

# Remote Monitoring and Maintenance Technology Providing “ Anytime, Anywhere” Equipment Support — Development of a Common Remote Monitoring and Maintenance Platform —

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It is necessary for the providers of equipment to give their customers full support, and to provide them with security and safety once the customers start operating the equipment. As doing the above is becoming more important than ever before, a framework is needed that monitors equipment status and maintains it over its entire life cycle. Therefore, a common platform for the construction of remote maintenance systems has been developed, and is the subject of this report.

## 1. Introduction

Providers of equipment must not only sell equipment to their customers but also give their customers full support as well as provide them with security and safety once they start operating the equipment. As this is becoming more important than ever before, a framework is needed to monitor equipment status and maintain the equipment over its entire life cycle.

To efficiently monitor and maintain equipment operating in Japan and many other countries around the world, a remote monitoring and maintenance system capable of accessing equipment from a remote location, monitoring equipment status, and collecting operating data is required.

IHI provides a wide variety of products, including industrial machines, logistics systems, energy plants, social infrastructure, ships, and aircraft engines. It is inefficient to monitor and maintain all these products using different systems. For this reason, we developed a common platform for the construction of remote maintenance systems that can be used across the IHI Group. This report outlines that system.

## 2. Common platform

### 2.1 Purpose of developing the common platform

The IHI common platform is a piece of IT infrastructure that supports the construction of remote monitoring and maintenance environments which can be used by any division of the IHI Group. Through provision of a common

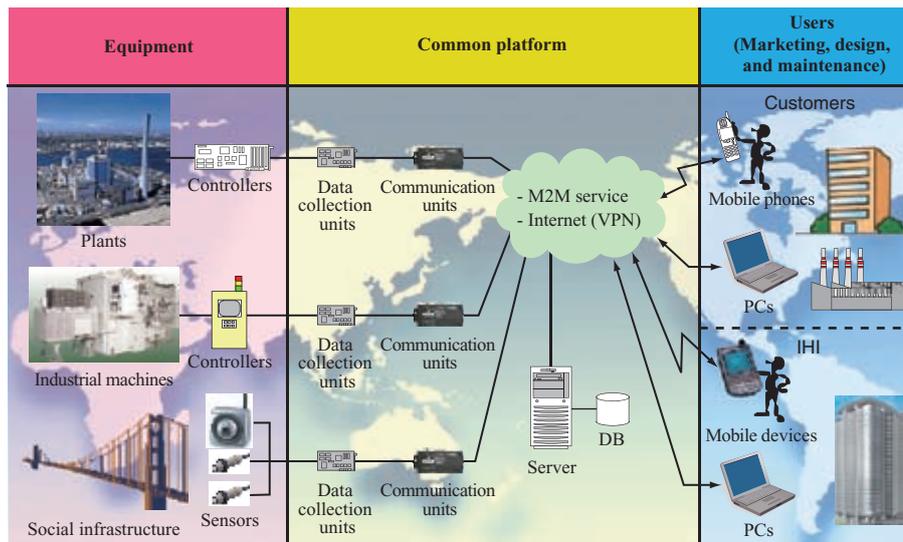
platform that can be shared across the IHI Group and supporting system operation and upgrades, the common platform was developed to reduce system introduction and operational costs as well as the burden of system operation on each division in addition to promoting the introduction of remote monitoring and maintenance environments.

### 2.2 Overview of the common platform

The common platform consists of ① a data collection unit that collects data from equipment, ② a communication unit that transmits such data to the server, ③ communication infrastructure that sends the data to the server, and ④ the server (including the database) that accumulates the data transmitted in ② and ③. The conceptual diagram of the common platform is shown in Fig. 1.

Those in charge can access the common platform via the Internet to monitor equipment status and obtain information required for maintenance. Managing equipment operating data through a common server enables information to be shared among personnel within divisions as well as between IHI and its customers. This enhances both communications between divisions and those between IHI and customers.

The communication infrastructure uses M2M service provided by an IT vendor, Fujitsu Ltd. The M2M service consists of a mobile phone network as well as Fujitsu's own backbone network and provides stable communication environments inside and outside Japan. In addition, the network is secure and reliable.



(Note) VPN : Virtual Private Network

Fig. 1 Overview of the common platform

### 3. Functions of the common platform

The common platform has the following functions: ① equipment monitor, preventive maintenance, and diagnosis, ② maintenance work support, ③ trouble response support, and ④ remote maintenance. These functions are illustrated in Fig. 2 and explained below.

#### 3.1 Equipment monitor, preventive maintenance, and diagnosis

##### 3.1.1 Equipment monitor

The data collection unit, which is directly connected to the equipment, collects operating data on the equipment. The unit periodically transmits to the server the necessary data culled from among all collected data. This allows users to acquire data both before and after an incident if a problem occurs.

Via the Internet, users can also search the data that has been accumulated on the server as well as check equipment operational status in addition to checking for abnormalities. Equipment status can be monitored anytime, anywhere over the Internet. Figure 3 shows an example display of a list of operational status of equipment.

##### 3.1.2 Preventive maintenance and equipment diagnosis

Users can analyze equipment status in more detail by viewing trend graphs of operating data collected on the equipment. Figure 4 shows an example display of such a trend graph.

Efforts are underway to apply data analysis techniques to understand statuses that indicate equipment performance deterioration and signs of abnormalities.

Data analysis techniques must be applied case-by-case depending on the features of the equipment as well as the amount and type of data. Data analysis techniques suitable for each piece of equipment will be developed in cooperation with the relevant divisions.

#### 3.2 Maintenance work support

Users can view a list of scheduled times for parts replacements calculated on the basis of parameters specified for individual parts and the operating data collected on the equipment. Users can also centrally manage services by recording information on the maintenance conducted by each service engineer and such engineers' visits to customers.

#### 3.3 Trouble response support

If any abnormality occurs in a piece of equipment, the common platform can notify the persons concerned via e-mail of the occurrence of such an abnormality to allow them to quickly respond to the problem with knowledge of the equipment status.

If the monitoring data deviates from the predetermined parameter range, the common platform can notify the persons concerned via e-mail in the same manner. Based on continuous monitoring of equipment status, the common platform allows users to take the necessary actions to prevent equipment from halting due to abnormalities. The platform also has a guidance function which shows users how to deal with problems when necessary.

#### 3.4 Remote maintenance

Users can remotely access equipment controllers and directly check the equipment status. By viewing the same screen as seen on the local controllers, they can give local service engineers precise instructions regarding their work to assure prompt and precise maintenance of equipment.

### 4. To deliver safety and security to customers

By constructing the remote maintenance system, our objective is to deliver safety and security to customers for the entire product life cycle. The ultimate benefits for customers from this system are described below and shown in the schematic in Fig. 5.

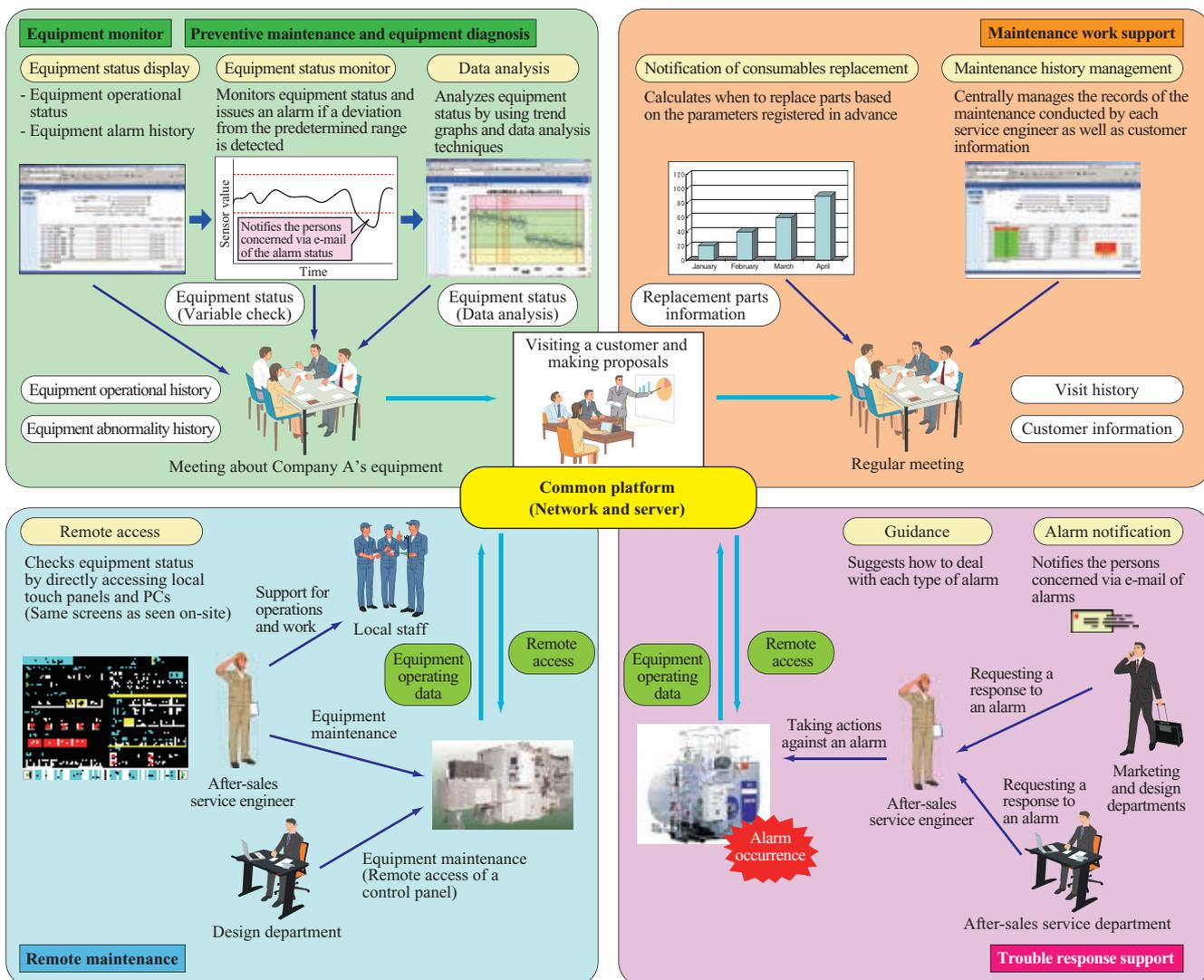


Fig. 2 Overview of functions of the common platform

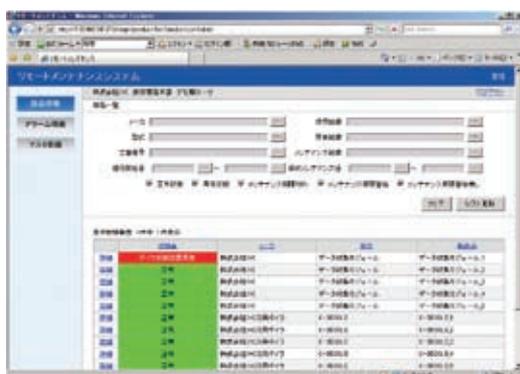


Fig. 3 Example display of a list of operational status of equipment

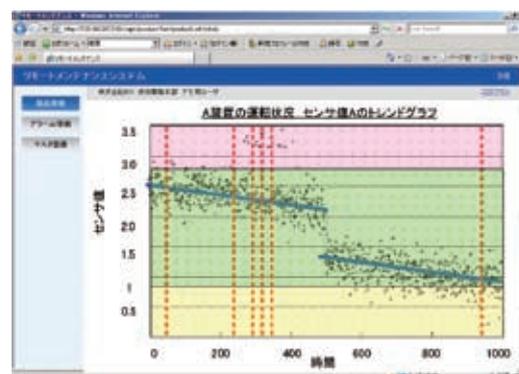


Fig. 4 Example display of a trend graph

#### 4.1 Maintaining regular contact with customers after they start operating equipment

We will make proposals for status-based maintenance of equipment from the viewpoint of our customers on the basis of the operational status and abnormality history of the equipment, the maintenance history and visits by

each service engineer, and other specific information and quantitative evaluation results. This will contribute to reductions in maintenance cost.

We will provide more in-depth services to our customers by sharing information from service engineers and sales personnel concerning maintenance and their visits to customers.

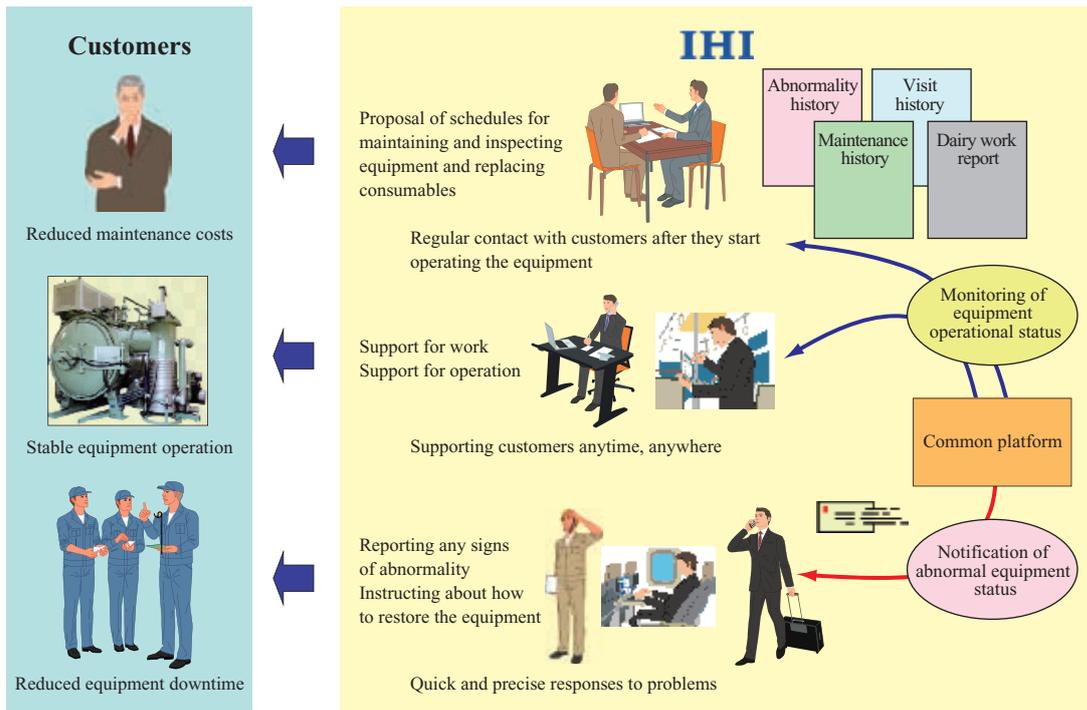


Fig. 5 Advantages of introducing the common platform

#### 4.2 Supporting customers anytime, anywhere

We will support our customers to ensure that their equipment keeps operating stably in tip-top condition by monitoring the equipment operational status remotely as well as supporting operations and the work of local service engineers and customers' operators anytime, anywhere.

We will ensure safety for our customers by periodically monitoring the status of equipment after it has been put into operation and verifying that it continues to operate stably.

#### 4.3 Quick and precise responses to trouble

If any problem occurs in the equipment, the common platform can immediately notify the persons concerned via e-mail of the occurrence of trouble to allow them to quickly respond to the problem. The platform also has a guidance function to support primary actions to recover from trouble.

In addition, the common platform allows users to identify any abnormal equipment status and instruct local service engineers as well as customers' operators about how to deal with such abnormalities. This minimizes the time required to restore customers' valuable equipment.

### 5. Conclusion

We developed the common platform to construct a remote maintenance system that can be used throughout the IHI Group. We will collect data from actual products in cooperation with the relevant divisions and use such data to expand our maintenance business. We will also make efforts to expand functions that meet the needs of our customers and divisions.