HighWire Measurement Data Integration Architecture

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Properties of a good measurement integration measurement directors wants and needs from a measurement system

Measurement data independent of SCADA and immutable (Can I control my own destiny?)

The biggest impediment AMP has encountered toward good measurement is the requirement to depend on what a SCADA group was willing to provide for the measurement system. The foundation of measurement is based on **measurement records** from devices including PLC(s), flow computers, tank gauges, etc. Scada is driven by the need-to-know discrete data points now. A similar example comes from trading, the price (pressure) right now is important to traders (operators); however, the trade (measurement) is a record that contains many properties that come together at the time of the trade (measurement.) You must know what date and time the trade happened, what the volume was, what the price was, how the amount is calculated, and the financial instrument involved etc.

Just as trade capture system cannot accept the possibility of a trade being change before it is saved in the system of record, measurement systems have the same requirement. SCADA systems like to fill in data when it is missing because the last value may be good enough until the next value come available. This is mostly not true for a custody measurement system.

The early drivers for SCADA as the source of measurement have been security, bandwidth and connectivity issues. Tight record size was to be critical driver in database record design in the 80-90s; however, so was the amount of request made to a measurement device. With the advent of new technologies, the bandwidth is becoming less of a driver. When the device can just tell you when a measurement when it gets one the bandwidth can be shared better.

Event based vs. polling (Can this interfere with SCADA or cause a security breach)

When electronic flow computers where first created they depended on the communication protocols available at the time and were connected locally most likely to a printer. An example would be serial communications like the earliest computer terminals used by airline reservation systems. With the advent of TCP and the internet the flow computers were hooked to a network. This drove the advent of polling a flow computer for data, all they had was request reply. Event models of communication were not perfected until later. Polling is wasteful because request very many requests before the result might be there. Also, it has complications that the data is constantly changing and if you don't ask the flow computer enough you might miss the data. Other problems that arise with polling because there many systems that require the data measurement, SCADA and other systems like systems of reference like PI. With Topic based event model, by definition, the receiver cannot control the sender unless the send allows for it by becoming a receiver of requests.

Shared source of data and guaranteed delivery. (Does it produce reliable and comparable data)

Topic based publishing of data has become a common pattern for system architectures. This pattern allows for publish once and receipt by many. This architecture is utilized for efficiency, it also disconnects the sender from the receiver. The sender does not have to know about the receiver and new receivers can be added without changing the sender. Messages can be guaranteed to be delivered or transient based on the needs of the receivers. Measurement needs guaranteed delivery whereas SCADA in many cases does not care what the pressure was 2 weeks ago.

First principles for architecture. (Keep it simple stupid)

Good measurement happens when there are fewer moving parts between the source of the measurement and the measurement system. Elon Musk says, “The best part is no part”. He always asks what the part does, how much does it cost, how does it add value, and how can we do without it. As far as measurement is concerned most systems (stopping points) in between the device and the measurement system add no value and most cases are a determent to reliable correct and immutable measurements. “That device said it was this measurement how can it be anything else?” What value for a measurement system can be added.

Industry accepted standards (Did I buy OS2 instead of Windows, token ring instead of ethernet?)

Modbus has been wildly successful as a standard, TCP/IP by a gigantic magnitude more and it enable the internet. The internet allowed for remote polling software. This can be very subjective is what starts many fights until time determines a winner. When choosing an architecture, you need to investigate current developments with the honest understanding of what your real underlying requirements are. You should also examine what others are doing in your industry and what the big technology companies have adopted. There are many game changing technologies that are currently inplay, for example AWS/Azure hosting, queue brokers hosted by the former, IOT/MQTT brokers hosted by the former, and Starlink technologies. When to adopt becomes an issue, sometime late adopters like some countries that adopted cell technology later have better cell networks now. Some like K-Mart waited too long and Walmart cleaned their clock with their technology choices. Beware of bespoke applications not using industry standard that can put you in a corner later.

Properties of Cost (How much will this cost?)

In measurement it can be you can either pay me know or pay me later. An example is measurement acquisition is many times underfunded; however, usually this requires additional personnel that will likely cost more over time. The items above cover topics that in the end will save money which is why they are many times the drivers for good measurement management.