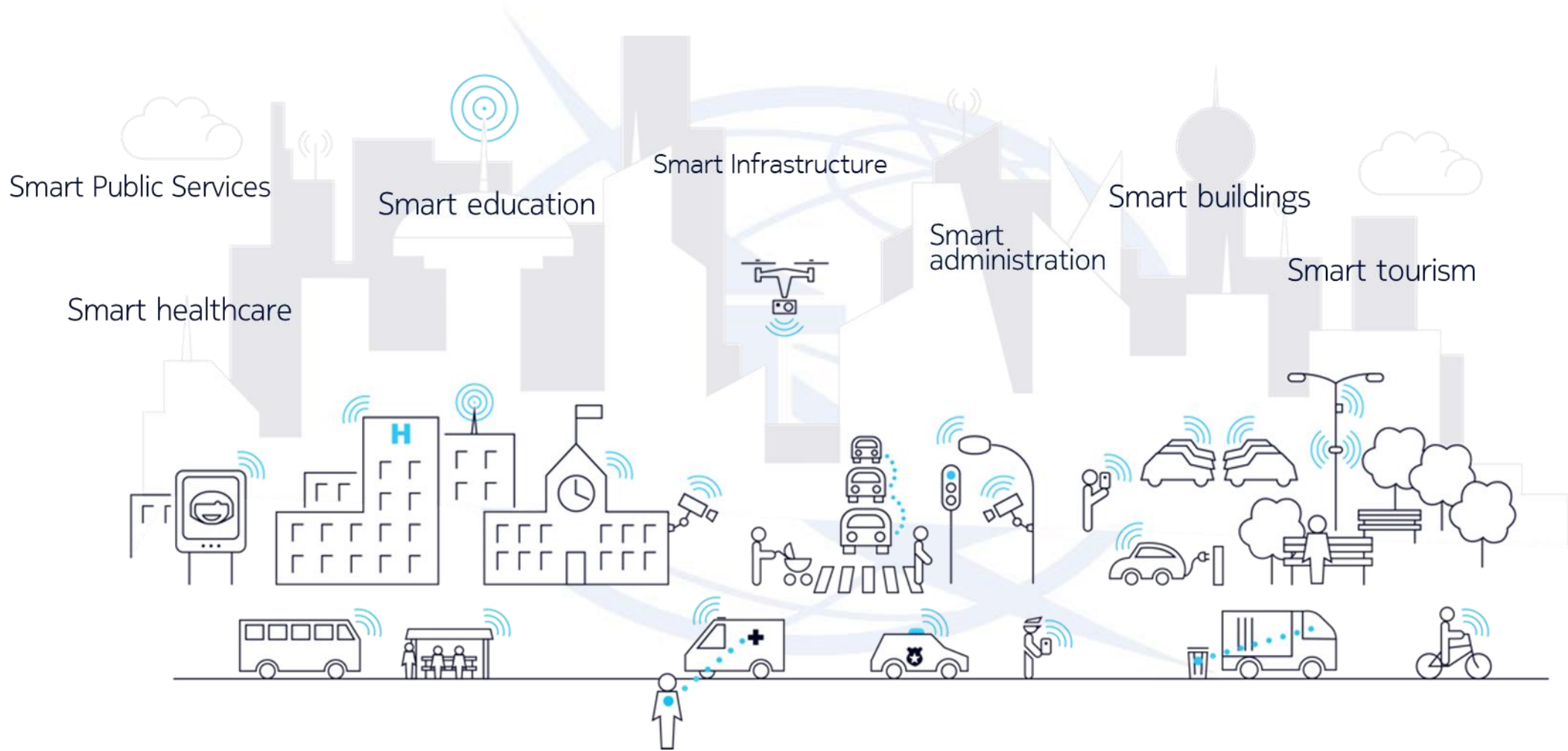


ICT Standardization for Smart Sustainable Cities

Dr. Shane HE
ITU-T Q3/20 Rapporteur
Nokia Bell-Labs and CTO group
1st Digital African Week

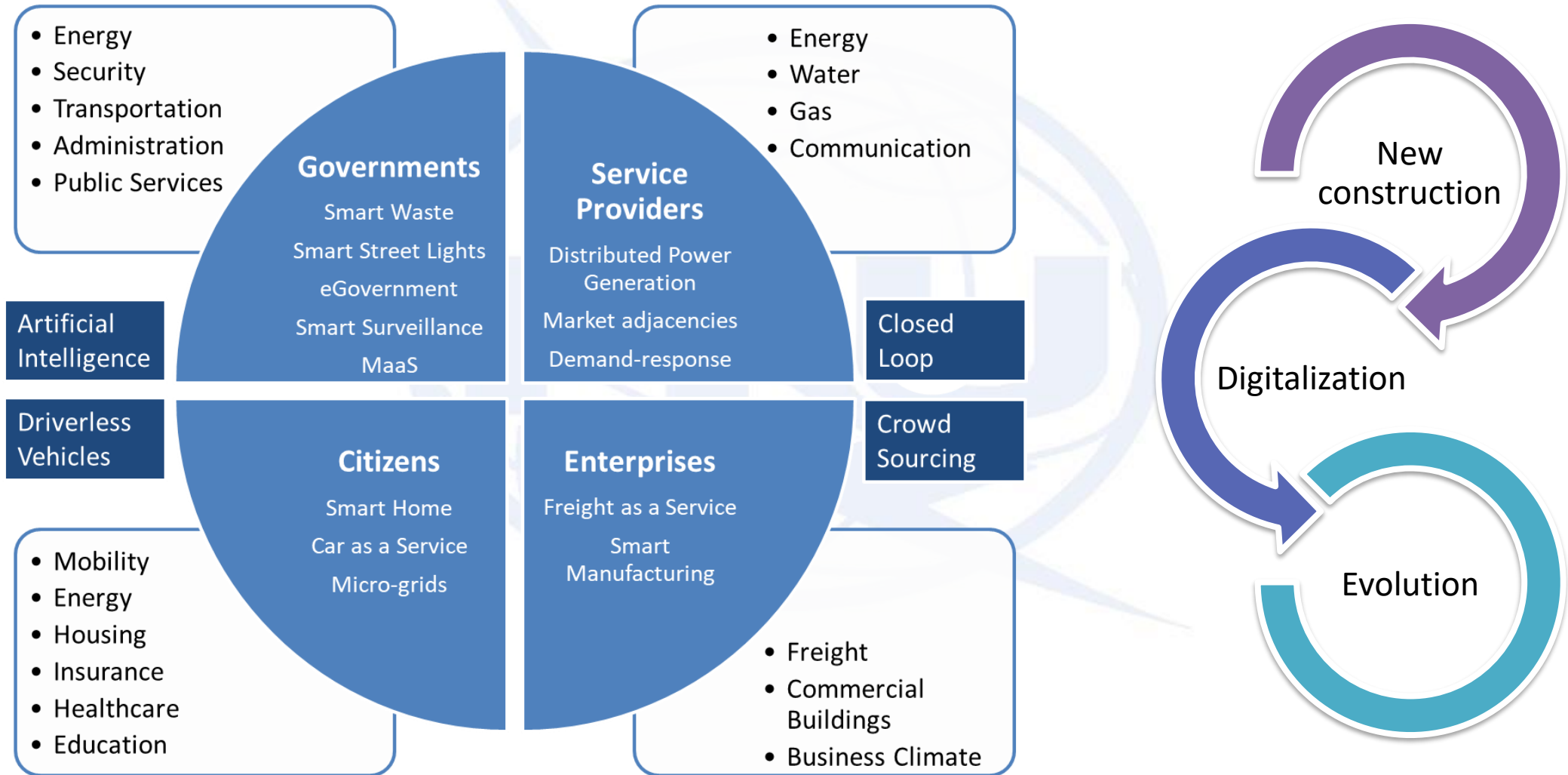


What makes a city smart?



Smart applications improve people's quality of life, engagement, bolster innovation and social and economic development, and make cities more attractive places to live, visit and do business.

Smart Sustainable Cities stakeholders and tasks



Source: ABI research

Build Cities with converged standards

...Use cases



...Requirements

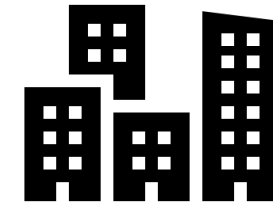


...Verticals



**Converged
standards**

Platforms, APPs, ...



Smart Sustainable Cities



ITU-T SG20 Structure

ACRONYM	TITLE
WP1/20	
Q1/20	End to end connectivity, networks, interoperability, infrastructures and Big Data aspects related to IoT and SC&C
Q2/20	Requirements, capabilities, and use cases across verticals
Q3/20	Architectures, management, protocols and Quality of Service
Q4/20	e/Smart services, applications and supporting platforms
WP2/20	
Q5/20	Research and emerging technologies, terminology and definitions
Q6/20	Security, privacy, trust and identification for IoT and SC&C
Q7/20	Evaluation and assessment of Smart Sustainable Cities and Communities
Regional groups	
SG20RG-LATAM	ITU-T SG20 Regional Group for the Latin American Region
SG20RG-EECAT	ITU-T SG20 Regional Group for Eastern Europe, Central Asia and Transcaucasia
SG20RG-ARB	ITU-T SG20 Regional Group for the Arab Region
SG20RG-AFR	ITU-T SG20 Regional Group for the Africa Region
Other groups under SG20	
JCA-IoT and SC&C	Joint Coordination Activity on Internet of Things and Smart Cities and Communities
FG-DPM	Focus Group on Data Processing and Management to support IoT and Smart Cities & Communities

Q2/20: Requirements, capabilities and use cases across verticals

Scope

This Question addresses the support of emerging services and applications for IoT and SC&C, with consideration of the different verticals. On the basis of use cases and related ecosystem aspects, requirements and capabilities imposed on IoT are specified.

Studies include:

- use cases for IoT and SC&C services and applications in different verticals
- requirements and capabilities for their support

Capabilities subject to specification include, but are not limited to:

- vertical specific capabilities and capabilities common to applications in different verticals

Main tasks

Developing Recommendations, Reports, Handbooks, Guidelines etc. as appropriate for the support of emerging services and applications for IoT and SC&C, covering:

- different verticals
- use cases
- ecosystem aspects taking into account business models and use cases
- requirements for IoT and SC&C services and applications
- capabilities imposed on the IoT

Providing the necessary collaboration for joint activities in this field within ITU and between ITU-T and other relevant SDOs, consortia and fora.

More details in: <https://www.itu.int/en/ITU-T/studygroups/2017-2020/20/Pages/q2.aspx>

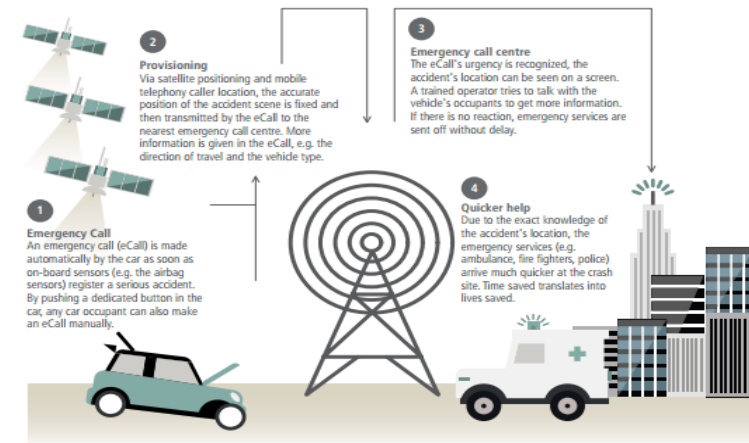


Q2/20 main progress

14 Approved Recommendations + 1 Sup (2017-2020)

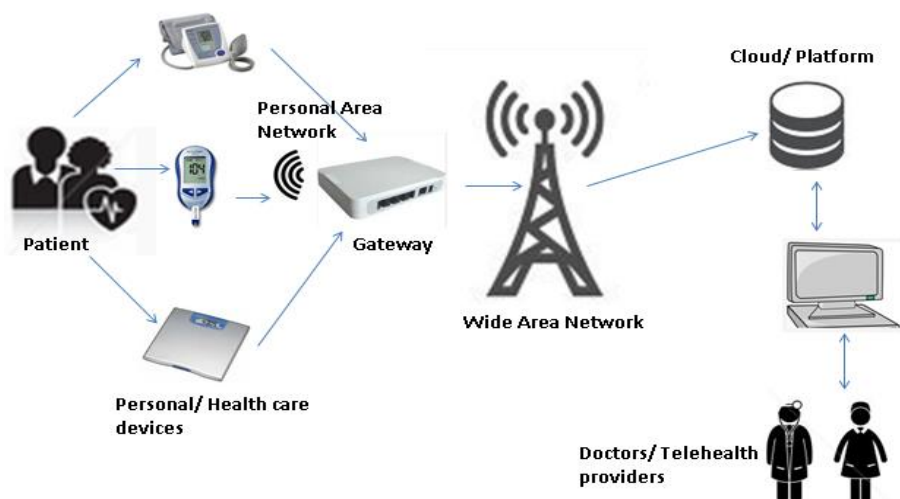
Work item	Question	Subject/title	Timing	Work item	Question	Subject/title	Timing
■ Y.4003 (ex Y.SmartMan-IIoT-overview)	Q2/20	Overview of smart manufacturing in the context of the industrial Internet of things	2018-05	■ Y.4121 (ex Y.IoT-GP-Reqts)	Q2/20	Requirements of an Internet of Things enabled network for support of applications for global processes of the Earth	2018-05
■ Y.4101/Y.2067	Q2/20	Common requirements and capabilities of a gateway for Internet of Things applications	2017-09	■ Y.4202 (ex Y.WPT-usecase)	Q2/20	Framework of wireless power transmission application service	2018-12
■ Y.4114 (ex Y.IoT-BigData-reqts)	Q2/20	Specific requirements and capabilities of the IoT for Big Data	2017-03	■ Y.4203 (ex Y.IoT-things-description-reqts)	Q2/20	Requirements of things description in the Internet of things	2018-12
■ Y.4116 (ex Y.TPS-req)	Q2/20	Requirements of transportation safety service including use cases and service scenarios	2017-09	■ Y.4204 (ex Y.Accessibility-IoT)	Q2/20	Accessibility requirements for the Internet of things applications and services	2018-12
■ Y.4117 (ex Y.IoT-WDS-Reqts)	Q2/20	Requirements and capabilities of Internet of Things for support of wearable devices and related services	2017-09	■ Y.4206 (ex Y.UCS-reqts)	Q2/20	Requirements and capabilities of user-centric work space service	2019-04
■ Y.4118 (ex Y.IoT-AC-reqts)	Q2/20	Internet of Things requirements and technical capabilities for support of accounting and charging	2018-01	■ Y.4207 (ex Y.SEM)	Q2/20	Requirements and capability framework of smart environmental monitoring	2019-04
■ Y.4119 (ex Y.AERS-reqts)	Q2/20	Requirements and capability framework for IoT-based automotive emergency response system	2018-01	■ Y.Sup.53 to Y.4000 series (ex Y.Sup.IoT-Use-Cases)	Q2/20	IoT use cases	2018-12
■ Y.4120 (ex Y.IoT-Retail-Reqts)	Q2/20	Requirements of Internet of things applications for smart retail stores	2018-05				

Y.Sup.53 to Y.4000 series (ex Y.Sup.IoT-Use-Cases)

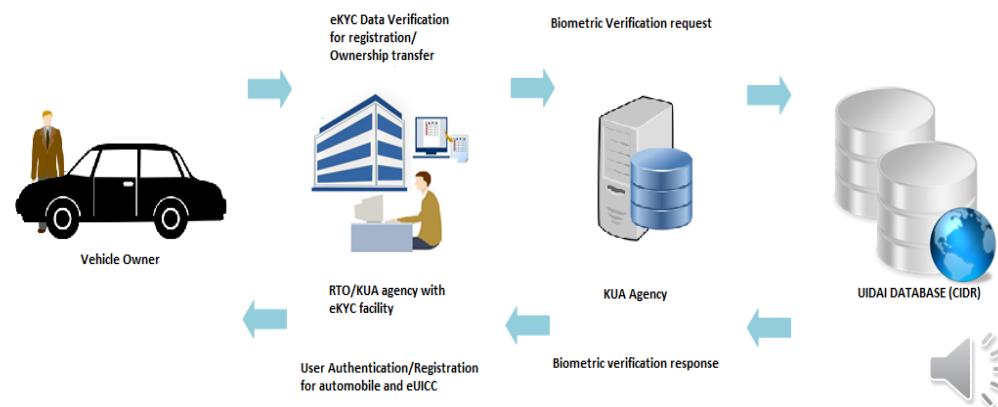


Vehicle Emergency Call System for automotive road safety

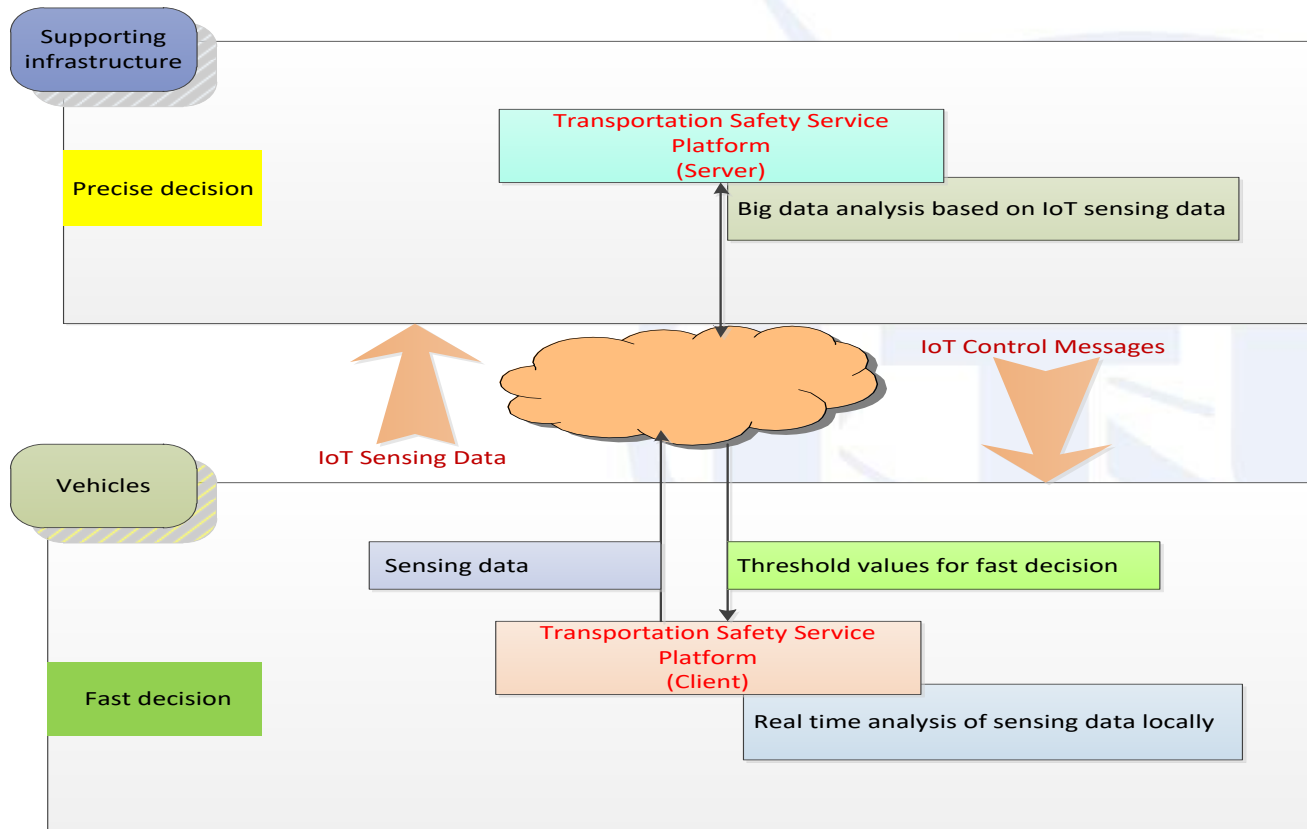
1. Remote monitoring of health of a patient



Digitization and automation of Vehicle Tracking, Safety, Conformance, Registration and Transfer via the application of e-SIM and Digital Identity



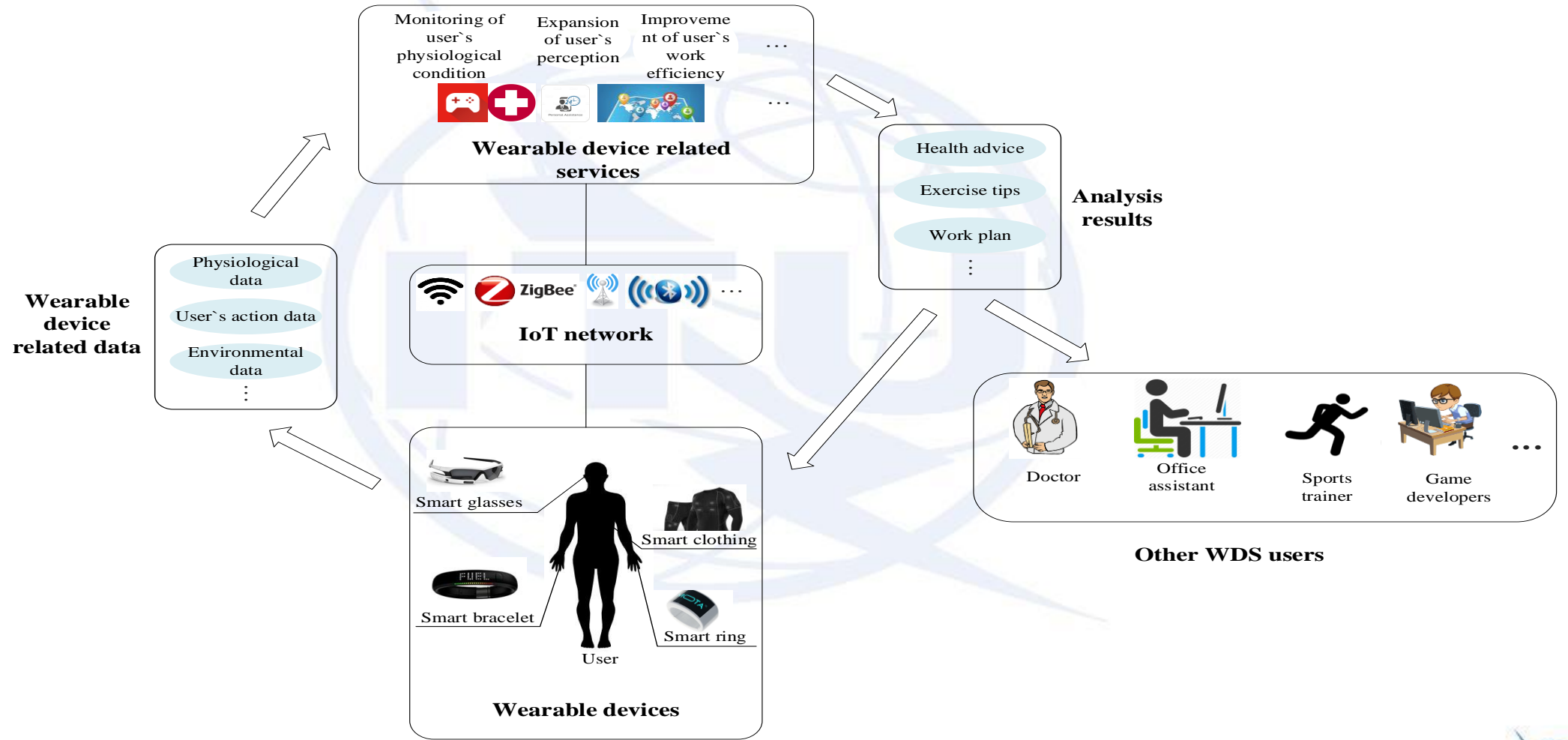
Y.4116 “Requirements of transportation safety services including use cases and service scenarios”



Vehicles locally process and compare sensing data to threshold values for fast decision. Sensing data from vehicles and transportation infrastructure are delivered to the transportation safety service platform (server side). The platform generates threshold values (e.g. safety indexes) for more accurate decision based on big data analysis. The generated threshold values are delivered to vehicles for appropriate adjustment of the local decision making process.

Figure : Example of decision making based on distributed processing technology

Y.4117 "Requirements and capabilities of IoT for support of wearable devices and related services"



Analytics applications with wearable devices and related services

Q3/20: Architectures, management, protocols and Quality of Service

Scope

This Question addresses IoT functional architectures, protocols, management mechanisms, and QoS (including performance) of IoT and Smart Sustainable Cities and Communities (SC&C), which needed to construct architectural frameworks for the following reasons:

- to control network attachment procedures (including mobility management);
- to control session establishment and release, to control network resources (including QoS control);
- to interact with services and applications and to interact with legacy networks, etc.

Main Tasks

Developing Recommendations, Reports, Handbooks, Guidelines, etc. as appropriate on:

- Conducting studies on general reference models on IoT and vertical industry needs;
- Developing frameworks to identify the basic architectural compositions and views on IoT;
- Determining the requirements that the connectivities and protocols are intended to support;
- Identifying performance requirements of connectivity technologies that will enable them to meet the IoT requirements;
- Identifying mechanisms for achieving QoS and its measurement principles required for IoT and SC&C;
- Identifying interfaces for interoperability between different IoT network elements;
- Defining interworking with legacy systems;
- Developing intelligence control related technologies that will provide support to IoT applications and services for various verticals and systems;
- Identifying mechanisms for achieving architectural interoperability for IoT and SC&C;
- Providing the necessary collaboration for joint activities in this field within ITU and between ITU-T and SDOs, consortia and fora.

More details in: <https://www.itu.int/en/ITU-T/studygroups/2017-2020/20/Pages/q3.aspx>



Q3/20 main progress

23 Approved Recommendations (2017-2020)

Work item	Question	Subject/title	Timing	Study group	Study period
Y.4115 (ex Y.IoT-DE-RA)	Q3/20	Reference architecture for IoT device capabilities exposure	2017-03	SG20	2017-2020
Y.4416 (ex Y.NGNe-IoT-arch)	Q3/20	Architecture of the Internet of things based on next generation network evolution	2018	SG20	2017-2020
Y.4417 (ex Y.IoT-son)	Q3/20	Framework of self-organization network in the IoT environments	2018	SG20	2017-2020
Y.4418 (ex Y.gw-IoT-arch)	Q3/20	Functional architecture of gateway for Internet of things applications	2018	SG20	2017-2020
Y.4455 (ex Y.IoT-NCE)	Q3/20	Reference architecture for IoT network service capability exposure	2017-09	SG20	2017-2020
Y.4460 (ex Y.dev-IoT-arch)	Q3/20	Architectural reference models of devices for IoT applications	2019-04	SG20	2017-2020
Y.4500.1 (ex Y.oneM2M.ARC)	Q3/20	oneM2M- Functional Architecture	2017-09	SG20	2017-2020
Y.4500.2 (ex Y.oneM2M.REQ)	Q3/20	oneM2M- Requirements	2018-01	SG20	2017-2020
Y.4500.4 (ex Y.oneM2M.SLCP)	Q3/20	oneM2M- Service Layer Core Protocol Specification	2018-01	SG20	2017-2020
Y.4500.5 (ex Y.oneM2M.DM.OMA)	Q3/20	oneM2M- Management enablement (OMA)	2018-10	SG20	2017-2020
Y.4500.6 (ex Y.oneM2M.DM.BBF)	Q3/20	oneM2M Management enablement (BBF)	2018-01	SG20	2017-2020
Y.4500.8 (ex Y.oneM2M.PB.CoAP)	Q3/20	oneM2M- CoAP Protocol Binding	2018-01	SG20	2017-2020
Y.4500.9 (ex Y.oneM2M.PB.HTTP)	Q3/20	oneM2M- HTTP Protocol Binding	2018-01	SG20	2017-2020
Y.4500.10 (ex Y.oneM2M.PB.MQTT)	Q3/20	oneM2M- MQTT Protocol Binding	2018-01	SG20	2017-2020
Y.4500.11 (ex Y.oneM2M.CT)	Q3/20	oneM2M- Common Terminology	2018-01	SG20	2017-2020
Y.4500.12 (ex Y.oneM2M.BO)	Q3/20	oneM2M Base Ontology	2018-01	SG20	2017-2020
Y.4500.13 (ex Y.oneM2M.InteropTest)	Q3/20	oneM2M- Interoperability Testing	2018-01	SG20	2017-2020



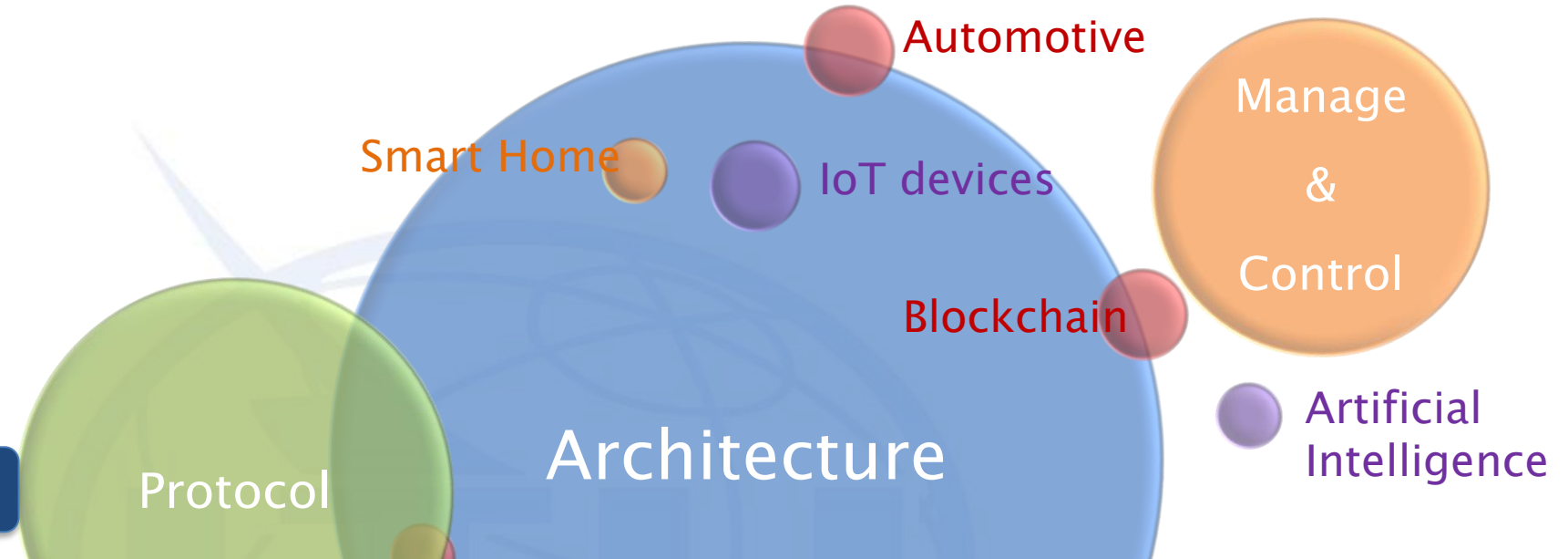
23 Approved Recommendations (2017-2020)

Y.4500.14 (ex Y.oneM2M.IWK.LwM2M)	Q3/20	oneM2M- LwM2M Interworking	2018-01	SG20	2017-2020
Y.4500.15 (ex Y.oneM2M.TF)	Q3/20	oneM2M- Testing framework	2018-01	SG20	2017-2020
Y.4500.20 (ex Y.oneM2M.PB.WebSocket)	Q3/20	oneM2M- WebSocket Protocol Binding	2018-01	SG20	2017-2020
Y.4500.22 (ex Y.oneM2M.FDC)	Q3/20	oneM2M- Field Device Configuration	2018-01	SG20	2017-2020
Y.4500.23 (ex Y.oneM2M.HAIM)	Q3/20	oneM2M-Home Appliances Information Model and Mapping	2018-01	SG20	2017-2020
Y.4500.32 (ex Y.oneM2M.MAF,MEF)	Q3/20	oneM2M- MAF and MEF Interface Specification	2018-01	SG20	2017-2020

6 Approved TRs (2017-2020)

Y.oneM2M.Ind.DE	Q3/20	oneM2M Industrial Domain Enablement	2017-09
Y.oneM2M.DG.SEM	Q3/20	oneM2M-Developer Guide of Implementing semantics	2017-09
Y.oneM2M.DG.AppDev	Q3/20	oneM2M- Application developer guide: Light control example using HTTP binding	2017-09
Y.oneM2M.DG.CoAP	Q3/20	oneM2M Developer Guide of CoAP binding and long polling for temperature monitoring	2017-09
Y.oneM2M.DG.DM	Q3/20	oneM2M- Developer guide of device management	2017-09
Y.oneM2M.UCC	Q3/20	oneM2M Use Case Collection	2017-09

Q3/20 key activities

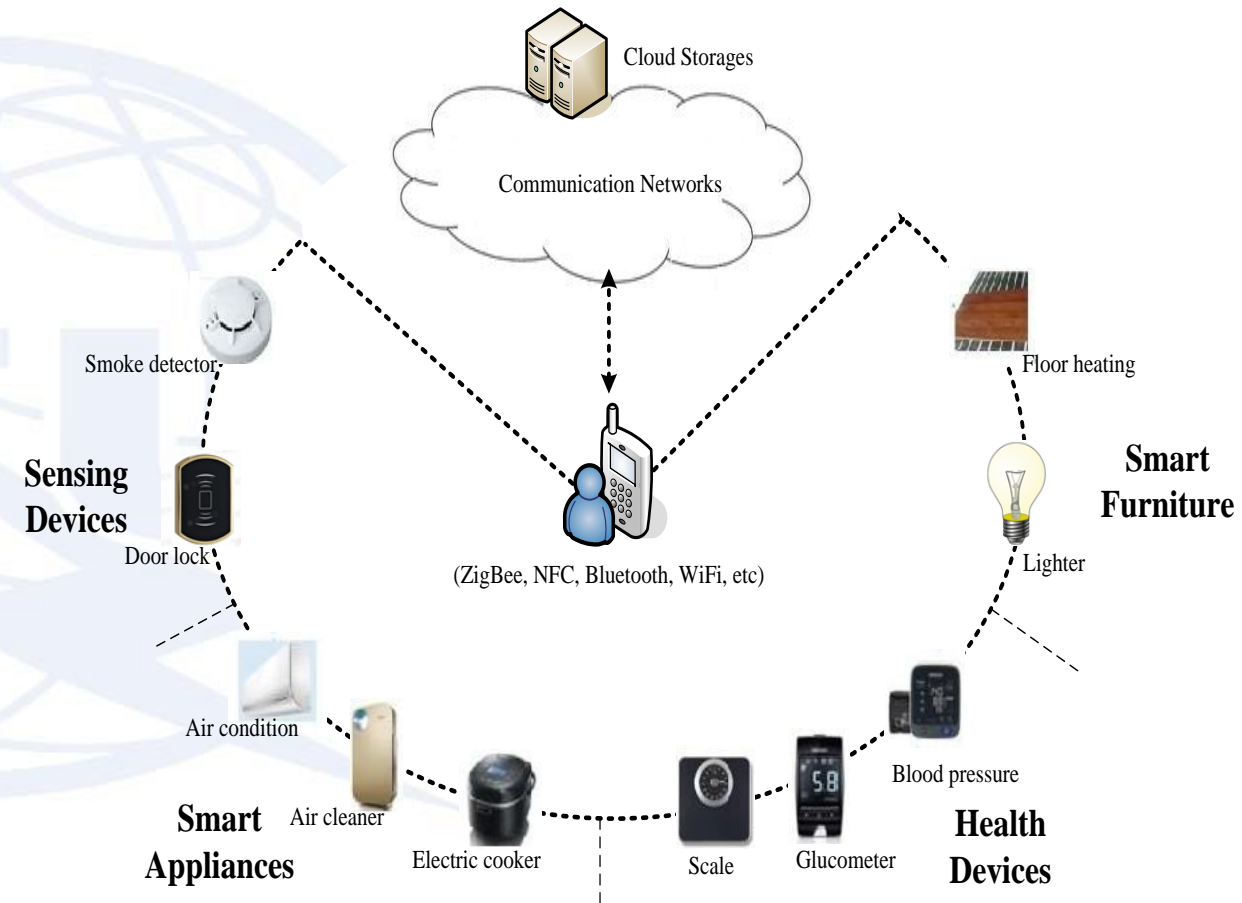
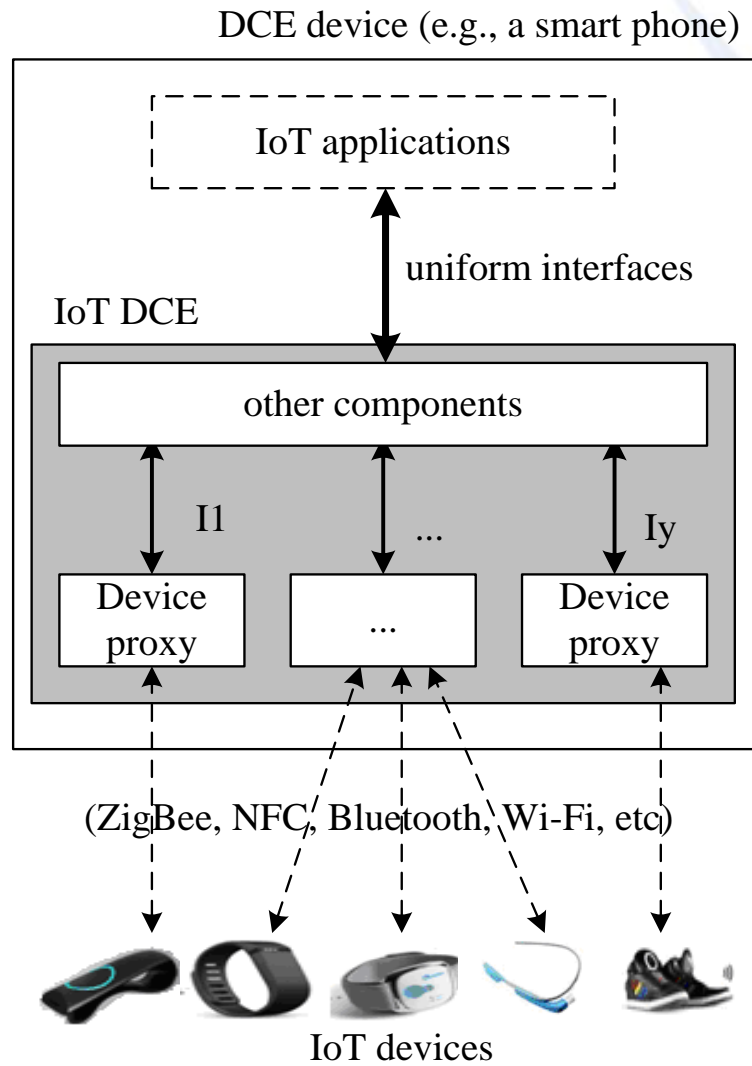


Ongoing WIs

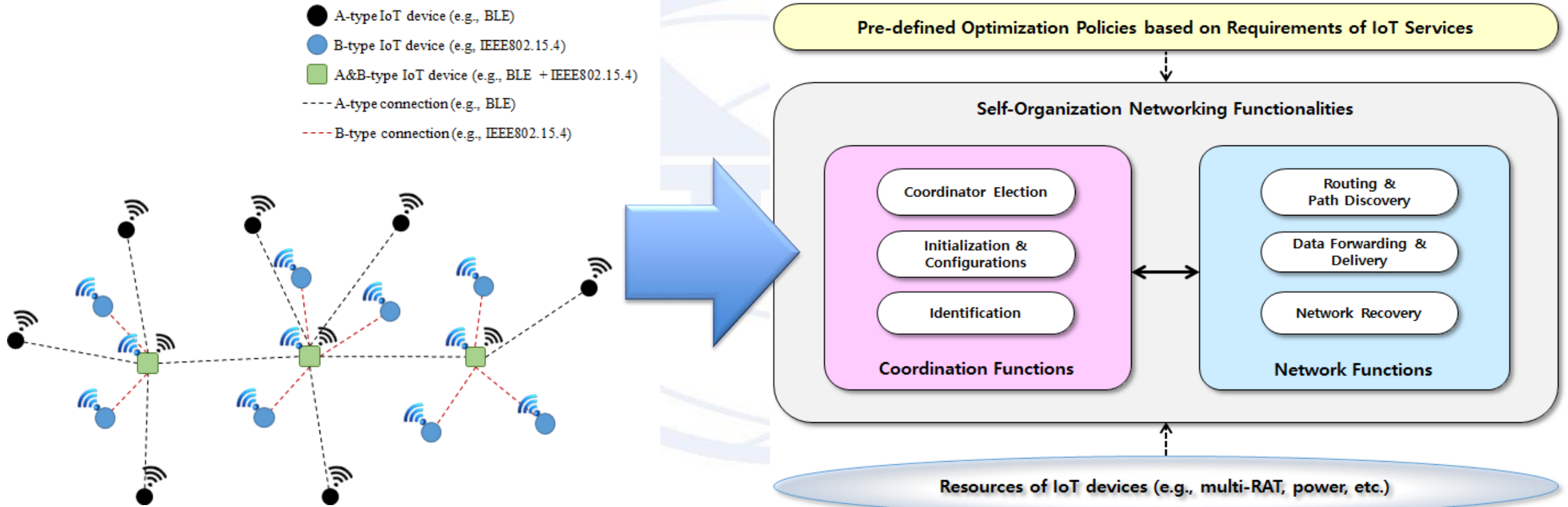
Y.IoT-rf-dlt	OID-based Resolution framework for transaction of distributed ledger assigned to IoT resources	Y.AERS-msd	Minimum set of data structure for automotive emergency response system
Y.IoT-rmc	Reference architecture of accessing IoT resources for management and control	Y.AERS-mtp	Minimum set of data transfer protocol for automotive emergency response system
Y.IoT-sd-arch	Functional architecture of Service Discovery for Interworking between Heterogeneous IoT Platforms	Y.cnce-IoT-arch	Functional architecture of cellular-radio network capability exposure for smart hospital based on Internet of things
Y.NDA-arch	Functional architecture of network-based driving assistance for autonomous vehicles	Y.dec-IoT-arch	Decentralized IoT communication architecture based on information centric networking and blockchain
Y.SCCE-arch	Reference architecture of spare computational capability exposure of IoT devices for smart home	Y.IoT-ics	Requirements and functional architecture of Open IoT identity correlation service
Y.SSC-AISE-arc	Reference architecture of artificial intelligence service exposure for smart sustainable cities	Y.UIS-IoT	Unified Identity/Identifier/Locator Split (UIS) Services and Architecture in IoT Environment
Y.UAV.arch	Functional architecture for unmanned aerial vehicles and unmanned aerial vehicle controllers using IMT-2020 networks	Y.IoT-AOS-prot	Protocols of supporting autonomic operations in the Internet of things



ITU-T Recommendation Y.4115: IoT device capability exposure

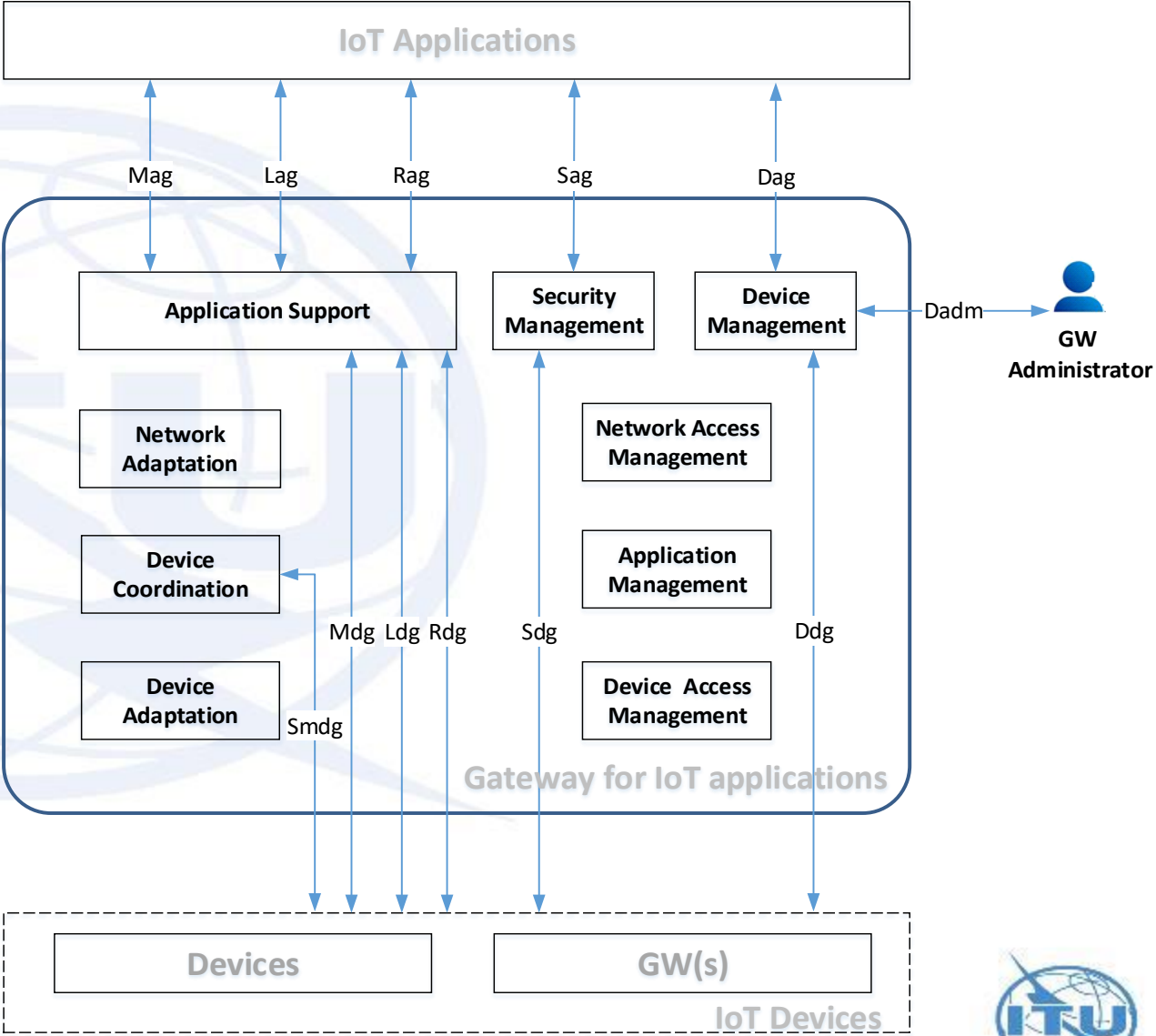


ITU-T Recommendation Y.4417: Framework of self-organization network in the IoT environments



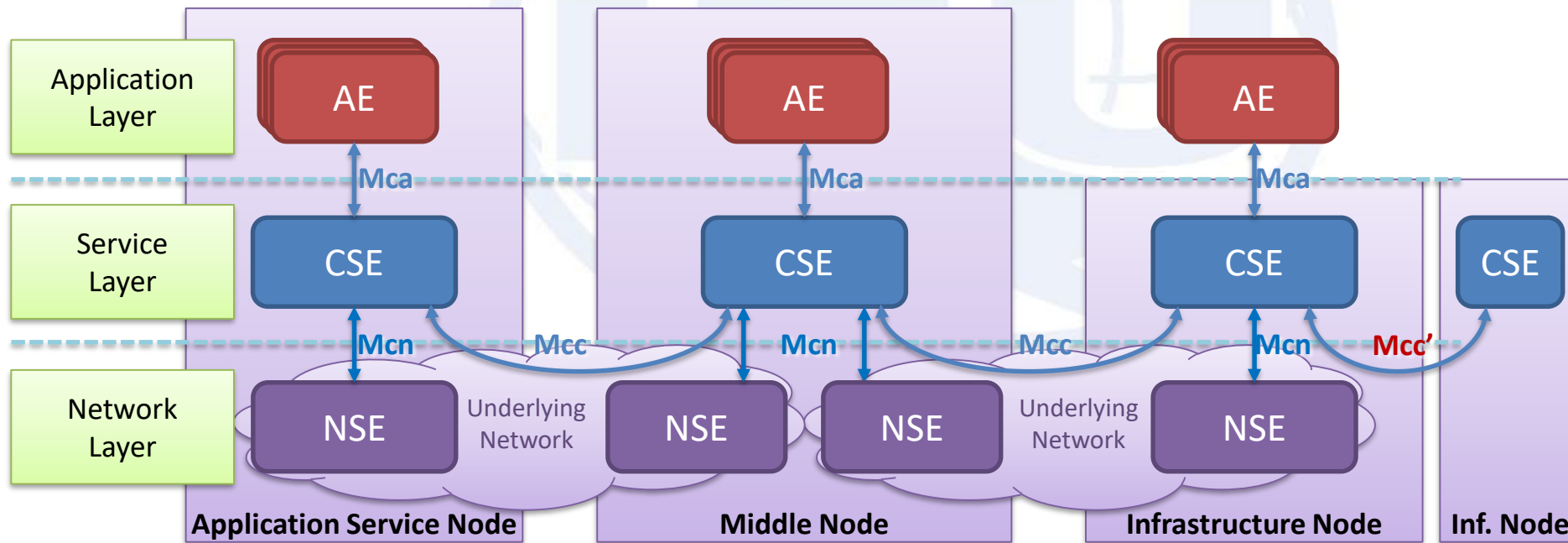
ITU-T Recommendation Y.4418: Gateway for IoT applications

- Functional architecture
- functional entities
- reference points
- Logical flows



ITU-T Recommendation Y.4500.1: oneM2M Functional Architecture

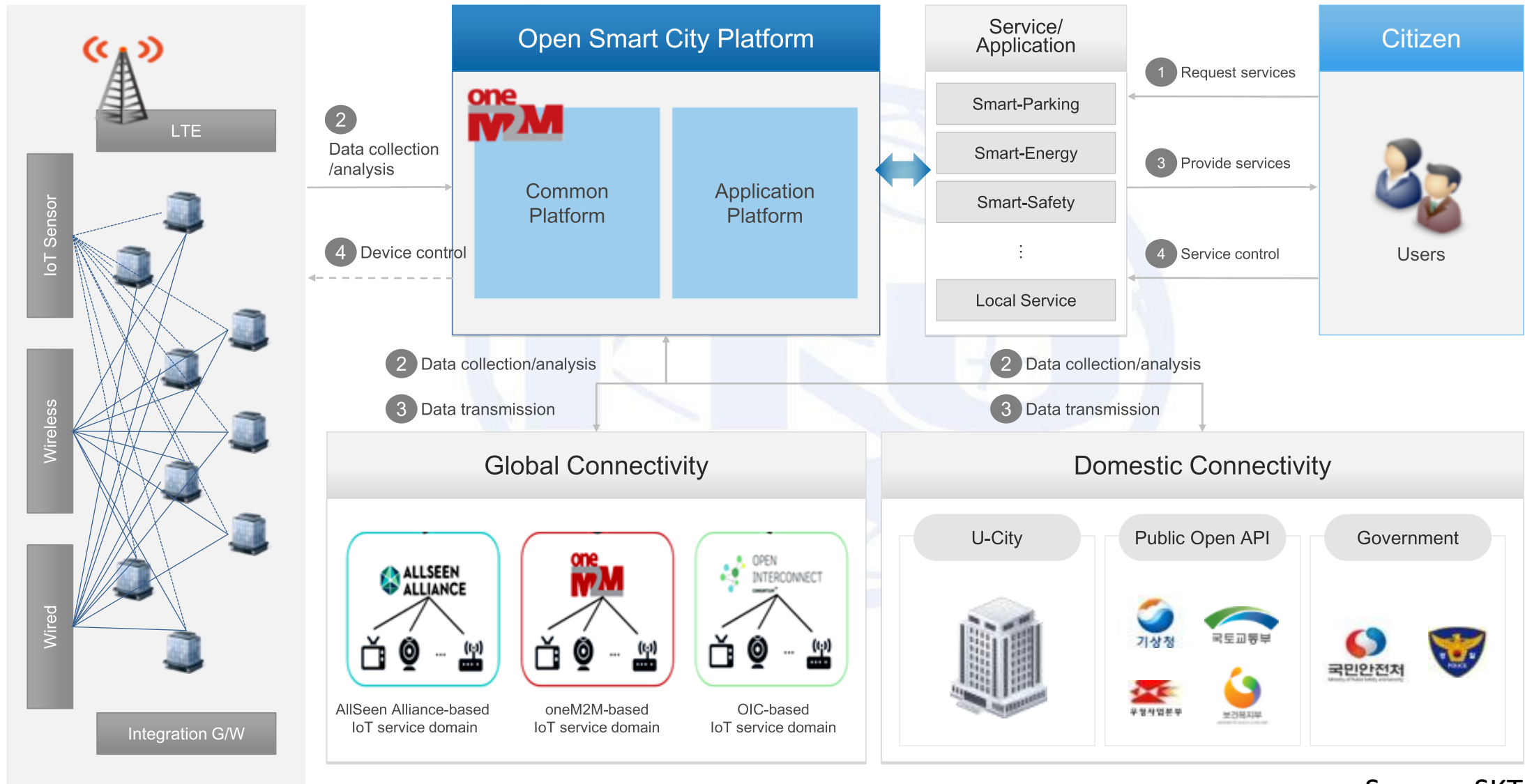
- Reference Point** One or more interfaces - Mca, Mcn, Mcc and Mcc' (between 2 service providers)
- Common Services Entity** Provides the set of "service functions" that are common to the M2M environments
- Application Entity** Provides application logic for the end-to-end M2M solutions
- Network Services Entity** Provides services to the CSEs besides the pure data transport
- Node** Logical equivalent of a physical (or possibly virtualized, especially on the server side) device



Multiple protocol bindings (HTTP, CoAP, MQTT, or WebSocket) over Mca, Mcc, Mcc'



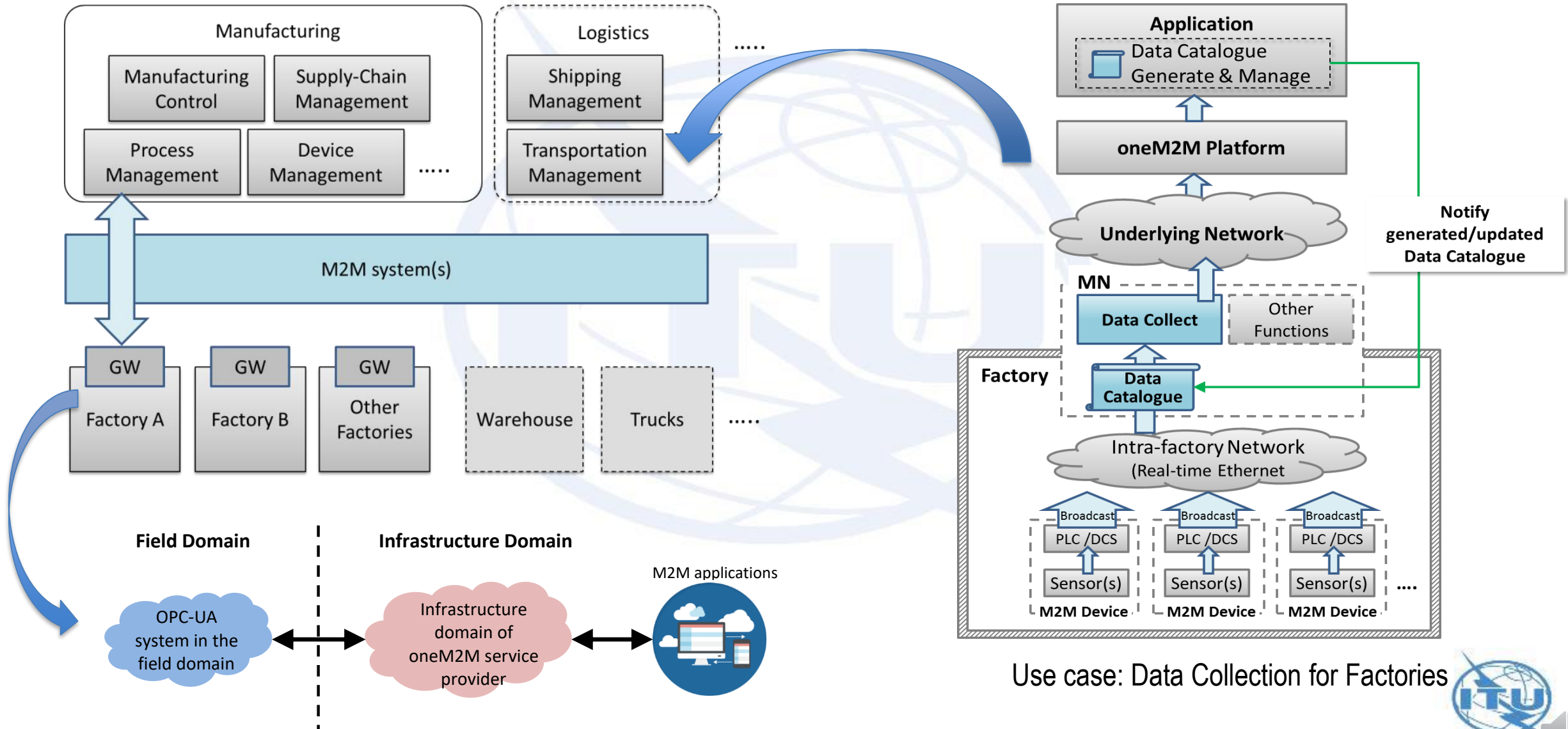
oneM2M based smart city deployment example - Busan



Source: SKT



Technical Report: oneM2M Industrial Domain Enablement



Q4/20: e/Smart services, applications and supporting platforms

Scope

This Question is tasked to focus on e/smart services and applications aspects related to the verticals, to facilitate seamless e/smart services among heterogeneous IoT environments.

Studies include:

- Analysis of service functional requirements:
- e/Smart services and applications platforms for IoT and SC&C;
- Middleware and application interfaces (e.g., APIs, Web interfaces) for e/smart services and applications;
- Specification of application profiles
- Context/event management and reasoning standards including context modelling language and context-awareness processing;
- Service management standards...

Main tasks







Developing Recommendations Reports, Handbooks, Guidelines etc. as appropriate for the support of emerging services and applications for IoT and SC&C, covering:

- e/Smart services and applications platforms for IoT and SC&C;
- SC&C applications and services including, inter alia, smart grid, water, mobility, logistic, waste, healthcare, e-government, emergency telecommunications, education, transport, utilities, finance, etc.;
- Functionality profiles of e/smart applications and services;
- Information modelling relevant to e/smart services and applications;
- Middleware for e/smart services and applications including SC&C; APIs, Web interfaces among IoT middleware entities;
- Context modelling languages for context awareness of IoT middleware;
- Autonomic service management for e/smart services and applications including SC&C;
- Business support capabilities like service activation, enrolment, contract management, billing and troubleshooting for e/smart services and applications including SC&C;

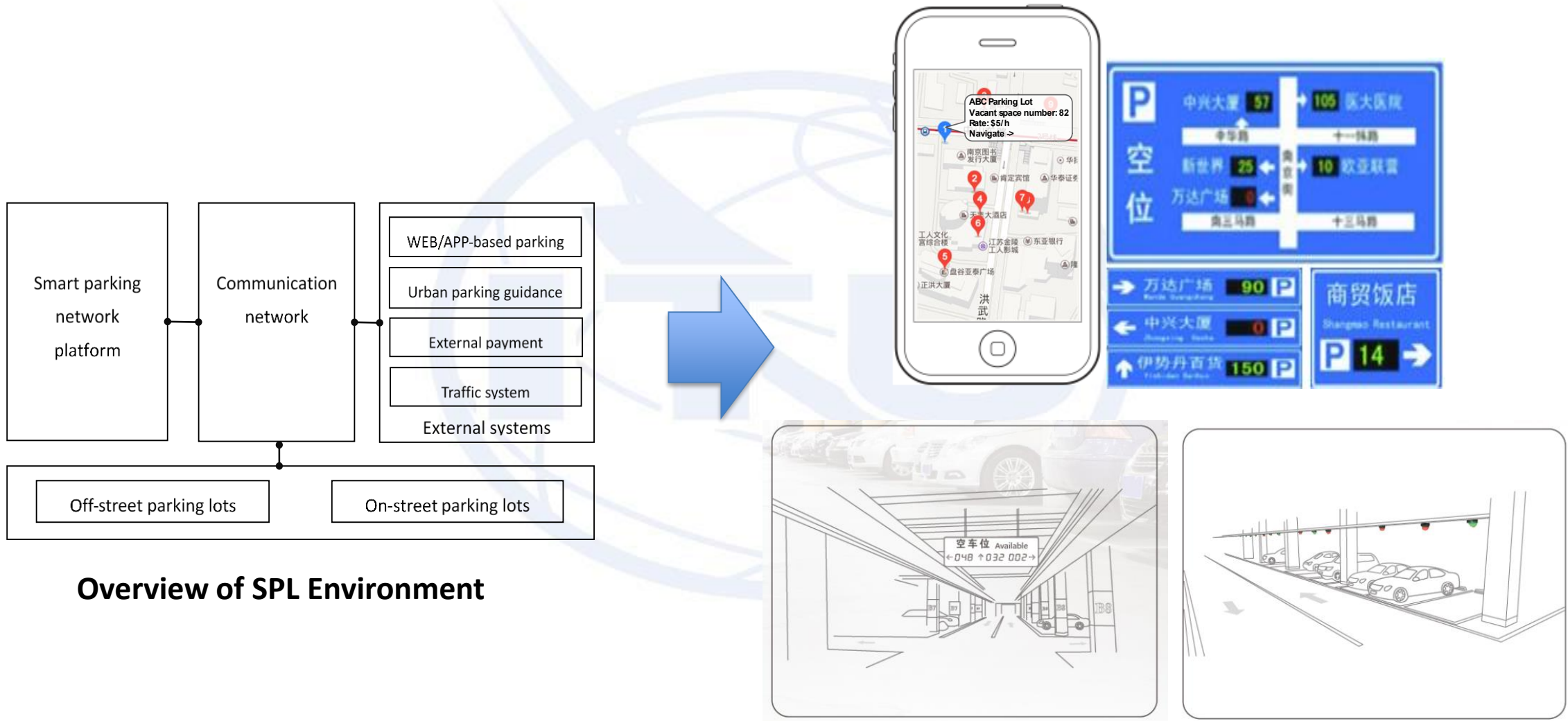
Providing the necessary collaboration for joint activities in this field within ITU and between ITU-T and other relevant SDOs, consortia and fora.

Q4/20 main progress

6 Approved Recommendations (2017-2020)

Work item	Question	Subject/title	Timing	Study group	Study period
 Y.4415 (ex Y.WoO-hn)	Q4/20	Architecture of web of objects based virtual home network	2018-Q2	SG20	2017-2020
 Y.4456 (ex Y.SPL)	Q4/20	Requirements and Functional Architecture for Smart Parking Lot in Smart City	2018-Q4	SG20	2017-2020
 Y.4457 (ex Y.TPS-afw)	Q4/20	Architectural framework for transportation safety services	2018-Q2	SG20	2017-2020
 Y.4458 (ex Y.SSL)	Q4/20	Requirements and functional architecture of smart street light service	2018-12	SG20	2017-2020
 Y.4555 (ex Y.IoT-SQ-fns)	Q4/20	Service functionalities of self-quantification over Internet of things	2018-12	SG20	2017-2020
 Y.4556 (ex Y.SC-Residential)	Q4/20	Requirements and functional architecture of smart residential community	2018-12	SG20	2017-2020

Y.4456: Requirements and Functional Architecture for Smart Parking Lot in Smart City

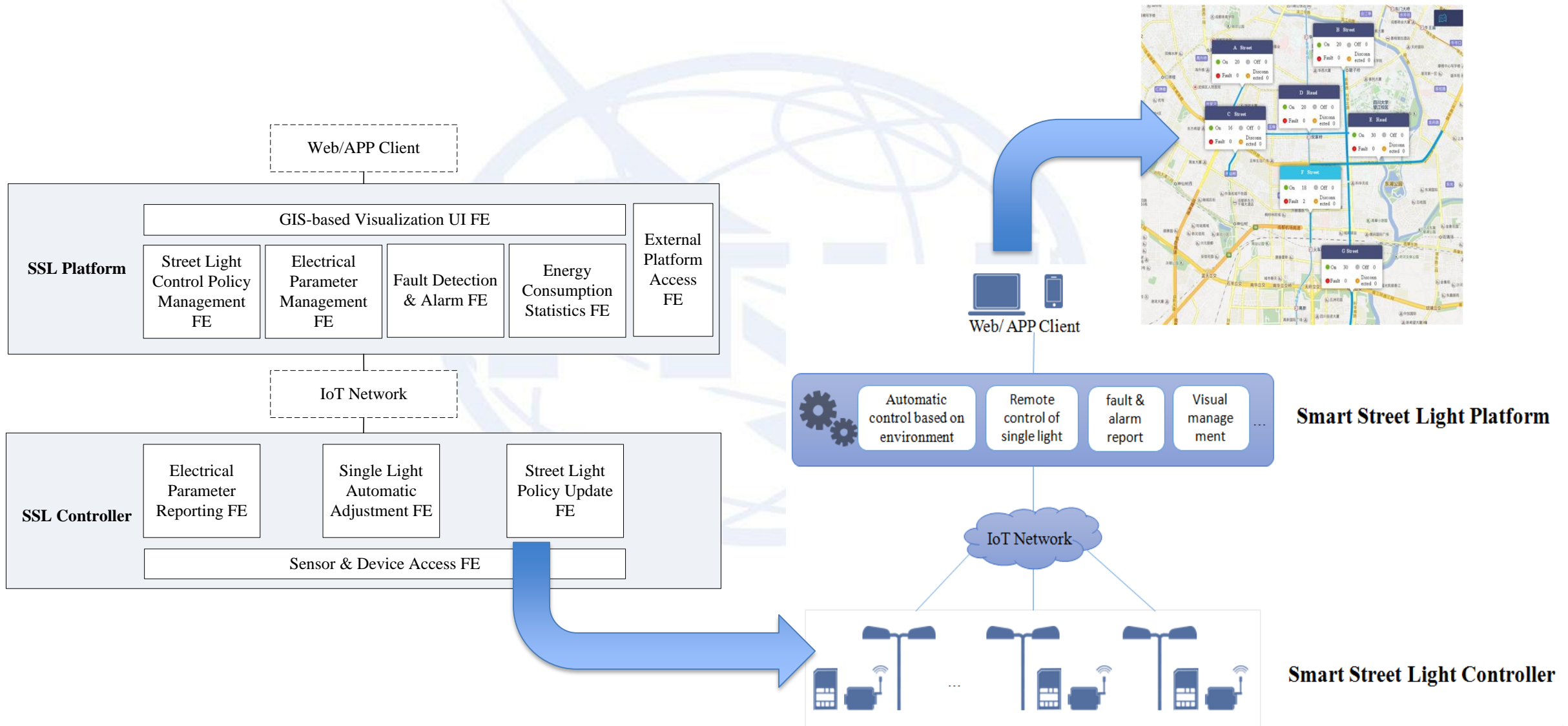


Overview of SPL Environment

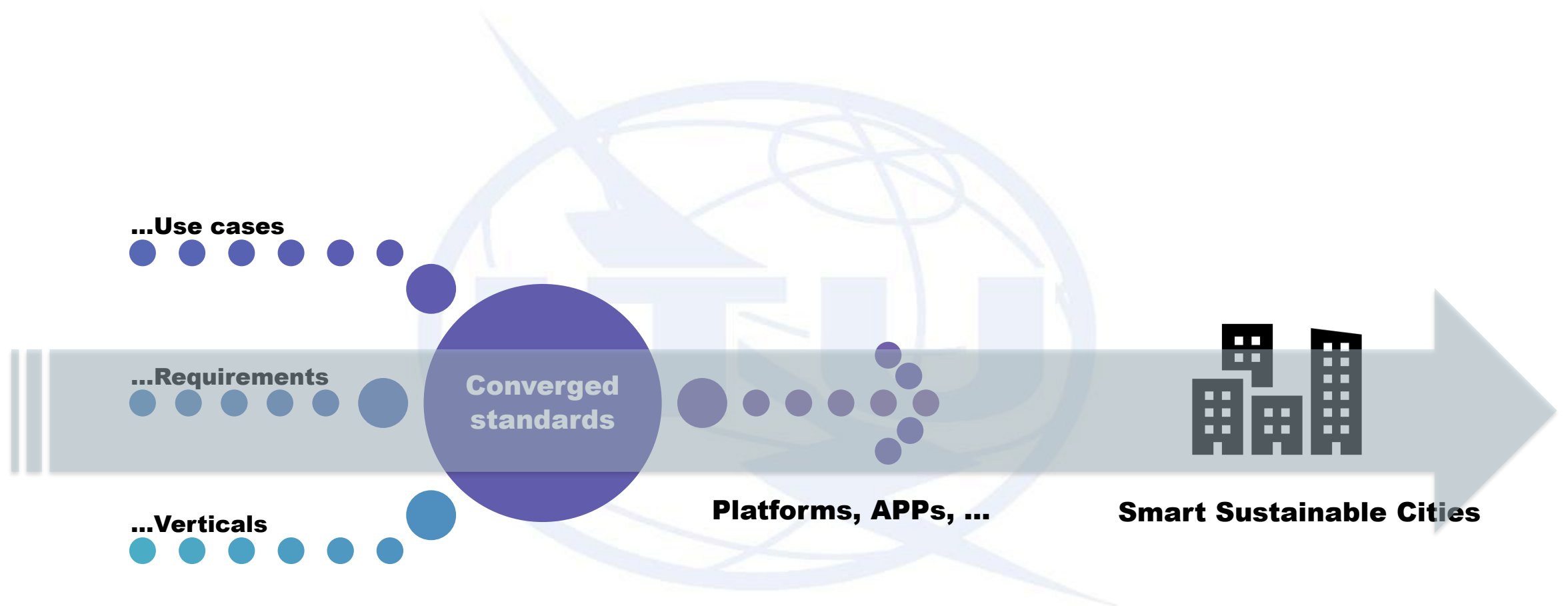
Parking guidance



Y.4458: Requirements and functional architecture of smart street light service



Build Cities with converged standards



ITU-T SG20: Strengthening Regional & International Collaboration

Regional Groups

- SG20RG-LATAM
- SG20RG-ARB
- SG20RG-AFR
- SG20RG-EECAT

JCA-IoT and SC&C

- Collaboration and coordination with other SDOs on topics on IoT and SC&C
- IoT and SC&C online standards roadmap

FG-DPM

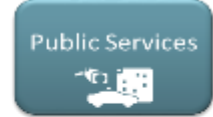


SDOs



oneM2M Partnership Project

Over 200 member organizations in oneM2M



www.oneM2M.org

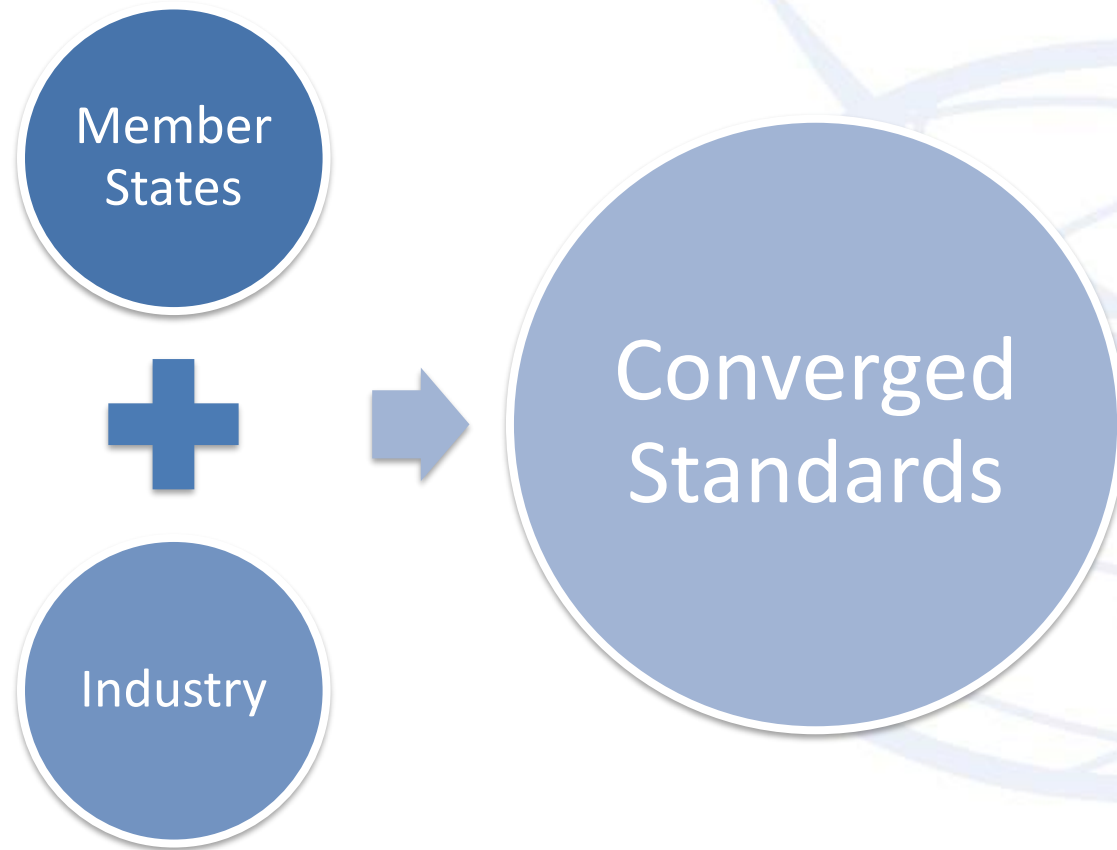
All document are publically available

REQUIREMENTS
TS-0002

TECHNICAL REPORTS

TECHNICAL SPECS

International Collaboration



Benefit:

- ✓ Membership of both organizations have been calling for convergence of IoT standards and alignment of work.
- ✓ The work done in both organizations is complementary.
- ✓ One of the ITU-T strategic objectives is cooperation and collaboration.
- ✓ Industry and Member States benefit from converged and aligned standards

Progress:

- ✓ 16 oneM2M Technical specifications approved as ITU-T Recommendations and 1 got AAP consent at last ITU-T SG20 meeting (Y.4500 series)
- ✓ 6 oneM2M Technical reports approved as ITU-T technical reports
- ✓ Discussion is going on for next step collaboration



Thank you!

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