April 14, 2011

Freescale Industrial Control & Networking
Single Chip Solutions

Alexandra Dopplinger, P.Eng.
Global Segment Marketing Manager, Robotics & Factory Automation
Session Introduction

 Presenter: Alexandra Dopplinger, P.Eng.
  - Global Segment Marketing Manager, Robotics & Factory Automation
    - alex.dopplinger@freescale.com
  - Expertise
    - Robotics and Factory Automation market
    - Industrial network protocols

 Session Abstract:
  - Identify best industrial control and networking solutions

 Session Duration: 60 minutes
  - Presentation (45 min), Q&A (15 min)
Agenda

► Industrial Control Application Overview

► Freescale Control Processor Roadmap
  • Control processor protocol enablement

► Where to Find Best Solutions

► Summary
Industrial Control Application Overview
Factory Automation Applications

► Communicate with real-time deterministic protocols
► Ruggedized for harsh environment

• Industrial Control
  • Programmable Logic Control (PLC)
  • Input-Output Control
  • Process, Temperature, Motion, Position Control

• Industrial Networking
  • Gateway, Router, Switch, Converter, Hub

• Human Machine Interface (HMI)

• Industrial Peripherals
  • Robot, Actuator, Switch Gear, Power Management

www.freescale.com/factoryautomation
**Key Elements of Generic Industrial Control**

**Application Processor**
- Control algorithm
  - Decide what happens next
  - Position elevators
  - Coordinate motion in conveyors
- Communications
  - Fieldbus, Ethernet, CAN
- Human machine interfaces
  - LED, LCD, keypad, HMI

**I/O Control Processor (MPU, MCU, FPGA)**
- Real-time actuator or sensor control
  - Sensor inputs: Temp, current, position
  - Control outputs
  - Detect problems

**Motor Control Processor (DSC, DSP, FPGA)**
- Real-time motor control
  - Start, stop, speed-up, slow-down
  - Control / PID loop
  - Detect problems with motor
Freescale Devices Support All Industrial Protocol Levels

**Target Applications**

- Motor drives
- Motion control
- Synchronized servos

- Conveyor belts
- Picker arms
- PLCs, I/O Control
- Valves

- Sensors
- Data scanner
- Inventory management

**Protocols**

- **IRT**
  - Deterministic
  - Jitter matters for Sync
  - Cycle Time: 1 to 100 ms

- **RT**
  - Deterministic
  - Jitter matters for Sync
  - Cycle Time: 1 to 100 ms

- **NRT**
  - Non-deterministic
  - Jitter doesn’t matter
  - Cycle Time: > 100 ms

**IEEE® 1588 Precision Time Protocol**

VERY Jitter sensitive; Cycle Time does not matter

**IEEE 1588 Precision Time Protocol**

- Very Jitter sensitive; Cycle Time does not matter

**ISO 1588-2**

- Jitter matters for Sync
- Cycle Time: 1 to 100 ms

**ISO 8802-1**

- Jitter doesn’t matter
- Cycle Time: > 100 ms

**IEEE 802.3**

- Jitter matters for Sync
- Cycle Time: 1 to 100 ms

**ISO 8802-3**

- Jitter doesn’t matter
- Cycle Time: > 100 ms

**IEEE 802.4**

- Jitter matters for Sync
- Cycle Time: 1 to 100 ms

**ISO 8802-4**

- Jitter doesn’t matter
- Cycle Time: > 100 ms

**ISO 8802-7**

- Jitter matters for Sync
- Cycle Time: 1 to 100 ms

**ISO 8802-11**

- Jitter doesn’t matter
- Cycle Time: > 100 ms

**Modbus**

- Jitter matters for Sync
- Cycle Time: 1 to 100 ms

**EtherCAT**

- Jitter doesn’t matter
- Cycle Time: > 100 ms

**EtherCAT Lite**

- Jitter matters for Sync
- Cycle Time: 1 to 100 ms

**EtherCAT Classic**

- Jitter doesn’t matter
- Cycle Time: > 100 ms

**EtherCAT Smart**

- Jitter matters for Sync
- Cycle Time: 1 to 100 ms

**EtherCAT Simple**

- Jitter doesn’t matter
- Cycle Time: > 100 ms

www.freescale.com/connectivity

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Single-Chip Industrial Control Solutions

Replace this....

- Two chips from two vendors
  - ASIC for Industrial Ethernet or Fieldbus
  - Still need applications processor

With lower cost solution

One chip for Control Application +

Industrial Ethernet and/or Fieldbus protocol

freescale.com/connectivity
Freescale Control Processor Roadmap
Industrial Control Processor Solutions

► Industrial Protocols supported on QorIQ, PowerQUICC, i.MX and ColdFire processors
  • Scalable system performance from 100 to 38,000+ MIPS
  • Reduced system cost with integrated processors starting <$7
  • Fanless operation at 85C: 800 MIPS <3W, 1900 MIPS <3W

► Leading partner solutions and tools
  • PROFINET and EtherNet/IP™ protocol stacks from Molex
  • PROFIBUS layer 2 from DoGav; Layer 7 to be announced
  • EtherCAT® from acontis and Koenig-KPA
  • IEEE® 1588, PROFINET and CAN from IXXAT
  • Industrial-grade safety-certified OS from Green Hills, QNX and others

► Rugged devices with long life and reliability
  • Industrial or automotive qualification for -40C to +85C ambient
  • Stability of 10- or 15-year product longevity statement
Freescale Product Longevity Program

► Embedded applications need **long-term product support**

► Freescale has a long record of providing long-term production support for our products

► Freescale’s **formal product longevity program**

  • A broad range of devices are made available for a minimum of **10 or 15 years from time of launch**

  • Participating Freescale products, terms and conditions at [www.freescale.com/productlongevity](http://www.freescale.com/productlongevity)
# Freescale 32-bit Processor Families

<table>
<thead>
<tr>
<th>QorIQ Multicore MPU</th>
<th>ColdFire MPU</th>
<th>i.MX MPU</th>
</tr>
</thead>
<tbody>
<tr>
<td>PowerQUICC MPU</td>
<td>ColdFire MCU</td>
<td>Kinetis MCU</td>
</tr>
<tr>
<td>PX MCU Family</td>
<td>ColdFire+ MCU</td>
<td>&lt;1W for battery-operated applications up to 1600+ MIPS, LCD, graphics, extensive connectivity</td>
</tr>
</tbody>
</table>

- **QorIQ Multicore MPU**
  - Multicore with broadest scalability from 100 to 38,000+ MIPS, leading on-chip connectivity

- **ColdFire MPU**
  - Up to 300 MIPS with flash memory, extensive peripherals, free MQX or Linux® OS

- **i.MX MPU**
  - Kinetis MCU

**Applications**:

- Networking
- Automotive
- Industrial
- Consumer
- Automotive
- Industrial
QorIQ and PowerQUICC High-Performance Processors

► QorIQ platform evolved from industry-leading PowerQUICC communications processors
  • Single core @ 800 MHz <3 Watts
  • Eight cores @ 1.5 GHz/core <30 Watts
  • 10/100/1000 Ethernet, CAN, UART, PCI Express®, USB, SPI, GPIO
  • Integrated security, secure boot, anti-tamper

► Industrial qualification and long product life
  • Operation in harsh environments from -40C to +85C
  • Included in product longevity program

Pin-compatible solutions up to 38,000+ MIPS with leading MIPS/Watt
One chip runs PROFINET + Control Application <3W @ 800 MHz
P1010 QorIQ Processor - Launched Nov/10

- e500 v2, 533 - 800 MHz
- 256KB Frontside L2 cache w/ECC, HW cache coherent
- 36-44 bit physical addressing

- System Unit
  - 16/32-bit DDR3, 800 MHz data rate w/ECC
  - Integrated SEC 4.x Lite Security Engine with Secure Boot
  - Flash Controller supporting NOR, SLC and MLC based NAND devices
  - One USB 2.0 Controllers Host/Device support with Integrated PHY
  - SD/MMC card controller supporting booting from Flash cards
  - VortiQa based data path acceleration with (3) 10/100/1000 Ethernet Controllers w/ Jumbo Frame support, SGMII interface, IEEE 1588 v2 support
  - Two PCIe Express 1.0a Controllers operating up to 2.5Gbps
  - Two SATA Controller, 3.0 Gb/S
  - Two eCAN3.0 Controllers
  - 4x UARTs, 2x I2Cs

- Process & Package
  - 45nm SOI
  - 425-pin TEPBGA I (19mmx19mm, 0.8mm pitch)
  - <3W power consumption

1900 MIPS, 3xEthernet, 2xCAN, 2xPCI-Express, 4xUART, <3W
MPC8309 PowerQUICC Processor – Launched Aug/10

- e300c3 up to 400 MHz
  - 16K I/D 4-way L1 cache
  - Double Precision FPU + Dual IU
- DDR2 up to 333MHz
  - 32/16-bit, with ECC Support
- Local Bus
  - Both NAND / NOR flash boot support
- x3 10/100Mbps Ethernet
  - MII / RMII
  - IEEE1588 Support
- PCI-2.3, 32-bit @ 66 MHz
- x2 HDLC/TDM
  - Up to 128 channels
- USB 2.0 - Host / Device / OTG
- eSDHC (host controller)
- 4x CAN 2.0B Controllers
- 4x UART, 2x I²C, SPI, GTM, RTC
- 64 Muxed GPIO
  - MUX’d 16 GPIO with eSDHC / x4 CAN
- Multi-channel DMA controller

PCI-2.3
32-Bit
66MHz

e300c3
DP-FPU
Dual IPU

16KB
I-Cache
16KB
D-Cache

QUICC Engine™
32-bit RISC Engine
DMA

Accelerators
RAM

Baud Rate

3x MII/RMII
IEEE1588

x2 HDLC/TDM

- Power: Sub-1.6W @ 333MHz CPU, 200MHz QE
- Package: 489 MAPBGA, 19x19mm, 0.8mm pitch

Shipping now
10Ku price starts at $8.55 (SRP @10Ku)

770 MIPS, DP FP, 3xEthernet, 4xCAN, 2xPROFIBUS, 4xUART, PCI, <2W
i.MX Applications Processors for Industrial Control and HMI

► Evolved from handheld battery-operated devices
  • Single core @ 800 MHz <1 Watt
  • 10/100 Ethernet, CAN, UART, SPI, SDIO, USB, GPIO
  • Integrated video and graphics processors offload CPU
  • On-chip power management to increase battery life

► Market-leading human machine interface
  • High resolution color LCD controller with touch screen
  • Hardware accelerated video processing and graphics rendering
  • Camera interface

► Industrial qualification and long product life
  • Operation in harsh environments from -40C to +85C
  • Included in product longevity program

Pin-compatible solutions up to 1600 MIPS <1W
Industrial MPUs – Launched Sep/10

**i.MX28x**
- ARM9 architecture
- <0.5 W for hand-held and battery-powered applications
- On-chip power management
- Graphical display controller
- Secure boot
- Linux® OS and Windows® Embedded CE OS

**MCF5441x**
- ColdFire V4 architecture
- 10 serial ports
- Motor control integration - PWM Timers, DACs, ADCs
- DACs for sensors and audio interface
- True Random Number Generator (RNG) for enhanced data security
- MQX RTOS, Linux OS, and CodeWarrior v10

**Shared features:**
- Extensive connectivity
- Dual 10/100 Ethernet with IEEE 1588 time-stamping
- 3-port Layer 2 Ethernet switch (L2 Switch)
- <0.5 W for fanless operation
- Industrial qualification
- Product Longevity–15 years
Kinetis Product Family – Launched June/10

First available broad-market MCU samples based on ARM® Cortex™-M4!

<table>
<thead>
<tr>
<th>MCU Family</th>
<th>Common System IP</th>
<th>Common Analog IP</th>
<th>Common Digital IP</th>
<th>Development Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>K70 Family</td>
<td>32-bit ARM Cortex-M4 Core w/ DSP Instructions</td>
<td>16-bit ADC</td>
<td>CRC</td>
<td>Bundled IDE w/ Processor Expert</td>
</tr>
<tr>
<td>K60 Family</td>
<td>Next Generation Flash Memory High Reliability, Fast Access</td>
<td>Programmable Gain Amplifiers</td>
<td>I²C</td>
<td>Bundled OS USB, TCP/IP, Security</td>
</tr>
<tr>
<td>K50 Family</td>
<td>FlexMemory w/ EEPROM capability</td>
<td>SRAM</td>
<td>Programmable Delay Block</td>
<td>Modular Tower H/ware Development System</td>
</tr>
<tr>
<td>K40 Family</td>
<td>Memory Protection Unit</td>
<td>12-bit DAC</td>
<td>UART/SPI</td>
<td>Application Software Stacks, Peripheral Drivers &amp; App. Libraries (Motor Control, HMI, USB)</td>
</tr>
<tr>
<td>K30 Family</td>
<td>Low Voltage, Low Power Multiple Operating Modes, Clock Gating (1.71V-3.6V with 5V tolerant I/O)</td>
<td>High-speed Comparators</td>
<td>External Bus Interface</td>
<td>Broad 3rd party ecosystem</td>
</tr>
<tr>
<td>K20 Family</td>
<td>Low-power Touch Sensing</td>
<td></td>
<td>Motor Control Timers</td>
<td></td>
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<tr>
<td>K10 Family</td>
<td></td>
<td></td>
<td>eSDHC</td>
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</tbody>
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Control Processor Enablement
1-Chip PROFINET, EtherCAT, EtherNet/IP Solutions

Replace this....

- Two chips from two vendors
  - ASIC or FPGA for protocol
  - Still need applications processor

With lower cost solution

One chip for Control Application

freescale.com/PROFINET, /EtherCAT, /EtherNet/IP
Molex PROFINET IO Controller on QorIQ P2020 Processor

- Operating System - Linux
- PROFINET RT STACK
- TCP/IP
- Real Time Channel
- Automation API
- Parameter Data
- Process Data
- PLC Application
- Gbit Ethernet MAC
- RMII/MII
- eTSEC

P2020

PROFINET
### Processors for 1-Chip PROFINET, EtherCAT Master, EtherNet/IP

<table>
<thead>
<tr>
<th>High-End Networking</th>
<th>Power Architecture</th>
<th>ARM</th>
<th>ColdFire</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1000 DMIPS</td>
<td>MPC8641</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4W - 10W</td>
<td>P2020 QoriQ</td>
<td></td>
<td></td>
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<tr>
<td>&gt; $20</td>
<td>P2010 QoriQ</td>
<td></td>
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<tr>
<td></td>
<td>P1020/21 QoriQ</td>
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<td></td>
<td>P1011/12 QoriQ</td>
<td></td>
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<tr>
<td>Pin Compatible Families</td>
<td>P1010 QoriQ</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>High-End PLC/PAC</th>
<th>Power Architecture</th>
<th>ARM</th>
<th>ColdFire</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 – 1500 DMIPS</td>
<td>MPC8536</td>
<td></td>
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<tr>
<td>&lt; 2.5W – 5W</td>
<td>i.MX51x</td>
<td></td>
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<tr>
<td>&gt; $15</td>
<td>MPC837x</td>
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<tr>
<td></td>
<td>MPC8360</td>
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<tr>
<td></td>
<td>i.MX53x</td>
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<tr>
<td></td>
<td>P10xx QoriQ</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>PLC/PAC and HMI</th>
<th>Power Architecture</th>
<th>ARM</th>
<th>ColdFire</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 – 800 DMIPS</td>
<td>MPC5121e/23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1.5W</td>
<td>MPC8314/15</td>
<td></td>
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<tr>
<td>&lt; $10 - 20</td>
<td>MPC8313</td>
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<td></td>
<td>MPC8308</td>
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<td></td>
<td>MPC5125</td>
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<td>MPC8309/06</td>
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<tr>
<td></td>
<td>i.MX53x</td>
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<td></td>
<td>i.MX35x</td>
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<td></td>
<td>i.MX25x</td>
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<td></td>
<td>i.MX28x</td>
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<td></td>
<td>MCF5441x</td>
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<thead>
<tr>
<th>I/O Control</th>
<th>Power Architecture</th>
<th>ARM</th>
<th>ColdFire</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 – 400 DMIPS</td>
<td>MCF5445x – Ethernet + USB</td>
<td></td>
<td></td>
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<tr>
<td>&lt; 1W</td>
<td></td>
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<td></td>
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<tr>
<td>&lt; $10</td>
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<table>
<thead>
<tr>
<th>Process Control</th>
<th>Power Architecture</th>
<th>ARM</th>
<th>ColdFire</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 – 200 DMIPS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 0.5W</td>
<td></td>
<td></td>
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<tr>
<td>&lt; $1 – $5</td>
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</tbody>
</table>

**PROFINET and EtherNet/IP partners**
- Molex and IXXAT

**EtherCAT partners**
- acontis technology and Koenig-KPA
1-Chip PROFINET and PROFIBUS Solutions

Replace this....

- Two chips from two vendors
  - ASIC for PROFINET or PROFIBUS
  - Still need applications processor

With lower cost solution

One chip for Control Application
+ and/or

freescale.com/PROFIBUS, /PROFINET
### Processors for 1-Chip PROFIBUS

#### High-End Networking
- >1000 DMIPS
- 4W - 10W
- > $20

#### High-End PLC/PAC
- 500 – 1500 DMIPS
- < 2.5W – 5W
- > $15

#### PLC/PAC and HMI
- 300 – 800 DMIPS
- < 1.5W
- < $10 - 20

#### I/O Control
- 200 – 400 DMIPS
- < 1W
- < $10

#### Process Control
- 50 – 200 DMIPS
- < 0.5W
- < $1 – $5

<table>
<thead>
<tr>
<th>Configure as either Master or Slave</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Up to 125 slaves per master</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Line bit rate supports up to 12 Mbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Upper limit depends on device speed</td>
</tr>
</tbody>
</table>

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How to Acquire PROFIBUS Solution

► PROFIBUS applications processor from Freescale
  • Includes PROFIBUS layer 2 link-layer microcode
    ▪ Licensed and supported from DoGav
    ▪ Coming soon:
      – Included with Freescale evaluation board support package (BSP)
      – Free download from www.freescale.com
      – Supported by Freescale

► PROFIBUS layer 7 application software options
  • Use your own, integrated with DoGav layer 2 microcode
  • Buy from protocol stack vendor, e.g. TMG, Softing, etc.

freescale.com/PROFIBUS
Industrial Protocol Software Solutions
## Industrial Protocol Stack Support for Freescale Processors

<table>
<thead>
<tr>
<th>Industrial Protocol</th>
<th>ColdFire and ColdFire+</th>
<th>i.MX and Kinetis</th>
<th>QorIQ and PowerQUICC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IEEE® 1588</strong></td>
<td><img src="image" alt="IXXAT" /></td>
<td><img src="image" alt="IXXAT" /></td>
<td><img src="image" alt="IXXAT" /></td>
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<tr>
<td><img src="image" alt="PROFINET" /></td>
<td><img src="image" alt="molex" /></td>
<td><img src="image" alt="molex" /></td>
<td><img src="image" alt="molex" /></td>
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<tr>
<td><img src="image" alt="EtherCAT Technology Group" /></td>
<td><img src="image" alt="acontis" /></td>
<td><img src="image" alt="acontis" /></td>
<td><img src="image" alt="acontis" /></td>
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<tr>
<td><img src="image" alt="Modbus-IDA" /></td>
<td><img src="image" alt="IXXAT" /></td>
<td><img src="image" alt="IXXAT" /></td>
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<tr>
<td><strong>POWERLINK</strong></td>
<td><img src="image" alt="IXXAT" /></td>
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<td><img src="image" alt="PROFIBUS" /></td>
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<td><img src="image" alt="IXXAT" /></td>
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<tr>
<td><strong>DeviceNet™</strong></td>
<td><img src="image" alt="IXXAT" /></td>
<td><img src="image" alt="IXXAT" /></td>
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<tr>
<td><strong>CAN</strong></td>
<td><img src="image" alt="IXXAT" /></td>
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</tr>
</tbody>
</table>
acontis is a German-based leading supplier for EtherCAT Master technology

- Established 1999 with global distribution
  - Used by many Blue Chip companies
  - Located in Weingarten, Germany

- Freescale products supported
  - QorIQ and PowerQUICC processors
  - ColdFire MCUs and MPUs
  - i.MX applications processors

- Contact: Stefan Zintgraf
  - s.zintgraf@acontis.com, +49 751 56030 30
  - Haehnlehofstr. 5, D-88250 Weingarten, Germany


AT-EM EtherCAT Master Stack

- Full EtherCAT compliance to support all EtherCAT protocols and slaves
- Powerful feature packs
  - Hot connect, redundancy, distributed clocks
- Sophisticated diagnostic features
DoGav is an Israel-based software solution provider with more than 10 years experience developing production-ready microcode for PowerQUICC processors

• Established 1984
  ▪ 5 employees in Petach Tikva, Israel
  ▪ USA sales based in New York, USA

• Freescale products supported
  ▪ QorIQ and PowerQUICC processors
  ▪ 25+ years collaboration with Freescale and Motorola

• Contact David Gabbay
  ▪ dg@dogav.net, +972-3-933-7197
  ▪ 18 Nahum St., Petach Tikva, 49247 Israel
  ▪ www.dogav.net

Protocols supported
  – PROFIBUS DPv1
    – Master and Slave
IXXAT is a German-based leading supplier for embedded communication systems for industrial and automotive applications

- Established 1987 with 20+ profitable growth years
  - 80 employees (most are developers)
    - Weingarten, Germany; New Hampshire, USA
  - Represented globally in >15 countries

- Freescale products supported
  - QorIQ and PowerQUICC processors
  - ColdFire MCUs and MPUs
  - i.MX applications processors

- Contact Bill Seitz
  - seitz@ixxat.com, 603-471-0800 X102
  - 120 Bedford Center Rd., Bedford, NH 03110

- Download free evaluations from www.ixxat.com

Protocols supported:
- IEEE 1588
- PROFINET
- EtherNet/IP
- EtherCAT
- Modbus
- POWERLINK
- CAN – CANOpen, J1939, DeviceNet
Koenig Prozessautomatisierungs GmbH (KPA)

Koenig-KPA is a German-based provider of EtherCAT protocol stacks, configuration tools and services

- Established 1986 in Feucht, Germany
  - Joined EtherCAT Technology Group (ETG) 2004
  - 60+ employees
    - Feucht, Germany (near Nuremberg)
    - Associated company “Visutech” in Minsk, Belarus
  - Distribution partners
    - RADIC Technologies, Steinhoff, easiTEC S.r.l., Micronet

- Freescale products supported
  - QorIQ and PowerQUICC processors

- Contact Gerhard Spiegel
  - gerhard.spiegel@koenig-pa.com
  - Phone: +49 (9128) 725 652
  - www.koenig-pa.de

EtherCAT Specialties

- KPA Studio EtherCAT
  - configuration & diagnostics tool
- KPA Master EtherCAT
  - master stack for various OS
- KPA Slave EtherCAT
  - slave stack for various OS
- KPA Slave Tester EtherCAT
  - slave tester tool
- KPA EtherCAT Boards
  - PCI & PC104 slave boards
Molex delivers complete interconnect solutions for data communications, telecommunications, consumer electronics, industrial, automotive, medical, military, lighting and solar apps.

• Established 1938
  - 2nd largest connector manufacturer; $3B sales in 2010
  - Active participant in ODVA (technical board) and PI (PROFINET core working group) organizations
  - PROFINET Competence Center
  - Official provider of EtherNet/IP tools for ODVA Plugfest

• Freescale products supported
  - QorIQ and PowerQUICC processors
  - ColdFire MCUs and MPUs
  - i.MX applications processors

• Contact Martial Maneché martial.maneche@molex.com
  - +33 (0)2 32 96 51 32 / +33 (0)6 26 64 00 07
  - 41 rue mazagran, 76320 Caudebec-les-Elbeuf, FRANCE

• Contact our experts: www.molex.com/links/iccc profinet@molex.com or ethernetip@molex.com

Technology provider for:
- PROFINET IO
- EtherNet/IP
- CIP Safety™ EtherNet/IP
- CIP Safety DeviceNet™
Real-Time Automation (RTA)

RTA is a USA-based leading supplier of industrial protocols and solutions

- Established 1989 by John Rinaldi
  - 10 employees in Milwaukee WI, USA
  - Focus on networking, control & developers
  - "Media is irrelevant"

- Freescale products supported
  - QorIQ and PowerQUICC processors
  - ColdFire MCUs and MPUs
  - i.MX applications processors

- Contact John Rinaldi
  - rinaldi@rtaautomation.com, 414-453-5100
  - 150 S. Sunnyslope Road Suite 150, Brookfield, WI 53220

- Download evaluation information from www.rtaautomation.com

Protocols supported:
- PROFINET
- PROFIBUS
- EtherNet/IP
- Modbus
- CAN – CANOpen®, DeviceNet
Green Hills Software is the largest independent embedded software company in the world

- Proven since 1982
- Headquarters in Santa Barbara, California
- European headquarters, the United Kingdom

- Freescale products supported
  - QorIQ and PowerQUICC processors
  - i.MX applications processors
  - Kinetis, ColdFire and PX MCUs and MPUs
  - Qorivva MCUs

- Contact Robert Redfield
  - rmr@ghs.com, +1 805 455 1158

- More info at www.ghs.com

Technology provider for:
- IEC 61508 SIL 3 certified RTOS
- Extensive middleware support includes EtherCAT Master, CAN, PROFIBUS (planned)
- Integrated development tools for complete lifecycle
- Complete set of analysis, development, and certification support services
QNX Software Systems is a leading supplier of middleware, development tools, real-time operating system software and services for both general embedded and life-critical systems

- More than 30 years of service
- Headquarters in Ottawa, Canada
- Global supplier to Cisco, Delphi, General Electric, Siemens, Thales and many other leading customers
- Technical support centers in USA, Europe and Japan

- Freescale products supported
  - QorIQ and PowerQUICC processors
  - i.MX applications processors

- Contact Romain Saha
  - rsaha@qnx.com, +01 613-271-9217

- More info at www.qnx.com

Technology provider for:
- IEC 61508 SIL 3 certified Neutrino® RTOS
- Extensive middleware support includes EtherCAT Master, PROFINET (planned)
- Full development lifecycle support with highly-integrated Momentics® development suite
Where to Find Best Solutions
Find Solutions Fast @ freescale.com/FactoryAutomation

### Factory Automation

**Rugged, Reliable, Reusable:** Freescale offers industrial control and networking solutions for many wired and wireless industrial communications protocols and human machine interfaces. Our safe and secure systems withstand hacking, cloning, tampering and soft errors in harsh environments typical of a manufacturing or processing facilities.

#### Featured Applications

- **Industrial Control**
  - Programmable Logic Control (PLC)
  - Input-Output Control (I/O Control)
  - Process Control, Temperature Control
  - Motor Control with Wireless Sensors
  - Motion Control
  - Single Board Computer
- **Industrial Networking**
  - Fieldbus-to-Ethernet Gateway
  - Industrial Gateway (Router)
  - Industrial Ethernet Switch
  - Industrial Converter (Bridge)
  - Industrial Hub
- **Human Machine Interface (HMI)**
- **Industrial Peripherals**
  - Mobile Robot (Battery Operated)
  - Robotic Arm
  - Robotic Manipulator
  - Network-Enabled High-Performance UPS
  - Digital Power Control

### Design Resources

- **Getting Started**
  - Industrial Control and Networking Solutions
  - Industrial Control and Networking Trends and Roadmap
  - Industrial Network Protocols Training
  - PROFINET, EtherCAT® and EtherNet/IP™ Panel Discussion
- **Technologies, Standards & Protocols**
  - Industrial Network and Fieldbus Protocols
  - IEEE® 802.15.4 Wireless Protocol
  - LCD
  - Motor Control
  - Product Longevity

### Design Partners

- All Freescale Alliance Members

### Related Video

- [Robotic Arm Powered by a Flexis™ AC MCU](#)
  - Human air hockey competitor can’t beat the robotic arm powered by the Flexis AC MCU (Video - 3:32)
  - [Touch Sensing Introduction](#)
  - Enable products for touch sensing in less than 10

### Training & Events

- Hannover Messe, Apr 4–8: ETG booth
- 10 Mar, Robotics Trends’ Virtual Conference
- Freescale Technology Forum

### Industry News

- Building a low cost deterministic industrial Ethernet system
- Freescale enables EtherCAT® on QorIQ, PowerQUICC and i.MX

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Application Summary Pages for each application type
Recommended Solutions @ freescale.com/FactoryAutomation

Block diagram with product page links and differentiators for recommended devices
## Programmable Logic Control (PLC)

### Support Options
- Enter a Service Request
- Manage Existing Service Requests

### Training

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Network Protocols (Part 2) - EtherCAT®</td>
<td>Webinar</td>
<td>1 Hours</td>
</tr>
<tr>
<td>Freescale solutions for EtherCAT protocol on PowerQUICC and...</td>
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</tr>
<tr>
<td>Industrial Network Protocols (Part 2) - PROFIBUS</td>
<td>Webinar</td>
<td>30 Minutes</td>
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<tr>
<td>Learn about the latest single-chip PROFIBUS solutions in the...</td>
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<tr>
<td>Industrial Network Protocols (Part 1)</td>
<td>Webinar</td>
<td>2 Hours</td>
</tr>
<tr>
<td>Learn solutions for PROFINET®, PROFIBUS®,...</td>
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<tr>
<td>Implementing Industrial and Low-Power Applications using...</td>
<td>Webinar</td>
<td>50 Minutes</td>
</tr>
<tr>
<td>Motor control, factory automation and a bicycle trip...</td>
<td></td>
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</tr>
<tr>
<td>Personal Service &amp; Industrial Robots – Solutions from...</td>
<td>Webinar</td>
<td>30 Minutes</td>
</tr>
<tr>
<td>Processors and sensors for robot control, motion and...</td>
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</tr>
<tr>
<td>Proximity Sensors: Designing Cost-Effective Touch Screens...</td>
<td>Training Presentation</td>
<td>35 Minutes</td>
</tr>
<tr>
<td>Learn how to convert any LCD panel into a touch screen LCD...</td>
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</tr>
<tr>
<td>Power Supply Management Solutions for Microcontrollers</td>
<td>Webinar</td>
<td>1 Hours</td>
</tr>
<tr>
<td>Discuss power management ICs, regulators, and battery...</td>
<td></td>
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<tr>
<td>Inertial Applications Using 6-bit Accelerometer</td>
<td>Webinar</td>
<td>28 Minutes</td>
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<tr>
<td>Discuss motion, shake, orientation and tap detection.</td>
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<tr>
<td>IEEE® 802.15.4 Protocol Options Overview</td>
<td>Webinar</td>
<td>1 Hours</td>
</tr>
<tr>
<td>ZigBee®, RF-4CE, Wireless HART and several proprietary...</td>
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<tr>
<td>Embedded Control System Security: Protect Against Software...</td>
<td>Webinar</td>
<td>55 Minutes</td>
</tr>
<tr>
<td>Industrial processors and system features to prevent hacking...</td>
<td></td>
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</tr>
<tr>
<td>Industrial Control and Networking Trends and Roadmap</td>
<td>Webinar</td>
<td>1 Hours</td>
</tr>
<tr>
<td>Learn about the latest reference designs, enablement and...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial Control and Networking Solutions</td>
<td>Webinar</td>
<td>20 Minutes</td>
</tr>
<tr>
<td>Industrial control and network processors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Today’s session will link here

freescale.com/CAN
freescale.com/EtherCAT
freescale.com/EtherNetIP
freescale.com/IEEE1588
freescale.com/PROFIBUS
freescale.com/PROFINET
Session Summary

- **Industrial Protocols supported on QorIQ, PowerQUICC, i.MX and ColdFire processors**
  - Scalable system performance from 100 to 38,000+ MIPS
  - Reduced system cost with integrated processors starting <$7
  - Fanless operation at 85C: 800 MIPS <3W, 1900 MIPS <3W

- **Leading partner solutions and tools**
  - PROFINET and EtherNet/IP protocol stacks from Molex
  - PROFIBUS layer 2 from DoGav; Layer 7 to be announced
  - EtherCAT from acontis and Koenig-KPA
  - IEEE 1588, PROFINET and CAN from IXXAT
  - Industrial-grade safety-certified OS from Green Hills, QNX and others

- **Rugged devices with long life and reliability**
  - Industrial or automotive qualification for -40C to +85C ambient
  - Stability of 10- or 15-year product longevity statement
Freescale:

- Industrial applications – www.freescale.com/industrial
- Factory Automation applications – www.freescale.com/factoryautomation
- Industrial protocols – www.freescale.com/connectivity
- PROFIBUS – www.freescale.com/PROFIBUS
- PROFINET – www.freescale.com/PROFINET
- EtherCAT – www.freescale.com/EtherCAT
- EtherNet/IP – www.freescale.com/EtherNetIP
- CAN – www.freescale.com/CAN
- IEEE 1588 – www.freescale.com/IEEE1588
- Motor control – www.freescale.com/motorcontrol

Protocol and operating system partners:

- DoGav Systems Limited – www.dogav.net
- IXXAT Automation GmbH – www.ixxat.com
- Koenig Prozessautomatisierungs GmbH – www.koenig-pa.de
- Molex Inc. – www.molex.com
- Real-time Automation (RTA) – www.rtaautomation.com
- Green Hills Software – www.ghs.com
- QNX Software Systems – www.qnx.com
By now, you should be able to:

► Identify best industrial control solutions

► Leverage Freescale and partner solutions to quickly implement your industrial control applications

► Contact me at alex.dopplinger@freescale.com

Thank-you for considering Freescale solutions!