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Technical Report D0.2

**Data processing and management for IoT and
smart cities and communities: methodology for
data processing and management concept
building**

ITU-T



FOREWORD

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Technical Report D0.2

**Data processing and management for IoT
and smart cities and communities:
methodology for data processing and
management concept building**

Summary

This Technical Report describes methodologies for DPM concept system building, including principles, process and evaluation criteria.

It is intended to be used by:

- those engaged in DPM activities,
- those involved in DPM activities of ITU-T and other standards bodies,
- developers of national or sector-specific standards, guides, procedures and codes of practice relating to the DPM,
- members of ITU-T FG-DPM.

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Additional information and materials relating to this Technical Report can be found at: www.itu.int/go/tfgdpm. If you would like to provide any additional information, please contact Denis Andreev (TSB) at tsbfdpm@itu.int.

Keywords

Trusted data; technical enablers; data processing and management.

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1 Scope

This document provides methodologies for concept and taxonomy building, which have been used in the development of the Technical Specification “Data Processing and Management for IoT and Smart Cities and Communities: Vocabulary” [FG-DPM TS D0.1] and can be used for its future continual improvement. It aims to encourage a mutual and consistent understanding of, and a coherent approach to, the activities relating to DPM, and the use of uniform terminology.

2 References

- [ITU Standards Landscape] ITU Standards Landscape for IoT & Smart Sustainable Cities
<https://www.itu.int/net4/ITU-T/landscape/#?topic=0.78&workgroup=1>
 (Referenced 19.07.2019)
- [IEC/ISO/ITU Draft White Paper] IEC/ISO/ITU Smart City Coordination Task Group: 2019 Draft White Paper: Suggested Priority Terms in Need of Common Definitions to Support Standards Activities for Smart city, April 17, 2019
- [IEC Electropedia] IEC Electropedia <http://www.electropedia.org/>
 [IEC 62559-2] IEC 62559-2:2015, Use case methodology - Part 2: Definition of the templates for use cases, actor list and requirements list.
- [ISO/IEC 16500-8] ISO/IEC 16500-8:1999, Information technology — Generic digital audio-visual systems — Part 8: Management architecture and protocols
- [ISO 704] ISO 704:2009, Terminology work – Principles and methods.
 [ISO 1087-1] ISO 1087-1:2000, Terminology work – Vocabulary – Part 1: Theory and application.
- [ISO 10241-1] ISO 10241-1:2011, Terminological entries in standards — Part 1: General requirements and examples of presentation.
- [ISO Online Browsing Platform] ISO Online Browsing Platform <http://www.iso.org/obp>
 (Referenced 19.07.2019)
- [FG-DPM TS D0.1] Technical Specification D0.1, “Data Processing and Management for IoT and Smart Cities and Communities: Vocabulary”.
- [FG-DPM TS D2.1] Technical Specification D2.1, “Data Processing and Management Framework for IoT and Smart Cities and Communities”.
 (Referenced 19.07.2019)
- [Industrial IoT] Industrial IoT terms
<https://www.iiconsortium.org/vocab/index.htm>
 (Referenced 19.07.2019)
- [SEVOCAB] Software and Systems Engineering Vocabulary
https://pascal.computer.org/sev_display/index.action
 (Referenced 19.07.2019)
- [SF-SSCC] Sector Forum for Smart and Sustainable Cities and Communities
 Overview of Standards and Specifications relevant to Smart Cities
ftp://ftp.cencenelec.eu/EN/EuropeanStandardization/Fields/SmartLiving/City/SF-SSCC_Overview_of_Standards_for_SmartCities.pdf
 (Referenced 19.07.2019)
- [UNBIS] United Nations Bibliographic Information System terms

<https://lib-thesaurus.un.org/LIB/DHLUNBISThesaurus.nsf/MultiEng/85759FD34196A99A85256AA0005FBD0B?OpenDocument>
(Referenced 19.07.2019)

3 Terms and Definitions

3.1 Terms defined elsewhere

This technical report uses the following terms defined elsewhere:

3.1.1 concept [ISO 1087-1]: Unit of knowledge created by a unique combination of characteristics.
NOTE - Concepts are not necessarily bound to particular languages. They are, however, influenced by the social or cultural background, which often leads to different categorizations.

3.1.2 data processing and management (DPM) [FG-DPM TS D0.1]: Data Processing and Management (DPM) is the combination of all activities either directly performed on or indirectly influencing data.

NOTE 1 - Directly performed activities include among others [collecting/acquiring/capturing], exchanging, storing, securing, manipulating, reusing, aggregating, curating, disposing, monetizing and deleting data.

NOTE 2 - Indirectly influencing activities include among others policy and standards making, skills and innovation enhancement.

3.1.3 term [ISO 1087-1]: Verbal designation of a general concept in a specific domain or subject.

3.1.4 use case [IEC 62559-2]: Specification of a set of actions performed by a system, which yields an observable result that is, typically, of value for one or more actors or other stakeholders of the system.

3.1.5 vocabulary [ISO 1087-1]: Terminological dictionary which contains designations and definitions from one or more specific subject fields.

3.2 Terms defined in this Technical Report

None

4 Abbreviations and acronyms

This Technical Report uses the following abbreviations and acronyms:

DPM Data Processing and Management
FG-DPM Focused Group on Data Processing and Management
SC&C Smart Cities and Communities

5 Methodology of DPM concept building

5.1 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 DPM concept building could contain at least 5 components:

- A multi-dimensional view with common concerns and interests of multiple stakeholders (see 5.2.2);
- A set of principles guiding the scopes of concept of DPM for support IoT and SC&C (see 5.3);
- A set of procedures suggesting the direction and order to proceed (see 5.4);
- A series of rules identifying issues to be avoided (see 5.5);
- A collection of evaluative criteria for assessing the quality of the outcome (see 5.6).

Adapted from [ISO/IEC 16500-8]

In addition, a concept is a unit of knowledge created by a combination of characteristics. Concepts are not independent of one another. Analysis of the relationships among concepts within field of DPM and their arrangement into a concept system is a prerequisite of a coherent vocabulary.

A concept in a specific domain is represented by a term. Concepts are not necessarily bound to particular languages. They are, however, influenced by the social or cultural background which often leads to different categorizations.

This document facilitates consistent understanding of core concepts on DPM for support IoT and SC&C, used in deliverables of FG-DPM beyond languages and cultural practices.

5.2 Methods for DPM concept building

5.2.1 Identification of concept relationships

As a rule, there are three primary forms of concept relationships indicated in the following concept diagrams: generic, partitive and associative [ISO 704]. There are three forms of concept relationships used in this document.

- **Associative.** Associative relations are non-hierarchical. An associative relation exists when a thematic connection can be established between concepts by virtue of experience [ISO 704]. Associate relations are depicted by a line with arrowheads at each end, which shows the nature of relationship between one concept and another within a concept system, e.g. cause and effect, activity and location, activity and result, tool and function, material and product. [ISO 704]
- **Partitive.** Partitive relations are hierarchical. A partitive relation is said to exist when the superordinate concept represents a whole, while the subordinate concepts represent parts of that whole. The parts come together to form the whole [ISO 704]. Partitive relations are depicted by a rake without arrows, which shows subordinate concepts within hierarchy forming constituent parts of the superordinate concept, e.g. spring, summer, autumn and winter can be defined as parts of the concept year. [ISO 704].
- **Generic.** Generic relations are hierarchical. A generic relation exists between two concepts when the intension of the subordinate concept includes the intension of the superordinate concept plus at least one additional delimiting characteristic [ISO 704]. The generic relations are depicted by a fan or tree diagram without arrows, which shows superordinate concepts within the hierarchy inherit all the characteristics of the superordinate concept and contain description of these characteristics distinguishing them from the subordinate and coordinate concepts, e.g. the relation of spring, summer, autumn and winter to season [ISO 704].

5.2.2 A multidimensional view on DPM to support IoT and SC&C

Five dimensional views on DPM with high level considerations of multiple stakeholders common concerns about DPM are recommended for DPM concept building and concept mapping, in alignment with the interests and objectives of FG-DPM and, in particular, the FG-DPM DPM framework [FG-DPM TS D2.1].

The five dimensions are governance, ecosystem, data trust, data lifecycle and data commercialization, intended. respectively, as follows:

- **governance** includes all the policy related matters applicable to all other aspects.

- **ecosystem** includes all factors and mechanisms that directly or indirectly impact DPM activities.
- **data trust** includes actions taken to safeguard security, privacy and quality of data and enhance data trustworthiness.
- **data lifecycle** includes processing and management activities conducted on data from its creation to its use and disposal
- **data commercialization** is the process of creating commercial value from data, including various activities such as monetization, valuation, pricing, licensing, distribution, marketing and sales [FG-DPM TS D0.1]

5.3 Principles of DPM concept building

The terms used in the context of DPM need to be:

- highly relevant and pertinent to DPM for support IoT and SC&C; highly relevant to reaching and clarity and consensus in DPM for support IoT and SC&C; in frequent use and applicable throughout all DPM deliverables;
- Definitions must be accurate, clear and positive. Inaccurate and negative definitions are not acceptable. Nor should definitions be circular or include, or paraphrase, the term being defined. The language used in a definition must either be common English language terms or defined elsewhere in the text;
- the associated definitions must be able to stand alone. In other words, the meaning should be understandable without requiring reference. This is particularly important since the terms and definitions are being extracted for use by delegates, and consumers on the web.

The terms to not used in the context of DPM concern terms which:

- are not pertinent to the DPM in support of IoT, SC &C and which are unlikely to be relevant in the future;
- are not in frequent use;
- may have different interpretations, where there is no consensus, and which are therefore likely to cause confusion or conflicts, contradictions or inconsistency;
- criteria for not selecting terms are subjective and partial. If a definition of a concept is controversial, but is a core concept, should be included.

In considering definitions for the key terms identified, the first step is to review existing definitions of those terms within ISO, IEC or ITU and either adopt or adapt them. Only if there are no existing relevant definitions to draw on, a new definition is given.

5.4 Process of DPM concept building

Where there are existing generic definitions that, in general, are applicable to the work of the DPM for support IoT and SC&C, then the normal approach is to use these and, where necessary, to add notes clarifying how they should be applied in the specific context. The only exceptions to this is where the term is central to the work of the DPM for support IoT and SC&C. In this case, it might be more appropriate to develop a new definition, based on the generic one, but written in a way to specifically address the smart city/IoT context. The following process is conducted:

- Using the principles given in 5.3 to develop a list of terms for which clear definitions are needed by DPM for support IoT and SC&C;
- Review whether those terms have already been defined by ITU, IEC, ISO and other SDOs;
- If they have already been defined, they should be considered whether those definitions are relevant and appropriate to DPM for support IoT and SC&C;
- If there are definitions that are more or less appropriate and simply need to be modified to meet the needs of DPM for support IoT and SC&C, then the preferred option is to add extra notes to the existing definition. Should more fundamental changes be required, then coordination of this process with the relevant committee is recommended, with the aim of developing a definition that is suitable for all, or develop a new definition, based on the generic one, but explicitly focused on data processing and management in support of IoT, SC & C;
- If there are no definitions that are relevant or appropriate, then a new definition is created;
- Where there are terms that might be useful for other FG-DPM Groups, then coordination with the other SDOs is beneficial to allow term definitions in a way that they can be used across all the DPM dimensions to support IoT and SC&C.

NOTE - Definitions are checked against available terminology sources, including the following:

- ITU Standards Landscape for IoT & Smart Sustainable Cities at <https://www.itu.int/net4/ITU-T/landscape#?topic=0.78&workgroup=1>
- IEC/ISO/ITU Smart City terminology coordination Task team
- IEC Electropedia: at <http://www.electropedia.org/>
- ISO Online Browsing Platform at <http://www.iso.org/obp>
- Industrial IoT terms at <https://www.iiconsortium.org/vocab/index.htm>
- SEVOCAB: Software and Systems Engineering Vocabulary at https://pascal.computer.org/sev_display/index.action
- SF-SSCC: Sector Forum for Smart and Sustainable Cities and Communities Overview of Standards and Specifications relevant to Smart Cities at ftp://ftp.cencenelec.eu/EN/EuropeanStandardization/Fields/SmartLiving/City/SF-SSCC_Overview_of_Standards_for_SmartCities.pdf
- UNBIS: United Nations Bibliographic Information System terms at <https://lib-thesaurus.un.org/LIB/DHLUNBISThesaurus.nsf/MultiEng/85759FD34196A99A85256AA0005FBD0B?OpenDocument>

5.5 Rules for DPM concept building

The selection of terms and the wording of definitions aims, as far as possible, to follow established usage. However, the context of usage (including application, cultural, and linguistic factors) may lead to apparent contradictions. Terms with broadly inconsistent usage are indicated as such, where consensus is not possible a majority solution is sought. Where contradictory usages reflect established practice then appropriate notes are recorded. [ISO 10241-1].

Technical terms appearing in a definition are defined either in the ITU-T publication or other authoritative publications. If there is more than one term for a concept, the entry term shall be used in other definitions.

The whole terminological work is then discussed and finally approved by the FG-DPM.

5.6 Evaluation criteria for assessment of the DPM concepts

5.6.1 Introduction

Concepts and vocabulary are in conformity with the principles build up in 5.3.

5.6.2 Dimension relevance assessment

The assessment criteria are DPM dimensions relevance to help the integration, interoperability and effectiveness of DPM activities as an organic whole. The following five dimensions are considered in alignment with [FG-DPM TS D2.1]:

- Dimension criteria 1 (DC1): governance;
- Dimension criteria 2 (DC2): ecosystem;
- Dimension criteria 3 (DC3): data trust
- Dimension criteria 4 (DC4): data lifecycle
- Dimension criteria 5 (DC5): data commercialisation

5.6.3 Stakeholder relevance assessment

The assessment criteria are stakeholders [FG-DPM TS D0.1] relevance. The use cases have to be relevant to three types of specific city stakeholders as follows:

- Stakeholders criteria 1 (SC1): the citizen and society;
- Stakeholders criteria 2 (SC2): the city authorities and city governance bodies;
- Stakeholders criteria 3 (SC3): the industry and local business.

5.6.4 Dimension and stakeholder matrix relevance assessment

The assessment criteria are the relevance of use cases or use stories to dimensions and stakeholders identified above, and the priority concern about stakeholders and beneficiaries.

The level of relevance can be identified according to the relationships of use cases with dimensions and stakeholders of DPM. Moreover, it can be assessed according to the concerns about beneficiaries of DPM. The dimensions and stakeholder matrix relevance assessment is shown in Table 1.

- Matrix criteria 1(MC1): highly relevant, above 50% relevance;
- Matrix criteria 2 (MC2): relevant, below 50% relevance;
- Matrix criteria 3 (MC3): neutral, 0 relevance;
- Matrix criteria 4 (MC4): not known about relevance.

Table 1 is used for the dimensions and stakeholder matrix relevance assessment.

Table 1 – DPM dimensions and stakeholder matrix relevance assessment

DPM dimensions	Highly relevant	Relevant	Neutral	Unknown
	MC1	MC2	MC3	MC4
Governance				
Ecosystem				
Data trust				
Data lifecycle				
Data commercialisation				

5.7 Basic DPM concepts to support IoT and SC&C

The basic vocabulary and basic DPM concepts which are frequently used in FG-DPM deliverables are identified in table 2, classified according to the five dimensions described in clause 5.2.

Table 2 – DPM basic concepts according to the DPM dimensions

Concept number	DPM dimension	Basic DPM concept	DPM concept reference in [b-FG-DPM TS D0.1]
1	Governance	blockchain	3.1.2
2		data governance	3.2.5
3		data processing and management (DPM)	3.2.7
4		Internet of things	3.1.9
5		scenario	3.1.18
6		Smart Cities and Communities (SC&C)	3.2.11
7	Ecosystem	application	3.1.1
8		capabilities	3.1.3
9		community	3.1.4
10		ecosystem	3.2.9

Concept number	DPM dimension	Basic DPM concept	DPM concept reference in [b-FG-DPM TS D0.1]
11		requirements	3.1.15
12		service	3.1.20
13		stakeholders	3.1.22
14		use case	3.1.25
15		use case template	3.1.26
16	Data trust	risk	3.1.16
17		safety	3.1.17
18		security	3.1.19
19		trust	3.1.24
20	Data lifecycle	closed data	3.2.1
21		data	3.1.5
22		data consistency	3.1.6
23		data management	3.1.7
24		data processing	3.1.8
25		data exchange	3.2.4
26		data sharing	3.2.8
27		interoperability	3.1.10
28		lifecycle	3.1.11
29		minimal interoperability	3.2.10
30		open data	3.2.11
31		personal data	3.1.12

Concept number	DPM dimension	Basic DPM concept	DPM concept reference in [b-FG-DPM TS D0.1]
32		processed data	3.1.13
33		raw data	3.1.14
34		shared data	3.1.21
35		thing	3.1.23
36	Data commercialisation	content owner	3.2.2
37		data commercialization	3.2.3
38		data marketplace	3.2.6
