

The Increasing Emergence of Wireless Devices in the Refining & Petrochemical Industry

**Why, Where, and How to Apply Wireless
Equipment in a Smart Way**

www.signal-fire.com



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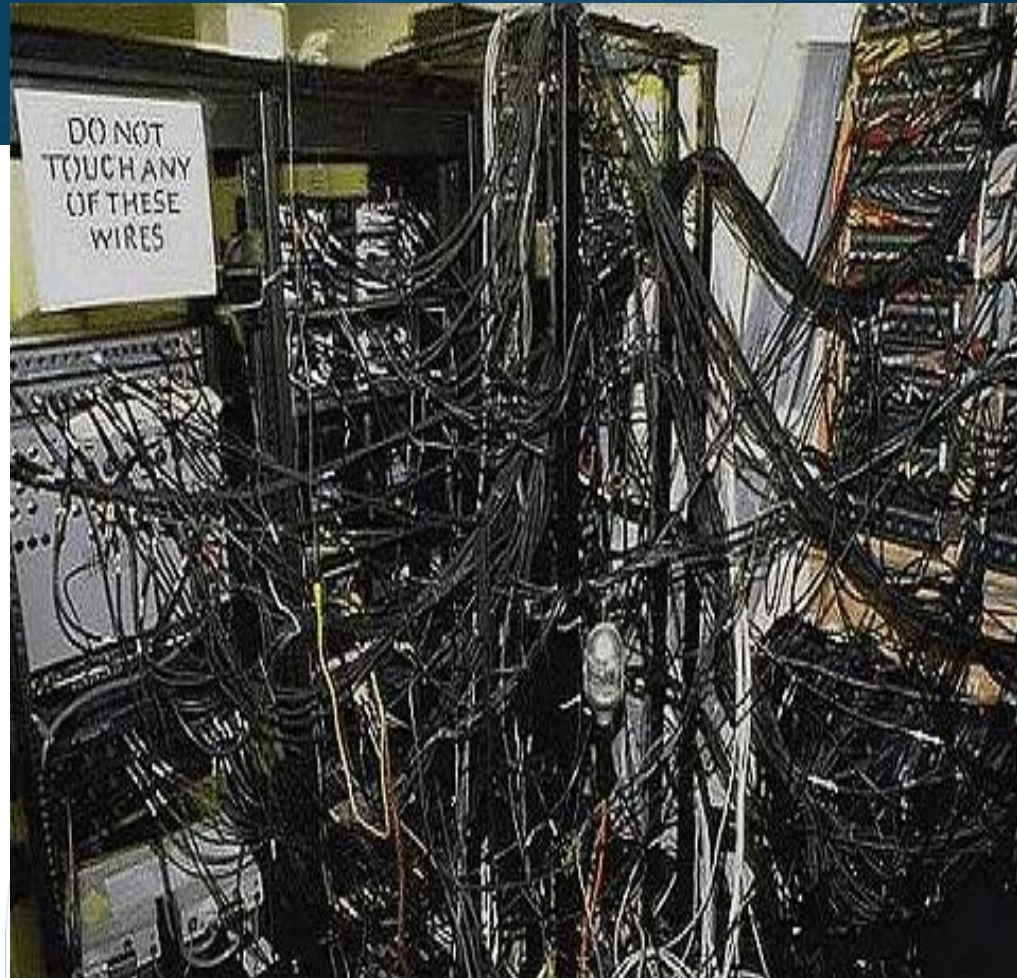
A Very Short History

FOUNDER OF SIGNALFIRE TELEMETRY

- Company Founded 2006
 - Saw Multiple Requests for Low Cost, Low Bandwidth, High Reliability Data Transfer Network
 - Nothing “Real” Existed
 - “Utility” Data
 - Streetlights – 10’s of thousand’s of nodes, very small data per node
 - Parking Meters, Vehicle Parking Sensing System
 - Identified the Upstream Oil and Gas Market as a User of this type of Radio Technology – **Needed a System**
 - “Practical” Part of a SCADA System
 - Upstream Oil and Gas Monitoring and Control
 - Midstream and Downstream

Why Wireless?

- Eliminating Cabling – Especially attractive after the initial installation is done.
- Physical Limitations – There are many places where you can't, or it is very impractical to run cables.
- Cost – As range increases, wiring costs do as well.



Why?

This is Expensive and Time Consuming



When and When Not to Use Wireless

OPEN AND CLOSED LOOP APPLICATIONS

- Open Loop Applications – Monitoring and some control where latency is not 100% critical.
- Closed Loop Applications – Control and Monitoring Combined with low latency requirements
- Closed Loop Applications are not often accepted using wireless technology
- There is a way to deal with this but it requires specialized equipment designed for a particular task at the measurement and control point and it is not always practical

Wireless Choices – How do you choose??

WIRELESS PROTOCOLS – NO ONE SIZE FITS ALL!!

- Frequencies – 915 MHz, 2.4 GHz, Licensed
 - ISM (free/no license) bands 915 MHz/2.4 GHz
 - 915 MHz – longer range ~ 2X
- Standards-Based vs Proprietary Protocol
 - Standards – Wireless HART, ISA 100, Zigbee
 - Supposed Interoperability
 - Proprietary Protocols – Usually associated with a particular vendor
 - Oleumtech, Accutech, SignalFire, Freewave...
 - What is the real difference?
 - Proprietary protocols have been designed to solve a specific problem
 - Standards-based protocols often developed by a consortium and must “serve multiple masters”

Power – Important in Many Remote Applications

LOW POWER PROTOCOLS

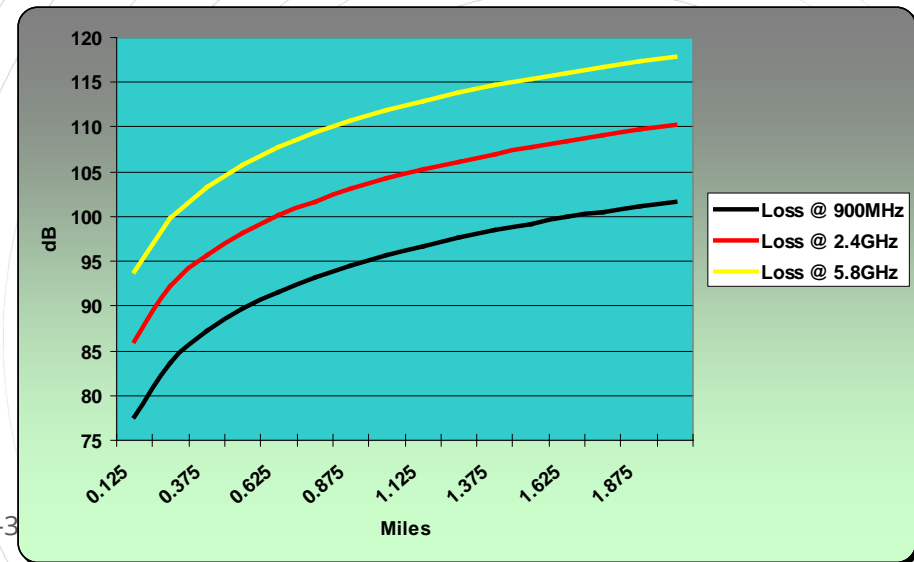
- Low Power Operation is CRITICAL to Many Installations – Especially Ones that are “Add-Ons”
 - 6 V, 12 V, 24 V Switching power supplies = Lower current @ higher voltages
 - 12 Volt Operation allows you to use more standard (lower cost) solar solutions
- Battery Power
 - Many systems allow you to power both the wireless AND sensor with a single battery power source
- Best Solution (w.r.t. Power) has:
 - Mixture of battery and “line” power wireless nodes
 - Wide range switching power supply input
 - Low power operation at all times

Speed & Range – Important in Many Applications

Data Reliability – Important in ALL Applications

COMPETING ISSUES

- Speed – Is this really necessary? Sometimes. Don't Over-Spec!!
 - Higher Data Rates = Reduced Range = Lower Reliability
- Range – Important to Data Reliability
 - Longer Range = Better Link = Higher Reliability/Easier Install
 - Lower Frequencies = Longer Range = ...
- Protocol – Want acknowledged system – no lost data
 - Data Reliability is Job #1
- Best Solution has:
 - Lower Frequency and Lower/Reasonable Speed for Higher Reliability
 - < 1 GHz, < 100 Kbit
 - Fully Acknowledged Protocol (for when the data does not make it first try)



Sensor Choices

SENSORS AVAILABLE WITH PARTICULAR WIRELESS SYSTEMS

- Sensor Choice is Particularly Important
 - What happens when you want to use a sensor from manufacturer A for level, B for pressure, and C for flow and A has Wireless HART, B has their own wireless solution and C has no wireless solution at all?
- Sensor Agnostic Systems
 - Critical to integration success of a complete system
- Diagnostic Tools Also Important
 - Remote Configuration
 - Easy for field worker to use
 - Intuitive – Huge issue for sensor networks

Wireless Applications

CHEMICAL PROCESSING

- Applications include:
 - Tank level monitoring
 - Chemical injection/flow measurement
 - Batch processing/flow measurement
 - Steam trap monitoring
 - Pressure & temperature monitoring & control (process lines, cokers, heaters, boilers)
 - Pump performance monitoring
 - Valve actuation/pump control (pressure relief & shutoff valves)
 - Equipment condition monitoring (switches, proximity sensors)
 - Corrosion rate monitoring
 - Vibration monitoring



One Common Application Picture

TANK LEVEL MONITORING

- Monitoring tank levels in a wide variety industries:
 - Oil field
 - Chemical processing plant
 - Water & wastewater treatment facility
 - Storage tank farm
 - Beverage processing plant (i.e. dairy, winery, brewery, etc.)
 - Agriculture
- Can be used to signal an alarm, valve or pump for process control based on tank level feedback.
- Reasons for monitoring are typically for safety & inventory purposes



Sentinel Float Stick

Attempt an Overview of What is Important!

IN GENERAL

- Low Frequency for Longer Range - < 1 GHz
- Reasonable Data Rate for Application for Longer Range
- Mesh Network for Reliable Long Range Networks and Interference
- Low Power is Important – Especially for “Add On” Systems
 - 6V/12V/24V Operation with Switching Power Supplies for Line Power
- Class 1 Div 1 Capability
- Robust Data Protocol
- Easy to Use and Intuitive Setup and Diagnostics
- Diverse Sensor Interfaces – Lets you pick your favorite sensor for each measurement type and mix them all into a single wireless system