COMMUNICATION SYSTEMS FOR GAS MEASUREMENT DATA

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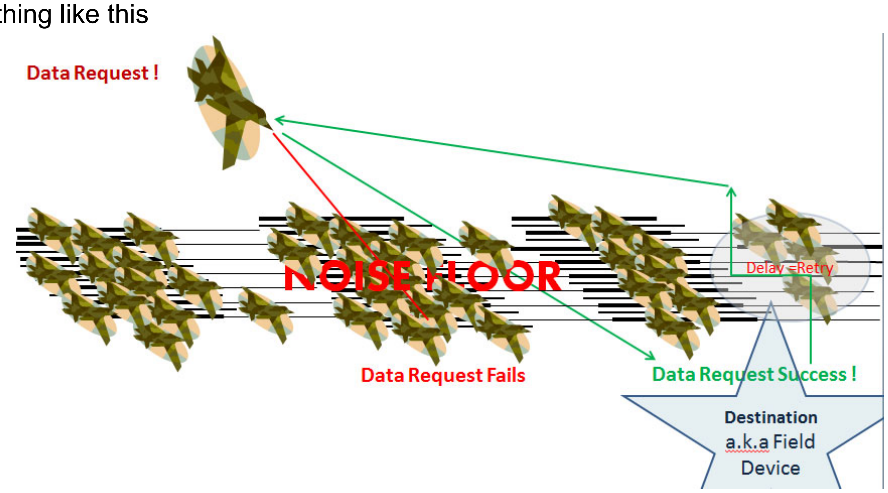
To understand and improve success in the collection of SCADA and EFM data you must first understand the world you operate in. I know most anyone in the industry has their concept of it but I want to introduce you some new ways of viewing this world from a somewhat non-technical stance.

I always think of SCADA networks this way, what if there were no air traffic controls on airports or any airspace? Busy airports would have constant airline crashes, multiple airplanes trying use the same runway, multiple airplanes at the same altitude etc… In general it would be chaos.

In this analogy you are trying to fly an airplane through flocks of birds, in a fog with other airplanes, no radar, altimeter or air traffic controllers to tell you where you or other planes are so you can avoid colliding.

However you still have to successfully take off, reach the correct destination, and land safely. Then take off again as other planes are landing blindly. Then travel back to your original point of origin 100% of the time without crashing. And you want to do this every few minutes or even seconds.

It might look something like this



Think of it as haphazardly being able to hit the gaps with the lowest amount noise to be successful!

Frequency ranges typically utilized in the field are 900 MHz and 2.4 GHz. These frequency ranges were released as "junk band" or public use by the FCC in the 1980's and 1990's. These frequencies were adopted by everything from cell phone manufacturers, wireless home phones, two way handheld radios and many more. This is part of what causes your increases in the noise floor.

Statistics indicate that there are approximately 1,000,000 radios deployed across the U.S. and sales expectations for 2013 are upwards of 100,000 additional radios. In the ISHM world, we can expect a great many of these to end up in the Bakken play and you have the opportunity to engineer the networks for optimum efficiency due to being in on the ground floor of drilling and production.

As RF frequency (hz / ghz) increases the signal is easier to deflect so as you move from 900 mhz radios to 2.4ghz you can expect to deal with more signal deflection and interference from other towers, tree's buildings etc.

Simply put, the signal is easier to block than the older 900 mhz range. Generally speaking it will be a little more sensitive.

However, new technologies from the radio manufacturers is making it easier to pick a frequency and radio network or sub-frequency, then maintain it.

Many radios have been installed using the default TCP ports and default RF network ID#. This should be avoided to reduce chatter and conflicts between networks.

In a perfect world each company, in each field, would have their own assigned IP's, TCP port range and RF network range. But since we don't live in that world one company will pick ranges that work for them, place towers and repeaters as they require them. Many times this increases the failure rate for another company so they make changes or add repeaters etc. and the fight continues perpetually. Signal to noise ratios decrease shortening RF range and increasing failures.

The Wattenburg field in Northeast Colorado is a prime example in that RF ranges have been continuously reduced over the last several years, from nearly 30 miles to approximately a 6 mile range. Some companies have been more successful than others in defending their distances however, overall success is not what it was and the noise floor has been ever increasing which is what typically causes the communication problems encountered by the field engineers.

Simultaneous to these change's data requirements have been ever increasing in quantity and frequency. So you have a situation where the communications backbone is degrading and the data haul has become more frequent and for larger data quantities.

So what can you do about it? How do you monitor for predictive failures caused by this pattern of behavior? Become more successful in SCADA data and EFM data collection?

Key data points that I would recommend tracking within the SCADA system are as follows:
1. Queue time – How long was it held before transmission?
2. Thread counts – Active TCP connections.
3. TCP connect time – Length of time it took to connect to the TCP port.
4. Number of retries – Packet retries <u>and</u> poll retries from time outs.
5. Turnaround time's – How long from request generation to successful response?
6. Request response size –data response size tracking allows you to identify problems based on traffic size.

Interpretation:
1. If queue times increase then poll frequency is exceeding turnaround times. If this is not typical then something in the com path has degraded.
2. Thread counts should be maximized. This is accomplished by diversifying the TCP port configurations in the communications paths to the field devices.
3. TCP connect times, these can indicate degradation in the network that will have to be researched by network engineering in many cases.
4. Number of retries, this is impacted by the entire com path as well as the com setup in SCADA. Device timeouts and packet timeouts impact retries.
5. Turnaround times degrading usually indicates RF retries and issues within the signal to noise ratios on that RF network.
6. Request Response size will allow you to compare similar requests, with similar responses and retries to derive the optimum configuration.

- One key assumption is that the SCADA system you are using will continuously try to collect missing data.

Key components for scheduling SCADA polls

1. Balance the polling frequency based on data priority.
2. Do not exceed the request response time or you will grow and possibly overload the queue which could crash the SCADA system.
3. Know the write frequency of the device data. IE: Totalflow NGC's write new data every 5 minutes so asking any faster than that is not useful information and just added traffic.
4. Remember sometimes not all data writes on the same schedule even within the same device.

Scheduling Historical Data Polls for EFM data

1. Once a day is all you need to poll for Daily historical records. They write after there are 24 hours of data collected. These can be collected the following hour after the contract time.
2. Log Period records are typically 1 hour intervals. Thus, that would be an adequate rate unless you are using time zone times, and then this would require more research to balance the schedule.
3. Finally, run missing data reports and identify sites that will need to be hand collected due to being offline.

In closing, remember you need data based on priority, frequency, and device data storage rates.
All companies are competing for the same bandwidth in the same fields. Therefore, you can expect failures and performance degradation. How you mitigate the impact is by configuring your system to monitor and identify predictive failure patterns. This will allow you to avoid downtime and identify normal versus abnormal situations.