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# Using a Versatile IP Platform for SOC Design

Bill Finch, CAST, Inc.

Jim Bruister, SoC Solutions, LLC



## IP is an Evolving Necessity

- Reusing or buying IP is essential for getting today's systems done
- Processor-based SoCs have their own design and verification issues, requiring special expertise
- Many companies are applying the reusable IP approach to complete systems or subsystems
- The result is platforms or "kernels" that migrate easily from one design to the next

## Our Definitions

- Platform
  - Essential collection of components that enables any given system design to function
  - Skeleton of the SoC that supports application components
  - An “integrated”, “verified”, “functioning”, “documented” embedded microprocessor-based subsystem
- Kernel
  - The minimum useful platform for any design
  - Not application specific

## The SOC Kernel

- Combines multiple IP cores:
  - input/output interfaces
  - communication operations
  - memory device controllers
- Includes essential software such that the kernel can function:
  - Boot code or Kernel code
  - Low-level Operating System (OS)
  - Peripheral Driver code

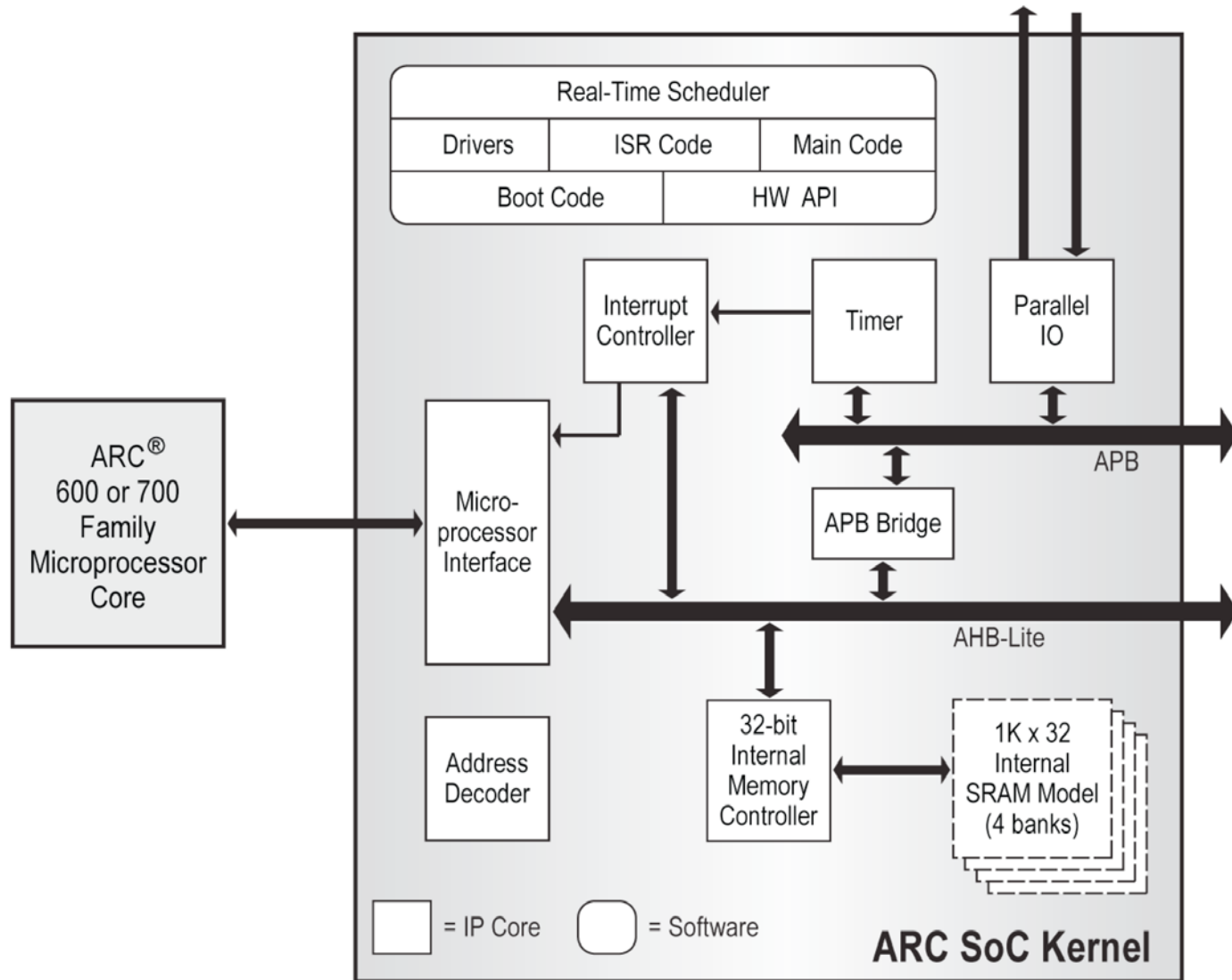
## Product Line Strategy and Migration

- Companies often have product roadmaps and plan on periodically introducing “derivative” products
- A well-planned product line will make these new development costs incremental by reusing a large portion of the initial hardware, silicon, and software design:
  - a Platform Strategy
- Product line planning should also weigh the costs of porting these designs to different silicon vendors and different silicon types:
  - FPGAs, Structured ASICs, ASICs, ASSPs

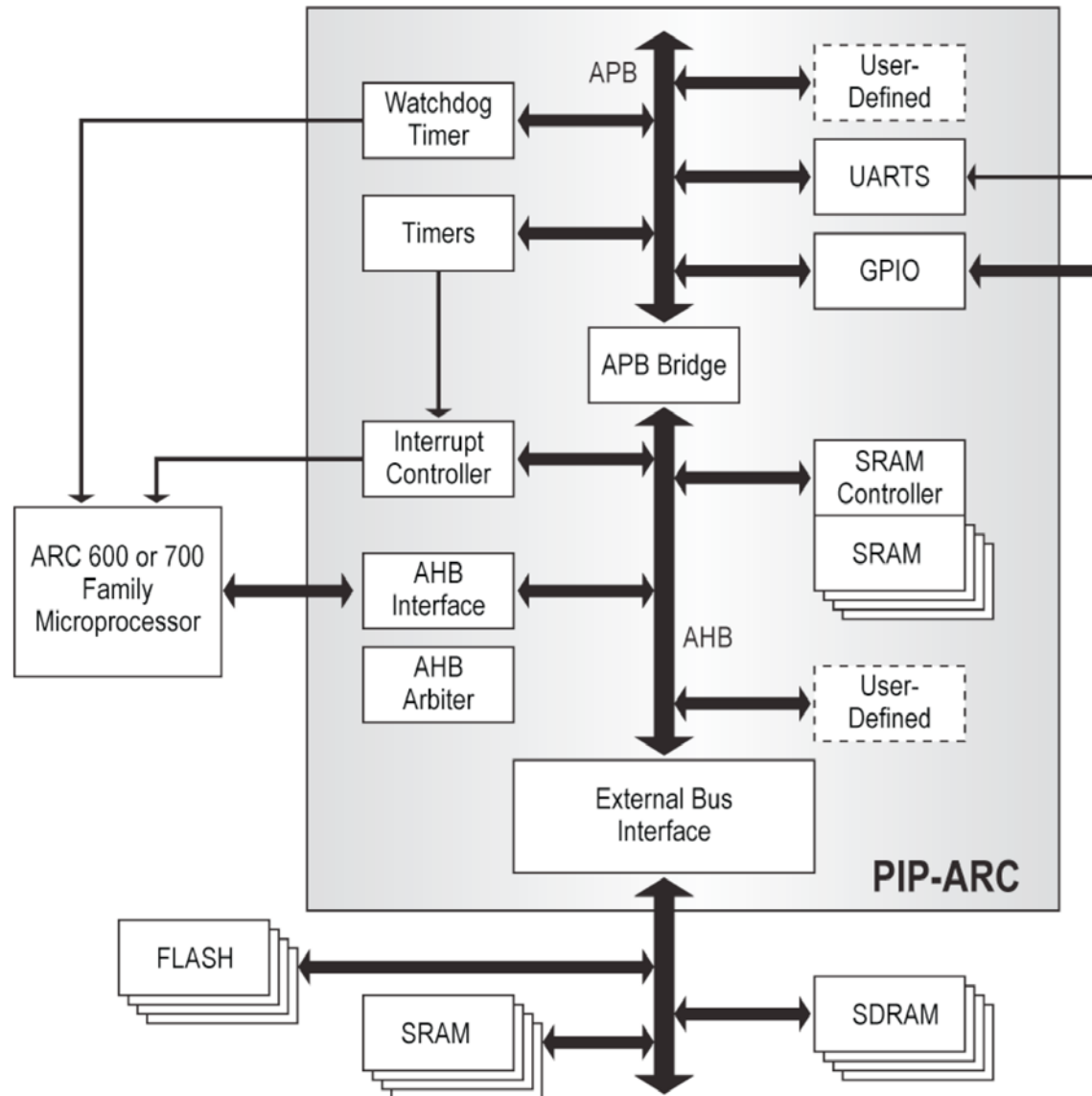
# SoC Architectures Have Much in Common

- 32 bit RISC Processor
- Common Bus Architecture
  - High-speed Memory Bus
  - Low-speed Peripheral Bus
  - AMBA is a good example
- Common Peripherals
  - RTOS or Kernel Support
    - Interrupt Controller, Timers, WatchDog, Memory Controllers
  - Communications
    - UART, COM, SPI, USB
  - General Purpose IO

# SoC Kernel for ARC Systems



# Expanded Kernel Becomes a PIP



## Choosing the Right IP Platform

- Evaluate the number of available third-party IP cores for peripherals and functions
  - *CAST supplies many*
- Evaluate the system-design experience of the provider
  - *SoC Solutions has multiple years and many designs*
- Check for system-level prototyping support
  - FPGA Prototype Boards,  
Bus Functional Models

# CAST: Broad IP Product Line

## Processors

8-bit: 8051s, Z80  
16-bit: 68000, 80186  
DSPs: 16- and 24-bit  
32-bit: APS family for  
embedded systems

## Memory & Peripherals

Memory Controllers:  
DDR1/DDR2 SDRAM  
ATA/IDE Interface  
NAND Flash, SDR SDRAM

Storage Controller  
ATA/IDE Interface

Device Controllers:  
IR Remote Control  
Smart Card Reader  
TV Display, VGA Display

Gen. Purpose I/O Unit

## Communications

Synchronous UARTS  
SDLC

## Multimedia

Video Compression  
H.264  
MPEG-4  
Still Image  
Compression  
JPEG, Lossless  
JPEG 2000  
Audio: I2S, SPDIF  
CSC, Image Conversion

## Interfaces

MACs  
FireWire  
USB & OTG  
PCI Express  
PCI  
CAN, LIN  
I2C, SPI  
ECP & EPP

## Encryption

AES  
DES, Triple DES  
MD5  
SHA-1, SHA-256

## Replacement Series

Processors, Bit Slices  
Controllers  
Peripherals, Timers,  
UARTs  
Z80 Support, TTL Parts

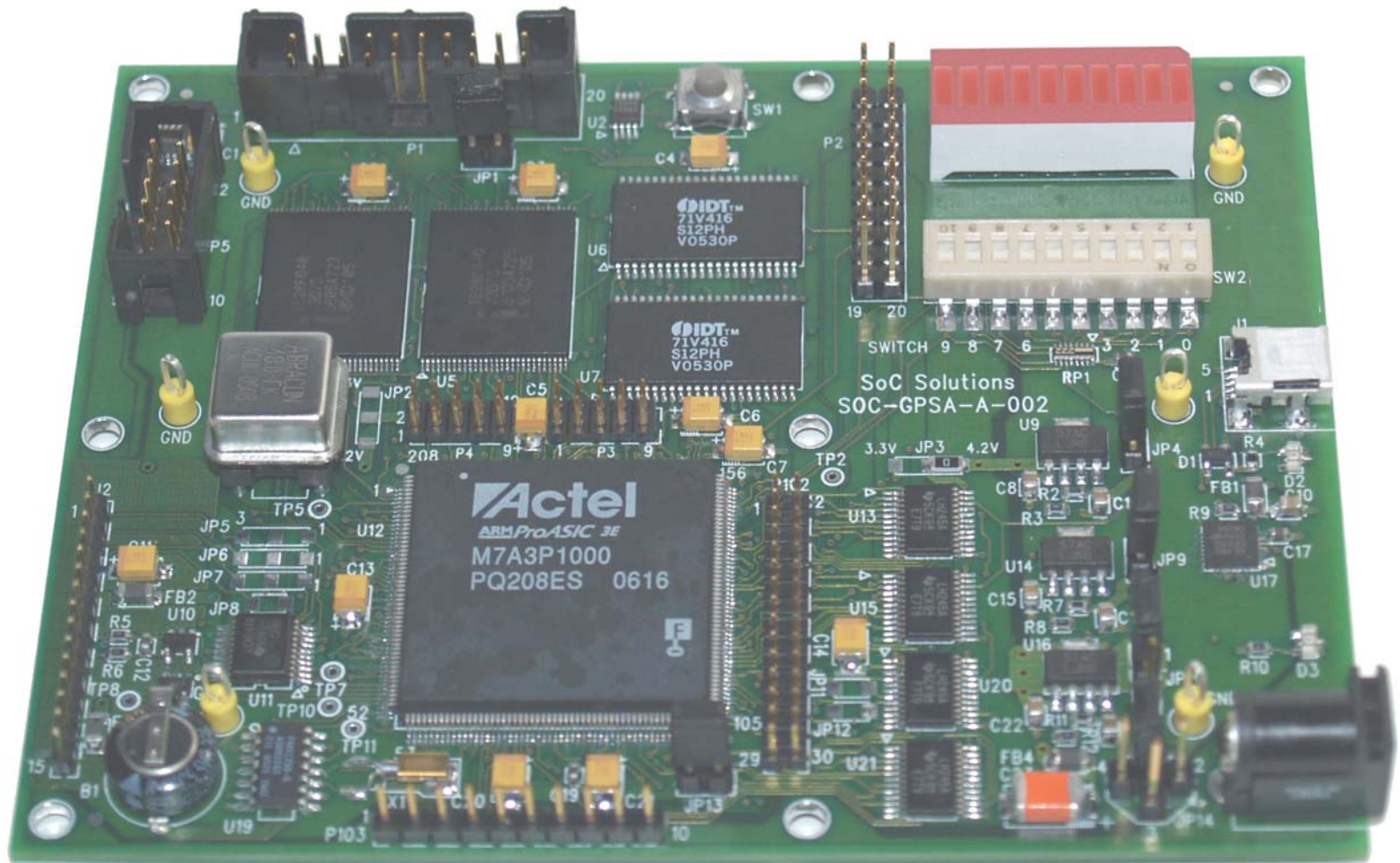
## SoC Kernels

ARC SOC Kernel  
SoC Kernel AMBA  
SoC Kernel eASIC

## Pre-Integrated Platforms

ARC 600 with AMBA  
ARC 700 with AMBA

# Example Prototype System Board



## Completed PiP-AMBA SoC Designs

- 802.11 Wireless Chip
- GPS Baseband Chip
- Audio Compression Chip
- Laser Display Chip
- Secure Microcontroller Chip with RSA and DES
- Motor Controller Chip
- Industrial Controller Chip
- Smart Sensor Chip

## Conclusions

- Designing microprocessor-based SoCs is expensive so there should be a high level of reuse
- A smart product line development strategy will leverage hardware and software design reuse that is:
  - device technology independent
  - well supported
- Using a pre-integrated embedded microprocessor-based IP platform can be a key strategy for success
- ARC and CAST together can offer best-in-class Kernels, Platforms, and Support, in Israel and around the world

## Who is CAST, and What is *IP That Works*?

- Fourteen years delivering IP
  - Privately Owned: independent & focused
  - Worldwide Team: US and Czech employees plus 70+ engineering partners
  - Successful: hundreds of satisfied customers
- Effective product strategy
  - Broad Line: 100+ standards-based cores
  - Flexible: ASICs, Structured ASICs, FPGAs
  - Targeted: select customers who resonate with us, avoid bleeding edge and big-company mentality
  - Customer Focused: quality, usable IP products backed by fast and effective support