Evolving of Monitoring and Control System "MICREX-VieW XX (Double X)"

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ABSTRACT

The small-and medium-scale monitoring and control system "MICREX-VieW XX" has continued to evolve to meet the various needs of customers ever since its debut in the market. We have recently added to it some new system configurations that can contain all-in-one stations for high cost performance and a remote-monitoring system. Existing systems can also be easily upgraded using the dedicated migration controller "XCS-3000R," a migration tool and a network adapter. In addition, we are currently developing functionality for IoT applications that make it possible to expand the applicable range of plant monitoring, to record and save long-term monitoring data, to execute applications via connection with the Internet, and to ensure enhanced security.

1. Introduction

The "MICREX-VieW XX (Double X[1][2])" is a small- and medium-scale monitoring and control system achieving safe and stable plant operation. Since its market launch in June 2014, it has been widely applied to business sectors including steel, food, chemical and environment. This paper describes the continuous evolution of the MICREX-VieW XX that allows communication link with higher- and lower-level systems, provides system architecture to address the age of Internet of Things (IoT) in monitoring and control systems such as large-capacity communication, and offers solutions to satisfy the needs of customers.

2. "MICREX-VieW XX"

2.1 Positioning

Figure 1 shows the position map of the monitoring and control systems offered by Fuji Electric. Monitoring and control systems vary from small-scale systems used for line or cell control to large-scale systems that monitor and control an entire plant.

The "MICREX-VieW Series" offers a lineup consisting of the "MICREX-VieW XX," "MICREX-VieW FOCUS" and "MICREX-VieW Compact" that can be selected according to the scale and applicable range of the system. All of these systems provide high continuity and commonality by sharing application assets, engineering tools, controller platforms and I/Os.

The MICREX-VieW XX is a system covering from small- to medium-large scales and can be used for a wide range of applications, mainly for line or cell control, from high-speed control of electric machinery to multi-point measurement control.

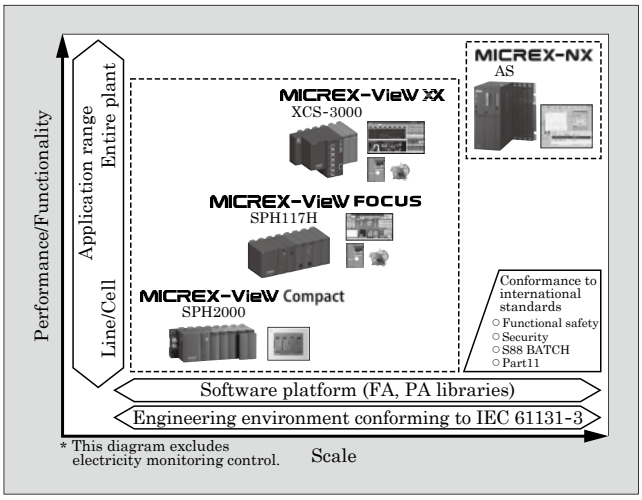

Fig.1 Position map of monitoring and control systems offered by Fuji Electric

The MICREX-VieW XX has been providing solutions to satisfy various needs of customers by solving the following problems with conventional systems.

2.2 Problems with conventional systems

With conventional monitoring and control systems, when the scale of the monitoring target became large in the factory automation (FA) or process automation (PA) sectors, it was difficult to use the existing control system architecture and engineering tools (including created applications) as they were. This made it necessary to connect multiple systems via gateways or modify engineering tools, raising the problem of increased cost of introducing and maintaining a monitoring and control system. There is a new problem of ensuring a smooth link with and inheriting existing application

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assets which is required to continue stable plant operation after a facility upgrade.

Another challenge is to satisfy various needs while achieving stable plant operation, such as to expand the applicable range of monitoring, to record long-term history of alarms and operations, and to execute applications via an Internet connection.

3. Enhanced Functionality of "MICREX-VieW XX"

In addition to the standard system configurations of the MICREX-VieW XX (single configuration and redundant configuration), this section describes system configurations that use all-in-one stations for high cost performance and that allow easy remote monitoring operations from anywhere.

3.1 Various system architectures

(1) Standard system configuration

Figure 2 shows the standard system configuration (single configuration). Figure 3 shows the completely redundant system configuration. This is one of the

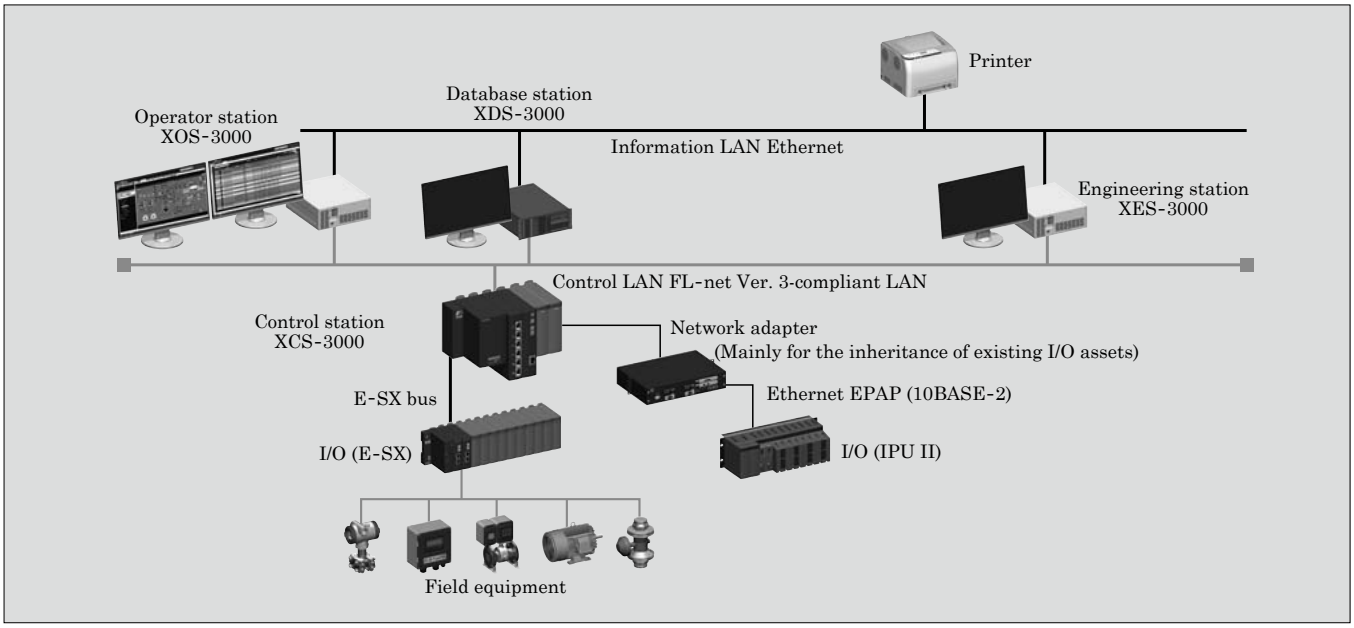

Fig.2 Standard system configuration (single configuration)

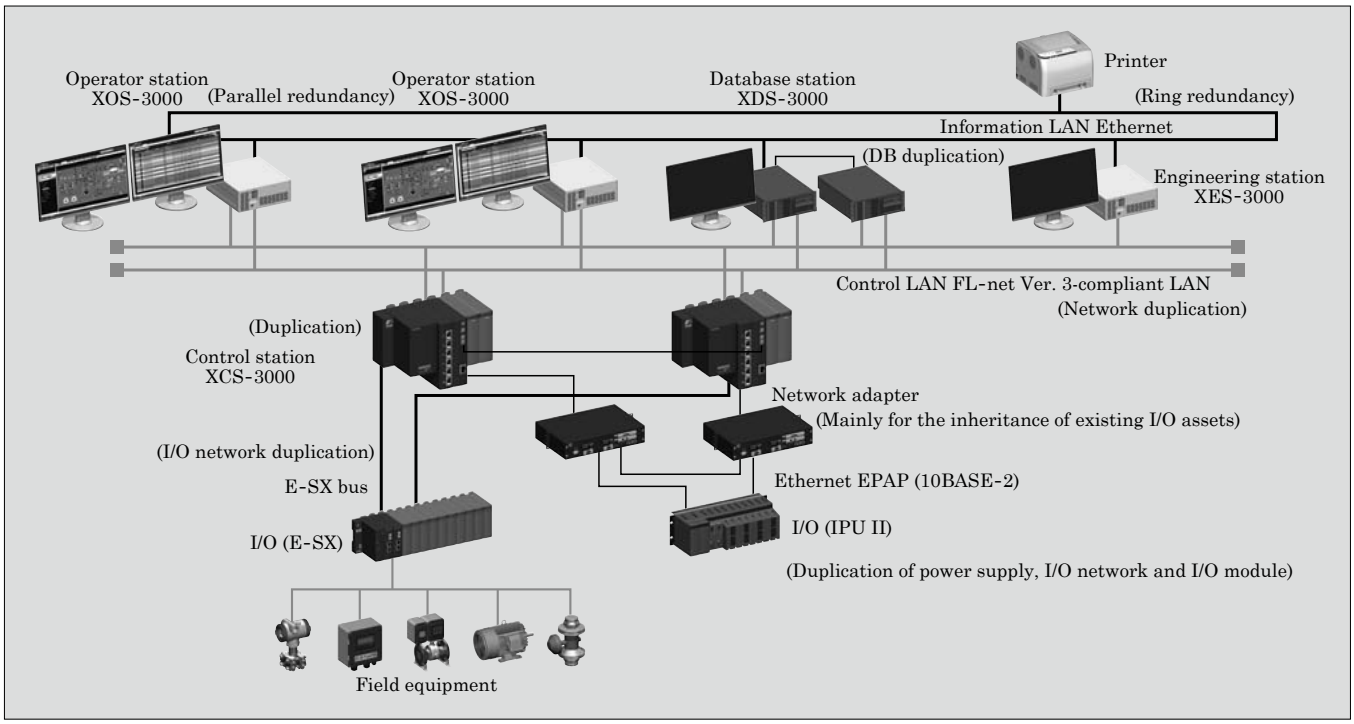

Fig.3 Standard system configuration (completely redundant configuration)

redundant configurations in which every component is designed to be redundant to achieve high reliability. These are typical system configurations of the MICREX-VieW XX.

A scalable and high-cost performance system can be built according to customer requests, from a compact system based on a single configuration of each component to a highly reliable redundant system employing dual installation of components (such as a control station) and a network using dual line or ring topology. The use of a network adapter makes it easy to inherit the assets of I/O or other existing hardware.

(2) System configuration using all-in-one station

Figure 4 shows a system configuration using the all-in-one station "XAL-3000." This system configuration uses the XAL-3000 and is intended for relatively small-scale systems with the 10 or fewer "XCS-3000" control stations. The XAL-3000 can achieve function-

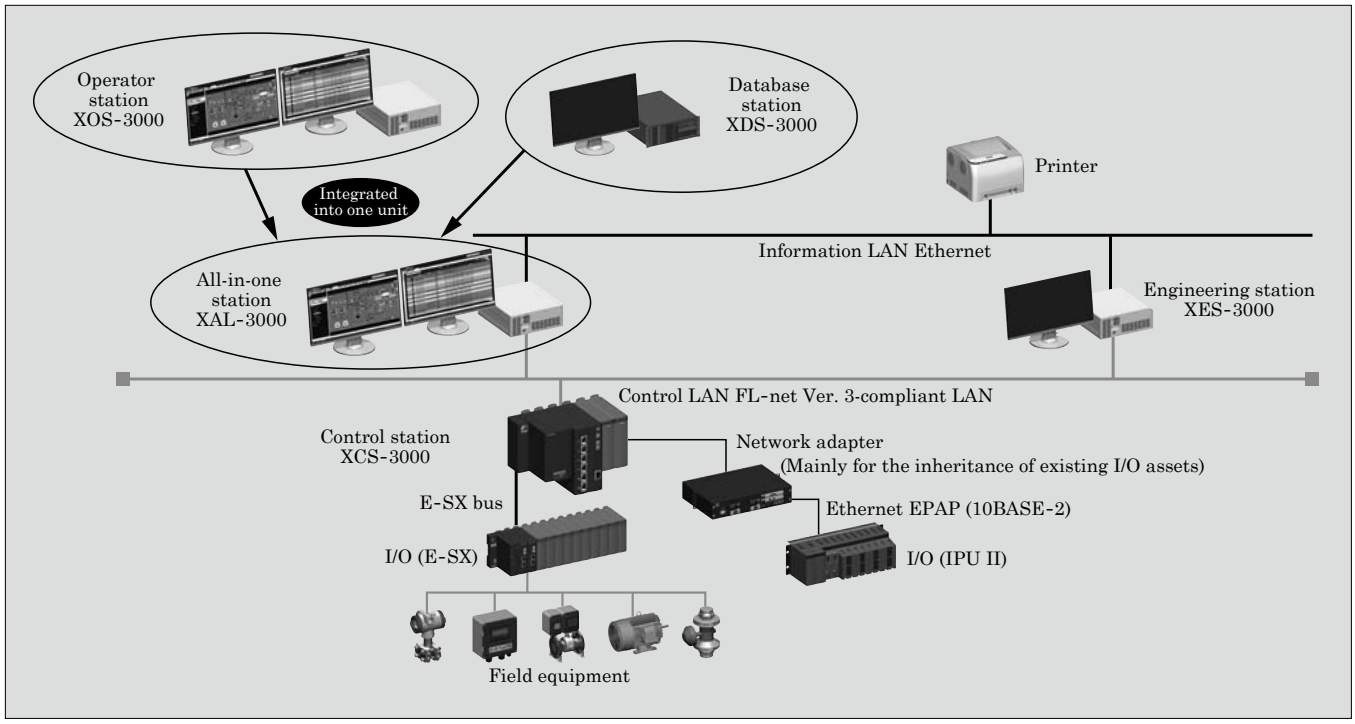

Fig.4 System configuration using all-in-one station

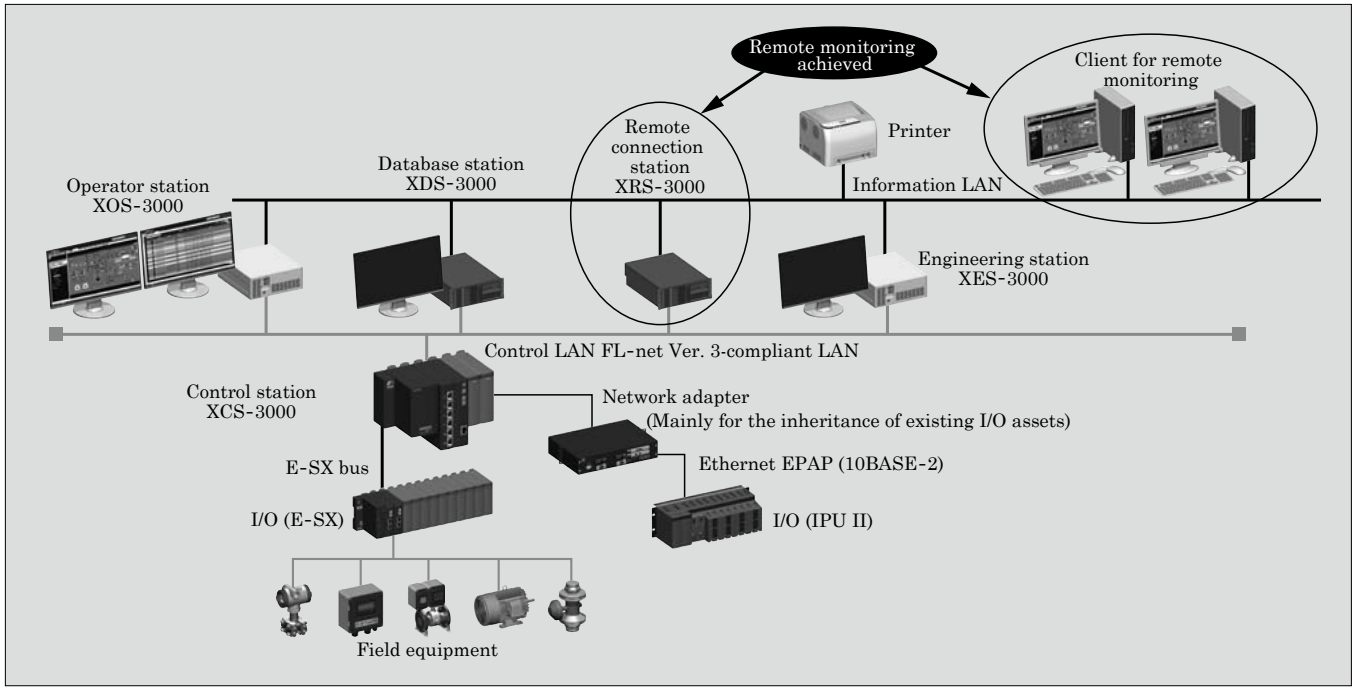

Fig.5 Remote monitoring system configuration

ality of both the operator station "XOS-3000" and database station "XDS-3000."

In order to improve database reliability and to reduce costs due to the increase in the XAL-3000 units, the system is configured with the 2 XAL-3000 units arranged side-by-side and then combined with the XOS-3000, which is less expensive than the XAL-3000. This allows the user to build a monitoring system providing high-cost performance as well as high reliability.

(3) Configuration of remote monitoring system

Figure 5 shows a configuration of a remote monitoring system. This is a configuration of a system that enables remote monitoring operation with a general-purpose PC in an office some distance away from the site.

To perform remote monitoring, install the "XRS-3000," which is a remote connection station with server functionality, on the control LAN, connect the client to the information LAN, and use the Windows*1 Remote Desktop function on the client. The client can be a portable notebook computer or tablet computer with Full HD display.

In this way, plant monitoring operations equivalent to the XOS-3000 can be achieved easily from anywhere. Furthermore, since a single XRS-3000 can connect up to 4 computers, the introduction and maintenance costs can be reduced.

3.2 Enhanced asset inheritance

Aging monitoring and control system should be reliably upgraded within a short period of time without affecting the plant operation. Consequently, many plants upgrade their systems partially through several steps (see Fig. 6).

The MICREX-VieW XX includes the "XCS-3000R" and a migration tool for inheriting the application assets of existing controllers and a network adapter for inheriting the assets of existing hardware. This allows it to provide flexible system upgrades satisfying the needs during upgrades described above. Such assets can then be utilized effectively to achieve data collection or data interchange with higher-level systems.

(1) "XCS-3000R"

The XCS-3000R is a controller dedicated to migration. While using the latest hardware as with the XCS-3000, it has an emulator function on the controller platform common to the XCS-3000 in order to run the programs of existing controllers as they are (see Fig. 7). The emulator function includes various mechanisms to continuously use existing applications, such as program execution control, virtual address space

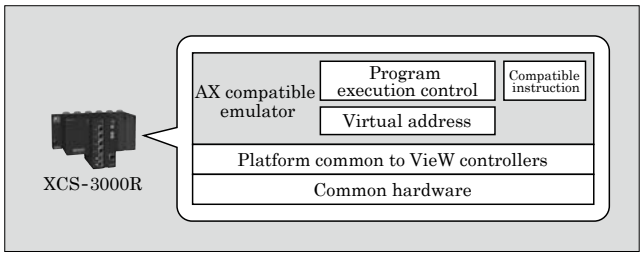

Fig.7 Conceptual drawing of "XCS-3000R"

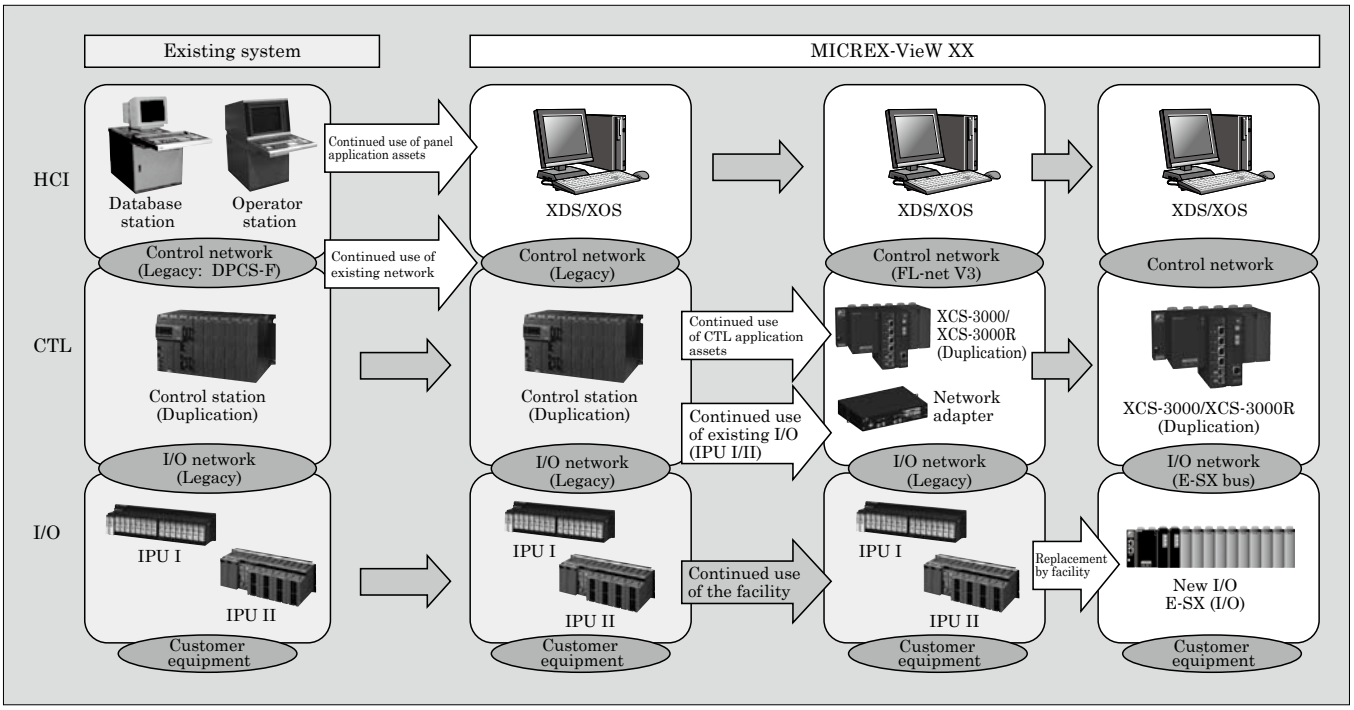

Fig.6 Example of upgrading an existing system through several steps

*1: Windows: A trademark or a registered trademark of Microsoft Corporation

management and compatible instructions.

By using the XCS-3000R, users can continue to use their existing facility, application assets and familiar engineering environments, while replacing the aging controllers smoothly.

(2) Migration tool

The migration tool is used to inherit the application assets of users. It allows inheritance of application assets created with the conventional controller engineering tool "FPROCES-C."

As shown in Fig. 8, the migration tool is used together with the latest migration controller XCS-3000R. This allows users to upgrade to the latest controller and I/O equipment while continuously using their existing application assets and familiar controller engineering tools. Moreover, users can improve the operation stability of the entire system while upgrading the system with no stress and applying the latest technologies.

(3) Network adapter

The network adapter is equipment used to connect existing I/O equipment and control network to the XCS-3000/XCS-3000R to allow hardware assets to be inherited.

The network adapter can connect networks shown in Table 1 and can be flexibly used in different system configurations required for upgrade. This allows users to establish a flexible upgrade plan in accordance with the life cycle of the facility such as a controller and I/O equipment as shown in Fig. 6. Consequently, users can upgrade to the latest system in several steps while reducing the total system cost and upgrade period. For example, since the network adapter supports FL-net, it can be combined with the built-in FL-net of the XCS-3000 to create a system configuration with a dual FL-net line. By connecting the network adapter to an existing control LAN and connecting the XCS-3000 to the control LAN of a new system, users can connect to both old and new monitoring systems so that they can add and build a new system while effectively utilizing the existing system.

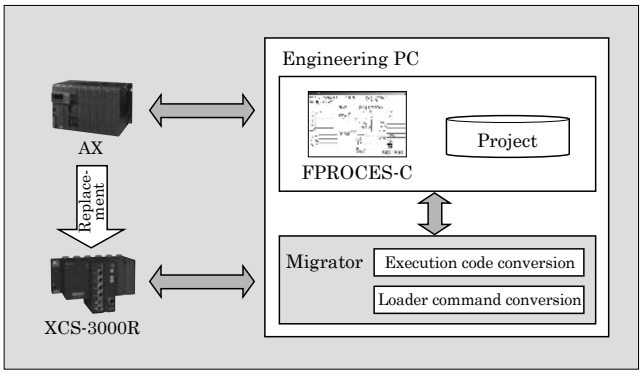

Fig.8 Conceptual drawing of migration tool

Table 1 Networks supported by network adapter

Type	Network to be connected
Control network	FL-net
	DPCS-F
	PE-link
I/O network	Ethernet EPAP (IPU II)
	T-link

4. Evolved Functionality of "MICREX-VieW XX"

The evolution of IoT technologies has been making it possible to collect various types of data from many devices and equipment that had not transmitted data previously. Customers have become more aware of the need to collect and utilize the information obtained through IoT. This poses a challenge for plants since they have to deal with a larger amount of data than before while their scales remain the same. For the MICREX-VieW XX, we have been developing functionality that makes it possible to expand the applicable range of monitoring to handle a larger amount of plant data, to record and save long-term monitoring data including alarm and operation histories, to execute applications via an Internet connection, and to ensure enhanced security.

4.1 Faster data collection performance for handling larger amount of data

With the XCS-3000, the Gigabit Ethernet network, which was conventionally provided as a separate communication module, has been incorporated within the CPU module, resulting in a remarkable improvement in real-time data collection performance. Moreover, the number of TAGs and I/Os that can be handled with the MICREX-VieW XX has been increased. These improvements have enabled high-speed collection of real-time data synchronized with the control cycle, so that users can check the plant conditions in more detail. Combining real-time data with historical or various other types of data and applying Fuji Electric's data analysis technology makes it possible to conduct various operations, including failure prediction, preventive maintenance of facilities, advanced energy management and flexible production planning.

4.2 Long-term storage (archive) technologies

Historical data handled with the MICREX-VieW XX, including the history of alarms and operations, trend data and reports, are stored for one year as important records of target facilities and processes for easy reference. In recent years, these historical data have been attracting attention because various analyses of these data provide new findings that may lead to stable operation or improved efficiency of the plant. Consequently, the solution of efficiently accumulating historical data for a long period of time is being desired.

For the MICREX-VieW XX, we have been developing the archive station "XAS-3000" as a system that

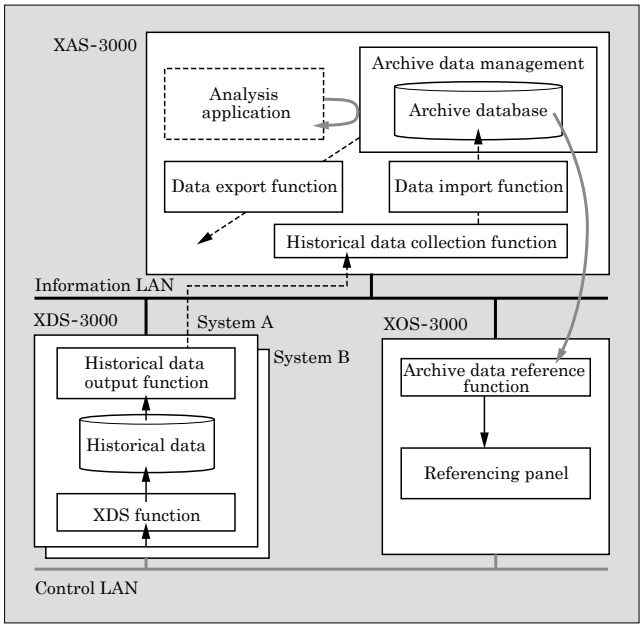

Fig.9 Configuration drawing of an archive station

stores historical data for a long period of time. The XAS-3000 can store historical data collected from the XDS-3000 for up to 10 years (see Fig. 9).

The historical data accumulated in the XAS-3000 can be viewed with the screen panel of the XOS-3000 in the same way as the data within the past one year. In addition, the data can be accessed through the use of open SQL (Structured Query Language) and be analyzed from various keys including data time, plant facility and information source (tag). Using this SQL access function enables quick customization such as incorporating an analysis engine specialized for the plant.

4.3 IoT-ready communication technologies

One of the important IoT technologies is communication technologies between systems, equipment or devices. There are currently several options for communication technologies applicable to IoT and they have been used in various ways depending on the purpose. OPC Unified Architecture (UA) has been gaining attention as an important option for communication technologies in the age of IoT. OPC UA is a successor technology to OPC Data Access (DA), which had grown as a communication technology for control systems. OPC UA is an open technology providing both performance and security.

Fuji Electric has quickly focused attention on this OPC UA and incorporated an OPC UA server function into the MICREX-VieW XX. Equipment and various systems with an OPC UA client function capable of connection to OPC UA can access the information of the plant managed by the MICREX-VieW XX while ensuring high security.

Studies have also been made on the configuration in which in the near future an IoT-ready higher-level system built on a cloud will collect the plant data retained by a monitoring and control system such as the MICREX-VieW XX (see Fig. 10). Also in such a configuration, the use of the OPC UA server function allows the configuration to be ready for IoT without any modification.

4.4 Security technologies

The international standards have been organized to meet control system security requirements, which encourages the development of an environment for applying security evaluation and certification based on common criteria. Fuji Electric has been participating in IEC/TC65/WG10, which is a domestic council of IEC 62443, and also involved as a joint enterprise in the Control System Security Center (CSSC) established in 2012 which is a corporation approved by Japanese Ministry of Economy, Trade and Industry. The aim of this is to improve Japan's international competitiveness in the control system market and to promote the creation of a security evaluation and certification scheme for control systems.

We also actively work on the latest technologies for security measures including intrusion detection and

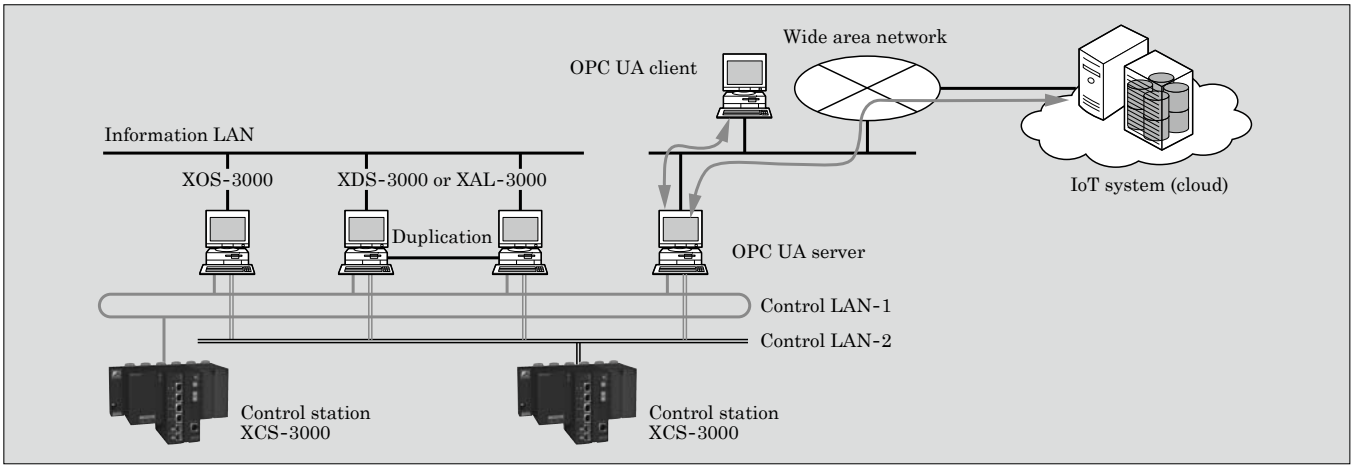

Fig.10 Conceptual drawing of the collaboration with IoT-ready systems when OPC UA server is used

operation monitoring as well as guidelines for building a secure system. We promote the building of secure systems covering areas from the component level to an entire system.

In view of the coming age of IoT, and in order to provide users with a safe and secure system to achieve stable plant operations, we have developed the MICREX-VieW XX by placing importance on security from the design stage to achieve systems with ensured security.

5. Postscript

This paper described the evolving of the monitoring and control system "MICREX-VieW XX." The MICREX-VieW XX is sure to contribute to the manufacturing of high-quality products and stable and efficient operations required in various plants. We will commit to expanding the functions of our monitoring and control systems in order to solve the issues of our customers.

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