Flexibility for systems to adapt to change

Industrial Ethernet solutions

Build adaptability into your products.

Real-time transmission. Rock-solid reliability. Harsh environments. Low-cost implementation. With considerations like these, designing industrial systems is far from simple.
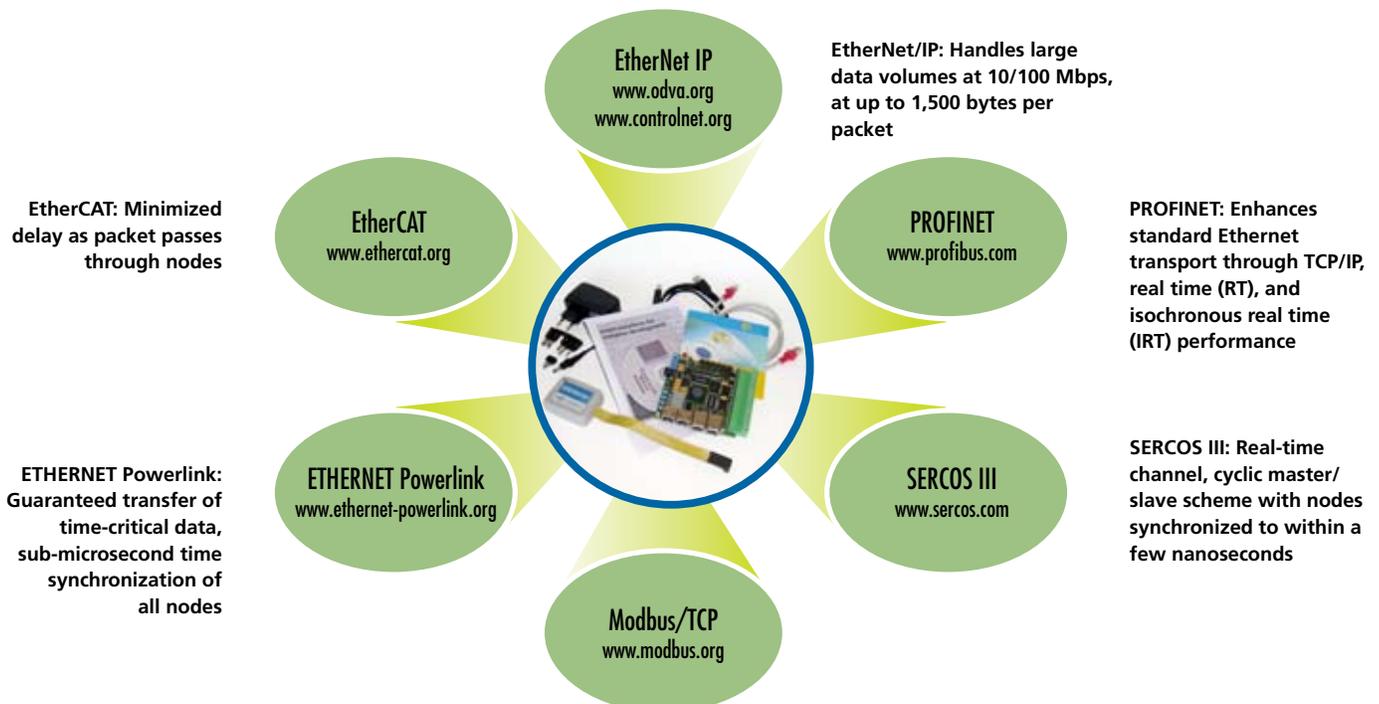
This is where industrial Ethernet standards along with Altera® FPGAs play a vital role. With a single FPGA and Ethernet PHY device, you can easily implement any industrial Ethernet standard into your product. What's more, by reprogramming the FPGA's hardware configuration, you can cost-effectively support emerging industrial Ethernet standards.

Altera FPGAs deliver the performance, flexibility, and interoperability to equip you to create reliable multi-standard Ethernet applications for demanding industrial applications.

Overcome obstacles through dedicated standards

Industrial systems must function under extreme physical conditions, delivering real-time data transmission and reception without fail. What's more, budgets dictate that these applications must be built to last. These complexities have driven the development of dedicated industrial Ethernet standards that provide an array of advantages:

- Increased speed, up to 10/100/1000 Mbps and with a roadmap to 10G
- Increased distance and overall performance
- Ability to use standard and less costly Ethernet equipment such as access points, switches, cables, and hubs
- Better interoperability

EtherNet IP
www.odva.org
www.controlnet.org

EtherNet/IP: Handles large data volumes at 10/100 Mbps, at up to 1,500 bytes per packet

EtherCAT: Minimized delay as packet passes through nodes

EtherCAT
www.ethercat.org

PROFINET
www.profibus.com

PROFINET: Enhances standard Ethernet transport through TCP/IP, real time (RT), and isochronous real time (IRT) performance

ETHERNET Powerlink: Guaranteed transfer of time-critical data, sub-microsecond time synchronization of all nodes

ETHERNET Powerlink
www.ethernet-powerlink.org

SERCOS III
www.sercos.com

SERCOS III: Real-time channel, cyclic master/slave scheme with nodes synchronized to within a few nanoseconds

Modbus/TCP
www.modbus.org

With a single Cyclone® III device-based industrial Ethernet evaluation board, you can implement and evaluate many different Ethernet protocol standards running in a Cyclone FPGA. Each standard requires intellectual property (IP) components from Altera partners. See www.altera.com/industrial for more details.

Cut cost per node, raise productivity

From programmable logic controller (PLC) interfaces to factory automation, networking infrastructure systems, and more, the types of industrial applications that can benefit from industrial Ethernet technology continue to grow. What these diverse applications have in common is the need for flexibility and interoperability, which makes FPGAs the ideal solution.

With FPGAs you can design a single hardware platform that can support multiple industrial Ethernet protocols. Reconfigure the FPGA during manufacturing or even in the field to accommodate any changes in Ethernet specifications. There's no need to produce multiple dedicated adapter cards to support different standards. Over time, this drives down the cost per node and increases productivity. FPGA programmability also means that you can design to avoid obsolescence—critical for long product life cycles.

Lowest power FPGA with security

Altera's Cyclone FPGA series can support all industrial Ethernet standards via our Nios® II embedded processor, offering a low-power, flexible, single-chip solution. All industrial Ethernet solutions require a hardware media access controller (MAC) and a matching software stack. The MAC is implemented on the Cyclone FPGA, while the software stack runs on the Nios II processor.

Altera's SOPC Builder automated system integration tool allows you to easily create FPGA-based systems that can integrate processing [such as 32-bit RISC processors or digital signal processing (DSP) IP] and I/O standard interfaces (such as PCI, CAN, or UART) with the industrial Ethernet standard of your choice.

Our Cyclone III LS variant is the market's lowest power FPGA with high-assurance design features. With up to 200K logic elements for less than ¼ Watt of static power, 60-nm Cyclone III LS FPGAs equip you to reduce board size, decrease system power, and simplify board design. Security features at the silicon, software, and IP levels protect against tampering and reverse engineering. You also get, through Quartus® II design software, design separation support to implement information assurance and high reliability systems on a single programmable device.

Want to dig deeper?

To learn more about Altera's industrial solutions, visit us at **www.altera.com/industrial**, or contact your local sales representative.

What else is on your mind?

What kinds of design resources are available for common industrial design protocols?

Software and hardware are available for each of the current industrial design protocols, and can be licensed from their respective vendors. We'll continue to support new protocols as they become available. Table 1 outlines current protocol support.

Table 1. Industrial Ethernet solution providers

	EtherNet IP	EtherCAT	ETHERNET Powerlink	PROFINET	Modbus/ TCP	SERCOS III
IXXAT	✓	✓	✓	✓	TBD	TBD
Softing	✓	✓		✓	✓	
Beckhoff		✓				
Automata						✓
ZHAW				✓		

How can I support several different protocols within a single FPGA?

To support any one protocol, program the FPGA with the appropriate MAC hardware block and run the matching software stack on the Nios II processor. To support a different protocol, simply re-program the FPGA with a different MAC hardware block and change the software stack. The FPGA configuration and Nios II software can be stored in a flash memory device. By re-writing the contents of this flash device during production or in the field, you can easily change the protocol supported. You can also store multiple FPGA configurations in a single flash memory (to support dynamic switching) and/or program the FPGA with a design that contains several MAC hardware blocks and Nios II processors to simultaneously support multiple standards from a single device.

How can I evaluate industrial Ethernet capabilities in an FPGA?

Buy a Cyclone III industrial Ethernet evaluation board and obtain an evaluation version of your preferred industrial Ethernet standard.

What other IP is available for Altera FPGAs?

There are over 200 IP cores available today. For more information, visit **www.altera.com/products/ip/**.

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