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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 – Definitions and terminologies

Vocabulary for smart cities and communities

Recommendation ITU-T Y.4051

International Telecommunication Union

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
Services, applications, computation and data processing	Y.4550–Y.4699
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.4051

Vocabulary for smart cities and communities

Summary

Recommendation ITU-T Y.4051 contains vocabulary applied to the work on smart cities and communities (SC&C). The vocabulary terms and definitions in this Recommendation are defined in published ITU-T Recommendations and Supplements, and standards from other international standards developing organizations (SDOs) such as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). Additionally, this vocabulary also includes and defines new terms to meet the needs of the work of ITU on SC&C.

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Table of Contents

Recommendation ITU-T Y.4051

Vocabulary for smart cities and communities

1 Scope

This Recommendation contains terms and definitions applied to smart cities and communities (SC&C) works. The terms and definitions in this Recommendation are defined in published ITU-T Recommendations and Supplements, and standards of other international standards developing organizations (SDOs) such as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). In addition, this Recommendation also includes and defines new terms to meet the needs of SC&C works of ITU.

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 L.1201] Recommendation ITU-T L.1201 (2014), *Architecture of power feeding systems of up to 400 VDC*1201.

[ITU-T L.1410] Recommendation ITU-T L.1410 (2014), *Methodology for environmental life cycle assessments of information and communication technology goods, networks and services*.

[ITU-T X.1054] Recommendation ITU-T X.1054 (2012), *Information technology – Security techniques – Governance of information security*.

[ITU-T X.1311] Recommendation ITU-T X.1311 (2011), *Information technology – Security framework for ubiquitous sensor networks*.

[ITU-T Y.101] Recommendation ITU-T Y.101 (2000), *Global Information Infrastructure terminology: Terms and definitions*.

[ITU-T Y.1901] Recommendation ITU-T Y.1901 (2009), *Requirements for the support of IPTV services*.

[ITU-T Y.2091] Recommendation ITU-T Y.2091 (2011), *Terms and definitions for next generation networks*.

[ITU-T Y.2261] Recommendation ITU-T Y.2261 (2006), *PSTN/ISDN evolution to NGN*.

[ITU-T Y.4201] Recommendation ITU-T Y.4201 (2017), *High-level requirements and reference framework of smart city platform*.

[ITU-T Y.4900] Recommendation ITU-T Y.4900/L.1600 (2016), *Overview of key performance indicators in smart sustainable cities.*

[ISO 4225] ISO 4225 (1994), *Air quality – General aspects – Vocabulary*.

[ISO 14001] ISO 14001 (2015), *Environmental management systems – Requirements with guidance for use*.

[ISO 14040] ISO 14040 (2006), *Environmental management – Life cycle assessment – Principles and framework*.

[ISO 14050] ISO 14050 (2009), *Environmental management – Vocabulary*.

[ISO 14064-1] ISO 14064-1 (2006), *Greenhouse gases – Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals*.

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[ISO 30400] ISO 30400 (2016), *Human resource management – Vocabulary*.

[ISO 37100] ISO 37100 (2016), *Sustainable cities and communities – Vocabulary*.

[ISO/IEC 14543-2-1] ISO/IEC 14543-2-1 (2006), *Information technology – Home electronic systems (HES) architecture – Part 2-1: Introduction and device modularity*.

[ISO/IEC 30134-1] ISO/IEC 30134-1 (2016), *Information technology – Data centres – Key performance indicators – Part 1: Overview and general requirements*.

[ITU-R V.662-3] Recommendation ITU-R V.662-3 (2006), *Terms and definitions*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 air pollution [ISO 4225]: Usually the presence of substances in the atmosphere resulting either from human activity or natural processes, present in sufficient concentration, for a sufficient time and under circumstances such as to interfere with comfort, health or welfare of persons or the environment.

3.1.2 application [ITU-T Y.2261]: A structured set of capabilities, which provide value-added functionality supported by one or more services, which may be supported by an API interface.

3.1.3 availability [b-ISO/TR 18638]: Property of data or of resources being accessible and usable on demand by an authorized entity.

3.1.4 city [ITU-T Y.4900]: An urban geographical area with one (or several) local government and planning authorities.

3.1.5 city platform [ITU-T Y.4201]: A computer system or integration of computer systems that uses information and communication technologies (ICTs) to access data sources and process them to offer urban operation and services to the city.

NOTE – The concept is extended to a community.

3.1.6 community [b-ISO/TS 37151]: Group of people with an arrangement of responsibilities, activities and relationships.

NOTE – A community shares geographic areas.

3.1.7 community infrastructure [b-ISO/TS 37151]: System of facilities, equipment and services that support the operations and activities of communities.

NOTE – Such community infrastructures include, but are not limited to, energy, water, transportation, waste and information and communication technologies (ICTs).

3.1.8 data centre [ISO/IEC 30134-1]: Structure, or group of structures, dedicated to the centralized accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and environmental control together with the necessary levels of resilience and security required to provide the desired service availability.

NOTE 1 – A structure can consist of multiple buildings and/or spaces with specific functions to support the primary function.

NOTE 2 – The boundaries of the structure or space considered the data centre, which includes the information and communication technology equipment and supporting environmental controls, can be defined within a larger structure or building.

3.1.9 environment [ISO 14050]: Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation.

NOTE – Surroundings in this context extend from within an organization to the local, regional and global system.

3.1.10 environmental aspect [ISO 14001]: Element of an *organization's* activities or products or services that interacts or can interact with th*e environment.*

NOTE 1 – An environmental aspect can cause (an) environmental impact(s). A significant environmental aspect is one that has or can have one or more significant environmental impact(s).

NOTE 2 – Significant environmental aspects are determined by the organization applying one or more criteria.

3.1.11 environmental impact [ISO 14001]: Change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.

3.1.12 global information infrastructure (GII) [ITU-T Y.101] A collection of networks, end user equipment, information, and human resources which can be used to access valuable information, communicate with each other, work, learn, receive entertainment from it, at any time and from any place, with affordable cost on a global scale.

3.1.13 greenhouse gas [ISO 14064-1]: Gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds.

NOTE – Greenhouse gas includes carbon dioxide, methane, nitrous oxide, hydro fluorocarbons, per fluorocarbons and sulphur hexafluoride.

3.1.14 greenhouse gas emission [ISO 14064-1]: Total mass of a GHG released to the atmosphere over a specified period of time.

3.1.15 identifier [ITU-T Y.2091]: An identifier is a series of digits, characters and symbols or any other form of data used to identify subscriber(s), user(s), network element(s), function(s), network entity(ies) providing services/applications, or other entities (e.g., physical or logical objects). Identifiers can be used for registration or authorization. They can be either public to all networks, shared between a limited number of networks or private to a specific network (private IDs are normally not disclosed to third parties).

3.1.16 information [ITU-R V.662-3]: Intelligence or knowledge capable of being represented in forms suitable for communication, storage or processing.

NOTE – Information may be represented for example by signs, symbols, pictures or sounds.

3.1.17 infrastructure [ITU-T L.1410]: Basic structures needed for the operation of the society, such as transportation systems, buildings and power plants, etc.

3.1.18 interoperability [ITU-T Y.101]: The ability of two or more systems or applications to exchange information and to mutually use the information that has been exchanged.

3.1.19 key performance indicator (KPI) [ISO/IEC 30134-1]: *Indicator* representing the resource usage effectiveness or efficiency of a given system.

3.1.20 life cycle [ISO 14040]: Consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal.

3.1.21 metadata [ITU-T Y.1901]: Structured, encoded data that describe characteristics of information-bearing entities to aid in the identification, discovery, assessment, and management of the described entities.

3.1.22 organization [ISO 37100]: Person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives.

NOTE 1 – The concept of organization includes, but is not limited to sole-trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private.

NOTE 2 – The concept of organization refers to an entity/institution inside the community that is tasked with implementing the management system, e.g., the local government. The community identifies an organization that it entrusts with the implementation of this document.

3.1.23 productivity [ISO 30400]: Quality, state or fact of being able to generate, create, enhance or bring forth goods, services and knowledge.

NOTE – Productivity may refer to industry productivity, workforce productivity, etc.

3.1.24 quality of life [b-ISO/IWA 18]: Product of the balance between social, health, economic and environmental conditions which affect human and social development

NOTE – It is a broad-ranging concept, incorporating a person's physical health, psychological state, level of independence, social relationships, personal beliefs and relationship to salient features in the environment.

3.1.25 reference model [ISO/IEC 14543-2-1]: Model that describes the general principles of interconnections in a system and the network architecture resulting from those principles.

3.1.26 renewable energy [ITU-T L.1201]: This is mainly non-fossil fuel converted into electricity (e.g., solar energy, wind, water flow, and biomass).

3.1.27 resilience [ITU-T X.1311]: Ability to recover from security compromises or attacks.

3.1.28 smart city platform [ITU-T Y.4201]: A city platform that offers direct integration of city platforms and systems or through open interfaces between city platforms and third parties in order to offer the urban operation and services supporting the functioning of the city services, as well as efficiency, performance, security and scalability.

3.1.29 smart community infrastructure [b-ISO/TS 37151]: Community infrastructure with enhanced technological performance that is designed, operated, and maintained to contribute to *sustainable development* and resilience of the community.

NOTE 1 – It is the community infrastructure that is considered to be "smart".

NOTE 2 – Sustainable development tends to require community infrastructures that meet multiple, often contradictory, needs at a same time.

NOTE 3 – Information and communication technologies is an enabler but not a precondition for achieving smart community infrastructures.

3.1.30 smart sustainable city (SSC) [ITU-T Y.4900]: A smart sustainable city (SSC) is an innovative ***city*** that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects.

NOTE 1 – City competitiveness refers to policies, institutions, strategies and processes that determine the city's sustainable productivity.

NOTE 2 – 'Smart sustainable city' is also called 'smart city' in some other SDOs.

3.1.31 stakeholder [ITU-T X.1054]: Any person or organisation that can affect, be affected by, or perceive themselves to be affected by an activity of the organisation.

NOTE – A decision maker can be a stakeholder.

3.1.32 sustainability [b-ISO/TS 37151]: State of the global system, including environmental, social and economic aspects, in which the needs of the present are met without compromising the ability of future generations to meet their own needs.

NOTE 1 – The *environmental*, social, and economic aspects interact, and are often referred to as the three dimensions of sustainability.

NOTE 2 – Sustainability is the goal of *sustainable development*.

3.1.33 sustainability indicator [ISO 21929-1]: *Indicator* related to economic, environmental, social, or cultural impacts.

3.1.34 sustainable development [b-ISO/TS 37151]: Development that meets the environmental, social, and economic needs of the present without compromising the ability of future generations to meet their own needs.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 city sustainability: The sustainability of *smart sustainable city* is based on five main aspects:

– economic: the ability to generate income and employment for the livelihood of the inhabitants;

– social: the ability to ensure well-being (safety, health, education etc.) and inclusiveness of the citizens can be equally delivered despite differences in class, race or gender;

– environmental: the ability to protect future quality and reproducibility of natural resources;

– governance: the ability to maintain social conditions of stability, democracy, participation, transparency, ethics and justice;

– cultural: the ability to promote cultural identity and adequacy, value and emotional wellbeing.

3.2.2 gender equality: Equal rights, opportunities and obligations for women and men.

3.2.3 indicator: A quantitative, qualitative or descriptive measure.

3.2.4 information security: Security preservation of confidentiality, integrity and availability of information.

3.2.5 SSC application: An application for SSC, which utilizing the opened basic and industry big data and capabilities provided by the SSC public support platform, to leverage the full intelligent running and management for the SSC and to meet the needs of the governments, enterprises, and public in the SSC.

NOTE – An SSC application can provide customized data processing capabilities and wide-open services that cross different industries and systems in SSC.

3.2.6 SSC information infrastructure: The SSC information infrastructures provide static and dynamic perception of the overall urban status, seamless high-speed message transmission, effective processing and interconnected information sharing. Besides traditional digital systems, new infrastructures are needed to integrate the various smart city systems to give a firm protection and strong guarantee to all kinds of SSC applications.

3.2.7 SSC support platform: An information platform which leveraging information resources managements and optimization and providing data management service and capability openness for SSC applications.

NOTE – A SSC support platform is based on the SSC information infrastructure that serves as a foundation or base for realizing certain functionalities for SSC.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ICT Information and Communication Technology

ISO International Organization for Standardization

KPI Key Performance Indicator

SDO Standard developing organization

SSC Smart Sustainable City

5 Conventions

None.

Appendix I

Classification of the vocabulary

(This appendix does not form an integral part of this Recommendation.)

I.1 Vocabulary classification

Table I.1 provides listings of the same terms and definitions from clauses 3.1 and 3.2 in groupings according to logical classifications.

Table I.1 – Classification of the vocabulary

Terms and definitions	Clause
General items	
city	3.1.4
community	3.1.6
identifier	3.1.15
indicator	3.2.3
information	3.1.16
key performance indicator (KPI)	3.1.19
metadata	3.1.21
organization	3.1.22
smart sustainable city (SSC)	3.1.30
Items related to environmental sustainability	
air pollution	3.1.1
environment	3.1.9
environmental aspect	3.1.10
environmental impact	3.1.11
greenhouse gas	3.1.13
greenhouse gas emissions	3.1.14
renewable energy	3.1.26
sustainability	3.1.32
sustainability indicator	3.1.33
sustainable development	3.1.34
Items related to application, infrastructure, information, etc.	
application	3.1.2
city platform	3.1.5
community infrastructure	3.1.7
data centre	3.1.8
global information infrastructure	3.1.12
information security	3.2.4
infrastructure	3.1.17
interoperability	3.1.18

Table I.1 – Classification of the vocabulary

reference model	3.1.25
smart city platform	3.1.28
smart community infrastructure	3.1.29
SSC application	3.2.5
SSC information infrastructure	3.2.6
SSC support platform	3.2.7
Items related to productivity and economic sustainability	
city sustainability	3.2.1
productivity	3.1.23
Items related to quality of life, equality and social inclusion	
availability	3.1.3
gender equality	3.2.2
life cycle	3.1.20
quality of life	3.1.24
resilience	3.1.27
stakeholder	3.1.31

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[b-ITU-T Y.4000] Recommendation ITU-T Y.4000/Y.2060 (2012), *Overview of Internet of Things*.

[b-ITU-T Y.4050] Recommendation ITU-T Y.4050/Y.2069 (2012), *Terms and definitions for Internet of Things*.

[b-ITU-T Y.4902] Recommendation ITU-T Y.4902/L.1602 (2016), *Key performance indicators related to the sustainability impacts of information and communication technology in smart sustainable cities*.

[b-ISO/IWA 18] ISO/IWA 18 (2016), *Framework for integrated community-based life-long health and care services in aged societies*.

[b-ISO/TR 18638] ISO/TR 18638 (2017), *Health informatics – Guidance on health information privacy education in healthcare organizations*.

[b-ISO/TS 37151] ISO/TS 37151 (2015), *Smart community infrastructures – Principles and requirements for performance metrics*.

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Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
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Series N	Maintenance: international sound programme and television transmission circuits
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Series P	Telephone transmission quality, telephone installations, local line networks
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Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
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Series U	Telegraph switching
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