



# Leverage Altera Programmable Solutions in Industrial Applications

# Agenda

- Industrial market overview
- Altera<sup>®</sup> solutions
- Success stories
- Summary

# Industrial Market for Semiconductors

- Industrial market represented 8% of world semiconductor market in 2005 (\$20.9B)
  - Estimated 2006 market: \$23.3B, approximately 11% growth
  - From 2005-2010, market is estimated to have a 8.7% CAGR (Gartner); 2<sup>nd</sup> highest growth rate behind communications market (10.9%)
- Industrial market represents 23.8% of the world FPGA/PLD market (\$784M) in 2005
  - 2005-2010 CAGR of 9%
- Industrial semiconductor market is very fragmented with no application area accounting for more than 14% of the worldwide market
- Largest industrial markets for semiconductors: factory automation and drives

Source: 2005 IMS Research “ World Market for Semiconductors in Industrial”

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# Industrial Market Sub Segments

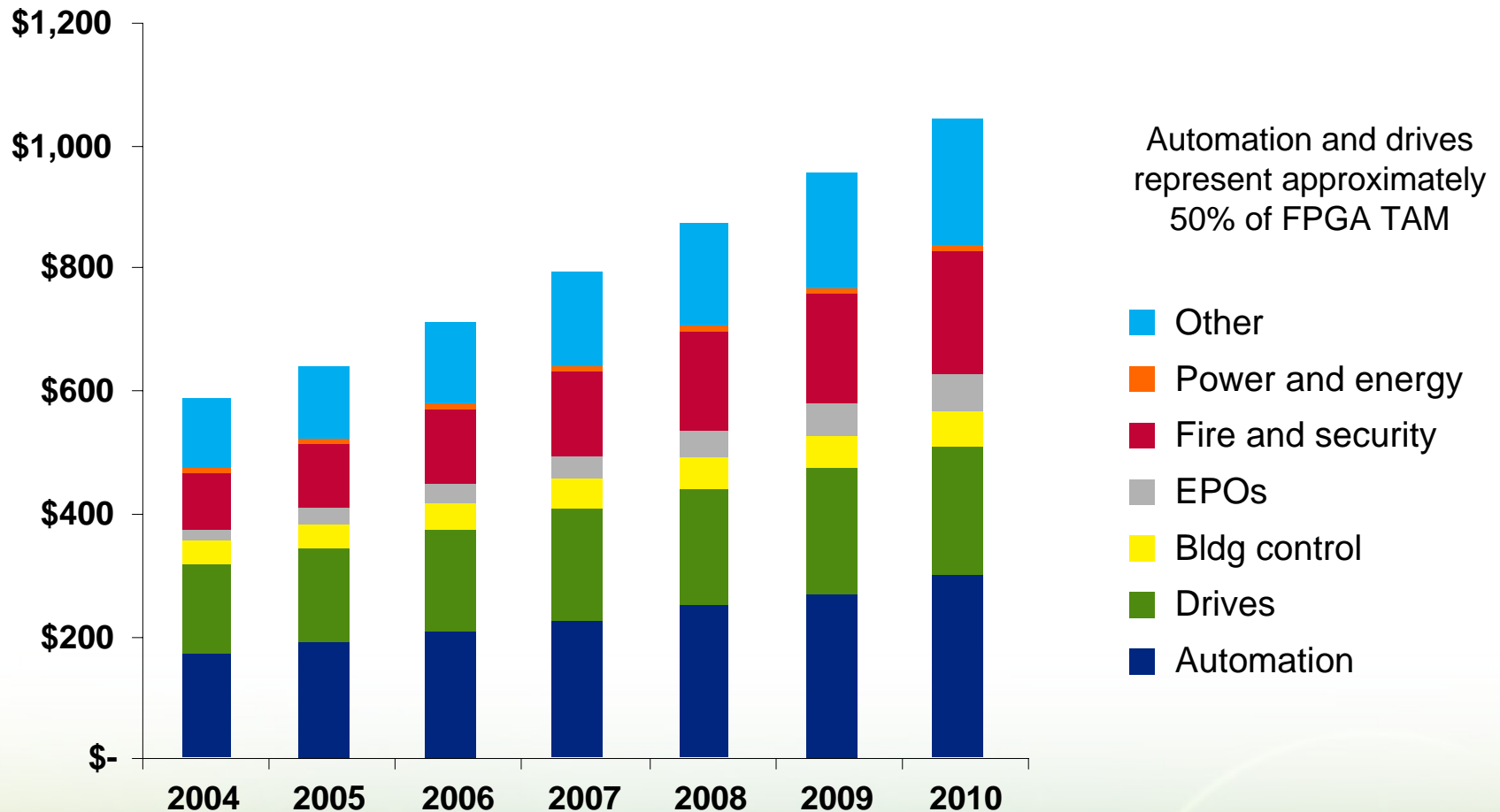


Variable Speed Drives



Factory automation	EPOS, EFT, and automatic ID	Drives	Other
<p>PLCs and I/O modules                      Distributed control systems                      Temp/process controllers                      Operator panels (HMI)                      Industrial networking</p>	<p>ATMs                      Barcode scanners                      Card payment terminals                      Card readers                      Portable data collection terminals                      Printers (barcode, label, POS)                      RFID</p>	<p>AC, DC, servo, stepper drives                      Position controllers                      Motor control                      Motion control</p>	<p>Semiconductor manufacturing equipment                      Electronic signboards                      AC/DC power supplies                      Intruder alarm systems                      CCTV cameras and equipment                      Robotics</p>

# FPGA TAM in Industrial Sub Segments



Source: 2005 IMS Research “ World Market for Semiconductors in Industrial”

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# Industrial Automation Market Dynamics

- Networks now a subject in industrial
  - Multiple Ethernet standards being implemented at plant level
  - Wireless no clear direction yet—but clearly a trend in next 3-5 years
  - 51% annual growth over next 5 years for Ethernet field devices and switches (to 7M units)
- More intelligence integrated in products
  - More safety features in industrial automation
  - Intelligence in motion control applications—convergence of drives and controllers
- Market leaders expanding markets
  - Moving sideways into process automation space
  - Upstream into the white space of data management at enterprise levels
  - Offer complete manufacturing solutions instead of discrete products (i.e. Siemens' recent acquisition of UGS)



# Altera Industrial Solutions

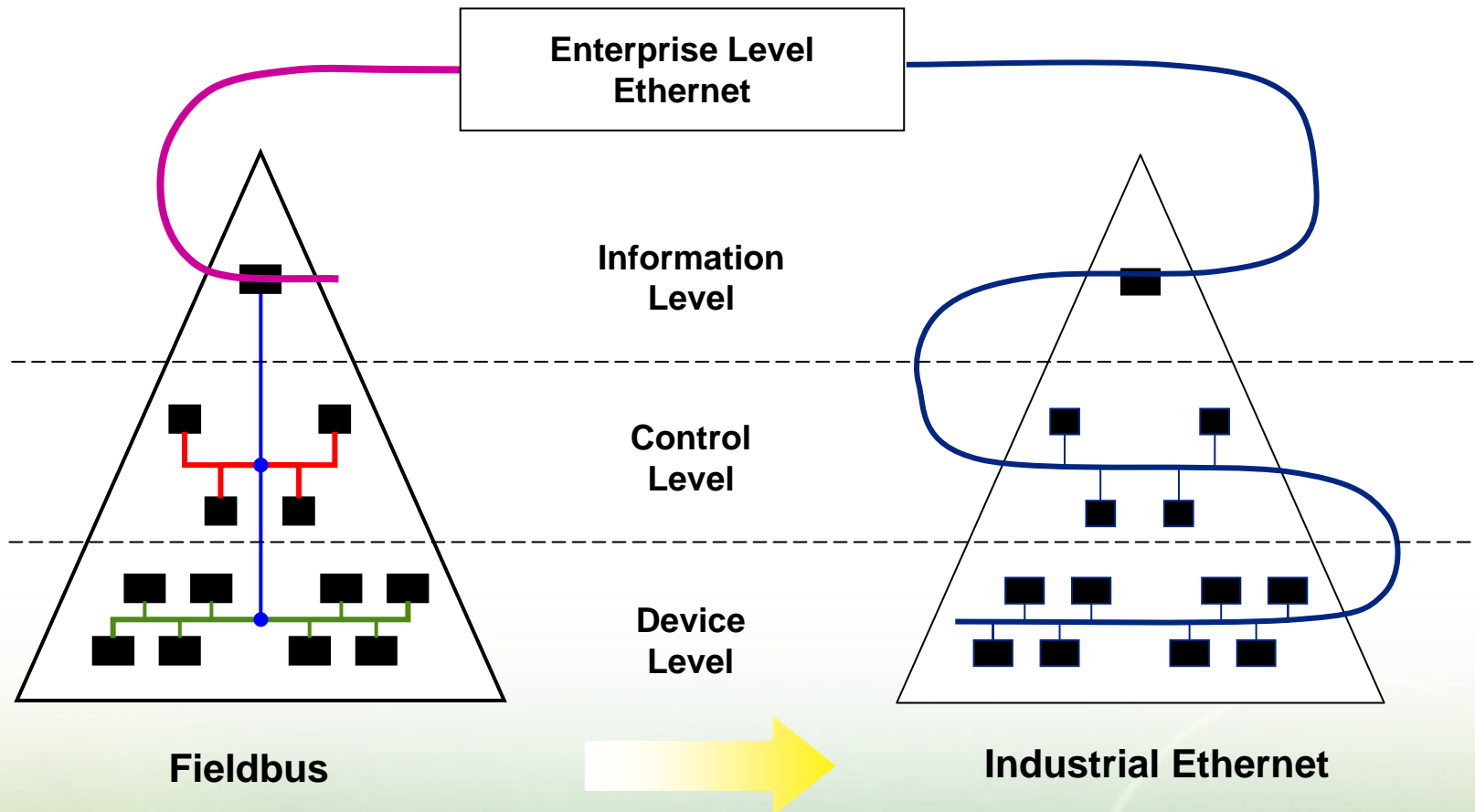
# Altera Industrial Solutions

- Industrial Ethernet
- Industrial graphics controller
- Motion control
- Freescale/Altera/EBV development kits
  - SnakeBytes development board
  - IEEE 1588 switch board
  - EBV - DBC2C20 development board

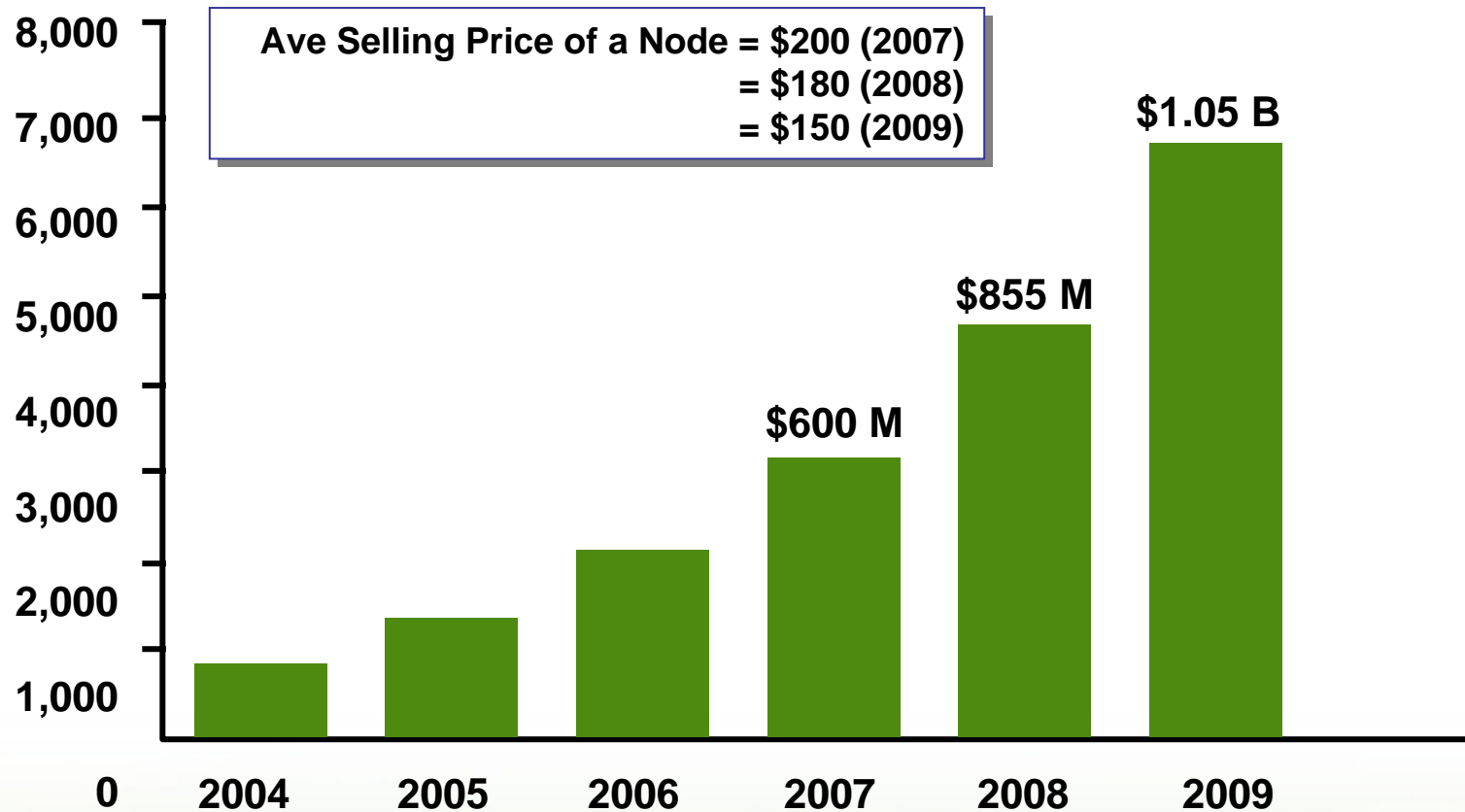


# Industrial Ethernet

*Factories Are Migrating From Multi-tiered Heterogeneous Fieldbus Networks to a Single Ethernet-based Network Solution*



# The Market is Growing >50% CAGR



Total shipments of Ethernet devices (thousands of nodes)

Source: ARC Advisory Group 2005

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# “Open” Industrial Ethernet Protocols Are Emerging as Standards



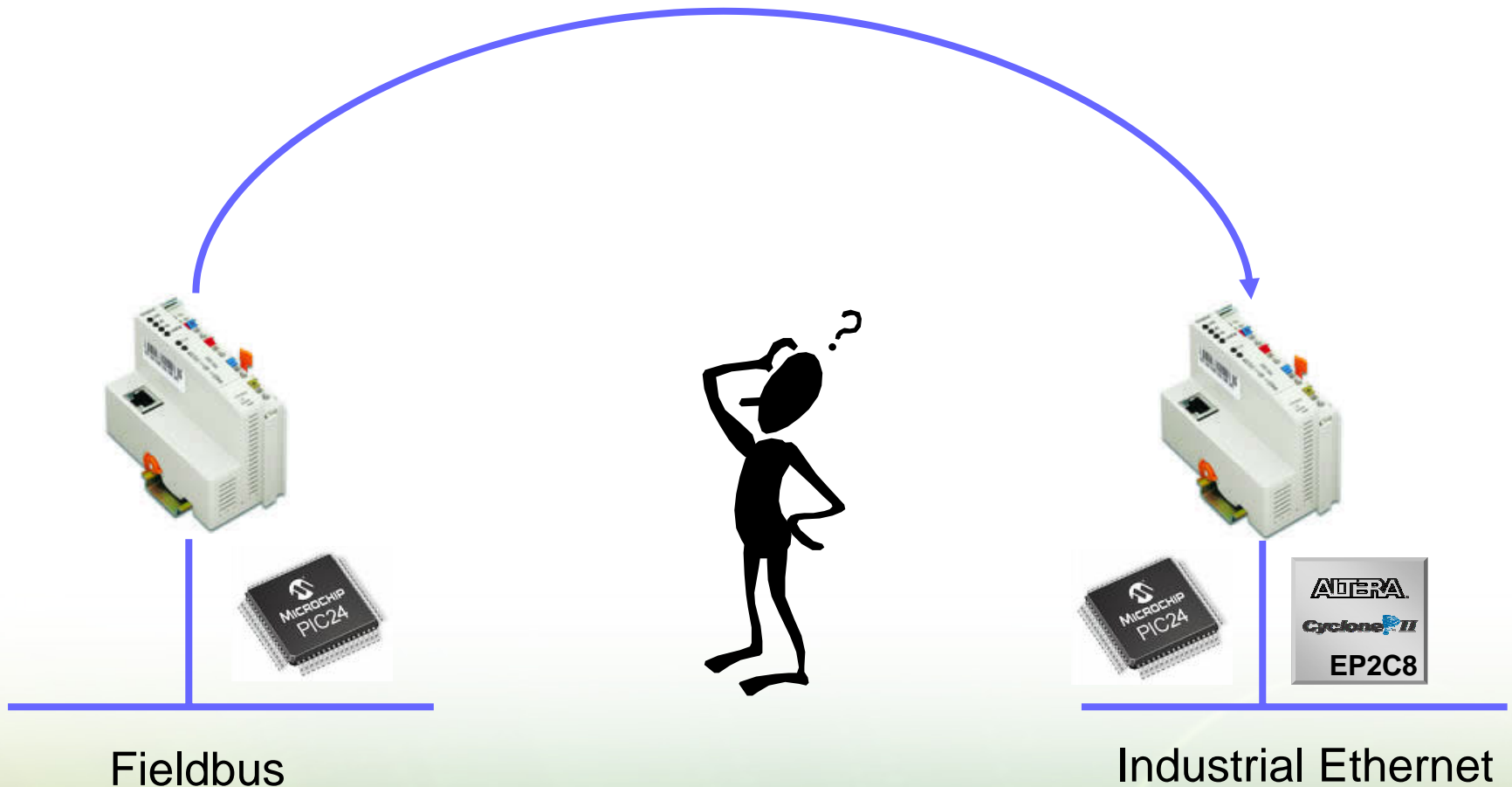
IEEE 1588

# The Device Manufacturer's Dilemma

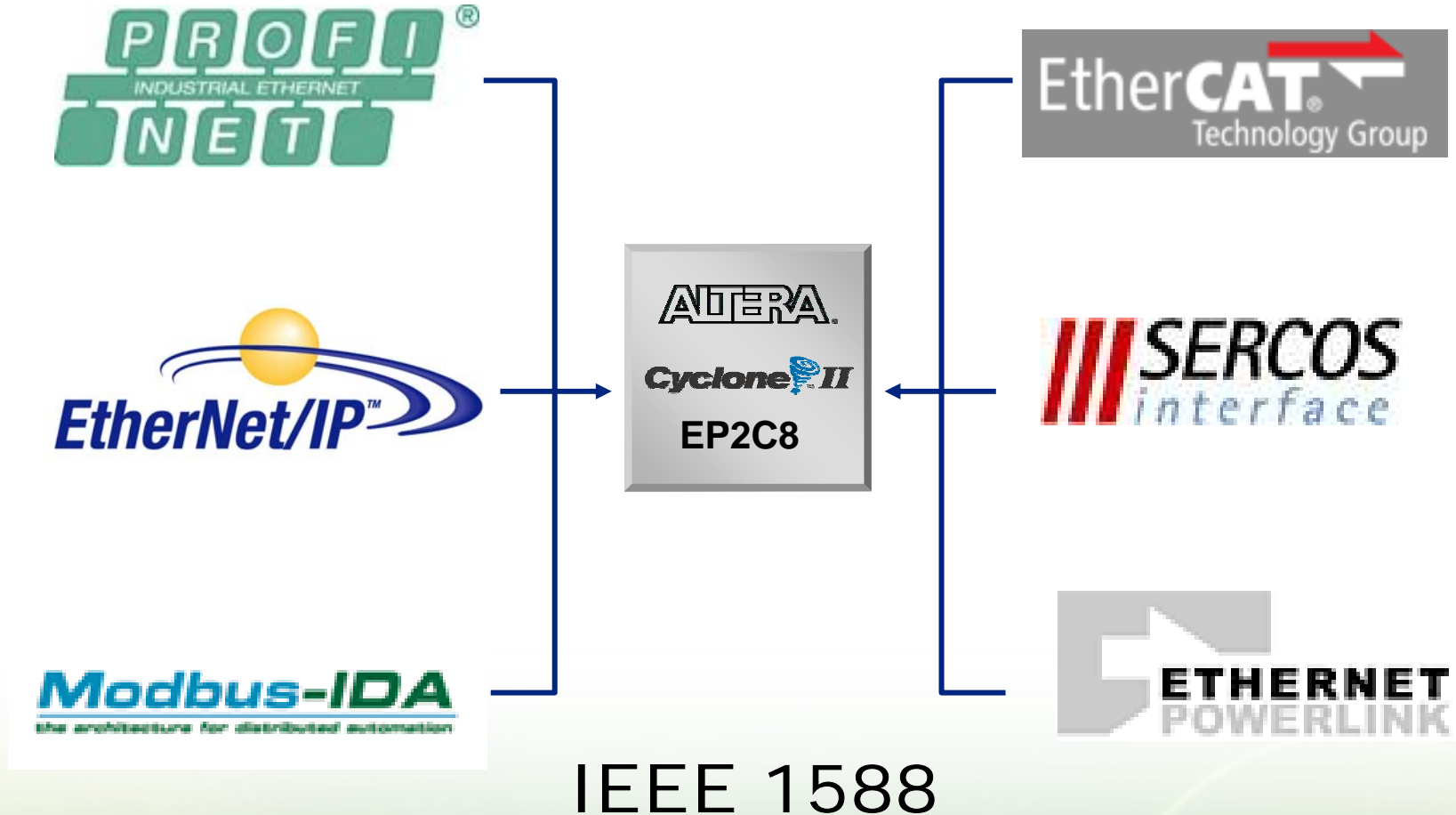
- Sensor or actuator (device) manufacturers already have fieldbus solutions that employ 8-, 16-bit and DSP-type processors
- These devices are not designed to communicate over 32-bit Ethernet
- Yet, to stay in business, device manufacturers are compelled to offer Ethernet communication
- This creates a market opportunity to add a communication capability



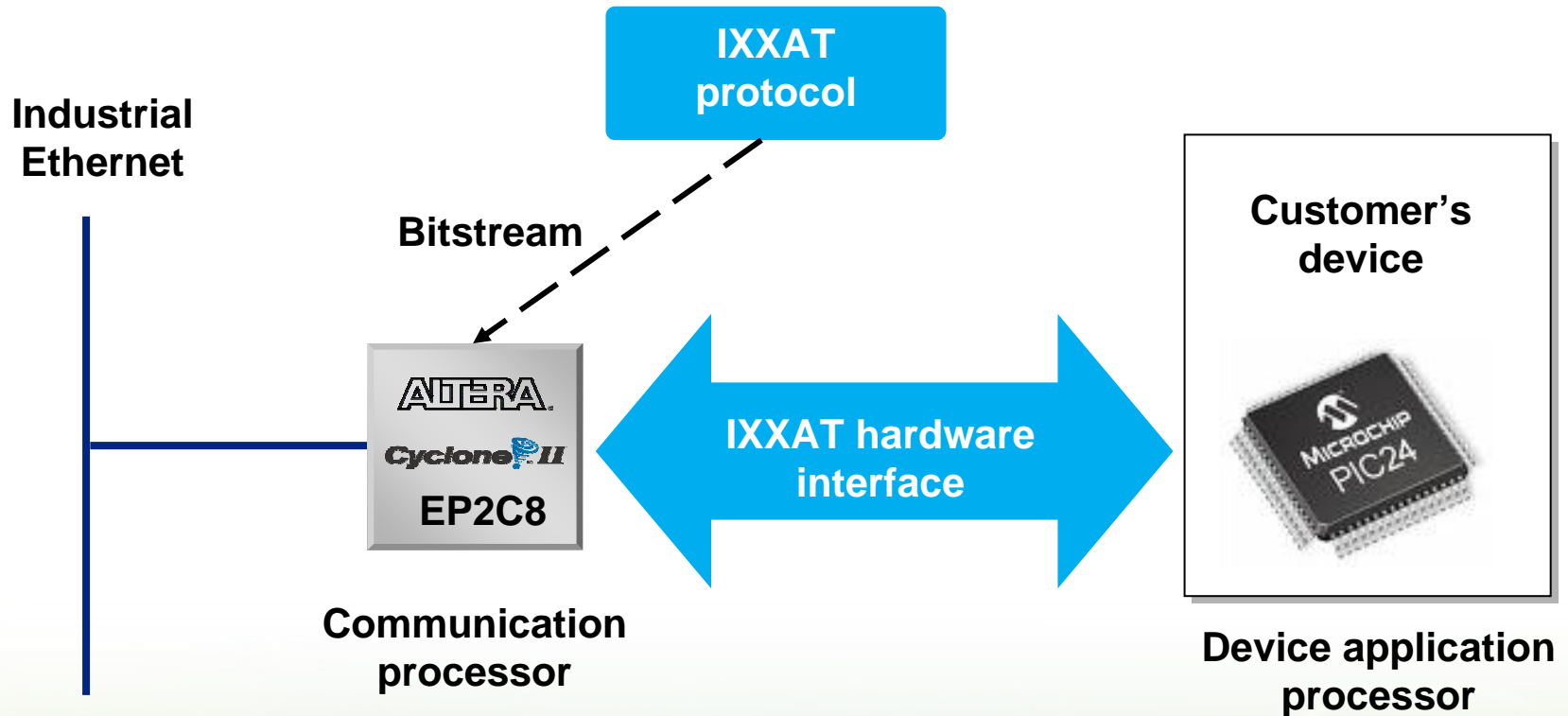
# So, How Do I Add an Industrial Ethernet Interface to My Product?



# IXXAT Offers All Standard Protocol Software

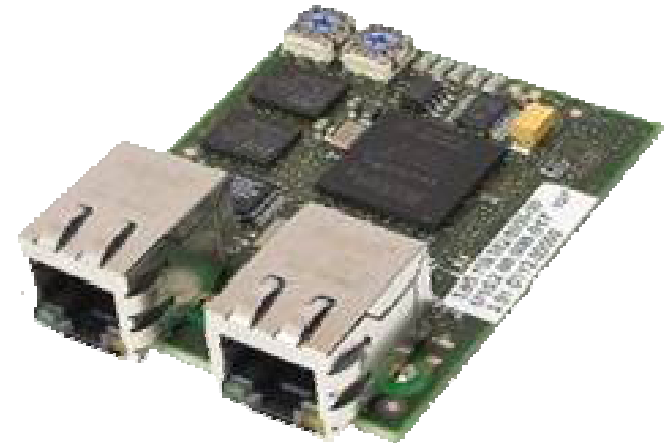


# IXXAT Software Pre-Engineered to Run on Altera Cyclone II FPGA



# Licensing Model

- Development package on Cyclone® II FPGA
  - Schematics
  - Executable for the FPGA (bitstream) including:
    - Protocol stack
    - Media access control (MAC)
    - TCP/IP stack
    - Interface application
  - Host application program interface (API) in source code
  - Package available for each protocol
- Per-unit royalty secured by security PROM
  - Software maintenance included





# Altera Industrial Solutions

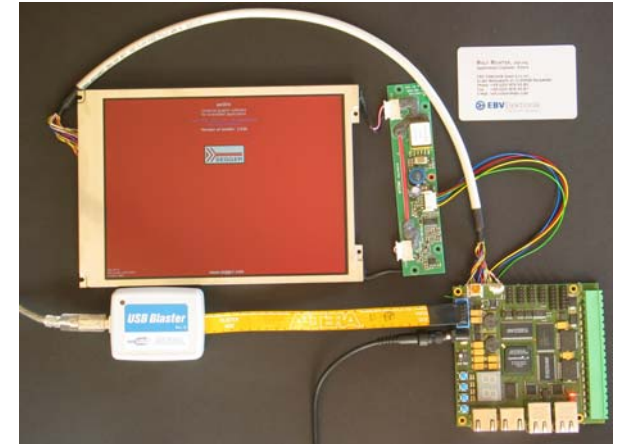
- Industrial Ethernet
- Industrial graphics controller
- Motion control
- Freescale/Altera/EBV development kits
  - SnakeBytes development board
  - IEEE 1588 switch board
  - EBV - DBC2C20 development board

# Altera's Scalable Graphics Controller Platform Solutions

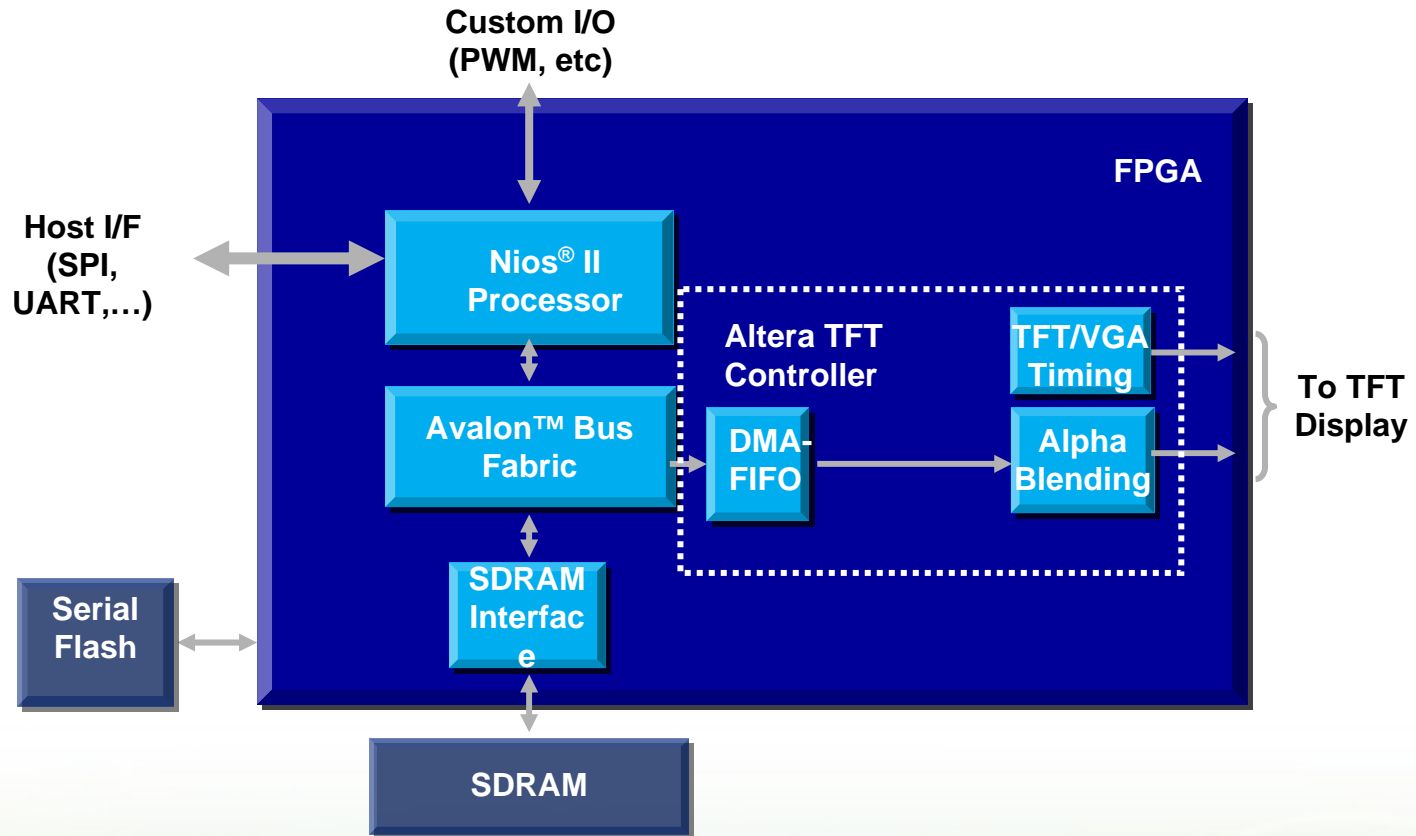
- Basic graphic solution
- Low-end graphics controller
- Graphics coprocessor (frame-buffer-controller)
- PCI-based graphics controller

# Basic Graphic Solution

- TFT demo based on DBC2C20 board
- Resolution up to 1024 x 768
- 8-bit color table (256 colors out of  $2^{18}$ ) or 16-bit color (565 with 64K colors)
- Driver available for Segger
  - EmWin graphic library
- Free reference design available



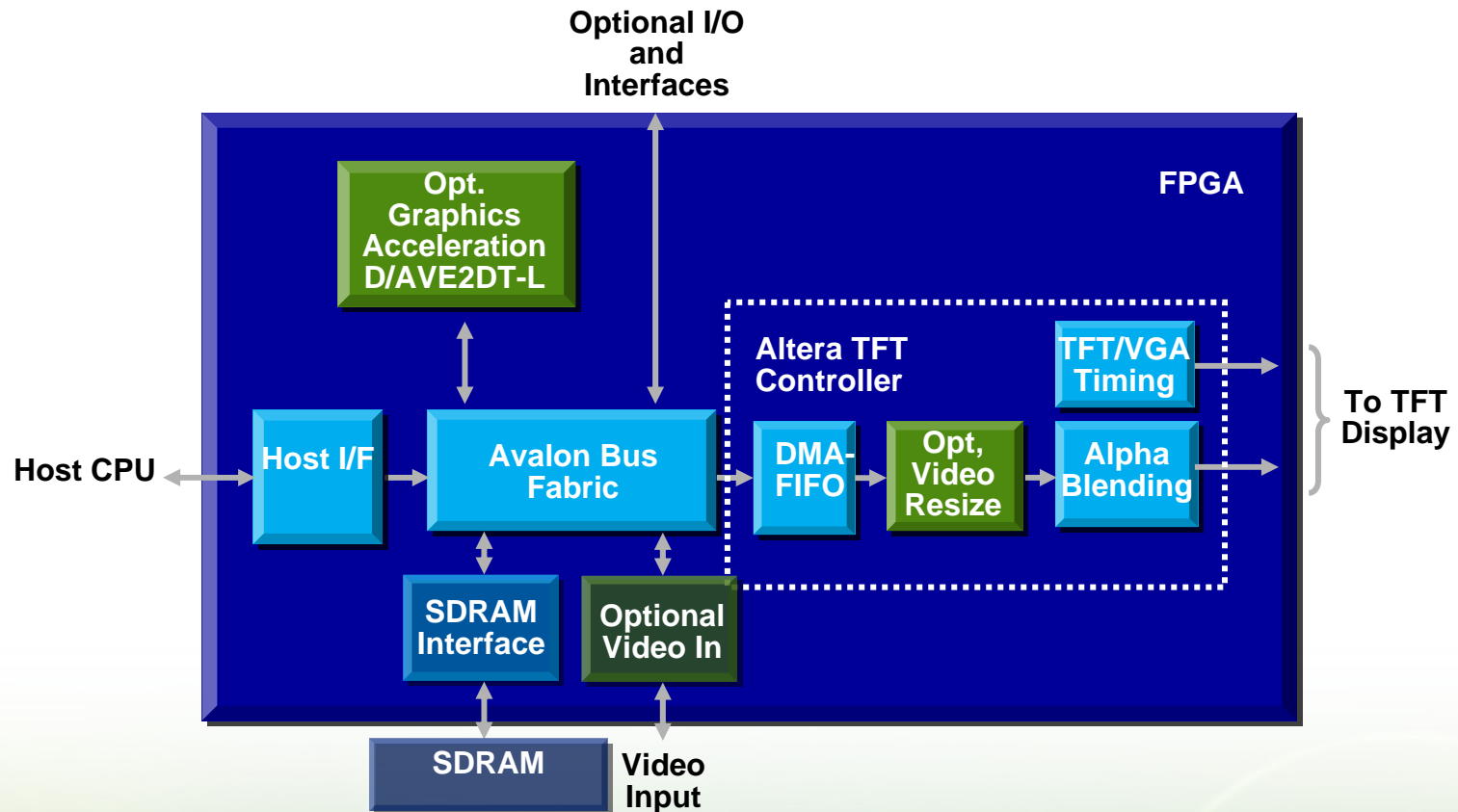
# Low-End Graphics Controller Block Diagram



# Low-End Graphics Controller Features

- Fully independent solution
- No MIPS from host-system required
- Free choice of the host-bus interface
- Supports multiple TFT display resolutions, display sizes, and feature sets with one single platform
- Scales in complexity and cost
- Integrated u-processor can work as interpreter for standard graphic command sets
- Allows integration of custom features and interfaces with the integrated processor (PWM, I<sup>2</sup>C,...)
- No limitation for character font and style (one worldwide onscreen display concept)

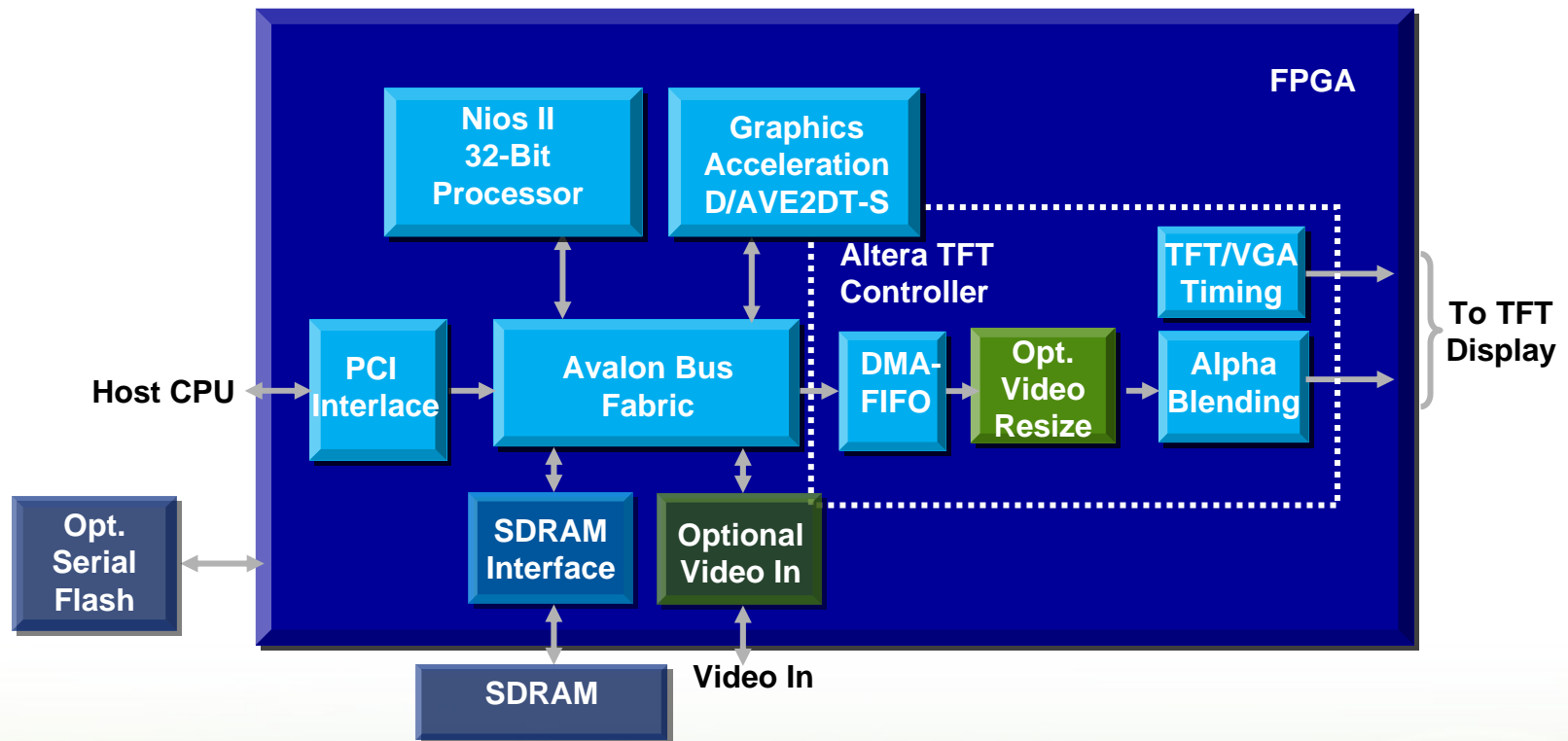
# Graphics Coprocessor (Frame Buffer Controller) – Block Diagram



# Graphics Coprocessor (Frame Buffer Controller) – Features

- One platform for multiple host processors and host interfaces
- Releases the host from high-speed display tasks
- Supports multiple TFT display resolutions, display sizes, and feature sets with one single platform
- Supports separate frame buffer but also unified memory architecture
- Scales in complexity and cost
- Optional on-board graphic acceleration
- Allows extension of host I/O and interface capabilities (PWM, I<sup>2</sup>C, memory I/F)

# PCI-Based Graphics Controller Block Diagram

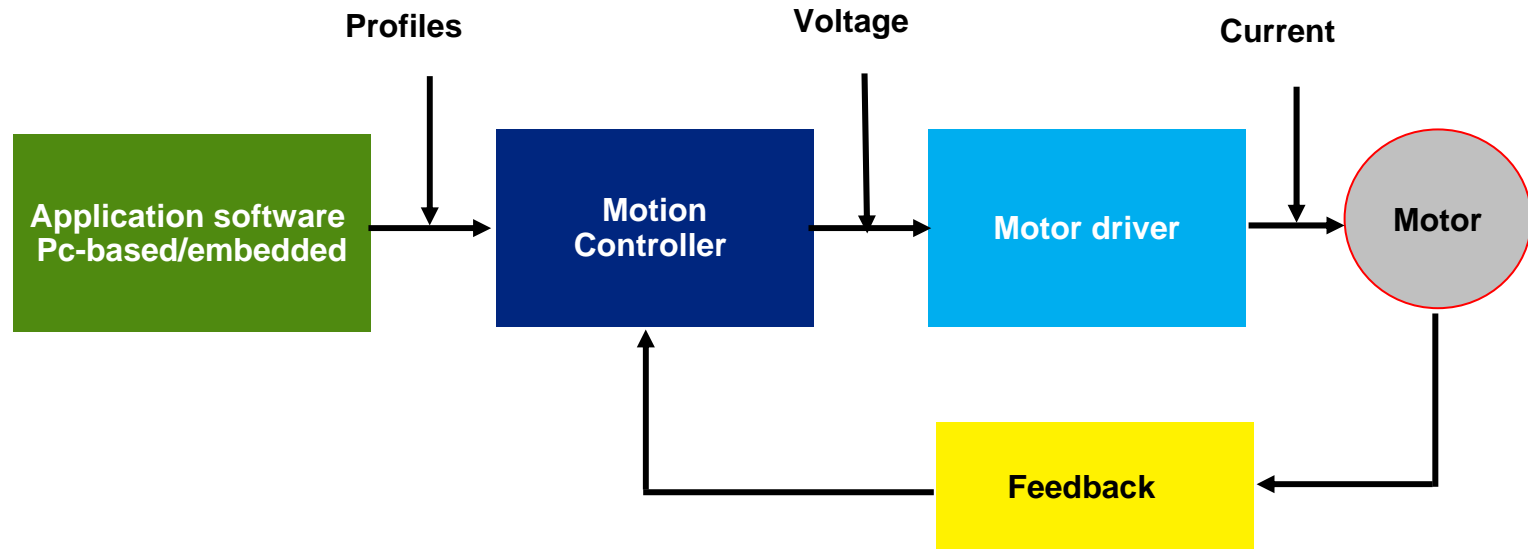




# Altera Industrial Solutions

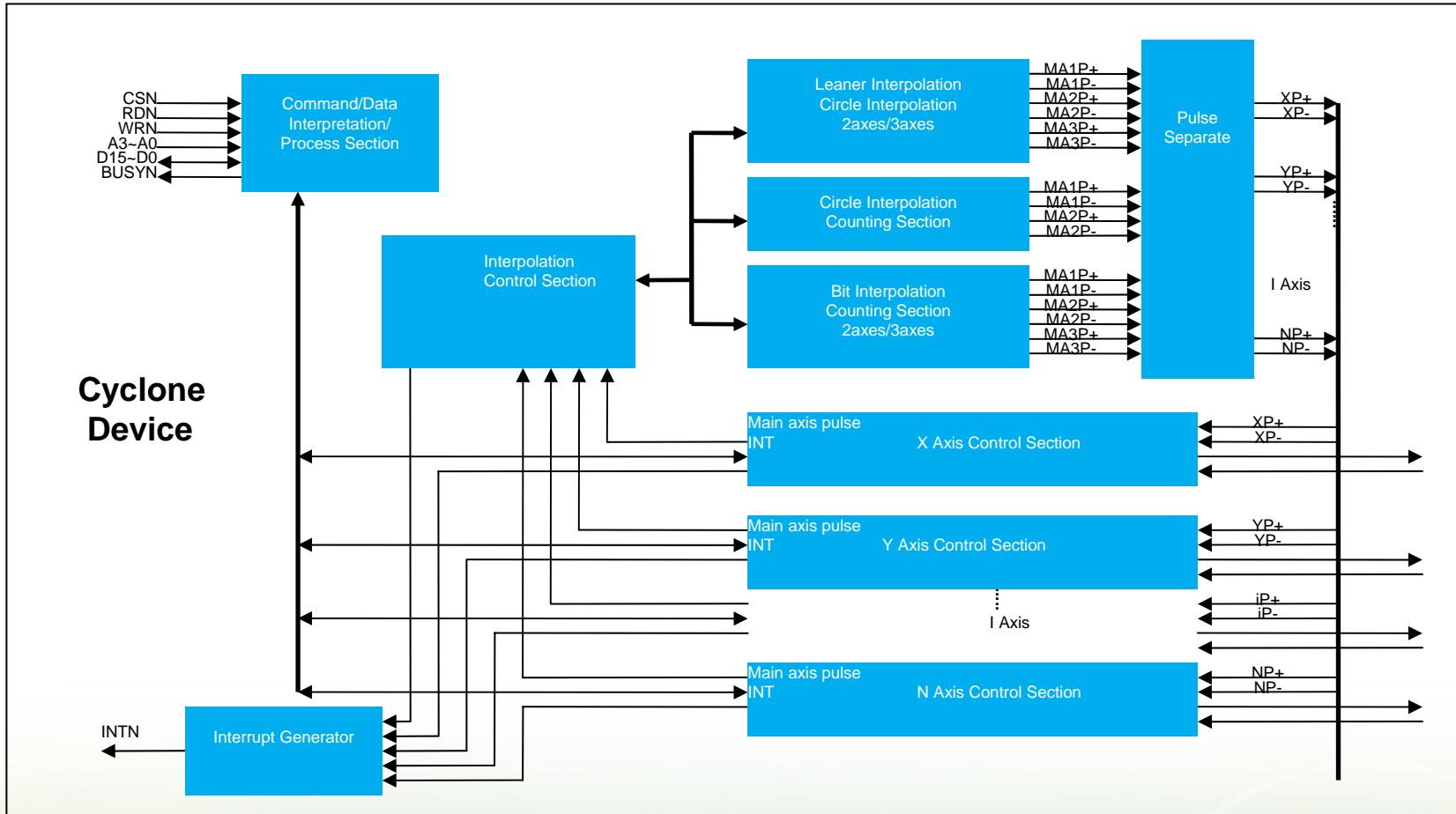
- Industrial Ethernet
- Industrial graphics controller
- **Motion control**
- Freescale/Altera/EBV development kits
  - SnakeBytes development board
  - IEEE 1588 switch board
  - EBV - DBC2C20 development board

# Typical Motion Control System



- Where programmable logic can play
  - Motion controller
  - Motor driver

# Multi-Axes Motion Controller SOC Platform



N={2,4}, Customization For More Axis And Functions

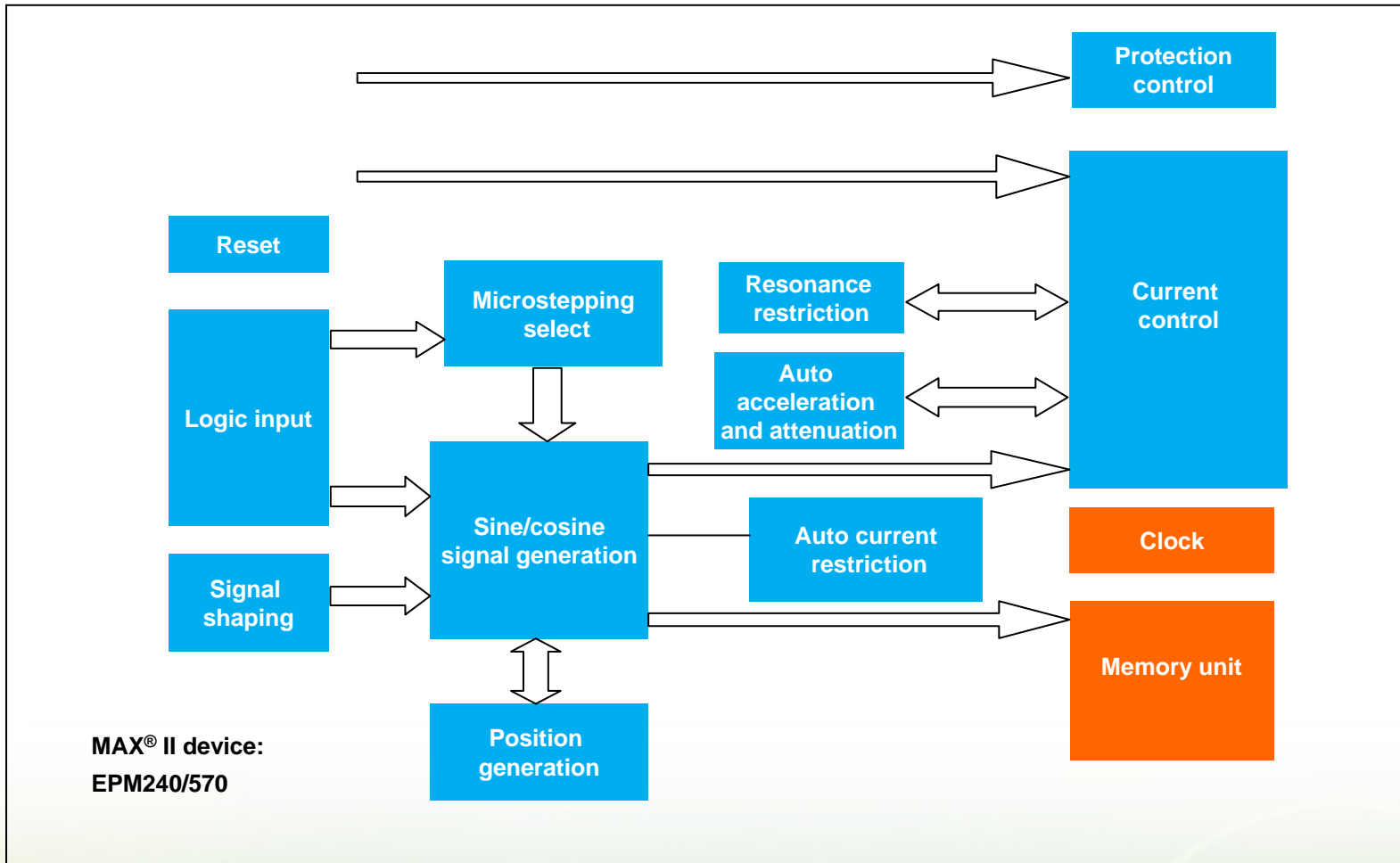


# Multi-Axes Control Key Features

- Speed control
- Position control
- Trapezoidal/S-curve acceleration/deceleration
- 2/3/4 axes interpolation
  - Linear interpolation, circular interpolation, and bit pattern interpolation
  - Interpolation speed range is from 1 PPS to 4 MPPS
- Counter, compare register, and software limit
- Automatic home search
- Servo motor feedback signals
- Support 8-/16-bit data bus interface



# Stepper Motor Driver



# Stepper Motor Driver Features

- Up to 256 subdivision or 250 subdivision
- Hardware sine/cosine signal generation
- 2 MHz or above input pulse frequency
- Auto current decrease function
- 16-shift subdivision selection, binary and decimal types
- Over-current, over-voltage, and short circuit protection

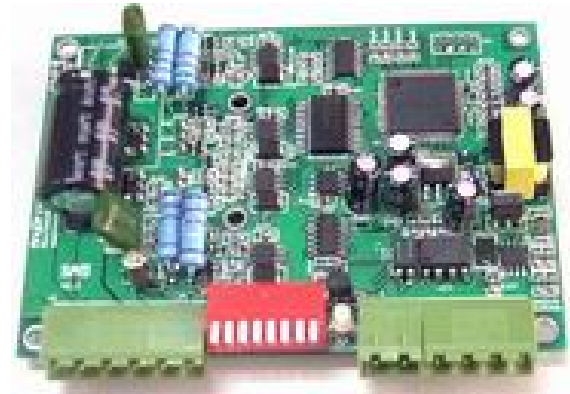


# Motion Control Target Markets

- Plastic machinery
- Textile machinery
- Packing machinery
- Rubber machinery
- Printing machinery
- Machine tool industry
- Medical equipment
- Loading/uploading machinery
- More.....



# Hardware Demo





# Altera Industrial Solutions

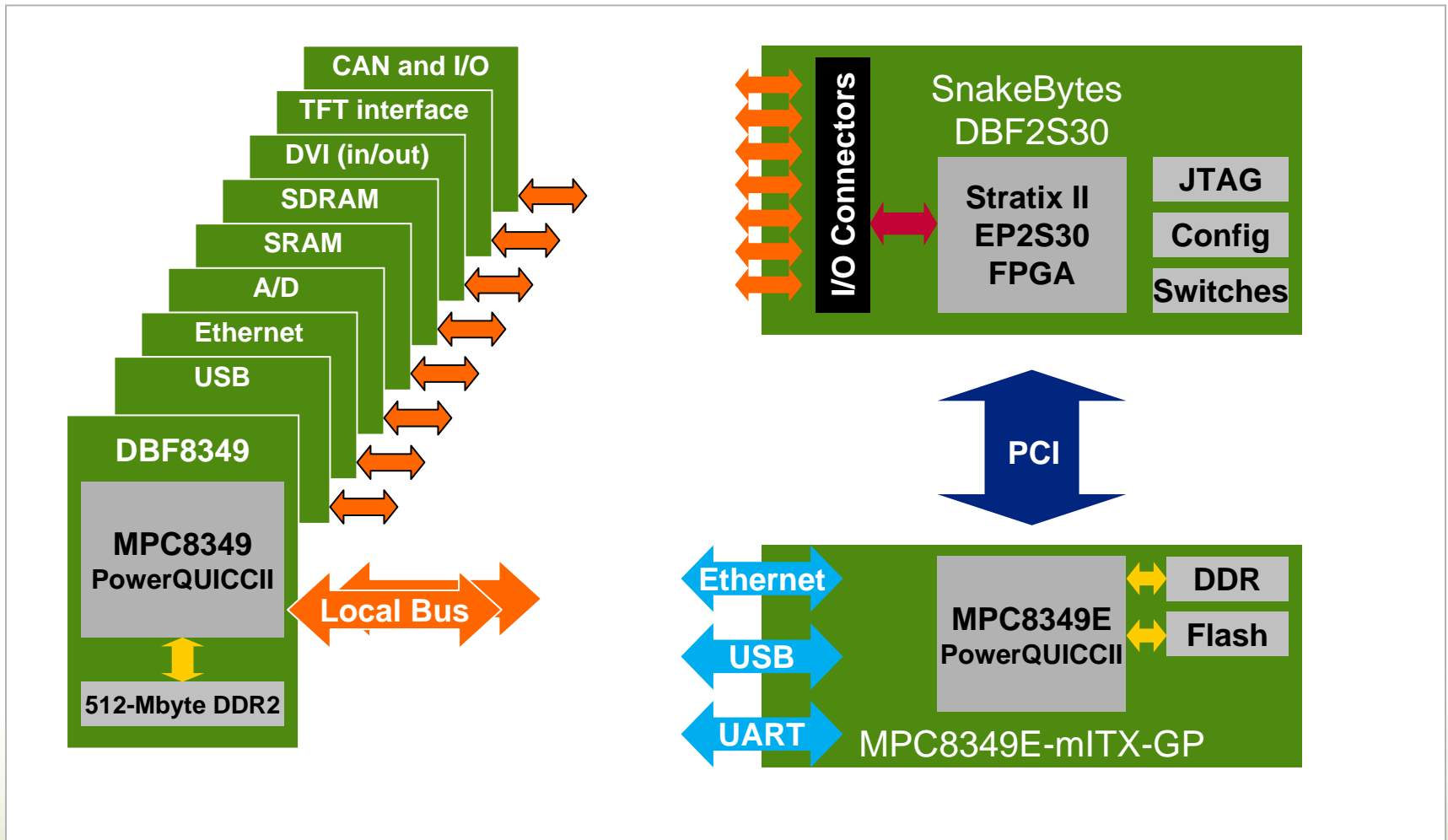
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# SnakeBytes - A Flexible Reference Design Platform

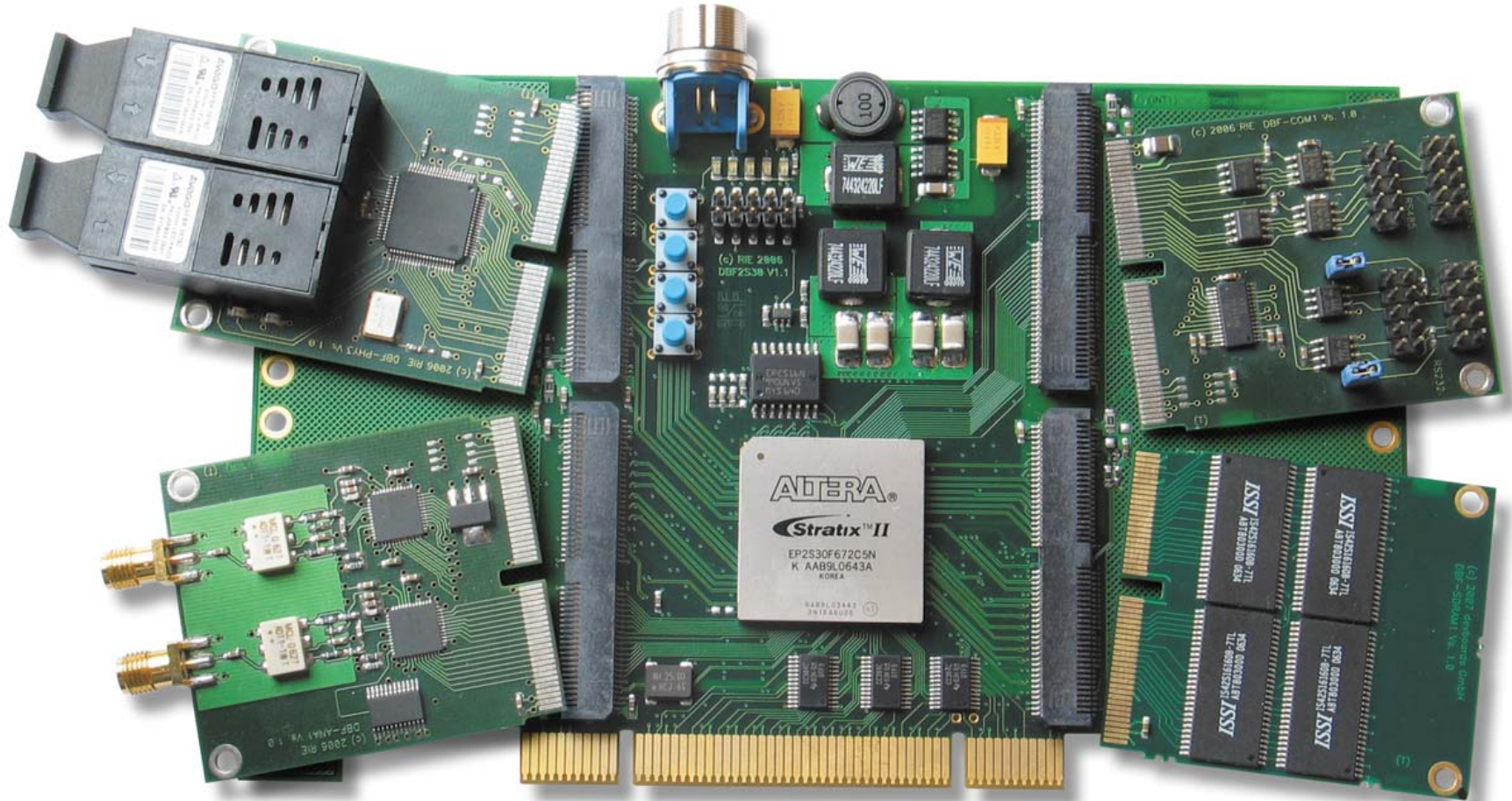
- Modular board system
- FPGA base board – DBF2S30
  - Stratix® II device: EP2S30F672C5 (or EP2S60 rev. 1.1)
  - Cyclone III device underway (after availability)
  - PCI connector (32 bit/33 MHz)
  - 7 I/O module slots with individual I/O bank supply
    - I/O module with 40 or 64 signals, differential routing
  - JTAG connector
  - Configuration devices for FPGA
- Wide range of daughtercards
- Connects via PCI to MPC8349E-mITX-GP development board



# Modular System



# DBF2S30 Board



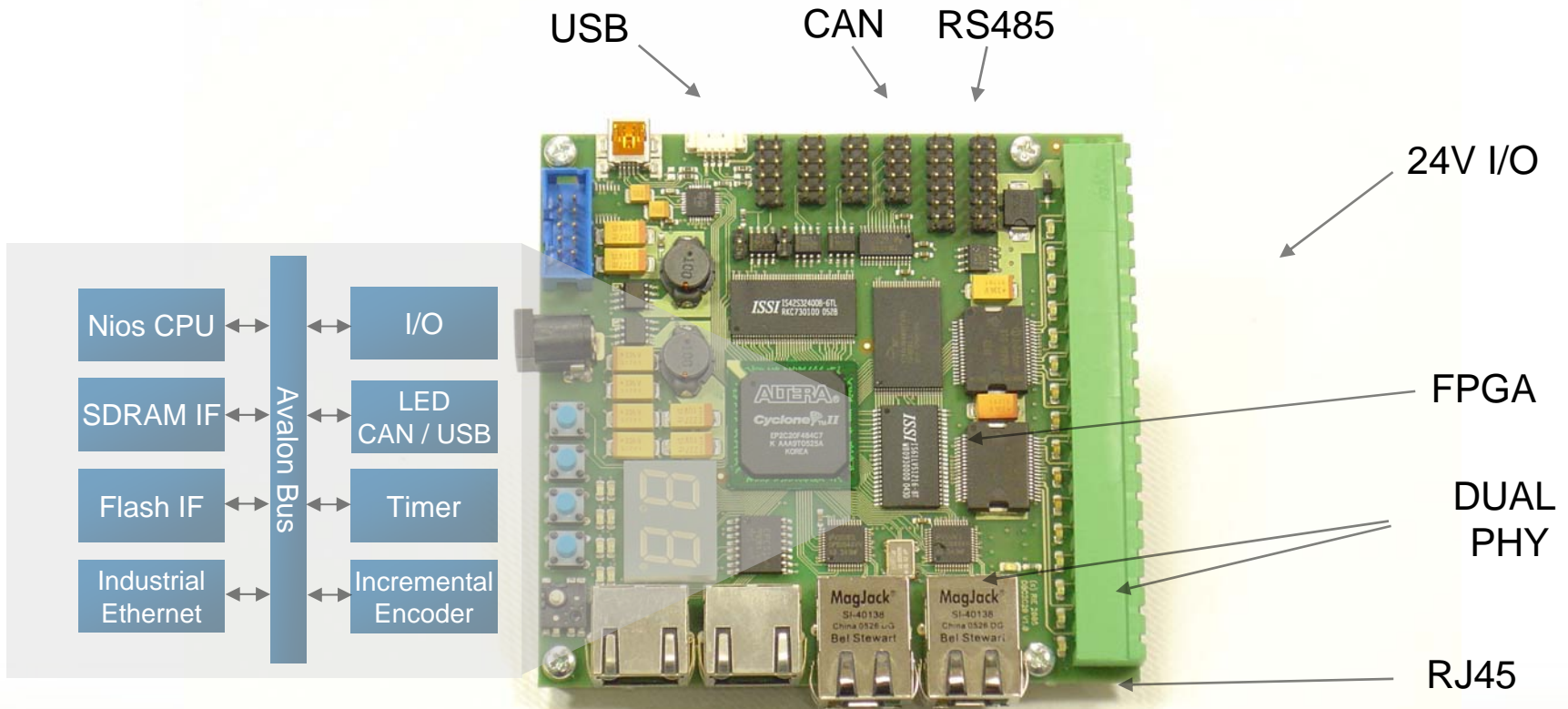
# Altera/MTIP/NSC IEEE 1588 Switch Board

## ■ Features:

- 32-bit Nios II embedded RISC processor
- High port density with low pin count RMII interfaces
- Full featured 10/100Mbps Ethernet media access control (MAC) devices compliant with the IEEE802.3-2002 standard
- Support for IEEE 1588 version 1 and version 2 transparent E2E and P2P clock sequencing
- \$999 reference board price



# EBV – DBC2C20 Development Board





# Success Stories

# Host Automation

## H2-EBC100 and H2-ECOM100



*“Utilizing the Nios® processor and Cyclone® FPGA approach, we can get the exact mix of peripherals we need, in a package that we need, at a reasonable cost. In addition, we can reduce the number of unique parts in our inventory by using the same hardware platform for all of our designs.”*

*—Bob Palermo, Senior Design Engineer*

### Application

100 Base-T Ethernet controllers for a programmable logic controller (PLC)

### Industry

Industrial automation

### Altera® value proposition

- Nios II + low-cost Cyclone FPGA= perfect microprocessor solution
- FPGA flexibility enables connection to proprietary PLC backplane and custom microcontroller peripheral set

### Altera products chosen:

**Cyclone** 

**Nios II**



# Hypercom Optimum L4100 and M2100



*“MAX® II CPLDs provide us with a low-cost, power-efficient means for implementing multiple functions in our point-of-sale (POS) terminals. Adopting them for our Optimum L4100 POS and M2100 wireless POS terminals reduces design complexity, minimizes board space, and lowers our manufacturing expenses. In some cases where we would have chosen an FPGA and the corresponding two-chip solution in the past, we have been able to achieve a single-chip solution with MAX II CPLDs, while retaining the ability to deliver in-field upgrades by updating the programmable logic device.”*

*–Mike Cargile, Hardware Development Director*

## Application

Point-of-Sale Terminals

## Industry

Industrial

## Altera® value proposition

- Lowest-Cost Programmable Logic Solution
- Single-Chip Solution in Compact Form Factor Ideal for Space-Constrained

## Altera products chosen:

**MAX II**

# Leica Geosystems TPS1200 Total Station



*“We use the Nios® II processor along with the embedded multipliers in the Cyclone® II device to provide DSP processor functionality. Altera’s cost-effective, flexible, system-on-a-programmable chip approach enabled us to avoid the risks and high costs of developing an ASIC.”*

*–Bruno Pfiffner, Project Leader, ASIC Design*

## Application

Terrestrial Survey Instrument

## Industry

Industrial

## Altera® value proposition

- FPGA Flexibility at ASIC Cost
- High Component Integration

## Altera products chosen:

**Cyclone** 

**Nios® II**

# Tagmaster Radio Frequency (RF) IF Reader



*“In our LR-3, LR-6, and LR-12 RFID readers, we use Cyclone® II FPGAs for digital signal processing (DSP) and baseband data decoding in the process of reading from and writing to RFID tags. Using a MAX® II CPLD for configuration control and security, we can add hardware-based features which would have been impossible with the ASIC-based approach of prior product generations.”*

*—Johan Franzén, Product Manager*

## Application

Radio Frequency ID Reader/ Writer

## Industry

Industrial

## Altera® value proposition

- FPGA-based signal processing reduces costs and shortens time-to-market
- Reconfigurability enables hardware upgrades in the field

## Altera products chosen:

**Cyclone**™

**MAX II**

# Summary

- High growth expected in industrial application
- Programmable logic devices provide significant differentiation to industrial customers
- Altera and third-party partners provide solutions to address customer needs
  - Industrial Ethernet
  - Graphic controller
  - Motion control
  - Development boards



**Thank You!**