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Information technology — Smart City ICT reference framework —

Part 3:
Smart city engineering framework

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1.

Introduction

0.1 General

The purpose of this international standard, Smart City ICT Reference Framework, is to assist city Chief Information Officers (CIO) and other stakeholders in planning and implementing a Smart City. It comprises the following three parts:

— Part 1: Smart City Business Process Framework

— Part 2: Smart City Knowledge Management Framework

— Part 3: Smart City Engineering Framework

Each of the three parts are each aimed at a different role or viewpoint within the city and thus separate focus needs to be maintained. The "separation of concerns" is a principle for the development of a city as it uses ICT to deliver the vision and objectives for the city. The value of using the separation of concerns is to simplify development and maintenance of the architecture as the city both develops and delivers improved outcomes for the city stakeholders.

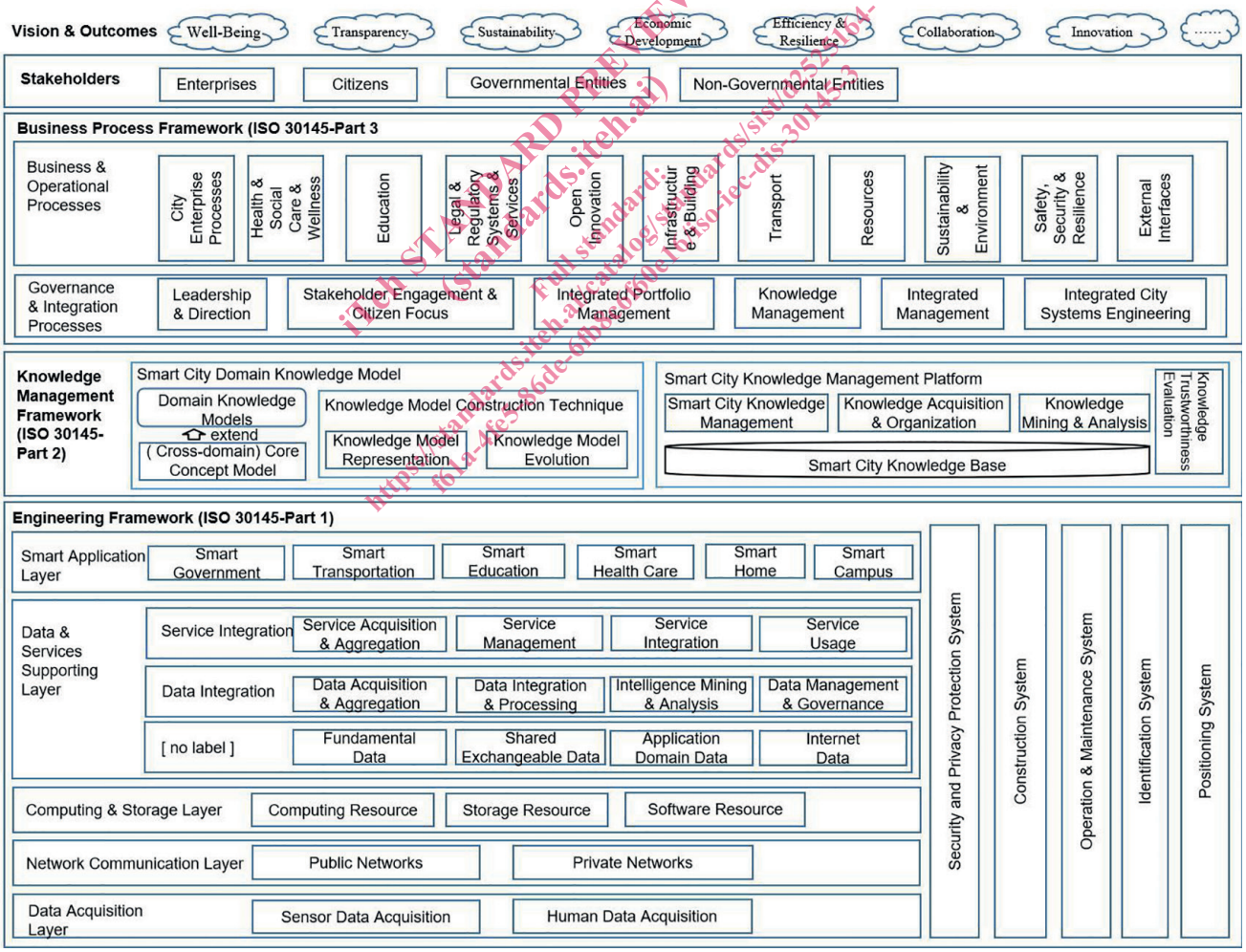

Figure 1 — Smart City ICT Reference Framework

Figure 1 shows the components of the smart city ICT reference framework which consist of 5 components: stakeholders, vision and outcomes, business process framework, knowledge management framework, and engineering framework. While stakeholders, vision and outcomes, and engineering framework are

described in this document, the business process framework and knowledge management framework are described in part 1 and part 2 of ISO/IEC 30145 series respectively.

0.2 Stakeholders

The stakeholders served by the Smart City ICT Reference Framework are businesses, citizens, government organizations and non-government organizations. This stakeholder list is not exhaustive but defines the key stakeholders in a Smart City and the user for the Smart City ICT reference framework.

0.3 Vision and Outcomes

The motivation of making a city smart is a result of a shared vision and a set of agreed outcomes from all the city stakeholders. The vision and outcomes of the Smart City ICT Reference Framework are Well-being, Transparency, Sustainability, Economic Development, Efficiency& Resilience, Collaboration and Innovation. This vision ad outcomes list is not exhaustive but defines the key vision and outcomes of a Smart City. The Smart City ICT Reference Framework articulates a vision that the Smart City will be transparent in the delivery of city services which meet city sustainability ambitions. This vision uses collaboration and innovation approaches to deliver desired city outcomes. City outcomes are expected to improve efficiency and resilience of city services and promote economic development activities which enhance the well-being of citizens.

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1 Scope

This document specifies a framework structured in layers of ICT technologies essential for smart cities operation. This framework also provides the mapping of the ICT techniques to various system entities in order to support the smart city's business, knowledge management, and operational systems from the engineering perspective.

Normative references

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:

— ISO Online browsing platform: available at https: //www .iso .org/obp

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

ISO/IEC 30141, *Internet of Things (IoT) — Reference Architecture*

ISO/IEC 17789, *Information technology — Cloud computing — Reference architecture*

ISO/IEC 20547-3, *Information technology — Big data reference architecture — Part 3: Reference architecture*

2 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:

— ISO Online browsing platform: available at https://www.iso.org/obp

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

For the purposes of this document, the terms and definitions given in:

ISO/IEC 20924 - Internet of Things (IoT) – Vocabulary

ISO/IEC 17789 Information technology — Cloud computing — Overview and vocabulary

ISO/IEC 20546 Information technology — Big data — Overview and vocabulary

and the following apply.

2.1
data
symbols and signals that represent properties of objects, persons, events and their environment

Note 1 to entry: In the English language the term "data" is generally used as a plural noun. For use in the singular, the term "data item" is sometimes used.

[SOURCE: Ackoff http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.585.5962&rep=rep1&type=pdf]

2.2
information
structured data that are endowed with meaning and purpose

Note 1 to entry: Information is data that have been shaped into a form that is meaningful and useful to human beings.

[SOURCE: https://en.wikipedia.org/wiki/DIKW_pyramid]

2.3
positioning system
System of instrumental and computational components for determining position

Note 1 to entry: Examples include inertial, integrated, linear, optical and satellite positioning systems.

[SOURCE: ISO 19116:2004, 4.20]

2.4
positional accuracy
closeness of coordinate value to the true or accepted value in a specified reference system

Note 1 to entry: The phrase "absolute accuracy" is sometimes used for this concept to distinguish it from relative positional accuracy. Where the true coordinate value may not be perfectly known, accuracy is normally tested by comparison to available values that can best be accepted as true.

[SOURCE: ISO 19116:2004, 4.20]

2.5
heterogeneous computing
Heterogeneous computing refers to systems that use more than one kind of processor or cores.

2.6
heterogeneous computing resources
Heterogeneous computing resource are the combination of hardware and software that can support heterogeneous computing.

2.7
data integration
Data integration is the process combining data residing in different sources and providing users with a unified view of them.

3 Abbreviations

3.1
WGS84
World Geodetic System

3.2
GPS
Global Positioning System

3.3
GLONASS
Global Navigation Satellite System

3.4
PZ-90
Parametry Zemli 1990 goda

4 Smart City Engineering Framework

4.1 Introduction

This document gives descriptions of Smart City from an engineering perspective. It consists of two parts, the horizontal engineering layers and the vertical systems. For each of the business processes defined and categorized in ISO/IEC 30145-1, a city will use the knowledge defined by the knowledge management framework in ISO/IEC 30145-2. Additionally, the knowledge defined by the knowledge management framework in ISO/IEC 30145-2 is used to understand how the engineering framework is implemented. The function of the horizontal layers is to provide a clear mapping of different techniques and components needed for Smart City business processes. The function of the vertical systems is to guarantee the consistency of the technical implementation of the Smart City.

4.2 Overview of the Smart City Engineering Framework

Figure 2 shows the smart city engineering framework from the ICT perspective. The framework consists of 5 horizontal layers and 5 vertical cross layer systems with 4 types of Smart City stake holders. The five layers are Data Acquisition Layer, Network Communication Layer, Computing and Storage Layer, Data and Service Supporting Layer and Smart Application Layer; whereas the five systems are Security and Privacy Protection System, Construction and Management System, Operation and Management System, Identification System and Positioning System. In addition, the four types of city users are citizens, enterprises, Governmental Entities and Non-governmental Entities. Five layers, five systems will be introduced in detail in section 4.3 to section 4.12 respectively.

Data Acquisition Layer provides the capability to sense the world and take actions. Network Communication Layer consists of Internet, telephone network, cable television network and their convergence. Computing and Storage Layer includes resources for computing, data storage and foundation software. Data and Services Supporting layer fuses the data capture capability, communication capability, data storage capability, computing capability into data management and service management capability. Smart Application Layer offers smart applications and their integrations across industries and domains with supporting from the underneath layers. Security and Privacy Protection System addresses the security requirements of a Smart City. Operation and Maintenance System addresses the ability of a Smart City to operate and maintain its IT services. Construction System addresses the ability of a Smart City to transit its IT services into sustainable operation that design, planning, construction, maintenance and other aspects of Smart City needed. Identification System provides all layers of the Engineering Framework with identification services. Positioning System is one of the basic systems in Smart City providing inertial, integrated, linear, optical and satellite positioning services.

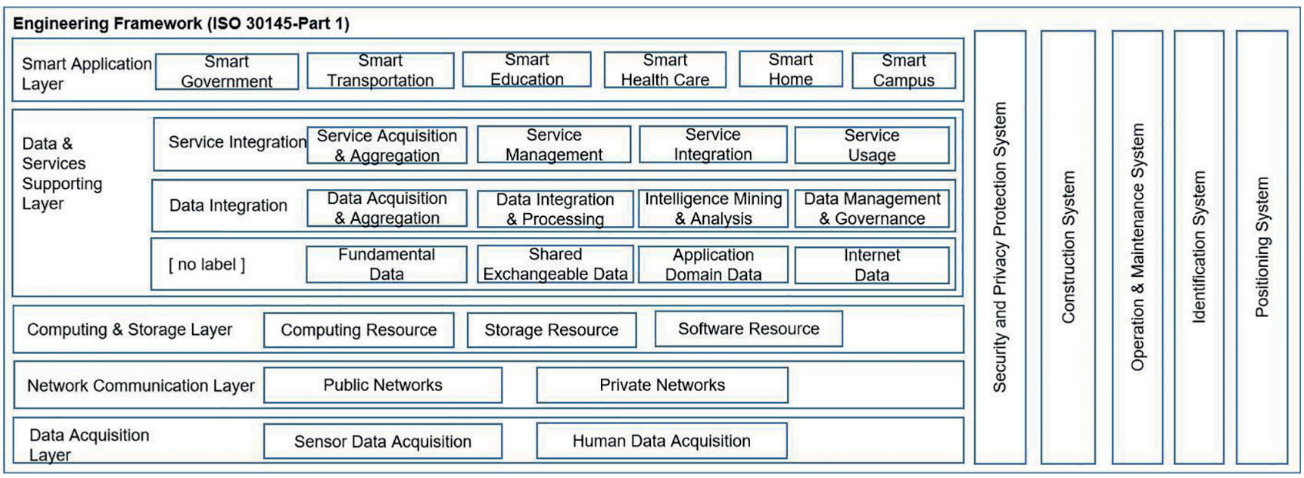

Figure 2 — Smart City Engineering Framework

From ISO/IEC 30141's six-domain IoT Reference Model (RM) and Reference Architecture (RA), the entities in the Smart City Engineering Framework, which is a layer-based framework, shown in Figure 2 can be mapped as shown in Table 2.

Table 2 — Mapping of the layers and entities in Smart City Engineering Framework to the six domains of ISO/IEC 30141 IoT RA.

ISO/IEC 30141 IoT RA	Smart City Engineering Framework		
Domain	**Layer**	**Sub-layer**	**Entities**
User Domain (UD)	Stakeholders (not identified within the Engineering Framework)	NA	• Not specified in the Engineering Framework; but in Stakeholder. They are: — Business entities; — Citizens; — Government organizations; and — Non-Government Organizations
Operation & Management Domain (OMD)	Data & Services Supporting Layer	Service Integration	• Service Management • Service Integration • Service Usage
		Data Integration	• Data Management & Governance
Application & Service Domain (ASD)	Smart Application Layer	N/A	• Smart Government • Smart Transportation • Smart Education • Smart Healthcare • Smart Home • Smart Campus
	Data & Services Supporting Layer	Service Integration	• Service Acquisition & Aggregation
		Data Integration	• Data Integration & Processing • Intelligent Mining & Analysis
	Computing & Storage Layer	N/A	• Computing Resource • Storage Resource • Software Resource