

Fiber and Cellular and Radio, Oh My!

Presented by

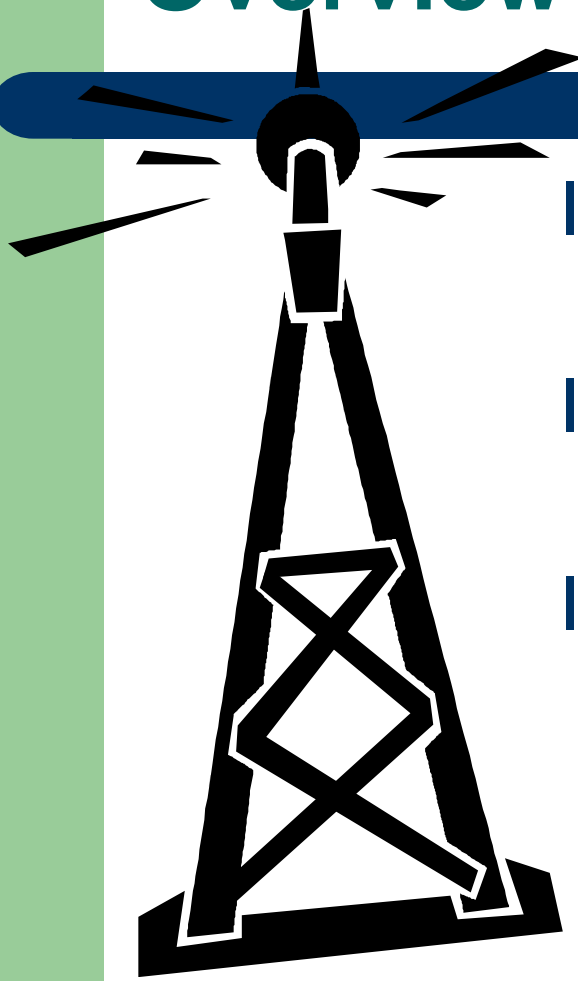
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WWOA

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Overview

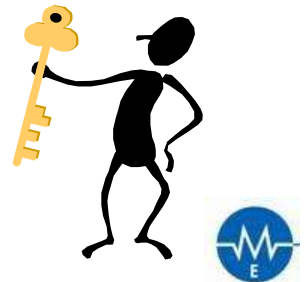
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- I. What are the current SCADA Communication Options?
 - II. How do they compare, Pros and Cons?
 - III. Application examples

PURPOSE

William Shakespeare had something to say about communication options:

*“Though this be madness,
yet there is method in it.”*

-Hamlet, Act II, Scene II.





COMMUNICATION OPTIONS



Option 1: No Communication

- There are still quite a few systems, mostly lift stations, that are still relying on alarm lights and vigilant neighbors.



Option 2: Metallic Pair

- A dedicated pair of conductors (metallic pair) which connects the remote location to a master control or monitoring/alarm location.
- This may be an actual dedicated pair of wires run along with the telephone wires, but may also be a signal which passes through the telephone company's switching equipment but still starts as a metallic pair at the remote site, and ends up as a metallic pair at the monitored end.



Option 3: Telephone Modem

- Dial-up Phone Service
- Telephone modem at remote and monitoring/alarm location.
- Typically involves automatically connecting with remote locations at prescribed intervals to obtain updates of status.



Option 4: Broadband Connection

- Broadband - High speed, Internet Protocol (IP)
- Carried over several different mediums
 - Cable
 - Telephone lines (DSL)
 - Cellular



Option 5 – Cellular Connection

- Cellular network communication
- Used for communication in a wide variety of system types
 - “Machine to Machine”
 - Alarm Dialer - Alternate to dial-up telephone land-line
 - Alarm Dialer – Hosted service. The service places the alarm phone call.
 - Hosted SCADA system



Option 6: Telemetry Radios

- VHF, UHF frequencies
 - FCC Licensed for specific frequency
 - Number of licenses is limited.
 - Licenses may not be available in certain areas.
 - Serial communication (slow dial-up modem speeds)
- 900 MHz, 2.4 MHz frequencies
 - License Free (no license required but may require registration.
 - Ethernet communication protocol



Comparisons, a Haiku

Pros and Cons Today
Let us compare and contrast
See what we can learn





COMPARE AND CONTRAST



Metallic Pair

- Where systems are still in place and working, fairly inexpensive; may be as low as \$5/month per site.
- Limited to simple monitoring or control On/Off control, power fail, high level, etc
- Can be used with dedicated modems to provide a bit more data and transmission capability, much like a dial-up modem, but continuous monitoring.



Metallic Pair

- 9.6 kbit/s for data transfer rate vs. theoretical dial-up modem speed of 56 kbit/s.
- Slow speed limits the amount of data transferred.
- Not practical to service/troubleshoot the remotes over the communication link.
- Security is high due to the physical isolation of this hard-wired network from any other communication system.



Dial-Up Modems

- Data transfer rates of 56 kbit/s (theoretical). Often slower because of noise in the transmission over telephone lines.
- Voice grade phone line required. Typical costs in the \$35 to \$50 per month range, per site.
- Not practical to service/troubleshoot the remotes controllers over the communication link.



Dial-Up Modems

- Takes time to dial up the remote locations, establish the connection, transfer data, terminate the connection, then move on to the next remote. May take several minutes to “poll” and reach all remote locations in a cycle.
- Video transmission is not practical.



Broadband - DSL

- Carried over telephone lines
- Availability may be limited based on distance from telephone company's DSL equipment locations.
- Service rates in the range of \$35 to \$50 per month.
- Data transfer rate speed is typically less than cable based broadband or cellular, but more than sufficient for SCADA system needs.
- Reliability and customer service similar to telephone company; business customers typically see a higher level of responsiveness

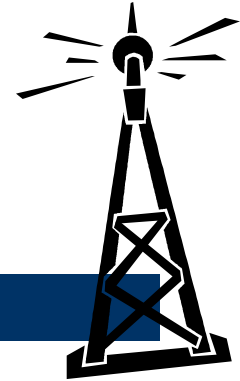


Broadband - Cable

- Carried over cable company's cable system
- Availability may be limited based on distance from cable company's equipment locations.
- Service rates competitive with DSL - in the range of \$35 to \$50 per month.
- Data transfer rate speed is typically much higher than DSL based. Will vary by service provider. Easily high enough to support SCADA system data transfer needs.
- Reliability and customer service similar to cable company; business customers typically see a higher level of responsiveness.



Broadband - Cellular



- Capabilities may vary somewhat by cellular service provider
- Ethernet Connectivity; local WiFi at panel.
- High Data transfer rates
- Machine-to-Machine capability
- Cost may be less than \$10/Month, depending on data usage needs.
- Cellular service cost may be part of an annual subscription cost for hosted services.



Telemetry Radios

- Completely self-contained radio network
- Built-in radio to radio security encryption
- Once installed, there are no ongoing monthly or subscription costs



Telemetry Radios

- Licensed UHF/VHF radios being phased out as systems are upgraded
- This radio technology is still viable and sometimes advantageous where difficult terrain and longer distances are involved.
- Ethernet capability is possible, although at a much lower data transfer rate.



Telemetry Radios

- License Free, Frequency Hopping – Spread Spectrum.
- Ethernet versions are the predominant choice for “future proofing” a radio upgrade with high speed data transfer capability and video capability.
- Historical Note: This radio technology was first invented and then patented by film actress Hedy Lamarr in 1942. She invented it to defeat the German U-boats’ ability to jam the U.S. Navy’s radio guided torpedoes. Used today for WiFi, cellular, etc.





APPLICATIONS



Decisions

- Which SCADA System Communication Option is best for your system?
- It Depends!
- Let's take a look at several examples to understand different circumstances may dictate different solutions.



Applications

- Scenario A – Small wastewater treatment system
 - One lift station
 - Lagoon treatment plant



Applications

- Scenario B – Small water system
 - Two wells
 - One tower (or reservoir and booster)
 - One well located at the tower (or reservoir and booster)



Applications

- Scenario C – Water and Wastewater systems with mechanical wastewater plant
 - Multiple lift stations
 - Multiple well locations
 - One or more towers or reservoir & booster pump locations
 - Wastewater Treatment Facility.





SUMMARY



Summary

- There more communication options available than ever before
- Factors to consider include:
 - Reliability
 - Service and support
 - “Future proofing”
 - Cost – Both initial and ongoing.
- Be sure to review all the options available, evaluate the pros and cons, and arrive at the best decision for your community.



A Limerick for You!

*There once was an operator named Pat
Who wanted to see what's the mat(ter)
Of course there's an App
On his tablet for that
And in an instant he knew how to re-act.*





- Any questions?

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