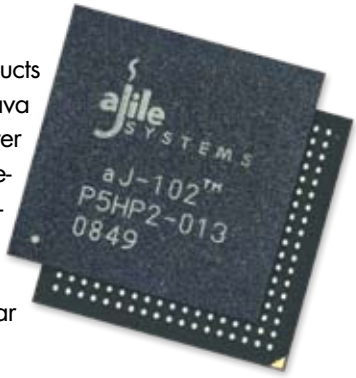
aJ-102™

Java Virtual Machine and RTOS on the Bare Metal

# Real-Time Network Direct Execution SoC for Java™ Platforms

aJile SYSTEMS

## Overview




The aJile Systems aJ-102 is the second device in a family of system-on-a-chip (SoC) products that directly executes both Java Virtual Machine (JVM) bytecode instructions, and real-time Java threading primitives. The native JVM bytecode implementation eliminates the typical interpreter or JIT software layers, and provides the most optimal Java performance in both memory requirements and execution time. The Java threading primitives ensure fast, atomic executive operations like context switching, object synchronization, scheduling and interrupt processing, and provide an embedded RTOS kernel.

The aJ-102 is ideally suited to power the next generation of internet edge devices, 3G cellular routers, handheld devices, mobile POS terminals, industrial PCs, and networked smart sensors.

## Features

### 32-bit Direct Execution Java Processor

- Native JVM bytecode instructions
- Extended bytecode instructions for I/O, threading primitives, graphics, DSP and control functions
- IEEE-754 floating-point arithmetic
- Fixed-point Multiplier Accumulator (MAC)
- Native Java threading
  - Hard real-time, multi-threading kernel
  - Thread-to-thread yield in less than 1µsec @ 160 MHz
  - Provide an embedded RTOS kernel
- Two independent JVM's in hardware
- 32 KB writeable control store (WCS)

### 32 KB Unified Instruction & Data Cache

### External Bus Interface (EBI)

- 8-, 16-, 32-bit interface
- FLASH (NOR & NAND), ROM, SRAM
- SDRAM and mobile SDRAM

### Peripheral Interrupt Controller

### Three 24-bit Timer/counters

### Six Pulse Width Modulations (PWMs)

### Watchdog Timer

### Real Time Clock (battery backup)

### Four 16550 Compatible UART's

### General Purpose I/O Ports

### DMA Controller

### Synchronous Serial Port (SSP)

### I²S/AC97/SPI

### I²C Interface

### SD / SDIO/ MMC Memory Card Interface

### CF Memory Card Interface V1.4

### Single-chip USB OTG Controller V2.0

### Single-chip 10/100 T-Base Ethernet Controller

### Encryption/decryption Engine

- DES/Triple-DES/AES encryption/decryption compliant with NIST standard
- AES 128/192/256-bit keys

### LCD Controller

- 24-bit TFT LCD panel interface
  - Resolution up to 1280x1280
- Input mode
  - RGB (12, 16, 15, 24 bpp)
  - Color palette (1, 2, 4, 8 bpp)
  - YcbCr422 (16 bpp)
  - YcbCr420
- Color palette RAM (256 by 16)
- Picture in Picture (PiP)
- Picture out of Picture (PoP)
- Output format
  - RGB parallel (18/24 bits)
  - Swap of parallel RGB and BGR
  - ITU-R BT. 656 output
- Video scalar
  - Down scaling ration from 1x1 to 1/256
  - Up scaling between 1x1 and 2x2
- Video output port

### IEEE 1149.1 (JTAG) Interface

### Clock and PLL's

### Designed for ultra-low-power operation

- Fully static operation up to 160 MHz
  - Core at 1.8V
  - I/O's at 1.8, 2.5, or 3.3V

### Industrial operating temperature

- -30° C to 85° C

### Implemented in 0.18 µm CMOS process

### Package

- 324-pin TFBGA
- 13 mm x 13 mm x 1.2 mm (0.65mm ball pitch)
- ROHS compliance

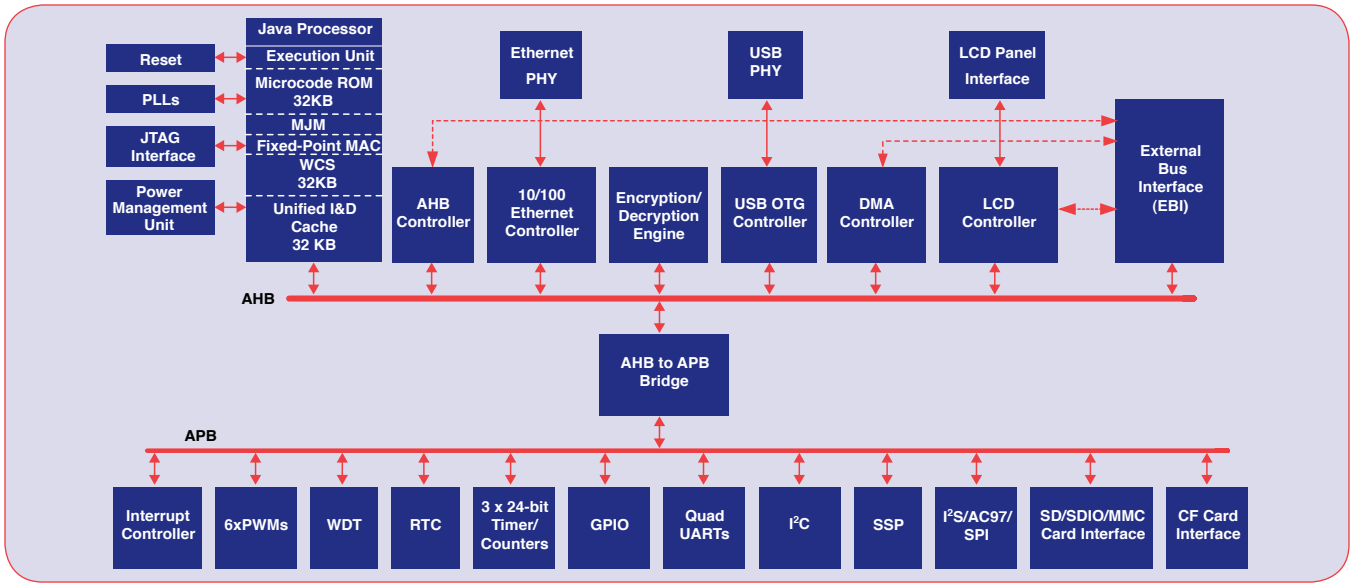



**Figure 1. Simplified Block Diagram**

## System Development Support

The aJ-102 SoC bundled with the aJile RTOS, an optimizing application builder (JEMBuilder), debugging tools and an evaluation board provides a complete silicon-based solution for the JME platform. The key components are:

## aJile RTOS

The aJile RTOS is implemented entirely in Java as illustrated in figure 2. In addition, the aJile Multiple JVM (MJM) enables multiple applications to execute concurrently and independently in a deterministic, timesliced schedule. This allows hard real-time applications to run independently and safely exist with networked applications.

## Development Tools

The development environment allows the use of any off-the-shelf IDE that produces Java standard class files such as Eclipse or Netbeans. It consists of the following key components:

- Optimizing Linker/Application Builder (JEMBuilder)
- Application Debugging Tools
- Evaluation kit "aJ-102evb"

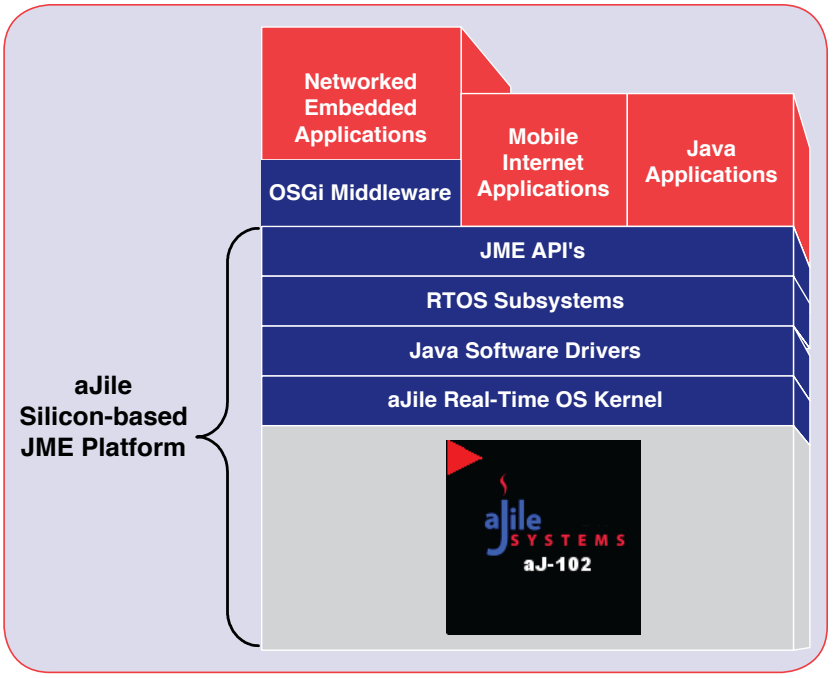



**Figure 2. The Silicon-based JME Platform**

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