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Introduction of FUJITSU Cloud Service K5 COLMINA Platform

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Fujitsu Limited

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Content

COLMINA

Fujitsu's Manufacturing Business

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- The only vendor in Japan developing applications for all aspects of manufacturing ranging from design through to production
- Providing various manufacturing solutions for over 30 years
- Used by more than 10,000 companies

Mechanical CAD
iCAD

Electrical CAD
E-BLADE

Analysis
Solutions

Design Information Management
PLEMIA

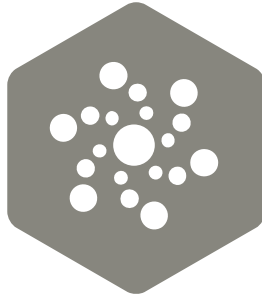Electrical Component Solutions

Production Verification
VPS

Process Verification
GP4

Procurement Support Solution

Market Process

Plan

Logistic

Fujitsu's Major Solutions

Design Process

Produce Process

Procure

Logistics Solution

Call Centre Solutions

Production Control/ Manufacturing Execution
GLOVIA

Factory IoT Solutions

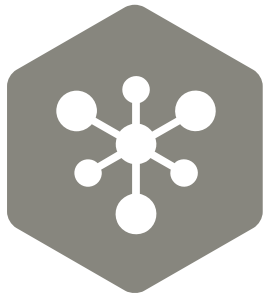Factory Automation Solutions

Robot Integration

Requests from Clients
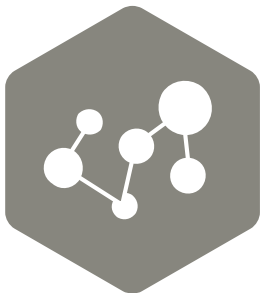
■ From efficient individual business systems to digitalization using leading technologies

AI Tech

IoT Tech

Connect Tech

Inquiries from Clients

Use of IoT in factories
49%

7% Other

3% Next generation factory

6% Visualization of factories

8% Detection of maintenance indicators

7% Use of AI to improve quality

20% Use of AI to make production more efficient

COLMINA: Realizing Clients' Needs
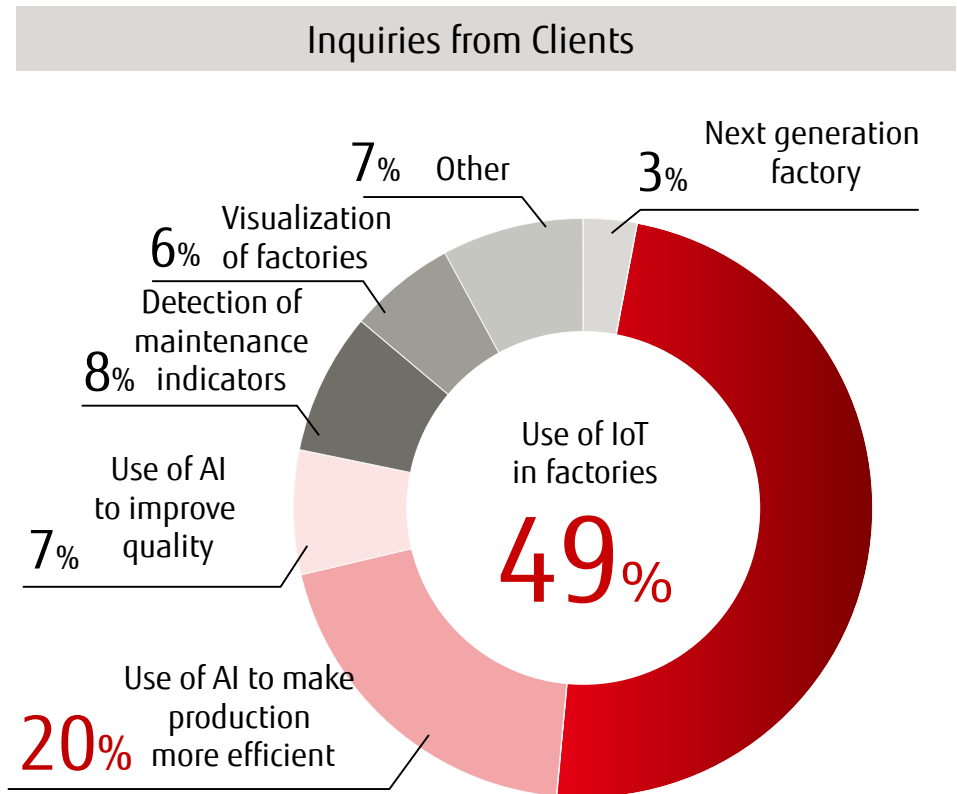
Fujitsu's Digital Place for Manufacturing

COLMINA

COLlaborative MONOZUKURI INnovation Agent

Digital Place for Manufacturing

COLMINA Services

PLM	SCM ERP
MES	Apps

COLMINA Platforms

Connect Tech   IoT Tech   AI Tech

COLMINA Edge

Connection between instruments and sensors

Apps

Value of Connected Manufacturers

- Not only efficiency improvements but also new business models/ ecosystems are realized by connecting various scenarios
- Digital Place for Manufacturing (COLMINA) provides various methods of connecting

Creating new services **by connecting things**

Upgrading supply chains **by connecting companies**

Company

Company

Company

Design/Development   Production   Maintenance
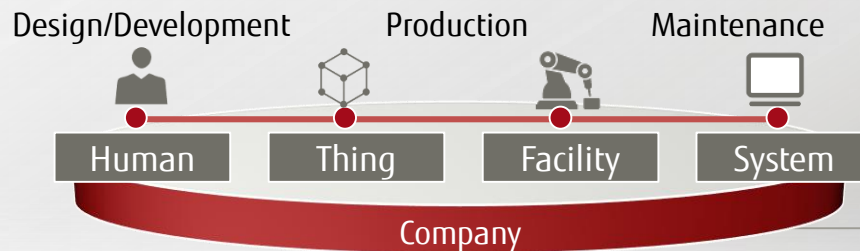
Digital manufacturing **by connecting manufacturing sites**

Human   Thing   Facility   System

Company

Digital Place for Manufacturers – 'COLMINA'

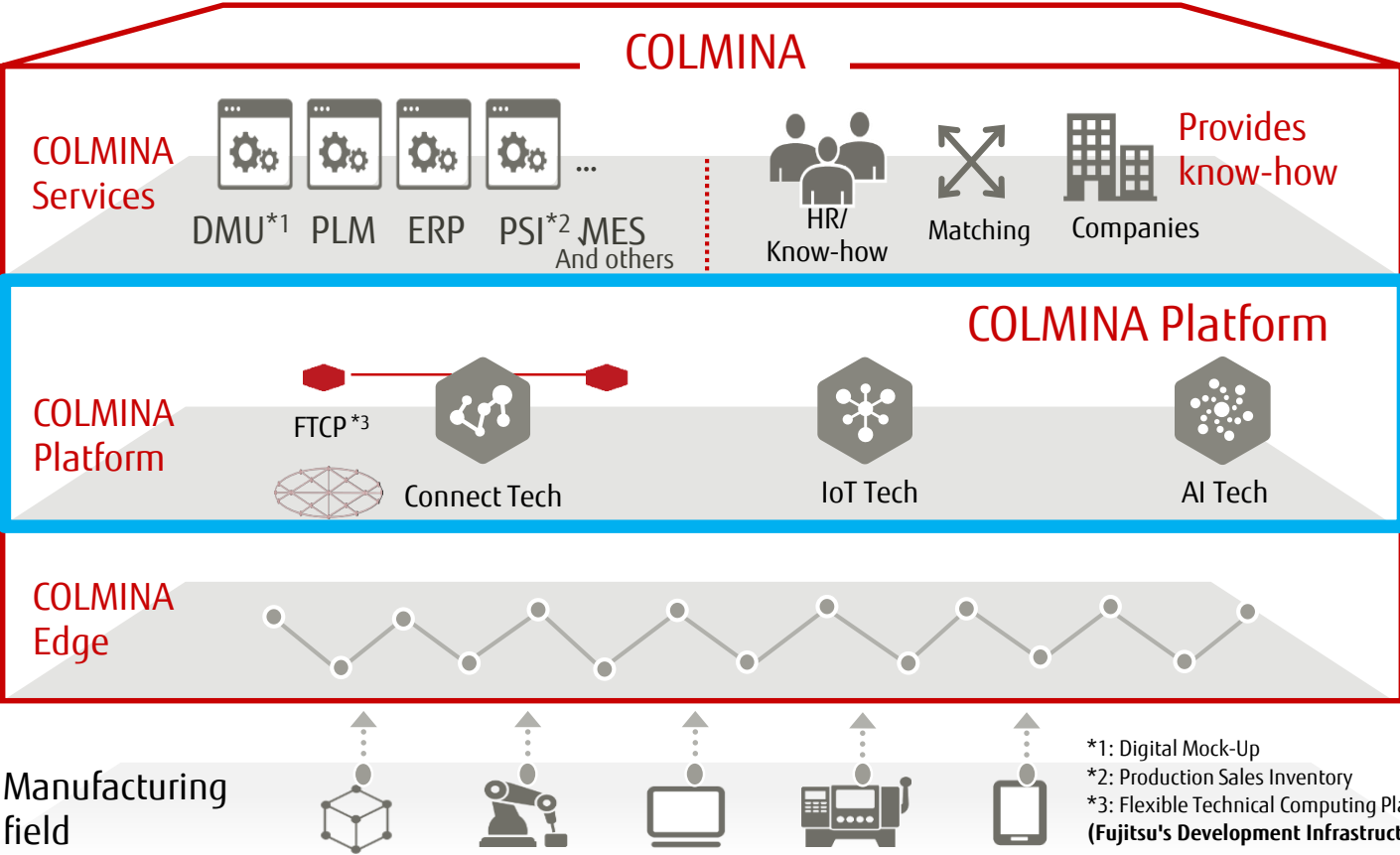**FUJITSU**

- ■ Digital place for creating new services by connecting manufacturing sites, companies and things
- ■ Provides areas where manufacturers can expand

COLMINA

COLMINA Services

DMU*1   PLM   ERP   PSI*2 MES ...
And others

HR/ Know-how   Matching   Companies

Provides know-how

Services ranging from design to production/ maintenance based on experience as a manufacturer

COLMINA Platform

COLMINA Platform

FTCP *3   Connect Tech   IoT Tech   AI Tech

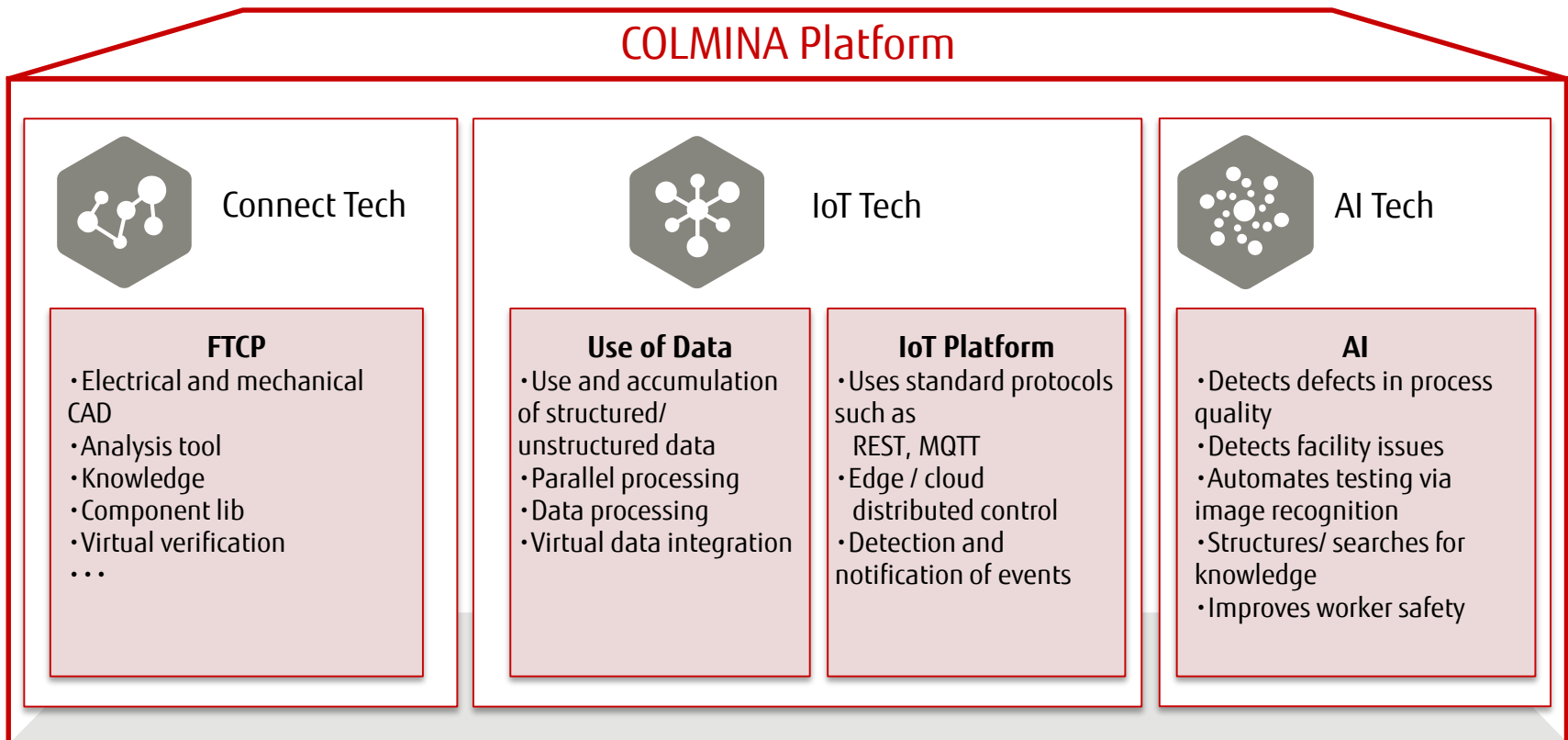Information platform that generates new services for manufacturers by connecting all kinds of manufacturing sites, humans and things via information

COLMINA Edge

Cooperation with other services to convert file formats after gathering data from various facilities

Manufacturing field

*1: Digital Mock-Up
*2: Production Sales Inventory
*3: Flexible Technical Computing Platform
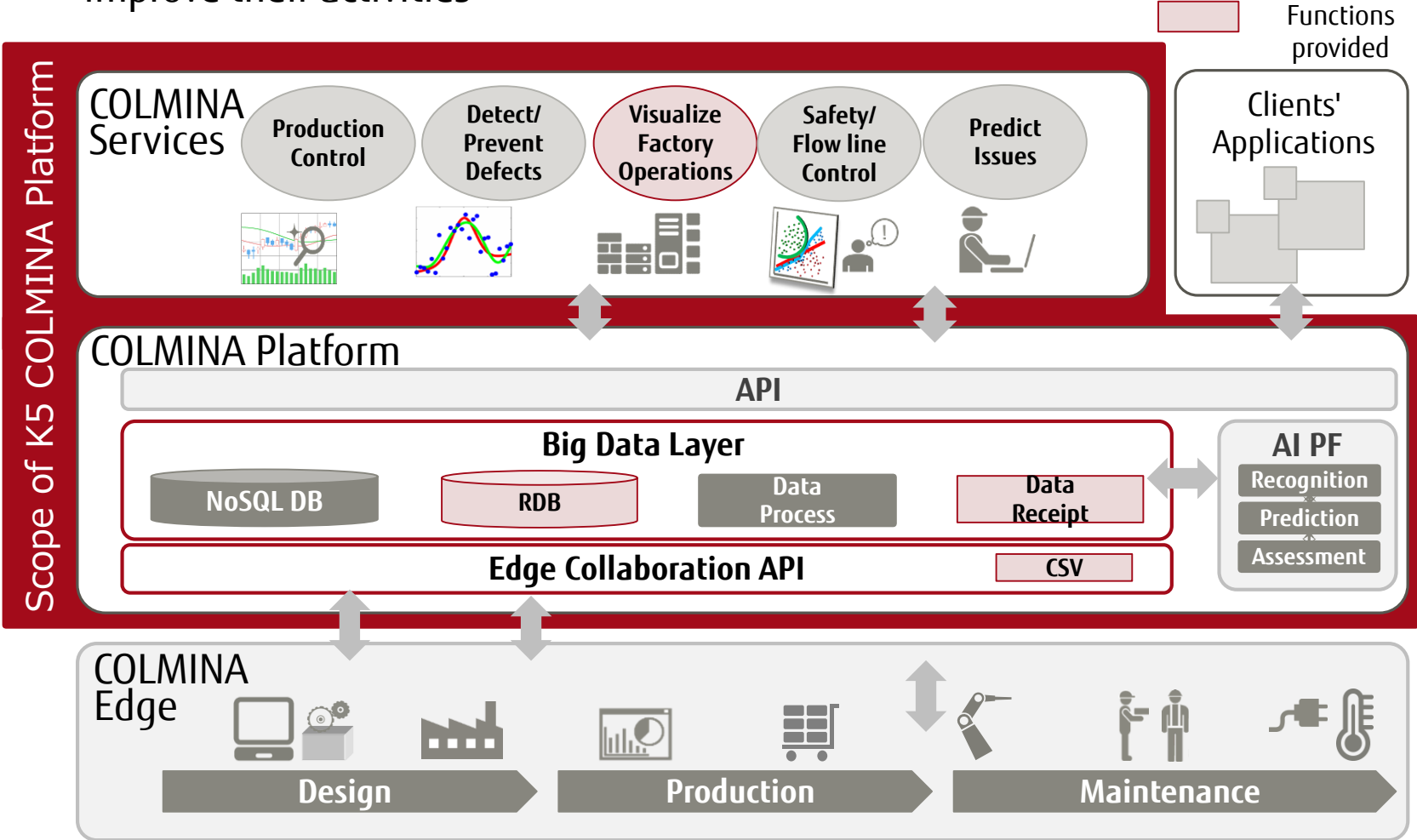**(Fujitsu's Development Infrastructure)**

The COLMINA Platform

■ **A platform for connecting things from factories through to maintenance fields**
  ■ Connect Tech: Connects the manufacturing sites of companies
  ■ IoT Tech: Improves efficiency and quality through accumulation and visualization
  ■ AI Tech: Boosts manufacturing using 4 AI technologies [learning, sensory-media, cognition and math] (planned functions)

COLMINA Platform

Connect Tech	IoT Tech		AI Tech
FTCP ·Electrical and mechanical CAD ·Analysis tool ·Knowledge ·Component lib ·Virtual verification ・・・	**Use of Data** ·Use and accumulation of structured/ unstructured data ·Parallel processing ·Data processing ·Virtual data integration	**IoT Platform** ·Uses standard protocols such as REST, MQTT ·Edge / cloud distributed control ·Detection and notification of events	**AI** ·Detects defects in process quality ·Detects facility issues ·Automates testing via image recognition ·Structures/ searches for knowledge ·Improves worker safety

COLMINA Platform Overview

- Makes it possible to grasp the exact status of manufacturing operations by **visualizing** accumulated factory and maintenance data
  - Contributes to QCD improvements for overall optimization by prompting workers to improve their activities

Functions provided

Scope of K5 COLMINA Platform

COLMINA Services

- Production Control
- Detect/Prevent Defects
- Visualize Factory Operations
- Safety/Flow line Control
- Predict Issues

Clients' Applications

COLMINA Platform

API

Big Data Layer

- NoSQL DB
- RDB
- Data Process
- Data Receipt

Edge Collaboration API CSV

AI PF
- Recognition
- Prediction
- Assessment

COLMINA Edge

Design → Production → Maintenance

COLMINA Platform Features

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■ COLMINA **visualizes** frontline operations via a dashboard by accumulating various structured data from manufacturing sites.

COLMINA Service

Graphically visualizes data through a dashboard

Helps clients identify, manage and resolve issues using accumulated data that is displayed hierarchically. For example, Factory – Production line – Instruments. This makes it possible to visually understand data accurately using graphs that show data variances and comparisons.

Offers efficient function changes without programming

Allows clients to set and change functions without the need for programming as data definitions are stored in a database, graphs are used to visualize data, and many master tables for creating graphs are included.

COLMINA Platform

Accumulates data related to manufacturing sites

Centrally manages a range of production data from manufacturing sites by using API programs to send and collect the output data relating to production results and equipment performance, thereby contributing to the manufacturing plans and quality initiatives within customer systems.

The portal provides access to a range of functions

The COLMINA Portal links to administrator functions that enable user administration tasks and the confirmation of service usage status, in addition to providing access to the data visualization service.

List of Functions Provided

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■ Provided functions

Accumulates data and builds a visualization dashboard without the need for programming (using data visualization powered by Intelligent Dashboard)

1 .Data Received

- ■ Receives data
- ■ CSV format
- ■ Records data

2 .Data Storage
(Data Lake)

- ■ Stores data (CSV→RDB)
- ■ Saves structured data (RDB)

3 .Authentication

- ■ Registers/ deletes users
- ■ Authenticates users
- ■ Changes passwords

4. COLMINA Portal

- ■ User settings
- ■ Checks status of received data
- ■ Service usage status

5.Data Visualization
(Intelligent Dashboard)

- ■ Visualizes
- ■ Displays alerts
- ■ Maintains masters

■ Future Functions   Analyzing/ learning functions will be gradually added to the following)

Data Received	API that inputs data from facility instruments, edge servers, sensors, etc.
Data Storage	Hybrid data storage function for structured data (RDB) and unstructured data (NoSQL) depending on their properties
Data Acquisition	API that refers, extracts, renews and deletes data from the data lake
Data Processing	Function that processes RDB/NoSQL data and stores it in the RDB
Data Visualization	Function that visualizes the progress of production lots/processes

The COLMINA Platform

Outline of the Functions: Data Receipt

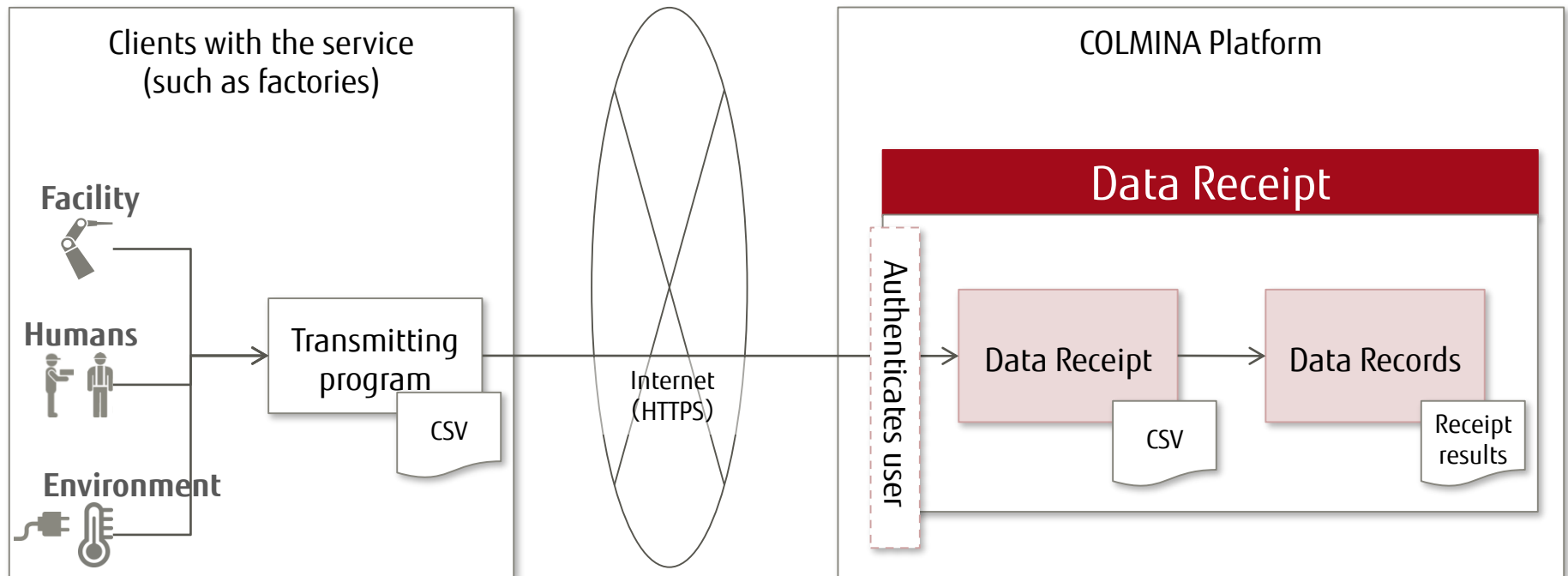## ■ Overview of the Data Receipt Function

Receives data (CSV format) from clients with the service, such as factories

■ Receives data (CSV)
- Receives data (CSV) sent based on external data receipt interface specifications

■ Records data
- Records data receipt results into recording table with receipt number for each receipt

Clients with the service
(such as factories)

Facility

Humans

Environment

Transmitting program

CSV

Internet
(HTTPS)

COLMINA Platform

Data Receipt

Authenticates user

Data Receipt

CSV

Data Records

Receipt results

Outline of the Functions: Data Storage (Data Lake)

■ Overview of the Data Storage Function
■ Stores received data in the storage area for structured data.
- Stores data (CSV→RDB)
  - Stores received CSV in RDB format
- Saves structured data (RDB)
  - Provides a storage area where structured data in RDB format is saved as actual result data

COLMINA Platform

Data Storage

Data Receipt

CSV

Data Storage
(CSV→RDB)

Structured Data
(Actual Results)
(RDB)
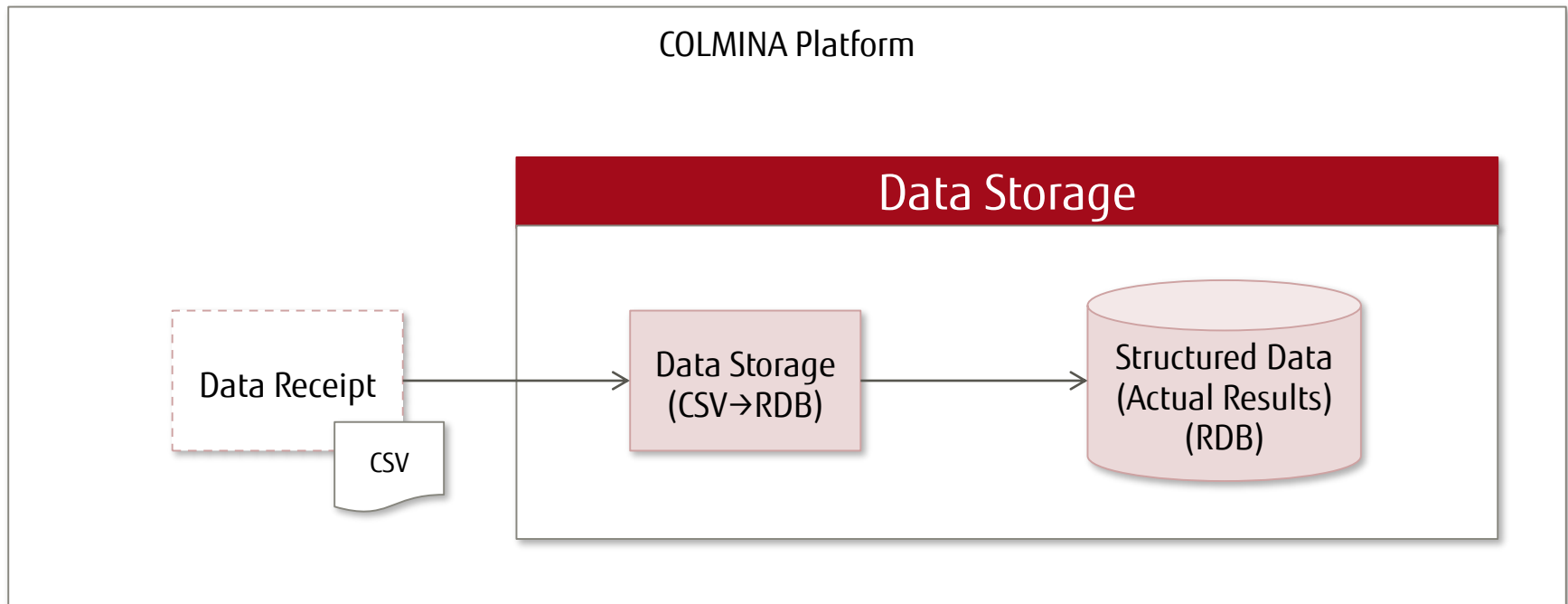
Outline of the Functions: Authentication

■ Overview of the Authentication Function
Authenticates users of the COLMINA Platform
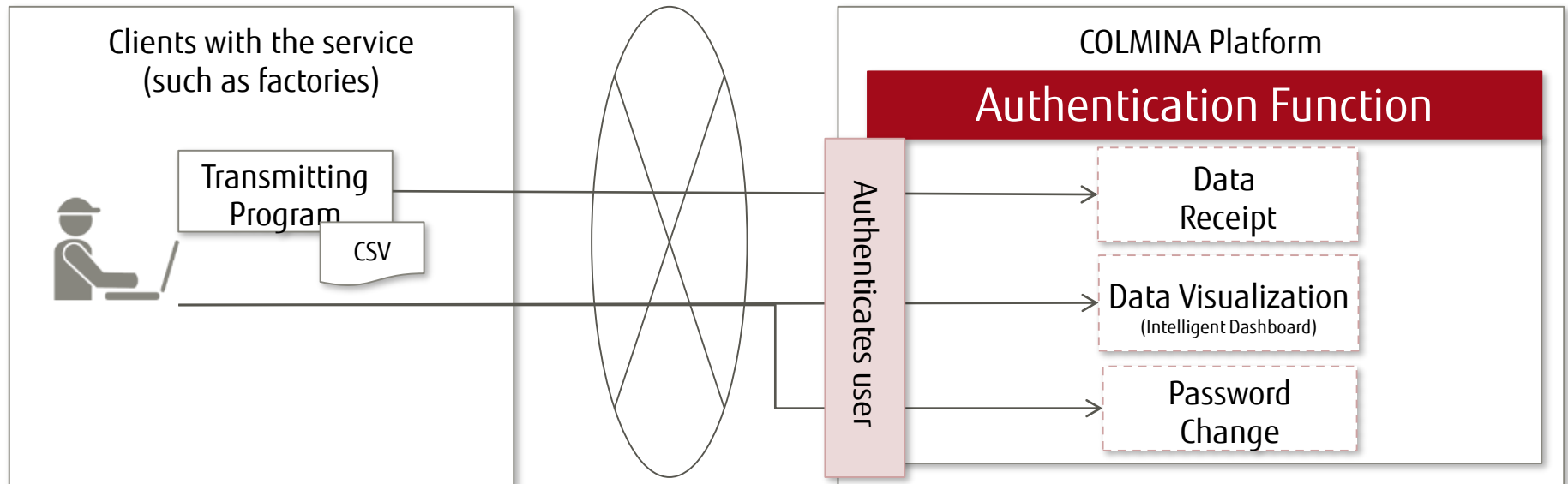
- ■ Authentication Method
  - Authenticates with the User ID and Password issued for each user
- ■ User Authentication
  - Authenticates when the user logs on to the data reception and data visualization displays
- ■ Password Changes
  - Displays the change-password screen

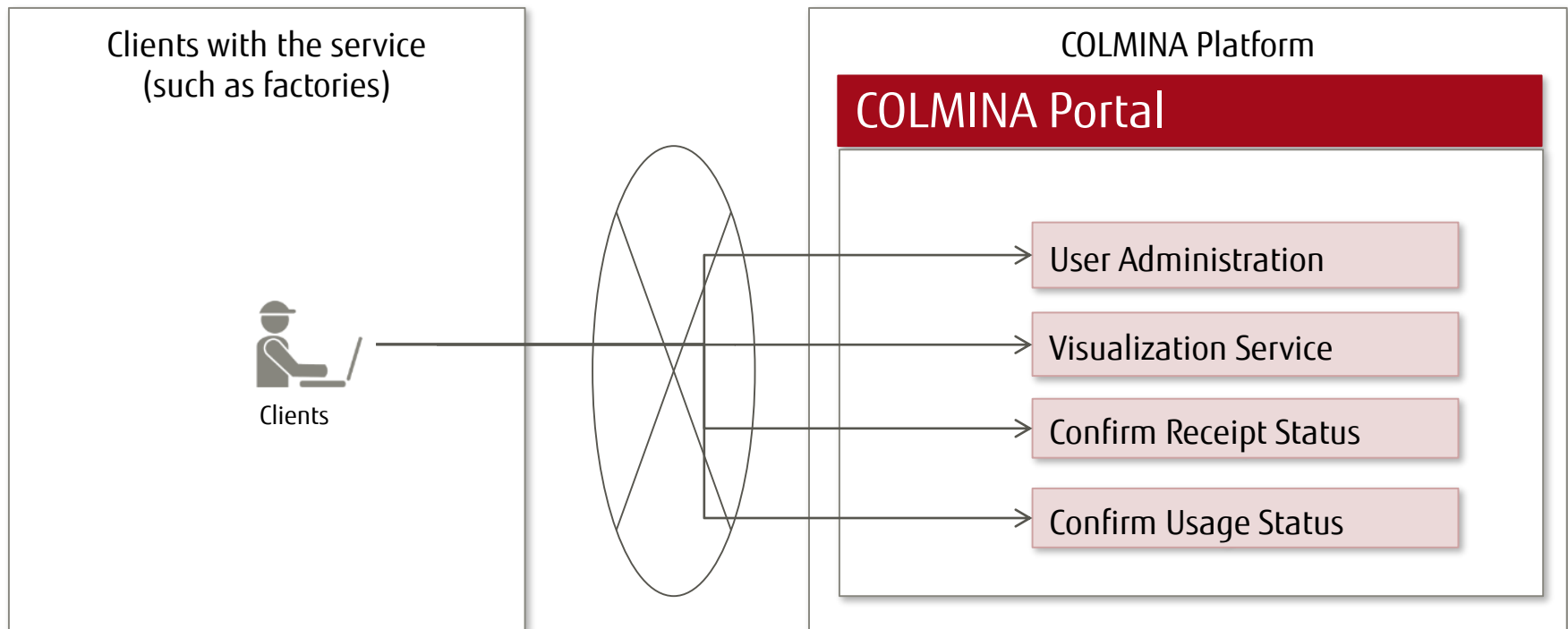# Outline of the Functions: COLMINA Portal

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■ Overview of the COLMINA Portal

A portal interface that provides access to administrator screens for tasks such as user administration, as well as to screens for data visualization and so on.

■ COLMINA Portal
- Access the user administration and other screens
- Access a range of services, including data visualization

Clients with the service
(such as factories)

COLMINA Platform

COLMINA Portal

Clients

User Administration

Visualization Service

Confirm Receipt Status

Confirm Usage Status

The COLMINA Service

Outline of the Functions: Data Visualization
(Intelligent Dashboard)

■ **Overview of the Data Visualization Function**

Visualizes data stored on the COLMINA Platform via the dashboard
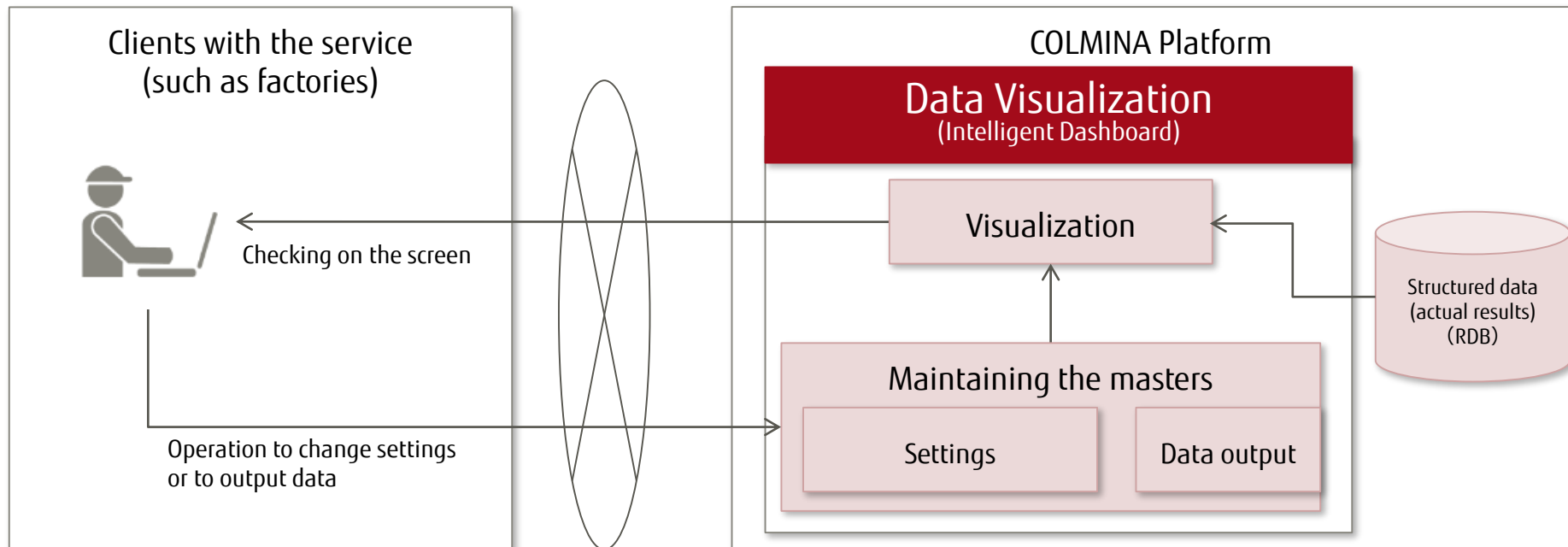
- ■ Visualizes
  - Displays stored structured data hierarchically using graphs on the dashboard
- ■ Displays alerts
  - Displays alarms on the dashboard based on pre-set thresholds
- ■ Maintains masters
  - Enables editing of the masters, such as changes to screen layouts and user permissions or downloading of stored data in CSV format

Clients with the service
(such as factories)

Checking on the screen

Operation to change settings
or to output data

COLMINA Platform

Data Visualization
(Intelligent Dashboard)

Visualization

Maintaining the masters

Settings | Data output

Structured data
(actual results)
(RDB)

Intelligent Dashboard Screen Example

- Monitors normal/ abnormal time periods and displays them visually together with values, graphs and icons
- Evaluates factories using 4 management criteria (quality, production, facility and energy) to resolve problems and prevent immediate dangers

Displays the total factory operating rate using meters and data such as electricity usage and productivity

Displays graphs showing total factory performance, human resource status, etc.

Alarm messages appear when necessary

Displays abnormality notifications using color-coded alarm symbols (e.g. a line fault is shown here)

Displays the operating rate for a line using meters, production efficiency, CO_2 emission rate, etc. with color-coded symbols

Hierarchy of Intelligent Dashboard Visualization

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■ This example contains 5 hierarchical layers
(nation-region- factory-line-facility)

Nation

Global Screen

Japan from the global map
as an example

Fujitsu factory

Line A
| Facility 01 | Facility 02 | Facility 03 |

Line B
| Facility 04 | Facility 05 |

Every screen requires definition
setting by clients

Region

Region Screen

Fujitsu factory in Japan from the map
of Japan as an example

Factory

Factory Screen

Multiple production lines (line
A and B) in Fujitsu's factory
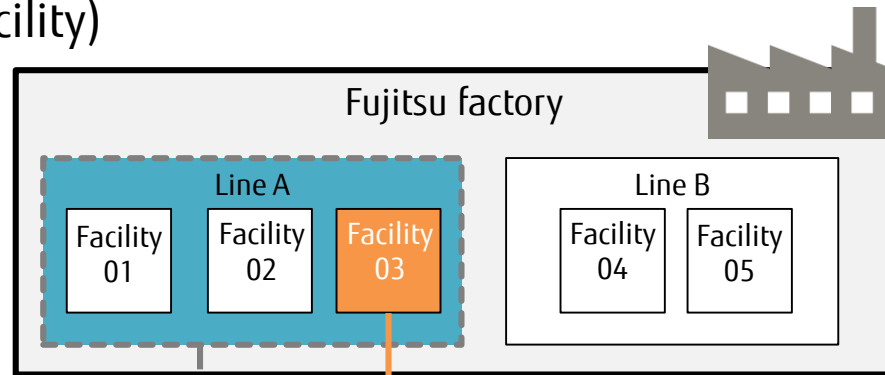
Line

Line Screen

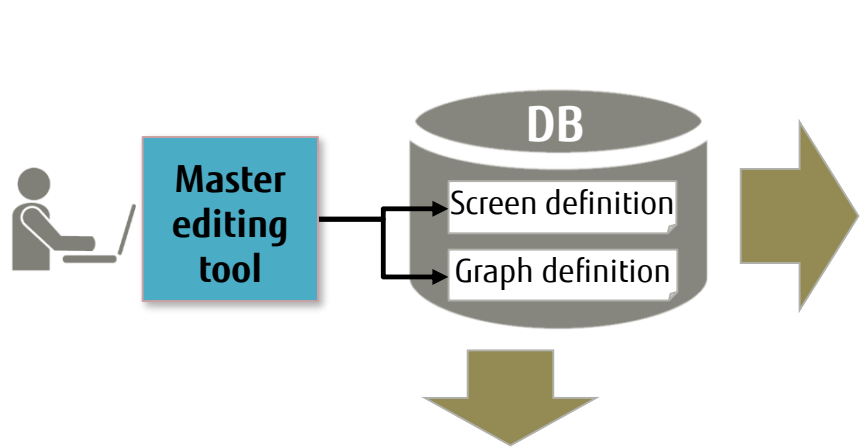Multiple facilities (facility 01, 02
and 03) in line A

Facility

Facility Screen

Facility 03

Screen Layers/ Display Position on the Intelligent Dashboard

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- Screen layer and graph positions can be defined using the master
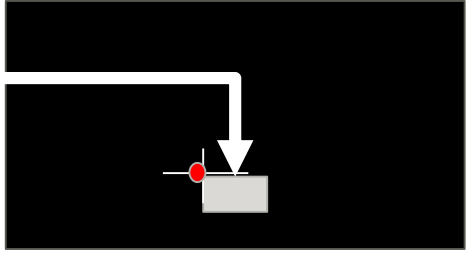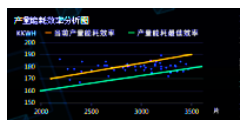- Editing tool requires no programming

Screen layers

| Layer1 Map | Layer2 Graph | Layer3 Alarm |

Combining 3 layers

Master editing tool

DB
- Screen definition
- Graph definition

Graph position

Define the upper left position in pixels

D3.js for coordinate definition

Billing/ Restrictions

COLMINA Platform Menu

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Menu	Unit	No. of Factories (*)	No. of Users	Disk Usage Amount
Plan01 (Factory:1, User:50, Disk:200GB)	Month	1	50	200GB
Plan02 (Factory:3, User:50, Disk:200GB)	Month	3	50	200GB
Plan03 (Factory:5, User:50, Disk:200GB)	Month	5	50	200GB
Plan04 (Factory:10, User:50, Disk:200GB)	Month	10	50	200GB
Plan05 (Factory:1, User:50, Disk:400GB)	Month	1	50	400GB
Plan06 (Factory:3, User:50, Disk:400GB)	Month	3	50	400GB
Plan07 (Factory:5, User:50, Disk:400GB)	Month	5	50	400GB
Plan08 (Factory:10, User:100, Disk:600GB)	Month	10	100	600GB
Plan09 (Factory:10, User:300, Disk:800GB)	Month	10	300	800GB
Plan10 (Factory:10, User:500, Disk:1TB)	Month	10	500	1TB

* The number of factories subject to data visualization using Intelligent Dashboard (a Fujitsu solution that supports total optimization by addressing issues specific to manufacturers and the visualization of overall factory operations by using IoT).

Service Subscription/Changing Plans (1/2)

- **To start or terminate the service or to change a plan**
- Allow at least 10 business days before the application to commence a service or to change a plan takes effect.
- When requesting service termination, allow at least five business days before the termination takes effect.
- When requesting a change of plan, apply for it on the PaaS Service Management screen of the K5 Portal. If Fujitsu agrees with the request, Fujitsu will notify the Customer the "Start date of changed use". The newly changed plan will take effect from the Start date of changed use.
  - Changing to a plan with a smaller disk usage amount than the current plan is not permitted. When plan changing involves changing the disk usage amount, the Customer is deemed to have terminated the service as of the date when the work to change the plan is executed. In this instance, the service cannot be used on the day when the plan is being changed.
  - Changing to a plan with a smaller number of maximum users than the current plan is not permitted.
  - Changing to a plan with a smaller number of factories being visualized than the current plan is not permitted. When changing the plan involves an increase of the number of factories being visualized, submit to the Help Desk by email the information on the factories being added. The information will be reflected on the plan approximately 10 working days after it is received.

  For details, refer to the COLMINA Platform Users Guide [https://k5-doc.jp-east-1.paas.cloud.global.fujitsu.com/doc/en/colminapf/document/manual/usersguide.pdf]

Service Subscription/Changing Plans (2/2)

■ Contact the Help Desk for enquiries related to the following items:
- Adding/removing factories
- Changing the intervals of aggregate batch activation
- Tenant Administrator password initialization requests
- Changing the default division location
- Changing the data retention duration
- Amount of this month's usage (factory list)

Billing System

■ **A fixed monthly fee is charged based on the selected plan.**

- A monthly fee is charged from the month of Start date of use for the selected plan. The Start date of use will be notified by email. When changing the plan, the fee will be charged as prescribed for the newly changed plan from the Start date of changed use notified by email.
- A fee for the previous month is determined as of the aggregation time (23:00 UTC on the last day of the month) as applicable to the plan currently subscribed to.
- The fee will not be calculated on daily pro rata basis.

Example: When changing from Plan 01 to Plan 02 and the Start date of changed use for the changed plan is 10 business days after the request date
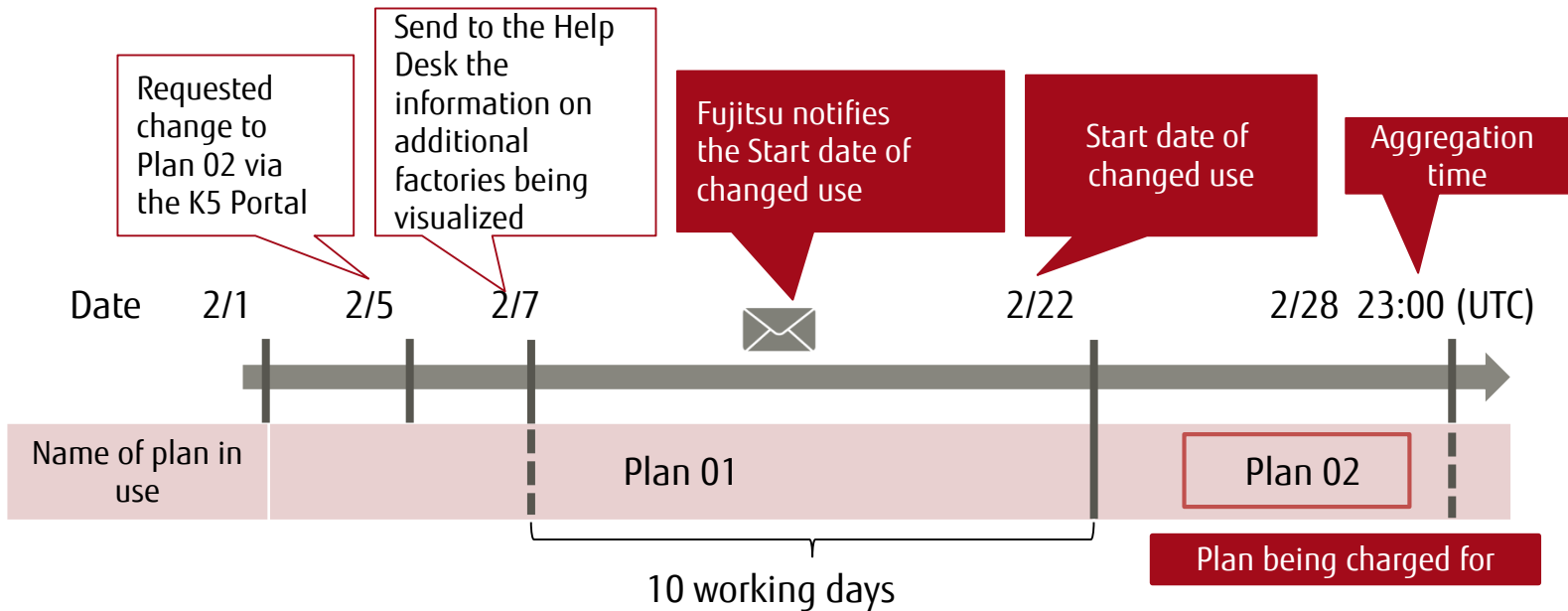
Restrictions and Cautions (1/3)

■ Restrictions/ cautions for the COLMINA Platform Basic Service

- Please refer to the service specifications and PaaS restrictions published on the K5 website for information about the regions in which this service is available
- Restrictions regarding data receipt are described below:

Data size per one communication		Communication interval	CSV format file maximum column	CSV format file maximum size/a record
517K bytes	1,000 records	Once/min	15 columns	529 bytes （Ave:75 bytes)

*Correct data reception is not guaranteed if one or more of the above restrictions are broken.

- Cautions regarding the data format are described below:

Character code	New line code	CSV layouts	Date format
UTF-8	LF	Values between double quotations separated with commas (E.g.: "value", " 6.242")	YYYY-MM-DD hh:mm:ss.SSS (Example:2017-05-25 20:42:36.123)

- Newer data will overwrite the stored data when data containing the same key item (time, data type, data element, etc.) is registered
- Transfer protocol: HTTPS, Method: POST
- Data access may be denied if concentrated accesses causing serious damage are observed or restrictions regarding data receipt are regularly broken

Restrictions and Cautions (2/3)

- Customers are solely responsible for data receipt and storage. Clients hereby accept that subject data gained at the data acquisition locations listed below are used to improve service quality and functionality, to produce statistics and for publishing. Fujitsu does not use the clients' data without prior consent.

Data acquisition locations	Subject Data
Servers communication facilities	-Communications data (time, number of accesses, communications volume) -Server performance data (load, resource usage) -Server system logs -Application/ Middleware logs constituting this service

- When customers provide Fujitsu with or use personal data and information through this service, they are required to notify the individuals who own the data or information of this, and obtain the individuals' consent. Also, customers expressly state and guarantee that providing Fujitsu with personal data and information, and the use of same, do not conflict with the laws and regulations of any country, or breach any rights of third parties.

- Fujitsu may delete customers' data without any notice to protect the company's environment when virus-infected or suspicious files are found on the service.

- Fujitsu does not recover data from backups that are created or registered. Customers are required to take their own backups, recover data or recreate it themselves.

- It is necessary for customers to create CSV format files (the standard format of this service) containing data to use with this service and send these to the specified URL.

- In addition to these service specifications, the terms of licensing described in the following service details manual will be applied to open source software, etc. set forth separately by Fujitsu. If there are discrepancies between the descriptions in these service specifications and in the service details manual, the terms of licensing set out in the service details manual shall take precedence.

Restrictions and Cautions (3/3)

■ Restrictions and Cautions for the Optional Services

■ Data Visualization (Intelligent Dashboard)
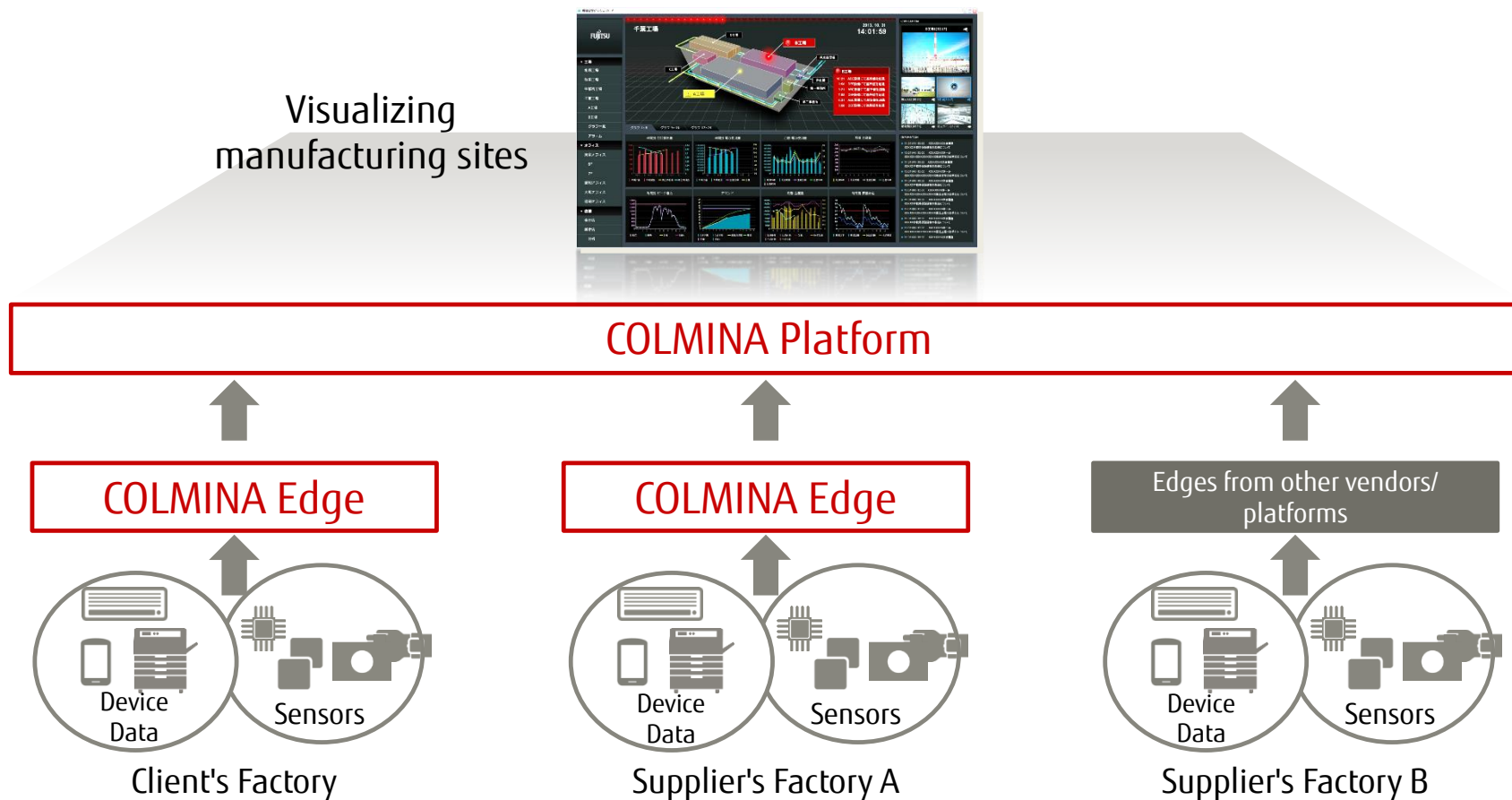
- Client environment requirements are as follows:

Item	Requirements
OS	Microsoft Windows Ver.7, 8.1, 10
Browser	Microsoft Internet Explorer Ver.11

- Six languages are available, including Japanese. The language to be displayed must be defined.
- Factories, production lines, facilities and alarm images must be prepared by the clients.
- The new line code when downloading and uploading CSV files is "CRLF".
   *The CSV files to be uploaded contain definition information on user management and screen layout.
- The maximum number of records that can be uploaded to the stored data in CSV format is 50,000. If this limitation is exceeded, it will become necessary to split the data by reducing the data retention period or via other means.
- Regardless of the amount of disk space used, the maximum number of data items that can be stored is 80 million.

Application Examples:
Upgrading Supply Chains/ Visualizing Multiple Factories
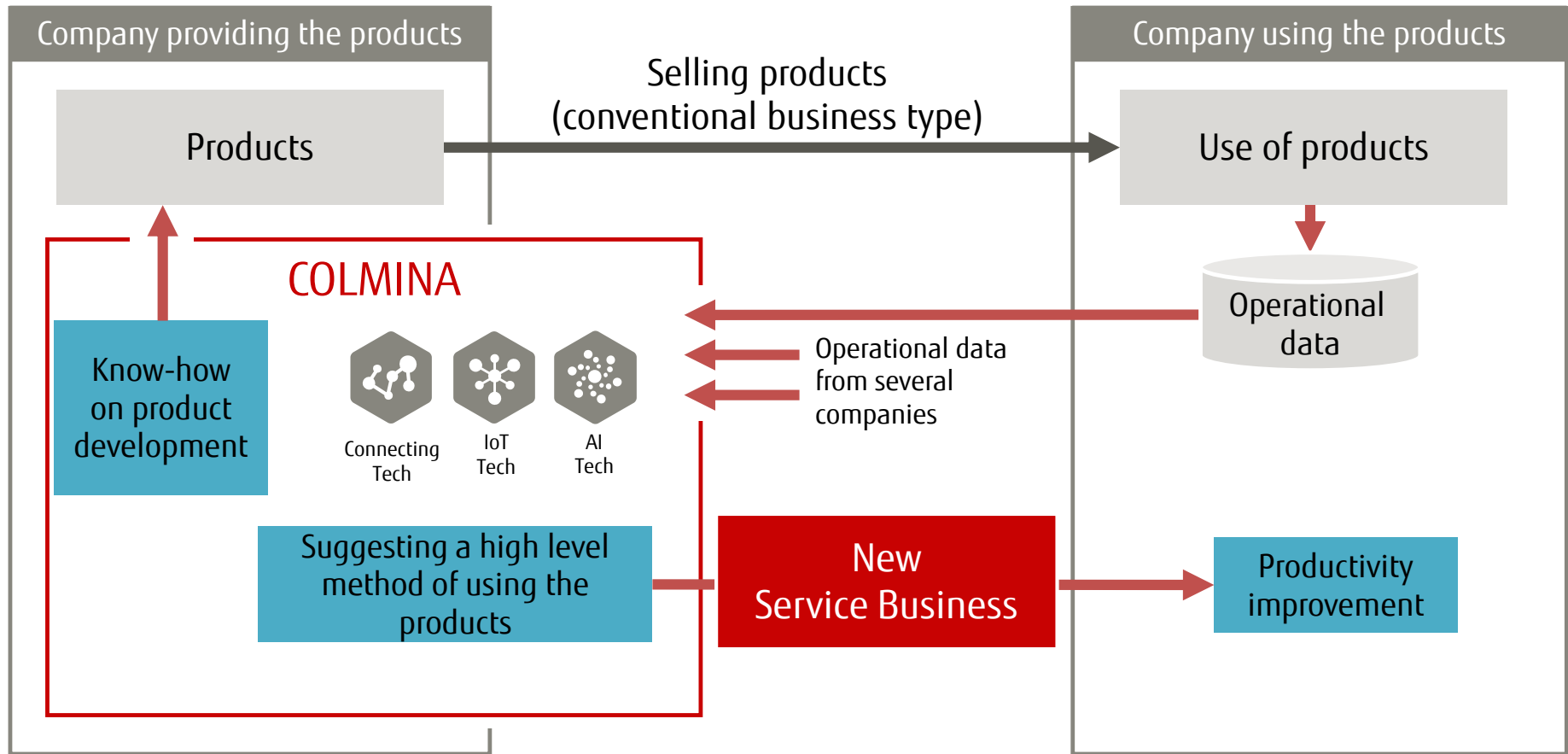
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- Visualizing Multiple Factories
  - Entire supply chains can be visualized at a high level by gathering information on each factory, including supplier-related data.
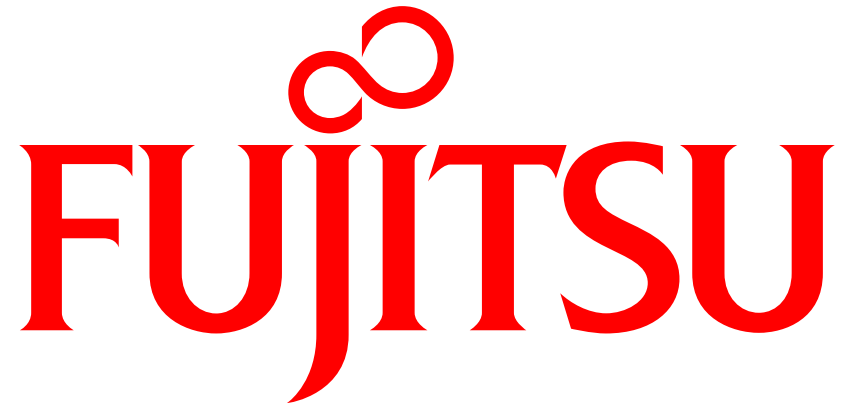

Visualizing manufacturing sites

COLMINA Platform

COLMINA Edge	COLMINA Edge	Edges from other vendors/ platforms

Device Data · Sensors

Client's Factory · Supplier's Factory A · Supplier's Factory B

Application Examples:
Creation of new services/Turning manufacturers into a service industry

- **Turning manufacturers into a service industry**
  - Clients can help business partners improve their productivity by suggesting to them a high level method of using the clients' products based on operational data.