Is ARM® Cortex™-A8 the new entry point in real-time embedded computing?

Presenters:
Russell Crane, Product marketing manager, Sitara™ ARM® Processors, Texas Instruments
Leo Forget, Product Manager, QNX Software Systems

April 18, 2012
Webinar agenda

• Introduction to ARM® technology at TI
• Sitara™ ARM product portfolio
• Sitara’s newest processor: the AM335x ARM Cortex™-A8 processor
• QNX company overview
• Why QNX Neutrino RTOS
• QNX / TI Collaboration
• Introduction to TI Wifi support on QNX
• Conclusion
TI ARM® investment and innovation

TI has shipped more than 7 billion ARM-based products and continues to invest in a large portfolio of scalable platforms from $1 to >1.5 GHz

Sitara™ ARM® processors offer

Performance
• Up to 450MHz ARM9™ to 1.5GHz Cortex™-A8 devices
• Industry’s first widely available Cortex-A8 devices - 2 DMIPS per MHz
• Graphics acceleration up to 27M polygons/s performance for advanced user interface
• High speed DDR2 and DDR3 memory performance

Connectivity
• 10/100/1000 Ethernet
• CAN 2.0 and High speed USB interface
• Multiple serial port options per device
• Lowest cost processor with SATA interface
• Flexible LCD controller for up 720p displays moving to 1080p in future devices
• Industrial peripheral support

Scalability
• Largest software compatible ARM MCU & Embedded MPU portfolio
• ARM only to ARM + accelerator functionality while reusing both SW and HW designs
• Leverage TI’s extensive portfolio of embedded ARM devices to maximize your product’s changing needs
• Fully pin-for-pin and software compatible options to scale from ARM only to ARM + DSP

Strength of Software
• Free and easy access to software
• Low cost development tools with reference code
• Application specific and advanced development kits
• Driver software available for most high-level operating systems
• QNX support for numerous Sitara devices
### Sitara™ ARM® processors available today

<table>
<thead>
<tr>
<th></th>
<th>AM18x</th>
<th>AM335x</th>
<th>AM35x</th>
<th>AM37x</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core</strong></td>
<td>ARM9 up to 456MHz</td>
<td>Cortex™-A8 up to 720MHz</td>
<td>Cortex-A8 up to 600MHz</td>
<td>Cortex-A8 up to 1GHz</td>
</tr>
<tr>
<td><strong>DMIPs</strong></td>
<td>Up to 410</td>
<td>Up to 1440</td>
<td>Up to 1200</td>
<td>Up to 2000</td>
</tr>
<tr>
<td><strong>Graphics</strong></td>
<td>N/A</td>
<td>SGX530</td>
<td>SGX530</td>
<td>SGX530</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>LPDDR1/DDR2</td>
<td>LPDDR1/DDR2/DDR3</td>
<td>LPDDR1/DDR2</td>
<td>LPDDR1</td>
</tr>
<tr>
<td><strong>RTOS</strong></td>
<td>QNX Neutrino</td>
<td>QNX Neutrino</td>
<td>QNX Neutrino</td>
<td>QNX Neutrino</td>
</tr>
<tr>
<td><strong>Key Features</strong></td>
<td>LCD Controller, SATA, Video In/Out, 10/100 EMAC, USB w/PHY</td>
<td>LCD Controller, CAN, 10/100/1000 EMAC</td>
<td>Display Subsystem, Video In/out, 10/100 EMAC, CAN USB w/PHY</td>
<td>Display Subsystem, Video In/out, PoP packaging, USB, Lowest power</td>
</tr>
<tr>
<td><strong>Apps</strong></td>
<td>Smart Meter, Wi-Fi Router</td>
<td>PND, Connected Home, Industrial Automation</td>
<td>IA, PLC, Infotainment</td>
<td>PND, Ed. Tablet, PDT</td>
</tr>
<tr>
<td><strong>Pricing</strong></td>
<td>Starting at $4.55 (10K)</td>
<td>Starting at $7.50 (10K)</td>
<td>Starting at $12.25 (10K)</td>
<td>Starting at $12.25 (10K)</td>
</tr>
</tbody>
</table>
Highly integrated, power-efficient ARM® Cortex™-A8 at ARM9™ prices

Highest ARM DMIPs per dollar today!

Lower system cost with support for DDR2/DDR3 memory, integrated Gigabit Ethernet, CAN, and PRU-ICSS

Full function and low cost development platforms fit your evaluation and cost requirements
AM335x ARM® Cortex™-A8-based processors are ideal for:

**Applications**
- Portable Navigation
- Connected Home
- Medical Devices
- Industrial Control and Automation
- Consumer Electronics
- Automotive
- Educational consoles

**Requirements**
- High Integration
- Network Connectivity
- Graphical User Interface
- Interface Options
- Affordable Tools
- Design Flexibility
- Scalability
AM335x ARM® Cortex™-A8 based processors

- Achieve faster processing power for system control and OS support
- Protect data with via hardware acceleration of data protection schemes
- Connect to sensors, actuators and control devices
- Create 3D graphical user interfaces
- Enable touch screen interfaces
- Support for Industrial Protocols
- Connect to existing technology with host and device support; Reduce system cost with embedded PHYs
- Deliver fast network connectivity with fast data throughput
- Optimize cost with flexible memory offerings

ARM® Cortex-A8 up to 720* MHz

Serial Interface
- UART x6
- SPI x2
- I²C x3
- McASP x2 (4ch)
- CAN x2 (2.0B)

System
- EDMA
- Timers x8
- WDT
- RTC
- eHRPWM x3
- eQEP x3
- eCAP x3
- JTAG/ETB

Parallel
- MMC/SD/SDIO x3
- USB 2.0 OTG + PHY x2

Memory Interface
- LPDDR1/DDR2/DDR3
- NAND/NOR (16b ECC)

Display
- 24 bit LCD Ctrl (WXGA)
- Touch Scr. Ctrl.**

Security
- w/ crypto acc.

L3/L4 Interconnect

PRU-ICSS
- EtherCAT
- PROFIBUS
- PROFINET
- Ethernet/IP

Graphics
- PowerVR
- SGX
- 3D Gfx

- 32K/32K L1 w/ SED
- 256K L2 w/ECC
- 64K RAM

- 64K Shared RAM

* 720 MHz only available on 15x15 package. 13x13 is planned for 500 MHz.
** Use of TSC will limit available ADC channels.
SED: single error detection/parity
AM335x processors - A scalable platform with 6 pin-pin compatible devices

<table>
<thead>
<tr>
<th>Pin-to-Pin Compatible</th>
<th>Graphics</th>
<th>Industrial Communications M: Master; S:Slave</th>
<th>Package</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM3359</td>
<td>3D graphics</td>
<td>M &amp; S: EtherCAT, PROFIBUS, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 /0.8mm</td>
<td>Sampling Today RTP: 2Q 2012</td>
</tr>
<tr>
<td>AM3358</td>
<td>3D graphics</td>
<td>M &amp; S: PROFIBUS, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 /0.8mm</td>
<td>Sampling Today RTP: 2Q 2012</td>
</tr>
<tr>
<td>AM3357</td>
<td>3D graphics</td>
<td>M &amp; S: EtherCAT, PROFIBUS, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 /0.8mm</td>
<td>Sampling Today RTP: 2Q 2012</td>
</tr>
<tr>
<td>AM3356</td>
<td>3D graphics</td>
<td>M &amp; S: PROFIBUS, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 /0.8mm</td>
<td>Sampling Today RTP: 2Q 2012</td>
</tr>
<tr>
<td>AM3354</td>
<td>3D graphics</td>
<td>M: EtherCAT, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 /0.8mm 13x13/0.65mm*</td>
<td>RTP: 2Q 2012</td>
</tr>
<tr>
<td>AM3352</td>
<td>3D graphics</td>
<td>M: EtherCAT, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 /0.8mm 13x13/0.65mm*</td>
<td>RTP: 2Q 2012</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Package</th>
<th>15x15mm (ZCZ)</th>
<th>13x13mm* (ZCE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARM speed</td>
<td>Up to 720 MHz</td>
<td>Up to 500 MHz</td>
</tr>
<tr>
<td>USB 2.0 OTG + PHY</td>
<td>x2</td>
<td>x1</td>
</tr>
<tr>
<td>EMAC</td>
<td>2-port switch</td>
<td>Single port</td>
</tr>
<tr>
<td>PRU-ICSS</td>
<td>All I/O pins</td>
<td>Reduced I/O pins</td>
</tr>
</tbody>
</table>
Get to market fast with AM335x dev. tools

<table>
<thead>
<tr>
<th>TMDXEVM3358</th>
<th>Starter Kit</th>
<th>TMDXIDK3359</th>
<th>TMDXICE3359</th>
<th>BeagleBone</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="TMDXEVM3358" /></td>
<td><img src="image2.png" alt="Starter Kit" /></td>
<td><img src="image3.png" alt="TMDXIDK3359" /></td>
<td><img src="image4.png" alt="TMDXICE3359" /></td>
<td><img src="image5.png" alt="BeagleBone" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feature</th>
<th>TMDXEVM3358</th>
<th>TMDXIDK3359</th>
<th>TMDXICE3359</th>
<th>BeagleBone</th>
</tr>
</thead>
<tbody>
<tr>
<td>uP/Freq</td>
<td>AM3358 – 720MHz</td>
<td>AM3358 – 720MHz</td>
<td>AM3359 – 720MHz</td>
<td>AM3359 – 720MHz</td>
</tr>
<tr>
<td>Memory</td>
<td>512MB DDR2</td>
<td>256MB DDR3</td>
<td>512MB DDR2</td>
<td>256MB DDR2</td>
</tr>
<tr>
<td>Display</td>
<td>7” SXGA Touch/LCD</td>
<td>4.3” WVGA Touch/LCD</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>PMIC</td>
<td>TPS65910</td>
<td>TPS65910</td>
<td>TPS65910</td>
<td>TPS65917</td>
</tr>
<tr>
<td>WLAN/ BT</td>
<td>WL1271</td>
<td>WL1271</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Features</td>
<td>Advanced Connectivity, RS-232 (4), 10/100 Ethernet CAN</td>
<td>2x Gb Ethernet ports, USB JTAG, Zigbee Connector, Accelerometer</td>
<td>PROFIBUS I/F CAN, PWM Controllers, Motor Axis Feedback</td>
<td>Temp Sensor, USB JTAG, Industrial Protocols, CAN</td>
</tr>
<tr>
<td>Software</td>
<td>QNX support today</td>
<td>QNX support coming soon</td>
<td>SYS/BIOS, StarterWare</td>
<td>SYS/BIOS, StarterWare</td>
</tr>
<tr>
<td>Available</td>
<td>Now</td>
<td>3Q12</td>
<td>Now</td>
<td>Now</td>
</tr>
<tr>
<td>Price</td>
<td>$995</td>
<td>N/A</td>
<td>$895</td>
<td>$99</td>
</tr>
</tbody>
</table>

**Software**
- QNX support today
- QNX support coming soon
- SYS/BIOS, StarterWare
An introduction to QNX and the Neutrino RTOS
QNX at a glance

Global presence: NA, Europe, Asia
Markets: Auto, medical, industrial, networking, consumer, mil-aero
History: 1980-2004 Privately owned
2004-2010 Harman International
2010-2012 Research In Motion
The world’s most reliable and high performance OS

**Mission-critical reliability**
- No crashes or reboots
- Predictable behavior
- Positive brand experience

**Technically superior performance**
- Responsive interfaces
- Exciting graphics
- Multi-core speed

**Rapid development**
- Fast coding
- Complete software execution visibility
- Trivial up scaling

**Industry standards**
- System safety and security
- Quality code
- Easy app porting

**Clean intellectual property**
- Low risk of lawsuits and recalls
QNX Product Portfolio

QNX Momentics
- Developer productivity
- Performance and footprint optimization
- Eclipse ecosystem

QNX Market Specific Solutions
- IEC 61508
- Common Criteria Secure EAL4+
- IEC 62304

QNX Middleware
- The cornerstone for a compelling, media-rich, user experience

QNX Neutrino RTOS
- The proven foundation for reliable, real-time embedded systems

QNX Board Support Packages
- Broad hardware support

Services
- Expedite your success with:
  - Training
  - Priority Support
  - Custom Engineering
  - Custom Services Plan
Mission-critical reliability

QNX microkernel architecture

- Microkernel has the fewest possible components with unrestricted CPU privileges
- A fault is contained so that it affects only the faulty component
- Failed components can be dynamically recovered while the system continues to operate

![Diagram of QNX microkernel architecture]
Technically superior performance

Hard real-time performance

Detailed benchmark reports are available from Dedicated Systems at their portal site: http://download.dedicated-systems.com/

3 Types of reports can be downloaded:
– RTOS Architecture reports
– Platform Evaluations
– Platform Comparison Reports
Technically superior performance

Hard real-time performance

Figure 9a: Average switch latency between x threads, in μs
Collaboration history

- Long term collaboration between TI and QNX
- Multi-customer and multi-market engagements in progress
- Collaboration: BlackBerry PlayBook and OMAP roadmap
- China University program
- On-site joint engineering
### QNX support for TI devices

<table>
<thead>
<tr>
<th>Device Family</th>
<th>QNX BSPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitara™</td>
<td>AM335x, AM35x, AM37x, AM18x</td>
</tr>
<tr>
<td>ARM® + DSP</td>
<td>L138, L137</td>
</tr>
<tr>
<td>Davinci</td>
<td>DM814x, DM37xx, DM355, DM365, DM644x</td>
</tr>
<tr>
<td>DRI (auto)</td>
<td>DRA446, DRA457, DRA459, DRA52x, DRA646, DRA626</td>
</tr>
<tr>
<td>WCU</td>
<td>WL1271, WL1273, WL1281Q, WL1283</td>
</tr>
</tbody>
</table>

QNX provides full-featured BSPs for these devices.

Download prebuilt images for trial purposes from Foundry27. ([www.foundry27.com](http://www.foundry27.com))
QNX support for AM335x ARM® Cortex™-A8 platform

**TI AM335x EVM**
- Startup
- Serial
- Ethernet
- Wifi*
- Bluetooth *
- SD
- I2C
- SPI
- USB/Host
- RTC
- Audio
- Watchdog
- Display Controller
- Touchscreen*
- Open GL ES 2.0 Support*
- EtherCAT*

**BeagleBoard.org BeagleBone**
- Startup
- Serial
- Ethernet
- Wifi*
- SD
- I2C
- SPI
- USB Host
- RTC
- Watchdog

* Functionality currently in development

Visit [www.qnx.com/partners/ti](http://www.qnx.com/partners/ti) for AM335x related updates
TiWi™ | 802.11 b/g/n + Bluetooth® module

- FCC/IC/CE/C-Tick certified
- Smaller than a penny (13mm x 18mm x 1.9mm)
- Extended operating temperature: -40 to 85 °C
- U.FL connector for external antenna
- On-module TCXO and power regulation
- Bluetooth®
TI WiFi support
WLAN driver feature overview

WLAN Driver Supports the following roles:
• Station (Client Mode )
• Soft Access Point
• WiFi- Direct device ( Client/GO )

MCP3.3 High level Features
• 802.11a/b/g/n
• Security: Open, WPA/WPA2, WEP (64/128)
• WPS and WPSv2 Provisioning (Enrollee and Registrar)
• WMM, WMM-PS ( WiFi multimedia)
• CCX
• ARP, Beacon, and Packet Filtering

• Supports WL1271, WL1273, WL1281 and WL1283 connectivity products.

• Based on TI’s MCP3.3 WiFi Driver Release.
Conclusion

• TI’s and QNX investment in ARM® remains high

• Sitara™ AM335x processor delivers Cortex™-A8 performance, robust graphics, and key peripherals to support numerous end applications

• QNX® Neutrino® RTOS software is an excellent option for the Sitara AM335x to enable customers to get to market quickly.

• Future TI products will continue to integrate the key features and drive higher performance while balancing our customer’s cost goals

• QNX will continue to work with TI in a collaborative fashion to support these future TI products.
Visit www.qnx.com/partners/ti for AM335x related update

For more information on AM335x visit www.ti.com/am335x

Slides will be available by April 20 at www.ti.com/qnxrtoswebinar

Contact your local Arrow Representative or visit www.arrownac.com