



ITU-T SG20 work progress on IoT and Smart Sustainable Cities and Communities

Potential interactions with 5G related activities

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ITU-T Study Group 20: Internet of things (IoT) and smart cities & communities (SC&C)

Lead Study Group on

Internet of things and its applications

Responsible for studies relating to IoT and its applications, and SC&C

Smart Cities and Communities, incl. its e-services and smart services

Including studies related to Big data aspects of IoT and SC&C, e-services and smart services for SC&C

IoT identification



Established in June 2015

Next interim physical/virtual Rapporteur meetings on 20-28 July 2017, Geneva

Next SG20 Meeting on 4-15 September 2017, Geneva

SG20 structure [updated at March 2017 SG20 meeting]

WP1/20	
<u>Q1/20</u>	End to end connectivity, networks, interoperability, infrastructures and Big Data aspects related to IoT and SC&C
<u>Q2/20</u>	Requirements, capabilities and use cases across verticals
<u>Q3/20</u>	Architectures, management, protocols and Quality of Service
<u>Q4/20</u>	e/Smart services, applications and supporting platforms
WP2/20	
<u>Q5/20</u>	Research and emerging technologies, terminology and definitions
<u>Q6/20</u>	Security, privacy, trust and identification
<u>Q7/20</u>	Evaluation and assessment of Smart Sustainable Cities and Communities
Regional groups	
<u>SG20RG-LATAM</u>	ITU-T SG20 Regional Group for the Latin American Region
<u>SG20RG-EECAT</u>	ITU-T SG20 Regional Group for Eastern Europe, Central Asia and Transcaucasia
<u>SG20RG-ARB</u>	ITU-T SG20 Regional Group for the Arab Region
<u>SG20RG-AFR</u>	ITU-T SG20 Regional Group for the Africa Region
Other groups under SG20	
<u>JCA-IoT and SC&C</u>	Joint Coordination Activity on IoT and SC&C [maintains IoT and SC&C standards roadmap]
<u>FG-DPM</u>	FG on Data Processing and Management to support IoT and SC&C (1 st meeting 17-19 July)

Work progress: ITU-T published Recommendations on IoT and SC&C aspects [including pre-SG20 achievements]

ITU-T Y.4000 series	Recommendation category	Number of published Recs
Y.4000-Y.4049	General	3
Y.4050-Y.4099	Definitions and terminologies	1
Y.4100-Y.4249	Requirements and use cases	16
Y.4250-Y.4399	Infrastructure, connectivity and networks	3
Y.4400-Y.4549	Frameworks, architectures and protocols	19
Y.4550-Y.4699	Services, applications, computation and data processing	3
Y.4700-Y.4799	Management, control and performance	3
Y.4800-Y.4899	Identification and security	5
Y.4900-Y.4999	Evaluation and assessment	4
Y.4000-Y.4999	Supplements	13

All approved and ongoing ITU-T IoT and SC&C specifications are collected in the “IoT Standards Roadmap” [cross-SDO roadmap] maintained by the JCA-IoT and SC&C



SG20 interactions with 5G related activities

ITU-T SG20 has been busy since its creation with a significant amount of studies according to its mandate and developed work program (a number of technical matters have been identified as key priorities for promoting a large scale adoption of IoT solutions within both business and social communities).

No official technical investigation and detailed technical discussions have been undertaken till now in SG20 on the interaction between IoT and 5G, and related standardization needs.

This presentation essentially concerns the author's personal considerations on requirements and potential action items from a standardization perspective in relation with the IoT-5G interaction. Ongoing activities within SG13 and SG20 as well as informal discussions with SG13 and SG20 colleagues have also inspired these considerations.

DISCLAIMER: According to the above, the following considerations do not represent an official position of SG20 with respect to the IoT-5G interaction, including on standardization needs and potential action items.



The supporting ICT infrastructure for IoT

IoT as defined in ITU-T [ITU-T Y.2060]:

“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.

NOTE2 - In a broad perspective, the IoT can be perceived as a vision with technological and societal implications.”

IoT deployments will benefit from integration of diverse leading technologies, incl.

- M2M Communications
- Big Data, Semantics, Artificial Intelligence
- Sensing, Actuation, advanced device technologies
- Security, Privacy Protection, Trust
- Distributed processing and storage (Cloud, Edge)
- Virtualization, Softwarization
- Distributed service support platforms (e.g. development, orchestration, delivery)
- High performance and flexible networking and transport

5G objective: it is expected that the supporting ICT infrastructure be able to integrate diverse technologies, as well as provide and deploy capabilities which are efficiently (re-)usable as well as flexibly adaptable to the specific requirements of the large and diverse set of IoT apps

On common requirements of IoT

Within the whole set of ITU-T IoT specifications, the following is a non-exhaustive list of key approved specifications concerning common requirements of IoT (application domain-independent technical requirements)

- *Y.2060 Overview of the Internet of things [NOTE - High level requirements]*
- *Y.2066 Common requirements of the IoT*
- *F.748.0 Common requirements for IoT applications*
- *Y.2078 Application support models of the IoT*
- *Y.2068 Functional framework and capabilities of the IoT*
- *Y.4113 Requirements of the network for the IoT*
- *Y.4702 Common requirements and capabilities of device management in the IoT*
- *Y.4115 Reference architecture for IoT device capabilities exposure*
- *Y.2076 Semantics-based requirements and framework of the IoT*
- *Y.4114 Specific requirements and capabilities of the IoT for Big Data*

5G objective: efficient support of these requirements by 5G networks

Action from standards perspective: to ensure adequate and constant interaction within ITU-T towards this objective (incl. for ongoing studies on common IoT requirements)

Remarks: specific activities are actually already in progress in WP1/13 (Y.IMT2020-Reqs).

**Non 5G-specific studies to be considered in 5G context for required support (BD, Sec., Trust ...)
SG20 is currently harmonizing common reqts between general IoT studies and SC&C specific.**

On application (domain) specific requirements of IoT

Within the whole set of ITU-T IoT specifications, the following non-exhaustive list mentions application domains with **approved and/or ongoing ITU-T specifications concerning application (domain) specific requirements of IoT**

- Smart Cities (incl. services and key performance indicators)
- Smart Residential Communities, Smart Rural Communities
- Smart Port, Smart Tourist destinations
- Smart Manufacturing (Industrial IoT context)
- Wearable devices and services
- Cooperative Intelligent Transport Systems and Transportation Safety Services
- Smart Retail
- Smart environmental monitoring, Earth Global Processes monitoring for disaster preparedness
- Smart Farming
- Smart Grids, utilities
- E-health
- Home Networks

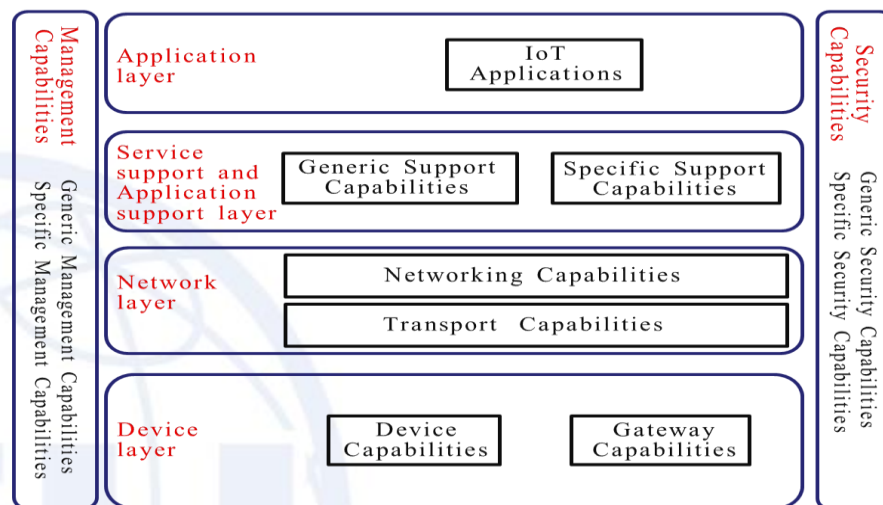
5G objective: flexible support of these requirements by 5G networks with efficient but open integration between IoT verticals and 5G ecosystem(s), and maximum capabilities reusability

Action from standardization perspective: to ensure adequate and constant interaction within ITU-T towards this objective (incl. related action plan)

On architectural and service platform aspects of IoT

ITU-T IoT Reference Model (capability view of the IoT infrastructure) [Y.2060]

- Application capabilities
- Service and Application Support capabilities
- Network capabilities
- Device and Gateway capabilities
- Cross-layer Management Capabilities
- Cross-layer Security Capabilities



The IoT architectural and service platform studies are ongoing in SG20

- Key target: specification of an IoT Reference Architecture (ongoing cooperation with other SDOs)
- Key target: converging (horizontal) distributed and modular service support platform
- Key target : smooth integration of diverse (vertical) IoT access networks and IoT devices
- Ongoing studies include specific functional components (e.g. capability exposure)
- Implementation and deployment perspective: different IoT architectures and service platforms (will) co-exist and need to interoperate.

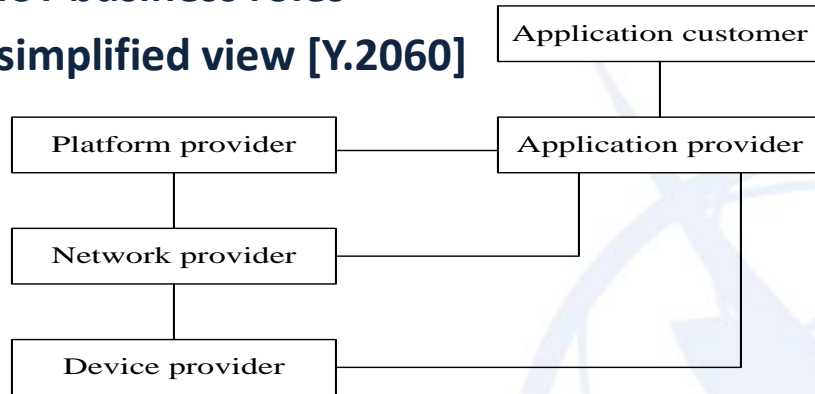
5G objective: to enable flexible support of different IoT architectures by 5G networks with efficient but open integration between IoT architectures and 5G network architecture (e.g. application-network data integration) and maximum functional component reusability

Action from standardization perspective: to ensure adequate ITU-T interaction towards goal

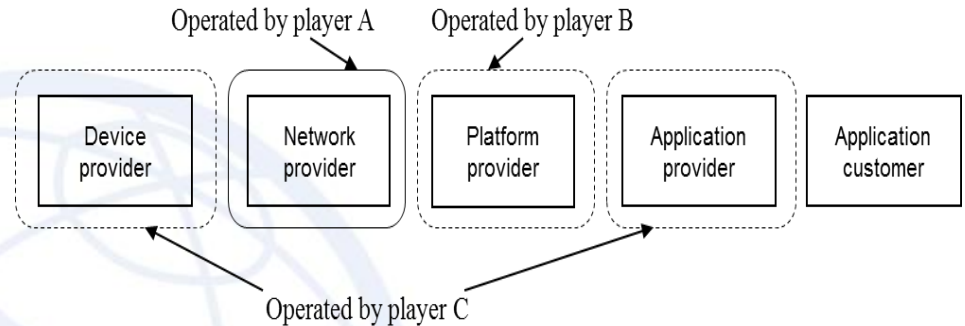
Remark: to consider study of IoT-5G architectural (components) mapping in medium term.

On IoT business ecosystems and models

IoT business roles - simplified view [Y.2060]



IoT business models - example from [Y.2060]



The above view and examples provided in [Y.2060] do not obviously represent all roles, relationships and models across the huge number of IoT and SC&C business deployments.

The main objective of [Y.2060] analysis was to build a proactive linkage between IoT deployments and technical standardization (requirements, functionalities, open interfaces).

The exercise has been also developed in specific application domains (incl. E-health and Big Data apps).

5G objective: to enable open integration into a wider ecosystem of IoT ecosystems and models with 5G ecosystem(s), ensuring efficient but flexible support of IoT business models and related requirements (incl. functional roles and related interfaces) by 5G networks.

Action from standardization perspective: to ensure adequate ITU-T interaction towards this objective (incl. potential priorities of study).

Remarks: an initial study is under development in WP1/13 (Y.IMT2020-BM) [some details of this ongoing study are provided in the following slide for information].

Smart Cities ecosystems are complex (multi-vertical) IoT ecosystems.

A SG13 study which can help in linking IoT and 5G concerning business ecosystems and models aspects: Y.IMT2020-BM "Business models of IMT-2020"

Business models will be a key factor for successful deployment and usage of 5G networks (no systematic study of 5G business models has been made up to now)

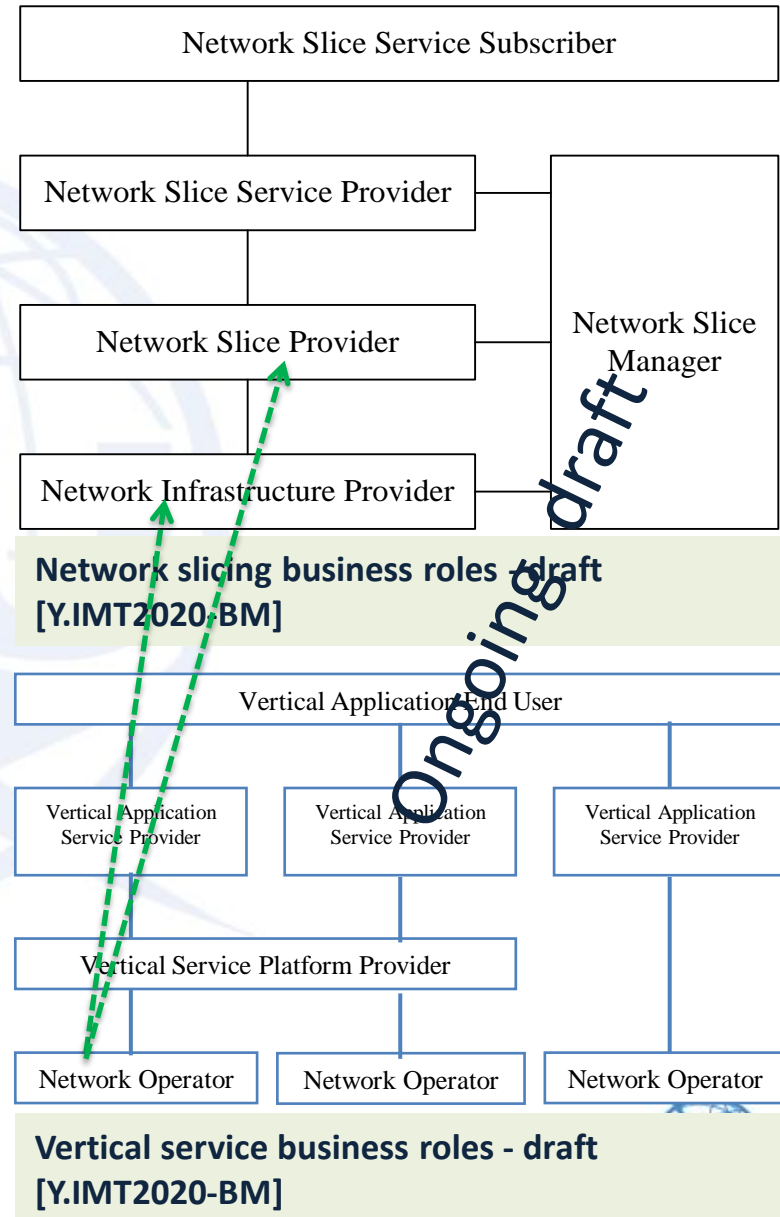
Highlighting key business roles and key business models of the 5G business ecosystem(s) is important from technical standardization viewpoint

- identifying relevant 5G use cases where roles can interact in multiple ways and implement multiple business models helps concepts and terminology consolidation, 5G requirements verification, 5G functional architecture reference points identification

Draft Y.IMT2020-BM analyses best practice use cases from different perspectives, building on key features of 5G networks, in order to identify key 5G business models and roles

Among the initial use cases under investigation:

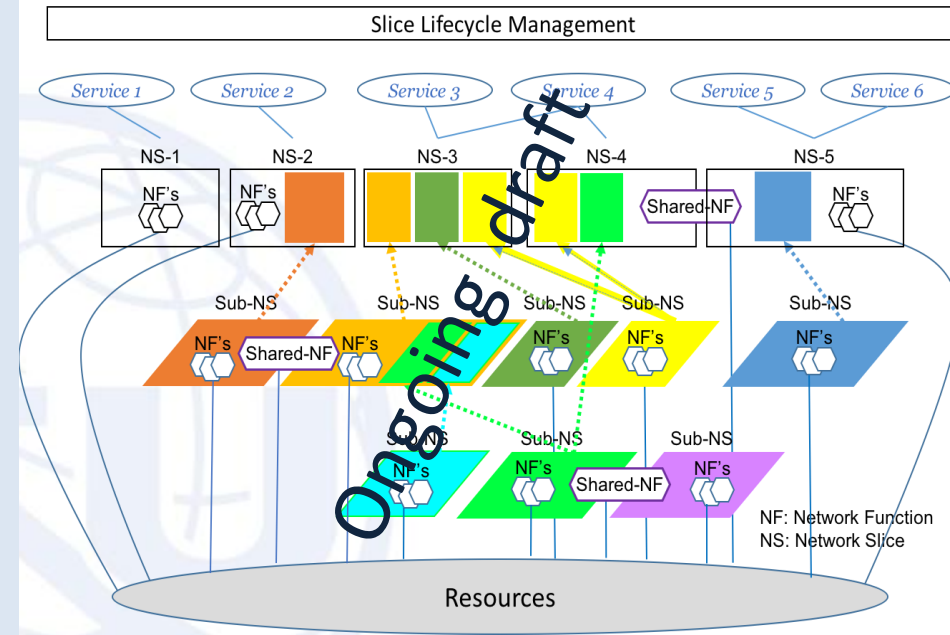
- network slicing services
- vertical services (e.g. IoT application domain-specific services)
- other services
- for further discussion: Big Data services? Cloud services?



Customized support by 5G network of IoT applications with diverse requirements: network slices for IoT

In order to develop the IoT-5G interaction on this matter, the following network slicing related topics - currently under study within SG13 - constitute baseline information:

- slice blueprint
- blueprint information (incl. service requirements, priority, sharing/isolation level, other)
- recursive slicing
- end-to-end slice vs per-domain slice
- static vs dynamic slice instantiation
- network function chaining in slice
- slice management and control in the context of globally optimal 5G network management



5G network slices [SG13 draft Y.IMT2020-frame]

5G objective: to enable flexible and dynamic management of network slices for IoT applications, ensuring scalability and high availability for simultaneous support of a large number of diverse (massive) IoT and non-IoT applications.

Action from standardization perspective: to ensure adequate ITU-T interaction towards this objective (candidate interaction items may include IoT network slice types and blueprints, (northbound) APIs of the 5G network, IoT network slice architectures).

Useful references

- **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>

- **Contacts**

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