Trustworthy Data Ecosystems with Blockchain for Cities and Communities

Gyu Myoung Lee
Rapporteur, ITU-T SG20, LJMU UK/KAIST KR
gmlee@kaist.ac.kr
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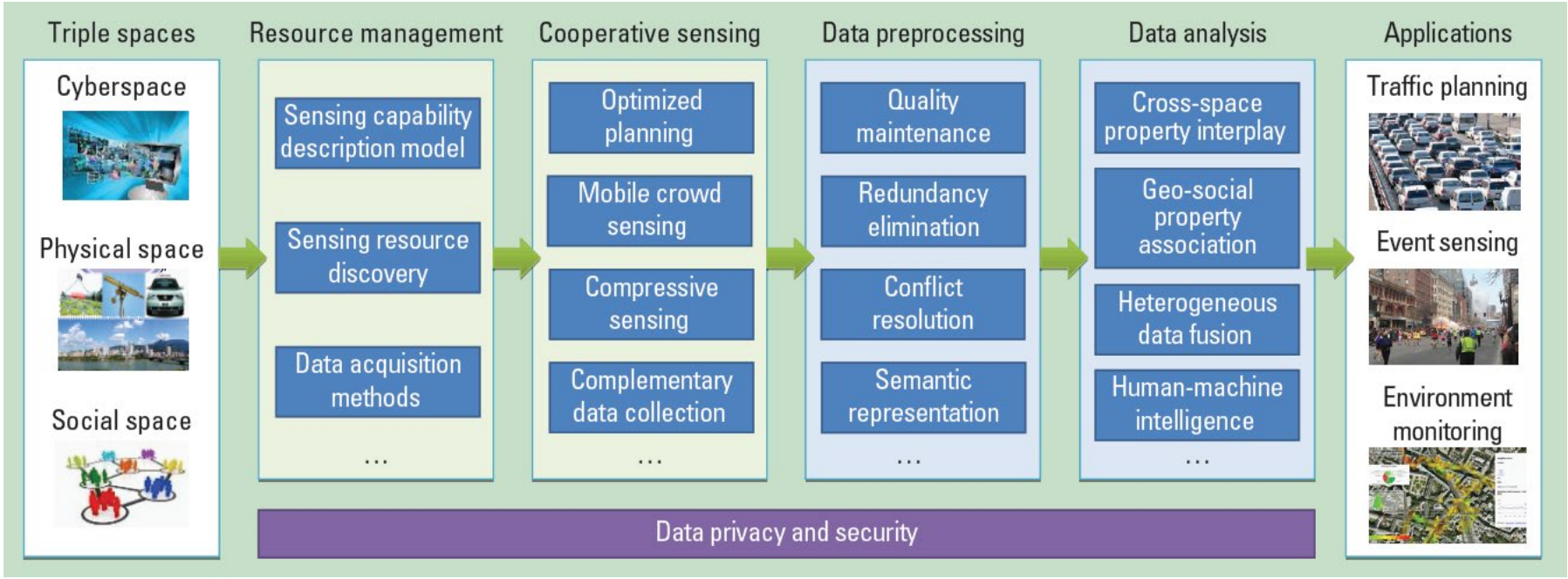
Data-driven

IoT and Smart Cities & Communities

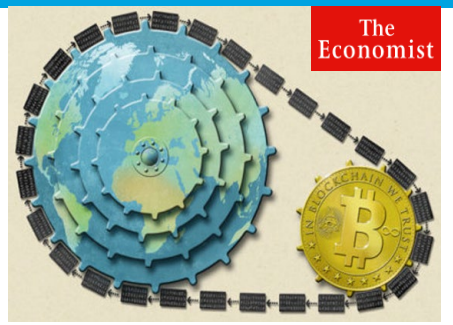
- Support higher volume and velocity of data



"A Data-Centric Framework for Cyber-Physical-Social Systems", IEEE IT Professional, Nov.-Dec. 2015.

BLOCKCHAIN — Internet of Value

A machine for creating trust



- The currency in the Internet is **data**.
- Revolutionizes how transactions are recorded
  - a **decentralized** **digital ledger** that records transactions
  - builds **trust** with **accountability** and **transparency**

INTERNET

Transfer information

TEXT IMAGES PROGRAMS VIDEOS

Internet of Value

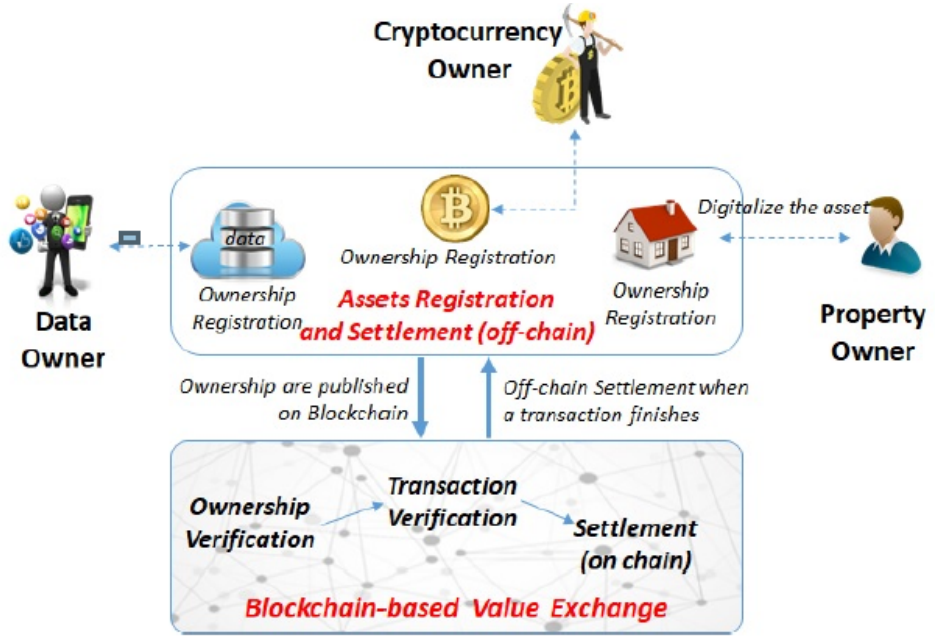
BLOCKCHAIN

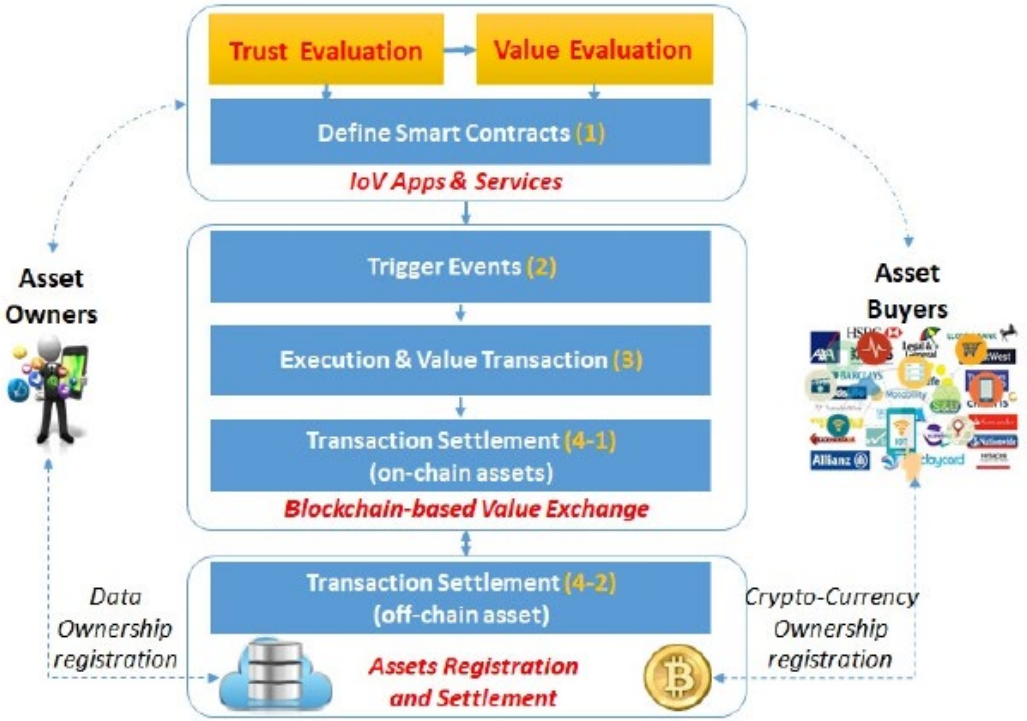
Transfer ownership

MONEY CONTRACTS PATENTS ASSETS

Internet of Value (IoV) with Blockchain

The **IoV** is as a platform of the next generation Internet that enables various types of assets to be digitalized and represented as digital value using **Blockchain**.



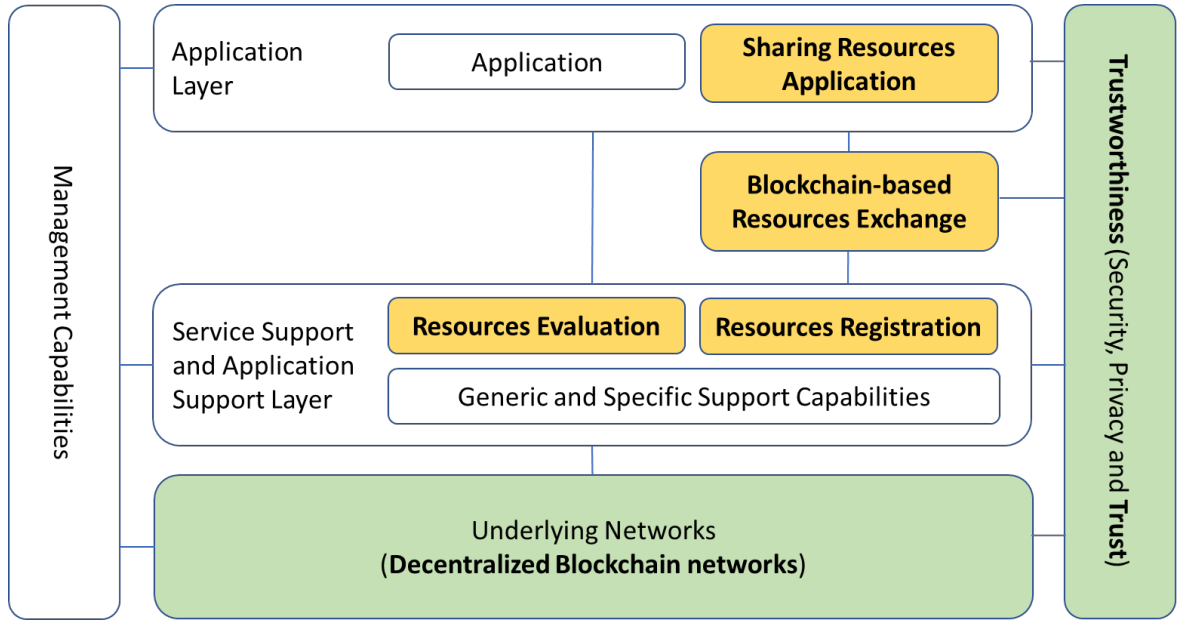


Nguyen B. Truong, Tai-Won Um, Bo Zhou, **Gyu Myoung Lee**, "Strengthening the Blockchain-based Internet of value with trust," IEEE ICC 2018, May 2018 (Kansas City, USA)

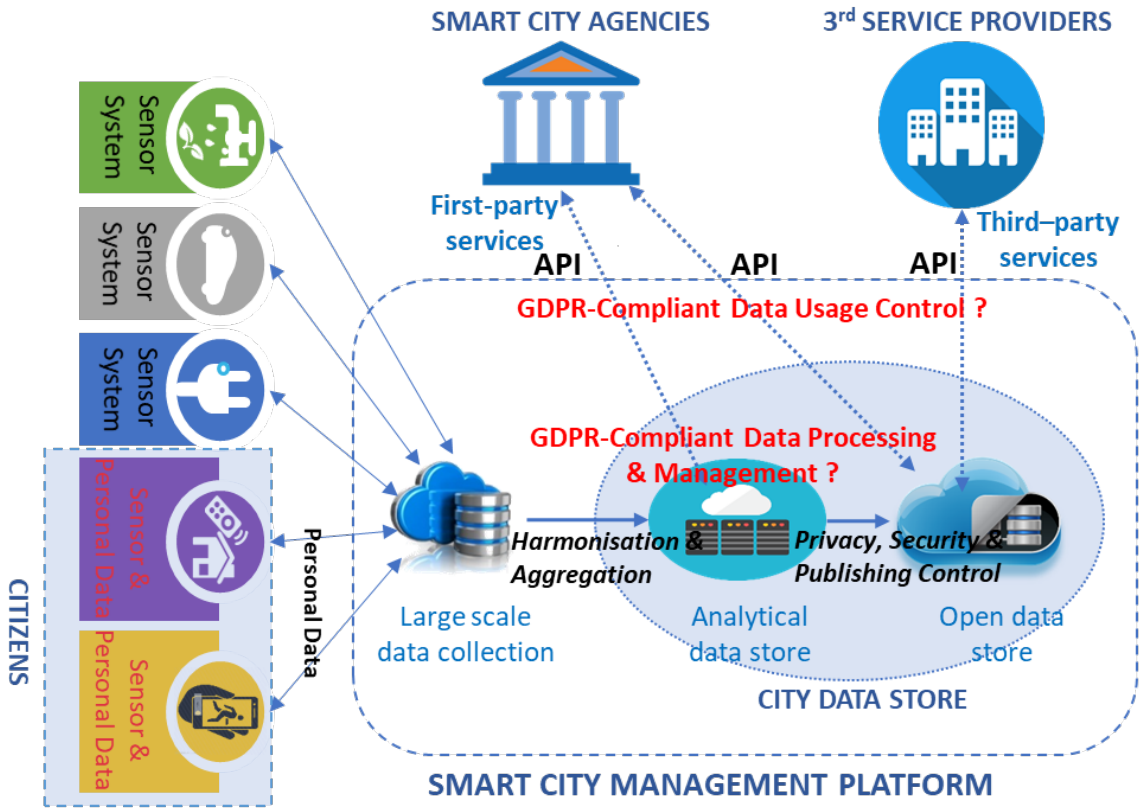
Internet of Resources with Blockchain

- Internet of Resources
  - Blockchain enabling P2P transactions of value in a secure manner without the introduce of an intermediary
  - A platform of the next generation Internet that enables various types of resources (assets) to be digitized and represented as digital resources, and directly and securely exchanged using Blockchain

Trust-enabled blockchain-based sharing networks

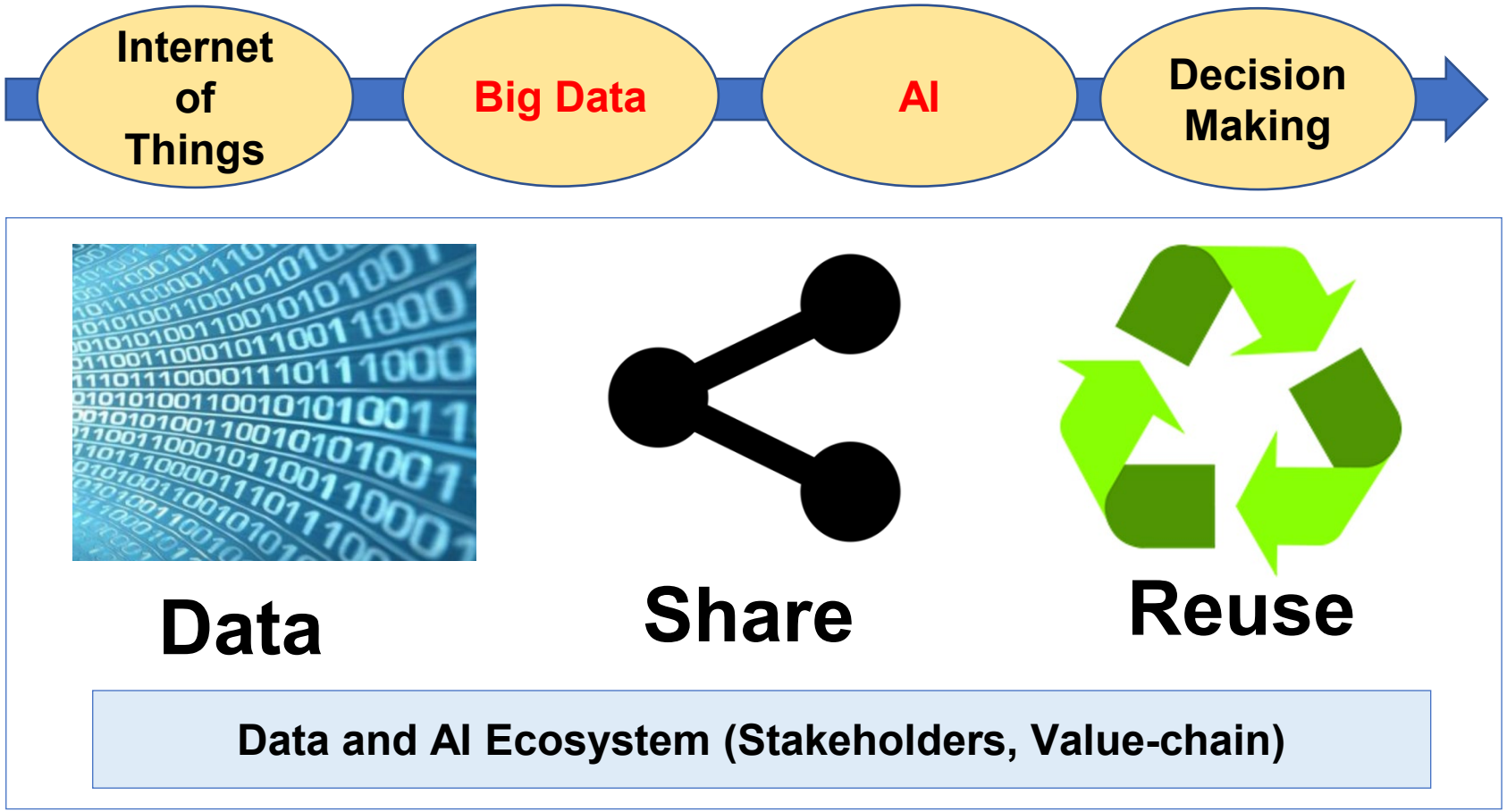


Data Management in Smart Cities



Nguyen Truong, **Gyu Myoung Lee**, Kai Sun, Florian Guitton, YiKe Guo, “A blockchain-based trust system for decentralized applications: when trustless needs trust,” Future Generation Computer Systems, ISSN 0167-739X, vol.124, pp.68-79, May 2021.
Nguyen Binh Truong, Kai Syn, **Gyu Myoung Lee**, Yike Guo, "GDPR-compliant personal data management: a blockchain-based solution," IEEE Transactions on Information Forensics and Security, ISSN 1556-6013, vol. 15, issue 1, pp.1746-1761, December 2020.

Necessity of Standardization



Blockchain-based data management

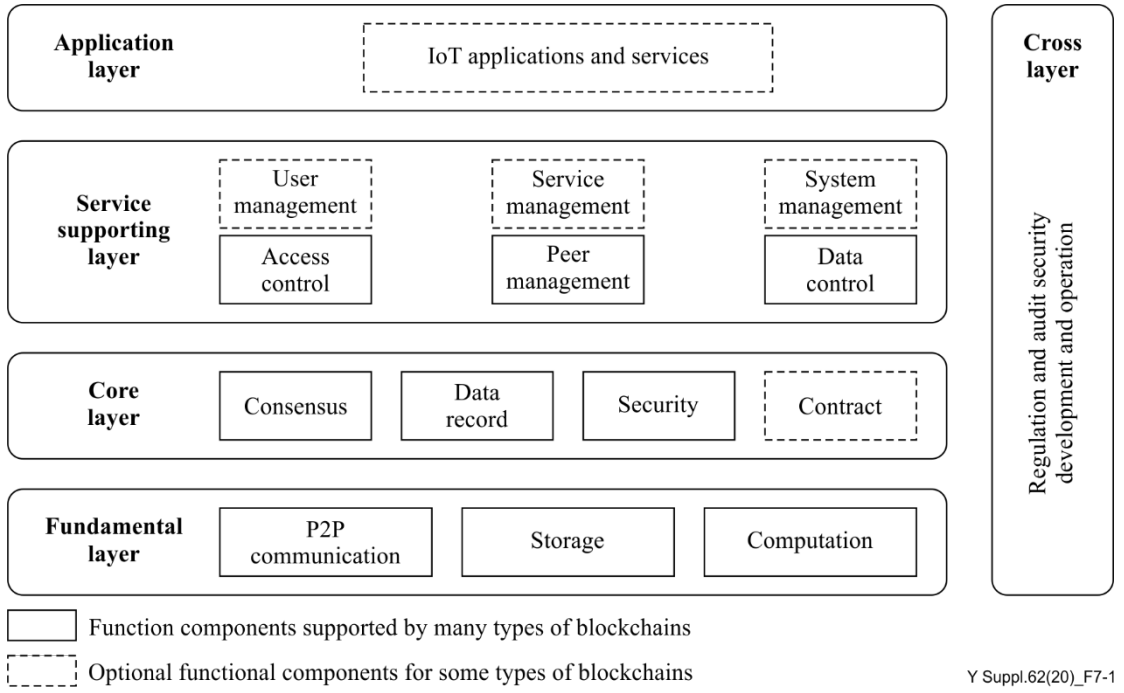
- ITU-T SG20
  - **Y.Suppl.62 (07/2020)** - *Overview of blockchain for supporting Internet of things and smart cities and communities in data processing and management aspects*
  - **Y.4560 (08/2020)** - *Blockchain-based data exchange and sharing for supporting Internet of things and smart cities and communities*
  - **Y.4561 (08/2020)** - *Blockchain-based data management for supporting Internet of things and smart cities and communities*

Y.Suppl.62

Overview of blockchain for supporting Internet of things and smart cities and communities in data processing and management aspects

- This Supplement provides an overview of blockchain related to data processing and management (DPM) for supporting Internet of things (IoT) and sustainable smart cities and communities (SC&C).
  - the advantages, challenges, key features and a common reference model of blockchain from the DPM perspective for supporting IoT and SC&C;
  - key issues for blockchain to support IoT and SC&C from the DPM perspectives;
  - the effects when using blockchain to support IoT and SC&C from the DPM perspective.

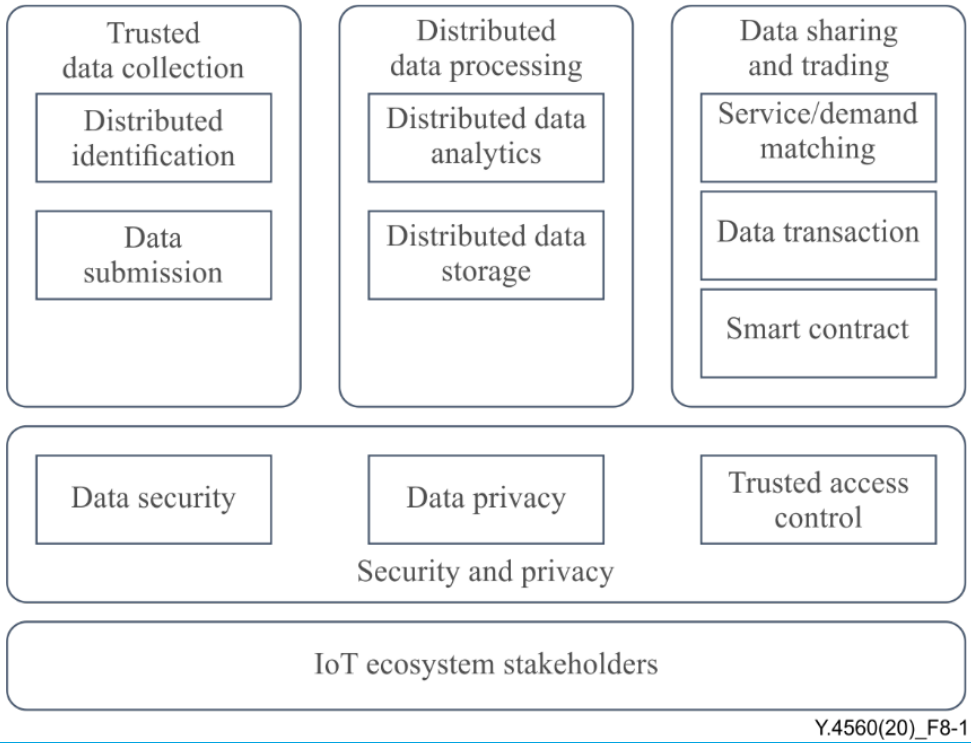
An abstract common reference model of blockchain



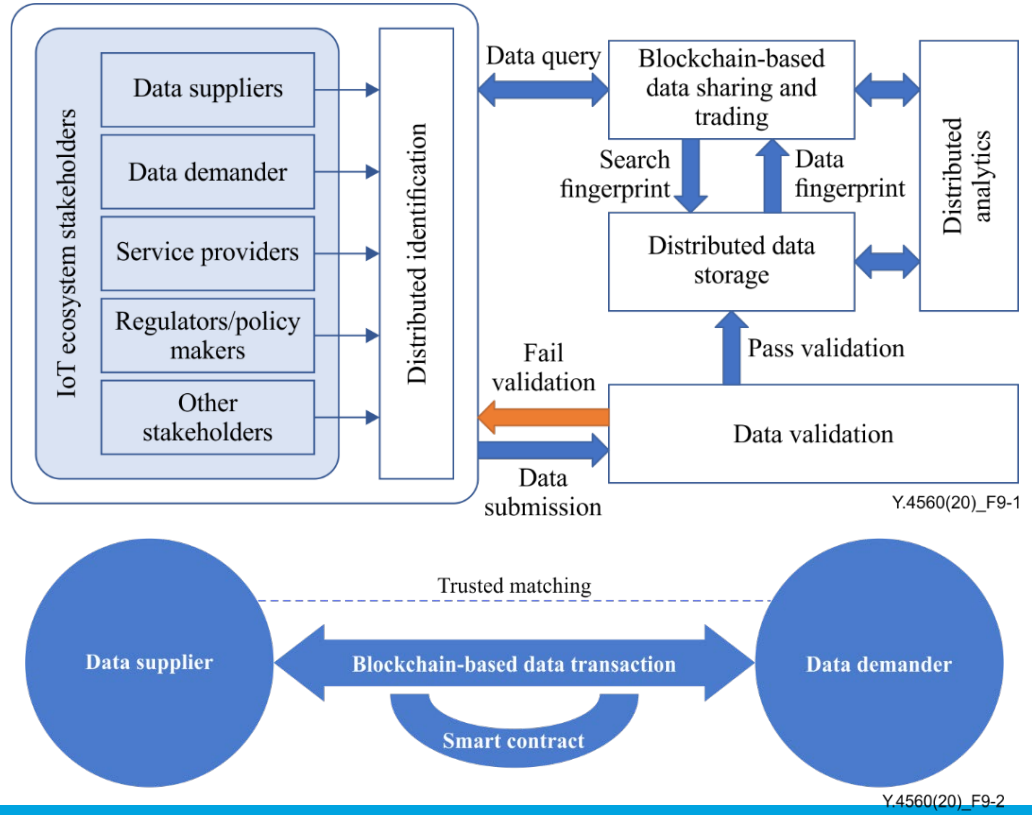
Y.4560

Blockchain-based data exchange and sharing for supporting Internet of things and smart cities and communities

A functional model of blockchain-based data exchange and sharing



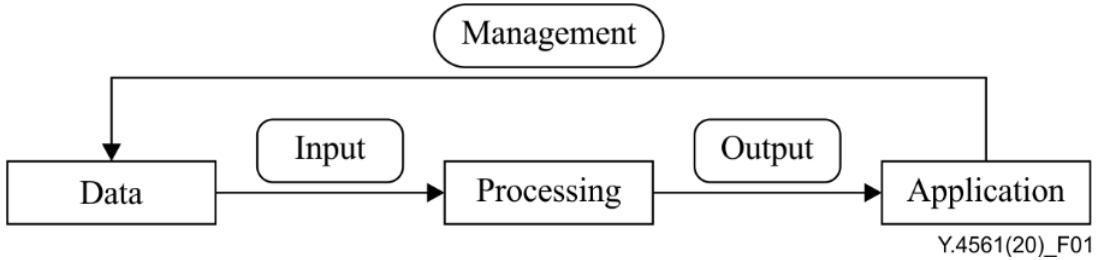
Blockchain-based data exchange and sharing platform



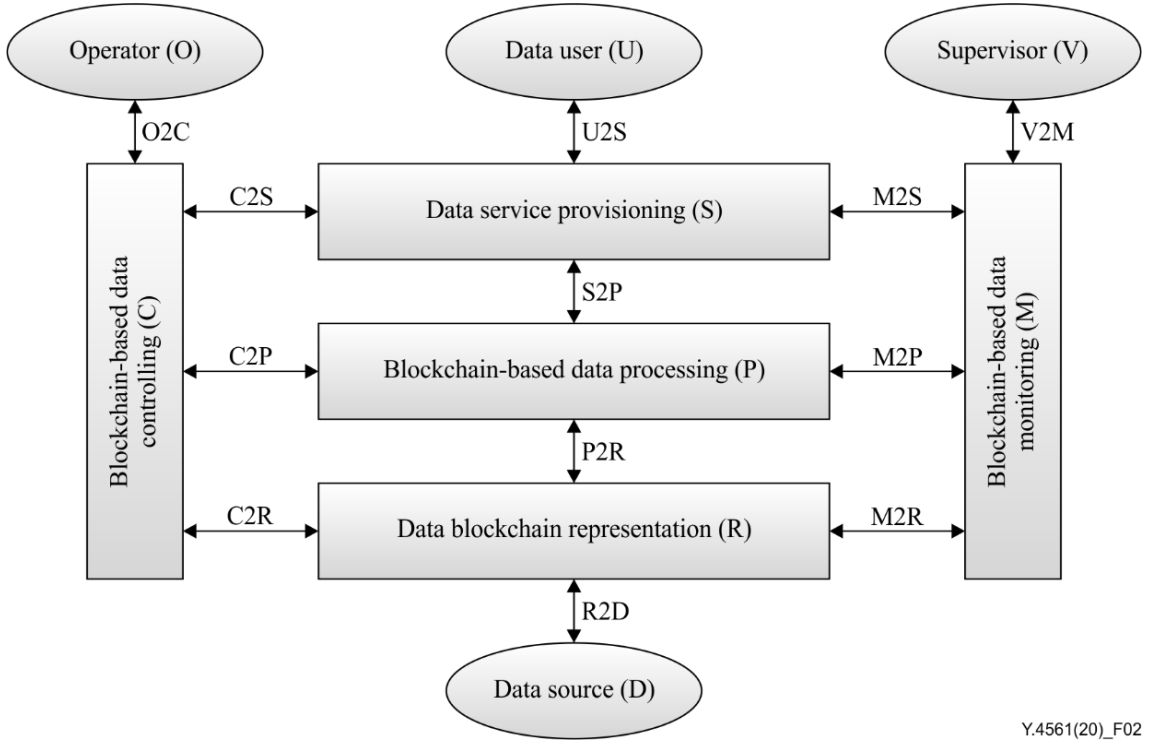
Y.4561

Blockchain-based data management for supporting Internet of things and smart cities and communities

- Requirements of blockchain-based data management,
- Generic reference model of blockchain-based data management,
- Common capabilities and procedures of blockchain-based data management.

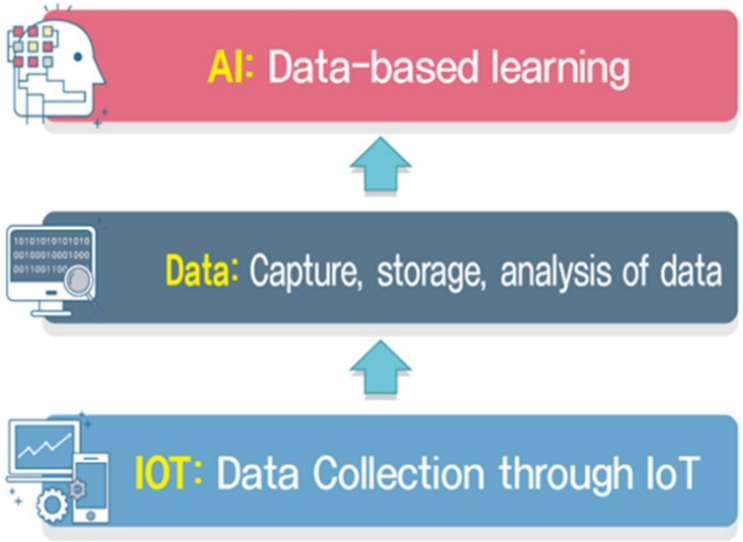


A generic reference model of blockchain-based data management



ITU-T SG20 - AIoT

Artificial Intelligence of Things (AIoT), a combination of AI, data and IoT, creates intelligent things that learn from the generated data and use these insights to make autonomous decisions with distributed and lightweight AI technologies to enable intelligence on the edge as well as to achieve more efficient and real-time IoT operations, improve human-machine interactions and enhance data management and analytics.



- AI at the edge
- Lightweight AI/ML (TinyML)
- Distributed Artificial Intelligence-as-a-Service (DAIaaS)
- **Decentralization with blockchain**
- Predictive Analytics and Real Time Processing with Accurate Decision

User-centric approaches

Project Resilience

AI and Data Commons
Global Initiative

XPRIZE

Cognizant

IEEE
Advancing Technology for Humanity

Blavatnik School of Government
University of Oxford

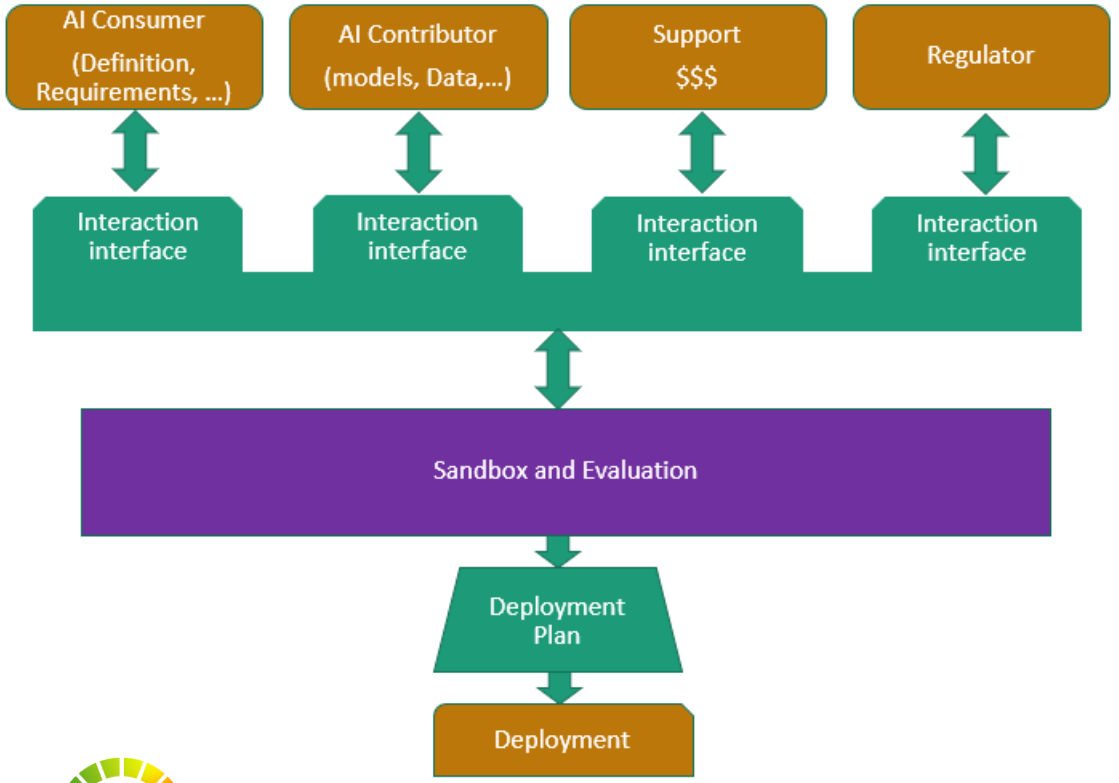
intel

The University of Texas at Austin

City of Los Angeles Founded 1781

ITU

aws

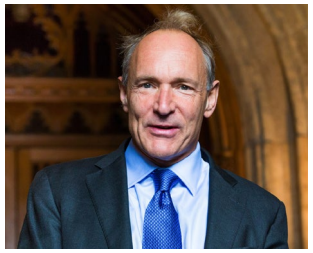


- **WG1 (Platform MVP)**: Babak Hodjat, Risto Miikkulaninen
- **WG2 (Data Contributions)**: Gyu Myoung Lee, Toby Philips
- **WG3 (Product Experience)**: Mohanty Sharada, Sean McGregor

AI for Good

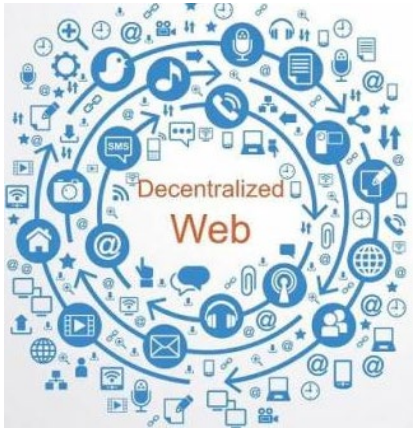
Webinars - https://aiforgood.itu.int/event/project-resilience-2/

Toward Decentralization



Tim Berners-Lee

Solid



Decentralisation: the next big step for the world wide web

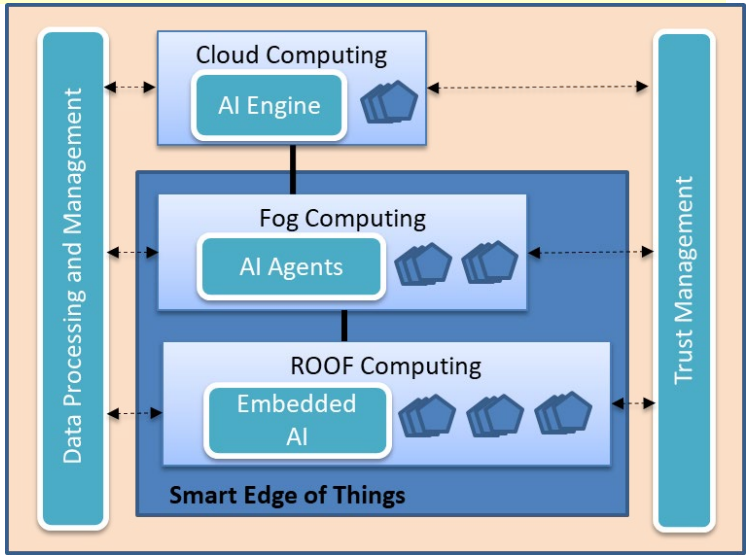
The decentralised web, or DWeb, could be a chance to take control of our data back from the big tech firms. So how does it work and when will it be here?

the guardian

Illustration: James Melaugh

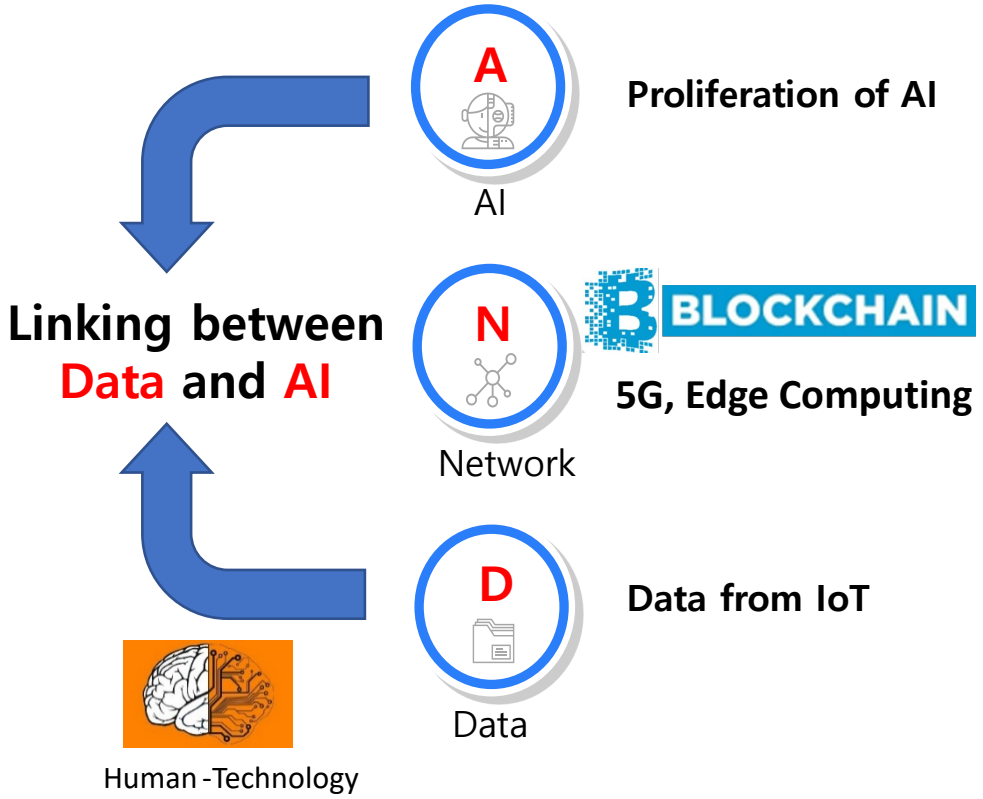
[The Guardian: September 2018]

Distributed Computing - Edge Intelligence



NOTE - ROOF: Real-time Onsite Operations Facilitation

Towards Data Ecosystems with Decentralization



Trustworhiness with Blockchain

- Transparency
- Data protection
- Privacy preserving
- Policy and regulatory issues
- Ethics

The Economist
Our guide to America's best colleges
Myanmar's free-ish election
Those ever-creative accountants
America takes the fight to IS
Coywolves: the new superpredator
OCTOBER 31ST-NOVEMBER 6TH 2015
Economist.com
The trust machine
How the technology behind bitcoin could change the world
IN BLOCKCHAIN WE TRUST

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&
A