

First Mile Wireless—Extending the Office Experience to the Wellhead



Executive Summary

The oil and gas industry has been working toward the digital oil field of the future, with the goal of being able to monitor and manage in real time all operational activities along the entire oil value chain. With a standard IP networking solution, companies can now begin to implement this vision by focusing on the “first mile,” which is where the oil wells and other assets of the exploration and production (E&P) companies are. These assets—land-based fields and pumps, offshore drilling rigs, production platforms, and mobile field management operations—are located in remote areas with harsh environments. By implementing the Cisco® First Mile Wireless solution, the oil and gas industry takes an important step toward a complete digital oilfield. First Mile Wireless provides integrated, high-speed connectivity that extends the office experience out to oil and gas fields, creating the platform for advanced sense-and-respond capabilities that enhance asset productivity and optimization.

Why First Mile Wireless?

Asset owners and operators face two primary issues in exploration and production: asset productivity and operating efficiency. Operators typically do not have visibility to sense the current state of the oil field and respond with actions to reduce well downtime or to increase the oil flow. Traditionally, these sense-and-respond capabilities have been restricted by the remoteness of the first mile and its lack of connectivity. Cisco First Mile Wireless resolves this limitation, enabling operators to transform their operations by creating the sense-and-respond capabilities that increase asset productivity, while reducing costs and improving communication and collaboration.

First Mile Wireless networks provide the platform to enhance operational visibility. This visibility takes many forms. For example, visibility enables technicians to gain access to the same resources in the field as they are used to in the office. Operations centers can continuously send and receive data to actually “see” what is happening in the field. The production control system can be extended to give deep insight into what is happening in the first mile in real time, not just once a day. Sensors on the equipment in the field can tell operators when it is likely to fail, not only when it has failed. Data from the field can be collected and transmitted to exploration and geoscience experts for analysis, without the need for the staff to travel to these remote locations. The wireless network can support the acquisition of data from the wellhead (even down-hole), transmit that data to a central location for management and analysis, and then communicate a response back to the

assets. As a result, operators can respond with actions that will reduce or eliminate well downtime or increase the oil flow.

In addition to providing visibility, First Mile Wireless networks can address the scarcity of expertise at the point of activity, the oil and gas fields. By extending the office experience to the wellhead and bringing operational visibility back to central locations, companies can make the most efficient use of experts, enabling them to manage multiple well operations and communicate with staff in the field in real time, and reducing operational costs.

The First Mile Wireless solution also provides security. Most oil fields are not occupied locally, so there is a need to maintain the physical security and alert authorities to compromises and potential dangers. In the case of offshore drilling and exploration platforms, although personnel reside on the rig, security is still a challenge.

Business Benefits

A 2003 study by Cambridge Energy Research Association (CERA) found that digital oilfields increase production by 2 to 10 percent over their nondigital counterparts. The study also found that digital oilfields save US\$4 to 8 billion in annual operational costs. A first step to establishing a digital oilfield is to provide economic, integrated, high-speed connectivity with the First Mile Wireless solution as key enabler towards a complete digital oilfield of the future (DOFF). The industry is recognizing that maintaining recovery rates and reducing extraction cost will require a move towards real-time systems—that is, real-time decisions made with real-time information.

Deploying the DOFF with IP-based technologies in remote field sites enables central operations to:

- Sense the current production situation with more precision and respond more quickly to problems, reducing equipment failure and increasing volumes. According to CERA, a communications network could significantly boost field profitability.
- Enhance recovery through better data and production planning.
- Optimize work processes, maintenance, and operations to reduce production downtime and lower production cost.
- Reduce capital costs with the use of a communications network and sensing applications to monitor and control remote machinery. CERA predicts a 5 to 10 percent reduction in capital costs.
- Take advantage of the knowledge of experts across the company and use it more efficiently.

Figure 1 summarizes the benefits for First Mile Wireless.

Figure 1. Benefits of First Mile Wireless



The benefits and drivers for the DOFF will be initially realized in the First Mile with networking solutions that can be implemented in this harsh and remote environment. Based on IP standards, these deployments can be easily expanded, enhanced, and upgraded at a later point of time to accomplish the vision of the DOFF while keeping cost of ownership low.

Solution

The Cisco First Mile Wireless solution improves extraction productivity and operating efficiency by cost-effectively providing secure and wireless connectivity to the First Mile of the oil value chain (Figure 3). With its wireless technologies, Cisco offers a set of easily manageable end-to-end solutions, providing wireless client access, telemetry, voice, video, physical security, and location services in a cost effective way. The Cisco First Mile Wireless solution is designed to withstand the harsh and remote deployment conditions of the first mile and to provide appropriate technology solutions, including the following:

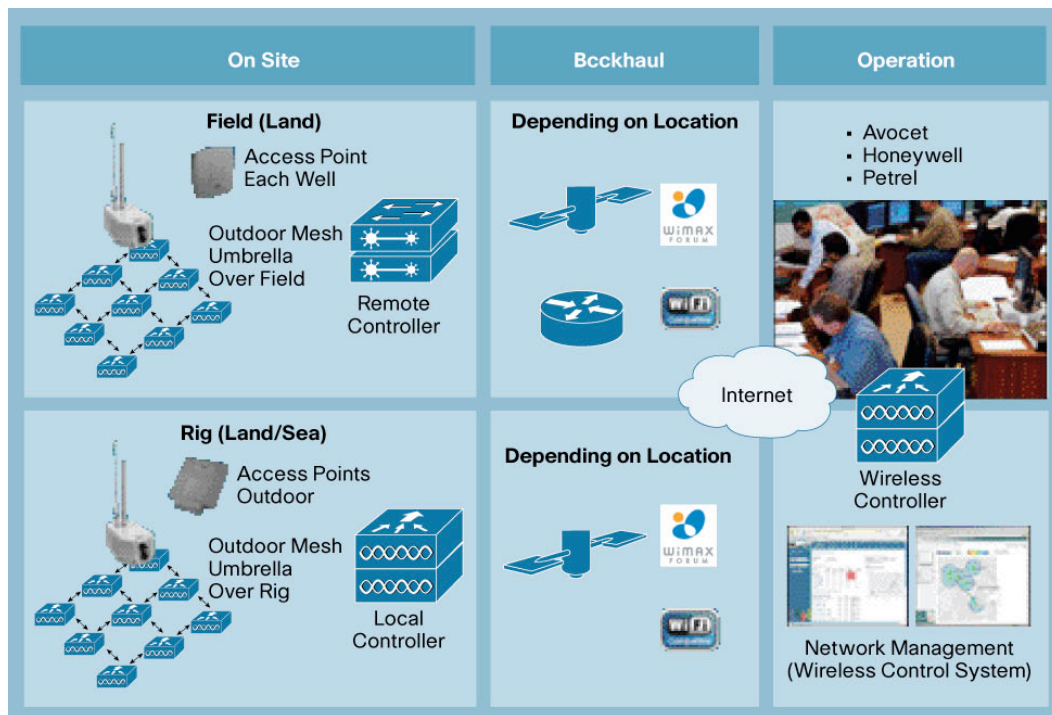
- **Remote locations** require various cost-effective options for backhaul. The high backhaul cost of very small aperture terminal (VSAT) and cellular links can be mitigated through use of wireless mesh, bridging, or WiMAX technologies. VSAT incurs a monthly service fee, while the other technologies involve only capital expenses and in-house maintenance.
- **Harsh environments**, which may contain corrosive materials or explosive gases or both, require products designed to the highest standards, able to withstand hazardous environments.
- **When there is no existing infrastructure** in remote locations, companies need ruggedized and fail-safe (redundant) solution architectures. Redundant gear for failover is highly recommended to prevent single points of failure.
- **Limited local skills** require zero-touch configuration and self-healing systems. Easy network manageability and high reliability are crucial.

- **High metal density** in deployment areas requires additional pre- and post-deployment site surveys, testing, and validation of RF devices.
- **Security** with the highest standards across the entire network is particularly important for operations in remote locations.

The Cisco First Mile Wireless solution consists of two main architectural components: a wireless fabric made up of layers of wireless technology, and a set of sense-and-respond business transformation capabilities to leverage the connectivity. Wireless connectivity is built up through three layers and consolidated network management. The components of the solution include:

- **Client:** Wired and wireless devices that take advantage of the connectivity in the field. These include low-power wireless sensors for environmental status, and PDAs or PCs for field service personnel.
- **Access:** Cisco Aironet[®] access points provide local access to these clients, arrayed in either a point-to-point or mesh configuration that can cover the entire area of the oilfield with wireless network connectivity. Cisco Aironet access points are ruggedized devices designed to operate in hazardous conditions common to oilfields.
- **Mobile network:** Operators in the first mile can stay connected with all central applications and data, in and around their vehicles and while driving with the Cisco 3200 Series Wireless and Mobile Router installed in the trunk of the service truck or vessel.
- **Backhaul:** Connecting the access points to the corporate networks through long-distance, high-speed wireless links. These high-speed links can be a combination of bridging Wi-Fi or WiMAX links, VSAT, or a wired connection using DSL or fiber.
- **Control:** Wireless connectivity is controlled and managed through resources in the corporate network, including wireless controllers, the Cisco Wireless Control System, and additional Cisco security products like intrusion detection and VLAN management.
- **Sense-and-respond capabilities:** The capability to monitor and manage all operational activities in real-time.

Figure 2. Connecting with the Cisco First Mile Wireless Network



Cisco Mesh Networking Overview

The Cisco First Mile Wireless solution is based on the Cisco Wireless Mesh Network providing wireless connectivity across the first mile (see also Figure 2). It is based on the Cisco Unified Wireless Network architecture, including Cisco Aironet 1500 Series lightweight outdoor mesh access points that can be deployed with zero-touch configuration. Intelligent wireless routing, based on the Adaptive Wireless Path Protocol (AWPP), creates a wireless mesh infrastructure that dynamically optimizes the network routes and self-heals from interference or outages, while the Radio Resource Management (RRM) software allows mesh access points to monitor their environments and adjust channels and frequencies in real time to avoid interference from other wireless devices. These automated capabilities help reduce deployment and maintenance costs.

Designed to support zero-configuration deployments, the Cisco Aironet 1500 Series easily and securely joins the mesh network and is managed and monitored by Cisco WCS. The wireless LAN controller is responsible for systemwide wireless LAN functions, such as security policies, intrusion prevention, RF management, quality of service (QoS), and mobility. Cisco WCS centralizes wireless LAN system management functions of RF prediction, policy provisioning, network optimization, troubleshooting, user tracking, and security monitoring. Compatible with Wi-Fi Protected Access 2 (WPA2) and employing hardware-based Advanced Encryption Standard (AES) encryption between wireless nodes, the Cisco Aironet 1500 Series provides end-to-end security.

Cisco Mobile Networks Overview

The Cisco Mobile Network can become part of the First Mile Wireless solution, providing a secure, wireless network in vehicles, which extends mission critical network applications to mobile staff. The Cisco 3200 Series Wireless and Mobile Router creates a mobile network, allowing a vehicle to maintain seamless connectivity whether it is stationary or in motion. Vehicles carrying staff in the field are transformed into mobile, IP-based offices, offering secure data, voice, and video communications from the mobile network to the central operations center.

Why Cisco?

Cisco Systems is the worldwide leader in networking technologies, with a 20-year track record in supporting customers of all sizes around the globe. By working with the established industry leader, municipalities and businesses can benefit from:

- More than two decades of experience building large-scale routing and RF networks
- Proven performance, reliability, and security
- A broad range of technical experts and engineers who understand the unique requirements of government agencies and enterprise customers
- Award-winning customer support services that help companies get the most out of their investments and extend the life of their network assets
- Ongoing investments in R&D initiatives benefiting municipalities and businesses
- Sustained value with upgradeable, standards-based solutions
- A phased approach to support the integration of new technologies or respond to new government mandates or regulations
- Best practices based on showcase network deployments

For More Information

Cisco First Mile Wireless Solution

<http://www.cisco.com/web/strategy/energy/fmw.html>

Cisco Outdoor Wireless Network solutions

<http://www.cisco.com/go/outdoorwireless>

Cisco wireless mesh technology

http://www.cisco.com/en/US/netsol/ns703/networking_solutions_solution.html

Cisco Aironet 1500 Series mesh access points

<http://www.cisco.com/en/US/products/ps6548/index.html>

Cisco 3200 Series Wireless and Mobile Router

<http://www.cisco.com/go/3200>



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