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Integrated Supervisory Control Platform: JFE-SCADA

1. Introduction

A SCADA (Supervisory Control and Data Acquisition) system is a system which collects and stores information (process data, equipment state, *etc.*) on plant equipment located in remote areas by way of the telecommunications infrastructure.

JFE Engineering undertook the development of SCADA software with an original specification suitable for remote monitoring of gas pipeline facilities and carried out system construction based on an integrated supervisory control platform called JFE-SCADA beginning in 2011 [1]. A Windows*1 10 compatible version was released in 2018, and now has a track record of implementation of SCADA systems covering more than 50 monitoring points.

2. Features of JFE-SCADA System

For stable operation of critical lifeline facilities, SCADA systems for pipeline equipment transporting natural gas are required to have high reliability and availability, including a function that enables real-time monitoring 24 hours a day, 365 days a year and a tool function which ensures safe operation and shutoff in the event of a wide-area disaster. To meet these needs, the JFE-SCADA system has the following features:

(1) Standby redundancy of database server

In duplexing the database server, a hot standby system using standby redundancy was adopted, as illustrated in **Fig. 1**. Only the primary server performs data collection by way of the communication line. Data collection by the secondary (standby) server is performed through the primary server, without using the communication line, thereby reducing the load on the communication line.

(2) Database equalization process

If one of the duplexed servers is shut down due to a malfunction or maintenance, the data of the affected server will be deficient during the stop (inconsistency of the databases of two servers). In the database equalization process, as shown in **Fig. 2**, the databases of the two servers can be equalized by complementing the deficient data for the shutdown period from the other server, which continues to operate during the stop.

(3) Standby redundancy of communication lines

A hot standby system by standby redundancy is also used in duplexing of communication lines (main network, backup network), as shown in **Fig. 3**. Under normal conditions, use of the main network has priority, and the backup network per-

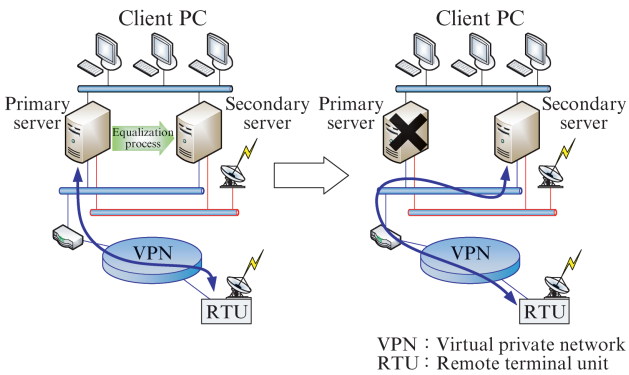

Fig. 1 Standby redundant system of database

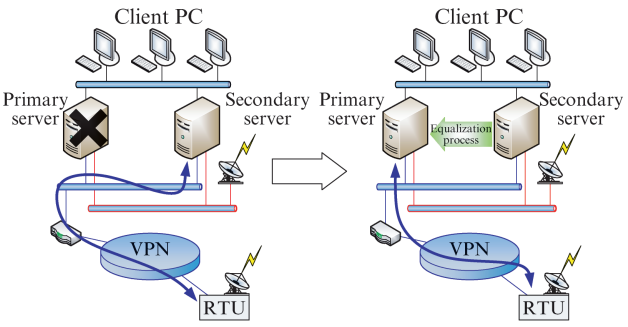

Fig. 2 Data complement by equalization processing

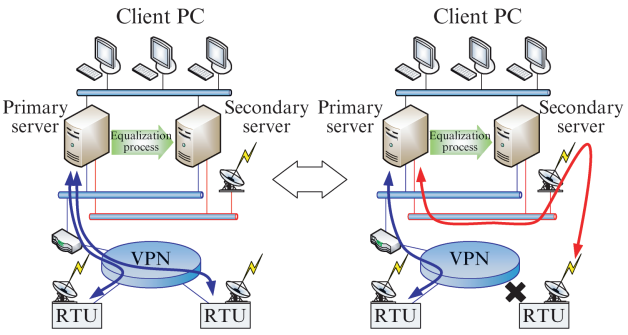

Fig. 3 Standby redundant system of communication line

*1: Windows is a trademark or registered trademark of Microsoft Corporation in the United States and other countries.

† Originally published in *JFE GIHO* No. 45 (Feb. 2020), p. 73−74

formed data collection when the main network is interrupted. When communication by the main network is restored, the system returns automatically to data collection by the main network, which has higher priority.

(4) Asymmetrical redundancy of communication lines

In JFE-SCADA, it is possible to set parameters such as the data collection cycle flexibly, depending on the performance of individual circuits (communication speed and capacity, *etc.*), assuming use of a VPN (Virtual Private Network) in the main communication line and satellite communication as the backup line. As shown in **Fig. 4**, this feature of asymmetrical redundancy, which makes it possible to set data collection parameters individually for each monitoring/operation point and communication line, enables optimum utilization of the communication performance of all lines, even with a mixed system configuration consisting of different types of communication lines.

3. Cloud JFE-SCADA System

Recent SCADA systems are not limited simply to visualization of the condition of plant equipment, but also make it possible to provide the information necessary for business operation to managers by data collection and analysis utilizing big data and IoT (Internet of Things). JFE Engineering is developing JFE-SCADA systems using a cloud-based big data server as an IoT platform for the company's various plants and products, and is expanding various types of data collection functions (see **Fig. 5**).

(1) Integrated monitoring of multiple systems

The cloud JFE-SCADA performs integrated monitoring of multiple monitoring and control systems and enables unified management of information for plants at various remote locations. The cloud SCADA server is connected with the on-premises JFE-SCADA server via a VPN line, and

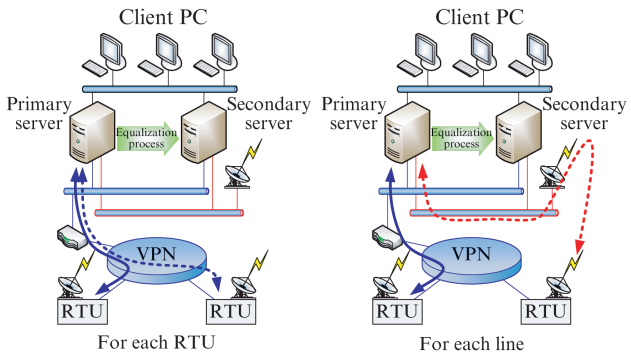

Fig. 4 Asymmetric redundant system of communication line

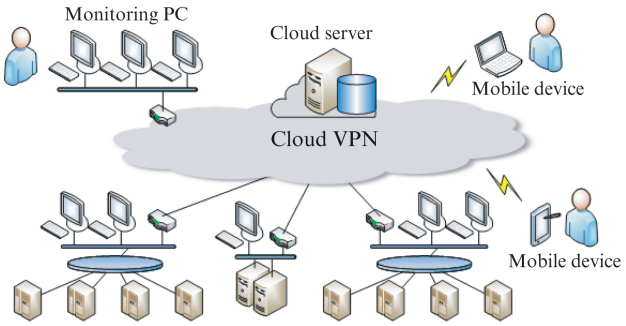

Fig. 5 Cloud JFE-SCADA system

also supports connection with control devices such as PLC (Programmable Logic Controller) and DCS (Distributed Control System).

(2) High-speed cycle data collection

The cloud server is capable of collecting and storing large volumes of data (big data). This system supports data collection with a high speed cycle (0.1 to 0.2 seconds) for equipment diagnosis (advance prediction, post-analysis) by using high-speed data logger units and edge computing terminals.

(3) Data collection by sensor network

Sensor networks using battery-powered wireless sensors enable easy, low-cost collection of unmeasured data of existing plant equipment, as the sensor can be installed without cable wiring. For example, data for equipment diagnosis can be collected by retrofitting wireless sensors for vibration measurement and temperature measurement. The cloud JFE-SCADA system supports data collection by linkage with sensor networks.

4. Conclusion

Big data and data acquired by sensor networks can be utilized in equipment diagnosis and anomaly sign detection, and thus are useful in stable plant operation. The data collected and stored by the JFE-SCADA system is expected to contribute to stable operation of plant equipment and improved safety and security in plant operation.

Reference

1) Matsushita, Y.; Goto, M. Present Condition of JFE-SCADA System and Future Prospects. JFE Technical Report. 2016, no. 21, p. 146–152.

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https://www.jfe-eng.co.jp/products/pipeline/pipe11.html