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**Intelligent transport systems —  
Shareable geospatial databases for ITS  
applications —**

**Part 1:  
Framework**

**iTeh STANDARD PREVIEW**  
*Systemes intelligents de transport — Base de données géospatiales  
partageables pour applications ITS —  
(standards.iteh.ai)  
Partie 1: Architecture*

ISO 19297-1:2019

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# Contents

Page

<b>Foreword</b> .....	<b>iv</b>
<b>Introduction</b> .....	<b>v</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Symbols and abbreviated terms</b> .....	<b>2</b>
<b>5 Shareable geospatial database framework</b> .....	<b>2</b>
5.1 Concept.....	2
5.2 Architecture of the shareable geospatial database framework.....	3
5.2.1 Tier 1.....	3
5.2.2 Tier 2.....	3
5.2.3 Tier 3.....	3
5.2.4 Tier 4.....	3
5.3 Characteristics and capabilities of the framework.....	4
5.3.1 Scalable architecture.....	4
5.3.2 Operational levels.....	4
5.3.3 Geospatial data model types.....	5
5.3.4 Real time data handling ITS applications support.....	5
<b>Annex A (informative) Geospatial data sharing</b> .....	<b>6</b>
<b>Annex B (informative) Possible services with the shareable geospatial database framework</b> .....	<b>10</b>
<b>Bibliography</b> .....	<b>12</b>

ISO 19297-1:2019

<https://standards.iteh.ai/catalog/standards/sist/ace484bc-cfda-4d47-9ed6-b42d17c336fe/iso-19297-1-2019>

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://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](http://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<sup>1)</sup> 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.

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# 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

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## 4 Symbols and abbreviated terms

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DB Database <https://standards.iteh.ai/catalog/standards/sist/ace484bc-cfda-4d47-9ed6-b42d17c336fe/iso-19297-1-2019>

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<sup>[6]</sup>. 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.

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### 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.

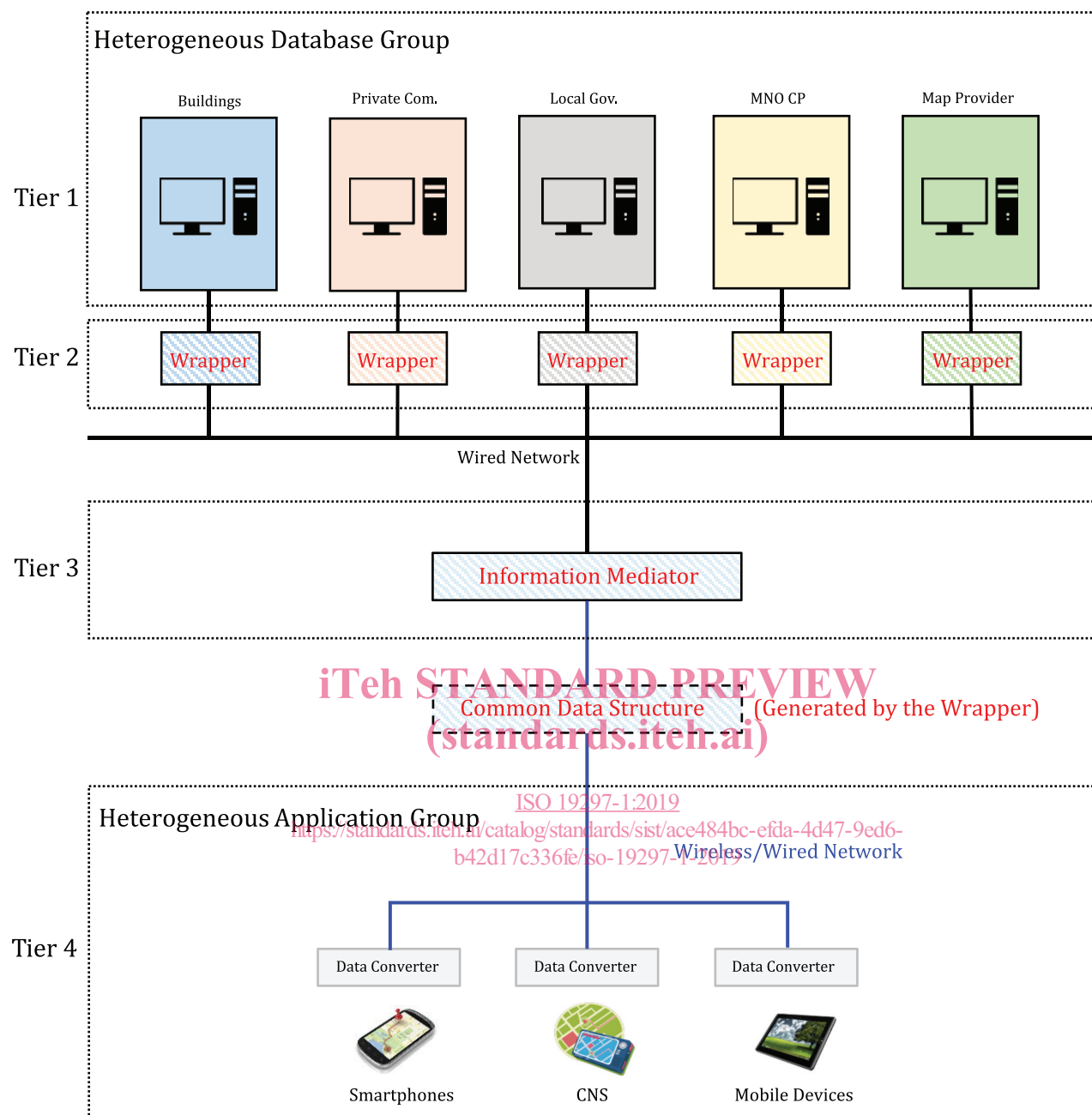


Figure 1 — Conceptual model of the shareable geospatial database framework

## 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,

this framework supports several ways of combining many different organization levels by connecting information mediators and wrappers.

### 5.3.3 Geospatial data model types

This shareable geospatial database framework shall be able to utilize all the ITS related service centres or institutions that maintain various kinds of geospatial databases. Vector-based geospatial data content such as road networks will dominate the volume of data handling within the databases, however image-based geospatial data content such as satellite imagery may be transferable to user applications.

### 5.3.4 Real time data handling ITS applications support

The shareable database framework shall be able to handle real time data transferring between databases servers and user applications with the aid of the framework components, i.e. wrappers, information mediators, and a common data structure. For example, this capability is necessary for some ITS applications such as multimodal transportation routing applications that need real time data coming from several databases simultaneously.

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