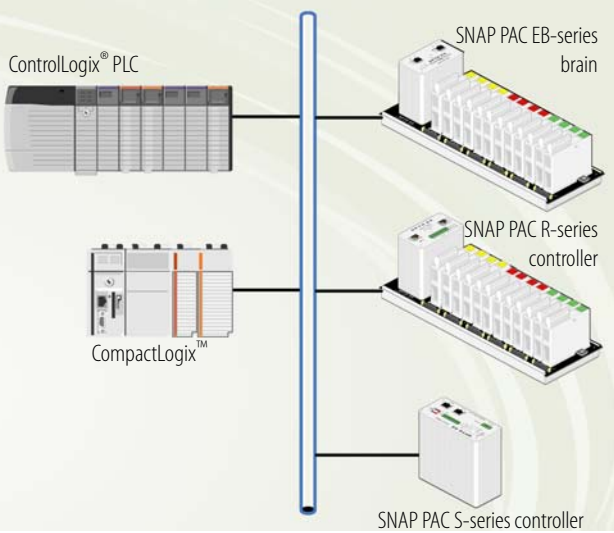
EtherNet/IP Implementation in SNAP PAC Products

Introduction

Built on the standard TCP/IP suite of protocols, EtherNet/IP™ gets the "IP" part of its name from CIP™, the Common Industrial Protocol™. As the name implies, EtherNet/IP adapts CIP to standard Ethernet technology, and thus provides tools to deploy manufacturing applications on an enterprise network. Introduced in 2001, EtherNet/IP is now supported by hundreds of vendors around the world and is a standard networking solution in industrial automation.

By supporting EtherNet/IP, SNAP PAC controllers and I/O processors (*brains*) can communicate with other manufacturers' devices that also support EtherNet/IP. This allows you to integrate SNAP PAC devices into automation environments currently populated by equipment from Siemens®, Allen-Bradley®, WAGO, and others.



CIP automation environment with PLCs and Opto 22 devices

Opto 22 Advantage

With EtherNet/IP support in SNAP PACs, you can add the rich and sophisticated functionality of Opto 22 equipment to your EtherNet/IP systems.

While other manufacturer's devices may report only states and counts, our SNAP PAC System™ devices can offer distributed intelligence to process and report a wealth of functions, including PID loops, high-speed counting and latching, alarming, serial device data, and so on.

Opto 22 Products

You can use any device from the SNAP PAC family of products in an EtherNet/IP environment, including the latest generation of SNAP PAC controllers and I/O brains. There are two basic approaches:

- Use SNAP PAC I/O with a SNAP PAC EB-series brain to deliver I/O data to an EtherNet/IP enabled scanner such as an Allen-Bradley PLC.
- Use SNAP PAC S- and R- series controllers to send scratch pad variable data to an EtherNet/IP enabled scanner such as an Allen-Bradley PLC.

Architecture

In EtherNet/IP terminology, a device may function as a *scanner or* an *adapter.*

Scanner

A *scanner* is capable of originating I/O data connection requests with adapter class products, as well as with other scanner class products. Scanner class devices may also originate or be the targets of explicit connection requests to and from other classes of products, and they can send or receive messages to or from all other classes of products. An example of a scanner is an Allen-Bradley PLC.

Adapter

An *adapter* cannot store or originate the data communications parameters necessary to establish a connection. Therefore, it cannot originate real-time I/O data connections, which is why it sends and receives I/O data only when it is requested to do so by a scanner. Adapter class devices receive message requests from all other classes of products, and they may exchange peer data using messages with any class of device, but they cannot originate these relationships.

SNAP PAC Implementation

Our SNAP PAC controllers and I/O brains are implemented as *adapters*, and as such are able to send and receive data only when requested to do so by a scanner. The PAC or brain (adapter) is therefore a *target* of instructions and requests for information sent by a scanner, which is usually a PLC but might be a PC running control software.

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Messaging

As adapters, SNAP PAC controllers and I/O brains are able to exchange messages with scanners using both *implicit* and *explicit* messaging. Examples of PLCs that support both implicit and explicit messaging are Allen-Bradley ControlLogix and CompactLogix. The SCL 5/05, MicroLogix 1100, and MicroLogix 1400 support explicit messaging only.

Implicit Messaging

Also known as *I/O messaging*, *implicit* messages contain no protocol information, only real-time I/O data. That means that the format must have already been defined when the connection is established, so both devices understand it. A target adapter responds to connection requests from a scanner by producing and consuming I/O messages.

The advantages of implicit messaging are speed and efficiency. Typically, an implicit message might report states based on a change of state or time. Since the format is already defined, the message is faster to send and interpret. In addition, implicit message connections typically use UDP/IP resources to multicast messages to multiple destinations, so that only one message packet is sent, but many scanners that need the same data can receive it simultaneously.

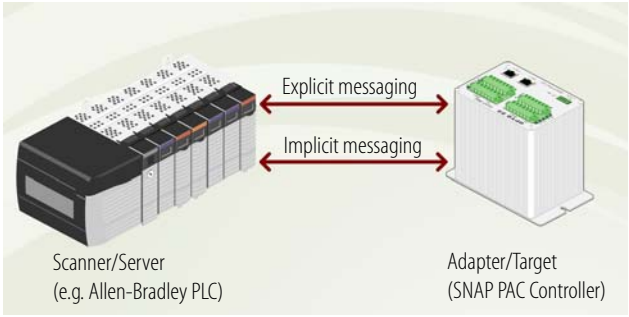
Each implicit message contains a single block of data that is referred to as an *assembly object* or just *assembly*. The block size is limited to 512 bytes of data.

To configure SNAP I/O and construct implicit messages, you use our free custom software, the EtherNet/IP Configurator.

Explicit Messaging

Contained in each *explicit* message is a pre-defined CIP protocol that states the meaning of the message. Explicit messages transport one data item at a time, and they provide the means for typical request/response oriented functions. Explicit messages are typically point-to-point.

For explicit messaging between a scanner and SNAP PAC devices, no special configuration is required on a SNAP PAC device. The scanner must be programmed to send the explicit message request. For example, an Allen-Bradley PLC can be programmed to send an explicit message to our device to invoke service 14 against attribute 137 of instance 1 of class 10 on our SNAP-PAC-R1. This means to read the current input value for point 0 as a REAL (floating point) data type. Using explicit messaging, every class we implement can be accessed in this manner.



Opto 22 EtherNet/IP Implementation

As much as possible, we use standard CIP objects, extending them for our additional functions. In some cases we have defined new objects when our implementation differs substantially from other manufacturers.

Custom Software for Configuration

Explicit messaging requires no special configuration on our device (just programming of the scanner). For implicit messaging, however, we have created the EtherNet/IP Configurator custom software, which you use to configure I/O and create assembly instances.

Documentation / Defining the Classes

The *EtherNet/IP for SNAP PAC Protocol Guide* (Opto 22 form #1770) describes how to set up Opto 22 devices for implicit messaging. It also includes standard documentation of the objects, including classes of objects, attributes, services, etc.

Additional Resources

For an overview of CIP and EtherNet/IP technology, see http://www.odva.org/Portals/0/Library/Publications_Numbered/PUB00138R2_CIP_Adv_Tech_Series_EtherNetIP.pdf

For information on the network infrastructure for EtherNet/IP, see http://www.odva.org/Portals/0/Library/Publications_Numbered/PUB00035R0_Infrastructure_Guide.pdf

For a good starting point for Ethernet/IP research on the ODVA web site, see http://www.odva.org/default.aspx?tabid=67