Cement Plants Unwired

William J. Miller, MaCT, USA, describes how the company's Wave Relay™ system can generate the best results at a fraction of the cost of traditional wired systems.

Introduction

St. Lawrence Cement in Hagerstown, Maryland, USA, is the first cement plant to install broadband wireless mesh network as an alternative to running wire. The installation provides the communication infrastructure that is used to monitor energy usage, provide emergency telephone access via Voice-over IP (VoIP), HART device integration and remote maintenance. The wireless system makes use of Wave Relay®, a multi-hop wireless mesh networking communication system which provides the ability to seamlessly connect users, devices and networks over large geographic areas and in challenging RF environments. It offers the ability to secure data and control traffic over multiple hops on an end-to-end basis. The architecture provides a secure, scalable and high performance extended network spanning both wired and/or wireless network links.

Energy Monitoring

The plant plans to replace its old KWH meters in 2007, but there will be a substantial installation cost. The meters are located in sections of the plant that are not wired with Ethernet connectivity, and so the installation will need at least seven fiber optic cable runs. This will require the permission of both the city and the company responsible for the railroad that runs through the property. It will take a long time to complete, and require a large investment.

In contrast, the wireless project was installed on a maintenance budget in a fraction of the time and for a fraction of the cost. However, the wireless system had to demonstrate that it provided sufficient security to protect the network assets. Scalability, performance, and reliability were also a concern. The KWH meters utilize multi-drop serial to Ethernet converters to connect to the network. The Wave Relay™ system then seamlessly bridges the Ethernet traffic through the wireless network, back to the plant's wired network. This allows the KWH meters to deliver the data directly to a wired server in the maintenance office.

Figure 1 St Lawrence Cement's Hagerstown plant.

Figure 2 Installation of sector antennas and wireless router.

The Wave Relay® system was chosen as an alternative to running wire. The system provides sufficient band-width to provision other services that use Ethernet and TCP/IP. The network provides the infrastructure to enable rapid deployment of future networking applications, further increasing the return of investment of areas of the plant, providing greater utility.

Figure 3 Wave Relay™ installation.

Figure 4 2.4 GHz sector and 5.8 GHz backhaul dish antenna

While wired cable runs deliver bandwidth to a specific location, the wireless network provides wider coverage

The plant Hagerstown plant currently uses wireless for monitoring the chain gas and material temperature. Since the kiln rotation and the temperature transmitters are often out of direct line of sight, a dual channel battery powered wireless device operating at 900 MHz was used to connect the thermocouple signals to the plant's distributed control system. This shows an excellent use of wireless, however it has limited scalability. The wireless mesh network can be used to provide an interface to any Ethernet device in the same way it would if connected to the wired network. If a device is not in the vicinity of a wireless router, an additional router can easily be added to the network at any time. This opens up other potential uses for the wireless net-work where additional wire would have been required. The broadband wireless network provides secure communications, along with considerable bandwidth. There is also sufficient bandwidth for future expansion.

Voice-over-IP (VoIP)

VoIP is used to meet a state safety requirement that requires an emergency phone to be placed in all elevators to provide communication during a power failure. The use of VoIP was chosen to replace existing Gaytronics phones in the silo personnel elevators that frequently did not work. The wireless network reduced the expense of installing new phones in the elevators. The Wave Relay® system can provide a battery backup which provides 12 hrs of operation in the event of a loss of power and provides communications to a VoIP phone that is connected wirelessly to the plants digital PBX.

There are three silos on the property with elevators which all received the upgrade. Since there is no wired Ethernet connectivity in the silos, the wireless mesh system was used to eliminate more expensive cable runs. The wireless mesh network provides high speed 5.8 GHz links between the silos, which serves as a backhaul to the network. The backhaul links are able to carry approximately 65 Mbps of Ethernet data traffic. The Wave Relay® system is designed to provide the maxi-mum possible through-put between all of the nodes in the network by intelligently selecting routing paths.

HART Device Integration

HART transmitters are being installed at the Hagerstown plant that will provide 4-20 ma signals to the plant distributed control system. The HART transmitters will be interfaced via HART multiplexers to the wireless net-work via Ethernet. The wireless interface can be used to interface major field buses, and provide integrated calibration including asset condition monitoring and supports for asset optimization. This will allow the maintenance personnel to rapidly respond to degrading conditions with alarms, fault tracking, calibration, and reporting.

Remote Maintenance

The wireless network provides maintenance personnel with the ability to remotely access the plant computers from the field. This includes the engineering workstation, operator screens, and any device on the wired or

wireless network. This capability provides substantial time savings to perform maintenance tasks since the broadband wireless network provides connectivity at line speed. The remote user has the experience of being on the wired network, and yet these actions are restricted to authorized plant personnel. The wireless network can easily accommodate any new devices to perform monitoring or control. The installation of a high speed wireless network can provide flexible operation and maintenance capabilities.

Conclusion

The Wave Relay® system has proved itself to be easy to use, with no configuration and no software to install. The system provides a direct wire replacement for a fraction of the cost of running wire. Any application that runs over Ethernet can easily be deployed using the wireless mesh network. The system is easy to install and can be expanded or reused. Further benefits include robust security, high performance and scalable operations. The system offers an immediate return on investment, since it was designed to provide secure mobile access in challenging environments such as cement plants.