Clipboards are out! Protocol Gateways help make IoT efficient, accurate and low cost.

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Having complete and current data about any process can result in better decision making. One of the primary benefits of the Internet of Things (IoT), sometimes called the Industrial Internet, is that companies can make improvements in the production processes, the end-products, and logistics which also reduces costs and energy usage. By capturing and centralizing information from all the pieces/parts that go into production, and doing so in a timely, automatic, non-intrusive manner, analytic programs can find places for improvement.

Whether it be a factory, a processing plant, or a remote stand-alone location such as a wellsite, a typical manufacturing operation contains a mixed bag of sensors, instruments, PLC's, drives, RFID/barcode readers, energy management systems and other intelligent devices that don't all communicate on the same network.

Over time, sensors and automation are purchased from multiple OEM's, who in turn purchase equipment from multiple vendors, and these purchases occur at different points of time and stages in the development of automation technology. Companies merge and move equipment between plants, and upgrades to equipment are made at staggered intervals for many reasons including funding, scheduling downtime, changes to the end product, or breakdowns and obsolescence of parts.

Additionally, more and more sensors are being added to equipment new and old, so that more data can be added to the analysis. For example, an engine oil sensor can provide information so that maintenance can be scheduled based on need and optimal performance instead of a “suggested maintenance interval”. Automation replaces manual processes to improve efficiency, and this allows more information to be easily tied into the data collection process.

Does all this “stuff” just natively communicate to each other or in the same “language”? Of course not! Different media (serial, ethernet, wireless, proprietary networks) and different protocols even on the same media are common. Even as industrial control products have embraced “open architecture” and “standards”, there are still a lot of options available.

Sensor and equipment vendors select which communication methods to support based on a variety of factors, including cost, complexity, and in some cases, a desire to protect intellectual property. Different parts of the world embrace different standards.

So how can a manufacturer who wants to optimize their process get the data from the machines to a central database most effectively?
Gateways are the answer.

A gateway, sometimes referred to as a protocol converter, is a device that can communicate on multiple networks, passing the information from one to another. Using a mix of gateways, it's possible to connect all the diverse equipment in a facility to a common network, and from there to a data acquisition system and/or database. As shown in Figures 1, 2 and 5, gateways can transfer data over multiple communication media options.

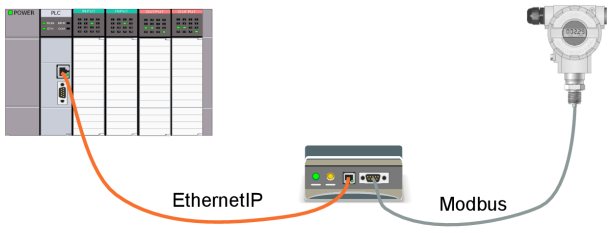

Figure 1 - Dedicated two-protocol hardwired gateway

Gateways can be dedicated hardware, or the function can be embedded in the firmware or software of an intelligent device, such as a PLC, HMI or computer. Some examples are shown in Figures 2.

Embedded into most gateway products are the hardware interface and low-level protocol details of their supported protocols. Configuring the gateway for a specific application is normally accomplished through a simple mapping process, identifying the source/target addresses for each protocol, as well as the network specific information such as baud rates, node addresses, or other.

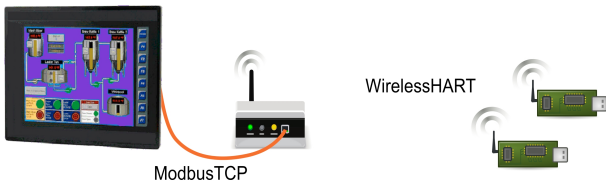

Figure 2a - Dedicated WirelessHART to Modbus TCP gateway

Gateway functionality can be embedded in hardware such as a dedicated WirelessHART to ModbusTCP gateway (Figure 2a), or implemented in the software or firmware of intelligent devices like a multi-protocol PLC that supports remote I/O, Ethernet/IP and DeviceNet (Figure 2b), or HMI supporting Modbus, ModbusTCP and Ethernet/IP (Figure 2c).

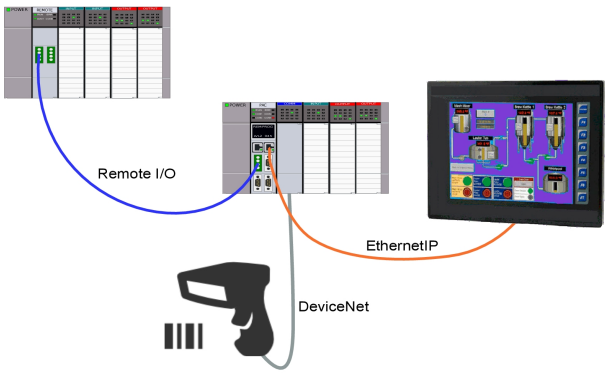

Figure 2b - Multi-protocol PLC provides gateway functionality

Gateway products that pass data from one communication protocol to another are available from dozens of vendors, and you can find a dual-protocol gateway to convert between almost any two protocols.

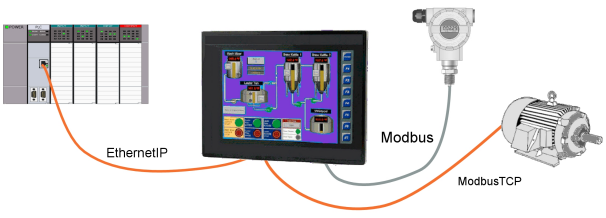

Figure 2c - HMI as multi-protocol gateway

Many PLC's today include both Ethernet and serial interfaces (and/or support added protocols via communication modules), and thus could potentially be used for protocol gateway functions. Most modern HMI products have multiple ports (eg: serial, Ethernet, USB) and support more than one driver simultaneously, and so can be used as a gateway for the most popular industrial protocols.

Some gateway products are even more flexible. They include a host of hardware interfaces with user-selectable I/O drivers so a single product can serve a wide variety of communication needs. One example is SoftPLC Corporation's Smart Gateway, which has an embedded 4 port managed Ethernet router and 6 serial ports, each of which can be configured for different protocols such as ASCII, Modbus, DF1, CAN/J1939, ModbusTCP, and many others. SoftPLC Gateways also provide hardware options to add support for a wide variety of fieldbus networks *(eg: DH+, Profibus, DeviceNet)* and remote access *(eg: wireless, cell modem)*. In fact, SoftPLC Gateways can support up to 16 networks simultaneously with no data limits.

Figure 3 - SoftPLC Corporation's Smart Gateway includes a 4-port managed Ethernet router and six serial ports that can be configured for protocols ranging from ASCII, Modbus/ModbusTCP, DF1, CAN/J1939, and others.

Appropriate use and selection of gateways provides connectivity to all devices, whether they are single sensors or controllers with thousands of data values. Gateways can make the IoT a practical reality.

Example Gateway Applications

Multi-Vendor Automotive Parts Line

An automotive manufacturer needed to upgrade an outer body parts stampling/forming machine due to new OSHA safety regulations, and the desire to enhance performance. The original machine controls consisted of an Allen-Bradley PLC-5/80 connected via an obsolete Ethernet sidecar module to an obsolete Mitsubishi PLC Ethernet interface module. It was decided that replacing the PLC-5 was beyond the scope of this upgrade.

The new design required the addition of a number of Siemens Safety PLC's, providing a non-obsolete ethernet connection to the Mitsubishi PLC, and implementing a high-speed serial interface to an upgraded OmniLink Press Controller.

To tie all the equipment together seamlessly at the high data transmission speed required, protocol gateways were required. Many of the gateway products evaluated supported only 2 protocols at a time, which would require multiple gateways on the machine. Instead, they used a single SoftPLC Smart Gateway, which provides all of the following in a single module:

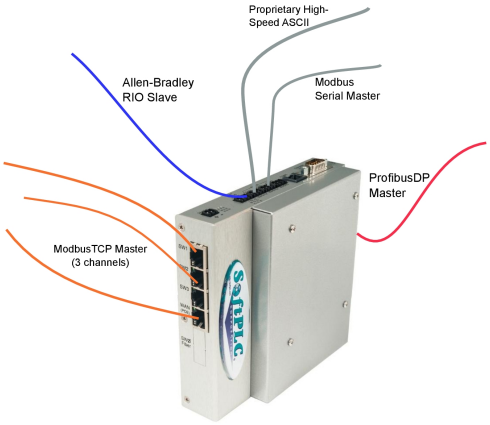

Figure 4 - Multi-Protocol Smart Gateway connections to stamping line equipment

- ModbusTCP to/from the Mitsubishi PLC
- Profibus to/from the Siemens Safety PLC's
- Modbus serial to/from the Press Controller for low priority data
- Custom serial protocol from the Press Controller for the high speed data
- Allen-Bradley RIO (remote I/O) Slave to the PLC-5
- ModbusTCP to/from the HMI, which is tied into the plant MES system

Distributed Assets Data Acquisition

A company that provides chemicals used at oil well pumping sites was able to improve delivery logistics which reduced their customer's downtime while reducing fuel and labor costs. At each well site, level sensors were added to the chemical tanks, and a gateway was used at each site to log the tank levels and send them over cellular connections to a private VPN in the cloud. A logistics application used this data to optimize truck drivers routes.

To reduce communication costs, where wells were clustered together, a local mesh network connected multiple sensor gateways to a master gateway connected to the internet cloud.

As shown in Figure 5, a mesh of gateways at multi-well cluster with a master gateway that connects to the cloud via a cellular network. Cloud data is then forwarded on to a Logistics application at headquarters.

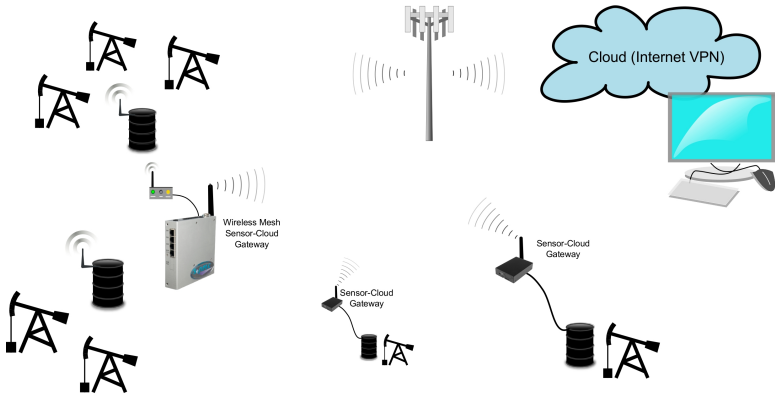

Figure 5 - IoT/M2M solution using modem-equipped gateways