AICT2022

Networking to be data centric with trust

-Data Exchange Network utilize blockchain-

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Self introduction

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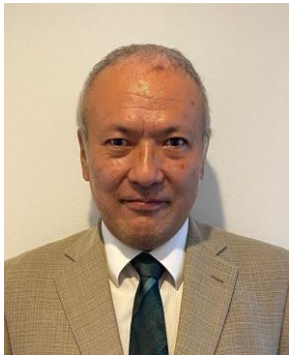
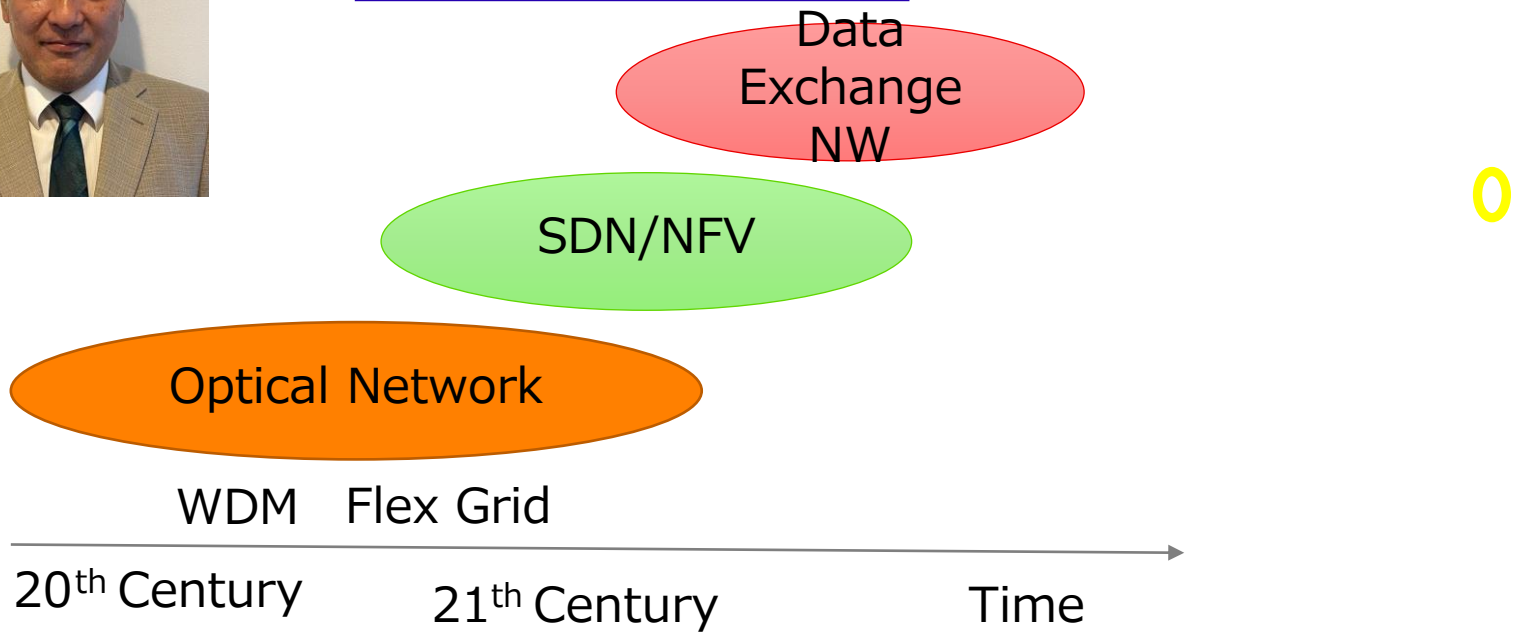


Engaged in 30year in
Network technology



Digital transformation
Communication point of view

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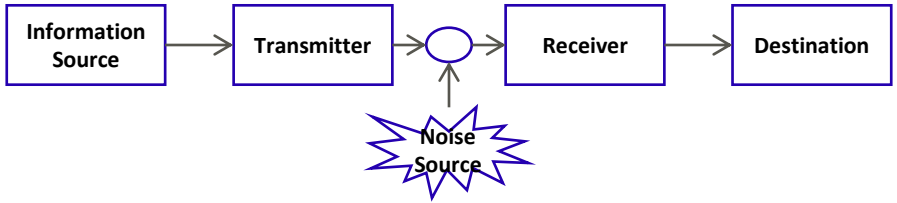
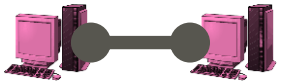
○Three levels of problems in communication by Shannon Weaver (1949)



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?**



20th Century

21st Century Digital transformation

Challenge for Level C problem → Digital transformation

Network evolution towards Digital transformation

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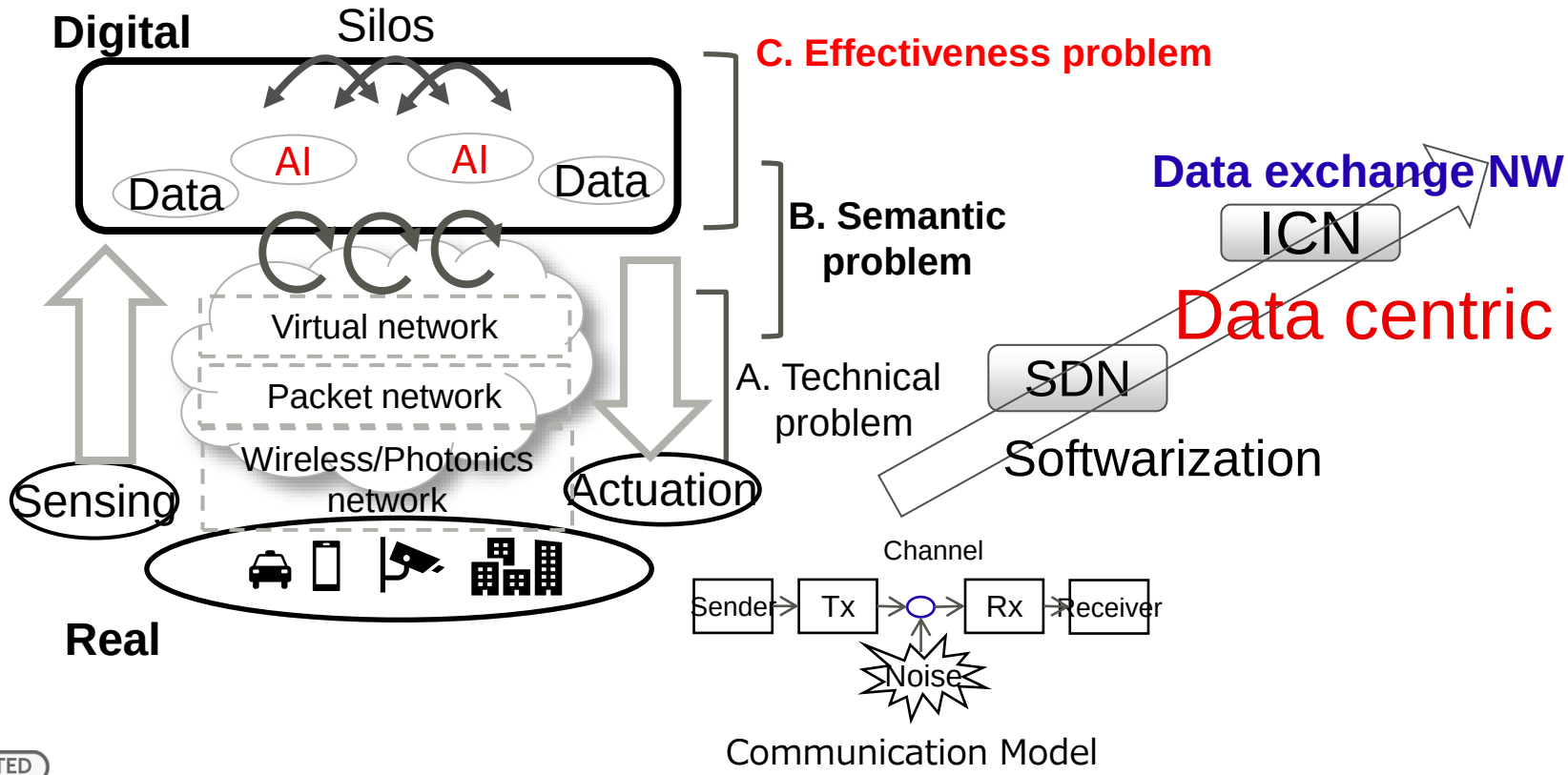
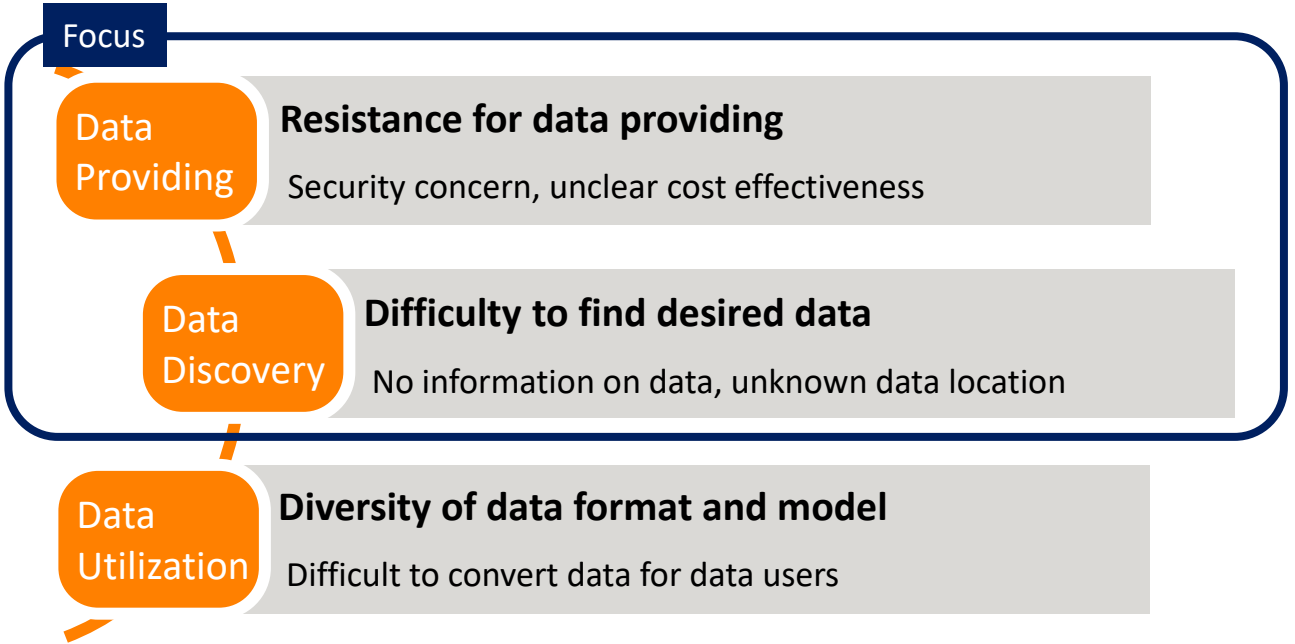


Challenges on data exchange



Decentralized: a more trustworthy data exchange

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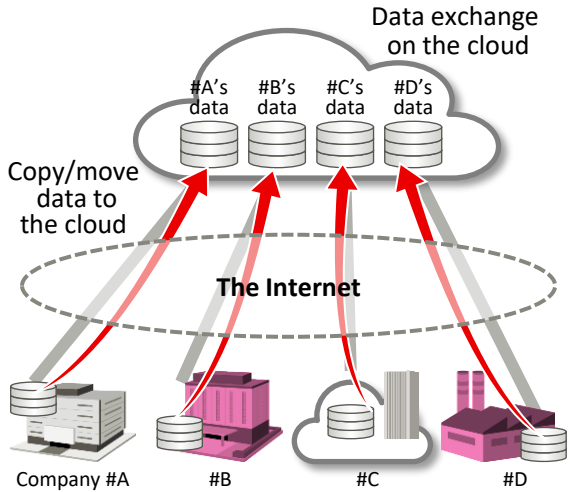
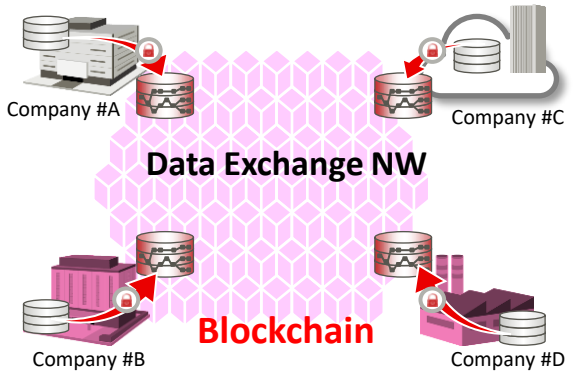
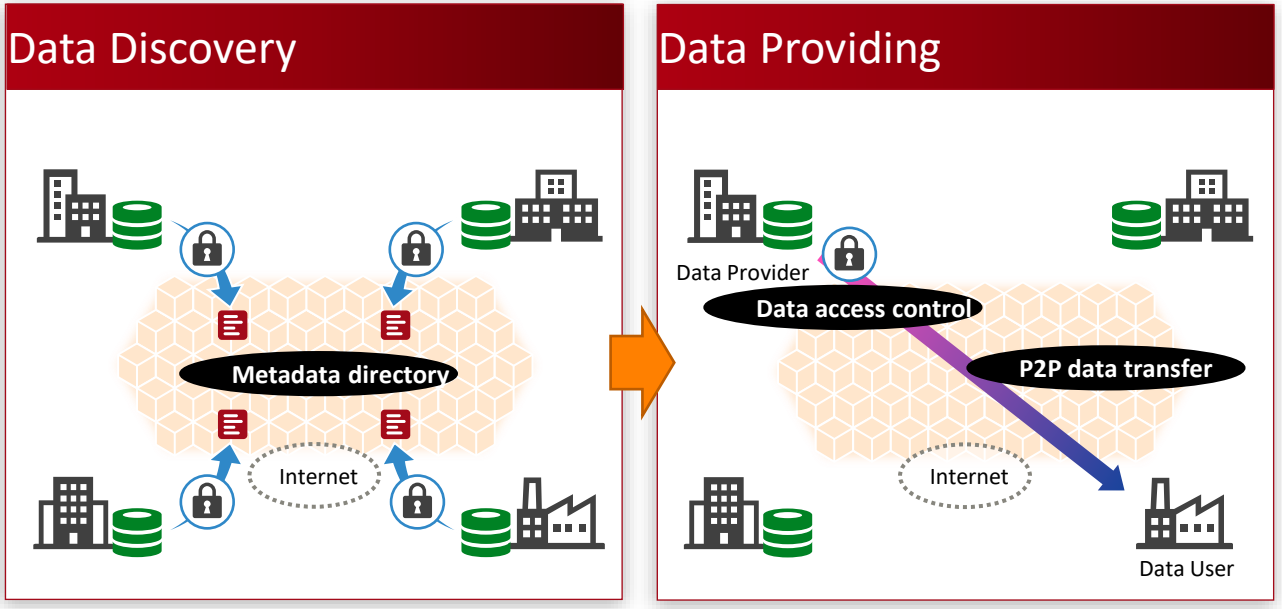
	Centralized	Decentralized
	Management and security of data depend on cloud vendors	Each and every owner manages his own data
Data location	Cloud	Cloud / On-premise / Smart device
Connection	Static	Dynamic and flexible
Openness	Service providers enclose data	Equally open to every participant





Requirements for decentralized data exchange



Blockchain-based decentralized data exchange

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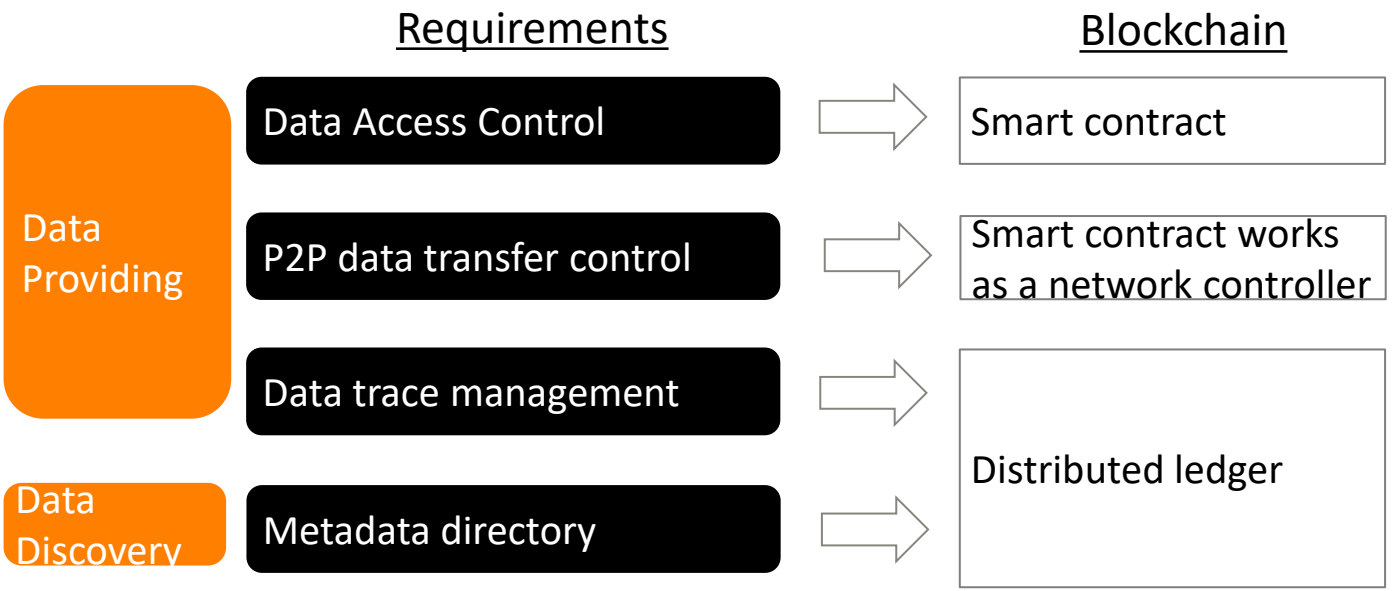
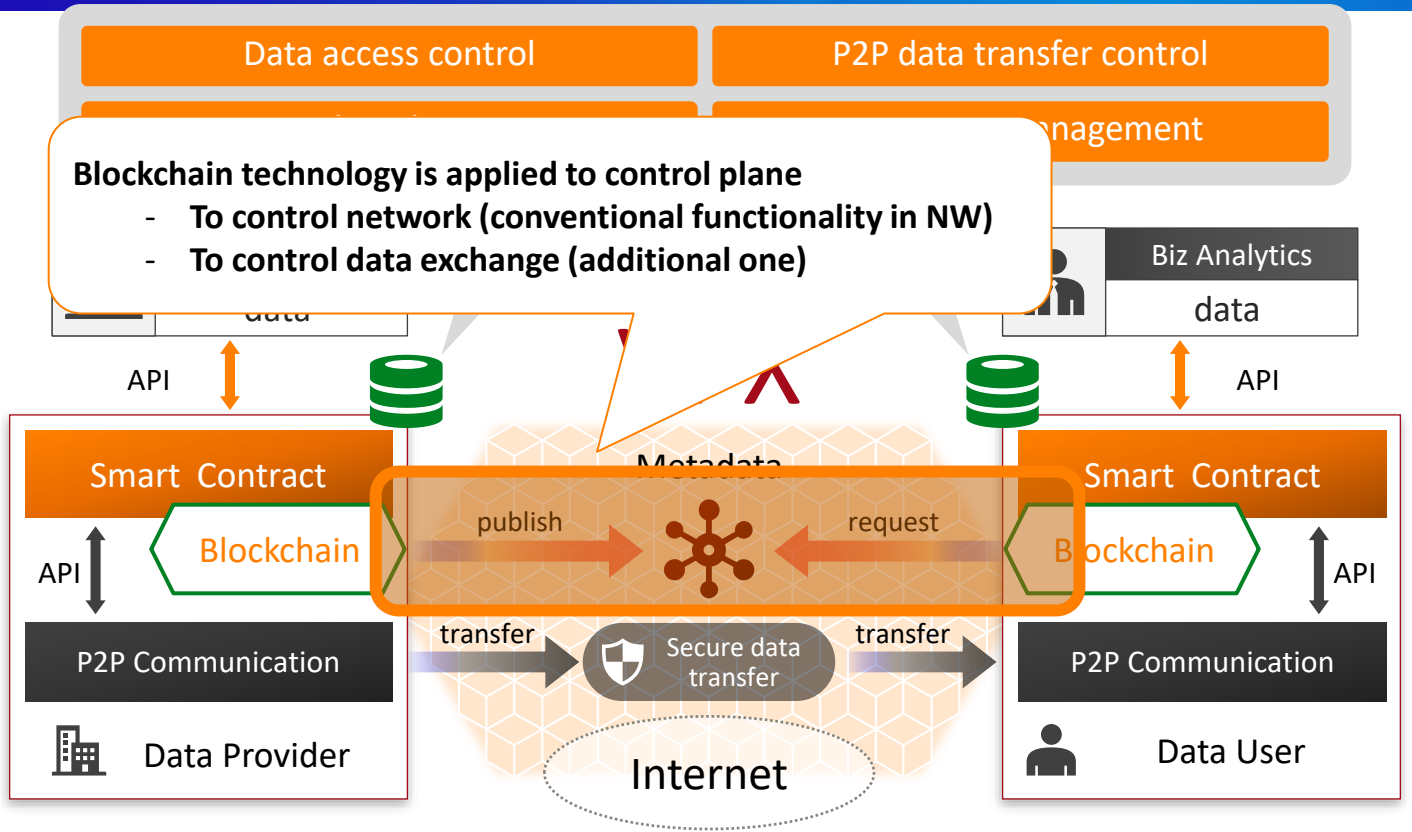
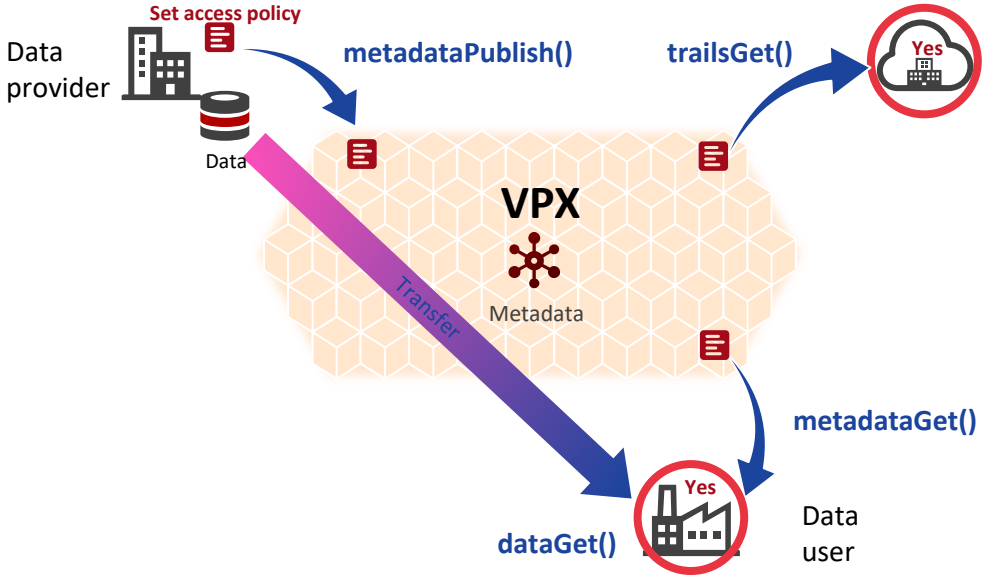


VPX: Virtual Private digital eXchage

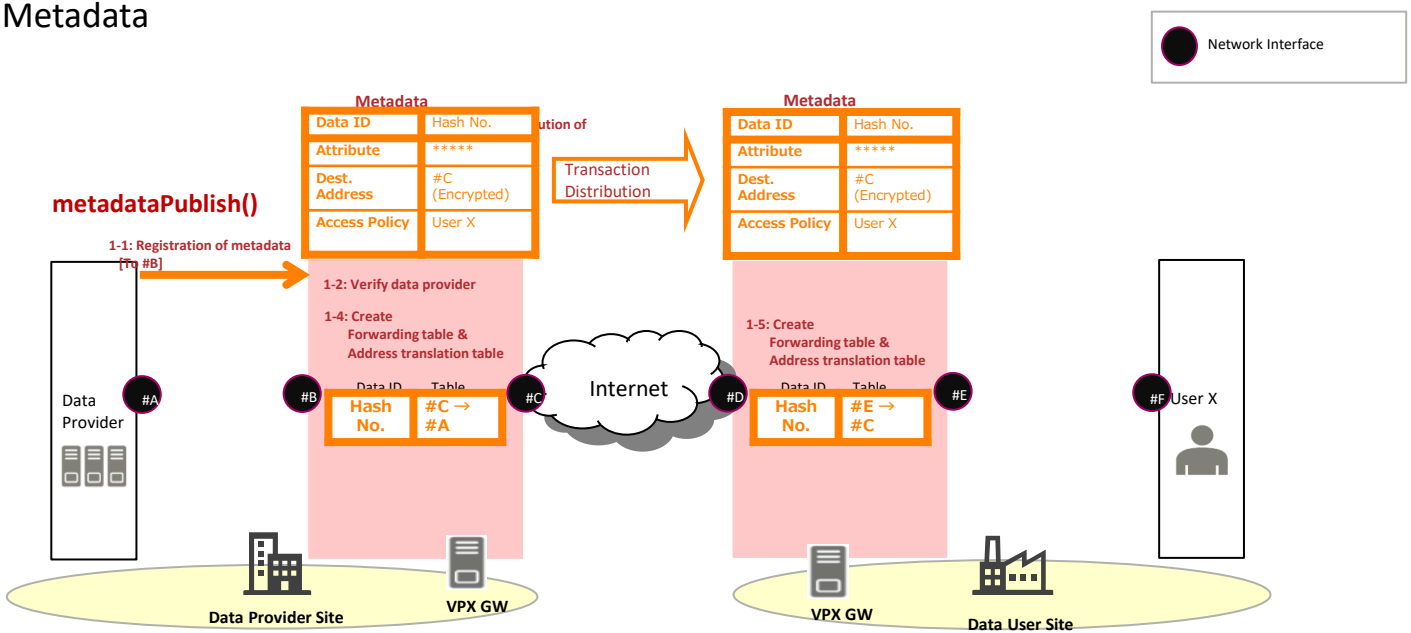


Major APIs for VPX users



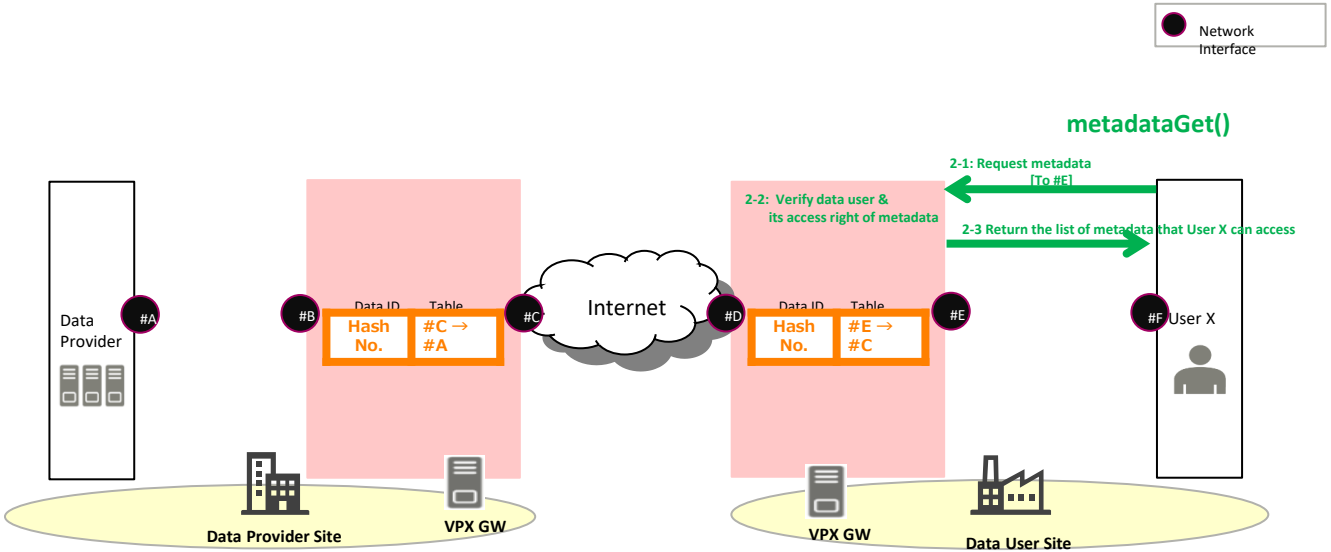
VPX API procedures

Step 1: Publish Metadata



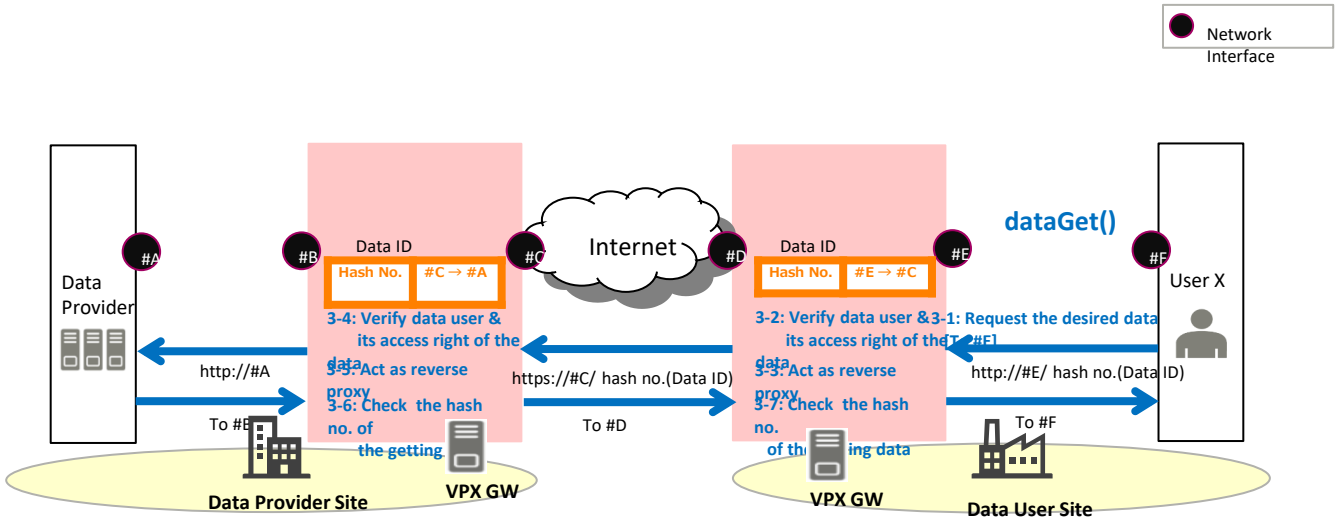
VPX API procedures

- Step 2: Find desired data



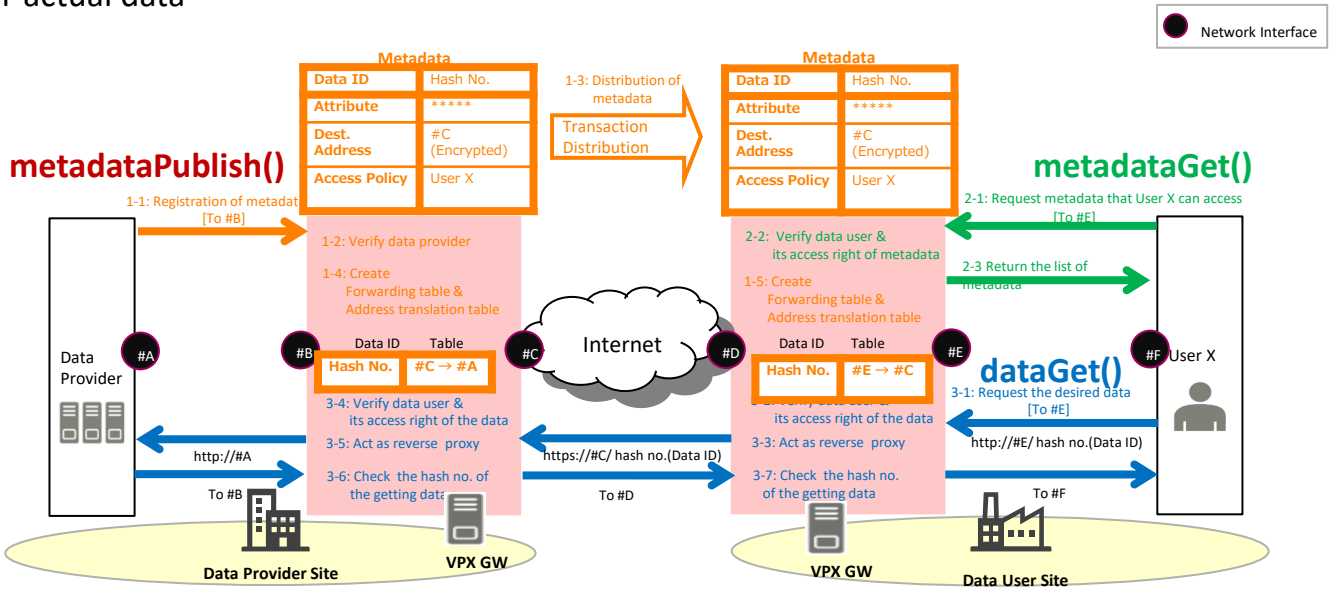
VPX API procedures

Step 3: Transfer actual data



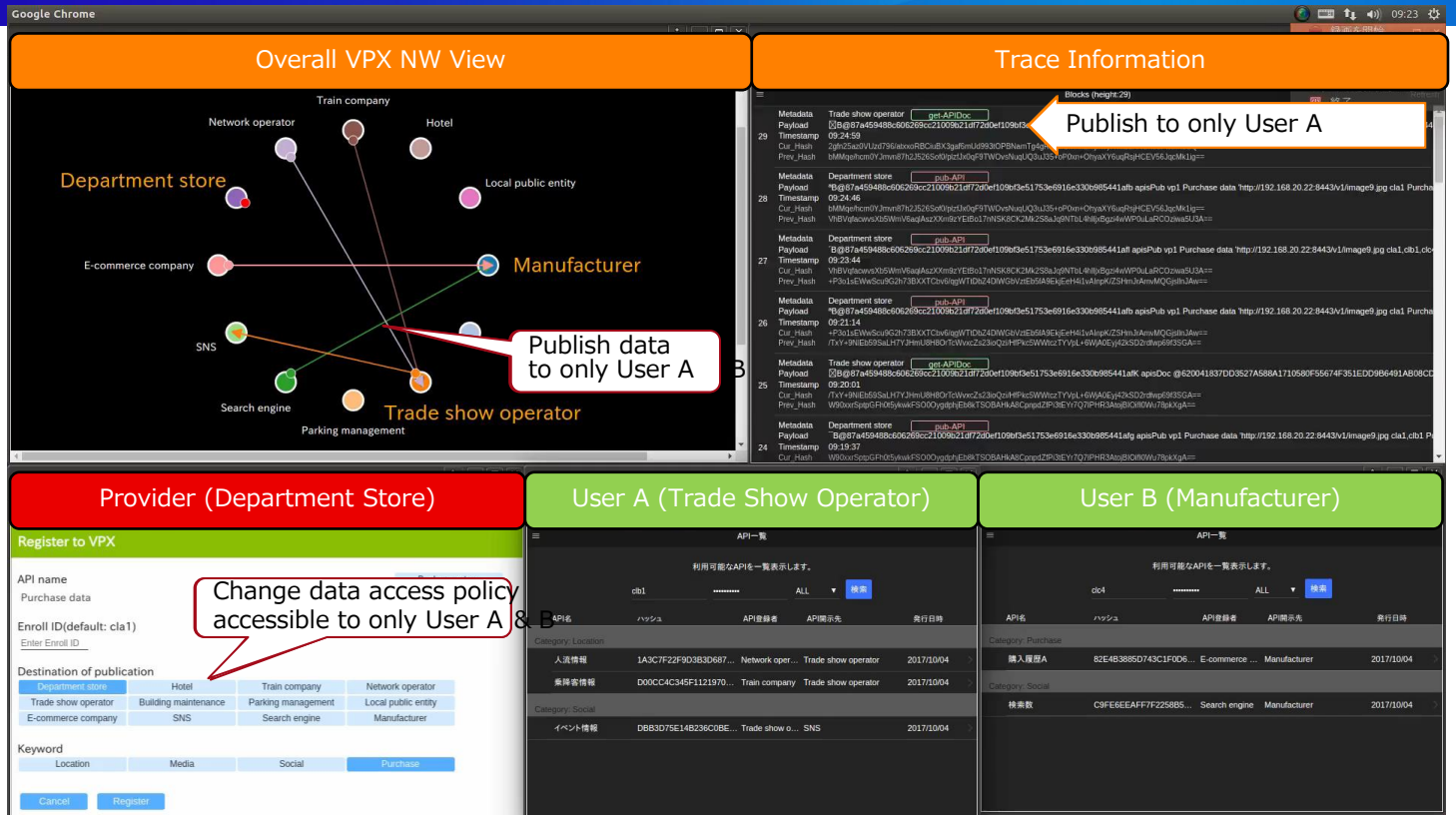
VPX API procedures

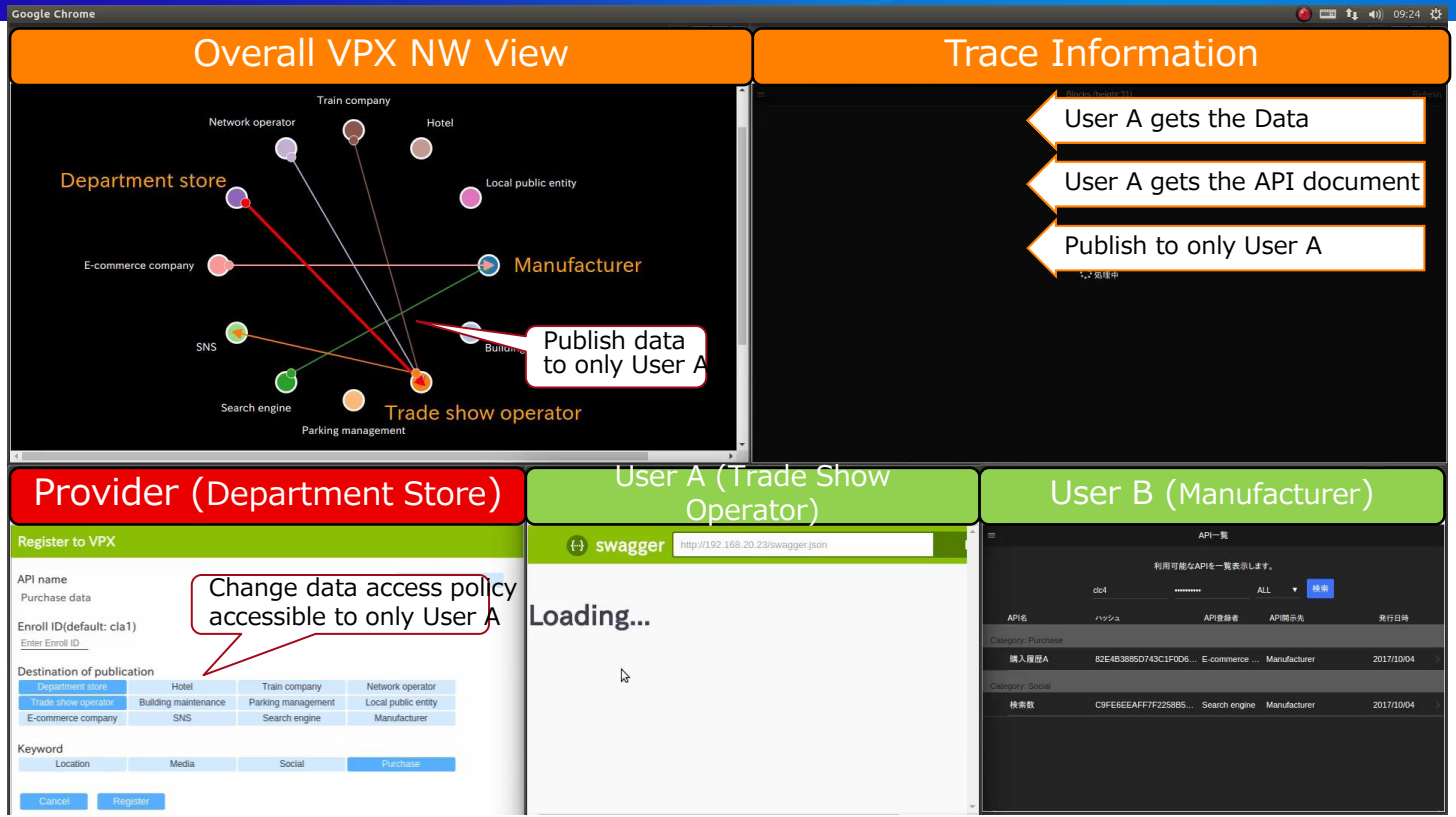
- Step 1: Publish Metadata
- Step 2: Find desired data
- Step 3: Transfer actual data



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

How it works

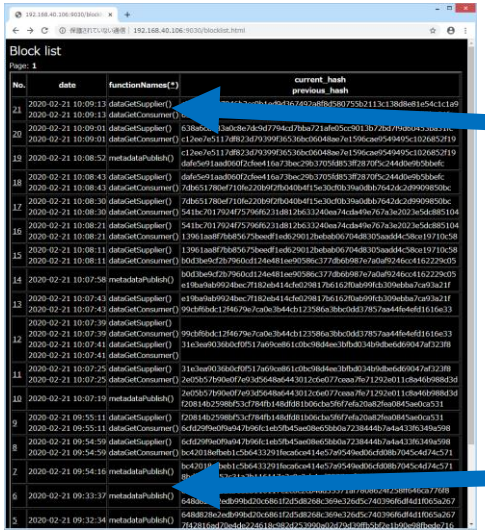




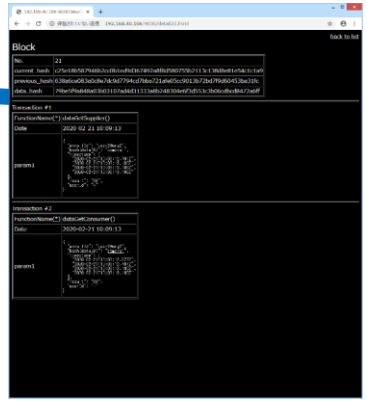
VPX traces on the blockchain

- The log of each VPX API call is stored on the blockchain
- Participants can trace data exchange transactions

Trace information via trailsGet()



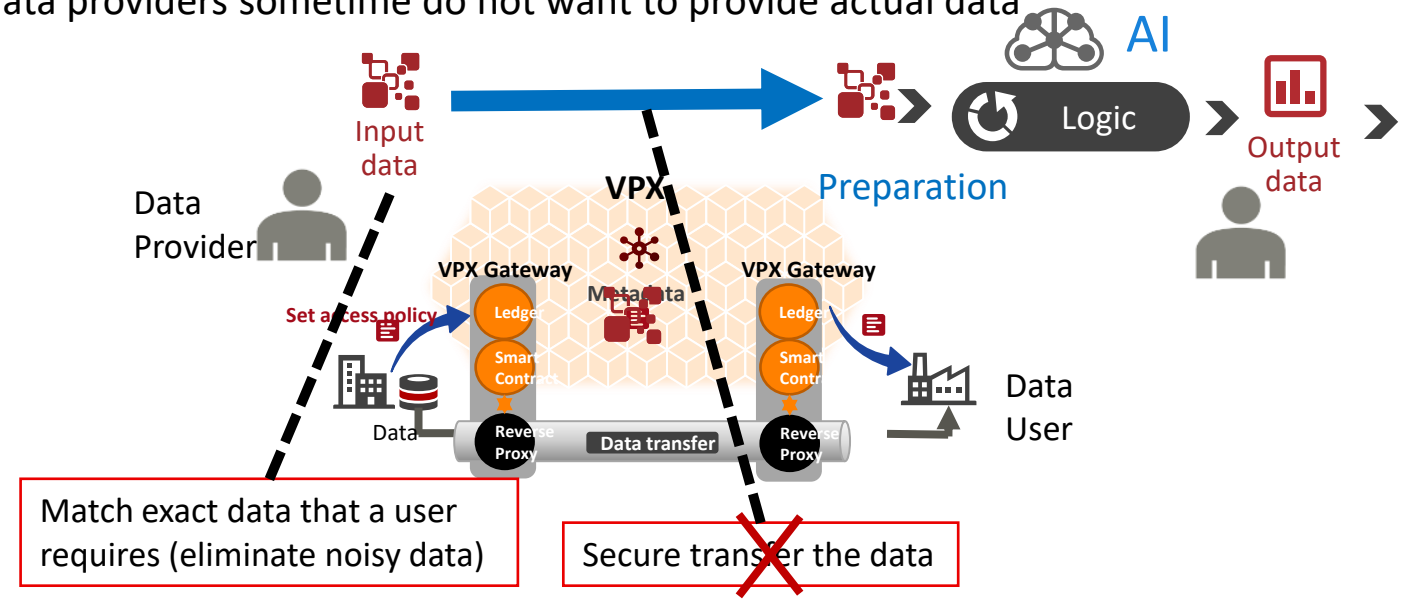
The log of dataGet()



The log of metadataPublish()

Application ： data exchange for AI

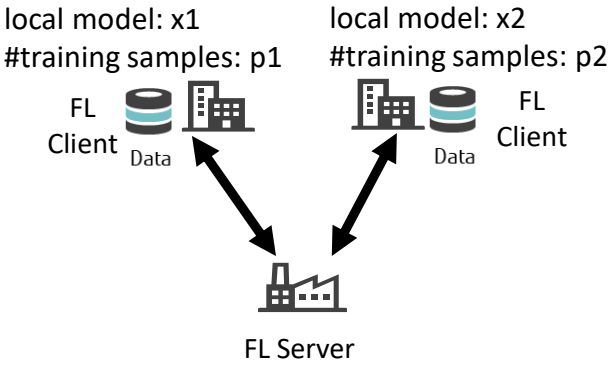
- High quality of AI requires high quality of Data
- Data exchange is to “find data and transfer”, which is needed for AI training, validation, and testing phases
- However, data providers sometime do not want to provide actual data



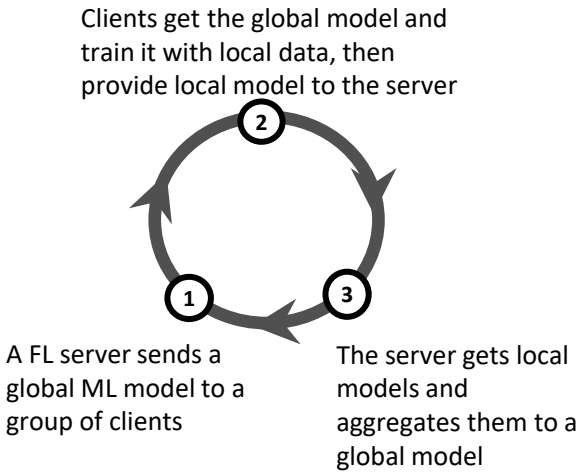
How to train AI models without transferring actual data from data providers?

Federated learning

- 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



Three steps in a single training round

Federated learning on VPX

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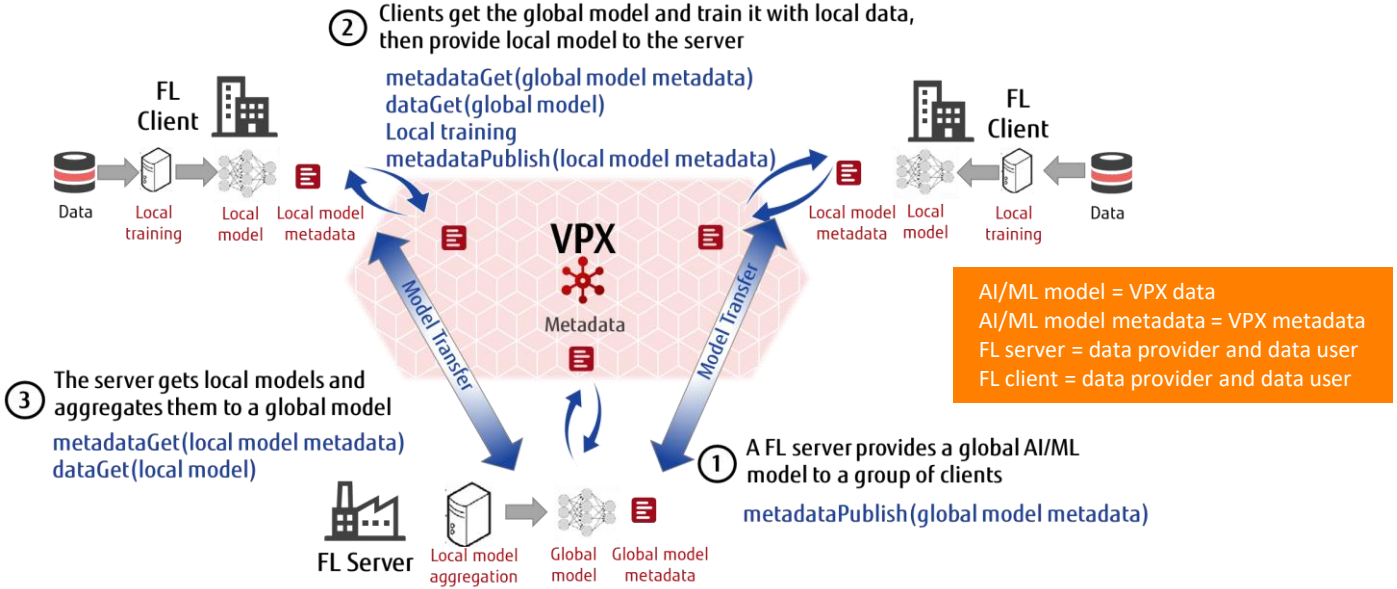
- VPX seamlessly provides a secure, distributed platform for FL tasks

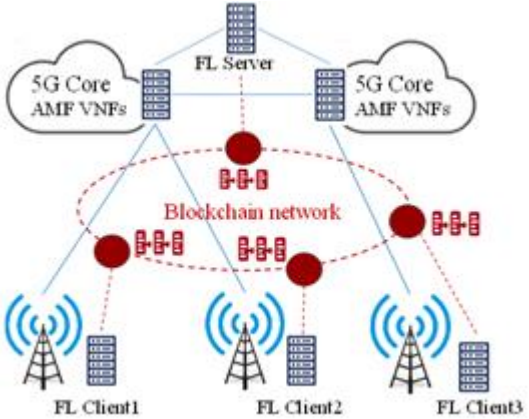


AI/ML model = VPX data
AI/ML model metadata = VPX metadata
FL server = data provider and data user
FL client = data provider and data user

A single training round in FL

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

Traffic Prediction Use Case



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

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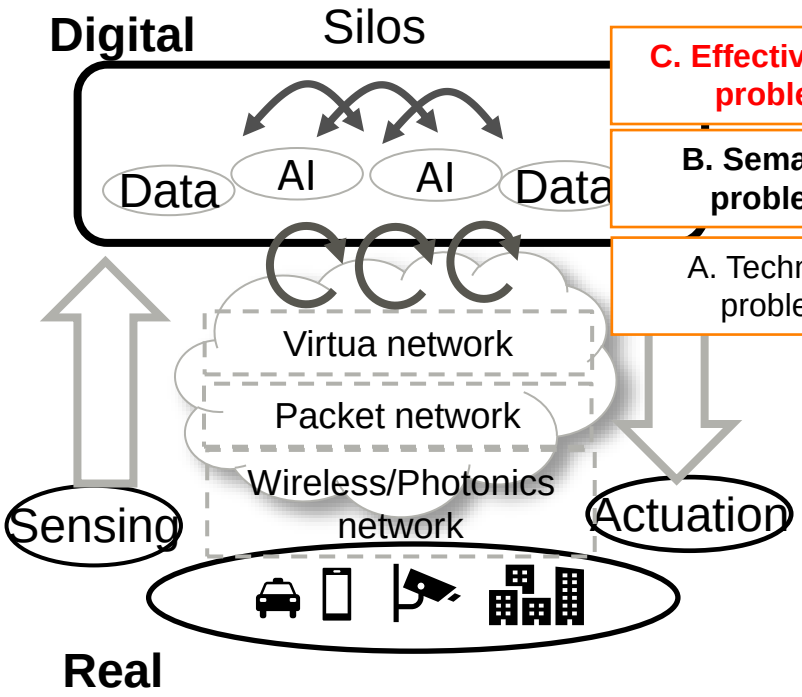


C. Effectiveness problem

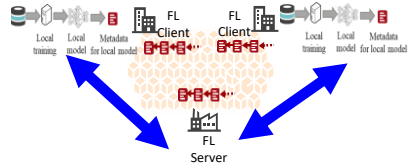
B. Semantic problem

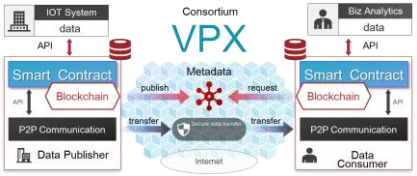
A. Technical problem

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

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Future direction

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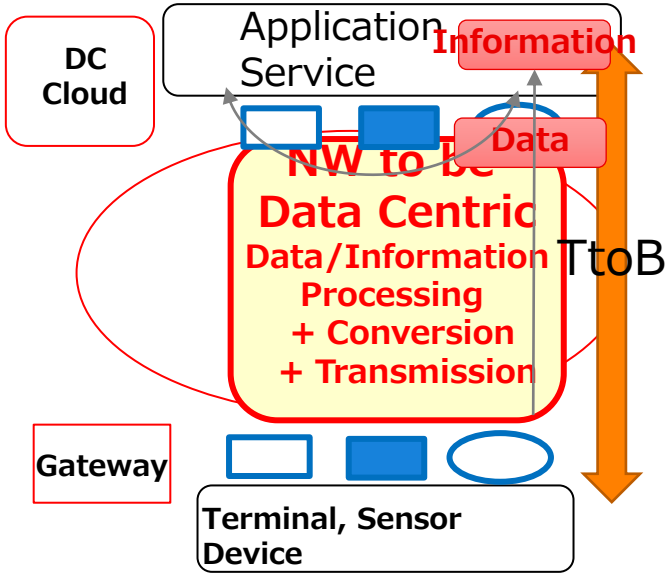
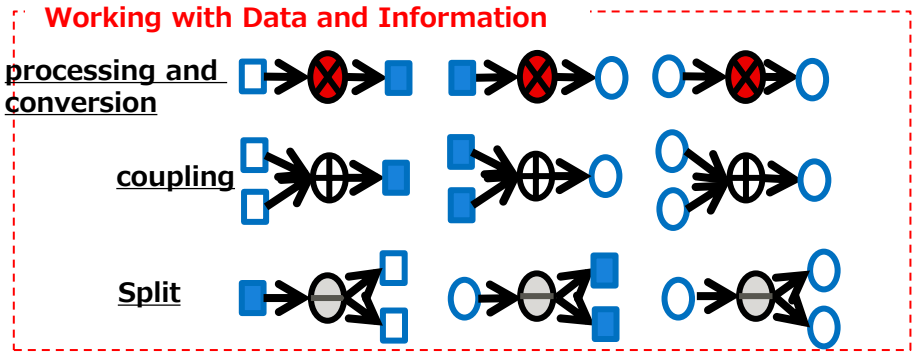
Data are securely exchanged between App,Things then transform to information

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

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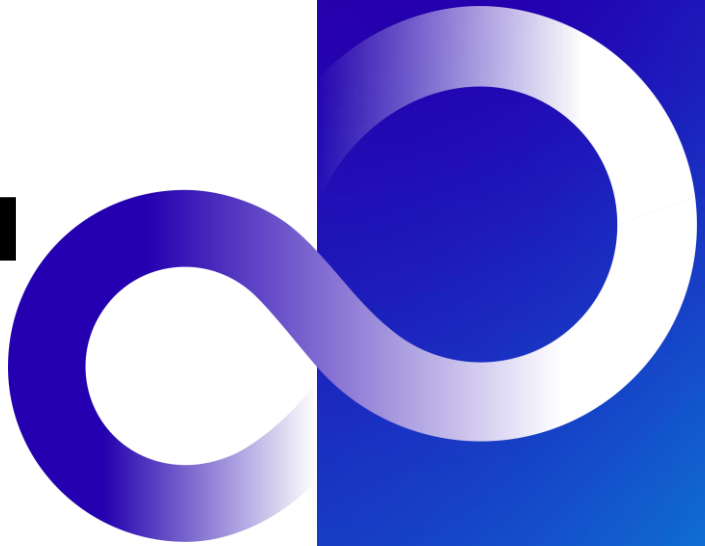
Thank you



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