SITARA ARM Microprocessors for Industrial Automation

Efficient & Scalable architectures for the entire system
Industrial communications is the heart of industrial automation – Connect to Control

- Industrial Automation System = HMI + PLC + Sensors + Motor Control
- Connectivity is the heart of automation for greater productivity
- TI is uniquely positioned to provide efficient & scalable system solutions
  HW (Analog & Processor) + SW (communications & applications)
TI Processors provide efficient & Scalable architectures for the entire Industrial Automation system

**Market Requirements**

- **Scalable CPU for different performance requirements**
  (such as ARM9, Cortex-A8, DSP…etc)

- **Advanced user interface (2D/3D graphics)**

- **Operating Systems (HLOS and RTOS)**
  (Linux, Windows® Embedded CE, Android, RTOS)

- **Integrated support for various industrial communication protocols such as Profibus and EtherCAT**

- **Quality and reliability**
  Guaranteed 10+ years product life
  Extended Temperature, 70K+ Power on Hours

**What Value Sitara Could Bring to your System?**

- Differentiated ARM + PRU (Programmable real-time unit) architecture
- Scalable ARM portfolio for the entire system – HMI, PLC and I/O
- Industry-leading low power ARM architecture
- Complete signal-chain offering (Embedded Processing + Analog)
Implementing industrial communications is a complex problem

- **Key requirements:** Real-time, low-latency and reliability
- Several standards are developed to meet these requirements
  - +120 Serial based standards.
  - +25 Ethernet based standards.
- Enhanced MAC (medium-access layer) functionality for different standards requiring **specialized hardware (especially for slave)**

### Serial-based popular standards
- CAN
  - CAN-Open
  - DeviceNet
- Modbus
- Profibus
- CC-Link

### Ethernet-based popular standards
- EtherCAT
- Ethernet/IP
- Powerlink
- ProfiNet
- Sercos III
- CC-Link IE
- Mechatrolink
- Modbus TCP

- **Implementation of these protocols TODAY require ASICs or FPGAs**
- **TI’s ARM processors have a flexible, cost-efficient solution that eliminates this need**
TI solves the complex communications problem by integrating multi-protocol support in the ARM SoCs.

**Typical Solution – Today**
- MCU/MPU for application
- External ASIC/FPGA for communications (especially for slave)

**TI’s ARM + PRU solution = 4 benefits**
- System BOM savings (>40%) by eliminating the external ASIC
- Supports multiple protocols using the same hardware (PRU is completely programmable)
- Easily adapt to changing standards or create own (requires PRU expertise)
- Scalable solution for HMI, PLC and I/O devices
PRU (Programmable Real-time Unit) For Configurable Logic

Enabling real-time Ethernet Master and Slave communications

Architecture

- Two 32-bit RISC cores for real-time functions each running at 200MHz
- 8KB IRAM, 8KB DRAM, 12KB Shared RAM
- Single-cycle execution & Direct I/O interface sampling at ~5ns
- Logic, Control and arithmetic instructions
- 32-bit MULT and Interrupt controller
- Efficient bit/byte/word manipulations

Capabilities

- Implement Real-time communication interfaces (including slave i/f): PROFIBUS, EtherCAT, PROFINET & Ethernet/IP
  - Implement custom IP (such as EnDAT 2.2, SINC3 decimation, PWMs, DP Memory, Manchester Coding, 9 bit UART or a Backplane bus)

Advantages

- Completely programmable & Flexible
- Reduce system cost & complexity

AM335x SoC: ARM + PRU

PRU-ICSSv2

RAM

Interrupt Controller (INTC)

PRU (x2, 200MHz)

INTER

MII x2

UART

GPIO

ARM

Shared Memory
Sitara™ ARM® Processor roadmap

**AM37x**
- 800MHz/1GHz
- LPDDR1
- 10k $12 - $24

**AM35x**
- 600MHz
- 10/100 Enet, CAN
- LPDDR1 / DDR2
- 10k $12 - $17

**ARM9**
- 375/450MHz
- 10/100 Enet, SATA
- SDRAM / LPDDR1 / DDR2
- 10k $5 - $8

**Cortex-A8**
- Up to 1.5 GHz
- 2x GbE, HDMI, 2x PCIe, 2x SATA
- 2x DDR2 / DDR3
- 10k $29 - $31

**AM389x**
- Up to 1.0 GHz
- GbE, HDMI, PCIe, SATA
- 2x LPDDR1 / DDR2 / DDR3
- 10k $22 - $32

**AM43x Next**
- Increased ARM performance
- Increased Interface Options
- Increased Security Features

**AM43x**
- Up to 720 MHz
- 1G-Ethernet switch, TSC/ADC
- LPDDR1 / DDR2 / DDR3
- 10k $22 - $32

**AM2x Next**
- Increased Interface Options
- Lower Power

**AM2x**
- 600MHz
- 10/100 Enet, CAN
- LPDDR1 / DDR2
- 10k $12 - $17

**AM387x**
- Up to 1.0 GHz
- 1G-Ethernet switch, TSC/ADC
- LPDDR1 / DDR2 / DDR3
- 10k $22 - $32

**AM389x**
- Up to 1.5 GHz
- 2x GbE, HDMI, PCIe, SATA
- 2x DDR2 / DDR3
- 10k $29 - $31

**AM387x**
- Up to 1.0 GHz
- 1G-Ethernet switch, TSC/ADC
- LPDDR1 / DDR2 / DDR3
- 10k $22 - $32

**ICSS**
- PRU Industrial Communication Sub System
- 3D Graphics Accelerator
- Recently Announced

**Available Now**
- Production
- Sampling
- Development
- Concept

**2012**

**2013**

**2014**
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 GbE, CAN, and PRU

Full function and low cost development platforms fit your evaluation and cost requirements
AM335x is a 3-in-1 Scalable platform for industrial HMI, PLC and I/O communications

**I/O modules**
- **AM3356/7** 275MHz
  - Sensor GPIOs
  - Power
  - SPI serial or NOR Flash
  - Industrial comm Slave
- **ISO1176T TLK110 Transceiver**
- **Profibus EtherCAT**
- **ARM + PRU (AM3356/7-275)**
  - Low end I/O comms
  - AM3356/7 @ 275MHz
  - No need for DDR
  - Uses Sys/BIOS RTOS
- **2 development tools (IDK and ICE reference design)**

**Slave PLC**
- **AM3356/7** 600/720MHz
  - Ethernet
  - USB
  - Power
  - NAND Flash
  - DDR
  - Industrial comm Slave/Master
- **ISO1176T TLK110 Transceiver**
- **Profibus EtherCAT**
- **ARM + PRU (AM3356/7-720)**
  - Mid/High-end PLC
  - AM3356/7 @ 720MHz
  - Based on Sys/BIOS OS and 3P RTOS options
- **2 development tools (IDK and ICE reference design)**

**Master PLC**
- **AM3358/9** AM3352/4
  - Ethernet
  - USB
  - Power
  - NAND Flash
  - DDR
  - Industrial comm Master and optional slave
  - 720MHz
  - Based on Linux, WinCE and Android
- **Display**
- **ARM Only (AM3352)**
- **ARM + GFX (AM3354)**
- **ARM + PRU+GFX (AM3358/9)**
- **2 development tools (General Purpose EVM & Beaglebone)**

**HMI**
- **AM3358/9** AM3352/4
  - Display
  - Power
  - NAND Flash
  - DDR
  - Industrial comm Master and optional slave
  - 720MHz
  - Based on Linux, WinCE and Android
- **ARM Only (AM3352)**
- **ARM + GFX (AM3354)**
- **ARM + PRU+GFX (AM3358/9)**
- **2 development tools (General Purpose EVM & Beaglebone)**
EtherCAT Slave

**Devices**
- AM335x

**Features**
- ARM Cortex A8
- **Beckhoff EtherCAT stack – Free production license for ETG members (ETG membership is free)**
- **Compatible with other third party EtherCAT stacks**
- Uses SYS/BIOS RTOS from TI
- TLK100/TLK110 Industrial Ethernet transceiver

**Benefits**
- Lower ASIC cost and reduced PCB area
- EtherCAT Master /slave integrated on application processor

**Availability**
- AM335x sampling NOW
- Guaranteed long term availability
EtherCAT Master

Devices
- AM18xx
- AM35xx
- AM335x
- Several other Sitara devices with Ethernet peripheral

SW
- Master stack from 3Ps - 3S/CoDeSys or ETG
- Linux and other HLOS support from TI
- Compatible with third party OS/RTOS

Benefits
- Lower cost and power and PCB area
- EtherCAT Master/Slave integrated on application processor

Support
- TI’s Industrial SDK with Linux
- 3rd party free/commercial protocol stack

Availability
- AM18xx and AM35xx available now
- AM335x sampling NOW
- Guaranteed long term availability
PROFIBUS – Available now on AM1810/AM335x
Complete system solution for faster time to market

Features
- PROFIBUS DP (Distributed Periphery) V0 and V1
- Profibus Slave (certified by Siemens authorized Test Labs)
- Profibus Master (not certified yet)
- 12 Mbaud/second maximum

Benefits
- Lower total BOM with reduced cost PCB area
- Low power and extended temperature

Support
- TI supported firmware and development platforms
- Pre-tested 3rd party (TMG) protocol stack for evaluation
- Production license of TMG Stack for one-time fee of €5000
- PROFIBUS white paper, application note and additional design information at PROFIBUS page (www.ti.com/profibus)
Scalable solution for different Profibus applications

- **AM1810 AM335x MPU**
  - **ISO1176T PROFIBUS Transceiver**
  - **Profibus RS-485**
  - **SPI serial Flash**
  - **I/O modules**

- **Optimized system cost requiring no OS or external DDR/SDRAM**
- **Fast (<1s) power up**
- **Easy development with complete abstraction for the communications**

- **High-end HMI & PLC**
  - **AM1810 AM335x MPU**
  - **ISO1176T PROFIBUS Transceiver**
  - **Profibus RS-485**
  - **NAND Flash**
  - **DDR**
  - **Display Ethernet USB**

- **Capability to run HLOS such as Linux**
- **Uses an external DDR or SDRAM**
- **For high-end applications such as PLC and HMI systems**
Data Concentrators and Home Area Networks
Data Concentrators – main functions

- Communication of the data between the meters and the utility servers
- Collection, measurement and analyzing of energy usage, and communicate that data to a central database for billing, troubleshooting, and analyzing
- Power analytics (peak consumptions, periods of low load, etc)
- Energy Quality monitoring
- Power protection and circuits breaking
- Substation automation and Intelligent Control and Monitoring
Smart Grid Infrastructure (SGI) EVM

- Evaluate DSP-based Analytics and Metrology Algorithms
- Integrate Smart Grid Communications software
- Reference design based on TI digital and analog technology

Platform Software
- Standard Linux BSP supplied by TI
  - Includes Linux kernel, drivers and network stacks
- DSP/BIOS LINK for inter-processor communication
- DSP/BIOS Real-time Operating System

Power Analytics Package
- Metrology Demo
  - RMS Voltage, Current
  - Active, Reactive, Apparent power
- Digital Signal Libraries for Analytics
  - FFT, DFT, IIR Filter
- DSP Based Rogowski Digital Integrator

PLC Communications Package
- G3 MAC Concentrator
- Prime MAC Concentrator
- Upper layer SW Stack for ARM

Available Now!
SGI EVM Detailed View

Hardware Features

Three-phase power system:
- 3 current and voltage inputs plus neutral

Isolation to prevent damage from high voltages, currents

OMAP-L138 processor:
- Integra DSP + ARM for Control, communications and signal processing.
- Full Linux BSP supported by TI

High performance AIC provides 16-bit sampling at 96dB SNR.

Supports control and data communications:
- 2x Ethernet, PLC, sub-1Ghz & 2.4GHz RF
- RS232, CAN

Designed to best practices for high-speed systems:
- Good Ref design for ESD system tests.
- BOM and schematics available

Evaluate TI’s solutions for data concentrator based on ARM and DSP+ARM technology
And extend concentrator with TI’s analytics solution

500 - 1000 Node Concentrator Demo
G3 PLC standard
PRIME standard

Available Now!

* TI separately provides SW/HW/chipsets via companion devices for PLC, WiFi, ZigBee, and WMBUS.
Metrology & Digital Integrator Demo

Demonstrates ability of OMAP-L138 to execute metrology algorithms, Rogowski coil digital integrator algorithm, support for high-level OS, and network communication.

**OMAP-L138**
- **DSP/BIOS**
  - Digital Integrator
  - Metrology
  - FFT
- **Linux**
  - Network comm
  - DSP load/execute
- **I2C** (cntrl)
- **McASP** (data)
- **DSPLINK** (SW Link)

**Metrology Features**
- Active, reactive, and apparent power.
- Power factor, frequency (calculated from phase voltage).
- RMS current and voltage.
- Code reused from MSP430F471xx three-phase electric watt-hour meter.
- NOTE: Not all metering features supported.

**Peripheral Usage**
- McASP for getting data from AIC34 at a sampling rate of 9.6kHz w/ 16-bit data
- I2C for sending control data to AIC34

**Configuration Options**
- # phases, metrology parameter calculation, scaling factors, digital integrator on/off, etc.
Data Concentrator Demo

Demonstrates ability of OMAP-L138/AM18xx to act as data concentrator and communicate with multiple service nodes via a C2000-based power line communication system-on-module (SOM) daughtercard.

- 3-Chip Solution: ARM926-based AM18xx/OMAP-L138 as application processor, F28069+AFE031 as PLC PHY + lower MAC sub-system
- OMAP-L138 contains C674x DSP which can be used for metrology applications
- Single phase reference design system built on field proven PLC PHY + MAC
- Support both G3 and PRIME standards
- NIB Management to handle 1000s PLC service nodes and switches
- Linux OS on ARM926 to support MAC and above SW stack
- Convergence to both IPv6 and IE61334-4-32
- COSEM/DLMS demo application framework
Next Gen PLC Data Concentrator Platform

- Single-/triple-phase power line communication for G3/PRIME
- AM3356 application processor
  - 275MHz, Cortex-A8 ARM core
  - 64KB L1, 256KB L2, 128KB RAM
- Communication interfaces
  - 2 Gigabit Ethernet ports
  - Sub 1GHz & 2.4 GHz RF
  - WiFi/GSM/GPRS/WiMAX (DC or 3P)
  - RS232, MMC/SD, & USB
- On-board memory
  - 2 Gbit DDR2
  - 128 Mbit NOR flash
  - 64 Mbit SPI flash
  - 2 Gbit NAND flash
- Availability: 4Q12
HAN Gateway Reference Design

AM3352 ARM Cortex A8

*Second UART for debug; may mux function with other UART.
Reference design – What will you get?

• Jump start your gateway project with TI’s reference design
  – Included hardware:
    • Full form factor gateway design
    • Schematics
    • Layout
    • Gerbers
    • BOM
  – Included software:
    • U-Boot bootloader
    • Linux OS distribution
    • ZigBee ESI sample application
    • Web server based demo interface

• Single ZigBee device supports both HA and SE profiles
• WiLink 8 solution provides Wi-Fi and NFC in a single chip
WL1271 Wi-Fi + Bluetooth for AM335x

Platform Overview
TI wireless connectivity: Your best choice

Find the right connectivity solution
- Industry’s broadest portfolio of proven wireless connectivity solutions
- Support for a wide array of applications

Get to market quickly
- Complementary connectivity solutions for TI embedded processors
- “Out-of-the-box” tools and software solutions
- Extensive support infrastructure for hassle-free development

Leverage TI’s proven experience
- 10+ years connectivity experience with over 1 billion units shipped
- Broad industry knowledge across various technologies and markets
- Ongoing technology and product investments
Key Advantages of Ti WL1271 Platform

Designing a battery-powered device
WL1271 is optimized for low power applications

Designing with a TI embedded processor
WL1271 is provided as a system solution with AM335x, AM/DM37x, AM18x, and OMAP35x processors

Need multi-function connectivity
WL1271 offers Wi-Fi and Bluetooth in a single core, with options of ANT and BLE in upcoming platforms

Need fast time to market, while avoiding heavy engineering investment
WL1271 is provided as a module solution to speed design and minimize RF expertise required
Key WL1271 Markets

Portable Consumer
- eBook, Portable media player,
  Internet radio

Industrial and Home Automation
- Smart metering, Thermostat, Control tablets

Video
- Camera, Conferencing, Console

Portable Enterprise
- Portable data terminal, Education tablets

Smart Machines
- Vending machines, Toll systems, Printers
WL1271 Module
WLAN 802.11 b/g/n and Bluetooth® v4.0 BLE Module

Features
• IEEE 802.11 b/g/n compliant
• Bluetooth 4.0 with Bluetooth Low Energy
• Wi-Fi Direct
• TI's proven 6th generation Wi-Fi and Bluetooth solution
• Pre-integration with high performance Cortex-A8 based AM335x processor platform
• Open-source compliant Wi-Fi and Bluetooth drivers
• FCC Certified, ETSI & EMC Tested WL1271 module
• Sample applications and demos

Benefits
• Seamless, direct and high throughput Wi-Fi connectivity between devices (no external access points needed)
• High throughput, reliable signal integrity, best in class coexistence, enhanced low power
• Simplified and reduced hardware and software integration effort, get started quickly
• Platform enables high performance processing and increased level of integration at value-line pricing
• Open-source compliant Wi-Fi and Bluetooth drivers
• Certified modules lowers manufacturing and operating costs, saves board space and minimizes RF expertise required

Applications
• Mobile consumer devices
• Industrial and home automation, metering
• Portable data terminals
• Video conferencing, video camera
WL1271 Features and Benefits

**Performance**
- Best in class link budget
- Increased range

**Coexistence**
- Best-in-class coexistence
- More connections in parallel
- Simplified design process

**Low Power**
- Best-in-class Wi-Fi idle-connect current and Bluetooth power

**Software**
- Access to cutting-edge features

**System Integration**
- Simplified design process
- Reduced operating costs and time to market

**Typical WLAN transmit power:** +12.5dBm, 65Mbps, OFDM (n)
**Typical WLAN receiver sensitivity:** -73dBm, 65Mbps
**+9.5dBm increased Bluetooth transmit power**
**-92dBm Bluetooth receiver sensitivity**

**Dense combo integration:** Wi-Fi 802.11a/b/g/n, Bluetooth 4.0
**Enhanced WiFi/Bluetooth inter-core communication prioritizes packet scheduling**

**Enhanced Low Power (ELP) mechanism allows sleeping between WiFi beacons (0.7mA avg power), and fast wakeup time**

**Low power scan results in 1/3rd the Bluetooth power consumption (145uA) than traditional reception window scan**

**Open source compliant driver (mac802.11)**
**Roadmap to new features (e.g. BLE)**

**Fully integrated, pre-certified modules available**
**Pre-integration of module and host controller, including hardware reference design, software stack, and application code**
WL1271 MPU Platform block diagram

- TI Platforms enable complete system integration of module and host MPU
- Primary WL1271 engagement model is through TI Platforms
- WL1271-TypeTN platform includes AM335x
## Platform Value

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HW Design</strong></td>
<td>WL127X – AM335x interfaces defined and validated</td>
</tr>
<tr>
<td></td>
<td>Reduces risk.</td>
</tr>
<tr>
<td></td>
<td>No need for design trade-off analysis</td>
</tr>
<tr>
<td><strong>Software</strong></td>
<td>WPA Supplicant, Networking (TCP/IP) Stack, mac80211 WLAN Driver, BlueZ</td>
</tr>
<tr>
<td></td>
<td>Stack and Open Obex Profiles</td>
</tr>
<tr>
<td></td>
<td>All components required to enable end to end WLAN and Bluetooth</td>
</tr>
<tr>
<td></td>
<td>functionality delivered with Platform</td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td>Complete system integration of all components including Firmware,</td>
</tr>
<tr>
<td></td>
<td>Low Level Drivers and Applications</td>
</tr>
<tr>
<td></td>
<td>Reduces engineering costs and enables faster time to market</td>
</tr>
<tr>
<td><strong>Optimization</strong></td>
<td>System level power consumption and throughput optimization</td>
</tr>
<tr>
<td></td>
<td>Enables lower power and higher throughput in complex system use cases</td>
</tr>
<tr>
<td><strong>Validation</strong></td>
<td>Validation of all features and functionality</td>
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<td></td>
<td>Lowers risk and enables faster time to market</td>
</tr>
<tr>
<td><strong>Collateral</strong></td>
<td>Getting Started Guides, Build instruction</td>
</tr>
<tr>
<td></td>
<td>guides, datasheets, schematics and layout</td>
</tr>
<tr>
<td></td>
<td>Enables quicker time to market for developers</td>
</tr>
</tbody>
</table>
ECS Partner Network

**ECS Partner Network**

**GPS modules Platform support**

**WinCE Platform Support Customization**

**Bluetooth modules**

**Modules, customization support, design services**

**Low cost WiFi modules Porting and customer support**

**Catalog WiFi/BTH modules On-board design services**

**Bluetooth Stack and Profile provider**

**Linux Platform Support Customization**

**BT Platform Support BT Customization**

**BT Platform Support BT Customization**

**GPS modules Platform support**

**Panasonic ideas for life**

**Low-cost WiFi Modules Processor porting and support**
AM335x:

- What’s inside?
- What tools to use for your application development?
**AM335x Cortex™-A8 based processors**

**Benefits**
- High performance Cortex-A8 at ARM9/11 prices
- Rich peripheral integration reduces system complexity and cost

**Sample Applications**
- Industrial / Home Automation
- Portable Navigation Devices
- E-Tablets
- Robotics
- Consumer electronics
  - Advanced Toys
  - Smart Appliances
  - Low power instrumentation
  - Wireless Accessories
  - Networking

**Software and development tools**
- Free Linux and Android support packages direct from TI
- StarterWare enables quick and simple programming and migration among TI embedded processors
- WinCE and RTOS (QNX, Wind River, Mentor, etc) from partners
- Full featured and low cost development board options

**Power Estimates**
- Total Power: 600mW-1000mW
- Standby Power: ~25mW
- Deep Sleep Power: ~5-7mW

**Schedule and packaging**
- Status: In production
- Dev. Tools: Available today
- Docs: Available today
- Packaging: 13x13, 0.65mm via channel array
  - 15x15, 0.8mm

**More Information**
- www.ti.com/am335x

Availability of some features, derivatives, or packages may be delayed from initial silicon availability.
Peripheral limitations may apply among different packages.
Some features may require third party support.
All speeds shown are for commercial temperature range only.

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

**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
- ADC (8ch)
  - 12-bit SAR**

**Parallel**
- MMC/SD/SDIO x3
- GPIO
- USB 2.0 OTG
  + PHY x2
- EMAC 2port
  - 10/100/1G
  - w/1588 & switch (MII,RMII, RGMII)

**Display**
- 24 bit LCD Ctrl (WXGA)
- Touch Scr. Ctrl. (TSC)**
- Security w/ crypto acc.
- 64K Shared RAM

**PRU-ICSS**
- EtherCAT®
- PROFINET®
- Ethernet/IP™ and more

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* 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 - A scalable platform with 6 pin-pin compatible devices

<table>
<thead>
<tr>
<th>Pin-to-Pin Compatible</th>
<th>ARM Cortex-A8 (MHz)</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>720</td>
<td>3D graphics</td>
<td>M &amp; S: EtherCAT, PROFIBUS, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 / 0.8mm</td>
<td>In Production</td>
</tr>
<tr>
<td>AM3358</td>
<td>720</td>
<td>3D graphics</td>
<td>M &amp; S: PROFIBUS, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 / 0.8mm</td>
<td>In Production</td>
</tr>
<tr>
<td>AM3357</td>
<td>275/720</td>
<td>3D graphics</td>
<td>M &amp; S: EtherCAT, PROFIBUS, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 / 0.8mm</td>
<td>In Production</td>
</tr>
<tr>
<td>AM3356</td>
<td>275/600/720</td>
<td>3D graphics</td>
<td>M &amp; S: PROFIBUS, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 / 0.8mm</td>
<td>In Production</td>
</tr>
<tr>
<td>AM3354</td>
<td>500/600/720</td>
<td>3D graphics</td>
<td>M: EtherCAT, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 / 0.8mm</td>
<td>Production: 1Q13</td>
</tr>
<tr>
<td>AM3352</td>
<td>275/500/600/720</td>
<td>3D graphics</td>
<td>M: EtherCAT, Profinet, Sercos-III, Powerlink, Ethernet/IP</td>
<td>15x15 / 0.8mm</td>
<td>In Production</td>
</tr>
</tbody>
</table>

**Package**  | 15x15mm (ZCZ) | 13x13mm* (ZCE) |
<table>
<thead>
<tr>
<th></th>
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<th></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</td>
<td>All I/O pins</td>
<td>Reduced I/O pins</td>
</tr>
</tbody>
</table>

Texas Instruments
Packages

ZCE Package:
- 13x13 mm 0.65 pitch via channel array [0.8 routable] package
- VDD_MPU and VDD_CORE rail is merged

ZCZ Package:
- 15x15 0.8 pitch Full Array Package
- VDD_CORE and VDD_MPU rail is separate
what does "allows" mean? was this statement not finished?
Memory interface (mDDR/DDR2/DDR3 controller)

Benefit: The mDDR/DDR2/DDR3 memory controller is used to interface with JESD79-2E/JESD79-3C/JESD209A standard compliant DDR2/3/ mDDR SDRAM devices respectively. Memory types such as DDR1 SDRAM, SDR SDRAM, SBSRAM, and asynchronous memories are not supported. mDDR (Mobile DDR) here refers to LPDDR1 (Low power DDR) memory type.

Features of the EMIF4 include:

- Frequency Targets
  - mDDR: 200 MHz Clock (400MHz Data Rate)
  - DDR2: 266 MHz Clock (532 MHz Data Rate)
  - DDR3: 303 MHz Clock (606 MHz Data Rate)
- 16 bit data bus
- 1GB total addressable space
- Supported Memory configurations
  - 1 part (x16 devices)
  - 2 parts (x8 devices)
  - 4 parts (x4 devices)
- Supports a maximum of 4 address loads and 1 data load

Performance Numbers/DDR BW utilization:

- 664 MHz.
  - DDR2: 200 MHz Clock (400MHz Data Rate)
  - CortexA8: 500 MHz Clock
External memory interface

Benefit: The DDR2/3/mDDR memory controller is used to interface with JESD79-2E/JESD79-3C/JESD209A standard compliant DDR2/3/mDDR SDRAM devices respectively. Memory types such as DDR1 SDRAM, SDR SDRAM, SBSRAM, and asynchronous memories are not supported. mDDR (Mobile DDR) here refers to LPDDR1 (Low power DDR) memory type.

Features of the GPMC include:
- 8-bit and 16-bit wide data bus
- Programmable cycle timings for each chip select
- Up to 16-bit ECC support for NAND Flash using BCH code (t=4, 8 or 16) or Hamming code for 8-bit or 16-bit NAND-flash
- Integrated ELM (Error Locator Module) to provide ECC calculation (up to 16b) for NAND support. Supports 4-bit, 8-bit and 16-bit per 512byte block error location based on BCH algorithms

Features of the MMC/SD include support for:
- Multimedia card (MMC v4.3/SD 2.0)
- Card detect and write protect on an MMCSD port
- Split rail for 3.3V operation while other device I/O is running at 1.8V (MMCSD0 only). This interface uses standard LVCMOS I/Os
- 48 MHz I/O clock rate

Supported on all AM335x variants
Benefit: The EMAC module provides an efficient interface between the ARM processor and the networked community. 2x Port Industrial Gigabit Ethernet (10/100/1000 Mbps) with integrated switch – MII/RMII/RGMII and MDIO interfaces. Supports 1588 time-stamping, AV Sync, Industrial Ethernet protocols

The basic feature set of the EMAC module is:

- 10/100/1000 3 port Ethernet switch
- Supports standard Media Independent Interface (MII) and Reduced Media Independent Interface (RMII) & gig Reduced Media Independent Interface (RGMII) to physical layer device (PHY)
- Includes MDIO module to communicate with PHY
- Eight receive channels with VLAN tag discrimination for receive quality of service (QoS) support
- Eight transmit channels with round-robin or fixed priority for transmit quality of service (QoS) support
- Ether-Stats and 802.3-Stats statistics gathering
- Transmit CRC generation selectable on a per channel basis
- Hardware flow control

Supported on all AM335x variants
USB 2.0 – Universal Serial Bus

Benefit: 2xOTG controllers with integrated PHYs provide a mechanism that complies with the USB2.0 standard for data transfer between USB devices up to 480 Mbps. Its dual-role feature allows the capability to operate as a host or peripheral.

Features of the USB include:

- Operating as a host, it compiles with USB2.0 standard for high-speed, full-speed and low-speed operation with a peripheral
- Operating as a peripheral, it compiles with USB2.0 standard for high-speed and full-speed operation with a host
- Supports all modes of transfers (control, bulk, interrupt, and isochronous)
- Supports 16 simultaneous Transmit (TX) and 16 Receive (RX) endpoints, in addition to endpoint 0
- Includes a DMA controller that supports 16 TX and 16 RX DMA channels with a max single data transfer size up to 4Mbytes

2-ports supported on ZCZ
The liquid crystal display controller (LCDC) is used to interface to character display panels for text message display or to graphical display panels for image/video display up to WXGA.

Features of LCDC include the following:

- Up to 24-bits data output; 8 bits-per-pixel (RGB)
- Up to WXGA resolution
- Integrated LCD interface display driver (LIDD) controller
- Integrated raster controller
- Integrated DMA engine to pull data from the external frame buffer without burdening the processor via interrupts or a firmware timer.
- 512 word deep internal FIFO
- Touchscreen controller is also supported. This information is covered within the ADC section of the peripheral overview
AM335x has numerous serial peripherals...

Benefit: Support for many interfaces

- 8 GP Timers & 1 watchdog timer
  - Free-running 32-bit upward counter. Runs off 32KHz or 19.2, 24, 25, 26 MHz system clock.
  - WDT: MPU Watchdog (runs of 32KHz system clock)
- I2C (3)
  - 3 I2C ports compliant with Philips I2C specification version 2.1
  - Support for standard (up to 100K bits/s) and fast (up to 400K bits/s) modes
- General-Purpose I/O (GPIO) Interface (1)
  - Synchronous interrupt requests in active mode from each channel are processed by interrupt
    generation submodule by the microprocessor unit (MPU) subsystems.
  - Asynchronous wake-up request
- Multichannel Audio Serial Port Interface (2)
  - Data Clock 50 MHz
  - Two Clock Zones and up to 4 Serial Data Pins per McASP port
  - Supports TDM, I2S and Similar Formats
  - Supports DIT mode
- Universal Asynchronous Receiver Transmitters (UART) (6)
  - 1 UART will support full Modem Control
  - All UARTs support IrDA, CIR and RTS, CTS flow control.
  - Supports baud rate up-to 3.6M bits/s.
AM335x has numerous serial peripherals (cont.)

- **ADC (8)**
  - 12-bit Successive Approximation Register (SAR) ADC with a sample rate of 100KSPS. ADC input can be selected from any of the 8 analog inputs multiplexed through an 8:1 analog switch. SAR ADC can be configured to support a 4-wire/5-wire/8-wire resistive touch screen controller (TSC) interface. When configured as TSC, it takes away pins/channels for general purpose ADC use.

- **eCAP (3)**
  - Up to Three (3) 32-bit enhanced Capture Modules – configurable has 3 capture inputs or 3 auxiliary PWM outputs

- **eHRPWM (3)**
  - Up to Three (3) enhanced High Resolution PWM modules (eHRPWM) – with dedicated 16-bit time base counter with time and frequency controls. Configurable has 6 Single Ended or 6 Dual Edge Symmetric or 3 Dual Edge Asymmetric outputs

- **eQEP (3)**
  - Up to Three (3) 32-bit enhanced Quadrature Pulse Encoder modules
Clocks

AM335x includes complex clock management

• 5 ADPLLs to generate various system clocks:
  – ARM MPU subsystem
  – DDR interface
  – USB & Peripherals (MMC/SD, UART, SPI, I2C, etc.)
  – L3, L4, Ethernet, SGX
  – LCD Pixel Clock

• Supports auto clock gating on AM335x when peripheral is not used.

• Input Clocks to device
  – SysClock - 19.2, 24, 25, 26 MHz system clock
  – RTC Clock - 32kHz clock. (Optional as we can derive from sys_clk)
Get to market fast with AM335x dev. tools

<table>
<thead>
<tr>
<th>Module</th>
<th>uP/Freq</th>
<th>Memory</th>
<th>Display</th>
<th>PMIC</th>
<th>WLAN/BT</th>
<th>Features</th>
<th>Software</th>
<th>Available</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM335x EVM (TMDXEVM3358)</td>
<td>AM3358 – 720MHz</td>
<td>512MB DDR2</td>
<td>7” Touch/LCD</td>
<td>TPS65910</td>
<td>WL1271</td>
<td>Advanced Connectivity UART (4) 10/100 Ethernet CAN, USB JTAG, Zigbee Connector, Accelerometer</td>
<td>Android, Linux, StarterWare, WinCE</td>
<td>Now</td>
<td>$995</td>
</tr>
<tr>
<td>AM335x Starter Kit (TMDSSSK3358)</td>
<td>AM3358 – 720MHz</td>
<td>256MB DDR3</td>
<td>4.3” Touch/LCD</td>
<td>TPS65910</td>
<td>WL1271</td>
<td>2x Gb Ethernet ports, USB JTAG, Zigbee Connector, Accelerometer</td>
<td>Android, Linux, StarterWare</td>
<td>3Q12</td>
<td>$199</td>
</tr>
<tr>
<td>Industrial Dev. Kit (TMDXIDK3359)</td>
<td>AM3359 – 720MHz</td>
<td>512MB DDR2</td>
<td>N/A</td>
<td>TPS65910</td>
<td>N/A</td>
<td>PROFIBUS I/F CAN, PWM Controllers, Motor Axis Feedback</td>
<td>SYS/BIOS, StarterWare</td>
<td>Now</td>
<td>$895</td>
</tr>
<tr>
<td>Industrial Communications Engine (TMDXICE3359)</td>
<td>AM3359 – 720MHz</td>
<td>256MB DDR2</td>
<td>N/A</td>
<td>TPS65910</td>
<td>N/A</td>
<td>Temp Sensor USB JTAG, Industrial Protocols CAN</td>
<td>SYS/BIOS, StarterWare</td>
<td>Now</td>
<td>$99</td>
</tr>
<tr>
<td>BeagleBone</td>
<td>AM3358 – 720MHz</td>
<td>256MB DDR2</td>
<td>Optional</td>
<td>TPS65917</td>
<td>N/A</td>
<td>USB-Powered 10/100 Ethernet Expansion, USB JTAG</td>
<td>Linux, Android, StarterWare</td>
<td>Now</td>
<td>$89</td>
</tr>
</tbody>
</table>
BeagleBone
Enabling Cortex™-A8 development at $89

• Size of a credit-card
• Extensive hardware connectivity with Linux
• Large open source community support
• Single cable and 10-second Linux boot
• Order from www.beagleboard.org

USB 2.0 Host | 256MB DDR2
5V Power Supply (opt.) | LEDs
10/100 Ethernet | Expansion (3)
TI Power Mgmt | MicroSD
On-board emulator | USB 2.0 Client
BeagleBone CAPES

- Adafruit Proto Cape Kit
- BeagleBone Breadboard
- BeagleBone DVID
- BeagleBone LCD

...
AM335x Starter Kit Introduction
Based on the AM3358 Sitara™ Cortex®-A8 Processor
AM335x Starter Kit Features - Front

Available through TI eStore and Distribution

$199
AM335x Starter Kit Features - Back

- AM3358/9ZCZ-720MHz, Cortex-A8
- 256MB DDR3
- uSD/MMC
- Gb Ethernet x2 (Switch)
- WL1271 WiFi/BT Module
- USB 2.0 OTG (2)
- Audio in/out
- +5V Power Supply

Pre-FCC and CE Certified – Ready for Production!
### AM335x SK BOM Optimized w/ TI Content

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Mfr</th>
<th>MfrNum</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>TI</td>
<td>TPD6E001RSE</td>
<td>ESD Protection Array 6Chan +-15kV</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>SN74AUP2G08DCU</td>
<td>Low Power Dual AND Gate</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>TPD2E001DRL</td>
<td>ESD Protection Array 2Chan +-15kV</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>XAM3359ZCZ</td>
<td>ARM MPU Cortex A8 Processor ZCZ Package</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>TPS78633DCQ</td>
<td>Linear Power Regulator 3.3V 1.5A</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>SN74LVC1G00DCK</td>
<td>Single Two input positive NAND</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>SN74LVC1G07DCK</td>
<td>Driver Open Drain output</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>TPS61081DRC</td>
<td>Regulator WLED Driver 1.3A</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>SN74AVC4T245PW</td>
<td>Bus Transceiver 4bit Voltage Translator</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>TPS79518DCQ</td>
<td>Linear Power Regulator 1.8V 500mA</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>TPS51200DRC</td>
<td>DDR Termination Regulator SinkSource</td>
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<td>2</td>
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<td>TPD4S012DRY</td>
<td>ESD 4channel USB Interface</td>
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<tr>
<td>1</td>
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<td>TPS52051BD</td>
<td>Power Distribution Switch Current Limited 500mA</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>TPS63010YFF</td>
<td>Buck-Boost Converter with 2A Switches</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>TPS71718DCK</td>
<td>Low Dropout 1.8V 150mA Linear Regulator</td>
</tr>
<tr>
<td>1</td>
<td>TI</td>
<td>TPS65910A3A1RSL</td>
<td>Integrated Power Management Unit for DDR3</td>
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<tr>
<td>1</td>
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<td>TPS79501DCQ</td>
<td>Power Regulator LDO adjustable 500mA</td>
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<td>1</td>
<td>TI</td>
<td>TLV320AIC3106iRG</td>
<td>Low power stereo audio codec</td>
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<tr>
<td>1</td>
<td>TI</td>
<td>SN74LVC2G07DCK</td>
<td>Dual Buffer with open drain outputs</td>
</tr>
</tbody>
</table>

**19 TI components - 22 Placements**

Complete Bill of Materials available on StarterKit Wiki
AM335x Starter Kit – What’s in the box?

- AM335x StarterKit
- +5V Power Supply
- International Blades
- USB Cable
- 4GB uSD (Linux)
- 8GB uSD (Android)
- uSD to SD Adapter
- Quick Start Guide
- Android DVD (not shown)

All delivered in a compact, rugged plastic container
AM335x Industrial Communications Engine (ICE)
Reference Design Optimized for low-end Industrial slave communications

- USB JTAG
- Host Interface
- DPRAM (Not populated)
- NOR FLASH
- 6 x LEDs
- Temp Sensor
- SPI Flash
- Power
- MMC
- TPS65910
- 24V I/O
- 8 x LEDs
- DDR2
- TLK110

- Simplified system BOM without requiring DDR & High level OS
- Easy SW development with complete abstraction for the communications protocols

$99
AM335x Industrial Development Kit (IDK)
Motor control with communications

$895

✓ Demonstrates multiple communications with motor control
AM335x – It’s all about SW!
**AM335x software solutions**

<table>
<thead>
<tr>
<th><strong>Linux</strong></th>
<th><strong>Android</strong></th>
<th><strong>WinCE</strong></th>
<th><strong>StarterWare</strong></th>
<th><strong>RTOS 3P</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Complete Linux software development kit</td>
<td>- Gingerbread based SDK</td>
<td>- Windows Embedded Compact 7 SDK</td>
<td>- OS free programming tool</td>
<td>- Broad support for numerous RTOS including QNX and Integrity</td>
</tr>
<tr>
<td>- Based on Linux kernel 3.1</td>
<td>- Graphics accel for optimal performance</td>
<td>- Full support for ARM v7 instructions provide greater Cortex-A8 performance</td>
<td>- Easily migrate from MCU code compatibility with Stellarisware</td>
<td>- Mentor Graphics, Ittiam, VisualON solutions for both graphics and video</td>
</tr>
<tr>
<td>- Integrated support for WL1271 WiFi/BT</td>
<td>- arowboat.org community</td>
<td>- Peripheral and graphics libraries</td>
<td>- USB and networking stacks</td>
<td>- Commercial Linux, Android, WinCE customization options</td>
</tr>
<tr>
<td>- Includes easy to navigate launcher GUI based on QT/HTML5.0</td>
<td>- RowboPERF benchmarking application</td>
<td>- Pre-integrated ARM video Codecs</td>
<td>- Code examples</td>
<td>- Solutions for PRU development and system optimization</td>
</tr>
<tr>
<td>- Graphics and video demos, benchmarks, real-time comparisons</td>
<td>- Pre-integrated ARM video Codecs</td>
<td>- 3D graphics SDK integrated</td>
<td>- Small memory footprint</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>- Integrated Flash Support</td>
<td>- Example applications</td>
<td>- Optimized for low latency</td>
<td>-</td>
</tr>
</tbody>
</table>

Available for free via www.ti.com
Going from HW to SW

Option 1: Use BareBone SW
- **Advantages**
  - Optimized: memory, cycles
  - MCU-like code, complete code control & visibility
- **Limitations**:
  - Complex use case, task scheduling
  - Multiple stack handling

Option 2: Select an Operating System
- **RTOS**
  - TI: SYSBIOS – Industrial SDK
  - Ext 3rd Parties: Nucleus, QNX, FreeRTOS,…
- **HLOS**
  - Linux, Android, WinCE
**StarterWare as Barebone SW**

**StarterWare Package**
- Peripheral Usage Examples
- Demo Application
- Uses multiple peripherals
- Configures PLL, EMIF and loads application

**StarterWare Libraries**
- Graphics Library
- EMAC, USB Stacks
- System / Device Abstraction Layer
- Peripheral Register Layer
- Peripheral Hardware
- ARM Core

**Show individual driver usage**
- Simple and intuitive API
- Interrupt + EDMA capability
- Peripheral drivers
- Interrupt controller
- Pinmux

**Free, OS-less software development tools for embedded devices with ARM**
- Peripheral driver libraries
- ARM interrupt controller code
- Graphics library
- Lightweight network and USB stacks
- Canned UBL to configure device and boot applications
ARM MPU StarterWare

• StarterWare software gives you a simple starting point to develop your own programs, using library APIs to perform peripheral configuration and IO
  – Provides C-based, no-OS platform support
  – Provides device abstraction layer libraries, peripheral programming examples such as Ethernet, graphics and USB and board level example applications
  – Can be used stand-alone or with an RTOS
  – Eases transitions from micro controller to processor for customers already using TI’s StellarisWare ® Software for MCU’s

• Availability – all NRE and royalty free
AM335x software summary
ARM® Cortex-A8+graphics

Board Support Package
- Linux – Open Source – TI Developed
- Android – Open Source – TI Developed
- Windows Embedded CE – TI Developed
- StarterWare – TI Developed
- Commercial Linux and Android – Many Partners
- RTOS – QNX, VxWorks, Nucleus, Integrity etc.

Application Frameworks – Java, Qt, GStreamer, Flash, Android, DShow, Direct Draw

User Interface

Browser/ Media Players

“Applications”

Video, Imaging, Speech, Audio Codecs and Frameworks on ARM/NEON™

OpenGL® ES and OpenVG™ Library On SGX

PRU Subsystem

OS Kernel

ARM Cortex-A8 with on chip USB, High End CAN controller (HECC) and Ethernet MAC

Accelerators – SGX530 and Neon

AM335x
# Sitara Linux® SDK Roadmap

<table>
<thead>
<tr>
<th>Release Version</th>
<th>Now</th>
<th>4Q 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device &amp; Platform</td>
<td>Device</td>
<td>Dev Platform</td>
</tr>
<tr>
<td>AM335x</td>
<td>AM335xEVM</td>
<td>Beagle Bone</td>
</tr>
<tr>
<td></td>
<td>AM335xEVM</td>
<td></td>
</tr>
<tr>
<td>AM335x-SK</td>
<td>AM335x-EVM</td>
<td>Beagle Bone</td>
</tr>
<tr>
<td>AM37x</td>
<td>AM37 EVM</td>
<td>Beagle XM</td>
</tr>
<tr>
<td>AM35x</td>
<td>AM3517EVM</td>
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<tr>
<td>AM180x</td>
<td>AM18xEVM</td>
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</table>

<table>
<thead>
<tr>
<th>OS Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linux 3.3.7 (BeaglexM AM37x), Linux 3.2 (AM335x), 2.6.37 other platforms; uboot/SPL v2012.04; v2011.09 toolchain – gcc4.5.3</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>New Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Same Sitara SDK Look &amp; Feel across devices</td>
</tr>
<tr>
<td>• AM335x EVM-SK support</td>
</tr>
<tr>
<td>• AM335x SmartReflex support, dual emac support, accelerated cryptography</td>
</tr>
<tr>
<td>• Updated Flash Tool</td>
</tr>
<tr>
<td>• WLAN examples – Wifi Direct, Display and Battleship game</td>
</tr>
<tr>
<td>• File System Optimizer</td>
</tr>
<tr>
<td>• Clock Tree Tool</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDK 5.05</td>
</tr>
</tbody>
</table>
Android™ on – www.arowboat.org

- **Rowboat** ([www.arowboat.org](http://www.arowboat.org)) – a community portal for Android on TI ARM® Cortex™-A8 platforms
  - A completely free, open-source project for all customers, developers, and third parties
    - Supported by TI Development team
  - Android base port and graphics support available for TI EVMs and Community boards (Beagleboard now) on rowboat.
  - Includes: Code (binary and source), Wiki, How-to's, links, IRC, FAQs, and more

- **TI Android Development Kit**
  - Derived from rowboat to aid customers development and out of the box experience.
    - Stable periodic snapshots (approx. every 6 months) available on [www.ti.com](http://www.ti.com)
    - Tested by TI quality assurance team
    - Include product specific documentation

- **Commercial support for Android developers from** [Mentor Graphics](http://www.mentor.com)
# ARM MPU Android® Dev Kit Roadmap 2012

## Device & Platform Supported

<table>
<thead>
<tr>
<th>Device Platform</th>
<th>Device</th>
<th>Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM335x</td>
<td>eTab RDK EVM SK</td>
<td>Accessory Dev Kit</td>
</tr>
<tr>
<td>AM37x EVM Beagle XM Flashboard</td>
<td>AM33x EVM BeagleBone EVM SK</td>
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## OS Version

<table>
<thead>
<tr>
<th>2012 4Q</th>
<th>2012 4Q</th>
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</thead>
<tbody>
<tr>
<td>Android 4.0 Ice cream Linux Kernel 3.2</td>
<td>Android 4.0 Ice cream Starterware</td>
</tr>
<tr>
<td>Android ICS Latest Kernel</td>
<td></td>
</tr>
</tbody>
</table>

## Features

### Connectivity:
- Ethernet
- WLAN, BT, USB

### Peripherals:
- LCD, USB, NAND, MMC/SD, UART, Audio Out/In, Accelerometer, Backlight control,
- RDK: Multitouch, Haptics, USB Camera

### Framework:
- OpenGL 3D SGX acceleration, UBIFS, Power Management, USB 3G MODEM

### Tools:
- Fast boot, ADB, CCSv5

### Applications:
- RowboPERF, Browser, Media player, Gallery etc

## DevKit

<table>
<thead>
<tr>
<th>Release</th>
<th>Now</th>
<th>2012 4Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latest release*</td>
<td>Sept 30</td>
<td>Dec 30</td>
</tr>
</tbody>
</table>

* Also includes links to prior Gingerbread releases
Windows® Compact Embedded for Sitara Processors

- WinCE 6.0 R3 and WEC7 SDKs available today from Adeneo Embedded
  - Drivers, application framework, and graphics packages with targeted applications and demo available here
    - WinCE 6.0 R3 for AM17x/18x
    - WinCE 6.0 R3 for OMAP3530 and AM37x
    - WEC7 for AM35x/AM37x

- Support, maintenance and services are now provided by Adeneo Embedded for WinCE and WEC7 SDKs
  - Contact Adeneo Embedded directly for more information on roadmaps, training, services and custom support

- Information on additional Windows Embedded Partners from Microsoft is available here

Links
- MSFT WinCE SW Roadmap
- TI WinCE e2e Forum
- TI Embedded processor wiki
Graphics Support

• **3D Graphics SDK is integrated into Linux®, Android® and Windows® Embedded (CE) SDKs**
  – Available free to customers/App developers for Linux, Android and WinCE
  – Utilizes POWERVR SGX 3D H/W accelerator
  – Khronos Open API (Open GL ES, Open VG) compliant
  – Standard development kits available for Linux, Android and WinCE
  – Proof-of-concept demonstration and example software with SDK

• **Neon Accelerated 2D Graphics library available for Linux SDK from TI**
  – BitBlit Engine Library Integrated with Qt 4.6.x (Object code only)
  – Available for AM and DM37x processors now
  – Customer information required for delivery
  – Download link available with Linux SDK download page

• **Neon Accelerated 2D graphics library available for WinCE and Android**
  – Open Source Acceleration for Android (SKIA)
  – TI library for DirectDraw Acceleration for WinCE
  – Software as part of TI Android and WinCE deliverables

• **Active 3rd party options and application specific solutions**
  – TI works with [Intelligraphics](#) and [ALT Software](#) for Graphics Driver customization and integration support.

More…
Code Composer Studio™ IDE

- **Integrated development environment**
  - A suite of development kits for compiling, editing, debugging, profiling and analyzing applications for TI embedded processors
  - Based on the Eclipse application framework that has been enhanced for TI processors

- **Low cost**
  - Many free kit choices: evaluation, free when using XDS100, 16KB code size limited kits for MSP430
  - Low priced options

- **High performance compilers**
  - Tunable performance for high performance and great code density
  - 20+ years of deployed experience

- **XDS JTAG Debug Controllers (Emulators)**
  - Wide range of solutions available from low cost XDS100s at $79 to high performance XDS560
  - Available from TI or from 3rd parties

- **Linux & Android Application Development**
  - [Code Composer Studio v5](#) Limited Release supports the development of Linux and Android based applications

- **Resources**
  - [CCS](#) and [Compiler](#) forums for support
  - [Mediawiki](#) for documentation and training material