HANNOVER MESSE 2019, 1-5 April

Connected Industries Open Framework for Industrial Value Chain Transformation

1st April 2019

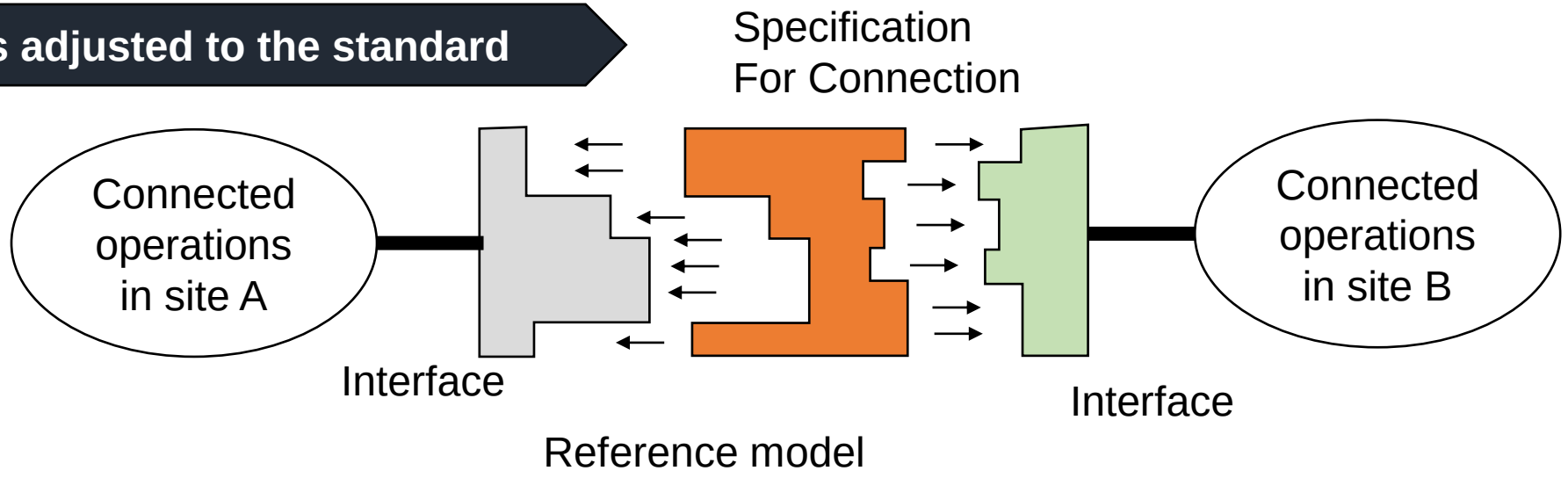
Prof. Dr. Yasuyuki Nishioka
Industrial Value Chain Initiative
Hosei Unversity

Outline

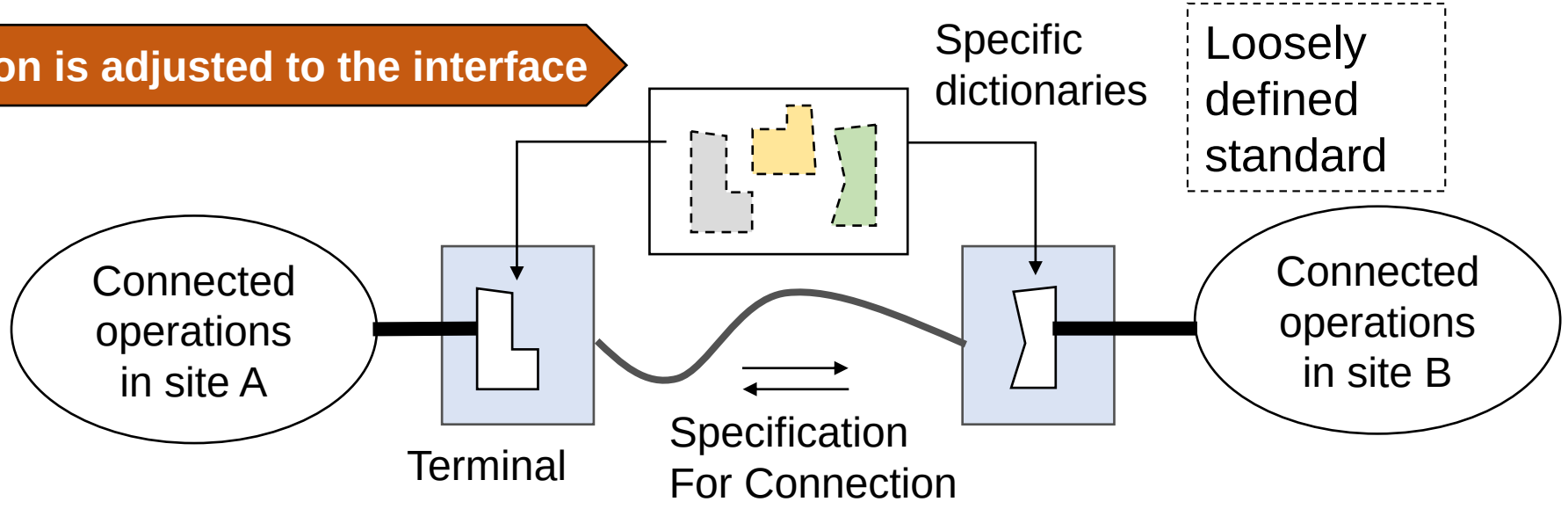
1. Overview of Industrial Value Chain Initiative
2. Smart Manufacturing Scenarios in 2018
3. What is Connected Industries Open Framework ?
4. Result of Use Cases Development in the Project
5. Road Map of Digital Transformation of Manufacturing

Loosely defined standard for connected manufacturing

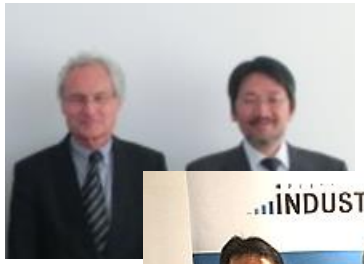
Interface is adjusted to the standard



Specification is adjusted to the interface

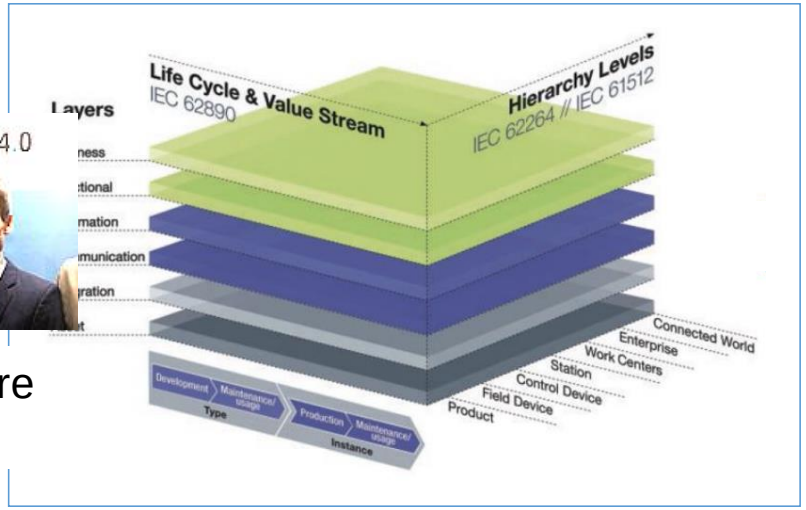


Smart Manufacturing Reference Architecture

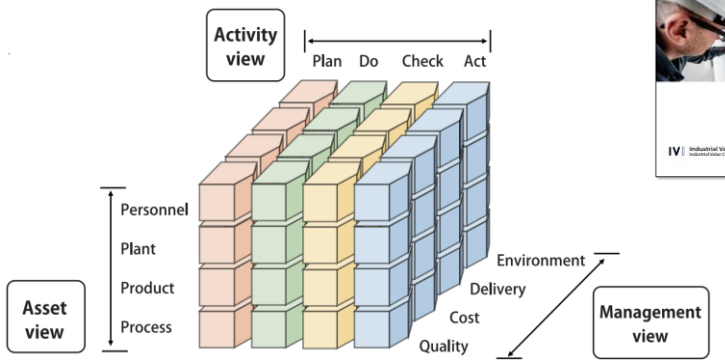


Reference Architecture Model Industrie 4.0

PLATTFORM INDUSTRIE4.0

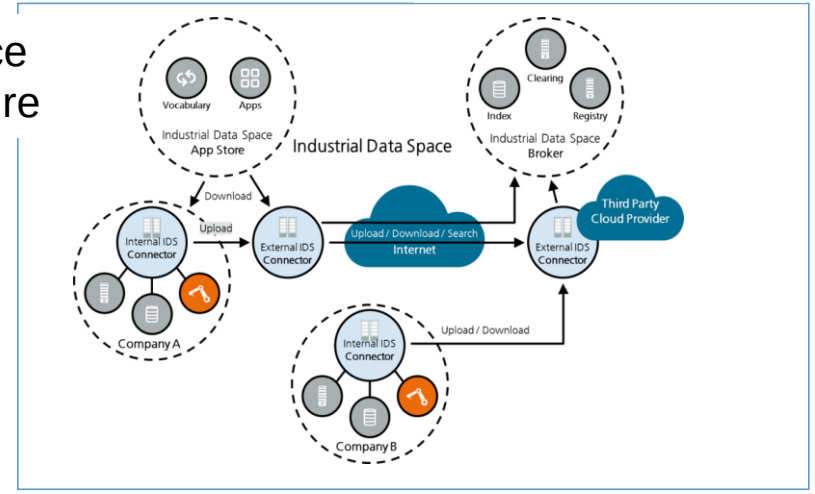


Industrial Value Chain Initiative



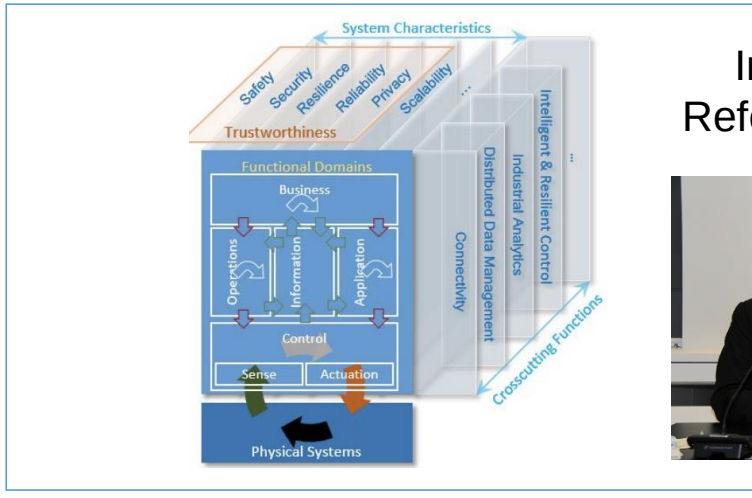
Industrial Value Chain Reference Architecture

INTERNATIONAL DATA SPACES ASSOCIATION



Industrial Data Space Reference Architecture

industrial internet CONSORTIUM



Industrial Internet Reference Architecture

Members of IVI

250+ companies, 600+ individuals

Regular Members of IVI

250+ companies, 600+ individuals

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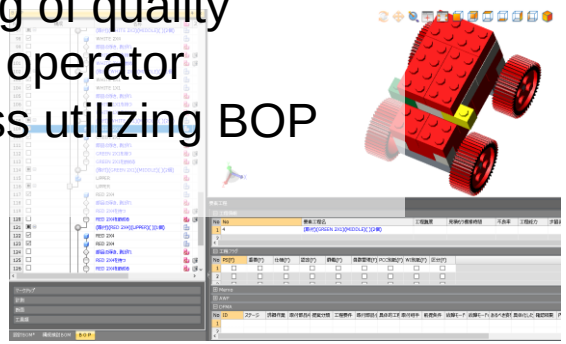
Smart Manufacturing Scenarios in 2018

No	Title	Facilitator
1	Key performance Index for connectable factory floors and management	Yamazaki Mazak Corporation
2	Secure and large-scale data distribution services	Toshiba Corporation
3	Visualization of decision making based on risks and losses in applying condition-based maintenance	Daikin Industries, Ltd.
4	Improving quality, productivity and automation of production lines with Artificial Intelligence	Mazda Motor Corporation
5	Predictive maintenance and quality control anyone can use by using sensor data	Misuzu Industries Corporation
6	Developing of quality according operator uniqueness utilizing BOP	Brother Industries, ltd.
7	Simplification and efficiency improvement in the operation phase of robot equipment	Yaskawa Electric Corporation
8	Visualization of achievements of people / goods / behavior analysis and optimization	Mazda Motor Corporation
9	Evolution to high-efficiency manufacturing by autonomization	Nikon Corporation
10	Visualization of kaizen status at remote manufacturing sites	Ricoh Co., Ltd.
11	Visualization and optimization of energy consumption and productivity of manufacturing facilities	Panasonic Industrial Devices SUNX Co., Ltd.
12	Optimization by tracking the actual time and location of parts transportation trucks	Mazda Motor Corporation
13	Progress announcement service for small and medium enterprises	Fujitsu Limited
14	Real-time data collection and utilization between factory processes by extended MES	Kojima Industries Corporation
15	Construction of small parts management system using digital tag	DMW Corporation
16	Quality control for each worker - Secure real-time management of quality KPI -	IHI Corporation
17	Stabilization of product quality by using AI on edge of production	Mitsubishi Electric Corporation
18	Improvement of quality in forging production line	Mitsubishi Electric Corporation
19	Constructive and continuous data collection and analysis	CKD Corporation

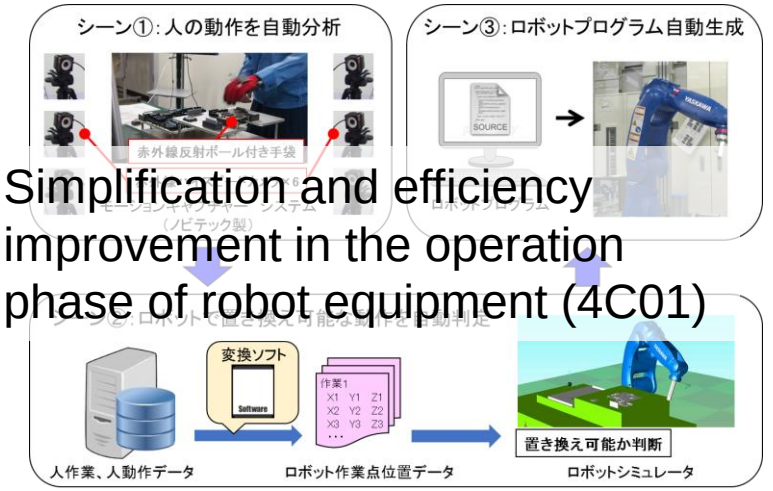
2015 : 20 scenarios　　2016 : 25 scenarios　　2017 : 22 scenarios　　2018 : 19 scenarios

Selected Outputs of 2018 scenario WGs

Developing of quality according operator uniqueness utilizing BOP (4A01)

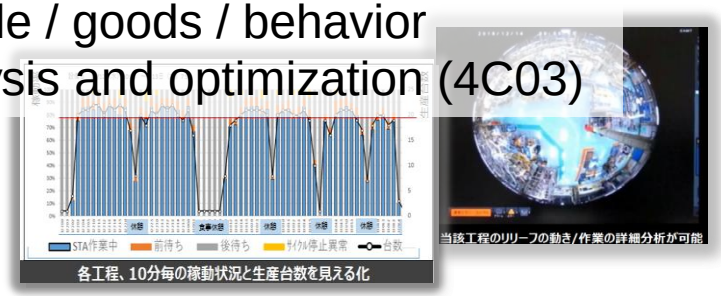


Quality control for each worker
- Secure real-time management of quality KPI (4A04)



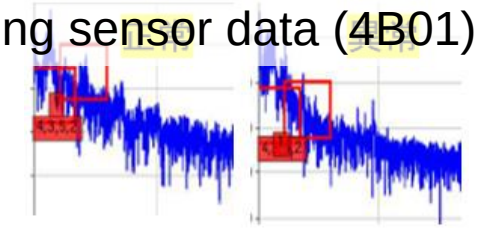
Simplification and efficiency improvement in the operation phase of robot equipment (4C01)

Visualization of achievements of people / goods / behavior analysis and optimization (4C03)

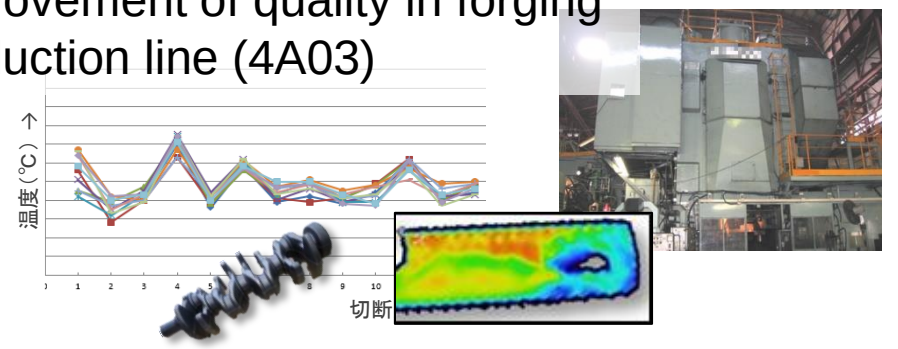


Evolution to high-efficiency manufacturing by autonomization (4C04)

Predictive maintenance and quality control anyone can use by using sensor data (4B01)

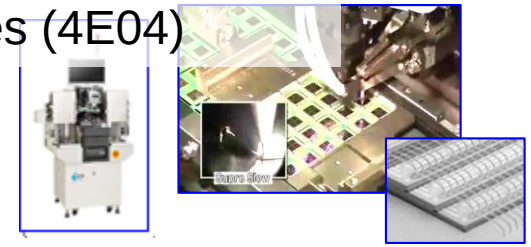


Improvement of quality in forging production line (4A03)

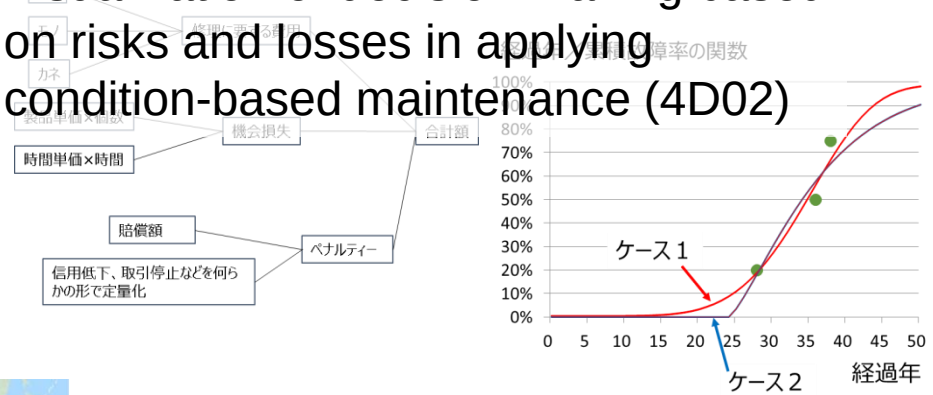


Selected Outputs of 2018 scenario WGs

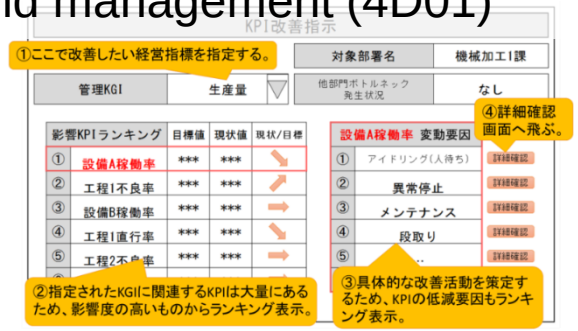
Secure and large-scale data distribution services (4E04)



Visualization of decision making based on risks and losses in applying condition-based maintenance (4D02)

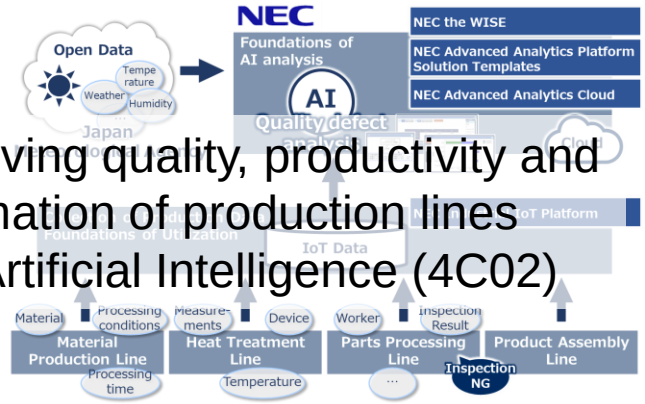


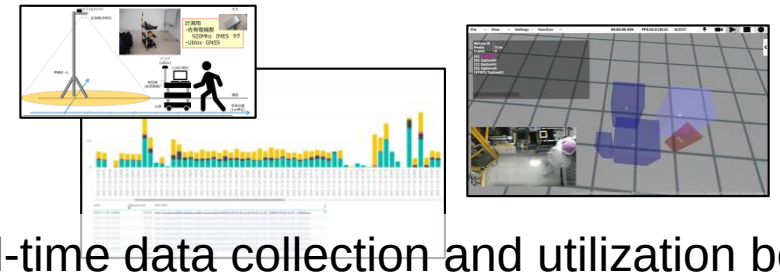
Key performance Index for connectable factory floors and management (4D01)



Visualization of kaizen status at remote manufacturing sites (4C05)

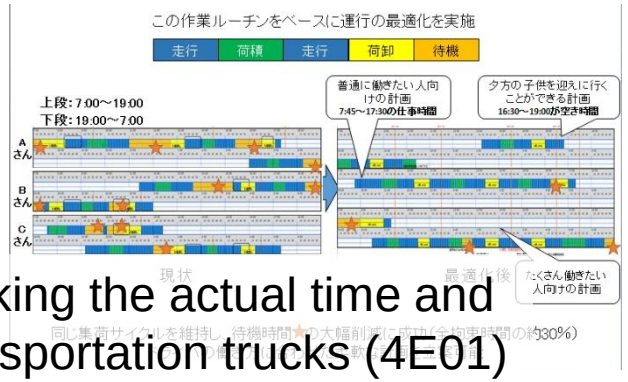
Improving quality, productivity and automation of production lines with Artificial Intelligence (4C02)



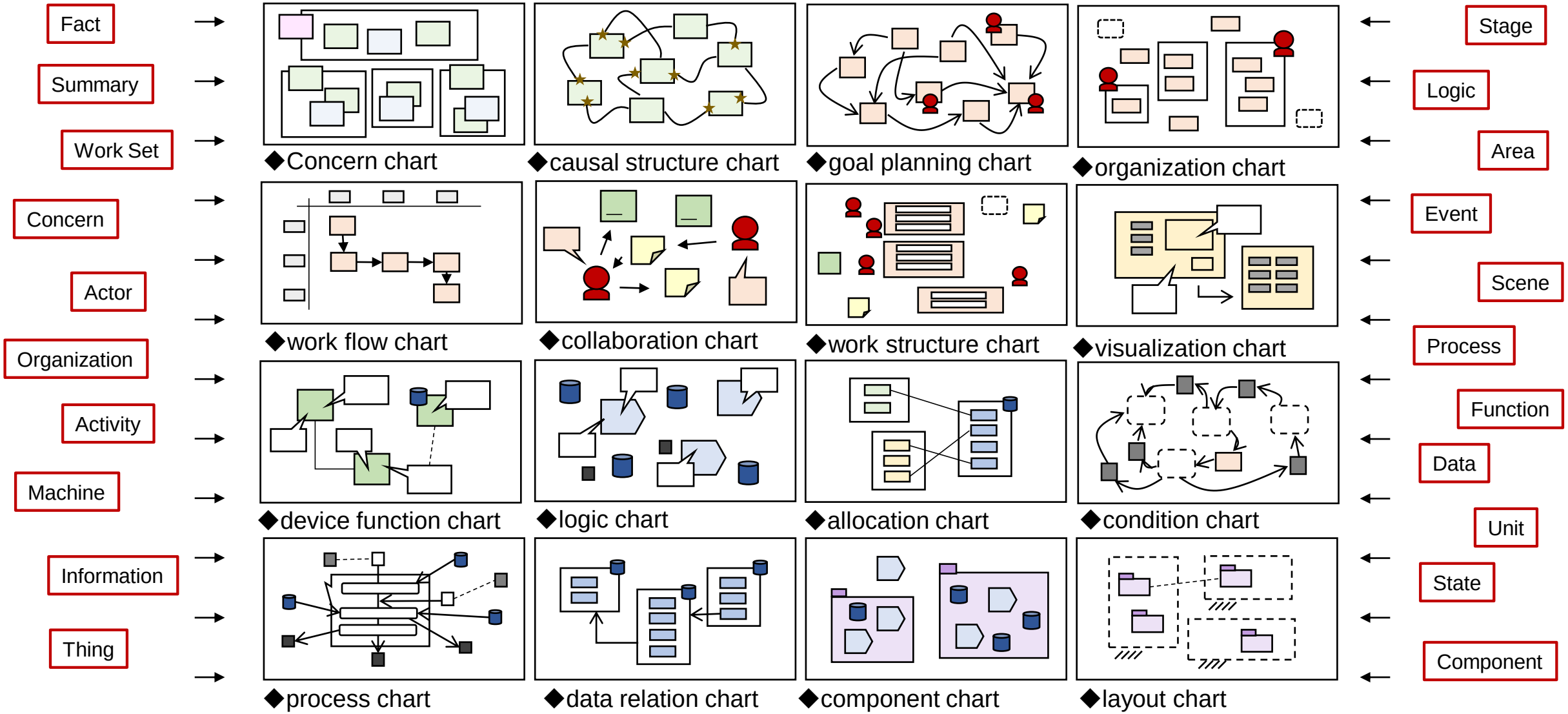


Real-time data collection and utilization between factory processes by extended MES (4E02)

Optimization by tracking the actual time and location of parts transportation trucks (4E01)



16 Digital tools for Smart Thinking Organization



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1. Overview of Industrial Value Chain Initiative
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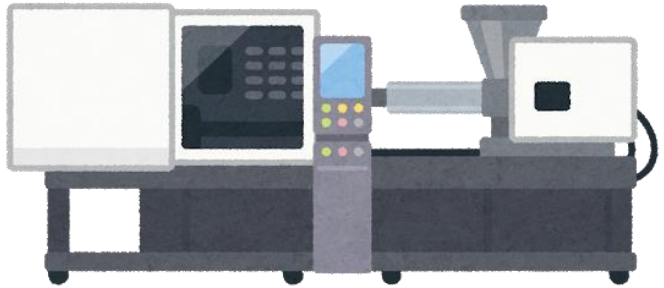
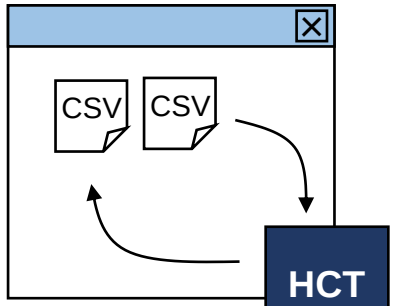
Simple and Easy to implement a connected world

Operations in a office and a factory are connected seamlessly by means of data connections with liability



Machine Shop floor

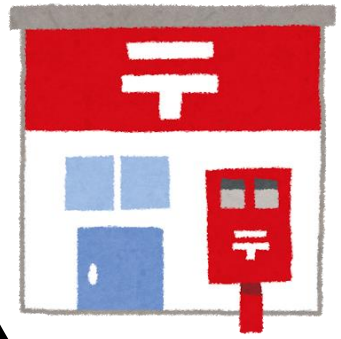
Automation



HCT

Design Office

HCS



Maintenance Service

Supplier

HCT

Customer Center

Batch transfer

Data is distributed in a form of encrypted file. This is not real-time basis, but reliable.

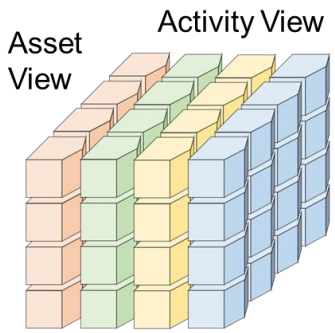
Simple protocol

Same as a post office, data is sent without handshake process.

peer to peer

Data is not stored is the Internet, so that security management is feasible

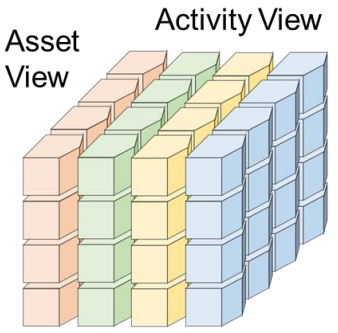
Double stages translation by adaptable dictionaries



Data Provider

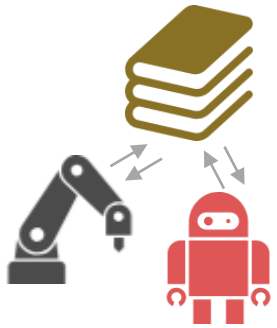
Common dictionaries are selected to adjust the local dictionaries for each side.

Data User



AS-IS approach

Common dictionary (standard)



Actual words

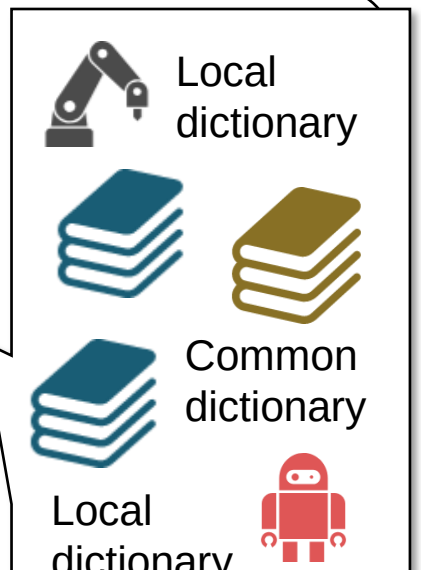
A common single dictionary is defined and both side adjusts the local words to it.

Undefined local words are out of control and difficult to maintenance them.

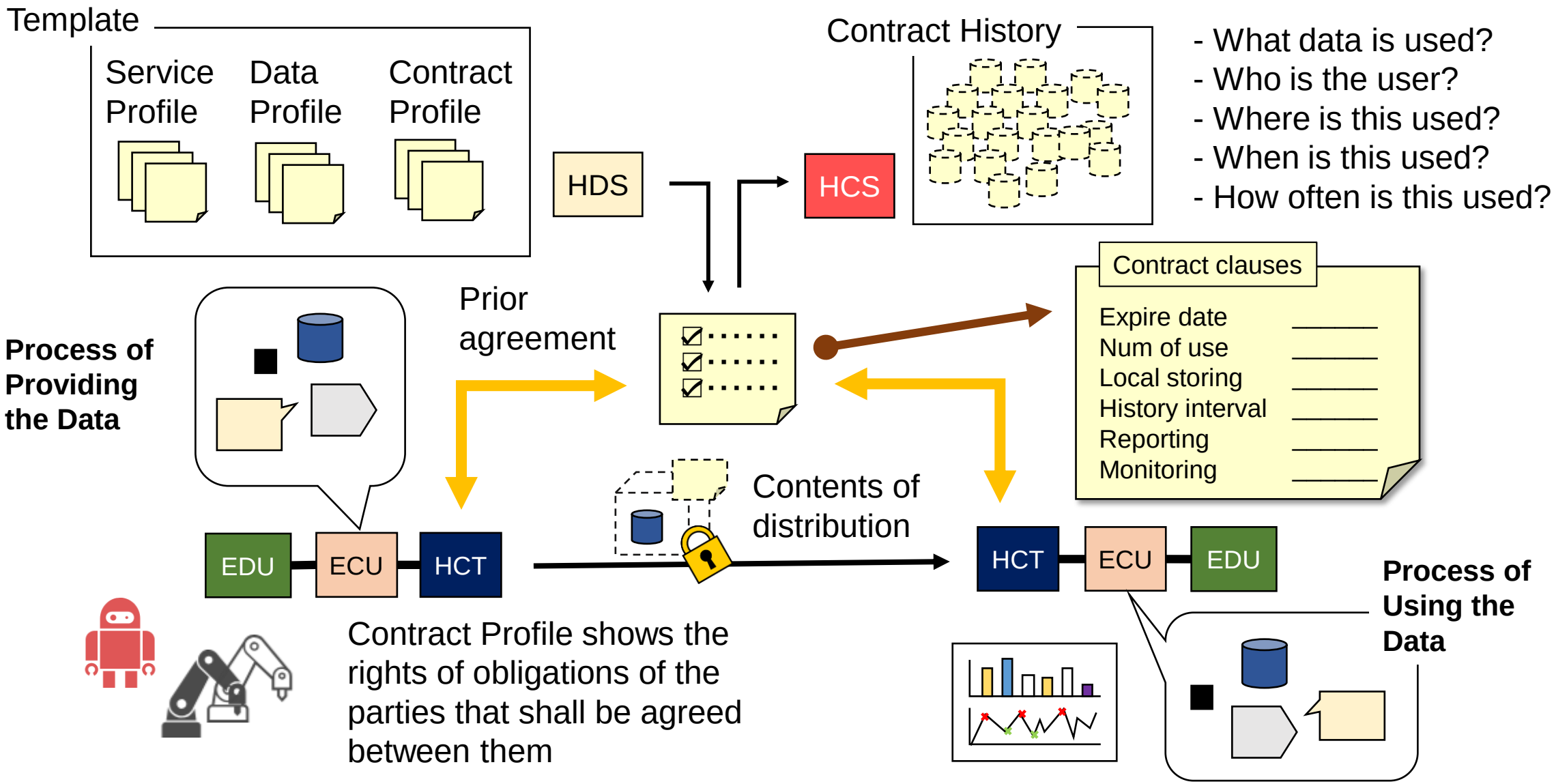
TO-BE approach

Each side can define the local words of its dictionary and prepare the translation map

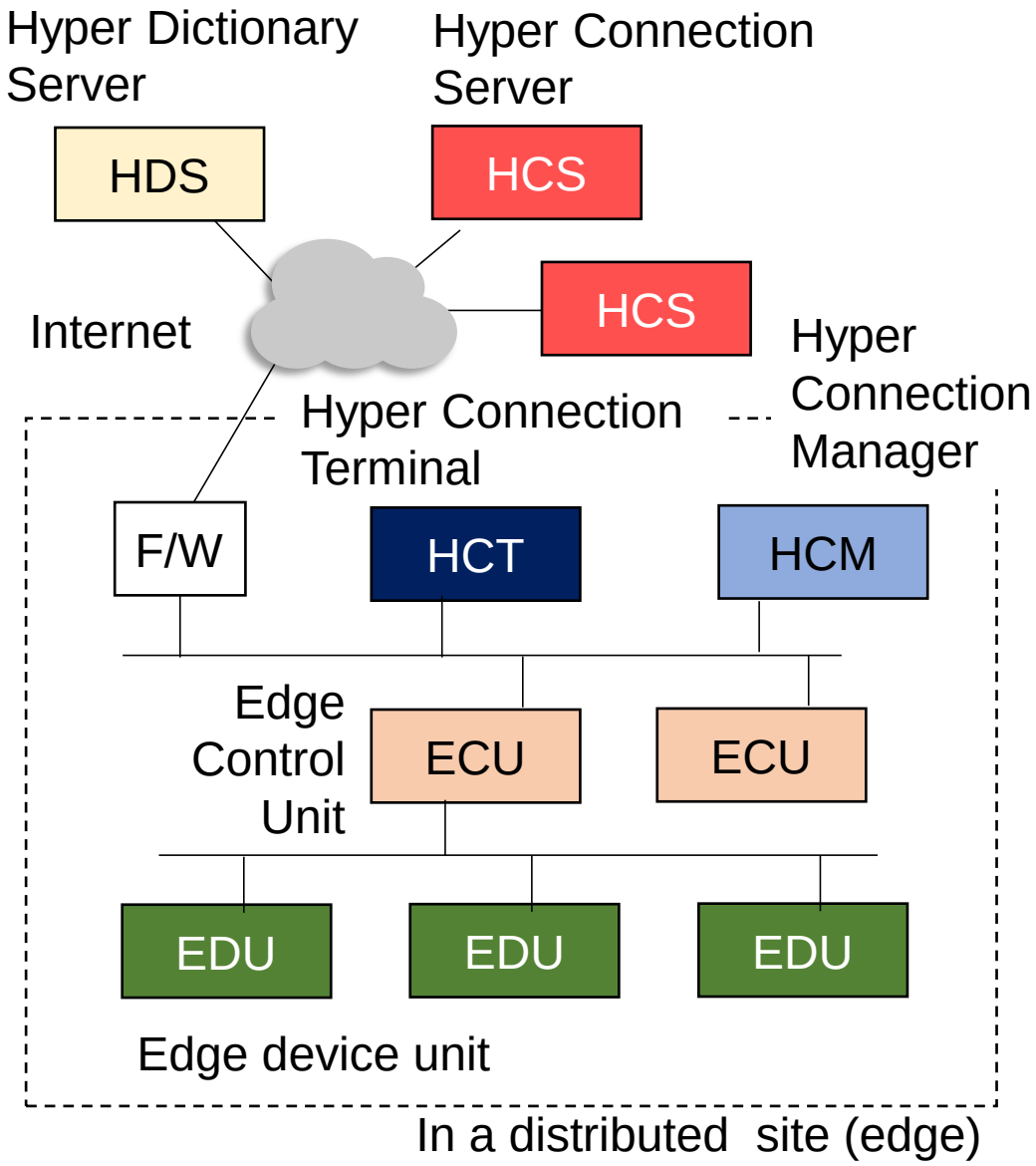
Local site can flexibly choose the words to adjust the system to the reality.



Trade profiles for data distribution and delivery



System Architecture



System Integration Phase

Register parties, controller and devices, and dictionaries.

System Integrator, Production Line builders

Trade contract setup phase

Agree the contract to distribute data using document templates

Marketer, accountant and Data base engineer

System execution phase

Distribute an actual data and use it in accordance with the contract

Field operator and practitioner of the daily works

Monitoring and Evaluation Phase

confirm the transaction history of the data transfer and use

Quality assurance staff, accountant and managers

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Use case categories of platform data distribution

✓ Open and/or closed business model implementation regarding **data as intellectual properties**

Scenario 1

CNC data of machine tools are securely managed in a remote site and by decentralizing the remote site.

TOSHIBA

DMG MORI

Machine tool

✓ **Enhance of quality assurance** by sharing the result of testing data among supply chain

Scenario 2

Monitoring results of a inspection process and inquiring a image data of a particular NG lot.

FUJITSU

FANUC

Robot

✓ **Accounting integration** with manufacturing operations by confirming the performance data

Scenario 3

Lot inspection at supplier SME directly by the customer and generating account payable

NEC

MITSUBISHI ELECTRIC

PLC

.. data as intellectual properties

Scenario 1

Open and/or closed business model implementation regarding **data as intellectual properties**

CNC data of machine tools are securely managed in a remote site by decentralizing its data control.

The CNC program that interactively modified by the field operator according to individual order items or prototypes, is disassembled into additional conditions and parameters, and is shared among the company. Actual orders are managed between sites considering cost, quality, and delivery time by associating them with the job characteristics.

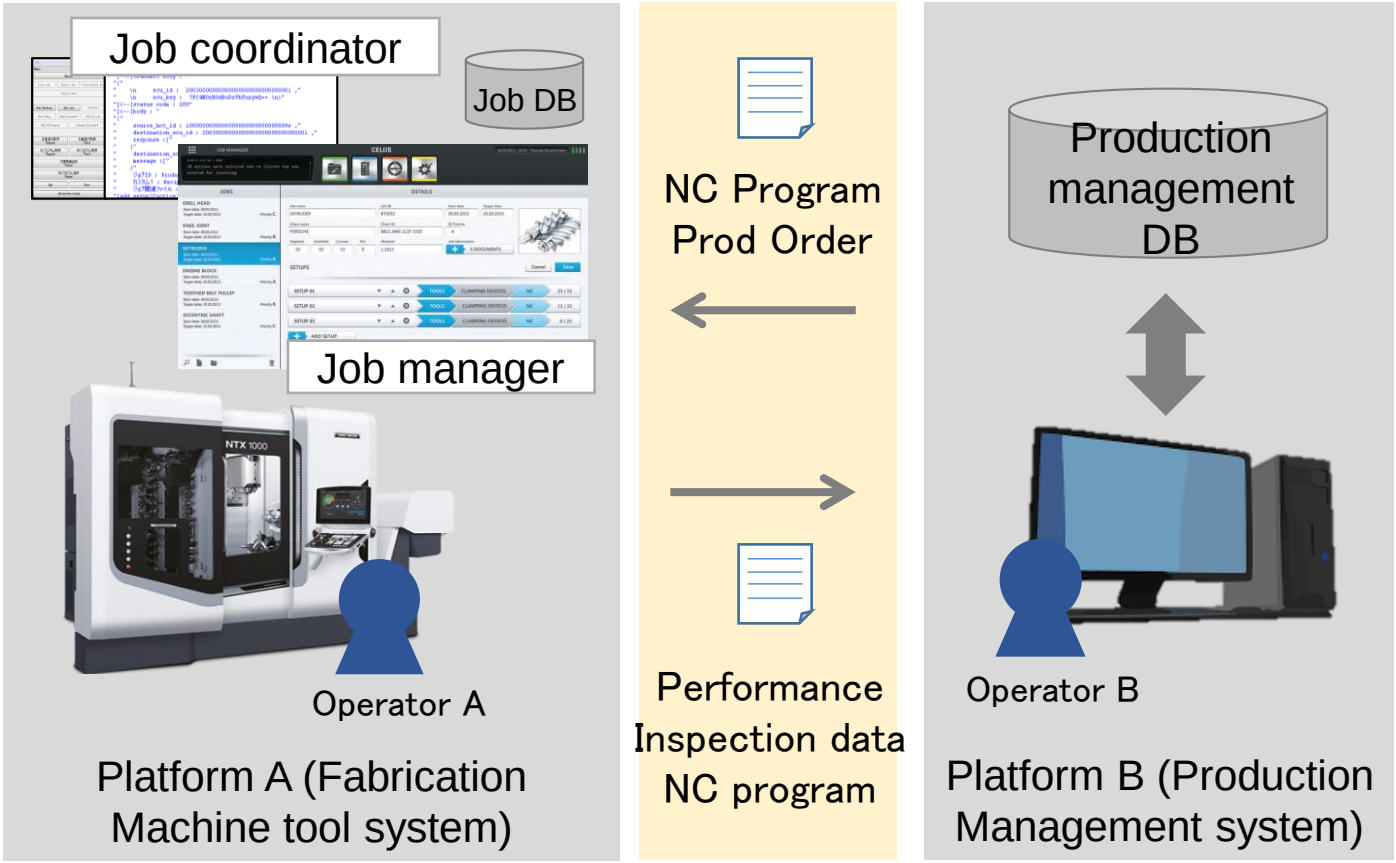
CELOS

Meister series

DMG MORI ⇄ TOSHIBA

(A) fabricator (B) maker

1) Push production orders and NC program by maker (A << B)
2) Fabricator makes parts after updating the NC program
3) Push production result and NC program by fabricator (A >> B)



Enhance of quality assurance .. Scenario 2

✓**Enhance of quality assurance** by sharing the result of testing data among supply chain

Monitoring results of a inspection process, and inquiring a image data of a particular problematic lot.

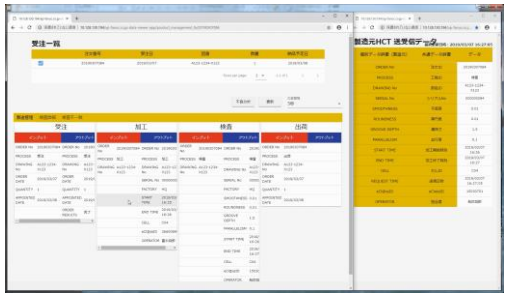
1) Push production order by maker (A << B)
2) Push production result by fabricator (A >> B)
3) Push shipping result by fabricator (A >> B)
4) Pull quality data (pictures) by maker (A >> B)

The results of workpiece loading, unloading and quality inspection (image inspection) after processing are linked with external data. Then the system externally acquires data necessary for quality control inside the edge. When an incident occurs, managers identify the cause and improve it from the data inside and outside the edge.

FIELD system ⇄ COLMINA

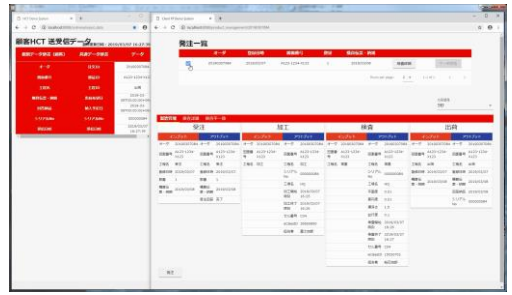
FANUC ⇄ FUJITSU

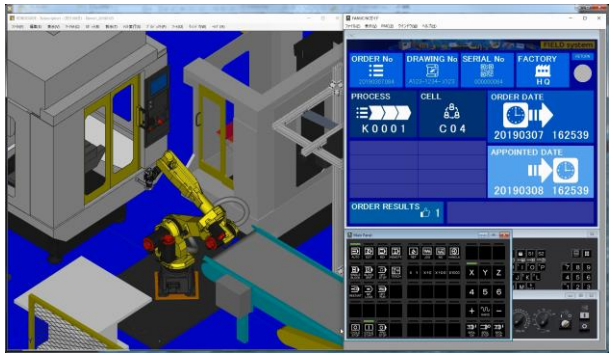
(A) fabricator (B) maker



Sales order panel of supplier

Purchas order panel of customer (maker)





Production line of supplier

- Real time reporting of production line status
- Quality data distribution by push/pull procedures

Accounting integration ..

Scenario 3

✓**Accounting integration** with manufacturing operations by confirming the performance data

Lot inspection at supplier SME directly by the customer and generating an account payable

Order is automatically accepted when supply parts from the manufacturer arrive at the supplier side. IoT gateway at the point of passage of materials in the factory monitors and logs there, and necessary inspection data is checked at each station. In the maker side, account payable is generated when the parts complete and ready to ship. The maker or 3PL goes and pick up them.

Edgecross

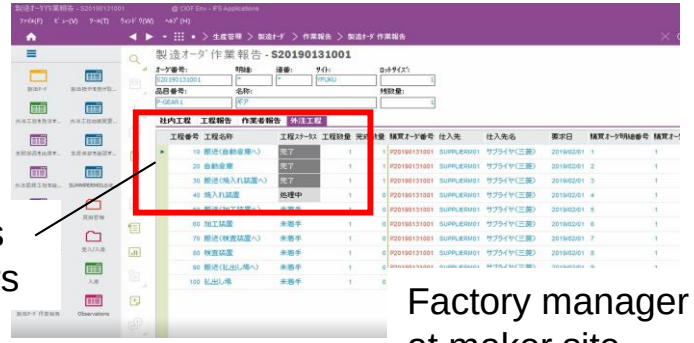
IFS Applications 10

MITSUBISHI ELECTRIC ⇄ NEC

(A) supplier SME (B) maker

1) Push purchase order by maker (A << B)
2) Push production progress by supplier (A >> B)
3) Pull direct acceptance by maker (A >> B)

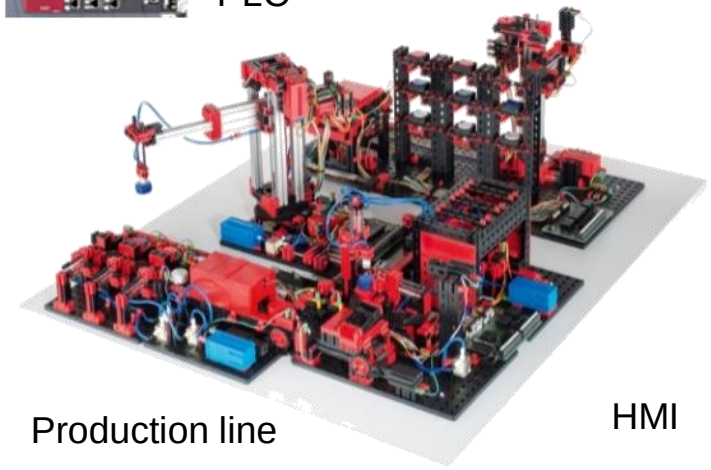
IPC



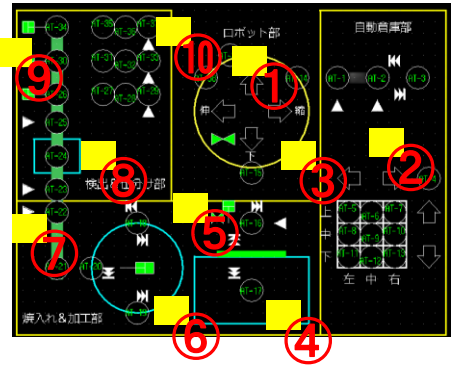
Monitor the status of purchase orders

Factory manager at maker site

PLC

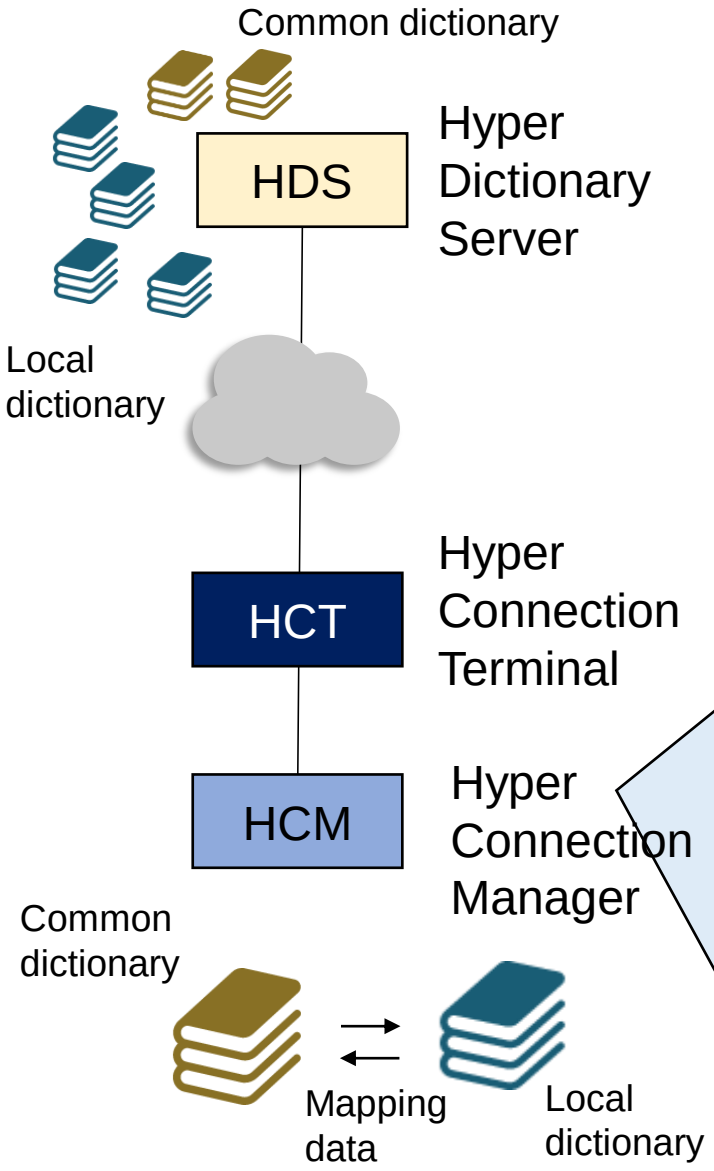


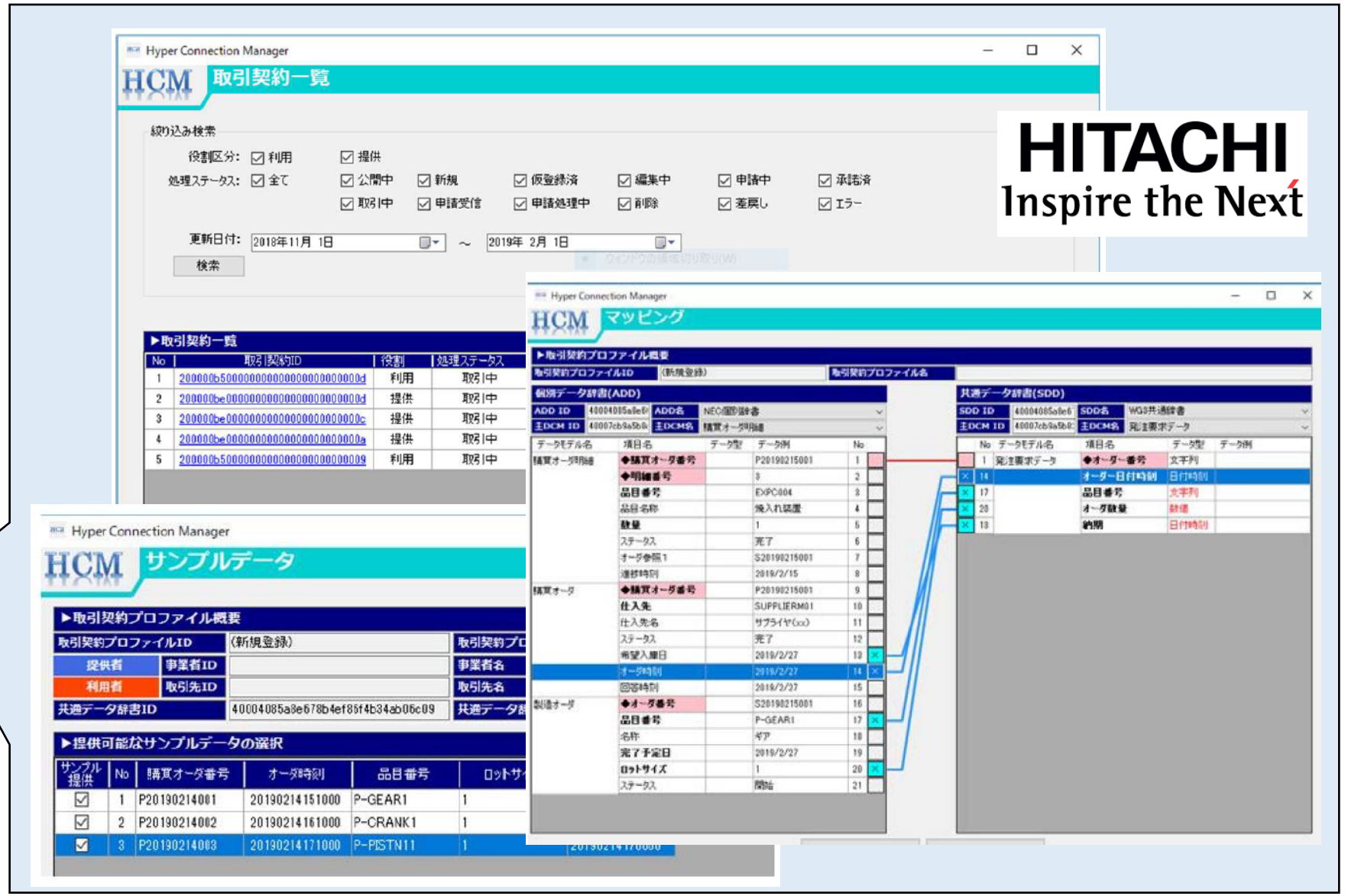
Production line



HMI

Trade contract setup phase





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Road map and goals of CIOF

	Goals of Activities	Technical Achievement
FY2019	Implement all the functions of the minimum executable model, and start services by stable operation and support.	Collect words and relations of dictionaries for preliminary study on developing a self-organizing common dictionary
FY2020	Solution partners start their service operation so that users can choose and implement with a little integration cost	Design an additional function of dictionaries that recommends the correct words and mapping for the local users
FY2021	For scaling up and security improvement, implementation architecture and infrastructure are redesigned and rebuilt	Apply the technology of AI-based automatic translation between the local and common dictionaries
FY2022	Develop a strong authentication system both on hardware and software, so that proof of delivery is available	Optimize the rules and processes of translation and delivery on data trade using context depending historical data.
FY2023	Expand the system in open-basis, and contribute to developing international rules and standard of the data economy	Data trade is monitored by AI and it detects unauthorized use, as well as ranking and rating of the parties

Why don’t you join us?

Danke schön.

https://www.iv-i.org/en/