Self-Organizing Networks: Worry-Free Wireless Solutions for Dynamic Plants

KEY POINTS

- Data reliability of 99% from utilization of multiple communication paths and automatic path configuration
- Decrease costs with elimination of site surveys
- Reduce time spent on configuration and management
- Lower energy usage and maintenance costs by extended battery life

Self-organizing networks combine the high reliability of wired networks with the flexibility and low cost of wireless networks.

OVERVIEW

Of the many technologies available today, self-organizing networks are the most promising solution for wireless field networks in process applications. Self-organizing networks dynamically manage their own configuration and communications by automatically making changes to ensure messages reach their destinations. They are easy to install and add more devices to existing networks.

THE BASICS

Self-organizing networks combine the high reliability of wired networks with the flexibility and low cost of wireless networks. Two concepts make this possible: multiple communication paths and automatic path configuration.

Multiple communication paths.

Each wireless device in a self-organizing network can act as a router for other nearby devices, passing messages along until they reach their destination. This provides redundant communication paths, and better reliability than solutions requiring direct, line-of-sight communication between each device and its gateway.

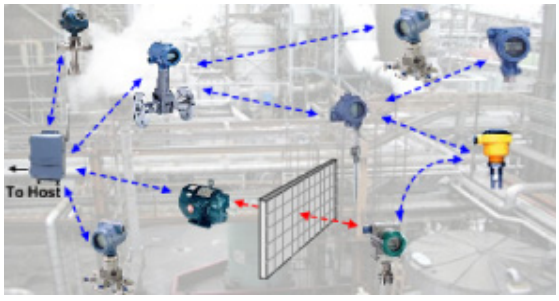
Automatic path configuration.

The self-organizing network automatically finds and uses the most efficient path whenever there is a change in the network or conditions relating to communication. It finds the path that optimizes data reliability while minimizing power consumption. For example, if a truck or scaffold blocks the hop between two routers, then the routers will find alternative paths around the obstruction.

ADVANTAGES

High reliability.

Self-organizing networks have over 99% data reliability, compared to 40% in networks that cannot provide the redundant communication paths that a self-organizing network offers. Self-organizing networks constantly chose the communication path offering the best reliability. Best of all, reliability increases with the expansion of your network since more devices offer more potential communication paths, and greater assurance that messages will reach their destinations.



If communication between devices is disrupted, the self-organizing network recognizes the problem and automatically re-routes communications along the next best path.

ROSEMOUNT®

For more information:
www.rosemount.com

EMERSON™
Process Management

Self-organizing.

A self-organizing network knows how to get a message to its destination, or how to communicate with new devices as they're added to the network. Each time a new device joins the network, it automatically adjusts and brings the new device into the network. If a device or communication path fails, the message is automatically redirected to another device in the network. If a better quality path is created with the addition of a new device, the network reorganizes and takes advantage of it. The network automatically "heals" itself, so any changes to the environment will not stop a message from reaching its destination.

No site surveys.

A site survey is a physical check of the plant to identify clear, line-of-sight paths for communication links between gateways and wireless devices. A site survey may be time consuming and expensive since it can take hundreds of hours, especially when plant structures, equipment, and other obstacles limit available communication paths. Site surveys cannot predict conditions that might disrupt future communications. A self-organizing network site survey can be omitted since the devices automatically determine the best paths of communication and adjust for any temporary or permanent changes in the plant.

Energy efficiency.

A self-organizing network is more energy efficient than traditional point-to-point wireless networks. For example, a one-watt radio in a point-to-point network has a coverage range of 1500 meters while in a self-organizing network, ten .001-watt (1 mW) devices can cover the same area with 150-meter hops. The 100 – 1 difference in power comes from a single device not having to "scream" all the way to the gateway. Instead, self-organizing networks can "whisper" from device to device until the message reaches its destination. Self-organizing networks also conserve energy with a "sleep" mode which minimizes power usage by turning off communication electronics. Since the battery life is much longer, there are large savings on maintenance costs.

Easy installation.

A self-organizing network is easy to install and manage, with no sophisticated planning or costly site survey being needed. All you need to know is the maximum number of devices the network can support, and the wireless signal range of the devices and gateway. If each device or gateway is within range of another, you will have a reliable and efficient network and when devices are installed they automatically join the network, self-organize, and transmit data.

Diagnostics.

Imagine being able to receive measurement data, troubleshoot device problems, and upload software revisions all at the same time. These capabilities will be available in self-organizing networks based on an emerging standard for wireless access to HART information. HART devices that use wireless technology can communicate diagnostic data, such as the health of a device or process. This diagnostic data can be routed dynamically to other wireless devices to allow neighboring devices to respond to a "warning" from a failing device.

TARGET APPLICATIONS

The first generation of self-organizing network solutions will target applications with update rates faster than once a minute to as long as once per hour. This differs from wired solutions, where update rates are more commonly in tenths of a second. Secure, self-organizing networks are well suited for typical monitoring applications. For example, most plants have hundreds, if not thousands, of points that are monitored manually.With manual data collection schedules ranging from once per shift, day, week, month, or even never; in comparison, once every few seconds seems almost like real-time data.

Automated wireless monitoring also eliminates many of the problems of manual data collection, including clipboard notation errors, inaccuracies from dial gage indication, and poor repeatability of handheld measurement equipment. Open-loop control is also supported by these networks in addition to some forms of latency-tolerant control. Potential open-loop control applications include those where it could take an operator an hour, or more, to obtain the appropriate work permit or go to the site to perform the appropriate control action, such as turning on a pump or closing a manual block valve. In these cases, one-minute updates provide plenty of response time.

Emerson Process Management
Rosemount Division
8200 Market Boulevard
Chanhassen, MN 55317 USA
T (U.S.) 1-800-999-9307
T (International) (952) 906-8888
F (952) 949-7001
www.rosemount.com

Emerson Process Management
Emerson Process Management GmbH & Co.
Argelsreider Feld 3
82234 Wessling
Germany
T 49 (8153) 9390
F 49 (8153) 939172

Emerson Process Management
Emerson Process Management Asia Pacific
Private Limited
1 Pandan Crescent
Singapore 128461
T (65) 6777 8211

ROSEMOUNT®

For more information:
www.rosemount.com

EMERSON™
Process Management

00840-0100-4180, Rev AA