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SYSTEMS
REFERENCE DELIVERABLE

Smart city system – Methodology for concepts building

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SMART CITY SYSTEM –
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FOREWORD

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IEC SRD 63235, which is a Systems Reference Deliverable, has been prepared by IEC systems committee Smart Cities.

The text of this Systems Reference Deliverable is based on the following documents:

Draft SRD	Report on voting
SyCSmartCities/135/DTS	SyCSmartCities/153/RVDTS

Full information on the voting for the approval of this Systems Reference Deliverable can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This document provides methodologies being performed and to be continually performed in the sustainable development of a future part of IEC 60050[1] on smart city systems.

The methodology in this document provides system approaches to coordination, cooperation and connectivity of the terminology sources including IEC, ISO and ITU. The methodology fosters a multi-dimensional system of systems view on smart city systems across dimensions, domains and layers along the lifecycle of a smart city system, scenarios and use cases, supporting the sustainable development of smart city system arrangements, activities and artefacts, convergence of people, process and productivity globally.

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[1] Planned as IEC 60050-831, *International Electrotechnical Vocabulary (IEV) – Smart city systems*.

SMART CITY SYSTEM –
METHODOLOGY FOR CONCEPTS BUILDING

1   Scope

This document, which is a Systems Reference Deliverable, provides a holistic system of systems approach to provide views, methodology framework, principles, processes, rules, and evaluation criteria for smart city system concepts building.

The methodology is applicable to continual improvement of a future part of IEC 60050 on smart city systems, but is not limited to it.

NOTE   It is planned that smart city systems will form the subject of IEC 60050-831.

This document does not specify the definitions of a smart city system.

2   Normative references

There are no normative references in this document.

3   Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

• IEC Electropedia: available at http://www.electropedia.org/

• ISO Online browsing platform: available at http://www.iso.org/obp

3.1
characteristic
abstraction of a property (3.5)

Note 1 to entry: Characteristics are used for describing concepts (3.2).

[SOURCE: ISO 1087:2019, 3.2.1, modified – The EXAMPLE has been deleted.]

3.2
concept
unit of knowledge created by a unique combination of **characteristics** (3.1)

Note 1 to entry: Concepts are not necessarily bound to particular natural languages. They are, however, influenced by the social or cultural background, which often leads to different categorizations.

Note 2 to entry: This is the concept "concept" as used and designated by the term "concept" in terminology work. It is a very different concept from that designated by other domains such as industrial automation or marketing.

[SOURCE: ISO 1087:2019, 3.2.7]

3.3
concept system
system of concepts
set of concepts (3.2) structured in one or more related domains (3.4) according to the concept relations among its concepts (3.2)

[SOURCE: ISO 1087:2019, 3.2.28]

3.4
domain
subject field
field of special knowledge

Note 1 to entry: The borderlines and granularity of a domain are determined from a purpose-related point of view. If a domain is subdivided, the result is again a domain.

[SOURCE: ISO 1087:2019, 3.1.4]

3.5
property
feature of an object

Note 1 to entry: One or more objects can have the same property.

[SOURCE: ISO 1087:2019, 3.1.3, modified – The EXAMPLES have been deleted.]

3.6
term
designation that represents a general concept by linguistic means

[SOURCE: ISO 1087:2019, 3.4.2, modified – The EXAMPLE and Note 1 to entry have been deleted.]

4   Methodology for smart city system concepts building

4.1   General

Methodology refers to a coherent, integrated set of methods from which a coherent sub-set can be selected for particular applications. A methodology for building smart city system concepts should contain at least six components:

a) a system of systems view with common concerns and interests of multiple stakeholders (see 4.2);

b) a methodology framework of constructs essential to the problem (see 4.3);

c) a set of principles guiding the scopes of concept and taxonomy of a smart city system (see 4.4);

d) a set of procedures suggesting the direction and order to proceed (see 4.5);

e) a series of rules identifying things to be avoided (see 4.6); and

f) a collection of evaluative criteria for assessing the quality of the product (see 4.7).

NOTE   Adapted from the definition of methodology in ISO/IEC 16500-8:1999, 3.14.

4.2   A system of systems view

A system of systems view (see Figure 1) considers the smart city as a complex system, made up of many vertical domains such as transport, health, education, and employment. These vertical domains are interconnected by three cross-cutting systems that include views of social system, digital system and physical system of a city and system approach, which work together as a complementary whole in responding to the concerns and interests of different stakeholders (ISO/IEC 30182:2017, 2.14). Each of these cross-cutting systems, in turn, can be subdivided into other horizontal, cross-cutting domains.

Taking this system of systems view enables the total capability of a city to be enhanced in a way and to an extent that none of the constituent systems can accomplish on its own. Each constituent system is a useful system by itself, having its own management, goals and resources, but when coordinated within the smart city system (SCS) contributes to providing the unique capability of the SCS.

The social system provides a multi-dimensional governance framework (ISO/IEC TR 38502:2017, 3.1) for coordinating arrangements of strategies, policies, decision-making structures and accountabilities to multiple stakeholders' concerns in social space and convergence.

A digital system provides a multi-domain architecture framework (ISO/IEC/IEEE 24748-1:2018, 3.7) for cooperating activities of conventions, principles and practices for individual domain architecture and enabling digital transformation.

A physical system provides a multi-layer application framework (ISO/IEC/IEEE 24765:2017, 3.177) to connect artefacts in each subsystem and enable interfaces between systems in physical space to support all necessary interactions.

An integration of the three systems supports the convergence of multi-dimensional, multi-domain and multi-layer concerns and interests of multiple stakeholders as well as enhancing the adaptive capacity of a city as an ecosystem to deliver a sustainable, prosperous and inclusive future for its citizens.
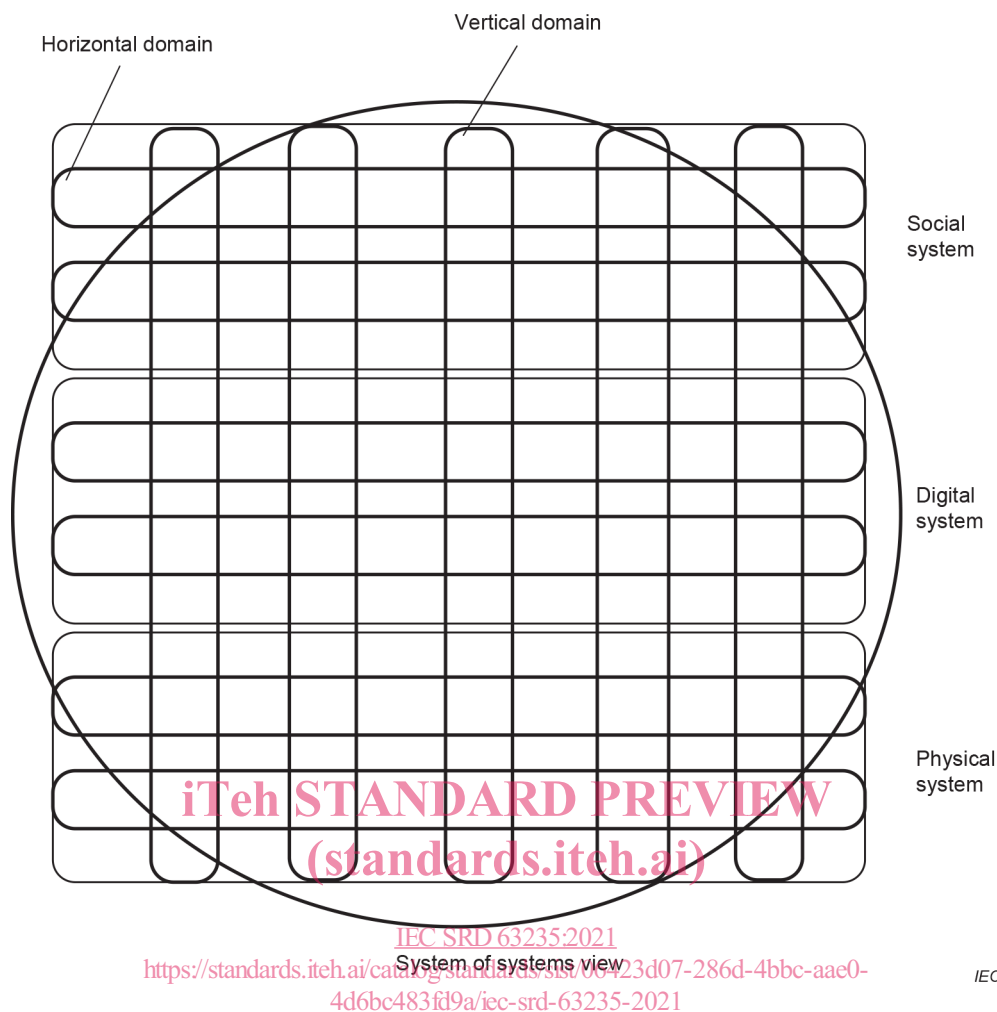
Figure 1 – Concept views of smart city systems

4.3   A methodology framework

A methodology framework refers to a way, or structure, that supports a number of different methods and languages to be used together when developing a system.

NOTE   This definition of methodology framework is adapted from ISO/IEC 16500-8:1999, 3.15.

The methodology framework for a smart city system concept system refers to a system of systems way of thinking that supports multi-dimensional, multi-domain and multi-layer, lifecycle and use case analysis approaches to be used together as a complementary whole in developing a smart city system, as shown in Figure 2.
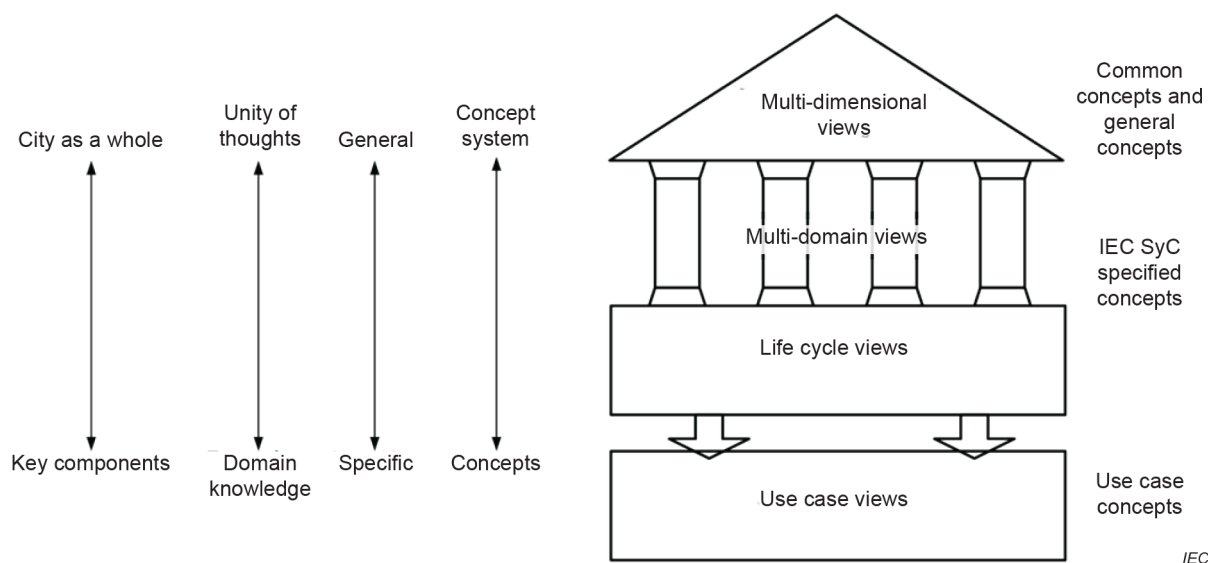
City as a whole — Key components

Unity of thoughts — Domain knowledge

General — Specific

Concept system — Concepts

Multi-dimensional views — Common concepts and general concepts

Multi-domain views — IEC SyC specified concepts

Life cycle views

Use case views — Use case concepts

Figure 2 – A methodology framework for building smart city system concept

A methodology framework for smart city system concept building would have the following considerations.

a) At the high-level, seeing the city as an organic whole to build a multi-dimensional smart city coordination framework supporting people-interdependent and shared visions.

b) At the intermediate-level, setting up a multi-domain smart city cooperation framework to support communication within each specific system to enable solutions and processes to be compared, harmonized and aligned, as well as working together towards shared goals in the management of other critical infrastructure.

c) At the low-level, establishing a lifecycle connectivity framework to bring alternatives and complementary approaches together towards productivity-oriented shared solutions.

These all form integrated parts of the organic whole, operating as a multi-layer application framework having a reusable architecture for all or part of a system, thus supporting shared solutions.

4.4 Principles

The terms included need to be:

a) highly relevant and pertinent to the smart city system domain;

b) highly relevant to reaching clarity and consensus in the smart city system domain;

c) highly relevant to electrotechnical, digital or system domain scoping and positioning, where there is a need for clarity and consensus on a coordinated lifecycle governance and cross-domain and cross-object continuity service for setting frameworks and applications;

d) in frequent use and applicable throughout all current and future documents of the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), and Telecommunication Standardization Sector of the International Telecommunication Union (ITU-T);

e) highly relevant to the social system, e.g. the interests of citizens, city governance and management, and industry and where there is a need for clarity and consensus;

f) highly relevant to the digital system and physical system, e.g. electrotechnical, digital or system domain scoping and positioning;

g) highly relevant to interests and needs in a particular setting; for example, documents developed for SyC Smart Cities such as city needs matrix and smart city linking stakeholders and concerns validation, where there is a need for clarity and consensus, e.g. "safety", "security", "risk".