A History of Wireless Communication and Yokogawa's Approach

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Wireless technology has a long history, and it began around the time that James C. Maxwell theoretically predicted and then proved the existence of electromagnetic waves in the 1860s, and when Heinrich R. Hertz experimentally confirmed the actual existence of the electromagnetic wave in 1888. In 1895, Guglielmo Marconi succeeded in receiving Morse code on a radio wave transmitted by a spark-gap transmitter with a receiver 2.4 km away. This experiment demonstrated the basic concept and framework of wireless communication today. In wireless communication, the transmitter sends target information by superimposing it on a carrier wave, and the receiver obtains the information by extracting the superimposed information from the carrier wave.

After that, research into wireless communication was advanced mainly for military use, and various wireless technologies were developed and improved. Wireless communication was also expanded on a commercial basis in the area of broadcasting, one of the significant applications of wireless communication. Radio broadcasts started in the first half of the 20th century and TV broadcasts started in the second half. Since the late 1980s, wireless communication has been widely used in mobile phones and other mobile terminals by individuals as these technologies, principally in semiconductor and software, have rapidly developed in line with the spread of the new infrastructure of the Internet. These are also even changing models of business and social life.

Wireless communication technologies are being developed and spreading in various fields of industry. In particular, the research and development of wireless sensor network technology and its applications are in rapid progress. New systems are being developed, which integrate general purpose sensor nodes and devices, and can operate for several years with batteries while autonomously configuring their own networks. Meanwhile, wireless digital technologies have advanced, and their practical use for resolving security issues such as radio interception or interference, which are problems with conventional analog wireless systems, have significantly progressed. On the basis of development of these platforms, the applications of wireless communication technologies are spreading to various fields, including disaster prevention, disaster response, crime prevention, security checks, environmental protection, health and welfare, transport and logistics, and monitoring and control of buildings and facilities.

Yokogawa has developed field wireless devices and systems for various sites in industries, and they are currently used in many plants. Their effectiveness in many actual applications is proven-such advantages as no need of wiring, and the potential for mounting sensors on mobile or rotating bodies, something physically impossible with traditional wired systems.

Since ancient times, human beings have used numerous ways to transmit information. Human voices were used first, then sounds such as drums or conch shell horns, and then smoke from signal fires were used. Interestingly, some proof has been found that the color or interval of smoke signals was changed to specify different meanings. The ingenuity and wisdom of ancient people is impressive, as they understood the necessity of the digitization of information, and seemed to have achieved it. After this, text began to be used for transmitting information, and a variety of methods were implemented, including mail delivery systems using horses. This was the beginning of today's postal system and has developed further into telegraph, telephone, Internet based email systems, and Social

Network Systems (SNS). At present, it can be said that human beings are faced with an explosive diversity in information transmission.

Industrial plants are also faced with a situation with changes similar to those described above. Traditional sensing targets in plants were simple physical quantities including temperature and flow rate or stoichiometric amount. However, with recent advances of field devices in functionality, performance and digitization, various types of data including vibration, sound and video can be obtained, and concurrent access to accumulated time series data is possible as well. These make it possible to grasp entire system conditions more comprehensively than with only the traditional measurements. Measurement and control including this data is thus becoming more important. Meanwhile, for these data, more complex parameters need to be set to the field devices. To respond to these trends, digital communication is inevitably required, and for that purpose, the importance of industrial wireless communication and sensor networks is increasing.

The cloud computing model has emerged as the infrastructure used to process such complex and large volumes of data. The measurement data can be used for whole plant safety, maintainability, and efficiency by using data analysis, trend analysis and so on, which other systems cannot perform easily.

Yokogawa has a research department studying, proposing, and promoting new strategies in field digitization together with a department developing and promoting wireless solutions. By effectively using platforms such as evolved devices and systems, Yokogawa offers proposals to improve customer safety and efficiency throughout the life cycle of a plant, from startup to operations, including improvement and maintenance.

Compatibility and operability are important factors for both wired and wireless communication. When both parties follow a common protocol for communication, interoperability is ensured. From this point of view, standardization and regularization are crucial for field wireless devices and systems. On the basis of a variety of application experiences in the process automation area, and on customer feedback, Yokogawa has studied various factors such as security, reliability, robustness, real-time performance, functionality and expandability in communication. As a result, Yokogawa decided to participate in defining the ISA100.11a standard, and has been making efforts to improve it to a user friendly, international standard for wireless communication. In 2010, Yokogawa developed the world's first field wireless devices and field wireless integrated gateway for configuring a system that conforms to the ISA100.11a standard. In 2012, we launched field wireless devices and systems which support almost all the features defined in the ISA100.11a. Yokogawa declares that it will continue promoting this standard with other companies, and with contributing to its further standardization and interoperation among the products of different companies.

This issue of the Yokogawa Technical Report describes Yokogawa's overall wireless instrumentation technologies, its efforts for international standardization and so on, and also specifically reports various field wireless products developed by Yokogawa, and the technologies supporting these products. Field wireless technologies keep progressing rapidly and new applications are constantly created. Yokogawa will work hard in this evolving field and keep offering new value to customers. We are convinced that Yokogawa will meet your expectations.