Methods of Gathering Electronic Gas Measurement (EGM) Data

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Introduction

This paper is intended to discuss various methods used to collect Electronic Gas Measurement (EGM) data. There are quite a few options on the market today when it comes to remote measurement data collection in the Natural Gas industry. Due to advancements in technology, we have seen changes in most all the options available making each product viable and made to serve a particular niche. Depending on your company's philosophy and direction, the data collection equipment may be as simple as a hard line phone modem or as advanced as satellite monitoring. We have seen a large rise and then decline of spread spectrum radio networks due to the sheer number of radio networks and realized interference. Quite a few companies are choosing to move from serial and go with IP technology all the way to the RTU in an effort to bridge multiple networks and protocols. Licensed radio networks have been around for quite some time and are still being utilized in certain geographical areas where the power in a particular frequency band is essential to meet performance and reliability requirements. In very dense and remote areas, companies are forced to utilize satellite communications to ensure efficient communication to end devices. Satellite communication devices can prove costly but are often the only alternative when attempting remote data collection in some parts of the United States.

Data Collection Methods

Spread Spectrum Radio

- Spread-spectrum telecommunications is a signal structuring technique that employs direct sequence, frequency hopping, or a hybrid of these, which can be used for multiple access and/or multiple functions. This technique decreases the potential interference to other receivers while achieving privacy (1). Spread Spectrums will operate in the 900 MHz or 2.4 GHz range. A 1 watt radio may travel up to 15 Miles line of site.

Licensed Radio

- Licensed radios have been used extensively in the natural gas sector for years. The radio will transmit a signal within a licensed frequency and the user can expect an extended communication range as compared to the spread spectrum radio. Licensed radios can operate in the 370-520 MHz and 900MHz range. There is a 5 watt and 10 watt option available and the signal can travel up to 60 Miles.

Cellular Modems

- Cellular Modems provide a fast and effective way to deliver a gateway for remote data collection from an RTU or PLC. Cellular modems are activated by a licensed cellular network provider and assigned an individual IP and telephone number. Updates in technology have allowed an individual cellular modem to connect on separate cellular provider networks allowing for a more enhanced coverage area. Cellular Modems can be costly to maintain due to frequent replacement costs and service fees.

Satellite Systems

- Satellite communication systems provide a high speed satellite communication link to end devices for internet and network communications. Satellite networks are often utilized in very remote areas and can be somewhat costly to operate.

Internet Protocol (IP)

Although IP (Internet Protocol) technology has been around for roughly four decades, the Oil and Gas industry has only recently moved toward using this technology universally and in conjunction with end devices the last five years. These end devices can be described as RTU's, Natural Gas Chromatographs (NGC's) and Ultrasonic Meters (USM's). Prior to IP technology, serial connections were mostly used to communicate with the stated end devices. In the recent past, it has been common to have IP technology strategically located at a master serial radio point within a serial communication backbone radio network. The IP technology commonly used, such as a cellular modem, served as a bridge between a

serial network radio connected to an end device and the SCADA system. With the availability of new technologies in the industry device manufactures started to make Ethernet communications standard on their products. As a result, there has been an industry wide push to make IP or Ethernet communications a more prevalent means of communicating across the board. With the described advancement in IP technology, there are many advantages in using IP over using serial communications.

Advantages of IP communications:

- IP networks can help more easily bridge an ever expanding Oil and Gas industry from end devices to SCADA systems
- IP is very adaptable and can easily mix different protocols for communication purposes
- Divestitures and acquisitions can easily be integrated into an existing communication network using IP because of its adaptability and expandable protocols
- IP networks can communicate with multiple master radios simultaneously as compared to a serial network which has a one to one relationship
- Simple Network Management Protocol (SNMP), TELNET or HTTP can be used for common trouble shooting and diagnostics (**cite**)

Communication Infrastructure

It is very important that this paper discusses the role a communication infrastructure or a "backbone" plays in the measurement data collection process. Establishing this infrastructure is crucial to ensure that measurement data from each and every end device added to a network is collected timely and efficiently. Often times this infrastructure is developed as the "play" is drilled out and/or compressor stations are added. This can then contribute to additional headaches if the build out is not strategically planned. By using new technologies developed by Geographical Information Systems (GIS), such as layered mapping programs, companies can stay a few steps ahead of the drill bits and logistically develop a communication infrastructure. When consulting GIS, Wireless Engineers can utilize geographical information, existing communication hardware and company owned property so to plan and design optimum field sites to install towers and other communication equipment. Similar technologies are also used by wireless communication companies to preform sight surveys which help ensure accurate positioning of radio or modem network master hubs so that rework is not done when additional end devices are added.

The CLOUD

Once the EGM data is collected from end devices and passed through an integral network of IP addresses, what do we do with that data? Where should the data be stored? The technologically advancing world, including the Oil and Gas industry, has in the last decade been introduced to the CLOUD. Most people are aware of iCloud, the data storage location used by Apple to house and transfer data for your iPhones, but are not aware of the limitless possibilities for this technology. The CLOUD is defined as a network of servers used to both deliver services and to store data. (1) Typically, most CLOUD data services are provided by large information and technology companies such as Google, Amazon, Apple and Microsoft. CLOUD services and storage can be purchased at very economical rates when compared to installing and maintaining an in-house system of servers. This is due to most maintenance being outsourced by the stated larger companies above, making their respective CLOUD services very efficient and cost effective. There are multiple points however, to take into consideration when it comes to purchasing external CLOUD services and outsourcing application housing and data storage. One particular point, and what one may also consider a disadvantage, is security. The data housed on an outsourced CLOUD server network will more than likely end up residing on a public domain. To combat this, currently you can purchase space on a public CLOUD in which you have the option of storing information that is encrypted by the server before being stored. The encryption is such that a complex algorithm will decrypt the data before storage and retrieval so that the data is kept secure. Even with this encryption however, your data will eventually live on a public server and that server is subject to cyber-attacks. For future state solutions, the CLOUD can be a good cost effective data application and storage location for many oil and gas companies but risk needs to be properly accessed so that confidential data is not potentially compromised. Please see below all the advantages and disadvantages of moving applications and data storage to the CLOUD vs. internal company servers.

Advantages:

- Lower costs for data storage and maintenance
- Data expansion space that will grow with the company

- Sharing and accessing data is easily done from any internet connection and from most all mobile devices
- Multiple, redundant servers in place to help prevent data interruptions or loss
- Updating applications or devices linked to the CLOUD can be done easily from one central location

Disadvantages:

- There is always a risk with storing data outside of the internal network
- Risk of leaks or data breaches caused by Cyber-Attacks
- Outages that do happen will be out of your local IT group's control
- Encrypted data will be accessible but not easily decrypted if an outage occurs
- Troubleshooting issues with data and applications stored on the CLOUD will most likely be done with an outsourced firm

Conclusion

Wireless technologies today are ever changing and progressing at an astounding speed. If oil and gas companies, like most all other companies in the world, resist evolving and updating their communication infrastructure and databases, they will soon be left behind and possibly struggling to maintain a system that is no longer supported or meets their business requirements. It is very important for each company to evaluate their business needs with respect to data collection to ensure that their current systems are not so outdated that necessary functions cannot be met. In today's world, oil and gas companies must leverage their Information and Technology System Specialists, GIS Specialists and Wireless Engineers when developing new or updating existing communication infrastructure to ensure a seamless flow of measurement data into their SCADA systems and beyond.

References

(1) https://en.wikipedia.org/wiki/Spread_spectrum