Expanding the 96Boards Ecosystem

Bill Davies – Technical Marketing, Dieter Kiermaier - Senior FAE
Agenda

- Arrow in the IoT space
  - Hardware
  - ArrowConnect
  - Services
- Community
  - DragonBoard 410c, Meerkat, Chameleon
- Community Extended
  - DragonBoard820c, DragonBoard600c, ANT
- Enterprise
  - Oxalis
- IoT
  - Titanium
- Mezzanine
  - PoE, Security, Cellular, LoRa, Sensor
From Sensor to Sunset
From Sensor to Sunset™
Arrow Supports with complete technology and services capabilities
ARROW IoT – Bridging the GAP

**EDGE**

- Arrow IoT Certified Designs
  - Premise Hardware
- Embedded - SDKs
  - SOC/MCU Devices
- SW Gateway Agent
  - Devices + OS Gateway

**CLOUD**

- Arrow Connect SaaS
  - Cloud Based Infrastructure & Data Center
- Developer Portal
  - Device Provisioning, Monitoring, Control & Updates
- APIs | Custom Applications
  - Business Applications & Advanced Analytics
Arrow Connect – Certified Partner Ecosystem & Multi Protocol Support

**SENSORS**

- Arrow Connect Embedded
  - Protocols: BLE, WIFI, LoRa, Zigbee, DUST, UDP, Ethernet
  - Arrow Connect Gateway Agent
  - Protocols: MQTT, CoAP, HTTP, HTTPS, REST, AMQP

- Linux / Windows 10 Ent
  - iOS / Android

**GATEWAYS**

- Arrow Connect Embedded
- Arrow Connect Gateway Agent

**DATA PLATFORM**

- Arrow Connect SaaS
  - Data Platform Agnostic Integration

**VISUALIZATION & ANALYTICS**

- Arrow Connect Management Portal
  - Arrow
  - splunk
  - Power BI

**EDGE**

**CLOUD**

**TRANSPORT**

- APIs

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Arrow Cellular Starter Kit

Titanium 96Boards IoT Edition

Arrow Connect Embedded C SDK

Environment Sensors

Arrow Connect Cloud Platform

Telemetry

Cat 1/M1 Cellular

Control
Arrow 96Boards Products
Arrow joined Linaro 96Boards Steering Committee

96Boards Specifications

The 96Boards initiative is designed to offer a single software and hardware community across multiple vendor boards supporting a range of different features. A fixed set of minimum functions including USB, SD, HDMI and standardized low speed and high speed peripheral connectors are provided. Vendors may add customized hardware and feature sets provided the minimum functions are available. We expect this to extend the platform life, increase the market for add-on hardware, and accelerate open source upstreaming of support for new SoC features.

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.
## 96Boards - 2017

### CE and EE Platforms

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<th>Oct</th>
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**Legend**
- MP
- Dev
- Concept
# 96Boards - 2017

IoT Platforms

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Legend

- MP
- Dev
- Concept

Titanium

Titanium
Oxalis
Oxalis 96Boards – based on LS1012A

SaM-Board 1012 provides the full flexibility of the LS1012A SoC and provides latest built-in security features!

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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<tbody>
<tr>
<td>SoC</td>
<td>NXP Layerscape LS1012A</td>
</tr>
<tr>
<td>CPU</td>
<td>Cortex-A53 @ 800 MHz</td>
</tr>
<tr>
<td>RAM</td>
<td>1 GByte</td>
</tr>
<tr>
<td>Storage</td>
<td>16 MB SPI Flash + SD</td>
</tr>
<tr>
<td>Ethernet</td>
<td>2 x 10/100/1000</td>
</tr>
<tr>
<td>USB</td>
<td>2 x USB 3.0</td>
</tr>
<tr>
<td>SATA</td>
<td>1 x SATA</td>
</tr>
<tr>
<td>Misc</td>
<td>96 Boards I/O connector</td>
</tr>
<tr>
<td>Size</td>
<td>160 x 120 mm</td>
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</table>
LS1012A Differentiators and Target Applications

Performance starts with the core

- First 64-bit ARM Cortex-A53 core to be offered in a sub-10x10 mm package, delivering over 2,000 CoreMark® of performance at 1W (typical) for outstanding performance at exceptionally low power utilization

- **Best in class** 2.5 CoreMark / mW ratio

Broadest range of peripheral and I/O features in the sub-$10 ASP price range

- Only product in its class to offer **Packet Acceleration** for IP forwarding and NAS, delivering outstanding packet throughput for this power/package envelope

- **Trust and Security acceleration** enables root of trust and high performance encryption consistent with much higher cost microprocessors

- **First in its class** to offer 64-bit support for **battery powered** mobile applications and **performance efficiency**

- Only 1W 64-bit processor to combine **USB 3.0 with integrated PHY, PCIe, 2.5 Gigabit Ethernet and SATA3 on a single SoC** to enable lower system-level costs

- Enables **low-cost, 4-layer board** level designs together with **high system level integration** to support ultra-small form factor systems

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### LS1012A Target Applications

- **Consumer NAS**
- **Value tier IOT gateway**
- **Battery Powered Mobile NAS**
- **Entry BB Ethernet Gateway**
- **Trusted Gateway**
- **Industrial Automation & Control**
- **Building Control systems**
- **Ethernet Drives**
- **Networked Audio**
Meerkat
Meerkat 96Boards – based on i.mx7

Key Features

> i.MX7 board features
  - Dual ARM® Cortex®-A7 at 1.0 GHz
  - Cortex-M4 at 266 MHz
  - (Mobile Industry Processor Interface) MIPI-CSI (Camera Serial Interface)
  - MIPI-DSI (Display Serial Interface)
  - 512 MB DRAM
  - 802.11 b/g/n + BT
  - 1/3 power of i.MX 6 series
  - 250 µW standby power

> Wireless module
  - LSR Sterling-LWB
  - Certifications Pending
  - 2.4 GHz 802.11 b/g/n
  - BT 2.1+EDR (Enhanced Data Rate), BLE 4.1

> Beta board availability: May’17
Meerkat 96Boards – i.mx7 Processor Features

**Specifications:**
- **Package:** 19x19@0.75mm BGA 12x12@0.4mm BGA*
- **Qualification:** Consumer (0C to 95C Tj) Extended Consumer (-20C to 105C Tj) • 10yr lifetime at 100% duty cycle

**Key Features and Advantages**
- 1 GHz, Cortex-A7, 32KB I/D, 512KB L2 Cache
- 200MHz Cortex M4, 16KB I/D, 64KB TCM
- **Memory Support**
  - 16/32bit LP-DDR2/3, DDR3/L @ 533MHz
  - Total of 256KB OCRAM
  - 3x SDIO3.0/eMMC5.0, 8-bit NAND (BCH62)
- **Display / Camera**
  - 24-bit Parallel LCD and MIPI DSI (2-lane)
  - Parallel (up to 24-bit) and MIPI CSI (2-lane)
- **EPDC**
- **I/O**
  - 2x USB 2.0 OTG w/ PHY + 1x USB 2.0 HOST/HSIC
  - 2x GigE Ethernet Ports-AVB;
  - PCIe 2.1
  - Security module - enabling PCI 4.0 compliance

**System Control**
- JTAG
- PLL, OSC
- Clock & Reset
- Smart DMA
- GPTx4, FlexTI x 2
- Watch Dog x4
- Power Mgmt LDO
- Temp Monitor
- Internal Memory
  - 256KB SRAM
  - 96KB ROM
  - ADC
  - 2x 12-bit ADC
- Security
  - Secure RTC
  - RSA 4096
  - Clifiers
  - DPA protection
  - 10 tamper pins
  - RNG
  - 32KB Secure ROM

**Main CPU Platform**
- Core #0
  - Cortex-A7
  - 32KB I-cache, 32KB D-cache
- Core #1
  - Cortex-A7
  - 32KB I-cache, 32KB D-cache, NEON, FPU

**Core #3**
- Cortex-M4
- 16KB I-cache, 16KB D-cache, 64KB TCM

**Imaging Processing**
- Resizing, Blending, Inversion / Rotation

**Connectivity**
- MMC5.0 / SD3.0 x3
- USB2.0 OTG x2 (w/ PHY)
- USB2.0 HOST (w/ HSIC)
- 10bit ENET A/B x 2
- UART x7
- SPI x4
- i2S x3
- GPIO, Keypad
- CAN x2
- PWM x4
- FlexTimer x2
- Smart Card VF x2
- PCIe v2.1 (1lane)

**External Memory**
- NOR FLASH/GRAM
- 6bit NAND (DQ807)
- Dual-Ch, Quad SPI
- 32/16bit LP-DDR2/3, DDR3/DDR3L

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*Note: The diagram illustrates the various components and connections related to the processor and system control, including I/O interfaces, memory support, and connectivity options.*
Meerkat – why i.mx7?

Advanced Heterogeneous Architecture
- Up to Dual Cortex-A7 @ 1GHz
- Cortex-M4 @ 200MHz
  - Offload Tasks
  - Optimize Power
  - Increase Security

Unmatched Power Efficiency
- 3x improvement in Power Efficiency vs i.MX 6
- 100 uW/MHz for Cortex-A7
- 70 uW/MHz for Cortex-M4
- One third the power consumed in the Low Power suspend mode (250uW) vs i.MX 6

Enabling Flexible High Speed Connectivity
- PCI-e v2.1
- Dual Gbit Ethernet with AVB
- DDR QuadSPI support
- eMMC 5.0

Complete Security Infrastructure
- Secure Boot
- Crypto H/W Acceleration
- Internal and External Tamper Detection
- Secure RAM
- DPA attack Resistance
- Secure JTAG
Chameleon
Chameleon 96Boards – based on Cyclone® V SoC

Chameleon96 Board Features:
• FPGA
  • Intel PSG Cyclone® V SE 5CSEBA6U19I7N device
  • Integrated USB-Blaster™ II JTAG cable
  • Configuration sources: SD Card, JTAG
  • HDMI display output
  • WiFi 802.11 a/b/g/n + Bluetooth 4.1 module interface
• Hard Processor System
  • 800 MHz dual-core ARM® Cortex®-A9 processor
  • 512MB DDR3 SDRAM (16 bit data bus)
  • USB Interface
  • Micro SD card interface
  • Serial UART
  • User LEDs
  • Warm reset button
• 96Boards Standard Expansion Connectors
  • Low speed expansion connector (20x2) with UART, SPI, I2C, I2S, GPIO connectivity
  • High speed expansion connector (30x2) with USB 2.0 Host, SPI, I2C, GPIO, and MIPI CSI-2 connectivity
Chameleon 96Boards – based on Cyclone® V SoC
Ant 96Boards – based on RZG1/E
Ant 96Boards – RZ/G Enablement

Optimize Your High-End Industrial Design with RZ/G Linux Platform

- Advanced Security Package
- Super Long-Term
- Real-Time
- Security
- Functional Safety
- Cloud Development

CIP Linux Platform Benefits
- Save up to 40% in development time!
- Fast start on the cloud and switch to local!
- Focus on differentiation and value!
- No worries about software maintenance!
- Best support by Renesas and partners!

CIP Linux Platform Features
- Super Long Term Support of 10-15 years;
- Advanced security, safety and real-time;
- Verified software package and add-ons;
- Pre-integrated application software;
- Market Place built on Microsoft Cloud Azure and Softbank IT.

Path to production
DragonBoard820c
Main Features

Processor
- Qualcomm Kyro Quad-core 64-bit CPU
- Qualcomm® Adreno™ 530 624MHz GPU
- supports 4K UltraHD@30fps video

Memory
- 3 GB LPDDR4
- 32 GB UFS Flash

Connectivity
- WiFi
- Bluetooth 4.1
- Gigabit Ethernet
- GPS

Interfaces
- USB 2.0, USB 3.0
- Supports up to 3 image sensors
- 40-pin Low Speed expansion connector
- UART, SPI, I²C, GPIO, etc.
IoT Edition – Titanium
PSoC6
Titanium

PSoC6 IoT Edition

> Based on Cypress PSoC6
> 40 Pin Low Speed Connector
> MBED enabled
> Bosch BME680 integrated sensor
  > Temp, humidity, pressure, Air Quality

> Available in November 2017
Cypress PSoC6

Purpose Built for the Internet of Things

> **Ultra-Low-Power Performance**
>  > Advanced ULP 40-nm process
>  > Integrated Buck converter and LDO regulator
>  > Dynamic voltage and frequency scaling (DVFS with PLL/FLL)
>  > Active power as low as 15-μA/MHz (M0+)
>  > 150-MHz ARM® Cortex®-M4 and 100-MHz ARM® Cortex®-M0+
>  > Embedded SONOS Flash with SRAM and DMA
96Boards Mezzanine Cards
Tresor

Conception

SLB 9670
TPM 2.0
SPI

SLB 9645
TPM 1.2
I²C

EEPROM
for automatic DT
Selection

Trust-E
IoT
I²C

OPTIGA™ TPM Security Functions

- **Device Authentication**
  - One-way authentication
  - Mutual authentication

- **System Integrity**
  - Secure Boot
  - Remote platform verification

- **Secure Channel**
  - Encrypted Communication
  - Key Generation

- **Dedicated functions for**
  - Platform manufacturer
  - System operators
  - Vendor/User/Enterprises

- **User Management**
  - Password Protection
  - User management and keys

- **Lifecycle Management**
  - Key Backup and refurbishment
  - Personalization and identities
  - Supply chain tracking

- **Secure Updates**
  - Remote maintenance
  - In-field flexibility and reaction

- **Secure Clock and Time**
  - Reliable clock when offline
  - Timer and Monotonic Counter
Tresor Features

Complete Security Verification Toolkit

Tresor gives the developers and the maker community access to latest security solutions – both for evaluation but also for own developments

Features:
- TPM 1.2
- TPM 2.0
- Lightweight security solution based on Trust-X Technology (added in V2 of the board after release of Trust-X)
- EEPROM to enable auto Device-Tree selection feature

Software:
- TPM Framework in Linux kernel
- TrouSers
- Hardened OpenSSL / GNUTLS
Tresor Block Diagram
Complete Security Verification Toolkit
WITH THIS SHIELD THE DRAGONBOARD410C EXPANDS ITS FUNCTIONALITIES WITH:

- Gigabit Ethernet through Microchip LAN7850
- Hardware Asymmetric Crypto Engine through TPM Atmel AT97SC3205T
- POE+ PD IEEE 802.3at 25.5W Compliant through Linear Technology LT4276
PoE+ Ethernet Mezzanine

Mezzanine Card Closer Look

PoE+ Mezzanine Boards key components:

Linear Technology LT4276
Allows to power the DragonBoard and an additional 12V device over an external Ethernet PoE+ line

Microchip LAN7850
Provides Gigabit Ethernet through high Speed USB 2.0

Microchip Trusted Platform Module AT97SC3205T
Secures the system by Hardware Asymmetric Crypto Engine

PoE Injectors
PoE+ Ethernet Mezzanine

Ethernet Part

**LAN7850**
Hi-Speed USB 2.0 to 10/100/1000 Ethernet Controller with HSIC
The USB of the DragonBoard410C is used for the Ethernet communication in 10/100/1000Mbps link rate.
PoE+ Ethernet Mezzanine

Trusted Platform Module

**AT97SC3205T**
Trusted Platform Module I2C Interface
Compliant to the Trusted Computing Group (TCG) Version 1.2 Specification
Hardware Asymmetric Crypto Engine
FIPS-140-2 Module Certified
Including:
High-quality Random Number Generator (RNG), HMAC, AES, SHA, RSA
NV Storage Space for 2066 bytes of User Defined Data
PoE+ Ethernet Mezzanine

Use Cases / Markets

- 802.3at – 30W/60W
- 802.3af – 15.4W
- 802.3bt – 90W

VoIP
WLAN
IP Cameras
Access Control
P2P Radio
Small Cells
Digital Signage
Point of Sale
LED
D3 Camera Mezzanine

Use Cases / Markets

For fast evaluation of embedded vision with the DragonBoard™ 410c

The DesignCore™ Camera Mezzanine Board with 5MP micro camera module enables rapid development of embedded vision applications. It supports the DragonBoard™ 410c by Arrow Electronics. It is the first easy solution for adding cameras on 96Boards.

Direct MIPI CSI-2 access to camera data allows more realistic evaluation of embedded vision designs. It eliminates the need to decode USB or Ethernet protocols, resulting in lower power and higher performance.

The miniature camera module (included) features an OmniVision 5MP image sensor and micro lens with autofocus. Available output formats include 5MP at 15fps and 1080p at 30fps.

The mezzanine board includes demonstration software running Linux to display 1080p video via HDMI. It is ideal for algorithm development, end application development, and evaluation of image sensors and optics.

DesignCore™ Camera Mezzanine Board OV5640
Camera Interfaces: Two MIPI CSI-2 (2-lane)
Expansion Interfaces: Two UART, two SPI, one I2C, one PCM, GPIO

Leopard Imaging Micro Camera Module OV5640
OmniVision OV5640 1/4" 5MP CMOS image sensor
Micro lens with VCM-driven autofocus
Focal length: 3.5mm
Focus distance: 10cm to infinity
FOV: 65°
AR1337 Camera Mezzanine

13MP CMOS Image Sensor

In Cooperation with MM Solution we are developing the first raw sensor camera mezzanine card for the Dragonboard with ISP enablement!

Stay tuned…
Cellular Mezzanine

Capable of supporting LoRa, Cat1, CatM
Thank You