LOCAL AND WIDE AREA NETWORKING OF GAS FLOW COMPUTER

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1.0 Introduction

Communication has been around ever since man developed language and hand signs to exchange and share ideas. Smoke signals were used in the ancient world to send information from one place to another. In fact, a smoke signal is one form of wireless communication. The advance in semiconductors, communication, network and computer technology has led to the growth of electronic forms of communication. Electronic data can be transferred between computers in the same office and sometimes even between offices in different cities.

Electronic flow computers are used widely by the gas industry for measurement and control purposes. Measurement data is retrieved periodically and stored in the central computer system for accounting, engineering and administrative purposes. Control commands are sent by the gas control department or the field operators to the gas flow computers. Data are collected from the field and shared by different departments so that decisions can be made more efficiently. Because of this, an effective communication system between the electronic flow computers, the central computer system and remote offices need to be developed.

Electronic flow measurement systems can now make use of this office interconnectivity to effectively move data from the electronic flow computer to individual workstations out in the field offices and the central office. Electronic flow measurement systems can utilize existing general-purpose business equipment for communicating measurement and control data across networks.

2.0 Terms

Local Area Network (LAN): A Local Area Network is the interconnection of multiple computers contained within a single building or facility.

Wide Area Network (WAN): A Wide Area Network is the interconnection of multiple computers that covers a broad geographical area such as a city, state or country.

TCP/IP: Transmission Control Protocol / Internet Protocol (TCP/IP) is a name given to the collection of protocols that have been used to construct the global Internet. It is the typical protocol used for communications between computers across a LAN or WAN.

IP Addressability: IP addressability is the ability to configure a device with an address that is unique to a particular LAN/WAN.

Ethernet: Ethernet was developed in the 1970s by Xerox Corporation. It uses a single cable to connect all computers or devices together through an interface hub. CSMA/CD (Carrier Sense Multiple Access/Collision Detection) is used to regulate traffic and to avoid collision on the network. Today, the physical interface is the same as the IEEE 802.3 standard.

3.0 Electronic Flow Measurement Data

Measurement data stored in electronic flow computers consists of vast amounts of hourly and daily records in addition to alarm and event logs that must be retrieved on a periodic basis. Various departments use this data for everything from accounting to engineering. An example of this would be retrieving historical tubing and casing pressure information so that it can be analyzed by the engineering department.

A typical historical record consists of volume, energy, average differential pressure, average static pressure, average temperature, average square root extension, flow time, and possibly average gas quality values. This data is stored

for each hour for each meter run in each flow computer in the system. Because of the nature of historical data, retrieval is done at a less critical rate than control data. For accounting or analysis purposes, the data can be retrieved on a daily basis.

Control data is needed at a much faster rate. Decisions made by gas control personnel must be made using up to date information. When the commands are actually made to the flow computers, it must take place immediately, giving the operator immediate feedback.

Typical control data consists of instantaneous flow rates, set points for PID loops, nomination values, as well as valve control commands and statuses. This is a typically small amount of data retrieved and transmitted in real time.

4.0 LAN/WAN

LAN is a computer network dedicated to share data among workstations, computers and devices (nodes) within an office. An interface device converts the user information (data) into a predetermined form (the protocol, usually TCP/IP) on a communication medium (Ethernet). These types of networks have the ability to transfer data at rates of 100 megabits per second or higher. A central server is used to store data and control the traffic within the network. Data, printers, storage media (such as hard drives) can be shared within the network. With common protocol and medium, computers and devices can share information easily.

WANs are built to provide communication solutions for offices that need to exchange digital information between two distant places (in one or more different cities). Since the distance is long, the local telecommunication company is involved to provide and maintain the necessary service.

The main purpose of a WAN is to provide reliable, fast and safe communication between two or more places (nodes) with low delays and at low prices. WANs enable an organization to have one integral network between all its departments and offices, even if they are not all in the same building or city, providing communication between the organization and the rest of the world.

5.0 WLAN – Wireless Local Area Network

WLAN connects computers over short distances using RF (Radio Frequency) radios usually in the ISM (Industrial, Scientific and Medical) frequency bands in the 2.4 GHz range. It is usually an extension of an existing LAN/WAN system where cabling is impossible with the existing structure or mobility is necessary. Just like IEEE 802.3 specifies the hardware standard for Ethernet, IEEE 802.11 specifies WLAN operations in the 2.4 GHz ISM band. 802.11b specifies operations up to 11Mbps and 802.11g extends the operations up to 54Mbps. Two different transmission techniques are used with the 802.11: FHSS (Frequency Hopping Spread Spectrum) or DSSS (Direct Sequence Spread Spectrum). The carrier frequency in a FHSS radio hops in a pseudorandom sequence known only to the radios within the network. With a DHSS radio, a pseudorandom sequence is multiplied with the signal before the signal is transmitted and since the sequence is known to the receiver, the signal is then decoded at the other end. Today there are ultrawideband radio networks that build on a mixture of standard and proprietary technologies.

6.0 LAN/WAN for Data Sharing

Most companies using gas flow computers are spread across a wide geographical area. The flow computers are typically in extremely remote locations. A field office is usually setup in close proximity to the flow computers for ease of maintenance and control. The accounting and engineering departments are located in a more centralized location. Data from the flow computers must migrate from the remote flow computer all the way to the central offices.

The existing LAN/WAN used for other business purposes (e.g. email, accounting, etc.) can be utilized for the sharing of this data. Host systems can use existing shared drives to move data from one office to the next. For example, a host system will communicate with the gas flow computer and store that data on the shared drive. Workstations remote to the host system can then access that data for reporting and analysis purposes.

Another method of data sharing is the use of TCP/IP between host programs. Host programs that are capable of communicating via TCP/IP

can transmit data using the existing hardware to access data. For example, instead of transferring large files across the network, a program running on a workstation in a central office can request specific data from the host system residing in the field office. This type of system is typically used for data that is more time critical such as control parameters that must be immediately relayed to the flow computer.

6.0 LAN/WAN for Flow Computers

An alternate use of the existing LAN/WAN infrastructure is the direct communications of a host system with a flow computer. An IP addressable LAN/WAN interface device can be connected to the host port of the flow computer. This makes it possible to connect a flow computer to any existing network on the LAN/WAN and allow a host system to retrieve its' data. For example, a flow computer measuring gas on an offshore platform can link into the existing microwave network used for email, voice and network connectivity. A host system that resides anywhere on the LAN/WAN can then communicate with this device without the need of a satellite or cell phone system.

A communication system such as a radio network can also be connected to the LAN/WAN using an existing network interface device. A host system can request information across the network and through the connected radio network; data can then be transmitted to the flow computers in the field and back to the host.

7.0 Conclusion

Existing LAN/WAN infrastructure can be utilized to create a fast, reliable and cost effective communication network between the flow computers, the host system in the field office and the computers in the central office. Different departments and offices in different locations and cities can then share electronic flow measurement data. Taken further, because of the use of TCP/IP and the LAN/WAN, data can now be shared on the internet.