

Recommendation

ITU-T Y.4223 (09/2023)

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 –
Requirements and use cases

Common requirements and capabilities of smart cities and communities from IoT and ICT perspectives

ITU-T Y-SERIES RECOMMENDATIONS

Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities

GLOBAL INFORMATION INFRASTRUCTURE	Y.100-Y.999
INTERNET PROTOCOL ASPECTS	Y.1000-Y.1999
NEXT GENERATION NETWORKS	Y.2000-Y.2999
FUTURE NETWORKS	Y.3000-Y.3499
CLOUD COMPUTING	Y.3500-Y.3599
BIG DATA	Y.3600-Y.3799
QUANTUM KEY DISTRIBUTION NETWORKS	Y.3800-Y.3999
INTERNET OF THINGS AND SMART CITIES AND COMMUNITIES	Y.4000-Y.4999
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.4223

Common requirements and capabilities of smart cities and communities from IoT and ICT perspectives

Summary

Smart cities and communities (SC&C) share the goal of achieving urban sustainability without sacrificing the quality of life (QoL) of their citizens. SC&C strive to create a sustainable living environment for citizens using Internet of things (IoT) technologies and information communication technologies (ICTs).

SC&C standardization is ongoing in ITU-T and other relevant standards developing organizations, related to aspects including, but not limited to, SC&C framework, infrastructure, integrated sensing and management systems, platforms, data processing and services and applications (e.g., smart water management, smart buildings, smart residential community, smart tourism and smart parking lots, amongst many others). Based on the fundamental characteristics of smart cities and communities, Recommendation ITU-T Y.4223 specifies common requirements and capabilities of SC&C from IoT and ICT perspectives.

The specified common requirements and capabilities are intended to be generally applicable in SC&C.

History *

Edition	Recommendation	Approval	Study Group	Unique ID
1.0	ITU-T Y.4223	2023-09-22	20	11.1002/1000/15477

Keywords

Characteristics, common capabilities, common requirements, smart cities and communities, SC&C, smart city platform, SCP.

* To access the Recommendation, type the URL <https://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents/software copyrights, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the appropriate ITU-T databases available via the ITU-T website at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2023

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

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	2
6	Overview of smart cities and communities – views and characteristics	2
	6.1 Views of SC&C.....	2
	6.2 Fundamental characteristics of SC&C from IoT and ICT perspectives.....	4
7	Common requirements of SC&C from IoT and ICT perspectives.....	4
	7.1 Requirements of service and application systems	5
	7.2 Requirements of smart city platform systems	5
	7.3 Requirements of sensing and infrastructure systems.....	6
	7.4 Requirements of security and management systems	6
8	Common capabilities of SC&C from IoT and ICT perspectives.....	7
	8.1 Service and application capability set	7
	8.2 Smart city platform capability set.....	8
	8.3 Sensing and infrastructure capability set.....	9
	8.4 Security and management capability set	10
	Annex A – List of common requirements of SC&C.....	11
	Appendix I – Details of typical city infrastructure sensors.....	15
	Appendix II – Some detailed considerations related to SC&C applications in different application domains.....	17
	II.1 Public security applications	17
	II.2 Traffic and transportation management applications	17
	II.3 Municipal administration applications	17
	II.4 Water management applications.....	17
	II.5 Public safety applications	18
	II.6 Urban plan applications.....	18
	II.7 Land resource management applications.....	18
	II.8 Energy management applications.....	19
	II.9 e-government applications.....	19
	II.10 Education applications.....	19
	II.11 Environmental protection applications.....	19
	II.12 Health applications	20
	II.13 Civil administration applications.....	20

	Page
II.14 Citizen-centric service applications.....	20
Bibliography.....	21

Recommendation ITU-T Y.4223

Common requirements and capabilities of smart cities and communities from IoT and ICT perspectives

1 Scope

This Recommendation identifies the fundamental characteristics of smart cities and communities (SC&C) and specifies SC&C common requirements and capabilities from Internet of things (IoT) and information communication technologies (ICTs) perspectives. The specified common requirements and capabilities are intended to be generally applicable in SC&C.

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.3180] Recommendation ITU-T Y.3180 (2022), *Mechanism of traffic awareness for application-descriptor-agnostic traffic based on machine learning.*
- [ITU-T Y.4000] Recommendation ITU-T Y.4000/Y.2060 (2012), *Overview of the Internet of things.*
- [ITU-T Y.4101] Recommendation ITU-T Y.4101/Y.2067 (2017), *Common requirements and capabilities of a gateway for Internet of things applications.*
- [ITU-T Y.4200] Recommendation ITU-T Y.4200 (2018), *Requirements for the interoperability of smart city platforms.*
- [ITU-T Y.4201] Recommendation ITU-T Y.4201 (2018), *High-level requirements and reference framework of smart city platforms.*
- [ITU-T Y.4216] Recommendation ITU-T Y.4216 (2022), *Requirements of sensing and data collection system for city infrastructure.*
- [ITU-T Y.4805] Recommendation ITU-T Y.4805 (2017), *Identifier service requirements for the interoperability of smart city applications.*
- [ITU-T Y.4900] Recommendation ITU-T Y.4900/L.1600 (2016), *Overview of key performance indicators in smart sustainable cities.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

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

3.1.2 city infrastructure [ITU-T Y.4216]: The interconnected structures that enable people to get the resources they need in the city, and the interconnected structures to provide public services for social and economic activities in the city.



3.1.3 data mining [b-ITU-T X.1217]: A computational process to discover patterns in large data sets involving methods of artificial intelligence, machine learning, statistics, and database systems.

3.1.4 smart city platform (SCP) [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 urban operation and services supporting the functioning of city services, as well as efficiency, performance, security and scalability.

3.1.5 smart sustainable city [ITU-T Y.4900]: A smart sustainable city 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.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AI	Artificial Intelligence
CAN	Controller Area Network
ICT	Information and Communication Technology
IoT	Internet of Things
KPI	Key Performance Indicator
OAM	Operation, Administration and Maintenance
QoL	Quality of Life
QoS	Quality of Service
RTD	Resistance Temperature Detector
SC&C	Smart Cities and Communities
SCP	Smart City Platform

5 Conventions

In this Recommendation:

The expression "is required" indicates a requirement which must be strictly followed and from which no deviation is permitted if conformance with this Recommendation is to be claimed.

The expression "is recommended" indicates a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance with this Recommendation.

6 Overview of smart cities and communities – views and characteristics

6.1 Views of SC&C

Following the definition of a smart sustainable city [ITU-T Y.4900], the development of a smart city should meet the needs of present and future generations with respect to economic, social, environmental and cultural aspects.

NOTE 1 – It is recognized that these needs and SC&C technologies may change.

The key performance indicators (KPIs) for evaluating the performance of a smart sustainable city are recommended to be categorized into six dimensions, as shown in Figure 1 [ITU-T Y.4900]:

- Information and communication technology (ICT);
- Environmental sustainability;
- Productivity;
- Quality of life (QoL);
- Equity and social inclusion;
- Physical infrastructure.

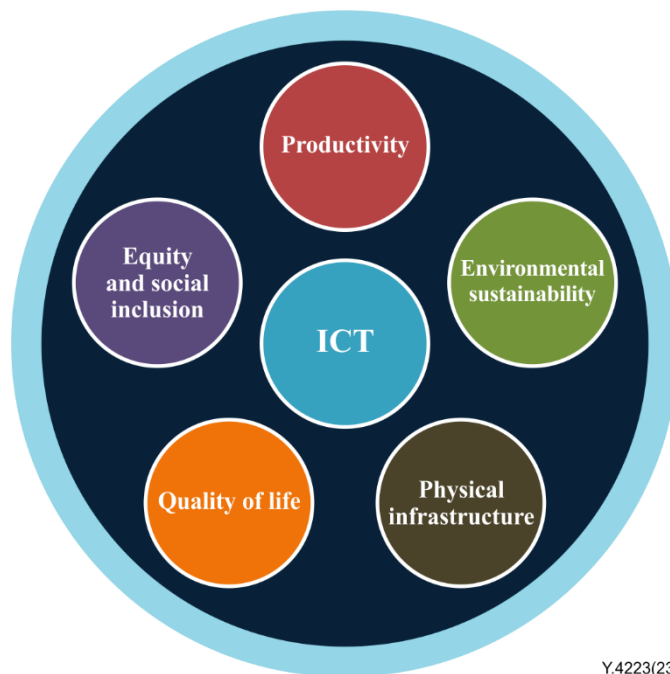


Figure 1 – Dimensions of KPIs for smart sustainable cities [ITU-T Y.4900]

From another point of view, these six dimensions of a smart sustainable city can be adapted to physical space and information space, as shown in Figure 2.

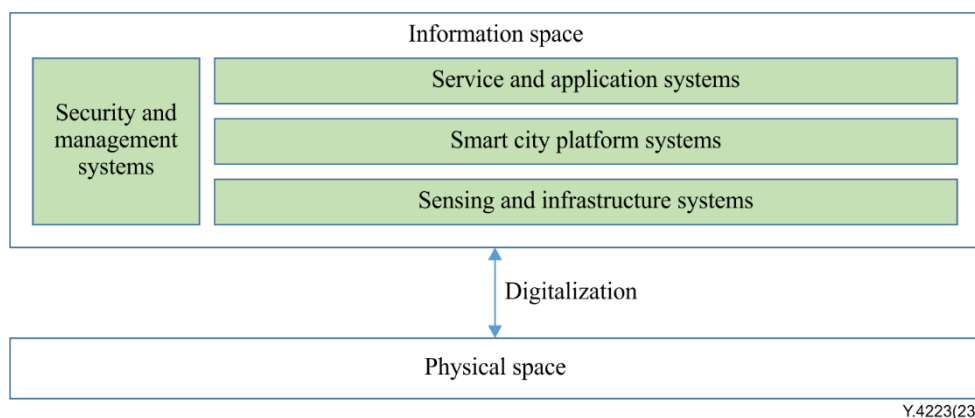


Figure 2 – The two spaces of smart sustainable cities

- Physical space: The physical space in a city can be represented by different physical systems according to location or function, such as land, water, energy, transportation and