Hitachi’s Efforts towards Digitalization

December 5, 2018
Hitachi, Ltd.
Service & Platform Business Division Group
IoT & Cloud Service Business Division
General Manager

Tetsuhiko Hirata
Contents

1. Impact of Digitalization
2. Efforts Towards Digitalization
3. IoT Platform Solution
1-1. Digital transformation

Previously unknown solutions

Disruptive services that will change the future
Digitalization allows us to increase operational efficiency and achieve innovation.

This is a chance for growth, even for traditional industries.
1-3. Hitachi’s IoT Initiative

Hitachi

OT

Over 108 years

Urban

Industry

Products

Consumer

IoT

Innovation is Our DNA

IT

Over 59 years

Cloud Computing

Telecommunication

AI

IT System/Integration

Analytics Security
2-1. Hitachi's digitalization efforts (1)

From selling products to providing services
Maintenance division for medical equipment at Hitachi

We want to avoid sudden failures in examination equipment, and provide more reliable support.
2-1. From selling products to providing services (2) Achieving goals

Before

MRI sales and maintenance are separate.

- If equipment suddenly fails...
  Changes to examination schedules
  Greater burden on physicians (hospitals) and patients

- Difficult repairs
  Identifying the cause of the failure and procuring components requires time and money.

Digitalization

After

Continuous support after MRI delivery

- Maintenance prior to failure
  Smooth examinations
  Less time and money required for repairs

Product oriented: Selling a MRI

Service oriented: Selling reliable examinations

Creating a service from maintenance to ensure operational uptime
2-1. From selling products to providing services (3) Structure of the solutions

Predict failures based on remote status monitoring and failure mode analysis, and request maintenance in advance.
Outcome: Operational uptime of the equipment is increased, which improves the efficiency of examinations.

*Predictive maintenance: System to ensure operational uptime

MRI maintenance service

MRI maintenance system

Predictive maintenance*

- Maintenance personnel (inspection)
- Sensor data
- Data collection
- Data integration
- Failure mode analysis
- Issuance of notifications
- Maintenance request
Extending predictive maintenance to other areas, such as elevators and programmable controllers

2-1. From selling products to providing services (4) Standardizing solutions

- Elevator
- MRI
- Programmable controller

Equipment maintenance solution

Predictive maintenance

- Issuance of notifications
- Failure mode analysis
- Data collection
- Data integration

Maintenance request

Sensor data
Enabling the use of solutions for a wide range of devices, such as automobiles and smart meters.
Relentless cost reductions in the manufacturing industry
At Hitachi manufacturing sites
Through efficient production planning, we want to meet strict deadlines and reduce costs.
2-2. Cost reductions in the manufacturing industry (2) Achieving goals

Before
Costs were high because of complicated production planning that resulted from small-scale production of many different goods

- Production lines stopped frequently due to accidents
- Long production lead times

Measures based on experience and intuition

After
Visualization of production processes, and reduced costs

Production processes were visualized, and simulations were conducted. Stop times for production lines were controlled based on the results.

Production lead times halved due to measures based on data
2-2. Cost reductions in the manufacturing industry (3) Structure of the solutions

Production plans and actual data from the manufacturing site were visualized, leading to real-time solutions.
Outcome: Reduction in inventory assets, reduction in overall cost prices, and improved energy efficiency

Using the high-efficiency production model makes it possible to check daily for whether the results are deviating from the plan, and to determine what measures to put in place.

<table>
<thead>
<tr>
<th>Work site</th>
<th>Work instructions to employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees scan their RFID cards and perform their work. Data on the work performed by the employees is fed back into the system.</td>
<td>Work changes accompanying personnel assignments are communicated to the employees by the group leader.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High-efficiency production model of the Omika factory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmation of work planning and assignment of personnel</td>
</tr>
<tr>
<td>Through the use of the factory simulation, personnel and component allocation for the next day is adjusted in consideration of the effect on other processes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work progress data</th>
<th>Check progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>The work improvement support system is used to identify production processes where work time is longer than usual.</td>
<td></td>
</tr>
</tbody>
</table>

Using the high-efficiency production model makes it possible to check daily for whether the results are deviating from the plan, and to determine what measures to put in place.

RFID: Radio-frequency identification
2-2. Cost reductions in the manufacturing industry (4) Standardizing solutions

Promoting visualization at other factories within Hitachi

- Confirmation of work planning and assignment of personnel
- Work instructions to employees
- Work progress data
- Check progress
Enabling solutions for various customer factories

<table>
<thead>
<tr>
<th>Car manufacturing factories</th>
<th>Machine tool plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factories for mass production of clothing and other goods</td>
<td>Machine part plants</td>
</tr>
</tbody>
</table>

Factory visualization solution

- Work instructions to employees
- Work progress data

IoT platform

- Studio
- Core
- Analytics
- Foundry

Providing to customers
Construction of IoT platform that took the manufacturing line as an example
3-2. Approach to a solution (1)

**Field support system**
The system receives an issued maintenance event and allocates maintenance personnel and maintenance components, dispatching them to the customer’s location.

**System integrating OT and IT**
The remaining life is acquired from the equipment monitoring system, and the field support system is notified if a threshold is exceeded.

**Equipment monitoring system**
Predicted values for remaining life are calculated by analyzing sensor data.
3-2. Approach to a solution (2)

**IT**

Dynamics 365

The system receives an issued maintenance event and allocates maintenance personnel and maintenance components, dispatching them to the customer’s location.

**IoT**

Node-RED

Issuance of a maintenance event when a threshold is exceeded

**OT**

MATLAB

Acquisition of remaining life

- **Equipment monitoring system**
  - Acquisition of sensor data
  - Dynamic 365
  - MATLAB
  - Manufacturing machine

- **Field support system**
  - Dispatch of maintenance personnel
  - Node-RED
  - IoT

- **Predicted values for remaining life**
  - Calculated by analyzing sensor data.
3-3. Complexity of wo systems configuration

IT

Dynamics
Salesforce
ServiceNow
Proprietary

OT

MATLAB
Modelica
R
Python

Device

Grinder
Turbine engine
Cooling pumps
Automobiles

© Hitachi, Ltd. 2018. All rights reserved.
3-4. Challenges of OT and IT systems integration

IT systems must be integrated with various OT systems (such as MATLAB, Modelica, R, and Python)

Challenge: The data sent from the OT systems is in various different formats, so IT systems must be modified for each of the OT systems with which integration is desired.
For $m$ OT systems and $n$ IT systems, companies don't want to provide implementations for $m \times n$ combinations.

All combinations can be achieved by $m + n$ implementations, by using a bridge between the OT systems and IT systems.
3-6. IoT Platform to integrate OT and IT systems

**IoT Platform**

- **IT**
  - Dynamics
  - Salesforce
  - ServiceNow
  - Proprietary

- **OT**
  - MATLAB
  - Modelica
  - R
  - Python

- **Device**
  - Grinder
  - Turbine engine
  - Cooling pumps
  - Automobiles
● Hitachi is currently promoting efforts to digitalize both internally and externally.
● The core is in IoT platform of Lumada when embodying it.
● Going to the activity even better by promoting in conjunction with the standardization.
HITACHI
Inspire the Next