Control System Platform

1 Small-sized embedded computer (I/O extended model)

1 Small-sized Embedded Computer

For social infrastructure systems from which a high level of reliability and availability is expected, new needs with a focus on practical use are emerging, such as the provision of diverse services for practical use and the utilization of precise and up-to-date information on users' premises. These needs cannot be met without introducing a smart system to practical operations. When there is insufficient installation space on the premises under harsh environmental conditions, it is necessary to ensure that the system supports different communication environments and that electronic and information equipment that processes operational information can be operated stably for a long period of time. In response, Hitachi offers small-sized embedded computers without fans or hard disk drives (HDDs) to reduce the necessity of maintenance and achieve a compact size that can be installed in an area equivalent to A4 size.

The main features are as follows.

(1) RS485 serial communication (Recommended Standard 485) and digital input/output

It is compatible with a monitoring terminal and with a control system for lamps, alarms and motors.

(2) Simplified graphical display function

It is applicable for touchscreen control devices and information display units.

(3) Real-time programming environments

It may be introduced to control applications for ensuring response times, and it opens the way for using Hitachi's development assets concerning existing applications.

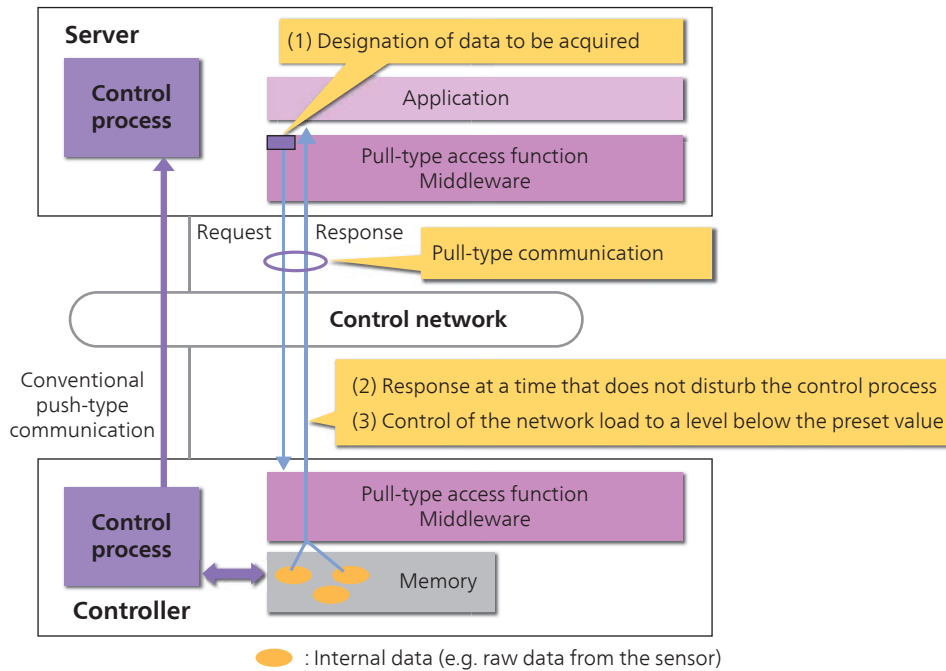## 2 Decentralized Autonomous Middleware with Pull-type Access Function

In the event of adding any new service or extra value to a control system in operation, it is necessary to temporarily stop its operation and change the software in the controller if the necessary data is not transferred between the server and the controller. To address this problem, Hitachi developed decentralized autonomous middleware with pull-type access function, which is designed to retrieve the desired data from the controller as needed without affecting the operation of the system.

The main features are as follows.

(1) Even when the system is online, it is capable of retrieving the desired data from the controller after the server specifies the addition or change of data to be retrieved.

(2) Data retrieval is performed in a pull-type manner, i.e. by responding to a request. The controller executes the response process at a time when the control process is not disturbed.

(3) The network load arising from additional data collection is confined to a predetermined level or lower.

2 Overview of the access function of the pull-type data retrieval middleware

Labels in figure:
Server
Control process
(1) Designation of data to be acquired
Application
Pull-type access function Middleware
Request   Response
Pull-type communication
Control network
Conventional push-type communication
(2) Response at a time that does not disturb the control process
(3) Control of the network load to a level below the preset value
Control process
Pull-type access function Middleware
Memory
Controller
: Internal data (e.g. raw data from the sensor)

In the future, Hitachi will capitalize on this middleware to make the operation and maintenance (O&M) service and other new services a reality.

3   Intelligent L2 Switches for Industrial Use

Characterized by a long-life design with a service life of 10 years, high performance and excellent reliability and environmental resistance, a lineup of intelligent L2 switches for industrial use was added, which are 26-port switches with a transfer rate of 1 Gbps designed for use in a central control unit or equivalent to which numerous devices are connected.

Similar to the existing 10-port models, this series supports the original optical ring protocol with high reliability based on more than 40 network functions such as the simple network management protocol (SNMP) and the spanning tree protocol (STP) and basic technologies of the control network which complies with International Electrotechnical Commission Publicly Available Specifications (IEC-PAS) 62953. Even in the event of high load concentration from all 26 ports, its original firmware function exclusively prioritizes the necessary packets to enable troubleshooting in 500 milliseconds or less, as same as existing models.

Its new functions include filtering out unwanted communication loads arising from broadcast and other communications at the L2 to L4 levels. In addition, without fans or slits, it operates under ambient temperature conditions of -10 to 55°C. This means that it can be installed in a rack where devices are placed close together and under other adverse temperature conditions.

3 Intelligent L2 switch 4000

4 Example of attachment of wireless module for image analysis to a round-shaped gauge

4 Wireless Module for Image Analysis

At worksites, there are numerous items used for visual inspections of equipment including the round-shaped mechanical pressure gauge connected directly to the piping and other meters, silica gel that changes in hue when it needs replacement, and the oil gauge. Meanwhile, the age deterioration of these items and a shortage of workers pose problems in terms of equipment maintenance and operation. As a service that solves these issues, Hitachi is working to automate on-site equipment inspection. Inspection records are automatically transformed into data to achieve closer linkages between IT and operational technology (OT).

Under these circumstances, Hitachi embarked on the development of a wireless module for image analysis that helps automate the visual inspection of equipment at worksites. This module will optically read the indication of the instrument and send the read value and a supporting image over the wireless sensor network as an inspection record. An optical reading means that there is no need to stop the existing equipment, and that the module may be introduced easily. It incorporates technology that downsizes the image analysis data to be wirelessly transmitted inside the module, intermittent drive control technology and a normally-off feature to operate nothing but those constituents that actually need to be operated to ensure several years of operation using batteries only. Because there is no need to install cables and it has a waterproof rating of IP67, it may be installed outdoors. The wireless sensor network secures a high level of reliability by means of spatial and frequency redundancy and other aspects and adopts mainstream protocol on the 2.4 GHz band to make it easy to introduce internationally.

5 Enhanced User Authority Function in Integrated Digital Monitoring and Control System

By ensuring the four S-qualities, namely the safe, secure, stable and symphonic qualities, the integrated digital monitoring and control system has been adopted in many different areas, including industry, gas, waterworks and sewerage. In addition, it works with the manufacturing execution system (MES) and mission-critical systems to help increase productivity and efficiency. In response to growing requests for enhanced security, Hitachi has recently upgraded the user-specific operation authority settings in audit trails aimed at preventing falsification and unauthorized use of data in a bid to achieve greater security.

The main features are as follows.
(1) In addition to the functions for limiting change of the control level and parameters and storing logs of operations, it enables printing of a screen shot of trend charts portraying performance data, limits printing of slips and enables storage of print logs.
(2) It prevents changes, reproduction and deletion of data in slips and tags and keeps logs of operations.
(3) It has an emergency log on function that enables operations by forcefully disabling user authority settings when emergency action is required.
(4) It provides a powerful search function to easily
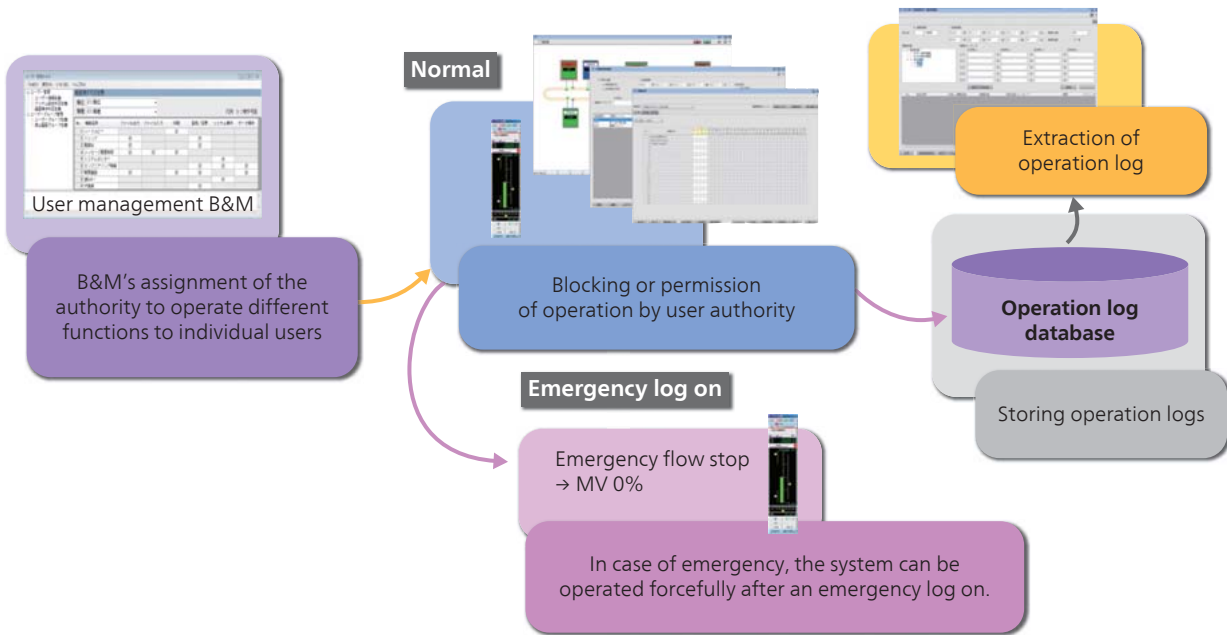
B&M: builder & maintenance, MV: manipulative variable

5 Overview of the user authority function of the integrated digital monitoring and control system

identify unauthorized outputs from output logs.

6 | One-way Relay Unit Beneficial to Cyber Security

Cyber-attacks against control systems are on the rise every year, and countermeasures are required. A common method of protecting from cyber-attacks is to install a firewall (FW) at the entrance and exit of the control system to filter out unauthorized access attempts. However, FWs have a number of drawbacks, such as short product support service periods, the risk of unauthorized intrusion through security halls and errors in policy definition in the control system using different communication protocols. They are unable to completely prevent unauthorized connection to control systems requiring long-term maintenance. Hitachi therefore developed a one-way relay unit that blocks cyber-attacks against control systems.

The main features are as follows.
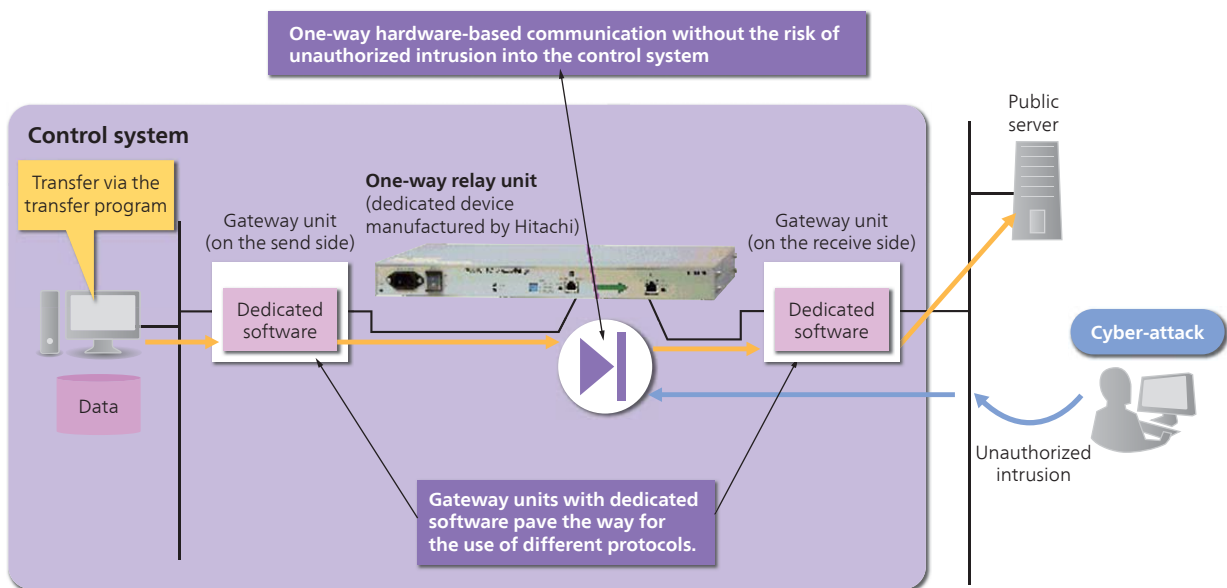
6 Example of application of one-way relay unit

(1) Through the use of Hitachi's hardware with long-term support available, it achieves one-way communication to eliminate the risk of the occurrence of security holes.

(2) The installation of gateway units with dedicated software for communication protocol conversion on the upstream and downstream sides of the one-way relay unit attains one-way data communication in different communication protocols without policy definition.

The application of this unit will be expanded not only to control systems in different sectors but also to the medical service and other domains.

7 Walk-through Type Explosives Trace Detection System

According to recent statistics* on international terrorist attacks, explosives are used in more than half of the attacks. In this situation, it is more and more necessary to carry out explosives inspections to prevent any explosives from being carried into key infrastructure or public facilities.

Hitachi has recently commercialized a walk-through type explosives trace detection system boasting a high throughput by combining the mass analysis technology developed over a long period of time by the Hitachi Group with the technology for collecting microparticles with the use of high speed air flows. Its inspection is extremely fast, taking only around three seconds. This means that it can test up to 1,200 persons or so per hour. It also supports explosive inspection concurrently with smartcard authentication to provide convenience to those who pass through the system and to reduce the labor and workload of inspections on operators.

A combination of this system with surveillance cameras, a face authentication system and others lead to the provision of advanced security solutions sought by customers to contribute to social safety and security.

*U.S. Department of State: Country Reports on Terrorism

Smartcard insertion slot

Explosive detected

Explosive not detected

7 Walk-through type explosives trace detection system that works in three seconds