2020 IT 21
Global Conference

**Digital New Deal
Technology Essentials
디지털 뉴딜 기술 핵심**

모빌리티 분야의 데이터 공유 체계

심상규 상무 (펜타시큐리티시스템)

[요약문]

　모빌리티 분야는 기존의 부품사와 제조사가 주도하는 하드웨어 중심의 시장을 벗어나 IT 기술을 적용하여 다양한 서비스로 시장이 확장되고 있다. IT 기술이 모빌리티 분야에서 점점 더 중요해지면서 데이터의 중요성 또한 높아지고 있다. 자동차가 수집하는 데이터는 자동차의 자율주행을 위해 가장 중요한 핵심 요소로 부각되고 있는 반면, 자동차를 이용하는 사용자에 의해서 생성되는 데이터는 그 중요성이 덜 인지되고 있다. 본 발표는 사용자에 의해서 생성되거나 자동차가 자율적으로 생성하는 데이터를 공유하고 공유된 데이터를 더욱 효율적으로 활용하여 데이터의 가치를 높이는 방안으로서 데이터 공유 체계를 살펴보고자 한다. 자동차를 포함한 모빌리티 분야는 다양한 관계자들이 포함되는 생태계이기 때문에 탈중앙화를 제공하는 블록체인 기술은 모빌리티 데이터의 공유 체계에서 핵심 기술이 될 것으로 기대된다. 본 발표는 블록체인 기반의 데이터 공유 체계를 살펴보고 활용 방향으로 모색한다.

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2016.03~2018.02 동덕여자대학교 컴퓨터학과 겸임교수
2019.09~현재. POSTECH 산학협력 겸임교수
2019.10~현재. 아우토크립트(AutoCrypt) Co-Founder, CSO
관심분야 : 융합보안, 모빌리티 서비스, 스마트시티, 블록체인 등

모빌리티 분야의 데이터 공유 체계

September 2020

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Paradigm Shift : Car will be another Smart Device!

Autonomous Driving
Connectivity
Electrification

Service Platform
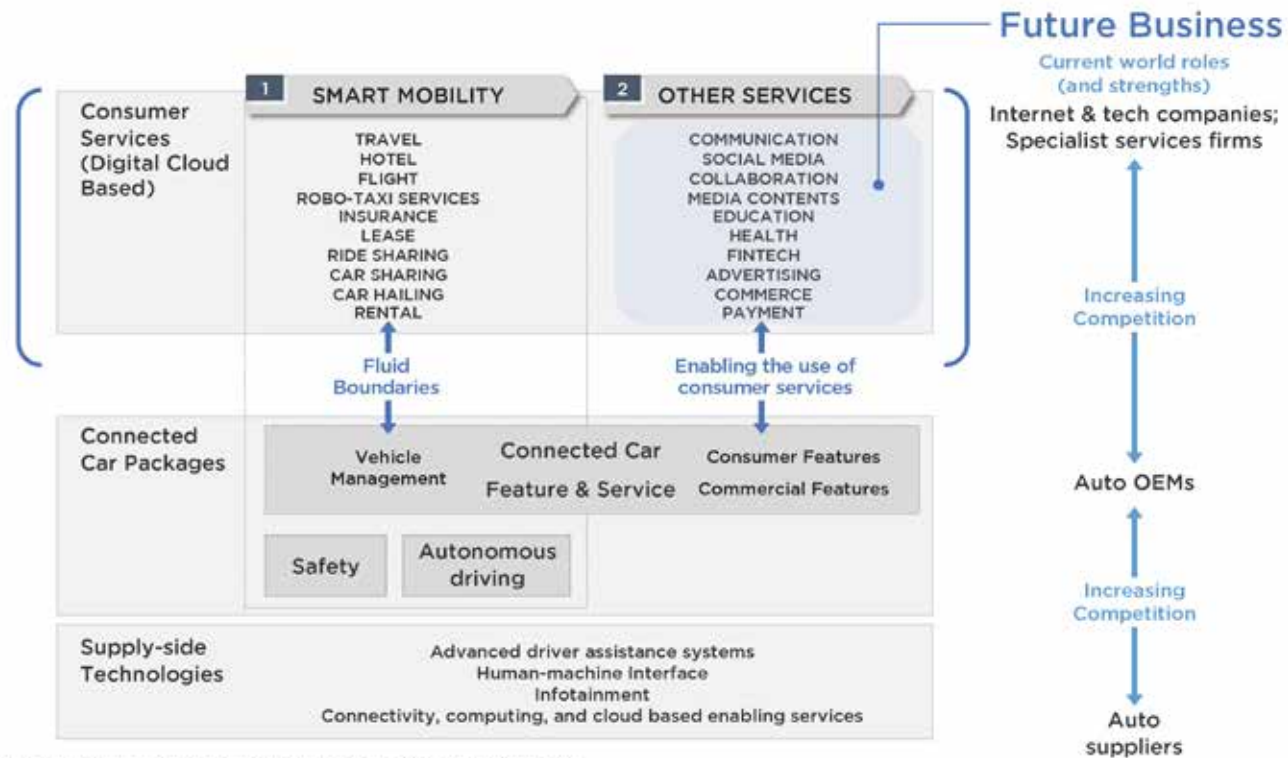Online Services
User-selected SW
Personalized

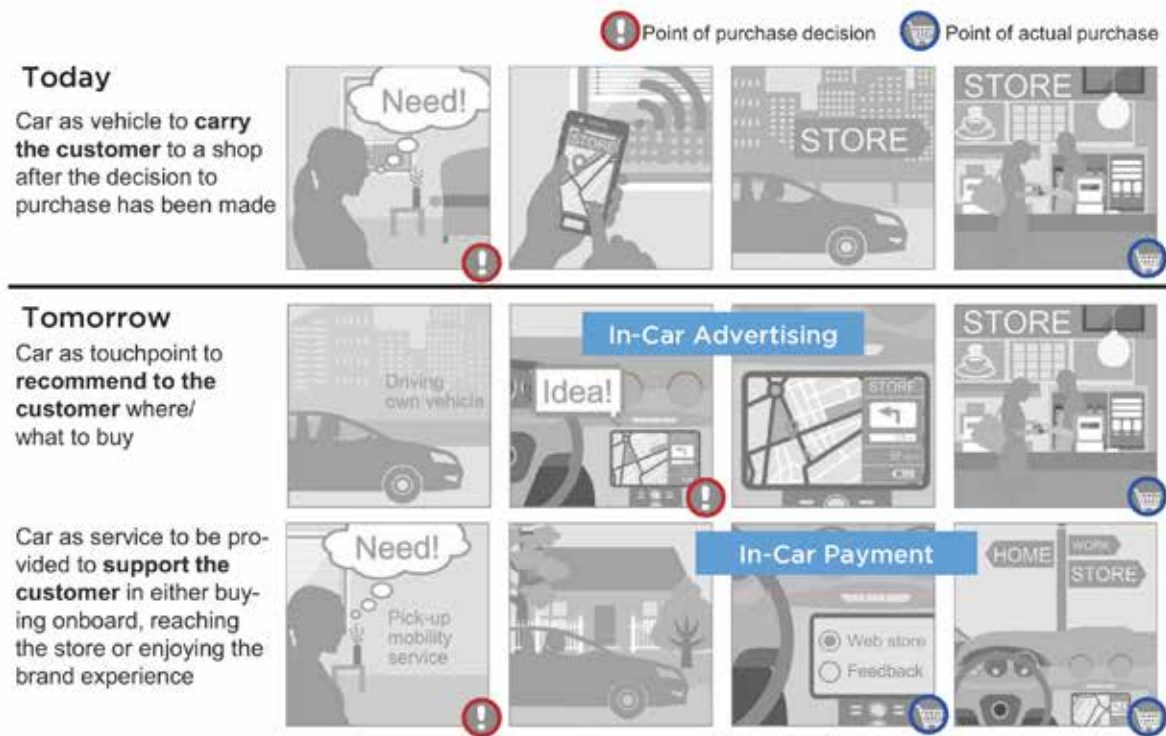Car carries Smart Phone   Car uses Smart Phone   Car is another Smart Device

Paradigm Shift : Future Business in Future

Paradigm Shift : Use Case - In-Car Advertising & In-Car Payment

Car beCAMES smart !

Connectivity

Autonomous

Mobile Service

Electrification

Security

Car beCAMES smart ! : Mobile Service

Consumer Services (Digital Cloud Based)	**1** SMART MOBILITY	**2** OTHER SERVICES
	TRAVEL HOTEL FLIGHT ROBO-TAXI SERVICES INSURANCE LEASE RIDE SHARING CAR SHARING CAR HAILING RENTAL	COMMUNICATION SOCIAL MEDIA COLLABORATION MEDIA CONTENTS EDUCATION HEALTH FINTECH ADVERTISING COMMERCE PAYMENT

Fluid Boundaries

Enabling the use of consumer services

Mobile Services

Connected Car Packages	Vehicle Management	Connected Car Feature & Service	Consumer Features Commercial Features
	Safety	Autonomous driving	

Supply-side Technologies	Advanced driver assistance systems Human-machine Interface Infotainment Connectivity, computing, and cloud based enabling services

Auto OEMs

Increasing Competition

Auto suppliers

https://www.strategyand.pwc.com/reports/connected-car-2016-study (2016.09)

Car = New Screen of Mobile Services

Car beCAMES smart ! : Mobile Service

User : Owner, Driver
OEM
Supplier
Government
Authority
TelCo
Service Provider
SW Provider

Service Platform

IT Security

androidauto
Apple CarPlay
amazon alexa
BMW Open Mobility Cloud
here Open Location Platform

Mobility Service Providers

Declaration of Amsterdam (2016.04, EU) - Joint Agenda

Use of data

- Data generated through the use of connected and automated vehicles can serve public and private value-added services. Clarification is needed on the availability for public and private use and responsibilities of the parties involved.

Ensure privacy and data protection

- Respecting existing legislation on privacy and data protection, the conditions for the (re-) use and sharing of data generated by connected and automated vehicles need to be clarified.

Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication

- In order to maximize benefits in road safety and environmental performance, it is essential to ensure that new services and systems are compatible and interoperable at European level and to coordinate investments towards reliable communication coverage, exploit the full potential of hybrid communications, where relevant, and improve the performance of location accuracy, benefiting in particular from the use of GALILEO and EGNOS.

Security

- In the light of the increase in cyber-threats and serious vulnerabilities, it is essential to ensure security and reliability of connected and automated vehicle communications and systems. Common trust models and certification policies should be developed to prevent risks and support cybersecurity, whilst ensuring safe and interoperable deployment.

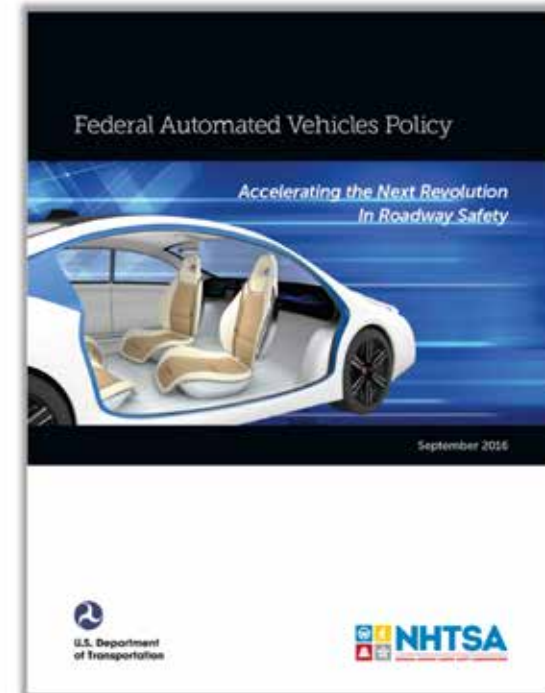**Declaration of Amsterdam**

Cooperation in the field of connected and automated driving

14-15 April 2016

nlEU 2016

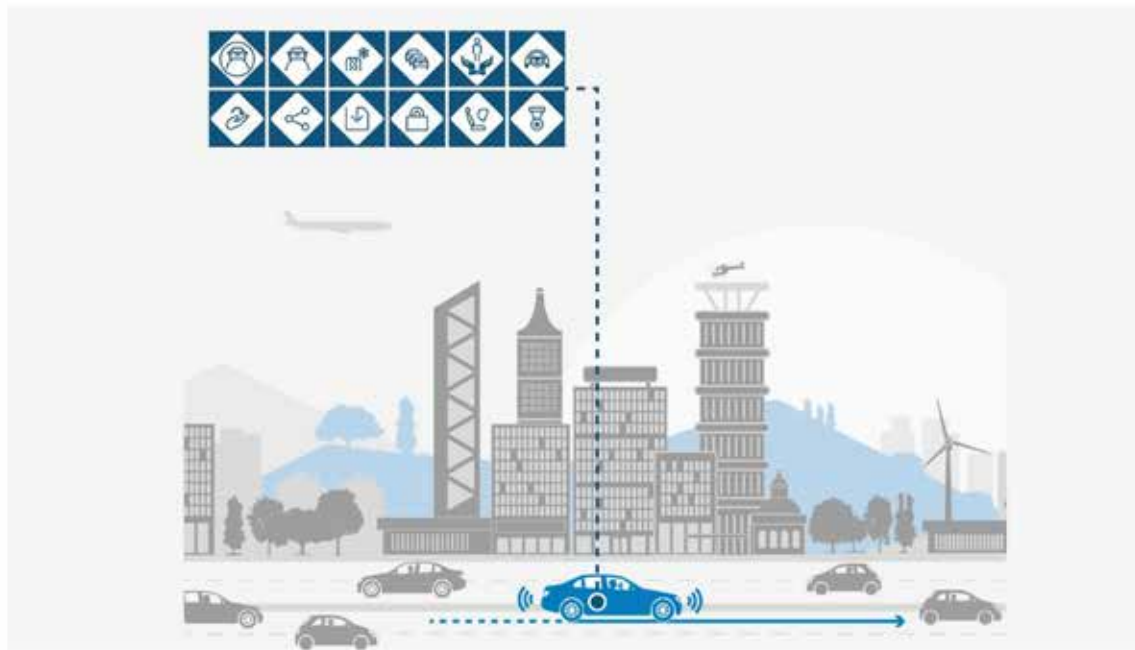https://english.eu2016.nl/documents/publications/2016/04/14/declaration-of-amsterdam

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"Federal Automated Vehicles Policy" (2016.09, US)
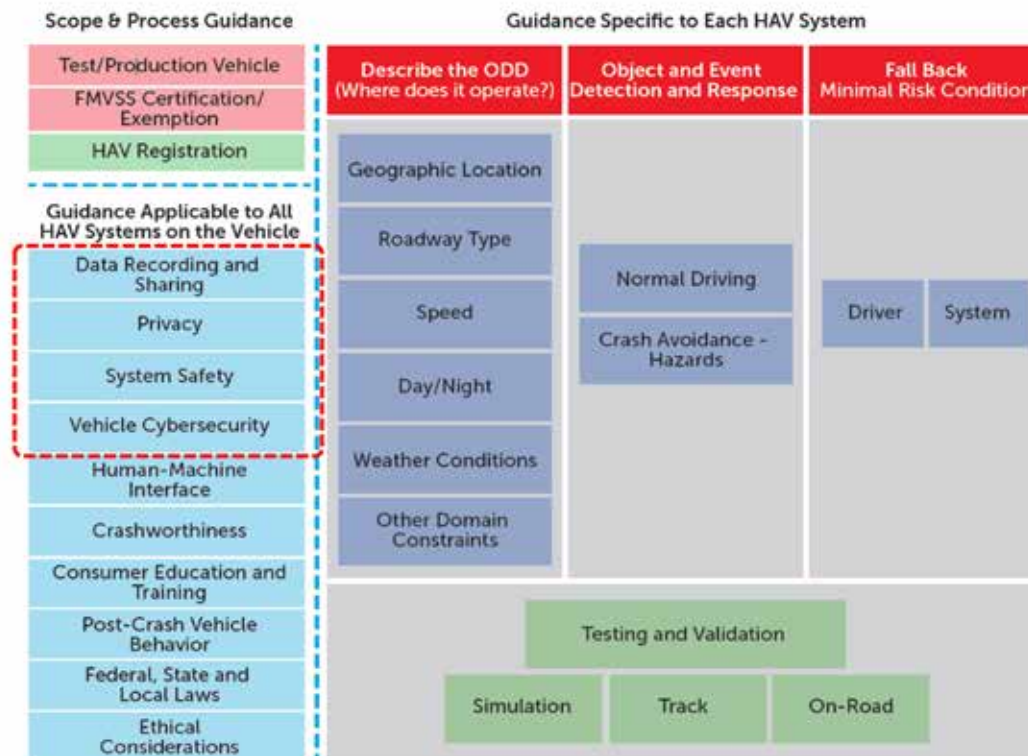
https://www.transportation.gov/AV/federal-automated-vehicles-policy-september-2016/

"Safety First for Automated Driving (SaFAD)" – June 2019

https://www.daimler.com/innovation/case/autonomous/safety-first-for-automated-driving-2.html

5 Public

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"Safety First for Automated Driving (SaFAD)" – June 2019 : 12 Guiding Principles

Safety Layer
The system recognizing its limits and minimizes risk in returning control to the driver

Safe Operation
How the system reacts if critical components become unstable or cease functioning

Operational Design Domain
The operating conditions in which the system is designed to function

Behavior in Traffic
The system behavior needs to be easy to understand and predictable for surrounding road users

User Responsibility
The user's state must be suitable for a takeover procedure

Vehicle-Initiated Handover
If the driver does not comply with a takeover request, the automated driving system must perform a maneuver to minimize risk.

Driver-Initiated Handover
Activating and deactivating the automated driving system shall require an explicit driver's intent

Effects of Automation
Overall evaluation of system safety shall take automation effects on the driver into account

Data Recording
When an event or incident is recognized, automated vehicles shall record relevant data in a manner that complies with applicable privacy laws

Security
Steps shall be taken to protect the automated driving system from security threats

Passive Safety
Vehicle layout shall accommodate changes to crash scenarios brought about by vehicle automation

Safety Assessment
Verification and validation shall be used to ensure that the safety goals are met

"The World's Most Valuable Resource is No Longer Oil, but Data." (The Economist, May 2017)

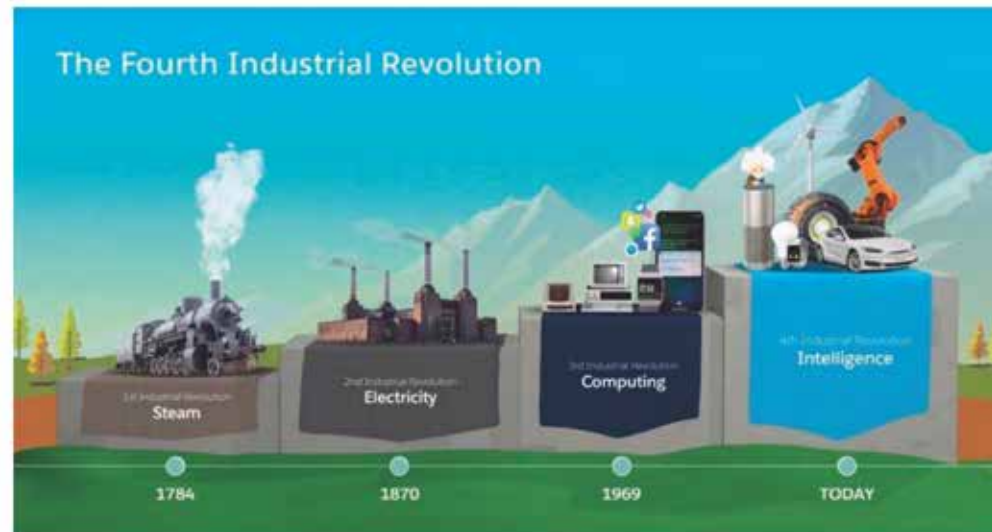* Source: The Economist (2017.05.06)

https://www.economist.com/leaders/2017/05/06/the-worlds-most-valuable-resource-is-no-longer-oil-but-data
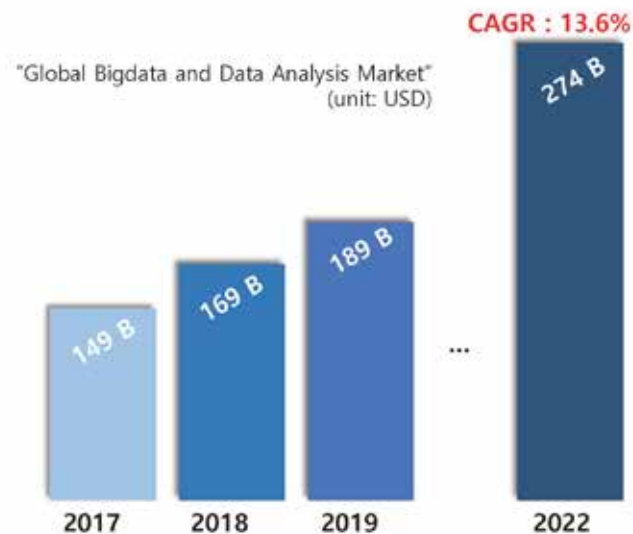
The world is running toward 4th industrial revolution

- Intelligence and its underlying data are the single most powerful driving forces of 4th industrial revolution.

https://eng.enc-news.com/articles/912/

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Data Economy : Why should I share my data with others?

- Sharing data makes data more usable and valuable.
- Data sharing/trading market is getting bigger and bigger every year.

"Global Bigdata and Data Analysis Market" (unit: USD)

CAGR : 13.6%

New data bills usher in era of 'data economy'

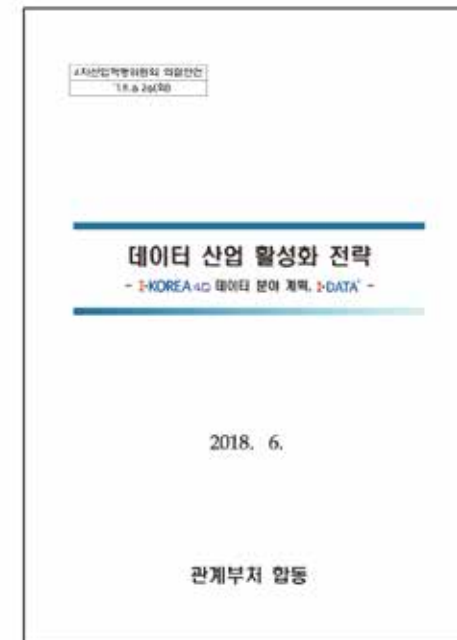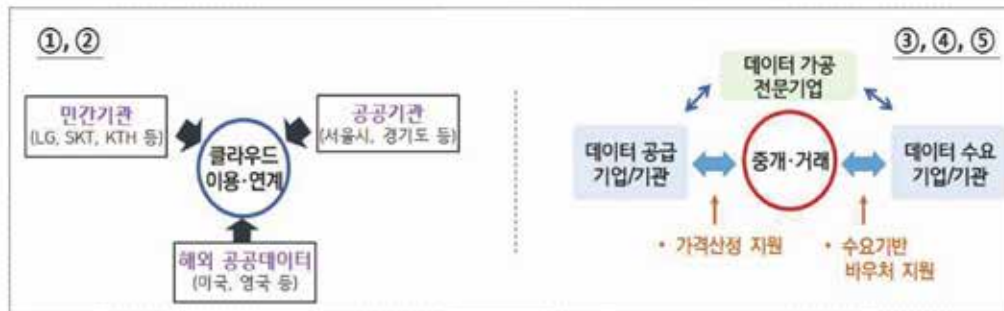**Digital Realty Publishes Report on Value of Data Economy for G7 Countries**

https://www.aithority.com/technology/analytics/digital-realty-publishes-report-on-value-of-data-economy-for-g7-countries/
https://www.koreatimes.co.kr/www/biz/2020/01/488_281735.html

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"데이터 산업 활성화 전략" (2018.06)

< 데이터 경제의 가치창출 체계 >

< 데이터 거래 기반 구축 추진방안 >

Barrier to putting data to work : Security i.e. Trustworthy Data

- ▪ The big obstacle for data sharing and trading are Authenticity, Integrity, Ownership and Privacy of the data.
- ▪ Building trust among stakeholders is the key for sharing data.

Why Executives Don't Trust Their Own Data And Analytics Insights

In spite of major investments in data analytics, research suggests most decision makers don't trust the insights they reveal.
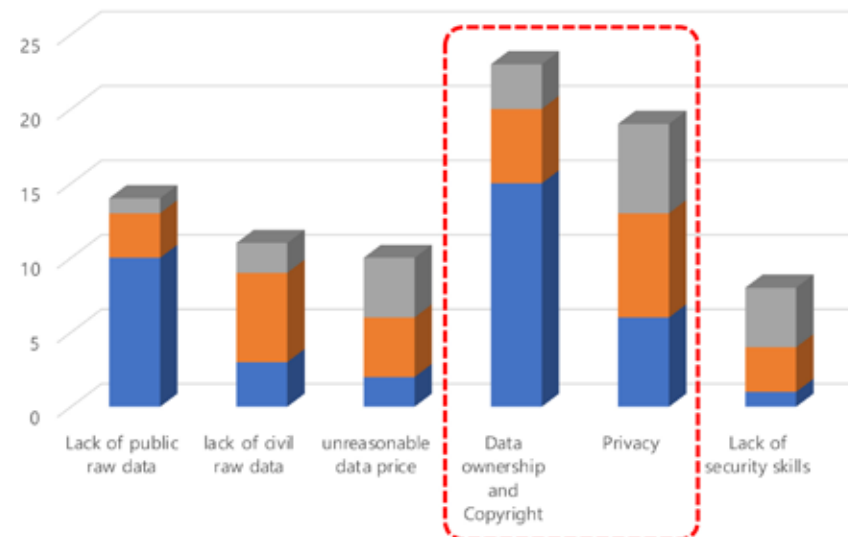
[PHOTO: ALEJANDRO ESCAMILLA VIA UNSPLASH]

BY JARED LINDZON 3 MINUTE READ

Organizations of all shapes and sizes are investing heavily in data and analytics, yet few trust the resulting findings.

Yet, according to a recent survey of over 2,000 data and analytics (D&A) decision makers in 10 countries by KPMG and Forrester Consulting, only ==38% of respondents have a high level of confidence in their customer insights, and only one third trust the analytics== they generate from their business operations.

2/3 of people don't trust their own data and analysis

Worries about copyright and ownership

https://www.fastcompany.com/3065294/why-executives-dont-trust-their-own-data-and-analytics-insights
https://www.spri.kr/posts/view/22802?code=industry_trend

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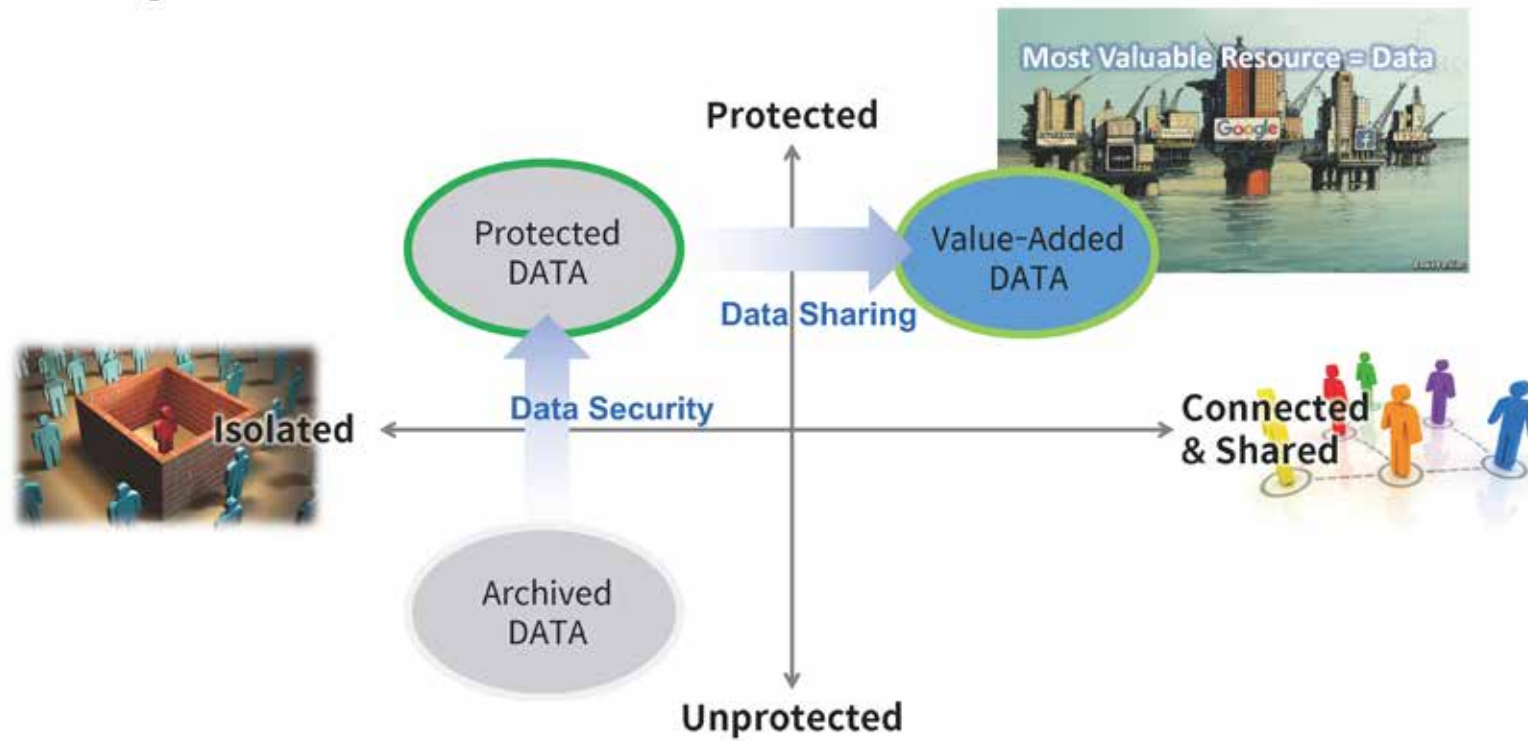## Making the different silos of collected data available and facilitating DataOps

- Over the next two years, enterprise data is projected to increase at a 42.2% annual growth rate.
- Only 32% of data available to enterprises is put to work. The remaining 68% goes unleveraged.
- On average, organizations now periodically transfer about 36% of data from edge to core. Within only two years, this number will grow to 57%. The volume of data immediately transferred from edge to core will double, from 8% to 16%.
- The top five barriers to putting data to work are:
  - 1) making collected data usable,
  - 2) managing the storage of collected data,
  - 3) ensuring that needed data is collected,
  - 4) ensuring the security of collected data, and
  - 5) making the different silos of collected data available.
- The solution to a great deal of data management challenges is DataOps — the discipline connecting data creators with data consumers. Only an average of 10% of organizations report having implemented DataOps fully across the enterprise. A majority of respondents say that DataOps is "very" or "extremely" important.
- Along with other data management solutions, DataOps leads to measurably better business outcomes: boosted customer loyalty, revenue, profit, and a host of other benefits.
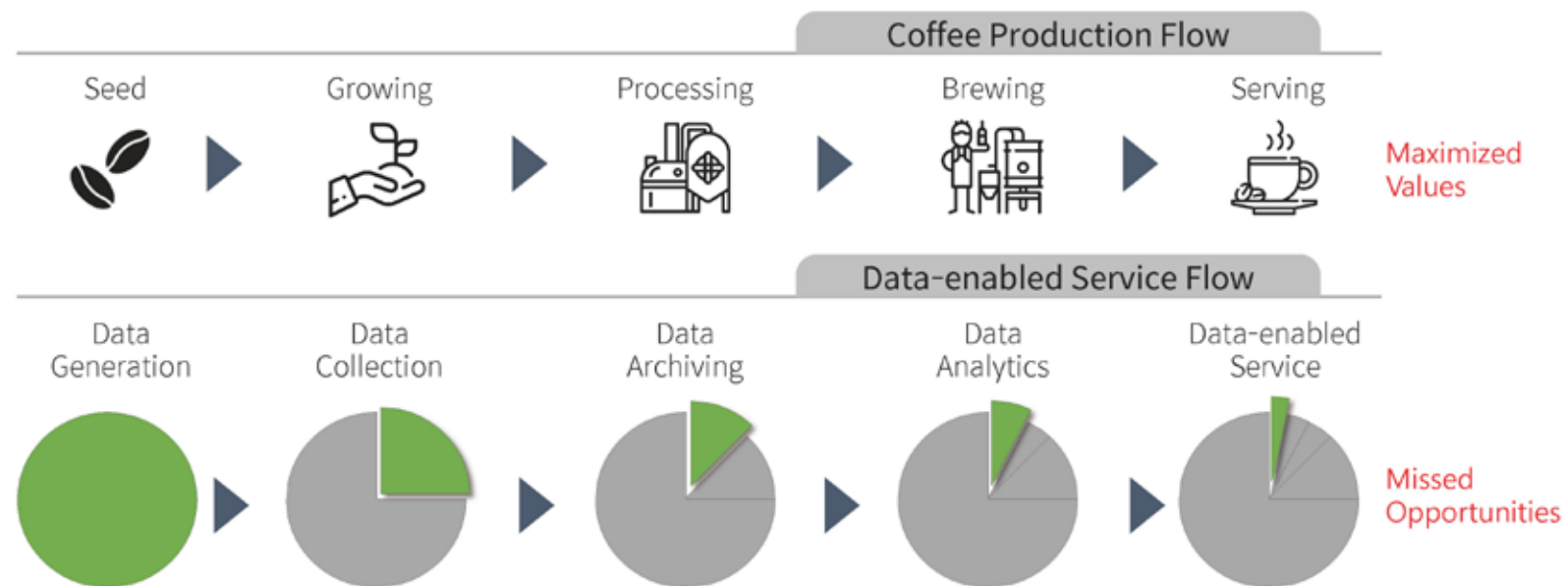
SEAGATE

RETHINK DATA

Put More of Your Business Data to Work—
From Edge to Cloud

A SEAGATE TECHNOLOGY REPORT

IDC | WITH RESEARCH AND ANALYSIS BY IDC

* Source: "Rethink Data", Seagate (July 2020)
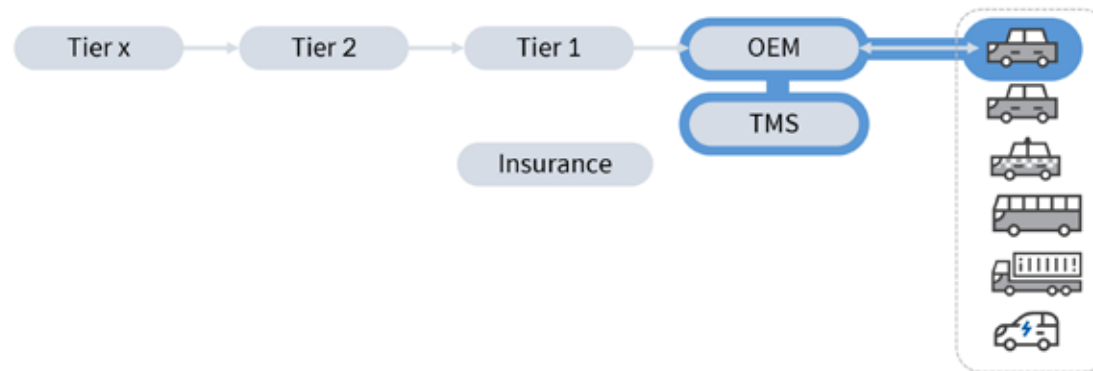https://www.seagate.com/files/www-content/our-story/rethink-data/files/Rethink_Data_Report_2020.pdf
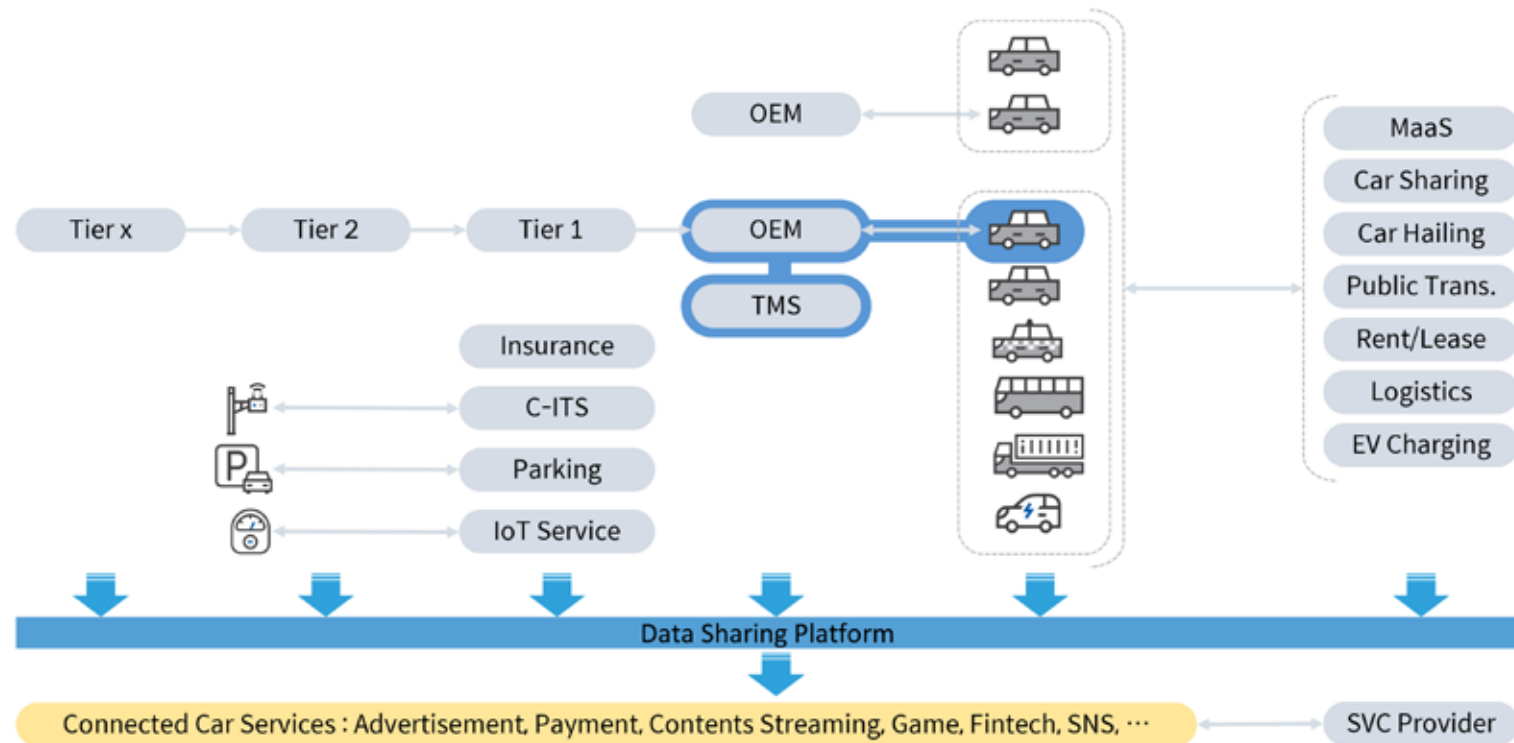
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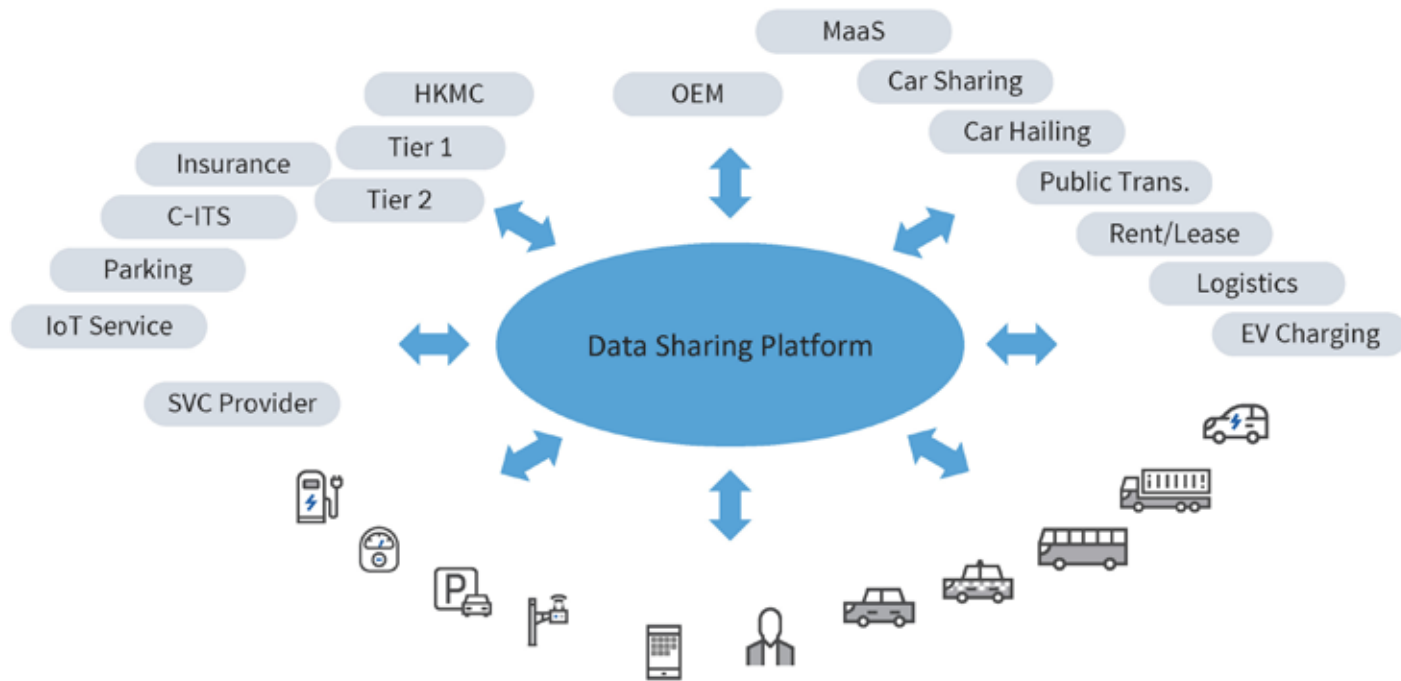
Discovering Value of Data

Missed Potential Value of Data

Telematics

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Mobility Data Economy - Ecosystem

Data Sharing Platform : Stakeholders & End Entities

Our Approach for making *the different silos* of collected data *available*

- Centralized Model needs a Master System, which can be *a single point of failure*.
- Master System takes more cost to availability and sustainability.
- Decentralized Model uses blockchain's Distributed Ledger Technologies giving availability and integrity.

[Centralized Model]

[Decentralized Model]
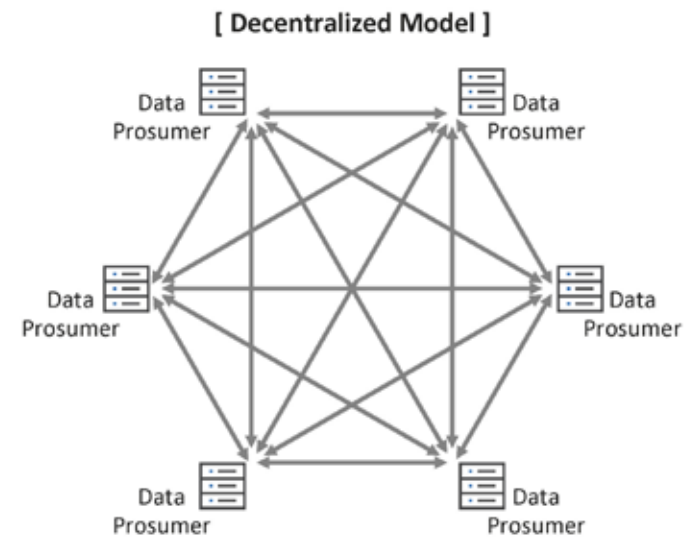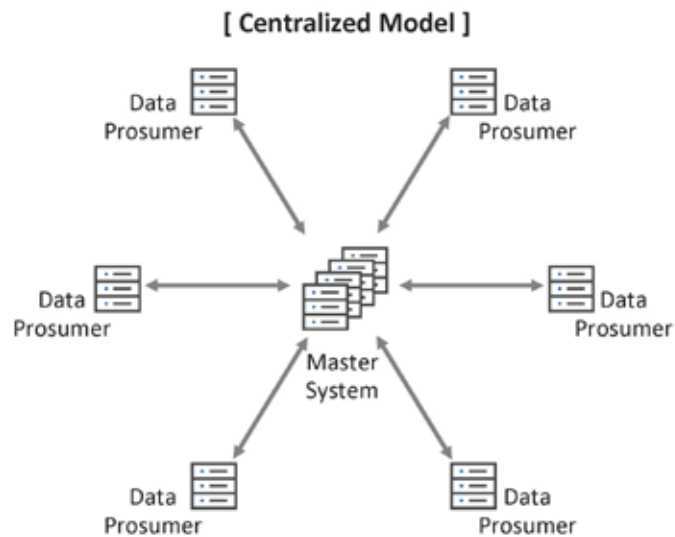
Our Approach for Security & Trustworthy Data

- Data Blockchain stores *Privilege Data* for authentication, ownership and integrity validation.
- Existing bigdata system can be integrated with Data Blockchain.
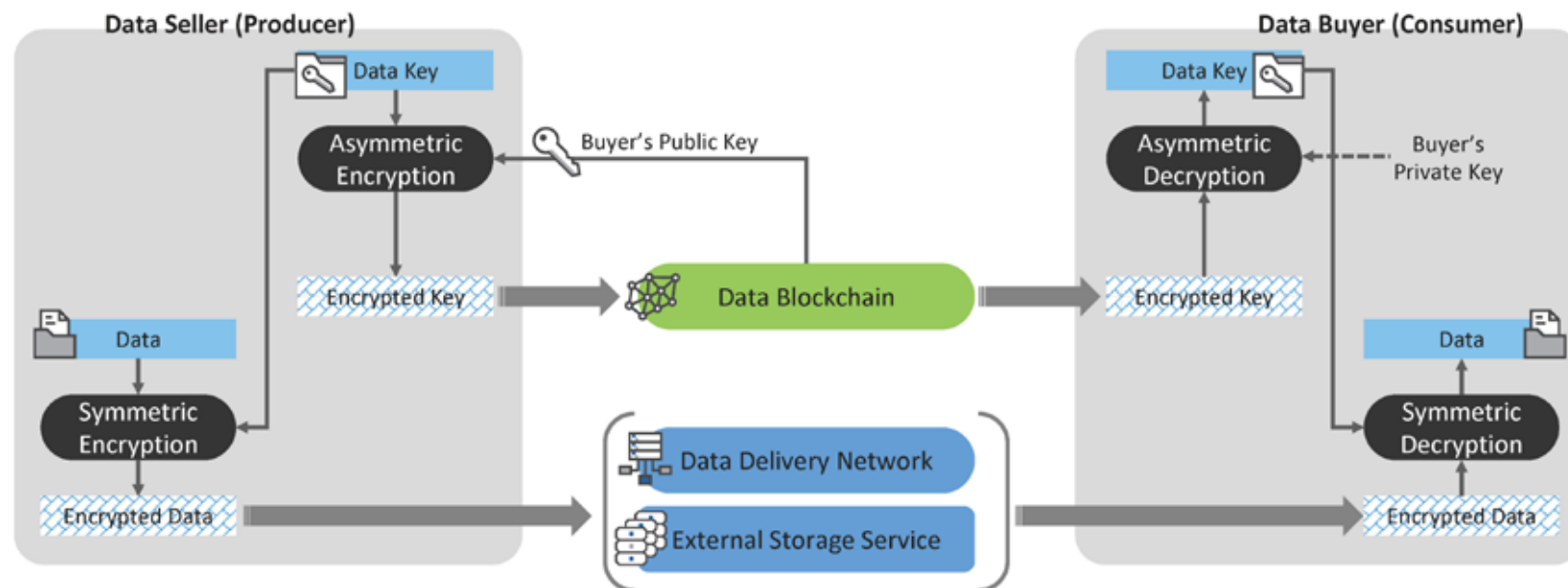- Users can easily retrieve data and validate the retrieved data via Data Market.

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- 306 -
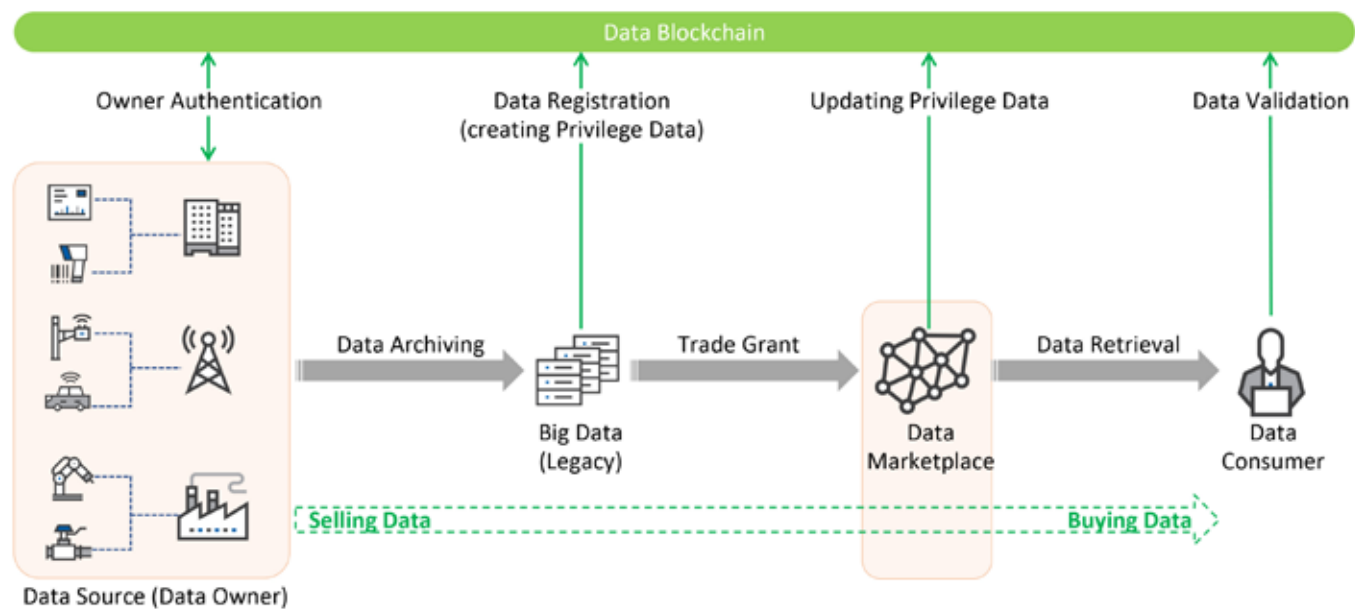
System Architecture for *Blockchain-based Data Sharing Platform*

- **Data Blockchain** stores metadata and privilege data for authentication, ownership and integrity validation.
- **Data Marketplace** helps sellers and consumers to register data, to retrieve data and to manage data trades.
- **Data Delivery Network** feeds real-time or unbound data to subscribing consumers.
- Seller's data can be delivered via *External Storage Service* or via *Data Delivery Network*.
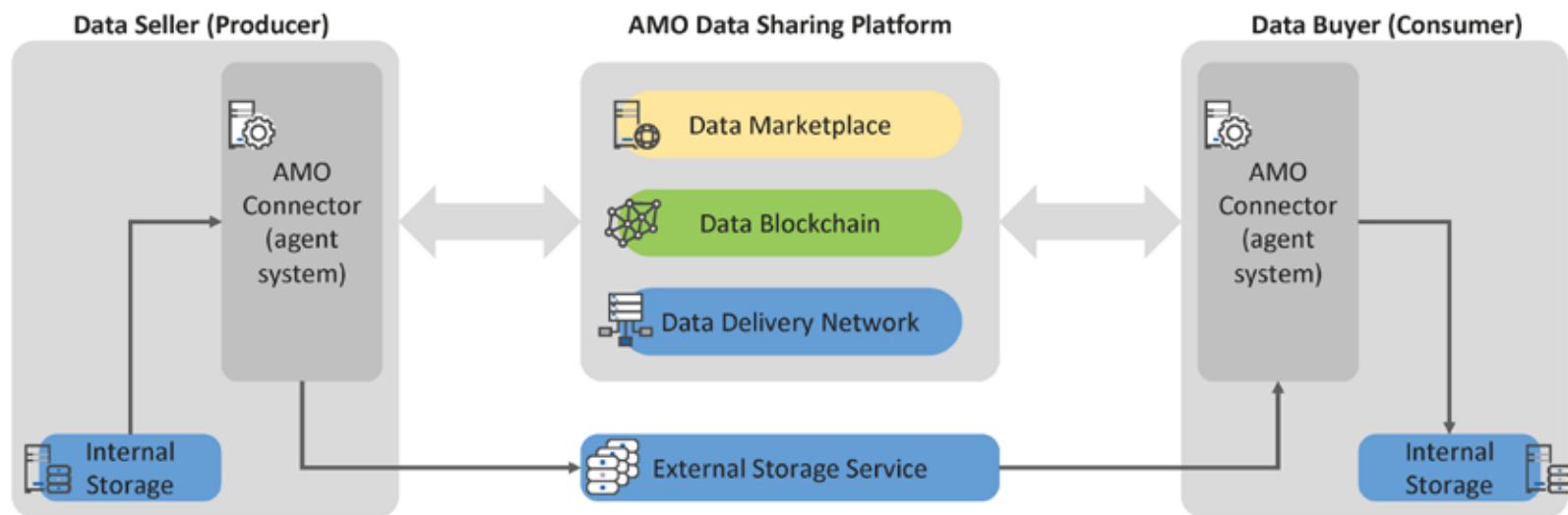
Trust Model for Data Trade

- Seller's data is encrypted with a *Data Key*, which is recorded using encryption with the Buyer's Public Key.
- The *Encrypted Data* may be stored using *External Storage Service* or feed by *Data Delivery Network*.
- Buyer can decrypt the *Encrypted Data* using *Data Key* decrypted with *his* Private Key.
- All encryption and decryption processes are executed securely inside of *AMO Connectors (Agent Systems)*.

Data Seller (Producer)

Data Key

Asymmetric Encryption

Buyer's Public Key

Data

Symmetric Encryption

Encrypted Key

Encrypted Data

Data Blockchain

Data Delivery Network

External Storage Service

Data Buyer (Consumer)

Data Key

Asymmetric Decryption

Buyer's Private Key

Encrypted Key

Data

Symmetric Decryption
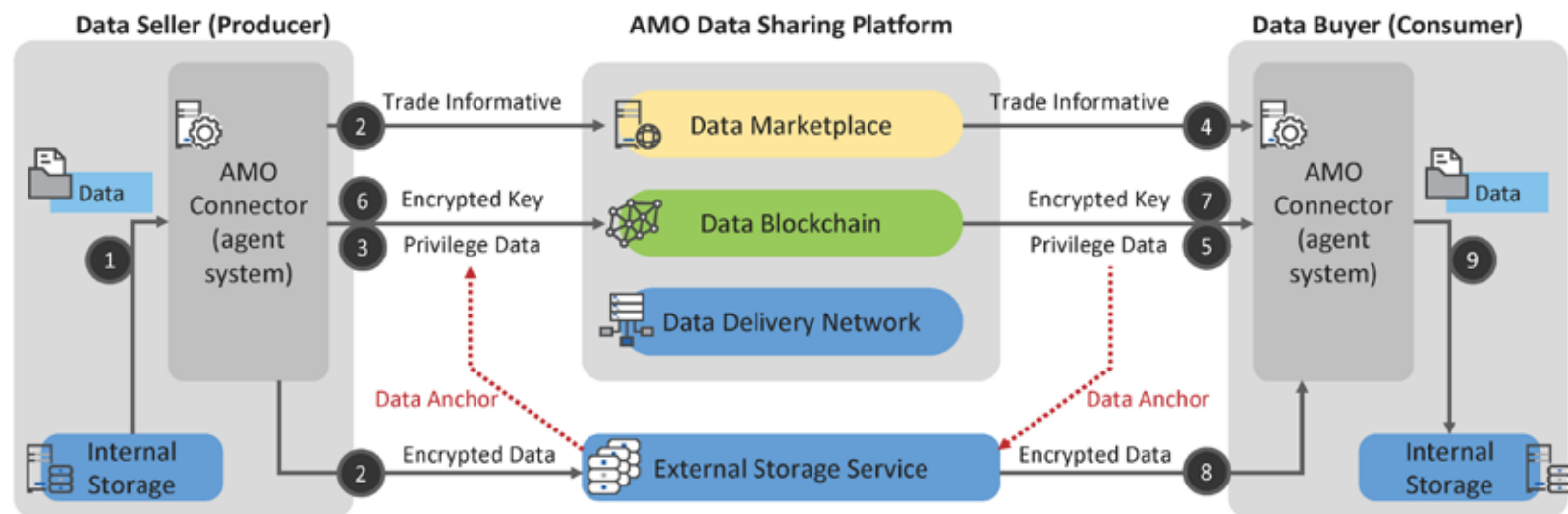
Encrypted Data

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Data Marketplace for Data Trades

- *Data Marketplace* provides an interface for *Data Trade* between Data Seller and Data Buyer.
- Data Seller registers *Trade Informative* of his data, which includes description, price, example, constraints and related information.
- Responding to *Trade Request* from Data Buyer, Data Seller grants the requested trade.
- *Trade Grant* updates the Privilege Data that Data Seller registered and makes the bought data available to Data Buyer.
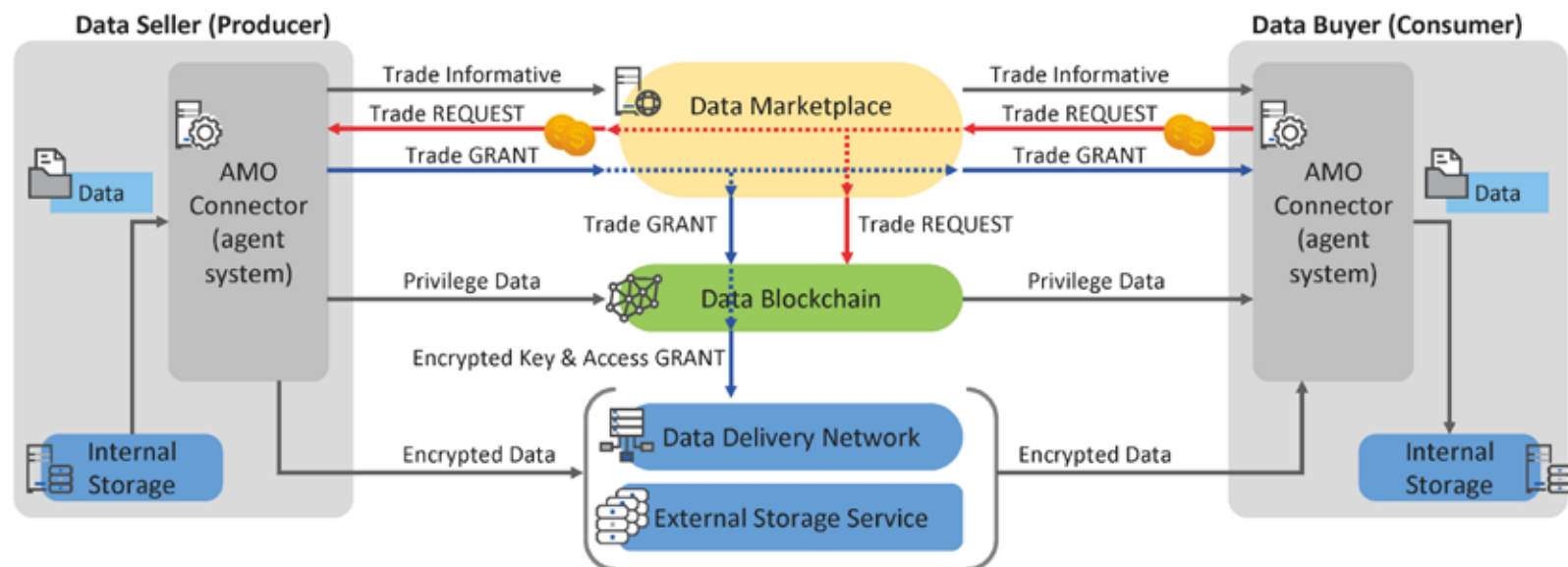
Data Trade for Archived Data (Bound Data)

- Data Seller registers *Encrypted Data* and its *Trade Informative* and generates *Privilege Data*.
- Data Buyer searches and retrieves proper *Trade Informative* he wants.
- When Data Buyer pays the price of Seller's data, he can get the *Encrypted Key* and decrypt the *Encrypted Data*.
- *Data Anchor* in *Privilege Data* describes how to access the *Encrypted Data*.

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Data Trade for Real-time Data (Unbound Data)

- Data Seller registers *Trade Informative* of *Encrypted Data* he will share and generates *Privilege Data*.
- Data Buyer searches and retrieves proper *Trade Informative* he wants.
- When Data Buyer subscribes Seller's data feed, he can get the *Encrypted Key*.
- New data of Seller is delivered to Data Buyer through *Data Delivery Network* in real-time during the subscribed period.
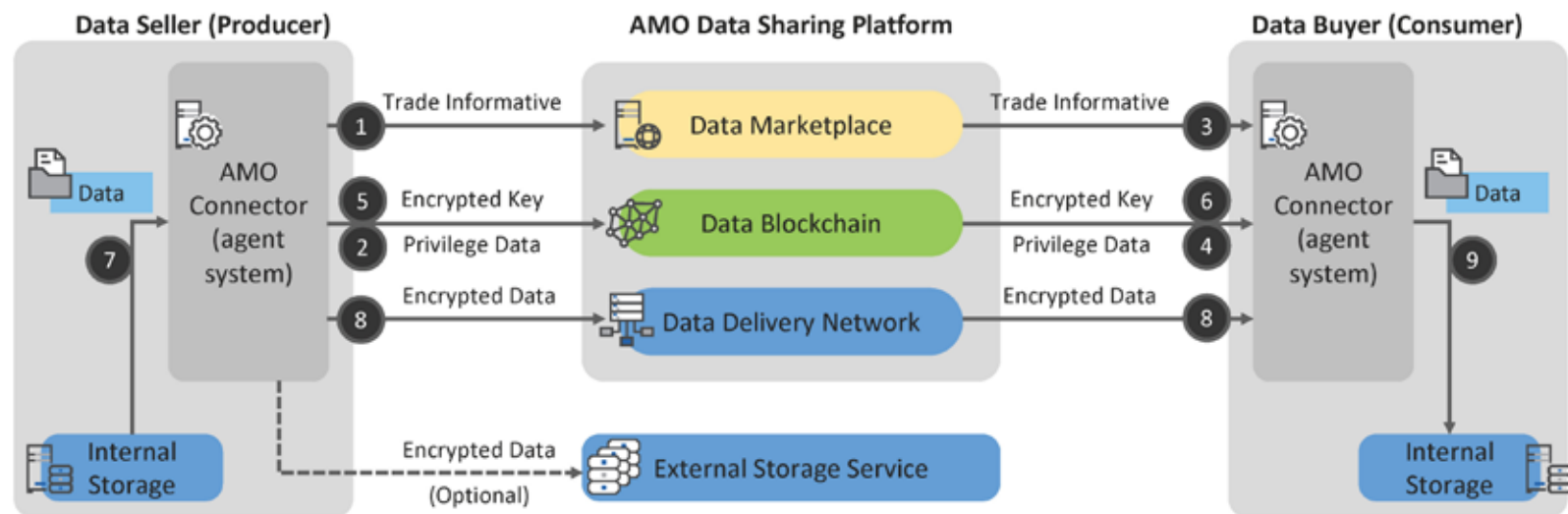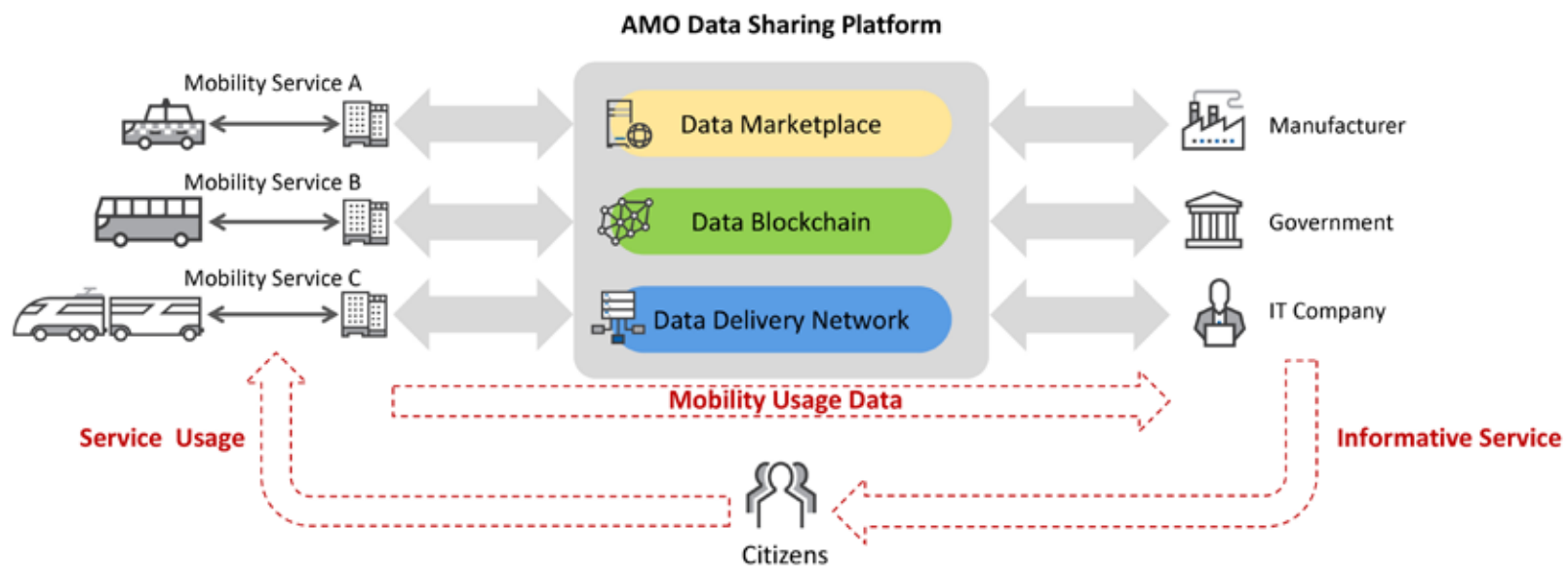
Data Delivery Network for Real-time Services

- *Data Delivery Network* makes data be shared on creation, in real-time.
- *Data Delivery Network* provides the easiest and most reliable data streaming infrastructure.
- With a dynamic resource scheduling function based on global state, optimal path for data flow can be obtained.
- Each node of *Data Delivery Network* has each own *Operator* which performs data processing during delivery.
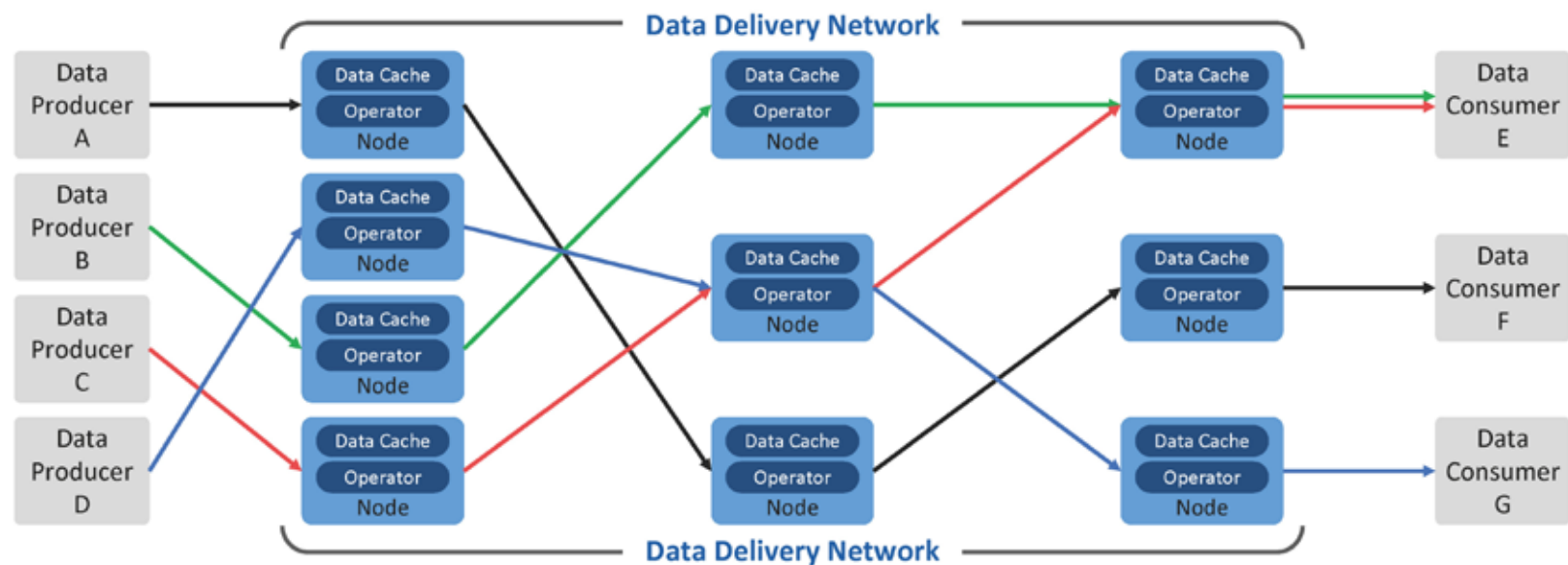
Usecase 1. Data Sharing among Mobility Services

- Mobility Service Providers share *Mobility Usage Data* of Citizens in real-time through *Data Delivery Network*.
- Manufacturer can provide a customer care service by analyzing the *Mobility Usage Data*.
- Government can optimize the urban traffic controls using the *Mobility Usage Data*.
- IT Company can develop a new service for drivers, i.e. infomercial, transit recommendation, etc.

AMO Data Sharing Platform

Mobility Service A

Mobility Service B

Mobility Service C

Data Marketplace

Data Blockchain

Data Delivery Network

Manufacturer

Government

IT Company

Service Usage

Mobility Usage Data

Informative Service

Citizens

Usecase 2. Digital Persona – "myData for Mobility"

- When a User gets a car from Mobility Service Provider, he sets up the car.
- The *Usage Data* are recorded in *Storage Service* as different types of data depending on its changing frequency.
  - Static Data (home/office address, seat position, etc), Transient Data (destination en route, song play list, etc), Dynamic Data (current position, song on play, etc)
- When a User transits to a new car from another Mobility Service Provider, his favorites and convenient are waiting for him.
- Any move or access of User's Usage Data needs User's explicit grant for security.


AMO Data Sharing Platform

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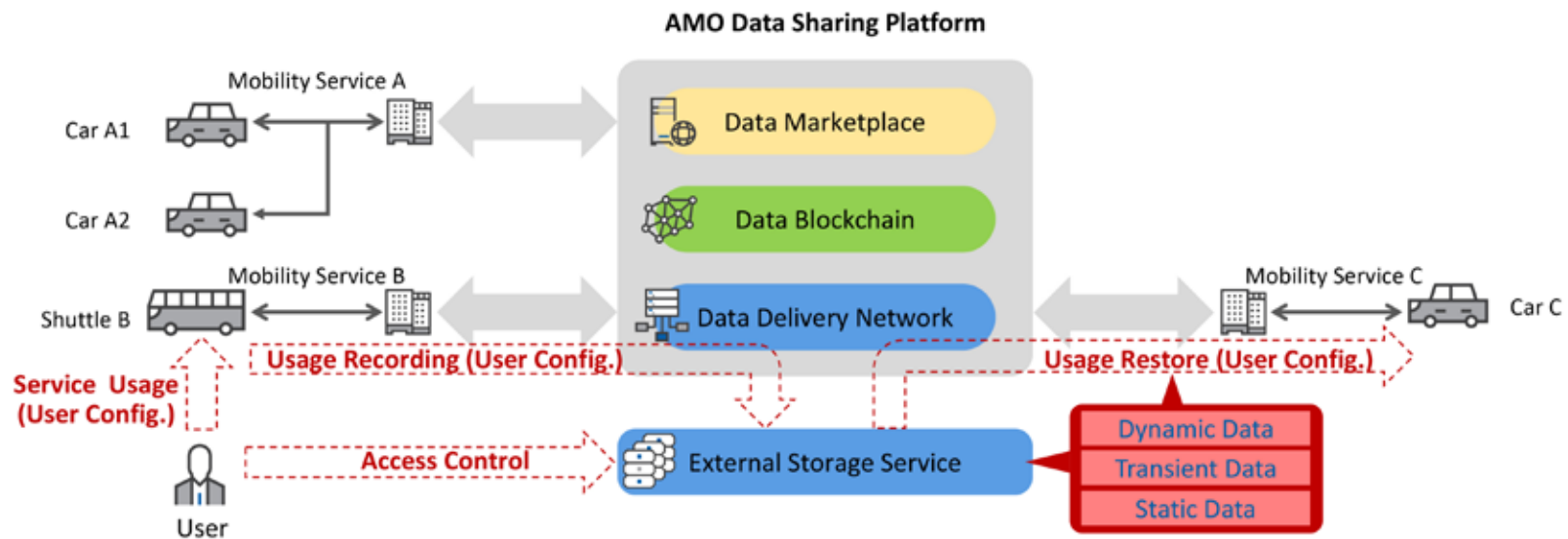
Usecase 3. Data Sharing in Smart City

- Each Smart City Service has its different silo data store, which can be a legacy system.
- Data to be shared can be delivered through *Data Delivery Network* or archived in Smart City Bigdata System.
- Data Blockchain guarantees the integrity and access control of the shared data.
- Researchers can analyze the shared data and produce a new Smart City Service.
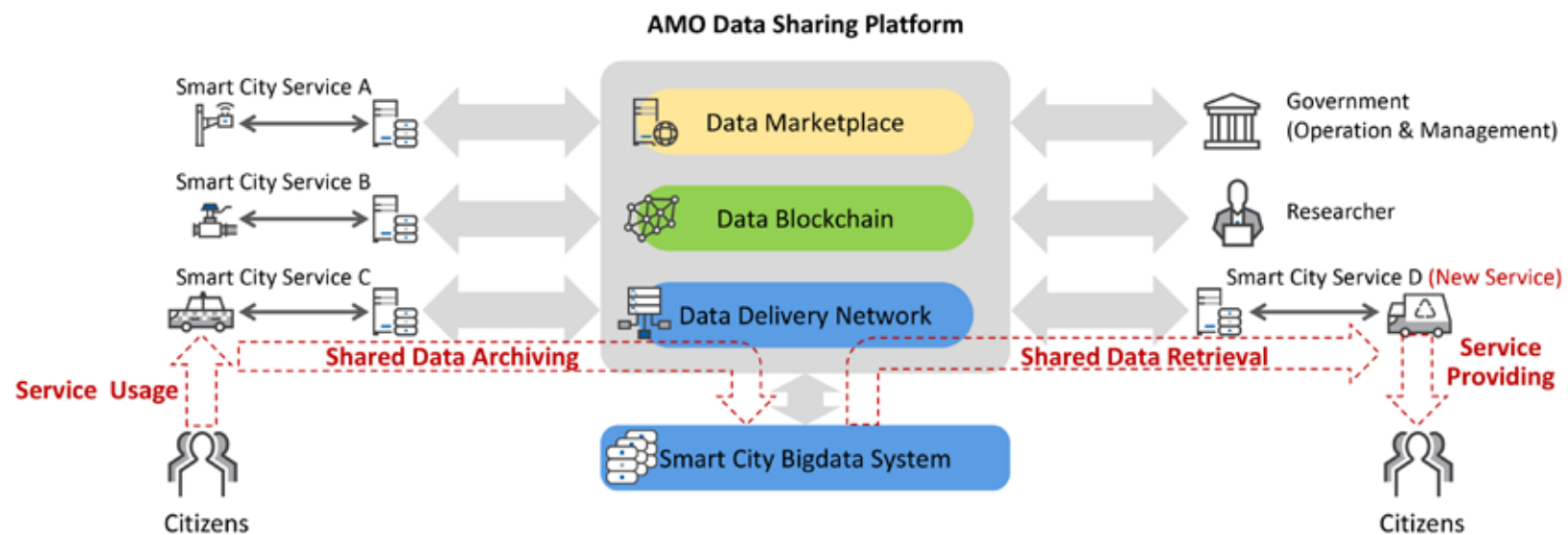
Usecase 4. Edge Cloud Management

- *Edge Cloud* enables various data service with *ultra low latency* especially in 5G environments.
- Each Edge Cloud gathers its own data and the gathered data should be available on other edges by sharing data.
- Data ownership and usage reports are recorded as *Privilege Data* following the *Data Flow*.
- *Data Policy* describes data sharing policy between Edge Clouds and is distributed through *Data Blockchain*.

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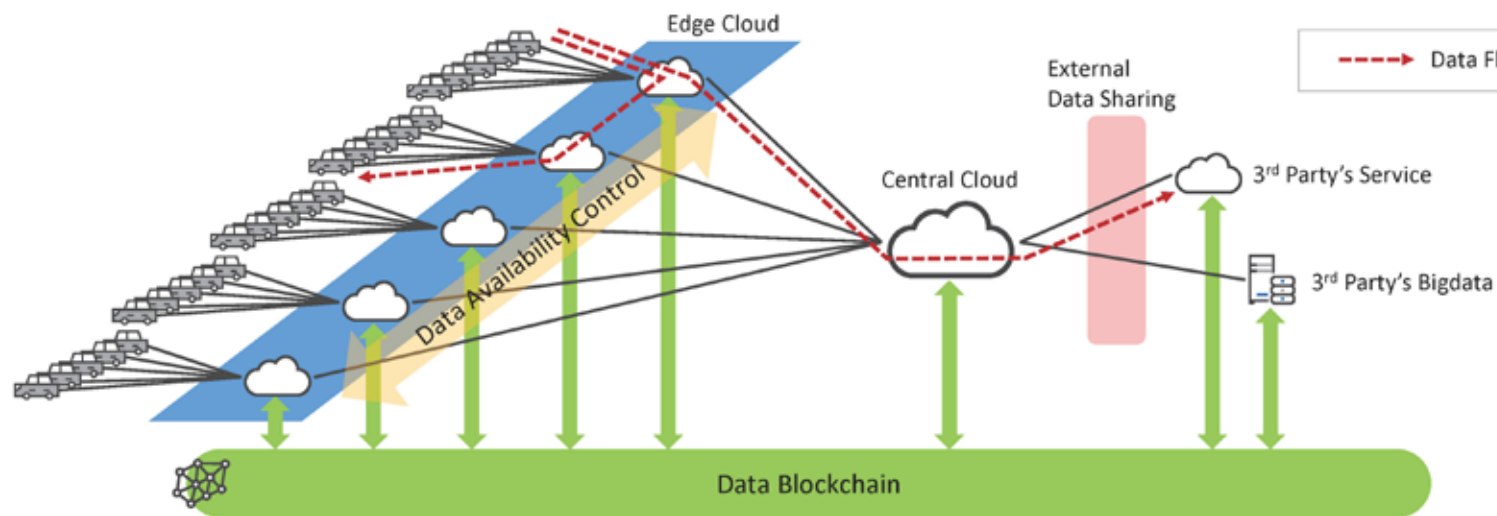
Usecase 5. Supply Chain Management

- In Supply Chain Management, many stakeholders need to share the data produced in each process.
- Each stakeholder registers its own data with the corresponding *Metadata* and *Privilege Data* in Data Blockchain.
- Data to be shared can be delivered through *Data Delivery Network* in more efficient way.
- Other stakeholders and 3rd Parties can validate and verify the ownership and integrity of the data.
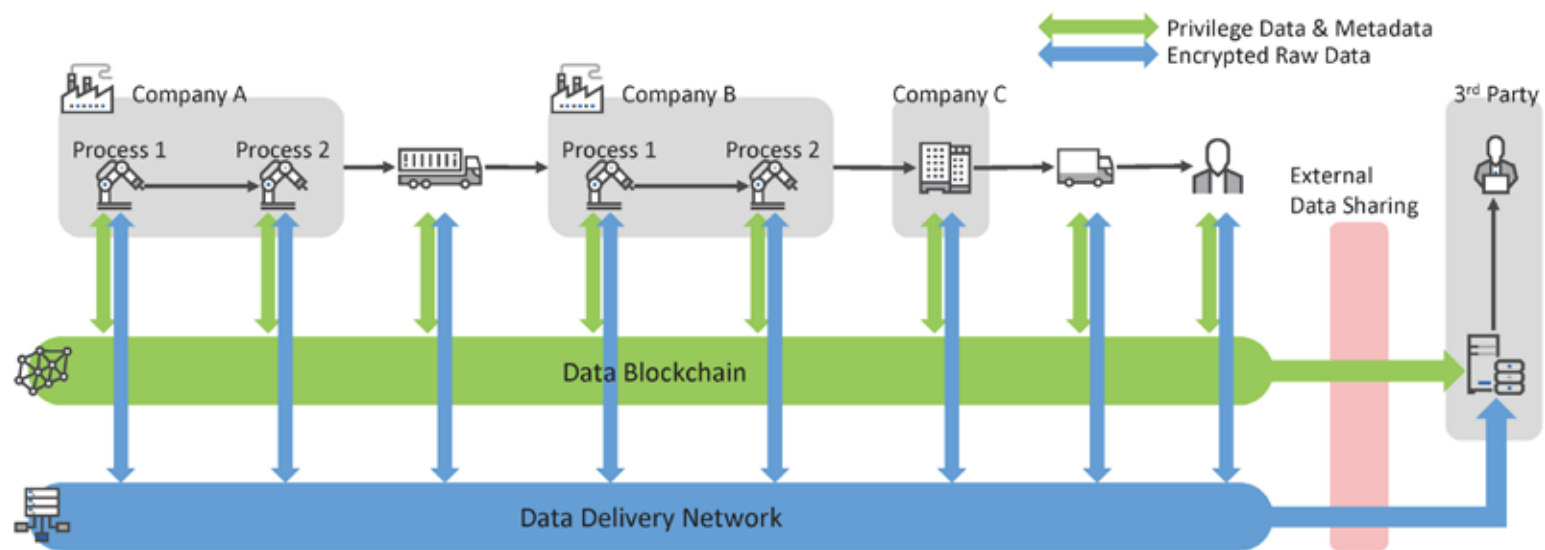
Usecase 6. Data Flow Management for Bigdata System

- Bigdata System archives vast data and connects *Data Producers* and *Data Consumers*.
- Data contributed by *Data Producers* is registered in *Data Blockchain*, delivered through *Data Delivery Network*, and archived.
- The authenticity and integrity are preserved by *Privilege Data* in *Data Blockchain*, among all participants.
- *Data Flow Management* can prevent *'Data Pollution'* and give reliability and trustworthiness of the Bigdata System.

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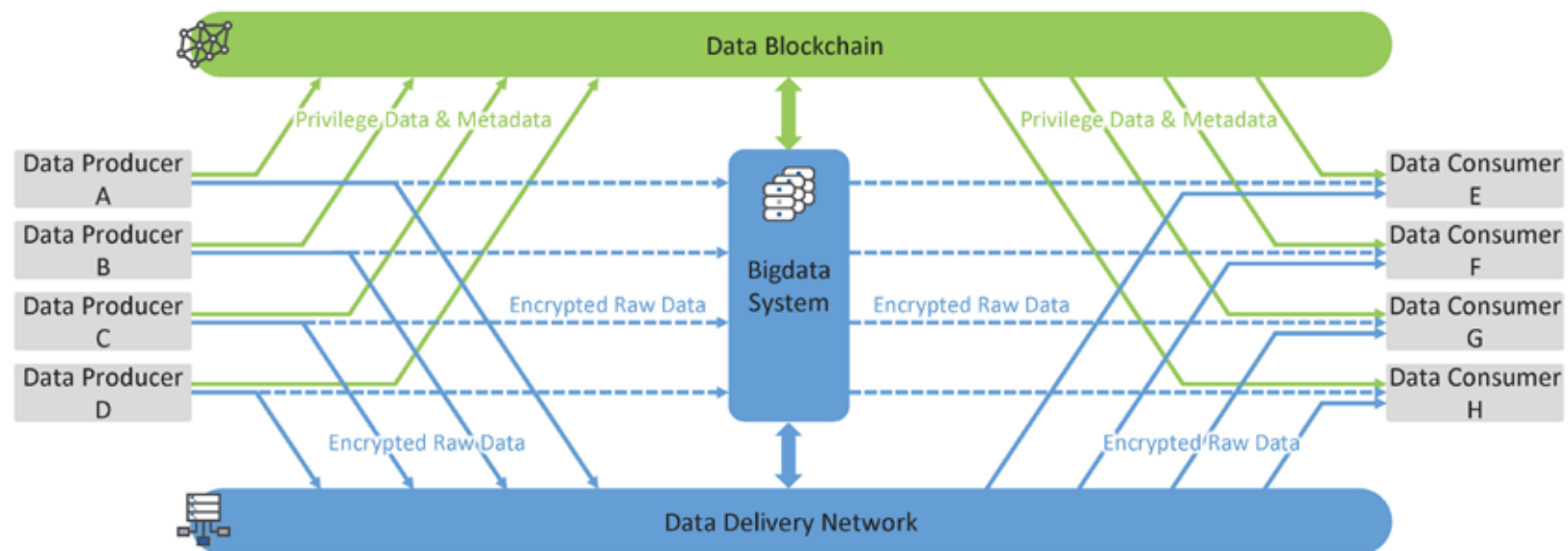
Penta SECURITY

enterprise · iot · blockchain

:: AMO

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GLOBAL   www.pentasecurity.com
JAPAN   www.pentasecurity.co.jp
CHINA   www.jiam2.tech