPU.

STM32F429/439

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Java for MCUs

- ## High performance needed

  - Cortex M4F or M7

- ## Substantial memory requirements

  - STM32F4 and STM32F7 families meet this

  - Both have up to 2MB internal flash, 256KB internal SRAM

  - Both support external SDRAM, external NOR, NAND, QSPI flash, SRAM

  - Application Storage on SDCard or external flash

16 MB NOR Flash

STM32F429

USB HS/FS

Ethernet

Power from USB or power supply (included)

LCD

ST-LINK/V2

2GB Micro SD

32 MB external SDRAM & 2 MB external SRAM (Under the display)

Audio Codec & jack

STM32 F4

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Development Environment

- IDE: Netbeans (https://netbeans.org/downloads/index.html)

- To load VM on board use STLink (STLink Utility, Keil, etc)
  - ST-Link Utility is at http://www.st.com/web/en/catalog/tools/PF258168

- Java ME from http://www.oracle.com/technetwork/java/embedded/javame/embed-me/downloads/java-embedded-java-me-download-2162242.html
  - See Getting Started Guide for detailed instructions

STM32F469 Discovery Board

Key Features
- STM32F469ZIT6 microcontroller built-in 2 MByte Flash, 256 KByte RAM
- 2.4" QVGA TFT LCD
- SDRAM 64 Mbits
- L3GD20, ST MEMS motion sensor, 3-axis digital output gyroscope
- Six LEDs
- Two pushbuttons (user and reset)
- USB OTG with micro-AB connector
- Arduino Uno extension connector (Shield add-on)
- DSI Host Display controller

Salestype:
STM32F769I-DISCO

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STM32F7 Discovery Board

**Salestype
STM32F746G-DISCO**

Key Features

STM32F746NGH6 built-in 1 Mbyte Flash + 340 Kbytes of RAM
4.3-inch 480x272 color LCD-TFT with capacitive touch screen
Audio line in and line out jack
Stereo speaker outputs
2 ST MEMS microphones
SPDIF RCA input connector
Two push buttons (user and reset)
128-Mbit Quad-SPI extra Flash memory
64-Mbit extra SDRAM
microSD card connector
USB OTG HS
USB OTG FS
Ethernet connector
Arduino Uno V3 connectors

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Advantages of Developing with Java ME

Embedding future-proof solutions

- Robust and Secure

- Feature-rich

- In-Field updatability

- Low footprint / power aware

- Up-stack Value

- Economics of scale

- Platform independence

- Controlled app execution

- Wide API and protocol support

- Update function throughout lifetime

- Size-optimized features and APIs

- Build with commodity components

- Open, standardized, interoperable

- Platform independent applications

Comprehensive Security built-in

What security standards are used by Java? How STM32 support them?

- Secure code loading, verification, and execution (sandboxing)

- Managing access to protected functionality and resources (HW)

- Data encryption (protocols, connectivity)

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STM32 security offering

- In addition to legacy security mechanisms offered by Cortex-M (like MPU or TrustZone-M), ST adds security features on STM32 portfolio:
  - Unique Identifiers, per chip
  - Watchdogs
  - Anti Tamper
    - Anti-tamper detection pins, Backup registers automatically erased at tampering
  - Flash Memory security
    - Read protection, Write protection, included ECC for error correction
  - PcRoP
    - Sectors of flash set as "execute only", thus preventing the code to be read
  - Firewall
    - Even more restrictive than MPU and PcRoP. Made to protect a specific part of code or data Flash Memory, and/or to protect data into the SRAM from the rest of the code executed outside the protected area.
  - True RNG, Hardware Hash and cryptographic means
    - Hardware: True RNG, MD5, SHA-1/2, AES-128/256
    - Software: ST provides a library optimized on STM32 to ensure efficient of lots of standards
  - Power Supply, Clock integrity and Temperature sensor systems
    - Ability to detect attacks in voltage, frequency or temperature

What are JAVA ME8 supported communications?

- Versatile and flexible networking and connectivity, including wireless support (3GPP, CDMA, WiFi)

- Improved access to peripheral devices through Device Access API

- Improved tooling support (Developer Agent, On-device Debugging, Memory Monitor, Network Monitor, CPU Profiler, Logging)

- New APIs for RESTful programming JSON API

- Async HTTP APIOAuth 2.0 API

- JSR 75 (File Connection API), JSR 120 (Wireless Messaging API), JSR 172 (Web Services API), JSR 177 (Security and Trust Services API), JSR 179 (Location API) and JSR 280 (XML API)

What are the other major added benefits of developing with Java?

- Embedded C

- Limited flexibility, high cost

- H/W – S/W interdependencies

- Upgrade complexity

- Impact on security/integrity

- Embedded Java

- Extend lifetime, flexibility and value

- Cross-platform, modular S/W applications

- In field S/W upgrades keeping system integrity

- Partial Flash update by App

- STM32/Java ME8 ready for IoT market

- Get a feel of embedded apps by attending Hands-on Seminars:

  - http://www.st.com/web/en/seminar.html

STM32F7 Hands-on seminars

Seminar overview

STM32F7 MCUs: The world's first ARM® Cortex®-M7-based 32-bit microcontrollers, setting the benchmark in performance

Join our free SM32F7 hands-on seminar. Discover how the STM32F7's ARM Cortex-M7 core and new peripheral set bring high performance to your most demanding applications.

The seminar will feature hands-on classes using the STM32CubeMX initialization code generator and Keil's MDK-ARM software development environment to build and debug a range of embedded projects with an STM32F7 Discovery kit.

During the sessions you will learn how to:

- increase the competitiveness of your applications leveraging the performance of the STM32F7 MCUs with DSP functionality
- take full advantage of the STM32 ecosystem to kickstart your application development and reduce time-to-market
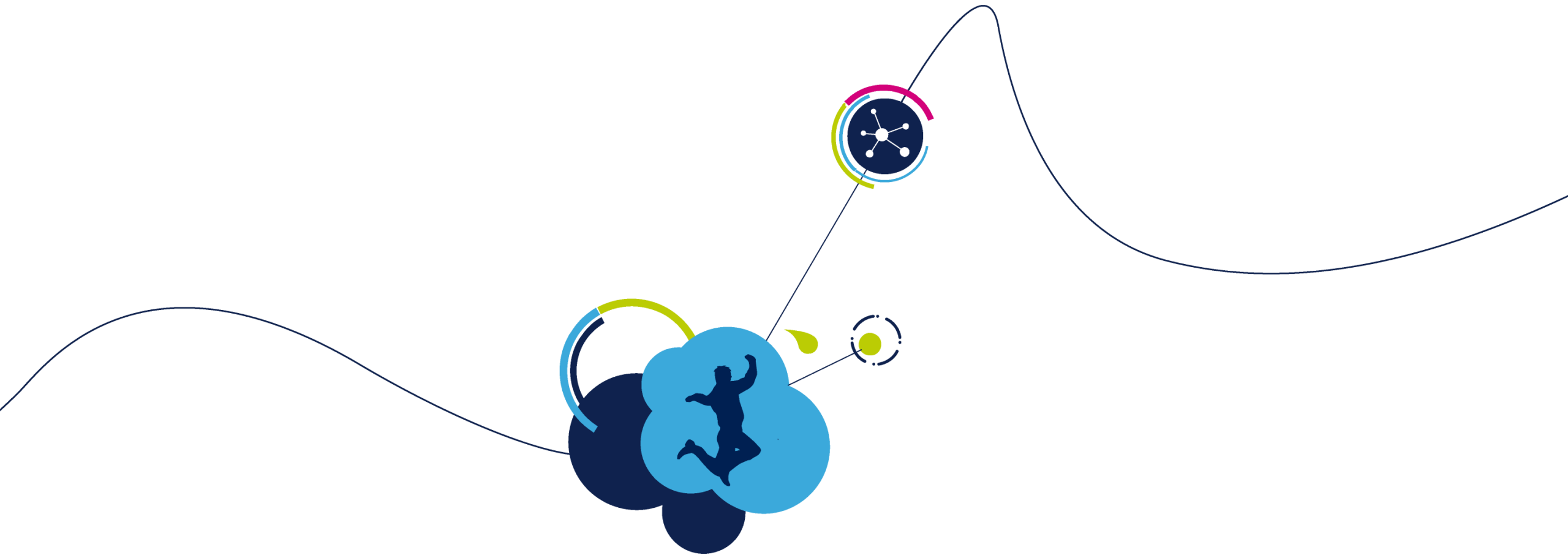
If you have a myST account, click **HERE TO REGISTER NOW**.

If you do not have a myST account, click **HERE TO CREATE** your account

Seminar Agenda

9:00 Introduction

9:30 Presentation of ARM® Cortex®-M7 core

Thank you