IoT Standardization activities and progress

Dr. Xueqin JIA
Institute of Technology and Standards Research, CAICT
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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 ecosystem

- IoT standards
- IoT standardization activities of the ITU-T
- IoT standard system of the ITU-T
- IoT standardization progress (incl. ITU-T SG20 and CCSA)
- IoT Standardization challenges
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: A large and long industry chain
What’s IoT? How define it?

- **Thing:** Physical thing and Virtual thing
- **More than “connected things”**

**Internet of Things (IoT):** A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies.

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 detector measure information related to surrounding environments and converts it into digital electronic signals.
- Data carrying device: is attached to a physical thing to in-directly 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.
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
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- IoT Standardization challenges
IoT related SDOs (non-exhaustive)

- Policy/economy
- Operation
- Application
- Service/Data model
- Networking
- Link/PHY

Health, Vehicle, ...

oneM2M platform
W3C
WoT
Zigbee

Network control, routing, ...

NB-IoT
WLAN, WPAN, ...

ITU
ITU-T SG3
ITU-T SG2
ITU-T SG20
ITU-T SG13
ITU-R
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), TIA (US), 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 provides more energy efficient and supports data interoperability between smart sensors.

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<th>Zigbee application enhancement: dotdot</th>
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Lamp: who are you? What can you do? 
Curtain: ......
Contents

- IoT ecosystem
- Key technologies enabling IoT infrastructure
- **IoT standardization activities of ITU-T**
- IoT standard system of ITU-T
- IoT standardization progress (incl. ITU-T SG20 and CCSA)
- IoT Standardization challenges
Brief introduction on ITU

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

ITU
- UN specialized agency for ICTs
- standards developing organization
- unique public/private partnership
The structure of ITU

**ITU-T: standardization**
produces interoperable technical ICT standards

**ITU-R: Radio comm.**
coordinates global wireless communication

**General Secretariat**
provides coordination for the whole organization

**ITU-D: Development**
provides assistance to the un-connected
Introduction on ITU-T

Operational aspects: SG2
Economic and policy issues: SG3
Environment and circular economy: SG5
Broadband cable and TV: SG9
Protocols and test specifications: SG11
Performance, QoS and QoE: SG12
Future networks ( & cloud): SG13
Transport, Access and Home: SG15
Multimedia: SG16
Security: SG17
IoT, smart cities and communities: SG20
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.
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<td>Requirements, capabilities, and use cases across verticals</td>
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- **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 diagram](image)
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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Standardization general approach

Use cases
- Automotive
- Home
- Energy
- E-Health

Requirements
- Security & privacy
- Device Management
- Data exchange
- Connectivity

Architecture
- Reference arch.
- Functional arch.
- Technical framework
- Key capabilities

APIs / protocols
- Reference points
- Device certification
- Open source

Test / Interop
...
ITU-T Standard system of SG20 on IoT and SSC

Source: WP2/20 Chairman adapted from ITU-T FG-SSC Technical Report
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# Q1/20

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

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<td>Framework and high-level requirements of smart cities and communities</td>
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<td>Framework and Service scenarios for Smartwork</td>
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Q5/20
Research and emerging technologies, terminology and definitions

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Security, privacy, trust and identification

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<td>Y.IoT-sec-safety</td>
<td>Security capabilities supporting safety of the Internet of Things</td>
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### 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
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.
Contents

- IoT ecosystem
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Five main challenges have to be overcome for IoT:

1. **Robust connectivity:** Latency, availability, coverage, cost
2. **Interoperability and open interfaces:** Enabling platforms to talk with each other
3. **Domain knowledge:** Deep, vertical-specific insights
4. **Privacy and security:** Prevent malware injection and data misuse
5. **Standardization:** Standard connectivity for billions of things
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

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.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 Y2065 "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

(Trainer information)

Trainer: Dr. Xueqin JIA
E-mail: jiaxueqin@ritt.cn
Department: IoT and Service & Resource Dept
Address: Building B, No 52, Huayuan North Road, Haidian District, Beijing, P.R.China 100191
Thank you for your attention!

中国信息通信研究院 http://www.caict.ac.cn