

PEMEX Onshore Developments Feature End-to-End Wireless

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Keywords

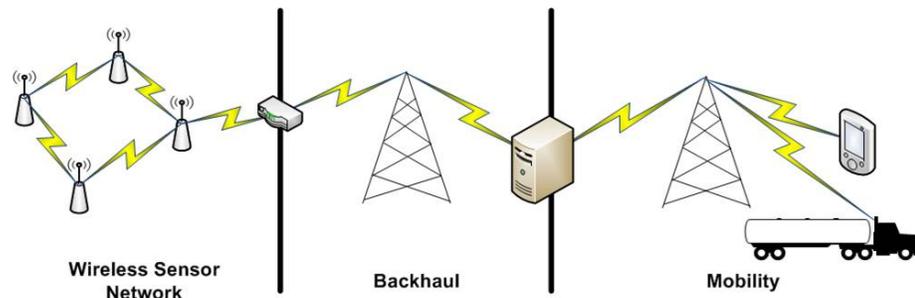
Backhaul, Industrial Wireless, Oil & Gas, SCADA, Wireless, WirelessHART

Backhaul: A Major Wireless Application

When people speak of “wireless” in the oil & gas industry, they often are referring to wireless sensing and measurements. In other contexts, wireless refers to the telecommunication and IT systems that enable remote voice communication and wireless local area networking. But a third major application of wireless is critical in oil and gas; the “backhaul.” (See related [ARC Insight](#).) This telecommunications term refers to the portion of a telecom network that connects the network edge to the core network of the telecom service provider.

While much of the hype about industrial wireless concerns wireless sensing, backhaul networks for SCADA systems represent a growing wireless application, especially for managing new and dispersed oil & gas resources. PEMEX provides a good example.

SCADA systems in upstream oil & gas consist of many network edge locations at well pads and other production assets that send process measurement and state information to control centers located many kilometers away. Petroleum geology determines the location of the wells and production assets. The SCADA system’s backhaul network (most often wireless) must serve these remote locations reliably. This presents technology and cost challenges for the automation system designers.



Backhaul: A Critical Automation Application Often Served by Wireless



Backhaul Design Considerations

Network security

Operating temperature/humidity

Hazardous location certification

Required range

Radio frequency interference

Cellular coverage availability

Data rate required

Carrier frequency

Future system expansion

Ease of installation

Ease of commissioning

Degree of standardization

Supplier-specific considerations

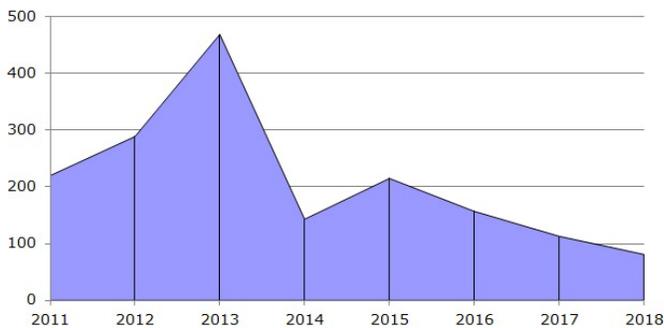
Backhaul Design Considerations

Wireless Backhaul Options

In most cases, both endpoints of any backhaul link will consist of standardized network technologies, usually Ethernet. The challenge faced by the network designers is to extend that network, at reasonable cost, over a distance of many miles. A number of factors enter into the choice of technology (see table), and different technologies will be optimal for different segments of any SCADA system. The major wireless technology options are cellular data, WiMAX, and both pre-standard and proprietary radios. Each has different installed cost characteristics. Given that a typical SCADA backhaul network will integrate dozens or hundreds of remote sites, the design process is challenging. Standardizing the remote interfaces is critical simply because it reduces the dimensionality of the design problem. Given a decent model of the installed cost behaviors, engineers can develop reasonable design rules that they can apply to the many segments of the SCADA system backhaul network.

PEMEX Veracruz Project Case

State-owned PEMEX has an ambitious plan for developing onshore oil & gas resources in its North Region of Mexico. This calls for completing over 1,000 wells in the Veracruz area over the next few years (see chart). To support these new installations, PEMEX has standardized on equipment both at the well pads and throughout the upstream system. Instruments at most of the remote locations will use IEC 62591 (WirelessHART) communication

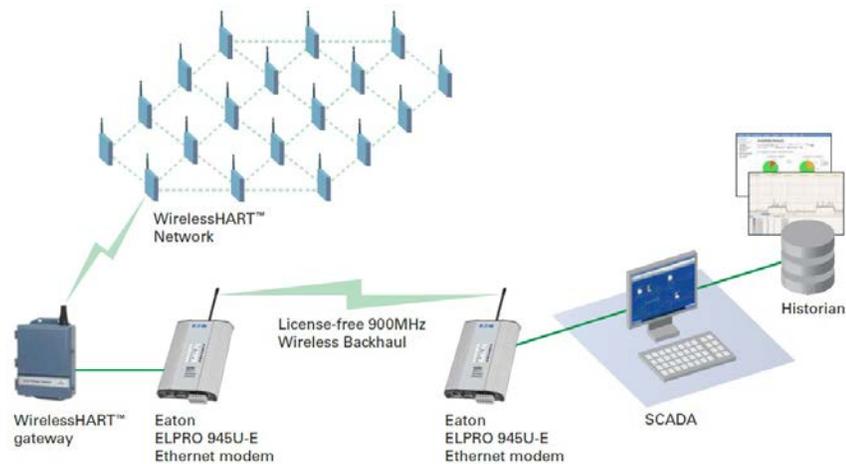


Veracruz New Well Completion Plan
Source: PEMEX

that will be managed by a WirelessHART gateway at the well pad. That gateway provides an Ethernet network connection that needs to be backhauled to PEMEX's SCADA system.

Given the remote locations of the wells, wireless was the obvious low-cost network technology. A small fraction of the locations had cellular coverage cel-

lular the choice in these locations. The remaining backhaul segment lengths ranged from 40-150 km (25-93 miles), often over challenging terrain.



Typical PEMEX Veracruz Backhaul Segment Design
Source: PEMEX

PEMEX decided to use Ethernet modems with pre-standard RF technology. The technology uses IEEE 802.11 media access but its RF layer is adapted for sub-gigahertz operation in unlicensed ISM bands. (These properties will be included in a future 802.11 standard, but that work will not be complete until 2016.) The Ethernet modems also have additional features for relay operation. Since pre-standard products with these critical features were already available, PEMEX decided to take advantage of them.

WiMAX technology would have provided greater multi-vendor interoperability, but at a higher installed cost point. The backhaul supplier chosen (Eaton) had an extensive product set that could accommodate the variety of required licensed and unlicensed radio frequencies and segment ranges and could also provide cellular modems for the locations served by cellular. The products also had features for network meshing, repeater operation, and data compression that simplified or improved the system design and performance. PEMEX has confidence in the supplier, and could also work with a single system integrator subcontractor familiar with both WirelessHART networks and the backhaul products.

ARC's Takeaway

The main lesson of this installation is that incorporating pre-standard elements into an overall wireless system is not necessarily a bad thing to do.

These technologies are optimized for particular forms of service that match the end user needs in SCADA backhaul. The important supplier selection question is not whether the entire system conforms to existing IEEE 802.11 standards, but how easy the system is to integrate, support, and expand over time. Because PEMEX's system had standard and pre-standard networks throughout each backhaul segment, PEMEX system engineering could design an integrated network serving the many remote networks, simplifying overall system integration.

Upstream oil & gas applications for wireless backhaul have been one of the most common wireless applications in recent years, while well pads have also become one of the most common applications for wireless process measurement. Based on this increasing volume, ARC expects to see improved fit between products serving these applications. This should further reduce the ownership costs for oil & gas companies.

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