IoT Week 2018, Bilbao

IoT Standards Trends & Convergence Plenary Session

7 June 2018, 15:30-17:00

Data Processing and Management to support IoT and SC&C: some findings and ongoing studies in ITU-T and AIOTI WG03

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Opportunities and challenges of (Big) Data for networks and services

Process optimization and data monetization via analytics - driving revenue by sharing, analysing and interpreting data, for multiple purposes

- Extraction of tangible business and technology value
- Response and action in real time, improving productivity/business processes, lowering costs
- Long-range forecasts enabling strategic actions - business differentiation
- New/improved business models and service offer, faster, more efficiently and agile

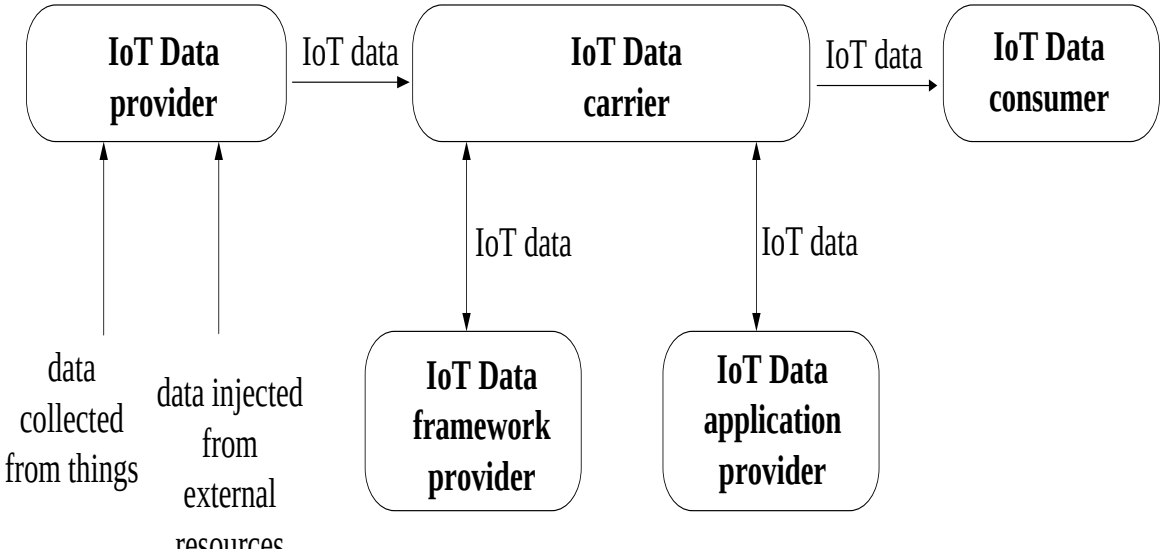
Some significant challenges

- Dealing with the “V”s of data : Volume, Variety, Velocity, Variability, Veracity
- Discovery of appropriate devices and data sources, and integration of heterogeneous devices, networks and data
- Scalability for large device numbers, diverse and huge data, computational complexity of data interpretation
- Availability and (open) access to data, data query
- Trust, security and privacy of data
- Interpretation (extraction of actionable intelligence from data)
- Massive data mining, efficient processing, flexible learning
- **Other non-technical challenges are also essential (incl. data ownership and data governance)**

A foundational ITU-T Recommendation on Big Data in IoT:

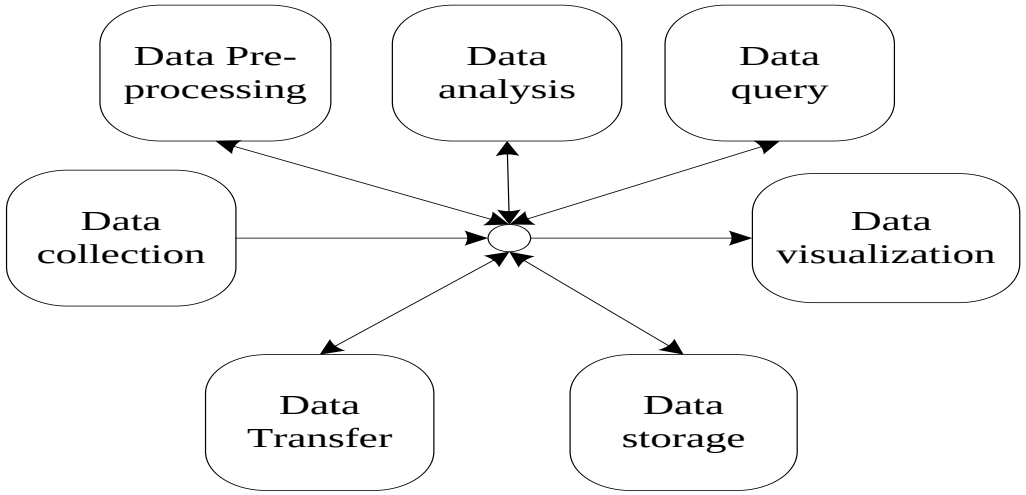
ITU-T Y.4114 “Specific requirements and capabilities of the IoT for Big Data”

Specific requirements and capabilities the IoT is expected to support to address the challenges related to Big Data



The IoT data roles identified in Y.4114

[the key roles relevant in an IoT deployment from a data operation perspective]



Abstract representation of IoT data operations and related data flows (diverse concrete IoT deployments do not imply unique logical sequencing of IoT data operations)

To build on within ITU-T FG-DPM (e.g. “Data sharing” as critical additional data operation)

ITU-T Focus Group on Data Processing and Management to support IoT and Smart Cities & Communities (ITU-T FG-DPM)

Essential tasks

- Identify challenges in IoT and smart cities for DPM
- Identify key requirements ad capabilities for DPM
- Promote the establishment of trust-based data management frameworks for IoT and SC&C
- Investigate the role of emerging technologies to support data management incl. blockchain
- Identify and address standards gaps and challenges

1st meeting in July 2017 (SG20 is parent SG)

1st ITU Workshop on Data Processing and Management for IoT and Smart Cities & Communities: Brussels, Belgium, 19 Feb. 2018

WG1 - Use Cases, Requirements and Applications/ Services	WG2 - DPM Framework, Architectures and Core Components	WG3 - Data sharing, Interoperability and Blockchain	WG4 - Security, Privacy and Trust including Governance	WG5 - Data Economy, commercialization and monetization

Liaisons/interactions established with numerous SDOs, Fora, Alliances and projects
E.g. ISO, ETSI ISG CIM, BDVA, various H2020 projects

“Use Cases Analysis and General Requirements for DPM” (FG-DPM D1.1): a key entry point for the whole FG-DPM work

- **Objectives**
  - Identify from DPM perspective - per each use case - ecosystem’s actors and business roles, data characteristics, capabilities, requirements and other
  - **Facilitate comparison among different use cases (across single or multiple domains)** to enable common DPM features to be identified/adopted, and facilitate single/cross-domain applications’ implementation
  - **Allow creation of new services at little extra cost**
  - **Feed other FG-DPM deliverables** (DPM framework, area-specific frameworks, others)

- **Progress so far**
  - **“Unified DPM Use Case template”** developed and **disseminated to numerous potential DPM use cases contributors (incl. SDOs, Alliances, EU H2020 projects)**
  - Numerous DPM use cases collected
  - Comparison of DPM use cases started - identifying common/use case-specific requirements
  - DPM capabilities’ global picture discussion initiated (WG1, WG2, others)

Blockchain technology for Data Exchange and Sharing

Some benefits of Blockchain in IoT

- Efficient ensurance of integrity, authenticity, auditability and traceability of transactions (data) => trust based information transmission
- Decentralized approach (lower maintenance costs)
- Multi-party consensus (data security)
- Distributed approach (multi-party collaboration)
- Enabler of data monetization

Some limitations of Blockchain in IoT

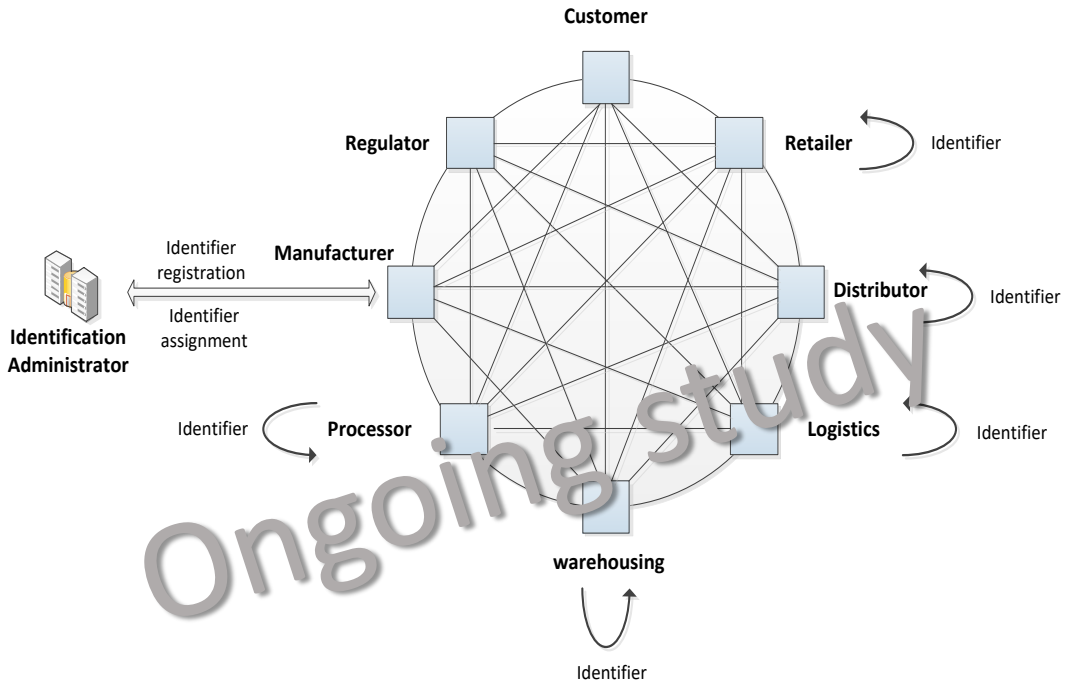
- Not suitable for massive IoT data service transactions and frequent data transmissions
- High performance and capacity requirements not fitting constrained IoT environments
- Big storage capacity needs cannot cope with IoT devices' storage as the blockchain grows
- Data security and privacy is relative

Source: ongoing FG-DPM D3.6

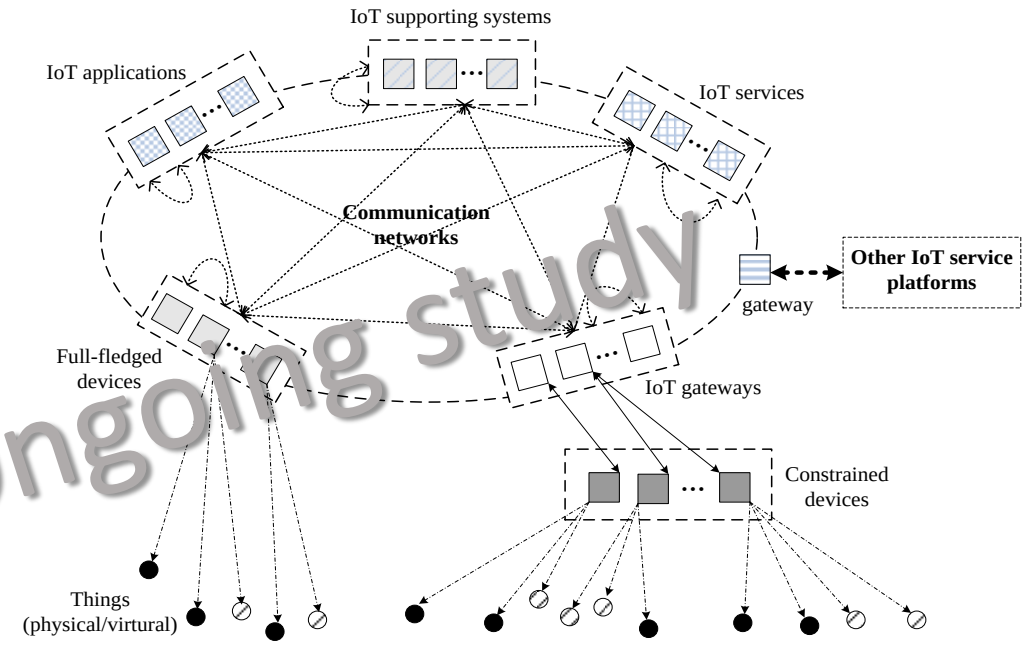
*Blockchain technology fosters a new generation of transactional applications that **establish trust, accountability, transparency and efficiency.** It shows great promises across a wide range of business applications in many fields, including IoT and Smart Cities & Communities.*

Blockchain technology for IoT in ITU-T FG-DPM and SG20

Ongoing FG-DPM D.3.6 deliverable



Ongoing draft Rec. Y.IoT-BoT-fw in SG20



Blockchain-based supply chain traceability use case

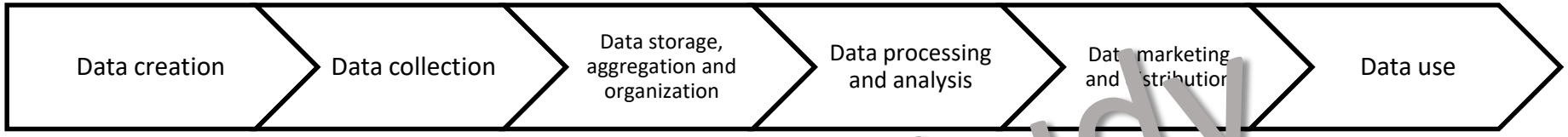
Exchanging and sharing static and dynamic information among the supply chain actors

Blockchain of things as decentralized service platform

With the increase of connected things and other demands (e.g., trust and transactions), centralized IoT service platforms may become key bottlenecks

Data Economy, commercialization and monetization (ongoing FG-DPM D5.1)

Data Core Activities



Data Support Activities

Data Value Chain

(business perspective)

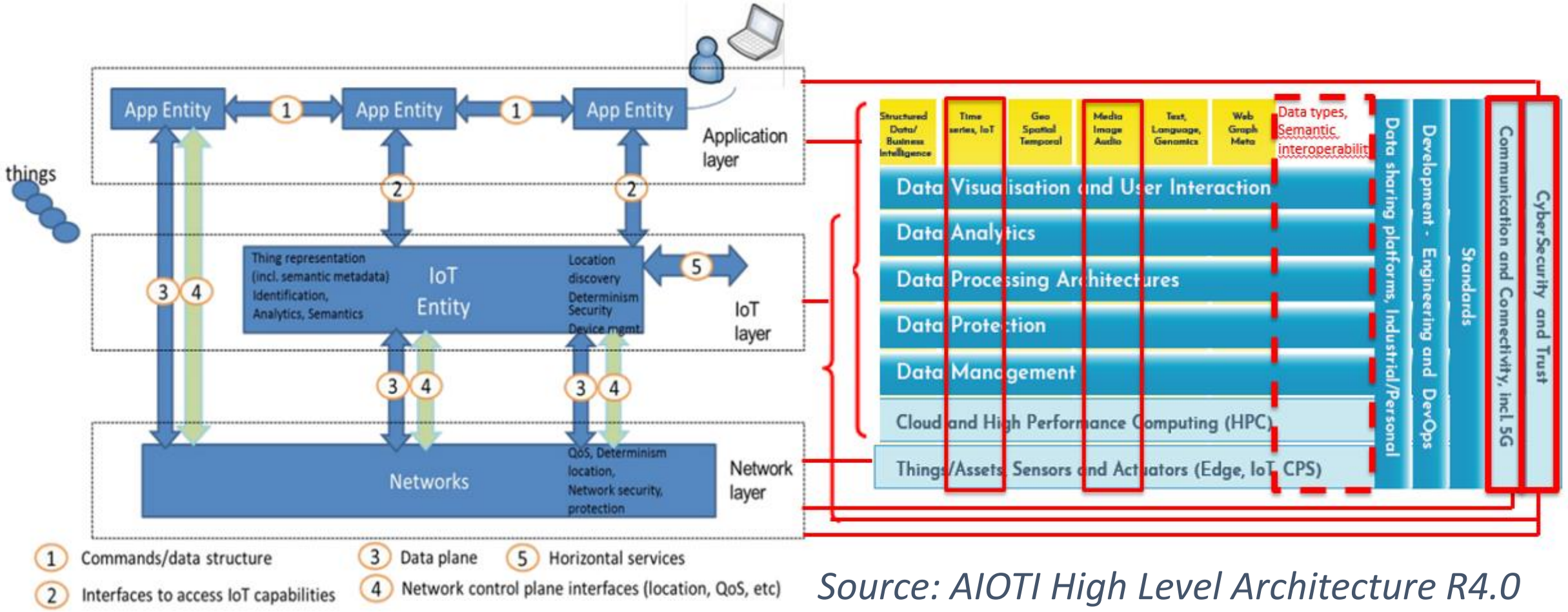
Data laws, regulations and policies: formulation and enforcement of data related laws, regulations and policies

Data security and privacy services: provisioning of data related security and privacy services for implementing and enforcing data laws, regulations and policies.

ICT connectivity and infrastructure services: provisioning of ICT connectivity and infrastructure services for implementing data value chain activities

Interaction between FG-DPM WG5 (business perspective on DPM) and FG-DPM WG1/WG2 (technical perspective on DPM)

BDVA's BDV Reference Model mapping to AIOTI High Level Architecture



Source: AIOTI High Level Architecture R4.0

A key step in front of the IoT standardization work plan: Big Data-IoT architectural integration

Enhancing DPM with Machine Learning (ML) technologies

Potential of ML for network design, operation and optimization

- coping with massively increased complexity
- enhancing network operations' efficiency and robustness
- increasing network self-organization feasibility
- providing reliable predictions

As well as potential of ML to enable new advanced applications

But a number of challenges need to be addressed [beyond trust]

- how to deal with stringent requirements of many applications (latency)
- how to ensure robust ML given small data sets and under latency constraints
- how to deal with distribution of data at different locations and diverse data formats
- usage of distributed learning to have efficient usage of scarce resources
- how to deal with (wireless) channel noise, dynamicity and unreliability
- how to ensure good tracking capabilities
- how to exploit context info and expert knowledge (hybrid ML approaches)

Source: discussion in initial meetings of ITU-T FG-ML5G

ITU-T FG on "Machine Learning for Future Networks including 5G" (FG-ML5G)
- created in Nov 2017 , SG13 as Parent ITU-T Study Group
- a number of challenges and opportunities common to the IoT

Initial AI studies within ITU-T SG20 [early stages of development]

- Technical Report on “Artificial Intelligence and Internet of Things” (TR.AI4IoT)
- Draft Rec. Y.SSC-AISE-arc “Reference architecture of artificial intelligence service exposure for smart sustainable cities”

International coordination on Big Data and AI/ML standardization activities is expected among relevant SDOs, Alliances and Consortia