

The New Digi One™ IAP: From Connectivity to True Interoperability

White Paper

Abstract

This paper provides information about the challenges of achieving interoperability between industrial equipment from different system vendors. It discusses various solutions, including the Digi One IAP device server from Digi International®.

What is interoperability?

The promise of interoperability by industrial equipment vendors has almost turned into a cliché. Customers need equipment from one vendor to easily, seamlessly and cost-effectively communicate with a system from another vendor. However, suppliers of automation systems, including PLCs and associated peripherals, have made a business of locking in customers by offering equipment which is only compatible with their own products.

Customers don't believe the hype

Suppliers have launched massive spin campaigns to claim their newest “Industrial Ethernet” is actually “open”, when in practical application it is not. While many suppliers’ protocols are truly based on published “standards”, the truth is that the major PLC vendors continue to ensure their products are not interoperable because *their* equipment only supports *their* standard.

The result is that customers no longer believe the hype. They don't believe it because no matter how state-of-the-art, the newest Brand X PLC will not directly communicate with the newest Brand Z PLC.

Current “interoperable” solutions fall short

This is not to say that third parties have not seen the opportunity to capitalize on the gap. Groups such as the OPC Foundation have even come together to try to develop a means of tackling the problem. Still, setting standards for interoperability (easy and seamless installation, cost-effective) has been challenging.

One of the classes of products created to promote interoperability is the “hardware register-mapping” variety. The concept is a good one – to systematically ensure that each value on one PLC can be mapped, or manually linked, one-by-one, to a desired location in another PLC. A few problems arise with this method. First, it is highly time consuming. The average 256 I/O PLC could take hours or even days to go through the mapping process. The intricacies of register types and the knowledge required of different vendors means that only specialists (usually the device vendors) are able to do this. In addition, hardware register-mapping does not ensure that all forms of communication work. For example, a program upload/download function cannot be supported. Finally, the products are inherently expensive, ranging from \$1,500 to \$4,000. The hardware alone can be prohibitive, but add the configuration costs and the price may be doubled.

The other class is the “software register-mapping” camp. The best example is OPC-DX. Again, the pursuit is noble – to convince commonly available OPC server vendors to “DX-enable” so that virtually any supported device can talk to another. However, many of the same problems exist. First, the software register-mapping still has to happen to one data object at a time. The advantage with OPC-DX is that at least there is a standard defined to perform this function. But the major problem with OPC-DX is that it requires a computer that supports Microsoft® COM objects. This translates into another expensive piece of equipment with security, maintenance and upgrade issues. Plus, computers are still relatively expensive and unreliable. An OPC-DX setup requires an average PC (\$1500) plus at least two OPC servers (\$800 to \$3000 each). With the equipment and cost of configuration time, this solution can be more expensive than the hardware-only versions.

Finally someone gets interoperability right

The Digi One IAP device server from Digi International has been the leading solution for Industrial serial-to-Ethernet protocol conversion since its release in 2002. Its unique ability to seamlessly convert Modbus to Modbus/TCP and DF1 to Allen-Bradley Ethernet or EtherNet/IP puts it into a class all its own. It also features Digi's patented RealPort® COM port redirection technology for support of virtually any serial protocol. The newest release (September 1, 2004) adds several new features including cross protocol bridging and ASCII to protocol conversion.

Digi International closely studied the multi-vendor communication issues at hand and realized there was a better way to ensure interoperability. The result is the new Digi One IAP (Release E) which in addition to its roots as a serial-to-Ethernet and Industrial Protocol converter, now adds interoperability to its feature set. Digi One IAP has the ability to bridge Modbus (serial and Ethernet) to the Rockwell/Allen-Bradley DF1 (serial), A-B Ethernet and EtherNet/IP protocols (and vice versa). Configuration is as easy as enabling the feature in the Digi® unit and configuring the PLC as normal with new required points.

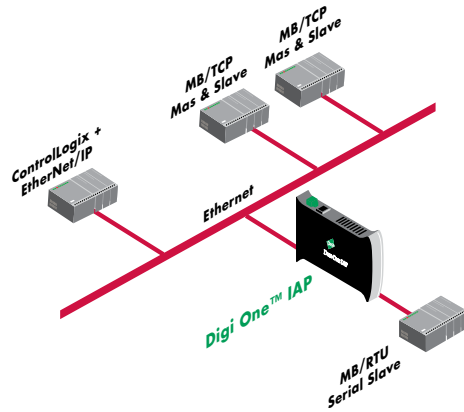
Another interoperability problem rarely tackled is the ability to convert ASCII devices such as bar-code readers, RFID, scales and cameras into Industrial Ethernet protocols. This is difficult because ASCII has no defined standard for delimiting, thus making it difficult to extract the relevant data. Digi One IAP has the unprecedented ability to integrate ASCII devices with major industrial protocols by allowing it to store the data from the ASCII device in a “virtual register” on Digi One IAP until it is polled by any of the supported protocols.

A key benefit of the new Digi One IAP is that the interoperability is not limited to just serial-to-Ethernet; the protocol routing can be done over all of its ports. Digi One IAP can act as a serial-only, serial-to-Ethernet or Ethernet-only bridge for multiple protocols.

In other words, requests/responses can be:

- Serial-to-Serial – ASCII, Modbus, DF1
- Serial-to-Ethernet – ASCII, Modbus, DF1 (serial types); Modbus/TCP, A-B Ethernet, EtherNet/IP (Ethernet types)
- Ethernet-to-Ethernet – Modbus/TCP, A-B Ethernet, EtherNet/IP

Digi One IAP also supports a true multi-master, protocol-diverse environment, which means that multiple masters can poll any slave at the same time, even if the masters are speaking different protocols (see diagram below). In other words, an EtherNet/IP master and a Modbus/TCP master could both poll a Modbus/RTU serial slave simultaneously.



Slave \ Master	MB /RTU	MB/ASCII	MB/TCP	MB/UDP	DF1 FD	DF1 HD	A-B Eth	E'Net/IP	ASCII
MB /RTU	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MB/ASCII	Yes	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MB/TCP	Yes	Yes	–	Yes	Yes	Yes	Yes	Yes	Yes
MB/UDP	Yes	Yes	Yes	–	Yes	Yes	Yes	Yes	Yes
DF1 FD	Yes	Yes	Yes	Yes	–	Yes	Yes	Yes	Yes
DF1 HD	Yes	Yes	Yes	Yes	Yes	–	Yes	Yes	Yes
A-B Eth	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes	Yes
E'Net/IP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes
ASCII	No	No	No	No	No	No	No	No	–

Does Digi meet the key interoperability requirements with Digi One IAP?

Easy and Seamless:

- Digi does not use protocol mapping. Instead we developed a method called protocol bridging. Digi One IAP is smart enough to receive a request from any supported protocol and turn it directly into a request to any other supported protocol. Users need no specialized knowledge of a PLC, only the register that needs to be polled.
- Digi One IAP does not interfere with native protocol access to the serial device. Therefore, users can still do uploads and downloads by Ethernet as if the protocol bridging were not happening.
- Because there is no unnecessary configuration, programming time is about the same as when adding the same number of new points to a controller.
- No specialized knowledge is required to use Digi One IAP – any PLC programmer can configure it.

Cost-Effective:

- Although many new features have been added to the new Digi One IAP (Release E), the price remains the same. For the same price as the previous version, users get two serial ports and one Ethernet port for up to 64 separate connections.

List of new features of the Digi One IAP Release E:

- Cross protocol translation
- ASCII to protocol translation
- Peer-to-peer for A-B DF1
- Improved EtherNet/IP support
- 64 TCP sockets support
- Masters “route” through a table to slaves
- Enhanced WebUI and setup wizards

Summary

Customers today demand interoperability of industrial equipment from different vendors. The Digi One IAP device server provides Industrial serial-to-Ethernet and protocol conversion, providing a means of easy, seamless and cost-effective connectivity for any serial device.

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DIGI INTERNATIONAL WORLDWIDE HQ
877-912-3444 / 952-912-3444 / www.digi.com

DIGI INTERNATIONAL FRANCE
+33-1-55-61-98-98 / www.digi.fr

DIGI INTERNATIONAL JAPAN
+81-3-5428-0261 / www.digi-intl.co.jp

DIGI INTERNATIONAL SINGAPORE
+65-6213-5380

DIGI INTERNATIONAL CHINA
+86-21-50492199 / www.digi.com.cn

