Standardization and Challenges for Web of Things in ITU-T

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3 February 2022

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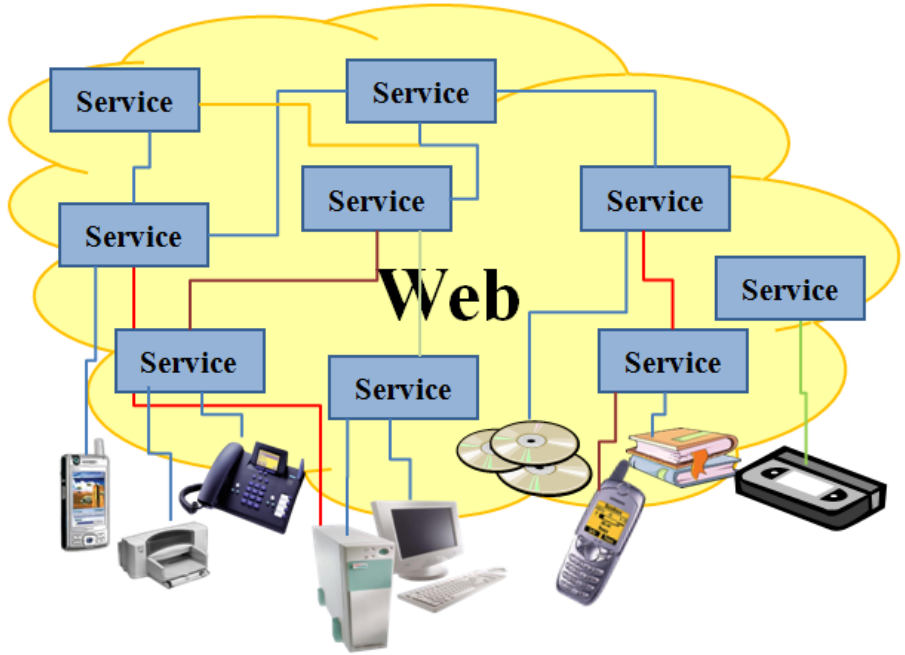
Work Items on Web of Things in ITU-T

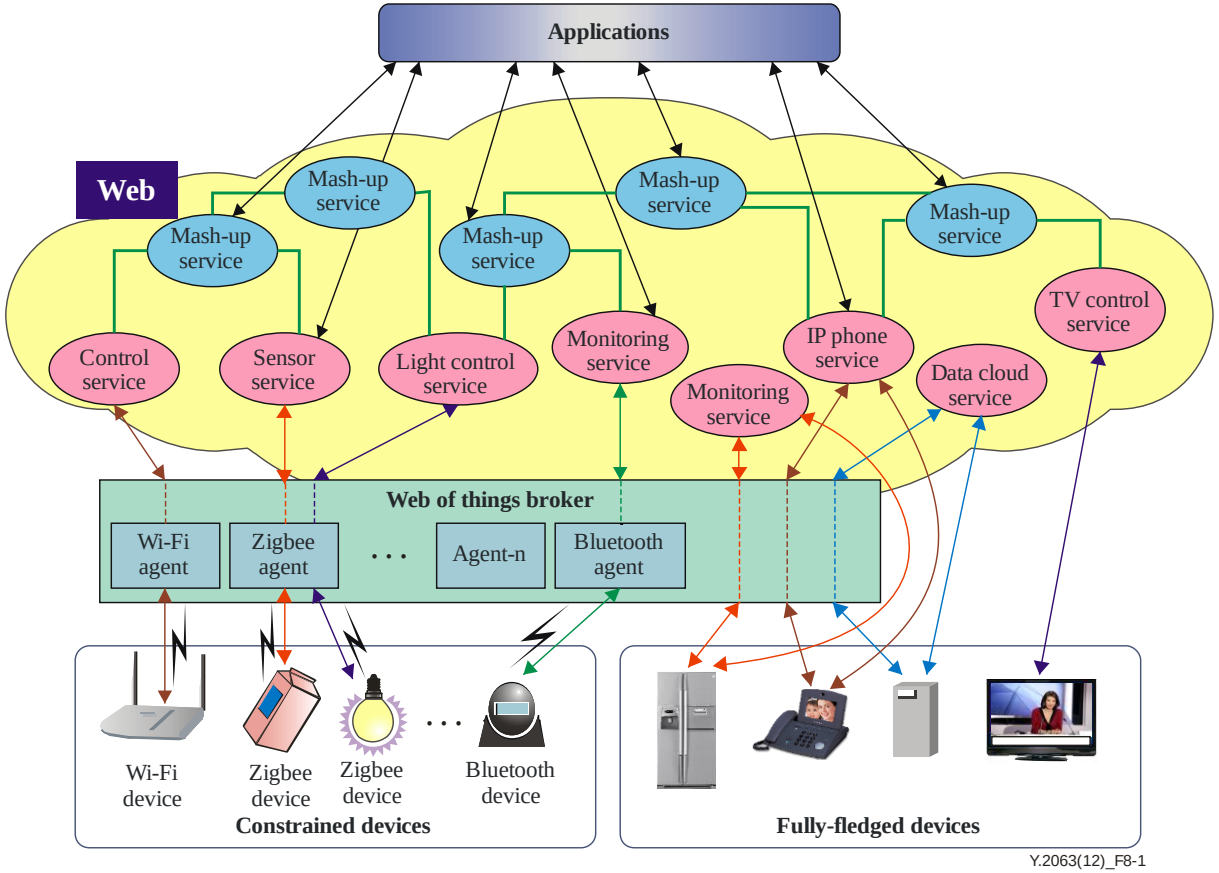
- Y.4400 (07/2012) Framework of the web of things
- Y.4414 (11/2015) Web of things service architecture
- Y.4452 (09/2016) Functional framework of web of objects
- Y.4415 (06/2018) Architecture of web of objects-based virtual home network
- Y.eHealth-Semantic, Architecture of web of objects based semantic mediation model in eHealth service

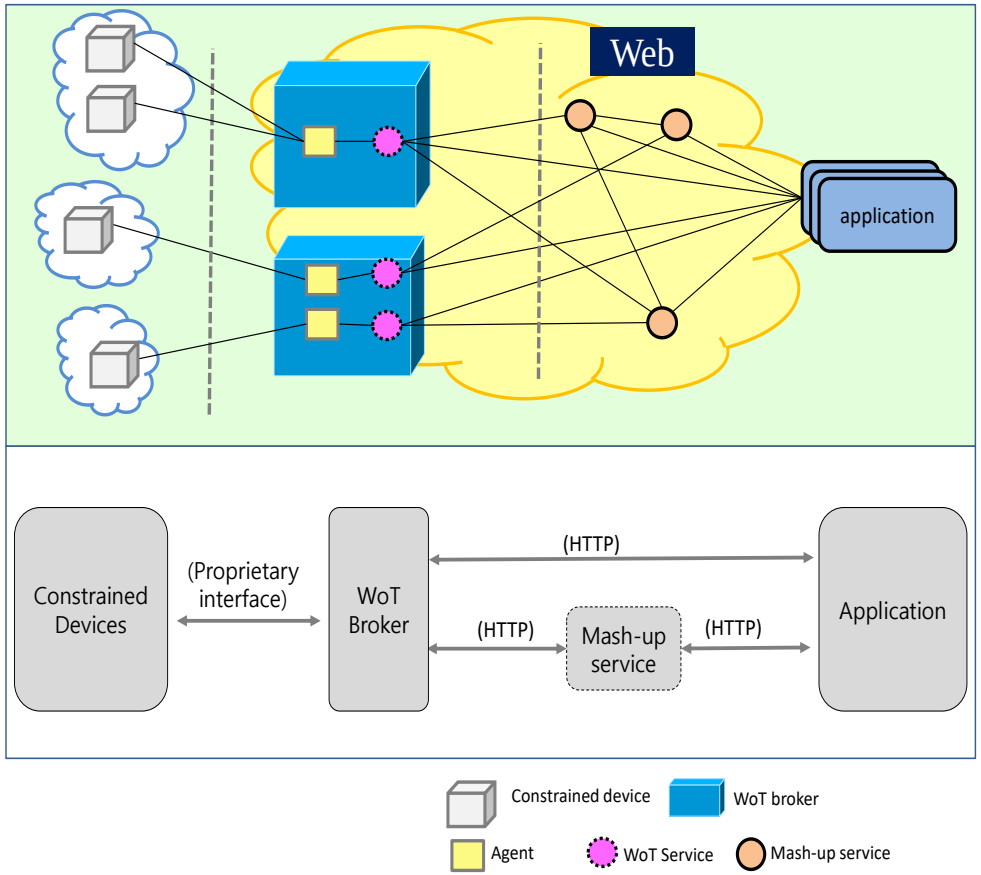
Web of Things

- A way to realize the IoT where (physical and virtual) things are connected and controlled through the World Wide Web
  - The physical devices are mapping the services into the web and those are considered as web resources so that service developers and/or service providers can easily create web applications for the physical devices.

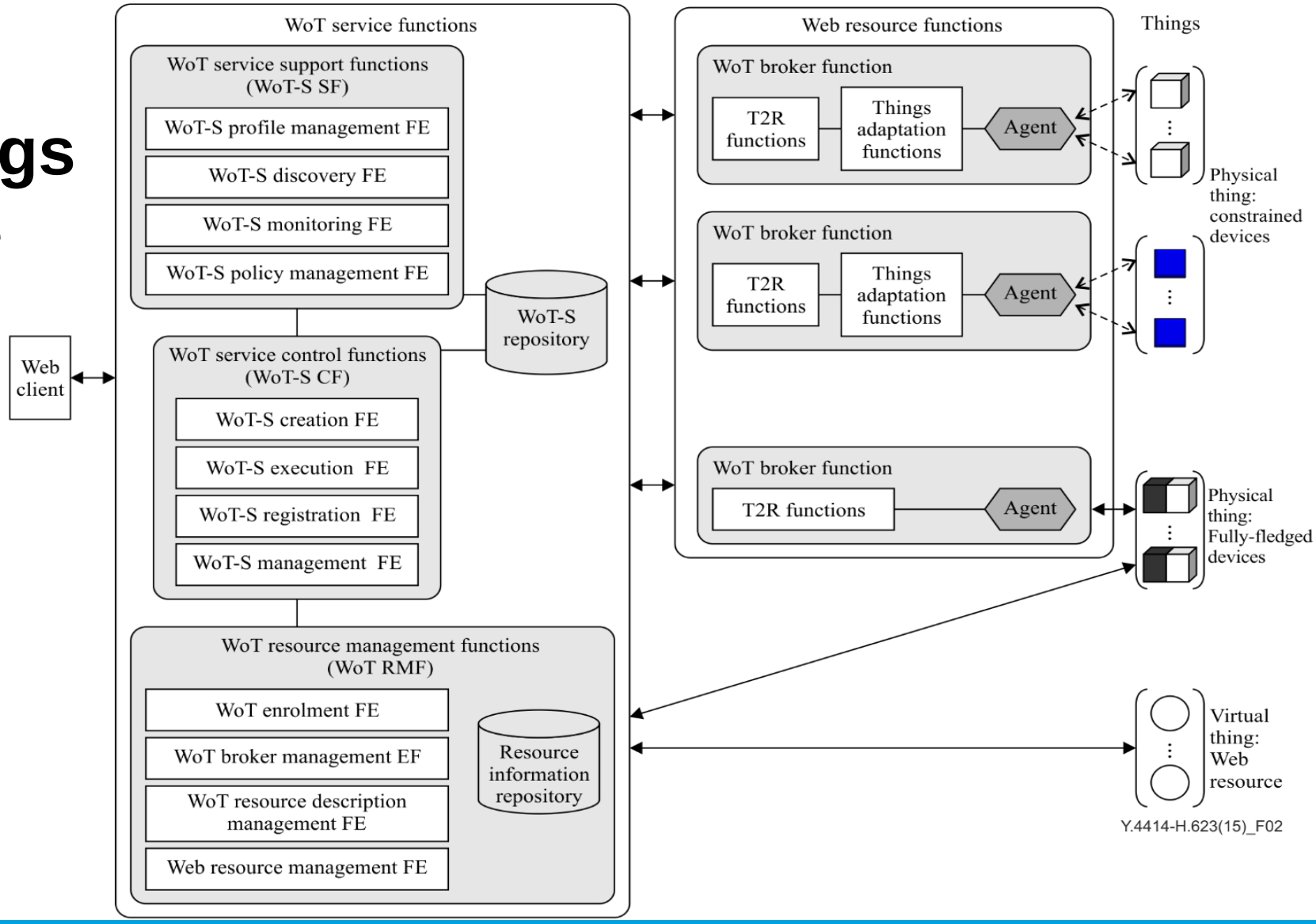


Y.4400 - Framework of the web of things





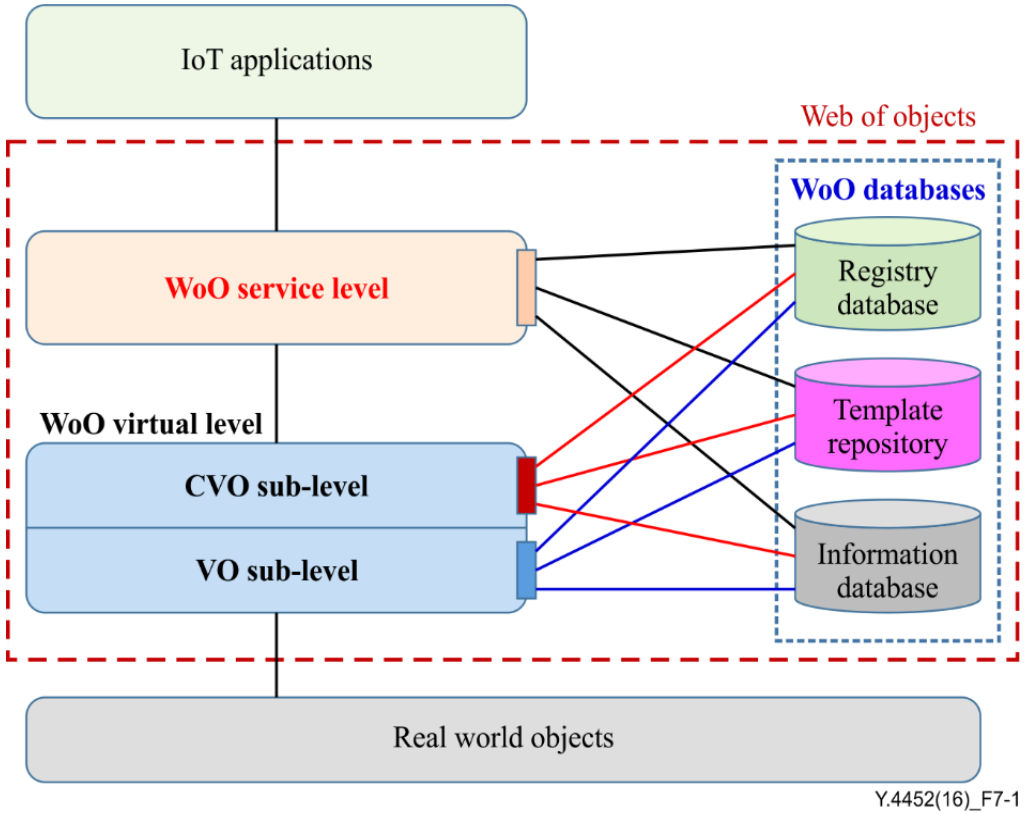
Y.4414 - Web of things service architecture

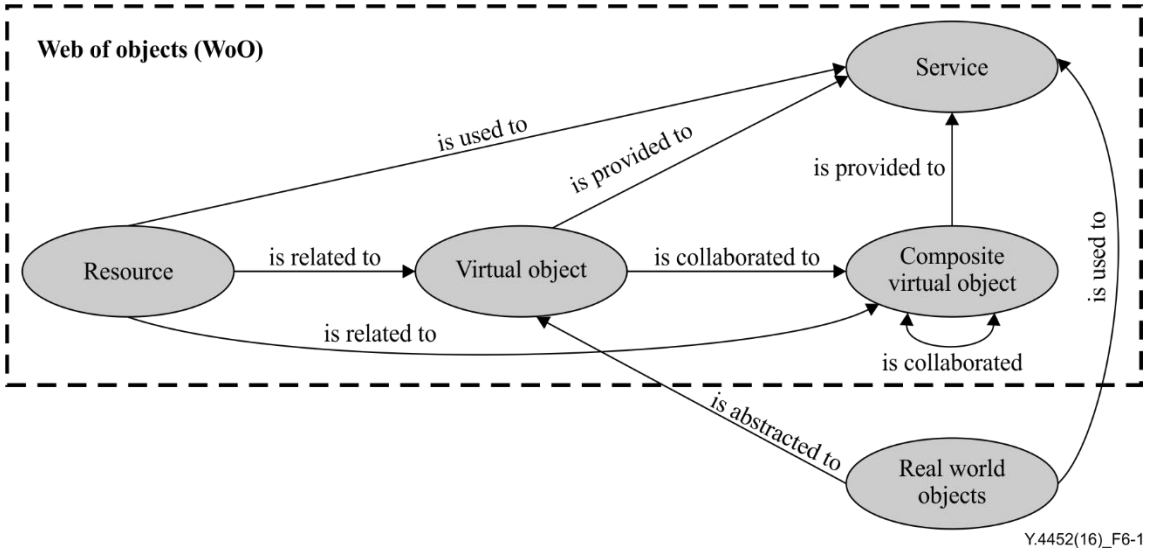


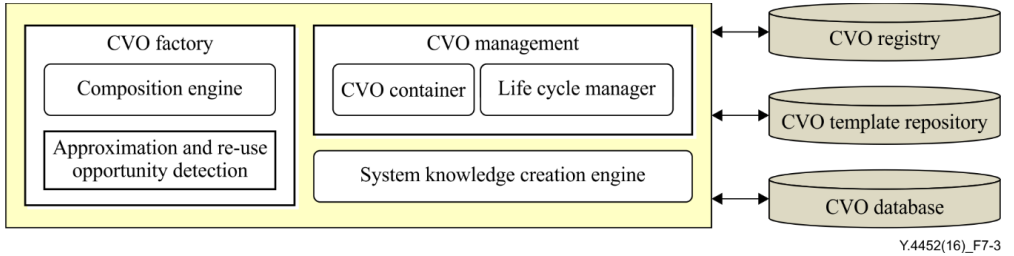
* T2R: Things to resource

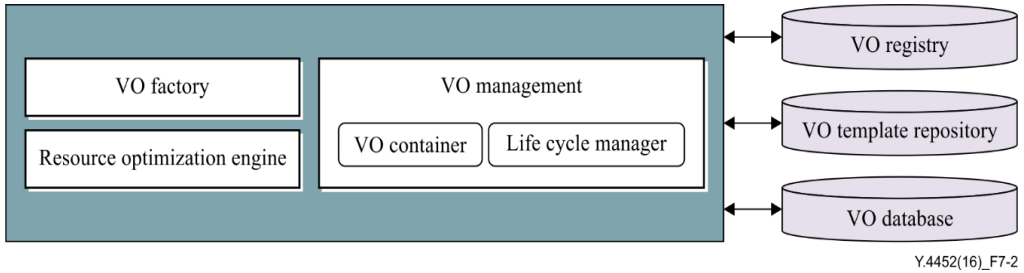
<---> Proprietary interface

Y.4452 - Functional framework of web of objects

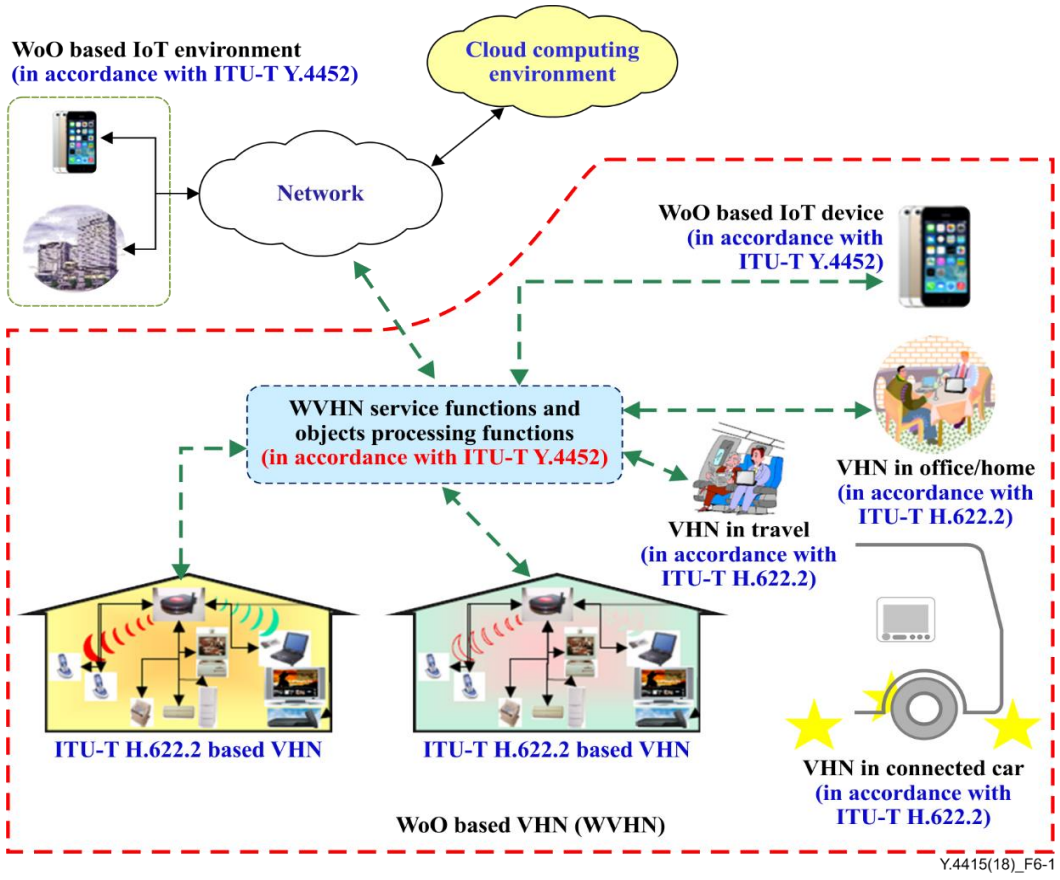


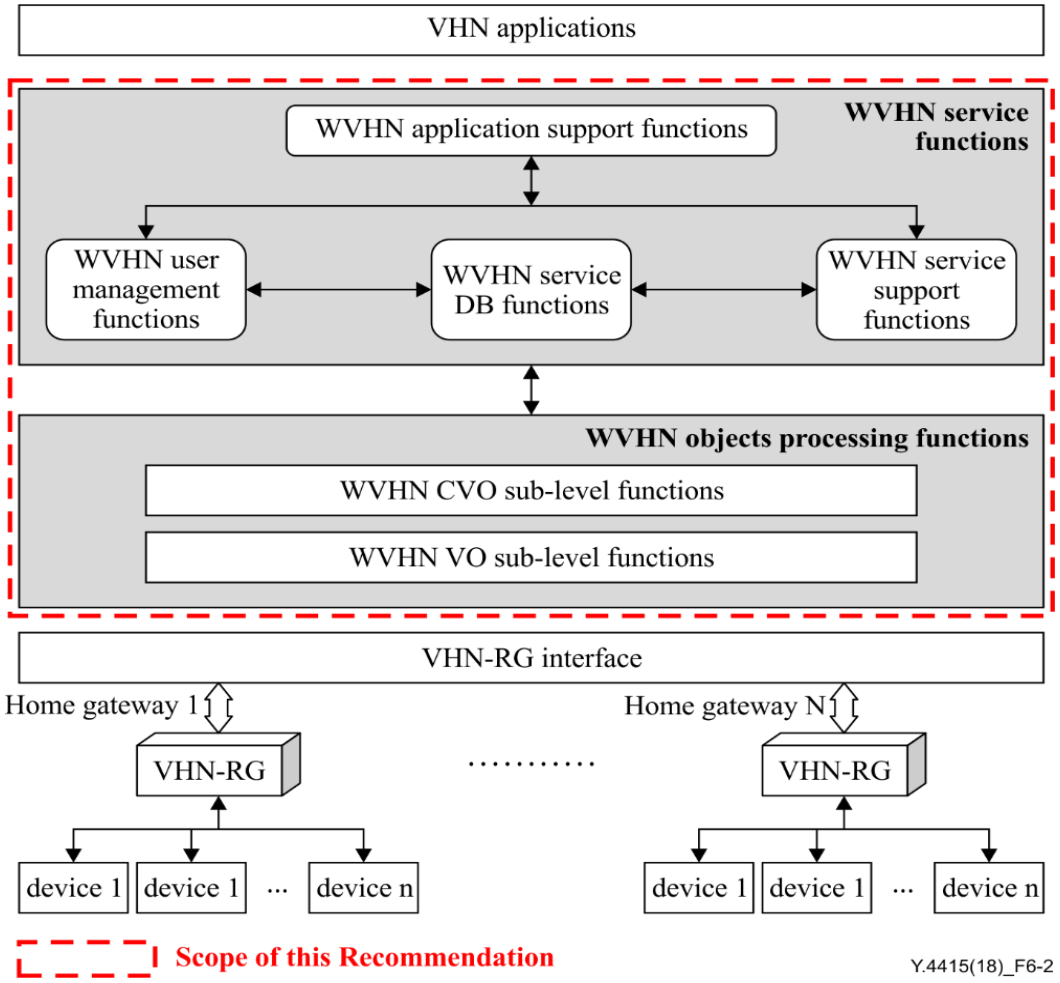




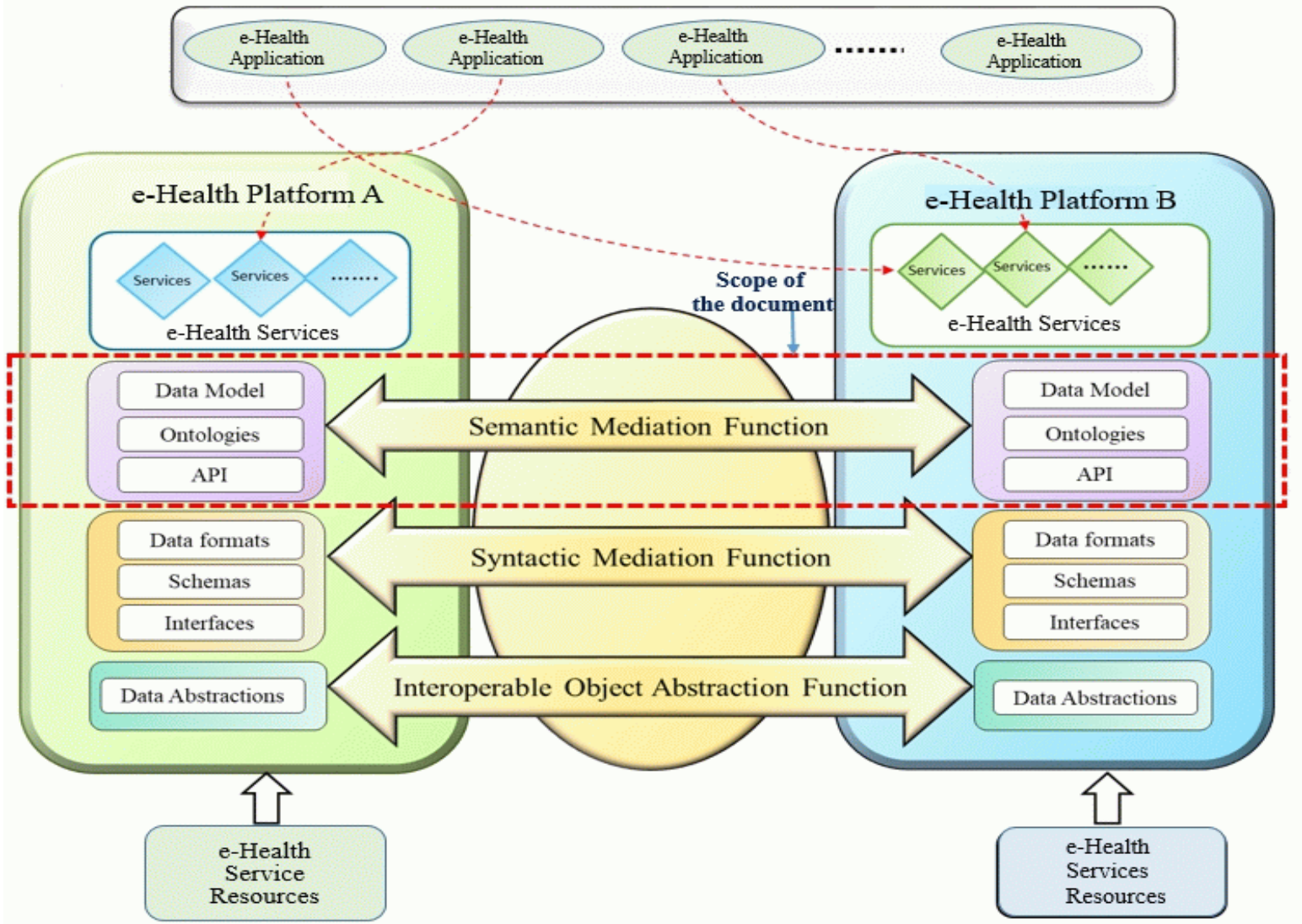


Y.4415 - Architecture of web of objects-based virtual home network





Y.eHealth-Semantic - Architecture of web of objects based semantic mediation model in eHealth service



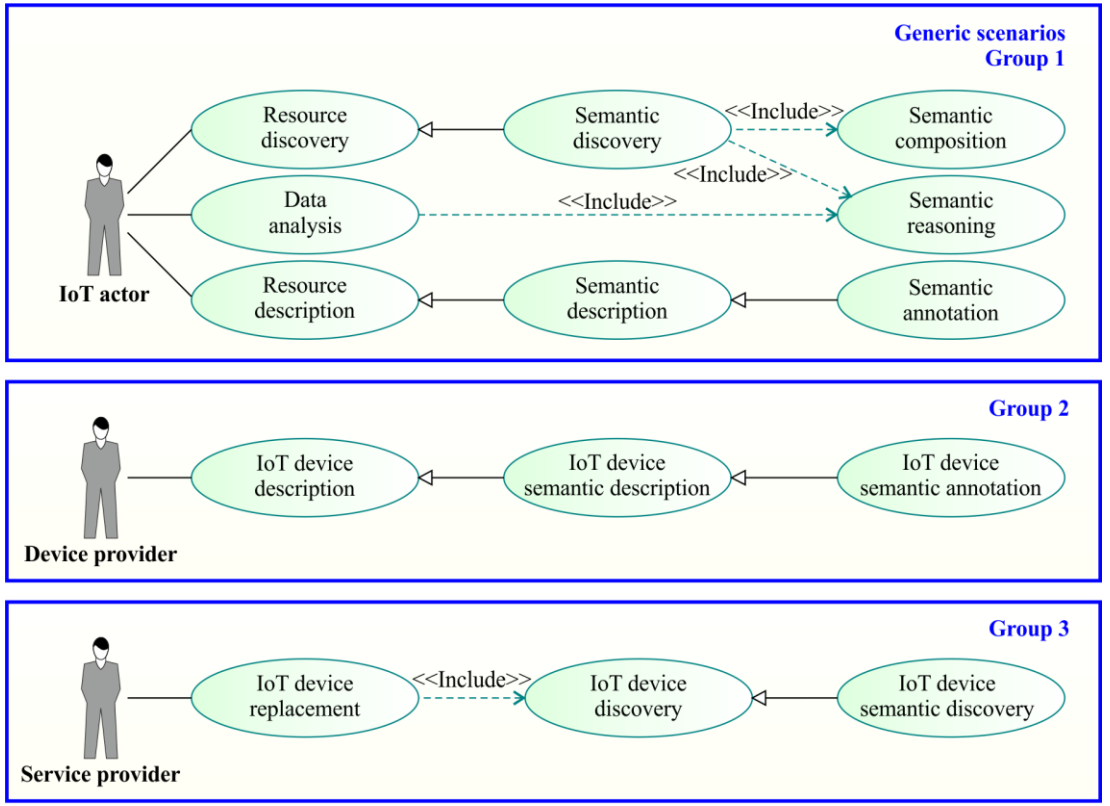
Work Items on Web of Things related studies in ITU-T

- Y.4111 (02/2016) Semantics based requirements and framework of the Internet of things
- Y.4203 (02/2019) Requirements of things description in the Internet of Things
- Y.Suppl.69 (05/2021) Web based data model for IoT and smart city systems and services

Y.4111 - Semantics based requirements and framework of the Internet of things

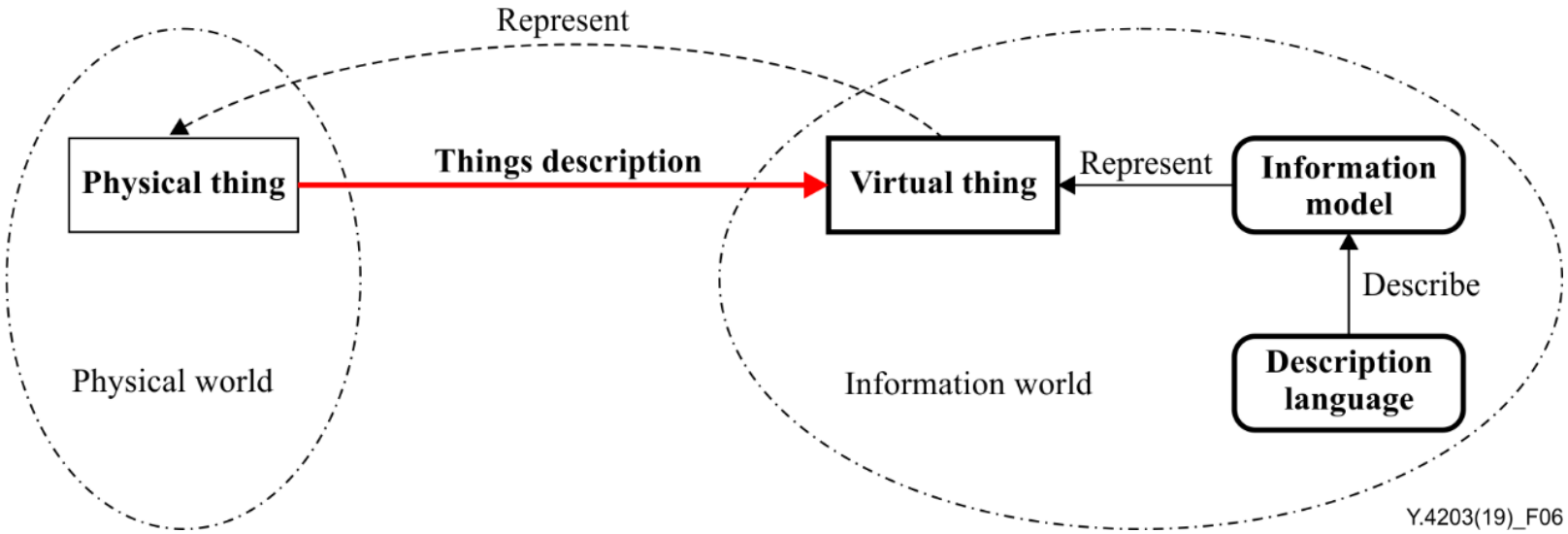
- Essential requirements of the IoT infrastructure for data and services:
  - interoperability, scalability, discovery, consistency, reusability and composability, analytics and reasoning for actionable intelligence, automatic operations
- Semantics based requirements for IoT
  - IoT ontology, Semantic annotation, Semantic interoperability, Semantic discovery, Semantic reasoning, Semantic composition

Semantics based use cases for IoT actors



Y.4203 - Requirements of things description in the Internet of Things

- Things description specifies a general way for how to map physical things in the physical world to virtual things in the information world in order to enable things of the IoT to be effectively discovered, interpreted and used.



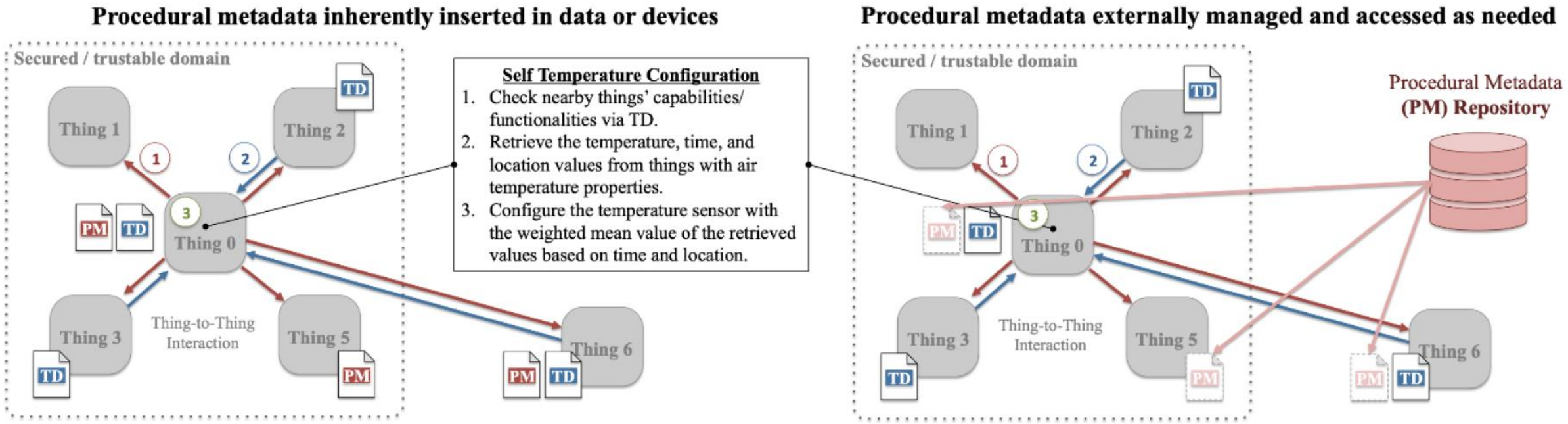
Y.Suppl.69 - Web based data model for IoT and smart city systems and services (1)

- Metadata: common descriptions of devices and data
  - Descriptive metadata*: information for finding or understanding a resource
  - Administrative metadata*: information to help manage the data resource
  - Structural metadata*: information on how the components are organized, including relationships
- Procedural metadata
  - to provide the common descriptions on composable procedures of not only individual devices but also smart systems as a whole based on existing data models and ontologies

* J. Riley (2017). *Understanding Metadata: What is Metadata, and What is it For?: A Primier*. National Information Standards Organization (NISO). Jan. 2017.

Y.Suppl.69 - Web based data model for IoT and smart city systems and services (2)

- Procedural metadata: Example



Potential work items in Smart Cities context (1)

- In June 2021, IEEE and ITU initiated a joint-collaboration to develop the “Global Observatory for Urban Intelligence” (GOUI).
- The aims are to:
  - provide an ongoing understanding of cities
  - understand how digital transformation can best serve cities in developing social, economic and environmental dimension of urban growth, for sustainability and resilience

Potential work items in Smart Cities context (2)

- GOUI: The objectives
  - Create a NEW Smart Cities Ontology as a common language
  - Correlations via semantics
  - Digital Twins - model cities to better understand them
    - Simulation
    - Monitoring
    - Analysis, reporting and prediction

The way forward

- Challenges for Web of Things
  - New applications based on Web
  - Evolution of web technologies

- Collaboration between ITU-T and W3C
  - Web technologies for IoT and Smart Cities
    - Use cases, requirements and architectures, protocols
  - Web-based solutions
    - Digital twins, data analytics, sharing, processing and management, interoperability

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