



AICT2022

FUJITSU

# Networking to be data centric with trust

-Data Exchange Network utilize blockchain-

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# Self introduction



Engaged in 30year in  
Network technology

Data  
Exchange  
NW

SDN/NFV

Optical Network

WDM Flex Grid

20<sup>th</sup> Century

21<sup>th</sup> Century

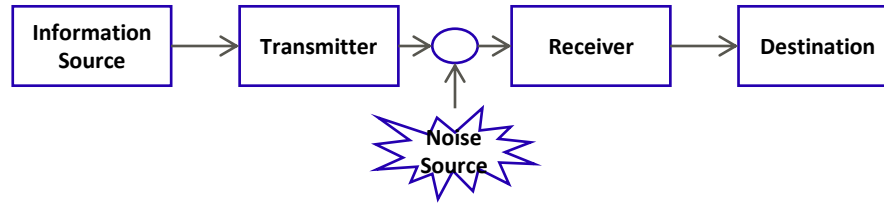
Time

0

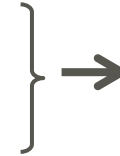
# Digital transformation

## Communication point of view

### ○ Three levels of problems in communication by Shannon Weaver (1949)



- A. The technical problem:  
how accurately can the message be transmitted.
- B. **The semantic problem:**  
how precisely is **the meaning 'conveyed'**.
- C. **The effectiveness problem**  
how effectively does **the received meaning affect behavior?**



20<sup>th</sup> Century

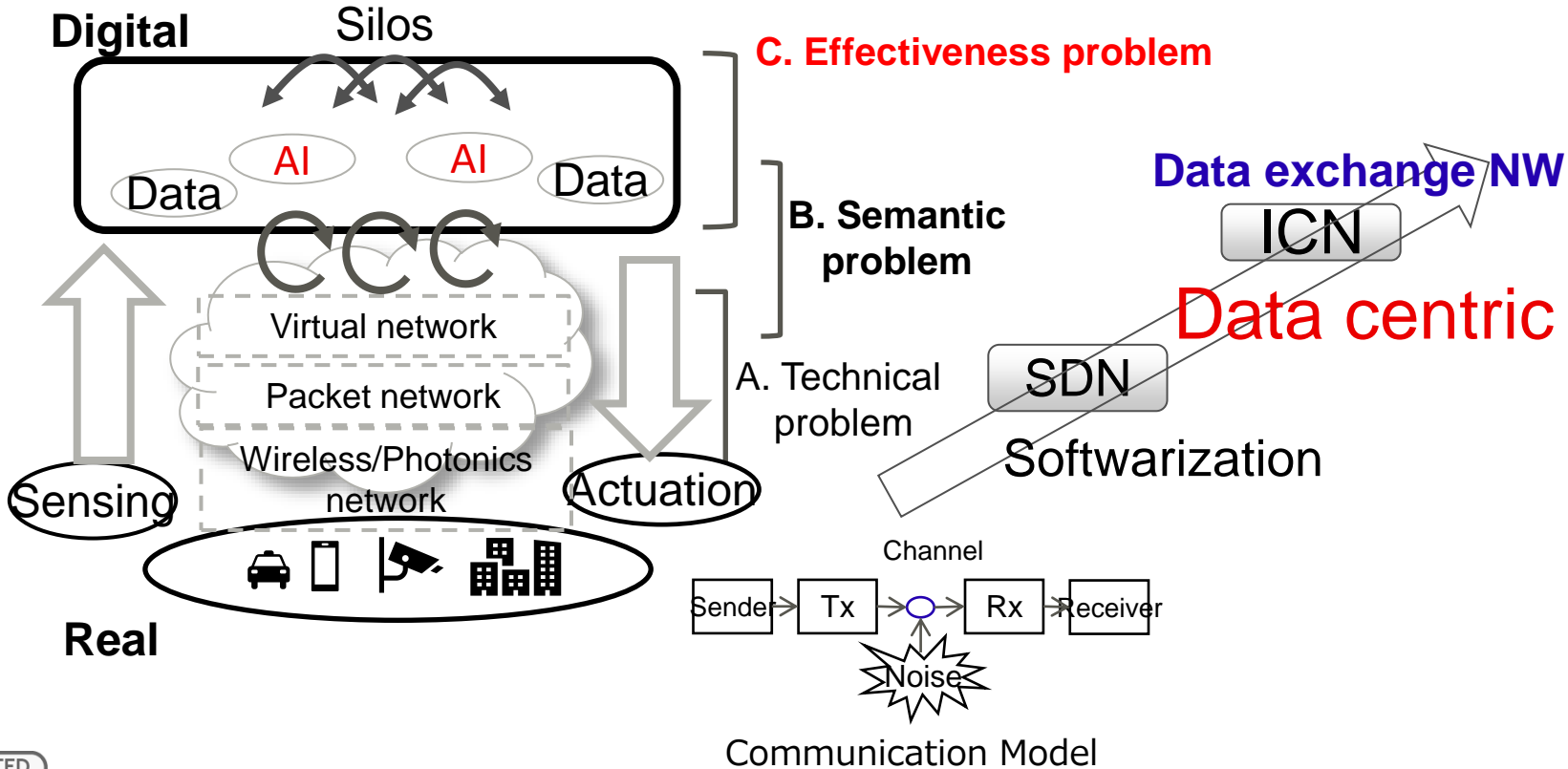


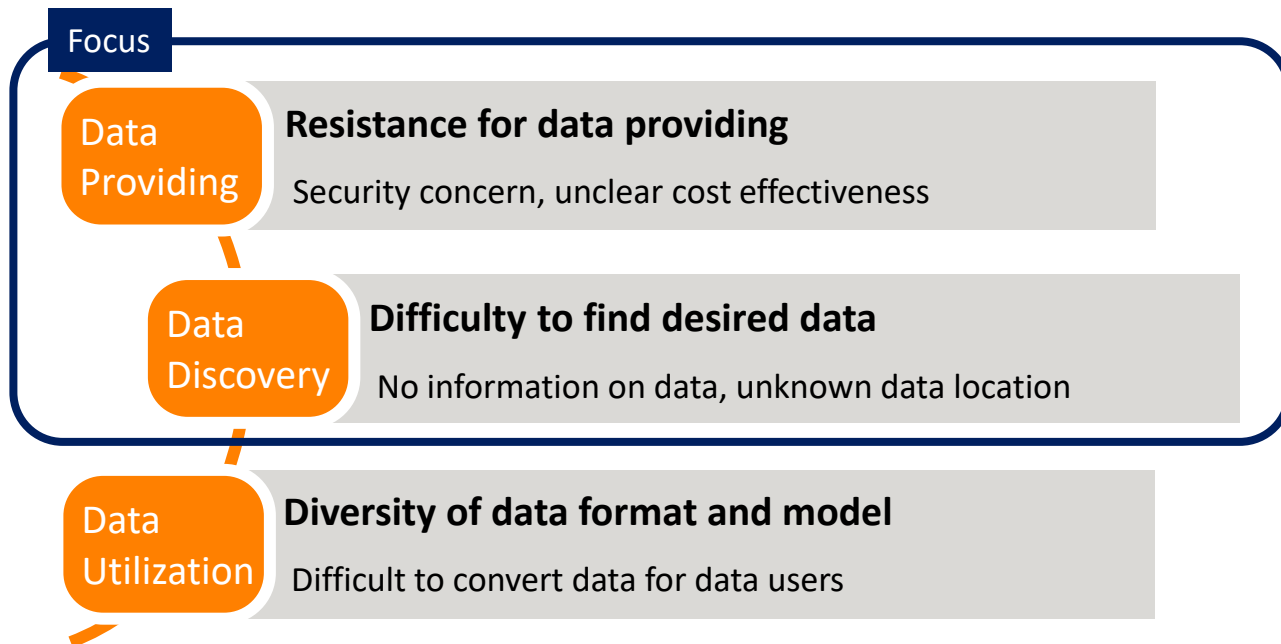
**21<sup>st</sup> Century**  
**Digital**  
**transformation**



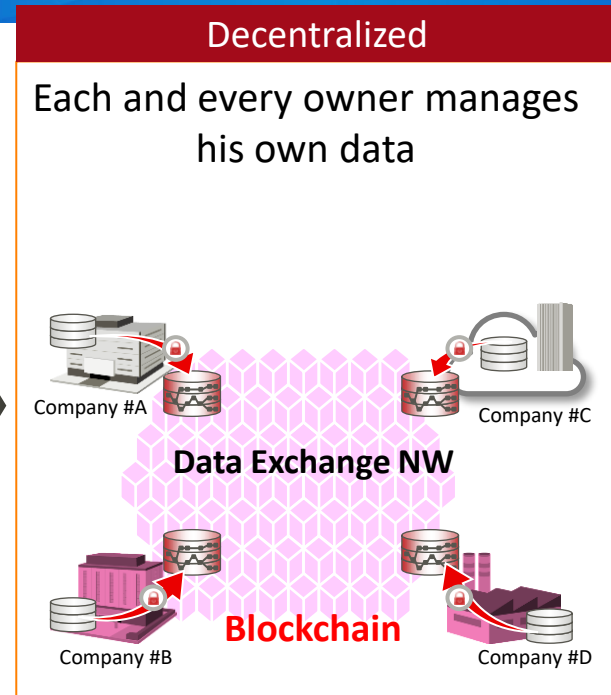
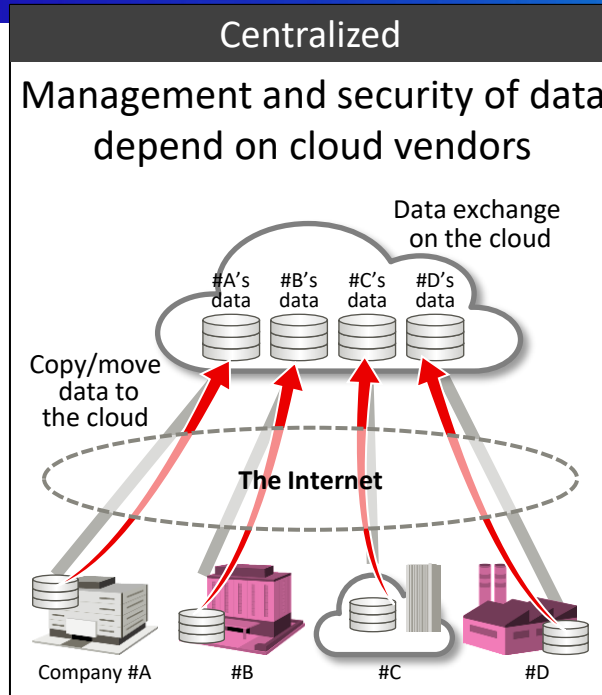
Challenge for Level C problem → Digital transformation

# Network evolution towards Digital transformation





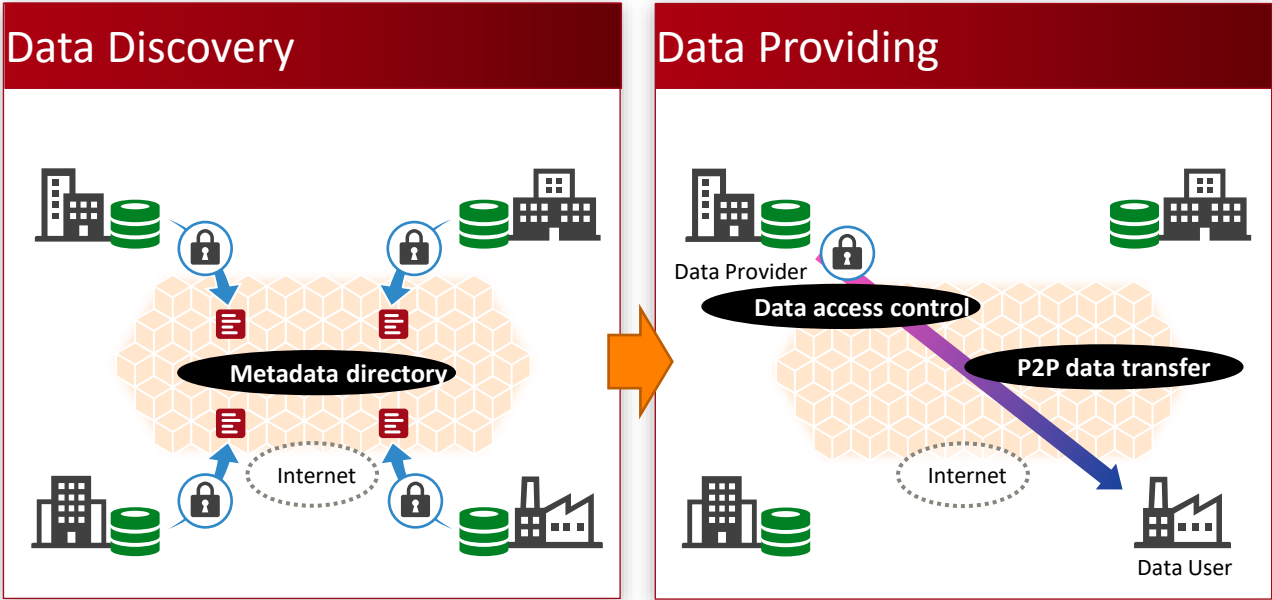
# Decentralized: a more trustworthy data exchange

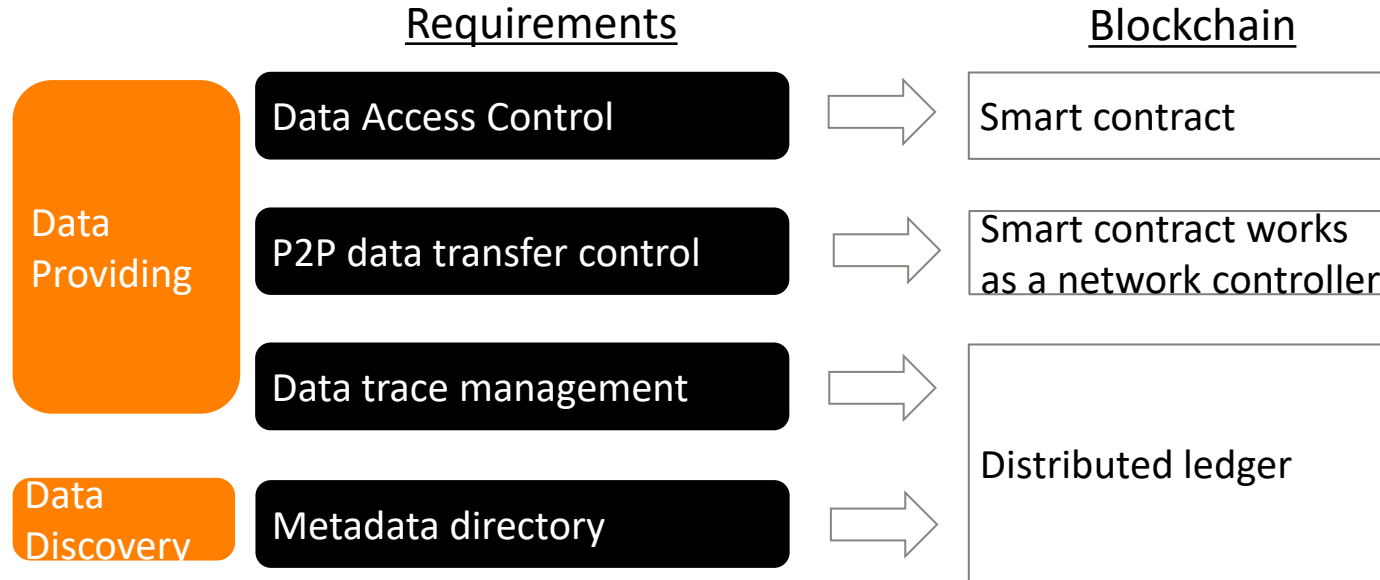


Data location	Cloud
Connection	Static
Openness	Service providers enclose data

Cloud / On-premise / Smart device
Dynamic and flexible
Equally open to every participant

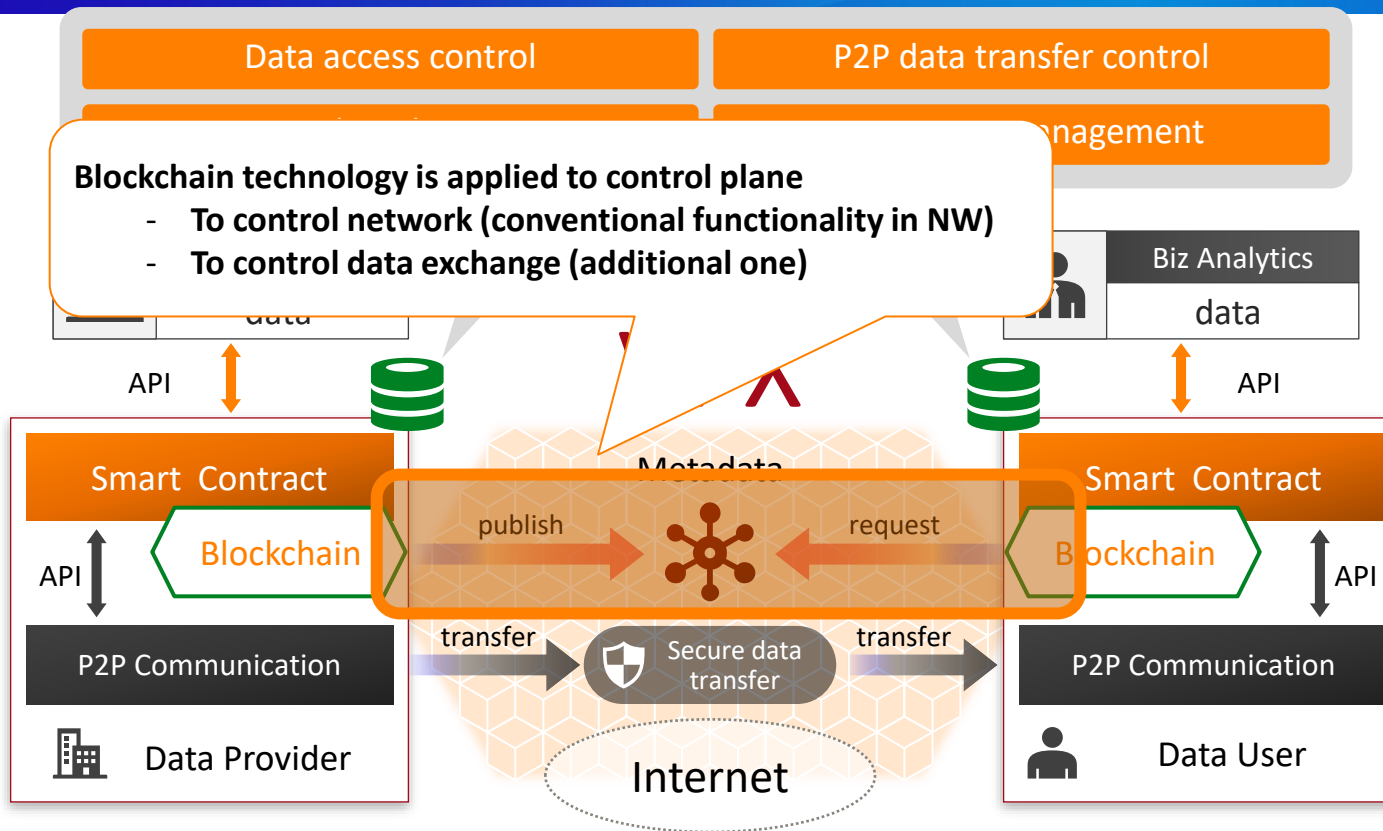
# Requirements for decentralized data exchange



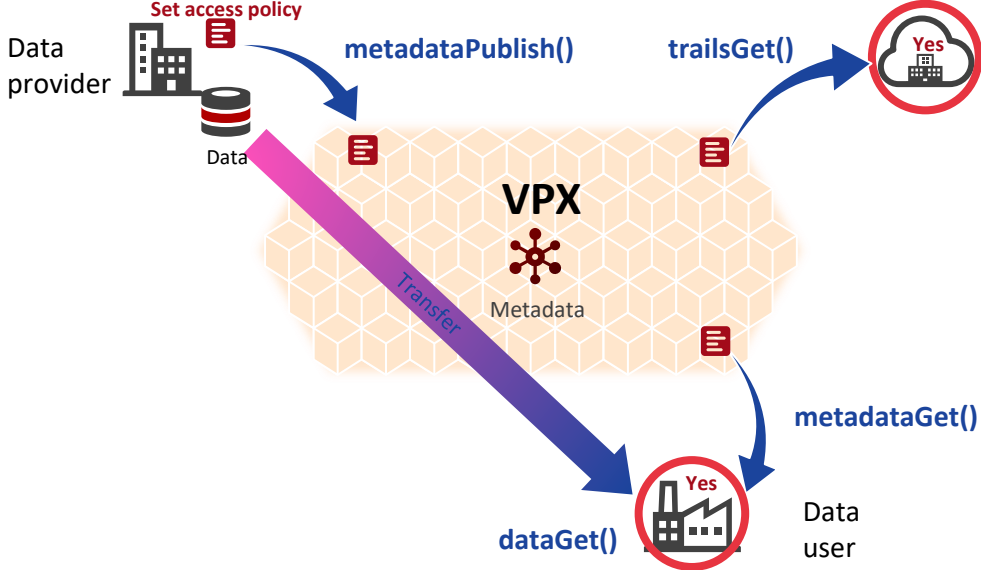




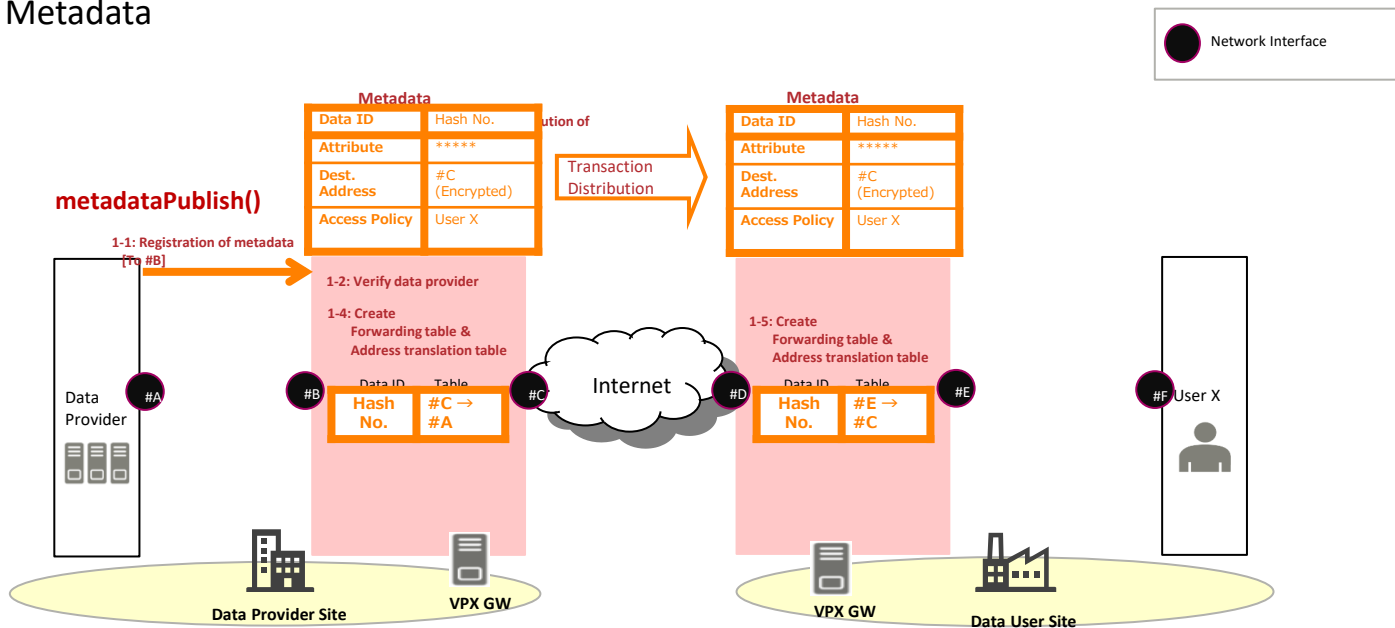
# VPX: Virtual Private digital eXchange



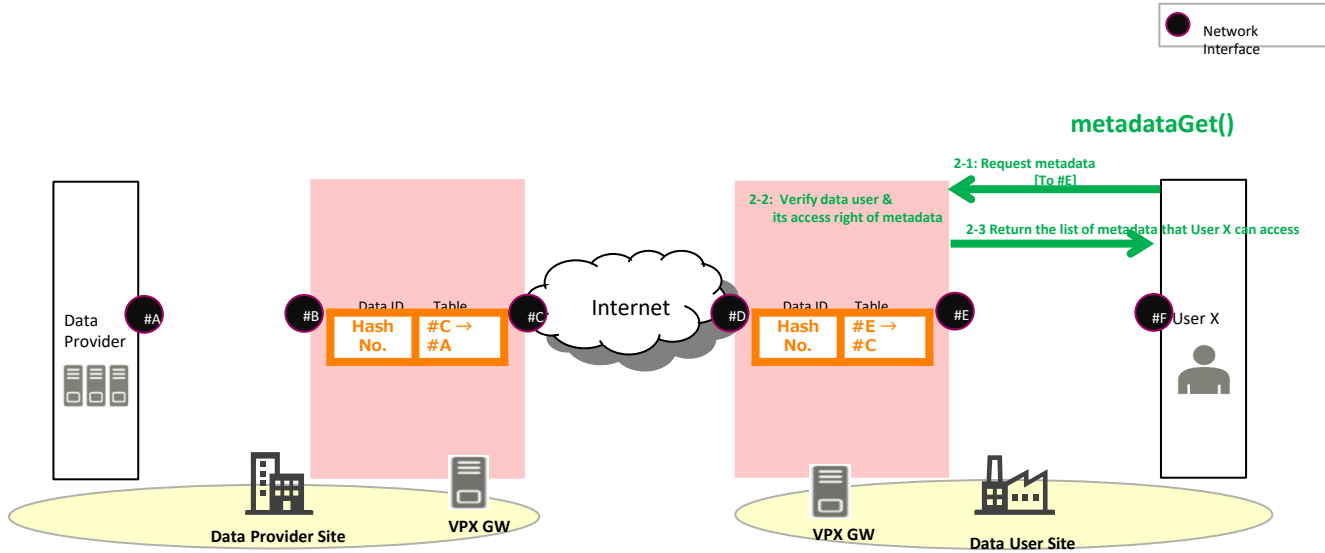
# Major APIs for VPX users



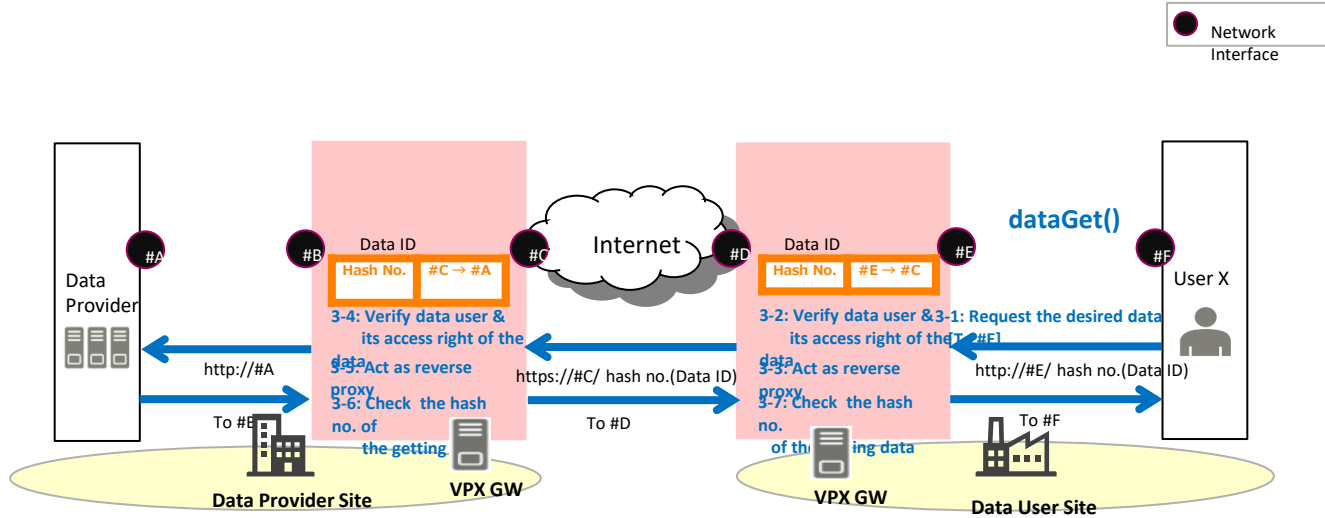
## Step 1: Publish Metadata



## Step 2: Find desired data

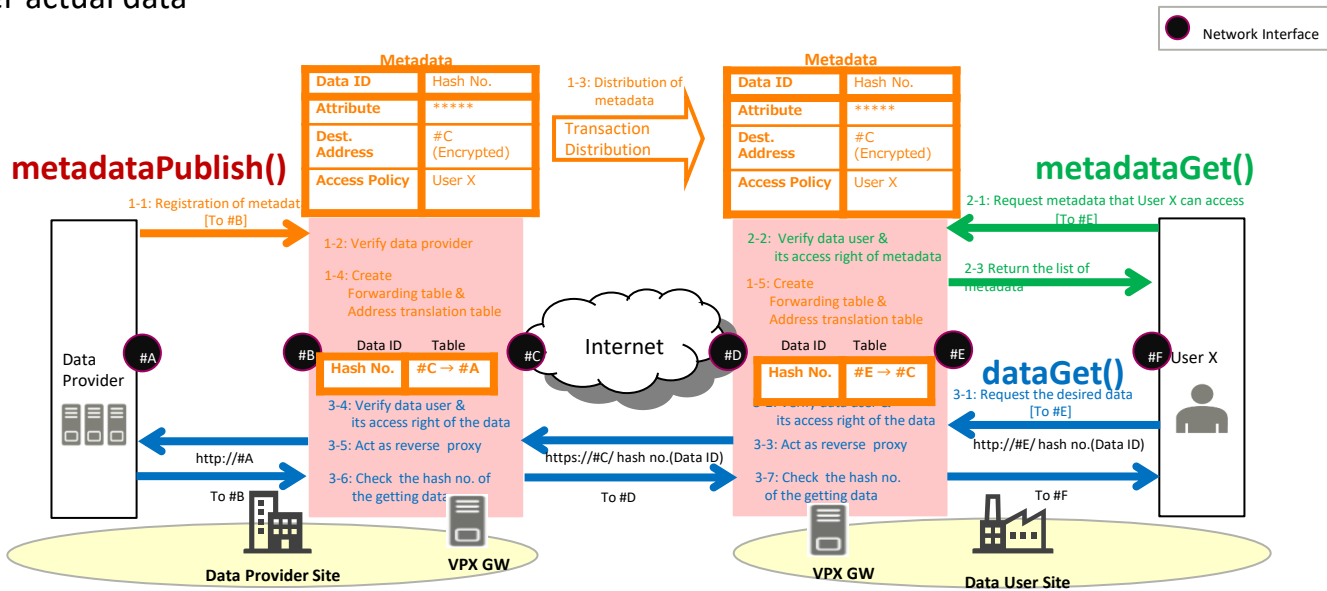


## Step 3: Transfer actual data



# VPX API procedures

- Step 1: Publish Metadata
- Step 2: Find desired data
- Step 3: Transfer actual data



All requests and data go through VPX gateways, thus hiding the location of actual data from VPX participants

# How it works

### Overall VPX NW View

Publish data to only User A

### Trace Information

```

                Blocks (height: 29)
                -----
                Metadata Trade show operator [get-APIDoc]
                Payload [0]@87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                29 Timestamp 09:24:59
                Cur_Hash 87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                Prev_Hash 87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                Metadata Department store [pub-API]
                Payload "B@87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                28 Timestamp 09:24:46
                Cur_Hash 87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                Prev_Hash 87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                Metadata Department store [pub-API]
                Payload "B@87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                27 Timestamp 09:23:44
                Cur_Hash 87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                Prev_Hash 87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                Metadata Department store [pub-API]
                Payload "B@87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
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                Cur_Hash 87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                Prev_Hash 87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                Metadata Trade show operator [get-APIDoc]
                Payload [0]@87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                25 Timestamp 09:20:02
                Cur_Hash 87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                Prev_Hash 87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                Metadata Department store [pub-API]
                Payload "B@87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
                24 Timestamp 09:19:57
                Cur_Hash 87a459488c606269cc21009621d7230e109b3e5173e6916e330b985441a1f
            
```

Publish to only User A

### Provider (Department Store)

Register to VPX

API name  
Purchase data

Enroll ID(default: cla1)  
Enter Enroll ID

Destination of publication

Department store	Hotel	Train company	Network operator
Trade show operator	Building maintenance	Parking management	Local public entity
E-commerce company	SNS	Search engine	Manufacturer

Keyword

Location	Media	Social	Purchase
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Cancel
Register

Change data access policy accessible to only User A & B

### User A (Trade Show Operator)

API一覧

利用可能なAPIを一覧表示します。

cb1      ALL      検索

API名	ハンズ	API登録者	API提供先	発行日時
Category: Location				
人流情報	1A3CF2F9D3B3D687...	Network oper...	Trade show oper...	2017/10/04
乗降客情報	D00CC4C345F1121970...	Train company	Trade show operator	2017/10/04
Category: Social				
イベント情報	DB83D75E14B236C0BE...	Trade show o...	SNS	2017/10/04

### User B (Manufacturer)

API一覧

利用可能なAPIを一覧表示します。

cb4      ALL      検索

API名	ハンズ	API登録者	API提供先	発行日時
Category: Purchase				
購入履歴A	82E4B3865D743C1F0D6...	E-commerce ...	Manufacturer	2017/10/04
Category: Social				
検索数	CSFE6EEAFF7F2Z58B5...	Search engine	Manufacturer	2017/10/04

### Overall VPX NW View

### Trace Information

- User A gets the Data
- User A gets the API document
- Publish to only User A

### Provider (Department Store)

Register to VPX

API name  
Purchase data

Enroll ID(default: cla1)  
Enter Enroll ID \_\_\_\_\_

Destination of publication

Department store	Hotel	Train company	Network operator
Trade show operator	Building maintenance	Parking management	Local public entity
E-commerce company	SNS	Search engine	Manufacturer

Keyword

Location	Media	Social	Purchase
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Change data access policy accessible to only User A

### User A (Trade Show Operator)

swagger

Loading...

### User B (Manufacturer)

API一覧

利用可能なAPIを一覧表示します。

dc4 ..... ALL

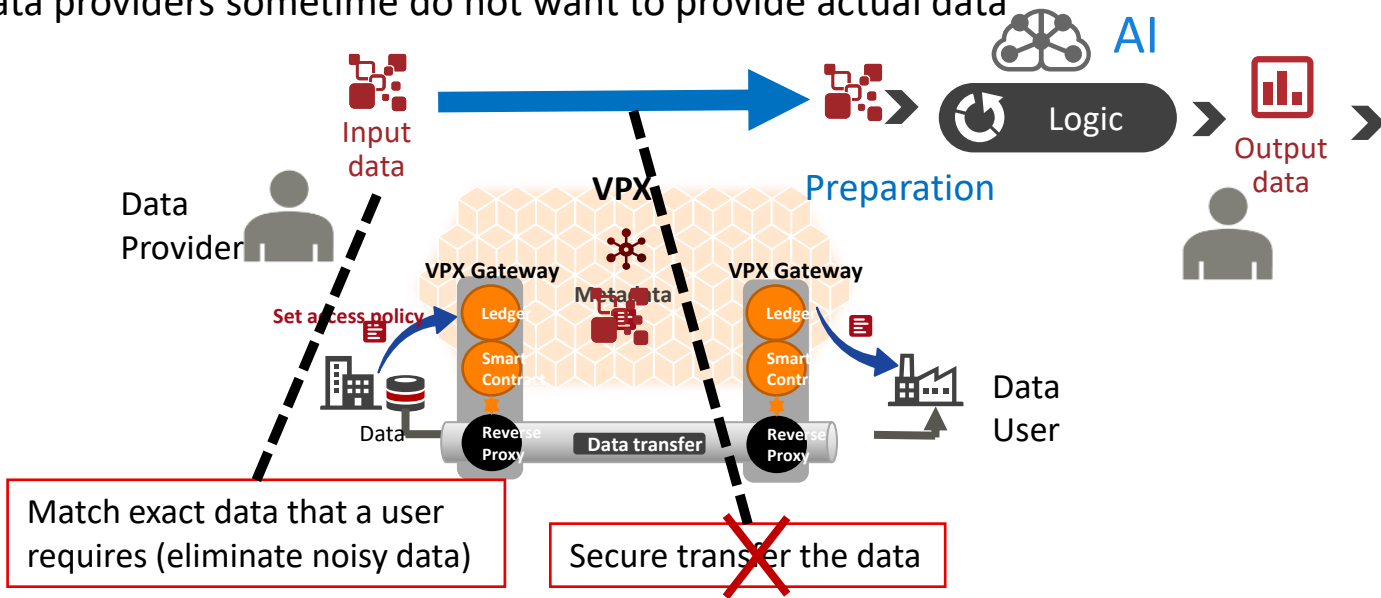
API名	パス名	API登録者	API開示先	発行日時
Category: Purchase				
購入履歴A	82E4B3885D743C1F0D6...	E-commerce ...	Manufacturer	2017/10/04
Category: Social				
検索数	CSFE6EEAFF7F2258B5...	Search engine	Manufacturer	2017/10/04





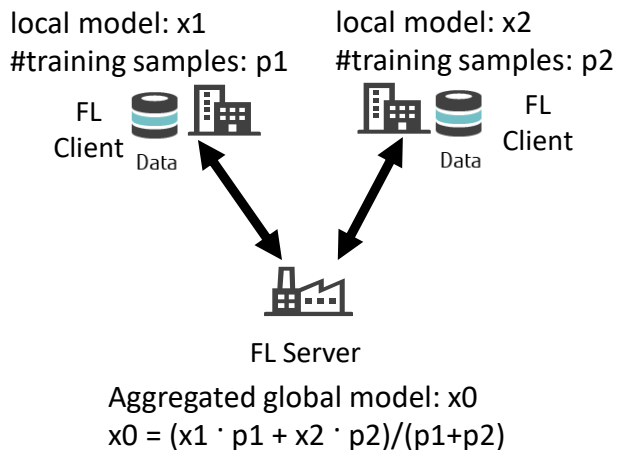
# Application : data exchange for AI

- High quality of AI requires high quality of Data
- Data exchange is to “find data and transfer”, which is needed for AI training, validation, and testing phases
- However, data providers sometime do not want to provide actual data



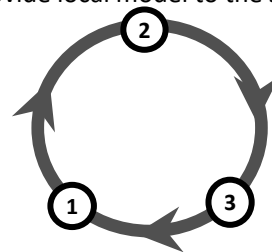
How to train AI models without transferring actual data from data providers?

- Federated learning (FL) is a distributed AI/ML, which trains AI/ML models locally at clients with data
- FL usually involves a central server and a group of clients
- FL can have hundreds of training rounds when converged
  - Each training round includes three steps, as shown below
- FL server aggregates received local models from clients, e.g., weighted avg.



FL server and clients

Clients get the global model and train it with local data, then provide local model to the server

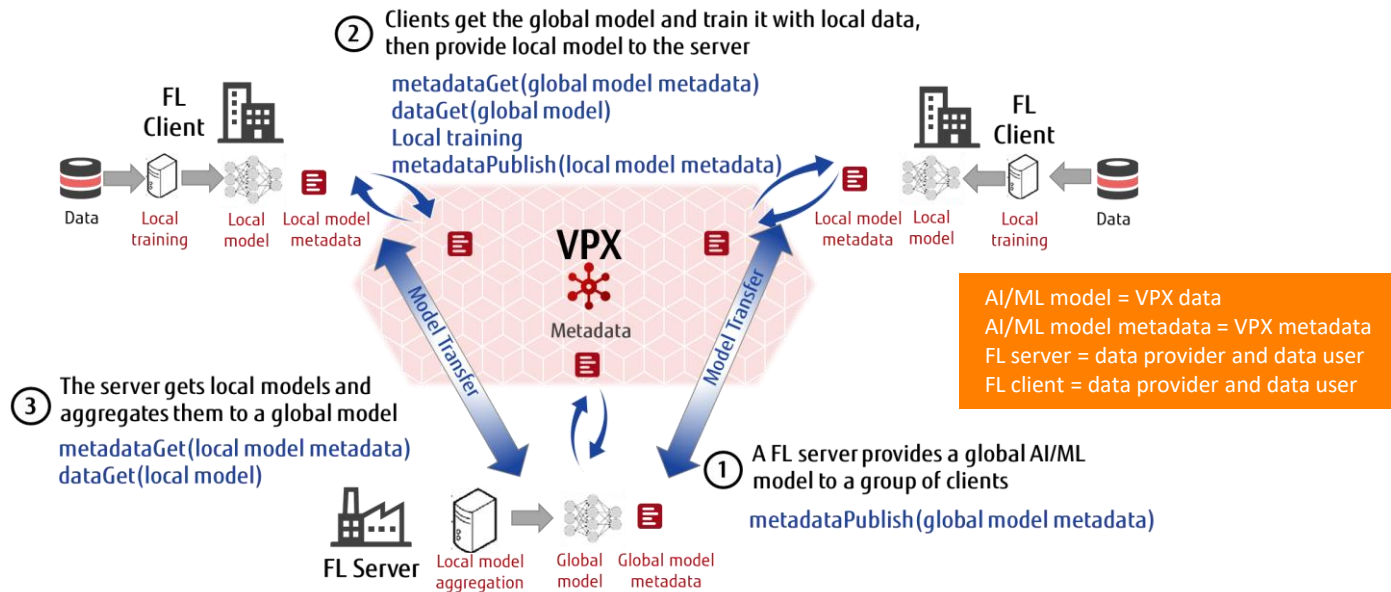


A FL server sends a global ML model to a group of clients

The server gets local models and aggregates them to a global model

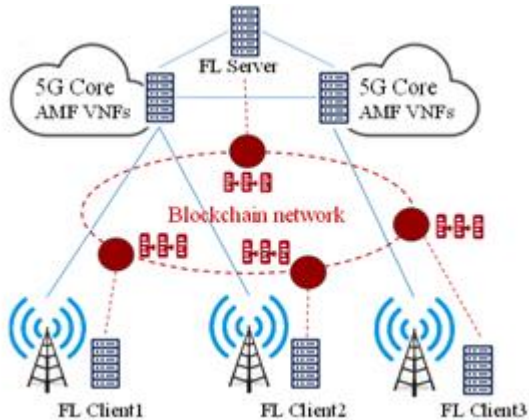
Three steps in a single training round

- VPX seamlessly provides a secure, distributed platform for FL tasks



A single training round in FL

Qiong Zhang, et.al  
Demo: A Blockchain Based Protocol for Federated Learning  
presented at ICNP2020



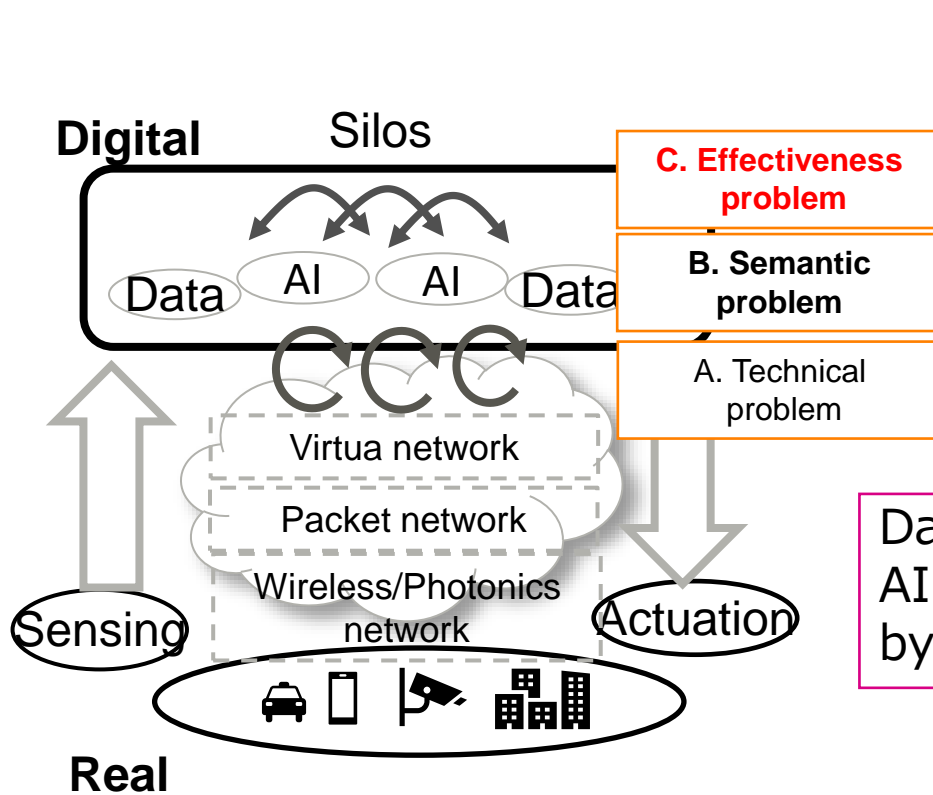
Presented at Netsoft 2021

Demo: A Blockchain Based Protocol for Secure Aggregation in Federated Learning

Qiong Zhang, Paparao Palacharla Fujitsu Network Communications, Richardson, Texas, USA

Motoyoshi Sekiya, Junichi Suga, Toru Katagiri Fujitsu Laboratories Limited, Kawasaki, Japan

# Summary : our approach for "Level C" problem

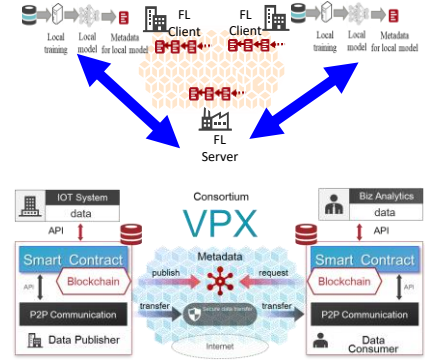


Secure AI exchange  
*FL on VPX*

Secure Data exchange  
*VPX*

**Data exchange NW**

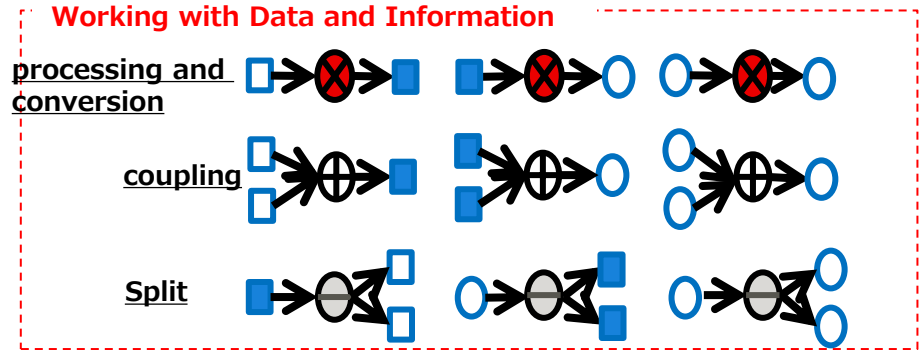
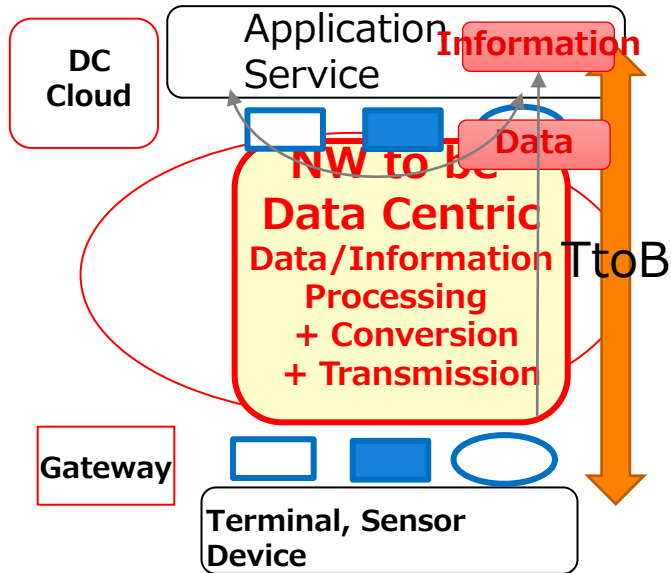
Data Exchange NW is bases  
AI will help to solve Level B /C problem  
by analisys



# Future direction

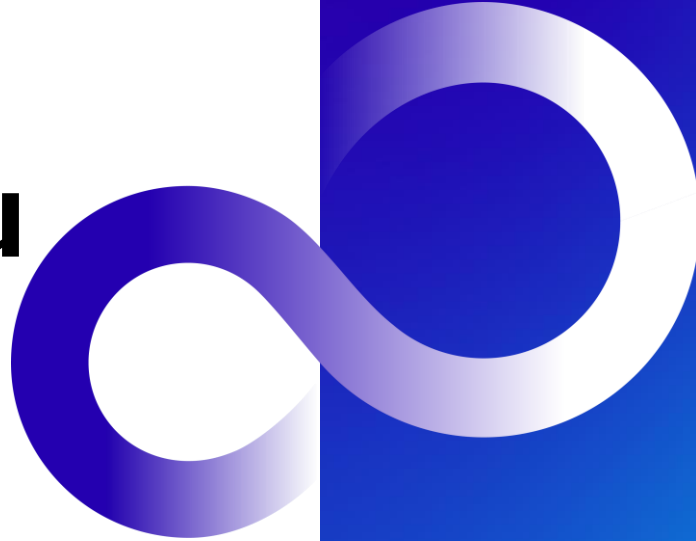
Data are securely exchanged between App, Things then transform to information

Data are transform to info during data exchange through network  
Top to Bottom in trust be important



- Unstructured data = "Express objective facts in numerical values, characters, graphics, images, sounds, etc."
- Structured data = "Enable software to collect and interpret information efficiently, including the relationship between unstructured data"
- Information = "Data useful for a particular purpose or data that has been processed from the data" → Meaningful data

**Thank you**



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