e) Develop guidelines and techniques to protect personal information and also to protect personally identifiable information (PII) using CYBEX, STIX and TAXII techniques and related security tools.

Moving Forward

With proposing an effective mandate and Question for the next study period (2021~2024) for Study Group 17, it was currently agreed that a new Question will be established for emerging security technologies including quantum based security in SG17, and for this new Question to incorporate the incubation function to be transferred from Q4. It was also agreed that Q5 (countering spam by technical means) will be merged into Q4 since this combining would achieve broader participation in the work of Q5. Q4/17 will produce a set of Recommendations for providing security solutions for telecommunication/ICT accountability, assurance and incident response and recovery, including technical aspects of managed security services and technical measures for countering spam.

ITU-T SG20, Question 4 (E/Smart Services, Applications and Supporting Platforms)

Gyu Myoung Lee, (LJMU/KAIST Korea), Rapporteur of Q4/20

ITU-T Q4/20 has focused on various vertical services and applications for IoT and smart cities, and supporting platforms with middleware functionalities like context/event management, autonomic service management and business support capabilities. Since 2019, Q4/20 has completed the development of seven new recommendations as follows:

Recommendation ITU-T Y.4555 (February 2019): "Service functionalities of self-quantification over Internet of things." It clarifies the concept of self-quantification services, identifies their considerations and specifies their requirements and functionalities.

Recommendation ITU-T Y.4458 (June 2019): "Requirements and functional architecture of a smart street light service." It specifies requirements and the functional architecture of a smart street light service which is a key means to reduce energy consumption, promote maintenance management efficiency and improve the quality of municipal services as part of a smart city's services.

Recommendation ITU-T Y.4556 (December 2019) "Requirements and functional architecture of smart residential community." It presents the key components and specifies requirements and the functional architecture of a smart residential community which is an IoT-based approach for residents to acquire safe, comfortable and convenient living conditions in a residential community.

Recommendation ITU-T Y.4463 (January 2020): "Framework of delegation service for Internet of things devices." It gives an overview and types of delegation service in an IoT environment, and also describes the requirements and architectural models of the delegation service for transferring ownership (i.e., access rights to the IoT devices) among authorized IoT devices.

Recommendation ITU-T Y.4464 (January 2020): "Framework of blockchain of things as decentralized service platform." It introduces a decentralized IoT service platform, blockchain of things (BoT), which is enabled by blockchain-related technologies. It analyzes the concept, common characteristics and high-level requirements of BoT, and provides common capabilities and functionalities, general procedures and relevant use cases for BoT

Recommendation ITU-T Y.4465 (January 2020): "Framework of Internet of things services based on visible light communications." After describing the technical overview of visible light communications (VLC) and the concepts of IoT services based on VLC, it describes requirements and a reference model.

Recommendation ITU-T Y.4466 (January 2020): "Framework of smart greenhouse service." It specifies requirements, a reference model, a functional architecture and interfaces for a smart greenhouse service which enables precision farming with the help of IoT devices (e.g., sensors and actuators) installed in a smart greenhouse.

With the progress of the IoT services standardization work and the successful completion of the above standards, Q4/20 is continuously contributing to develop 17 on-going draft recommendations. In particular, the ITU-T Focus Group on data processing and management (FG-DPM) successfully developed 15 deliverables on data issues in IoT and smart cities last year and Q4/20 continued the work on data exchange and sharing with blockchain based on the FG-DPM results. Taking into account the data ecosystem that affects various stakeholders, ITU-T SG20 will develop a series of Recommendations on effective DPM, data analytics and sharing including big data aspects for IoT and smart cities in the next study period (2021-2024).

Building the Standards for an IoT Future: Introducing oneM2M

Roland Hechwartner, oneM2M Technical Plenary Chair

There is a renewed interest in interoperable and scalable Internet-of-Things (IoT) systems because of the promise of Artificial Intelligence (AI) and Machine Learning (ML) technologies. To reach their full potential, however, IoT applications and their AI/ML complements need reliable and cost-effective ways to share data. That means "things" such as devices and applications need to be able to talk to and understand each other. Proprietary and silo-solutions make this difficult.

Developers initially customized a technology stack for each IoT system on a use-case by use-case basis. Over time, IoT platforms took on the role of managing communications between connected devices and applications by offering developers a toolbox of service functions. Example functions include device management (e.g. lightweight machine to machine (LWM2M)), registration (for sensor, device, and application identities), connectivity management (e.g. cellular or Wi-Fi) and security (e.g. datagram transport layer security (DTLS), transport layer security (TLS), and public key infrastructure (PKI)). One consequence of adopting IoT platforms is that it is now necessary to make it easy for "things" and "platforms" to talk to and understand each other.

Horizontal Architecture for IoT Solutions

oneM2M solves this challenge by standardizing a middleware technology layer. This resides between a lower layer, comprising devices and communications technologies, and an upper layer of IoT applications. The common services layer standardizes 14 common service functions (CSFs). These help to manage technology components along the IoT stack from device and communications management to discovery and semantics capabilities. Other cross-cutting CSFs support location and security functions.

Developers can build a simple system with a subset of CSFs to address their initial deployment needs. They can then combine others as they add data discovery, semantic interoperability, and usage charging to enable data sharing and to monetize

high-value data sources. oneM2M's modular CSFs fit into a coherent framework, making it straightforward to use other CSFs as application and use case deployment requirements change.

oneM2M's Open Standard Approach

oneM2M is an international initiative which promotes a scalable and interoperable standard for IoT systems. It brings together major telecom standards developing organizations (SDOs) from the Americas, China, Europe, Japan, Korea, and India.

The organization has more than 200 members who contribute to standardization activities and launched Release 1 in 2015. oneM2M's certification and interoperability testing activities are important aspects of a robust standard. Members continue to add new capabilities with support for edge computing, industrial, railway and vehicular needs in Release 3 and the soon to be published Release 4.

Building a Flexible Standard to Deliver a Thriving IoT Ecosystem

Dr. Ken Figueredo, InterDigital Inc.

The concept of connected devices has been around for a long time and really took off soon after the term 'Internet of Things' (IoT) was coined. As IoT devices began to proliferate, a standard was required to address emerging IoT requirements without reinventing elements where tried and tested specifications already existed. When launched in 2012, oneM2M was built around these ideas with the aim of enabling interoperability and economies of scale between IoT devices and applications.

Building the Foundations

oneM2M began by defining a horizontal architecture using middleware technology to connect many different types of IoT devices and applications. It equips organizations to invest and develop their applications, without fear of vendor lock-in or needing to commit to one connectivity technology.

Extensibility and modularity were key principles in the inception of Release 1 of the standard that oneM2M published in 2015. This version established a framework and horizontal architecture that is applicable in any IoT vertical. Members contributing to the standard anticipated the need to establish the bedrock on which future improvements and developments would be added. The scene was set for oneM2M users to cut development costs, reduce deployment complexity and speed up time to market.

Enhancing the Foundations

oneM2M continues to evolve as a stable standard and to address new IoT requirements. In 2016, oneM2M published Release 2 which enables interworking with different types of IoT devices such as those conforming to lightweight machine to machine (LWM2M), Open Connectivity Foundation, and 3GPP specifications. It also contains end-to-end security, dynamic authorization and content security features.

Having established the technical foundations, Release 3 focused on application and revenue opportunities in industrial, smart-home and cellular segments. The layering of services on top of 3GPP networks places better IoT-enablement tools at the disposal of mobile network operators. Other standardization developments include support for time-series data and advanced semantic queries.

Standardizing New Features

As more organizations and national agencies advocate IoT standardization, oneM2M is preparing its next release, scheduled for early 2021. In keeping with the original modular concept, Release 4 addresses new priorities in the IoT market. These include requirements to support fog and edge computing and the industrial, railway and vehicular domains. With support from the EU and Korea, oneM2M is also organizing its seventh interoperability testing event which is an important forum to improve the standard.