Introduction to Data Spaces

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IPA Information-technology Promotion Agency, Japan

Data Space Group
Digital Engineering Department
Digital Infrastructure Center (DISC)

About this document

This document is for **beginners** who want **to learn about "Data Spaces**".

The Purpose is to understand**,**
- What are data spaces
- What is the organizational structure for data spaces promotion
- What use cases are expected in Japan

Background: global data spaces initiatives

EU, US, and China are increasing their competitiveness and influence by being ambitious over data linkage methods. It is imperative that measures be taken in Japan's domestic industry.

EU

Data spaces from the social economic activity data accumulation

Data collection
Develop data infrastructure and rules to collect large amounts of data from society.

Activities
Data collaboration across countries and organizations can now be done securely and quickly, and the use of data by companies will rapidly advance.

International standardization led by the EU

gaia-x

INDUSTRIAL DATA SPACE ASSOCIATION

Bai du 百度
Alibaba.com
Tencent 腾讯

G A F A M

USA/China

Data spaces from the personal economic activity data accumulation

Data collection
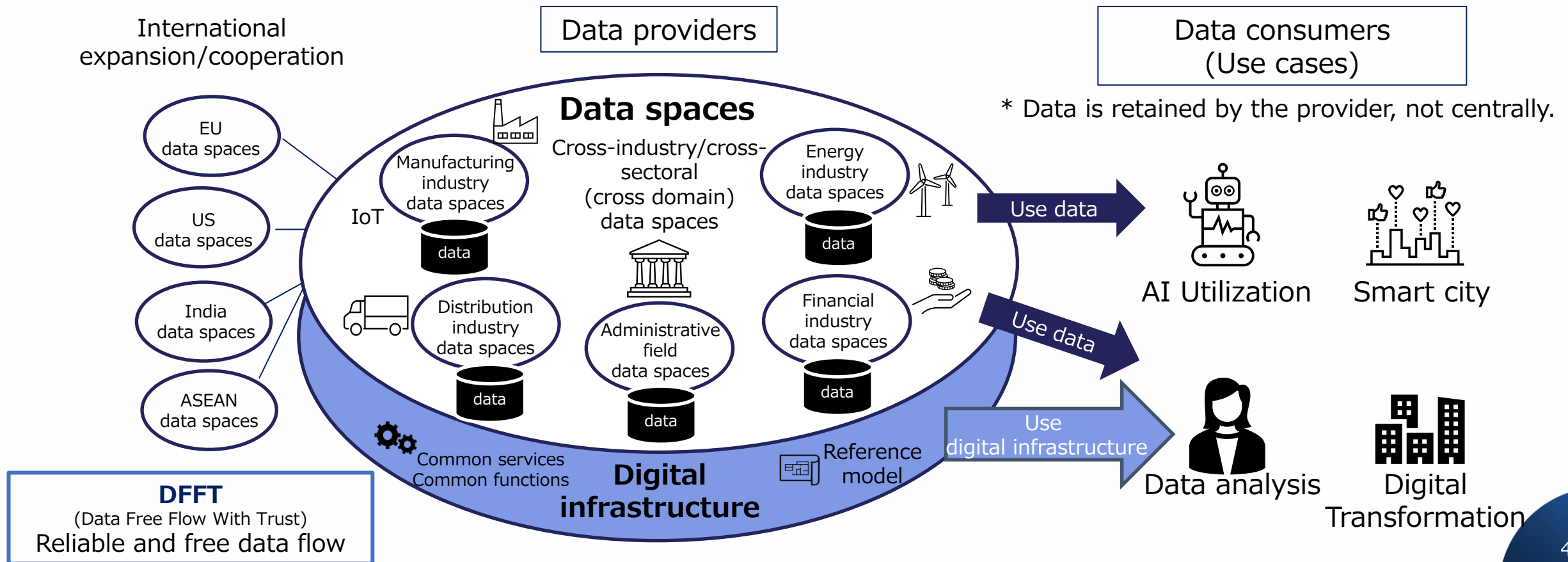Huge companies alone collect vast amounts of personal data.

Activities
Utilize big data collected by platformer to develop services.

De facto standardization led by stand-alone companies

What are data spaces?

- Concept that focuses on indispensable data in the digital society.
- Standardized mechanism that ensures reliability and data sharing among different organizations, countries, and different industries ecosystems.
- Large amount of "diverse" and "reliable" data can be used with security.

International expansion/cooperation

Data providers

Data consumers (Use cases)

* Data is retained by the provider, not centrally.

Data spaces

EU data spaces

US data spaces

India data spaces

ASEAN data spaces

Manufacturing industry data spaces

IoT

data

Cross-industry/cross-sectoral (cross domain) data spaces

Energy industry data spaces

data

Distribution industry data spaces

data

Administrative field data spaces

data

Financial industry data spaces

data

Common services Common functions

Digital infrastructure

Reference model

Use data → AI Utilization   Smart city

Use data

Use digital infrastructure → Data analysis   Digital Transformation

DFFT
(Data Free Flow With Trust)
Reliable and free data flow

Advantages of data spaces

Widespread use of data spaces will contribute to the realization of "Society 5.0 *1,"
which combines economic development through data-driven management and solutions to social issues.

Business benefits

Realization of data-driven management

1. Business speed improvement
Anyone can easily and quickly start a new business using data.

2. New business development
People with diverse expertise can work together for problems.

3. Better marketing strategy and early detection of problems
Advanced data analysis to discover new patterns and trends and provide useful information.

4. Adding value to data owned by the organization
Create value from data that has not previously been valued.

5. Improved data security and cyber attack countermeasures
Confidentiality (can exchange data with trusted parties).
Integrity (can prevent data tampering) can be ensured.

Social benefits

Privacy and a better life for everyone

1. Sustainable
Enables the realization of a green society.
Analyze energy consumption data & use energy resources efficiently.

2. Knowledge/ convenient (by digital technology)
Optimize transportation systems using traffic data to ease congestion and reduce travel time.
Provide more accurate weather forecasts by combining existing weather data with IoT data, for example.

3. Safe and secure
Forecasting: Predict future events (natural disasters, health crises, etc.) and mitigate risks.
Disaster prevention: Ensure rapid evacuation guidance.

4. Equality and less disparity
Education (research data, education statistics, learning methods, etc.), Business (businesses using data) will have equal opportunities.

*1 Society 5.0 is a data-driven society promoted by the government of Japan.

Active and Inevitable aspects of data spaces

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Sharing is inevitable and should be actively shared, by the concept of data sovereignty.

Active perspective

To enhance competitiveness, proactively utilize data linkage in business

New business development
Utilize data from different industries

Problem solving
Analyze from a new perspective

Inevitable perspective

Obligation and necessity, it is necessary to coordinate with regulations and international rules.

Regulatory compliance
Necessity to comply with the rules

Prevention of isolation
Other than Japan Use data space

Example: EU General Data Protection Regulation (GDPR) etc.

Data sovereignty

- "Data sovereignty" is a fundamental concept for **trusting** and sharing data in the data spaces.
- Data providers can decide to whom and for how long data will be provided, etc.

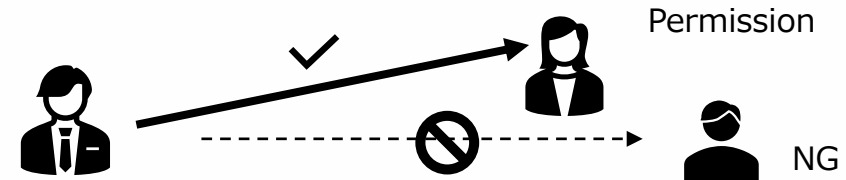### 1. Rights reserved by data provider
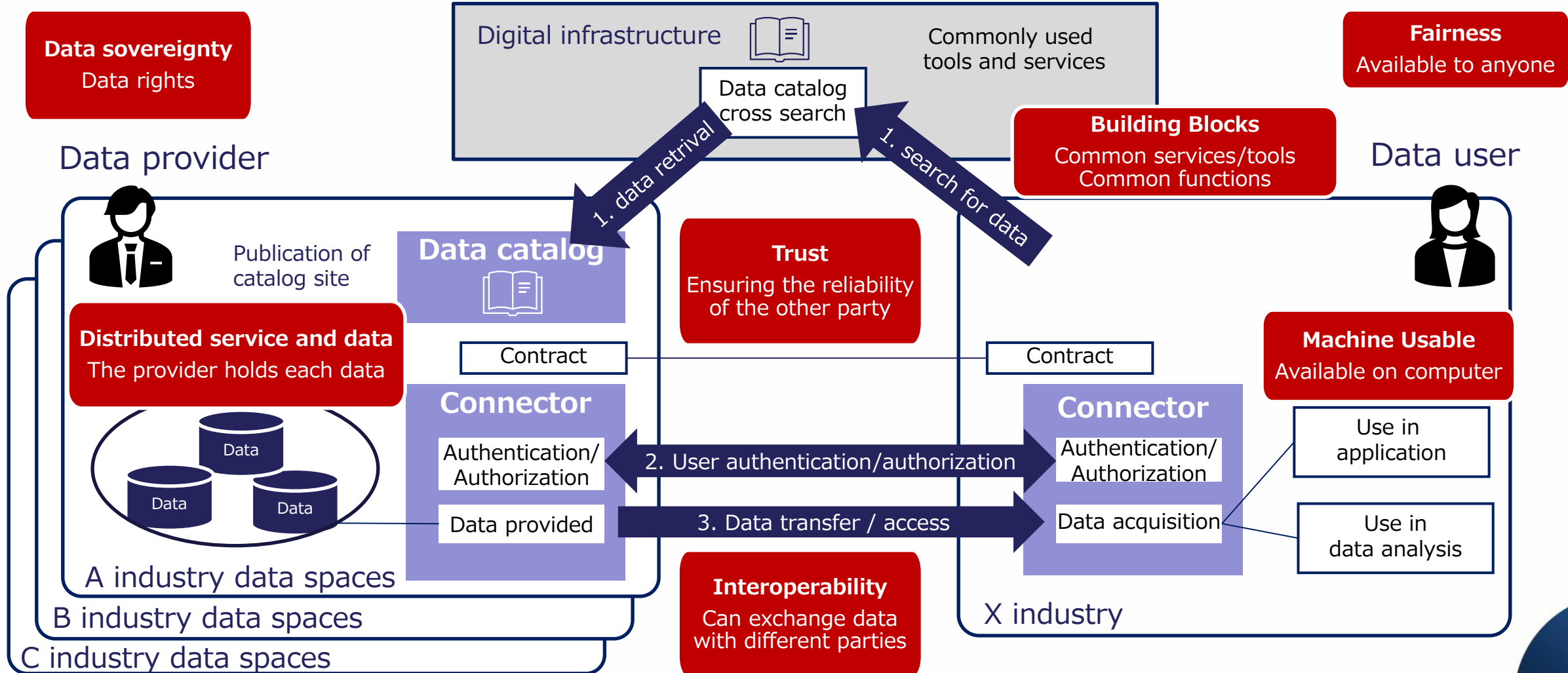
Data spaces

Data is managed by data owner   Data is not centrally managed

### 2. Limited sharing to specific users

Permission

NG

The image of data space characteristics and data exchange

"Interoperability" and "Data sovereignty" are particularly important characteristics of data spaces.
Three main steps for collaboration between data spaces
- first, data retrieval, second, authentication/authorization, and third, data transfer/access.

Data sovereignty
Data rights

Digital infrastructure

Commonly used tools and services

Data catalog cross search

Fairness
Available to anyone

Building Blocks
Common services/tools
Common functions

Data provider

Data user

Publication of catalog site

Data catalog

1. data retrival

1. search for data

Trust
Ensuring the reliability of the other party

Machine Usable
Available on computer

Distributed service and data
The provider holds each data

Contract

Contract

Data

Data

Data

Connector
Authentication/Authorization

Data provided

Connector
Authentication/Authorization

Data acquisition

Use in application

Use in data analysis

2. User authentication/authorization

3. Data transfer / access

A industry data spaces

B industry data spaces

C industry data spaces

Interoperability
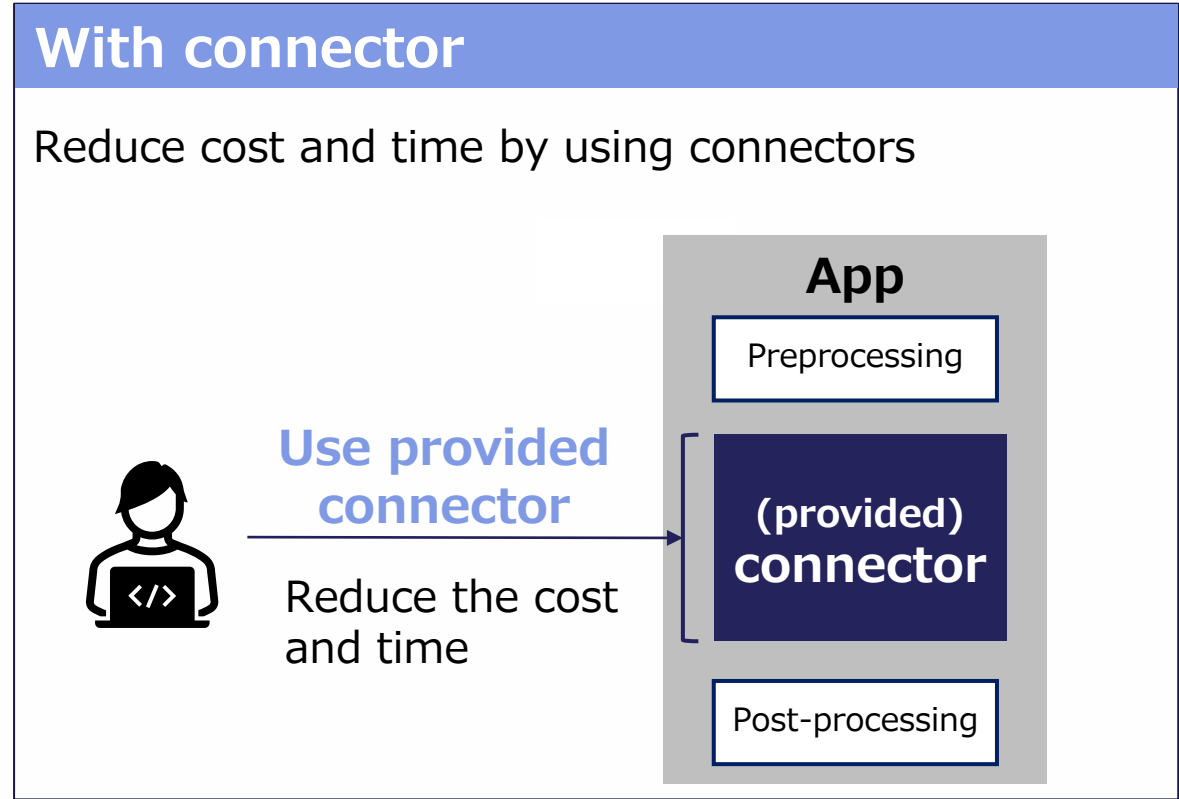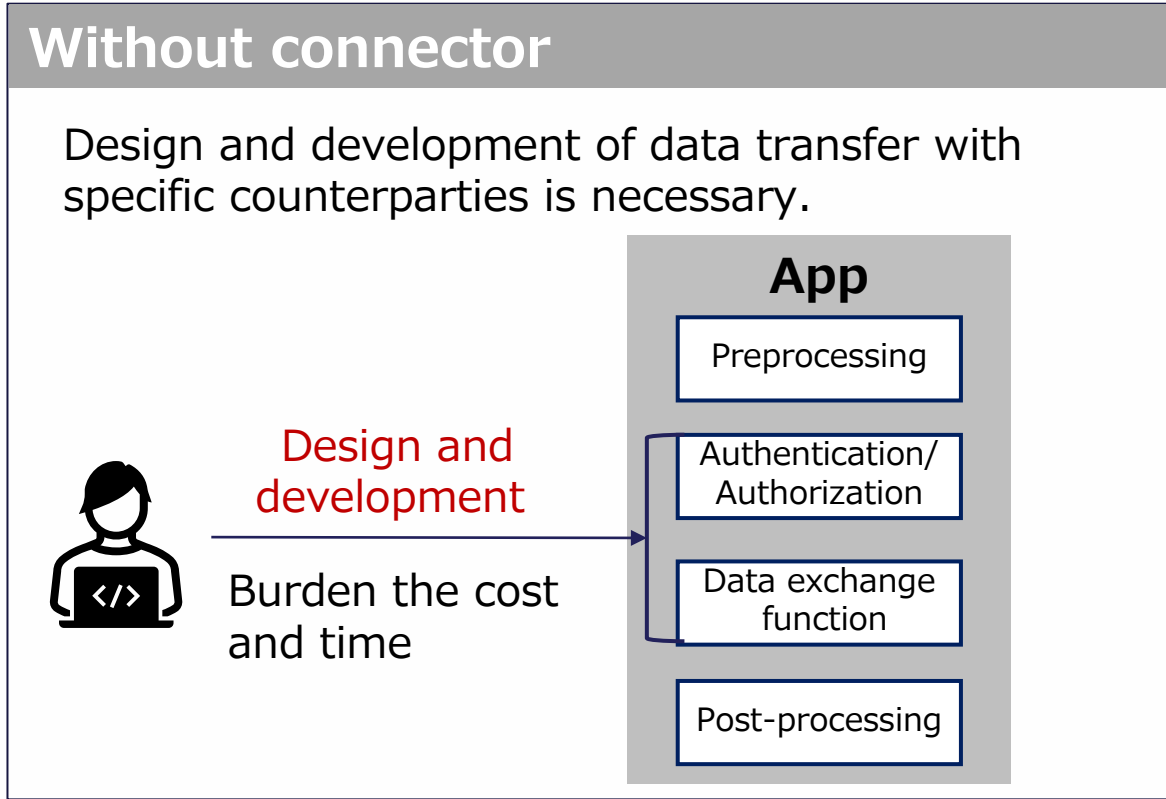Can exchange data with different parties

X industry

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"Connector" that realizes data exchange

- By using connector, **providers and users can connect each other and exchange the data.**

- Connector is like "Outlet".
  "Appliances" can receive "electricity" by using the common "Outlet".
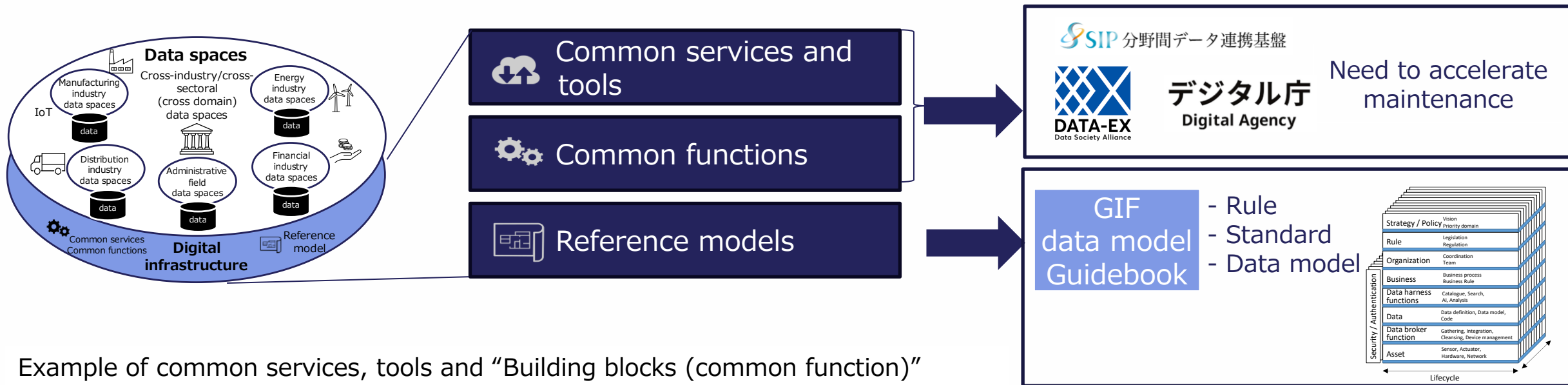 "Apps" can access "data" by using a common "Connector".

Outlet

Electricity

Electricity

Electricity

Connector

App N — Data — **Connector**

App T — Data

App S — Data
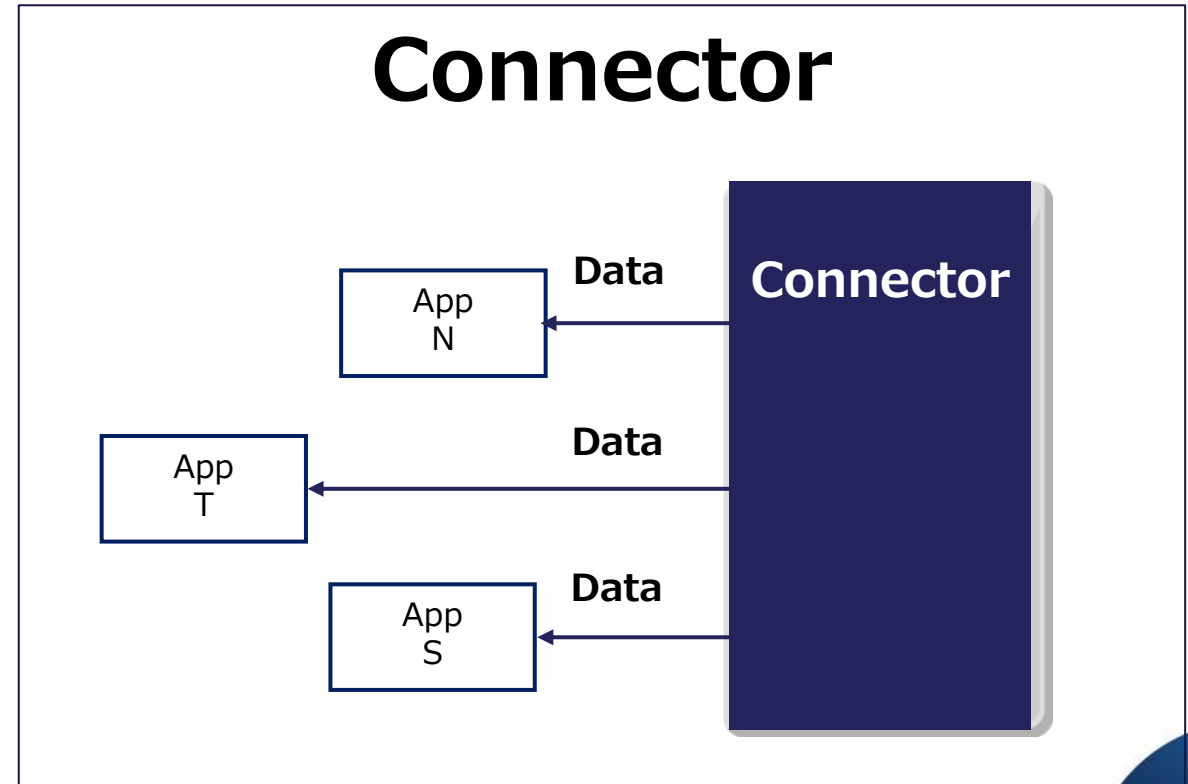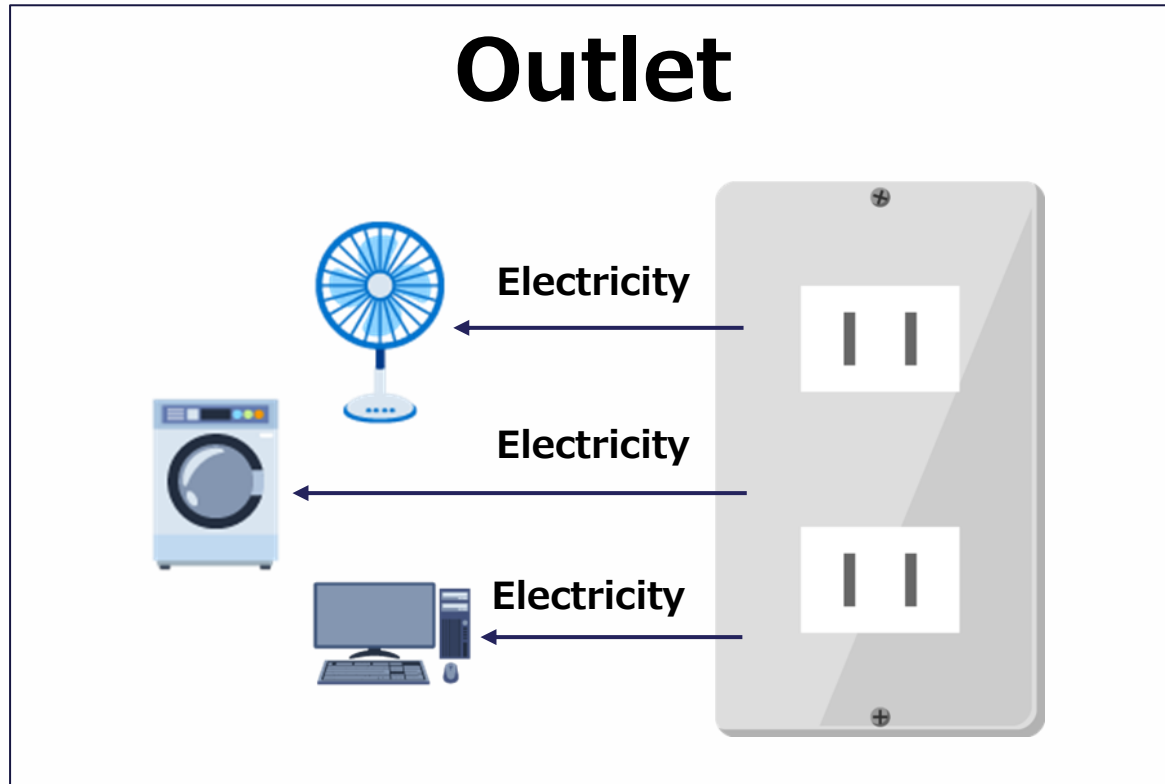
Benefits of using connector

When developing data exchange applications, the provided connector can be used to **reduce the cost and time** required for design and development.

Without connector

Design and development of data transfer with specific counterparties is necessary.

Design and development

Burden the cost and time

App

| Preprocessing |
| Authentication/ Authorization |
| Data exchange function |
| Post-processing |

With connector

Reduce cost and time by using connectors

Use provided connector

Reduce the cost and time

App

| Preprocessing |
| **(provided) connector** |
| Post-processing |

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Digital infrastructure

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Digital Infrastructure provides common services, tools, functions, and reference models underlying the data space in addition to connectors.

Data spaces

Cross-industry/cross-sectoral (cross domain) data spaces

- Manufacturing industry data spaces
- IoT
- Energy industry data spaces
- Distribution industry data spaces
- Administrative field data spaces
- Financial industry data spaces

Common services / Common functions — Reference model

Digital infrastructure

- Common services and tools
- Common functions
- Reference models

SIP 分野間データ連携基盤

DATA-EX Data Society Alliance

デジタル庁 Digital Agency

Need to accelerate maintenance

GIF data model Guidebook
- Rule
- Standard
- Data model

Strategy / Policy	Vision, Priority domain
Rule	Legislation, Regulation
Organization	Coordination, Team
Business	Business process, Business Rule
Data harness functions	Catalogue, Search, AI, Analysis
Data	Data definition, Data model, Code
Data broker function	Gathering, Integration, Cleansing, Device management
Asset	Sensor, Actuator, Hardware, Network

Security / Authentication — Lifecycle

Example of common services, tools and "Building blocks (common function)"

1. Data search	2. Authentication/ Authorization	3. Data exchange	4. Data utilization	5. Development environment	6. Guideline
Data catalog	ID service	Connector	AI/Analysis	OSS catalog	Knowledge
Data dictionary	Access control	Broker	Visualization	Test bed	Teaching materials
Base registry	Log management	Delivery	Knowledge Base	Test data	
Market place	Billing management	Data management			

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Differences from other data sharing structure

Comparing traditional data management and the structure of the data space is decentralized for reliability, interoperability, and data sovereignty *1.
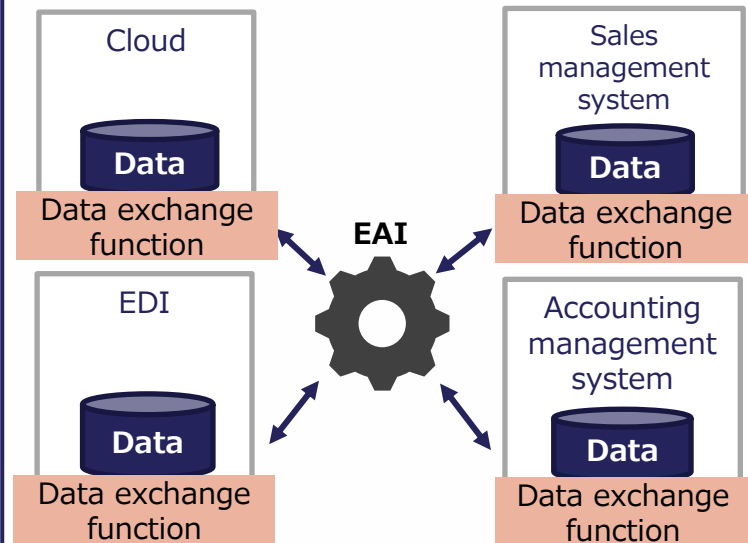
Platformer type

| Structure type	Centralized
Characteristic	Platforms hold & handle data.
Sovereignty	N/A
Example	Google
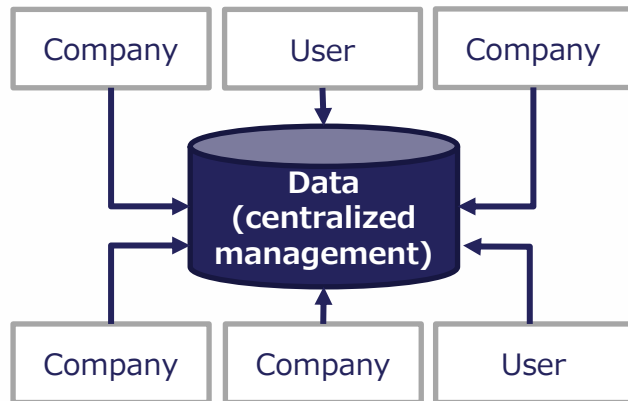
EAI
(Enterprise Application Integration) *2

Structure type	Distributed
Characteristic	Mechanism for exchange data between systems within a company.
Sovereignty	N/A
Example	Data Spider

Data spaces

Structure type	Federated
Characteristic	Can ensure reliability and share data between different organizations and countries
Sovereignty	Yes
Example	Catena-X
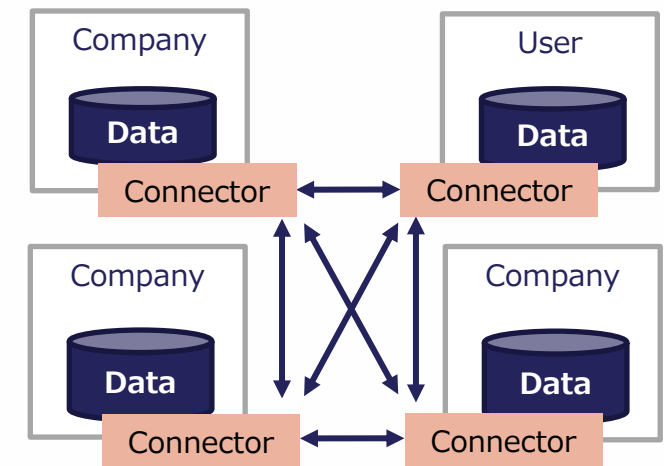
*1: Whether or not the data provider can be involved in the handling of its own data.
*2: System that links multiple systems used for business within a company to efficiently integrate data and processes.

Role in acceralating data spaces in Japan

Government of Japan, DSA, and IPA plan to work together to promote data spaces.

Policy/Strategy	Vision, Scope
Legal rules, Organization	Laws, Regulations, Implementing agencies, Management organization
Business, Function	Using data spaces for services, solutions
Data spaces	Data space across industries and sectors Data space by industry and sector

Digital infrastructure (framework, platform)

Common service tools	Data catalog Dictionary, ID	Development environment
Common functions	Connector access control	Data utilization
Reference model	Technical rules data model, vocabulary	Guideline

Data	Base registry Open data
Assets (Equipment/System)	IoT/Sensor, Hardware, Network

Japan

One Team
・Digital Agency
・Ministry of Economy, Trade and Industry
・Related ministries
・Information-technology Promotion Agency (IPA) *
・National Printing Bureau *
・Japan Institute for Local Government Information Systems (J-LIS) *
・National Institute of Information and Communications Technology (NICT) *
・Data Society Promotion Council (DSA)
…

* Strengthening cooperation is stated in the priority policy program for realizing a digital society.

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Area of the data space

Data spaces are used in a wide range of fields in society.

In each field, one or more projects are underway, and there are many data spaces with limited functions or regions.

In Japan, there are many initiatives similar to data spaces.

Japan Standard Industrial Classification : Major Classification	EU	Japan
A. Agriculture, forestry	EDS agriculture	Semi-public (agriculture)
B. Fishery	Fishing	-
C. Mining, Quarrying, Gravel extraction	-	-
D. Construction	EDS construction	Smart buildings, Underground objects Land Transport PF
E. Manufacturing	EDS Industry / Industrial, Mobility	Intercompany transactions, Batteries
F. Electricity, Gas, Heat supply, Water industry	EDS energy	Water supply
G. Information and communication	EDS media	-
H. Transportation industry, Postal industry	EDS railway, mobility, aviation, shipping	Autonomous mobile robot Mobility (service)
I. Wholesale trade, Retail trade	-	-
J. Financial industry, Insurance industry	EDS Finance	Finance
K. Real estate business, Goods rental business	-	Land Transport PF
L. Academic research, Professional / Technical services industry	EDS cultural heritage	-
M. Accommodation industry, food service industry	EDS tourism	-
N. Life -related service industry, Entertainment industry	EDS tourism	-
O. Education , Learning support industry	EDS skills	Public Service
P. Medical care, Welfare	EDS health	Public Service
Q. Complex service business	EDS smart community	Public Service
R. Service industry (n.e.c.)	-	-
S. Public service (excluding those classified elsewhere)	EDS administration, Administration (law, procurement, safety)	Public personal authentication Public service
T. Unclassifiable industries	EDS green deal	CFP carbon footprint

* EDS: European Data Spaces

👆 Data spaces focus point

· Establishment of a digital infrastructure for industry-academia-government collaboration to eliminate the administrative digital divide within Osaka.
· The usage of the catalog enables the provision of services utilizing Osaka open data.

Background

There was a disparity in efforts to utilize data among municipalities in Osaka Prefecture due to financial, human resources, know-how, and other limitations.
Aim for a society where all residents can access advanced digital services.

Effort

- Osaka Prefectural Government will take the lead in making ID sharing possible starting in FY2022.
- Establish a digital infrastructure and start providing services.
- Establish an environment to provide a variety of digital services to those who need them, when they need them.

Effect

- Development of Osaka digital infrastructure
  -> 43 municipalities in Osaka can share the usage of data and services that were previously disparate or fragmented.
- ID sharing
  -> Enables services to be linked and can provide personalized services.
- Increased digitization of business operations improves operational efficiency.

Expected benefits

Business	Social
1. Business speed improvement	1. Sustainable society
2. New business development	2. Knowledge society / convenient society (utilization of digital technology)
3. Better marketing strategy, catch the detection earlier	
4. Adding value to data owned by the organization	3. Safe and secure society
5. Improved data security and cyber attack countermeasures	4. A society with equality and less disparity

Focus points of this case

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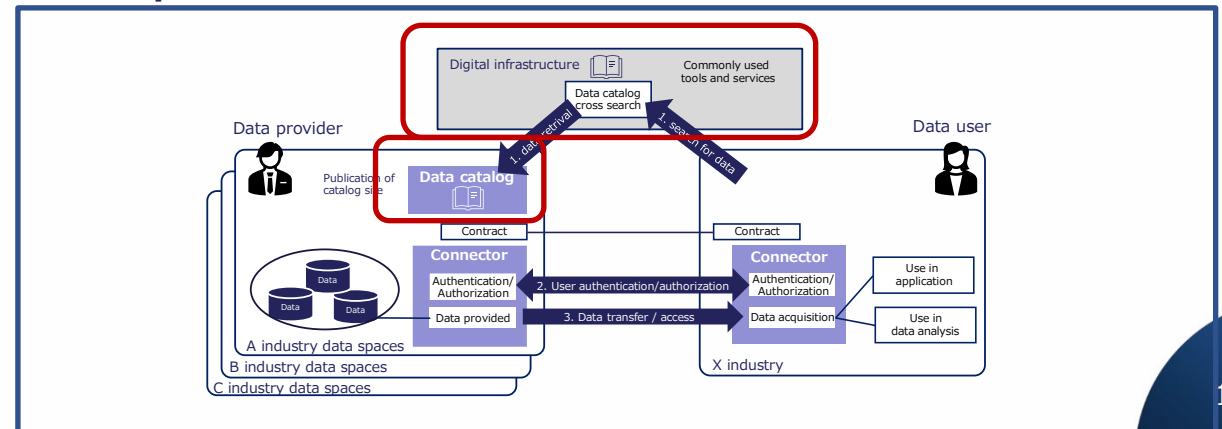
👆 **Data spaces focus point**
- Establish of a digital infrastructure for public-private partnership.
- Possibility of creating new business by combining open data provided by private sectors with open data and provided by the Sapporo City.

Background

The public-private partnership digital infrastructure for coordinated use of public and private sectors data in the Sapporo area is being built and consider full-scale promotion of data utilization.

Effort

- Estate developers and restaurants combine external data such as "weather data" and "event data" from outside the Sapporo City to confirm the optimization of marketing and business operations.
- Conduct a demonstration experiment connecting CADDE connector to the Sapporo City's digital infrastructure.

Effect

- Realize the optimization of marketing and business operations.
- By using the connector when using external data, there is no need to develop separate interface functions for data exchange.

Expected benefits

Business
1. **Business speed improvement**
2. **New business development**
3. **Better marketing strategy, catch the detection earlier**
4. **Adding value to data owned by the organization**
5. Improved data security and cyber attack countermeasures

Social
1. Sustainable
2. **Knowledge/ convenient (utilization of digital technology)**
3. Safe and secure
4. Equality and less disparity

Focus points of this case

15
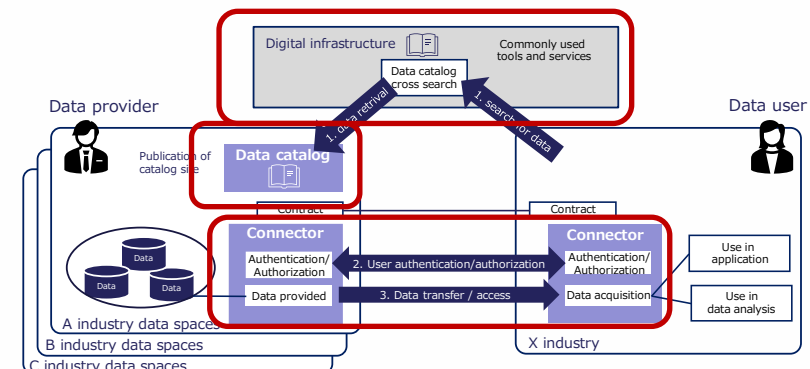
Understand consumer needs and improve marketing strategies.
Ensure credibility and the ability to provide and obtain data.

Effort
- improvement marketing strategy based on consumption information data that the manufacturer has not been able to catch before.
- Stores that previously refused to provide data on the grounds that the source of supply was unknown can now provide data because the reliability of the data is assured.

Effect
- Manufacturer: Can catch up with consumer needs.
  -> Leads to improve marketing strategy.
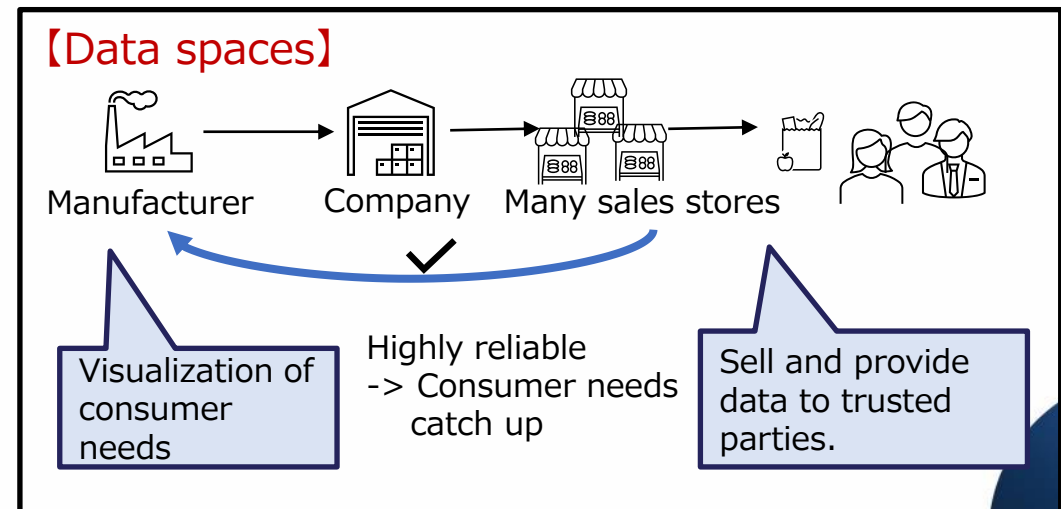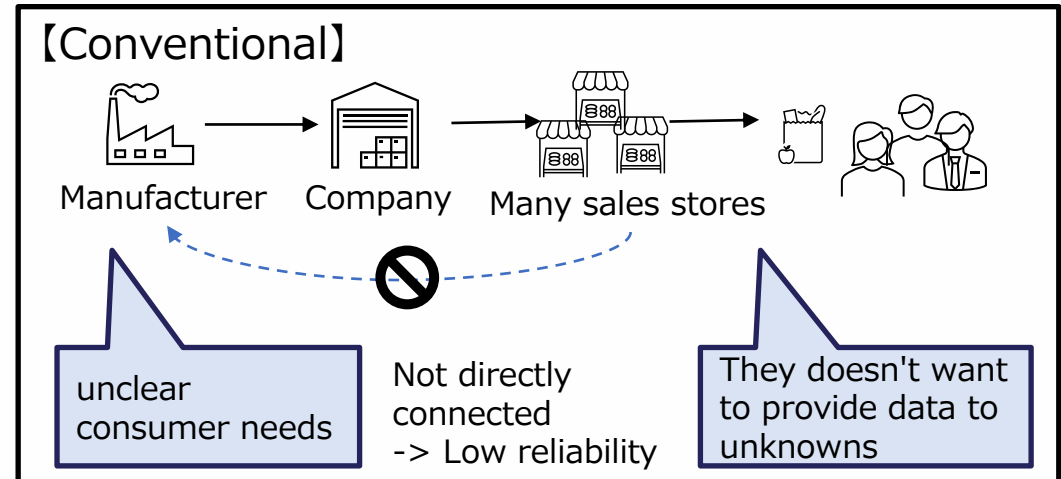- Sales store: Data that had no value create business value.

Expected benefits

Business benefits	【Social benefits】
1. Business speed improvement	1. Sustainable
2. New business development	2. Knowledge / convenient (by digital technology)
3. Better marketing strategy, catch the detection earlier	3. Safe and secure
4. Adding value to data owned by the organization	4. Equality and less disparity
5. Improved data security and cyber attack countermeasures	

【Conventional】

Manufacturer   Company   Many sales stores

unclear consumer needs

Not directly connected
-> Low reliability

They doesn't want to provide data to unknowns

【Data spaces】

Manufacturer   Company   Many sales stores

Visualization of consumer needs

Highly reliable
-> Consumer needs catch up

Sell and provide data to trusted parties.

Inquiries

To promote data spaces, please contact us.

Contact

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