Implementing SNMP in Process Control

As Ethernet continues its steady march onto the plant floor, industrial users are beginning to make use of Ethernet functionality that was initially only used by Enterprise network administrators. Simple Network Management Protocol (SNMP) is one of the tools embedded in many modern Ethernet devices that offer the industrial user unprecedented access to real-time network performance and troubleshooting data. A modern distributed control system can be likened to a three-legged table–the first leg being the distributed controllers, the second leg being the HMI software, and the third leg being the network, which connects the controllers and software together. If any one of these legs becomes unstable, the performance of the whole system becomes suspect. Modern PLCs and DCS controllers often have dedicated data registers within them that offer real-time "health" information about the controller. This diagnostic data helps to verify that the controller is performing reliably. In the same fashion, SNMP management data reports on the real-time health of Ethernet network devices. Implementing an SNMP-based network management system can help to ensure that Ethernet network-based control systems perform as reliably as they should.

What is SNMP?

SNMP is a protocol designed to give remote management access to an Ethernet network device. The protocol was developed in the 1980s as a tool to allow network managers the ability to monitor and control their rapidly growing TCP/IP Ethernet infrastructures. Prior to remote network management tools such as SNMP, a network administrator would have to be physically attached to a network device to access configuration and troubleshooting information. Although there were initially a number of remote management protocols, SNMP has become the de facto standard. Manageable network devices are actually quite similar to PLCs in a fashion. An SNMP agent embedded on the manageable device monitors diagnostic and device configuration data. This SNMP agent is embedded on a microprocessor that is built into the network device. The management agent has data stored in memory locations, just like data registers in a PLC. The data can be accessed by polling the SNMP agent in the network device from a remote computer, using SNMP protocol. The database within the manageable device is called an MIB (Management Information Base.) There are two types of MIBs, public and private. Public MIBs contain information that is common amongst most network devices. The private MIB contains information unique to that manufacturer's product.

Currently, network administrators use a variety of network management software tools which allow them to display and historically record network status information. A huge amount of data can be polled from the network devices, including port link status (Is the port connected?), port link speed (10MB/100MB, etc.), data rates per port, network errors per port, power supply status, and many others. SNMP is not a read-only protocol, however. SNMP also allows an administrator to configure remotely as well as performing management functions, such as enabling a port, setting data communication rates on a port, etc. SNMP and manageable network devices can offer functionality that would help industrial users to maintain confidence in the performance of their control system network.

How do I implement SNMP in my network?

The first requirement for SNMP management is the use of a TCP/IP-based network. Almost all modern Ethernet control protocols are based on TCP/IP, so very few systems are limited by this requirement. Secondly, you must have "manageable" network devices. A network hub or switch does not have to have a management agent embedded in order to operate. Unmanaged network devices do not have on board the processor necessary to house the SNMP agent. Many manufacturers offer two versions of their network devices, one which is unmanaged, the other managed. Fortunately, more and more devices are offering SNMP management. UPS manufacturers, serial device server manufacturers, and others are implementing SNMP in their devices. Having the ability to know when a UPS switches to battery power in a remote location can be very useful! The third requirement is to use a Network management software package. Most of the current network management software packages are designed for a commercial network administrator. Implementing the network management software in a industrial control network generally is accomplished using a dedicated network administrator PC, since many control system designers are cautious about running multiple applications on their SCADA/HMI servers. Unfortunately, this leads to a total control system that has two "dashboards." One dashboard displays the network status. The other "dashboard" is the HMI package, which displays real-time PLC and control system parameters. Industrial Networking Solutions has released a new hybrid network management package called IndustrialSNMP Suite. IndustrialSNMP has a traditional SNMP management tool interface so that a control system network administrator can read and write data to remote manageable network devices. However, a powerful new tool has been implemented. Using the popular Microsoft OPC Server within IndustrialSNMP, control systems can now monitor and operate both the controllers and their manageable network devices from within the HMI environment. SNMP MIB data tags can be made into HMI "tags." This flexible driver can both read and write to the network devices, and SNMP MIB data can now be stored in the same database as control system tags. This merging of the network and control system data into the same database ensures that analysis of control system upsets can also account for network status at the time of the upset.

Additionally, since MIB data can be somewhat cryptic, IndustrialSNMP has incorporated predefined tag databases for a range of popular manageable network devices. By using these predefined tags databases, control system designers can save the time previously spent scouting through the MIB for pertinent tags. Although IndustrialSNMP Suite allows the designer access to any available MIB data, the pre-selected tags are those found most useful to control system operators. Information about each network

device includes port link status, port speeds, power supply health, and traffic flow on each port, amongst other vital information. Additionally, the cost of operating two “dashboards” is no longer necessary. The powerful historical data logging, trending, and graphical user interface tools that are part of modern HMI software, can now be used to track network data as well. The cost and lack of database integration inherent in the traditional two “dashboard” system is no longer necessary.

Accessing and using SNMP data is the next logical step in the progression of Ethernet into the modern process control environment. Having the ability to ensure the health and performance of the network at all times further strengthens Ethernet as a communication backbone for future control systems.