At the Heart of the Smartphone

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Remind me…what does ARM do?

We design & license Intellectual Property:
(ARM does NOT make chips)
•Cores – Scalable performance
•Tools
•Software

We are leaders in:
Performance with low power
Java
Security
3D
Standards – MIPI/OpenMax/AMBA
Tools

ARM is at the heart of nearly every mobile device

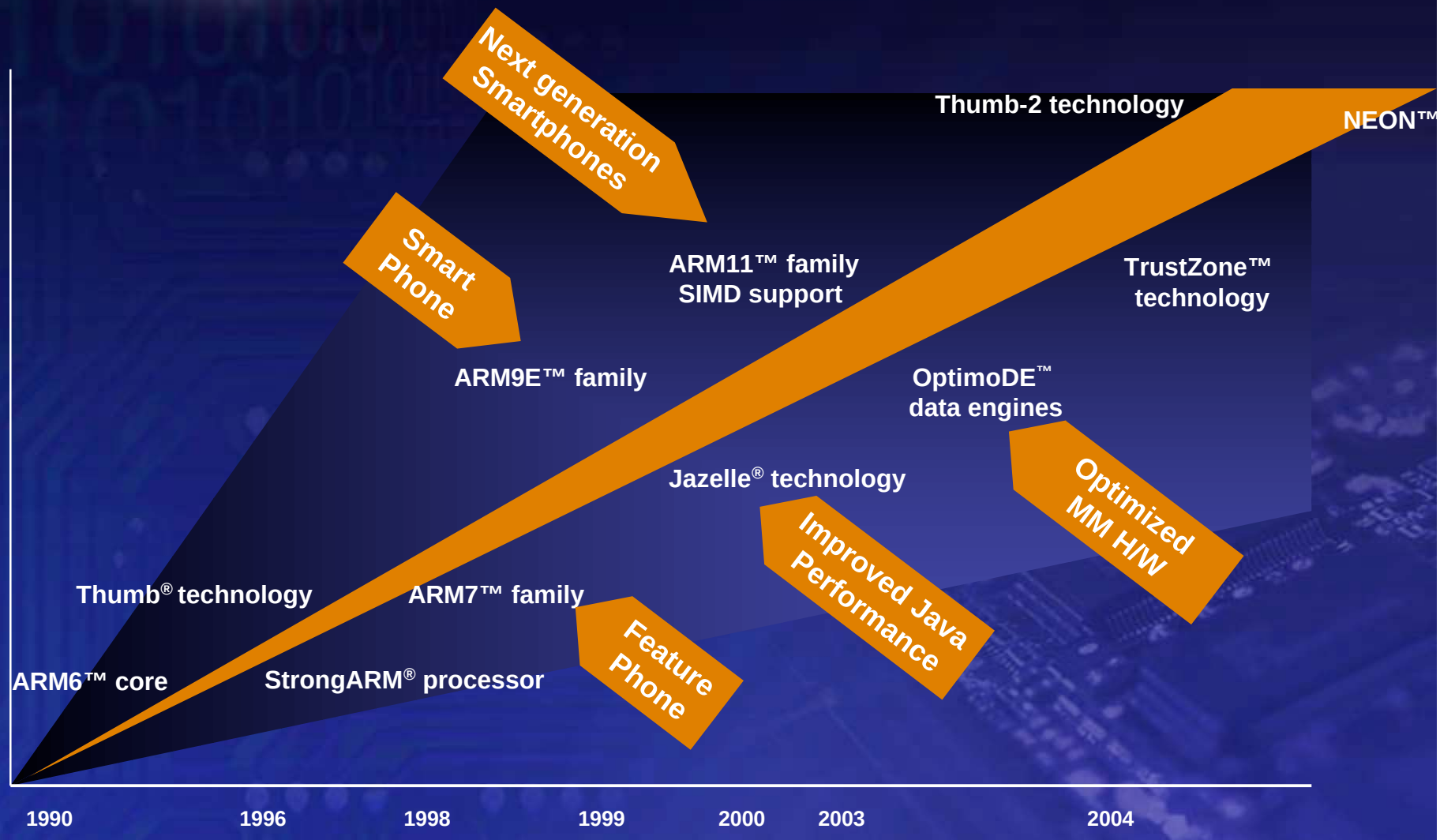
What Defines a Smartphone?

- Traditional definition is a phone with an open OS
  - Two processors, one for apps, one for baseband
- Another definition
  - Phone platform that allows convergence of functionality
  - OS provides flexible and clean development environment
- Smartphone's form and function will proliferate
  - Driven by key functionality for target market

Smartphone Media Predictions

- Music Download Services to the Phone
  - Not just Motorola and Apple
  - AAC HE is CODEC of choice
    - Very effective at 32 Kbps
- Improved video capabilities
  - Camcorder functionality
    - Quality, resolution, framerate
    - Fun effects
  - Playback
    - Resolution and content
- H.264 download becomes prominent
  - Same quality half the bandwidth
- 3D gaming appearing on the phone
- Rollout of TV to phone services

ARM Mobile Roadmap



Hardware and Software Implementation

- ARM provides platforms for both H/W and S/W implementations
  - Flexibility to address market needs
  - Enhanced instruction sets
    - ARM 11 SIMD for multimedia
    - NEON SIMD with floating point support
  - Software components
    - SWERVE graphics engine
  - H/W components
    - OptimoDE
    - MBX
- Focus is on providing common API
  - Common software core for multiple devices
- Enhanced by H/W & S/W solutions from the ARM community

The DSP Dilemma

To solve complex embedded signal processing problems there are two conventional choices:

Either:

- Deploy general purpose DSP architecture
- Flexible but often non-optimal
- **Will this result in a competitive solution?**

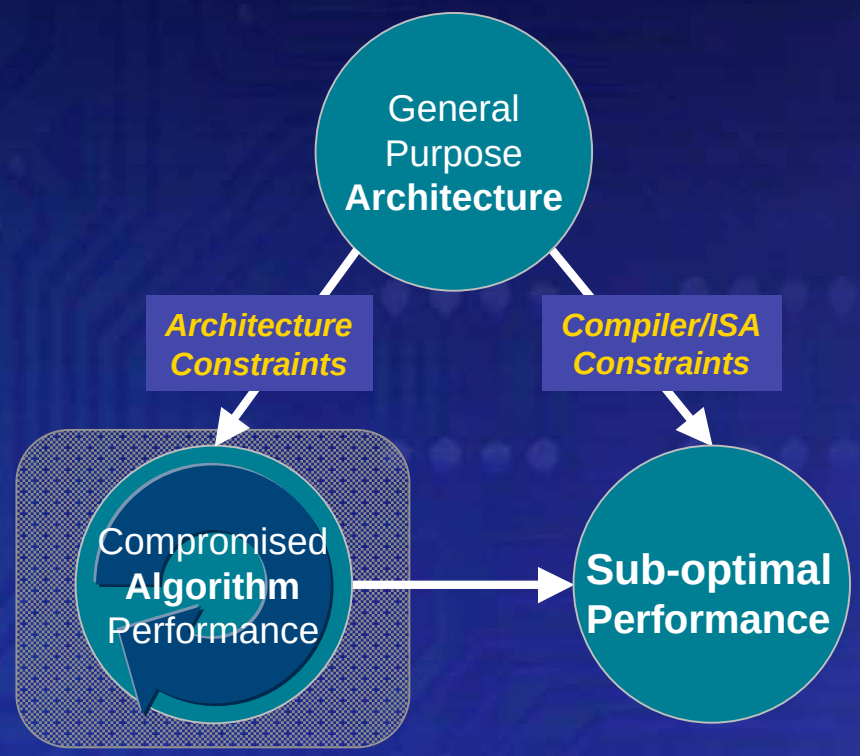
Or:

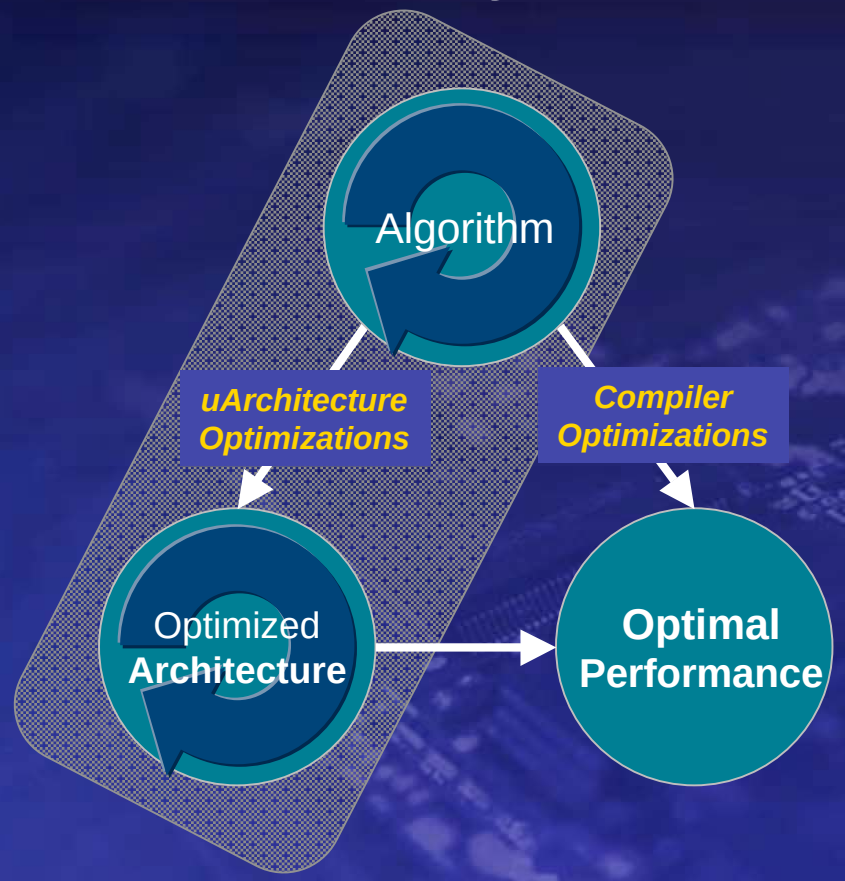
- Develop a highly optimized point solution
- High risk (no flexibility)
- High cost (long development cycle)
- **Frequently the more expensive option!**

Why are Data Engines Different?

Classic ISA Approach
"Fit algorithm to the architecture"

Data Engine Approach
"Tune architecture to algorithm class"





OptimoDE Successes

Audio: MP3

48KHz, 320Kbit stereo stream

6MHz & 30Kgates

Video: H.264

352x288, CIF, 30FPS, 384kbps

90 MHz and 100Kgates

Imaging: JPEG

160x120

40MHz & 45Kgates

OptimoDE™

ARM® Optimal Data Engine technology

WLAN: IEEE802.11a

64 FFT/IFFT, Radix-4, 60MBit/s

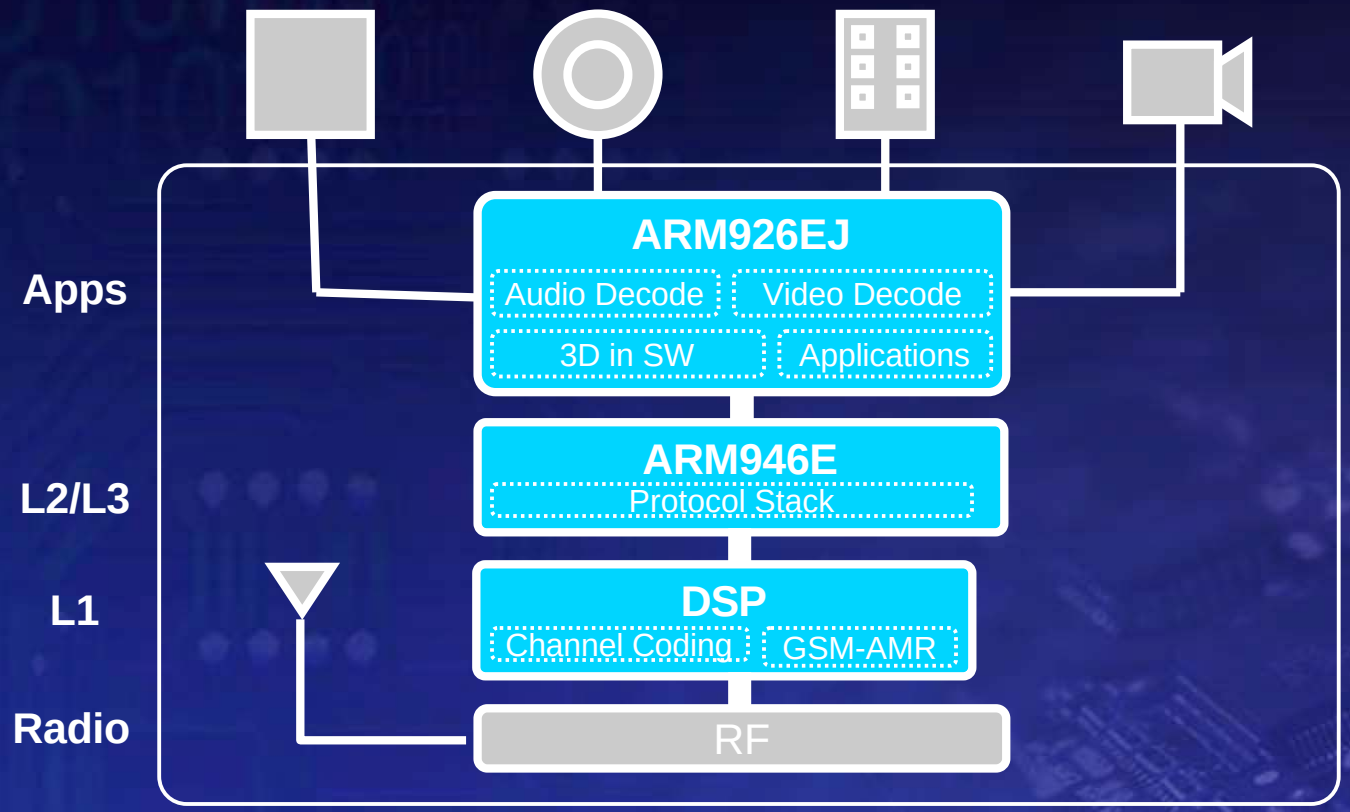
60MHz & 17.5 gates

Wireless: 3g modem

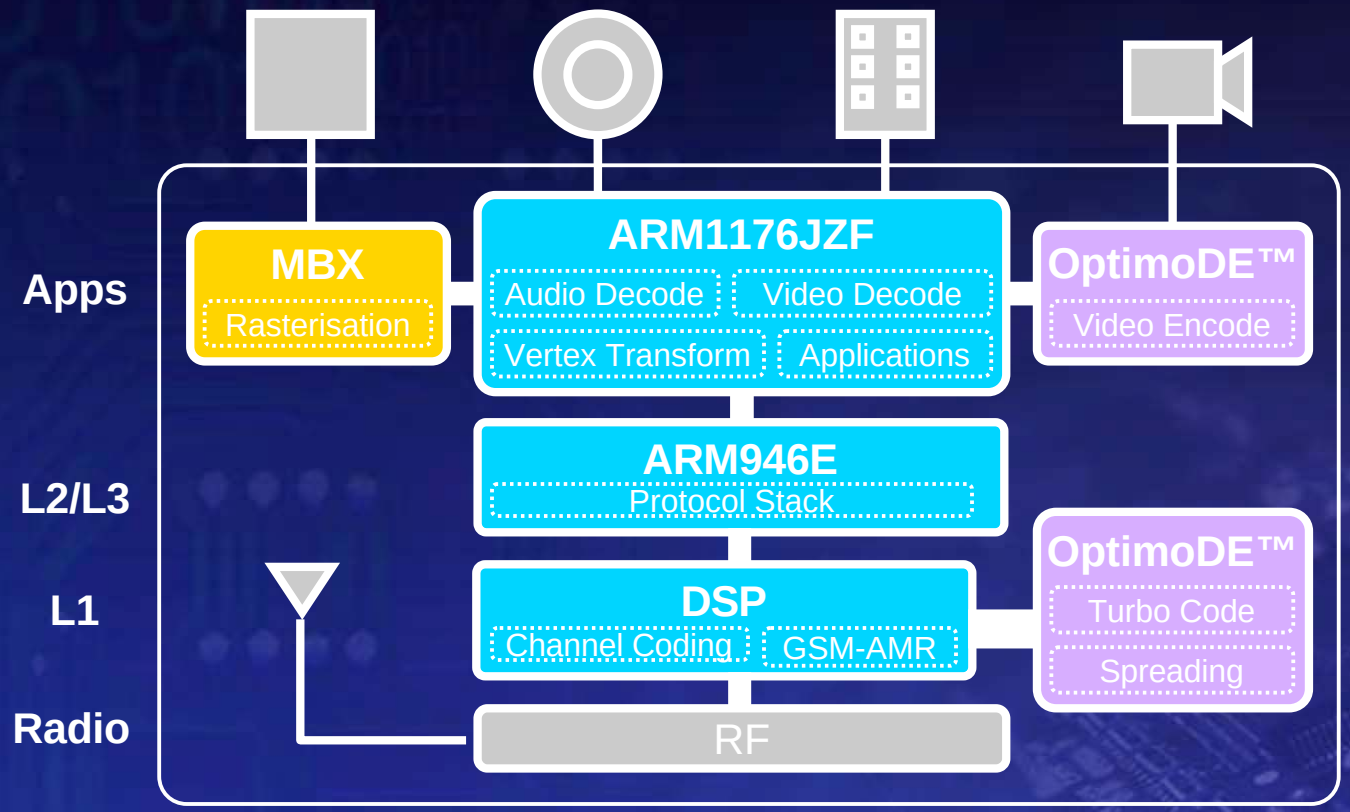
2Mbit Turbo Decoder

40MHz & 45Kgates

Example: 3G Smart Phone Today (2004)



Example: 3G Smart Phone in 2006



Summary

ARM is driving the multimedia capabilities of the Smartphone

- Different solutions for different market segments
- Enhancing the ARM cores for software
  - ARM 11
  - NEON
- Providing dedicated H/W solutions
  - OptimoDE
  - MBX graphics
- Providing common API's
  - Between ARM components
  - OpenMax initiative