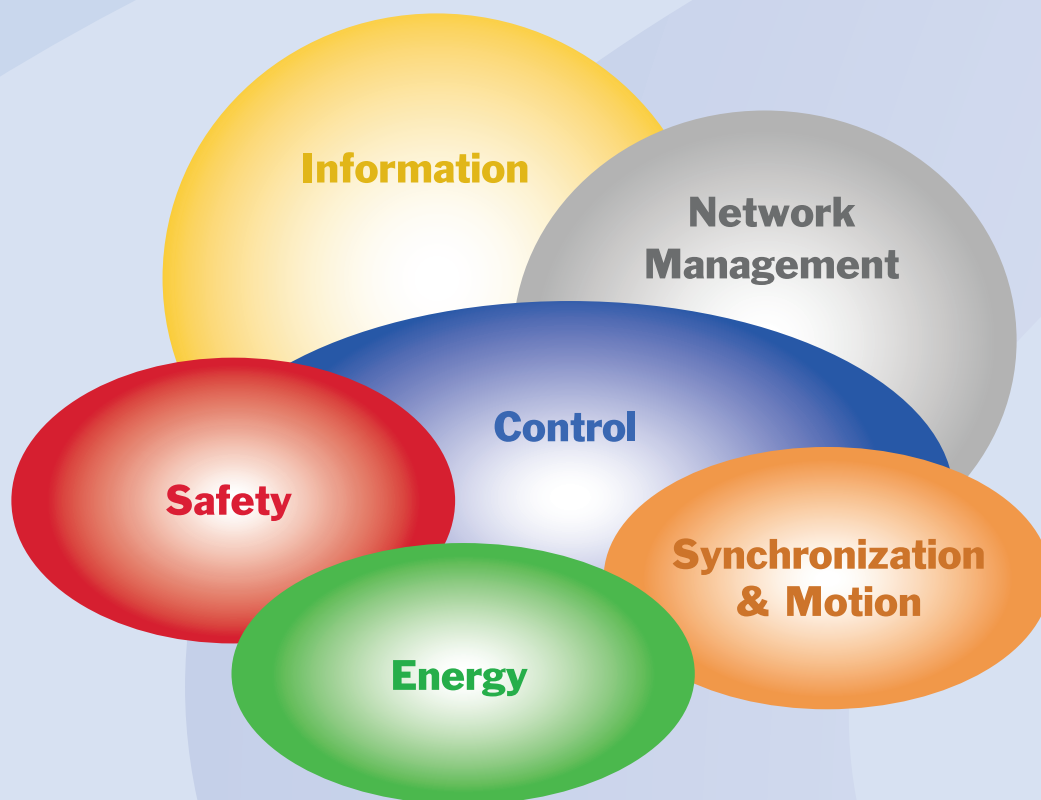


The Common Industrial Protocol (CIP™)



ODVA's four best-in-class networks — EtherNet/IP™, DeviceNet™, ControlNet™ and CompoNet™

— all are linked by one of industrial automation's most versatile protocols: the **Common Industrial Protocol**, known as **CIP™**. CIP encompasses a comprehensive suite of messages and services for the collection of industrial automation applications — control, safety, energy, synchronization & motion, information and network management. CIP allows users to integrate these applications with enterprise-level Ethernet networks and the Internet. Supported by hundreds of vendors around the world and truly media-independent, CIP provides users with a unified communication architecture throughout the industrial enterprise. CIP allows users to benefit today from the many advantages of open networks and protects their existing automation investments, while providing an extensible and upgradable communication architecture.

CIP Networks at a Glance

With media independence comes choice — the ability to choose the CIP Network best suited for your application. As a single, media-independent platform that is shared by a variety of networking technologies, CIP provides the interoperability and interchangeability that is essential to open networks and open systems. Four network adaptations of CIP are available.

EtherNet/IP CIP on Ethernet Technology

EtherNet/IP provides users with the network tools to deploy standard Ethernet technology (IEEE 802.3 combined with the TCP/IP Suite) for industrial automation applications while enabling Internet and enterprise connectivity...data anytime, anywhere. EtherNet/IP offers various topology options including a conventional star with standard Ethernet infrastructure devices, or device level ring (DLR) with EtherNet/IP devices so enabled. QuickConnect™ functionality allows devices to be exchanged while the network is running.

DeviceNet CIP on CAN Technology

DeviceNet provides users with a cost-effective network to distribute and manage simple devices throughout their architecture. DeviceNet uses a trunkline-dropline topology and has DC power available on the network cable to simplify installations by providing a single connection point for network communications and device power up to 24 Vdc, 8 Amps. QuickConnect functionality allows devices to be exchanged while the network is running.

ControlNet CIP on CTDMA Technology

ControlNet provides users with the tools to achieve deterministic, high-speed transport of time-critical I/O and peer-to-peer interlocks. ControlNet offers a choice of topology options including trunkline-dropline, star or tree. Hardware options are also offered for applications requiring intrinsically safe hardware. Redundant network communication is also available.

CompoNet CIP on TDMA Technology

CompoNet enables users to maximize network throughput for applications needing to transmit small packets of data quickly between controllers, sensors and actuators. Its simple network connector and cabling scheme reduces overall system cost and time.



Comprehensive Application Coverage in a Single Protocol

Functional Safety

Safety application coverage in CIP provides the ability to mix safety devices and standard devices on the same network or wire for seamless integration and increased flexibility. CIP Safety™ provides fail-safe communication between nodes such as safety I/O blocks, safety interlock switches, safety light curtains and safety PLCs in safety applications up to Safety Integrity Level (SIL) 3 according to IEC 61508 standards. CIP Safety has also been adopted by *sercos international*.

Energy Optimization

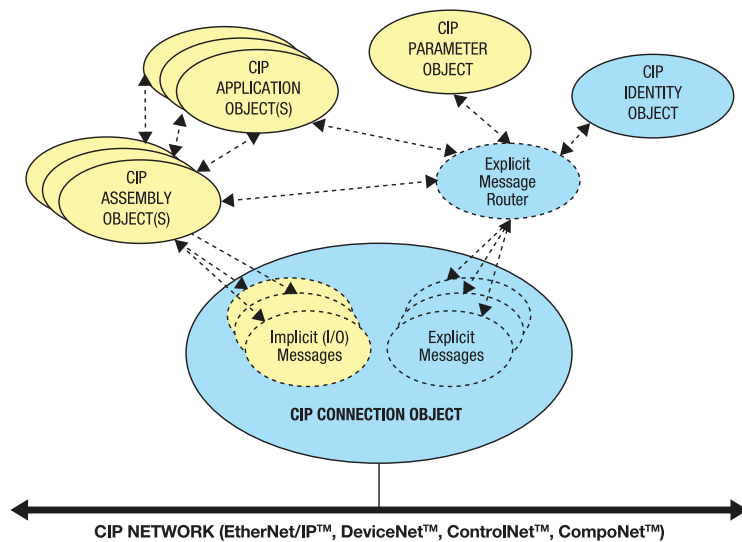
Energy application coverage in CIP provides a family of objects and services for the optimization of energy usage (OEU™) and allows scalability of implementation within the device from basic energy awareness to more advanced functions for control of energy, aggregation and reporting of energy information or dynamic demand-response. Further, the CIP family of energy objects and services will allow systems to monitor energy usage and manage energy for efficient energy consumption through dynamic control of energy state and analysis of energy information. Protocol neutral energy attributes allow for flexibility in the propagation of energy information via multiple protocols to facilitate an e-business model such as capturing energy requirements as a line item on production bills of material or to implement demand-response mechanisms for dynamic energy transactions.

Synchronization

Synchronization services in CIP provide the increased control coordination needed for control applications where absolute time synchronization is vital to achieve real-time synchronization between distributed intelligent devices and systems. CIP Sync™ is compliant with IEEE-1588™ standard, and allows synchronization accuracy between two devices of fewer than 100 nanoseconds. Real-time synchronization can be achieved over conventional 100Mbps, Ethernet systems with a switch-based architecture.

Distributed Motion Control

Motion application coverage in CIP eliminates the need for a purpose-built motion-optimized network by allowing high performance motion control and other devices to be combined on a single EtherNet/IP network. This approach results in a modular and streamlined approach to system design and lowers overall system and training cost. CIP Motion™ achieves real-time deterministic behavior of multiple axes through a common sense of time, allowing for 100 axes to be coordinated with a 1 millisecond network update to all axes. Clock synchronization between axes of fewer than 100 nanoseconds can be readily achieved, meeting the needs of the most demanding motion control applications.



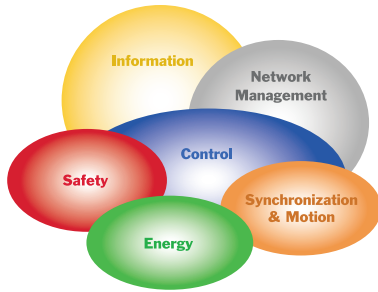
The Technical Approach to CIP

CIP is a media independent protocol using a producer-consumer communication model, and is a strictly object oriented protocol at the upper layers. Each CIP object has attributes (data), services (commands), connections, and behaviors (relationship between attribute values and services). CIP includes an extensive object library to support general purpose network communications, network services such as file transfer, and typical automation functions such as analog and digital input/output devices, HMI, motion control, and position feedback.

To provide interoperability, the same object (or group of objects) implemented in two or more devices behaves identically from device to device. A grouping of objects used in a device is referred to as that device's "Object Model." The Object Model in CIP is based on the producer-consumer communication model, which can provide more efficient use of network resources than

a source-destination model by allowing the exchange of application information between a sending device (e.g., the producer) and many receiving devices (e.g., the consumers) without requiring data to be transmitted multiple times by a single source to multiple destinations.

In order to provide further interoperability in CIP Networks comprised of devices from multiple vendors, CIP defines a standard grouping of objects as "Device Profiles." In addition to the set of objects implemented in the device, Device Profiles specify configuration options and I/O data formats. Devices that implement one of the standard Device Profiles will respond to all the same commands and will have the same network behavior as other devices that follow that same profile. CIP also can provide simple integration of Modbus® devices through use of its native Modbus translation services.



The CIP Advantage: The key to advanced information technology and network integration

CIP's common application layer allows complete integration of control with information, multiple CIP Networks and Internet technologies. Built on a single, media-independent platform with a common application layer, CIP provides seamless communication from the plant floor through the enterprise with a scalable and coherent architecture. CIP allows companies to integrate I/O control, device configuration and data collection across multiple networks. This ultimately helps minimize engineering and installation time and costs while maximizing ROI.

Comprehensive suite of messages and services for industrial automation provides functionality needed for control, safety, energy, synchronization & motion, information and network management.

Producer-consumer architecture allows efficient use of network bandwidth with an extensible network footprint.

Seamless bridging and routing allows flexible topology schemes for network architectures without having to program or configure intermediate devices.

Device profiles provide common application interface.

Managed by ODVA

Founded in 1995, ODVA is a global association whose members are comprised of the world's leading automation companies. ODVA's mission is to advance open, interoperable information and communication technologies in industrial automation. ODVA recognizes its media independent network protocol, the Common Industrial Protocol or "CIP"— and the network adaptations of CIP — EtherNet/IP, DeviceNet, CompoNet and ControlNet — as its core technology and the primary common interest of its membership. ODVA's vision is to contribute to the sustainability and prosperity of the global community by transforming the model for information and communication technology in the industrial ecosystem. For future interoperability of production systems and the integration of the production systems with other systems, ODVA embraces the adoption of commercial-off-the-shelf (COTS) and standard, unmodified Internet and Ethernet technologies as a guiding principle wherever possible. This principal is exemplified by EtherNet/IP — the world's number one industrial Ethernet network.



© 2011 ODVA, Inc.
Ann Arbor, Michigan USA
Tel +1 734-975-8840
Fax +1 734-922-0027
Email odva@odva.org
Web www.odva.org

PUB00122R1-ENGLISH

DeviceNet, EtherNet/IP, ControlNet, CompoNet, CIP, CIP Motion, CIP Energy, CIP Safety, CIP Sync and QuickConnect are trademarks of ODVA. Other trademarks are property of their respective owners.