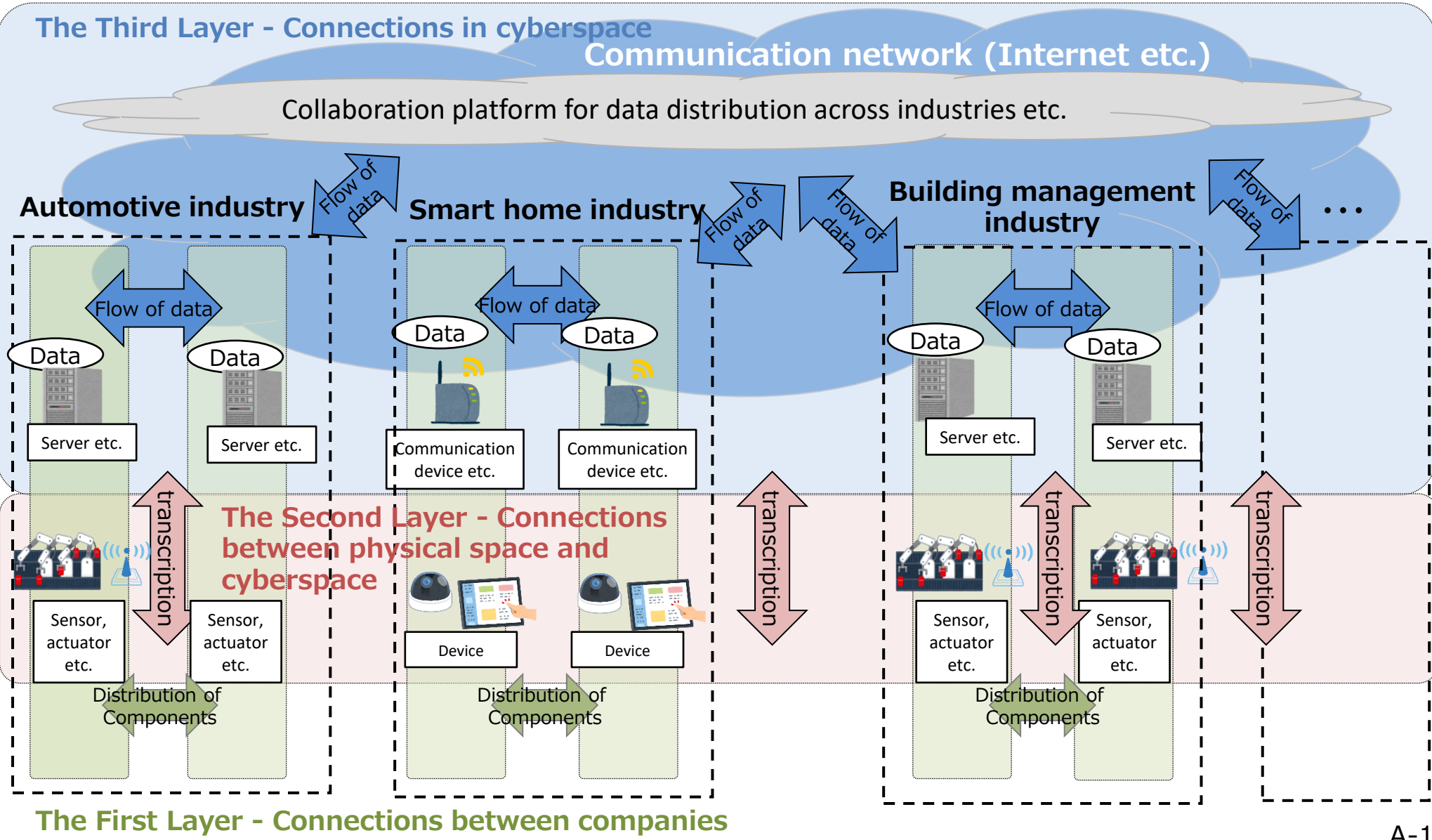


Appendix A. Use case

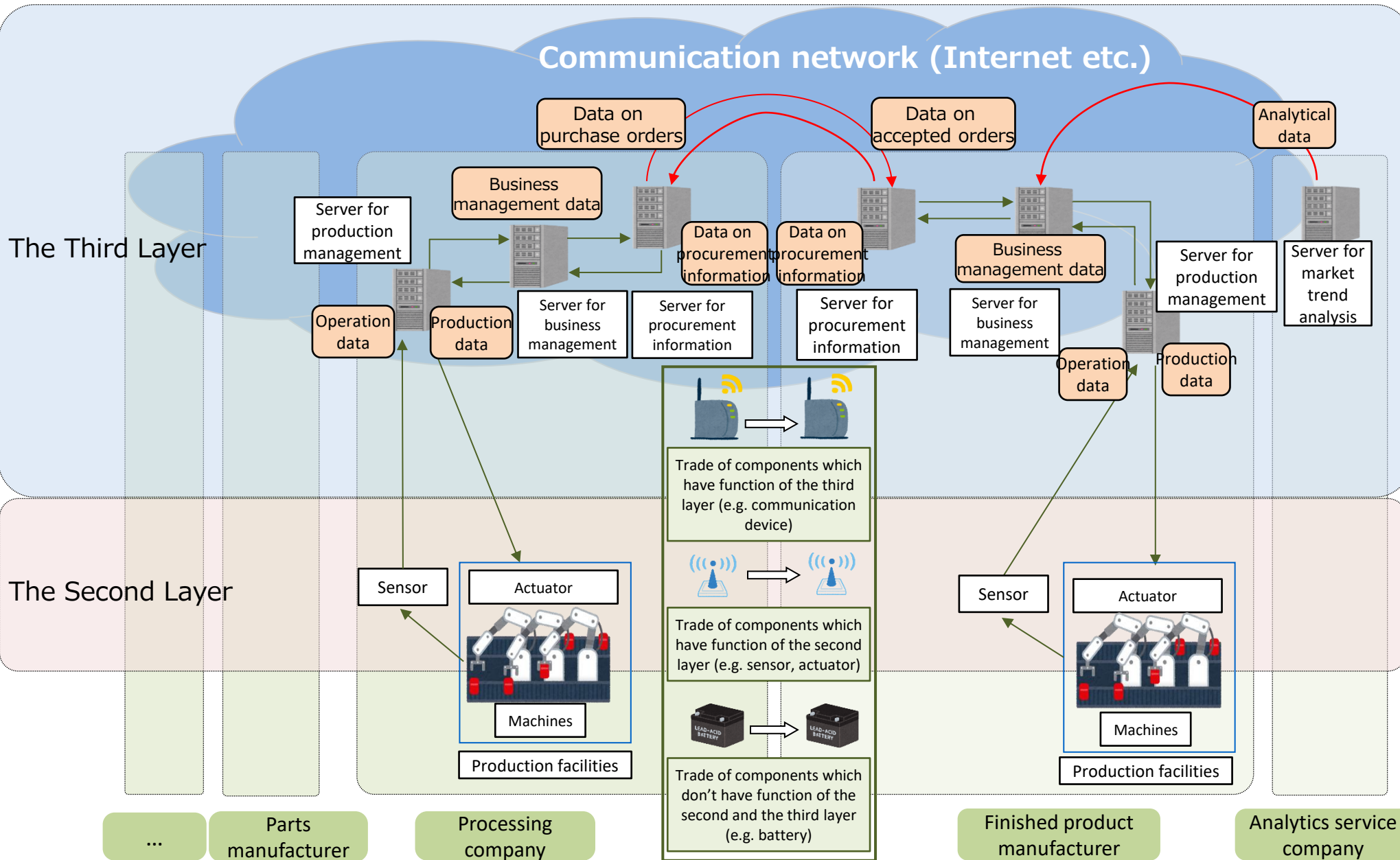
~References for specifying the targets of analysis~

Use case #1: Connections of components, data etc. in “Society5.0”

■ In “Society5.0”, cyberspace and physical space are highly integrated, and various components, data etc. are distributed across companies and even among industries.



Use case #2: Manufacturing process



Point of view in the use case #2 - Manufacturing process

1. Assumed “value creation process”

- A series of transactions in the manufacturing process; acquirer places an order for a product, and supplier produces the products based on the design drawing.

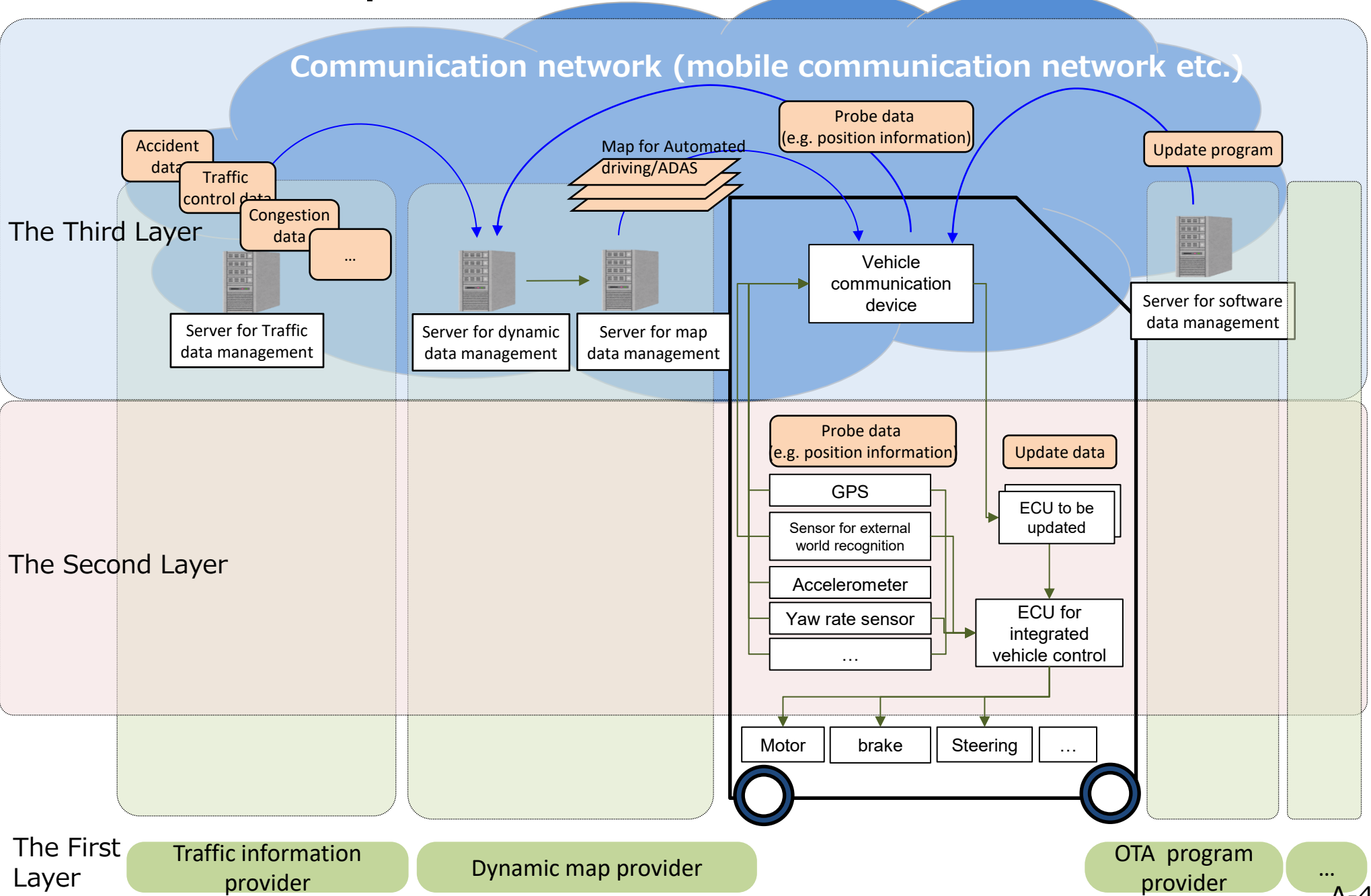
2. Features

- Along with progress toward Society5.0, the number of IoT devices will significantly increase.
- Also, there will be an increase of using external data such as market trend analysis data

3. Image of classification of elements to each layer

Layer	Example: Classification of elements to each layer in use case #2
The First Layer	• Parts manufacturer: An organization providing manufactured parts to processing company. • Processing company: An organization processing parts supplied by parts manufacturer. • Finished product manufacturer: An organization completing the product by assembling parts. • Analytics company: An organization providing finished product manufacturer with analytical data about market trends etc.
The Second Layer	• Sensor: A component monitoring the operation status of the production facilities and transducing that to electronic data. • Actuator: A component actuating the production facilities based on data about production management.
The Third Layer	• Communication device: A system component enabling connection of data among organizations. • Server for data processing: A system component performing functions such as storage, processing and analysis of data etc.. • Data to be processed – Data on procurement information: Data about order plans, transactions between organizations, etc.. – Analytical data: Analytical data about market trends etc., used for improvement of production plan.

Use case #3: Example of connected car in the future



Point of view in the use case #3 – Example of connected car in the future

1. Assumed “value creation process”

- A process that utilizes data obtained from sensors etc. to support human driving, or ultimately autonomously driving.

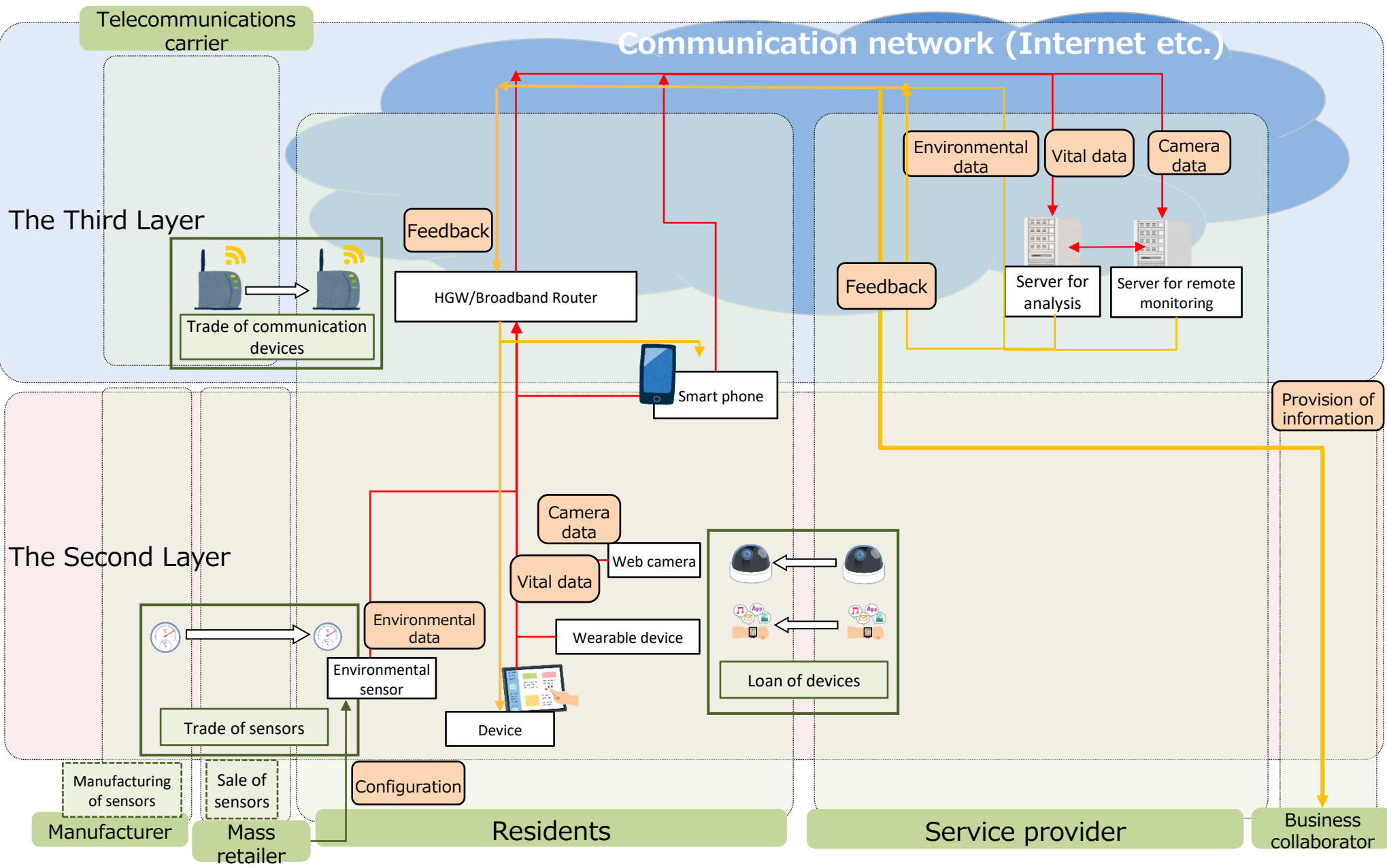
2. Features

- Along with progress of connected (automotive IoT), exchange of data inside and outside the car occurred, and connection between physical space and cyberspace and connections in cyberspace increased.
- In order to realize future automatic driving, it is possibility to require exchange of various data such as map data, congestion/traffic regulation data in addition of the surrounding data obtained by the outside world recognition sensor etc.

3. Image of classification of elements to each layer

Layer	Example: Classification of elements to each layer in use case #3
The First Layer	• Traffic information provider: An organization providing traffic control data and congestion data etc. for dynamic map provider. • Dynamic map provider: An organization analyzing probe data (e.g. position information) and, providing the result of analysis for automobiles. • OTA center: An organization providing difference data for vehicles.
The Second Layer	• ECU for driving control: A component controlling the motor, brake, steering, etc. based on information such as dynamic map. • Car proximity sensor: A component measuring the distance to the surrounding obstacles using a camera, radar, etc.. • GPS : A component for acquiring the location information of the vehicle.
The Third Layer	• Transmitter/receiver: A system component enabling connection of data among vehicles. • Server for data processing: A system component performing functions such as storage, processing and analysis of data etc.. • Data to be processed – Congestion data: Data about road congestion based on location information etc. of individual vehicle. Used to create dynamic map. – Dynamic map: Data combining map data, traffic congestion data, traffic control data, etc. used by vehicles for automatic driving.

Use case #4: Smart home



Point of view in the use case #4 - Smart home

1. Assumed “value creation process”

- A process in which services that meet the needs of residents are provided by utilizing data of daily life acquired from IoT devices etc. bought by residents or leased from service providers.

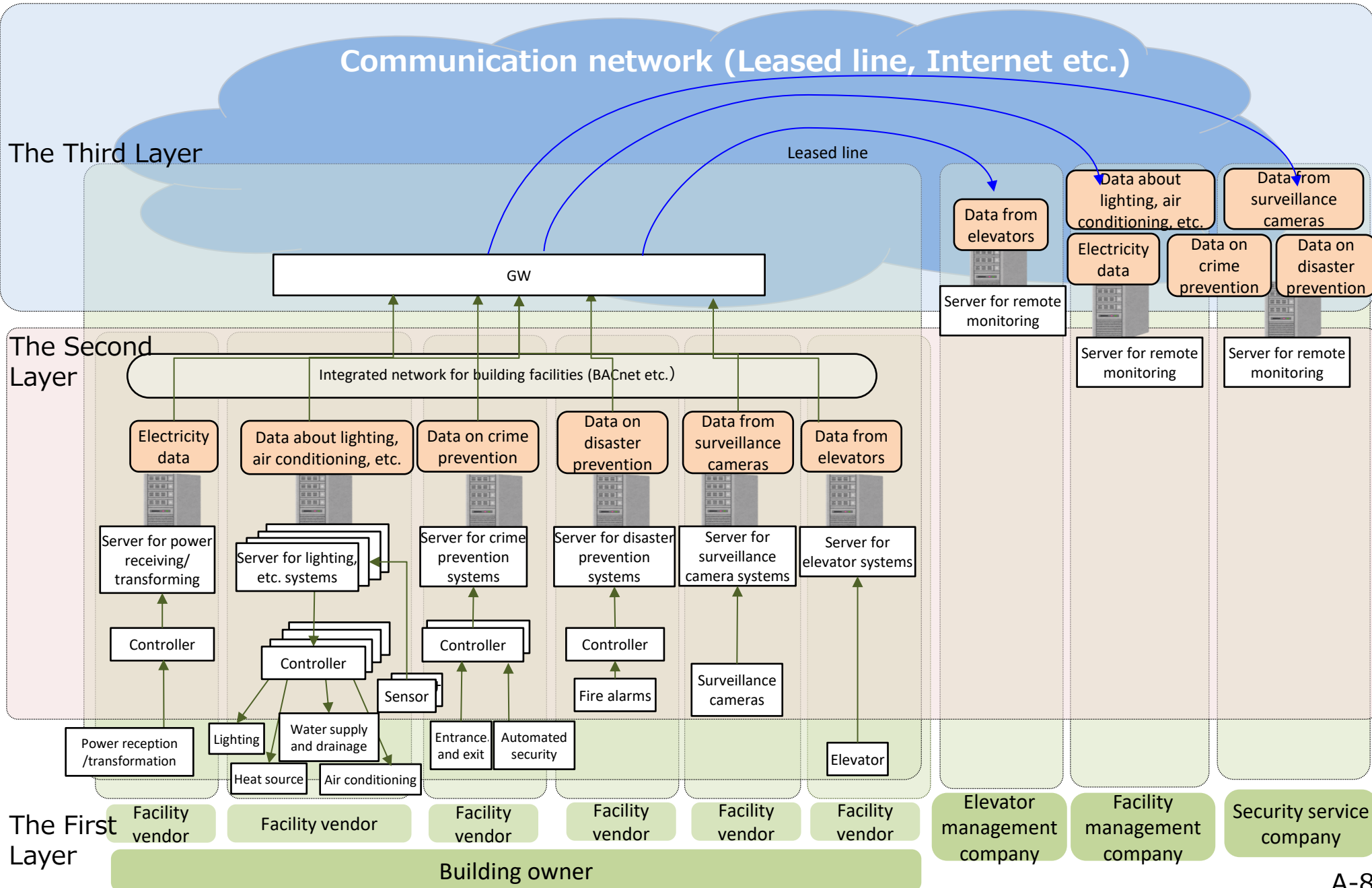
2. Features

- While consumer appliance, security camera, health equipment, etc. are connected to the Internet and becoming IoT device, data relating to daily life is exchanged through the network and, it is possible to operate IoT device via the network. So, it is important to ensure trustworthiness in the transcript operation of IoT device connecting cyberspace and physical space.
- In many cases, an administrator is not clearly determined in the maintenance of the IoT device and the management of the state.

3. Image of classification of elements to each layer

Layer	Example: Classification of elements to each layer in use case #4
The First Layer	• Residents: People that purchase or rent an IoT device and set it at home to provide data on their daily life and enjoy services based on it. • Service provider: An organization acquiring data from the household and implementing services based on it. • Telecommunications carrier: An organization providing internet and LTE network by lending communication devices to residents etc.. • Business collaborator: An organization receiving information from service provider and providing services based on it. • Manufacturer: An organization manufacturing sensors connecting to the internet etc.. • Mass retailer: An organization selling sensors, etc. manufactured by manufacturer and setting them.
The Second Layer	• Sensor, Wearable device, Web camera, Network connected appliance: A component transcribing activities in daily life into digital data. • Device: A component used for data browsing or input.
The Third Layer	• HGW : A system component enabling connection of data between a household and others. • Server for data processing: A system component performing functions such as storage, processing and analysis of data etc.. • Data to be processed – Environmental data: Data such as temperature and humidity. – Vital data: Data such as heart rate, body temperature and so on.

Use case #5: Building management



Point of view in the use case #5 - Building management

1. Assumed “value creation process”

- The process that the owner of a building signs a contract with facility management firm and utilizes data obtained from the building toward energy management and optimization of the building, and the process that the owner of the building monitors or manages it from remote site(s).

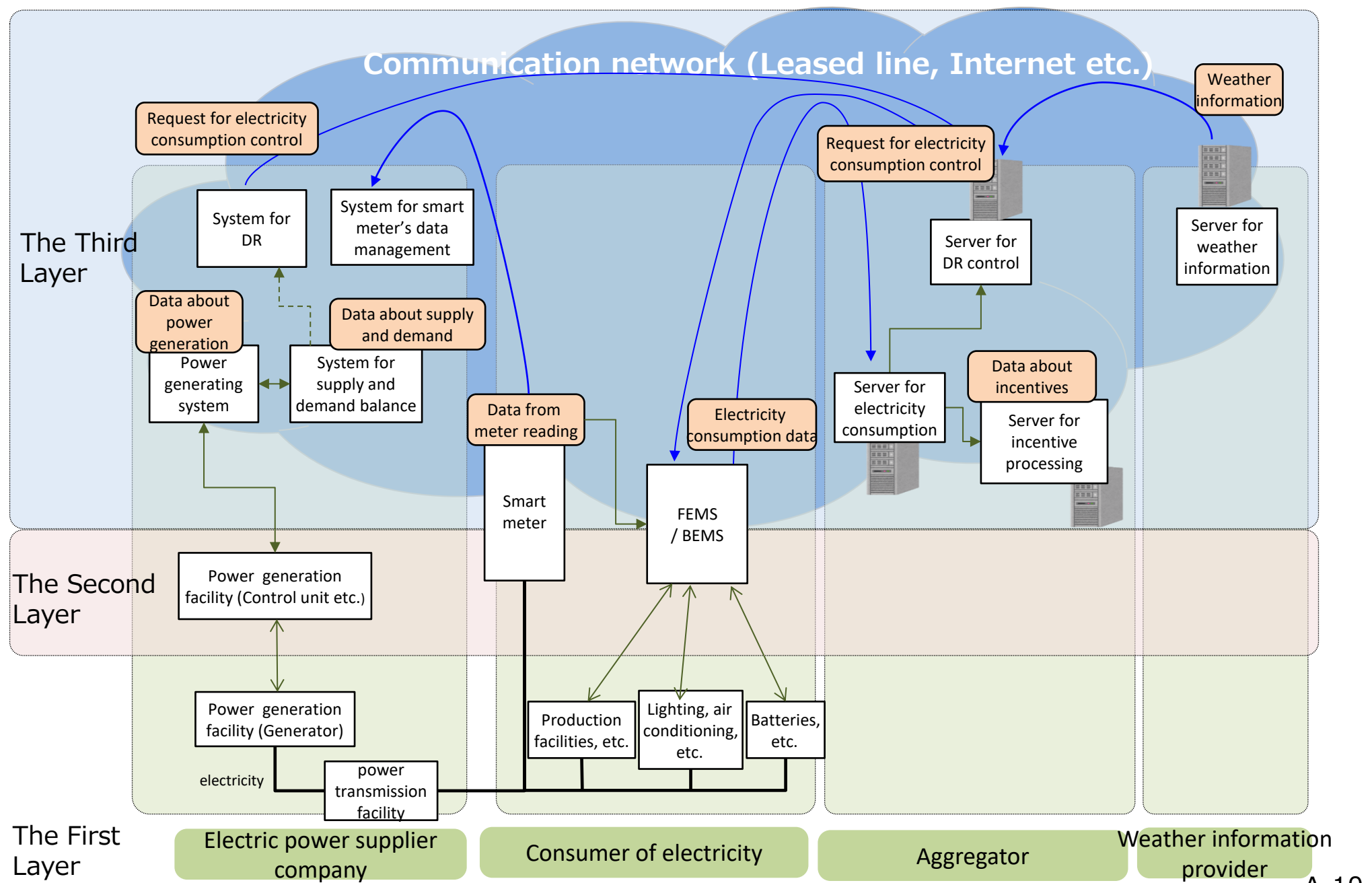
2. Features

- Evolution in IP-based communication regarding many control system(s) in the building
- Necessity in handshake of various data such as power supply data, elevation machine(s)’ data to realize monitor/manage the building(s) from remote site(s)
- Many stakeholders such as elevation machines monitor firm(s) and facility management firm(s)

3. Image of classification of elements to each layer

Layer	Example: Classification of elements to each layer in use case #5
The First Layer	• Building: Objective(s) monitored/managed by building system(s) • Elevator management company: Organization that monitors/manages the operation status of elevators built in the building from remote site(s) • Facility management company: Organization that monitors/manages the power usage of the building(s) and others from remote site(s) • Security company: Organization that monitors/manages the building(s) through surveillance camera(s) or other(s)
The Second Layer	• Controller: Control device (Lighting, Heat source, Air-conditioning) • Surveillance camera: A component that monitors occurrence of emergency event(s)
The Third Layer	• Integrated network (BACnet etc.): System component toward achievement in data handshake between inside building(s) and outside building(s) • Server for data processing: A system component performing functions such as storage, processing and analysis of data etc.. • Data to be processed – Electricity data: Various power consumption of device(s) inside building(s). Data utilized by facility management firms. – Data on crime prevention: Combined data regarding such as those in an access-controlled secure room and those in automated security. Data utilized by security firm(s).

Use case #6: Electric power system (Demand response)



Point of view in the use case #6 – Electric power system (Demand response)

1. Assumed “value creation process”

- Process of demand-response toward reducing power supply through incentive

2. Features

- Increase in various data handshake as per power supply due to increasing smart-meter(s)
- Increase in the number of stakeholders in power supply due to evolution of de-regulation of power

3. Image of classification of elements to each layer

Layer	Example: Classification of elements to each layer in use case #6
The First Layer	• Electric power supplier company: An organization that requests aggregator toward reducing power usage • Consumer of electricity: An organization that executes reducing power consumption due to request toward reducing power consumption • Aggregator: An organization that requires manufacturers (plants, buildings) to reduce electric power consumption requested by electric company/companies. • Weather information provider: An organization that provides weather information to aggregators
The Second Layer	• Smart meter: A component that convert(s) electric consumption into read data • FEMS/BEMS: A system that manages energy consumption in plants or in buildings
The Third Layer	• Smart meter: System component that sends read data • Server for data processing: A system component performing functions such as storage, processing and analysis of data etc.. • Data to be processed – Weather information: Weather data such as temperature and humidity. Utilized for electric demand forecast – Request for electricity consumption control: Data such as the amount of electric power consumption. Utilized to request the reduction of power consumption from power firm(s) to aggregator(s), or from aggregator(s) to consumer(s)