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Intelligent transport systems — Shareable geospatial databases for ITS applications —

Part 1: Framework

Systèmes intelligents de transport — Base de données géospatiales partageables pour applications ITS —

Partie 1: Architecture

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

A list of all parts in the ISO 19297 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The advancement of telecommunication and database technologies has helped the introduction of new types of services such as indoor navigation and multimodal navigation deployed on rapidly proliferating mobile devices such as smartphones. These newly emerging services may require geospatial databases that contain diverse and detailed content beyond the map databases used in current car navigations systems. A new database service framework that enables the usage and sharing of geospatial databases can facilitate emerging ITS applications and services.

This document addresses a database service framework and the components of the framework based on a federated database architecture commonly adopted to resolve heterogeneousness between databases. The purpose of the ISO 19297 series of standards is to promote the interoperability of geospatial databases for both suppliers and user environments, to enable the usage and sharing of geospatial databases and to facilitate ITS applications that satisfy market needs.

The ISO 19297 series of standards is a two-part standard. The following is a brief description of the parts.

— Part 1: Framework

  ISO 19297-1 describes the concept, architecture and characteristics of the shareable geospatial database framework and use cases. It provides an introduction to the standard series and identifies key components of the framework, which will be developed as separate standards.

— Part 4: Common data structure

  ISO 19297-4[1)] explains a common data structure for data delivery. A common data structure transports query results to information mediators or user applications. Thus, data sources coming from heterogeneous geospatial databases become homogenous to information mediators or user applications.

1) To be published. Current stage: 20.00.

Intelligent transport systems — Shareable geospatial databases for ITS applications —

Part 1: Framework

1 Scope

This document defines a shareable geospatial database service framework and provides an overview of the ISO 19297 series of standards. This is intended to enhance user accessibility and interoperability of databases. It does not cover ITS applications or service specific issues.

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:

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

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

3.1
data warehouse
special kind of database system built upon existing operational databases that plays a key role in building a decision support system for an organization or an enterprise

3.2
federated database
collection of co-operating database systems that are autonomous and heterogeneous

3.3
feature catalogue
catalogue containing definitions and descriptions of the feature types, feature attributes and feature relationships occurring in one or more sets of geographic data, together with any feature operations that can be applied

[SOURCE: ISO 19101-1:2014, 4.1.13]

3.4
geospatial database
database that is optimized to store and query data that represents objects defined in a geometric space

3.5
indoor navigation
application of monitoring and controlling the movement of people or vehicles from one place to another within a building

3.6
information mediator
software module that exploits encoded knowledge about certain sets or subsets of data to create information for a higher layer of applications

3.7
interoperability
capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units

[SOURCE: ISO/IEC 2382:2015, 2121317, modified — <fundamental terms> at the beginning of the definition has been deleted. Notes 1 and 2 to entry have been deleted.]

3.8
multimodal navigation
application that provides information on a trip from an origin to a destination using alternative modes of transportation or a combination of transport modes for one trip

3.9
volunteered geographic information
harnessing of tools to create, assemble, and disseminate geographic data provided voluntarily by individuals

3.10
wrapper
software component that establishes the communication and the data flow between *information mediators* (3.6) and data sources

4 Symbols and abbreviated terms

DB	Database
GDF	Geographic Data File
ITS	Intelligent Transport Systems
LDM	Local Dynamic Map
LDO	Logical Data Organization
OLAP	Online Analytical Processing
POI	Point of Interest
PSF	Physical Storage Format
W3C	World Wide Web Consortium

5 Shareable geospatial database framework

5.1 Concept

A shareable geospatial database framework should allow diverse ITS applications to access, query, process, and download various types of geospatial data content stored in separated databases in a simple and unified way. The framework originates from a wrapper and information mediator-based architecture where a pool of participating geospatial databases operated by individual organizations or enterprises form a virtually integrated database, and the architecture makes these coupled databases easily accessible over the internet.

5.2 Architecture of the shareable geospatial database framework

5.2.1 Tier 1

The shareable geospatial database framework consists of four tiers (Figure 1). Tier 1 represents a pool of service centres operated by map providers, mobile network operators, private companies, central or local governments, and even commercial buildings (e.g. department stores) participating in the federated database architecture. These service centres have full autonomy in their operations and great diversity of geospatial data content.

5.2.2 Tier 2

Tier 2 denotes wrappers. A wrapper is a software component that establishes the communication and the data flow between information mediators and data sources. Access and querying of databases by users is transparent regardless of the database type due to the standardized interfaces of wrappers. Wrappers are usually closely coupled with the service centre databases.

5.2.3 Tier 3

Tier 3, information mediators, exist between wrappers and user application tiers. An information mediator is a software module that exploits encoded knowledge about certain sets or subsets of data to create information for a higher layer of applications[6]. An information mediator offers two important functions: information reconciliation and information brokerage. Information reconciliation refers to the actions of translation, distribution, and dispatching user requests to acquire proper query results. The information brokerage function covers a series of processes so that user applications are able to get information about services, feature catalogues, and metadata.

The mediator-wrapper architecture effectively resolves database heterogeneity and greatly lessens the burdens of building a huge integrated centralized geospatial data store.

5.2.4 Tier 4

Tier 4 in the architecture comprises a group of ITS user applications running on various types of platforms including mobile phones, car navigation systems (i.e. ITS stations), tablets, and ordinary personal computing devices.

All the tiers in the architecture are interconnected with a standard networking methodology (i.e. internet/intranet). Internet, common protocols, and standard web environment provide a very convenient and interoperable environment between the constituents of all four layers.

A conceptual model of the shareable geospatial database framework is shown in Figure 1. In addition to the four tiers, there is another indispensable constituent of this architectural framework; a common data structure that helps to transport geospatially-related data content from wrappers to user applications via information mediators.

Data flows between the database tier and the application tier is bidirectional. Applications should be able to query and fetch geospatial data from the one or more servers through the information mediators and wrappers. Database servers may also be able to get user data within this framework. Applications that need data uploading from the users such as volunteered geographic information applications, will be one of the examples.

Due to the diverse and heterogeneous environments of service centres and user applications, service specific issues such as billing, traffic management, security, physical service architectures, and transaction handling are not covered in this architectural framework.

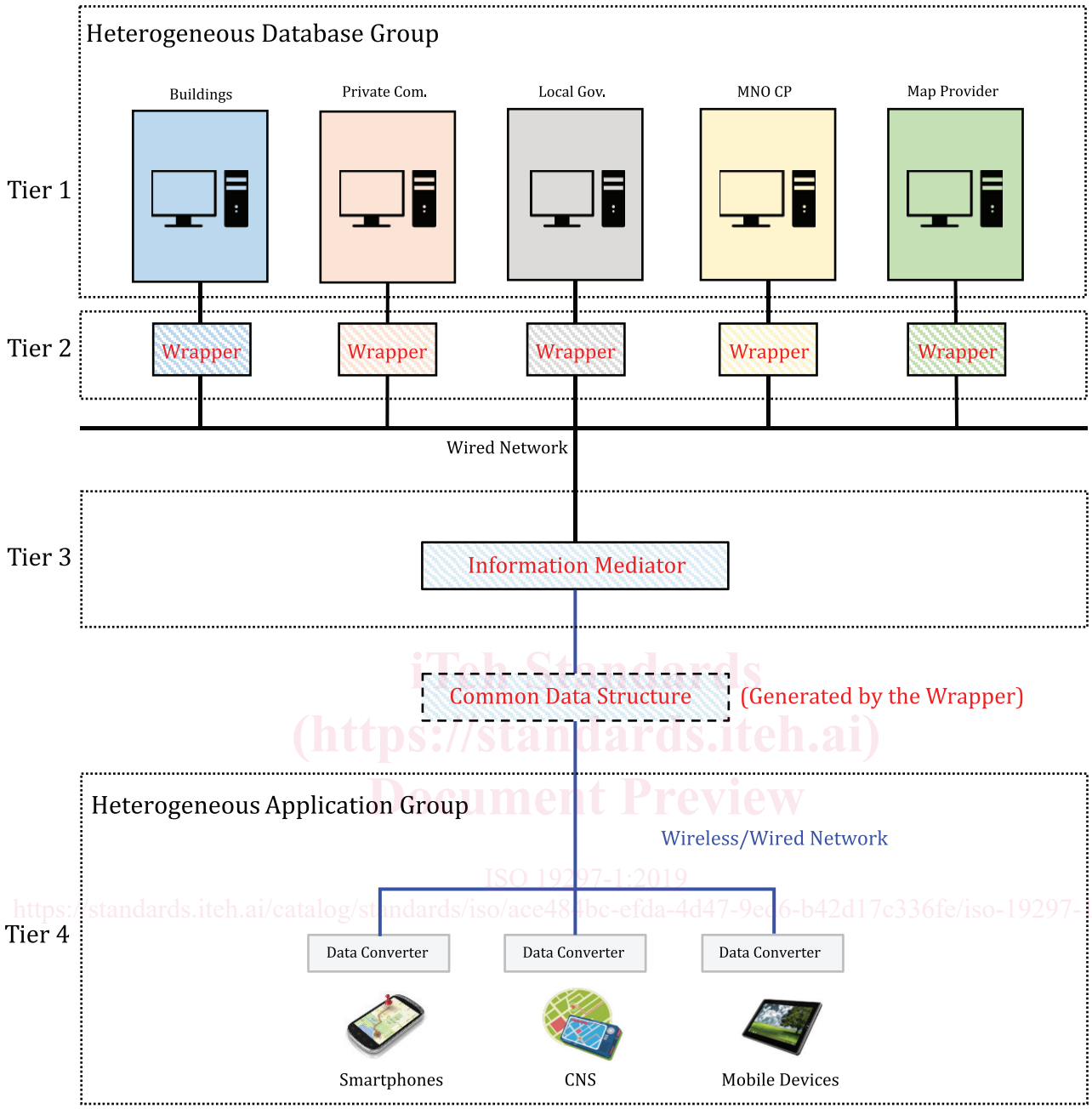

Figure 1 — Conceptual model of the shareable geospatial database framework

5.3 Characteristics and capabilities of the framework

5.3.1 Scalable architecture

The shareable geospatial database framework shall be scalable enough to ensure the addition of source databases, i.e. participation of service centres into the framework, in an easy and cost-effective manner. Addition of new geospatial databases will increase accessible data content for user applications.

5.3.2 Operational levels

The framework shall be applicable to all organizations (local, regional, national, and international) regardless of size. Because interconnections between the components in the framework are conveniently implementable over the Internet, the framework can be implemented globally. Moreover,