

# ITU-T

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

## Y.4555

(02/2019)

SERIES Y: GLOBAL INFORMATION  
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS,  
NEXT-GENERATION NETWORKS, INTERNET OF  
THINGS AND SMART CITIES

Internet of things and smart cities and communities –  
Services, applications, computation and data processing

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### **Service functionalities of self-quantification over Internet of things**

Recommendation ITU-T Y.4555

# ITU-T Y-SERIES RECOMMENDATIONS

## GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS, NEXT-GENERATION NETWORKS, INTERNET OF THINGS AND SMART CITIES

### GLOBAL INFORMATION INFRASTRUCTURE

|                                           |             |
|-------------------------------------------|-------------|
| General                                   | Y.100–Y.199 |
| Services, applications and middleware     | Y.200–Y.299 |
| Network aspects                           | Y.300–Y.399 |
| Interfaces and protocols                  | Y.400–Y.499 |
| Numbering, addressing and naming          | Y.500–Y.599 |
| Operation, administration and maintenance | Y.600–Y.699 |
| Security                                  | Y.700–Y.799 |
| Performances                              | Y.800–Y.899 |

### INTERNET PROTOCOL ASPECTS

|                                                                    |               |
|--------------------------------------------------------------------|---------------|
| General                                                            | Y.1000–Y.1099 |
| Services and applications                                          | Y.1100–Y.1199 |
| Architecture, access, network capabilities and resource management | Y.1200–Y.1299 |
| Transport                                                          | Y.1300–Y.1399 |
| Interworking                                                       | Y.1400–Y.1499 |
| Quality of service and network performance                         | Y.1500–Y.1599 |
| Signalling                                                         | Y.1600–Y.1699 |
| Operation, administration and maintenance                          | Y.1700–Y.1799 |
| Charging                                                           | Y.1800–Y.1899 |
| IPTV over NGN                                                      | Y.1900–Y.1999 |

### NEXT GENERATION NETWORKS

|                                                                   |               |
|-------------------------------------------------------------------|---------------|
| Frameworks and functional architecture models                     | Y.2000–Y.2099 |
| Quality of Service and performance                                | Y.2100–Y.2199 |
| Service aspects: Service capabilities and service architecture    | Y.2200–Y.2249 |
| Service aspects: Interoperability of services and networks in NGN | Y.2250–Y.2299 |
| Enhancements to NGN                                               | Y.2300–Y.2399 |
| Network management                                                | Y.2400–Y.2499 |
| Network control architectures and protocols                       | Y.2500–Y.2599 |
| Packet-based Networks                                             | Y.2600–Y.2699 |
| Security                                                          | Y.2700–Y.2799 |
| Generalized mobility                                              | Y.2800–Y.2899 |
| Carrier grade open environment                                    | Y.2900–Y.2999 |

### FUTURE NETWORKS

Y.3000–Y.3499

### CLOUD COMPUTING

Y.3500–Y.3999

### INTERNET OF THINGS AND SMART CITIES AND COMMUNITIES

|                                                                |                      |
|----------------------------------------------------------------|----------------------|
| General                                                        | Y.4000–Y.4049        |
| Definitions and terminologies                                  | Y.4050–Y.4099        |
| Requirements and use cases                                     | Y.4100–Y.4249        |
| Infrastructure, connectivity and networks                      | Y.4250–Y.4399        |
| Frameworks, architectures and protocols                        | Y.4400–Y.4549        |
| <b>Services, applications, computation and data processing</b> | <b>Y.4550–Y.4699</b> |
| Management, control and performance                            | Y.4700–Y.4799        |
| Identification and security                                    | Y.4800–Y.4899        |
| Evaluation and assessment                                      | Y.4900–Y.4999        |

For further details, please refer to the list of ITU-T Recommendations.

# Recommendation ITU-T Y.4555

## Service functionalities of self-quantification over Internet of things

### Summary

Recommendation ITU-T Y.4555 describes 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.

### History

| Edition | Recommendation | Approval   | Study Group | Unique ID*                                                                   |
|---------|----------------|------------|-------------|------------------------------------------------------------------------------|
| 1.0     | ITU-T Y.4555   | 2019-02-13 | 20          | <a href="http://handle.itu.int/11.1002/1000/11830-en">11.1002/1000/13862</a> |

### Keywords

Functionality, IoT, requirement, self-quantification, service.

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\* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

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## Table of Contents

|   |                                                                    | Page |
|---|--------------------------------------------------------------------|------|
| 1 | Scope.....                                                         | 1    |
| 2 | References.....                                                    | 1    |
| 3 | Definitions .....                                                  | 1    |
|   | 3.1 Terms defined elsewhere .....                                  | 1    |
|   | 3.2 Terms defined in this Recommendation.....                      | 2    |
| 4 | Abbreviations and acronyms .....                                   | 2    |
| 5 | Conventions .....                                                  | 3    |
| 6 | Introduction to self-quantification over Internet of things .....  | 3    |
|   | 6.1 Concept.....                                                   | 3    |
|   | 6.2 Technical implications.....                                    | 4    |
|   | 6.3 General service models.....                                    | 6    |
| 7 | Considerations .....                                               | 7    |
|   | 7.1 Interoperability .....                                         | 7    |
|   | 7.2 Security.....                                                  | 7    |
|   | 7.3 Human body safety.....                                         | 7    |
| 8 | Requirements .....                                                 | 8    |
|   | 8.1 Interoperability .....                                         | 8    |
|   | 8.2 Security.....                                                  | 11   |
|   | 8.3 Human body safety.....                                         | 13   |
| 9 | Functionalities.....                                               | 13   |
|   | 9.1 General functional architecture .....                          | 13   |
|   | 9.2 Sequence diagrams of self-quantification services.....         | 18   |
|   | Appendix I – Usage scenarios of self-quantification services ..... | 22   |
|   | I.1 Usage scenario for one-user and one-device .....               | 22   |
|   | I.2 Usage scenario for one-user and two-devices .....              | 23   |



# Recommendation ITU-T Y.4555

## Service functionalities of self-quantification over Internet of things

### 1 Scope

This Recommendation describes service functionalities of self-quantification over Internet of things (IoT) with the purpose of fostering interoperability of self-quantification services.

The following elements are within the scope of this Recommendation:

- Concept, technical implications and general service models to clarify the idea of self-quantification services and to categorize them into three different service models.
- Considerations to emphasize three important aspects of self-quantification services.
- Requirements to specify three different categories of requirements, which support the identified considerations.
- Functionalities to define a general functional architecture based on the identified requirements and to illustrate sequential diagrams of three different service models.

This Recommendation builds on the overview of IoT [ITU-T Y.4000] and the common requirements of the IoT [ITU-T Y.4100], providing specific requirements in support of the self-quantification application domain.

Usage scenarios of self-quantification services are provided in Appendix I.

NOTE – Regulatory, legal and business aspects are outside the scope of this Recommendation.

### 2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- |                |                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------|
| [ITU-T Y.2091] | Recommendation ITU-T Y.2091 (2011), <i>Terms and definitions for next generation networks</i> .   |
| [ITU-T Y.4000] | Recommendation ITU-T Y.4000/Y.2060 (2012), <i>Overview of Internet of things</i> .                |
| [ITU-T Y.4100] | Recommendation ITU-T Y.4100/Y.2066 (2014), <i>Common requirements of the Internet of things</i> . |

### 3 Definitions

#### 3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

**3.1.1 application** [ITU-T Y.2091]: A structured set of capabilities, which provide value-added functionality supported by one or more services, which may be supported by an API interface.

**3.1.2 application domain** [ITU-T Y.4100]: An area of knowledge or activity applied for one specific economic, commercial, social or administrative scope.

NOTE – Transport application domain, health application domain and government application domain are examples of application domains.

**3.1.3 device** [ITU-T Y.4000]: With regard to the Internet of things, this is a piece of equipment with the mandatory capabilities of communication and the optional capabilities of sensing, actuation, data capture, data storage and data processing.

**3.1.4 Internet of things (IoT)** [ITU-T Y.4100]: 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 – From a broader perspective, the IoT can be perceived as a vision with technological and societal implications.

**3.1.5 service** [ITU-T Y.2091]: A set of functions and facilities offered to a user by a provider.

## 3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

**3.2.1 self-quantification:** A practice of measuring, integrating and analyzing health, mental, dietary, physical, social and environmental data of a person to produce more meaningful information to the user.

NOTE 1 – Self-quantification measures ambient temperature, humidity, atmospheric pressure, etc., and relates them to users' body temperature, heart rate, etc., by means of quantifying each factor.

NOTE 2 – Self-quantification does not specify nor unify a specific way to quantify intangible status around users.

## 4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

|       |                                                     |
|-------|-----------------------------------------------------|
| AAA   | Authentication, Authorization and Accounting        |
| ACL   | Access Control List                                 |
| API   | Application Programming Interface                   |
| BLE   | Bluetooth Low Energy                                |
| E2E   | End-to-End                                          |
| HIPAA | Health Insurance Portability and Accountability Act |
| IMT   | International Mobile Telecommunications             |
| IoT   | Internet of Things                                  |
| JSON  | JavaScript Object Notation                          |
| LTE   | Long Term Evolution                                 |
| PKI   | Public Key Infrastructure                           |
| SI    | International System of units                       |
| Wi-Fi | Wireless Fidelity                                   |
| XML   | Extensible Markup Language                          |

## 5 Conventions

In this Recommendation:

The keywords "**is required to**" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.

The keywords "**is recommended**" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

The keywords "**can optionally**" indicate an optional requirement which is permissible, without implying any sense of being recommended. These terms are not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

## 6 Introduction to self-quantification over Internet of things

This clause introduces the concept, technical implications and general service models of self-quantification over IoT.

### 6.1 Concept

Self-quantification, also known as quantified self or lifelogging, is a practice of measuring, integrating and analyzing health, mental, dietary, physical, social and environmental data of a person to produce more meaningful information to the user. The concept derives from a convergence of data acquisition and users' daily life to gain insight into the behaviour and habits of users. Self-quantification service provides a set of functionalities that enables and supports requirements of self-quantification.

Most recently, the culture of collecting, transmitting, analyzing and sharing data has moved from a business or marketing level to a much more personal level. Users are now tracking every aspect of their lives especially with the aid of smart wearable technologies.

Knowing where you are today and being able to measure and compare against past data is the essence of self-quantification. From a technological perspective, miniaturization of sensors and processors, ever-increasing processing power, improved battery life and ubiquitous communications infrastructure have enabled possibilities for always-on wearable devices that can be carried around all day. Other key technology drivers are cloud computing and big data computing that seamlessly facilitate communication among a number of different self-quantification services.

A wide range of sensors enables users to digitize and save information for future uses. However, if there are no current or practical sensors that can measure preferable information, for the time being, smart device applications providing self-quantification services allow users to assess their current status and input data into the applications. Typical examples include mental status or dietary consumption.

Table 1 enumerates possible data that can be measured with self-quantification services.

**Table 1 – List of possible data that can be measured with self-quantification services**

| Category      | Data                                                                       |
|---------------|----------------------------------------------------------------------------|
| Health        | Heart rate, blood glucose, body temperature, body PH, fertility, pregnancy |
| Mental        | Mood, stress, alertness                                                    |
| Dietary       | Calories, alcohol, nicotine, caffeine, water, medicine, drugs              |
| Physical      | Sleep, step, run, cycle power, cycle cadence, speed, time                  |
| Social        | Social media uploads, social media interactions (like, love, sad, etc.)    |
| Environmental | Temperature, geolocation (GPS location, altitude)                          |

Practitioners of self-quantification include people with chronic medical conditions who need to track their symptoms to try and establish patterns in their state, which could help to identify correlation factors for their conditions. Sports enthusiasts, who keep track of their progress to achieve performance goals are also avid practitioners of self-quantification. Apart from the above two categories, ordinary people, who are simply curious or willing to achieve short or long-term goals also take advantage of self-quantification services. Such goals include quitting smoking, losing weight, sleeping better, and so on.

Most importantly however, the most powerful use scenarios take place when two or more different types of data combine together and provide information or insight which cannot be provided by measuring only one data. Such use scenarios can only be guaranteed by interoperability between self-quantification services. In this sense, this Recommendation aims to foster interoperability of self-quantification services.

NOTE 1 – Huge advances in sensing technology and integrating various data allow users to take advantage of collected data. It is then possible to understand personal health and fitness status by processing and visualizing them. By analyzing these data, people have a better understanding of not only their health status but also their relationship to the world around them.

NOTE 2 – The benefits of self-quantification services are as follows:

- Help users to deeply understand their health and fitness status and how to interact with the world around them.
- Learn users' behaviours and help them to adapt to their needs by risk profiling and preventing diseases.
- Find actionable intelligence in the data they collect.
- Motivate people with more serious health concerns to track multiple health aspects, which consequently could produce greater volumes and a broader range of data types.
- Capture an enormous amount of data and a broad range of data types that need to be streamed to provide feedback and trigger services in critical time frames.
- Derive valuable insight into personal habits and behaviour and could target marketing campaigns.

## 6.2 Technical implications

IoT is the foundation of self-quantification and self-quantification services are built upon IoT ecosystems. IoT allows self-quantification to seamlessly transfer and receive measured and processed data of users and their environment. There are necessary actors for self-quantification which correspond to the IoT elements, which are defined in [ITU-T Y.4000]; the actors include self-quantification services, sensors, users, surrounding environment and remote servers. Figure 1 shows how actors of self-quantification align with elements of IoT. It is noted that not all actors correspond to the existing elements.