

## UNIT- V

### ADVANCED ARM PROCESSORS

ARM Cortex processors are based on the ARMv7 and ARMv8 architectures, designed for high performance, low power consumption, and scalability across embedded systems, mobile devices, and servers.

#### Cortex Processor Families

Family	Target Use Case	Key Features
Cortex-M	Microcontrollers, IoT	Lowpower,deterministic interrupts
Cortex-R	Real-time systems (automotive, etc)	Fault tolerance, fast response
Cortex-A	Application processors (phones, etc)	Highperformance,MMU,OS support

#### Architecture Features

- RISC Architecture: Simplified instruction set for faster execution.
- Thumb-2 ISA: Mix of 16-bit and 32-bit instructions for better code density.
- Harvard Architecture (Cortex-M): Separate buses for instructions and data.
- Pipeline Execution: Multi-stage instruction processing for speed.
- Load-Store Design: Operations only on registers, not directly on memory.
- Register Bank:
  - 16 general-purpose registers (R0–R15)
  - Special registers: SP (R13), LR (R14), PC (R15)

#### Program Status Registers:

- CPSR (Current Program Status Register)
- SPSR (Saved Program Status Register)
- Interrupt Handling:
  - NVIC (Nested Vectored Interrupt Controller)
  - Supports up to 240 interrupts with prioritization
- Memory Management:
  - MMU in Cortex-A for virtual memory
  - MPU in Cortex-M for memory protection
- Security Features:
  - TrustZone (in Cortex-A)
  - Secure boot and privilege levels

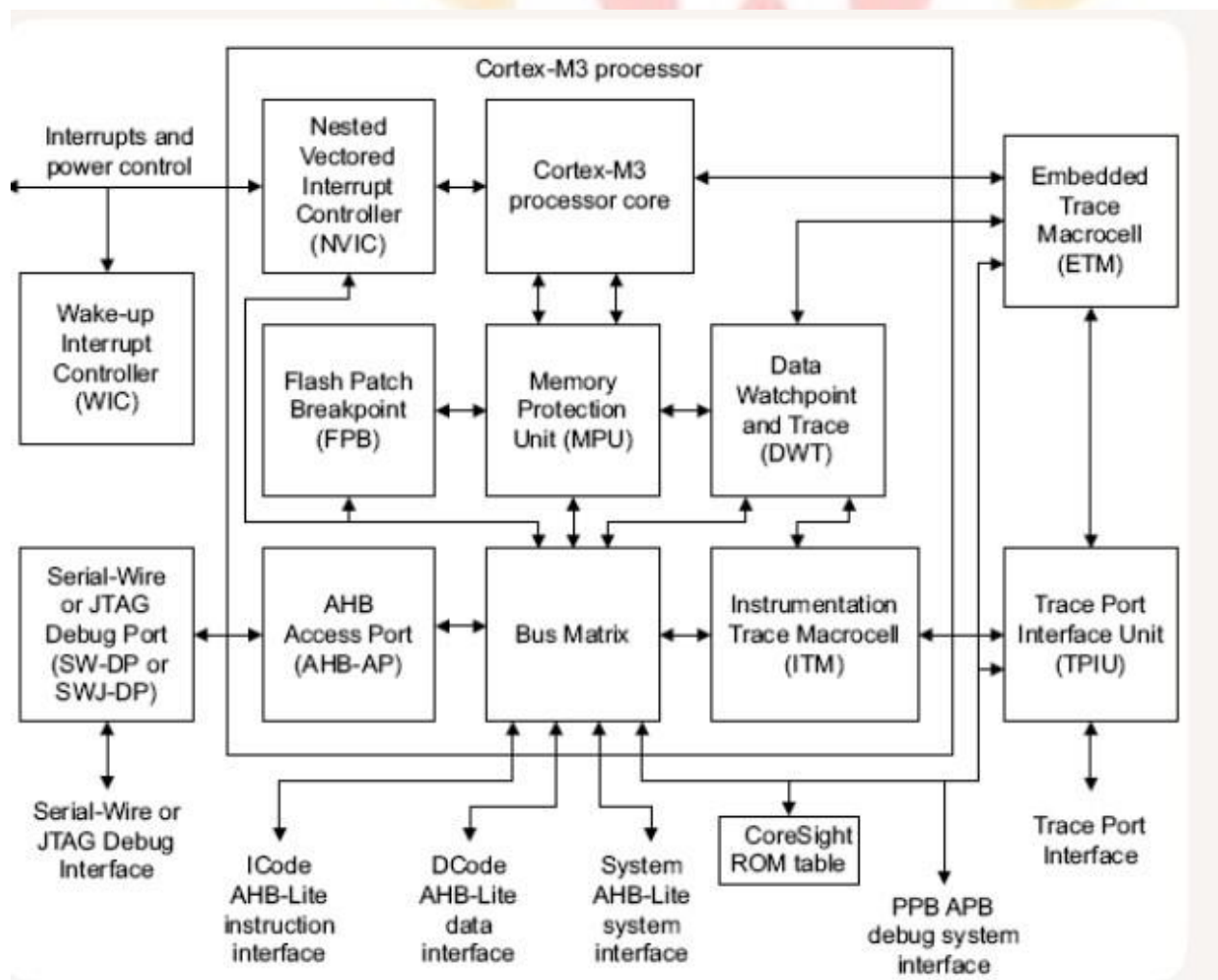
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Debugging & Development Support

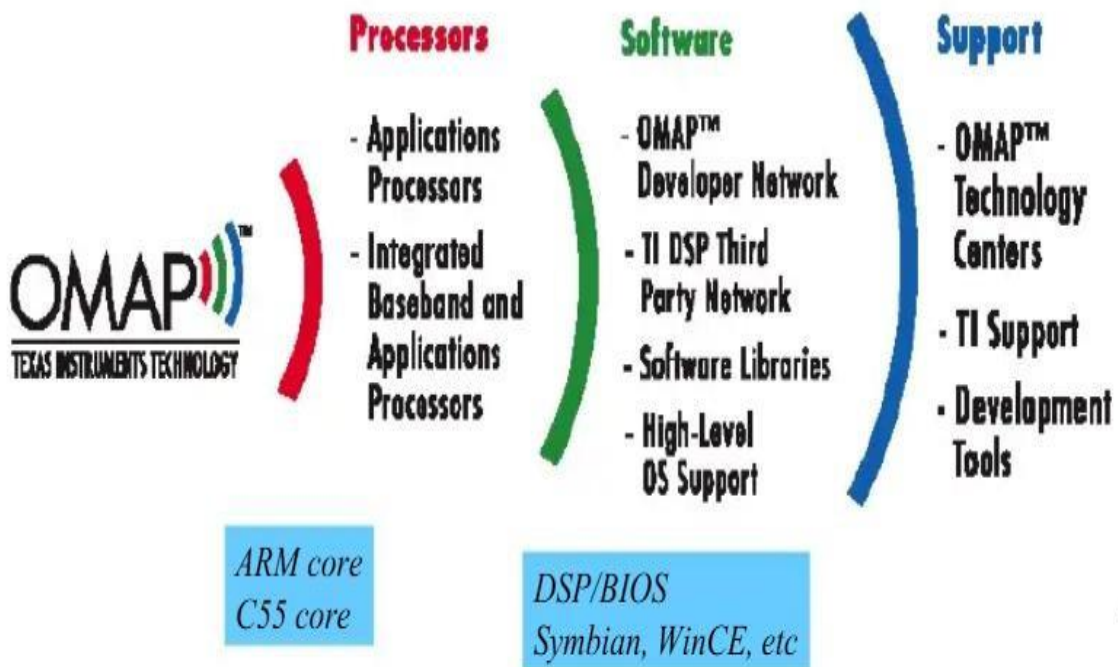
- JTAG & Serial Wire Debug: For hardware-level debugging
- ETM (Embedded Trace Macrocell): Instruction tracing
- DWT (Data Watchpoint and Trace): Profiling and watchpoints
- ITM (Instrumentation Trace Macrocell): Real-time data logging

- Processor Core
- NVIC
- Bus Matrix
- Memory Interfaces
- Debug System
- Peripherals

CORTEX processor Architecture:



# What's OMAP?



**NRCM**

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OMAP (Open Multimedia Applications Platform) processors, developed by Texas Instruments, are a family of

System-on-Chip (SoC) solutions designed primarily for mobile and multimedia applications. They combine general-purpose ARM cores with specialized co-processors to deliver high performance and low power consumption

### Architecture Highlights

- **Dual-core design:** Combines an ARM processor (e.g., ARM926, Cortex-A8, Cortex-A9, Cortex-A15) with a TI DSP (Digital Signal Processor) for efficient multimedia processing.
- **Multimedia accelerators:** Includes IVA (Image, Video, Audio) engines for hardware-accelerated encoding/decoding.
- **PowerVR GPUs:** Integrated graphics processors for 2D/3D rendering and gaming.

OMAP processors are grouped into three categories:

- **High-performance application processors:** Found in smartphones and tablets; capable of running full OSes like Android or Linux.
- **Basic multimedia processors:** Used in consumer electronics with moderate processing needs.
- **Integrated modem + application processors:** Designed for low-cost mobile phones with built-in communication capabilities.

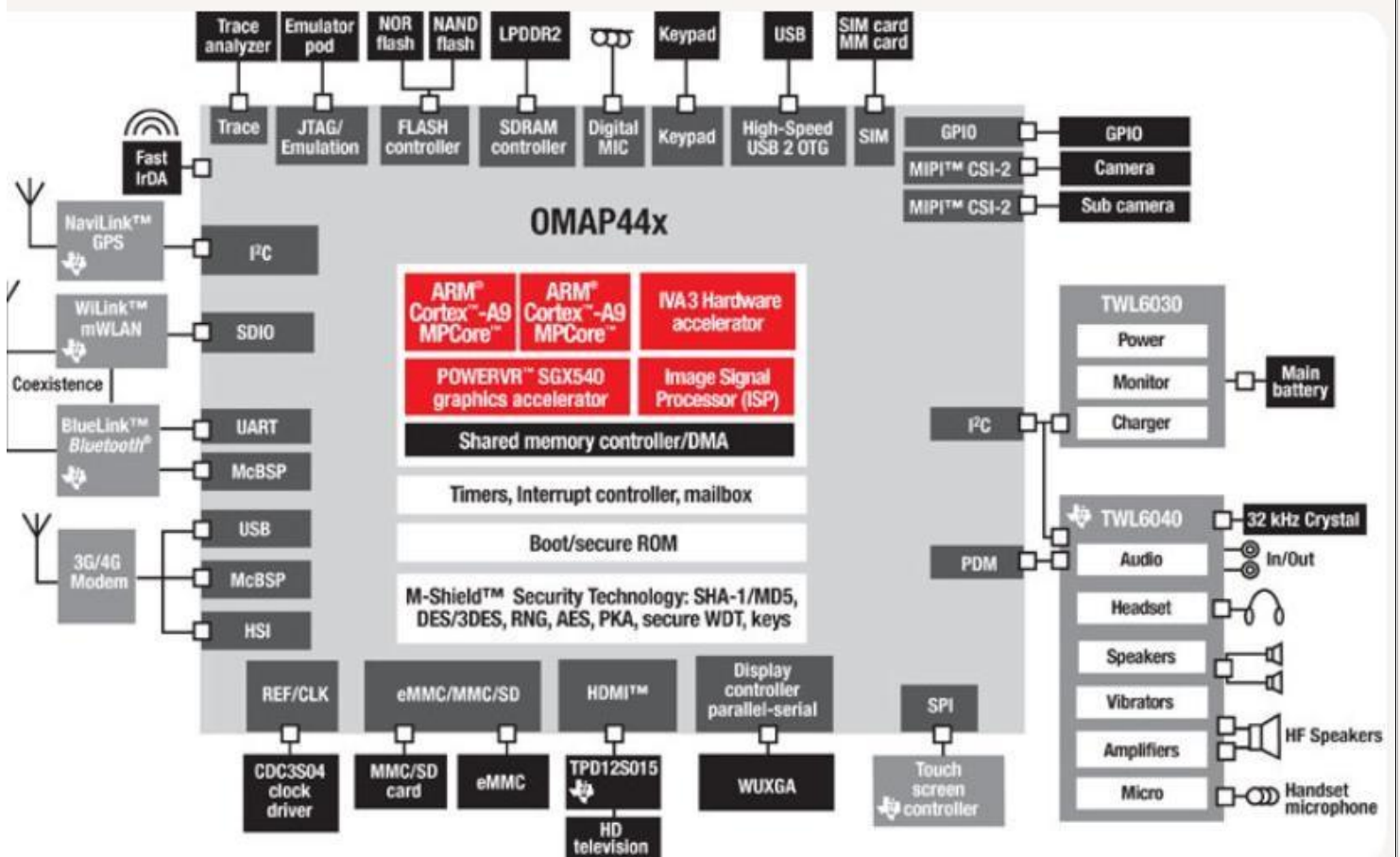
### Technical Features

- **Advanced imaging:** Support for high-megapixel cameras, JPEG compression, and image signal processing.
- **Video capabilities:** Up to 1080p HD video encoding/decoding, support for formats like MPEG-4, H.264.
- **Audio support:** MP3, AAC, MIDI, and other codecs with streaming and equalizer features.
- **Connectivity:** USB OTG, Bluetooth, WLAN, A-GPS, and IrDA.
- **Security:** Secure bootloader, hardware encryption, and unique die ID for device authentication.

### Applications

- Smartphones and tablets
- Digital cameras and camcorders
- Automotive infotainment systems
- Industrial automation and medical devices

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