BUSINESS EDITION

Edition 1/2017 | € 9.75

elektor

HOMELAB STARTUP TRADE

Our Business
The makers of the Voltera V-One desktop PCB printer

The Business Case
for commercial Linux

Server Based Solutions
for self-organizing networks

Special Edition

embeddedworld2017

Exhibition&Conference
... it´s a smarter world

Focus on: Embedded, Microcontrollers & Tools

Voltera V-One • **From Makers to Market using 96Boards** • Network Engine SoC Reference for 400 Gbps • **WaWision** • The Business Case for Commercial Embedded Linux • **Intel Apollo Lake** • Hubs Become Central to the IoT • **Industry Predictions for 2017** • Infographics • **Talking Heads** • From the Garage up to Industrial Production • **Server Based Solutions for Self-Organizing Networks**

From Makers to Market using 96Boards

By **Amir Sherman,** Director of Engineering Solutions & Embedded Technology, Arrow EMEA

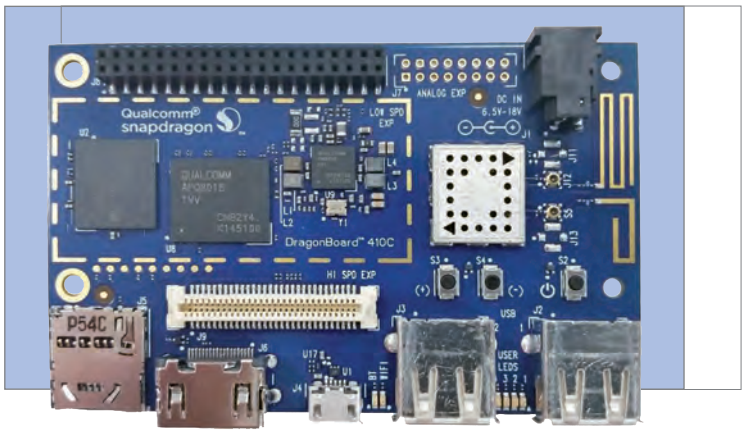

Figure 1. The DragonBoard 410c is one of the world's first ARMv8 64-bit development boards to be produced in high volumes and made available at an attractive price point of $75, making it easy for developers to work on advanced mobile technologies.

Many designers are using the community boards available in the market for their proof of concept and to evaluate their idea on a valid, working platform. One of the most popular community boards in the world is the Raspberry Pi powered by the Raspberry Pi foundation. But how can you use a community board and go to the next step of pre-production and mass production?

In many cases you can't use the Raspberry Pi 'as is' because it was never meant to be used in production environment: it doesn't support industrial temperature ranges (-40 to +85 degrees C); it was not tested for mass production; and there are some other limitations as well.
In other cases, and for high quantity requirements, most companies want to develop their own board. They may want to design in the application processors built into the community boards and to use the boards as the reference design.
The success of the Raspberry Pi has led to companies developing further community boards based on popular embedded application processors including those from NXP (Freescale i.MX6), Qualcomm (Snapdragon), Intel PSG (Formerly Altera) CycloneV and many others.

All of these boards have been compared to the Raspberry Pi. In most cases they have better performance or smaller sizes but this has not affected the success of the Raspberry Pi.
One of the main community platforms that presents a different way forward is the 96Boards organization powered by Linaro. Linaro's mission is to bring together industry and the open source community to work on key projects, deliver great tools, reduce industry wide fragmentation and provide common software foundations for all.

The 96Boards hardware specification defines various standardized form factors, unlike the Raspberry Pi. The Raspberry Pi uses only Broadcom SoCs and the form factor changes from board to board. With 96Boards, the user has a choice of various SoCs at different price points.

96Boards is the first open specification to define a platform for the delivery of compatible low-cost, small footprint 32-bit and 64-bit Cortex-A boards from the range of ARM SoC vendors. Standardized expansion buses for peripheral I/O, display and cameras allow the hardware ecosystem to develop a range of compatible add-on products that will work on any 96Boards product over the lifetime of the platform.

The 96Boards' specifications

There are currently three 96Boards specifications for low-cost ARM Cortex-A and Cortex-M development boards:

- the Consumer Edition (CE) targets the mobile, embedded and digital home segments;
- the Enterprise Edition (EE) targets the networking and server segments;
- the IoT Edition (IE) targets the Internet of Things (IoT) and embedded segments.

One of the main successes of the 96Boards consumer edition was the DragonBoard 410c, which utilized the Qualcomm® Snapdragon™ 410 a 64-bit processor that started to appear in smartphones around the world just over two years ago.
The DragonBoard 410c (**Figure 1**) was not only one of the first low-cost ARMv8 64-bit development boards to be mass produced, but also one of the first 96Boards branded products. Over the last year, Qualcomm Technologies, Inc., Linaro, and Arrow have built strong software and ecosystem support around the DragonBoard 410c. Developers who select this platform benefit from a wide variety of operating system choices including Android, Debian Linux, OpenEmbedded, Ubuntu Core and Windows 10 IoT . These operating systems pair with the many available IoT development kits such as Amazon Web Services (AWS), AT&T M2X, Brillo, IBM Bluemix Watson and Microsoft Azure.
At Embedded World 2017 Arrow will introduce several new 96boards to the market:

Meerkat. Based on the 96Boards™ specification, meerkat (**Figure 2**) features the NXP® i.MX7D processor, a dual-core ARM® Cortex™-A7 at up to 1.2 GHz clock speed per core and ARM Cortex-M4. The connectivity on the board is: WLAN 802.11 b/g/n 2.4 GHz, Bluetooth 4.1, One USB 2.0 OTG micro AB, Two USB 2.0 HOST, On-board BT and WLAN antenna. I/O Interfaces — one 40-pin Low Speed (LS) expansion connector: two UART, SPI, I²S, I²C x2, GPIO x12, DC power, RGMII, CAN, PWM and more interfaces based on the 12 GPIO lines (outside the 96Boards specifications). The second I/O Interfaces based on 60-pin High Speed (HS) expansion connector that supports: SDHC/SDIO, 2L-MIPI DSI, 2L-MIPI CSI, I²C, USB 2.0 HOST & USB 2.0 HOST HSIC. The board can be made compatible with Arduino using an add-on mezzanine board. The OS Support is Linux based on Debian.

Chameleon96. Based on the 96Boards™ specification The Chameleon96 (**Figure 3**) features the Intel® Cyclone V SoC FPGA, a dual-core ARM® Cortex™-A9 at up to 800 MHz clock speed per core, capable of 32-bit operation. It is designed to support feature-rich functionality, including multimedia.

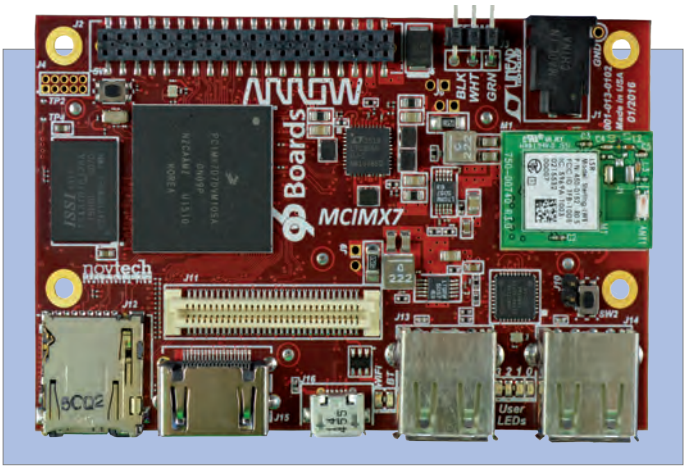

Figure 2. A meerkat is small, fast, has a variety of communication skills and communicates within a large group (source: Wikipedia).

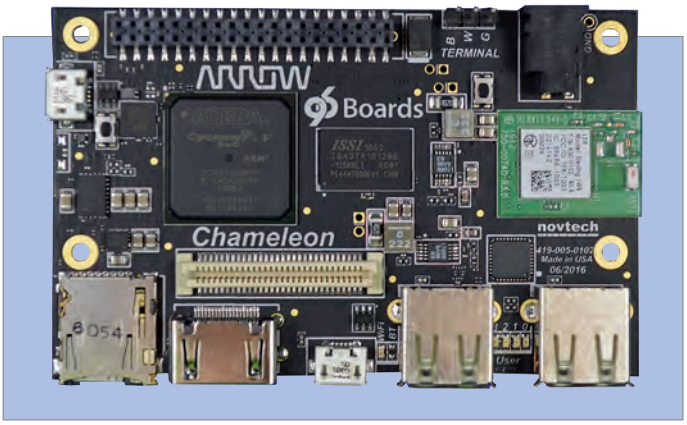

Figure 3. The Chameleon96 meets all 96Boards mandatory specification (excluding MIPI SDI Interface) and most optional specifications. The board supports Linux at launch and offers advanced processing power, WLAN, Bluetooth, and USB, all packed into a board the size of a credit card.

The board specifications are: processor based on Intel® Cyclone V SoC FPGA Dual-core ARM® Cortex®-A9 at up to 800 MHz per core plus 110 K LE FPGA fabric. Graphics based on Intel® Video Suite for FPGA, the boards drive a 1080 p at 60 fps through an HDMI interface and as a two lane MIPI CSI interface. The use of the FPGA fabric for the video processing allows development of custom IPU/GPU/VPU solutions on this platform. Memory/storage on board is: 512 MB DDR3 up to 400 MHz (shipped with 512 MB, can support 1 GB) and SD 3.0 (UHS-I). Video capabilities are 1080 p @60 fps HD video playback & camera support via the MIPI CSI. Audio support is PCM/AAC+/MP3/WMA, ECNS, Audio+ post-processing (optional). The connectivity on board is: WLAN 802.11 b/g/n 2.4 GHz, Bluetooth 4.1, one USB 2.0 OTG micro AB, two USB 2.0 HOST (The board supports OTG or the host's ports at one time, not both), On-board BT and WLAN antenna. The I/O Interfaces are the same as others on the 96boards form factor and the board can be made compatible with Arduino using an add-on mezzanine board. The User Interface consists of Power/Reset with 6 LED indicators: 4 user controllable and 2 for radios (BT and WLAN activity). The OS-support is Linux based on Debian.

Oxalis. The 96Boards EE (Enterprise Edition) carrier board which holds the SoM based on NXP Network Processor QorIQ® LS1012A processor, optimized for battery-backed or USB-powered, space-constrained networking and IoT applications. It integrates a single ARM Cortex-A53 core running up to 800 MHz with a hardware packet forwarding engine and high-speed interfaces to deliver line-rate networking performance in an ultra-small size envelope at 1-W typical power dissipation. The Oxalis incorporates the same Trust Architecture and software compatibility of higher-tier QorIQ LS family devices, enabling scalable, secure applications that leverage a common 64-bit software platform. Also connected to the LS1012A are 64 MB QSPI Flash, 1 GB DDR3L, 2x GBit Ethernet, SATA, 2x USB 3.0, mPCIe, PoE and other peripherals. ⏮

The Author

Amir Sherman has more than 20 years of embedded experience with a focus on microcontrollers and microprocessors. He has been working for Arrow Electronics for the last 15 years as an embedded field application engineer (FAE) as well as an FAE and technical manager.