ARM Microprocessors for Industrial Automation
Efficient & Scalable architectures for the entire system

Jun 2012
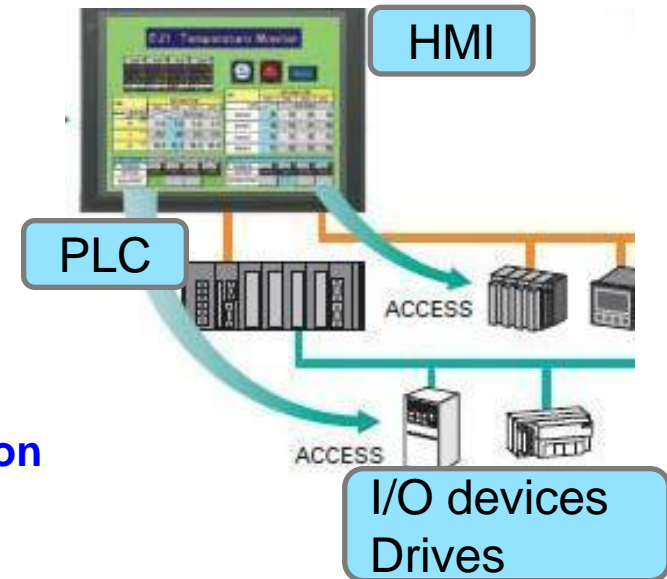
Agenda

- High-level Information
  - ➤ TI ARM Value proposition in Industrial Automation
  - ➤ TI Hero Industrial ARM product: AM335x
  - ➤ Demos

- Detailed Information - Integrated Industrial Communications
  - ➤ EtherCAT
  - ➤ PROFIBUS

- Q&A

TI Processors provide efficient & Scalable architectures for the entire Industrial Automation system
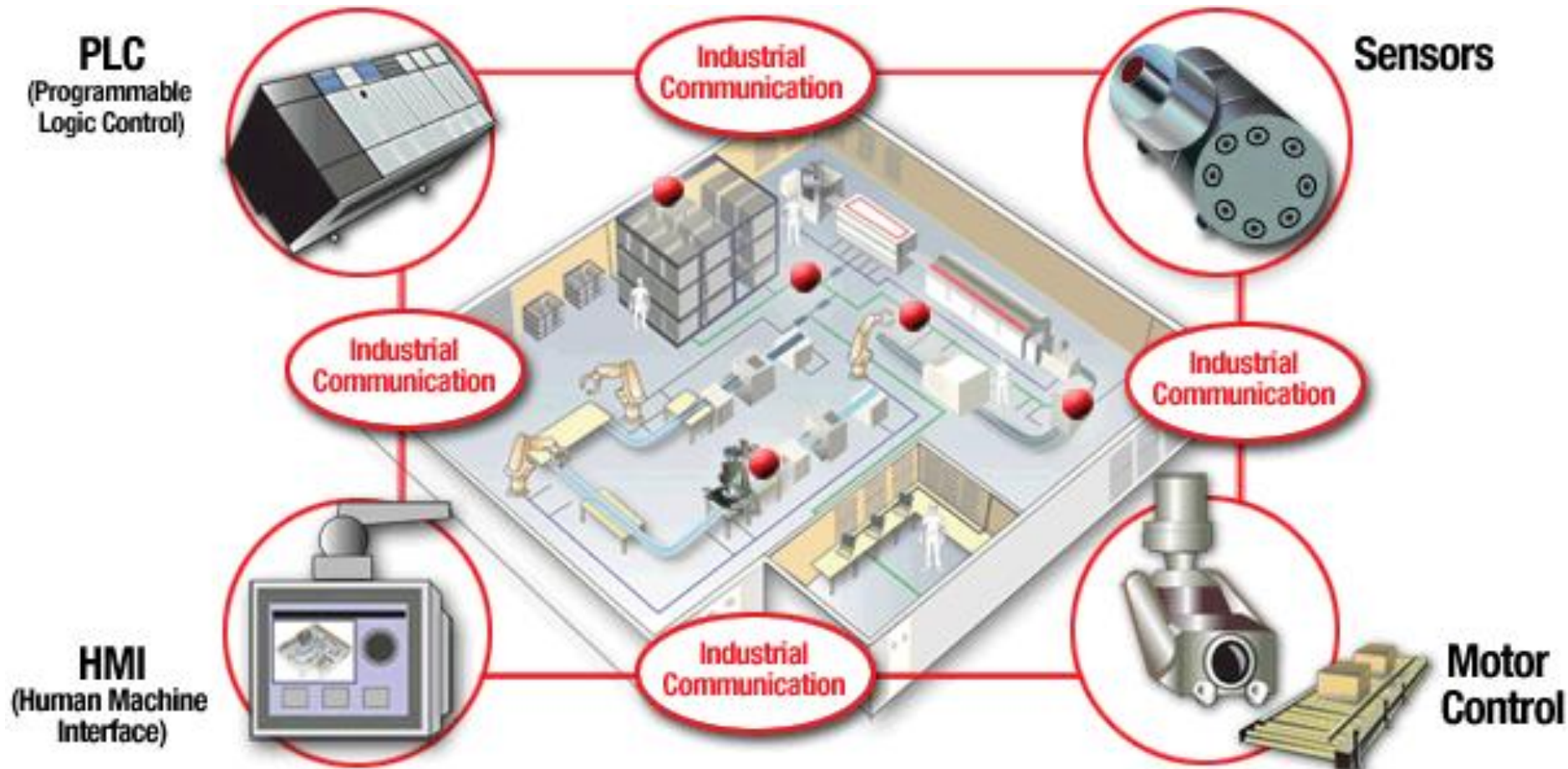
Requirements

✓**Scalable CPU for different performance requirements**
  (such as ARM9, Cortex-A8…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, low FIT rates

HMI

PLC

ACCESS

ACCESS

I/O devices
Drives

TI ARM Value Proposition

- **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)**

TEXAS INSTRUMENTS

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)

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

✓ **Implementation of these protocols TODAY require ASICs or FPGAs**
✓**TI's ARM processors have a flexible, cost-efficient solution that eliminates this need**

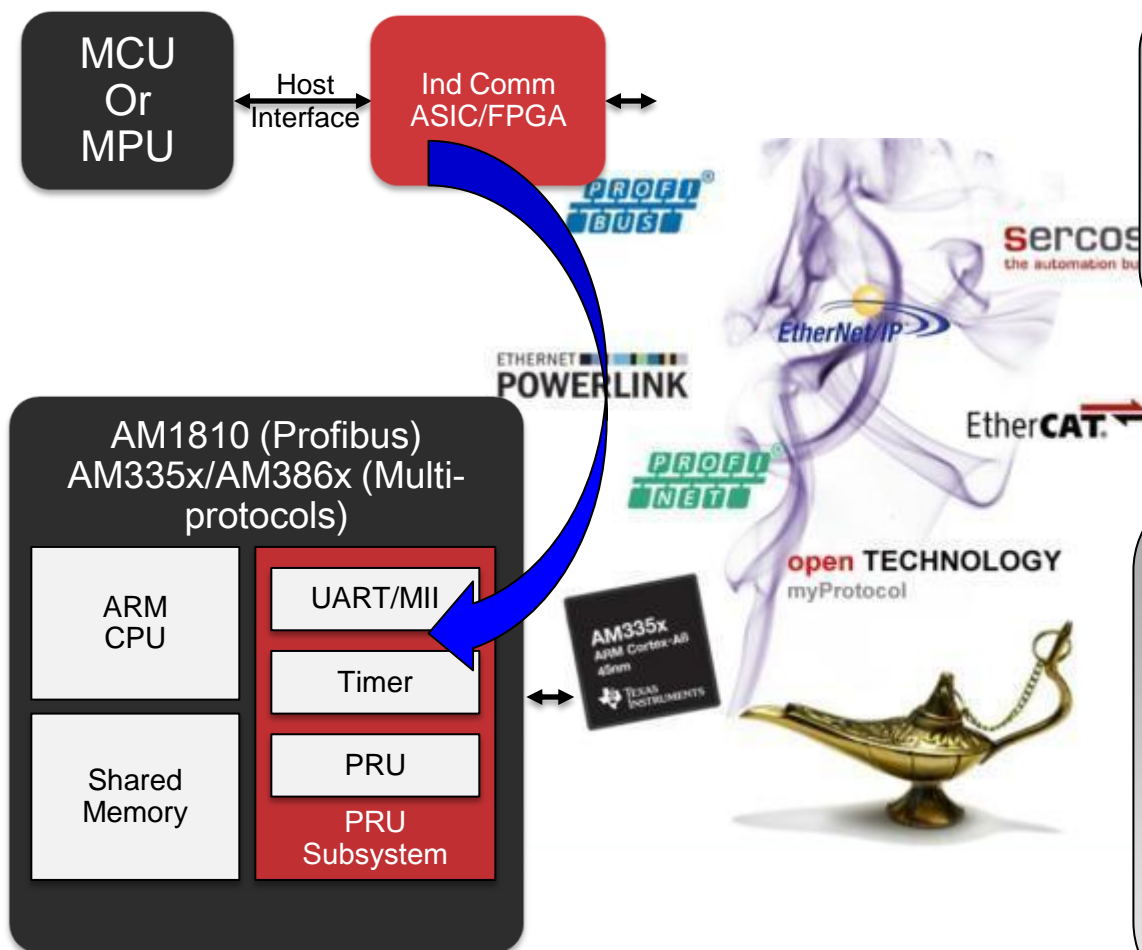Ethernet-based
popular standards

EtherCAT
Ethernet/IP
ProfiNet
Sercos III
Mechatrolink
Powerlink
Modbus TCP

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TI solves the complex communications problem by integrating multi-protocol support in the ARM SoCs

MCU Or MPU

Host Interface

Ind Comm ASIC/FPGA

AM1810 (Profibus) AM335x/AM386x (Multi-protocols)

- ARM CPU
- Shared Memory
- UART/MII
- Timer
- PRU
- PRU Subsystem

AM335x ARM Cortex-A8 45nm

PROFIBUS

ETHERNET POWERLINK

PROFINET

sercos the automation bus

EtherNet/IP

EtherCAT

open TECHNOLOGY myProtocol

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 (myProtocol)**
- **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
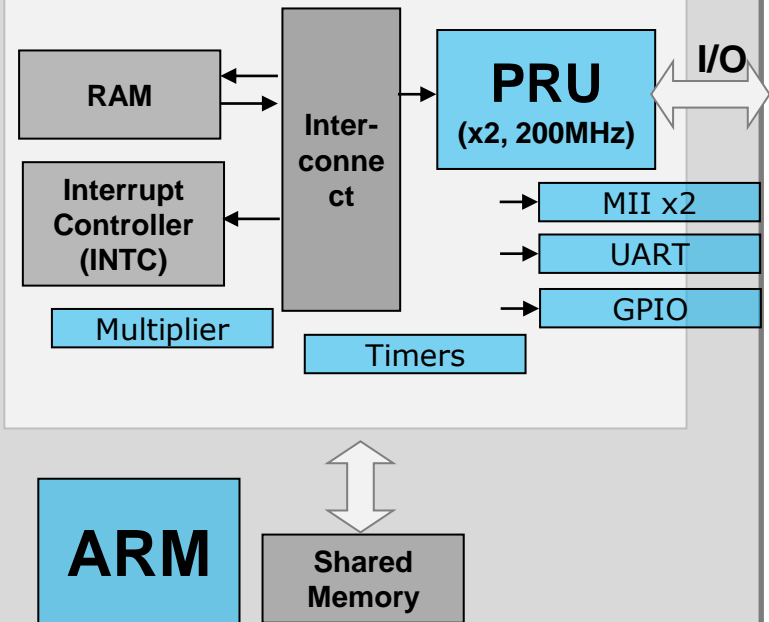- Efficient bit/byte/word manipulations

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 subsystem (PRU SS)

RAM

Inter-connect

PRU (x2, 200MHz)

I/O

Interrupt Controller (INTC)

MII x2

UART

GPIO

Multiplier

Timers

ARM

Shared Memory

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TI's new AM335x ARM® Cortex™-A8 MPUs: Feature packed and low power

Feature-packed ARM Cortex-A8 MPUs at ARM9 power levels and price points

AM3352
AM3354
AM3356
AM3357
AM3358
AM3359

- Starting sub $5 in volume
- Less than 5 mW with flexible power options
- Integrated 3D graphics, LCD and touch screen controller, Gigabit Ethernet, PRU, CAN, LPDDR/DDR2/DDR3
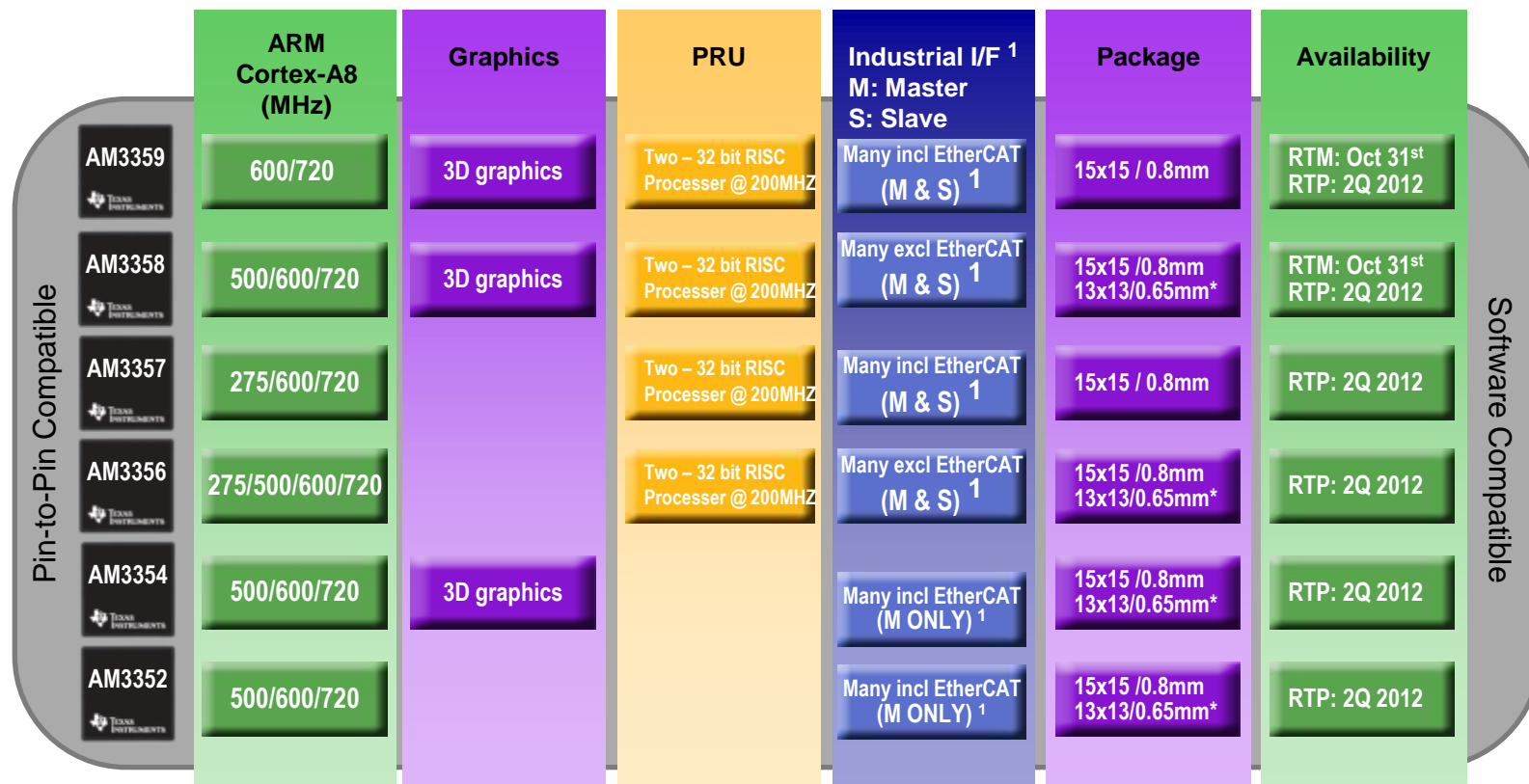
Get to market in six months with multiple, easy and affordable development tools

- $89 open source platform -- BeagleBone from BeagleBoard.org
- Full development kit with 7" LCD screen, wireless connectivity
- Free, complete SDK with Android, Linux, and WinCE support
- StarterWare™ to enable programming like a microcontroller
- Multiple, compatible 3P RTOS and security solutions

TEXAS INSTRUMENTS
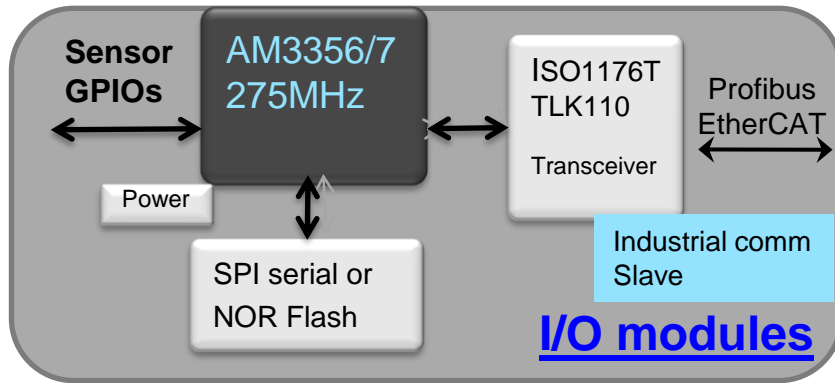
AM335x – A scalable platform with 6 pin-pin compatible devices

Pin-to-Pin Compatible	ARM Cortex-A8 (MHz)	Graphics	PRU	Industrial I/F [1] M: Master S: Slave	Package	Availability	Software Compatible
AM3359	600/720	3D graphics	Two – 32 bit RISC Processer @ 200MHZ	Many incl EtherCAT (M & S) [1]	15x15 / 0.8mm	RTM: Oct 31st RTP: 2Q 2012	
AM3358	500/600/720	3D graphics	Two – 32 bit RISC Processer @ 200MHZ	Many excl EtherCAT (M & S) [1]	15x15 /0.8mm 13x13/0.65mm*	RTM: Oct 31st RTP: 2Q 2012	
AM3357	275/600/720		Two – 32 bit RISC Processer @ 200MHZ	Many incl EtherCAT (M & S) [1]	15x15 / 0.8mm	RTP: 2Q 2012	
AM3356	275/500/600/720		Two – 32 bit RISC Processer @ 200MHZ	Many excl EtherCAT (M & S) [1]	15x15 /0.8mm 13x13/0.65mm*	RTP: 2Q 2012	
AM3354	500/600/720	3D graphics		Many incl EtherCAT (M ONLY) [1]	15x15 /0.8mm 13x13/0.65mm*	RTP: 2Q 2012	
AM3352	500/600/720			Many incl EtherCAT (M ONLY) [1]	15x15 /0.8mm 13x13/0.65mm*	RTP: 2Q 2012	

Package	15x15mm	13x13mm
ARM speed	Up to 720 MHz	Up to 500 MHz
USB 2.0 OTG + PHY	x2	x1
EMAC	2-port switch	Single port
PRU	All I/O pins	Reduced I/O pins

[1] TOP protocols supported are: ETherCAT/PROFIBUS (11/22/11), Ethernet_IP/Powerlink/Sercos-III/Profinet (1Q12)
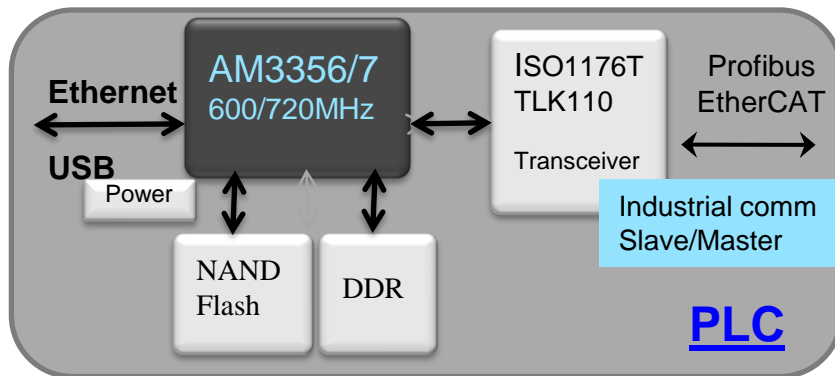
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AM335x is a 3-in-1 Scalable platform for industrial HMI, PLC and I/O communications

Sensor GPIOs

AM3356/7 275MHz

Power

SPI serial or NOR Flash

ISO1176T TLK110 Transceiver

Profibus EtherCAT

Industrial comm Slave

I/O modules

ARM + PRU (AM3356/7-275)
- ✓ Low end I/O comms
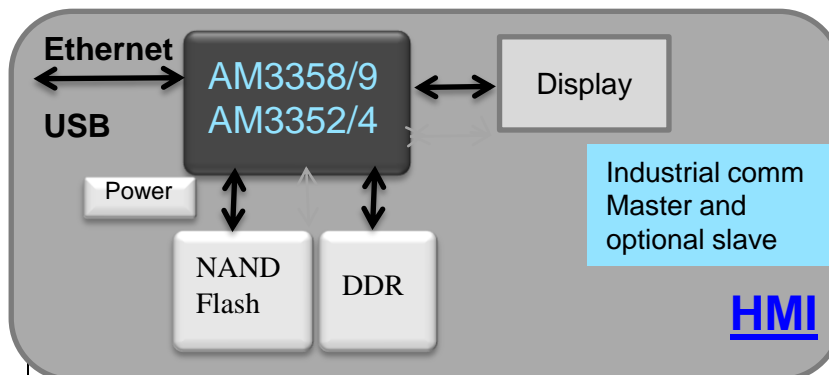- ✓ AM3356/7 @ 275MHz
- ✓ No need for DDR
- ✓ Uses Sys/BIOS RTOS

✓ 2 development tools (IDK and ICE reference design)

Ethernet

USB

AM3356/7 600/720MHz

Power

NAND Flash

DDR

ISO1176T TLK110 Transceiver

Profibus EtherCAT

Industrial comm Slave/Master

PLC

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)

Ethernet

USB

AM3358/9 AM3352/4

Power

NAND Flash

DDR

Display

Industrial comm Master and optional slave
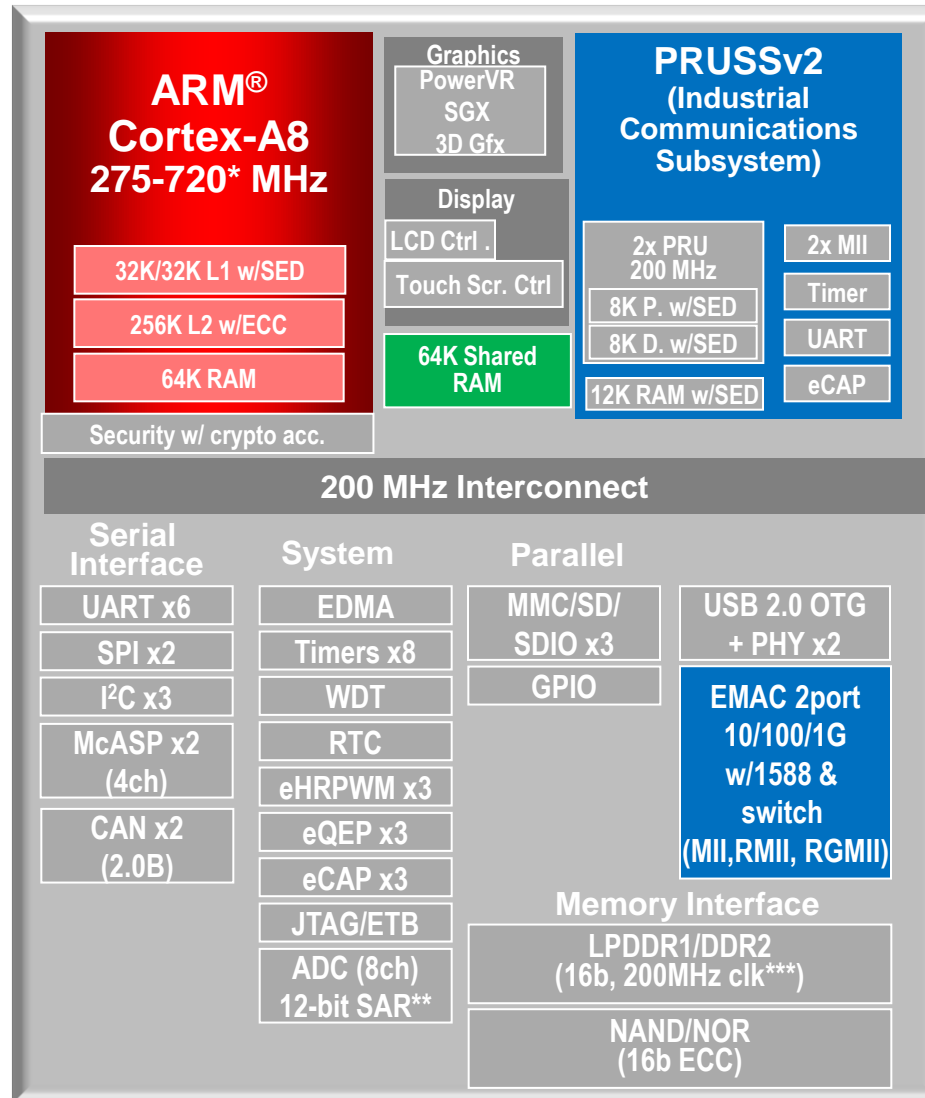
HMI

ARM Only (AM3352)
ARM + GFX (AM3354)
ARM + PRU+GFX (AM3358/9)
- ✓ 720MHz
- ✓ Based on Linux, WinCE and Android

✓ 2 development tools (General Purpose EVM & Beaglebone)

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AM335x Block Diagram : 3-in-1 Scalable platform for industrial HMI, PLC and I/O communications

Security w/ crypto acc

ARM® Cortex-A8 275-720* MHz

- 32K/32K L1 w/SED
- 256K L2 w/ECC
- 64K RAM
- Security w/ crypto acc.

Graphics PowerVR SGX 3D Gfx

Display
- LCD Ctrl .
- Touch Scr. Ctrl

64K Shared RAM

PRUSSv2 (Industrial Communications Subsystem)

- 2x PRU 200 MHz
- 8K P. w/SED
- 8K D. w/SED
- 12K RAM w/SED
- 2x MII
- Timer
- UART
- eCAP

200 MHz Interconnect

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)

Memory Interface
- LPDDR1/DDR2 (16b, 200MHz clk***)
- NAND/NOR (16b ECC)

Benefits
- High performance Cortex-A8 at ARM9/11 prices
- PRU Subsystem for flexible, configurable communications

EtherCAT **EtherNet/IP** **SERCOS interface**

PROFI NET **ETHERNET POWERLINK** **PROFI BUS**

Software and development tools
- Linux, Android, WinCE and drivers direct from TI
- StarterWare enables quick and simple programming of and migration among TI embedded processors
- 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: ~2mW

Schedule and packaging
- Samples: October 31, 2011; Production: 2Q'12
- Dev. Tools: Order open October 31, 2011
- Prelim docs: available today
- Packaging: 13x13, 0.65mm via channel array
                    15x15, 0.8mm

TEXAS INSTRUMENTS

Get to market fast with extensive AM335x development tools

AM335x evaluation module	AM335x BeagleBone	AM335x Industrial development kit	AM335x Industrial Communications Engine
$995	**$89**	**$895**	**$99**

AM335x evaluation module

- AM3358ZCZ – up to 720MHz
- 512MB DDR2
- 7" LCD Touchscreen
- WL1271 WL/BT Module
- TPS65910 Power Mgmt.
- Android and Linux SDK
- Available through TI eStore and Distribution
- Ships w/ Linux and Android SDKs

AM335x BeagleBone

- Newest member of the BeagleBoard family
- AM3358 – up to 720MHz
- 256MB DDR2
- Small Form Factor
- TPS65917 Power Mgmt.
- Available through Distribution and beagleboard.org

AM335x Industrial development kit

- AM3359ZCZ – up to 720MHz
- Evaluate Industrial Comms & Motor Control
- Motor control using AM335x or C2000
- Based on Sys/BIOS RTOS
- Available through TI eStore and Distribution
- P/N: TMDXIDK3359

AM335x Industrial Communications Engine

- Reference Design for Industrial Comms
- Optimized BOM and form factor
- Embedded XDS100
- Sys/BIOS RTOS
- Available through TI eStore and Distribution
- P/N: TMDXICE3359

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AM335x evaluation module

$995

- 720MHz AM3358 processor
- 512MB DDR2 SDRAM
- 7" LCD resistive touchscreen
- Accelerometer, temp sensor, light sensor
- Test/measurement points

7"

Serial/RS-232 (4)	
10/100 Ethernet (1)	
5V Power Supply	
Power Switch	
Navigation/Buttons	
WL1271 WiFi/BT Module	
SD/MMC (2)	
USB 2.0 OTG (2)	
Audio in/out	
JTAG	
CAN (2)	

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BeagleBone
Enabling Cortex™-A8 development at $89

$89 MSRP

3.4"

AM3358

TOP SIDE

2.1"

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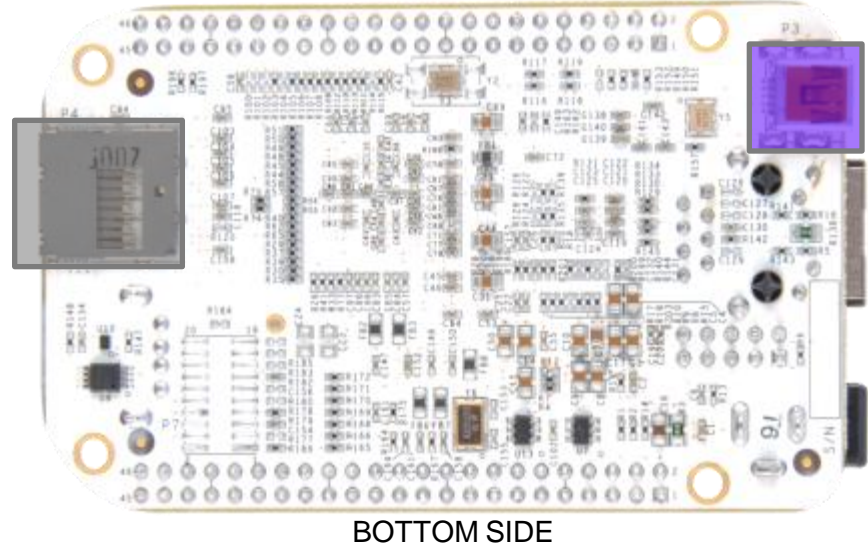
- **Size of a credit-card**
- **Extensive hardware connectivity with Linux**
- **Large open source community support**
- **Single cable and 10-second Linux boot**
- **Order from www.beagleboard.org**

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	

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14

AM335x Industrial Development Kit (IDK)
Motor control with communications

$895

Block diagram labels:

- JTAG
- LED
- CM3 LM3S5R31
- µSD Card
- DDR2
- SPI FLASH
- PROFIBUS
- SUB-D9
- MUX
- ISO1050 — CAN
- ISO1176T — PRUSS_UART
- RJ45 — TLK110 — RMII
- RJ45 — TLK110 — PRUSS_MII0
- RJ45 — TLK110 — PRUSS_MII1
- EtherCAT
- 25MHz
- CDCE925PW
- RESET
- 24V — SW — Power TPSxx
- 5V, 3V3, 2V5, 1.8V & isolated 5V
- PROFINET
- EtherNet/IP
- ETHERNET POWERLINK
- SERCOS interface
- AM3359
- IRQ
- SPI1_CS0
- MMC0
- DDR
- SPI1_CS1
- GPIO
- 4x ECAT LED
- SPI0_CS1
- ISO7441 / HVS882 — Pin Header
- I2C
- TPIC2810 / 8x LED — Pin Header
- JTAG — JTAG
- ePWM (AM335x)
- eCAP (PWM)
- ePWM (Piccolo)
- MUX
- 24..48V
- DRV8412
- JTAG
- SPI0_CS0
- SYNC_O
- IRQ
- PRUSS_GPIO (EnDat)
- UART
- Piccolo F28027
- 3x ADC
- TXB0106PW — position encoder
- SN65NVD10
- 3x OPA365
- TRS3232E
- Debug UART Pin Header
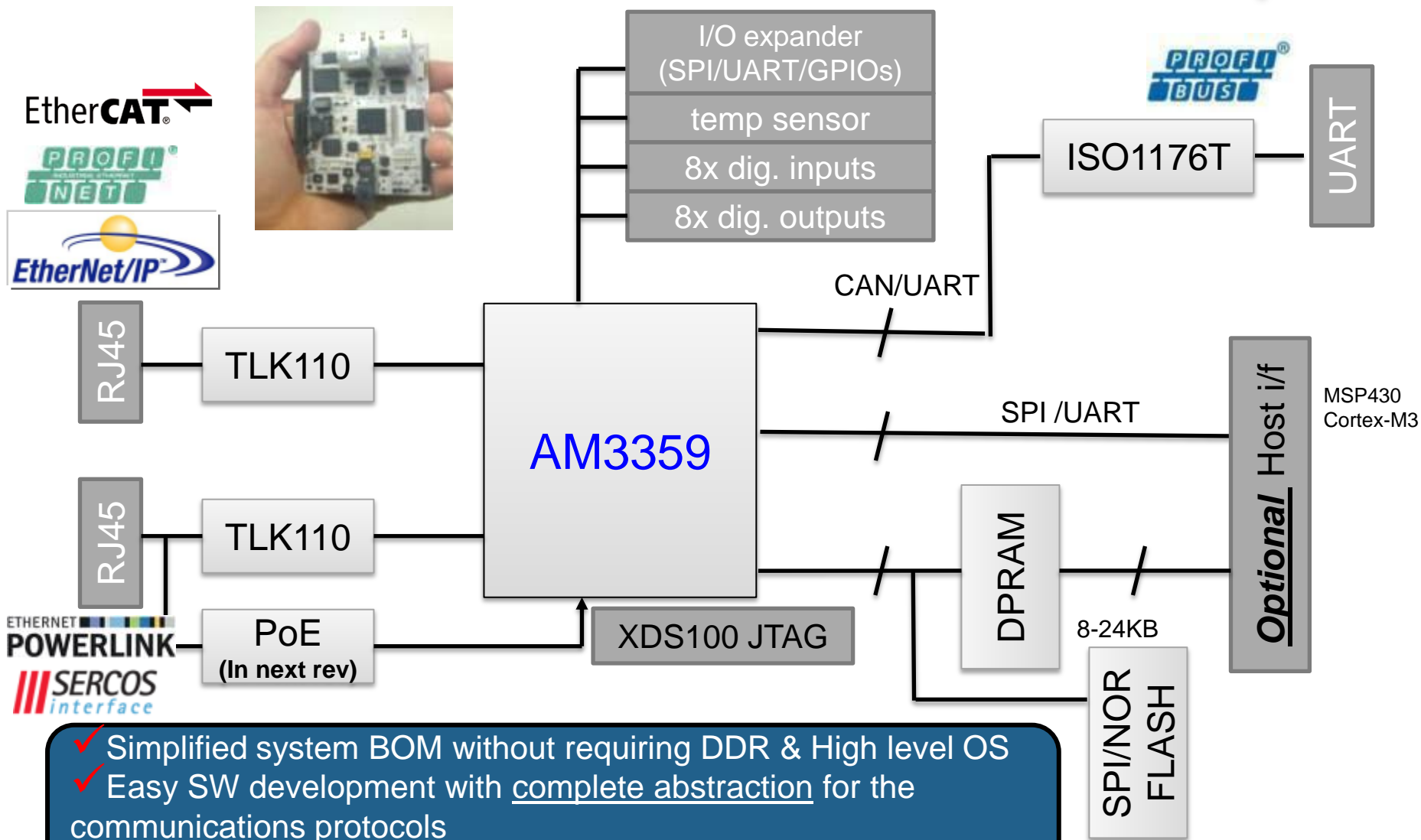- 4x OUT — M
- Pin Header

✓ Demonstrates multiple communications with motor control
✓ Availability – Jun, 2012

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AM335x Industrial Communications Engine *(ICE)*
Reference Design Optimized for low-end Industrial slave communications

$99

EtherCAT

PROFI NET

EtherNet/IP

ETHERNET POWERLINK

SERCOS interface

RJ45 — TLK110 — **AM3359**

RJ45 — TLK110

PoE **(In next rev)**

I/O expander (SPI/UART/GPIOs)

temp sensor

8x dig. inputs

8x dig. outputs

CAN/UART

PROFI BUS

ISO1176T — UART

SPI /UART

XDS100 JTAG

DPRAM

8-24KB

SPI/NOR FLASH

Optional Host i/f

MSP430 Cortex-M3

✓ Simplified system BOM without requiring DDR & High level OS
✓ Easy SW development with <u>complete abstraction</u> for the communications protocols
✓ Availability – Nov 22nd 2011

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Support for Popular Industrial Communication Protocols
Integrated HW support (M-Master, S-Slave)

Protocol	AM1810 OMAPL138 (ARM9)	AM335x AM386x (Cortex-A8)	Availability	Stack Partners	Engagement Model
CANOpen, Devicenet	NA	✓	NOW	TCS PORT	w/ 3P
Profibus	✓ (M & S)	✓ (M & S)	NOW	TMG	5000€ NRE (slave). w/ 3P (Master)
Modbus-TCP	✓	✓	NOW	PORT	w/ 3P
EtherCAT	✓ (M)	✓ (M & S)	Nov/11	Beckoff PORT	Free from ETG
Ethernet/IP (w/switch)	✓ (M)	✓ (M & S)	Nov/11 (Demo[1])	Kalki Pyramid	w/ 3P
Ethernet/IP (w/ PRU)	✓ (M)	✓ (M & S)	2Q12 (Demo[1])	Kalki Pyramid	w/ 3P
PROFINET RT	✓ (M)	✓ (M & S)	Nov/11 (Demo[1])	Molex PORT	w/ 3P
PROFINET – IRT	NA	✓ (M & S)	1Q12	Molex PORT	w/ 3P
Powerlink	NA	✓ (M & S)	Nov/11 (Demo[1])	B&R	w/ 3P
Sercos-III	NA	✓ (M & S)	Nov/11 (Demo[1])	Automata	w/ 3P

[1] : Demo on 11/22/2011. Release in 1Q/12

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Get to market fast with best in class tools & development platforms
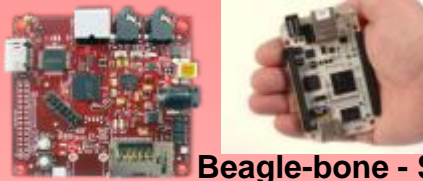
Development Tools

Various development tool options allow designers of all experience levels to quickly develop applications

- Design
- Code and build
- Debug
- Analyze
- Tune

Green Hills SOFTWARE INC.

RealView Tools by ARM®

CodeSourcery

LAUTERBACH DEVELOPMENT TOOLS

Development Boards

Low cost boards <$200

Beagle-bone - $89

Beagle-XM - $149

Full Featured and End Equipment specific

AM/DM37x - $1495

ICE - $99

Low cost and full featured easy-to-use platforms to enable all developers to get started quickly

- Simple app dev kits
- Fully featured EVMs
- Reference designs & demos

On-Demand Support

- **Local Support**
  - Industry's largest field sales / applications team
- **WIKI's**
  - www.ti.com/sitarawiki
- **E2E Forum**
  - www.ti.com/e2e_sitara
- **Training**
  - www.ti.com/training
- **TI Web/Product Folders**
  - www.ti.com/sitara
  - www.ti.com/arm
- **Linux Community**
  - Beagleboard.org
  - Hawkboard.org
- **Open Source Projects**
  - Designsomething.org

Industrial Demos

Industrial Automation Demos – 1/2

1. Industrial Automation HMI and Motor Control Demo

AM18xx to control HMI and 2 slave devices

Piccolo™ Driving Synchronous Motors and Communicating with AM18xx

HMI: Qt running on Linux OS

Integrated Profibus Master/slave on AM1810 and OMAPL138

2. Profibus Communication Board

More info/videos of the demos at http://www.ti.com/automation

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Industrial Automation Demos 2/2
Dual Axis Motion & HMI Demo at SPS'2010

Caribouboard is a proof-of-concept system based on OMAPL138 to demonstrate multiple field communications capability of AM335x

More info/videos of the demos at http://www.ti.com/automation
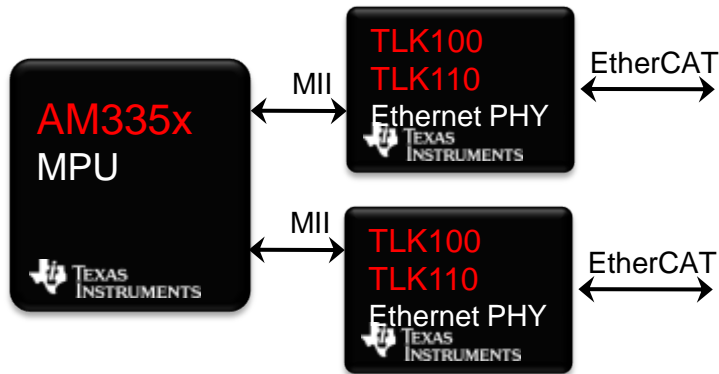
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EtherCAT
Complete system solution for faster time to market

EtherCAT - Introduction

- Emerging Real-time Ethernet Standard
  - Driven by Beckhoff Automation
  - Accepted as physical layer for other standards

- Technical Features
  - Based on IEEE802.3 Ethernet Standard
  - 100 Mbps Full-duplex
  - Distributed Clocks and Synchronization
  - Standards
    - IEC 61158, IEC 61784-2 and IEC 61800-7
    - IEC 61784-3 for Safety over Ethernet
  - TwinCAT, CANopen, SERCOS application layers

- Applications
  - Industrial Drives
  - Distributed I/O
  - Industrial Computing and Control

- EtherCAT Technology Group (ETG)
  - Drives development of EtherCAT
  - Founded in 2003 by Beckhoff Automation
  - Beckhoff assigned rights to EtherCAT to ETG
  - Free membership

- Global presence
  - 1350+ Members from 50 countries

- Active
  - Worldwide training centers
  - Plug-fests
  - Technical committees
  - Working groups

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EtherCAT Slave

AM335x MPU — MII — TLK100 TLK110 Ethernet PHY (TEXAS INSTRUMENTS) — EtherCAT

AM335x MPU — MII — TLK100 TLK110 Ethernet PHY (TEXAS INSTRUMENTS) — EtherCAT

Availability

	2010	2011	2012
EtherCAT Master Stack			
AM335x			
TLK100			

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**
- No-OS or RTOS (TI SYS/BIOS) compatible
- TLK100/TLK110 Industrial Ethernet transceiver

Benefits

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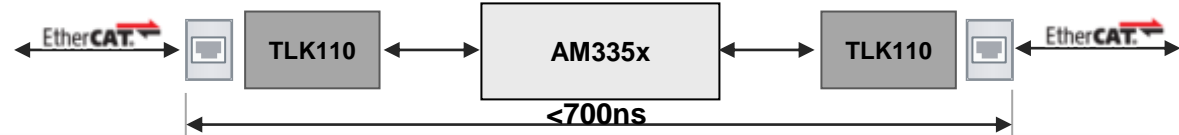
Support

- TI's Industrial SDK with SYS/BIOS kernel
- 3rd party support for free/commercial protocol stack

Availability

- AM335x sampling in 4Q2011
- 15x15 at 0.8mm pitch extended temp package
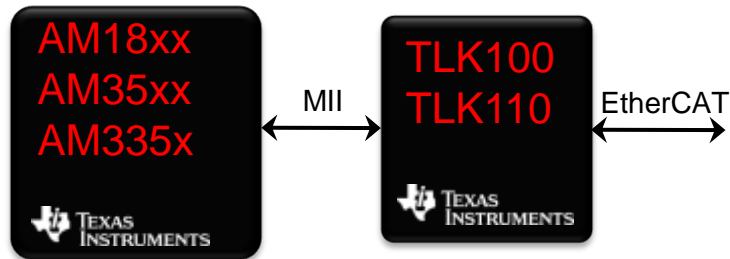- Guaranteed long term availability

24

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EtherCAT Slave – Features

Attribute	Parameters
Ports	Two MII 100Base-TX (700ns RX-TX latency with TI PHY)
FMMUs (Fieldbus Memory Management Unit)	Up to 8
Sync Managers	Up to 8
Timer	64 bit
Distributed Clocks	Supported; Protocol feature to ensure all devices in the network have the same time.
Sync Signals	Sync0 supported
Latch Signals	Supported
Host Interrupts	Supported; interrupting the host to communicate various events
Bitwise Operations	Supported with some restrictions (more details available later)
Digital I/O	Supported; upto 8 pins mapped to PRU. Many other GPIOs.
Watchdog	Supported
Operating System	OS Independent. SDK supplied with SYS/BIOS real-time kernel.

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EtherCAT Slave – Compliance Testing

- Developed in conjunction with EtherCAT Technology Group (ETG)

- Hosting and participation in multiple EtherCAT plug-fest events – 4Q 2011 starting from Oct/17 2011

- Tested with off-the-shelf EtherCAT slave devices

- Tested against TwinCAT and CoDeSys

- Tested against Compliance Test Tool from ETG

- Conformance Testing at official EtherCAT test centers planned in 4Q 2011

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EtherCAT Master

AM18xx
AM35xx
AM335x

TEXAS INSTRUMENTS

MII ←→

TLK100
TLK110

TEXAS INSTRUMENTS

EtherCAT ←→

Availability

| | 2010 | 2011 | 2012 |

EtherCAT Master Stack
AM18xx
AM335x
AM35xx
TLK100

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

Features
- ARM9 / ARM Cortex A8
- 3S/CoDeSys or open source EtherCAT stack
- TLK100/TLK110 Industrial Ethernet transceiver
- Linux support included in SDK
- Compatible with third party OS/RTOS

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

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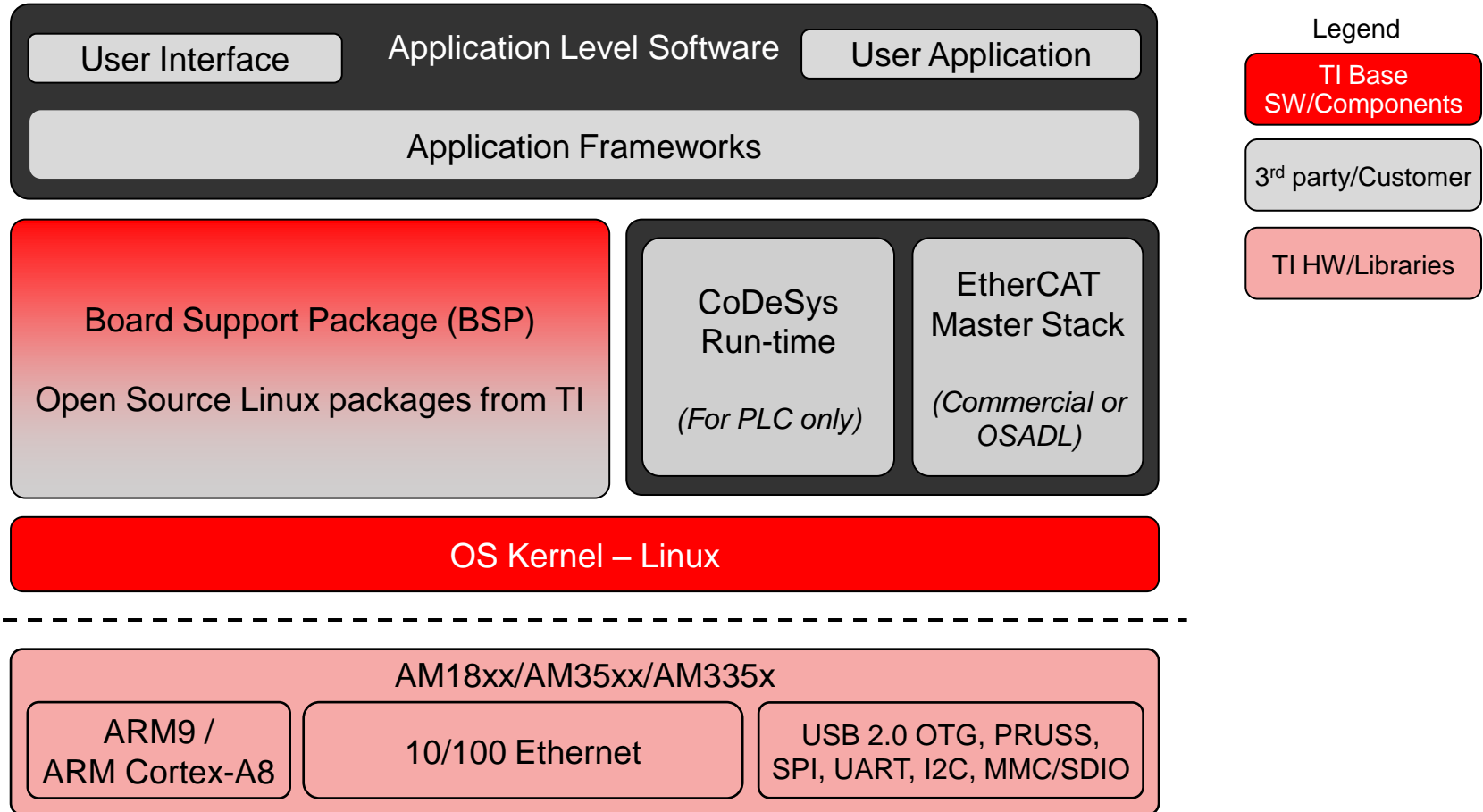- 3rd party free/commercial protocol stack

Availability
- AM18xx and AM35xx available now
- AM335x sampling in September 2011
- Guaranteed long term availability

TEXAS INSTRUMENTS

EtherCAT Master – Software

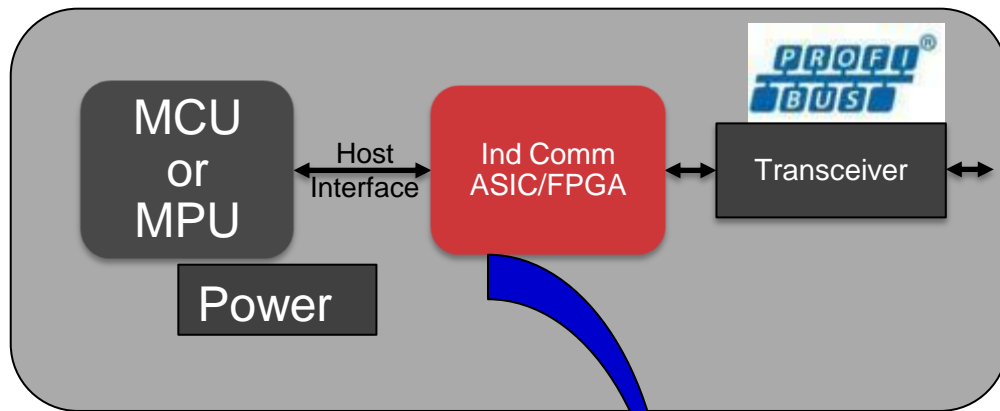# EtherCAT Master – Tools and Support

- Silicon Platform
  - TI ARM MPUs with ARM9 or ARM Cortex-A8 and integrated Ethernet MAC
  - TI Ethernet PHY such as TLK100 or TLK110

- Software
  - Linux Industrial Software Development Kit from TI
  - PLC run time (if PLC functionality integrated in EtherCAT master)
    - CoDeSys run-time commercial license from 3S Software
  - EtherCAT master stack
    - Included in CoDeSys (if PLC run-time is used), or
    - Alternate EtherCAT master libraries available from third parties

- Support
  - TI support for its devices and its software development kits
  - Third party support for respective products

Profibus
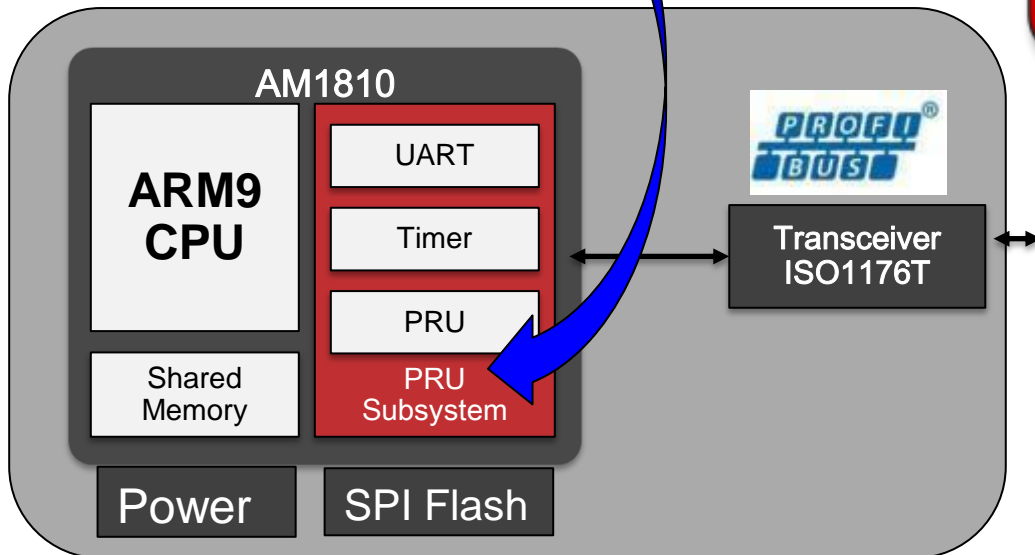## _Complete system solution for faster time to market_

TI ARM Advantage for Profibus implementation
BOM Analysis

Typical Solution Today

- uC/Processor (~$3/1ku)
- External ASIC/FPGA for communications (~$12/1ku)
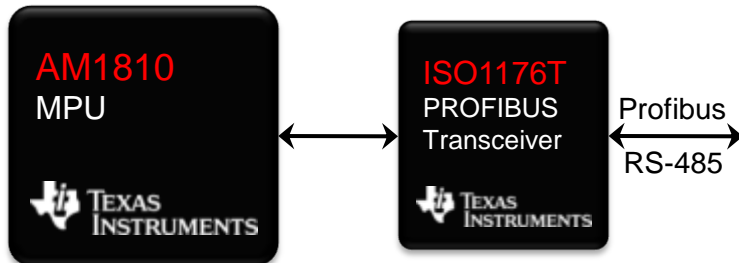- **Different ASIC for slave and master functionality**
- Extended temp (-40 to 85C)

TI Solution – 5 benefits

- **System BOM saving of ~$5.85 (~40% cost reduction)**
  - AM1810 ($8.95/1ku) + SPI Flash ($0.25) eliminating the ASIC. Additional savings if other peripherals are required
- **Supports both Profibus Master (PLC) and Slave (I/O devices)**
- **Flexible and scalable with a high performance ARM core**
- **Industrial temp (-40 to 105C)**
- **Complete solution with Processor + Analog**

PROFIBUS – Available now on AM1810
Complete system solution for faster time to market

AM1810
MPU

ISO1176T
PROFIBUS
Transceiver

Profibus
RS-485

Certificate

PROFIBUS Nutzerorganisation e.V. grants to

Texas Instruments Deutschland GmbH
Haggertystraße 1, 85356 Freising

the Certificate No: **Z01544** for the PROFIBUS Slave:

Model Name:	Sitara Evaluation Module (EVM)
Revision:	**V1.0**; SW/FW: 1.0; HW: 1.0
GSD:	PRU_0CDA.GSD; File Version 17.10.2009

This certificate confirms that the product has successfully passed the certification tests with the following scope:

☑	DP-V0	MS0, Sync, Freeze, Fail_Safe
☑	DP-V1	MS1, MS2, I&M
☑	Physical Layer	RS485

| Test Report Number: | 543-1 |
| Authorized Test Laboratory: | Siemens AG, Fürth, Germany |

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)

Availability

- AM1810 Production **NOW**
- Guaranteed 10+ years suppl

PROFIBUS – Features

Attribute	Parameters
ARM9 Frequency	Up to 375 MHz
Data Rates (baud)	12M, 6M, 3M, 1.5M, 500k, 187.5k, 93.75k, 19.2k, 9.6k
DP v0 Support	Cyclic exchange of data and diagnosis
DP v1 Support	Acyclic/cyclic data exchange and alarm handling
DP v2 Support	Not yet supported
Response Time	11 bit minimum TSDR Response Time
Operating System	Certified solution is based on Embedded Real-Time Linux, but PROFIBUS Solution in AM1810 is agnostic to OS

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TI: Innovation in Industrial Automation Solutions

http://www.ti.com/automation

Embedded Processing — **Robust Processor Roadmap**

Development kits & boards

Specific 3rd Party & Partner Network

Industrial Automation

WW Support & Industrial Systems Expertise

Application-specific Reference Design

Analog ICs — **Complete Signal Chain**

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Thanks