



IoT Standardization activities and progress

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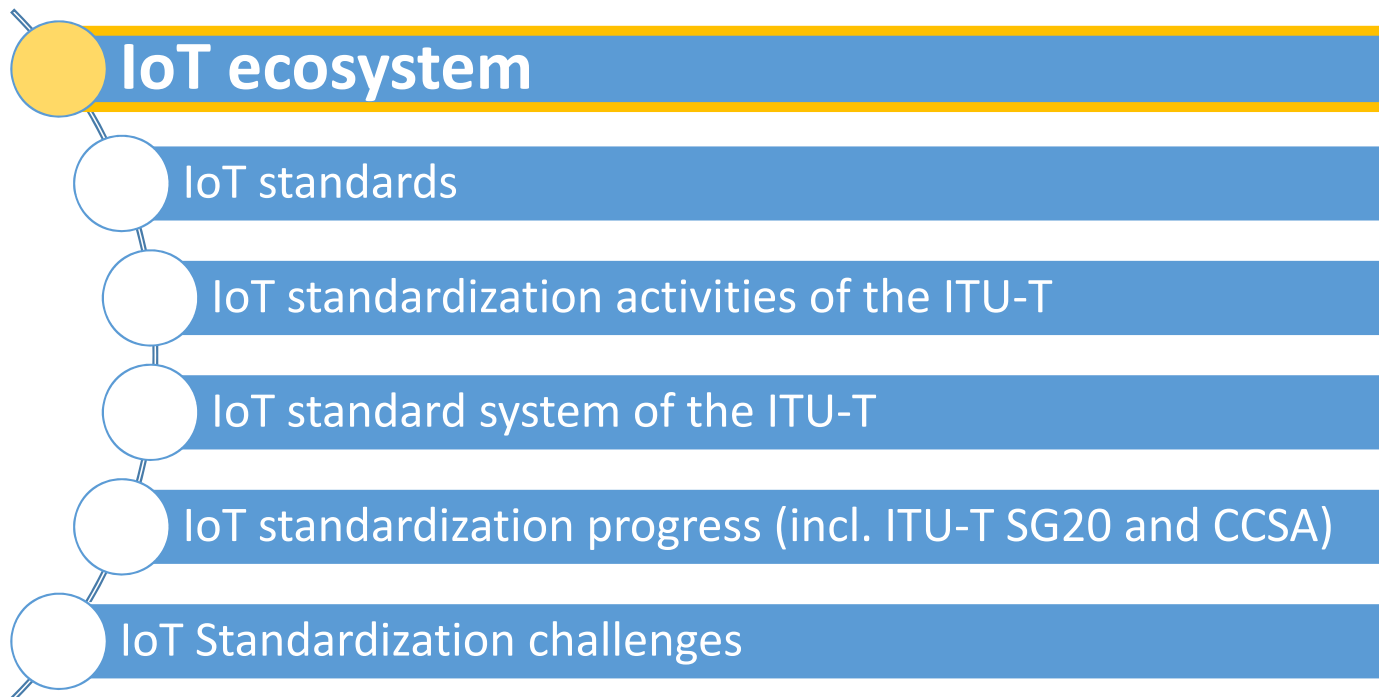
2017-10-31

Course Objectives



- Introduce IoT and its definition defined by ITU-T
- Introduce IoT ecosystem to show who are involved in the IoT
- Introduce IoT activities and Recommendations in the SG20 of ITU-T
- Introduce CCSA's work on IoT

Contents



IoT improves our lives



Smart cities



Livestock farming



Irrigation



Storage and logistic



Mobile health

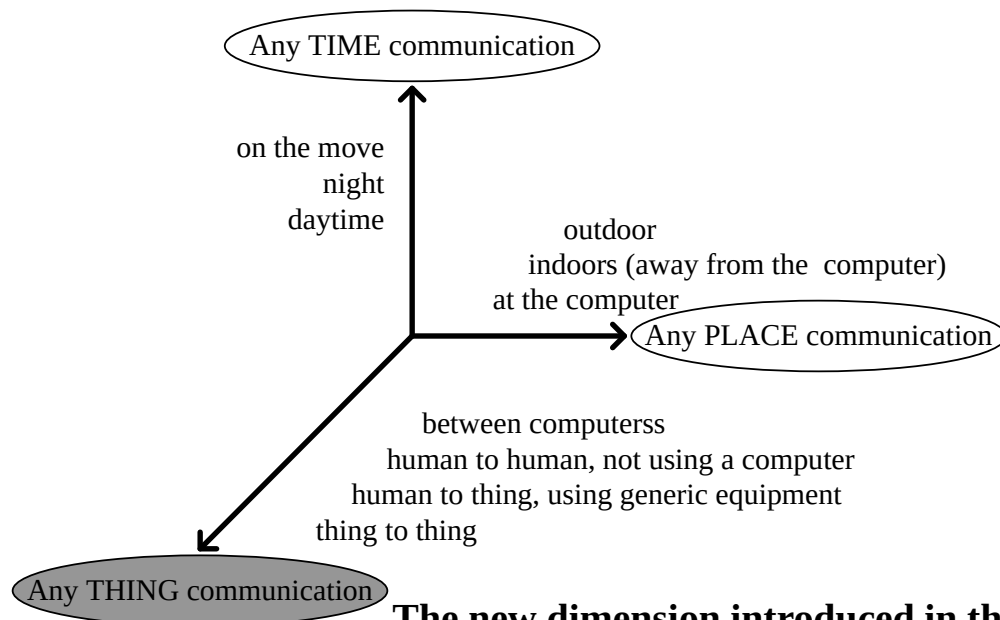


Fresh water

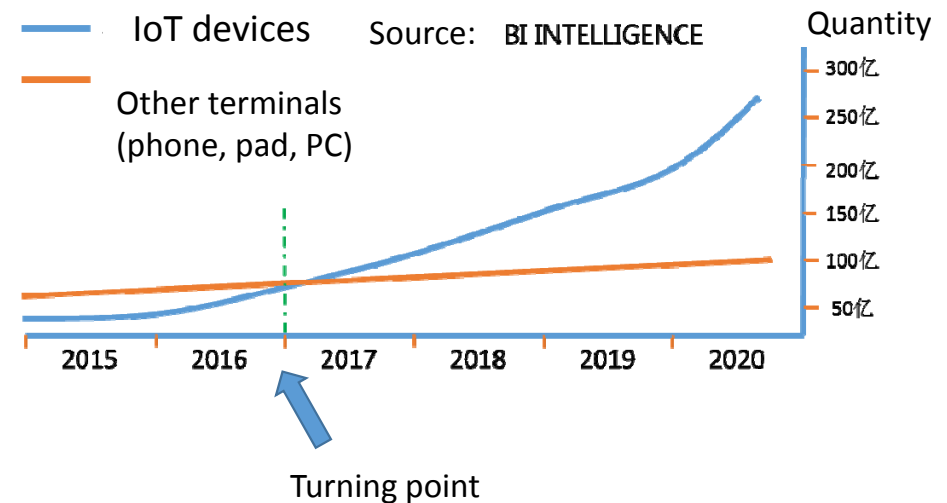
IoT expands business market space



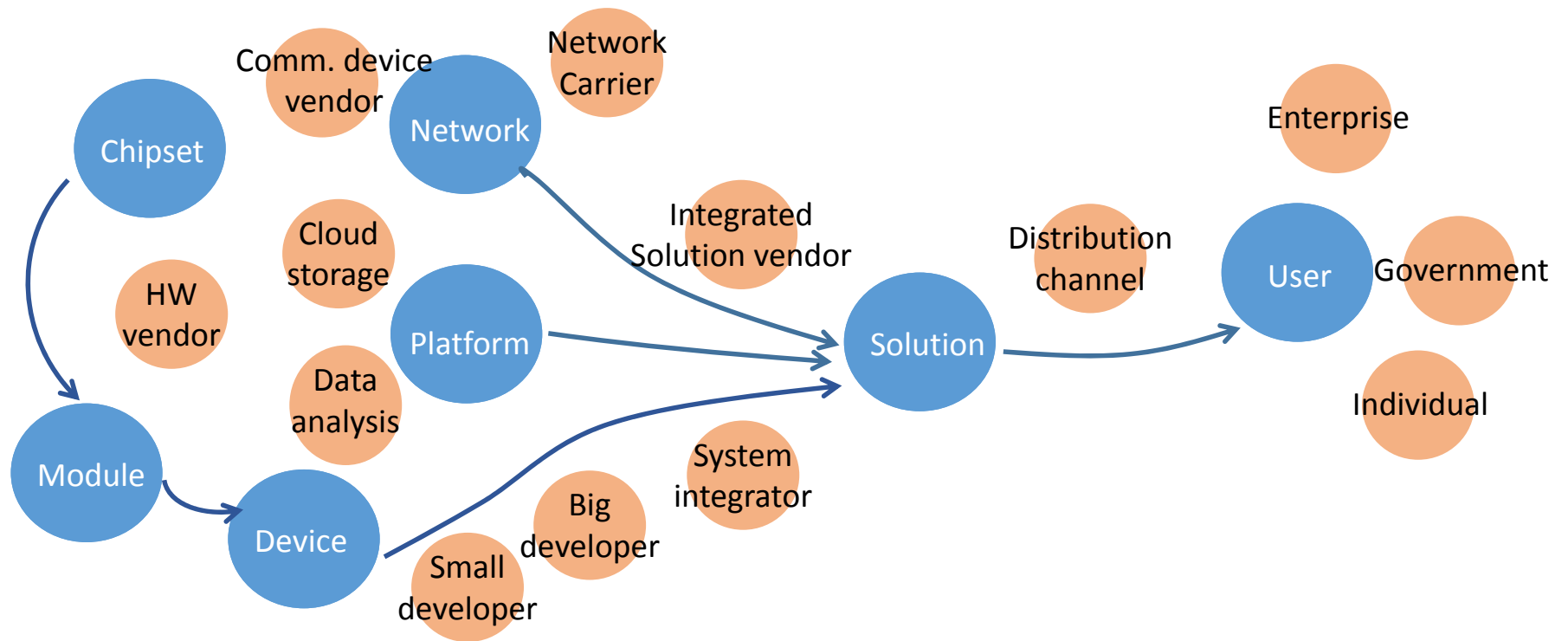
IoT expands network subscribers from human to machines. Correspondingly, the market space will be largely extended not only for telecommunication industry but also for other industries which are influenced by telecom. industry.



The new dimension introduced in the Internet of Things [b-ITU Report]



IoT ecosystem



IoT ecosystem: A large and long industry chain



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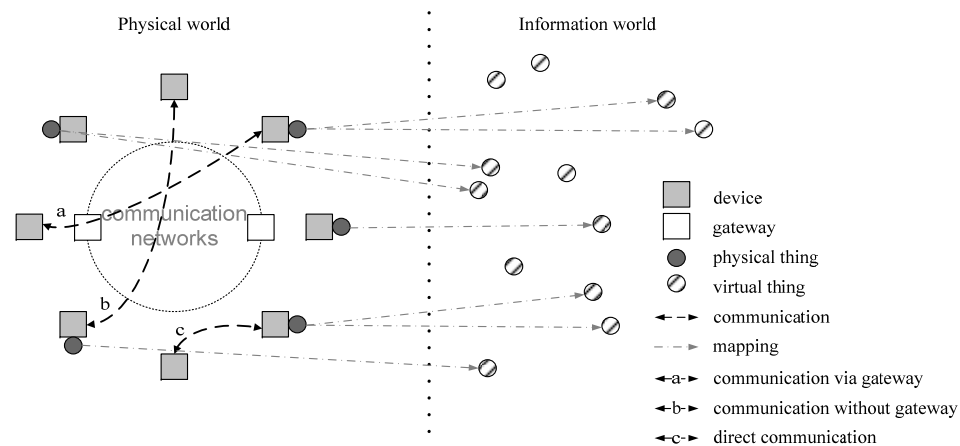
NOTE 1 – Through the exploitation of identification, data capture, processing and communication capabilities, the IoT makes full use of things to offer services to all kinds of applications, whilst ensuring that security and privacy requirements are fulfilled.

NOTE 2 – In a broad perspective, the IoT can be perceived as a vision with technological and societal implications.

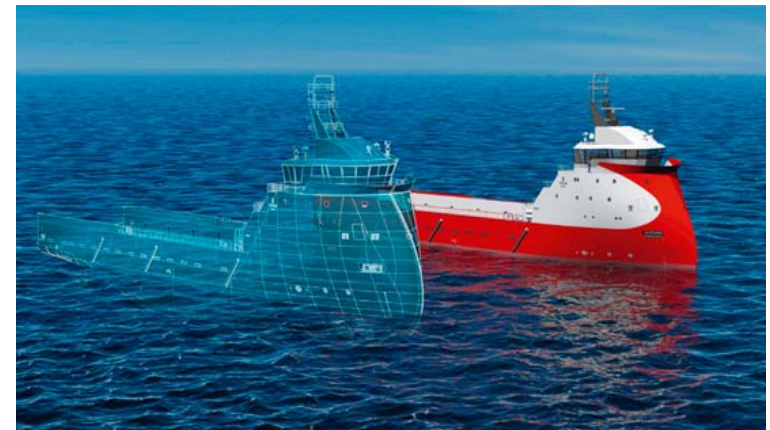
IoT makes linkage between phys. world and information world



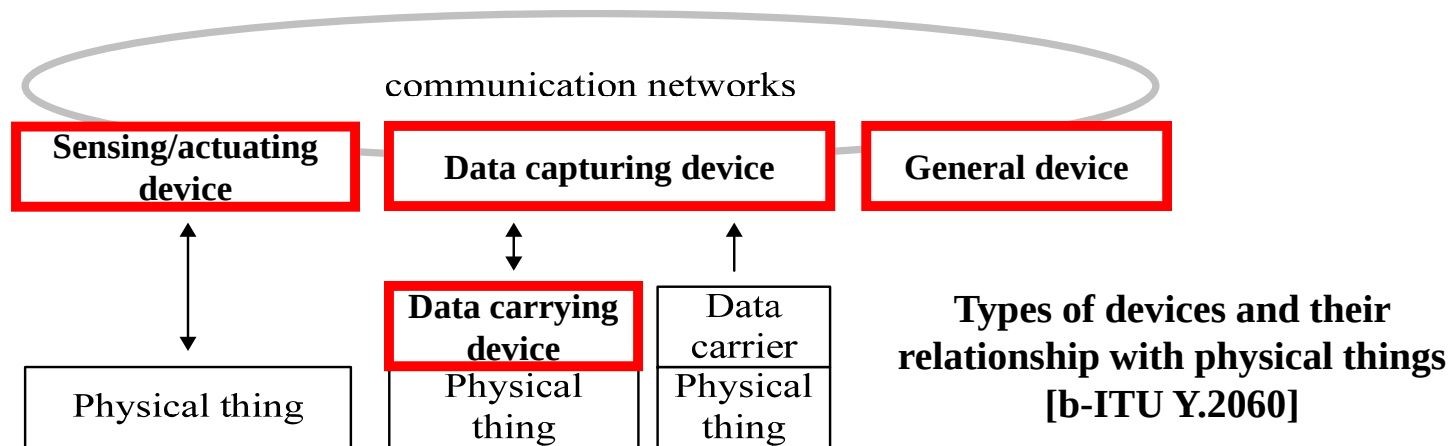
- IoT makes the linkage between the physical world and the information world where the physical world will be impacted by the information world largely.
- Virtual thing in the information world on behalf of physical thing of the physical world as their digital twins. The knowledge and capabilities of the information world will expand the local knowledge and capabilities of the physical things and bring unimaginable experiences to the users.



Technical overview of IoT [b-ITU Y.2060]

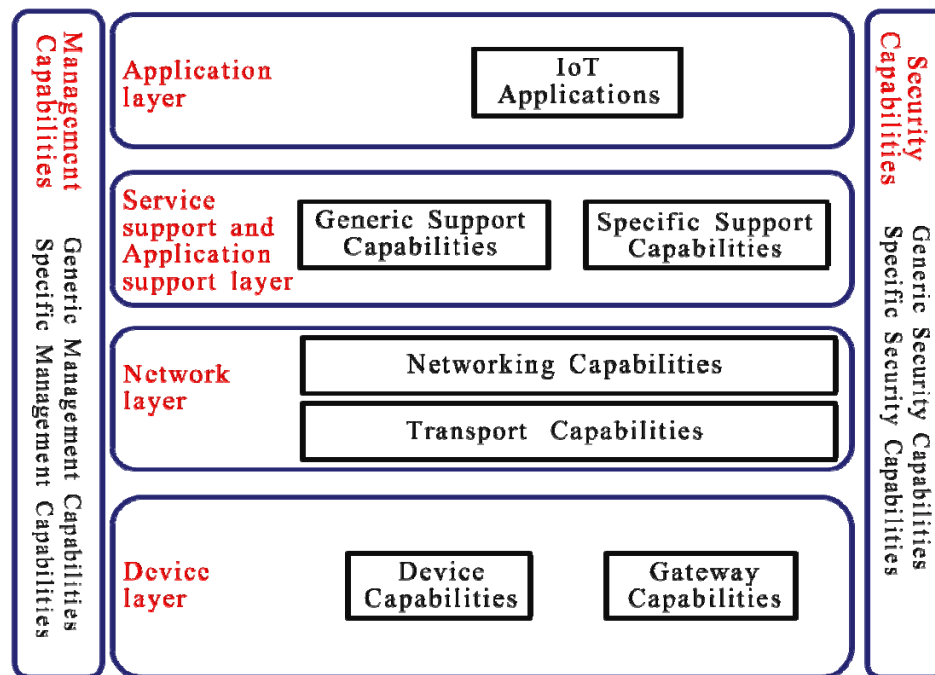


Phys. things attached to the communication networks via variety devices



- Sensing and actuating device: may detect or measure information related to surrounding environments and convert it into digital electronic signals.
- Data carrying device: is attached to a physical thing to indirectly connect the physical thing with the communication networks;
- Data capturing device: refers to a reader/writer device with the capability to interact with physical things
- A general device: has embedded processing and communication capabilities, and may communicate with the communication networks via wired or wireless technologies.

IoT reference model



IoT reference model [b-ITU Y.2060]

The IoT reference model is specified by ITU-T Y.2060:

- The Application layer contains IoT applications.
- The Service support and Application support layer consists of generic support capabilities and Specific support capabilities.
- Network layer contains two types of capabilities: networking capabilities and transport capabilities.
- Device layer contains two types of capabilities: device capabilities and gateway capabilities.

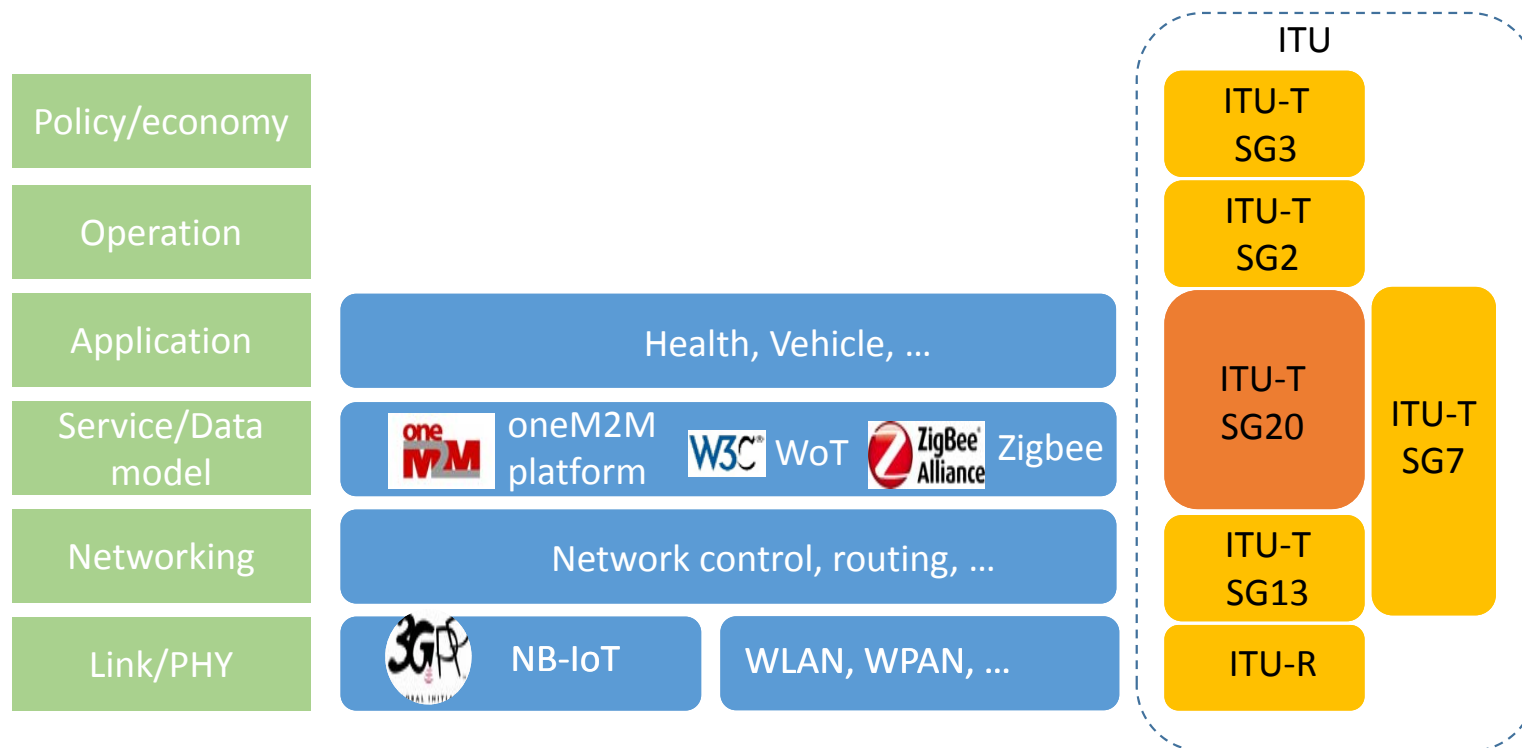
- The first and most basic IoT Recommendation of ITU-T, Published in 2012.
- Widely referred by many SDOs, e.g., ITU-T, oneM2M, CCSA.

Contents



- IoT ecosystem
- IoT standards**
- IoT standardization activities of ITU-T
- IoT standard system of the ITU-T
- IoT standardization progress (incl. ITU-T SG20 and CCSA)
- IoT Standardization challenges

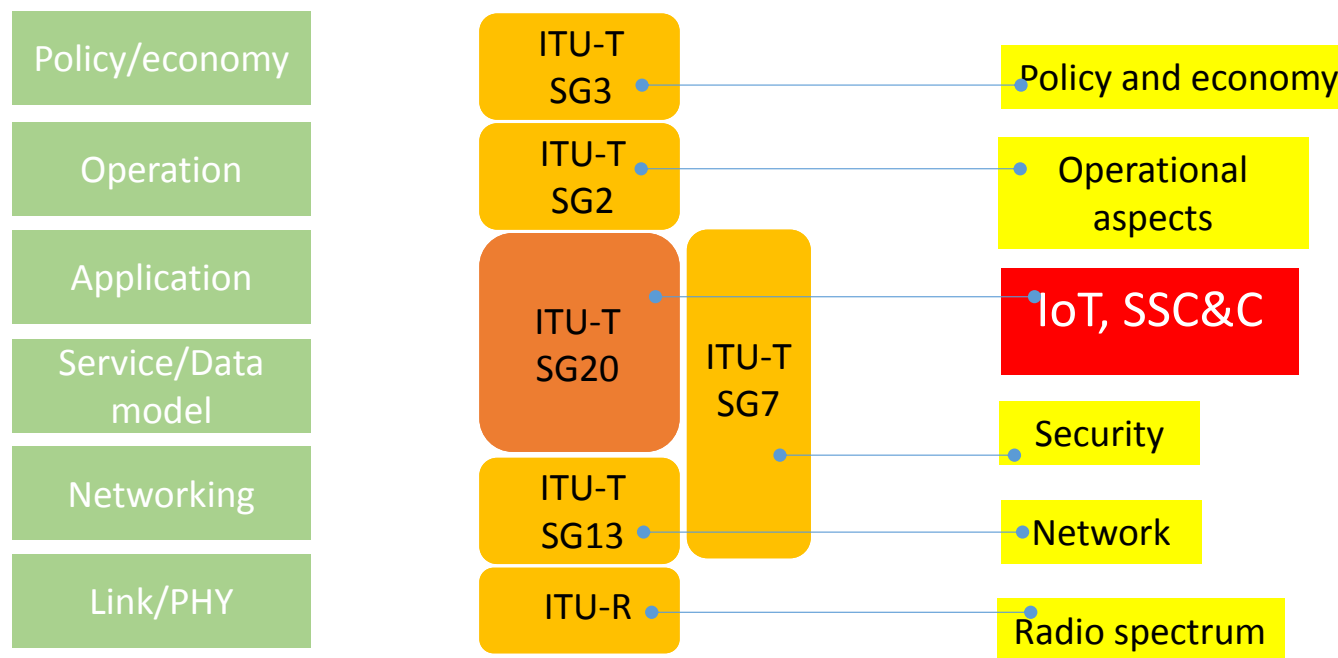
IoT related SDOs (non-exhaustive)



ITU: multiple aspects involved in IoT



- ITU is the United Nations specialized agency for information and communication technologies – ICTs.
- ITU allocates global radio spectrum and satellite orbits, develop the technical standards that ensure networks and technologies seamlessly interconnect, and strive to improve access to ICTs to underserved communities worldwide.



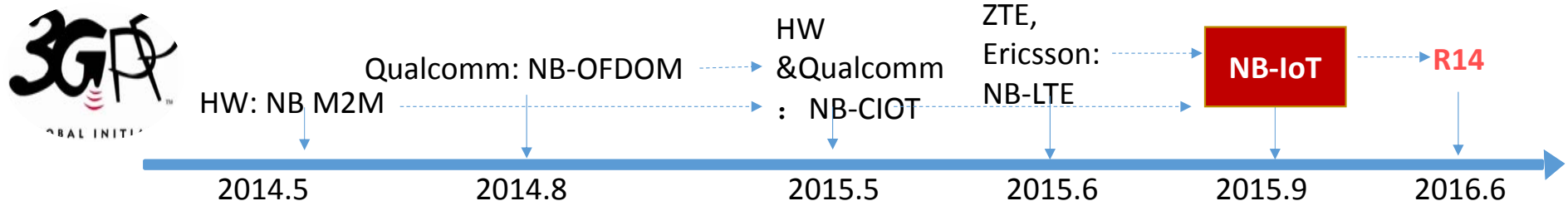
3GPP and NB-IoT



- The 3rd Generation Partnership Project (3GPP) unites 7 telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
- NB-IoT is a new narrowband radio technology to address the requirements of the IoT which will provide improved indoor coverage, support of massive number of low throughput devices, low delay sensitivity, ultra-low device cost, low device power consumption and optimized network architecture.

NB-IoT

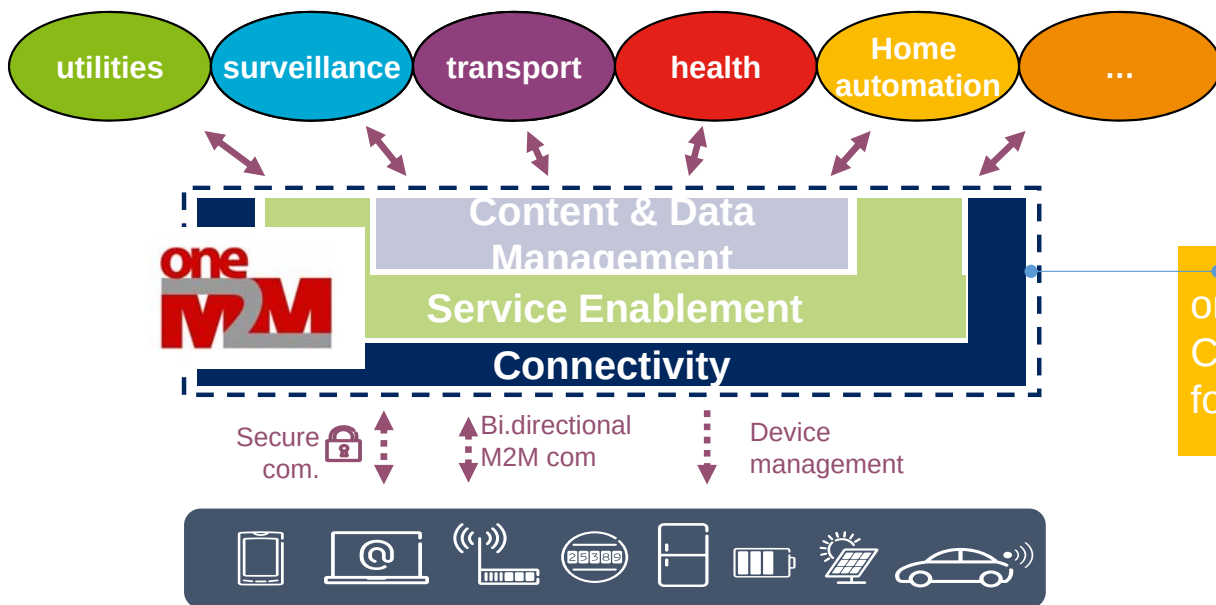
- In China, NB-IoT commercial projects have started, mainly used in smart cities / towns
 - ❑ NB-IoT operates in an licensed frequency
 - ❑ Low cost, monolithic chip cost target of \$1, while modules are expected to cost no more than \$5; High coverage and penetrating power, the test shows that it can even be used in underground space;
 - ❑ The large connection, one sector maximum, supports 100 thousand connections, 50 to 100 times the traditional mobile capacity.



oneM2M and its platform



- oneM2M is the global standards initiative for Machine to Machine Communications and IoT.
- Eight Partner Type 1 organizations in oneM2M are: ARIB(Japan), ATIS (US), CCSA (China), ETSI (European), TTA (Korea), TTC(Japan), TSDSI (India), TTA (Korea), TTC(Japan)

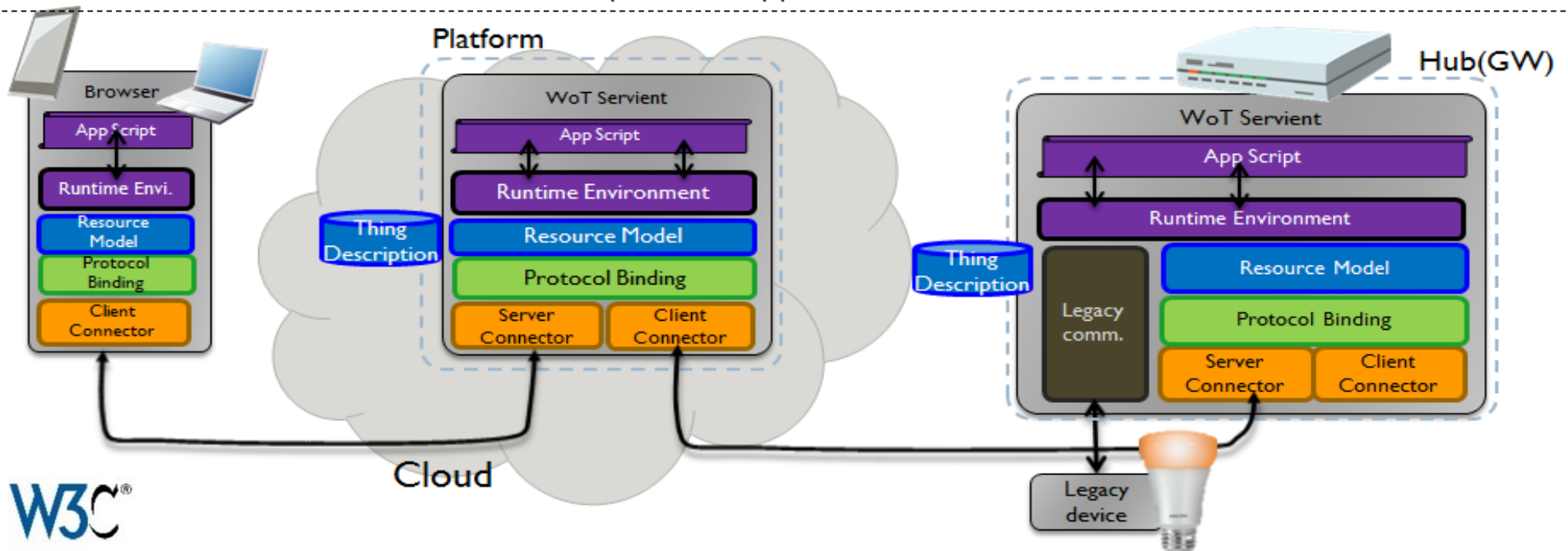


oneM2M platform:
Common set of functionalities
for all verticals

W3C and WoT



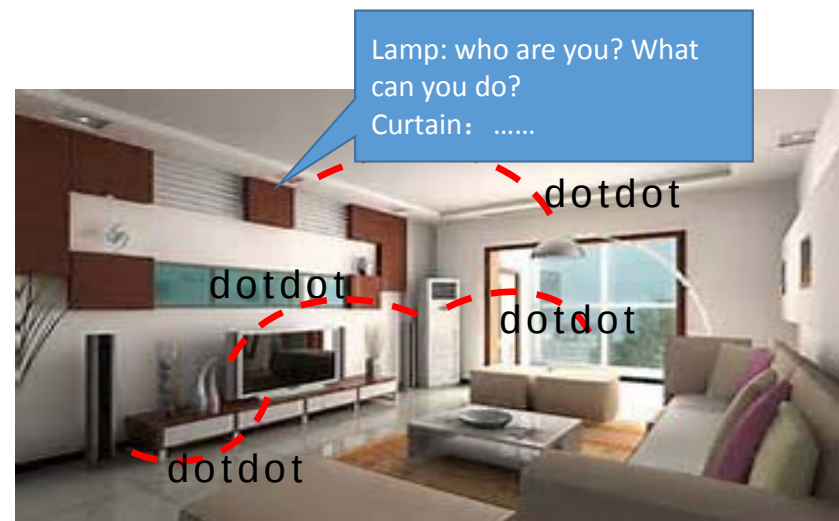
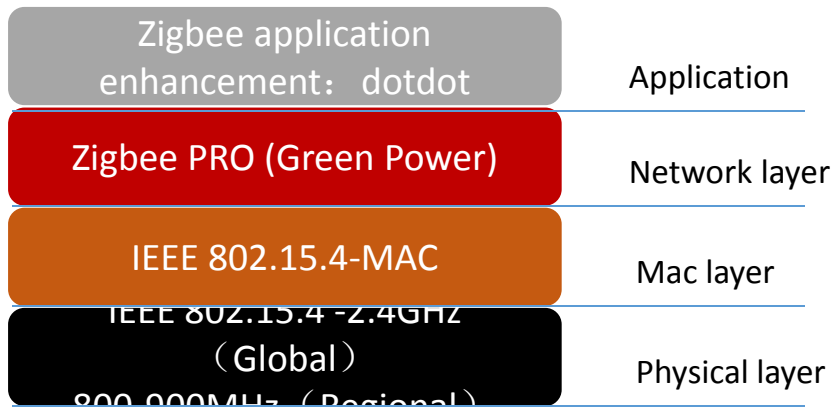
- W3C launched the [Web of Things Working Group](#) to develop initial standards for the Web of Things, tasked with the goal to counter the fragmentation of the IoT.
- WoT is developing platform independent APIs for application developers, and a means for different platforms to discover how to inter-operate with one another. The approach WoT are taking is based upon rich metadata and interaction models exposed to applications.



ZigBee alliance: Zigbee PRO 2017



- Zigbee is the wireless language that everyday devices use to connect to one another.
- In 2017, launched Zigbee Pro 2017 which provide more energy efficient and support data interoperability between smart sensors.



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- IoT ecosystem
- Key technologies enabling IoT infrastructure
- IoT standardization activities of ITU-T**
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Brief introduction on ITU



ITU

- UN specialized agency for ICTs
- standards developing organization
- unique public/private partnership



Members:

- 193 Member States (Governments and regulatory bodies)
- Over 700 Private Sector (Sector Members and Associates)
- Over 90 Academia



The structure of ITU

ITU-T: standardization

produces interoperable technical ICT standards



General Secretariat

provides coordination for the whole organization



ITU-R: Radio comm.

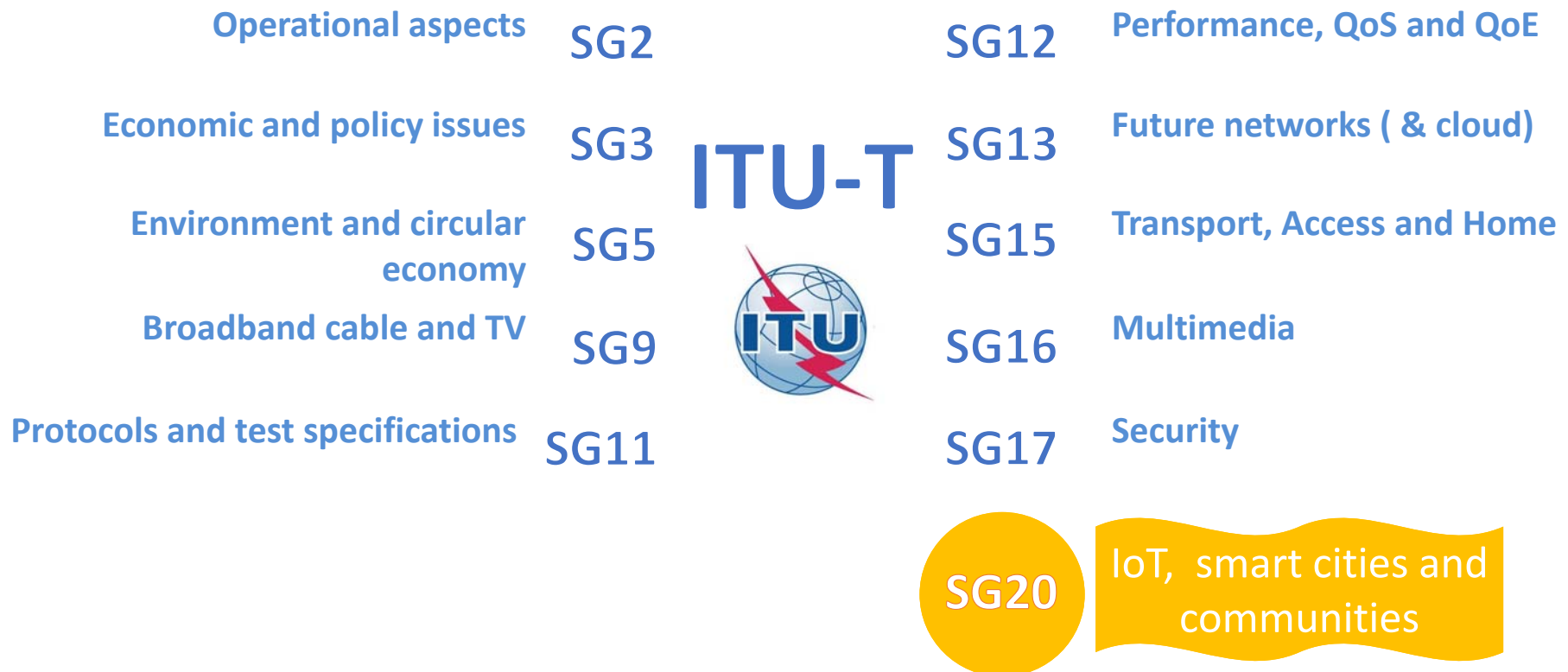
coordinates global wireless communication



ITU-D: Development

provides assistance to the un-connected

Introduction on ITU-T



The born of SG20



SG 20 was set up in the middle of 2015 with its first plenary held in Geneva, Oct. 2015. Before SG20, ITU-T ever set up IoT GSI and FG M2M.

- Because the tasks had finished, IoT GSI closed after the born of SG20.
- FG M2M completed its task (4 deliveries issued) and closed in 2014.



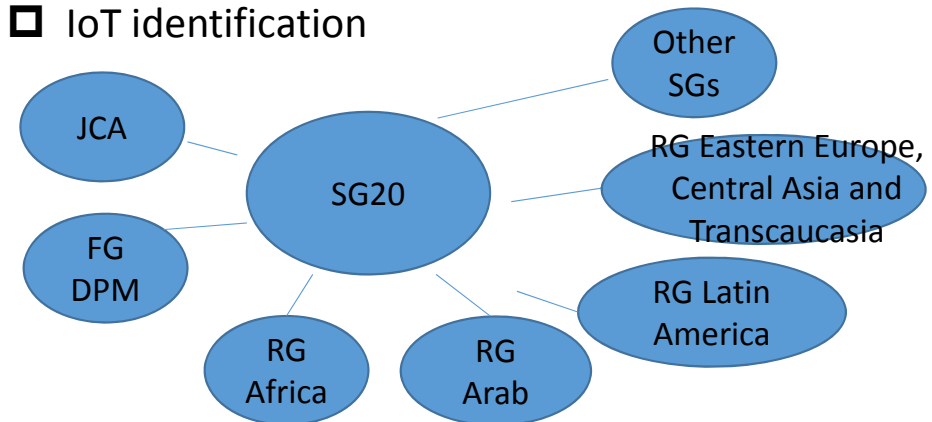
ITU-T SG20 is responsible for international standards to enable the coordinated development of IoT technologies, including machine-to-machine communications and ubiquitous sensor networks.

The structure of SG20

	Title
Working Party 1	
Question 1/20	End to end connectivity, networks, interoperability, infrastructures and Big Data aspects related to IoT and SC&C
Question 2/20	Requirements, capabilities, and use cases across verticals
Question 3/20	Architectures, management, protocols and Quality of Service
Question 4/20	e/Smart services, applications and supporting platforms
Working Party 2	
Question 5/20	Research and emerging technologies, terminology and definitions
Question 6/20	Security, privacy, trust and identification
Question 7/20	Evaluation and assessment of Smart Sustainable Cities and Communities



- Study Group 20 is working to address the standardization requirements of Internet of Things technologies, with an initial focus on IoT applications in smart cities and communities (SC&C).
- ITU-T SG20 is the leading group in ITU-T on:
 - ❑ Internet of things (IoT) and its applications;
 - ❑ Smart Cities and Communities (SC&C), including its e-services and smart services
 - ❑ IoT identification



Related groups

SG20 management team



SG20 Chairman

- Nasser Saleh AL MARZOUQI (United Arab Emirates)

8 SG20 Vice Chairmen

- Fabio BIGI (Italy)
- Silvia GUZMÁN ARAÑA (Spain)
- Takafumi HASHITANI (Japan)
- Hyoung Jun KIM (Republic of Korea)
- Abdulrahman M. AL HASSAN (Saudi Arabia)
- Ziqin SANG (China)
- Sergio TRABUCHI (Argentina)
- Sergey ZHDANOV (Russian Federation)



SG20 activities on Smart Sustainable Cities



Panel discussions and events



Development and implementation of standards



Knowledge sharing and research

Flipbook on Shaping smarter and more sustainable cities



Content:

Empowering SSC Transitions

Exploring the SSC Infrastructure

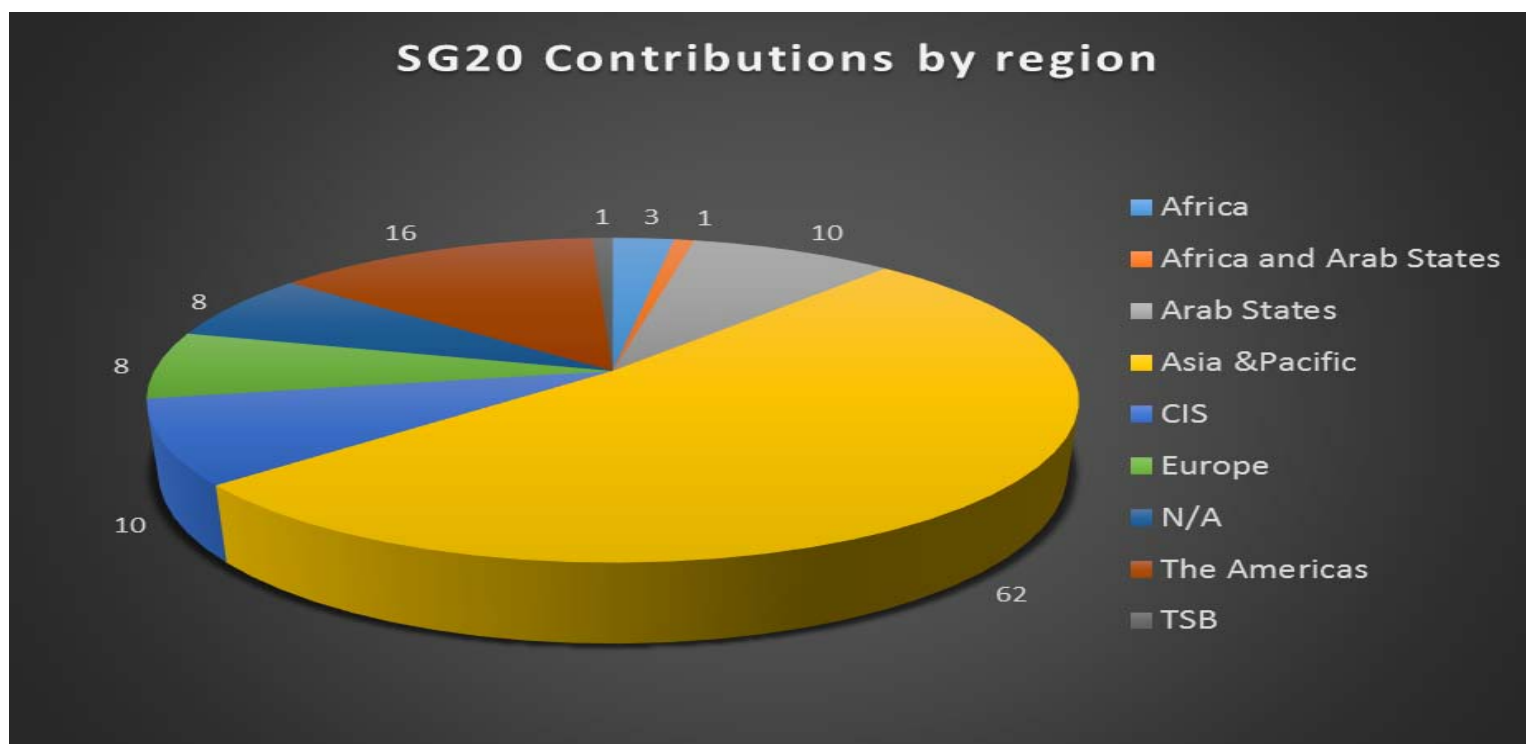
Metrics for Measuring SSC Transitions

Paving the way for SSC

ITU-T SG20 plenary meeting of 2017 March



The meeting had 195 participants during the meeting period. Remote participation services were provided; some delegates joined both remotely and physically.

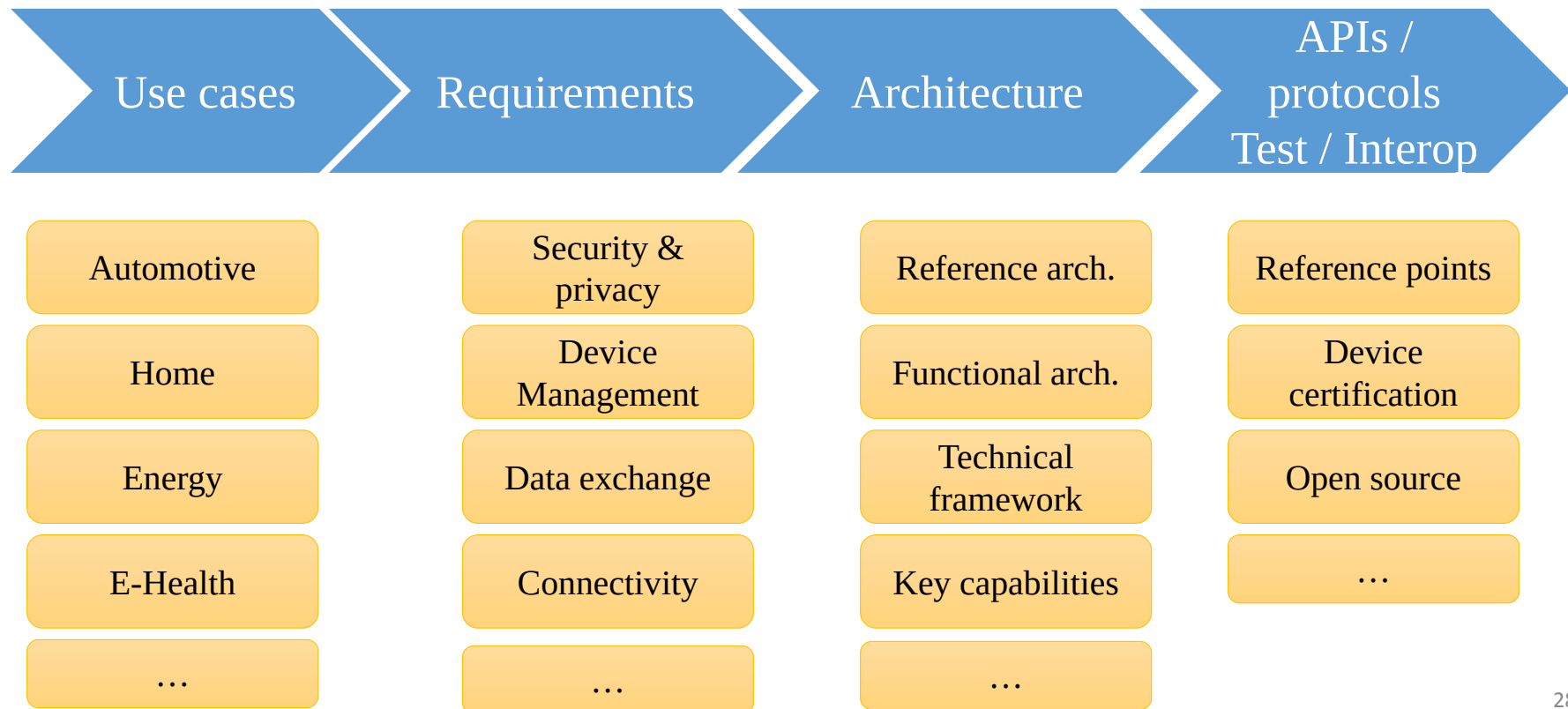


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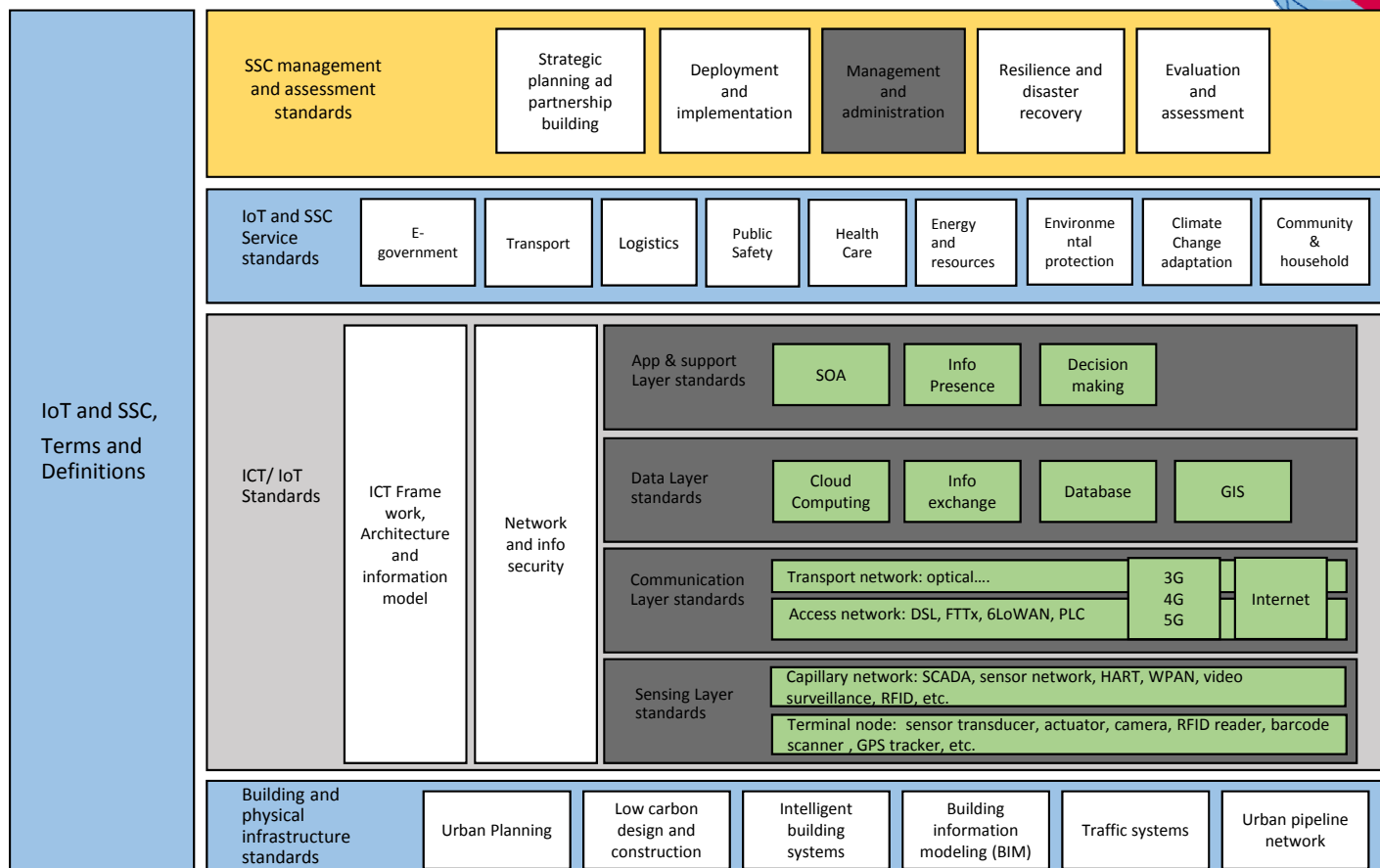


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Standardization general approach



ITU-T Standard system of SG20 on IoT and SSC



Source: WP2/20 Chairman adapted from ITU-T FG-SSC Technical Report

Published ITU-T Recommendations taken responsible by SG20



ITU-T Y. 4000 series	Recommendation Category	number
Y. 4000–Y. 4049	General	3
Y. 4050–Y. 4099	Definitions and terminologies	1
Y. 4100–Y. 4249	Requirements and use cases	13
Y. 4250–Y. 4399	Infrastructure, connectivity and networks	3
Y. 4400–Y. 4549	Frameworks, architectures and protocols	15
Y. 4550–Y. 4699	Services, applications, computation and data processing	3
Y. 4700–Y. 4799	Management, control and performance	2
Y. 4800–Y. 4899	Identification and security	5
Y. 4900–Y. 4999	Evaluation and assessment	4

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Q1/20

End to end connectivity, networks, interoperability, infrastructures and Big Data aspects related to IoT and SC&C



Work Item	Title
Y.frame-scc	Framework and high-level requirements of smart cities and communities
Y.fsn	Framework and Service scenarios for Smartwork
Y.Infra	Overview of city infrastructure
Y.ism-ssc	A Technical Framework of Integrated Sensing & Management for Smart Sustainable Cities
Y.isw-ssc	The Integrated Sensor Web Resource Metadata for Smart Sustainable Cities
Y.SC-infra-TS	Telecommunication systems as infrastructure in smart cities and communities
Y.SC-OpenData	Framework of Open Data in Smart Cities
Y.SC-Overview	An overview of smart cities and communities and the role of information and communication technologies
Y.SSCP	Requirements for interoperability of smart and sustainable city platforms based on a multi- layered model

Q2/20

Requirements, capabilities, and use cases across verticals



Work Item	Title
Y.IoT-things-description-reqts	Requirements of things description in the Internet of Things
Y.IoT-WDS-Reqts	Requirements and capabilities of Internet of Things for support of wearable devices and related services
Y.SEM	Requirements and capability framework of Smart Environmental Monitoring
Y.SmartMan-IIoT-overview	Overview of Smart Manufacturing in the context of Industrial Internet of Things
Y.Smartport	Requirements of smart management of supply services in smart port
Y.SRC	Requirements for deployment of smart services in Rural Communities
Y.TPS-req	Requirements of transportation safety service including use cases and service scenarios
Y.WPT-usecase	Use cases of Wireless Power Transfer Application Service
Y.IoT-NCM-reqts (TD 179 Rev.2)	Requirements and capabilities of network connectivity management in the Internet of Things
Y.IoT-AERS-reqts (TD 186 Rev.1)	Requirements and capability framework for IoT-based automotive emergency response system

Q3/20

Architectures, management, protocols and Quality of Service



Work Item	Title
Supp-Y.IPv6-IoT	IPv6 Potential for the Internet of Things and Smart Cities
Y.gw-IoT-arch	Functional architecture of gateway for IoT applications
Y.IoT-ics	Requirements and functional architecture of Open IoT identity correlation service
Y.IoT-NCE	Reference architecture for IoT network service capability exposure
Y.IoT-sd-arch	Functional architecture of Service Discovery for Interworking between Heterogeneous IoT Platforms
Y.IoT-son	Framework of self-organization network in the IoT environments
Y.IPv6RefModel	Reference Model of IPv6 Subnet Addressing Plan for Internet of Things Deployment
Y.IPv6-suite	Reference Model of Protocol Suite for IPV6 interoperable Internet of Things Deployments
Y.NGNe-IoT-arch	Architecture of the Internet of Things based on NGNe
Y.IoT-rmc (TD 183 Rev.1)	Reference architecture of accessing IoT resources for management and control

Q4/20

e/Smart services, applications and supporting platforms



Work Item	Title
<u>Y.del-fw</u>	Framework of delegation service for the IoT devices
<u>Y.IoT-SQ-fns</u>	Service Functionalities of Self-quantification over Internet of things
<u>Y.ISG-fr</u>	Framework of IoT-based Smart Greenhouse
<u>Y.Pops</u>	Postproduction service of Smart Farming on the network
<u>Y.Psfs</u>	Functional model for production service of Smart Farming
<u>Y.SC-Residential</u>	Requirements of Smart Residential Communities
<u>Y.smart-evacuation</u>	Framework of Smart Evacuation during emergencies in Smart Cities and Communities
<u>Y.social-device</u>	Framework of the social device networking
<u>Y.SPL</u>	Requirements and Reference Framework for Smart Parking Lots in smart city
<u>Y.SSL</u>	Requirements and Reference Framework for Smart Street Light
<u>Y.STD</u>	Reference Model for Smart Tourist Destinations: platform interoperability and functionalities
<u>Y.TPS-afw</u>	Architectural framework for providing transportation safety service
<u>Y.WoO-hn</u>	Service capability and architecture in web of objects enabled home network

Q5/20

Research and emerging technologies, terminology and definitions



Work Item	Title
Y.CrowdSystems (ex Y Req-Arch-CS)	Requirements and Functional Architecture of IoT-related Crowdsourced Systems
Y.HEP	Framework for Home Environment Profiles and Levels of IoT Systems
Y.SCC-Terms	Vocabulary for Smart Cities and Communities
TR.AI4IoT (TD 123 Rev.1)	Artificial Intelligence and Internet of Things

Q6/20

Security, privacy, trust and identification



Work Item	Title
Y.4805 (ex Y.SC-Interop)	Identifier service requirements for the interoperability of Smart City applications
Y.IoT-DA-Counterfeit	Information Management Digital Architecture to combat counterfeiting in IoT
Y.IoT-Interop	An Interoperability framework for IoT
Y.IoT-IoD-PT	Identity of IoT devices based on secure procedures and ensures privacy and trust of IoT systems
Y.IoT-sec-safety	Security capabilities supporting safety of the Internet of Things

Q7/20

Evaluation and assessment of Smart Sustainable Cities and Communities



Work Item	Title
Y.IoT-EH-PFE	Performance evaluation frameworks of e-health systems in the IoT
Y.ODI	Open Data Indicator in smart cities

CCSA and SG20



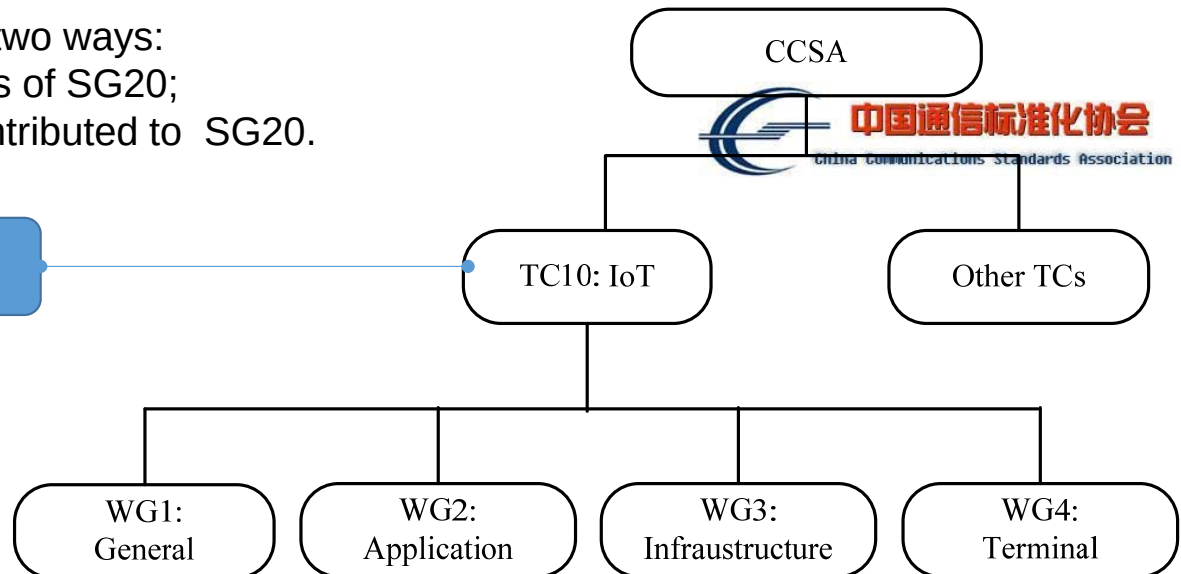
China Communications Standards Association (CCSA) is a non-profit legal person organization established by enterprises and institutes in China for carrying out standardization activities in the field of Information and Communications Technology (ICT) across China. CCSA is organized with the approval of MII and registration in the Ministry of Civil Affairs.

TC10 keeps progressing with SG20 by two ways:

- Adopt and/or refer Recommendations of SG20;
- Mature standards of TC10 will be contributed to SG20.



SG20



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Five main challenges have to be overcome for IoT



Robust connectivity:
Latency, availability, coverage, cost

1

Standardization:
Standard connectivity for billions of things

2

5
Domain knowledge:
Deep, vertical-specific insights

3

Interoperability and open interfaces:
Enabling platforms to talk with each other

4

Privacy and security:
Prevent malware injection and data misuse

IoT standardization challenges



- Differentiated society and culture for countries, together with different economy and environment development level
- Huge and complex IoT ecosystem; Segmented IoT service requirements
- Involving experts with multidisciplinary knowledge
- How improve visibility of IoT standards on market and technology development
 - ▣ Standards: define what we need to do
 - ▣ Open source: implement functions defined by standards
 - ▣ How the two aspects coordinate with each other efficiently



Useful references



- **ITU-T SG20:** <http://www.itu.int/en/ITU-T/studygroups/2017-2020/20/Pages/default.aspx>
- **JCA-IoT and SC&C:** <http://www.itu.int/en/ITU-T/jca/iot/Pages/default.aspx>
- **FG-DPM:** <http://www.itu.int/en/ITU-T/focusgroups/dpm/Pages/default.aspx>



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From 2015 to now, takes the responsibility of the Associated Rapporteur of Q.2/20, and works on the following work items as the main editor:

- ▣ ITU-T Y.2076 "Semantics based requirements and framework of the Internet of Things", released in January 2016
- ▣ ITU-T Y.4114 "Specific requirements and capabilities of the Internet of Things for Big Data", released in July 2017
- ▣ ITU-T Y.IoT-things-description "Requirements of things description in the Internet of Things", on going
- ▣ ITU-T Y.2075 "Capability framework for e-health monitoring services", released in September 2015
- ▣ ITU-T Y.2065 "Service and capability requirements for e-health monitoring services", released in March 2014
- ▣ ITU-T Y.IoT-EH-PFE "Performance evaluation frameworks of e-health systems in the IoT", on going



Thank you for your attention!

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